

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 5.0 Vdc/6 A Output

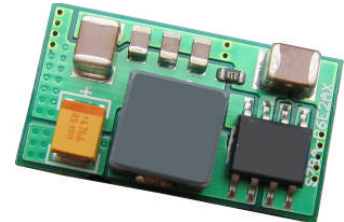
bel
POWER PRODUCTS

SRBA-06E1Ax

RoHS Compliant

Rev.B

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency
- Active Low/High (Option)
- UL60950-1 Recognized (UL/cUL)
- Under-Voltage Lockout (UVLO)
- Remote On/Off
- OCP/SCP
- Wide Input
- Wide Trim Range



Description

The Bel SRBA-06E1Ax modules are a series of non-isolated dc/dc converters that can deliver up to 6 A of output current with full load efficiency of 92% at 5.0 Vdc output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 Vdc to 5.0 Vdc over a wide range of input voltage. 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 and over current protection.

Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Model Number Active Low | Model Number Active High |
|----------------|-----------------|---------------------|-------------------|--------------------|-------------------------|--------------------------|
| 3.3 V - 5.0 V | Vo,set+1V -14 V | 6 A | 30.0 W | 92% | SRBA-06E1AL | SRBA-06E1A0 |
| 0.75 V - 3.3 V | 4.5 V - 14 V | 6 A | 19.8 W | 88% | SRBA-06E1AL | SRBA-06E1A0 |

Notes: 1. Add "G" suffix at the end of the model numbers 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 | - | 15 V | |
| Output Enable Terminal Voltage | -0.3 V | - | 15 V | |
| Ambient Temperature | -40 °C | - | 85 °C | |
| Storage Temperature | -55 °C | - | 125 °C | |

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

Input Specifications

| Parameter | Min | Typ | Max | Notes |
|--|-------------|--------|--------|--|
| Input Voltage | | | | |
| Vo, set ≤ 3.3 V | 4.5 V | 12 V | 14 V | |
| Vo, set > 3.3 V | Vo,set + 1V | 12 V | 14 V | |
| Input Current (full load) | | | | |
| Vo=5.0 V | - | 2.75 A | 4.8 A | |
| Vo=3.3 V | - | 1.85 A | 4.8 A | |
| Vo=1.8 V | - | 1.05 A | 3.2 A | |
| Vo=0.75 V | - | 0.55 A | 1.8 A | |
| Input Current (no load) | | | | |
| Vo=5.0 V | - | - | 100 mA | |
| Vo=0.75 V | - | - | 20 mA | |
| Remote Off Input Current | - | 3 mA | 5 mA | |
| Input Reflected Ripple Current (pk-pk) | - | 120 mA | 200 mA | Tested with two 100 uF/25 V input Tantalum capacitors & simulated source impedance of 1uH, 5 Hz to 20 MHz. |
| Input Reflected Ripple Current (rms) | - | 60 mA | 100 mA | |

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Input Specifications (continue)

| Parameter | Min | Typ | Max | Notes |
|---|-----|------------------------|-----------------------|-----------------------------------|
| I ² t Inrush Current Transient | - | 0.002 A ² s | 0.02 A ² s | |
| Turn-on Voltage Threshold | | | | |
| V _o , set ≤ 3.3 V | - | 4.3 V | 4.5 V | |
| V _o , set = 5.0 V | - | 6.0 V | 6.5 V | |
| Turn-off Voltage Threshold | | | | |
| V _o , set ≤ 3.3 V | - | 4.0 V | 4.3 V | Shut down or below 90% set point. |
| V _o , set = 5.0 V | - | 5.5 V | 6.0 V | |

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

Output Specifications

| Parameter | Min | Typ | Max | Notes | |
|--|---------------------------------|------------------------|------------------------|--|--|
| Output Voltage Set Point | -2%V _{o,set} | - | 2%V _{o,set} | V _{in} =12 V, I _o =I _o max | |
| Output Voltage Set Point | -2.5%V _{o,set} | - | 3.5%V _{o,set} | Over all operating input voltage, resistive load, and temperature conditions | |
| Load Regulation | - | 0.4%V _{o,set} | - | I _o =I _{omin} to I _{omax} | |
| Line Regulation | - | 0.3%V _{o,set} | - | V _{in} =V _{inmin} to V _{inmax} | |
| Regulation Over Temperature (-40°C to +85°C) | - | 0.5%V _{o,set} | - | T _{ref} =T _{amin} to T _{amax} | |
| Output Current | 0 A | - | 6 A | | |
| Current Limit Threshold | 6.8 A | - | 15 A | | |
| Short Circuit Surge Transient | - | 0.25 A ² s | - | | |
| Ripple and Noise (pk-pk) | | | | Tested with 0-20 MHz BW, with external 10 uF/10 V tantalum capacitor & 1 uF/10 V ceramic capacitor at the output | |
| V _o =5.0 V | - | 100 mV | 140 mV | | |
| V _o =3.3 V | - | 80 mV | 120 mV | | |
| V _o =0.75 V | - | 35 mV | 70 mV | | |
| Ripple and Noise (rms) | | | | | |
| V _o =5.0 V | - | 35 mV | 50 mV | | |
| V _o =3.3 V | - | 25 mV | 40 mV | | |
| V _o =0.75 V | - | 10 mV | 15 mV | | |
| Turn on Time | - | 6 mS | 12 mS | | |
| Overshoot at Turn on | - | 0% | 3% | | |
| Output Capacitance | | | | | |
| ESR ≥ 1mohm | 0 uF | - | 1000 uF | | |
| ESR ≥ 10mohm | 0 uF | - | 2200 uF | | |
| Transient Response | | | | | |
| 50% ~ 100% Max Load | V _o = 0.75 -5.0 V | - | 200 mV | 350 mV | di/dt=2.5 A/uS; V _{in} =12 V; and with 10 uF/10 V tantalum capacitor & 1 uF/10 V ceramic capacitor at the output. |
| Settling Time | | - | 25 uS | 50 uS | |
| 100% ~ 50% Max Load | | - | 200 mV | 350 mV | |
| Settling Time | | - | 25 uS | 50 uS | |

Note: All specifications are typical at nominal input (V_{in}=12 V), full load at 25 °C unless otherwise stated.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input

0.75 Vdc - 5.0 Vdc/6 A Output



General Specifications

| Parameter | Min | Typ | Max | Notes |
|---------------------------------------|----------------------|---------|---------|--|
| Efficiency | | | | Measured at Vin=12 V, Io=Io, max |
| Vo=5.0 V | 88% | 92% | - | |
| Vo=3.3 V | 85% | 88% | - | |
| Vo=1.8 V | 80% | 84% | - | |
| Vo=0.75 V | 68% | 73% | - | |
| Switching Frequency | 220 kHz | 250 kHz | 280 kHz | |
| Output Voltage Trim Range (wide trim) | 0.7525 V | - | 5 V | |
| MTBF | 3,560,000 hours | | | Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25 °C) |
| Dimensions | | | | Surface Mount |
| Inches (L x W x H) | 0.8 x 0.45 x 0.251 | | | |
| Millimeters (L x W x H) | 20.32 x 11.42 x 6.38 | | | |
| Weight | - | 5 g | - | |

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

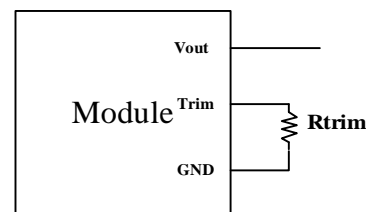
Control Specifications

| Parameter | Min | Typ | Max | Notes |
|------------------------|--------|-----|-------|---|
| Remote On/Off | | | | |
| Signal Low (Unit Off) | -0.3 V | - | 0.4 V | SRBA-06E1A0; Remote On/Off pin open, Unit on. |
| Signal High (Unit On) | 2.5 V | - | 14 V | |
| Signal Low (Unit On) | -0.3 V | - | 0.4 V | SRBA-06E1AL; Remote On/Off pin open, Unit on. |
| Signal High (Unit Off) | 2.5 V | - | 14 V | |

Output Trim Equations

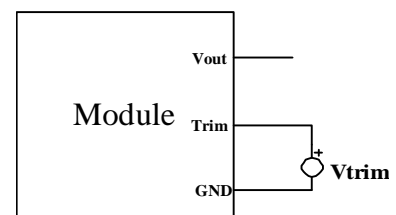
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{10.507}{V_{adj} - 0.7525} - 1$$



Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

$$V_{trim} = 0.7 - 0.0667 \times (V_o - 0.7525)$$



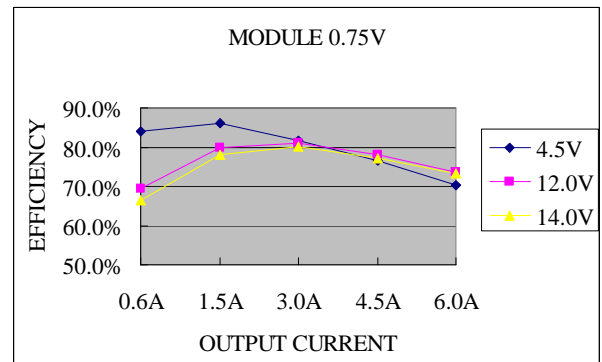
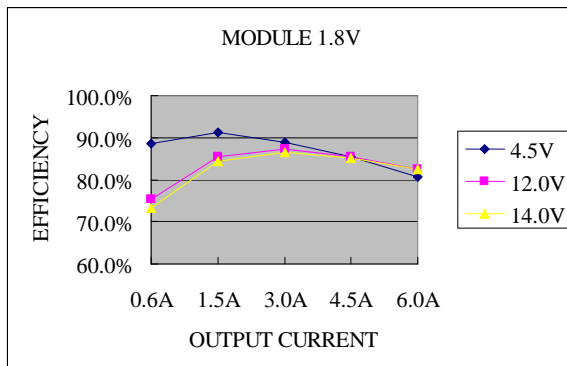
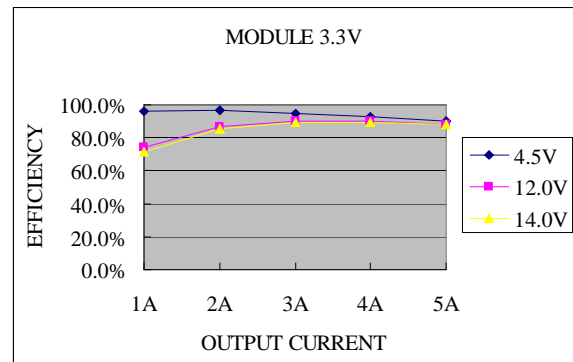
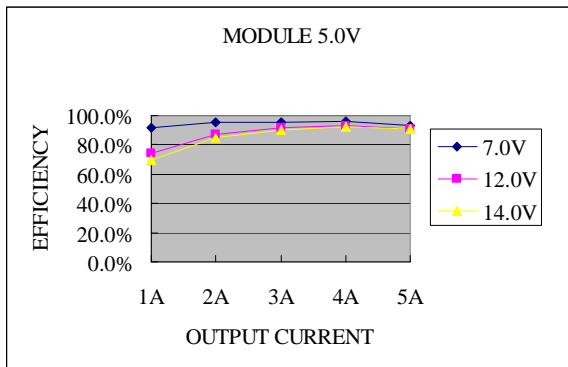
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Efficiency Data



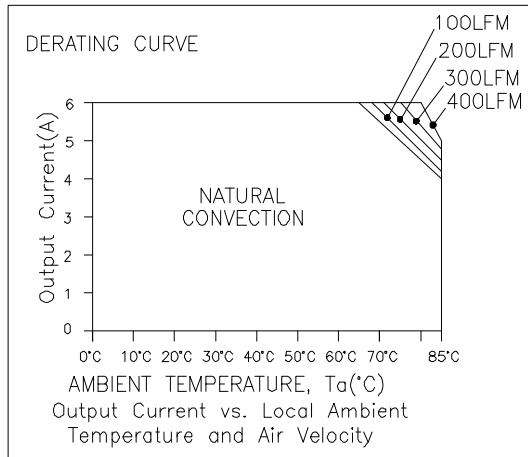
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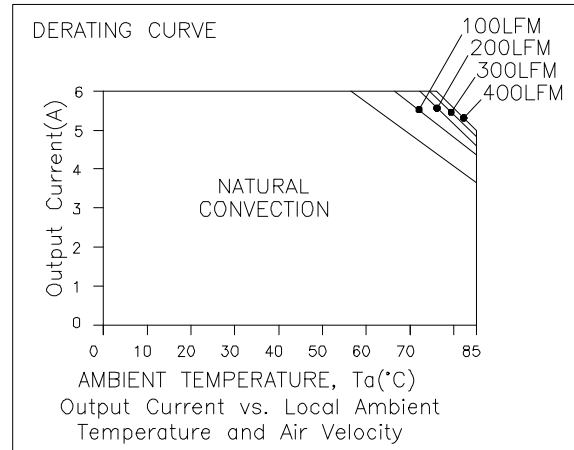
0.75 Vdc - 5.0 Vdc/6 A Output



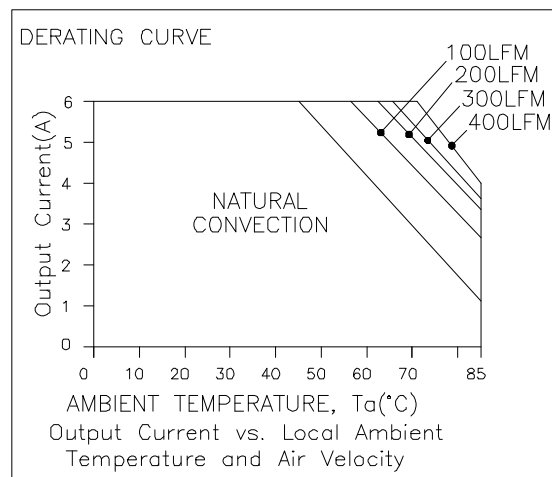
Thermal Derating Curves



Vo=0.75 V



Vo=2.5 V



Vo=5 V

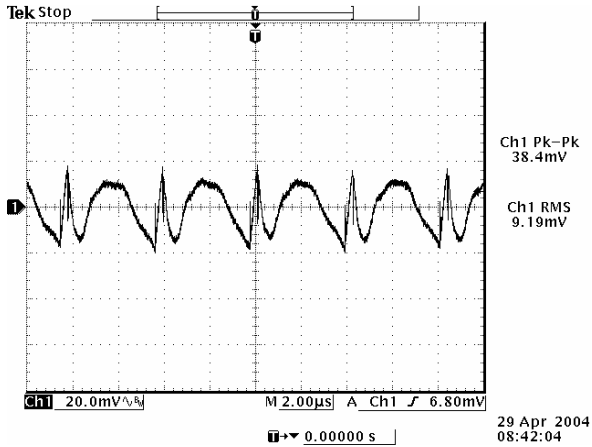
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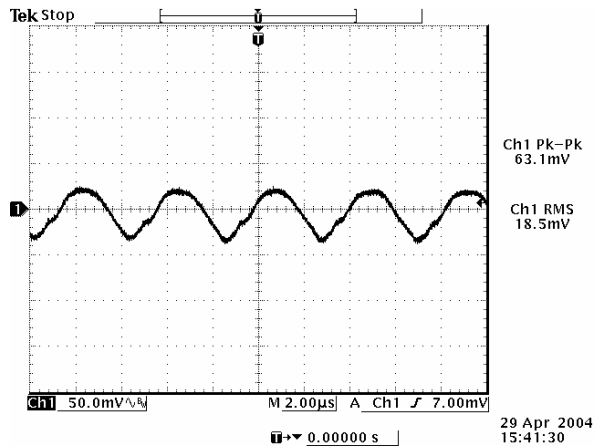
0.75 Vdc - 5.0 Vdc/6 A Output



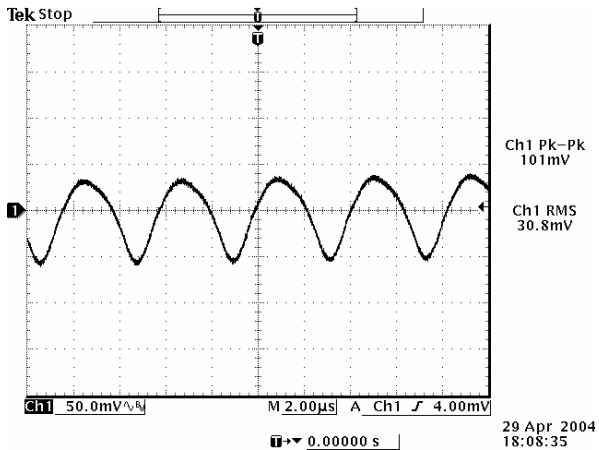
Ripple and Noise Waveforms



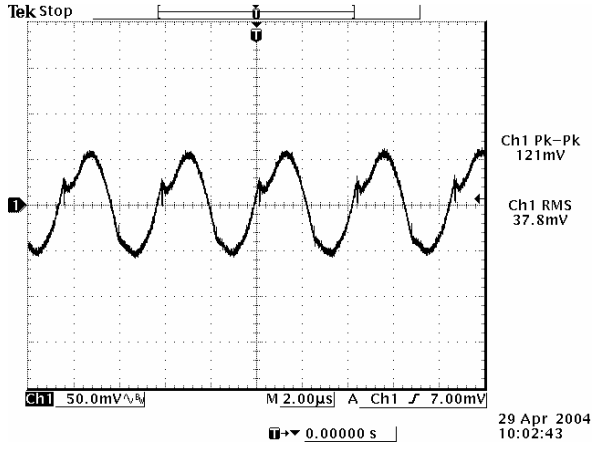
12 V input, 0.75 V output



12 V input, 1.8 V output



12 V input, 3.3 V output



12 V input, 5.0 V output

Note: Ripple and noise at full load, 0-20 MHz BW, with 10 uF/10 V tantalum capacitor and 1 uF/10 V ceramic capacitor at the output, Ta=25 deg C.

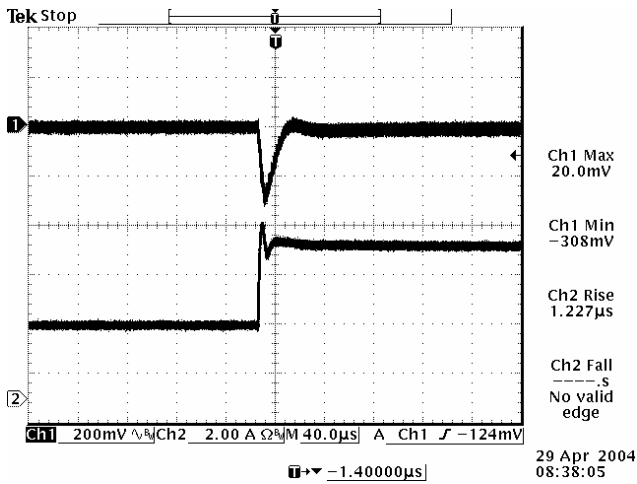
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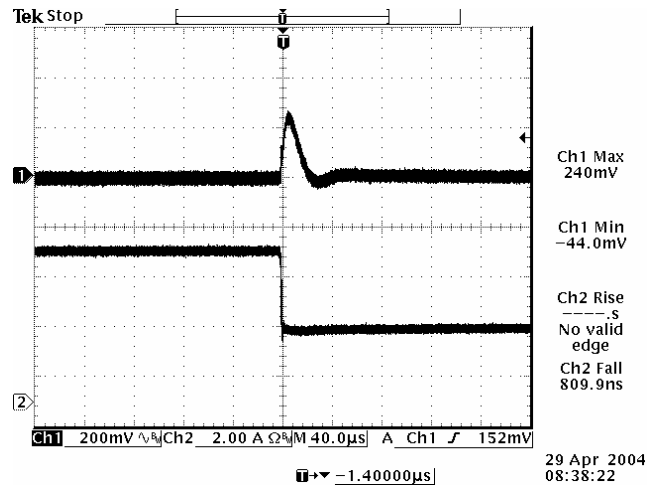
0.75 Vdc - 5.0 Vdc/6 A Output



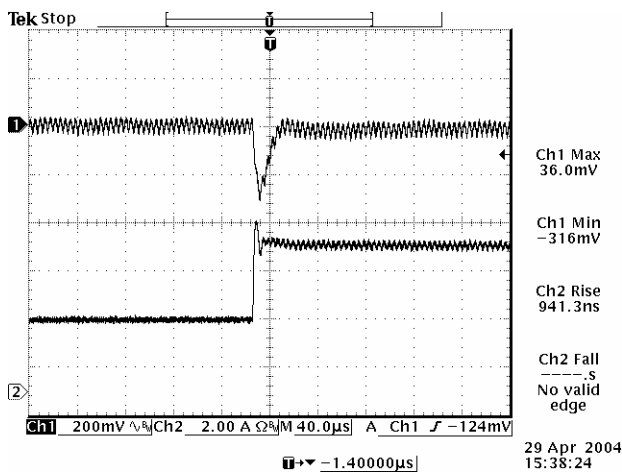
Transient Response Waveforms



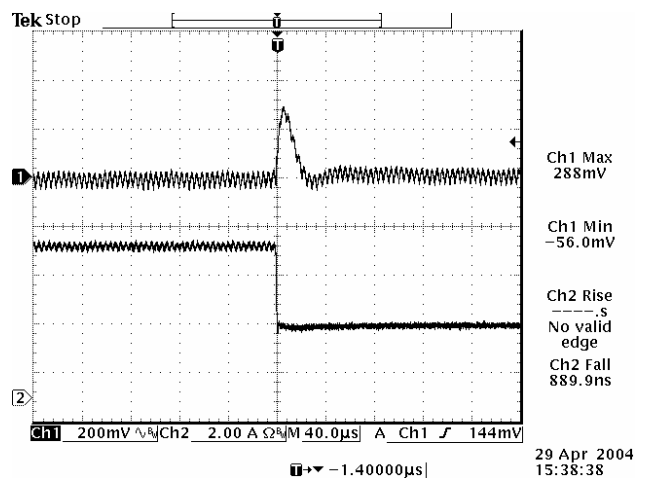
50% to 100% load step at $V_{in}=12\text{ V}$, $V_o=0.75\text{ V}$



100% to 50% load step at $V_{in}=12\text{ V}$, $V_o=0.75\text{ V}$



50% to 100% load step at $V_{in}=12\text{ V}$, $V_o=1.8\text{ V}$



100% to 50% load step at $V_{in}=12\text{ V}$, $V_o=1.8\text{ V}$

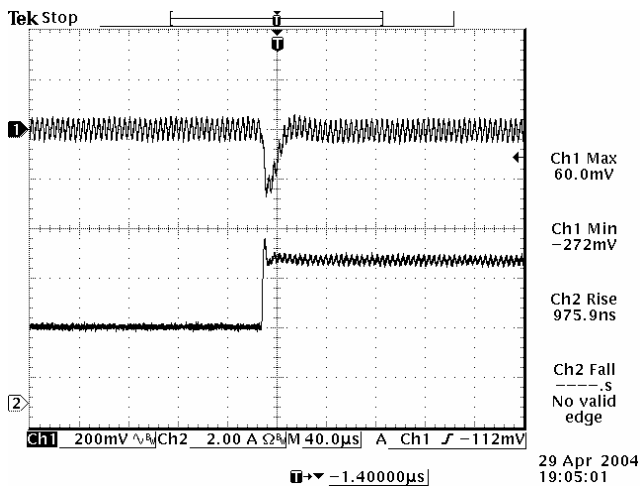
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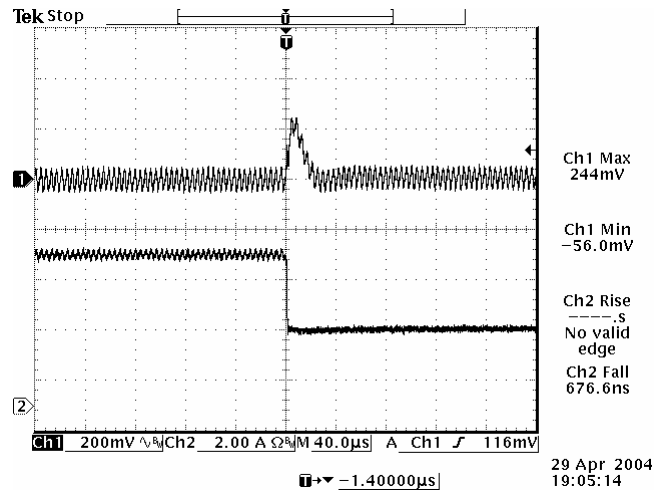
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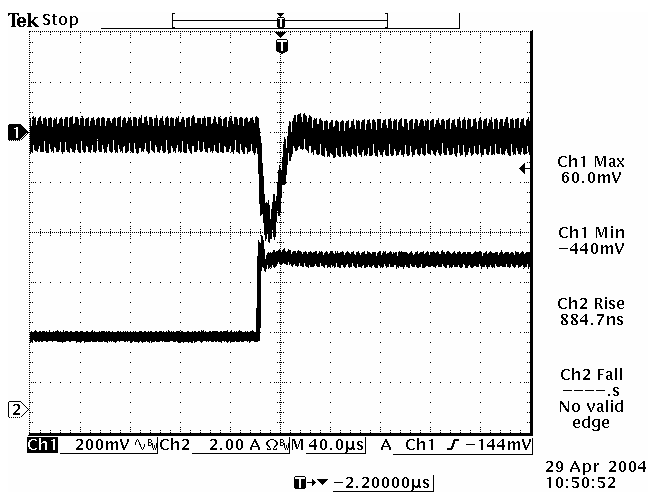
Transient Response Waveforms (continued)



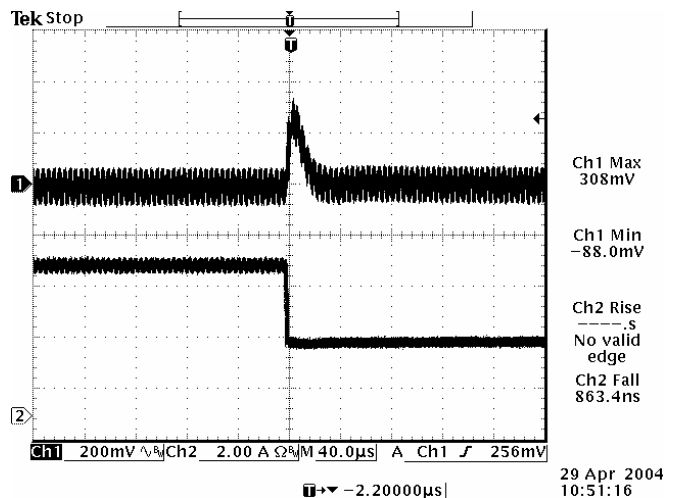
50% to 100% load step at $V_{in}=12$ V, $V_o=3.3$ V



100% to 50% load step at $V_{in}=12$ V, $V_o=3.3$ V



50% to 100% load step at $V_{in}=12$ V, $V_o=5$ V



100% to 50% load step at $V_{in}=12$ V, $V_o=5$ V

Note: Transient response at $di/dt=2.5$ A/uS, with 10 uF/10 V tantalum capacitor and 1 uF/10 V ceramic capacitor at the output, $T_a=25$ deg C.

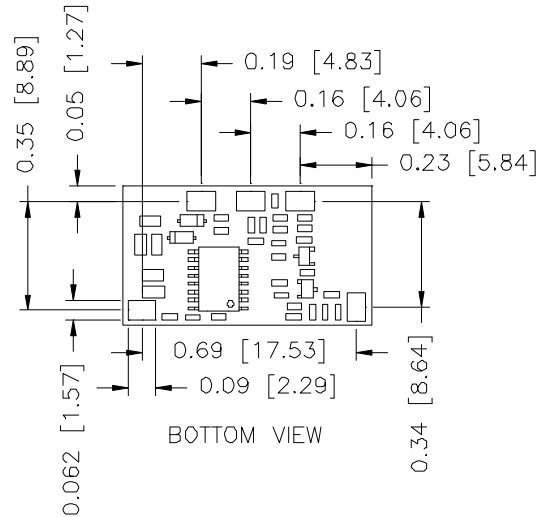
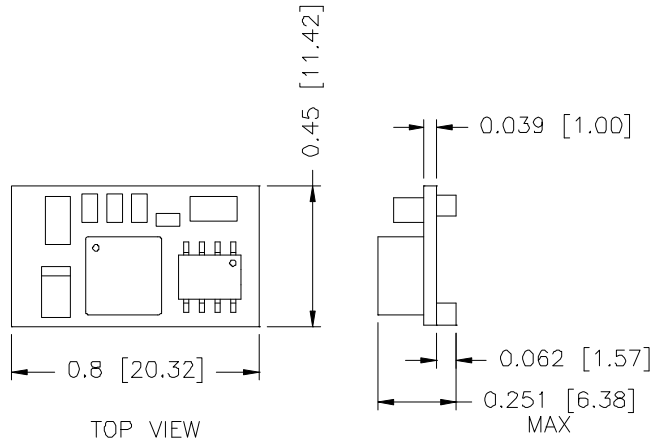
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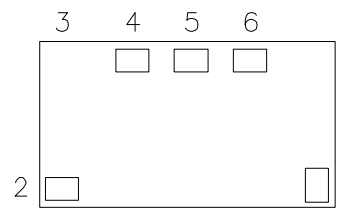
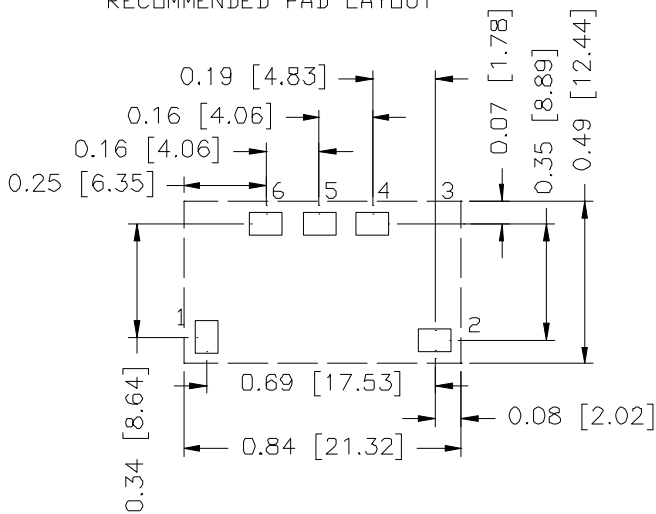
0.75 Vdc - 5.0 Vdc/6 A Output



Mechanical Outline



RECOMMENDED PAD LAYOUT



Pin Connections

| Pin | Function |
|-----|---------------|
| 1 | Remote On/Off |
| 2 | Vin+ |
| 3 | N/A |
| 4 | Ground |
| 5 | Trim |
| 6 | Vout+ |

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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