

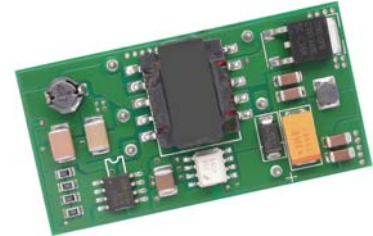
## ISOLATED DC/DC CONVERTERS

48 Vdc Input, 3.3 Vdc/2 A, 5 Vdc/2 A, 12 Vdc/1 A, 24 Vdc/0.5 A Output

**bel**  
POWER PRODUCTS

### 0RLC-10Txxx Series RoHS Compliant Rev.A

- Isolated
- Fixed Frequency
- High Power Density
- High Efficiency
- Output Over-Voltage Shutdown
- Safety Approval to UL60950-1 (Pending)
- Low Cost
- Trim
- OCP/SCP
- Remote On/Off
- Active Low/High (Option)



### Description

The 0RLC-10T Series are isolated dc/dc converters that operate from a nominal 48 Vdc source. These units will provide up to 12 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 and short circuit protection. 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 High | Model Number Active Low |
|----------------|-----------------|---------------------|-------------------|--------------------|--------------------------|-------------------------|
| 3.3 Vdc        | 36 Vdc - 75 Vdc | 2 A                 | 6.6 W             | 77%                | 0RLC-10T033              | 0RLC-10T03L             |
| 5.0 Vdc        | 36 Vdc - 75 Vdc | 2 A                 | 10 W              | 82%                | 0RLC-10T050              | 0RLC-10T05L             |
| 12 Vdc         | 36 Vdc - 75 Vdc | 1 A                 | 12 W              | 83%                | 0RLC-10T120              | 0RLC-10T12L             |
| 24 Vdc         | 36 Vdc - 75 Vdc | 0.5 A               | 12 W              | 85%                | 0RLC-10T240              | 0RLC-10T24L             |

- 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                                    |
|-----------------------------|--------|-----|--------|--|
| Continuous Input Voltage    | -0.3 V | -   | 75 V   |  |
| Peak/Surge Input Voltage    | -0.3 V | -   | 100 V  | Transients of 100 ms or less in duration |
| Remote On/Off (Active Low)  | -0.3 V | -   | 18 V   |  |
| Remote On/Off (Active High) | -0.3 V | -   | 7 V    |  |
| Ambient Temperature         | 0 °C   | -   | 70 °C  |  |
| Storage Temperature         | -40 °C | -   | 125 °C |  |

### Input Specifications

| Parameter                                 | Min  | Typ                    | Max                    | Notes  |
|---|------|------------------------|------------------------|--|
| Input Voltage                             | 36 V | -                      | 75 V                   |  |
| Input Current (no load)                   | -    | -                      | 40 mA                  |  |
| Input Current (full load)                 | -    | -                      | 0.45 A                 |  |
| Remote Off Input Current (Active Low)     | -    | 5 mA                   | 10 mA                  |  |
| Remote Off Input Current (Active High)    | -    | -                      | 10 mA                  |  |
| Input Reflected Ripple Current (pk-pk)    | -    | 15 mA                  | 30 mA                  | With simulated source impedance of 10 uH, 5 Hz to 20 MHz; use a 47uF/100 V electrolytic capacitor with ESR = 1 ohm max. at 200 kHz at 25 °C. |
| Input Reflected Ripple Current (rms)      | -    | 5 mA                   | 10 mA                  |  |
| I <sup>2</sup> t Inrush Current Transient | -    | 0.039 A <sup>2</sup> s | 0.062 A <sup>2</sup> s |  |
| Turn-on Voltage Threshold                 | -    | 30 V                   | -                      |  |

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

## ISOLATED DC/DC CONVERTERS

48 Vdc Input, 3.3 Vdc/2 A, 5 Vdc/2 A, 12 Vdc/1 A, 24 Vdc/0.5 A Output



### Output Specifications

| Parameter                                      | Min     | Typ     | Max     | Notes  |
|--|---------|---------|---------|--|
| Output Voltage Set Point                       |         |         |         | Vin=48 V for all outputs                                 |
| Vo=3.3 V                                       | 3.201 V | 3.30 V  | 3.399 V |  |
| Vo=5.0 V                                       | 4.850 V | 5.00 V  | 5.150 V |  |
| Vo=12 V  | 11.64 V | 12.00 V | 12.36 V |  |
|  | Vo=24 V | 23.28 V | 24.00 V | 24.72 V  |
| Line Regulation                                |         |         |         |  |
| Vo=3.3 V                                       | -       | 5 mV    | 10 mV   |  |
| Vo=5.0 V                                       | -       | 10 mV   | 15 mV   |  |
| Vo=12 V  | -       | 20 mV   | 36 mV   |  |
| Vo=24 V  | -       | 35 mV   | 48 mV   |  |
| Load Regulation                                |         |         |         |  |
| Vo=3.3 V                                       | -       | 10 mV   | 15 mV   |  |
| Vo=5.0 V                                       | -       | 15 mV   | 25 mV   |  |
| Vo=12 V  | -       | 36 mV   | 60 mV   |  |
| Vo=24 V  | -       | 48 mV   | 80 mV   |  |
| Regulation Over Temperature<br>(0 °C to 70 °C) | -       | 75 mV   | 150mV   |  |
| Output Current                                 |         |         |         |  |
| Vo=3.3 V                                       | 0.2 A   | -       | 2.0 A   |  |
| Vo=5.0 V                                       | 0.2 A   | -       | 2.0 A   |  |
| Vo=12 V  | 0.1 A   | -       | 1.0 A   |  |
| Vo=24 V  | 0.05 A  | -       | 0.5 A   |  |
| Current Limit Threshold                        |         |         |         |  |
| Vo=3.3 V                                       | -       | 3.0 A   | -       |  |
| Vo=5.0 V                                       | -       | 3.0 A   | -       |  |
| Vo=12 V  | -       | 1.5 A   | -       |  |
| Vo=24 V  | -       | 0.75 A  | -       |  |
| Short Circuit Surge Transient                  | -       | TBD     | -       | A <sup>2</sup> s   |
| Ripple and Noise (rms)                         |         |         |         | 0 - 20 MHz BW ,<br>with 1 uF ceramic load<br>capacitance |
| Vo=3.3 V                                       | -       | 10 mV   | 15 mV   |  |
| Vo=5.0 V                                       | -       | 18 mV   | 30 mV   |  |
| Vo=12 V  | -       | 21 mV   | 40 mV   |  |
|  | Vo=24 V | -       | 45 mV   | 70 mV  |
| Ripple and Noise (pk-pk)                       |         |         |         |  |
| Vo=3.3 V                                       | -       | 40 mV   | 60 mV   |  |
| Vo=5.0 V                                       | -       | 60 mV   | 100 mV  |  |
| Vo=12 V  | -       | 80 mV   | 120 mV  |  |
| Vo=24 V  | -       | 120 mV  | 180 mV  |  |
| Turn on Time                                   |         |         |         |  |
| Power On                                       | -       | -       | 200 mS  |  |
| Remote On                                      | 0.5 mS  | -       | 40 mS   |  |
| Overshoot at Turn on                           | -       | 0%      | 3%      |  |
| Output Capacitance                             |         |         |         |  |
| Vo=3.3 V                                       | 0 uF    | -       | 800 uF  |  |
| Vo=5.0 V                                       | 0 uF    | -       | 800 uF  |  |
| Vo=12 V  | 0 uF    | -       | 100 uF  |  |
| Vo=24 V  | 0 uF    | -       | 20 uF   |  |

## ISOLATED DC/DC CONVERTERS

48 Vdc Input, 3.3 Vdc/2 A, 5 Vdc/2 A, 12 Vdc/1 A, 24 Vdc/0.5 A Output



### Output Specifications (continued)

| Parameter                 |               | Min      | Typ      | Max    | Notes  |   |        |
|---------------------------|---------------|----------|----------|--------|--------|---|--------|
| <b>Transient Response</b> |               |          |          |        |        |   |        |
| 50% ~ 100%<br>Max Load    | Overshoot     | Vo=3.3 V | -        | 100 mV | 150 mV | di/dt = 0.1 A/uS; Vin = 48 V; Ta = 25 °C and 1 uF ceramic capacitor |        |
|                           | Settling Time |          | -        | 200 uS | 300 uS |   |        |
| 100% ~ 50%<br>Max Load    | Overshoot     |          | -        | 100 mV | 150 mV |   |        |
|                           | Settling Time |          | -        | 200 uS | 300 uS |   |        |
| 50% ~ 100%<br>Max Load    | Overshoot     |          | Vo=5.0 V | -      | 100 mV |   | 150 mV |
|                           | Settling Time |          |          | -      | 100 uS |   | 150 uS |
| 100% ~ 50%<br>Max Load    | Overshoot     | -        |          | 100 mV | 150 mV |   |        |
|                           | Settling Time | -        |          | 100 uS | 150 uS |   |        |
| 50% ~ 100%<br>Max Load    | Overshoot     | Vo=12 V  |          | -      | 150 mV |   | 250 mV |
|                           | Settling Time |          |          | -      | 150 uS |   | 200 uS |
| 100% ~ 50%<br>Max Load    | Overshoot     |          | -        | 150 mV | 250 mV |   |        |
|                           | Settling Time |          | -        | 150 uS | 200 uS |   |        |
| 50% ~ 100%<br>Max Load    | Overshoot     |          | Vo=24 V  | -      | 350 mV | 500 mV  |        |
|                           | Settling Time |          |          | -      | 200 uS | 250 uS  |        |
| 100% ~ 50%<br>Max Load    | Overshoot     | -        |          | 350 mV | 500 mV |   |        |
|                           | Settling Time | -        |          | 200 uS | 250 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=3.3 V                | 73%                   | 77%     | -  |
|                     | Vo=5.0 V                | 78%                   | 82%     | -  |
|                     | Vo=12 V                 | 79%                   | 83%     | -  |
|                     | Vo=24 V                 | 81%                   | 85%     | -  |
| Switching Frequency | 200 kHz                 | 250 kHz               | 300 kHz |  |
| Output Trim Range   | 95%Vo                   | -                     | 105%Vo  | For all outputs  |
| MTBF                | TBD                     |                       |         | Calculated Per Bell Core SR-332 (Io = Nomal; Ta = 25 °C) |
| Dimensions          |                         |                       |         |  |
|                     | Inches (L x W x H)      | 1.91 x 0.98 x 0.477   |         |  |
|                     | Millimeters (L x W x H) | 48.51 x 24.89 x 12.12 |         |  |
| Weight              | -                       | 10.3 g                | -       |  |

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

### Control Specifications

| Parameter              | Min         | Typ    | Max | Notes |
|------------------------|-------------|--------|-----|-------|
| <b>Remote On/Off</b>   |             |        |     |       |
| Signal Low (Unit On)   | Active Low  | -0.3 V | -   | 0.8 V |
| Signal High (Unit Off) |             | 3.5 V  | -   | 18 V  |
| Signal Low (Unit Off)  | Active High | -0.3 V | -   | 0.8 V |
| Signal High (Unit On)  |             | 3.5 V  | -   | 7 V   |

The remote on/off pin open, Unit On.

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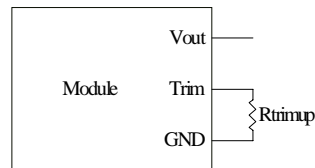
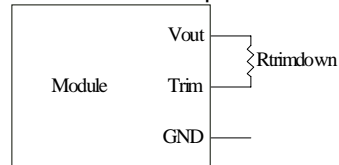


## Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage ( $V_{adj}$ ) and the nominal output voltage of the converter ( $V_{nom}$ ) are shown below. The Trim Down resistor should be connected between the Trim pin and  $V_{out}$ . The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

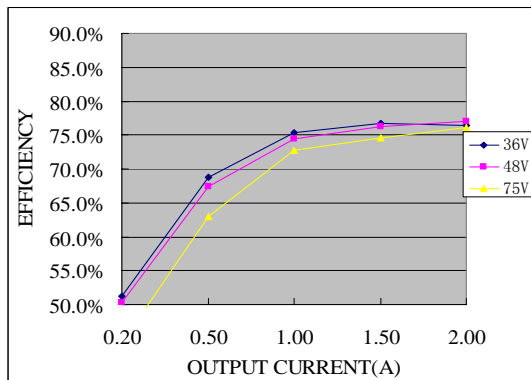
$$R_{TrimDown} = \frac{A}{V_{nom} - V_{adj}} - B$$

$$R_{TrimUp} = \frac{C}{V_{adj} - V_{nom}} - D$$

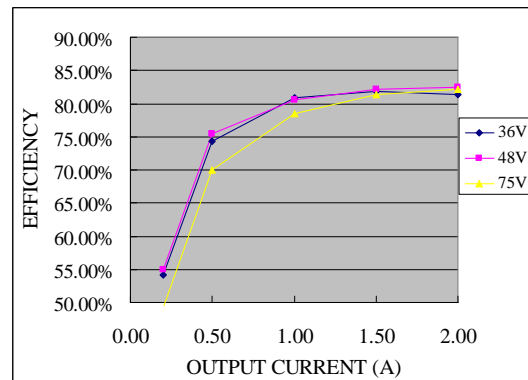


| Vnom | A       | B      | C      | D      |
|------|---------|--------|--------|--------|
| 24   | 489.490 | 28.310 | 26.660 | 6.810  |
| 12   | 113.550 | 16.990 | 13.020 | 6.490  |
| 5.0  | 56.410  | 51.200 | 18.228 | 36.500 |
| 3.3  | 21.628  | 75.400 | 13.020 | 64.900 |

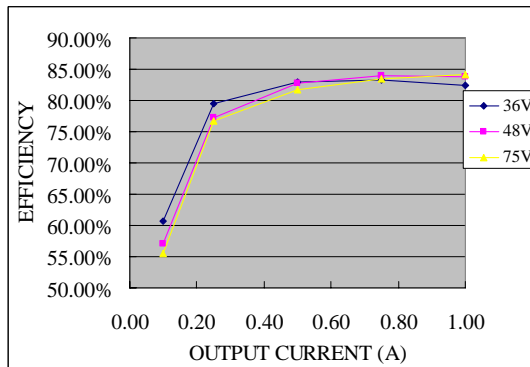
## Efficiency Data



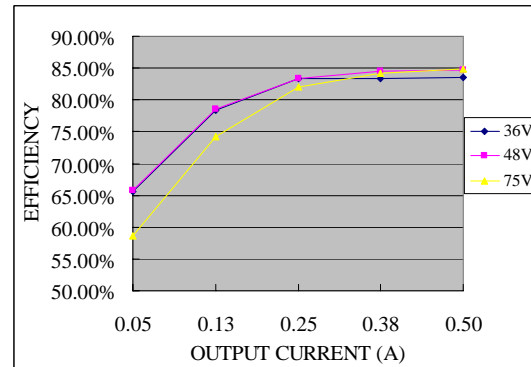
ORLC-10T033



ORLC-10T050



ORLC-10T120



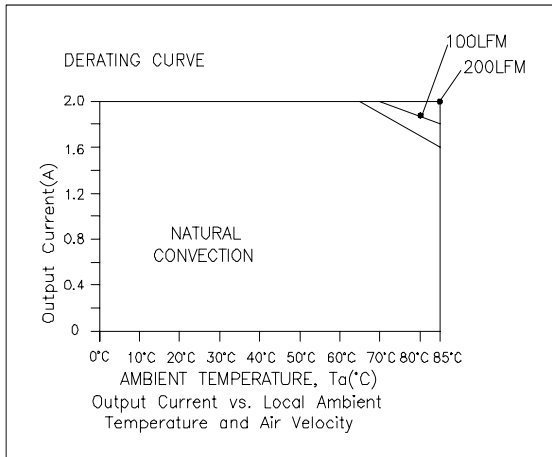
ORLC-10T240

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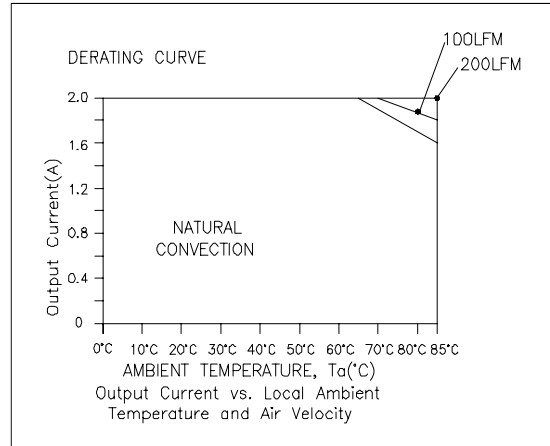
48 Vdc Input, 3.3 Vdc/2 A, 5 Vdc/2 A, 12 Vdc/1 A, 24 Vdc/0.5 A Output



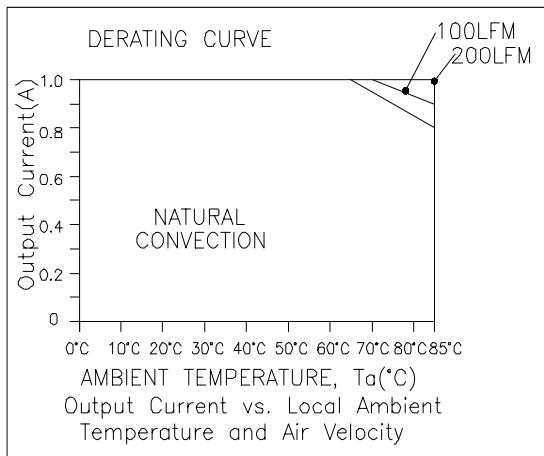
## Thermal Derating Curves



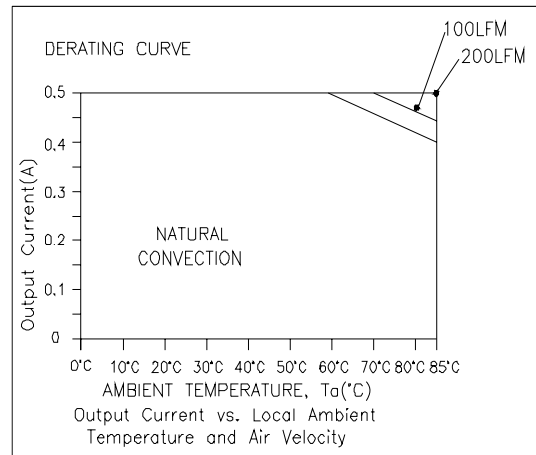
Vo=3.3 V, Io=2 A



Vo=5 V, Io=2 A



Vo=12 V, Io=1 A



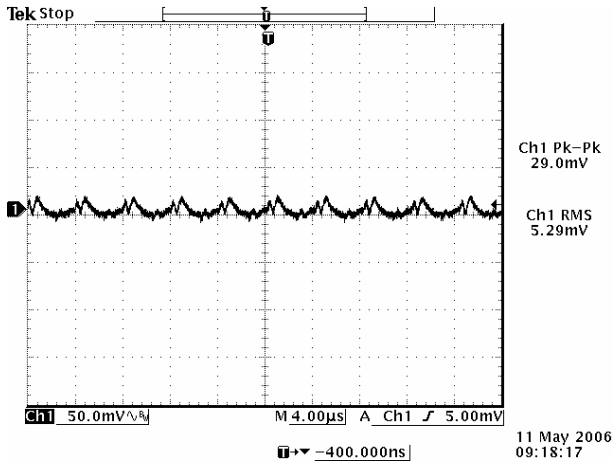
Vo=24 V, Io=0.5 A

# ISOLATED DC/DC CONVERTERS

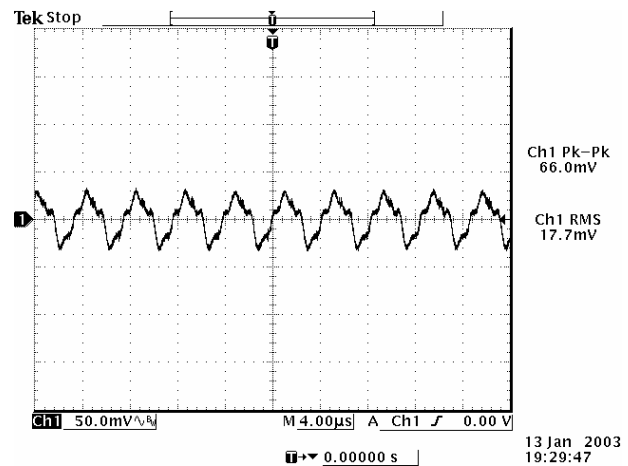
48 Vdc Input, 3.3 Vdc/2 A, 5 Vdc/2 A, 12 Vdc/1 A, 24 Vdc/0.5 A Output



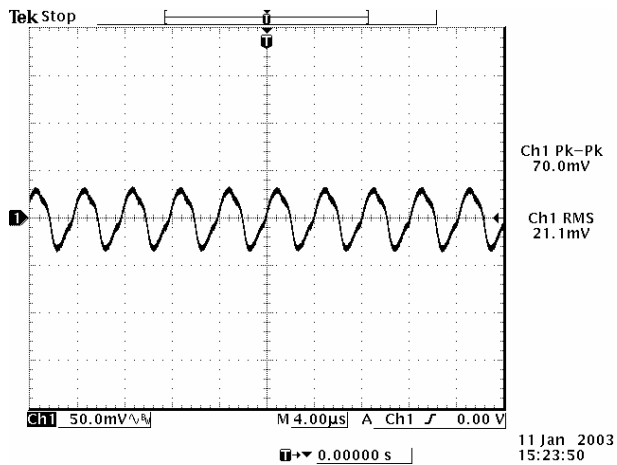
## Ripple and Noise Waveforms



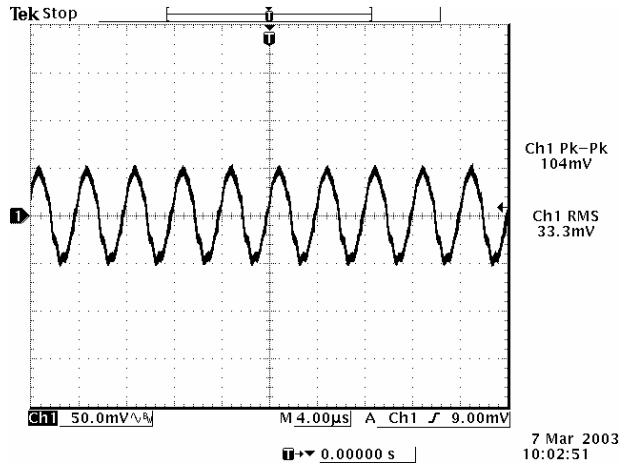
Vo=3.3 V



Vo=5.0 V



Vo=12 V



Vo=24 V

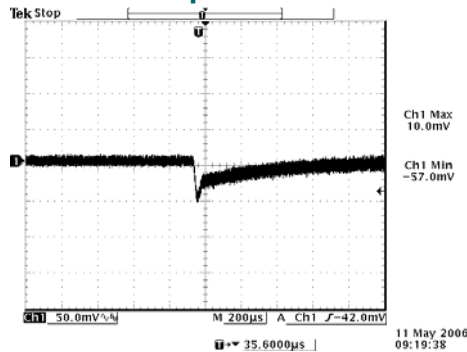
**Note:** Ripple and noise at full load, 48 Vdc input, with a 1 uF ceramic capacitor at the output, and Ta=25 deg C.

# ISOLATED DC/DC CONVERTERS

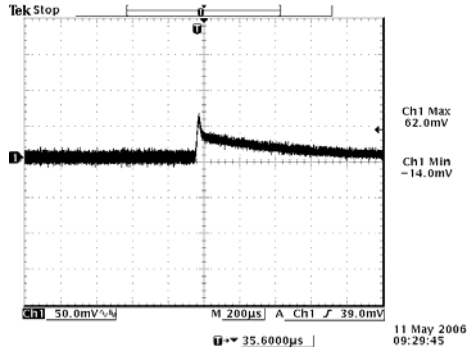
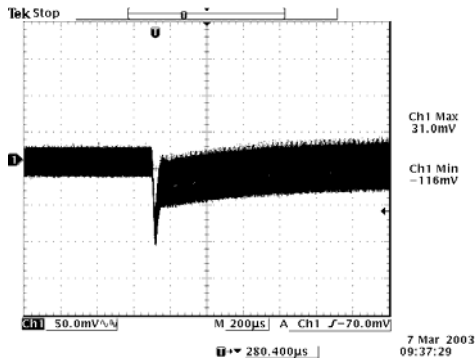
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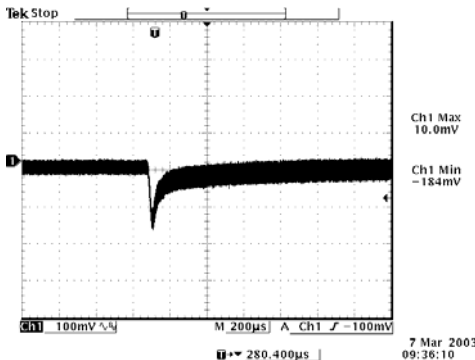
## Transient Response Waveforms



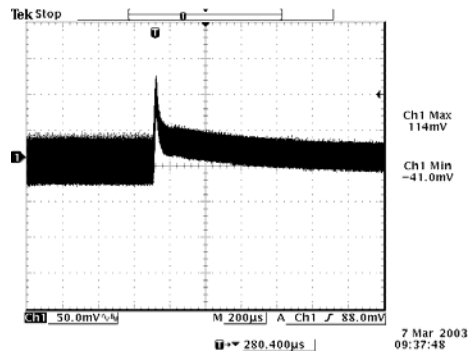
Vout=3.3 V 50% to 100% Load Transients



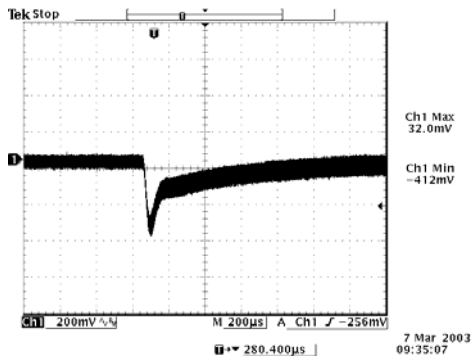
Vout=5.0 V 50% to 100% Load Transients



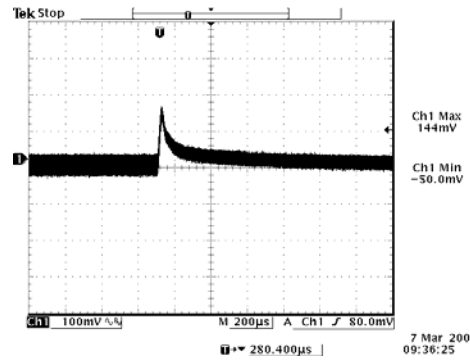
Vout=3.3 V 100% to 50% Load Transients



Vout=12 V 50% to 100% Load Transients

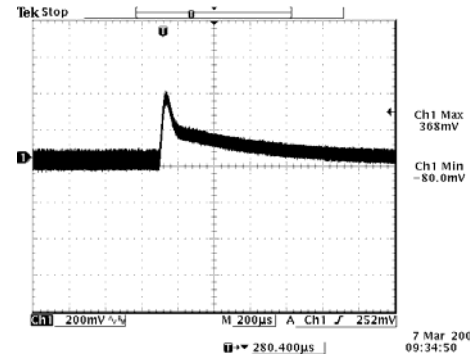


Vout=5.0 V 100% to 50% Load Transients



Vout=24 V 50% to 100% Load Transients

Vout=12 V 100% to 50% Load Transients



Vout=24 V 100% to 50% Load Transients

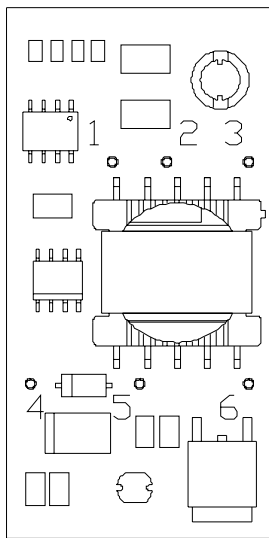
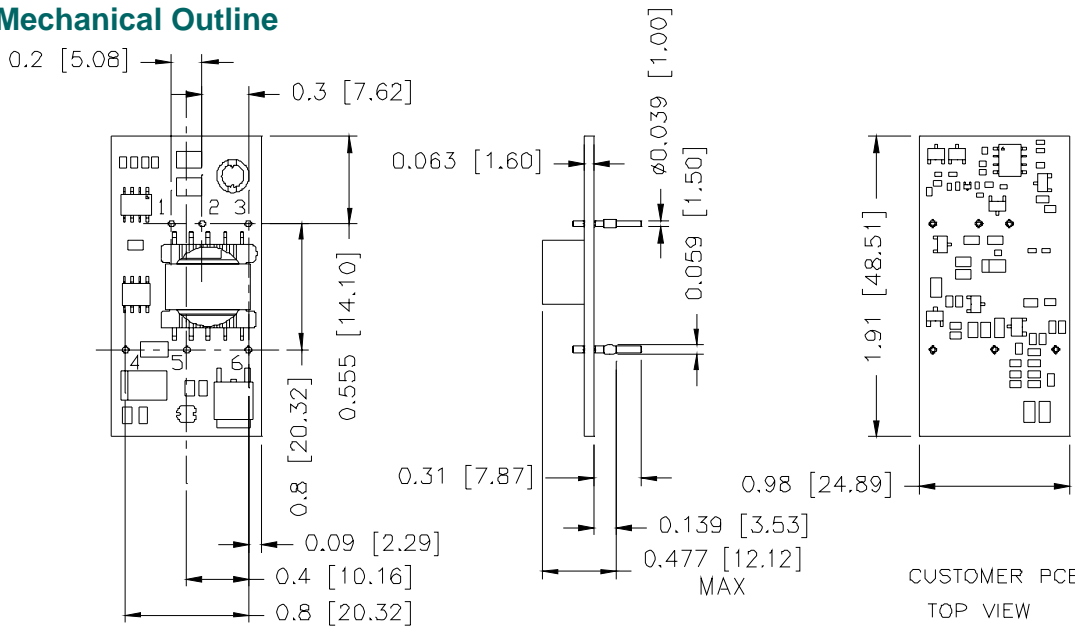
**Note:** Transient response at Vin=48 V, di/dt=0.1 A/µs, with external 1 µF ceramic capacitor, and Ta=25 deg C.

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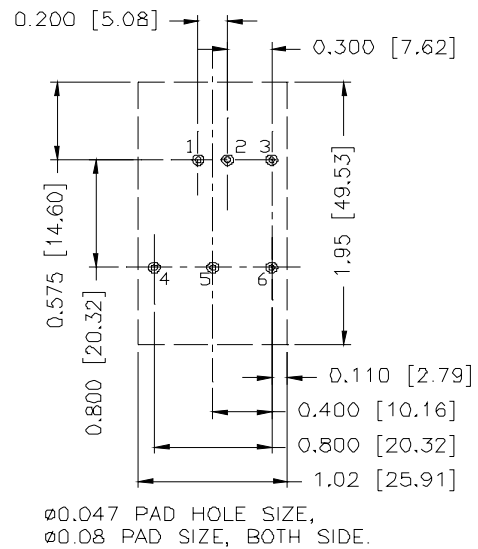


## Mechanical Outline



## Pin Connections

| Pin | Function |
|-----|----------|
| 1   | Vin+     |
| 2   | Vin-     |
| 3   | Enable   |
| 4   | Vo+      |
| 5   | Trim     |
| 6   | Vo-      |



## 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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- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
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«FORSTAR» (основан в 1998 г.)

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