

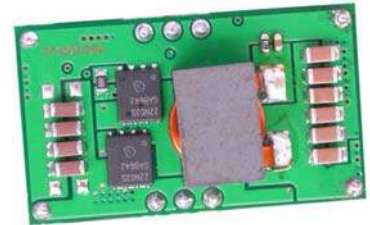
Non-ISOLATED DC/DC CONVERTERS

5.0 Vdc Input, 0.8 Vdc - 3.6 Vdc/22 A Output

bel
POWER PRODUCTS

ORLB-22B1A0 RoHS Compliant PRELIMINARY Rev.A

- Non-Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Wide Trim Range
- Margen Up/Down
- Remote On/Off
- Input Under Voltage Lockout
- SCP/OCP
- Auto-Track Sequencing
- Over Temperature Protection



Description

The Bel ORLB-22B1A0 modules are a series of non-isolated dc/dc converters that can deliver up to 22 A of output current with full load efficiency of 93% at 3.3 Vdc output. These modules provide precisely regulated voltage programmable via external resistor from 0.8 Vdc to 3.6 Vdc. This modules has a sequencing feature. Their open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote On/Off, programmable output voltage, over current protection, over-temperature protection, and margin up/down controls.

Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Model Number |
|-------------------|-------------------|---------------------|-------------------|--------------------|--------------|
| 0.8 Vdc - 3.6 Vdc | 4.5 Vdc - 5.5 Vdc | 22 A | 79 W | 95% | ORLB-22B1A0 |

- Notes:** 1. Add "G" suffix at the end of the model number to indicate Tray 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 | - | 5.5 V | |
| Remote On/Off (Active High) | -0.3 V | - | Vin+0.3 V | |
| Ambient Temperature | -40 °C | - | 85 °C | |
| Storage Temperature | -55 °C | - | 125 °C | |

Note: The module includes an Auto-Track sequencing feature. This is accomplished via an additional sequencing pin. When not used sequencing feature, tie the SEQ pin to Vin.

Input Specifications

| Parameter | Min | Typ | Max | Notes |
|--------------------------|-------|-------|-------|-------|
| Input Voltage | 4.5 V | 5.0 V | 5.5 V | |
| Input Current | | | | |
| Vo=3.3 V | - | - | 18 A | |
| Vo=2.5 V | - | - | 14 A | |
| Vo=1.8 V | - | - | 11 A | |
| Vo=1.5 V | - | - | 9 A | |
| Vo=1.2 V | - | - | 8 A | |
| Vo=1.0 V | - | - | 7 A | |
| Input Current (no load) | - | 65 mA | 80 mA | |
| Remote Off Input Current | - | 8 mA | 15 mA | |

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Input Specifications

| Parameter | Min | Typ | Max | Notes |
|---|-------|--------|-----------------------|---|
| Input Reflected Ripple Current (rms) | - | 60 mA | 100 mA | With simulated source impedance of 1uH, 5Hz to 20MHz and a 1000uF/16V external input electrolytic caps. |
| Input Reflected Ripple Current (pk-pk) | - | 200 mA | 300 mA | |
| I ² t Inrush Current Transient | - | - | 0.01 A ² s | |
| Turn-on Input Voltage | 4.1 V | 4.3 V | 4.5 V | |
| Turn-off Input Voltage | 3.1 V | 3.7 V | 4.2 V | |

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

Output Specifications

| Parameter | Min | Typ | Max | Notes |
|--|--------------|--------|--------------------|---|
| Output Voltage Set Point Accuracy | -2%Vo, set | - | 2%Vo, set | Vin=5 V, Io=Iomax |
| Output Voltage Set Point | -3%Vo, set | - | 3%Vo, set | Over all operating input voltage, resistive load, and temperature conditions |
| Line Regulation | -0.3%Vo, set | - | 0.3%Vo, set | |
| Load Regulation | -0.3%Vo, set | - | 0.3%Vo, set | |
| Temperature Regulation (-40 °C to +85 °C) | -1%Vo, set | - | 1%Vo, set | |
| Ripple and Noise (rms) | - | 10 mV | 20 mV | 0-20 MHz BW, with external 10 uF/10 V Tan cap, 1uF/10 V TDK ceramic cap at the output. |
| Ripple and Noise (pk-pk) | - | 25 mV | 40 mV | |
| Output Current | 0 A | - | 22 A | |
| Current Limit Threshold | 25 A | 32 A | 40 A | |
| Short Circuit Surge Transient | - | - | 1 A ² s | |
| Turn on Time | - | 6 mS | 10 mS | |
| Overshoot at Turn On | - | 0% | 3% | |
| Output Capacitance Ceramic Non-ceramic | 0 uF 0 uF | - - | 300 uF 11000 uF | External load capacitance is the calculated maximum. The minimum ESR limitation will often result in a lower value. |

Transient Response

| | | | | | | |
|------------------------|---------------|--------|---|--------|--------|---|
| 50% ~ 100% Max Load | Overshoot | Vo=All | - | 120 mV | 200 mV | di/dt=1 A/us, Vin=5 Vdc, Ta=25°C, and with 330 uF/6.3 V Tan Cap and 1uF/10 V ceramic cap at the output. |
| | Settling Time | | - | 20 uS | 50 uS | |
| 100% ~ 50% Max Load | Overshoot | | - | 120 mV | 200 mV | |
| | Settling Time | | - | 20 uS | 50 uS | |

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

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General Specifications

| Parameter | Min | Typ | Max | Notes | |
|---------------------------|-------------------------|----------------------|-----------|---|------------------------------|
| Efficiency | Vo=3.3 V | 92% | 95% | - | Measured at Vin=5 V, Io=14 A |
| | Vo=2.5 V | 91% | 94% | - | |
| | Vo=1.8 V | 88% | 91% | - | |
| | Vo=1.5 V | 87% | 90% | - | |
| | Vo=1.2 V | 85% | 88% | - | |
| | Vo=1.0 V | 83% | 86% | - | |
| Switching Frequency | 275 kHz | 300 kHz | 325 kHz | | |
| Margin Up/Down Adjust | -5%Vo, set | - | 5%Vo, set | | |
| Output Voltage Trim Range | 0.8 V | - | 3.6 V | | |
| Over Temperature Shutdown | - | 125 °C | - | | |
| MTBF | TBD | | | Calculated Per Bell Core SR-332 (Io = 80% Io max; Ta = 25 °C) | |
| Dimensions | Inches (L x W x H) | 1.495 x 0.87 x 0.354 | | | |
| | Millimeters (L x W x H) | 37.97 x 22.1 x 8.99 | | | |
| Weight | - | 7 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 Off) | -0.2 V | - | 0.8 V | The remote On/Off pin open, Unit On. |
| Signal High (Unit On) | 1.5 V | - | Vin-0.5 V | |
| Voltage Sequencing | | | | |
| Sequencing Voltage | -0.3 V | - | Vin+0.3 V | |
| Sequencing Slew Rate Capability | - | - | 1 V/msec | |
| Sequencing Delay time | 20 msec | - | - | Delay from Vin,min to application of voltage on SEQ pin |
| Tracking Accuracy | Power-Up | - | 100 mV | 200 mV |
| | Power-Down | - | 200 mV | 400 mV |

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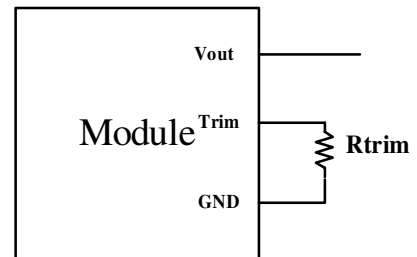


Output Trim Equations

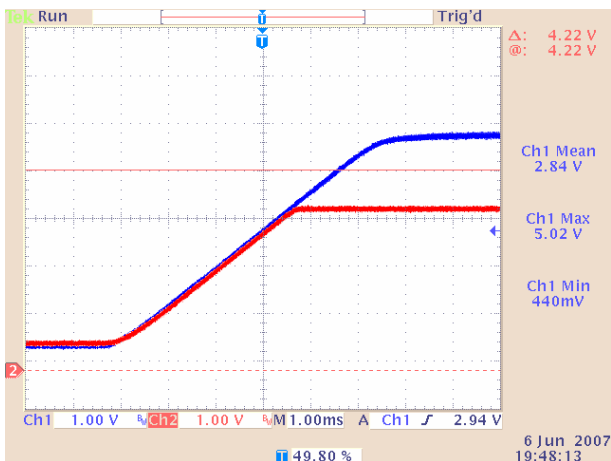
Equations for calculating the trim resistor (in kΩ) is shown below. Rtrim is the required resistance between TRIM and GND, Vadj_up is the desired output voltage.

$$R_{trimup}(V_{adj_up}) := \left(\frac{8}{V_{adj_up} - 0.8} - 2.49 \right)$$

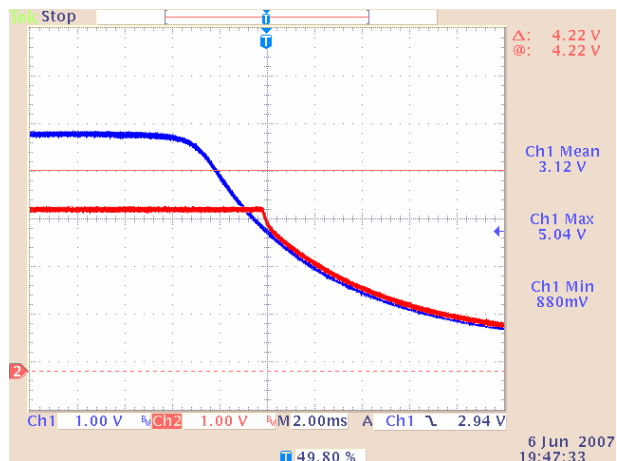
| Vadj_up (V) | Rtrim (KΩ) |
|-------------|------------|
| 0.8 | Open |
| 1 | 36.5 |
| 1.2 | 17.4 |
| 1.5 | 8.87 |
| 1.8 | 5.49 |
| 2.5 | 2.21 |
| 3.3 | 0.698 |



Auto-Track Sequencing



5 Vdc input, 3.3 Vdc output



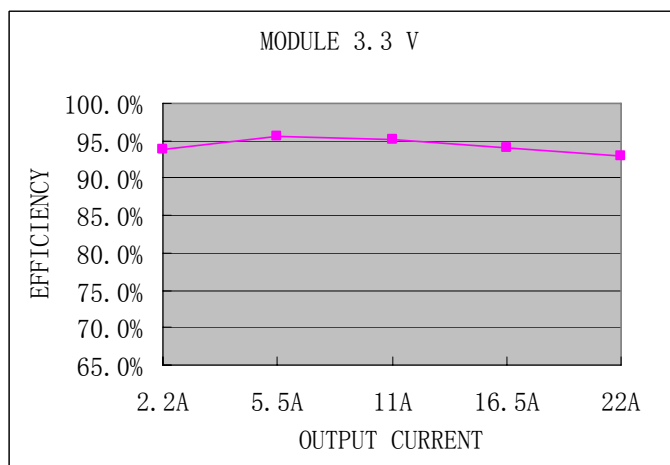
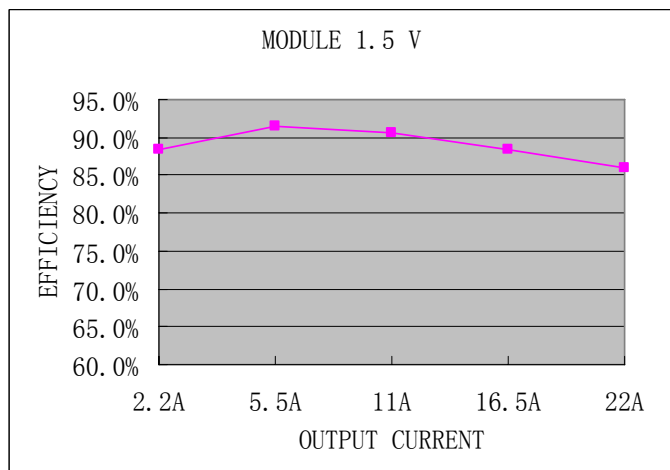
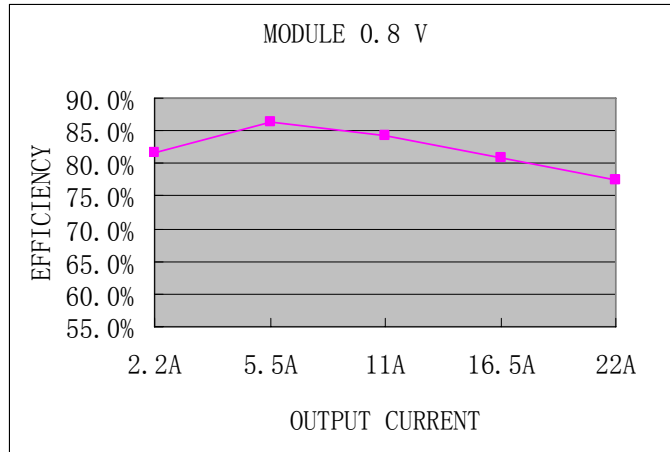
5 Vdc input, 3.3 Vdc output

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5.0 Vdc Input, 0.8 Vdc - 3.6 Vdc/22 A Output



Efficiency Data

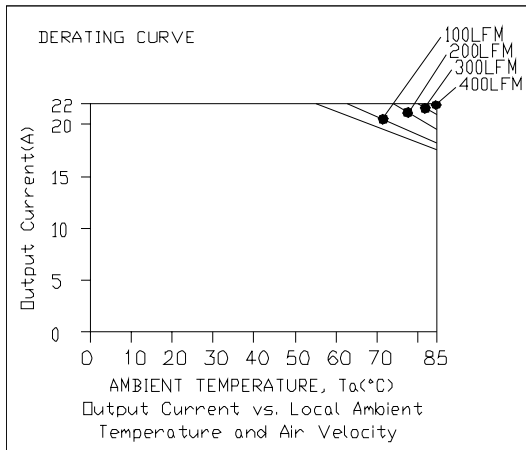


Non-ISOLATED DC/DC CONVERTERS

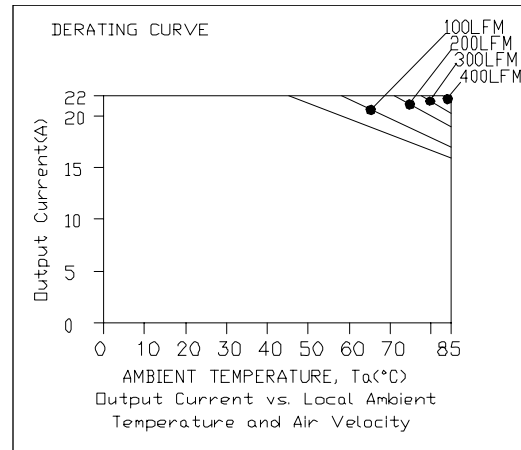
5.0 Vdc Input, 0.8 Vdc - 3.6 Vdc/22 A Output



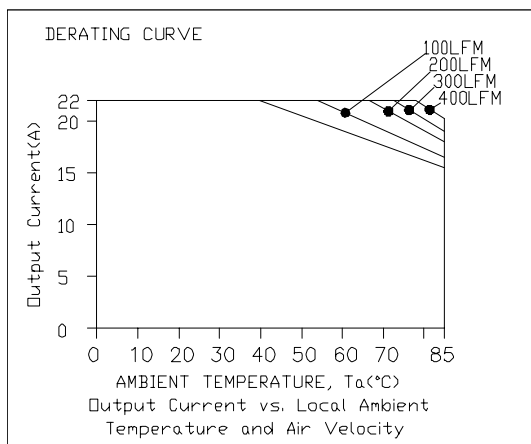
Thermal Derating Curves



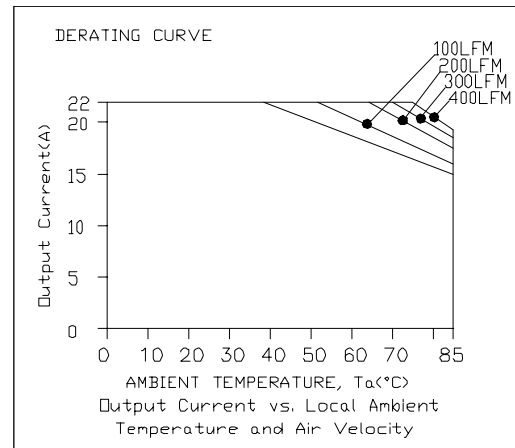
$V_o=0.8\text{ V}$



$V_o=1.5\text{ V}$



$V_o=2.5\text{ V}$



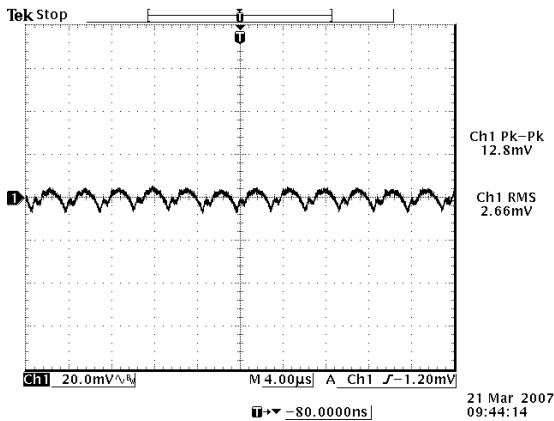
$V_o=3.3\text{ V}$

Non-ISOLATED DC/DC CONVERTERS

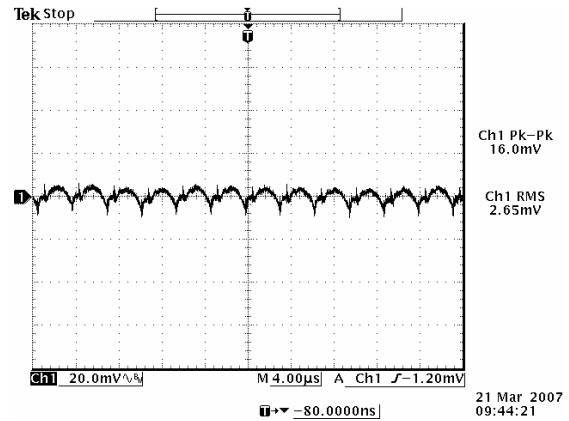
5.0 Vdc Input, 0.8 Vdc - 3.6 Vdc/22 A Output



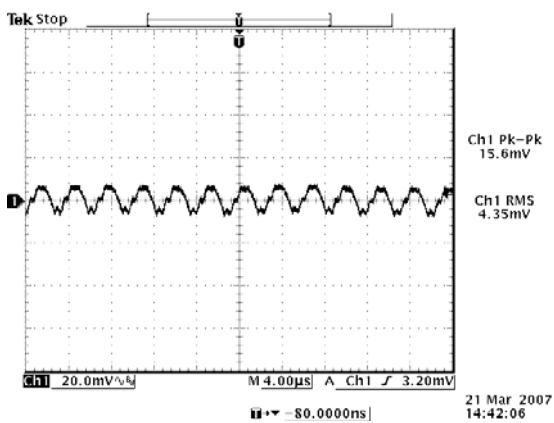
Ripple and Noise Waveform



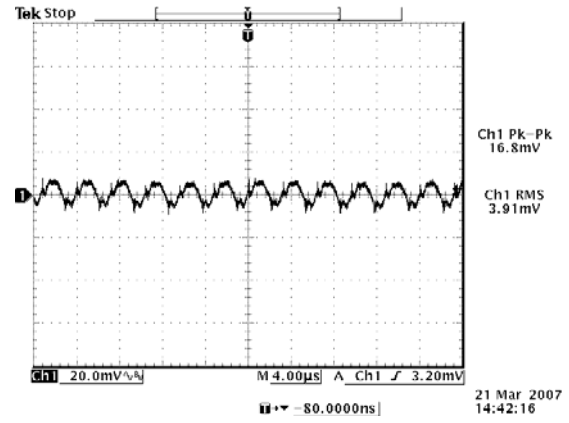
Ripple and noise at no load, 0.8 V output



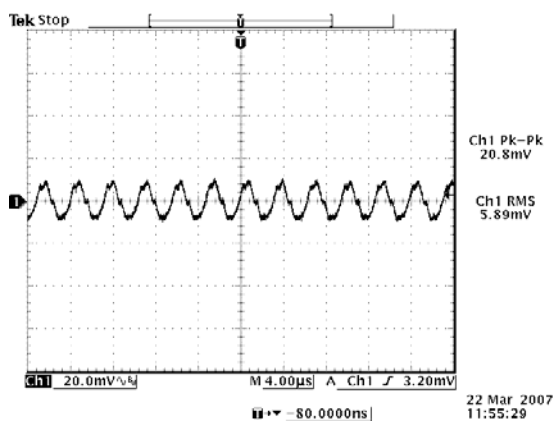
Ripple and noise at full load, 0.8 V output



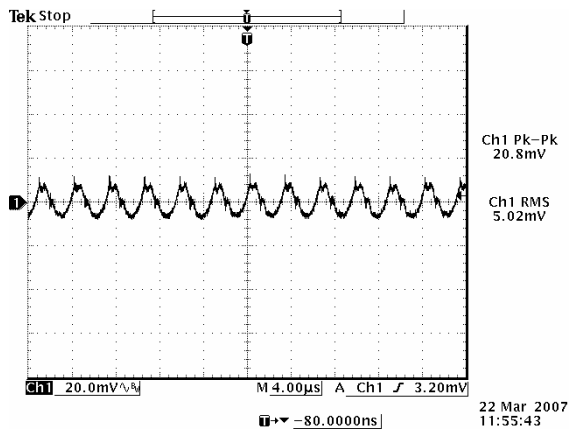
Ripple and noise at no load, 1.5 V output



Ripple and noise at full load, 1.5 V output



Ripple and noise at no load, 3.3 V output



Ripple and noise at full load, 3.3 V output

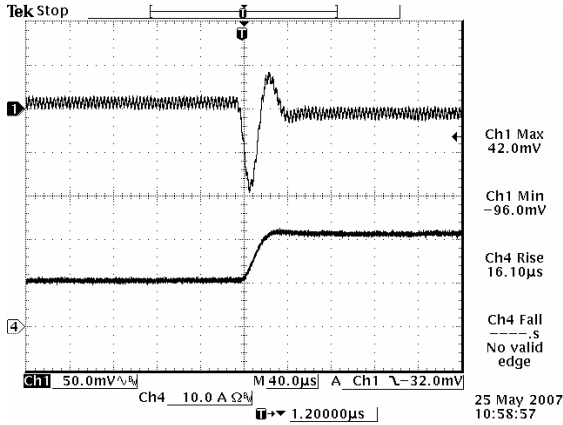
Note: Ripple and noise at 5 V input, 0-20MHz BW, with 10 uF/10 V Tan Cap and 1uF/10 V ceramic cap at the output, Ta=25 deg C.

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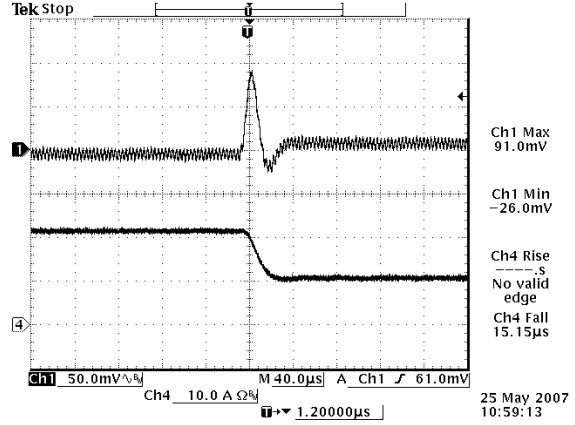
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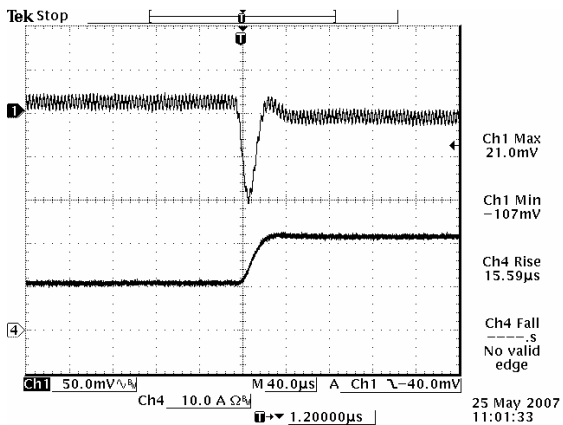
Transient Response Waveforms



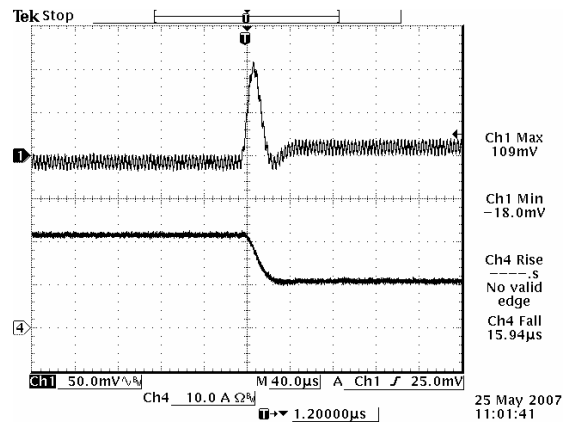
Vout=1.5 V 50% - 100% Load Transients



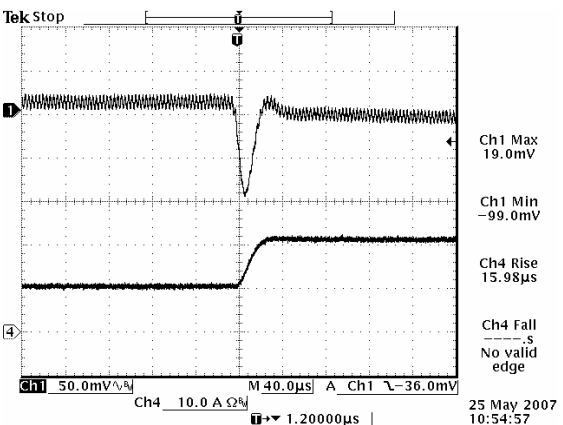
Vout=1.5 V 100% - 50% Load Transients



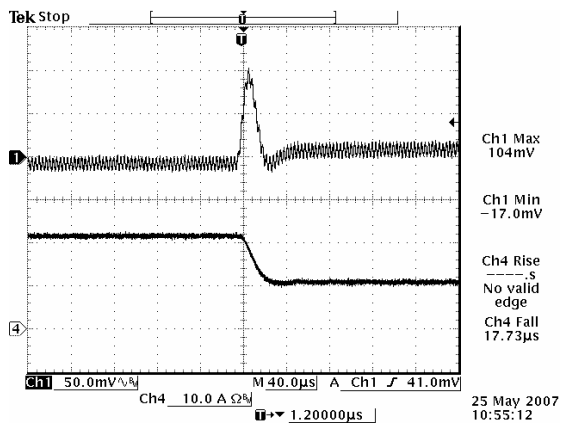
Vout=2.5 V 50% - 100% Load Transients



Vout=2.5 V 100% - 50% Load Transients



Vout=2.5 V 50% - 100% Load Transients



Vout=2.5 V 100% - 50% Load Transients

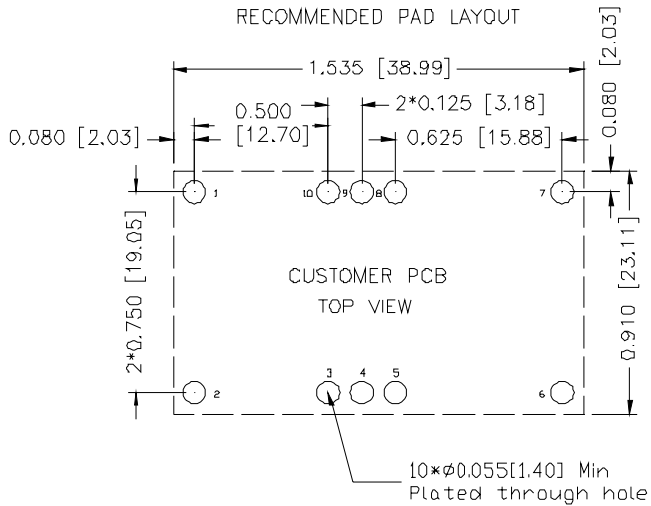
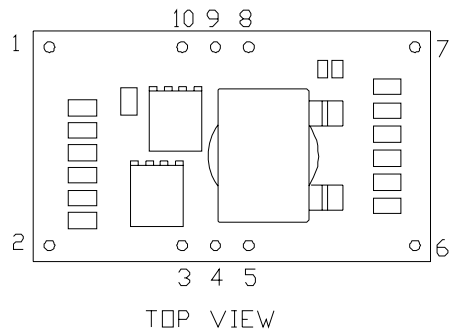
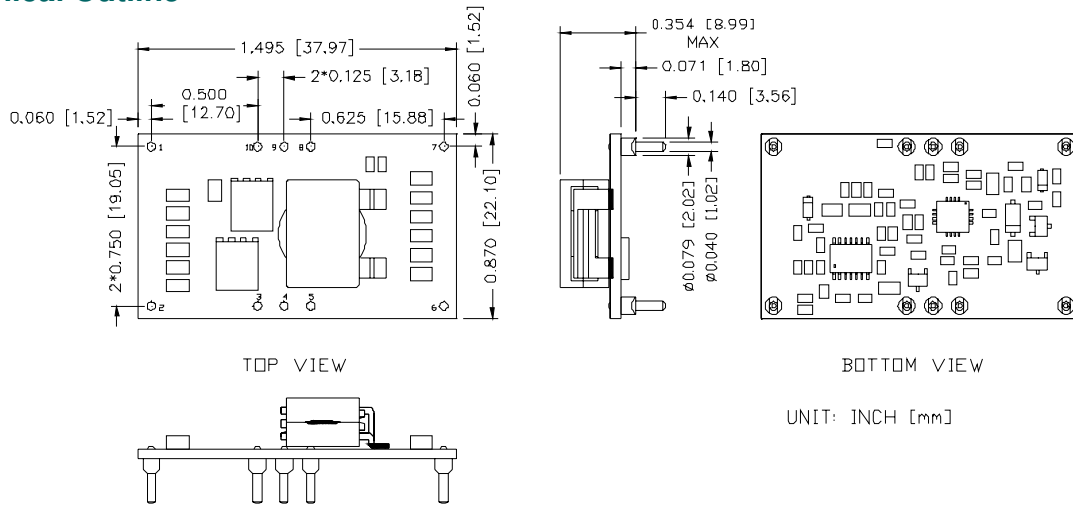
Note: Transient response at $di/dt=1$ A/uS, with 330 uF/6.3V Tantalum Cap and 1uF/10 V Ceramic Cap at the output and $T_a=25$ deg C.

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Mechanical Outline



Pin Connections

| Pin | Function | Pin | Function |
|-----|----------|-----|-------------|
| 1 | GND | 6 | Vout |
| 2 | Vin | 7 | GND |
| 3 | Remote | 8 | Track |
| 4 | Trim | 9 | Margen Down |
| 5 | Vo sence | 10 | Margen Up |

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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