

NON-ISOLATED DC/DC CONVERTERS

5 Vdc - 13.8 Vdc Input

0.6 Vdc - 5.0 Vdc/50 A Output



Jan. 21, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

xRP2-50E1Ax

RoHS Compliant

Rev.H

Features

- Non-Isolated
- High Efficiency
- Fixed Switching Frequency
- Low Cost
- Excellent Thermal Performance
- Wide Input Voltage Range
- Output Over-Voltage Shutdown
- OCP/SCP
- Low Output Ripple
- Power Good Signal
- Remote On/Off
- Wide Output Trim Range



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The xRP2-50E1Ax is a non-isolated dc/dc converter that operates over a wide range of input voltage ($V_{in} = 5 \text{ Vdc} - 13.8 \text{ Vdc}$). This unit can provide a precisely regulated output voltage from 0.6 Vdc to 5.0 Vdc and can deliver up to 50 A of output current. This unit is designed to be highly efficient and low cost. The converter is provided in an industry standard package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency ($V_o=1.8 \text{ Vdc}$)	Part Number Horizontal Mount	Part Number Vertical Mount
0.6 V - 5.0 V	5.0 V - 13.8 V	50 A	250 W	86%	0RP2-50E1A0	VRP2-50E1A0
0.6 V - 5.0 V	5.0 V - 13.8 V	50 A	250 W	86%	0RP2-50E1A1	VRP2-50E1A1

Note: Add "G" suffix at the end of the model numbers listed above to indicate "Tray Packaging".

Part Number Explanation

$\frac{x}{1} \frac{R}{2} \frac{P2}{3} - \frac{50}{4} \frac{E}{5} \frac{1A}{6} \frac{x}{7}$

1---Using "0" means horizontal mount, and using "V" means Vertical mount

2---RoHS 6, change "R" to "7" means RoHS 5

3---Series name (SIP)

4---Series code (output current 50A)

5---Input range (5-13.8V)

6---Output voltage (0.6-5.0V)

7---Suffix, "0" means model has a trim resistor equation

"1" means model has a trim voltage equation

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	15 V	
Output Enable Terminal Voltage	-0.3 V	-	15 V	
Ambient Temperature	0 °C	-	70 °C	
Storage Temperature	-55 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
Vo ≤ 2.8 V	5 V	12 V	13.8 V	
Vo > 2.8 V	1.8*Vo	12 V	13.8 V	
Input Current (full load)	-	-	38 A	
Input Reflected Ripple Current (pk-pk)	-	35 mA	-	With simulated source impedance of 1 uH, 5 Hz to 20 MHz. Use a 1000 uF/16 V electrolytic capacitor with ESR=0.1 ohm max, at 100 kHz at 25°C.
Input Reflected Ripple Current (rms)	-	10 mA	-	
I ² t Inrush Current Transient	-	-	1 A ² s	
Turn-on Voltage Threshold	4.4 V	4.6 V	4.8 V	
Under Voltage Threshold	4.0 V	4.3 V	4.6 V	

Note: All specifications are typical at 25 °C unless otherwise stated.

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point Accuracy				
Vo ≥ 1 V	-1.5 % Vo	-	+1.5 % Vo	Vin=Vinmin, Io=Iomax
Vo < 1 V	-10 mV	-	+10 mV	
Load Regulation				
Vo ≥ 2.5 V	-	-	0.6% Vo	
Vo < 2.5 V	-	-	12 mV	
Line Regulation				
Vo ≥ 2.5 V	-	-	0.3% Vo	
Vo < 2.5 V	-	-	9 mV	
Regulation Over Temperature (0 °C to +70 °C)	-	-	0.02% Vo/C	
Output Current	0 A	-	50 A	
Current Limit Threshold	105% Io	130% Io	180% Io	
Output Ripple and Noise (pk-pk)				
Vo=5.0 V	-	-	110 mV	Test conditions: 0-20MHz BW, with a 1µF ceramic capacitor and a 10 uF Tantalum cap at output.
Vo=3.3 V	-	-	100 mV	
Vo=2.5 V	-	-	100 mV	
Vo=1.5 V	-	-	80 mV	
Vo=1.0 V	-	-	60 mV	
Vo=0.6 V	-	-	60 mV	

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Output Specifications (continued)

Parameter	Min	Typ	Max	Notes	
Output Ripple and Noise (rms)				Test conditions: 0-20MHz BW, with a 1μF ceramic capacitor and a 10 uF Tantalum cap at output.	
Vo=5.0 V	-	-	35 mV		
Vo=3.3 V	-	-	35 mV		
Vo=2.5 V	-	-	35 mV		
Vo=1.5 V	-	-	30 mV		
Vo=1.0 V	-	-	25 mV		
Vo=0.6 V	-	-	25 mV		
Turn On Time	-	-	10 mS		
Rise Time	-	-	3 mS		
Overshoot at Turn on and off	-	-	0.5%		
Output Capacitance					
ESR≥1 mΩ	0 uF	-	4700 uF		
Transient Response					
50% ~ 100% Max Load	Vo=All	-	-	300 mV	Test conditions: di/dt = 10 A/uS; Vin =12 V; Co=0 uF.
Settling Time		-	-	100 uS	
100% ~ 50% Max Load		-	-	300 mV	
Settling Time		-	-	100 uS	

Note: All specifications are typical at nominal input, full load at 25°C unless noted.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=5.0 V	-	93%	-	
Vo=3.3 V	-	91%	-	
Vo=2.5 V	-	88%	-	
Vo=1.8 V	-	86%	-	
Vo=1.5 V	-	84%	-	
Vo=1.2 V	-	82%	-	
Vo=1.0 V	-	75%	-	
Vo=0.6 V	-	68%	-	
Switching Frequency	-	330 kHz	-	
Output Voltage Trim Range	0.6 V	-	5 V	Trim pin is open, Vo = 0.6 V.
Over Voltage Protection	110% Vo,set	115%Vo,set	130%Vo,set	Vin=12 V, Io=full load.
MTBF	3,361,100 hours			Calculated Per Bell Core SR-332 (Io =40 A, Vo=1.92 V; Vin=12 V; Ta = 25 °C, 100LFM forced air flow.)
Dimensions (horizontal mount)				
Inches (L × W × H)	1.45 x 1.1 x 0.783			
Millimeters (L × W × H)	36.83 x 27.94 x 19.9			
Dimensions (vertical mount)				
Inches (L × W × H)	1.45 x 1.1 x 0.743			
Millimeters (L × W × H)	36.83 x 27.94 x 18.87			
Weight	-	28.5 g	-	

Note: All specifications are typical at 25 °C unless otherwise stated.

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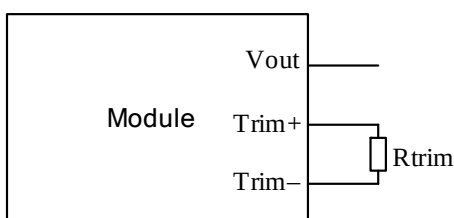
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off (Active High)				
Signal Low (Unit Off)	-0.3 V	-	0.8 V	Remote On/Off pin is open, unit is off.
Signal High (Unit On)	2 V	-	V _{in,max}	
Current Source/Sink	0 mA	-	3.3 mA	
PwGood (PowerGood)				
PwGood = High = Power Good	2.4 V	-	5.25 V	
	-	-	2 mA	
PwGood = Low = Power Not Good	0 V	-	0.4 V	
	-	-	4 mA	

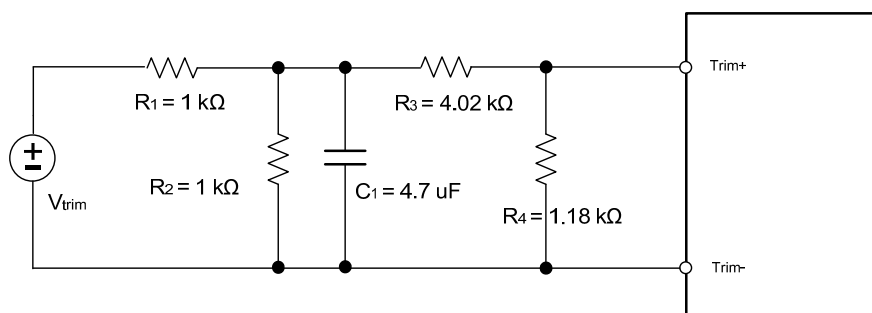
Output Trim Equation

xRP2-50E1A0--- Trim resistor equation

$$R_{trim} = \frac{1.2}{V_o - 0.6} (K\Omega)$$



xRP2-50E1A1--- Trim voltage equation



$$V_o = 1.8824 - 0.2212 V_{trim} (V)$$

V_o = 1.847V when V_{trim} is open.

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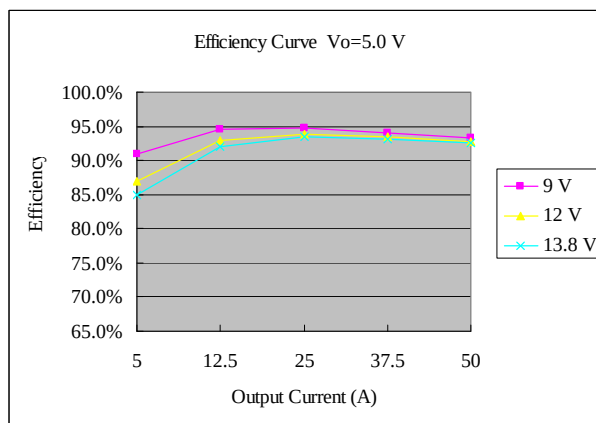
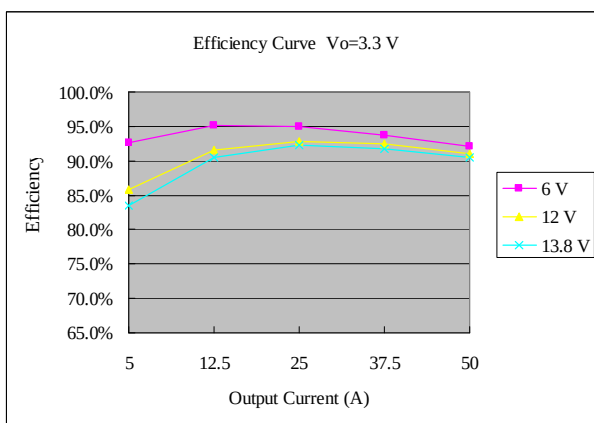
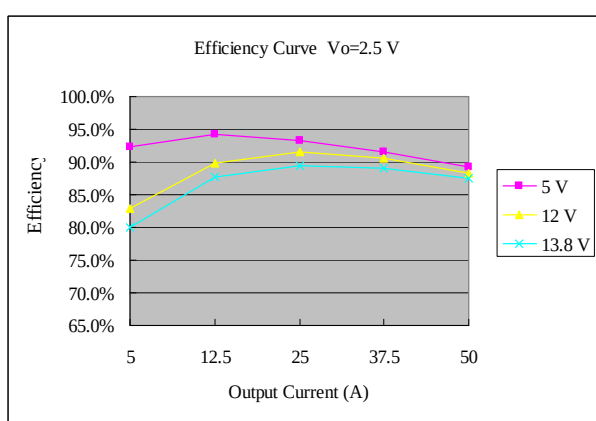
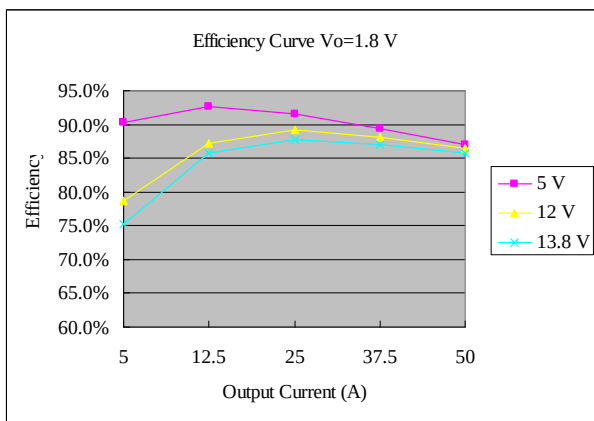
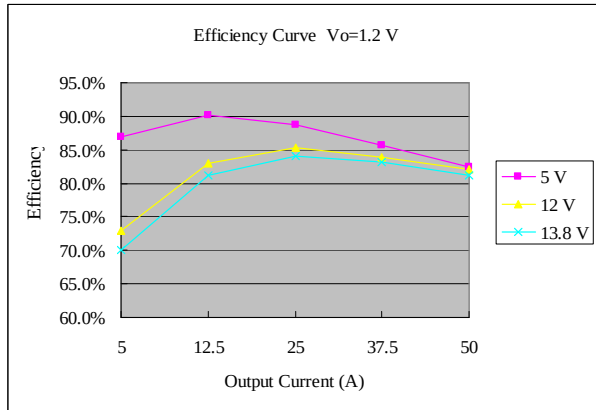
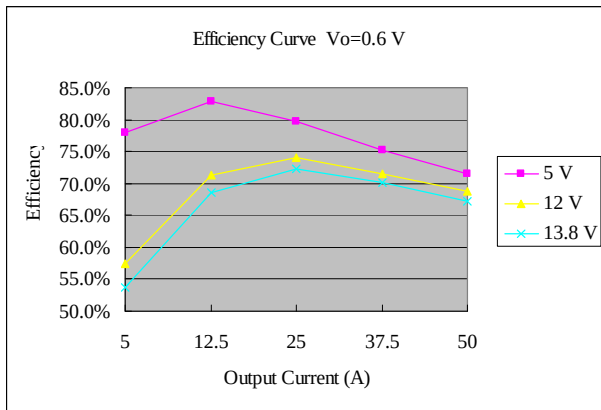
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Efficiency Data



NON-ISOLATED DC/DC CONVERTERS

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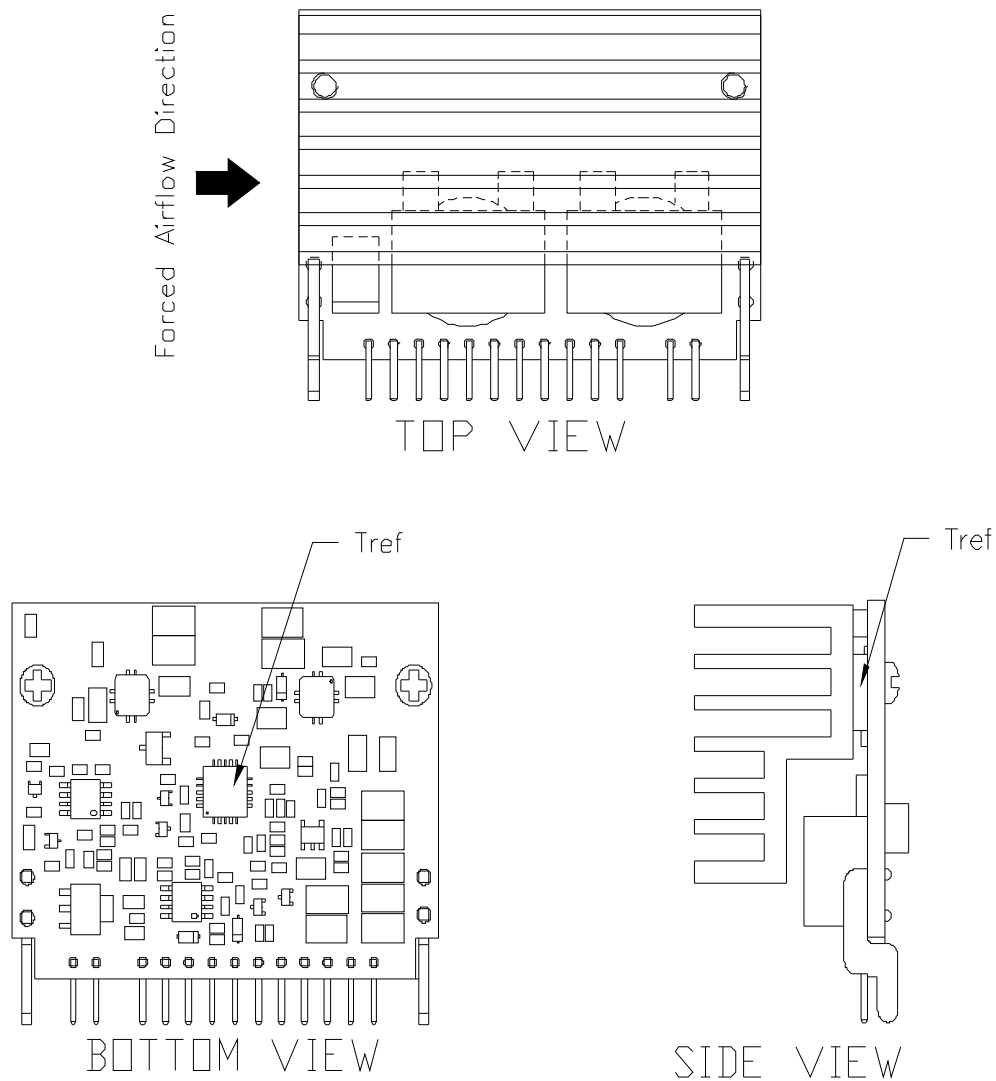
0.6 Vdc - 5.0 Vdc/50 A Output

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Thermal Derating Curves



The thermal reference point Tref is shown above. For reliable operation this temperature should not exceed 115°C. The output power of the module should not exceed the rated power for the module.

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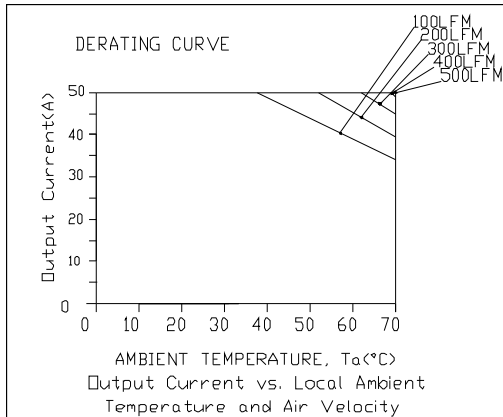
0.6 Vdc - 5.0 Vdc/50 A Output

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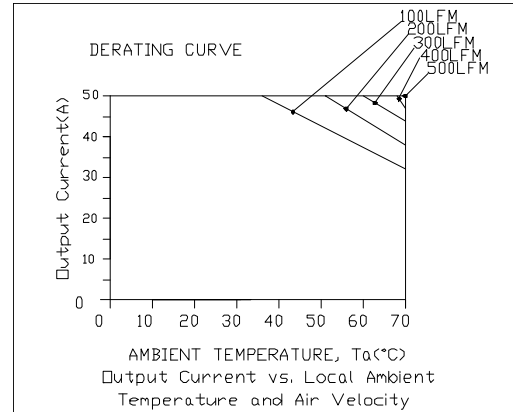
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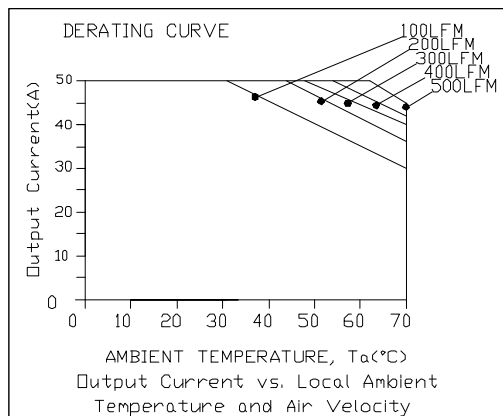
Thermal Derating Curves (continued)



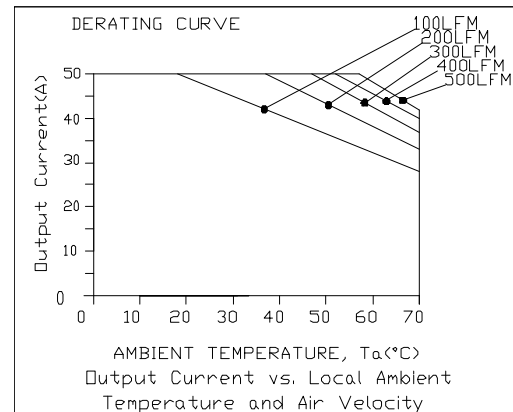
$V_{in}=12\text{ V}$, $V_o=0.6\text{ V}$



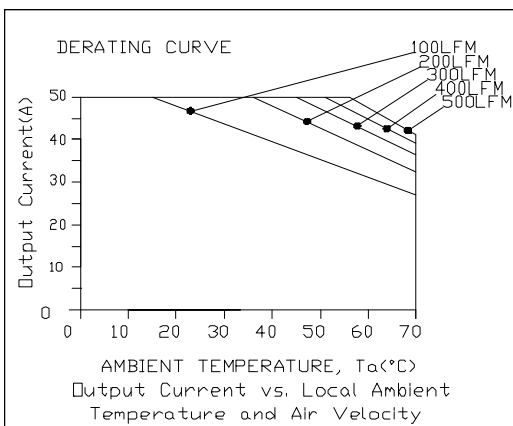
$V_{in}=12\text{ V}$, $V_o=1.2\text{ V}$



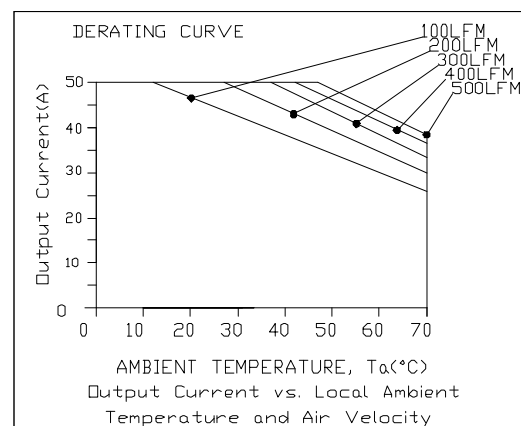
$V_{in}=12\text{ V}$, $V_o=1.8\text{ V}$



$V_{in}=12\text{ V}$, $V_o=2.5\text{ V}$



$V_{in}=12\text{ V}$, $V_o=3.3\text{ V}$



$V_{in}=12\text{ V}$, $V_o=5.0\text{ V}$

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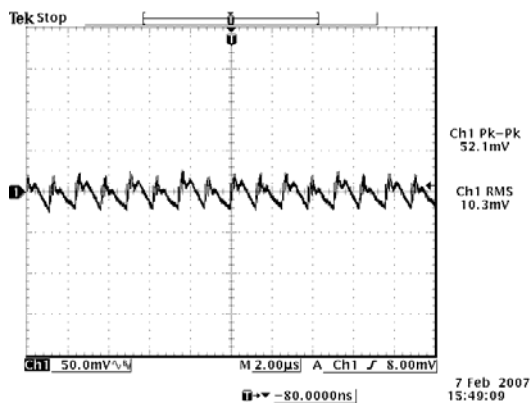
0.6 Vdc - 5.0 Vdc/50 A Output



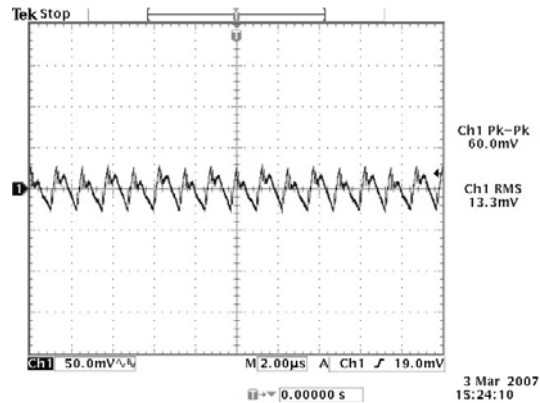
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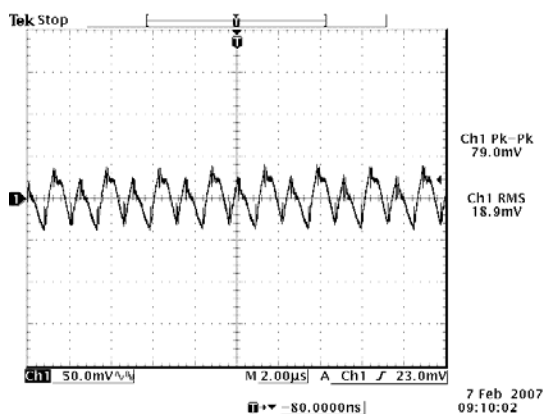
Ripple and Noise Waveforms



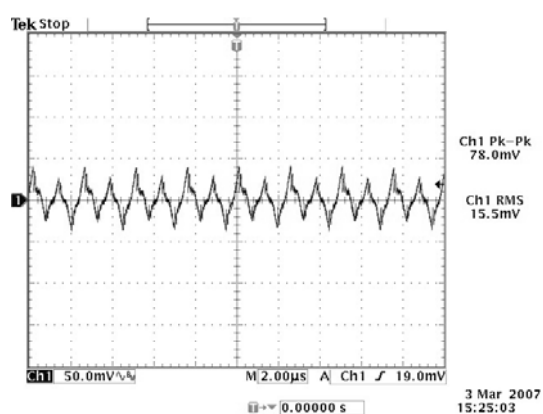
12 Vdc input, 0.6 Vdc/50 A output



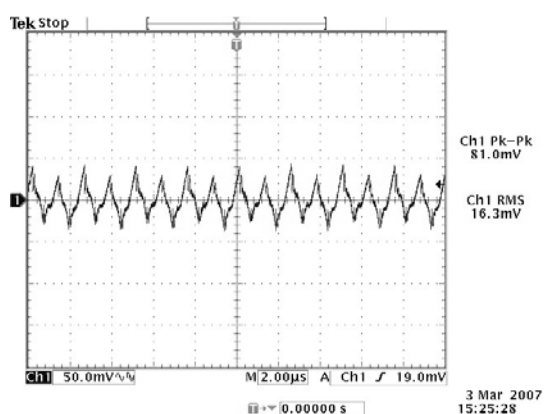
12 Vdc input, 1.2 Vdc/50 A output



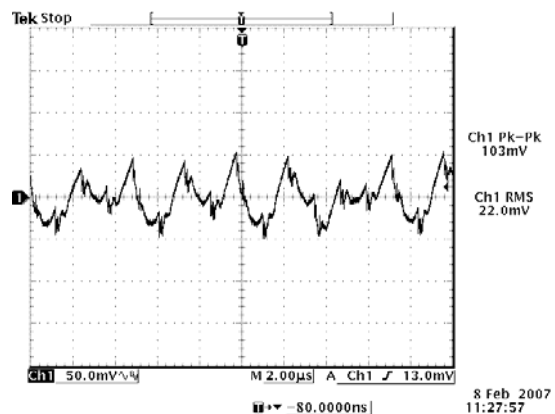
12 Vdc input, 1.8 Vdc/50 A output



12 Vdc input, 2.5 Vdc/50 A output



12 Vdc input, 3.3 Vdc/50 A output



12 Vdc input, 5.0 Vdc/50 A output

Note: Ripple and noise at full load, 0-20 MHz BW, with a 10 μ F and a 1 μ F ceramic cap at the output, and $T_a=25$ deg C.

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5 Vdc - 13.8 Vdc Input

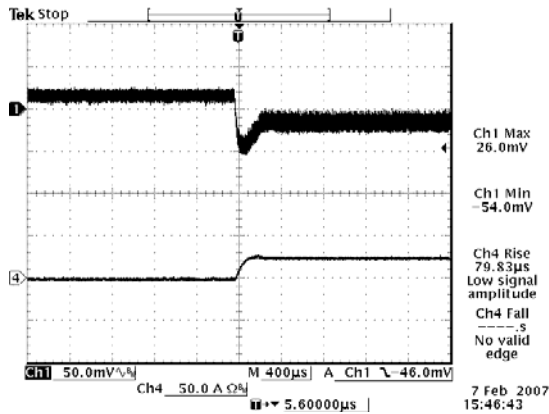
0.6 Vdc - 5.0 Vdc/50 A Output



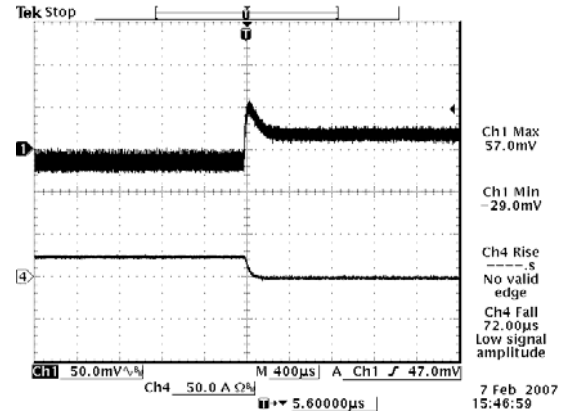
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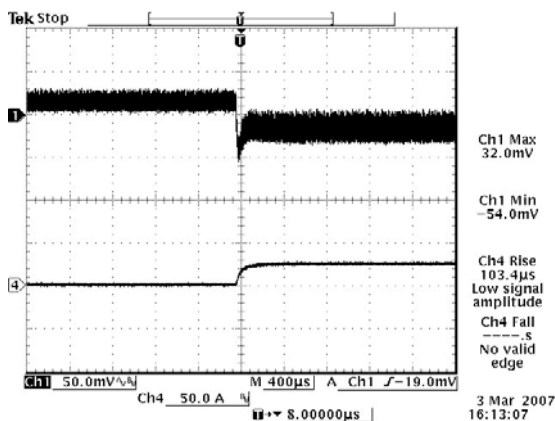
Transient Response Waveforms



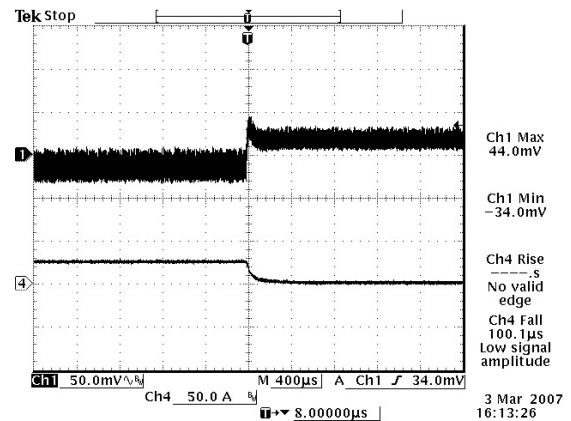
Vout= 0.6 V 0%-50% Load Transient



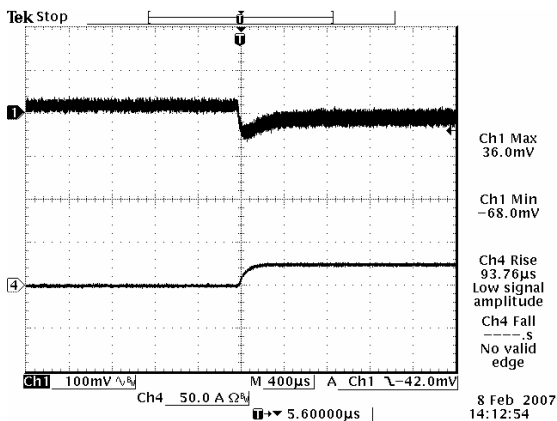
Vout=0.6 V 50%-0% Load Transient



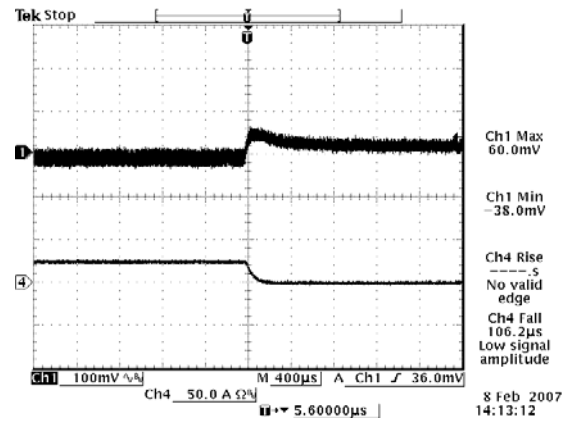
Vout=1.2 V 0%-50% Load Transient



Vout=1.2 V 50%-0% Load Transient



Vout=1.8 V 0%-50% Load Transient



Vout=1.8 V 50%-0% Load Transient

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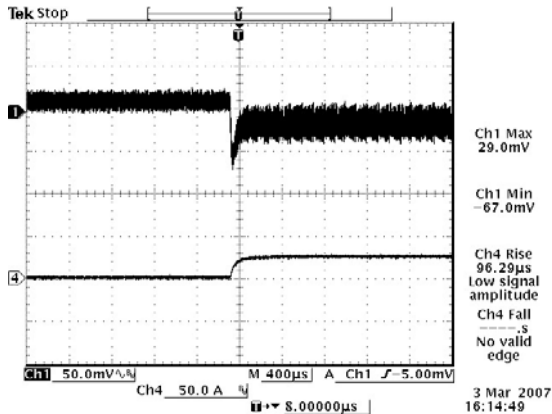
0.6 Vdc - 5.0 Vdc/50 A Output



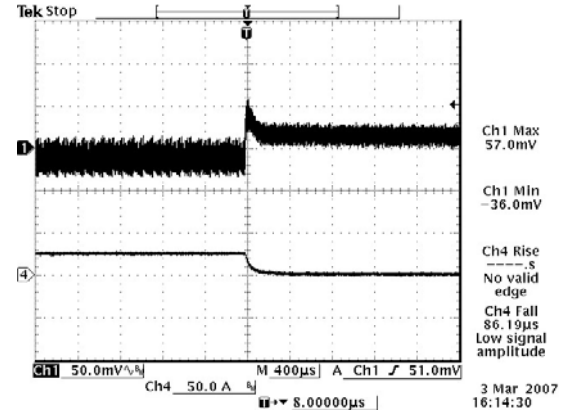
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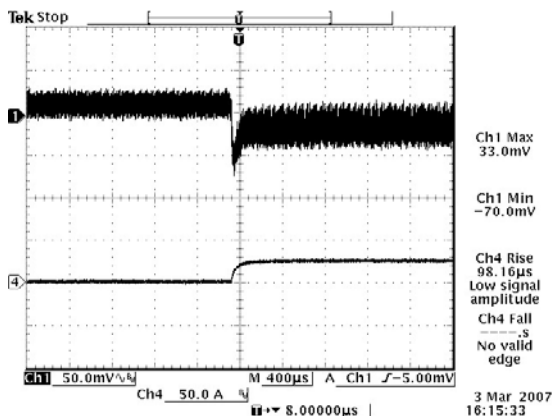
Transient Response Waveforms (continued)



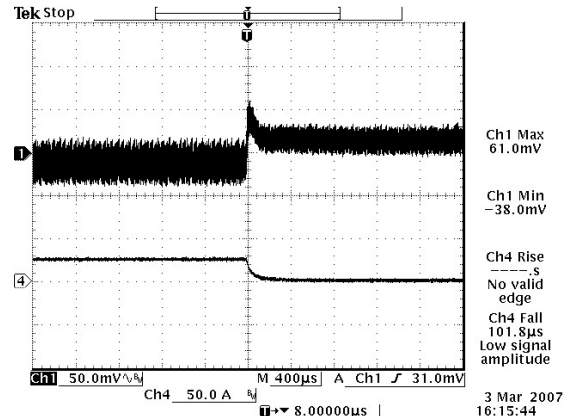
Vout= 2.5 V 0%-50% Load Transient



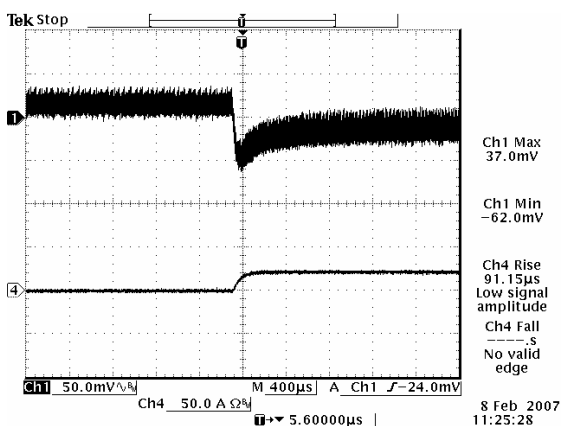
Vout=2.5 V 50%-0% Load Transient



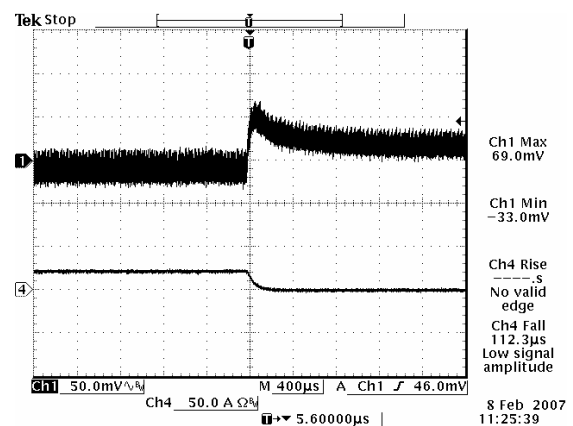
Vout=3.3 V 0%-50% Load Transient



Vout=3.3 V 50%-0% Load Transient



Vout=5 V 0%-50% Load Transient



Vout=5 V 50%-0% Load Transient

Note: Transient response at $di/dt = 10 \text{ A}/\mu\text{S}$, with external electrolytic cap 4700 μF , and $T_a = 25 \text{ deg C}$.

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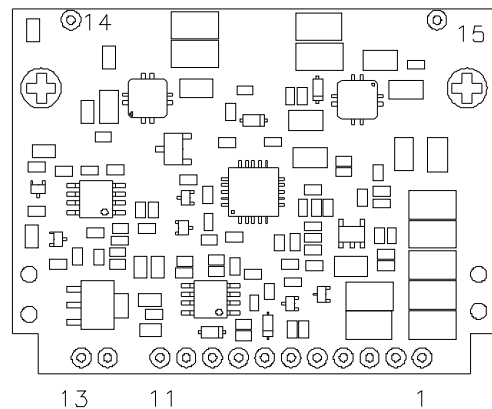
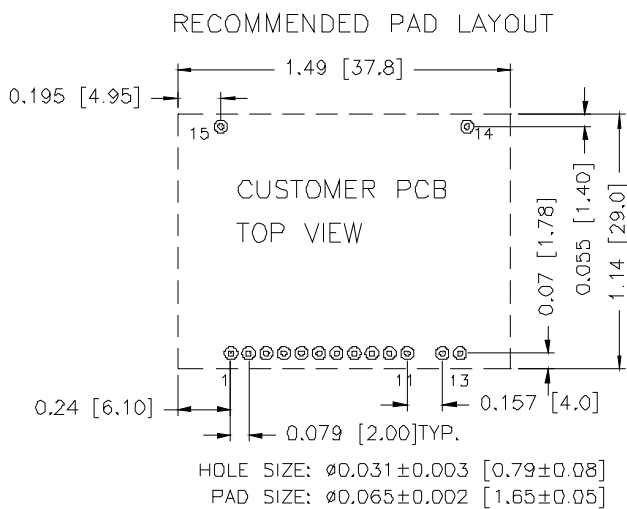
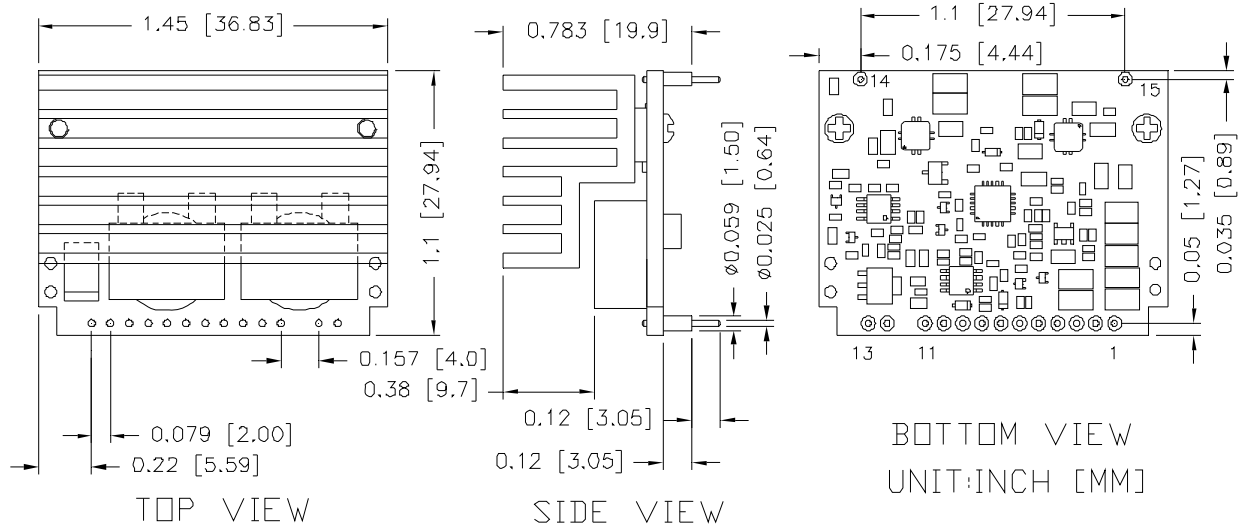


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Mechanical Outline

0RP2-50E1Ax



Pin Connections

Pin	Function	Pin	Function
1	Vout	9	PwGOOD
2	Vout	10	Sense-
3	Vout	11	Sense+
4	GND	12	Vin
5	GND	13	Vin
6	Enable	14	GND
7	Trim-	15	GND
8	Trim+		

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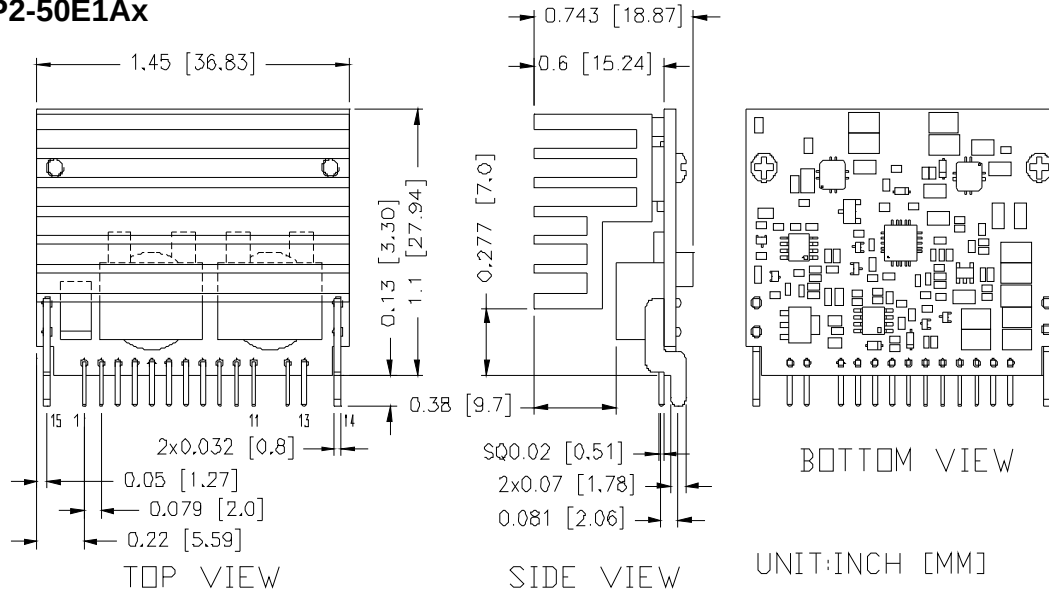


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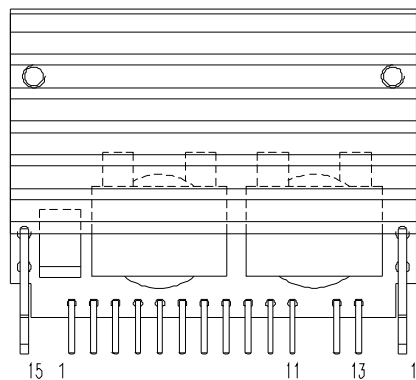
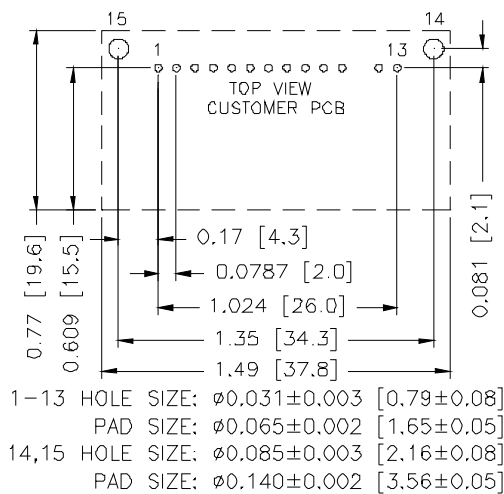
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Mechanical Outline (continued)

VRP2-50E1Ax



RECOMMENDED PAD LAYOUT



Pin Connections

Pin	Function
1	Vout
2	Vout
3	Vout
4	GND
5	GND
6	Enable
7	Trim-
8	Trim+
9	PwGOOD
10	Sense-
11	Sense+
12	Vin
13	Vin
14	GND
15	GND

Note: This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

Note:

- 1) All Pins: Material - Copper Alloy;
Finish – 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.
- 2) Undimensioned components are shown for visual reference only.
- 3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

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Revision History

Date	Revision	Changes Detail	Approval
2010-1-21	H	1. Change to Bel new datasheet format; 2. Add new part number "xRP2-50E1A1"	YF Sun

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products.



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CORPORATE

Bel Fuse Inc.
206 Van Vorst Street
Jersey City, NJ 07302
Tel 201-432-0463
Fax 201-432-9542
www.belfuse.com

FAR EAST

Bel Fuse Ltd.
8F/ 8 Luk Hop Street
San Po Kong
Kowloon, Hong Kong
Tel 852-2328-5515
Fax 852-2352-3706
www.belfuse.com

EUROPE

Bel Fuse Europe Ltd.
Preston Technology Management Centre
Marsh Lane, Suite G7, Preston
Lancashire, PR1 8UD, U.K.
Tel 44-1772-556601
Fax 44-1772-888366
www.belfuse.com