

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
- 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
- Output Over-Voltage Shut Down
- Over Temperature Protection
- OCP /SCP
- Remote On/Off
- Output Voltage Trim

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

0 R XC - 75 T D3 x
1 2 3 4 5 6 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 manufacturer'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 | V _{O1} =3.3 V V _{O2} =1.8 V | 3.24 V 1.76 V | 3.3 V 1.8 V | 3.36 V 1.84 V | V _{in} =48 V, I _o =50%Load |
| Line Regulation | V _{O1} =3.3 V V _{O2} =1.8 V | - - | - - | 10 mV 10 mV | |
| Load Regulation | V _{O1} =3.3 V V _{O2} =1.8 V | - - | - - | 20 mV 20 mV | |
| Cross Regulation | V _{O1} =3.3 V V _{O2} =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 V _{O1} =3.3 V V _{O2} =1.8 V | 0 A 0 A | - - | 15 A 15 A | | |
| Current Limit Threshold V _{O1} =3.3 V V _{O2} =1.8 V | 16 A 16 A | - | 26 A 26 A | Hiccup Mode | |
| Ripple and Noise (rms) V _{O1} =3.3 V V _{O2} =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) V _{O1} =3.3 V V _{O2} =1.8 V | - - | 40 mV 40 mV | 80 mV 80 mV | | |
| Ripple and Noise (pk-pk) V _{O1} =3.3 V V _{O2} =1.8 V | - - | - - | 100 mV 100 mV | over all operating input voltage, load and ambient temperature condition | |
| Short Circuit Surge Transient | | | | | |
| Rise Time V _{O1} =3.3 V V _{O2} =1.8 V | 8 mS 4 mS | - - | 12 mS 6 mS | | |
| Turn on Time V _{O1} =3.3 V V _{O2} =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 V _{O1} =3.3 V V _{O2} =1.8 V | 0 uF 0 uF | - - | 5000 uF 10000 uF | | |
| Transient Response | | | | | |
| 25% ~ 75% Max Load | Overshoot | V _{O1} =3.3 V | - | 100 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 | |
| 75% ~ 25% Max Load | Overshoot | V _{O1} =3.3 V | - | 100 mV | |
| | Settling Time | | - | 100 uS | |
| 25% ~ 75% Max Load | Overshoot | V _{O2} =1.8 V | - | 90 mV | |
| | Settling Time | | - | 100 uS | |
| 75% ~ 25% Max Load | Overshoot | V _{O2} =1.8 V | - | 90 mV | |
| | Settling Time | | - | 100 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) | -2 V | - | 0.8 V | The remote on/off pin open, Unit Off. |
| Signal High (Unit Off) | | | | |
| Signal Low (Unit Off) | 2.4 V | - | 18 V | |
| Signal High (Unit On) | | | | |
| Current Source | - | 0 mA | 3 mA | The remote on/off pin open, Unit On. |

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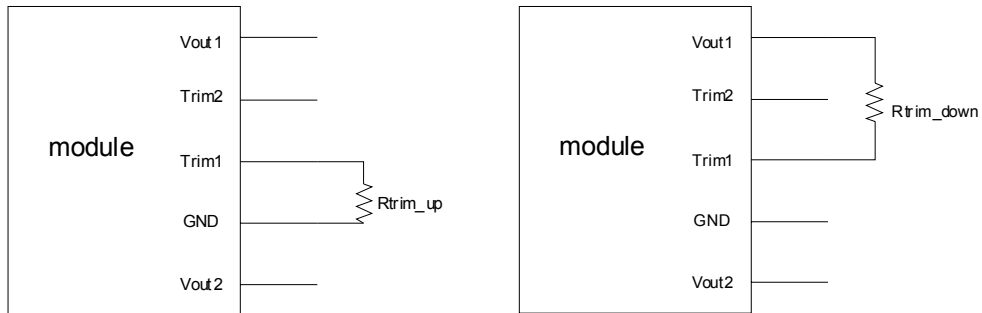
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Output Trim Equations

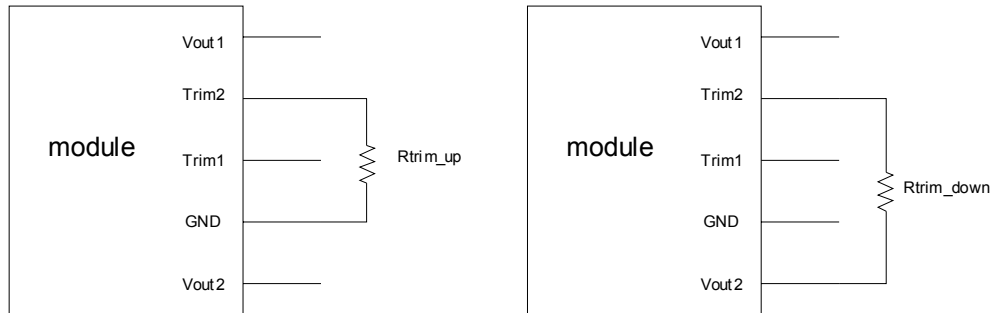
Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected between the Trim pin and Vout pin. The Trim Up resistor should be connected between the Trim pin and the GND pin. Only one of the resistors should be used for any given application.

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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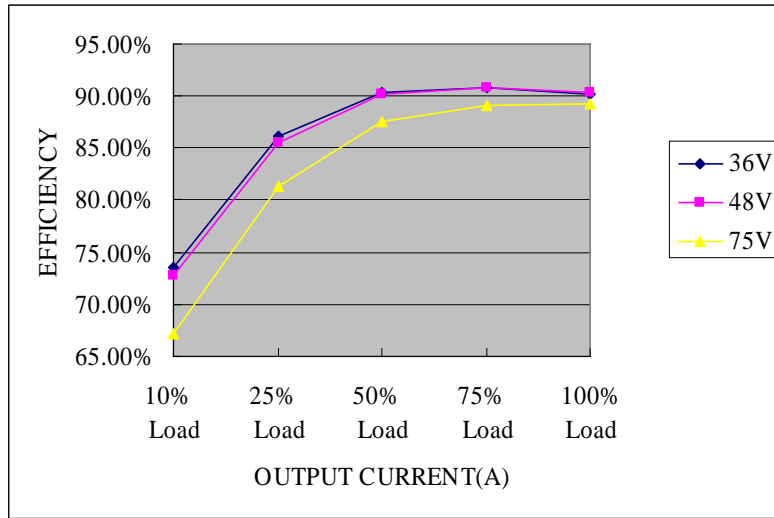
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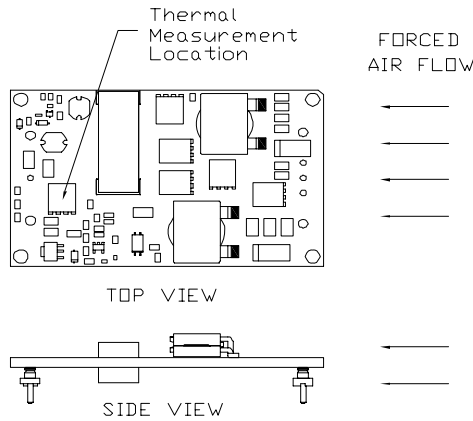
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Efficiency Data

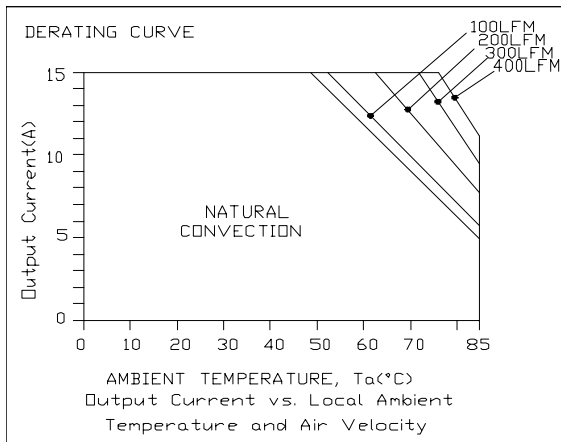


Thermal Derating Curve

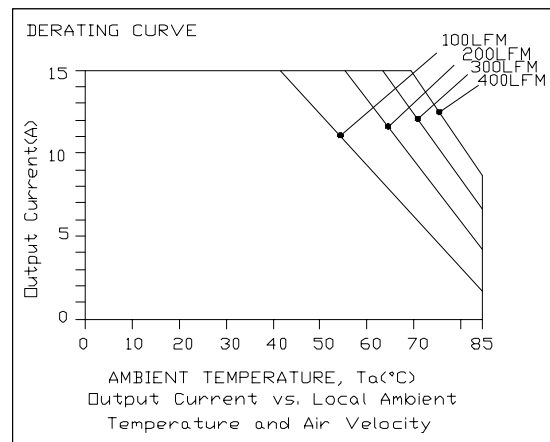
Maximum junction temperature of semiconductors derated to 125 degree C.



Derating curve under 48V input



Derating curve under 75V input



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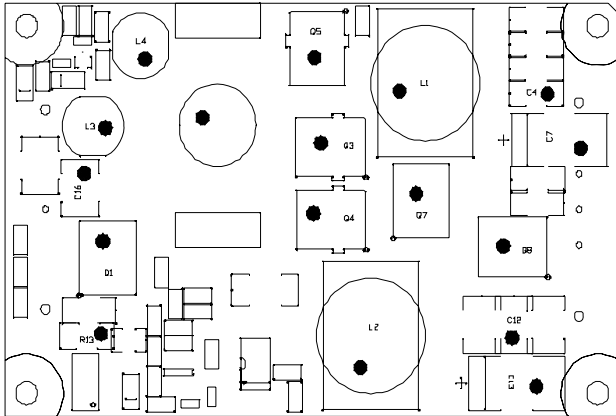
48 Vdc Input 3.3 Vdc/15 A, 1.8 Vdc/15 A Dual Outputs



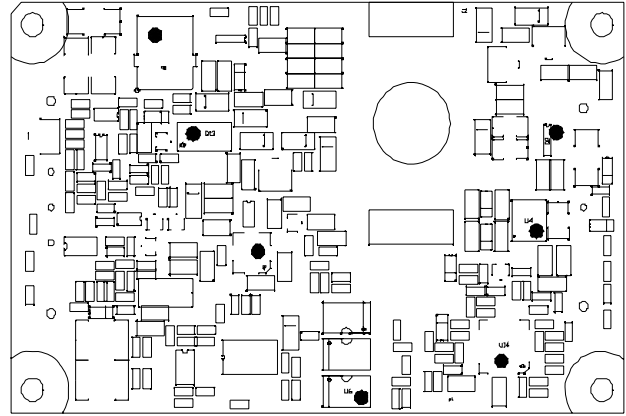
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Thermal Derating Curve (continued)



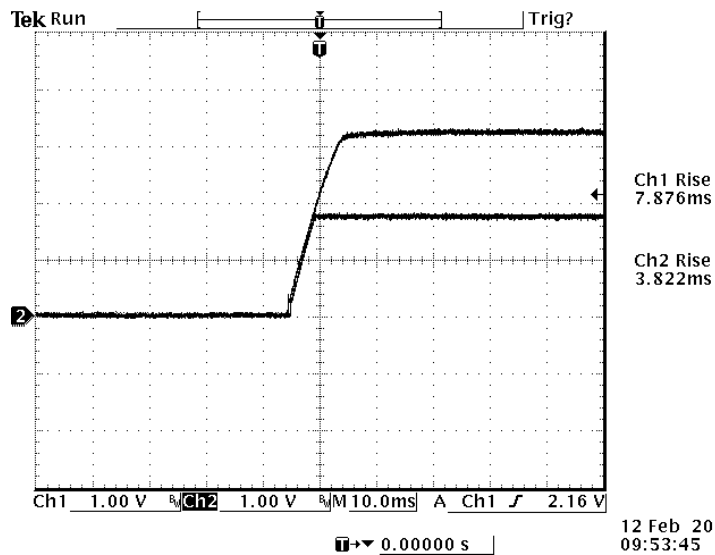
Temperature reference points on top side



Temperature reference points on bottom side

Startup & Shutdown

Rise time



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

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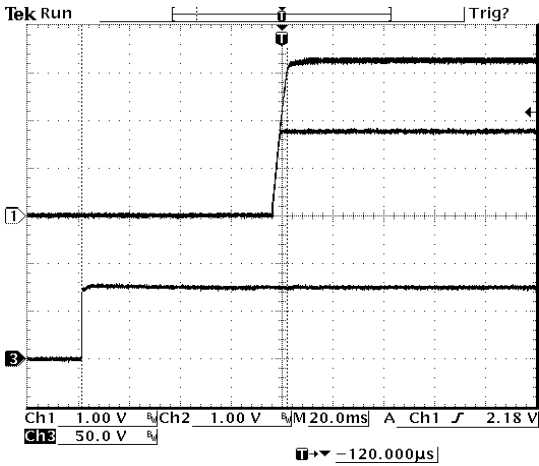


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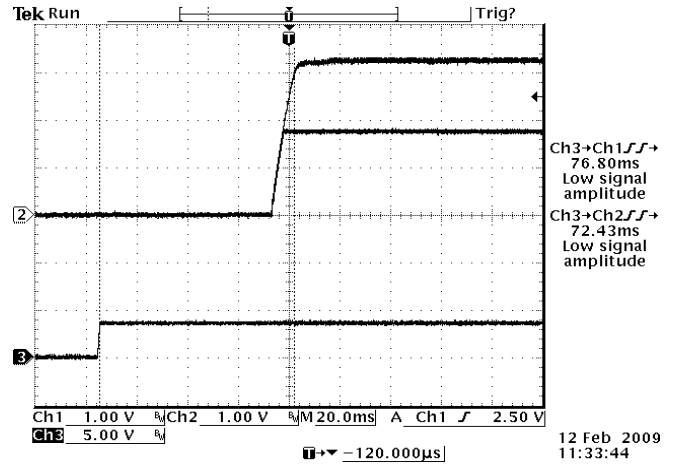
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Startup & Shutdown

Startup time



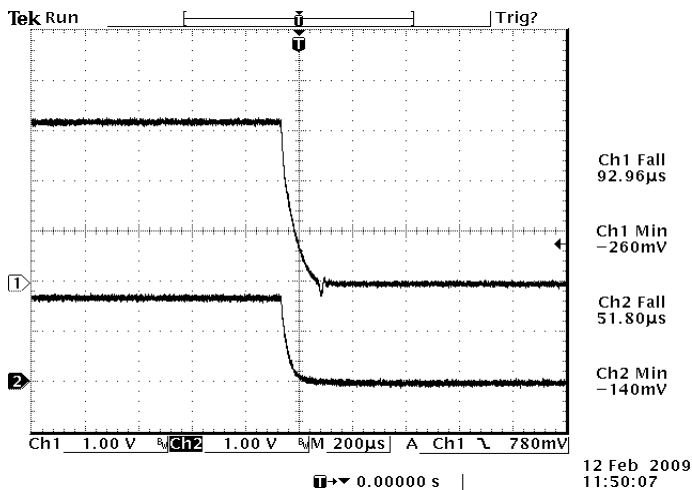
Startup from Vin
Ch1: Vo1, Ch2: Vo2, Ch3: Vin



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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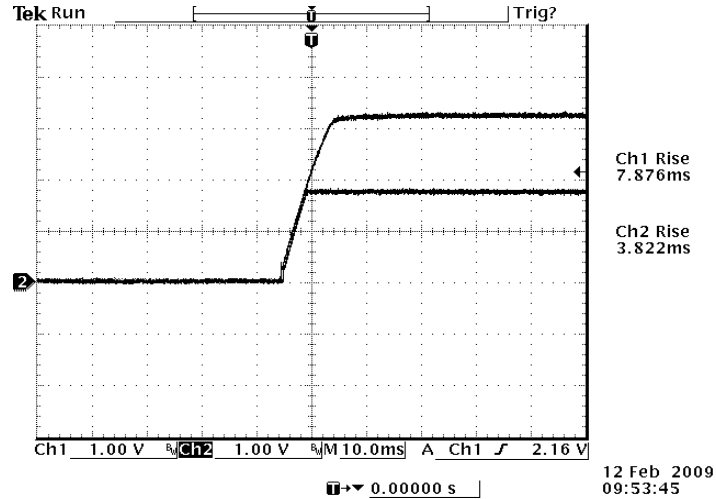
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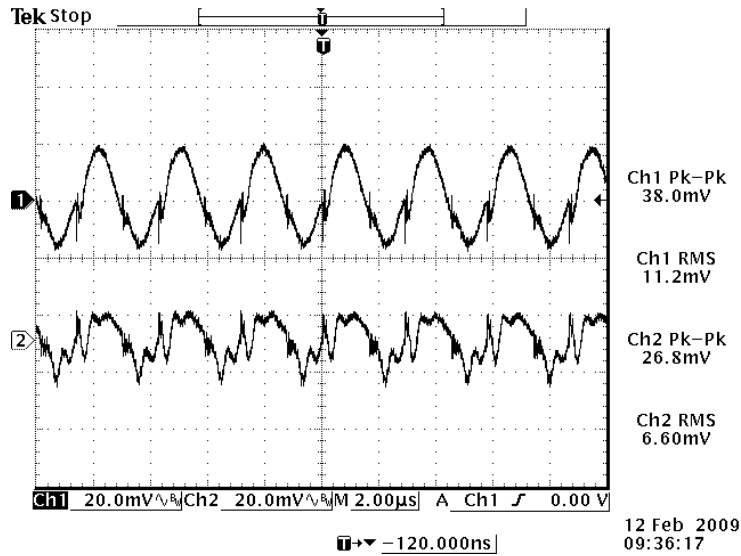
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Startup Sequence



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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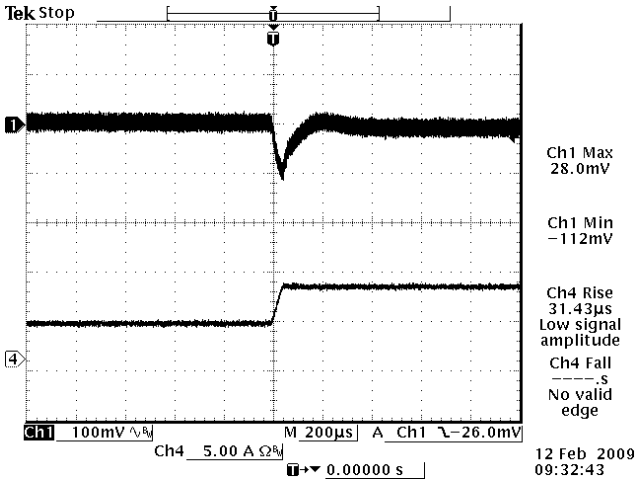
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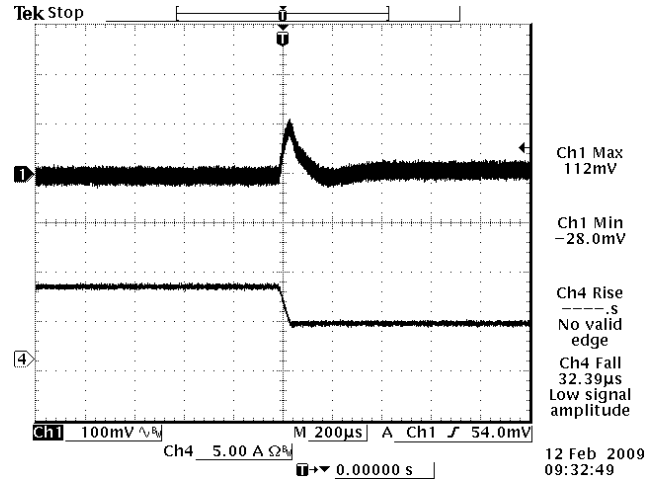
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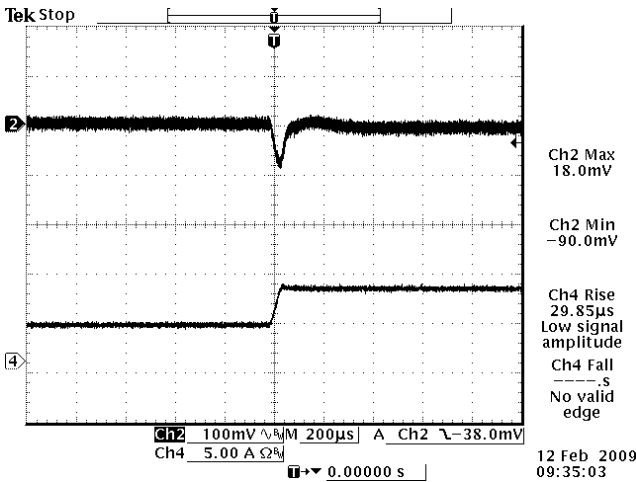
Transient Response Waveforms



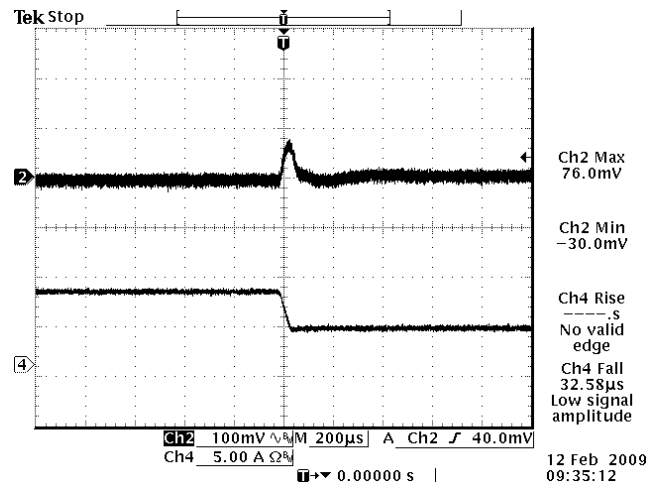
Vout=3.3 V 25%-50% Load Transients



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/uS, with external 10uF Tantalum Cap and 1uF Ceramic Cap, Ta=25 deg C.

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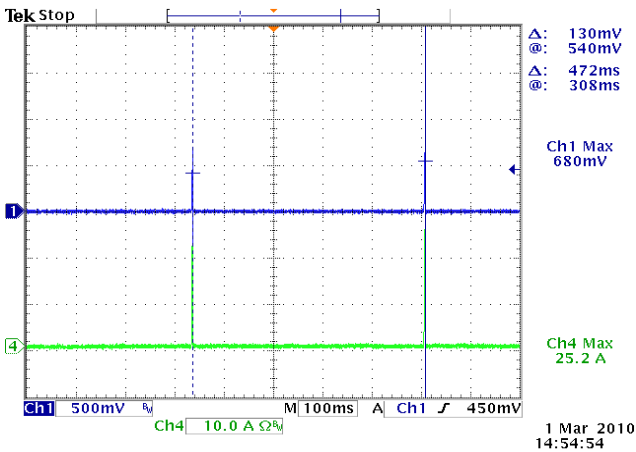


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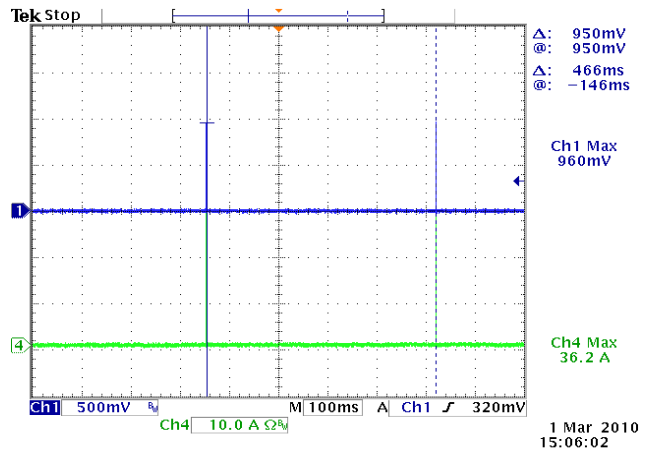
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Over Current Protection

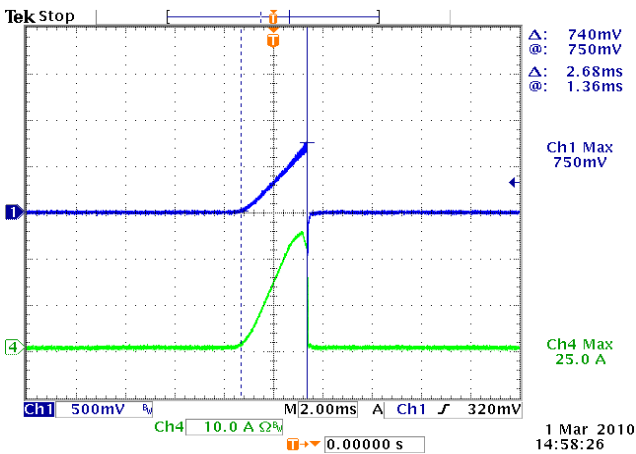
To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few milli-seconds. If the overcurrent condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart 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.



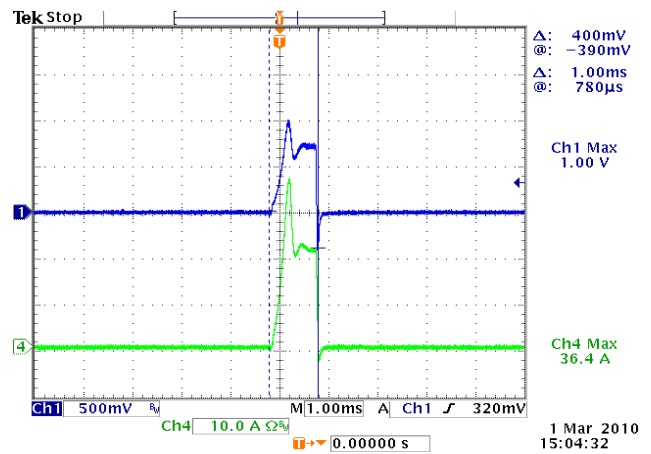
Vo1=3.3V



Vo2=1.8V



Expansion of on time portion of Vo1



Expansion of on time portion of Vo2

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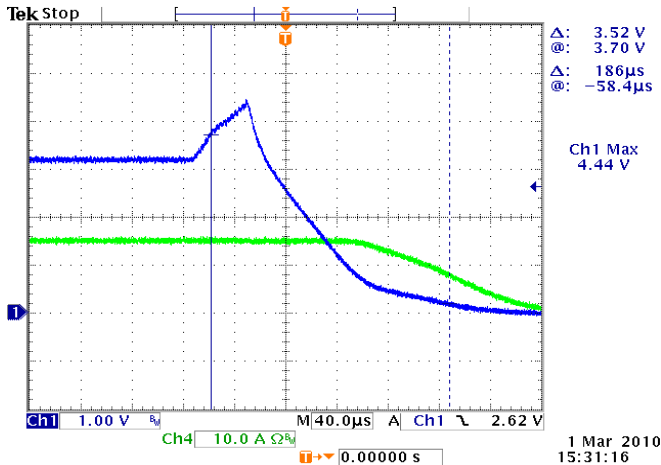


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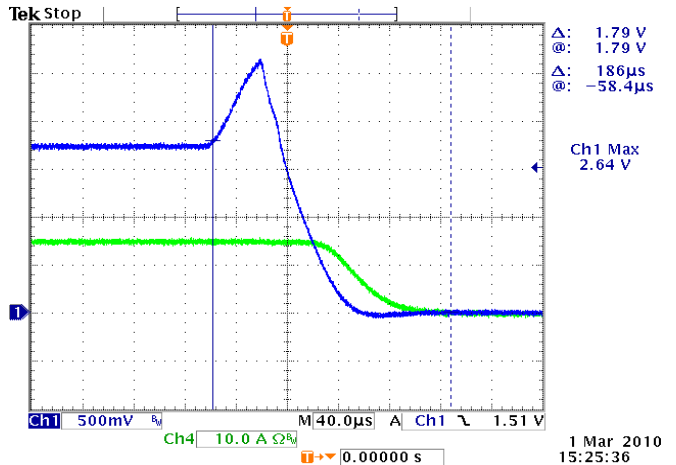
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Over Voltage Protection

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.



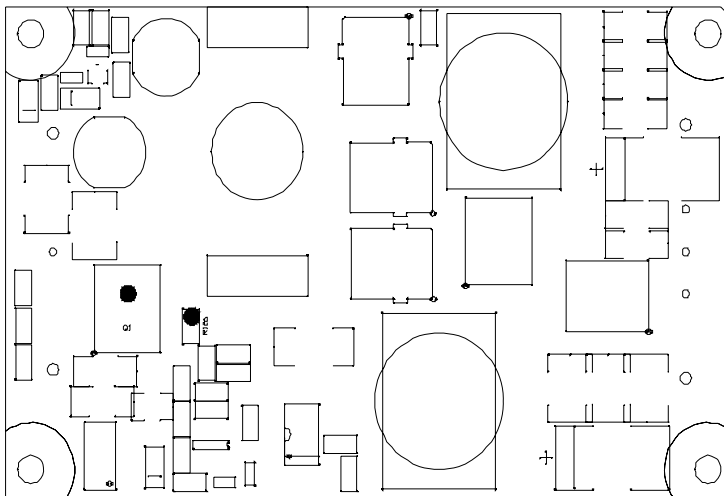
Vo1=3.3V



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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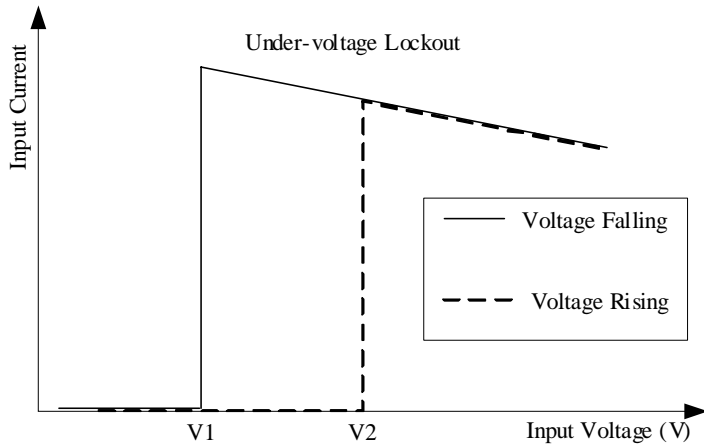
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Under Voltage Lockout



V1=30V
V2=33V

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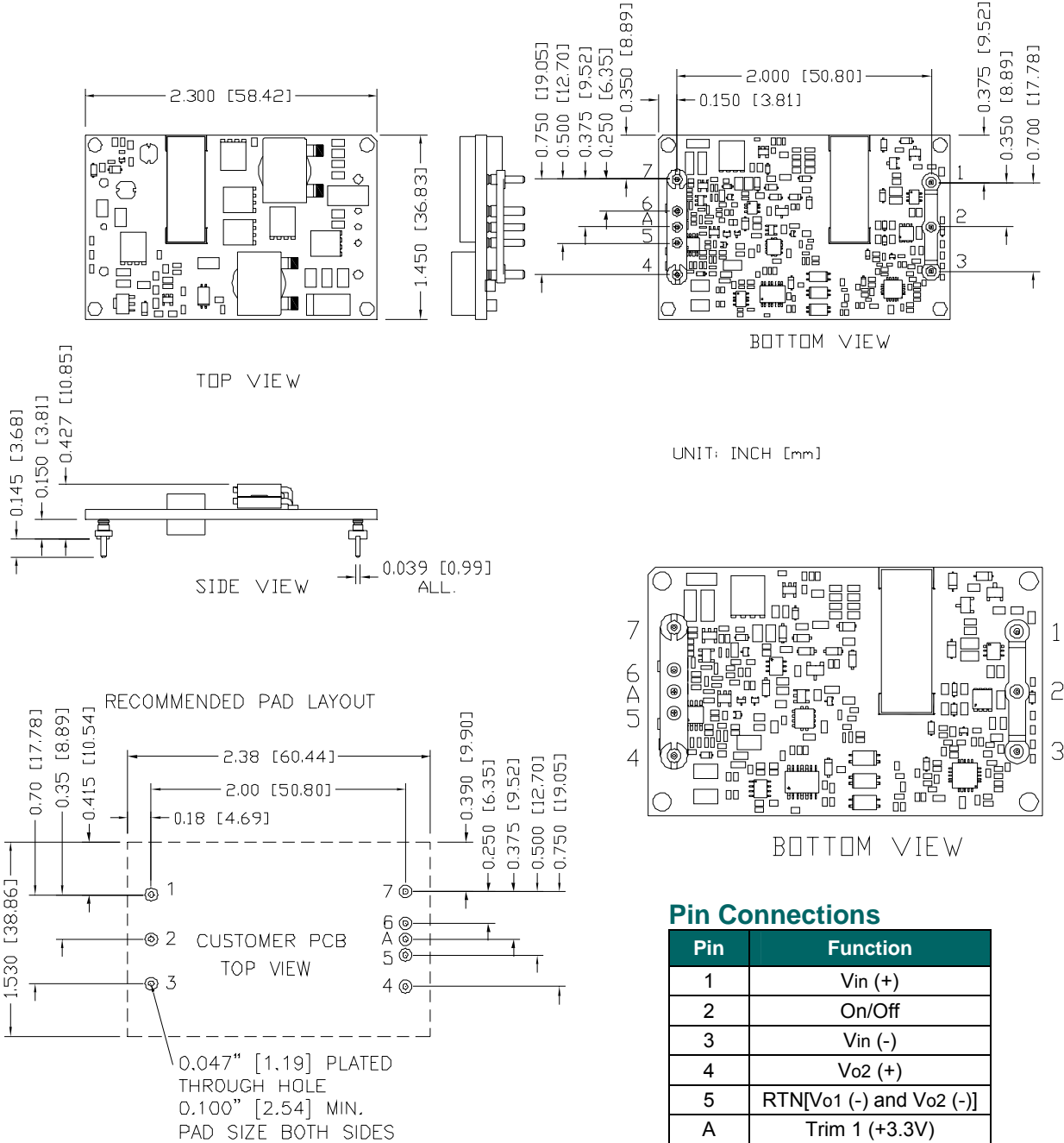
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Mechanical Outline



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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