TDK-Lambda

PXC-M03 Dual Output Series: DC-DC Converter Module

4.5 ~ 9 VDC, 9 ~ 18 VDC, 18 ~ 36 VDC and 36~ 75 VDC input; ±5 to ±15 VDC Dual Output
3 Watts Output Power

FEATURES

- DUAL OUTPUT UP TO ±300mA
- REINFORCED INSULATION FOR 250VAC WORKING VOLTAGE
- CLEARANCE AND CREEPAGE DISTANCE :8.0mm/2MOPP
- 5000VAC INPUT TO OUTPUT 2MOPP ISOLATION
- NO MINIMUM LOAD REQUIRED
- HIGH EFFICIENCY UP TO 87.5%
- BUILT-IN EMI CLASS A FILTER
- 2μA PATIENT LEAKAGE CURRENT
- SMALL SIZE: 1.25×0.80×0.40 INCH
- 2:1 ULTRA WIDE INPUT VOLTAGE RANGE
- FIXED SWITCHING FREQUENCY
- INPUT UNDER-VOLTAGE PROTECTION
- OUTPUT OVER-VOLTAGE PROTECTION
- OVER-CURRENT PROTECTION
- OUTPUT SHORT CIRCUIT PROTECTION
- REMOTE ON/OFF
- COMPLIANT TO RoHS II & REACH

CE MARKED
SAFETY APPROVALS: ANSI/AAMI ES60601-1
EN60601-1
IEC60601-1

APPLICATIONS

- MEDICAL EQUIPMENT
- TELECOM/DATACOM
- INDUSTRY CONTROL SYSTEM
- MEASUREMENT EQUIPMENT
- SEMICONDUCTOR EQUIPMENT
- PV POWER SYSTEM
- IGBT GATE DRIVER

OPTIONS

- PIN CONNECTION
- REMOTE ON/OFF
- TRIM

GENERAL DESCRIPTIONS

The PXC-M03 series offer 3 watts of output power from a 1.25 x 0.80 x 0.40 inch package. PXC-M03 series have 2:1 wide input voltage of 4.5~9VDC, 9~18VDC, 18~36VDC and 36~75VDC. The PXC-M03 has features 5000VAC of isolation, short circuit protection, over-current protection and over-voltage protection. All models are particularly suited to IGBT isolated power supplies, measurement equipment, telecommunications, industry and medical equipment applications.

Contents

Output Specifications					
Parameter	Model	Min	Typ	Max	Unit
Output Voltage (Vin(nom); Full Load; Ta=25℃)	xxD05 xxD12 xxD15	4.95 11.88 14.85	5 12 15	5.05 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 -1.0		+0.5 +1.0	%
Output Ripple and Noise Peak to Peak (20MHz Bandwidth) With a 10μF/25V X7R MLCC	xxD05 xxD12 xxD15		30 40 40	75 100 100	mVp-p
Cross Regulation (Asymmetrical Load 25% / 100% of Full Load)	All	-5.0		+5.0	% of Vout
Voltage adjustability (see page 30) (Only for B-type Pin connection option)	All	-10		+10	% of Vout
Temperature Coefficient	All	-0.02		+0.02	%/℃
Output Voltage Overshoot (Vin,min to Vin,max; Full Load; Ta=25℃)	All		0	3	% of Vout
Dynamic Load Response (Vin= Vin(nom); Ta=25℃) Load step change from 75% to 100% or 100 to 75% of Full Load Peak Deviation Setting Time (Vo＜10% peak deviation)	 All All		 3 250		 % of Vout μs
Output Current	xxD05 xxD12 xxD15	0 0 0		±300 ±125 ±100	mA
Output Capacitance Load	xxD05 xxD12 xxD15			±430 ±75 ±56	μF
Output Over Voltage Protection (see page 32)	xxD05 xxD12 xxD15	5.6 13.5 17		7.0 18.2 22.0	VDC
Output Over Current Protection (see page 31) (% of Iout rated; Hiccup mode)	All		150		% of FL
Output Short Circuit Protection (see page 32)	All	Continuous, automatic recovery			

Input Specifications					
Parameter	Model	Min	Typ	Max	Unit
Operating Input Voltage					
Continuous	05Dxx	4.5	5	9	VDC
	12Dxx	9	12	18	VDC
	24Dxx	18	24	36	VDC
	48Dxx	36	48	75	VDC
Transient (3sec,max)	05Dxx			16	VDC
	12Dxx			25	VDC
	24Dxx			50	VDC
	48Dxx			100	VDC
Input Standby Current	05D05		25		mA
(Typ. value at Vin(nom); No Load)	05D12		25		mA
	05D15		25		mA
	12D05		10		mA
	12D12		10		mA
	12D15		10		mA
	24D05		6		mA
	24D12		6		mA
	24D15		6		mA
	48D05		4		mA
	48D12		4		mA
	48D15		4		mA
Under Voltage Lockout Turn-on Threshold	05Dxx			4.5	VDC
	12Dxx			9	VDC
	24Dxx			18	VDC
	48Dxx			36	VDC
Under Voltage Lockout Turn-off Threshold	05Dxx		4		VDC
	12Dxx		8		VDC
	24Dxx		16		VDC
	48Dxx		33		VDC
Input reflected ripple current (5 to 20MHz, 12µH source impedance)	All		20		mAp-p
Start Up Time (Vin(nom) and constant resistive load)	All				ms
Power up	All		30		ms
Remote ON/OFF	All		30		ms
Remote ON/OFF Control (see page 33) (The Ctrl pin voltage is referenced to negative input)	xxDxx-**P**				
Ctrl pin Low Voltage, Module ON	xxDxx-**P**		Short or 0 ~ 1.2VDC		
Ctrl pin High Voltage, Module OFF	xxDxx-**P**		Open or 2.2 ~ 12VDC		
Input Current of Remote Control Pin		-0.5		1	mA
Remote Off State Input Current			2.5		mA

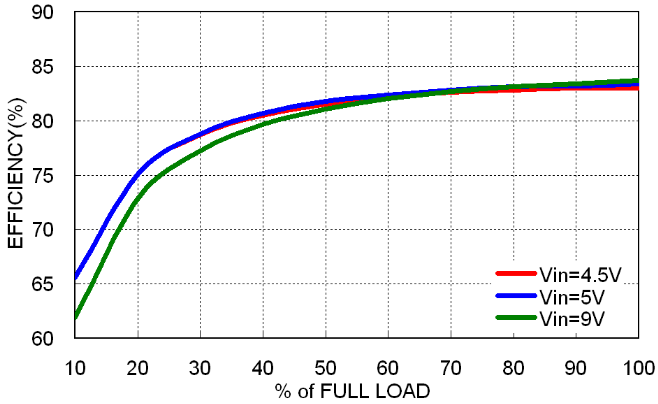
General Specifications					
Parameter	Model	Min	Typ	Max	Unit
Efficiency (Vin(nom); Full Load; Ta=25℃)	05D05 05D12 05D15 12D05 12D12 12D15 24D05 24D12 24D15 48D05 48D12 48D15		83 86 86 83.5 87.5 86.5 83 87 86 83 86 86		%
Isolation voltage (1 minute) Input to Output	All	5000			VAC
Isolation capacitance	All		12	17	pF
Leakage current (240VAC,60Hz)	All			2	μA
Switching Frequency	All	135	150	165	kHz
Clearance/Creepage	All	8			mm
Weight	All		14.0		g
MTBF(see page 37) MIL-HDBK-217F Ta=25ºC, Full load	All		6.444×10^6		hours
Safety Approvals	All	ANSI/AAMI ES60601-1 IEC60601-1, EN60601-1			
Case Material		Non-conductive black plastic			
Base Material	All	Non-conductive black plastic			
Potting Material	All	Silicone (UL94 V-0)			

Environmental Specifications					
Parameter	Model	Min	Typ	Max	Unit
Operating Ambient Temperature Without Derating With Derating	All	 -40 94		 94 105	℃
Storage Temperature	All	-55		125	℃
Thermal Impedance (20LFM)	All		18		℃/W
Relative humidity	All	5		95	% RH
Thermal Shock	All	MIL-STD-810F			
Vibration	All	MIL-STD-810F			

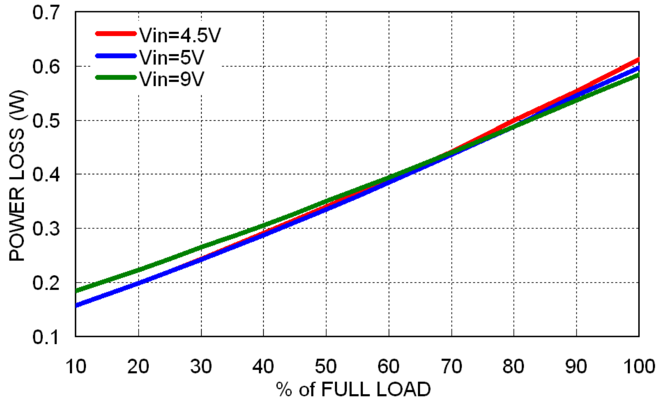
EMC Characteristics			
Characteristic	Standard	Condition	Level
EMI	EN55011 EN55022 FCC Part 18	Module stand-alone	Class A
	EN55011 EN55022 FCC Part 18	With external input filter	Class B
ESD	EN61000-4-2	Air ±8kV Contact ±6kV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast Transient(see page 34)	EN61000-4-4	±2kV	Perf. Criteria A
Surge(see page 34)	EN61000-4-5	±2kV	Perf. Criteria A
Conducted Immunity	EN61000-4-6	10V r.m.s	Perf. Criteria A

Characteristic Curves

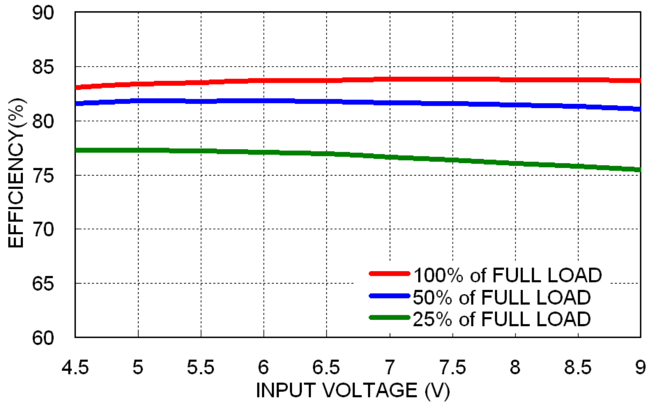
All test conditions are at 25℃.The figures are for PXC-M03-05D05



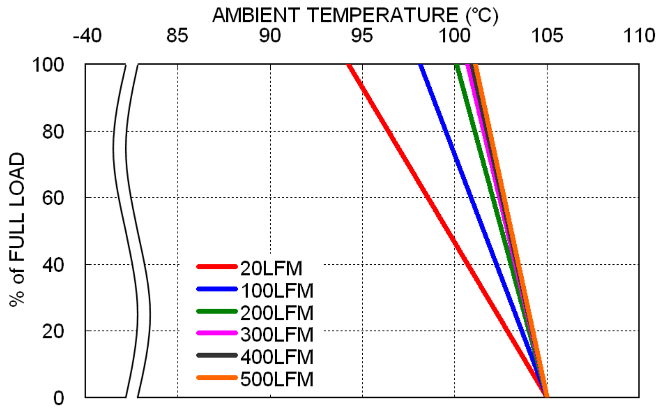
Efficiency versus Output Current



Power Dissipation versus Output Current



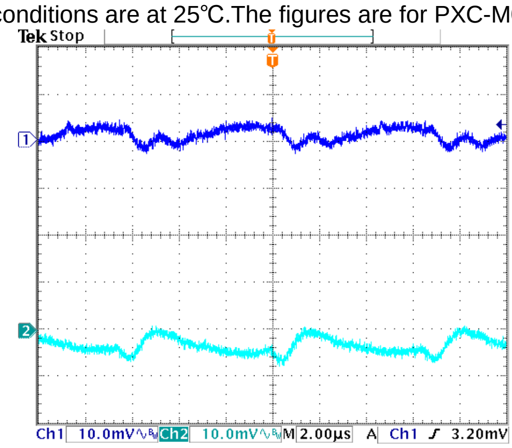
Efficiency versus Input Voltage
Full Load



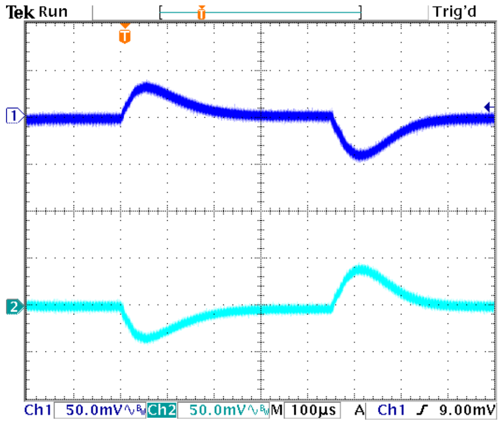
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

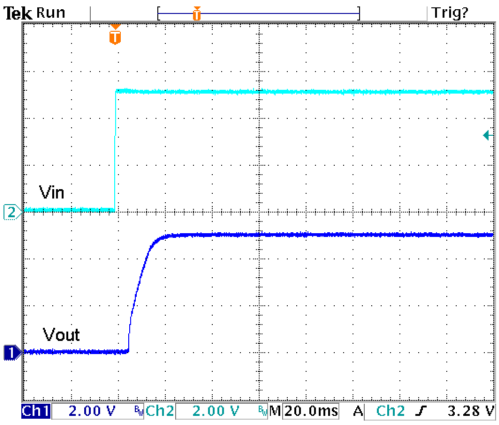
All test conditions are at 25℃.The figures are for PXC-M03-05D05



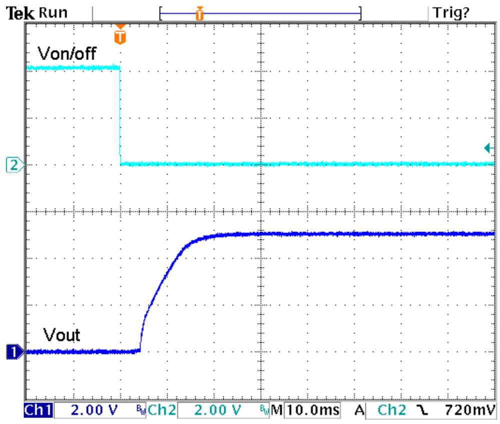
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



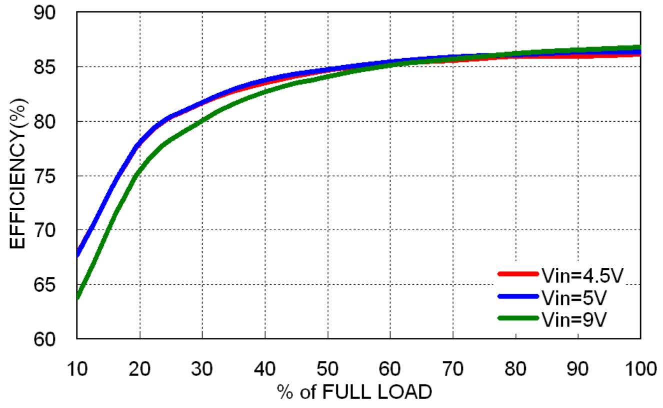
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



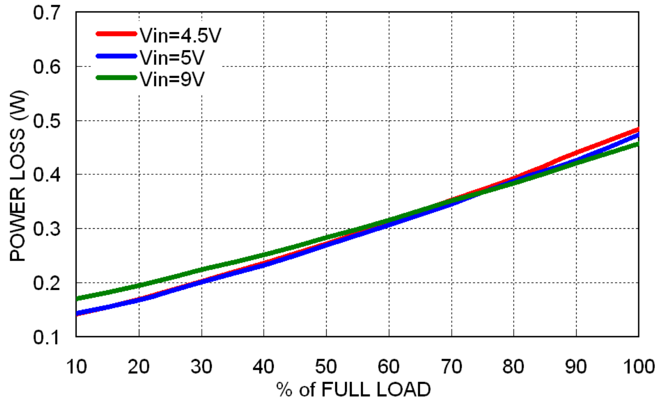
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

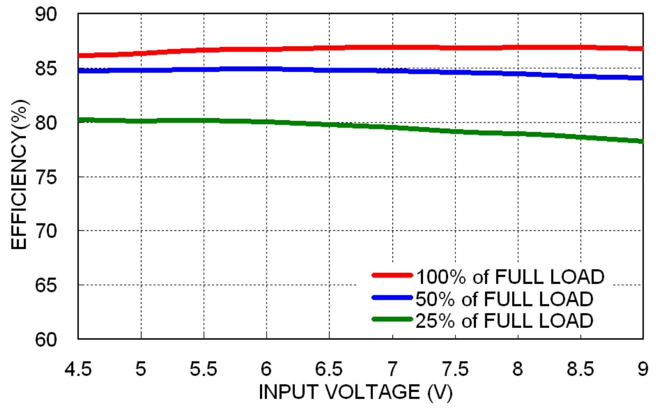
All test conditions are at 25℃.The figures are for PXC-M03-05D12



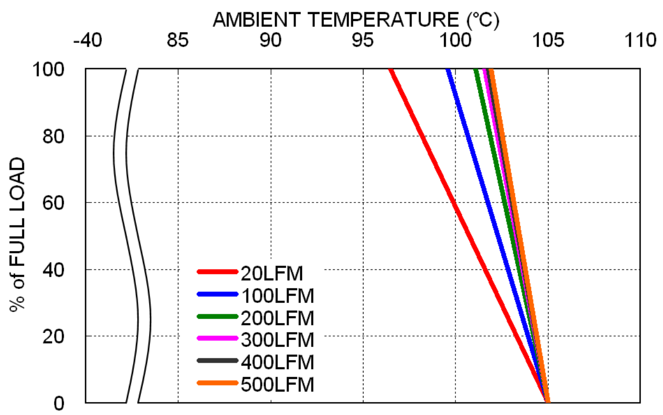
Efficiency versus Output Current



Power Dissipation versus Output Current



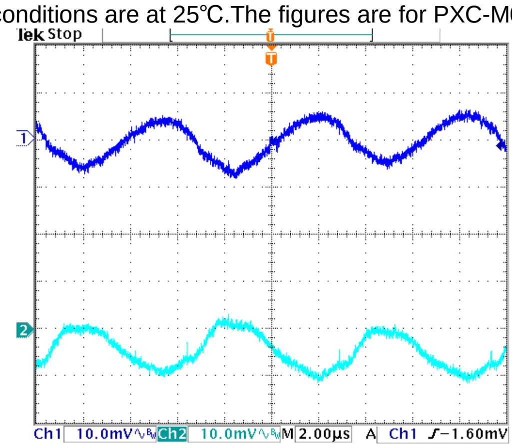
Efficiency versus Input Voltage
Full Load



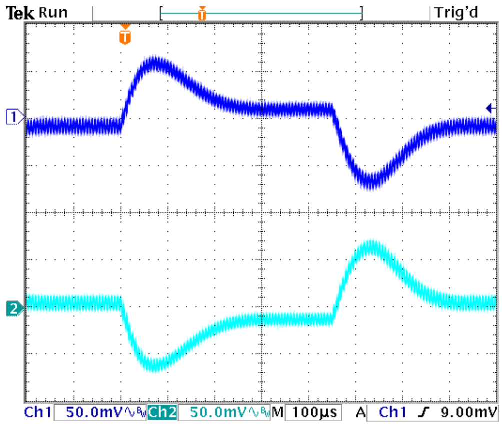
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

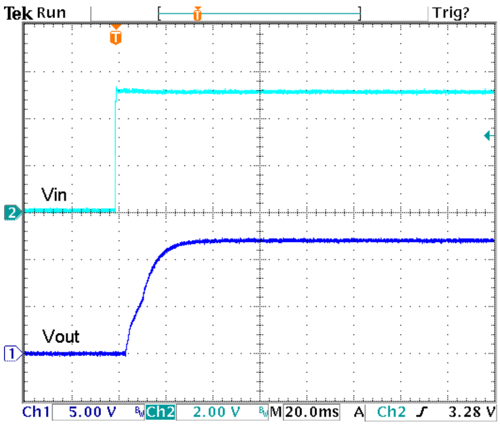
All test conditions are at 25℃.The figures are for PXC-M03-05D12



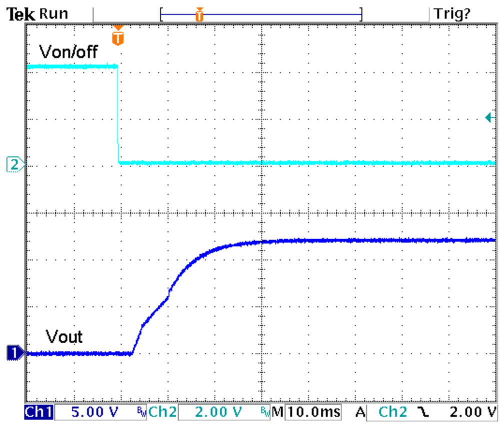
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



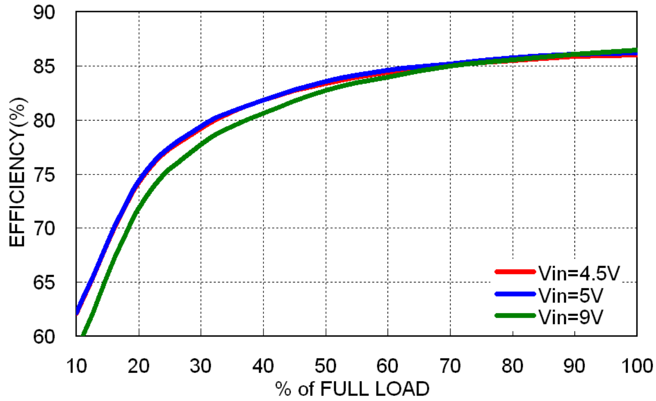
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



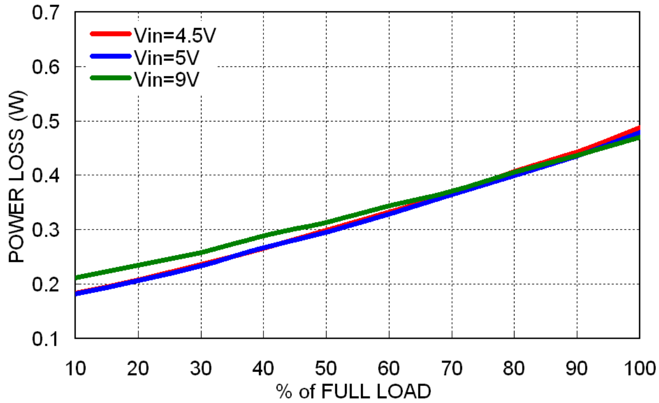
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

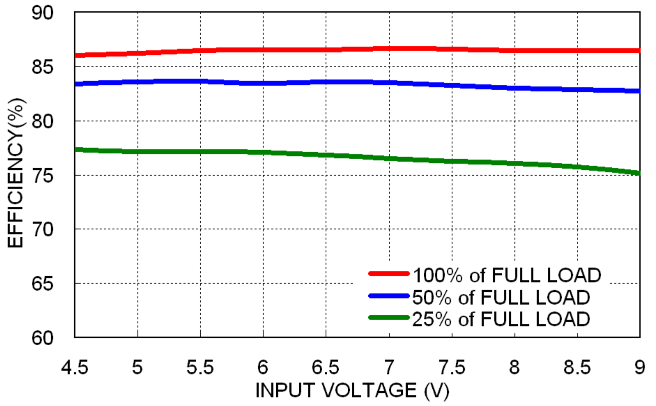
All test conditions are at 25℃.The figures are for PXC-M03-05D15



Efficiency versus Output Current

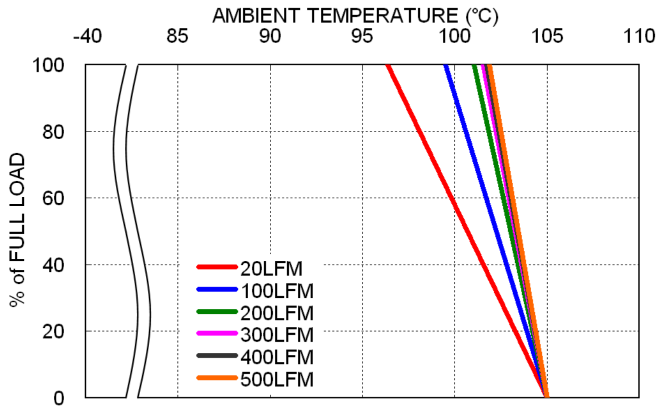


Power Dissipation versus Output Current



Efficiency versus Input Voltage

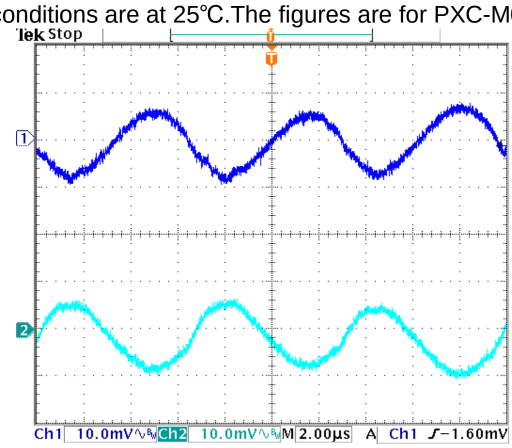
Full Load



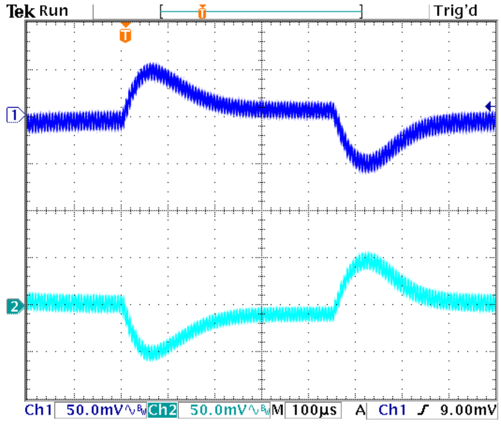
Derating Output Current versus Ambient Temperature and Airflow Vin(nom)

Characteristic Curves (Continued)

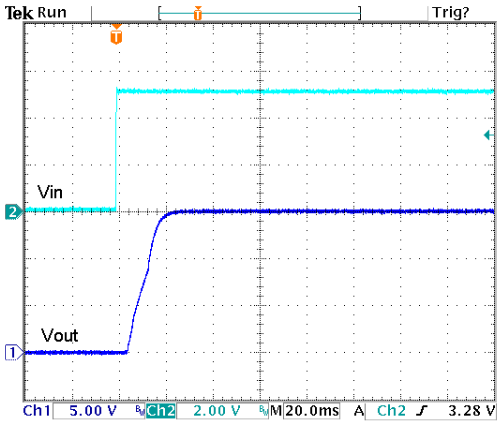
All test conditions are at 25℃.The figures are for PXC-M03-05D15



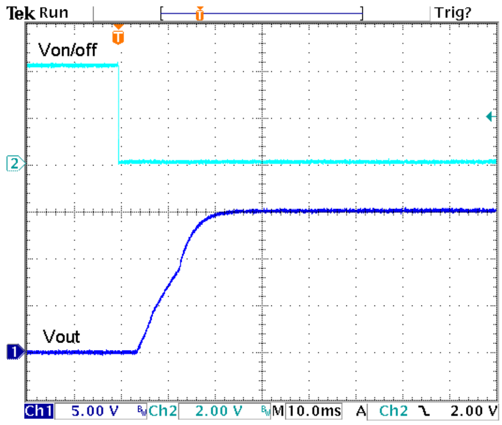
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



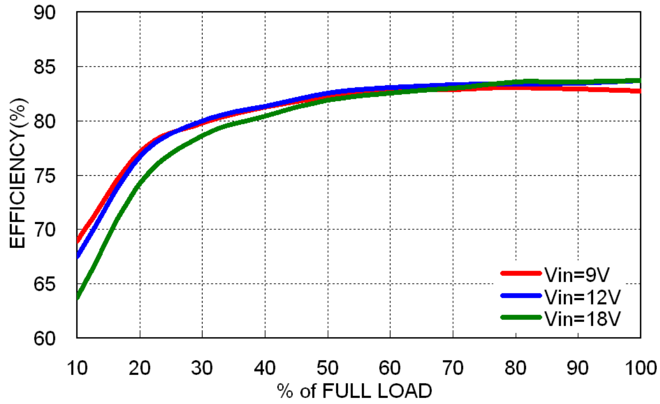
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



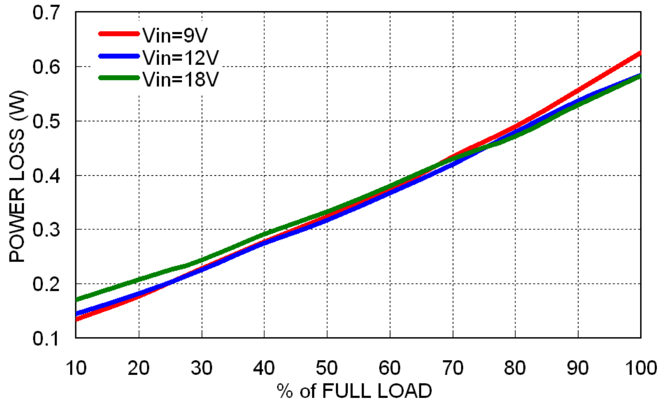
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

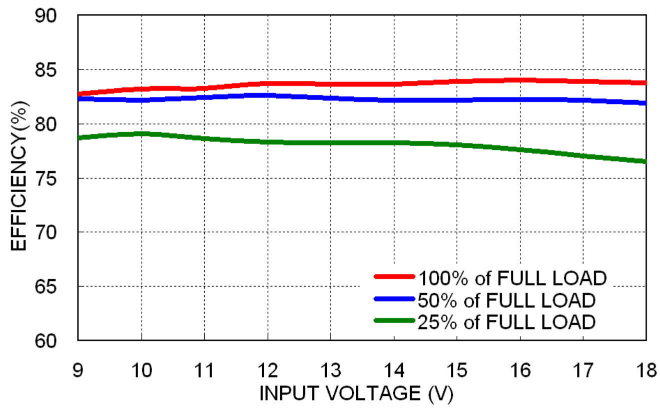
All test conditions are at 25℃.The figures are for PXC-M03-12D05



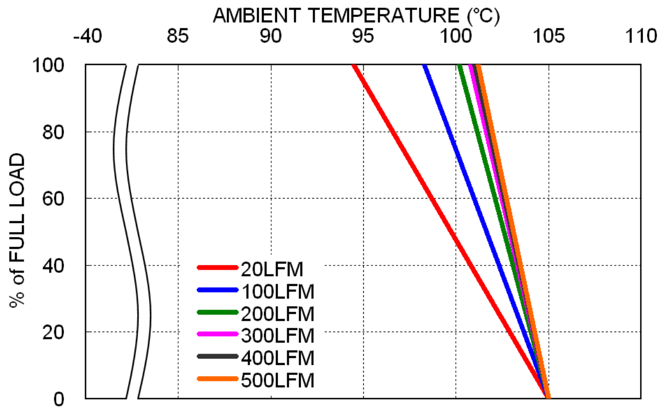
Efficiency versus Output Current



Power Dissipation versus Output Current



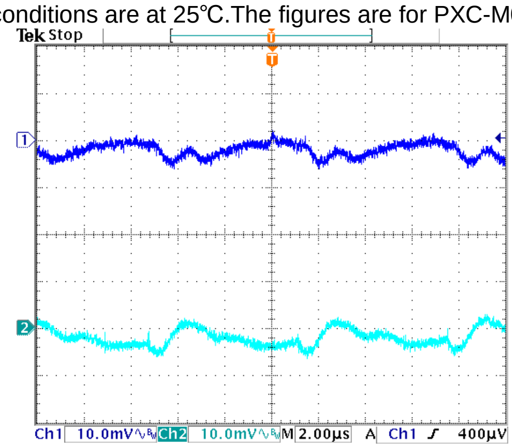
Efficiency versus Input Voltage
Full Load



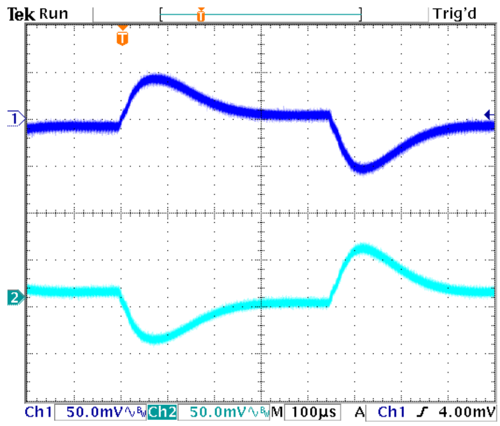
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

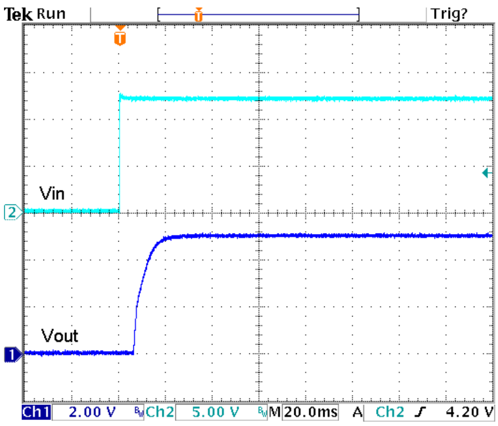
All test conditions are at 25℃.The figures are for PXC-M03-12D05



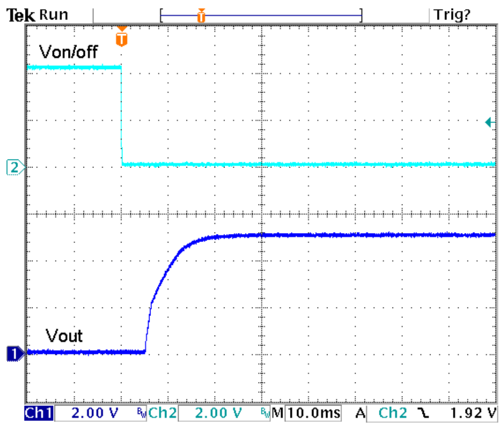
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



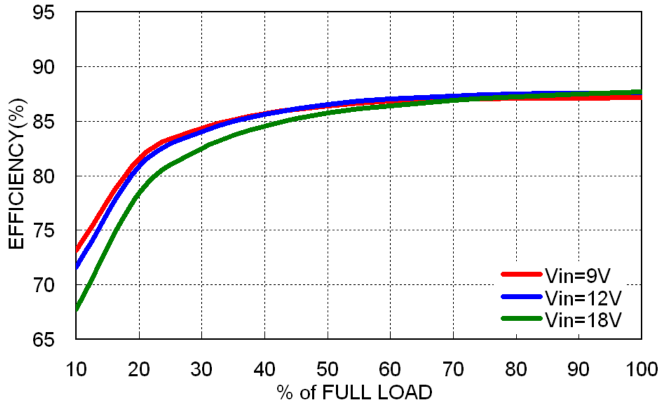
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



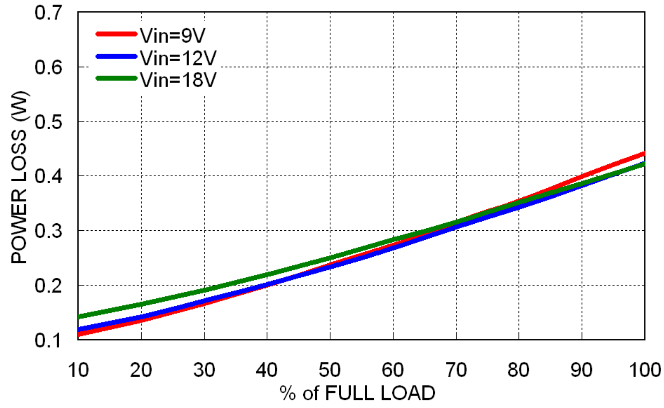
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

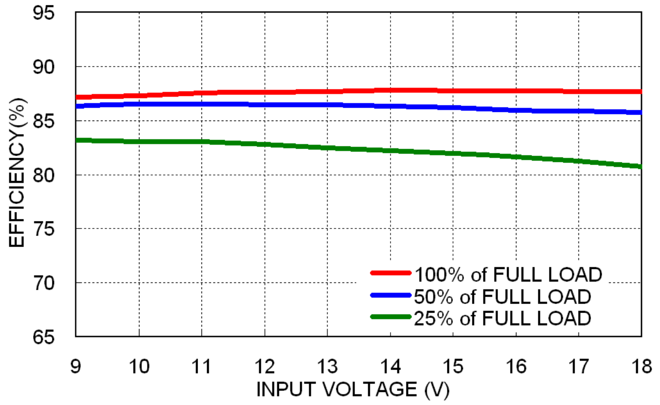
All test conditions are at 25℃.The figures are for PXC-M03-12D12



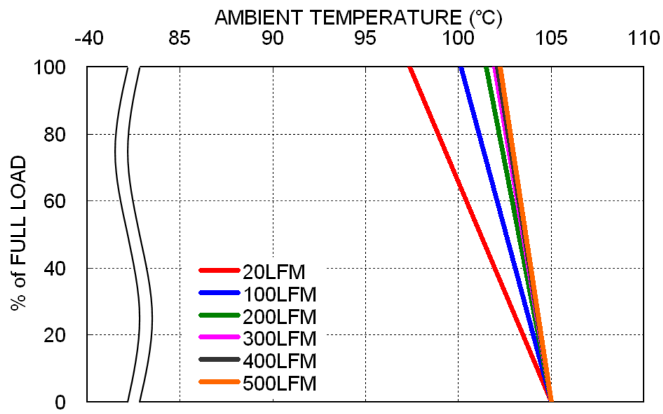
Efficiency versus Output Current



Power Dissipation versus Output Current



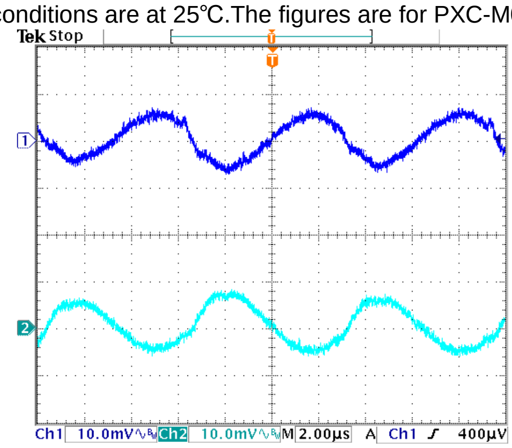
Efficiency versus Input Voltage
Full Load



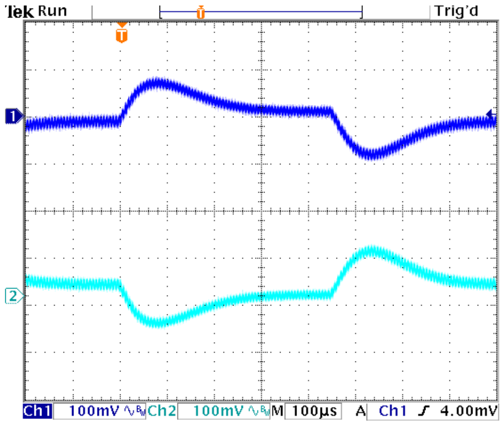
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

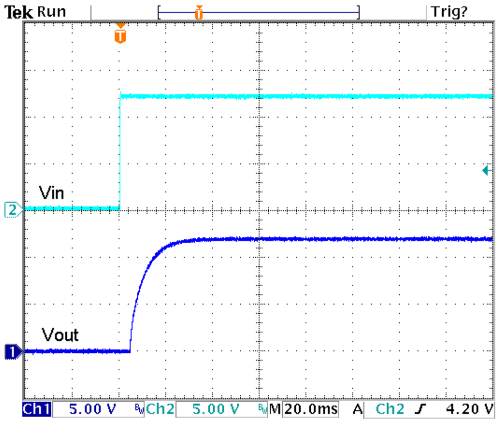
All test conditions are at 25℃.The figures are for PXC-M03-12D12



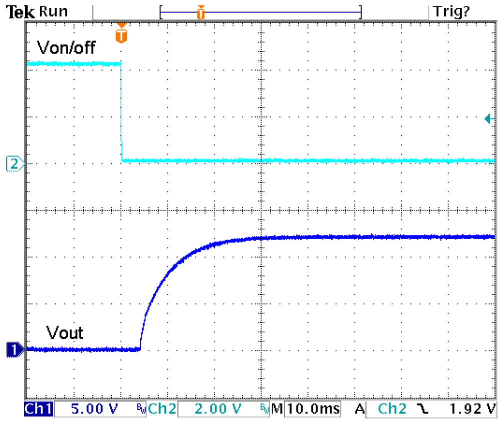
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



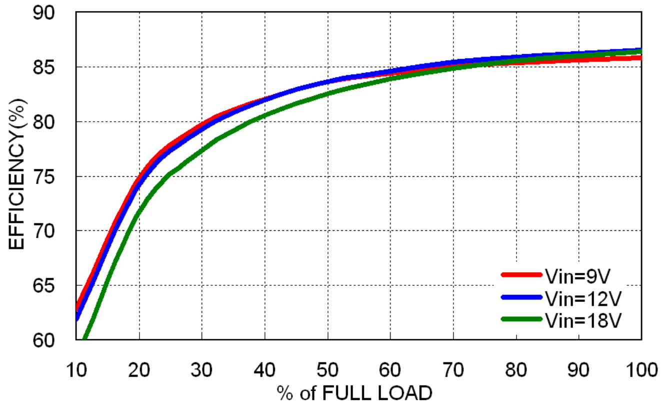
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



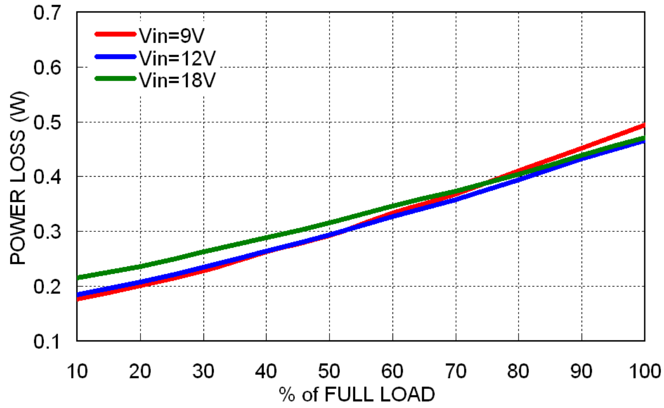
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

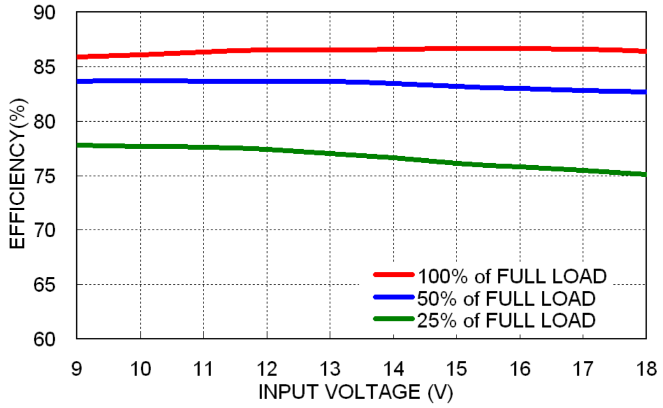
All test conditions are at 25℃.The figures are for PXC-M03-12D15



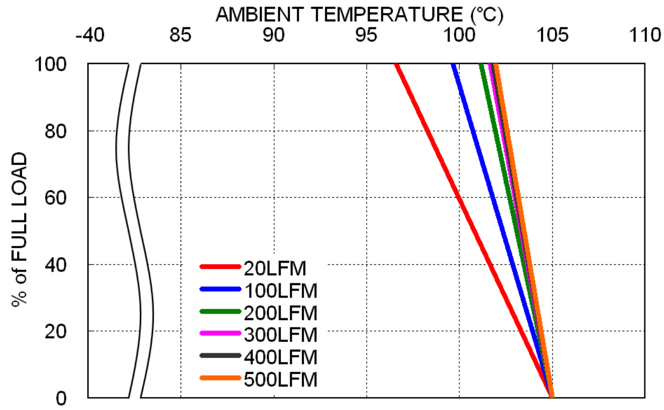
Efficiency versus Output Current



Power Dissipation versus Output Current



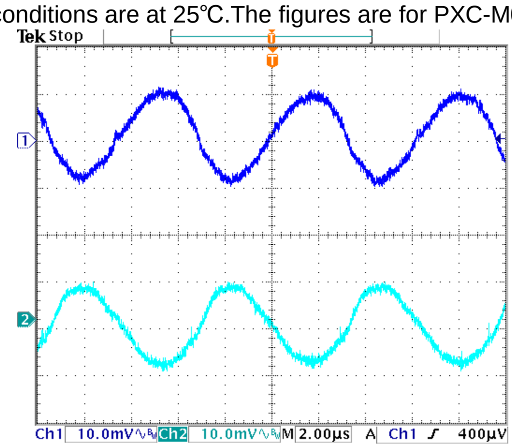
Efficiency versus Input Voltage
Full Load



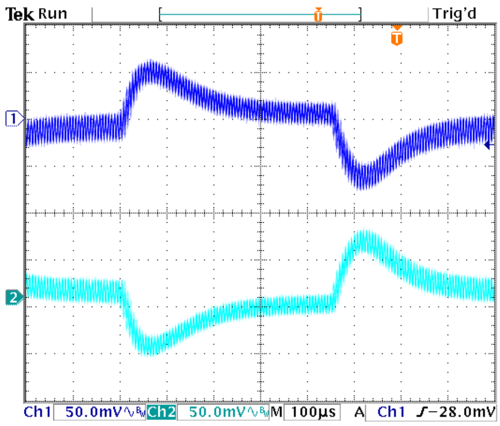
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

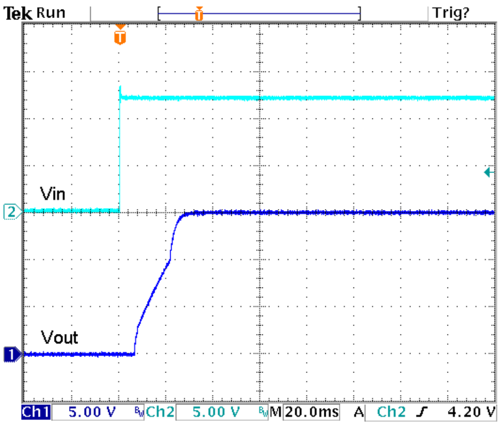
All test conditions are at 25℃.The figures are for PXC-M03-12D15



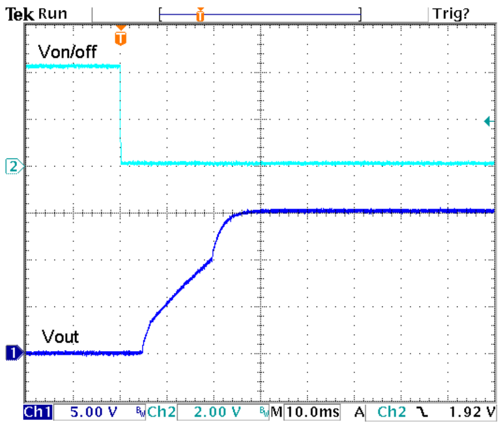
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



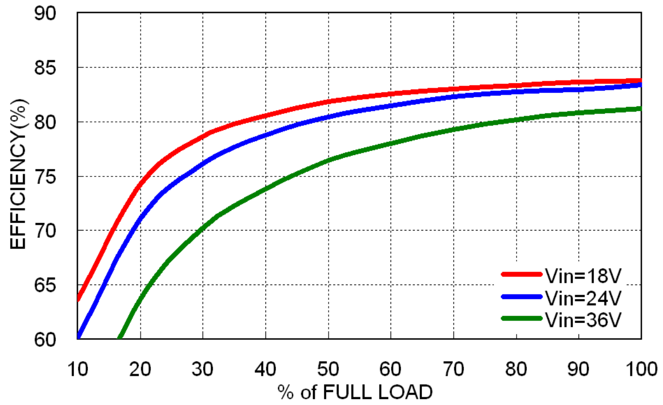
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



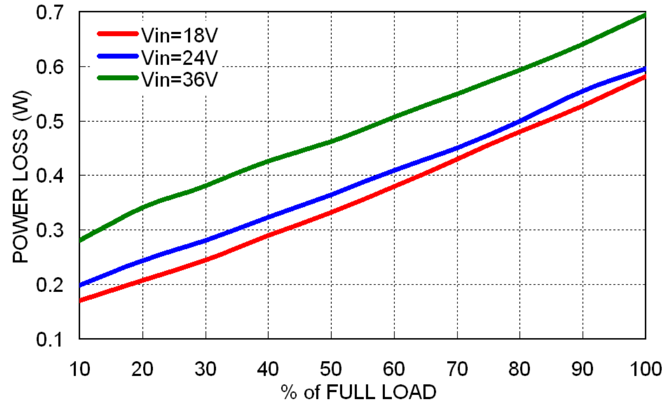
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

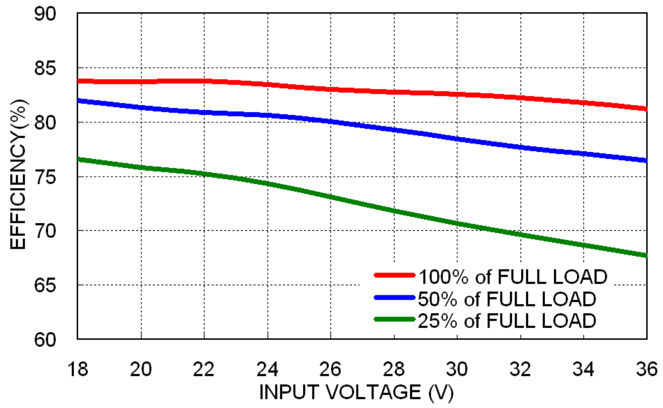
All test conditions are at 25℃.The figures are for PXC-M03-24D05



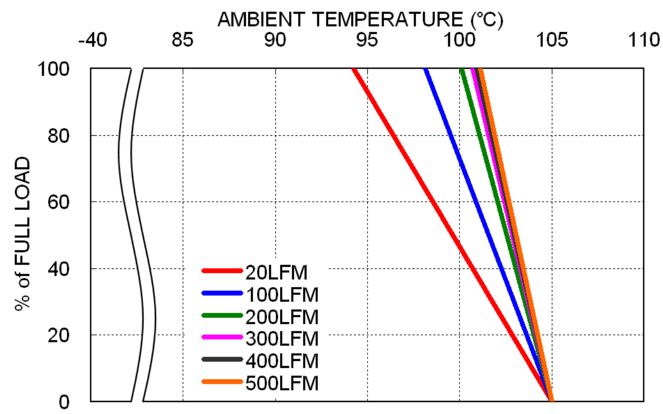
Efficiency versus Output Current



Power Dissipation versus Output Current



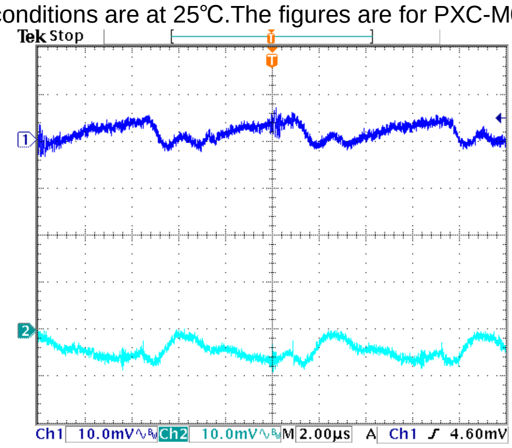
Efficiency versus Input Voltage
Full Load



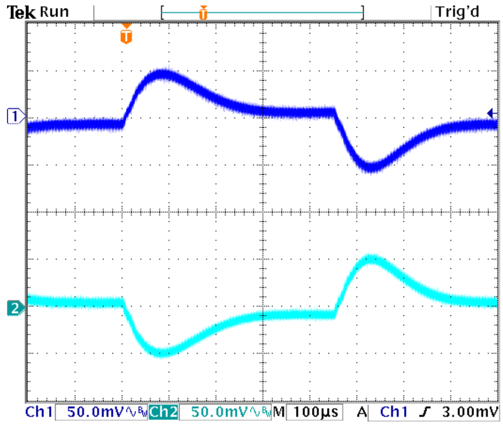
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

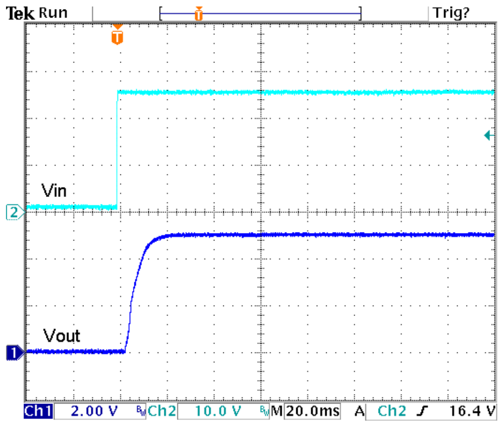
All test conditions are at 25℃.The figures are for PXC-M03-24D05



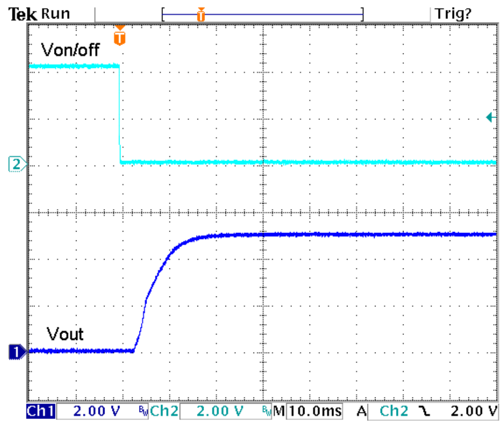
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



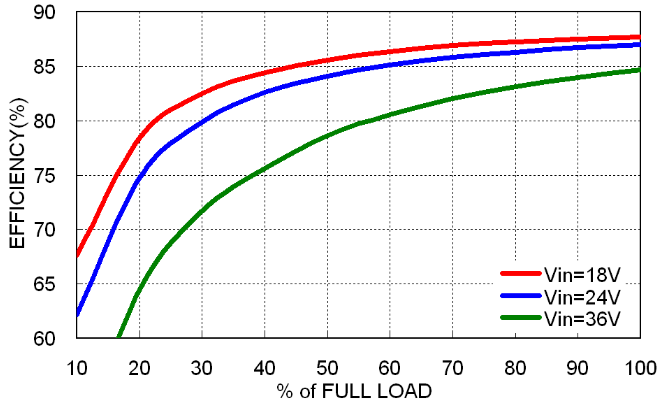
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



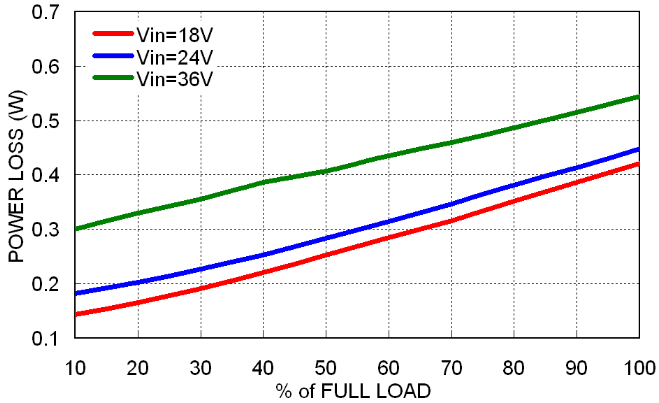
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

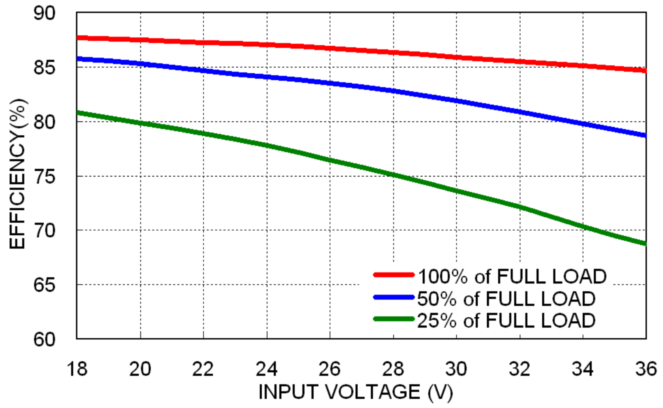
All test conditions are at 25℃.The figures are for PXC-M03-24D12



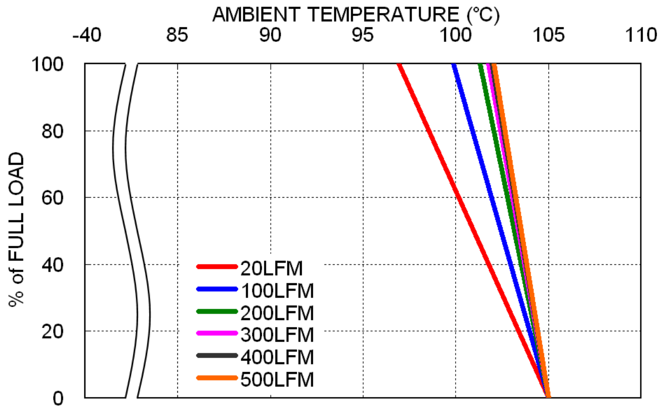
Efficiency versus Output Current



Power Dissipation versus Output Current



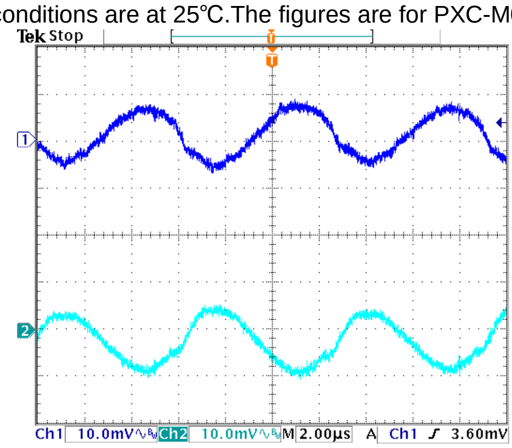
Efficiency versus Input Voltage
Full Load



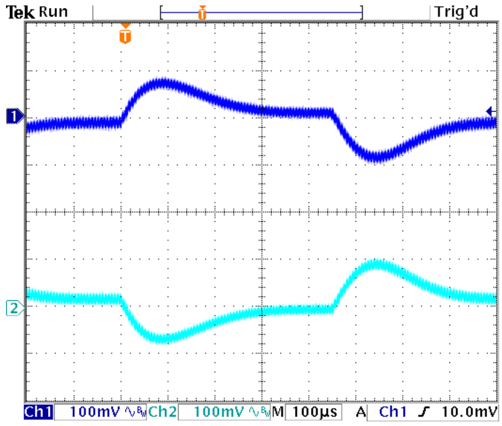
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

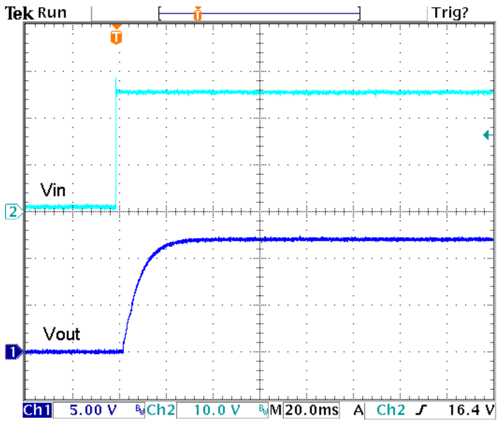
All test conditions are at 25℃.The figures are for PXC-M03-24D12



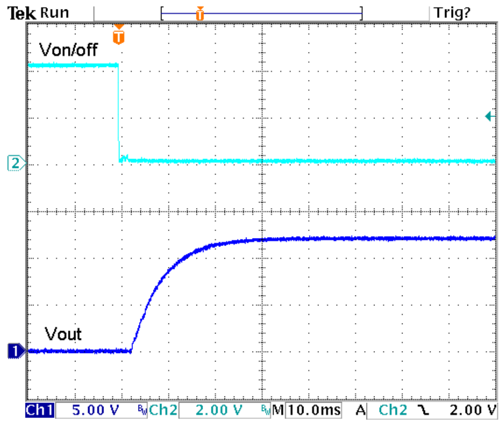
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



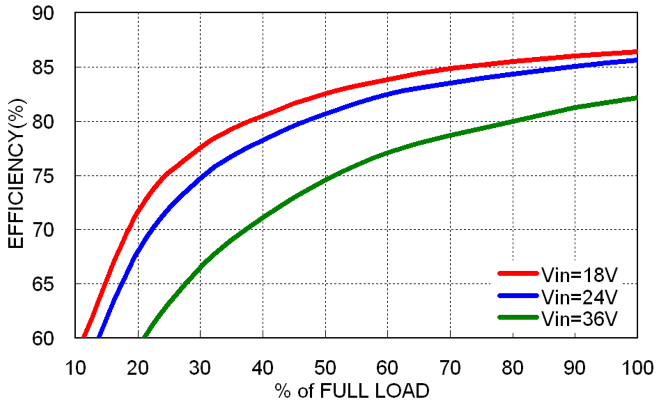
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



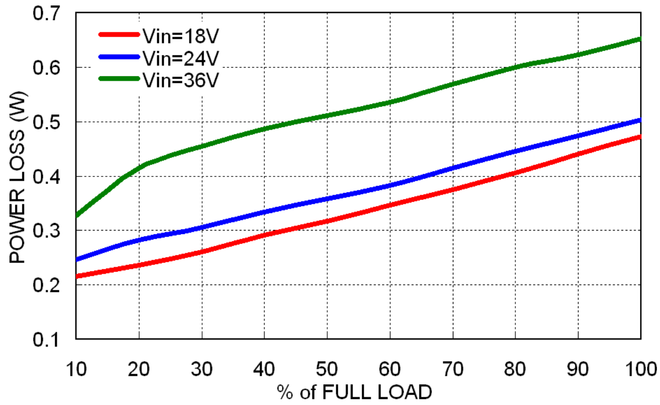
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

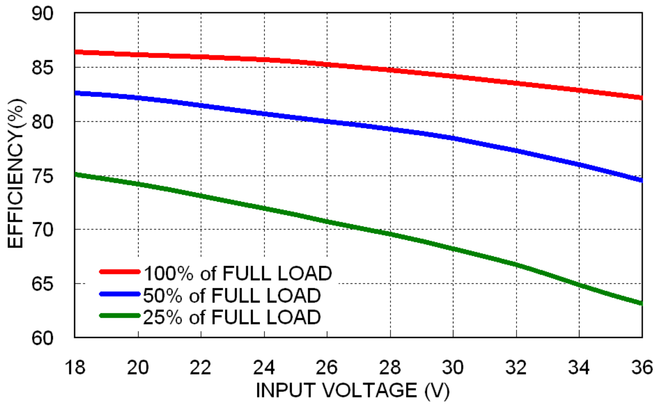
All test conditions are at 25℃.The figures are for PXC-M03-24D15



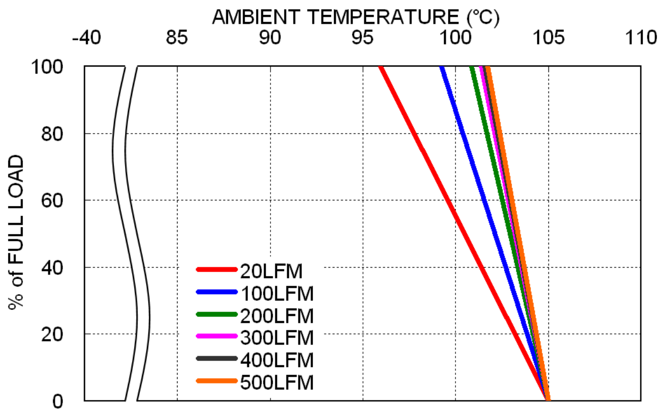
Efficiency versus Output Current



Power Dissipation versus Output Current



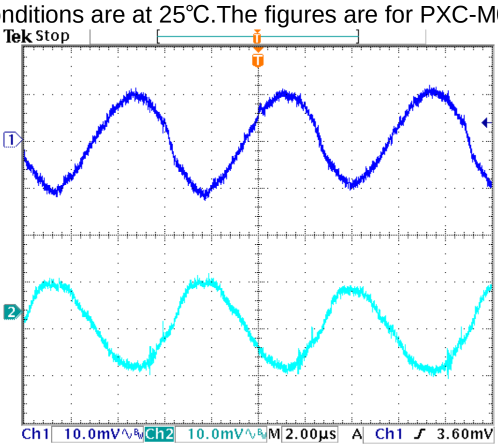
Efficiency versus Input Voltage
Full Load



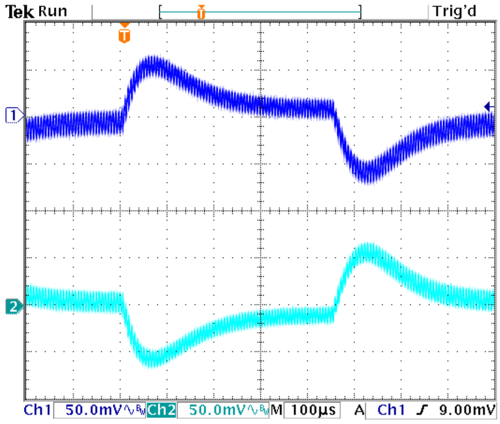
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

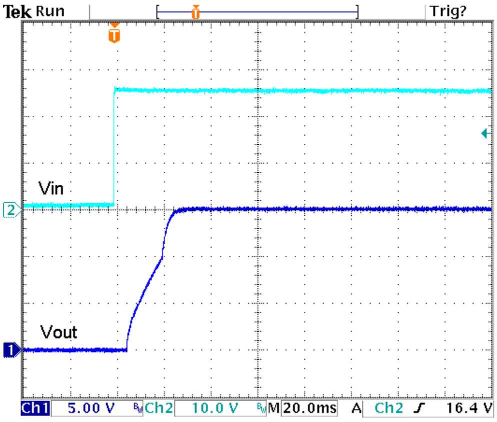
All test conditions are at 25℃.The figures are for PXC-M03-24D15



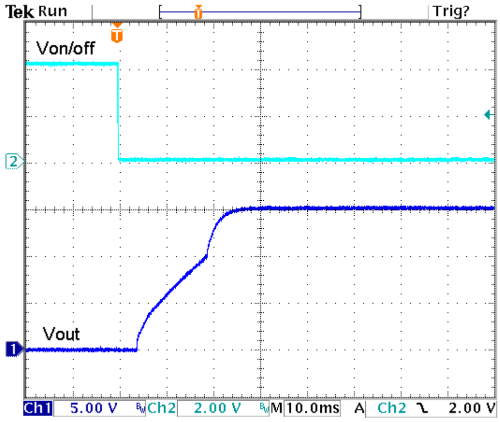
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



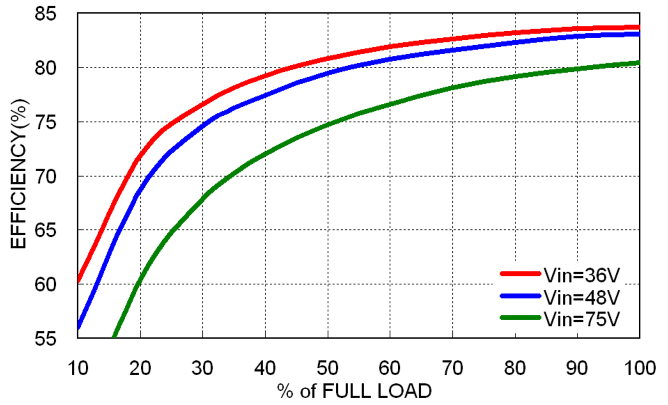
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



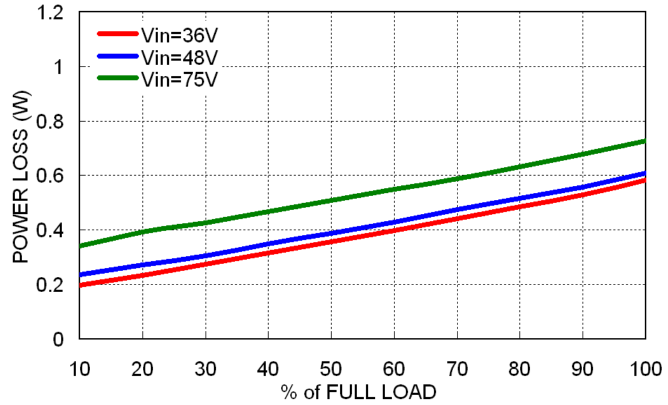
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

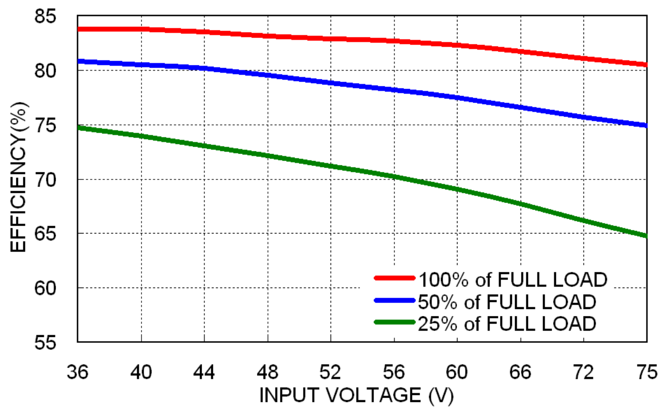
All test conditions are at 25℃.The figures are for PXC-M03-48D05



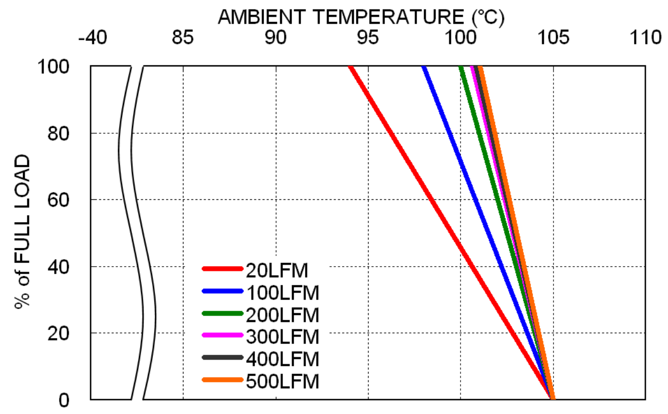
Efficiency versus Output Current



Power Dissipation versus Output Current



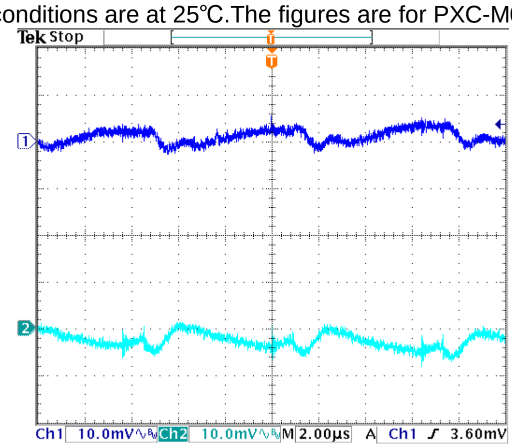
Efficiency versus Input Voltage
Full Load



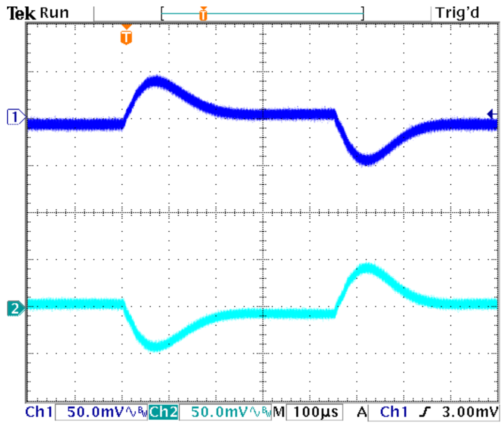
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

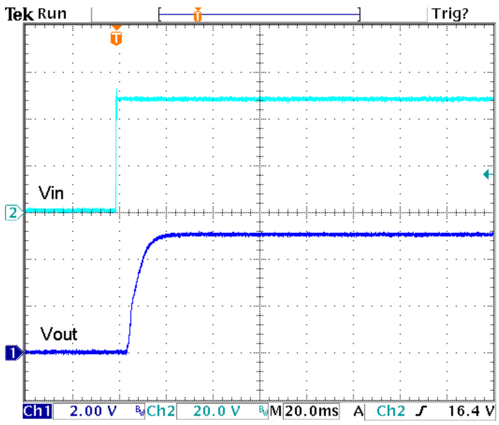
All test conditions are at 25℃.The figures are for PXC-M03-48D05



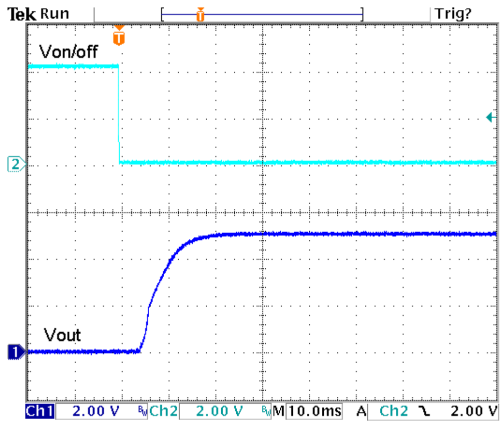
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



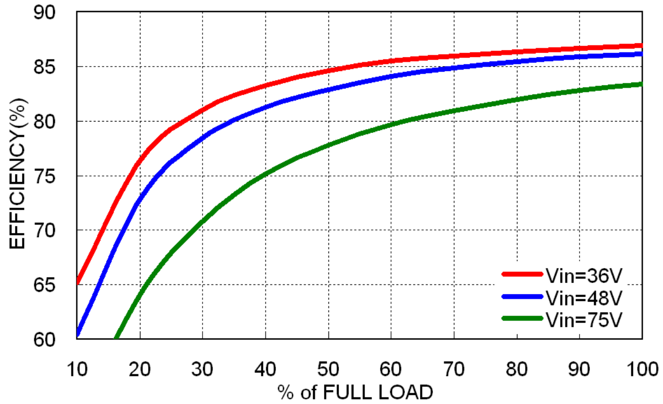
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



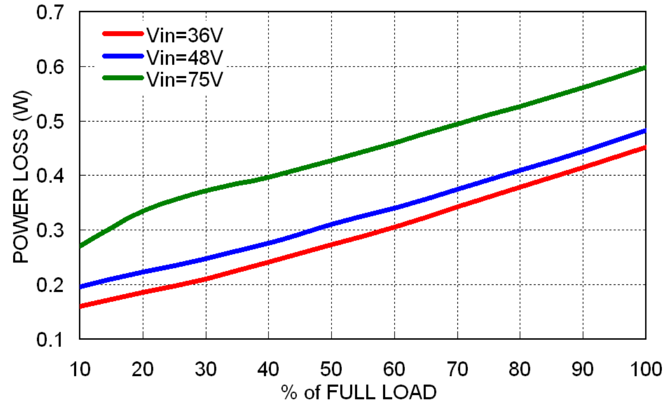
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

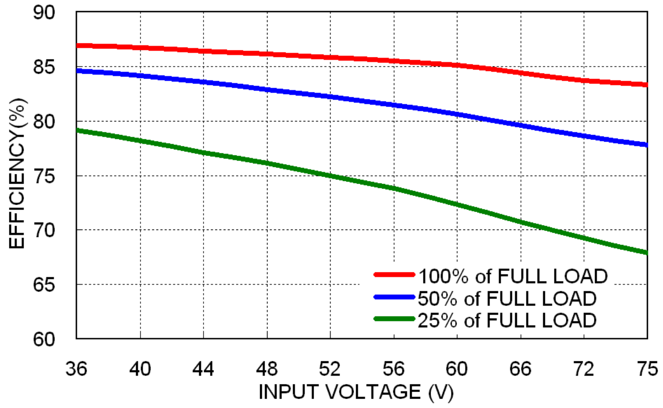
All test conditions are at 25℃.The figures are for PXC-M03-48D12



Efficiency versus Output Current

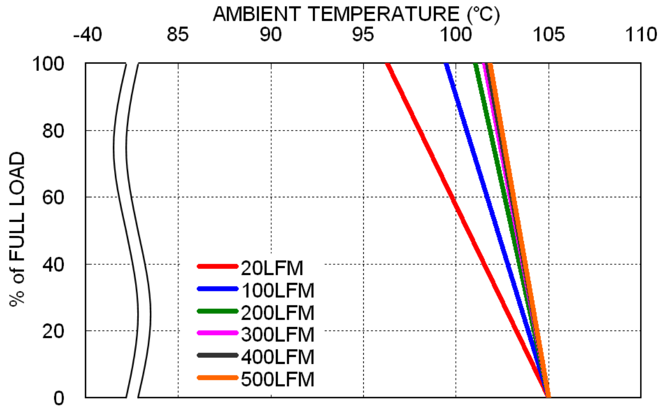


Power Dissipation versus Output Current



Efficiency versus Input Voltage

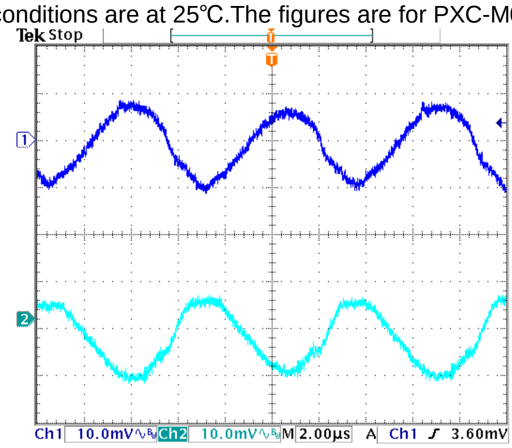
Full Load



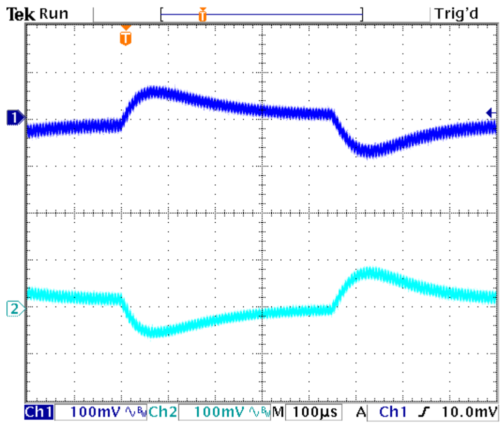
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

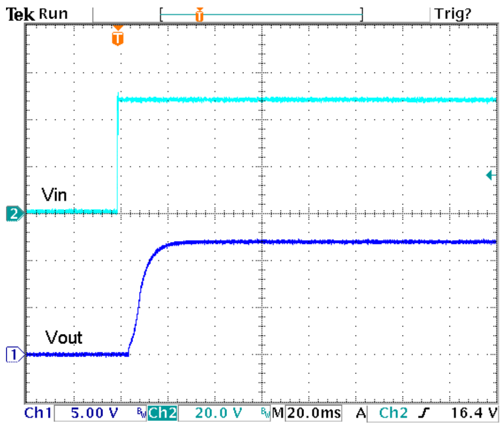
All test conditions are at 25℃.The figures are for PXC-M03-48D12



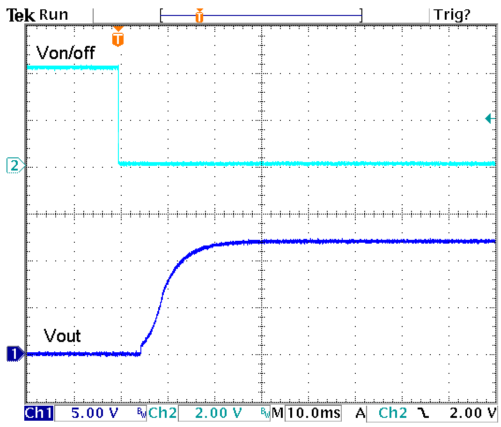
Typical Output Ripple and Noise.
Vin(nom); Full Load



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



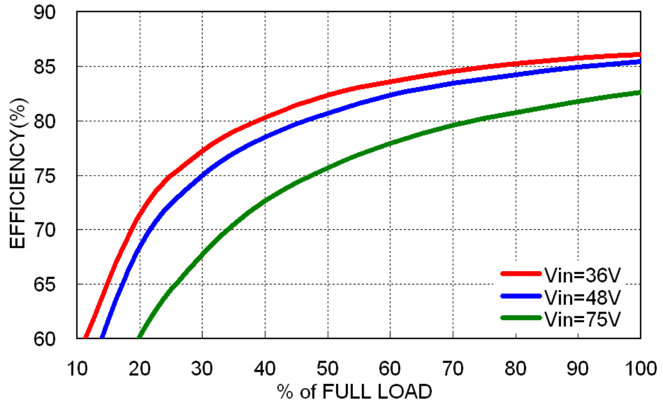
Typical Input Start-Up and Output Rise Characteristic
Vin(nom); Full Load



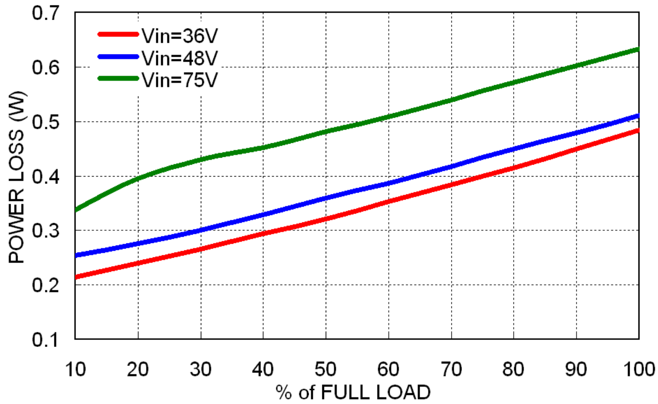
Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

Characteristic Curves (Continued)

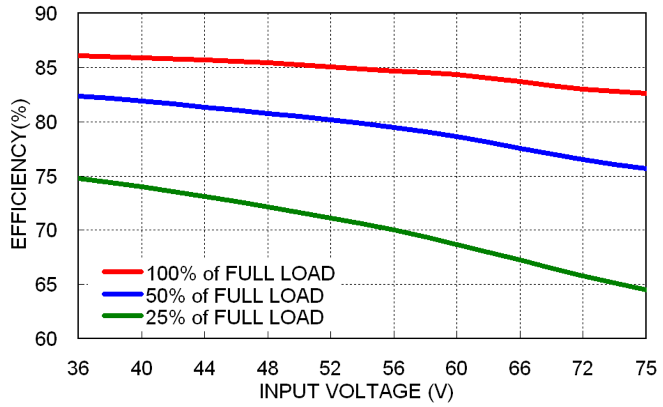
All test conditions are at 25℃.The figures are for PXC-M03-48D15



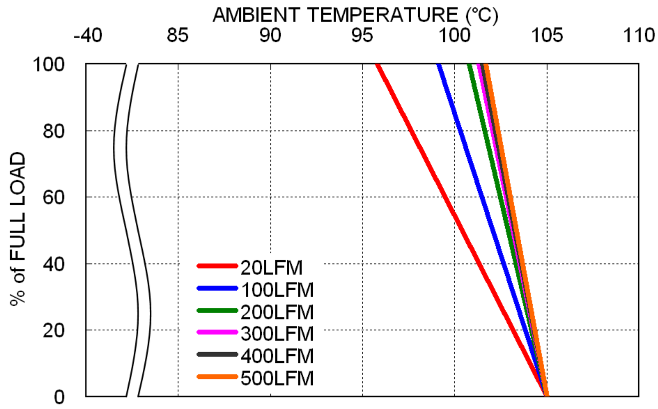
Efficiency versus Output Current



Power Dissipation versus Output Current



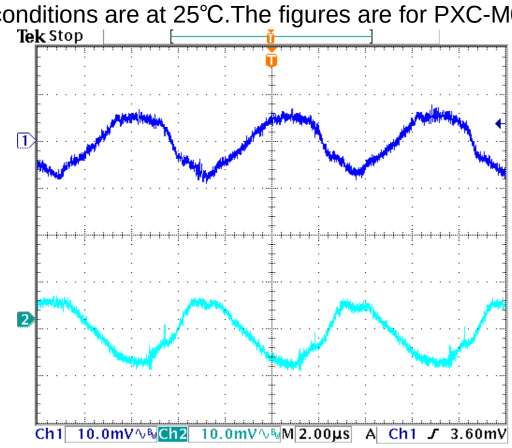
Efficiency versus Input Voltage
Full Load



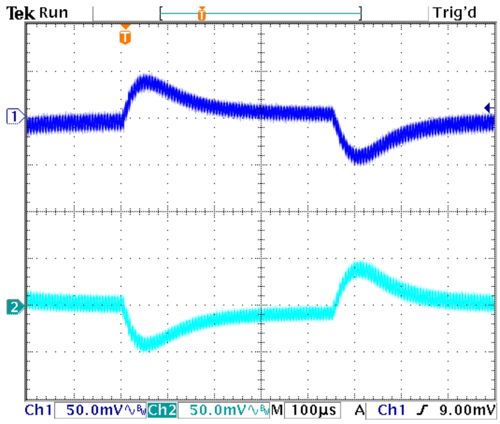
Derating Output Current versus Ambient Temperature and Airflow
Vin(nom)

Characteristic Curves (Continued)

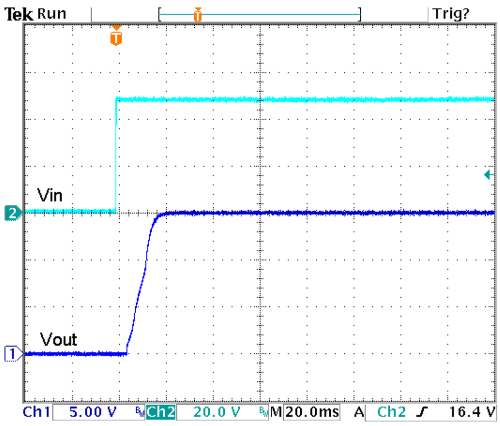
All test conditions are at 25℃.The figures are for PXC-M03-48D15



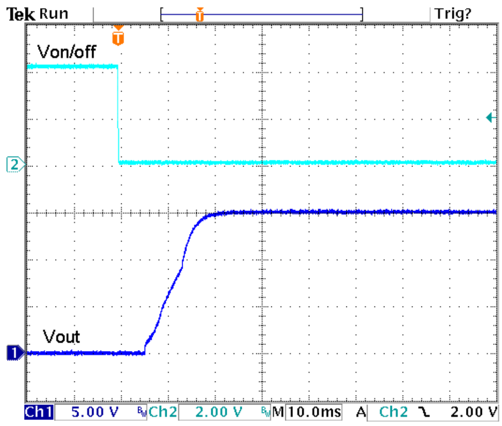
Typical Output Ripple and Noise.
Vin(nom); Full Load



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

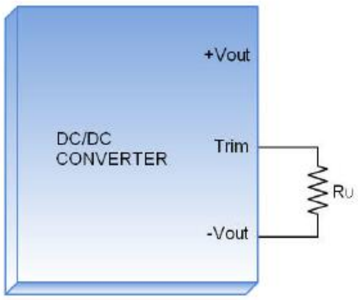


Using ON/OFF Voltage Start-Up and Output Rise Characteristic
Vin(nom); Full Load

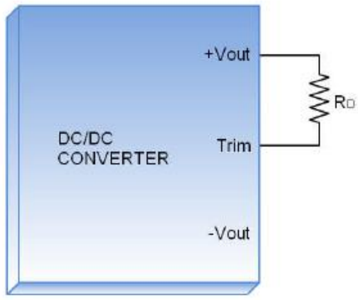
Output Voltage Adjustment

Output voltage adjustment is an optional function for PXC-M03-xxDxx-xT.

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



TRIM-DOWN

Output voltage adjustment configurations

TRIM TABLE

xxD05-xT TRIM-UP

Trim-Up (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	±5.047	±5.097	±5.147	±5.196	±5.246	±5.296	±5.346	±5.396	±5.446	±5.496
RU (kΩ)	71.84	34.42	21.95	15.71	11.97	9.47	7.69	6.36	5.32	4.48

TRIM-DOWN

Trim-Down (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	±4.947	±4.897	±4.847	±4.797	±4.747	±4.697	±4.647	±4.597	±4.547	±4.497
RD (kΩ)	219.16	106.58	69.05	50.29	39.03	31.53	26.17	22.14	19.02	16.52

xxD12-xT TRIM-UP

Trim-Up (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	±12.113	±12.233	±12.352	±12.472	±12.592	±12.712	±12.832	±12.952	±13.072	±13.192
RU (kΩ)	568.20	277.60	180.73	132.30	103.24	83.87	70.03	59.65	51.58	45.12

TRIM-DOWN

Trim-Down (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	±11.873	±11.753	±11.633	±11.513	±11.393	±11.273	±11.153	±11.033	±10.913	±10.793
RD (kΩ)	4949.80	2440.40	1603.93	1185.70	934.76	767.47	647.97	558.35	488.64	432.88

xxD15-xT TRIM-UP

Trim-Up (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	±15.131	±15.281	±15.43	±15.58	±15.73	±15.88	±16.03	±16.179	±16.329	±16.479
RU (kΩ)	236.25	111.62	70.08	49.31	36.85	28.54	22.61	18.16	14.69	11.92

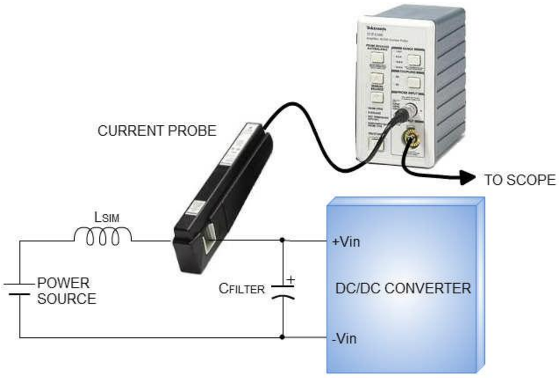
TRIM-DOWN

Trim-Down (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	±14.831	±14.681	±14.532	±14.382	±14.232	±14.082	±13.932	±13.782	±13.633	±13.483
RD (kΩ)	2707.75	1332.38	873.92	644.69	507.15	415.46	349.96	300.84	262.64	232.08

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. Install choke (LSIM) to simulate the impedance of power source. External input capacitors CFILTER serve primarily as energy-storage elements, minimizing line voltage variations caused by transient IR drops in conductors from backplane to the DC/DC. The capacitor must be as close as possible to the input terminals of the power module for lower impedance. The input reflected-ripple current measurement configuration is shown below:

Input reflected-ripple current measurement setup



PXC-M03-05Dxx

Component	Value	Voltage	Reference
LSIM	12μH	----	Inductor
CFILTER	47μF	100V	Nippon chemi-con KY-series

PXC-M03-12Dxx

Component	Value	Voltage	Reference
LSIM	12μH	----	Inductor
CFILTER	47μF	100V	Nippon chemi-con KY-series

PXC-M03-24Dxx

Component	Value	Voltage	Reference
LSIM	12μH	----	Inductor
CFILTER	47μF	100V	Nippon chemi-con KY-series

PXC-M03-48Dxx

Component	Value	Voltage	Reference
LSIM	12μH	----	Inductor
CFILTER	47μF	100V	Nippon chemi-con KY-series

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 PXC-M03 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 Circuitry Protection

Continuous and auto-recovery mode.

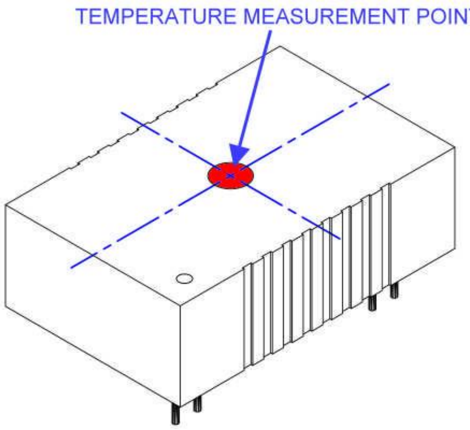
During short circuit, converter will shut down. The average current during this condition will be very low and the device is safe in this condition.

Output Over Voltage Protection

The output over-voltage protection consists of circuitry that internally clamps the output voltage. If a more accurate output over-voltage protection scheme is required then this should be implemented externally via use of the remote on/off pin.

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 as shown in the figure below. The temperature at this location should not exceed 105℃. When operating, adequate cooling must be provided to maintain the test point temperature at or below 105℃. Although the maximum point temperature of the power modules is 105℃, limiting this temperature to a lower value enhances the reliability.

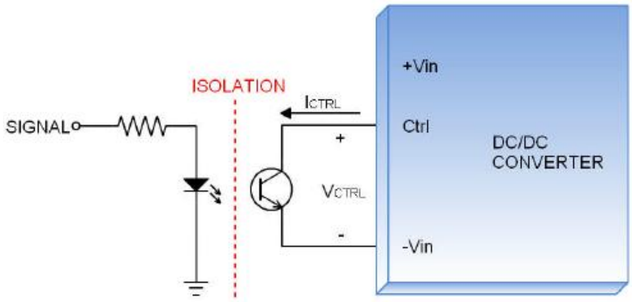


Remote On/off Control

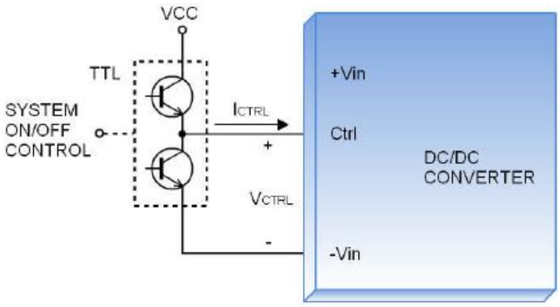
Only for B-type pin connection option with suffix -P,. Ex.: PXC-M03-24D05-P

The module is ON during logic Low and turns OFF during logic High. The Ctrl pin is an open collector/drain logic input signal that 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.

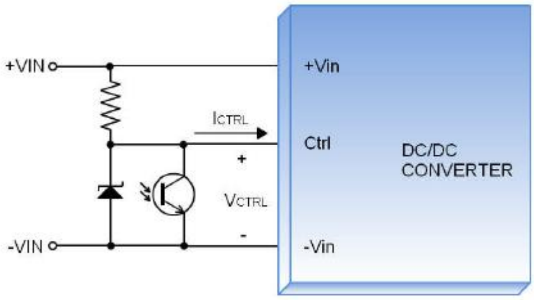
Remote ON/OFF Implementation



Isolated-Control Remote ON/OFF



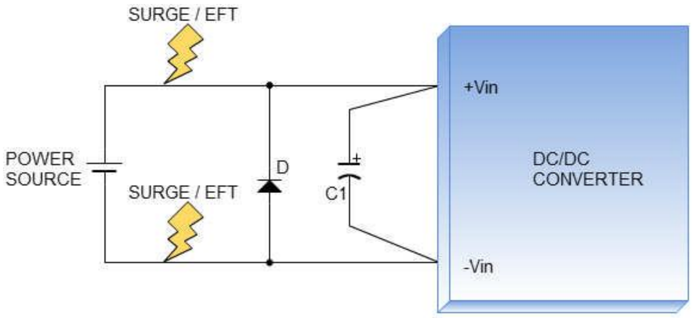
Level Control Using TTL Output



Level Control Using Line Voltage

EMS Considerations

The PXC-M03 series can meet Fast Transient EN61000-4-4 and Surge EN61000-4-5 performance criteria A with external components connected to the input terminals of the module. Please see the following schematic shown below.



Surge / Fast Transient

PXC-M03-05Dxx

Component	Value	Voltage	Reference
D	10A	45V	Vishay V10P45
C1	1000μF	25V	Nippon chemi-con KY-series

PXC-M03-12Dxx

Component	Value	Voltage	Reference
C1	470μF	50V	Nippon chemi-con KY-series

PXC-M03-24Dxx

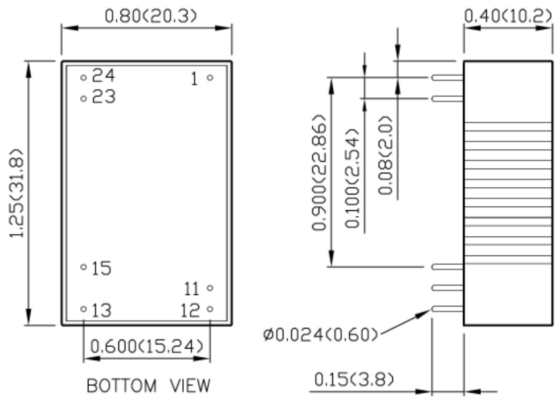
Component	Value	Voltage	Reference
C1	470μF	50V	Nippon chemi-con KY-series

PXC-M03-48Dxx

Component	Value	Voltage	Reference
C1	330μF	100V	Nippon chemi-con KY-series

Mechanical Data

PXC-M03-xxDxx Type A

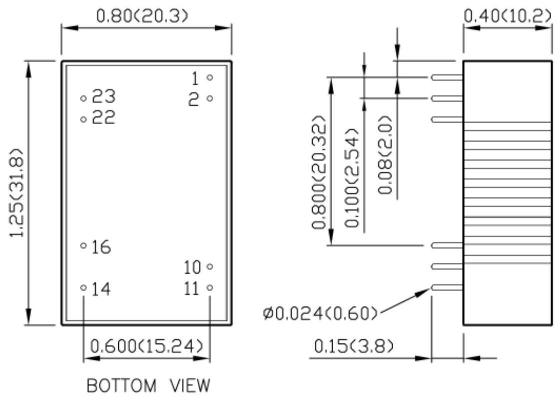


PIN CONNECTION

PIN	FUNCTION
1	+ Vin
11	Com
12	No pin
13	-Vout
15	+Vout
23	- Vin
24	- Vin

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. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004 (0.1)

PXC-M03-xxDxx Type B



PIN CONNECTION

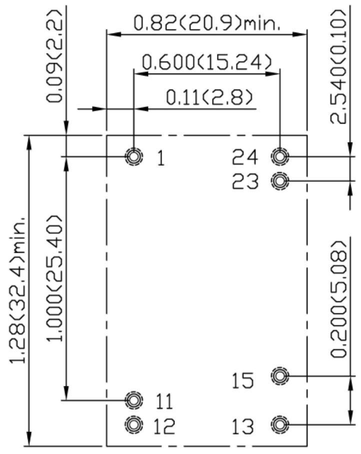
PIN	FUNCTION
1	Ctrl (Option) / No pin
2	- Vin
10	Trim (Option) / No pin
11	-Vout
14	+Vout
16	Com
22	+Vin
23	+Vin

*If no Ctrl or Trim option, there is no pin on the corresponding pin number.

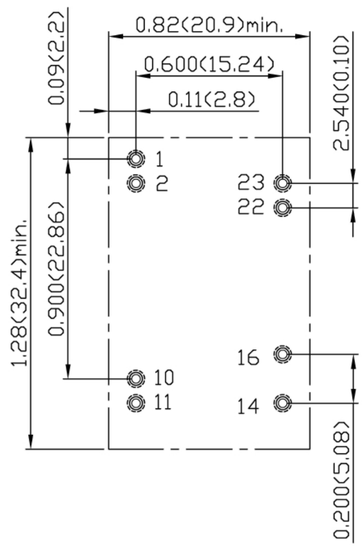
1. All dimensions in Inch (mm)
2. Tolerance: X.XX±0.02 (X.X±0.5)
   X.XXX±0.01 (X.XX±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004 (0.1)

Recommended Pad Layout

PXC-M03-xxDxx Type A



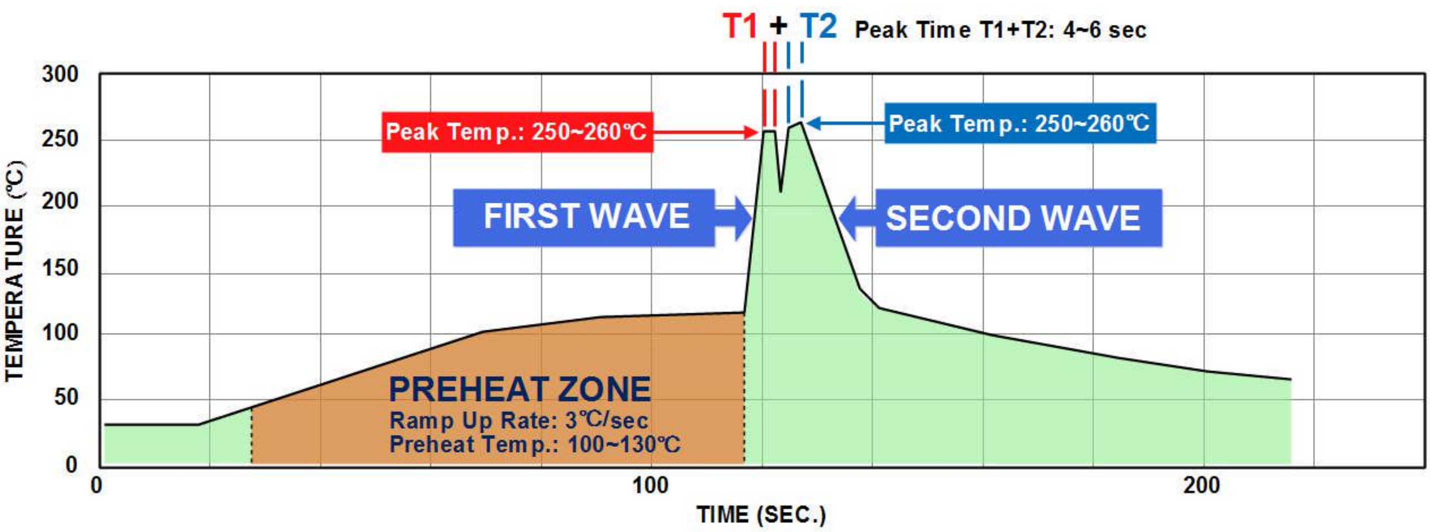
PXC-M03-xxDxx Type B



1. All dimensions in Inch (mm)
   Tolerance: X.XX±0.02 (X.X±0.5)
   X.XXX±0.01 (X.XX±0.25)
2. Pin pitch tolerance ±0.01 (0.25)
3. Pin dimension tolerance ±0.004 (0.1)

Soldering Considerations

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℃

Packaging Information

Tube

10pcs converters in a Tube
All dimensions in inches (mm)

Part Number Structure

PXC-M03 - 48 D 05 A - P T

PXC-M03	48	D	05	A	P	T
Series Name	**Input Voltage (VDC)**	**Output Quantity**	**Output Voltage (VDC)**	**Pin Connection Option**	**Remote On/Off Option**	**Trim Option**
	05: 4.5~9 **12:** 9~18 **24:** 18~36 **48:** 36~75	**S:** Single	**3P3:** 3.3 **05:** 5 **12:** 12 **15:** 15 **24:** 24	**A:** A type **□:** B type	**□:** No On/Off control **P:** Remote On/Off (Only for B type Pin connection)	**□:** No Trim **T:** Trim (Only for B type Pin connection)
		D: Dual	**05:** ±5 **12:** ±12 **15:** ±15			

Model Number	Input Range VDC	Output Voltage VDC	Output Current @Full Load mA	Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load µF
PXC-M03-05D05A/□		±5	±300	25	83	±430
PXC-M03-05D12A/□	4.5 ~ 9	±12	±125	25	86	±75
PXC-M03-05D15A/□		±15	±100	25	86	±56
PXC-M03-12D05A/□		±5	±300	10	83.5	±430
PXC-M03-12D12A/□	9 ~ 18	±12	±125	10	87.5	±75
PXC-M03-12D15A/□		±15	±100	10	86.5	±56
PXC-M03-24D05A/□		±5	±300	6	83	±430
PXC-M03-24D12A/□	18 ~ 36	±12	±125	6	87	±75
PXC-M03-24D15A/□		±15	±100	6	86	±56
PXC-M03-48D05A/□		±5	±300	4	83	±430
PXC-M03-48D12A/□	36 ~ 75	±12	±125	4	86	±75
PXC-M03-48D15A/□		±15	±100	4	86	±56

Safety and Installation Instructions

Fusing Consideration

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. See suggested values below:

Model	Fuse Rating (A)	Fuse Type
PXC-M03-05Dxx	1.25	Slow-Blow
PXC-M03-12Dxx	0.63	Slow-Blow
PXC-M03-24Dxx	0.315	Slow-Blow
PXC-M03-48Dxx	0.315	Slow-Blow

Based on the information provided in this data sheet on inrush energy and maximum dc input current at low Vin.

MTBF and Reliability

The MTBF has been calculated using:
MIL-HDBK 217F NOTICE2 FULL LOAD, Operating Temperature at 25℃. The resulting figure for MTBF is 6.444×10^{6} hours.