

# Product and Application Information

## General High Voltage Evaluation User Safety Guidelines



Save all warnings and instructions for future reference.

**Failure to follow warnings and instructions may result in personal injury, property damage, or death due to electrical shock and burn hazards.**

The module is a Rectified AC to -DC CONVERTER typically provided as an open-frame, unenclosed assembly. All testing with live AC/DC input voltage is to be carried out **solely by qualified professional users having training, expertise, and knowledge of electrical safety & risks in development and application of high voltage electrical circuits**. If you are not suitably qualified to carry out open frame testing of this module, you should immediately stop from further work and seek support from your managers.

1. Work Area Safety (at a minimum, others may be applicable under your work safety regulations)
  1. Keep work area clean and orderly.
  2. Qualified observer(s) must be present anytime circuits are energized.
  3. Effective barriers and signage must be present in the area where the module and its interface electronics are energized, indicating operation of accessible high voltages may be present, for the purpose of protecting inadvertent access.
  4. All interface circuits, power supplies, evaluation modules, instruments, meters, scopes and other related apparatus used in a development environment exceeding 50Vrms/75VDC must be electrically located within a protected Emergency Power Off EPO protected power strip.
  5. Use stable and nonconductive work surface.
  6. Use adequately insulated clamps and wires to attach measurement probes and instruments. No freehand testing whenever possible.
2. Electrical Safety

As a precautionary measure, it is always a good engineering practice to assume that the entire Module may have fully accessible and active high voltages.

  1. De-energize the Module and all its inputs, outputs and electrical loads before performing any electrical or other diagnostic measurements. Revalidate that Module input power has been safely de-energized.
  2. With the Module de-energized, proceed with required electrical circuit configurations, wiring, measurement equipment connection, and other application needs, while still assuming the surrounding circuitry and measuring instruments are electrically live.
  3. When Setup is complete, energize the Module as intended.

**WARNING: WHILE THE MODULE IS ENERGIZED, NEVER TOUCH IT OR ITS ELECTRICAL CIRCUITRY- ANY PART OF IT MAY HAVE HIGH VOLTAGES CAPABLE OF CAUSING ELECTRICAL SHOCK HAZARD.**

### Personal Safety

4. Wear personal protective equipment (for example, latex gloves or safety glasses with side shields) or protect the Module in an adequate lucent plastic box with interlocks to protect from accidental touch.

## 1.0 Description

The GMR10K000 is a 100W module that typically requires rectified AC input and is a high efficiency converter with HV isolation. Max dc input is 400V Attains max efficiency >90%  
 The module uses full feedback control to provide a well-regulated 20v output with nominal load of up to 100W – can exceed 100W during sustained transient. The main devices used in this design are wide-input range nonlinear controller with frequency adjustment and skipping cycles at low loads.

GaN device for primary switch and energy efficient GaN synchronous rectifiers with zero-voltage switching attain high efficiency in the smallest volume of its class.

## Features

- \* **Smallest High voltage isolated module for effective system level integration**
- \* **Easy integration into systems board for system start-up for laptop adaptors, Tablet, TV, set-top box and printers, audio soundbars, smart speakers, Power tools and electric bike power outlets with off-board ac rectifier\***
- \* **USB Power delivery and fast chargers**
- \* **Does not require detailed thermal management operating at its max power and temperature.**

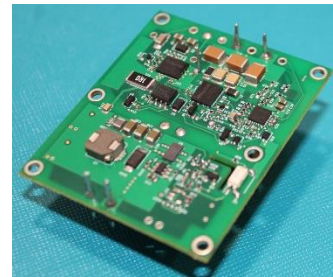
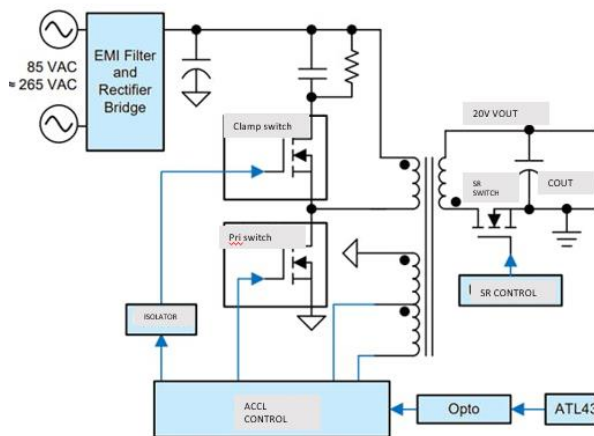


Fig. 1: Equivalent Schematic and 3D Module view

Table 1: Performance and Geometrical Information

EFFICIENCY WITH LOAD	POWER Loss	Input Current	OUTPUT RIPPLE	Pri Switch DISSIPATION	Pri Clamp switch dissipation	Pri Peak Current	Cout Peak current	Geom Info Pin footprint
Fig.3	Fig.4	Fig.5	Fig.6	Fig.7	Fig.8	Fig.11	Fig.12	Fig.13 ,14

## 2.1 Test Setup Requirements

**Safety:** This evaluation module is not encapsulated and there are accessible voltages that are greater than 50 V<sub>DC</sub>. The open frame module is supplied with conformal coating/vacuum impregnation.

### **WARNING**

**If you are not trained in the proper safety of handling and testing power electronics, please do not test this module.**

**Read this user's guide thoroughly before making test.**

**Voltage Source:** AC Line voltage

**Voltmeter:** Digital voltage meter

**Power Analyzer:** Capable of measuring 1 W to 100 W of input power and capable of handling 400 V input voltage. Some power analyzers may require a precision shunt resistor for measuring input current to measure input power of 100 W or less. Please read the power analyzer's user manual for proper measurement setups for full power and for stand-by power.

**Oscilloscope:**

- 4-Channel, 100 MHz bandwidth.
- Probes capable of handling 1000 V.

**Output Load:** Resistive or electronic load capable of handling 100 W at 20V

**Recommended Wire Gauge:** Insulated 22 AWG to 18 AWG.

### **WARNING**

**Caution: Do not leave Module powered when unattended**

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## 2.2 Test Setup Diagram

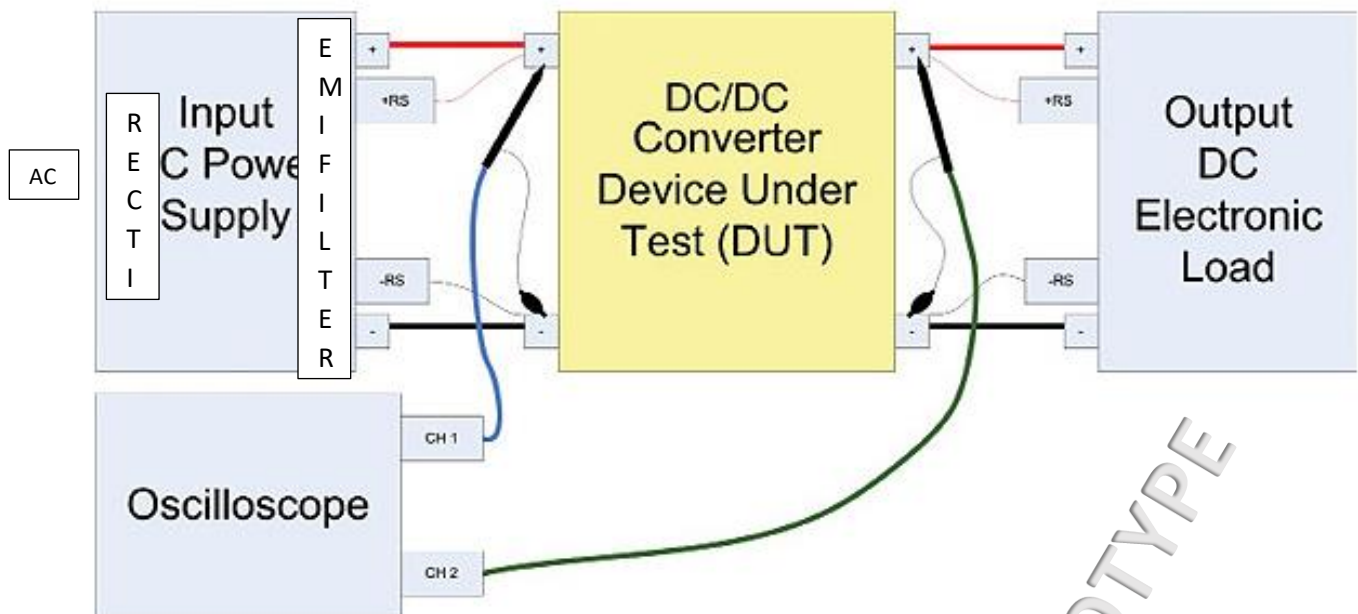


Figure 2. Module Test Setup Diagram

## 2.3 Eval Kit and Test Fixture:

Ganmar offers an Evaluation kit with 1 Modules installed in a socket. The Evaluation board is a high-performance Test Fixture. It contains high performance EMI filter as well for full characterization of such filter Ganmar Technologies also offers for integration in customer system as needed during EMI qualification of the whole system.

## 2.4 AC Input Rectifier Module:

There is an accompanying AC UP TO 265 Peak input modules complete with fuse, rectifier, EMI filter with high performance common mode choke, ability to connect to a safety /shielding Earth. Maximum rectified output voltage allowed is 380VDC.

## 3.0 Objective Specifications and Model Design Report

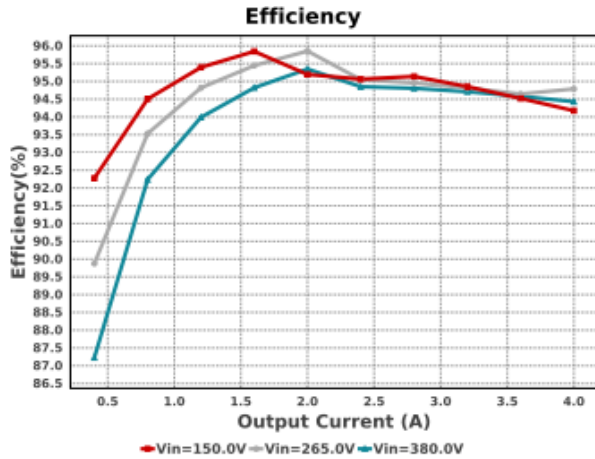


Figure 3: Efficiency with Load

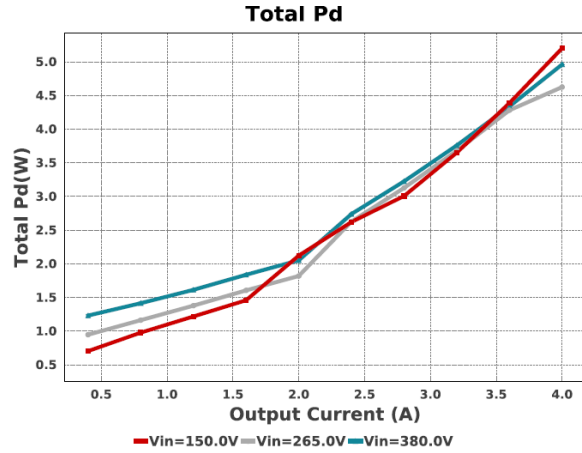


Figure 4: Power Loss with Load

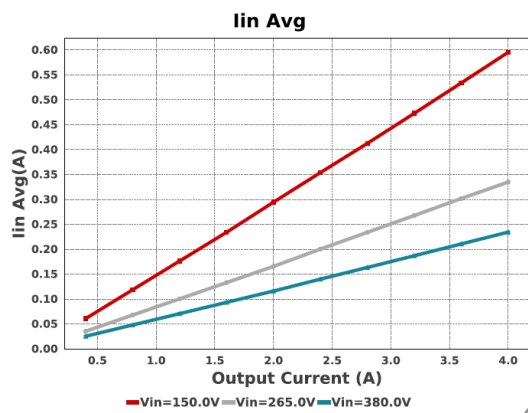


Figure 5: Avg line Current with Load

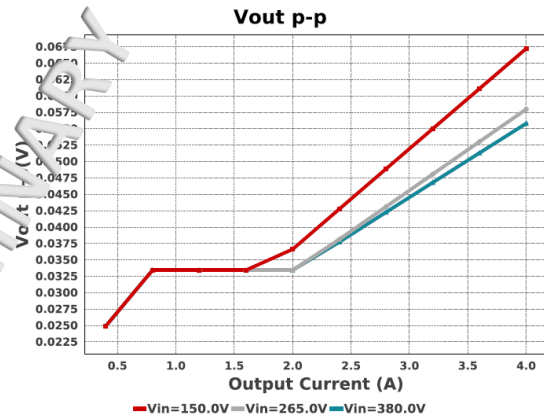


Figure 6: output ripple with Load

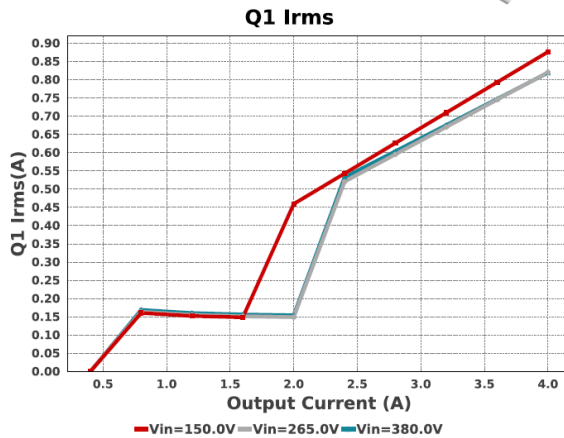


Figure 7: Pri Switch dissipation with Load

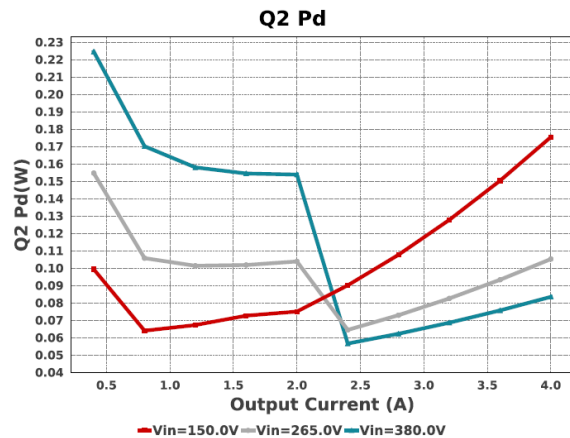


Figure 8: Clamp Switch dissipation with Load

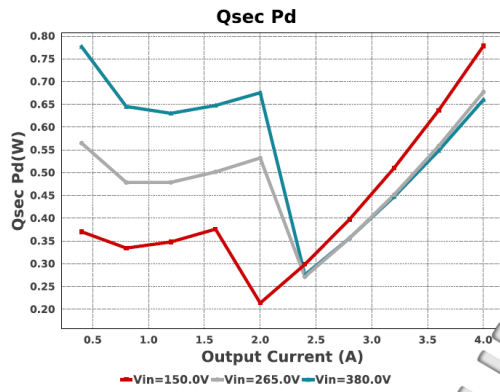


Figure 9: Sec switch Power Loss

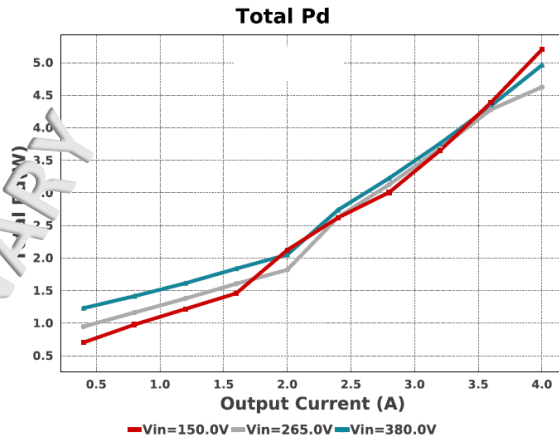


Figure 10: Total Power Loss

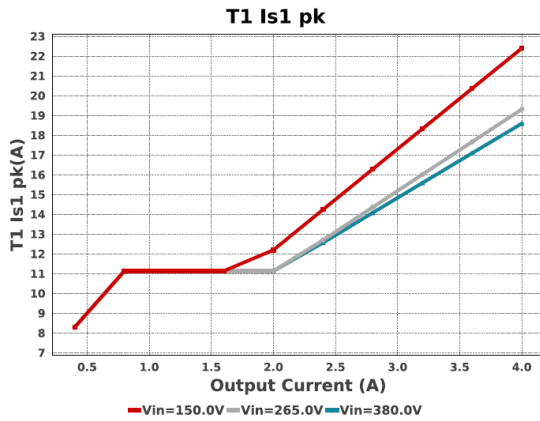


Figure 11: Primary Peak current

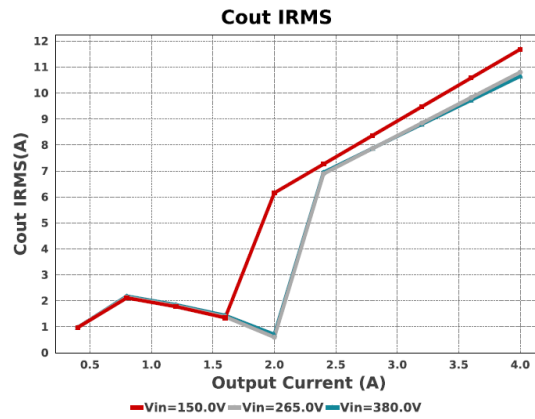


Figure 12: Cout RMS Current

## Mechanical

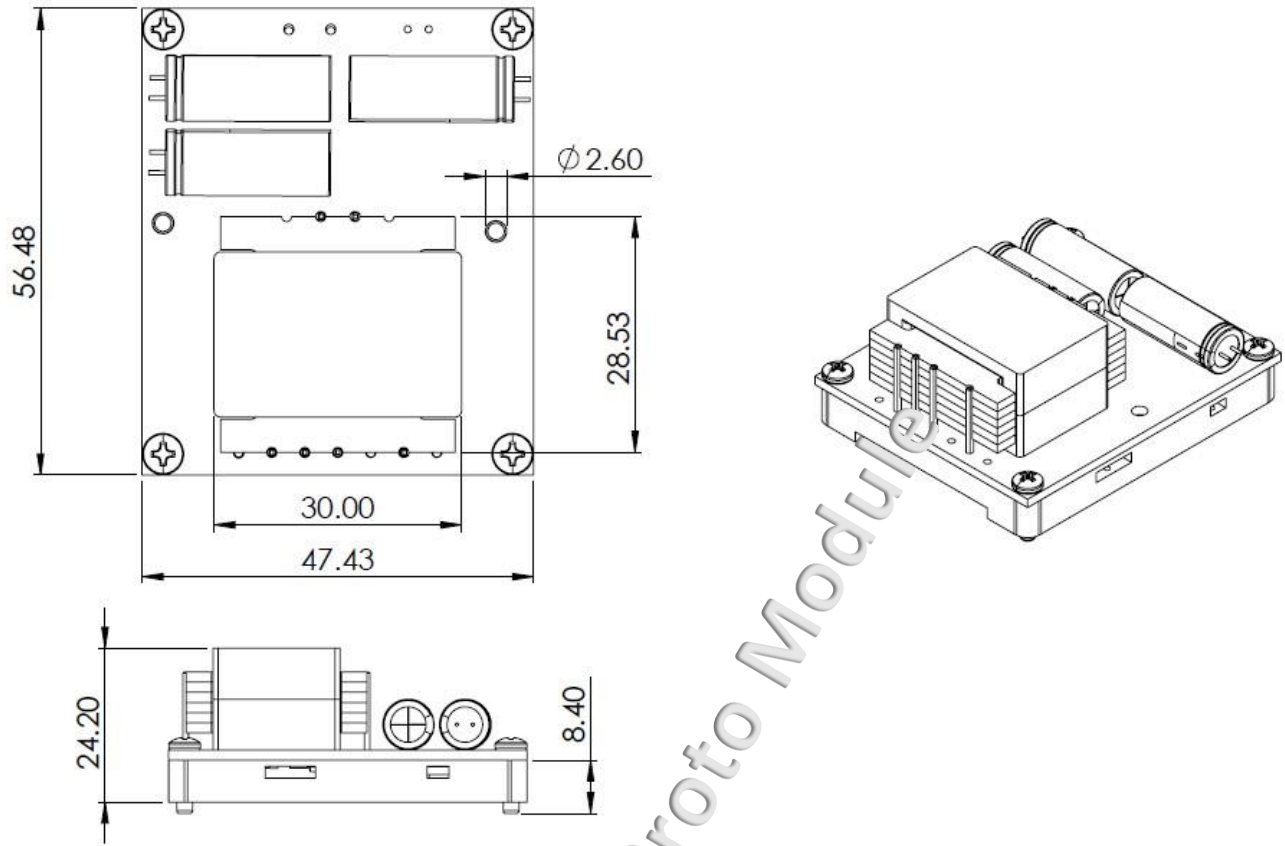
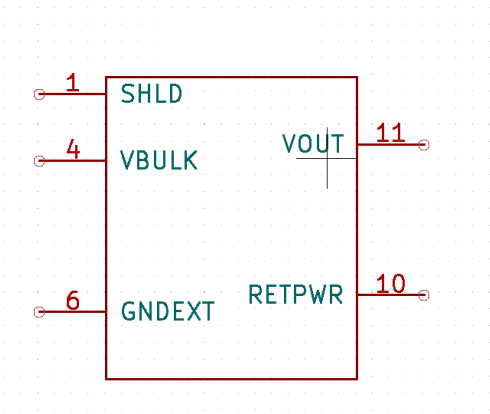
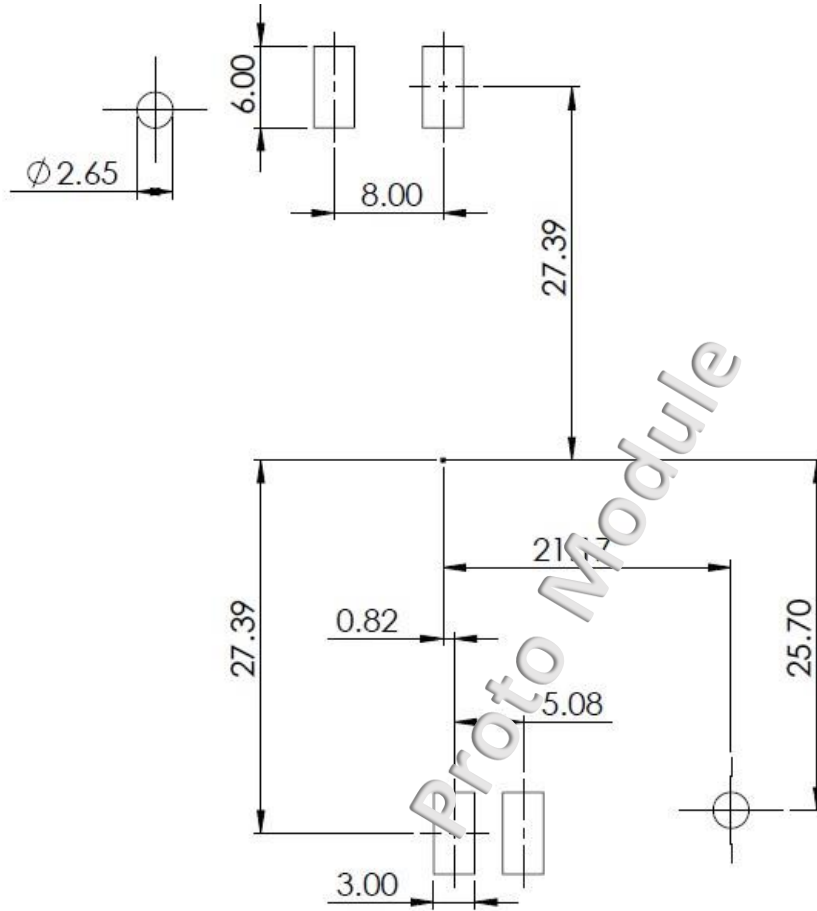


Fig 11: GMR10K000 Views



### GMR10K000 Pinout

PCB Layout



Parameters	Values	Comments
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<b>Nominal Input Voltage Range</b>	100 – 265 VAC MAX	380 VDC MAX
<b>Nominal Output Voltage</b>	20 VDC	( ≤ 20.5 VDC during turn-on transient)
<b>Output Voltage Margin</b>	±5%	-
<b>Nominal Output Current</b>	3.25 A	-
<b>Input Voltage Margin</b>	< 2%	-
<b>Output Power Margin</b>	< 2%	-
<b>Output Ripple</b>	< 100mV	
<b>Noise Voltage</b>	3.0kHz – 150kHz 150kHz – 200kHz ≤200kHz – 500kHz 0.5MHz – 30MHz	≤5mV ≤3mV ≤2mV ≤1mV
<b>Dimensions</b>	L*W*H = 47mm X 37mm X 26.65mm	See 3D PROTOTYPE SAMPLE
<b>Standby Power Loss</b>	≤0.1 W	Vin = 115 VAC Io = 0A
<b>Turn-on Time</b>	≤2 sec	-
<b>Overload Range</b>	85 W	-
<b>Overload Protection</b>	Reduced Voltage or Hiccup Mode	Auto Recovery
<b>Conducted Emission</b>	Class B	For > 400kHz, ≥15dB
<b>Dielectric</b>	Leakage current < 5mA No breakdown or flashover	4000 VAC 1min Leakage current (between input and output)
<b>Insulation</b>	≥50 MΩ between input and output	DC 500V
<b>Impulse Withstand Voltage</b>	No Breakdown No Flashover No arc discharge	Spec TBD
<b>Electrical Fast Transient (EFT) Burst Immunity Test</b>	Level 4	Normal output No Shutdown
<b>Electrostatic Discharge (ESD) Test</b>	Level 4	Normal output No Shutdown
<b>Surge Test</b>	Level 4	Normal output

		No Shutdown
<b>Mean Time Between Failure</b>	$\geq 100000$ hrs	-
<b>Operating Temperature</b>	-40 to 75 °C	-
<b>Storage Temperature</b>	-40 to 85 °C	-

**Note: Not all values are tested in the proto modules. Some are by design. Rest are still in-process**