

# NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

1.2V-5.0V/3A Output



## x7AH-03H Series

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Remote On/Off
- Input Under Voltage Lockout
- OCP/SCP
- Low Cost



## Description

The Bel x7AH-03Hxx0 is part of the low cost non-isolated DC/DC power converter series. It is packaged in a compact, overmolded package rated at 3A. 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 of 3.3V output is typically 90% at full load. Typical features include remote on/off, input under voltage lockout, over current protection and short circuit protection.

## Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Part Number Surface Mount | Part Number Vertical Mount |
|----------------|---------------|---------------------|-------------------|--------------------|---------------------------|----------------------------|
| 5.0V           | 8.0V – 32V    | 3A                  | 15W               | 92%                | S7AH-03H500               | V7AH-03H500                |
| 3.3V           | 4.9V – 32V    | 3A                  | 10W               | 90%                | S7AH-03H330               | V7AH-03H330                |
| 2.5V           | 4.5V – 32V    | 3A                  | 7.5W              | 88%                | S7AH-03H250               | V7AH-03H250                |
| 1.8V           | 4.5V – 32V    | 3A                  | 5.4W              | 85%                | S7AH-03H180               | V7AH-03H180                |
| 1.5V           | 4.5V – 32V    | 3A                  | 4.5W              | 83%                | S7AH-03H150               | V7AH-03H150                |
| 1.2V           | 4.5V – 32V    | 3A                  | 3.6W              | 81%                | S7AH-03H120               | V7AH-03H120                |

**Note:** Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “R” for “Reel Packaging”, and “G” for “Tray Packaging”.

## Absolute Maximum Ratings

| Parameter                      | Min   | Typ | Max   | Notes |
|--------------------------------|-------|-----|-------|-------|
| Input Voltage (continuous)     | -0.3V | -   | 34V   |       |
| Output Enable Terminal Voltage | -0.3V | -   | 12V   |       |
| Ambient Temperature            | -40°C | -   | 85°C  |       |
| Storage Temperature            | -40°C | -   | 125°C |       |

## Input Specifications

| Parameter                                 | Min  | Typ                  | Max                 | Notes   |
|---|------|----------------------|---------------------|---|
| Input Voltage                             | 4.5V | -                    | 32V                 | See “Part Selection” for more details.  |
| Input Current (no load)                   | -    | 30mA                 | -                   |   |
| Input Current (full load)                 | -    | -                    | 3A                  |   |
| Remote Off Input Current                  | -    | 4mA                  | -                   |   |
| Input Reflected Ripple Current (pk-pk)    | -    | 200mA                | 400mA               | Tested with simulated source impedance of 500nH, 5Hz to 20MHz and two 100uF/50V electrolytic capacitors and a 3.3uF/50V ceramic capacitor at the input. |
| Input Reflected Ripple Current (RMS)      | -    | 100mA                | 150mA               |   |
| I <sup>2</sup> t Inrush Current Transient | -    | 0.02A <sup>2</sup> s | 0.1A <sup>2</sup> s |   |
| Turn on Voltage Threshold <sup>1</sup>    | -    | 4.1V                 | 4.5V                |   |
| Turn off Voltage Threshold <sup>2</sup>   | -    | 3.3V                 | 4.0V                |   |

- Notes:**
1. The max Turn on Voltage threshold of the 3.3V & 5.0V output module will be relaxed to 4.9V & 8.0V respectively.
  2. The max Turn off Voltage threshold of the 3.3V output module will be relaxed to 4.5V. The 5.0V output module does not have such function.

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## Output Specifications

| Parameter                                       | Min           | Typ                  | Max                 | Notes  |  |
|---|---------------|----------------------|---------------------|--|--|
| Output Voltage Set Point                        |               |                      |                     | Test conditions:<br>Vin=12V, Io=50% full load                                |  |
| Vo=5.0V   | 4.900V        | 5.0V                 | 5.100V              |  |  |
| Vo=3.3V   | 3.234V        | 3.3V                 | 3.366V              |  |  |
| Vo=2.5V   | 2.450V        | 2.5V                 | 2.550V              |  |  |
| Vo=1.8V   | 1.764V        | 1.8V                 | 1.836V              |  |  |
| Vo=1.5V   | 1.470V        | 1.5V                 | 1.530V              |  |  |
| Vo=1.2V   | 1.176V        | 1.2V                 | 1.224V              |  |  |
| Line Regulation                                 |               |                      |                     |  |  |
| Vo=5.0V   | -             | ±10mV                | ±15mV               |  |  |
| Vo=1.2-3.3V                                     | -             | ±5mV                 | ±10mV               |  |  |
| Load Regulation                                 |               |                      |                     |  |  |
| Vo=5.0V   | -             | ±10mV                | ±15mV               |  |  |
| Vo=1.2-3.3V                                     | -             | ±5mV                 | ±10mV               |  |  |
| Regulation Over Temperature<br>(-40°C to +85°C) | -             | 30mV                 | 50mV                |  |  |
| Output Current                                  | 0A            | -                    | 3A                  |  |  |
| Current Limit Threshold                         | 3.3A          | -                    | 9A                  |  |  |
| Short Circuit Surge Transient                   |               |                      |                     |  |  |
| Vo=1.2V-5.0V                                    | -             | 0.02A <sup>2</sup> s | 0.1A <sup>2</sup> s |  |  |
| Ripple and Noise (RMS)                          |               |                      |                     | Tested with 0-20MHz BW,<br>with a 220uF tantalum<br>capacitor at the output. |  |
| Vo=1.2V-5.0V                                    | -             | 25mV                 | 50mV                |  |  |
| Ripple and Noise (pk-pk)                        |               |                      |                     |  |  |
| Vo=1.2V-5.0V                                    | -             | 60mV                 | 100mV               |  |  |
| Turn on Time                                    | -             | 15mS                 | 50mS                |  |  |
| Overshoot at Turn on                            | -             | 2%                   | 5%                  |  |  |
| Output Capacitance                              | 220uF         | -                    | 1200uF              |  |  |
| <b>Transient Response</b>                       |               |                      |                     |  |  |
| 50% ~ 100%<br>Max Load                          | Overshoot     | Vo=5.0V              | -                   | 150mV  | Test conditions:<br>di/dt = 0.5A/uS; Vin = 12V;<br>with a 220uF Tantalum<br>capacitor at the output. |
|   | Settling Time |                      | -                   | 100uS  |  |
| 100% ~ 50%<br>Max Load                          | Overshoot     | Vo=5.0V              | -                   | 150mV  |  |
|   | Settling Time |                      | -                   | 100uS  |  |
| 50% ~ 100%<br>Max Load                          | Overshoot     | Vo=3.3V              | -                   | 130mV  |  |
|   | Settling Time |                      | -                   | 100uS  |  |
| 100% ~ 50%<br>Max Load                          | Overshoot     | Vo=3.3V              | -                   | 130mV  |  |
|   | Settling Time |                      | -                   | 100uS  |  |
| 50% ~ 100%<br>Max Load                          | Overshoot     | Vo=1.8V -<br>2.5V    | -                   | 100mV  |  |
|   | Settling Time |                      | -                   | 50uS   |  |
| 100% ~ 50%<br>Max Load                          | Overshoot     | Vo=1.8V -<br>2.5V    | -                   | 100mV  |  |
|   | Settling Time |                      | -                   | 50uS   |  |
| 50% ~ 100%<br>Max Load                          | Overshoot     | Vo=1.2V -<br>1.5V    | -                   | 90mV   |  |
|   | Settling Time |                      | -                   | 40uS   |  |
| 100% ~ 50%<br>Max Load                          | Overshoot     | Vo=1.2V -<br>1.5V    | -                   | 90mV   |  |
|   | Settling Time |                      | -                   | 40uS   |  |

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

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4.5V-32V Input      1.2V-5.0V/3A Output



## General Specifications

| Parameter                       | Min                     | Typ    | Max    | Notes   |
|---------------------------------|-------------------------|--------|--------|---|
| Efficiency                      | Vo=5.0V                 | 89%    | 92%    | Measured at Vin=12V, full load and Ta=25°C                |
|                                 | Vo=3.3V                 | 87%    | 90%    |   |
|                                 | Vo=2.5V                 | 85%    | 88%    |   |
|                                 | Vo=1.8V                 | 82%    | 85%    |   |
|                                 | Vo=1.5V                 | 80%    | 83%    |   |
|                                 | Vo=1.2V                 | 78%    | 81%    |   |
| Switching Frequency             | 200KHz                  | 300KHz | 400KHz |   |
| Output Trim Range (narrow trim) | 90%Vo                   | -      | 110%Vo |   |
| MTBF                            | 8,120,000 hours         |        |        | Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25°C) |
| Dimensions (surface mount)      | Inches (L x W x H)      |        |        |   |
|                                 | 0.78 x 0.70 x 0.32      |        |        |   |
| Dimensions (vertical)           | 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     |        |        |   |
| Weight                          | Millimeters (L x W x H) |        |        |   |
|                                 | 17.78 x 7.82 x 16.51    |        |        |   |
| Weight                          | -                       | 5.1g   | -      |   |

## Control Specifications

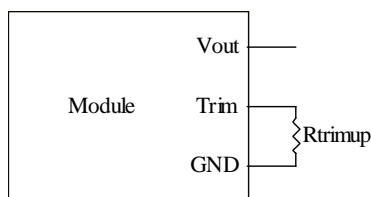
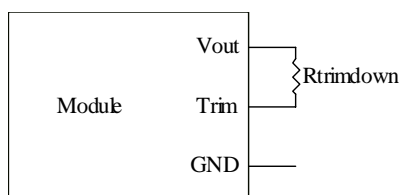
| Parameter              | Min   | Typ | Max | Notes                            |
|------------------------|-------|-----|-----|----------------------------------|
| <b>Remote On/Off</b>   |       |     |     |                                  |
| Signal Low (Unit On)   | -0.3V | -   | 1V  | Remote on/off pin open, unit on. |
| Signal High (Unit Off) | 2.8V  | -   | 12V |                                  |

## Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) 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.

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

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



| Vnom | A      | B      | C      | D      |
|------|--------|--------|--------|--------|
| 5.0  | 61.850 | 29.400 | 11.760 | 14.700 |
| 3.3  | 53.840 | 61.700 | 17.200 | 40.200 |
| 2.5  | 9.556  | 15.620 | 4.496  | 10.000 |
| 1.8  | 3.849  | 13.830 | 3.064  | 10.000 |
| 1.5  | 3.102  | 14.420 | 3.536  | 10.000 |
| 1.2  | 1.794  | 10.910 | 3.536  | 6.490  |

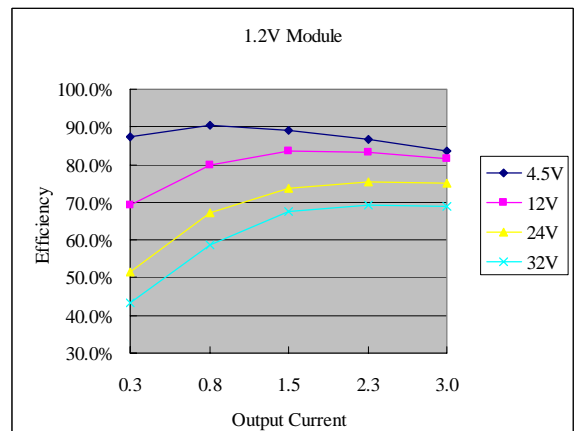
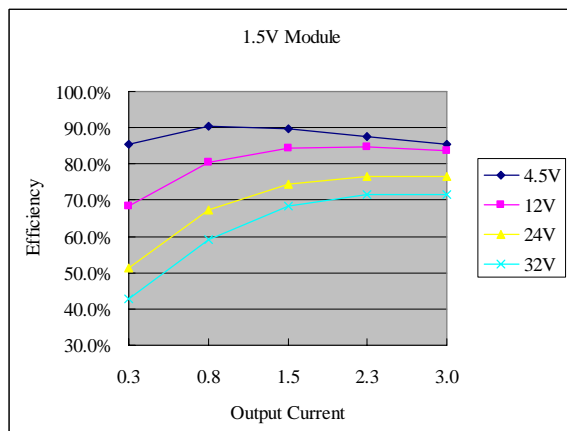
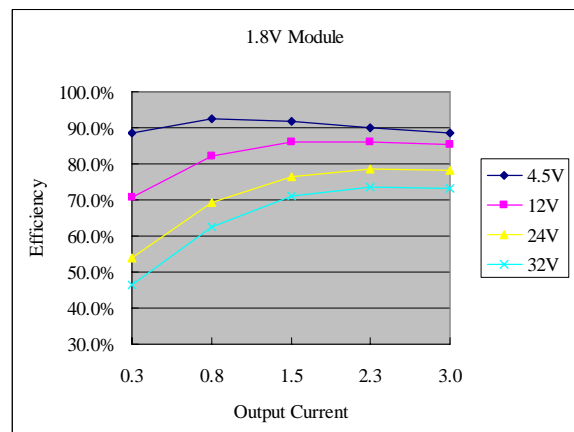
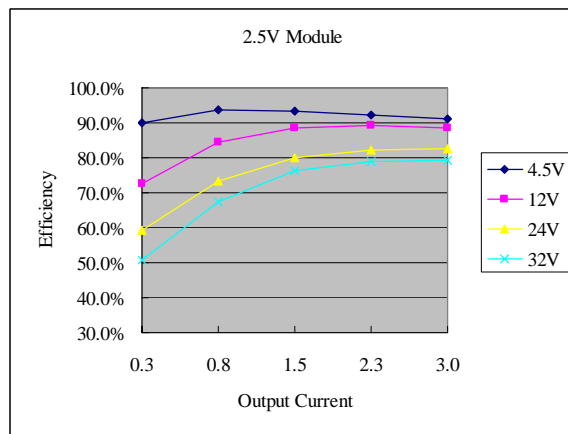
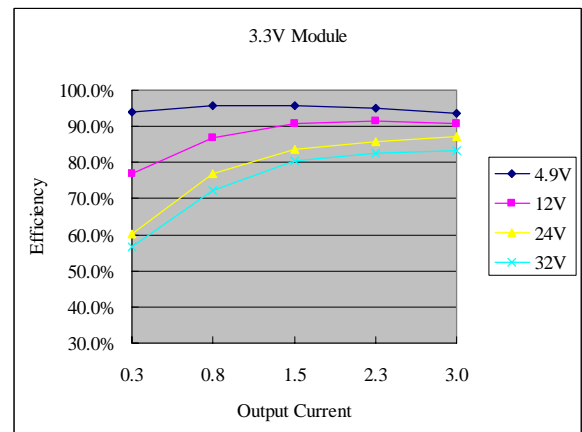
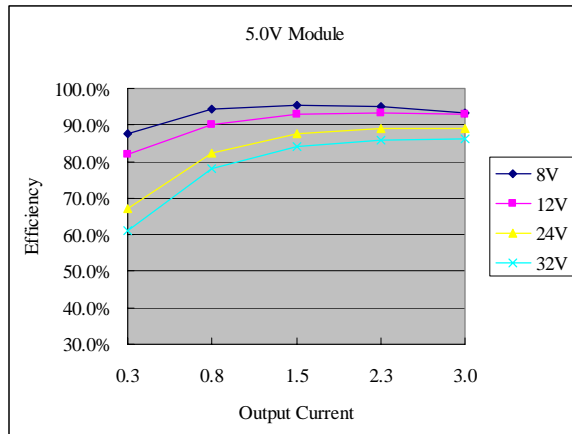
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4.5V-32V Input

1.2V-5.0V/3A Output



## Efficiency Data



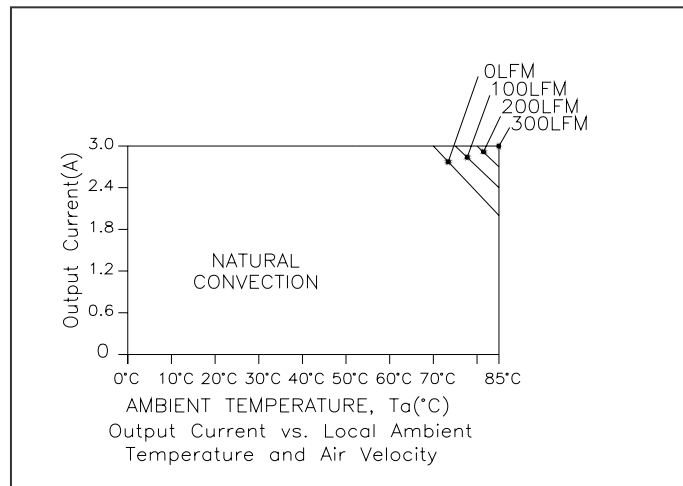
# NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

1.2V-5.0V/3A Output



## Thermal Derating Curve

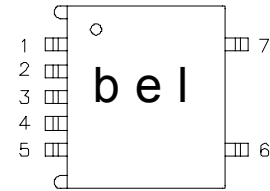
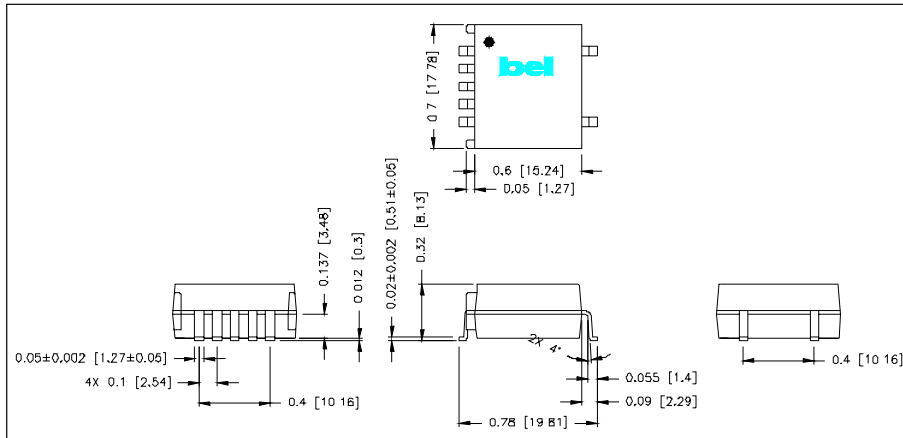


Vin=24V

# NON-ISOLATED DC/DC CONVERTERS

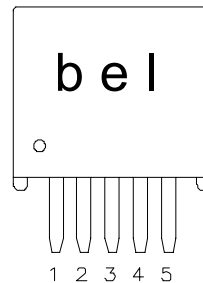
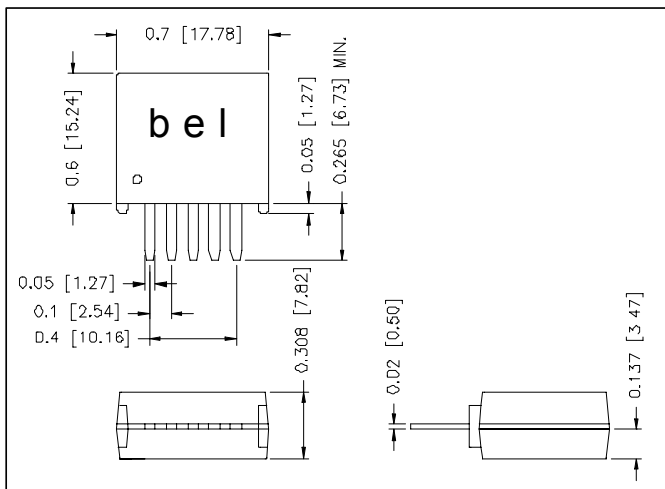
4.5V-32V Input

1.2V-5.0V/3A Output



## Pin Connections

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



## Pin Connections

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

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