TCS542-DM

Digital Stepper Drive

Manual

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Thanks for selecting stepper motor driver. We hope that the superior performance, outstanding quality, excellent cost performance of our product can help you accomplish your motion control project.

The content in this manual has been carefully prepared and is believed to be accurate, but no responsibility is assumed for inaccuracies.

Technovision Control Systems Pvt. Ltd.

Version	Editor	Verifier
V1.0	R&D	R&D

Contents

1. Overview

The TCS542 is a two phase digital stepper driver based on ARM. Its Micro step resolutions and output current are programmable. And it has advanced control algorithm, which can brings a unique level of system smoothness, provides optimum torque and mid-range instability. The control algorithm of Multi-Stepping can make stepper motor has smooth system performance. The control algorithm of torque compensation can improve the torque of motor in the high speed. The control algorithm of motor self-test and parameter auto-setup technology offers optimum responses with different motors and easy-to-use. The control algorithm of smoothness can enhance the acceleration and deceleration of motor. Its unique features make the TCS542 to be an ideal solution for applications.

2. Features

Parameter auto-setup and motor self-test

Multi-Stepping inside, Small noise, low heating, smooth movement

Torque compensation in high speed

Variable current control technology, High current efficiency

Accelerate and decelerate control inside, Great improvement in smoothness of starting or stopping the motor

Support PUL/DIR and CW/CCW modes

Storage the position of motor

Optically isolated input and compatible with 5V or 24V

User-defined micro steps

Micro-step resolutions and Output current programmable

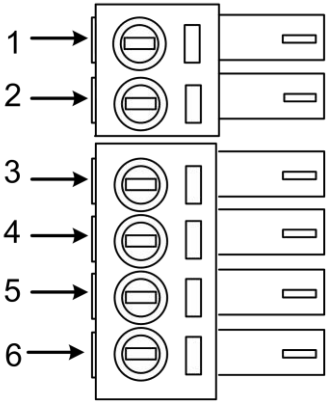
Over current and over voltage protection

Automatic detection, flexible selection of pulse edge count mode;

Green light means running while red light means protection or off line

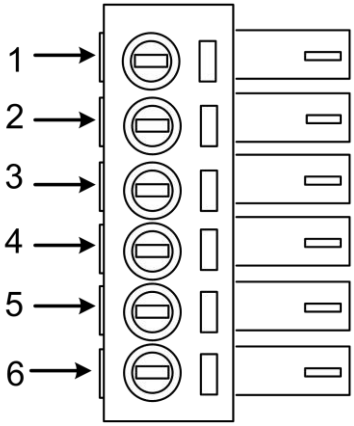
3. Ports Introduction

3.1 Control Signal Input Ports



Port	Symbol	Name	Remark
1	ENA-	Pulse signal +	Compatible with 5V or 24V
2	ENA+	Pulse signal -	
3	DIR-	Direction signal+	Compatible with 5V or 24V
4	DIR+	Direction signal-	
5	PLS-	Enable signal +	Compatible with 5V or 24V
6	PLS+	Enable signal-	

3.2 Power Interface Ports



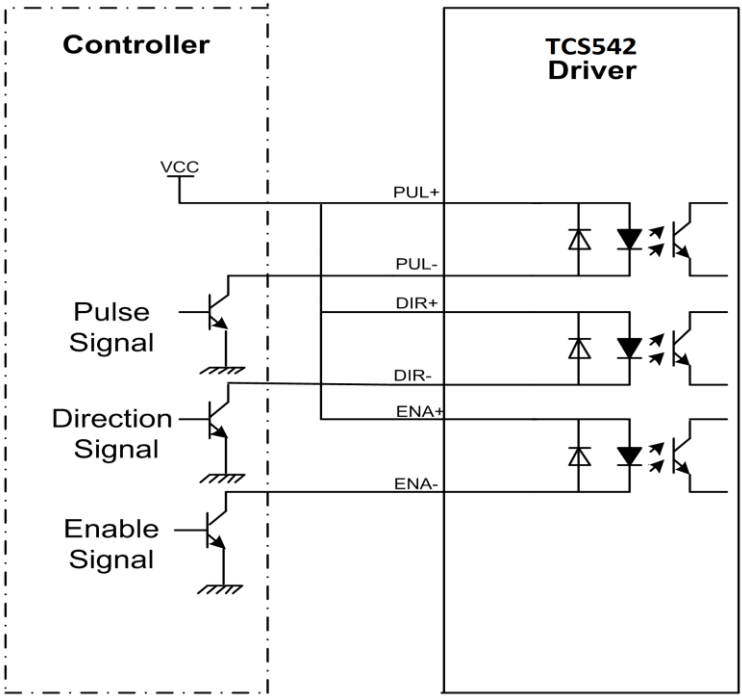
1	Motor Phase Wire Input Ports	B-	Phase B-	Motor Phase A
2		B+	Phase B+	
3		A-	Phase A-	Motor Phase B
4		A+	Phase A+	
5	Power Input Ports	VCC	Input Power +	DC24V-48V
6		GND	Input Power-	

4. Technological Index

Input Voltage		DC24V-48V
Pulse Frequency max		200K
Communication rate		57.6Kbps
Over voltage value		60V
Overall Dimensions (mm）		118×75.5×34
Weight		Approximate 260g
Environment Specifications	Environment	Avoid dust, oil fog and corrosive gases
	Operating Temperature	+70℃ Max
	Storage Temperature	-20℃~+80℃
	Humidity	40~90%RH
	Cooling method	Natural cooling or forced air cooling

5. Connections to Control Signal

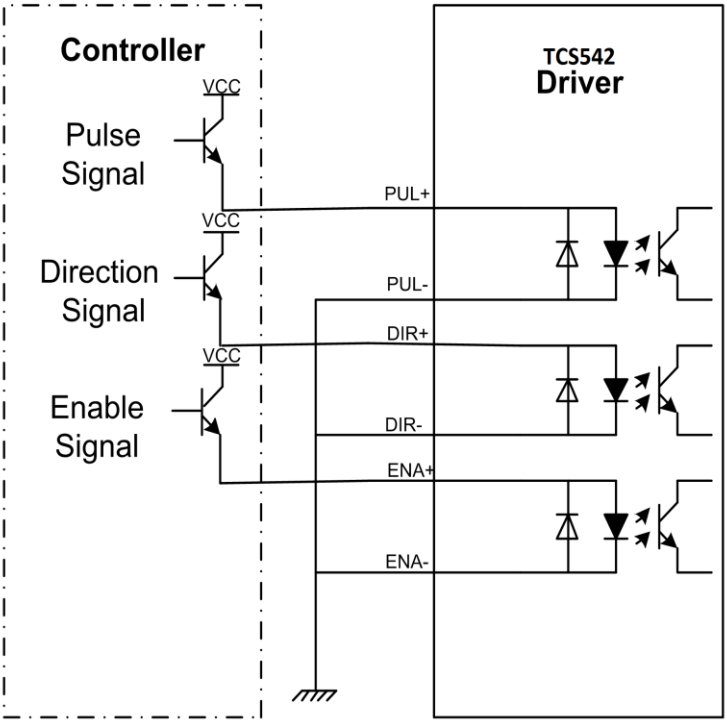
5.1 Connections to Common Anode



Remark:

VCC is compatible with 5V or 24V;

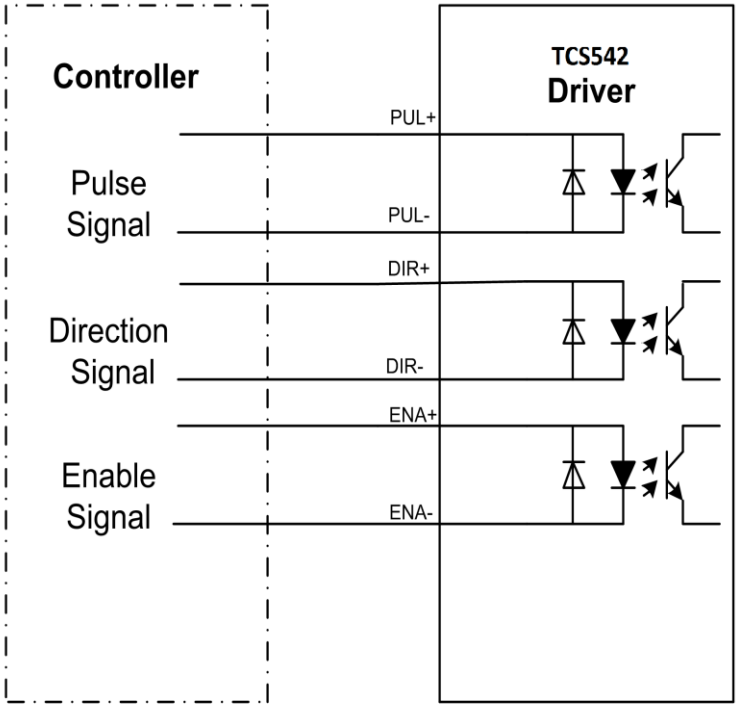
5.2 Connections to Common Cathode



Remark:

VCC is compatible with 5V or 24V;

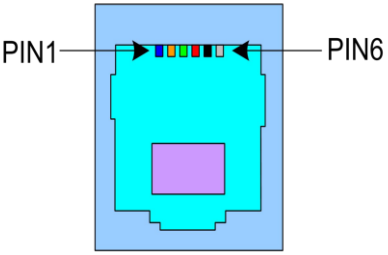
5.3 Connections to Differential Signal

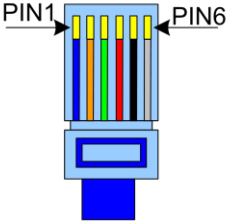


Remark:

VCC is compatible with 5V or 24V;

5.4 Connections to 232 Serial Communication Interface

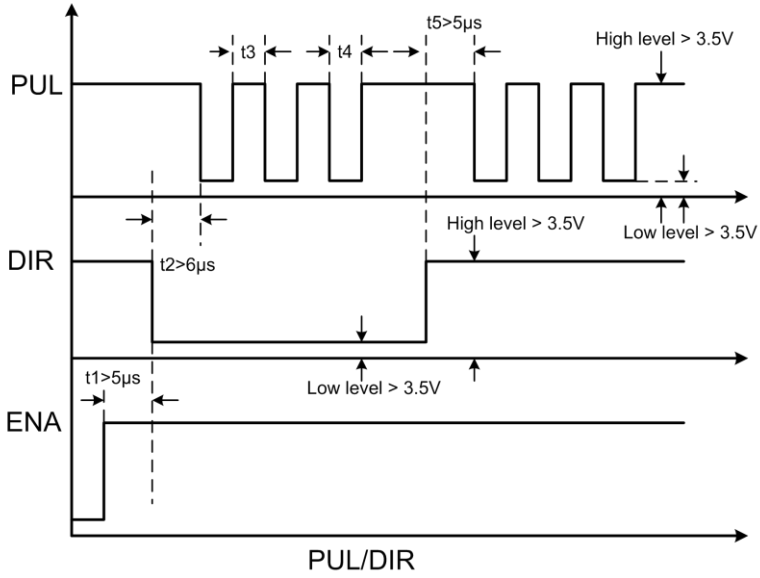




Crystal Head foot	Definition	Remark
1	TXD	Transmit Data
2	RXD	Receive Data
4	+5V	Power Supply to HISU
6	GND	Power Ground

5.5 Sequence Chart of Control Signals

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:



Remark:

a. t1: ENA must be ahead of DIR by at least 5 μ s. Usually, ENA+ and ENA- are NC (not connected).

b. t2: DIR must be ahead of PUL active edge by 6 μ s to ensure correct direction;

c. t3: Pulse width not less than 2.5 μ s;

d. t4: Low level width not less than 2.5 μ s.

6. DIP Switch Setting

6.1 Introduction of SW-2

6.1.1 Current Setting

The SW-2 current setting is in the following table.

Dial switch / Current		SW1	SW2	SW3
Peak	RMS			
1.0A	0.71A	1	1	1
1.46A	1.04A	0	1	1
1.91A	1.36A	1	0	1
2.37A	1.69A	0	0	1
2.84A	2.03A	1	1	0
3.31A	2.36A	0	1	0
3.76A	2.69A	1	0	0
4.2A	3.0A	0	0	0

6.1.2 Standstill current Setting

SW4 is used for setting the standstill current , “off” means the standstill current is set to be half of the selected dynamic current or other current, which can be set by the HISU, the details can be seen in the tenth sections. While “on” means the standstill current is set to be the same as the selected dynamic current.

6.1.3 Micro steps Setting

The micro steps setting is in the following table. And the micro steps can be also setting through the HISU. The details can be seen in the tenth

Sections.

SW-2 micro steps setting is in the following table

Dial witch / Micro steps	SW5	SW6	SW7	SW8
400	0	1	1	1
800	1	0	1	1
1600	0	0	1	1
3200	1	1	0	1
6400	0	1	0	1
12800	1	0	0	1
25600	0	0	0	1
1000	1	1	1	0
2000	0	1	1	0
4000	1	0	1	0
5000	0	0	1	0
8000	1	1	0	0
10000	0	1	0	0
20000	1	0	0	0
25000	0	0	0	0

6.2 Introduction of SW-1

The SW-1 switch is mainly a number of auxiliary functions, the auxiliary functions of the first three switch are respectively motor self-detection, pulse counting mode and single pulse selection; fourth and fifth are set for the smoothing coefficient, and the last one is reserved.

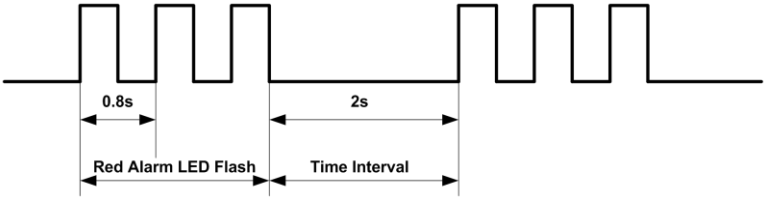
SW-1 switches auxiliary functions are shown in the following table

Selection / DIP Switch	0	1
SW1	Run	Self-Test
SW2	Pulse & Dir	CW/CCW
SW3	Up Edge	Down Edge

The smooth coefficients of the SW-1 switches are shown in the following table

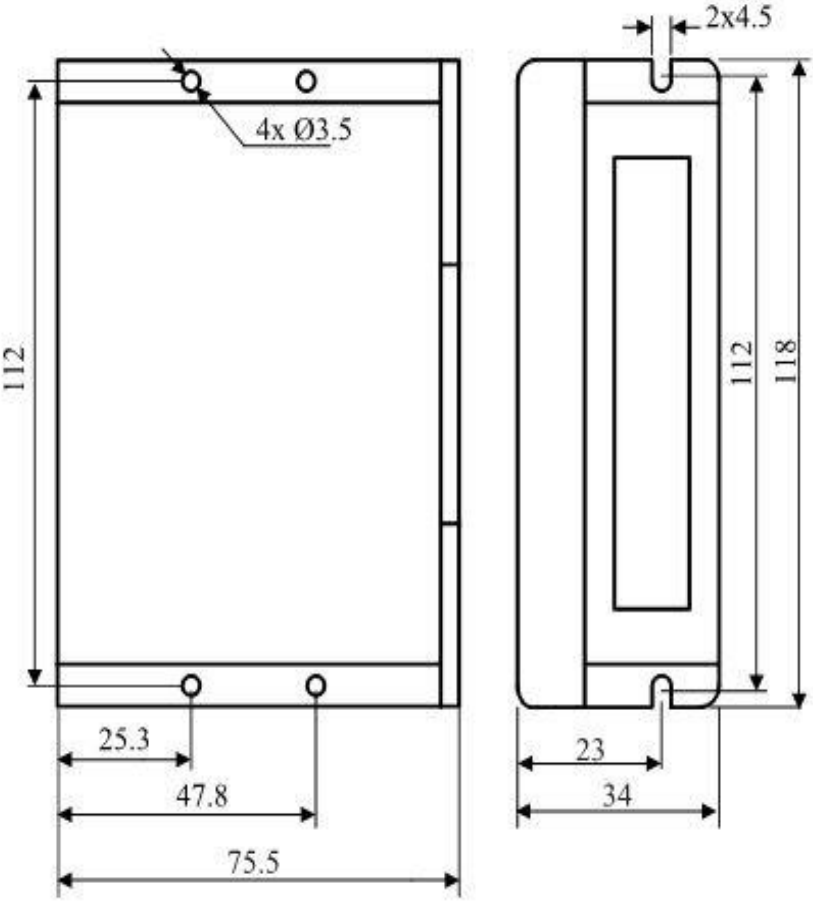
Smoothness	SW4	SW5
0	0	0
1	0	1
2	1	0
3	1	1

7. Faults alarm and LED flicker frequency



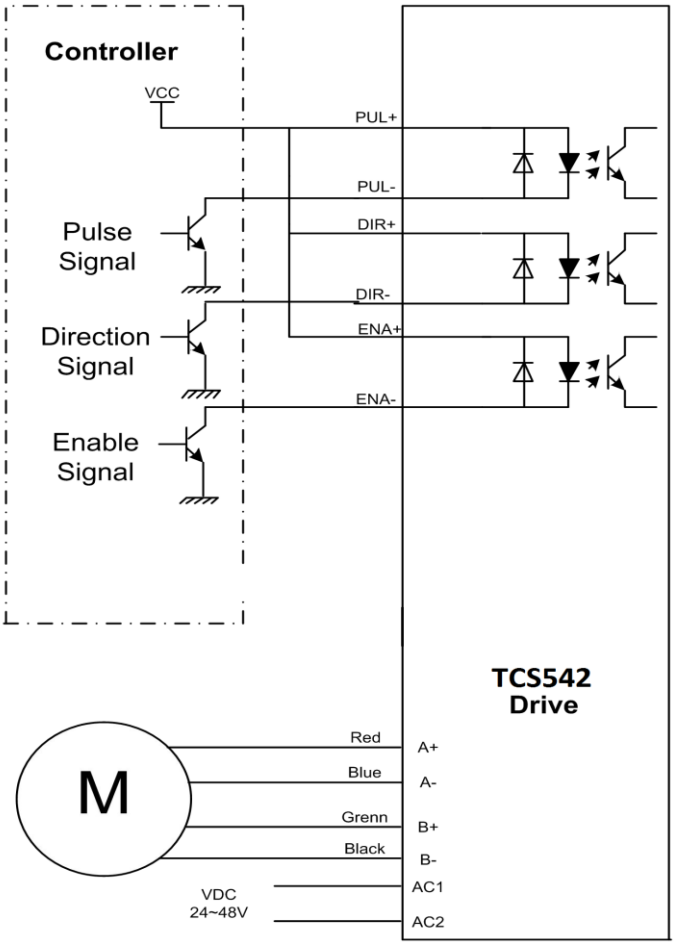
Flicker Frequency	Description to the Faults
1	Error occurs when the motor coil current exceeds the drive's current limit.
2	Voltage reference error in the drive
3	Parameters upload error in the drive
4	Error occurs when the input voltage exceeds the drive's voltage limit.

8. Appearance and Installation Dimensions



9. Typical Connection

Here is the typical connection of TCS542.



10. Parameter Setting

The parameter setting method of TCS542 drive is to use a HISU adjuster through the 232 serial communication ports, only in this way we can set the parameters we want. There are a set of best default parameters to the corresponding motor which are carefully adjusted by our engineers, users only need refer to the following table, specific condition and set the correct parameters.

Actual value = Set value × the corresponding dimension

Mode	Definition	Range	Dime-nsion	Drive Restart	Default Value
P1	Current loop Kp	0—4000	1	Y	1000
P2	Current loop Ki	0—1000	1	Y	50
P3	Damping coefficient	0—500	1	N	200
P4	Amplitude of first resonance point	0—100	1	N	0
P5	Phase of first resonance point	0—100	1	N	0
P6	Amplitude of second resonance point	0—100	1	N	0
P7	Phase of second resonance point	0—100	1	N	0
P8	Anti-resonance coefficient	0—1000	1	N	0
P9	Reserved				

P10	Enable signal level	0—1	1	N	0
P11	Initial direction selection	0—1	1	N	1
P12	Reserved				
P13	Command Type	0—1	1	Y	0
P14	User-defined micro steps	4—1000	50	Y	0
P15	Time of standstill current	0—4000	1ms	N	1000
P16	Percentage of standstill current	0—100	1	Y	50
P17	Speed smoothness	0—10	1	Y	0
P18	Enable of position memory	0—1	1	Y	0
P19	User-defined resistance of motor	0—100	mh	Y	0
P20	User-defined inductance of motor	0—100	0.1Ohm	Y	0
P21	Result of position memory	0—128	1		0
P22	Reserved				

There are total 22 parameter configurations, use the HISU to download the configured parameters to the drive, the detail descriptions to every parameter configuration are as follows:

Item	Description
Current loop Kp (P1) Current loop Ki (P2)	The P1 and P2 is used to set Kp and Ki of Current loop at the moment of power-on. When the motor is turning, the Kp and Ki is got by the Self-tuning algorithm.
Damping coefficient (P3)	This parameter is used to change the damping coefficient in case of the desired operating state is under resonance frequency. This parameter is useful in high speed.
Amp 1—2 **Phase 1—2** **(P4,P5,P6,P7)**	TCS542 Driver provides robust anti-resonance control to stop the vibrations and maintain equilibrium. **Amp1** and **Phase1** is Phase adjustment for 1st and Amplitude adjustment for 1st resonance area respectively. Usually between 0.6rps and 1.2rps. **Amp2** and **Phase2** is Phase adjustment for 2nd and Amplitude adjustment for 2nd resonance area respectively. Usually between 1.2rps and 2.4rps.

Anti-resonance coefficient (P8)	This parameter is used for reducing resonance. Usually between 3rps and 4rps.
Enable signal level (P10)	This parameter is set to control the Enable Input signal level. 0 means high, while 1 means low.
Initial direction selection (P11)	For the initial direction selection, 1 indicates that the initial direction is the counter clockwise, and the 0 indicates the initial direction is clockwise.
User-defined micro steps ((P14)	This parameter is set of user-defined micro steps. The actual micro steps = the set value × 50. For example, if the parameter is 4, the micro steps is 4 × 50 =800. But If this parameter is 0, which means micro steps is set by the outer DIP switches.
Time of standstill current (P15)	This parameter is set the time when the standstill current is set to be half of the selected dynamic current or other current.
Percentage of standstill current (P16)	This parameter is set the percentage of standstill current.

Speed smoothness (P17)	This parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.
Enable of position memory (P18)	This parameter is set to enable the function of position memory. 0 means disable, while 1 means enable. If set 1, the TCS542 can remember the position of motor in the next time of power on.
User-defined inductance of motor (P19)	This parameter is set the inductance of motor. **0 means TCS542 gets the inductance by control algorithm of Parameter auto-setup**, while 1 means TCS542 gets the inductance through user sets.
User-defined resistance of motor (P20)	This parameter is set the resistance of motor. **0 means TCS542 gets the resistance by control algorithm of Parameter auto-setup**, while 1 means TCS542gets the resistance through user sets.
Result of position memory (P21)	This parameter is set to control the smoothness of Display the result of position memory

11. Processing Methods to Common Problems and Faults

11.1 Power on power light off

No power input, please check the power supply circuit. The voltage is too low.

11.2 Power on red alarm light on

Please check the motor is connected with the drive.

The stepper digital drive is over voltage or under voltage. Please lower or increase the input voltage.

11.4 After input pulse signal but the motor not running

Please check the input pulse signal wires are connected in reliable way.

Please make sure the input pulse mode is corresponding with the real input mode.

The Driver is disabled.