

# PXF40xxWSxx Single Output DC/DC Converter

9 to 36 Vdc and 18 to 75 Vdc input, 3.3 to 15 Vdc Single Output, 40W



## Features

- Single output current up to 10A
- 40 watts maximum output power
- 4:1 ultra wide input voltage range of 9-36 and 18-75VDC
- Six-sided continuous shield
- Case grounding
- High efficiency up to 88%
- Low profile: 2.00 x 2.00 x 0.40 inch (50.8x50.8x10.2 mm )
- Fixed switching frequency
- RoHS directive compliant
- Input to output isolation: 1600Vdc,min
- Over-temperature protection
- Input under-voltage protection
- Output over-voltage protection
- Over-current protection, auto-recovery
- Output short circuit protection, auto-recovery
- Remote ON/OFF

## Options

- Heat sinks available for extended operation
- Remote ON/OFF logic configuration

## Applications

- Wireless Network
- Telecom/Datacom
- Industry Control System
- Measurement Equipment
- Semiconductor Equipment

## General Description

The PXF40-xxWSxx single output offers 40 watts of output power from a 2.00 x 2.00 x 0.4 inch package. This series with 4:1 ultra wide input voltage of 9-36VDC and 18-75VDC, features 1600VDC of isolation, short-circuit, over-voltage and over-temperature protection, as well as six sided shielding. All models are particularly suited for telecommunications, industrial, mobile telecom and test equipment applications.

## Table of Contents

|                                |     |                                     |     |
|--------------------------------|-----|-------------------------------------|-----|
| Absolute Maximum Rating        | P2  | Heat Sink Consideration             | P25 |
| Output Specification           | P2  | Remote ON/OFF Control               | P26 |
| Input Specification            | P3  | Mechanical Data                     | P27 |
| General Specification          | P4  | Recommended Pad Layout              | P27 |
| Characteristic Curves          | P5  | Output Voltage Adjustment           | P28 |
| Test Configurations            | P21 | Remote Sense Application Circuit    | P29 |
| EMC Considerations             | P22 | Soldering Consideration             | P29 |
| Input Source Impedance         | P24 | Packaging Information               | P30 |
| Output Over Current Protection | P24 | Part Number Structure               | P30 |
| Output Over Voltage Protection | P24 | Safety and Installation Instruction | P31 |
| Thermal Consideration          | P25 | MTBF and Reliability                | P31 |

| Absolute Maximum Ratings                      |                  |     |           |          |
|-----------------------------------------------|------------------|-----|-----------|----------|
| Parameter                                     | Model            | Min | Max       | Unit     |
| Input Voltage                                 |                  |     |           |          |
| Continuous                                    | 24WSxx<br>48WSxx |     | 36<br>75  | $V_{DC}$ |
| Transient (100ms)                             | 24WSxx<br>48WSxx |     | 50<br>100 |          |
| Operating Ambient Temperature (with derating) | All              | -40 | 105       | °C       |
| Operating Case Temperature                    | All              |     | 105       | °C       |
| Storage Temperature                           | All              | -55 | 125       | °C       |

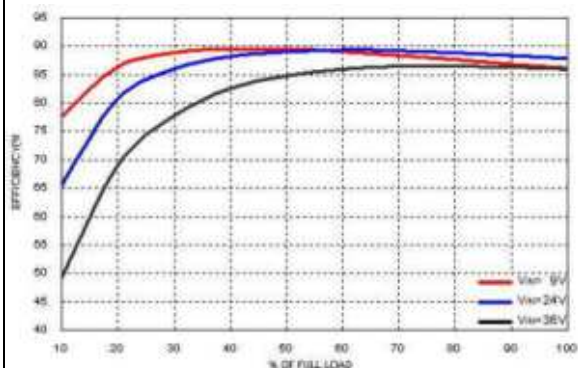
| Output Specifications                                                                                                                                                                                         |                                       |                                 |                        |                                 |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|------------------------|---------------------------------|---------------|
| Parameter                                                                                                                                                                                                     | Model                                 | Min                             | Typ                    | Max                             | Unit          |
| Output Voltage<br>( $V_{in} = V_{in(nom)}$ ; Full Load ; $T_A=25^{\circ}C$ )                                                                                                                                  | xxWS3P3<br>xxWS05<br>xxWS12<br>xxWS15 | 3.267<br>4.95<br>11.88<br>14.85 | 3.3<br>5<br>12<br>15   | 3.333<br>5.05<br>12.12<br>15.15 | $V_{DC}$      |
| Voltage Adjustability                                                                                                                                                                                         | All                                   | -10                             |                        | +10                             | %             |
| Output Regulation<br>Line ( $V_{in(min)}$ to $V_{in(max)}$ at Full Load)<br>Load (Min. to 100% of Full Load)                                                                                                  | All                                   | -0.2<br>-0.5                    |                        | +0.2<br>+0.5                    | %             |
| Output Ripple & Noise<br>Peak-to-Peak (20MHz bandwidth)                                                                                                                                                       | xxWS3P3<br>xxWS05<br>xxWS12<br>xxWS15 |                                 |                        | 50<br>50<br>75<br>75            | mVp-p         |
| Temperature Coefficient                                                                                                                                                                                       | All                                   | -0.02                           |                        | +0.02                           | %/°C          |
| Output Voltage Overshoot<br>( $V_{in(min)}$ to $V_{in(max)}$ ; Full Load ; $T_A=25^{\circ}C$ )                                                                                                                | All                                   |                                 |                        | 3                               | % $V_{OUT}$   |
| Dynamic Load Response<br>( $V_{in} = V_{in(nom)}$ ; $T_A=25^{\circ}C$ )<br>Load step change from<br>75% to 100% or 100 to 75% of Full Load<br>Peak Deviation<br>Setting Time ( $V_{OUT}$ -10% peak deviation) | All<br>All                            |                                 | 250<br>250             |                                 | mV<br>$\mu S$ |
| Output Current                                                                                                                                                                                                | xxWS3P3<br>xxWS05<br>xxWS12<br>xxWS15 | 0<br>0<br>50<br>50              |                        | 10000<br>8000<br>3333<br>2666   | mA            |
| Output Over Voltage Protection<br>(Zener diode clamp)                                                                                                                                                         | xxWS3P3<br>xxWS05<br>xxWS12<br>xxWS15 |                                 | 3.9<br>6.2<br>15<br>18 |                                 | $V_{DC}$      |
| Output Over Current Protection                                                                                                                                                                                | All                                   |                                 |                        | 150                             | % FL.         |
| Output Short Circuit Protection                                                                                                                                                                               | All                                   | Hiccup, automatic recovery      |                        |                                 |               |

| Input Specification                                                                                                                                                                            |                                                                                |                  |                                               |                                                            |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------|-----------------------------------------------|------------------------------------------------------------|-----------------|
| Parameter                                                                                                                                                                                      | Model                                                                          | Min              | Typ                                           | Max                                                        | Unit            |
| Operating Input Voltage                                                                                                                                                                        | 24WSxx<br>48WSxx                                                               | 9<br>18          | 24<br>48                                      | 36<br>75                                                   | V <sub>DC</sub> |
| Input Current<br>(Maximum value at Vin = Vin(nom); Full Load)                                                                                                                                  | 24WS3P3<br>24WS05<br>24WS12<br>24WS15<br>48WS3P3<br>48WS05<br>48WS12<br>48WS15 |                  |                                               | 1677<br>2008<br>2008<br>2008<br>838<br>992<br>1004<br>1004 | mA              |
| Input Standby Current<br>(Typical value at Vin = Vin(nom); No Load)                                                                                                                            | 24WS3P3<br>24WS05<br>24WS12<br>24WS15<br>48WS3P3<br>48WS05<br>48WS12<br>48WS15 |                  | 80<br>100<br>50<br>50<br>60<br>65<br>30<br>30 |                                                            | mA              |
| Under Voltage Lockout Turn-on Threshold                                                                                                                                                        | 24WSxx<br>48WSxx                                                               |                  |                                               | 9<br>18                                                    | V <sub>DC</sub> |
| Under Voltage Lockout Turn-off Threshold                                                                                                                                                       | 24WSxx<br>48WSxx                                                               |                  | 8<br>16                                       |                                                            | V <sub>DC</sub> |
| Input Reflected Ripple Current<br>(5 to 20MHz, 12μH Source Impedance)                                                                                                                          | All                                                                            |                  | 20                                            |                                                            | mAp-p           |
| Start Up Time<br>(Vin = Vin(nom) and Constant Resistive Load)<br>Power Up<br>Remote ON/OFF                                                                                                     | All                                                                            |                  |                                               | 20<br>20                                                   | mS              |
| Remote ON/OFF Control<br>(The ON/OFF pin voltage is referenced to -V <sub>IN</sub> )<br>Negative Logic DC-DC ON(Short)<br>DC-DC OFF(Open)<br>Positive Logic DC-DC ON(Open)<br>DC-DC OFF(Short) | All                                                                            | 0<br>3<br>3<br>0 |                                               | 1.2<br>12<br>12<br>1.2                                     | V <sub>DC</sub> |
| Remote Off Input Current                                                                                                                                                                       | 24WSxx<br>48WSxx                                                               |                  | 10<br>5                                       |                                                            | mA              |
| Input Current of Remote Control Pin                                                                                                                                                            | All                                                                            | -0.5             |                                               | 0.5                                                        | mA              |

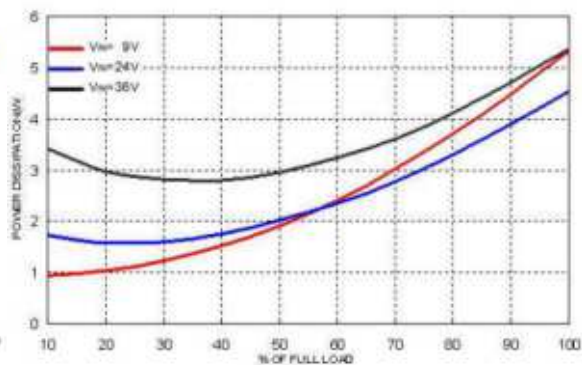
| General Specifications                                                   |         |      |                     |      |             |
|--------------------------------------------------------------------------|---------|------|---------------------|------|-------------|
| Parameter                                                                | Model   | Min  | Typ                 | Max  | Unit        |
| Efficiency<br>( $V_{in} = V_{in(nom)}$ ; Full Load ; $T_A=25^{\circ}C$ ) | 24WS3P3 |      | 86                  |      | %           |
|                                                                          | 24WS05  |      | 87                  |      |             |
|                                                                          | 24WS12  |      | 87                  |      |             |
|                                                                          | 24WS15  |      | 87                  |      |             |
|                                                                          | 48WS3P3 |      | 86                  |      |             |
|                                                                          | 48WS05  |      | 88                  |      |             |
|                                                                          | 48WS12  |      | 87                  |      |             |
|                                                                          | 48WS15  |      | 87                  |      |             |
| Isolation Voltage                                                        |         |      |                     |      |             |
| Input to Output                                                          | All     | 1600 |                     |      | $V_{DC}$    |
| Input (Output) to Case                                                   |         | 1600 |                     |      |             |
| Isolation Resistance                                                     | All     | 1    |                     |      | GΩ          |
| Isolation Capacitance                                                    | All     |      |                     | 2500 | pF          |
| Switching Frequency                                                      | All     |      | 300                 |      | KHz         |
| Weight                                                                   | All     |      | 60                  |      | g           |
| MTBF(See Page 31)                                                        |         |      |                     |      |             |
| Bellcore TR-NWT-000332, $T_C=40^{\circ}C$                                | All     |      | $1.105 \times 10^6$ |      | hours       |
| MIL-HDBK-217F                                                            |         |      | $1.511 \times 10^5$ |      |             |
| Over Temperature Protection                                              | All     |      | 110                 |      | $^{\circ}C$ |

## Characteristic Curves

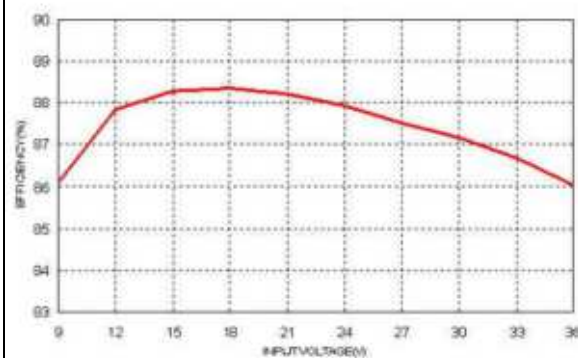
All test conditions are at 25°C. The figures are for PXF40-24WS3P3.



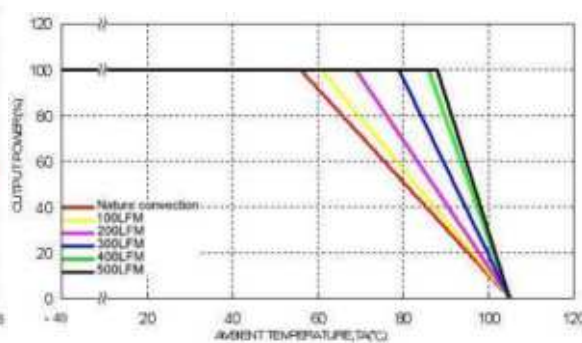
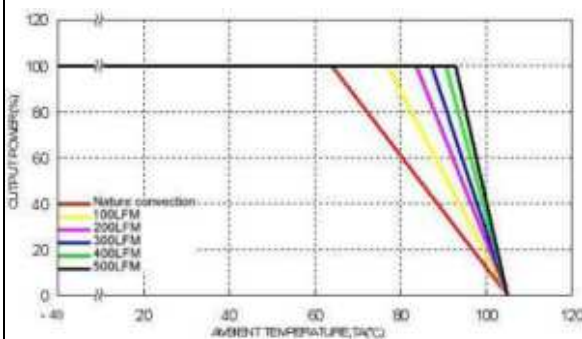
Efficiency Versus Output Current



Power Dissipation Versus Output Current

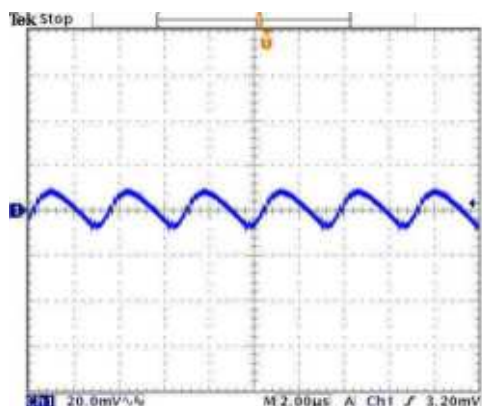


Efficiency Versus Input Voltage. Full Load

Derating Output Current Versus Ambient Temperature and Airflow  
 $V_{in} = V_{in(nom)}$ Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow,  $V_{in} = V_{in(nom)}$

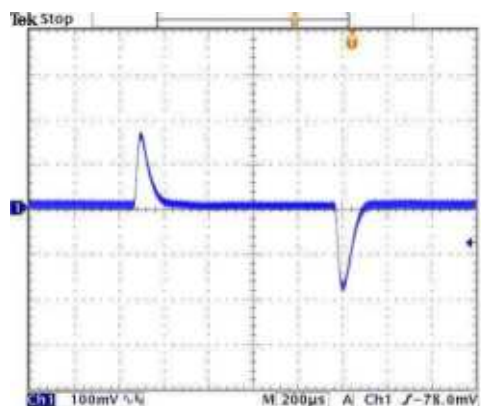
## Characteristic Curves (Continued)

All test conditions are at 25°C. The figures are for PXF40-24WS3P3.

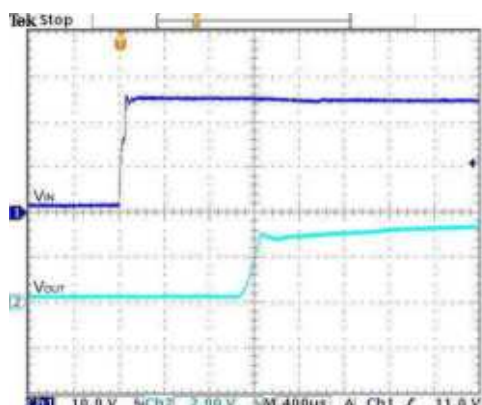


**Typical Output Ripple and Noise.**

$V_{in} = V_{in(nom)}$ , Full Load

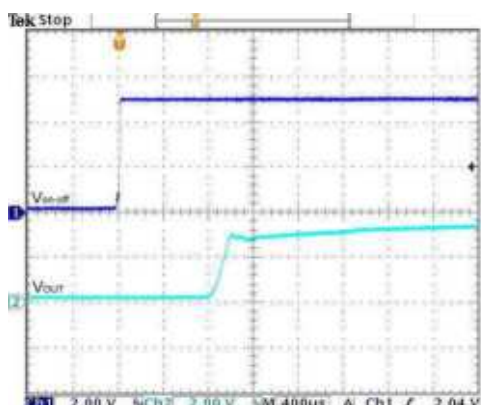


**Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ;  $V_{in} = V_{in(nom)}$**



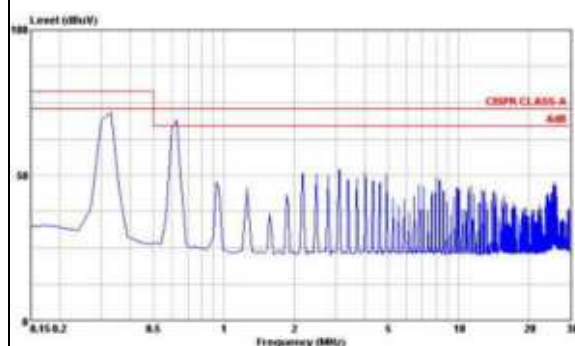
**Typical Input Start-Up and Output Rise Characteristic**

$V_{in} = V_{in(nom)}$ , Full Load



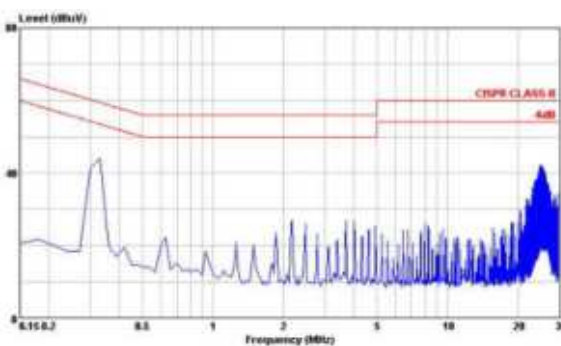
**Using ON/OFF Voltage Start-Up and  $V_o$  Rise Characteristic**

$V_{in} = V_{in(nom)}$ , Full Load



**Conduction Emission of EN55022 Class A**

$V_{in} = V_{in(nom)}$ , Full Load

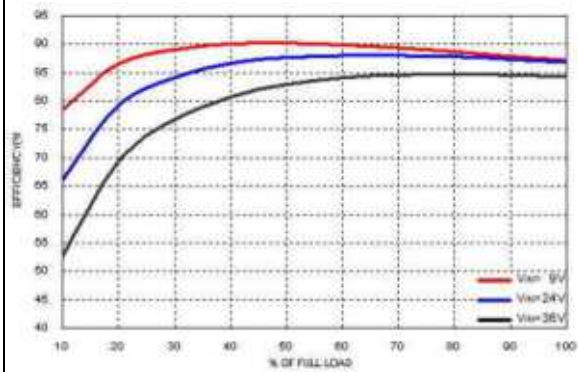


**Conduction Emission of EN55022 Class B**

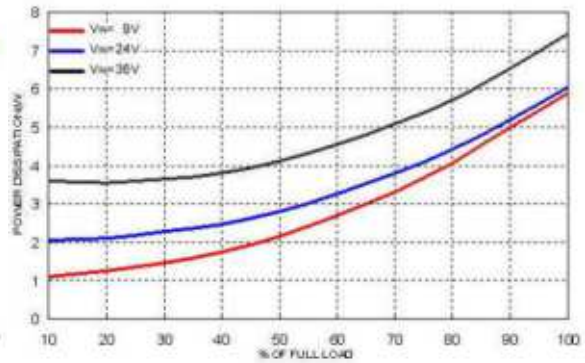
$V_{in} = V_{in(nom)}$ , Full Load

## Characteristic Curves (Continued)

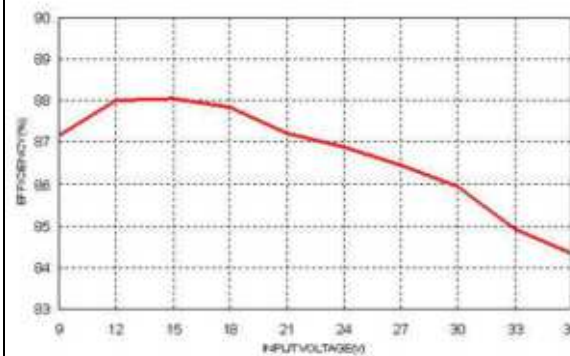
All test conditions are at 25°C. The figures are for PXF40-24WS05.



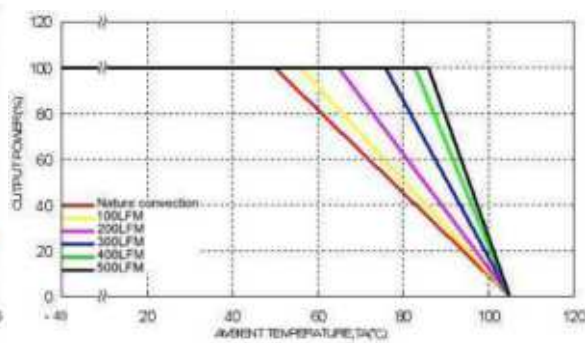
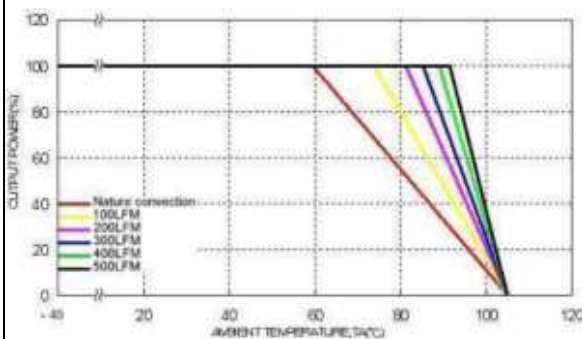
Efficiency Versus Output Current



Power Dissipation Versus Output Current

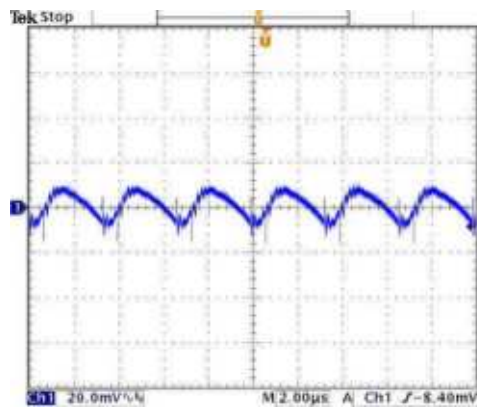


Efficiency Versus Input Voltage. Full Load

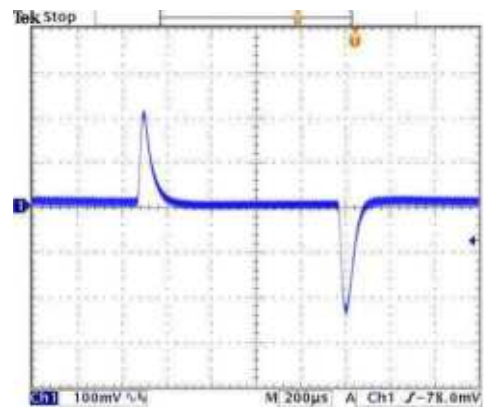
Derating Output Current Versus Ambient Temperature and Airflow  
Vin=Vin(nom)Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow, Vin = Vin(nom)

## Characteristic Curves (Continued)

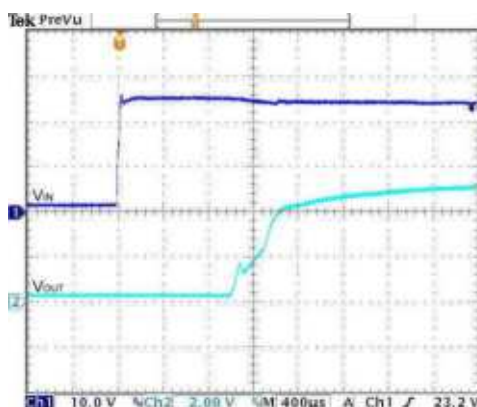
All test conditions are at 25°C. The figures are for PXF40-24WS05.



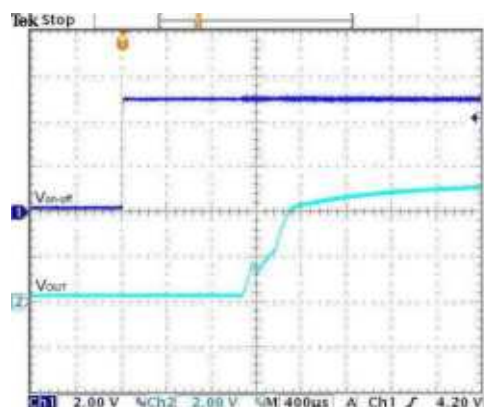
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



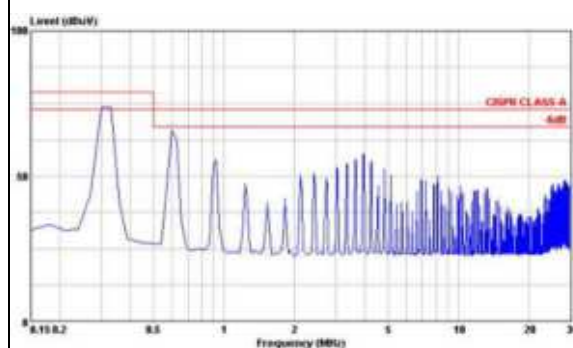
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



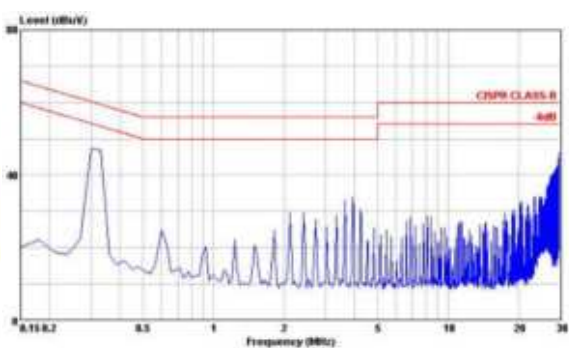
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



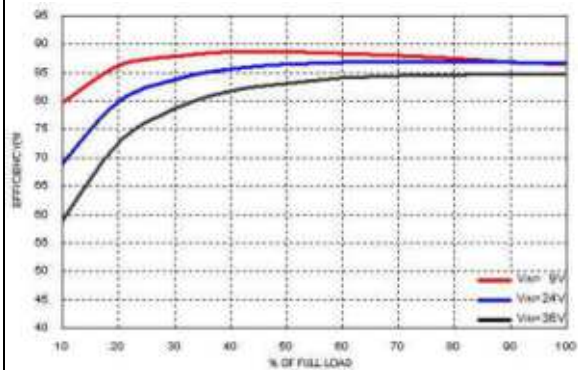
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



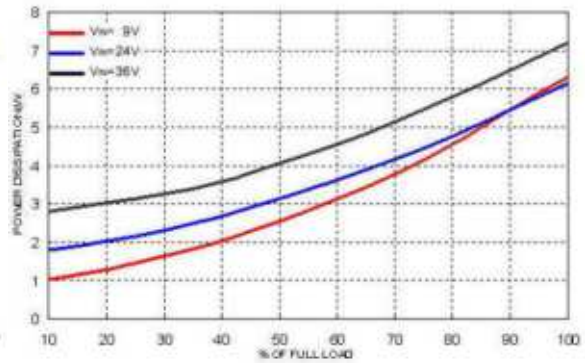
Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

## Characteristic Curves (Continued)

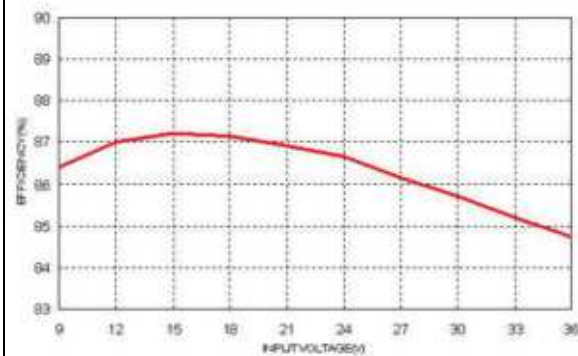
All test conditions are at 25°C. The figures are for PXF40-24WS12.



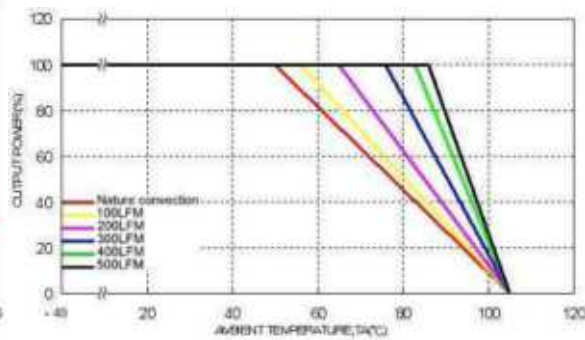
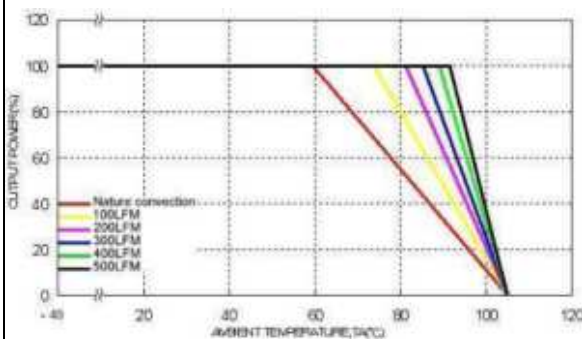
Efficiency Versus Output Current



Power Dissipation Versus Output Current

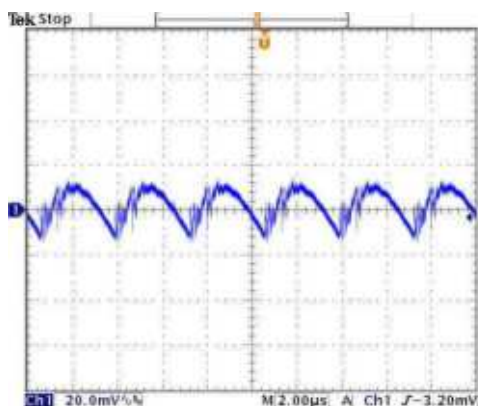


Efficiency Versus Input Voltage. Full Load

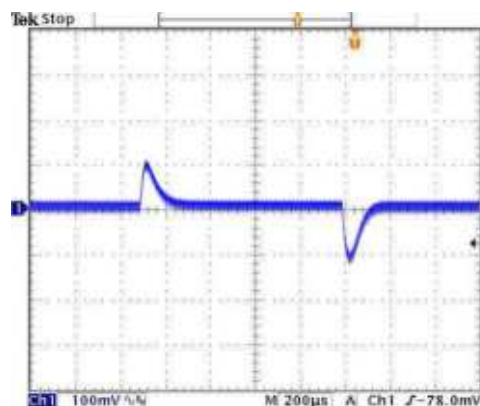
Derating Output Current Versus Ambient Temperature and Airflow  
Vin=Vin(nom)Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow, Vin = Vin(nom)

## Characteristic Curves (Continued)

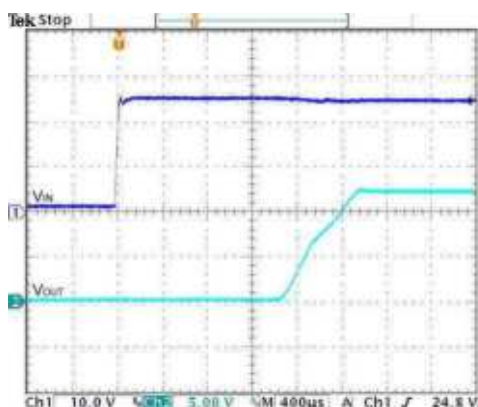
All test conditions are at 25°C. The figures are for PXF40-24WS12.



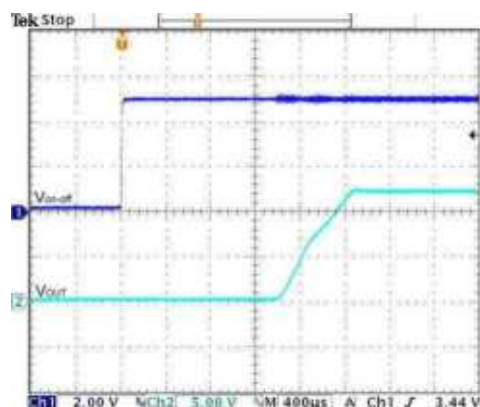
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



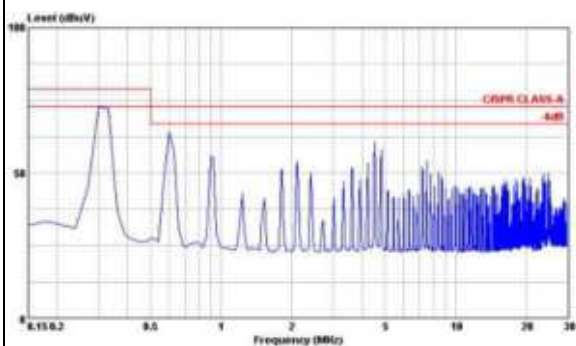
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



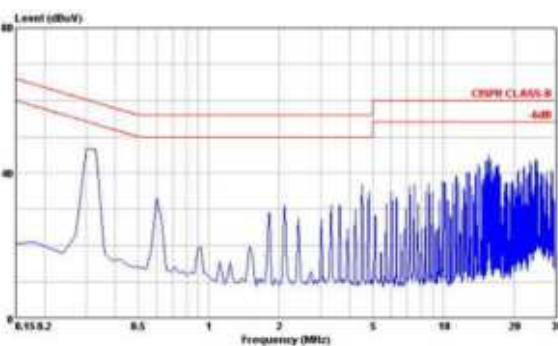
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



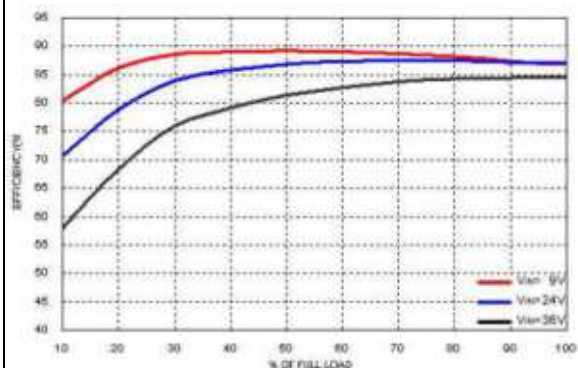
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



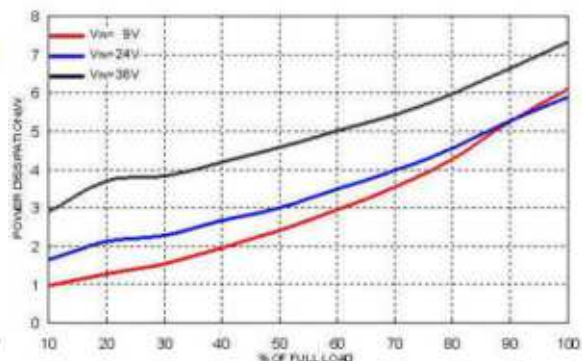
Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

## Characteristic Curves (Continued)

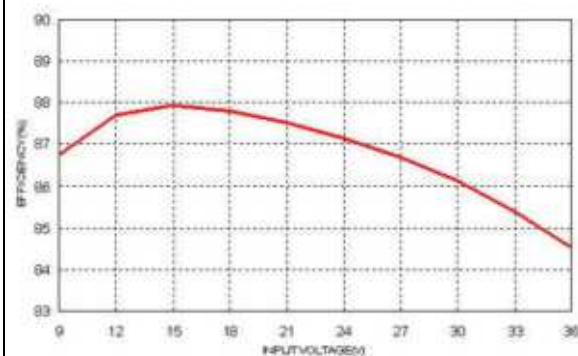
All test conditions are at 25°C. The figures are for PXF40-24WS15.



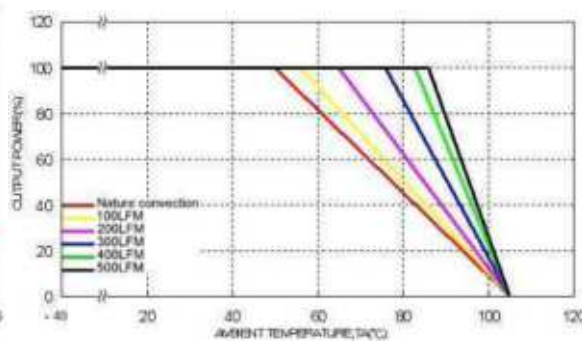
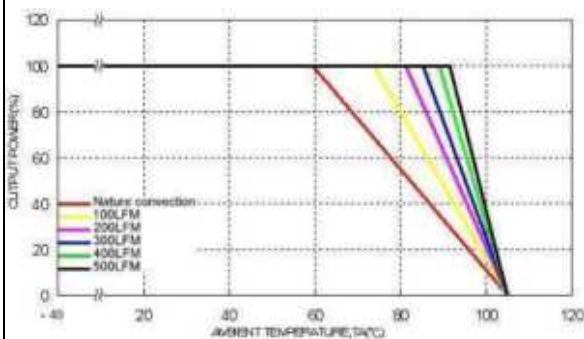
Efficiency Versus Output Current



Power Dissipation Versus Output Current

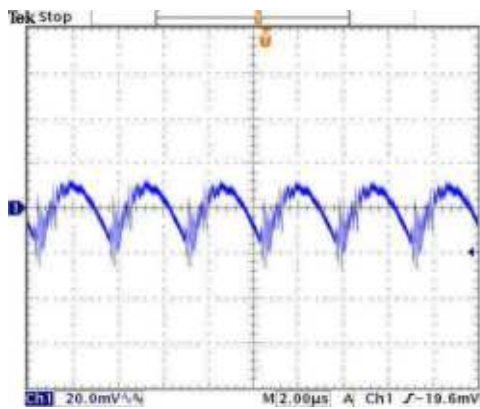


Efficiency Versus Input Voltage. Full Load

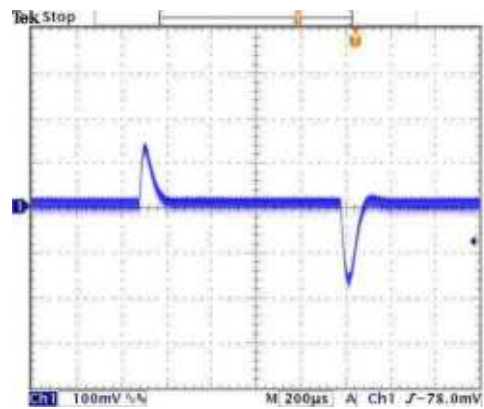
Derating Output Current Versus Ambient Temperature and Airflow  
Vin = Vin(nom)Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow, Vin = Vin(nom)

## Characteristic Curves (Continued)

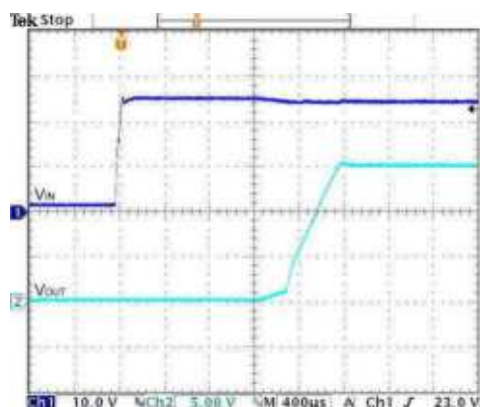
All test conditions are at 25°C. The figures are for PXF40-24WS15.



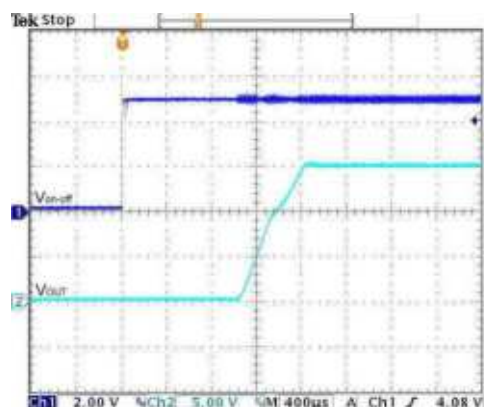
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



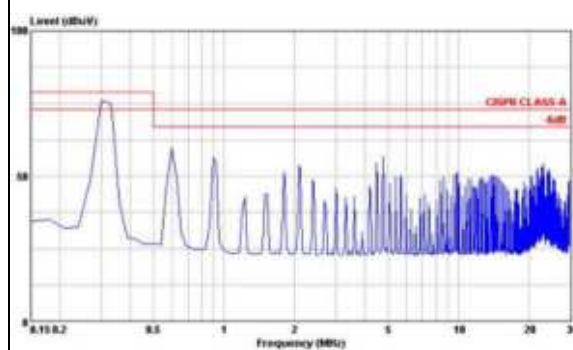
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



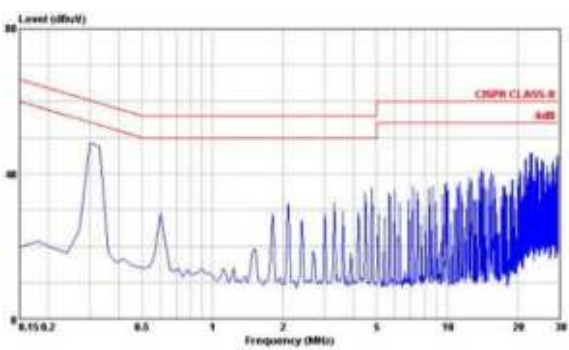
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



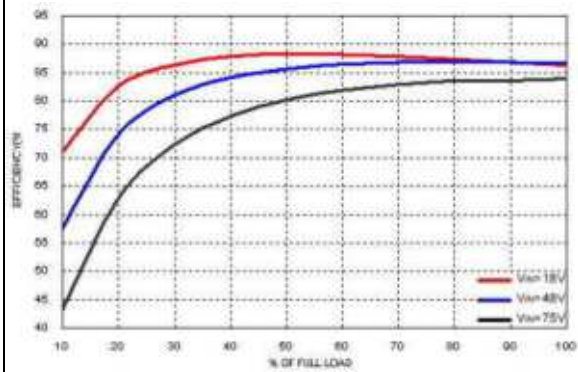
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



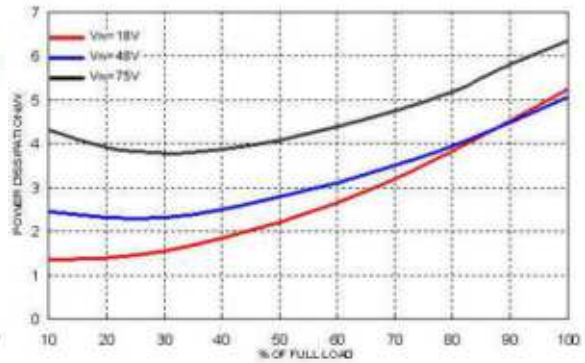
Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

## Characteristic Curves (Continued)

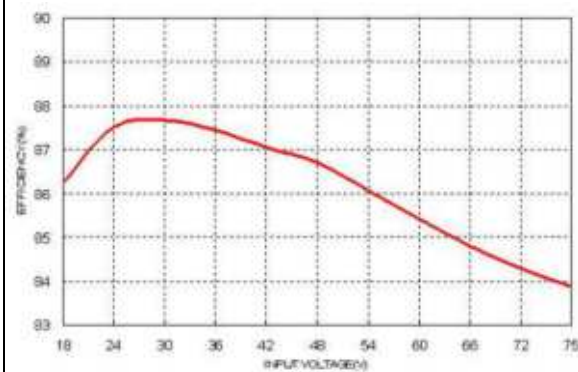
All test conditions are at 25°C. The figures are for PXF40-48WS3P3



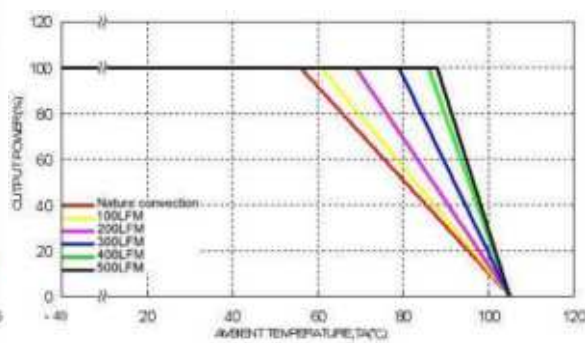
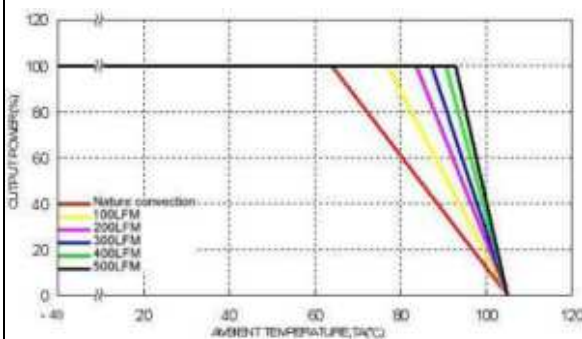
Efficiency Versus Output Current



Power Dissipation Versus Output Current

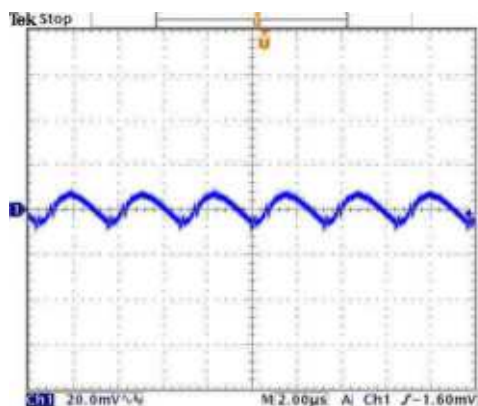


Efficiency Versus Input Voltage. Full Load

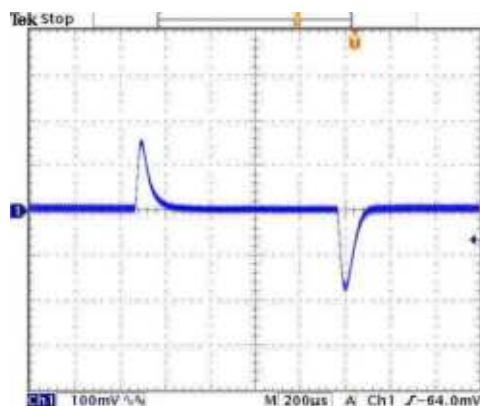
Derating Output Current Versus Ambient Temperature and Airflow  
 $V_{in}=V_{in(nom)}$ Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow,  $V_{in} = V_{in(nom)}$

## Characteristic Curves (Continued)

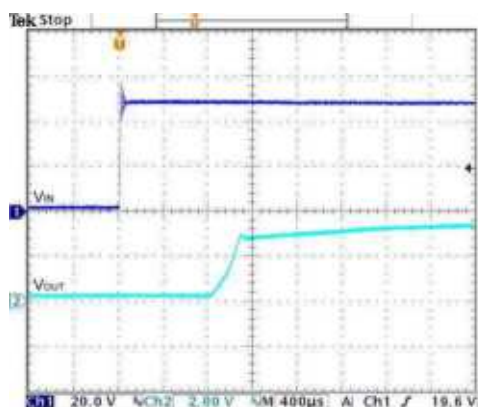
All test conditions are at 25°C. The figures are for PXF40-48WS3P3.



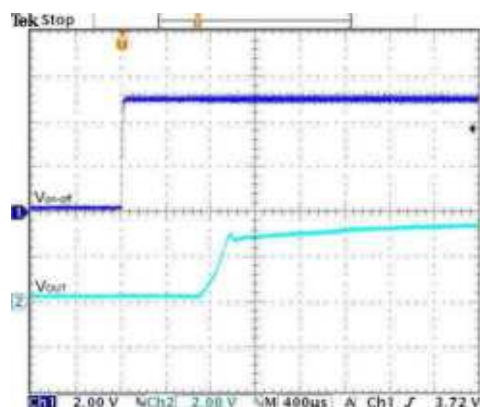
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



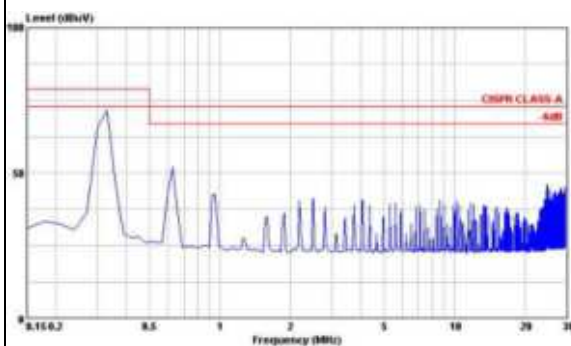
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



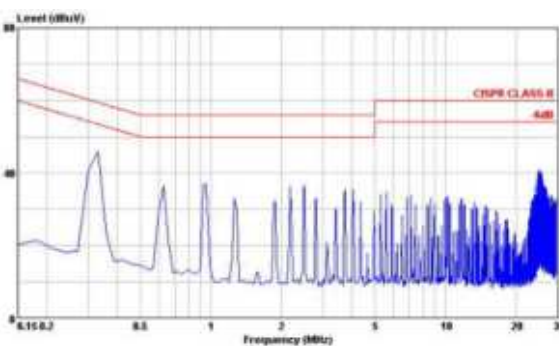
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



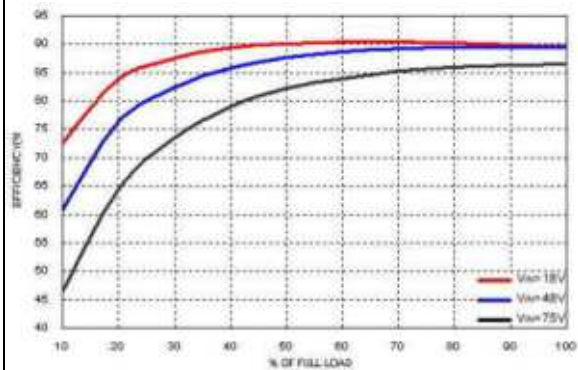
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



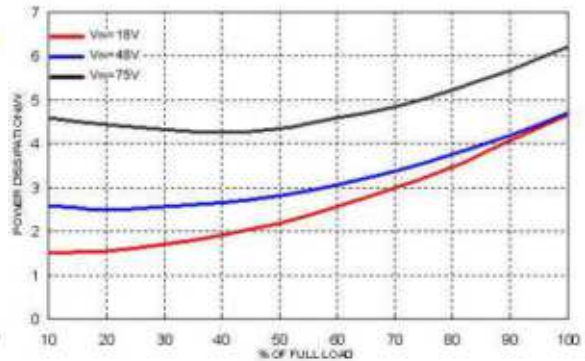
Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

## Characteristic Curves (Continued)

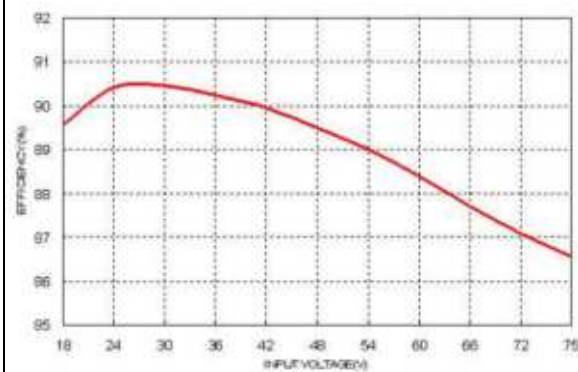
All test conditions are at 25°C. The figures are for PXF40-48WS05.



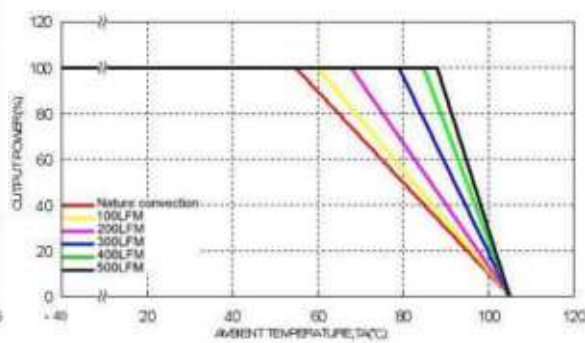
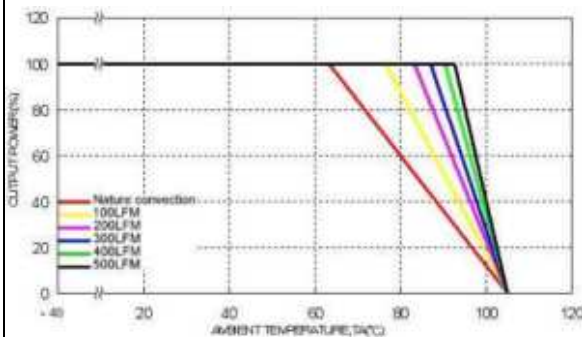
Efficiency Versus Output Current



Power Dissipation Versus Output Current

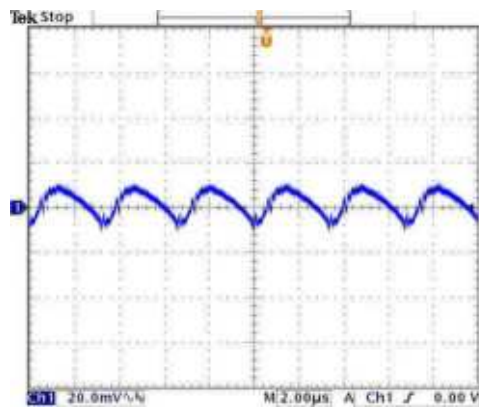


Efficiency Versus Input Voltage. Full Load

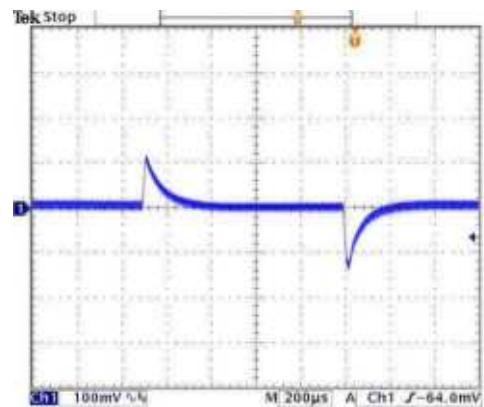
Derating Output Current Versus Ambient Temperature and Airflow  
 $V_{in}=V_{in(nom)}$ Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow,  $V_{in} = V_{in(nom)}$

## Characteristic Curves (Continued)

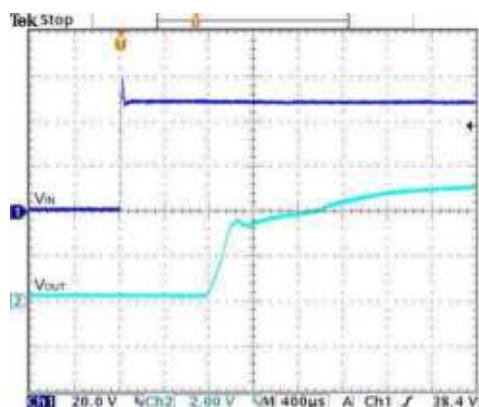
All test conditions are at 25°C. The figures are for PXF40-48WS05.



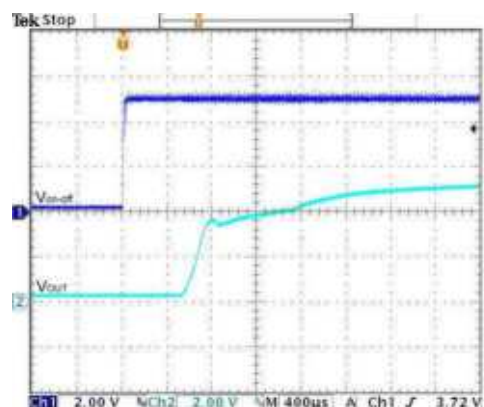
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



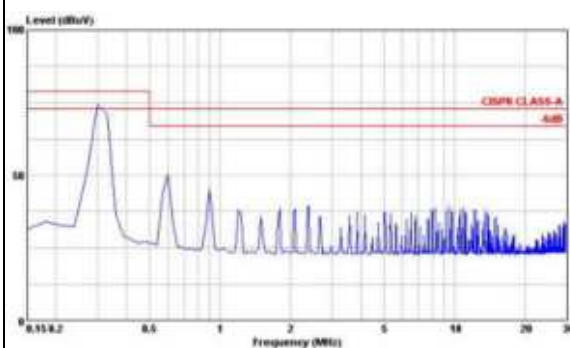
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



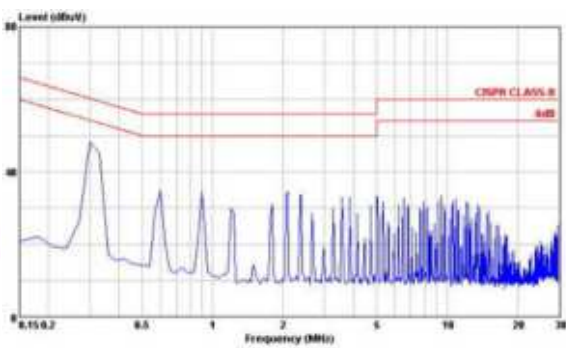
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



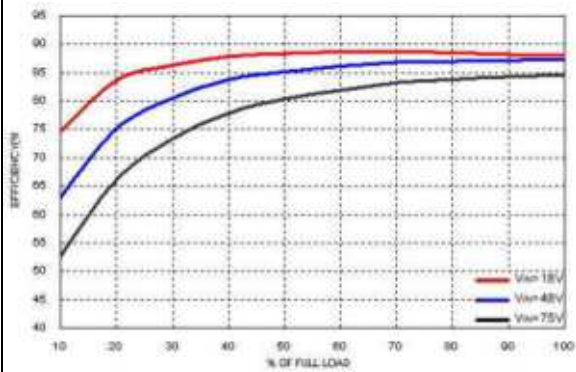
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



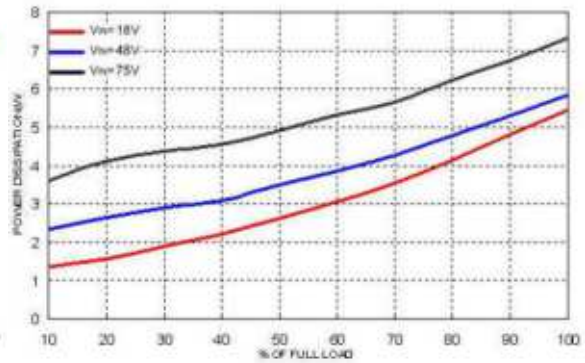
Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

## Characteristic Curves (Continued)

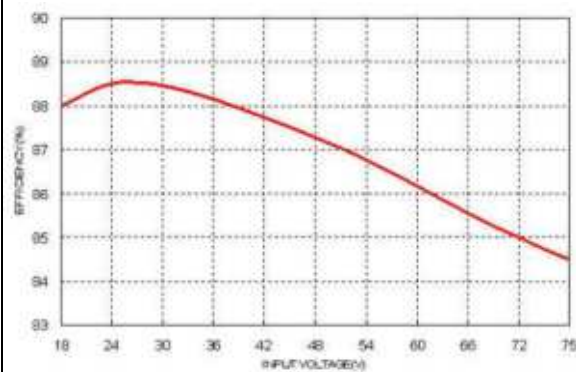
All test conditions are at 25°C. The figures are for PXF40-48WS12.



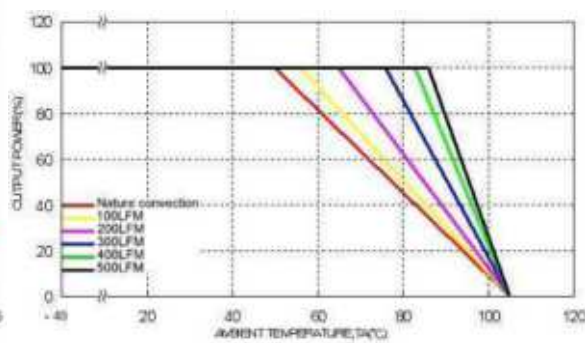
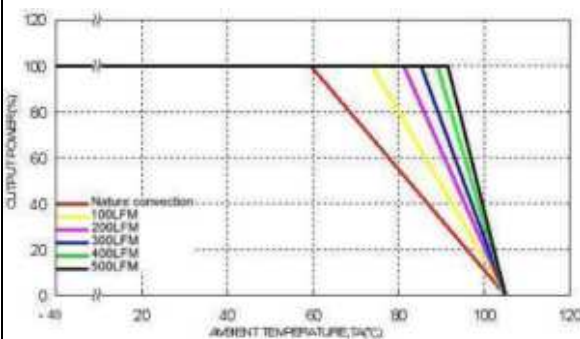
Efficiency Versus Output Current



Power Dissipation Versus Output Current

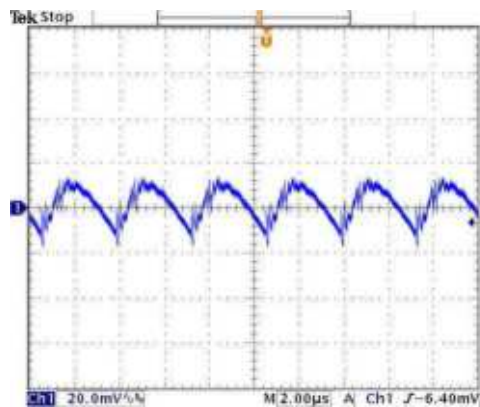


Efficiency Versus Input Voltage. Full Load

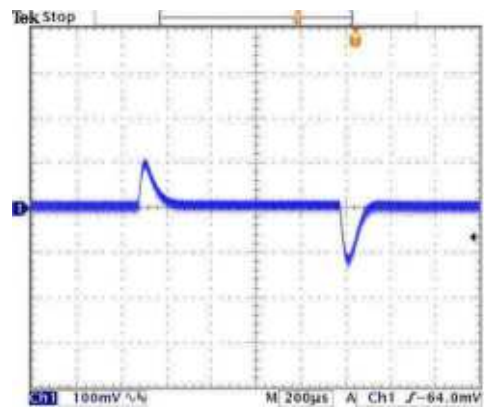
Derating Output Current Versus Ambient Temperature and Airflow  
Vin=Vin(nom)Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow, Vin = Vin(nom)

## Characteristic Curves (Continued)

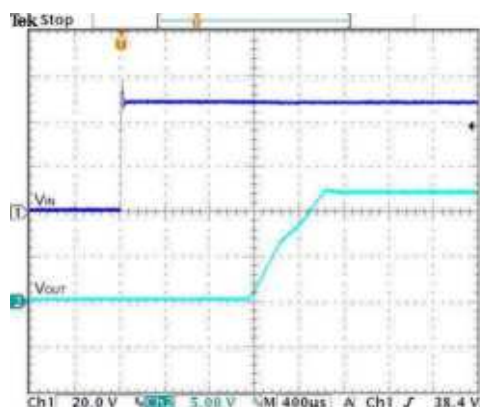
All test conditions are at 25°C. The figures are for PXF40-48WS12.



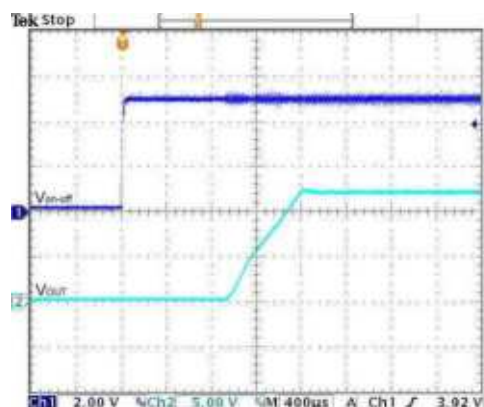
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



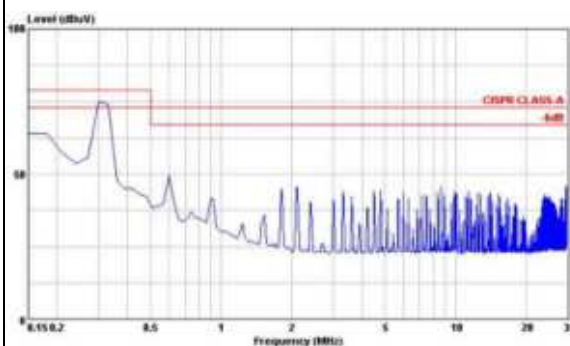
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



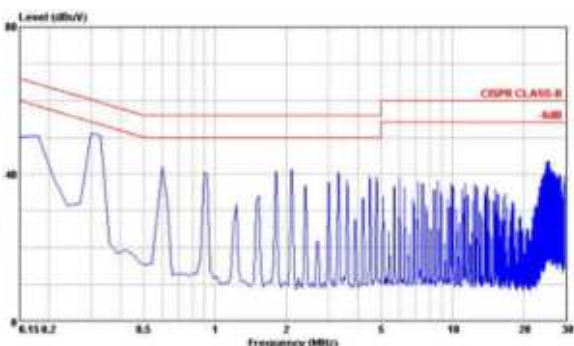
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



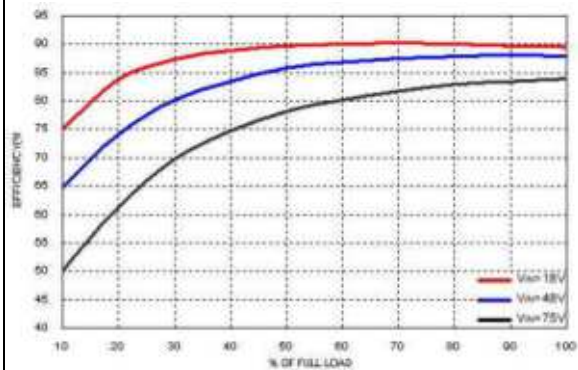
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



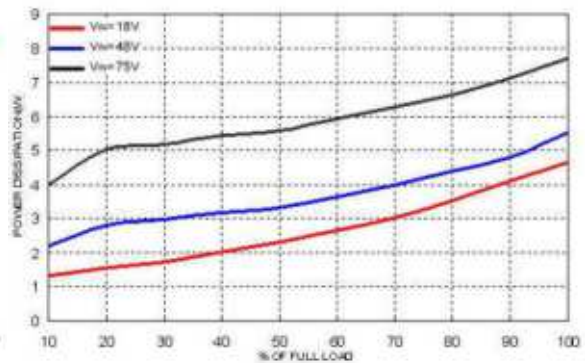
Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

## Characteristic Curves (Continued)

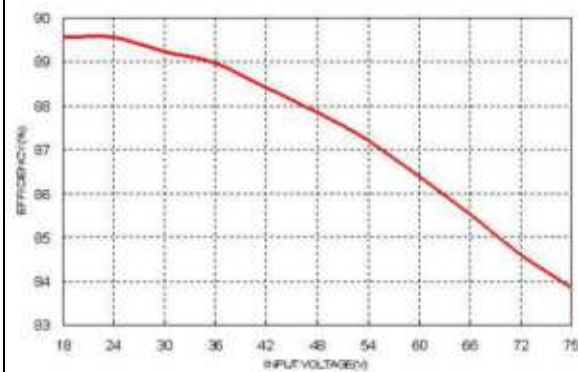
All test conditions are at 25°C. The figures are identical for PXF40-48WS15.



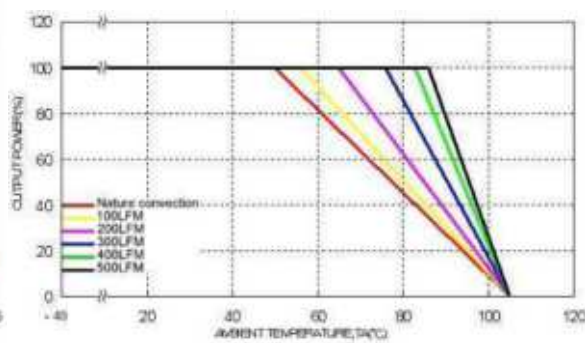
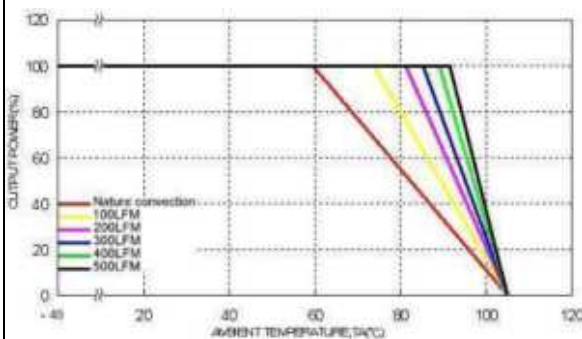
Efficiency Versus Output Current



Power Dissipation Versus Output Current

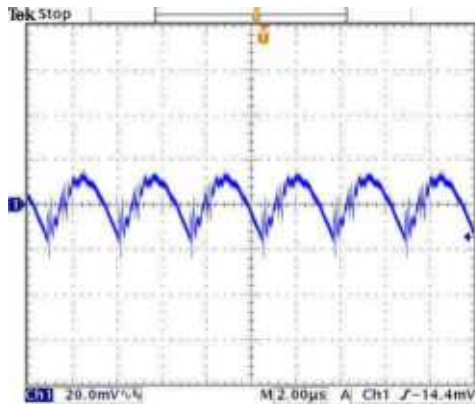


Efficiency Versus Input Voltage. Full Load

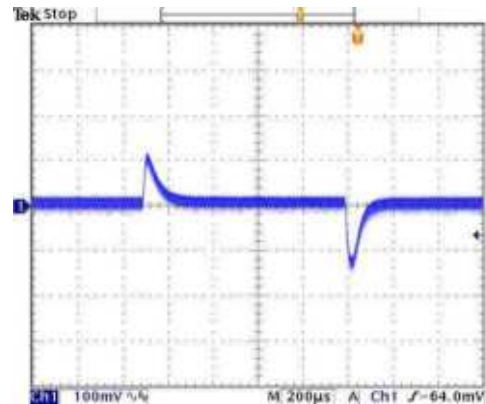
Derating Output Current Versus Ambient Temperature and Airflow  
Vin=Vin(nom)Derating Output Current Versus Ambient Temperature with Heat-Sink  
and Airflow, Vin = Vin(nom)

## Characteristic Curves (Continued)

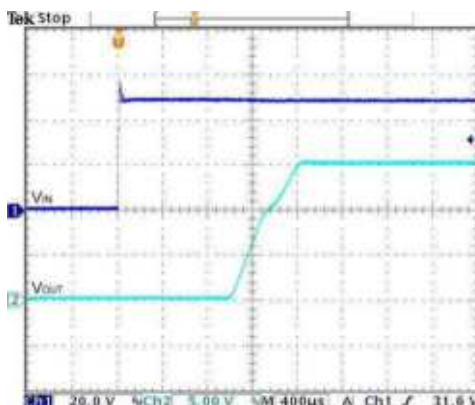
All test conditions are at 25°C. The figures are for PXF40-48WS15.



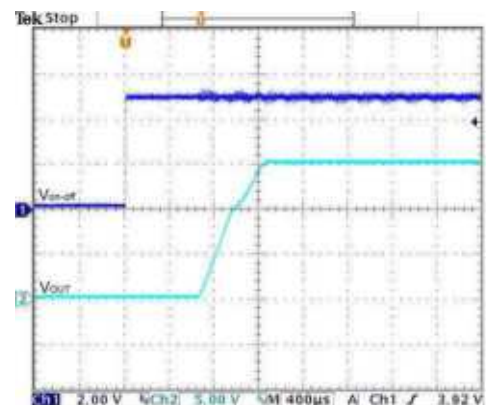
Typical Output Ripple and Noise.  
Vin=Vin(nom), Full Load



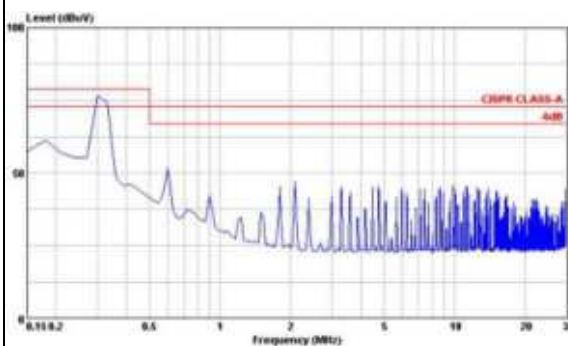
Transient Response to Dynamic Load Change from  
100% to 75% to 100% of Full Load ; Vin=Vin(nom)



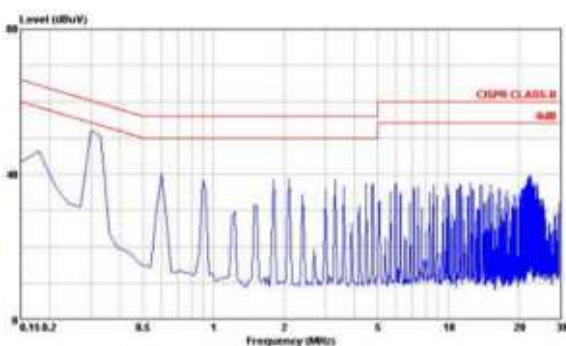
Typical Input Start-Up and Output Rise Characteristic  
Vin=Vin(nom), Full Load



Using ON/OFF Voltage Start-Up and Vo Rise Characteristic  
Vin=Vin(nom), Full Load



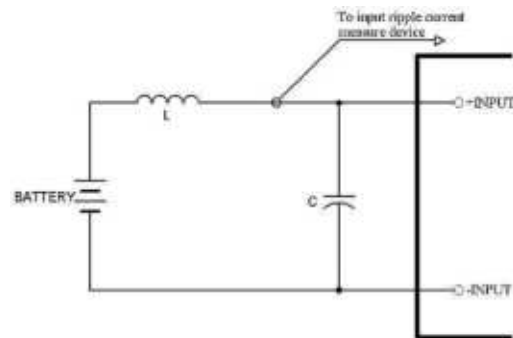
Conduction Emission of EN55022 Class A  
Vin=Vin(nom), Full Load



Conduction Emission of EN55022 Class B  
Vin=Vin(nom), Full Load

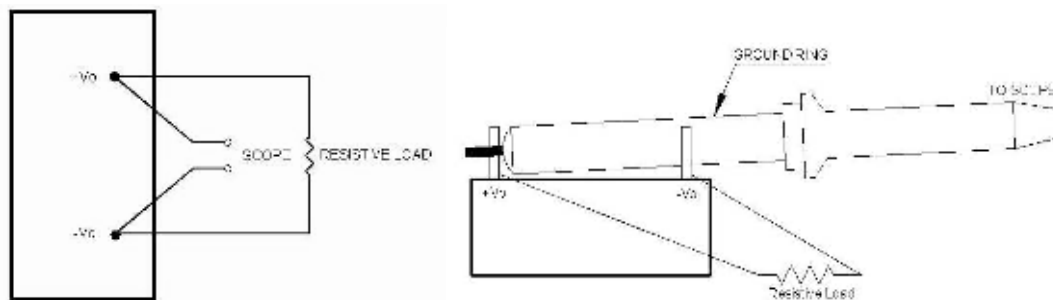
## Test Configurations

## Input reflected-ripple current measurement test:

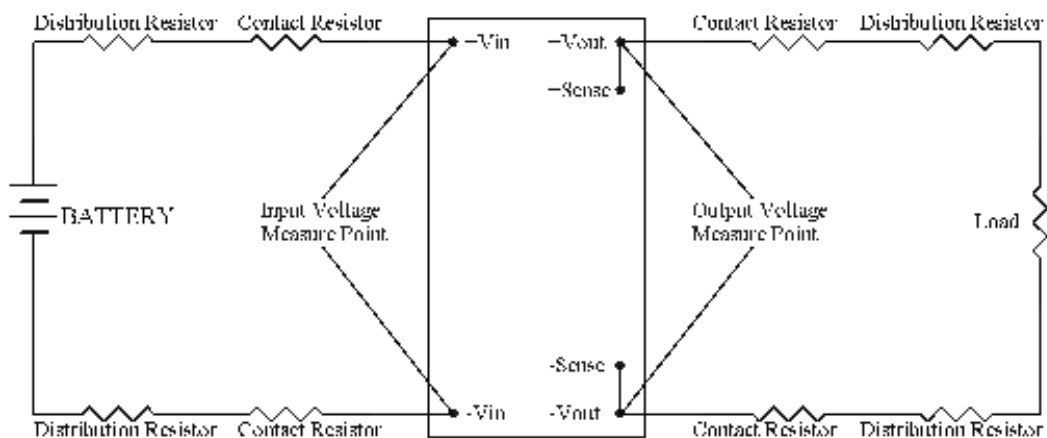


| Component | Value | Voltage | Reference                       |
|-----------|-------|---------|---------------------------------|
| L         | 12μH  | ---     | ---                             |
| C         | 47μF  | 100V    | Aluminum Electrolytic Capacitor |

## Peak-to-peak output ripple &amp; noise measurement test:



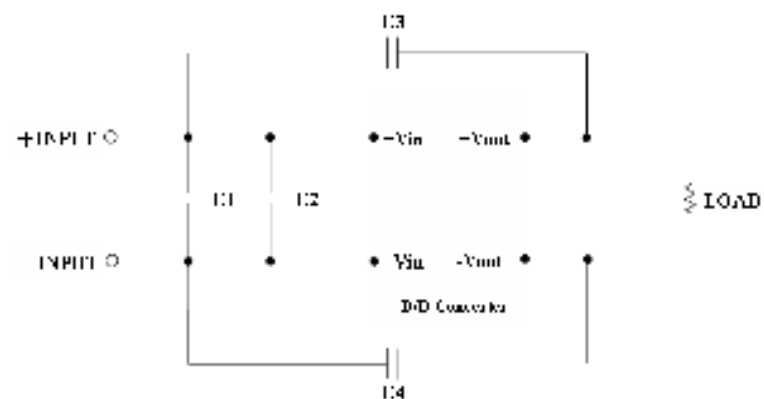
## Output voltage and efficiency measurement test:



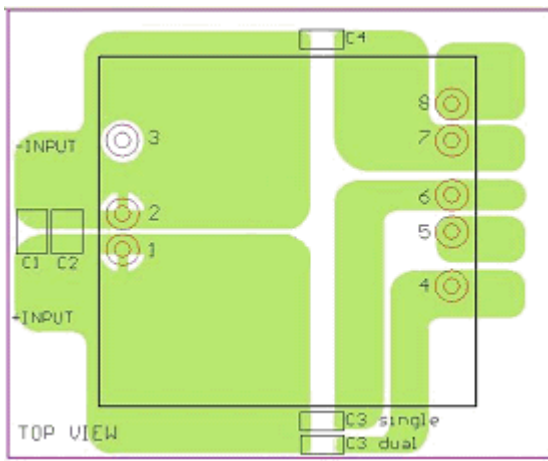
Note: All measurements are taken at the module terminals.

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

EMC Considerations



Suggested Schematic for EN55022 Conducted Emission Class A Limits



Recommended Layout with Input Filter

To meet conducted emissions EN55022 CLASS A the following components are needed:

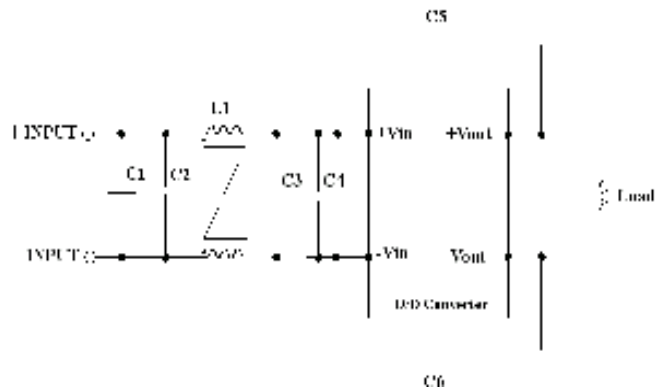
PXF40-24WSxx

| Component | Value  | Voltage | Reference |
|-----------|--------|---------|-----------|
| C1,C2     | ----   | ----    | ----      |
| C3,C4     | 1000pF | 2KV     | 1206 MLCC |

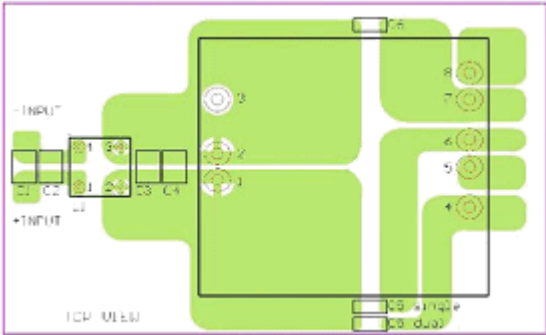
PXF40-48WSxx

| Component | Value  | Voltage | Reference |
|-----------|--------|---------|-----------|
| C1,C2     | 2.2uF  | 100V    | 1812 MLCC |
| C3,C4     | 1000pF | 2KV     | 1206 MLCC |

EMC Considerations (Continued)



Suggested Schematic for EN55022 Conducted Emission Class B Limits



Recommended Layout with Input Filter

To meet conducted emissions EN55022 CLASS B the following components are needed:

PXF40-24WSxx

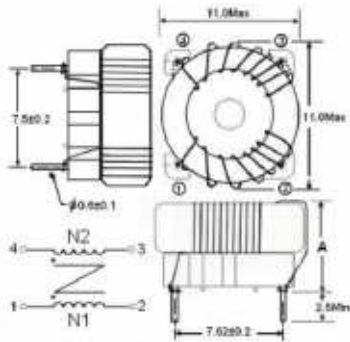
| Component | Value  | Voltage | Reference    |
|-----------|--------|---------|--------------|
| C1,C3     | 4.7uF  | 50V     | 1812 MLCC    |
| C5,C6     | 1000pF | 2KV     | 1206 MLCC    |
| L1        | 450uH  | ----    | Common Choke |

PXF40-48WSxx

| Component | Value  | Voltage | Reference    |
|-----------|--------|---------|--------------|
| C1,C2     | 2.2uF  | 100V    | 1812 MLCC    |
| C3,C4     | 2.2uF  | 100V    | 1812 MLCC    |
| C5,C6     | 1000pF | 2KV     | 1206 MLCC    |
| L1        | 830uH  | ----    | Common Choke |

This Common Choke L1 is defined as follows:

- L: 450 $\mu$ H $\pm$ 35% / DCR:25m $\Omega$ , max  
A height:9.8 mm, Max
- L: 830 $\mu$ H $\pm$ 35% / DCR:31m $\Omega$ , max  
A height:8.8 mm, Max
- Test condition:100KHz / 100mV
- Recommended through hole: $\Phi$ 0.8mm
- All dimensions in millimeters



#### 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 DC-DC converter. Input external L-C filter is recommended to minimize input reflected ripple current. The inductor has a simulated source impedance of 12 $\mu$ H and the capacitor is Nippon chemi-con KZE series 47 $\mu$ F/100V. The capacitor must be located as close as possible to the input terminals of the converter for lower impedance.

#### Output Over Current Protection

When excessive output currents occur in the system, circuit protection is required on all converters. Normally, overload current is maintained at approximately 150 percent of rated current for PXF40-xxWsxx series.

Hiccup-mode is a method of operation in the converter whose purpose is to protect the converter from being damaged during an over-current fault condition. It also enables the converter to restart when the fault is removed.

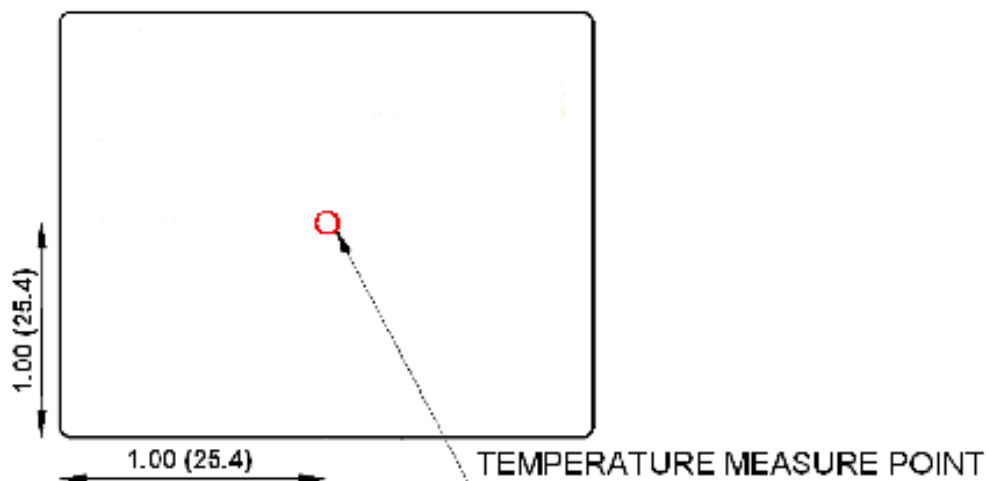
One of the problems resulting from over current is that excessive heat may be generated in power devices; especially MOSFET and Schottky diodes and the temperature of those devices may exceed their specified limits. A protection mechanism has to be used to prevent those power devices from being damaged.

#### Output Over Voltage Protection

The output over-voltage protection consists of an 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.

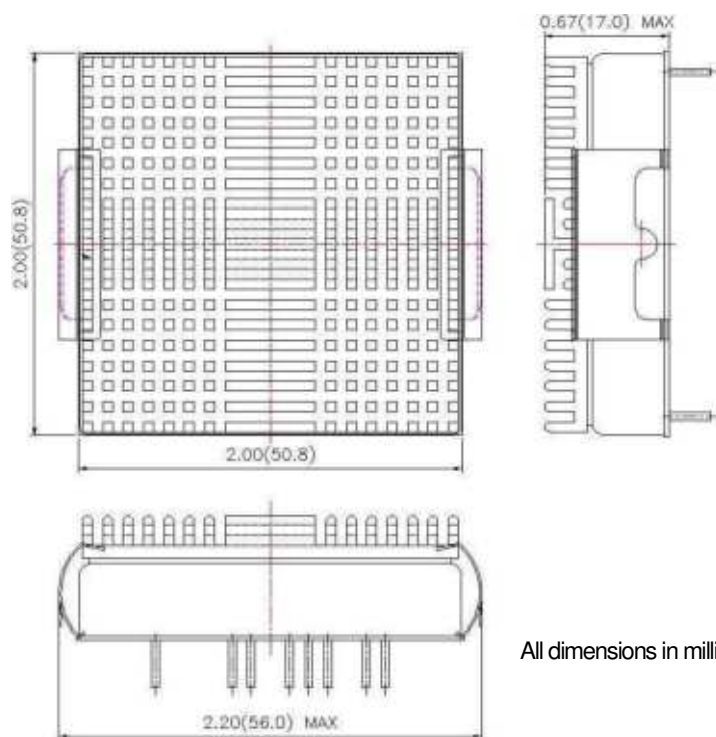
### Thermal Consideration

The converter operates in a variety of thermal environments. 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°C. When operating, adequate cooling must be provided to maintain the test point temperature at or below 105°C. Although the maximum point temperature of the converter is 105°C, limiting this temperature to a lower value will increase the reliability of the unit.



### Heat Sink Consideration

Use heat-sink (7G-0026A) for lowering temperature; thus increasing the reliability of the converter.

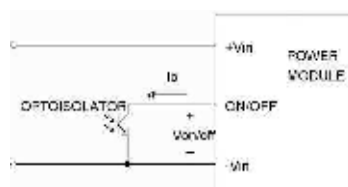


All dimensions in millimeters

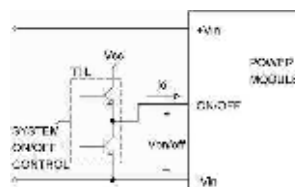
## Remote ON/OFF Control

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

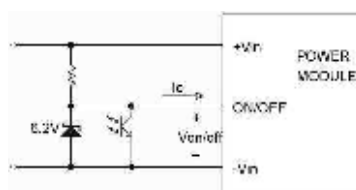
## Remote ON/OFF Implementation Circuits



Isolated-Control Remote ON/OFF



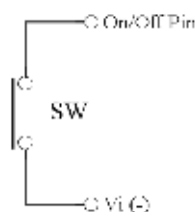
Level Control Using TTL Output



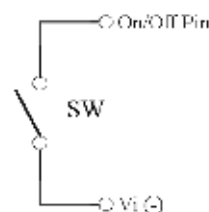
Level Control Using Line Voltage

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

a. Positive logic:

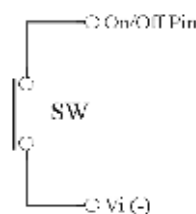


Turned off at Low-level logic

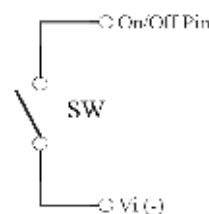


Turned on at High-level logic

b. Negative logic:



Turned on at Low-level logic



Turned off at High-level logic

**Mechanical Data**

**Bottom View Dimensions:**

- Overall Width: 2.00 (50.8)
- Pin 1 to Pin 3 Offset: 1.10 (27.9)
- Pin 3 to Pin 2 Offset: 0.400 (10.16)
- Pin 2 to Pin 1 Offset: 0.200 (5.08)
- Pin 8 to Pin 7 Offset: 0.100 (2.54)
- Pin 7 to Pin 6 Offset: 0.300 (7.62)
- Pin 6 to Pin 5 Offset: 0.600 (15.24)
- Pin 5 to Pin 4 Offset: 0.200 (5.08)
- Pin 4 to Pin 5 Offset: 0.800 (20.32)

**Side View Dimensions:**

- Overall Height: 1.800 (45.72)
- Pin Diameter: DIA. 0.04 (1.0)
- Pin Offset from Edge: 0.40 (10.2)
- Pin Offset from Edge: 0.22 (5.6)
- Pin Offset from Edge: 0.10 (2.5)

**Notes:**

- All dimensions in Inches (mm)  
Tolerance:  $XX \pm 0.02$  ( $XX \pm 0.5$ )  
 $XXX \pm 0.01$  ( $XXX \pm 0.25$ )
- Pin pitch tolerance  $\pm 0.01$  (0.25)
- Pin dimension tolerance  $\pm 0.004$  (0.1)

| PIN CONNECTION |          |
|----------------|----------|
| PIN            | FUNCTION |
| 1              | +INPUT   |
| 2              | -INPUT   |
| 3              | CTRL     |
| 4              | -SENSE   |
| 5              | +SENSE   |
| 6              | +OUTPUT  |
| 7              | -OUTPUT  |
| 8              | TRIM     |

**EXTERNAL OUTPUT TRIMMING**

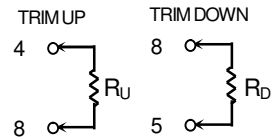
Output can be externally trimmed by using the method shown below.

TRIM UP

TRIM DOWN

| PIN CONNECTION |          |
|----------------|----------|
| PIN            | FUNCTION |
| 1              | +INPUT   |
| 2              | -INPUT   |
| 3              | CTRL     |
| 4              | -SENSE   |
| 5              | +SENSE   |
| 6              | +OUTPUT  |
| 7              | -OUTPUT  |
| 8              | TRIM     |

Output can be externally trimmed by using the method shown below.



## Recommended Pad Layout

ALL Dimensions in Inches (millimeters)  
Tolerances:xx,xxx in  $\pm 0.010$  in (xx,xx mm  $\pm 0.25$ mm)

PAD SIZE (LEAD FREE RECOMMENDED)  
PIN THROUGH HOLE:  $\varnothing 0.047$ in(1.2mm)  
TOP VIEW PAD:  $\varnothing 0.079$ in(2.0mm)  
BOTTOM VIEW PAD:  $\varnothing 0.118$ in(3.0mm)

2.020 [51.30]mm min

1.168 [29.15]

0.200 [5.08] 0.400 [10.16]

1 2 3

TOP VIEW

1.800 [45.71]

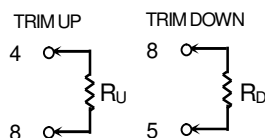
2.375 [60.31]mm min

0.100 [2.54] 0.200 [5.08] 0.300 [7.62] 0.600 [15.24] 0.800 [20.32]

4 5 6 7 8

## Output Voltage Adjustment

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the SENSE(+) or SENSE(-) pins. With an external resistor between the TRIM and SENSE(-) pin, the output voltage set point increases. With an external resistor between the TRIM and SENSE(+) pin, the output voltage set point decreases.



## TRIM TABLE

## PXF40-xxWS3P3

| Trim up (%)        | 1      | 2      | 3      | 4      | 5     | 6     | 7     | 8     | 9     | 10    |
|--------------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|
| $V_{OUT}$ (Volts)= | 3.333  | 3.366  | 3.399  | 3.432  | 3.465 | 3.498 | 3.531 | 3.564 | 3.597 | 3.630 |
| $R_U$ (K Ohms)=    | 57.930 | 26.165 | 15.577 | 10.283 | 7.106 | 4.988 | 3.476 | 2.341 | 1.459 | 0.753 |
| Trim down (%)      | 1      | 2      | 3      | 4      | 5     | 6     | 7     | 8     | 9     | 10    |
| $V_{OUT}$ (Volts)= | 3.267  | 3.234  | 3.201  | 3.168  | 3.135 | 3.102 | 3.069 | 3.036 | 3.003 | 2.970 |
| $R_D$ (K Ohms)=    | 69.470 | 31.235 | 18.490 | 12.117 | 8.294 | 5.745 | 3.924 | 2.559 | 1.497 | 0.647 |

## PXF40-xxWS05

| Trim up (%)        | 1      | 2      | 3      | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|--------------------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| $V_{OUT}$ (Volts)= | 5.050  | 5.100  | 5.150  | 5.200 | 5.250 | 5.300 | 5.350 | 5.400 | 5.450 | 5.500 |
| $R_U$ (K Ohms)=    | 36.570 | 16.580 | 9.917  | 6.585 | 4.586 | 3.253 | 2.302 | 1.588 | 1.032 | 0.588 |
| Trim down (%)      | 1      | 2      | 3      | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
| $V_{OUT}$ (Volts)= | 4.950  | 4.900  | 4.850  | 4.800 | 4.750 | 4.700 | 4.650 | 4.600 | 4.550 | 4.500 |
| $R_D$ (K Ohms)=    | 45.533 | 20.612 | 12.306 | 8.152 | 5.660 | 3.999 | 2.812 | 1.922 | 1.230 | 0.676 |

## PXF40-xxWS12

| Trim up (%)        | 1       | 2       | 3       | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|--------------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|
| $V_{OUT}$ (Volts)= | 12.120  | 12.240  | 12.360  | 12.480 | 12.600 | 12.720 | 12.840 | 12.960 | 13.080 | 13.200 |
| $R_U$ (K Ohms)=    | 367.910 | 165.950 | 98.636  | 64.977 | 44.782 | 31.318 | 21.701 | 14.488 | 8.879  | 4.391  |
| Trim down (%)      | 1       | 2       | 3       | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| $V_{OUT}$ (Volts)= | 11.880  | 11.760  | 11.640  | 11.520 | 11.400 | 11.280 | 11.160 | 11.040 | 10.920 | 10.800 |
| $R_D$ (K Ohms)=    | 460.990 | 207.950 | 123.600 | 81.423 | 56.118 | 39.249 | 27.199 | 18.162 | 11.132 | 5.509  |

## PXF40-xxWS15

| Trim up (%)        | 1       | 2       | 3       | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|--------------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|
| $V_{OUT}$ (Volts)= | 15.150  | 15.300  | 15.450  | 15.600 | 15.750 | 15.900 | 16.050 | 16.200 | 16.350 | 16.500 |
| $R_U$ (K Ohms)=    | 404.180 | 180.590 | 106.060 | 68.796 | 46.437 | 31.531 | 20.883 | 12.898 | 6.687  | 1.718  |
| Trim down (%)      | 1       | 2       | 3       | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| $V_{OUT}$ (Volts)= | 14.850  | 14.700  | 14.550  | 14.400 | 14.250 | 14.100 | 13.950 | 13.800 | 13.650 | 13.500 |
| $R_D$ (K Ohms)=    | 499.820 | 223.410 | 131.270 | 85.204 | 57.563 | 39.136 | 25.974 | 16.102 | 8.424  | 2.282  |

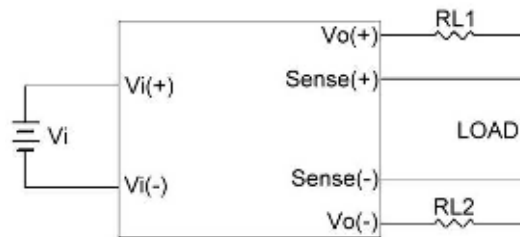
### Remote Sense Application Circuit

The Remote Sense function, when used, regulates the voltage at the load terminals; this compensates for any voltage drop that may exist between the output of the converter and the load. The voltage compensation is limited to less than 10 % of the nominal output voltage rating of the converter.  
i.e.:

$$[V_o (+) \text{ to } V_o (-)] - [\text{Sense } (+) \text{ to } \text{Sense } (-)] < 10\% V_o$$

If the Remote Sense function is not used the SENSE (+) should be connected to OUTPUT (+) and the SENSE (-) should be connected to OUTPUT(-) of the converter.

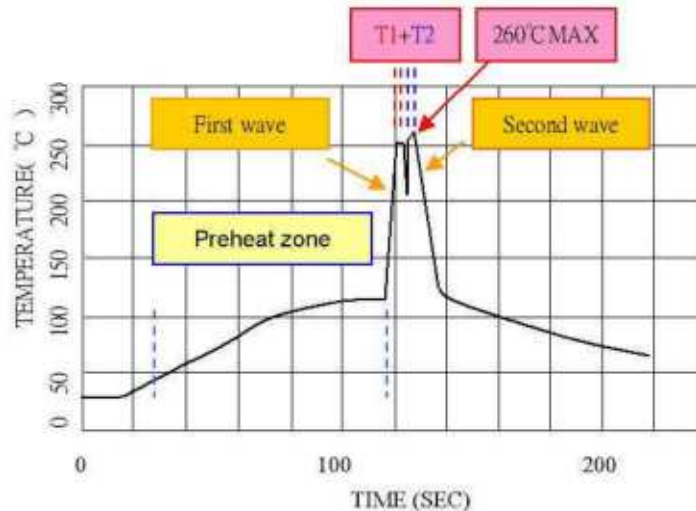
RL1 and RL2 are conduction losses



Remote Sense shown connected to the load.

### Soldering Consideration

Lead free wave solder profile for PXF40WS-SERIES



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

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

**Hand Welding:**Soldering iron - Power 90W

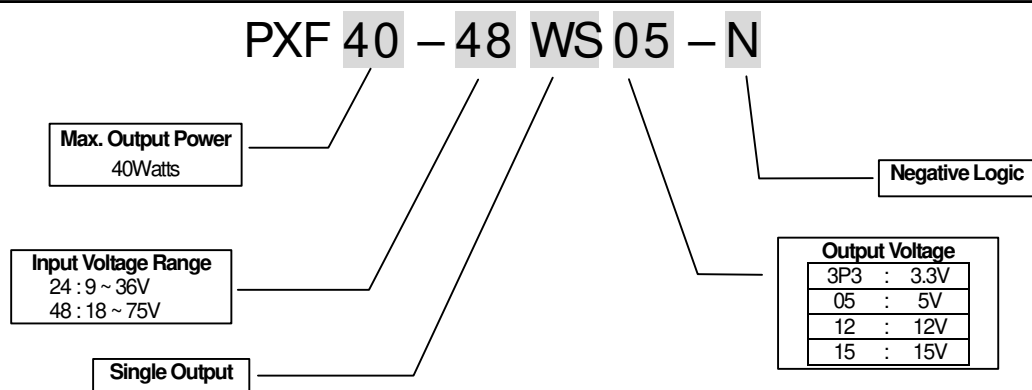
Welding Time: 2-4 sec

Temp.:380-400 °C

## Packaging Information

10 PCS per TUBE

## Part Number Structure



| Model Number  | Input Range | Output Voltage | Output Current | Input Current            | Eff <sup>(2)</sup><br>(%) |
|---------------|-------------|----------------|----------------|--------------------------|---------------------------|
|               |             |                | Full Load      | Full Load <sup>(1)</sup> |                           |
| PXF40-24WS3P3 | 9 – 36 VDC  | 3.3 VDC        | 10000mA        | 1677mA                   | 86                        |
| PXF40-24WS05  | 9 – 36 VDC  | 5 VDC          | 8000mA         | 2008mA                   | 87                        |
| PXF40-24WS12  | 9 – 36 VDC  | 12 VDC         | 3333mA         | 2008mA                   | 87                        |
| PXF40-24WS15  | 9 – 36 VDC  | 15 VDC         | 2666mA         | 2008mA                   | 87                        |
| PXF40-48WS3P3 | 18 – 75 VDC | 3.3 VDC        | 10000mA        | 838mA                    | 86                        |
| PXF40-48WS05  | 18 – 75 VDC | 5 VDC          | 8000mA         | 992mA                    | 88                        |
| PXF40-48WS12  | 18 – 75 VDC | 12 VDC         | 3333mA         | 1004mA                   | 87                        |
| PXF40-48WS15  | 18 – 75 VDC | 15 VDC         | 2666mA         | 1004mA                   | 87                        |

Note 1. Maximum value at nominal input voltage and full load.

Note 2. Typical value at nominal input voltage and full load.

## Safety and Installation Instruction

**Fusing Consideration**

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

This encapsulated converter can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of a sophisticated power architecture. For maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a slow-blow fuse with a maximum rating of 8A for PXF40-24WSxx converters and 5A for PXF40-48WSxx converters. Based on the information provided in this data sheet on Inrush energy and maximum DC input current; the same type of fuse with a lower rating can be used. Refer to the fuse manufacturer's data for further information.

## MTBF and Reliability

**The MTBF of PXF40-xxWSxx series of DC/DC converters has been calculated using:**

Bellcore TR-NWT-000332 Case I: 50% stress, Operating Temperature at 40°C (Ground fixed and controlled environment ). The resulting figure for MTBF is  $1.105 \times 10^6$  hours.

MIL-HDBK 217F NOTICE2 FULL LOAD, Operating Temperature at 25°C °C. The resulting figure for MTBF is  $1.511 \times 10^5$  hours.