ISOLATED DC/DC CONVERTERS

48 Vdc Input 28 Vdc/12.5 A Output

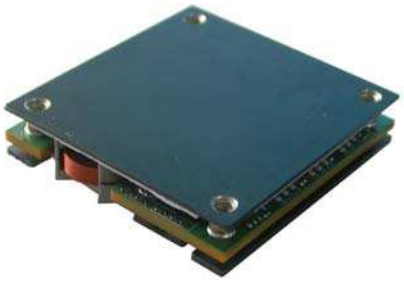
Aug. 10, 2010

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

0RH1-T5T28x RoHS Compliant PRELIMINARY Rev.A

Features

- Isolated
- High Efficiency
- Fixed Frequency (250 KHz)
- High Power Density
- Low Cost
- Remote On/Off
- Positive/Negative Remote Sense
- Input Under/Over Voltage Lockout
- Output Voltage Trim
- Output Over-Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Output Pre-bias Start Up
- Basic Insulation
- Class 1, Category 2, Isolated DC/DC Converter (refer to IPC-9592)
- UL60950-1 Recognized (UL/cUL) (Pending)



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The 0RH1-T5T28x is isolated dc/dc converter that operates from a nominal 48 Vdc source. The unit will provide up to 350 W of output power from a nominal 48 Vdc input. This unit is designed to be highly efficient and low cost. Features include remote on/off, over current protection, input under voltage and over voltage lockout. This converter is provided in an industry standard half- brick package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High	Model Number Active Low
28 Vdc	36 Vdc - 75 Vdc	12.5 A	350 W	93%	0RH1-T5T280	0RH1-T5T28L

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

Part Number Explanation

0	R	H1	–	T5	T	28	x
1	2	3		4	5	6	7

1---Through hole mount
2---RoHS 6, change “R” to “7” means RoHS 5
3---Series name
4---Series code
5--- Input range (36-75V)
6---Output voltage (28V)
7---Suffix

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Continuous non-operating Input Voltage	-0.3	-	80	V	
Input Voltage (continuous)	-	-	100	V	100mS maximum
Remote On/Off	-0.3	-	18	V	
I/O Isolation Voltage	-	-	1500	V	
Ambient Temperature	-40	-	85	°C	
Storage Temperature	-55	-	125	°C	

Note: Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

Input Specifications

Parameter	Min	Typ	Max	Unit	Notes
Operating Input Voltage	36	48	75	V	
Input Current (full load)	-	-	12	A	
Input Current (no load)	-	80	120	mA	
Remote Off Input Current	-	10	20	mA	
Input Reflected Ripple Current (rms)	-	10	-	mA	Tested with simulated source impedance of 12 uH, 5 Hz to 20 MHz; Use 100 uF/100 V electrolytic capacitor with ESR=1 ohm max, at 200 KHz@25℃.
Input Reflected Ripple Current (pk-pk)	-	50	-	mA	
I^2t Inrush Current Transient	-	-	0.5	A^2s	
Turn-on Voltage Threshold	33	34.5	36	V	
Turn-off Voltage Threshold	32	33	35	V	
Other Information:					
Recommended Input Fast-acting Fuse On System Board	-	16	-	A	

CAUTION: This converter is not internally fused. An input line fuse must be used in application.

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

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output Voltage Set Point	27.58	28.00	28.42	V	Vin=48V, Io=100% load at 25C ambient.
Load Regulation	-	-	±100	mV	
Line Regulation	-	-	±100	mV	
Regulation Over Temperature (-40deg.C-85deg.C)	-	-	±300	mV	
Total Output Voltage Range	27.25	28.00	28.75	V	Over all load, line and temperature conditions
Ripple and Noise (pk-pk)	-	120	280	mV	0-20MHz BW, with a 1µF ceramic capacitor and a 10uF Tantalum cap at output.
Ripple and Noise (rms)	-	-	100	mV	
Output Current	0	-	12.5	A	

Output Specifications (continued)

Parameter			Min	Typ	Max	Unit	Notes
Output Voltage Trim Range			22.4	-	30.8	V	
Output DC Current Limit			13.5	17	20	A	
Short Circuit Surge Transient			-	-	5	A^2s	
Rise Time			30	-	80	mS	
Turn on Time			-	50	80	mS	Ton(Enable form Vin)
			-	50	80	mS	Ton(Enable form ON/OFF)
Overshoot at Turn on			-	0	3	%	
Output Capacitance			0	-	3300	uF	
Transient Response							
△V 50%~75% of Max Load	Overshoot	Vo= 28V	-	300	600	mV	di/dt=0.1 A/us, Vin=48 Vdc, Ta=25℃, with a 2.2μF ceramic capacitor and 440 uF low ESR aluminum capacitor output.
	Settling Time		-	400	1000	uS	
△V 75%~50% of Max Load	Overshoot		-	300	600	mV	
	Settling Time		-	400	1000	uS	

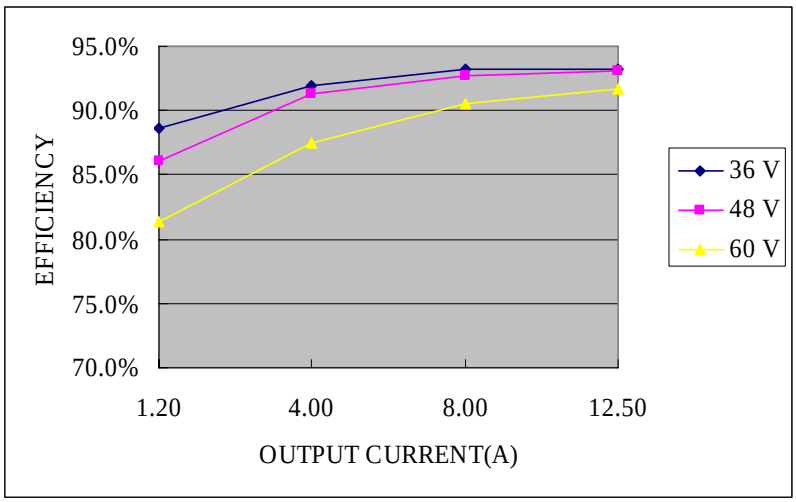
Note: All specifications are typical at nominal input, full load at 25℃ unless otherwise stated.

General Specifications

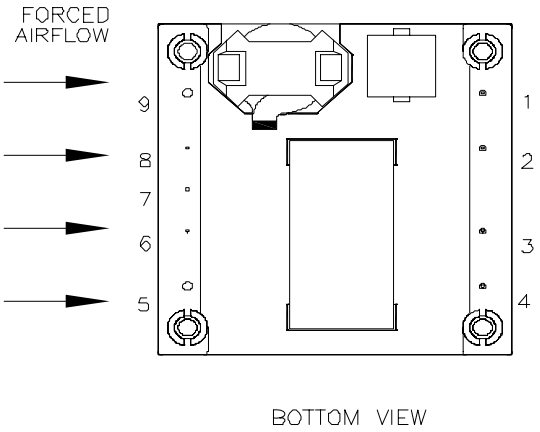
Parameter	Min	Typ	Max	Unit	Notes
Efficiency	91.5	93	-	%	Vin=48V, full load at 25C ambient
Switching Frequency	-	250	-	kHz	
Over Temperature Protection	-	105	-	℃	
Remote Sense Compensation	0	-	2	V	
Over Voltage Protection (Static)	32	-	35	V	This voltage is achieved by trimming up output slowly
Weight	-	105	-	g	
FIT	TBD			-	Calculated Per Bell Core SR-332 (Vin=48 V, Vo=28 V, Io=12.5 A, Ta = 25 °C, FIT=10^9/MTBF)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	2.40 x 2.28 x 0.50 60.96 x 57.91 x 12.70			-	
Isolation characteristics					
Input to Output	-	-	1500	V	
Input to Case	-	-	1500	V	
Output to Case	-	-	500	V	
Isolation Resistance	10M	-		ohm	
Isolation Capacitance	-	3300	-	pF	

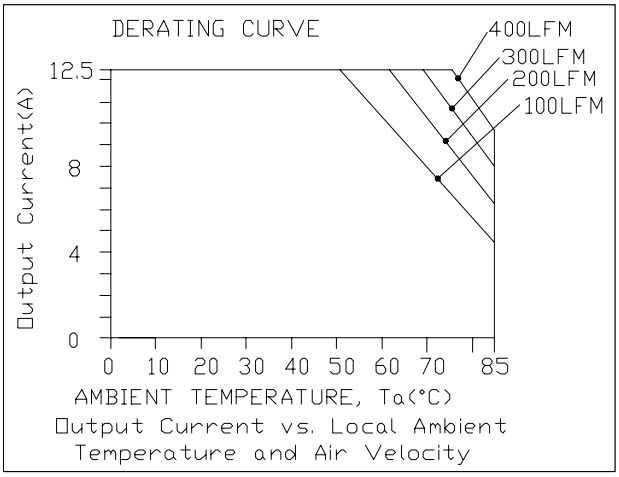
Note: All specifications are typical at 25 °C unless otherwise stated.

Efficiency Data



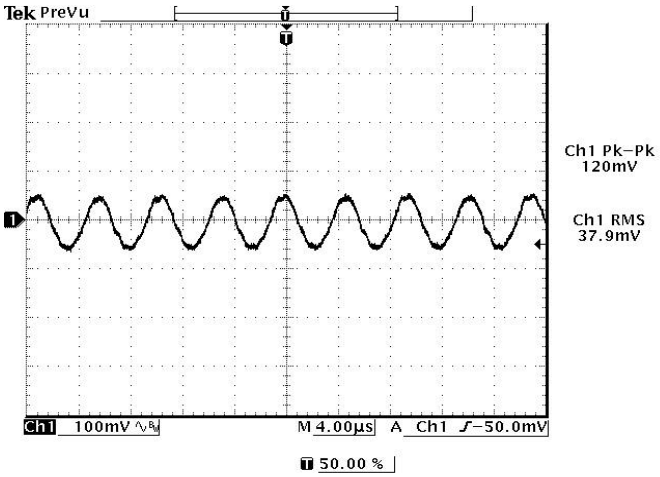
Thermal Derating Curve





Vin=48V, with maximum junction temperature of semiconductors derated to 120C

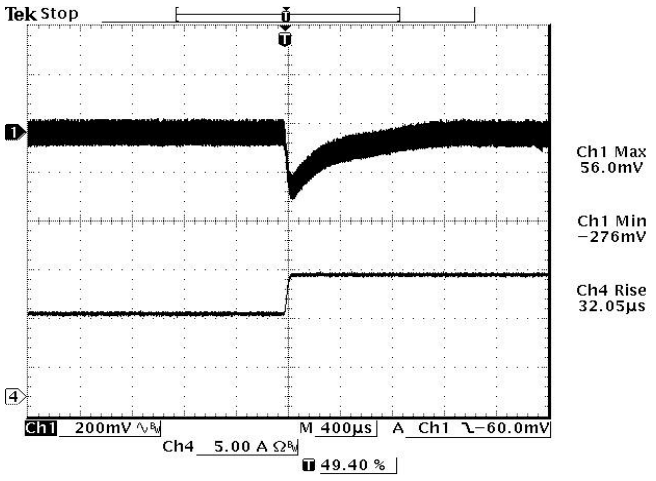
Ripple and Noise Waveform



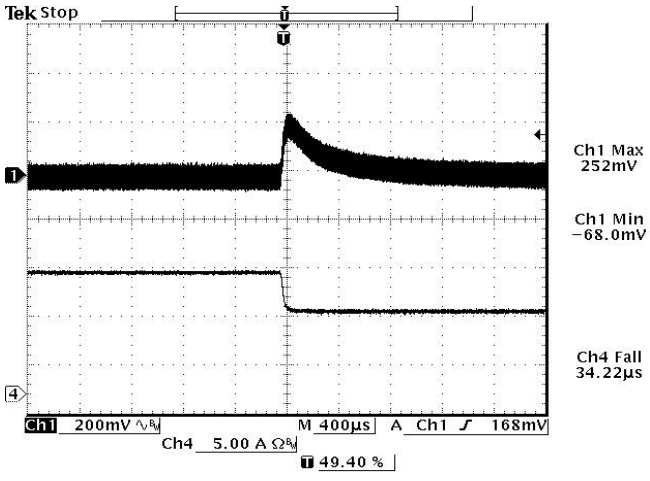
48Vdc input, 28Vdc/12.5A output

Note: Ripple and noise at full load, with a 2.2uF ceramic cap and a 440uF low ESR aluminum capacitor at output, and Ta=25 deg C

Transient Response Waveforms



Vout=28V, 50% to 75% Load Transients



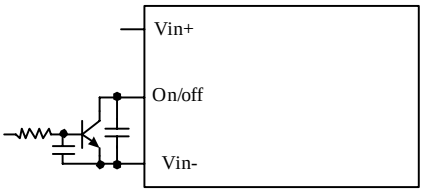
Vout=28V, 75% to 50% Load Transients

Note: Transient response at di/dt=0.1A/us, Vin=48Vdc, Ta=25℃, with a 2.2µF ceramic capacitor and 440µF low ESR aluminum capacitor at output.

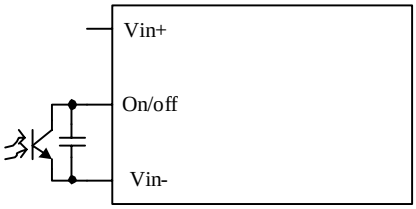
Remote On/Off

Parameter		Min	Typ	Max	Unit	Notes
Signal Low (Unit On)	Active Low	-0.3	-	0.8	V	The remote on/off pin open, Unit off.
Signal High (Unit Off)		2.4	-	18	V	
Signal Low (Unit Off)	Active High	-0.3	-	0.8	V	The remote on/off pin open, Unit on.
Signal High (Unit On)		2.4	-	18	V	
Current Sink		0	-	2	mA	

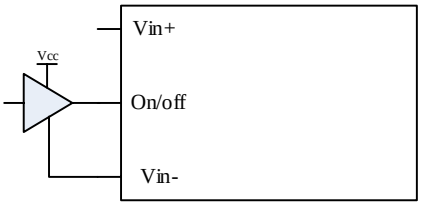
Recommended remote on/off circuit for active low



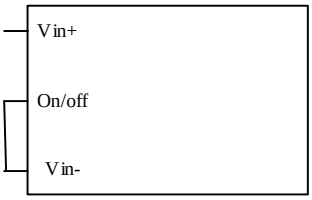
Control with open collector/drain circuit



Control with photocoupler circuit

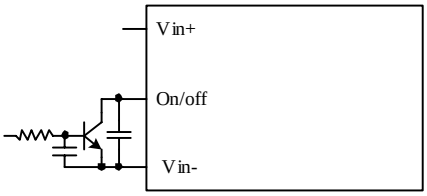


Control with logic circuit

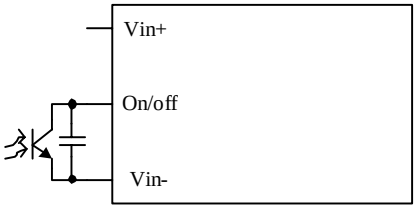


Permanently on

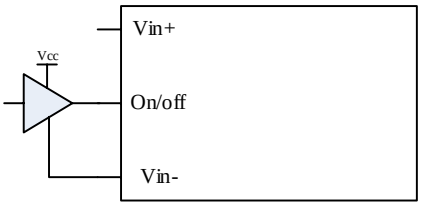
Recommended remote on/off circuit for active high



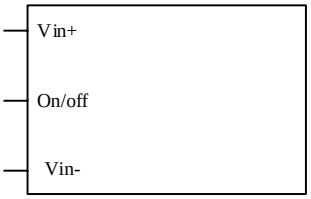
Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit



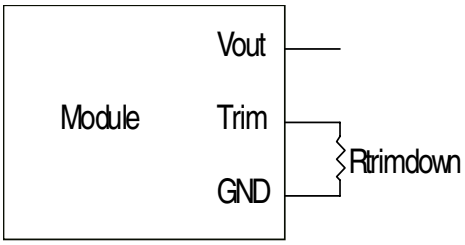
Permanently on

Output Trim Equations

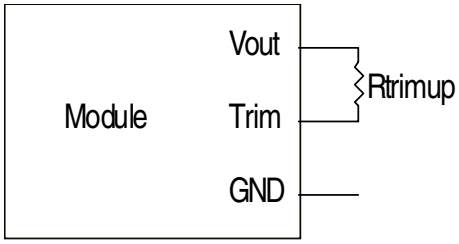
Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected between the Trim pin and Sense (-) pin. The Trim Up resistor should be connected between the Trim pin and the Sense (+). Only one of the resistors should be used for any given application.

Minimum trim down voltage is 22.4V
Maximum trim up voltage is 30.8V.
The total voltage increased by trim and remote sense should not exceed 10% of the nominal output voltage.

$$Rtrimdown = \frac{100}{|delta|} - 2[k\Omega]$$



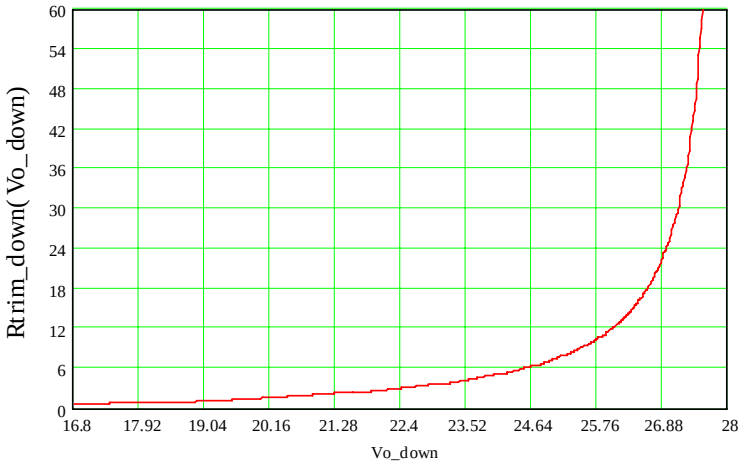
$$Rtrimup = \frac{(100 + delta)\cdot Vo - 122.5}{1.225\cdot delta} - 2[k\Omega]$$

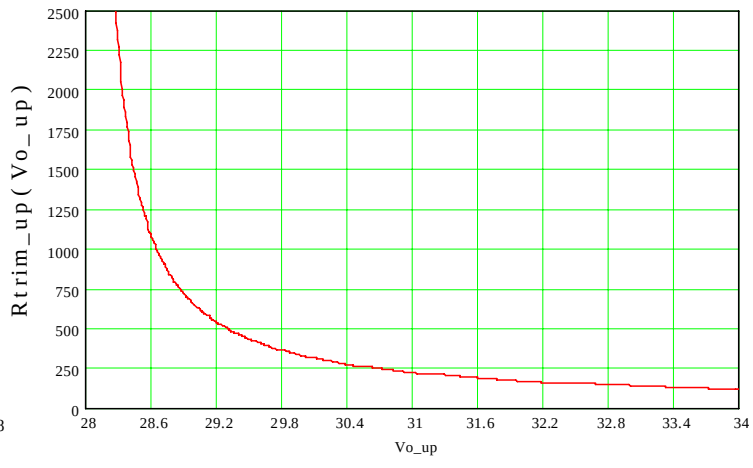


Note:

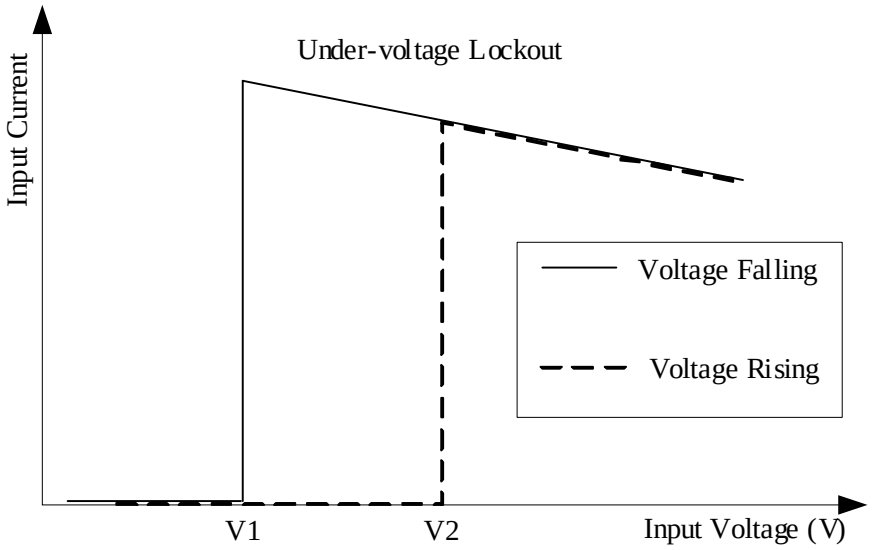
$$delta = \frac{(Vo\_req - Vo)}{Vo} \times 100[\%]$$

Vo_req=Desired (trimmed) output voltage [V]
Output voltage Vo=28 V



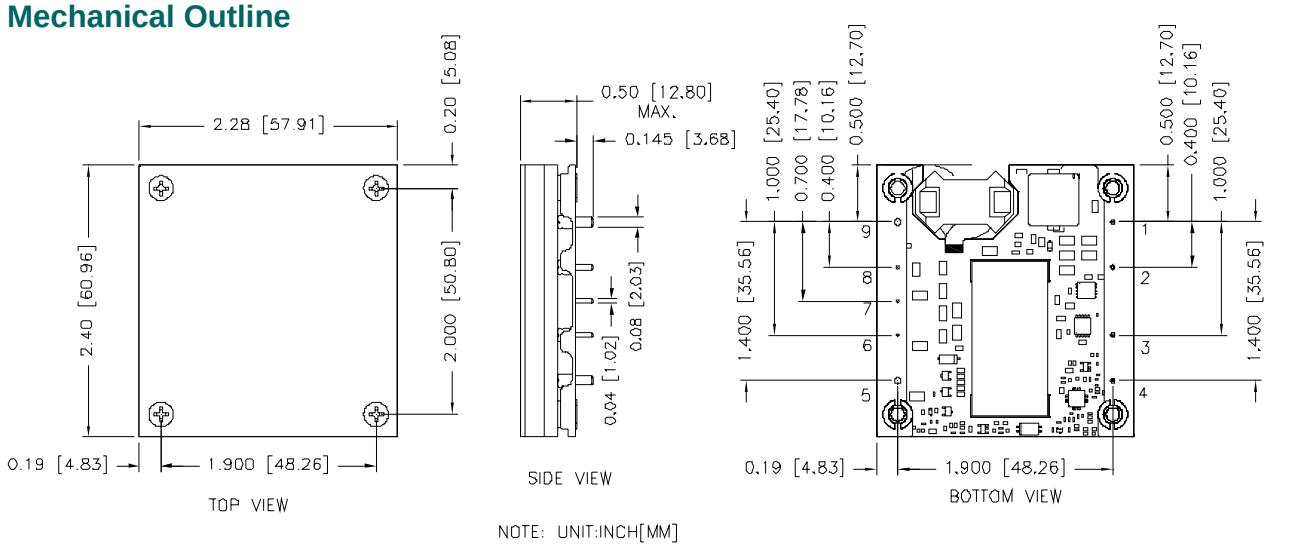


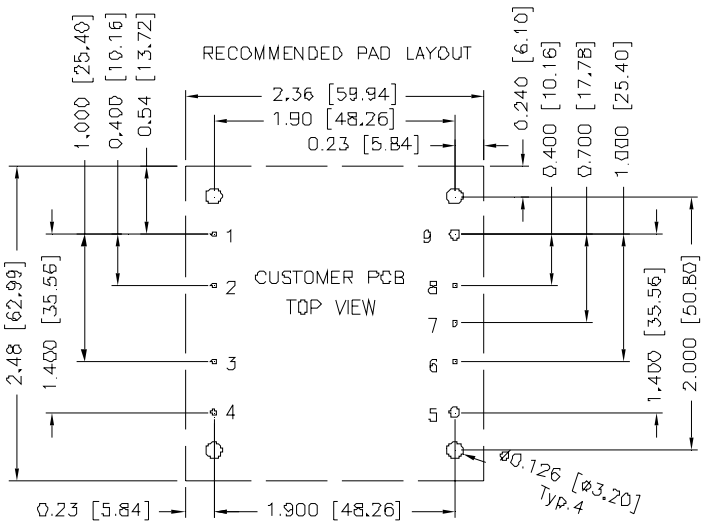
Input Under-voltage Lockout



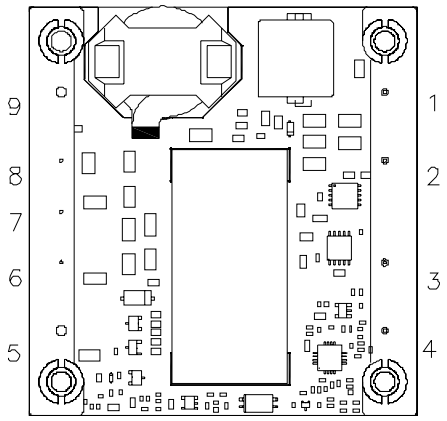
V1=33V
V2=34.5

Mechanical Outline





1,2,3,4,6,7,8 ø0.047 PAD HOLE SIZE,
ø0.08 min PAD SIZE, BOTH SIDE.
5,9 ø0.093 HOLE SIZE,
ø0.12 min PAD SIZE, BOTH SIDE.



BOTTOM VIEW

Pin	Function	Dia.	Pin	Function	Dia.
1	Vin(+)	0.04"	6	Sense(-)	0.04"
2	CNT	0.04"	7	Trim	0.04"
3	Case	0.04"	8	Sense(+)	0.04"
4	Vin(-)	0.04"	9	Vout(+)	0.08"
5	Vout(-)	0.08"			

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 ºC 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).

Revision History

Date	Revision	Changes Detail	Approval
2010-08-10	PA	First release	JZ Wang

RoHS Compliance

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

©2010 Bel Fuse Inc. Specifications subject to change without notice. 081010

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