RGF Series Filter Module

80V Input, 20A or 40A Output

RGF filter modules are designed to help reduce differential mode conducted emissions from switching power supplies with high input current requirements. The modules take advantage of TDK component technology and help simplify system-level compliance to CISPR and other compliance standards. RGF modules are encapsulated to protect the components while operating in harsh environments. The robust five-sided metal case features two threaded and two non-threaded mounting holes to facilitate easy mounting and enhanced cooling in either conduction or convection cooled systems.

Features

- Size - 52.8 mm x 35.2 mm x 12.7mm (2.08 in. x 1.39 in. x 0.5 in.)
- Through Hole Pins (3.7mm / 0.145")
- Maximum weight 48g (1.69 oz)
- Provides exceptional differential mode filtering, minimizing the need for additional external components
- Low Power Loss
- ISO Certified manufacturing facilities

Optional Features

- Short 2.79mm (0.110”) pin length
- Long 4.57mm (0.180”) pin length

Ordering Information:

Product Identifier	Platform	Input Voltage	Output Current	Units		Safety Class	Feature Set
RG	**F**	**48**	**020**	**A**	**-**	**0**	**01**
TDK Lambda Rugged	52.8 x 35.2 mm Filter	0 to 80 V	020 – 20 040 – 40	Amps			See option table

Option Table:

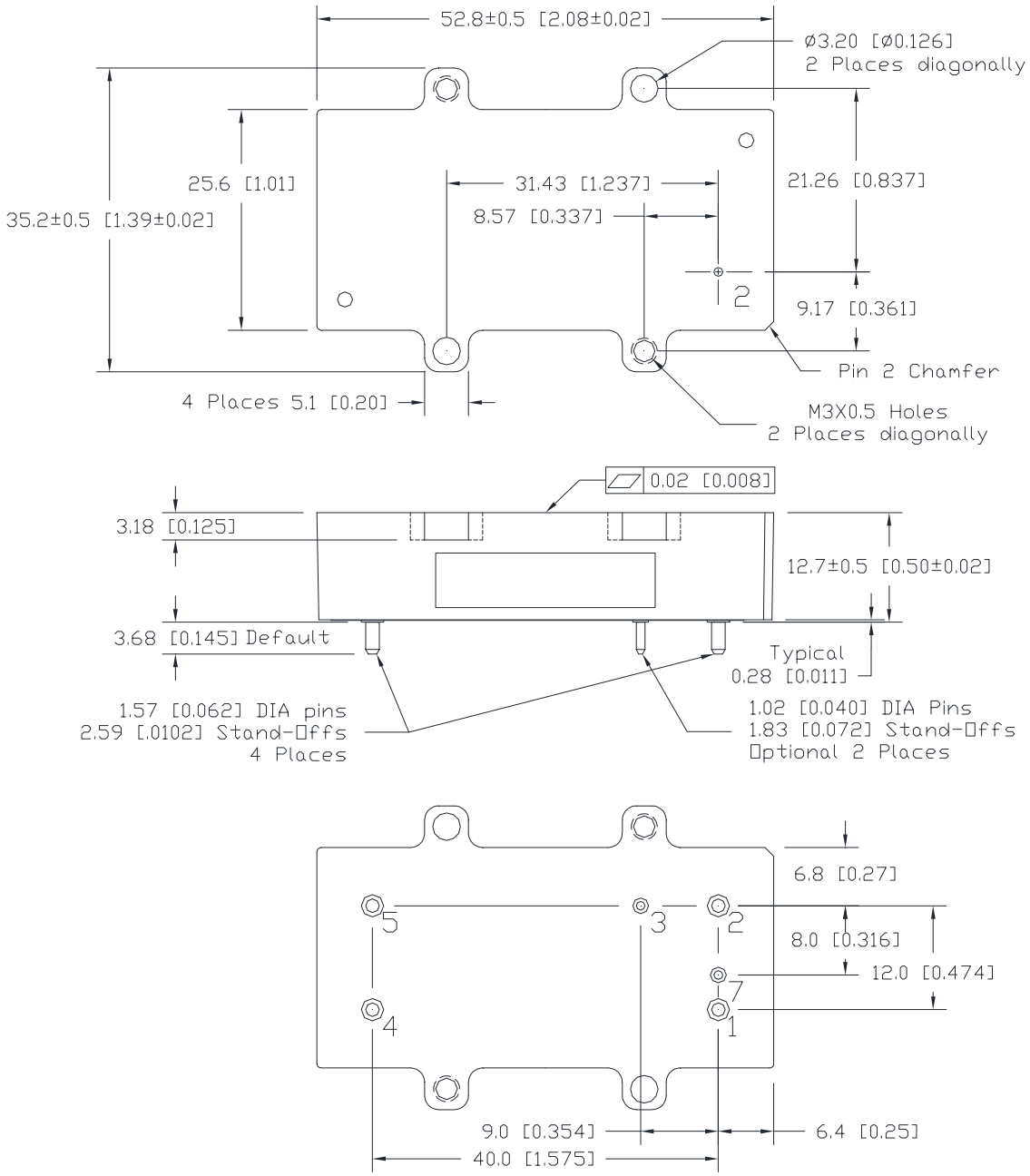
Feature Set	Through-hole pins-hole 0.145” tail length
01	x

Product Offering:

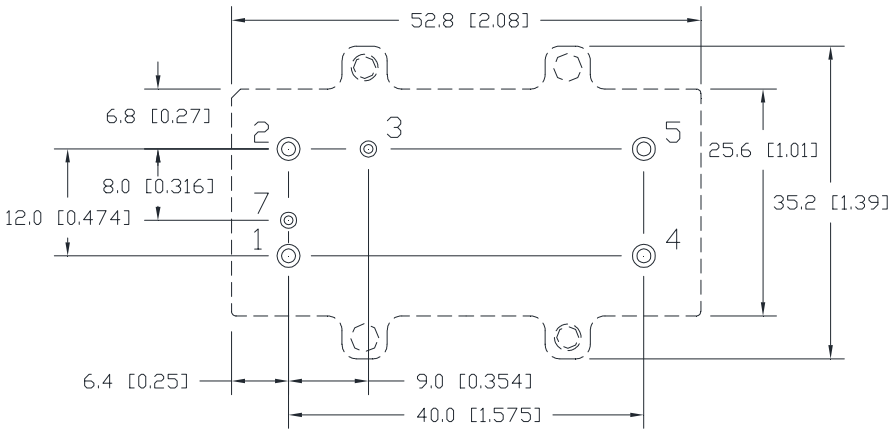
Product Code	Input Voltage	Output Current
RGF48020A-001	0 – 80 V	20 A
RGF48040A-001	0 – 80 V	40 A

Mechanical Specification: (–00x-R product options)

Dimensions are in mm [in]. Unless otherwise specified, tolerances are:
x.x ± 0.5 [0.02] / x.xx ± 0.25 [0.010]



Recommended Hole Pattern:



Pin Assignment:

PIN	Function	PIN	Function
1	GND / Vin (-), connect to power source	4	GND / Vout (-), connect to Vin(-) terminal of power module to be filtered
2	Vin (+), connect to power source	5	Vout(+), connect to Vin(+) terminal of power module to be filtered
3	CASE	7	Not present

Notes:

(1) Pin 1 and Pin 4 are internally connected. However, they must also be connected by an external copper trace or plane sufficient to carry the load current to ensure proper performance.
(2) Pin base material is brass or copper with tin gold over nickel plating.
(3) Maximum Weight: 48g (1.69 oz.)

Absolute Maximum Ratings:

Stresses in excess of Absolute Maximum Ratings may cause permanent damage to the device.

Characteristic	Min	Max	Unit	Notes & Conditions
Continuous Input Voltage	-0.25	80	Vdc	
Transient Input Voltage (100ms)		100	Vdc	
Storage Temperature	-55	125	˚C	
Operating Temperature Range (Tc)	-40	120*	˚C	Measured at the location specified in the thermal measurement figure; absolute maximum temperature varies with output current - see curve in the thermal performance section of the data sheet.

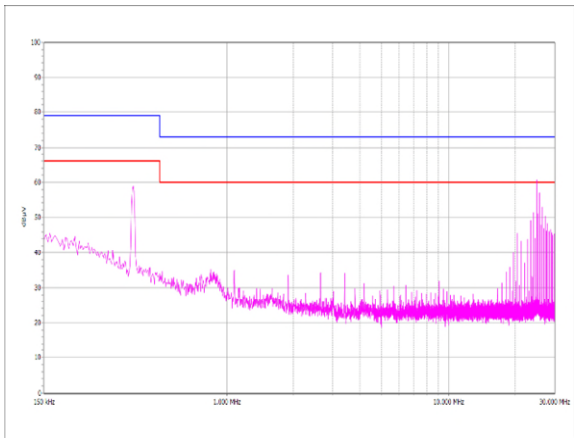
*Engineering estimate

Input Characteristics:

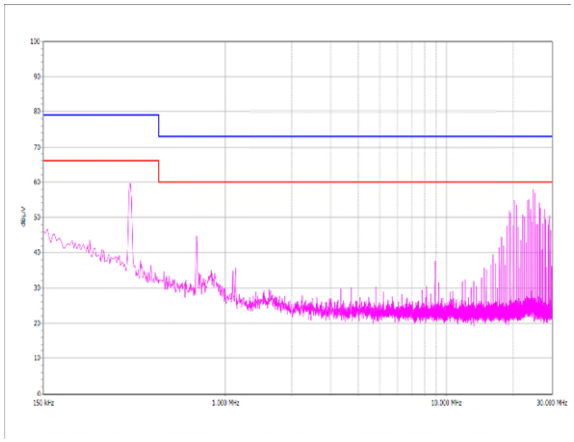
Unless otherwise specified, specifications apply over all rated Input Voltage, Resistive Load and Temperature Conditions.

Characteristic	Min	Typ	Max	Unit	Notes & Conditions
Resistance Positive Leg	---	5.4	---	mΩ	RGF48020A
	---	2.3	---		RGF48040A
Resistance Negative Leg	---	0.7	---	mΩ	
Inrush Transient	---	---	0.4	A^2s	
Maximum Current	---	---	20	A	RGF48020A
	---	---	40	A	RGF48040A
Differential Mode Attenuation at 300 kHz	---	45	---	dB	RGF48020A 50Ω source and load impedance
	---	40	---		RGF48040A 50Ω source and load impedance

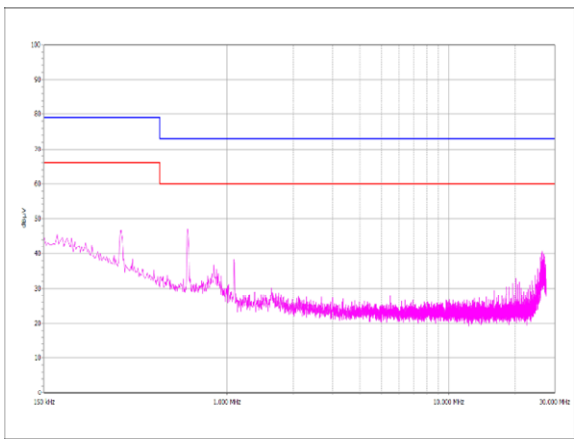
Electrical Characteristics:



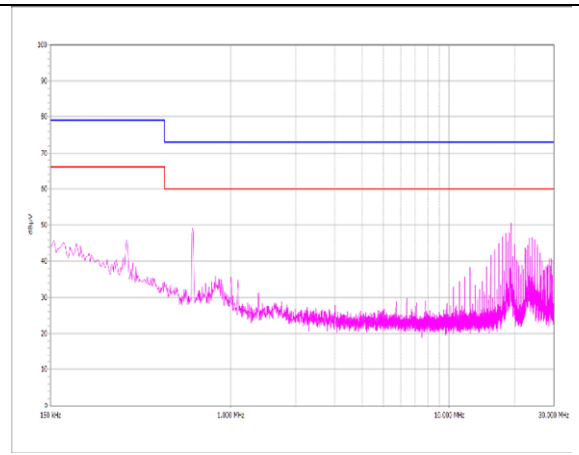
RGF48020A typical conducted emissions with RGA4W250W010A-001 at 24Vin, 12Vo and 80% load



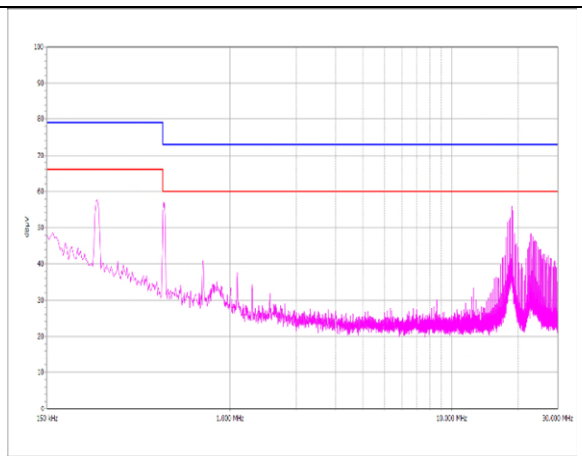
RGF48040A typical conducted emissions with RGA4W250W020A-001 at 48Vin, 12Vo and 80% load



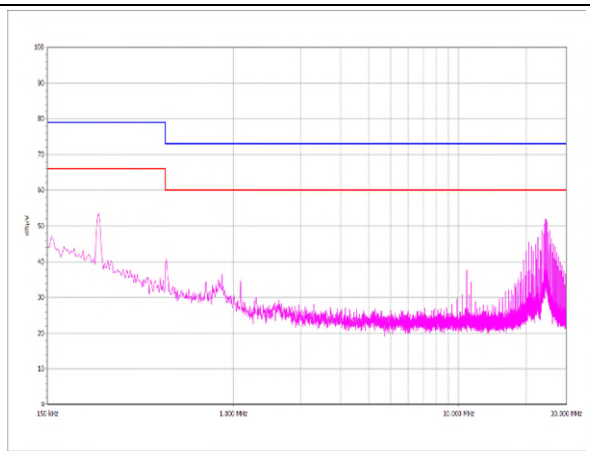
RGF48020A typical conducted emissions with RGB24750W045A-001 at 24Vin, 12Vo and 60% load



RGF48040A typical conducted emissions with RGB24750W045A-001 at 24Vin, 12Vo and 90% load



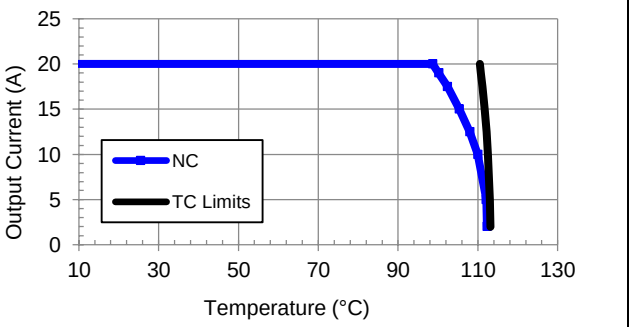
RGF48020A typical conducted emissions with RGC4W300W008A-001 at 48Vin, 12Vo and 100% load



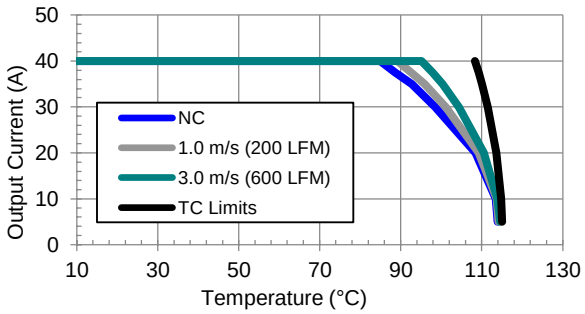
RGF48040A typical conducted emissions with RGC4W300W008A-001 at 24Vin, 48Vo and 100% load

These typical test results are quasi-peak data collected over 150KHz to 30MHz range and are plotted against CISPR32 Class A average and quasi-peak limits. Vertical scale is 10dbuV per division. The tests were conducted in TDK-Lambda's lab environment using each product's standard evaluation kit.

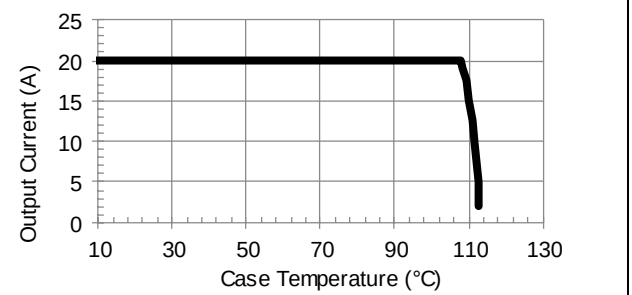
Thermal Performance:



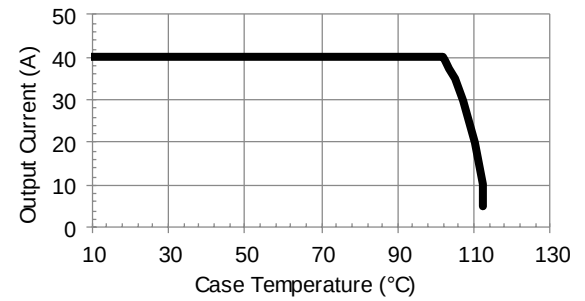
RGF48020A maximum output current vs. ambient temperature at nominal input voltage for natural convection (60lfm) with airflow from pin 2 to pin 1 with pin 1 and pin 4 connected external to the module.



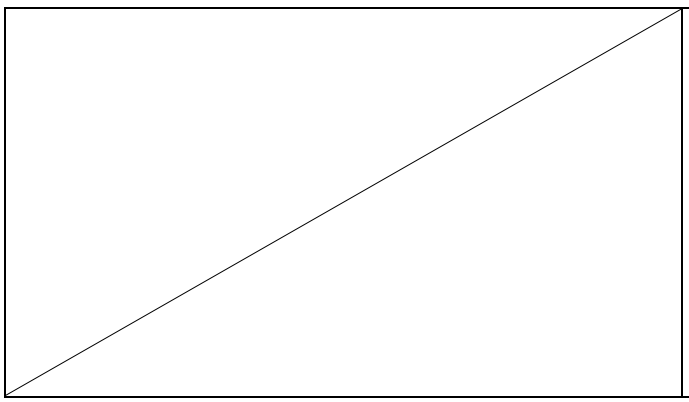
RGF48040A maximum output current vs. ambient temperature at nominal input voltage for natural convection 0.3m/s (60lfm) to 3m/s (600lfm) with airflow from pin 2 to pin 1 with pin 1 and pin 4 connected external to the module.

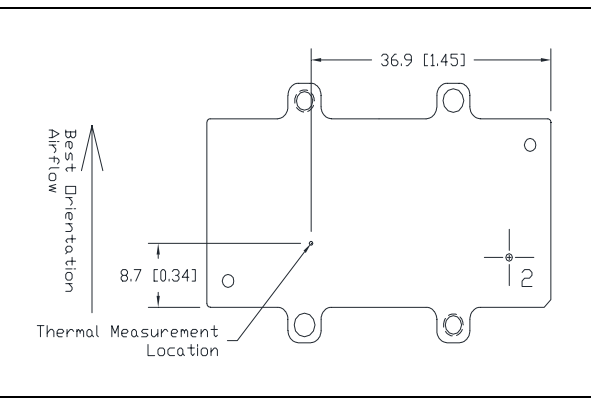


RGF48020A typical maximum output versus case temperature in an enclosed environment with Vin = 24V



RGF48040A typical maximum output versus case temperature in an enclosed environment with Vin = 24V

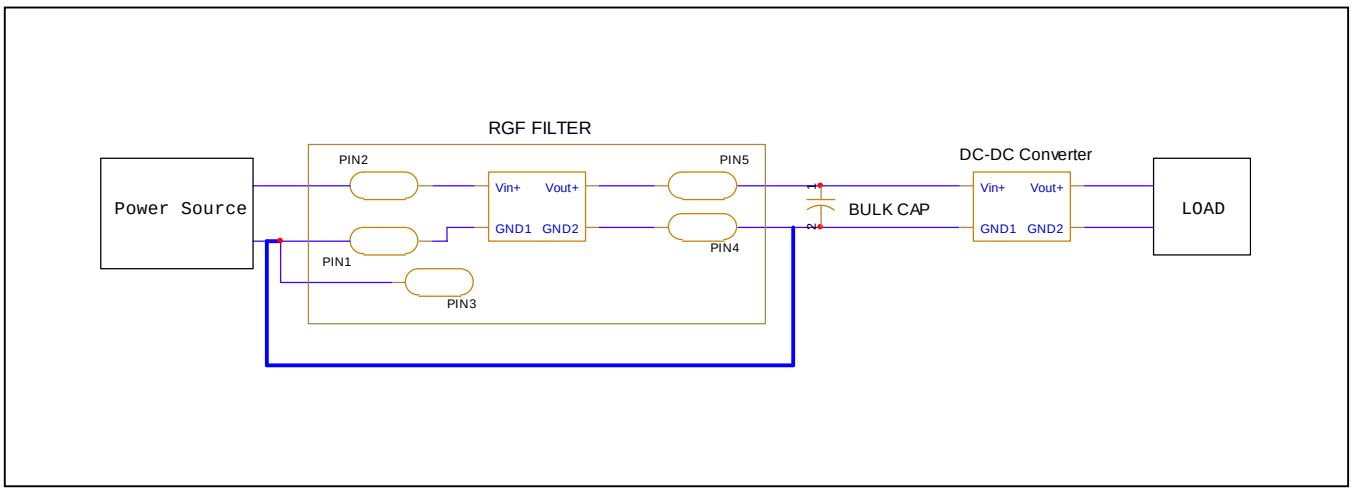




RGF48 thermal measurement location – top view

The thermal curves provided are based upon measurements made in TDK-Lambda's experimental test setup that is described in the Thermal Management section. Due to the large number of variables in system design, TDK-Lambda recommends that the user verify the module's thermal performance in the end application. The critical component should be thermocoupled and monitored and should not exceed the temperature limit specified in the derating curve above. It is critical that the thermocouple be mounted in a manner that gives direct thermal contact or significant measurement errors may result. TDK-Lambda can provide modules with a thermocouple pre-mounted to the critical component for system verification tests.

Simplified Schematic:



Notes:

(1) When paired with a DC-DC converter module, the RGF filter module produces a significant amount of differential mode attenuation over a broad frequency range which reduces system noise and simplifies compliance to typical EMI standards. The RGF filter module does not contain common-mode noise filtering elements, so it is most appropriate for filtering non-isolated DC-DC converters. For isolated converters, the RGF filter module can still be used in conjunction with appropriate common-mode noise reducing components.

(2) To ensure system stability, it is crucial to include the recommended input bulk capacitance (BULK CAP) for the DC-DC converter module at its input.

(3) TDK capacitor technology and the internal damping in the RGF filter module will help users avoid input filter oscillations, a common issue with other competitive solutions' highly inductive filter designs.

(4) Although Pin 1 and Pin 4 are internally connected, these pins must also be externally connected via a copper trace or plane capable of carrying the load current to ensure proper thermal performance.

(5) The RGF filter module will not be damaged by reverse input voltage or by applying voltage at the output pins.

(6) RGF filter modules can be connected in series to achieve ultra-low noise levels. However, they should not be connected in parallel as there is no mechanism to ensure current sharing between parallel filter modules.

(7) In all applications, especially those with high current, it is essential to confirm both thermal and electrical performance in the end application.

Thermal Management:

An important part of the overall system design process is thermal management; thermal design must be considered at all levels to ensure good reliability and lifetime of the final system. Superior thermal design and the ability to operate in severe application environments are key elements of a robust, reliable module.

A finite amount of heat must be dissipated from the filter module to the surrounding environment. This heat is transferred by the three modes of heat transfer: convection, conduction and radiation. While all three modes of heat transfer are present in every application, convection is the dominant mode of heat transfer in most applications. However, to ensure adequate cooling and proper operation, all three modes should be considered in a final system configuration.

The open frame design of the filter module provides an air path to individual components. This air path improves convection cooling to the surrounding environment, which reduces areas of heat concentration and resulting hot spots.

Test Setup:

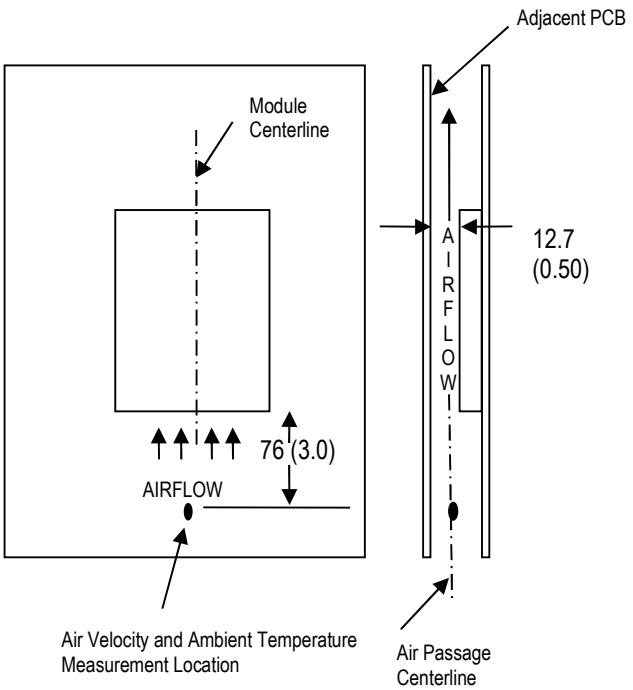
The thermal performance data of the filter module is based upon measurements obtained from a wind tunnel test with the setup shown in the wind tunnel figure. This thermal test setup replicates the typical thermal environments encountered in most modern electronic systems with distributed power architectures. The electronic equipment in networking, telecom, wireless, and advanced computer systems operate in similar environments and utilizes vertically mounted PCBs or circuit cards in cabinet racks.

The module, as shown in the figure, is mounted on a printed circuit board (PCB) and is vertically oriented within the wind tunnel. The cross section of the airflow passage is rectangular. The spacing between the top of the module and a parallel facing PCB is kept at a constant (0.5 in). The power module's orientation with respect to the airflow direction can have a significant impact on the module's thermal performance.

Thermal De-rating:

For proper application of the module in a given thermal environment, output current de-rating curves are provided as a design guideline on the Thermal Performance section for the module of interest. The module temperature should be measured in the final system configuration to ensure proper thermal management of the module. For thermal performance verification, the module temperature should be measured at the component indicated in the thermal measurement location figure on the thermal performance page for the module of interest.

In all conditions, the module should be operated below the maximum operating temperature shown on the de-rating curve. For improved design margins and enhanced system reliability, the power module may be operated at temperatures below the maximum rated operating temperature.



Wind Tunnel Test Setup Figure
(Dimensions are in millimeters and (inches)

Heat transfer by convection can be enhanced by increasing the airflow rate that the module experiences. The maximum output current of the module is a function of ambient temperature (Ta) and airflow rate as shown in the thermal performance figures on the thermal performance page for the module of interest. The curves in the figures are shown for natural convection through 2 m/s (400 ft/min). The data for the natural convection condition has been collected at 0.3 m/s (60 ft/min) of airflow, which is the typical airflow generated by other heat dissipating components in many of the systems that these types of modules are used in. In the final system configurations, the airflow rate for the natural convection condition can vary due to temperature gradients from other heat dissipating components.

Reliability:

The modules are designed using TDK Lambda's stringent design guidelines for component derating, product qualification, and design reviews. The MTBF is calculated to be greater than 60 million hours at full output power and Ta = 40˚C using the Telcordia SR-332 calculation method.

Quality:

TDK Lambda's product development process incorporates advanced quality planning tools such as FMEA and Cpk analysis to ensure designs are robust and reliable. All products are assembled at ISO certified assembly plants.

Warranty:

TDK Lambda's comprehensive line of power solutions includes efficient, high-density DC-DC converters. TDK Lambda offers a three-year limited warranty. Complete warranty information is listed on our web site or is available upon request from TDK-Lambda.

Safety Considerations:

For safety agency approval of the system in which the filter module is installed, the module must be installed in compliance with the creepage and clearance requirements of the safety agency.

To preserve maximum flexibility, the filter modules are not internally fused. An external input line normal blow fuse with a maximum value of 50A is required by safety agencies. A lower value fuse can be selected based upon the maximum dc input current and inrush energy of the filter module.

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