

ISOLATED DC/DC CONVERTERS

48 Vdc Input 3.3 Vdc/15 A, 1.8 Vdc/15 A Dual Outputs



Mar. 24, 2010

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

0RXC-75TD3x RoHS Compliant PRELIMINARY Rev.E

- Isolated
- Fixed Frequency (350 kHz)
- High Efficiency
- High Power Density
- Low Cost
- Input Under-Voltage Lockout
- Output Over-Voltage Shut Down
- Over Temperature Protection
- OCP /SCP
- Remote On/Off
- Output Voltage Trim
- Class 1, Category 2, Isolated DC/DC Converter (refer to IPC-9592)
- UL 60950-1 - Edition 2 and CSA C22.2 NO. 60950-1 (2nd ED.) and IEC 60950-1, 2nd ED Recognized

Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The 0RXC-75TD3x series are isolated dc/dc converters that operate from a nominal 48 Vdc source. These units will provide up to 77 W of output power from a nominal 48 Vdc input. These units are designed to be highly efficient and very low cost. Features include remote on/off, over current protection, short circuit protection and input under-voltage lockout. These converters are provided in an industry standard package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low	Model Number Active High
3.3 Vdc/1.8 Vdc	36 Vdc - 75Vdc	15 A	77 W	90%	0RXC-75TD3L	0RXC-75TD30

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

Part Number Explanation

$\frac{0}{1} \frac{R}{2} \frac{XC}{3} - \frac{75}{4} \frac{T}{5} \frac{D3}{6} \frac{x}{7}$

1---Through hole

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

3---Series name

4---Series code

5---Input range (36-75V)

6---Output voltage, Dual outputs

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

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Continuous Input Voltage	-0.3 V	-	80 V	
Input Transient Voltage	-	-	100 V	100 mS maximum
Remote On/Off	-2 V		18 V	
I/O Isolation Voltage	-	-	1880 V	
Operating Temperature Range ¹	-40 °C	-	125 °C	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

Note: 1. Measured at the location specified in the thermal measurement figure. Maximum temperature varies with model number, output current and module orientation.

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

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	36 V	-	75 V	
Input Current (no load)	-	70 mA	100 mA	
Input Current (full load)	-	-	2.5 A	
Remote Off Input Current	-	9 mA	20 mA	
Input Reflected Ripple Current (pk-pk)	-	10 mA	30 mA	With simulated source impedance of 10 uH, 5 Hz to 20 MHz; use a 100uF/100 V electrolytic capacitor with ESR = 1 ohm max, at 200 kHz
Input Reflected Ripple Current (rms)	-	2 mA	4 mA	
I ² t Inrush Current Transient	-	-	1 A ² s	
Turn-on Voltage Threshold	31 V	33 V	35 V	
Turn-off Voltage Threshold	28 V	30 V	32 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 5A on system board. Refer to the fuse manufacture's datasheet for further information.

Notes: 1. This converter has internal C-L-C (0.47uF-2.2uH-4.4uF) filter.

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point Vo1=3.3 V Vo2=1.8 V	3.24 V 1.76 V	3.3 V 1.8 V	3.36 V 1.84 V	Vin=48 V, Io=50%Load
Line Regulation Vo1=3.3 V Vo2=1.8 V	- -	- -	10 mV 10 mV	
Load Regulation Vo1=3.3 V Vo2=1.8 V	- -	- -	20 mV 20 mV	
Cross Regulation Vo1=3.3 V Vo2=1.8 V	- -	- -	15 mV 10 mV	

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Output Specifications (continued)

Parameter		Min	Typ	Max	Notes	
Regulation Over Temperature (-40 °C to 85 °C)		-	-	0.02%Vo/°C		
Output Current	VO1=3.3 V VO2=1.8 V	0 A 0 A	- -	15 A 15 A		
Current Limit Threshold	VO1=3.3 V VO2=1.8 V	16 A 16 A	-	26 A 26 A	Hiccup Mode	
Ripple and Noise (rms)	VO1=3.3 V Vo2=1.8 V	- -	10 mV 10 mV	20 mV 20 mV	0 - 20 MHz BW, with a 1 uF ceramic load capacitor and 10uF tantalum capacitor at the output	
Ripple and Noise (pk-pk)	VO1=3.3 V VO2=1.8 V	- -	40 mV 40 mV	80 mV 80 mV		
Ripple and Noise (pk-pk)	VO1=3.3 V VO2=1.8 V	- -	- -	100 mV 100 mV	over all operating input voltage, load and ambient temperature condition	
Short Circuit Surge Transient						
Rise Time	VO1=3.3 V VO2=1.8 V	8 mS 4 mS	- -	12 mS 6 mS		
Turn on Time	VO1=3.3 V VO2=1.8 V	- -	70 mS 70 mS	90 mS 90 mS	Enable form Vin and ON/OFF	
Overshoot at Turn on		-	0%	5%		
Output Capacitance	VO1=3.3 V VO2=1.8 V	0 uF 0 uF	- -	5000 uF 10000 uF		
Transient Response						
25% ~ 75% Max Load	Overshoot	VO1=3.3 V	-	100 mV	180 mV	di/dt=0.1 A/us, Vin=48 Vdc, External 10 uF Tantalum Cap and 1uF Ceramic CapTa=25°C.
	Settling Time		-	100 uS	150 uS	
75% ~ 25% Max Load	Overshoot		-	100 mV	180 mV	
	Settling Time		-	100 uS	150 uS	
25% ~ 75% Max Load	Overshoot	VO2=1.8 V	-	90 mV	160 mV	
	Settling Time		-	100 uS	150 uS	
75% ~ 25% Max Load	Overshoot		-	90 mV	160 mV	
	Settling Time		-	100 uS	150 uS	

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

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General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency	88%	90%	-	Vin = 48 V, full load
Switching Frequency	300 kHz	350 kHz	400 kHz	
Isolation Resistance	10M ohm	-	-	
Isolation Capacitance	-	1500 pF	-	
Output Voltage Trim Range Vo1=3.3 V Vo2=1.8 V	2.97 V 1.62 V	- -	3.63 V 1.98 V	Trim1 (Pin A) trims 3.3V output and Trim2 (pin6) trims 1.8V output
Over Temperature Protection	-	125 °C	-	
Over Voltage Protection Vo1=3.3 V Vo2=1.8 V	3.9 V 2.2 V	- -	5 V 2.8 V	Latch
FIT	540			Calculated Per Bell Core SR-332 (Vin=48 V, Vo1=3.3 V@12A, Vo2=1.8 V@12A, Ta = 25C, FIT=10 ⁹ /MTBF)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	2.3 x 1.45 x 0.427 58.42 x 36.83 x 10.85			
Weight	-	30 g	-	

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

Control Specifications

Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit On)	Active Low	-2 V	-	0.8 V	The remote on/off pin open, Unit Off.
Signal High (Unit Off)		2.4 V	-	18 V	
Signal Low (Unit Off)	Active High	-2 V	-	0.8 V	The remote on/off pin open, Unit On.
Signal High (Unit On)		2.4 V	-	18 V	
Current Source	-	0 mA	-	3 mA	

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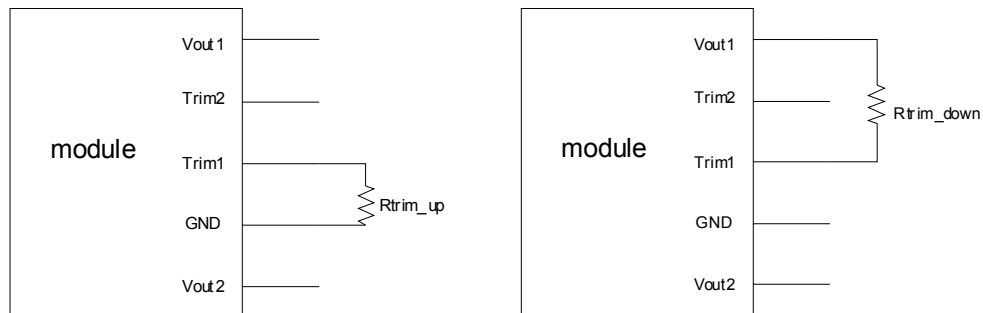
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Output Trim Equations

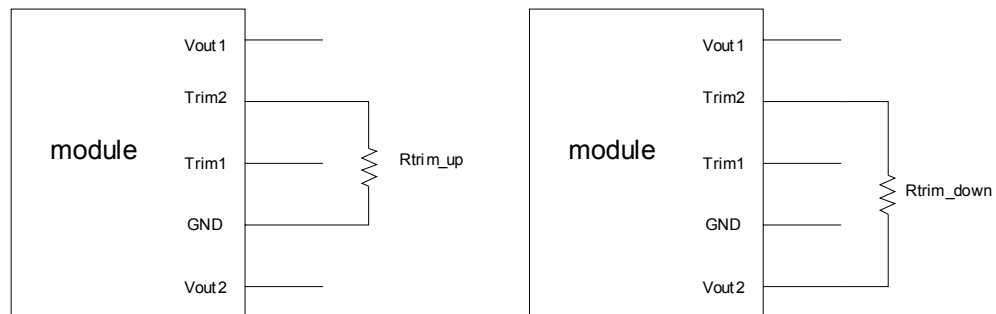
Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected between the Trim pin and Vout pin. The Trim Up resistor should be connected between the Trim pin and the GND pin. Only one of the resistors should be used for any given application.

Trim for 3.3V output



Vout(%)	10	9	8	7	6	5	4	3	2	1
Rup (K Ω)	1.80	3.98	6.70	10.20	14.87	21.40	31.20	47.53	80.20	178.20
Rdown(K Ω)	2.23	4.94	8.33	12.70	18.51	26.66	38.87	59.23	99.95	222.10

2) Trim for 1.8V output



Vout(%)	10	9	8	7	6	5	4	3	2	1
Rup (K Ω)	0.00	0.72	1.62	2.78	4.33	6.49	9.74	15.14	25.96	58.41
Rdown(K Ω)	0.00	0.88	1.98	3.40	5.29	7.93	11.90	18.51	31.73	71.39

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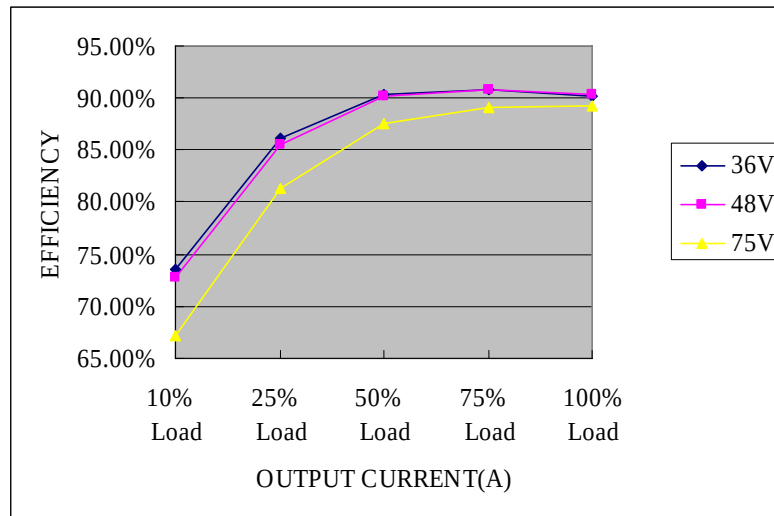
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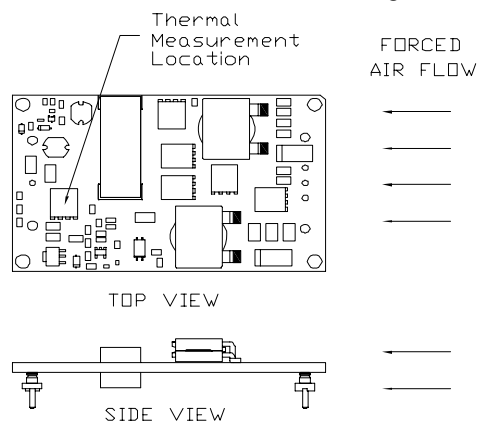
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Efficiency Data

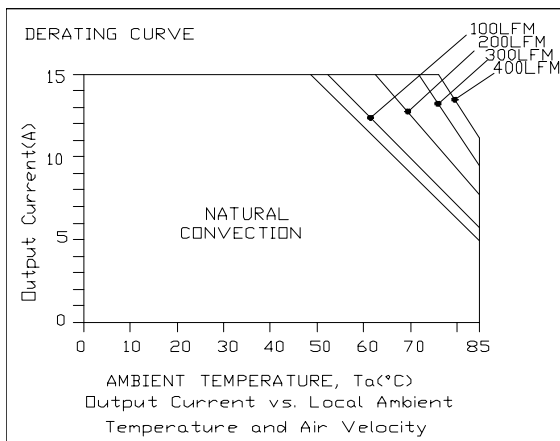


Thermal Derating Curve

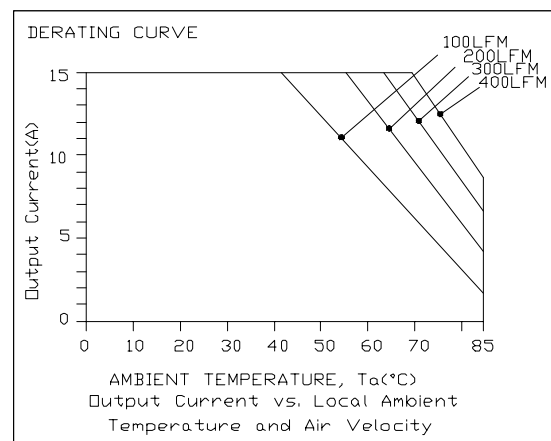
Maximum junction temperature of semiconductors derated to 125 degree C.



Derating curve under 48V input



Derating curve under 75V input



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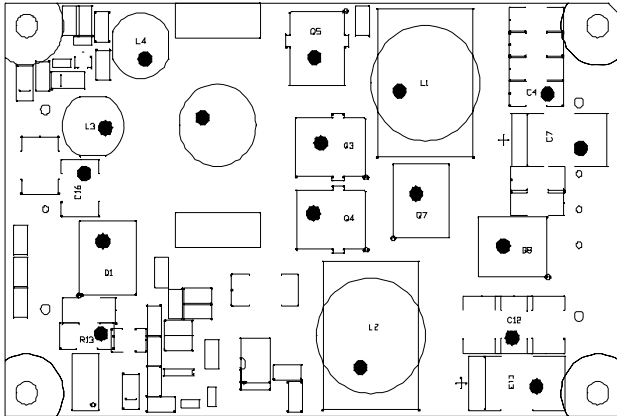
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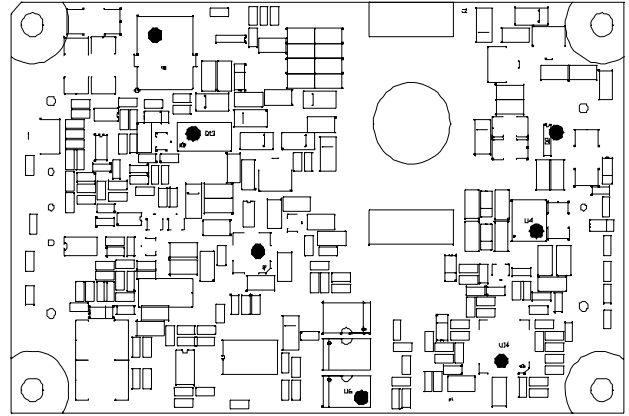
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Thermal Derating Curve (continued)



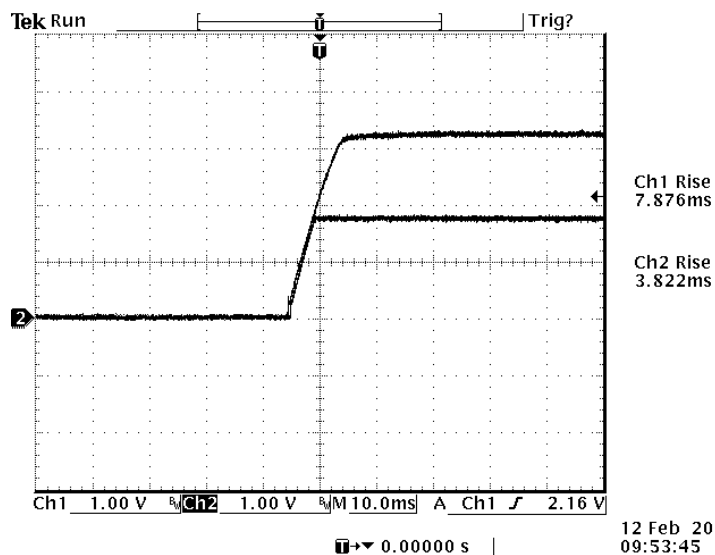
Temperature reference points on top side



Temperature reference points on bottom side

Startup & Shutdown

Rise time



Test Condition: $V_{in}=48V$, $V_{out1}=3.3V$, $I_{o1}=15A$, $V_{out2}=1.8V$, $I_{o2}=15A$

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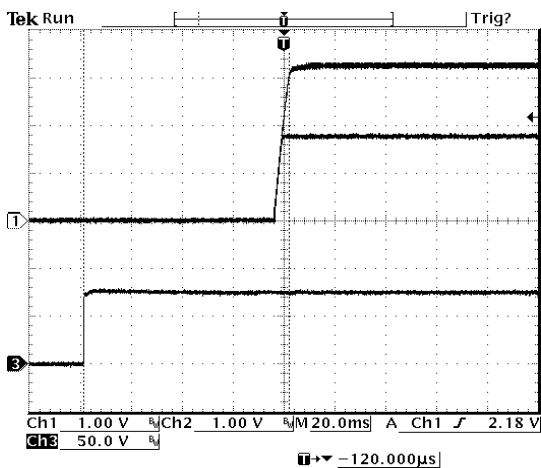


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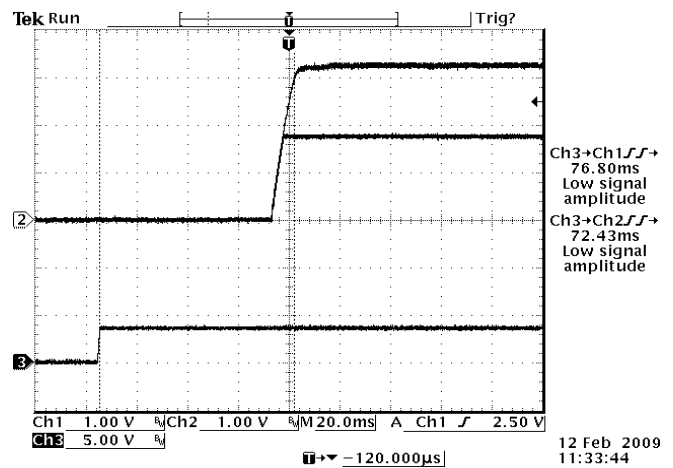
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Startup & Shutdown

Startup time



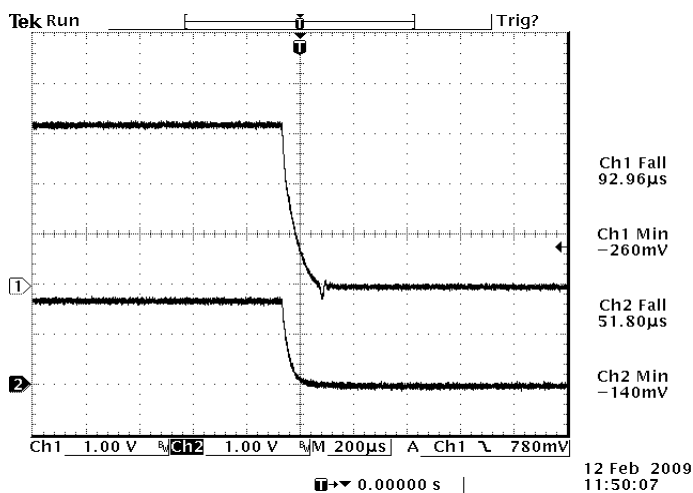
Startup from Vin
Ch1: Vo1, Ch2: Vo2, Ch3: Vin



Startup from on/off
Ch1: Vo1, Ch2: Vo2, Ch3: on/off

Test Condition: Vin=48V, Vout1=3.3V, Io1=15A. Vout2=1.8V, Io2=15A

Shutdown



Test Condition: Vin=48V, Vout1=3.3V, Io1=15A. Vout2=1.8V, Io2=15A

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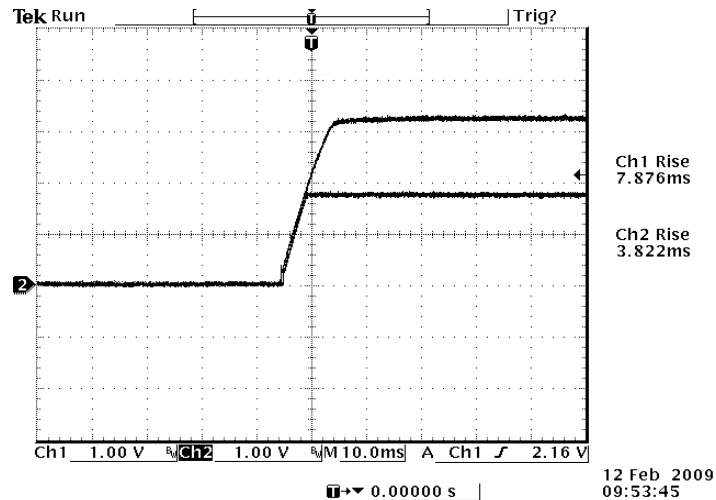
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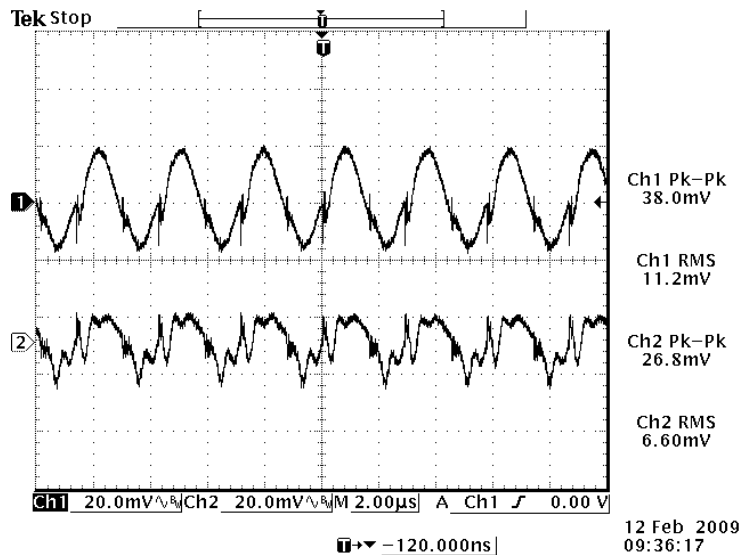
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Startup Sequence



Test condition: $V_{in}=48V$, $V_{out1}=3.3V$, $I_{o1}=15A$, $V_{out2}=1.8V$, $I_{o2}=15A$

Ripple and Noise Waveform



CH1 3.3Vdc/15A output, CH2 1.8Vdc/15A output

Note: Ripple and noise at full load, 48 Vdc input, with a 10µF Tan cap and 1µF ceramic cap at the output, $T_a=25$ deg C.

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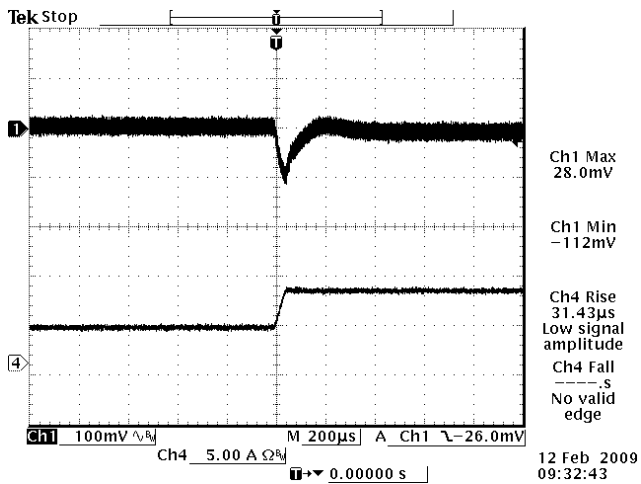
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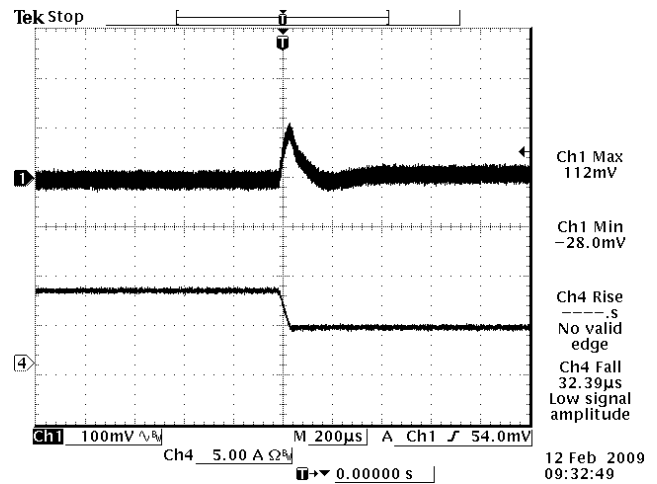
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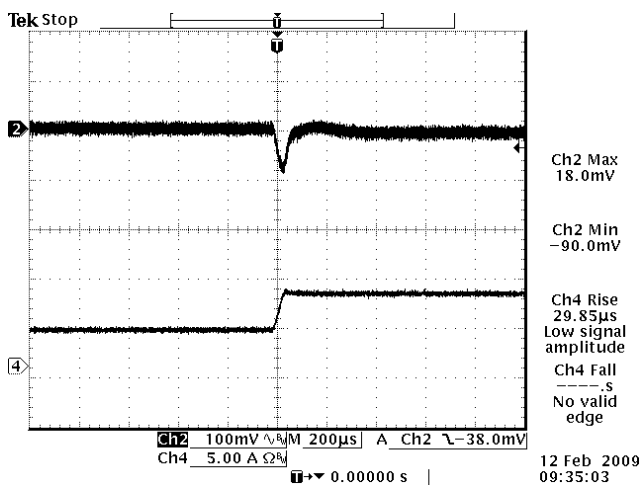
Transient Response Waveforms



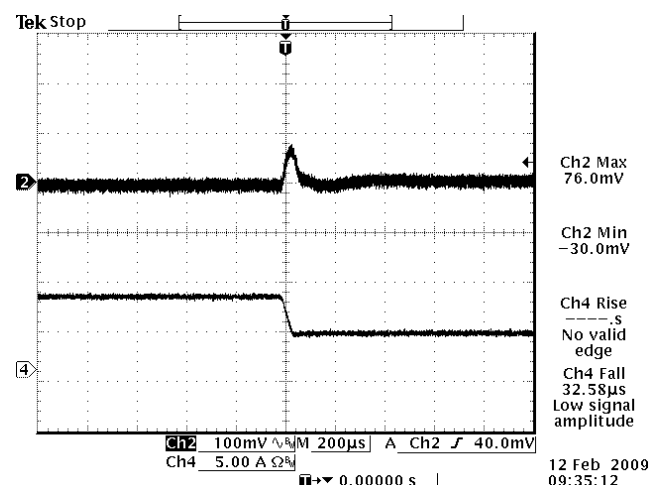
Vout=3.3 V 25%-50% Load Transients



Vout=3.3 V 50%-25% Load Transients



Vout=1.8 V 25%-50% Load Transients



Vout=1.8 V 50%-25% Load Transients

Note: Transient Response at Vin=48 V, di/dt=0.1A/µS, with external 10µF Tantalum Cap and 1µF Ceramic Cap, Ta=25 deg C.

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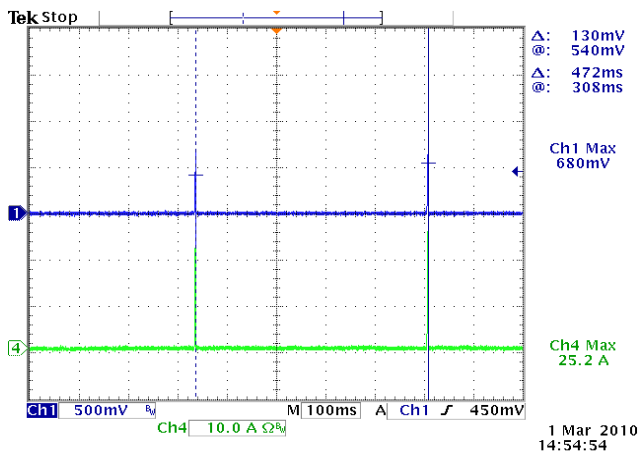


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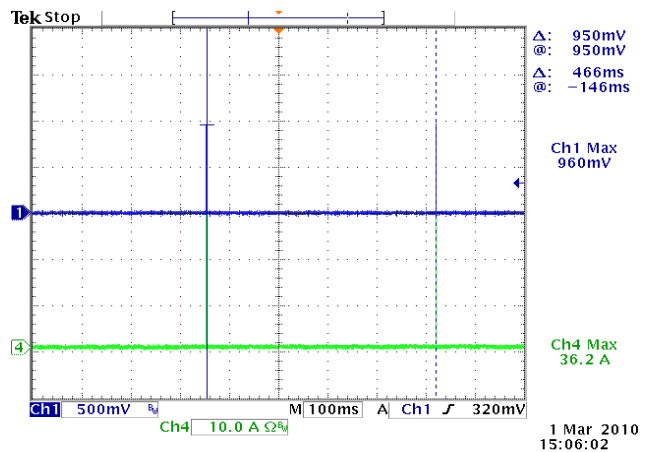
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Over Current Protection

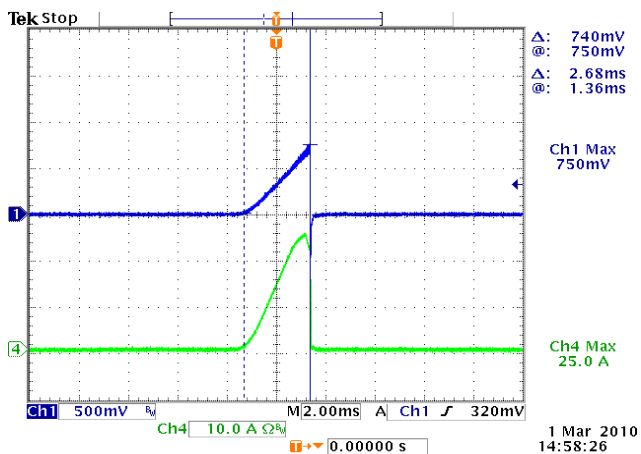
To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few milli-seconds. If the overcurrent condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart once every 400mS. The module operates normally when the output current goes into specified range. The typical average output current is 0.15A during hiccup.



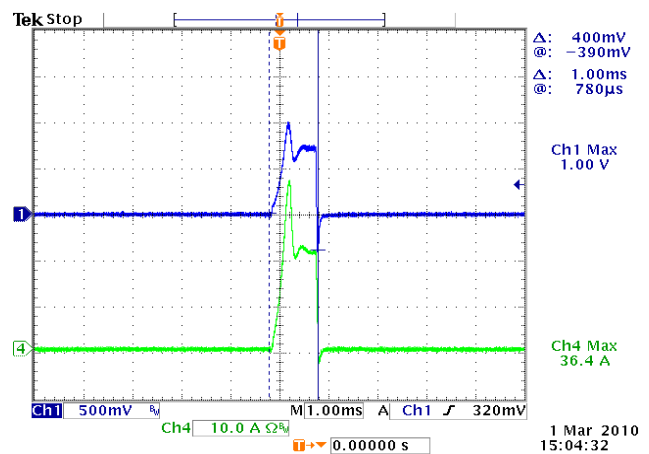
Vo1=3.3V



Vo2=1.8V



Expansion of on time portion of Vo1



Expansion of on time portion of Vo2

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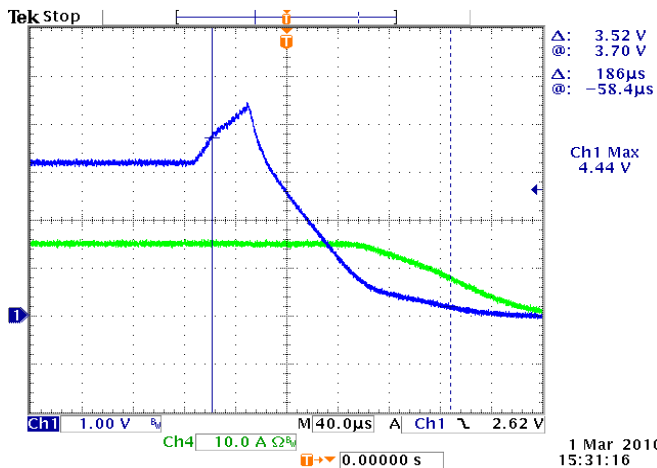


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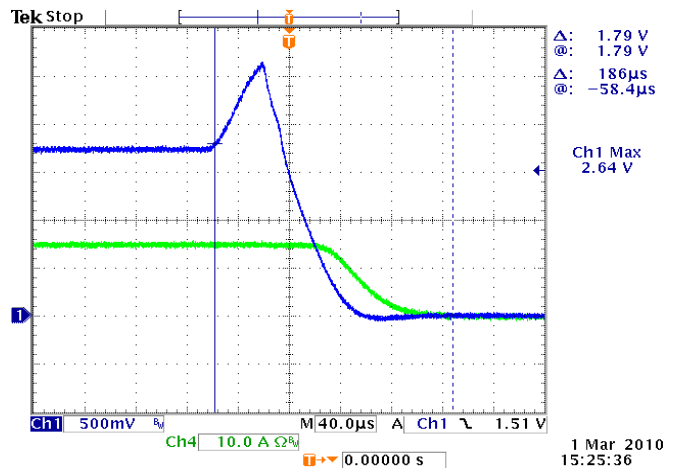
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Over Voltage Protection

The output overvoltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over voltage protection threshold, the module will shutdown into latch off mode. The overvoltage latch can be reset by either cycling the input power or toggling the on/off signal for one second at least.



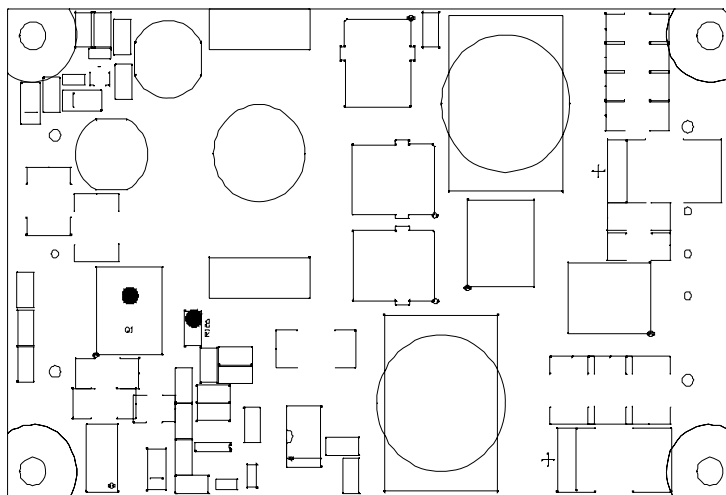
Vo1=3.3V



Vo2=1.8V

Over Temperature Protection

The OTP is achieved by thermistor R126 and the threshold is set at 110C in non-latch mode; the hottest component Q1 reaches 125C with 100LFM air flow correspondingly. It will restart automatically when the temperature falls down to 100C. The protecting point will be varied a little under different conditions (air flow, ambient temperature, input voltage, load...).



TOP VIEW

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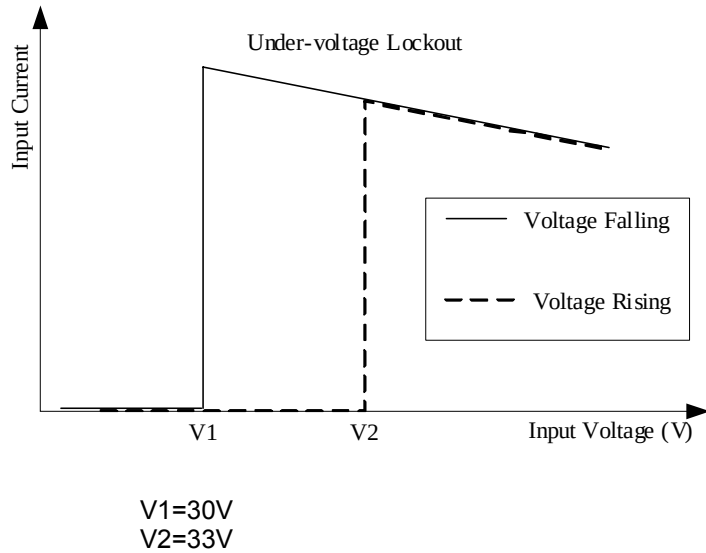
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Under Voltage Lockout



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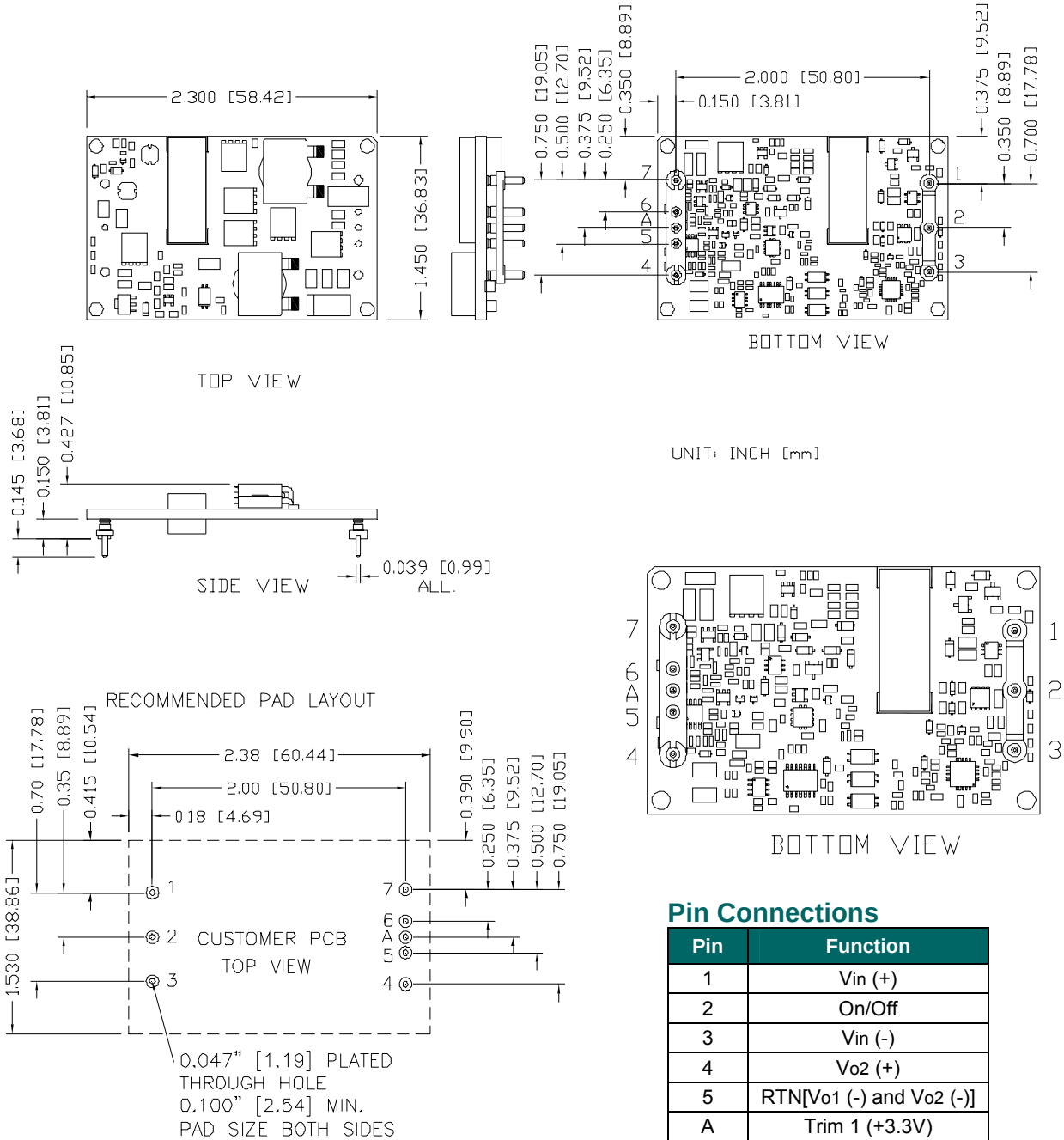
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Mechanical Outline



Pin Connections

Pin	Function
1	Vin (+)
2	On/Off
3	Vin (-)
4	Vo2 (+)
5	RTN[Vo1 (-) and Vo2 (-)]
A	Trim 1 (+3.3V)
6	Trim 2 (+1.8V)
7	Vo1 (+)

Note: Vo1=3.3 V, Vo2=1.8 V.

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Revision History

Date	Revision	Changes Detail	Approval
2010-03-02	D	1. Update to Bel new datasheet version, add startup & shutdown, OCP, OVP, OTP and so on; 2. Update output DC current limit	Jack Fan
2010-03-24	E	1. Update isolated voltage; 2. Add operating temperature range; 3. Update thermal derating curves	Jack Fan

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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