TDK-Lambda

DPX30-xxWDxx DC-DC Converter Module

10 ~ 40VDC, 18 ~ 75VDC input; ±12 to ±15 VDC Dual Output;
30 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)
- INTERNAL INPUT FUSE PROTECTION
- INTERNAL INPUT REVERSE POLARITY PROTECTION
- INTERNAL INPUT IN-RUSH CURRENT LIMIT CIRCUIT
- INTERNAL 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
- COMPLIANT TO RoHS II & REACH

CE MARKED

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

APPLICATIONS

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

OPTIONS

- REMOTE ON/OFF

GENERAL DESCRIPTION

The DPX30-xxWDxx series was designed to offer easy installation with snap-on type mounting to a DIN-rail. Internal protection circuits such as input voltage reversal and in-rush current limit protection, as well as output short-circuit, over-current protection and over-voltage protection. A green LED at the front displays the status of the output.

Contents

Output Specifications					
Parameter	Model	Min	Typ	Max	Unit
Output Voltage (Vin(nom); Full Load; Ta=25℃)	xxWD12 xxWD15	11.88 14.85	12 15	12.12 15.15	VDC
Output Regulation Line (Vin(min) to Vin(max); Full Load) Load (0% to 100% of Full Load)	All	-0.5 -1.5		+0.5 +1.5	%
Output Ripple and Noise Peak to Peak (20MHz Bandwidth)	All		100	125	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 Setting Time (Vout 10% peak deviation)	All All		250 250		mV μs
Output Current	xxWD12 xxWD15	0 0		±1.25 ±1	A
Output Capacitance Load	xxWD12 xxWD15			±1000 ±680	μF
Output Over Voltage Protection (see page 14) (Zener diode clamp)	xxWD12 xxWD15		15 18		VDC
Output Indicator	All	Green LED			
Output Over Current Protection (see page 14) (% of Iout rated; Hiccup mode)	All			150	% of FL
Output Short Circuit Protection (see page 14)	All	Continuous, automatic recovery			

Input Specifications					
Parameter	Model	Min	Typ	Max	Unit
Operating Input Voltage Continuous Transient (100ms,max)	 24WDxx 48WDxx 24WDxx 48WDxx	 10 18	 24 48	 40 75 50 100	VDC
Input Standby Current (Vin(nom); No Load)	 24WD12 24WD15 48WD12 48WD15		 34 40 28 28		mA
Under Voltage Lockout Turn-on Threshold	 24WDxx 48WDxx			 10 18	VDC
Under Voltage Lockout Turn-off Threshold	 24WDxx 48WDxx		 8 16		VDC
Input Reflected Ripple Current (see page 14) (Vin(nom); Full Load)	All		15		mAp-p
Start Up Time (Vin(nom) and constant resistive load) Power up Remote ON/OFF	All		 100 20		ms
Remote ON/OFF Control (see page 15) (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) **Negative Logic** (Optional) On/Off pin Low Voltage (Remote ON) On/Off pin High Voltage (Remote OFF)	xxWDxx-P xxWDxx-**N**	Open or 3 ~ 12VDC Short or 0 ~ 1.2VDC Short or 0 ~ 1.2VDC Open or 3 ~ 12VDC			
Input Current of Remote Control Pin	All	-0.5		0.5	mA
Remote Off State Input Current	All		3		mA
Input Fuse (Slow Blow)	 24WDxx 48WDxx		 6 4		A
In-rush Current	All		15		A

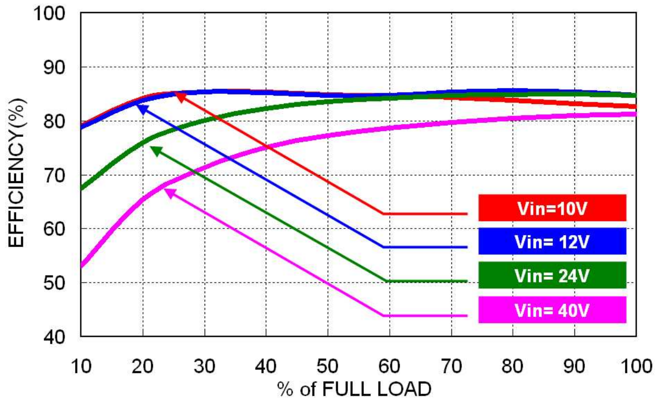
General Specifications					
Parameter	Model	Min	Typ	Max	Unit
Efficiency (Vin(nom); Full Load; Ta=25℃)	 24WD12 24WD15 48WD12 48WD15		 82 83 83 84		%
Isolation Voltage (1 minute) Input to Output Input to Chassis, Output to Chassis	All	 1600 1600			VDC
Isolation Resistance (500VDC)	All	1			GΩ
Isolation Capacitance	All			4000	pF
Switching Frequency	All	270	300	330	kHz
Safety Meets	All	IEC60950-1,UL60950-1, EN60950-1			
Weight	All		170		g
MTBF (see page 17) MIL-HDBK-217F Ta=25ºC, Full load	All		8.412×10^5		hours
Chassis Material	All		Aluminum		

Environmental Specifications						
Parameter		Model	Min	Typ	Max	Unit
Operating Ambient Temperature	Without derating	All	-40		+65	℃
	With derating	All	+65		+99	℃
Storage Temperature		All	-40		105	℃
Relative Humidity		All	5		95	% RH
Thermal Shock		All	MIL-STD-810F			
Vibration		All	IEC60068-2-6			

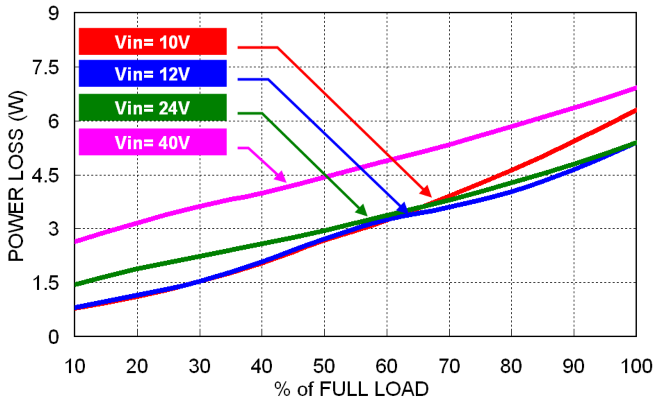
EMC Characteristics			
Characteristic	Standard	Condition	Level
EMI	EN55022	Module stand-alone	Class B
ESD	EN61000-4-2	Air ±8kV Contact ±6kV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast Transient (see page 16)	EN61000-4-4	±2kV	Perf. Criteria A
Surge (see page 16)	EN61000-4-5	±1kV	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

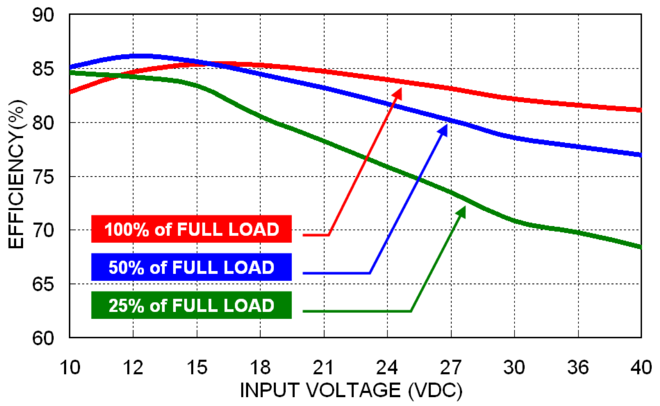
All test conditions are at 25℃.The figures are for DPX30-24WD12



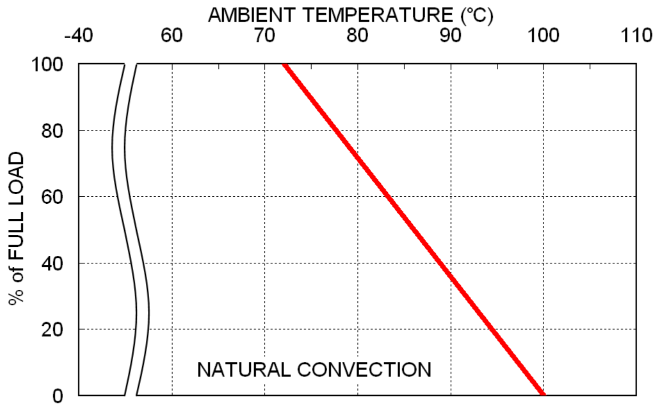
Efficiency versus Output Load



Power Dissipation versus Output Load



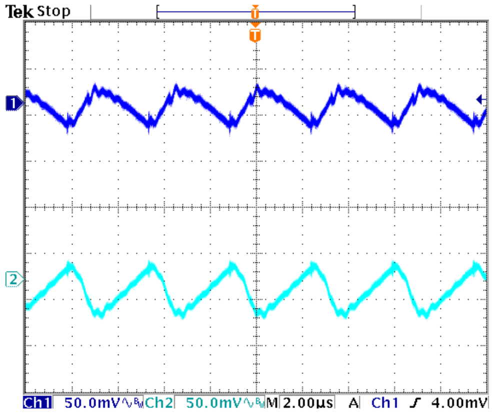
Efficiency versus Input Voltage



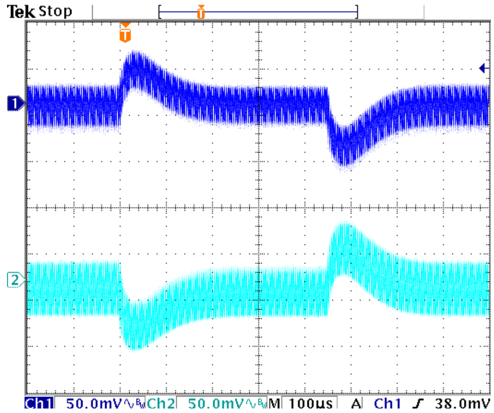
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

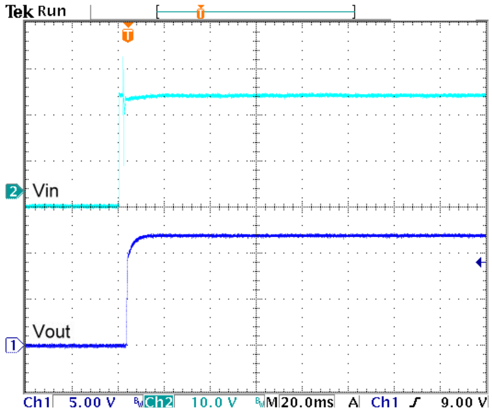
All test conditions are at 25℃.The figures are for DPX30-24WD12



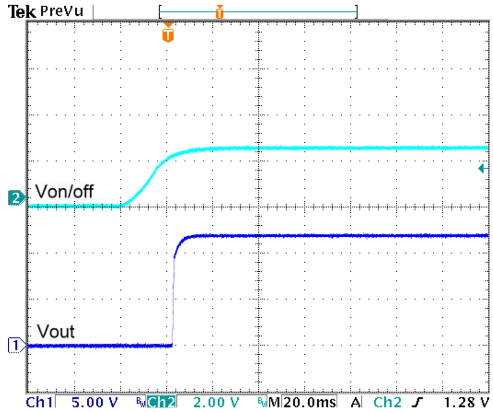
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



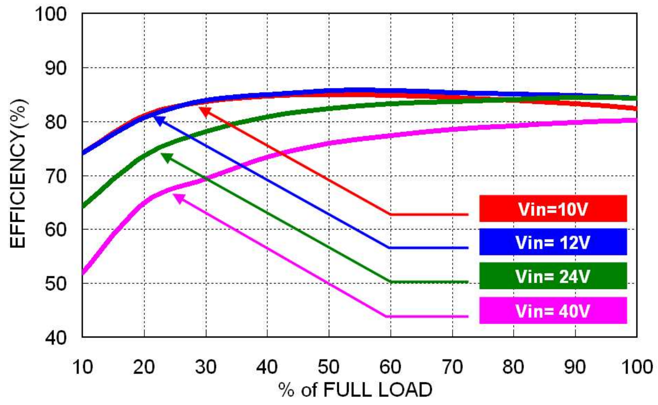
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



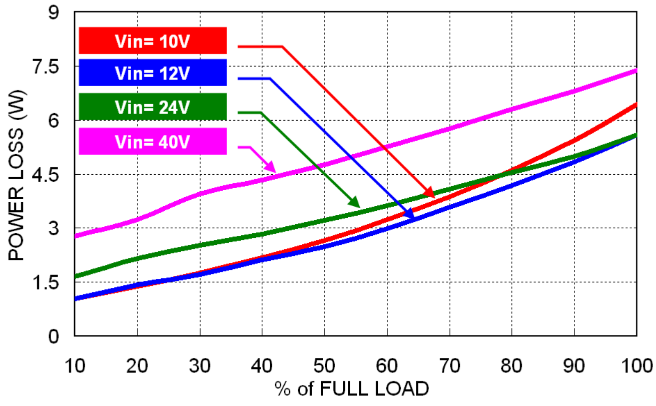
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

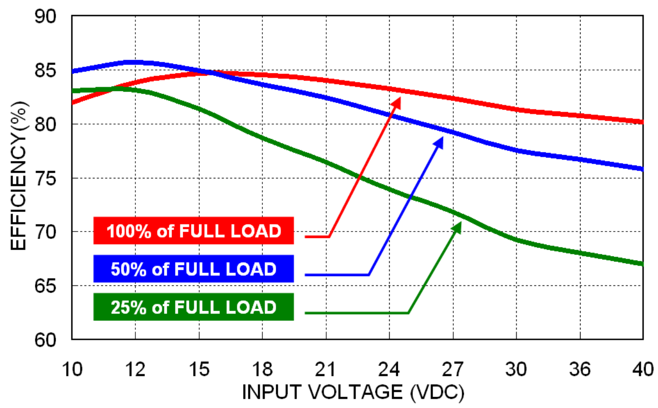
All test conditions are at 25℃.The figures are for DPX30-24WD15



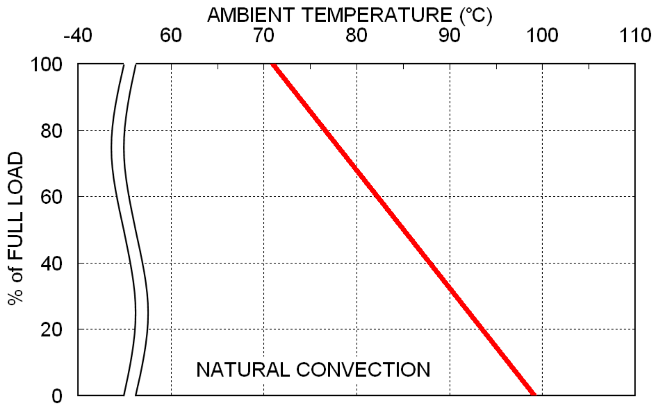
Efficiency versus Output Load



Power Dissipation versus Output Load



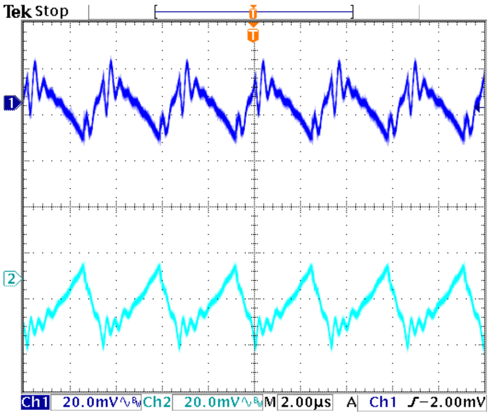
Efficiency versus Input Voltage



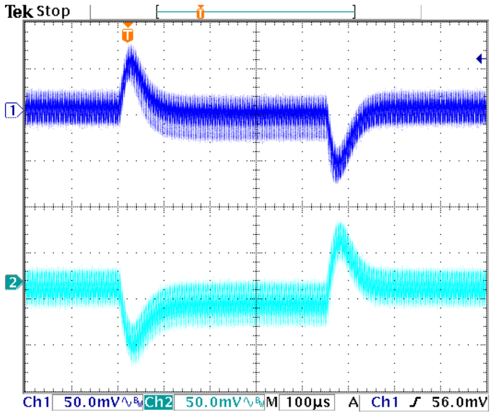
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

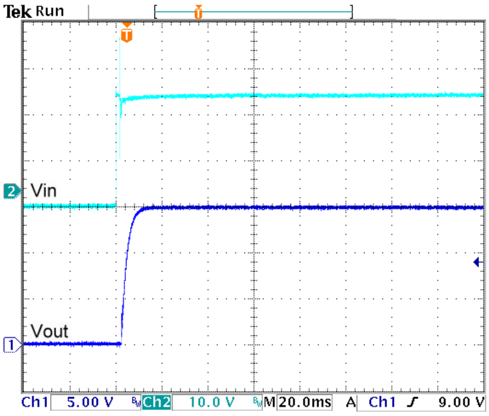
All test conditions are at 25℃.The figures are for DPX30-24WD15



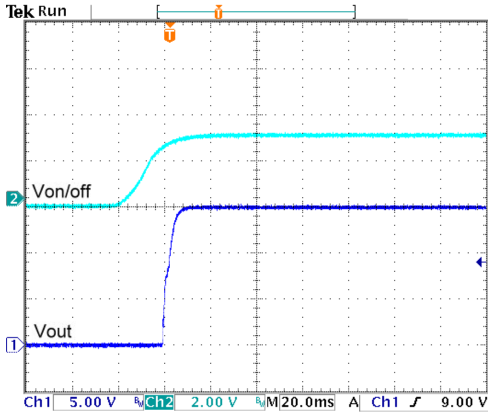
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



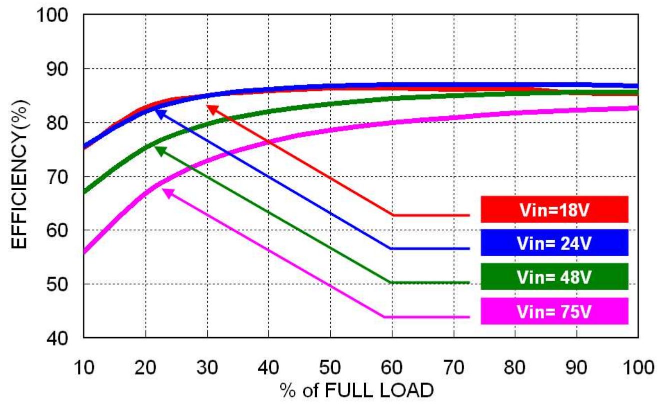
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



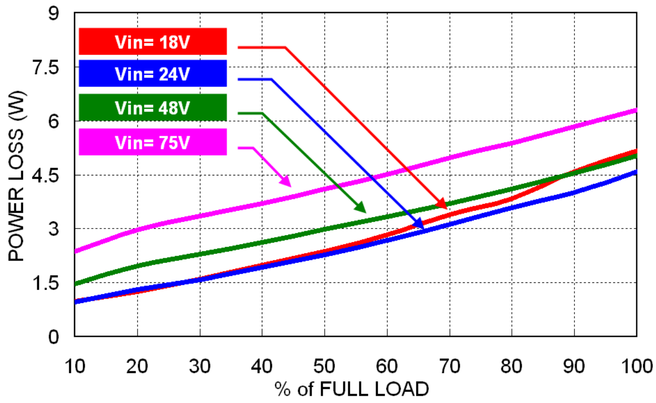
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

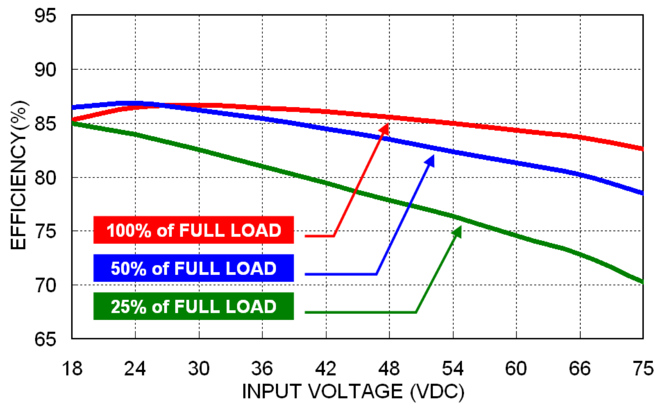
All test conditions are at 25℃.The figures are for DPX30-48WD12



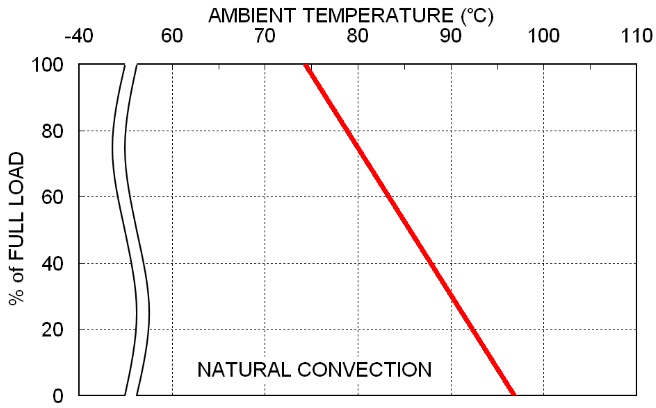
Efficiency versus Output Load



Power Dissipation versus Output Load



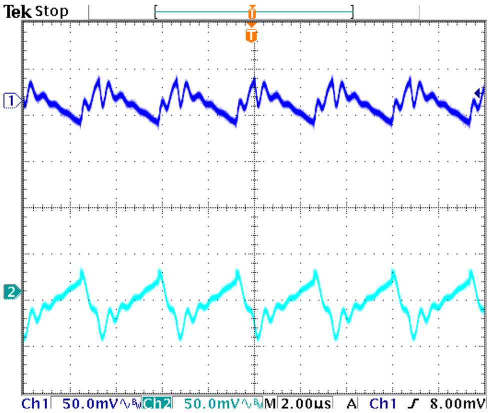
Efficiency versus Input Voltage



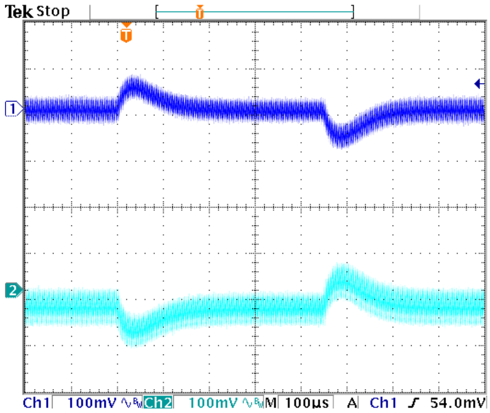
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

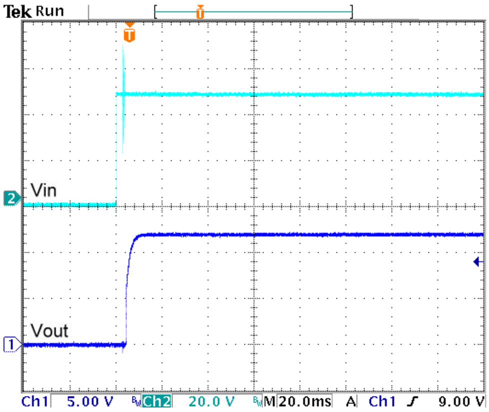
All test conditions are at 25℃.The figures are for DPX30-48WD12



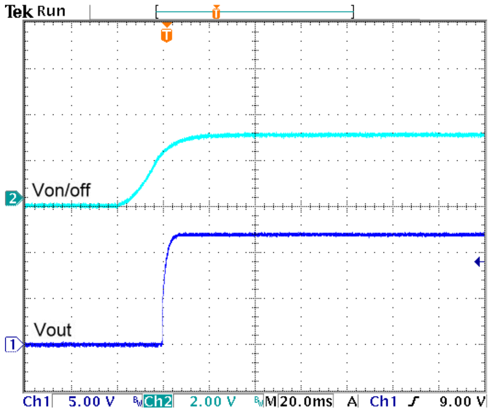
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



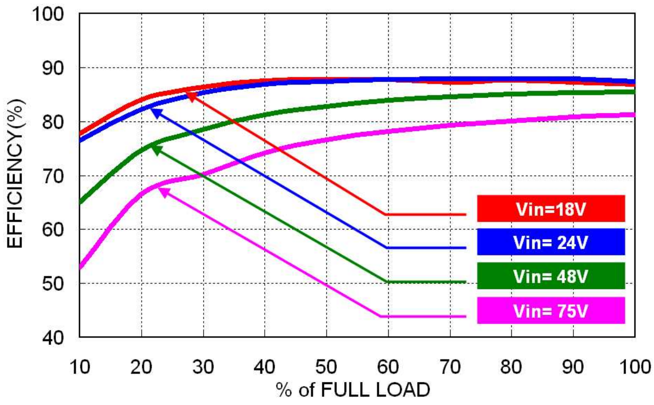
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



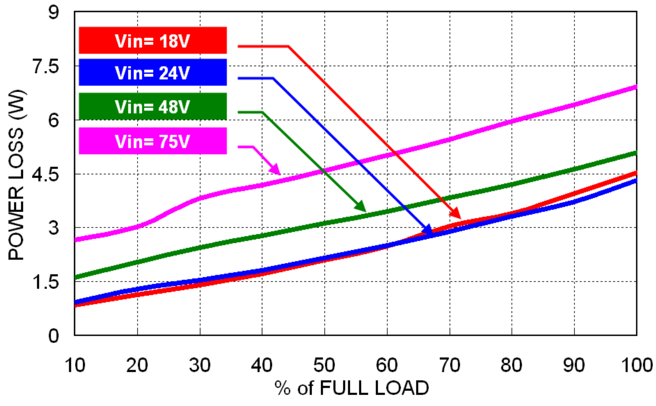
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

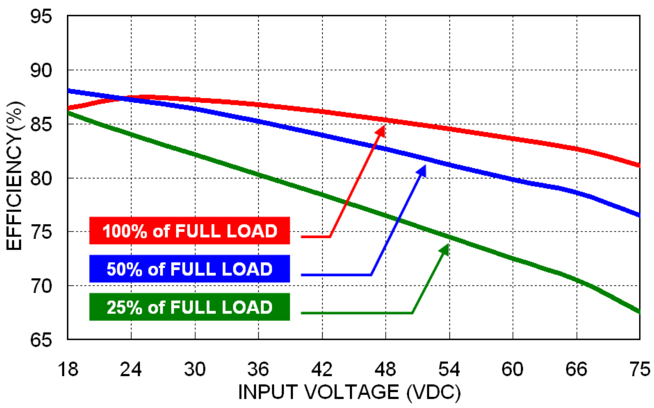
All test conditions are at 25℃.The figures are for DPX30-48WD15



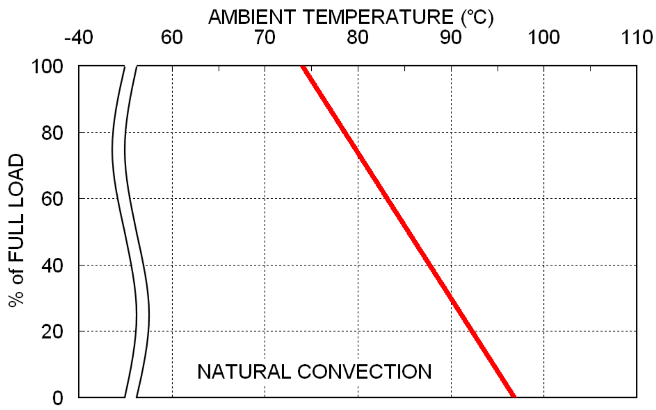
Efficiency versus Output Load



Power Dissipation versus Output Load



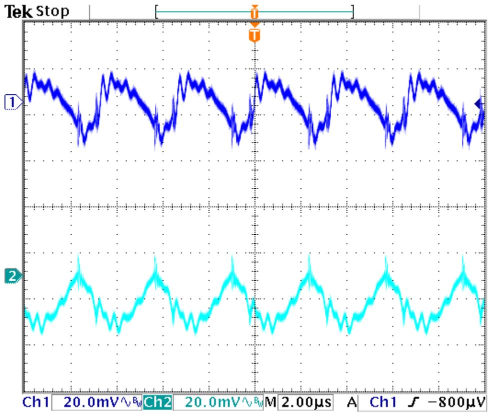
Efficiency versus Input Voltage



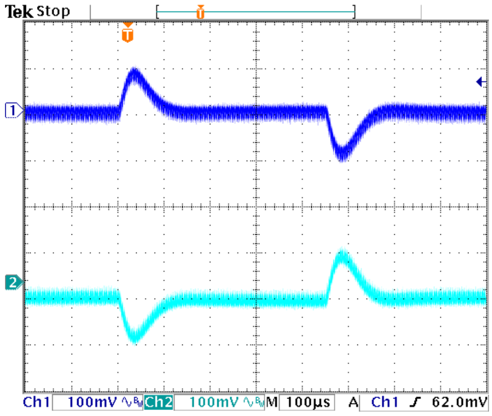
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

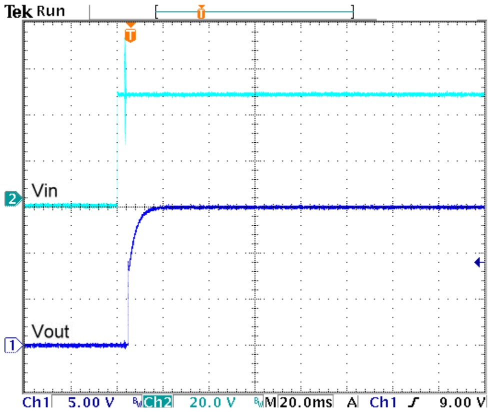
All test conditions are at 25℃.The figures are for DPX30-48WD15



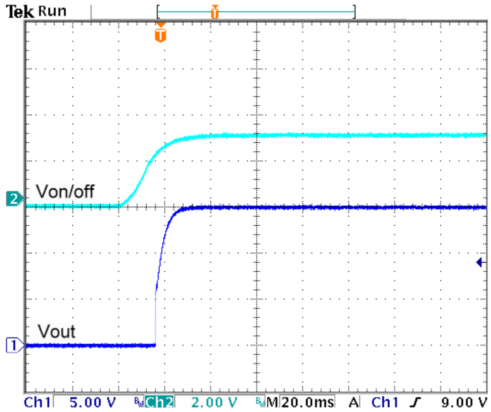
Typical Output Ripple and Noise.
Vin(nom); Full Load



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

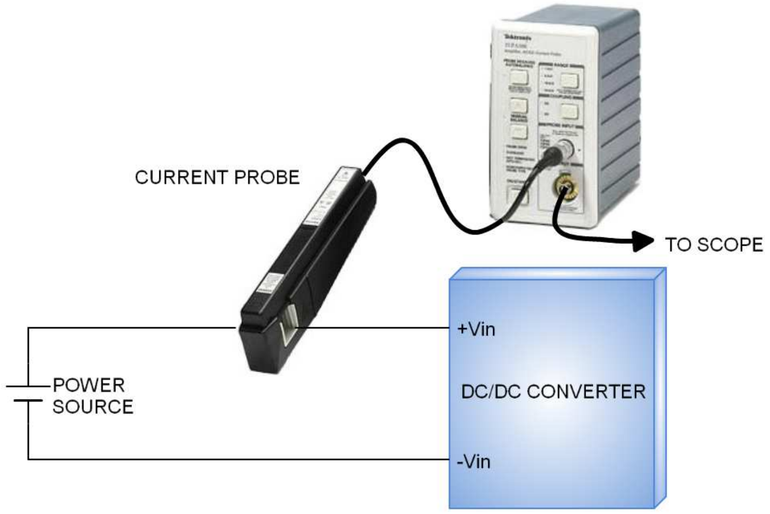


Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

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 input reflected-ripple current measurement configuration 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 DPX30-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

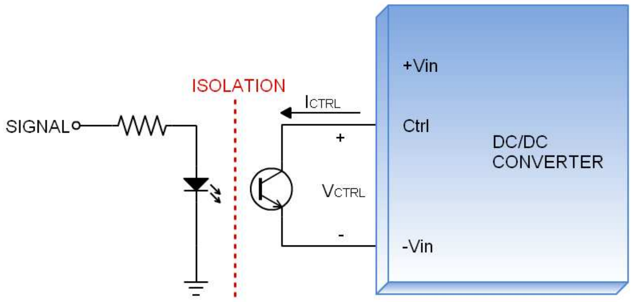
Continuous and auto-recovery mode.
During short circuit, converter still shut down. The average current during this condition will be very low and the device can be safety in this condition.

Output Over Voltage Protection

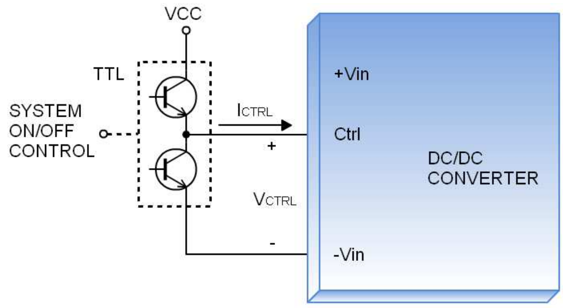
The output over-voltage protection consists of output Zener diode that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over-voltage protection threshold, then the Zener diode clamps the output voltage.

Remote On/off Control

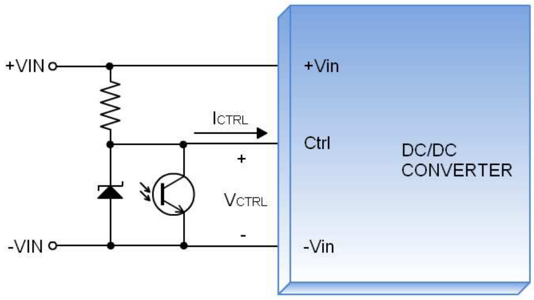
The Ctrl Pin is used to turn the power module on and off. The user must use a switch to control the logic voltage (high or low) level of the pin referenced to -Vin. The switch can be an open collector transistor, FET, or Photo-Coupler. The switch must be capable of sinking up to 1 mA at low-level logic 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.



Isolated-Closure Remote ON/OFF



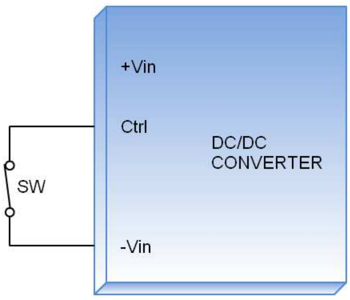
Level Control Using TTL Output



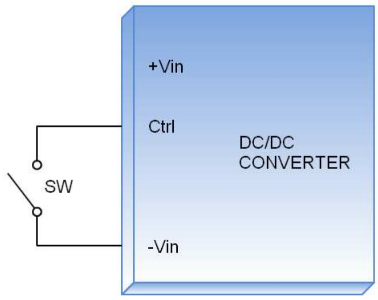
Level Control Using Line Voltage

There are two remote control options available, positive logic and negative logic.

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 by using a low-logic level.

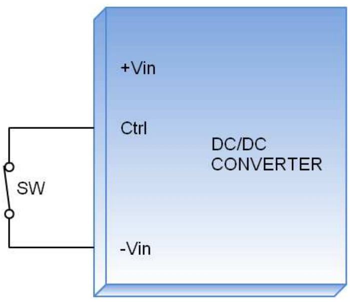


When DPX30-xxWDxx-P module is turned off using a Low-logic level

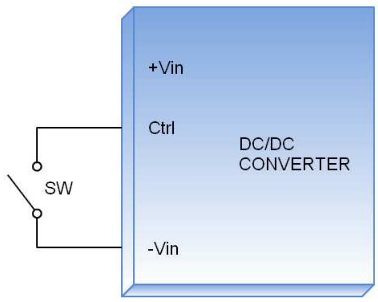


When DPX30-xxWDxx-P module is turned on using a High-logic level

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 using a a high-logic level.



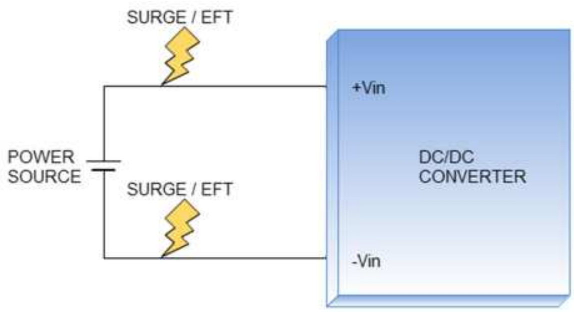
When DPX30-xxWDxx-N module is turned on using a Low-logic level



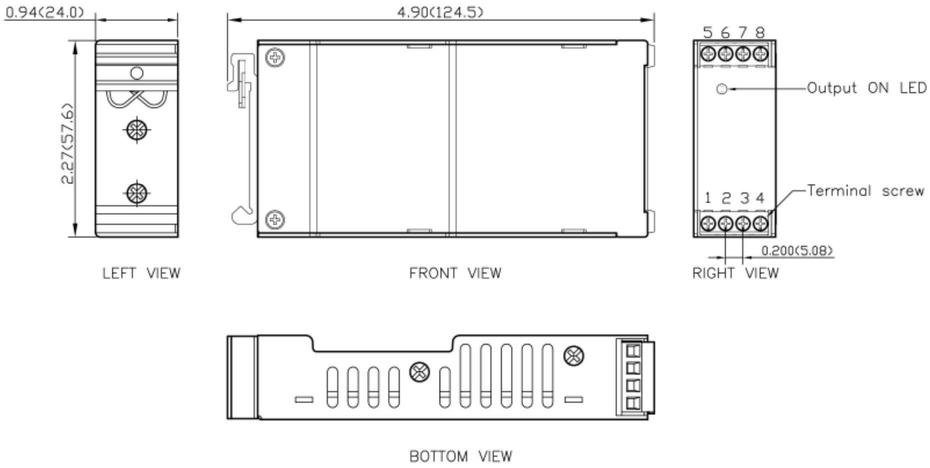
When DPX30-xxWDxx-N module is turned off Using a High-logic level

EMS Considerations

The DPX30-xxWDxx series can meet Fast Transient EN61000-4-4 and Surge EN61000-4-5 performance criteria A. Please see the following schematic below.



Mechanical Data



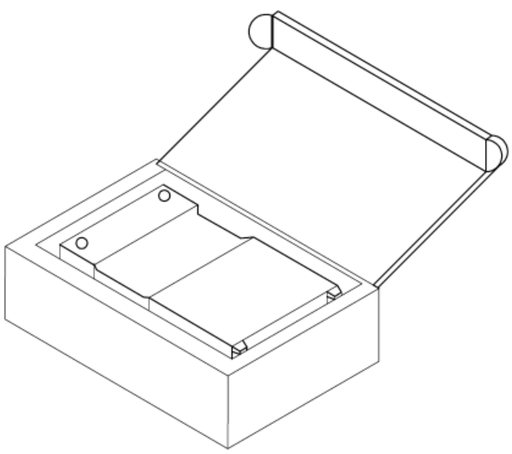
PIN CONNECTION

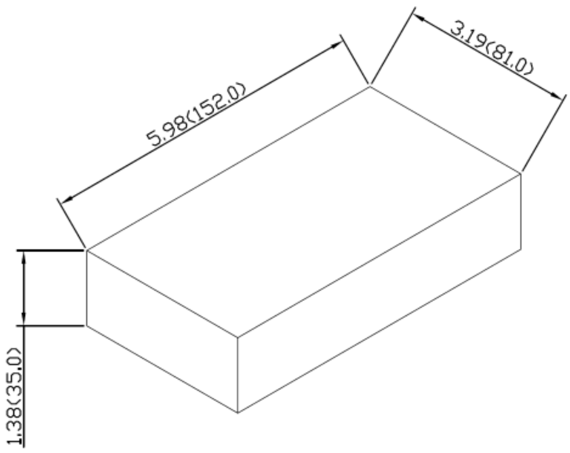
PIN	FUNCTION
1	Ctrl
2	-Vin
3	-Vin
4	+Vin
5	NC
6	-Vout
7	Common
8	+Vout

* 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

DPX30 - 48W D 12 - N

Series Name	Input Voltage (VDC)	Output	Output Voltage (VDC)	Remote Control Option
DPX30	**24:** 10~40 **48:** 18~75	**D:** Dual	**12:** ±12 **15:** ±15	**P:** Positive logic **N:** Negative logic

Model Number	Input Range VDC	Output Voltage VDC	Output Current @Full Load A	Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load μF
DPX30-24WD12	10 ~ 40	±12	±1.25	34	82	±1000
DPX30-24WD15	10 ~ 40	±15	±1	40	83	±680
DPX30-48WD12	18 ~ 75	±12	±1.25	28	83	±1000
DPX30-48WD15	18 ~ 75	±15	±1	28	84	±680

MTBF and Reliability

The MTBF of DPX30-xxWDxx DC/DC converters has been calculated using
MIL-HDBK-217F NOTICE2 FULL LOAD, Operating Temperature at 25℃. The resulting figure for MTBF is 8.412×10^{5} hours.