# THE DATASHEET OF

# SRBA-06A2A0G

# SRBA-06A2A

## Non-Isolated DC-DC Converter

The Bel SRBA-06A2A modules are a series of non-isolated dc/dc converters that 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 to 5.5 VDC over a wide range of input voltage (8.3 - 14 VDC).

These modules have a sequencing feature that enables designers to implement various types of output voltage sequencing when powering multiple voltages on a board. The open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote on/off, over current protection, short current protection, wide input, and programmable output voltage.

### Key Features & Benefits

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency
- Flexible Output Voltage Sequencing
- Under-Voltage Lockout (UVLO)
- OCP/SCP
- Wide Input
- Wide Trim Range
- Remote On/Off
- Active Low/High
- Approved to IEC/EN 62368-1
- Approved to CSA/UL 62368-1

RoHS Compliant

### Applications

- Networking
- Computers and Peripherals
- Telecommunications

## 1. MODEL SELECTION

| MODEL NUMBER ACTIVE LOW | MODEL NUMBER ACTIVE HIGH | OUTPUT VOLTAGE | INPUT VOLTAGE | MAX. OUTPUT CURRENT | MAX. OUTPUT POWER | TYPICAL EFFICIENCY |
|---|---|---|---|---|---|---|
| SRBA-06A2ALG | SRBA-06A2A0G | | | | | |
| SRBA-06A2ALH | SRBA-06A2A0H | 0.75 - 5.5 V | 8.3 - 14 V | 6 A | 33 W | 92% |
| SRBA-06A2ALR | SRBA-06A2A0R | | | | | |

### PART NUMBER EXPLANATION

| S | R | BA | - | 06 | A | 2A | x | y |
|---|---|---|---|---|---|---|---|---|
| Mounting Type | RoHS Status | Series Name | | Output Current | Input Range | Output Voltage | Active Logic | Package Type |
| Surface Mount | RoHS | Bobcat | | 6 A | 8.3 - 14 V | 0.75 - 5.5 V | L – Active Low<br>0 – Active High | G - Tray Package<br>H - Tray Package [1]<br>R - Tape & Reel Package |

**NOTE:** [1] Add "H" suffix at the end of the model number to indicate Tray packaging and RoHS compliant without requiring exemption 7c-III.

## 2. ABSOLUTE MAXIMUM RATINGS

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Input Voltage (Continuous) | | -0.3 | - | 15 | V |
| Output Enable Terminal Voltage | | -0.3 | - | 15 | V |
| Sequencing Voltage [1] | | -0.3 | | Vin | V |
| Ambient Temperature | | -40 | - | 85 | °C |
| Storage Temperature | | -55 | - | 125 | °C |
| Altitude | | - | - | 2000 | m |

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

[1] SRBA-06A2A series of modules include a sequencing feature that enables users to implement various types of output voltage sequencing in their applications. This is accomplished via an additional sequencing pin. When the sequencing feature is not used, tie the SEQ pin to Vin or leave the SEQ pin floating.

## 3. INPUT SPECIFICATIONS

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

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Input Voltage | | 8.3 | 12 | 14 | V |
| Input Current (full load) | Vo = 5.0 V | - | 2.75 | 4.0 | A |
| | Vo = 3.3 V | - | 1.85 | 2.8 | |
| | Vo = 2.5 V | - | 1.45 | 2.2 | |
| | Vo = 1.8 V | - | 1.05 | 1.6 | |
| | Vo = 1.2 V | - | 0.75 | 1.1 | |
| | Vo = 0.75 V | - | 0.55 | 0.8 | |
| Input Current (no load) | Vo = 5.0 V | - | - | 100 | mA |
| | Vo = 0.75 V | - | - | 20 | |
| Remote Off Input Current | | - | 1 | 2 | mA |
| Input Reflected Ripple Current (pk-pk) | Tested with two 100 µF/25 V tan input capacitors & simulated source impedance of 1 µH, 5 Hz to 20 MHz. | - | 120 | - | mA |
| Input Reflected Ripple Current (rms) | | - | 40 | - | mA |
| $I^2t$ Inrush Current Transient | | - | 0.002 | 0.02 | $A^2s$ |
| Turn-on Voltage Threshold | | - | 8.1 | 8.2 | V |
| Turn-off Voltage Threshold | | - | 7.5 | 8.0 | V |


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## 4. OUTPUT SPECIFICATIONS

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

| PARAMETER | DESCRIPTION | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage Set Point | Vin = 12 V, full load. | | -2% | - | 2% | Vo,set |
| Output Voltage Set Point | Over entire operating input voltage range, resistive loads and temperature conditions | | -2.5% | - | 3.5% | Vo,set |
| Adjustment Range Selected by External Resistor or Voltage | | | 0.7525 | - | 5.5 | V |
| Load Regulation | Io = Io, min to Io, max | | - | 0.4% | - | Vo,set |
| Line Regulation | Vin = Vin, min to Vin, max | | - | 0.3% | - | Vo,set |
| Regulation Over Temperature (-40 °C to +85 °C) | Tref=Ta,min to Ta,max | | - | 0.5% | - | Vo,set |
| Output Current Range | | | 0 | - | 6 | A |
| Current Limit Threshold | | | 7.2 | - | 18 | A |
| Short Circuit Surge Transient | | | - | 0.25 | - | $A^2s$ |
| Ripple and Noise (Pk-Pk) | Vo = 0.75 -3.63 V | Tested with 0-20 MHz, with 10 µF/10 V tantalum capacitor & 1 µF/10 V TDK ceramic capacitor at the output | - | 50 | 75 | mV |
| Ripple and Noise (RMS) | | | - | 15 | 30 | mV |
| Ripple and Noise (Pk-Pk) | Vo = 5.0 V | | - | 75 | 100 | mV |
| Ripple and Noise (RMS) | | | - | 30 | 40 | mV |
| Turn on Time | | | - | 8 | 10 | ms |
| Overshoot at Turn on | | | - | 0% | 3% | Vo,set |
| Output Capacitance | ESR ≥ 1 mΩ | | 0 | - | 1000 | µF |
| | ESR ≥ 10 mΩ | | 0 | - | 3000 | |
| ***Transient Response*** | | | | | | |
| △V 50%~100% of Max Load | Vo = 0.75 - 5.5 V | di/dt = 2.5 A/µs; Vin = 12 V; and with 10 µF/10 V tantalum capacitor & 1 µF /10 V ceramic capacitor at the output | - | 200 | - | mV |
| Settling Time | | | - | 50 | - | µs |
| △V 100%~50% of Max Load | | | - | 200 | - | mV |
| Settling Time | | | - | 50 | - | µs |

## 5. GENERAL SPECIFICATIONS

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

| PARAMETER | | DESCRIPTION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Efficiency | Vo = 5.0 V | Measured at Vin = 12 V, full load | 90% | 92% | - | - |
| | Vo = 3.3 V | | 87% | 89% | - | |
| | Vo = 2.5 V | | 85% | 88% | - | |
| | Vo = 1.8 V | | 83% | 86% | - | |
| | Vo = 1.2 V | | 79% | 82% | - | |
| | Vo = 0.75 V | | 71% | 74% | - | |
| Switching Frequency | | | 250 | 300 | 350 | kHz |
| Over Temperature Shutdown | | | - | 135 | - | °C |
| Output Trim Range (Wide Trim) | | | 0.7525 | - | 5.5 | V |
| MTBF | | Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25°C) | - | 3,079,469 | - | hour |
| Weight | | | - | 3 | - | g |
| Dimensions (L × W × H) | | | 0.8 x 0.45 x 0.251 | | | inch |
| | | | 20.32 x 11.42 x 6.39 | | | mm |

## 6. CONTROL SPECIFICATIONS

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| ***Remote on/off*** | | | | | |
| Signal Low (Unit Off) | SRBA-06A2A0; Remote On/Off pin open, Unit on. | -0.3 | - | 0.4 | V |
| Signal High (Unit On) | | 2.5 | - | 14 | V |
| Signal Low (Unit On) | SRBA-06A2AL; Remote On/Off pin open, Unit on. | -0.3 | - | 0.4 | V |
| Signal High (Unit Off) | | 2.5 | - | 14 | V |
| ***Voltage Sequencing*** | | | | | |
| Sequencing Voltage | Sequencing Voltage applied on SEQ pin should be higher than output voltage. | 0 | - | Vin | V |
| Sequencing Slew Rate Capability | | - | - | 2 | V/ms |
| Sequencing Delay Time | Delay from Vin, min to application of voltage on SEQ pin | 10 | - | - | ms |
| Tracking Accuracy | Power-Up | - | 100 | 200 | mV |
| | Power-Down | - | 200 | 400 | mV |



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## 7. EFFICIENCY DATA

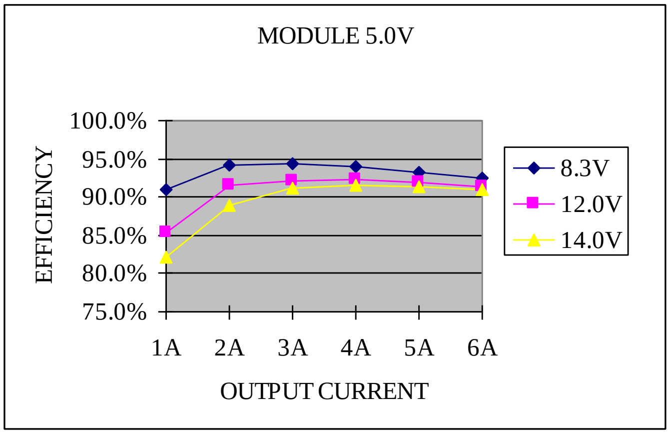


*Figure 1. Vo = 5.0 V*

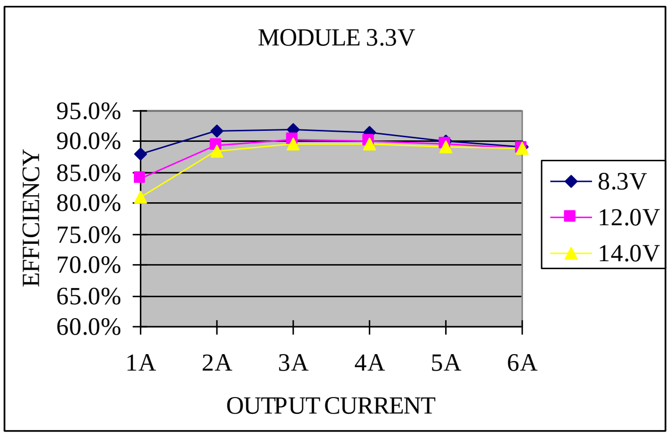


*Figure 2. Vo = 3.3 V*

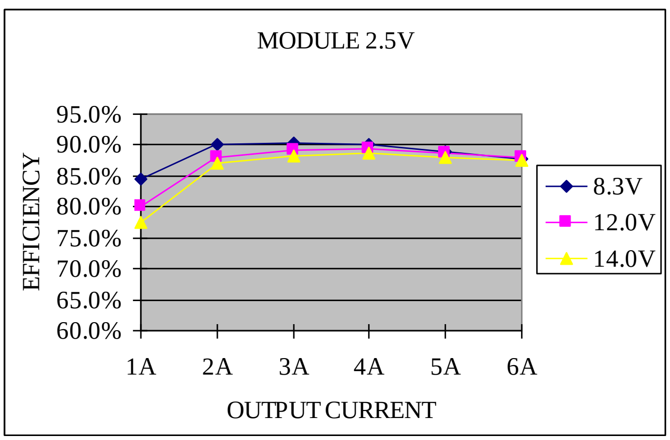


*Figure 3. Vo = 2.5 V*

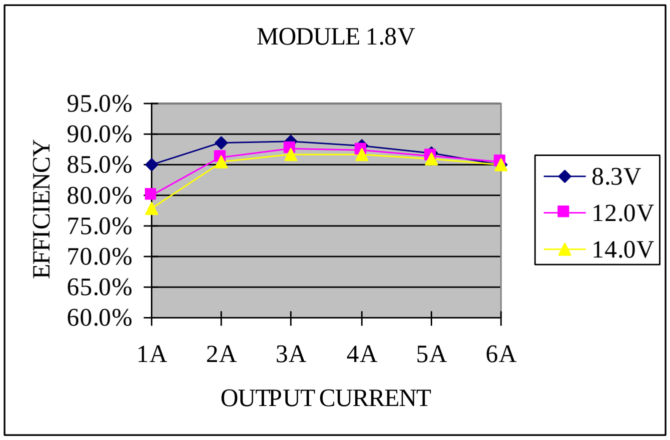


*Figure 4. Vo = 1.8 V*

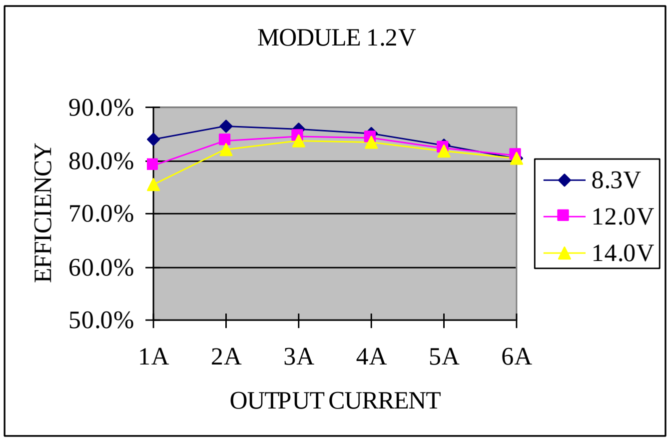


*Figure 5. Vo = 1.2 V*

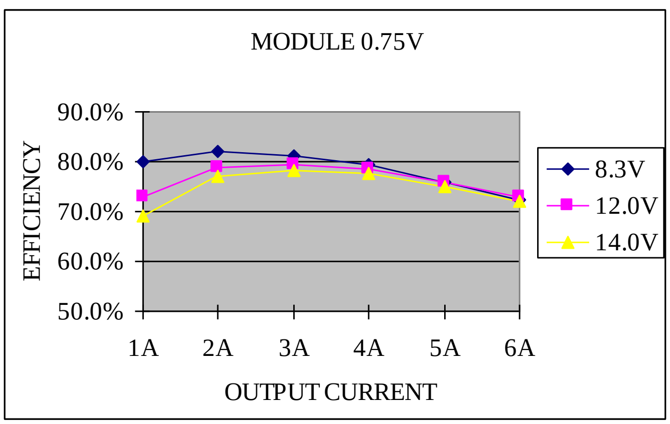


*Figure 6. Vo = 0.75 V*



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## 8. 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.

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

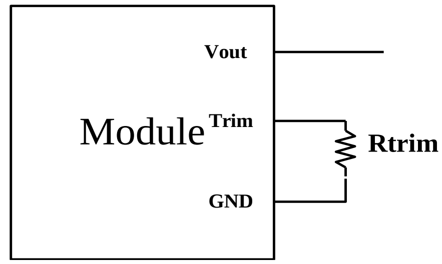


*Figure 7. Trim up circuit-1*

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.

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

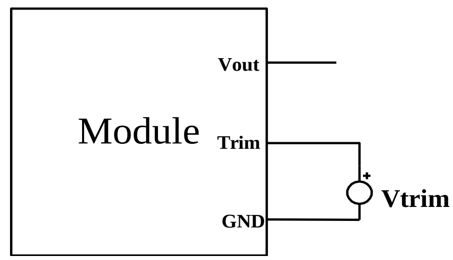


*Figure 8. Trim up circuit-2*

## 9. RIPPLE AND NOISE WAVEFORMS

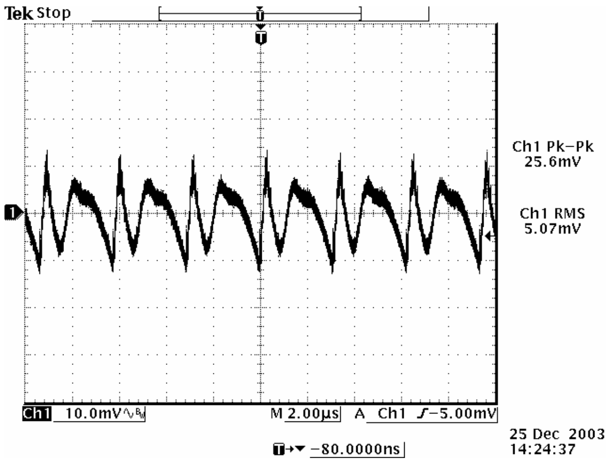


*Figure 9. Ripple and noise, Vin = 12 V, Vo = 0.75 V*

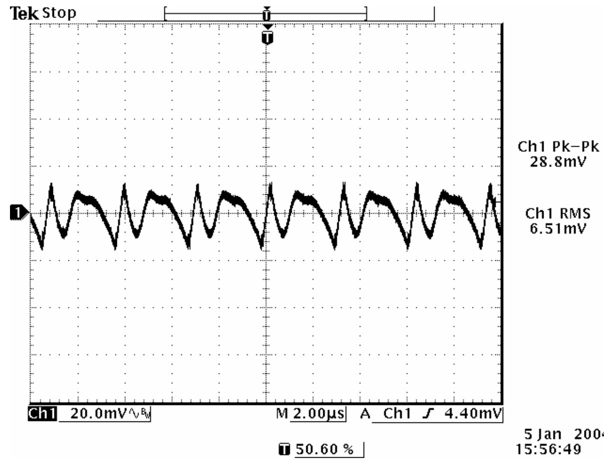


*Figure 10. Ripple and noise, Vin = 12 V, Vo = 1.2 V*

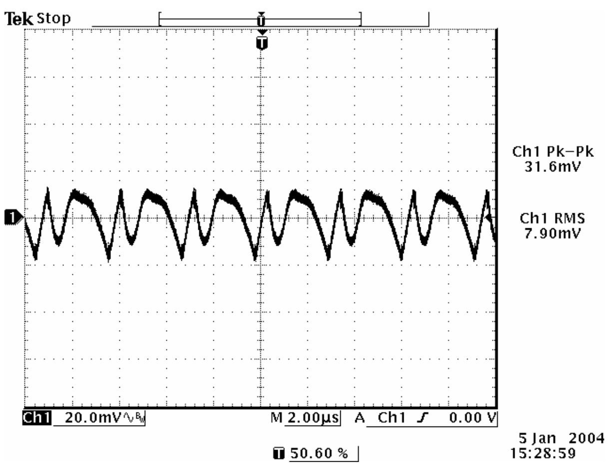


*Figure 11. Ripple and noise, Vin = 12 V, Vo = 1.8 V*

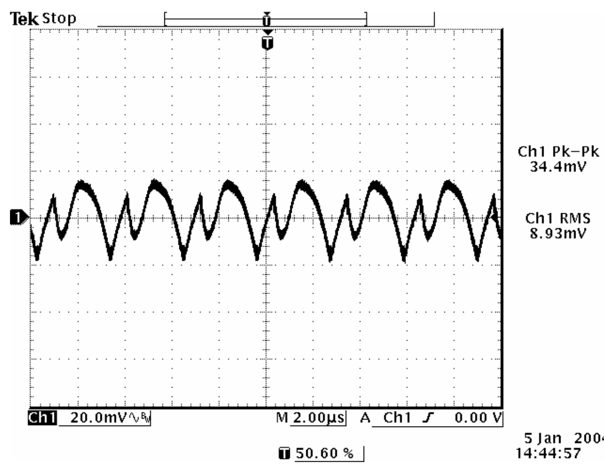


*Figure 12. Ripple and noise, Vin = 12 V, Vo = 2.5 V*



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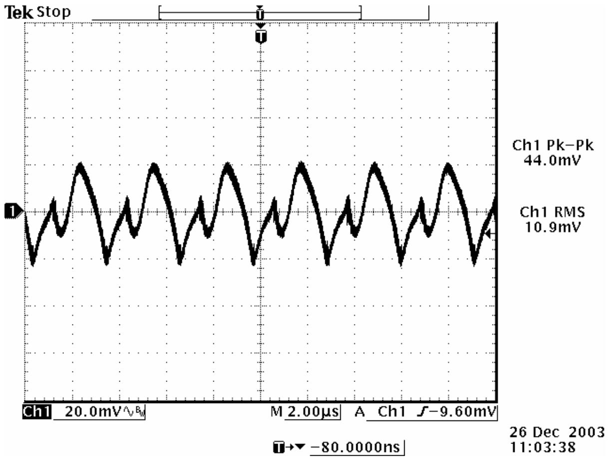


*Figure 13. Ripple and noise, Vin = 12 V, Vo = 3.3 V*

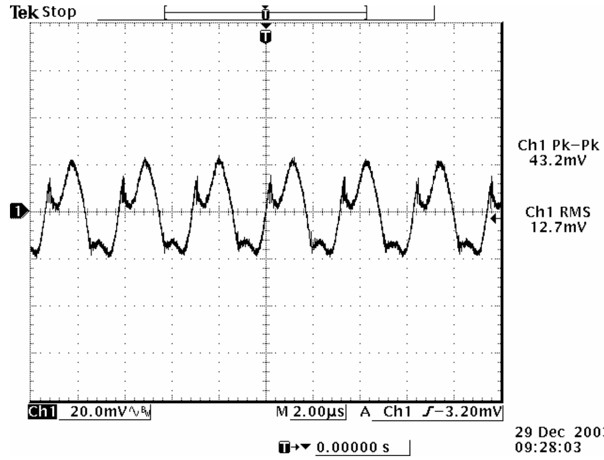


*Figure 14. Ripple and noise, Vin = 12 V, Vo = 5.0 V*

**Note:** The output ripple and noise are tested at 0-20 MHz BW, 10 μF/10 V tantalum capacitor and 1 μF/10 V ceramic capacitor, Ta = 25°C.

## 10. TRANSIENT RESPONSE WAVEFORMS

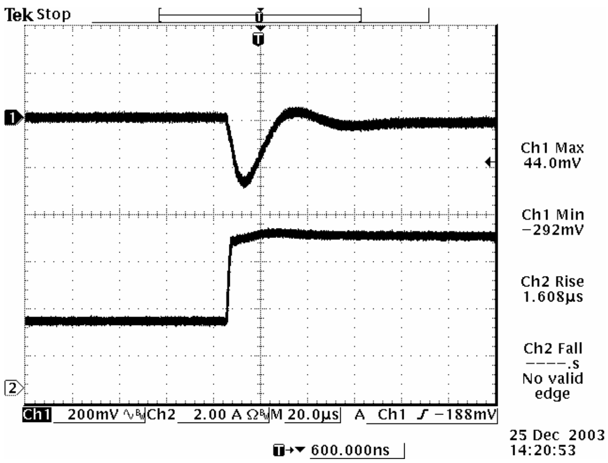


*Figure 15. 50% to 100% load step at Vin = 12 V, Vo = 0.75 V*

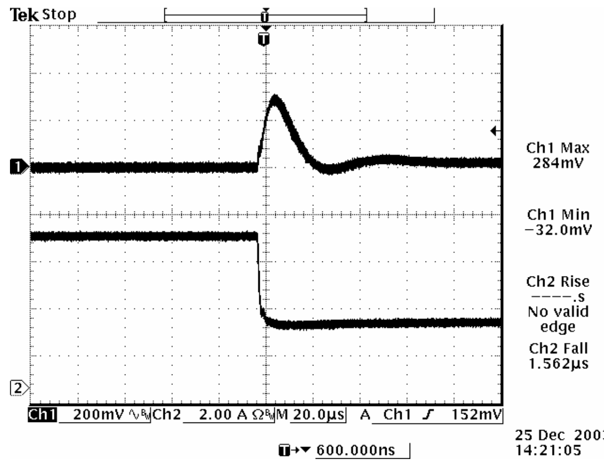


*Figure 16. 100% to 50% load step at Vin = 12 V, Vo = 0.75 V*

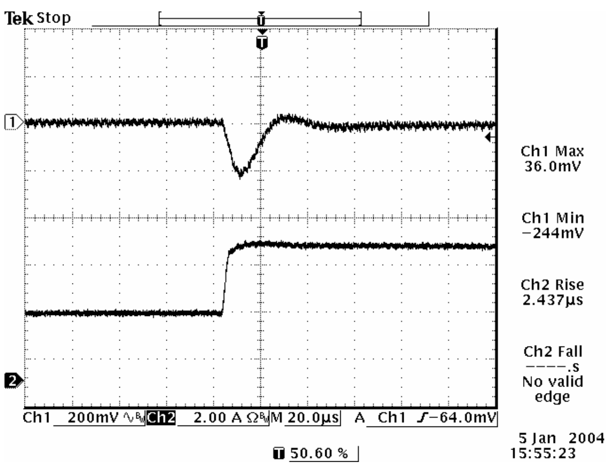


*Figure 17. 50% to 100% load step at Vin = 12 V, Vo = 1.2V*

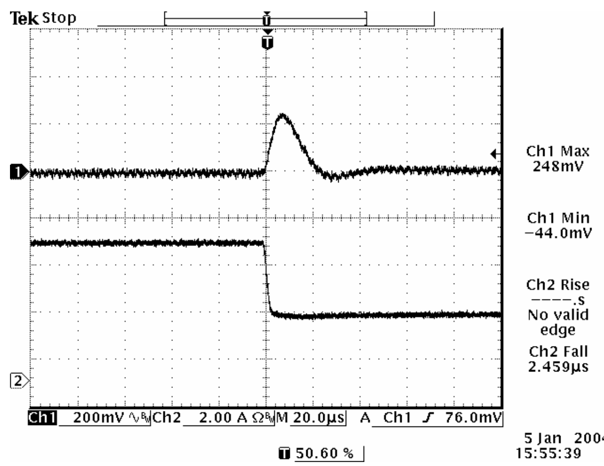


*Figure 18. 100% to 50% load step at Vin = 12 V, Vo = 1.2 V*



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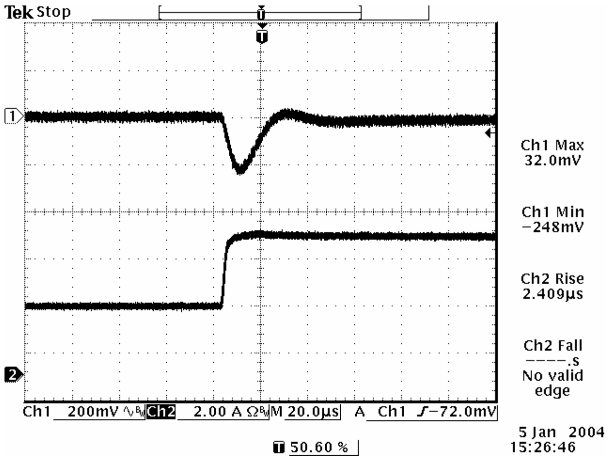


*Figure 19. 50% to 100% load step at Vin = 12 V, Vo = 1.8 V*

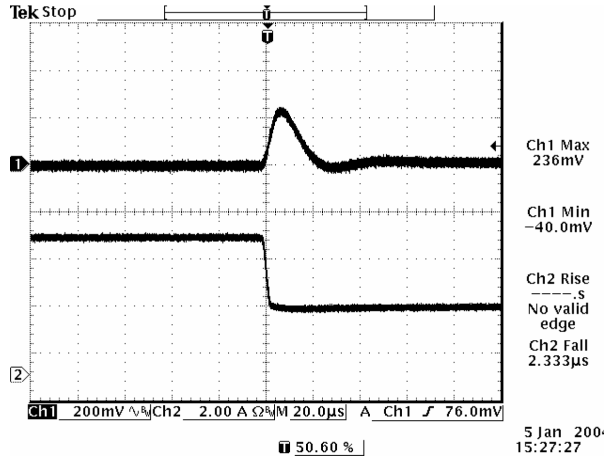


*Figure 20. 100% to 50% load step at Vin = 12 V, Vo = 1.8 V*

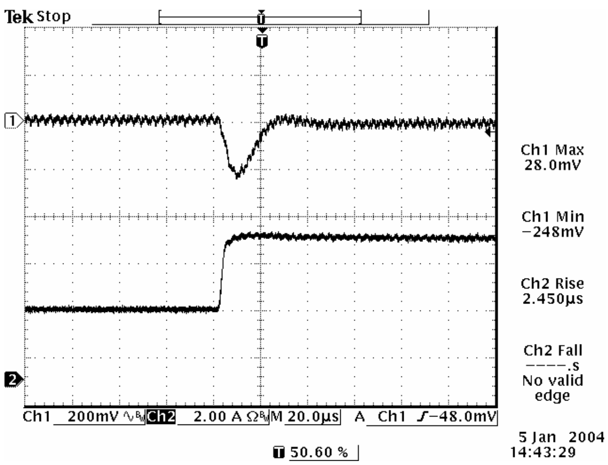


*Figure 21. 50% to 100% load step at Vin = 12 V, Vo = 2.5 V*

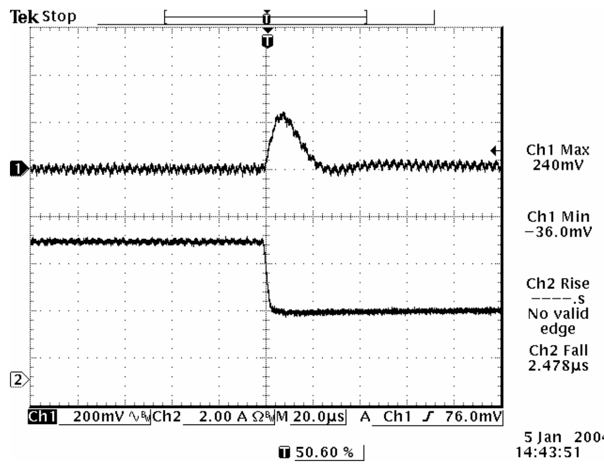


*Figure 22. 100% to 50% load step at Vin = 12 V, Vo = 2.5 V*

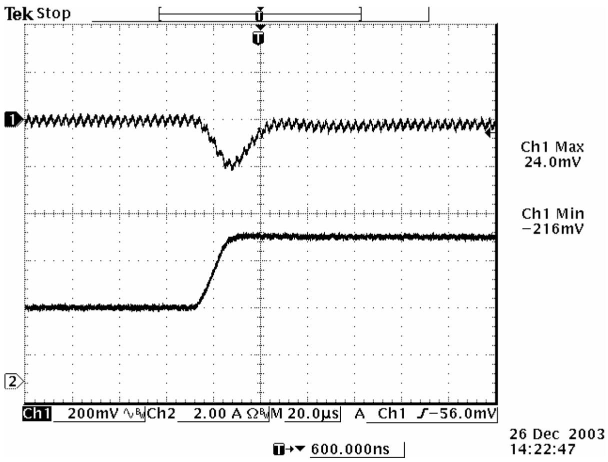


*Figure 23. 50% to 100% load step at Vin = 12 V, Vo = 3.3 V*

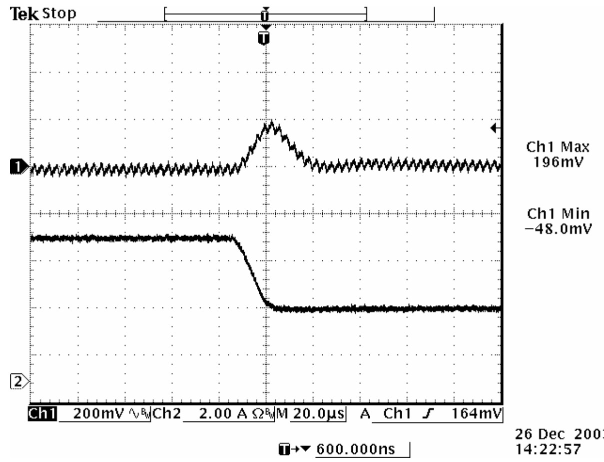


*Figure 24. 100% to 50% load step at Vin = 12 V, Vo = 3.3 V*

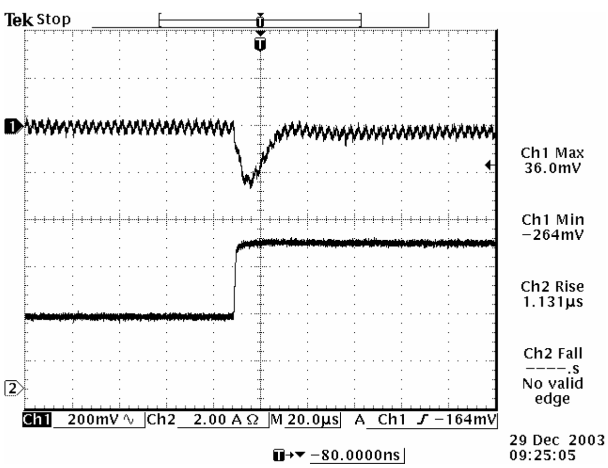


*Figure 25. 50% to 100% load step at Vin = 12 V, Vo = 5.0 V*

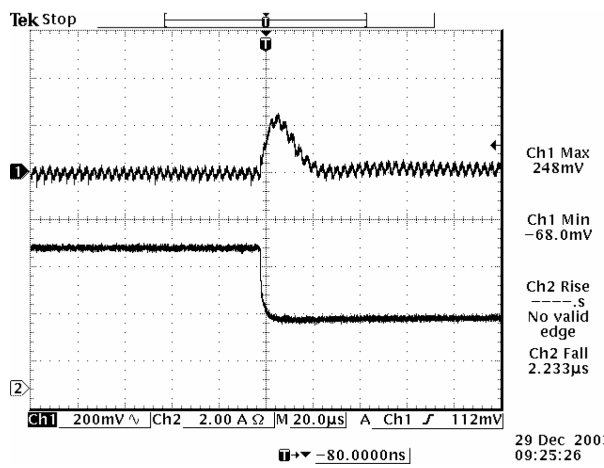


*Figure 26. 100% to 50% load step at Vin = 12 V, Vo = 5.0 V*

**Note:** Transient response is tested at di/dt = 2.5 A/us, with 10 µF/10 V tantalum capacitor and 1 µF/10 V ceramic capacitor, Ta=25°C.



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## 11. THERMAL DERATING CURVE

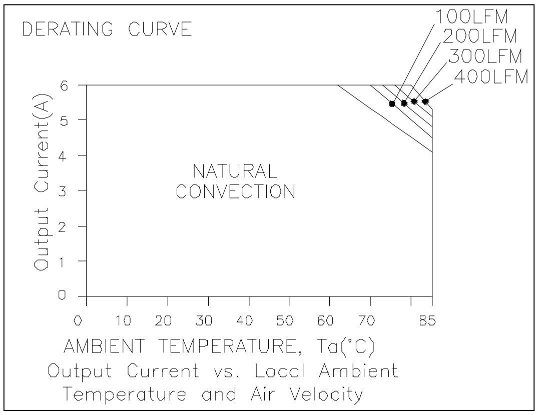


*Figure 27. Vin = 12 V, Vo = 0.75 V*

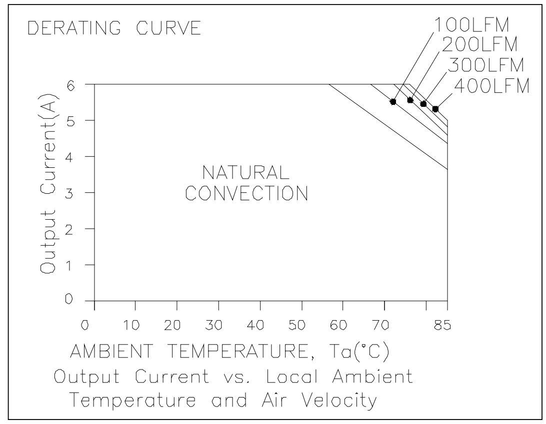


*Figure 28. Vin = 12 V, Vo = 2.5 V*

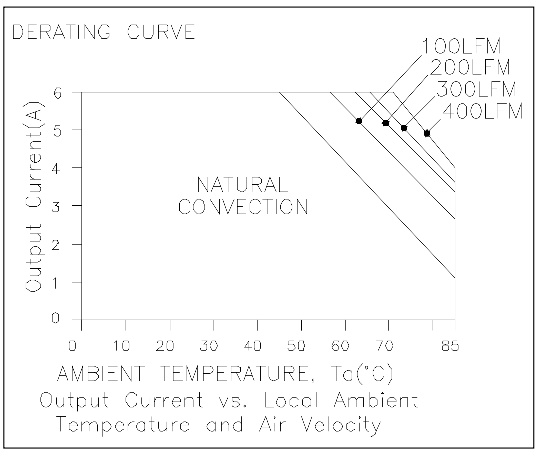


*Figure 29. Vin = 12 V, Vo = 5.0 V*

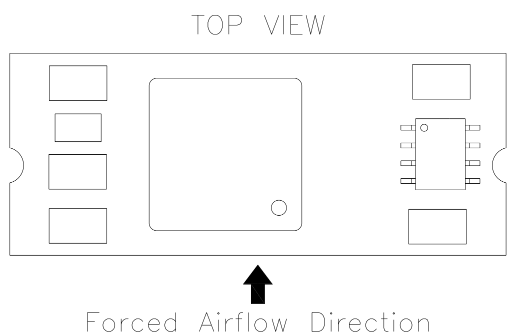


*Figure 30. Airflow direction*

## 12. MECHANICAL DIMENSIONS

### OUTLINE

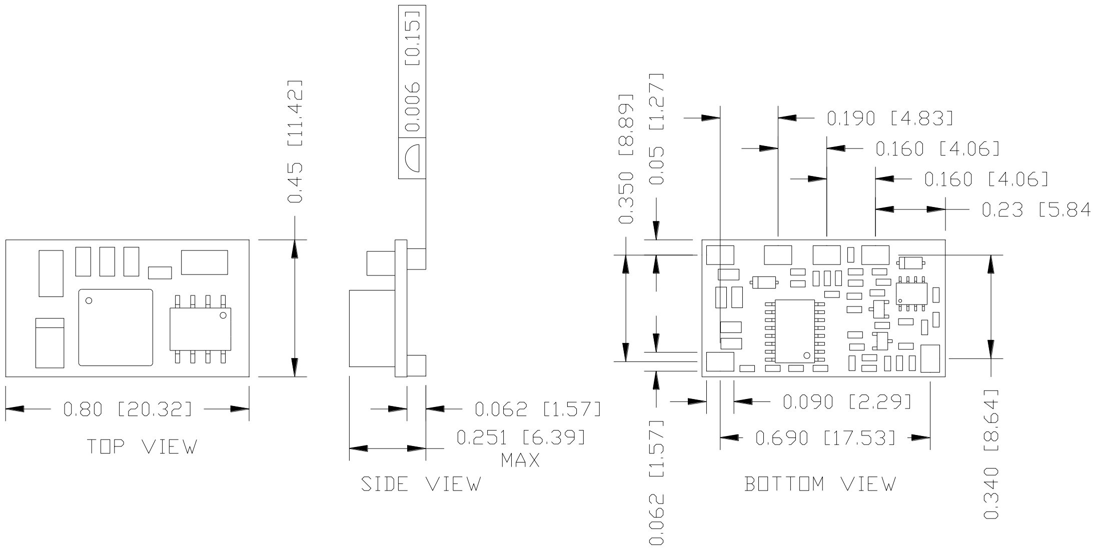


*Figure 31. Outline*

**Note:** These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 245°C.

**Notes:**

1) All Pins: Material - Copper Alloy;
   Finish - Gold plated.
2) Un-dimensioned components are shown for visual reference only.
3) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm]. x.xxx +/-0.010 inch [0.25 mm].



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## PIN DEFINITIONS

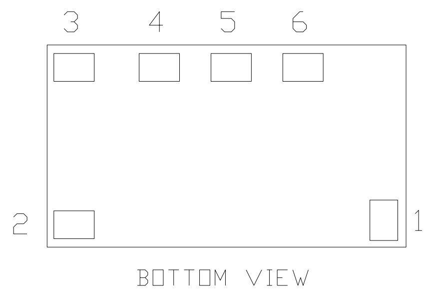


*Figure 32. Pins*

| PIN | FUNCTION | PIN | FUNCTION |
|---|---|---|---|
| 1 | Remote On/Off | 4 | Ground |
| 2 | Vin (+) | 5 | Trim |
| 3 | SEQ | 6 | Vout (+) |

## RECOMMENDED PAD LAYOUT

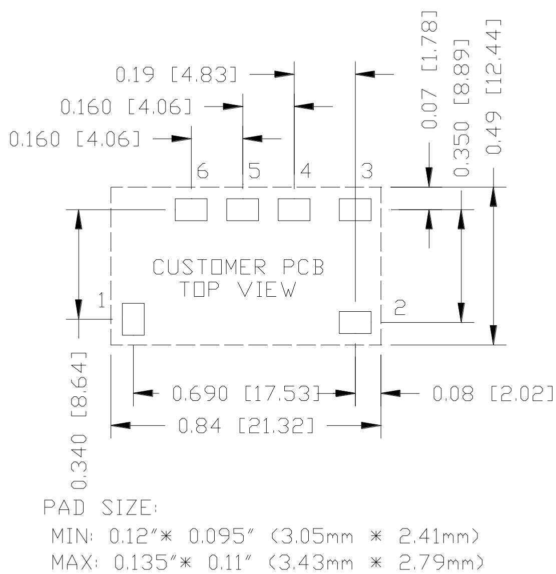


*Figure 33. Recommended pad layout*

## 13. REVISION HISTORY

| DATE | REVISION | CHANGES DETAIL | APPROVAL |
|---|---|---|---|
| 2007-07-12 | A | First release. | Lynn |
| 2011-08-25 | B | Update the reflow solder temperature. | HL.Lu |
| 2012-07-05 | C | Adding the 7C-III compliance suffix statement. | HL.Lu |
| 2013-01-25 | D | Update UL. | HL.Lu |
| 2021-08-02 | AE | Add object ID, altitude, thermal test setup and tape & reel package. Update to new form. Update safety certificate and mechanical outline. | XF.Jiang |

**For more information on these products consult: tech.support@psbel.com**

**NUCLEAR AND MEDICAL APPLICATIONS -** Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.
**TECHNICAL REVISIONS -** The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

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