CATALOG [PDF]

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		Endured Pulse Power Flat Chip Resistors (Anti Sulfuration)	SG73P-RT	
		Endured Surge Voltage Flat Chip Resistors (Anti Sulfuration)	SG73S-RT	
		Flat Chip Resistors For High Voltage (Anti Sulfuration)	HV73-RT	
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Category		Product Name	Part Number	Link
Low Resistance/ Shunt Resistors	Current Sensing	Large Current Shunt	HS	
		Chip Type Power Shunt	PSL2	
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		Metal Plate Chip Type Low Resistance Resistors (High Power)	TLR (High Power)	
		Metal Plate Chip Type Low Resistance Resistors	TLR	
		Metal Plate Chip Type Low Resistance Resistors	TLR Small	
		Metal Plate Chip Type Jumper	TLRZ	
		Metal Plate Chip Type Low Resistance Resistors	TLRH	
		Current Detecting Chip Resistors (High Power)	SL (High Power)	
		Current Detecting Chip Resistors	SL (Metal)	
		Wide Terminal Type Flat Chip Resistors	WK73S	
		Wide Terminal Type Flat Chip Resistors (High Power)	WK73S (High Power)	
		Wide Terminal Type Low Resistance Flat Chip Resistors (Low T.C.R.)	WU73	
		Low Resistance Flat Chip Resistors (For Automotive, Low T.C.R.)	UR73V	
		Low Resistance Flat Chip Resistors (Low T.C.R.)	UR73	
		Low Resistance Flat Chip Resistors	SR73	
		Ceramic Case Surface Mount Resistors	BLR	
		Surface Mount Type Custom Milliohm Resistors	LR72	
		Chip Current Sensing Resistors	CSR	

Category		Product Name	Part Number	Link
Resistors (Leaded)	General	Coat-Insulated Fixed Carbon Film Resistors	CF	
		Coat-Insulated Fixed Carbon Film Resistors (Flame Retardant Coating)	CFP	
		Coat-Insulated Fixed Metal Film Resistors	MF	
		Coat-Insulated Fixed Metal Film Resistors	SN 3A/3D	
		Coat-Insulated Metal Film Fixed Resistors	SNF	
		Jumper Wires	Z/J-Z/JL	
	Precision	Coat-Insulated Precision Fixed Metal Film Resistors	RNS	
		Plate - Shaped High Precision Metal Film Resistors	MRS	
	High Voltage	Coat Insulated Glazed Metal Film Fixed Resistors	RK	
		Discharge Path Resistors	RK1/2G	
		Coat-Insulated Fixed Anti Surge Resistors	RCR	
		High Voltage High Resistance Thick Film Resistors	GS	
		Thick Film Resistors For High Voltage	RK92	
		Thick Film Resistors For High Voltage	RK92-L	
		Ceramic Resistors for Anti Pulse・Surge	PCF	
		Ceramic Resistors for Anti Pulse・Surge	HPC	
		Ceramic Resistors	CPCN	
		High Voltage Power Resistors	PSN・PV・PSO・PN・PWW・PAP	
	Power Type	Fixed Metal Oxide Film Resistors (Small type)	MOS	
		Fixed Metal Film Resistors (Small type)	MOSX	
		Special Power Resistors (Small Type)	SPR	
		Fixed Metal Film Resistors (Small Type)	SPRX	
		Coat-Insulated Miniature Wirewound Resistors	CW	
		Coat-Insulated Miniature Wirewound Resistors	CW-H	
		Coat-insulated Miniature Precision Power Wirewound Resistors	RW	
		Rectangular Type Wirewound Resistors With Glass Core	BGR	
		Rectangular Type Wirewound Resistors With Ceramic Core	BWR	
		Rectangular Type Metal Oxide Film Resistors	BSR	
		Rectangular Type Wirewound Resistors With Glass Core (For Automotive)	BGRV	
		Rectangular Type Wirewound Resistors With Ceramic Core (For Automotive)	BWRV	
		Rectangular Type Metal Oxide Film Resistors (For Automotive)	BSRV	
		Rectangular Type Metal Plate Resistors	BPR	
		Custom Milliohm Resistors	LR	
	Fusing Resistor	Coat-insulated Fusing Resistors	RF	
		Coat-insulated Fusing Resistors (Constant Current Fusing Type)	RF25CC	
		Coat-Insulated Wirewound Resistors (With Fusing Function)	CWFS	
	Network	Thick Film Resistors For High Voltage (High-Precision High Voltage Divider)	RK92D	
		Precision Metal Film Resistor Networks (Balance Resistors)	MRP	
		Standard Thick Film Resistor Networks	RKL・RKC・RKH	
		CR Networks	CR	

Category		Product Name	Part Number	Link
Precautions for the Thermal Sensors, Terms and Definitions				
Thermal Sensors	Platinum Thin Film (SMD)	Platinum Thin Film Thermal Chip Sensors	SDT73H	
		Platinum Thin Film Thermal Chip Sensors	SDT73S	
		Platinum Thin Film Thermal Chip Sensors (For Automotive)	SDT73V	
	Platinum Thin Film (Leaded)	Small type Platinum Thin Film Thermal Sensors (Small Heater Element)	SDT310VASP2	
		Small Type Platinum Thin Film Thermal Sensors	SDT310	
		Platinum Thin Film Thermal Sensors	SDT101	
	Platinum Thin Film (Custom)	Thermal Sensors	ST	
		Air Flow Sensor Units	AFS	
	Linear P.T.C. Resistors (SMD)	Thin Film Resistance Thermal Chip Sensors	LP73	
		Linear Positive Temp. Coefficient Flat Chip Resistors (For Automotive)	LT73V	
		Linear Positive Temp. Coefficient Flat Chip Resistors	LT73	
	Linear P.T.C. Resistors (Leaded)	Thin Film Resistance Thermal Sensors	LP	
	NTC Thermistors (SMD)	NTC Flat Chip Thermistors	NT73	
Precautions for Fusing Components, Terms and Definitions				
Fuses	Flat Chip	Chip Current Fuses	TF10BN	
		Chip Current Fuses (Anti Pulse)	TF16AT	
		Chip Current Fuses	TF16SN	
		Chip Current Fuses (For Automotive)	TF16VN	
	Ceramic Case	Chip Current Fuses	CCF1N	
		Chip Current Fuses (Anti Sulfuration)	CCF1F	
Precautions for Varistors, Terms and Definitions				
Varistors	Multilayer Type	Multilayer Type Metal Oxide Varistors	NV73 1H/1E	
		Multilayer Type Metal Oxide Varistors	NV73	
		Multilayer Type Metal Oxide Varistors (For Automotive)	NV73DL	
		Multilayer Type Metal Oxide Varistors for Load Dump Surge	NV73DS	
Terminal		Checker Chips	RCU・RCT・RCS・RCW	
LTCC Module Hybrid IC		LTCC Multilayer Substrates	KLC	
		Custom Module	KLCJ	
		Custom Hybrid IC	KA	
Others		APPENDIX A (Minimum Ordered Quantity)		
		APPENDIX B (Recommended Pad Dimensions)		
		APPENDIX C (Packagings for Chip Components)		
		APPENDIX C (Packagings for Axial Taping)		
		APPENDIX C (Packagings for Radial Taping)		
		APPENDIX C (Forming) ※Not Available Taping		
		APPENDIX C (Surface Mounted Device Style Lead forming)		
		Color Code, Resistance Tolerance, Resistance Marking, E Series Numbers		
		Certifications (ISO9001, IATF16949, ISO14001, JIS Q 17025)		
		Sales Offices for Contact		

Measures for environmental hazardous materials

Today, the disruption of the global environment has been taken up as a serious issue for human beings and a mission for its safeguard has become all the important. We, at KOA, started active management of chemical substances included in our products, and complied with EU RoHS Directive in July of 2006 and Management Electronic Products (China RoHS) in March of 2007. "Regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals" was enforced in June of 2007 as the chemical regulation in Europe. Social demand to environmental statutes is increasing like this, and we are actively addressing to the compliance with these laws and regulations. In addition to the compliance, we are also advancing various activities such as halogen-free specifications to reduce hazardous substances and certification as a laboratory according to JIS Q 17025.

EU-RoHS

The restriction of Hazardous Substances Directive (2002/95/EC), (RoHS), became effective on July 1 of 2006 requiring the usage of restriction of following six hazardous substances in the manufacture of electrical and electronic equipment placed on the market. This directive was amended on June 8 of 2011, to Recast Directive 2011/65/EU of the European Parliament and of the Council. The original directive was expired as of January 2, 2013 and replaced by a new directive (2011/65/EU) on the following day. Later, Annex II (Restricted Substances List) was amended by Commission Delegated Directive (2015/863/EU) and four phthalates were added to the restricted substances list. The followings are restricted substances and maximum concentration:

- Lead (0.1wt%)
- Mercury (0.1wt%)
- Cadmium (0.01wt%)
- Hexavalent Chromium (0.1wt%)
- Polybrominated biphenyls [PBBs] (0.1wt%)
- Polybrominated diphenyl ethers [PBDEs] (0.1wt%)
- Bis (2-ethylhexyl) phthalate [DEHP] (0.1wt%)
- Butyl benzyl phthalate [BBP] (0.1wt%)
- Dibutyl phthalate [DBP] (0.1wt%)
- Diisobutyl phthalate [DIBP] (0.1wt%)

※The percentage in parentheses show the maximum concentration value in the homogeneous material.

The restriction of applications in the annex in the directive is exempted.

KOA's products applicable with this exemption to EU RoHS2 are as follows (as of July 2022):

- Copper alloy containing up to 4% lead by weight.
- Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound.

To meet EU-RoHS2, you need to choose lead (Pb) free material for termination surface material when our product has both type designation, leaded and lead free. Please contact our sales representatives for details.

Revised China RoHS (Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products)

China RoHS became effective in March 2007 and the Revised China RoHS was promulgated in January 2016 and became effective on July 1, 2016. The compliance management catalog (target products) and exemption list for the second step (inclusion restriction) were released in March 2018 and we must comply with requirements of the "evaluation system" from November 1, 2019.

For each product, we disclose the content information of the six hazardous substances directed by China RoHS. Please contact our sales representatives for details.

REACH

"Regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals" (REACH) has been enforced on June 1 of 2007 in EU area.

This regulation is aiming at safety evaluation and risk management of chemical substances, which are required to register according to the amount if used in businesses. Substance of Very High Concern (SVHC) must be registered if it is included in article. The European Waste Framework Directive has also been revised. As a result, products placed on the EU market after January 2021 are required to register SCIP data if the concentration of SVHC exceeds 0.1wt% in order to also provide information on environmentally hazardous substances to waste disposal companies. Information communication on such substances is also required throughout the supply chain using information communication tools such as chemSHERPA.

⚠ CAUTION

Precautions

All product specifications and data are subject to change without prior notice. Be sure to request and confirm the latest technical specifications before you order and/or use.

★Matters common to all products

●General

- For precautions in general, refer to the "JEITA RCR-1001B Safety application guide on components for use in electronic and electrical equipment" issued by JEITA.

●Application

- Identify the application before the use of the product and contact us in advance if it involves transportation (automobiles, airplanes, trains and ships), medical equipment, space equipment, energy equipment, traffic and information facilities, which requires high reliability and its malfunction may threaten human life or property.
- Consider sufficient fail-safe design if the products are used in applications requiring high reliability. Ensure safety of a whole system by setting proactive circuits and redundant circuits to avoid the single failure of the product leading to unsafety of the equipment.

●Environment for use

- The products are not to be used in special environments unless otherwise specified. Examine and confirm the performance and reliability before you use the products under the following environments:
  1. Under direct sunlight, outside exposure and in dust.
  2. In liquids such as water, oil, organic solvent and chemicals and in areas where these liquids are used.
  3. In places where the products are exposed to sea breeze or corrosive gases including SO_2, H_2S, Cl_2, NH_3, NO_2, etc.
  4. In places with large static electricity and strong electromagnetic waves.
  5. In places subject to dew condensation.
  6. When the products or printed circuit boards are sealed and coated by resin or other coating materials
  7. In places where the products are exposed to the mist from lubricant oil.

●Sulfuration

- Products with silver electrodes may increase the resistance value under sulfur atmosphere such as sulfide gases (H_2S, SO_2, etc.) or by attaching sulfide compounds. Take anti-sulfur measures under these conditions.

●Anti-pulse characteristics

- If transient overload (voltage, current and power) such as pulse and surge are applied to the products, the performance and reliability may be degraded. Contact KOA if you need anti-pulse characteristics data.
- Pay attention to the discharge between terminations when high voltage is applied.

●Storage

- Store the products in dust free areas and keep them away from extremely high and low temperature, moisture, dew condensation, direct sunlight, sea breeze, corrosive gases such as SO_2, H_2S, Cl_2, NH_3, NO_2, etc. or mist from a lubricant oil. Use the desiccant if necessary.
- Consult us about the conditions and period of storage.

●Storage of the products with lead-free termination

- Be careful of the degradation of solderability, it may proceed faster for the products with Pb-free terminals than the products with Pb-contained terminals.

●Mounting

- Avoid damage and physical shock to the product by nipping them with hard tools like pliers and tweezers or by imperfect adjustment of the mounting machine, which may affect the characteristics or lead to disconnections and cracks.
- If the bottom point of nozzle on the mounting machine is too low, the product may be knocked on to the printed board, which may deteriorate the characteristics or lead to cracks. Decelerate the nozzle just before mounting and mount the product after correcting a deformation of the printed circuit board.
- Do not use the products which have fallen when mounting, or which have been removed from the printed circuit board.
- Contact us if the printed circuit boards after mounting are molded and sealed by coating materials.
- Do not stack the printed circuit boards after mounting, for this may damage the products.
- Characteristics of the film type resistors and sensors may be changed by overvoltage from electrostatics. Keep electrostatics away from products while assembling and handling (monitors of insertion machine and inspection machine, human contact and etc.).
- Prevent or eliminate adhesion of ionic substances such as salts, salinity and sweat, as they may degrade the resistances to moisture or corrosion.

●Soldering

- Perform soldering within the temperature, time and the number of cycles, specified in technical specifications or precautions for each product. If the products are exposed to high temperature for long periods of time, the color and characteristics may change or disconnection may occur.
- Prevent any external force on the products until solder is cooled.
- Handle carefully to prevent mechanical stress on solder fillet, which may result from the warping of printed circuit board.
- Confirm the residues of the flux in solder do not affect the product.
- Confirm the products are corresponding to conductive adhesive when used in place of solder.

●Precautions for soldering with lead-free solder

- In lead-free soldering, temperature may rise higher compared to eutectic solder. Confirm there is no problem under actual soldering conditions.
- The lift-off phenomenon may occur for both-sided mounting board with through holes. Confirm the connective strength of solder in the actual board beforehand.

●Washing

- Confirm that the ionic residues in the solder flux do not remain after washing because it may cause deterioration of moisture resistance and corrosion resistance when these substances are attached to the products.
- Confirm the reliability in advance when using no washing solder, water or soluble agent.
- Since lead-free solder may contain much of the ionic materials, use the RMA type solder or flux or wash sufficiently.
- Wash thoroughly after soldering to remove ionic substances like sweat and salinity. Control washing agent appropriately to remove whole ionic substances. Consult KOA when using washing agent such as acid, alkaline, and organic solvent other than alcohols.
- The ultrasonic washing may destruct the products due to resonance by vibration. High hydraulic pressure may also damage the products. Consult KOA for the washing conditions in advance.
- Dry the products sufficiently after washing.

●Dispose of the products

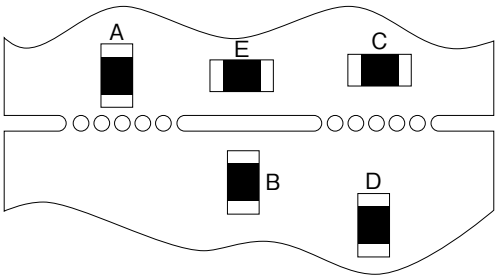
- Confirm the related laws and regulations for appropriate handling and disposal of products or packing materials.

Precautions

★Common matters in the products for surface mount devices

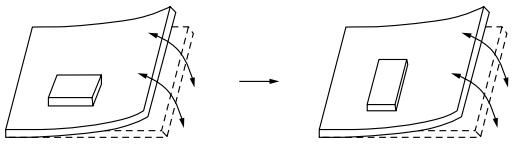
●Since the distortion of printed circuit board causes stress to the products, pay attention to the following items.

- Arrange the long side of the chip resistor parallel with the direction of the smaller thermal expansion coefficient of printed circuit board.
- Crack at the solder fillet may occur in the cyclic thermal stress because the thermal expansion coefficient is different between the product and the printed circuit board. The land size, amount of solder and heat radiation from the printed circuit board are needed to be designed carefully. Especially the large size resistors that are larger than 5.0 x 2.5mm needs attention.
- If the products are arranged near groove line, the product or termination may be damaged by large stress when you split the board. Mount the products on the board to minimize the stress referred to the following figure.



【The level of stress on terminations A>B≒C>D>E】

- Make a proper layout to avoid the stress from the warp or deformation of the board. Otherwise, solder cracks may occur or the products may be damaged.



- Pay attention to the products mounted on the periphery of the board or near the connectors so that no stress is placed on the products when you push/pull the connectors.
- Pay attention to the layout where the products are mounted near large components to avoid the crack, because the stress works in the direction to large components when the solder solidifies.
- Design each land on right and left to have the same size.Different land size may change characteristics or cause cracks and tombstone effect while the solder is cooled down.

●Mounting and soldering

- Imperfect adjustment of mounting machine may cause cracks, chipping and alignment error. Check and inspect the mounting machine in advance.
- Set the backup pins in proper layout otherwise the components mounted on the backside of the board are damaged. Do not set these pins at the position of the nozzle.
- Adjust the bottom dead point of dispenser away from the board when you apply adhesive. It may damage the components mounted on the backside of the board.
- Confirm that the products are corresponding to flow soldering when you perform it.
- Pay attention to the amount of solder because improper amount of solder place large stress on the products and cause cracks or malfunctions.

●Soldering by soldering iron

- Solder by soldering iron at the temperature specified in technical specifications or precautions for each product.
- Perform preheating as much as possible.
- Keep the tip of the soldering iron away from the body and the termination of the products.
- Avoid damage and physical shock to the products, when you nip the products with hard tools like pliers and tweezers.

★Common matters in lead type products

●Mechanical stress

- Pay attention to resonance by vibration after mounting.
- Do not add bending or twisting stress to the product body.
- Fix large size products firmly.
- Take larger curvature radius to avoid excessive stress on the root of the terminals when you need to bend the lead wires. Excessive stress, if applied, may make the lead wire separate from the electrode cap and damage the product.
- Do not add excessive stress to the product body when lead wires are cut or clinched by mounting machine.

●Temperature rise

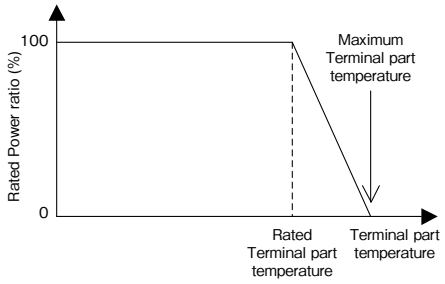
- Pay attention to the heat radiation and interaction to other components, because large size resistors generate large amount of heat, when the rated power is applied.

Introduction of the derating curves based on the terminal part temperature

●Background

Recently, the miniaturization, high power density and high temperature of the usage environment for the automotive devices have advanced. And requests for resistors to conform the high temperature is increasing. Figure 1 is the derating curve based on the terminal part temperature and this is introduced to realize these requests for the surface mount resistors safely.

Rated terminal part temperature is the maximum terminal part temperature of the surface mount resistor at which the rated power may be applied continuously including the temperature rise by self heat generation.

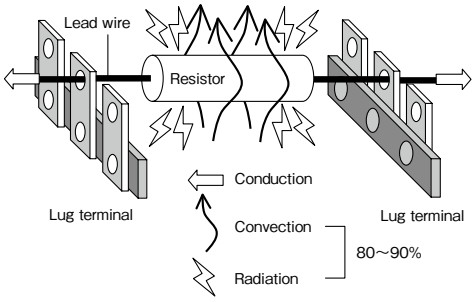


【Figure 1. Derating curve based on the terminal part temperature】

The derating curves based on the terminal part temperature is already used in the metal plate type ultra-low resistance value resistors for current sensing. It is because these resistors are used in sensing of large currents such as inverters and converters which the terminal part temperature rise irrelevantly from the ambient temperature because of the generated heat from the nearby switching elements or the large current applied to the copper pattern.
This point of view was deployed to the general resistors as well.

●Overview of the establishment of the derating curves based on ambient temperature

The idea of the traditional derating curve based on the ambient temperature defined in the JIS and IEC standard was established in the vacuum tube era, far back from the appearance of the surface mount resistors. There were no printed boards in those days and the cylindrical shaped resistors with lead wires were wired in the air to lug terminals as shown in Figure 2.

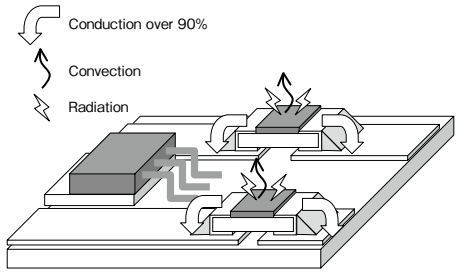


【Figure 2. Heat dissipation of cylindrical resistors】

The Joule heat that is generated in the resistor is dissipated in three pathways regardless of the shape of the resistor. The first path is conduction to the connected parts such as the terminal. The second path is convection including the heat transfer to the atmosphere by natural convection and airflow. The third path is radiation by infrared.
The larger the area connected to the resistor becomes, the larger the heat conduction will be. And the larger the surface area of the resistor becomes, larger the convection and radiation will be.
When the cylindrical shape resistor with lead wire is mounted on the lug terminal, the lead wire which is the heat path by conduction is thin and long so the heat resistance is large and the heat dissipation will be small. In the contrast, the heat dissipation ratio of the convection and radiation becomes large since the area will be large. It is determined in the simulation that 80% to 90% of the heat of the cylindrical shape resistor with lead wire is dissipated directly into the ambient air. The temperature of the resistor can be calculated by adding the ambient temperature and the temperature rise caused by the self-heating, so the ambient temperature will be most sufficient for the usage environment temperature standard of the resistors. This is why the derating curve based on ambient temperature was provided to the customers as the index of design.

●Heat dissipation of surface mount resistors

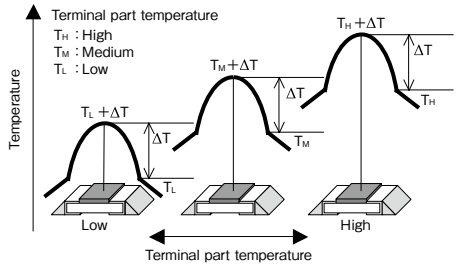
The Figure3 shows the main heat path of the present surface mount resistors. The surface mount resistors have only small surface area so the convection and radiation will be small. On the other hand, they are connected to the print board patterns in a large area so the ratio by conduction will be very large. In estimation, the ratio by conduction through the terminal to the board takes over 90% even when the convection and radiation is presumed at the maximum level. Therefore, the control point of the surface mount resistor should be the temperature of the terminal part which is the connection point of the board and the main heat path.



【Figure 3. Heat dissipation of surface mount resistors】

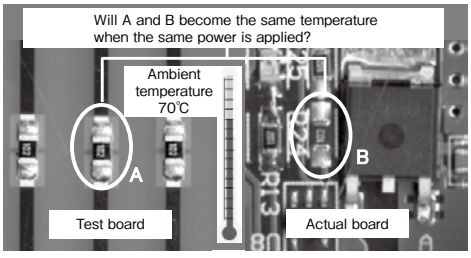
●Derating curve suitable for the surface mount resistor

The temperature of the resistor will increase the same ΔT from the standard terminal part temperature regardless of the ambient temperature when the same power is applied as shown in Figure 4. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



【Figure 4. Contributing factor to the temperature of the surface mount resistor】

Even when the same power is applied to the surface mount resistor under the same ambient temperature, the temperature will not be the same if the printed board which the resistor is mounted is different. It is because the terminal part temperature changes. There is a possibility that the temperature of the resistors becomes higher than the endurance test of ambient temperature 70℃ which is defined in the JIS and IEC standard and implemented at our site when they are mounted closely to each other or there are other heat generating devices mounted on the board as shown in Figure 5.
The traditional derating curve based on the ambient temperature is established from the endurance test of ambient temperature 70℃. There will be no problem if the resistors are used with electrically and thermally sufficient margins, but it is inferable that the recent requests for miniaturization, high power density and high temperature usage environment would lead to reducing the margins at the device designing phase.
Using the derating curve based on the terminal part temperature will be a rational method to reduce the margin. We will provide the derating curve suitable for the surface mount resistors based on the tests implemented under the conditions that the terminal part temperature becomes the rated terminal part temperature (refer to the Terms and definitions).



【Figure 5. Temperature differs depending on the board】

Introduction of the derating curves based on the terminal part temperature

●How to use the derating curve based on the terminal part temperature

Some examples of rational method to reduce the margins or reduce the number of resistors or replace with a smaller size will be shown.

The prior conditions will be the following. Be aware that the terminal part temperature does not always become 120℃ when the ambient temperature is 100℃.

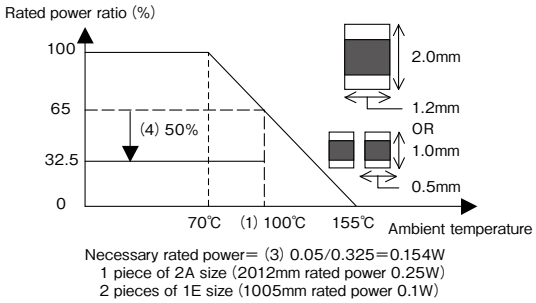
(1) Ambient temperature of the board: 100℃

(2) Terminal part temperature of the surface mount resistor: 120℃

(3) Actual load power: 0.05W

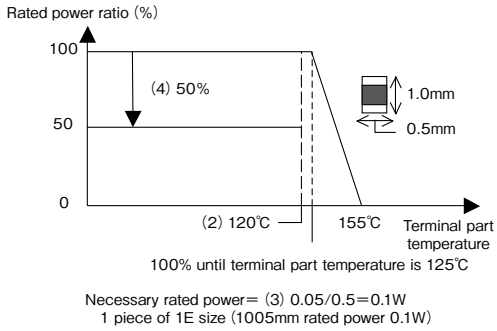
(4) Margins defined by the customer internal regulations: 50%

The necessary rated power for the resistor will be calculated from the conditions (1), (3), (4) using the derating curve based on the ambient temperature. The result is shown in Figure 6. For the RK73B products, one piece of 2A size, or two pieces of 1E size will be necessary.



【Figure 6. Selection by the traditional derating curve】

However, when the resistor is selected from the conditions (2), (3), (4) using the derating curve based on the terminal part temperature, one piece of 1E size will be sufficient.



【Figure 7. Selection by the derating curve based on terminal part temperature】

As seen above, the number of resistors and the mounting area can be reasonably reduced by using the derating curve based on the terminal part temperature and this will lead to cost saving.

●Derating curve suitable for the surface mount resistor

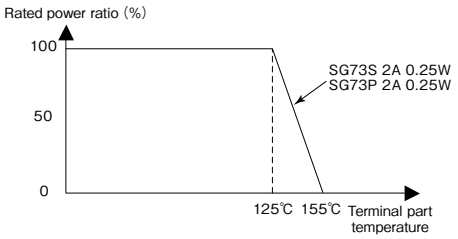
As shown in Table 1, for the surface mount resistors, there are products that have 2 rated powers for the same type in the rating column. The high rated power is basically available and applicable only to boards with adequate heat dissipation design for example multilayer boards, DCB (direct copper bonding) boards and single layer boards with wide heat dissipation area land. The derating curve based on the terminal part temperature is given priority to the derating curve based on the ambient temperature.The rated terminal part temperature is set low for the products with high power ratings even when they have the same rated ambient temperature.

In addition, we implement load life tests for the products with high rated power by using a test board that can specially control the terminal part temperature.

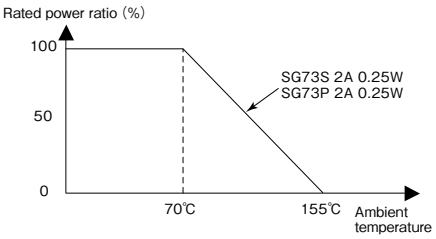
【Table1. Rating column of products with 2 rated power】

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.
SG73S 2A SG73P 2A	0.25W	70℃	125℃
	0.5W	70℃	100℃

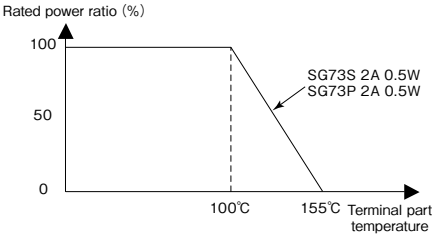
In the case of Table1, there will be 3 derating curves as shown from Fig.8 to Fig.10.



【Figure 8. Derating curve of 0.25W rated power based on terminal part temperature】



【Figure 9. Derating curve of 0.25W rated power based on ambient temperature】



【Figure 10. Derating curve of 0.5W rated power based on terminal part temperature】

How to use each derating curve is shown as the following.

● When 0.25W is the rated power

When the terminal part temperature can be measured:

The derating curve in Figure 8 can be applicable and it can be used with rated power 0.25W up to terminal part temperature 125° C. The derating curve with the horizontal axis based on the terminal part temperature supersedes the conventional derating curve with the horizontal axis based on the ambient temperature. Therefore, even when the ambient temperature exceeds 100° C, it can be used with rated power 0.25W as long as the terminal part temperature is below 125° C.

When the terminal part temperature is not measured and only the ambient temperature is measured:

The product may be used by derating the load power from the ambient temperature 70° C according to the conventional derating curve shown in Figure 9. However, as mentioned in the past descriptions, the temperature of the resistor differs according to the wiring patterns and heat generating components nearby, even when the ambient temperature is the same, so it is not a derating method with good precision.

● When 0.5W is the rated power.

Managing the terminal part temperature is the requirement to apply the rated power 0.5W. Only the derating curve with the horizontal axis based on the terminal part temperature as shown in Fig.10 can be used but it can assure up to the high power. The product can be used with 0.5W if the terminal part temperature is below 100℃.

● Reference

Please refer to IEC TR 63091:2017 "Study for the derating curve of surface mount fixed resistors -Derating curves based on terminal part temperature".

Precautions for the Resistors

Refer to the precautions in the beginning part of this catalogue for the matters common to all products

●General in fixed resistors

- When the resistors are operated in ambient temperature above the rated temperature, the power rating must be derated according to the derating curve.
- Resistors in general may emit flame, fire, smoke or red heat when overload is applied.
- Flame retardant resistors may emit smoke or cause red heat when overload is applied but unlikely to emit flame or fire.
- When the resistors are sealed and coated by coating materials such as resin, deterioration of the resistor by thermal stress or resin may affect the characteristics. Confirm with KOA for the performance and reliability specifications in advance.
  When the resin absorbs moisture, the resistance to moisture and corrosion of the resistor may deteriorate, so be aware.
- When the resistor is coated, potted or molded by resin materials, the curing stress could cause peeling of protective coating and crack of solder fillet, resulting in the resistance change and disconnection. Do not coat nor seal the flame retardant coated resistors nor metal oxide film resistors.
- Allow enough intervals for cooling after mounting metal film resistors, before washing the flux. Residues of ionic substances may deteriorate resistances to moisture and corrosion.
- When a power exceeding the rated power is applied in a short time, we can not guarantee the safety only that the average power is below the rated power. Please contact KOA with the surge voltage or current waveform for advise.
- Cylindrical film resistors have inductance due to the spiral trimming. Please be aware when using in a high-frequency circuit.
- The flame retardant resistors are weak against mechanical stress compared with the general resistors due to the special coating. Please do not apply impact, vibration or pinching with pliers, tweezers to the resistor body. Do not apply any external force to the protective coating until drying is fully completed after washing.

●Wirewound type resistors

- Wirewound type resistors have inductances and parasitic capacitances resulting from the winding structure. Therefore, they could resonate when used in a high frequency circuit.

●Fusing resistors

- Confirm beforehand that the overload condition of the abnormal situations are within the fusing area.
- Contact KOA in advance when excess overload of the rated voltage is continuously applied, since there is a possibility of damage accumulated in the resistor.
- The arc phenomenon may occur when high voltage is applied again after fusing by over current. Make sure to use the product below the maximum open circuit voltage.
- Contact KOA about the maximum open circuit voltage for it varies depending on the product type and resistance.
- The fusing characteristics could change when the resistors are coated, potted and molded by resin materials.

●Reference

- For the basic precautions of using resistors, refer to the technical report, "JEITA RCR-2121B Safety application guide for fixed resistors for use in electronic equipment", issued by JEITA.

Terms and Definitions

■Nominal Resistance
• Designed resistance value usually indicated on the resistor.

■Power Rating
• Maximum allowable power at rated temperature. Some of our chip resistor arrays and networks specify the whole power rating as a package.

■Rated Ambient Temperature
• Maximum ambient temperature at which the power rating may be applied continuously. The rated ambient temperature refers to the temperature around the resistor mounted inside the equipment, not to the air temperature outside the equipment.

■Rated Terminal Part Temperature
• Maximum terminal part temperature of the surface mount resistor at which the power rating may be applied continuously.
Includes the temperature rise by self heat generation.

■Derating Curve
• Curve that expresses the relation between ambient temperature or terminal part temperature and the maximum allowable power, which is generally expressed in percentage.

■Rated Voltage
• Maximum allowable D.C. or A.C. voltage(rms), capable to be continuously applied to a resistor or a resistor element under the rated ambient temperature or terminal part temperature. It shall be calculated from the rated power and nominal resistance using the following formula.

$$\text{Rated Voltage (V)} = \sqrt{\text{Rated Power (W)} \times \text{Nominal Resistance Value (}\Omega\text{)}}$$

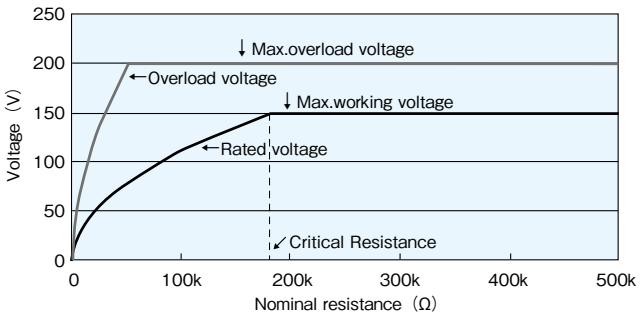
The rated voltage shall not exceed the max. working voltage.

■Critical Resistance
• The maximum nominal resistance value at which the rated power can be applied without exceeding the maximum working voltage. The rated voltage is equal to the max. working voltage at the critical resistance value.

■Maximum Working Voltage
• Maximum D.C. or A.C. voltage (rms) that can be continuously applied to the terminations of a resistor. However, the maximum value of the applicable voltage is the rated voltage at the critical resistance value or lower.
Maximum working voltage and rated voltage are calculated D.C. voltage based on rated power. Sine wave is assumed for the A.C. voltage so the peak voltage should be $\sqrt{2}$ times the maximum working voltage. When the wave form is not a sine wave, or when the resistance value exceeds the critical resistance, please contact us for the applicable peak voltage.

■Overload Voltage
• Allowable voltage which is applied in 5s. under short time overload test. Overload voltage shall be 2.5 times of rated voltage or max. overload voltage, whichever is lower.

■Maximum Overload Voltage
• Largest value of overload voltage



【Example of various voltage of RK73G 2A】

■Dielectric Withstanding Voltage
• A.C. voltage(rms) that can be applied to a designated spot between the electrode and the outer coating in one minute, in the voltage proof test.

■Temperature Coefficient of Resistance(T.C.R.)
• Relative variation of resistance between two given temperatures when temperature is changed by 1K, which is shown by the following formula.

$$\text{T.C.R. } (\times 10^{-6}/\text{K}) = \frac{R - R_0}{R_0} \times \frac{1}{T - T_0} \times 10^6$$

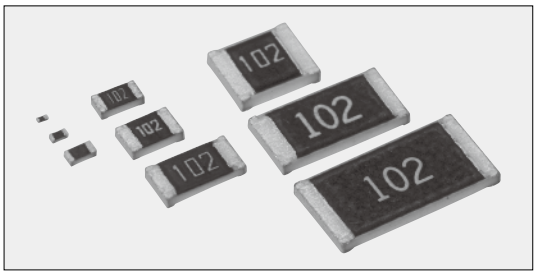
R : Resistance value (Ω) at T℃
R_0 : Resistance value (Ω) at T_0℃
T : Measured test temperature (℃)
T_0 : Measured base temperature (℃)

THICK FILM (GENERAL PURPOSE)

EU RoHS

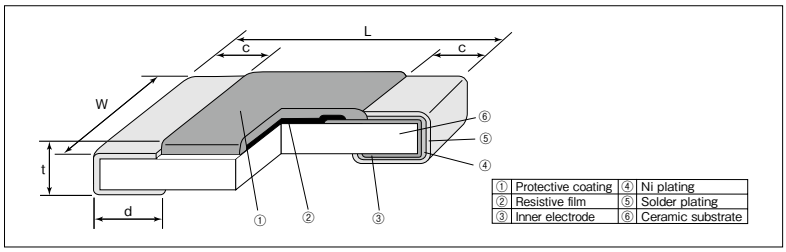
INDEX

RK73B Flat Chip Resistors



Coating color : Black

■Construction



■Features

- Wide lineup from 01005 to 2512 size.
- Excellent heat resistance and weather resistance are ensured by the use of metal glaze thick film.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested (Exemption 1F).

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1F (01005)	0.4±0.02	0.2±0.02	0.10±0.03	0.11±0.03	0.13±0.02	0.04
1H (0201)	0.6±0.03	0.3±0.03	0.1±0.05	0.15±0.05	0.23±0.03	0.14
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1E AT (0402)			0.25±0.1	0.3±0.15		
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		
2E (1210)		2.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$		15.5
W2H (2010) ※1	5.0±0.2	2.5±0.2		0.65±0.15		24.3
W3A (2512) ※1	6.3±0.2	3.1±0.2				37.1
W3A2 (2512) ※1						

※1 RK73B 2H, 3A and 3A2 are also still available (different "d" dimensions=$0.4^{+0.2}_{-0.1}$mm)

■Type Designation

Example

RK73B	2B		T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1F : 0.03W 1H : 0.05W 1E : 0.1W 1J : 0.1W 0.125W 2A : 0.25W 2B : 0.25W 2E : 0.5W W2H : 0.75W W3A : 1W W3A2 : 2W※4	Nil : Standard A : Heat shock resistance※2	T : Sn G : Au※3 (L : Sn/Pb※4)	TX : 4mm width-1mm pitch plastic embossed TBL・TCM : 2mm pitch press paper TPL・TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	3 digits	G : ±2% J : ±5%

※2 With type A (1E,1J,2A,2B) only T is available as the terminal surface material.
※3 Products with gold plated electrodes are also available with 1E, 1J and 2A types (10Ω~1MΩ), so please consult with us.
※4 With type 1F, 1H, W2H, W3A, W3A2 only T is available as the terminal surface material.
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

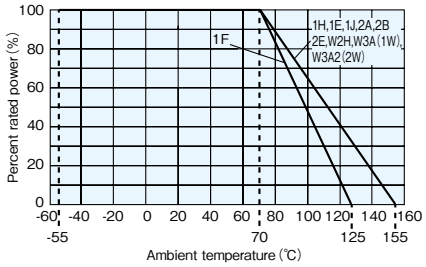
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) G : ±2% E24	J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TX	TBL	TCM※7	TPL・TP	TD	TE
1F	0.03W	70℃	—	±200	100k~1M	100k~10M	20V	30V	40,000	20,000	—	—	—	—
				±250	10~91k	10~91k								
				0~+300	1~9.1	1~9.1								
1H	0.05W	70℃	125℃	±200	10~10M	10~10M	25V	50V	—	—	15,000	—	—	—
				±400	—	1~9.1								
1E	0.1W	70℃	125℃	±200	1~10M	1~10M	75V	100V	—	—	—	TPL : 20,000 TP : 10,000	—	—
1J	0.1W	70℃	125℃	±200	1.1k~10M	1.1k~10M			—	—	—	TP : 10,000※6	5,000	—
				±400	—	11M~22M								
	0.125W	70℃	125℃	±200	1~1k	1~1k								
2A	0.25W	70℃	125℃	±200	1~1M	1~1M	150V	200V	—	—	—	TP : 10,000※6	5,000	4,000※6
				±400	1.1M~10M	1.1M~10M								
2B	0.25W	70℃	125℃	±200	1~5.6M	1~5.6M	200V	400V	—	—	—	—	5,000	4,000※6
				±400	6.2M~10M	6.2M~22M								
2E	0.5W	70℃	125℃	±200	10~5.6M	1~5.6M			—	—	—	—	5,000	4,000※6
				±400	—	6.2M~10M								
W2H	0.75W	70℃	125℃	±200	10~5.6M	1~5.6M			—	—	—	—	—	4,000
				±400	—	6.2M~22M								
W3A	1.0W	70℃	125℃	±200	10~5.6M	1~5.6M	200V	400V	—	—	—	—	—	4,000
				±400	—	6.2M~22M								
W3A2	2.0W※5	70℃	95℃	±200	10~5.6M	1~5.6M	200V	400V	—	—	—	—	—	4,000
				±400	—	6.2M~22M								

Operating Temperature Range : −55℃~+125℃ (1F), −55℃~+155℃ (1H・1E・1J・2A・2B・2E・W2H・W3A・W3A2)
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value or Max. working voltage, whichever is lower.}}$
For flat chip jumper resistor, please refer to RK73Z series.
※5 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※6 Standard packaging : TD(4mm pitch punch paper)
※7 Standard taping specification of 1H is TCM. Previously available "TC(10,000pcs/Reel)" is not recommended for new designs.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.
While using under high power, the temperature of the product may increase depending on the condition of heat dissipation from PCB.
Be sure to check the terminal part temperature as well as precautions to use on delivery specifications before use.

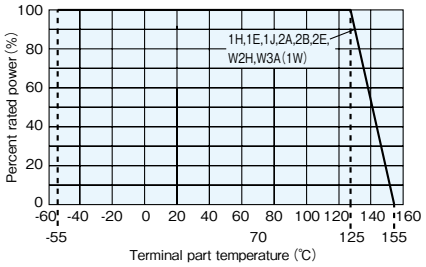
■Derating Curve

Ambient temperature

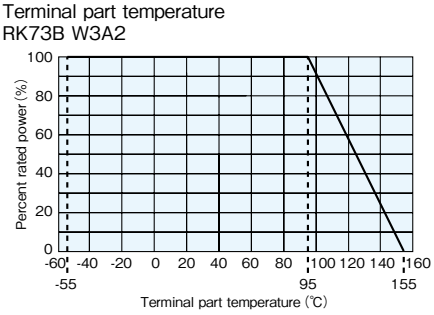


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



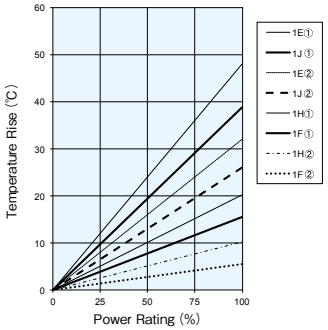
Terminal part temperature
RK73B W3A2



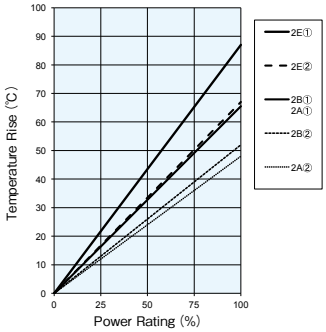
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

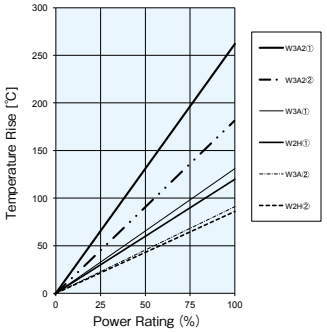
RK73B 1F-1J



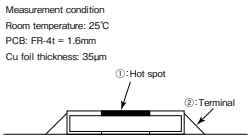
RK73B 2A-2E



RK73B W2H-W3A2

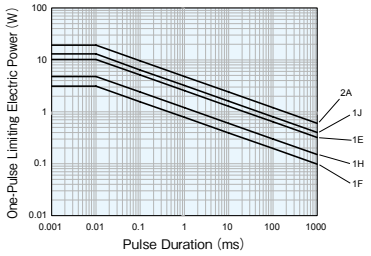


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

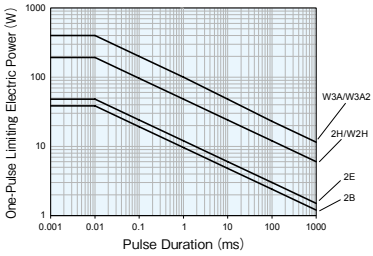


■One-Pulse Limiting Electric Power

RK73B 1F-2A



RK73B 2B-W3A2



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25/+125℃
Overload (Short time)	2	1 : 1F 0.5 : others	Rated voltage×2.5 for 5s(1E, 2B, W3A2 : Rated voltage×2 for 5s)
Resistance to soldering heat	1 : 1F~W3A2 (10Ω≦R≦1MΩ) 3 : 1F~W3A2 (R<10Ω, R>1MΩ)	0.5 : 1F~W3A2 (10Ω≦R≦1MΩ) 1 : 1F~W3A2 (R<10Ω, R>1MΩ)	260℃±5℃, 10s±1s
Rapid change of temperature	1 : 1F, Characteristic「A」(Heat shock resistance) 0.5 : others	0.5 : 1F, Characteristic「A」(Heat shock resistance) 0.3 : others	Characteristic「Nil」(Standard) : −55℃(30min.)/+125℃(30min.)100 cycles Characteristic「A」(Heat shock resistance) : −55℃(30min.)/+125℃(30min.)1000 cycles
Moisture resistance	2 : 1J, 2A, 2B 3 : others	0.75 : 1J, 2A, 2B 1.5 : 1F 1 : others	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2 : 1J, 2A, 2B 3 : others	0.75 : 1J, 2A, 2B 1 : others	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.5 : 1F 0.3 : others	+125℃, 1000h : 1F +155℃, 1000h : 1H, 1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2

■Precautions for Use

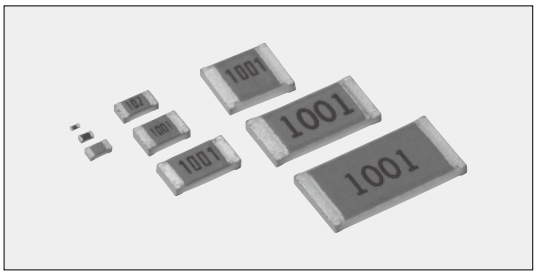
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of W2H/W3A/W3A2 which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1F~2E, but the crack tends to occur in the types of W2H/W3A/W3A2. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- Care should be taken that RK73B1F may be damaged when static electricity occurs and is applied in the equipment assembly process.

THICK FILM (PRECISION)

EU RoHS

INDEX

RK73H Flat Chip Resistors (Precision Grade)



Coating color : Black (1F, 1H),
Blue (1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2)

■Features

- Wide lineup from 01005 to 2512 size.
- Excellent heat resistance and weather resistance are ensured by the use of metal glaze thick film.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested (Exemption 1F).

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

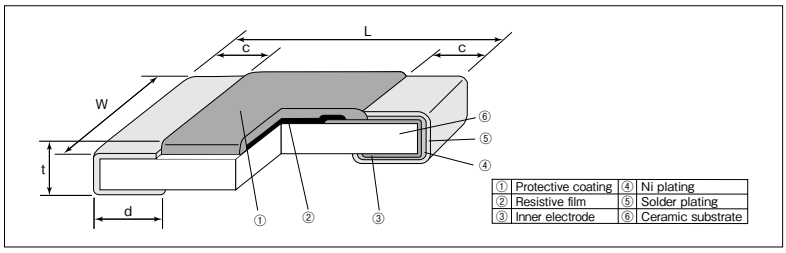
■Type Designation

Example

RK73H	2B		T	TD	1002	F
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1F : 0.03W 1H : 0.05W 1E : 0.1W 1J : 0.1W 0.125W 2A : 0.25W 2B : 0.25W 2E : 0.5W W2H : 0.75W W3A : 1W W3A2 : 2W※5	Nil : Standard A : Heat shock resistance※2	T : Sn G : Au※3 (L : Sn/Pb※4)	TX : 4mm width-1mm pitch plastic embossed TBL・TCM : 2mm pitch press paper TPL・TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	4 digits	D : ±0.5% F : ±1%

※2 With type A (1E,1J,2A,2B) only T is available as the terminal surface material.
※3 Products with gold plated electrodes are also available with 1E, 1J and 2A types (10Ω～1MΩ), so please consult with us.
※4 With type 1F, 1H, W2H, W3A, W3A2 only T is available as the terminal surface material.
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Solder plating
③	Inner electrode	⑥	Ceramic substrate

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1F (01005)	0.4±0.02	0.2±0.02	0.10±0.03	0.11±0.03	0.13±0.02	0.04
1H (0201)	0.6±0.03	0.3±0.03	0.1±0.05	0.15±0.05	0.23±0.03	0.14
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1E AT (0402)			0.25±0.1	0.3±0.15		
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		
2E (1210)		2.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$		15.5
W2H (2010) ※1	5.0±0.2	2.5±0.2		0.65±0.15		24.3
W3A (2512) ※1	6.3±0.2	3.1±0.2				37.1
W3A2 (2512) ※1						

※1 RK73H 2H, 3A and 3A2 are also still available (different "d" dimensions=$0.4^{+0.2}_{-0.1}$mm)

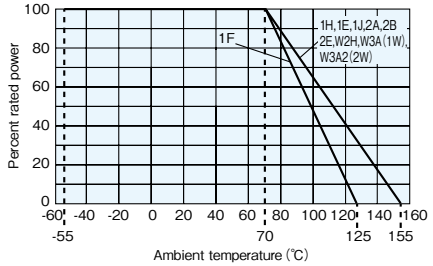
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TX	TBL	TCM※8	TPL・TP	TD	TE
1F	0.03W	70℃	—	±200	—	100k～2M※5	20V	30V	40,000	20,000	—	—	—	—
				±250		10～91k※5								
1H	0.05W	70℃	125℃	±200	10～1M	10～10M※5	25V	50V	—	—	15,000	—	—	—
				±400	—	1～9.1※5								
1E	0.1W	70℃	125℃	±100	10～1M	10～1M	75V	100V	—	—	—	TPL : 20,000 TP : 10,000	—	—
				±200	—	1～9.76 1.02M～10M								
1J	0.1W	70℃	125℃	±100	1.02k～1M	1.02k～1M			—	—	—	TP : 10,000※7	5,000	—
				±200	—	1.02M～10M								
	0.125W			±100	10～1k	10～1k								
				±200	—	1～9.76								
2A	0.25W	70℃	125℃	±100	10～1M	10～1M	150V	200V	—	—	—	TP : 10,000※7	5,000	4,000※7
				±200	—	1～9.76								
				±400		1.02M～10M								
2B	0.25W	70℃	125℃	±100	10～1M	10～1M	200V	400V	—	—	—	—	5,000	4,000※7
				±200	—	1～9.76 1.02M～5.6M								
				±400		5.62M～10M								
2E	0.5W	70℃	125℃	±100	10～1M	10～1M			—	—	—	—	5,000	4,000※7
				±200	—	1～9.76 1.02M～5.6M								
				±400		5.62M～10M								
W2H	0.75W	70℃	125℃	±100	10～1M	10～1M			—	—	—	—	—	4,000
				±200	—	1～9.76 1.02M～5.6M								
				±400		5.62M～10M								
W3A	1W	70℃	125℃	±100	10～1M	10～1M			—	—	—	—	—	4,000
				±200	—	1～9.76 1.02M～5.6M	200V	400V						
				±400		5.62M～10M								
W3A2	2W※6	70℃	95℃	±100	10～1M	10～1M			—	—	—	—	—	4,000
				±200	—	1～9.76 1.02M～5.6M	200V	400V						
				±400		5.62M～10M								

Operating Temperature Range : −55℃～+125℃ (1F)、−55℃～+155℃ (1H・1E・1J・2A・2B・2E・W2H・W3A・W3A2)
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
For flat chip jumper resistor, please refer to RK73Z series.
※5 The nominal resistance value for RK73H1F (10Ω≦R≦2MΩ) and RK73H1H (1Ω≦R≦9.1Ω, 1MΩ≦R≦10MΩ) is E24.
※6 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※7 Standard packaging : TD(4mm pitch punch paper)
※8 Standard taping specification of 1H is TCM. Previously available "TC(10,000pcs/Reel)" is not recommended for new designs.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.
While using under high power, the temperature of the product may increase depending on the condition of heat dissipation from PCB.
Be sure to check the terminal part temperature as well as precautions to use on delivery specifications before use.

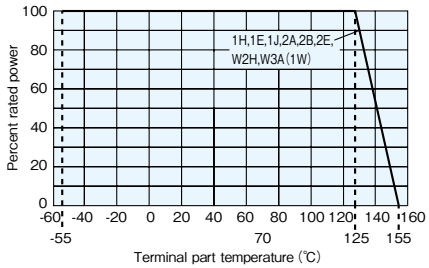
■Derating Curve

Ambient temperature



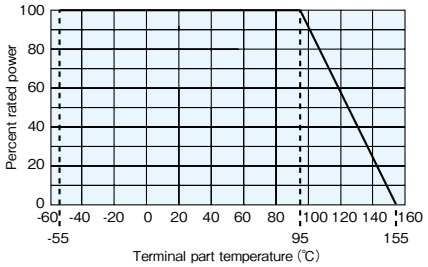
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



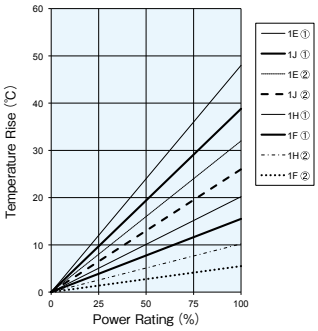
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

Terminal part temperature
RK73H W3A2

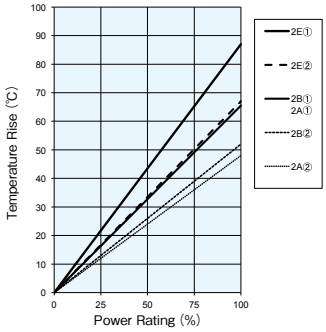


■Temperature Rise

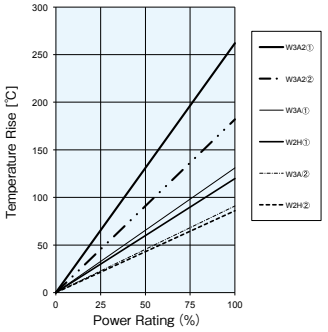
RK73H 1F-1J



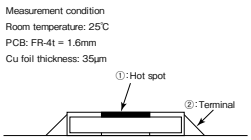
RK73H 2A-2E



RK73H W2H-W3A2

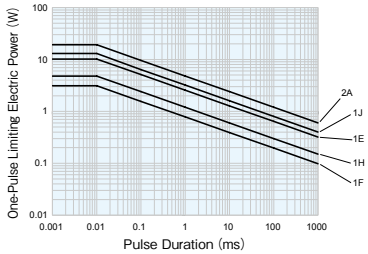


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

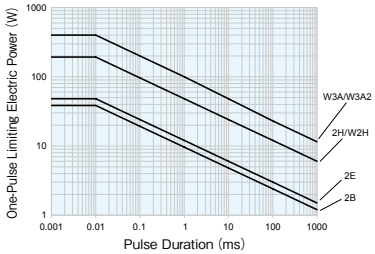


■One-Pulse Limiting Electric Power

RK73H 1F-2A



RK73H 2B-W3A2



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

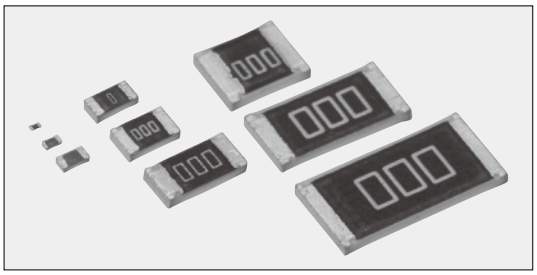
■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	1 : 1F 0.5 : others	Rated voltage×2.5 for 5s (1E, 2B, W3A2 : Rated voltage×2 for 5s)
Resistance to soldering heat	1 : 1F~W3A (10Ω≦R≦1MΩ) 3 : 1H~W3A (R<10Ω, R>1MΩ)	0.5 : 1F~W3A (10Ω≦R≦1MΩ) 1 : 1H~W3A (R<10Ω, R>1MΩ)	260℃±5℃, 10s±1s
Rapid change of temperature	1 : 1F, Characteristic「A」 (Heat shock resistance) 0.5 : others	0.5 : 1F, Characteristic「A」 (Heat shock resistance) 0.3 : others	Characteristic「Nil」(Standard) : −55℃ (30min.)/+125℃ (30min.) 100 cycles Characteristic「A」(Heat shock resistance) : −55℃ (30min.)/+125℃ (30min.) 1000 cycles
Moisture resistance	2 : 1J, 2A, 2B 3 : others	0.75 : 1J, 2A, 2B 1.5 : 1F 1 : others	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2 : 1J, 2A, 2B 3 : others	0.75 : 1J, 2A, 2B 1 : others	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.5 : 1F 0.3 : others	+125℃, 1000h : 1F +155℃, 1000h : 1H, 1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2

■Precautions for Use

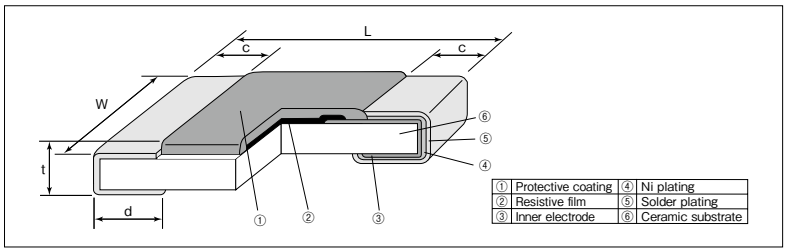
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON /OFF of load is repeated, especially when large types of W2H/W3A/W3A2 which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1F~2E, but the crack tends to occur in the types of W2H/W3A/W3A2. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- Care should be taken that RK73H1F may be damaged when static electricity occurs and is applied in the equipment.

RK73Z Flat Chip Jumper Resistors



Coating color : Green (1H, 1E)
Black (1F, 1J, 2A, 2B, 2E, W2H, W3A)

■Construction



■Features

- Wide lineup from 01005 to 2512 size.
- Excellent heat resistance and weather resistance, because of the use of glaze thick film as resistive film.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested (Exemption 1F).

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1F (01005)	0.4±0.02	0.2±0.02	0.10±0.03	0.11±0.03	0.13±0.02	0.04
1H (0201)	0.6±0.03	0.3±0.03	0.1±0.05	0.15±0.05	0.23±0.03	0.14
1E (0402)	1.0$^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	0.25$^{+0.05}_{-0.1}$	0.35±0.05	0.68
1E AT (0402)			0.25±0.1	0.3±0.15		
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.2	0.3$^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	0.4$^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		
2E (1210)		2.6±0.2	0.5±0.3	0.4$^{+0.2}_{-0.1}$		15.5
W2H※1 (2010)	5.0±0.2	2.5±0.2		0.65±0.15		24.3
W3A※1 (2512)	6.3±0.2	3.1±0.2				37.1

※1 RK73Z 2H and RK73Z 3A are also still available (different "d" dimensions=0.4$^{+0.2}_{-0.1}$mm)

■Type Designation

Example

RK73Z	2B		T	TD
Product Code	Current Rating	Characteristic	Terminal Surface Material	Taping
	1F : 0.5A 1H : 0.5A 1E : 1A 1J : 1A 2A : 2A 2B : 2A 2E : 2A W2H : 2A W3A : 2A	Nil : Standard A : Heat shock resistance※2	T : Sn G : Au※3 (L : Sn/Pb※4)	TX : 4mm width-1mm pitch plastic embossed TBL・TCM : 2mm pitch press paper TPL・TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk

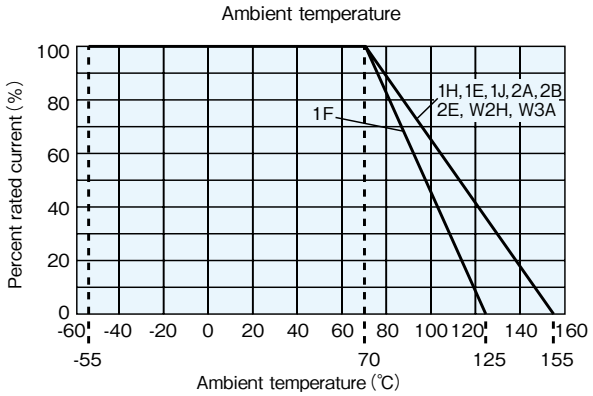
※2 With type A (1E,1J,2A,2B) only T is available as the terminal surface material.
※3 Products with gold plated electrodes are also available with 1E, 1J and 2A types (10Ω～1MΩ), so please consult with us.
※4 With type 1F and 1H, W2H, W3A only T is available as the terminal surface material.
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

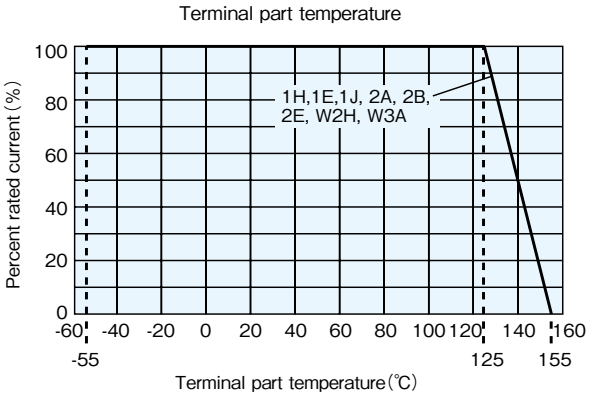
Type	Rated Ambient Temp.	Rated Terminal Part Temp.	Resistance	Current Rating	Max. Overload Current	Operating Temp. Range	Packaging & Q'ty /Reel (pcs)					
							TX	TBL	TCM※6	TPL・TP	TD	TE
1F	70℃	—	50mΩ max.	0.5A	1A	−55℃～+125℃	40,000	20,000	—	—	—	—
1H		125℃					—	—	15,000	—	—	—
1E	70℃	125℃	50mΩ max.	1A	2A		—	—	—	TPL : 20,000 TP : 10,000	—	—
1J							—	—	—	TP : 10,000※5	5,000	—
2A	70℃	125℃	50mΩ max.	2A	5A	−55℃～+155℃	—	—	—	TP : 10,000※5	5,000	4,000※5
2B					10A		—	—	—	—	5,000	4,000※5
2E							—	—	—	—	5,000	4,000※5
W2H							—	—	—	—	—	4,000
W3A							—	—	—	—	—	4,000

※5 Standard packaging : TD(4mm pitch punch paper)
※6 Standard taping specification of 1H is TCM. Previously available "TC(10,000pcs/Reel)" is not recommended for new designs.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer tovIntroduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve

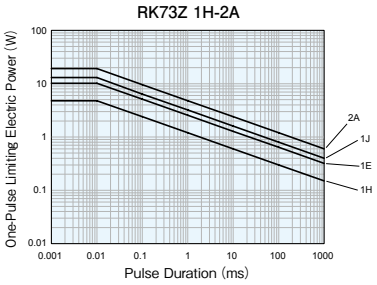


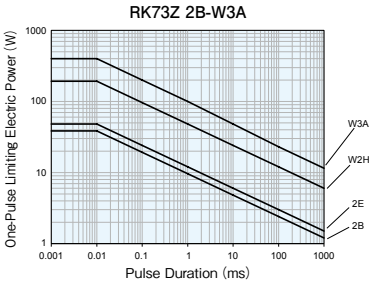
For resistors operated at an ambient temperature of 70℃ or higher, the current shall be derated in accordance with the above derating curve.



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■One-Pulse Limiting Electric Power





Please ask us about the resistance characteristic of continuous applied pulse.
Please calculate One-Pulse Limiting Electric Power using upper limit of resistance (50mΩ or 100mΩ) for applied current.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

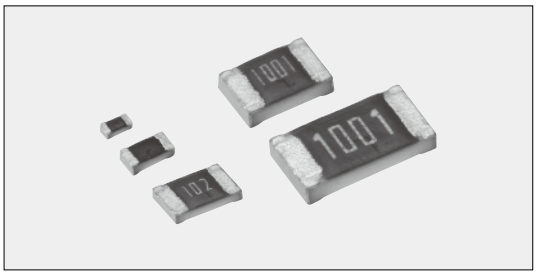
■Performance

Test Items	Performance Requirements		Test Methods
	Limit	Typical	
Resistance	50mΩ Max. after the test	15mΩ Max. after the test	25℃
Overload (Short time)	50mΩ Max. after the test	18mΩ Max. after the test	Max. overload current, 5s, 1 cycle
Resistance to soldering heat	50mΩ Max. after the test	15mΩ Max. after the test	260℃±5℃, 10s±1s
Rapid change of temperature	50mΩ Max. after the test	15mΩ Max. after the test	Characteristic「Nil」(Standard) : −55℃ (30min.)/+125℃ (30min.) 100 cycles Characteristic「A」(Heat shock resistance) : −55℃ (30min.)/+125℃ (30min.) 1000 cycles
Moisture resistance	100mΩ Max. after the test	18mΩ Max. after the test	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	100mΩ Max. after the test	18mΩ Max. after the test	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	100mΩ Max. after the test	15mΩ Max. after the test	+125℃, 1000h : 1F +155℃, 1000h : 1H, 1E, 1J, 2A, 2B, 2E, W2H, W3A

■Precautions for Use

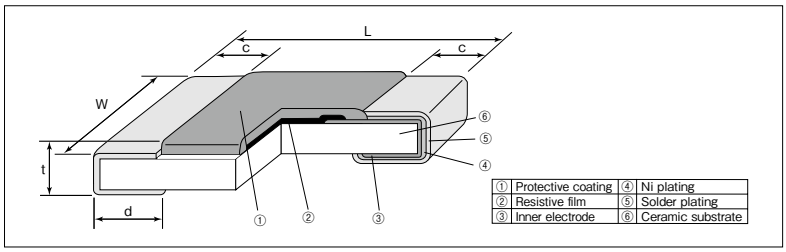
• The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of W2H/W3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1F～2E, but the crack tends to occur in the types of W2H/W3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

RK73G Flat Chip Resistors (Ultra Precision Grade)



Coating color : Black (1H, 1E), Dark blue (1J, 2A, 2B)

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Solder plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- Metal-glaze thick film resistor for surface mounting.
- High precision resistor with T.C.R. ±50×10^{-6}/K and tolerance ±0.25%.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Car electronics, Industrial equipment, Industrial measurement
- Replacement of metal film chip resistors.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight(g) (1000pcs)
1H(0201)	0.6±0.03	0.3±0.03	0.1±0.05	0.15±0.05	0.23±0.03	0.14
1E(0402)	$1.0^{\pm0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1E AT(0402)			0.25±0.1	0.3±0.15		
1J(0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
1J AT(0603)			0.35±0.15	0.5±0.2		
2A(0805)	2.0±0.2	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT(0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B(1206)	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT(1206)			0.55±0.35	0.8±0.2		

■Type Designation

Example

RK73G	2A		T	TD	1002	D
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1H : 0.05W 1E : 0.1W 1J : 0.1W 2A : 0.125W 2B : 0.25W	Nil : Standard A : Heat shock resistance※1	T : Sn (L : Sn/Pb※2)	TCM : 2mm pitch press paper TPL・TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	4 digits	C : ±0.25% D : ±0.5% F : ±1%

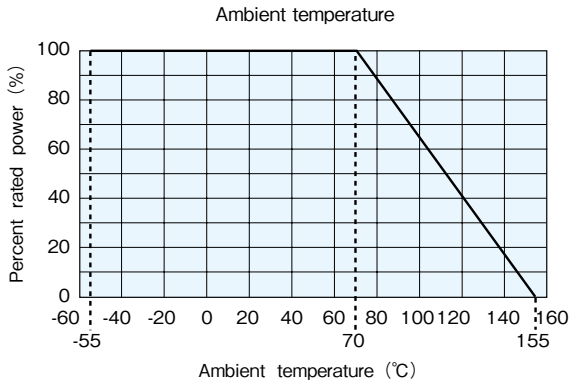
※1 With type A (1E,1J,2A,2B) only T is available as the terminal surface material.
※2 With type 1H, only T is available as the terminal surface material.
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

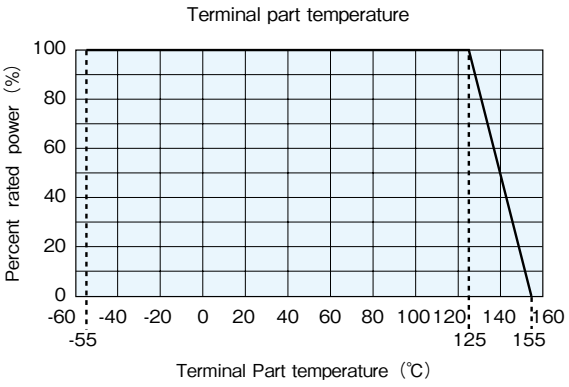
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) C:±0.25% E24・E96	D:±0.5% E24・E96	F:±1% E24・E96	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty /Reel (pcs) TCM※5	TPL・TP	TD	TE
1H	0.05W	70℃	125℃	±50	—	100～1M※3	100～1M※3	25V	50V	15,000	—	—	—
1E	0.1W				100～1M	10～1M	10～1M	50V	100V	—	TPL : 20,000 TP : 10,000	—	—
1J	0.1W							75V	150V	—	TP : 10,000※4	5,000	—
2A	0.125W							150V	200V	—	—	5,000	4,000※4
2B	0.25W							200V	400V	—	—	5,000	4,000※4

Operating Temperature Range : −55℃～+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
For flat chip jumper resistor, please refer to RK73Z series.
※3 The nominal resistance value for RK73G 1H (D : ±0.5%、F : ±1%) is E24.
※4 Standard packaging : TD(4mm pitch punch paper)
※5 Standard taping specification of 1H is TCM. Previously available "TC(10,000pcs/Reel)" is not recommended for new designs.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve

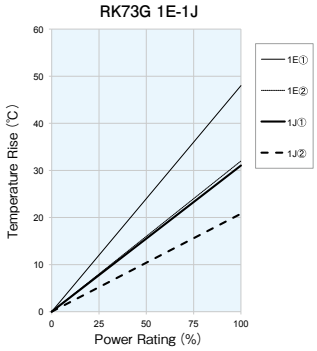


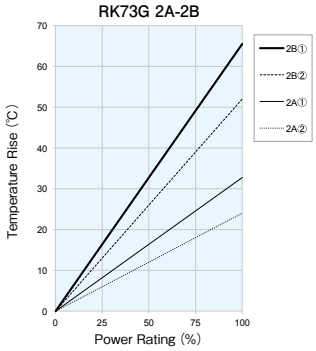
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.



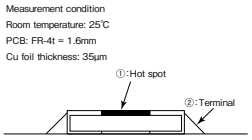
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

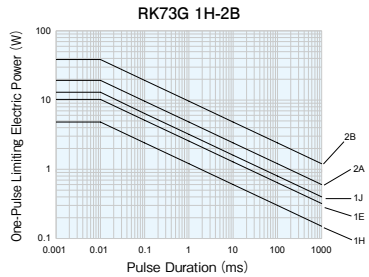




Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

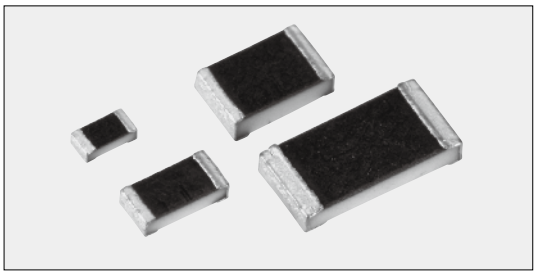
■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃ : 1H +25℃/−55℃ and +25℃/+125℃ : 1E, 1J, 2A, 2B
Overload (Short time)	2	0.6	Rated voltage×2.5 for 5s (1E, 2B : Rated voltage×2 for 5s)
Resistance to soldering heat	1	1 : 1H 0.4 : 1E, 1J, 2A, 2B	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : Characteristic 「Nil」(Standard) 1 : Characteristic 「A」 (Heat shock resistance)	0.3 : Characteristic 「Nil」(Standard) 0.5 : Characteristic 「A」 (Heat shock resistance)	Characteristic 「Nil」(Standard) −55℃ (30min.)/+125℃ (30min.) 100 cycles Characteristic 「A」(Heat shock resistance) : −55℃ (30min.)/+125℃ (30min.) 1000 cycles
Moisture resistance	3 : 1H, 1E 2 : 1J, 2A, 2B	1 : 1H, 1E 0.6 : 1J, 2A, 2B	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3 : 1H, 1E 2 : 1J, 2A, 2B	1 : 1H, 1E 0.6 : 1J, 2A, 2B	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.6	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

RS73 High Reliability Chip Resistors



Coating color : Black

■Features

- Metal-glaze thick film resistor for surface mounting.
- High precision resistor with T.C.R. ±25×10^{-6}/K～ and tolerance ±0.1%～.
- High reliability with ⊿R of ±0.2%～±0.5% in the Reliability test.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

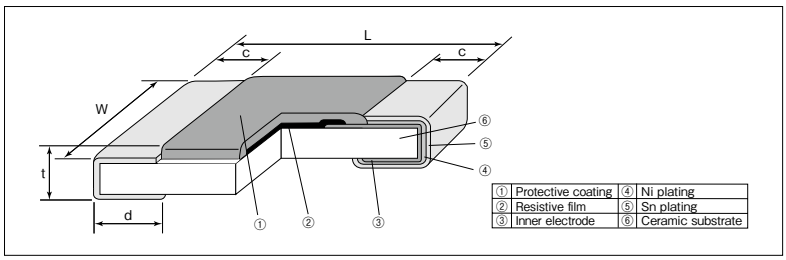
■Applications

- Car electronics, Industrial equipment, Industrial measurement

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight(g) (1000pcs)
	L	W	c	d	t	
1E(0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J(0603)	1.6±0.2	0.8±0.1	0.2±0.1	0.3±0.1	0.45±0.1	2.14
2A(0805)	2.0±0.2	1.25±0.1	0.25±0.15	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B(1206)	3.2±0.2	1.6±0.2	0.35±0.15	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14

■Type Designation

Example

RS73F	1J	T	TD	1002	B
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
RS73F RS73G	1E : 0.125W 1J : 0.2W 2A : 0.25W 2B : 0.33W	T : Sn	TPL・TP : 2mm pitch punch paper TD : 4mm pitch punch paper BK : Bulk	4 digits	B : ±0.1% C : ±0.25% D : ±0.5% F : ±1.0%

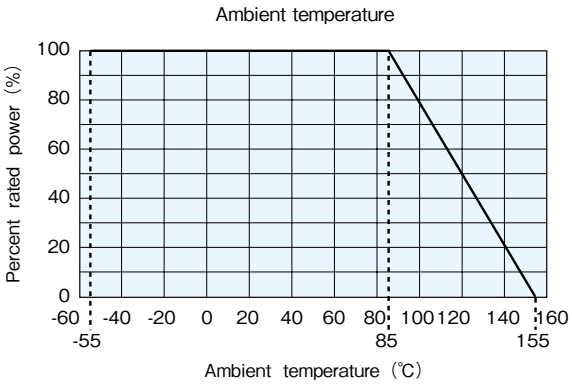
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

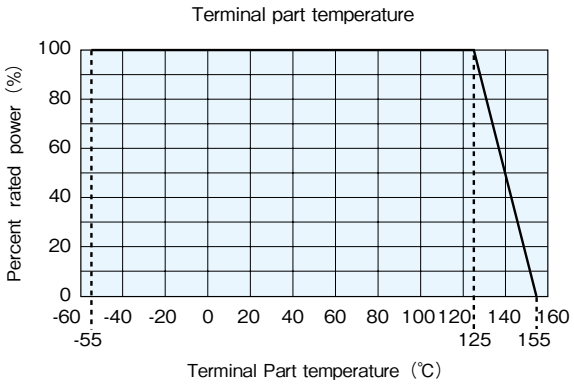
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω)※2				Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel(pcs)	
					B:±0.1% E24・E96	C:±0.25% E24・E96	D:±0.5% E24・E96	F:±1.0% E24・E96			TPL・TP	TD
RS73F1E	0.125W	85℃	125℃	±25※1	300～100k	300～1M	300～1M	300～1M	75V	100V	TPL:20,000 TP:10,000	—
RS73G1E				±50								
RS73F1J	0.2W			±25※1	10～1M	10～1M	10～1M	10～1M	100V	150V	—	5,000
RS73G1J				±50								
RS73F2A	0.25W			±25※1	10～3M	10～6.8M	10～10M	10～10M	150V	300V		
RS73G2A				±50								
RS73F2B	0.33W			±25※1	10～1M	10～1M	10～10M	10～10M	200V	400V		
RS73G2B				±50								

Operating Temperature Range : −55℃～+155℃
Rated voltage=√Power Rating×Resistance value or Max. working voltage, whichever is lower.
For flat chip jumper resistor, please refer to RK73Z series.
※1 Measurement Temperature: +25℃/+125℃. Cold T.C.R. (−55℃/+25℃) is −50～+25×10^{-6}/K.
※2 Please inquire of us about E192.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve

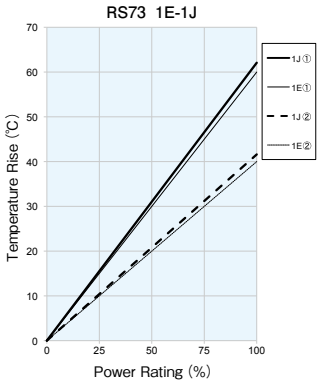


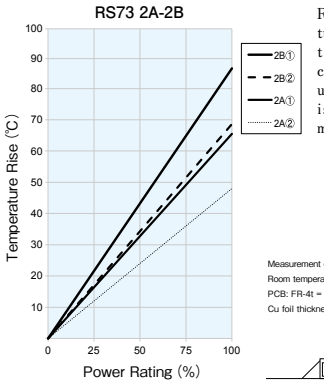
For resistors operated at an ambient temperature of 85℃ or higher, the power shall be derated in accordance with the above derating curve.



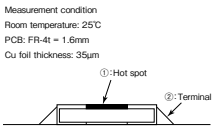
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

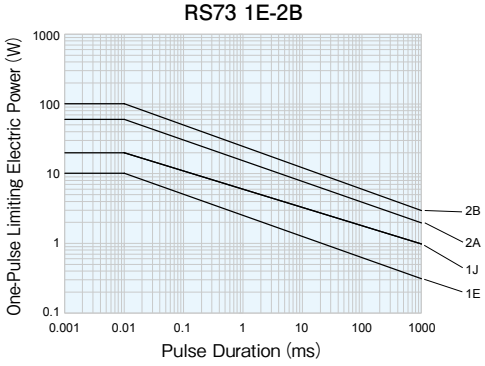




Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

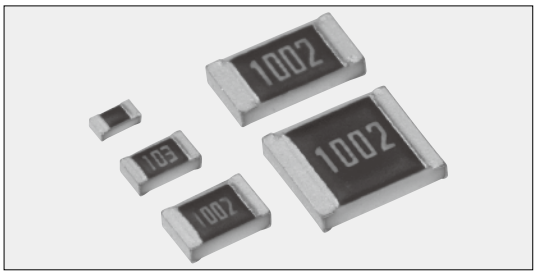
■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	0.2	0.03	Rated voltage×2.5 for 5s
Resistance to soldering heat	0.2	0.1	260℃±5℃, 10s±1s
Rapid change of temperature	0.2 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.4 : others	0.05 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.2 : others	−55℃ (30min.) / +125℃ (30min.) 1000 cycles
Moisture resistance	0.2 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦10MΩ) 0.4~0.5 : others	0.04 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦10MΩ) 0.08 : others	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 85℃ or rated terminal part temperature	0.2 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.4 : others	0.05 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.2 : others	85℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.2 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦100kΩ) 0.4~0.5 : others	0.1 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦100kΩ) 0.2~0.3 : others	+155℃, 1000h

■Precautions for Use

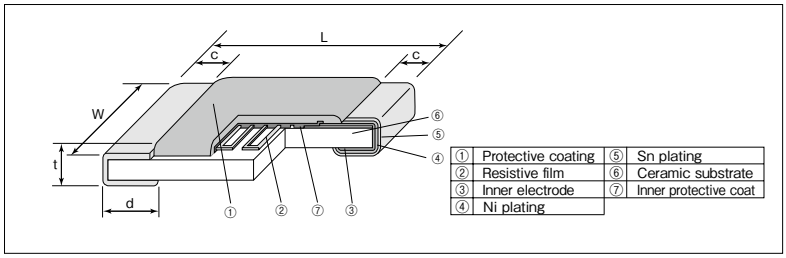
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

RN73H Metal Film Flat Chip Resistors (For Automotive, High reliability)



Coating color : Black

■Construction



■Features

- SMD metal film resistors.
- High precision type ±0.05% is also available as standard.
- High performance T.C.R. ±5×10^{-6}/K is also available as standard.
- Low current noise.
- Operating temperature range ～155℃.
  Rated ambient temperature : 85℃
- High reliability with ΔR of ±0.1% in the long-term reliability test.
- Endurance at 85℃ (3,000h) : ΔR of ±0.1%
- Improved moisture resistance by special protective coating.
- High precision resistor solution for tough environments, especially in high reliable automotive, medical and industrial applications.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.
- Sulfur resistance verified according to ASTM B 809-95.

■Applications

- Automotive electronics (Power Train, Body Control)
- Industrial equipment
- Medical equipment
- Measurement equipment

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2133A

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1E (0402)	1.0$^{+0.1}_{-0.05}$	0.5±0.05	0.25±0.1	0.25$^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.2	0.4±0.2	0.3$^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	0.4$^{+0.2}_{-0.1}$	0.6±0.1	9.14
2E (1210)		2.5±0.2				14.5

■Type Designation

Example

RN73H	2B	T	TD	1002	B	25
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10^{-6}/K)
	1E:0.063W 1J:0.1W 2A:0.125W 2B:0.25W 2E:0.25W	T:Sn G:Au※1	TP:2mm pitch punch paper TD:4mm pitch paper TE:4mm pitch plastic embossed BK:Bulk	4 digits	A:±0.05% B:±0.1% C:±0.25% D:±0.5% F:±1%	05 10 25 50 100

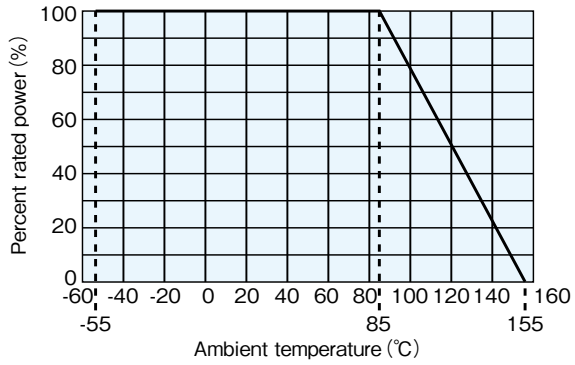
※1 Products with gold plated electrodes are also available with 1E and 1J type, so please consult with us.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

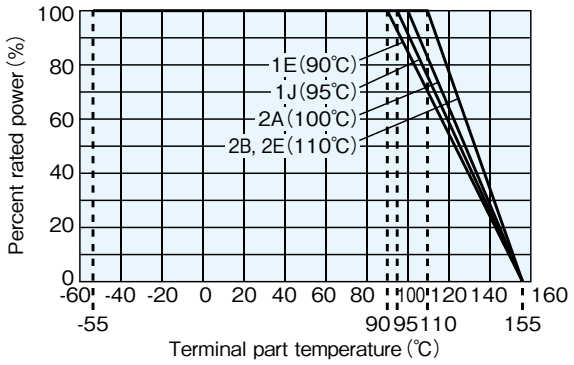
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) E24・E96・E192 A:±0.05%	B:±0.1%	C:±0.25%	D:±0.5%	F:±1%	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty/Reel (pcs) TP	TD	TE
1E	0.063W	85℃	90℃	±5	–	220～10k	–	–	–	50V	100V	10,000	–	–
				±10	–	47～100k	47～100k	47～100k	47～100k					
				±25	–	47～300k	47～300k	47～300k	47～300k					
				±50	–	47～300k	47～300k	10～300k	10～300k					
1J	0.1W	85℃	95℃	±5	100～59k	100～59k	–	–	–	75V	150V	–	5,000	–
				±10	47～59k	47～360k	47～360k	47～360k	47～360k					
				±25	47～59k	15～1M	15～1M	10～1M	10～1M					
				±50	–	15～1M	15～1M	10～1M	10～1M					
				±100	–	–	–	10～1M	10～1M					
2A	0.125W	85℃	100℃	±5	100～100k	100～100k	–	–	–	150V	300V	–	5,000	4,000
				±10	47～100k	47～1M	47～1M	47～1M	47～1M					
				±25	47～100k	15～1.5M	15～1.5M	10～1.5M	10～1.5M					
				±50	–	15～1.5M	15～1.5M	10～1.5M	10～1.5M					
				±100	–	–	–	10～1.5M	10～1.5M					
2B	0.25W	85℃	110℃	±5	100～300k	100～300k	–	–	–	200V	400V	–	5,000	4,000
				±10	47～300k	47～1M	47～1M	47～1M	47～1M					
				±25	47～300k	15～1M	15～1M	10～1M	10～1M					
				±50	–	15～1M	15～1M	10～1M	10～1M					
				±100	–	–	–	10～1M	10～1M					
2E	0.25W	85℃	110℃	±10	100～510k	100～510k	100～510k	100～510k	100～510k	200V	400V	–	5,000	4,000
				±25	51～510k	15～1M	15～1M	10～1M	10～1M					
				±50	–	15～1M	15～1M	10～1M	10～1M					
				±100	–	–	–	10～1M	10～1M					

Operating Temperature Range : −55℃～+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve



For resistors operated at an ambient temperature of 85℃ or higher, the power shall be derated in accordance with the above derating curve.



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃ : T.C.R.=±5(×10⁻⁶/K) +25℃/−55℃ and +25℃/+155℃ : others
Overload (Short time)	0.05	0.01	Rated voltage × 2.5 or Max. overload., whichever is less, for 5s
Resistance to soldering heat	0.05※2	0.01	260℃±5℃, 10s±1s
Rapid change of temperature	0.1※2	0.02	1E, 1J, 2A : −55℃ (30min.)/+155℃ (30min.) 1000 cycles 2B, 2E : −55℃ (30min.)/+155℃ (30min.) 500 cycles
Moisture resistance	0.1※2	0.05	85℃±2℃, 85%±5%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 85℃	0.1	0.03	85℃±2℃, 3000h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.1※2	0.05	+155℃, 1000h

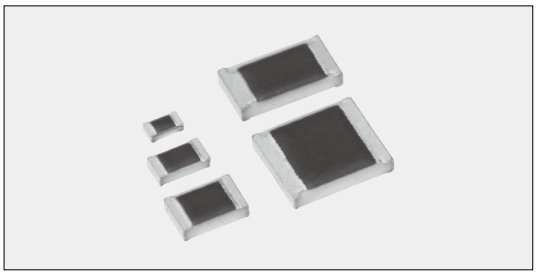
※2 Depends on resistance value.

■Precautions for Use

- The properly and electrostatically measured taping materials are used for the components, but attention should be paid to the fact that there is some danger the parts absorb on the top tapes to cause a failure in the mounting and the parts are destructed by static electricity (1J, 2A, 2B, 2E: 1kV and more, 1E: 0.5kV and more at Human Body Model 100pF, 1.5kΩ) to change the resistance in the conditions of an excessive dryness or after the parts are given vibration for a long time as they are packaged on the tapes. Similarly, care should be given not to apply the excessive static electricity when mounting on the boards.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. while perspiration and saliva include ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. Therefore these kinds of ionic substances may induce electrical corrosion when they invade into the products. Either thorough washing or using RMA solder and flux are necessary since lead free solder contains ionic substances. Washing process is needed, before putting on moisture proof material in order to prevent electrical corrosion.
- When heat-resistant masking tapes are attached to the chip resistors at the time of mounting and then detached, there is a possibility of exfoliation of the top electrodes. It is known that the heat applied in the mounting process will enhance the adhesion strength of the tape adhesive so please avoid the use. If the use of masking tapes are unavoidable, then please be sure not to attach the tape adhesives directly on the products.
  When high-pressure shower cleaning is implemented, there is a possibility of exfoliation of the top electrodes caused by the water pressure stress so please avoid the implementation.
  If the implementation is unavoidable, then please evaluate the products beforehand.

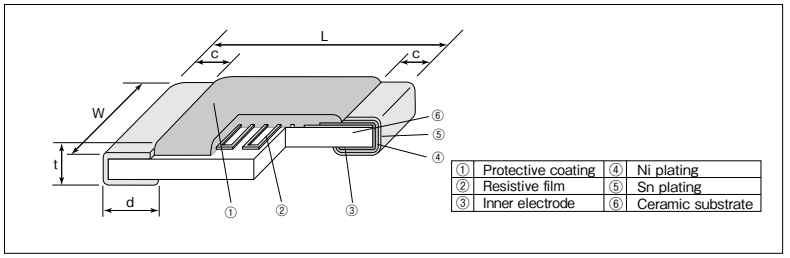
METAL FILM (PRECISION)

RN73R Metal Film Flat Chip Resistors (High reliability)



Coating color : Black

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- SMD metal film resistors.
- High precision type ±0.05% is also available as standard.
- High performance T.C.R. ±5×10^{-6}/K is also available as standard.
- Low current noise.
- Operating temperature range ～155℃.
  Rated ambient temperature : 85℃
- High reliability with ΔR of ±0.1%～±0.25% in the long-term reliability test.
- Endurance at 85℃ (1,000h) : ΔR of ±0.1%
- Improved moisture resistance by high humidity protective coating.
- Suitable for control circuits in various industrial equipment.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.
- Sulfur resistance verified according to ASTM B 809-95.

■Applications

- Automotive electronics
- Industrial equipment
- Measurement equipment

※For higher precision, RN73H series is available.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2133A

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.25±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.2	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2E (1210)		2.5±0.2				14.5

■Type Designation

Example

RN73R	2B	T	TD	1002	B	25
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10^{-6}/K)
	1E : 0.063W 1J : 0.1W 2A : 0.125W 2B : 0.25W 2E : 0.25W	T : Sn	TP : 2mm pitch punch paper TD : 4mm pitch paper TE : 4mm pitch plastic embossed BK : Bulk	4 digits	A : ±0.05% B : ±0.1% C : ±0.25% D : ±0.5% F : ±1%	05 10 25 50 100

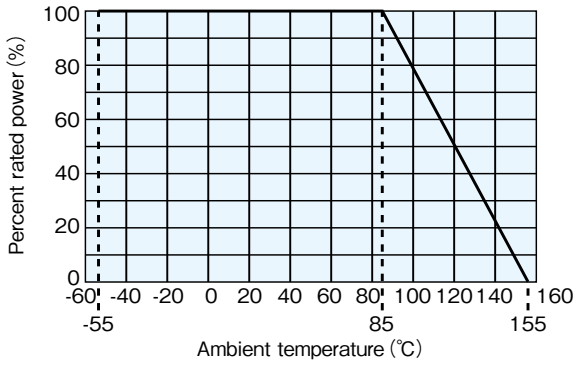
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

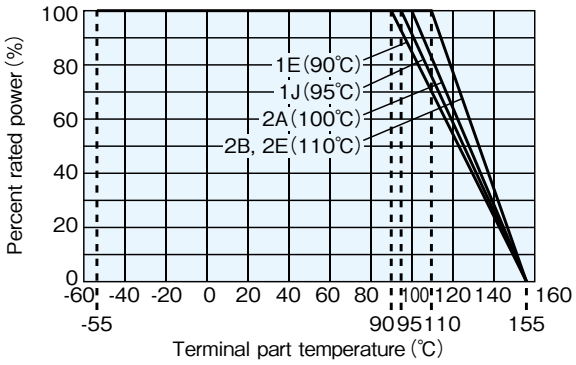
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) E24・E96・E192 A:±0.05%	B:±0.1%	C:±0.25%	D:±0.5%	F:±1%	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty/Reel (pcs) TP	TD	TE
1E	0.063W	85℃	90℃	±10	–	47～10k	47～10k	47～10k	47～10k	50V	100V	10,000	–	–
				±25	–	47～300k	47～300k	10～300k	10～300k					
				±50	–	47～300k	47～300k	10～300k	10～300k					
1J	0.1W	85℃	95℃	±5	100～59k	100～59k	–	–	–	75V	150V	–	5,000	–
				±10	47～59k	47～59k	47～59k	47～59k	47～59k					
				±25	47～59k	15～1M	15～1M	10～1M	10～1M					
				±50	–	15～1M	15～1M	10～1M	10～1M					
				±100	–	–	–	10～1M	10～1M					
2A	0.125W	85℃	100℃	±5	100～100k	100～100k	–	–	–	150V	300V	–	5,000	4,000
				±10	47～100k	47～100k	47～100k	47～100k	47～100k					
				±25	47～100k	15～1.5M	15～1.5M	10～1.5M	10～1.5M					
				±50	–	15～1.5M	15～1.5M	10～1.5M	10～1.5M					
				±100	–	–	–	10～1.5M	10～1.5M					
2B	0.25W	85℃	110℃	±5	100～300k	100～300k	–	–	–	200V	400V	–	5,000	4,000
				±10	47～300k	47～300k	47～300k	47～300k	47～300k					
				±25	47～300k	15～1M	15～1M	10～1M	10～1M					
				±50	–	15～1M	15～1M	10～1M	10～1M					
				±100	–	–	–	10～1M	10～1M					
2E	0.25W	85℃	110℃	±10	100～510k	100～510k	100～510k	100～510k	100～510k	200V	400V	–	5,000	4,000
				±25	51～510k	15～1M	15～1M	10～1M	10～1M					
				±50	–	15～1M	15～1M	10～1M	10～1M					
				±100	–	–	–	10～1M	10～1M					

Operating Temperature Range : −55℃～+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve



For resistors operated at an ambient temperature of 85℃ or higher, the power shall be derated in accordance with the above derating curve.



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

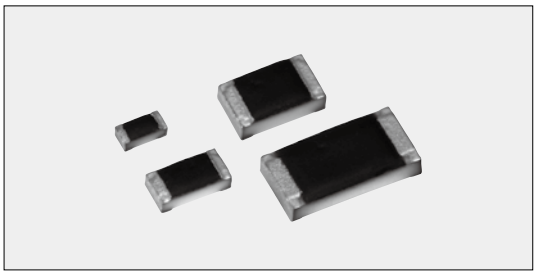
Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃ : T.C.R.=±5(×10⁻⁶/K) +25℃/−55℃ and +25℃/+155℃ : others
Overload (Short time)	0.05	0.01	Rated voltage × 2.5 or Max. overload., whichever is less, for 5s
Resistance to soldering heat	0.05※1	0.01	260℃±5℃, 10s±1s
Rapid change of temperature	0.1※1	0.04	1E, 1J, 2A : −55℃ (30min.)/+155℃ (30min.) 1000 cycles 2B, 2E : −55℃ (30min.)/+155℃ (30min.) 500 cycles
Moisture resistance	0.25	0.07	85℃±2℃, 85%±5%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 85℃	0.1	0.04	85℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.25	0.10	+155℃, 1000h

※1 Depends on resistance value.

■Precautions for Use

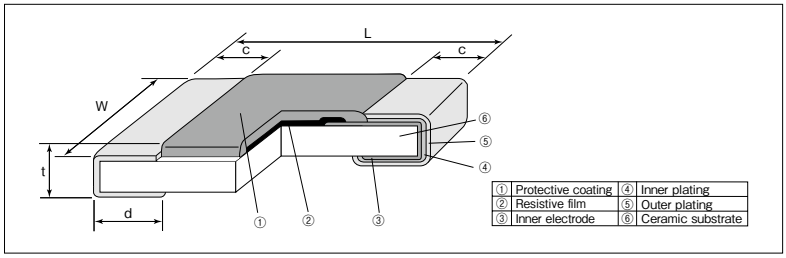
- The properly and electrostatically measured taping materials are used for the components, but attention should be paid to the fact that there is some danger the parts absorb on the top tapes to cause a failure in the mounting and the parts are destructed by static electricity (1J, 2A, 2B, 2E: 1kV and more, 1E: 0.5kV and more at Human Body Model 100pF, 1.5kΩ) to change the resistance in the conditions of an excessive dryness or after the parts are given vibration for a long time as they are packaged on the tapes. Similarly, care should be given not to apply the excessive static electricity when mounting on the boards.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. while perspiration and saliva include ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. Therefore these kinds of ionic substances may induce electrical corrosion when they invade into the products. Either thorough washing or using RMA solder and flux are necessary since lead free solder contains ionic substances. Washing process is needed, before putting on moisture proof material in order to prevent electrical corrosion.
- When heat-resistant masking tapes are attached to the chip resistors at the time of mounting and then detached, there is a possibility of exfoliation of the top electrodes. It is known that the heat applied in the mounting process will enhance the adhesion strength of the tape adhesive so please avoid the use. If the use of masking tapes are unavoidable, then please be sure not to attach the tape adhesives directly on the products.
  When high-pressure shower cleaning is implemented, there is a possibility of exfoliation of the top electrodes caused by the water pressure stress so please avoid the implementation.
  If the implementation is unavoidable, then please evaluate the products beforehand.

HSG73P High Temperature Flat Chip Resistors



Coating color：Black

■Construction



■Features

- High heat resistance that can be used even at high temperatures of 155℃ or higher. The maximum operating temperature of Sn plating products compatible with solder mounting is 175℃, and Au plating products compatible with conductive glue mounting is 200℃.
- Excellent heat resistance and weather resistance are ensured by the use of metal glaze thick film.
- High stability and high reliability with the triple-layer structure of electrode.
- Superior to RK73 series chip resistors pulse withstanding voltage and high power.
- Applicable to various kinds of automatic mounters for taping, etc.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.15	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1E AT (0402)				0.3±0.15		
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.15	0.3±0.1	0.45±0.1	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.25	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B (1206)	3.2±0.2	1.6±0.2	0.55±0.35	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT (1206)				0.8±0.2		

■Type Designation

Example

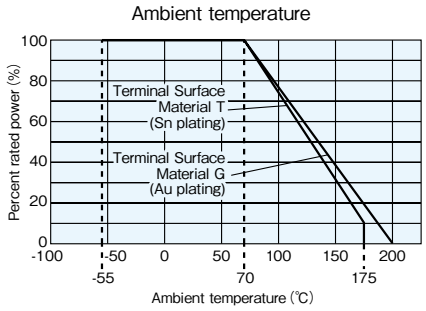
HSG73P	2B		T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E：0.125W 0.2W※1 1J：0.2W 0.33W 2A：0.25W 0.5W 2B：0.33W 0.75W	Nil:Standard NEW A:Heat shock resistance※2	T：Sn G：Au	TP：2mm pitch punch paper TD：4mm pitch punch paper BK：Bulk	F：4 digits J：3 digits	F：±1% J：±5%

※2 With type A only T is available as the terminal surface material.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

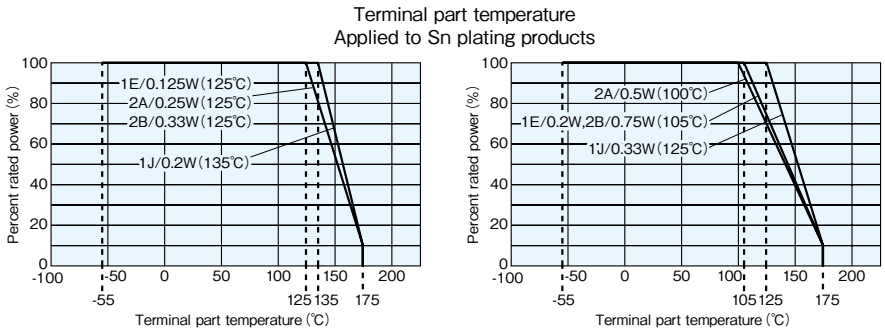
Type	Power Rating	Rated Ambient Temp.		Rated Terminal Part Temp.		T.C.R. (×10⁻⁶/K)	Resistance Range(Ω)		Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs)	
		Terminal Surface Material:T (Sn plating)	Terminal Surface Material:G (Au plating)	Terminal Surface Material:T (Sn plating)	Terminal Surface Material:G (Au plating)		F：±1% E24	J：±5% E24			TP	TD
1E	0.125W	70℃	70℃	125℃	—	±200	10～1M	1～10M	75V	100V	10,000	—
	0.2W※1	70℃	—	105℃	—							
1J	0.2W	70℃	70℃	135℃	—	±200	10～1M	1～10M	150V	200V	—	5,000
	0.33W※1	70℃	—	125℃	—							
2A	0.25W	70℃	70℃	125℃	—	±200	10～1M	1～10M	200V	400V	—	5,000
	0.5W※1	70℃	—	100℃	—							
2B	0.33W	70℃	70℃	125℃	—	±200	10～1M	1～10M	200V	400V	—	5,000
	0.75W※1	70℃	—	105℃	—							

Operating Temperature Range：−55℃～+175℃(Terminal Surface Material:T)、−55℃～+200℃(Terminal Surface Material:G)
Rated voltage＝$\sqrt{\text{Power Rating}\times\text{Resistance value or Max. working voltage, whichever is lower.}}$
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the “Rated Ambient Temperature” or the “Rated Terminal Part Temperature” in your usage conditions, please give priority to the “Rated Terminal Part Temperature”.
For more details, please refer to “Introduction of the derating curves based on the terminal part temperature” on the beginning of our catalog.

■Derating Curve

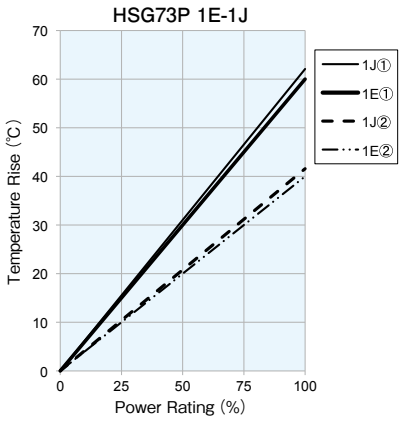


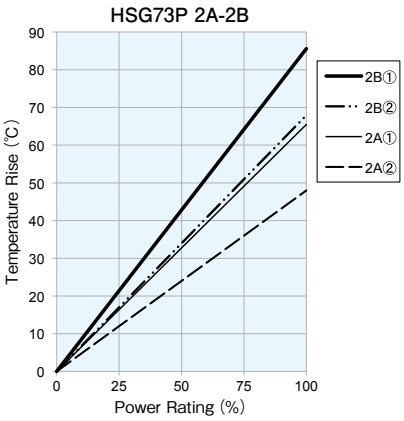
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.



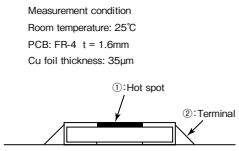
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※1, please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

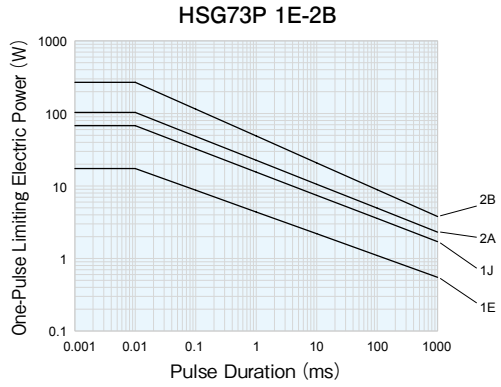




Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.

■Performance

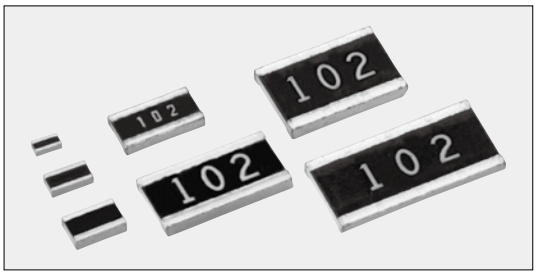
Test Items	Performance Requirements ΔR±(%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	Characteristic「Nil」(Standard) : +25℃/−55℃,+25℃/+125℃ Characteristic「A」(Heat shock resistance) : +25℃/−55℃,+25℃/+175℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s (2A : 0.5W, 2B : 0.75W Rated volatege×2 for 5s)
Rapid change of temperature	0.5 : Characteristic「Nil」(Standard) 1 : Characteristic「A」(Heat shock resistance)	0.3 : Characteristic「Nil」(Standard) 0.5 : Characteristic「A」(Heat shock resistance)	Characteristic「Nil」(Standard) : −55℃ (30min.) /+125℃ (30min.) 100 cycles Characteristic「A」(Heat shock resistance) : −55℃ (30min.) /+175℃ (30min.) 1000 cycles
Moisture resistance	2 : 1J, 2A, 2B 3 : 1E	0.75 : 1J, 2A, 2B 1 : 1E	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	2 : 1J, 2A, 2B 3 : 1E	0.75 : 1J, 2A, 2B 1 : 1E	70℃±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2	0.5	+200℃, 1000h (Terminal Surface Material「G」: Au plating products)
Endurance at 175℃	1	0.3	+175℃,1000h,Power Rating×10%(Terminal Surface Material「T」: Sn plating products)

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

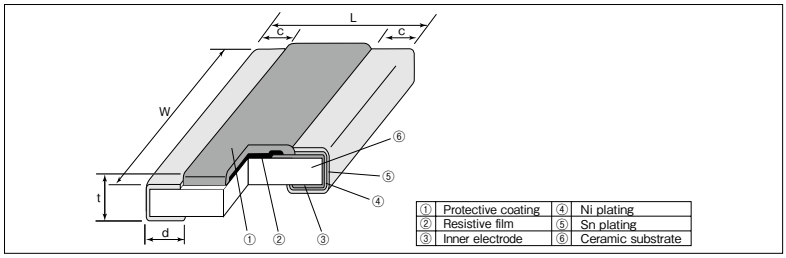
THICK FILM (WIDE TERMINAL TYPE)

WK73R Wide Terminal Type Flat Chip Resistors



Coating color : Black

■Construction



■Features

- Flat chip resistors of wide terminal type.
- High reliability and performance with T.C.R.±100×10^{-6}/K, resistance tolerance ±0.5%.
- Suitable for both reflow and flow solderings.
- Products meet EU-RoHS requirements.
  EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Power supply, ECU etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1E (0204)	0.5±0.05	1.0±0.05	0.15±0.05	0.15±0.05	0.35±0.05	0.65
1J (0306)	0.8±0.1	1.6±0.1	0.15±0.1	0.2±0.1	0.45±0.1	2.13
2A (0508)	1.25±0.15	2.0±0.15	0.3±0.2	0.35±0.2	0.55±0.1	4.93
2B (0612)	1.6±0.15	3.2±0.2	0.3±0.2	0.45±0.15	0.6±0.1	12.0
2H (1020)	2.5±0.15	5.0±0.15	0.4±0.2	0.75±0.15		30.2
2J (1218)	3.1±0.15	4.6±0.15	0.4±0.2			33.3
3A (1225)		6.3±0.15	0.45±0.2			45.6

■Type Designation

Example

WK73R	2B	T	TD	1002	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E:0.33W※1 1J:0.5W※1 2A:0.75W※1 1W※1 2B:0.75W 1W※1 2H:1W 2J:1W 3A:1.5W 2W※1	T : Sn	TP: 2mm pitch punch paper TD: 4mm pitch punch paper TE: 4mm pitch plastic embossed BK: Bulk	D,F: 4 digits J: 3 digits	D:±0.5% F:±1% J:±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

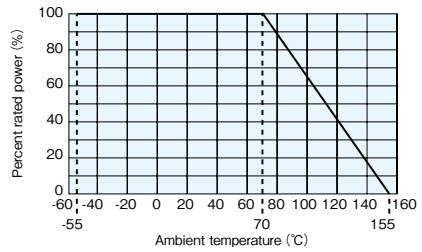
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) D : ±0.5% E24・E96	Resistance Range (Ω) F : ±1% E24・E96	Resistance Range (Ω) J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty/Reel (pcs) TP	TD	TE
WK73R1E	0.33W※1	70℃	125℃	±100	–	10~1M	10~1M	75V	100V	10,000	–	–
WK73R1J	0.5W※1	70℃	125℃	±100	–	10~1M	10~1M	150V	200V	–	5,000	–
WK73R2A	0.75W※1	70℃	125℃	±100	–	20.5k~1M	22k~1M	200V	400V	–	5,000	–
	1W※1	70℃	125℃	±100	–	10~20k	10~20k					
WK73R2B	0.75W	70℃	125℃	±100	10~1M	10~1M	10~1M			–	5,000	–
	1W※1	70℃	115℃	±100	10~9.76k	10~9.76k	10~9.1k					
WK73R2H	1W	70℃	125℃	±100	–	10~430k	10~430k			–	–	4,000
				±200	–	432k~1M	470k~1M					
WK73R2J	1W	70℃	100℃	±100	–	10~510k	10~510k			–	–	4,000
				±200	–	511k~1M	560k~1M					
WK73R3A	1.5W	70℃	125℃	±100	–	10~330k	10~330k			–	–	4,000
				±200	–	332k~1M	360k~1M					
	2W※1	70℃	115℃	±100	–	10~330k	10~330k					
				±200	–	332k~1M	360k~1M					

Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

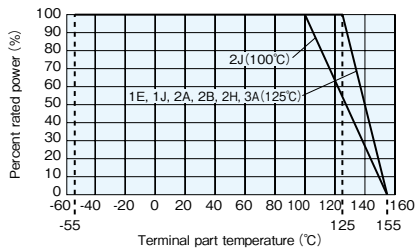
■Derating Curve

Ambient temperature

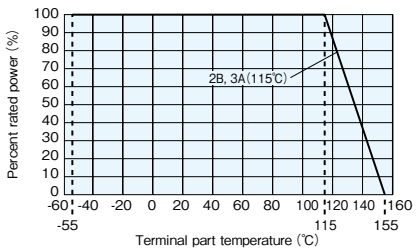


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the derating curve.

Terminal part temperature



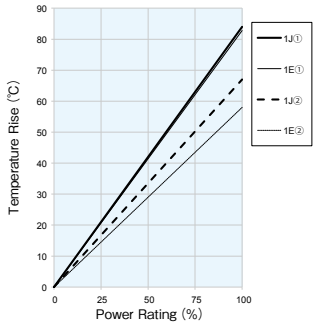
Terminal part temperature
WK73R2B(1W)、WK73R3A(2W)



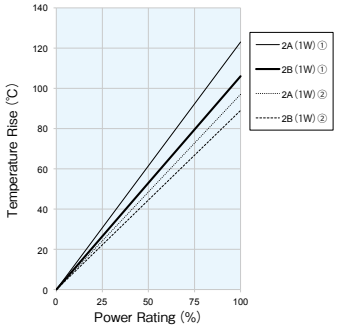
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

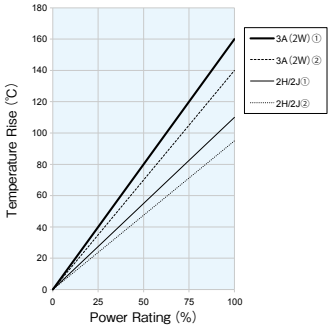
WK73R 1E-1J



WK73R 2A-2B

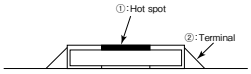


WK73R 2H-3A



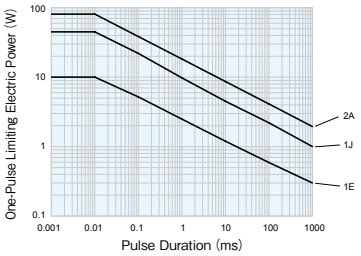
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm

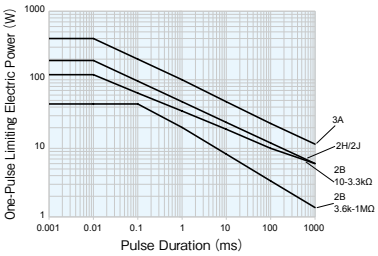


■One-Pulse Limiting Electric Power

WK73R 1E-2A



WK73R 2B-3A



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

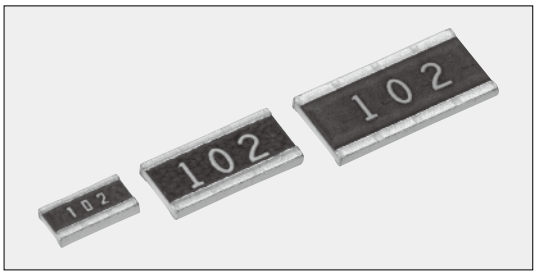
Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2.5 for 5s (WK73R1E(0.33W)、WK73R2A(0.75W、1W)、WK73R2B(1W)、WK73R3A(2W)) Rated voltage×2.0 for 5s
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	3 : 1E 2 : others	1 : 1E 0.2 : others	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3 : 1E 2 : others	1 : 1E 0.2 : others	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.2	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WK73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

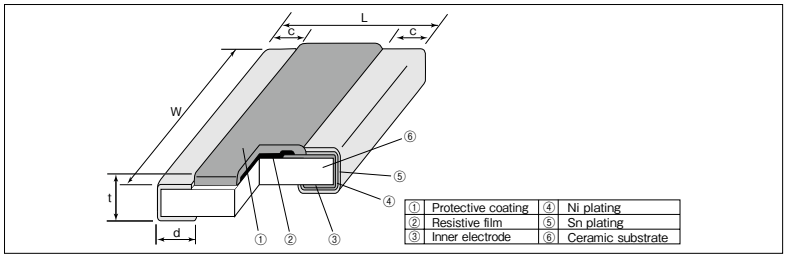
THICK FILM (WIDE TERMINAL TYPE)

WK73R Wide Terminal Type Flat Chip Resistors (High Power)



Coating color : Black

■Construction



■Features

- Higher power than conventional type.
- Flat chip resistors of wide terminal type.
- High reliability and performance with T.C.R. $\pm 100 \times 10^{-6}$/K, resistance tolerance ±0.5%.
- Suitable for both reflow and flow solderings.
- Products meet EU-RoHS requirements.
  EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Power supply, ECU etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
2B15 (0612)	1.6±0.15	3.2±0.2	0.3±0.2	0.45±0.15	0.6±0.1	12.0
2H2 (1020)	2.5±0.15	5.0±0.15	0.4±0.2	0.75±0.15		30.2
3A3 (1225)	3.1±0.15	6.3±0.15	0.45±0.2			45.6

■Type Designation

Example

WK73R	2B15	T	TD	1002	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2B15:1.5W※1 2H2:2W※1 3A3:3W※1	T : Sn	TD: 4mm pitch punch paper TE: 4mm pitch plastic embossed BK: Bulk	D,F: 4 digits J: 3 digits	D:±0.5% F:±1% J:±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

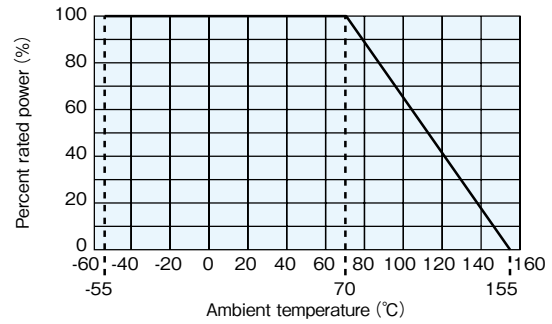
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	Resistance Range (Ω) F:±1% E24・E96	Resistance Range (Ω) J:±5% E24	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty/Reel (pcs) TD	Taping & Q'ty/Reel (pcs) TE
WK73R2B15	1.5W※1	70℃	95℃	±100	10~9.76k	10~9.76k	10~9.1k	200V	400V	5,000	–
WK73R2H2	2W※1	70℃	95℃	±100	–	10~430k	10~430k			–	4,000
				±200	–	432k~1M	470k~1M				
WK73R3A3	3W※1	70℃	95℃	±100	–	10~330k	10~330k			–	4,000
				±200	–	332k~1M	360k~1M				

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature". For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

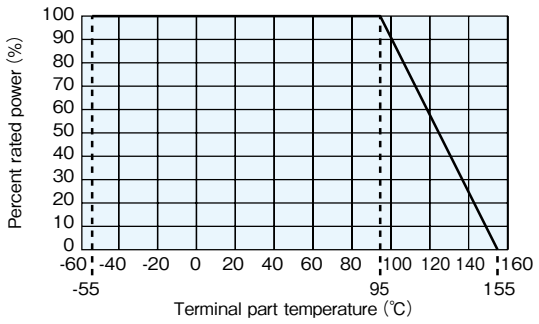
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the current shall be derated in accordance with the above derating curve.

Terminal part temperature

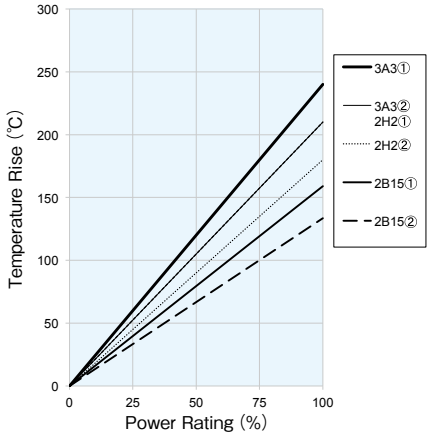


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.

- Please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog before use.

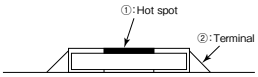
■Temperature Rise

WK73R 2B15-3A3



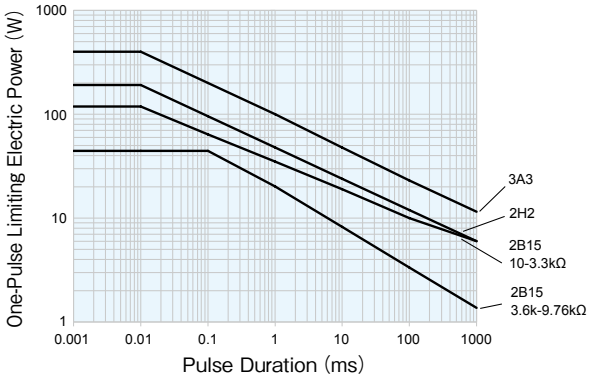
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

WK73R 2B15-3A3



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

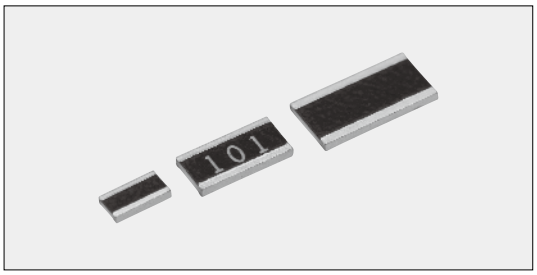
■Performance

Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2.0 for 5s
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.)/+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.2	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.2	+155℃, 1000h

■Precautions for Use

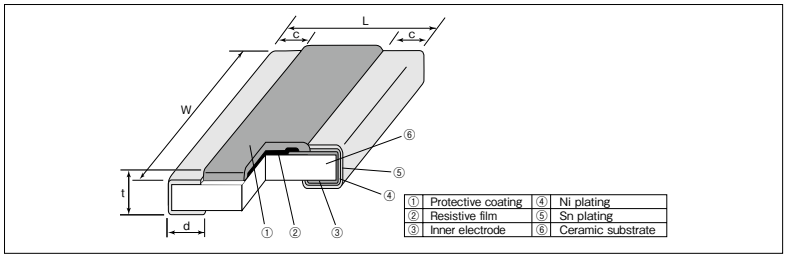
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WK73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

WG73 Wide Terminal Type Pulse Power Flat Chip Resistors



Coating color : Wine red

■Construction



■Features

- Superior to WK73 series in pulse withstanding voltage.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

■Applications

- E.C.U.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134A

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c±0.2	d±0.15	t±0.1	
2B (0612)	$1.6^{+0.1}_{-0.2}$	$3.2^{+0.1}_{-0.3}$	0.3	0.45	0.6	12.0
2H (1020)	2.5±0.15	5.0±0.15	0.4	0.75		30.2
3A (1225)	$3.1^{+0.2}_{-0.1}$	6.3±0.15	0.45			45.6

■Type Designation

Example

WG73	2H	T	TE	101	K
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2B : 1W 2H : 1.5W 3A : 2W	T : Sn	TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	3 digits	K : ±10% M : ±20%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

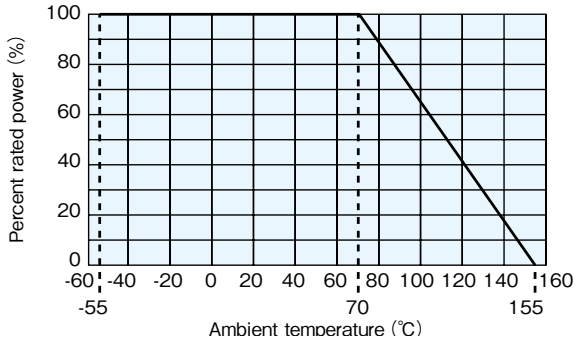
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)		Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty /Reel (pcs)	
					K : ±10% E12	M : ±20% E12			TD	TE
2B	1W	70℃	125℃	±100	560m~1k	560m~1k	200V	400V	5,000	—
2H	1.5W								—	4,000
3A	2W								—	4,000

Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

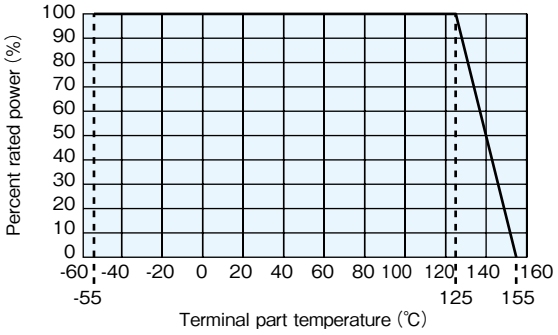
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the derating curve.

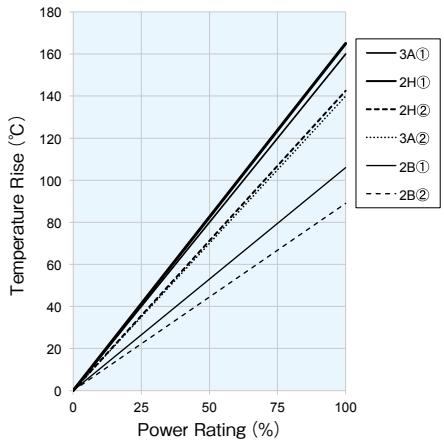
Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

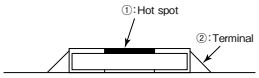
■Temperature Rise

WG73 2B-3A



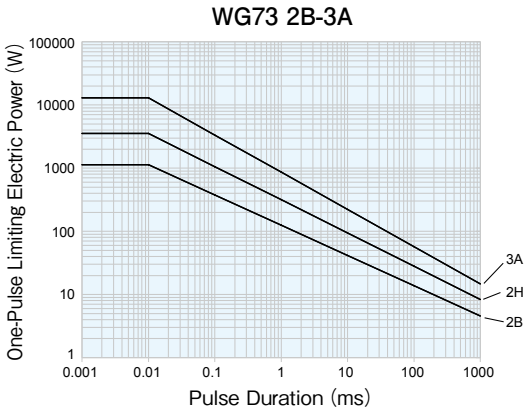
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

WG73 2B-3A



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

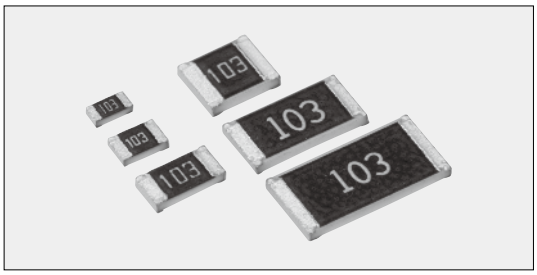
Test Items	Performance Requirements ΔR±(%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage(DC)×2.5 for 5s
Resistance to soldering heat	1	0.2	260℃±5℃、10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.2	40℃±2℃、90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.2	+155℃、1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WG73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

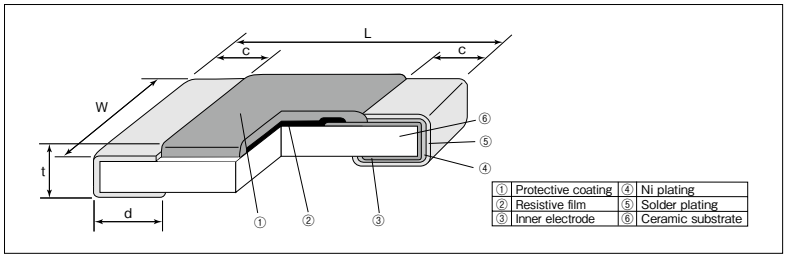
THICK FILM (ANTI SURGE)

SG73 Surge Current Flat Chip Resistors



Coating color：Wine red

■Construction



■Features

- Superior to RK73 series chip resistors in surge withstanding voltage and pulse withstanding voltage.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- E.C.U.
- Circuits to catch inductive lighting surge.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L±0.2	W	c	d	t±0.1	Weight (g) (1000pcs)
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55	
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		
2E (1210)		2.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$		15.5
W2H (2010) ※1	5.0	2.5±0.2		0.65±0.15		24.3
W3A (2512) ※1	6.3	3.1±0.2				37.1

※1 SG73 2H and SG73 3A are also still available (different "d" dimensions=$0.4^{+0.2}_{-0.1}$mm)

■Type Designation

Example

SG73	2A		T	TD	103	K
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J:0.1W 2A:0.125W 2B:0.33W 2E:0.5W W2H:0.75W W3A:1W	Nil:Standard A:Heat shock resistance※3	T:Sn (L:Sn/Pb※2)	TP:2mm pitch punch paper TD:4mm pitch punch paper TE:4mm pitch plastic embossed BK:Bulk	3桁	K:±10% M:±20%

※2 With type A, only T is available as the terminal surface material.
※3 With SG73 W2H, W3A only the symbol T is available as the terminal surface material.
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

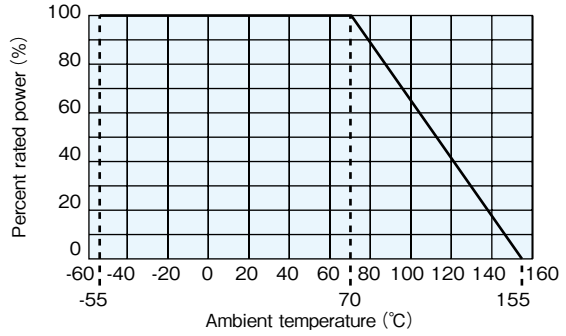
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) K:±10% M:±20% E12	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1J	0.1W	70℃	125℃	±400	1～8.2	50V	100V	10,000※4	5,000	—
				±200	10～1M					
2A	0.125W	70℃	125℃	±400	1～8.2	150V	200V	10,000※4	5,000	4,000※4
				±200	10～1M					
2B	0.33W	70℃	125℃	±400	1～8.2	200V	400V	—	5,000	4,000※4
				±200	10～1M					
2E	0.5W	70℃	125℃	±400	1～8.2			—	5,000	4,000※4
				±200	10～1M					
W2H	0.75W	70℃	125℃	±400	1～8.2			—	—	4,000
				±200	10～1M					
W3A	1.0W	70℃	125℃	±400	1～8.2			—	—	4,000
				±200	10～1M					

Operating Temperature Range：−55℃～+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※4 Standard packaging：TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

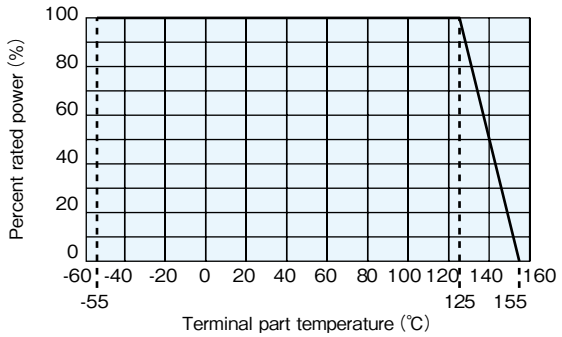
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

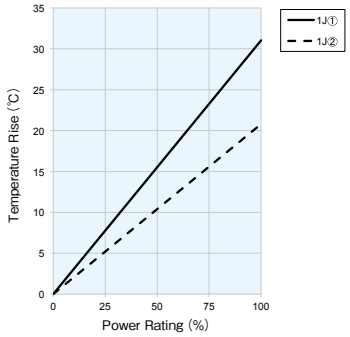
Terminal part temperature



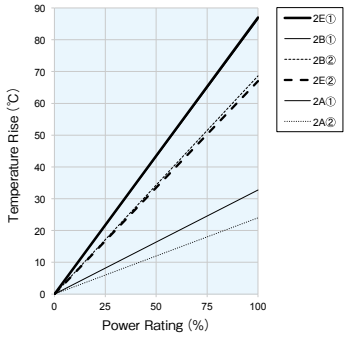
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

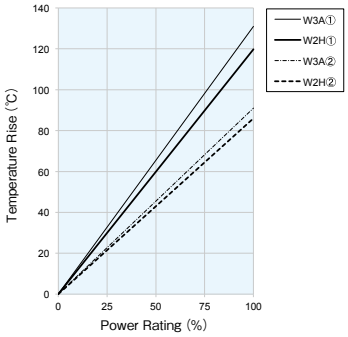
SG73 1J



SG73 2A-2E

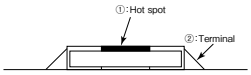


SG73 W2H-W3A



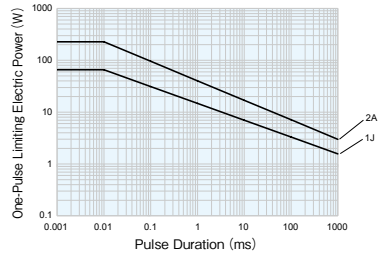
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm

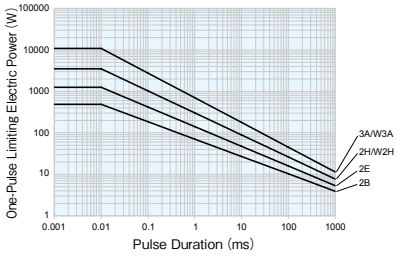


■One-Pulse Limiting Electric Power

SG73 1J-2A



SG73 2B-W3A



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : Characteristic「Nil」(Standard) 1 : Characteristic「A」(Heat shock resistance)	0.3 : Characteristic「Nil」(Standard) 0.5 : Characteristic「A」(Heat shock resistance)	Characteristic「Nil」(Standard) : −55℃ (30min.) /+125℃ (30min.) 100 cycles Characteristic「A」(Heat shock resistance) : −55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	3	0.75	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h

■Precautions for Use

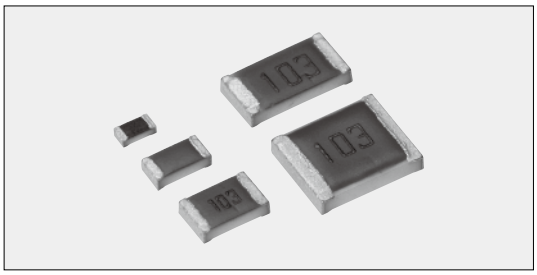
• The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of W2H/W3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1J~2E, but the crack tends to occur in the types of W2H/W3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

THICK FILM (ANTI SURGE)

EU RoHS

INDEX

SG73P Endured Pulse Power Flat Chip Resistors



Coating color : Black (1E, 1EW)
Green (1J, 2A, 2B, 2E, 2E1)

■Features

- Superior to RK73 series chip resistors in pulse withstanding voltage and high power.
- Resistance tolerance is available from ±0.5%.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

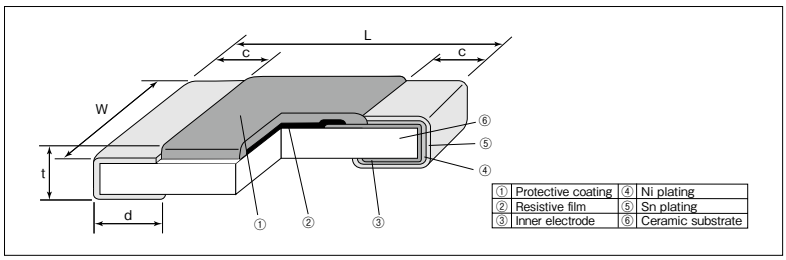
■Applications

- E.C.U.
- Circuits to catch inductive lighting surge.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.15±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1EW (0402)						
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0±0.2	1.25±0.1	$0.3^{+0.2}_{-0.1}$	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B (1206)	3.2±0.2	1.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		
2E (1210)		2.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$		15.5
2E1 (1210)						

■Type Designation

Example

SG73P	2A		T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E : 0.125W 0.2W※1 1J : 0.2W 0.33W※1 2A : 0.25W 0.5W※1 2B : 0.33W 0.75W※1 2E : 0.5W 0.75W※1 2E1 : 1W※1	Nil : Standard A : Heat shock resistance※2	T : Sn	TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	D,F : 4 digits G,J : 3 digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

※2 With type A, only T is available as the terminal surface material.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

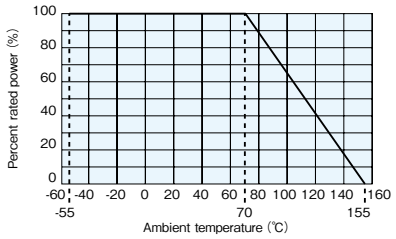
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D : ±0.5% E24・E96	F : ±1% E24・E96	G : ±2% J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1E	0.125W	70℃	125℃	±200	10~1M	1~1M	1~10M	75V	100V	10,000	—	—
	0.2W※1	70℃	105℃									
1EW	0.25W※1	70℃	125℃	±100	10~1M	10~1M	10~1M	75V	100V	10,000	—	—
				±200	—	1~9.76	1~9.1 1.1M~10M					
1J	0.2W	70℃	135℃	±100	510~576k	510~576k	510~560k	150V	200V	10,000※5	5,000	—
				±100※3	10~499 590k~1M	1~499 590k~1M	1~470 620k~10M					
	0.33W※1	70℃	125℃	±100	510~576k	510~576k	510~560k					
				±100※3	10~499 590k~1M	1~499 590k~1M	1~470 620k~10M					
2A	0.25W	70℃	125℃	±100	100~100k	100~100k	100~100k	400V	600V (800V)※4	10,000※5	5,000	4,000※5
				±200	10~97.6 102k~1M	1~97.6 102k~1M	1~91 110k~10M					
	0.5W※1	70℃	100℃	±100	100~100k	100~100k	100~100k					
				±200	10~97.6 102k~1M	1~97.6 102k~1M	1~91 110k~10M					
2B	0.33W	70℃	125℃	±100	300~1M	300~1M	300~1.1M	200V	400V	—	5,000	4,000※5
				±200	10~294	1~294	1~270 1.2M~10M					
	0.75W※1	70℃	105℃	±100	300~1M	300~1M	300~1.1M					
				±200	10~294	1~294	1~270 1.2M~10M					
2E	0.5W	70℃	125℃	±200	10~1M	1~1M	1~10M	200V	400V	—	5,000	4,000※5
	0.75W※1	70℃	110℃									
2E1	1.0W※1	70℃	95℃	±200	10~1M	1~1M	1~10M	200V	400V	—	5,000	4,000※5

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value or Max. working voltage, whichever is lower.}}$
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※3 Cold T.C.R. (−55℃~+25℃) is ±150×10⁻⁶/K.
※4 Applies when power rating is 0.4W or lower.
※5 Standard packaging : TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

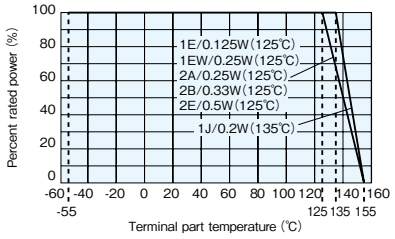
■Derating Curve

Ambient temperature

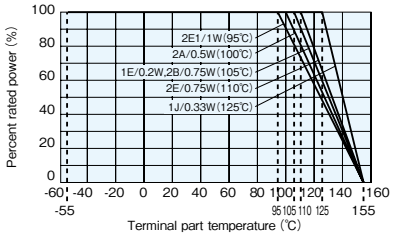


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



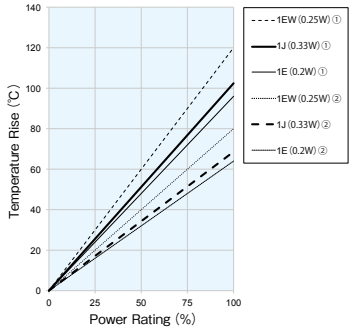
Terminal part temperature



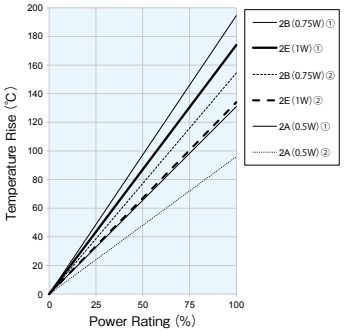
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※1 or ※4, please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

SG73P 1E-1J

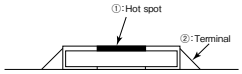


SG73P 2A-2E



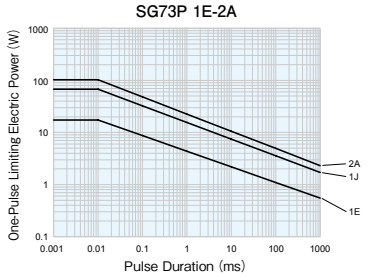
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm

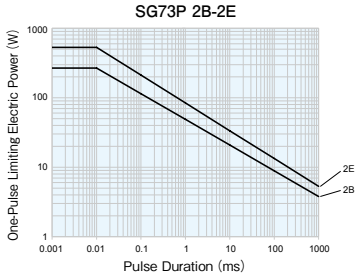


■One-Pulse Limiting Electric Power

SG73P 1E-2A



SG73P 2B-2E



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

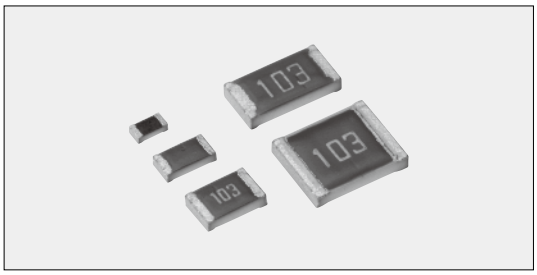
Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s(1EW : 0.25W, 2A : 0.4W, 0.5W, 2B : 0.75W, 2E : 0.75W, 2E1 : 1W Rated voltage×2 for 5s)
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : Characteristic 「Nil」(Standard) 1 : Characteristic 「A」(Heat shock resistance)	0.3 : Characteristic 「Nil」(Standard) 0.5 : Characteristic 「A」(Heat shock resistance)	Characteristic 「Nil」(Standard) : −55℃ (30min.) /+125℃ (30min.) 100 cycles Characteristic 「A」(Heat shock resistance) : −55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	3	0.75	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

THICK FILM (ANTI SURGE)

SG73S Endured Surge Voltage Flat Chip Resistors



Coating color：Black（1E）
Green（1J, 2A, 2B, 2E, 2E1）

■Features

- Superior to RK73 series chip resistors in surge withstanding voltage and high power.
- Resistance tolerance is available from ±0.5%.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

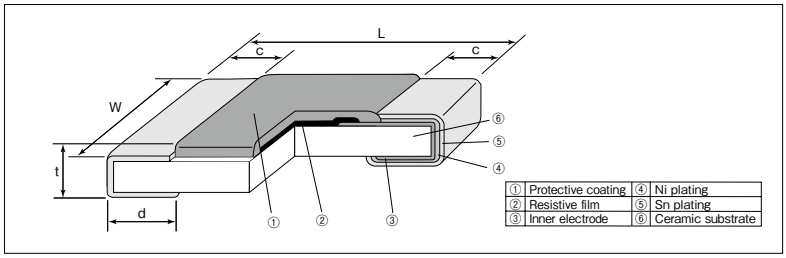
■Applications

- E.C.U.
- Circuits to catch inductive lighting surge.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.15±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0±0.2	1.25±0.1	$0.3^{+0.2}_{-0.1}$	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55±0.1	
2B (1206)	3.2±0.2	1.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		
2E (1210)		2.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$		15.5
2E1 (1210)						

■Type Desiqnation

Example

SG73S	2A		T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E : 0.125W 0.2W※1 1J : 0.2W 0.33W※1 2A : 0.25W 0.5W※1 2B : 0.33W 0.75W※1 2E : 0.5W 0.75W※1 2E1 : 1W※1	Nil : Standard A : Heat shock resistance※2	T : Sn	TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	D,F : 4 digits G,J : 3 digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

※2 With type A, only T is available as the terminal surface material.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

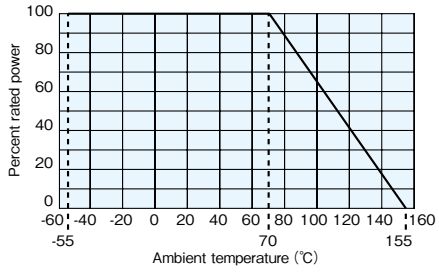
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D : ±0.5% E24・E96	F : ±1% E24・E96	G : ±2% J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1E	0.125W	70℃	125℃	±200	10～1M	1～1M	1～10M	75V	100V	10,000	—	—
	0.2W※1	70℃	105℃									
1J	0.2W	70℃	135℃	±100	510～576k	510～576k	510～560k	150V	200V	10,000※5	5,000	—
				±100※3	10～499 590k～1M	1～499 590k～1M	1～470 620k～10M					
	0.33W※1	70℃	125℃	±100	510～576k	510～576k	510～560k					
				±100※3	10～499 590k～1M	1～499 590k～1M	1～470 620k～10M					
2A	0.25W	70℃	125℃	±200	10～1M	1～1M	1～10M	400V	600V (800V)※4	10,000※5	5,000	4,000※5
	0.5W※1	70℃	100℃									
2B	0.33W	70℃	125℃	±200	10～1M	1～1M	1～10M	200V	400V	—	5,000	4,000※5
	0.75W※1	70℃	105℃									
2E	0.5W	70℃	125℃	±200	10～1M	1～1M	1～10M	200V	400V	—	5,000	4,000※5
	0.75W※1	70℃	110℃									
2E1	1.0W※1	70℃	95℃	±200	10～1M	1～1M	1～10M	200V	400V	—	5,000	4,000※5

Operating Temperature Range：−55℃～+155℃
Rated voltage＝$\sqrt{\text{Power Rating} \times \text{Resistance value or Max. working voltage, whichever is lower.}}$
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※3 Cold T.C.R.（−55℃～+25℃） is ±150×10⁻⁶/K.
※4 Applies when power rating is 0.4W or lower.
※5 Standard packaging：TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

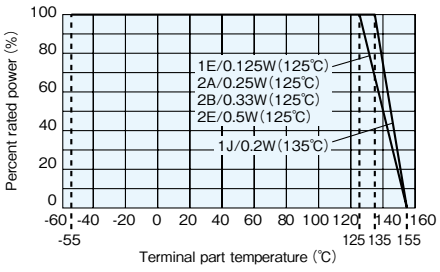
■Derating Curve

Ambient temperature

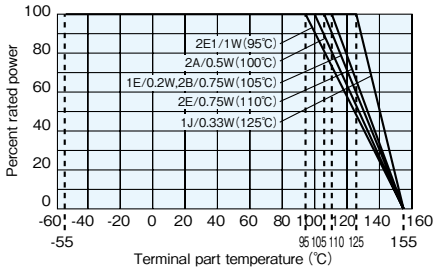


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



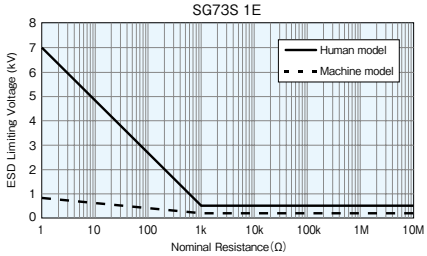
Terminal part temperature



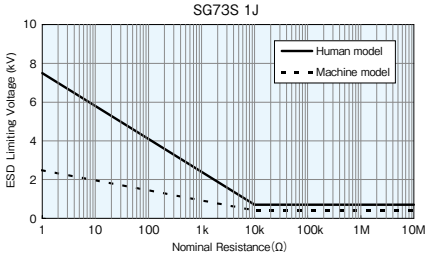
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※1 or ※4, please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■ESD Limiting Voltage

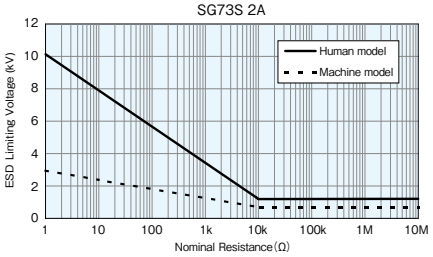
SG73S 1E



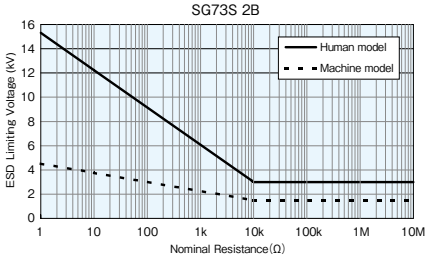
SG73S 1J



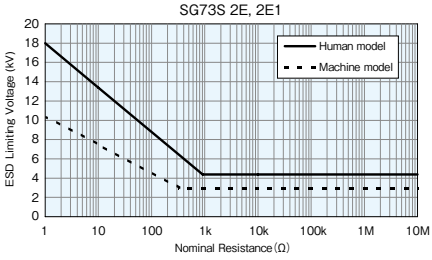
SG73S 2A



SG73S 2B

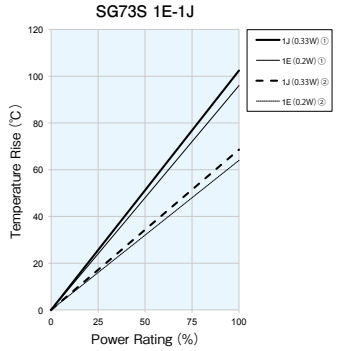


SG73S 2E, 2E1

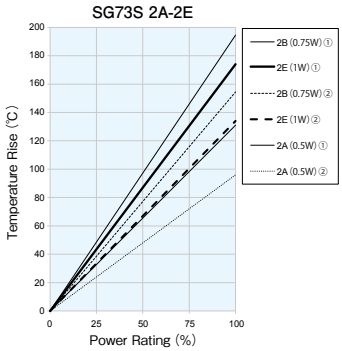


■Temperature Rise

SG73S 1E-1J

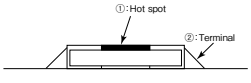


SG73S 2A-2E



Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



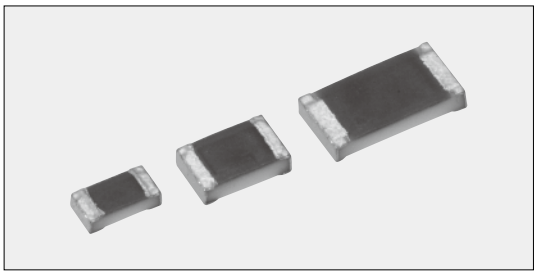
■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s (2A : 0.4W, 0.5W, 2B : 0.75W, 2E : 0.75W, 2E1 : 1W Rated voltage×2 for 5s)
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5:Characteristic [Nil] (Standard) 1:Characteristic [A] (Heat shock resistance)	0.3:Characteristic [Nil] (Standard) 0.5:Characteristic [A] (Heat shock resistance)	Characteristic [Nil] (Standard) : −55℃ (30min.) /+125℃ (30min.) 100 cycles Characteristic [A] (Heat shock resistance) : −55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	3	0.75	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

SG73G Endured Pulse Power Flat Chip Resistors (Ultra Presicion Grade)



Coating color：Green
No marking

■Features

- Superior to RK73 series chip resistors in pulse withstanding voltage and high power.
- High Precision resistor with T.C.R. ±50×10⁻⁶/K and Tolerance ±0.25%.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

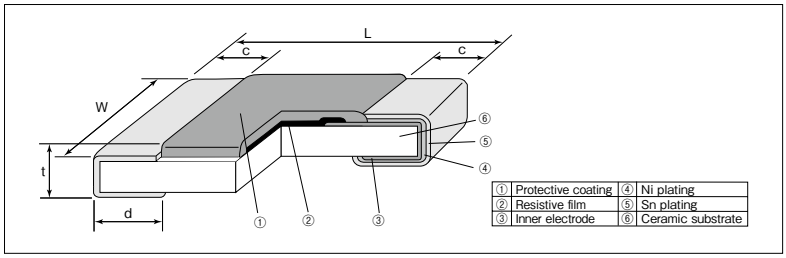
■Applications

- Car electronics, Power supply, Industrial equipment

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W	c	d	t±0.1	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0	1.25±0.1	$0.3^{+0.2}_{-0.1}$	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55	
2B (1206)	3.2	1.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		

■Type Designation

Example

SG73G	2A		T	TD	1002	D
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J : 0.2W 0.33W※1 2A : 0.25W 0.5W※1 2B : 0.33W 0.5W※1	Nil : Standard A : Heat shock resistance※2	T : Sn	TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	4桁	C : ±0.25% D : ±0.5%

※2 With type A, only T is available as the terminal surface material.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

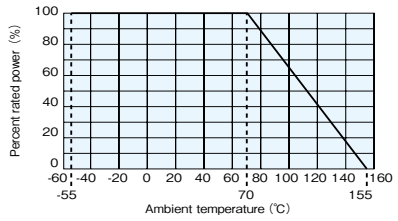
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) C : ±0.25% E24・E96	Resistance Range (Ω) D : ±0.5% E24・E96	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1J	0.2W	70℃	125℃	±50	10～1M	10～1M	150V	200V	10,000※3	5,000	—
	0.33W※1	70℃	125℃								
2A	0.25W	70℃	125℃				200V	400V	10,000※3	5,000	4,000※3
	0.5W※1	70℃	100℃								
2B	0.33W	70℃	125℃				200V	400V	—	5,000	4,000※3
	0.5W※1	70℃	120℃								

Operating Temperature Range：−55℃～+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value or Max. working voltage, whichever is lower.}}$
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※3 Standard packaging：TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

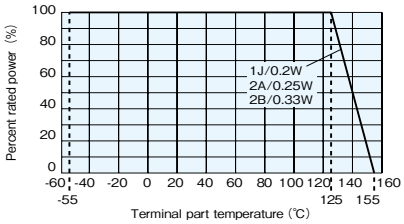
■Derating Curve

Ambient temperature

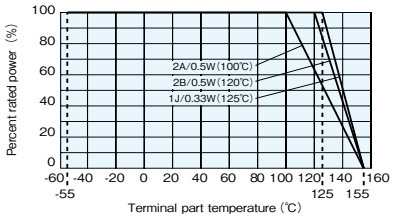


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



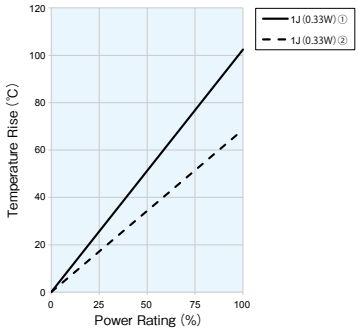
Terminal part temperature



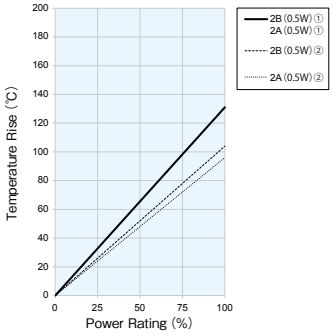
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※1, please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

SG73G 1J

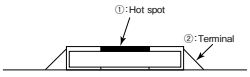


SG73G 2A-2B



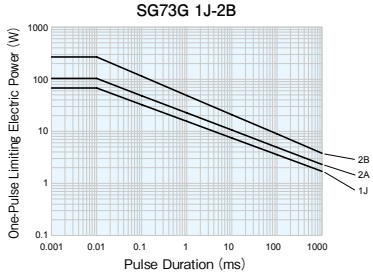
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

SG73G 1J-2B



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

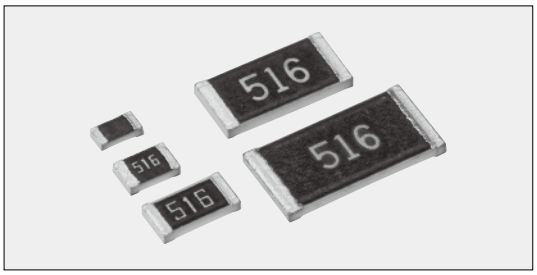
■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s(2A : 0.5W, Rated voltage×2 for 5s)
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : Characteristic「Nil」(Standard) 1 : Characteristic「A」(Heat shock resistance)	0.3 : Characteristic「Nil」(Standard) 0.5 : Characteristic「A」(Heat shock resistance)	Characteristic「Nil」(Standard) : −55℃ (30min.) /+125℃ (30min.) 100 cycles Characteristic 「A」(Heat shock resistance) : −55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

HV73 Flat Chip Resistors For High Voltage



Coating color : Black

■Features

- Superior to RK73 series in maximum working voltage.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

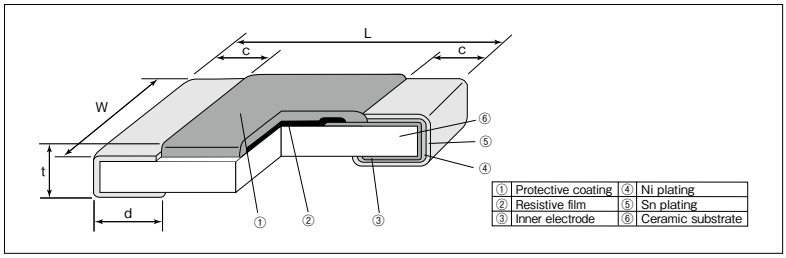
■Applications

- Camera Strobe, LCD back-light, AC Adapters etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■ Construction



■ Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W	c	d	t±0.1	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2H (2010)	5.0	2.5±0.2				24.3
3A (2512)	6.3	3.1±0.2				37.1

■ Type Designation

Example

HV73	2B	T	TD	1004	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J:0.1W 2A:0.25W 2B:0.25W 2H:0.5W 3A:1W	T : Sn	TD:4mm pitch punch paper TE:4mm pitch plastic embossed BK:Bulk	D,F:4 digits G,J:3 digits	D:±0.5% F:±1% G:±2% J:±5%

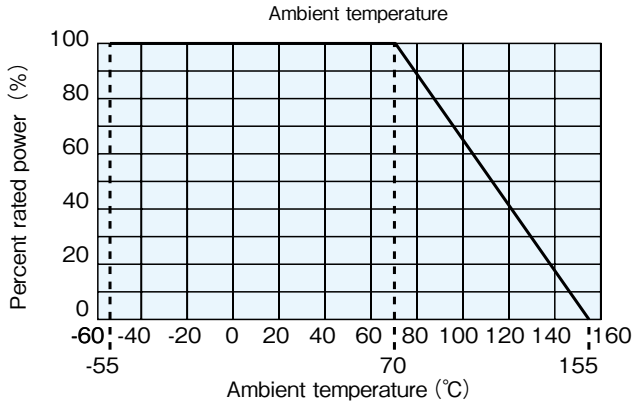
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

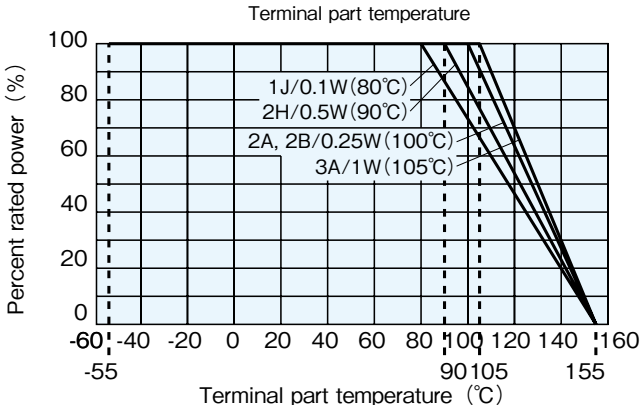
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Max. Working Voltage	Max. Overload Voltage (D.C.)※1	Taping & Q'ty/Reel (pcs) TD	TE
1J	0.1W	70℃	80℃	±100※2	—	10k~10M	10k~10M	10k~10M	350V	500V	5,000	–
2A	0.25W	70℃	100℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	400V	800V	5,000	–
				±200	—	—	—	11M~51M				
2B	0.25W	70℃	100℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	800V	1000V	5,000	–
				±200	—	—	—	11M~51M				
2H	0.5W	70℃	90℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	2000V(D.C.)	3000V	–	4,000
				±200	—	10.2M~51M	11M~51M	11M~51M				
				±300	—	51.1M~100M	56M~100M	56M~100M				
3A	1W	70℃	105℃	±100	43k~1M	43k~10M	43k~10M	43k~10M	3000V(D.C.)	4000V	–	4,000
				±200	—	10.2M~20M	11M~20M	11M~51M				

Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 Max. overload voltage is specified by D.C. voltage.
※2 Cold T.C.R.(−55℃~+25℃) of 1.02MΩ~10MΩ is ±200×10⁻⁶/K.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■ Derating Curve

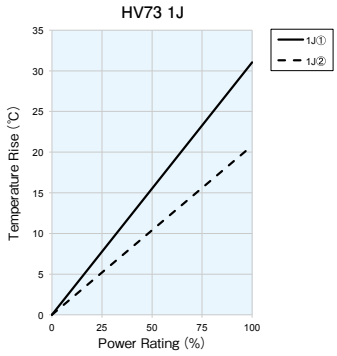


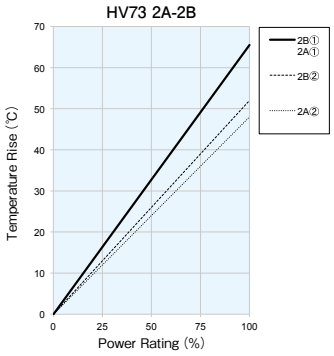
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

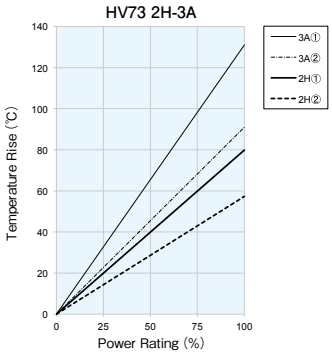


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

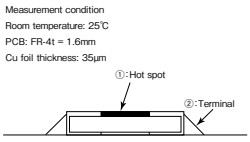
■Temperature Rise



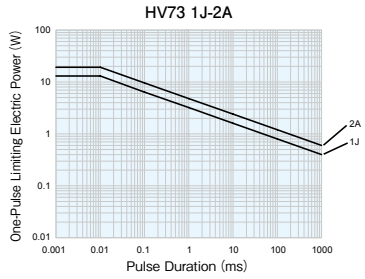


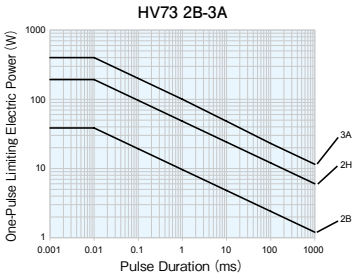


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power





The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■ Performance

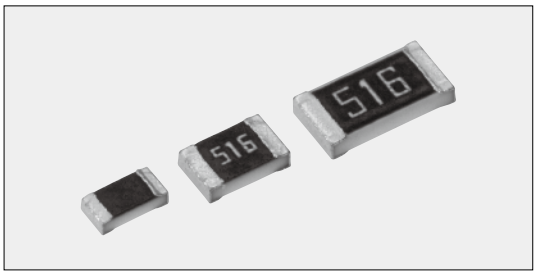
Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage (D.C.) ×2.5 for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : (10kΩ≦R≦10MΩ) 1 : (10MΩ<R≦100MΩ)	0.3 : (10kΩ≦R≦10MΩ) 0.5 : (10MΩ<R≦100MΩ)	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	2	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2	0.3	+155℃, 1000h

■Precautions for Use

- Max. overload voltage is specified by D.C. voltage. When using in A.C. voltage, the peek value of A.C. voltage shall not exceed the Maximum overload voltage.
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of 2H/3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1J～2B, but the crack tends to occur in the types of 2H/3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

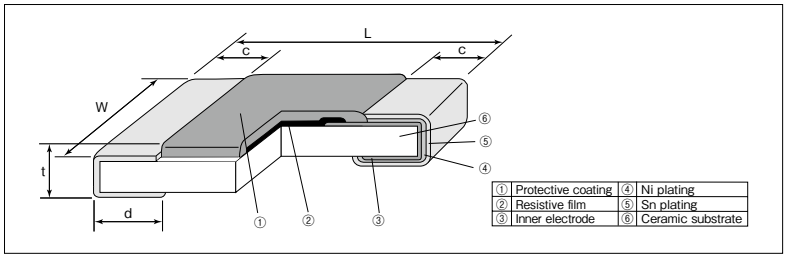
THICK FILM (FOR HIGH VOLTAGE)

HV73V Flat Chip Resistors For High Voltage (For Automotive)



Coating color : Black

■Construction



■Features

- Superior to RK73 series in maximum working voltage.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- Suitable for high reliable applications like automotives. AEC-Q200 Tested.

■Applications

- Inverter, DC-DC converter, Battery Management, Charger, HID lamp

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W	c	d	t±0.1	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
1J AT (0603)			0.35±0.15	0.5±0.2		
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2A AT (0805)			0.45±0.25	0.6±0.2	0.55	
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2B AT (1206)			0.55±0.35	0.8±0.2		

■ Type Designation

Example

HV73V	2A		T	TD	104	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J : 0.1W 2A : 0.25W 2B : 0.33W	Nil : Standard A : Heat shock resistance※1	T : Sn	TD : 4mm pitch punch paper BK : Bulk	D,F : 4 digits G,J : 3 digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

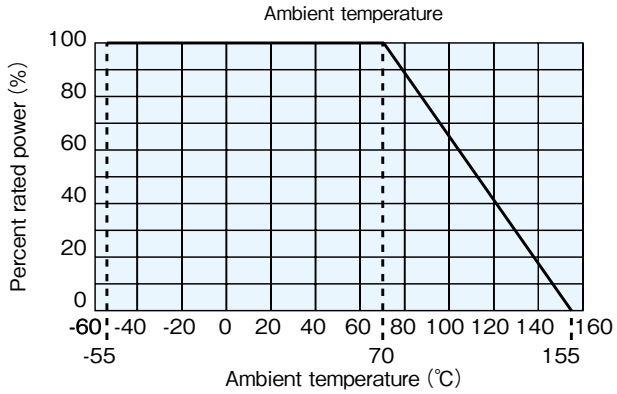
※1 With type A, only T is available as the terminal surface material.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

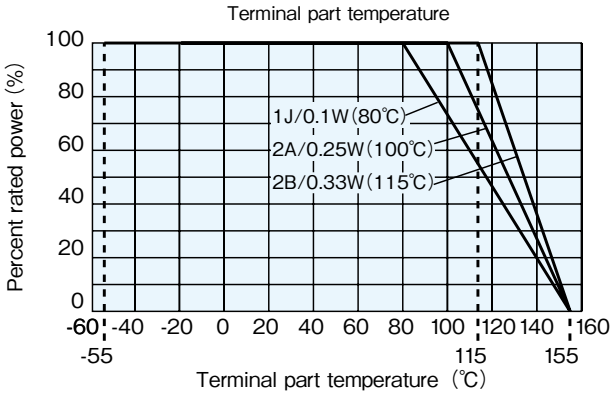
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Max. Working Voltage	Max. Overload Voltage (D.C.)※2	Taping & Q'ty/Reel (pcs) TD
HV73V1J	0.1W	70℃	80℃	±100※3	—	10k~10M	10k~10M	10k~10M	350V	500V	5,000
HV73V2A	0.25W		100℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	400V	800V	
				±200	—	—	—	11M~51M			
HV73V2B	0.33W		115℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	800V	1200V	
				±200	—	—	—	11M~51M			

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
※2 Max. overload voltage is specified by D.C. voltage.
※3 Cold T.C.R. (−55℃~+25℃) of 1.02MΩ~10MΩ is ±200×10⁻⁶/K.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■ Derating Curve

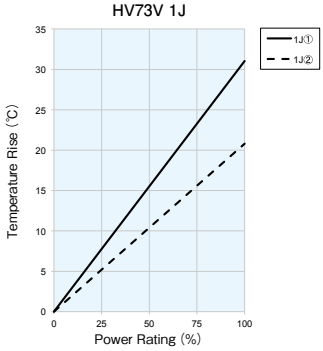


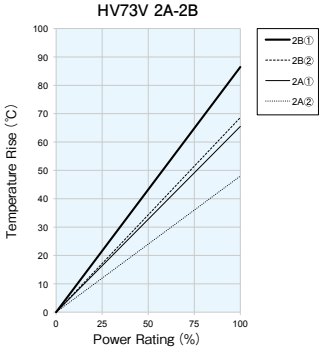
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.



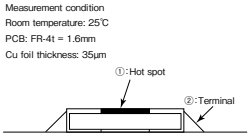
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

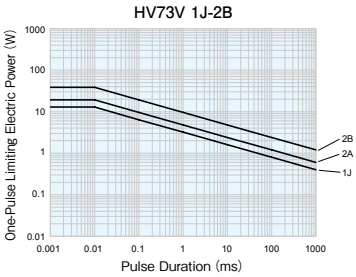




Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

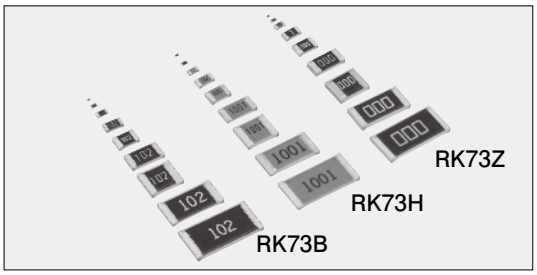
■Performance

Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage (D.C.) ×2.5 for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s
Rapid change of temperature	0.5：(10kΩ≦R≦10MΩ) 1 ：(11MΩ≦R≦51MΩ) Characteristic「A」 (Heat shock resistance)	0.3：(10kΩ≦R≦10MΩ) 0.5：(11MΩ≦R≦51MΩ) Characteristic「A」 (Heat shock resistance)	Characteristic「Nil」(Standard)： −55℃ (30min.) /+125℃ (30min.) 100 cycles Characteristic「A」(Heat shock resistance)： −55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2	0.3	+155℃, 1000h

■Precautions for Use

- Max. overload voltage is specified by D.C. voltage. When using in A.C. voltage, the peek value of A.C. voltage shall not exceed the Maximum overload voltage.
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

RK73B·RK73H·RK73Z-RT Flat Chip Resistors (Anti Sulfuration)



Coating Color :
Black (RK73B 1F, 1H, 1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2)
(RK73H 1F, 1H) (RK73Z 1J, 2A, 2B, 2E, W2H, W3A)
Blue (RK73H 1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2)
Green (RK73Z 1H, 1E)

■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Excellent heat resistance and weather resistance are ensured by the use of metal glaze thick film.
- High stability and high reliability with the triple-layer structure of electrode.
- Suitable for both flow and reflow solderings.
- This products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested. (Exemption 1F)

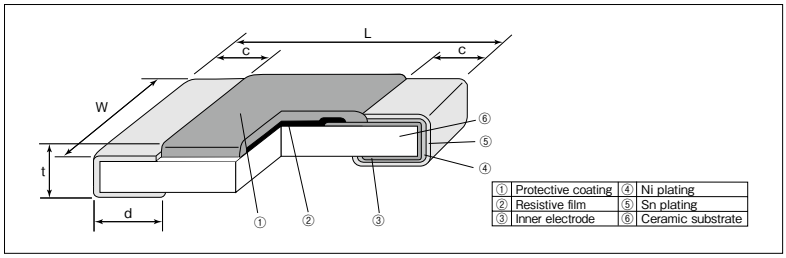
■Applications

- Car electronics, Power supply, Industrial robot

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1F (01005)	0.4±0.02	0.2±0.02	0.1±0.03	0.11±0.03	0.13±0.02	0.04
1H (0201)	0.6±0.03	0.3±0.03	0.1±0.05	0.15±0.05	0.23±0.03	0.14
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.5 ±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2E (1210)		2.6±0.2				15.5
W2H (2010)	5.0±0.2	2.5±0.2		0.65±0.15		24.3
W3A (2512)	6.3±0.2	3.1±0.2				37.1
W3A2 (2512) ※1						

※1 Exemption RK73Z

■Type Designation

Example

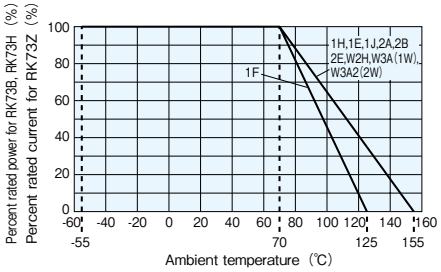
RK73H	2A	R	T	TD	1002	F
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
RK73B RK73H	1F : 0.03W 1H : 0.05W 1E : 0.1W 1J : 0.1W 0.125W 2A : 0.25W 2B : 0.25W 2E : 0.5W W2H : 0.75W W3A : 1W W3A2 : 2W※3	R : Anti sulfuration	T : Sn	TX : 4mm width-1mm pitch plastic embossed TBL·TCM : 2mm pitch press paper TPL·TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	RK73B : 3 digits RK73H : 4 digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

RK73Z	2A	R	T	TD
Product Code	Current Rating	Characteristic	Terminal Surface Material	Taping
RK73Z	1H : 0.5A 1E : 1A 1J : 1A 2A : 2A 2B : 2A 2E : 2A W2H : 2A W3A : 2A	R : Anti sulfuration	T : Sn	TCM : 2mm pitch press paper TPL·TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

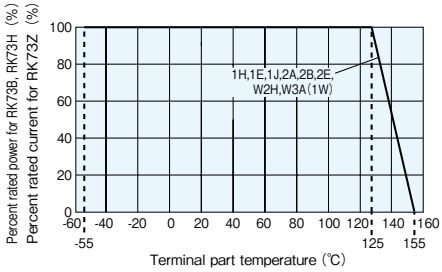
■Derating Curve

RK73B · RK73H · RK73Z-RT
Ambient temperature



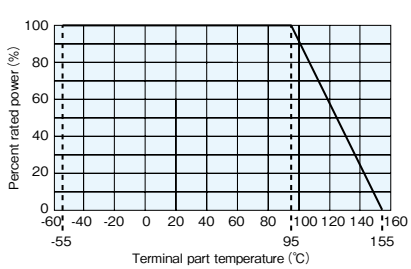
For resistors operated at an ambient temperature of 70℃ or higher, the power (for RK73B, RK73H) or a current rating (for RK73Z) shall be derated in accordance with the above derating curve.

RK73B · RK73H · RK73Z-RT
Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

RK73B · RK73H-RT
Terminal part temperature W3A2



■Ratings

RK73B, RK73H

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) RK73H D : ±0.5% E24・E96	RK73H F : ±1% E24・E96	RK73B G : ±2% E24	RK73B J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TX	TBL	TCM※5	TPL・TP	TD	TE
1F	0.03W	70℃	–	±200	–	100k～2M※2	100k～1M	100k～10M	20V	30V	40,000	20,000	–	–	–	–
				±250		10～91k※2	10～91k	10～91k								
				0～+300		–	1～9.1	1～9.1								
1H	0.05W	70℃	125℃	±200	100～100k	100～1M	–	100～1M	25V	50V	–	–	15,000	–	–	–
				±300	–	10～97.6		10～91								
1E	0.1W	70℃	125℃	±100	100～1M	10～1M	–	–	75V	100V	–	–	–	TPL:20,000 TP :10,000	–	–
				±200	–	1.02M～10M	10～10M	1～10M								
1J	0.1W	70℃	125℃	±100	1.02k～1M	1.02k～1M	–	–			–	–	–	TP :10,000※4	5,000	–
	0.125W			±200	–	1.02M～10M	1.1k～10M	1.1k～10M								
				±100	100～1k	10～1k	–	–								
				±200	–	–	10～1k	1～1k								
2A	0.25W	70℃	125℃	±100	100～1M	10～1M	–	–	150V	200V	–	–	–	TP :10,000※4	5,000	4,000※4
				±200	–	1.02M～10M	10～10M	1～10M								
2B	0.25W	70℃	125℃	±100	100～1M	10～1M	–	–	200V	400V	–	–	–	–	5,000	4,000※4
				±200	–	1.02M～10M	10～10M	1～10M								
2E	0.5W	70℃	125℃	±100	100～1M	10～1M	–	–			–	–	–	–	5,000	4,000※4
				±200	–	–	10～1M	1～1M								
W2H	0.75W	70℃	125℃	±100	10～1M	10～1M	–	–			–	–	–	–	–	4,000
				±200	–	1～9.76 1.02M～10M	1～10M	1～10M								
W3A	1W	70℃	125℃	±100	10～1M	10～1M	–	–			–	–	–	–	–	4,000
				±200	–	1.02M～10M	10～10M	1～10M								
W3A2	2W※3	70℃	95℃	±100	10～1M	10～1M	–	–	200V	400V	–	–	–	–	–	4,000
				±200	–	1.02M～10M	10～10M	1～10M								

Operating Temperature Range : −55℃～+125℃ (1F)、−55℃～+155℃ (1H・1E・1J・2A・2B・2E・W2H・W3A・W3A2)

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

※2 The nominal resistance value for RK73H1F (F:±1%) is E24.

※3 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the previous page.

※4 Standard packaging : TD(4mm pitch punch paper)

※5 Standard taping specification of 1H is TCM. Previously available "TC(10,000pcs/Reel)" is not recommended for new designs.

If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".

For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

While using under high power, the temperature of the product may increase depending on the condition of heat dissipation from PCB.

Be sure to check the terminal part temperature as well as precausions to use on delivery specifications before use.

RK73Z

Type	Rated Ambient Temperature	Rated Terminal Part Temp.	Resistance	Current Rating	Max. Overload Current	Operating Temp. Range	Packaging & Q'ty/Reel (pcs) TCM※5	TPL・TP	TD	TE
1H	70℃	125℃	100mΩmax.	0.5A	1A	−55℃～+155℃	15,000	–	–	–
1E	70℃	125℃	50mΩmax.	1A	2A		–	TPL:20,000 TP :10,000	–	–
1J							–	TP :10,000※4	5,000	–
2A	70℃	125℃	50mΩmax.	2A	5A		–	TP :10,000※4	5,000	4,000※4
2B					10A		–	–	5,000	4,000※4
2E							–	–	5,000	4,000※4
W2H							–	–	–	4,000
W3A							–	–	–	4,000

■Performance

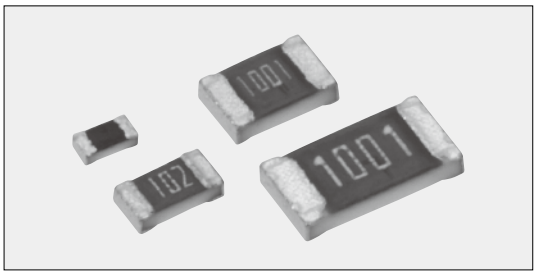
Test Items	RK73H, RK73B Performance Requirements ΔR± (%+0.1Ω) Limit	RK73H, RK73B Typical	RK73Z Performance Requirements Limit	RK73Z Typical	Test Methods
Resistance	Within specified tolerance	—	R≦100mΩ : 1H R≦50mΩ : others	R≦90mΩ : 1H R≦40mΩ : others	25℃
T.C.R.	Within specified T.C.R.	—	—	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	1 : 1F 0.8 : others	R≦100mΩ : 1H R≦50mΩ : others	R≦90mΩ : 1H R≦40mΩ : others	RK73B,RK73H : Rated voltage×2.5 for 5s (1E, 2B, W3A2:Rated voltage×2 for 5s) Max. overload current, 5s
Resistance to soldering heat	1 : 10Ω≦R≦1MΩ 3 : R<10Ω, R>1MΩ	1 : R<10Ω, R>1MΩ 0.5 : others	R≦100mΩ : 1H R≦50mΩ : others	R≦90mΩ : 1H R≦40mΩ : others	260℃±5℃, 10s±1s
Rapid change of temperature	1 : 1F 0.5 : others	0.5 : 1F 0.3 : others	R≦100mΩ : 1H R≦50mΩ : others	R≦90mΩ : 1H R≦40mΩ : others	−55℃ (30min.)/+125℃ (30min.) 100 cycles
Moisture resistance	2 : 1J, 2A, 2B 3 : others	0.75 : 1J, 2A, 2B 1.5 : 1F 1 : others	R≦150mΩ : 1H R≦100mΩ : others	R≦100mΩ : 1H R≦50mΩ : others	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2 : 1J, 2A, 2B 3 : others	0.75 : 1J, 2A, 2B 1 : others	R≦150mΩ : 1H R≦100mΩ : others	R≦100mΩ : 1H R≦50mΩ : others	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.5	R≦150mΩ : 1H R≦100mΩ : others	R≦100mΩ : 1H R≦50mΩ : others	+125℃, 1000h : 1F +155℃, 1000h : 1H, 1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2
Sulfuration test	5	0.3 : 1F, 1H 0.2 : others	R≦150mΩ : 1H R≦100mΩ : others	R≦100mΩ : 1H R≦50mΩ : others	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

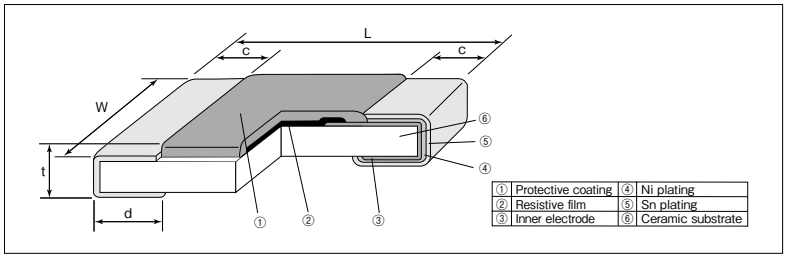
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of W2H/W3A/W3A2 which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy(FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1F～2E, but the crack tends to occur in the types of W2H/W3A/W3A2. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- Care should be taken that RK73B1F and RK73H1F may be damaged when static electricity occurs and is applied in the equipment assembly process.

RK73G-RT Flat Chip Resistors (Ultra Precision Grade, Anti Sulfuration)



Coating color : Black (1E),
Dark blue (1J, 2A, 2B)

■Construction



■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Metal-glaze thick film resistor for surface mounting.
- High precision resistor with T.C.R. $\pm 50 \times 10^{-6}$/K and tolerance $\pm 0.25\%$.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Car electronics, power supply, industrial robot.
- Replacement of metal film chip resistors.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14

■Type Designation

Example

RK73G	2A	R	T	TD	1002	D
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E : 0.1W 1J : 0.1W 2A : 0.125W 2B : 0.25W	R : Anti sulfuration	T : Sn	TPL·TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	4 digits	C : ±0.25% D : ±0.5% F : ±1%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

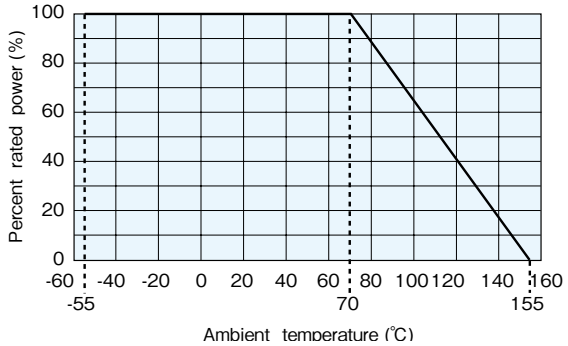
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. ($\times 10^{-6}$/K)	Resistance Range (Ω)			Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty /Reel (pcs)		
					C : ±0.25% E24·E96	D : ±0.5% E24·E96	F : ±1% E24·E96			TPL·TP	TD	TE
1E	0.1W	70℃	125℃	±50	—	30～1M	30～1M	50V	100V	TPL : 20,000 TP : 10,000	—	—
1J	0.1W				100～1M			75V	150V	TP : 10,000※1	5,000	—
2A	0.125W							150V	200V	—	5,000	4,000※1
2B	0.25W							200V	400V	—	5,000	4,000※1

Operating Temperature Range : −55℃～+155℃
Rated voltage = √Power Rating×Resistance value or Max. working voltage, whichever is lower.
※1 Standard packaging : TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

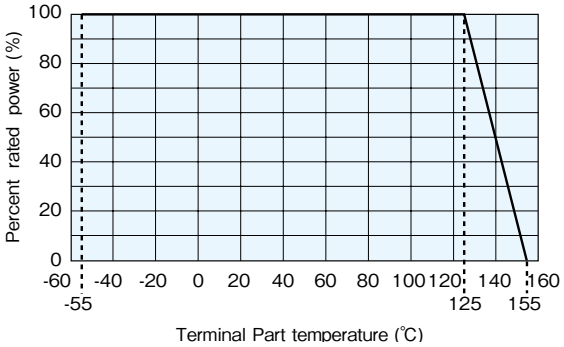
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.

※Please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog before use.

■Performance

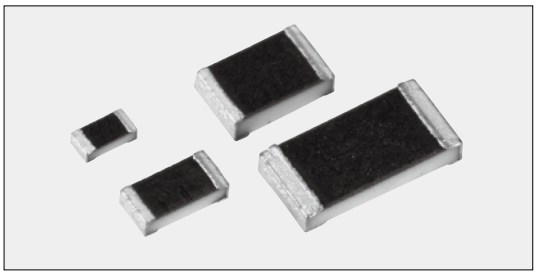
Test Items	Performance Requirements ΔR±(%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload(Short time)	2	0.6	Rated voltage×2.5 for 5s (1E, 2B : Rated voltage×2 for 5s)
Resistance to soldering heat	1	0.4	260℃±5℃, 10s±1s
Rapid change of temperature	0.5	0.3	−55℃(30min.)/+125℃(30min.)100 cycles
Moisture resistance	3 : 1E 2 : 1J, 2A, 2B	1 : 1E 0.6 : 1J, 2A, 2B	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3 : 1E 2 : 1J, 2A, 2B	1 : 1E 0.6 : 1J, 2A, 2B	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.6	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

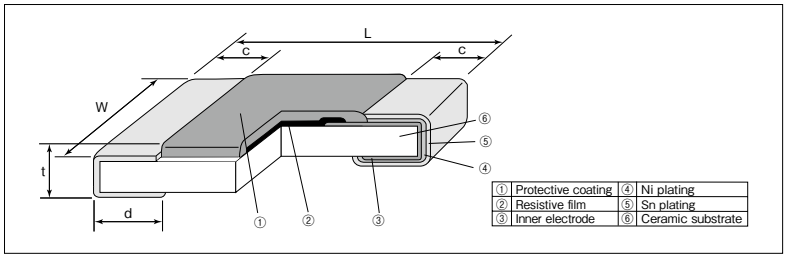
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

RS73-RT ▌High Reliability Chip Resistors (Anti Sulfuration)



Coating color : Black

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Metal-glaze thick film resistor for surface mounting.
- High precision resistor with T.C.R. $\pm 25\times10^{-6}$/K～ and tolerance ±0.1%～.
- High reliability with ⊿R of ±0.2%～±0.5% in the Reliability test.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Car electronics, Industrial equipment, Industrial measurement

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.2±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	0.25±0.15	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.35±0.15	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14

■Type Designation

Example

RS73F	1J	R	T	TD	1002	B
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
RS73F RS73G	1E : 0.125W 1J : 0.2W 2A : 0.25W 2B : 0.33W	R : Anti sulfuration	T : Sn	TPL・TP : 2mm pitch punch paper TD : 4mm pitch punch paper BK : Bulk	4 digits	B : ±0.1% C : ±0.25% D : ±0.5% F : ±1.0%

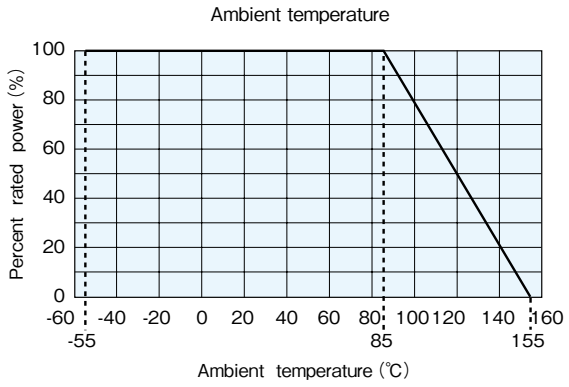
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

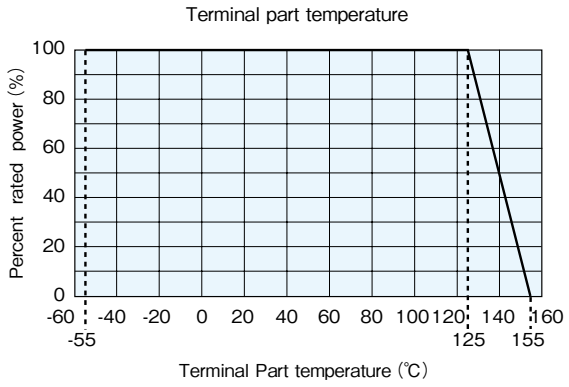
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) ※2				Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty /Reel(pcs)	
					B:±0.1% E24・E96	C:±0.25% E24・E96	D:±0.5% E24・E96	F:±1.0% E24・E96			TPL・TP	TD
RS73F1E	0.125W	85℃	125℃	±25※1	300～100k	300～1M	300～1M	300～1M	75V	100V	TPL:20,000 TP:10,000	—
RS73G1E				±50								
RS73F1J	0.2W			±25※1	10～1M	10～1M	10～1M	10～1M	100V	150V	—	5,000
RS73G1J				±50								
RS73F2A	0.25W			±25※1	10～3M	10～6.8M	10～10M	10～10M	150V	300V		
RS73G2A				±50								
RS73F2B	0.33W			±25※1	10～1M	10～1M	10～10M	10～10M	200V	400V		
RS73G2B				±50								

Operating Temperature Range : −55℃～+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
For flat chip jumper resistor, please refer to RK73Z series.
※1 Measurement Temperature: +25℃/+125℃. Cold T.C.R. (−55℃/+25℃) is −50～+25×10⁻⁶/K.
※2 Please inquire of us about E192.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve



For resistors operated at an ambient temperature of 85℃ or higher, the power shall be derated in accordance with the above derating curve.



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	0.2	0.03	Rated voltage×2.5 for 5s
Resistance to soldering heat	0.2	0.1	260℃±5℃, 10s±1s
Rapid change of temperature	0.2 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.4 : others	0.05 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.2 : others	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	0.2 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦10MΩ) 0.4~0.5 : others	0.04 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦10MΩ) 0.08 : others	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 85℃ or rated terminal part temperature	0.2 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.4 : others	0.05 : 1E(300Ω≦R≦20kΩ) 1J(10Ω≦R≦1MΩ) 2A,2B(10Ω≦R≦10MΩ) 0.2 : others	85℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.2 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦100kΩ) 0.4~0.5 : others	0.1 : 1E(300Ω≦R≦10kΩ) 1J(10Ω≦R≦200kΩ) 2A,2B(10Ω≦R≦100kΩ) 0.2~0.3 : others	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

THICK FILM FOR HIGH TEMPERATURE

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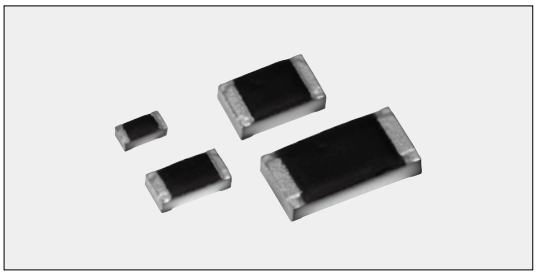
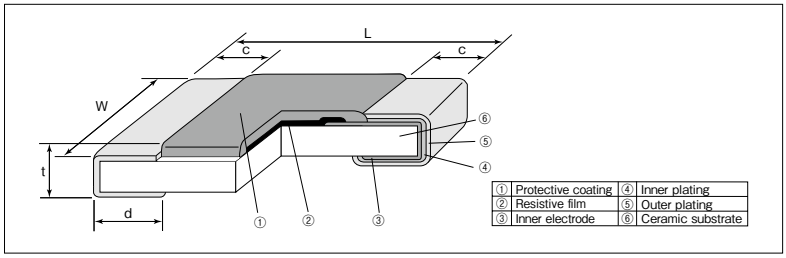
INDEX

HSG73P-RT High Temperature Flat Chip Resistors (Anti Sulfuration)



Coating color : Black

■Construction



■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- High heat resistance that can be used even at high temperatures of 155℃ or higher. The maximum operating temperature of Sn plating products compatible with solder mounting is 175℃.
- Excellent heat resistance and weather resistance are ensured by the use of metal glaze thick film.
- High stability and high reliability with the triple-layer structure of electrode.
- Superior to RK73 series chip resistors pulse withstanding voltage and high power.
- Applicable to various kinds of automatic mounters for taping, etc.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.2±0.15	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.15	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.25	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.55±0.35	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14

■Type Designation

Example

HSG73P	2B	R	T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E : 0.125W 0.2W※1 1J : 0.2W 0.33W※1 2A : 0.25W 0.5W※1 2B : 0.33W 0.75W※1	R : Anti sulfuration	T : Sn	TP : 2mm pitch punch paper TD : 4mm pitch punch paper BK : Bulk	F : 4 digits J : 3 digits	F : ± 1% J : ± 5%

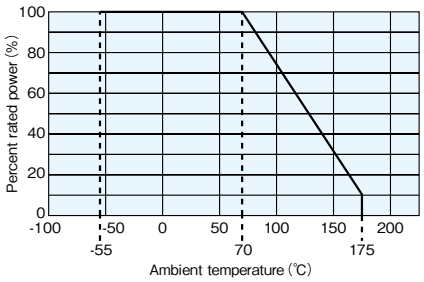
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range(Ω) F : ±1% E24	Resistance Range(Ω) J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	Packaging & Q'ty/Reel (pcs) TD
1E	0.125W	70℃	125℃	±200	10～1M	1～10M	75V	100V	10,000	–
	0.2W※1	70℃	105℃							
1J	0.2W	70℃	135℃	±200	10～1M	1～10M	150V	200V	–	5,000
	0.33W※1	70℃	125℃							
2A	0.25W	70℃	125℃	±200	10～1M	1～10M	200V	400V	–	5,000
	0.5W※1	70℃	100℃							
2B	0.33W	70℃	125℃	±200	10～1M	1～10M	200V	400V	–	5,000
	0.75W※1	70℃	105℃							

Operating Temperature Range : −55℃～+175℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

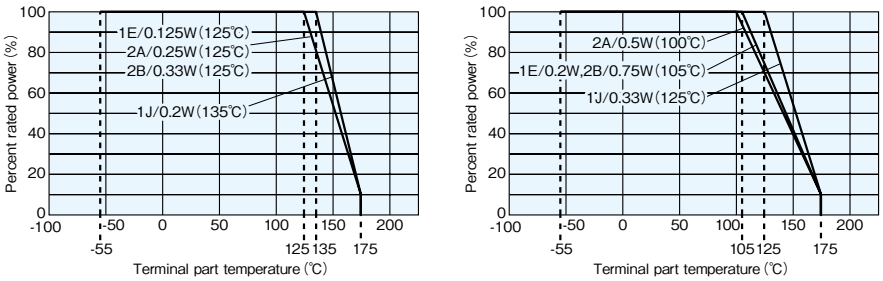
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※1, please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

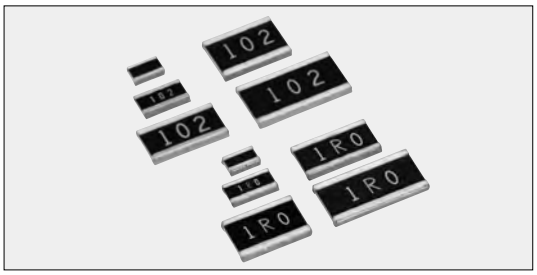
Test Items	Performance Requirements ΔR±(%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃, +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s(2A : 0.5W, 2B : 0.75W : Rated voltage×2 for 5s)
Rapid change of temperature	0.5	0.3	−55℃ (30min.) /+125℃ (30min.) 100 cycies
Moisture resistance	2 : 1J, 2A, 2B 3 : 1E	0.75 : 1J, 2A, 2B 1 : 1E	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	2 : 1J, 2A, 2B 3 : 1E	0.75 : 1J, 2A, 2B 1 : 1E	70℃±2℃ 1000h 1.5h ON/0.5h OFF cycle
Endurance at 175℃	1	0.3	+175℃,1000h,Power Rating×10%
Sulfuration test	5	0.2	Soaked in industtial oil with sulfur substance 3.5% contained 105℃±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

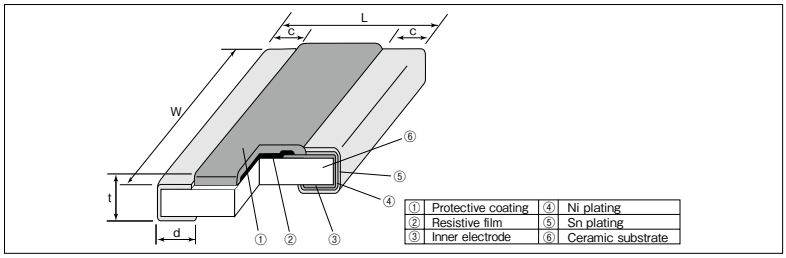
- The substrate of chip resistors is alumina. Cracks may occur at the connection due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

WK73-RT Wide Terminal Type Flat Chip Resistors (Anti Sulfuration)



Coating color：Black

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- Anti-sulfuration flat chip resistors of wide terminal type.
- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Suitable for both flow and reflow solderings.
- This products meet EU-RoHS requirements.
  EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Car electronics, Power supply, Industrial robot

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c±0.2	d	t±0.1	
2A (0508)	1.25±0.15	2.0±0.15	0.3	0.35±0.2	0.55	4.93
2B (0612)	$1.6^{+0.1}_{-0.2}$	$3.2^{+0.1}_{-0.3}$	0.3	0.45±0.15	0.6	12.0
2H (1020)	$2.5^{+0.1}_{-0.2}$	$5.0^{+0.1}_{-0.2}$	0.4	0.75±0.15		30.2
2J (1218)	$3.1^{+0.1}_{-0.2}$	$4.6^{+0.1}_{-0.2}$	0.4			33.3
3A (1225)	$3.1^{+0.2}_{-0.1}$	6.3±0.15	0.45			45.6

■Type Designation

Example

WK73R	2B	R	T	TD	1002	F
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
WK73S WK73R	2A:0.75W※1 1W※1 2B:0.75W 1W※1 2H:1W 2J:1W 3A:1.5W 2W※1	R:Anti sulfuration	T：Sn	TD:4mm pitch punch paper TE:4mm pitch plastic embossed BK:Bulk	F:4 digits J:3 digits	F：±1% J：±5%

Resistance Value (Ω)	3 digits	Resistance Value (Ω)	4 digits
1～9.1	1R0～9R1	1～9.76	1R00～9R76

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

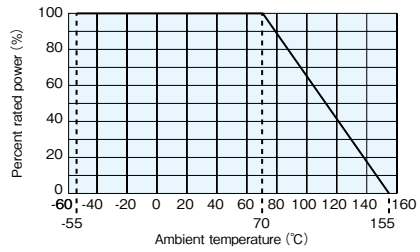
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) F：±1% E24・E96	Resistance Range (Ω) J：±5% E24	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty/Reel (pcs) TD	Taping & Q'ty/Reel (pcs) TE
WK73S2A	1W※1	70℃	125℃	±100	1～9.76	1～9.1	200V	400V	5,000	–
WK73R2A	0.75W※1	70℃	125℃	±100	20.5k～1M	22k～1M				
	1W※1	70℃	125℃	±100	10～20k	10～20k				
WK73S2B	0.75W	70℃	125℃	±100	1～9.76	1～9.1				
	1W※1	70℃	115℃	±100	1～9.76	1～9.1				
				±150	0.3～0.976	0.3～0.91				
WK73R2B	0.75W	70℃	125℃	±100	10～9.76k	10～9.1k				
				±200	10k～1M	10k～1M				
	1W※1	70℃	115℃	±100	10～9.76k	10～9.1k				
WK73S2H	1W	70℃	125℃	±100	1～9.76	1～9.1			–	4,000
				±150	0.2～0.976	0.2～0.91				
WK73R2H	1W	70℃	125℃	±100	10～430k	10～430k				
				±200	432k～1M	470k～1M				
WK73S2J	1W	70℃	100℃	±100	1～9.76	1～9.1			–	4,000
WK73R2J	1W	70℃	100℃	±100	10～510k	10～510k				
				±200	511k～1M	560k～1M				
WK73S3A	1.5W	70℃	125℃	±100	1～9.76	1～9.1			–	4,000
	2W※1	70℃	115℃	±100	1～9.76	1～9.1				
WK73R3A	1.5W	70℃	125℃	±100	10～330k	10～330k				
				±200	332k～1M	360k～1M				
	2W※1	70℃	115℃	±100	10～330k	10～330k				
				±200	332k～1M	360k～1M				

Operating Temperature Range：−55℃～+155℃
Rated voltage＝√Power Rating×Resistance value or Max. working voltage, whichever is lower.
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

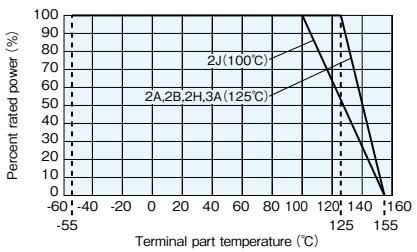
■Derating Curve

Ambient temperature

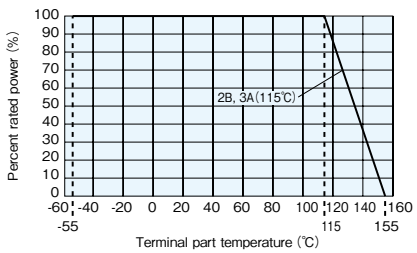


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the derating curve.

Terminal part temperature



Terminal part temperature
WK73S/R2B(1W)、WK73S/R3A(2W)



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

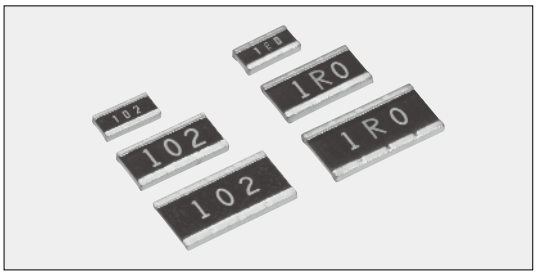
Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2.5 for 5s (WK73S/R2A(0.75W、1W)、WK73S/R2B(1W)、WK73S/R3A(2W) Rated voltage×2.0 for 5s)
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.2	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.2	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

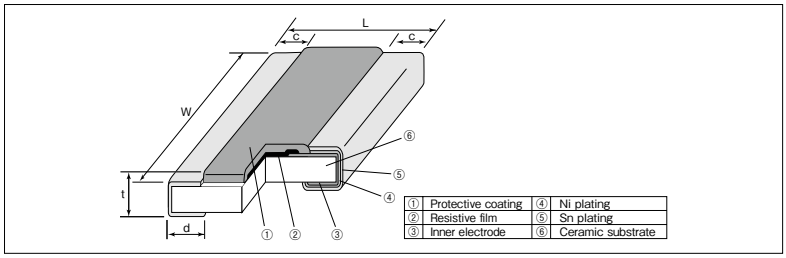
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WK73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

WK73-RT Wide Terminal Type Flat Chip Resistors (High Power/Anti Sulfuration)



Coating color : Black

■Construction



■Features

- Higher power than conventional type.
- Anti-sulfuration flat chip resistors of wide terminal type.
- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Suitable for both flow and reflow solderings.
- This products meet EU-RoHS requirements.
  EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Car electronics, Power supply, Industrial robot

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
2B15 (0612)	$1.6^{+0.1}_{-0.2}$	$3.2^{+0.1}_{-0.3}$	0.3±0.2	0.45±0.15	0.6±0.1	12.0
2H2 (1020)	$2.5^{+0.1}_{-0.2}$	$5.0^{+0.1}_{-0.2}$	0.4±0.2	0.75±0.15		30.2
3A3 (1225)	$3.1^{+0.2}_{-0.1}$	6.3±0.15	0.45±0.2			45.6

■Type Designation

Example

WK73R	2B15	R	T	TD	1002	F
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
WK73S WK73R	2B15:1.5W※1 2H2:2W※1 3A3:3W※1	R:Anti sulfuration	T : Sn	TD:4mm pitch punch paper TE:4mm pitch plastic embossed BK:Bulk	F:4 digits J:3 digits	F : ±1% J : ±5%

Resistance Value (Ω)	3 digits	Resistance Value (Ω)	4 digits
1~9.1	1R0~9R1	1~9.76	1R00~9R76

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

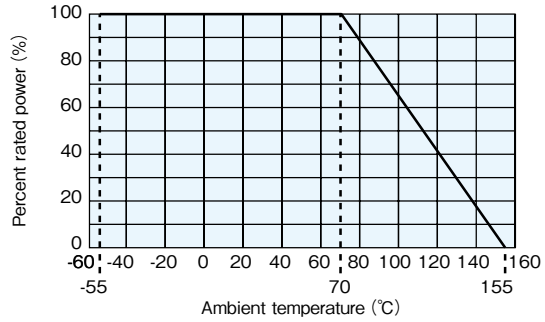
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) F : ±1% E24・E96	Resistance Range (Ω) J : ±5% E24	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty/Reel (pcs) TD	Taping & Q'ty/Reel (pcs) TE
WK73S2B15	1.5W※1	70℃	95℃	±100	1~9.76	1~9.1	200V	400V	5,000	–
				±150	0.3~0.976	0.3~0.91				
WK73R2B15	1.5W※1	70℃	95℃	±100	10~9.76k	10~9.1k				
WK73S2H2	2W※1	70℃	95℃	±100	1~9.76	1~9.1			–	4,000
				±150	0.2~0.976	0.2~0.91				
WK73R2H2	2W※1	70℃	95℃	±100	10~430k	10~430k				
				±200	432k~1M	470k~1M				
WK73S3A3	3W※1	70℃	95℃	±100	1~9.76	1~9.1			–	4,000
WK73R3A3	3W※1	70℃	95℃	±100	10~330k	10~330k				
				±200	332k~1M	360k~1M				

If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
Rated voltage = √Power Rating × Resistance value or Max. working voltage, whichever is lower.
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.
Operating Temperature Range : −55℃~+155℃

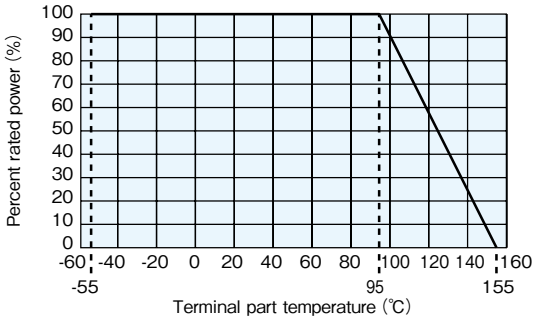
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the current shall be derated in accordance with the above derating curve.

Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog before use.

■Performance

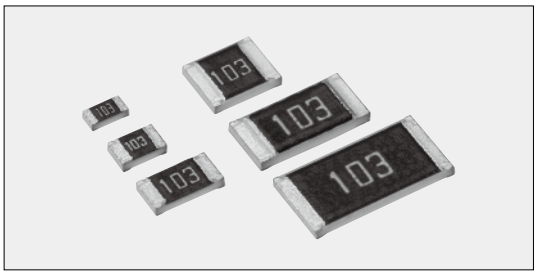
Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2.0 for 5s
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.2	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.2	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WK73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

SG73-RT Surge Current Flat Chip Resistors (Anti Sulfuration)



Coating color：Wine red

■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Superior to RK73 series chip resistors in surge withstanding voltage and pulse withstanding voltage.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

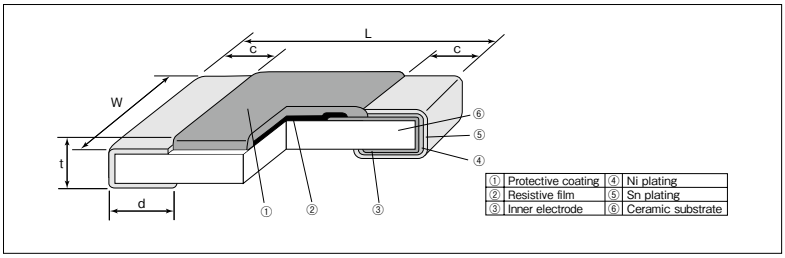
■Applications

- Car electronics, Power supply, Industrial robot

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight(g) (1000pcs)
	L±0.2	W	c	d	t±0.1	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2E (1210)		2.6±0.2				15.50
W2H (2010)	5.0	2.5±0.2		0.65±0.15		24.30
W3A (2512)	6.3	3.1±0.2				37.10

■Type Designation

Example

SG73	2A	R	T	TD	103	K
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J:0.1W 2A:0.125W 2B:0.33W 2E:0.5W W2H:0.75W W3A:1W	R:Anti sulfuration	T：Sn	TP:2mm pitch punch paper TD:4mm pitch punch paper TE:4mm pitch plastic embossed BK:Bulk	3 digits	K:±10% M:±20%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

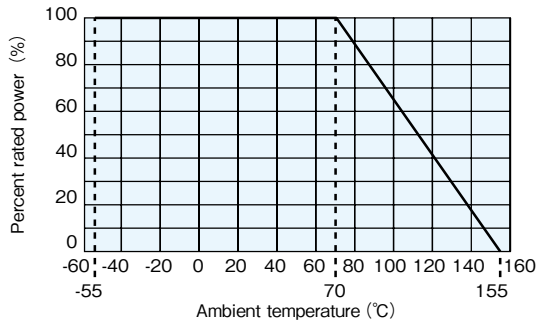
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) K:±10% M:±20% E12	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1J	0.1W	70℃	125℃	±400	1～8.2	50V	100V	10,000※1	5,000	—
				±200	10～1M					
2A	0.125W	70℃	125℃	±400	1～8.2	150V	200V	10,000※1	5,000	4,000※1
				±200	10～1M					
2B	0.33W	70℃	125℃	±400	1～8.2	200V	400V	—	5,000	4,000※1
				±200	10～1M					
2E	0.5W	70℃	125℃	±400	1～8.2			—	5,000	4,000※1
				±200	10～1M					
W2H	0.75W	70℃	125℃	±400	1～8.2			—	—	4,000
				±200	10～1M					
W3A	1.0W	70℃	125℃	±400	1～8.2			—	—	4,000
				±200	10～1M					

Operating Temperature Range：−55℃～+155℃
Rated voltage＝$\sqrt{\text{Power Rating}\times\text{Resistance value or Max. working voltage, whichever is lower.}}$
※1 Standard packaging：TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

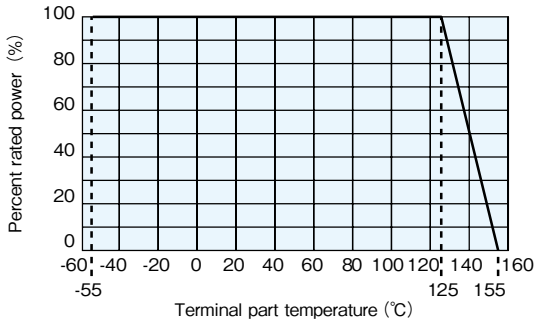
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

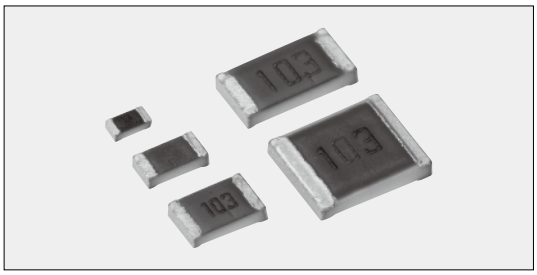
Test Items	Performance Requirements ΔR±(%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5	0.3	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	3	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of W2H/W3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1J～2E, but the crack tends to occur in the types of W2H/W3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

SG73P-RT Endured Pulse Power Flat Chip Resistors (Anti Sulfuration)



Coating color : Black (1E)
Green (1J, 2A, 2B, 2E, 2E1)

■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Superior to RK73 series chip resistors pulse withstanding voltage and high power.
- SG73P (for pulse) are able to select Resistance tolerance is available from ±0.5%.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

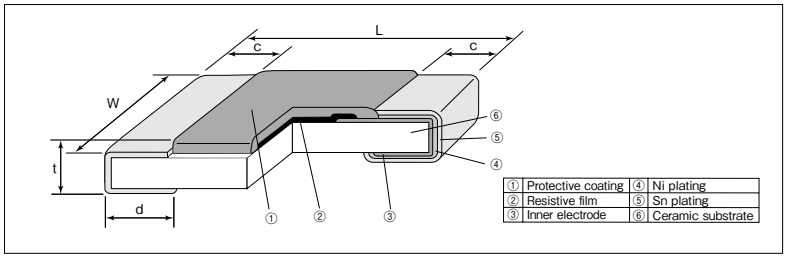
■Applications

- Car electronics, Power supply, Industrial robot

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.15±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	$0.3^{+0.2}_{-0.1}$	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2E (1210)		2.6±0.2				15.5
2E1 (1210)						

■Type Designation

Example

SG73P	2A	R	T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E : 0.125W 0.2W※2 1J : 0.2W 0.33W※2 2A : 0.25W 0.5W※2 2B : 0.33W 0.75W※2 2E : 0.5W 0.75W※2 2E1: 1W※2	R : Anti sulfuration	T : Sn	TP: 紙テープ (2mmピッチ) TD: 紙テープ (4mmピッチ) TE: エンボステープ (4mmピッチ) BK: バルク	D,F : 4digits G,J : 3digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

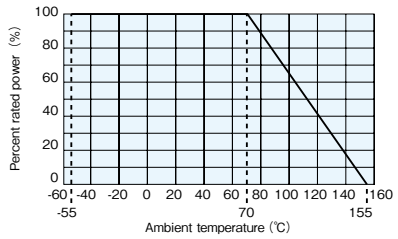
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1E	0.125W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M	75V	100V	10,000	—	—
	0.2W※2	70℃	105℃										
1J	0.2W	70℃	135℃	±100※1	100~1M	10~1M	10~10M	1~10M	150V	200V	10,000※4	5,000	—
	0.33W※2	70℃	125℃										
2A	0.25W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M	400V	600V (800V)※3	10,000※4	5,000	4,000※4
	0.5W※2	70℃	100℃										
2B	0.33W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M	200V	400V	—	5,000	4,000※4
	0.75W※2	70℃	105℃										
2E	0.5W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M			—	5,000	4,000※4
	0.75W※2	70℃	110℃										
2E1	1.0W※2	70℃	95℃	±200	100~1M	10~1M	10~10M	1~10M	200V	400V	—	5,000	4,000※4

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 Cold T.C.R. (−55℃~+25℃) is ±150×10⁻⁶/K.
※2 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※3 Applies when power rating is 0.4W or lower.
※4 Standard packaging : TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

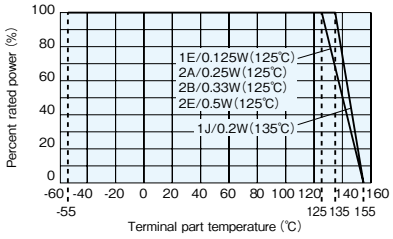
■Derating Curve

Ambient temperature

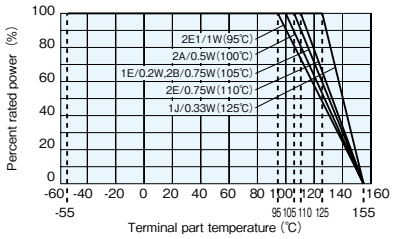


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※2 or ※3, please use the derating curues based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

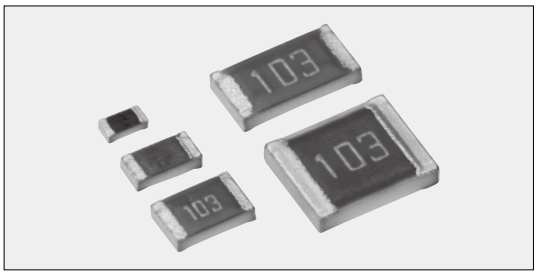
Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s(2A : 0.4W, 0.5W, 2B : 0.75W, 2E : 0.75W, 2E1 : 1W Rated voltage×2 for 5s)
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5	0.3	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	3	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

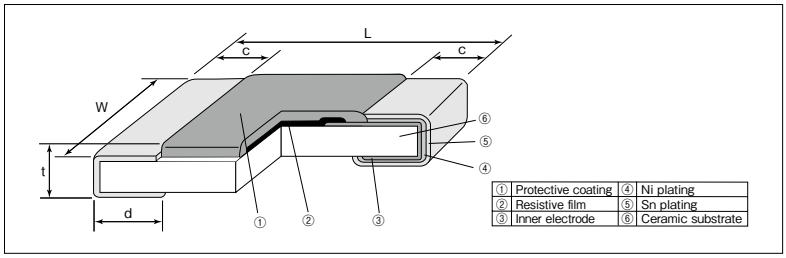
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

SG73S-RT Endured Surge Voltage Flat Chip Resistors (Anti Sulfuration)



Coating color : Black (1E)
Green (1J, 2A, 2B, 2E, 2E1)

■Construction



■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Superior to RK73 series chip resistors in surge withstanding voltage and high power.
- SG73S (for pulse) are able to select Resistance tolerance is available from ±0.5%.
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Car electronics, Power supply, Industrial robot

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1E (0402)	$1.0^{+0.1}_{-0.05}$	0.5±0.05	0.15±0.1	$0.25^{+0.05}_{-0.1}$	0.35±0.05	0.68
1J (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	$0.3^{+0.2}_{-0.1}$	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	$0.4^{+0.2}_{-0.1}$	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2E (1210)		2.6±0.2				15.5
2E1 (1210)						

■Type Designation

Example

SG73S	2A	R	T	TD	103	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E : 0.125W 0.2W※2 1J : 0.2W 0.33W※2 2A : 0.25W 0.5W※2 2B : 0.33W 0.75W※2 2E : 0.5W 0.75W※2 2E1: 1W※2	R : Anti sulfuration	T : Sn	TP: 2mm pitch punch paper TD: 4mm pitch punch paper TE: 4mm pitch plastic embossed BK: Bulk	D,F : 4digits G,J : 3digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

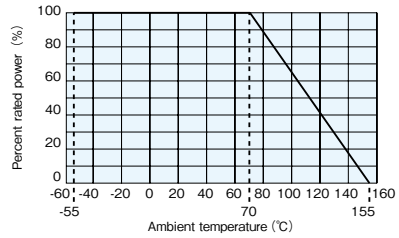
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D: ±0.5% E24・E96	F: ±1% E24・E96	G: ±2% E24	J: ±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty/Reel (pcs) TP	TD	TE
1E	0.125W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M	75V	100V	10,000	—	—
	0.2W※2	70℃	105℃										
1J	0.2W	70℃	135℃	±100※1	100~1M	10~1M	10~10M	1~10M	150V	200V	10,000※4	5,000	—
	0.33W※2	70℃	125℃										
2A	0.25W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M	400V	600V (800V)※3	10,000※4	5,000	4,000※4
	0.5W※2	70℃	100℃										
2B	0.33W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M	200V	400V	—	5,000	4,000※4
	0.75W※2	70℃	105℃										
2E	0.5W	70℃	125℃	±200	100~1M	10~1M	10~10M	1~10M			—	5,000	4,000※4
	0.75W※2	70℃	110℃										
2E1	1.0W※2	70℃	95℃	±200	100~1M	10~1M	10~10M	1~10M	200V	400V	—	5,000	4,000※4

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 Cold T.C.R. (−55℃~+25℃) is ±150×10⁻⁶/K.
※2 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
※3 Applies when power rating is 0.4W or lower.
※4 Standard packaging : TD(4mm pitch punch paper)
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

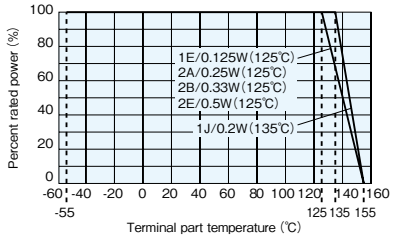
■Derating Curve

Ambient temperature

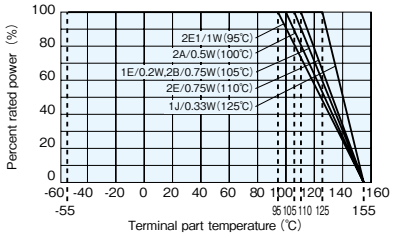


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※2 or ※3, please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

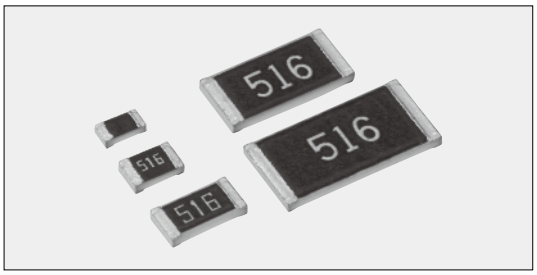
Test Items	Performance Requirements ΔR±(%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s(2A : 0.4W, 0.5W, 2B : 0.75W, 2E : 0.75W, 2E1 : 1W Rated voltage×2 for 5s)
Resistance to soldering heat	1	0.75	260℃±5℃, 10s±1s
Rapid change of temperature	0.5	0.3	−55℃ (30min.) / +125℃ (30min.) 100 cycles
Moisture resistance	3	0.75	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

HV73-RT Flat Chip Resistors For High Voltage (Anti Sulfuration)



Coating color : Black

■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Superior to RK73 series in maximum working voltage.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

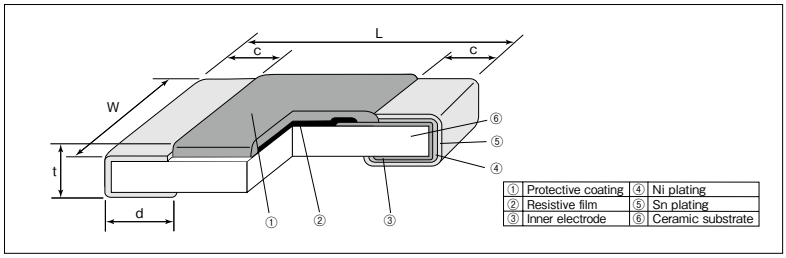
■Applications

- Power supply, industrial robot.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■ Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■ Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W	c	d	t±0.1	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2H (2010)	5.0	2.5±0.2				24.3
3A (2512)	6.3	3.1±0.2				37.1

■ Type Designation

Example

HV73	2B	R	T	TD	1004	F
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J : 0.1W 2A : 0.25W 2B : 0.25W 2H : 0.5W 3A : 1W	R : Anti sulfuration	T : Sn	TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	D,F : 4digits G,J : 3digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

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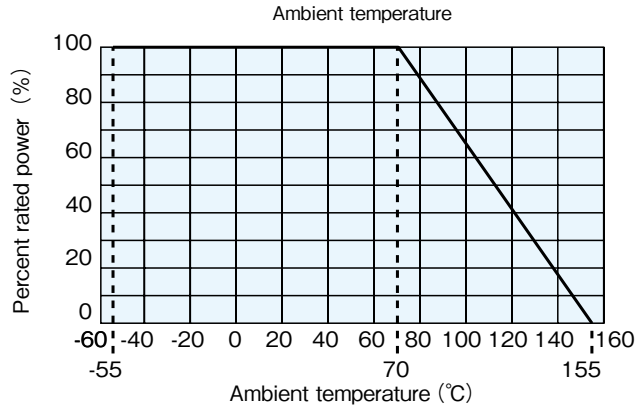
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

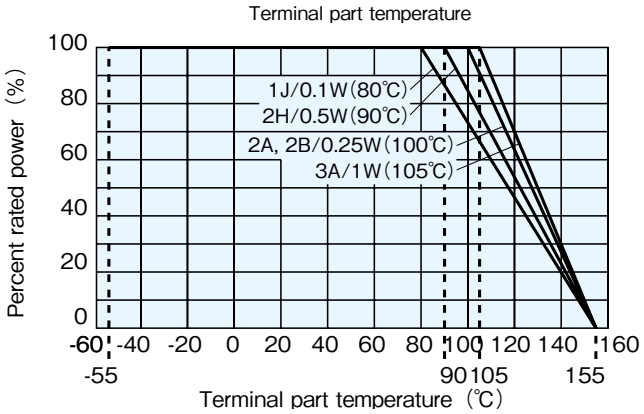
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Max. Working Voltage	Max. Overload Voltage (D.C.)※1	Taping & Q'ty/Reel (pcs) TD	TE
1J	0.1W	70℃	80℃	±100※2	—	10k~10M	10k~10M	10k~10M	350V	500V	5,000	–
2A	0.25W	70℃	100℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	400V	800V	5,000	–
				±200	—	—	—	11M~51M				
2B	0.25W	70℃	100℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	800V	1000V	5,000	–
				±200	—	—	—	11M~51M				
2H	0.5W	70℃	90℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	2000V (D.C.)	3000V	–	4,000
				±200	—	—	—	11M~51M				
3A	1W	70℃	105℃	±100	43k~1M	43k~10M	43k~10M	43k~10M	3000V (D.C.)	4000V	–	4,000
				±200	—	10.2M~20M	11M~20M	11M~51M				

Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 Max. overload voltage is specified by D.C. voltage.
※2 Cold T.C.R.(−55℃~+25℃) of 1.02MΩ~10MΩ is ±200×10⁻⁶/K.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■ Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■ Performance

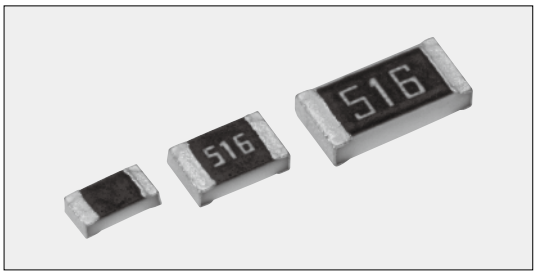
Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage (D.C.) ×2.5 for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : (10kΩ≦R≦10MΩ) 1 : (11MΩ≦R≦51MΩ)	0.3 : (10kΩ≦R≦10MΩ) 0.5 : (11MΩ≦R≦51MΩ)	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	2	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2	0.3	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

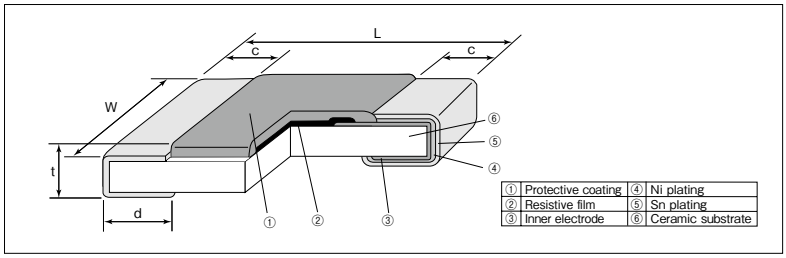
- Max. overload voltage is specified by D.C. voltage. When using in A.C. voltage, the peek value of A.C. voltage shall not exceed the Maximum overload voltage.
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when large types of 2H/3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy (FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1J～2B, but the crack tends to occur in the types of 2H/3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

HV73V-RT Flat Chip Resistors For High Voltage (For Automotive, Anti Sulfuration)



Coating color : Black

Construction



Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Superior to RK73 series in maximum working voltage.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- Suitable for high reliable applications like automotives. AEC-Q200 Tested.

Applications

- Inverter, DC-DC converter, Battery Management, Charger, HID lamp

Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W	c	d	t±0.1	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.45	2.14
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5	4.54
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14

Type Designation

Example

HV73V	2A	R	T	TD	104	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J : 0.1W 2A : 0.25W 2B : 0.33W	R : Anti sulfuration	T : Sn	TD : 4mm pitch punch paper BK : Bulk	D,F : 4digits G,J : 3digits	D : ±0.5% F : ±1% G : ±2% J : ±5%

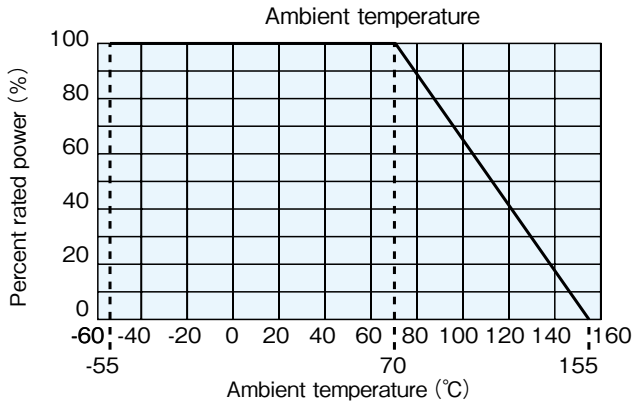
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

Ratings

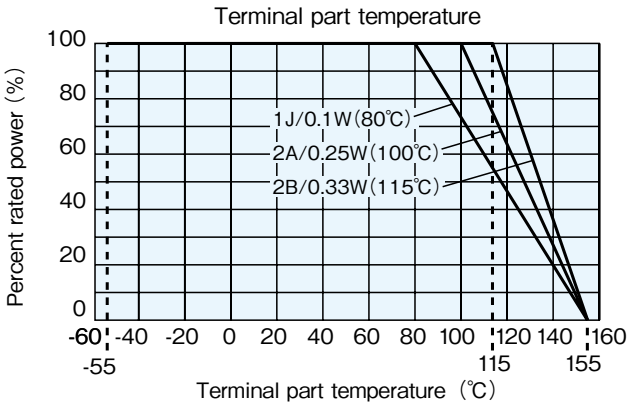
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Max. Working Voltage	Max. Overload Voltage (D.C.)※1	Taping & Q'ty/Reel (pcs) TD
HV73V1J	0.1W	70℃	80℃	±100※2	—	10k~10M	10k~10M	10k~10M	350V	500V	5,000
HV73V2A	0.25W		100℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	400V	800V	
				±200	—	—	—	11M~51M			
HV73V2B	0.33W		115℃	±100	100k~1M	100k~10M	100k~10M	100k~10M	800V	1200V	
				±200	—	—	—	11M~51M			

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 Max. overload voltage is specified by D.C. voltage.
※2 Cold T.C.R. (−55℃~+25℃) of 1.02MΩ~10MΩ is ±200×10⁻⁶/K.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature". For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■ Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

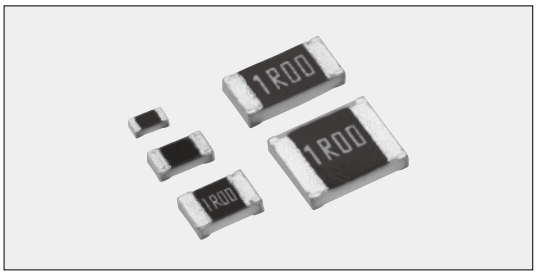
Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage (D.C.) ×2.5 for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : (10kΩ≦R≦10MΩ) 1 : (11MΩ≦R≦51MΩ)	0.3 : (10kΩ≦R≦10MΩ) 0.5 : (11MΩ≦R≦51MΩ)	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	2	0.75	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.75	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2	0.3	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

■Precautions for Use

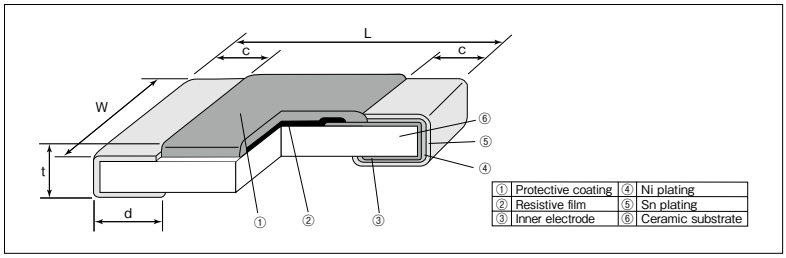
- Max. overload voltage is specified by D.C. voltage. When using in A.C. voltage, the peek value of A.C. voltage shall not exceed the Maximum overload voltage.
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

SR73-RT Low Resistance Flat Chip Resistors (Anti Sulfuration)



Coating color : Black

■Construction



Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof inner top electrode material.
- Current detecting resistors for power supply, motor circuits, etc.
- High reliability and performance with resistance tolerance ±1.0%, T.C.R. ±100×10^{-6}/K
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Dimensions

Type (Inch Size Code)	Resistance Range (Ω)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
1E (0402)	1～10	$1.0^{+0.1}_{-0.05}$	$0.5^{+0.1}_{-0.05}$	0.2±0.1	0.25±0.1	0.35±0.05	0.68
1J (0603)	0.1～0.43	1.6±0.2	$0.8^{+0.15}_{-0.1}$	$0.35^{+0.15}_{-0.1}$	$0.35^{+0.2}_{-0.1}$	0.45±0.1	2.50
	0.47～10			0.35±0.1	0.35±0.1		2.14
2A (0805)	0.1～0.43	2.0±0.2	1.25±0.1	0.4±0.2	$0.4^{+0.2}_{-0.1}$	0.5±0.1	5.13
	0.47～10				$0.3^{+0.2}_{-0.1}$		4.54
2B (1206)	0.1～0.43	3.2±0.2	1.6±0.2	0.5±0.3	$0.5^{+0.2}_{-0.1}$	0.6±0.1	10.0
	0.47～10				$0.4^{+0.2}_{-0.1}$		9.14
2E (1210)	0.1～0.39		2.6±0.2		$0.5^{+0.2}_{-0.1}$		16.3
	0.43～10				$0.4^{+0.2}_{-0.1}$		15.5

■Applications

- Car electronics, Power supply, Industrial robot

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Type Designation

Example

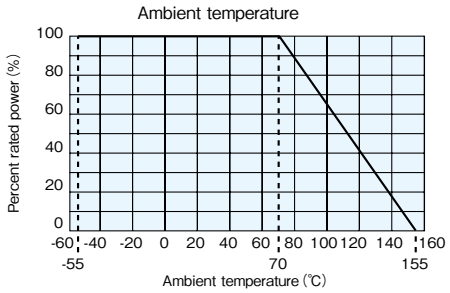
SR73	2B	R	T	TD	R10	J
Product Code	Power Rating	Characteristic	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1E:0.166W 1J:0.2W 2A:0.33W 0.5W※2 2B:0.33W 0.5W※2 2E:0.5W 0.66W※2	R:Anti sulfuration	T : Sn	TPL・TP: 2mm pitch punch paper TD:4mm pitch punch paper BK:Bulk	F:4 digits G,J:3 digits Ex. 0.1Ω:R100	F : ±1% G : ±2% J : ±5%

Resistance Value (Ω)	3digits
0.1～0.91	R10～R91
1～9.1	1R0～9R1
10	100

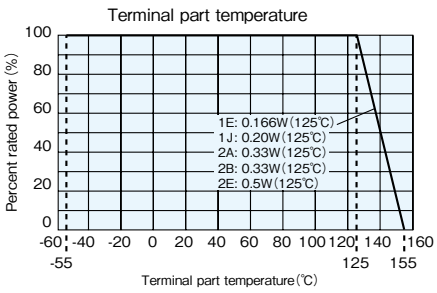
Resistance Value (Ω)	4digits
0.1～0.976	R100～R976
1～9.76	1R00～9R76
10	10R0

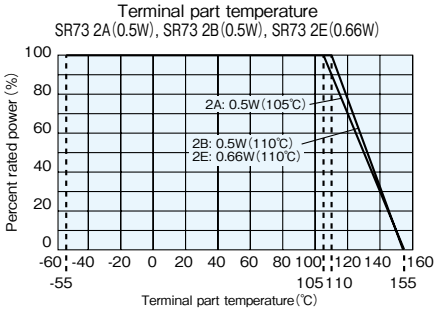
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.





When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
If you want to use at the rated power of ※2 please use the derating curves based on the terminal part temperature of right side.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) F:±1% E24・E96※1	Resistance Range (Ω) G:±2% E24	Resistance Range (Ω) J:±5% E24	Taping & Q'ty /Reel (pcs) TPL・TP	Taping & Q'ty /Reel (pcs) TD
1E	0.166W	70℃	125℃	±200	1～10	1～10	1～10	TPL:20,000 TP :10,000	–
1J	0.2W	70℃	125℃	±200	0.2～10	0.2～10	0.2～10	–	5,000
				±300	0.1～0.18	0.1～0.18	0.1～0.18		
2A	0.33W	70℃	125℃	±100	0.47～10	—	—	–	5,000
				±200	0.2～0.43	0.2～10	0.2～10		
				±250	0.1～0.18	0.1～0.18	0.1～0.18		
	0.5W※2	70℃	105℃	±100	0.47～10	—	—		
				±200	0.2～0.43	0.2～10	0.2～10		
				±250	0.1～0.18	0.1～0.18	0.1～0.18		
2B	0.33W	70℃	125℃	±100	0.47～10	—	—	–	5,000
				±200	0.2～0.43	0.2～10	0.2～10		
				±250	0.1～0.18	0.1～0.18	0.1～0.18		
	0.5W※2	70℃	110℃	±100	0.47～10	—	—		
				±200	0.2～0.43	0.2～10	0.2～10		
				±250	0.1～0.18	0.1～0.18	0.1～0.18		
2E	0.5W	70℃	125℃	±100	0.43～10	—	—	–	5,000
				±200	0.2～0.39	0.2～10	0.2～10		
				±250	—	—	0.1～0.18		
	0.66W※2	70℃	110℃	±100	0.43～10	—	—		
				±200	0.2～0.39	0.2～10	0.2～10		
				±250	—	—	0.1～0.18		

Operating Temperature Range：−55℃～+155℃

Rated voltage＝$\sqrt{\text{Power Rating}\times\text{Resistance value}}$

※1 The nominal resistance value for SR731E(1Ω～10Ω), SR731J, 2A, 2B (0.1Ω～0.43Ω) and SR732E (0.1Ω～0.39Ω) is in E24.

※2 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the previous page.

If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature". For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Performance

Test Items	Performance Requirements ΔR± (%+0.005Ω) Limit	Performance Requirements ΔR± (%+0.005Ω) Typical	Test Methods
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s
Resistance to soldering heat	1	0.3	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.3	−55℃ (30min.)/+125℃ (30min.) 100 cycles
Moisture resistance	2	1	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	1	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h
Sulfuration test	5	0.2	Soaked in industrial oil with sulfur substance 3.5% contained 105℃ ±3℃ 500h

Please refer to conventional products for characteristic data such as temperature rise.

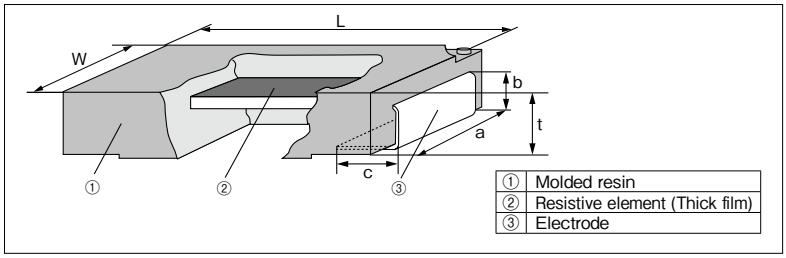
■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them.
- The resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

SLR Mold Type Thick Film Resistors

Coating color : Black

■ Construction



■Features

- Thick film resistor protected by liquid crystal polymer resin
- Excellent heat cycle characteristics
- Encapsulated with flame retardant resin molding. (UL94 V-0)
- High operating temperature range up to 180℃
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode,resistor element and glass.
- AEC-Q200 Tested.

■Applications

Automotive ECU, etc.
Industrial Batteries, etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■ Dimensions

Type (Inch Size Code)	Dimensions (mm)						Weight (g) (1000pcs)
	L	W	t	a	b	c	
SLR1 (2512)	6.3±0.3	3.1±0.2	1.9±0.2	2.4±0.2	1.2±0.2	1.2±0.3	90

■ Type Designation

Example

SLR	1	T	TE	R301	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
SLR	1:1.0W	T:Sn	TE:8mm pitch Plastic embossed TED:8mm pitch Plastic embossed BK:Bulk	D,F:4 digits J:3 digits	D:±0.5% F:±1% J:±5%

Resistance Value (Ω)	3 digits
0.33~0.91	R33~R91
1~9.1	1R0~9R1

Resistance Value (Ω)	4 digits
0.301~0.976	R301~R976
1~9.76	1R00~9R76

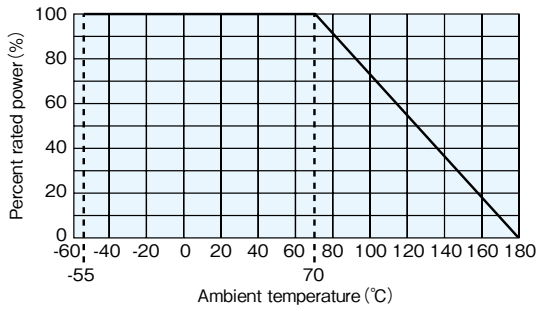
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

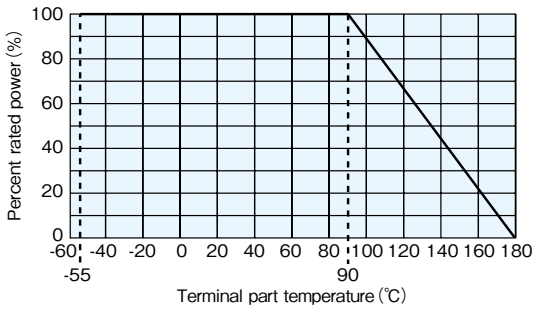
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	Resistance Range (Ω)			T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage	Operating Temp. Range	Taping & Q'ty/Reel (pcs)	
				D:±0.5% E24・E96	F:±1% E24・E96	J:±5% E24					TE	TED
SLR1	1W	70℃	90℃	301m~1M	301m~1M	330m~1M	±100	200V	400V	−55℃~+180℃	1,000	2,000

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
If any questions arise whether to use the"Rated Ambient Temperature"or the"Rated Terminal Part Temperature"in your usage conditions, please give priority to the"Rated Terminal Part Temperature".
For more details, please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog.

■ Derating Curve

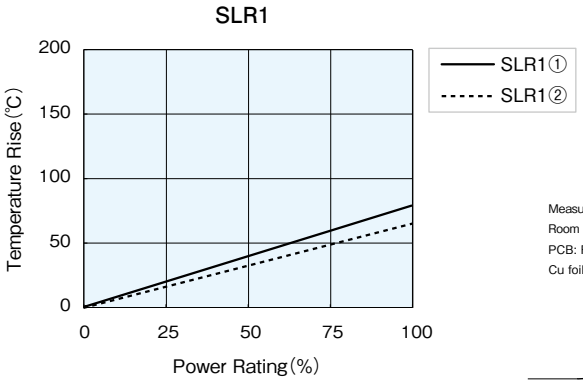


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

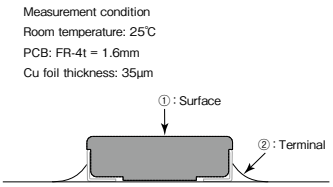


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※ Please refer to "Introduction of the derating curve based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

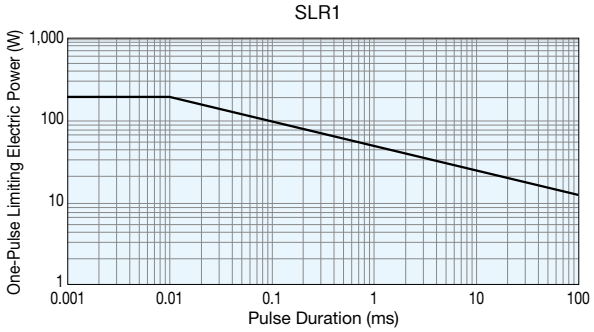


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power

The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.



■ Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃ / +125℃
Overload (Short time)	1	0.1	Rated power×5 for 5s
Resistance to soldering heat	1	0.3	260℃±5℃、10s±1s
Rapid change of temperature	1	0.4	−55℃(30min.)/+155℃(30min.)1000 cycles
Moisture resistance	2	0.2	40℃±2℃、90%～95%Rh 1000h 1.5h ON/0.5h OFF cycles
Endurance at 70℃	2	0.2	70℃±2℃、1000h 1.5h ON/0.5h OFF cycles

MOLD TYPE RESISTORS

NEW EU RoHS

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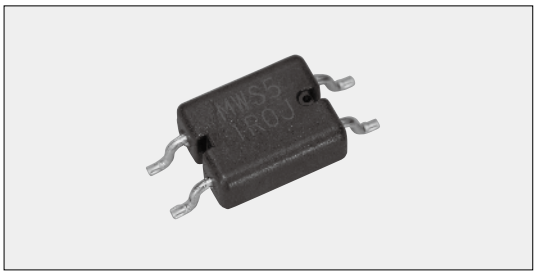
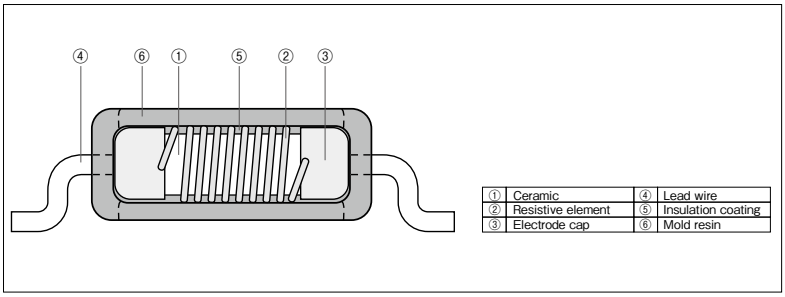
MWS Mold Wirewound Resistors



Coating color : Black

■Construction



■Features

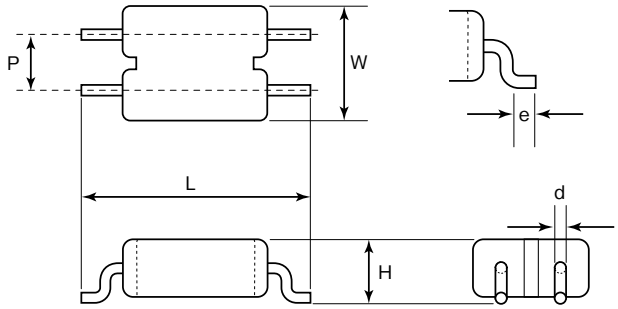
- Flame retardant coating (UL94 V-0)
- Products meet EU-RoHS requirements.
- It has excellent pulse resistance and is suitable as a surface mount component for precharge resistance, snubber resistance, and damping resistance.
- AEC-Q200 Tested.

■Applications

- Car electronics
- Industrial equipment

■Dimensions

Type	Dimensions (mm)						Weight (g) (1000pcs)
	L	W	H	P	e	d (Nominal)	
MWS5	16.9±0.2	8.6±0.2	4.8±0.2	4.2±0.2	1.4±0.2	0.8	1000



■Type Designation

Example

MWS	5	C	TEG	100	J
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	5:5W	C:SnCu	TEG:12mm pitch plastic embossed	3 digits	±5%

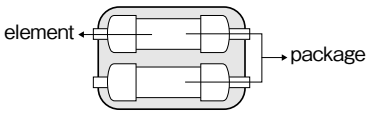
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

For further information on taping, please refer to APPENDIX C on the back pages.

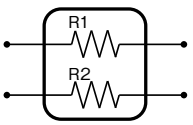
■Ratings

Type	PowerRating		Rated Terminal Part Temp.	Resistance Range (Ω) J:±5% (E24)	T.C.R. (×10⁻⁶/K)	Operating Temp. Range	Taping & Q'ty/ Reel (pcs)
	Package	Piece					
MWS5	5W	2.5W	+130℃	1~470	±200	−55℃~+200℃	1500

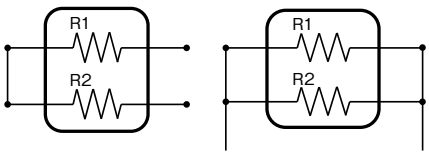
• Element and package



• Equivalent circuit (R1=R2)



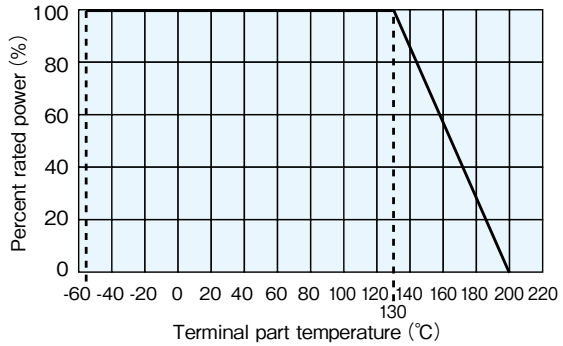
• Connection example (R1=R2)



Series connection　　Pararel connection

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$

■Derating Curve



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※ Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

Test Characterisics	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance内	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25C/+125℃
Rapid change of temperature	2	0.6	−55℃(30min.) / +155℃(30min.) 1000cyc.
Overload(Short time)	5	2	Power Rating ×4, 5s
Resistance to soldering heat	1	0.8	350℃±10℃, 3.5sec. or 260℃±5℃, 10s
Moisture resistance	5	3	Power Rating×1/10, 85℃, 80~85%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance of Rated Terminal part Temperature	5	3	130℃±2℃, rated voltage, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormaly in appearance such as disappearance of making, etc.	—	On immersing the sample in IPA for 3 minutes, the resistor surface should be lightly wiped with a dry cloth (velvet or gauze).
High temperature exposure	2	0.3	+155℃ , 1000h

■Precautions for Use

- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.

THICK FILM (For Embedded Substrates)

EU RoHS

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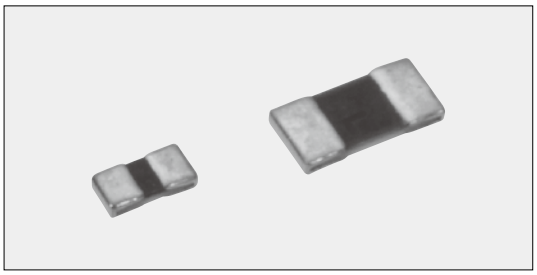
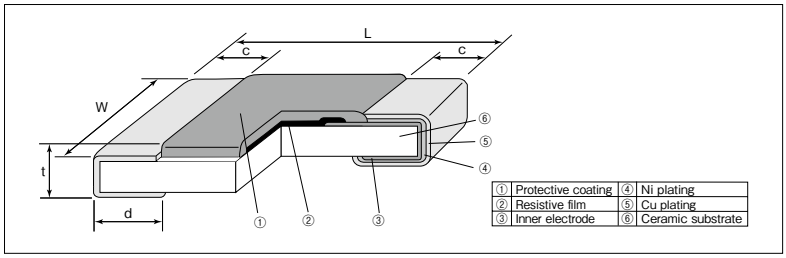
XR73B·XR73H·XR73Z ■ Flat Chip Resistors For Embedded Substrates



Coating color : Black

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Cu plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- Interlayer embedding in the multilayer substrate is applicable from the height of from 0.13 to 0.14mm.
- Cu via hole connection is applicable by the Cu electrode.

■Applications

- Communication module, Semiconductor packaging substrate.
- Smart phone, Tablet PC, Notebook PC, Wearable Device etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134A

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight(g) (1000pcs)
	L	W	c	d	t	
1H(0201)	0.6±0.03	0.3±0.03	0.23±0.03	0.23±0.03	0.13±0.02	0.11
1E(0402)	1.0±0.05	0.5±0.05	0.28±0.05	0.28±0.05	0.14±0.03	0.26

■Type Designation

Example

XR73H	1E	U	TWL	103	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
XR73B XR73H	1H : 0.063W 1E : 0.063W	U : Cu	TWL:2mm pitch plastic embossed TWA:1mm pitch plastic embossed BK:Bulk	F : 4 digits J : 3 digits	F : ±1% J : ±5%

XR73Z	1E	U	TWL
Product Code	Current Rating	Terminal Surface Material	Taping
XR73Z	1H : 1A 1E : 1A	U : Cu	TWL:2mm pitch plastic embossed TWA:1mm pitch plastic embossed BK:Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For the specification of TWA taping is 1H only.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

XR73B, XR73H

Type	Power※1 Rating	Rated Ambient Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) XR73H F:±1% E24・E96	Resistance Range (Ω) XR73B J:±5% E24	Max. Working Voltage	Max. Overload Voltage	Taping & Q'ty /Reel (pcs) TWL	Taping & Q'ty /Reel (pcs) TWA
1H	0.063W	70℃	±200	10~1M	10~10M	50V	100V	20,000	40,000
			±400	1.0~9.1※2	1.0~9.1				
1E	0.063W		±100	10~1M	—	50V	100V	20,000	—
			±200	1.0~9.76 1.02M~10M	1.0~10M				

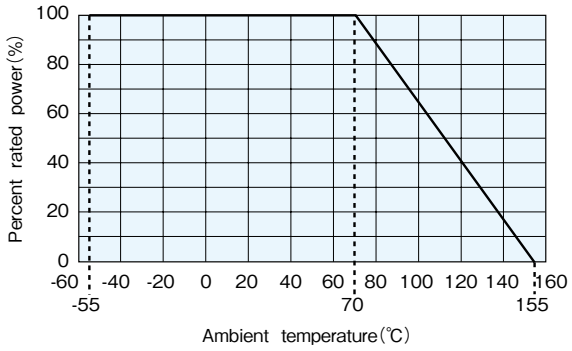
Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 The ratings will be for the surface mounted condition.
※2 The nominal resistance value for XR73H1H(1Ω≦R≦9.1Ω) is E24.

XR73Z

Type	Resistance	Current※ Rating	Rated Ambient Temp.	Max. Overload Current	Taping & Q'ty /Reel (pcs) TWL	Taping & Q'ty /Reel (pcs) TWA
1H	50mΩ max.	1A	70℃	2A	20,000	40,000
1E		1A		2A	20,000	—

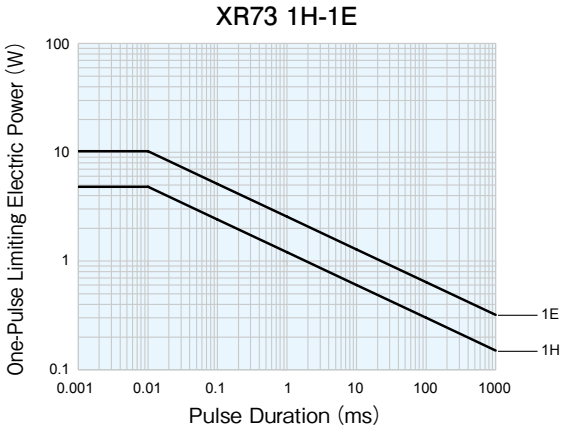
Operating Temperature Range : −55℃~+155℃
※The ratings will be for the surface mounted condition.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with derating curve on the left.

■One-Pulse Limiting Electric Power



The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance※

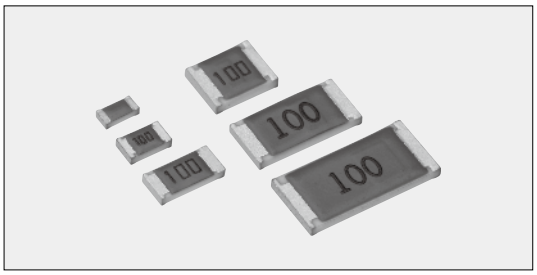
Test Items	XR73H, XR73B		XR73Z		Test Methods
	Performance Requirements ΔR±(%+0.05Ω)		Performance Requirements		
	Limit	Typical	Limit	Typical	
Resistance	Within specified tolerance	—	50mΩMax. after the test	15mΩMax. after the test	25℃
T.C.R.	Within specified T.C.R.	—	—	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	50mΩMax. after the test	R≦20mΩ：1E R≦40mΩ：1H	Rated voltage(DC)×2.5 for 5s (1H:Rated voltage(DC)×2 for 5s)
Rapid change of temperature	1	0.5	100mΩMax. after the test	R≦20mΩ：1E R≦40mΩ：1H	−55℃(30min.)/+125℃(30min.) 100 cycles
Moisture resistance	3	1.5	100mΩMax. after the test	R≦20mΩ：1E R≦40mΩ：1H	40℃±2℃、90%~95%RH、1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	3	1	100mΩMax. after the test	R≦20mΩ：1E R≦40mΩ：1H	70℃±2℃、1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.5	100mΩMax. after the test	R≦20mΩ：1E R≦40mΩ：1H	+155℃、1000h

※ The perfoemance will be for the surface mounted condition.

■Precautions for Use

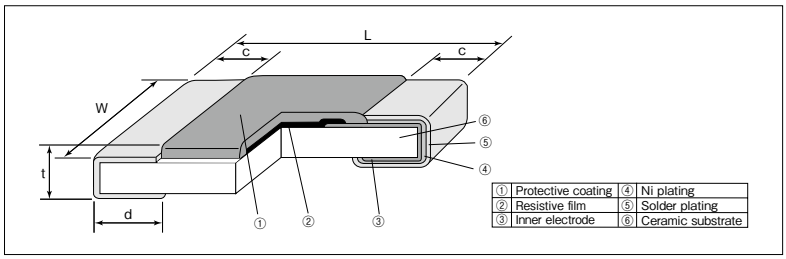
- This product is on the assumption that it is connected by embedding the product into the board and then Cu plating. Please evaluate the connection before use.
- This product is a very thin chip compared to the general flat chip resistors so, please adjust the mounting conditions appropriately (Nozzle figure, push in amount, mounting speed etc…).
- The heat dissipation condition differs depending on the material of the board and wiring pattern so please evaluate under the embedded condition before use.

RF73 Fusing Flat Chip Resistors



Coating color : Brown

■ Construction



■Features

- In normal condition, it works as a resistor and when excessive voltage is applied, it protects circuits by fusing quickly.
- The same shape as RK73 series.
- Recognized by safety standard UL1412. (1J is not recognized.)
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

■Approval Awarded

RF73 2A, 2B, 2E, 2H, 3A :
UL1412 File No.E117262

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2124

■Dimensions

Type (Inch Size Code)	Dimensions (mm) L±0.2	W	c	d	t±0.1	Weight (g) (1000pcs)
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.5	2.14
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$		4.54
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6	9.14
2E (1210)		2.6±0.2				15.5
2H (2010)	5.0	2.5±0.2				24.3
3A (2512)	6.3	3.1±0.2				37.1

■ Type Designation

Example

RF73	2B	T	TD	100	J
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1J :0.063W 2A:0.1W 2B:0.125W 2E:0.25W 2H:0.5W 3A:1.0W	T : Sn (L : Sn/Pb)	TD: 4mm pitch punch paper TE: 4mm pitch plastic embossed BK:Bulk	3 digits	J : ±5%

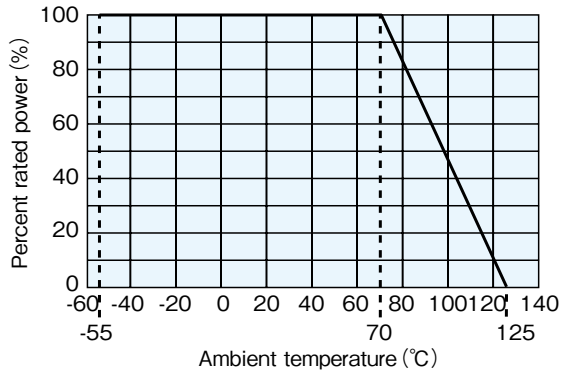
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

Type	Power Rating	Resistance Range (Ω) E24	Resistance Tolerance	Fusing Characteristics Fusing Power Resistance Range					Fusing Time	T.C.R. (×10⁻⁶/K)	Taping & Q'ty/Reel (pcs) TD	TE
1J	0.063W	1~100	J : ±5%		2.6W 1.0Ω	2.4W 1.1~20Ω	2.1W 22~100Ω		60s Max.	+1000~−500 (1.0~3.3Ω) ±500 (3.6~100Ω)	5,000	–
2A	0.1W	0.2~510		3.0W 0.2~0.47Ω	2.6W 0.51~1.0Ω	2.4W 1.1~20Ω	2.1W 22~100Ω	2.0W 110~510Ω		+1000~−500 (0.2~4.3Ω) ±500 (4.7~510Ω)	5,000	4,000※1
2B	0.125W			3.75W 0.2~0.47Ω	2.875W 0.51~10Ω	2.5W 11~24Ω	2.0W 27~100Ω	1.75W 110~510Ω			5,000	4,000※1
2E	0.25W			4.5W 0.2~0.47Ω	4.1W 0.51~4.7Ω	3.5W 5.1~27Ω	3.2W 30~100Ω	3.0W 110~510Ω			5,000	4,000※1
2H	0.5W			5.5W 0.2~0.47Ω	5.0W 0.51~4.7Ω	4.0W 5.1~27Ω	3.5W 30~100Ω	3.2W 110~510Ω			–	4,000
3A	1.0W			6.5W 0.2~0.47Ω	6.0W 0.51~4.7Ω	5.0W 5.1~30Ω	4.5W 33~100Ω	4.0W 110~510Ω			–	4,000

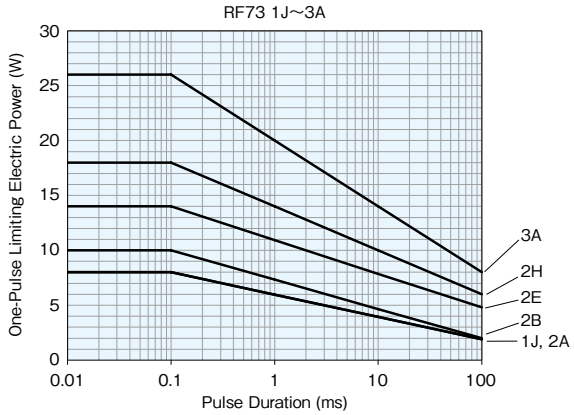
Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃~+125℃
※1 Standard packaging : TD(4mm pitch punch paper)

■ Derating Curve



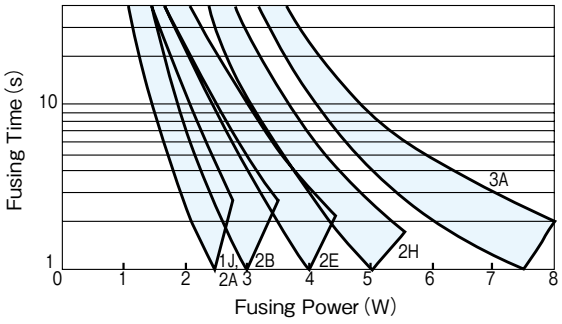
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with derating curve on the left.

■ One-Pulse Limiting Electric Power



Please ask us about the resistance characteristic of continuous applied pulse. The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■ Example of Fusing Characteristics



■ Performance

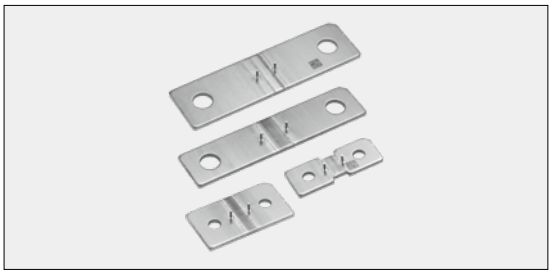
Test Items	Performance Requirements ΔR± (%+0.1Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	5	2	Rated voltage×2 for 5s (Except 2E, 2H, 3A : ×1.5)
Resistance to soldering heat	3	0.5	260℃±5℃, 10s±1s
Rapid change of temperature	0.5 : 2A~3A 3 : 1J	0.3 : 2A~3A 0.6 : 1J	−55℃ (30min.) /+125℃ (30min.) 5 cycles
Moisture resistance	5	2	40℃±2℃, 90%~95%RH, 500h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	5	1	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.6	+125℃, 100h

■Precautions for Use

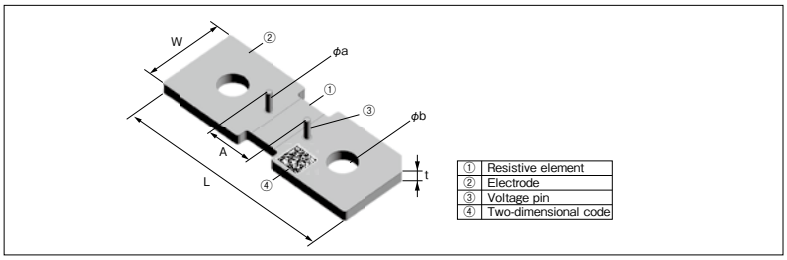
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON /OFF of load is repeated, especially when large types of 2H/3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy(FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1J~2E, but the crack tends to occur in the types of 2H/3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- Maximum open-circuit voltage is the maximum value of the voltage applicable to both ends of resistors, when a fuse resistor becomes open conditions in a circuit. It differs according to the form of a product and a resistance value and is specified individually. The maximum open-circuit voltage is the lower one, whichever the voltage 1000 times of the rated power or the voltage shown in below table. Use the components under the voltage applied between the terminals of resistors to be under the maximum open-circuit voltage regardless of normal operating or abnormal operating time of equipment.

Type	1J	2A	2B	2E	2H	3A
Maximum Open-Circuit Voltage	50V	50V	50V	50V	100V	100V

HS Large Current Shunt



■Construction



■Features

- Ultra low resistance, suitable for large current sensing.
- Excellent T.C.R. achieved (50±25 ×10^{-6}/K～)
- Correct electric current detection by a voltage pin is possible.
- Bus bar and Cable can be screwed on.
- 2D code means individual resistance information.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

■Applications

- Hybrid Electric Vehicle, Electric Vehicle
- BEMS, HEMS

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Dimensions

Type	Resistance (Ω)	Dimensions (mm)						Weight (g) (1pcs)
		L±0.25	W±0.25	A±0.2	φa±0.2	φb±0.1	t±0.2	
HSAN2P4022M5	50μ	40.0	22.0	8.5	1.0	5.4	2.0	15
HSAN2P8022M8		80.0	22.0	8.5	1.0	8.3	2.0	30
HSAN2P4015M5	100μ	40.0	15.0	8.5	1.0	5.4	2.0	10
HSBN2P8018M8		80.0	18.0	12.0	1.0	8.3	2.0	25
HSAN2P4015M5	200μ	40.0	15.0	8.5	1.0	5.4	1.0	5

■Type Designation

Example

HS	A	N	2P	4015
Product Code	Resistance Size	Current Terminal Surface Material	Number of Voltage Pin	Outward Form Size
	A : Width 5mm B : Width 8.2mm	N : Pure Cupper	0P : 0 pin 2P : 2 pin ※1	4022 : 50μΩ 8022 : 50μΩ 4015 : 100μΩ 200μΩ 8018 : 100μΩ length×width

M5	PT	L10	J	Y
Conclusion Hole	Packing form	Nominal Resistance	Resistance Tolerance	2D Code
M5 : M5 hole M8 : M8 hole	PT : Tray	50U : 50μΩ L10 : 100μΩ L20 : 200μΩ	J : ±5%	Nil : Non Code Y : With resistance value

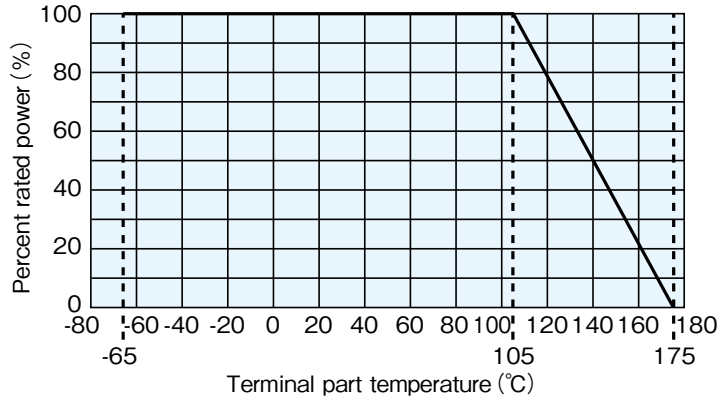
※1 Voltage pin: φ1mm, length 4mm, Sn plating.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Type	Power Rating※2 (Current Rating)	T.C.R. (×10^{-6}/K)	Resistance Range (Ω)	Rated Terminal Part Temp.	Operating Temp. Range
HS	50W (1000A)	75±50	50μ	105℃	−65℃～+175℃
	36W (600A)	50±25	100μ		
	18W (300A)		200μ		

※2 A power rating shall be guaranteed with a method shown in the item. (:Performance)

■Derating Curve

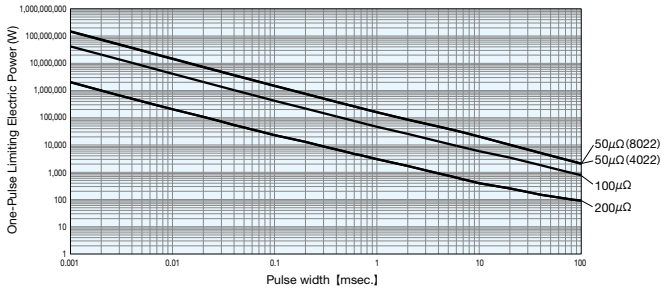


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

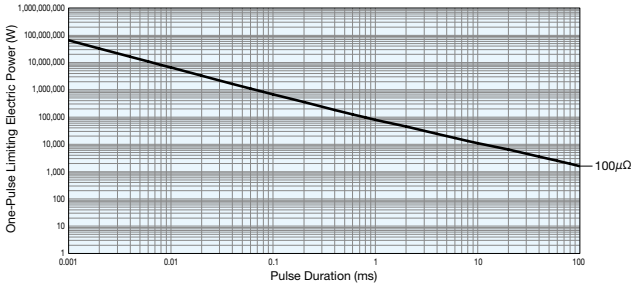
■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

HSA



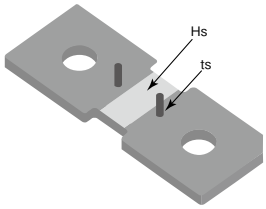
HSB



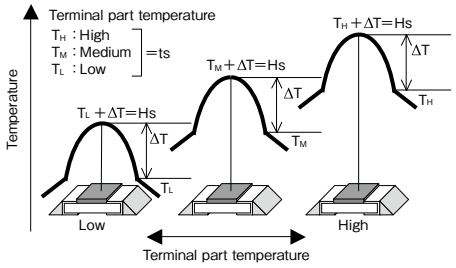
■Thermal Resistance

Resistance (Ω)	Rth (℃/W)
50μ	0.57
100μ	1.2
200μ	2.3

Rth=(Hs-ts)/Power



The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

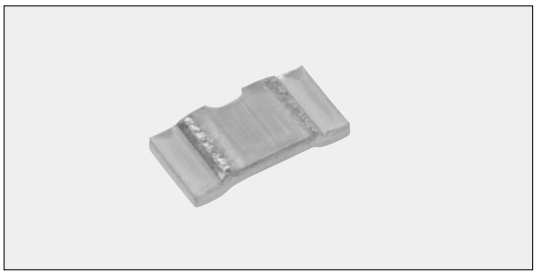
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R	Within specified T.C.R	—	50μΩ : +25℃/+125℃ 100μΩ, 200μΩ : +25℃/+100℃
Rapid change of temperature	0.5	−0.1	−55℃ (30min.) /+150℃ (30min.) 1000cycles
Endurance at 105℃ and less of terminal part temperature	1.0	−0.1	Terminal part temp. : 105℃±3℃, 1000h., 1.5h ON/0.5h OFF cycle
Low temperature exposure	0.5	−0.05	−65℃, 1000h.
High temperature exposure	1.0	−0.4	+175℃, 1000h.

■Precautions for Use

- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.

PSL2 Chip Type Power Shunt



■Features

- Ultra low resistance, suitable for large current sensing.
- Automatic mounting machines are applicable.
- Suitable for reflow soldering. (Not suitable for flow soldering.)
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

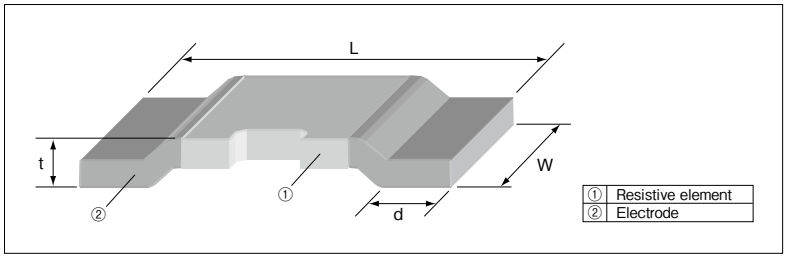
■Applications

- Current sensing for module of Automobiles, Inverter power supplies etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



■Dimensions

Type (Inch Size Code)	Resistance (Ω)	Dimensions (mm)				Weight (g) (1000pcs)
		L	W	d	t	
PSL2 (2512)	0.2m	6.3±0.15	3.15±0.15	1.15±0.15	1.40±0.15	181
	0.3m				1.32±0.15	161
	0.5m				1.12±0.15	128

■Type Designation

Example

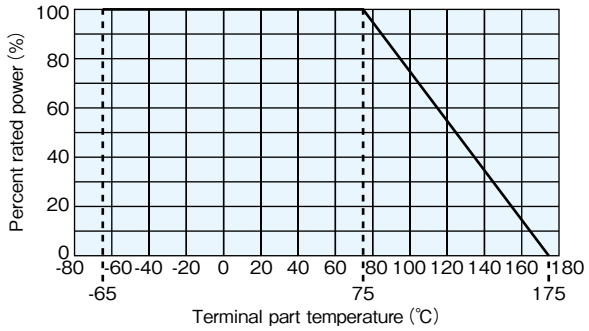
PS	L	2	N	TEB	L500	F
Product Code	Style &Power Rating	Terminal Number	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	L(0.2m) : 9W L(0.3m) : 8W L(0.5m) : 8W		N : Pure Cupper	TEB:8mm pitch plastic embossed BK:Bulk	4 digits L200 : 0.2mΩ L300 : 0.3mΩ L500 : 0.5mΩ	F : ±1%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating (Current Rating)	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)	Resistance Tolerance	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel(pcs)
							TEB
PSL2	9W(212A)	250±100	0.2m	F : ±1%	75℃	−65～+175℃	5,000
	8W(163A)	±175	0.3m				
	8W(126A)	±115	0.5m				

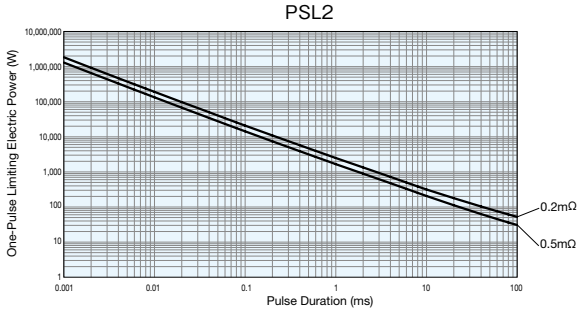
■Derating Curve



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of catalog berofe use.

■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.



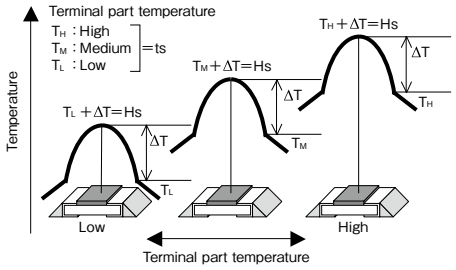
■Thermal Resistance

Type	Resistance (Ω)	Rth (℃/W)
PSL2	0.2m	3.2
	0.5m	6.7

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



■Performance

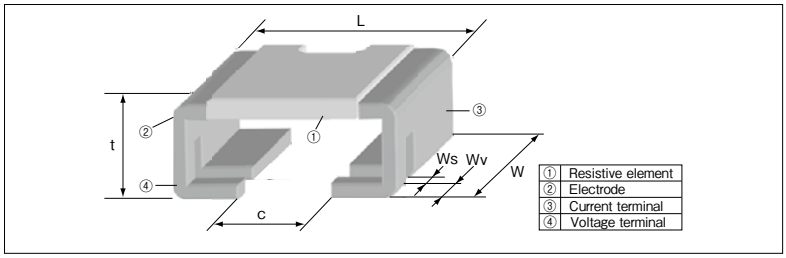
Test Items	Perfomance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R	Within specified T.C.R	—	+25℃/+125℃
Overload (Short time)	0.5	0.1	0.2mΩ : 27W for 5s. 0.3mΩ, 0.5mΩ : 24W for 5s.
Resistance to soldering heat	0.5	0.1	260℃±5℃、15s±1s
Rapid change of temperature	0.5	0.1	−55℃ (30min.)/+150℃ (30min.) 1000 cycles
Moisture resistance	0.5	0.05	85℃±3℃、85%±3%RH、1000h、10% Bias
Endurance at 75℃ and less of terminal part temperature	1.0	0.3	Terminal part temp. : 75℃±3℃、1000h、1.5h ON/0.5h OFF cycle
Low temperature exposure	0.5	0.02	−65℃、1000h
High temperature exposure	1.0	0.5	+175℃、1000h

■Precautions for Use

- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction induction with surrounding inductors.
- For resistance values of PSL2 the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

PSF4 Chip Type Power Shunt

■Construction



■Features

- Correcter electric current detection is possible to 4-terminal Construction.
- Excellent T.C.R. achieved (±50×10⁻⁶/K)
- Ultra low resistance, suitable for large current sensing.
- Automatic mounting machines are applicable.
- Suitable for reflow soldering. (Not suitable for flow soldering.)
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

■Applications

- Current sensing for module of Automobiles, Inverter power supplies etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Dimensions

Type (Inch Size Code)	Resistance (Ω)	Dimensions (mm)						Weight (g) (1000pcs)
		L	W	c	Ws	Wv	t	
PSF4 (1216)	0.5m	3.0±0.1	3.8±0.1	0.95±0.15	0.7±0.05	0.5±0.05	1.8±0.1	70
	1m							45

■Type Designation

Example

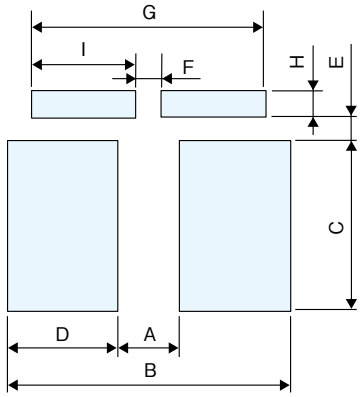
PS	F	4	N	TEB	L500	F
Product Code	Style &Power Rating	Terminal Number	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	F(0.5m):5W F(1m):3W		N:Pure Cupper	TEB:plastic embossed BK:Bulk	4 digits L500:0.5mΩ 1L00:1mΩ	F:±1%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating (Current Rating)	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)	Resistance Tolerance	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs)
							TEB
PSF4	5W(100A)	±50	0.5m	F : ±1%	130℃	−65～+175℃	3,000
	3W(54A)		1m				

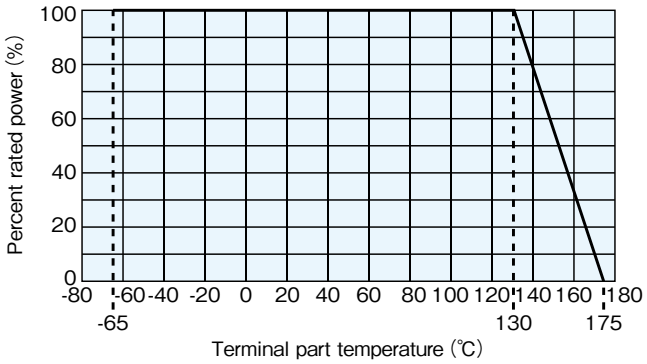
■Recommended Pad Dimensions



Type (Inch Size Code)	Dimensions (mm)								
	A	B	C	D	E	F	G	H	I
PSF4(1216)	0.6	3.6	2.95	1.5	0.5	0.6	3.6	0.7	1.5

※These pad dimensions are only for standard pattern and the characteristics are not guaranteed, which you are suggested to confirm before use.

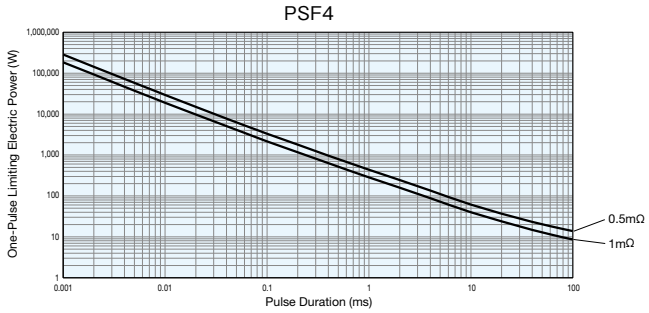
■Derating Curve



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of catalog berofe use.

■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.



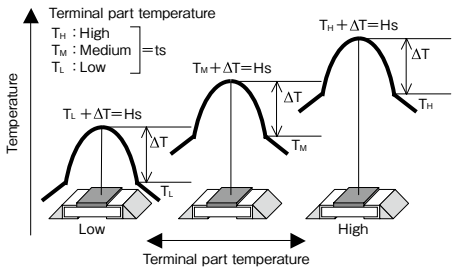
■Thermal Resistance

Type	Resistance (Ω)	Rth (℃/W)
PSF4	0.5m	8
	1m	14

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



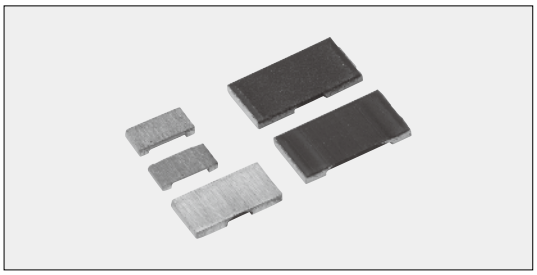
■Performance

Test Items	Perfomance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R	Within specified T.C.R	—	+25℃/+125℃
Overload (Short time)	0.5	0.1	0.5mΩ : 15W for 5s. 1mΩ : 9W for 5s.
Resistance to soldering heat	0.5	0.1	260℃±5℃、15s±1s
Rapid change of temperature	0.5	0.1	−55℃ (30min.)/+150℃ (30min.) 1000 cycles
Moisture resistance	0.5	0.05	85℃±3℃、85%±3%RH、1000h、10% Bias
Endurance of rated terminal part temperature	1.0	0.5	Terminal part temp. : 130℃±3℃、1000h、1.5h ON/0.5h OFF cycle
Low temperature exposure	0.5	0.01	−65℃、1000h
High temperature exposure	1.0	0.6	+175℃、1000h

■Precautions for Use

• In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction induction with surrounding inductors.

TLR Metal Plate Chip Type Low Resistance Resistors (High Power)



Coating color : Black (2BW(1mΩ,1.5mΩ), 2BP(1mΩ,1.5mΩ), 3AP(0.5m～1.5mΩ), 3APS(2mΩ))

■Features

- Ultra low resistances (0.5mΩ～), suitable for large current sensing.
- Ultra low height with a thickness of 0.6mm, suitable for use of small equipment.
- Excellent high-frequency characteristics.
- Automatic mounting machines are applicable.
- Suitable for reflow soldering. (Not suitable for flow soldering)
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

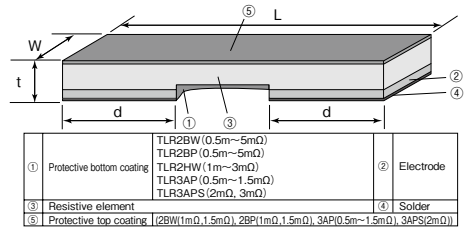
■Applications

- Current sensing for CPU
- Inverter power supplies
- DC-DC converters
- Mobile device etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■ Construction



①	Protective bottom coating	TLR2BW(0.5m～5mΩ) TLR2BP(0.5m～5mΩ) TLR2HW(1m～3mΩ) TLR3AP(0.5m～1.5mΩ) TLR3APS(2mΩ, 3mΩ)	②	Electrode
③	Resistive element		④	Solder
⑤	Protective top coating	(2BW(1mΩ,1.5mΩ), 2BP(1mΩ,1.5mΩ), 3AP(0.5m～1.5mΩ), 3APS(2mΩ))		

■ Dimensions

Type (Inch Size Code)	Resistance (Ω)	Dimensions (mm) L	W	d	t
2BW (1206)	0.5m	3.2±0.2	1.6±0.2	1.25±0.2	0.7±0.2
	1m, 1.5m			1.1±0.2	0.6±0.2
	2m, 3m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, 11m, 12m, 13m, 15m, 16m, 18m, 20m			0.5±0.2	
2BP (1206)	0.5m	3.2±0.2	1.6±0.2	1.25±0.2	0.7±0.2
	1m, 1.5m			1.1±0.2	0.6±0.2
	2m, 3m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, 11m, 12m, 13m, 15m, 16m, 18m, 20m			0.5±0.2	
2HW (2010)	0.5m	5.0±0.2	2.5±0.2	1.9±0.2	0.7±0.2
	1m			1.8±0.2	0.65±0.2
	1.5m				0.6±0.2
	2m, 2.5m, 3m, 4m, 5m, 6m			1.5±0.2	
	7m, 8m, 9m, 10m			0.5±0.2	
3AP (2512)	0.5m	6.35±0.25	3.18±0.25	2.725±0.25	0.6±0.25
	0.68m, 0.75m, 0.82m			2.675±0.25	
	1m, 1.5m, 3m, 4m			2.20±0.25	
	2m			2.50±0.25	
	5m, 6m, 7m, 8m			1.20±0.25	
	9m, 10m			0.77±0.25	
3APS (2512)	2m, 3m	6.35±0.25	3.18±0.25	1.20±0.25	0.6±0.25

■Type Designation

Example

TLR	2BW	D	TD	10L0	F	75
Product Code	Power Rating	Termination Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10⁻⁶/K)
	2BW : 1.0W 2BP : 1.5W 3.0W 2HW : 2.0W 3AP : 3.0W 5.0W 3APS : 3.0W	D : SnAgCu	TD : 4mm pitch punch paper TE : Plastic embossed BK : Bulk	F : 4 digits	F : ±1%	50 : ±50 75 : ±75

Resistance Value (Ω)	4 digits
0.5m～0.82m	L500～L820
1m～9m	1L00～9L00
10m～20m	10L0～20L0

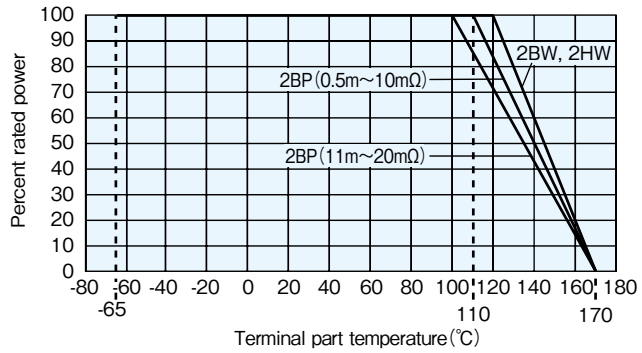
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

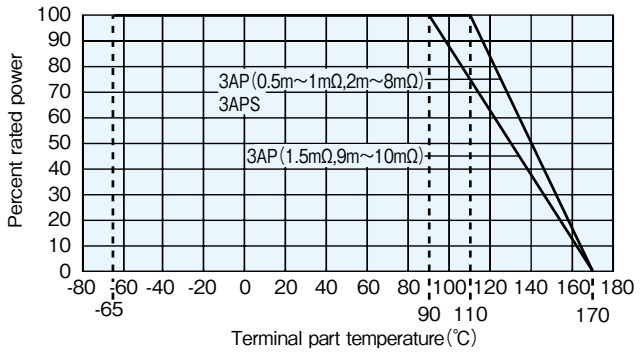
Type	Power Rating	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)	Resistance Tolerance	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs) TD	TE
TLR2BW	1.0W	±50	2m,3m,4m,5m,6m,7m,8m,9m,10m, 11m,12m,13m,15m,16m,18m,20m	F : ±1%	+120℃ and less	−65℃～ +170℃	5000	–
		±75	0.5m,1m,1.5m,2m,3m,4m,5m,6m,7m,8m,9m, 10m,11m,12m,13m,15m,16m,18m,20m					
TLR2BP	1.5W	±50	5m,6m,7m,8m,9m,10m		+110℃ and less			
			11m,12m,13m,15m,16m,18m,20m		+100℃ and less			
		±75	5m,6m,7m,8m,9m,10m		+110℃ and less			
			11m,12m,13m,15m,16m,18m,20m		+100℃ and less			
	3.0W	±50	2m,3m,4m		+110℃ and less			
		±75	0.5m,1m,1.5m,2m,3m,4m					
TLR2HW	2.0W	±50	0.5m,1m,1.5m,2m,2.5m,3m,4m,5m,6m,7m 8m,9m,10m		+120℃ and less		–	4000
		±75						
TLR3AP	3.0W	±50	5m,6m,7m,8m,9m,10m		5m～8m : +110℃ and less 9m～10m : +90℃ and less		–	2000
		±75						
	5.0W	±50	2m,3m,4m		0.5m～1m,2m～4m : +110℃ and less 1.5m : +90℃ and less			
		±75	0.5m,0.68m,0.75m,0.82m,1m,1.5m,2m,3m,4m					
TLR3APS	3.0W	±50,±75	2m,3m		+110℃ and less			

■Derating Curve

TLR2BW, TLR2BP, TLR2HW



TLR3AP, TLR3APS

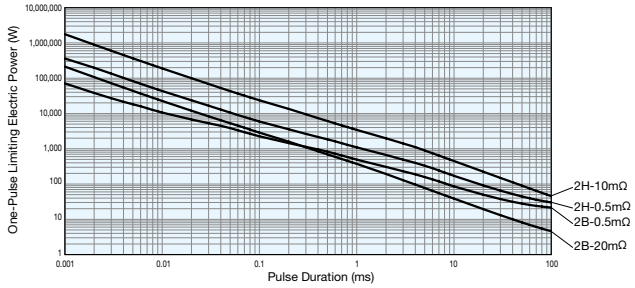


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

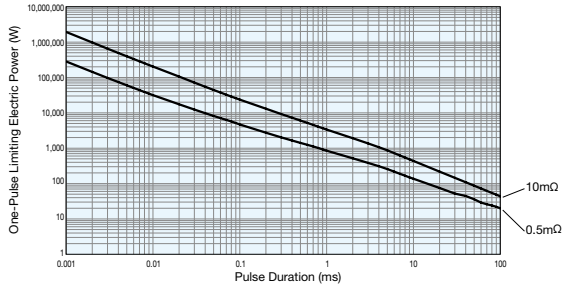
■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

TLR2BW/2BP, TLR2HW



TLR3AP



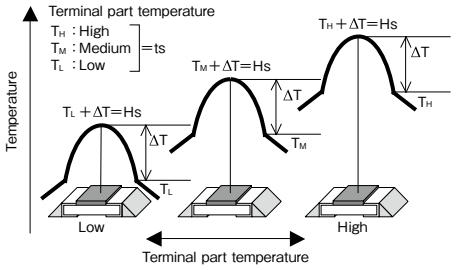
■Thermal Resistance

Type	Size	Resistance (Ω)	Rth (℃/W)
TLR	2BW 2BP	0.5m	7.2
		20m	116
	2HW	0.5m	9
		10m	61.1
	3AP	0.5m	6
		10m	62

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



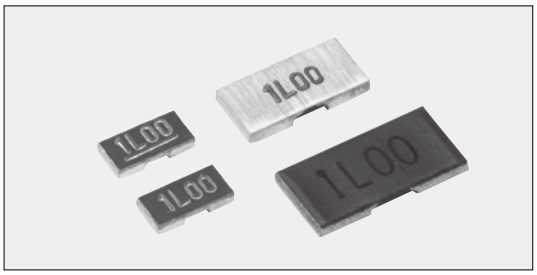
■Performance

Test Items	Performance Requirements ΔR%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	0.5	0.3	260℃±5℃, 10s$^{+2}_{0}$s
Rapid change of temperature	0.5	0.3	−55℃ (15min.) /+150℃ (15min.) 1000 cycles
Moisture resistance	0.5	0.1	MIL-STD-202-106 0% power, 7a and 7b not required
Biased humidity	0.5	0.1	85℃±2℃, 85%RH, 1000h, 10% Bias
Endurance of Rated Terminal Part Temperature	1	0.3	120℃±2℃(2BW, 2HW), 110℃±2℃(3AP 0.5m~1mΩ, 2m~8mΩ) 90℃±2℃(3AP 1.5mΩ, 9m~10mΩ)、110℃±2℃(3APS 2mΩ, 3mΩ)、 110℃±2℃(2BP 0.5m~10mΩ)、100℃±2℃(2BP 11m~20mΩ) 1000h, 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.6	+155℃, 1000h
	2	0.8	+170℃, 1000h

■Precautions for Use

- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- In the resistance values of TLR the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

TLR Metal Plate Chip Type Low Resistance Resistors



Coating color : Black (2BN(1mΩ,1.5mΩ), 2B(1mΩ,1.5mΩ), 3AW(0.5m～1.5mΩ))

■Features

- Ultra low resistances (0.5mΩ～), suitable for large current sensing.
- Ultra low height with a thickness of 0.6mm, suitable for use of small equipment.
- Excellent high-frequency characteristics.
- Automatic mounting machines are applicable.
- Suitable for reflow soldering. (Not suitable for flow soldering)
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

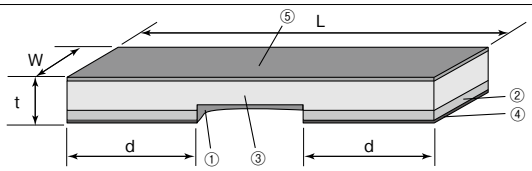
■Applications

- Current sensing for CPU
- Inverter power supplies
- DC-DC converters
- Mobile device etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■ Construction



①	Protective bottom coating	②	Electrode
③	Resistive element	④	Solder
⑤	Protective top coating (2BN(1mΩ,1.5mΩ),2B(1mΩ,1.5mΩ),3AW(0.5m~1.5mΩ))		

■ Dimensions

Type (Inch Size Code)	Resistance (Ω)	Dimensions (mm)			
		L	W	d	t
2B 2BN (1206)	1m, 1.5m	3.2±0.2	1.6±0.2	1.1±0.2	0.6±0.2
	2m, 3m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, 11m, 12m, 13m, 15m, 16m, 18m, 20m			0.5±0.2	
2H (2010)	1m	5.0±0.2	2.5±0.2	1.8±0.2	0.65±0.2
	2m, 3m, 4m, 5m, 6m			1.5±0.2	0.6±0.2
	7m, 8m, 9m, 10m			0.5±0.2	
3AW (2512)	0.5m	6.35±0.25	3.18±0.25	2.725±0.25	0.6±0.25
	0.68m, 0.75m, 0.82m			2.675±0.25	
	1m, 1.5m, 2m, 3m, 4m			2.20±0.25	
	5m, 6m, 7m, 8m			1.20±0.25	
	9m, 10m			0.77±0.25	

■Type Designation

Example

TLR	2B	D	TD	10L0	F	75
Product Code	Power Rating	Termination Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10⁻⁶/K)
	2BN : 0.5W 2B : 0.5W 2H : 1.0W 3AW : 2.0W	D : SnAgCu	TD : 4mm pitch punch paper TE : Plastic embossed BK : Bulk	F : 4 digits	F : ±1%	Nil : ±150 50 : ±50 75 : ±75

Resistance Value (Ω)	4 digits
0.5m～0.82m	L500～L820
1m～9m	1L00～9L00
10m～20m	10L0～20L0

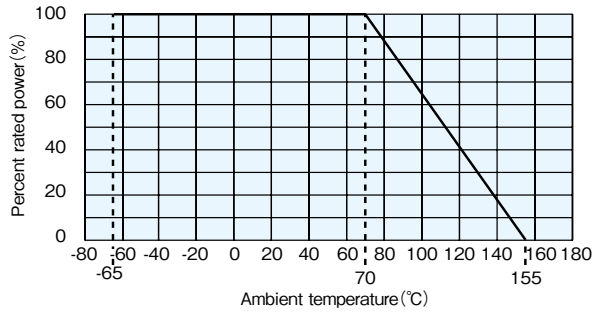
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

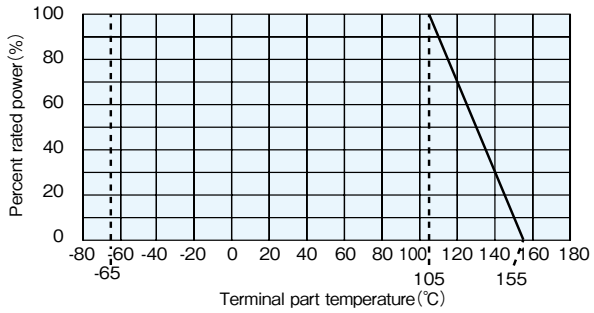
Type	Power Rating	Rated Ambent Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)	Resistance Tolerance	Operating Temp. Range	Taping & Q'ty/Reel (pcs)	
								TD	TE
TLR2B	0.5W	+70℃	+105℃	± 50	2m,3m,4m,5m,6m,7m,8m,9m,10m, 11m,12m,13m,15m,16m,18m,20m	F : ±1%	−65℃～+155℃	5,000	–
				± 75	1m,1.5m,2m,3m,4m,5m,6m,7m,8m,9m, 10m,11m,12m,13m,15m,16m,18m,20m				
TLR2BN				±150	1m,1.5m,2m,3m,4m,5m,6m,7m,8m, 10m,11m,12m,13m,15m,16m,18m,20m			5,000	–
TLR2H	1.0W			± 50	1m,2m,3m,4m,5m,6m,7m,8m,9m,10m			–	4,000
				± 75					
				±150					
TLR3AW	2.0W			± 50	2m,3m,4m,5m,6m,7m,8m,9m,10m		−65℃～+155℃	–	2,000
				± 75	0.5m,0.68m,0.75m,0.82m,1m,1.5m, 2m※1,3m,4m,5m,6m,7m,8m,9m,10m				
				±150	0.5m,0.68m,0.75m,0.82m,1m,1.5m, 2m,3m,4m,5m,6m,7m,8m,9m,10m				

※1 Please ask separately us about dimensions of 2mΩ.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■ Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

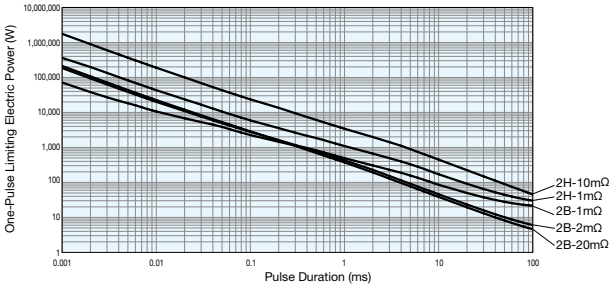


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

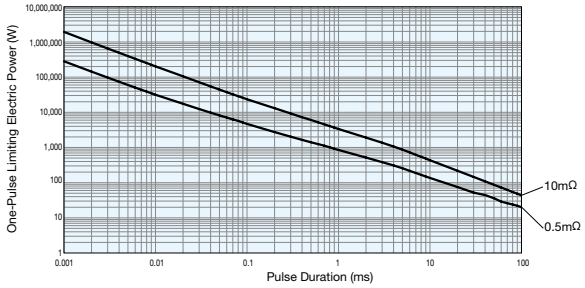
■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

TLR2B/2BN, TLR2H



TLR3AW



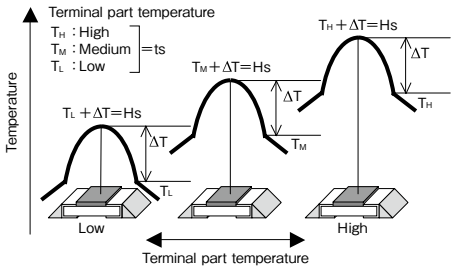
■Thermal Resistance

Type	Size	Resistance (Ω)	Rth (℃/W)
TLR	2B 2BN	1m	11.8
		2m	18.3
		20m	116
	2H	1m	17
		10m	61.1
	3AW	0.5m	6
		10m	62

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



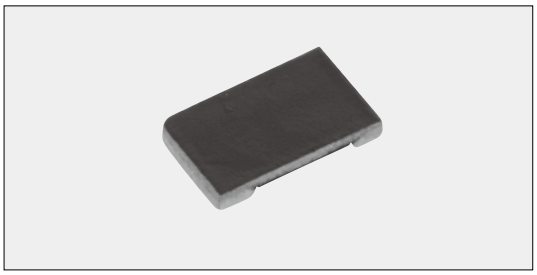
■ Performance

Test Items	Performance Requirements ΔR%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	0.5	0.3	260℃±5℃, 10s$^{+2}_{-0}$s
Rapid change of temperature	0.5	0.4	−55℃ (15min.) /+150℃ (15min.) 1000 cycles
Moisture resistance	0.5	0.1	MIL-STD-202, 106, 0% power, 7a and 7b not required
Biased humidity	0.5	0.1	85℃±2, 85%RH, 1000h, 10% Bias
Endurance at 70℃	1	0.3	70℃±2℃, 1000h, 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.6	+155℃ (2BN, 2B, 2H, 3AW) , +170℃ (3A) , 1000h

■Precautions for Use

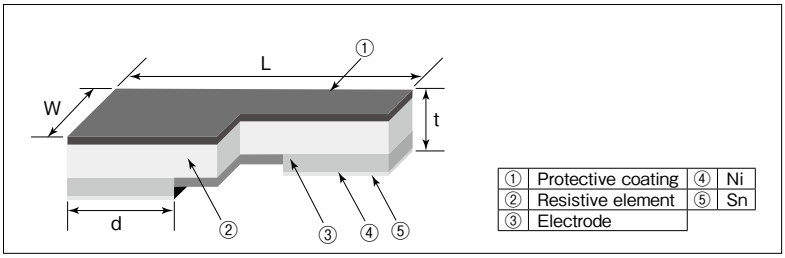
- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- In the resistance values of TLR the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

TLR Metal Plate Chip Type Low Resistance Resistors



Coating color : Black

■ Construction



①	Protective coating	④	Ni
②	Resistive element	⑤	Sn
③	Electrode		

■Features

- SMD type of small size, metal plate low resistance resistor for current detection.
- Low height suitable for use of Small equipment such as mobile phone.
- High reliability and performance with T.C.R ±100×10^{-6}/K
- Suitable for reflow soldering. (Not suitable for flow soldering.)
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

■Applications

- Mobile phones, PDAs, Media players, Computers etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■ Dimensions

Type (Inch Size Code)	Resistance	Dimensions (mm)				Weight (g) (1000pcs)
		L	W	d	t	
2A(0805)	2mΩ	2.0±0.2	1.25±0.2	0.60±0.20	0.30±0.15	5.6
	3mΩ				0.25±0.15	4.0
	4mΩ			0.45±0.20		3.7
	5mΩ			0.65±0.20	0.30±0.15	4.8
	6mΩ			0.55±0.20		4.7
	7mΩ			0.50±0.20		4.6
	8mΩ			0.50±0.20	0.26±0.15	3.8
	9mΩ			0.45±0.20		3.7
	10mΩ			0.35±0.20		3.6

■Type Designation

Example

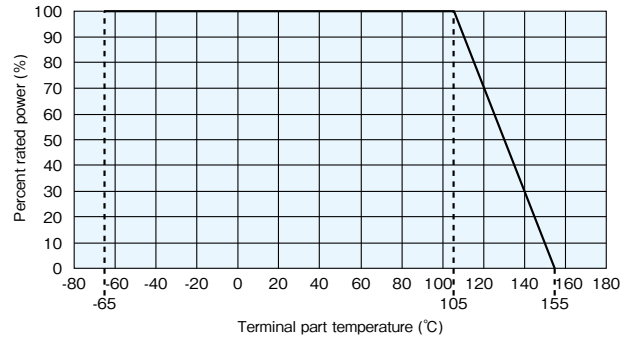
TLR	2A	T	TD	10L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2A : 1.0W	T : Sn	TD : 4mm pitch punch paper BK : Bulk	F : 4 digits	F : ±1%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

Type	Power Rating	T.C.R. (×10^{-6}/K)	Resistance Range (Ω)	Resistance Tolerance	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs)
							TD
TLR 2A	1.0W	±100	2m、3m、4m 5m、6m、7m、8m、9m、10m	F : ±1%	105℃	−65℃～+155℃	5,000

■ Derating Curve

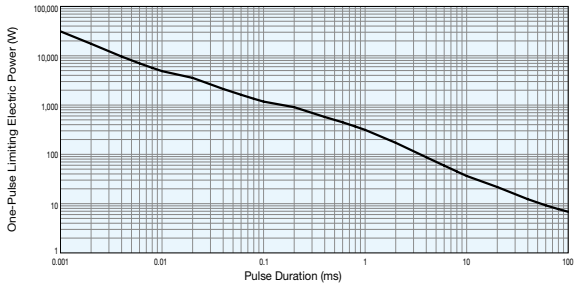


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

TLR2A



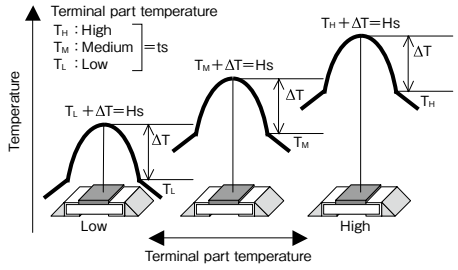
■Thermal Resistance

Type	Resistance (Ω)	Rth (℃/W)
TLR2A	2m	26.1
	10m	54.7

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



■ Performance

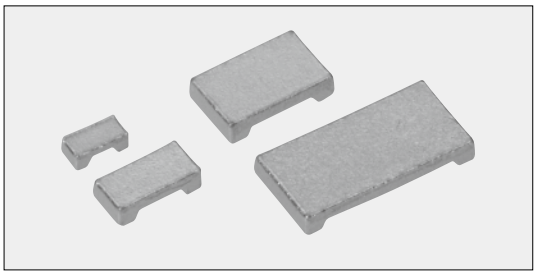
Test Items	Performance Requirements ΔR%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1	0.05	Rated power×2.5 for 5s
Resistance to soldering heat	1	0.01	260℃±5℃ 10~12秒
Rapid change of temperature	1	0.2	−55℃ (15min.)/+150℃ (15min.) 1000 cycles
Moisture resistance	1	0.3	85℃、85%RH、1000h、10% Bias
Endurance at 105℃ and less of terminal part temperature	1	0.4	Terminal part temp.:105℃、1000h、1.5h ON/0.5h OFF cycle
Low temperature exposure	1	0.05	−65℃、96h
High temperature exposure	1 (2m~4m、7m~10m) 2 (5m、6m)	0.5 (2m~4m、7m~10m) 0.8 (5m、6m)	155℃ 1000h

■Precautions for Use

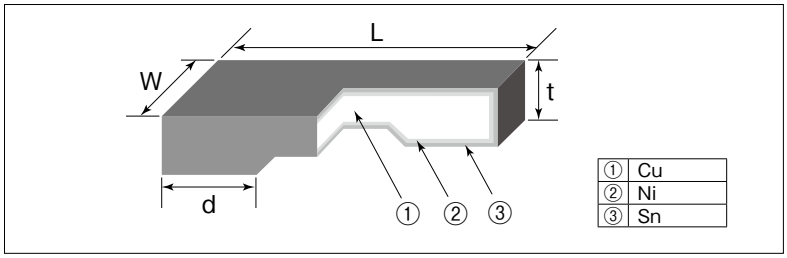
- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- For resistance values of TLR the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

JUMPER (Metal Plate)

TLRZ Metal Plate Chip Type Jumper



■Construction



■Features

- SMD type of small size, high rated current jumper.
- Low height suitable of use of Small equipment such as mobile phone.
- Suitable for reflow soldering. (Not suitable for flow soldering.)
- AEC-Q200 Tested.
- Products meet EU-RoHS requirements.

■Applications

· Mobile phones, PDAs, Media players, Computers etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Dimensions

Type (Inch Size Code)	Dimensions (mm)				Weight (g) (1000pcs)
	L	W	d	t	
1E (0402)	1.0±0.1	0.5±0.1	0.2±0.1	0.4±0.05	1.1
1J (0603)	1.6±0.1	0.8±0.1	0.3±0.1	0.5±0.05	4.6
2A (0805)	2.0±0.1	1.25±0.1			8.9
2B (1206)	3.2±0.1	1.6±0.1			15.3

■Type Designation

Example

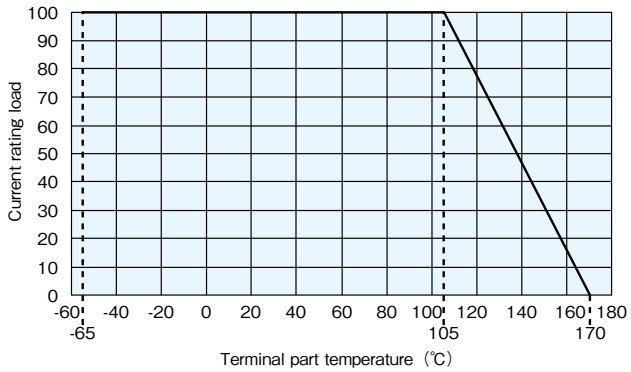
TLRZ	1J	T	TD
Product Code	Current Rating	Terminal Surface Material	Taping
	1E : 10A 1 J : 26A 2A : 31.6A 2B : 50A	T : Sn	TB : 2mm pitch press paper TD : 4mm pitch punch paper BK : Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Resistance	Current Rating	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs)	
					TB	TD
TLRZ 1E	0.5mΩ max.	10A	+105℃ and less	−65℃～+170℃	10,000	−
TLRZ 1J	0.2mΩ max.	26A			−	5,000
TLRZ 2A		31.6A				
TLRZ 2B		50A				

■Derating Curve

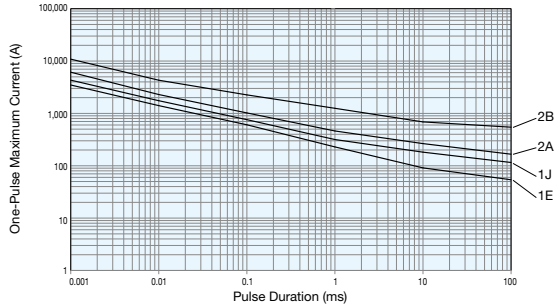


When the terminal part temperature of the jumper exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■One-Pulse Maximum Current

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values.so be sure to check the products on actual equipment when you use them.

TLRZ



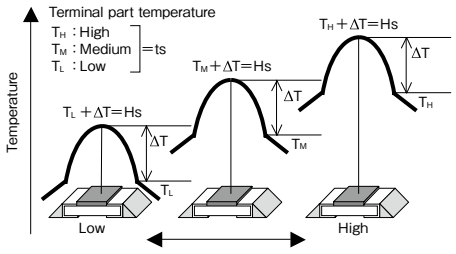
■Thermal Resistance

Type	Size	Rth
TLRZ	1E	<0.5℃/W
	1J	
	2A	
	2B	

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



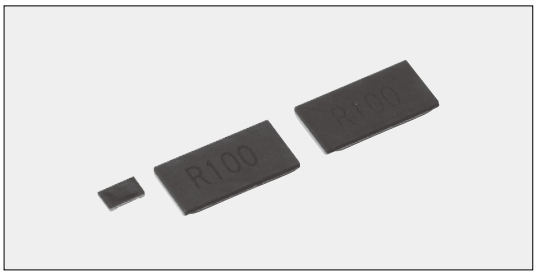
■Performance

Test Items	Performance Requirements ΔR%		Test Methods
	Limit	Typical	
Resistance	MAX 0.5mΩ 1E MAX 0.2mΩ 1J/2A/2B	MAX 0.25mΩ 1E MAX 0.15mΩ 1J/2A/2B	25℃
Overload (Short time)			1E : 20A、1J/2A : 40A、2B : 80A、5s
Resistance to soldering heat			260℃±5℃、10~12s
Rapid change of temperature			−55℃ (30min.) ~ +155℃ (30min.) 1000 cycles
Moisture resistance			85℃、85%RH、1E : 1A、1J/2A : 2A、2B : 4A、1000h
Endurance of rated terminal part temperature			Terminal part temp. : 105℃、1000h、1.5h ON/0.5h OFF cycle
Low temperature exposure			−65℃、1000h
High temperature exposure			170℃、1000h

■Precautions for Use

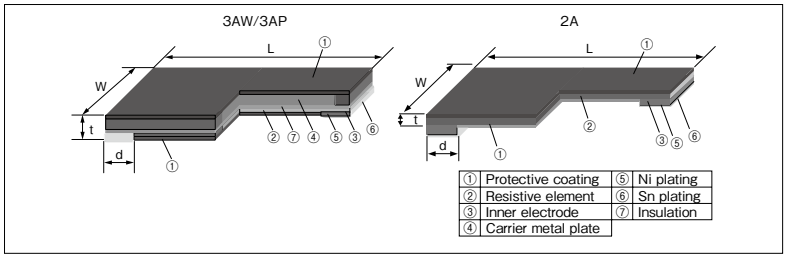
- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- For resistance values of TLRZ the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

TLRH Metal Plate Chip Type Low Resistance Resistors



Coating color ：Black

■Construction



■Features

- SMD Type of small size, low resistance resistor for current detection.
- Carrier metal plate inside, resistor of high radiation of heat structure. (3AW/3AP)
- High reliability and performance with Low T.C.R.
- Automatic mounting machines are applicable.
- Suitable for reflow soldering. (2A:Not Suitable for flow soldering)
- Products meet EU-RoHS requirments.
- AEC-Q200 Tested.

■Applications

- Inverter power supplies
- Motor control
- Mobile PC

■Reference Standards

IEC 60115-8
JIS C 5201-8

■Dimensions

Type (Inch Size Code)	Resistance (Ω)	Dimensions (mm)				Weight(g) (1000pcs)
		L	W	d	t	
2A(0805)	12m～100m	2.0±0.2	1.25±0.2	0.35±0.2	0.25±0.15	4
3AW(2512)	10m～270m	6.3±0.2	3.2±0.2	0.75±0.2	0.5±0.2	52
3AP(2512)	6m～39m			1.8±0.2		60
	40m～120m			1.3±0.2		55

■Type Designation

Example

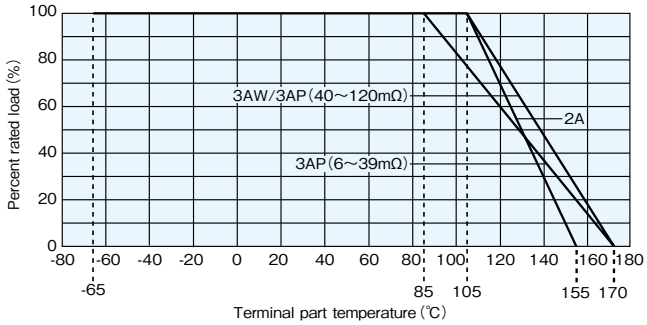
TLRH	3AW	T	TE	33L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2A(12～27mΩ)： 0.5W 2A(33～50mΩ)： 0.33W 2A(56～100mΩ)：0.25W 3AW：2.0W 3AP(6～39mΩ)： 5W 3AP(40～120mΩ)：4W	T：Sn	TD：4mm pitch punch paper TE：Plastic embossed BK：Bulk	F：4 digits EX 33L0：33mΩ R100：100mΩ	F：±1%

Contact us when you have control request for environmental hazardous material other than The substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) F：±1% (E12)	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs) TD	Taping & Q'ty/Reel (pcs) TE
TLRH2A	0.25W	±75	56m～100m	105℃	−65℃～+155℃	5,000	−
	0.33W		33m～50m				
	0.50W		12m～27m				
TLRH3AW	2.0W	±75	10m～22m		−65℃～+170℃	−	2,000
		±50	24m～270m				
TLRH3AP	4.0W		40m、47m、50m～120m				
	5.0W		18m、20m、22m、25m～39m	85℃			
		±75	6m、7m、8m、9m、10m、12m				

■Derating Curve

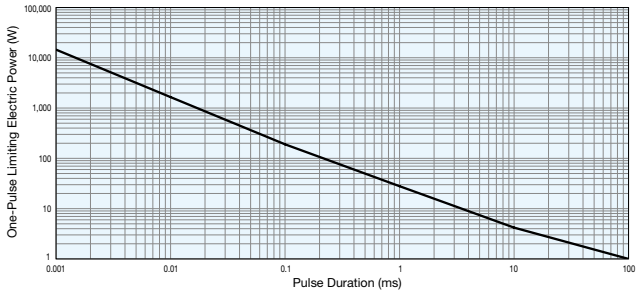


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

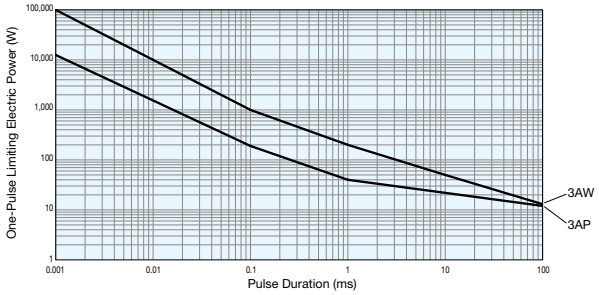
■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

TLRH2A



TLRH3AW/TLRH3AP



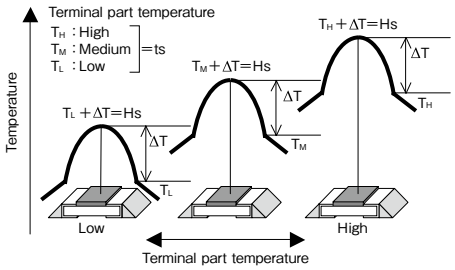
■Thermal Resistance

Type	Size	Resistance (Ω)	Rth (℃/W)
TLRH	2A	27m	123
		50m	195
		100m	280
	3AW	10m	5.2
		270m	7.4
	3AP	18m	7.4
		120m	4.1

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



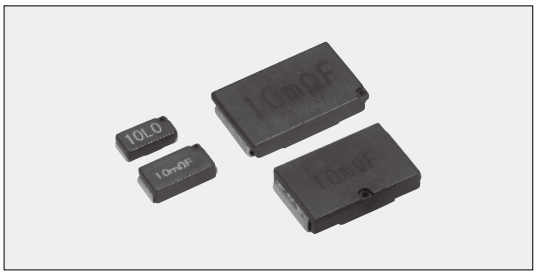
■Performance

Test Items	Performance Requirements ΔR%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+100℃
Overload (Short time)	0.5	0.05 : 2A 0.2 : 3AW/3AP	Rated power×2.5 for 5s : 2A, 3AW 8W for 5s : 3AP
Resistance to soldering heat	0.5	0.1	260℃±5℃, 10s～12s
Rapid change of temperature	0.5	0.2 : 2A 0.1 : 3AW/3AP	−55℃ (15min.) /+150℃ (15min.) 1000 cycles
Moisture resistance	0.5	0.1	85℃±2℃, 85%RH, 1000h, 10% Bias
Endurance of Rated Terminal part Temperature	1	0.45 : 2A 0.3 : 3AW/3AP	105℃±2℃ : 2A, 3AW, 3AP (40～120mΩ) 85℃±2℃ : 3AP (6～39mΩ) 1000h, 1.5h ON/0.5h OFF cycle
Low temperature exposure	0.5	0.05 : 2A 0.02 : 3AW/3AP	−65℃, 96h
High temperature exposure	2	0.2 : 3AP	170℃, 1000h : 3AP (6～12mΩ)
	1	0.5 : 2A 0.2 : 3AW/3AP	155℃, 1000h : 2A/3AP (6～12mΩ) 170℃, 1000h : 3AW/3AP (18～120mΩ)

■Precautions for Use

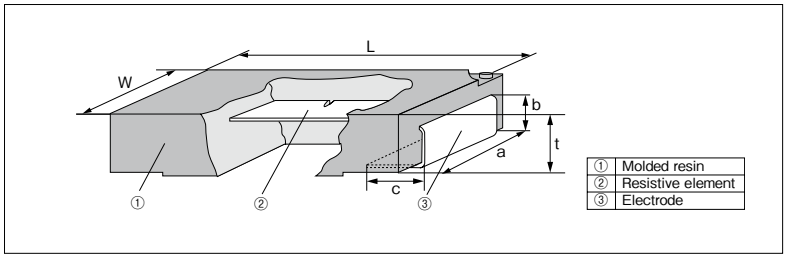
- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- For resistance values of TLRH the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

SL·SLN Current Detecting Chip Resistors (High Power)



Coating color：Black

■ Construction



■Features

- SMD type of small size, ultra-low resistance (3mΩ～) and high accuracy (±0.5%) resistor for current sensing.
- Encapsulated with flame retardant resin molding. (UL94 V-0)
- Excellent dimension accuracy, mountability and shock-resistance due to molded products.
- Excellent terminal strength and solderability due to structure of a metal plate terminal electrode.
- Easy to absorb the thermal expansion and shrinkage because of a metal plate terminal structure.
- Suitable for flow, reflow and iron solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

Automotive
Note PCs
Battery packs
AC Adapters
DC-DC converters, etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■ Dimensions

Type (Inch Size Code)	Dimensions (mm)						Weight (g) (1000pcs)
	L±0.3	W±0.2	t±0.2	a±0.2	b±0.2	c	
SLW07 (2010)	5.0	2.5	1.7	2.0	0.9	1.2±0.3	45
SLW1 (2512)	6.3	3.1	1.9	2.4	1.2	1.2±0.3	90
SLN3 (4527)	11.5	7.0	2.4	5.5	1.6	2.55±0.4	500
SLN5 (4527)	11.5	7.0	2.5	5.5	1.9	2.55±0.4	600

■ Type Designation

Example

SL	W1	T	TE	20L0	F	75
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R (×10⁻⁶/K)
SL SLN	W07:1.0W W1:1.5W 3:3W 5:7W	T:Sn	TE:Plastic embossed TED:Plastic embossed (SLN5 only) BK:Bulk	D,F:4 digits J:3 digits	D:±0.5% F:±1% J:±5%	Nil:0~150 0~200 ±75(SLN3/SLN5) ±100 ±110 ±180 50:±50(SLW1) 75:±75(SLW1)

Resistance Value (Ω)	3 digits
5m～9.1m	5L0～9L1
10m～91m	10L～91L
0.1～0.91	R10～R91

Resistance Value (Ω)	4 digits
3m～9.1m	3L00～9L10
10m～91m	10L0～91L0
0.1～0.91	R100～R910

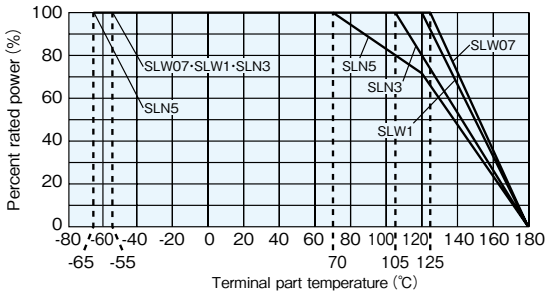
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

Type	Power Rating	Resistance Range※1 (Ω) D:±0.5% E24・E96※3	Resistance Range※1 (Ω) F:±1% E24・E96※3	Resistance Range※1 (Ω) J:±5% E24	T.C.R. (×10⁻⁶/K)	Rated Terminal Part Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs) TE・TED (SLN5)
SLW07	1W	–	5m～100m		0～200:R≦10mΩ 0～150:R≧11mΩ	125℃	−55℃～+180℃	2,000
SLW1	1.5W	10m～100m	5m～100m	3m～100m	±180:R<15mΩ ±100:R≧15mΩ ±75:20m≦R≦100mΩ ±50:34.8m≦R≦100mΩ	120℃		1,000
SLN3	3W	5m～110m			±110:R<10mΩ ±75:R≧10mΩ	105℃		
SLN5	7W (5W※2)	3m～200m		–		70℃ (120℃※2)	−65℃～+180℃	

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value.}}$
※1 5m, 6m, 7m, 8m and 9mΩ are available in each resistance range.
※2 When the rated terminal part temperature is 120 ℃, rated power is 5W.
※3 SLW07 and SLN5 (3m～4.7mΩ) offer only E24 series.

■ Derating Curve

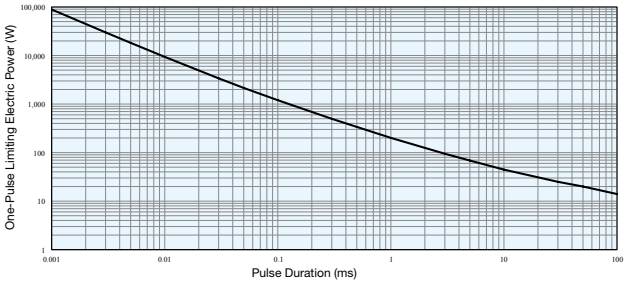


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

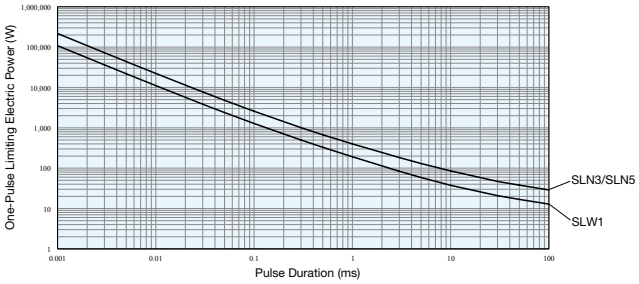
■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

SLW07



SLW1, SLN3, SLN5



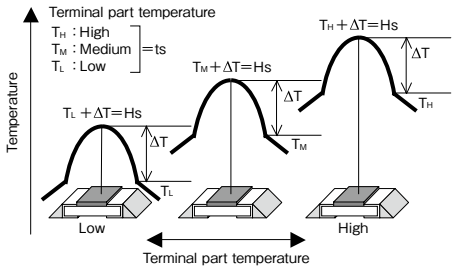
■Thermal Resistance

Type	Resistance (Ω)	Rth (℃/W)
SLW07	5m	26
	22m	48
	100m	78
SLW1	5m	16
	20m	39
	100m	59
SLN3	5m	11
	11m	19
SLN5	5m	11
	11m	19
	200m	15

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



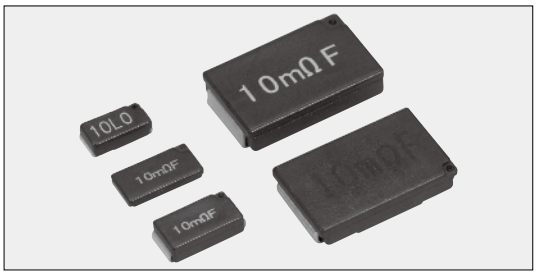
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1 : SLW07, SLW1 0.5 : SLN3 2 : SLN5	1 : SLW07, SLW1 0.25 : SLN3 0.5 : SLN5	SLW07 : 3W for 5s SLW1 : 5W for 5s SLW1 (T.C.R : ±50/±75) : 4W for 5s) SLN3 : 10W for 5s SLN5 : 15W for 5s
Resistance to soldering heat	1 : SLW07, SLW1	1 : SLW07, SLW1	260℃±5℃, 10s±1s
	0.5 : SLN3, SLN5	0.5 : SLN3, SLN5	260℃±5℃, 10s~12s
Rapid change of temperature	1 : SLW07, SLW1	0.5 : SLW07, SLW1	−55℃ (30min.) /+150℃ (30min.) 100 cycles
	0.5 : SLN3, SLN5	0.3 : SLN3, SLN5	−55℃ (15min.) /+150℃ (15min.) 1000 cycles
Moisture resistance	2 : SLW07, SLW1	1 : SLW07, SLW1	40℃±2℃, 90~95%RH, 1000h 1.5h ON/0.5h OFF cycle
	0.5 : SLN3, SLN5	0.35 : SLN3, SLN5	SLN3 : 85℃±2℃, 85%RH, 1000h, 0.3W SLN5 : 85℃±2℃, 85%RH, 1000h, 0.7W
Endurance of Rated Terminal part Temperature	2	1 : SLW07, SLW1, SLN3 1.2 : SLN5	Terminal part temp. : 125℃ (SLW07) : 120℃ (SLW1, SLN5 5W) : 105℃ (SLN3) : 70℃ (SLN5 7W) 1.5h ON/0.5h OFF cycles
Low temperature exposure	0.5	0.25	SLW07, SLW1 : −55℃, 1h SLN3, SLN5 : −65℃, 24h

■Precautions for Use

- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

TSL·SL(Metal plate)·SLN Current Detecting Chip Resistors
SLZ Jumper Type



Coating color : Black

■Features

- SMD type of small size, ultra-low resistance (3mΩ～) and high accuracy (±0.5%) resistor for current sensing.
- Encapsulated with flame retardant resin molding. (UL94 V-0)
- Excellent dimension accuracy, mountability and shock-resistance due to molded products.
- Excellent terminal strength and solderability due to structure of a metal plate terminal electrode.
- Easy to absorb the thermal expansion and shrinkage because of a metal plate terminal structure.
- Suitable for flow, reflow and iron solderings.
- Products with lead free termination meet EU-RoHS requirements.
- AEC-Q200 Tested.

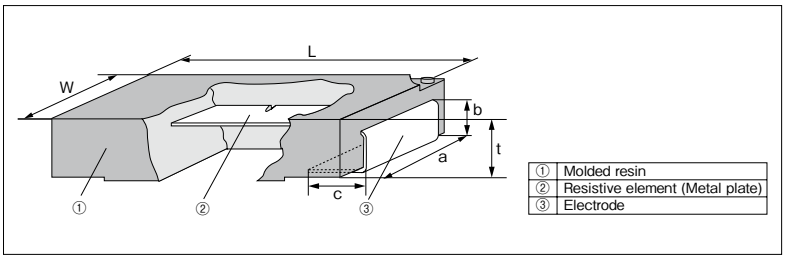
■Applications

Automotive
Note PCs
Battery packs
AC Adapters
DC-DC converters, etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■ Construction



■ Dimensions

Type (Inch Size Code)	Dimensions (mm)						Weight (g) (1000pcs)
	L±0.3	W±0.2	t±0.2	a±0.2	b±0.2	c	
SL07(2010)	5.0	2.5	1.7	2.0	0.9	1.2±0.3	45
TSL1(2512)	6.3	3.1	1.0	2.4	0.7	1.2±0.3	41
SL1・SLZ1(2512)	6.3	3.1	1.9	2.4	1.2	1.2±0.3	90
SL2(4527)	11.5	7.0	2.5	5.0	1.7	2.6±0.5	476
SLN2(4527)	11.5	7.0	2.4	5.5	1.6	2.55±0.4	500

■ Type Designation

Example

SL	1	T	TE	20L0	F	75
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R (×10⁻⁶/K)
TSL SL SLN	07:0.75W 1:1.0W 2:2.0W	T:Sn	TE:Plastic embossed BK:Bulk	D,F:4 digits J,G:3 digits Ex. 0.1Ω:R10 5mΩ:5L0	D:±0.5% F:±1% G:±2% J:±5%	Nil:0~150 0~200 ±75(SLN2) ±100 ±110 ±180 50:±50(SL1) 75:±75(SL1)

SLZ	1	T	TE
Product Code	Current Rating	Terminal Surface Material	Taping
	1:44A	T:Sn	TE:8mm pitch plastic embossed BK:Bulk

Resistance Value (Ω)	3 digits
3m～9.1m	3L0～9L1
10m～91m	10L～91L
0.1～0.36	R10～R36

Resistance Value (Ω)	4 digits
5m～9.1m	5L00～9L10
10m～91m	10L0～91L0
0.1～0.36	R100～R360

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Ratings

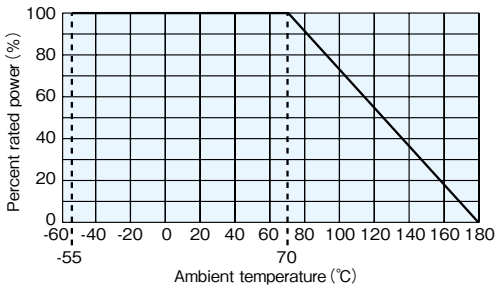
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	Resistance Range(Ω) ※1				T.C.R. (×10⁻⁶/K)	Operating Temp. Range	Taping & Q'ty/Reel(pcs)
				D:±0.5% E24・E96※2	F:±1% E24・E96※2	G:±2% E24	J:±5% E24			TE
SL07	0.75W	70℃	125℃	–	5m～100m	–	5m～100m	0～200:R<11mΩ 0～150:R≧11mΩ	−55℃～+180℃	2,000
TSL1	1W			10m～100m	5m～100m	–	5m～100m	±180:R<15mΩ ±100:R≧15mΩ		3,000
SL1	1W			10m～102m	5m～102m	3m、4m	3m～100m	±180:R<15mΩ ±100:R≧15mΩ		1,000
SL1(TCR±50ppm)	1W			34.8m～200mΩ	34.8m～200mΩ	–	36m～200mΩ	±50ppm		
SL1(TCR±75ppm)	1W			20m～300mΩ	20m～300mΩ	–	20m～300mΩ	±75ppm		
SL2	2W			10m～360mΩ	5m～360mΩ	3m、4m	3m～360mΩ	±180:R<11mΩ ±100:R≧11mΩ		
SLN2	2W		105℃	5m～200m	5m～200m	–	5m～200m	±110:R<10mΩ ±75:R≧10mΩ		

※1 3m, 4m, 5m, 6m, 7m, 8m and 9mΩ are available in each resistance range.
※2 SL07 and SL1 (T.C.R: ±50ppm, 102mΩ≦R≦200mΩ) offer only E24 series.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

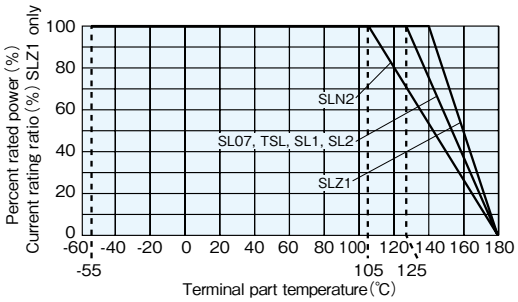
■Jumper Ratings

Type	Resistance	Current Rating	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Operating Temp. Range	Taping & Q'ty/Reel (pcs)
SLZ1	0.5mΩ max.	44A	140℃	4000 max.	−55℃～+180℃	1,000

■ Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

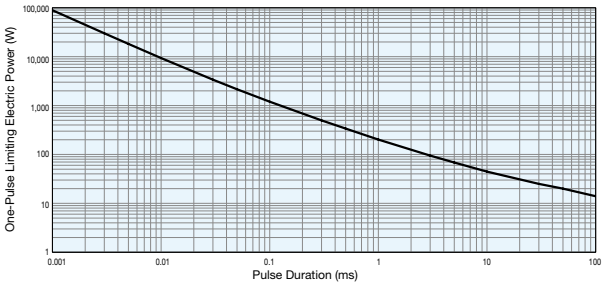


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※ Please refer to "Introduction of the derating curve based on the terminal part temperature" on the beginning of our catalog before use.

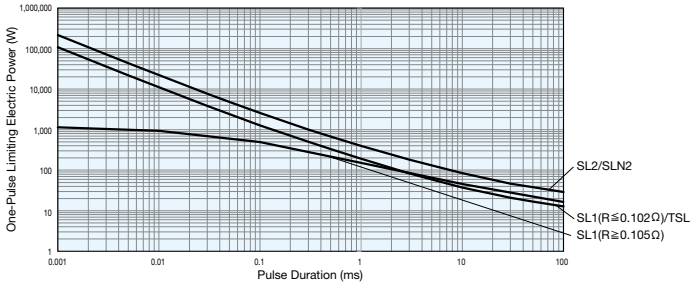
■One-Pulse Limiting Electric Power

Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

SL07



SL1/TSL,SL2/SLN2



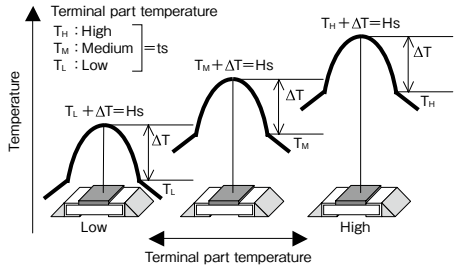
■Thermal Resistance

Type	Resistance (Ω)	Rth (℃/W)
SL07	5m	26
	22m	48
	100m	78
SL1 TSL	5m	16
	20m	39
	100m	59
SL2	5m	16
	20m	41
	200m	55
SLN2	5m	19
	11m	24
	200m	46

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



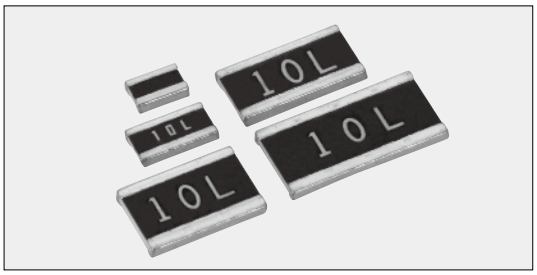
■ Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃ / +125℃
Overload (Short time)	1 : SL07, TSL1, SL1, SL2 0.5 : SLN2	1 : SL07, TSL1, SL1, SL2 0.25 : SLN2	SL07 : Rated power×4 for 5s TSL1 : Rated power×2.5 for 5s SL1, SL2, SLN2 : Rated power×5 for 5s (SL1 (T.C.R : ±50/±75) : Rated power×4 for 5s)
Resistance to soldering heat	1 : SL07, TSL1, SL1, SL2	1 : SL07, TSL1, SL1, SL2	260℃±5℃, 10s±1s
	0.5 : SLN2	0.5 : SLN2	260℃±5℃, 10s~12s
Rapid change of temperature	1 : SL07, TSL1, SL1, SL2	0.5 : SL07, TSL1, SL1, SL2	−55℃ (30min.) /+150℃ (30min.) 100 cycles
	0.5 : SLN2	0.25 : SLN2	−55℃ (15min.) /+150℃ (15min.) 1000 cycles
Moisture resistance	2 : SL07, TSL1, SL1, SL2	0.5 : SL07, TSL1, SL1, SL2	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
	0.5 : SLN2	0.25 : SLN2	85℃±2℃, 85%RH±3%RH, 1000h Rated power×0.1
Endurance at 70℃	2 : SL07, TSL1, SL1, SL2 1 : SLN2	1	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Low temperature exposure	0.5	0.25	SL07, TSL1, SL1, SL2 : −55℃, 1h SLN2 : −65℃, 24h

■Precautions for Use

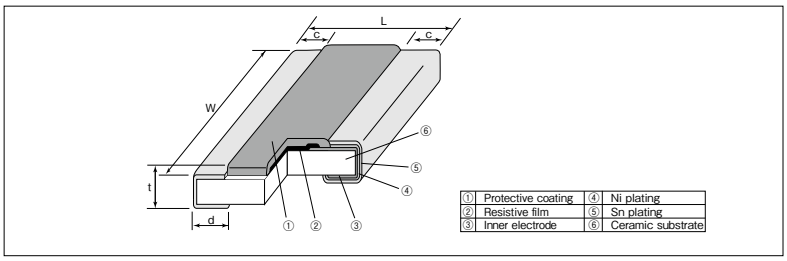
- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

WK73S Wide Terminal Type Flat Chip Resistors



Coating color : Black

■Construction



■Features

- Flat chip resistors of wide terminal type.
- High reliability and performance with T.C.R.±100×10^{-6}/K, resistance tolerance ±0.5%.
- Suitable for both reflow and flow solderings.
- Products meet EU-RoHS requirements.
  EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Power supply, ECU etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Resistance Range (Ω)	Dimensions (mm) L±0.15	W	c	d	t±0.1	Weight (g) (1000pcs)
2A (0508)	20m~61.9m	1.25	2.0±0.15	0.4±0.15	0.35±0.2	0.55	4.93
	62m~9.76			0.3±0.2			
2B (0612)	10m~9.76	1.6	3.2±0.2	0.3±0.2	0.45±0.15	0.6	12.0
2H (1020)	10m~9.76	2.5	5.0±0.15	0.4±0.2	0.75±0.15		30.2
2J (1218)	10m~9.76	3.1	4.6±0.15	0.4±0.2			33.3
3A (1225)	10m~9.76		6.3±0.15	0.45±0.2			45.6

■Type Designation

Example

WK73S	2B	T	TD	33L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2A:1W※1 2B:0.75W 1W※1 2H:1W 2J:1W 3A:1.5W 2W※1	T : Sn	TD: 4mm pitch punch paper TE: 4mm pitch plastic embossed BK: Bulk	D,F: 4 digits J: 3 digits	D:±0.5% F:±1% J:±5%

Resistance Value (Ω)	3 digits
10m~91m	10L~91L
0.1~9.1	R10~9R1

Resistance Value (Ω)	4 digits
22m~97.6m	22L0~97L6
0.1~9.76	R100~9R76

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) D : ±0.5% E24・E96	F : ±1% E24・E96	J : ±5% E24	Taping & Q'ty/Reel (pcs) TD	TE
WK73S2A	1W※1	70℃	125℃	±100	—	1~9.76	1~9.1	5,000	—
				0~+200	—	30m~976m	30m~910m		
				0~+300	—	20m~29.4m	20m~27m		
WK73S2B	0.75W	70℃	125℃	±100	430m~9.76	430m~9.76	430m~9.1		
				±200	—	30m~422m	30m~390m		
				±800	—	—	10m~27m		
	1W※1	70℃	115℃	±100	430m~9.76	430m~9.76	430m~9.1		
				±200	—	30m~422m	30m~390m		
				±800	—	—	10m~27m		
WK73S2H	1W	70℃	125℃	±100	—	220m~9.76	220m~9.1	—	4,000
				±200	—	27m~215m	27m~200m		
				±800	—	—	10m~24m		
WK73S2J	1W	70℃	100℃	±100	—	240m~9.76	240m~9.1	—	4,000
				±200	—	33m~237m	33m~220m		
				±800	—	—	10m~30m		
WK73S3A	1.5W	70℃	125℃	±100	—	360m~9.76	360m~9.1	—	4,000
				±200	—	33m~357m	33m~330m		
				±300	—	22m~32.4m	22m~30m		
				±800	—	—	10m~20m		
	2W※1	70℃	115℃	±100	—	360m~9.76	360m~9.1		
				±200	—	33m~357m	33m~330m		
				±300	—	22m~32.4m	22m~30m		
				±800	—	—	10m~20m		

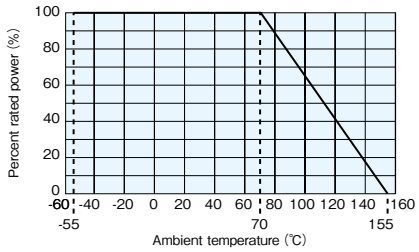
Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$

※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.

If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

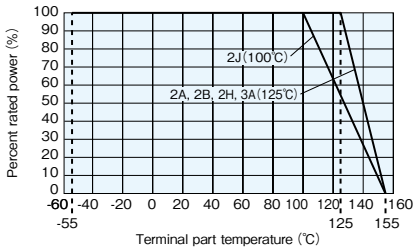
■Derating Curve

Ambient temperature

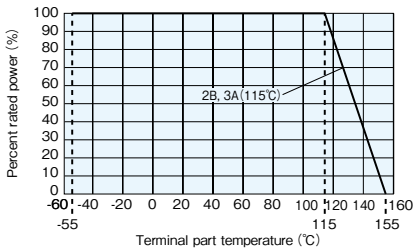


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the derating curve.

Terminal part temperature



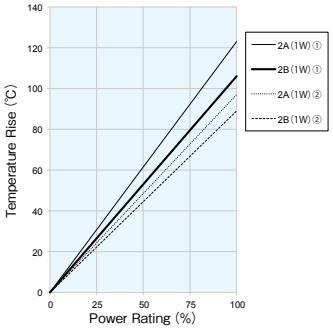
Terminal part temperature
WK73S2B(1W)、WK73S3A(2W)



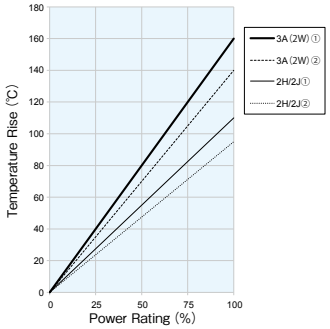
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

WK73S 2A-2B

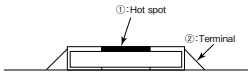


WK73S 2H-3A



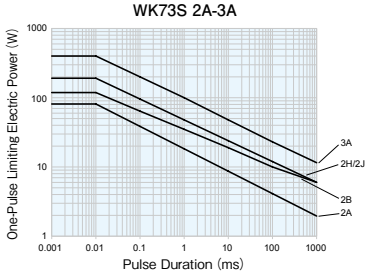
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

WK73S 2A-3A



Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

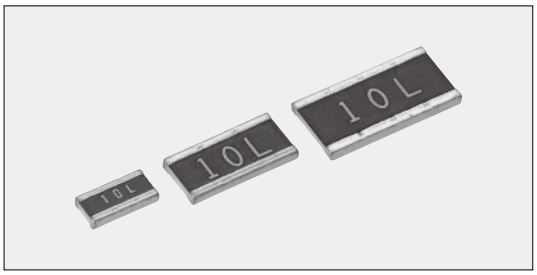
■Performance

Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2.5 for 5s (WK73S2A、WK73S2B(1W)、WK73S3A(2W) Rated voltage×2.0 for 5s)
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.2	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2 : J (±5%) 1 : others	0.5 : J (±5%) 0.2 : others	+155℃, 1000h

■Precautions for Use

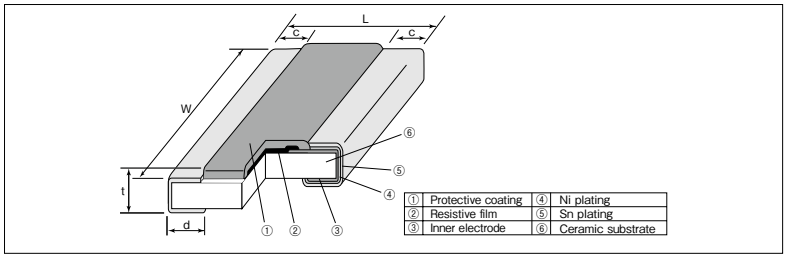
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WK73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

WK73S Wide Terminal Type Flat Chip Resistors (High Power)



Coating color : Black

■Construction



■Features

- Higher power than conventional type.
- Flat chip resistors of wide terminal type.
- High reliability and performance with T.C.R.±100×10^{-6}/K, resistance tolerance ±1%.
- Suitable for both reflow and flow solderings.
- Products meet EU-RoHS requirements.
  EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested.

■Applications

- Power supply, ECU etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.15	W	c±0.2	d±0.15	t±0.1	
2B15 (0612)	1.6	3.2±0.2	0.3	0.45	0.6	12.0
2H2 (1020)	2.5	5.0±0.15	0.4	0.75		30.2
3A3 (1225)	3.1	6.3±0.15	0.45			45.6

■Type Designation

Example

WK73S	2B15	T	TD	33L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2B15: 1.5W※1 2H2: 2W※1 3A3: 3W	T : Sn	TD: 4mm pitch punch paper TE: 4mm pitch plastic embossed BK: Bulk	D,F: 4 digits J: 3 digits	D: ±0.5% F: ±1% J: ±5%

Resistance Value (Ω)	3 digits
10m~91m	10L~91L
0.1~9.1	R10~9R1

Resistance Value (Ω)	4 digits
22m~97.6m	22L0~97L6
0.1~9.76	R100~9R76

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

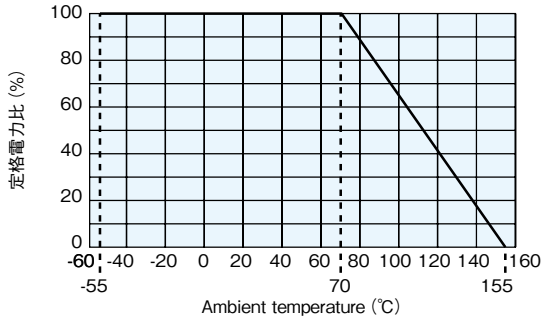
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) D: ±0.5% E24・E96	Resistance Range (Ω) F: ±1% E24・E96	Resistance Range (Ω) J: ±5% E24	Taping & Q'ty/Reel (pcs) TD	Taping & Q'ty/Reel (pcs) TE
WK73S2B15	1.5W※1	70℃	95℃	±100	430m~9.76	430m~9.76	430m~9.1	5,000	–
				±200	–	30m~422m	30m~390m		
				±800	–	–	10m~27m		
WK73S2H2	2W※1	70℃	95℃	±100	–	220m~9.76	220m~9.1	–	4,000
				±200	–	27m~215m	27m~200m		
				±800	–	–	10m~24m		
WK73S3A3	3W※1	70℃	95℃	±100	–	360m~9.76	360m~9.1	–	4,000
				±200	–	33m~357m	33m~330m		
				±300	–	22m~32.4m	22m~30m		
				±800	–	–	10m~20m		

Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$
※1 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

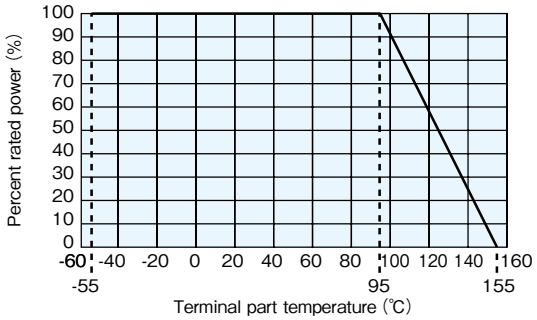
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the current shall be derated in accordance with the above derating curve.

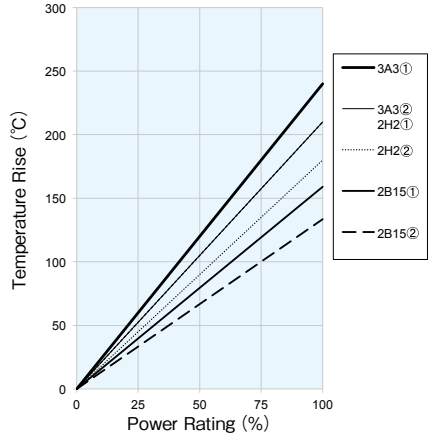
Terminal part temperature



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog before use.

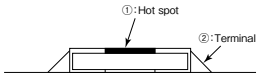
■Temperature Rise

WK73S 2B15-3A3



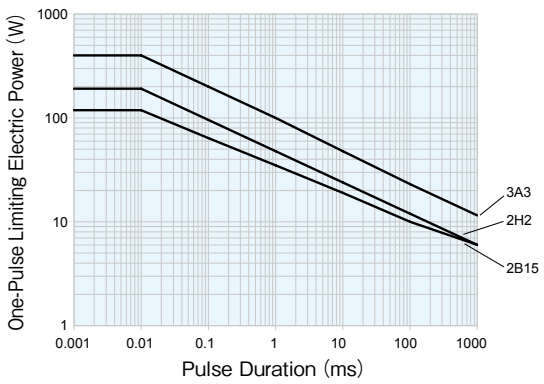
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

WK73S 2B15-3A3



Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2.0 for 5s
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	1	−55℃ (30min.)/+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.2	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	2 : J (±5%) 1 : others	0.5 : J (±5%) 0.2 : others	+155℃, 1000h

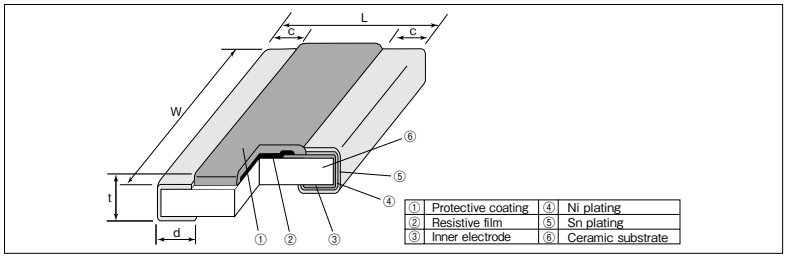
■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WK73 series which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

WU73 Wide Terminal Type Low Resistance Flat Chip Resistors (Low T.C.R.)

Coating color : Black

■Construction



■Features

- Flat chip resistors of wide terminal type.
- High reliability and performance with T.C.R. $\pm 75\times10^{-6}$/K～, resistance tolerance ±1%.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

■Applications

- Power supply, ECU etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.15	$W^{\pm0.1}_{\pm0.3}$	c±0.2	d±0.15	t±0.1	
2B (0612)	1.6	3.2	0.4	0.45	0.6	12.0
2B15 (0612)	1.6	3.2	0.4	0.45	0.6	12.0

■Type Designation

Example

WU73	2B	T	TD	10L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
WU73	2B:1W 2B15:1.5W※2	T : Sn	TD: 4mm pitch punch paper BK: Bulk	4 digits Ex. 10L0 : 10mΩ R100 : 100mΩ	F : ±1%

Resistance Value (Ω)	4 digits
10m～91m	10L0～91L0
0.1	R100

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. ($\times10^{-6}$/K)	Resistance Range (Ω) E24 & 25m, 50m※1	Resistance Tolerance	Operating Temp. Range	Taping & Q'ty/Reel (pcs)
WU73 2B	1W	70℃	115℃	±100	10m～12m	F : ±1%	−55℃～155℃	5,000
				±75	13m～27m			
				±100	30m～100m			
WU73 2B15	1.5W※2	70℃	95℃	±100	10m～12m			
				±75	13m～27m			
				±100	30m～100m			

Rated voltage = $\sqrt{\text{Power Rating}\times\text{Resistance value}}$

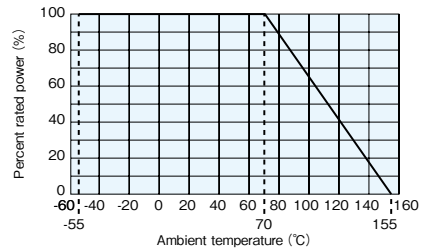
※1 25mΩ and 50mΩ are available.

※2 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.

If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature". For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

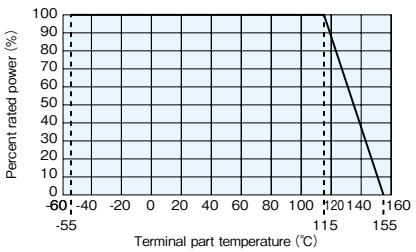
■Derating Curve

Ambient temperature

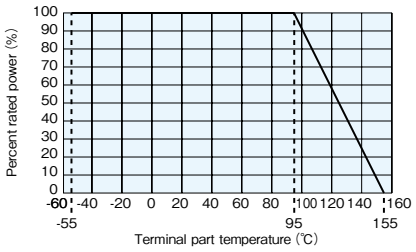


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the derating curve.

Terminal part temperature



Terminal part temperature
WU73 2B15(1.5W)

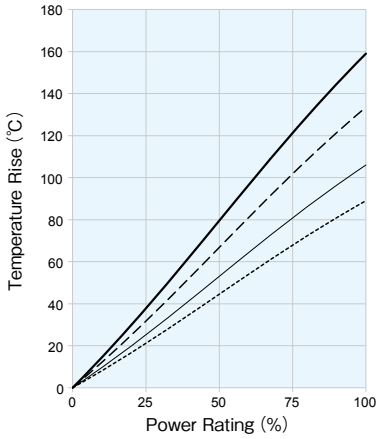


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.

※Please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog before use.

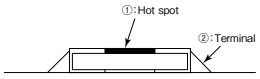
■Temperature Rise

WU73 2B



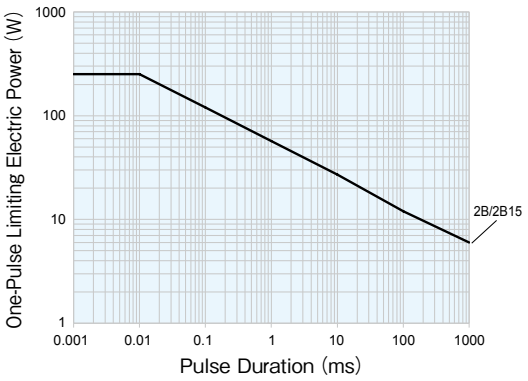
Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

WU73 2B/2B15



Please ask us about the resistance characteristic of continuous applied pulse. The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

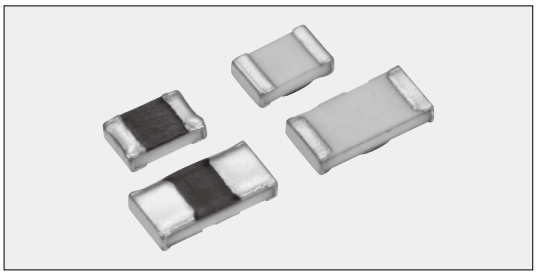
Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.2	Rated voltage×2 for 5s
Resistance to soldering heat	1	0.2	260℃±5℃, 10s±1s
Bending test	1	0.1	Holding point 90mm, Bending 1time. Bending 5mm
Rapid change of temperature	2	0.3	−55℃ (30min.) /+125℃ (30min.) 1000 cycles
Moisture resistance	2	0.1	40℃±2℃, 90~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	0.2	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.1	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated, especially when WU73 which have self-heating. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pa careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

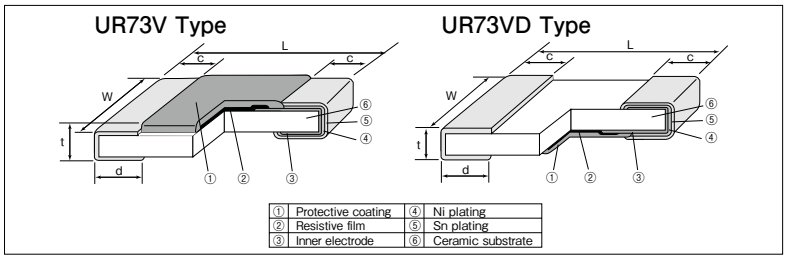
THICK FILM (LOW RESISTANCE)

UR73V Low Resistance Flat Chip Resistors (For Automotive, Low T.C.R.)



Coating color : Black

■Construction



①	Protective coating	④	Ni plating
②	Resistive film	⑤	Sn plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- Current detecting resistors for power supplies, motor circuits, etc.
- Low resistance (100mΩ or under) and high accuracy resistors (±1%) for current detection.
- High reliability and performance with T.C.R. $\pm 75\times10^{-6}$/K～.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.
- Operating temperature range ～155℃.

■Applications

- Car electronics, Computers, HDDs, Cellular-telephones, Power supplies, and Motor circuits, etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8

■Dimensions

Type (Inch Size Code)	Resistance range (Ω)	Dimensions (mm) L	W	c	d	t	Weight (g) (1000pcs)
UR73VD 2A (0805)	10m～16m	2.0±0.2	1.25±0.2	0.4±0.2	0.7±0.2	0.6±0.1	5.74
	18m～36m				0.6±0.2		
UR73V 2A (0805)	39m～100m	2.0±0.2	1.25±0.2	0.4±0.2	0.4±0.2	0.6±0.1	5.60
UR73VD 2B (1206)	10m～13m	3.2±0.2	1.6±0.2	0.4±0.3	1.25±0.2	0.6±0.1	11.12
	15m～16m				1.15±0.2		
	18m～20m				1.1±0.2		
	22m～27m				1.0±0.2		
UR73V 2B (1206)	30m～33m	3.2±0.2	1.6±0.2	1.0±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	10.09
	36m～39m			0.9±0.3			
	43m～100m			0.65±0.3			

■Type Designation

Example

UR73VD	2B	T	TD	10L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
UR73VD : Face-down	2A : 0.5W 2B : 0.5W 1W※2	T : Sn	TD : 4mm pitch punch paper BK : Bulk	4 digits Ex. 10L0 : 10mΩ	F : ±1%

UR73V	2B	T	TD	30L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
UR73V	2A : 0.5W 2B : 0.5W 1W※2	T : Sn	TD : 4mm pitch punch paper BK : Bulk	4 digits Ex. 30L0 : 30mΩ R100 : 100mΩ	F : ±1%

Resistance Value (Ω)	4 digits
10m～91m	10L0～91L0
0.1	R100

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

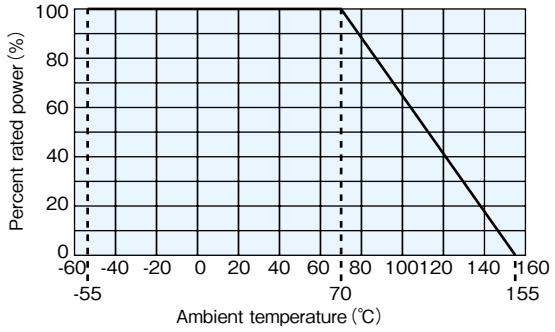
■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) E24 & 25m, 50m※1	Resistance Tolerance	Operating Temp. Range	Taping & Q'ty/Reel (pcs) TD
UR73VD 2A	0.5W	70℃	100℃	0～+250	10m～11m	F : ±1%	−55℃～+155℃	5,000
				0～+150	12m～13m			
				±75	15m～36m			
UR73V 2A				±75	39m～100m			
UR73VD 2B	0.5W	70℃	125℃	0～+250	10m～11m	F : ±1%	−55℃～+155℃	5,000
				±75	12m～27m			
	1W※2	70℃	95℃	0～+250	10m～11m			
				±75	12m～27m			
UR73V 2B	0.5W	70℃	125℃	±75	33m～75m			
				±100	30m, 82m～100m			
	1W※2	70℃	95℃	±75	33m～75m			
				±100	30m, 82m～100m			

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$
※1 25mΩ and 50mΩ are available.
※2 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the next page.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

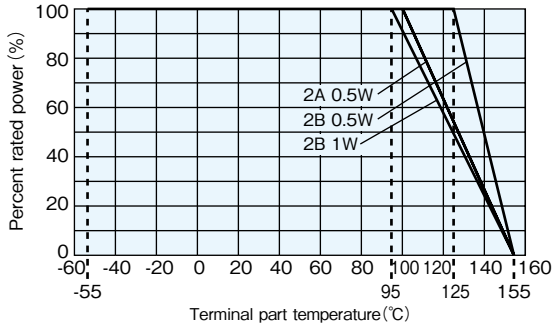
■Derating Curve

Ambient temperature



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

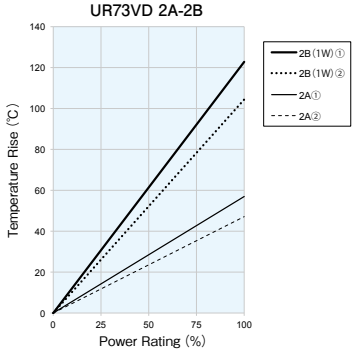
Terminal part temperature



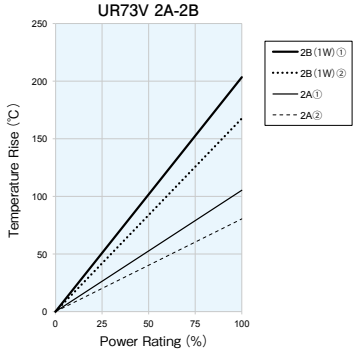
When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Temperature Rise

UR73VD 2A-2B

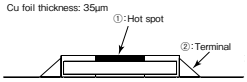


UR73V 2A-2B

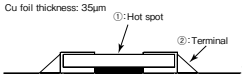


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

UR73V
Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm

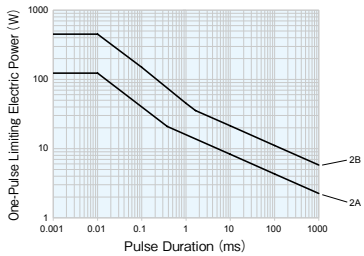


UR73VD
Measurement condition
Room temperature: 25℃
PCB: FR-4t = 1.6mm
Cu foil thickness: 35μm



■One-Pulse Limiting Electric Power

UR73V/UR73VD 2A-2B



Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

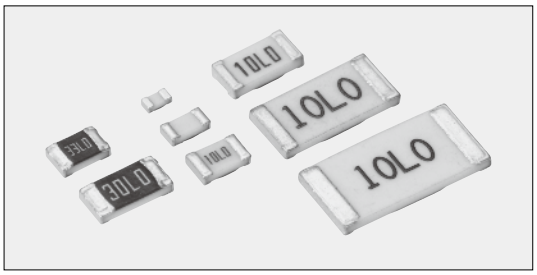
Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage × 2.5 for 5s (2B:1W : Rated voltage × 2 for 5s)
Resistance to soldering heat	1	0.3	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.5	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	2	1	40℃±2℃ 90~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	1	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+155℃, 1000h

■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

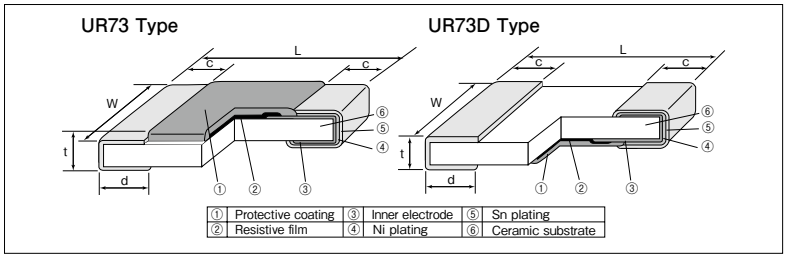
THICK FILM (LOW RESISTANCE)

UR73 Low Resistance Flat Chip Resistors (Low T.C.R.)



Coating color : Indigo

■Construction



■Features

- Current detecting resistors for power supplies, motor circuits, etc.
- Low resistance (100mΩ or under) and high accuracy resistors (±1%) for current detection.
- High reliability and performance with T.C.R. $\pm 100 \times 10^{-6}$/K.
- Suitable for flow and reflow solderings.
- Products meet EU-RoHS requirements.

■Applications

- Computers, HDDs, Cellular-telephones, Power supplies, and Motor circuits, etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8

■Dimensions

Type (Inch Size Code)	Resistance range (Ω)	Resistance range (mm) L	W	c	d	t	Weight (g) (1000pcs)
UR73D 1E (0402)	24m~100m	$1.0^{+0.1}_{-0.05}$	$0.5^{+0.1}_{-0.05}$	0.25±0.1	0.3±0.1	0.4±0.05	0.72
UR73D 1J (0603)	10m~27m	1.6±0.2	$0.8^{+0.15}_{-0.1}$	0.35±0.1	0.55±0.1	0.5±0.1	2.84
	30m~100m				0.35±0.1		
UR73D 2A (0805)	10m~16m	2.0±0.2	1.25±0.2	0.4±0.2	0.6±0.2	0.55±0.1	5.74
	18m~30m				0.5±0.2		
UR73 2A (0805)	33m~100m	2.0±0.2	1.25±0.2	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.55±0.1	5.60
UR73D 2B (1206)	10m~16m	3.2±0.2	1.6±0.2	0.5±0.2	1.0±0.2	0.6±0.1	11.12
	18m~27m				0.8±0.2		
UR73 2B (1206)	30m~100m	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	10.09
UR73D 2H (2010)	10m~30m	5.0±0.2	2.5±0.2	0.65±0.3	1.6±0.3	0.65±0.1	29.80
	33m~100m				0.65±0.3		
UR73D 3A (2512)	10m~30m	6.3±0.2	3.1±0.2	0.8±0.3	2.0±0.3	0.6±0.1	47.69
	33m~100m				0.8±0.3		

■Type Designation

Example

UR73D	2A	T	TD	10L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
UR73D : Face-down	1E : 0.125W 1J : 0.25W 2A : 0.33W 2B : 0.5W 2H : 0.75W 3A : 1W	T : Sn	TP : 2mm pitch punch paper TD : 4mm pitch punch paper TE : 4mm pitch plastic embossed BK : Bulk	4 digits Ex. 10L0 : 10mΩ R100 : 100mΩ	F : ±1%

UR73	2B	T	TD	47L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	2A : 0.33W 2B : 0.5W	T : Sn	TD: 4mm pitch punch paper BK: Bulk	4 digits Ex. 47L0 : 47mΩ R100 : 100mΩ	F : ±1%

Resistance Value (Ω)	4 digits
10m~91m	10L0~91L0
0.1	R100

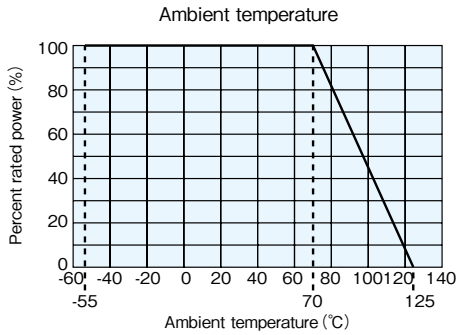
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information or taping, please refer to APPENDIX C on the back pages.

■Ratings

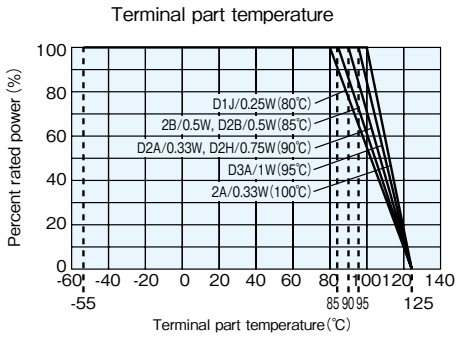
Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) E24 & 25m, 50m※1	Resistance Tolerance	Operating Temp. Range	Taping & Q'ty/Reel (pcs) TP	TD	TE
UR73D 1E※2	0.125W	70℃	—	±500	24m~27m	F : ±1%	−55℃~+125℃	10,000	—	—
				±100	30m~100m					
UR73D 1J	0.25W	70℃	80℃	±300	10m~27m			—	5,000	—
				±200	30m~43m					
				±100	47m~100m					
UR73D 2A	0.33W	70℃	90℃	±250	10m~30m			—	5,000	—
UR73 2A	0.33W	70℃	100℃	±250	33m~43m			—	5,000	—
				±100	47m~100m					
UR73D 2B	0.5W	70℃	85℃	±200	10m~27m			—	5,000	—
UR73 2B	0.5W	70℃	85℃	±200	30m~43m			—	5,000	—
				±100	47m~100m					
UR73D 2H	0.75W	70℃	90℃	±250	10m~30m			—	—	4,000
				±100	33m~100m					
UR73D 3A	1W	70℃	95℃	±250	10m~30m			—	—	4,000
				±100	33m~100m					

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$
※1 25mΩ and 50mΩ are available.
※2 Please inquire before use.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve

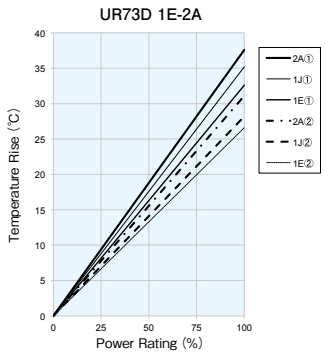


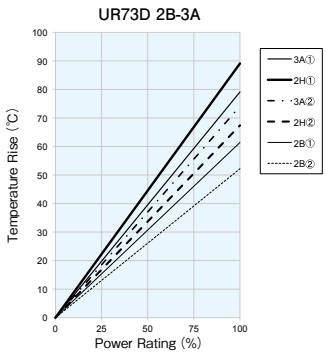
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

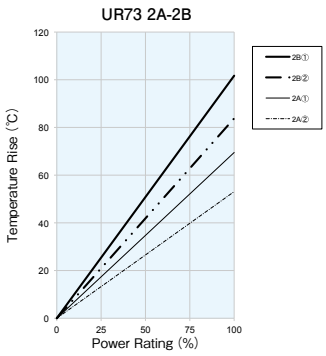


When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

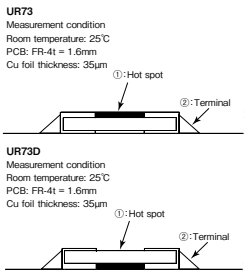
■Temperature Rise



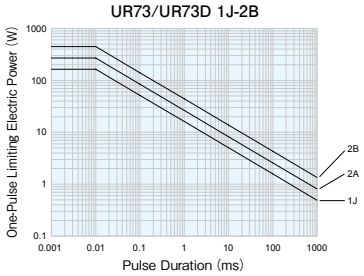


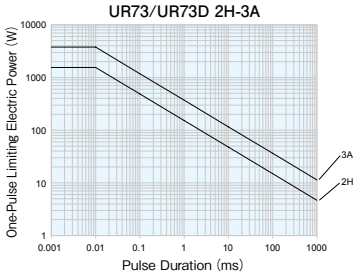


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.



■One-Pulse Limiting Electric Power





Please ask us about the resistance characteristic of continuous applied pulse. The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage × 2.5 for 5s
Resistance to soldering heat	1	0.3	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.5	−55℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	2	1	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	2	1	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+125℃, 1000h

■Precautions for Use

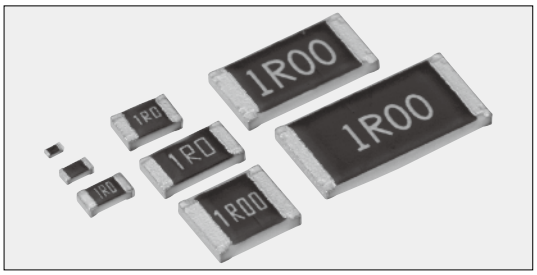
- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON /OFF of load is repeated, especially when large types of 2H/3A which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy(FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1E～2B, but the crack tends to occur in the types of 2H/3A. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

THICK FILM (LOW RESISTANCE)

EU RoHS

INDEX

SR73 Low Resistance Flat Chip Resistors



Coating color : Black (1H)
Indigo (1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2)

■Features

- Current detecting resistors for power supply, motor circuits, etc.
- High reliability and performance with resistance tolerance ±0.5%, T.C.R. ±100×10^{-6}/K
- Suitable for both reflow and flow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.
- AEC-Q200 Tested (Exemption 1H).

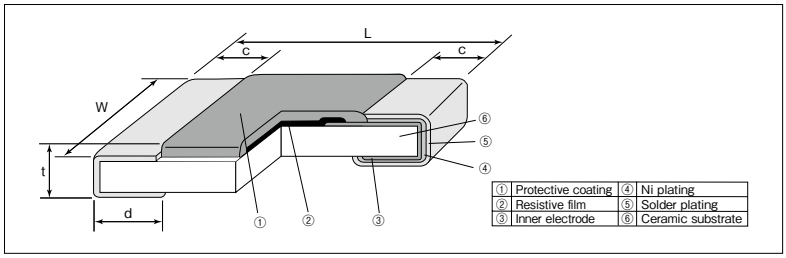
■Applications

- Car electronics, Computers, HDDs, Cellular-telephones, Power supplies, and Motor circuits, etc.

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2134C

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
1H (0201)	0.6±0.03	0.3±0.03	0.1±0.05	0.15±0.05	0.23±0.03	0.14
1E (0402)	$1.0^{+0.1}_{-0.05}$	$0.5^{+0.1}_{-0.05}$	0.25±0.1	0.25±0.1	0.35±0.05	0.68
1J (0603)	1.6±0.2	$0.8^{+0.15}_{-0.1}$	0.35±0.1	0.35±0.1	0.45±0.1	2.14
2A (0805)	2.0±0.2	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	0.5±0.1	4.54
2B (1206)	3.2±0.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14
2E (1210)		2.6±0.2				15.5
W2H (2010)※1	5.0±0.2	2.5±0.2		0.65±0.15		24.3
W3A (2512)※1	6.3±0.2	3.1±0.2				37.1
W3A2 (2512)※1						

※1 SR73 2H, 3A and 3A2 are also still available (different "d" dimensions=$0.4^{+0.2}_{-0.1}$mm)

■Type Designation

Example

SR73	2B	T	TD	R10	J
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1H:0.1W 1E:0.166W 1J:0.2W 0.25W 2A:0.33W 0.5W※5 2B:0.33W 0.5W※5 2E:0.5W 0.66W※5 W2H:0.75W W3A:1.0W W3A2:2.0W※5	T:Sn G:Au※2 (L:Sn/Pb)※3	TCM:2mm pitch press paper TPL・TP: 2mm pitch punch paper TD:4mm pitch punch paper TE:4mm pitch plastic embossed BK:Bulk	D,F:4 digits G,J:3 digits Ex. 0.1Ω:R100 47mΩ:47L	D:±0.5% F:±1% G:±2% J:±5%

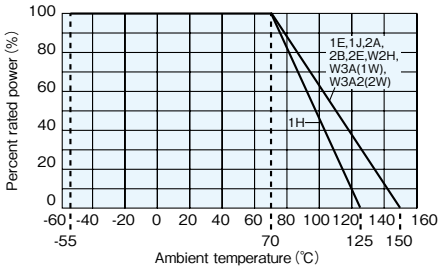
Resistance Value (Ω)	3digits
24m～91m	24L～91L
0.1～0.91	R10～R91
1～9.1	1R0～9R1
10	100

Resistance Value (Ω)	4digits
0.1～0.976	R100～R976
1～9.76	1R00～9R76
10	10R0

※2 Products with gold plated electrodes are also available only 1J, 2A and 2B type (0.1Ω～10Ω、F:±1%、J:±5%), so please consult with us.
※3 With type 1H, W2H and W3A, W3A2 only T is available as the terminal surface material. The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

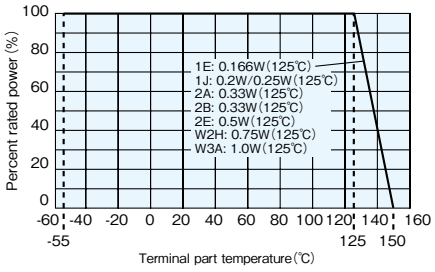
■Derating Curve

Ambient temperature

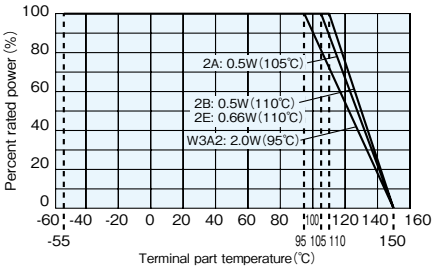


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

Terminal part temperature



Terminal part temperature
SR73 2A(0.5W), SR73 2B(0.5W),
SR73 2E(0.66W), SR73 W3A2



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Ratings

Type	Power Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Taping & Q'ty /Reel (pcs) TCM	TPL・TP	TD	TE
1H※4	0.1W	70℃	—	0～+400	—	1～10	—	0.27～10	TCM:15,000	—	—	—
				0～+500	—	—	—	0.18～0.24				
1E※4	0.166W	70℃	125℃	±200	—	0.51～10	0.51～10	0.51～10	—	TPL:20,000 TP :10,000	—	—
				±300	—	0.2～0.47	0.2～0.47	0.2～0.47				
				±500	—	0.1～0.18	0.1～0.18	0.1～0.18				
1J	0.2W	70℃	125℃	±200	—	1.02～10	1.1～10	1.1～10	—	TP :10,000※6	5,000	
	0.25W	70℃	125℃	±200	—	0.1～1	0.1～1	0.1～1				
2A	0.33W	70℃	125℃	±100	0.15～10	0.1～10	—	—	—	TP :10,000※6	5,000	4,000※6
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.051～0.091				
				±800	—	—	—	0.03～0.047				
	0.5W※5	70℃	105℃	±100	0.15～10	0.1～10	—	—				
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.051～0.091				
				±800	—	—	—	0.03～0.047				
2B	0.33W	70℃	125℃	±100	0.15～10	0.1～10	—	—	—	—	5,000	4,000※6
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.056～0.091				
				±800	—	—	—	0.03～0.051				
	0.5W※5	70℃	110℃	±100	0.15～10	0.1～10	—	—				
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.056～0.091				
				±800	—	—	—	0.03～0.051				
2E	0.5W	70℃	125℃	±100	—	0.1～10	—	—	—	—	5,000	4,000※6
				±200	—	—	0.1～10	0.047～10				
				±500	—	—	—	0.036～0.043				
				±1000	—	—	—	0.024～0.033				
	0.66W※5	70℃	110℃	±100	—	0.1～10	—	—				
				±200	—	—	0.1～10	0.047～10				
				±500	—	—	—	0.036～0.043				
				±1000	—	—	—	0.024～0.033				
W2H	0.75W	70℃	125℃	±100	—	0.1～10	—	—	—	—	—	4,000
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.056～0.091				
				±800	—	—	—	0.033～0.051				
W3A	1W	70℃	125℃	±100	—	0.1～10	—	—	—	—	—	4,000
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.056～0.091				
				±800	—	—	—	0.039～0.051				
W3A2	2W※5	70℃	95℃	±100	—	0.1～10	—	—	—	—	—	4,000
				±200	—	—	0.1～10	0.1～10				
				±500	—	—	—	0.056～0.091				
				±800	—	—	—	0.039～0.051				

Operating Temperature Range：−55℃～+125℃ (1H)、−55℃～+150℃ (1E、1J、2A、2B、2E、W2H、W3A、W3A2)

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$

※4 The nominal resistance value for SR73 1H, SR73 1E (F：±1%) is in E24.

※5 If you use at the rated power, please keep the condition that the terminal of the resistor is below the rated terminal part temperature. Please refer to the derating curves based on the terminal temperature of right side on the previous page.

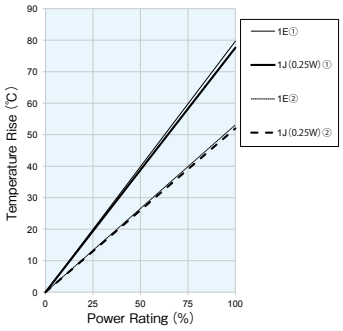
※6 Standard packaging：TD(4mm pitch punch paper)

If any questions arise whether to use the"Rated Ambient Temperature"or the"Rated Terminal Part Temperature"in your usage conditions, please give priority to the"Rated Terminal Part Temperature".
For more details, please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog.
While using under high power, the temperature of the product may increase depending on the condition of heat dissipation from PCB.
Be sure to check the terminal part temperature as well as precausions to use on delivery specifications before use.

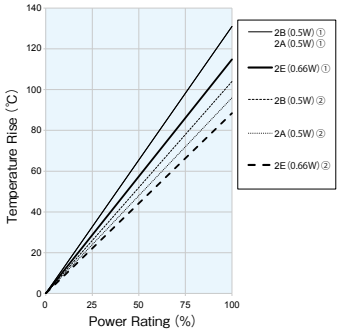
THICK FILM (LOW RESISTANCE)

■Temperature Rise

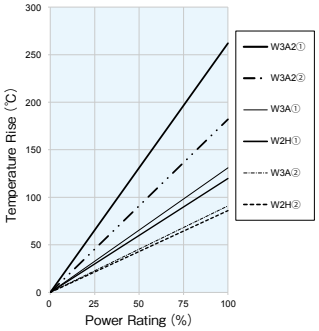
SR73 1E-1J



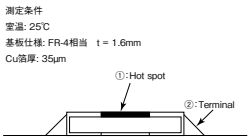
SR73 2A-2E



SR73 W2H-W3A2

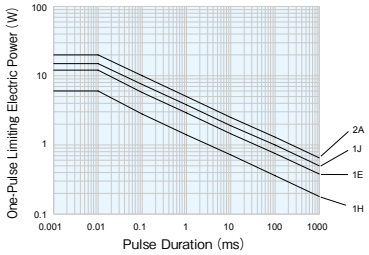


Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions.

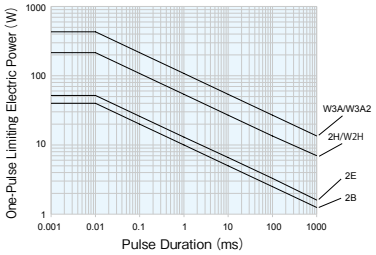


■One-Pulse Limiting Electric Power

SR73 1H-2A



SR73 2B-W3A2



Please ask us about the resistance characteristic of continuous applied pulse. The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

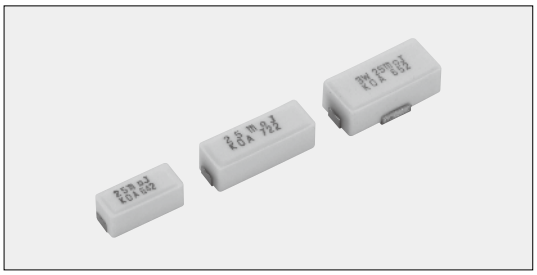
■Performance

Test Items	Performance Requirements ΔR± (%+0.005Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	2	0.5	Rated voltage×2.5 for 5s (W3A2 : Rated voltage×2.0 for 5s)
Resistance to soldering heat	3 : 1H 1 : 1E～W3A2	0.75 : 1H 0.3 : 1E～W3A2	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.3	−40℃ (30min.) /+125℃ (30min.) 100 cycles
Moisture resistance	3 : 1H 2 : 1E～W3A2	1	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃ or rated terminal part temperature	3 : 1H 2 : 1E～W3A2	1	70℃±2℃ or rated terminal part temperature ±2℃ 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.3	+125℃, 1000h : 1H +150℃, 1000h : 1E, 1J, 2A, 2B, 2E, W2H, W3A, W3A2

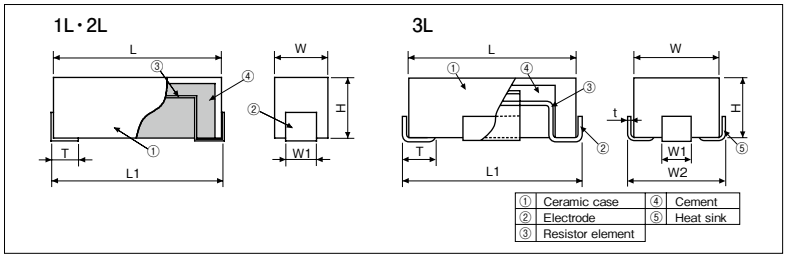
■Precautions for Use

- The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON / OFF of load is repeated, especially when large types of W2H/W3A/W3A2 which have large thermal expansion and also self heating. By general temperature cycle test using glass-epoxy(FR-4) boards under the maximum/minimum temperatures of operating temperature range, the crack does not occur easily in the types of 1H～2E, but the crack tends to occur in the types of W2H/W3A/W3A2. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.
- The resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

BLR Ceramic Case Surface Mount Resistors



Construction



Features

- Suitable to sense large current due to ultra low resistances.
- Flame retardant resistor in a ceramic case.
- All custom-made products.
- Automatic mounting is available.
- Products meet EU-RoHS requirements.

Dimensions

Type (Inch Size Code)	Dimensions (mm)								Weight(g) (1000pcs)
	L±0.5	L1±1	W±0.5	W2	H±0.5	W1±0.3	(t)	T±1	
BLR1L	13	14	5.5	–	5.2	3	–	2.5	750
BLR2L	18	19	6.3	–	6.0	3	–	3.0	1600
BLR3L	18	19.3	8.2	9.2	6.0	3	0.3	3.0	2000

Type Designation

Example

BLR	1L	N	TE	50L	J
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1L : 1W 2L : 2W 3L : 15W	N : No surface treatment	TE : Taping	3 digits	J : ±5% K : ±10%

Resistance Value (Ω)	3 digits
8m~9.1m	8L0~9L1
10m~50m	10L~50L

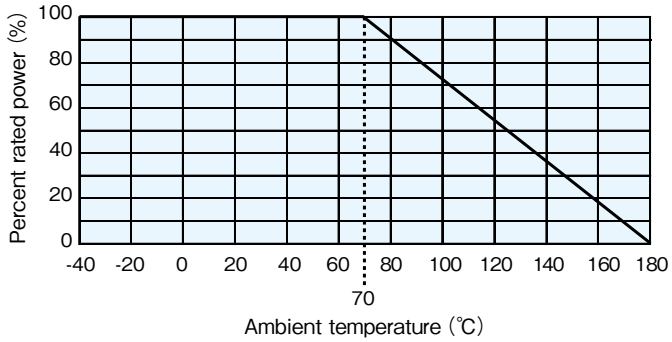
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

Ratings

Type	Power Rating	Resistance※1 Range (Ω)	Resistance Tolerance	T.C.R. (×10⁻⁶/K)	Rated Ambient Temperature	Operating Temperature Range	Taping & Q'ty/Reel (pcs) TE
BLR1L	1W	25m、50m	J : ±5% K : ±10%	±200	+70℃	−40℃~+180℃	1,000
BLR2L	2W	8m、12m、13m、16m、17.5m、20m、22m、25m					
BLR3L	15W※2						750

※1 Please consult with us in advance about resistance value for custom-made products.
※2 It is assumed to be used on aluminum circuit board.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

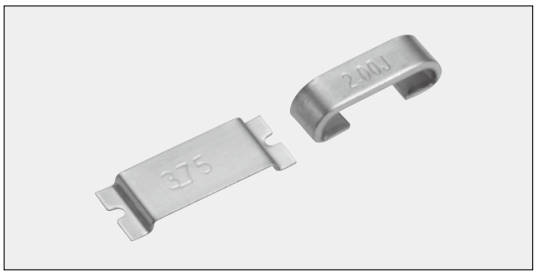
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	−	25℃
T.C.R.	Within specified value	−	+25℃/+125℃
Cold resistance	5	2	−55℃ 1000h
Heat resistance	5	2	+125℃ 1000h
Moisture resistance	5	2	40℃±2℃, Power rating×1/10, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Load life	5	2	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

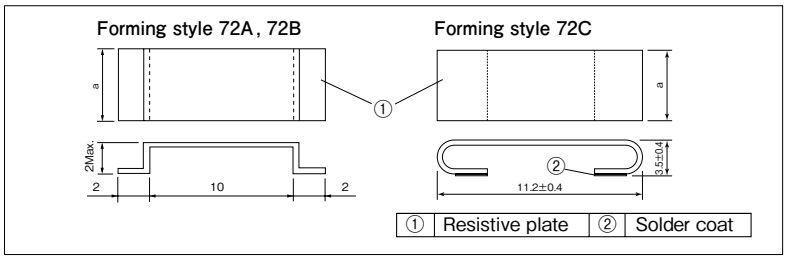
- Take care of soldering since the surface treatment is not made on the electrodes of these resistors.
- In the resistance values of 50mΩ or below, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

LR72 Surface Mount Type Custom Milliohm Resistors



■Construction

(mm)



■Features

- The super low resistance (2mΩ～) is suitable to sense large current.
- All custom-made products.
- Easy soldering. Applicable for reflow soldering.
- An automatic mounting machine is applicable.
- Products with lead free termination meet EU-RoHS requirements.

■Dimensions

Type	Dimensions (mm)
	a
LR72A	5.2 ± 0.2
LR72B	3.0 ± 0.2
LR72C	3.2 ± 0.4

■Type Designation

Example

LR72	A	N	TE	2L5	J
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal※3 Resistance	Resistance Tolerance
	A : 0.5W B : 0.25W C : 1W	N : Non-presolder※1 D : SnAgCu※2	TE : Taping	3 digits	J : ±5%

※1 Only A and B styles are non-presolder type.
※2 Oniy C style is SnAgCu type.
※3

Resistance Value (Ω)	3 digits
2.5m、5m、8m	2L5、5L0、8L0

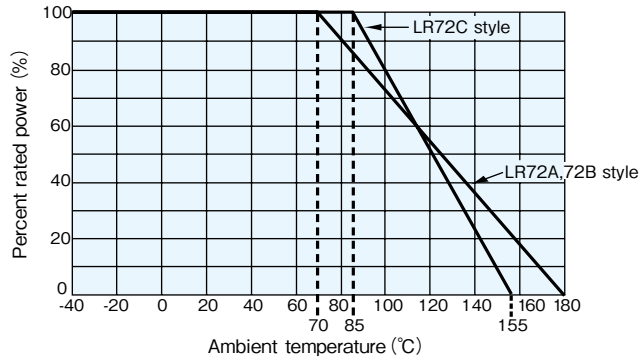
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating※4	Resistance※5 Range (mΩ)	Resistance Tolerance	T.C.R. (×10⁻⁶/K)	Rated Ambient Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs)
							TE
LR72A	0.5W	2.5、5、8	J : ±5%	±100	+70℃	−40℃～+180℃	2,000
LR72B	0.25W	3					
LR72C	1W	2、3		±350	+85℃	−40℃～+155℃	1,500

※4 Rated power in case of glass epoxy resin (FR-4) is used for the substrate material.
※5 Please consult with us in advance about resistance value for custom-made products.
Other shapes and resistances than the above are also available on request.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Performance

Test Items	Performance Requirements ΔR ±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	2	1.6	350℃±10℃, 3s
Moisture resistance	5	4.5	Power rating×1/10, 40℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	5	4.5	Rated voltage, 70℃, 1000h, 1.5h ON/0.5h OFF cycle

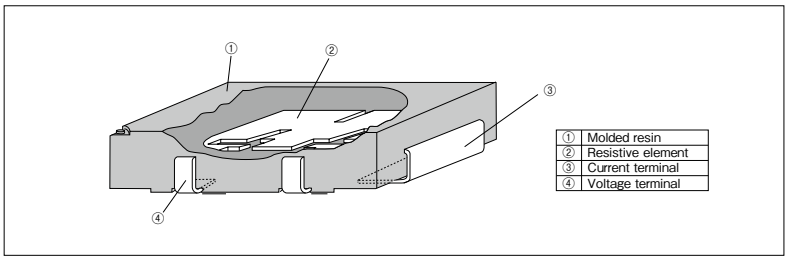
■Precautions for Use

- In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.
- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

CSR ▌Chip Current Sensing Resistors

Coating color：Black

■Construction



■Features

- Current sensing chip resistors of 4-terminal construction with current terminals and voltage (KELVIN) terminals.
- Despite ultra low resistance, high resistance accuracy is realized.
- No change in resistance value after soldering to a circuit board, even for D (±0.5%) or F (±1.0%) class.
- Excellent T.C.R. achieved (±50×10^{-6}/K)
- Flame retardant type resin is used. (UL94 V-0)
- Suitable for reflow, flow and iron solderings.
- Products with lead free termination meet EU-RoHS requirements.

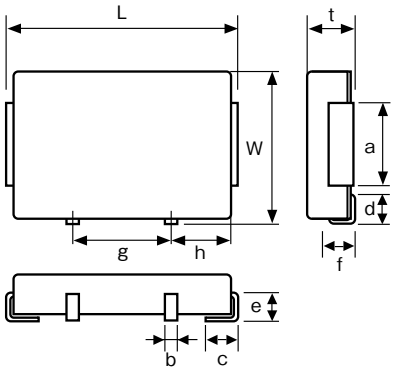
■Applications

- Electric automobiles
- Industrial robots

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Dimensions



Dimensions (mm)	Type	
	CSR1	CSR2
L±0.5	10.8	12.8
W±0.3	6.2	8.2
t±0.2	2.1	3.1
a±0.3	3.0	5.0
b±0.2	0.8	1.0
c±0.5	1.4	2.0
d±0.5	1.2	2.0
e±0.3	1.3	2.2
f±0.3	1.3	2.2
g±0.1	5.0	6.0
h±0.1	2.5	3.0
Weight (g) Net/1,000pcs.	320	690

■Type Designation

Example

CSR	1	T	TE	10L0	F
Product Code	Power Rating	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance
	1：1W 2：2W	T：Sn	TE：Plastic embossed BK：Bulk	4 digits	D：±0.5% F：±1%

Resistance Value (Ω)	4 digits
5m～8.2m	5L00～8L20
10m～50m	10L0～50L0

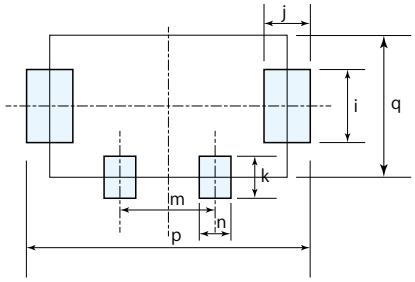
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating	Resistance Range (Ω)	Resistance Tolerance	T.C.R. (×10^{-6}/K)	Rated Ambient Temp.	Operating Temp. Range	Taping & Q'ty/Reel (pcs)
							TE
CSR1	1W	5m～50m (E12)	D:±0.5%, F:±1.0%	±50	+70℃	−55℃～+125℃	1,000
CSR2	2W		F:±1.0%				

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$.

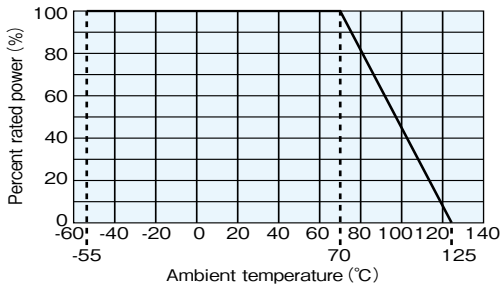
■Recommended Pad Dimensions



Type	Dimensions (mm)						
	i	j	k	m	n	p	q
CSR1	3.0	2.0	2.0	5.0	1.6	12.0	6.0
CSR2	5.3	2.3	3.2	6.0	2.2	14.3	8.0

※These pad dimensions are only for standard pattern and the characteristics are not guaranteed, which you are suggested to confirm before use.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

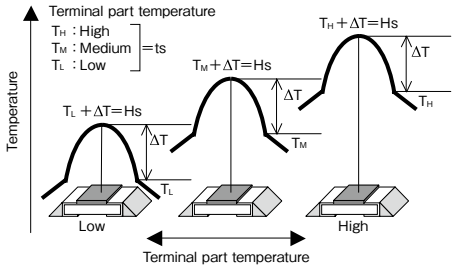
■Thermal Resistance

Type	Resistance (Ω)	Rth (℃/W)
CSR1	20m	42
CSR2	20m	30

Rth=(Hs-ts)/Power

Regarding the temperature rise, the value of the temperature varies per conditions and board for use since the temperature is measured under our measuring conditions. Please refer to us before use.

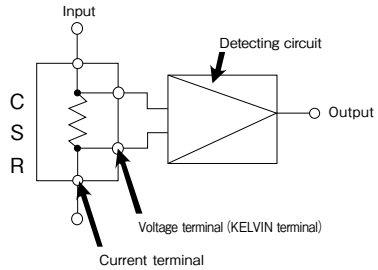
The temperature of the resistor will increase the same ⊿T from the standard terminal part temperature regardlless of the ambient temperature when the same power is applied. This is because there is hardly any heat dissipation from the resistor surface to the ambient air.



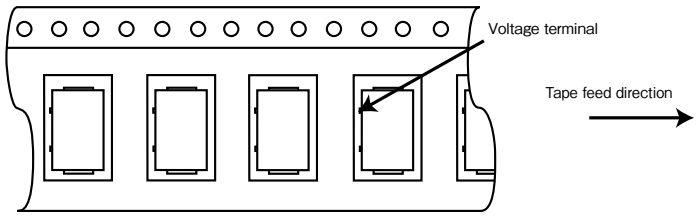
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1	1	Rated power×5 for 5s
Resistance to soldering heat	1	1	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.5	−55℃ (30min.) /+125℃ (30min.) 500 cycles
Moisture resistance	2	0.5	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	1	0.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Low temperature exposure	0.5	0.25	−55℃, 1h
High temperature exposure	0.5	0.25	+125℃, 100h

■Example For Circuit



■Taping Direction



■Precautions for Use

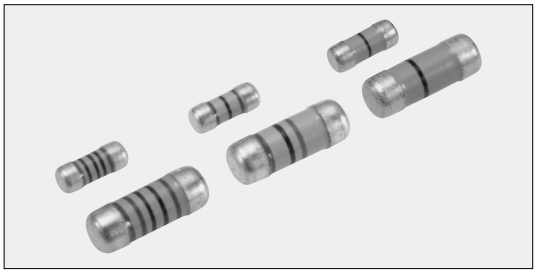
• In case of using the low ohm resistors as shunt resistors, please lay out a pattern considering the electromagnetic induction with surrounding inductors.

MELF (METAL FILM, CARBON FILM)

EU RoHS

INDEX

RN41 ▌MELF Type Fixed Metal Film Resistors
RD41 ▌MELF Type Fixed Carbon Film Resistors
CC ▌MELF Type Cross-conductors



Coating color : RN41/CC : Blue, RD41 : Ivoly
Color code : RD41 : 3 color-bands
RN41 (E24) : 4 color-bands
RN41 (E24·96) : 5 color-bands
CC : 1 color-band

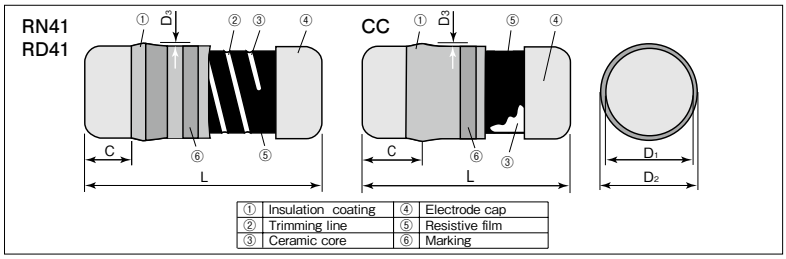
■Features

- SMD resistors.
- Free direction for mounting due to cylindrical design.
- High precision products (Resistance tolerance ±0.1% and T.C.R.±25×10^{-6}/K) available. (RN41)
- The electrode strength is firm.
- The noise characteristics is excellent.
- Suitable for reflow, flow and iron solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested (RN41 2ES/3AS, CC 12M/25)

■Reference Standards

IEC 60115-8
JIS C 5201-8
EIAJ RC-2132A

■Construction

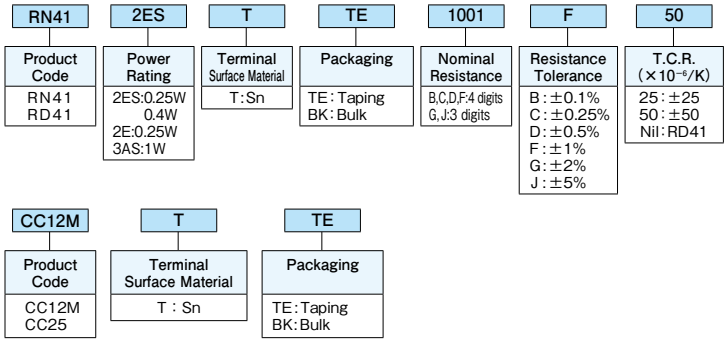


■Dimensions

Type (Inch/DIN Size Code)	Dimensions (mm) L	C	D1	D2 Max.	D3 Max.	Weight (g) (1000pcs)
2ES (1406/0204)	3.5±0.2	0.5~0.9	1.4±0.1	1.55	0.1	20
CC12M (1406/0204)						
2E・3AS (2309/0207)	5.9±0.2	0.5min	2.2±0.1	2.4	0.15	75
CC25 (2309/0207)						

■Type Designation

Example



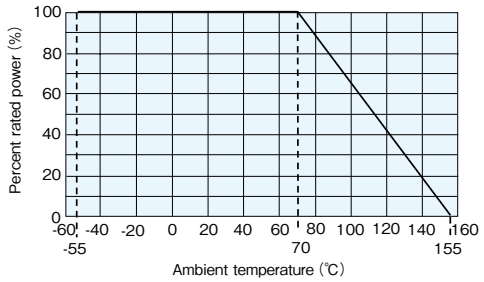
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating	Current Rating	Rated Ambient Temp.	Rated Terminal Part Temp.	T.C.R. (×10⁻⁶/K)	Resistance Range and Resistance Tolerance (Ω) B:±0.1% E24・E96	C:±0.25% E24・E96	D:±0.5% E24・E96	F:±1% E24・E96	G:±2% E24	J:±5% E24	Max. Working Voltage	Max. Overload Voltage	Packaging & Q'ty (pcs) Box	Reel
RN41 2ES	0.25W	—	70℃	90℃	±25	43~511k	100~100k	100~604k	—	—	—	200V	400V	40,000	3,000
					±50	—	—	—	1.0~5.11M	—	0.22~0.91				
	0.4W※1,※2	—	—	90℃	±50	—	—	—	1.0~5.11M	—	0.22~0.91	200V	400V	40,000	3,000
RN41 3AS	1W※1,※2	—	70℃	90℃	±50	—	—	—	1.0~1M	—	0.22~0.91	400V	600V	10,000	1,500
RD41 2ES	0.25W	—	70℃	—	—※3	—	—	—	—	2.2~1M	2.2~1M	200V	400V	40,000	3,000
RD41 2E	0.25W	—	70℃	—	—※3	—	—	—	—	1.0~2.2M	1.0~2.2M	300V	600V	10,000	1,500
CC12M	—	2A	70℃	—	—	20mΩ or under						—	—	40.000	3,000
CC25	—	5A												10.000	1,500

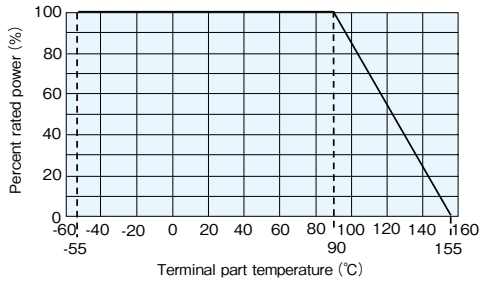
Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※1 A power rating is guaranteed at the terminal part temperature.
※2 A power rating shall be guaranteed with a method shown in the item. (:Performance) Please inquire before you order and/or use.
※3 Please contuct us for T.C.R. of RD41.
If any questions arise whether to use the "Rated Ambient Temperature" or the "Rated Terminal Part Temperature" in your usage conditions, please give priority to the "Rated Terminal Part Temperature".
For more details, please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.
Please contact us about CC series's derating curve.

RN41 2ES, 3AS



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
Please refer to "Introduction of the derating curves based on the terminal part temperature" on the beginning of our catalog before use.

■Performance

Test Items	Type	RD41, RN41 Performance Requirements※4 ΔR± (%+0.05Ω)		CC Performance Requirements		Test Methods
		Limit	Typical	Limit	Typical	
Resistance	RN41 RD41	Within specified tolerance	—	Max. 20mΩ	Max. 7.5mΩ	25℃
T.C.R.	RN41 RD41	Within specified T.C.R.	—	—	—	+25℃/+125℃
Overload (Short time)	RN41	2ES : Test group D	0.3	—	—	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
	RD41	1.0	0.5			
Intermittent overload	RD41	1.0	—			Rated voltage×4 or Max. Intermittent overload voltage, whichever is lower, 10,000 cycles.
Resistance to soldering heat	RN41	2ES : Test group D	—	Max. 20mΩ	Max. 7.5mΩ	260℃±5℃, 10s±1s
	RD41	1.0	0.5			
Rapid change of temperature	RN41	2ES : Test group D	—	Max. 20mΩ	Max. 7.5mΩ	−55℃ (30min.) /+125℃ (30min.) 5 cycles
	RD41	1.0	0.75			
Moisture resistance	RN41	2ES : Test group C	—	Max. 20mΩ	Max. 7.5mΩ	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
	RD41	5.0	2.5			
Endurance at 70℃	RN41	2ES : Test group A	—	Max. 20mΩ	Max. 7.5mΩ	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
	RD41	2.0	1.0			
Low temperature exposure	RD41	1.0	0.75	—	—	−55℃, 1h
High temperature exposure	RN41	2ES : Test group C	0.75	—	—	+155℃, 2h RN41 2ES, 3AS : 155℃, 1000h
	RD41	2.0	1.0			

※4 Performance requirement for RN41 3AS are different from the above, so consult with us about the detail.

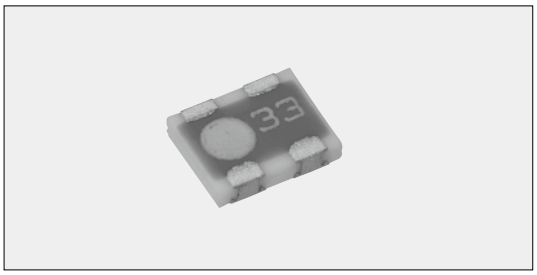
RN41 Test group

Stability class	Stability class for each resistance Resistance range	Limit resistance changing attests Test group A	B	C	D
0.25	10～332kΩ	±(0.25+0.05Ω)	±(0.50+0.05Ω)	±(0.25+0.05Ω)	±(0.05+0.05Ω)
0.5	1～<10Ω			±(0.50+0.05Ω)	±(0.10+0.05Ω)
1	0.22～<1Ω			±(1.00+0.05Ω)	±(0.25+0.05Ω)
2	>332kΩ～5.11MΩ	±(0.50+0.05Ω)	±(1.00+0.05Ω)	±(2.00+0.05Ω)	±(0.50+0.05Ω)

■Precautions for Use

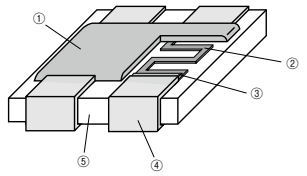
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.

CNN Thin Film Chip Networks



Coating color : Black

■Construction



①	Protective coating
②	Resistive film
③	Inner electrode
④	Outer electrode
⑤	Ceramic substrate

■Features

- Metal film chip network resistors.
- Excellent in relative T.C.R. and relative accuracy.
- Pair resistors for high precision OP-Amplifiers.
- As custom products, any pairs between 1kΩ and 100kΩ are available on request.
- Suitable for reflow soldering.
- Products with lead free termination meet EU-RoHS requirements.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Type Designation

Example

CNN	2A	2	T	TE	103/103	B	A
Product Code	Style	Number of Elements	Terminal Surface Material	Taping	Nominal Resistance	Absolute Resistance Tolerance	Resistance Ratio
CNN		2	T:Sn	TE:4mm pitch plastic embossed BK:Bulk	3 digits/ 3 digits	B:±0.1% C:±0.25%	A : 0.05% B : 0.1%

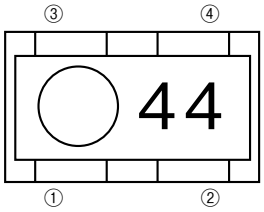
The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

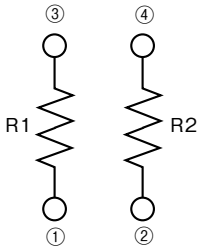
■Ratings

Type (Inch size)	POWER Rating	Resistance (Ω)	Resistance Tolerance		T.C.R. (×10⁻⁶/K)		Max. Working Voltage	Max. Overload Voltage	Rated Ambient Temperature	Operating Temperature Range	Taping & Q'ty/Reel (pcs)
			Absolute	Relative	Absolute	Relative					TE
CNN2A (0805×2)	0.05W/ Element	1k, 10k, 100k	B:±0.1% C:±0.25%	A:0.05% B:0.1%	±25	5	50V	100V	+70℃	−55℃~+125℃	4,000

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Circuit Construction





• Standard

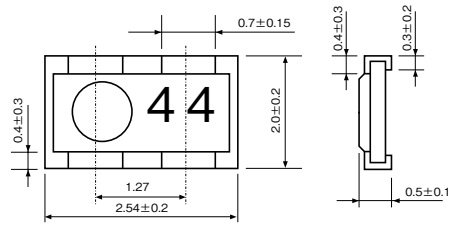
Resistance						
R1	1kΩ	1kΩ	1kΩ	10kΩ	10kΩ	100kΩ
R2	1kΩ	10kΩ	100kΩ	10kΩ	100kΩ	100kΩ

First marking number	3	3	3	4	4	5
Second marking number	3	4	5	4	5	5

• Custom

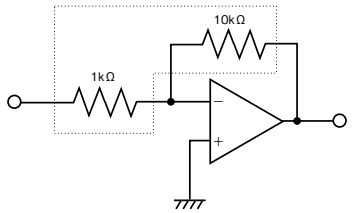
Custom products of any pairs between 1kΩ and 100kΩ are available on request.
Please ask us beforehand for the custom products.

■Dimensions (mm)

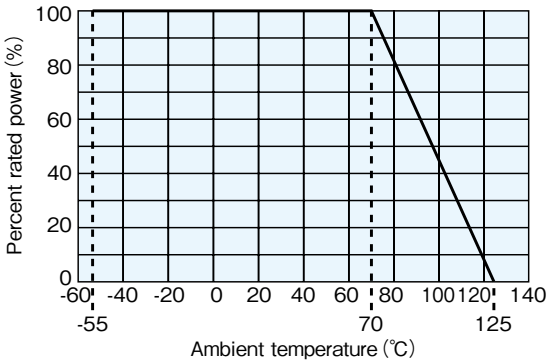


Weight 9.70g/1000pcs

■Example of Application



■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

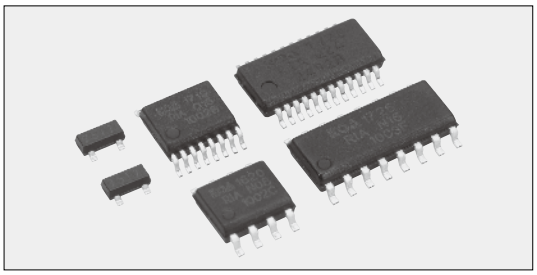
■Performance

Test Items	Performance Requirements Absolute ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃
Overload (Short time)	0.1	0.01	Rated voltage×2.5 or Max. overload vol., whichever less, for 5s
Resistance to soldering heat	0.1	0.02	260℃±5℃, 10s±1s
Rapid change of temperature	0.25	0.01	−55℃ (30min.) /+125℃ (30min.) 5 cycles
Moisture resistance	0.25	0.03	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	0.25	0.03	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.25	0.02	125℃, 100h

■Precautions for Use

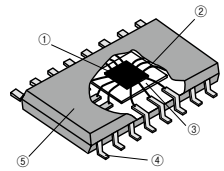
- The properly and electrostatically measured taping materials are used for the components, but attention should be paid to the fact that there is some danger the parts absorb on the top tapes to cause a failure in the mounting and the parts are destructed by static electricity (1kV and more, Human Body Model 100pF 1.5kΩ) to change the resistance in the conditions of an excessive dryness or after the parts are given vibration for a long time as they are packaged on the tapes. Similarly, care should be given not to apply the excessive static electricity when mounting on the boards.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. while perspiration and saliva include ionic impurities like sodium (Na^+), chrorine (Cl^-) etc. Therefore these kinds of ionic substances may induce electrical corrosion when they invade into the products. Either thorough washing or using RMA solder and flux are necessary since lead free solder contains ionic substances. Washing process is needed, before putting on moisture proof material in order to prevent electrical corrosion.
- When heat-resistant masking tapes are attached to the chip resistors at the time of mounting and then detached, there is a possibility of exfoliation of the top electrodes. It is known that the heat applied in the mounting process will enhance the adhesion strength of the tape adhesive so please avoid the use. If the use of masking tapes are unavoidable, then please be sure not to attach the tape adhesives directly on the products.
  When high-pressure shower cleaning is implemented, there is a possibility of exfoliation of the top electrodes caused by the water pressure stress so please avoid the implementation.
  If the implementation is unavoidable, then please evaluate the products beforehand.

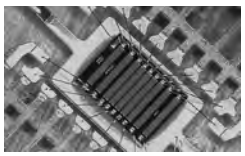
KPC KOA's Integrated Passive Components



Coating color : Body color : Black

Construction





①	Si wafer
②	Bonding wire
③	Die pad
④	Lead
⑤	Molded resin

Features

- Thin film (metal film) Resistor array on silicon wafer.
- Excellent resistance matching, TCR tracking and stabilities.
- Custom circuits are available with flexible layout. (Different resistance combination possible)
- Higher integration saves board space and overall assembly costs.
- Excellent reliability with standard molded IC package.
- Suitable for reflow soldering.
- Products with lead free termination meet EU-RoHS requirements.

Applications

- Making peripheral resistors for analog operational amplifiers highly accurate 1 chip network.
- Automotives, Analog instrumentations, IC testers
- Computers, Data communications, Network systems
- Operational amplifiers, Terminations, Pull-up/Pull-down

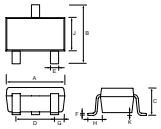
Reference Standards

IEC 60115-1 JIS C 5201-1 JIS C 5101-1

Dimensions

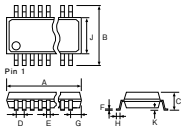
●SOT type

SOT-23



●QSOP, SOIC-N

QSOP, SOIC-N



Package Symbol	Package	Number of Pins	Dimensions (mm) A±0.2	B±0.2	C±0.2	D±0.1	E±0.1	F±0.1	G±0.1	H±0.2	J±0.2	K±0.1	Taping & Q'ty/Reel TE	Weight (g) 1000pcs
S03	SOT-23	3	2.92	2.3	0.95	1.91	0.44	0.13	0.51	0.53	1.3	0.11	3,000	9
Q16	QSOP	16	4.90	5.99	1.60	0.635	0.25	0.20	0.20	0.66	3.81	0.18	2,500	76
Q20		20	8.66						1.47					125
Q24		24							0.84					129
N08	SOIC-N	8	4.83			1.27	0.41		0.52					73
N14		14	8.66											150
N16		16	9.91											153

Type Designation

● Resistor Networks : RIA, RBA, RBB, RLA

Example

RIA	Q20	T	TE	1002	B	E	B	T
Circuit Code	Package Symbol	Terminal Surface Material	Taping	Nominal Resistance	Absolute Resistance Tolerance	T.C.R. (×10⁻⁶/K)	Relative Resistance Tolerance	T.C.R. Tracking (×10⁻⁶/K)
RIA : Isolated resistor network RBA: Bussed resistor network RBB: High speed bussed network RLA: R/2R Ladder network	Package type symbol+ Number of pins Q16, Q20, Q24: QSOP N08, N14, N16: SOIC Narrow	T:Sn	TE: Plastic embossed	4 digits 3 digits	B:±0.1% C:±0.25% D:±0.5% F:±1% G:±2% J:±5%	T:±10 E:±25 C:±50 H:±100	A:0.05% B:0.1% C:0.25% D:0.5% F:1% G:2% Nil:Not specified	Y:05 T:10 E:25 C:50 Nil:Not specified

Specifications are limited by the circuit and resistance value.
Please contact us separately.

● Resistor Networks : RNX, RTX, RTY

Example

RNX	Q20	T	TE	5001
Circuit Code	Package Symbol	Terminal Surface Material	Taping	Custom Code
RNX: Custom Resistor Network RTX,RTY: SOT-23 Resistor network	Package type symbol+ Number of pins	T:Sn	TE:Plastic embossed	

● Resistor Networks : RDA, RDB

Example

RDA	Q20	T	TE	471J	511J	H
Circuit Code	Package Symbol	Terminal Surface Material	Taping	Nominal Resistance & Tolerance of R1	Nominal Resistance & Tolerance of R2	T.C.R. (×10⁻⁶/K)
RDA: Dual terminator network RDB: Differential terminator network	Same as above (Except Q24, N14, N08)	T:Sn	TE:Plastic embossed	3 digits G: ±2% J: ±5%	3 digits G: ±2% J: ±5%	E:±25 C:±50 H:±100

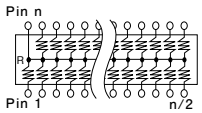
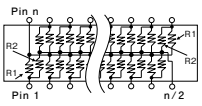
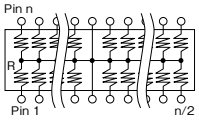
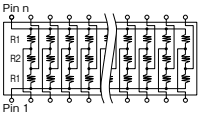
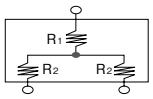
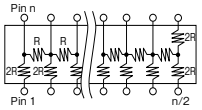
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Package		QSOP			SOIC			SOT-23
Package Symbol		Q16	Q20	Q24	N08	N14	N16	S03
Package Power Rating		0.8W	1.0W	1.0W	0.4W	0.6W	0.8W	0.2W
Resistance Range	10Ω～1kΩ	Power Rating 200mW/Resistor Element※1						
	1.1kΩ～	Power Rating 50mW/Resistor Element※1						
Max. Working Voltage		100V						
Rated Voltage		√Rated Power×Nominal Resistance Value, Rated Voltage should not exceed Max. Working Voltage.						
Rated Ambient Temp.		+70℃						
Operating Temp. Range		−55℃～+125℃※2						

Above ratings are based on the thermal resistances using a multi-layer circuit board (EIA/JESD51). For mounting on a mono-layer board, power derating shall be needed. Please inquire of us about conditions.
※1 Total power consumption of all elements should not exceed the package power rating.
※2 About operating temperature range −55℃～+155℃, We can provide as custom devices. Please inquire of us about it.

●Standard Resistor Networks

Circuit Code	Circuit Schematics (Top View)	Number of Pins	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) E24 and Absolute Tolerance		Circuit Code	Circuit Schematics (Top View)	Number of Pins	T.C.R. (×10⁻⁶/K)	Resistance Range(Ω) (E24) and Resistance Tolerance
				F:±1%	G:±2%, J:±5%					G:±2%, J:±5%
RBA		8, 14, 16 20, 24	E:±25	100～100k	100～100k	RDA		16, 20	E:±25	R1= 150～10k R1:R2= 1:1～1:4
			C:±50	51～100k	51～100k				C:±50	
			H:±100	30～100k	10～100k				H:±100	
RBB		8, 14, 16 20, 24	E:±25	100～100k	100～100k	RDB		16, 20	E:±25	R1= 150～10k R1:R2= 1:1～1:4
			C:±50	51～100k	51～100k				C:±50	
			H:±100	30～100k	10～100k				H:±100	
RTX		3 SOT-23 Only	E:±25	100～40k	100～40k	RLA		14, 16	H:±100	1k～30k
			C:±50	51～40k	51～40k					
			H:±100							

■Performance

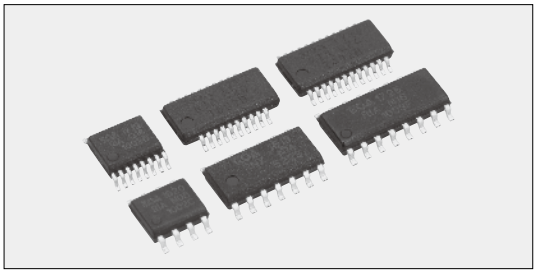
Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance		25℃
T.C.R.	Within specified T.C.R.		+25℃/−55℃, +25℃/125℃
Resistance to soldering heat	0.1※3	0.05	260℃±5℃, 10s±1s
Rapid change of temperature	0.5※3	0.05	−55℃(30min.)/+125℃(30min.) , 100 cycles
Moisture resistance	0.5※3	0.05	40℃±2℃, 90～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	0.25※3	0.05	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.25※3	0.10	+125℃, 1000h

※3 Guaranteed value differs depending on resistance value.

■Precautions for Use

- The resistor of this product is formed by narrow patterning a thin metal film. Thus, application of excessive voltage causes burn and destruction of the resistive film, abnormality in resistance or open resistance and loss of proper function. The properly and electrostatically measured taping materials are used for the components, but attention should be paid to the fact that there is some danger the parts may be destructed by static electricity(equivalent to 500V and more at 100pF, 1.5kΩ) to cause a change in resistance in the conditions of an excessive dryness when mounting on the boards. Similarly, care should be given not to apply the excessive static electricity at the time of mounting on the boards. When designing, consideration can be taken into withstanding ESD for customized KPC products. Please consult with us about the details.
- Hand soldering by iron soldering or repairment are not recommended because KPC is a multi-pin product.

KPC RIA Isolated Resistor Networks
KPC RNX Custom Resistor Networks



Body color：Black

■Applications

- Automotives, medical instrument, industrial machines, Measurement equipment
- Computers and networks
- High precision OP amp circuit, High precision voltage divider

■Features

- High precision resistor networks
- Combination of different resistance is available for custom circuit.
- Relative resistance tolerance 0.05%～
- TCR tracking 5×10⁻⁶/K～

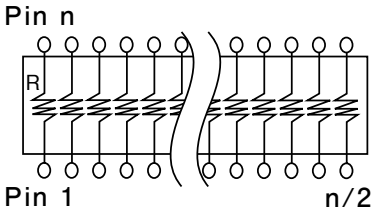
■Ratings

Number of Pins	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) and Absolute Tolerance					Relative resistance tol.	TCR Tracking (×10⁻⁶/K)
		B：±0.1%	C：±0.25%	D：±0.5%	F：±1%	G：±2%、J：±5%		
8, 14 16, 20 24	T: ±10	510～100k	510～100k	510～100k	510～100k	510～100k	A：0.05% B：0.1% C：0.25% D：0.5% F：1% G：2%	Y：5 T：10 E：25 C：50
	E: ±25			100～510k	100～510k	100～510k		
	C: ±50			51～510k	51～510k	51～510k		
	H: ±100				30～510k	10～510k		

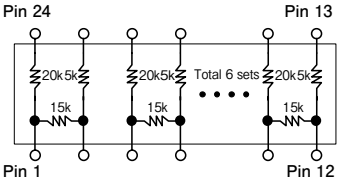
Rated power (70℃) ：10Ω～1kΩ 200mW/element 1.1kΩ～ 50mW/element
Please inquire of us about your custom devices and circuits. (Different resistance combination available)
Depending on the circuit and package, much higher resistances are possible.
For RIA20, 24 pin, highest resistance value/element is up to 100kΩ.

■Circuit Construction (Top View)

●High Precision Resistor Networks



●Custom High Precision Resistor Networks

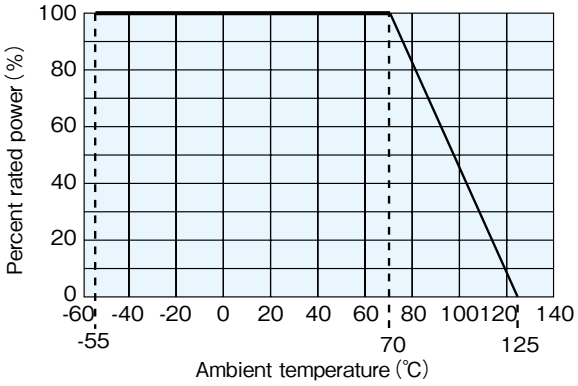


(Example of use)

Resistance Value	5kΩ、15kΩ、20kΩ	Total 18 elements
Tol.	abs. ±0.1%	relative 0.1%
T.C.R.	abs.±10×10⁻⁶/K	TCR Tracking 5×10⁻⁶/K

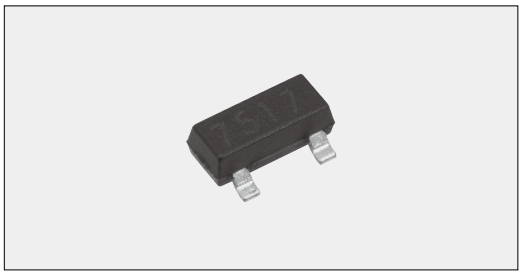
Please inquire of us about your custom devices and circuits.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

KPC RTY Precision Voltage Divider



■Features

- Expanded flexibility of component layout.
- Relative precision of pair resistors are guaranteed.
- Relative resistance tolerance 0.05%～
- TCR tracking 5×10^{-6}/K～

■Application

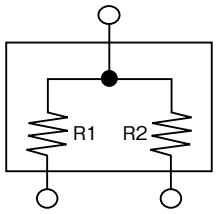
- Voltage dividing circuit
- Reference voltage circuit
- OP amplifier circuit
- Matching resistors

■Ratings

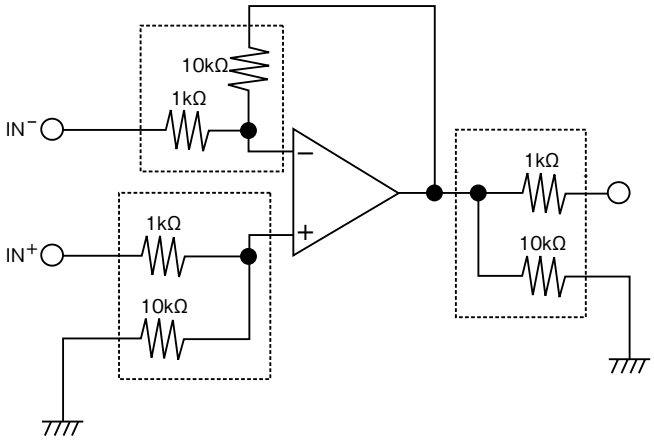
T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) and Absolute Tolerance					Relative resistance tol.	TCR Tracking (×10⁻⁶/K)
	B : ±0.1%	C : ±0.25%	D : ±0.5%	F : ±1%	G : ±2%、J : ±5%		
T: ±10	1k～40k	1k～40k	1k～40k	1k～40k	1k～40k	A : 0.05% B : 0.1% C : 0.25% D : 0.5% F : 1% G : 2%	Y : 5 T : 10 E : 25 C : 50
E: ±25	1k～150k	1k～150k	100～150k	100～150k	100～150k		
C: ±50			51～200k	51～200k	51～200k		
H: ±100				30～200k	30～200k		

Max. total resistance in a package is up to 200kΩ

■Schematic (Top View)



■Example of Application

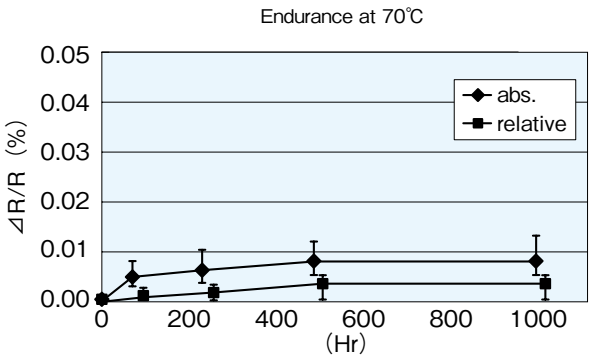


■Package Ratings

Package Symbol	Package	Number of pins	Package power rating (W)
S03	SOT-23	3	0.2

■Typical Characteristics

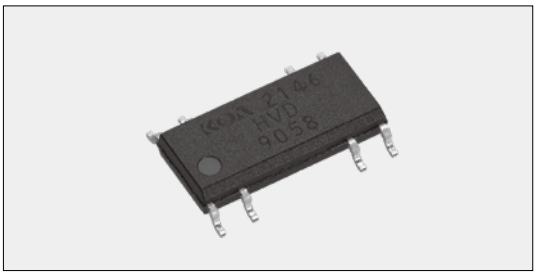
Endurance at 70℃ (Typical:1kΩ, 8 resistors/package)



Merit of thin film resistor networks

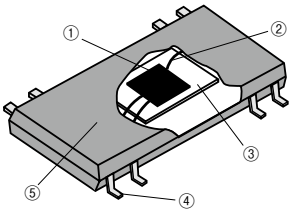
Metal thin film resistors formed by sputtering method have very similar characteristic among pair resistors. When their characteristic of T.C.R., aging, etc. for relative precision is requested, it's very suitable to apply thin film resistor networks to utilize the characteristic as above.

HVD Thin Film Network Resistors For High Voltage Divider



Coating color : Black

■Construction



①	Resistors chip
②	Bonding wire
③	Die pad
④	Lead
⑤	Molded resin

■Features

- High precision high voltage divider.
- Max. resistance value 51MΩ, Max. working voltage 1000V, Max. resistance ratio 1000:1.
- Relative precision of pair resistors are guaranteed.
- Higher integration saves board space and overall assembly costs.
- Excellent reliability with Standard molded IC package.
- Suitable for reflow soldering.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

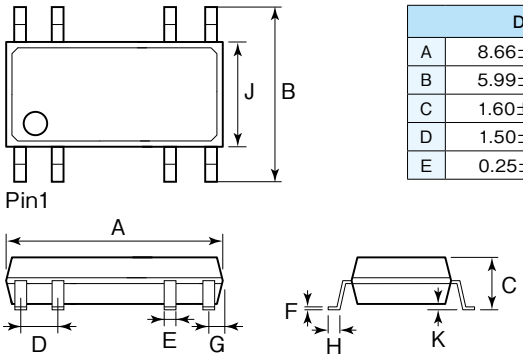
■Applications

- High voltage divider for HEV/EV.
- High magnification of the operational amplifier circuit.

■Reference Standards

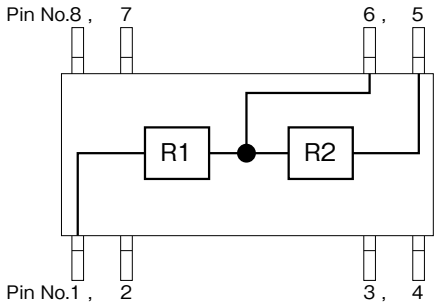
IEC 60115-6-2
JIS C 5201-6-2
IEC 60664-1
JIS C 60664-1

■Dimensions



Dimensions (mm)			
A	8.66±0.2	F	0.20±0.1
B	5.99±0.2	G	0.29±0.1
C	1.60±0.2	H	0.66±0.2
D	1.50±0.1	J	3.81±0.2
E	0.25±0.1	K	0.18±0.1

■Circuit Construction



■Type Designation

Example

HVD	P08	T	TE	XXXX
Circuit Code	Package Symbol	Terminal Surface Material	Taping Number	Product Identification Number
HVD : High Voltage Divider	Package type symbol +Number of pins	T : Sn	TE : Plastic embossed	

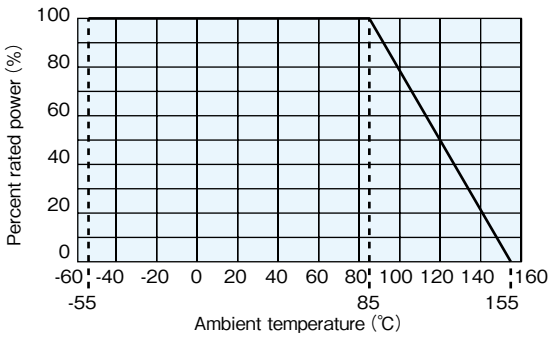
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

	Max. Working Voltage	Power Rating/ Resistor Element	Resistance Range Max.Resistance ratio(1000:1) (R1+R2)/R2	Absolute Resistance Tolerance	Relative Resistance Tolerance	T.C.R. (×10⁻⁶/K)	T.C.R. Tracking (×10⁻⁶/K)	Taping & Q' ty/Reel (pcs) TE	Weight (g) 1000 pcs
R1	1000V	250mW	0.5MΩ～51MΩ	±0.1%、±0.25%、±0.5%、±1%	0.1% 0.25% 0.5%	±25 ±50	10 25	2,500	136
R2	15V	50mW	1.5kΩ～1MΩ	–					

Rated Ambient Temperature : +85℃
Operating Temperature Range : −55℃～+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.
Guaranteed value differs depending on resistance value.

■Derating Curve



For resistors operated at an ambient temperature of 85℃ or higher, the power shall be derated in accordance with the above derating curve.

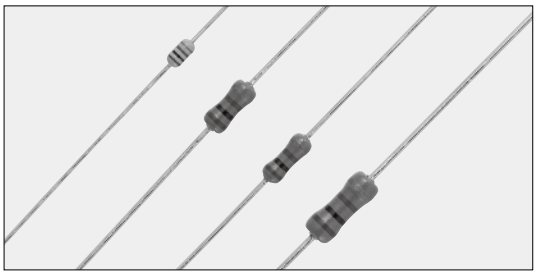
■Performance

Test Items	Performance Requirements (Ratio) ΔR%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃、+25℃/+155℃
Resistance to soldering heat	0.1	0.02	260℃±5℃、10s±1s
Rapid change of temperature	0.1	0.01	−55℃(30min.) /+155℃(30min.) 1000cycles
Moisture resistance	0.1	0.02	85℃±2℃、85%±5%RH、1,000h 1.5h ON/0.5h OFF cycles
Endurance at 85℃	0.1	0.01	85℃±2℃、1,000h 1.5h ON/0.5h OFF cycles
High temperature exposure	0.1	0.03	+155℃、1,000h

■Precautions for Use

- The resistor of this product is formed by narrow patterning a thin metal film. Thus, application of excessive voltage causes burn and destruction of the resistive film, abnormality in resistance or open resistance and loss of proper function. The properly and electrostatically measured taping materials are used for the components, but attention should be paid to the fact that there is some danger the parts may be destructed by static electricity(equivalent to 500V and more at 100pF, 1.5kΩ) to cause a change in resistance in the conditions of an excessive dryness when mounting on the boards. Similarly, care should be given not to apply the excessive static electricity at the time of mounting on the boards.
  When designing, consideration can be taken into withstanding ESD for customized KPC products. Please consult with us about the details.
- Hand soldering by iron soldering or repairment are not recommended because KPC is a multi-pin product.

CF Coat-Insulated Fixed Carbon Film Resistors



Coating colors : CFS1/4-Ivory Others-venetian red
Marking : Color code

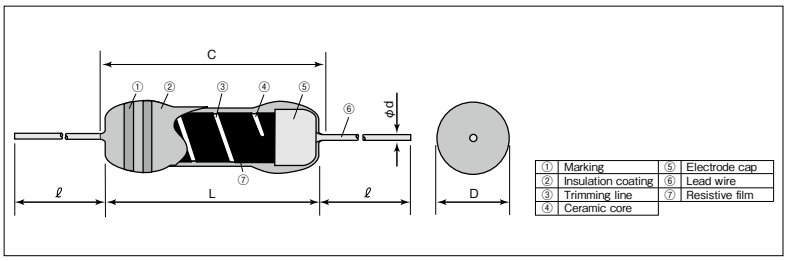
■Features

- General-purpose lead-type resistors.
- Automatic insertion is applicable.
- Various types of formings are available.
- Stronger in pulse resistance than chip resistors of the same power.
- The smaller type of 1/4W(CFS 1/4) is available.
- Products meet EU-RoHS requirements.

■Reference Standards

IEC 60115-2
JIS C 5201-2
EIAJ RC-2136

■Construction



■Dimensions

Type	Dimensions (mm)						Weight(g) (1000pcs)
	L	C Max.	D	d(Nominal)	ℓ ※3 Standard	ℓ ※3 Long	
CFS1/4	3.2±0.2	3.4	$1.7^{+0.2}_{-0.1}$	0.45	14min.※1	20min.※2	80
CF1/4	6.1±0.5	7.1	2.3±0.3	0.6			160
CFS1/2	6.3±0.5	7.1	2.85±0.3	0.6	20min.	—	290
CFB1/2	9.0±1.0	11.0	3.5±0.5	0.7		—	520

※1 Forming code S is applied for bulk type. ※3 Lead length changes depending on taping and forming type.
※2 Long type is custom-made

■Type Designation

Example

CF	1/4	C	T52	A	103	J
Product Code	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	S1/4:0.25W 1/4:0.25W S1/2:0.5W B1/2:0.5W	C:SnCu	See table below	A:AMMO R:REEL Nil:BOX	3 digits	G:±2% J:±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Type	Straight		Axial Taping		Radial Taping					U Forming		M Forming			
	S	Nil	T26	T52	VT	MT	MHT	VTP	VTE	U	UCL	M5	M10	M12.5	M12.5
CFS 1/4C	○※1	○※2	○	○	○	○	○	—	—	○	—	M5F	—	—	—
CF 1/4C	○※1	○※2	○	○	○	—	—	○	○	—	○	—	M10H	M12.5H	—
CFS 1/2C	—	○	○	○	○	—	—	○	○	○	—	—	M10H	—	—
CFB 1/2C	—	○	—	○	—	—	—	—	—	—	—	—	—	—	M12.5K

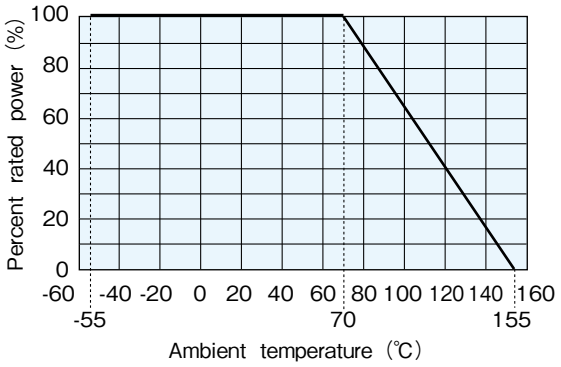
■Ratings

Type	Power Rating	Resistance Range (Ω) E24		T.C.R. (×10⁻⁶/K)				Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)	
		G:±2%	J:±5%	+350~−450	0~−700	0~−1000	0~−1300				T26A	T52A
CFS 1/4C	0.25W	10~330k	2.2~1M	2.2Ω~47kΩ	51kΩ~100kΩ	110kΩ~330kΩ	360kΩ~1MΩ	250V	500V	300V	5,000	3,000
CF 1/4C	0.25W	10~1M	2.2~5.1M	2.2Ω~100kΩ	110kΩ~330kΩ	360kΩ~1MΩ	1.1MΩ~5.1MΩ	300V	600V	500V	2,000	2,000
CFS 1/2C	0.5W		1.0~5.1M	1.0Ω~91kΩ	100kΩ~1MΩ	1.1MΩ~2.2MΩ	2.4MΩ~5.1MΩ	350V	700V	700V		
CFB 1/2C	0.5W		2.2~5.1M	2.2Ω~100kΩ	110kΩ~1MΩ	1.1MΩ~2.2MΩ	2.4MΩ~5.1MΩ	400V	800V		—	

Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃~+155℃

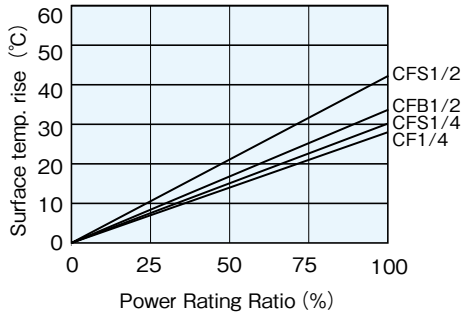
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve

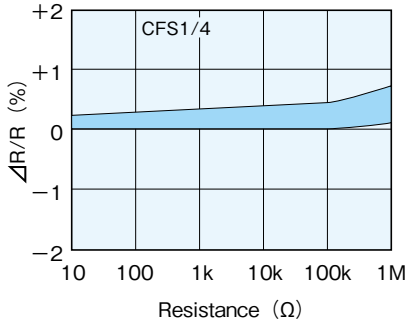


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Surface Temperature Rise



■Load Life At 70℃ 1000Hr



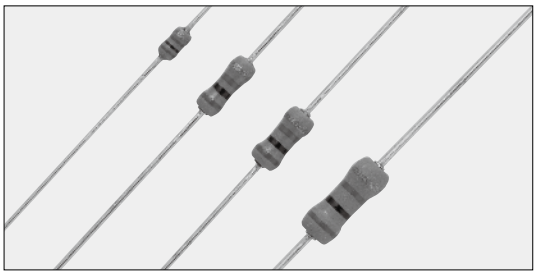
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	Measuring points are at 10mm±1mm from the end cap.
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1	0.5	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s.
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s, 350℃±10℃, 3.5s±0.5s
Terminal strength	No lead-coming off and loose terminals	—	Twist 360°, 5 times
Rapid change of temperature	1	0.5	−55℃ (30min.) /+125℃ (30min.) 5 cycles
Moisture resistance	5	2.5	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	3	1.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

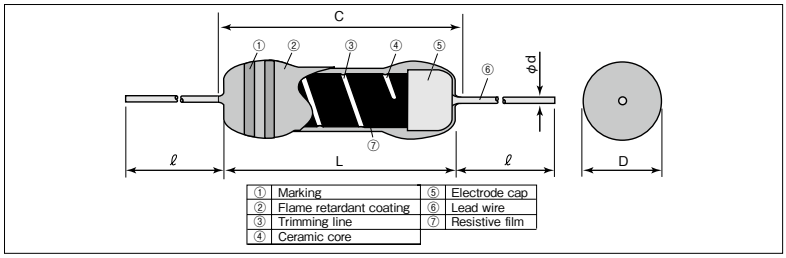
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.

CFP Coat-Insulated Fixed Carbon Film Resistors (Flame retardant coating)



Coating color : Green
Marking : Color code

■Construction



■Features

- Equivalent to flame retardant coat. (UL94 V-0)
- Automatic insertion is applicable.
- Stronger in pulse resistance than chip resistors of the same power.
- The smaller type of 1/4W (CFPS 1/4) is available.
- Products meet EU-RoHS requirements.

■Reference Standards

IEC 60115-2
JIS C 5201-2

■Dimensions

Type	Dimensions (mm)						Weight(g) (1000pcs)
	L	C Max.	D	d(Nominal)	ℓ ※3 Standard	ℓ ※3 Long	
CFPS1/4	3.2±0.2	3.4	$1.7^{+0.2}_{-0.1}$	0.45	14min.※1	20min.※2	80
CFP1/4	6.1±0.5	7.1	2.3±0.3	0.6			160
CFPS1/2	6.3±0.5	7.1	2.85±0.3	0.6	20min.	—	290
CFPB1/2	9.0±1.0	11.0	3.5±0.5	0.7		—	520

※1 Forming code S is applied for bulk type.
※2 Long type is custom-made
※3 Lead length changes depending on taping and forming type.

■Type Designation

Example

CFP	1/4	C	T52	A	103	J
Product Code	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	S1/4:0.25W 1/4:0.25W S1/2:0.5W B1/2:0.5W	C:SnCu	See table below	A : AMMO R : REEL Nil : BOX	3 digits	G:±2% J:±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

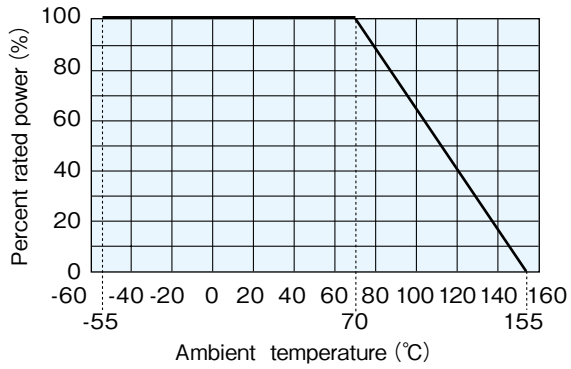
Type	Straight		Axial Taping			Radial Taping					M Forming	L Forming
	S	Nil	T26	T52	L52	VT	MT	MHT	VTP	GT		
CFPS 1/4C	○※1	○※2	○	○	—	—	○	○	—	—	M5F	—
CFP 1/4C	○※1	○※2	○	○	○	○	—	—	○	○	M10H	L10A
CFPS 1/2C	—	○	○	○	—	○	—	—	○	○	—	—
CFPB 1/2C	—	○	—	○	○	—	—	—	—	—	M12.5K	L12.5A

■Ratings

Type	Power Rating	Resistance Range (Ω) (E24)		T.C.R. (×10⁻⁶/K)				Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)		
		G:±2%	J:±5%	+350~−450	0~−700	0~−1000	0~−1300				T26A	T52A	L52A
CFPS 1/4C	0.25W	10~100K	2.2~1M	2.2Ω~47kΩ	51kΩ~100kΩ	110kΩ~330kΩ	360kΩ~1MΩ	250V	500V	300V	5,000	3,000	—
CFP 1/4C	0.25W	10~1M		2.2Ω~100kΩ	110kΩ~330kΩ	360kΩ~1MΩ	—	300V	600V	500V	2,000	2,000	2,000
CFPS 1/2C	0.5W			2.2Ω~91kΩ	100kΩ~1MΩ	—	—	350V	700V	700V			—
CFPB 1/2C	0.5W			2.2Ω~100kΩ	110kΩ~1MΩ	—	—	400V	800V		—		2,000

Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃~+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

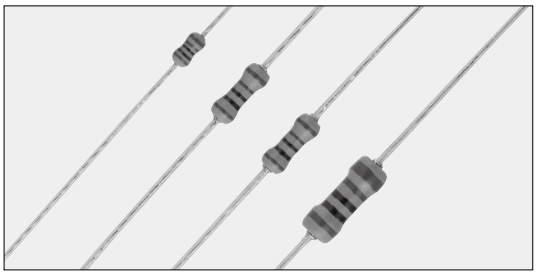
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	Measuring points are at 10mm±1mm from the end cap.
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload(Short time)	1	0.5	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s、350℃±10℃, 3.5s±0.5s
Terminal strength	No lead-coming off and loose terminals	—	Twist 360°, 5 times
Rapid change of temperature	1	0.5	−55℃(30min.)/+125℃(30min.) 5 cycles
Moisture resistance	5	2.5	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	3	1.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	Ultrasonic washing with Isopropyl alcohol for 2 min. Power : 0.3W/cm^2, f : 28kHz, Temp. : 35℃±5℃
Flame retardant	No evidence of flaming or self-flaming.	—	Flame test : The test flame shall be applied and removed for each 15 sec respectively to repeat the cycle 5 times. Overload flame retardant : AC Voltage corresponding to 2, 4, 8, 16 and 32 times the power rating shall be applied for each 1min. until disconnection occurs. However the applied voltage shall not exceed 4 times the maximum operating voltage.

■Precautions for Use

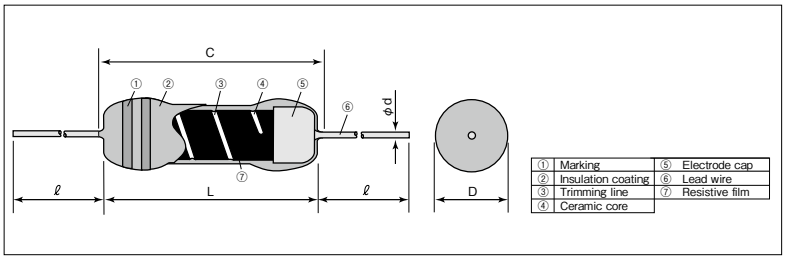
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, estc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.

MF Coat-Insulated Fixed Metal Film Resistors



Coating color : Light gray
Marking : Color code

■Construction



■Features

- High precision and low T.C.R. metal film resistors.
- Automatic insertion is applicable.
- Various formings are available.
- Excellent stability for a long time.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested (Exemption MF1/2).

■Reference Standards

IEC 60115-1
JIS C 5201-1
EIAJ RC-2137

■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L	C Max.	D	d (Nominal)	ℓ ±3※1	
MFS1/4	3.2±0.2	3.4	$1.7^{+0.2}_{-0.1}$	0.45	28	120
MF1/4	6.3±0.5	7.1	2.3±0.3	0.6		215
MFS1/2						215
MF1/2	9.0±1.0	11.1	3.5±0.4			360

※1 Lead length changes depending on taping and forming type.

■Type Designation

Example

MF	1/4	D	C	T52	A	1002	F
Product Code	Power Rating	T.C.R. (×10⁻⁶/K)	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	S1/4 : 0.25W 1/4 : 0.25W S1/2 : 0.5W 1/2 : 0.5W	C : ±50 D : ±100 L : ±200	C : SnCu	See table below	A : AMMO R : REEL Nil: BOX	D, F : 4 digits G : 3 digits	D : ±0.5% F : ±1% G : ±2%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Type	Axial Taping		Radial Taping				U Forming	M Forming				
	T26	T52	VT	VTP	VTE	MT	U	M5		M10	M12.5	M15
MFS1/4□C	○	○	○	–	–	○	○	M5F	M5R	–	–	–
MF1/4□C	○	○	○	○	○	–	○	–	–	M10F	M12.5R	–
MFS1/2□C	○	○	○	○	○	–	–	–	–	M10R	–	–
MF1/2□C	–	○	–	–	–	–	–	–	–	–	M12.5R	M15R

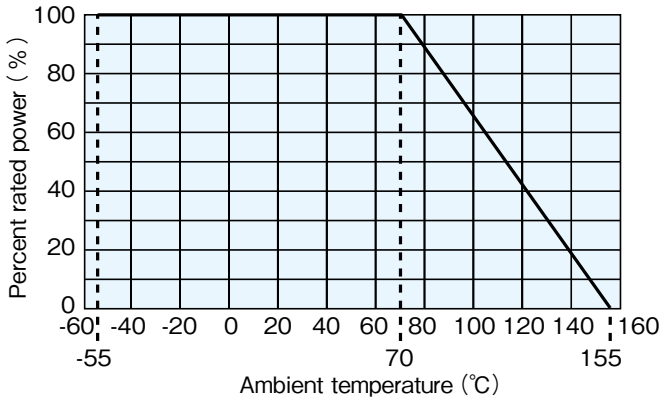
□ : T.C.R.

■Ratings

Type	Power Rating	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)			Max. Working Voltage	Max. Overload Voltage	Dielectri Withstanding Voltage	Taping & Q'ty/AMMO (pcs)	
			D : ±0.5% E24・E192	F : ±1% E24・E96	G : ±2% E24				T26A	T52A
MFS1/4CC	0.25W	C : ±50	49.9～562k	10～1M	–	250V	500V	300V	3,000	3,000
MFS1/4DC		D : ±100							3,000	3,000
MF1/4CC	0.25W	C : ±50	10～2.21M	10～2.21M	–			500V	2,000	2,000
MF1/4DC		D : ±100							2,000	2,000
MF1/4LC		L : ±200	–	1.0～10	0.51～10				2,000	2,000
MFS1/2CC	0.5W	C : ±50	10～1M	10～2.2M	10～2.2M	350V	700V		2,000	2,000
MFS1/2DC		D : ±100							2,000	2,000
MF1/2CC	0.5W	C : ±50	10～5.05M	10～4.99M	–			700V	–	2,000
MF1/2DC		D : ±100		10～5.11M						2,000
MF1/2LC		L : ±200	–	1.0～10	0.51～10					2,000

Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃～+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

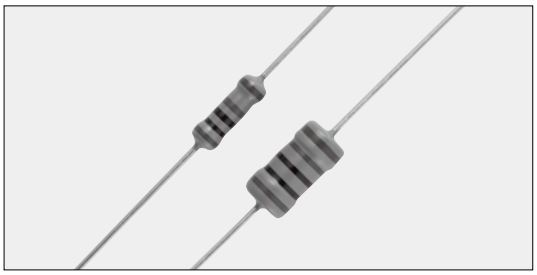
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	0.5	0.3	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s : MFS1/4, MF1/4, MF1/2 Rated voltage×2 or Max. overload vol., whichever is lower, for 5s : MFS1/2
Resistance to soldering heat	0.75 : MFS1/4 0.5 : MF1/4, MFS1/2, MF1/2	0.4 : MFS1/4 0.25 : MF1/4, MFS1/2, MF1/2	260℃±5℃, 10s±1s
Rapid change of temperature	1.0	0.3	−55℃ (30min.) /+155℃ (30min.) 5 cycles
Moisture resistance	1.5 : MFS1/4 1 : MF1/4, MFS1/2, MF1/2	1 : MFS1/4 0.75 : MF1/4, MFS1/2, MF1/2	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	1.5 : MFS1/4 1 : MF1/4, MFS1/2, MF1/2	1 : MFS1/4 0.75 : MF1/4, MFS1/2, MF1/2	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.

SN 3A/3D Coat-Insulated Fixed Metal Film Resistors



Coating color : Light gray
Marking : Color code

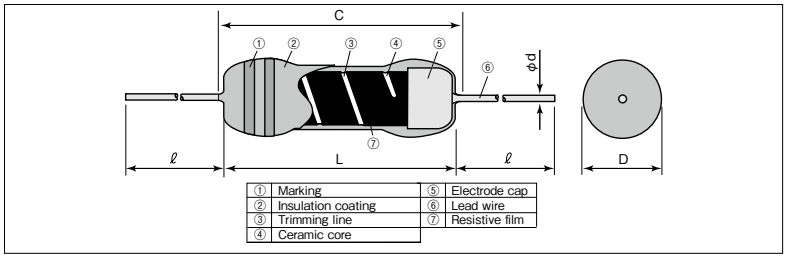
■Features

- High precision and low T.C.R. metal film resistor.
- Excellent stability for a long time.
- Products meet EU-RoHS requirements.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L±2	C Max.	D±1.0	d (nominal)	ℓ ±3	
SN3A	14.1	18.3	4.8	1.0	38	1,240
SN3D	16.5	21.5	8.4			3,340

■Type Designation

Example

SN	3A	D	C	1002	F
Product Code	Power Rating	T.C.R. (×10⁻⁶/K)	Termination Surface Material	Nominal Resistance	Resistance Tolerance
	3A : 1W 3D : 2W	C : ±50 D : ±100 L : ±200	C : SnCu	D,F : 4digits G : 3digits	D : ±0.5% F : ±1% G : ±2%

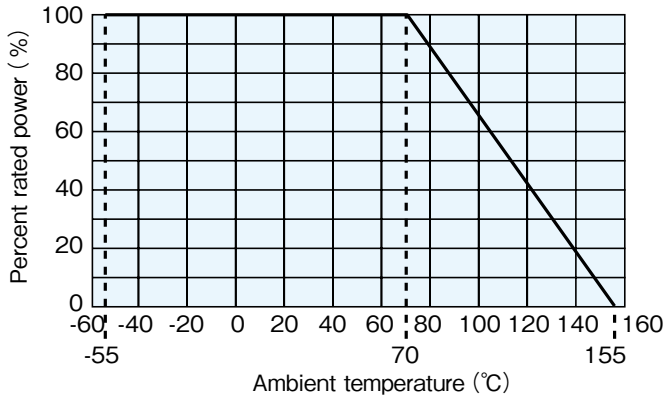
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Type	Power Rating	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω)			Max. Working Voltage	Max. Overload Voltage	Dielectri Withstanding Voltage
			D : ±0.5% E24・E192	F : ±1% E24・E96	G : ±2% E24			
SN3ACC	1W	C : ±50	–	10~1M	–	500V	1000V	1000V
SN3ADC		D : ±100	10~1M	10~1M	10~1M			
SN3ALC		L : ±200	–	4.99~10	1~10			
SN3DDC	2W	D : ±100	10~1.5M	10~1.5M	10~1.5M			
SN3DLC		L : ±200	–	–	5.1~10			

Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

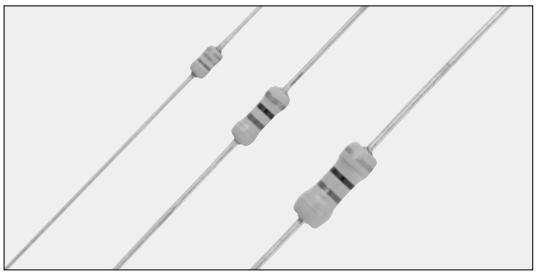
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω) Limit	Test Methods
Resistance	Within specified tolerance	25℃
T.C.R.	Within specified T.C.R.	+25℃/+125℃
Overload (Short time)	0.5	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	0.25	260℃±5℃, 10s±1s
Rapid change of temperature	0.5	−55℃ (30min.) /+155℃ (30min.) 5 cycles
Moisture resistance	1	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	1	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.

SNF Coat-Insulated Metal Film Fixed Resistors



Coating color : Light blue
Marking : Color code : 4 color-bands

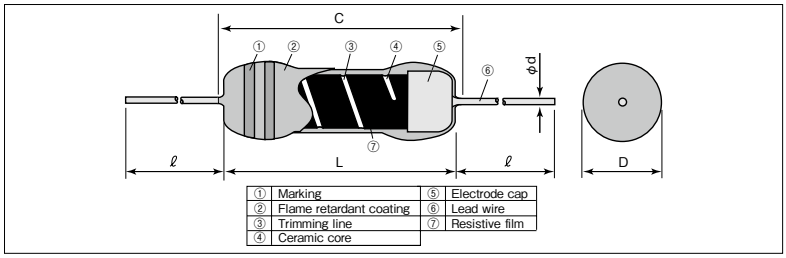
■Features

- Flame retardant coating.
  (Equivalent to UL94 V-0)
- Automatic insertion is applicable.
- Various types of formings are available.
- Products meet EU-RoHS requirements.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



■Dimensions

Type	Dimensions (mm)						Weight (g) (1000pcs)
	L	C Max.	D	d (Nominal)	ℓ※3 Standard	ℓ※3 Long	
SNF2C	3.2±0.2	3.4	$1.7^{+0.2}_{-0.1}$	0.45	14min.※1	20min.※2	80
SNF2E	6.1±0.5	7.1	2.3±0.3	0.6			160
SNF2H	9.0±1.0	11.0	3.5±0.5	0.7	20min.	—	520

※1 Forming code S is applied for bulk type.
※2 Long type is custom-made
※3 Lead length changes depending on taping and forming type.

■Type Designation

Example

SNF	2E	C	T52	A	100	J
Product Code	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	2C: 0.25W 2E: 0.25W 2H: 0.5W	C : SnCu	See table below	A : AMMO R : REEL Nil : BOX	3 digits	J : ±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

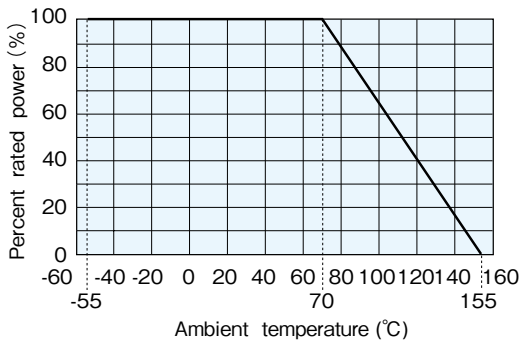
Type	Straight		Axial Taping		M Forming			
	S	Nil	T26	T52	M5	M10	M12.5	M15
SNF2CC	○	○※2	○	○	M5F	—	—	—
SNF2EC	○	○※2	○	○	—	M10F	M12.5R	—
SNF2HC	—	○	—	○	—	—	M12.5K	M15K

■Ratings

Type	Power Rating	Resistance Range (Ω) J:±5% E24	T.C.R. (×10⁻⁶/K)	Max. Working Voltage (V)	Max. Overload Voltage (V)	Dielectric Withstanding Voltage	Operating Temp. Range	Taping & Q'ty /AMMO (pcs)	
								T26A	T52A
SNF2CC	0.25W	0.47~9.1	+350~−450	$E=\sqrt{P\times R}$	E×2.5	300V	−55℃~+155℃	3,000	3,000
SNF2EC		0.47~100				500V		2,000	2,000
SNF2HC	0.50W					700V		—	2,000

Rated Ambient Temperature : +70℃
Rated voltage $=\sqrt{\text{Power Rating}\times\text{Resistance value}}$

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

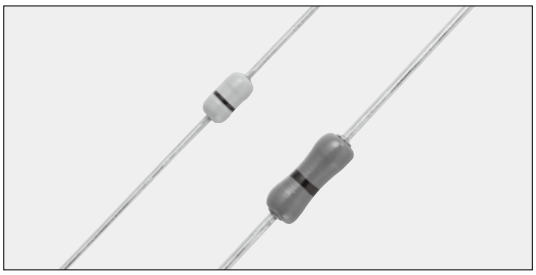
■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1	0.5	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s、350℃±10℃, 3.5s±0.5s
Terminal strength	No lead-coming off and loose terminals	—	Twist 360° , 5 times
Rapid change of temperature	1	0.5	−55℃ (30min.) /+125℃ (30min.) 5 cycles
Moisture resistance	5	2.5	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	3	1.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	Ultrasonic washing with Isopropyl alcohol for 2 min. Power : 0.3W/cm², f : 28kHz, Temp. : 35℃±5℃
Flame retardant	No evidence of flaming or self-flaming.	—	Flame test : The test flame shall be applied and removed for each 15 sec respectively to repeat the cycle 5 times. Overload flame retardant : AC Voltage corresponding to 2, 4, 8, 16 and 32 times the power rating shall be applied for each 1min. until disconnection occurs. However the applied voltage shall not exceed 4 times the maximum operating voltage.

■Precautions for Use

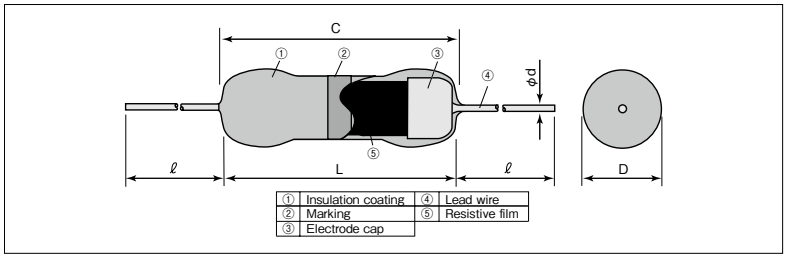
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.

Z Coat-Insulated Zero OHM Resistors



Coating color : Ivory (Z16) :Venetian Red (Z25)
Marking : Color code with one black band

■Construction



■Features

- Zero OHM resistors of the same shape of CFS1/4 series and CF1/4 series.
- Automatic insertion is applicable.
- Products meet EU-RoHS requirements.

■Dimensions

Type	Dimensions (mm)						Weight(g) (1000pcs)
	L	C Max.	D	d(Nominal)	ℓ※3 Standard	ℓ※3 Long	
Z16	3.2±0.2	3.4	$1.7^{+0.2}_{-0.1}$	0.45	14min.※1	20min.※2	80
Z25	6.1±0.5	7.1	2.3±0.3	0.6			160

※1 Forming code S is applied for bulk type.
※2 Long type is custom-made
※3 Lead length changes depending on taping and forming type.

■Type Designation

Example

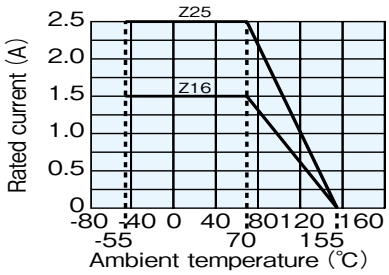
Z16	C	T52	A
Product Code	Terminal Surface Material	Taping & Forming	Packaging
Z16 Z25	C : SnCu	S : Standard Nil : Long T26 : 26mm taping T52 : 52mm taping	A : AMMO R : REEL Nil : BOX

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Maximum Amperage	Rated Ambient Temperature	Operating Temperature Range	Dielectric Withstanding Voltage	Resistance	Taping & Q'ty/AMMO (pcs)	
						T26A	T52A
Z16C	1.5A	+70℃	−55℃～+155℃	300V	20mΩ or less	5,000	3,000
Z25C	2.5A	+70℃	−55℃～+155℃	500V		2,000	2,000

■Derating Curve



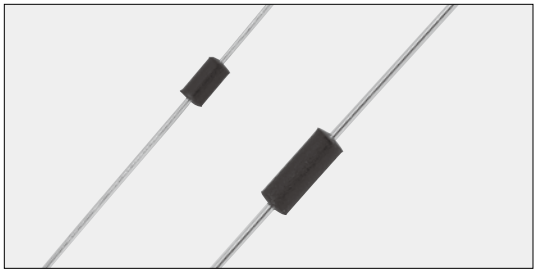
For resistors operated in an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the derating curve in the lelf figure.

■Performance

Test Items	Performance Requirements	Test Methods JIS C 5201-1
Resistance	20mΩ or less	Measuring points are at 10mm±1mm from the end cap.
Resistance to soldering heat	20mΩ or less	260℃±5℃, 10s±1s、350℃±10℃, 3.5s±0.5s
Terminal Strength	No lead-coming off and loose terminals	Pulling test : Z16 : 5N, 30s, Z25 : 10N, 30s Twist test : 360°, 5 times Bending test : 5N, 90°, 2 times (Z16 : 2.5N)
Rapid change of temperature	20mΩ or less	−55℃ (30min.) /+125℃ (30min.) 5 cycles
Moisture resistance	20mΩ or less	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	20mΩ or less	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	Ultrasonic washing with Isopropyl alcohol for 2 min. Power:0.3W/cm², f:28kHz, Temp.:35℃±5℃

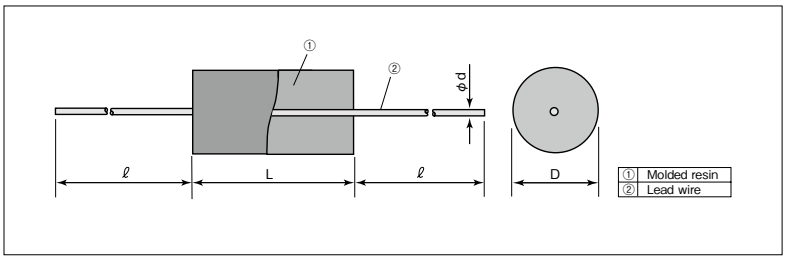
J-Z Insulated Jumper Wires

EU RoHS



Body color : Black
No marking

■Construction



■Features

- Automatic insertion is applicable.
- Higher than Z series in allowable current.
- Products meet EU-RoHS requirements.

■Dimensions

Type	Dimensions (mm)				Weight (g/1000pcs)
	L	D	d (nominal)	ℓ ±3※1	
J1/6Z	$3.4^{+0.1}_{-0.2}$	1.7±0.2	0.5	30	110
J1/4Z	6.5±0.5	$2.3^{+0}_{-0.3}$	0.6		190

※1 Lead length changes depending on taping and forming type.

■Ratings

Type	Max. Allowable Current	Rated Ambient Temp.	Operating Temp. Range
J1/6ZC	8A	+70℃	−55℃～+125℃
J1/4ZC	10A		

■Type Designation

Example

J	1/6Z	C	T26	A
Product Code	Style	Terminal Surface Material	Taping	Package
	1/6Z 1/4Z	C : SnCu	T26 : 26mm taping T52 : 52mm taping Nil : Bulk	A : AMMO R : REEL Nil : BOX

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

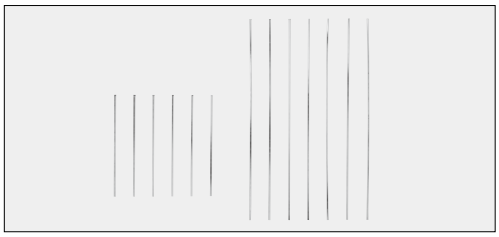
■Taping

Taping Type Name	Taping & Q'ty (pcs)	
	AMMO	Reel
J1/6ZCT26A	2,000	–
J1/6ZCT52□	2,000	5,000
J1/4ZCT26A	2,000	–
J1/4ZCT52□	2,000	5,000

The code for package enters □.

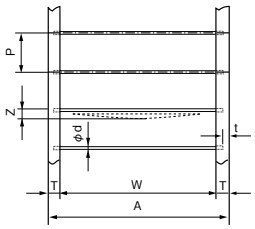
JL Jumper Wires

EU RoHS



Coating : None

■Dimensions (mm)



Type	Dimension (mm)			
	W	P		A
T26	$26^{+1.0}_{-0}$	5.00±0.3		39±1.0
T52	52±1	5.08±0.38		64.5±1.0
	d (Nominal)	T	t	Z
T26	0.5, 0.6	6.2±0.5	2.5 Max.	0.8 Max.
T52				

■Features

- Automatic insertion is applicable.
- Products meet EU-RoHS requirements.

■Ratings

Type	Nominal Diameter	Max. Allowable Current	Rated Ambient Temp.	Operating Temp. Range
JL5C	0.5mm	8A	+70℃	−55℃～+125℃
JL6C	0.6mm	10A		

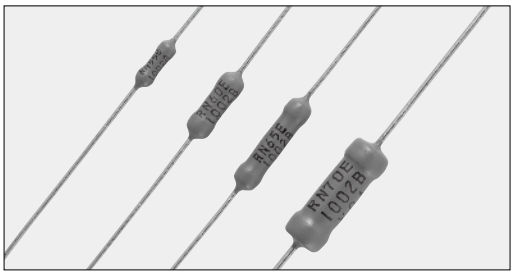
■Type Designation

Example

JL	6	C	T26	A
Product Code	Nominal Diameter	Terminal Surface Material	Taping	Package
	5 : 0.5 (mm) 6 : 0.6 (mm)	C : SnCu	T26 : 26mm taping T52 : 52mm taping	A : AMMO

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

RNS Coat-Insulated Precision Fixed Metal Film Resistors



Coating color : Light gray
Marking : Alphanumeric

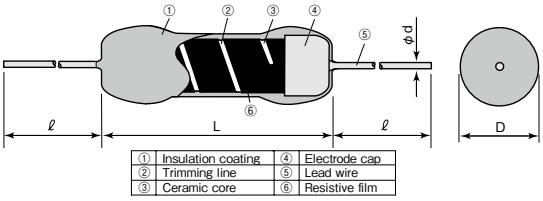
■Features

- High precision resistors with resistance tolerance ±0.1% and T.C.R. ±5×10^{-6}/K.
- Excellent long term stability in resistance value.
- Automatic insertion is applicable.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested (RNS1).

■Standard Approved

MIL-R-10509G standard (USA)

■Construction



①	Insulation coating	④	Electrode cap
②	Trimming line	⑤	Lead wire
③	Ceramic core	⑥	Resistive film

■Dimensions

Type	Dimensions (mm)				Weight (g/1000pcs)
	L±1	D±0.5	d (Nominal)	ℓ±3※	
RNS1/8	6.4	2.3	0.6	38	260
RNS1/4	9.5	3.5			440
RNS1/2	13.5				530
RNS1	15.5	5.5	0.8		1400

※ Lead length changes depending on taping and forming type.

■Type Designation

Example

RNS	1/8	E	C	T52	A	1003	B
Product Code	Power Rating	T.C.R. (×10^{-6}/K)	Termination Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	1/8 : 0.125W 1/4 : 0.25W 1/2 : 0.5W 1 : 1W	Y : ±5 T : ±10 E : ±25 C : ±50	C : SnCu	See table below	A : AMMO R : REEL Nil : BOX	4 digits	B : ±0.1% C : ±0.25% D : ±0.5% F : ±1%

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For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

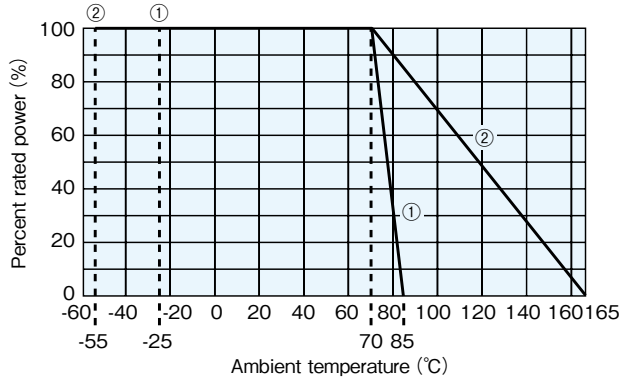
Type	Axial Taping			Radial Taping		
	T26	T52	T521	VT	VTP	VTE
RNS1/8	○	○	—	○	○	○
RNS1/4	—	○	—	—	—	—
RNS1/2	—	○	—	—	—	—
RNS1	—	—	○	—	—	—

■Ratings

Type	Power Rating	T.C.R. (×10^{-6}/K)	Resistance Range (Ω) B : ±0.1% E24・E192	C : ±0.25% E24・E192	D : ±0.5% E24・E192	F : ±1% E24・E96	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Rated Ambient Temperature	Operating Temperature Range
RNS1/8 (RN55)	0.125W	Y : ±5	100～100k	100～100k	100～100k	100～100k	200V	400V	500V	+70℃	−25℃～+85℃
		T : ±10	100～200k	100～200k	100～200k	100～200k					
		E : ±25	5.1～750k	5.1～1.62M	0.2～2M	0.2～2M					−55℃～+165℃
		C : ±50									
RNS1/4 (RN60)	0.25W	E : ±25	5.1～1M	5.1～2M	0.2～2M	0.2～2M	250V	500V	700V		
		C : ±50	5.1～1.5M		0.2～5.1M	0.2～5.1M					
RNS1/2 (RN65)	0.5W	E : ±25	5.1～1.5M	5.1～2M	0.2～2.4M	0.2～4.7M	300V	600V	700V		
		C : ±50	5.1～2M	5.1～2.4M	0.2～5.1M	0.2～5.1M					
RNS 1 (RN70)	1W	E : ±25	5.1～2M	5.1～2.4M	0.2～5.1M	0.2～5.1M	350V	700V	1000V		
		C : ±50	5.1～2.4M			0.2～6.8M					

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



①T.C.R. : Y (±5×10⁻⁶/K), T (±10×10⁻⁶/K)
②T.C.R. : E (±25×10⁻⁶/K), C (±50×10⁻⁶/K)
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

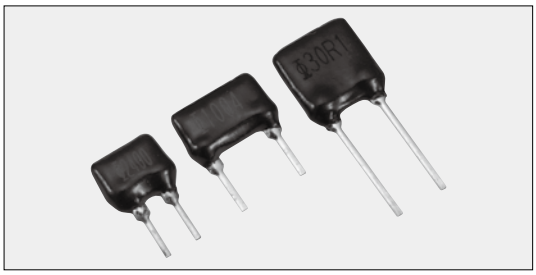
■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	Y, T : +25℃/+65℃ E, C : +25℃/+125℃
Overload (Short time)	0.25	0.15	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s.
Resistance to soldering heat	0.2	0.075	350℃±10℃, 3.5s±0.5s
Rapid change of temperature	0.2	0.075	−55℃ (30min.) /+85℃ (30min.) 5 cycles
Moisture resistance	0.75	0.5	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	0.5	0.35	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

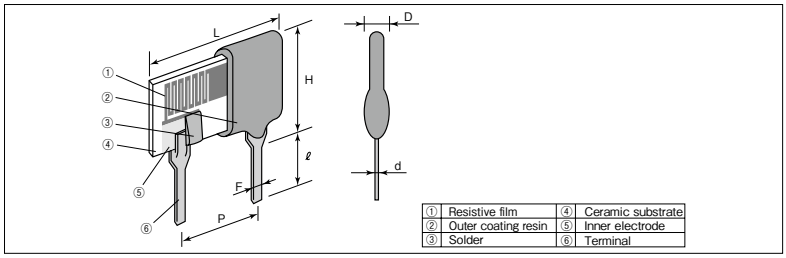
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.

MRS Plate - Shaped High Precision Metal Film Resistors



Coating color : Black
Marking : Alphanumeric

■Construction



①	Resistive film	④	Ceramic substrate
②	Outer coating resin	⑤	Inner electrode
③	Solder	⑥	Terminal

■Features

- Easily usable lead frame shape with wide resistance range.
- Super-high precision resistors with resistance tolerance ±0.01% and T.C.R. ±2.5×10^{-6}/K.
- High density mounting available due to its plate shape and thinness (t=2.5mm Max.).
- Excellent in long-term stability.
- Products meet EU-RoHS requirements.

■Applications

- Therâmo Controllers
- Medical Equipment
- Oscilloscopes
- Measuring Equipment
- Recorders

■Dimensions

Type	Dimensions (mm)							Weight (g) (1000pcs)
	L max.	H max.	D max.	P±0.2	F(Nom.)	d(Nom.)	ℓ	
MRS1/8	5.6	6.2	2.5	2.54	0.5	0.25	3±0.5	103
MRS1/4	7.5			5.08				137
MRS1/3		9.0		3.81			8±2	212

■Type Designation

Example

MRS	1/3	S	D	1002	T
Product Code	Power Rating	T.C.R. (×10^{-6}/K)	Terminal Suface Material	Nominal Resistance	Resistance Tolerance
	1/8 : 0.125W 1/4 : 0.25W 1/3 : 0.3W	S : ±2.5 Y : ±5 T : ±10 E : ±25	D : SnAgCu	4 digits	T : ±0.01% Q : ±0.02% A : ±0.05% B : ±0.1% C : ±0.25% D : ±0.5%

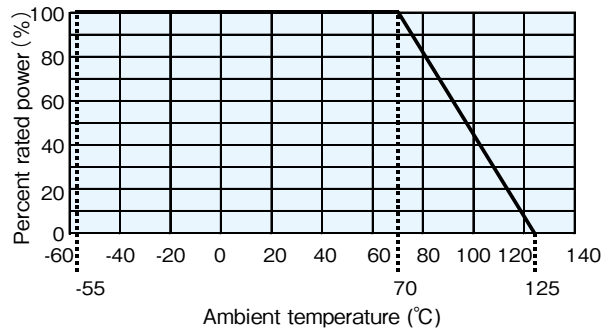
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Type	Power Rating	T.C.R. (×10^{-6}/K)	Resistance Range※1 (Ω)						Max. Working Voltage	Max. Overload Voltage
			T : ±0.01% E96	Q : ±0.02% E96	A : ±0.05% E24·E96※2 & 25, 50×10^{n}	B : ±0.1% E24·E96※2 & 25, 50×10^{n}	C : ±0.25% E24·E96 & 25, 50×10^{n}	D : ±0.5% E24·E96 & 25, 50×10^{n}		
MRS1/8YD	0.125W	Y : ±5	–	–	100~250k	100~250k	100~250k	100~250k	200V	400V
MRS1/8TD		T : ±10	–	–	100~250k	100~510k	30~510k	30~510k		
MRS1/8ED		E : ±25	–	–	100~250k	100~510k	10~510k	10~510k		
MRS1/4YD	0.25W	Y : ±5	–	–	100~510k	100~510k	100~510k	100~510k	250V	500V
MRS1/4TD		T : ±10	–	–	100~510k	100~1M	30~1M	30~1M		
MRS1/4ED		E : ±25	–	–	100~510k	100~1M	10~1M	10~1M		
MRS1/3SD	0.3W	S : ±2.5	100~100k	30.1~100k	30.1~100k	30.1~100k	–	–	200V	
MRS1/3YD		Y : ±5	100~100k	30.1~100k	10~100k	10~100k	–	–		
MRS1/3TD		T : ±10	100~100k	30.1~100k	10~100k	10~100k	–	–		

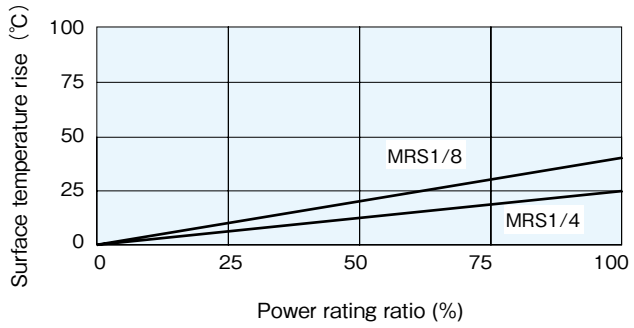
※1 Please consult with us for resistance other than E24 and E96.
※2 MRS1/3 is available only in E96 series.
Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃ ~ +125℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Surface Temperature Rise



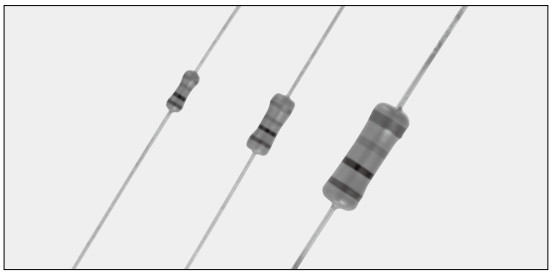
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)	Test Methods
Resistance	Within specified tolerance	25℃
T.C.R.	Within specified T.C.R.	+25℃/+65℃
Overload (Short time)	0.05	Rated Voltage×2.5 or Max. overload Vol. whichever is lower, for 5s
Resistance to soldering heat	0.1 : MRS1/8, 1/4 0.05 : MRS1/3	350℃±10℃ 3.5s±0.5s
Rapid Change of temperature	0.1 : MRS1/8, 1/4 0.05 : MRS1/3	MRS1/8,1/4 : -55^{+0}_{-5}℃(30min.)/+125^{+3}_{-0}℃(30min.) 5 cycles MRS1/3 : -55^{+0}_{-5}℃(30min.)/+125^{+3}_{-0}℃(30min.) 50 cycles
Dielectric withstanding voltage	0.5 : MRS1/8, 1/4 0.05 : MRS1/3	500V(a.c.) for 1min. between terminals and coatings
Endurance at 70℃	0.1 : MRS1/8, 1/4 0.05 : MRS1/3	70℃±2℃, 1 000h 1.5h ON/0.5h OFF cycle
Moisture resistance	0.1 : MRS1/8, 1/4 0.05 : MRS1/3	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Insulation resistance	10,000MΩ and more	500V(d.c.), 1min.
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	Soaking in 2-propanol of 20℃~25℃ for 180s±10s

■Precautions for Use

- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- Pay attention to use when the components are polluted by ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. included in perspiration and saliva, because it leads to electric erosion.

RK RK1/2G | Coat Insulated Glazed Metal Film Fixed Resistors Discharge Path Resistors



Coating color : Light gray
Marking : Color code

■Features

- Respondable to resistance tolerance ±1% and T.C.R. ±100×10^{-6}/K.
- Resistors up to high resistance range in small sizes are available.
- Highly stable against environmental conditions and overload.
- Products meet EU-RoHS requirement. EU-RoHS regulation is not intended for Pb-glass contained in resistor element.

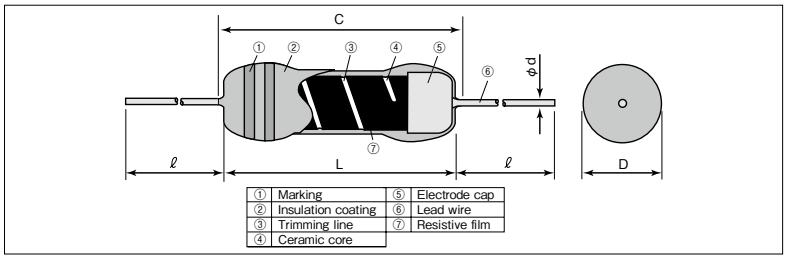
■Approval Awarded

- UL1676 c-UL (CSA-C22.2 No.1-M94) (File No.E159326) Recognized.
  Products Discharge Path Resistors RK 1/2GC

■Reference Standards

- EIAJ RC-2128

■Construction



■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L	C Max.	D	d (Nominal)	ℓ※2	
RK 1/4	6.3±0.5	7.1	2.3±0.3	0.6	24 Min.	250
RK 1/2	9.5±1.0	11.1	3.5±0.4			380
RK 1	15.5±1.0	18.3	5.5±0.5	0.8	38±3	1340
RK 1/2G※1	9.5±1.0	11.1	3.5±0.4	0.6	24 Min.	380

※1 Discharge path resistor
※2 Lead length changes depending on taping and forming type.

■Type Designation

Example

RK	1/4	B	C	T52	A	106	J
Product Code	Power Rating	T.C.R. (×10^{-6}/K)	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	1/4 : 0.25W 1/2 : 0.5W 1 : 1W	D : ±100 L : ±200 G : ±250 B : ±350	C : SnCu	See table below	A : AMMO R : REEL Nil : BOX	F : 4 digits G, J : 3 digits	F : ±1% G : ±2% J : ±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Type	Axial Taping			U Forming	L Forming		M Forming				
	T26	T52	T521	U	L10A	L20A	M10		M12.5	M15	
RK1/4□C	○	○	–	○	○	–	M10F	M10R	M12.5R	–	–
RK1/2□C	–	○	–	–	–	–	–	–	M12.5F	M15F	M15R
RK1□C	–	–	○	–	–	○	–	–	–	–	–
RK1/2GC	–	○	–	–	–	–	–	–	M12.5F	M15F	M15R

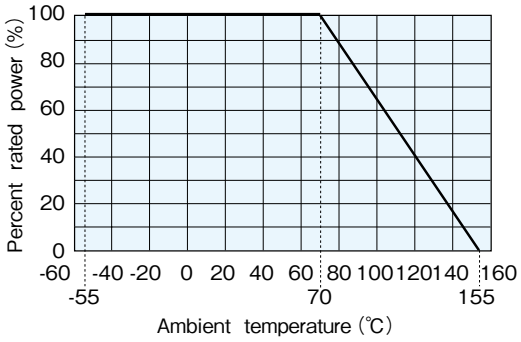
□ :T.C.R.

■Ratings

Type	Power Rating	T.C.R. (×10^{-6}/K)	Resistance Range (Ω)			Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)		
			F:±1% E24・E96	G:±2% E24	J:±5% E24				T26A	T52A	T521A
RK1/4DC	0.25W	D:±100	3.09M~25M	–	–	500V	700V	500V	2,000	2,000	–
RK1/4LC		L:±200	–	3.3M~33M	3.3M~33M						–
RK1/4BC		B:±350	100k~25M	100k~33M	100k~33M						–
RK1/2DC	0.5W	D:±100	5.11M~33M	–	–	700V	1000V	700V	–		–
RK1/2LC		L:±200	–	6.2M~33M	6.2M~33M				–		–
RK1/2BC		B:±350	100k~35M	100k~51M	100k~51M				–		–
RK1BC	1W	B:±350	100k~51M	100k~100M	100k~100M	1000V	1500V	1000V	–	–	500
RK1/2GC※3	0.5W	G:±250	–	–	1M~12M	350V	700V	700V	–	2,000	–

※3 Discharge path resistor
Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃ ~ +155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve

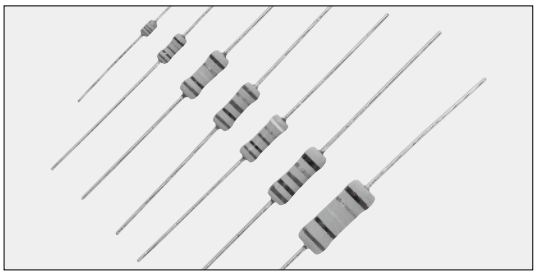


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1 : RK 2.5 : RK1/2G	0.6 : RK 1 : RK1/2G	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	1 : RK 5 : RK1/2G	0.5 : RK 1 : RK1/2G	260℃±5℃, 10s±1s or 350℃±10℃, 3.5s±0.5s
Dielectric withstanding voltage	No breakdown	—	1 min.
Insulation resistance	Not less than 10,000MΩ	—	100V, 1 min.
Rapid change of temperature	1 : RK 5 : RK1/2G	0.5 : RK 1 : RK1/2G	−55℃ (30min.) / +155℃ (30min.) 5 cycles
Moisture resistance	5 : RK 10 : RK1/2G	2 : RK 5 : RK1/2G	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	5 : RK 10 : RK1/2G	2 : RK 5 : RK1/2G	70℃±2℃, 1000h 1.5h ON/0.5h OFF
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	The resistor shall be immersed for 5s in IPA.
Impulse	No such abnormalities as short-circuit, burnout, breakdown, etc.	—	Discharge from 1000pF capacitor 50 pulses. Interval 2.5s Charge voltage : 1.25kV (RK1/4), 2.5kV (RK1/2) and 6kV (RK1).

RCR Coat-Insulated Fixed Anti Surge Resistors



Coating color : Blue gray
Marking : Excluding RCR16···4 line color codes+5th color code※1
RCR16···4 line color codes
※1 RCR50+, RCR50EN(1MΩ～12MΩ) : Green, RCR60 : White, Others : Black
Please confirm contents on technical specifications about the color code of F grade product.

■Features

- Excellent anti-surge characteristics.
- Stable characteristics of moisture resistance up to high resistance range.
- RCR50+(1MΩ～12MΩ), RCR50EN (1MΩ～12MΩ) and RCR60 (1MΩ～12MΩ) are conductive-path and Discharge-path Resistors recognized by UL1676 and c-UL (CSA-C22.2 No.1-M94).
- RCR25EN (100kΩ～33MΩ), RCR50EN (100kΩ～33MΩ) and RCR60 (100kΩ～56MΩ) is approved by EN62368-1 G.10 safety.
- Products meet EU-RoHS requirement. EU-RoHS regulation is not intended for Pb-glass contained in resistor element.
- Automatic mounting machine is applicable by surface mounted device style lead forming.

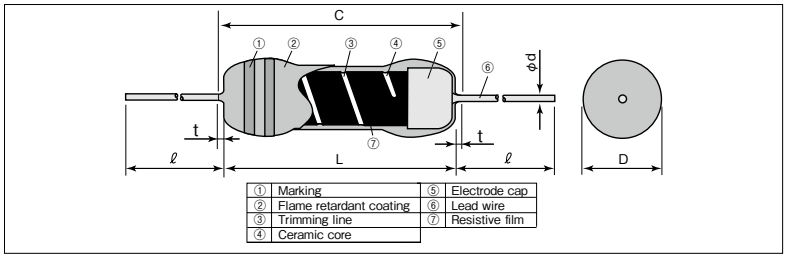
■Applications

- TV
- Copy machines
- LBP
- Switching power supplies
- AC adapters

■Approvals Awarded

Type	UL1676 & c-UL (CSA-C22.2 No.1-M94)	EN62368-1 G.10
RCR25EN	—	○
RCR50+	○(1MΩ～12MΩ)	—
RCR50EN		○
RCR60		○

■Construction



① Marking	⑤ Electrode cap
② Flame retardant coating	⑥ Lead wire
③ Trimming line	⑦ Resistive film
④ Ceramic core	

■Dimensions

Type	Dimensions (mm)						Weight (g) (1000pcs)
	L	C Max.	t Max.	D	d (Nominal)	ℓ ※2	
RCR16	3.2±0.2	3.4	—	$1.7^{+0.2}_{-0.1}$	0.45	20min.	150
RCR25 RCR25EN	6.3±0.5	7.1	—	2.5±0.5	0.6		240
RCR50(+) RCR50EN	9.5±1.0	—	3.0	3.5±0.4	0.7		520
RCR60	$9.5^{+1.0}_{-0.2}$	—	3.0	3.5±0.4	0.7		520
RCR75	12.0±1.0	—	3.0	4.0±0.5	0.8		800
RCR100	15.5±1.0	—	3.0	$6.0^{+1.0}_{-0.4}$	0.8		1400

※2 Lead length changes depending on taping and forming type.

■Type Designation

Example

RCR	50	EN	C	T52	A	106	J
Product Code	Power Rating	Safty Approvals Marking	Terminal Surface Material	Taping & Forming	Packaging Forming	Nominal Resistance	Resistance Tolerance
	16:0.25W 25:0.25W 50:0.5W 60:1W 75:2W 100:3W	+:RCR50+ EN:RCR25EN, RCR50EN Nil:Others	C:SnCu	See table below	A:AMMO R:REEL TEB·TEG:Plastic embossed (N forming) Nil:BOX	F:4 digits J:3 digits	F:±1% J:±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

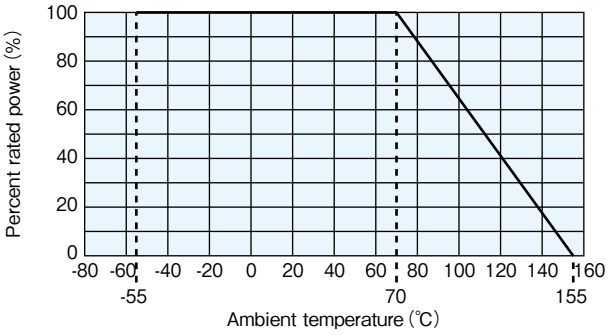
Type	Axial Taping				L Forming			M Forming				N Forming	
	T26	T52	T521	T631	L15A	L20A	L25A	M5	M10	M15	M20	N17	N20
RCR16	○	○	—	—	—	—	—	M5F	—	—	—	—	—
RCR25	○	○	—	—	—	—	—	—	M10F	—	—	—	—
RCR25EN	○	○	—	—	—	—	—	—	M10F	—	—	—	—
RCR50	—	○	—	—	○	—	—	—	—	M15F	—	—	—
RCR50+	—	○	—	—	○	—	—	—	—	M15F	—	—	—
RCR50EN	—	○	—	—	○	—	—	—	—	M15F	—	—	—
RCR60	—	○	—	—	○	—	—	—	—	M15F	—	—	—
RCR75	—	○	—	—	○	—	—	—	—	—	—	○	—
RCR100	—	—	○	○	—	○	○	—	—	—	M20E	—	○

■Ratings

Type	Power Rating	Resistance Range (Ω)		Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)			
		F:±1%(E24・E96)	J:±5%(E24)				T26	T52	T521	T631
RCR16	0.25W	100k～5.1M	100k～5.1M	500V	1000V	300V	5000	3000	—	—
RCR25 RCR25EN		100k～9.1M	100k～33M	D.C. 1600V A.C. 1150V	D.C. 2000V A.C. 1500V	700V	2000	2000	—	—
RCR50	0.5W	3.3Ω～910k	3.3～910k	2000V	2500V	700V	—	2000	—	—
			13M～33M							
RCR50+		1M～9.1M	1M～12M							
RCR50EN		100k～9.1M	100k～33M							
RCR60	1W	100k～9.1M	100k～56M	4000V	5000V	700V	—	2000	—	—
RCR75	2W	100k～9.1M	100k～100M	5000V	5000V	700V	—	1000	—	—
RCR100	3W	100k～9.1M	100k～51M	5000V	5000V	1000V	—	—	500	1000

Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃～+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value or Max. working voltage, whichever is lower.}}$

■Derating Curve



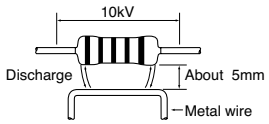
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Notice on Surge Load

Surge withstanding load voltage for the resistors cannot be guarantee when the undermentioned 4 items get to a remarkable overload in comparison with the conditions shown by surge withstanding voltage in Anti-surge characteristics. You are kind by requested to contact to us in advance if such a case is anticipated.

(1) Peak voltage to be applied
(2) Pulse width
(3) Conditions of protecting insulation around the resistor
(4) Situation of proximity conductivity object

As the fig. below for instance when a metal wire is placed at less than 5mm away from the resistor body, there is such a case that causes an electric discharge by a surge load 10kV and then destroys the outer coating.



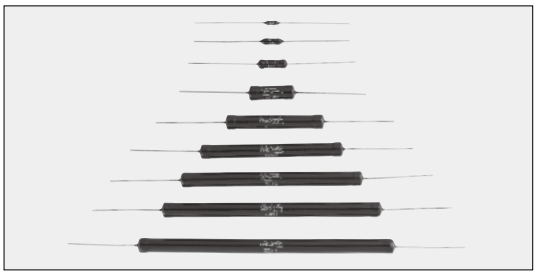
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified	—	Measuring points are at 10mm±1mm from the end cap.
T.C.R.	Type / T.C.R. / Resistance Range RCR16: ±200×10⁻⁶/K: 100kΩ～5.1MΩ RCR25 RCR25EN: ±350×10⁻⁶/K: 100kΩ～33MΩ RCR50 (+): ±500×10⁻⁶/K: 3.3Ω～91kΩ; ±350×10⁻⁶/K: 100kΩ～33MΩ RCR50EN: ±350×10⁻⁶/K: 100kΩ～33MΩ RCR60: ±350×10⁻⁶/K: 100kΩ～56MΩ RCR75: ±350×10⁻⁶/K: 100kΩ～100MΩ RCR100: ±200×10⁻⁶/K: 100kΩ～51MΩ	—	+25℃/+125℃
Overload (Short time)	1	0.5	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s or 350℃±10℃, 3.5s±0.5s
Terminal strength	No lead-coming off and loose terminals	—	Twist 360° , 5 times
Rapid change of temperature	1	0.5	−55℃ (30min.) /+155℃ (30min.) 5 cycles
Moisture resistance	5	2.5	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle RCR16, 25, 50(+), 60 : Rated Voltage RCR75, 100 : Power Rating×0.1
Endurance at 70℃	5	2.5	70℃±2℃, 1000h, Rated Voltage 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	Ultrasonic washing with Isopropyl alcohol for 2 min. Power : 0.3W/cm², f : 28kHz, Temp. : 35℃±5℃
Anti-surge characteristics	10	2.5	Discharge test : 2kV～10kV 0.01 μF capacitor discharge pulse 10 times. (1pulse/5s max.) Type / RCR16 / RCR25・RCR25EN / RCR50・RCR50+ / RCR50EN / RCR60 / RCR75 / RCR100 Applied voltage: 2kV / 3kV / 3.3Ω～6.2Ω : 10kV; 6.8Ω～10Ω : 7kV; 11Ω～9.1kΩ : 5kV; 10kΩ～91kΩ : 7kV; 100kΩ～33MΩ : 10kV / 10kV / 10kV / 10kV / 10kV
EN60065 test (RCR50EN, RCR60 Only)	20	—	Discharge test : 10kV 1000pF capacitor discharge pulse 50 times. (1pulse/5s max.)

■Precautions for Use

- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- Do not touch the resistors with high-resistance value by hand to prevent surface-leakage current.
- Consult with us when there are electric conductors near to because it may cause corona and short-circuit by discharge.
- Please do not apply resistors under such bad conditions as high temperature, high humidity, and foul adhesion, or with resin molding, because it may cause the change of resistance value.
- The resistance film of less than RCR50 100kΩ is different. Therefore, the characteristic might decrease when it is polluted by a remarkable moisture environment and the ionic material so inquire of our company beforehand, please.

GS High Voltage High Resistance Thick Film Resistors



Coating color : Brown
Marking : Alphanumeric

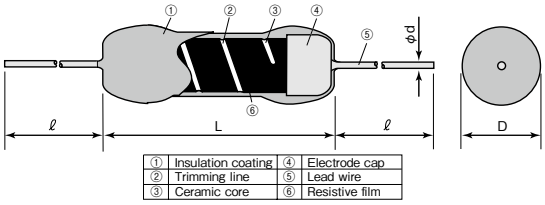
■Features

- Miniature construction endurable to high voltage and high power.
- Resistors excellent in anti-surge characteristics.
- Wide resistance range of 500kΩ～10GΩ and small T.C.R.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in resistor element and Pb contained in Brass cap.

■Applications

- Copying machines.
- LBPs.
- Charging and discharging resistors for power supply circuits.
- High voltage dividing resistors.

■Construction



①	Insulation coating	④	Electrode cap
②	Trimming line	⑤	Lead wire
③	Ceramic core	⑥	Resistive film

■Dimensions

Type	Dimensions (mm)				Weight (g) (1000pcs)
	L	D	d (Nominal)	ℓ	
GS 1/4	6.3±1.0	2.3±0.5	0.65	38±3	320
GS 1/2	9.5±1.0	3.5±0.6	0.8		590
GS 1	15.0±1.5	4.5±1.0			1,230
GS 2	24.0±1.5	7.9±1.0	1.0		4,190
GS 3	52.0±2.0				7,750
GS 5	76.0±2.0				10,790
GS 7	97.0±3.0				13,350
GS 10	117.0±3.0				16,180
GS 12	137.0±3.0				18,440

■Type Designation

Example

GS	1/2	L	C	106	J
Product Code	Power Rating	T.C.R. (×10⁻⁶/K)	Terminal Surface Material	Nominal Resistance	Resistance Tolerance
	1/4 : 0.25W 1/2 : 0.5W 1 : 1W 2 : 2W 3 : 3W 5 : 5W 7 : 7W 10 : 10W 12 : 12W	D : ±100 L : ±200	C : SnCu	D,F : 4 digits G,J,K : 3 digits	D : ±0.5% F : ±1% G : ±2% J : ±5% K : ±10%

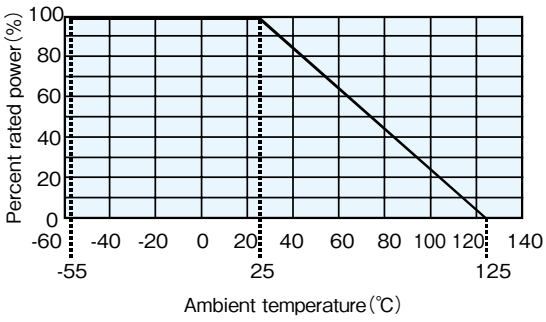
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
Custom forming for all of items and custom taping for GS1/4 · GS1/2 are available on request.

■Ratings

Type	Power Rating	T.C.R. (×10⁻⁶/K)	Resistance Range (Ω) D : ±0.5% E24·25×10ⁿ·50×10ⁿ	F : ±1% E24·25×10ⁿ·50×10ⁿ	G : ±2% E24·25×10ⁿ·50×10ⁿ	J : ±5% E24·25×10ⁿ·50×10ⁿ	K : ±10% E24·25×10ⁿ·50×10ⁿ	Max. Working Voltage	Max. Overload Voltage	Impulse Withstand Voltage
GS 1/4DC	0.25W	D : ±100	500k～20M	500k～100M	500k～100M	500k～100M	500k～100M	0.5kV	1kV	1.25kV
GS 1/4LC		L : ±200								
GS 1/2DC	0.5W	D : ±100	500k～50M		500k～200M	500k～200M	500k～200M	1kV	2kV	2.5kV
GS 1/2LC		L : ±200			500k～500M	500k～500M	500k～500M			
GS 1DC	1W	D : ±100			500k～500M	500k～500M	500k～500M	3kV	4.5kV	6kV
GS 1LC		L : ±200			500k～1G	500k～5G	500k～5G			
GS 2DC	2W	D : ±100			500k～500M	500k～500M	500k～500M	5kV	7.5kV	10kV
GS 2LC		L : ±200			500k～1G	500k～5G	500k～5G			
GS 3DC	3W	D : ±100			500k～500M	500k～500M	500k～500M	15kV	20kV	30kV
GS 3LC		L : ±200			500k～1G	500k～10G	500k～10G			
GS 5DC	5W	D : ±100			500k～500M	500k～500M	500k～500M	20kV	30kV	40kV
GS 5LC		L : ±200			500k～1G	500k～10G	500k～10G			
GS 7DC	7W	D : ±100	1M～50M	1M～100M	1M～500M	1M～500M	1M～500M	30kV	40kV	50kV
GS 7LC		L : ±200	500k～50M	500k～100M	500k～1G	500k～10G	500k～10G			
GS 10DC	10W	D : ±100	1M～50M	1M～100M	1M～500M	1M～500M	1M～500M	35kV	50kV	60kV
GS 10LC		L : ±200	500k～50M	500k～100M	500k～1G	500k～10G	500k～10G			
GS 12DC	12W	D : ±100	1M～50M	1M～100M	1M～500M	1M～500M	1M～500M	40kV	60kV	70kV
GS 12LC		L : ±200	500k～50M	500k～100M	500k～1G	500k～10G	500k～10G			

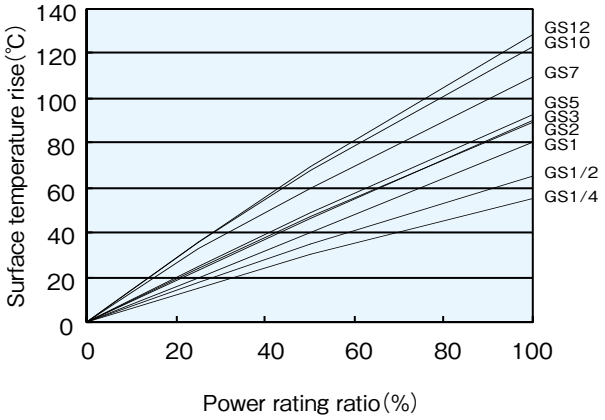
Rated Ambient Temperature : +25℃
Operating Temperature Range : −55℃～+125℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at an ambient temperature of 25℃ or higher, the power shall be derated in accordance with the above derating curve.

■Surface Temperature Rise



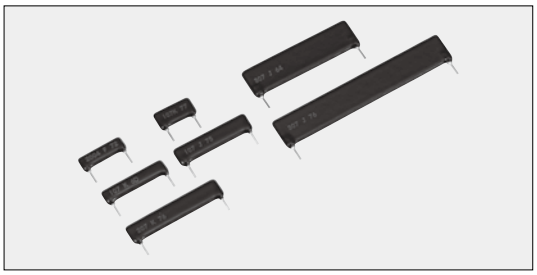
■Performance

Test Items	Performance Requirements ΔR±%	Test Methods
Resistance	Within specified tolerance	25℃
T.C.R.	Within specified T.C.R.	+25℃/+125℃
Overload (Short time)	2 : T.C.R. 200×10⁻⁶/K 0.5 : T.C.R. 100×10⁻⁶/K	Rated voltage×2.5 (GS1/4, GS1/2), Rated voltage×2 (GS1～GS12) or Max. overload voltage, whichever is lower, for 5s
Resistance to soldering heat	2 : T.C.R. 200×10⁻⁶/K 0.5 : T.C.R. 100×10⁻⁶/K	350℃±10℃, 3s±0.5s or 260℃±5℃, 10s±1s
Rapid change of temperature	2 : T.C.R. 200×10⁻⁶/K 0.5 : T.C.R. 100×10⁻⁶/K	−55℃ (30min.) /+125℃ (30min.), 5 cycles
Moisture resistance	5 : T.C.R. 200×10⁻⁶/K 2 : T.C.R. 100×10⁻⁶/K	40℃, 90%～95%RH, 1000h
Endurance at 25℃	3 : T.C.R. 200×10⁻⁶/K 2 : T.C.R. 100×10⁻⁶/K	25℃, 1000h 1.5h ON/0.5h OFF cycle
Voltage coefficient	±50×10⁻⁶/ V : T.C.R. 200×10⁻⁶/K ±10×10⁻⁶/ V : T.C.R. 100×10⁻⁶/K	GS1/4, 1/2 only Rated voltage or max. working voltage, whichever is lower and 1/10 of its voltage.
Voltage characteristics	5 : T.C.R. 200×10⁻⁶/K 3 : T.C.R. 100×10⁻⁶/K	GS1～12 Rated voltage or max. working voltage, whichever is lower and 1/10 of its voltage.
Resistance to solvent	No evidence of damage to protective coating and marking.	Soaking in IPA for 1min and brushing 10 times -3 cycles- liquid temp. 25℃±5℃
Impulse withstand voltage	No abnormality in appearance and flash-over.	An impulse voltage shall be applied 5 times at an interval of 1min.

■Precautions for Use

- Impulse withstanding voltage is specified for waveform of 1/40μs or 1.2/50μs as a standard. Please inquire of us in advance when using other than the standard waveform, since the specified value may change, depending on time constant or length of wave tail.
- Use the components under less dusty places, as continual applying of high voltage makes dust adhere to the surface of the resistors and causes surface leakage and corona. Also periodic cleaning of the surface of resistors is needed.
- Use them at 50% or under of the rated power for stable use for a long time.
- Do not touch the resistors with high resistance value by hand to prevent surface-leakage current.
- Set the products away from near electric conductors 1cm or over per 3kVd.c. to avoid occurrence of corona and short-circuit by discharge, if there are electric conductors near to.
- Ceramic is used for the core of these resistors. Pay attention to the handling as the characteristics may be deteriorated by damage and inner crack when they are fallen or shocked.
- In case of using in oil, inquire of us in advance.
- Take care that the resistors may become instable in resistance value by absorption of humidity when they are stored or used in high humidity environment.

RK92 Thick Film Resistors For High Voltage



Coating color : Black
Marking : Alphanumeric

■Features

- High resistance resistors for high voltage circuits.
- Thin SIP shape.
- The flame retardant coats corresponding to UL94V-0 are used.
- Thick film resistors (RuO_2) ensure high stabilities in life and change in aging.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

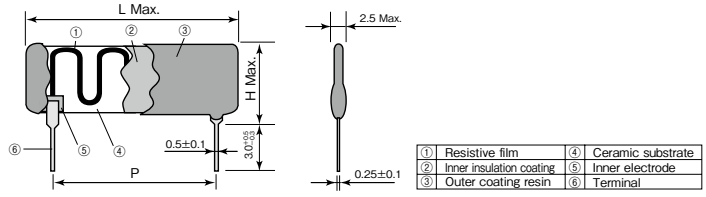
■Applications

- PPCs
- LBPs
- Air conditioners
- Microwave ovens
- High voltage circuits for fly-back transformers, etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



■Dimensions

Style	Max. Workin Vol. Symbol	Dimensions (mm)			Weight(g) (1000pcs)
		L Max.	H Max.	P±0.2	
4L	Nil	12.7	5.08	10.16	196
5L	Nil	15.3		12.7	227
6L	Nil	17.8		15.24	258
3C	Nil or 4	10.8	6.5	7.62	194
4C	5	13.3		10.16	241
5C	Nil or 6	15.8		12.7	286
6C	7	18.4		15.24	331
7C	Nil or 8	20.9		17.78	377
8C	Nil or 9	23.5		20.32	422
9C	Nil	26.0		22.86	468
11X	Nil	31.0	10	27.94	1007
18X	Nil	48.9		45.72	1672
18D	Nil	48.9	13.2	45.72	2373

■Type Designation

Example

RK92 – 3C – 4 – D – 1004 – F – 50

Product Code	Style	Max. Working Voltage symbol	Terminal Surface Material	Nominal Resistance	Resistance Tolerance	T.C.R. (×10⁻⁶/K)
RK92 (Standard)	4L 5L 6L 3C 5C 7C 8C 9C 11X 18X 18D	Nil	D : SnAgCu (L : Sn/Pb)	F : 4digits G, J, K, M : 3digits	F : ±1% G : ±2% J : ±5% K : ±10% M : ±20%	Nil
						100
RK92 (Presison)	18D	Nil	D : SnAgCu	D, F : 4digits	D : ±0.5% F : ±1%	100
	3C	4 (kV)				50
	4C	5 (kV)				
	5C	6 (kV)				
	6C	7 (kV)				
	7C	8 (kV)				
	8C	9 (kV)				

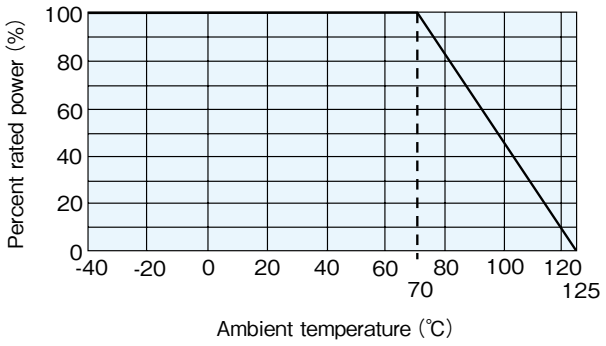
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
The terminal surface material lead free is standard.

■Ratings

Style	Max. Working Vol. symbol	Power Rating	Resistance Range (Ω) E12・2×10ⁿ・3×10ⁿ・4×10ⁿ・5×10ⁿ						T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Rated Ambient Temp.	Operating Temp. Range
			D : ±0.5%	F : ±1%	G : ±2%	J : ±5%	K : ±10%	M : ±20%				
4L	Nil	0.5W	—	2M～10M	2M～10M	—	—	—	±300	1kV	+70℃	−40℃～+125℃
5L	Nil	0.5W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G		10kV		
6L	Nil	0.6W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G				
3C	Nil	0.5W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G		7kV		
5C	Nil	0.75W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G		10kV		
7C	Nil	0.85W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G				
8C	Nil	1.0W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G				
9C	Nil	1.1W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G				
11X	Nil	1.7W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G				
18X	Nil	2.7W	—	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G		15kV		
18D	Nil	4W	1M～100M	1M～500M	1M～500M	1M～1G	1M～1G	1M～1G	±100			
3C	4	0.5W	1M～100M	1M～100M	—	—	—	—	±50	4kV		
4C	5	0.6W	1M～100M	1M～100M	—	—	—	—		5kV		
5C	6	0.75W	1M～150M	1M～150M	—	—	—	—		6kV		
6C	7	0.8W	1M～150M	1M～150M	—	—	—	—		7kV		
7C	8	0.85W	1M～200M	1M～200M	—	—	—	—		8kV		
8C	9	1W	1M～200M	1M～200M	—	—	—	—		9kV		

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



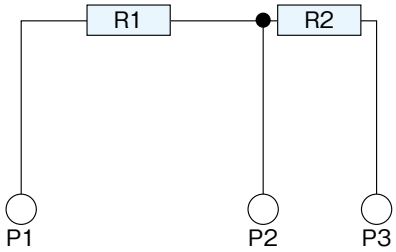
For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.5	−40℃ (30min.) /+125℃ (30min.) 5 cycles
Moisture resistance	5	3	40℃±2℃, 90%～95%RH, 1000h
Endurance	5	3	25℃ 1000h Rated voltage

■3 terminals product

• Circuit Schematics

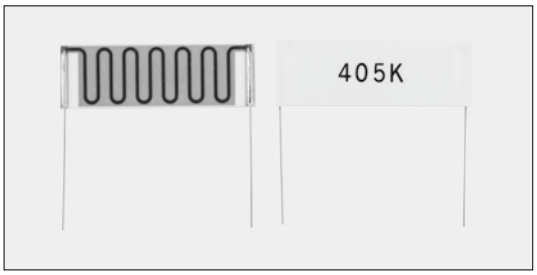


• Resistance Value The partial Ratio, Terminal pitch, The dimensions, Please refer to us.

■Precaution for Use

• The conditions for lead-free terminal resistors are set up at 260℃ Max. within 10s.

RK92-L Thick Film Resistors For High Voltage



Coating color : Green
Marking : Alphanumeric

■Features

- Resistors excellent in overload capability.
- Thin SIP shape.
- Thick film resistors (RuO_2) ensure high stabilities in life and change in aging.
- Meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

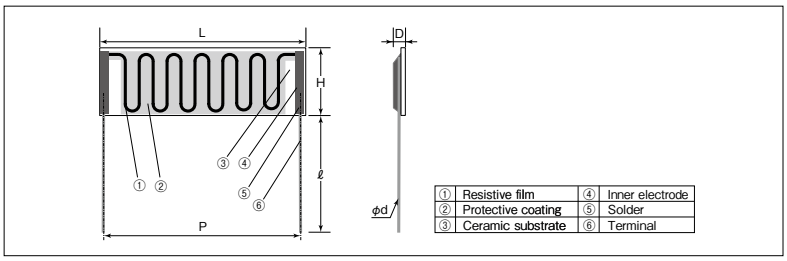
■Applications

- Charging and discharge resistors for power supply circuits.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



■Dimensions

Style	Dimensions (mm)						Weight (g) (300pcs)
	L	H	P	D	ℓ	φd (Nominal)	
18FL	48.5 Max.	16.5 Max.	45.0±1.0	2.5 Max.	30.0±1.0	0.65	974

■Type Designation

Example

RK92	–	18FL	4W	D	305	K
Product Code		Style	Power Rating	Terminal Surface Material	Nominal Resistance	Resistance Tolerance
				D : SnAgCu	3 digits	K : ±10%

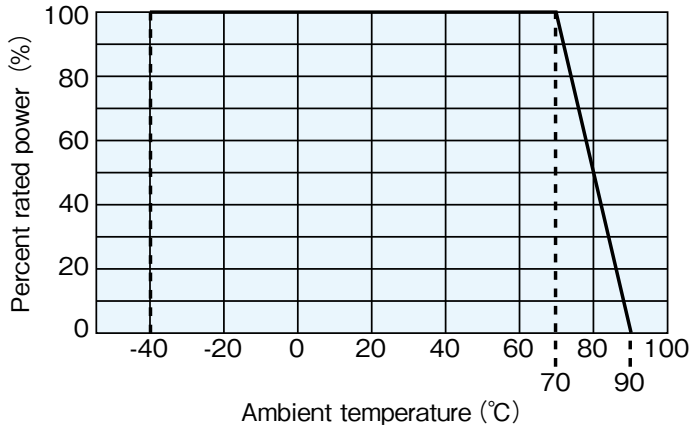
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Style	Power Rating	Resistance Range (Ω) K : ±10%	T.C.R. (×10⁻⁶/K)	Rated Ambient Temp.	Operating Temp. Range
18FL	4W	1.2M～16M (1.2M、3M、4M、5M 8M、12M、16M)	±300	+70℃	−40℃～+90℃

Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

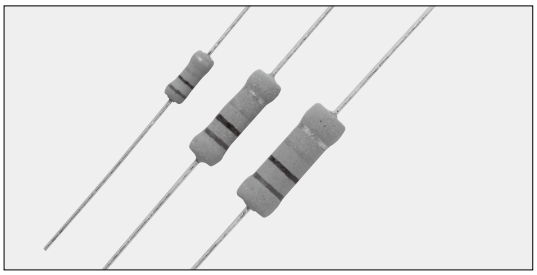
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Temperature cycling	2	1.0	−40℃ (30min.) /+130℃ (30min.) 10 cycles
Endurance	3	1.5	Insulating oil 1000h Rated voltage

■Precautions for Use

• The condition for lead-free terminal resistors are set up at 260℃ Max. within 10s.

PCF Ceramic Resistors for Anti Pulse・Surge



Coating color：Light green
Marking：Color code

■Features

- KOA original bulk ceramic resistors.
- Excellent in anti-pulse characteristics.
- Higher reliability against disconnection compared to wirewound resistors and film resistors.
- Products meet EU-RoHS requirements.
- Flame retardant coating. (Equivalent to UL-94 V-0)
- Non-Inductive resistors.
- AEC-Q200 Tested.

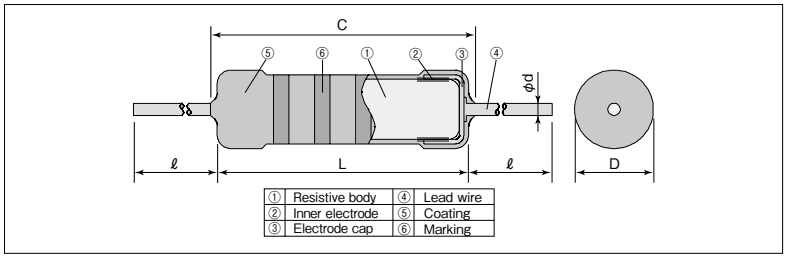
■Applications

- High voltage circuits for X-ray generators and electron microscopes.
- Power supply circuits for machine tools, etc.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



■Dimensions

Type	Dimensions (mm)					Weight(g) (1000pcs)
	L±1	C max.	D	d(Nominal)	ℓ±3※1	
PCF1/2	9.0	11.1	3.5±0.5	0.7	30.0	450
PCF1	16.5	19.0	5.5±1.0	0.8	38.0	1340
PCF2	19.0	22.5	7.0±1.0			2240

※1 Lead length changes depending on taping type.

■Type Designation

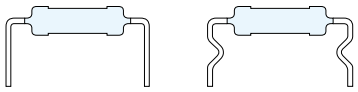
Example

PCF	1	C	T631	R	103	K
Product Code	Power Rating	Terminal Surface Material	Taping	Packaging	Nominal Resistance	Resistance Tolerance
PCF	1/2:0.5W 1:1.0W 2:2.0W	C:SnCu	See table Below	R:REEL Nil:BOX	3 digits	K:±10% M:±20%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Taping

Type	Axial Taping	
	T52	T631
PCF1/2	○	—
PCF1	—	○
PCF2	—	○



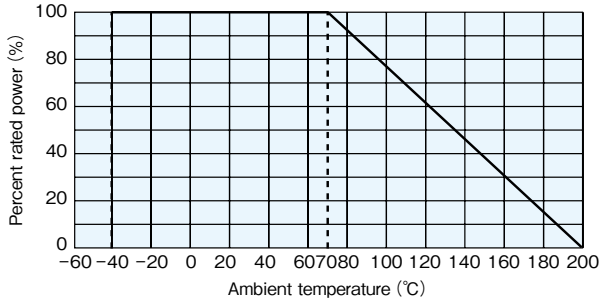
Contact us for lead forming details.

■Ratings

Type	Power Rating	Resistance Range (Ω)		T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping & Q'ty/reel (pcs)	
		K:±10% E12	M:±20% E6					T52R	T631R
PCF1/2	0.5W	4.7～100k	4.7～100k	−500～−1300：3.3Ω≦R<10Ω −600～−1500：10Ω≦R<100Ω	200V	400V	500V	2,000	—
PCF1	1.0W	3.3～390k	3.3～390k	−700～−1800：100Ω≦R<1kΩ −900～−1900：1kΩ≦R<100kΩ	300V	600V		—	1,000
PCF2	2.0W			−900～−2000：100kΩ≦R<200kΩ −900～−2200：200kΩ≦R≦390kΩ	400V	800V	700V	—	500

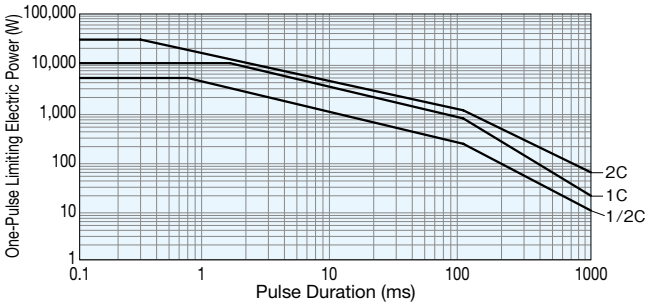
Rated Ambient Temperature：+70℃
Operating Temperature Range：−40℃～+200℃
Rated voltage＝$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at the ambient temperature of 70℃ or higher, the power rating shall be derated in accordance with the above derating curve.

■One-Pulse Limiting Electric Power

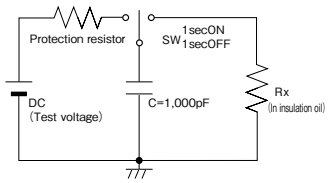


※The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.
The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃ Resistance / Measuring voltage 3.3Ω≦R<10Ω / 0.3V 10Ω≦R<100Ω / 1.0V 100Ω≦R≦390kΩ / 3.0V
T.C.R.	−500~−1300:3.3Ω≦R<10Ω −600~−1500:10Ω≦R<100Ω −700~−1800:100Ω≦R<1kΩ −900~−1900:1kΩ≦R<100kΩ −900~−2000:100kΩ≦R<200kΩ −900~−2200:200kΩ≦R≦390kΩ	—	+25℃/−40℃、+25℃/+75℃ and +25℃/+125℃
Voltage coefficient (Apply for 1kΩ or over)	0~−0.20%/V	—	Rated voltage and rated voltage×10%
Overload (Short time)	2	0.4	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s.
Resistance to pulse	Refer to the right table	—	The resistor mounted on to the test circuit as below is applied with high voltage impulse 10000 cycles.
Resistance to soldering heat	2	0.8	350℃±10℃、3.5s±0.5s
Rapid change of temp.	2	0.4	−40℃ (30min.) /+85℃ (30min.) 5 cycles
Moisture resistance	5	0.6	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycles
Load life	5	0.4	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycles
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	Dipping in IPA or Xylene for 3 min. and leaving for 10 min.after removing drops, then brushing 10 times.

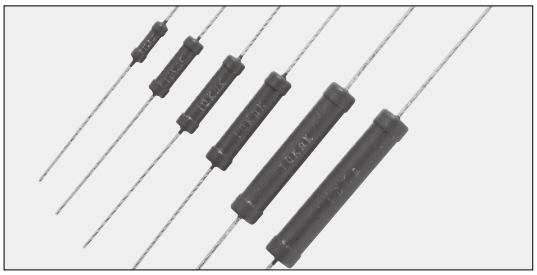
Type	Test voltage	Performance Requirements ΔR±(%+0.05Ω)
PCF1/2	10kV:4.7Ω≦R<10kΩ	5
	10kV:10kΩ≦R<33kΩ	10
	10kV:33kΩ≦R≦100kΩ	25
	4kV:10kΩ≦R≦100kΩ	5
PCF1	14kV:3.3Ω≦R<30kΩ	5
	14kV:30kΩ≦R≦390kΩ	10
	7kV:30kΩ≦R≦390kΩ	5
PCF2	20kV:3.3Ω≦R<10kΩ	5
	20kV:10kΩ≦R≦390kΩ	10
	11kV:10kΩ≦R≦390kΩ	5



■Precautions for Use

- Under the environment where surge like thunders etc. is apt to happen, the resistors used for open circuit, resistors connected directly to input, output or ground, and resistors used for the circuit pulse applied to, may be destructed by surge or pulse. Therefore, the resistors need to be selected after sufficient check on the supposition of the worst condition against possible surge and pulse.
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Pleasewash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coatingfilm of resistors for 20 minutes afterdrying. Especially no PC boards shall be piled up.
- When overload is impressed continuously by the trouble of the circuit part because this product is hard to be snapped, a resistor body continues being overheated and emits smoke from a resistor and neighboring flammable materials and may catch fire. In a steady use state and heterology, please design the circuit so that the surface temperature of this product is not as above 200 degrees Celsius.

HPC Ceramic Resistors for Anti Pulse・Surge



Coating color：Reddish brown
Marking: Alphanumeric

■Features

- KOA original bulk ceramic resistors.
- Excellent in anti-pulse characteristics.
- Higher reliability against disconnection compared to wirewound resistors and film resistors.
- Products meet EU-RoHS requirements.
- Non-Inductive resistors.
- AEC-Q200 Tested.

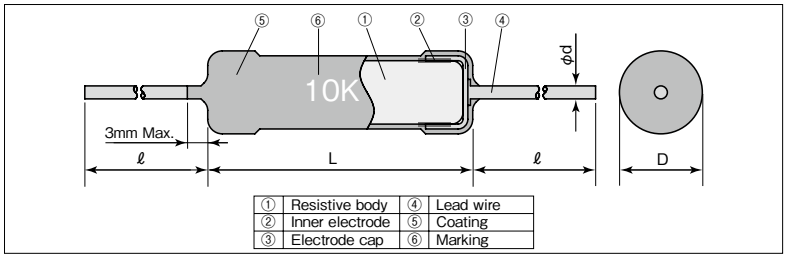
■Applications

- High voltage circuits for X-ray generators and electron microscopes.
- Power supply circuits for machine tools, etc.
- Active discharge resistors for EV.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Construction



①	Resistive body	④	Lead wire
②	Inner electrode	⑤	Coating
③	Electrode cap	⑥	Marking

■Dimensions

Type	Dimensions (mm)				Weight (g) (1000pcs)
	L±2	D±1	d (Nominal)	ℓ±3※1	
HPC1/2	11	3.5	0.8	38	690
HPC1	16	4.5			1260
HPC2	21	5.0			1780
HPC3	26	6.0			2830
HPC4	38	7.0	1.0		5880
HPC5	44	7.5			7930

※1 Lead length changes depending on taping type.

■Type Designation

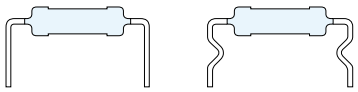
Example

HPC	1	C	T631	R	103	K
Product Code	Power Rating	Terminal Surface Material	Taping	Packaging	Nominal Resistance	Resistance Tolerance
	1/2:0.5W 1:1.0W 2:2.0W 3:3.0W 4:4.0W 5:5.0W	C:SnCu	See table Below	A:AMMO R:Reel Nil:BOX	3 digits	K:±10% M:±20%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Taping

Type	Axial Taping	
	T52	T631
HPC1/2	○	—
HPC1	—	○



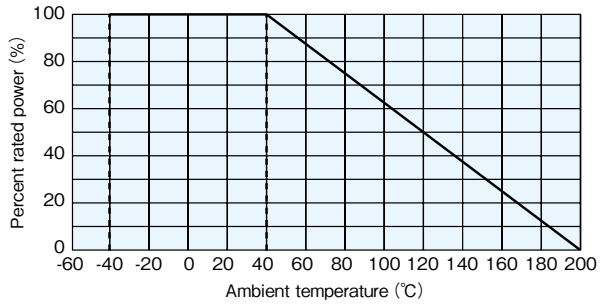
Contact us for lead forming details.

■Ratings

Type	Power Rating	Resistance Range (Ω)		T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage	Rated Ambient Temp.	Operating Temp. Range
		K：±10% E12	M：±20% E6					
HPC1/2	0.5W	10～390k	3.3～330k	−500～−1300：3.3Ω≦R<10Ω −600～−1500：10Ω≦R<100Ω −700～−1800：100Ω≦R<1kΩ −900～−1900：1kΩ≦R<100kΩ −900～−2000：100kΩ≦R<200kΩ −900～−2200：200kΩ≦R≦390kΩ	200V	400V	+40℃	−40℃～+200℃
HPC1	1W				300V	600V		
HPC2	2W				400V	800V		
HPC3	3W				450V	900V		
HPC4	4W				500V	1000V		
HPC5	5W				550V	1100V		

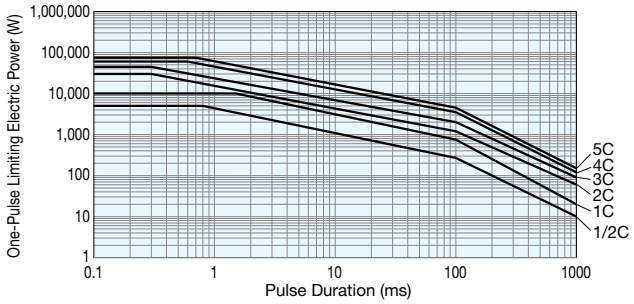
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at the ambient temperature of 40℃ or higher, the power rating shall be derated in accordance with the above derating curve.

■One-Pulse Limiting Electric Power

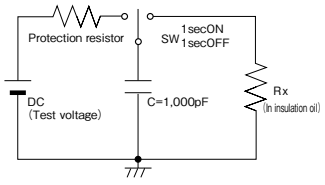


※The maximum applicable voltage is equal to the max. overload voltage.
Please ask us about the resistance characteristic of continuous applied pulse.The pulse endurance values are not assured values,so be sure to check the products on actual equipment when you use them.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃ Resistance: Measuring voltage 3.3Ω≦R<10Ω: 0.3V 10Ω≦R<100Ω: 1.0V 100Ω≦R≦390kΩ: 3.0V
T.C.R.	−500~−1300:3.3Ω≦R<10Ω −600~−1500:10Ω≦R<100Ω −700~−1800:100Ω≦R<1kΩ −900~−1900:1kΩ≦R<100kΩ −900~−2000:100kΩ≦R<200kΩ −900~−2200:200kΩ≦R≦390kΩ	—	+25℃/−40℃ and +25℃/+125℃
Voltage coefficient (Apply for 1kΩ or over)	0~−0.2%/V (HPC1/2) 0~−0.1%/V (HPC1) 0~−0.05%/V (HPC2,3,4,5)	—	Rated voltage and rated voltage×10%
Overload (Short time)	2	0.4	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s.
Resistance to pulse	Refer to the right table	—	The resistor mounted on to the test circuit as below is applied with high voltage impulse 10,000 cycles.

Type	Test voltage	Performance Requirements ⊿R±(%+0.05Ω)
HPC1/2	8kV:3.3Ω≦R<30kΩ	5
	8kV:30kΩ≦R≦390kΩ	10
	5kV:30kΩ≦R≦390kΩ	5
HPC1	15kV:3.3Ω≦R<30kΩ	5
	15kV:30kΩ≦R≦390kΩ	10
	7kV:30kΩ≦R≦390kΩ	5
HPC2	25kV:3.3Ω≦R<30kΩ	5
	25kV:30kΩ≦R≦390kΩ	10
	15kV:30kΩ≦R≦390kΩ	5
HPC3,HPC4,HPC5	25kV	5

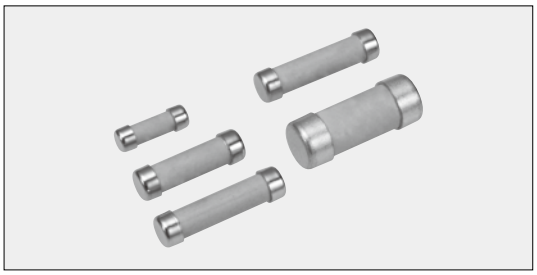


Resistance to soldering heat	2	0.8	350℃±10℃, 3.5s±0.5s
Rapid change of temperature	2	0.4	−40℃ (30min.) /+85℃ (30min.) 5 cycles
Moisture resistance	5	0.6	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Load life	5	0.4	40℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	5	1.7	+200℃, 1000h
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	Dipping in IPA or Xylene for 3 min. and leaving for 10 min.after removing drops, then brushing 10 times.

■Precautions for Use

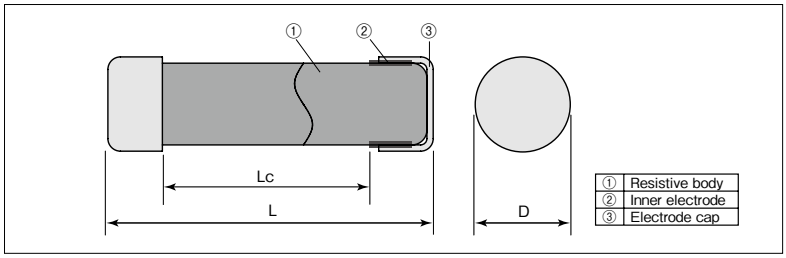
- Under the environment where surge like thunders etc. is apt to happen, the resistors used for open circuit, resistors connected directly to input, output or ground, and resistors used for the circuit pulse applied to, may be destructed by surge or pulse. Therefore, the resistors need to be selected after sufficient check on the supposition of the worst condition against possible surge and pulse.
- The coating of this product is used to make the marking easy to see,and there is no electric characteristic (dielectric withstanding voltage etc,) .The coating of this product is weak to an external impact. So,the coating of the cap might peel off while transporting it. Please judge the product which reads the marking easily even if there are peeling off,a bruise,and a pinhole in the coating to be a non-defective unit.
- Be careful to handle these resistors because coating are weak to outer shock.please wash them to a minimum.No external force is given to the coating films until they are well dried because the coating films become weaker right after washing.Please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying.Especially no PC boards shall be piled up.
- When overload is impressed continuously by the trouble of the circuit part because this product is hard to be snapped, a resistor body continues being overheated and emits smoke from a resistor and neighboring flammable materials and may catch fire. In a steady use state and heterology, please design the circuit so that the surface temperature of this product is not as above 200 degrees Celsius.

CPCN Ceramic Resistors



No coating

■Construction



■Features

- Excellent noise prevention of engine ignition circuit system.
- High reliability against disconnection.
- Products meet EU-RoHS requirements.

■Reference Standards

IEC 60115-1
JIS C 5201-1

■Dimensions

Type	Dimensions (mm)			Cap Material	Weight (g) (1000pcs)
	L	Lc	D		
CPCN1/2	10.7±0.5	5.4Min.	3.5±0.1	Fe(Ni/Cu plating)	330
CPCN1	16.0±0.6	9.6Min.	4.75±0.3		810
CPCN2N	18.3±0.6	11.5Min.			920
CPCN2NS				SUS304	920
CPCN3		10.0Min.	7.2±0.3	Fe(Sn/Cu plating)	2350

■Type Designation

Example

CPCN	2N	S	502	M
Product Code	Power Rating Symbol	Cap Material Symbol	Nominal Resistance	Resistance Tolerance
CPCN	1/2:0.5W 1:1.0W 2N:1.5W 3:2.0W	S:SUS304 Nil:Fe(plating)	3 digits	M:±20%

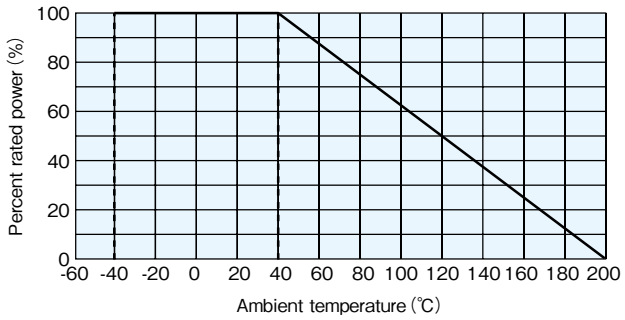
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Type	Power Rating	Nominal Resistance	Resistance Tolerance	T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage	Rated Ambient Temp.	Operating Temp. Range	Packaging Q'ty/Bag (pcs)
CPCN1/2	0.5W	1kΩ, 5kΩ 10kΩ, 15kΩ	M:±20%	−1200±300	86V	215V	+40℃	−40℃～ +200℃	1,000
CPCN1	1.0W				122V	305V			1,000
CPCN2N CPCN2NS	1.5W	1kΩ, 2kΩ, 5kΩ 10kΩ, 15kΩ			150V	375V			1,000
CPCN3	2.0W	15kΩ			173V	432V			500

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at the ambient temperature of 40℃ or higher, the power rating shall be derated in accordance with the above derating curve.

■Performance

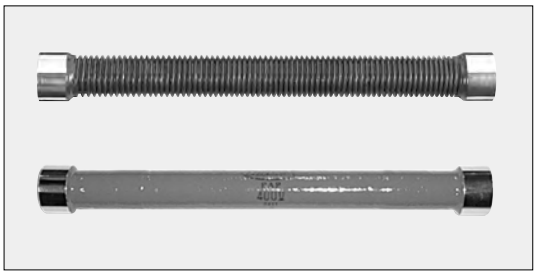
Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods			
	Limit	Typical				
Resistance	Within specified tolerance	—	25℃			
			Resistance	Measuring voltage		
			1kΩ, 2kΩ, 5kΩ	10V		
			10kΩ, 15kΩ	30V		
T.C.R.	−1200±300×10⁻⁶/K	—	+25℃/−40℃ and +25℃/+125℃			
Voltage coefficient	0～−0.2%/V	—	Rated voltage and rated voltage×10%			
Overload (Short time)	2	0.3	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s			
Load life at high voltage pulse	30	—	Continuous 250h high voltage pulse on the test circuit (Refer to JIS D 5111) CPCN½, CPCN1 : In insulation oil			
Resistor body strength	No mechanical damage	—	Type	Holding distance	Duration	Load
			CPCN1/2	5.0±0.2mm	10s	98N (10kgf)
			CPCN1	9.0±0.3mm		
			CPCN2N, 2NS	12.3±0.3mm		490N (50kgf)
			CPCN3			
Rapid change of temperature	5	—	−55℃ (15min.) / +155℃ (15min.) 500 cycles			
Moisture resistance	5	0.9	40℃±2℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle			
Load life	5	0.7	40℃±2℃, 1000h 1.5h ON/0.5h OFF cycle			
Low temperature exposure	5	0.7	−40℃, 24h			
High temperature exposure	5	2.0	+200℃, 1000h			

The resistance measurement before and after the test should be performed at a difference of ±1℃ of room temp.

■Precautions for Use

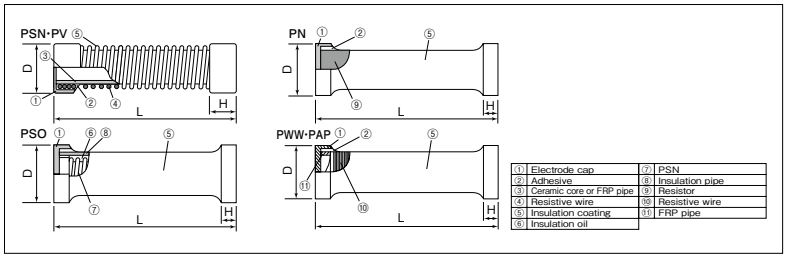
- Under the environment where surge like thunders etc. is apt to happen, the resistors used for open circuit, resistors connected directly to input, output or ground, and resistors used for the circuit pulse applied to, may be destructed by surge or pulse. Therefore, the resistors need to be selected after sufficient check on the supposition of the worst condition against possible surge and pulse.
- Please design the receiving terminal and the mounting method so that big power is not applied to the resistor when you assemble the resistor. Especially, comparatively weak power might be broken in the condition that the one side of the resistor is fixed.Please do not add the outside power when you assemble the resistor with the one side of the resistor fixed.

PSN·PV·PSO·PN·PWW·PAP High Voltage Power Resistors



Body color : Red
Marking : Alphanumeric

■Construction



■Features

- PSN can respond to high voltage and high power with a wide resistance range of 500Ω～6GΩ.
- PSO is made completely moisture preventive to be PSN that can be used under high moisture environment.
- PN is a non-inductive type and can be used for high frequency.
- PWW and PAP type are non-inductive wire wound resistors.
- PWW resistors have the same shapes as PSN and can be used for a low resistance area that cannot be produced with PSN resistors.
- PAP resistors are non-inductive wire wound resistors with inductance lessened than PWW can be used for pulse wave measurement, impulse generators, etc.
- Products with Pb free symbol "F" meet EU-RoHS requirement.

■Applications

- Resistors for charging and discharging for high voltage, resistors for surge absorption, and protective resistors at the time of a short- circuit.
- Voltage Equalizing Resistors at the time of using and connecting diodes and capacitors in series.
- Dividers for DC voltage and for measuring lightning and switching impulses.

■Precautions for Use

- Impulse withstanding voltage is specified for waveform of 1/40μs or 1.2/50μs as a standard. Please inquire of us in advance when using other than the standard waveform, since the specified value may change, depending on time constant or length of wave tail.
- Use the components under less dusty places, as continual applying of high voltage makes dust adhere to the surface of the resistors and causes surface leakage and corona. Also periodic cleaning of the surface of resistors is needed.
- Use them at 50% or under of the rated power for stable use for a long time.
- Do not touch the resistors with high resistance value by hand to prevent surface-leakage current.
- Set the products away from near electric conductors 1cm or over per 3kVd.c. to avoid occurrence of corona and short-circuit by discharge, if there are electric conductors near to.
- Take care that the resistors may become instable in resistance value by absorption of humidity when they are stored or used in high humidity environment.

■Type Designation

Example

PSN

PSN	–	0.5	CP	F	A	105	J
Product Code		Power Rating	Cap※1	RoHS	Holder※2	Nominal Resistance	Resistance Tolerance
		0.5:2W 1:5W 2:10W 3:25W 4:50W 5:125W 6:250W	C M CP		Nil:No holder A B	3 digits	J:±5% K:±10% M:±20%

PSO

PSO	–	1	C	F	105	J
Product Code		Power Rating	Cap※1	RoHS	Nominal Resistance	Resistance Tolerance
		1:4W 2:8W 3:20W 4:40W 5:100W 6:200W	C		3 digits	J:±5% K:±10% M:±20%

PV

PV	–	0.5	CP	F		105	J
Product Code		Power Rating	Cap※1	RoHS	Holder※2	Nominal Resistance	Resistance Tolerance
		0.5:2W 1:4W 2:7W 5:12W 8:20W	C M CP		Nil:No holder A B	3 digits	J:±5% K:±10% M:±20%

PN

PN	–	1	CP	F	105	J
Product Code		Power Rating	Cap※1	RoHS	Nominal Resistance	Resistance Tolerance
		0.5:1.5W 1:3W 2:6W 3:9W 4:12W	C M CP		3 digits	J:±5% K:±10% M:±20%

PWW·PAP

PWW	–	3	M	F	A	102	J
Product Code		Power Rating	Cap※1	RoHS	Holder※2	Nominal Resistance	Resistance Tolerance
PWW PAP		3:25W 4:50W 5:100W 6:200W	M		Nil:No holder A B	3 digits	J:±5% K:±10% M:±20%

※2 See next page for detail.

※1 Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
P series resistors use brass for the electrode cap. Lead in brass is a substance not subject to the EU-RoHS (exemption 6(c)), but please note that it exceeds the threshold of the EU-REACH (Reach 19th SVHC list).

■Ratings

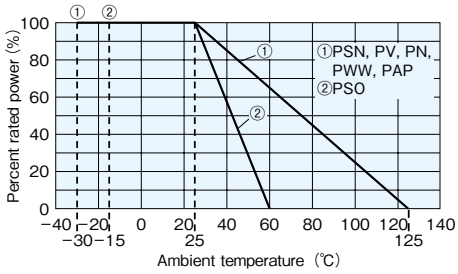
Type	Power Rating (W)	Resistance Range (Ω) J：±5% K：±10% M：±20% (E24※3)	T.C.R. (×10⁻⁶/K)	Max.Working Voltage	Impulse Withstand Voltage	Operating Temperature Range	Energy Rating 1 time/5 min.	Dimensions (mm) L	D±0.5	H (Nominal)	Weight (g) (1pcs)
PSN-0.5	2	500～500M	±1500：+25℃/−15℃ ±1000：+25℃/+85℃ (R<1GΩ)	15kV	20kV	−30℃～+125℃	50J	50±2	17.5	10	20
PSN-1	5	1k～1G		30kV	40kV		125J	100±2			30
PSN-2	10	2k～2G		60kV	80kV		400J	200±2	24	15	85
PSN-3	25	3k～3G		90kV	120kV		1.8kJ	300±2	33	20	250
PSN-4	50	4k～4G		120kV	160kV		4.0kJ	400±3	45		600
PSN-5	125	5k～5G		150kV	200kV		9.0kJ	500±3	62	25	800
PSN-6	250	6k～6G		300kV	400kV		20.0kJ	1000±5			1350
PV-0.5	2	500～500M		24kV	32kV		45J	80±2	9.5	8	12
PV-1	4	1k～1G		45kV	60kV		90J	150±2			23
PV-2	7	1.5k～1.5G					270J		17.5	10	45
PV-5	12	2.5k～2.5G		75kV	100kV		650J	250±2	24	15	105
PV-8	20	2.5k～2.5G					950J		33	20	220
PSO-1	4	1k～1G	±3000 (R≧1GΩ)	30kV	40kV	−15℃～+60℃	100J	105±5	28	10	150
PSO-2	8	2k～2G		60kV	80kV		320J	205±5	38		370
PSO-3	20	3k～3G		90kV	120kV		1.5kJ	320±5	46	20	760
PSO-4	40	4k～4G		120kV	160kV		3.2kJ	420±5	65		1900
PSO-5	100	5k～5G		150kV	200kV		7.2kJ	530±5	80	25	3500
PSO-6	200	6k～6G		300kV	400kV		16.0kJ	1050±5			6200
PN-0.5	1.5	50～500k		—	20kV	−30℃～+125℃	35J	50±2	17	8	25
PN-1	3	100～1M			40kV		70J	100±2		12	55
PN-2	6	200～2M			80kV		130J	200±2			80
PN-3	9	300～3M			120kV		200J	300±2			100
PN-4	12	400～4M			160kV		270J	400±2			125
PWW-3	25	10～800	±200	—	120kV	−30℃～+125℃	2kJ～5kJ	300±2	33	20	310
PWW-4	50	15～1.5k			160kV		4kJ～12kJ	400±3	45		660
PWW-5	100	25～2.5k			200kV		7kJ～20kJ	500±3	62	25	1300
PWW-6	200	50～5k			400kV		14kJ～40kJ	1000±5			2700
PAP-3	25	10～400		—	120kV	−30℃～+125℃	1kJ～2kJ	300±2	33	20	250
PAP-4	50	10～800			160kV		1.5kJ～4kJ	400±3	45		510
PAP-5	100	15～1k			200kV		3.5kJ～10kJ	500±3	62	25	960
PAP-6	200	25～2k			400kV		7kJ～25kJ	1000±5			1850

Rated Ambient Temperature：+25℃

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

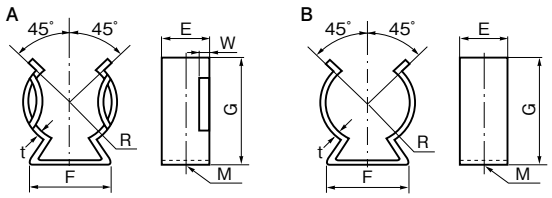
※3 Please ask of us about resistance other than E24 series.

■Derating Curve



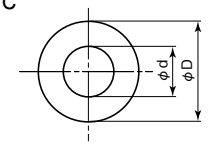
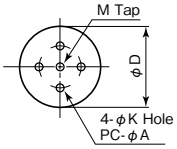
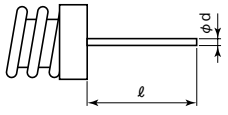
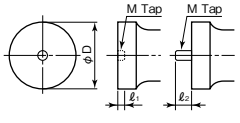
For resistors operated at an ambient temperature of 25℃ or higher, the power shall be derated in accordance with the above derating curve.

■Holder Dimensions (PSN・PV・PWW・PAP) (mm)



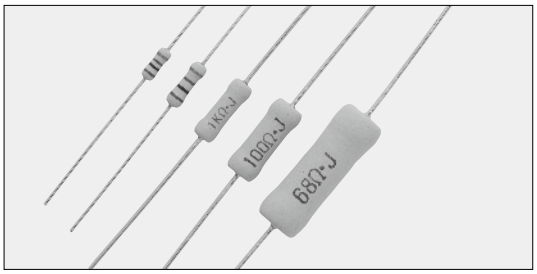
Type	R	E	F	G	M	t	W
PSN-0.5・PSN-1・PV-2	8.5	11	16	24	φ4.2	0.8	1.5±0.5
PSN-2・PV-5	11.5	15	18	32		1.0	
PSN-3・PV-8・PWW-3・PAP-3	16	18	24	40	φ6.5		1.5±1.0
PSN-4・PWW-4・PAP-4	22	20	36	59		1.5	2.0±1.0
PSN-5,6・PWW-5,6・PAP-5,6	30	25	46	74		1.5	

■Cap Dimensions (mm)

Cap Shape	C	M	CP	C
				

Type	D	d	D	M	K	A	d	ℓ	D	M	ℓ1	ℓ2
PSN-05・PSN-1・PV-2	17.5	7	17.5	3	2	7	1.0	90	—	—	—	—
PSN-2・PV-5	24	12	24	4		10	1.2	120				
PSN-3・PV-8・PWW-3・PAP-3	33	14	33	5	4	14	—	—				
PSN-4・PWW-4・PAP-4	—	—	45	6		16	—	—				
PSN-5,6・PWW-5,6・PAP-5,6	—	—	62	8	7	26	—	—				
PV-0.5・PV-1	9.5	Without hole	—	—	—	—	0.9	90				
PN-0.5	17	Without hole	—	—	—	—	1.0	90	—	—	—	—
PN-1	—	—	17	4								
PN-2～PN-4							1.2	120				
PSO-1	—	—	—	—	—	—	—	—	28	4	8	—
PSO-2									38	6	10	
PSO-3									46	8	—	15
PSO-4									65	10		20
PSO-5,6									80	12		25

MOS Fixed Metal Oxide Film Resistors (Small type)
MOSX Fixed Metal Film Resistors (Small type)



Coating color： Lavender
Marking：Color code （0.5W, 1W）
Alphanumeric （2W, 3W, 5W）

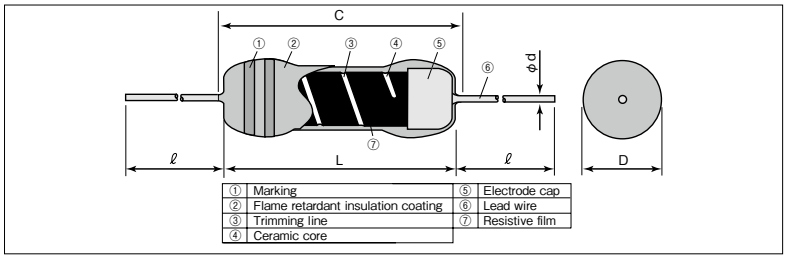
■Features

- Small size power type resistors.
- Flame retardant coating. (Equivalent to UL94 V-0)
- Automatic insertion is applicable.
- Various types of formings are available.
- High reliability.
- Products meet EU-RoHS requirements.
- Automatic mounting machine is applicable by surface mounted device style lead forming.

■Reference Standards

IEC 60115-4
JIS C 5201-4
EIAJ RC-2138

■Construction



■Dimensions

Type	Dimensions （mm）					Weight(g) (1000pcs)
	L	C Max.	D	d(Nominal)※1	ℓ※1	
MOS(X)1/2	6.2±0.5	7.1	2.5±0.5	0.6	24Min.	250
MOS(X)1	9.0±1.0	11.1	3.0±0.5			350
MOS(X)2	12.0±1.0	15.0	4.0±0.5	0.8		800
MOS(X)3	15.5±1.0	18.0	6.0±1.0		30±3	1,400
MOS(X)5	24.5±1.0	28.0	9.0±1.0		38±3	5,240

※1 Lead length changes depending on taping and forming type. Example：1C, 1CT52, 1CT526=0.6mm 1C8, 1CT528=0.8mm

■Type Designation

Example

MOS	1	C	T52	A	103	J
Product Code	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
MOS:小形酸化金属皮膜固定抵抗器 MOSX:小形金属皮膜固定抵抗器	1/2:0.5W 1:1W 2:2W 3:3W 5:5W	C:SnCu	See table below	A:AMMO R:REEL Nil:BOX TEB･TEG:Plastic embossed (N forming)	F:4 digits G,J:3 digits	F：±1% G：±2% J：±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Type	Axial Taping				Stand-off Axial Taping			VT Radial Taping			GT Radial Taping		L Forming※2							U Forming		M Forming※2						N Forming※2		
	T26	T52	T521	T631	L52	L521	L631	VTP	VTE	VTF	GT	GT4	L10A	L12.5A	L15A	L20A	L25A	L30A	L35A	U	UCL	M10	M12.5	M15	M20	M26	M30	N14.5	N17	N20
MOS(X)1/2C	○	○	—	—	—	—	—	○	○	—	○	—	○	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—
MOS(X)1C	—	○	—	—	○	—	—	○	—	—	○	○	—	○	○	—	—	—	—	○	○	—	○	○	—	—	—	○	—	—
MOS(X)2C	—	○	○	—	—	○	—	○	—	○	○	○	—	—	○	○	—	—	—	○	○	—	—	○	○	—	—	—	○	—
MOS(X)3C	—	—	○	○	—	○	○	—	—	—	○	—	—	—	—	○	○	○	—	○	○	—	—	—	○	○	—	—	—	○
MOS(X)5C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○	○	—	—	—	—	—	—	—	○	—	—	—

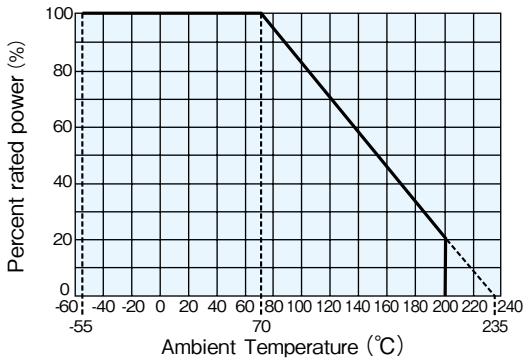
※2 P168,169 Ref. Secondary Processed Products

■Ratings

Type	Power Rating	Resistance Range (Ω) F：±1%(E24･E96)※3	G：±2%(E24)※3	J：±5%(E24)	T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping&Q'ty/AMMO pack （pcs） T26A	T52A	T521A	T631A
MOS1/2C	0.5W	10～47k	10～47k	10～47k	±300	$E=\sqrt{P\times R}$(V)	600V	400V	2,000	2,000	—	—
MOS1C	1W	10～68k	10～68k	10～100k				500V	—	2,000	—	—
MOS2C	2W	10～100k	10～100k			350V	700V		—	1,000	1,000	—
MOS3C	3W	—						700V	—	—	500	1,000
MOS5C	5W					500V	1000V	800V	—	—	—	—
MOSX1/2C	0.5W	1.0～9.1	0.22～9.1	0.1～9.1		$E=\sqrt{P\times R}$(V)	E×2.5(V)	400V	2,000	2,000	—	—
MOSX1C	1W							500V	—	2,000	—	—
MOSX2C	2W								—	1,000	1,000	—
MOSX3C	3W	—						700V	—	—	500	1,000
MOSX5C	5W							800V	—	—	—	—

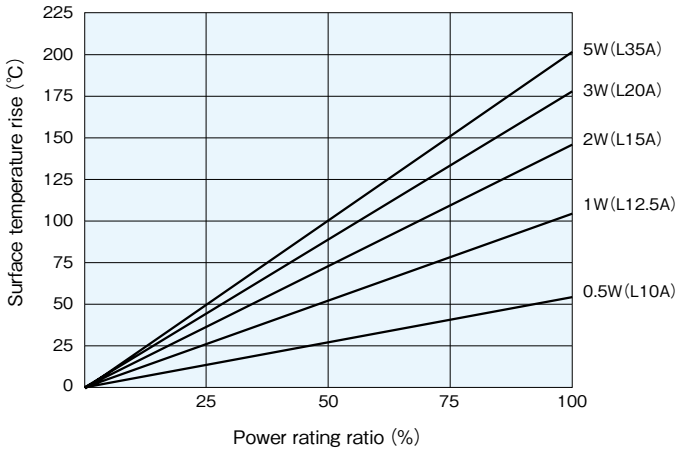
※3 Please consult with us for resistance other than catalog specification (tol.F/G)
Rated Ambient Temperature：+70℃
Operating Temperature Range：−55℃～+200℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or above, a power rating shall be derated in accordance with the above derating curve.

■Surface Temperature Rise



■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	Measuring points are 10mm±1mm from the end cap.
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	±(2%+0.1Ω)	1	Rated voltage×2.5 for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s, 350℃±10℃, 3.5s±0.5s
Terminal strength	No lead-coming off and loose terminals	—	Twist 360°, 5 times
Rapid change of temperature	1	0.5	−55℃(30min.)/+155℃(30min.) 5 cycles
Moisture resistance	±(5%+0.1Ω)	2.5	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	±(5%+0.1Ω)	2.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible	—	Ultrasonic washing with Isopropyl alcohol for 2 min. Power : 0.3W/cm², f : 28kHz, Temp : 35℃±5℃
Flame retardant	No evidence of flaming or self-flaming.	—	Flame test : The test flame shall be applied and removed for each 15 sec respectively to repeat the cycle 5 times. Overload flame retardant : AC voltage corresponding to 2, 4, 8, 16 and 32 times the power rating shall be applied for each 1min. until disconnection occurs. However the applied voltage shall not exceed the value of 4 times the maximum operating voltage.

■Precautions for Use

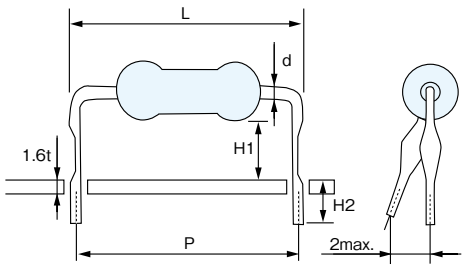
- Coating color, marking and dimensions are different depending on the manufacturing base. Verify them on the delivery specification.
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.

POWER TYPE

MOS ▌Fixed Metal Oxide Film Resistors (Small type)
MOSX ▌Fixed Metal Film Resistors (Small type)

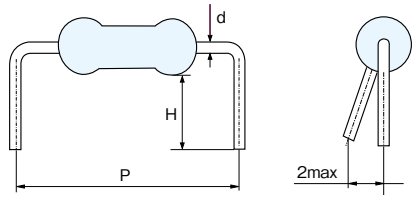
■Secondary Processed Products (mm)

L Forming



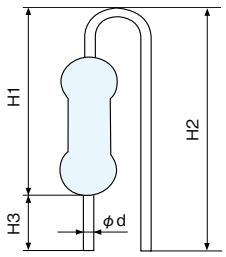
Type MOS MOSX	P±1	H_1±1	H_2±1	d (Nominal)	L max.	Substrate hole dia
1/2CL10A	10.0	5.3	4.0	0.6		φ0.8
1CL12.5A	12.5	7.0		0.8		φ1.0
1CL15A	15.0	6.5			17.5	
2CL15A		7.0				
2CL15F		4.5				
2CL20A	20.0	9.0				
2CL20D		4.8				
3CL20A		8.0				
3CL20C		10.0				
3CL20T		4.0				
3CL25A	25.0	7.0				
3CL30A	30.0	7.0				
5CL30A		8.5				
5CL35A	35.0	5.5				

M Forming



Type MOS MOSX	P±1	H±1	d (Nominal)	Substrate hole dia
1/2CM10C	10.0	3.5	0.6	φ0.8
1/2CM10F	10.0	5.0	0.6	
1CM12.5C	12.5	3.5	0.8	φ1.0
1CM12.5D	12.5	4.0	0.8	
1CM15F	15.0	5.0	0.8	
1CM15J	15.0	6.3	0.8	
1CM15S	15.0	11.0	0.8	
2CM15C	15.0	3.5	0.8	
2CM15E	15.0	4.5	0.8	
2CM20D	20.0	4.0	0.8	
2CM20U	20.0	13.5	0.8	
3CM20E	20.0	4.6	0.8	
3CM26E	26.0	4.7	0.8	
5CM30U	30.0	13.0	0.8	

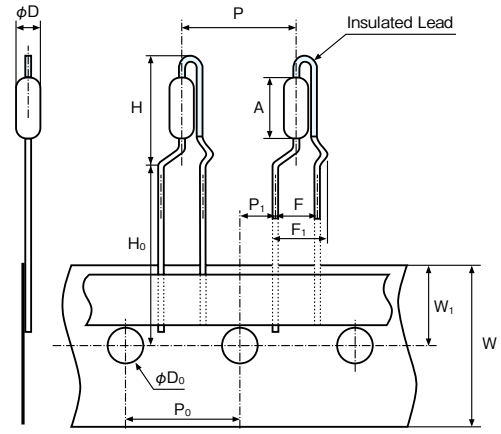
UCL Forming



Type MOS MOSX	H1±1	H2±1	H3±1	d (Nominal)	Insertion pitch	Substrate hole dia
1CUCL	13.0	17.0max.	3.5	0.8	5.0	φ1.0
2CUCL	14.5	18.5max.	3.5			
3CUCL	20.0max.	22.0	4.0			

■Secondary Processed Products (mm)

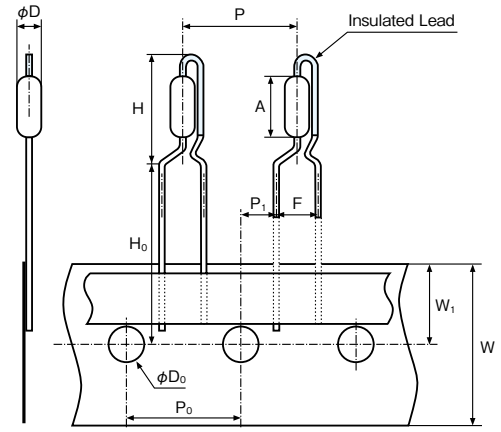
VTF Radial Taping



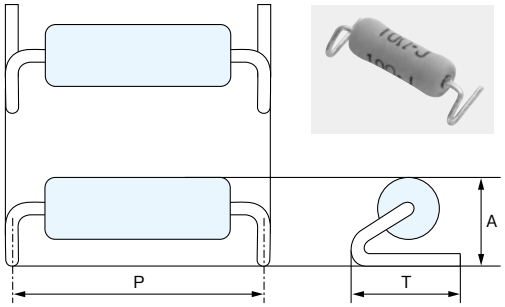
Breed	MOS/MOSX			
Rating	1/2C	1C	2C	2C
Type	VTP	VTP	VTP	VTF
A	6.2±0.5	9.0±10	12.0±1.0	12.0±1.0
ϕD	2.5±0.5	3.0±0.5	4.0±0.5	4.0±0.5
d(nominal)	0.6		0.65	0.8
F	5.0±0.5			
F_1				7.3max.
H	13max.	16max.	22.5max.	22.5max.
H_0	16+1.0/−0			
P	12.7±1.0			
P_0	12.7±0.3			
P_1	3.85±0.7			
W	18.0±0.5			
W_1	9.0±0.5			
ϕD_0	4.0±0.2			
Substrate hole dia	ϕ0.8			ϕ1.0

- The color of insulated lead : Green
- Insertion pitch : 5.0mm

VTP Radial Taping



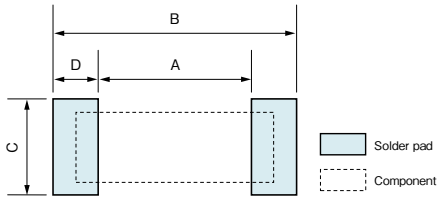
N Forming



Breed	MOS/MOSX		
Rating	1C	2C	3C
Type	N14.5TEB	N17TEB	N20TEG
P±1	14.5	17.0	20.0
T±0.5	5.0	6.0	7.5±1.0
A±0.5	4.8	5.8	6.5
d(nominal)	0.8	0.8	0.8

- Need a dedicated nozzle for automatic mounting.
- Please inquire to us before use.

Recommended Pad Dimensions

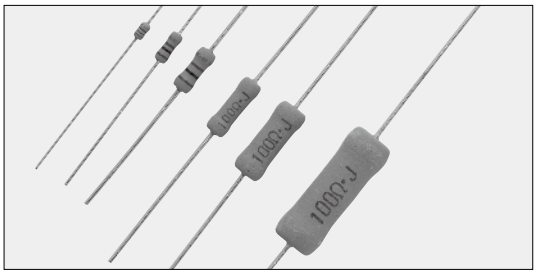


Breed	MOS/MOSX		
Rating	1C	2C	3C
Type	N14.5TEB	N17TEB	N20TEG
A	12.5	14.6	17.6
B	16.5	19.4	22.4
C	7.0	8.0	9.5
D	2.0	2.4	2.4

- Please refer to APPENDIX for the packaging specification.

Various lead forming shapes are available upon request. Please feel free to ask us.

SPR Special Power Resistors (Small type)
SPRX Fixed Metal Film Resistors (Small type)

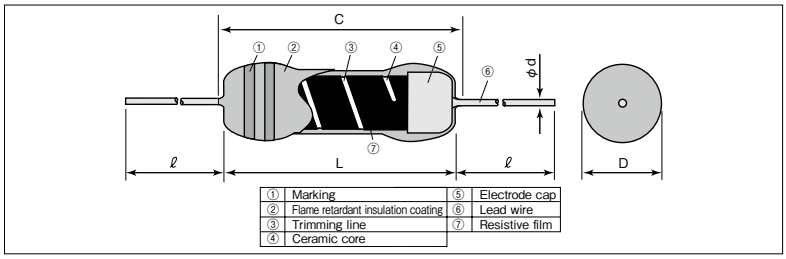


Coating color : Light green
Marking : Color code (0.25W, 0.5W, 1W)
Alphanumeric (2W, 3W, 5W)

■Features

- Small size power type resistors.
- Flame retardant coating. (Equivalent to UL94 V-0)
- Automatic insertion is applicable.
- Various types of formings are available.
- High reliability.
- Excellent in pulse characteristic.
- Products meet EU-RoHS requirements.
- Automatic mounting machine is applicable by surface mounted device style lead forming.

■Construction



①	Marking	⑤	Electrode cap
②	Flame retardant insulation coating	⑥	Lead wire
③	Trimming line	⑦	Resistive film
④	Ceramic core		

■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L	C Max.	D	d (Nominal)	ℓ ※1	
SPR(X)1/4	3.3±0.3	3.5	1.7±0.3	0.45	20Min.	140
SPR(X)1/2	6.2±0.5	7.1	2.5±0.5	0.6	24Min.	250
SPR(X)1	9.0±1.0	11.1	3.5±0.5	0.8		500
SPR(X)2	12.0±1.0	15.0	4.2±0.8			800
SPR(X)3	15.5±1.0	18.0	6.0±1.0		30±3	1,400
SPR(X)5	24.5±1.0	28.0	9.0±1.0		38±3	4,600

※1 Lead length changes depending on taping and forming type.

■Type Designation

Example

SPR	1	C	T52	A	103	J
Product Code	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
SPR: Special Power Resistors (Small type) SPRX : Fixed Metal Film Resistors (Small type)	1/4:0.25W 1/2:0.5W 1:1W 2:2W 3:3W 5:5W	C:SnCu	See table below	A:AMMO R:REEL Nil:BOX TEB·TEG:Plastic embossed (N forming)	F:4 digits G,J:3 digits	F:±1% G:±2% J:±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

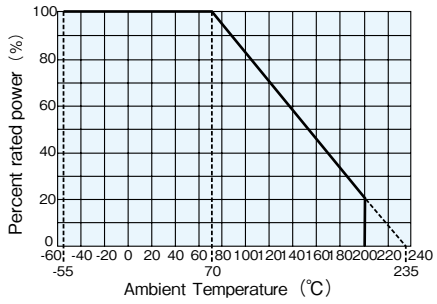
Type	Axial Taping				Stand-off Axial Taping			VT Radial Taping				GT Radial Taping	L Forming							U Forming	M Forming				N Forming	
	T26	T52	T521	T631	L52	L521	L631	VT	VTP	VTE	VTF	GT	L10A	L12.5A	L15A	L20A	L25A	L30A	L35A	U	M10	M12.5	M15	M20	N17	N20
SPR(X)1/4	○	○	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SPR(X)1/2	○	○	—	—	○	—	—	—	○	○	—	○	○	—	—	—	—	—	—	—	M10F	—	—	—	—	—
SPR(X)1	—	○	—	—	○	—	—	—	○	—	—	○	—	○	○	—	—	—	—	○	—	M12.5D	M15F	—	—	—
SPR(X)2	—	○	○	—	—	○	—	—	○	—	○	○	—	—	○	○	—	—	—	○	—	—	M15E	M20U	○	—
SPR(X)3	—	—	○	○	—	○	○	—	—	—	—	○	—	—	—	○	○	—	—	○	—	—	—	M20E	—	○
SPR(X)5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○	○	—	—	—	—	—	—	—

■Ratings

Type	Power Rating	Resistance Range (Ω)			T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)			
		F:±1% (E24·E96) ※2	G:±2% (E24) ※2	J:±5% (E24)					T26A	T52A	T521A	T631A
SPR1/4	0.25W	—	—	2.2~10k	±350	$E=\sqrt{P\times R}$(V)	500V	300V	2,000	2,000	—	—
SPR1/2	0.5W	10~91k	10~91k	2.2~91k			800V	500V	2,000	2,000	—	—
SPR1	1W						1,000V		—	2,000	—	—
SPR2	2W							700V	—	1,000	1,000	—
SPR3	3W					500V			—	—	500	1,000
SPR5	5W	10~100k	10~100k	2.2~110k		600V	1,200V	800V	—	—	—	—
SPRX1/4	0.25W	—	—	0.1~2.0		$E=\sqrt{P\times R}$(V)	E×2.5(V)	300V	2,000	2,000	—	—
SPRX1/2	0.5W	1.0~2.0	0.22~2.0					500V	2,000	2,000	—	—
SPRX1	1W								—	2,000	—	—
SPRX2	2W							700V	—	1,000	1,000	—
SPRX3	3W	—	—						—	—	500	1,000
SPRX5	5W							800V	—	—	—	—

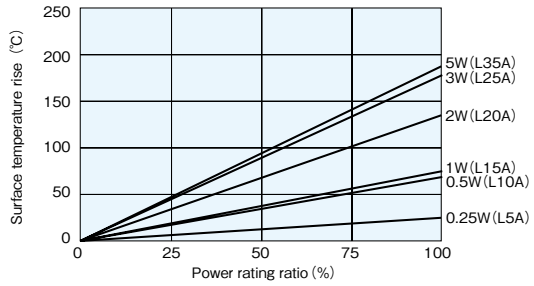
※2 Please consult with us for resistance other than catalog specification (tol.F/G)
Rated Ambient Temperature : +70℃
Operating Temperature Range : −55℃~+200℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.

■Derating Curve

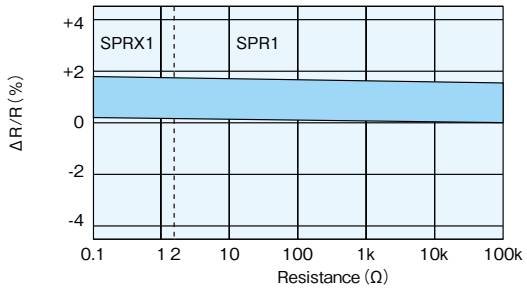


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■ Surface Temperature Rise



■Load Life at 70℃ 1000h



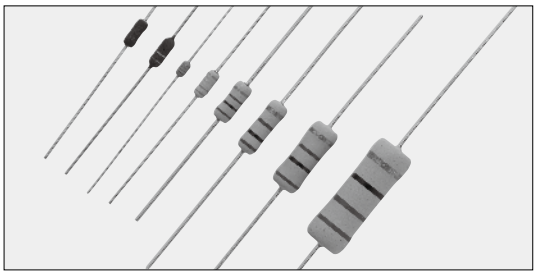
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	Measuring points are 10mm±1mm from the end cap.
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	±(1%+0.1Ω)	0.5	Rated voltage×2.5 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	1	0.5	260℃±5℃, 10s±1s, 350℃±10℃, 3.5s±0.5s
Terminal strength	No lead-coming off and loose terminals	—	Twist 360°, 5 times
Rapid change of temperature	1	0.5	−55℃(30min.)/+155℃(30min.) 5 cycles
Moisture resistance	±(3%+0.1Ω) : 1/4W~2W ±(5%+0.1Ω) : 3W, 5W	1.5 : 1/4W~2W 2.5 : 3W, 5W	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	±(3%+0.1Ω) : 1/4W~2W ±(5%+0.1Ω) : 3W, 5W	1.5 : 1/4W~2W 2.5 : 3W, 5W	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	Ultrasonic washing with Isopropyl alcohol for 2 min. Power : 0.3W/cm², f : 28kHz, Temp : 35℃±5℃
Flame retardant	No evidence of flaming or self-flaming.	—	Flame test : The test flame shall be applied and removed for each 15 sec respectively to repeat the cycle 5 times. Overload flame retardant : AC voltage corresponding to 2, 4, 8, 16 and 32 times the power rating shall be applied for each 1min. until disconnection occurs. However the applied voltage shall not exceed the value of 4 times of the maximum operating voltage.

■Precautions for Use

- Water and moisture may affect and change the high resistance range of this product largely. Consult us in advance when you consider using this product for such applications that may cause serious damage.
- Ionic impurities such as flux etc. attached to these products or mounted onto PCB, negatively affect the moisture resistance, corrosion resistance, etc. Ionic substances like sweat and salt that may be caused according to the storage environment, mounting conditions and mounting environment, also affect the above characteristics. Wash thoroughly these ionic substances. Confirm the reliability of washing and decide the dry conditions so that washing solvent is not to be remained inside the product after washing. Do not apply electricity to the product nor use the product itself until the drying is fully completed.
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.

CW Coat-Insulated Miniature Wirewound Resistors

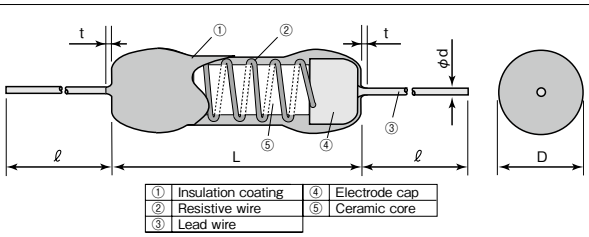


Coating color : Green (CW1/4), Blue (CW, CW□X, CW□P)
Black (CW1S, CW1SS)
Marking : Color code (CW, CW□X, CW1SS※1)
Alphanumeric (CW□P, CW1S)
※1 Two silver lines for CW1SS.

■Features

- Products meet EU-RoHS requirements.
- CW1SS has UL1412 approval. (File No. E320246)
- Automatic mounting machine is applicable by surface mounted device style lead forming.
- Flame retardant coating (Equivalent to UL94 V-0)

■Construction



①	Insulation coating	④	Electrode cap
②	Resistive wire	⑤	Ceramic core
③	Lead wire		

■Dimensions

Type	Dimensions (mm) L	D	ℓ±3.0※2	d (Nominal)	t Max.	Weight (g) (1000pcs)
CW1/4	3.3±0.3	1.9±0.3	30	0.45	0.5	140
CW1/2	6.5±1.0	2.5±1.0		0.6	1	250
CW1	9.0±1.0	3.5±1.0		0.8	3	650
CW1X		3.5$^{+1.5}_{0}$				
CW1P		3.5±1.0				
CW2	12±1.0	4.0±1.0			3	950
CW2X		4.0$^{+1.5}_{0}$				
CW2P		4.0±1.0				
CW3	15±1.0	6.0±1.0			3	1780
CW3X		6.0$^{+1.5}_{0}$				
CW3P		6.0±1.0				
CW5	24±1.5	9.0±1.5	38		3	4400
CW1S	6.5±1.0	2.5±1.0	30	0.6	1	250
CW1SS						

※2 Lead length changes depending on taping and forming type.

■Type Designation

Example

CW	3	P	C	T521	A	10R0	F
Product Code	Power Rating	Style	Terminal Surface Material	Taping & Forming	Packaging	Nominal※3 Resistance	Resistance Tolerance
	1/4 : 0.25W 1/2 : 0.5W 1 : 1W 2 : 2W 3 : 3W 5 : 5W	Nil : Power type (R≧0.1Ω) X : Power type (R<0.1Ω) P : Precision type S : Small type SS : Small type, UL approved.	C : SnCu	See table below	A : AMMO R : REEL TEB·TEG : Plastic embossed (N forming) Nil : BOX	C, D, F : 4 digits G, J, K : 3 digits	C : ±0.25% D : ±0.5% F : ±1% G : ±2% J : ±5% K : ±10%

Resistance Value (Ω)	3 digits
10m~91m	10L~91L
0.1~0.91	R10~R91
1~9.1	1R0~9R1

Resistance Value (Ω)	4 digits
0.1~0.976	R100~R976
1~9.76	1R00~9R76

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Type	Axial Taping T26	T52	T521	T631	Stand-off axial taping L52	Radial Taping VTP	GT	L Forming L10A	L12.5A	L15A	L20A	L25A	L30A	L35A	N Forming N17	N20
CW1/4	○	○														
CW1/2		○			○	○		○								
CW1		○			○	○※3			○	○						
CW2		○	○			○	○			○	○				○	
CW3			○	○			○				○	○				○
CW5													○	○		
CW1X		○			○				○	○						
CW2X			○			○	○			○	○					
CW3X			○	○							○	○				
CW1S		○			○	○		○								
CW1SS		○														
CW1P		○			○	○※3			○	○						
CW2P		○	○			○	○			○	○					
CW3P			○	○			○				○	○				

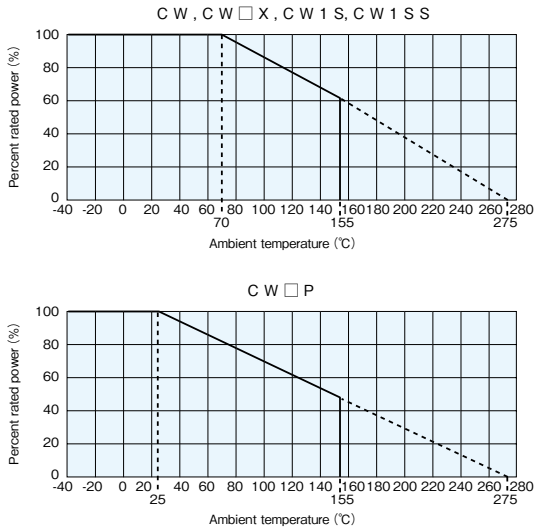
※3 Applicable to 0.47Ω or over.

■Ratings

Type	Power Rating	Rated Ambient Temp.	Resistance Range (Ω) C : ±0.25% E24・E96	D : ±0.5% E24・E96	F : ±1% E24・E96	G : ±2% E24	J : ±5% E24	K : ±10% E24	T.C.R. (×10⁻⁶/K)	Operating Temp. Range	Taping & Q'ty/AMMO (pcs) T26A	T52A	T521A	T631A
CW1/4	0.25W	+70℃	–	–	–	–	0.47~15	0.47~15	±250	−40℃ ~+155℃	2,000	3,000	–	–
CW1/2	0.5W		–	–	–	–	0.1 ~100	0.1 ~100			–	2,000	–	–
CW1	1W		–	–	–	0.1~390	0.1 ~390	–			–	1,000	–	–
CW2	2W		–	–	–	0.1~390	0.1 ~390	–			–	1,000	1,000	–
CW3	3W		–	–	–	0.1~390	0.1 ~390	–			–	–	500	500
CW5	5W		–	–	–	0.1~390	0.1 ~390	–			–	–	–	–
CW1X	1W		–	–	–	–	0.01~0.091	0.01~0.091	±500		–	1,000	–	–
CW2X	2W		–	–	–	–	0.01~0.091	0.01~0.091			–	–	1,000	–
CW3X	3W		–	–	–	–	0.01~0.091	0.01~0.091			–	–	500	500
CW1S	1W		–	–	–	–	0.1 ~100	0.1 ~100	±250		–	2,000	–	–
CW1SS	1W		–	–	–	–	10	–	±100		–	2,000	–	–
CW1P	1W	+25℃	1~100	0.47~220	0.1~430	–	–	–	±90 : R≧10Ω ±50 : R<10Ω	−40℃ ~+155℃	–	1,000	–	–
CW2P	2W		1~390	0.47~390	0.1~390	–	–	–			–	1,000	1,000	–
CW3P	3W		1~390	0.47~390	0.1~390	–	–	–			–	–	500	500

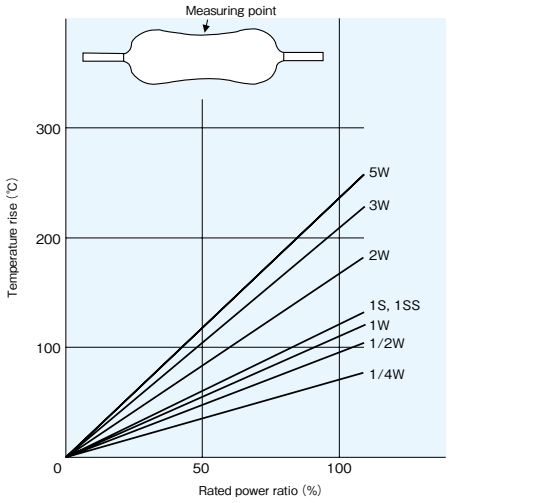
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$.

■Derating Curve



For resistors operated at an ambient temperature or higher,the power shall be derated in accordance with the above derating curve.

■Temperature Rise (Ref.)



Fixing Board t=1.2 Material : Glass Epoxy Board

■Performance

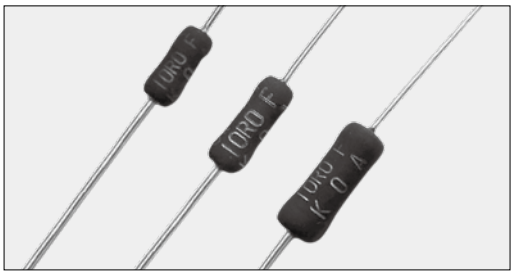
Test Items	Performance Requirements ΔR±(%+0.05Ω) : CW, CW1S, CW1SS, CW□P ΔR±(%+0.005Ω) : CW□X		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	CW, CW□X, CW1S, CW1SS : +25℃/+125℃ CW□P : +25℃/−40℃ and +25℃/+155℃
Overload (Short time)	1 : CW, CW□X 2 : CW1S, CW1SS 0.5 : CW□P 0.2 : CW□P (R<10Ω) ※4	0.8 : CW, CW□X 1.8 : CW1S, CW1SS 0.4 : CW□P 0.18 : CW□P (R<10Ω)	Power rating×10, 5s (CW, CW□X, CW1S, CW1SS) Power rating×6.25, 5s (CW□P) Power rating×5, 5s (CW□P : R<10Ω) ※4
Resistance to soldering heat	1 : CW, CW1S, CW1SS, CW□X 0.5 : CW□P 0.2 : CW□P (R<10Ω) ※4	0.8 : CW, CW1S, CW1SS, CW□X 0.4 : CW□P 0.18 : CW□P (R<10Ω)	350℃±10℃, 3.5s or 260℃±5℃, 10s
Moisture resistance	5 : CW, CW1S, CW□X 2 : CW□P 0.5 : CW□P (R<10Ω) ※4	4 : CW, CW1S, CW□X 1.6 : CW□P 0.45 : CW□P (R<10Ω)	Power rating×1/10, 40℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 25℃ or 70℃	5 : CW, CW1S, CW1SS, CW□X 2 : CW□P 0.5 : CW□P (R<10Ω) ※4	4 : CW, CW1S, CW□X 1.6 : CW□P, CW1SS 0.45 : CW□P (R<10Ω)	70℃, 1000h (CW, CW□X, CW1S, CW1SS) 25℃, 1000h (CW□P) 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance such as disappearance of marking, etc.	—	On immersing the sample in IPA for 3 minutes, the resisor surface should be lightly wiped with a dry cloth (velvet or gauze).
Thunder surge	3 : CW1SS	—	Combination wave +1.5kV 20sec 3cycles

※4 Refer to MIL-PRF-26G standard.

■Precautions for Use

- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.

CW-H Coat-Insulated Miniature Wirewound Resistors



Coating color : Black
Marking : Alphanumeric

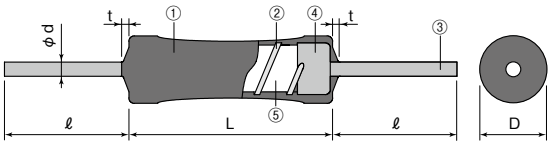
■Features

- Resistors meet MIL-PRF-26.
- High precision resistor with T.C.R. : ±20×10⁻⁶/K.
- Excellent stability for a long time.
- Products meet EU-RoHS requirements.

■Reference Standards

MIL-PRF-26
JIS-C-5201-1

■Construction



①	Insulation coating	④	Electrode cap
②	Resistive wire	⑤	Ceramic core
③	Lead wire		

■Dimensions

Type	Dimensions (mm)					Weight(g) (1000pcs)
	L±1.0	D±1.0	ℓ±3.0	d (Nominal)	t Max.	
CW1H	9.0	3.5	30	0.8	3	650
CW2H	12.0	4.0				950
CW3H	15.0	6.0				1,780

■Type Designation

Example

CW	1	H	C	T52	A	1R00	F
Product Code	Power Rating	Style	Termination Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	1 : 1W 2 : 2W 3 : 3W	H : Stability	C : SnCu	See table below	A : AMMO R : Reel Nil : BOX	4 digits	D : ±0.5% F : ±1%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Type	Axial Taping			Radial Taping		L Forming			
	T52	T521	T631	VTP	GT	L12.5A	L15A	L20A	L25A
CW1H	○			○※1	○	○	○		
CW2H	○※1	○		○	○		○	○	
CW3H		○	○		○			○	○

※1 Applicable to 0.47Ω or over

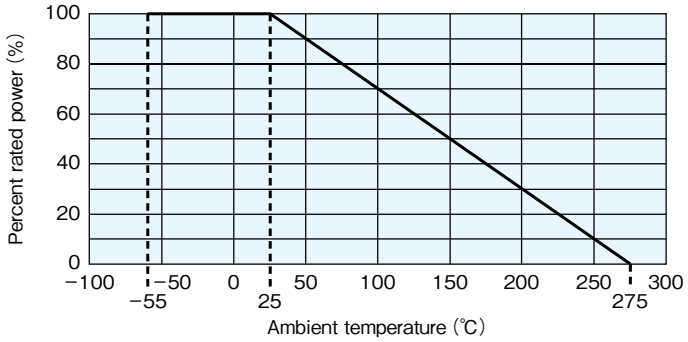
■Ratings

Type	Power Rating	Rated Ambient Temperature	Resistance Range (Ω) D : ±0.5% E24・E96	Resistance Range (Ω) F : ±1% E24・E96	T.C.R. (×10⁻⁶/K)	Operating Temp. Range	Max. Working Voltage (V)	Max. Overload Voltage (V)	Taping & Q'ty /AMMO (pcs) T52	T521	T631
CW1H	1W	+25℃	0.47～220	0.1～430	±20 : R≧10Ω ±50 : R<10Ω	−55℃～+275℃	$E=\sqrt{(P\times R)}$	$E=\sqrt{(P\times R\times 5)}$	1,000	–	–
CW2H	2W		0.47～750	0.1～2k					1,000	1,000	–
CW3H	3W		0.47～1k	0.1～3k					–	500	500

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$.

High Power Type Resistors

■Derating Curve



For resistors operated at an ambient temperature of 25℃ or higher, the power shall be derated in accordance with the above derating curve.

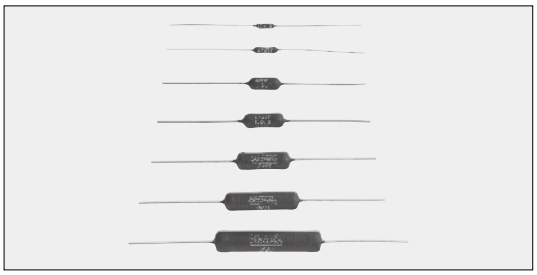
■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/125℃
Short time overload	0.2	0.15	Power rating×5, 5s
Resistance to soldering heat	0.2	0.15	350℃±10℃, 3s±0.5s 260℃±5℃, 10s±1s
Load life	0.5	0.45	25℃, Power rating 1.5h ON/0.5h OFF 2000h
Low Temperature	0.2	0.15	−55℃, 24h
High Temperature	0.5	0.45	+275℃, 250h

■Precautions for Use

- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats.Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.

RW Coat-insulated Miniature Precision Power Wirewound Resistors



Coating color : Black
Marking : Alphanumeric

■Features

- Resistors meet MIL-R-26E (U and V characteristics) and surface temp. (hot spot) 350℃ max.
- Resistors with a wide range of 0.1Ω～62kΩ, covering applications from precision to power.
- RW□N type resistors are non-inductive wound and can be used in high frequency bands.
- Products meet EU-RoHS requirements.

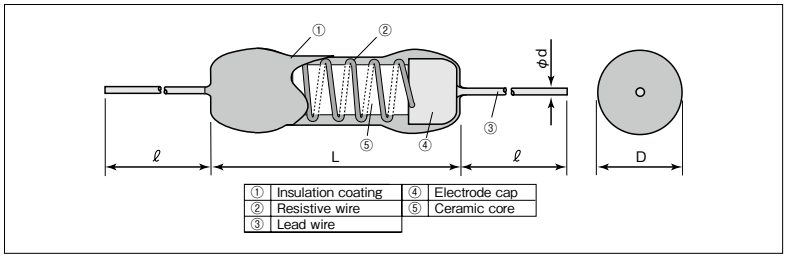
■Applications

- Inrush current preventitive resistors.
- Resistors for various power supplies such as instrumentations, communications, medical, etc.
- Resistors for semiconductor burn-in boards.

■Reference Standard

MIL-R-26E

■Construction



①	Insulation coating	④	Electrode cap
②	Resistive wire	⑤	Ceramic core
③	Lead wire		

■Dimensions

Type	Dimensions (mm)				Weight(g) (1000pcs)
	L	D	d (Nominal)	ℓ	
RW1/2・RW1/2N	8.0±1.0	$1.6^{+1.0}_{-0}$	0.5	38±3	180
RW1 ・RW1N	10.5±1.0	2.7±1.0			270
RW2 ・RW2N	13.0±1.0	5.2±1.0	0.8		1,000
RW3 ・RW3N	16.5±1.0	6.4±1.0	1.0		1,820
RW5 ・RW5N	22.0±1.0	7.8±1.5			3,240
RW7 ・RW7N	31.5±1.0				5,060
RW10 ・RW10N	46.0±1.5	9.3±1.5			8,900

■Type Designation

Example

RW	1/2		T	100	J
Product Code	Power Rating	Winding Method	Terminal Surface Material	Nominal Resistance	Resistance Tolerance
	1/2 : 0.5W 1 : 1W 2 : 2W 3 : 3W 5 : 5W 7 : 7W 10 : 10W	Nil : Standard winding N : Non-inductive winding	T : Sn	D, F : 4 digits H, J : 3 digits	D : ±0.5% F : ±1% H : ±3% J : ±5%

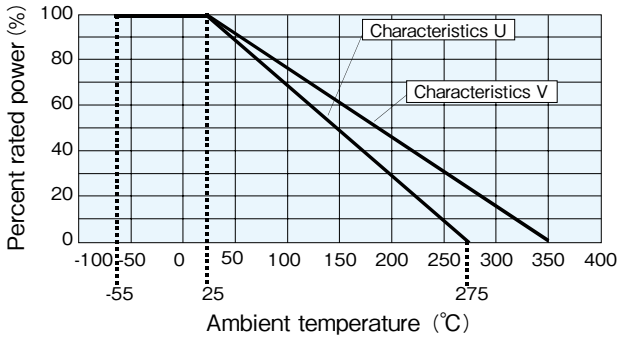
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Type	Power Rating		Resistance Range (Ω)				T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Max. Overload Voltage
	Characteristics U	Characteristics V	D : ±0.5% E24・E96 25×10ⁿ・50×10ⁿ	F : ±1% E24・E96 25×10ⁿ・50×10ⁿ	H : ±3% E24 25×10ⁿ・50×10ⁿ	J : ±5% E24 25×10ⁿ・50×10ⁿ			
RW1/2T	0.5W	–	10～2.61k	10～2.61k	0.47～2.7k	0.47～2.7k	+20/−50 : R≧10Ω +50/−70 : 1Ω≦R<10Ω +400/−90 : R<1Ω	80V	150V
RW1/2NT			–	10～2.37k	10～2.4k	10～2.4k			
RW1T	1W	–	1～5.11k	1～5.11k	0.1～5.1k	0.1～5.1k		130V	300V
RW1NT			–	10～3.74k	10～3.6k	10～3.6k			
RW2T	2W	3W	1～10k	1～10k	0.1～10k	0.1～10k		140V	500V
RW2NT			–	15～10k	10～10k	10～10k			
RW3T	3W	5W	1～15k	1～15k	0.1～15k	0.1～15k		200V	600V
RW3NT			–	15～15k	15～15k	15～15k			
RW5T	5W	7W	1～30.1k	1～30.1k	0.1～30k	0.1～30k		400V	700V
RW5NT			–	20～29.4k	20～30k	20～30k			
RW7T	7W	10W	1～45.3k	1～45.3k	0.1～47k	0.1～47k		600V	800V
RW7NT			–	36～44.2k	36～43k	36～43k			
RW10T	10W	14W	1～60.4k	1～60.4k	0.1～62k	0.1～62k		1000V	1500V
RW10NT			–	62～49.9k	62～51k	62～51k			

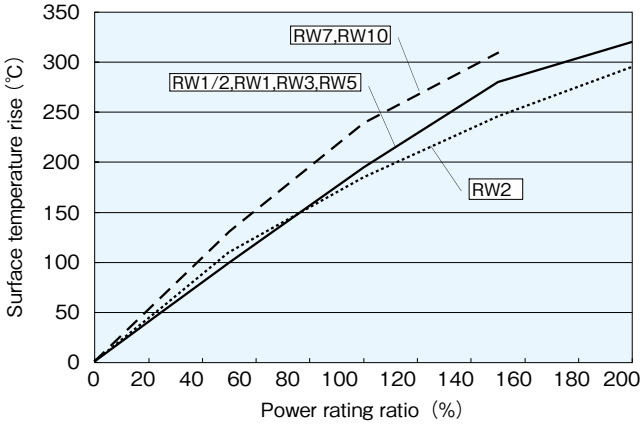
※Resistance tolerance B (±0.1%) available. Please refer to us.
Rated Ambient Temperature : +25℃
Operating Temperature Range : Characteristics U −55℃～+275℃, Characteristics V −55℃～+350℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value or Max. working voltage, whichever is lower.}}$
Characteristics U and V: Each performance is different depending on use conditions, but no difference of the product itself.

■Derating Curve



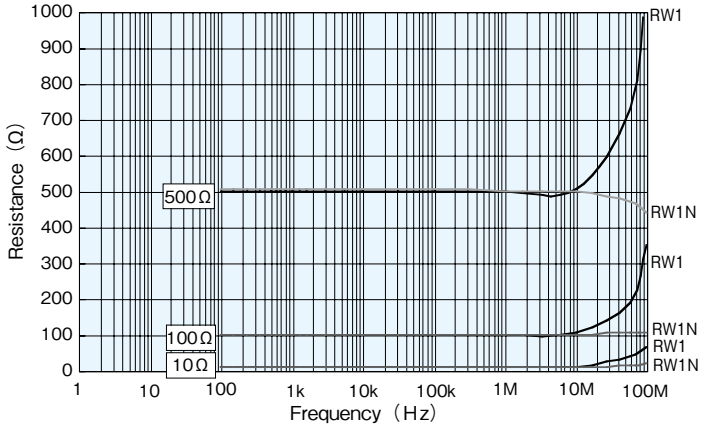
For resistors operated at an ambient temperature of 25℃ or higher, the power shall be derated in accordance with the above derating curve.

■Surface Temperature Rise



(Characteristics U)

■Frequency Characteristic (Reference)



■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)	Test Method
Resistance	Within specified tolerance	25℃
T.C.R.	Within specified T.C.R.	+25℃/−55℃、+25℃/+125℃
Overload (Short time)	0.2 : U	Rated power×5 or Max. overload vol., whichever is lower, for 5s
	2 : V	Rated power×10 or Max. overload vol., whichever is lower, for 5s
Resistance to soldering heat	0.1	350℃±10℃, 3s±0.5s or 260℃±5℃, 10s±1s
Moisture resistance	0.2 : U 2 : V	Power rating×1/10, 40℃, 90%～95%RH, 1000 h 1.5h ON/0.5h OFF cycle
Endurance at 25℃	0.5 : U 3 : V	25℃, 2000 h 1.5h ON/0.5h OFF cycle
High temperature exposure	0.2 : U	275$^{+5}_{-0}$℃, 250h
	2 : V	350$^{+5}_{-0}$℃, 250h

■Precautions for Use

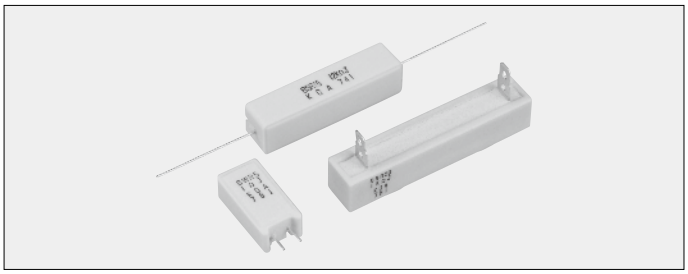
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.

POWER TYPE

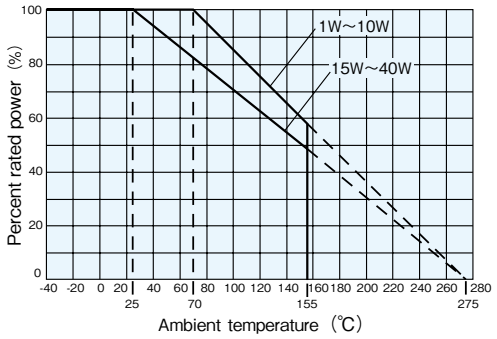
EU RoHS

INDEX

BGR ▌Rectangular Type Wirewound Resistors With Glass Core
BWR ▌Rectangular Type Wirewound Resistors With Ceramic Core
BSR ▌Rectangular Type Metal Oxide Film Resistors



■Derating Curve



For resistors operated at an ambient temperature or higher,the power shall be derated in accordance with the above derating curve.

■Ratings

Type	Power Rating	Resistance Range (Ω) E24				Style & Weight (g/1pcs)													
		F : ±1%	G : ±2%	J : ±5%	K : ±10%	S	N	E	P	X	Y	YS	Z	H	Q	HA	HB	QA	QB
BWR1	1W	1～56	0.22～75	0.1～75	—	1.3	—	—	—	—	—	—	—	—	—	—	—	—	—
BWR2	2W	1～160	0.22～200	0.1～200	—	2.1	3.9	—	—	—	—	—	—	—	—	—	—	—	—
BWR3	3W	1～300	0.22～390	0.1～390	—	3.9	5.9	—	—	—	—	—	—	—	—	—	—	—	—
BWR5	5W	1～300	0.22～390	0.1～390	—	5.1	7.2	5.7	5.6	—	—	—	—	—	—	—	—	—	—
BWR7	7W	1～360	0.22～390	0.1～390	—	7.5	10.8	—	—	—	—	—	—	—	—	—	—	—	—
BWR10	10W	1～390	0.22～390	0.1～390	—	10.2	15.0	—	—	—	—	—	—	—	—	—	—	—	—
BWR15	15W	1～390	0.22～390	0.1～390	—	18.8	—	—	—	—	—	—	—	—	—	—	—	—	—
BWR20	20W	1～390	0.22～390	0.1～390	—	23.3	—	—	—	—	—	—	—	—	—	—	—	—	—
BGR5	5W	—	—	10～390	0.39～9.1	—	—	—	—	6.1	7.6	6.6	7.6	—	6.2	—	—	—	—
BGR7	7W	—	—	10～390	0.39～9.1	—	—	—	—	8.2	9.1	7.8	9.1	—	7.8	—	—	—	—
BGR10	10W	—	—	10～390	0.39～9.1	—	—	—	—	11.0	12.4	10.4	11.4	9.9	10.7	13.6	—	14.5	—
BGR15	15W	—	—	10～390	0.51～9.1	—	—	—	—	18.8	—	—	20.5	18.4	18.6	24.4	27.5	24.6	27.7
BGR20	20W	—	—	10～390	0.51～9.1	—	—	—	—	22.3	—	—	24.0	21.9	22.1	27.9	31.0	28.1	31.3
BGR30	30W	—	—	10～390	2.2～9.1	—	—	—	—	—	—	—	—	59.3	59.6	73.9	73.5	74.2	73.8
BGR40	40W	—	—	10～390	2.2～9.1	—	—	—	—	—	—	—	—	70.4	70.6	85.0	84.6	85.2	84.8
BSR2	2W	—	—	430～13k	—	2.1	3.8	—	—	—	—	—	—	—	—	—	—	—	—
BSR3	3W	—	—	430～27k	—	3.9	5.9	—	—	—	—	—	—	—	—	—	—	—	—
BSR5	5W	—	—	430～51k	—	5.1	7.2	5.7	—	6.1	7.6	6.6	7.6	—	6.2	—	—	—	—
BSR7	7W	—	—	430～56k	—	7.4	10.8	—	—	8.2	9.1	7.8	9.1	—	7.8	—	—	—	—
BSR10	10W	—	—	430～75k	—	10.2	15.0	—	—	11.0	12.4	10.4	11.4	10.9	10.7	13.7	—	14.5	—
BSR15	15W	—	—	430～56k	—	18.8	—	—	—	18.5	—	—	20.5	18.4	18.6	24.4	27.5	24.6	27.7
BSR20	20W	—	—	430～56k	—	23.3	—	—	—	22.0	—	—	24.0	21.9	22.1	27.9	31.0	28.1	31.3

Type	Power Rating	Rated Ambient Temperature	Max.Working Voltage (V)		Max.Overload Voltage (V)		T.C.R. (×10⁻⁶/K)			Operating Temp. Range
			BSR	BGR・BWR	BSR	BGR・BWR	BWR	BSR	BGR	
BWR1	1W	+70℃	—	E=√P・R	—	E=√P・R・10	±100	—	—	−40℃～+155℃
B□R2	2W		250		500			±300		
B□R3	3W		300		600					
B□R5	5W		350		700				±250	
B□R7	7W		500		1000					
B□R10	10W		700		1400					
B□R15	15W	+25℃	700		1400					
B□R20	20W		750		1500					
BGR30	30W		—		—		—	—		
BGR40	40W									

Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
Please consult with us in advance about custom-made products.

■Type Designation

Example

BWR	3	C	N	100	J
Product Code	Power Rating	Terminal※1 Surface Material	Style※2	Nominal Resistance	Resistance Tolerance
BGR : Wirewound (Glass core) BWR : Wirewound (Ceramic core) BSR : Metal oxide film	See table above	C : SnCu T : Sn	Nil : S style N : N style E : E style P : P style X : X style Y : Y style YS : YS style Z : Z style H : H style Q : Q style HA : HA style HB : HB style QA : QA style QB : QB style	F : 4 digits G,J,K : 3 digits	F : ±1% G : ±2% J : ±5% K : ±10%

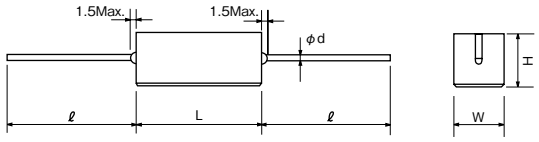
※1 Lead-Free plated terminal symbols.
C (SnCu) : N, E, S and P styles
T (Sn) : X, Y, YS, Z, H and Q styles
※2 No indication on style means S style.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Features

- High-power resistor.
- Using flame-retardant/insulated ceramic case.
- Excellent in anti-pulse and inrush current.
- Products meet EU-RoHS requirements.

■Dimensions

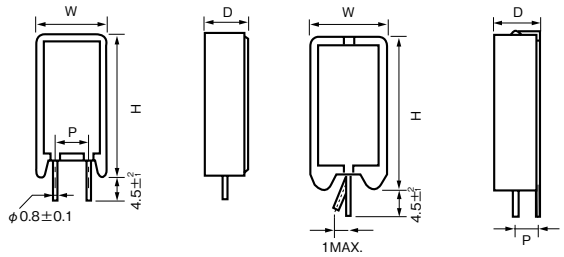
①S Style



Type	Dimensions (mm)				
	L	W	H	ℓ ±3	d±0.1
BWR1C	13±1.0	5.5±1.0	5.5±1.0	30	0.6
BWR2C・BSR2C	18±1.5	6.3±1.0	6.3±1.0	35	0.8
BWR3C・BSR3C	22±1.5	8.0±1.0	8.0±1.0		
BWR5C・BSR5C		9.5±1.0	9.5±1.0		
BWR7C・BSR7C	35±1.5				
BWR10C・BSR10C	48±1.5				
BWR15C・BSR15C		12.5±1.2	12.5±1.2		
BWR20C・BSR20C	63.5±1.5	12.5±1.5	12.5±1.5		

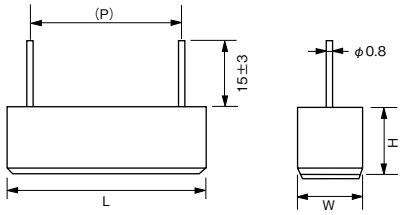
②N Style

③E Style



Type	Dimensions (mm)			
	W±1	D±1	H±1.5	P±2 1
BWR2CN・BSR2CN	11	7	20.5	5
BWR3CN・BSR3CN	12	8	25	
BWR5CN・BSR5CN	13	9	25.5	
BWR7CN・BSR7CN			38.5	
BWR10CN・BSR10CN	16	12	35	7.5
BWR5CE・BSR5CE	9.5	9.5	23.5	5

④P Style



Type	Dimensions (mm)			
	L	W±1.5	H±1.5	(P)
BWR5CP	23±1.5	9.5	9.5	20

Parenthesized dimensions are for reference.
Please refrain from using these parts as a board-insertion type.
Only soldering doesn't have enough joint strength.
Additional fixation is recommended.

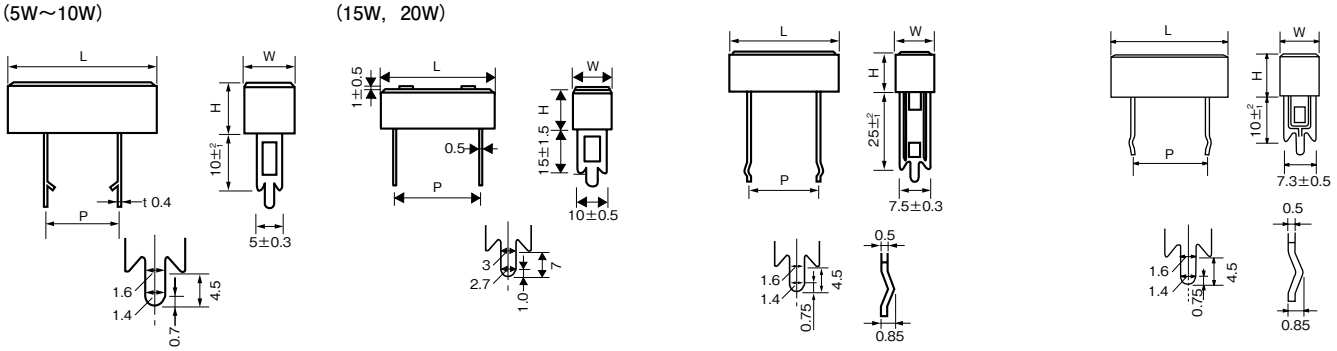
⑤X Style

(5W～10W)

(15W, 20W)

⑥Y Style

⑦YS Style



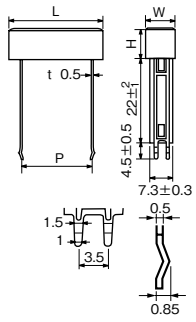
Type	Dimensions (mm)			
	L±1.5	W±1.0	H±1.0	P±1.5
BGR5TX・BSR5TX・BGR5TY・BSR5TY・BGR5TYS・BSR5TYS	27	9.5	9.5	15
BGR7TX・BSR7TX・BGR7TY・BSR7TY・BGR7TYS・BSR7TYS	35			22.5
BGR10TX・BSR10TX・BGR10TY・BSR10TY・BGR10TYS・BSR10TYS	48			35
BGR15TX・BSR15TX		12.5	12.5	32.5
BGR20TX・BSR20TX	63.5			47.5

POWER TYPE

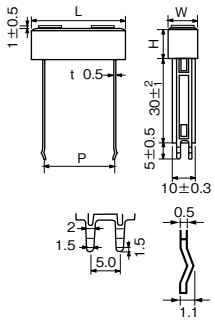
■Dimensions

⑧Z Style

(5W～10W)

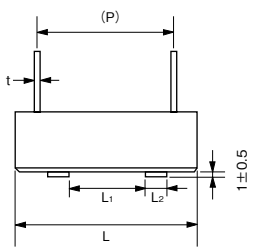


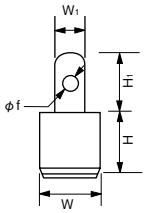
(15W, 20W)



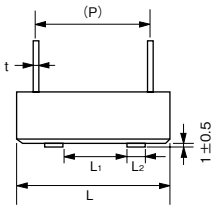
Type	Dimensions (mm)			
	L±1.5	W±1.0	H±1.0	P
BGR5TZ・BSR5TZ	27	9.5	9.5	15^{+6}_{-2}
BGR7TZ・BSR7TZ	35			22.5^{+6}_{-2}
BGR10TZ・BSR10TZ	48			35^{+6}_{-2}
BGR15TZ・BSR15TZ		12.5	12.5	32.5^{+4}_{-0}
BGR20TZ・BSR20TZ	63.5			47.5^{+4}_{-0}

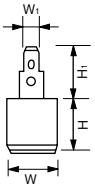
⑨H Style



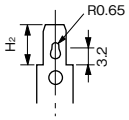


⑩Q Style

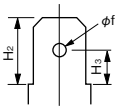




(15W, 20W)



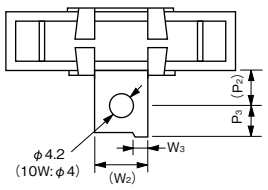
(5W,7W,10W,30W,40W)

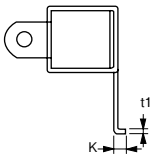


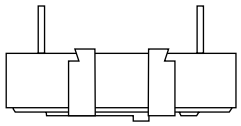
Type	Dimensions (mm)											
	L	L_1	L_2	W	W_1	H	H_1±1.0	H_2	(H_3)	(P)	t	(ϕf)
BGR10TH・BSR10TH	48±1.5	25±1.0	4.5	9.5±1.0	5.0	9.5±1.0	7.0	—	—	35	0.4	2.0
BGR15TH・BSR15TH			7.0	12.5±1.2	6.0	12.5±1.2	8.5			34.5	0.5	2.5
BGR20TH・BSR20TH	63.5±2									49.5		
BGR30TH	75±2.5	40±1.2	10.0	19.0±1.5	7.5	19.0±1.5	11.0			56		3.0
BGR40TH	90±2.5									71		
BGR5TQ・BSR5TQ	27±1.5	—	—	9.5±1.0	4.75	9.5±1.0	10.5	6.5	3.3	15.0	0.5	2.2
BGR7TQ・BSR7TQ	35±1.5	—	—							22.5		
BGR10TQ・BSR10TQ	48±1.5	25±1.0	4.5							35.0		
BGR15TQ・BSR15TQ			7.0	12.5±1.2		12.5±1.2	13.0	6.35	—	34.5		—
BGR20TQ・BSR20TQ	63.5±2									49.5		
BGR30TQ	75±2.5	40±1.2	10.0	19.0±1.5	6.3	19.0±1.5	12.0	8.0	4.1	56	0.8	1.7
BGR40TQ	90±2.5									71		

Parenthesized dimensions are for reference.

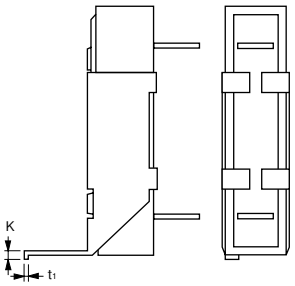
⑪HA・QA Style

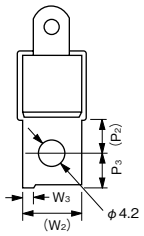






⑫HB・QB Style



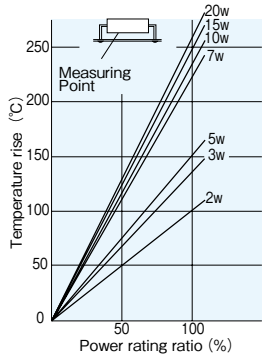


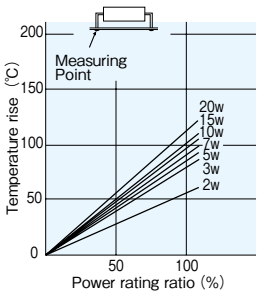
Type	Dimensions (mm)					
	(P_2)	P_3±1	(W_2)	W_3±0.3	K±0.3	t_1
BGR10THA・BSR10THA・BGR10TQA・BSR10TQA	8.0	6	12	3.0	2.8	0.6
BGR15THA・BSR15THA・BGR15TQA・BSR15TQA BGR15THB・BSR15THB・BGR15TQB・BSR15TQB					3.0	0.8
BGR20THA・BSR20THA・BGR20TQA・BSR20TQA BGR20THB・BSR20THB・BGR20TQB・BSR20TQB						
BGR30THA・BGR30TQA BGR30THB・BGR30TQB	10	8	18	3.0	3.0	
BGR40THA・BGR40TQA BGR40THB・BGR40TQB						

Parenthesized dimensions are for reference.

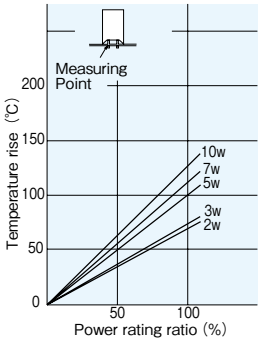
■Temperature Rise (Ref.)

①S Style

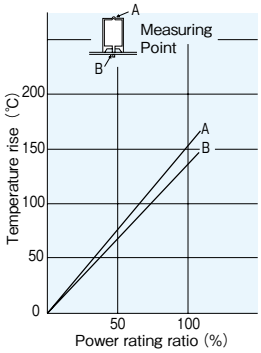




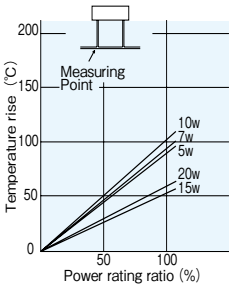
②N Style



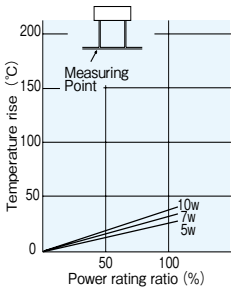
③E Style



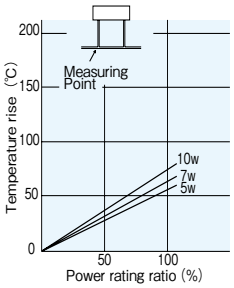
④X Style



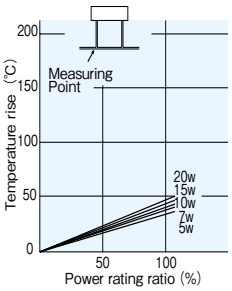
⑤Y Style



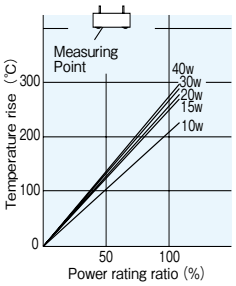
⑥YS Style



⑦Z Style



⑧H, Q Style



■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	1 : BWR, BSR 2 : BGR	0.8 : BWR 1.7 : BGR 0.9 : BSR	350℃±10℃、3.5s
Moisture resistance	3 : BWR, BGR 5 : BSR	2.4 : BWR 2.55 : BGR 4.5 : BSR	Power rating×1/10、40℃、90%~95%RH、1000h 1.5h ON/0.5h OFF cycle
Endurance at 25℃ or 70℃	3 : BWR 5 : BGR, BSR	2.4 : BWR 4.25 : BGR 4.5 : BSR	25℃ or 70℃, rated voltage, 1000h, 1.5h ON/0.5h OFF cycle

■Precautions for Use

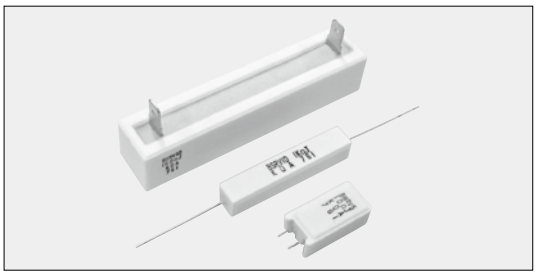
- The products attached by ionic impurities negatively affects their moisture resistance, corrosion resistance, etc. Please pay careful attention to products handling as well as storage, mounting conditions and environment.
- When the pulse including surge is impressed to the resistor, it may cause disconnection. Please confirm us about the conditions for use in advance.
- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.

POWER TYPE

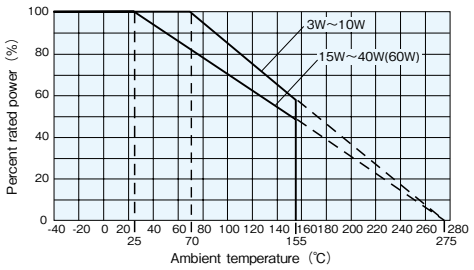
EU RoHS

INDEX

BGRV ▌Rectangular Type Wirewound Resistors With Glass Core (For Automotive)
BWRV ▌Rectangular Type Wirewound Resistors With Ceramic Core (For Automotive)
BSRV ▌Rectangular Type Metal Oxide Film Resistors (For Automotive)



■Derating Curve



For resistors operated at an ambient temperature or higher,the power shall be derated in accordance with the above derating curve.

■Features

- High-power resistor.
- Using flame-retardant/insulated ceramic case.
- Excellent in anti-pulse and inrush current.
- Suitable for high reliable applications like Automotives. AEC-Q200 Tested.※1
- Products meet EU-RoHS requirements.

■Applications

- Pre-charge/(Passive and Active) Discharge resistors for HEV, PHEV, EV.

■Ratings

Type	Power Rating	Pulse Energy Capacity (J) ※2	Resistance Range (Ω) E24		Style & Weight (g/1pcs)					
			J : ±5%	K : ±10%	S※1	N※1	Q	QA	QC	QE
BWRV3	3W	11	1.0~390	—	3.9	5.9	—	—	—	—
BWRV5	5W	17	1.0~390	—	5.1	7.2	—	—	—	—
BWRV7	7W	52	1.0~390	—	7.5	10.8	—	—	—	—
BWRV10	10W	100	1.0~390	—	10.2	15.0	—	—	—	—
BWRV15	15W	100	1.0~390	—	18.8	—	—	—	—	—
BWRV20	20W	180	1.0~390	—	23.3	—	—	—	—	—
BWRV40	40W(60W)	549	4.3~220	—	—	—	93.5	—	—	107.5
BGRV5	5W	16	10~390	5.1~9.1	—	—	6.2	—	—	—
BGRV7	7W	31	10~390	5.1~9.1	—	—	7.9	—	—	—
BGRV10	10W	60	10~390	5.1~9.1	—	—	10.7	14.5	—	—
BGRV15	15W	60	10~390	5.1~9.1	—	—	18.6	24.6	—	—
BGRV20	20W	95	10~390	5.1~9.1	—	—	22.1	28.1	—	—
BGRV30	30W	161	10~390	5.1~9.1	—	—	59.6	—	84.6	73.9
BGRV30TQW			10~100		—	—				
BGRV40	40W	226	10~390	5.1~9.1	—	—	70.6	—	105.0	95.0
BGRV40TQW			10~100		—	—				
BSRV3	3W	—	430~27k	—	3.9	5.9	—	—	—	—
BSRV5	5W	—	430~51k	—	5.1	7.2	6.2	—	—	—
BSRV7	7W	—	430~56k	—	7.5	10.8	7.9	—	—	—
BSRV10	10W	—	430~75k	—	10.2	15.0	10.7	14.5	—	—
BSRV15	15W	—	430~56k	—	18.8	—	18.6	24.6	—	—
BSRV20	20W	—	430~56k	—	23.3	—	22.1	28.1	—	—

※1 S Style and N Style lead terminal products are not compatible with the AEC-Q200 vibration test only by soldered PCB mounting. When using the product, please take into account vibration measures such as fixing the product with silicone resin.
※2 Average value between 10Ω~100Ω

■Type Designation

Example

BGRV	40	T	Q		A	300	J
Product Code	Power Rating	Terminal※3 Surface Material	Style※4	Dimensional accuracy※5	Mounting bracket	Nominal Resistance	Resistance Tolerance
BGRV : Wirewound(Glass core) BWRV : Wirewound(Ceramic core) BSRV : Metal oxide film	See table above	C : SnCu T : Sn	Nil : S style N : N style Q : Q style	Nil : standard W : High-Precision	Nil : None A : A style C : C style E : E style	3 digits	J : ±5% K : ±10%

※3 Lead-Free plated terminal symbols.
C (SnCu) : S, N styles
T (Sn) : Q styles
※4 No indication on style means S style.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

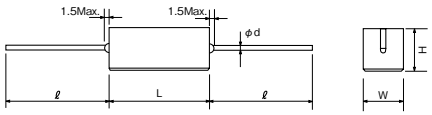
■Ratings

Type	Power Rating	Rated Ambient Temperature	Max. Working Voltage (V)			Max.Overload Voltage (V)			T.C.R. (×10⁻⁶/K)			Operating Temp. Range
			BGRV	BWRV	BSRV	BGRV	BWRV	BSRV	BGRV	BWRV	BSRV	
B□RV3	3W	+70℃	—	E=√P·R	300	—	E=√P·R·10	600	—	±250	±300	−40℃~+155℃
B□RV5	5W				350			700	±250			
B□RV7	7W				500			1,000				
B□RV10	10W				700			1,400				
B□RV15	15W	+25℃			700			1,400				
B□RV20	20W				750			1,500				
BGRV30	30W			—	—		—	—		—	—	
BGRV40	40W											
BWRV40	40W(60W※6)		—	E=√P·R		—	E=√P·R·10		—	±250		

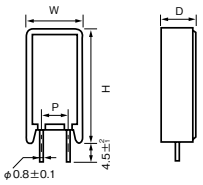
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
Please consult with us in advance about custom-made products.
※6 Please note that when used at a rated power of 60W, the surface temperature of the product will reach approximately 300°C.

■Dimensions

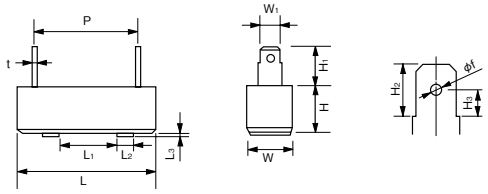
①S Style※1



②N Style※1



③Q Style



Type	Dimensions (mm)				
	L±1.5	W	H	ℓ ±3	d±0.1
BWRV3C·BSRV3C	22.0	8.0±1.0	8.0±1.0	35	0.8
BWRV5C·BSRV5C		9.5±1.0	9.5±1.0		
BWRV7C·BSRV7C	35.0				
BWRV10C·BSRV10C	48.0				
BWRV15C·BSRV15C		12.5±1.2	12.5±1.2		
BWRV20C·BSRV20C	63.5	12.5±1.5	12.5±1.5		

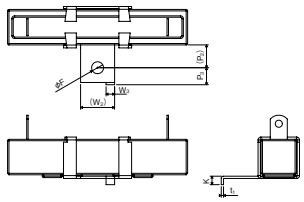
Type	Dimensions (mm)			
	W±1.0	D±1.0	H±1.5	P^{+2}_{-1}
BWRV3CN·BSRV3CN	12.0	8.0	25.0	5.0
BWRV5CN·BSRV5CN	13.0	9.0	25.5	
BWRV7CN·BSRV7CN			38.5	
BWRV10CN·BSRV10CN	16.0	12.0	35.0	7.5

※1 S Style and N Style lead terminal products are not compatible with the AEC-Q200 vibration test only by soldered PCB mounting. When using the product, please take into account vibration measures such as fixing the product with silicone resin.

Type	Dimensions (mm)												
	L	L_1	L_2	L_3±0.5	W	W_1±0.1	H	H_1±1.0	H_2	(H_3)	P	t	(φf)
BGRV5TQ·BSRV5TQ	27±1.5	–	–	–	9.5±1.0	4.75	9.5±1.0	10.5	6.5	3.3	(15.0)	0.5±0.05	2.2
BGRV7TQ·BSRV7TQ	35±1.5	–	–	–							(22.5)		
BGRV10TQ·BSRV10TQ	48±1.5	25±1.0	4.5	1.0							(35.0)	0.8±0.08	1.4
BGRV15TQ·BSRV15TQ			7.0		12.5±1.2		12.5±1.5	13.0	6.35	3.15	(34.5)		
BGRV20TQ·BSRV20TQ	63.5±2										(49.5)		
BGRV30TQ	75±1.0	40±1.0	10.0		19.0±1.0	6.3	19.0±1.0	12.0	8.0	4.1	(56.0)		1.7
BGRV30TQW※5	75±0.5	40±0.5			19.0±0.5		19.0±0.5				56.0±0.5		
BGRV40TQ	90±1.0	40±1.0			19.0±1.0		19.0±1.0				(71.0)		
BGRV40TQW※5	90±0.5	40±0.5			19.0±0.5		19.0±0.5				71.0±0.5		
BWRV40TQ	91±1.0				20.0±0.5		20.0±0.5						

※5 High-Precision Dimension Products.
( ) Parenthesized dimensions are for reference.

QA Style



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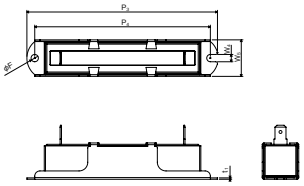
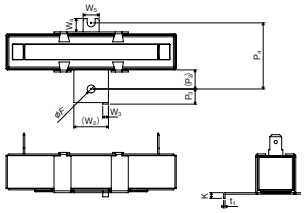
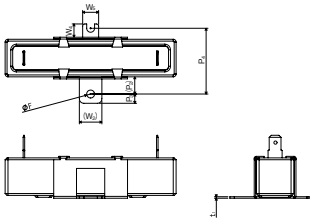


QE Style (BGRV)



QE Style (BWRV40)



Type	Dimensions (mm)								
	(P_2)	P_3±1.0	P_4±1.0	(W_2)	W_3±0.3	(W_4)	(W_5)	K±0.3	t_1	φF
BGRV10TQA·BSRV10TQA	8.0	6.0	–	12.0	3.0	–	–	2.8	0.6	4.0
BGRV15TQA·BSRV15TQA								3.0	0.8	4.2
BGRV20TQA·BSRV20TQA										
BGRV30TQC·BGRV30TQWC BGRV40TQC·BGRV40TQWC	–	110	101	–	–	4.2	21.0	–		
BGRV30TQE·BGRV30TQWE BGRV40TQE·BGRV40TQWE	10.0	8.0	35.0	18.0	3.0	7.0	8.5	3.0		
BWRV40TQE	8.1	4.9		12.0	–			–		

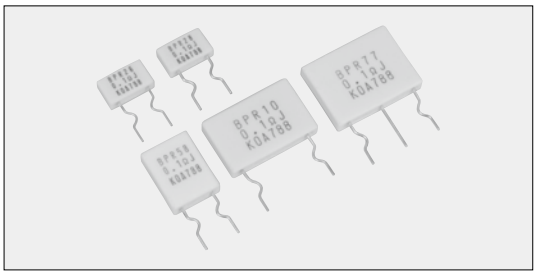
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	1 : BWRV, BSRV 2 : BGRV	0.5 : BWRV, BSRV 1.0 : BGRV	350℃±10℃、3.5s
Moisture resistance	3 : BWRV, BGRV 5 : BSRV	2.0 : BWRV, BGRV 2.5 : BSRV	Power rating×1/10、40℃、90%~95%RH、1000h 1.5h ON/0.5h OFF cycle
Endurance at 25℃ or 70℃	3 : BWRV 5 : BGRV, BSRV	2.0 : BWRV 2.5 : BGRV, BSRV	25℃ or 70℃, rated voltage, 1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

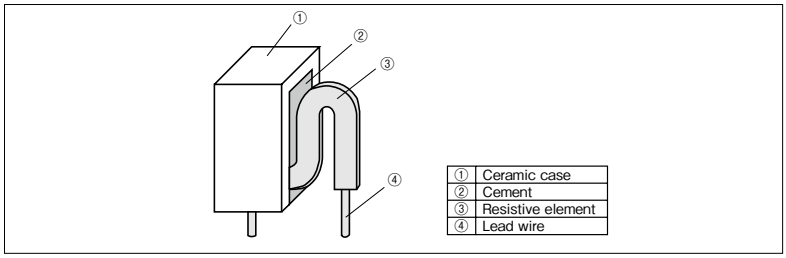
- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.
- The products attached by ionic impurities negatively affects their moisture resistance, corrosion resistance, etc. Please pay careful attention to products handling as well as storage, mounting conditions and environment.
- When the pulse including surge is impressed to the resistor, it may cause disconnection. Please confirm us about the conditions for use in advance.

BPR Rectangular Type Metal Plate Resistors



Case : Ceramic
Marking : Alphanumeric

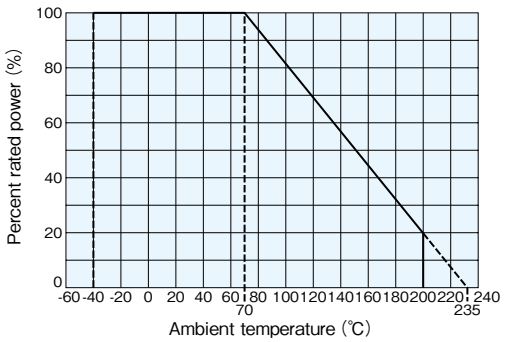
■Construction



■Features

- Power type current detecting resistors.
- Flame retardant resistors in Ceramic Case.
- Automatic insertion for a 5mm pitch between terminals is applicable. (BPR26, BPR58 Radial Taping)
- Low inductance.
- Space saving.
- Products meet EU-RoHS requirements.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Type Designation

Example

BPR	5	8	C	F	R10	J
Product Code	Power Rating	Lead Wire Diameter	Terminal Surface Material	Taping & Forming	Nominal Resistance	Resistance Tolerance
	2:2W 3:3W 5:5W	6:φ0.6mm 8:φ0.8mm	C:SnCu	Nil:Straight lead (Pitch 9.0mm) F:Forming (Pitch 9.0mm) FT:Radial taping (BPR26FT-BPR58FT only) (Pitch 5.0mm)	3 digits Ex. 0.1Ω:R10 47mΩ:47L	J:±5% K:±10%
	10:10W	8:φ0.8mm				
	55:5W+5W 77:7W+7W	Blank				

Resistance Value (Ω)	3 digits
10m~82m	10L~82L
0.1~0.82	R10~R82
1	1R0

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on radial taping, please refer to APPENDIX C on the back page.

■Dimensions and Ratings

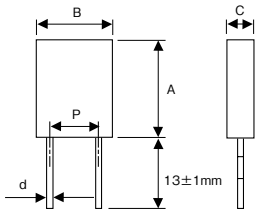
Type	Power Rating	Resistance Range (Ω)※1		T.C.R. (×10⁻⁶/K)	Dimensions (mm)					Weight (g/1,000pcs)
		J : ±5% (E12)	K : ±10% (E12)		A	B	C±1	d±0.1	P±1	
BPR26	2W	0.01 0.1~0.68	0.01~0.68	±350※2	8.5±1.0	13.0±1.0	4.0	0.6	9.0	1,190
BPR28	2W							0.8		1,220
BPR38	3W				13.0±1.0	14.0±1.0	5.0			2,240
BPR58	5W	0.01, 0.1~1.0	0.01~1.0		18.0±1.0					3,470
BPR108	10W	—	0.05, 0.1~1.0		17.0±1.5	26.0±1.5			20.0	5,560
BPR55	5W+5W	0.05, 0.1 0.22~0.47	0.03~0.47						10.0	5,830
BPR77	7W+7W				20.0±1.8					7,060

Rated Ambient Temperature : +70℃
Operating Temperature Range : −40℃ ~ +200℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$
※1 See table standard resistance
※2 Application range : The straight style of 0.018Ω over

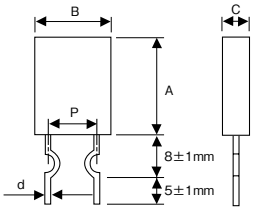
■Dimensions (mm)

Please inquire of us if the dimensions for the case and lead position are required.

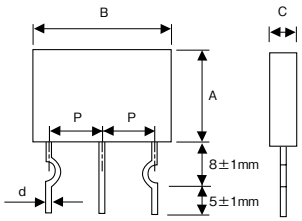
Single Straight Style



Single Forming Style



Twin Style



■Standard Resistance

Resistance (Ω)	26, 28		38		58		108		55		77	
	J : ±5%	K : ±10%	J : ±5%	K : ±10%	J : ±5%	K : ±10%	J : ±5%	K : ±10%	J : ±5%	K : ±10%	J : ±5%	K : ±10%
0.01	○	○	○	○	○	○	—	—	—	—	—	—
0.012		○		○		○	—	—	—	—	—	—
0.015		○		○		○	—	—	—	—	—	—
0.018		○		○		○	—	—	—	—	—	—
0.02※3		○		○		○	—	—				
0.022		○		○		○	—	—				
0.027		○		○		○	—	—				
0.03※3		○		○		○	—	—		○		
0.033		○		○		○	—	—				
0.039		○		○		○	—	—				
0.04※3		○		○		○						
0.047		○		○		○						
0.05※3		○		○		○		○	○	○		○
0.068		○		○		○						
0.082		○		○		○						
0.1	○	○	○	○	○	○		○	○	○		○
0.12	○	○	○	○	○	○				○		
0.15	○	○	○	○	○	○		○		○		
0.18	○	○	○	○	○	○		○		○		
0.22	○	○	○	○	○	○		○	○	○	○	○
0.27	○	○	○	○	○	○		○	○	○		
0.33	○	○	○	○	○	○			○	○	○	○
0.39	○	○	○	○	○	○			○	○		
0.47	○	○	○	○	○	○			○	○		
0.56	○	○	○	○	○	○						
0.68	○	○	○	○	○	○			—	—	—	—
0.82					○	○			—	—	—	—
1					○	○		○	—	—	—	—

※3 : Out of E12 Series
○ : Available
Blank : Please consult.
— : Not available

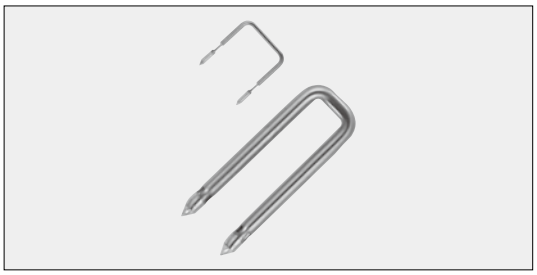
■Performance

Test Items	Performance Requirements ΔR%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃ (Measurement position : 10mm under from the case)
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃ (Application range : The straight style of 0.018Ω over)
Overload (Short time)	2	1	Rated voltage×2.5 for 5s (Application range : 0.05Ω over)
Resistance to soldering heat	2	1	260℃±5℃, 10s±1s
Moisture resistance	5	3	40℃±2℃、90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	5	3	70℃±2℃、1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	3	2	+125℃、100h
Resistance to solvent	No evidence of damage to protective coating and marking	—	After immersing the sample in I.P.A for 60s ±10s, the resistor surface should be rubbed with absorbent cotton 10 times.

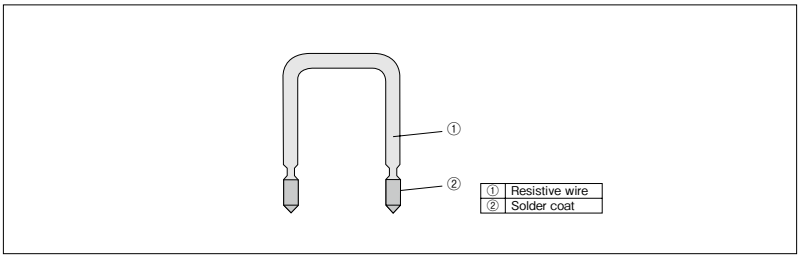
■Precautions for Use

- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.
- Recommendation condition of a solderability.
  Peak temperature : 260℃±5℃　　Peak time : 5s～10s

LR Custom Milliohm Resistors



■Construction



■Features

- The super low resistance (3mΩ～) is suitable for high power current sensing.
- Pitches and heights adjustable according to mounting conditions.
- All custom-made products.
- Easy soldering.
- Products meet EU-RoHS requirements.

■Type Designation

Example

LR	09	D	L	10	20L	J
Product Code	Symbol	Terminal Surface Material	Style	Insertion Pitch	Nominal Resistance	Resistance Tolerance
	06～20：L-Style 23～29：T-Style	D：SnAgCu N：No surface treatment	L：L-Style(06～20) T：T-Style(23～29)	Insertion pitch	3 digits	H：±3% J：±5%

Resistance Value (Ω)	3 digits
3m～9.1m	3L0～9L1
10m～91m	10L～91L
0.1	R10

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

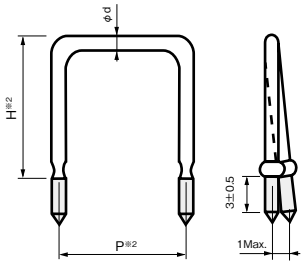
■Ratings

Type	Symbol	φd Diameter (mm)	Max. Current Rating※1 (A)	Resistance Range※1 (mΩ)	Resistance Tolerance	T.C.R. (×10⁻⁶/K)	Rated Ambient Temp.	Operating Temp. Range
LR06D	06	0.6	3.0	50～100	H：±3% J：±5%	±100	+70℃	−40℃～+180℃
LR07D	07	0.7	4.0	30～70				
LR08D	08	0.8	4.5	28～50				
LR09D	09	0.9	5.0	20～40				
LR10D	10	1.0	5.5	15～30				
LR11D	11	1.1	6.0	15～20				
LR12D	12	1.2	7.0	10～20				
LR13D	13	1.3	7.5	10～20				
LR14D	14	1.4	8.0	10～20				
LR15D	15	1.5	9.0	10～20				
LR16D	16	1.6	9.5	10～15				
LR18D	18	1.8	11	5～10				
LR20D	20	2.0	12	5～10				
LR23D	23	2.3	14	3～10				
LR26D	26	2.6	18	3～5				
LR29D	29	2.9	21	3～5				

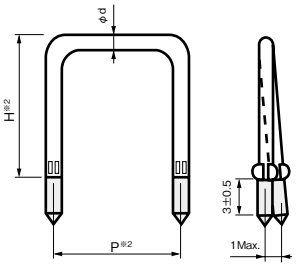
※1 The resistance range is when the pitch is 10mm.
Other diameters and resistance are also available on request.

■Dimensions

L style

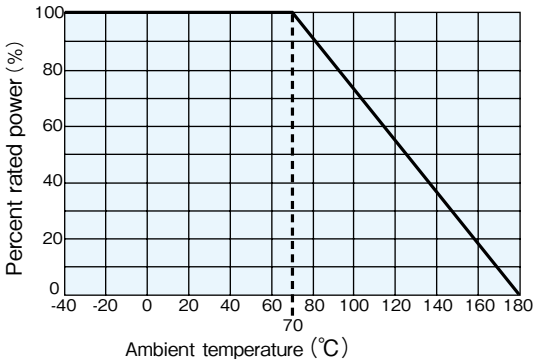


T style※3



※2 Please consult with us about dimensions "P" and "H".
※3 T Style is applied for the diameter of φ2.3 or above.

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

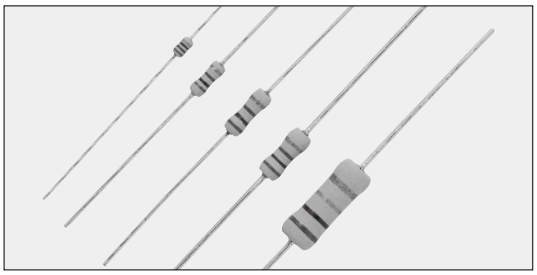
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Resistance to soldering heat	2	1.6	350℃±10℃, 3s
Moisture resistance	3	2.7	Power rating×1/10, 40℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	5	3	Rated voltage, 70℃, 1000h, 1.5h ON/0.5h OFF cycle

■Precautions for Use

- In the resistance values of 50mΩ or under, the resistance value after soldering may change depending on the size of pad pattern or solder amount. Make sure the effect of decline/increase of resistance value before designing.

RF Coat-insulated Fusing Resistors



Coating color : Blue
Marking : Color code

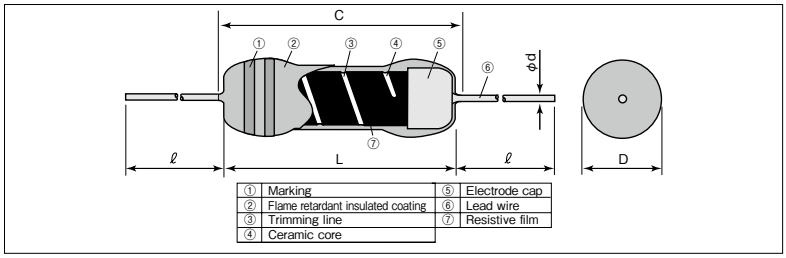
■Features

- Function as a resistor in normal condition.
- Quick fusing protects circuit from excessive overload at an abnormal time.
- Flame retardant coating. (Equivalent to UL94 V-0.)
- EU-RoHS regulation is not intended for Pb-glass contained in insulation coating.

■Reference Standards

IEC 60115-1
JIS C 5201-1
EIAJ RC-2125

■Construction



■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L	C Max.	D	d (Nominal)	ℓ※1	
RF16	3.2±0.2	3.4	$1.7^{+0.25}_{0}$	0.45	30±3	120
RF25	6.3±0.5	7.1	2.3±0.3	0.6		230
RF50	8.5±0.5	9.5	3.0±0.3			290
RF1	9.0±1.0	11.1	3.5±0.5	0.8		460
RF2	15.5±1.0	18.0	6.0±1.0			1410

※1 Lead length changes depending on taping and forming type.

■Type Designation

Example

RF	25	C	T52	A	100	J
Product Code	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	16 : 0.17W 25 : 0.25W 50 : 0.5W 1 : 1W 2 : 2W	C : SnCu	See table below	A : AMMO R : REEL Nil : BOX	3 digits	J : ±5%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

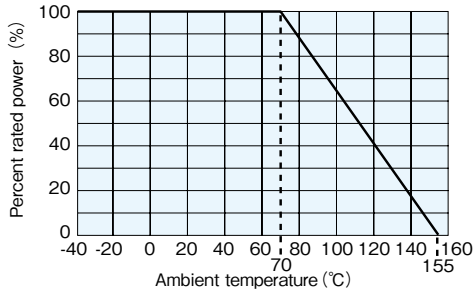
Type	Axial Taping				Radial Taping					L Forming					M Forming			
	T26	T52	T521	T631	MHT	VTP	VTE	VT	GT	L10A	L12.5A	L15A	L20A	L25A	M5	M10	M12.5	M15
RF16	○	○	—	—	○	—	—	—	—	—	—	—	—	—	M5F	—	—	—
RF25	○	○	—	—	—	○	○	○	—	○	—	—	—	—	—	M10X	—	—
RF50	—	○	—	—	—	—	—	—	○	—	○	○	—	—	—	—	M12.5E	—
RF1	—	○	—	—	—	—	—	—	○	—	○	○	○	—	—	—	—	M15F
RF2	—	—	○	○	—	—	—	—	○	—	—	—	○	○	—	—	—	—

■Ratings

Type	Power Rating	Resistance Range (Ω) (E24) J : ±5%	Fusing Characteristics							T.C.R. (×10⁻⁶/K)	Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)		
			Fusing Power						Fusing Time			T26A	T52A	T521A
RF16	0.17W	1.0~1k	—	—	—	3W 1Ω~4.7Ω	2.5W 5.1Ω~1kΩ	—	60s Max.	±1000 : R≦4.7Ω ±350 : R≧5.1Ω	250V	2,000	2,000	—
RF25	0.25W	0.1~10k	10W 0.1Ω~0.18Ω	7.5W 0.2Ω~0.43Ω	6.25W 0.47Ω~0.91Ω	—	3.75W 1Ω~4.7Ω 2.4kΩ~10kΩ	3W 5.1Ω~2.2kΩ	30s Max.			2,000	2,000	—
RF50	0.5W	0.1~15k	—	—	12.5W 0.1Ω~0.43Ω	—	7.5W 0.47Ω~2Ω 1.1kΩ~15kΩ	6W 2.2Ω~1kΩ			300V	—	2,000	—
RF1	1W	0.1~10k	—	30W 0.1Ω~0.18Ω	25W 0.2Ω~0.43Ω	—	15W 0.47Ω~2Ω 1.1kΩ~10kΩ	12W 2.2Ω~1kΩ			350V	—	2,000	—
RF2	2W	1.0~3k	—	—	—	36W 1Ω~3.6Ω	30W 1.1kΩ~3kΩ	24W 3.9Ω~1kΩ			600V	—	—	500

Rated Ambient Temperature : +70℃
Operating Temperature Range : −40℃~+155℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$

■Derating Curve

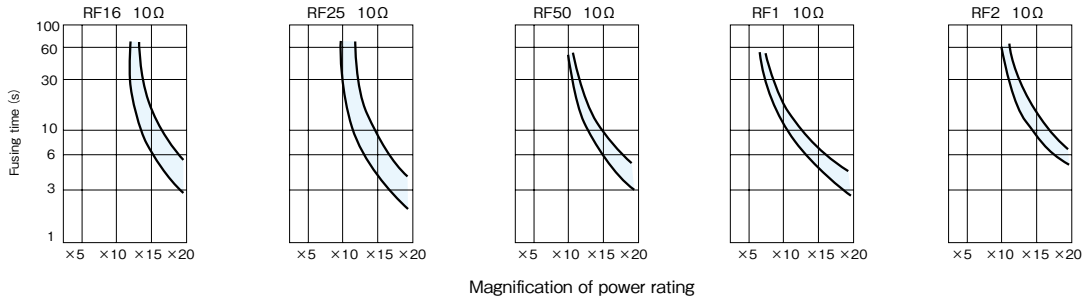


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Characteristics

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+125℃
Overload (Short time)	1	0.5	Rated voltage×2.5 for 5s
Resistance to soldering heat	1	0.5	350℃±10℃, 3.5s±0.5s or 260℃±5℃, 10s±1s
Rapid change of temperature	1	0.5	−40℃(30min.)/+85℃(30min.) 5 cycles
Moisture resistance	5	2.5	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	5	2.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	The resistor shall be immersed in IPA for 30s.
Flame retardant	No evidence of flaming or self-flaming.	—	Flame test : The test flame shall be applied and removed for each 15s respsctively to repeat the cycle 5 times. Overload flame retardant: A.C. Voltage corresponding to 2, 4, 8, 16 and 32 times the power rating shall be applied for each 1min. until disconnection occurs.

■Example of Fusing Characteristics

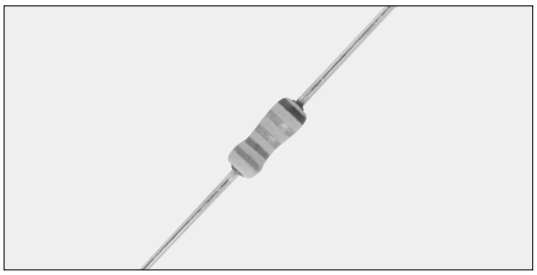


■Precautions for Use

- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- Maximum open-circuit voltage is the maximum value of the voltage applicable to both ends of resistors, when a fuse resistor becomes open conditions in a circuit. It differs according to the form of a product and a resistance value and is specified individually. The maximum open-circuit voltage is the lower one, whichever the voltage 1000 times of the power rating or the voltage shown in below table. Use the components under the voltage applied between the terminals of resistors to be under the maximum open-circuit voltage regardless of normal operating or abnormal operating time of equipment.

Rated Power	0.17W	0.25W	0.5W	1W	2W
Maximum Open-Circuit Voltage	100V	200V	250V	300V	300V

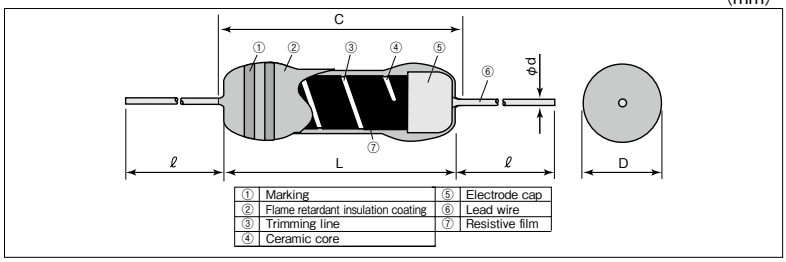
RF25CC Coat-insulated Fusing Resistors (Constant Current Fusing Type)



Coating color : Blue
Marking : Color code
5th Color band : Green for indentification

■Construction

(mm)



①	Marking	⑤	Electrode cap
②	Flame retardant insulation coating	⑥	Lead wire
③	Trimming line	⑦	Resistive film
④	Ceramic core		

■Features

- Fuse within 60sec in case of over-current.
- Constant current fusing type.
- Fuse at low magnification at 5 times or 10 times of power rating.
- Flame retardant coating. (Equivalent to UL94 V-0.)
- Products meet EU-RoHS requirement. EU-RoHS regulation is not intended for Pb-glass contained in insulation coating.

■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L	C Max.	D	d (Nominal)	ℓ※1	
RF25CC	6.3±0.5	7.1	2.3±0.3	0.6	30±3	230

※1 Lead length changes depending on taping and forming type.

■Reference Standards

IEC 60115-1
JIS C 5201-1
EIAJ RC-2125

■Type Designation

Example

RF	25	C	C	T52	A	R68	K
Product Code	Power Rating	Terminal Surface Material	Constant Current Fusing Type	Taping & Forming	Packaging	Nominal Resistance	Resistance Tolerance
	25 : 0.25W	C : SnCu		See table below	A : AMMO R : REEL Nil : BOX	3 digits	K : ±10%

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping and forming, please refer to APPENDIX C on the back pages.

■Taping & Forming Matrix

Axial Taping		L Forming	M Forming	Radial Taping	
T26	T52	L10A	M10	VTP	VTE
○	○	○	M10X	○	○

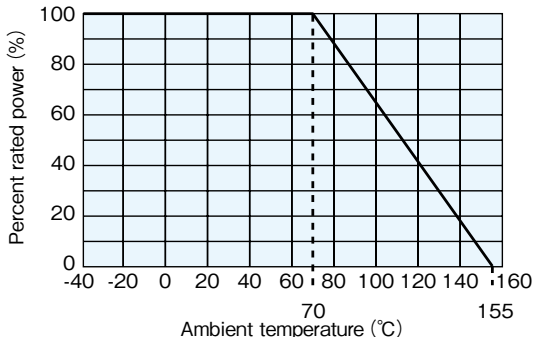
■Ratings

Power Rating	Resistance Range (Ω) E24	Resistance Tolerance	Fusing Characteristics			Dielectric Withstanding Voltage	Taping & Q'ty/AMMO (pcs)	
			Fusing Power		Fusing Time		T26A	T52A
0.25W	0.1～0.91	K : ±10%	2.5W 0.1Ω	1.25W 0.11Ω～0.91Ω	60s Max.	250V	2,000	2,000

Rated Ambient Temperature : +70℃
Operating Temperature Range : −40℃～+155℃
Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$

Fusing Resistors

■Derating Curve

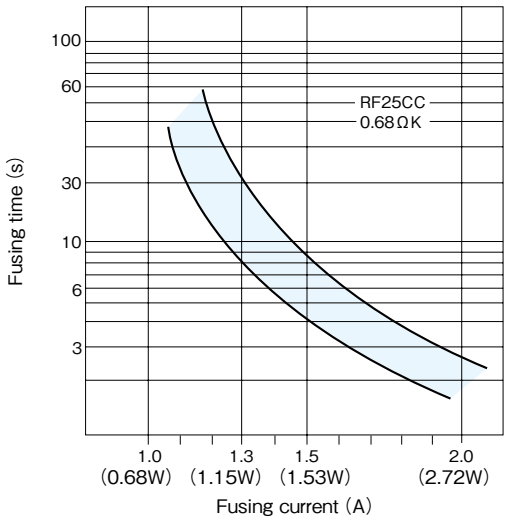


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

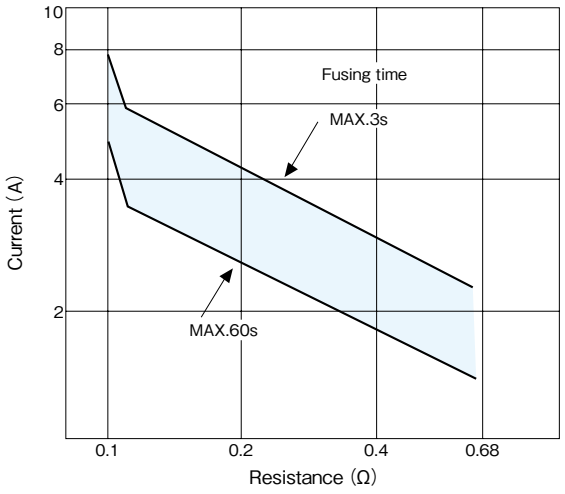
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
Resistance to soldering heat	5	2.5	350℃±10℃, 3.5s±0.5s or 260℃±5℃, 10s±1s
Humidity	5	2.5	40℃±2℃, 90%~95%RH, 1000h No Load
Endurance at 70℃	5	2.5	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormality in appearance. Marking shall be easily legible.	—	The resistor shall be immersed in IPA for 30s.
Flame retardant	No evidence of flaming or self-flaming.	—	Flame test : The test flame shall be applied and removed for each 15s respectively to repeat the cycle 5 times. Overload flame retardant: A.C. Voltage corresponding to 2, 4, 8, 16 and 32 times the power rating shall be applied for each 1min. until dis-connection occurs.

■Example of Fusing Characteristics



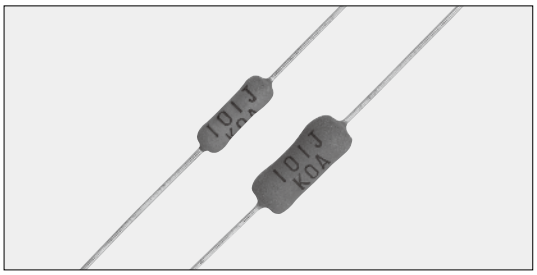
■I-R Characteristics



■Precautions for Use

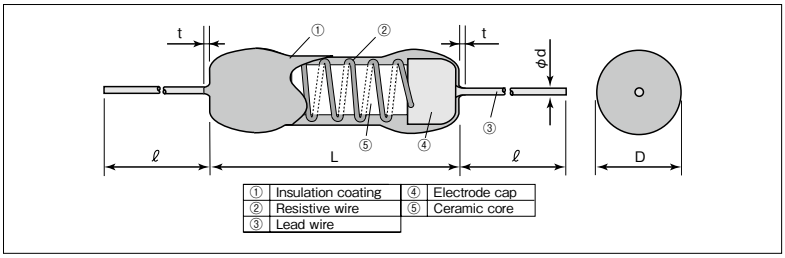
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.

CWFS Coat-Insulated Wirewound Resistors(With Fusing Function)



Coating color : Gray
Alphanumeric

■Construction



■Features

- Flame retardant coating (Equivalent to UL94 V-0)
- Fail-safe mains fusing at AC 250V※1.

※1 CWFS23 4.7Ω～9.1Ω : AC200V

- Products meet EU-RoHS requirements.

■Approval Awarded

- UL1412 Recognized File No. E134679

■Dimensions

Type	Dimensions (mm)					Weight(g) (1000pcs)
	L	D	ℓ±3.0	d(Nominal)	t Max.	
CWFS23	12±1.0	4.0±1.0	30	0.8	3	950
CWFS35	15±1.0	6.0±1.0	30	0.8	3	1780

■Type Designation

Example

CWF	S	23	C	T52	A	100	J
Product Code	Type	Power Rating	Terminal Surface Material	Taping & Forming	Packaging	Normal Resistance	Resistance Tolerance
	S : Safety Fusing	23 : 3W 35 : 5W	C : SnCu	See table below	A : AMMO Nil : Box	3 digits	J : ±5%

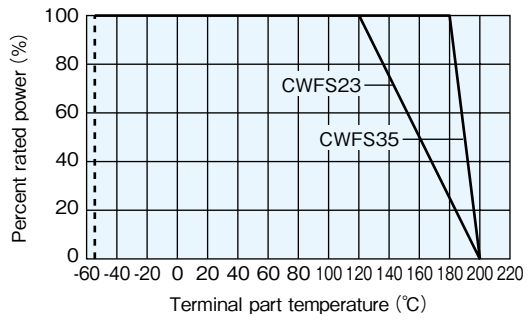
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.
Lead length changes depending on taping and forming type.

■Ratings

Type	Power Rating	Rated Terminal Part Temp.	Resistance Range(Ω)	Fusing Characteristics		T.C.R. (×10⁻⁶/K)	Taping & Q'ty/AMMO(pcs)	
			J : ±5%(E24)	Fusing Power	Fusing Time		T52A	T521A
CWFS23	3W	+120℃	4.7～100	90W	30s Max.	±100	1,000	1,000
CWFS35	5W	+180℃		150W	30s Max.		—	500

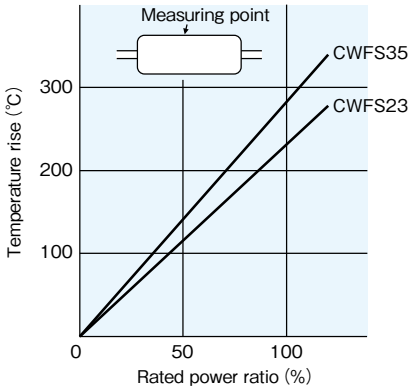
Operating Temperature Range : −55℃～+200℃
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$

■Derating Curve



When the terminal part temperature of the resistor exceeds the rated terminal part temperature shown above, the power shall be derated according to the derating curve.
※Please refer to"Introduction of the derating curves based on the terminal part temperature"on the beginning of our catalog before use.

■Temperature Rise (Ref.)

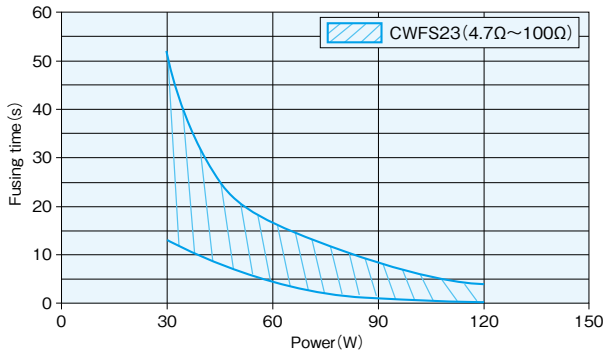


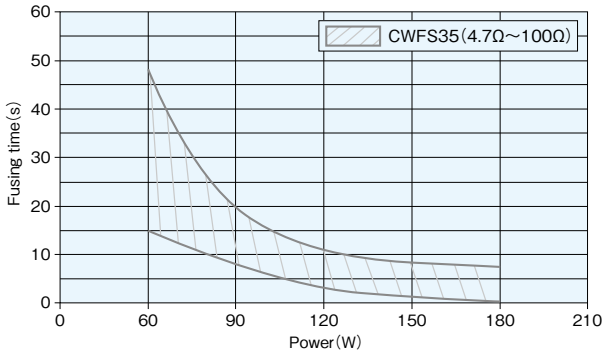
Fixing Board t=1.2 Material : Glass Epoxy Board

■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	±100×10⁻⁶/K	—	+25℃/−55℃ and +25℃/+125℃
Fusing time	30s	4s	Power Rating×30
Overload (Short time)	5	2	Power Rating×10, 5s
Resistance to soldering heat	1	0.8	350℃±10℃, 3.5s or 260℃±5℃, 10s
Moisture resistance	5	4	Power Rating×1/10, 40℃, 90%～95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance of Rated Terminal part Temperature	5	3	120℃±2℃ : CWFS23 180℃±2℃ : CWFS35 1000h, 1.5h ON/0.5h OFF cycle
Resistance to solvent	No abnormaly in appearance such as disappearance of making, etc.	—	On immersing the sample in IPA for 3 minutes, the resistor surface should be lightly wiped with a dry cloth (velvet or gauze).

■Example of Fusing Characteristics

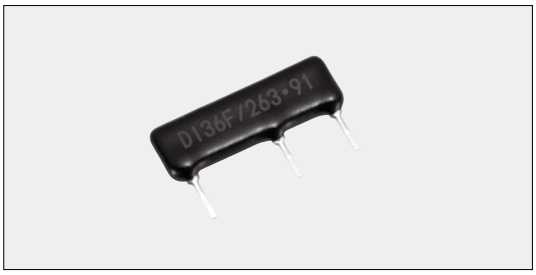




■Precautions for Use

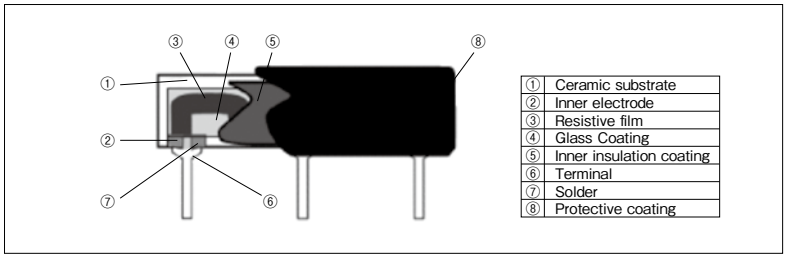
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- In case of using them for an AC circuit, abnormal phenomena like oscillation etc. occasionally happen as they have an inductance or a parasitic capacitance because of their wiring structures. Use them by taking the dispersion of constants of other components into the consideration.

RK92D Thick Film Resistors For High Voltage (High-precision high voltage divider)



Coating color : Black
Marking : Alphanumeric

■Construction



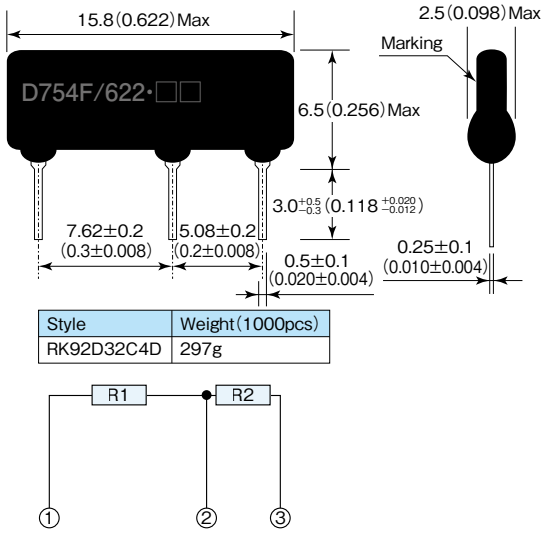
■Features

- High-precision high voltage divider for high voltage circuits.
- Thin SIP shape.
- The flame retardant coats corresponding to UL94V-0 are used.
- Higher relative accuracy of resistance value is possible with one package.
- Thick film resistors (RuO_2) ensure high stabilities in life and change in aging.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

■Applications

- PPCs and LBPs for power supply circuits
- High voltage power supplies of analyzing devices and medical equipment.
- High voltage detecting circuits for smart meters and power monitoring system.

■Dimensions※1 mm (inch)



Style	Weight(1000pcs)
RK92D32C4D	297g

※1 Please contact us for the outline method and circuit diagram of custom products.

■Type Designation

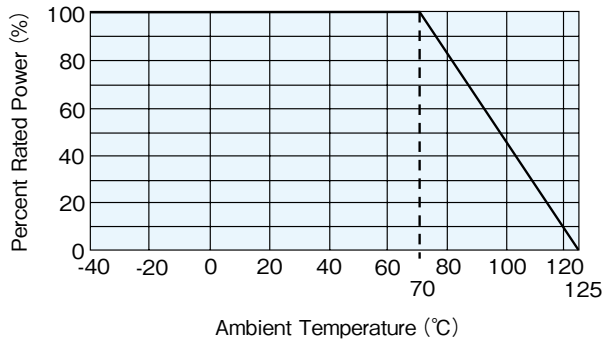
	RK92	D	3	2	C	4		D	754/622	F
	Product Code	Type	Terminal pitch 1	Terminal pitch 2	Height symbol	Voltage symbol	Manufacturing serial number (Internal circuit is indicated by A00)	Terminal symbol	Resistance symbol	Resistance Tolerance
	RK92 (Standard)	D	3	2	C	4	Nil	D	(R1+R2)/R2	F
Ex.※1)	RK92 (Custom)	D	8	2	C	Nil	A00	D	Nil	Nil

■Ratings※2

Style	Max. Working Vol. symbol	Nominal Resistance	Power Rating		Resistance (Ω)		Resistance Tolerance (R1+R2)	Relative Resistance ratio		T.C.R.(×10⁻⁶/K)		Max. Working Voltage	Rated Ambient Temp.	Operating Temp. Range
			R1	R2	(R1+R2) E24	R2		(R1+R2)/R2	Tolerance	Absolute	Relative			
32C	4	754/622	0.5W	0.2W※3	750k	6.25k	F:±1%	120	0.2%	±100	50	4kV	70℃	−40℃～+125℃
		205/103			2M	10k		200						
		136/263			13M	26k		500						
		336/333			33M	33k		1000						

※2 Please consult with us about custom rating products.
※3 0.2W is a calculated value based on designing. The actual value is smaller than 0.2W according to the relative resistance ratio in the catalog.

■Derating Curve

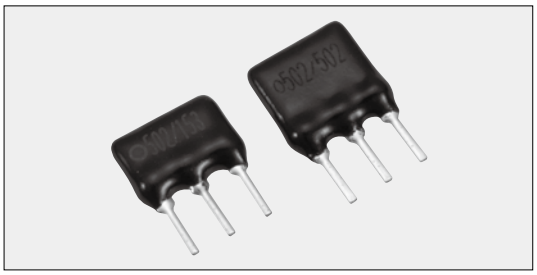


For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Performance

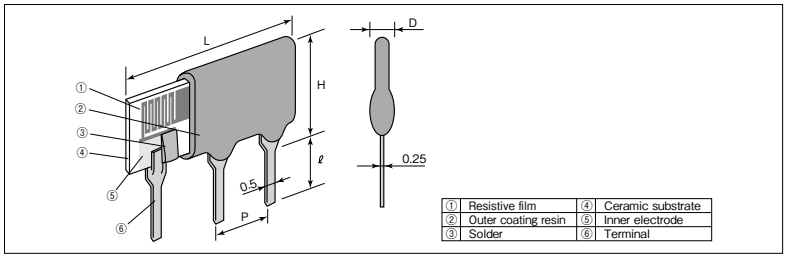
Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance		25℃
T.C.R.	Within specified T.C.R.		+25℃/+125℃
Resistance to soldering heat	±0.5	±0.2	260℃±5℃, 10s±1s
Rapid change of temperature	±0.5	±0.2	−40℃(30min.)/+125℃(30min.) 5 cycles
Moisture Resistance	±2	±1	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance	±2	±1	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

MRP Precision Metal Film Resistor Networks (Balance Resistors)



Coating color：Black
Marking：Alphanumeric

■Construction



①	Resistive film	④	Ceramic substrate
②	Outer coating resin	⑤	Inner electrode
③	Solder	⑥	Terminal

■Features

- Relative resistance tolerance 0.025% is available.
- Relative T.C.R. tracking 2×10^{-6}/K is available.
- Excellent in stability and electrical characteristics.
- Products meet EU-RoHS requirements.

■Applications

- Thermo Controllers, Oscilloscopes, Recorders, Medical Equipment

■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L max.	H max.	D max.	P	ℓ※1	
MRPL03	8.5	6.5	2.5	2.54±0.2	3±0.5	183
MRPA03		8.5				256

※1 Length of lead frame (ℓ) : 4.5±0.5mm is also available.

■Type Designation

MRP	L03	E	A	D	103/103	B	A
Product Code	Style	Absolute T.C.R. ($\times10^{-6}$/K)	T.C.R. Tracking ($\times10^{-6}$/K)	Terminal Surface Material	Nominal Resistance R1/R2	Absolute Resistance Tolerance	Resistance Ratio Tolerance
	L03 A03	E : ±25 C : ±50	A : 2 Y : 5 T : 10	D : SnAgCu	3 digits/3 digits	B : ±0.1% C : ±0.25% D : ±0.5% F : ±1%	E : 0.025% A : 0.05% B : 0.1% C : 0.25% D : 0.5%

※Resistance combination of R1,R2 is standardized to 200/20k・1k/1k・1k/2k・1k/4k・1k/9k・1k/10k・1k/20k・10k/10k・10k/100k・50k/50k・100k/100k
Refer to us for combination of different kinds of resistance except those mentioned above.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

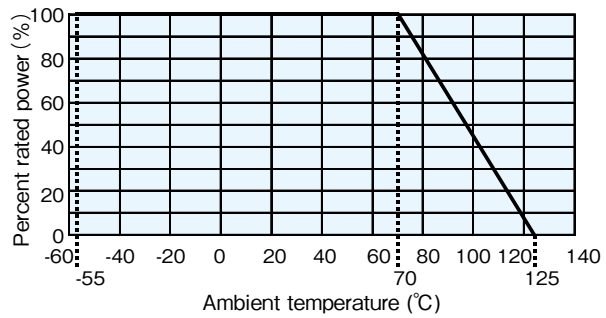
■Ratings

Type	Power Rating		Absolute T.C.R. ($\times10^{-6}$/K)	T.C.R. Tracking ($\times10^{-6}$/K)	Resistance Range (Ω)	Resistance Tolerance	Max. Working Voltage	Max. Overload Voltage	Resistance Ratio
	Element	Package							
MRPL03	100mW	200mW	E : ±25 C : ±50	A : 2(R2/R1≦10) Y : 5 T : 10	50～100k	B : ±0.1% C : ±0.25% D : ±0.5% F : ±1%	100V	200V	See below table
MRPA03									

		Resistance Ratio Tolerance				
		E : 0.025%	A : 0.05%	B : 0.1%	C : 0.25%	D : 0.5%
Absolute Resistance Tolerance	B : ±0.1%	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	–	–
	C : ±0.25%	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	–
	D : ±0.5%	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ
	F : ±1%	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ	50Ω～100kΩ
R1/R2 Relative Resistance Ratio		100max.	100max.	150max.	150max.	150max.

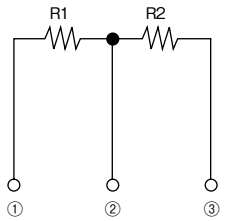
Rated Ambient Temperature：+70℃
Operating Temperature Range：−55℃～+125℃
Rated voltage＝$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※Refer to us for manufacturing smaller values of absolute T.C.R..

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Equivalent Circuit Diagram



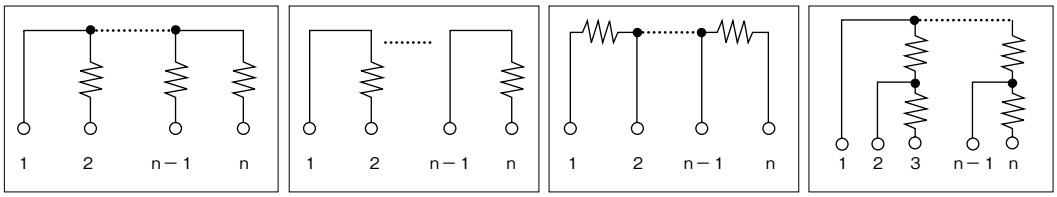
The left side terminal on the marked surface is Pin No.1.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)	Test Methods
Resistance	Within specified tolerance	25℃
T.C.R.	Within specified T.C.R.	+25℃/+65℃
Overload(Short time)	0.05	Rated Voltage×2.5 or max. overload vol. whichever is lower, for 5s
Resistance to soldering heat	0.1	350℃±10℃, 3.5s±0.5s
Rapid change of temperature	0.1	-55^{+0}_{-5}℃(30min.)/+125^{+3}_{-0}℃(30min.) 5 cycles
Moisture resistance	0.1	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	0.1	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle
Resistance to solvents	No abnormality in outer coating and markings	Soaking in 2-propanol of 20℃~25℃ for 180s±10s.
Insulation resistance	10,000MΩ or above	500V (d.c.) for 1min. between Terminals and Coating
Withstand voltage	0.5	500V (a.c.) for 1min. between Terminals and Coating

■Custom Circuit Examples

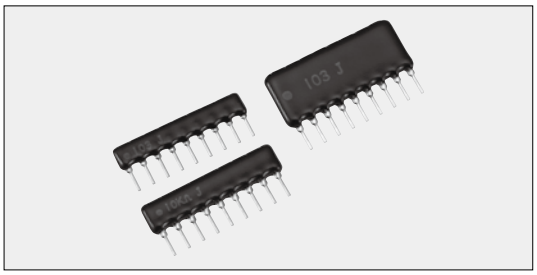
Refer to us for the following circuit constructions, resistances, etc.



■Precautions for Use

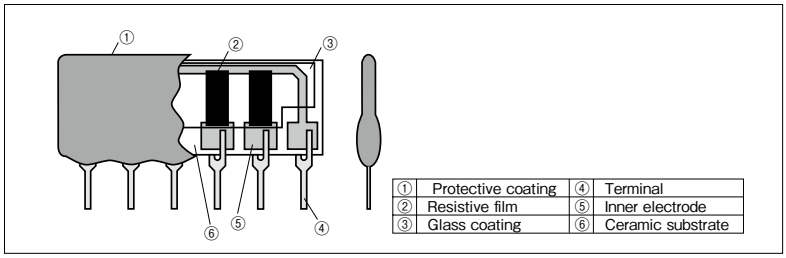
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- Pay attention to use when the components are polluted by ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. included in perspiration and saliva, because it leads to electric erosion.

RKL・RKC・RKH Standard Thick Film Resistor Networks



Coating color：Black
Marking：Alphanumeric

Construction



①	Protective coating	④	Terminal
②	Resistive film	⑤	Inner electrode
③	Glass coating	⑥	Ceramic substrate

Features

- Various types of standard circuits in different sizes and power are available. (Seated height 5.08mm, 6.5mm, 10.7mm Max.)
- For automatic insertion machines, stick magazines (the tip of lead terminal is cut to a V shape) and taping packages (TBA:All leads taping, TPA, TUA:3 leads taping) are applicable.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

Type Designation

Example

	RKL	8	C	D	STP	103	J
Circuit	Product Code	Number of Elements	Circuit Symbol	Terminal Surface Material	Taping & Stick	Nominal Resistance	Resistance Tolerance
A, B, C, D, S	RKL RKC RKH		A, B, C, D, S	D : SnAgCu (L : Sn/Pb)	Nil: Bulk STP:Stick STB:Stick TPA(4~9pins) or TUA(10pins): Taping (3 leads) TBA(4~10pins) : Taping (All leads)	G, J : 3 digits F : 4 digits	F : ±1% G : ±2% J : ±5% ※R circuit: G, J only
T, E, R	RKL RKC RKH		T, E, R			R1/R2 3 digits/3 digits	

The symbol'S'showing 1.8 pitch is added to the type designation after its circuit symbol.
The taping style of RKH is bulk only.

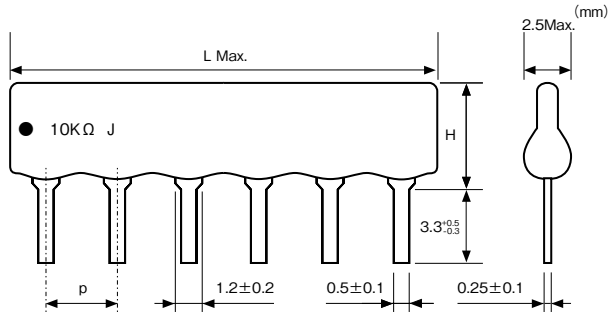
	RKC	8	L	D	STP	103
Circuit	Product Code	Number of Bits	Circuit Symbol	Terminal Surface Material	Taping & Stick	Output Impedance (L circuit) Resistance of MSB (K circuit)
L	RKC		L	D : SnAgCu (L : Sn/Pb)	See table above	3 digits
K	RKC		K		Nil： Bulk	

Tolerance：±1/2 LSB

M−	6000	D
Custom R. Net Symbol	KOA Ref. No.	Terminal Surface Material

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■ Dimensions and Wattage/Package



■ Weight (g/1000pcs)

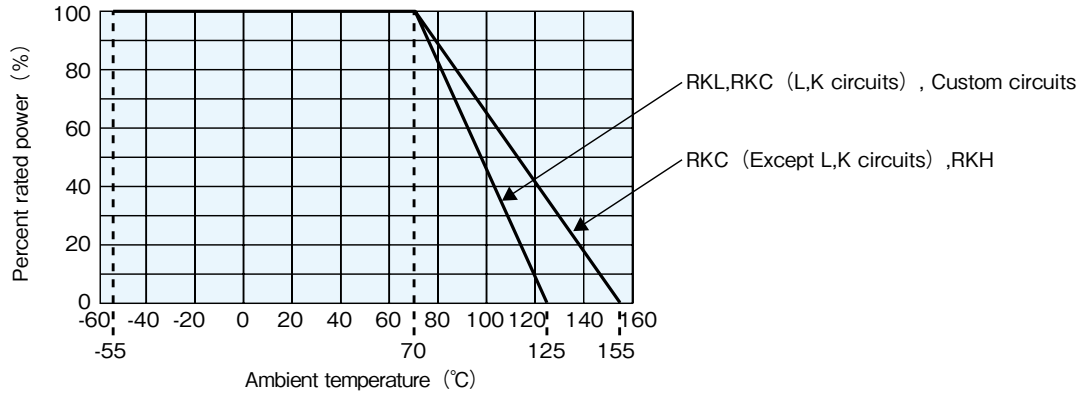
	Number of Pins						
	3	4	5	6	7	8	9
RKL	147	185	228	271	314	357	400
RKC	160	217	273	330	387	444	501
RKH	—	416	511	606	701	796	891

	Number of Pins						
	10	11	12	13	14	15	16
RKL	443	486	529	—	—	—	—
RKC	558	615	672	728	785	842	893
RKH	986	1081	1176	1271	—	—	—

			Number of Pins													H Max. (mm)	p (mm)
			3	4	5	6	7	8	9	10	11	12	13	14	15	16	
RKL	L (mm) Max.		8.20	10.16	12.70	15.24	17.78	20.32	22.86	25.40	27.94	30.48	—	—	—	—	5.08	2.54±0.2
	W	B,A,R circuit	250	375	500	625	750	875	1000	1050	1150	1250	—	—	—	—		
		C,T,E circuit	—	—	500	—	750	—	1000	—	1150	—	—	—	—	—		
		D circuit	—	—	375	500	625	750	875	1000	1125	1250	—	—	—	—		
		S circuit	—	400	—	600	—	800	—	1000	—	1200	—	—	—	—		
RKC (2.54 pitch)	L (mm) Max.		8.2	10.8	13.2	15.8	18.3	20.9	23.4	25.9	28.5	31.0	33.6	36.1	38.7	41.3	6.5	2.54±0.2
	W	B,A,R circuit	250	375	500	625	750	875	1000	1050	1150	1250	1350	1450	1500	1550		
		C,T,E circuit	—	—	500	—	750	—	1000	—	1150	—	1350	—	—	—		
		D circuit	—	—	375	500	625	750	875	1000	1125	1250	1350	1450	—	—		
		S circuit	—	500	—	750	—	1000	—	1050	—	1250	—	1450	—	—		
RKH	L (mm) Max.		—	10.8	13.3	15.8	18.3	20.9	23.4	25.9	28.5	31.0	33.6	—	—	—	10.7	2.54±0.2
	W	B,A,R circuit	—	525	700	875	1050	1250	1400	1500	1600	1700	1800	—	—	—		
		C,T,E circuit	—	—	700	—	1050	—	1400	—	1600	—	1800	—	—	—		
		D circuit	—	—	700	875	1050	1250	1400	1500	1600	1700	—	—	—	—		
		S circuit	—	500	—	1050	—	1400	—	1500	—	1700	—	—	—	—		
RKC (1.8 pitch)	L (mm) Max.		—	10.2	10.8	12.7	15.5	15.8	17.8	20.4	20.9	23.5	25.4	28.5	—	—	6.5	1.8±0.15
	W		—	300	400	500	580	650	720	760	820	850	880	900	—	—		

W : Wattage/Package (mW) Max.
RKC (1.8pitch) are custom circuits only.
Rated voltage = $\sqrt{\text{Power Rating} \times \text{Resistance value}}$ or Max. working voltage, whichever is lower.

■ Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Precautions for Use

- The conditions of flow soldering for lead-free terminal resistors are set up at 260℃ max. within 10s.
- A few cross talks will happen in network resistors. Design the circuit taking the effect by the cross talks into consideration as very low voltage will occur to the resistor elements that don't pass current by the voltage drop in common electrode if current flows to the common electrodes.

RKL・RKC・RKH Standard Thick Film Resistor Networks

■ Ratings

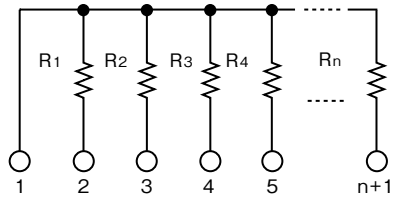
Type	Circuit Symbol	Number of Pins	Power Rating (mW/Element)	Resistance Range	Resistance Tolerance	T.C.R. (×10⁻⁶/K)	Max. Working Voltage	Rated Ambient Temp.	Operating Temp. Range
RKC	B	3~16	125	22Ω~2.2MΩ (E24)	F : ±1% G : ±2% J : ±5%	±200	200V	+70℃	−55℃~ +155℃
	C	5~13							
	D	5~14							
	A	4~14							
	T	5~13							
	E	5~13							
	S	4~14	250						
	R	4~16	125	100Ω~100kΩ (E24)	G : ±2% J : ±5%				
	L	6~10	20	R=2.5kΩ, 5kΩ 10 kΩ, 25kΩ 50 kΩ, 100kΩ	±1/2LSB (Bit Error)	±200	20V	+70℃	−55℃~ +125℃
	K	5~9	40	R1 (MSB):100Ω Min Rn (LSB):1MΩ Max	±1/2LSB (Bit Error)				
RKL	B	3~12	125	22Ω~1MΩ (E24)	F : ±1% G : ±2% J : ±5%	±200	100V	+70℃	−55℃~ +125℃
	C	5~11							
	D	5~12							
	A	3~12							
	T	5~11							
	E	5~11							
	S	4~12	200						
	R	4~11	125	100Ω~100kΩ (E24)	G : ±2% J : ±5%				
RKH	B	4~13	250	56Ω~2.2MΩ (E24)	F : ±1% G : ±2% J : ±5%	±200	250V	+70℃	−55℃~ +155℃
	C	5~13							
	D	5~12							
	A	4~12							
	T	5~13							
	E	5~13							
	S	4~12	500						
	R	5~11	250	100Ω~100kΩ (E24)	G : ±2% J : ±5%				
M-	RKL	3~12	100 125 250 500 1000	10Ω~10MΩ	±0.5% ±1% ±2% ±5%	±100 ±150 ±200	100V	+70℃	−55℃~ +125℃
	RKC (1.8pitch)	4~14					50V		
	RKC (2.54pitch)	3~16					200V		
	RKH	4~13					250V		

■ Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/−55℃ and +25℃/+125℃ (RKL) +25℃/−55℃ and +25℃/+155℃ (RKC, RKH)
Overload (Short time)	0.5	0.25	Rated voltage×2.5 for 5s
Resistance to soldering heat	0.5	0.25	260℃±5℃, 10s±1s
Rapid change of temperature	0.5	0.25	−40℃ (30min.) / +85℃ (30min.) 5 cycles
Moisture resistance	2	1	40℃±2℃, 90%~95%RH, 1000h 1.5h ON / 0.5h OFF cycle
Endurance at 70℃	2	1	70℃±2℃, 1000h 1.5h ON / 0.5h OFF cycle

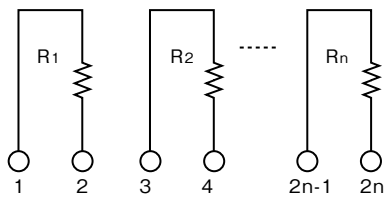
■ Circuit Schematics

B circuit



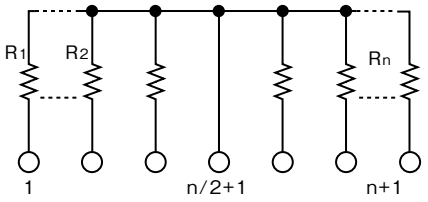
R1 = R2 = R3 = R4 =·····= Rn
n : number of elements
example
RKC8B 103 J
RKL8B 472 J
RKH8B 332 J

S circuit



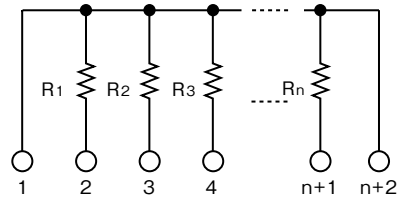
R1 = R2 =·····= Rn
n : number of elements
example
RKC4S 103 J
RKL4S 472 J
RKH4S 332 J

C circuit



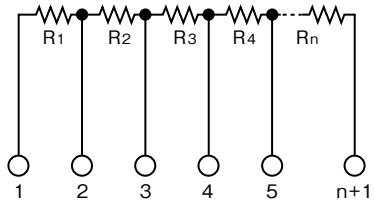
R1 = R2 =·····= Rn
n : number of elements
example
RKC8C 103 J
RKL8C 472 J
RKH8C 332 J

D circuit



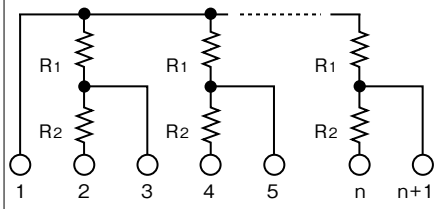
R1 = R2 = R3 =·····= Rn
n : number of elements
example
RKC8D 103 J
RKL8D 472 J
RKH8D 332 J

A circuit



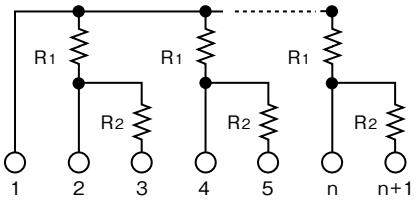
R1 = R2 = R3 = R4 =·····= Rn
n : number of elements
example
RKC8A 103 J
RKL8A 472 J
RKH8A 332 J

T circuit



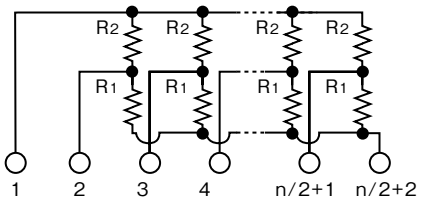
R1 = R2 or R1 ≠ R2
n : number of elements
example
RKC8T 103/103 J
RKL8T 103/103 J
RKH8T 103/103 J

E circuit



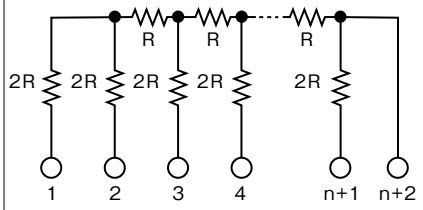
R1 = R2 or R1 ≠ R2
n : number of elements
example
RKC8E 103/103 J
RKL8E 103/103 J
RKH8E 103/103 J

R circuit



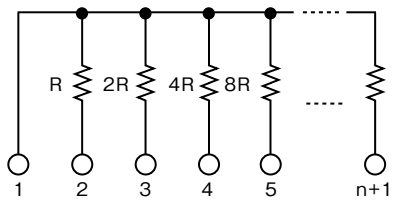
R1 = R2 or R1 ≠ R2
n : number of elements
example
RKC16R 331/471 J
RKL16R 331/471 J
RKH16R 331/471 J

L circuit



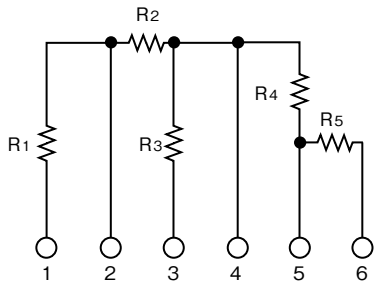
n : number of bits
example
RKC5L 253

K circuit

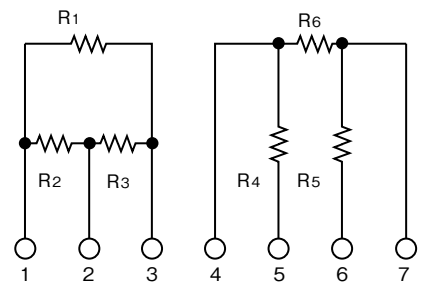


n : number of bits
example
RKC4K 102

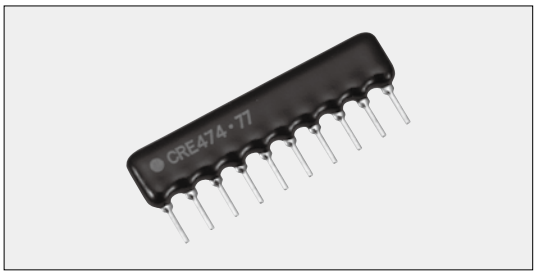
Example of custom circuit



Example of custom circuit

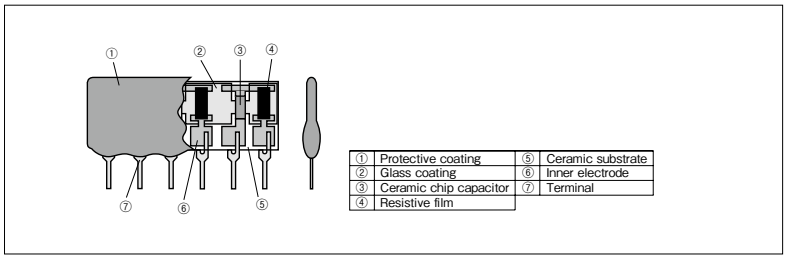


CR Series CR Networks



Coating color : Black
Marking : Alphanumeric

■Construction



■Features

- Stable in life and change with the passage of time with metal glaze resistors (RuO_2).
- Free from short circuit, unexpected solder melting and terminal disconnection due to the high temp. solder (Lead free) used to connect terminals.
- Capable of reducing the numbers of parts and part insertions.
- Custom orders are available.
- Products with lead free termiration meet EU-RoHS requirements. EU-RoHS requlation is not intended for Pb-glass contained in electrode, resistor element and glass.

■Type Designation

Example

CR	E	6	01	D
Product Code	Circuit Symbo	Number of Cells	KOA Ref. No.	Terminal Surface Material
	A B C D E F M	4～8(CRA) 3～8(CRB) 2～6(CRC,CRD CRE,CRF) Nil (CRM)		D : SnAgCu Nil : Sn/Pb

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

	Resistor	Capacitor
Max. Operating Voltage	50V	
Constant Range	10Ω～1MΩ	10pF～0.1μF
T.C.	±200×10⁻⁶/K	CH, B, R※1
Tolerance	±5% (J)	±5% (J) ±10% (K) ±20% (M)
Operating Temp. Range	−25℃～+85℃	
Storage Temp. Range	−55℃～+125℃	

※1

T.C. Type	T.C.			Operating Temp. Range
	Reference Temp.	Temp. range	Capacitance Change or Temperature coefficient	
CH	20℃	+20℃～+125℃	0±60×10⁻⁶/K	−55℃～+125℃
B	20℃	−25℃～+85℃	±10%	−25℃～+85℃
R	20℃	−55℃～+125℃	±15%	−55℃～+125℃

■Max. Wattage / Package

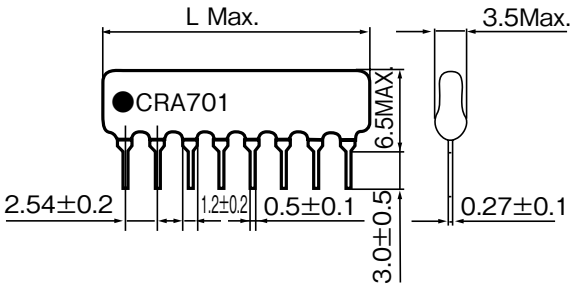
	Number of Pins				
	5	6	7	8	9
mW/Package	500	625	750	875	1000

	Number of Pins				
	10	11	12	13	14
mW/Package	1050	1150	1250	1350	1450

■Response to Lead-Free

- Lead-free products are added to the series. Solder of Sn/Ag/Cu is used for the joining solder. Please inquire of us about soldering temperatures.

■Dimensions (mm)



Type	Dimensions (mm)		
	Number of Pins	L Max.	H Max.
CRA□	5~9	2.54×P※2+0.6	6.5
CRB□	5~10		
CRC□	5~13		
CRD□	5~13		
CRE□	6~14		
CRF□	5~13		

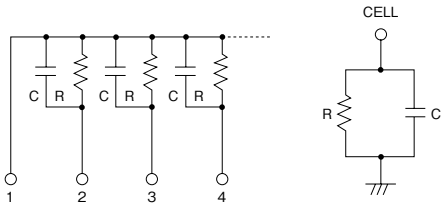
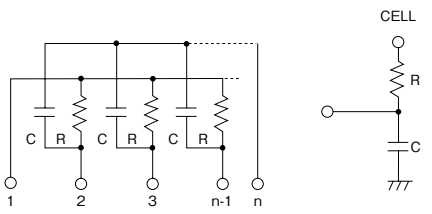
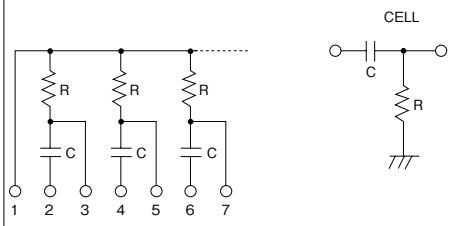
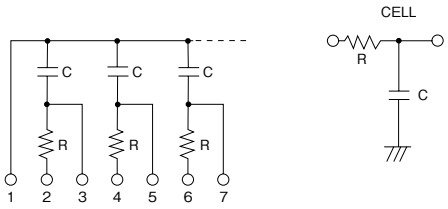
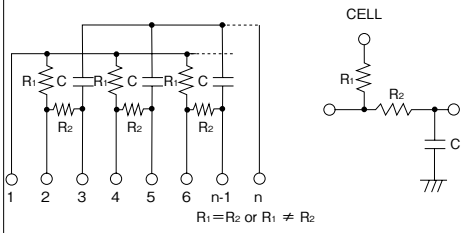
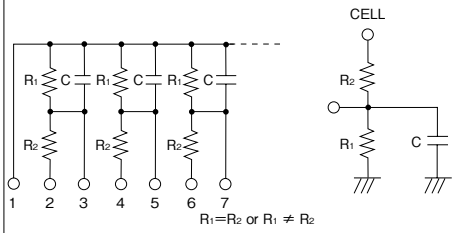
※2 P=Number of pins

■When ordering the CR series, please indicate the following items shown below:

For circuit code A~F, please indicate the following items.
Resistance
Capacitance
Operating voltage
Capacitance tolerance
T.C.

For circuit code M, please add the following items.
Circuit schematics
Pin layout
Dimensions
Conditions for use
Resistor (Power rating,Tolerance,T.C.R.)

■Circuit Constructions

CRA □□□	CRB □□□	CRC □□□
		
NO.OF CELLS 4~8	NO.OF CELLS 3~8	NO.OF CELLS 2~6
CRD □□□	**CRE □□□**	**CRF □□□**
		
NO.OF CELLS 2~6	NO.OF CELLS 2~6	NO.OF CELLS 2~6

■Precautions for Use

- The conditions of flow soldering for lead-free terminal resistors are set up at 255℃ max. within 5s.
- A few cross talks will happen in network resistors. Design the circuit taking the effect by the cross talks into consideration as very low voltage will occur to the resistor elements that don't pass current by the voltage drop in common electrode if current flows to the common electrodes.

Precautions for the Thermal Sensors

Refer to the precautions in the beginning part of this catalogue for particulars common to all products.

●Particulars common to Thermal Sensors

- Excessive voltage such as ESD, could damage thermal sensors.
- Water drops from condensation or impure substances that adheres between the electrode wires may cause insulation deficiency and lower the resistance value of the thermal sensors. Be aware when using this product.
- Avoid sudden changes in temperature to maintain the accuracy of the thermal sensors.
- Some of the thermal sensors use special temperature sensing films. Contact us if the sensors are constantly operated under high temperature environment.
- It is necessary to suppress self heating in the design to maintain accuracy of the thermal sensor if rated temperature is set.

Platinum Thin-Film Thermal Sensors

- Welding is recommended to connect the lead wires of SDT101B, SDT310P, SDT310MTM, SDT310AP, SDT310HCTP and SDT310VASP2 since they are heat resistant lead wires. Select the flux for stainless-steel when soldering. Wash the flux with hot water after the soldering to remove the residues completely.
- The 3-wire or 4-wire method is recommended for implementing high precision temperature measuring for both SDT101 and SDT310 series.
- When molded or placed in a metal tube cover filled with resin, the resistance value may change depending on the kind of resins used.

Terms and definitions

■Platinum Thin Film Thermal Chip Sensors

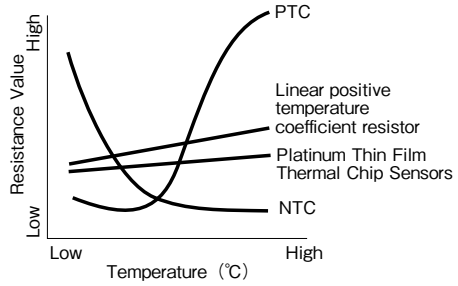
- Also known as a platinum resistance temperature detector, an electronic component whose resistance value changes with temperature as determined by standards.
- It uses a platinum thin film as a resistor and has excellent environmental resistance, and its resistance value rises almost linearly as the temperature rises.

■Linear positive temperature coefficient resistor

- Unlike the platinum thin film thermal chip sensors,there are many types of resistance value changes with temperature, and there are many types of resistance values, and the resistance value changes with temperature.
- The resistance value change range is narrow compared to the thermistors but the linearity is high.

■Thermistor

- The parts, named after thermally sensitive resistors, are semi conductor temperature sensitive elements, resistances of which largely vary according to change in temperature. There are 2 kinds of thermistors by the difference in characteristics of resistance change :
- PTC (Positive Temperature Coefficient) : The theremistor which resistance increases with the rise in temperature.
- NTC (Negative Temperature Coefficient) : The thermistor which resistance decreases with the rise in temperature. This type is usually called thermistors.



■Thermal Time Constant

- Time needed for a sensor temperature to change 63.2% when the ambient temperature of a sensor is rapidly changed in a condition in which self heat-generation can be ignored.

■Thermal Dissipation Constant

- The necessary power which is needed to increase the temperature of the element 1℃ by self heating and is expressed in the following formula:

$$\delta\,(\mathrm{W/℃}) = \mathrm{W}/(\mathrm{T_1} - \mathrm{T})$$

W : Electrical input power (W)
T : Standard Temperature (℃)
T_1 : Self heat-generated temperature applied by power (℃)

■Self-heating coefficient

- Self-heating coefficient expressed in ℃/mW is values measured at temperature : 0℃ in flowing oil with a velocity >0.2m/s, which is value of elements and vary with connecting or fixing methods.

Terms and definitions

■Temperature Coefficient of Resistance (T.C.R.)

- Relative variation of resistance between two given temperatures when temperature is changed by 1K, which shows by the following formula.

$$\text{T.C.R. } (\times 10^{-6}/\text{K}) = \frac{R - R_0}{R_0} \times \frac{1}{T - T_0} \times 10^6$$

R : Resistance value (Ω) at T (℃)
R_0 : Resistance value (Ω) at T_0 (℃)
T : Measured test temperature (℃)
T_0 : Measured base temperature (℃)

■Specified Current

- The electricity which it is charged with in the element is moved to the range that rise in temperature due to a self-heat generation can be ignored.Oridinarily recommended measuring currents are 1mA for 100Ω and 0.1mA for 500Ω.

■Rated Power

- The maximum value of power which can be continuously applied to a resistor at a rated ambient temperature.

■Critical Resistance Value

- The maximum nominal resistance value at which the rated power can be applied without exceeding the maximum working voltage.
- The rated voltage is equal to the maximum working voltage in the critical resistance value.

■Maximum Working Voltage

- Maximum D.C. or A.C. voltage (rms) that can be continuously applied to the resistor or the thermosensor. However, the maximum value of the applicable voltage is the rated voltage at the critical resistance value or lower.

■Overload Voltage

- Allowable voltage which is applied in 5 sec. under short time overload test. Overload voltage shall be 2.5 times of rated voltage or max. overload voltage, whichever is lower.

■Rated Ambient Temperature

- Maximum ambient temperature at which the power rating may be applied continuously. The rated ambient temperature refers to the temperature around the resistor mounted inside the equipment, not to the air temperature outside the equipment.

■Derating Curve

- Curve that expresses the relation between ambient temperature and the maximum allowable power, which is generally expressed in percentage.

■External Conductor

- The conductor connected to a temperature sensor that is located outside of the protective body.

■Internal Conductor

- The conductor connected to a temperature sensor that is located inside of the protective body.

■Resistance-Temperature Characteristic of a Thermistor (NTC)

- It means the relation between a zero load resistance and a temperature in a temperature range and is approximately expressed in the following formula :

$$R = R_0 \exp\{B(1/T - 1/T_0)\}$$

R : Resistance Value in Temperature T (K).
R_0 : Resistance Value in Temperature T_0 (K).
B : B Constants T (K)=t (℃)+273.15

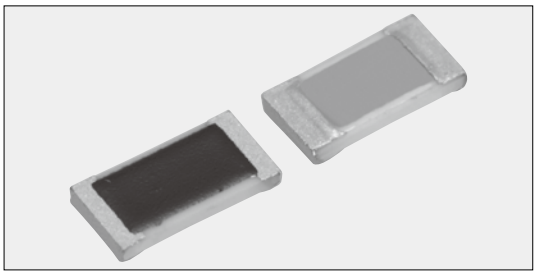
■B Constant of a Thermistor (NTC)

- Size of change in the resistance found from optional 2 temperatures in the resistance temperature characteristics and is calculated from the following formula:

$$B\,(K) = \frac{\ln R - \ln R_1}{1/T - 1/T_1}$$

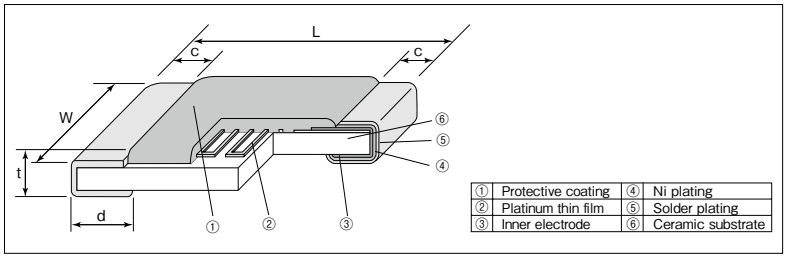
R : Resistance Value in T (K)
R_1 : Resistance Value in T_1 (K)
T : Standard Temperature (K)
T_1 : Regulated Temperature (K)

SDT73H·SDT73S Platinum Thin Film Thermal Chip Sensors



Coating color : SDT73H Black SDT73S Milky white

■Construction



①	Protective coating	④	Ni plating
②	Platinum thin film	⑤	Solder plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- SMD platinum thin film thermal sensors.
- T.C.R. is equivalent to JIS・IEC standards.
- Suitable for temperature control in various industrial equipment.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements.

■Applications

- Temperature compensation for various kinds of sensor drive circuits.
- Temperature compensation for telecommunication, measuring and medical equipment.
- Temperature compensation for ICs.

■Reference Standards

IEC 60751[-1995] JIS C 1604[-1997]

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W±0.2	c±0.3	d±0.3	t±0.15	
SDT73H2B (1206)	3.2	1.6	0.5	0.5	0.5	9.0
SDT73S2B (1206)						

■Type Designation

Example

SDT73H	2B	T	TE	100	F	385
Product Code	Size	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10⁻⁶/K)
SDT73H SDT73S	2B : 3.2×1.6mm	T : Sn	TEK : 4mm pitch plastic embossed TE : 4mm pitch plastic embossed BK : Bulk	100 : 100Ω 500 : 500Ω ※SDT73S is only 100Ω	C : ±0.2% F : ±1% ※SDT73S is only F	385 : +3850

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Resistance (Ω at 0℃)	Resistance Tolerance※1 (%)	Thermal Time Constant※2 (s)	Thermal Dissipation Constant※2 (mW/℃)	T.C.R.※3 (×10⁻⁶/K)	T.C.R. Tolerance (×10⁻⁶/K)	Operating Temperature Range (℃)	Specified Current※5 (mA) max.	Taping & Q'ty/Reel (pcs)	
									TEK	TE
SDT73H 2B	100、500	C : ±0.2、F : ±1	6.5	2.4	3850	±50	−55～+155	100Ω : 1 500Ω : 0.1	1000	5000
SDT73S 2B	100	F : ±1					−55～+250※4			

※1 Please consult with us about the products equivalent to class B of JIS.
※2 Thermal time constant and thermal dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.
Thermal dissipation constant is approx. 4mW/℃ under the surface mounting condition.
※3 T.C.R. Measuring Temperature:0℃/+100℃
※4 When always using a SDT73S, 200℃ or less is recommended.
※5 The electricity which it is charged with in the element is moved to the range that rise in temperature due to a self-heat generation can be ignored.
Oridinarily recommended measuring currents are 1mA for 100Ω and 0.1mA for 500Ω.

■Precautions for Use

- When measuring current higher than rated current (100Ω : 1mA, 500Ω : 0.1mA) is used, calculate a rise in temperature by self-heating and confirm the error range.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- When the components are polluted by ionic impurities like sodium(Na^+), chlorine(Cl^-) etc. included in perspiration and saliva, it leads to electric erosion. Avoid the pollution when storage, mounting and using. Consider not to remain ionic substances on the components. Wash by pure water etc. and dry them when you find pollution.
- Please pay attention that the top of an iron does not direct touch to the components. There is a risk that may cause a change in resistance. Take care that another risk may happen that the protecting coat is carbonized in an instant when touched directly by the top of the iron, also climatic-proof for electric corrosion or insulation of protecting coat may be dropped down. Be sure not to give high temperature on the top of the iron as it will degrade the protecting coat.
- Avoid storing components under direct sun rays, high temperature/humidity. Direct sun rays will cause quality change of taping and difficulty of keeping appropriate peeling strength. 5～35℃/35～75%RH, there is no deterioration of solderability for 12 months, but take special care for storing, because condensation, dust, and toxic gas like hydrogen sulfide, sulfurous acid gas, hydrogen chloride, etc. may drop solderability.

■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	0℃
T.C.R.	3850±50(×10⁻⁶/K)	3850±10(×10⁻⁶/K)	0℃/+100℃
Insulation resistance	100MΩ or more	—	d.c.100V
Dielectric withstanding voltage	0.5	−0.019	a.c.100V 60s~70s
Resistance to soldering heat	0.5	−0.004	260℃, 10s
Rapid change of temperature	0.5	−0.033(SDT73H) −0.048(SDT73S)	−55℃ (30min) /+25℃ (2~3min) /+155℃ (30min) /+25℃ (2~3min) 10 cycles (SDT73H, SDT73S) +25℃(30min)/+250℃(30min) 10 cycles(SDT73S)
Moisture resistance	0.5	−0.016	40℃, 90%~95%RH, 1000h, 1mA 1.5h ON/0.5h OFF cycle
Normal temperature load life	0.5	−0.010	20℃±10℃, 1000h 1mA Continuous turning on electricity
High temperature load life	0.5	−0.017(SDT73H) −0.020(SDT73S)	+155℃, 1000h(SDT73H), +250℃, 1000h(SDT73S) 1mA Continuous turning on electricity
High temperature exposure	0.5	−0.022(SDT73H) −0.023(SDT73S)	+155℃, 1000h(SDT73H), +250℃, 1000h(SDT73S)
Low temperature exposure	0.5	−0.029	−55℃, 1000h

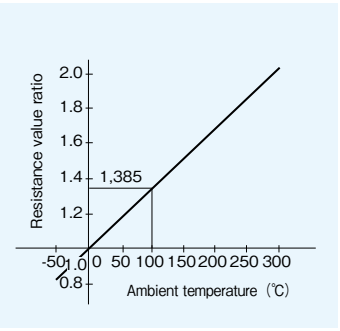
■Pt100 Resistance-Temperature Characteristic (JIS C 1604-1997)

100Ω at 0℃

Temperature (℃)	0	−1	−2	−3	−4	−5	−6	−7	−8	−9
−50	80.31	79.91	79.51	79.11	78.72	78.32	—	—	—	—
−40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70
−30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67
−20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62
−10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48
	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95
150	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.43	171.80
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49
200	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16
210	179.53	179.89	180.26	180.63	180.99	181.36	181.72	182.09	182.46	182.82
220	183.19	183.55	183.92	184.28	184.65	185.01	185.38	185.74	186.11	186.47
230	186.84	187.20	187.56	187.93	188.29	188.66	189.02	189.38	189.75	190.11
240	190.47	190.84	191.20	191.56	191.92	192.29	192.65	193.01	193.37	193.74
250	194.10	—	—	—	—	—	—	—	—	—

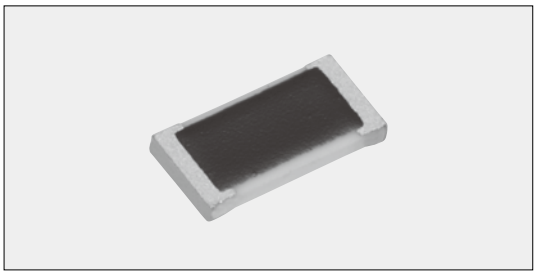
Note :
Desired temperature values are obtained by adding temperatures in the vertical and horizontal axes. When calculating a resistance value of 105℃, read the value in the column where 100℃ in the vertical axis and 5℃ in the horizontal axis cross. The value will be 140.40Ω. The value for 500Ω at 0℃ will be the value obtained by multiplying the resistance value in this table by 5.

■Temperature Characteristics



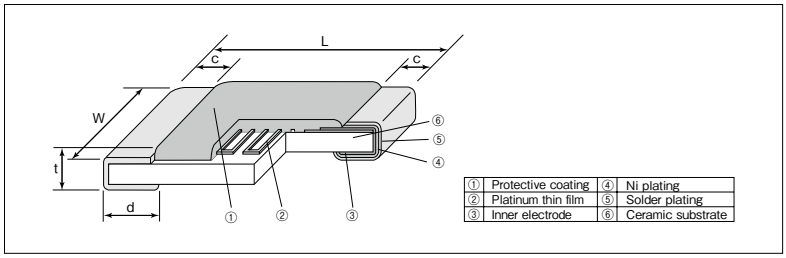
Approximate Expression for Resistance-Temperature Characteristics
−55℃~0℃ : $R_T = R_0 \{1 + C_1 T + C_2 T^2 + C_3 (T-100) T^3\}$
0℃~+250℃ : $R_T = R_0 (1 + C_1 T + C_2 T^2)$
R_T : Resistance value at T℃
R_0 : Resistance value at 0℃
T : Ambient temperature (℃)
Constants C_1, C_2, C_3 : $C_1 = 3.9083 \times 10^{-3}$℃$^{-1}$
$C_2 = -5.775 \times 10^{-7}$℃$^{-2}$
$C_3 = -4.183 \times 10^{-12}$℃$^{-4}$

SDT73V Platinum Thin Film Thermal Chip Sensors (For Automotive)



Coating color : Black

■Construction



①	Protective coating	④	Ni plating
②	Platinum thin film	⑤	Solder plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- SMD platinum thin film thermal sensors for automotive.
- T.C.R. is equivalent to JIS・IEC standards.
- Suitable for both flow and reflow solderings.
- AEC-Q200 Tested.
- Products meet EU-RoHS requirements.

■Applications

- Temperature compensation of the electronic component for automotive.
- Temperature compensation for various kinds of sensor drive circuits.
- Temperature compensation for telecommunication and measuring equipment.

■Reference Standards

IEC 60751^{-1995} JIS C 1604^{-1997}

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W±0.2	c±0.3	d±0.3	t±0.15	
2B (1206)	3.2	1.6	0.5	0.5	0.5	9.0

■Type Designation

Example

SDT73V	2B	T	TE	100	F	385
Product Code	Size	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10^{-6}/K)
	2B : 3.2×1.6mm	T : Sn	TEK : 4mm pitch plastic embossed TE : 4mm pitch plastic embossed BK : Bulk	100 : 100Ω 500 : 500Ω	C : ±0.2% F : ±1%	385 : +3850

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Resistance (Ω at 0℃)	Resistance※1 Tolerance (%)	Thermal Time※2 Constant (s)	Thermal Dissipation※2 Constant (mW/℃)	T.C.R.※3 (×10^{-6}/K)	T.C.R. Tolerance (×10^{-6}/K)	Operating Temperature Range (℃)	Specified※4 Current (mA) max.	Taping & Q'ty/Reel (pcs)	
									TEK	TE
SDT73V 2B	100 500	C : ±0.2 F : ±1	6.5	2.4	3850	±50	−55～+155	100Ω : 1 500Ω : 0.1	1,000	5,000

※1 Please consult with us about the products equivalent to class B of JIS.
※2 Thermal time constant and thermal dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.
Thermal dissipation constant is approx. 4mW/℃ under the surface mounting condition.
※3 T.C.R. Measuring Temperature:0℃/+100℃
※4 The electricity which it is charged with in the element is moved to the range that rise in temperature due to a self-heat generation can be ignored.
Oridinarily recommended measuring currents are 1mA for 100Ω and 0.1mA for 500Ω.

■Precautions for Use

- When measuring current higher than rated current (100Ω : 1mA, 500Ω : 0.1mA) is used, calculate a rise in temperature by self-heating and confirm the error range.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- When the components are polluted by ionic impurities like sodium(Na^+), chlorine(Cl^-) etc. included in perspiration and saliva, it leads to electric erosion. Avoid the pollution when storage, mounting and using. Consider not to remain ionic substances on the components. Wash by pure water etc. and dry them when you find pollution.
- Please pay attention that the top of an iron does not direct touch to the components. There is a risk that may cause a change in resistance. Take care that another risk may happen that the protecting coat is carbonized in an instant when touched directly by the top of the iron, also climatic-proof for electric corrosion or insulation of protecting coat may be dropped down. Be sure not to give high temperature on the top of the iron as it will degrade the protecting coat.
- Avoid storing components under direct sun rays, high temperature/humidity. Direct sun rays will cause quality change of taping and difficulty of keeping appropriate peeling strength. 5～35℃/35～75%RH, there is no deterioration of solderability for 12 months, but take special care for storing, because condensation, dust, and toxic gas like hydrogen sulfide, sulfurous acid gas, hydrogen chloride, etc. may drop solderability.

■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods (According to AEC-Q200 specification)
	Limit	Typical	
High temperature exposure	0.5	−0.022	+155℃, 1000h
Rapid change of temperature	0.5	−0.058	−55℃(30min)/+25℃(2~3min)/+155℃(30min)/+25℃(2~3min) 1000 cycles
Moisture resistance	0.5	−0.041	25℃-65℃ (90%~100%RH) t=24 hours/cycle. Unpowered. It is carried out 10 times.
Moisture resistance	0.5	−0.016	85℃, 85%RH, 1000h, 1mA 1.5h ON/0.5h OFF cycles
High temperature load life	0.5	−0.017	155℃, 1000h 1mA Continuous turning on electricity
Mechanical Shock	0.5	−0.001	100gs maximum, 6Dms(Standard),12.3ft/s
Vibration	0.5	−0.009	Test from 10-2000Hz 5g's for 20 min. 12 cycles each of 3 orientations.
Resistance to Soldering Heat	0.5	−0.004	260℃, 10s
Thermal Shock	0.5	−0.032	−55℃(15min)/+155℃(15min) 300cycles
Solderability	95% coverage min.	−	235℃±5℃, 3s±0.5s
Terminal Strength	0.5	−0.011	1.8kg force is kept on the samples for 60 seconds.

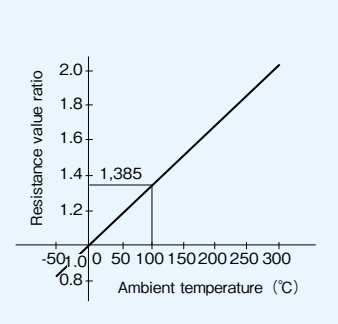
■Pt100 Resistance-Temperature Characteristic (JIS C 1604-1997)

100Ω at 0℃

Temperature (℃)	0	−1	−2	−3	−4	−5	−6	−7	−8	−9
−50	80.31	79.91	79.51	79.11	78.72	78.32	−	−	−	−
−40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70
−30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67
−20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62
−10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48
	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95
150	157.33	157.70	158.07	158.45	158.82	159.19	−	−	−	−

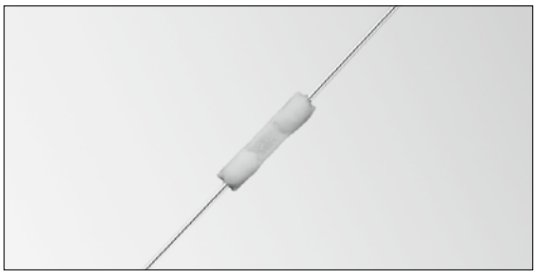
Note :
Desired temperature values are obtained by adding temperatures in the vertical and horizontal axes. When calculating a resistance value of 105℃, read the value in the column where 100℃ in the vertical axis and 5℃ in the horizontal axis cross. The value will be 140.40Ω. The value for 500Ω at 0℃ will be the value obtained by multiplying the resistance value in this table by 5.

■Temperature Characteristics



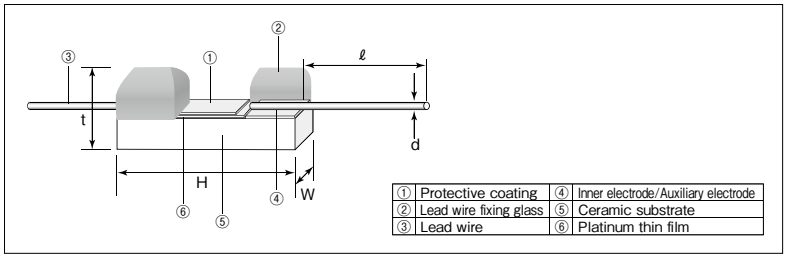
Approximate Expression for Resistance-Temperature Characteristics
−55℃~0℃ : $R_T=R_0\{1+C_1T+C_2T^2+C_3(T-100)T^3\}$
0℃~+155℃ : $R_T=R_0(1+C_1T+C_2T^2)$
R_T : Resistance value at T℃
R_0 : Resistance value at 0℃
T : Ambient temperature (℃)
Constants C_1, C_2, C_3 : $C_1=3.9083\times10^{-3}$℃$^{-1}$
$C_2=-5.775\times10^{-7}$℃$^{-2}$
$C_3=-4.183\times10^{-12}$℃$^{-4}$

SDT310VASP2 Small type Platinum Thin Film Thermal Sensors (Small Heater Element)



Coating color：White

■Construction



①	Protective coating	④	Inner electrode/Auxiliary electrode
②	Lead wire fixing glass	⑤	Ceramic substrate
③	Lead wire	⑥	Platinum thin film

■Features

- Achieves a thermal time constant of 2.8-seconds due to volume reduction.
- Excellent heat-resistance.
- Applies axial lead type suitable to use as heater element.
- AEC-Q200 Tested.
- Products meet EU-RoHS requirements.

■Applications

- Heater elements for thermal flowmeters of Industrial equipment, measuring instruments and automotive.
- Ultra-small thermal sensor of industrial equipment and measuring instrument.

■Reference Standards

IEC 60751-2008
JIS C 1604-2013

■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	$W^{+0.15}_{-0.1}$	H±0.1	t max.	l±2.0	d±0.05	
SDT310VASP2	0.4	2.0	0.65	10.0	0.12	4.3

■Type Designation

Example

SDT310V	AS	P	2	K	20	F	40
Product Code	Style	Terminal Surface Material	Generation	Packaging	Nomonal Resistance	Resistance Tolerance	T.C.R Tolerance
		P：Pt clad		K：Chip Tray B：Bulk	20：20Ω	F：±1%	40：±40×10⁻⁶/K

■Ratings

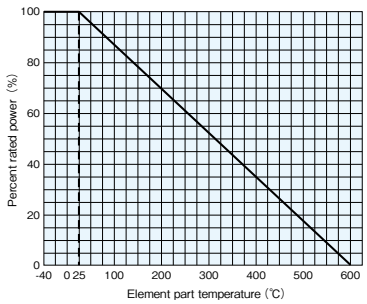
Resistance (Ω at 0℃)	Resistance Tolerance (%)	T.C.R※1 (×10⁻⁶/K)	Thermal Time Constant※2 (s)	Maximum Current (mA)	Power Rating (W)	Temperature Range※3 (℃)	Tray (pcs)
20	±1	3850±40	2.8	76	0.336	−55～+600	50

※1 T.C.R. Measuring Temperature:0℃/+100℃
※2 Thermal time constant is value measured in stationary air and is typical value ,which are values of elements and vary with connecting or fixing methods.
※3 Temperature of the device including a self-heating.

■Precautions for Use

- It is difficult to solder SDT310VASP2 because of using heat-resistant leads. Make use of welding to connect the leads wire.
- The sense warm part be careful of the treatment because there is fear to damage when giving a strong mechanical impact because it is using the glass courting.
- If SDT310VASP2 is used by being molded or placed in a metal protection tube filled with resin, the resistance value may occasionally vary slightly depending on the resin used.
- When forming a lead line, fix a lead line root and the load make not depend on the lead line root part.
- Part is intended to measure Air Flow Only - Not intended for Liquid Measurement.

■Derating Curve



For sensors operated at an element part temperature of 25℃ or higher, the power shall be derated in accordance with derating curve on the left.

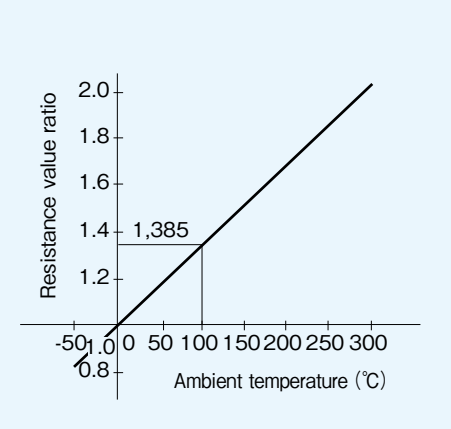
■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	0℃
T.C.R.	Within specified T.C.R.	—	0℃/+100℃
Rapid change of temperature	0.5	−0.15	−55℃ (30min) /+200℃ (30min) 1000 cycles
Moisture resistance	0.5	−0.12	85℃±2℃、85%RH、1000h、10mA 1.5h ON/0.5h OFF cycles
Normal temperature load life	0.5	0.10	25℃±10℃、1000h、76mA 1.5h ON/0.5h OFF cycles
High temperature load life	0.5	0.11	125℃、1000h 73mA Continuous turning on electricity
Mechanical Shock	0.5	0.04	100g's maximum, 6Dms (Standard), 12.3ft/s
Vibration	0.5	−0.03	Test from 10-1900hz 30g's for 20min. 12cycles each of 3 orientations.
Component Strength	400g and more	—	Pull test

■Pt20 Resistance-Temperature Characteristic
20Ω at 0℃

Temperature (℃)	0	−1	−2	−3	−4	−5	−6	−7	−8	−9
−50	16.06	15.98	15.90	15.82	15.74	15.66	—	—	—	—
−40	16.85	16.77	16.70	16.62	16.54	16.46	16.38	16.30	16.22	16.14
−30	17.64	17.57	17.49	17.41	17.33	17.25	17.17	17.09	17.01	16.93
−20	18.43	18.35	18.27	18.20	18.12	18.04	17.96	17.88	17.80	17.72
−10	19.22	19.14	19.06	18.98	18.90	18.82	18.75	18.67	18.59	18.51
0	20.00	19.92	19.84	19.77	19.69	19.61	19.53	19.45	19.37	19.30
	0	1	2	3	4	5	6	7	8	9
0	20.00	20.08	20.16	20.23	20.31	20.39	20.47	20.55	20.62	20.70
10	20.78	20.86	20.94	21.01	21.09	21.17	21.25	21.33	21.40	21.48
20	21.56	21.64	21.71	21.79	21.87	21.95	22.02	22.10	22.18	22.26
30	22.33	22.41	22.49	22.57	22.64	22.72	22.80	22.88	22.95	23.03
40	23.11	23.19	23.26	23.34	23.42	23.49	23.57	23.65	23.73	23.80
50	23.88	23.96	24.03	24.11	24.19	24.26	24.34	24.42	24.49	24.57
60	24.65	24.73	24.80	24.88	24.96	25.03	25.11	25.19	25.26	25.34
70	25.42	25.49	25.57	25.64	25.72	25.80	25.87	25.95	26.03	26.10
80	26.18	26.26	26.33	26.41	26.48	26.56	26.64	26.71	26.79	26.87
90	26.94	27.02	27.09	27.17	27.25	27.32	27.40	27.47	27.55	27.63
100	27.70	27.78	27.85	27.93	28.00	28.08	28.16	28.23	28.31	28.38
110	28.46	28.53	28.61	28.69	28.76	28.84	28.91	28.99	29.06	29.14
120	29.21	29.29	29.36	29.44	29.51	29.59	29.67	29.74	29.82	29.89
130	29.97	30.04	30.12	30.19	30.27	30.34	30.42	30.49	30.57	30.64
140	30.72	30.79	30.87	30.94	31.02	31.09	31.17	31.24	31.32	31.39
150	31.47	31.54	31.61	31.69	31.76	31.84	31.91	31.99	32.06	32.14
160	32.21	32.29	32.36	32.43	32.51	32.58	32.66	32.73	32.81	32.88
170	32.95	33.03	33.10	33.18	33.25	33.33	33.40	33.47	33.55	33.62
180	33.70	33.77	33.84	33.92	33.99	34.07	34.14	34.21	34.29	34.36
190	34.43	34.51	34.58	34.66	34.73	34.80	34.88	34.95	35.02	35.10
200	35.17	35.24	35.32	35.39	35.47	35.54	35.61	35.69	35.76	35.83
210	35.91	35.98	36.05	36.13	36.20	36.27	36.34	36.42	3649	36.56
220	36.64	36.71	36.78	36.86	36.93	37.00	37.08	37.15	37.22	37.29
230	37.37	37.44	37.51	37.59	37.66	37.73	37.80	37.88	37.95	38.02
240	38.19	38.17	38.24	38.31	38.38	38.46	38.53	38.60	38.67	38.75
250	38.82	38.89	38.96	39.04	39.11	39.18	39.25	39.33	39.40	39.47
260	39.54	39.61	39.69	39.76	39.83	39.90	39.97	40.05	40.12	40.19
270	40.26	40.33	40.41	40.48	40.55	40.62	40.69	40.77	40.84	40.91
280	40.98	41.05	41.12	41.20	41.27	41.34	41.41	41.48	41.55	41.63
290	41.70	41.77	41.84	41.91	41.98	42.05	42.13	42.20	42.27	42.34
300	42.41	42.48	42.55	42.62	42.70	42.77	42.84	42.91	42.98	43.05
310	43.12	43.19	43.26	43.33	43.41	43.48	43.55	43.62	43.69	43.76
320	43.83	43.90	43.97	44.04	44.11	44.18	44.25	44.33	44.40	44.47
330	44.54	44.61	44.68	44.75	44.82	44.89	44.96	45.03	45.10	45.17
340	45.24	45.31	45.38	45.45	45.52	45.59	45.66	45.73	45.80	45.87
350	45.94	46.01	46.08	46.15	46.22	46.29	46.36	46.43	46.50	46.57
360	46.64	46.71	46.78	46.85	46.92	46.99	47.06	47.13	47.20	47.27
370	47.34	47.41	47.48	47.55	47.62	47.69	47.76	47.83	47.90	47.97
380	48.04	48.10	48.17	48.24	48.31	48.38	48.45	48.52	48.59	48.66
390	48.73	48.80	48.87	48.94	49.00	49.07	49.14	49.21	49.28	49.35
400	49.42	49.49	49.56	49.63	49.69	49.76	49.83	49.90	49.97	50.04
410	50.11	50.18	50.24	50.31	50.38	50.45	50.52	50.59	50.66	50.72
420	50.79	50.86	50.93	51.00	51.07	51.13	51.20	51.27	51.34	51.41
430	51.48	51.54	51.61	51.68	51.75	51.82	51.88	51.95	52.02	52.09
440	52.16	52.22	52.29	52.36	52.43	52.50	52.56	5263	52.70	52.77
450	52.84	52.90	52.97	53.04	53.11	53.17	53.24	53.31	53.38	53.44
460	53.51	53.58	53.65	53.71	53.78	53.85	53.92	53.98	54.05	54.12
470	54.19	54.25	54.32	54.39	54.46	54.52	54.59	54.66	54.72	54.79
480	54.86	54.93	54.99	55.06	55.13	55.19	55.26	55.33	55.39	55.46
490	55.53	55.60	55.66	55.73	55.80	55.86	55.93	56.00	56.06	56.13
500	56.20	56.26	56.33	56.40	56.46	56.53	56.59	56.66	56.73	56.79
510	56.86	56.93	56.99	57.06	57.13	57.19	57.26	57.32	57.39	57.46
520	57.52	57.59	57.66	57.72	57.79	57.85	57.92	57.99	58.05	5812
530	58.18	58.25	58.32	58.38	58.45	58.51	58.58	58.64	58.71	58.78
540	58.84	58.91	58.97	59.04	59.10	59.17	59.24	59.30	59.37	59.43
550	59.50	59.56	59.63	59.69	59.76	59.82	59.89	59.96	60.02	60.09
560	60.15	60.22	60.28	60.35	60.41	60.48	60.54	60.61	60.67	60.74
570	60.80	60.87	60.93	61.00	61.06	61.13	61.19	61.26	61.32	61.39
580	61.45	61.52	61.58	61.65	61.71	61.77	61.84	61.90	61.97	62.03
590	62.10	62.16	62.23	62.29	62.36	62.42	62.48	62.55	62.61	62.68
600	62.74	—	—	—	—	—	—	—	—	—

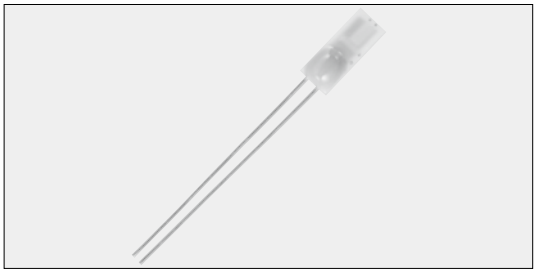
■Temperature Characteristics



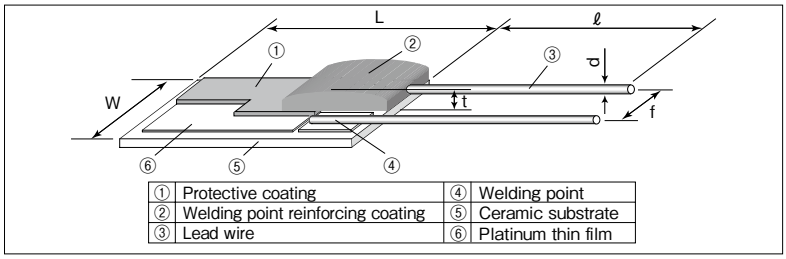
Approximate Expression for Resistance-Temperature Characteristics
−55℃～0℃ : $R_T=R_0\{1+C_1T+C_2T^2+C_3(T-100)T^3\}$
0℃～+400℃ : $R_T=R_0(1+C_1T+C_2T^2)$
RT : Resistance value at T℃
R0 : Resistance value at 0℃
T : Ambient temperature (℃)
Constants C_1, C_2, C_3 : $C_1=3.908\times10^{-3}℃^{-1}$
$C_2=-5.775\times10^{-7}℃^{-2}$
$C_3=-4.183\times10^{-12}℃^{-4}$

Note:
Desired temperature values are obtained by adding temperatures in the vertical and horizontal axes. When calculating a resistance value of 105℃, read the value in the column where 100℃ in the vertical axis and 5℃ in the horizontal axis cross. The value will be 28.08Ω.

SDT310HCTP Small type Platinum Thin Film Thermal Sensors (Narrow)



■Construction



①	Protective coating	④	Welding point
②	Welding point reinforcing coating	⑤	Ceramic substrate
③	Lead wire	⑥	Platinum thin film

■Features

- Characteristics are equivalent to IEC 60751-2008 ·JIS C 1604-2013.
- The small package (1.2mm×3mm) with a real ability of 100Ω resistance.
- Products meet RoHS requirements. RoHS regulation is not intended for Pb-glass contained in glass.

■Applications

- Cold Point compensation for thermocouple temperature controllers and temperature detection probe.
- Temperature compensation and revision for RF circuit of telecommunication equipment.

■Reference Standards

IEC 60751-2008
JIS C 1604-2013

■Dimensions

Type	Dimensions (mm)						Weight(g) (1000pcs)
	W±0.1	L±0.1	t max.	f (Nominal)	d±0.05	ℓ^{+2}_{-1}	
SDT310HCTP	1.2±0.1	3.0±0.1	1.1	0.5	0.15	8	13.3

■Type Designation

Example

SDT310	H	CT	P	100	A	3850
Product Code	Style	Operating Temperature	Terminal Surface Material	Nominal Resistance	Class	T.C.R. (×10⁻⁶/K)
	H : H style	CT : −55~400℃	P : Pt clad	100 : 100Ω	A : F0.15 B : F0.3	

■Ratings

Resistance (Ω at 0℃)	Tolerance Class		Tolerance (℃)	Resistance Tolerance (%)	T.C.R.※2 (×10⁻⁶/K)	Thermal Time※3 constant (s)	Self-heating※4 coefficient (℃/mW)	Specified※5 Current (mA) max.	Temperature Range (℃)
	IEC 60751-2008 JIS C 1604-2013	IEC 60751-1995 JIS C 1604-1997							
100	F0.15	Class A	±(0.15+0.002|t|)※1	±0.059	3850	2.8	0.09	1	−55~+300
	F0.3	Class B	±(0.3 +0.005|t|)※1	±0.12					−55~+400

※1 |t| is a measuring temperature indicated at ℃ that is not related to marking + · −.
※2 T.C.R. Mesuring Temperature:0℃/+100℃.
※3 Thermal time constant is value measured in stationary air and is typical value, which is value of element and vary with connecting or fixing methods.
※4 Self-heating coefficient expressed in ℃/mW is values measured at temperature:0℃ in flowing oil with a velocity >0.2m/s, which is value of elements and vary with connecting or fixing methods.
※5 Specified current is a current value that is used at reliability test under the condition of self heat-generation that can be disregarded. Recommended measuring currents 1mA for 100Ω.

■Precautions for Use

- It is difficult to solder SDT310HCTP because of using heat-resistant leads. Make use of welding to connect the leads wire.
- When an operating current is specified current, calculate a rise in temperature by self-heating to confirm an error.
- If SDT310HCTP is used by being molded or placed in a metal protection tube filled with resin, the resistance value may occasionally vary slightly depending on the resin used.

■Performance

Test Items	Performance Requirements ΔR± (%)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	0℃
T.C.R.	Within specified T.C.R.	—	0℃/+100℃
Insulation resistance	100MΩ or more	—	d.c.100V
Dielectric withstanding voltage	0.06	−0.003	a.c.100V 60s～70s
Rapid change of temperature	0.06(F0.15 at 300℃)	−0.002	−55℃(30min)/+25℃(2～3min)/+300 or 400℃(30min)/ +25℃(2～3min) 10 cycles
	0.12(F0.3 at 400℃)	0.013	
Moisture resistance	0.06	−0.002	60℃±2℃、90%～95%RH、1000h、1mA 1.5h ON/0.5h OFF cycle
High temperature load life	0.06(F0.15 at 300℃)	−0.016	300 or 400℃、1000h 1mA Continuous turning on electricity
	0.12(F0.3 at 400℃)	−0.022	
High temperature exposure	0.06(F0.15 at 300℃)	0.004	300 or 400℃、1000h
	0.12(F0.3 at 400℃)	0.014	
Low temperature exposure	0.06	0.010	−55℃、1000h

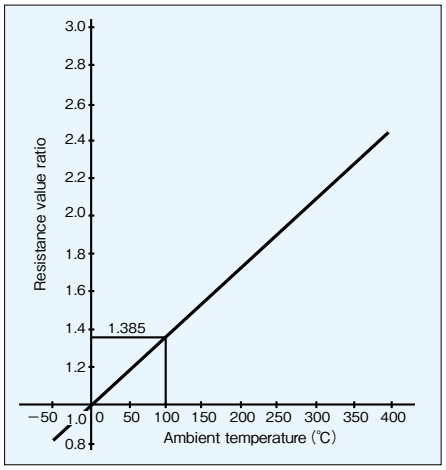
■Pt100 Resistance-Temperature Characteristic (JIS C 1604-2013)

100Ω at 0℃

Temperature (℃)	0	−1	−2	−3	−4	−5	−6	−7	−8	−9
−50	80.31	79.91	79.51	79.11	78.72	78.32	–	–	–	–
−40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70
−30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67
−20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62
−10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48
	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95
150	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.43	171.80
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49
200	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16
210	179.53	179.89	180.26	180.63	180.99	181.36	181.72	182.09	182.46	182.82
220	183.19	183.55	183.92	184.28	184.65	185.01	185.38	185.74	186.11	186.47
230	186.84	187.20	187.56	187.93	188.29	188.66	189.02	189.38	189.75	190.11
240	190.47	190.84	191.20	191.56	191.92	192.29	192.65	193.01	193.37	193.74
250	194.10	194.46	194.82	195.18	195.55	195.91	196.27	196.63	196.99	197.35
260	197.71	198.07	198.43	198.79	199.15	199.51	199.87	200.23	200.59	200.95
270	201.31	201.67	202.03	202.39	202.75	203.11	203.47	203.83	204.19	204.55
280	204.90	205.26	205.62	205.98	206.34	206.70	207.05	207.41	207.77	208.13
290	208.48	208.84	209.20	209.56	209.91	210.27	210.63	210.98	211.34	211.70
300	212.05	212.41	212.76	213.12	213.48	213.83	214.19	214.54	214.90	215.25
310	215.61	215.96	216.32	216.67	217.03	217.38	217.74	218.09	218.44	218.80
320	219.15	219.51	219.86	220.21	220.57	220.92	221.27	221.63	221.98	222.33
330	222.68	223.04	223.39	223.74	224.09	224.45	224.80	225.15	225.50	225.85
340	226.21	226.56	226.91	227.26	227.61	227.96	228.31	228.66	229.02	229.37
350	229.72	230.07	230.42	230.77	231.12	231.47	231.82	232.17	232.52	232.87
360	233.21	233.56	233.91	234.26	234.61	234.96	235.31	235.66	236.00	236.35
370	236.70	237.05	237.40	237.74	238.09	238.44	238.79	239.13	239.48	239.83
380	240.18	240.52	240.87	241.22	241.56	241.91	242.26	242.60	242.95	243.29
390	243.64	243.99	244.33	244.68	245.02	245.37	245.71	246.06	246.40	246.75
400	247.09	247.44	247.78	248.13	248.47	248.81	249.16	249.50	249.85	250.19

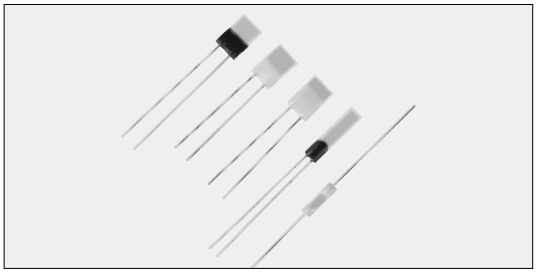
Note:
Desired temperature values are obtained by adding temperatures in the vertical and horizontal axes.When calculating a resistance value of 105℃, read the value in the column where 100℃ in the vertical axis and 5℃ in the horizontal axis cross.The value will be 140.40Ω.

■Temperature Characteristics



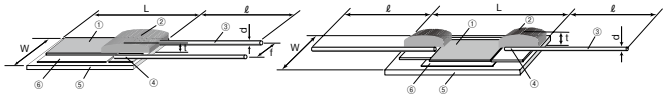
Approximate Expression for Resistance-Temperature Characteristics
−55℃～0℃ : $R_T=R_0\{1+C_1T+C_2T^2+C_3(T-100)T^3\}$
0℃～+400℃ : $R_T=R_0(1+C_1T+C_2T^2)$
R_T : Resistance value at T℃
R_0 : Resistance value at 0℃
T : Ambient temperature (℃)
Constants C_1, C_2, C_3 : $C_1=3.9083\times10^{-3}℃^{-1}$
$C_2=-5.775\times10^{-7}℃^{-2}$
$C_3=-4.183\times10^{-12}℃^{-4}$

SDT310 Small Type Platinum Thin Film Thermal Sensors



■Construction

SDT310LTC, SDT310P, SDT310MTM, SDT310HLTC　　SDT310AP



①	Protective coating	④	Welding point
②	Welding point reinforcing coating	⑤	Ceramic substrate
③	Lead wire	⑥	Platinum thin film

■Features

- T.C.R. is equivalent to JIS・IEC standards.
- The small package with a real ability of 1kΩ resistance.
- Thermal time constant is improved with the small package.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in glass.

■Applications

- Cold Point compensation and temperature detection probe for thermocouple temperature controllers.
- Hot wires and temperature compensation of anemometers.
- Temperature compensation and revision for RF circuit of telecommunication equipment.

■Reference Standards

IEC 60751[-1995]　JIS C 1604[-1997]

■Dimensions

Type	Dimensions (mm)						Weight (g) (1000pcs)
	W	L	t max.	f	d±0.05	ℓ	
SDT310LTC	2.0±0.25	3.0±0.25	1.2	1.1±0.25	0.2	10^{+5}_{-2}	18.5
SDT310P						8±2	24.5
SDT310MTM							25.4
SDT310HLTC	1.2±0.10	5.0±0.10	1.1	0.3±0.1		10^{+5}_{-2}	17.4
SDT310AP	0.8±0.2	3.0±0.25	1.2	–		8±2	13.1

■Type Designation

Example

SDT310		LT	C	100	A	3850
Product Code	Style	Operating Temperature Range	Terminal Surface Material	Nominal Resistance	Class or Resistance Tol.	T.C.R. (×10⁻⁶/K)
	Nil : Standard H : H style A : A style	LT:−55℃～+155℃ Nil:−55℃～+400℃ MT:−55℃～+650℃	C:SnCu (SDT310LT / SDT310HLT) P:Pt clad (SDT310・310A) M:Ptlr (SDT310MT)	10:10Ω (SDT310AP) 100:100Ω 500:500Ω 1K:1kΩ	A:± (0.15+0.002|t|) ℃ B:± (0.3+0.005|t|) ℃ C:± (1.0+0.01|t|) ℃ K:±10% (SDT310A)	

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

Type	Resistance Range (Ω at 0℃)	Tolerance Class Tolerance (℃)	Resistance Tolerance (%)	T.C.R.※1 (×10⁻⁶/K)	Thermal Time※2 constant (s)	Thermal Dissipation※2 constant (mW/℃)	Specified※3 Current (mA) max.	Operating Temperature Range (℃)
SDT310LTC	100 500, 1k	A:±(0.15+0.002|t|)	±0.059	3850	7.0	0.9	10Ω, 100Ω : 1 500Ω, 1kΩ : 0.1	−55～+155
		B:±(0.3 +0.005|t|)	±0.12					
		C:±(1.0 +0.01|t|)	±0.39					
SDT310P	100 500, 1k	A:±(0.15+0.002|t|)	±0.059					−55～+400
		B:±(0.3 +0.005|t|)	±0.12					
		C:±(1.0 +0.01|t|)	±0.39					
SDT310MTM	100	B:±(0.3 +0.005|t|)	±0.12					−55～+650
		C:±(1.0 +0.01|t|)	±0.39					
SDT310HLTC	1k	A:±(0.15+0.002|t|)	±0.059		2.8	1.0		−55～+155
		B:±(0.3 +0.005|t|)	±0.12					
		C:±(1.0 +0.01|t|)	±0.39					
SDT310AP	10	–	±10	3850±2%	6	1.0		−55～+400

※1 T.C.R. Mesuring Temperature : 0℃/+100℃

※2 Thermal time constant and dissipation constant are values measured in stationary air and are typical values, which are values of elements and vary with connecting or fixing methods.

※3 The electricity which it is charged with in the element is moved to the range that rise in temperature due to a self-heat generation can be ignored.. Recommended measuring currents are 1mA for 100Ω and 0.1mA for 500Ω or 1kΩ. SDT310AP can be used as hot-film sensor. Maximum specified current is 100mA when using under self-heating condition.

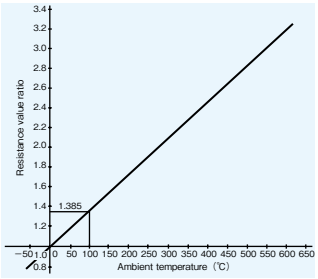
■Precautions for Use

- It is difficult to solder SDT310P, SDT310MTM and SDT310AP because of using heat-resistant leads. Make use of welding to connect the leads wire.
- When an operating current is specified current, calculate a rise in temperature by self-heating to confirm an error.
- If SDT310 series is used by being molded or placed in a metal protection tube filled with resin, the resistance value may occasionally vary slightly depending on the resin used.

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	0℃
T.C.R.	Within specified T.C.R.	—	0℃/+100℃
Insulation resistance	100MΩ or more	—	d.c.100V
Dielectric withstanding voltage	0.12	0.010	a.c.100V 60s～70s
Resistance to soldering heat (SDT310LTC)	0.5	0.014	350℃、3.5s
Rapid change of temperature	0.12	−0.026	−55℃ (30min)/+25℃ (2～3min)/+155℃ (30min)/+25℃ (2～3min) 10 cycles (SDT310LTC・SDT310HLTC) −55℃ (30min)/+25℃ (2～3min)/+400℃ (30min)/+25℃ (2～3min) 10 cycles (SDT310P・SDT310A) +25℃ (30min)/+650℃ (30min) 10 cycles (SDT310MTM)
Moisture resistance	0.5	−0.004	60℃±2℃、90%～95%RH、1000h、1mA 1.5h ON/0.5h OFF cycle
Normal temperature load life	0.5	−0.017	20℃±10℃、1000h 1mA Continuous turning on electricity
High temperature load life	0.5	−0.022	155℃±2℃(SDT310LTC・SDT310HLTC)、400℃±8℃(SDT310P・SDT310AP)、1000h、650℃±13℃(SDT310MTM)、250h 1mA Continuous turning on electricity
High temperature exposure	0.12 0.5 (SDT310MTM)	−0.027 −0.060 (SDT310MTM)	+155℃(SDT310LTC・SDT310HLTC)、+400℃(SDT310P・SDT310AP)、+650℃(SDT310MTM)、250h
Low temperature exposure	0.12	−0.036	−55℃、250h

■Temperature Characteristics



Approximate Expression for Resistance-Temperature Characteristics

−55℃～0℃ $:R_T=R_0\{1+C_1T+C_2T^2+C_3(T-100)T^3\}$

0℃～+650℃ $:R_T=R_0(1+C_1T+C_2T^2)$

R_T : Resistance value at T℃

R_0 : Resistance value at 0℃

T : Ambient temperature (℃)

Constants C_1, C_2, C_3 : $C_1=3.9083\times10^{-3}℃^{-1}$

$C_2=-5.775\times10^{-7}℃^{-2}$

$C_3=-4.183\times10^{-12}℃^{-4}$

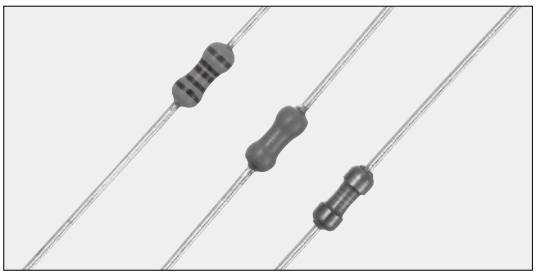
■Pt100 Resistance-Temperature Characteristic (JIS C1604-1997)

100Ω at 0℃

Temperature (℃)	0	−1	−2	−3	−4	−5	−6	−7	−8	−9
−50	80.31	79.91	79.51	79.11	78.72	78.32	—	—	—	—
−40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70
−30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67
−20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62
−10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48
	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95
150	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.43	171.80
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49
200	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16
210	179.53	179.89	180.26	180.63	180.99	181.36	181.72	182.09	182.46	182.82
220	183.19	183.55	183.92	184.28	184.65	185.01	185.38	185.74	186.11	186.47
230	186.84	187.20	187.56	187.93	188.29	188.66	189.02	189.38	189.75	190.11
240	190.47	190.84	191.20	191.56	191.92	192.29	192.65	193.01	193.37	193.74
250	194.10	194.46	194.82	195.18	195.55	195.91	196.27	196.63	196.99	197.35
260	197.71	198.07	198.43	198.79	199.15	199.51	199.87	200.23	200.59	200.95
270	201.31	201.67	202.03	202.39	202.75	203.11	203.47	203.83	204.19	204.55
280	204.90	205.26	205.62	205.98	206.34	206.70	207.05	207.41	207.77	208.13
290	208.48	208.84	209.20	209.56	209.91	210.27	210.63	210.98	211.34	211.70
300	212.05	212.41	212.76	213.12	213.48	213.83	214.19	214.54	214.90	215.25
310	215.61	215.96	216.32	216.67	217.03	217.38	217.74	218.09	218.44	218.80
320	219.15	219.51	219.86	220.21	220.57	220.92	221.27	221.63	221.98	222.33
330	222.68	223.04	223.39	223.74	224.09	224.45	224.80	225.15	225.50	225.85
340	226.21	226.56	226.91	227.26	227.61	227.96	228.31	228.66	229.02	229.37
350	229.72	230.07	230.42	230.77	231.12	231.47	231.82	232.17	232.52	232.87
360	233.21	233.56	233.91	234.26	234.61	234.96	235.31	235.66	236.00	236.35
370	236.70	237.05	237.40	237.74	238.09	238.44	238.79	239.13	239.48	239.83
380	240.18	240.52	240.87	241.22	241.56	241.91	242.26	242.60	242.95	243.29
390	243.64	243.99	244.33	244.68	245.02	245.37	245.71	246.06	246.40	246.75
400	247.09	247.44	247.78	248.13	248.47	248.81	249.16	249.50	249.85	250.19
410	250.53	250.88	251.22	251.56	251.91	252.25	252.59	252.93	253.28	253.62
420	253.96	254.30	254.65	254.99	255.33	255.67	256.01	256.35	256.70	257.04
430	257.38	257.72	258.06	258.40	258.74	259.08	259.42	259.76	260.10	260.44
440	260.78	261.12	261.46	261.80	262.14	262.48	262.82	263.16	263.50	263.84
450	264.18	264.52	264.86	265.20	265.53	265.87	266.21	266.55	266.89	267.22
460	267.56	267.90	268.24	268.57	268.91	269.25	269.59	269.92	270.26	270.60
470	270.93	271.27	271.61	271.94	272.28	272.61	272.95	273.29	273.62	273.96
480	274.29	274.63	274.96	275.30	275.63	275.97	276.30	276.64	276.97	277.31
490	277.64	277.98	278.31	278.64	278.98	279.31	279.64	279.98	280.31	280.64
500	280.98	281.31	281.64	281.98	282.31	282.64	282.97	283.31	283.64	283.97
510	284.30	284.63	284.97	285.30	285.63	285.96	286.29	286.62	286.95	287.29
520	287.62	287.95	288.28	288.61	288.94	289.27	289.60	289.93	290.26	290.59
530	290.92	291.25	291.58	291.91	292.24	292.56	292.89	293.22	293.55	293.88
540	294.21	294.54	294.86	295.19	295.52	295.85	296.18	296.50	296.83	297.16
550	297.49	297.81	298.14	298.47	298.80	299.12	299.45	299.78	300.10	300.43
560	300.75	301.08	301.41	301.73	302.06	302.38	302.71	303.03	303.36	303.69
570	304.01	304.34	304.66	304.98	305.31	305.63	305.96	306.28	306.61	306.93
580	307.25	307.58	307.90	308.23	308.55	308.87	309.20	309.52	309.84	310.16
590	310.49	310.81	311.13	311.45	311.78	312.10	312.42	312.74	313.06	313.39
600	313.71	314.03	314.35	314.67	314.99	315.31	315.64	315.96	316.28	316.60
610	316.92	317.24	317.56	317.88	318.20	318.52	318.84	319.16	319.48	319.80
620	320.12	320.43	320.75	321.07	321.39	321.71	322.03	322.35	322.67	322.98
630	323.30	323.62	323.94	324.26	324.57	324.89	325.21	325.53	325.84	326.16
640	326.48	326.79	327.11	327.43	327.74	328.06	328.38	328.69	329.01	329.32
650	329.64	—	—	—	—	—	—	—	—	—

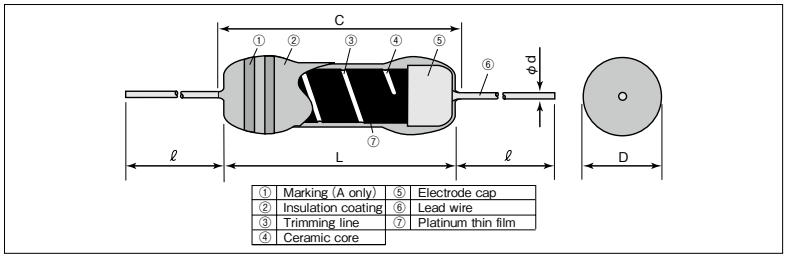
Note:
Desired temperature values are obtained by adding temperatures in the vertical and horizontal axes. When calculating a resistance value of 105℃, read the value in the column where 100℃ in the vertical
axis and 5℃ in the horizontal axis cross. The value will be 140.40Ω.
The value for 500Ω at 0℃ will be the value obtained by multiplying the resistance value in this table by 5. Similarly, the value for 1KΩ at 0℃ will be the value obtained by multiplying the resistance value by 10.

SDT101 Platinum Thin Film Thermal Sensors



Coating color : Ivory (SDT101A,SDT101SA), Transparent Brown (SDT101B)
Marking : Color code (SDT101A), No Marking (SDT101SA,SDT101B)

■Construction



■Features

- SDT101SA is ultra-compact sensor element and offers 1kΩ.
- Simple structure for lead forming.
- SDT101A and SDT101SA can be easily soldered.
- Ideal for low directivity heat flow sensor elements.
- AEC-Q200 Tested. (SDT101B 500Ω, SDT101SA)
- Products meet EU-RoHS requirements.

■Applications

- Temperature compensation of load cells for Electronic Weighing Instruments.
- Detections of outer air and cooling water temperatures and filter clogging of Air Conditioners.
- Measurement of flow rate of electronic fuel injection systems, correction of intake air temperature of Automobiles.
  Contact our sales representatives before you use the products for automotives.
- Cold point compensation and temperature detection probe of Thermocouple Temperature Controllers.
- Temperature compensations of various kinds of Measuring Instruments and Analyzers, Hot wires of Anemeters.

■Dimensions

Type	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.8	C±0.8	D±0.2	d±0.08	ℓ±3	
SDT101A	4.0	—	1.6	0.4	30	150
SDT101SA	—	4.0				
SDT101B	4.0	—	1.5			

■Type Designation

Example

SDT101	A	X	C	T26	A	100	D	F
Product Code	Operating Temperature	Reference Temperature※1	Terminal Surface Material	Taping	Packaging	Nominal Resistance	Resistance Tolerance	T.C.R. Tolerance
SDT101 SDT101S	A : −55℃~+150℃ B : −55℃~+300℃	X : 0℃	C:SnCu (A, SA) N:Ni (B only)	Nil:Bulk T26:26mm Taping (A only) T52:52mm Taping	Nil:Bulk A:AMMO (A only) R:REEL (B only)	10 : 10Ω 100 : 100Ω 500 : 500Ω 1K : 1000Ω (SA only)	D : ±0.5% F : ±1.0% G : ±2.0% (SA only)	F : ±1.0% G : ±2.0%

※1 There is also a product that has a standard temperature of 25℃ (symbol: Y) for custom support. (However, the temperature coefficient of resistance is measured at 0℃/100℃.) Please contact us.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

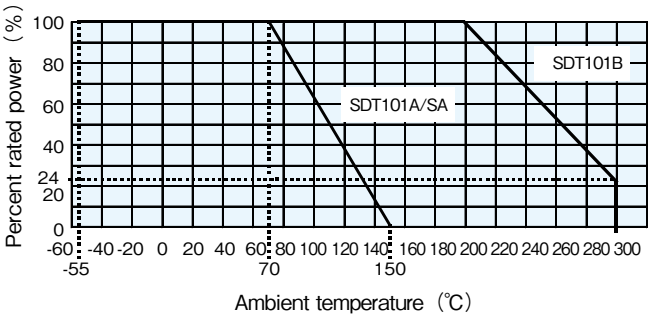
Type	Power Rating (W)	Thermal Time Constant※2 (s)	Thermal Dissipation Constant※2 (mW/℃)	Resistance Range (Ω)	Resistance Tolerance (%)	T.C.R.※3 (×10⁻⁶/K)	T.C.R. Tolerance (%)	Rated Ambient Temperature (℃)	Operating Temperature Range (℃)	Taping&Q'ty/AMMO(pcs)/REEL(pcs)		
										T26A	T52A	T52R
SDT101A	0.125	6	2.8	10、100、500	D:±0.5、F:±1.0	3500	F:±1.0、G:±2.0	+70	−55~+150	2,000	2,000	—
NEW SDT101SA				1000	G:±2.0		G:±2.0			—	—	—
SDT101B		9	1.8	10、100、500	D:±0.5、F:±1.0		F:±1.0、G:±2.0	+200	−55~+300	—	—	2,000

※2 Thermal time constant and thermal dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.
※3 T.C.R. Measuring Temperature : 0℃/+100℃

■Precautions for Use

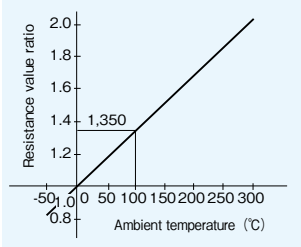
- It is difficult to solder SDT101B because of using heat-resistant leads. Make use of welding to connect the lead wires.
- When an operating current is 1mA or more, calculate a rise in temperature by self-heating to confirm an error.
- If SDT101, SDT101SA is used by being molded or placed in a metal protection tube filling with resin, the resistance value may occasionally vary slightly depending on the resin used.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- When the components are polluted by ionic impurities like sodium(Na+), chlorine(Cl−) etc. included in perspiration and saliva, resistance may be changed. Avoid the pollution when storage, mounting and using. Consider not to remain ionic substances on the components. Wash by pure water etc. and dry them when you find pollution.

■Derating Curve



For sensors operated at an ambient temperature or higher, the power shall be derated in accordance with the above derating curve.

■Example of Temperature Characteristics of Resistance



Approximate Expression for Resistance-Temperatuer Characteristics
(Values are not guaranteed values but typical ones.)

$R_T=R_0\ (1+C_1T+C_2T^2)$

R_T: Resistance value at T℃

R_0: Resistance value at 0℃

T: Ambient temperature (℃)

C_1, C_2:Constants $C_1=0.356297\times10^{-2}$ $C_2=-0.617945\times10^{-6}$

■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	0℃
T.C.R.	Within specified T.C.R.	—	0℃/+100℃
Overload (Short time)	0.5	0.2	Rated voltage×2.5 for 5s
Resistance to soldering heat	0.3	0.1	350℃、1s(SDT101A/SA)
Rapid change of temperature	0.5	0.2	−55℃ (30min.)/+25℃ (10min.)/ +150℃ (30min.)/+25℃ (10min.) 、5 cycles
Moisture resistance	1	0.3	80℃±2℃、90%~95%RH、1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	1	0.2	70℃±3℃ (SDT101A/SA) 、200℃±3℃ (SDT101B) 、1000h 1.5h ON/0.5h OFF cycle
High temperature exposure	1	0.7	+150℃ (SDT101A/SA) 、+300℃ (SDT101B) 、1000h
Shelf Life	0.3	0.1	Left for 1year on shelf in natural condition

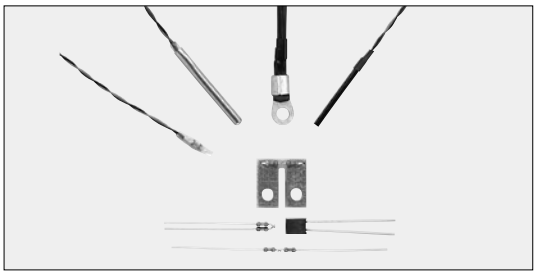
■Resistance-Temperature Characteristic Table (Typical Value)

100Ω at 0℃

Temperature (℃)	0	−1	−2	−3	−4	−5	−6	−7	−8	−9
−50	82.04	81.67	81.31	80.94	80.58	80.22	—	—	—	—
−40	85.66	85.29	84.93	84.57	84.21	83.85	83.49	83.12	82.76	82.40
−30	89.26	88.90	88.54	88.18	87.82	87.46	87.10	86.74	86.38	86.02
−20	92.85	92.49	92.13	91.78	91.42	91.06	90.70	90.34	89.98	89.62
−10	96.43	96.07	95.72	95.36	95.00	94.64	94.29	93.93	93.57	93.21
0	100.00	99.64	99.29	98.93	98.57	98.22	97.86	97.50	97.15	96.79
	0	1	2	3	4	5	6	7	8	9
0	100.00	100.36	100.71	101.07	101.42	101.78	102.13	102.49	102.85	103.20
10	103.56	103.91	104.26	104.62	104.97	105.33	105.68	106.04	106.39	106.74
20	107.10	107.45	107.81	108.16	108.51	108.87	109.22	109.57	109.92	110.28
30	110.63	110.98	111.33	111.69	112.04	112.39	112.74	113.09	113.44	113.80
40	114.15	114.50	114.85	115.20	115.55	115.90	116.25	116.60	116.95	117.30
50	117.65	118.00	118.35	118.70	119.05	119.40	119.75	120.10	120.45	120.80
60	121.15	121.50	121.84	122.19	122.54	122.89	123.24	123.59	123.93	124.28
70	124.63	124.98	125.32	125.67	126.02	126.37	126.71	127.06	127.41	127.75
80	128.10	128.44	128.79	129.14	129.48	129.83	130.17	130.52	130.86	131.21
90	131.56	131.90	132.25	132.59	132.93	133.28	133.62	133.97	134.31	134.66
100	135.00	135.34	135.69	136.03	136.37	136.72	137.06	137.40	137.75	138.09
110	138.43	138.77	139.12	139.46	139.80	140.14	140.49	140.83	141.17	141.51
120	141.85	142.19	142.53	142.88	143.22	143.56	143.90	144.24	144.58	144.92
130	145.26	145.60	145.94	146.28	146.62	146.96	147.30	147.64	147.98	148.32
140	148.65	148.99	149.33	149.67	150.01	150.35	150.69	151.02	151.36	151.70
150	152.04	152.38	152.71	153.05	153.39	153.72	154.06	154.40	154.74	155.07
160	155.41	155.74	156.08	156.42	156.75	157.09	157.43	157.76	158.10	158.43
170	158.77	159.10	159.44	159.77	160.11	160.44	160.78	161.11	161.44	161.78
180	162.11	162.45	162.78	163.11	163.45	163.78	164.11	164.45	164.78	165.11
190	165.45	165.78	166.11	166.44	166.78	167.11	167.44	167.77	168.10	168.44
200	168.77	169.10	169.43	169.76	170.09	170.42	170.76	171.09	171.42	171.75
210	172.08	172.41	172.74	173.07	173.40	173.73	174.06	174.39	174.72	175.04
220	175.37	175.70	176.03	176.36	176.69	177.02	177.35	177.67	178.00	178.33
230	178.66	178.99	179.31	179.64	179.97	180.30	180.62	180.95	181.28	181.60
240	181.93	182.26	182.58	182.91	183.24	183.56	183.89	184.21	184.54	184.87
250	185.19	185.52	185.84	186.17	186.49	186.82	187.14	187.47	187.79	188.11
260	188.44	188.76	189.09	189.41	189.73	190.06	190.38	190.70	191.03	191.35
270	191.67	192.00	192.32	192.64	192.96	193.29	193.61	193.93	194.25	194.57
280	194.90	195.22	195.54	195.86	196.18	196.50	196.82	197.14	197.47	197.79
290	198.11	198.43	198.75	199.07	199.39	199.71	200.03	200.35	200.67	200.99
300	201.31	—	—	—	—	—	—	—	—	—

Note :
Desired temperature values are obtained by adding temperatures in the vertical and horizontal axes.When calculating a resistance value of 105℃, read the value in the column where 100℃ in the vertical axis and 5℃ in the horizontal axis cross. The value will be 136.72Ω.
The value for 500Ω at 0℃ will be the value obtained by multiplying resistance value in this table by 5. Similarly,the value for 10Ω at 0℃ will be the value obtained by dividing the resistance value by 10.

ST Thermal Sensors



■Features

- All ST-series thermal sensors are custom-made products. ST-series thermal sensors are designed in various shapes in accordance with your application using a platinum thin-film thermal sensor (SDT101・SDT310series) as an element. Shapes of sensor parts can be designed flexibly to meet your shapes and dimensional needs, from simple resin mold parts to sensor parts sealed in metal protective tubes made of SUS316.
- Products with Pb Free symbol "F" meet EU-RoHS requirements.

■Applications

- Industrial Equipment : Environment testing machines, Constant-temperature ovens, pH meters, temperature controllers, mass flow meters, etc.
- Service Applications : Vending machines, fryers, steam convection ovens, etc.

■Type Designation

Example

ST3000 series

ST	31050201	F	A	X	1K	B	D
Product Code	Product No.	Pb Free Symbol	Element Type	Reference※1 Temperature	Nominal※2 Resistance	Resistance※2 Tolerance	T.C.R.Tolerance※2
			A : SDT101	X : 0℃	100 : 100Ω 500 : 500Ω 1K : 1kΩ	B : ±0.1% C : ±0.2% D : ±0.5% F : ±1%	D : ±0.5% F : ±1% G : ±2%

ST8100 series

ST	8102201	F	B	X	1K	B
Product Code	Product No.	Pb Free Symbol	Element Type	Reference Temperature	Nominal※2 Resistance	Class※2
			B:SDT310LTC C:SDT310P	X : 0℃	100 : 100Ω 500 : 500Ω 1K : 1kΩ	B:±(0.3+0.005|t|)℃ C:±(1.0+0.01|t|)℃

Full custom products that are not in the catalog have a "—" between the product code and product No.

※1 ST3000 series products with a reference temperature of 25℃(T.C.R. will be calculated between 0℃/100℃) are also available. Contact us.

※2 These are specified for inner element itself. Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Specifications

①Elements used for Thermal Sensors ST3000 and ST 8100 Series, and Manufacturing Ranges.

Series	Element	Resistance Value (Ω at 0℃)	Tolerance Class:Tolerance (℃)	Resistance Tolerance (%)	T.C.R. (×10⁻⁶/K)	T.C.R. Tolerance (%)
ST3000 series	SDT101A SDT101B	100 500 1k	—	B : ±0.1 C : ±0.2 D : ±0.5 F : ±1	3500	D : ±0.5 F : ±1 G : ±2
ST8100 series	SDT310LTC SDT310P	100 500 1k	B : ±(0.3+0.005|t|) C : ±(1.0+0.01|t|)	—	3850	—

ST3000 Series, 1kΩ, resistance tolerance B・C are produced in pair of SDT101 Series.
The combination of ST3000 series, resistance tolerance B-T.C.R. tolerance D is equivalent to class B of SDT310 tolerance to the measuring temperature.
In the above table specification there are restrictions on manufacturing range depending on part number. Please refer to the performance list.

②Shapes of ST3000 and ST8100 series.

ST3000 and ST8100 series are partially presented on the next page.

③Example of Processing Protective Tubes

Material
PPS
Epoxy Resin Coating
Fluorine Resin Shrinkage Tube
Polyimide
SUS304
SUS316
Cu

Processing of Fitting Terminals

⑤Example of Processing of Terminals

Processing of Connecting Terminals

④Example of Processing External Conductors

Material
Polyurethane Coated Wire
Parallel Heat-Resistant Vinyl Chroride Wire
Fluorine Resin Coated Wire

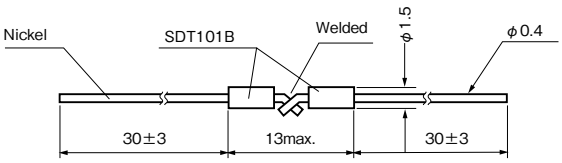
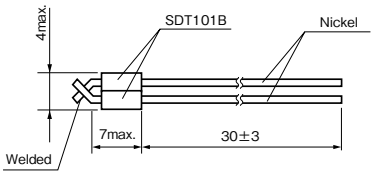
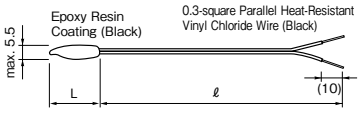
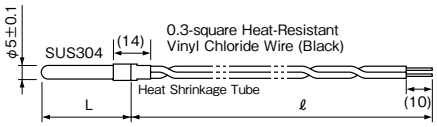
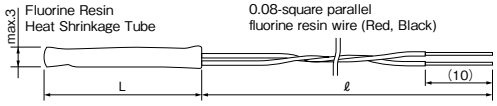
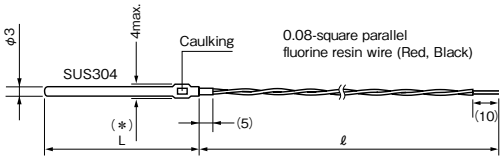
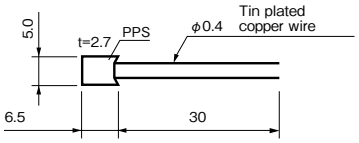
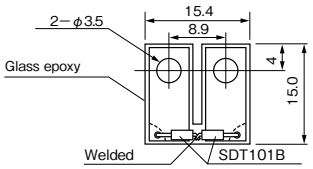
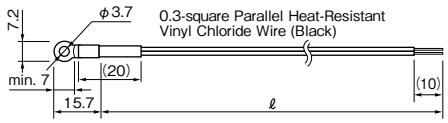
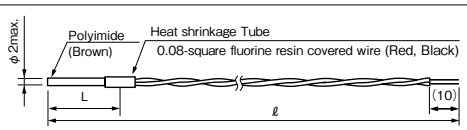
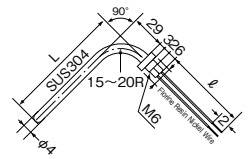
Form
2-Wire System
3-Wire・4-Wire System
Shielded Wire

⑥Others

Mounting on Printed Circuit Board

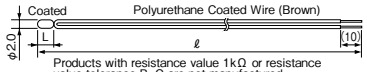
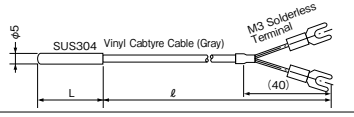
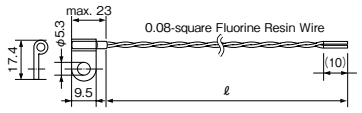
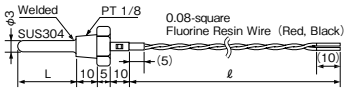
■Performance

ST3000 series

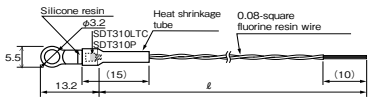
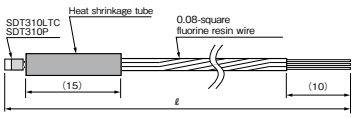
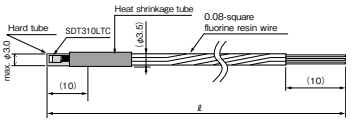
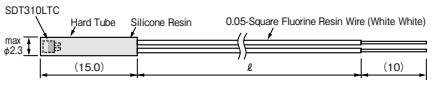
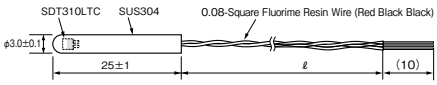
Shape Unit : mm	Product No.	L (mm)	ℓ (m)	Measurement Temperature Range (℃)
	31011 ● Lead wire without solder plating	–	–	−50～+300
	31012 ● Lead wire with solder plating	–	–	−40～+120
	31021 ● Lead wire without solder plating	–	–	−50～+300
	31022 ● Lead wire with solder plating	–	–	−40～+120
	31030201	max.30	0.1	−40～+100
	31030205		0.5	
	31030210		1.0	
	31030230		3.0	
	31040301	35	0.1	−40～+100
	31040305		0.5	
	31040310		1.0	
	31040330		3.0	
	31050201	max.23	0.1	−40～+220
	31050205		0.5	
	31050210		1.0	
	31050230		3.0	
	31060301	30	0.1	−40～+220
	31060305		0.5	
	31060310		1.0	
	31060330		3.0	
	31060501	50	0.1	
	31060505		0.5	
	31060510		1.0	
	31060530		3.0	
＊For product of resistance 1kΩ or product of resistance tolerance B, C, only L=50mm is available.				
	3201	–	–	−20～+120
	3202	–	–	−40～+140
	32050001	–	0.1	−20～+80
	32050005		0.5	
	32050010		1.0	
	32050030		3.0	
＊With the round terminals fixed, handle the wire without applying tensile stress or bending stress.				
	32090201	24	0.1	−40～+120
	32090205		0.5	
	32090210		1.0	
	32090230		3.0	
	32120907	90	0.07	−40～+300 Only top of protective tubes
	32121207	120		
	32121707	175		
	32121202	120	0.2	

THERMAL SENSORS

ST3000 series

Shape Unit : mm	Product No.	L (mm)	ℓ (m)	Measurement Temperature Range (℃)
	33010004	(8)	0.4	−20～+80
	33040305	35	0.5	−40～+60
	33040310		1.0	
	33040330		3.0	
	33060001	–	0.1	−20～+120
	33060005		0.5	
	33060010		1.0	
	33060030		3.0	
	33110305	30	0.5	−40～+220
	33110310		1.0	
	33110330		3.0	

ST8100 series

Shape Unit : mm	Product No.	Lead Wire Number	ℓ (m)	Measurement Temperature Range (℃)
 2 wire: Red Black 3 wire: Red Black Black	8102201	2	0.1	SDT310LTC : −40～+105 SDT310P : −40～+200
	8102205		0.5	
	8102210		1	
	8102301	3	0.1	
	8102305		0.5	
	8102310		1	
 2 wire: Red Black 3 wire: Red Black Black	8103201	2	0.1	SDT310LTC : −40～+105 SDT310P : −40～+200
	8103205		0.5	
	8103210		1	
	8103301	3	0.1	
	8103305		0.5	
	8103310		1	
 2 wire: Red Black 3 wire: Red Black Black	8104201	2	0.1	SDT310LTC Only: −40～+105
	8104205		0.5	
	8104210		1	
	8104301	3	0.1	
	8104305		0.5	
	8104310		1	
	8106201	2	0.1	SDT310LTC Only: −40～+125
	8106205		0.5	
	8106210		1	
	8107301	3	0.1	SDT310LTC Only: −40～+150
	8107305		0.5	
	8107310		1	

Do not pull rocked a covered wire or senser part in ST8100 series.

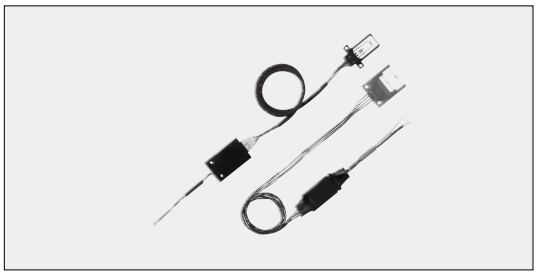
■Instructions in Selection

- Sensor resistance values described are specified by resistance values of the elements (SDT101,SDT310) used in the sensors. The resistance of the external conductor is added to the resistance value of element, impacting errors in temperature measurement. For this reason, the shorter the conductor is, the smaller the errors will be. For example, when a ST using element of SDT101 a 100Ω, a 2.9℃ detection error will result, assuming that the resistance of the external conductor is 1Ω. Select 3-wire or 4-wire system so that a measurement error by the resistance of an outer lead wire can be eliminated.
- Sensor elements have a sufficient heat resistance characteristic. Nevertheless, the operating temperature range will differ depending on the materials used in the external conductor and filler. Select an appropriate standard sensor in accordance with the operating temperature range and operating environment.
- This catalogue shows the specification of the element used in this product series.
  The specification of this product series may vary depending on processing or the combination of elements.
  Please ask us for details. We ensure the quality of the element itself.

■Guarantee of product

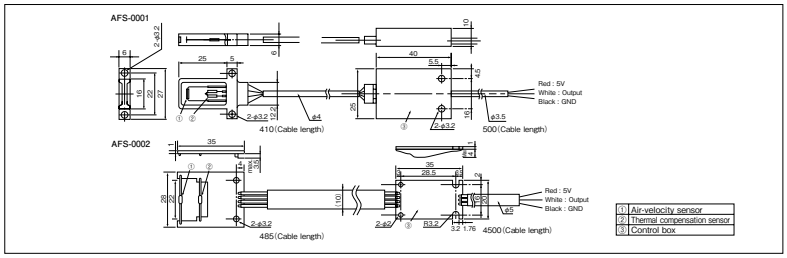
The guaranteed term of the product is one year after delivery. However, when trouble occurs during the guaranteed term because of our responsibility, the product is exchanged or is repaired. We guarantee the product itself, any damages caused by this product shall be excused.

AFS Air Flow Sensor Units



Construction

Unit : mm



Features

- The platinum thin-film thermal sensor realizes high and long-term stability.
- The small platinum thin-film thermal sensor and an even temperature differential operating circuit ensure a quick response.
- The built-in temperature compensation circuit assures correct values regardless of air temperature. The air velocity sensor and air velocity temperature compensation sensor are sensors with the same characteristics to enable correct temperature compensation.
- Products have no rotationg mechanism and are resistant to vibration.

Type Designation

Example

AFS	–	0001
Product Code		Product Number
		0001 0002

Ratings

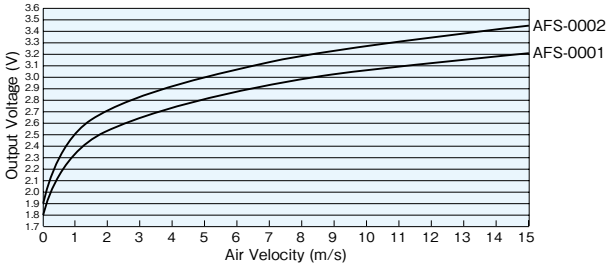
Items		AFS-0001	AFS-0002	Remarks
Detection Object		Clean air, ordinary pressure		
Detection Range (m/s)		0~15		
Detection Accuracy	(m/s)	±0.3	±0.5	0.5~less than 1.0 m/s
	(m/s)	±0.5	±0.7	1.0~less than 4.0 m/s
	(m/s)		±2	4.0~less than 12 m/s
	(m/s)		±3	12~15m/s
	(m/s)	±1.5		4.0~15m/s
Power Supply Voltage (V)		5±0.25		
Current Consumption (A)		0.2max.		Start-up time is excluded.
Output Voltage (V)		1.8~3.2	1.9~3.5	Non-linear analog (see output characteristics diagram)
Output Impedance (Ω)		100Typ.		
Start-Up Time (s)		15Typ.		
Operating Temperature Range (℃)		0~+60		
Operating Humidity Range (%RH)		30~85		Dew condensation not allowed
Storage Temperature Range (℃)		−10~+70		
Storage Humidity Range (%RH)		30~85		Dew condensation not allowed
Temperature Compensation Range (℃)		0~+60		

Applications

- Air flow control of hot water boilers.
- Air flow control of air conditioning systems for buildings.
- Air flow control and stoppage detection of fan motors.
- Air flow control of clean rooms and clean benches .
- Air velocity and air flow control of environmental equipment and apparatuses.
- Detection of clogging of filters.

Output Characteristics Diagram

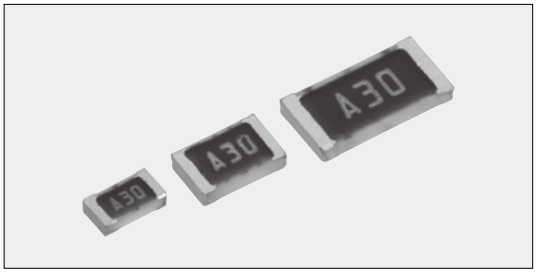
AFS Output Voltage (Typical Value)



Precautions in use

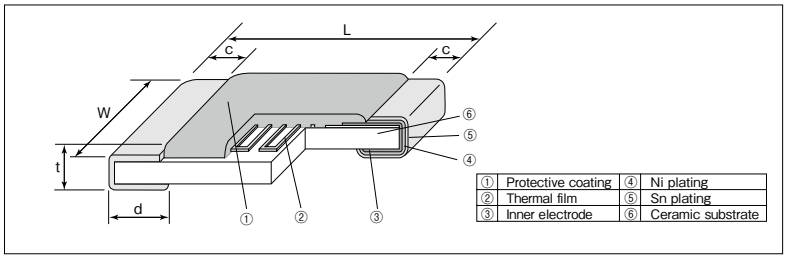
- The air-velocity detection sensor and temperature compensation sensor are calibrated as a single unit with the amplifier and must not be dismounted or replaced. Recalibration is required if the sensor is replaced.
- Mount the air-velocity sensor vertically to air direction.
- Do not apply a shock to, mount a cover on, or paint the air-velocity sensor.
- The air-velocity sensor is heated and must not be touched with fingers during its operation.Exercise care to combustible gas when mounting it.
- Dust, or waterdrop on air-velocity sensor section may cause an error.
- Refer to us if the length of the lead, which connects the probe of the sensor with the amp.section is to be changed.

LP73 Thin Film Resistance Thermal Chip Sensors



Coating color : Black

■Construction



■Features

- LP73s are thin-film thermal sensors of SMD type.
- LP73s accomodate resistance tolerance ±1%, a wide range of TCR +3000×10⁻⁶/K～+5000×10⁻⁶/K with the standard products.
- Suitable for control of temperatures in various industrial equipment.
- Suitable for both flow and reflow soldering.
- Products with lead free termination meet EU-RoHS requirements.

■Applications

- Temperature compensation on overheat prevention for Cameras and Small DC Motors.
- Temperature compensation for various kinds of Sensor Drive Circuits.
- Temperature compensation for Telecommunication and Measuring Devices.
- Temperature compensation for Hybrid ICs.

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W±0.2	c	d	t	
1J (0603)	1.6	0.8	0.3±0.2	0.3±0.2	0.5±0.1	1.91
2A (0805)	2.0	1.25	0.4±0.2	0.4±0.2	0.5±0.15	4.09
2B (1206)	3.2	1.6	0.5±0.3	0.5±0.3		7.61

■Type Designation

Example

LP73	2B	T	TE	103	J	3600
Product Code	Size	Terminal (Surface Material)	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10⁻⁶/K)
	1J:1.6×0.8mm 2A:2.0×1.25mm 2B:3.2×1.6mm	T : Sn	TE:4mm pitch plastic embossed BK:Bulk	3 digits	F : ±1% G : ±2% J : ±5%	

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating (W)	Thermal Time※1 Constant (s)	Thermal Dissipation※1 Constant (mW/℃)	Rated Ambient Temperature (℃)	Operating Temperature Range (℃)	Taping & Q'ty/Reel (pcs)
						TE
LP73 1J	0.016	2	1.2	+70	−55～+125	5,000
LP73 2A	0.031	4	1.8			
LP73 2B	0.063	6.5	2.4			

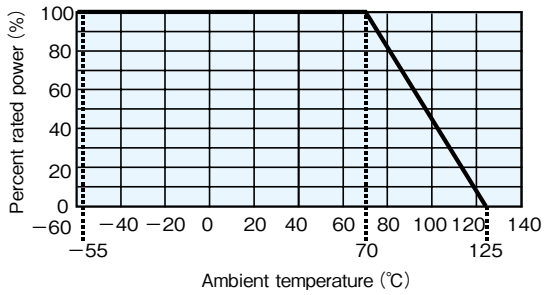
※1 Thermal time constant and dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.

■T.C.R. and Resistance Range

T.C.R. (×10⁻⁶/K)※2	T.C.R. Tolerance (%)	Resistance Range (E24 & 5.0×10ⁿ) (Ω)			Resistance Tolerance (%)
		1J	2A	2B	
3000	±5	100～1k	100～2k	100～10k	F : ±1、G : ±2、J : ±5
3300					
3600		100～300			G : ±2、J : ±5
		330～1k			F : ±1、G : ±2、J : ±5
4000		100～1k			
4500					
5000					

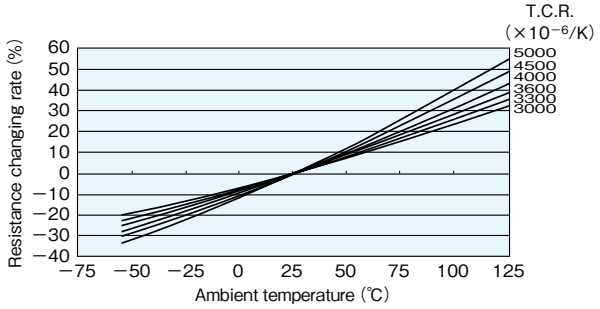
※2 T.C.R. Mesuring Temperature : +25℃/+65℃

■Derating Curve



For sensors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Example of Temperature Characteristics of Resistance



■Approximate Expression for Resistance-Temperature Characteristics

(Values are not guaranteed but typical.)

$R_T=R_{25}(C_0+C_1T+C_2T^2)$ R_T : Resistance value at T℃

R_{25} : Resistance value at 25℃

T : Ambient temperature (℃)

C_0, C_1, C_2 : Constants

T.C.R.	C_0	C_1	C_2
3000	0.931258	0.00265213	3.90112×10^{-6}
3300	0.924355	0.00292569	4.00516×10^{-6}
3600	0.916356	0.00323714	4.34428×10^{-6}
4000	0.907039	0.00361006	4.33457×10^{-6}
4500	0.897412	0.00395222	6.05201×10^{-6}
5000	0.886014	0.00437224	7.48809×10^{-6}

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	−	25℃
T.C.R.	Within specified T.C.R.	−	+25℃/+65℃
Overload	0.5	0.3	Rated voltage×2.5 for 5s.
Resistance to soldering heat	0.5	0.3	260℃±5℃、10s$^{+1}_{0}$s
Rapid change of temperature	0.5	0.3	−55℃ (30min.)/+25℃ (2~3min.)/+125℃ (30min.)/+25℃ (2~3min.) 5 cycles
Moisture resistance	2	1.5	40℃±2℃、90%~95%RH、1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	2	1.5	70℃±2℃、1000h 1.5h ON/0.5h OFF cycle

Confirming resistance drift is recommended since this product has a tendency to have bigger resistance change than general flat chip over 70℃.
Please pay attention not to be applied ESD, it may cause of resistance change.

Actual Value (Out of guarantee)

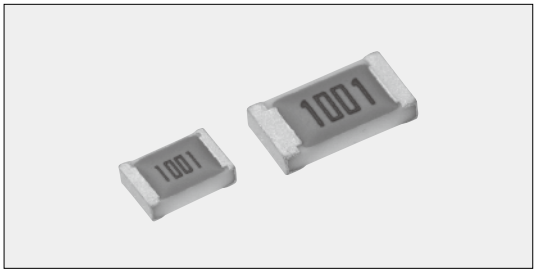
Test Items	Reference	Test Mrthods
High temperature exposure	8%	+125℃, 1000h
ESD	500V	Human model, 100pF 1.5kΩ

■Precautions for Use

- The resistance varies by its self heat-generation. Reasonable care must be exercised in using it by taking its self-heating into consideration. Sensors operated at rated power will cause temperature errors in excess of 10℃.
- The properly and electrostatically measured taping materials are used for the components, but attention should be paid to the fact that there is some danger the parts absorb on the top tapes to cause a failure in the mounting and the parts are destructed by static electricity to change the resistance in the conditions of an excessive dryness or after the parts are given vibration for a long time as they are packaged on the tapes. Similarly, care should be given not to apply the excessive static electricity when mounting on the boards.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- When the components are polluted by ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. included in perspiration and saliva, it leads to electric erosion. Avoid the pollution when storage, mounting and using. Consider not to remain ionic substances on the components. Wash by pure water etc. and dry them when you find pollution.
  It is recommended to avoid using adhesive or masking tapes. Because the upper coating can stick off by peeling masking tapes which covers our product to flow-solder larger parts or by knocking and rubbing with adhesive tapes and by brushing to remove the solder balls.
- Please pay attention that the top of an iron does not direct touch to the components. There is a risk that may cause a change in resistance. Take care that another risk may happen that the protecting coat is carbonized in an instant when touched directly by the top of the iron, also climatic-proof for electric corrosion or insulation of protecting coat may be dropped down. Be sure not to give high temperature on the top of the iron as it will degrade the protecting coat.
- Avoid storing components under direct sun rays, high temperature/humidity. Direct sun rays will cause quality change of taping and difficulty of keeping appropriate peeling strength. 5~35℃/35~75%RH, there is no deterioration of solderability for 12 months, but take special care for storing, because condensation, dust, and toxic gas like hydrogen sulfide, sulfurous acid gas, hydrogen chloride, etc. may drop solderability.

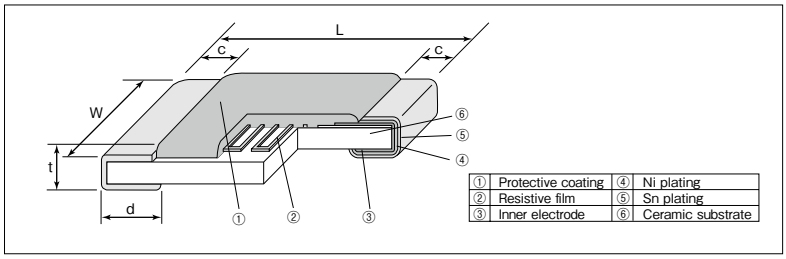
THERMAL SENSORS

LT73V Linear Positive Temp. Coefficient Flat Chip Resistors (For Automotive)



Coating color：Orange

■Construction



■Features

- SMD thin film resistors with thermo-perceptivity.
- Various TCRs +150～+4500×10^{-6}/K are available.
- Operating temperature range ～155℃. Rated ambient temperature: 85℃
- Suitable for both flow and reflow soldering.
- AEC-Q200 Tested.
- Products meet EU-RoHS reguirements.

■Application

- Temperature compensation of current sensor, FET and semiconductor.
- Temperature compensation for various kinds of electorical circuits and sensor.

■Reference Standards

IEC 60115-8
JIS C 5201-8

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W±0.2	c	$d^{+0.2}_{-0.1}$	t±0.1	
2A (0805)	2.0	1.25	0.4±0.2	0.3	0.5	4.54
2B (1206)	3.2	1.6	0.5±0.3	0.4	0.6	9.14

■Type Designation

Examples

LT73V	2B	T	TD	102	J	0900
Product Code	Size	Termination Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10^{-6}/K)
	2A:2.0×1.25mm 2B:3.2×1.6mm	T:Sn	TD:4mm pitch paper TE:4mm pitch plastic embossed BK:Bulk	3 digits	G:±2% J:±5%	4 digits

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating (W)	Max. Working Voltage※1 (V)	Max. Overload Voltage (V)	Thermal Time Constant※2 (s)	Thermal Dissipation Constant※2 (mW/℃)	Rated Ambient Temperature (℃)	Operating Temperature Range (℃)	Taping & Q'ty/Reel (pcs)	
								TD	TE
2A	0.1	50	100	1.0	1.37	+85	−55～+155	5,000	4,000
2B	0.125	75	150	1.5	1.47			5,000	4,000

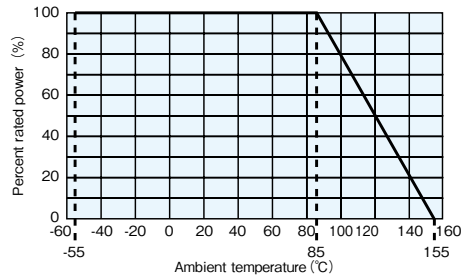
※1 Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※2 Thermal time constant and dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.

■T.C.R. and Resistance Range

T.C.R. (×10^{-6}/K)※3	T.C.R. Tolerance	Resistance Range (E24) (Ω)		Resistance Tolerance (%)
		2A	2B	
150・250・350・450・500	±100×10^{-6}/K	2k～15k	2k～22k	G:±2
600・700・800・900	±150×10^{-6}/K	1k～8.2k	1k～15k	J:±5
1000・1200・1400	±15%	1k～6.8k	1k～8.2k	
1600・1800		510～4.7k	1k～6.8k	
2000・2200・2400	±10%	510～4.7k	510～6.8k	
2600・2800・3000		510～3k	510～6.2k	
3300・3600・3900				
4200		100～1k	100～2k	
4500		51～510	51～510	

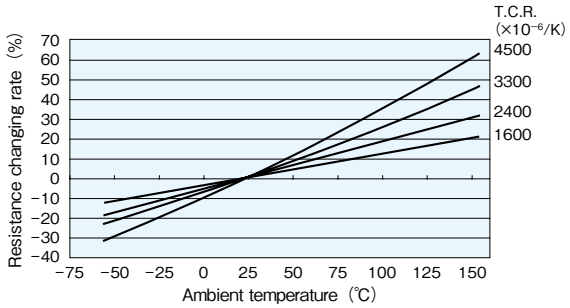
※3 T.C.R. Measuring Temperature:+25℃/+75℃

■Derating Curve



For resistors operated at an ambient temperature of 85℃ or higher, the power shall be derated in accordance with the above derating curve.

■Examples of Temperature Characteristics of Resistance



■Approximate Expression for Resistance-Temperature Characteristics

(Values are not guaranteed but typical.)

$R_T=R_{25}\ (C_0+C_1T+C_2T^2)$

R_T : Resistance value at T℃
R_{25} : Resistance value at 25℃
T : Ambient temperature (℃)
C_0, C_1, C_2 : Constants

T.C.R. (× 10^{-6}/K)	C_0	C_1	C_2
3000	0.9288	0.0028	1.9983×10^{-6}
3300	0.9232	0.0030	2.9980×10^{-6}
3600	0.9175	0.0032	4.0000×10^{-6}
3900	0.9099	0.0035	4.0064×10^{-6}
4200	0.9026	0.0038	3.9964×10^{-6}
4500	0.8948	0.0041	4.0064×10^{-6}

■Performance

Test Items	Performance Requirements ΔR± (%+0.05Ω)		Test Items
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+75℃
Overload(Short Time)	1	0.02	Rated voltage×2.5 or Max. overloadVol., whichever is lower, for 5s
Resistance to soldering heat	1	0.10	260±5℃, 10±1s
Rapid chang of temperature	2 : TCR≦+3300 5 : TCR≧+3600	0.53 2.59	−55℃ (30min.) /+155℃ (30min.) , 1000cycles
Moisture resistamce	3	0.15	1/10 rated power, 1.5h ON/0.5h OFF cycle. 1000h
Endurance at 85℃	2 : TCR≦+3300 5 : TCR≧+3600	0.30 0.76	85℃±2℃, 1000 h 1.5 h ON/0.5h OFF cycle.
High temperature load life	2 : TCR≦+3300 5 : TCR≧+3600	0.40 2.17	125℃, Rated voltage, 1000h
High temperature exposure	2 : TCR≦+3300 5 : TCR≧+3600	0.81 3.20	155℃, 1000h
Low temperature exposure	2	−0.10	−55℃, 1000h

Please pay attention not to be applied ESD, it may cause of resistance change.

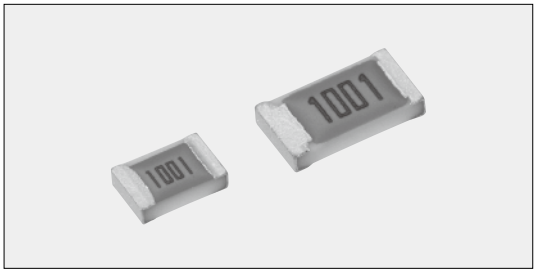
Actual Value (Out of guarantee)

Test Items	Reference	Test Methods
ESD	500V	Human body model, 100pF, 1.5kΩ

■Precautions for Use

- The resistance value of this resistor changes by its self-heating by power applied. Therefore, it is recommended to use it by taking its self heat-generation into consideration.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. while perspiration and saliva include ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. Therefore these kinds of ionic substances may induce electrical corrosion when they invade into the products. Either thorough washing or using RMA solder and flux are necessary since lead free solder contains ionic substances. Washing process is needed, before putting on moisture proof material in order to prevent electrical corrosion.
- An overcurrent such as surge, etc.may break the metal film of LT73V.
- When heat-resistant masking tapes are attached to the chip resistors at the time of mounting and then detached, there is a possibility of exfoliation of the top electrodes. It is known that the heat applied in the mounting process will enhance the adhesion strength of the tape adhesive so please avoid the use. If the use of masking tapes are unavoidable, then please be sure not to attach the tape adhesives directly on the products.
  When high-pressure shower cleaning is implemented, there is a possibility of exfoliation of the top electrodes caused by the water pressure stress so please avoid the implementation.
  If the implementation is unavoidable, then please evaluate the products beforehand.

LT73 Linear Positive Temp. Coefficient Flat Chip Resistors



Coating color：Orange

■Features

- SMD thin film resistors with thermo-perceptivity.
- Various TCRs +150～+4500×10^{-6}/K are available.
- Suitable for both flow and reflow soldering.
- Products with lead free termination meet EU-RoHS requirements.

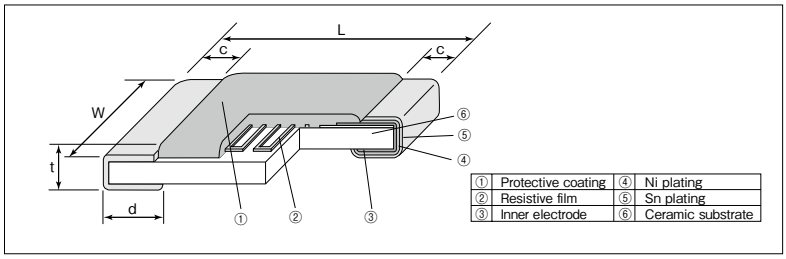
■Application

- Suitable for temperature control in various industrial equipment.

■Reference Standards

IEC 60115-8
JIS C 5201-8

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W±0.2	c	d $^{+0.2}_{-0.1}$	t±0.1	
2A (0805)	2.0	1.25	0.4±0.2	0.3	0.5	4.54
2B (1206)	3.2	1.6	0.5±0.3	0.4	0.6	9.14

■Type Designation

Examples

LT73	2B	T	TD	202	J	0150
Product Code	Size	Terminal Surface Material	Taping	Nominal Resistance	Resistance Tolerance	T.C.R. (×10^{-6}/K)
	2A:2.0×1.25mm 2B:3.2×1.6mm	T:Sn	TD:4mm pitch paper TE:4mm pitch plastic embossed BK:Bulk	3 digits	G:±2% J:±5%	4 digits

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating (W)	Max. Working Voltage※1 (V)	Max. Overload Voltage (V)	Thermal Time Constant※2 (s)	Thermal Dissipation Constant※2 (mW/℃)	Rated Ambient Temperature (℃)	Operating Temperature Range (℃)	Taping & Q'ty/Reel (pcs)	
								TD	TE
2A	0.1	50	100	1.0	1.37	+70	−40～+125	5,000	4,000
2B	0.125	75	150	1.5	1.47			5,000	4,000

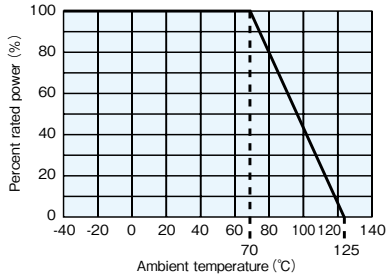
※1 Rated voltage=$\sqrt{\text{Power Rating}\times\text{Resistance value}}$ or Max. working voltage, whichever is lower.
※2 Thermal time constant and dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.

■T.C.R. and Resistance Range

T.C.R. (×10^{-6}/K)※3	T.C.R.Tolerance	Resistance Range (E24) (Ω)		Resistance Tolerance (%)
		2A	2B	
150・250・350・450・500	±100×10^{-6}/K	2k～24k	2k～51k	G:±2
600・700・800・900	±150×10^{-6}/K	1k～20k	1k～43k	J:±5
1000・1200・1400	±15%	1k～13k	1k～27k	
1600・1800		510～4.7k	1k～10k	
2000・2200・2400	±10%	510～4.7k	510～9.1k	
2600・2800・3000		510～3k	510～6.2k	
3300・3600・3900				
4200		100～1k	100～2k	
4500		51～510	51～510	

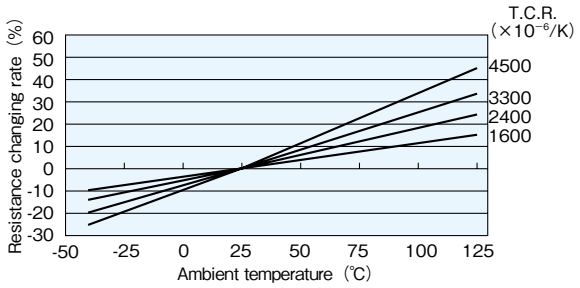
※3 T.C.R. Measuring Temperature:+25℃/+75℃

■Derating Curve



For resistors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Examples of Temperature Characteristics of Resistance



■Approximate Expression for Resistance-Temperature Characteristics

(Values are not guaranteed but typical.)

$R_T = R_{25}\ (C_0 + C_1T + C_2T^2)$

R_T : Resistance value at T℃
R_{25} : Resistance value at 25℃
T : Ambient temperature (℃)
C_0, C_1, C_2 : Constants

T.C.R. ($\times 10^{-6}$/K)	C_0	C_1	C_2
3000	0.9288	0.0028	1.9983×10^{-6}
3300	0.9232	0.0030	2.9980×10^{-6}
3600	0.9175	0.0032	4.0000×10^{-6}
3900	0.9099	0.0035	4.0064×10^{-6}
4200	0.9026	0.0038	3.9964×10^{-6}
4500	0.8948	0.0041	4.0064×10^{-6}

■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	—	25℃
T.C.R.	Within specified T.C.R.	—	+25℃/+75℃
Overload(Short time)	1	0.23	Rated voltage×2.5 or Max. overload vol. for 5s, whichever is lower.
Resistance to soldering heat	1	0.10	260℃±5℃, 10s±1s
Rapid change of temperature	1	0.10	−40℃(30min.)/+125℃(30min.) 5 cycles
Moisture resistance	3	0.54	40℃±2℃, 90%~95%RH, 1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	3	0.62	70℃±2℃, 1000h 1.5h ON/0.5h OFF cycle

Confirming resistance drift is recommended since this product has a tendency to have bigger resistance change than general flat chip over 70℃.
Please pay attention not to be applied ESD, it may cause of resistance change.

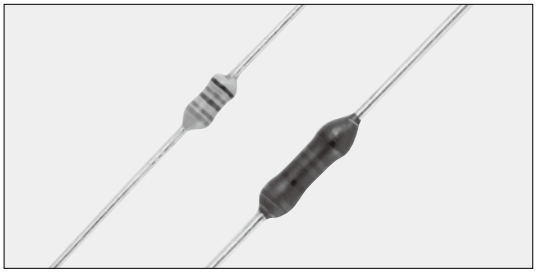
Actual Value (Out of guarantee)

Test Items	Reference	Test Methods
Low temperature exposure	0.05%	−40℃, 45min
High temperature exposure	0.6%	+125℃, 1000h
ESD	500V	Human body model, 100pF, 1.5kΩ

■Precautions for Use

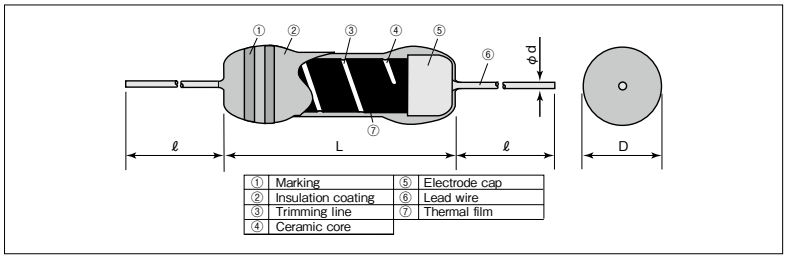
- The resistance value of this resistor changes by its self-heating by power applied. Therefore, it is recommended to use it by taking its self heat-generation into consideration.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. while perspiration and saliva include ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. Therefore these kinds of ionic substances may induce electrical corrosion when they invade into the products. Either thorough washing or using RMA solder and flux are necessary since lead free solder contains ionic substances. Washing process is needed, before putting on moisture proof material in order to prevent electrical corrosion.
- An overcurrent such as surge, etc.may break the metal film of LT73.
- When heat-resistant masking tapes are attached to the chip resistors at the time of mounting and then detached, there is a possibility of exfoliation of the top electrodes. It is known that the heat applied in the mounting process will enhance the adhesion strength of the tape adhesive so please avoid the use. If the use of masking tapes are unavoidable, then please be sure not to attach the tape adhesives directly on the products.
  When high-pressure shower cleaning is implemented, there is a possibility of exfoliation of the top electrodes caused by the water pressure stress so please avoid the implementation.
  If the implementation is unavoidable, then please evaluate the products beforehand.

LP Thin Film Resistance Thermal Sensors



Coating color : Ivory (LP1/16), Brown (LP1/8)
Marking : Color code

■Construction



■Features

- LP series is thin-film thermal sensors and accomodates resistance tolerance ±1% and high T.C.R. +5000×10⁻⁶/K with the standard products.
- Suitable for control of temperatures for various industrial equipment.
- Products meet EU-RoHS requirements.

■Applications

- Temperature compensation for Load Cells in a Electronic Weighing Instruments.
- Overheat prevention for Printer Heads.
- Temperature compensation for Home Electrical Appliances, Measuring Instruments and Communications Equipment.
- Overheat prevention for various PCBs.

■Dimensions

Type	Dimensions (mm)				Weight (g) (1000pcs)
	L	D±0.2	d±0.05	ℓ±3	
LP 1/16	$3.5^{+0.2}_{-0.4}$	1.7	0.5	30	150
LP 1/8	6.35±0.8	2.3	0.65	38	250

■Type Designation

Example

LP	1/8	C	T26	A	103	J	362
Product Code	Power Rating	Termination Surface Material	Taping	Packaging	Nominal Resistance	Resistance Tolerance	Symbol of T.C.R.
	1/16: 0.063W 1/8 : 0.125W	C:SnCu	Nil:Bulk T26:26mm Taping T52:52mm Taping	Nil : Bulk A : AMMO	3digits	F : ±1% G : ±2% J : ±5%	3digits 151 : 150 362 : 3600

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Power Rating (W)	Thermal Time Constant※1 (s)	Thermal Dissipation Constant※1 (mW/℃)	Rated Ambient Temperature (℃)	Operating Temperature Range (℃)	Taping & Q'ty/AMMO(pcs)	
						T26A	T52A
LP1/16C	0.063	8	2.5	+70	−55～+150	4,000	4,000
LP1/8C	0.125	14	4.5			2,000	2,000

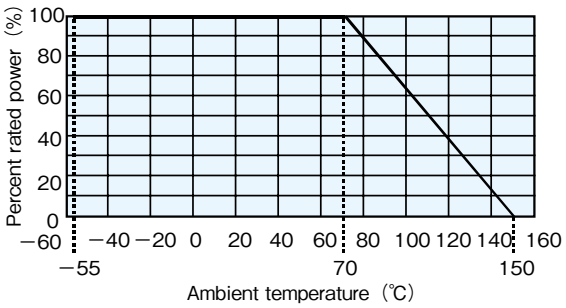
※1 Thermal time constant and dissipation constant are reference values, which are values of elements and vary with connecting or fixing methods.

■T.C.R. and Resistance Range

T.C.R. (×10⁻⁶/K)※2	T.C.R. Tolerance	Resistance Range (Ω) (E24 & 2.5, 5.0×10ⁿ)					
		LP1/16			LP1/8		
		F : ±1%	G : ±2%	J : ±5%	F : ±1%	G : ±2%	J : ±5%
150・250・350	±50×10⁻⁶/K	–	150～10k	150～10k	–	150～51k	150～51k
450			150～30k	150～30k		150～100k	150～100k
550・650・750・850	±10%						
950・1000・1200							
1400・1600・1800							
2000・2200・2400							
2500	±5%	100～30k	10～30k	1～30k	100～100k	10～100k	1～100k
3000		100～10k	10～10k	1～10k			
3300							
3600					100～51k	10～51k	1～51k
4000・4500・5000					100～20k	10～20k	1～20k

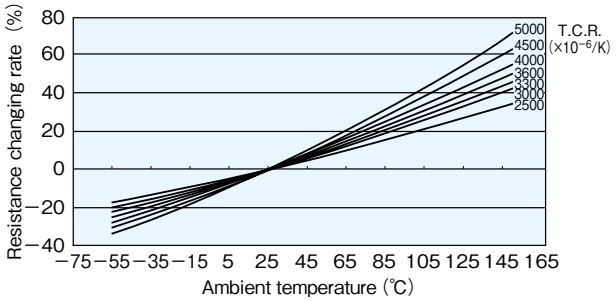
※2 T.C.R. Measuring Temperature : +25℃/+65℃. T.C.R. is guaranteed by random inspections.

■Derating Curve



For sensors operated at an ambient temperature of 70℃ or higher, the power shall be derated in accordance with the above derating curve.

■Example of Temperature Characteristics of Resistance



■Approximate Expression for Resistance-Temperature Characteristics

(Values are not guaranteed but typical.)

$R_T = R_{25}(C_0 + C_1T + C_2T^2)$

R_T : Resistance value at T℃
R_{25} : Resistance value at 25℃
T : Ambient temperature (℃)
C_0, C_1, C_2 : Constants

T.C.R.	C_0	C_1	C_2
3000	0.931258	0.00265213	3.90112×10^{-6}
3300	0.924355	0.00292569	4.00516×10^{-6}
3600	0.916356	0.00323714	4.34428×10^{-6}
4000	0.907039	0.00361006	4.33457×10^{-6}
4500	0.897412	0.00395222	6.05201×10^{-6}
5000	0.886014	0.00437224	7.48809×10^{-6}

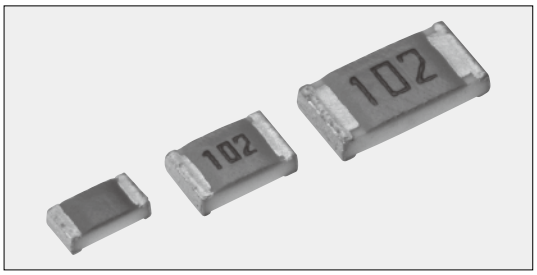
■Performance

Test Items	Performance Requirements ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	−	25℃
T.C.R.	Within specified T.C.R.	−	+25℃/+65℃
Overload (Short time)	0.5	0.2	Rated voltage×2.5 for 5s.
Resistance to soldering heat	0.5	0.2	350℃±10℃、1s
Rapid change of temperature	0.5	0.2	−55℃(30min.) /+25℃(10min.) / +150℃(30min.) /+25℃(10min.)、5 cycles
Moisture resistance	2	0.3	40℃±2℃、90%～95%RH、1000h 1.5h ON/0.5h OFF cycle
Endurance at 70℃	2	0.5	70℃±3℃、1000h 1.5h ON/0.5h OFF cycle

■Precautions for Use

- The resistance of the part changes by its self heat-generation, so use it in consideration of this. The sensor operated at rated power causes a temperature error of 10℃ or more.
- Some areas of $+3000\times10^{-6}$/K to $+5000\times10^{-6}$/K use a special temperature sensing film (patented). Consult with us if the sensor will be always operated in a high temperature region.
- Ionic impurities such as flux etc. that are attached to these products or those mounted onto a PCB, negatively affect their moisture resistance, corrosion resistance, etc. The flux may contain ionic substances like chlorine, acid, etc. Please wash them to get rid of these ionic substances especially when using lead-free solder that may contain much of the said substances for improving a wetting characteristic. Using RMA solder or RMA flux, or well-washing is needed. Also, attaching ionic substances such as perspiration, salt etc. by storage environments or mounting conditions/environments negatively affects their moisture resistance, corrosion resistance etc. Please wash them to remove the ionic substances when they are polluted.
- When the components are polluted by ionic impurities like sodium (Na^+), chlorine (Cl^-) etc. included in perspiration and saliva, it leads to electric erosion. Avoid the pollution when storage, mounting and using. Consider not to remain ionic substances on the components. Wash by pure water etc. and dry them when you find pollution.

NT73 NTC Flat Chip Thermistors



Coating color : Pink
Green (1J B Constant 3700K, 4100K only)

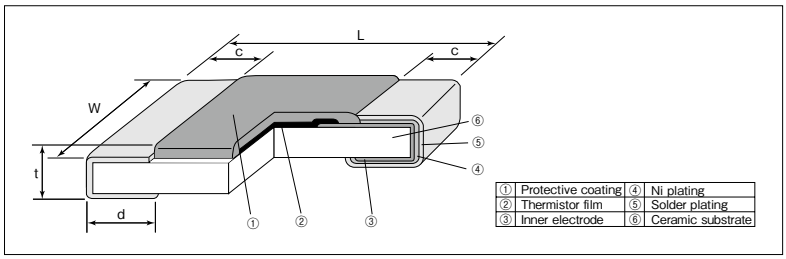
■Features

- SMD type thick film NTC chip thermistors.
- Thinner (0.5mm in 1608, 2012 sizes, 0.6mm in 3216 size) than the multilayer type.
- Excellent mountability due to its higher mechanical strength.
- Excellent mountability due to its solder plating at the terminal section.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, resistor element and glass.

■Reference Standards

IEC 60115-8 JIS C 5201-8
IEC 60539-1 JIS C 2570-1

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L±0.2	W	c	d	t	
1J (0603)	1.6	0.8±0.1	0.3±0.1	0.3±0.1	0.5±0.1	2.14
2A (0805)	2.0	1.25±0.1	0.4±0.2	$0.3^{+0.2}_{-0.1}$	$0.5^{+0.2}_{-0.1}$	4.54
2B (1206)	3.2	1.6±0.2	0.5±0.3	$0.4^{+0.2}_{-0.1}$	0.6±0.1	9.14

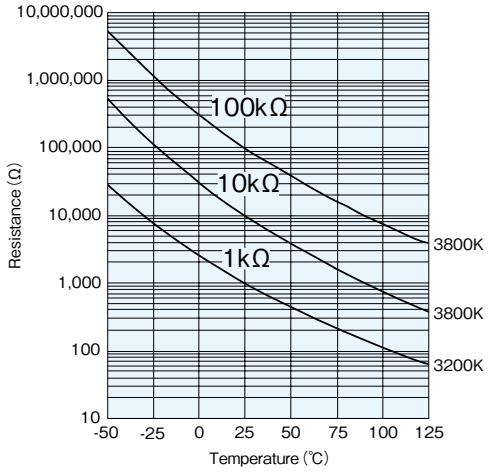
■Type Designation

Examples

NT73	2A	T	TD	103	K	3800	J
Product Code	Size	Termination Surface Material	Taping	Nominal Resistance	Resistance Tolerance	Nominal B Constant	B Constant Tolerance
	1J:1.6×0.8mm 2A:2.0×1.25mm 2B:3.2×1.6mm	T:Sn (L:Sn/Pb)	TD:4mm pitch punch paper BK:Bulk	3digits	J:±5% K:±10% L:±15%	4digits	H:±3% J:±5% K:±10%

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Resistance−Temperature Characteristic



The graph and the table show typical values.
Please ask us for combinations of resistance and B constant not on here.

(Typical)

Resistance (at 25℃)	1kΩ	5kΩ	10kΩ	100kΩ	10kΩ
B Constant (25℃/75℃)	3200K	3500K	3700K	3800K	4100K
Temp. (℃) / Unit	Ω	kΩ	kΩ	kΩ	kΩ
−55	38770	273.24	638.23	7692.5	1203.1
−50	28840	197.67	465.81	5414.6	820.76
−45	21706	144.85	343.25	3864.5	568.09
−40	16517	107.43	255.22	2794.3	398.57
−35	12698	80.577	191.37	2045.2	283.20
−30	9857.0	61.077	144.64	1514.1	203.64
−25	7721.2	46.759	110.13	1133.0	148.07
−20	6100.5	36.137	83.710	856.49	108.37
−15	4858.7	28.173	64.190	653.63	80.182
−10	3899.0	22.147	49.640	503.31	59.943
−5	3151.3	17.546	38.680	390.86	45.252
0	2564.2	14.004	30.370	305.97	34.478
5	2099.9	11.256	23.970	241.34	26.473
10	1730.0	9.1063	19.070	191.73	20.506
15	1433.5	7.4135	15.270	153.36	16.016
20	1194.2	6.0712	12.320	123.46	12.608
25	1000.0	5.0000	10.000	100.00	10.000
30	841.48	4.1398	8.1700	81.470	7.9880
35	711.39	3.4451	6.7100	66.739	6.4242
40	604.07	2.8809	5.5500	54.959	5.1999
45	515.10	2.4202	4.6100	45.484	4.2349
50	441.00	2.0421	3.8500	37.823	3.4692
55	379.00	1.7302	3.2300	31.594	2.8585
60	326.90	1.4718	2.7200	26.506	2.3682
65	282.95	1.2568	2.3100	22.330	1.9721
70	245.72	1.0771	1.9700	18.886	1.6504
75	214.08	0.92637	1.6800	16.035	1.3877
80	187.08	0.79937	1.4500	13.663	1.1724
85	163.96	0.69199	1.2500	11.682	0.99491
90	144.11	0.60087	1.0800	10.022	0.84926
95	127.00	0.52329	0.94000	8.6257	0.72802
100	112.21	0.45701	0.82000	7.4466	0.62662
105	99.377	0.40016	0.72000	6.4466	0.54156
110	88.224	0.35129	0.63000	5.5968	0.46982
115	78.501	0.30915	0.56000	4.8721	0.40906
120	70.004	0.27272	0.49000	4.2523	0.35741
125	62.558	0.24114	0.44000	3.7207	0.31332

■Ratings

Style	Resistanc (Ω) at 25℃	Resistance Tolerance (%)	B Constant (K) at 25℃/75℃	B Constant Tolerance (%)	Power Rating (mW)	Operating Temp.Range (℃)	Taping & Q'ty/Reel (pcs) TD
1J	6.8k	J:±5 K:±10	3500	K:±10	5	−55℃～+125	5,000
	10k			J:±5			
	15k		3800				
	10k		3700	H:±3			
	20k		3800	J:±5			
	22k						
	30k						
	33k						
	47k						
	68k						
	100k						
	47k		4100	H:±3			
2A	1k	K:±10 L:±15	3200	K:±10	5	−55℃～+125	5,000
	2k		3500				
	2.2k						
	2.4k						
	3.3k	J:±5 K:±10 L:±15		J:±5			
	4.7k						
	5k						
	10k						
	6.8k	K:±10、L:±15	3800	K:±10			
	10k	J:±5 K:±10 L:±15		J:±5			
	15k						
	20k						
	22k						
	30k						
	33k						
	47k						
	68k						
	100k						
	150k						
	50k		3950	H:±3			
	10k		4100				
	15k						
	20k						
	22k						
	30k						
	33k						
	47k						
	68k						
	100k						
	150k						
2B	1k	K:±10 L:±15	3200	K:±10	5	−55℃～+125	5,000
	2.2k		3500				
	3.3k						
	4.7k						
	6.8k		3800	J:±5			
	10k	J:±5 K:±10 L:±15					
	22k						
	33k						
	47k						
	68k						
	100k						

Thermal Dissipation Constant −In the atmosphere− (Reference)
1J:2.0mW/℃、2A:2.8mW/℃、2B:3.0mW/℃

■Performance

Test Items	Performance Requirement ΔR±(%+0.05Ω)		Test Methods
	Limit	Typical	
Resistance	Within specified tolerance	−	25℃
B Constant	Within specified tolerance	−	+25℃/+75℃
Resistance to soldering heat	1：others 2：1kΩ	0.5：others 1.0：1kΩ	260℃±5℃、10s±1s
Rapid change of temperature	3	1.3	−55℃(30min.)/+125℃(30min.) 50 cycles
Moisture resistance	3	1.1	40℃±2℃、90%～95%RH、1000h
Load life	3	2.5	80℃±2℃、DC5mW、1000h
High temperature exposure (80℃)	3	1.6	+80℃、1000h

Confirming resistance drift is recommended since this product has a tendency to have bigger resistance change than general flat chip over 80℃.
Please pay attention not to be applied ESD, it may cause of resistance change.

Actual Value (Out of guarantee)

Test Items	Reference	Test Mrthods
High temperature exposure	7%	+125℃、1000h
ESD	500V	Human model、100pF 1.5kΩ

■Precautions for Use

- The resistance value of this resistor changes by its self-heating by power applied. Therefore, it is recommended to use it by taking its self heat-generation into consideration.
- Though properly and electrostatically measured taping materials are used for the components, attention should be required because of some danger that the parts absorb on the top tapes to cause mounting failure and are destructed by static electricity to change the resistance under the extra dry conditions or after the packaged parts are given vibration for a long time. Similarly, care should be given not to apply the excessive static electricity when mounting the parts on the boards.

Precautions for Fusing Components

Refer to the precautions in the beginning part of this catalogue for the matters common to all products

●Anti-Surge Characteristics

Be careful of the short time over current (inrush current, reversible current at motor-lock etc.) that is generated in the circuit.

- Inrush current will differ according to the ambient temperature and the charging/discharging condition of the capacitor etc. Check the current wave form with the condition which will be the maximum current.
- When components that are highly dependent on temperatures such as thermistors are used within the circuit, check the current wave form with the condition which will be the maximum current.
- Set the sampling frequency at a level which the peak current can be detected when measuring the surge current with a digital oscilloscope.
- Generally, current probes are used for current measurement. When shunt resistors are used, be sure to use the lowest resistance value as possible according to the impedance in the circuit.

●Operation Check

- Before you decide which fuse product you use, please mount the selected fuse on actual device and confirm that rush current and surge current have enough margin and that the product has performance that enables to interrupt the abnormal current quickly.

●Soldering

- This product is suitable both for reflow-soldering and for flow-soldering, but an excessive heat may cause an open and change its characteristics.
- The part shall be soldered at the maximum temperature of 260℃ or less.
- If a soldering iron is used, it shall be at 350℃ or less and should be soldered in a short time. Further, pay attention that the products are not touched directly by the top of the iron. It may cause disconnection or characteristic change.

●Placement

- Please confirm sufficiently the evaluation of reliability and use those that have small contractile stress at a resin stiffening time. By contractile stress at the resin stiffening time, fuses might be broken, resistance value may be changed and disconnection might occur in case of resin coating/potting or molded sealing. There is a possibility that heat may fill the surrounding of the fuses by shielding and may cause the fusing characteristicsto change so, please check with the actual circuit.
- The fusing characteristics may change when there are components that generate heat very much around the fuses. Keep fuses away from those parts.

●Storage

- Avoid storing components under the condition of high temperature/high humidity (40℃/70%RH or more) which may deteriorate solderability.
- Also avoid direct sun light which may deteriorate solderability and induce changes in taping strength.

●Parts selection

- If you have any questions about the way of selecting fuses, please do not hesitate to ask us with the information on rated voltage, operating temperature, wave-forms of steady-state current and rush current, and fusing current.

●Reference

- For basic precautions, refer to JEITA technical report "JEITA RCR-4800 Safety application guide on fuse for use in electronic and electrical equipment".

Terms and Definitions

■Safety Standards

• The safety standards applicable to the fuse products are as follows. The certified safety standards differ to each product.
JAPAN Electrical Appliances and Materials Safety Act. (PSE) Class-B
U.S.A. UL (Underwriters Laboratories Inc.)
UL248
CANADA CSA (Canadian Standards Association)
C22.2 No.248
c-UL (Underwriters Laboratories Inc.)
UL248
※c-UL is equivalent to CSA in recognition.
INTERNATIONAL IEC (International Electrotechnical Commission) 60127-1, -4

■Rated Current

• Current specified by us to be suitable for safety standards of fusing time, not the applicable stationary current value.
Stationary current value of the circuit can be calculated with the following equation:
Stationary current value of circuit ≦Rated current value×Stationary derating coefficient
×Ambient temperature derating coefficient

Stationary Derating Coefficient
The table below indicates deratings for each type of products.

Type	Stationary Derating Coefficient
CCF1N, CCF1F	0.7
TF16AT	0.75
TF10BN, TF16SN, TF16VN	1.0

Ambient temperature derating coefficient
The following Deratings for Ambient Temperatures are required:

CCF

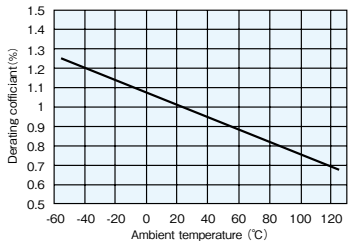


Fig.-1

TF (16AT, 10BN, 16SN)

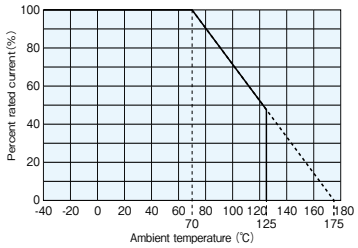


Fig.-2

TF16VN

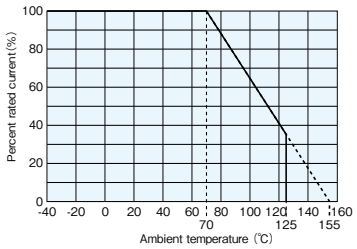


Fig.-3

• Regard the peak current as stationary current when current waveform is repeated pulse or AC waveform. Do not use the effective value of the current waveform.

■Rated Voltage

• A rated voltage indicates the voltage that does not run through electrodes after the fuse blows. In case of exceeding the rated voltage, the circuit voltage should be applied at voltage not higher than the rated voltage because the current may run again or may break the elements.

■Interrupting Capacity

• An interrupted capacity indicates current and voltage that can be interrupted when an abnormal situation arises. Make sure beforehand that voltage and current at the time of abnormality occurring in the circuit are within the interrupting capacity.

■Fusing Current

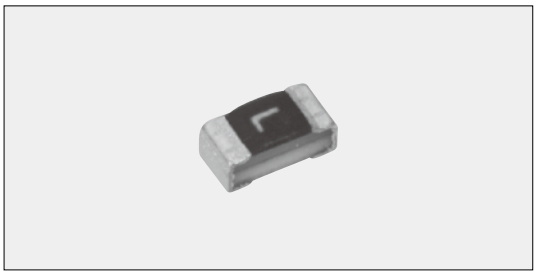
• It indicates a current that interrupts a circuit. Refer to the following list to quickly interrupt an abnormal current occurred in the circuit:

Type	Fusing Current	Fusing Time
CCF1N(0.4~10)	Rated Current×2 or Over	1s
TF16SN	Rated Current×2 or Over	
TF10BN	Rated Current×2 or Over	5s
TF16AT	Rated Current×2 or Over	
TF16VN	Rated Current×2.5 or Over	
CCF1N(12, 15)	Rated Current×2 or Over	60s
CCF1F	Rated Current×2 or Over	120s

If its fusing time is within 1 second, the variance in the fusing time affected by the surroundings (temperature, mounting pad dimensions, substrate material, etc.) will be negligible. But if it is not less than 1 second, it will be largely affected by them, so its verification should be made with an actual circuit.

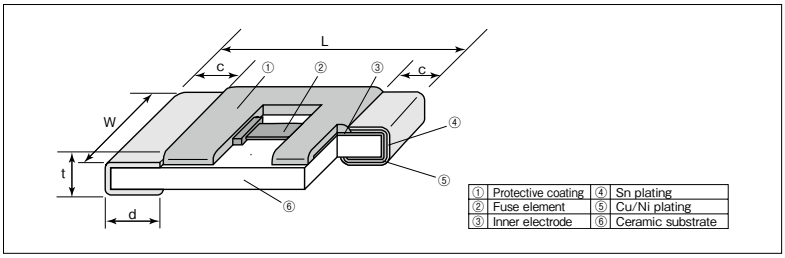
CHIP FUSE

TF10BN Chip Current Fuses



Coating color : Black

■Construction



①	Protective coating	④	Sn plating
②	Fuse element	⑤	Cu/Ni plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- 1005 size miniature and light chip current fuses for the secondary circuit. An occupied area reducible.
- Excellent in mechanical strength.
- The original construction and manufacturing method make the fusing characteristics stable.
- Low power consumption and less voltage dropping possible due to low internal resistance.
- Suitable for over current protection of circuit block in small electronic devices.
- Suitable for both reflow and flow soldering.
- Products meet EU-RoHS requirements.

■Approvals Awarded

UL248.14 File No. E131375
c-UL (CSA) C22.2 No. 248.14 File No. E131375

■Applications

- Cellular-telephones
- Digital still cameras
- Notebook personal computers

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
TF10BN (0402)	1.0±0.1	0.5±0.05	0.2±0.1	0.25±0.1	0.4±0.05	0.68

■Type Designation

Example

TF	10B	N	1.00	T	TB
Product Code	Style	Fusing Characteristics	Rated Current	Terminal Surface Material	Taping
	10B:1.0×0.5mm	N:Normal blow		T:Sn	TB:2mm pitch press paper BK:Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

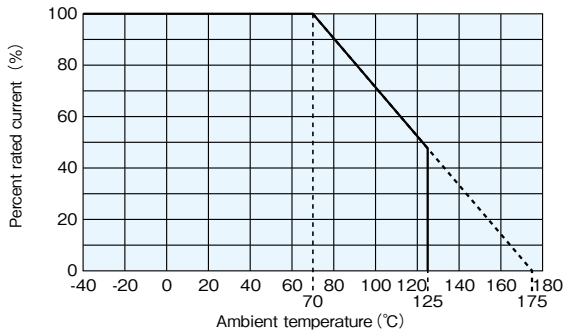
■Ratings

Type	Marking	Rated Current	Fusing Time	Internal R. (mΩ) Max.	Rated Voltage	Rated Ambient Temp.	Operating Temperature Range	Taping & Q'ty/Reel (pcs)
								TB
TF10BN0.20	A	0.20A	Open within 5s at 200% rated current. Refer to the graph of fusing characteristics.	1990	DC 32V	+70℃	−55～+125℃	10,000
TF10BN0.25	C	0.25A		1270				
TF10BN0.315	D	0.315A		850				
TF10BN0.50	F	0.50A		320				
TF10BN0.63	I	0.63A		200				
TF10BN0.80	K	0.80A		135				
TF10BN1.00	L	1.00A		115				
TF10BN1.25	M	1.25A		90				
TF10BN1.60	N	1.60A		58				
TF10BN2.00	S	2.00A		42				
TF10BN2.50	T	2.50A		35				
TF10BN3.00	V	3.00A		30				
TF10BN3.50	R	3.50A		27				
TF10BN4.00	X	4.00A		23				
TF10BN5.00	Y	5.00A		19				

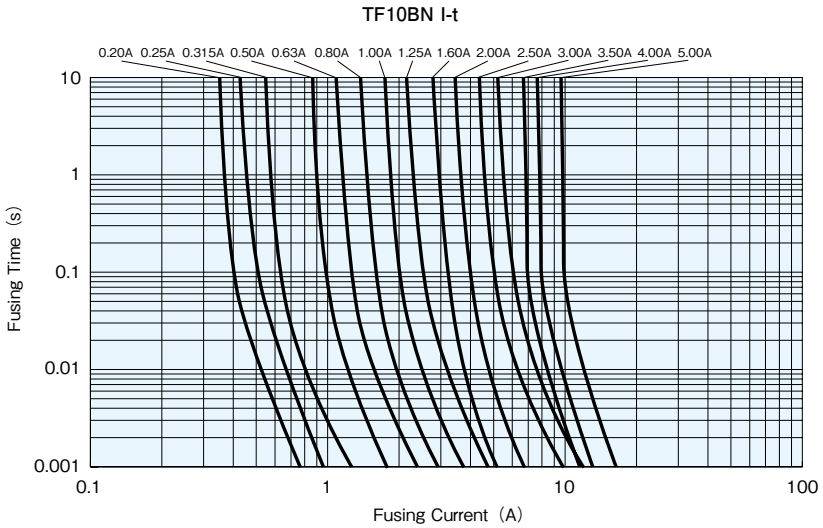
■Derating

- Stationary current
  Regard the peak of stationary current waveform as stationary current value when the stationary current is repeated pulse.
- Temperature Derating
  Rated current needs to be derated if used at an ambient temperature 70℃ or higher. Refer to the derating coefficient on the right figure.

■Rated Current Derating



■ Fusing Characteristics (Average Fusing Time)



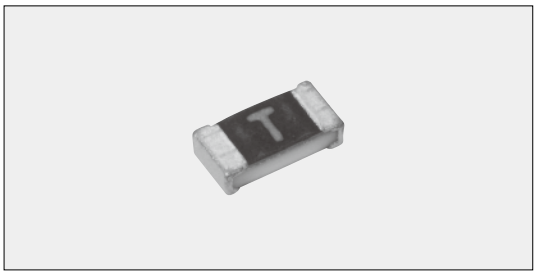
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Fusing characteristics	Within 5s	—	200% of rated current shall be carried. (at 25℃)
Bending test	No mechanical damages.	—	Distance between holding points 90mm, bending width 3mm, 1time
Resistance to soldering heat	10	5	260℃±3℃, 5s$^{+1}_{0}$s
Solderability	95% coverage min.	—	245℃±3℃, 3s±0.5s
Load life	10	5	70℃±2℃, 1000h, Rated current×100%, 1.5h ON/0.5h OFF cycle
Load life moisture	10	3	40℃±2℃, 90%~95%RH, 1000h, Rated current×100%, 1.5h ON/0.5h OFF cycle
Rapid change of temperature	10	5	−55℃ (30min) / +125℃ (30min) 10 cycles
Resistance to solvent	No evidence of damages to protective.	—	Conforming to MIL-STD-202F
Residual resistance	10kΩ or more	—	Measure DC resistance after fusing

■Precautions for Use

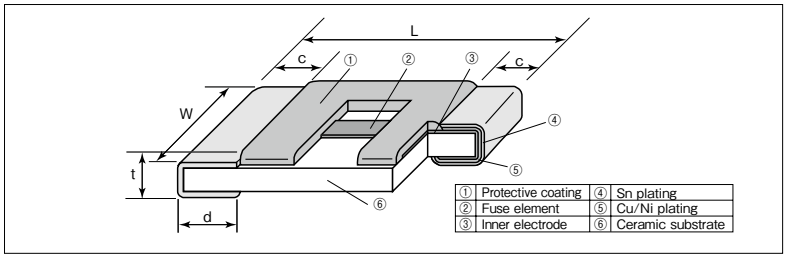
- The substrate material of TF10BN applies ceramics to achieve good fusing characteristics. Please keep away from oxygen gas/liquid because such environment may deteriorate element strength and the performance by glass component corrosion.
- When you select fuse product, please make sure to confirm "Precautions for Use of Fusing Components" in this catalogue and ask KOA sales.

TF16AT Chip Current Fuses (Anti Pulse)



Coating color : Black

■Construction



■Features

- Small and light chip current fuses for the secondary circuit.
- Excellent in anti-pulse characteristics.
- Original construction and manufacturing method stabilize fusing characteristics.
- Able to reduce an occupied area.
- Low power consumption and less voltage dropping due to exceedingly low internal resistance.
- Suitable for overcurrent protection of circuit block in small electronic devices.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements

■Approvals Awarded

UL248.14 File No. E131375
c-UL (CSA) C22.2 No. 248.14 File No. E131375

■Applications

- Notebook personal computers
- HDDs
- Cellular-telephones
- Digital still cameras

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight(g) (1000pcs)
	L	W	c	d	t	
TF16AT (0603)	1.6±0.1	0.8±0.08	0.3±0.1	0.3±0.1	0.45±0.05	2.15

■Type Designation

Example

TF	16A	T	2.50	T	TD
Product Code	Size	Fusing Characteristics	Rated Current	Terminal Surface Material	Taping
	16A:1.6×0.8mm	T:Anti-pulse		T:Sn	TD:4mm pitch punch paper BK:Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

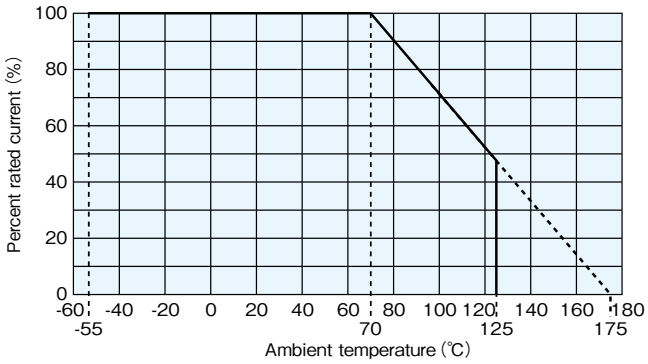
■Ratings

Type	Marking	Rated Current	Fusing Time	Internal R. (mΩ) Max.	Rated Voltage	Rated Ambient Temp.	Operating Temperature Range	Taping & Q'ty/Reel (pcs) TD
TF16AT0.25	C	0.25A	Open within 5s at 200% rated current. Refer to the graph of fusing characteristics.	498	32V	+70℃	−55～+125℃	5,000
TF16AT0.315	D	0.315A		384				
TF16AT0.50	F	0.50A		198				
TF16AT0.63	I	0.63A		143				
TF16AT0.80	K	0.80A		120				
TF16AT1.00	L	1.00A		94				
TF16AT1.25	M	1.25A		73				
TF16AT1.60	N	1.60A		59				
TF16AT2.00	S	2.00A		42				
TF16AT2.50	T	2.50A		32				
TF16AT3.15	U	3.15A		24				
TF16AT4.00	X	4.00A		17				
TF16AT5.00	Y	5.00A		14				

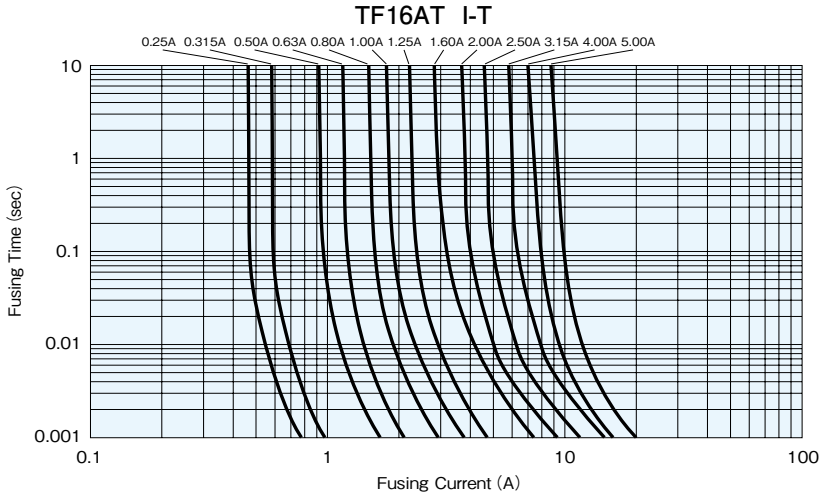
■Derating

- Normal derating
  Normal derating of this product should be 0.75max. as standards.
- Temperature Derating
  Rated Current needs to be derated if used at an ambient temperature of 70℃ or higher. Refer to the derating coefficient on the right figure.
- Stationary current
  Regard the peak of stationary current waveform as stationary current value when the stationary current is repeated pulse.

■Rated Current Derating



■Fusing Characteristics (Average Fusing Time)



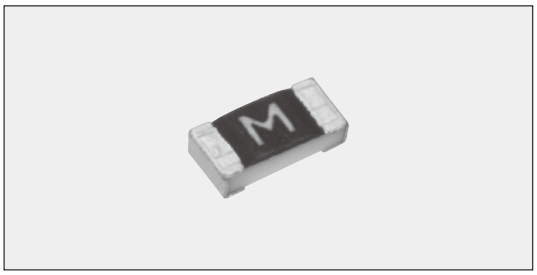
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Fusing characteristics	Within 5s	—	200% of rated current shall be carried. (at 25℃)
Bending test	No mechanical damages.	—	Distance between holding points 90mm, bending width 3mm, 1time.
Resistance to soldering heat	10	5	260℃±5℃, 10s±0.5s
Solderability	95% coverage min.	—	245℃±3℃, 3s±0.5s
Load life	10	5	70℃±2℃, 1000h, Rated current×75%, 1.5h ON/0.5h OFF cycle
Load life moisture	10	5	40℃±2℃, 90%～95%RH, 1000h, Rated current×75%, 1.5h ON/0.5h OFF cycle
Rapid change of temperature	10	5	−55℃ (30min) / +125℃ (30min) 10 cycles
Resistance to solvent	No evidence of damages to protective coating and marking.	—	Conforming to MIL-STD-202F
Residual resistance	10kΩ or more	—	Measure DC resistance after fusing

■Precautions for Use

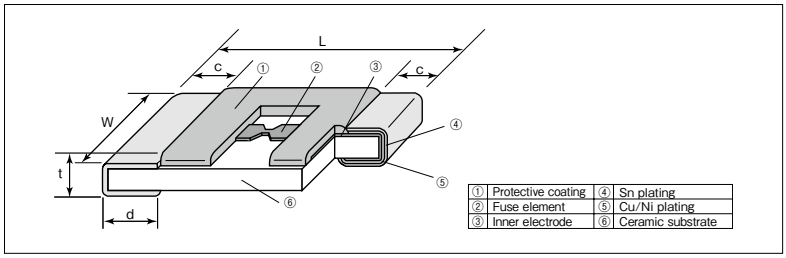
- The fuse element is protected by special resin so that the product achieves to have fusing characteristic. Adjust the bottom dead center of the nozzle and keep the product free from excessive stress when you mount it. Damage by excessive stress to the product may affect the characteristic or lead to disconnection.
- When you select fuse product, please make sure to confirm "Precautions for Use of Fusing Components" in this catalogue and ask KOA sales.

TF16SN Chip Current Fuses



Coating color : Black

Construction



①	Protective coating	④	Sn plating
②	Fuse element	⑤	Cu/Ni plating
③	Inner electrode	⑥	Ceramic substrate

Features

- Small and light chip current fuses for the secondary circuit.
- The original manufacturing method makes the fusing characteristics stable.
- Able to reduce an occupied area.
- Low power consumption and less voltage dropping due to low internal resistance.
- Suitable for overcurrent protection of circuit block in small electronic devices.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements.

Approvals Awarded

UL248.14 File No. E131375
c－UL (CSA) C22.2 No. 248.14 File No. E131375

Applications

- Notebook personal computers
- HDDs
- Mobile phones
- Digital still cameras

Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
TF16SN (0603)	1.6±0.2	0.8±0.1	0.3±0.1	0.3±0.1	$0.4^{+0.1}_{-0.05}$	2.15

Type Designation

Example

TF	16S	N	1.25	T	TD
Product Code	Size	Fusing Characteristics	Rated Current	Terminal Surface Material	Taping
	16S:1.6×0.8mm	N:Normal blow		T:Sn	TD:4mm pitch punch Paper BK:Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

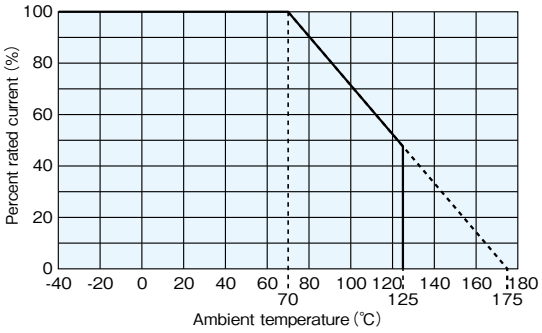
Ratings

Type	Marking	Rated Current	Fusing Time	Internal R. (mΩ) Max.	Rated Voltage	Rated Ambient Temp.	Operating Temperature Range	Taping & Q'ty/Reel (pcs)
								TD
TF16SN0.20	A	0.20A	Open within 1s at 200% rated current. Refer to the graph of fusing characteristics.	1500	32V	+70℃	−40～+125℃	5,000
TF16SN0.25	C	0.25A		960				
TF16SN0.315	D	0.315A		600				
TF16SN0.40	H	0.40A		440				
TF16SN0.50	F	0.50A		300				
TF16SN0.63	I	0.63A		190				
TF16SN0.70	J	0.70A		170				
TF16SN0.80	K	0.80A		135				
TF16SN1.00	L	1.00A		103				
TF16SN1.25	M	1.25A		78				
TF16SN1.60	N	1.60A		58				
TF16SN2.00	S	2.00A		47				
TF16SN2.50	T	2.50A		38				
TF16SN3.15	U	3.15A		28				

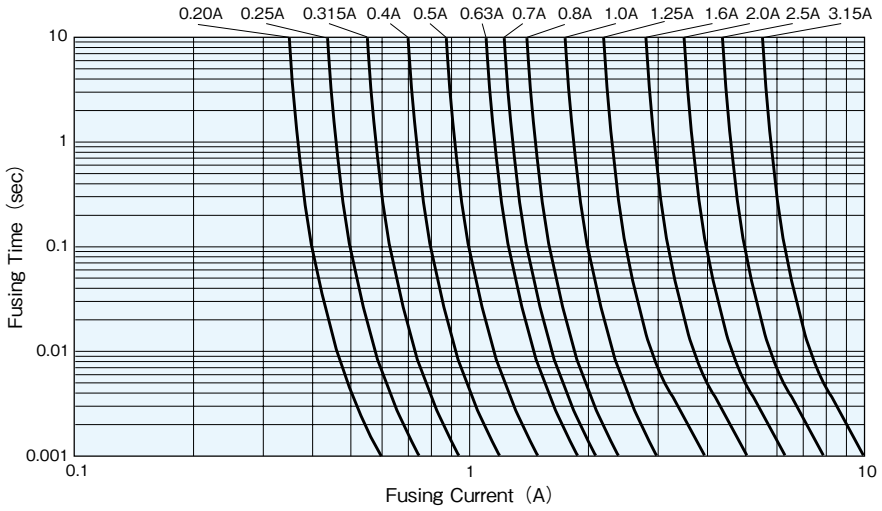
■Derating

- Stationary current
  Regard the peak of stationary current waveform as stationary current value when the stationary current is repeated pulse.
- Temperature Derating
  Rated current needs to be derated if used at an ambient temperature of 70℃ or higher. Refer to the derating coefficient on the right figure.

■Rated Current Derating



■Fusing Characteristics (Average Fusing Time)



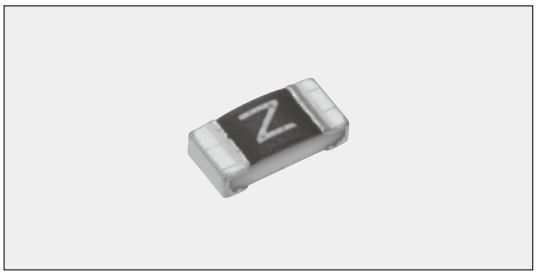
■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Fusing characteristics	Within 1s	—	200% of rated current shall be carried. (at 25℃)
Bending test	No mechanical damages.	—	Distance between holding points 90mm, bending width 2mm, 1time.
Resistance to soldering heat	10	4.5	260℃±5℃, 10s±0.5s
Solderability	95% coverage min.	—	245℃±3℃, 3s±0.5s
Load life	10	4.5	70℃±2℃, 1000h, Rated current×100%, 1.5h ON/0.5h OFF cycle
Load life moisture	10	4.5	40℃±2℃, 90%～95%RH, 1000h, Rated current×100%, 1.5h ON/0.5h OFF cycle
Rapid change of temperature	10	4	−40℃ (30min) /+125℃ (30min) 10 cycles
Resistance to solvent	No evidence of damages to protective coating and marking.	—	Conforming to MIL-STD-202F
Residual resistance	10kΩ or more	—	Measure DC resistance after fusing

■Precautions for Use

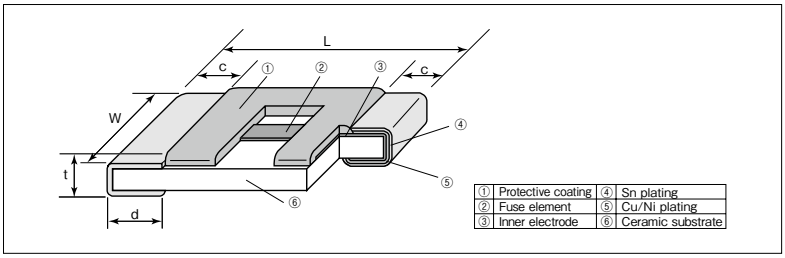
- The substrate material of TF16SN applies ceramics to achieve good fusing characteristics. Keep the product free from excessive stress when it is to be mounted. Keep it also away from excessive thermal stress continuously. It may cause cracks. Please confirm on actual device before use.
- When you select fuse product, please make sure to confirm "Precautions for Use of Fusing Components" in this catalogue and ask KOA sales.

TF16VN Chip Current Fuses (For Automotive)



Coating color : Black

■Construction



①	Protective coating	④	Sn plating
②	Fuse element	⑤	Cu/Ni plating
③	Inner electrode	⑥	Ceramic substrate

■Features

- Small and light chip current fuses for the secondary circuit.
- Temperature cycle (−55℃～+125℃), 1000cycle.
- Original construction and manufacturing method stabilize fusing characteristics.
- Suitable for overcurrent protection of circuit block in small electronic devices.
- Suitable for reflow solderings.
- Products meet EU-RoHS requirements.

■Applications

- Protection from overcurrent to electronic device for automotive.

■Dimensions

Type (Inch Size Code)	Dimensions (mm)					Weight (g) (1000pcs)
	L	W	c	d	t	
TF16VN (0603)	1.6±0.1	0.8±0.1	0.35±0.1	0.3±0.1	0.45±0.1	2.15

■Type Designation

Example

TF	16V	N	2.50		T	TD
Product Code	Size	Fusing Characteristics	Rated Current	Rated Voltage	Terminal Surface Material	Taping
	16V:1.6×0.8mm	N:Normal blow		Nil: DC 32V D: DC 125V DC 70V DC 50V	T : Sn	TD:4mm pitch punch paper BK:Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Ratings

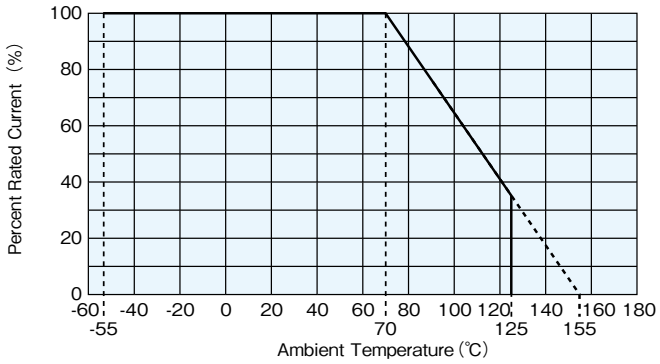
Type	Marking	Rated Current	Fusing Time (at 25℃)	Internal R. (mΩ) Max.	Rated Voltage	Rated Ambient Temp.	Operating Temperature Range	Taping & Q'ty/Reel (pcs)
								TD
TF16VN0.40	H	0.40A	Open within 5s at 250% rated current. Refer to the graph of fusing characteristics.	760	DC 32V (DC 125V)	+70℃	−55～+125℃	5,000
TF16VN0.50	F	0.50A		520				
TF16VN0.63	I	0.63A		370	DC 32V (DC 70V)			
TF16VN0.80	K	0.80A		200				
TF16VN1.00	L	1.00A		160				
TF16VN1.25	M	1.25A		130				
TF16VN1.60	N	1.60A		100				
TF16VN2.00	S	2.00A		80				
TF16VN2.50	T	2.50A		60				
TF16VN3.15	U	3.15A		40	DC 32V (DC 50V)			

High rated voltage products (DC 125V: 0.4A to 0.5A, DC 70V: 0.63A to 2.5A, DC 50V: 3.15A) are available. Please ask KOA sales before use.

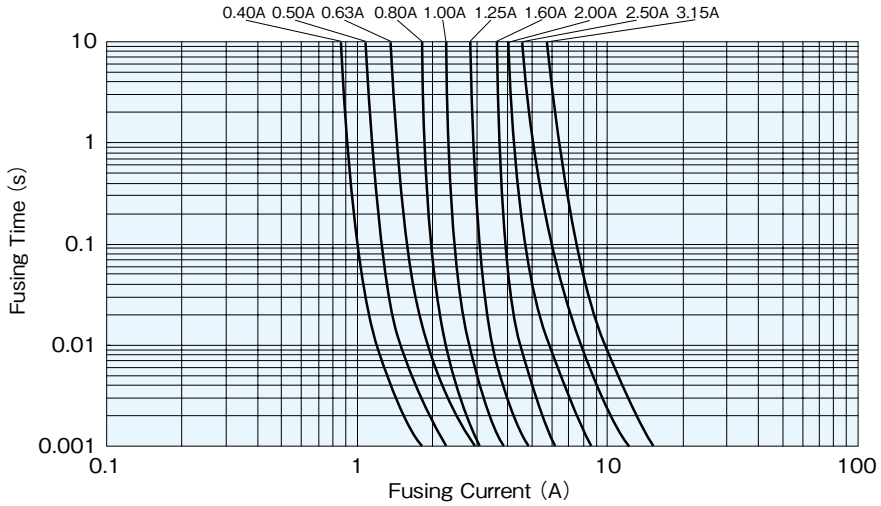
■Derating

- Stationary current
  Regard the peak of stationary current waveform as stationary current value when the stationary current is repeated pulse.
- Temperature Derating
  Rated Current needs to be derated if used at an ambient tem-perature of 70℃ or higher. Refer to the derating coefficient on the right figure.

■Rated Current Derating



■Fusing Characteristics (Average Fusing Time)



■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Fusing characteristics	Within 5s	—	250% of rated current shall be carried. (at 25℃)
Bending test	No mechanical damages.	—	Distance between holding points 90mm, bending width 2mm, 1time.
Resistance to soldering heat (Reflow soldering)	10	5	Pre-heating : 150 $^{+30}_{0}$ ℃, 90±30s Heating : 230℃ or more, 30±10s, max.260℃
Solderability	95% coverage min.	—	245℃±3℃, 3s±0.5s
Load life	10	5	70℃±2℃, 1000h, Rated current×100%, 1.5h ON/0.5h OFF cycle
Load life moisture	10	5	85℃±2℃, 85%±5%RH, 1000h, Rated current×10%, 1.5h ON/0.5h OFF cycle
Rapid change of temperature	10	5	−55℃ (30min) / +125℃ (30min) 1000 cycles
Resistance to solvent	No evidence of damages to protective coating and marking.	—	Conforming to MIL-STD-202F
Residual resistance	10kΩ or more	—	Measure DC resistance after fusing

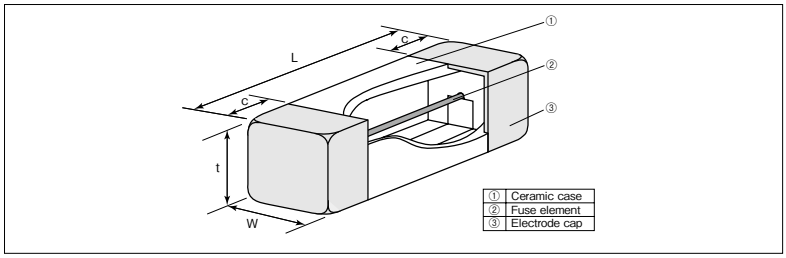
■Precautions for Use

- The substrate material of TF16VN applies ceramics to achieve good fusing characteristics. Please keep away from oxygen gas/liquid because such environment may deteriorate element strengh and the performance by glass component corrosion.
- Suitable for reflow soldering, not for flow soldering.
- When you select fuse product, please make sure to confirm "Precautions for Use of Fusing Components" in this catalogue and ask KOA sales.

CCF1N Chip Current Fuses

Body color : White

■Construction



■Features

- Surface mounting fuses suitable for primary and secondary circuits.
- Excellent mechanical strength with ceramic body.
- Stable fusing characteristics due to the original technology.
- Excellent Anti-Surge characteristics.
- Suitable for reflow and flow soldering.
- Products with lead free termination meet EU-RoHS requirements.

■Approvals Awarded

PSE (1～10A) Class B
UL248.14 File No.E171861 (250mA～15A)
c-UL(CSA)C22.2 No.248.14 File No.E171861
(250mA～15A)

■Applications

- Power supplies for note PCs
- Power supplies for Illumination inverters
- Copying machines, Laser beam printers
- Industrial equipment

■Dimensions

Type (Inch Size Code)	Dimensions (mm)				Weight (g) (1000pcs)
	L±0.2	W±0.2	t±0.2	c±0.2	
CCF1N (2410)	6.0	2.5	2.5	1.4	140

■Type Designation

Example

CCF	1	N	1		T	TE
Product Code	Style	Fusing Characteristics	Rated Current	Rated Voltage (UL)	Terminal Surface Material	Taping
		N:Normal blow		Nil: 125Va.c./60Vd.c. or 65Va.c./65Vd.c. D:125Va.c./160Vd.c.	T : Sn	TE:4mm pitch plastic embossed BK:Bulk

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

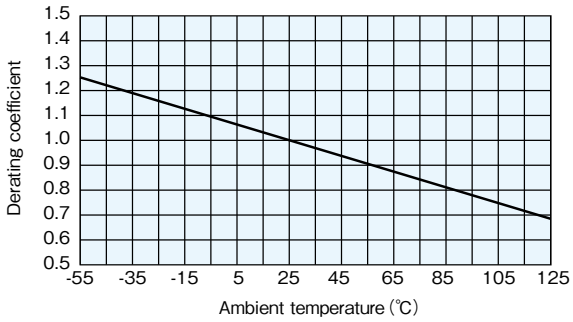
■Ratings

Type	Rated Current	Rated Voltage	Interrupting Capacity	Fusing Characteristics		Internal R. (mΩ) Max.	Nominal Melting I²t (A²・s)	Taping & Q'ty/Reel (pcs)
				Rated Current	Fusing Time			TE
CCF1N0.4	400mA	UL (c-UL) AC 125V DC 60V (DC 160V)	UL (c-UL) AC 125V 50A DC 60V 50A (DC 160V)	UL (c-UL) 100% 200%	4h Min. 1s Max.	650	0.024	1,000
CCF1N0.5	500mA					510	0.030	
CCF1N0.63	630mA					390	0.052	
CCF1N0.8	800mA					250	0.125	
CCF1N1	1A	PSE AC 100V UL (c-UL) AC 125V DC 60V (DC 160V)	PSE AC 100V 100A UL (c-UL) AC 125V 50A DC 60V 50A (DC 160V)	PSE 130% 160% 200% UL (c-UL) 100% 200%	4h Min. 1h Max. 1s Max. 4h Min. 1s Max.	90.4	0.156	
CCF1N1.25	1.25A					75.9	0.220	
CCF1N1.6	1.6A					59.3	0.513	
CCF1N2	2A					42.9	0.814	
CCF1N2.5	2.5A					36.6	1.31	
CCF1N3.15	3.15A					26.0	2.37	
CCF1N4	4A					20.1	3.85	
CCF1N5	5A					15.3	6.5	
CCF1N6.3	6.3A					11.4	10.6	
CCF1N7	7A					10.6	12.8	
CCF1N8	8A					9.5	17.0	
CCF1N10	10A					7.5	27.7	
CCF1N12	12A	UL (c-UL) AC 65V DC 65V	UL (c-UL) AC 65V 50A DC 65V 50A	UL (c-UL) 100% 200%	4h Min. 60s Max.	4.5	73.5	
CCF1N15	15A					3.5	125.5	
NEW CCF1N30	30A	DC 65V	DC 65V 100A	100% 200%	4h Min. 60s Max.	1.7	527.5	

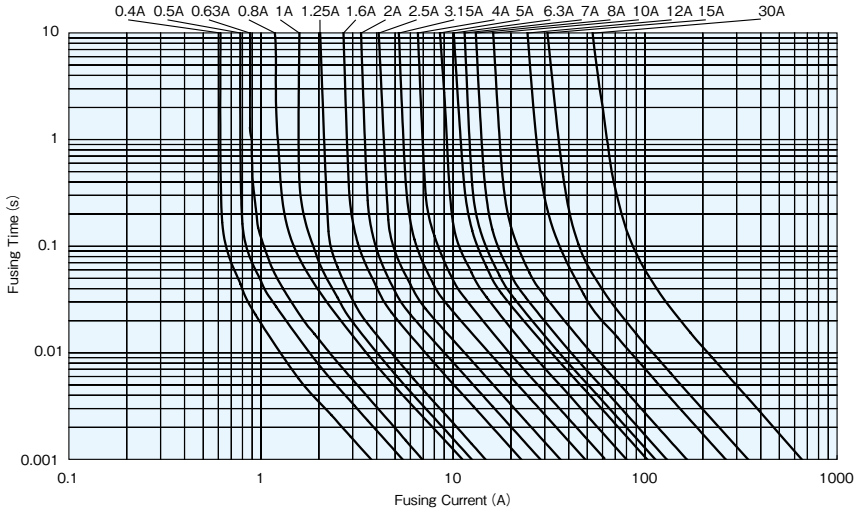
Operating Temp. Range : −55℃～+125℃
※High rated voltage products (DC 160 V: 400 mA to 10 A) are available. Please ask KOA sales.

■Deratings

- Stationary current
  Regard the peak of stationary current waveform as stationary current value when the stationary current is repeated pulse.
- Normal derating
  Normal derating of this product should be 0.7max. as standards.
- Deratings by ambient temperatures
  When using the products at the temperatures other than normal temperature (25℃ ±5℃), temperature adjustment will be required. Please refer to the derating coefficient as shown in the figure.



■Fusing Characteristic



■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Fusing characteristics	Within specified time. No restrike	—	Fusing time measured under rated current×160% and×200%. (at 25℃)
Surface Temp. Rise	Max. Temp. Rise 140℃ (For PSE)	—	Surface Temp. should be measured by Rated current×115%.
	Max. Temp. Rise 75℃ (For UL)	—	Surface Temp. should be measured by Rated current×100%.
Bending test	No mechanical damage.	—	Distance between holding points 90mm, bent by 3mm at arte of 1mm/s.
Resistance to soldering heat	10	3	260℃±5℃, 10s±0.5s
Solderability	95% coverage min.	—	235℃±5℃, 3s±0.5s
Load life	10	5	70℃±2℃、1000h、 Rated current×70%, 1.5h ON/0.5h OFF cycle
Load life moisture	10	5	40℃±2℃、90%～95%RH、1000h、 Rated current×70%, 1.5h ON/0.5h OFF cycle
Rapid change of temperature	10	5	−55℃ (30min) /+125℃ (30min) 100 cycles

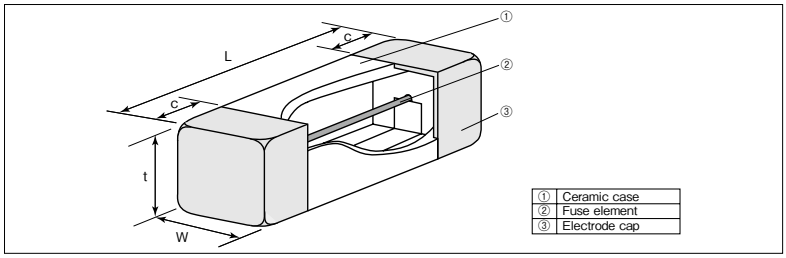
■Precautions for Use

- Store and use CCF products in dust-free room avoiding dew condensation, corrosive gas (H2S, SO2, HCℓ gas), etc. Otherwise the products are more likely to have lower solderability and fusing.
- High temperature affects on the product's performances. After mounting the products on your applications, be sure that the maximum temperature rise is 50 degrees or below and that if the circuit is interrupted or not under abnormal current.
- When you select fuse product, please make sure to confirm "Precautions for Use of Fusing Components" in this catalogue and ask KOA sales.

CCF1F Chip Current Fuses (Anti Sulfuration)

Coating color：White

■Construction



■Features

- Excellent anti-sulfuration characteristic due to using high sulfuration-proof material.
- Meets IEC60127-4 specifications. (7A or less)
- Stable fusing characteristics due to the original technology.
- Suitable for reflow and flow soldering.
- Products meet EU-RoHS requirements.

■Approvals Awarded

UL248.14 File No.E171861
c-UL(CSA)C22.2 No.248.14 File No.E171861

■Reference Standerd

IEC60127-4 Universal modular fuse-Links
Standard sheet2

■Applications

- Power supplies for Illumination inverters
- Copying machines, Laser beam printers
- Industrial equipment

■Dimensions (mm)

Type (Inch Size Code)	Dimensions (mm)				Weight (g) (1000pcs)
	L±0.2	W±0.2	t±0.2	c±0.2	
CCF1F(2410)	6.0	2.5	2.5	1.4	140

■Type Designation

Example

CCF	1	F	5	T	TE
Product Code	Style	Fusing Characteristics	Rated Current	Terminal Surface Material	Taping
		F:Fast-Acting		T:Sn	TE:4mm pitch plastic embossed BK:Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

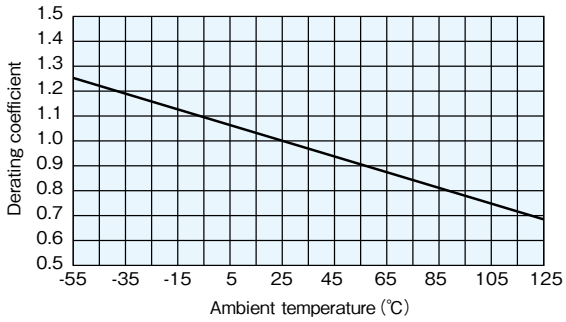
■Ratings

Type	Rated Current	Rated Voltage	Interrupting Capacity	Fusing Characteristics		Internal R. (mΩ) Max.	Nominal Melting I²t (A²・s)	Taping & Q'ty/Reel(pcs)
				Rated Current	Fusing Time			TE
CCF1F0.4	0.4A	UL(c-UL) AC125V DC125V	UL(c-UL) AC125V 50A DC125V 50A	UL(c-UL) 100% 200%	4h Min. 60s Max.	650	0.024	1,000
CCF1F0.5	0.5A					510	0.030	
CCF1F0.63	0.63A					390	0.052	
CCF1F0.8	0.8A					250	0.125	
CCF1F1	1A					90.4	0.156	
CCF1F1.25	1.25A					75.9	0.220	
CCF1F1.6	1.6A					59.3	0.513	
CCF1F2	2A					42.9	0.814	
CCF1F2.5	2.5A					36.6	1.31	
CCF1F3.15	3.15A					26.0	2.37	
CCF1F4	4A					20.1	3.85	
CCF1F5	5A					15.3	6.5	
CCF1F6.3	6.3A					11.4	10.6	
CCF1F7	7A					10.6	12.8	
CCF1F8	8A					9.5	17.0	
CCF1F10	10A					7.5	27.7	
CCF1F12	12A	UL(c-UL) AC65V DC65V	UL(c-UL) AC65V 50A DC65V 50A			4.5	73.5	
CCF1F15	15A					3.5	125.5	

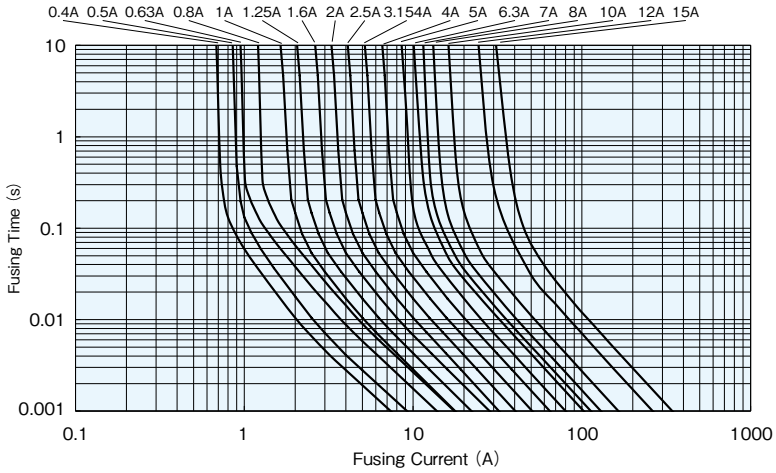
Operating Temperature Range：−55℃～+125℃

■Deratings

- Stationary current
  Regard the peak of stationary current waveform as stationary current value when the stationary current is repeated pulse.
- Normal derating
  Normal derating of this product should be 0.7max. as standards.
- Deratings by ambient temperatures
  When using the products at the temperatures other than normal temperature (25℃ ±5℃), temperature adjustment will be required. Please refer the derating coefficient as shown in the figure.



■Fusing Characteristic



■Performance

Test Items	Performance Requirements ΔR±%		Test Methods
	Limit	Typical	
Fusing Characterristics	Within specified time. Insuration resistance shall not be less than 0.1MΩ.	—	Fusing time measured under rated current×200% (at 25℃)
Syrface Temp. Rise	Max. Temp. Rise 75℃ and not Fusing (All the rating).	—	Surface temp. should be measured by rated current×100% 1hour
Bending Test	No mechanical damage	—	Distance between holding points 90mm, bent by 3mm at arte of 1mm/s
Resistance to soldering heat	10	3	260℃±5℃、10s±0.5s
Solderability	95% coverage min.	—	235℃±5℃, 3s±0.5s
Load life	10	5	70℃±2℃、1000hr、 Rated current×70%, 1.5h ON/0.5h OFF cycle
Load life moisture	10	5	40℃±2℃、90%～95%RH,1000hr、 Rated current×70%, 1.5h ON/0.5h OFF cycle
Rapid change of temperature	10	5	−55℃(30min.) /+125℃(30min.) 100cycles
Sulfuration test	10	—	Soaked in industrial oil with sulfur substance 3.5% contained 105℃±3℃ 500h

■Precautions for Use

- High temperature affects on the product's performances. After mounting the products on your applications, be sure that the maximum temperature rise is 50 degrees or below and that if the circuit is interrupted or not under abnormal current.
- When you select fuse product, please make sure to confirm "Precautions for Use of Fusing Components" in this catalogue and ask KOA sales.

Precautions for Varistors

Refer to the precautions in the beginning part of this catalogue for particulars common to all products.

●Selection and Protection

- It is recommended that the circuit voltage which is applied on a steady basis to be used at 80% or less of the max. allowable circuit voltage. Exceeding the specification will cause deterioration, short-circuits and etc.
- Select proper parts according to the surge energy and the number of the impressions if the varistors are used to absorb the surge for an inductive loading, .
- The rated surge endurance volume is defined in terms of shock-wave current wave form (starting up 8 μs/wave-tail length 20 μs).
- Insert fuses or thermo fuses in series with varistors if the size of the surge power cannot be estimated, in order to prevent varistors from bursting due to an excessive surge over the rating.
- There is a possibility of smoking or flaming in case of excessive surge which is over the ratings so do not fix close to combustible materials.
- Upon mold sealing, fully confirm the reliability and use the resin which have small contractile stress at stiffening since the protection coat may be peeled off, cracks may occur at the solder connection, and the characteristics of the varistor may change.
- Perform the withstand voltage test and the insulation resistance test with the varistors removed from an equipment since the test voltage may exceed the varistor voltage.

●Failure Mode

- Varistor voltage will drop and the leakage current will increase when excessive surge which is above the rating is applied to the varistor. Temperature will increase due to Joule heating as the leakage current increases, which will cause thermal runaway and short circuit.
- When commercial power of 200Vr.m.s. is connected to varistors for 100Vr.m.s. (270V/1mA), the varistor may burst and become open.

●Chip Varistors for Surface Mount

- Please perform damp-proofing on the surface of the varistors prior to the use when installing the equipment under a high-humidity and high-temperature environment.

●Reference

- For basic precautions, please refer to the technical report of EMAJ-R039 Safety application guide for varistors.

Terms and Definitions

■Maximum Allowable Circuit Voltage

• Maximum D.C. voltage or A.C. voltage (rms) that can be continuously applied.

■Maximum Energy (E)

• The maximum energy within the varistor voltage change rate of ±10% when a single impulse of 2ms is applied. (NV73 2E・2J・2L are applied 100 times.)

■Maximum Peak Current (I_P)

• The maximum peak current within the varistor voltage change rate of ±10%, when a single standard impulse of 8/20μs is applied in two times with an interval of 5min. (NV73 2E・2J・2L are 100 times. NV73DL, NV73DS are once.)

■Operating Temperature (T_{opt})

• The allowable ambient temperature range while the device is operating.

■Storage Temperature (T_{stg})

• The temperature range in which the elements do not deteriorate.

■Varistor Voltage (V_C)

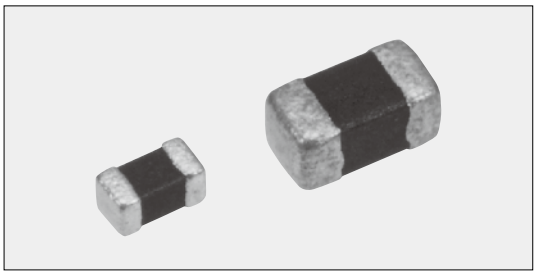
• The terminal voltages on both ends of the varistor when the specified current is applied.

■Clamping Voltage (V_P)

• The peak value of the voltage between two terminals of the varistor when the specified standard wave form impulse current (8/20μs) is applied.

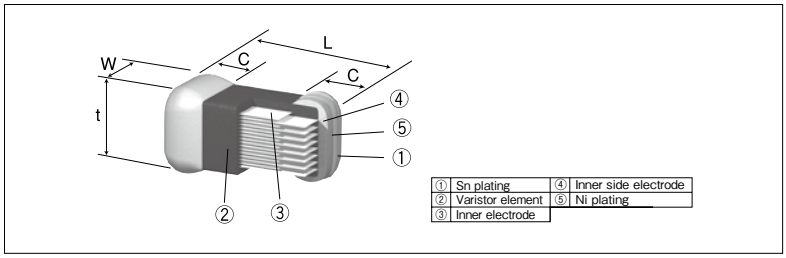
Voltage of Power line	Varistor voltage
3.3V d.c.	8.2V
5V d.c.	8.2V, 12V
12V d.c.	24V, 27V
24V d.c.	47V, 56V
48V d.c.	82V, 100V, 120V

NV73 1H/1E Multilayer Type Metal Oxide Varistors



Body color : Black

Construction



Features

- SMD type metal oxide varistors (0201 and 0402 inch size).
- Ideal for countermeasures against ESD with excellent responsivity (Conforming to IEC61000-4-2).
- 3pF available.
- Pb-free solder on terminal section.
- Two-way noise can be absorbed.
- Suitable for reflow soldering.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, varistor element and glass.

Dimensions

Type (Inch Size Code)	Dimensions (mm)				Weight (g) (1000pcs)
	L	W	t	c	
NV73A1H (0201)	0.6±0.03	0.3±0.03	0.3±0.03	0.1min.	0.299
NV73A□1E (0402)	1.0±0.1	0.5±0.1	0.6 max.	0.25±0.15	1.295

Applications

- Cellular-telephones, DSCs, Computers, PDAs, I/O, etc.

Type Designation

Example

NV73	A	L	1E	T	TP	12
Product Code	Energy Code	Capacitance Type	Size	Terminal Surface Material	Taping	Varistor Voltage
		Nil : Standard type L : Low capacitance type	1H : 0.6×0.3mm 1E : 1.0×0.5mm	T : Sn	TBM : 2mm pitch press paper (1H) TP : 2mm pitch paper (1E)	8 : 8V 12 : 12V 120 : 120V

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

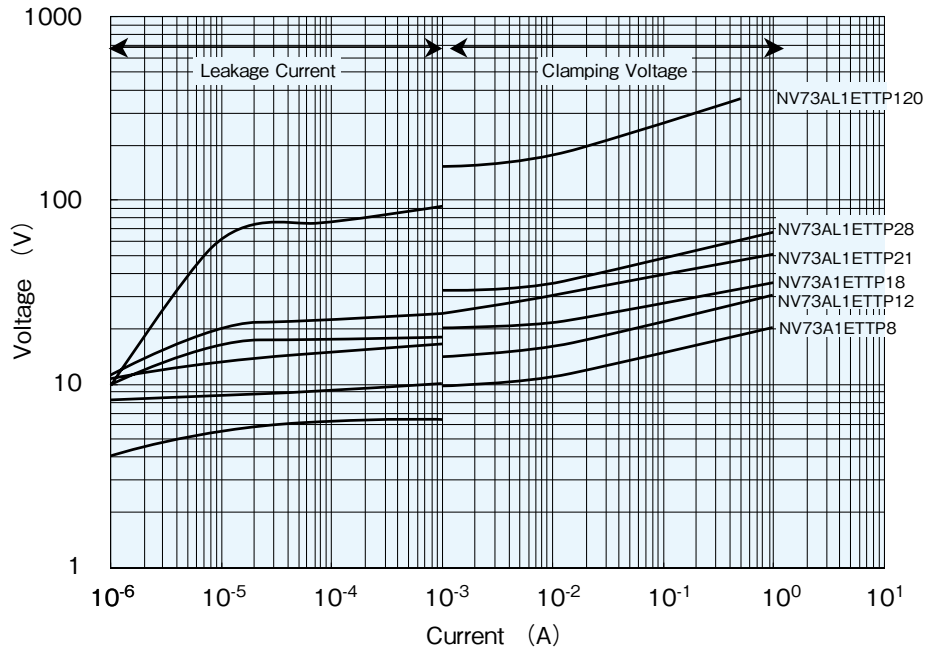
Ratings

Type	Varistor Voltage V_{1mA} (V)	Varistor Voltage Tolerance (V)	Max. Allowable Voltage d.c. (V)	Clamping Voltage Ic=1A (V) 8/20μs	Max. Energy (J) 10/1000μs	Max. Peak Current (A) 2 times 8/20μs	Capacitance (Typ) 1kHz (pF)
NV73A1HTTBM12	12	10～15.6	6.5	35	0.01	1	33
NV73A1ETTP8	8	6.4～9.6	5.5	20	0.05	20	480
NV73A1ETTP18	18	16.2～19.8	14	35	0.05	20	160
NV73AL1ETTP12	12	10～14	5.5	30	0.03	5	50
NV73AL1ETTP21	21	18～24	14	50	0.03	5	50
NV73AL1ETTP28	28	24～32	18	65	0.005	2	15
NV73AL1ETTP120	120	90～150	18	350 (Ic=0.5A)	0.005	0.5	3 (1MHz)

Operating Temperature Range : −40℃～+85℃
Storage Temperature Range : −40℃～+125℃
Q'ty / Reel 1H : TBM (15,000pcs) 、1E : TP (10,000pcs)

■Voltage-Current Curves (Reference) (Ta=25℃)

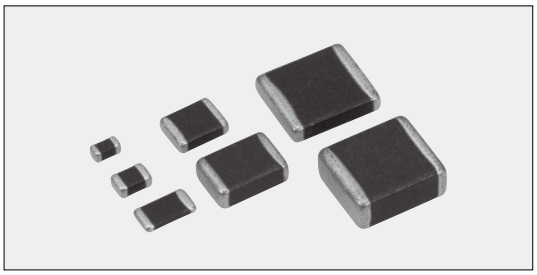
NV73A1E



■Performance

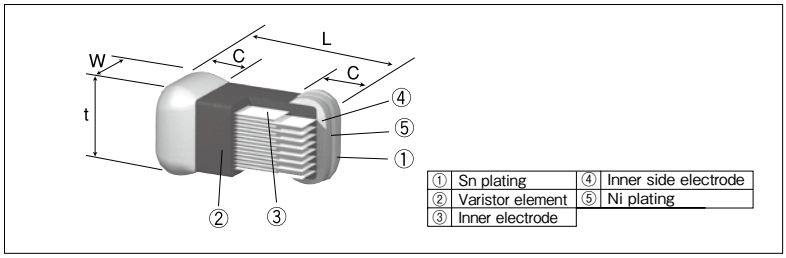
Test Items	Performance Requirements ΔV±%	Test Methods
Varistor Voltage	Within specified tolerance	Voltage between terminals when 1mA is flowed.
Solderability	95% coverage min.	230℃±5℃, 4s±1s
Resistance to soldering heat	10	260±5℃, 10s±0.5s
Rapid change of temperature	10	−40℃ (30min) / +125℃ (30min) 30cycles
Maximum peak current	10	A single standard impulse of 8/20μs, positive/negative applied once each
Maximum energy	10	A single standard impulse of 10/1000μs, once
High temperature life with d.c. bias	10	85℃±5℃、1000h Load: Maximum Allowable Voltage (d.c.)
High temperature & high humidity life with d.c bias	10	40℃±5℃、95%RH 500h Load: Maximum Allowable Voltage (d.c.)
Capacitance	Typical	1kHz : Others 1MHz : Varistor voltage 120V
High temperature storage life	10	125℃±5℃, 1000h
Low temperature storage life	10	−40℃±5℃, 1000h

NV73 Multilayer Type Metal Oxide Varistors



Body color：Black

■Construction



■Features

- Varistors own two-way symmetries and can absorb positive and negative surges.
- Multilayer construction allows its small size to absorb a large surge.
- Small space and high density mounting available due to the small package.
- Suitable for both flow and reflow solderings.
- Products with lead free termination meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, varistor element and glass.

■Applications

- Protection of ESD from input and output terminals of mobile devices.
- Absorption of surge voltages occurred from inductive load of motors, relays, etc.
- Protection of semiconductor elements against over voltages.
- Absorption of surge voltages generated from piezoelectric elements.

■Dimensions

Type (Inch Size Code)	Dimensions (mm)				Weight(g) (1000pcs)
	L	W	t	c	
NV73 1J(0603)	1.6±0.15	0.8±0.15	0.8±0.15	$0.4^{+0.15}_{-0.2}$	6～7
NV73 2A(0805)	2±0.2	1.25±0.2	1.3max.	0.5±0.25	8～16
NV73 2B(1206)	3.2±0.2	1.6±0.2	1.65max.	$0.5^{+0.35}_{-0.25}$	16～32
NV73 2E(1210)	3.2±0.2	2.5±0.2	1.5max.	0.5±0.2	33～56
NV73 2J(1812)	4.5±0.2	3.2±0.2	2.0max.	$0.5^{+0.3}_{-0.1}$	50～134
NV73 2L(2220)	5.7±0.2	5.0±0.2	2.5max.	$0.5^{+0.3}_{-0.1}$	100～230
NV73 C2L(2220)	5.9±0.2	5.1±0.2	2.7max.	$0.7^{+0.4}_{-0.3}$	190～440

■Type Designation

Example

Lead Free Type

NV73	A	1J	T	TE	24
Product Code	Energy Code	Size	Terminal Surface Material	Taping	Varistor Voltage
	A B C	1J：1.6×0.8mm 2A：2.0×1.2mm 2B：3.2×1.6mm 2E：3.2×2.5mm 2J：4.5×3.2mm 2L：5.7×5.0mm	T：Sn	TE：Taping BK：Bulk	

The terminal surface material lead free is standard.
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Performance (1J・2A・2B)

Test Items	Performance Requirements ΔV± %	Test Methods
Varistor Voltage	Within specified tolerance	Voltage between terminals when 1mA is flowed.
Resistance to soldering heat	10	270℃±5℃ 3s±0.5s
Solderability	95% Coverage min.	230℃±5℃ 4s±1s
Rapid change of temperature	10	−40℃ (30min) /+125℃ (30min) 30cycles
Maximum peak current	10	A single standard impulse of 8/20μs, positive/negative applied once each
Maximum energy	10	A single standard impulse of 2ms, once
High temperature life with d.c. bias	10	85℃±5℃、 Load: Maximum Allowable Circuit Voltage (d.c.) 1000h
High temperature life with a.c. bias	10	85℃±5℃、 Load: Maximum Allowable Circuit Voltage ($Va.c._{r.m.s.}$) 1000h
High temperature & high humidity life with d.c. bias	10	40℃±5℃ 95%RH Load: Maximum Allowable Circuit Voltage (d.c.) 500h
High temperature storage life	10	125℃±5℃ 1000h
Low temperature storage life	10	−40℃±5℃ 1000h

■Performance (2E・2J・2L)

Test Items	Performance Requirements ΔV± %	Test Methods
Varistor Voltage	Within specified tolerance	Voltage between terminals when 1mA is flowed.
Resistance to soldering heat	10	260℃±5℃ 4s±1s
Solderability	95% Coverage min.	235℃±5℃ 4s±1s
Rapid change of temperature	10	−40℃ (30min) /+125℃ (30min) 5cycles
Maximum peak current	10	A single standard impulse of 8/20μs, 100pluse, 30s interval
Maximum energy	10	A single standard impulse of 10/1000μs, 100pluse, 90s interval
High temperature life with d.c. bias	10	125℃±5℃、 Load: Maximum Allowable Circuit Voltage (d.c.) 1000h
低温直流電圧印加 Low temperature life with d.c. bias	10	−50℃±5℃、 Load: Maximum Allowable Circuit Voltage (d.c.) 1000h
高温高湿電圧印加 High temperature & high humidity life with d.c. bias	10	40℃±5℃ 95%RH Load: Maximum Allowable Circuit Voltage (d.c.) 500h
High temperature storage life	10	150℃±5℃ 1000h
Low temperature storage life	10	−50℃±5℃ 1000h

■Ratings (1J・2A・2B)

Operating Temp. Range：−40℃～+85℃　Storage Temp. Range：−40℃～+125℃　Q'ty/Reel：TE 2,500pcs

Type	Varistor Vol. Vc Ic=1mA (V)	Max. Allowable Vol.		Clamping Vol. (V)		Max. Energy E(J)	Max. Peak Current Ip(A) (2 times)
		a.c.r.m.s.(V)	d.c.(V)	V_{1A}	V_{2A}		
NV73A1JTTE8.2	6.8～9.8	4.2	6.0	—	21	0.1	30
NV73A1JTTE12	10～14.4	6.1	8.6	—	29		
NV73A1JTTE15	12.5～18	7.6	10.8	—	35		
NV73A1JTTE18	16～20	9.1	12.8	—	37		
NV73A1JTTE20	18～22	10.6	15.0	—	40		
NV73A1JTTE22	19～24	12.0	16.5	—	42		
NV73A1JTTE24	21.8～26.5	14.0	18.0	—	46		
NV73A1JTTE27	25～32	17.0	22.0	—	49		
NV73A2ATTE8.2	6.8～9.8	4.2	6.0	18	—	0.01	10
NV73A2ATTE12	10～14.4	6.1	8.6	24	—	0.03	20
NV73A2ATTE15	12.5～18	7.6	10.8	29	—	0.04	
NV73A2ATTE18	16～20	9.1	12.8	29	—		
NV73A2ATTE20	18～22	10.6	15.0	33	—	0.05	
NV73A2ATTE22	19～24	12.0	16.5	39	—		
NV73A2ATTE24	21.8～26.5	14.0	18.0	42	—	0.06	
NV73A2ATTE27	25～32	17.0	22.0	50	—	0.07	
NV73A2ATTE33	30～39	20.0	26.0	60	—	0.12	
NV73A2ATTE39	37～47	25.0	31.0	72	—	0.14	25
NV73A2ATTE47	45～54	30.0	38.0	86	—	0.16	
NV73B2ATTE8.2	6.8～9.8	4.2	6.0	—	18	0.03	20
NV73B2ATTE12	10～14.4	6.1	8.6	—	24	0.05	35
NV73B2ATTE15	12.5～18	7.6	10.8	—	30	0.07	
NV73B2ATTE18	16～20	9.1	12.8	—	32	0.08	
NV73B2ATTE20	18～22	10.6	15.0	—	36	0.09	
NV73B2ATTE22	19～24	12.0	16.5	—	40	0.11	
NV73B2ATTE24	21.8～26.5	14.0	18.0	—	42	0.12	
NV73B2ATTE27	25～32	17.0	22.0	—	58	0.24	
NV73B2ATTE33	30～39	20.0	26.0	—	66	0.25	50
NV73C2ATTE8.2	6.8～9.8	4.2	6.0	—	18	0.04	25
NV73C2ATTE12	10～14.4	6.1	8.6	—	24	0.09	50
NV73C2ATTE15	12.5～18	7.6	10.8	—	29	0.11	
NV73C2ATTE18	16～20	9.1	12.8	—	32	0.13	
NV73C2ATTE20	18～22	10.6	15.0	—	35	0.14	
NV73C2ATTE22	19～24	12.0	16.5	—	40	0.17	
NV73C2ATTE24	21.8～26.5	14.0	18.0	—	42	0.18	
NV73A2BTTE27	25～32	17.0	22.0	—	55	0.13	40
NV73A2BTTE33	30～39	20.0	26.0	—	60	0.15	
NV73A2BTTE39	37～47	25.0	31.0	—	72	0.18	
NV73A2BTTE47	45～54	30.0	38.0	—	85	0.22	
NV73A2BTTE56	52～62	35.0	45.0	—	100	0.26	
NV73B2BTTE8.2	6.8～9.8	4.2	6.0	—	18	0.03	30
NV73B2BTTE12	10～14.4	6.1	8.6	—	24	0.07	50
NV73B2BTTE15	12.5～18	7.6	10.8	—	29	0.09	
NV73B2BTTE18	16～20	9.1	12.8	—	32	0.10	
NV73B2BTTE20	18～22	10.6	15.0	—	35	0.11	
NV73B2BTTE22	19～24	12.0	16.5	—	40	0.12	
NV73B2BTTE24	21.8～26.5	14.0	18.0	—	42	0.14	
NV73B2BTTE27	25～32	17.0	22.0	—	52	0.16	
NV73C2BTTE8.2	6.8～9.8	4.2	6.0	—	18	0.06	40
NV73C2BTTE12	10～14.4	6.1	8.6	—	24	0.10	70
NV73C2BTTE15	12.5～18	7.6	10.8	—	29	0.13	
NV73C2BTTE18	16～20	9.1	12.8	—	29	0.15	
NV73C2BTTE20	18～22	10.6	15.0	—	31	0.17	
NV73C2BTTE22	19～24	12.0	16.5	—	35	0.19	
NV73C2BTTE24	21.8～26.5	14.0	18.0	—	38	0.20	
NV73C2BTTE27	25～32	17.0	22.0	—	48	0.24	

Detailed data other than the above-mentioned are also available, for which please ask our sales office.

NV73 Multilayer Type Metal Oxide Varistors

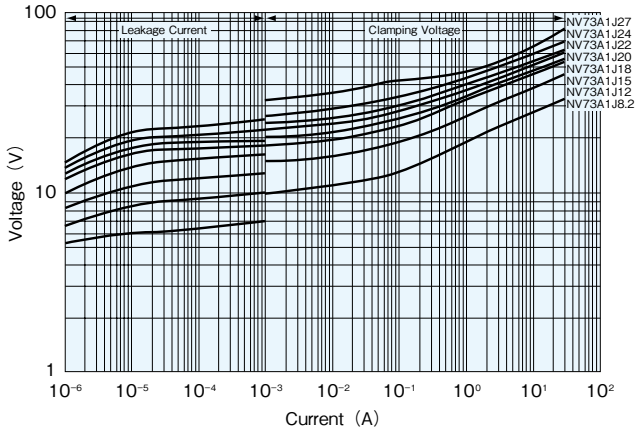
■Ratings (2E・2J・2L)

Operating Temp. Range：−50℃～+125℃　Storage Temp. Range：−50℃～+150℃　Q'ty/Reel　2E：TE (2,000pcs)、2J・2L：TE (1,000pcs)

Type	Varistor Vol. Vc	Max. Allowable Vol.		Clamping Vol. (V)			Max. Energy E(J) (100 times)	Max. Peak Current Ip(A) (100 times)
	Ic=1mA (V)	a.c.r.m.s.(V)	d.c.(V)	$V_{2.5A}$	V_{5A}	V_{10A}		
NV73A2ETTE15	12.8～17.3	8	11	30	−	−	1.0	400
NV73A2ETTE18	15.3～20.7	11	14	34	−	−	1.2	
NV73A2ETTE22	19.8～24.2	12	16.5	39	−	−	1.4	
NV73A2ETTE24	21.6～26.4	14	18	39	−	−		
NV73A2ETTE27	24.3～29.7	17	22	44	−	−	1.7	
NV73A2ETTE33	29.7～36.3	20	26	54	−	−	1.9	
NV73A2ETTE39	35.1～42.9	25	30	65	−	−	1.7	
NV73A2ETTE47	42.3～51.7	30	38	77	−	−	2.0	
NV73A2ETTE56	50.4～61.6	35	45	90	−	−		
NV73A2ETTE82	73.8～90.2	50	65	135	−	−	1.2	250
NV73A2ETTE100	90.0～110.0	60	85	165	−	−	1.4	200
NV73A2ETTE110	99.0～121.0	70	90	180	−	−		
NV73A2JTTE12	10.2～13.8	6	9	−	27	−	0.9	500
NV73A2JTTE15	12.8～17.3	8	11	−	32	−	1.2	
NV73A2JTTE18	16.2～19.8	11	14	−	35	−	1.4	
NV73A2JTTE22	19.8～24.2	12	16.5	−	41	−	1.6	
NV73A2JTTE24	21.6～26.4	14	18	−	44	−	1.7	
NV73A2JTTE27	24.3～29.7	17	22	−	49	−	2.0	
NV73A2JTTE33	29.7～36.3	20	26	−	54	−	2.5	
NV73A2JTTE39	35.1～42.9	25	30	−	65	−	2.9	
NV73A2JTTE47	42.3～51.7	30	38	−	77	−	3.5	
NV73A2JTTE56	50.4～61.6	35	45	−	90	−	4.2	
NV73A2JTTE68	61.2～74.8	40	56	−	110	−	4.8	
NV73A2JTTE82	73.8～90.2	50	65	−	135	−	4.5	400
NV73A2JTTE100	90.0～110.0	60	85	−	165	−	5.8	
NV73A2JTTE110	99.0～121.0	70	90	−	180	−		
NV73A2JTTE150	135.0～165.0	95	127	−	248	−		300
NV73B2JTTE15	12.8～17.3	8	11	−	32	−	1.8	800
NV73B2JTTE18	15.3～20.7	11	14	−	35	−	1.9	
NV73B2JTTE22	19.8～24.2	12	16.5	−	41	−	2.3	
NV73B2JTTE24	21.6～26.4	14	18	−	44	−		
NV73B2JTTE27	24.3～29.7	17	22	−	49	−	2.7	
NV73B2JTTE33	29.7～36.3	20	26	−	54	−	3.0	
NV73B2JTTE39	35.1～42.9	25	30	−	65	−	3.7	
NV73B2JTTE47	42.3～51.7	30	38	−	77	−	4.2	
NV73B2JTTE56	50.4～61.6	35	45	−	90	−		
NV73A2LTTE12	10.2～13.8	6	9	−	−	28	1.9	1,000
NV73A2LTTE15	12.8～17.3	8	11	−	−	33	2.3	
NV73A2LTTE18	16.2～19.8	11	14	−	−	36	2.7	
NV73A2LTTE22	19.8～24.2	12	16.5	−	−	41	2.9	
NV73A2LTTE24	21.6～26.4	14	18	−	−	45	3.1	
NV73A2LTTE27	24.3～29.7	17	22	−	−	48	3.8	
NV73A2LTTE33	29.7～36.3	20	26	−	−	57	4.3	
NV73A2LTTE39	35.1～42.9	25	30	−	−	65	5.5	
NV73A2LTTE47	42.3～51.7	30	38	−	−	77	6.3	
NV73A2LTTE56	50.4～61.6	35	45	−	−	90	7.7	
NV73A2LTTE68	61.2～74.8	40	56	−	−	110	8.8	
NV73A2LTTE100	90.0～110.0	60	85	−	−	165	6.8	
NV73A2LTTE110	99.0～121.0	70	90	−	−	180		
NV73B2LTTE15	12.8～17.3	8	11	−	−	33	4.2	1,200
NV73B2LTTE18	15.3～20.7	11	14	−	−	36	5.4	
NV73B2LTTE22	19.8～24.2	12	16.5	−	−	41	5.8	
NV73B2LTTE24	21.6～26.4	14	18	−	−	45		
NV73B2LTTE27	24.3～29.7	17	22	−	−	48	7.2	
NV73B2LTTE33	29.7～36.3	20	26	−	−	57	7.8	
NV73B2LTTE39	35.1～42.9	25	30	−	−	65	9.6	
NV73B2LTTE47	42.3～51.7	30	38	−	−	77	12.0	
NV73B2LTTE56	50.4～61.6	35	45	−	−	90	7.7	
NV73B2LTTE82	73.8～90.2	50	65	−	−	135	5.6	1,000
NV73C2LTTE39	35.1～42.9	25	30	−	−	65	5.6(1 time)	2,500(1 time)
NV73C2LTTE82	73.8～90.2	50	65	−	−	135	14 (1 time)	4,500(1 time)

■Voltage-Current Curves (Reference) (Ta=25℃)

NV73A1J



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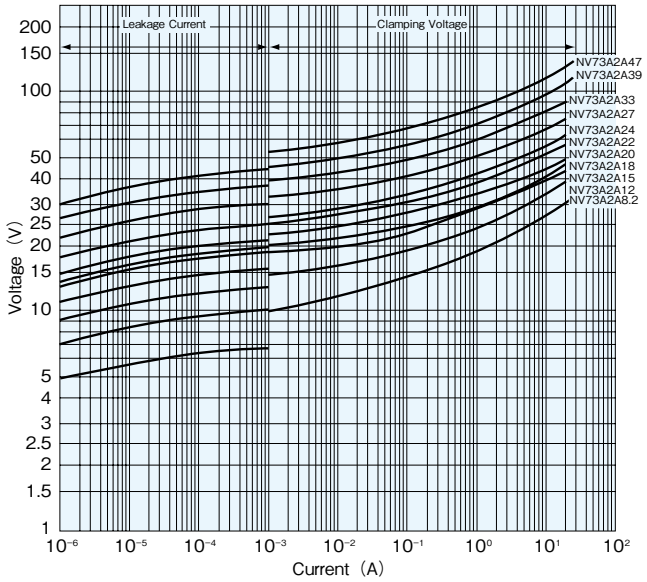

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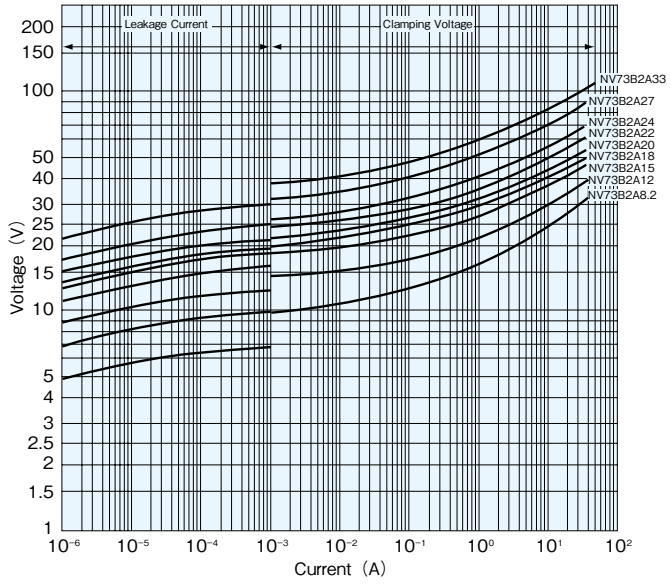

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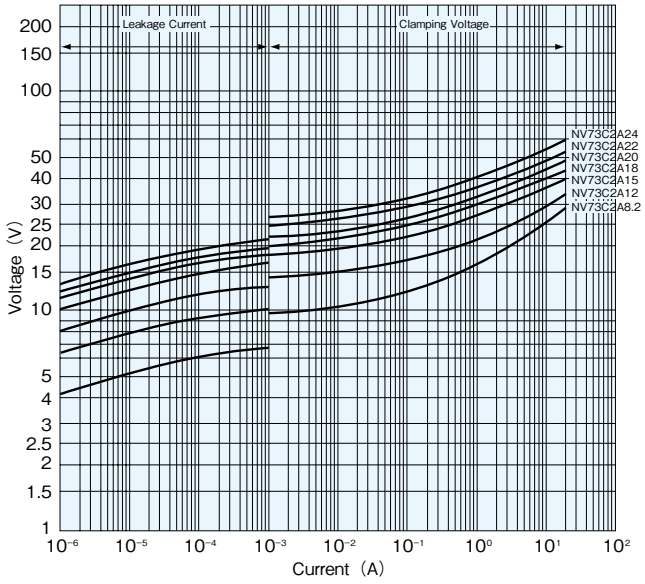
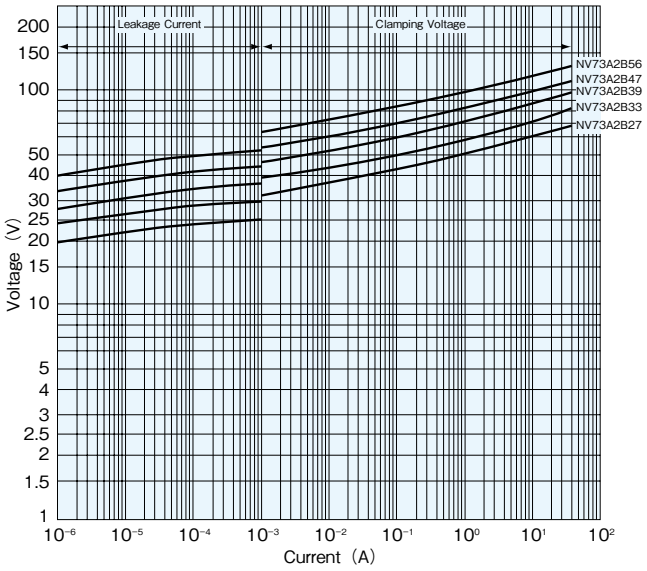


NV73 Multilayer Type Metal Oxide Varistors

■Voltage-Current Curves (Reference) (Ta=25℃)

NV73A2B



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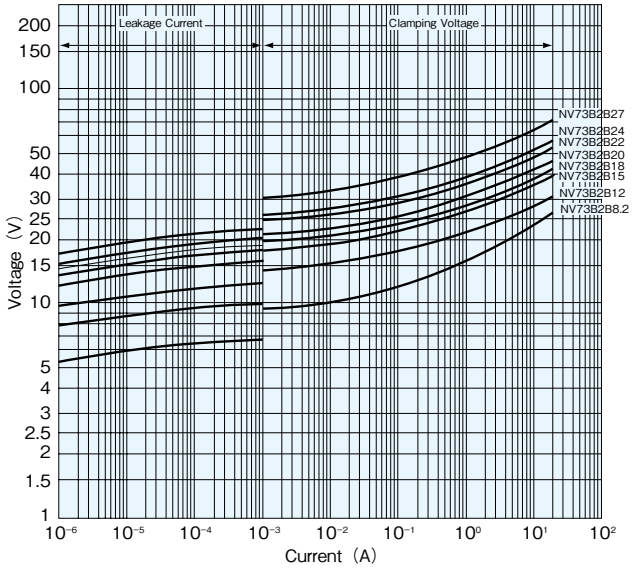

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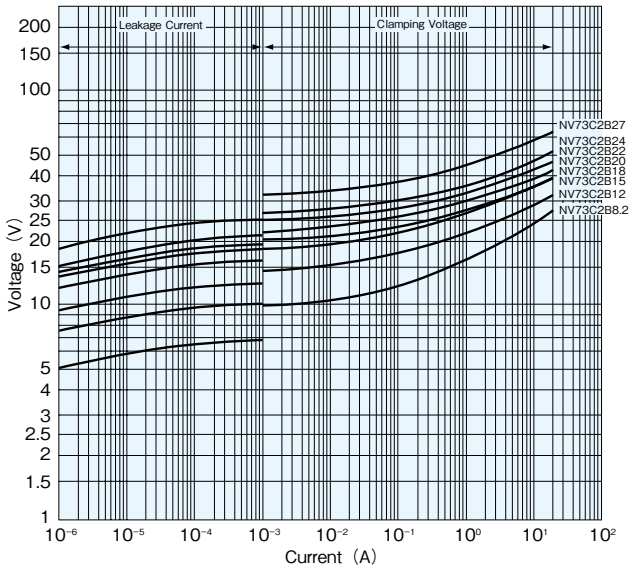
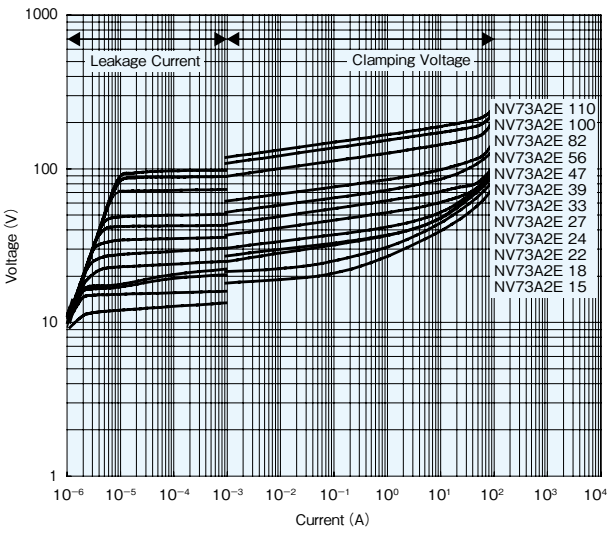
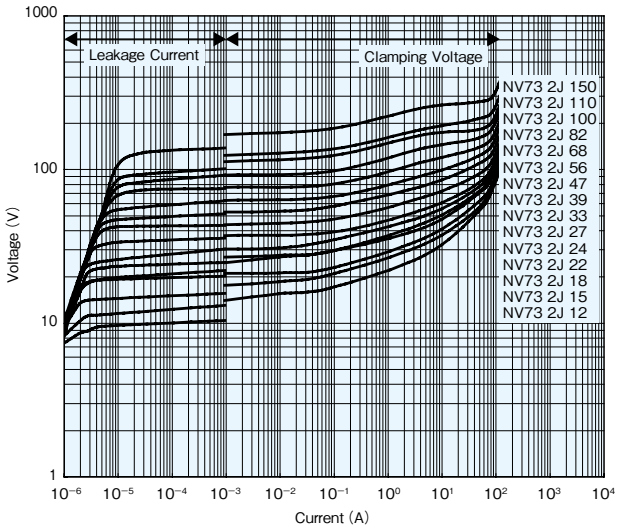


■Voltage-Current Curves (Reference) (Ta=25℃)

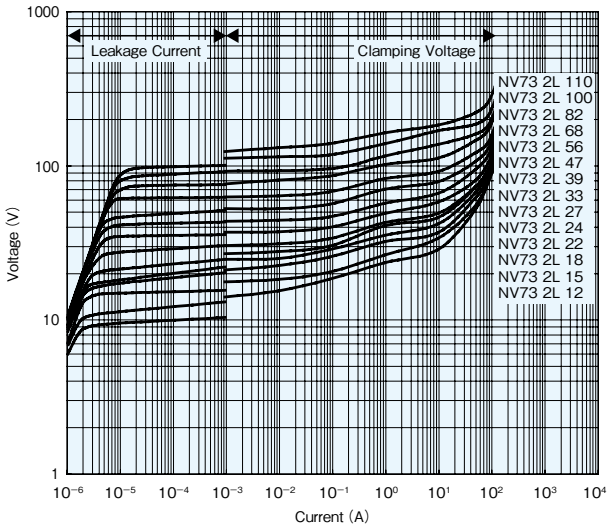
NV73 2E



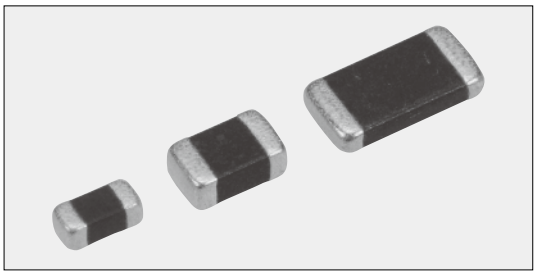
NV73 2J



NV73 2L



NV73DL Multilayer Type Metal Oxide Varistors (For Automotive)



Body color : Black

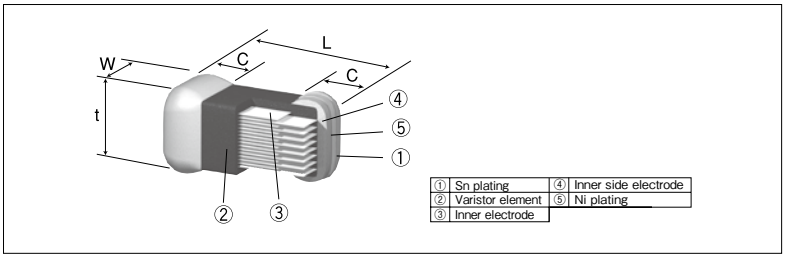
■Features

- SMD type metal oxide varistors.
- Ideal for the countermeasure against ESD.
- AEC-Q200 Tested.
- Symmetrical non-linearity V-I characteristics absorb positive and negative surge.
- High maximum energy type.
- Operating temperatures up to 125℃.
- Low leakage current.
- High resistance to cyclic temperature stress.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements. EU-RoHS regulation is not intended for Pb-glass contained in electrode, varistor element and glass.

■Applications

- Protection from surge to electronic device for automotive.
- Absorption of surge voltages occurred from inductive load of motors, relays,etc.
- Protection of semiconductor elements against over voltages.

■Construction



■Dimensions

Type (Inch Size Code)	Dimensions (mm)				Weight (g) (1000pcs)
	L	W	t Max.	c	
NV73DL 1J (0603)	1.6±0.15	0.8±0.15	1.0	0.4±0.15	3~6
NV73DL 2A (0805)	2.0±0.25	1.25±0.2	1.30	0.5±0.25	7~12
NV73DL 2B (1206)	3.2±0.3	1.6±0.3	1.45	0.55±0.3	17~27

■Type Designation

Example

NV73	DL	2A	T	TE	27
Product Code	Energy Code	Size	Termination Surface Material	Taping	Varistor Voltage
		1J : 1.6×0.8mm 2A : 2.0×1.2mm 2B : 3.2×1.6mm	T : Sn	TE : Plastic embossed BK : Bulk	

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

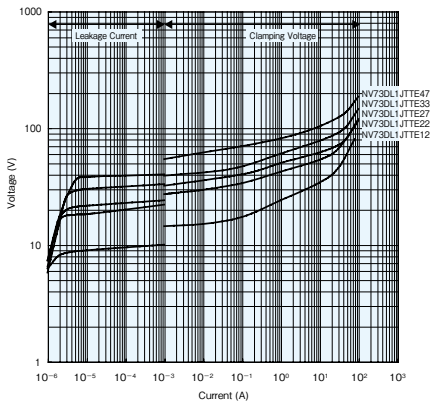
■Ratings

Type	Varistor Voltage (Range) (V)	Maximum Allowable Voltage		Clamping Voltage (V)		Maximum Energy	Maximum Peak Current	Short-Time Applied Voltage (5min.)	Capacitance (Typ) 1kHz (pF)
	V_{1mA}	A.C. ($V_{r.m.s.}$)	D.C. (V)	V_{1A}	V_{2A}	(J)	8/20μs (A) 1time	(V_{DC})	
NV73DL1JTTE12	10~14.4	6.1	8.6	24	–	0.1	80	10	630
NV73DL1JTTE22	22~27	14	16	42	–	0.2	100	24.5	390
NV73DL1JTTE27	24~32	17	22	50	–	0.2	100	24.5	320
NV73DL1JTTE33	33~39	20	26	60	–	0.3	100	24.5	200
NV73DL1JTTE47	40~54	30	34	81	–	0.3	100	42	130
NV73DL2ATTE12	10~14.4	6.1	8.6	24	–	0.1	120	10	1070
NV73DL2ATTE22	22~27	14	16	42	–	0.3	160	24.5	610
NV73DL2ATTE27	24~32	17	22	50	–	0.3	160	24.5	580
NV73DL2ATTE33	33~39	20	26	60	–	0.3	160	24.5	380
NV73DL2ATTE47	40~54	30	34	81	–	0.3	160	42	260
NV73DL2ATTE68	62~72	45	56	108	–	0.3	160	64	190
NV73DL2ATTE82	74~90	50	65	135	–	0.3	160	75	105
NV73DL2BTTE22	22~27	14	16	–	42	1	300	24.5	1600
NV73DL2BTTE27	24~32	17	22	–	50	1	300	24.5	1360
NV73DL2BTTE33	33~39	20	26	–	60	1	300	24.5	870
NV73DL2BTTE68	62~72	45	56	–	108	1.5	300	64	380
NV73DL2BTTE82	74~90	50	65	–	135	1.5	300	75	250

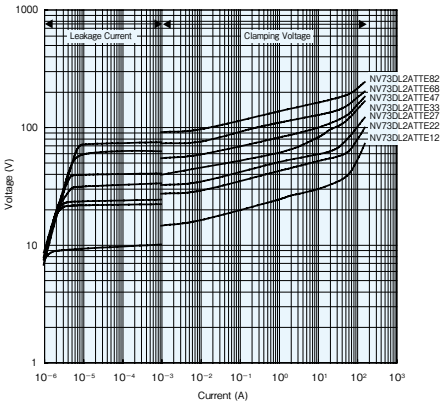
Operating Temperature Range : −40℃~+125℃ Storage Temperature Range : −40℃~+150℃
Q'ty/Reel : 2,500pcs

■Voltage-Current Curves (Reference) (Ta=25℃)

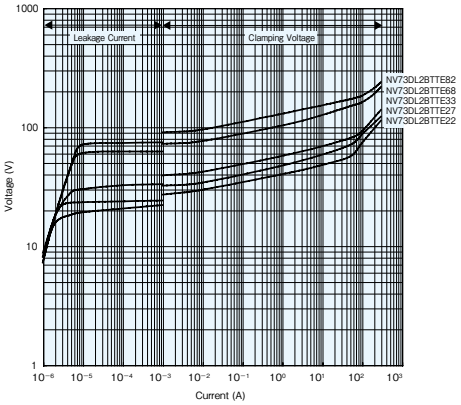
NV73DL1J



NV73DL2A



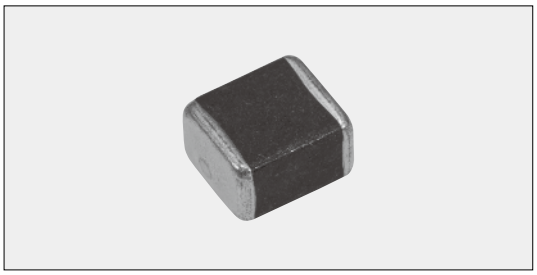
NV73DL2B



■Performance

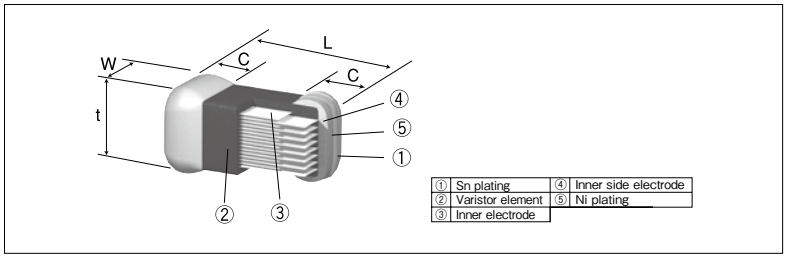
Test Items	Performance Requirements ΔV_{1mA}±%	Test Methods
Varistor voltage	Within specified tolerance	Voltage between terminals when 1mA is flowed.
Resistance to soldering heat	10	260℃±5℃、10s±0.5s
Solderability	95% coverage min	230℃±5℃、5s±0.5s
Rapid change of temperature	10	−40℃ (30min.) / +125℃ (30min.) 1000cycles
Short-time applied voltage	10	Maximum value of D.C. voltage that can be applied for a short period of time. (5min.)
Maximum peak current	10	A single standard impulse current of 8/20μs is applied.
Maximum energy	10	A single standard impulse of 2ms, once
Electrostatic discharge	10	25kV (Non contact) (NV73DL1J12, NV73DL2A12 : 15kV (Non contact))
Vibration resistance	No visible damage. No remarkable mechanical damage	Vibration frequency : 10Hz～2000Hz Full amplitude : 1.5mm, 10Hz～2000Hz～10Hz 20min. XYZ direction 4hrs for each total 12hrs
High temperature & high humidity life with bias	10	85℃±2℃, 85%RH, 1000h Applied voltage : Varistor voltage (V1mA) ×0.85
High temperature life with d.c. bias	10	125℃±2℃, 1000h Applied voltage : Varistor voltage (V1mA) ×0.85
Thermal shock	10	−55℃ (15min.) / +125℃ (15min.) 300cycles
Shock	10	Half sine wave, Applied time : 1ms, Applied cycle : 500m/s², 5cycles
High temperature storage	10	+150℃, 1000h
Low temperature storage	10	−40℃, 1000h

NV73DS Multilayer Type Metal Oxide Varistors for Load Dump Surge



Body color : Black

■Construction



■Features

- Symmetrical non-linearity V-I characteristics absorb positive and negative surge.
- Suitable for the protection from load dump surge on the electronic components for automotive.
- Meet for load dump surge test of JASO.
- Operating temperatures up to 125℃.
- High resistance to cyclic temperature stress.
- Suitable for both flow and reflow solderings.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested.

■Applications

- Protection from surge to electronic device for auto-motive.
- Absorption of surge voltages occurred from inductive load of motors, relays, etc.
- Protection of semiconductor elements against over voltages.

■Dimensions

Type (Inch Size Code)	Dimensions (mm)				Weight (g) (1000pcs)
	L	W	t Max.	c	
NV73DS 2L (2420)	6.1±0.35	5.1±0.35	3.7	1.05±0.2	420～550

■Type Designation

Example

NV73DS	A	2L	T	TE	27
Product Code	Energy Code	Size	Termination Surface Material	Taping	Varistor Voltage
	A B	2L : 6.1×5.1mm	T : Sn	TE : Plastic embossed (8mm pitch) BK : Bulk	

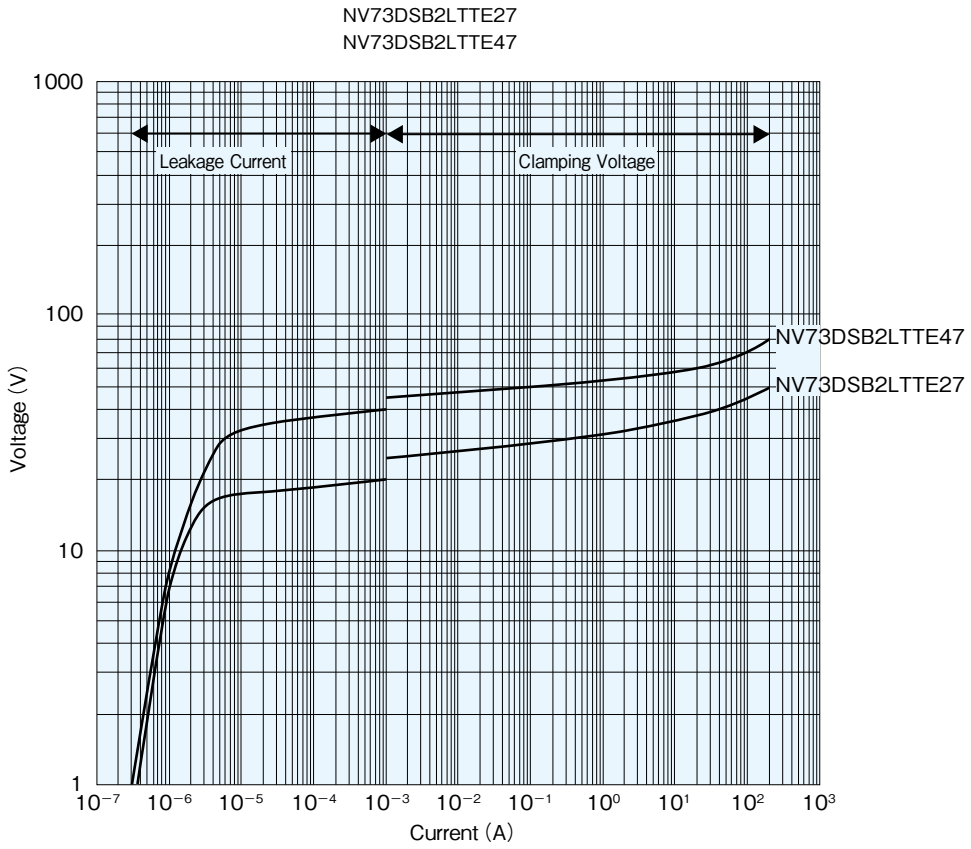
Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Ratings

Type	Varistor Voltage (Range) (V)	Maximum Allowable Voltage		Clamping Voltage (V)	Maximum Load Dump Surge Energy	Maximum Peak Current	Short-Time Applied Voltage (5min.)
	V_{1mA}	A.C. ($V_{r.m.s.}$)	D.C. (V)	V_{20A}	(J)	8/20μs (A) 1time	(V_{DC})
NV73DSB2LTTE27	20～25	14	16	40	63	200	24.5
NV73DSB2LTTE47	40～45	30	34	60	65	200	38
NV73DSA2LTTE27	20～25	14	16	40	70	200	24.5

Operating Temperature Range : −40℃～+125℃ Storage Temperature Range : −40℃～+150℃
Q'ty/Reel : 500pcs

■Voltage-Current Curves (Reference) (Ta=25℃)

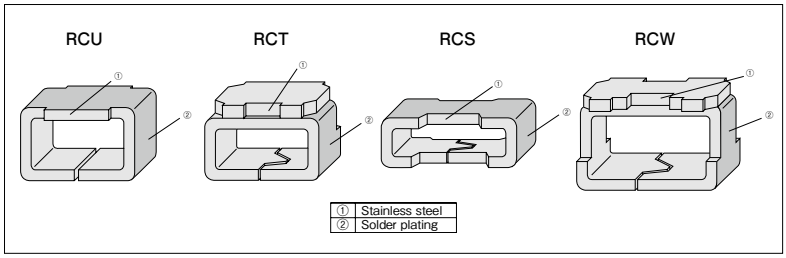


■Performance

Test Items	Performance Requirements ΔV_{1mA}±%	Test Methods
Varistor voltage	Within specified tolerance	Voltage between terminals when 1mA is flowed.
Resistance to soldering heat	10	260℃±5℃、10s±0.5s
Solderability	95% coverage min	230℃±5℃、5s±0.5s
Rapid change of temperature	10	−40℃ (30min.) / +125℃ (30min.) 1000cycles
Short-time applied voltage	10	Maximum value of D.C. voltage that can be applied for a short period of time. (5min.)
Maximum peak current	10	A single standard impulse current of 8/20μs is applied.
Electrostatic discharge	10	25kV (Non contact)
Vibration resistance	No visible damage. No remarkable mechanical damage	Vibration frequency : 10Hz～2000Hz Full amplitude : 1.5mm, 10Hz～2000Hz～10Hz 20min. XYZ direction 4hrs for each total 12hrs
High temperature & high humidity life with bias	10	85℃±2℃, 85%RH, 1000h Applied voltage : Varistor voltage (V_{1mA}) ×0.85
High temperature life with d.c. bias	10	125℃±2℃, 1000h Applied voltage : Varistor voltage (V_{1mA}) ×0.85
Thermal shock	10	−55℃ (15min.) / +125℃ (15min.) 300cycles
Shock	10	Half sine wave, Applied time : 1ms, Applied cycle : 500m/s², 5cycles
High temperature storage	10	+150℃, 1000h
Low temperature storage	10	−40℃, 1000h

RCU・RCT・RCS・RCW Checker Chips

■Construction



■Type Designation

Example

RCU	C	TE
Product Code	Terminal Surface Material	Taping
RCU RCT RCS RCW	C : SnCu	TE : 4mm pitch plastic embossed (7 inch reel) TED : 4mm pitch plastic embossed (10 inch reel) (Not RCW) BK : Bulk

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.
For further information on taping, please refer to APPENDIX C on the back pages.

■Features

- Surface-mountable chip type check terminals.
- Automatic mounting can be done by an ordinary chip mounter.
- Inch size code 1206, 0805 and 0603 are available.
  (for size 1206, two kinds of the height 1.25mm and 2mm are provided.)
- Suitable for both flow and reflow solderings.
- Since only the outside surface is solder-plated, the inside is structured unsolderable.
- Products meet EU-RoHS requirements.
- AEC-Q200 Tested (RCU).

■Applications

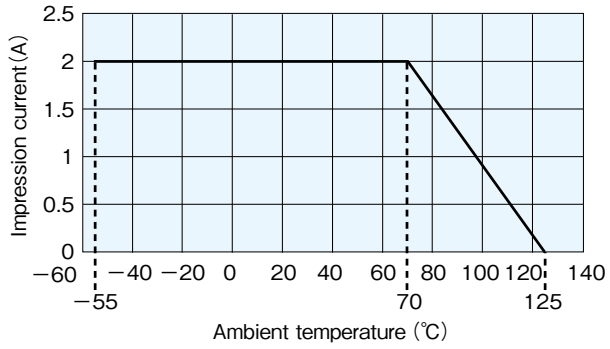
- Terminals for checking signals from a P.C. board when adjusting and repairing the set.

■Rating

Type	Rated Current	Resistance	Rated Ambient Temperature	Operating Temperature Range	Taping & Q'ty/Reel (pcs)	
					TE	TED
RCU	2A	50mΩ or less	+70℃	−55℃～+125℃	2,000	5,000
RCT					2,000	5,000
RCS					2,000※1	5,000※1
RCW					2,000	—

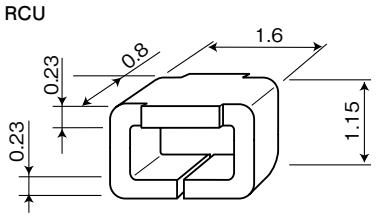
※1 RCS can be packaged upside down for taping.

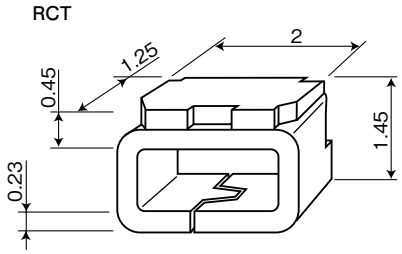
■Derating Curve

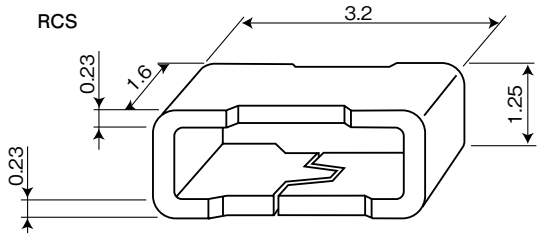


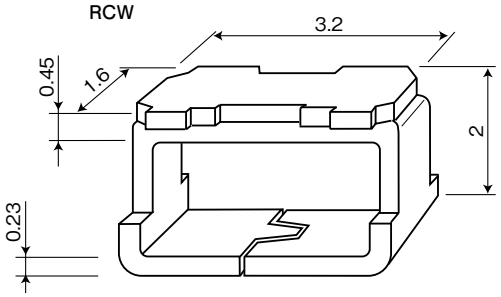
For terminals operated at an ambient temperature of 70℃ or higher, the current shall be derated in accordance with the above derated curve.

■Dimensions (mm)









Type (Inch Size Code)	Weight (g) (1000pcs)
RCU (0603)	6.4
RCT (0805)	13.9
RCS (1206)	21.5
RCW (1206)	26.8

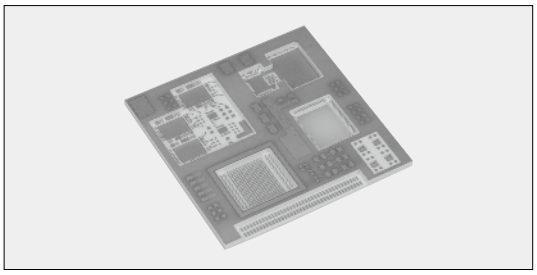
■Performance

Test Items	Performance Requirements		Test Methods
	Limit	Typical	
Resistance	50mΩ Max. after the test	10mΩ Max. after the test	25℃
Resistance to soldering heat	50mΩ Max. after the test	10mΩ Max. after the test	260℃±5℃, 10s±1s
Rapid change of temperature	50mΩ Max. after the test	10mΩ Max. after the test	−55℃ (30min.) /+125℃ (30min.) 100 cycles
High temperature exposure	50mΩ Max. after the test	10mΩ Max. after the test	+125℃, 240h

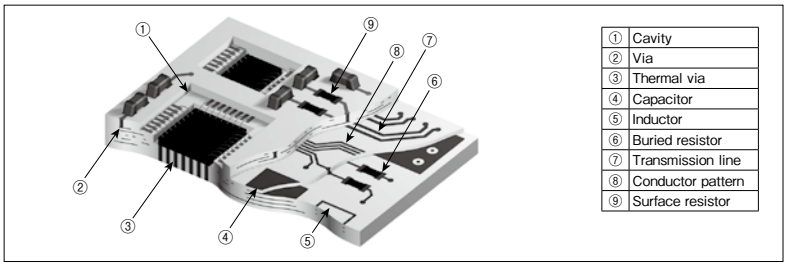
■Precautions for Use

• Regarding the connection of probes, pulling and pushing load at the measurement and inspection pointer must be 9.8N(1kgf) or less because the chips may drop off.

KLC LTCC Multilayer Substrates



■Construction



①	Cavity
②	Via
③	Thermal via
④	Capacitor
⑤	Inductor
⑥	Buried resistor
⑦	Transmission line
⑧	Conductor pattern
⑨	Surface resistor

■What is LTCC?

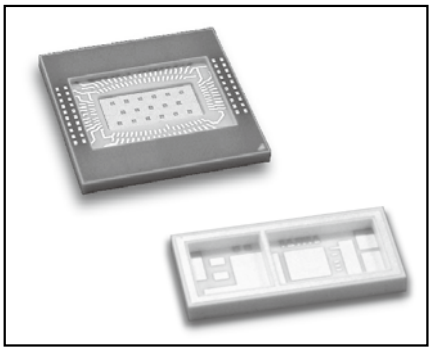
LTCC stands for Low Temperature Co-fired Ceramics.
LTCCs are multilayer ceramic substrates that can be fired simultaneously with low-resistance conductors since the glass-based material is added to the alumina material to lower the firing temperature compared to the general ceramic firing process.
On KOA's LTCC, silver (Ag) based paste that has low conductor resistance is co-fired to create the conductor patterns on each layer of the ceramic substrate. It realizes the multilayer substrate with excellent low-loss electrical characteristics as well as high dimensional accuracy.
KOA's LTCC also provides downsizing by integrating resistors and transmission lines in the inner and surface layers of the substrate. In addition, the thermal expansion coefficient close to silicon enhances the reliability of the bare chip mounting, and the cavity structure contributes to the lower profile package.

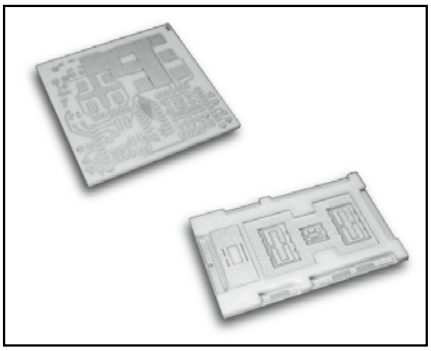
■Features

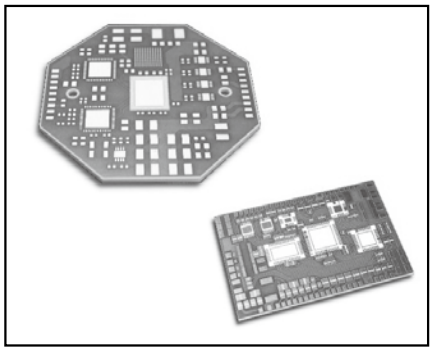
- Suitable for bare chip mounting as it has thermal expansion coefficient close to that of silicon and excellent dimensional accuracy and flatness.
- Excellent high frequency characteristics are achieved by the low-loss dielectric ceramic and the low-loss conductor.
- Downsizing and high integration density can be achieved by the multilayer wiring, the multi-cavity structure and the surface/buried resistor printing.
- The substrate and the cavity can be formed in round, polygonal, concave or convex shape.
- Thermal vias can be placed in the bare chip mounting area to improve the thermal conductivity of the substrate.
- The use of ceramic material contribute to the excellent heat and humidity resistance and prevents outgas and dust generation.
- Products meet EU-RoHS requirements.

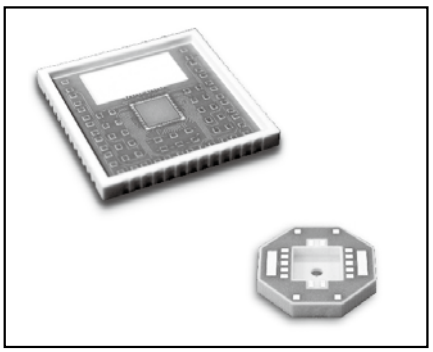
■Applications

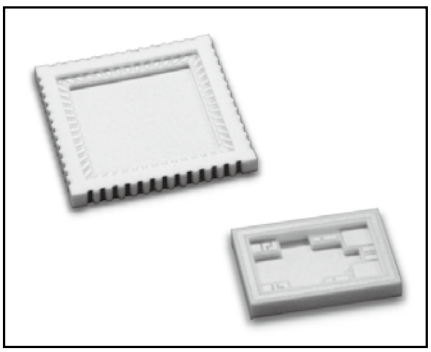
- Applications that deal with high frequencies like micro-waves, milli-waves, etc.
- Applications used in harsh environment, such as high temperature and humidity, etc.
- Various sensor packages.
- Multi-chip modules with mounted bare chips.
- MEMS packages.
- Interposer substrates.

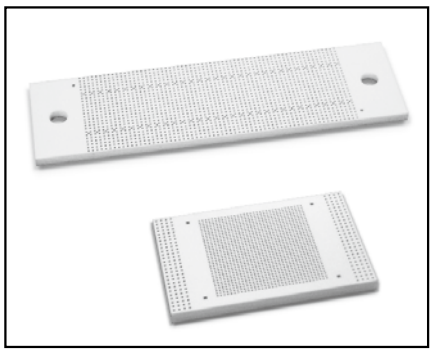

Sensor Module


RF Module


Multi Chip Module


MEMS Sensor Package


Various Device Package


Interposer Substrate

■Type Designation

Example

KLC	AB1
Product Code	KOA Ref. No.

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

■Characteristics of Substrate Material

Parameter	Characteristics
Bending strength (MPa)	250
Thermal expansion coefficient ($\times 10^{-6}$/K)	5.5
Thermal conductivity (W/m・K)	3
Insulation resistance (Ω・cm)	$>10^{13}$
Dielectric constant at 1GHz	6.6
Dielectric loss at 1GHz	0.004
Density (g/cm^3)	2.8
Surface roughness Ra (μm)	<0.4
Withstanding voltage (kV/mm)	>15
Substrate thickness (mm)	0.4~2.0 STD.
Layer thickness (μm/Layer)	80, 100, 125 STD.

■Conductor

Parameter	Characteristics
Material of conductor	Ag
Resistivity of conductor ($\mu\Omega$・cm)	2.5
Surface plating	Ni-Au, Ni-Pd-Au

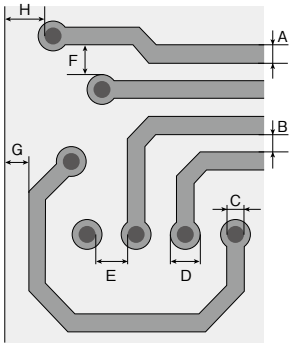
■Surface/Buried Printed Resistor

Parameter	Surface resistor	Buried resistor
Resistance range (Ω)	10~100k	10~200k
Resistance tolerance (%)	±5	±20~50

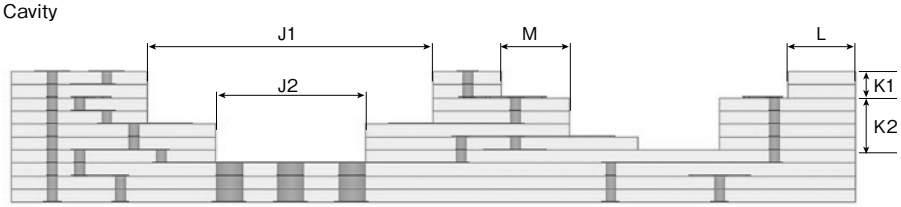
■Standard Design Rules

Symbol	Parameter	Design value
A	Line width	0.06mm Min.
B	Line to line spacing	0.06mm Min.
C	Via diameter	0.1mm, 0.15mm, 0.2mm
D	Via pad diameter	Via diameter+0.05mm Min.
E	Via to via spacing	0.2mm Min.
F	Via pad to line spacing	0.125mm Min.
G	Part edge to conductor spacing	0.2mm Min.
H	Part edge to via spacing	0.3mm Min.
J1, J2	Cavity width	0.6mm Min.
K1, K2	Cavity depth	0.1mm Min.
L	Wall width of cavity	0.5mm Min.
M	Shelf width in the cavity	0.5mm Min.

Surface layer/Inner layer



Cavity



*Please contact us for the use out of the standard design rules, and detailed design rules.

■High-Precision Specification

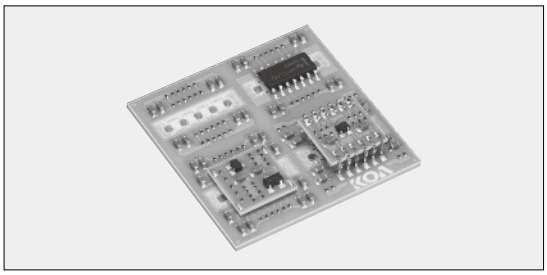
Substrates with higher precision based on the LTCC multilayer substrate are available.

・High-precision pad positioning and excellent flatness.

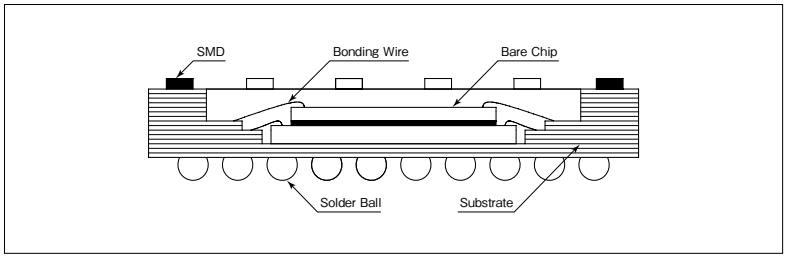
・High-density wiring structure by utilizing LTCC multilayer substrate.

Please contact us for details.

KLCJ Custom Module



■Construction



■Features

- Plural semiconductors in one package offers downsized system with high performance and standardization.
- Wiring space saving by multilayer fine patterns on LTCC substrate. No signal delay by shortened wiring distance.
- Less mounting problem because of the decreasing number of the terminals.

■Mounting Specifications

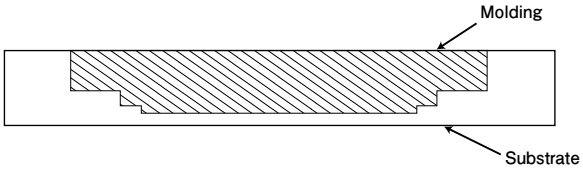
Item		Unit	minimum	Standard	Maximum	Note
Substrate Dimension		mm	—	—	100×100	
Substrate Thickness		mm	0.4	—	2.0	
Bare Chip Pad Pitch		μm	100	—	—	
Bare Chip Pad Dimension		μm	70	—	—	
Bare Chip Thickness		mm	0.1	0.2	—	
Molding Height		mm	0.3	1.0	1.2	Height from the chip surface
Wire Length		mm	0.3	—	3.0	
Wire Loop Height		μm	100	200	—	
Wire Diameter	Au		20	25	40	
Plating		Nonelectrical Au Plating				
Substrate		・LTCC				

■Package Specifications

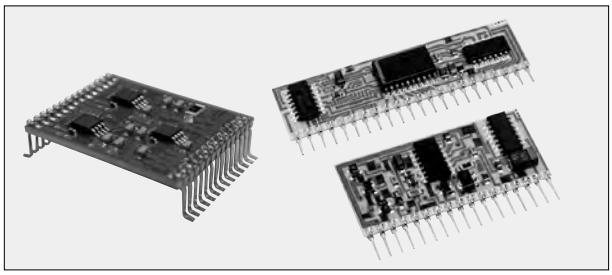
Item	Content
Terminal Pitch	0.8mm～
Mountable device	・SMD ・Bare Chip ・Printed Resistor
Package	・SON ・BGA ・LGA
Substrate for Package	・LTCC

■Molding

Material	Color	Note
Epoxy	Black	



KA Custom Hybrid IC



Features

- Adjustment processes are decreased by function and ratio trimmings.
- High density mounting by bonding (COB).
- Various types of package are available.
- High reliability achieved by KOA's original thick film technology.

EU-RoHS requirements

- Each constructional element of thick film printed circuit substrate and printed board has optimized material. Inner connecting solder is lead-free.

Applications

- Automotives applications (ECU, Power Windows)
- Power supply devices (DC/DC converters, AC/DC converters, Stabilizer, Lithium ion battery charger circuit)
- Industry devices (control circuits)
- Telecommunication equipment (Telephone switchboard, LAN, Transceivers, VCO, VTXO)

Type Designation

Example

KA	7777	D
Product Code	KOA Ref. No.	Terminal Surface Material
KA : Hybrid IC		D : SnAgCu T : Sn Nil : Sn/Pb

Component

KA Series				
Substrate materials	Item	Printing	Mounting	Bonding
	Alumina	○	○	○
	Glass epoxy	×	○	○
Conductors・Resistors	Item	Ag−Pd	Ag−Pt	
	Conductor resistance	18mΩ/□/15μm	5mΩ/□/10μm	
	Heat shock	−55℃～+125℃ 300 Cycles	−55℃～+125℃ 500 Cycles	
	Printed Resistor	5Ω～10MΩ ±100×10⁻⁶/K		
Mounting	Item	Specifications		
	COB	Au Wire, Al Wire		
	BGA	0.5mm Pitch～		
	QFP	0.4mm Pitch～		
	Chip	0.4mm×0.2mm～		
Package・Outside terminals	Package	Lead pitch		
	SIP	1.8mm, 2.0mm, 2.5mm, 2.54mm		
	DIP、SOP	1.27mm, 1.8mm, 2.54mm		
	ZIP	2.54mm		
	BGA、LGA	1.0mm～		
Overcoating ・ Plating	Over Coating	Color		UL Standard
	Epoxy metamorphic phenol	Black		94 V-0 approved
	Epoxy	Black		94 V-1 approved

Thick film printed circuit board is also available.

APPENDIX A

Minimum Ordered Quantity

• Please place an order by multiplying the integral number of the unit taping quantity or the under-mentioned basic unit bulk (bag) quantity.

Please refer to pages by product for quantities of taping.
Please refer to pages by APPENDIX C for quantities of forming.

■Chip Components

Type		Basic Unit/Bag	Q'ty/Box	Taping
RK73B, RK73H	1F～W3A2	1,000	–	○
RK73G	1H～2B	1,000	–	○
RK73Z	1F～W3A	1,000	–	○
RS73	1J～2B	1,000	–	○
HSG73P	1E～2B	1,000	–	○
XR73	1H, 1E	1,000	–	○
RN73H, RN73R	1E～2E	200	–	○
WK73, WU73, WG73	1E～3A3	1,000	–	○
SR73	1H～W3A2	1,000	–	○
UR73,UR73D,UR73V,UR73VD	1E～3A	1,000	–	○
HV73	1J～3A	1,000	–	○
SG73,SG73P,SG73S,SG73G	1E～W3A	1,000	–	○
SLR	1	100	–	○
MWS	5	–	1,500	○
PSL, PSF		100	–	○
TLR, TLRH, TLRZ	1E,1J,2A,2BN,2B,2H,3AW,2BW,2HW,2BP,3AP,3APS	100	–	○
SL, SLN	07,1,2,W07,W1,3,5	100	–	○
TSL	1	100	–	○
CSR	1, 2	100	–	○
BLR	1L, 2L, 3L	100	100	○
LR72	A, B, C	100	100	○
RD41	2ES	2,000	40,000	○
	2E	2,000	10,000	○
RN41	2ES	2,000	40,000	○
	3AS	2,000	10,000	○
CC	12M	2,000	40,000	○
	25	2,000	10,000	○
CPCN	1/2	1,000	10,000	–
	1, 2N, 2NS	1,000	5,000	–
	3	500	2,000	–
RF73	1J～3A	200	–	○
NT73	1J～2B	200	–	○
LT73, LT73V	2A, 2B	200	–	○
LP73	1J	1,000	–	○
	2A, 2B	500	–	○
SDT73H/V/S	2B	100	–	○
CNN	2A	100	–	○
TF	10B,16S,16A,16V	100	–	○
CCF	1N, 1F	100	–	○
NV73	1H・1E	–	–	○
NV73, NV73DL	1J～2L	1,000	–	○
NV73DS	2L	500	–	○
RCU		100	–	○
RCT		100	–	○
RCS		100	–	○
RCW		100	–	○

■Discrete Components

Type		Basic Unit/Bag or Box	Taping
CF (CFP)	S1/4CS, S1/4	2,000	○
	1/4, B1/2, S1/2, 1/4CS	1,000	○
MF	S1/4	2,000	○
	S1/2, 1/4, 1/2	1,000	○
SN	3A	1,000	–
	3D	500	–
SNF	2C	2,000	○
	2E, 2H	1,000	○
RNS	1/8～1	100	○
RK	1/4～1	1,000	○
RCR	16, 25	2,000	○
	50, 50+, 60, 75	2,000	○
	100	1,000	○
HPC	1/2	3,000	○
	1	1,000	○
	2, 3	1,000	–
	4, 5	500	–
PCF	1/2	2,000	○
	1	1,000	○
	2	500	○
RF	16～1	2,000	○
	2	1,000	○
RF25CC		2,000	○
MOS (MOSX)	1/2～2	2,000	○
	3, 1U, 2U	1,000	○
	5	500	–
SPR (SPRX)	1/4	2,000	○
	1/2～2	2,000	○
	3, 1U, 2U	1,000	○
	5	500	–
CW	1/2～3	1,000	○
	5	500	–
BPR※1	26, 28	(1,000)	○
	38	(1,000)	–
	58	(1,000)	○
	108, 55, 77	(400)	–
LR	6～29	1,000	–
BGR, BWR, BSR	2N,3N,5N	(1,500)	–
	7N	(700)	–
	10N	(600)	–
	5E,5P	500	–
BGR,BWR,BSR (Straight type)	1	500	–
	2, 3	(1,000)	–
	5	(700)	–
	7, 10	(500)	–
	15	(320)	–
	20	(300)	–
BGR, BSR (Lug terminal※2)	15, 20	500	–
	10～20HA,10～20QA	400	–
	30	150	–
	40	150	–
	30HA, 30QA	180	–
	40HA, 40QA	144	–
BWRV,BSRV	3N,5N	(1,500)	–
	7N	(700)	–
	10N	(600)	–
BWRV,BSRV (Straight type)	3	(1,000)	–
	5	(700)	–
	7,10	(500)	–
	15	(320)	–
	20	(300)	–
BGRV,BSRV (Lug terminal※2)	15, 20	500	–
	10～20QA	400	–
	30,40	150	–
	30～40QC	20	–
	30～40QE	75	–
BWRV (Lug terminal)	40	135	–
	40QE	75	–
Z	16	2,000	○
	25	1,000	○
J1/6Z, J1/4Z		1,000	○
JLT		–	○
RK92	4L, 5L, 6L, 3C, 4C, 5C	1,000	–
	6C, 7C, 8C, 9C, 11X, 18X		
	18D	500	–
RK92-L		300	–
RK92D		1,000	–

( ) is flat container.
※1 MOQ may vary depending on the country of purchase. Please contact our sales office in charge.
※2 Please contact us for other lug terminals.

Packaging

■Discrete Components

Type		Basic Unit/Bag	Q'ty/Box	Taping
RKL, RKC		3pin	1,000	–
		4～5pin	1,000	○
		6～9pin	1,000	○
		10pin	1,000	–
		11～17pin	1,000	–
RKH		4～8pin	1,000	–
		9pin	1,000	–
		10～13pin	1,000	–
GS※1	1/4	100	1,000 max.	※3
	1/2	50	2,000 max.	※3
	1	50	2,000 max.	–
	2, 3, 5	10	250 max.	–
	7, 10, 12	10	100 max.	–
LP※1	1/16	100	2,000 max.	○
	1/8	100	1,000 max.	○
SDT101	A, B	100	2,500 max.	○
SDT101S	A	100	2,500 max.	–
MRS	1/8～1/3	100	5,000	–
SDT310	HCTP,LTC,P,MTM,HLTC,AP	100	1,000 max.	–
	VASP2B(Bulk)	100	1,000 max.	–
	VASP2K(Tray)	200	1,000 max.	–
PSN･PV･PSO･PN･PWW･PAP		1	–	–
AFS		1	–	–
RW	1/2	20	1,000	–
	1	20	1,000	–
	2～7	20	500	–
	10	20	300	–
CR		100	1,000	–
MRP	3pin	100	3,000	–

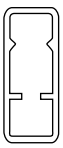
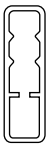
※3 Custom taping for GS1/4・GS1/2 are available on request.

■Stick Packaging

Type		Basic Unit/Stick		Stick/Box
RKC		〈STB〉	〈STP〉	〈STB〉&〈STP〉
	4Pin	54	46	50
	5Pin	42	37	50
	6Pin	34	31	50
	7Pin	30	27	50
	8Pin	26	23	50
	9Pin	23	21	50
	10Pin	21	19	50
	11Pin	19	17	50
	12Pin	18	15	50
	13Pin	16	14	50
	14Pin	15	13	50
RKL		〈STB〉	〈STP〉	〈STB〉&〈STP〉
	4Pin	55	48	50
	5Pin	44	38	50
	6Pin	37	32	50
	7Pin	31	27	50
	8Pin	27	24	50
	9Pin	24	21	50
	10Pin	22	19	50
	11Pin	20	17	50
	12Pin	18	16	50

The minimum packaging unit is 50 times of the stick basic unit.

■Stick (Magazine) Case

Type	Resistor Networks	
	RKL RKC	RKL RKC
Magazine symbol	STP	STB
Sectional view		
W×H×L (mm)	$5.0\times\begin{matrix}11.0\\12.5\end{matrix}\times508$	3.8×13.4×580
Q'ty (pcs)	13～46	15～54
Weight (g)	30	30

APPENDIX B

Recommended Pad Dimensions

■Standard Soldering Pad Dimensions

The optimum dimension of soldering pad at the time of soldering differs according to conditions, however, the following pad dimensions are recommended as standard.

■Flat Type Components

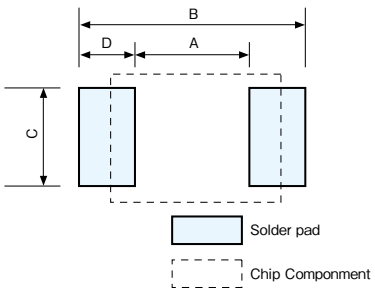
• For Reflow Soldering

Type	Style	Dimensions (mm)				
		Component Size	A	B	C	D
RK73 RS73 HV73 SG73 RN73 HSG73P SR73 LT73 NT73 LP73 SDT73 RF73	1F	0.4×0.2	0.12	0.48	0.18	0.18
	1H	0.6×0.3	0.25	0.7	0.3	0.225
	1E	1.0×0.5	0.5	1.3	0.3	0.4
	1J	1.6×0.8	1.0	2.0	0.6	0.5
	2A	2.0×1.25	1.3	2.5	1.05	0.6
	2B	3.2×1.6	2.2	4.0	1.4	0.9
	2E, 2E1	3.2×2.5	2.2	4.0	2.3	0.9
	W2H/2H	5.0×2.5	3.3/3.5	6.1/6.3	2.3	1.4
	W3A2, W3A, 3A	6.3×3.1	4.6	8.0	3.0	1.7
RK73 AT SG73 AT HV73 AT	1J	1.6×0.8	1.0	2.5	0.85	0.75
	2A	2.0×1.25	1.2	3.0	1.33	0.9
	2B	3.2×1.6	2.05	4.4	1.7	1.175
UR73	2A	2.0×1.25	1.3	2.6	1.1	0.65
	2B	3.2×1.6	2.2	4.2	1.6	1.0
UR73D	1E	1.0×0.5	0.4	1.7	0.5	0.65
	1J	1.6×0.8	0.5	2.5	0.9	1.0
	2A	2.0×1.25	0.8	3.4	1.3	1.3
	2B	3.2×1.6	1.2	4.6	1.8	1.7
	2H(10mΩ~30mΩ)	5.0×2.5	1.8	6.1	2.6	2.15
	2H(33mΩ~100mΩ)		3.3	6.1	2.5	1.4
	3A(10mΩ~30mΩ)	6.3×3.1	2.3	8.0	3.3	2.85
	3A(33mΩ~100mΩ)		4.6	8.0	3.2	1.7
UR73V	2A	2.0×1.25	1.2	3.4	1.3	1.1
	2B	3.2×1.6	2.2	4.2	1.6	1.0
UR73VD	2A(10mΩ~18mΩ)	2.0×3.1	0.6	3.4	1.3	1.4
	2A(20mΩ~36mΩ)		0.8	3.4	1.3	1.3
	2B(10mΩ~13mΩ)	3.2×1.6	0.7	4.4	1.6	1.85
	2B(15mΩ~16mΩ)		0.9	4.4	1.6	1.75
	2B(18mΩ~20mΩ)		1.0	4.4	1.6	1.7
	2B(22mΩ~27mΩ)		1.2	4.4	1.6	1.6
WK73 WU73 WG73	1E	0.5×1.0	0.2	1.1	1.0	0.45
	1J	0.8×1.6	0.4	1.7	1.6	0.65
	2A	1.25×2.0	0.55	2.35	2.0	0.9
	2B15, 2B	1.6×3.2	0.7	2.3	3.2	0.8
	2H2, 2H	2.5×5.0	1.0	3.5	5.0	1.25
	2J	3.1×4.6	1.6	3.9	4.6	1.15
	3A3, 3A	3.1×6.3	1.6	3.9	6.3	1.15
SLR	1	6.3×3.1	3.4	8.0	3.0	2.3
TF	10B	1.0×0.5	0.5	1.3	0.3	0.4
	16S, 16A, 16V	1.6×0.8	1.0	2.0	0.6	0.5
PS	L	6.3×3.15	3.4	7	3.4	1.8
	F	3.0×3.8	Described on the product page			
TLR	2A	2.0×1.25	0.5	2.5	1.3	1.0
	2BW, 2BP(0.5mΩ)	3.2×1.6	0.6	4.0	1.8	1.7
	2BN,2B,2BW,2BP(1mΩ,1.5mΩ)		0.8	4.0	1.8	1.6
	2BN,2B,2BW,2BP(2mΩ~20mΩ)		1.4	4.0	1.8	1.3
	2H, 2HW(0.5mΩ~1.5mΩ)	5.0×2.5	1.0	6.1	3.0	2.55
	2H, 2HW(2mΩ~6mΩ)		1.3	6.1	3.0	2.4
	2H, 2HW(7mΩ~10mΩ)		3.3	6.1	3.0	1.4
	3AW(0.5mΩ~0.82mΩ)	6.35×3.18	0.8	7.55	3.83	3.375
	3AW(1mΩ~4mΩ)		1.45	7.55	3.83	3.05
	3AW(5mΩ~8mΩ)		3.45	7.55	3.83	2.05
	3AW(9mΩ, 10mΩ)		4.4	7.55	3.83	1.575
	3AP(0.5mΩ~0.82mΩ)	6.35×3.18	0.8	7.55	3.83	3.375
	3AP(1mΩ, 1.5mΩ)		1.45	7.55	3.83	3.05
	3AP(2mΩ)		1.05	7.55	3.83	3.25
	3AP(3mΩ~4mΩ)		1.45	7.55	3.83	3.05
	3AP(5mΩ~8mΩ)		3.45	7.55	3.83	2.05
	3AP(9mΩ, 10mΩ)		4.4	7.55	3.83	1.575
	3APS		3.45	7.55	3.83	2.05
TLRH	2A	2.0×1.25	0.5	2.5	1.3	1.0
	3AW	6.3×3.2	4.4	7.5	3.7	1.55
	3AP	6.3×3.2	2.15	7.55	3.83	2.7
TLRZ	1E	1.0×0.5	0.5	1.3	0.6	0.4
	1J	1.6×0.8	0.5	2.0	0.9	0.75
	2A	2.0×1.25	0.5	2.5	1.45	1.0
	2B	3.2×1.6	2.2	3.8	1.8	0.8
SL	07, W07	5.0×2.5	2.3	7.0	2.6	2.35
	1, W1	6.3×3.1	3.4	8.0	3.0	2.3
	2	11.5×7.0	5.4	15.0	5.0	4.8
SLN	2, 3, 5	11.5×7.0	5.0	15.0	6.0	5.0
TSL	1	6.3×3.1	3.4	8.0	3.0	2.3
CCF	1N, 1F	6.0×2.5	3.0	7.2	2.8	2.1
NV73 NV73DL	1H	0.6×0.3	0.25~0.35	0.65~0.95	0.25~0.35	0.2~0.3
	1E	1.0×0.5	0.51	1.73	0.51	0.61
	1J	1.6×0.8	1.0	3.0	1.0	1.0
	2A	2.0×1.25	1.2	4.0	1.2	1.4
	2B	3.2×1.6	2.2	5.0	1.3	1.4
	2E	3.2×2.5	2.2	5.0	2.2	1.4
	2J	4.5×3.2	3.0	5.8	2.9	1.4
	2L	5.7×5.0	4.5	7.5	4.7	1.5
NV73DS	2L	6.1×5.1	4.5	7.5	4.7	1.5

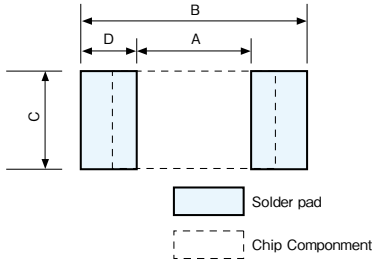
• For Flow Soldering

Type	Style	Dimensions (mm)				
		Component Size	A	B	C	D
RK73 RS73 HV73 SG73 RN73 HSG73P SR73 LT73 NT73 LP73 SDT73 RF73	1E	1.0×0.5	0.5	1.5	0.5	0.5
	1J	1.6×0.8	1.0	2.4	0.8	0.7
	2A	2.0×1.25	1.3	3.1	1.25	0.9
	2B	3.2×1.6	2.2	4.4	1.6	1.1
	2E, 2E1	3.2×2.5	2.2	4.4	2.5	1.1
	W2H/2H	5.0×2.5	3.3/3.5	6.1/6.3	2.5	1.4
	W3A2, W3A, 3A	6.3×3.1	4.6	8.0	3.2	1.7
RK73 AT SG73 AT HV73 AT	1J	1.6×0.8	1.0	2.5	0.85	0.75
	2A	2.0×1.25	1.2	3.0	1.33	0.9
	2B	3.2×1.6	2.05	4.4	1.7	1.175
UR73	2A	2.0×1.25	1.3	2.6	1.1	0.65
	2B	3.2×1.6	2.2	4.2	1.6	1.0
UR73D	1E	1.0×0.5	0.4	1.7	0.5	0.65
	1J	1.6×0.8	0.5	2.5	0.9	1.0
	2A	2.0×1.25	0.8	3.4	1.3	1.3
	2B	3.2×1.6	1.2	4.6	1.8	1.7
	2H(10mΩ~30mΩ)	5.0×2.5	1.8	6.1	2.6	2.15
	2H(33mΩ~100mΩ)		3.3	6.1	2.5	1.4
	3A(10mΩ~30mΩ)	6.3×3.1	2.3	8.0	3.3	2.85
	3A(33mΩ~100mΩ)		4.6	8.0	3.2	1.7
UR73V	2A	2.0×1.25	1.2	3.4	1.3	1.1
	2B	3.2×1.6	2.2	4.2	1.6	1.0
UR73VD	2A(10mΩ~18mΩ)	2.0×1.25	0.6	3.4	1.3	1.4
	2A(20mΩ~36mΩ)		0.8	3.4	1.3	1.3
	2B(10mΩ~13mΩ)	3.2×1.6	0.7	4.4	1.6	1.85
	2B(15mΩ~16mΩ)		0.9	4.4	1.6	1.75
	2B(18mΩ~20mΩ)		1.0	4.4	1.6	1.7
	2B(22mΩ~27mΩ)		1.2	4.4	1.6	1.6
TF	10B	1.0×0.5	0.5	1.5	0.5	0.5
	16S, 16A	1.6×0.8	1.0	2.4	0.8	0.7
NV73 NV73DL	1J	1.6×0.8	1.0	3.0	1.0	1.0
	2A	2.0×1.25	1.2	4.0	1.2	1.4
	2B	3.2×1.6	2.2	5.0	1.3	1.4
	2E	3.2×2.5	2.2	5.0	2.2	1.4
	2J	4.5×3.2	3.0	5.8	2.9	1.4
	2L	5.7×5.0	4.5	7.5	4.7	1.5
NV73DS	2L	6.1×5.1	4.5	7.5	4.7	1.5
CCF	1N, 1F	6.0×2.5	3.0	7.2	2.8	2.1

• For Reflow Soldering



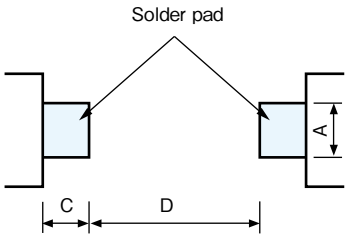
• For Flow Soldering



※These pad dimensions are only for standard pattern and the characteristics are not guaranteed, which you are suggested to confirm before use.

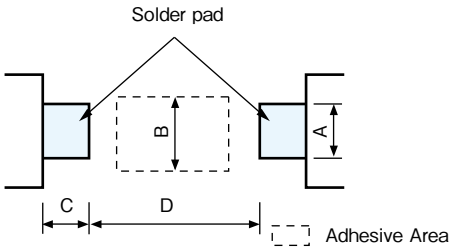
■Melf Type Components

• For Reflow Soldering



Type	Style	Dimensions (mm)			
		Component Size	A	C	D
RD41 RN41 CC	2ES·12M	3.5×1.40	1.5	1.3	1.7
	2E·25	5.9×2.2	2.2	2.2	3.0
	3AS		15.0	15.0	4.0

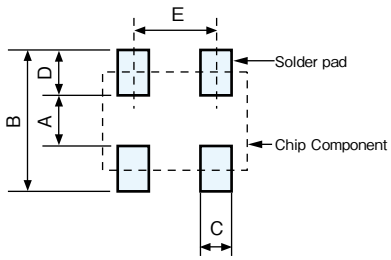
• For Flow Soldering



Type	Style	Dimensions (mm)				
		Component Size	A	B	C	D
RD41 RN41 CC	2ES·12M	3.5×1.40	1.5	2.2	1.5	2.0
	2E·25	5.9×2.2	2.0	3.0	3.0	4.0
	3AS		15.0	3.0	15.0	4.0

■Chip Networks

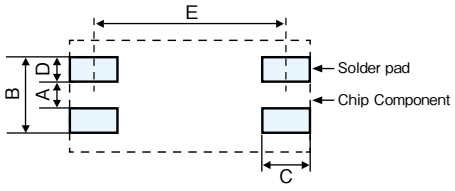
• For Reflow Soldering



Type	Style	Dimensions (mm)					
		Component Size	A	B	C	D	E
CNN	2A2	2.54×2.0	1.2	2.8	0.6	0.8	1.27

■MWS

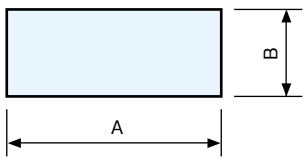
• For Reflow and Flow Soldering



Type	Style	Dimensions (mm)					
		Component Size	A	B	C	D	E
MWS	5	16.9×8.6	2.2	6.2	2.5	2.0	14.1

■Others

• For Reflow Soldering



Type	Dimensions (mm)	
	A	B
RCU	2.5~2.7	0.6~0.8
RCT	2.9~3.1	1.05~1.25
RCS	4.1~4.3	1.4~1.6
RCW		

※These pad dimensions are only for standard pattern and the characteristics are not guaranteed, which you are suggested to confirm before use.

APPENDIX C

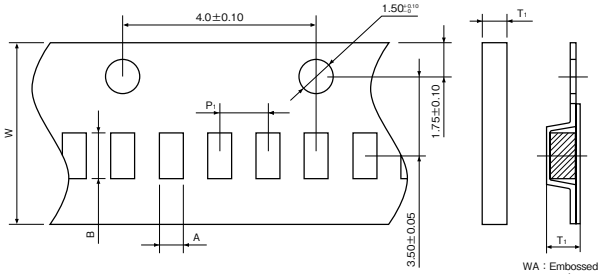
Packagings For Chip Components

Type		Component Size (mm) L	W	T	Carrier Tape	Q'ty/Reel (pcs)	Weight (g) Reel	NET/ 1000pcs	Taping (mm) A	B	W	P1	T1	Reel Size φa (mm)
RK73B RK73H RK73G RK73Z RS73 HSG73P HV73 SG73 SR73 RF73	1F	0.4	0.2	0.13	TX	40,000	114	0.04	0.25±0.04	0.45±0.04	4	1	0.40±0.1	180
					TBL	20,000	153		0.25±0.04	0.45±0.04	8	2	0.31±0.1	180
	1H	0.6	0.3	0.23	TCM	15,000	102	0.14	0.37±0.05	0.67±0.05	8	2	0.42±0.1	180
	1E	1.0	0.5	0.35	TPL	20,000	170	0.68	0.65±0.10	1.15±0.10	8	2	$0.42^{+0.2}_{0}$	180
					TP	10,000	95							
	1J	1.6	0.8	0.45	TP	10,000	116	2.14	1.1±0.1	1.9±0.1	8	2	$0.6^{+0.2}_{0}$	180
					TD	5,000	105		1.1±0.1	1.9±0.1	8	4	$0.6^{+0.2}_{0}$	180
	2A	2.0	1.25	0.5	TP	10,000	148	4.54	1.65±0.20	2.4±0.2	8	2	$0.75^{+0.2}_{0}$	180
					TD	5,000	125		1.65±0.20	2.4±0.2	8	4	$0.75^{+0.2}_{0}$	180
					TE	4,000	88		1.6±0.2	2.4±0.2	8	4	0.9±0.1	180
	2B	3.2	1.6	0.6	TD	5,000	140	9.14	2±0.2	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
					TE	4,000	88		1.9±0.2	3.5±0.2	8	4	1.0±0.1	180
	2E, 2E1	3.2	2.6	0.6	TD	5,000	165	15.5	2.85±0.20	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
					TE	4,000	111		2.85±0.20	3.5±0.2	8	4	1.0±0.15	180
	W2H、2H	5.0	2.5	0.6	TE	4,000	185	24.3	2.9±0.2	5.35±0.20	12	4	1.0±0.15	180
	W3A2、W3A、3A	6.3	3.1	0.6	TE	4,000	244	37.1	3.44±0.20	6.65±0.20	12	4	1.0±0.15	180
XR73B XR73H XR73Z	1H	0.6	0.3	0.13	TWA	40,000	102	0.11	0.37±0.05	0.67±0.05	8	1	0.50±0.1	180
					TWL	20,000	99					2		
	1E	1.0	0.5	0.14	TWL	20,000	98	0.26	0.6±0.05	1.12±0.05	8	2	0.50±0.1	180
RN73H RN73R LT73 LT73V	1E	1.0	0.5	0.35	TP	10,000	95	0.68	0.65±0.10	1.15±0.10	8	2	$0.42^{+0.2}_{0}$	180
	1J	1.6	0.8	0.45	TD	5,000	105	2.14	1.1±0.1	1.9±0.1	8	4	$0.6^{+0.2}_{0}$	180
	2A	2.0	1.25	0.5	TD	5,000	125	4.54	1.65±0.20	2.4±0.2	8	4	$0.75^{+0.2}_{0}$	180
					TE	4,000	83		1.6±0.2	2.4±0.2	8	4	1.0±0.15	180
	2B	3.2	1.6	0.6	TD	5,000	140	9.14	2±0.2	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
					TE	4,000	88		1.9±0.2	3.5±0.2	8	4	1.0±0.15	180
	2E	3.2	2.5	0.6	TD	5,000	165	14.5	2.85±0.20	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
					TE	4,000	111		2.85±0.20	3.5±0.2	8	4	1.0±0.15	180
UR73 UR73V	D1E	1.0	0.5	0.4	TP	10,000	95	0.72	0.65±0.10	1.15±0.10	8	2	$0.5^{+0.2}_{0}$	180
	D1J	1.6	0.8	0.5	TD	5,000	105	2.84	1.1±0.1	1.9±0.1	8	4	$0.68^{+0.2}_{0}$	180
	D2A	2.0	1.25	0.55	TD	5,000	125	5.74	1.65±0.2	2.4±0.2	8	4	$0.75^{+0.2}_{0}$	180
	2A				TD	5,000		5.60						
	D2B	3.2	1.6	0.6	TD	5,000	140	11.12	2±0.2	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
	2B				TD	5,000		10.09						
	D2H	5.0	2.5	0.65	TE	4,000	185	29.80	2.9±0.2	5.35±0.20	12	4	1.0±0.15	180
	D3A	6.3	3.1	0.6	TE	4,000	244	47.69	3.44±0.20	6.65±0.20	12	4	1.0±0.15	180
WK73 WU73 WG73	1E	0.5	1.0	0.35	TP	10,000	95	0.65	0.65±0.10	1.15±0.10	8	2	$0.42^{+0.2}_{0}$	180
	1J	0.8	1.6	0.45	TD	5,000	105	2.13	1.1±0.1	1.9±0.1	8	4	$0.6^{+0.2}_{0}$	180
	2A	1.25	2.0	0.55	TD	5,000	125	4.93	1.65±0.20	2.4±0.2	8	4	$0.75^{+0.2}_{0}$	180
	2B15、2B	1.6	3.2	0.6	TD	5,000	154	12	2.0±0.2	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
	2H2、2H	2.5	5.0	0.6	TE	4,000	209	30.2	2.9±0.2	5.35±0.20	12	4	1.0±0.15	180
	2J	3.1	4.6	0.6	TE	4,000	221	33.3	3.35±0.20	4.85±0.20	12	4	1.0±0.15	180
	3A3、3A	3.1	6.3	0.6	TE	4,000	278	45.6	3.44±0.20	6.65±0.20	12	4	1.0±0.15	180
SLR	1	6.3	3.1	1.9	TE	1,000	150	90	3.6±0.1	6.8±0.1	12	8	2.35±0.1	180
					TED	2,000	370							255
MWS	5	16.9	8.6	4.8	TEG	1,500	1,950	1,000	8.90±0.10	17.3±0.10	24	12	5.1±0.10	380
PS	L(0.2mΩ)	6.3	3.15	1.40	TEB	5,000	1,450	181	3.45±0.1	6.60±0.1	12	8	1.6±0.1	330
	L(0.3mΩ)	6.3	3.15	1.32	TEB	5,000	1,350	161	3.45±0.1	6.60±0.1	12	8	1.6±0.1	330
	L(0.5mΩ)	6.3	3.15	1.12	TEB	5,000	1,180	128	3.45±0.1	6.60±0.1	12	8	1.6±0.1	330
	F(0.5mΩ)	3.0	3.8	1.8	TEB	3,000	650	70	3.25±0.1	4.25±0.1	12	8	2.2±0.1	330
	F(1mΩ)	3.0	3.8	1.8	TEB	3,000	580	45	3.25±0.1	4.25±0.1	12	8	2.2±0.1	330
TLR	2A	2.0	1.25	0.25	TD	5,000	95	5	1.65±0.1	2.4±0.1	8	4	$0.42^{+0.2}_{0}$	178
	2BN、2B、2BW、2BP	3.2	1.6	0.6	TD	5,000	180	13	2.0±0.10	3.5±0.10	8	4	0.75±0.05	180
	2H、2HW	5.0	2.5	0.6	TE	4,000	283	48.7	2.9±0.10	5.35±0.10	12	4	0.77±0.1	180
	3AW、3AP、3APS	6.4	3.2	0.6	TE	2,000	313	100	3.55±0.10	6.75±0.10	12	8	1.0±0.1	180
TLRZ	1E	1.0	0.5	0.4	TB	10,000	99	1.1	0.65±0.1	1.15±0.1	8	2	0.6±0.03	180
	1J	1.6	0.8	0.5	TD	5,000	120	5	1.10±0.1	1.90±0.1	8	4	0.6±0.05	180
	2A	2.0	1.25	0.5	TD	5,000	145	9	1.65±0.2	2.40±0.1	8	4	0.75±0.05	180
	2B	3.2	1.6	0.5	TD	5,000	192	15.3	2.0±0.10	3.5±0.10	8	4	0.75±0.05	180

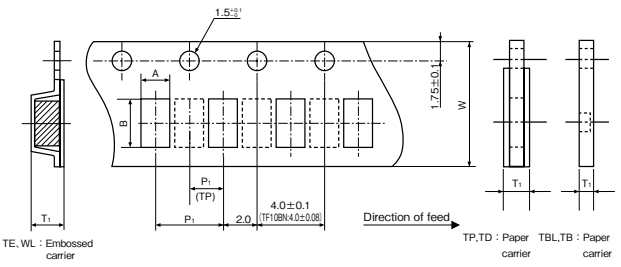
※RK73 series fit for φ255 and φ330 reels, and RN73 series for φ255 reel. For further details, please refer to individual specification sheets.

■Packaging specifications

●Carrier tape: TA、WA (mm)



●Carrier tape : TBL、TCM、TP、TD、TE、TE*、TB、WL (mm)

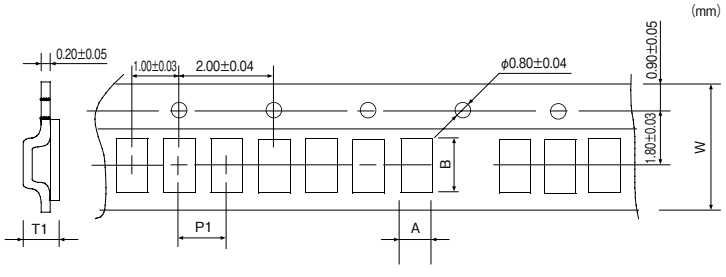


(Notes) Dotted lines are applicable to only "TP" and "TBL".

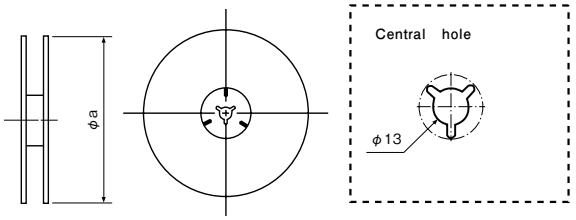
Type		Component Size (mm)			Carrier Tape	Q'ty/Reel (pcs)	Weight (g)		Taping (mm)					Reel Size φa (mm)
		L	W	T			Reel	NET/ 1000pcs	A	B	W	P1	T1	
TLRH	2A	2.0	1.25	0.25	TD	5,000	95	4	1.65±0.1	2.4±0.1	8	4	$0.42^{+0.2}_{0}$	178
	3AW、3AP	6.3	3.2	0.5	TE	2,000	200	52	3.55±0.20	6.75±0.20	12	8	1.0±0.1	178
SL	07、W07	5.0	2.5	1.7	TE	2,000	170	50	3.1±0.1	5.5±0.1	12	4	2.25±0.10	180
	1、W1	6.3	3.1	1.9	TE	1,000	150	90	3.6±0.1	6.8±0.1	12	8	2.35±0.10	180
	2	11.5	7.0	2.5	TE	1,000	710	476	7.7±0.1	12.2±0.10	24	12	3.1±0.1	255
SLN	2、3	11.5	7.0	2.4	TE	1,000	734	500	7.7±0.1	12.2±0.10	24	12	3.1±0.1	255
	5	11.5	7.0	2.5	TED	1,000	834	600	7.7±0.1	12.2±0.10	24	12	3.1±0.1	255
TSL	1	6.3	3.1	1.0	TE	3,000	200	41	3.4±0.1	6.6±0.1	12	4	1.3±0.1	180
CSR	1	10.8	6.2	2.1	TE	1,000	620	320	6.7±0.1	11.1±0.10	24	12	2.60±0.10	255
	2	12.8	8.2	3.1	TE	1,000	900	650	9±0.1	13±0.10	24	12	4.35±0.10	330
BLR	1L	13.0	5.5	2.5	TE	1,000	1200	750	6.2±0.1	15.0±0.1	24	12	6.7±0.1	330
	2L	18.0	6.3	3.0	TE	1,000	2000	1600	7.0±0.1	20.5±0.1	32	12	7.5±0.1	380
	3L	18.0	8.2	3.0	TE	750	1800	2000	10.0±0.1	20.5±0.1	32	12	7.0±0.1	380
LR72	A	14	5.2	2.0	TE	2,000	650	300	1.45±0.20	5.7±0.2	24	8	2.3±0.2	255
	B	14	3	2.0	TE	2,000	650	300	1.45±0.20	3.4±0.2	24	8	2.5±0.2	255
	C	11.2	3.2	3.5	TE	1,500	850	600	1.17±0.10	4.3±0.1	24	8	4.4±0.15	330
NT73	1J	1.6	0.8	0.45	TD	5,000	105	2.14	1.1±0.1	1.9±0.1	8	4	$0.6^{+0.2}_{0}$	180
	2A	2.0	1.25	0.5	TD	5,000	125	4.54	1.65±0.20	2.4±0.2	8	4	$0.75^{+0.2}_{0}$	180
	2B	3.2	1.6	0.6	TD	5,000	140	9.14	2±0.2	3.5±0.2	8	4	$0.75^{+0.2}_{0}$	180
LP73	1J	1.6	0.8	0.5	TE	5,000	73	1.91	1.1±0.1	1.9±0.1	8	4	0.6±0.1	180
	2A	2.0	1.25	0.5	TE	5,000	80	4.09	1.6±0.1	2.4±0.1	8	4	$0.85^{+0.2}_{0.1}$	180
	2B	3.2	1.6	0.5	TE	5,000	95	7.61	2.0±0.1	3.6±0.1	8	4	$0.85^{+0.2}_{0.1}$	180
SDT73H/V/S	2B	3.2	1.6	0.5	TEK/TE	1,000/5,000	38/74	9.0	2.0±0.1	3.6±0.1	8	4	$0.85^{+0.2}_{0.1}$	180
RD41、RN41 CC	2ES、12M	3.5	1.4	—	TE	3,000	106	20	1.7±0.1	3.7±0.1	8	4	2.0 max.	178
	2E、25、3AS	5.9	2.2	—	TE	1,500	180	75	2.4±0.1	6.2±0.1	12	4	2.9 max.	178
RCU		1.6	0.8	1.15	TE/TED	2,000/5,000	53/112	6.4	1.05±0.15	1.85±0.15	8	4	1.25±0.1	178/260
RCT		2.0	1.25	1.45	TE/TED	2,000/5,000	70/153	13.9	$1.65^{+0.1}_{0.2}$	2.45±0.15	8	4	1.70±0.1	178/260
RCS		3.2	1.6	1.25	TE/TED	2,000/5,000	81/179	21.5	2.0±0.2	3.6±0.2	8	4	1.45±0.15	178/260
RCW				2.0	TE	2,000	96	26.8	$1.95^{+0.1}_{-0.05}$	$3.4^{+0.1}_{-0.05}$	8	4	2.2±0.1	178
CNN	2A2	2.54	2.0	0.5	TE	4,000	100	9.7	2.4±0.2	2.9±0.2	8	4	1±0.15	180
KPC	Q16	4.9	5.99	1.6	TE	2,500	580	76	6.5±0.1	5.3±0.1	12	8	2.1±0.1	330
	Q20	8.66	5.99	1.6	TE	2,500	735	125	6.5±0.1	9.0±0.1	16	8	2.1±0.1	330
	Q24	8.66	5.99	1.6	TE	2,500	740	129	6.5±0.1	9.0±0.1	16	8	2.1±0.1	330
	N08	4.83	5.99	1.6	TE	2,500	575	73	6.5±0.1	5.3±0.1	12	8	2.1±0.1	330
	N14	8.66	5.99	1.6	TE	2,500	790	150	6.5±0.1	9.0±0.1	16	8	2.1±0.1	330
	N16	9.91	5.99	1.6	TE	2,500	800	153	6.5±0.1	10.3±0.1	16	8	2.1±0.1	330
	S03	2.92	2.30	0.95	TE	3,000	110	9	3.15±0.1	2.77±0.1	8	4	1.22±0.1	180
HVD		8.66	5.99	1.6	TE	2,500	758	136	6.5±0.1	9.0±0.1	16	8	2.1±0.1	330
NV73 NV73DL	1H	0.6	0.3	0.3	TBM	15,000	126	0.299	0.38±0.02	0.68±0.02	8	2	0.42±0.02	180
	1E	1.0	0.5	0.5	TP	10,000	144	1.295	0.65±0.1	1.15±0.1	8	2	$0.6^{+0.2}_{0}$	180
	1J	1.6	0.8	0.8	TE	2,500	58	7	1.2±0.1	1.9±0.1	8	4	1.75 max.	178
	2A	2.0	1.25	1.3 max.	TE	2,500	81	16	1.6±0.1	2.4±0.1	8	4	1.75 max.	178
	2B	3.2	1.6	1.65 max.	TE	2,500	114	32	2.0±0.1	3.6±0.1	8	4	1.75 max.	178
	2E	3.2	2.5	1.5 max.	TE	2,000	138	56	2.85±0.1	3.50±0.1	8	4	1.55 max.	178
	2J	4.5	3.2	2.0 max.	TE	1,000	190	134	3.60±0.1	4.90±0.1	12	8	2.05 max.	180
	2L	5.7	5.0	2.5 max.	TE	1,000	460	440	5.40±0.1	6.00±0.1	12	8	2.60 max.	180
NV73DS	2L	6.1	5.1	3.7 max.	TE	500	350	550	5.30±0.1	6.6±0.1	12	8	3.70 max.	180
TF	10B	1.0	0.5	0.45	TB	10,000	95	0.68	0.65±0.05	1.15±0.05	8	2	0.6±0.04	180
	16S,16A,16V	1.6	0.8	0.4	TD	5,000	105	2.15	1.1±0.1	1.9±0.1	8	4	$0.6^{+0.2}_{0}$	180
CCF	1N, 1F	6.0	2.5	2.5	TE	1,000	210	140	2.7±0.2	6.4±0.2	12	4	2.9±0.2	180

■Packaging specifications

●Carrier tape: TX



●Reel (mm)



(Notes) Reel holes, shapes and design are examples.

APPENDIX C

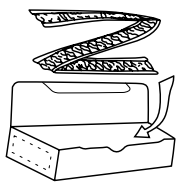
Axial Taping

Straight Type Name	Taping Type Name	Lead φd (mm)	Packaging Style	Packaging & Q'ty (pcs)		Weight (g)		
				AMMO	Reel	AMMO	Reel	Net 1000pcs
MOS1/2※1	MOS1/2CT26	0.6	T26	2000	—	350	—	140
MOS1/2	MOS1/2CT52	0.6	T52	2000	5000	590	1400	250
MOS1	MOS1CT52	0.6	T52	2000	4000	810	1550	350
MOS1	MOS1CT526	0.6	T52	2000	4000	810	1550	350
MOS1C8	MOS1CT528	0.8	T52	2000	4000	810	1550	350
MOS1	MOS1CL52	0.8	L52	2000	4000	810	1550	350
MOS2	MOS2CT52	0.8	T52	1000	2000	910	1750	800
MOS2	MOS2CT521	0.8	T521	1000	1000	910	950	800
MOS2	MOS2CL521	0.8	L521	1000	1000	910	950	800
MOS3	MOS3CT521	0.8	T521	500	1000	775	1500	1350
MOS3	MOS3CL521	0.8	L521	500	—	775	—	1350
MOS3	MOS3CT631	0.8	T631	1000	1000	1580	1600	1400
MOS3	MOS3CL631	0.8	L631	500	1000	775	1600	1400
SPR1/4※2	SPR1/4CT26	0.45	T26	2000	—	250	—	90
SPR1/4	SPR1/4CT52	0.45	T52	2000	5000	340	850	140
SPR1/2	SPR1/2CT26	0.6	T26	2000	—	350	—	140
SPR1/2	SPR1/2CT52	0.6	T52	2000	5000	590	1400	250
SPR1/2	SPR1/2CL52	0.65	L52	2000	5000	590	1400	250
SPR1	SPR1CT52	0.8	T52	2000	4000	1140	2150	500
SPR1	SPR1CL52	0.8	L52	2000	4000	1140	2150	500
SPR2	SPR2CT52	0.8	T52	1000	2000	910	1750	800
SPR2	SPR2CT521	0.8	T521	1000	1000	910	950	800
SPR2	SPR2CL521	0.8	L521	1000	1000	910	950	800
SPR3	SPR3CT521	0.8	T521	500	1000	775	1500	1350
SPR3	SPR3CL521	0.8	L521	500	—	775	—	1350
SPR3	SPR3CT631	0.8	T631	1000	1000	1580	1600	1400
SPR3	SPR3CL631	0.8	L631	500	1000	775	1600	1400
RF16	RF16CT26	0.45	T26	2000	—	220	—	90
RF16	RF16CT52	0.45	T52	2000	5000	340	800	150
RF25	RF25CT26	0.6	T26	2000	—	330	—	140
RF25	RF25CT52	0.6	T52	2000	5000	500	1300	230
RF50	RF50CT52	0.6	T52	2000	4000	660	1320	310
RF1	RF1CT52	0.8	T52	2000	4000	1080	2050	500
RF2	RF2CT521	0.8	T521	500	1000	700	1420	1300
RF2	RF2CT631	0.8	T631	1000	—	1410	—	1350
Z16	Z16CT26	0.45	T26	5000	—	615	—	110
Z16	Z16CT52	0.45	T52	3000	5000	530	920	150
Z25	Z25CT26	0.6	T26	2000	—	410	—	180
Z25	Z25CT52	0.6	T52	2000	5000	530	1400	240
J1/6Z	J1/6ZCT26	0.5	T26	2000	—	230	—	90
J1/6Z	J1/6ZCT52	0.5	T52	2000	5000	320	950	130
J1/4Z	J1/4ZCT26	0.6	T26	2000	—	320	—	130
J1/4Z	J1/4ZCT52	0.6	T52	2000	5000	460	1310	190
JL5	JL5CT26	0.5	T26	5000	—	420	—	75
JL5	JL5CT52	0.5	T52	5000	—	680	—	120
JL6	JL6CT26	0.6	T26	5000	—	515	—	100
JL6	JL6CT52	0.6	T52	5000	—	815	—	160
LP1/8	LP1/8CT26	0.65	T26	2000	—	410	—	170
LP1/8	LP1/8CT52	0.65	T52	2000	—	580	—	260
LP1/16	LP1/16CT26	0.5	T26	4000	—	450	—	100
LP1/16	LP1/16CT52	0.5	T52	4000	—	630	—	150
SDT101A	SDT101AXCT26	0.4	T26	2000	—	350	—	75
SDT101A	SDT101AXCT52	0.4	T52	2000	—	470	—	150
SDT101B	SDT101BXNT52	0.4	T52	—	2000	—	410	150

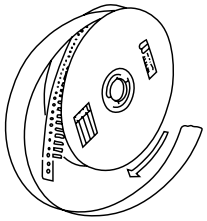
※1 : The same taping applicable also to MOSX.
※2 : The same taping applicable also to SPRX.

■Packaging

(1) AMMO Pack (Symbol : A) Standard



(2) Reel (Symbol : R)

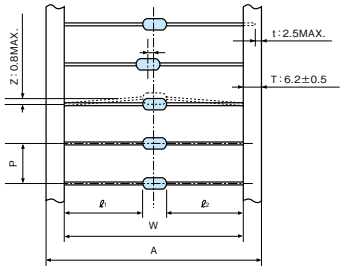


Axial Taping

Straight Type Name	Taping Type Name	Lead φd (mm)	Packaging Style	Packaging & Q'ty (pcs)		Weight (g)		
				AMMO	Reel	AMMO	Reel	Net 1000pcs
CFS1/4	CFS1/4 CT26	0.45	T26	5000	—	615	—	110
CFS1/4	CFS1/4 CT52	0.45	T52	3000	5000	530	920	150
CF1/4	CF1/4 CT26	0.6	T26	2000	—	410	—	180
CF1/4	CF1/4 CT52	0.6	T52	2000	5000	530	1400	240
CFB1/2	CFB1/2 CT52	0.7	T52	2000	4000	1110	2280	520
CFS1/2	CFS1/2 CT26	0.6	T26	2000	—	525	—	230
CFS1/2	CFS1/2 CT52	0.6	T52	2000	4000	640	1500	290
CFPS1/4	CFPS1/4 CT26	0.45	T26	5000	—	615	—	100
CFPS1/4	CFPS1/4 CT52	0.45	T52	3000	—	530	—	150
CFP1/4	CFP1/4 CT26	0.6	T26	2000	—	410	—	180
CFP1/4	CFP1/4 CT52	0.6	T52	2000	5000	530	1400	240
CFP1/4	CFP1/4 CL52	0.65	L52	2000	—	530	—	240
CFPB1/2	CFPB1/2 CT52	0.7	T52	2000	4000	1110	2280	520
CFPB1/2	CFPB1/2 CL52	0.65	L52	2000	—	1110	—	520
CFPS1/2	CFPS1/2 CT26	0.6	T26	2000	—	525	—	230
CFPS1/2	CFPS1/2 CT52	0.6	T52	2000	4000	640	1500	290
MFS1/4	MFS1/4 □CT26	0.45	T26	3000	—	350	—	90
MFS1/4	MFS1/4 □CT52	0.45	T52	3000	—	500	—	120
MFS1/2	MFS1/2 □CT26	0.6	T26	2000	—	360	—	160
MFS1/2	MFS1/2 □CT52	0.6	T52	2000	5000	500	1300	215
MF1/4	MF1/4 □CT26	0.6	T26	2000	—	360	—	160
MF1/4	MF1/4 □CT52	0.6	T52	2000	5000	500	1300	215
MF1/2	MF1/2 □CT52	0.6	T52	2000	4000	900	2000	360
SNF 2C	SNF 2CCT26	0.45	T26	3000	—	500	—	110
SNF 2C	SNF 2CCT52	0.45	T52	3000	—	430	—	150
SNF 2E	SNF 2ECT26	0.6	T26	2000	—	450	—	180
SNF 2E	SNF 2ECT52	0.6	T52	2000	5000	470	1400	240
SNF 2H	SNF 2HCT52	0.7	T52	2000	4000	950	2010	520
RNS1/4	RNS1/4 □CT52	0.6	T52	2000	4000	600	1550	440
RNS1/8	RNS1/8 □CT26	0.6	T26	2000	—	400	—	180
RNS1/8	RNS1/8 □CT52	0.6	T52	2000	5000	600	1550	260
RNS1/2	RNS1/2 □CT52	0.6	T52	2000	4000	1100	2150	530
RNS1	RNS1 □CT521	0.8	T521	500	1000	750	2100	1400
RCR16	RCR16 CT26	0.45	T26	5000	—	500	—	100
RCR16	RCR16 CT52	0.45	T52	3000	—	450	—	150
RCR25	RCR25 CT26	0.6	T26	2000	—	390	—	180
RCR25	RCR25 CT52	0.6	T52	2000	—	520	—	240
RCR25EN	RCR25EN CT26	0.6	T26	2000	—	390	—	180
RCR25EN	RCR25EN CT52	0.6	T52	2000	—	520	—	240
RCR50 (+)	RCR50(+)CT52	0.7	T52	2000	3000	1050	1630	520
RCR50EN	RCR50ENCT52	0.7	T52	2000	3000	1050	1630	520
RCR60	RCR60 CT52	0.7	T52	2000	3000	1050	1630	520
RCR75	RCR75 CT52	0.8	T52	1000	—	830	—	800
RCR100	RCR100 CT521	0.8	T521	500	—	750	—	1400
RCR100	RCR100 CT631	0.8	T631	1000	—	1450	—	1400
RK1/4	RK1/4 □CT26	0.6	T26	2000	—	360	—	250
RK1/4	RK1/4 □CT52	0.6	T52	2000	5000	500	1300	250
RK1/2	RK1/2 □CT52	0.6	T52	2000	4000	900	—	380
RK1	RK1 □CT521	0.8	T521	500	—	700	—	1340
PCF1/2	PCF1/2 CT52	0.7	T52	—	2000	—	1140	450
PCF1	PCF1 CT631	0.8	T631	—	1000	—	1530	1270
PCF2	PCF2 CT631	0.8	T631	—	500	—	1340	2160
HPC1/2	HPC1/2 CT52	0.8	T52	1000	2000	800	1440	600
HPC1	HPC1 CT631	0.8	T631	—	1000	—	1440	1170
CW1/4	CW1/4 CT26	0.45	T26	2000	—	460	—	150
CW1/4	CW1/4 CT52	0.45	T52	3000	—	690	—	150
CW1/2	CW1/2 CT52	0.6	T52	2000	—	570	—	250
CW1※3	CW1 CT52	0.8	T52	1000	—	580	—	650
CW2※3	CW2 CT52	0.8	T52	1000	—	780	—	950
CW2※3	CW2 CT521	0.8	T521	1000	—	790	—	950
CW3※3	CW3 CT521	0.8	T521	500	—	740	—	1780
CW3※3	CW3 CT631	0.8	T631	500	—	750	—	1780
CW1S	CW1S CT52	0.6	T52	2000	—	570	—	250
CWFS23	CWFS23 CT52	0.8	T52	1000	—	780	—	950
CWFS23	CWFS23 CT521	0.8	T521	1000	—	790	—	950
CWFS35	CWFS35 CT521	0.8	T521	500	—	740	—	1780

□ : T.C.R.　　※3 The same taping applicable also to CW-P, CW-X and CW-H.

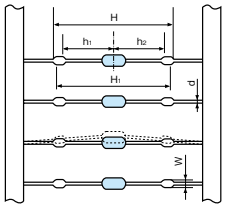
■T-Type



Packaging Style	Dimensions (mm)				
	W	P	A	$\lvert \ell_1 - \ell_2 \rvert$	Accumulated Tolerance
T26※5	$26^{+0.2}_{-0}$	5.00±0.3	39±1.0	0.2Max.※4	250.0±3mm/P×50
	26^{+1}_{-0}	5.00±0.3	39±1.0	1.0Max.	100.0±2mm/P×20
T52※5	52±1	5.08±0.38	64.5±1.0	1.0Max.	101.6±2mm/P×20
T521	52±1	10.16±0.80	64.5±1.0	1.0Max.	203.2±3mm/P×20
T631	63±1	10.16±0.80	—	1.0Max.	203.2±3mm/P×20

※4 Applied to CFS1/4 (CFPS1/4) T26 Only
※5 Contact us for LP and SDT series.

■L-Type



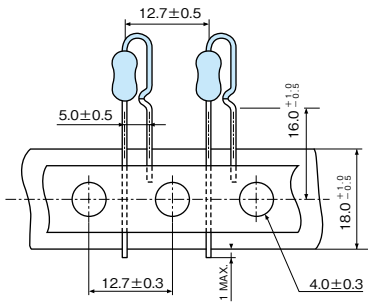
Type			Dimensions (mm)			
			H±1	W	d	h_1, h_2
MOS※1	1 □	L52	25.5	1.20～1.45	0.8	$\lvert h_1 - h_2 \rvert \leqq 1$
	2 □	L521	36.0		0.8	
	3 □	L631	42.5		0.8	
SPR※2	1/2□	L52	26.0	1.17～1.40	0.65	
	1 □	L52	25.5	1.20～1.45	0.8	
	2 □	L521	36.0		0.8	
	3 □	L631	42.5		0.8	
CFP	1/4□	L52	H1 : 24.5±1	1.17～1.4	0.65	
CFPB	1/2□	L52	H1 : 27.5±1		0.65	
CW	1/2□	L52	26.0	1.05～1.35	0.6	
CW	1 □	L52	27.5	1.20～1.40	0.8	

APPENDIX C

Radial Taping

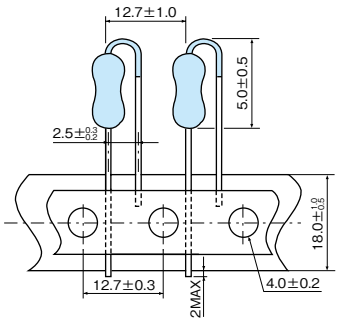
(mm)

VT



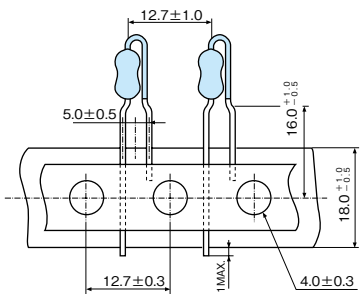
Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
MFS1/2 □CVT	0.6	2000	2500	750
MF1/4 □CVT	0.6	2000	2500	750
RNS1/8 □CVT	0.6	2000	2500	750
J1/4Z CVT※	0.6	2000	2500	670
CF1/4 CVT	0.6	2000	2500	720
CFS1/2 CVT	0.6	2000	2500	800
CFP1/4 CVT※	0.6	2000	2500	720
CFPS1/2 CVT※	0.6	2000	2500	800
RF25 CVT※	0.6	2000	2500	750

VT



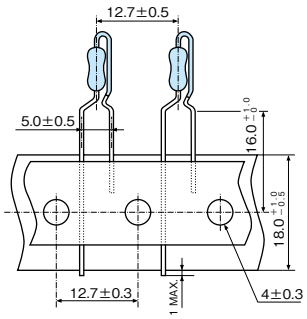
Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
MFS1/4 □CVT	0.45	3000	3000	620
CFS1/4 CVT	0.45	3000	3000	720
SPR1/4 CVT※	0.45	3000	3000	720

VTE



Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
MFS1/2 □CVTE	0.6	2000	2500	750
MF1/4 □CVTE	0.6	2000	2500	750
RNS1/8 □CVTE	0.6	2000	2500	750
MOS1/2 CVTE	0.6	2500	2500	930
SPR1/2 CVTE	0.6	2500	2500	930
CF1/4 CVTE	0.6	2500	2500	900
CFS1/2 CVTE	0.6	2500	2500	1000
RF25 CVTE	0.6	2000	2500	750

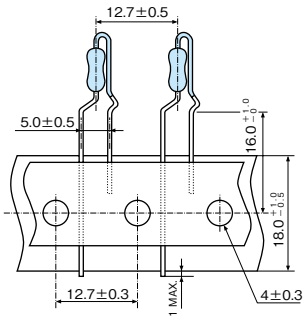
VTP



Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
MOS1/2 CVTP	0.6	2000	2500	740
MOS1 CVTP	0.6	1500	—	1110
MOS2 CVTP	0.65	1000	—	1080
SPR1/2 CVTP	0.6	2000	2500	740
SPR1 CVTP	0.6	1000	—	740
SPR2 CVTP	0.65	1000	—	1080
MFS1/2 □CVTP	0.6	2000	2500	750
MF1/4 □CVTP	0.6	2000	2500	750
RNS1/8 □CVTP	0.6	2000	2500	750
CF1/4 CVTP	0.6	2000	2500	740
CFS1/2 CVTP	0.6	2000	2500	800
CFP1/4 CVTP	0.6	2000	2500	740
CFPS1/2 CVTP	0.6	2000	2500	800
RF25 CVTP	0.6	2000	2500	750
RCR75 CYVTP※3	0.65	1000	—	1080

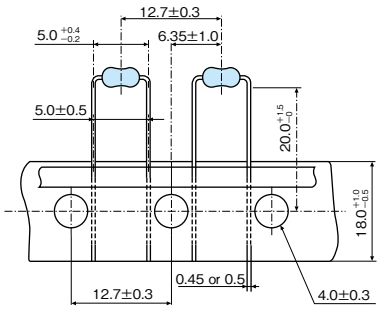
Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
CW1/2 CVTP※	0.6	2000	—	750
CW1 CVTP※	0.8	1000	—	740
CW2 CVTP※	0.8	1000	—	1080
J1/4Z CVTP※	0.6	2000	2500	670

VTF



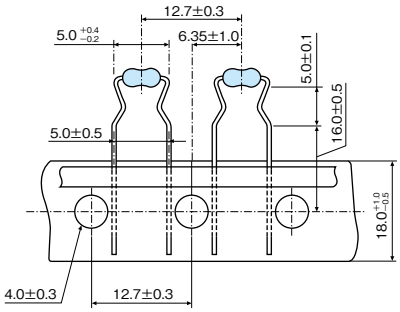
Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
SPR2CVTF	0.8	1000	—	1080
MOS2CVTF	0.8	1000	—	1060

MT



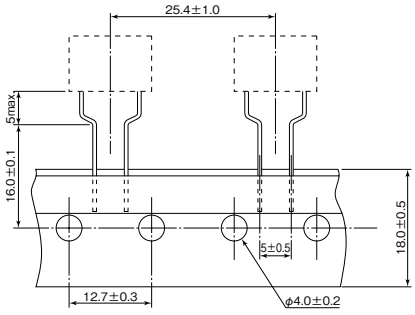
Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
MFS1/4 □CMT	0.45	3000	—	620
CFS1/4 CMT	0.45	3000	3000	630
CFPS1/4 CMT	0.45	3000	3000	630
J1/6Z CMT	0.5	2000	—	450

MHT



Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
CFS1/4 CMHT	0.45	3000	—	630
CFPS1/4 CMHT	0.6	3000	—	720
RF16 CMHT	0.45	3000	—	240

FT



Radial Type Name	Radial Lead φd	AMMO (pcs)	Reel (pcs)	Weight g/AMMO
BPR26 CFT	0.6	500	—	790
BPR58 CFT	0.8	500	—	1940

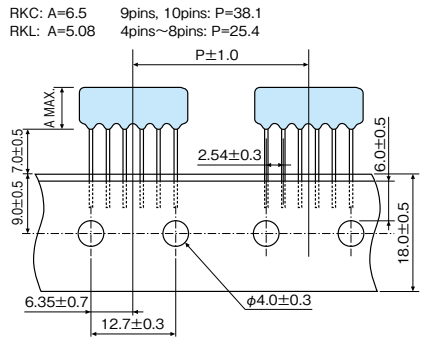
□ : T.C.R.

※The insulated coating on the lead wire is not available.
Also for MOSX・SPRX types, radial taping in the same shape as MOS・SPR types is applicable.

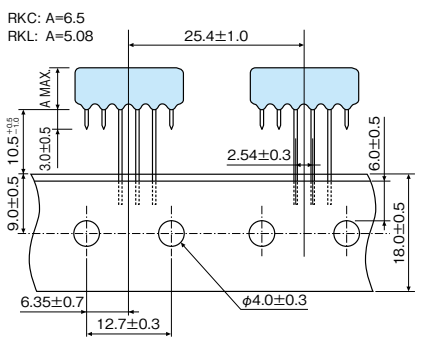
※3 Surge resistance is not guaranteed. Rating specifications are different. Please contact us for details.

(mm)

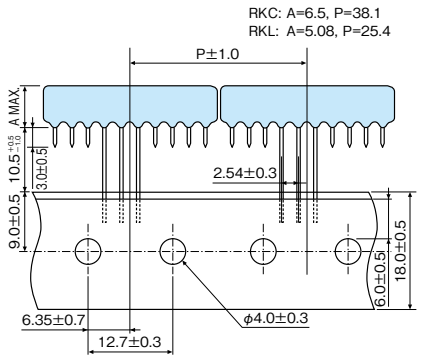
TBA (4pin-10pin)



TPA (4pin-9pin)



TUA (10pin)

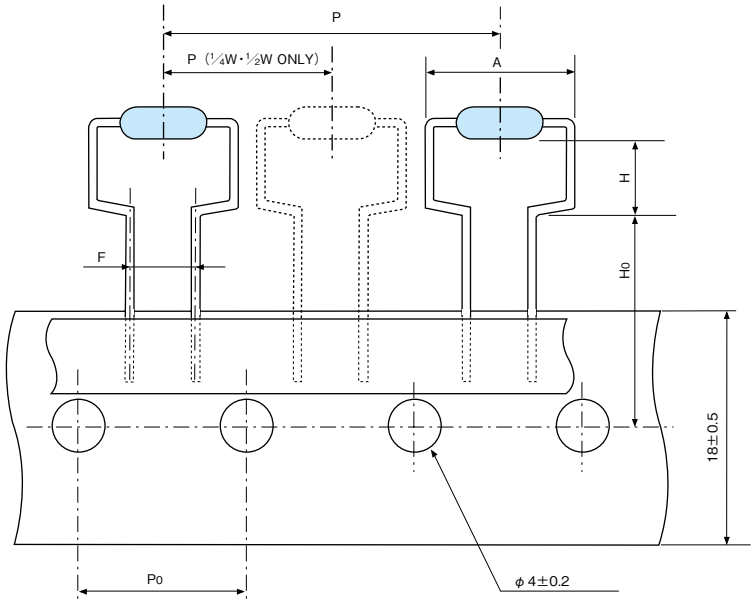


Radial Type Name	AMMO (pcs)	Weight g/AMMO
RKC TBA	1000	850(9Pin)
RKL TBA	1000	850(9Pin)

Radial Type Name	AMMO (pcs)	Weight g/AMMO
RKC TPA	1000	800(9Pin)
RKL TPA	1000	800(9Pin)

Radial Type Name	AMMO (pcs)	Weight g/AMMO
RKC TUA	1000	850(9Pin)
RKL TUA	1000	850(9Pin)

GT



Radial Type Name	Radial Lead ϕd	AMMO (pcs)	Weight g/AMMO	F	P	P0	H	H0	AMax.
MOS1/2CGT	0.6	2000	740	5±0.5	12.7±1.0	12.7±0.3	$6.5^{+0.6}_{-0}$	16±0.5	12
MOS1CGT	0.8	1000	730	$7.5^{+0.8}_{-0.2}$	30±1.0	15±0.3	$6.5^{+1.0}_{-0}$	19±0.7	14.5
MOS1CGT4	0.8	1000	700				$4.0^{+1.0}_{-0}$		
MOS2CGT	0.8	500	580				$7.5^{+1.0}_{-0}$		17.5
MOS2CGT4	0.8	500	560				$4.0^{+1.0}_{-0}$		
MOS3CGT	0.8	500	910				$8.5^{+1.0}_{-0}$		21
MOS3CGTS	0.8	500	910	7.5±0.5			5.5※1	19±1.0	
SPR1/2CGT	0.6	2000	740	5±0.5	12.7±1.0	12.7±0.3	$6.5^{+0.6}_{-0}$	16±0.5	12
SPR1CGT	0.8	1000	770	$7.5^{+0.8}_{-0.2}$	30±1.0	15±0.3	$6.5^{+1.0}_{-0}$	19±0.7	14.5
SPR2CGT	0.8	500	540				$7.5^{+1.0}_{-0}$		17.5
SPR3CGT	0.8	500	910				$8.5^{+1.0}_{-0}$		
CFP1/4CGT	0.65	2000	720	5±0.5	12.7±1.0	12.7±0.3	$6.5^{+0.6}_{-0}$	16±0.5	12
CFPS1/2CGT	0.8	1500	600						
CW1HCGT	0.8	1000	920	$7.5^{+0.8}_{-0.2}$	30±1.0	15±0.3	$6.5^{+1.0}_{-0}$	19±0.7	14.5
RF50CGT	0.8	1000	730						
RF1CGT	0.8	1000	770						
RF2CGT	0.8	500	1820				$8.5^{+1.0}_{-0}$		21
CW2CGT	0.8	500	1080				$7.5^{+1.0}_{-0}$		17.5
CW3CGT	0.8	500	1820				$8.5^{+1.0}_{-0}$		21

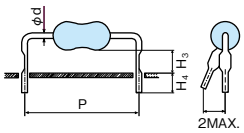
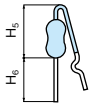
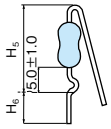
□ : T.C.R.

Also for MOSX・SPRX types, radial taping in the same shape as MOS・SPR types is applicable.

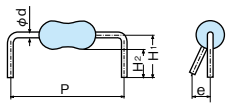
※1 Reference

APPENDIX C

Forming（Not Available Taping）

Forming Style	Forming Type Name	Forming Dimension (mm) P±1	H3±1orH5	H4±1orH6	d	Weight g/100pcs	Basic Unit (pcs)	Straight Type Name
L Forming 	CW1/2CL10A (CW1SCL10A)	10.0	5.3	4.5	0.6	24	2000	CW1/2 (CW1S)
	CW1CL12.5A (CW1PCL12.5A) (CW1HCL12.5A)	12.5	6.5	4.0	0.8	56	1000	CW1 (CW1P) (CW1H)
	CW1CL15A (CW1PCL15A) (CW1HCL15A)	15.0	5.3	4.5	0.8	56	1000	CW1 (CW1P) (CW1H)
	CW2CL15A (CW2PCL15A) (CW2HCL15A)	15.0	7.0	4.5	0.8	84	1000	CW2 (CW2P) (CW2H)
	CW2CL20A (CW2PCL20A) (CW2HCL20A)	20.0	8.0	4.5	0.8	84	1000	CW2 (CW2P) (CW2H)
	CW3CL20A (CW3PCL20A) (CW3HCL20A)	20.0	8.0	4.0	0.8	160	1000	CW3 (CW3P) (CW3H)
	CW3CL25A (CW3PCL25A) (CW3HCL25A)	25.0	7.0	4.5	0.8	160	1000	CW3 (CW3P) (CW3H)
	CW5CL30A	30.0	8.5	4.5	0.8	524	500	CW5
	CW5CL35A	35.0	5.5	4.5	0.8	524	500	CW5
	MOS1/2CL10A (MOSX1/2CL10A)	10.0	5.3±1.0	4.0±1.0	0.6	23	2000	MOS(X)1/2
	MOS1CL12.5A (MOSX1CL12.5A)	12.5	7.0±1.0	4.0±1.0	0.8	31	2000	MOS(X)1
	MOS1CL15A (MOSX1CL15A)	15.0	6.5±1.0	4.0±1.0	0.8	31	2000	MOS(X)1
	MOS2CL15A (MOSX2CL15A)	15.0	7.0±1.0	4.0±1.0	0.8	71	2000	MOS(X)2
	MOS2CL15F (MOSX2CL15F)	15.0	4.5±1.0	4.0±1.0	0.8	71	2000	MOS(X)2
	MOS2CL20A (MOSX2CL20A)	20.0	9.0±1.0	4.0±1.0	0.8	71	2000	MOS(X)2
	MOS2CL20D (MOSX2CL20D)	20.0	4.8±1.0	4.0±1.0	0.8	71	2000	MOS(X)2
	MOS3CL20A (MOSX3CL20A)	20.0	8.0±1.0	4.0±1.0	0.8	130	1000	MOS(X)3
	MOS3CL20C (MOSX3CL20C)	20.0	10.0±1.0	4.0±1.0	0.8	130	1000	MOS(X)3
	MOS3CL20T (MOSX3CL20T)	20.0	4.0±1.0	4.0±1.0	0.8	130	1000	MOS(X)3
	MOS3CL25A (MOSX3CL25A)	25.0	7.0±1.0	4.0±1.0	0.8	130	1000	MOS(X)3
	MOS3CL30A (MOSX3CL30A)	30.0	7.0±1.0	4.0±1.0	0.8	130	1000	MOS(X)3
	MOS5CL30A (MOSX5CL30A)	30.0	8.5±1.0	4.0±1.0	0.8	524	500	MOS(X)5
	MOS5CL35A (MOSX5CL35A)	35.0	5.5±1.0	4.0±1.0	0.8	524	500	MOS(X)5
	SPR1/2CL10A (SPRX1/2CL10A)	10.0	5.3	4.0	0.6	23	2000	SPR1/2 (SPRX1/2)
	SPR1CL12.5A (SPRX1CL12.5A)	12.5	6.5	4.0	0.8	54	2000	SPR1 (SPRX1)
	SPR1CL15A (SPRX1CL15A)	15.0	5.3	4.0	0.8	54	2000	SPR1 (SPRX1)
	SPR2CL15A (SPRX2CL15A)	15.0	7.0	4.0	0.8	71	2000	SPR2 (SPRX2)
	SPR2CL20A (SPRX2CL20A)	20.0	9.0	4.0	0.8	71	2000	SPR2 (SPRX2)
	SPR3CL20A (SPRX3CL20A)	20.0	8.0	4.0	0.8	141	1000	SPR3 (SPRX3)
	SPR3CL25A (SPRX3CL25A)	25.0	7.0	4.0	0.8	141	1000	SPR3 (SPRX3)
	SPR5CL30A (SPRX5CL30A)	30.0	8.5	4.0	0.8	456	500	SPR5 (SPRX5)
	SPR5CL35A (SPRX5CL35A)	35.0	5.5	4.0	0.8	456	500	SPR5 (SPRX5)
	RCR50（+）CL15A	15.0	5.3	4.5	0.7	34	2000	RCR50(+)
	RCR50ENCL15A	15.0	5.3	4.5	0.7	34	2000	RCR50EN
	RCR60CL15A	15.0	5.3	4.5	0.7	34	2000	RCR60
	RCR75CL15A	15.0	7.0	4.5	0.8	69	2000	RCR75
	RCR100CL20A	20.0	8.0	4.0	0.8	142	1000	RCR100
	RCR100CL25A	25.0	7.0	4.0	0.8	142	1000	RCR100
	RK1/4 □CL10A	10.0	5.3	4.5	0.6	23	1000	RK1/4
	RK1 □CL20A	20.0	8.8	4.5	0.8	146	1000	RK1
	CFP1/4CL10A	10.0	6.5	4.5	0.65	23	1000	CFP1/4
	CFPB1/2CL12.5A	12.5	6.5	4.5	0.65	44	1000	CFPB1/2
	RF25CL10A	10.0	5.35	5.0	0.6	23	2000	RF25
	RF50CL12.5A	12.5	6.0	5.2	0.6	29	2000	RF50
	RF50CL15A	15.0	6.0	5.3	0.6	29	2000	RF50
	RF1CL12.5A	12.5	6.5	4.8	0.8	46	2000	RF1
	RF1CL15A	15.0	5.3	4.5	0.8	46	2000	RF1
	RF1CL20A	20.0	5.3	4.5	0.8	46	2000	RF1
	RF2CL20A	20.0	8.0	5.0	0.8	141	1000	RF2
	RF2CL25A	25.0	7.0	4.5	0.8	141	1000	RF2
U Forming 	MFS1/4 □CU	—	5.5Max.	15.0±1.0	0.45	14	2000	MFS1/4
	CFS1/4CU	—	5.5Max.	15.0±1.0	0.45	12	2000	CFS1/4
U Forming 	MF1/4 □CU	—	9.5Max.	28.0±3.0	0.6	23	1000	MF1/4
	RK1/4□CU	—	9.5Max.	30.0±3.0	0.6	23	1000	RK1/4
	CF1/4CUCL	—	10.0Max.	10.0±3.0	0.6	23	1000	CF1/4
	CFS1/2CU	—	9.5Max.	30.0±3.0	0.6	44	1000	CFS1/2
U Forming 	MOS1CU (MOSX1CU)	—	21.0Max.	15.0Min.	0.8	55	1000	MOS1 (MOSX1)
	MOS2CU (MOSX2CU)	—	23.5Max.	15.0Min.	0.8	85	1000	MOS2 (MOSX2)
	MOS3CU (MOSX3CU)	—	26.0Max.	15.0Min.	0.8	150	1000	MOS3 (MOSX3)
	SPR1CU (SPRX1CU)	—	21.0Max.	15.0Min.	0.8	54	1000	SPR1 (SPRX1)
	SPR2CU (SPRX2CU)	—	23.5Max.	15.0Min.	0.8	93	1000	SPR2 (SPRX2)
	SPR3CU (SPRX3CU)	—	26.0Max.	15.0Min.	0.8	141	1000	SPR3 (SPRX3)
UCL Forming 	MOS1CUCL (MOSX1CUCL)	—	13.0±1.0	3.5±1.0	0.8	30	1000	MOS(X)1
	MOS2CUCL (MOSX2CUCL)	—	14.5±1.0	3.5±1.0	0.8	60	1000	MOS(X)2
	MOS3CUCL (MOSX3CUCL)	—	20.0Max.	4.0±1.0	0.8	130	1000	MOS(X)3

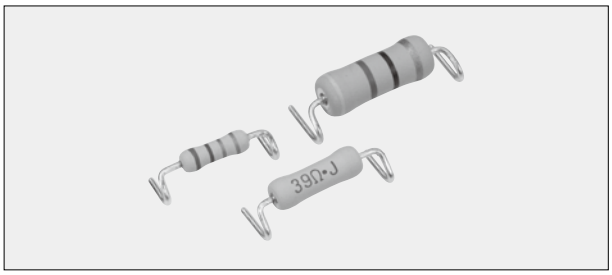
□ : T.C.R.

Forming Style	Forming Type Name	Forming Dimension (mm)					Weight g/100pcs	Basic Unit (pcs)	Straight Type Name
		P±1	H1	H2	e Max.	d			
M Forming 	MFS1/4□CM5F	5.0	–	5.0±1.0	2.0	0.45	14	2000	MFS1/4
	MFS1/4□CM5R	5.0	10.0±1.0	–	2.0	0.45	14	2000	MFS1/4
	MFS1/4□CM5W	5.0	–	15.0±1.0	2.0	0.45	14	1000	MFS1/4
	MFS1/2□CM10R	10.0	10.0±1.0	–	2.0	0.6	23	2000	MFS1/2
	MF1/4□CM10F	10.0	–	5.0±1.0	2.0	0.6	23	2000	MF1/4
	MF1/4□CM12.5R	12.5	10.0±1.0	–	2.0	0.6	23	2000	MF1/4
	MF1/2□CM12.5R	12.5	10.0±1.0	–	2.0	0.6	41	1000	MF1/2
	MF1/2□CM15R	15.0	10.0±1.0	–	2.0	0.6	41	1000	MF1/2
	SNF 2CCM5F	5.0	–	5.0±1.0	1.5	0.45	14	2000	SNF 2C
	SNF 2ECM10F	10.0	–	5.0±1.0	1.7	0.6	24	2000	SNF 2E
	SNF 2ECM12.5R	12.5	10.0±1.0	–	1.7	0.6	24	2000	SNF 2E
	SNF 2HCM12.5K	12.5	7.0±1.0	–	2.0	0.7	41	2000	SNF 2H
	SNF 2HCM15K	15.0	7.0±1.0	–	2.0	0.7	41	2000	SNF 2H
	RCR16CM5F	5.0	–	5.0±1.0	2.0	0.45	14	2000	RCR16
	RCR25CM10F	10.0	–	5.0±1.0	2.0	0.6	23	2000	RCR25
	RCR25ENCM10F	10.0	–	5.0±1.0	2.0	0.6	23	2000	RCR25EN
	RCR50(+)CM15F	15.0	–	5.0±1.0	2.0	0.7	40	2000	RCR50
	RCR50ENCM15F	15.0	–	5.0±1.0	2.0	0.7	40	2000	RCR50+
	RCR60CM15F	15.0	–	5.0±1.0	2.0	0.7	40	2000	RCR60
	RCR100CM20E	20.0	–	4.6±1.0	2.0	0.8	120	1000	RCR100
	RK1/4□CM10F	10.0	–	5.0±1.0	1.7	0.6	21	1000	RK1/4
	RK1/4□CM10R	10.0	–	10.0±1.0	1.7	0.6	21	1000	RK1/4
	RK1/4□CM12.5R	12.5	–	10.0±1.0	1.7	0.6	23	1000	RK1/4
	RK1/2□CM15F	15.0	–	5.0±1.0	2.0	0.6	40	1000	RK1/2
	RK1/2□CM12.5F	12.5	–	5.0±1.0	2.0	0.6	37	1000	RK1/2
	RK1/2□CM15R	15.0	–	10.0±1.0	2.0	0.6	37	1000	RK1/2
	CFS1/4CM5F	5.0	5.9±1.0	5.0±1.0	1.5	0.45	12	2000	CFS1/4
	CF1/4CM10H	10.0	6.0±1.0	4.8±1.0	1.7	0.6	23	1000	CF1/4
	CF1/4CM12.5H	12.5	6.0±1.0	4.8±1.0	1.7	0.6	23	2000	CF1/4
	CFB1/2CM12.5K	12.5	7.0±1.0	5.0±1.0	1.7	0.7	44	1000	CFB1/2
	CFS1/2CM10H	10.0	6.0±1.0	4.8±1.0	1.7	0.6	26	1000	CFS1/2
	CFPS1/4CM5F	5.0	5.9±1.0	5.0±1.0	1.5	0.45	12	2000	CFPS1/4
	CFP1/4CM10H	10.0	6.0±1.0	4.8±1.0	1.7	0.6	23	1000	CFP1/4
	CFPB1/2CM12.5K	12.5	7.0±1.0	5.0±1.0	2.0	0.7	44	1000	CFB1/2
	J1/6ZCM7.5H	7.5	–	$5.0^{+2.0}_{-0}$	1.5	0.5	5	1000	J1/6Z
	J1/4ZCM10H	10.0	–	$5.0^{+2.0}_{-0}$	1.5	0.6	9	1000	J1/4Z
	RF16CM5F	5.0	–	5.0±1.0	2.0	0.45	12	2000	RF16
	RF25CM10X	10.0	16.0±1.0	14.8±1.0	1.5	0.6	23	2000	RF25
	RF50CM12.5E	12.5	–	4.5±1.0	1.5	0.6	29	1000	RF50
	RF1CM15F	15.0	–	5.0±1.0	1.5	0.8	46	2000	RF1
	MOS1/2CM10C (MOSX1/2CM10C)	10.0	–	3.5±1.0	2.0	0.6	23	2000	MOS(X)1/2
	MOS1/2CM10F (MOSX1/2CM10F)	10.0	–	5.0±1.0	2.0	0.6	23	2000	MOS(X)1/2
	MOS1CM12.5C (MOSX1CM12.5C)	12.5	–	3.5±1.0	2.0	0.8	31	2000	MOS(X)1
	MOS1CM12.5D (MOSX1CM12.5D)	12.5	–	4.0±1.0	2.0	0.8	31	2000	MOS(X)1
	MOS1CM15F (MOSX1CM15F)	15.0	–	5.0±1.0	2.0	0.8	31	2000	MOS(X)1
	MOS1CM15J (MOSX1CM15J)	15.0	–	6.3±1.0	2.0	0.8	31	2000	MOS(X)1
	MOS1CM15S (MOSX1CM15S)	15.0	–	11.0±1.0	2.0	0.8	31	2000	MOS(X)1
	MOS2CM15C (MOSX2CM15C)	15.0	–	3.5±1.0	2.0	0.8	71	2000	MOS(X)2
	MOS2CM15E (MOSX2CM15E)	15.0	–	4.5±1.0	2.0	0.8	71	2000	MOS(X)2
	MOS2CM20D (MOSX2CM20D)	20.0	–	4.0±1.0	2.0	0.8	71	2000	MOS(X)2
	MOS2CM20U (MOSX2CM20U)	20.0	–	13.5±1.0	2.0	0.8	71	2000	MOS(X)2
	MOS3CM20E (MOSX3CM20E)	20.0	–	4.6±1.0	2.0	0.8	120	1000	MOS(X)3
	MOS3CM26E (MOSX3CM26E)	26.0	–	4.7±1.0	2.0	0.8	120	1000	MOS(X)3
	MOS5CM30U (MOSX5CM30U)	30.0	–	13.0±1.0	2.0	0.8	456	500	MOS(X)5
	SPR1/2CM10F (SPRX1/2CM10F)	10.0	–	5.0±1.0	2.0	0.6	23	2000	SPR(X)1/2
	SPR1CM12.5D (SPRX1CM12.5D)	12.5	–	4.0±1.0	2.0	0.8	44	2000	SPR(X)1
	SPR1CM15F (SPRX1CM15F)	15.0	–	5.0±1.0	2.0	0.8	44	2000	SPR(X)1
	SPR2CM15E (SPRX2CM15E)	15.0	–	4.5±1.0	2.0	0.8	71	2000	SPR(X)2
	SPR3CM20E (SPRX3CM20E)	20.0	–	4.6±1.0	2.0	0.8	120	1000	SPR(X)3

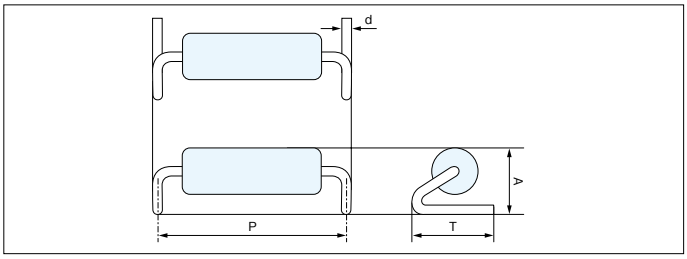
□ : T.C.R.

APPENDIX C

Surface mounted device style lead forming



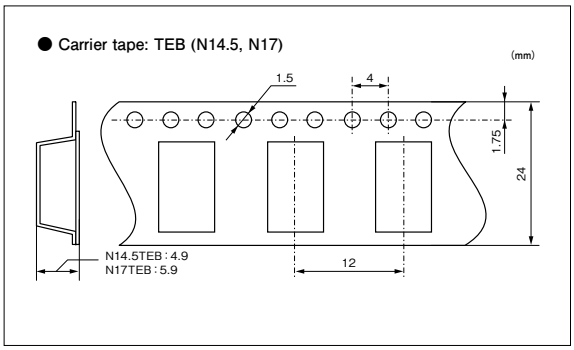
■Forming style

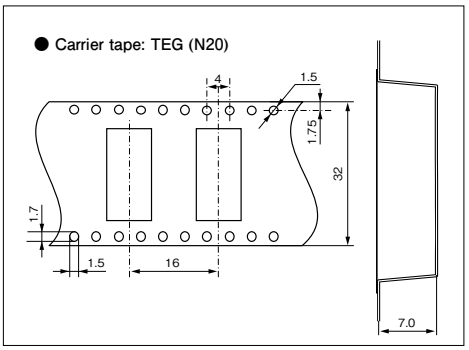


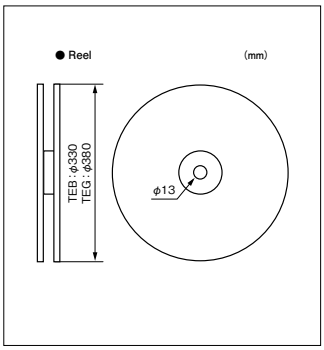
■Ratings

Type	Forming Type Name	Carrier Tape	Forming Dimension (mm)				Q'ty/Reel (pcs)	Weight (g)	
			P±1	T	A±0.5	d		Reel	NET/1000pcs
MOS(X)1	N14.5	TEB	14.5	5.0±0.5	4.8	0.8	1,000	700	350
MOS(X)2 SPR(X)2 RCR75 CW2	N17	TEB	17.0	6.0±0.5	5.8	0.8	1,000	900	600
MOS(X)3 SPR(X)3 RCR100 CW3	N20	TEG	20.0	7.5±1	6.5	0.8	900	1,800	1,400

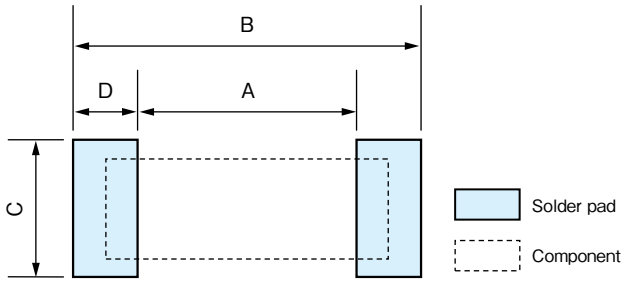
■Packaging Specifications







■Recommended Pad Dimensions

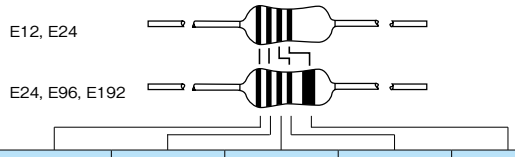


Type	Forming Type Name	Pad Dimension (mm)			
		A	B	C	D
MOS(X)1	N14.5TEB	12.5	16.5	7.0	2.0
MOS(X)2 SPR(X)2 RCR75 CW2	N17TEB	14.6	19.4	8.0	2.4
MOS(X)3 SPR(X)3 RCR100 CW3	N20TEG	17.6	22.4	9.5	2.4

•Need a dedicated nozzle for automatic mounting. Please inquire to us before use.

Color code · Resistance tolerance · Resistance marking · E series numbers

■Color code for discrete resistors



Color	1st Figure	2nd Figure	3rd Figure	Multiplier	Tolerance
Black	0	0	0	1	—
Brown	1	1	1	10	F : ±1%
Red	2	2	2	100	G : ±2%
Orange	3	3	3	1,000	A : ±0.05%
Yellow	4	4	4	10,000	—
Green	5	5	5	100,000	D : ±0.5%
Blue	6	6	6	1,000,000	C : ±0.25%
Purple	7	7	7	10,000,000	B : ±0.1%
Gray	8	8	8	—	—
White	9	9	9	—	—
Gold	—	—	—	0.1	J : ±5%
Silver	—	—	—	0.01	K : ±10%
Plain	—	—	—	—	M : ±20%

■Resistance tolerance

Symbol	A	B	C	D	F	G	J	K	M
Resistance tolerance	±0.05%	±0.1%	±0.25%	±0.5%	±1%	±2%	±5%	±10%	±20%

■Resistance marking of chip resistors

3 digits : The 1st and 2nd digits are significant of resistance and the 3rd digit means the multiplier numbers of zero to follow. R means a decimal point. L means a decimal point followed by mΩ.

Example

153 : 15×1000=15kΩ
1R5 : 1.5Ω
2L0 : 2mΩ

4 digits : The 1st, 2nd and 3rd digits are significant of resistance and the 4th digit means the multiplier numbers of zero to follow. R means a decimal point. L means a decimal point followed by mΩ.

Example

1542 : 154×100=15.4kΩ
R154 : 0.154Ω
2L00 : 2mΩ

■Significant figures of Nominal resistance

E3	E6	E12	E24	E96	E192	E96	E192	E96	E192	E96	E192	E96	E192
10	10	10	10	100	100	178	178	316	316	562	562
					101		180		320		569
			11	102	102	182	182	324	324	576	576
					104		184		328		583
		12	12	105	105	187	187	332	332	590	590
					106		189		336		597
			13	107	107	191	191	340	340	604	604
					109		193		344		612
	15	15	15	110	110	196	196	348	348	619	619
					111		198		352		626
			16	113	113	200	200	357	357	634	634
					114		203		361		642
		18	18	115	115	205	205	365	365	649	649
					117		208		370		657
			20	118	118	210	210	374	374	665	665
					120		213		379		673
22	22	22	22	121	121	215	215	383	383	681	681
					123		218		388		690
			24	124	124	221	221	392	392	698	698
					126		223		397		706
		27	27	127	127	226	226	402	402	715	715
					129		229		407		723
			30	130	130	232	232	412	412	732	732
					132		234		417		741
	33	33	33	133	133	237	237	422	422	750	750
					135		240		427		759
			36	137	137	243	243	432	432	768	768
					138		246		437		777
		39	39	140	140	249	249	442	442	787	787
					142		252		448		796
			43	143	143	255	255	453	453	806	806
					145		258		459		816
47	47	47	47	147	147	261	261	464	464	825	825
					149		264		470		835
			51	150	150	267	267	475	475	845	845
					152		271		481		856
		56	56	154	154	274	274	487	487	866	866
					156		277		493		876
			62	158	158	280	280	499	499	887	887
					160		284		505		898
	68	68	68	162	162	287	287	511	511	909	909
					164		291		517		920
			75	165	165	294	294	523	523	931	931
					167		298		530		942
		82	82	169	169	301	301	536	536	953	953
					172		305		542		965
			91	174	174	309	309	549	549	976	976
					176		312		556		988

※抵抗器以外の製品はお問い合わせ下さい。

■Ohmic code for resistance value

Tolerance≧2%	
Resistance value(Ω)	3Digit Code
50μ	50U
0.1m ~ 0.91m	L10 ~ L91
1m ~ 9.1m	1L0 ~ 9L1
10m ~ 91m	10L ~ 91L
0.1 ~ 0.91	R10 ~ R91
1 ~ 9.1	1R0 ~ 9R1
10 ~ 91	100 ~ 910
100 ~ 910	101 ~ 911
1k ~ 9.1k	102 ~ 912
10k ~ 91k	103 ~ 913
100k ~ 910k	104 ~ 914
1M ~ 9.1M	105 ~ 915
10M ~ 91M	106 ~ 916

Tolerance≦1%	
Resistance value(Ω)	4Digit Code
0.1m ~ 0.976m	L100 ~ L976
1m ~ 9.76m	1L00 ~ 9L76
10m ~ 97.6m	10L0 ~ 97L6
0.1 ~ 0.976	R100 ~ R976
1 ~ 9.76	1R00 ~ 9R76
10 ~ 97.6	10R0 ~ 97R6
100 ~ 976	1000 ~ 9760
1k ~ 9.76k	1001 ~ 9761
10k ~ 97.6k	1002 ~ 9762
100k ~ 976k	1003 ~ 9763
1M ~ 9.76M	1004 ~ 9764
10M ~ 97.6M	1005 ~ 9765

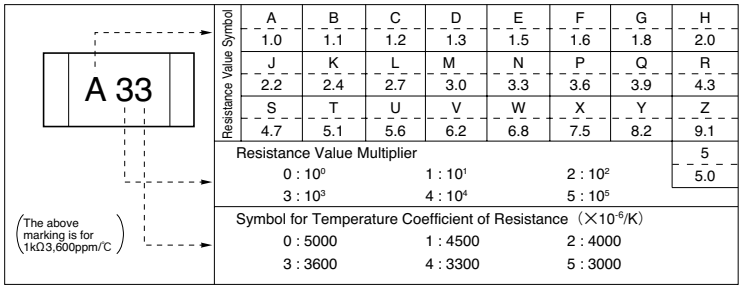
NT73

Nominal resistances are expressed.
3 digits : The 1st and 2nd digits are significant and the 3rd digit means the multiplier number of zero to follow. R means a decimal point.
Example 153 : 15×1000=15kΩ

LT73/LT73V

Nominal resistances are expressed.
4 digits : The 1st, 2nd and 3rd digits are significant and the 4th digit means the multiplier number of zero to follow. R means a decimal point.
Example 3302 : 330×100=33kΩ

LP73



Resistance Value Symbol								
A	B	C	D	E	F	G	H	
1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	
J	K	L	M	N	P	Q	R	
2.2	2.4	2.7	3.0	3.3	3.6	3.9	4.3	
S	T	U	V	W	X	Y	Z	
4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1	

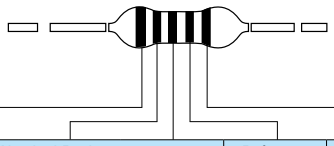
Resistance Value Multiplier

0 : 10^0	1 : 10^1	2 : 10^2	5
3 : 10^3	4 : 10^4	5 : 10^5	5.0

Symbol for Temperature Coefficient of Resistance (×10^{-6}/K)

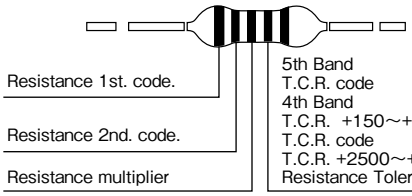
0 : 5000	1 : 4500	2 : 4000
3 : 3600	4 : 3300	5 : 3000

SDT101A



	Nominal Resistance			Reference Temperature (0℃)	T. C. R.
	1st Figure	2nd Figure	Multiplier		
10Ω	Brown	Black	Black	Black	Black
100Ω	Brown	Black	Brown	Black	Black
500Ω	Green	Black	Brown	Black	Black

LP



Color	1st Figure	2nd Figure	Multiplier	Tolerance
Black	0	0	1	—
Brown	1	1	10	F : ±1%
Red	2	2	100	G : ±2%
Orange	3	3	1,000	—
Yellow	4	4	10,000	—
Green	5	5	—	—
Blue	6	6	—	—
Purple	7	7	—	—
Gray	8	8	—	—
White	9	9	—	—
Gold	—	—	0.1	J : ±5%

Color Marking of T. C. R.

T.C.R.(×10^{-6}/K)	4th Band	5th Band
150	Black	Brown
250	Black	Red
350	Black	Orange
450	Black	Yellow
550	Black	Green
650	Black	Blue
750	Black	Purple
850	Black	Gray
950	Black	White
1000	White	Black
1200	White	Red
1400	White	Yellow
1600	White	Blue
1800	White	Gray
2000	Purple	Black
2200	Purple	Red
2400	Purple	Yellow
2500	—	Purple
3000	—	Gray
3300	—	White
3600	—	Black
4000	—	Yellow
4500	—	Orange
5000	—	Blue

THE KOA GROUP HAS BEEN MAKING EVERY ENDEAVOR IN ONE UNITED BOY TO FURTHER IMPROVE THE QUALITY AND TO CARRY OUT ACTIVITIES TAKING THE NATURAL ENVIRONMENT INTO CONSIDERATION.

ISO 9001 Registration

Company	Standards	Registered Date	Registration No.	Registrar
KOA Group	ISO 9001	Dec.1994	50300601 QM15	DQS
KOA KASEI CO., LTD.	ISO 9001	Nov.2007	04563	Intertek

IATF16949 Registration

Company	Standards	Registered Date	Registration No.	Registrar
KOA CORPORATION	IATF16949	May.2018	50300601 IATF16	DQS
KOA ELECTRONICS CO., LTD.	IATF16949	May.2018	50300601 IATF16	DQS
KASHIMA KOA DENKO CO., LTD.	IATF16949	May.2018	50300601 IATF16	DQS
SANADA KOA CORPORATION	IATF16949	May.2018	50300601 IATF16	DQS
SHANGHAI KOA ELECTRONICS CO., LTD.	IATF16949	May.2018	50300601 IATF16	DQS
KOA ELECTRONICS (TAICANG) CO., LTD.	IATF16949	May.2018	50300601 IATF16	DQS
KOA KAOHSIUNG CORPORATION	IATF16949	May.2018	50300601 IATF16	DQS
KOA DENKO (MALAYSIA) SDN. BHD.	IATF16949	May.2018	50300601 IATF16	DQS

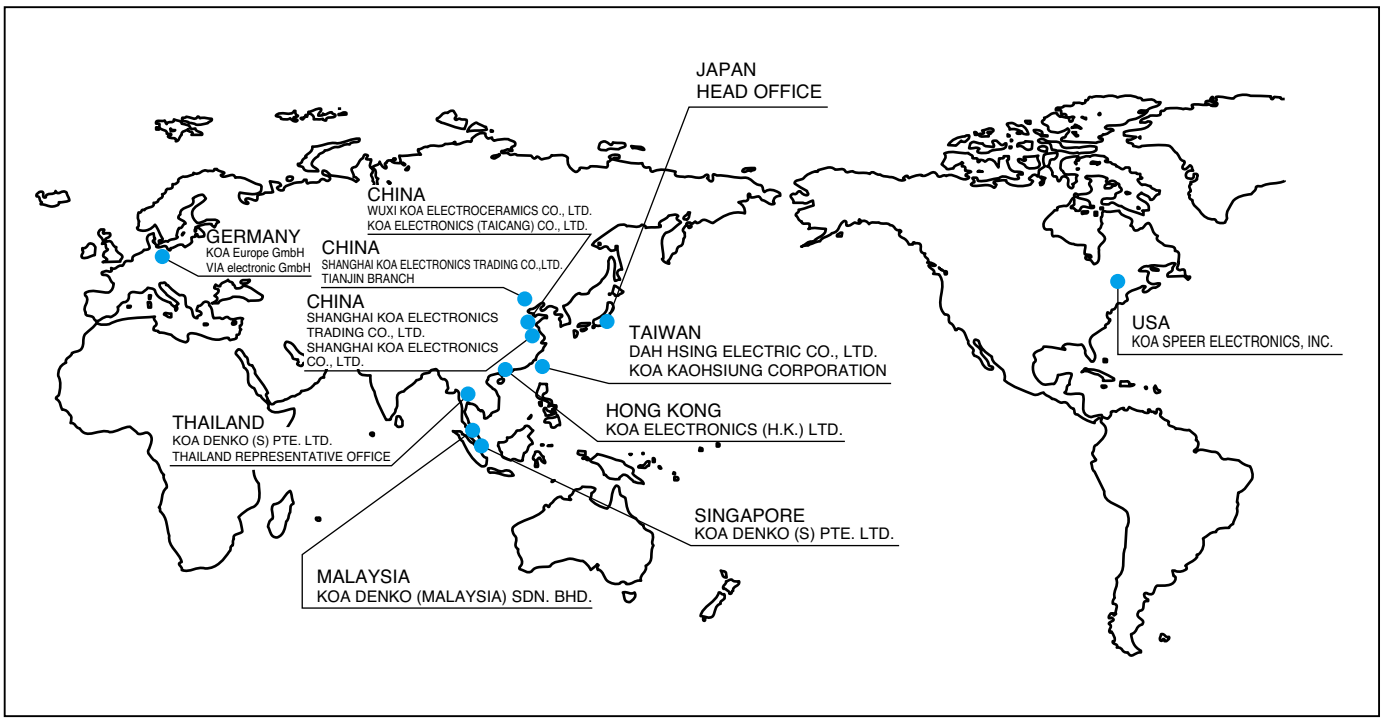
ISO 14001 Registration

Company	Registered Date	Registration No.	Registrar
KOA CORPORATION	Apr.1998	JQA-EM0155	JQA
KOA ELECTRONICS CO., LTD.	Mar.2001	JQA-EM0155	JQA
KASHIMA KOA DENKO CO., LTD.	Oct.2000	JQA-EM0155	JQA
KOA KASEI CO., LTD.	Apr.2002	JQA-EM0155	JQA
SANADA KOA CORPORATION	Feb.2000	JQA-EM0155	JQA
KOA KAOHSIUNG CORPORATION	Mar.2000	50600209 UM15	DQS
SHANGHAI KOA ELECTRONICS CO., LTD.	Dec.2001	04219E20114R6M	SQC
KOA ELECTRONICS (TAICANG) CO., LTD.	Jul.2002	00219E31342R3M	CQM
KOA DENKO (MALAYSIA) SDN. BHD.	Dec.2002	AJAEU/21/16408	AJA
WUXI KOA ELECTROCERAMICS CO., LTD.	Aug.2015	01221E20616R2M	CEPREI

ISO/IEC17025 Registration

Company	Site Name	Date of Certification	Registration No.	Registrar
KOA CORPORATION	Quality Assurance Center, Quality Assurance Initiative	Jul.2007	RTL02340	JAB

Global Network



KOA Overseas Sales Offices And Plants

Area	Country	Sales Offices	Address
Japan	JAPAN	GLOBAL SALES CENTER	2-17-2 MIDORI-CHO, FUCHU-SHI, TOKYO 183-0006, JAPAN TEL [+81] 42-336-5755 FAX [+81] 42-336-5353
North and South America	USA	KOA SPEER ELECTRONICS, INC.	199 BOLIVAR DRIVE, BRADFORD, PA 16701, UNITED STATES. TEL [+1] 814-362-5536 FAX [+1] 814-362-8883
Europe	GERMANY	KOA Europe GmbH	KADDENBUSCH 6, D-25578 DÄGELING ITZEHOE, GERMANY TEL [+49] 4821-8989-0 FAX [+49] 4821-8989-89
	GERMANY	VIA electronic GmbH	ROBERT-FRIESE-STRAßE 3, 07629 HERMSDOLF, GERMANY TEL [+49] 036601-9298-0 FAX [+49] 036601-9298-110
Asia	SINGAPORE	KOA DENKO (S) PTE. LTD.	80 BENDEMEER ROAD #03-01 SINGAPORE 339949 TEL [+65] 63395151 FAX [+65] 63398556
	THAILAND	KOA DENKO (S) PTE. LTD. THAILAND REPRESENTATIVE OFFICE	319 CHAMCHURI SQUARE BUILDING,24TH FLOOR, ROOM 24101, PHAYATHAI ROAD, PATHUMWAN SUB-DISTRICT, PATHUMWAN DISTRICT, BANGKOK, THAILAND 10330 TEL [+66] 2007-2427
	MALAYSIA	KOA DENKO (MALAYSIA) SDN. BHD.	LOTS 7, 8 & 9, BATU BERENDAM, FREE TRADE ZONE, 75350 MELAKA MALAYSIA TEL [+60] 6-2328031 FAX [+60] 6-2313171
	HONG KONG	KOA ELECTRONICS (H.K.) LTD.	UNIT 2315, METROPOLIS TOWER, 10 METROPOLIS DRIVE, HUNGHOM, KOWLOON, HONG KONG TEL [+852] 2492-6918 FAX [+852] 2492-7398
	CHINA	上海可爾電子貿易有限公司 SHANGHAI KOA ELECTRONICS TRADING CO., LTD.	200233 中国上海市徐汇区桂平路581号 No.581 Guiping Road, Xuhui District, Shanghai, China,200233 TEL [+86] 21-64320101 FAX [+86] 21-64320083
	CHINA	上海可爾電子貿易有限公司天津分公司 SHANGHAI KOA ELECTRONICS TRADING CO., LTD. TIANJIN BRANCH	300061 中国天津市和平区赤峰道136号天津国际金融中心8层856室 Rm 856 Modern International Financial Center,No.136 Chifeng Road,Heping District,Tianjin,China,300061 TEL [+86] 21-64320101 FAX [+86] 21-64320083
	CHINA	上海興亜電子元件有限公司 SHANGHAI KOA ELECTRONICS CO., LTD.	200233 中国上海市徐匯区漕河涇開発区桂平路581号 No.581 GuiPing Road, CaoHeJing Hi-Tech Park, XuHui District , ShangHai, CHINA, 200233 TEL [+86] 21-64850723 FAX [+86] 21-64852960
	CHINA	無錫興和電子陶瓷有限公司 WUXI KOA ELECTROCERAMICS CO., LTD.	214215 中国江蘇省宜興市和橋鎮西鋤村 Heqiao, Yixing City, Jiangsu Province, 214215 China TEL [+86] 510-87871645 FAX [+86] 510-87871626
	CHINA	興和電子（太倉）有限公司 KOA ELECTRONICS (TAICANG) CO., LTD.	215400 中国江蘇省太倉市太倉高新技術産業開発区洛陽東路77号 77, Luoyang East Road, High-tech Industrial Development Zone, Taicang, Jiangsu, 215400 China TEL [+86] 512-53561111 FAX [+86] 512-53561600
	TAIWAN	大興電工股份有限公司 DAH HSING ELECTRIC CO., LTD.	104 中華民國台北市南京東路1段34號11F 11th Floor,No.34 Sec.1, Nan-king East Road, Taipei, 104, Taiwan, R.O.C. TEL [+886] 2-2521-4166 FAX [+886] 2-2564-1859
	TAIWAN	高雄興亜股份有限公司 KOA KAOHSIUNG CORPORATION	811-677 中華民國高雄市楠梓區開發路17-2號 17-2, kai Fa Road Nanzih District, Kaohsiung City, 811-677, Taiwan R.O.C. TEL [+886] 7-363-4157 FAX [+886] 7-363-4543
	JAPAN	HEAD OFFICE	EARTH WING IN KOA PINE PARK 14016, OAZA, NAKA-MINOWA MINOWA-MACHI, KAMIINA-GUN, NAGANO, 399-4697, JAPAN TEL [+81] 265-70-7171

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