PXD15-xxDxx Dual Output DC/DC Converter

9 to 75 Vdc input, 5 to 15 Vdc Dual Output, 15W

TDK·Lambda

Features

- Low profile: 2.0X1.0X0.4 inches (50.8X25.4X10.2mm)
- 2:1 wide input voltage of 9-18, 18-36 or 36-75VDC
- 15 Watts output power
- Input to output isolation: 1600Vdc, min
- Operating case temperature range :100°C max
- Over-current protection, auto-recovery
- Output over voltage protection
- ISO 9001 certified manufacturing facilities
- UL60950-1, EN60950-1 and IEC60950-1 licensed
- CE Mark meet s2006/95/EC, 93/68/EEC and 2004/108/EC
- Compliant to RoHS EU directive 2002/95/EC

Applications

- Distributed power architectures
- Communication equipment
- Computer equipment

Option

- Positive logic & Negative logic Remote on/off

General Description

The PXD15-xxDxx dual output converter offers 15 watts of output power from a 2 x 1 x 0.4 inch package. This series has a 2:1 wide input voltage of 9-18, 18-36 or 36-75VDC.

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Oct.2005

Absolute Maximum Ratings					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Input Voltage Continuous Transient (100ms)	12Dxx			36	Vdc
	24Dxx			50	Vdc
	48Dxx			100	Vdc
Operating temperature range(With De-rating curve)	Standard	-40		+85	°C
Operating case range	All			100	°C
Storage temperature	All	-55		+105	°C
I/O Isolation voltage	All	1600			Vdc
I/O Isolation capacitance	All			300	pF

Output Specifications					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Operating Output Range	xxD05	4.95	5.00	5.05	Vdc
	xxD12	11.88	12.00	12.12	Vdc
	xxD15	14.85	15.00	15.15	Vdc
Line Regulation(LL to HL at Full Load)	All	-0.5		0.5	%
Load Regulation(Min. to 100% Full Load)	All	-1		1	%
Cross regulation asymmetrical 25%/100% Full Load				5	%
Output Ripple & Noise (20MHz bandwidth)	All			75	mVp-p
Temperature Coefficient	All	-0.02		+0.02	%/°C
Transient Response Recovery Time (25% load step change)	All		250		uS
Output Current	xxD05	0		±1500	mA
	xxD12	0		±625	mA
	12D15	±10		±500	mA
	24D15	0		±500	mA
	48D15	0		±500	mA
Output Over Voltage Protection Zener diode clamp	xxD05		6.2		Vdc
	xxD12		15		Vdc
	xxD15		18		Vdc
Output Over Current Protection	All		150		% FL.
Output Short Circuit Protection	All	Hiccup, automatic recovery			
Output Capacitor Load	xxD05			±1020	μF
	xxD12			±495	μF
	xxD15			±165	μF

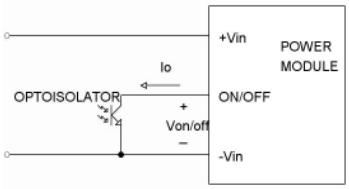
Input Specifications					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Operating Input voltage	12Dxx	9	12	18	Vdc
	24Dxx	18	24	36	Vdc
	48Dxx	36	48	75	Vdc
Input reflected ripple current	All		20		mA p-p
Start up time (nominal vin and constant resistive load)	All		20		mS
Remote ON/OFF					
Negative Logic DC-DC ON	All	0		1.2	Vdc
DC-DC OFF	All	3.5		12	Vdc
Positive Logic DC-DC ON	All	3.5		12	Vdc
DC-DC OFF	All	0		1.2	Vdc

General Specifications					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Efficiency Test at Vin, nom and full load	12D05		83		%
	12D12		86		%
	12D15		84		%
	24D05		84		%
	24D12		86		%
	24D15		86		%
	48D05		85		%
	48D12		88		%
	48D15		87		%
Isolation Resistance	All	10^9			Ω
Isolation Capacitance	All		300		pF
Switching Frequency (Vin, nom and full load)	All		300		kHz
Weight	All		27		g
MTBF	All		2.041×10^6		hours

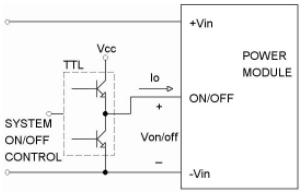
Remote On/Off Control

The Remote ON/OFF Pin is used to turn on and off the DC/DC converter. The user must use a switch to control the logic voltage (high or low) level of the pin referenced to -Vin. The switch can be an open collector transistor, FET or Opto-Coupler. The switch must be capable of sinking up to 0.5 mA for a low-level logic voltage. High-level logic of the ON/OFF signal, the allowable leakage current of the switch at 12V is 0.5mA.

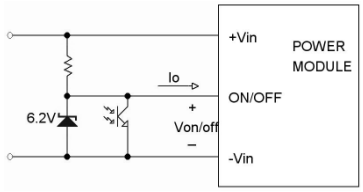
Remote ON/OFF Implementation Circuits



Isolated-Control Remote ON/OFF

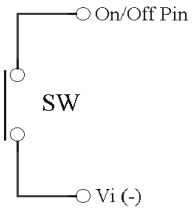


Level Control Using TTL Output

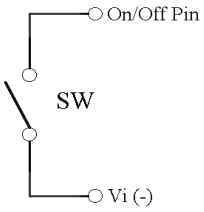


Level Control Using Line Voltage

Positive logic structure used to turn on the DC/DC module when the ON/OFF pin is at high-level logic. A low-level logic is used for turn off.



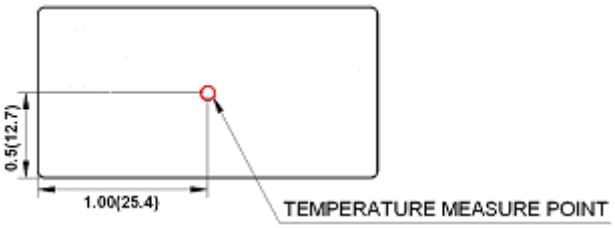
When PXD15-xxSxx module is turned off at Low-level logic



When PXD15-xxSxx module is turned on at High-level logic

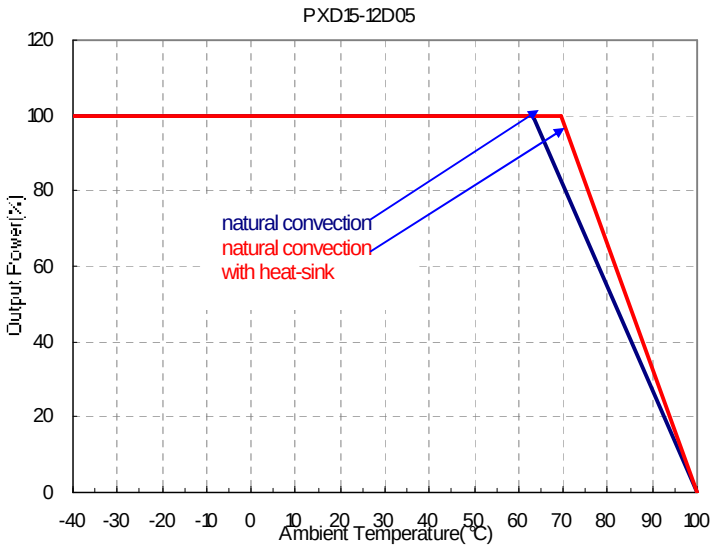
Thermal Consideration

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 as shown in the figure below. The temperature at this location should not exceed 100°C. When operating, adequate cooling must be provided to maintain the test point temperature at or below 100°C . Although the maximum point temperature of the power module is 100°C , limiting this temperature to a lower value will yield higher reliability.

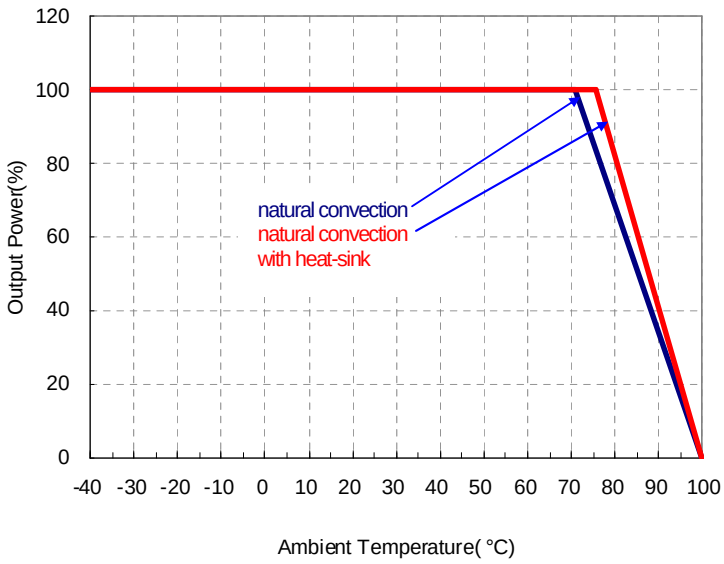


Measurement shown in inches(mm) TOP VIEW

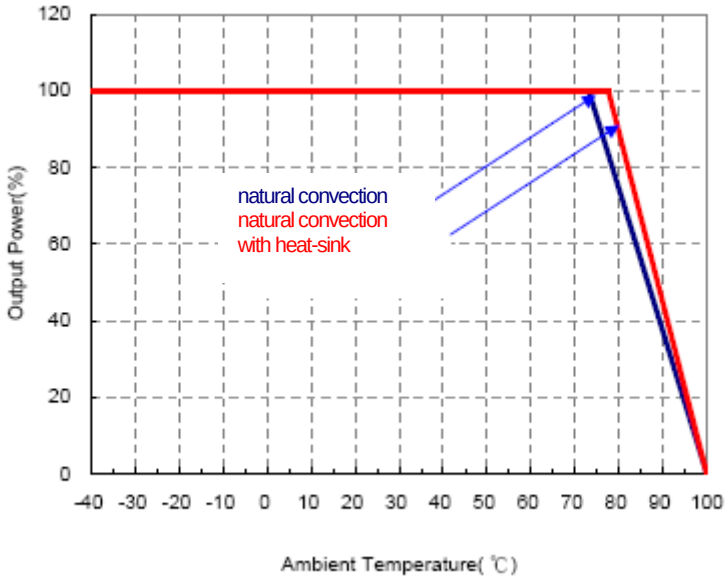
Following are de-rating curves for PXD15-12D05, PXD15-24D12, and PXD15-48D15



PXD15-24D12



PXD15-48D15



Output Over Current Protection

When excessive output currents occur in the system, circuit protection is required on all converters. Normally, overload current is maintained at approximately 150 percent of rated current for PXD15-xxDxx series..

Hiccup-mode is a method used in a converter whose purpose is to protect the converter from being damaged during an over-current fault condition. It also enables the converter to restart when the fault is removed. There are other ways of protecting the converter when it is over-loaded, such as the maximum current limiting or the current foldback method.

One of the problems resulting from over current is that excessive heat may be generated in power devices; especially MOSFET and Schottky diodes and the temperature of these devices may exceed their specified limits. A protection mechanism has to be used to prevent these power devices from being damaged.

The operation of hiccup is as follows. When the current sense circuit sees an over-current event, the controller shuts off the converter for a given time and then tries to re-start the converter. If the over-load condition has been removed, the converter will start-up and operate normally; otherwise, the controller will see another over-current event and shut off the converter again, repeating the previous cycle. Hiccup operation has none of the drawbacks of the other two protection methods, although it's circuit is more complicated because it requires a timing circuit. The excess heat due to overload lasts for only a short duration in the hiccup cycle, hence the junction temperature of the power devices is much lower.

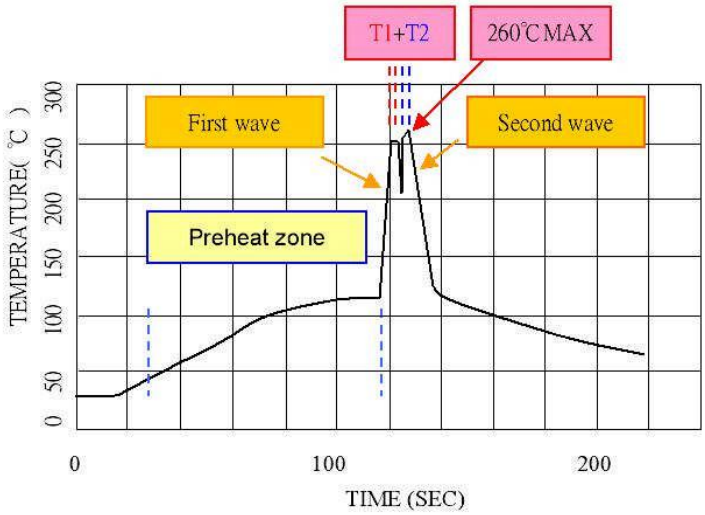
Short Circuit Protection

Continuous, hiccup and auto-recovery mode.

During short circuit, converter still shut down. The average current during this condition will be very low and the device can be safety in this condition.

Soldering and Reflow Consideration

Lead free wave solder profile for PXD15-xxDxx DIP type



Zone	Reference Parameter
Preheat zone	Rise temp. speed : 3°C / sec max. Preheat temp. : 100~130°C
Actual heating	Peak temp. : 250~260°C Peak time (T1+T2 time) : 4~6 sec

Reference Solder: Sn-Ag-Cu/Sn-Cu

Hand Welding: Soldering iron-Power 90W

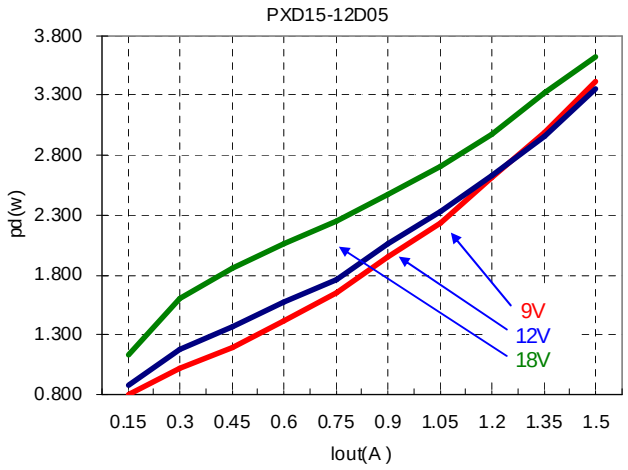
Welding Time: 2-4 sec

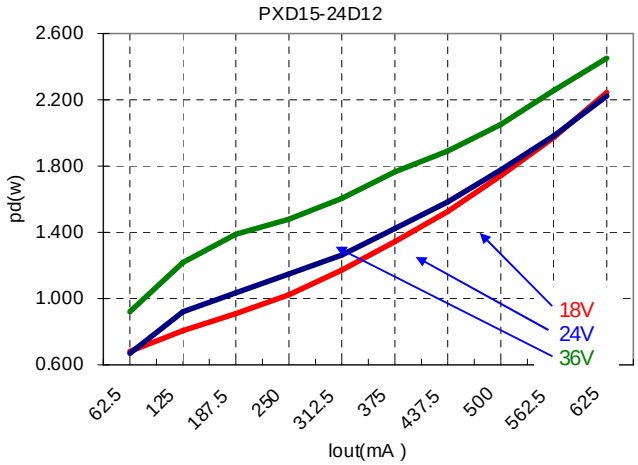
Temp.380-400 °C

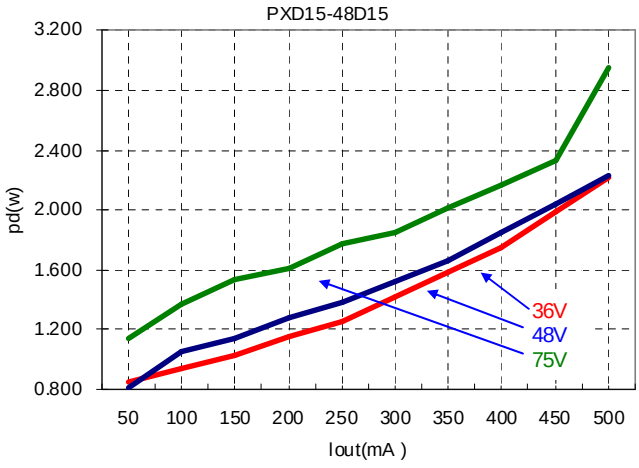
Characteristic Curve

Efficiency

a. Efficiency with load change under different line condition at room temperature

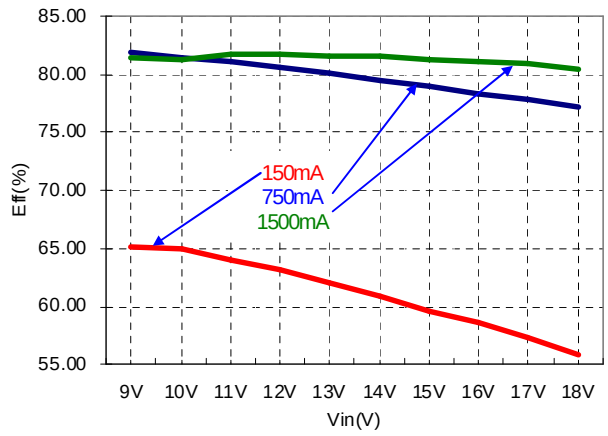




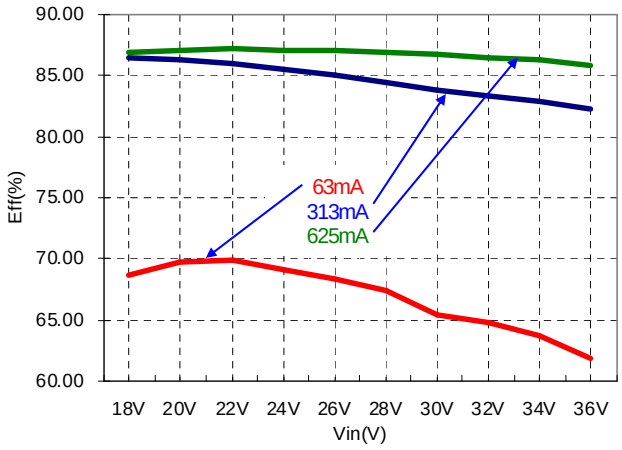


b. Efficiency with line change under different load condition at room temperature

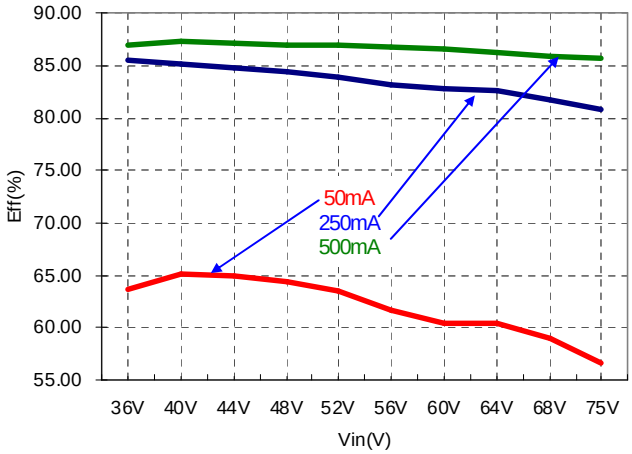
PXD15-12D05



PXD15-24D12

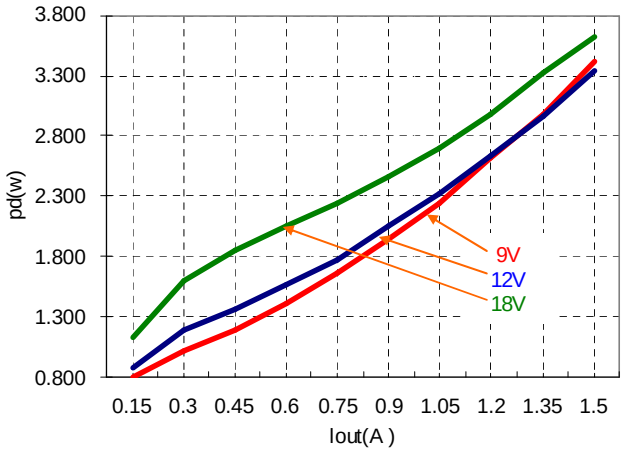


PXD15-48D15

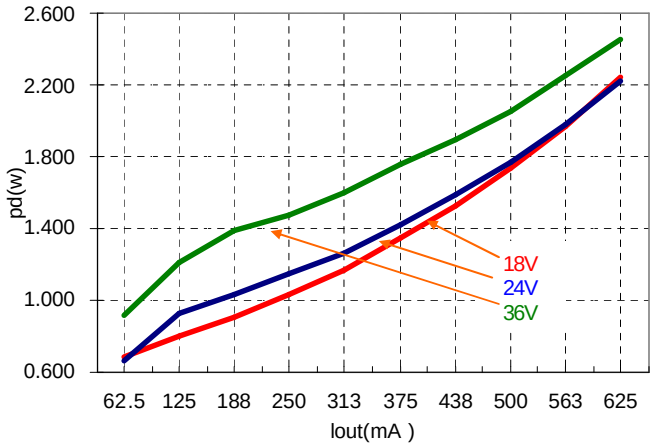


Power dissipation curve

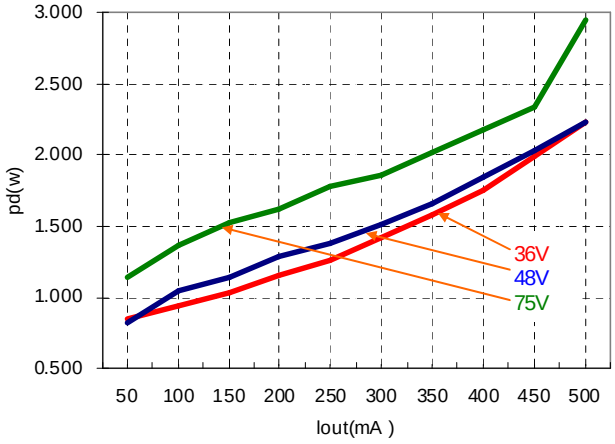
PXD1512D05



PXD15-24D12

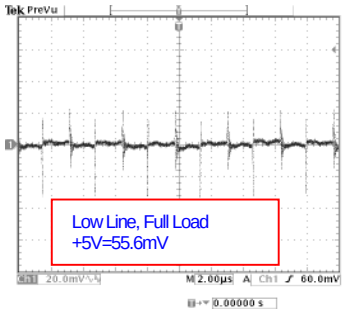


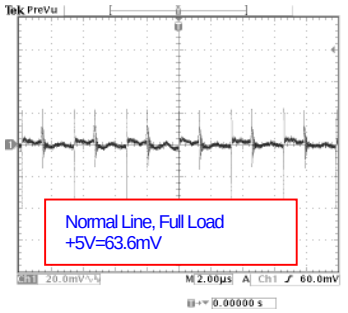
PXD15-48D15

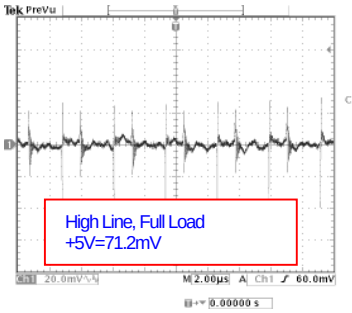


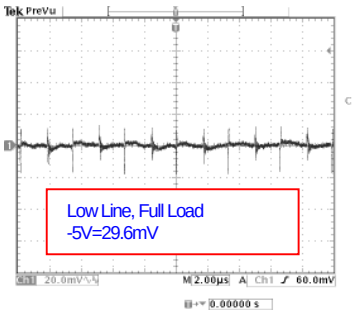
Output Ripple & Noise

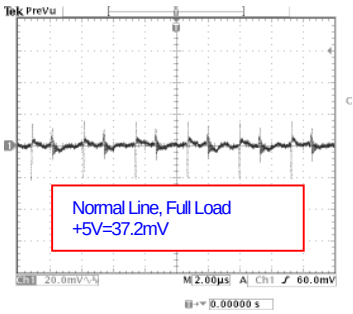
PXD15-12D05

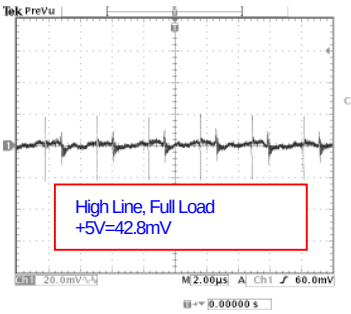












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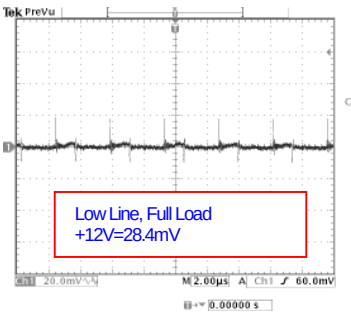
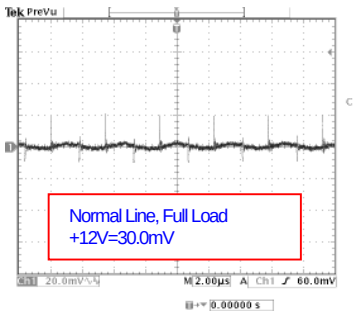
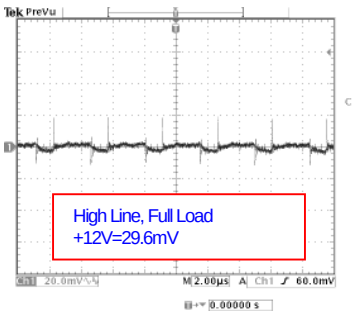
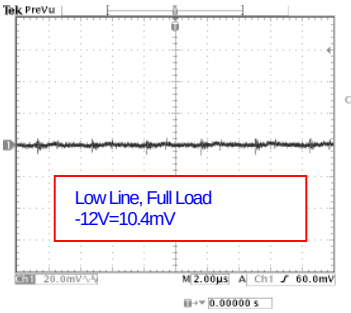
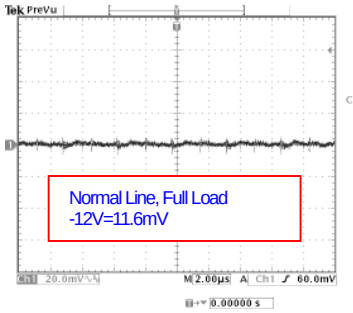
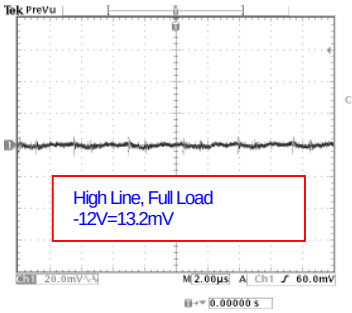






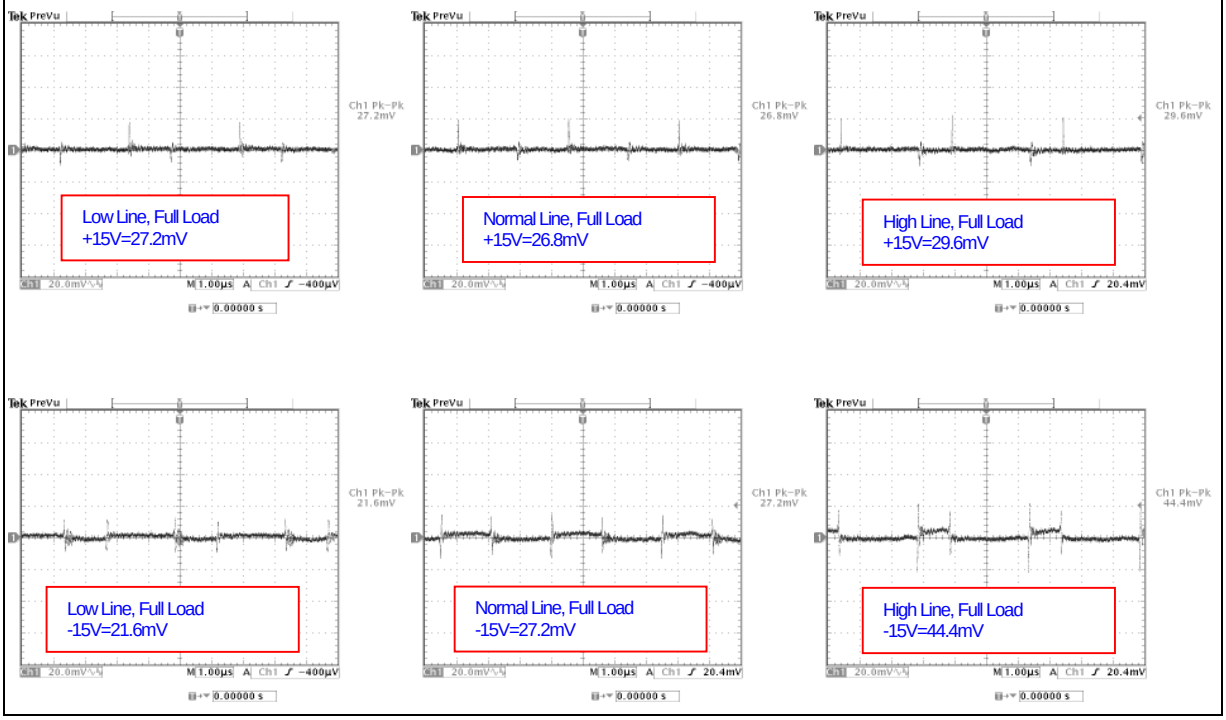






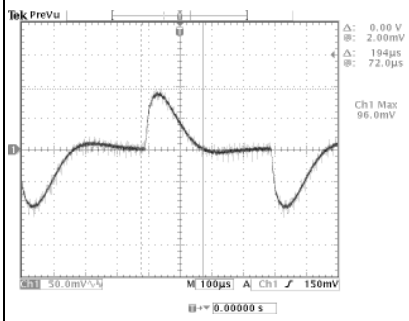
Output Ripple & Noise

PXD15-48D15

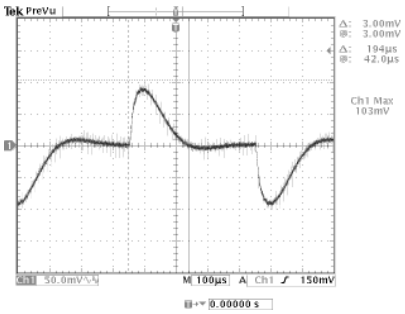


Transient Peak and Response

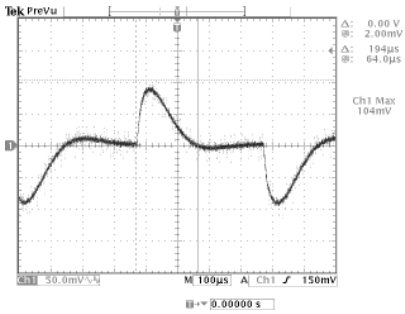
PXD15-12D05



Low Line, Full Load
Transient Peak 96.0mV
Transient Response 194uS

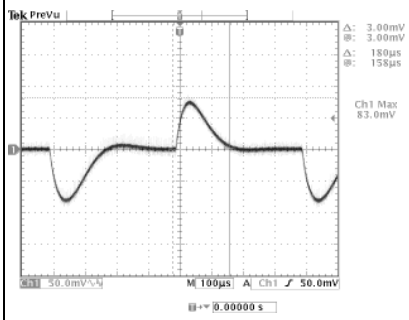


Normal Line, Full Load
Transient Peak 103.0mV
Transient Response 194uS

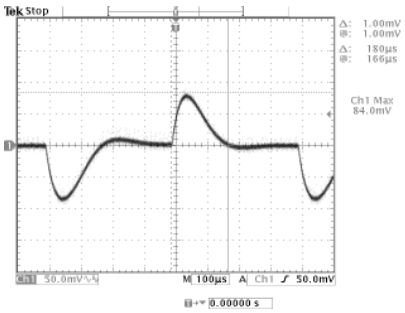


High Line, Full Load
Transient Peak104.0mV
Transient Response 194uS

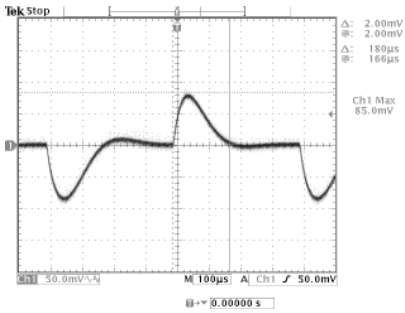
PXD15-24D12



Low Line, Full Load
Transient Peak 83.0mV
Transient Response 180uS

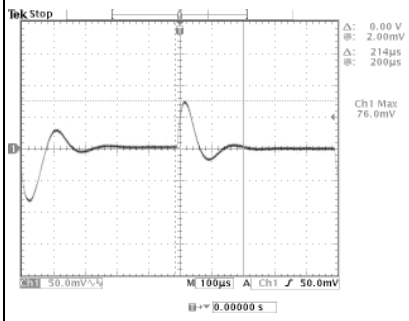


Normal Line, Full Load
Transient Peak 84.0mV
Transient Response180uS

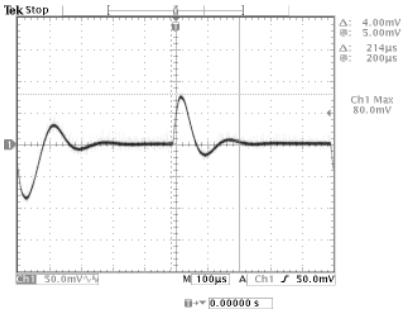


High Line, Full Load
Transient Peak85.0mV
Transient Response 180uS

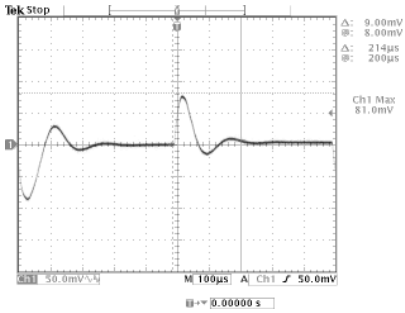
PXD15-48D15



Low Line, Full Load
Transient Peak 76.0mV
Transient Response 214uS



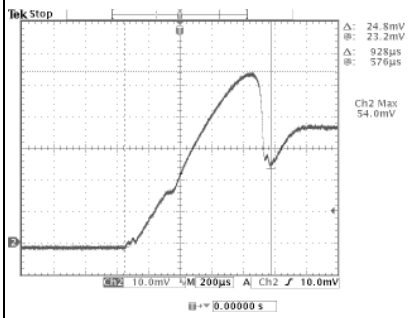
Normal Line, Full Load
Transient Peak 80.0mV
Transient Response214uS



High Line, Full Load
Transient Peak 81.0mV
Transient Response 214uS

Inrush Current

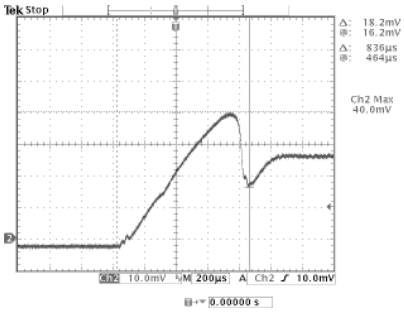
PXD15-12D05



Low Line, Full Load

Inrush current=(54.0/10) X500mA=2700mA

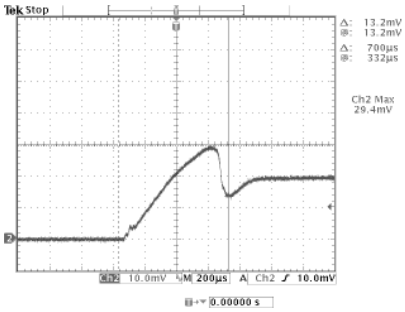
Duration: 928uS



Normal Line, Full Load

Inrush current=(40.0/10) x500mA=2000mA

Duration: 836uS

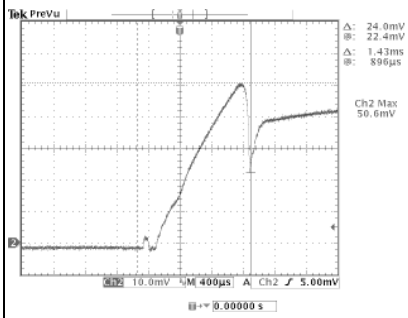


High Line, Full Load

Inrush current=(29.4/10) x500mA=1470mA

Duration: 700uS

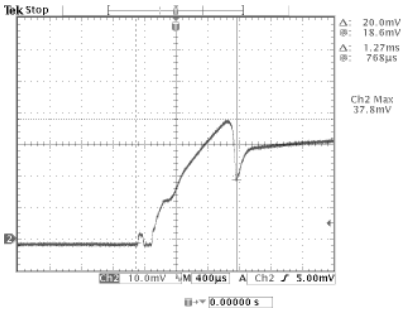
PXD15-24D12



Low Line, Full Load

Inrush current=(50.6/10) X200mA=1012mA

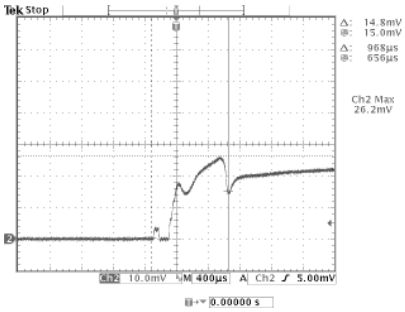
Duration: 1.43mS



Normal Line, Full Load

Inrush current=(37.8/10) x200mA=756mA

Duration: 1.27mS

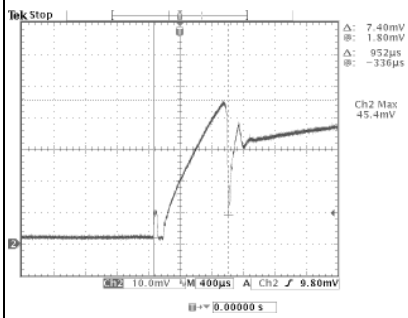


High Line, Full Load

Inrush current=(26.2/10) x200mA=524mA

Duration: 988uS

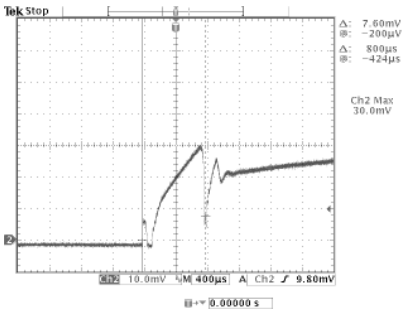
PXD15-48D15



Low Line, Full Load

Inrush current=(45.4/10) X100mA=454mA

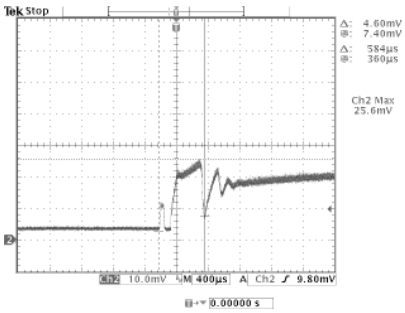
Duration: 952uS



Normal Line, Full Load

Inrush current=(30.0/10) x100mA=300mA

Duration: 800uS



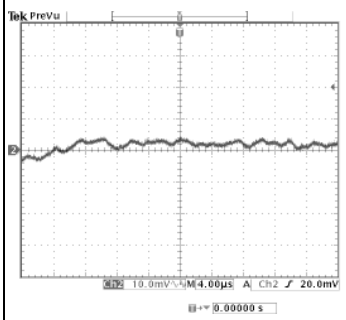
High Line, Full Load

Inrush current=(25.6/10) x100mA=256mA

Duration: 584uS

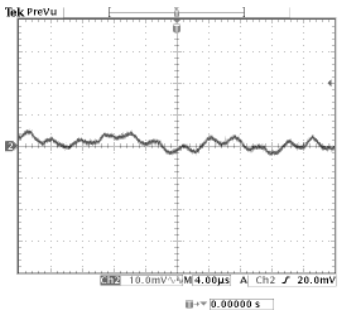
Input Ripple Current

PXD15-12D05



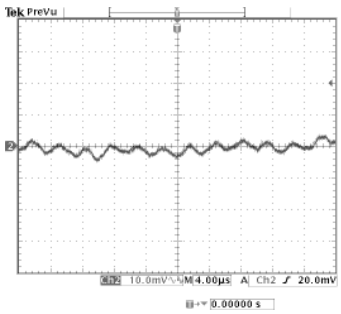
Low Line, Full Load

Ripple current=(8.2/10) x5=4.1mA



Normal Line, Full Load

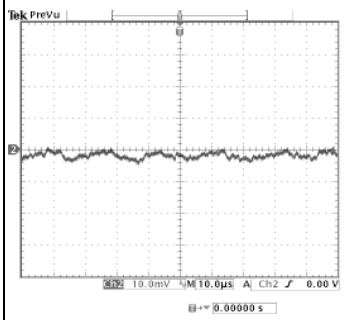
Ripple current=(7.6/10) x5=3.8mA



High Line, Full Load

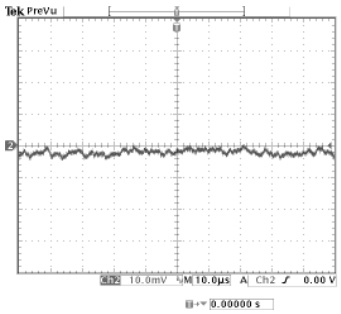
Ripple current=(9.2/10) x5=4.6mA

PXD15-24D12



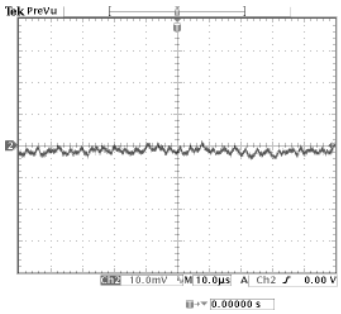
Low Line, Full Load

Ripple current=(5.8/10) x5=2.9mA



Normal Line, Full Load

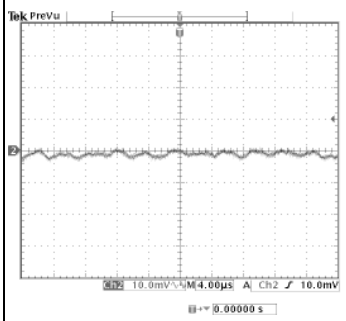
Ripple current=(5.2/10) x5=2.6mA



High Line, Full Load

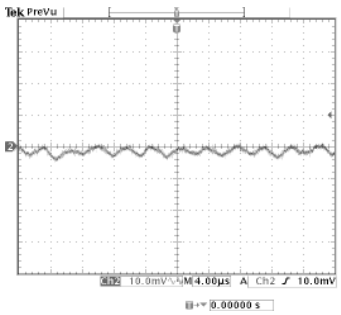
Ripple current=(6.2/10) x5=3.1mA

PXD15-48D15



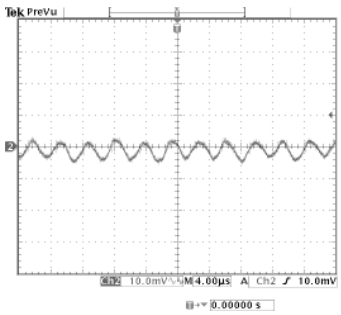
Low Line, Full Load

Ripple current=(5.810) x5=2.9mA



Normal Line, Full Load

Ripple current=(6.6/10) x5=3.3mA

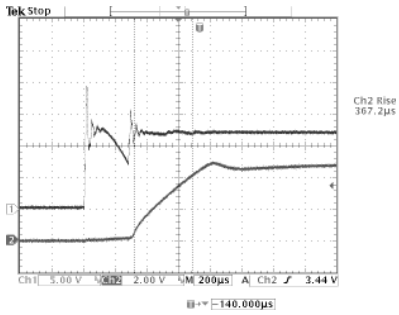


High Line, Full Load

Ripple current=(8.6/10) x5=4.3mA

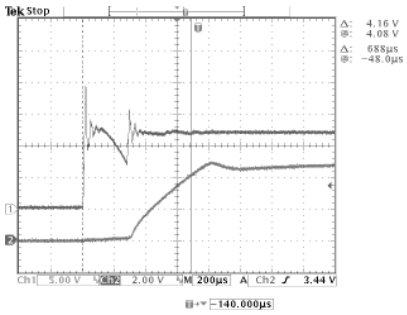
Delay Time and Rise Time

PXD15-12D05



Normal Line, Full Load

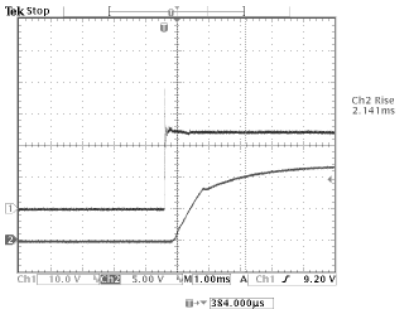
Rise Time=367.2uS



Normal Line, Full Load

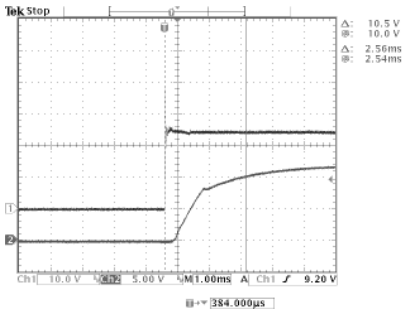
Delay Time= 688uS

PXD15-24D12



Normal Line, Full Load

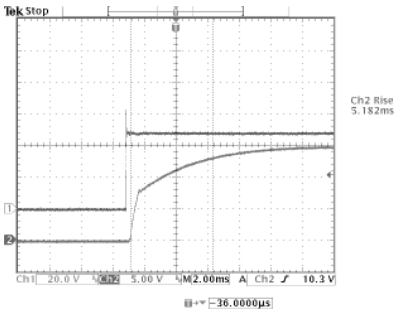
Rise Time=2.141mS



Normal Line, Full Load

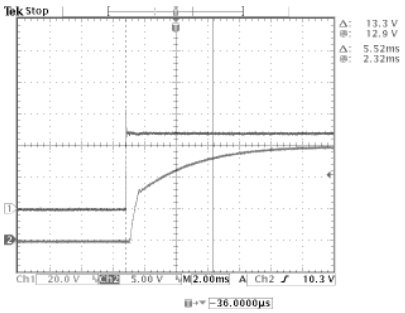
Delay Time=2.56mS

PXD15-48D15



Normal Line, Full Load

Rise Time=5.182mS

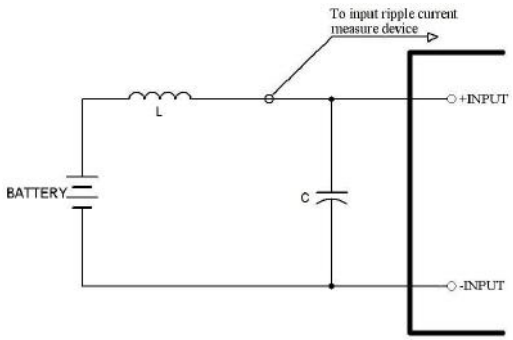


Normal Line, Full Load

Delay Time= 5.52mS

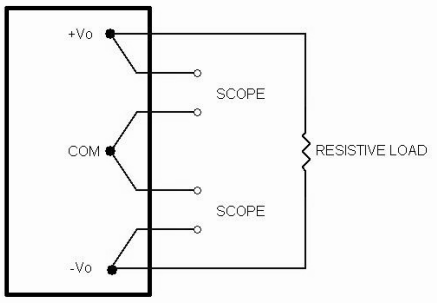
Testing Configurations

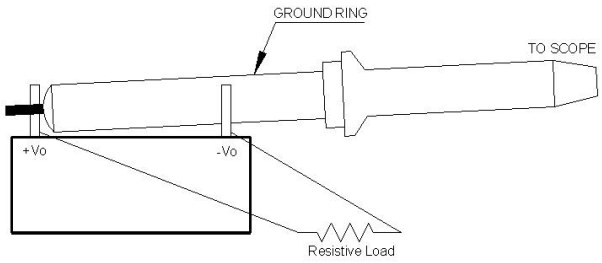
Input Reflected-ripple Current Measurement Test:



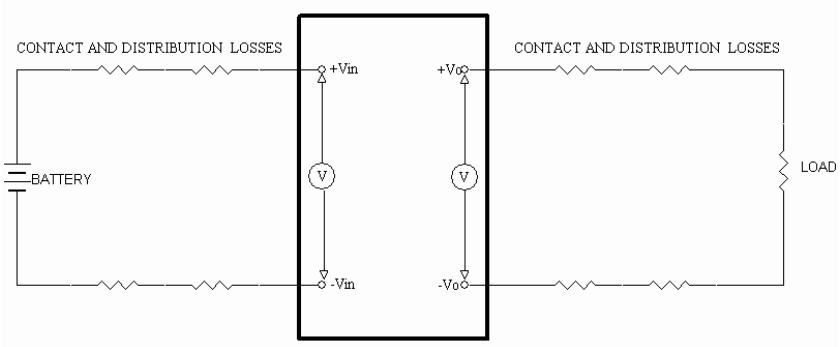
Component	Value	Voltage	Reference
L	12μH	----	----
C	100μF	100V	Aluminum Electrolytic Capacitor

Peak-to-Peak Output Ripple & Noise Measurement Test:





Output Voltage and Efficiency Measurement Test:



Note: All measurements are taken at the module terminals.

$$Efficiency = \left(\frac{V_o \times I_o}{V_{in} \times I_{in}} \right) \times 100\%$$

Part Number Structure

PXD 15 – 24 D 12

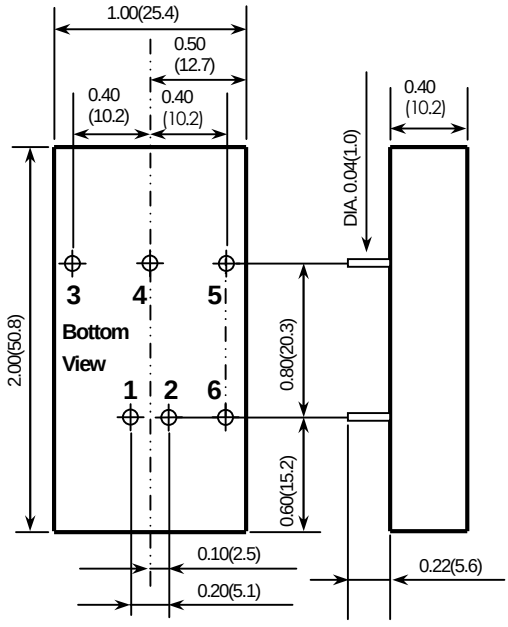
Total Output power
15 Watt

Input Voltage Range
12xxx : 9~18V
24xxx : 18~36V
48xxx : 36~75V

Dual Output

Output Voltage
05 : 5V
12 : 12V
15 : 15V

Mechanical Data



PIN CONNECTION	
PIN	Define
1	+ INPUT
2	- INPUT
3	+ OUTPUT
4	COMMON
5	- OUTPUT
6	CTRL (Option)

1. All dimensions in Inches (mm)
2. Pin pitch tolerance ±0.0014(0.35)
3. Tolerance : x.xx±0.02 (x.x±0.5)
   x.xxx±0.01 (x.xx±0.25)

Safety and Installation Instruction

Isolation consideration

The PXD15-xxDxx series features 1.6k Volt DC isolation from input to output, input to case, and output to case. The input to output resistance is greater than 10^9 ohms. Nevertheless, if the system using the converter needs to receive safety agency approval, certain rules must be followed in the design of the system using the model. In particular, all of the creepage and clearance requirements of the end-use safety requirement must be observed. These documents include UL-60950-1, EN60950-1 and CSA 22.2-960, although specific applications may have other or additional requirements.

Fusing Consideration

Caution: This converter is not internally fused. An input line fuse must always be used. This encapsulated converter can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a slow-blow fuse with maximum rating of 6.3 A. Based on the information provided in this data sheet on inrush energy and maximum DC input current, the same type of fuse with lower rating can be used. Refer to the fuse manufacturer's data for further information.

Minimum Load Requirement

10%(of full load) minimum load required. The 10% minimum load requirement is in order to meet all performance specifications. The PXD15-xxDxx series does not properly maintain regulation and operate under a no load condition. The output voltage drops off about 10%.

MTBF and Reliability

The MTBF of PXD15-xxDxx series of DC/DC converters has been calculated using:

1.MIL-HDBK-217F under the following conditions:

Nominal Input Voltage

Io = Io, max

Ta = 25°C

The resulting figure for MTBF is 1.044×10^6 hours.

2.Bell-core TR-NWT-000332 Case I:

50% stress, Operating Temperature at 40°C ℃ (Ground fixed and controlled environment)

The resulting figure for MTBF is 2.041×10^6 hours.