

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/16 A Output

Jan. 25, 2013

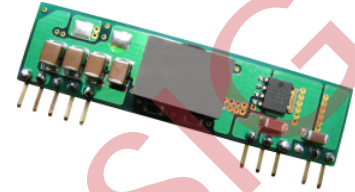
Bel Power Inc., a subsidiary of Bel Fuse Inc.

VRBC-16E1Ax

RoHS Compliant

Rev.B

- Non-Isolated
- High Efficiency
- Fixed Frequency
- Low Cost
- Industrial Temperature Range
- Logic Low/High (Option)
- Over Temperature Shutdown
- Certified to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1
- Under-voltage Lockout (UVLO)
- OCP/SCP
- Wide Trim
- Wide Input
- Remote Sense
- Remote On/Off



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel VRBC-16E1Ax is part of the non-isolated dc/dc converter series. The modules use a SIP package. These converters are available in a range of output voltages from 0.75 Vdc to 3.63 Vdc over a wide range of input voltage ($V_{in} = 4.5 \text{ Vdc} - 14 \text{ Vdc}$). The efficiency is typically 92% at 3.3 Vdc output at full load.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low	Model Number Active High
0.75 V - 3.63 V	4.5 V - 14 V	16 A	58 W	92%	VRBC-16E1AL	VRBC-16E1A0

Notes: 1. Add "G" suffix at the end of the model number to indicate Tray Packaging.

Part Number Explanation

$\frac{V}{1} \frac{R}{2} \frac{BC}{3} - \frac{16}{4} \frac{E}{5} \frac{1A}{6} \frac{x}{7}$

1---Vertical mount

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

3---Series name

4---Series code

5---Wide input range (4.5-14V)

6---Wide trim

7---Option, "x" of the model part number to be 0-9, A-Z, which will represent the special request of customer.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/16 A Output



Jan. 25, 2013

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

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	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
$V_{o,set} < 3.0$	4.5 V	-	14 V	
$V_{o,set} \geq 3.0$	$V_{o,set} + 1.5$ V	-	14 V	
Input Current (full load)	-	-	15 A	This power module is not internally fused. An input line fuse must always be used
Input Current (no load)	-	100 mA	-	
Remote Off Input Current	-	2 mA	-	
Input Reflected Ripple Current (pk-pk)	-	-	400 mA	Tested with one 1000 uF / 25 V AL input capacitor with ESR=0.03 ohm max and 6 x 47 uF/16 V Tantalum capacitors with ESR=0.013 ohm max at 100 kHz, & simulated source impedance of 1000 nH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	-	150 mA	
I ² t Inrush Current Transient	-	0.2 A ² s	0.4 A ² s	
Turn-on Voltage Threshold	-	4.3 V	-	
Turn-off Voltage Threshold	3.7 V	-	4.2 V	

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2% $V_{o,set}$	-	2% $V_{o,set}$	$V_{in}=12$ V, full load
Load Regulation	-	0.2% $V_{o,set}$	-	
Line Regulation	-	0.3% $V_{o,set}$	-	
Regulation Over Temperature (-40°C to +85°C)	-	0.3% $V_{o,set}$	-	
Output Current	0 A	-	16 A	
Current Limit Threshold	-	180% $I_{o,out}$	-	
Short Circuit Surge Transient	-	1 A ² s	3 A ² s	
Ripple and Noise (pk-pk)	-	30 mV	80 mV	Tested with 0-20 MHz, 10 uF tantalum capacitor & 1 uF ceramic capacitor at the output
Ripple and Noise (rms)	-	12 mV	35 mV	
Turn on Time	-	8 mS	20 mS	
Overshoot at Turn on	-	-	1% $V_{o,set}$	
Output Capacitance	0 uF	-	5600 uF	
Transient Response				
50% ~ 100% Max Load	All	-	100 mV	di/dt=0.5 A / uS; $V_{in}=12$ V and and without any external capacitor at the output.
Settling Time		-	80 uS	
100% ~ 50% Max Load		-	100 mV	
Settling Time		-	80 uS	

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

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/16 A Output



Jan. 25, 2013

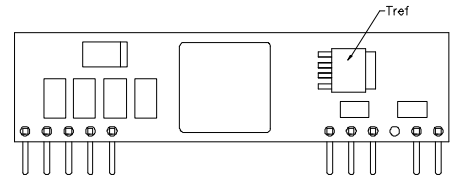
Bel Power Inc., a subsidiary of Bel Fuse Inc.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	- - - - - -	91.7% 90.4% 87.5% 86% 85% 79%	- - - - - -	Measured at Vin=12 V, Io=Io-max
Efficiency Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	- - - - - -	93.5% 91.5% 88.4% 87% 86% 80%	- - - - - -	Measured at Vin=5 V, Io=Io-max
Switching Frequency	250 kHz	280 kHz	310 kHz	
Over Temperature Shutdown ¹	-	130 °C	-	
Output Trim Range (Wide Trim)	0.7525 V	-	3.63 V	Total adjustment of trim, setpoint and remote sense combined should not exceed 3.63 V. Vo=0.7525 V when trim pin open
Remote Sense Compensation	-	-	0.5 V	Calculated Per Bell Core TR-332 (Io = 80%Io,max; Vin=12 V; Vo=3.3 V; Ta = 25°C)
MTBF	4,619,490 hours			
Dimensions Inches (L x W x H) Millimeters (L x W x H)	2.0 x 0.5 x 0.32 50.8 x 12.7 x 8.13			
Weight	-	7.1 g	-	

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

1. The Tref temperature measurement location:



Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2V	-	0.3V	VRBC-16E1A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2V	-	0.3V	VRBC-16E1AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5V	-	Vin, max	

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/16 A Output

bel

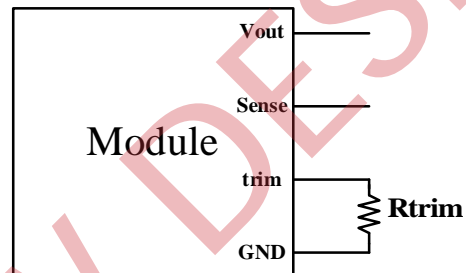
Jan. 25, 2013

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

Output Trim Equations

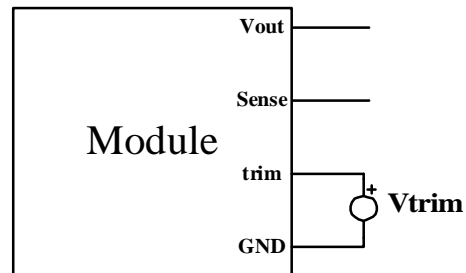
Equation for calculating the trim resistor (in Ω) given the desired output voltage (V_o) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{10500}{V_o - 0.7525} - 1000$$



Equation for calculating the trim voltage (in V) given the desired output voltage (V_o) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

$$V_{trim} = 0.7 - 0.0667 \times (V_o - 0.7525)$$



NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

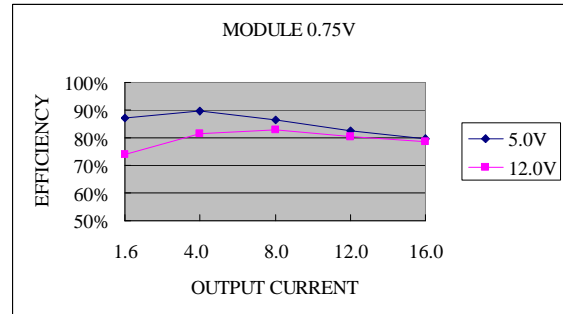
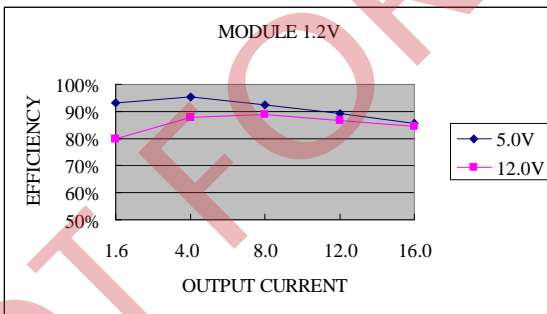
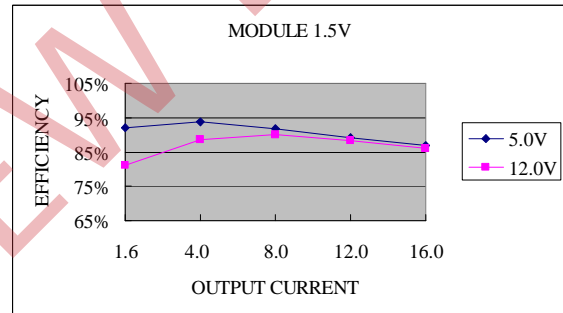
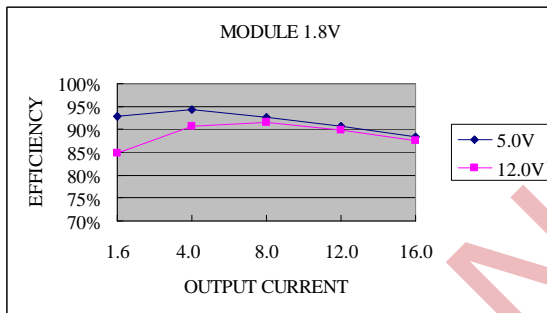
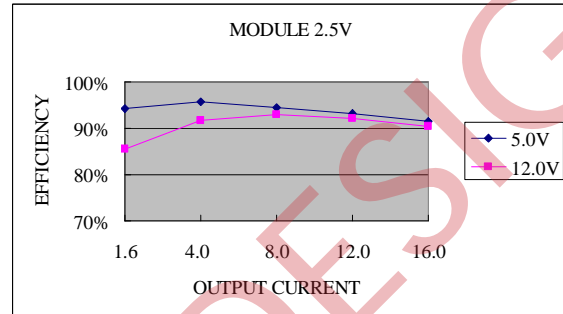
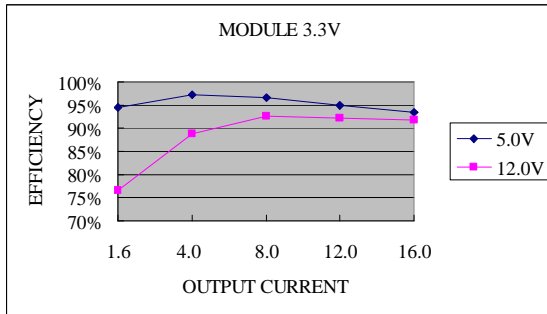
0.75 Vdc - 3.63 Vdc/16 A Output



Jan. 25, 2013

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

Efficiency Data



NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

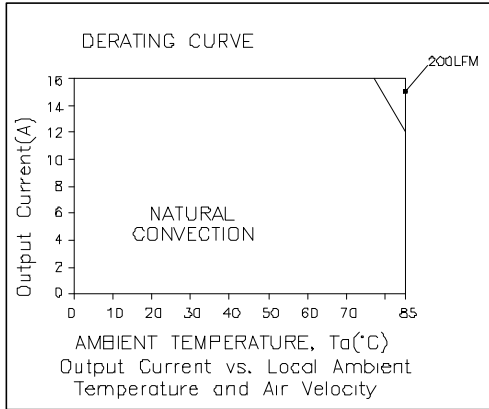
0.75 Vdc - 3.63 Vdc/16 A Output



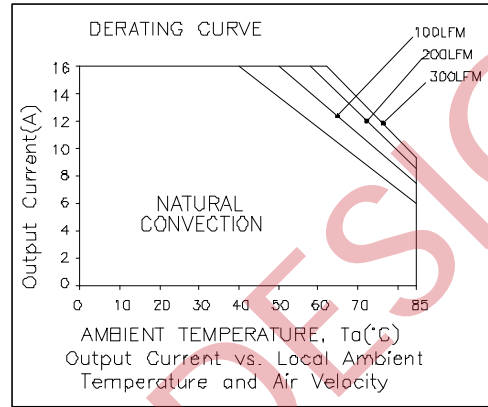
Jan. 25, 2013

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

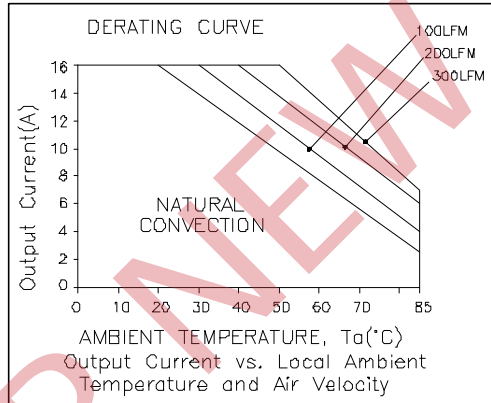
Thermal Derating Curves



$V_o=0.75$ V; $V_{in}=12$ V

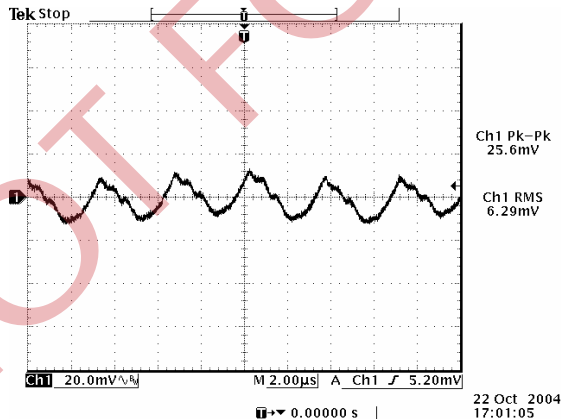


$V_o=1.8$ V; $V_{in}=12$ V

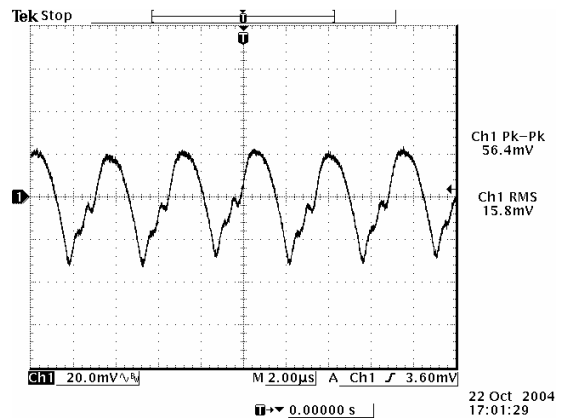


$V_o=3.3$ V; $V_{in}=12$ V

Ripple and Noise Waveforms



$V_{in}=5.0$ V, $V_o=3.3$ V



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

Note: External load with 10 uF tantalum capacitor and 1 uF ceramic at the output, full load, $T_a=25$ deg C.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

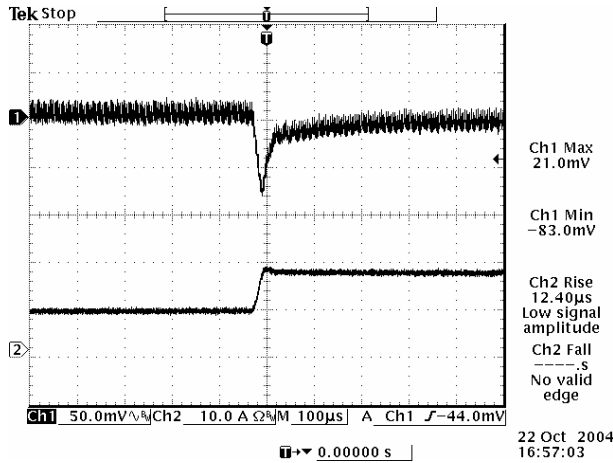
0.75 Vdc - 3.63 Vdc/16 A Output



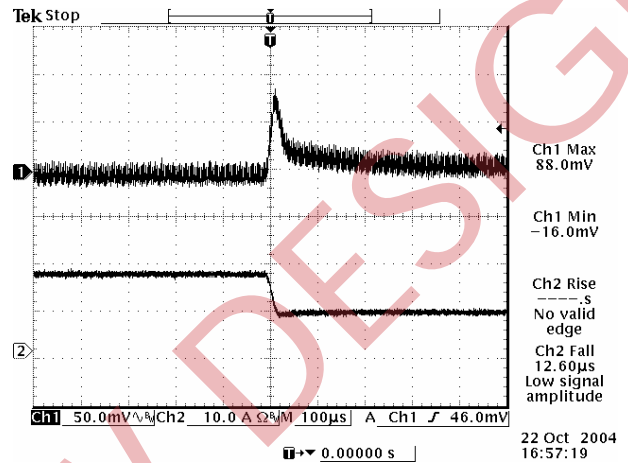
Jan. 25, 2013

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

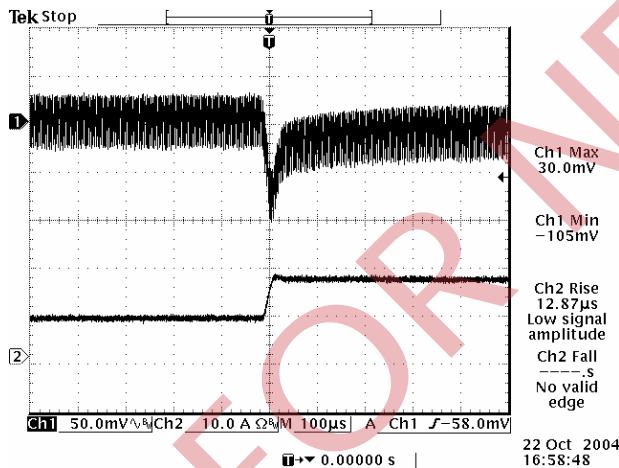
Transient Response Waveforms



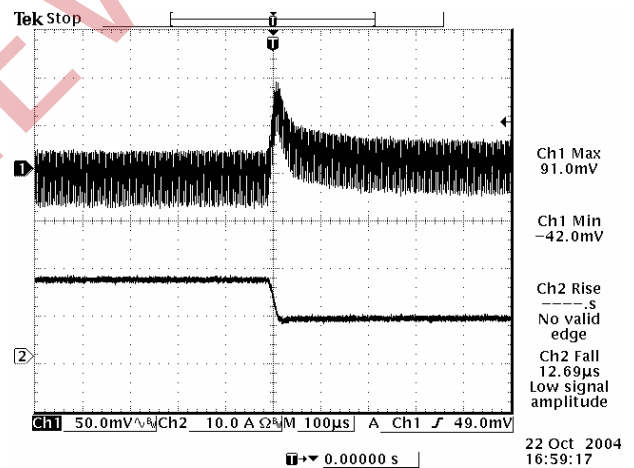
50% to 100% load Transient at $V_{in}=5$ V, $V_o=3.3$ V



100% to 50% load Transient at $V_{in}=5$ V, $V_o=3.3$ V



50% to 100% load Transient at $V_{in}=12$ V, $V_o=3.3$ V



100% to 50% load Transient at $V_{in}=12$ V, $V_o=3.3$ V

Note: External load capacitor $C_{ext}=0$ μ F, and $T_a=25$ deg C.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

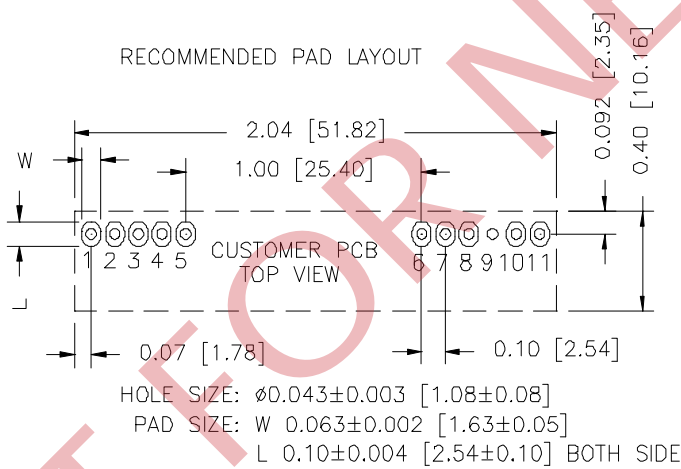
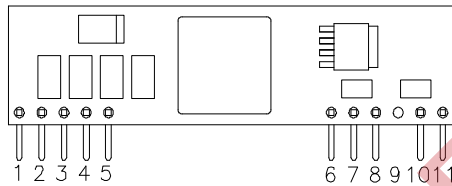
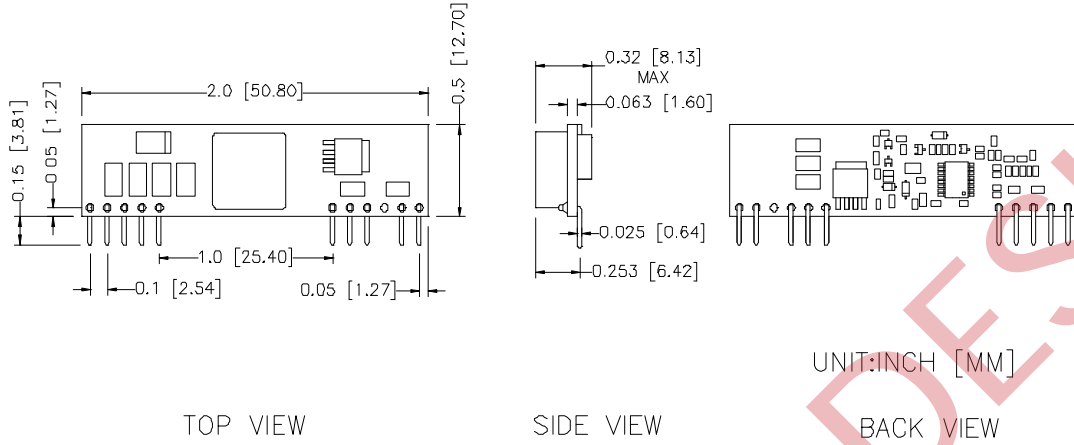
0.75 Vdc - 3.63 Vdc/16 A Output



Jan. 25, 2013

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

Mechanical Outline



Pin Connections

Pin	Function
1	Vo
2	Vo
3	Remote Sense
4	Vo
5	Ground
6	Ground
7	Vin
8	Vin
9	N/A
10	Trim
11	Remote On/Off

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).

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/16 A Output



Jan. 25, 2013

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

Revision History

Date	Revision	Changes Detail	Approval
2007-01-17	A	Change version to A	Lynn
2013-01-25	B	Update UL.	HL

RoHS Compliance

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



©2013 Bel Fuse Inc. Specifications subject to change without notice. 012513

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