

## NON-ISOLATED DC/DC CONVERTERS

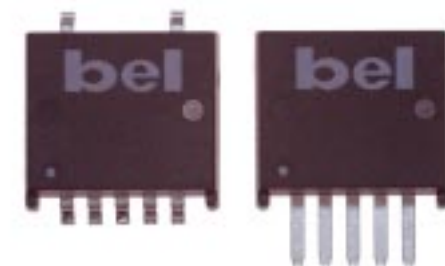
### 5V Input / 1.2V – 3.3V Output / 5A



BP02x7AH-05B

### S7AH-05B / V7AH-05B Series

- Nonisolated
- Compact, low profile surface mount package
- Fixed frequency
- High efficiency means less power dissipation
- Excellent thermal performance
- Optimized for cost
- Remote on/off
- Undervoltage lockout (UVLO)
- Over current and short circuit protection



### Description

The Bel S7AH-05B and V7AH-05B modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 5V source. These converters are available in a range of output voltages from 1.2V to 3.3V. They are packaged in a compact, overmolded package rated at 5A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. Standard features include remote on/off, over current and short circuit protection, and output voltage adjust. These products may be used almost anywhere low voltage silicon is employed and a 5V source is available. Typical applications include file servers, routers, line cards and other computing and communications equipment.

### Applications

- Distributed power architectures
- Data networking equipment
- Telecommunications
- Computers and peripherals

### Part Number Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Part Number Surface Mount | Part Number Vertical Mount |
|----------------|---------------|---------------------|-------------------|--------------------|---------------------------|----------------------------|
| 3.3V           | 5V            | 5A                  | 16.5W             | 92%                | S7AH-05B330               | V7AH-05B330                |
| 2.5V           | 5V            | 5A                  | 12.5W             | 90%                | S7AH-05B250               | V7AH-05B250                |
| 1.8V           | 5V            | 5A                  | 9.0W              | 86%                | S7AH-05B180               | V7AH-05B180                |
| 1.5V           | 5V            | 5A                  | 7.5W              | 84%                | S7AH-05B150               | V7AH-05B150                |
| 1.2V           | 5V            | 5A                  | 6W                | 82%                | S7AH-05B120               | V7AH-05B120                |

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## Absolute Maximum Ratings

| Parameter                      | Symbol | Min  | Typical | Max | Unit |
|--------------------------------|--------|------|---------|-----|------|
| Continuous Input Voltage       | Vin    | -0.3 |         | 6   | V    |
| Output Enable Terminal Voltage | Vouten | -0.3 |         | 6   | V    |
| Ambient Temperature            | Tamb   | 0    |         | 70  | °C   |
| Storage Temperature            | Tstor  | -40  |         | 100 | °C   |

Note: Use beyond the maximum ratings may cause a reliability degradation of the DC/DC converter or may permanently damage the device.

## Input Specifications

| Parameter                                         | Module                               | Symbol | Min  | Typical | Max                             | Units             |
|---------------------------------------------------|--------------------------------------|--------|------|---------|---------------------------------|-------------------|
| Operating Input Voltage                           | All                                  | Vin    | 4.5  |         | 5.5                             | V                 |
| Input Current                                     | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | lin    |      |         | 4.6<br>3.6<br>2.7<br>2.3<br>1.9 | A                 |
| No Load Input Current                             | All                                  |        |      | 30      |                                 | mA                |
| Remote Off Input Current                          |                                      |        |      | 4       | 8                               | mA                |
| Input Reflected Ripple Current <sup>1</sup>       | All                                  |        |      | 30      | 60                              | mA <sub>rms</sub> |
| Input Reflected Ripple Current (P-P) <sup>1</sup> | All                                  |        |      | 100     | 150                             | mApk              |
| I <sup>2</sup> t Inrush Current Transient         | All                                  |        |      | 0.02    | 0.05                            | A <sup>2</sup> s  |
| Turn On Voltage Threshold                         | All                                  |        | 4.19 | 4.3     | 4.5                             | V                 |
| Turn Off Voltage Threshold                        | All                                  |        |      | 3.9     | 4.49                            | V                 |

Note: Input capacitance one 270μF/16V, ESR = 0.018 Ω max at 100kHz @ 25° C.

1. With simulated source impedance of 500nH, 5Hz to 20MHz.

# NON-ISOLATED DC/DC CONVERTERS

## 5V Input / 1.2V – 3.3V Output / 5A



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### Output Specifications

| Parameter                             | Module | Symbol    | Min   | Typical | Max   | Units            |
|---------------------------------------|--------|-----------|-------|---------|-------|------------------|
| Output Voltage Set Point <sup>1</sup> | 3.3V   | Vout      | 3.234 | 3.3     | 3.366 | V                |
|                                       | 2.5V   |           | 2.45  | 2.5     | 2.55  |                  |
|                                       | 1.8V   |           | 1.764 | 1.8     | 1.836 |                  |
|                                       | 1.5V   |           | 1.47  | 1.5     | 1.53  |                  |
|                                       | 1.2V   |           | 1.176 | 1.2     | 1.224 |                  |
|                                       |        |           |       |         |       |                  |
| Load Regulation                       | 3.3V   |           |       | 6.0     | 15    | mV               |
|                                       | 2.5V   |           |       | 6.0     | 15    |                  |
|                                       | 1.8V   |           |       | 6.0     | 15    |                  |
|                                       | 1.5V   |           |       | 6.0     | 15    |                  |
|                                       | 1.2V   |           |       | 6.0     | 15    |                  |
|                                       |        |           |       |         |       |                  |
| Line Regulation                       | 3.3V   |           |       | 3.0     | 10    | mV               |
|                                       | 2.5V   |           |       | 3.0     | 10    |                  |
|                                       | 1.8V   |           |       | 3.0     | 8     |                  |
|                                       | 1.5V   |           |       | 3.0     | 8     |                  |
|                                       | 1.2V   |           |       | 3.0     | 8     |                  |
|                                       |        |           |       |         |       |                  |
| Regulation Over Temperature           | 3.3V   |           |       | 20      | 33    | mV               |
|                                       | 2.5V   |           |       | 20      | 25    |                  |
|                                       | 1.8V   |           |       | 10      | 18    |                  |
|                                       | 1.5V   |           |       | 10      | 15    |                  |
|                                       | 1.2V   |           |       | 8       | 12    |                  |
|                                       |        |           |       |         |       |                  |
| Total Output Voltage Regulation       | 3.3V   |           |       |         | 58    | mV               |
|                                       | 2.5V   |           |       |         | 50    |                  |
|                                       | 1.8V   |           |       |         | 41    |                  |
|                                       | 1.5V   |           |       |         | 38    |                  |
|                                       | 1.2V   |           |       |         | 35    |                  |
|                                       |        |           |       |         |       |                  |
| Output Ripple and Noise <sup>2</sup>  | All    |           |       | 50      | 100   | mVp-p            |
| Output Ripple and Noise <sup>2</sup>  | All    |           |       | 15      | 25    | mVrms            |
| Output Current Range                  | All    | Iout      | 0     |         | 5     | A                |
| Output DC Current Limit               | All    | Ioutlim   | 6.5   |         | 12.5  | A                |
| Short Circuit Surge                   | 3.3V   | Ioutsurge |       | 0.08    | 0.2   | A <sup>2</sup> s |
|                                       | 2.5V   |           |       | 0.05    | 0.1   |                  |
|                                       | 1.8V   |           |       | 0.05    | 0.1   |                  |
|                                       | 1.5V   |           |       | 0.05    | 0.1   |                  |
|                                       | 1.2V   |           |       | 0.05    | 0.1   |                  |
|                                       |        |           |       |         |       |                  |
| Turn on Time                          | All    | Ton       |       | 12      | 20    | ms               |
| Overshoot at Turn On                  | All    |           |       | 0       | 3     | %                |
| Output Capacitance                    | All    | Cout      | 0     |         | 2000  | μF               |

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

1. Vin = 5V, Iout = full load, Ta = 25° C.

2. 0 - 20MHz, 1μF ceramic cap and 10μF aluminum cap on output.

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## Output Specifications

| Parameter                       | Module | Symbol | Min | Typical | Max | Units |
|---------------------------------|--------|--------|-----|---------|-----|-------|
| Transient Response <sup>3</sup> |        |        |     |         |     |       |
| ΔV 50% to 100% of Max Load      | 3.3V   |        |     | 120     | 165 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| ΔV 100% to 50% of Max Load      |        |        |     | 120     | 165 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| Transient Response <sup>3</sup> |        |        |     |         |     |       |
| ΔV 50% to 100% of Max Load      | 2.5V   |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| ΔV 100% to 50% of Max Load      |        |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| Transient Response <sup>3</sup> |        |        |     |         |     |       |
| ΔV 50% to 100% of Max Load      | 1.8V   |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| ΔV 100% to 50% of Max Load      |        |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| Transient Response <sup>3</sup> |        |        |     |         |     |       |
| ΔV 50% to 100% of Max Load      | 1.5V   |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| ΔV 100% to 50% of Max Load      |        |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| Transient Response <sup>3</sup> |        |        |     |         |     |       |
| ΔV 50% to 100% of Max Load      | 1.2V   |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |
| ΔV 100% to 50% of Max Load      |        |        |     | 100     | 150 | mV    |
| Settling Time                   |        | Ts     |     | 25      | 50  | μs    |

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.  
 3. di/dt = 0.5A/1 $\mu$ S, Ta = 25° C without external load capacitance.

# NON-ISOLATED DC/DC CONVERTERS

## 5V Input / 1.2V – 3.3V Output / 5A



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### General Specifications

| Parameter                              | Module | Symbol          | Min | Typical | Max | Units |
|----------------------------------------|--------|-----------------|-----|---------|-----|-------|
| Efficiency <sup>1</sup>                | 3.3V   | $\eta$          | 89  | 92      |     | %     |
|                                        | 2.5V   |                 | 87  | 90      |     |       |
|                                        | 1.8V   |                 | 83  | 86      |     |       |
|                                        | 1.5V   |                 | 81  | 84      |     |       |
|                                        | 1.2V   |                 | 79  | 82      |     |       |
| Switching Frequency                    | All    | F <sub>sw</sub> | 260 | 300     | 340 | kHz   |
| Output Voltage Trim Range <sup>2</sup> | All    |                 | 90  |         | 110 | %     |
| Weight                                 | All    |                 |     | 4.7     |     | g     |

1. V<sub>in</sub>=5V, full load and T<sub>a</sub>=25° C.

2. See graphs on pages 10-12.

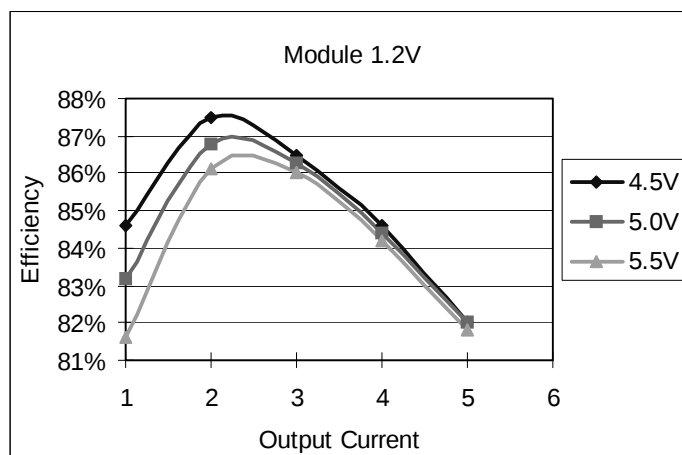
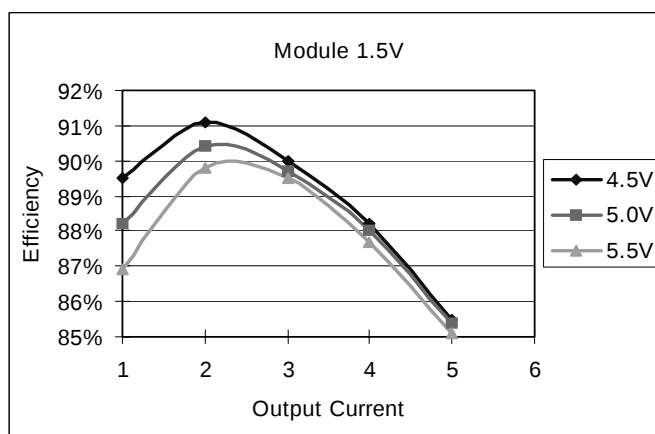
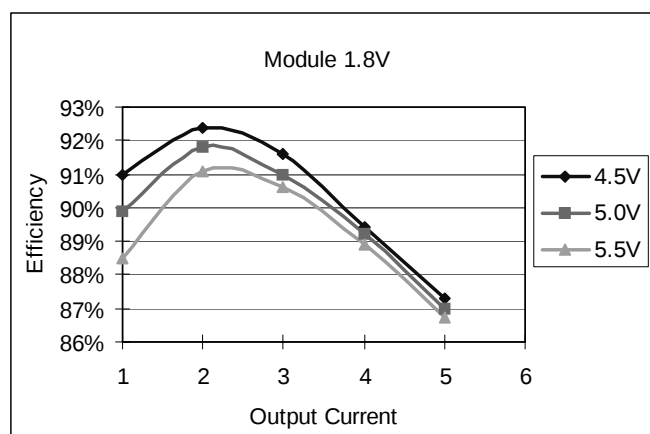
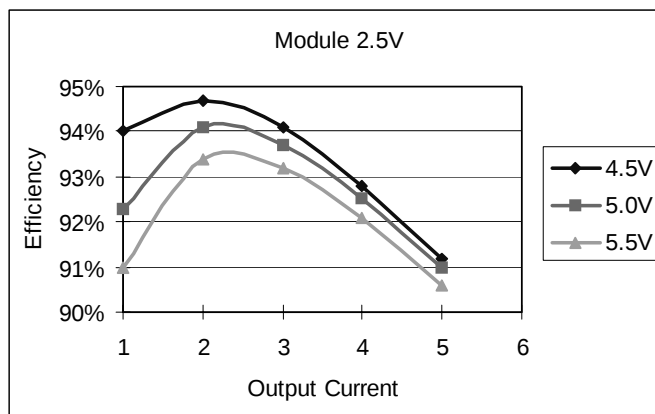
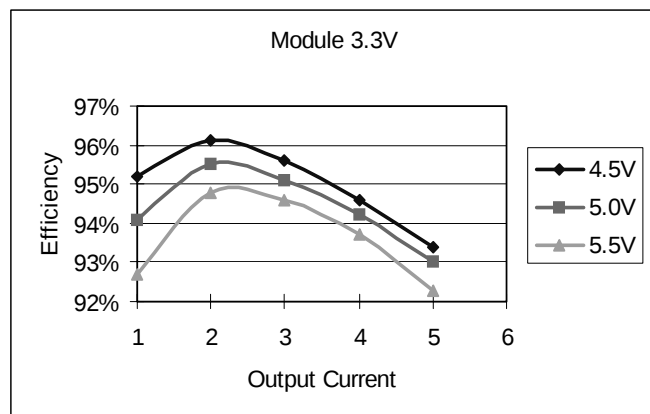
### Control Specifications

| Parameter                  | Module | Symbol             | Min | Typical | Max | Units |
|----------------------------|--------|--------------------|-----|---------|-----|-------|
| Remote On/Off <sup>3</sup> | All    | V <sub>outen</sub> |     |         |     | V     |
| Signal Low (Unit On)       | All    |                    | 0   |         | 1   | V     |
| Signal High (Unit Off)     | All    |                    | 2.8 |         | 5.5 | V     |

3. With remote on/off pin 1 open, the module is on.

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## Efficiency Data



# NON-ISOLATED DC/DC CONVERTERS

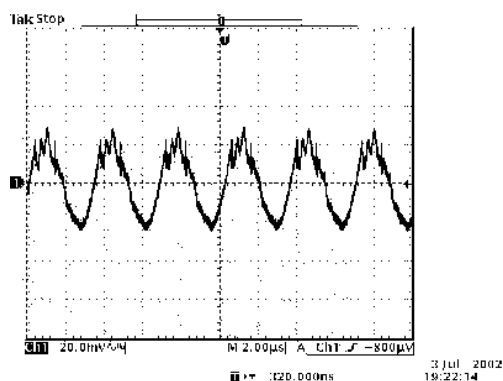
## 5V Input / 1.2V – 3.3V Output / 5A

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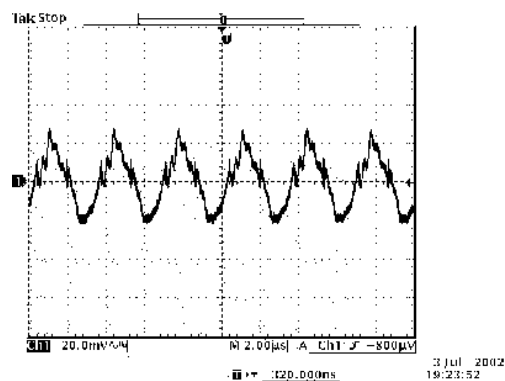
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### Ripple and Noise

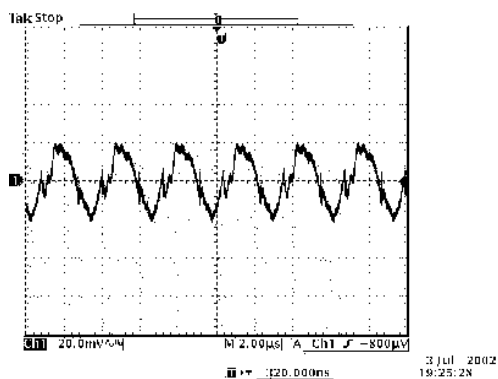
1 $\mu$ F ceramic cap and 10 $\mu$ F aluminum electrolytic cap added at the output.



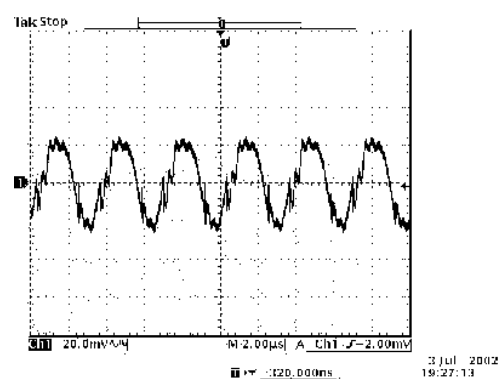
Ripple and noise at full load and 5Vdc input,  
3.3Vdc output and Ta=25° C



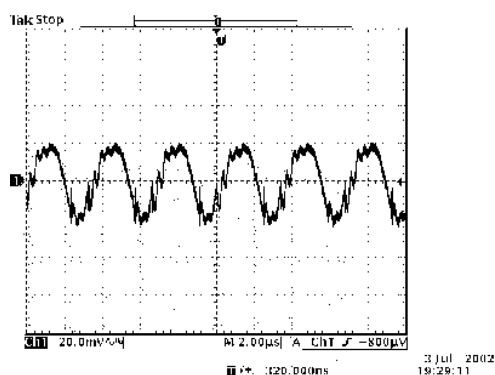
Ripple and noise at full load and 5Vdc input,  
2.5Vdc output and Ta=25° C



Ripple and noise at full load and 5Vdc input,  
1.8Vdc output and Ta=25° C



Ripple and noise at full load and 5Vdc input,  
1.5Vdc output and Ta=25° C



Ripple and noise at full load and 5Vdc input,  
1.2Vdc output and Ta=25° C

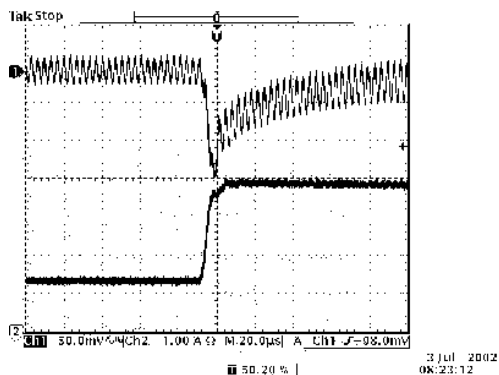


## NON-ISOLATED DC/DC CONVERTERS

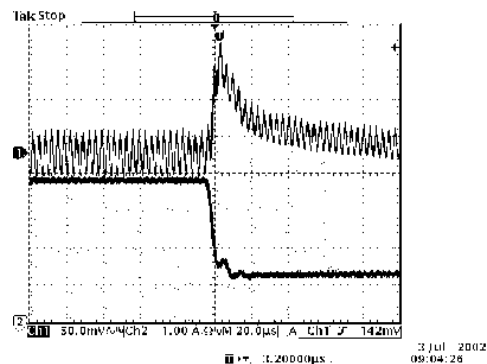
### 5V Input / 1.2V – 3.3V Output / 5A

BP02x7AH-05B

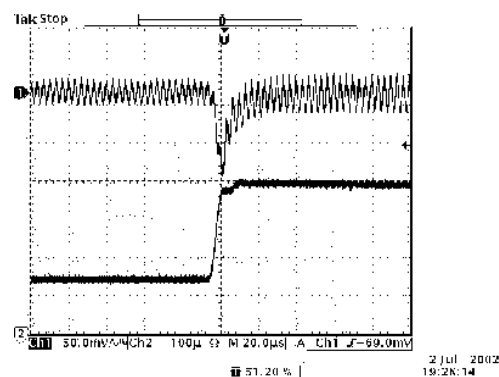
### Transient Response

Transient response:  $di/dt = 0.5A/\mu S$ , no external load capacitance

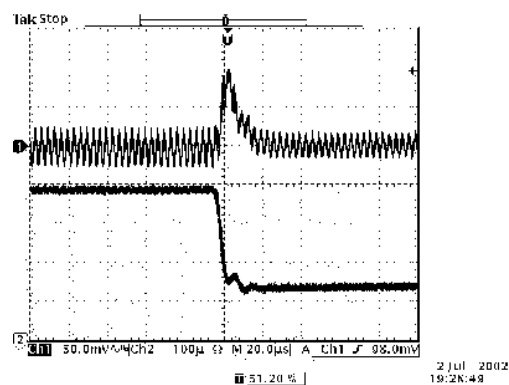
Vout=3.3V  
50% to 100% load transients at 5V input and Ta=25° C



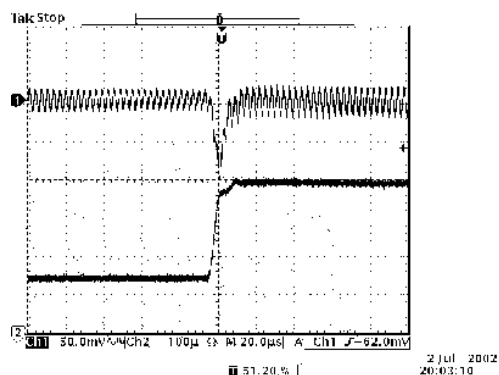
Vout=3.3V  
100% to 50% load transients at 5V input and Ta=25° C



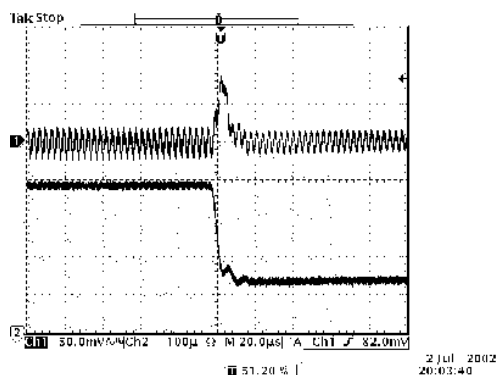
Vout=2.5V  
50% to 100% load transients at 5V input and Ta=25° C



Vout=2.5V  
100% to 50% load transients at 5V input and Ta=25° C



Vout=1.8V  
50% to 100% load transients at 5V input and Ta=25° C



Vout=1.8V  
100% to 50% load transients at 5V input and Ta=25° C

# NON-ISOLATED DC/DC CONVERTERS

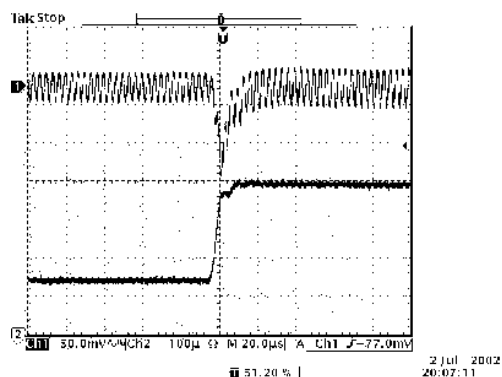
## 5V Input / 1.2V – 3.3V Output / 5A



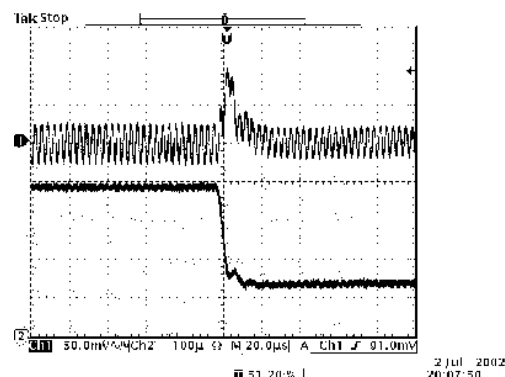
BP02x7AH-05B

### Transient Response

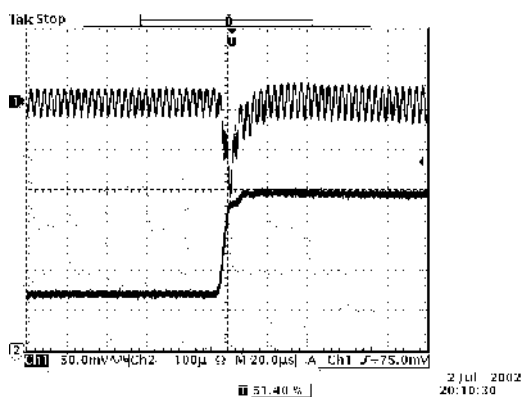
Transient response:  $di/dt = 0.5A/\mu S$ , no external load capacitance



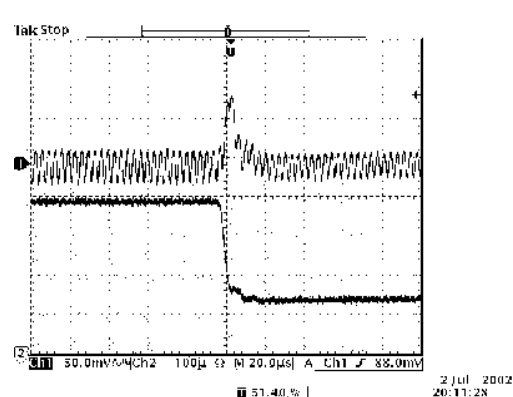
Vout=1.5V  
50% to 100% load transients at 5V input and Ta=25° C



Vout=1.5V  
100% to 50% load transients at 5V input and Ta=25° C



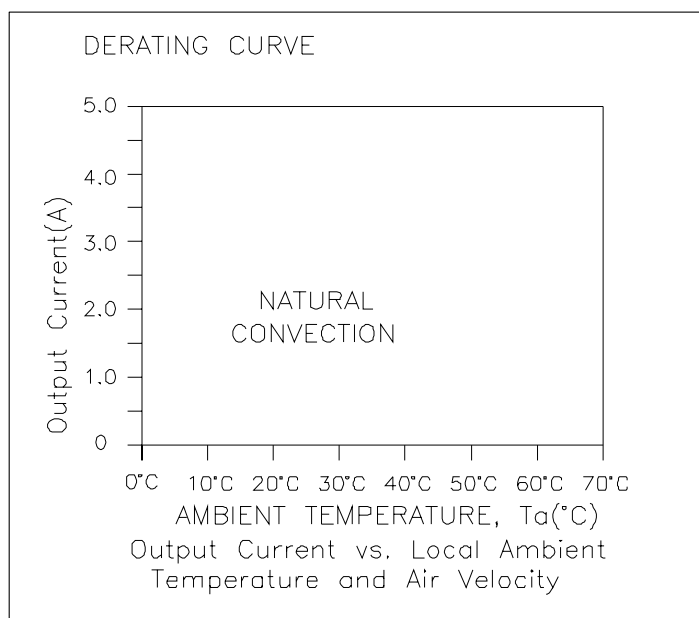
Vout=1.2V  
50% to 100% load transients at 5V input and Ta=25° C



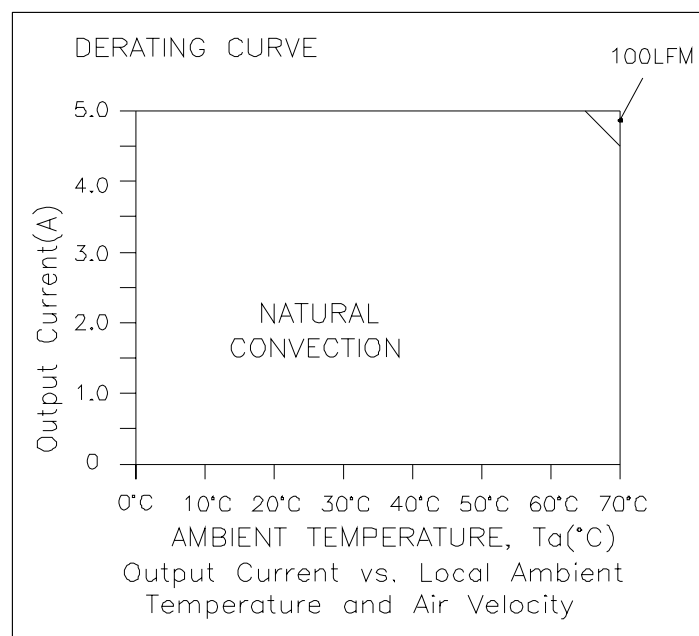
Vout=1.2V  
100% to 50% load transients at 5V input and Ta=25° C

## Thermal Considerations

### S7AH-05B



### V7AH-05B



# NON-ISOLATED DC/DC CONVERTERS

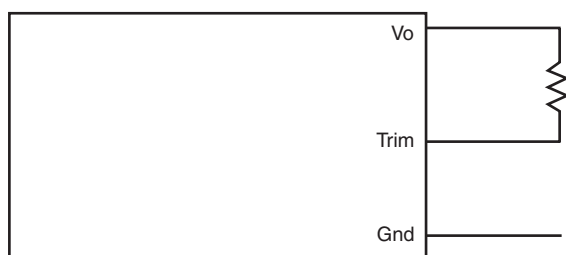
5V Input / 1.2V – 3.3V Output / 5A

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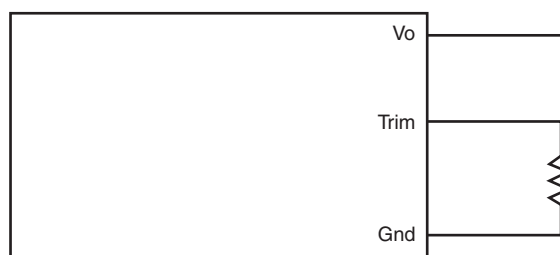
BP02x7AH-05B

## Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit

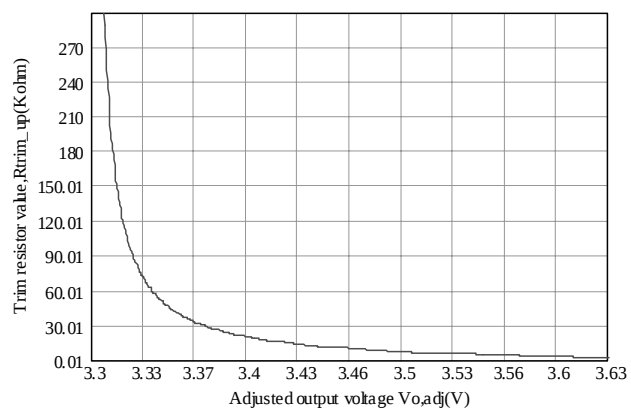
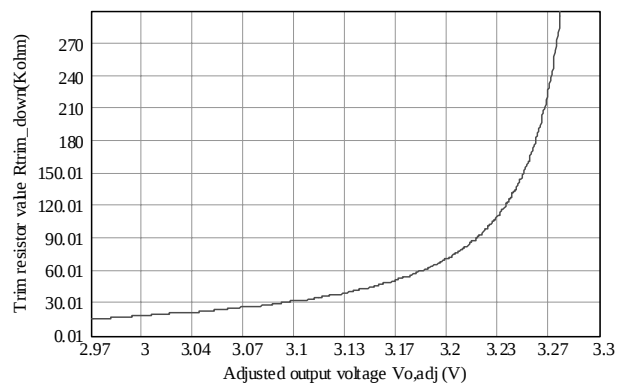


## Output Voltage Set-Point Adjustment

### x7AH-05B330 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{7.914}{V_o - V_{o, \text{adj}}} - 8.27 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{2.528}{V_{o, \text{adj}} - V_o} - 5.11 \right) \text{ Kohm}$$



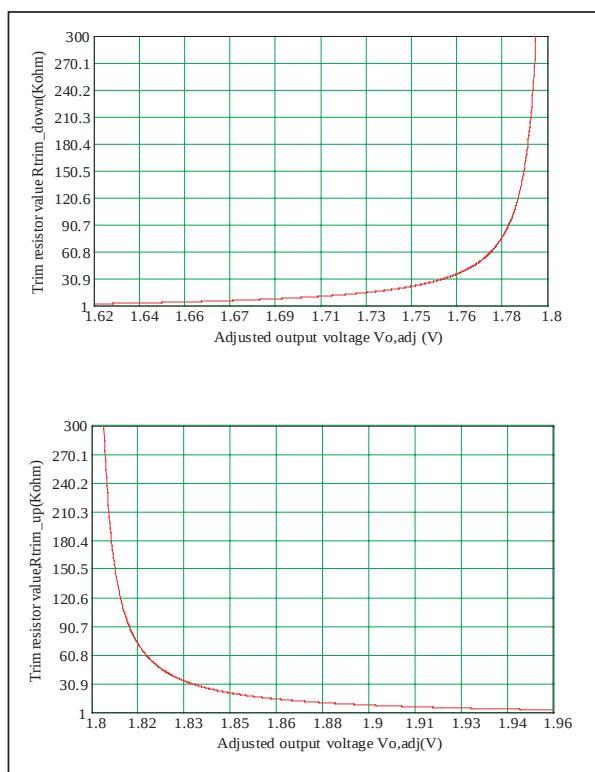
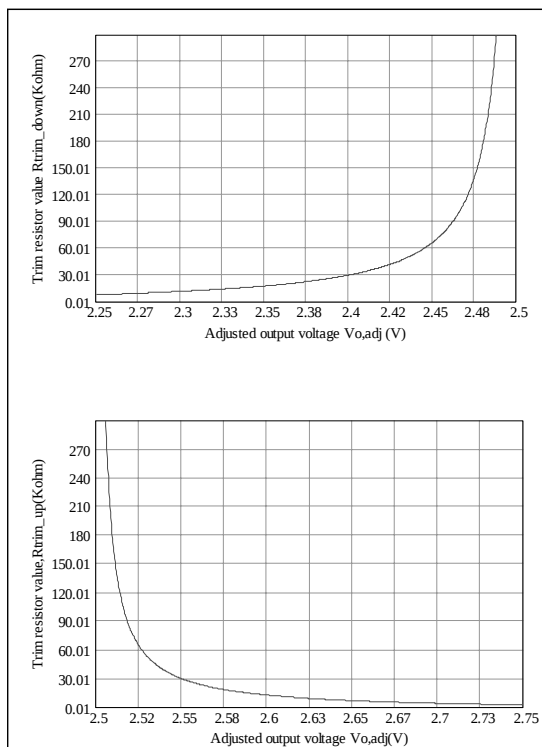
BP02x7AH-05B

## Output Voltage Set-Point Adjustment

### x7AH-05B250 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{3.664}{V_o - V_{o, \text{adj}}} - 6.79 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{1.72}{V_{o, \text{adj}} - V_o} - 4.64 \right) \text{ Kohm}$$



### x7AH-05B180 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{1.509}{V_o - V_{o, \text{adj}}} - 5.52 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{1.2}{V_{o, \text{adj}} - V_o} - 4.02 \right) \text{ Kohm}$$

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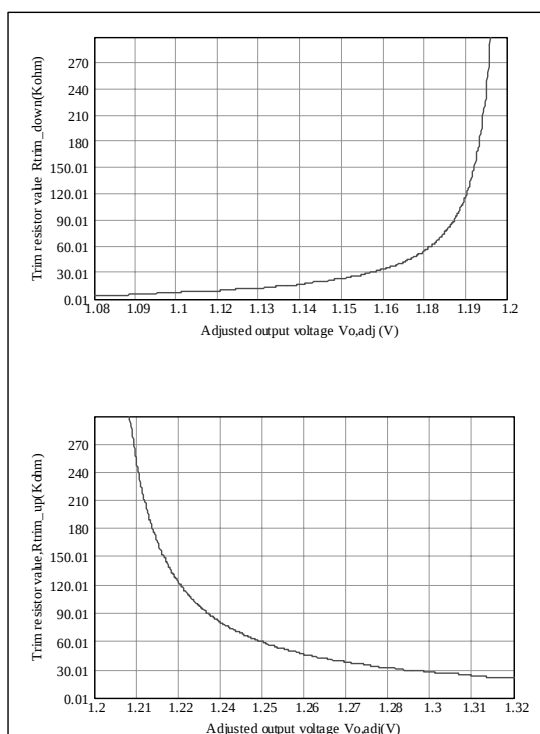
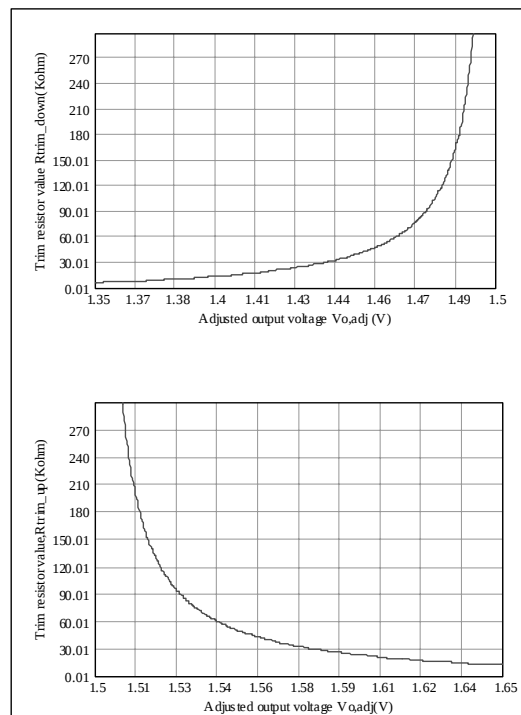
BP02x7AH-05B

### Output Voltage Set-Point Adjustment

#### x7AH-05B150 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{2.702}{V_o - V_{o, \text{adj}}} - 11.7 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.064}{V_{o, \text{adj}} - V_o} - 7.87 \right) \text{ Kohm}$$



#### x7AH-05B120 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{1.545}{V_o - V_{o, \text{adj}}} - 8.47 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.064}{V_{o, \text{adj}} - V_o} - 4.64 \right) \text{ Kohm}$$



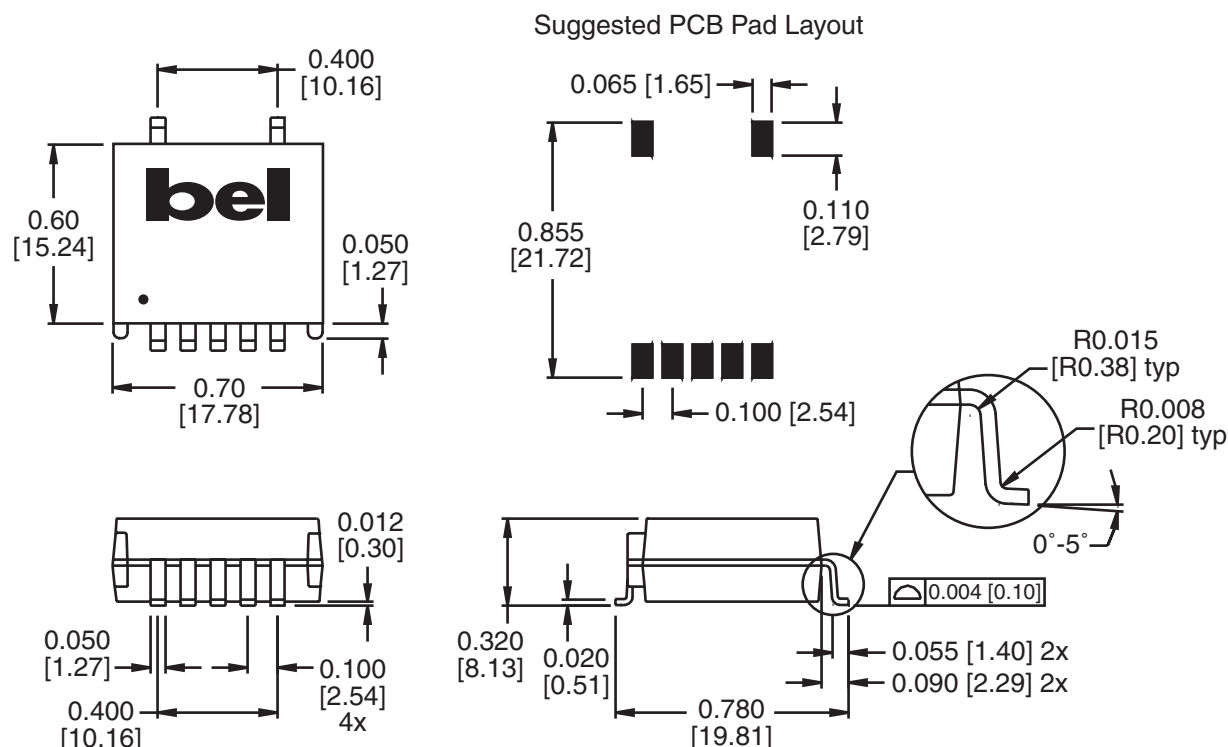
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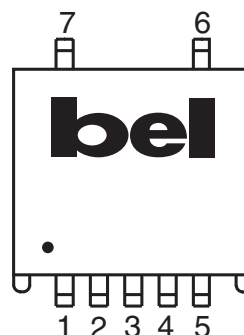
## Mechanical

S7AH-05B



Dimensions are in inches [millimeters].  
Standard dimension tolerance is  $\pm 0.005$  [0.13] unless otherwise noted.

| Pin | Function      |
|-----|---------------|
| 1   | Remote On/Off |
| 2   | +Vin          |
| 3   | Ground        |
| 4   | +Vo           |
| 5   | Trim          |
| 6   | No Connection |
| 7   | No Connection |



# NON-ISOLATED DC/DC CONVERTERS

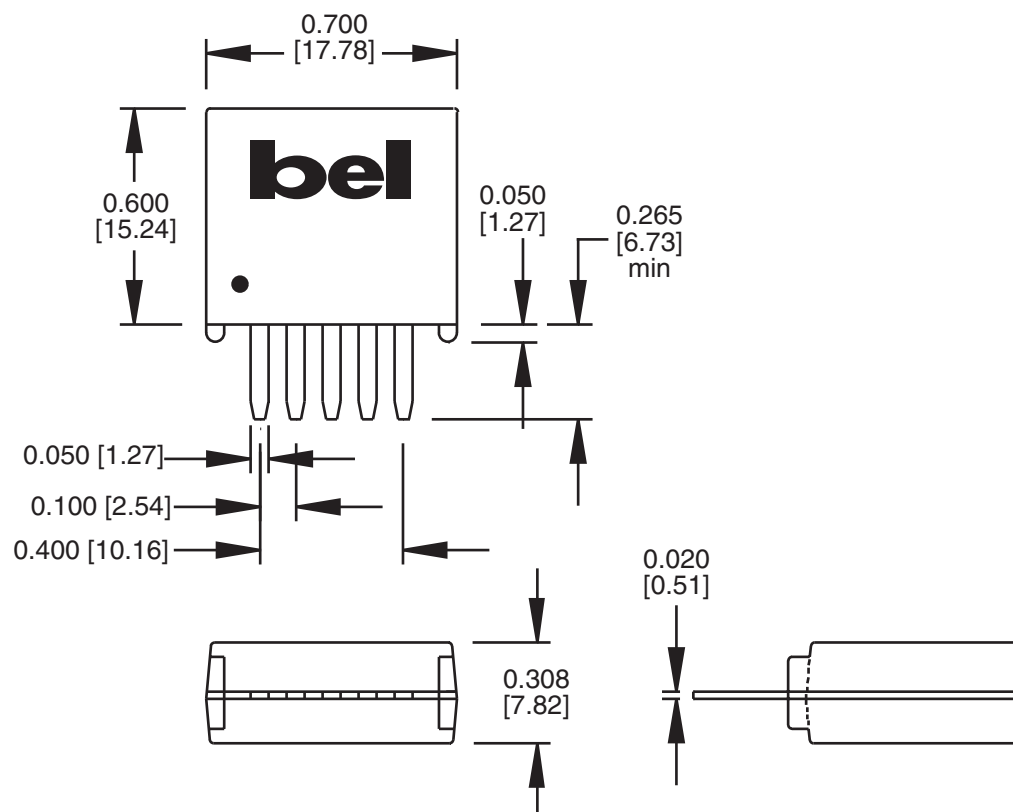
5V Input / 1.2V – 3.3V Output / 5A

**bel**  
POWER PRODUCTS

BP02x7AH-05B

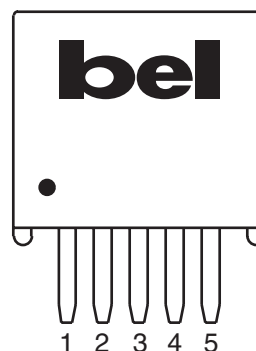
## Mechanical

V7AH-05B



Dimensions are in inches [millimeters].  
 Standard dimension tolerance is  $\pm 0.005$  [0.13] unless otherwise noted.

| Pin | Function      |
|-----|---------------|
| 1   | Remote On/Off |
| 2   | +Vin          |
| 3   | Ground        |
| 4   | +Vo           |
| 5   | Trim          |



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