

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/10 A Output

bel

Jan. 25, 2013

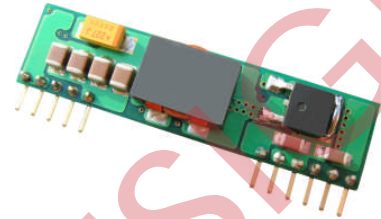
Bel Power, Inc. , a subsidiary of Bel Fuse, Inc.

VRBC-10E2Ax

RoHS Compliant

Rev.B

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Flexible Output Voltage Sequencing (Option)
- Remote Sense
- Certificated to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1
- Wide Input
- Wide Trim
- OCP/SCP
- Remote On/Off
- Active Low/High (Option)
- Over Temperature Protection
- Under-voltage Lockout (UVLO)
- Industrial Temperature Range



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel VRBC-10E2Ax is part of the non-isolate dc/dc power 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 Bel VRBC-10E2Ax has a sequencing feature that enables designers to implement various types of output voltage sequencing when powering. The efficiency is typically 94.3% at 3.3 V output at 5.0 Vdc input 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	10 A	36.3 W	94.3%	VRBC-10E2AL	VRBC-10E2A0

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

Part Number Explanation

$\frac{V}{1} \frac{R}{2} \frac{BC}{3} - \frac{10}{4} \frac{E}{5} \frac{2A}{6} \frac{x}{7}$

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/10 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	
Sequencing Voltage ¹	-0.3 V	-	V _{in}	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

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

1. VRBC-10E2Ax series of modules include a sequencing feature that enables users to implement various types of output voltage sequencing in their applications. This is accomplished via an additional sequencing pin. When not using the sequencing feature, either tie the SEQ pin to V_{in} or leave it unconnected.

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
V _{o,set} < 3.0 V	4.5 V	-	14 V	
V _{o,set} ≥ 3.0 V	V _{o,set} +1.5 V	-	14 V	
Input Current (full load)	-	-	8.6 A	An input line fuse must always be used.
Input Current (no load)	-	40 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 4 × 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	-	4.0 V	-	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2% V _{o,set}	-	2% V _{o,set}	V _{in} =5 V & 12 V, full load
Load Regulation	-	0.1% V _{o,set}	-	
Line Regulation	-	0.1% V _{o,set}	-	
Regulation Over Temperature (-40°C to +85°C)	-	0.3V _{o,set}	-	T _{ref} =T _{amin} to T _{amax}
Output Current	0 A	-	10 A	
Current Limit Threshold	-	200% I _{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, with 10 uF tantalum capacitor & 1 uF ceramic capacitor at the output
Ripple and Noise (rms)	-	12 mV	35 mV	

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/10 A Output



Jan. 25, 2013

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

Output Specifications(continued)

Parameter	Min	Typ	Max	Notes
Turn on Time	-	8 mS	20 mS	
Overshoot at Turn on	-	0%	1%	
Output Capacitance	0 uF	-	5600 uF	
Transient Response				
50% ~ 100% Max Load	Vo = 0.75 V - 3.63 V	-	160 mV	di/dt=2.5 A/uS; Vin=5 V & 12 V; and with 470 uF Tantalum capacitor at the output
Settling Time		-	50 uS	
100% ~ 50% Max Load		-	160 mV	
Settling Time		-	50 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency	Vo=3.3 V	-	94.3%	Measured at Vin=5 V, full load
	Vo=2.5 V	-	93%	
	Vo=1.8 V	-	91.5%	
	Vo=1.5 V	-	90.8%	
	Vo=1.2 V	-	89.3%	
	Vo=0.75 V	-	83%	
Efficiency	Vo=3.3 V	-	93%	Measured at Vin=12 V, full load
	Vo=2.5 V	-	92%	
	Vo=1.8 V	-	90%	
	Vo=1.5 V	-	89%	
	Vo=1.2 V	-	87.5%	
	Vo=0.75 V	-	81%	
Switching Frequency	265 kHz	300 kHz	335 kHz	
Over Temperature Shutdown	-	130°C	-	
Output Voltage Trim Range	0.7525 V	-	3.63 V	
Remote Sense Compensation	-	-	0.5 V	
MTBF	5,114,191 hours			Calculated Per Bell Core TR-332 (Io = 80%Iomax; Vo=3.3 V; Vin=12 V; Ta = 25 °C)
Dimensions	Inches (L x W x H)	2.0 x 0.5 x 0.32		
	Millimeters (L x W x H)	50.8 x 12.7 x 8.13		
Weight	-	7.1 g	-	

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

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 3.63 Vdc/10 A Output



Jan. 25, 2013

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

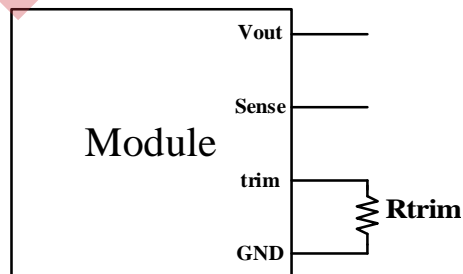
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2 V	-	0.3 V	VRBC-10E2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2 V	-	0.3 V	VRBC-10E2AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	Vin, max	
Voltage Sequencing				
Sequencing Delay Time	25 mS	-	-	Delay from Vinmin to application of voltage on SEQ pin
Sequencing Slew Rate Capability	-	-	2 V/mS	Vinmin to Vinmax; Iomin to Iomax; Vseq<Vo
Tracking Accuracy				
Power-Up	-	100 mV	200 mV	
Power-Down	-	300 mV	500 mV	

Output Trim Equations

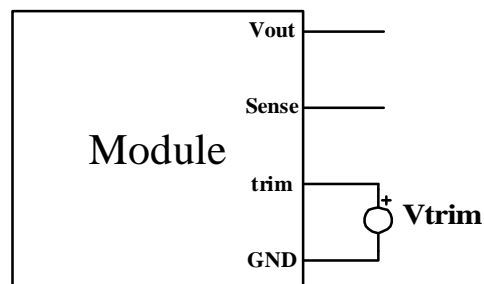
Equation for calculating the trim resistor (in Ω) given the desired output voltage (V_o) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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



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

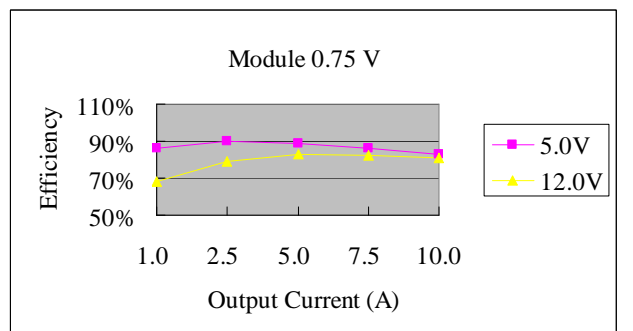
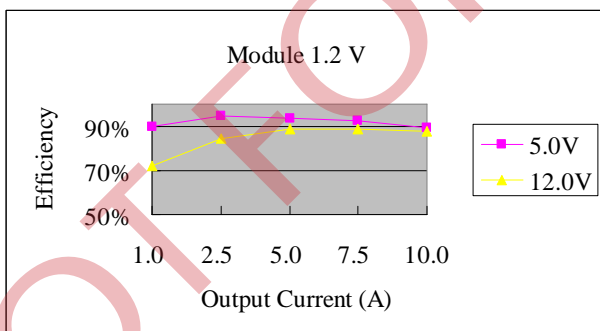
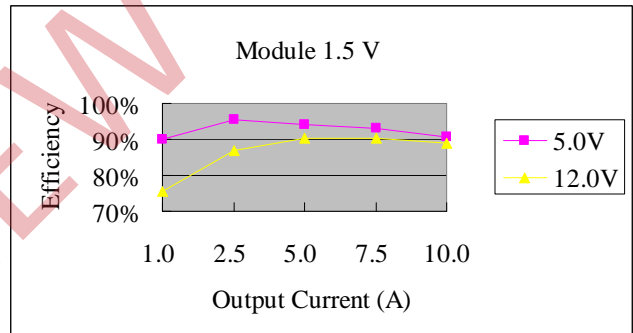
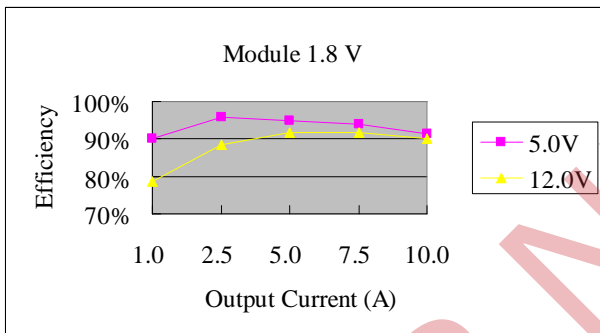
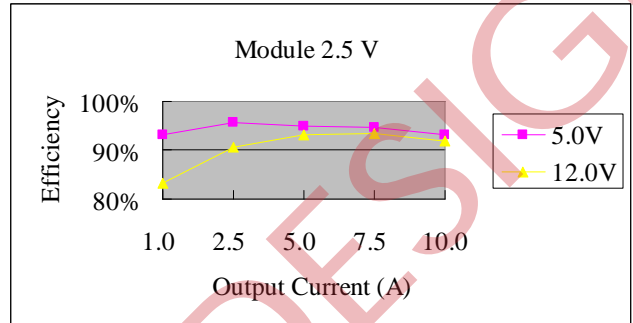
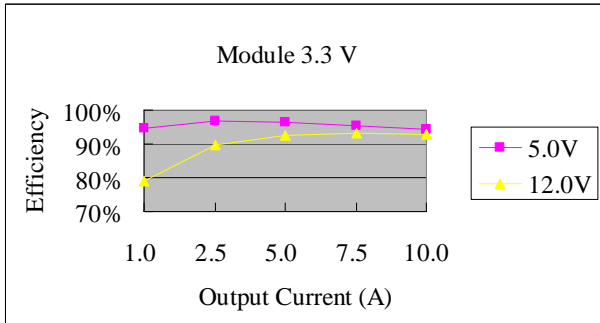
0.75 Vdc - 3.63 Vdc/10 A Output



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

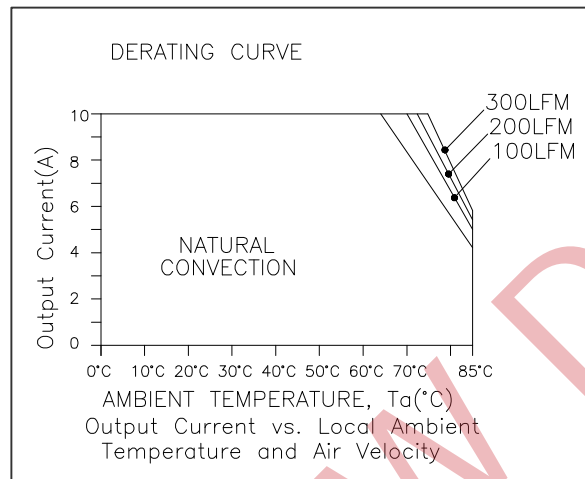
0.75 Vdc - 3.63 Vdc/10 A Output



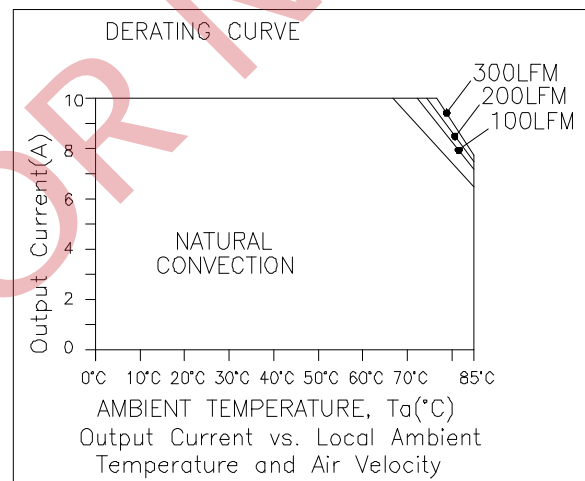
Jan. 25, 2013

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

Thermal Derating Curves



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



$V_{in}=5\text{ V}$, $V_o = 3.3\text{ V}$

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

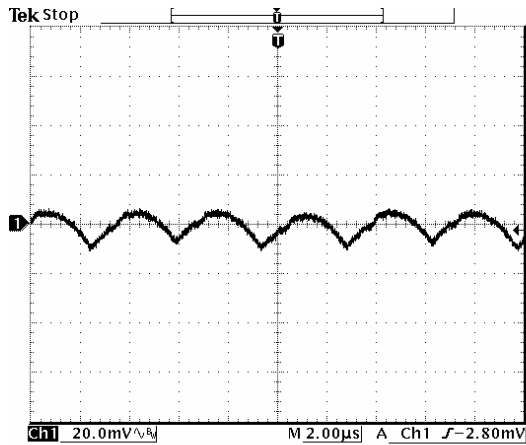
0.75 Vdc - 3.63 Vdc/10 A Output



Jan. 25, 2013

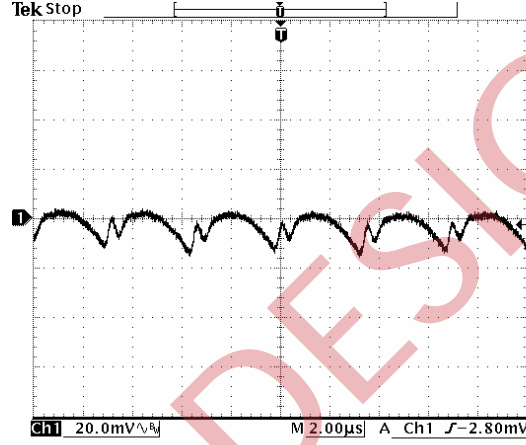
Bel Power, Inc., a subsidiary of Bel Fuse, Inc.

Ripple and Noise Waveforms



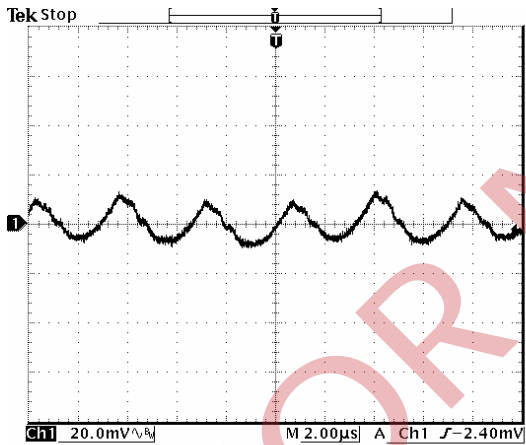
Vin=5 V, Vo=0.75 V

17 Aug 2004 14:19:31



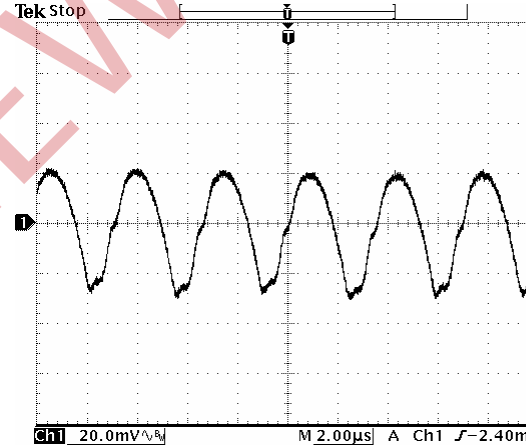
Vin=12 V, Vo=0.75 V

17 Aug 2004 14:20:10



Vin=5 V, Vo=3.3 V

18 Aug 2004 11:13:40



Vin=12 V, Vo=3.3 V

18 Aug 2004 11:14:16

Note: Ripple and noise at full load, external load with 10 uF tantalum capacitor and 1 uF ceramic at the output, and Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

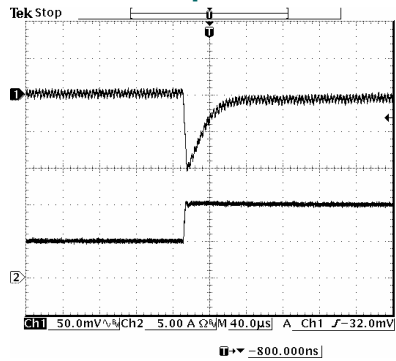
0.75 Vdc - 3.63 Vdc/10 A Output



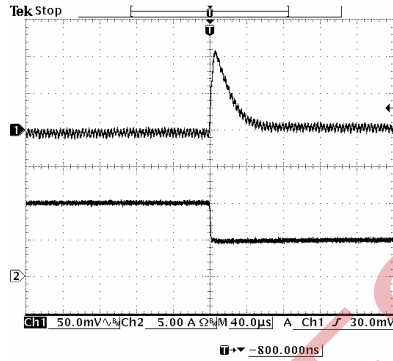
Jan. 25, 2013

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

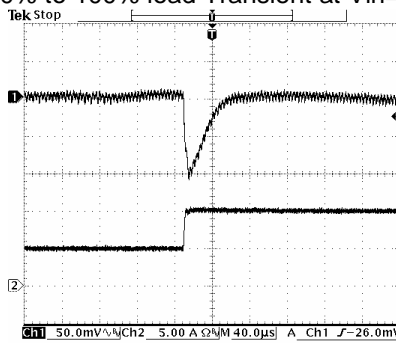
Transient Response Waveforms



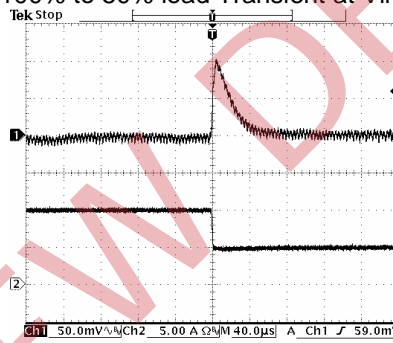
50% to 100% load Transient at Vin=5 V, Vo=0.75 V



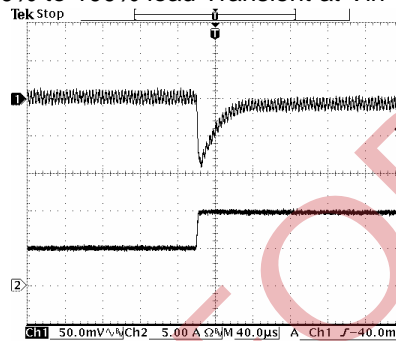
100% to 50% load Transient at Vin=5 V, Vo=0.75 V



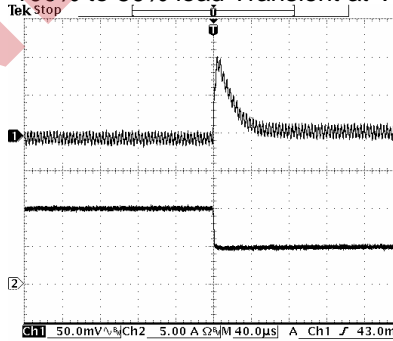
50% to 100% load Transient at Vin=12 V, Vo=0.75 V



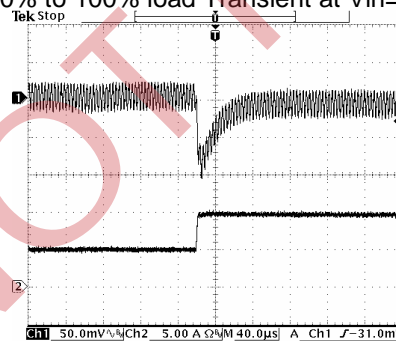
100% to 50% load Transient at Vin=12 V, Vo=0.75 V



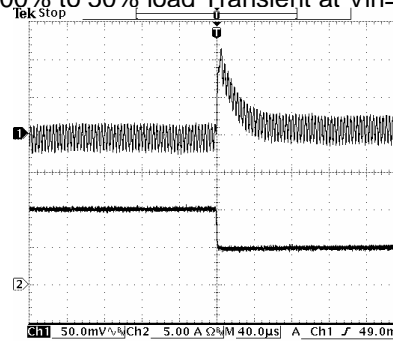
50% to 100% load Transient at Vin=5 V, Vo=3.3 V



100% to 50% load Transient at Vin=12 V, Vo=3.3 V



50% to 100% load Transient at Vin=12 V, Vo=3.3 V



100% to 50% load Transient at Vin=5 V, Vo=3.3 V

Note: Transient response at di/dt=2.5 A/uS, external load with 470 uF tantalum capacitor at the output.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

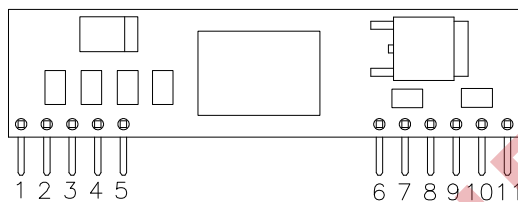
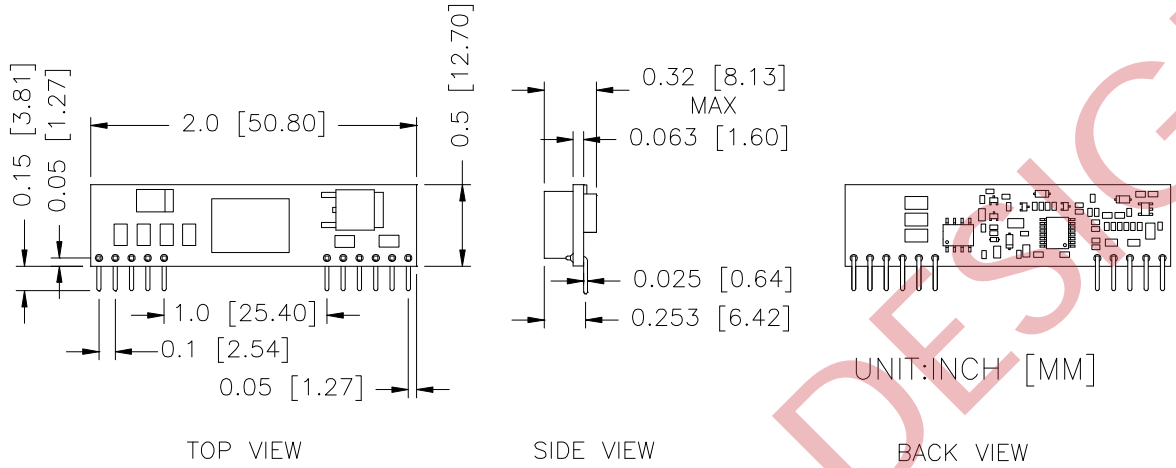
0.75 Vdc - 3.63 Vdc/10 A Output



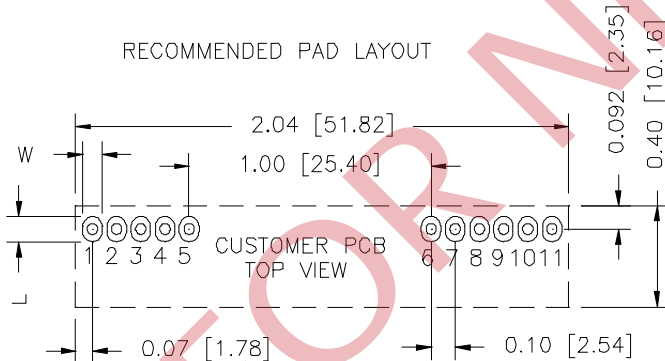
Jan. 25, 2013

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

Mechanical Outline



RECOMMENDED PAD LAYOUT



HOLE SIZE: $\varnothing 0.043 \pm 0.003$ [1.08 \pm 0.08]
 PAD SIZE: W 0.063 ± 0.002 [1.63 \pm 0.05]
 L 0.10 ± 0.004 [2.54 \pm 0.10] BOTH SIDE

Pin Connections

Pin	Function
1	Vout
2	Vout
3	Remote Sense
4	Vout
5	Ground
6	Ground
7	Vin
8	Vin
9	SEQ
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/10 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