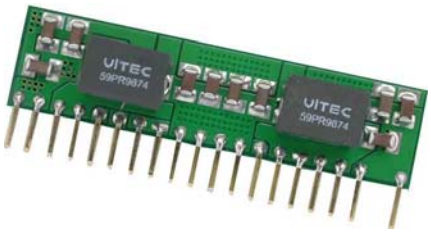
# NON-ISOLATED DC/DC CONVERTERS

**8 Vdc - 14 Vdc Input  0.8 Vdc - 3.63 Vdc / 30 A Outputs**

## VRBG-30A1A0  RoHS Compliant  PRELIMINARY  Rev.A

- Non-Isolated
- Fixed Frequency
- High Efficiency
- Wide Trim
- Low Cost
- Remote Sense
- Input Under Voltage Lockout
- Over Temperature Shutdown
- Short Circuit Protection
- Remote On/Off
- Industrial Temperature Range



## Description

The Bel VRBG-30A1A0 is part of the non-isolated dc/dc converter Power Module series. The modules use a SIP package. These converters are available in a range of output voltages from 0.8 Vdc to 3.63 Vdc over a wide range of input voltage (Vin = 8 Vdc - 14 Vdc).The efficiency is typically 92% at 12 Vdc input and 3.3 Vdc output at full load.

## Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Model Number |
|---|---|---|---|---|---|
| 0.8  Vdc - 3.3 Vdc | 8 Vdc - 14 Vdc | 30 A | 99 W | 92% | VRBG-30A1A0 |

**Notes:** 1. Add “G” or “R” suffix at the end of the model number to indicate Tray or Tape and Reel packaging.
2. All part numbers above indicate RoHS 6.  Change the second letter "R" to "7" for RoHS 5 part numbers.

## 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 | |
| Ambient Temperature | -40 °C | - | 85 °C | |
| Storage Temperature | -55 °C | - | 125 °C | |

## Input Specifications

| Parameter | Min | Typ | Max | Notes |
|---|---|---|---|---|
| Input Voltage | 8 V | 12 V | 14 V | |
| Input Current (full load) | - | - | 15 A | An input line fuse must always be used. |
| Input Current (no load) | - | 240 mA | - | |
| Remote Off Input Current | - | 20 mA | - | |
| Input Reflected Ripple Current (rms) | - | 5 mA | - | With a 1000 uF AL-Cap at the input. |
| $I^2t$ Inrush Current Transient | - | - | 1 $A^2s$ | |
| Turn On Voltage Threshold | - | 6.7 V | - | |
| Turn Off Voltage Threshold | - | 6.3 V | - | |

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

# NON-ISOLATED DC/DC CONVERTERS

**8 Vdc - 14 Vdc Input 0.8 Vdc - 3.63 Vdc / 30 A Outputs**

## Output Specifications

| Parameter | | Min | Typ | Max | Notes |
|---|---|---|---|---|---|
| Output Voltage Set Point | | -1.5%Vo, set | - | 1.5%Vo, set | $V_{in}$=12 V, $I_O$=half load |
| Line Regulation | | - | - | 0.2%Vo, set | |
| Load Regulation | | - | - | 1.5%Vo, set | |
| Temperature Regulation (-40 °C to +85 °C) | | - | - | 1%Vo, set | |
| Ripple and Noise (rms) | | - | 4 mA | 20 mV | 0-20 MHz BW, with a 20 µF ceramic capacitor and a 150 uF tantalum capacitor at the output. |
| Ripple and Noise (pk-pk) | | - | 15 mV | 100 mV | |
| Output Current | | 0 A | - | 30 A | |
| Short Circuit Surge Transient | | - | 1 $A^2s$ | 3 $A^2s$ | |
| Turn on Time | | - | 2 mS | 10 mS | |
| Overshoot at Turn On | | - | - | 5% | |
| Output Capacitance | | 150 uF | - | 10000 uF | |
| **Transient Response** | | | | | |
| 50% ~ 75% Max Load | Overshoot | Vo=3.3 V | - | 65 mV | 150 mV | di/dt=0.5 A/us, Vin=12 Vdc, with a 20 µF ceramic capacitor and a150 uF tantalum capacitor at the output. |
| | Settling Time | | - | 20 uS | 45 uS | |
| 75% ~ 50% Max Load | Overshoot | | - | 65 mV | 150 mV | |
| | Settling Time | | - | 20 uS | 45 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=0.8 V | - | 80% | - | Vin=12 V, full load |
| Vo=1.8 V | - | 87% | - | |
| Vo=2.5 V | - | 91% | - | |
| Vo=3.3 V | - | 92% | - | |
| Switching Frequency | - | 600 kHz | - | |
| Output Voltage Trim Range | 0.8 V | - | 3.63 V | |
| Over Temperature Shutdown | - | 130 °C | - | |
| Remote Sense Compensation | - | - | 0.5 V | |
| MTBF | TBD | | | Calculated Per Bell Core SR-332 ($I_O$ = Nominal; $T_a$ = 25 °C) |
| Dimensions | | | | |
| Inches (L × W × H) | 2.0 x 0.50 x 0.433 | | | |
| Millimeters (L × W × H) | 50.80 x 12.70 x 11.0 | | | |
| Weight | - | TBD | - | |

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

## Control Specifications

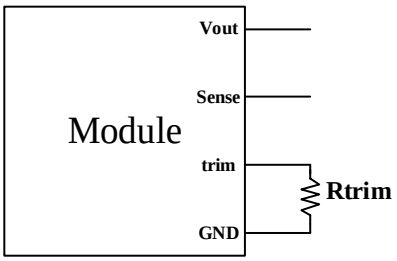
| Parameter | | Min | Typ | Max | Notes |
|---|---|---|---|---|---|
| **Remote On/Off** | | | | | |
| Signal Low (Unit Off) | | -0.3 V | - | 0.8 V | Remote on/off pin open, unit on |
| Signal High (Unit On) | | 2.8 V | - | Vin, max | |

## Output Trim Equations

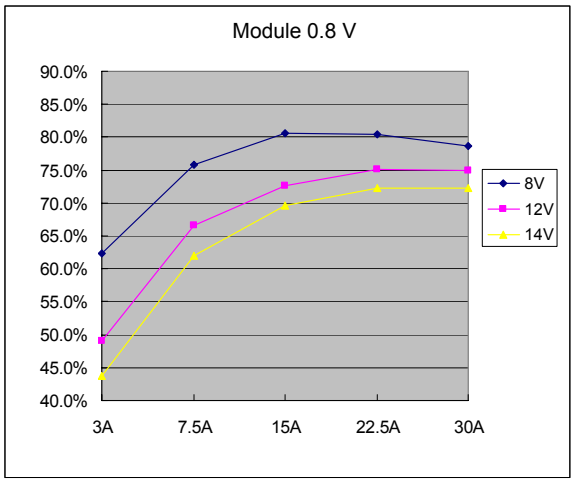
Equations for calculating the trim resistor are shown below (Unit: Ω). The Trim resistor should be connected between the Trim pin and Ground pin.

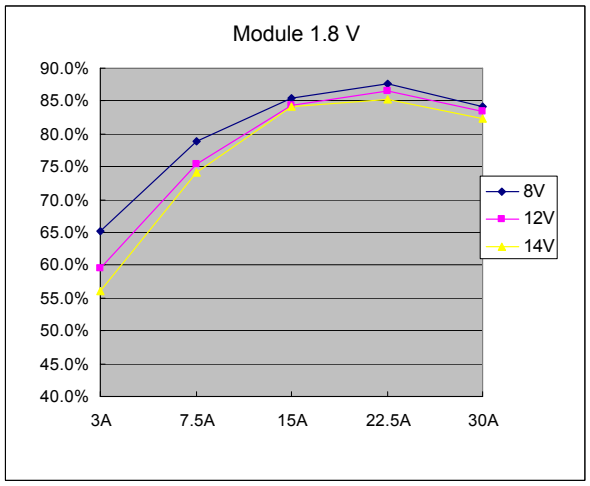
$$R\,trim = \left[ \frac{9680}{Vo - 0.8} - 715 \right]$$

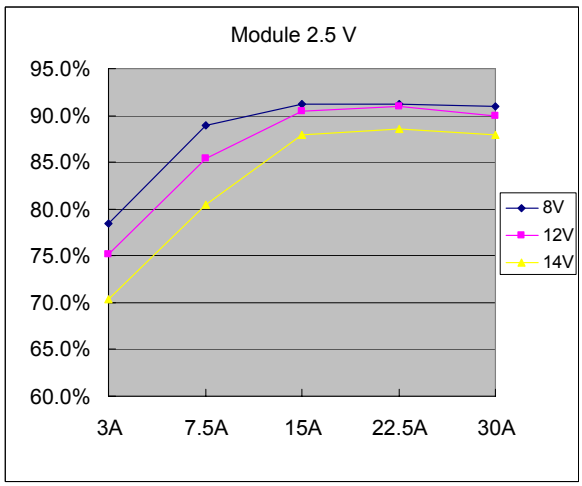
Vo is the desired output voltage

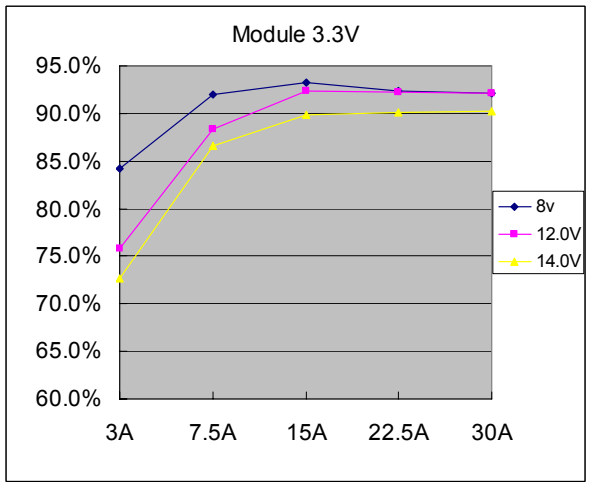



## Efficiency Data



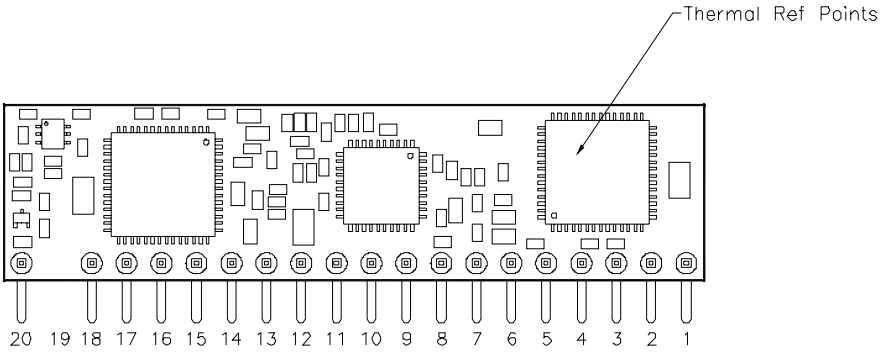



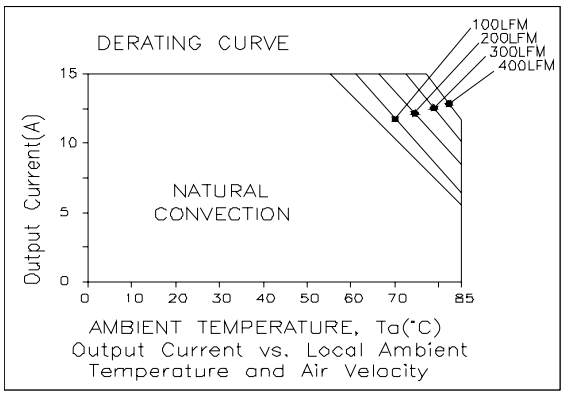



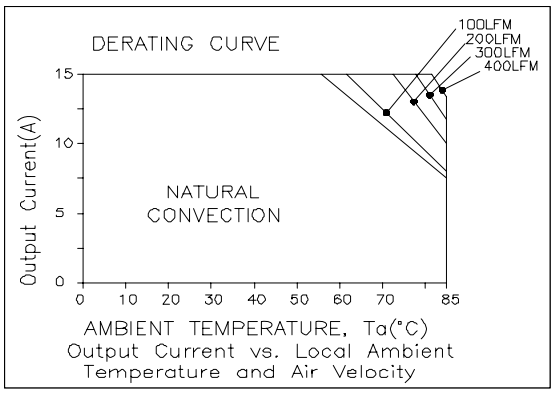
## Thermal Derating Curves

The maximum acceptable temperature measured at the thermal ref points is 110 deg, the thermal ref point is shown in Figure. All the derating curves were tested with two electronic loads connected in parallel.

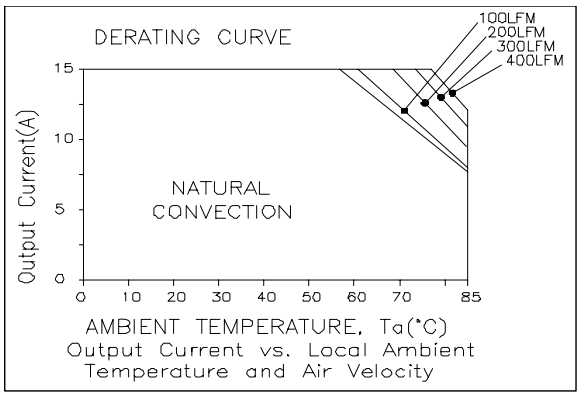


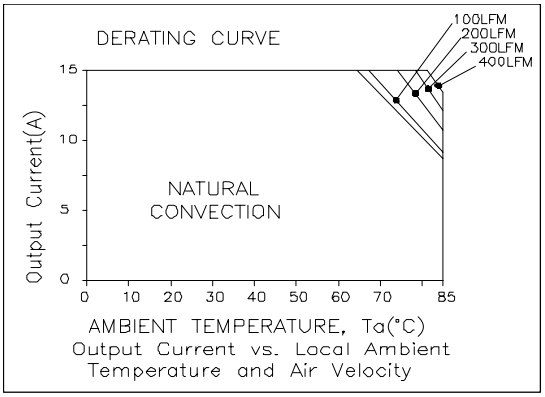

Vin=12 V, Vo=3.3 V




Vin=12 V,Vo=2.5 V

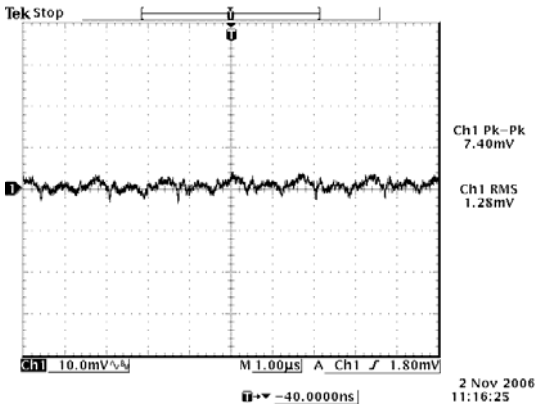



Vin=12 V, Vo=1.8 V

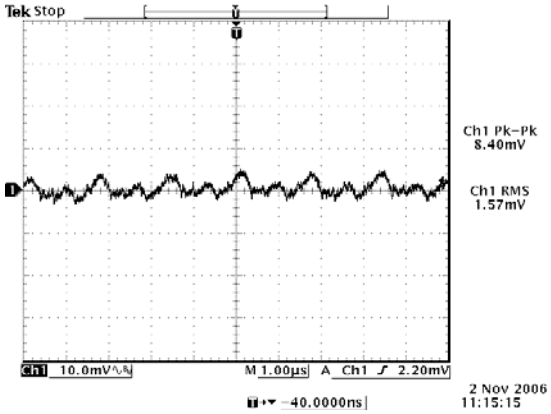



Vin=12 V, Vo=0.8 V

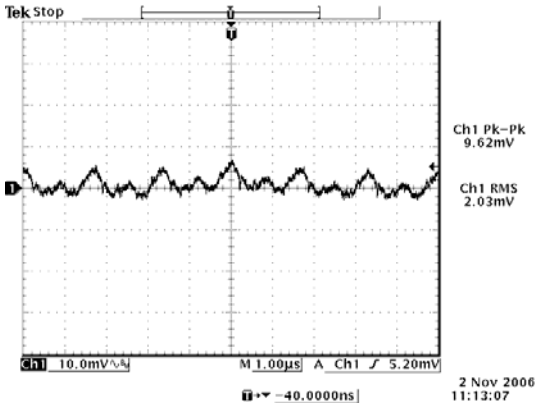
## Ripple and Noise Waveforms



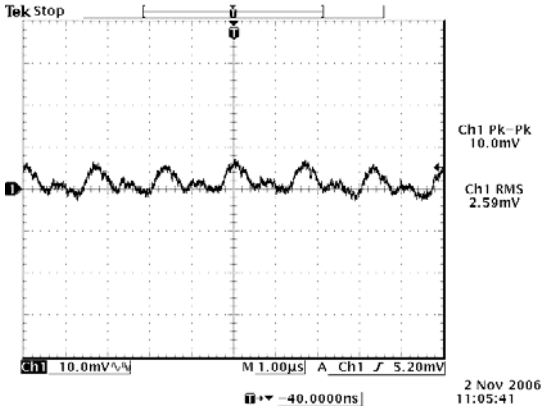

12 Vdc input, 0.8 Vdc output




12 Vdc input, 1.8 Vdc output



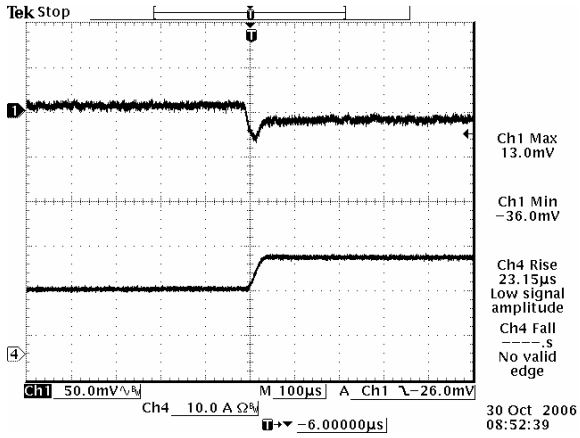

12 Vdc input, 2.5 Vdc output



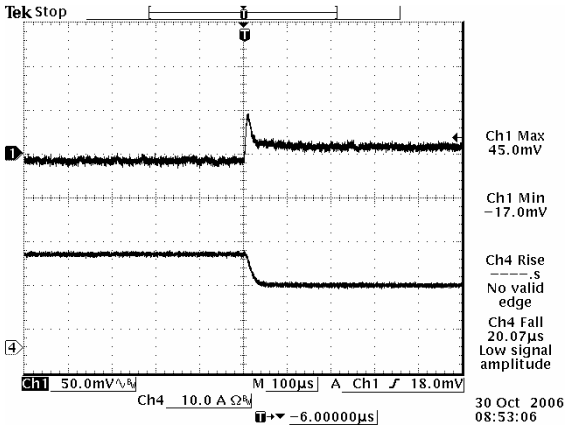

12 Vdc input, 3.3 Vdc output

**Note:** Ripple and noise at full load, external load with 150 uF tantalum cap and 20 uF ceramic at the output, and Ta=25 deg C.

## Transient Response Waveforms

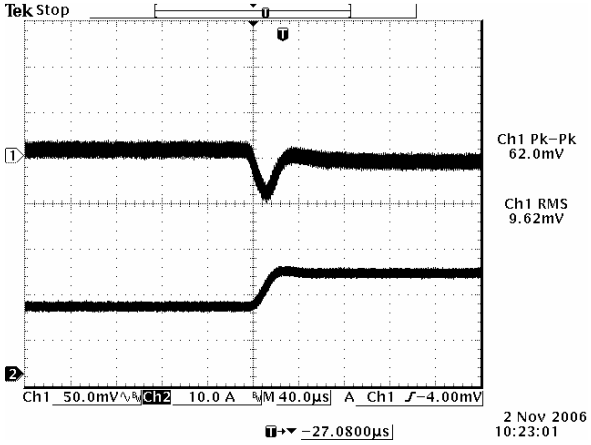



50% to 75% load Transient at 0.8 Vdc output

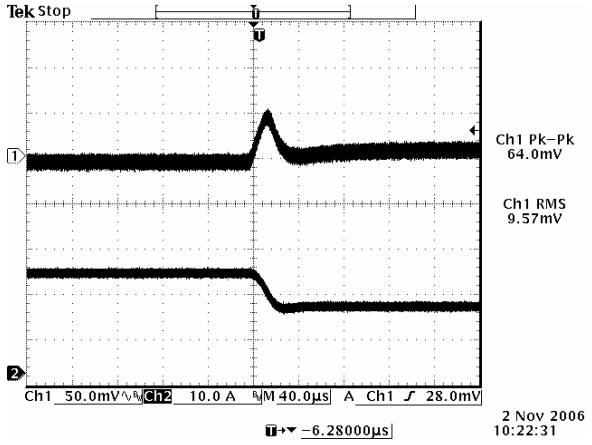



75% to 50% load Transient at0.8 Vdc output

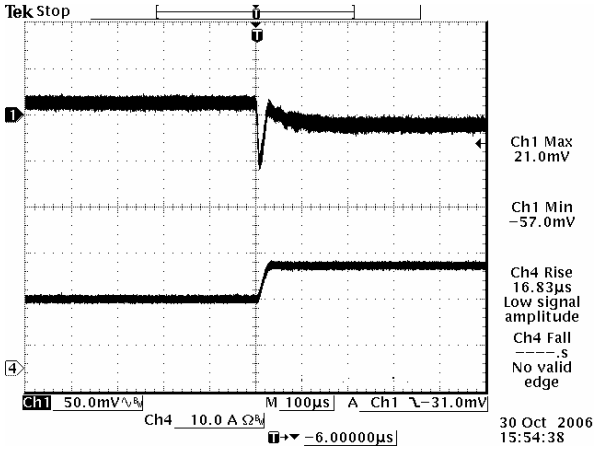
## Transient Response Waveforms (continued)



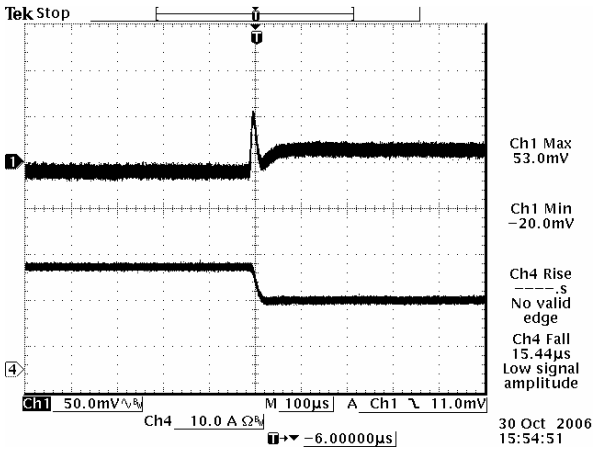

50% to 75% load Transient at 1.8 Vdc output



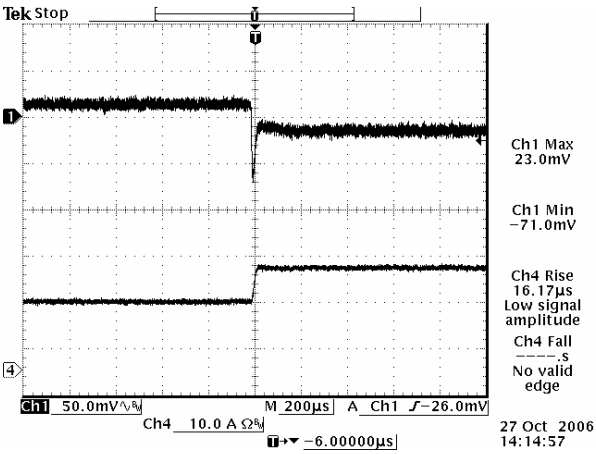

75% to 50% load Transient at 1.8 Vdc output



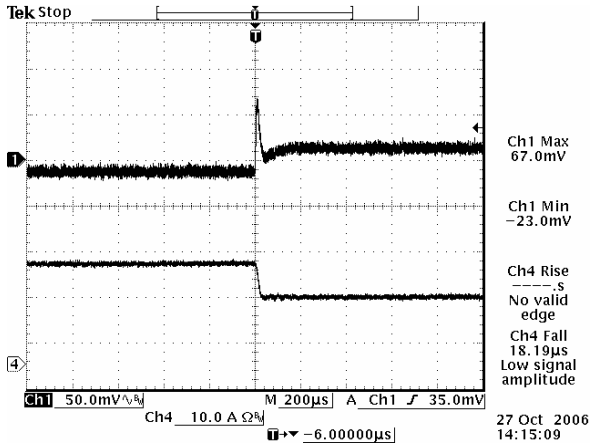

50% to 75% load Transient at 2.5 Vdc output




75% to 50% load Transient at 2.5 Vdc output




50% to 75% load Transient at 3.3 Vdc output



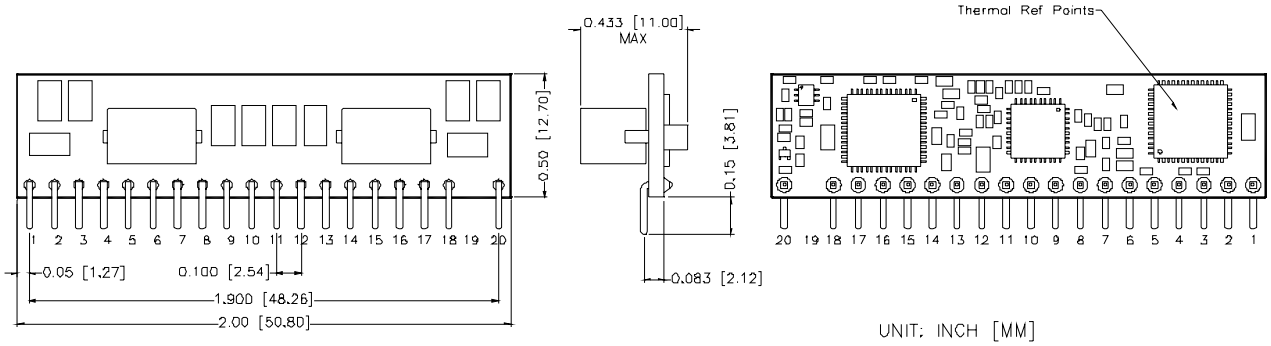

75% to 50% load Transient at 3.3 Vdc output

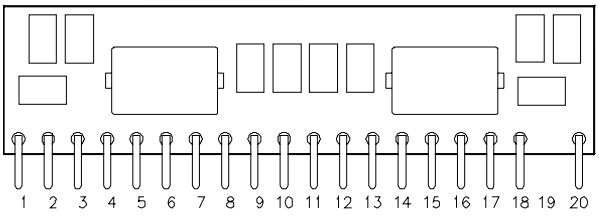
**Note**: Transient response at 12 Vdc input, di/dt=0.5 A/uS, with a 20 µF ceramic capacitor and a 150 uF tantalum capacitor at the output, Ta=25 deg C.

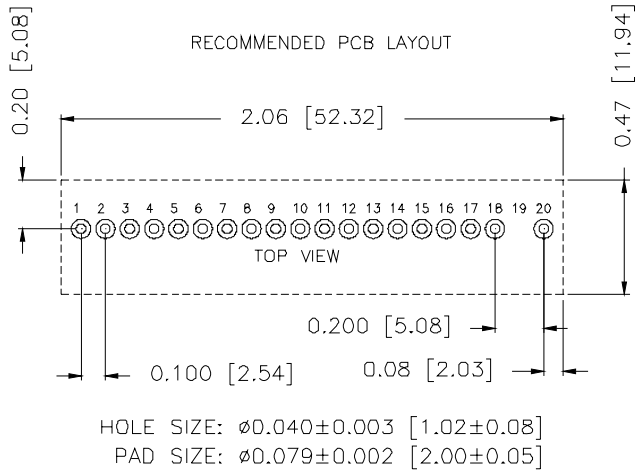
# NON-ISOLATED DC/DC CONVERTERS

**8 Vdc - 14 Vdc Input  0.8 Vdc - 3.63 Vdc / 30 A Outputs**

## Mechanical Outline




## Pin Connections

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Vin | 11 | Vout |
| 2 | Vin | 12 | Vout |
| 3 | Ground | 13 | Remote On/Off |
| 4 | Ground | 14 | Ground |
| 5 | Trim | 15 | Ground |
| 6 | Remote Sense+ | 16 | Ground |
| 7 | Ground | 17 | Ground |
| 8 | Ground | 18 | Vin |
| 9 | Vout | 19 | N/C |
| 10 | Vout | 20 | Vin |

## 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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