

PXD-M and PXG-M Applications Notes

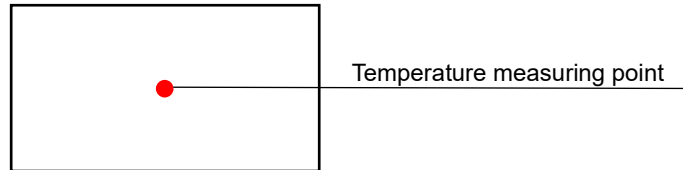
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Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point on the top of the converter as shown in the figure below. The temperature at this location should not exceed 105°C. When operating, adequate cooling must be provided to maintain the test point temperature at or below 105°C. Although the maximum point temperature of the power modules is 105°C, limiting this temperature to a lower value enhances the reliability.

Thermal test condition with vertical direction by natural convection (20LFM).

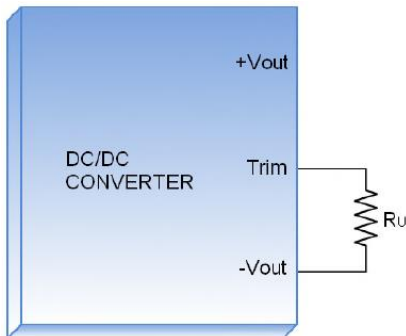


Output Voltage Adjustment

It allows the user to increase or decrease the output voltage of the module. This is accomplished by connecting an external resistor between the TRIM pin and either the +Vout or -Vout pins. With an external resistor between the TRIM and -OUTPUT pin, the output voltage increases. With an external resistor between the TRIM and +OUTPUT pin, the output voltage decreases. The external TRIM resistor needs to be at least 1/16W of rated power.

Trim Up Equation

$$R_U = \left[\frac{G \times L}{V_{o,up} - L - K} - H \right] \Omega$$



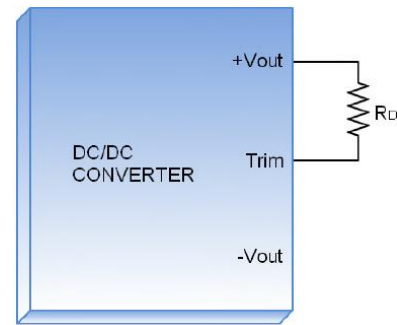
Example: PXG-M15-24WS05 (Trim-Up to 5.1VDC)

$$R_U = \left[\frac{5110 \times 2.5}{5.1 - 2.5 - 2.5} - 2050 \right] \Omega$$

$R_U = 125.7k\Omega$

Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H \right] \Omega$$



Example: PXG-M15-24WS12 (Trim-Down to 11.4VDC)

$$R_D = \left[\frac{(11.4 - 2.5) \times 10000}{(12 - 11.4)} - 5110 \right] \Omega$$

$R_D = 143.223k\Omega$

Trim Constants

Models	G	H	K	L
PXG-M15xxWS05 / PXG-M20xxWS05 / PXD-M30xxWS05	5,110	2,050	2.5	2.5
PXG-M15xxWS12 / PXG-M20xxWS12 / PXD-M30xxWS12	10,000	5,110	9.5	2.5
PXG-M15xxWS15 / PXG-M20xxWS15 / PXD-M30xxWS15	10,000	5,110	12.5	2.5
PXG-M15xxWS24 / PXG-M20xxWS24 / PXD-M30xxWS24	56,000	13,000	21.5	2.5

Fuse Considerations

Caution: This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. For maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The table below is based on the information provided in the data sheet on inrush energy and maximum DC input current at low Vin

Models	Fuse Rating (A)	Fuse Type
PXG-M15-24Wxxx	3.15	Slow-Blow
PXG-M15-48Wxxx	1.6	Slow-Blow
PXG-M20-24Wxxx	4	Slow-Blow
PXG-M20-48Wxxx	2	Slow-Blow
PXD-M30-24Wxxx	6.3	Slow-Blow
PXD-M30-48Wxxx	3.15	Slow-Blow

According to actual current value, calculating fuse ratings base on the following equations:

Eq. 1: $I_{FUSE} \geq I_{in} / (\text{Re rating} \times \text{Safety margin})$

Eq. 2: Melting $I^2t = I_{PULSE,act}^2 \cdot t / 0.22$

I_{FUSE} = current rating of fuse

I_{in} = actual value of input current

Re rating = % of fuse rating base on ambient temperature (Fuse rating is variety under different ambient temperature)

Safety margin = % of fuse rating set by user

Melting I^2t = pulse energy rating of fuse

$I_{PULSE,act}$ = actual input pulse current

t = width of the input pulse current

Reverse Input Voltage Protection

Avoid the reverse polarity input voltage; otherwise, it will damage the DC/DC converter. It is likely to protect the module from the reverse input voltage by installing an external diode. The diode can blow the line fuse to protect DC/DC converter. Recommend using Schottky diode below for reverse input voltage protection.

Models	Voltage Rating of Diode (V)	Current Rating of Diode
PXG-Mxx-24Wxxx and PXD-M30-24xxx	60	1~1.5 x Fuse Rating
PXG-Mxx-48Wxxx and PXD-M30-48xxx	100	

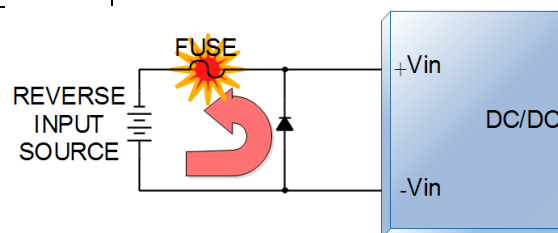


Fig. 1: Reverse Input Voltage Protection

Remote ON/OFF

For models with remote on/off option - suffix -N for Negative Logic (Example: PXG-M20-48WS05-N)

The module is ON during logic Low and turns OFF during logic High. The Ctrl pin is referenced to -Vin. If not using the remote on/off feature, the Ctrl and -Vin pins should be connected together (shorted) or apply 0-1.2V between these two pins for the module to be ON.

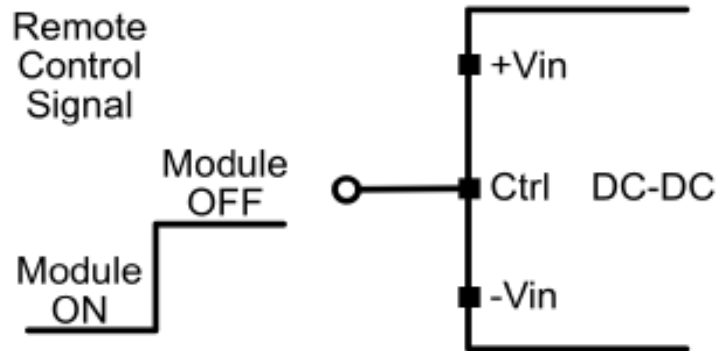


Fig. 2a: Suffix -N (Negative Logic)

Remote ON/OFF

For models with remote on/off option - suffix -P for Positive Logic (Example: PXG-M20-48WS05-P)

The module is ON during logic High and turns OFF during logic Low. The Ctrl pin is referenced to -Vin. If not using the remote on/off feature, the Ctrl and -Vin pins should be open or apply 3.5~12V between these two pins for the module to be ON.

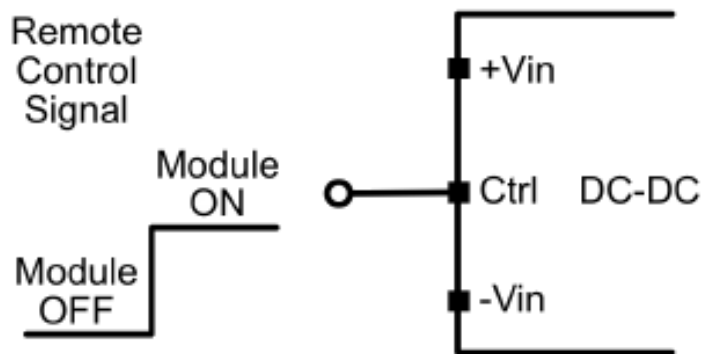


Fig. 2b: Suffix -P (Positive Logic)

Immunity Considerations			
Test	Standard	Test Level	Criteria
ESD	EN61000-4-2	Air \pm 15kV and Contact \pm 8kV	A
Radiated Susceptibility	EN61000-4-3	10V/m	A
EFT Burst	EN61000-4-4	\pm 2kV	A
Surge	EN61000-4-5	\pm 2kV	A
Conducted Susceptibility	EN61000-4-6	10 Vrms	A
Magnetic Fields	EN61000-4-8	100A/m continuous; 1000A/m 1s	A

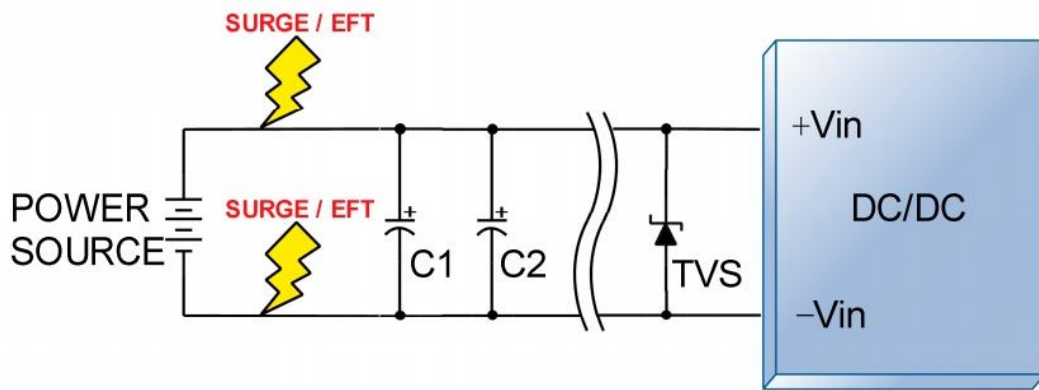


Fig. 3a: Surge and EFT Protections



Fig. 3b: PCB Trace (incorrect PCB layout reduces ability to suppress Surge and EFT)

Component Selection			
Model	Component	Specification	Reference
PXG-Mxx-24Wxxx and PXD-M30-24xxx	C1	220 μ F/100V	Nippon Chemi-con KY series
	C2		
	TVS	58V/3000W	SMDJ58A
PXG-Mxx-48Wxxx and PXD-M30-48xxx	C1	220 μ F/100V	Nippon Chemi-con KY series
	C2		
	TVS	120V/3000W	SMDJ120A

EMI Considerations

Standard modules meet EN55011-A, EN55032-A without external components (EN55032-B with external components)

Recommended external EMI filter for EN55032-B

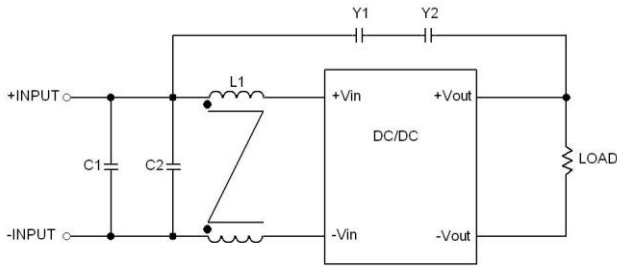


Fig. 4a: Single Output

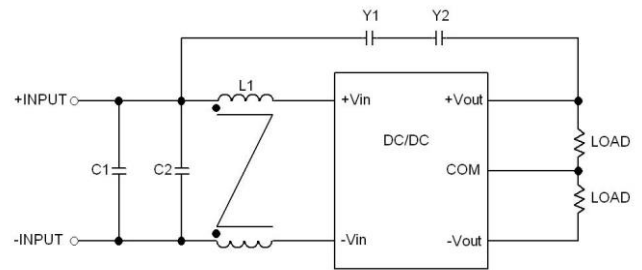


Fig. 4b: Dual Output

Component Selection

Model	C1	C2	Y1, Y2	L1
PXG-Mxx-24Wxxx and PXD-M30-24xxx	N/A	10 μ F/50V 1210 MLCC	100pF/400VAC	145 μ H, PMT-051
PXG-Mxx-48Wxxx and PXD-M30-48xxx	2.2 μ F/100V 1210 MLCC	2.2 μ F/100V 1210 MLCC	Y1	373 μ H, PMT-026

Recommended Layout Patterns (Single Output)

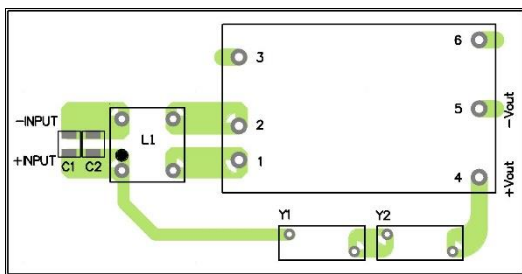


Fig. 5a: Top View

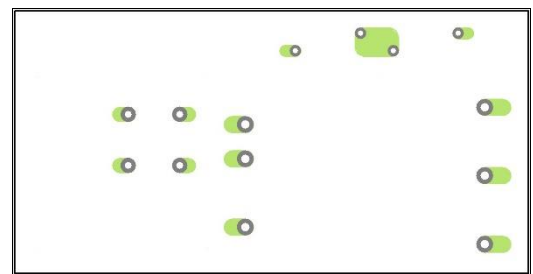


Fig. 5b: Bottom View

Recommended Layout Patterns (Dual Output)

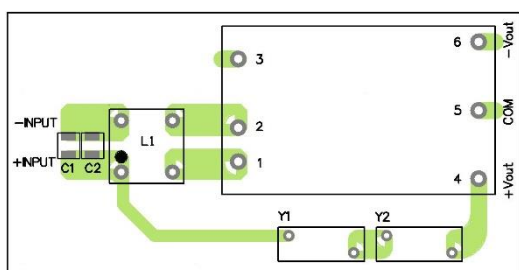


Fig. 6a: Top View

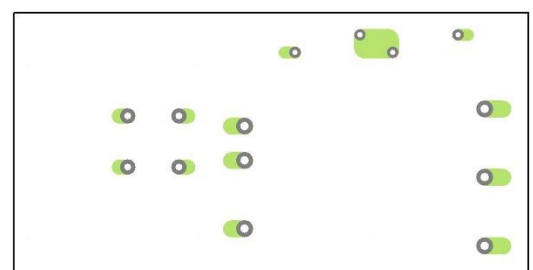
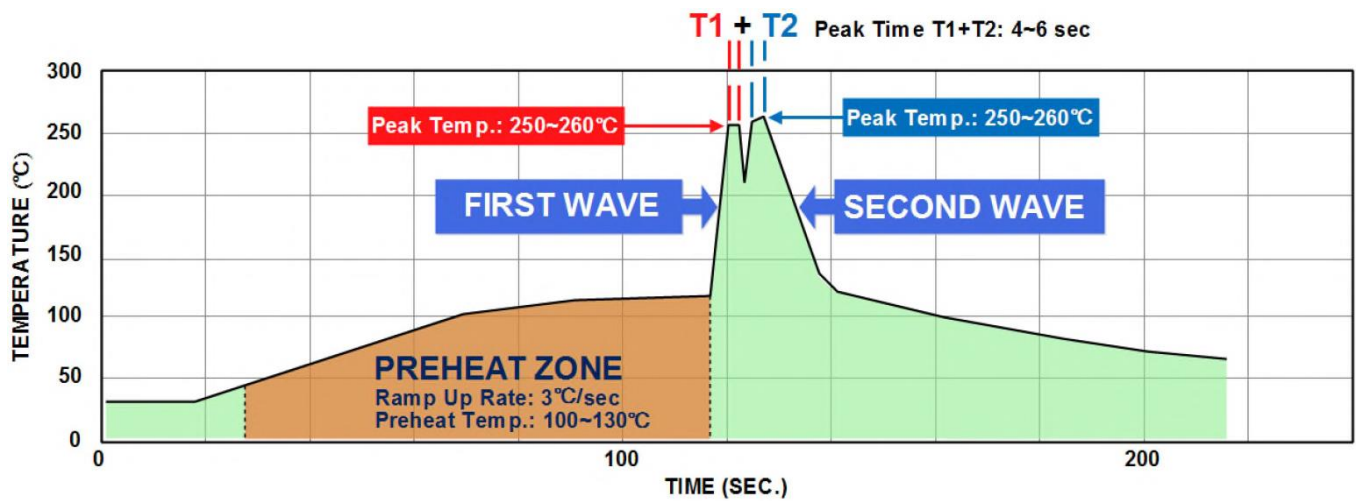


Fig. 6b: Bottom View

Wave Solder Profile



Lead free wave solder profile

Reference Solder: Sn-Ag-Cu ; Sn-Cu

Hand Soldering (Reference):

Soldering iron: Power 150W

Soldering time: 3~6 sec

Temp: 410~430°C