

## NON-ISOLATED DC/DC CONVERTERS

3.0 Vdc - 3.6 Vdc Input

5.0 Vdc/3 A Output

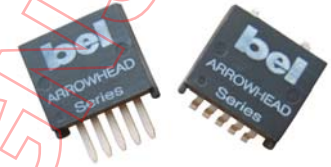
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POWER PRODUCTS

xRAH-03C500

RoHS Compliant

Rev.A

- Non-Isolated
- High Efficiency
- Fixed Frequency (530 kHz)
- Low Profile Package
- Allows Burst Mode Operation at Low Load Currents
- Trim Function (Option)
- UL60950-1 Recognized (UL/cUL)



### Description

The Bel xRAH-03C500 is a part of the low cost non-isolated dc/dc converter series. The modules use a SMD or SIP package for ease of layout and space savings. The output is closely regulated and the efficiency is typically 90% 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 |
|----------------|-------------------|---------------------|-------------------|--------------------|---------------------------|----------------------------|
| 5.0 Vdc        | 3.0 Vdc - 3.6 Vdc | 3 A                 | 15 W              | 90%                | SRAH-03C500               | VRAH-03C500                |

- Notes:** 1. Add "0" 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) | 2.8 V  | -   | 4.0 V  |       |
| Ambient Temperature        | 0 °C   | -   | 70 °C  |       |
| Storage Temperature        | -40 °C | -   | 125 °C |       |

### Input Specifications

| Parameter                                 | Min   | Typ                   | Max                   | Notes                                                                                                                                  |
|-------------------------------------------|-------|-----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Input Voltage                             | 3.0 V | -                     | 3.6 V                 |                                                                                                                                        |
| Input Current                             | -     | -                     | 6.3 A                 |                                                                                                                                        |
| Input Reflected Ripple Current (rms)      | -     | 30 mA                 | 60 mA                 | With simulated source impedance of 500 nH, 5 Hz to 20 MHz; Use one 270 uF/16 V capacitor with ESR = 0.018 ohm max. at 100KHz at 25 °C. |
| Input Reflected Ripple Current (pk-pk)    | -     | 100 mA                | 150 mA                |                                                                                                                                        |
| I <sup>2</sup> t Inrush Current Transient | -     | 0.02 A <sup>2</sup> s | 0.05 A <sup>2</sup> s |                                                                                                                                        |
| Turn-on Voltage Threshold                 | -     | 2.8 V                 | 2.9 V                 |                                                                                                                                        |

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

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### Output Specifications

| Parameter                                      | Min     | Typ    | Max     | Notes                     |                                                                            |
|------------------------------------------------|---------|--------|---------|---------------------------|----------------------------------------------------------------------------|
| Output Voltage Set Point                       | 4.875 V | 5.0 V  | 5.125 V | Vin=3.3 V, Iout=full load |                                                                            |
| Load Regulation                                | -       | 25 mV  | 50 mV   |                           |                                                                            |
| Line Regulation                                | -       | 20 mV  | 40 mV   |                           |                                                                            |
| Regulation Over Temperature<br>(0 °C to 70 °C) | -       | 20 mV  | 30 mV   |                           |                                                                            |
| Output Current                                 | 0 A     | -      | 3 A     |                           |                                                                            |
| Ripple and Noise <sup>1</sup> (rms)            | -       | 15 mV  | 25 mV   |                           |                                                                            |
| Ripple and Noise <sup>1</sup> (pk-pk)          |         |        |         |                           |                                                                            |
| Burst Mode <sup>2</sup>                        | -       | 100 mV | -       | Io = 0 A                  |                                                                            |
| Fixed Frequency                                | -       | 70 mV  | 100 mV  | Io = 3 A                  |                                                                            |
| Rise Time                                      | -       | 30 mS  | 50 mS   |                           |                                                                            |
| Overshoot at Turn on                           | -       | 0%     | 5%      |                           |                                                                            |
| Output Capacitance                             | 0 uF    | -      | 1500 uF |                           |                                                                            |
| Transient Response                             |         |        |         |                           |                                                                            |
| 50% ~ 100% Max Load                            | Vo=5 V  | -      | 100 mV  | 150 mV                    | di/dt = 0.5 A/uS; Vin = 3.3 V;<br>Ta = 25 °C without external<br>capacitor |
| Settling Time                                  |         | -      | 50 uS   | 120 uS                    |                                                                            |
| 100% ~ 50% Max Load                            |         | -      | 100 mV  | 150 mV                    |                                                                            |
| Settling Time                                  |         | -      | 50 uS   | 120 uS                    |                                                                            |

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

1. Test condition of the output ripple and noise: 0-20 MHz BW.

2. Recommend a 220 uF capacitor at output if the module operates at burst mode (light load).

### General Specifications

| Parameter                                                                   | Min                                        | Typ     | Max     | Notes                                                                          |
|-----------------------------------------------------------------------------|--------------------------------------------|---------|---------|--------------------------------------------------------------------------------|
| Efficiency<br>Vo=5.0 V                                                      | 87%                                        | 90%     | -       |                                                                                |
| Switching Frequency                                                         | 460 kHz                                    | 530 kHz | 630 kHz |                                                                                |
| Output Trim Range                                                           | 90% Vo                                     | -       | 110% Vo |                                                                                |
| MTBF                                                                        | 8,100,000 hours                            |         |         | Calculated Per Bell Core SR-332<br>(Vin=3.3 V; Vo=5 V; Io = 2.4 A; Ta = 25 °C) |
| Dimensions (surface mount)<br>Inches (L × W × H)<br>Millimeters (L × W × H) | 0.78 x 0.7 x 0.32<br>19.81 x 17.78 x 8.13  |         |         |                                                                                |
| Dimensions (vertical)<br>Inches (L × W × H)<br>Millimeters (L × W × H)      | 0.7 x 0.308 x 0.65<br>17.78 x 7.82 x 16.51 |         |         |                                                                                |
| Weight                                                                      | -                                          | 5.2 g   | -       |                                                                                |

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

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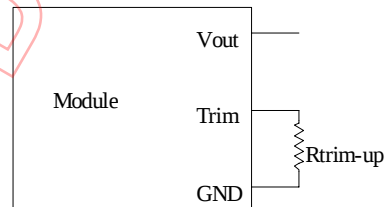
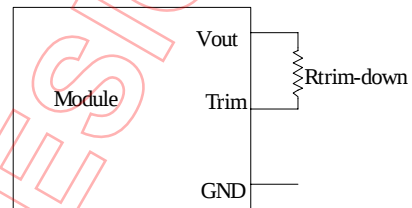
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### Output Trim Equations

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 Vout. 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.

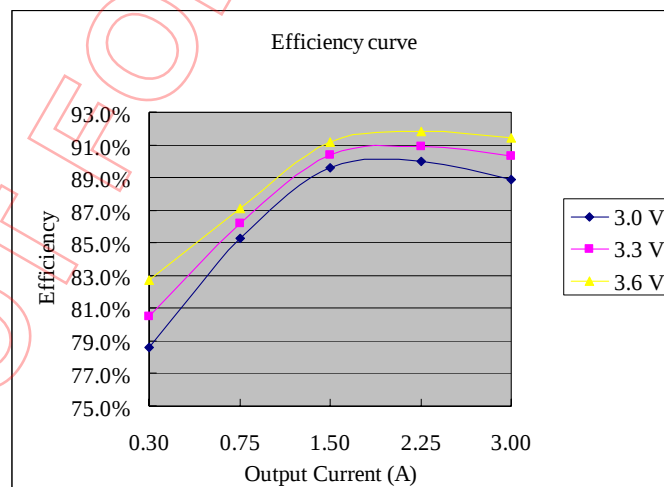
$$R_{trim-down} = \left( \frac{12.033}{V_o - V_{adj}} - 7.8 \right)$$

$$R_{trim-up} = \left( \frac{3.808}{V_{adj} - V_o} - 4.64 \right)$$



**Note:** Output voltage  $V_o = 5.0128$  V when Rtrim is open.

### Efficiency Data



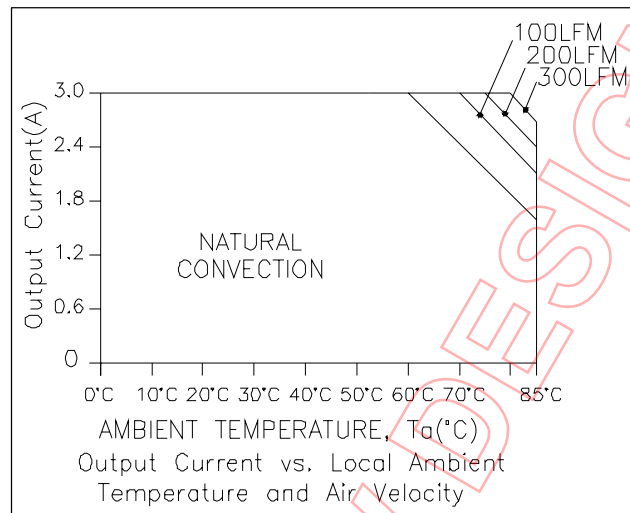
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5.0 Vdc/3 A Output

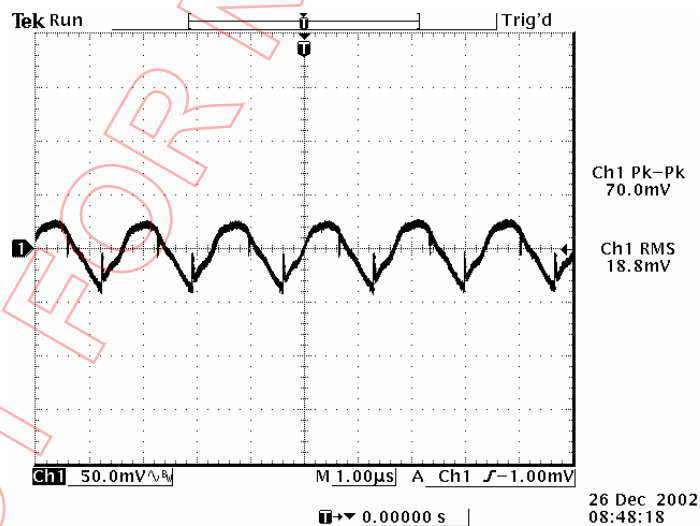
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### Thermal Derating Curve



xRAH-03C500

### Ripple and Noise Waveform



**Note:** Ripple and noise at full load, 3.3 Vdc input, 5 Vdc output and Ta=25 deg C.

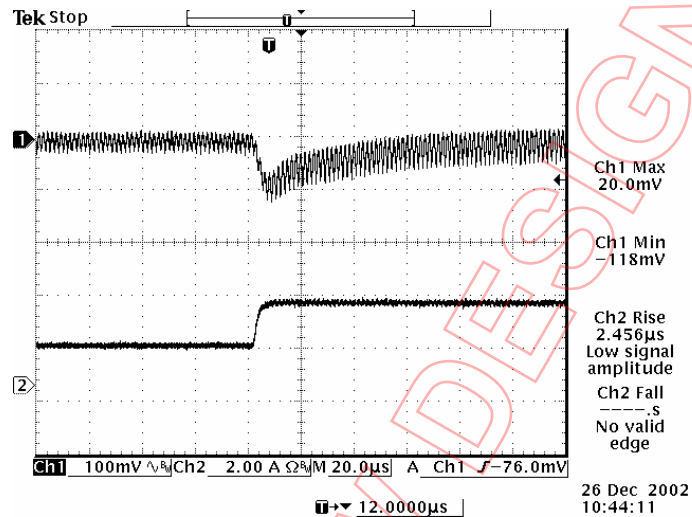
## NON-ISOLATED DC/DC CONVERTERS

3.0 Vdc - 3.6 Vdc Input

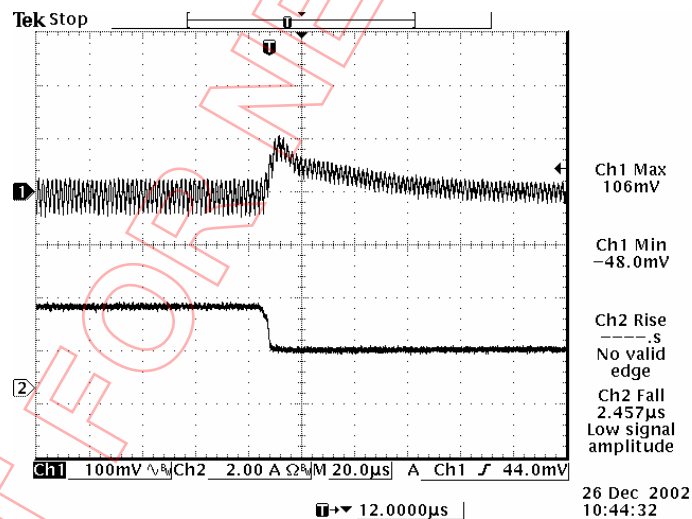
5.0 Vdc/3 A Output

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### Transient Response Waveforms



Transients 50% to 100% load, 3.3 Vdc Input ,5 Vdc Output,



Transients 100% to 50% load, 3.3 Vdc Input, 5 Vdc Output

**Note:** Transient response at  $di/dt=0.5$  A/μS, without external load capacitor,  $T_a=25$  deg C.

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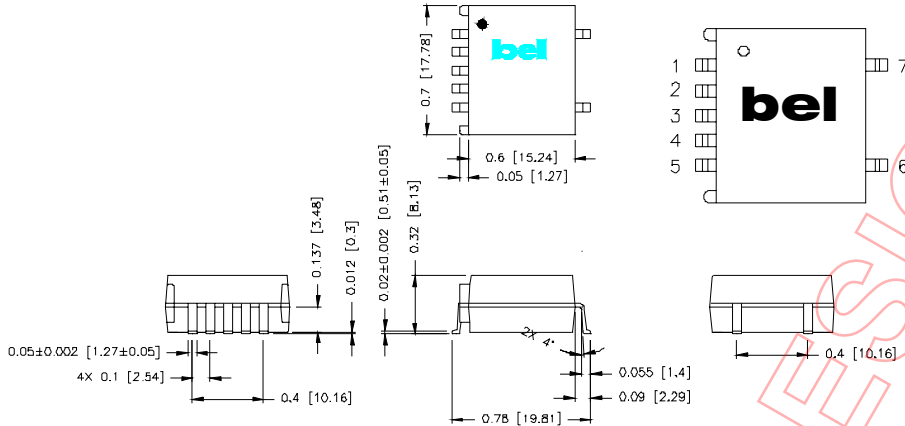
3.0 Vdc - 3.6 Vdc Input

5.0 Vdc/3 A Output



## Mechanical Outline

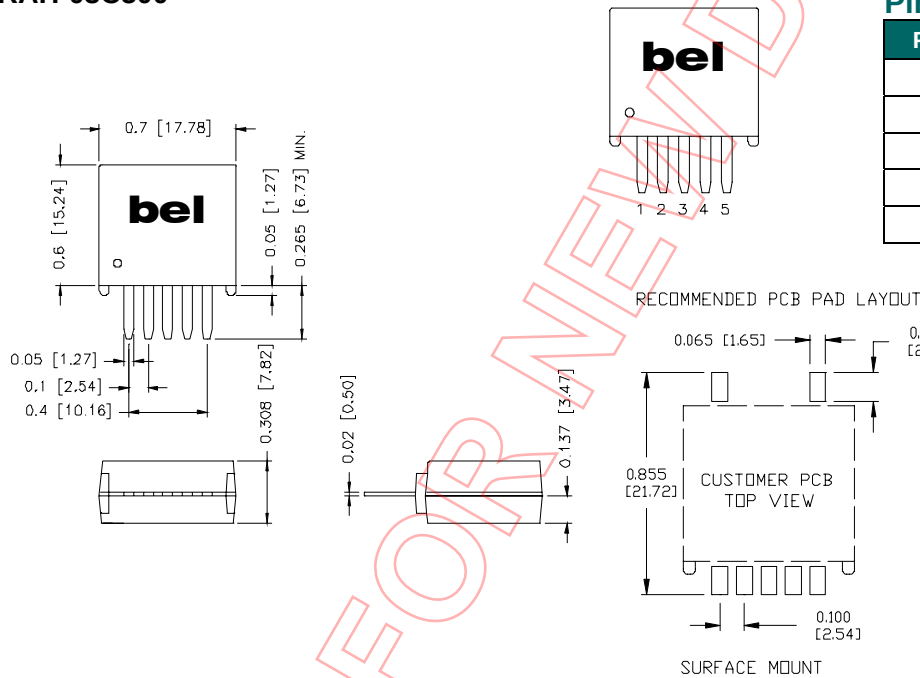
### SRAH-03C500



## Pin Connections

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

### VRAH-03C500



## Pin Connections

| Pin | Function      |
|-----|---------------|
| 1   | N/A           |
| 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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