

ISOLATED DC/DC CONVERTERS

18 Vdc - 75 Vdc Input 3.3 Vdc /10 A Output, 1/16 Brick



Jun. 17, 2010

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

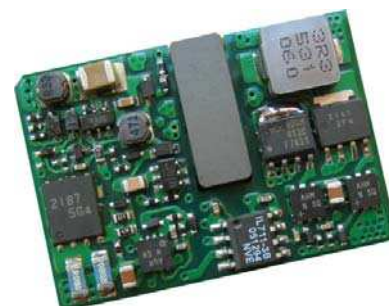
0RSB-40U03B

RoHS Compliant

Rev.A

Features

- Isolated
- High Efficiency
- High Power Density
- Fixed Frequency (500 kHz)
- Low Cost
- Input Under-Voltage Lockout
- Basic Insulation
- Class 1, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592)
- UL60950-1 Recognized (UL/cUL) (Pending)
- Output Over-Voltage Shutdown
- Output Voltage Trim
- OCP/SCP
- Over Temperature Protection
- Remote On/Off
- Positive/Negative Remote Sense
- Comply with ANSI T1.315



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The 0RSB-40U03B is an isolated dc/dc converter that operates from a nominal 24 Vdc or 48 Vdc source. This unit will provide up to 33 W of output power from an 18-75 Vdc wide input range. This unit is designed to be highly efficient and low cost. Features include remote on/off, over current protection and under voltage lockout. This converter is provided in an industry standard sixteenth brick through hole package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low
3.3 Vdc	18 Vdc-75 Vdc	10 A	33 W	87.5%	0RSB-40U03B

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

Part Number Explanation

0 R SB - 40 U 03 B
1 2 3 4 5 6 7

1---Through hole

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

3---Series name, 1/16 Brick

4---Series code

5---Input range 48V wide (18-75V)

6---Output voltage 3.3V

7---Option

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Continuous Input Voltage	-0.3	-	80	V	
Input Transient Voltage	-	-	100	V	100 mS 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	18	48	75	V	
Input Current (full load)	-	-	3.0	A	
Input Current (no load)	-	60	120	mA	
Remote Off Input Current	-	1	3	mA	
Input Reflected Ripple Current (rms)	-	3	7	mA	Tested with simulated source impedance of 10 μ H, 5 Hz to 20 MHz; use a 100 μ F/100 V electrolytic capacitor with ESR = 1 ohm max. at 200 kHz at 25 °C.
Input Reflected Ripple Current (pk-pk)	-	20	50	mA	
I ² t Inrush Current Transient	-	-	0.02	A ² s	
Turn-on Voltage Threshold	16.0	17.2	18.0	V	
Turn-off Voltage Threshold	15.6	16.8	17.6	V	

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

Recommend a fast-acting fuse with maximum rating of 3A on system board. Refer to the fuse manufacture's datasheet for further information.

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

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output Voltage Set Point	3.25	3.3	3.35	V	Vin=48V, Io=50% load
Load Regulation	-	± 4	± 9	mV	
Line Regulation	-	± 3	± 8	mV	
Regulation Over Temperature (-40deg.C-85deg.C)	-	± 9	± 16	mV	
Ripple and Noise (pk-pk)	-	55	90	mV	0-20 MHz BW, with a 1 μ F ceramic capacitor and a 330 μ F Tantalum cap at output.
Ripple and Noise (rms)	-	12	25	mV	
Ripple and Noise (pk-pk) under worst case	-	-	120	mV	over all operating input voltage, load and temperature conditions.

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Output Specifications (continued)

Parameter	Min	Typ	Max	Unit	Notes
Output Current Range	0	-	10	A	
Output DC Current Limit	11	14	16	A	
Short Circuit Surge Transient	-	-	1	A ² s	
Rise Time	-	10	15	mS	
Turn on Time	-	25	50	mS	Enable form Vin
	-	25	50	mS	Enable form ON/OFF
Overshoot at Turn on	-	0	5	%	
Output Capacitance	330	-	4700	uF	
Transient Response					
△V50%~75% of Max Load	Overshoot	-	180	250	mV
	Settling Time	-	80	150	uS
△V75%~50% of Max Load	Overshoot	-	180	250	mV
	Settling Time	-	80	150	uS

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

General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency	85	87.5	-	%	Vin=48V, full load
Switching Frequency	-	500	-	kHz	
Output Voltage Trim Range	2.97	-	3.63	V	
Over Temperature Protection	-	125	130	°C	
Over Voltage Protection(Static)	-	4	4.9	V	
Weight	-	14	-	g	
FIT	TBD			-	Calculated Per Bell Core SR-332 (Vin=48 V, Vo=3.3 V, Io=8 A, Ta = 25 °C, FIT=10 ⁹ /MTBF)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	1.30 x 0.90 x 0.46 33.02 x 22.86 x 11.69			-	
Isolation characteristics					
Input to Output	-	-	1500	V	
Isolation Resistance	10M	-		ohm	
Isolation Capacitance	-	3900	-	pF	

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

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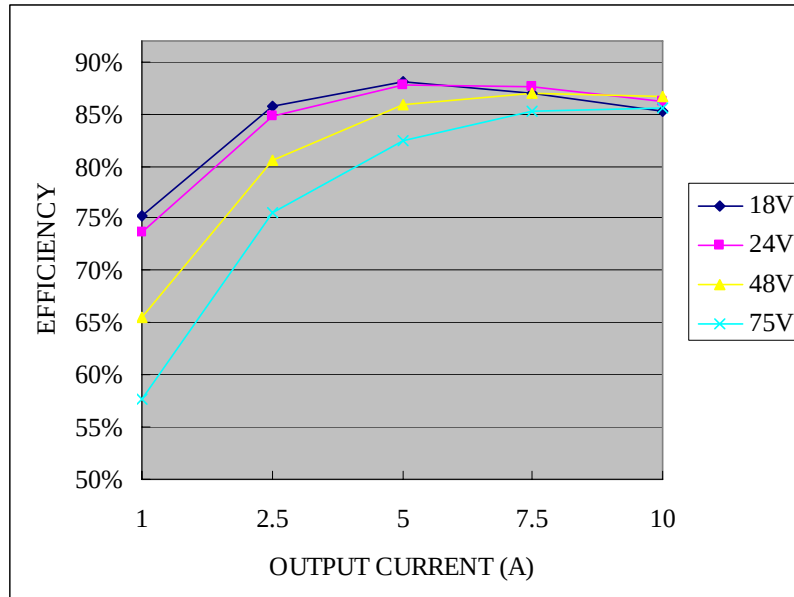
18 Vdc - 75 Vdc Input 3.3 Vdc /10 A Output, 1/16 Brick



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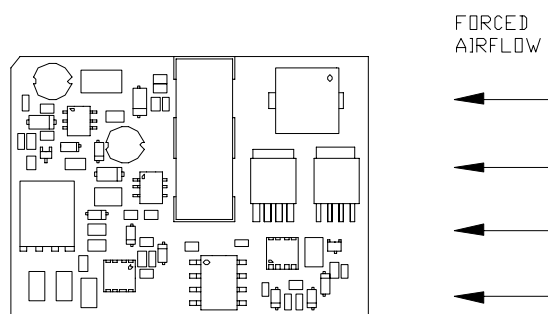
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Efficiency Data



Thermal Derating Curves

Maximum junction temperature of semiconductors derated to 120 degree C.



Top View

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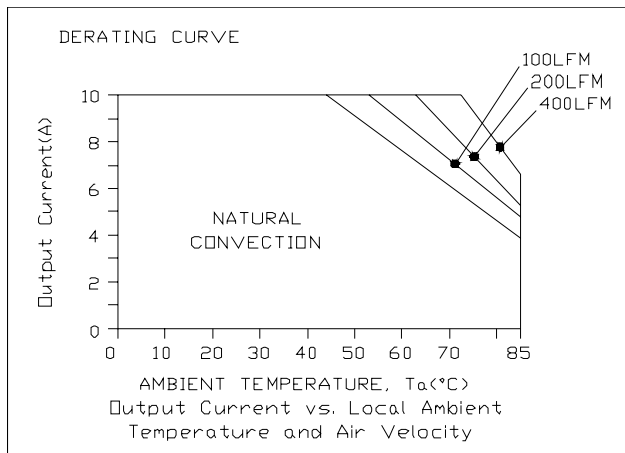


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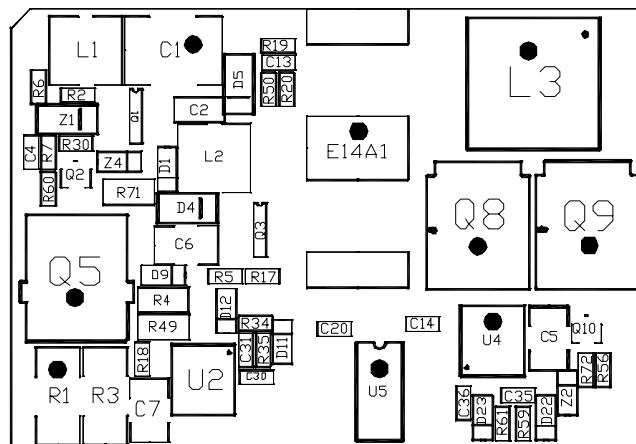
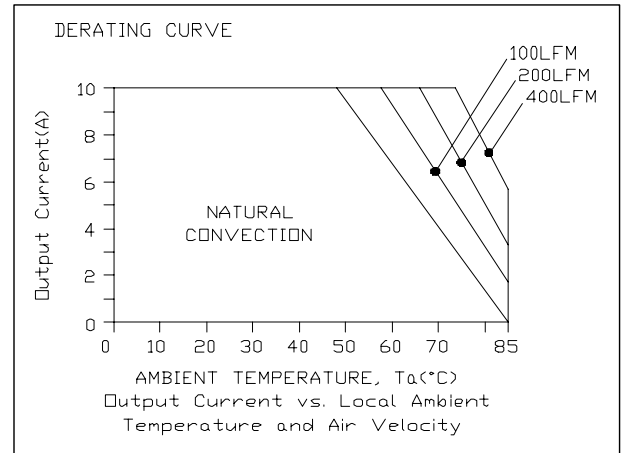
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Thermal Derating Curves (continued)

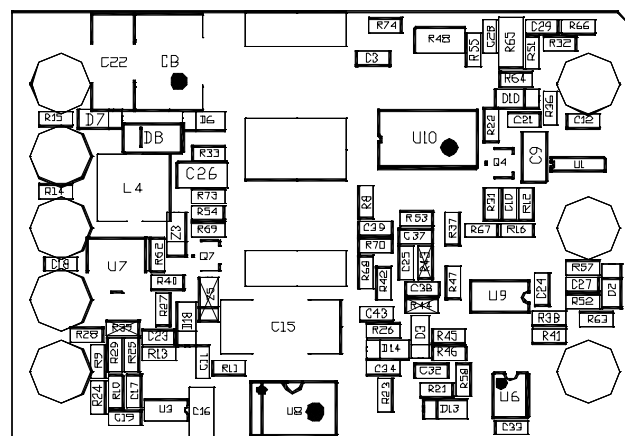
Derating curve under 24Vdc input



Derating curve under 48Vdc input



Temperature reference points on top side



Temperature reference points on bottom side

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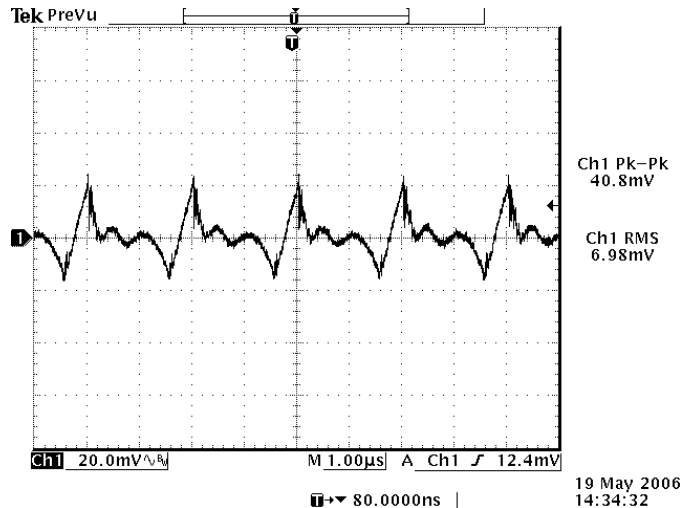
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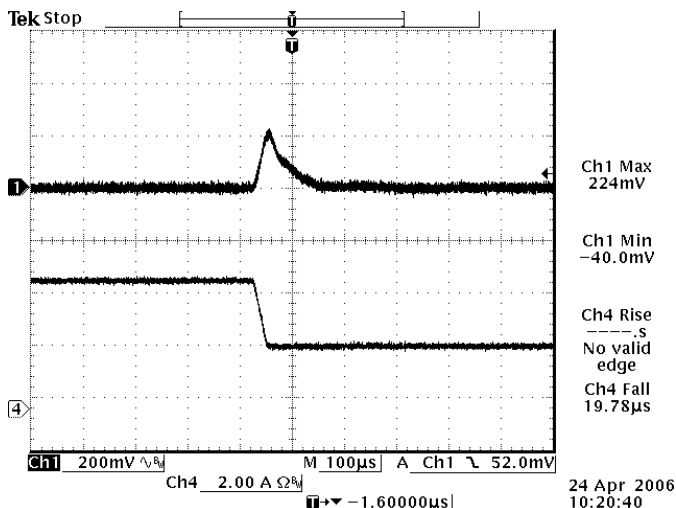
Ripple and Noise Waveform



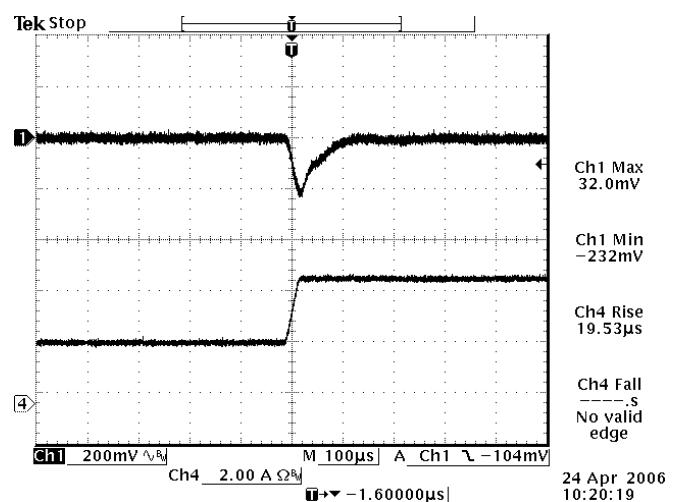
48 Vdc input, 3.3Vdc/10A output

Note: Ripple and Noise at full load, $T_a=25^\circ\text{C}$, with a $1\mu\text{F}$ ceramic capacitor and a $330\mu\text{F}$ Tantalum cap at the output.

Transient Response Waveforms



75%-50% Load Transients



50%-75% Load Transients

Note: Transient Response at $di/dt=0.1\text{A}/\mu\text{s}$, $T_a=25^\circ\text{C}$, with $1\mu\text{F}$ ceramic cap and $330\mu\text{F}$ tantalum cap at output.

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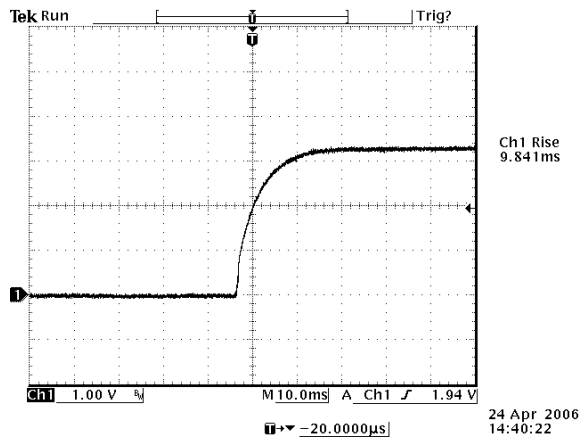


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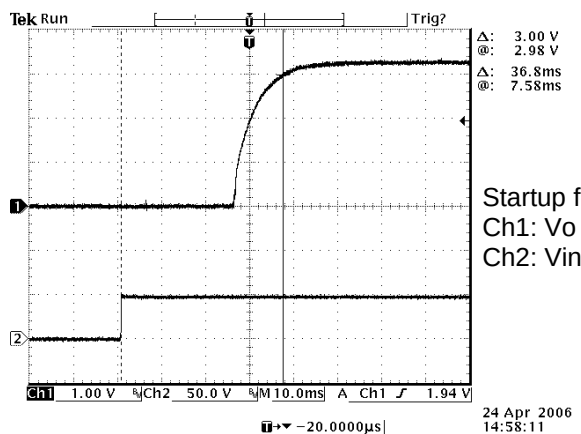
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Startup & Shutdown

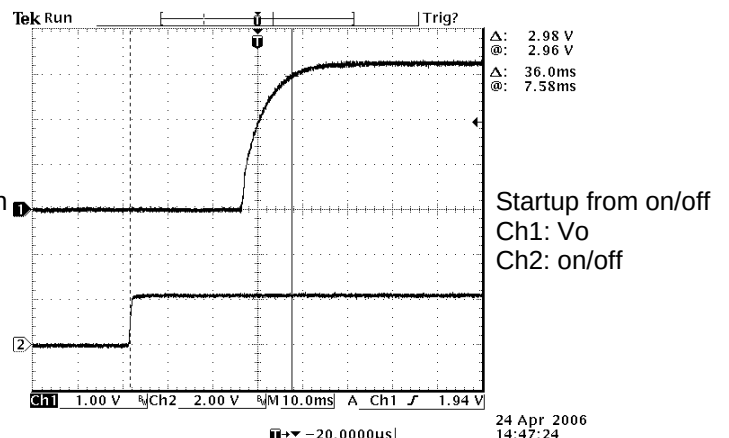
Rise Time



Test Condition:
48Vdc input, 3.3Vdc/10A
output, and Ta=25 deg C

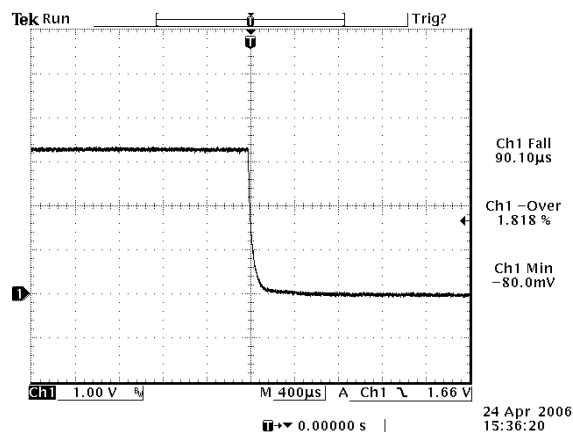


Test Condition: 48Vdc input, 3.3Vdc/10A output and Ta=25 deg C



Test Condition: 48Vdc input, 3.3Vdc/10A output and Ta=25 deg C

Shutdown



Test Condition:
48Vdc input, 3.3Vdc/10A
output, and Ta=25 deg C

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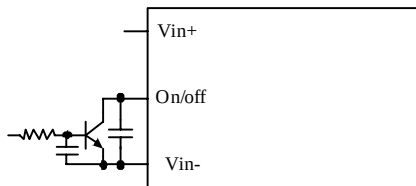
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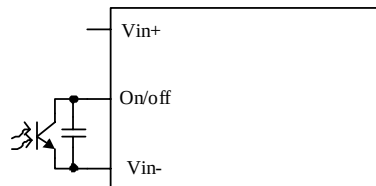
Remote On/Off

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	
Current Sink		0	-	1	mA	

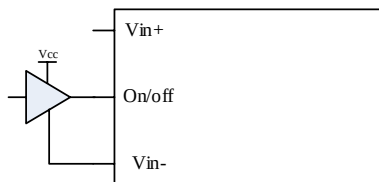
Recommended remote on/off circuit for active low



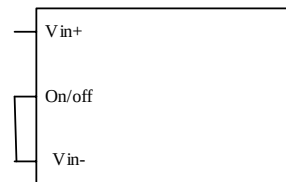
Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit



Permanently on

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Output Trim Equations

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

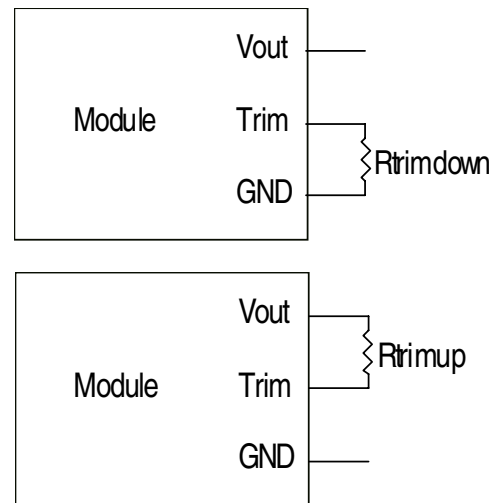
Minimum trim down voltage is 2.97V

Maximum trim up voltage is 3.63V.

The total voltage increased by trim and remote sense should not exceed 10% of the nominal output voltage.

$$R_{trimdown} = \frac{511}{|\delta|} - 10.22 [k\Omega]$$

$$R_{trimup} = \frac{(100 + \delta) \cdot V_o \cdot 5.11 - 626}{1.225 \cdot \delta} - 10.22 [k\Omega]$$

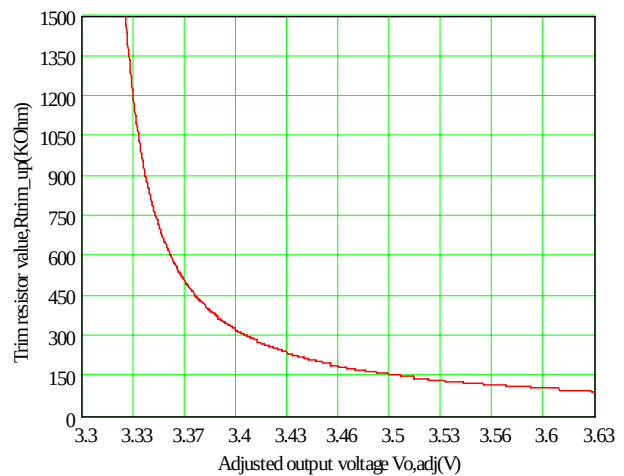
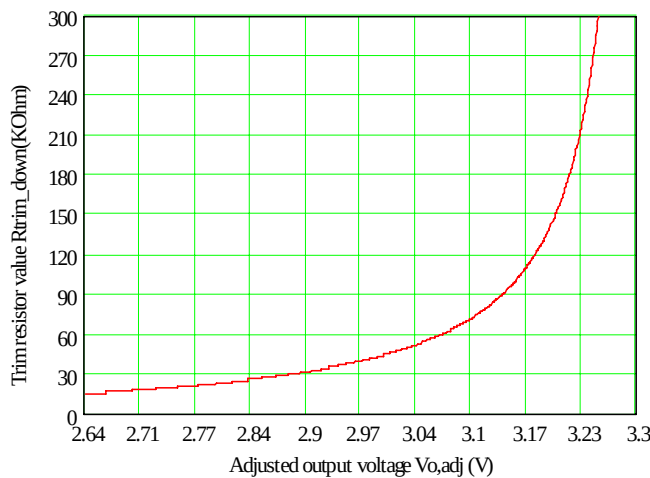


Note:

$$\delta = \frac{(V_{o_req} - V_o)}{V_o} \times 100 [\%]$$

V_{o_req} = Desired (trimmed) output voltage [V]

Output voltage V_o = 3.308 V



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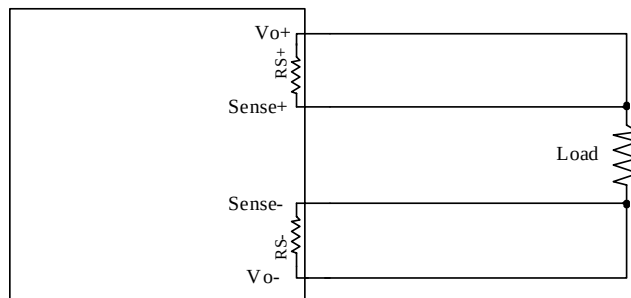
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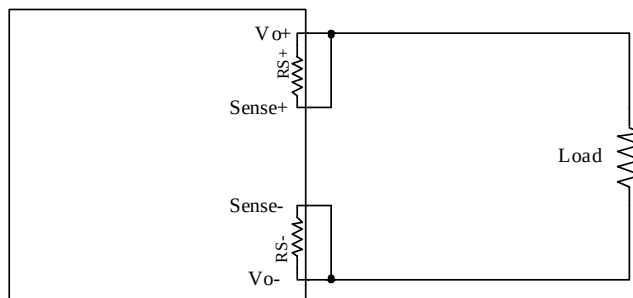
Remote Sense

This module has remote sense compensation feature. It can minimize the effects of resistance between module's output and load in system layout and facilitates accurate voltage regulation at load terminals or other selected point.

1. The remote sense lines carry very little current and hence do not require a large cross-sectional area.
2. This module compensates for a maximum drop of 10% of the nominal output voltage.
3. If the unit is already trimmed up, the available remote sense compensation range should be correspondingly reduced. The total voltage increased by trim and remote sense should not exceed 10% of the nominal output voltage.
4. When using remote sense compensation, all the resistance, parasitic inductance and capacitance of the system are incorporated within the feedback loop of this module. This can make an effect on the module's compensation, affecting the stability and dynamic response. A 0.1uF ceramic capacitor can be connected at the point of load to de-couple noise on the sense wires.
5. Recommend the connection of remote sense compensation as below figure. There are a resistor RS+ (100 ohm) from Vo+ to Sense+ and a resistor RS- (51 ohm) from Vo- to Sense- inside of this module.



6. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to Vo+ and sense- to Vo- at module's pin, the shorter the better. See below figure.



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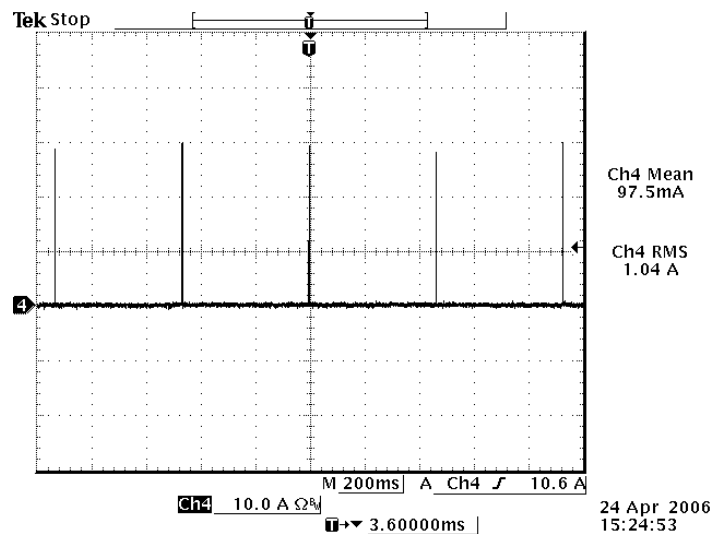


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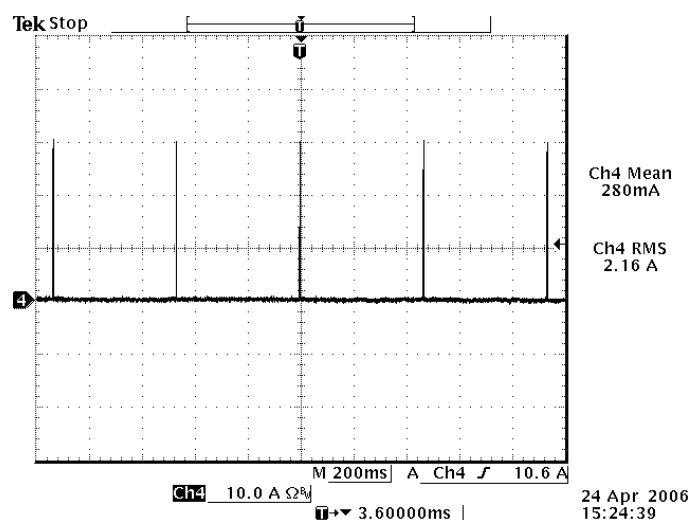
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Over Current Protection

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few milli-seconds. If the overcurrent condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart once every 400mS. The module operates normally when the output current goes into specified range. The typical average output current is 1A during hiccup.



48Vin



24Vin

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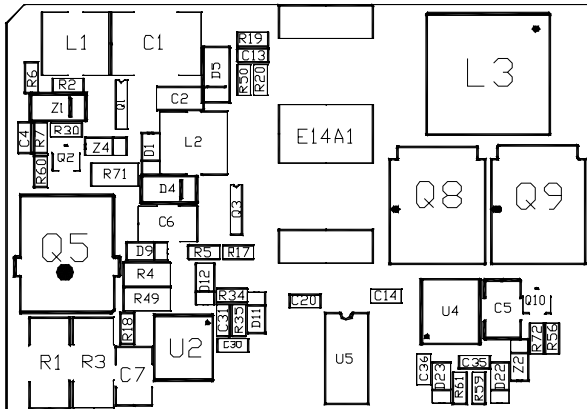


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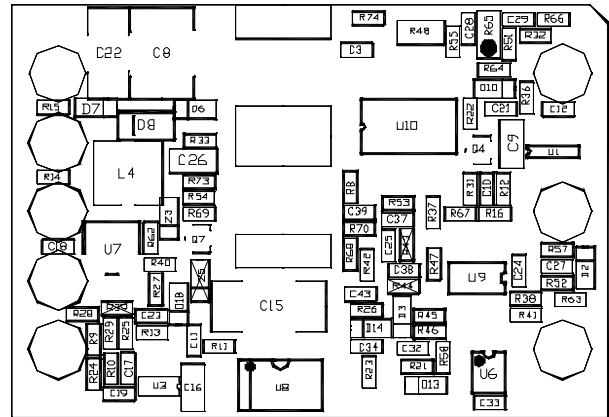
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Over Temperature Protection

The OTP is achieved by thermistor R65 and the threshold is set at 120C in non-latch mode; the hottest component Q5 reaches 130C with 100LFM air flow correspondingly. It will restart automatically when the temperature falls down to 110C. The protecting point will be varied a little under different conditions (air flow, ambient temperature, input voltage, load...).

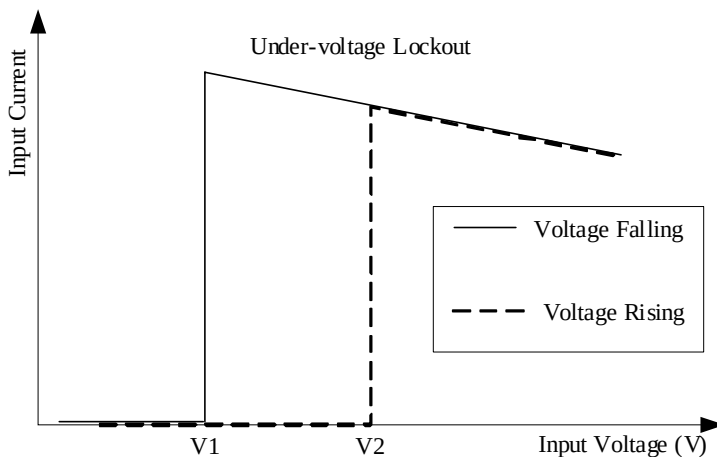


The hottest component on the top side: Q5



The thermistor on the bottom side: R65

Input Under-voltage Lockout



V1=16.8V
V2=17.2V

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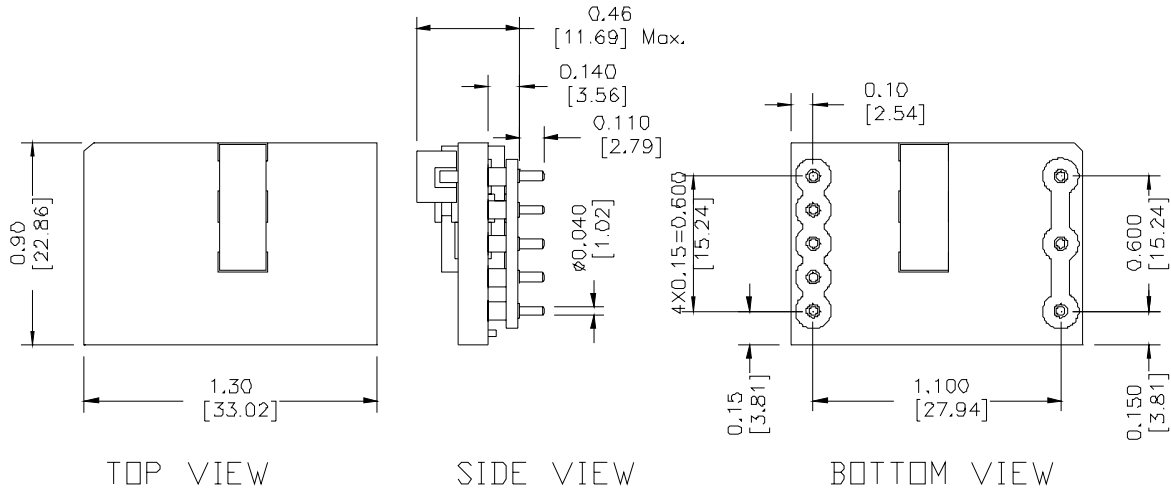


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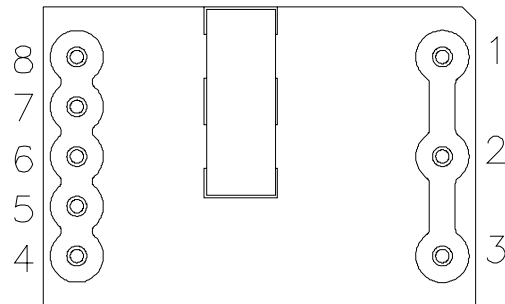
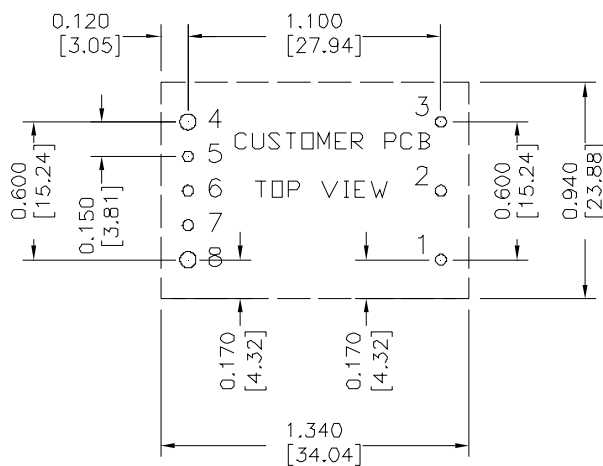
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Mechanical Outline

Pin Header: 3202-1700A03



RECOMMENDED PCB PAD LAYOUT



Pin Connections

Pin	Function	Pin Size
1	Vin+	0.040"
2	On/Off	0.040"
3	Vin-	0.040"
4	Vout-	0.062"
5	SENSE(-)	0.040"
6	TRIM	0.040"
7	SENSE(+)	0.040"
8	Vout+	0.062"

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
2010-6-17	A	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.



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