TDK·Lambda

DPX15-xxWDxx Dual Output: DC-DC Converter Module
9.5 ~ 36VDC, 18 ~ 75VDC input; ±5 to ±15 VDC Dual Output; 15 Watts Output Power

FEATURES

- NO MINIMUM LOAD REQUIRED
- 1600VDC INPUT TO OUTPUT ISOLATION
- SCREW TERMINALS FOR INPUT AND OUTPUT CONNECTIONS
- RELIABLE SNAP-ON FOR DIN RAIL TS-35/7.5 OR TS-35/15
- CASE PROTECTION MEETS IP20(IEC60529)
- INPUT FUSE PROTECTION
- INPUT REVERSE POLARITY PROTECTION
- INPUT IN-RUSH CURRENT LIMIT CIRCUIT
- OUTPUT DC-OK INDICATOR
- 4:1 WIDE INPUT VOLTAGE RANGE
- FIXED SWITCHING FREQUENCY
- INPUT UNDER-VOLTAGE PROTECTION
- OUTPUT OVER-VOLTAGE PROTECTION
- OVER-CURRENT PROTECTION
- OUTPUT SHORT CIRCUIT PROTECTION
- MEETS EN55022 CLASS B
- REMOTE ON/OFF
- COMPLIANT TO RoHS II & REACH

CE MARKED
SAFETY MEETS: UL60950-1
                 EN60950-1
                 IEC60950-1

APPLICATIONS

- COMMUNICATION SYSTEMS
- INDUSTRY CONTROL SYSTEMS
- FACTORY AUTOMATION EQUIPMENT
- SEMICONDUCTOR EQUIPMENT

OPTIONS

- REMOTE ON/OFF

GENERAL DESCRIPTION

The DPX15-xxWDxx series was designed for applications requiring din rail mountable DC-DC converters. Easy installation is provided with snap-on mounting to the DIN-rail. Internal circuits provide protection against reverse input voltage, input in-rush current, output short-circuit, output over-current, and output over-voltage conditions. A green LED at the front panel indicates the status of the output voltage.

Contents

    2016/04/29

Output Specifications					
Parameter	Model	Min	Typ	Max	Unit
Output Voltage (Vin(nom); Full Load; Ta=25℃)	xxWD05	4.94	5	5.06	VDC
	xxWD12	11.856	12	12.144	
	xxWD15	14.82	15	15.18	
Output Regulation Line (Vin(min) to Vin(max); Full Load)	All	-0.5		+0.5	%
Load (0% to 100% of Full Load)		-1.5		+1.5	
Output Ripple and Noise Peak to Peak (20MHz Bandwidth)	All		75	100	mVp-p
Cross Regulation (Asymmetrical Load 25% / 100% of Full Load)	All	-5.0		+5.0	% of Vout
Temperature Coefficient	All	-0.02		+0.02	%/℃
Output Voltage Overshoot (Vin(min) to Vin(max) Full Load; Ta=25℃)	All		0	5	% of Vout
Dynamic Load Response (Vin(nom); Ta=25℃) Load step change from 75% to 100% or 100 to 75% of Full Load Peak Deviation	All		250		mV
Settling Time (Vout 10% peak deviation)	All		250		µs
Output Current	xxWD05	0		±1500	mA
	xxWD12	0		±625	
	xxWD15	0		±500	
Output Capacitance Load	xxWD05			±3600	µF
	xxWD12			±625	
	xxWD15			±400	
Output Over Voltage Protection (see page 18) (Zener diode clamp)	xxWD05		6.2		VDC
	xxWD12		15		
	xxWD15		18		
Output Indicator	All	Green LED			
Output Over Current Protection (see page 18) (% of Iout rated; Hiccup mode)	All		150		% of FL
Output Short Circuit Protection (see page 18)	All	Continuous, automatic recovery			

Input Specifications					
Parameter	Model	Min	Typ	Max	Unit
Operating Input Voltage					
Continuous	24WDxx	9.5	24	36	VDC
	48WDxx	18	48	75	
Transient (100ms,max)	24WDxx			50	
	48WDxx			100	
Input Standby Current					
(Vin(nom); No Load)	24WD05		57		mA
	24WD12		35		
	24WD15		35		
	48WD05		37		
	48WD12		20		
	48WD15		20		
Under Voltage Lockout Turn-on Threshold					
	24WDxx			9.5	VDC
	48WDxx			18	
Under Voltage Lockout Turn-off Threshold					
	24WDxx		7.5		VDC
	48WDxx		15		
Input Reflected Ripple Current (see page 18)					mAp-p
(Vin(nom); Full Load)	All		10		
Start Up Time					
(Vin(nom) and constant resistive load)	All		100		ms
Remote ON/OFF Control (see page 19) (The Ctrl pin voltage is referenced to negative input) **Positive Logic** (Optional) On/Off pin High Voltage (Remote ON) On/Off pin Low Voltage (Remote OFF)	xxWDxx-**P**		Open or 3 ~ 12VDC Short or 0 ~ 1.2VDC		
Negative Logic (Optional) On/Off pin Low Voltage (Remote ON) On/Off pin High Voltage (Remote OFF)	xxWDxx-**N**		Short or 0 ~ 1.2VDC Open or 3 ~ 12VDC		
Input Current of Remote Control Pin		-0.5		0.5	mA
Remote Off State Input Current			2.5		mA
Input Fuse (Slow Blow)					
	24WDxx		6		A
	48WDxx		4		
In-rush Current	All		15		A

General Specifications

Parameter	Model	Min	Typ	Max	Unit
Efficiency (Vin(nom); Full Load; Ta=25℃)	24WD05		85		%
	24WD12		86		
	24WD15		86		
	48WD05		86		
	48WD12		86		
	48WD15		86		
Isolation Voltage (1 minute) Input to Output	All	1600			VDC
Input to Chassis, Output to Chassis		1600			
Isolation Resistance (500VDC)	All	1			GΩ
Isolation Capacitance	All			4000	pF
Switching Frequency	All	360	400	440	kHz
Safety Meets	All		IEC60950-1,UL60950-1, EN60950-1		
Weight	All		147.5		g
MTBF (see page 21) MIL-HDBK-217F Ta=25ºC, Full load	All		1.681×10^6		hours
Chassis Material	All		Aluminum		

Environmental Specifications

Parameter		Model	Min	Typ	Max	Unit
Operating Ambient Temperature	Without derating	All	-40		+85	℃
	With derating	All	+85		+93	
Storage Temperature		All	-40		105	℃
Relative Humidity		All	5		95	% RH
Thermal Shock		All		MIL-STD-810F		
Vibration		All		IEC60068-2-6		

EMC Characteristics

Characteristic	Standard	Condition		Level
EMI	EN55022	Module stand-alone		Class B
ESD	EN61000-4-2	Air	±8kV	Perf. Criteria A
		Contact	±6kV	
Radiated Immunity	EN61000-4-3	10V/m		Perf. Criteria A
Fast Transient (see page 28)	EN61000-4-4	±2kV		Perf. Criteria A
Surge (see page 28)	EN61000-4-5	±0.5kV		Perf. Criteria A
Conducted Immunity	EN61000-4-6	10V r.m.s		Perf. Criteria A
Power Frequency Magnetic Field	EN61000-4-8	100A/m continuous; 1000A/m 1 second		Perf. Criteria A

Characteristic Curves

All test conditions are at 25℃.The figures are for DPX15-24WD05
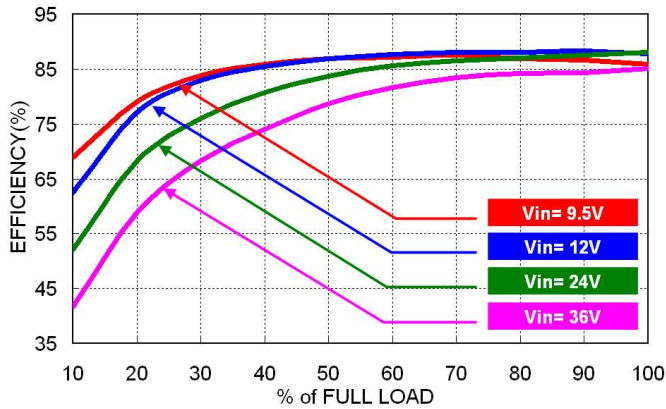
Efficiency versus Output Load
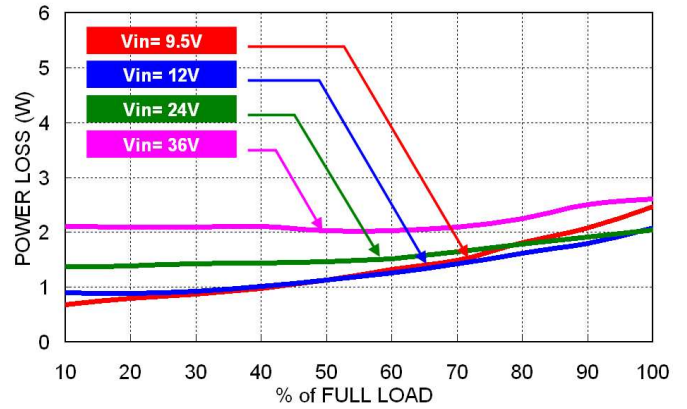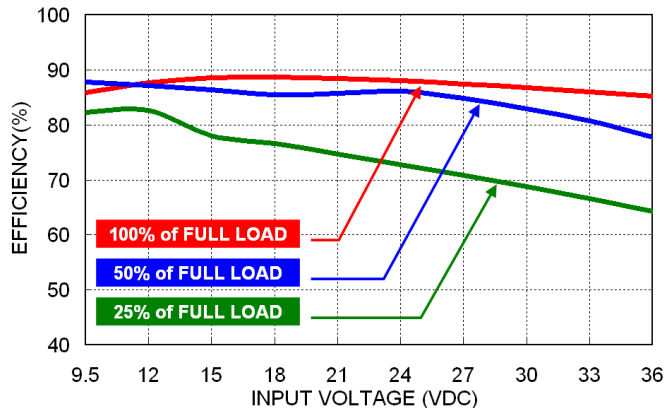
Power Dissipation versus Output Load
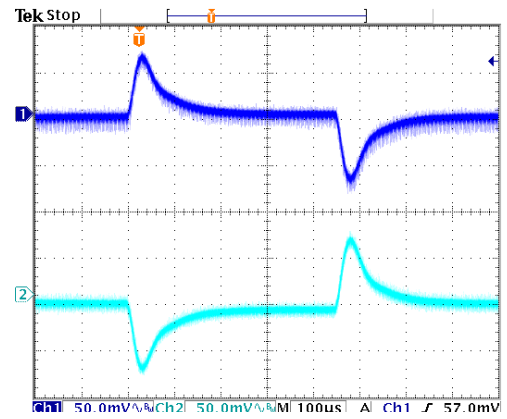
Efficiency versus Input Voltage
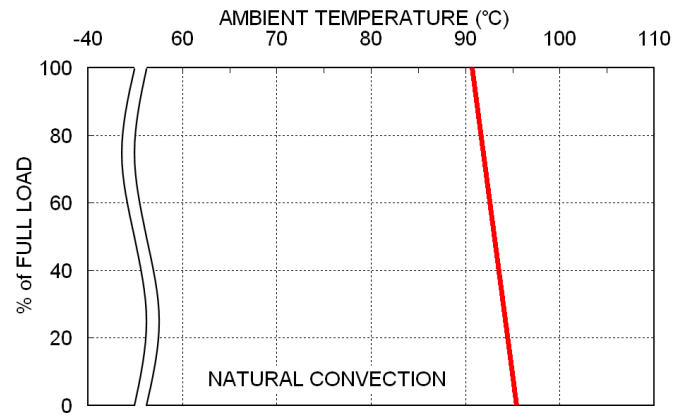
Derating Output Current versus Ambient Temperature and Airflow Vin(nom)
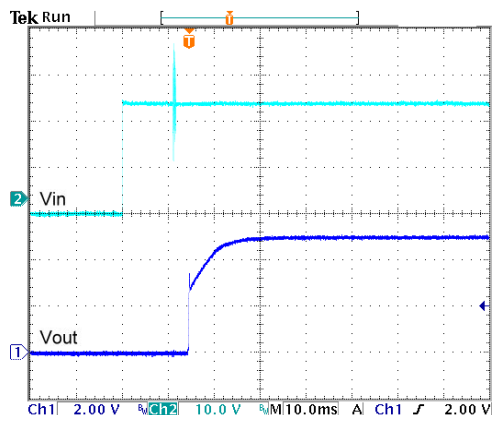
Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-24WD05
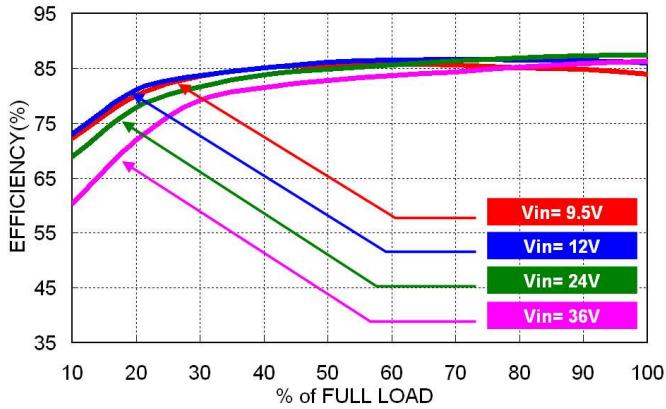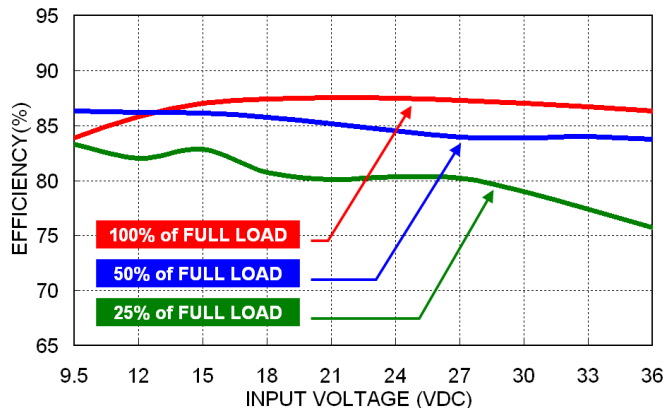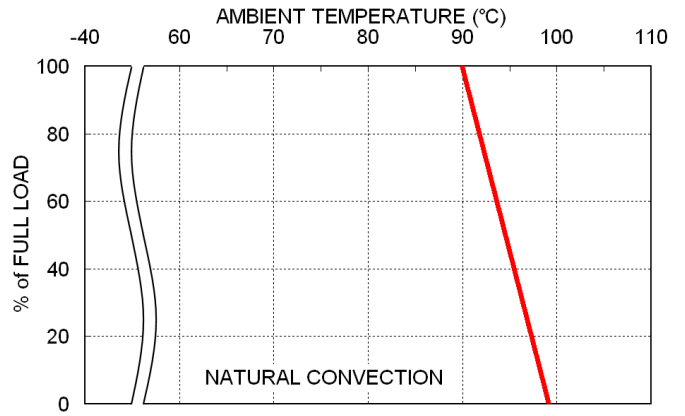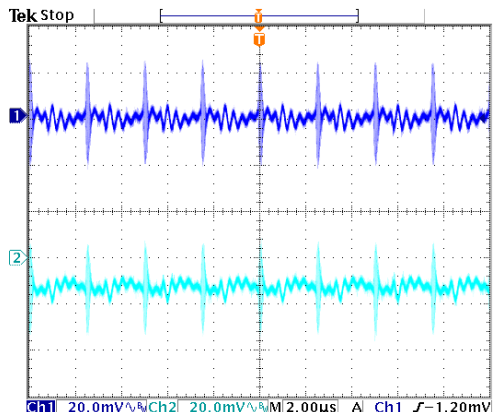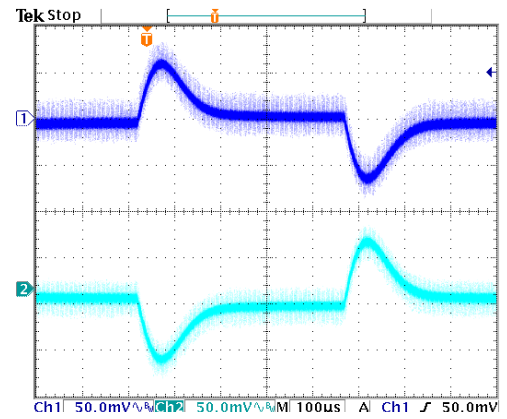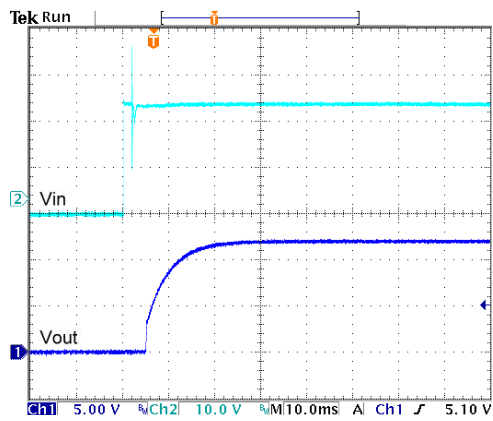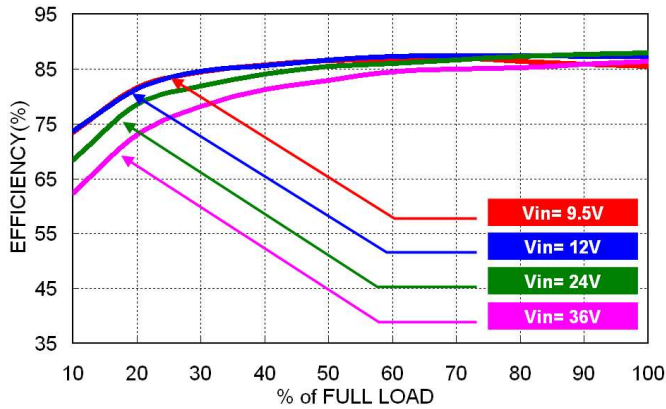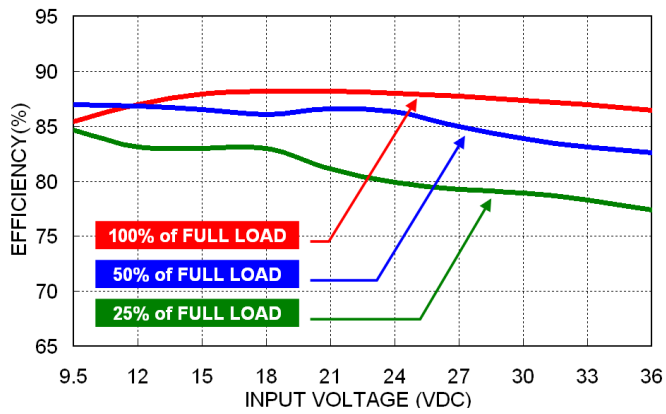

Typical Output Ripple and Noise.
Vin(nom); Full Load

Ch1 20.0mV Ch2 20.0mV M 2.00us A Ch1 ʃ −1.20mV

Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load; Vin(nom)

Ch1 50.0mV Ch2 50.0mV M 100us A Ch1 ʃ 57.0mV

Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Ch1 2.00 V Ch2 10.0 V M 10.0ms A Ch1 ʃ 2.00 V

Characteristic Curves (Continued)

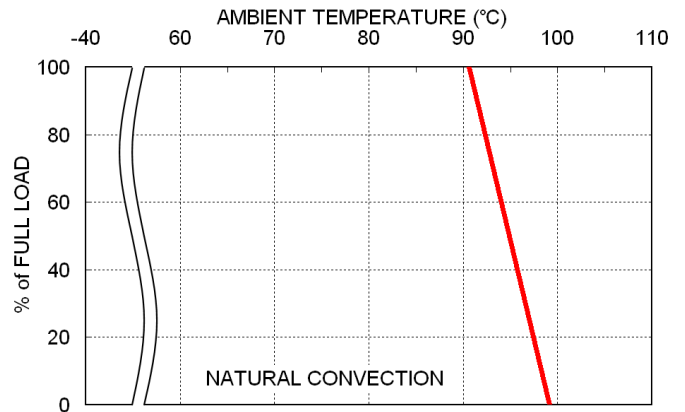All test conditions are at 25°C.The figures are for DPX15-24WD12

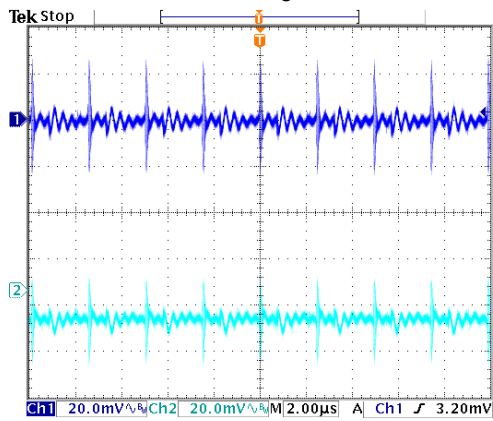Efficiency versus Output Load
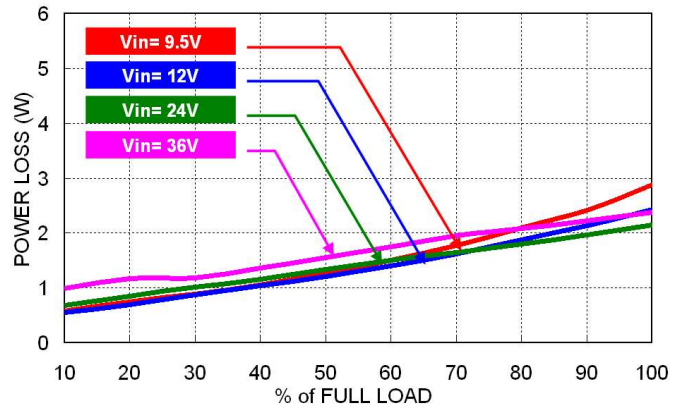
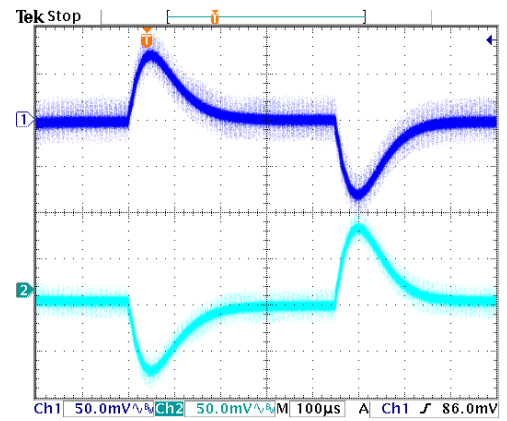Power Dissipation versus Output Load

Efficiency versus Input Voltage

Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

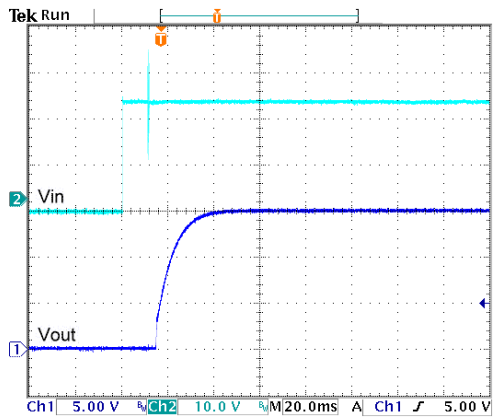## Characteristic Curves (Continued)

All test conditions are at 25°C. The figures are for DPX15-24WD12

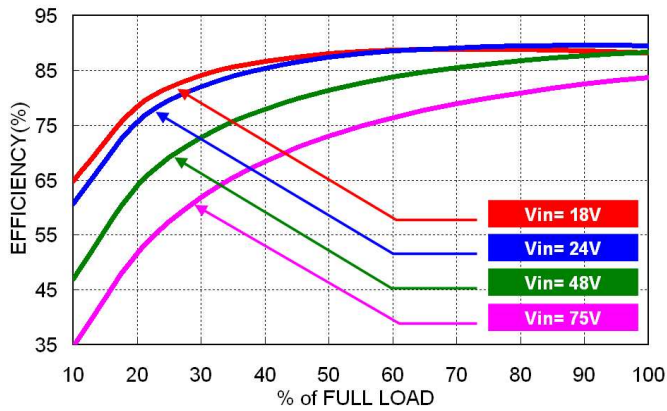Typical Output Ripple and Noise.
Vin(nom); Full Load

Transient Response to Dynamic Load Change from
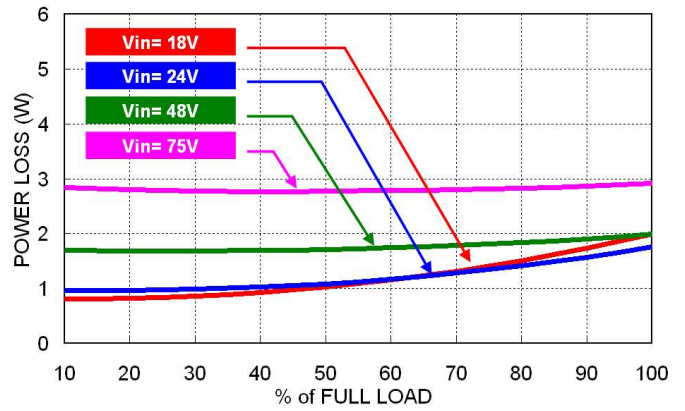100% to 75% to 100% of Full Load; Vin(nom)

Typical Input Start-Up and Output Rise Characteristic
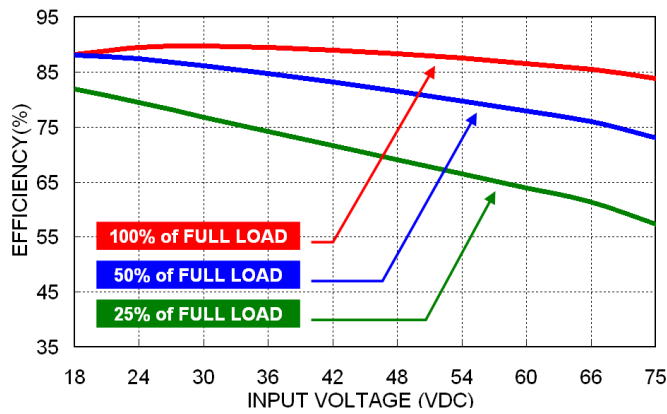Vin(nom); Full Load

Characteristic Curves (Continued)

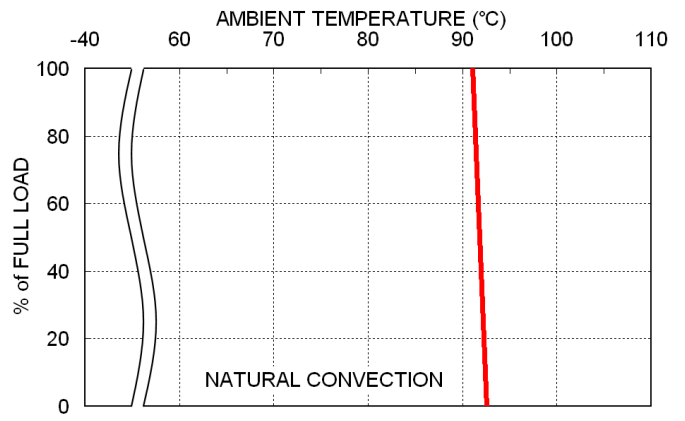All test conditions are at 25°C.The figures are for DPX15-24WD15

Efficiency versus Output Load
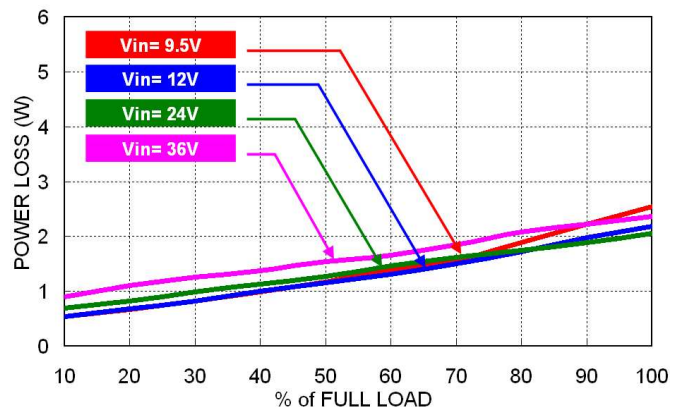
Power Dissipation versus Output Load

Efficiency versus Input Voltage

Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-24WD15

| Ch1 | 20.0mV | Ch2 | 20.0mV | M 2.00µs | A | Ch1 ƒ | 3.20mV |

Typical Output Ripple and Noise.
Vin(nom); Full Load

| Ch1 | 50.0mV | Ch2 | 50.0mV | M 100µs | A | Ch1 ƒ | 86.0mV |

Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load; Vin(nom)

Vin

Vout

| Ch1 | 5.00 V | Ch2 | 10.0 V | M 20.0ms | A | Ch1 ƒ | 5.00 V |

Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-48WD05

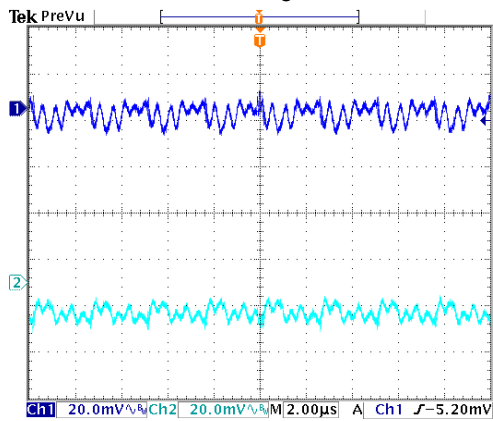Efficiency versus Output Load

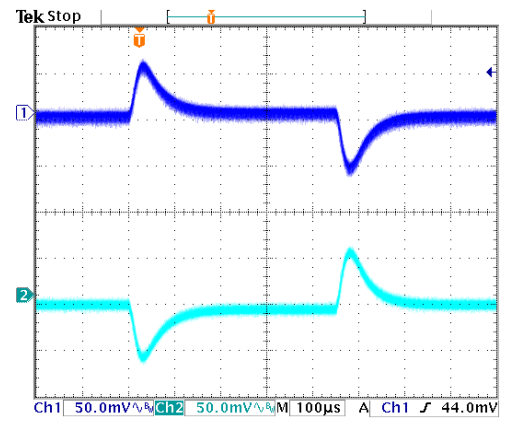Power Dissipation versus Output Load

Efficiency versus Input Voltage

Derating Output Current versus Ambient Temperature and Airflow
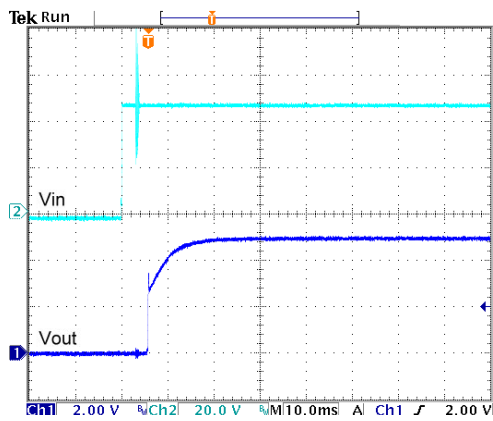Vin(nom)

Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-48WD05

Typical Output Ripple and Noise.
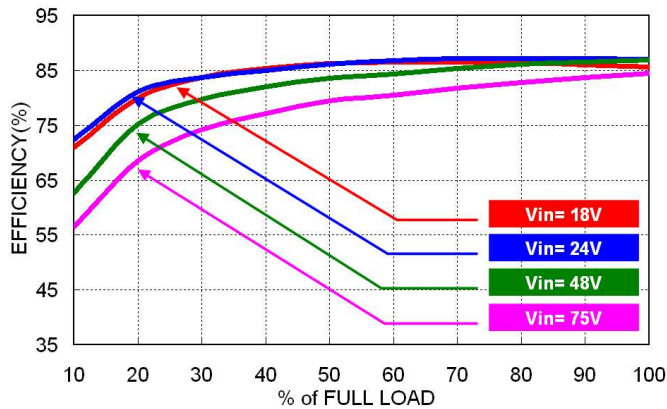Vin(nom); Full Load

Transient Response to Dynamic Load Change from
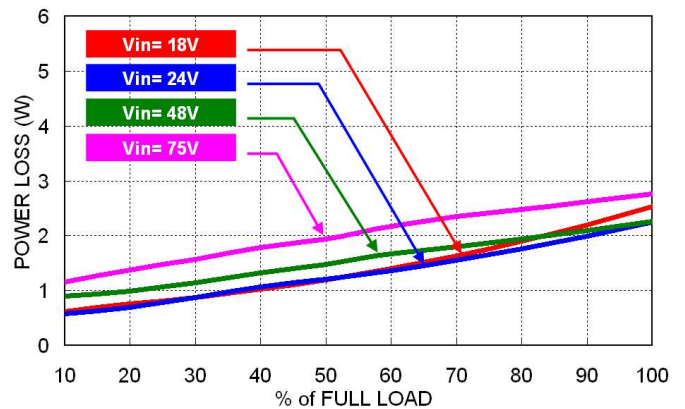100% to 75% to 100% of Full Load; Vin(nom)

Typical Input Start-Up and Output Rise Characteristic
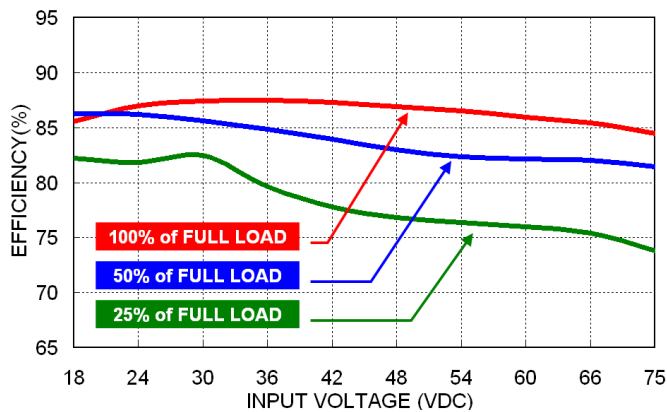Vin(nom); Full Load

Characteristic Curves (Continued)

All test conditions are at 25℃. The figures are for DPX15-48WD12
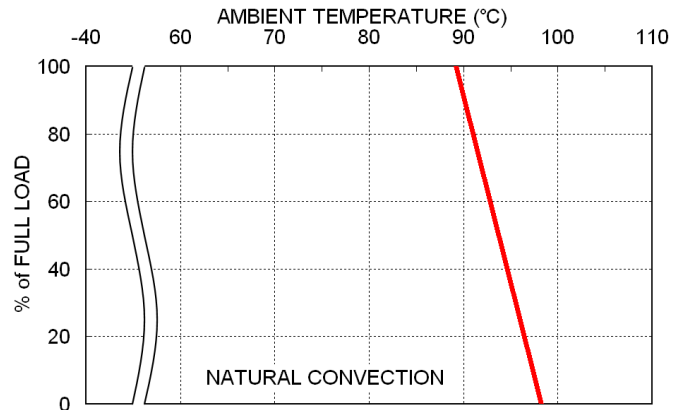

Efficiency versus Output Load
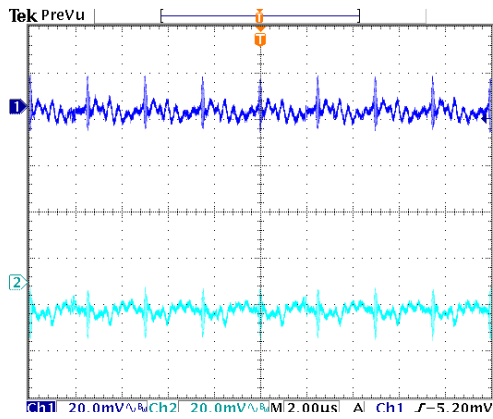

Power Dissipation versus Output Load

Efficiency versus Input Voltage

Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-48WD12

Typical Output Ripple and Noise.
Vin(nom); Full Load

Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load; Vin(nom)

Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-48WD15

Efficiency versus Output Load

Power Dissipation versus Output Load

Efficiency versus Input Voltage
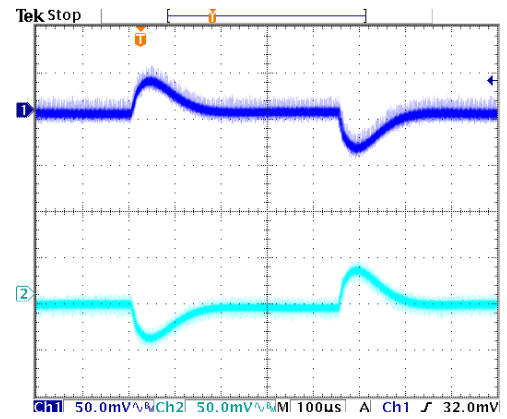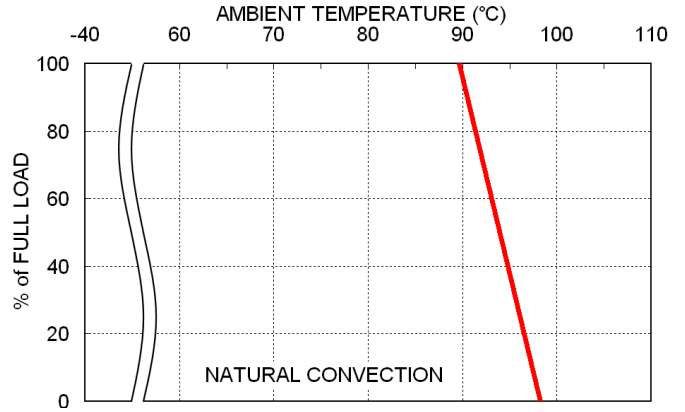
Derating Output Current versus Ambient Temperature and Airflow Vin(nom)
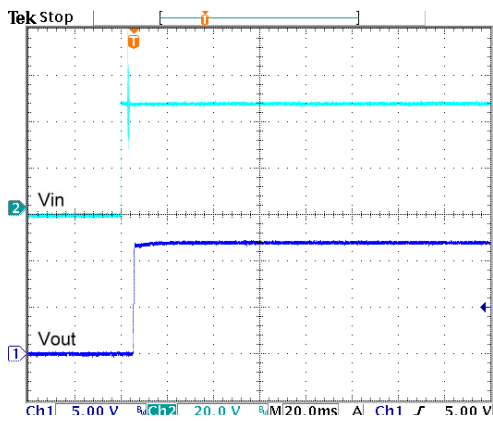
Characteristic Curves (Continued)

All test conditions are at 25℃.The figures are for DPX15-48WD15

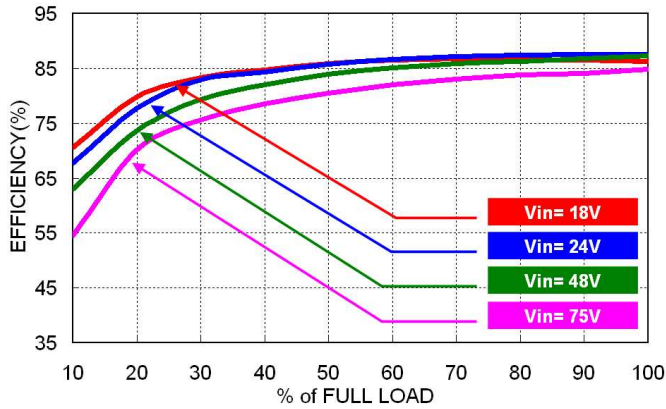Typical Output Ripple and Noise.
Vin(nom); Full Load

Transient Response to Dynamic Load Change from
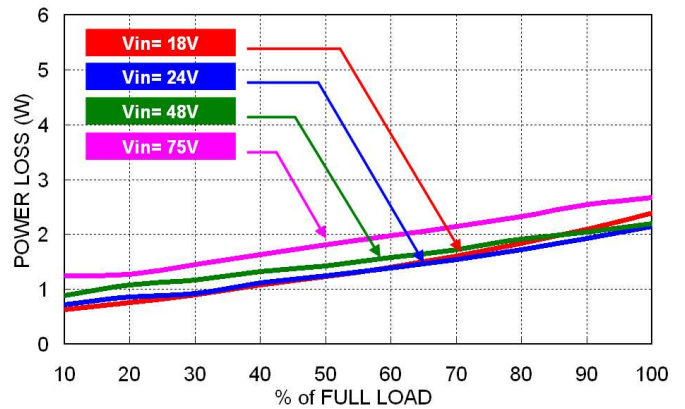100% to 75% to 100% of Full Load; Vin(nom)

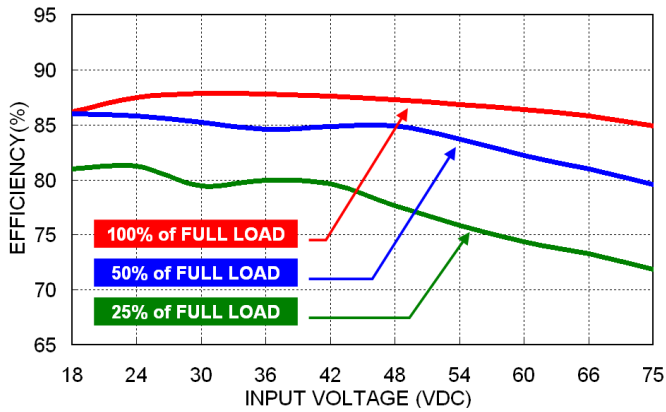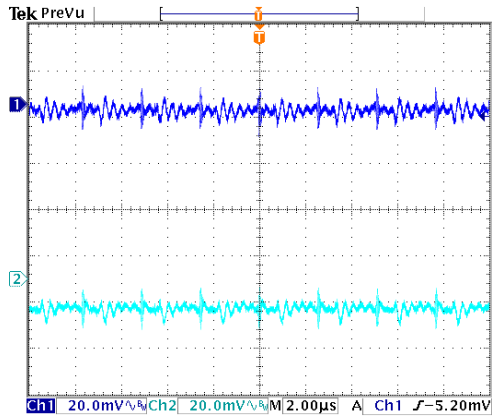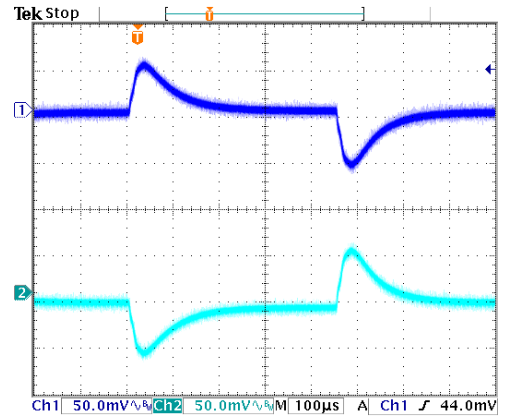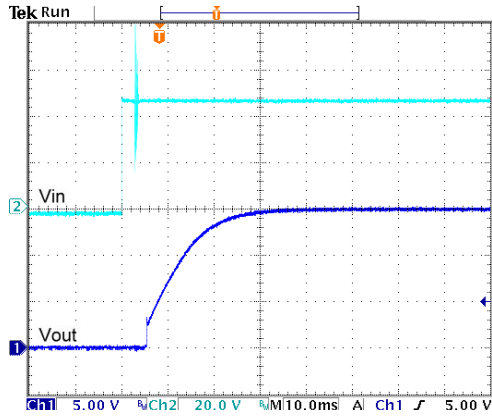Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Input Source Impedance

The power module should be connected to a low impedance input source. Highly inductive source impedance can affect the stability of the power module. The test configuration for the input reflected-ripple current measurement is shown below:

Input reflected-ripple current measurement setup
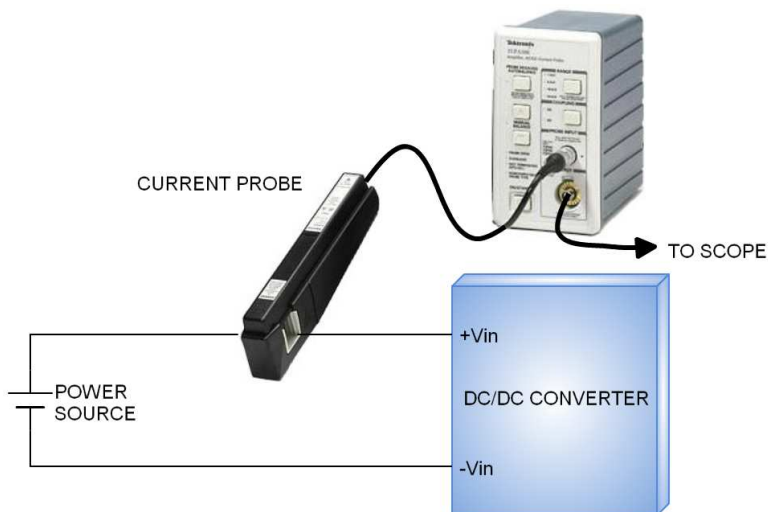
Output Over Current Protection

When excessive output currents occur in the system, circuit protection is required on all power supplies. Normally, overload current is maintained at approximately 150 percent of rated current for DPX15-xxWDxx series.

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

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 those devices may exceed their specified limits. A protection mechanism has to be used to prevent those 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 power supply for a given time and then tries to start up the power supply again. If the over-load condition has been removed, the power supply will start up and operate normally; otherwise, the controller will see another over-current event and shut off the power supply again, repeating the previous cycle. Hiccup operation has none of the drawbacks of the other two protection methods, although its 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.

The hiccup operation can be done in various ways. For example, one can start hiccup operation any time an over-current event is detected; or prohibit hiccup during a designated start-up is usually larger than during normal operation and it is easier for an over-current event is detected; or prohibit hiccup during a designated start-up interval (usually a few milliseconds). The reason for the latter operation is that during start-up, the power supply needs to provide extra current to charge up the output capacitor. Thus the current demand during start-up is usually larger than during normal operation and it is easier for an over-current event to occur. If the power supply starts to hiccup once there is an over-current, it might never start up successfully. Hiccup mode protection will give the best protection for a power supply against over current situations, since it will limit the average current to the load at a low level, so reducing power dissipation and case temperature in the power devices.

Output Short Circuit Protection

Continuous and auto-recovery mode.
During an output short circuit, the converter shuts down. The average current during this condition will be very low.

Output Over Voltage Protection

The output over-voltage protection consists of output Zener diode that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over-voltage protection threshold, then the Zener diode clamps the output voltage.

Remote On/off Control

The Ctrl Pin is used to turn the DC/DC power module on and off. 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 Photo-Coupler. The switch must be capable of sinking up to 1 mA at low-level logic voltage. A High-level logic of the Ctrl pin signal should be limited to a maximum voltage of 12V and a maximum current of 0.5 mA.
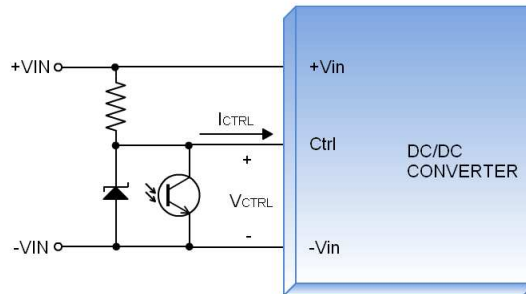
Remote ON/OFF Implementation
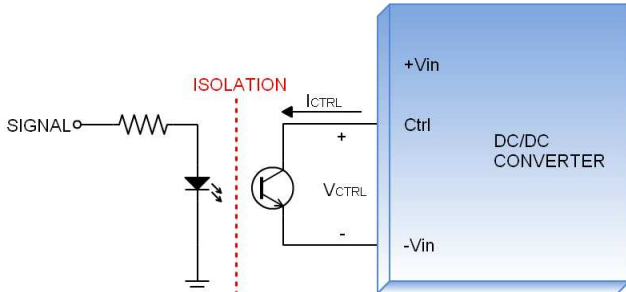
Isolated-Closure Remote ON/OFF
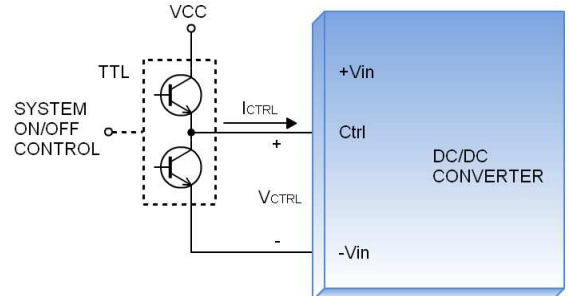


Level Control Using TTL Output

Level Control Using Line Voltage

There are two remote control options available, positive logic (optional) and negative logic (optional).
a. The positive logic structure turns on the DC/DC module when the Ctrl pin is at a high-logic level and turns the module off using a low-logic level.
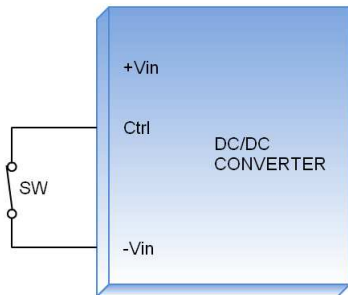
When DPX15-xxWDxx-P module is turned off
using a Low-logic level
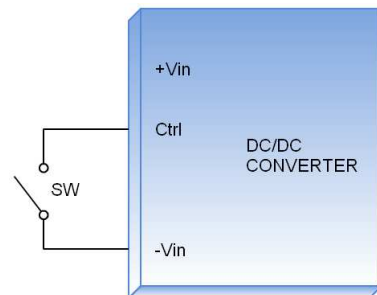
When DPX15-xxWDxx-P module is turned on
using a High-logic level

b. The negative logic structure turns on the DC/DC module when the Ctrl pin is at a low-logic level and turns the module off when using a high-logic level.
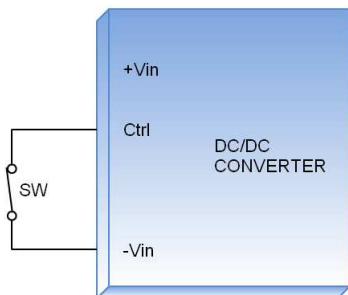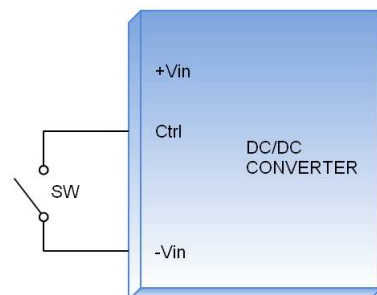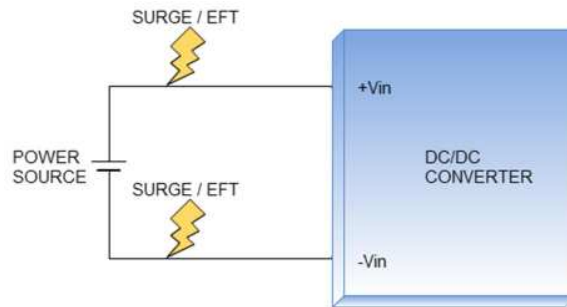

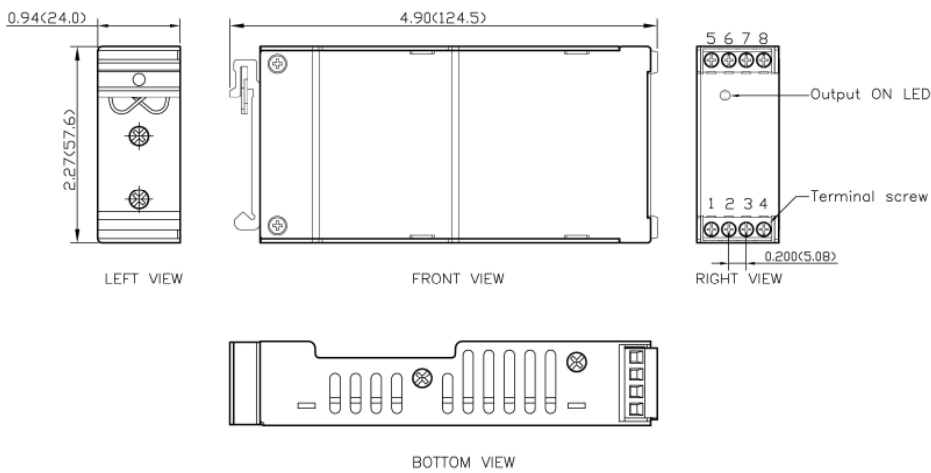When DPX15-xxWDxx-N module is turned on
using a Low-logic level

When DPX15-xxWDxx-N module is turned off
using a High-logic level

EMS Considerations

The DPX15-xxWDxx series can meet Fast Transient EN61000-4-4 and Surge EN61000-4-5 performance criteria A. Please see the following schematic:

Mechanical Data

LEFT VIEW   FRONT VIEW   RIGHT VIEW

BOTTOM VIEW

PINOUT

PIN	FUNCTION
1	Ctrl (Option)
2	-Vin
3	-Vin
4	+Vin
5	NC
6	-Vout
7	Common
8	+Vout

* NC : No Connection
* Screw terminals–wire range from 14 to 18 AWG

1. All dimensions in inch (mm)
2. Tolerance : X.XX±0.02 (X.X±0.5)
                    X.XXX±0.01 (X.XX±0.25)
3. Terminal screw locked torque :
      MAX 2.5kgf—cm (0.25N—m)

Packaging Information
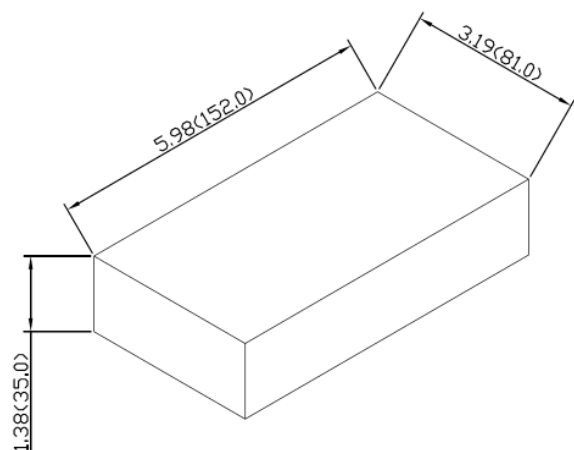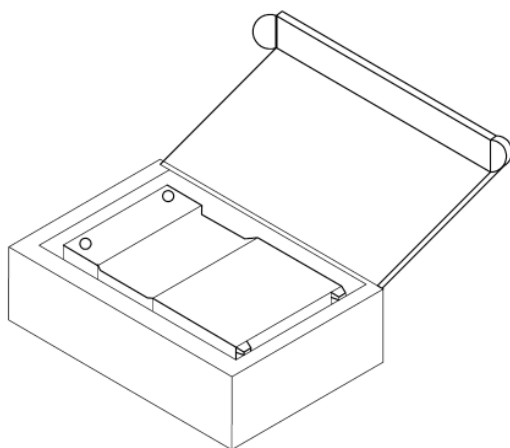
1PCS / BOX
All dimensions in mm

Part Number Structure

DPX15	-	48W	D	05	-	X

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)		Remote Control Option
	24: 9.5~36 **48:** 18~75	**D:** Dual	**05:** ±5 **12:** ±12 **15:** ±15		**P** : Positive logic **N:** Negative logic

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	μF
DPX15-24WD05	9.5 ~ 36	±5	±1500	57	85	±3600
DPX15-24WD12	9.5 ~ 36	±12	±625	35	86	±625
DPX15-24WD15	9.5 ~ 36	±15	±500	35	86	±400
DPX15-48WD05	18 ~ 75	±5	±1500	37	86	±3600
DPX15-48WD12	18 ~ 75	±12	±625	20	86	±625
DPX15-48WD15	18 ~ 75	±15	±500	20	86	±400

MTBF and Reliability

The MTBF for theDPX15-xxWDxx series of DC/DC converters has been calculated using
MIL-HDBK-217F @ at full load, operating temperature at 25℃. The resulting figure for MTBF is 1.681×10^6 hours.