

NON-ISOLATED DC/DC CONVERTERS

3.3 Vdc Input 0.9 Vdc - 2.5 Vdc/7 A Output



xRAH-07C1A0

RoHS Compliant

Rev.A

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



Description

The Bel xRAH-07C1A0 module is a series of non-isolated, step down dc/dc power converters that operate from a nominal 3.3 Vdc source. These converters are available in a range of output voltages from 0.9 Vdc to 2.5 Vdc (default output voltage is 1.8 Vdc). It is packaged in a compact, overmolder package rated at 7 A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. The output is closely regulated and the efficiency is typically 92% at full load.

Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Part Number Surface Mount | Part Number Vertical Mount |
|-------------------|---------------|---------------------|-------------------|--------------------|---------------------------|----------------------------|
| 0.9 Vdc - 2.5 Vdc | 3.3 Vdc | 7 A | 17.5 W | 92% | SRAH-07C1A0 | VRAH-07C1A0 |

- Notes:** 1. Add "O" suffix at the end of the model number to indicate "Tube Packaging", and "R" for "Reel Packaging", and "G" for "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 | - | 6 V | |
| Output Enable Terminal Voltage | -0.3 V | - | 6 V | |
| Ambient Temperature | -40 °C | - | 85 °C | |
| Storage Temperature | -40 °C | - | 125 °C | |

Input Specifications

| Parameter | Min | Typ | Max | Notes |
|---|-------|-----------------------|-----------------------|---|
| Input Voltage | 3 V | - | 3.6 V | |
| Input Current (no load) | - | - | 110 mA | |
| Input Current (full load) | | | | |
| Vo=2.5 V | - | - | 6.6 A | |
| Vo=1.8 V | - | - | 5.3 A | |
| Vo=1.5 V | - | - | 4.6 A | |
| Vo=1.2 V | - | - | 3.8 A | |
| Vo=1.0 V | - | - | 3.2 A | |
| Vo=0.9 V | - | - | 3.0 A | |
| Remote Off Input Current | - | 7 mA | 15 mA | |
| Input Reflected Ripple Current (pk-pk) | - | 150 mA | 250 mA | With simulated source impedance of 500 nH, 5 Hz to 20 MHz and a 270 uF/16 V with ESR=0.03 ohm max. at 100 kHz |
| Input Reflected Ripple Current (rms) | - | 50 mA | 80 mA | |
| I ² t Inrush Current Transient | - | 0.08 A ² s | 0.16 A ² s | |
| Turn on Voltage Threshold | 2.5 V | - | 2.8 V | |
| Turn off Voltage Threshold | - | 2.4 V | - | |

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Output Specifications

| Parameter | | Min | Typ | Max | Notes | |
|---|----------------|--------------------|-----------------------|-----------------------|---|--|
| Output Voltage Set Point | Vo=2.5 V | 2.450 V | 2.5 V | 2.550 V | Test conditions: Vin=3.3 V, Io= full load | |
| | Vo=1.8 V | 1.764 V | 1.8 V | 1.836 V | | |
| | Vo=1.5 V | 1.470 V | 1.5 V | 1.530 V | | |
| | Vo=1.2 V | 1.176 V | 1.2 V | 1.224 V | | |
| | Vo=1.0 V | 0.980 V | 1.0 V | 1.020 V | | |
| | Vo=0.9 V | 0.882 V | 0.9 V | 0.918 V | | |
| Line Regulation | Vo=1.5 V-2.5 V | - | ±3 mV | ±10 mV | | |
| | Vo=0.9 V-1.2 V | - | ±1 mV | ±5 mV | | |
| Load Regulation | Vo=1.5 V-2.5 V | - | ±3 mV | ±10 mV | | |
| | Vo=0.9 V-1.2 V | - | ±1 mV | ±5 mV | | |
| Regulation Over Temperature (-40 °C to +85 °C) | Vo=2.5 V | - | ±25 mV | ±40 mV | | |
| | Vo=1.8 V | - | ±15 mV | ±30 mV | | |
| | Vo=1.5 V | - | ±15 mV | ±30 mV | | |
| | Vo=1.2 V | - | ±10 mV | ±20 mV | | |
| | Vo=1.0 V | - | ±8 mV | ±15 mV | | |
| | Vo=0.9 V | - | ±8 mV | ±15 mV | | |
| Output Current | | 0 A | - | 7 A | | |
| Current Limit Threshold | | 8.4 A | - | 17.5 A | | |
| Short Circuit Surge Transient | | - | 0.08 A ² s | 0.12 A ² s | | |
| Ripple and Noise (rms) | Vo=2.5 V-0.9 V | - | 10 mV | 20 mV | Test condition: 0-20 MHz BW, with a 1 uF ceramic capacitor and 10 uF aluminum capacitor at the output. | |
| Ripple and Noise (pk-pk) | Vo=2.5 V-1.2 V | - | 40 mV | 80 mV | | |
| | Vo=1.0 V-0.9 V | - | 40 mV | 70 mV | | |
| Turn on Time | | - | 7 mS | 15 mS | | |
| Overshoot at Turn on | | - | 0% | 1% | | |
| Output Capacitance | | 0 uF | - | 2200 uF | | |
| Transient Response | | | | | | |
| 50% ~ 100% Max Load | Overshoot | Vo=1.8 V- 2.5 V | - | 120 mV | 180 mV | Test conditions: di/dt = 0.5 A/uS; Vin = 3.3 V; without any external capacitor at the output. |
| | Settling Time | | - | 40 uS | 80 uS | |
| 100% ~ 50% Max Load | Overshoot | | - | 120 mV | 180 mV | |
| | Settling Time | | - | 40 uS | 80 uS | |
| 50% ~ 100% Max Load | Overshoot | Vo=1.5 V | - | 100 mV | 150 mV | |
| | Settling Time | | - | 40 uS | 80 uS | |
| 100% ~ 50% Max Load | Overshoot | | - | 100 mV | 150 mV | |
| | Settling Time | | - | 40 uS | 80 uS | |
| 50% ~ 100% Max Load | Overshoot | Vo=0.9 V- 1.2 V | - | 50 mV | 100 mV | |
| | Settling Time | | - | 40 uS | 80 uS | |
| 100% ~ 50% Max Load | Overshoot | | - | 50 mV | 100 mV | |
| | Settling Time | | - | 40 uS | 80 uS | |

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

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General Specifications

| Parameter | Min | Typ | Max | Notes | |
|----------------------------|-------------------------|----------------------|---------|--|---|
| Efficiency | Vo=2.5 V | 90% | 92% | - | Measured at Vin=3.3 V, full load and Ta=25 °C |
| | Vo=1.8 V | 86% | 88% | - | |
| | Vo=1.5 V | 84% | 86% | - | |
| | Vo=1.2 V | 81% | 83% | - | |
| | Vo=1.0 V | 79% | 81% | - | |
| | Vo=0.9 V | 78% | 80% | - | |
| Switching Frequency | 250 kHz | 300 kHz | 340 kHz | | |
| Output Trim Range | 50% | - | 146% | Vo=1.8 V | |
| MTBF | 3,391,747 hours | | | Calculated Per Bell Core SR-332 (Vin=3.3 V; Vo=1.8 V; Io = 5.6 A; Ta = 25°C) | |
| Dimensions (surface mount) | Inches (L x W x H) | 0.78 x 0.70 x 0.32 | | | |
| | Millimeters (L x W x H) | 19.81 x 17.78 x 8.13 | | | |
| Dimensions (vertical) | Inches (L x W x H) | 0.70 x 0.308 x 0.65 | | | |
| | Millimeters (L x W x H) | 17.78 x 7.82 x 16.51 | | | |
| Weight | - | 5 g | - | | |

Control Specifications

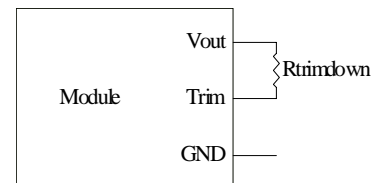
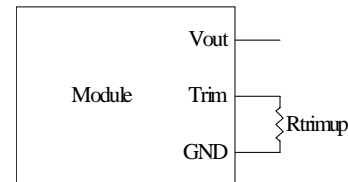
| Parameter | Min | Typ | Max | Notes |
|-----------------------|--------|-----|-------|----------------------------------|
| Remote On/Off | | | | |
| Signal Low (Unit Off) | -0.3 V | - | 1 V | Remote on/off pin open, unit on. |
| Signal High (Unit On) | 1.8 V | - | 3.6 V | |

Output Trim Equations

Equations for calculating the trim resistor given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trimup resistor should be connected between the Trim pin and Ground and the Trimdown resistor should be connected between the Trim pin and Vout pin.

$$R_{trim_up} = \left(\frac{3.064}{V_{o,adj} - V_o} - 0.261 \right) K\Omega$$

$$R_{trim_down} = \left(\frac{3.8488}{V_o - V_{o,adj}} - 4.091 \right) K\Omega$$



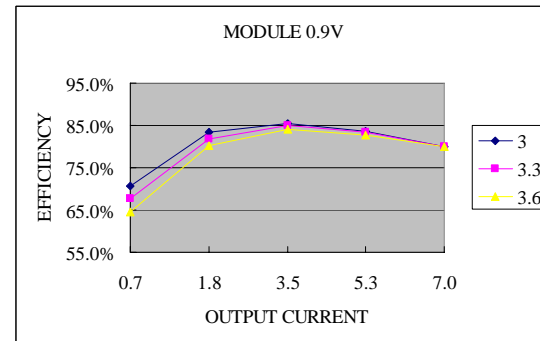
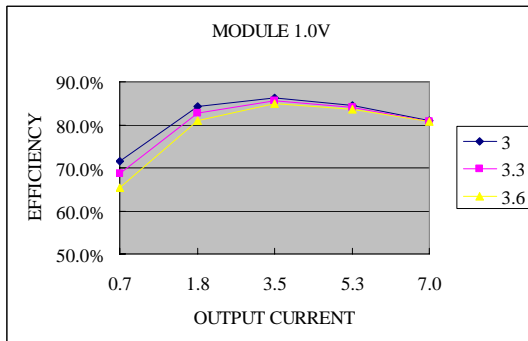
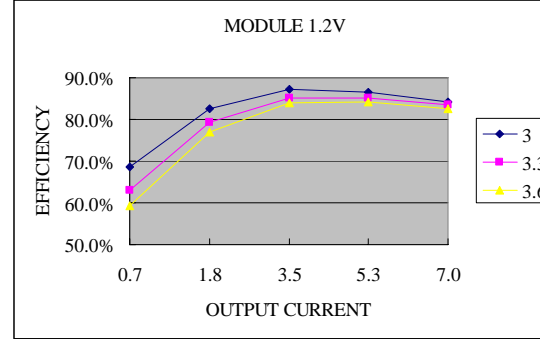
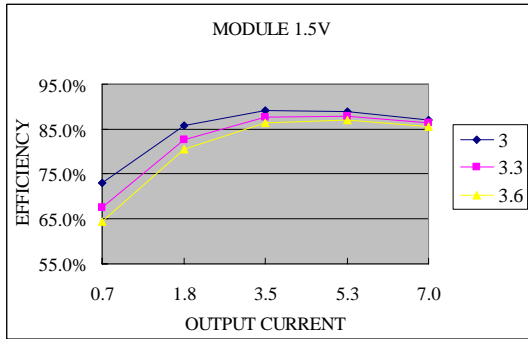
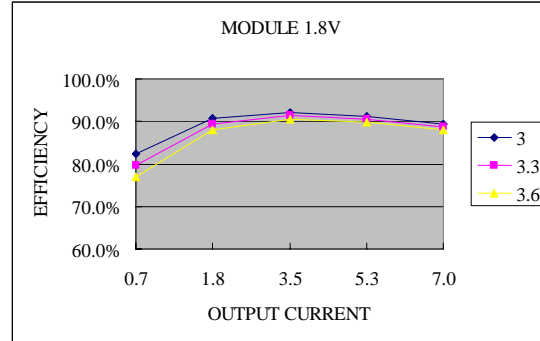
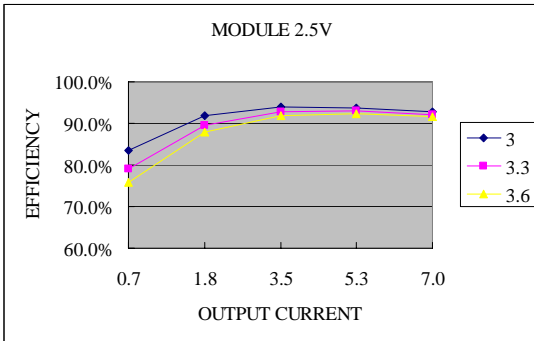
Note: Output voltage Vo=1.8 V when Rtrim is open.

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Efficiency Data

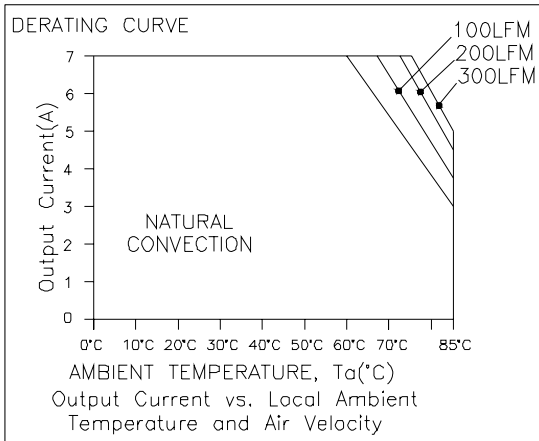


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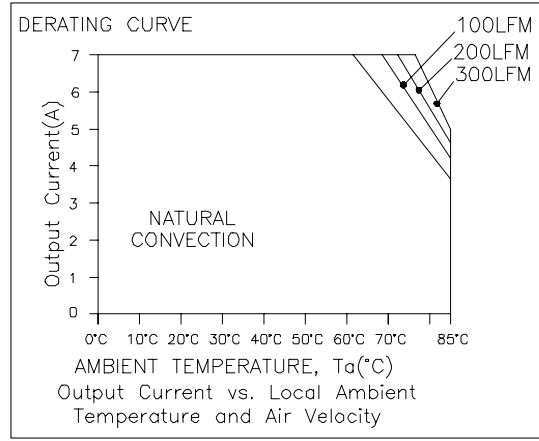
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Thermal Derating Curves

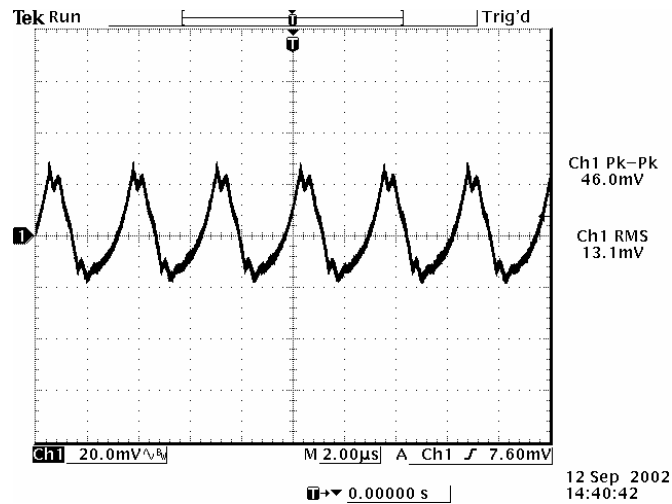


VRAH-07C1A0



SRAH-07C1A0

Ripple and Noise Waveforms



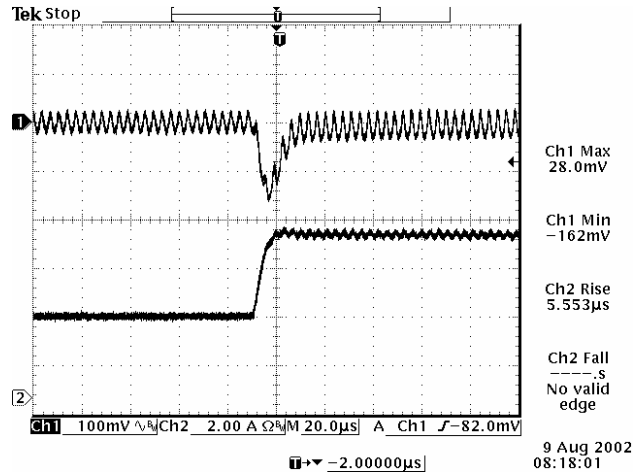
Note: Ripple and noise at full load, 3.3 Vdc input, 1.8 Vdc output and $T_a=25$ deg C, with 1 uF ceramic capacitor and 10 uF aluminum capacitor at the output.

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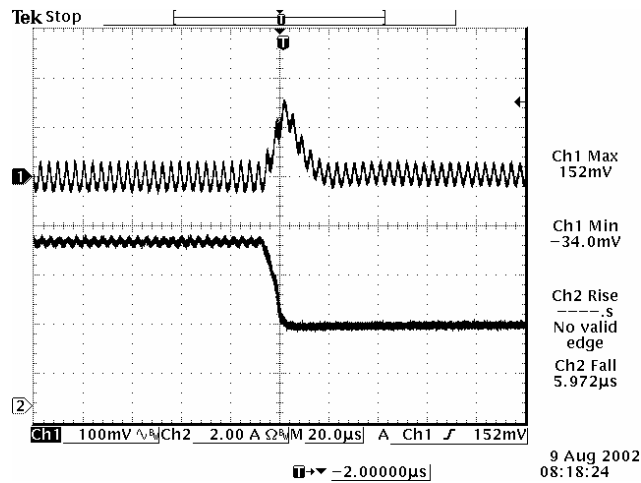
3.3 Vdc Input 0.9 Vdc - 2.5 Vdc/7 A Output



Transient Response Waveforms



50% to 100% load Transient at $V_{in}=3.3\text{ V}$, $V_o=1.8\text{ V}$



100% to 50% load Transient at $V_{in}=3.3\text{ V}$, $V_o=1.8\text{ V}$

Note: Transient Response at $di/dt=0.5\text{ A}/\mu\text{S}$, external load capacitance $C_o=0\mu\text{F}$ (electrolytic), $T_a=25\text{ deg C}$.

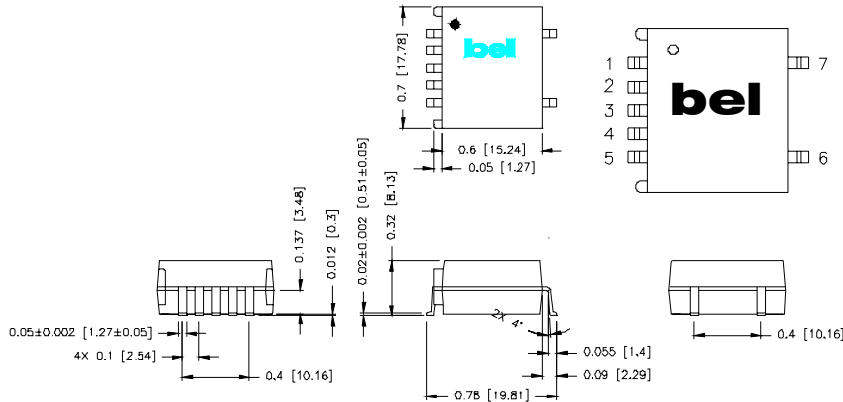
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Mechanical Outline

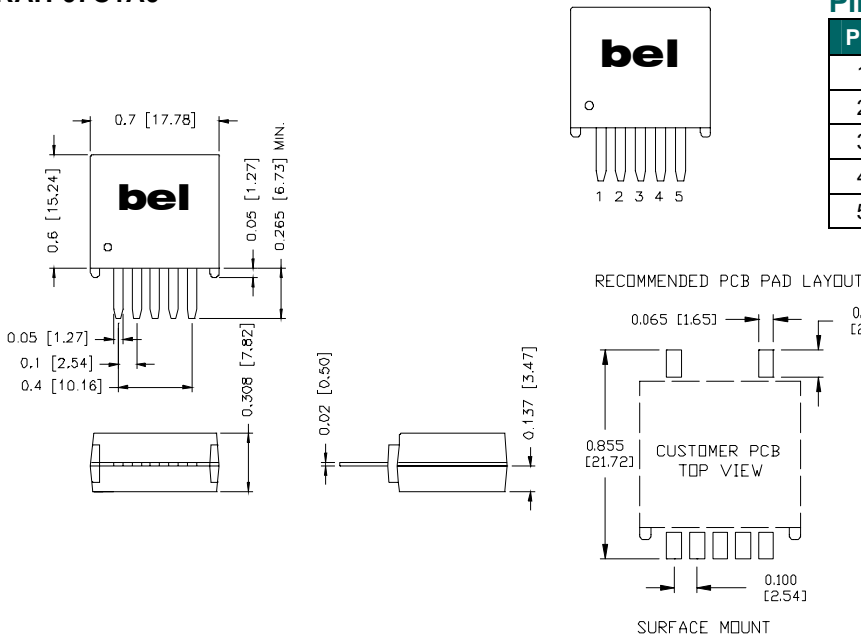
SRAH-07C1A0



Pin Connections

| Pin | Function |
|-----|------------------------|
| 1 | Remote On/Off (option) |
| 2 | Vin |
| 3 | Ground |
| 4 | Vout |
| 5 | Trim (option) |
| 6 | N/A |
| 7 | N/A |

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Pin Connections

| Pin | Function |
|-----|------------------------|
| 1 | Remote On/Off (option) |
| 2 | Vin |
| 3 | Ground |
| 4 | Vout |
| 5 | Trim (option) |

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. 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 240 °C.



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