

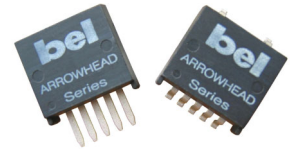
## NON-ISOLATED DC/DC CONVERTERS

3.3V Input 0.9V-2.5V/3A Output

**bel**  
POWER PRODUCTS

### x7AH-03C1A0 Series

- Non-Isolated
- High Efficiency
- Low Cost
- Excellent Thermal Performance
- Input Under Voltage Lockout
- OCP/SCP
- Wide Range Trim
- Remote On/Off
- Industrial Temperature Range



### Description

The Bel x7AH-03C1A0 modules are a series of non-isolated, step down DC/DC converters that operate from a nominal 3.3V source. These converters are available in a range of output voltages from 0.9V to 2.5V. 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 for 2.5V output is typically 93% 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 |
|----------------|---------------|---------------------|-------------------|--------------------|---------------------------|----------------------------|
| 0.9-2.5V       | 3.3V          | 3A                  | 7.5W              | 93%                | S7AH-03C1A0               | V7AH-03C1A0                |
| 2.5V           | 3.3V          | 3A                  | 7.5W              | 93%                | S7AH-03C250               | V7AH-03C250                |
| 1.8V           | 3.3V          | 3A                  | 5.4W              | 89%                | S7AH-03C180               | V7AH-03C180                |
| 1.5V           | 3.3V          | 3A                  | 4.5W              | 87%                | S7AH-03C150               | V7AH-03C150                |
| 1.2V           | 3.3V          | 3A                  | 3.6W              | 84%                | S7AH-03C120               | V7AH-03C120                |
| 0.9 V          | 3.3V          | 3A                  | 2.7W              | 81%                | S7AH-03C090               | V7AH-03C090                |

**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 | -   | 6V    |       |
| Output Enable Terminal Voltage | -0.3V | -   | 6V    |       |
| Ambient Temperature            | -40°C | -   | 85°C  |       |
| Storage Temperature            | -55°C | -   | 125°C |       |

### Input Specifications

| Parameter                 | Min | Typ | Max   | Notes |
|---------------------------|-----|-----|-------|-------|
| Input Voltage             | 3V  | -   | 3.6V  |       |
| Input Current (no load)   | -   | -   | 110mA |       |
| Input Current (full load) |     |     |       |       |
| Vo=2.5V                   | -   | -   | 3.1A  |       |
| Vo=1.8V                   | -   | -   | 2.3A  |       |
| Vo=1.5V                   | -   | -   | 1.9A  |       |
| Vo=1.2V                   | -   | -   | 1.6A  |       |
| Vo=0.9V                   | -   | -   | 1.2A  |       |
| Remote Off Input Current  | -   | 7mA | 14mA  |       |

## NON-ISOLATED DC/DC CONVERTERS

3.3V Input 0.9V-2.5V/3A Output



### Input Specifications (continued)

| Parameter                                 | Min | Typ                  | Max                  | Notes                                                                                                                |
|-------------------------------------------|-----|----------------------|----------------------|----------------------------------------------------------------------------------------------------------------------|
| Input Reflected Ripple Current (pk-pk)    | -   | 50mA                 | 100mA                | With simulated source impedance of 500nH, 5Hz to 20MHz; use a 270uF/6.3V capacitor with ESR=0.03 ohm max, at 100KHz. |
| Input Reflected Ripple Current (RMS)      | -   | 15mA                 | 25mA                 |                                                                                                                      |
| I <sup>2</sup> t Inrush Current Transient | -   | 0.01A <sup>2</sup> s | 0.02A <sup>2</sup> s |                                                                                                                      |
| Turn on Voltage Threshold                 | -   | 2.7V                 | -                    |                                                                                                                      |
| Turn off Voltage Threshold                | -   | 2.4V                 | -                    |                                                                                                                      |

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

### Output Specifications

| Parameter                                                                                              | Min                                            | Typ                                                                                                                  | Max                                                                                                                  | Notes                                       |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Output Voltage Set Point<br>Vo=2.5V<br>Vo=1.8V<br>Vo=1.5V<br>Vo=1.2V<br>Vo=0.9V                        | 2.450V<br>1.764V<br>1.470V<br>1.176V<br>0.882V | 2.5V<br>1.8V<br>1.5V<br>1.2V<br>0.9V                                                                                 | 2.550V<br>1.836V<br>1.530V<br>1.224V<br>0.918V                                                                       | Test conditions:<br>Vin=3.3V, Io= full load |
| Line Regulation<br>Vo=2.5V<br>Vo=1.8V<br>Vo=1.5V<br>Vo=1.2V<br>Vo=0.9V                                 | -<br>-<br>-<br>-<br>-                          | 1mV<br>1mV<br>1mV<br>1mV<br>1mV                                                                                      | 5mV<br>5mV<br>5mV<br>5mV<br>5mV                                                                                      |                                             |
| Load Regulation<br>Vo=2.5V<br>Vo=1.8V<br>Vo=1.5V<br>Vo=1.2V<br>Vo=0.9V                                 | -<br>-<br>-<br>-<br>-                          | 1mV<br>1mV<br>1mV<br>1mV<br>1mV                                                                                      | 5mV<br>5mV<br>5mV<br>5mV<br>5mV                                                                                      |                                             |
| Regulation Over Temperature<br>(-40°C to +85°C)<br>Vo=2.5V<br>Vo=1.8V<br>Vo=1.5V<br>Vo=1.2V<br>Vo=0.9V | -<br>-<br>-<br>-<br>-                          | 10mV<br>10mV<br>10mV<br>10mV<br>10mV                                                                                 | 20mV<br>20mV<br>20mV<br>20mV<br>20mV                                                                                 |                                             |
| Output Current                                                                                         | 0A                                             | -                                                                                                                    | 3A                                                                                                                   |                                             |
| Current Limit Threshold                                                                                | 5A                                             | -                                                                                                                    | 9A                                                                                                                   |                                             |
| Short Circuit Surge Transient<br>Vo=2.5V<br>Vo=1.8V<br>Vo=1.5V<br>Vo=1.2V<br>Vo=0.9V                   | -<br>-<br>-<br>-<br>-                          | 0.04A <sup>2</sup> s<br>0.04A <sup>2</sup> s<br>0.04A <sup>2</sup> s<br>0.04A <sup>2</sup> s<br>0.04A <sup>2</sup> s | 0.08A <sup>2</sup> s<br>0.08A <sup>2</sup> s<br>0.08A <sup>2</sup> s<br>0.08A <sup>2</sup> s<br>0.08A <sup>2</sup> s |                                             |

## NON-ISOLATED DC/DC CONVERTERS

3.3V Input 0.9V-2.5V/3A Output



### Output Specifications (continued)

| Parameter                |               | Min     | Typ  | Max    | Notes                                                                                                       |                                                                                                  |
|--------------------------|---------------|---------|------|--------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Ripple and Noise (RMS)   | Vo=2.5V       | -       | 10mV | 20mV   | Test conditions:<br>0-20MHz BW; 0.1uF<br>ceramic capacitor and 10uF<br>tantalum capacitor at the<br>output. |                                                                                                  |
|                          | Vo=1.8V       | -       | 10mV | 20mV   |                                                                                                             |                                                                                                  |
|                          | Vo=1.5V       | -       | 10mV | 20mV   |                                                                                                             |                                                                                                  |
|                          | Vo=1.2V       | -       | 10mV | 20mV   |                                                                                                             |                                                                                                  |
|                          | Vo=0.9V       | -       | 10mV | 20mV   |                                                                                                             |                                                                                                  |
| Ripple and Noise (pk-pk) | Vo=2.5V       | -       | 45mV | 70mV   |                                                                                                             |                                                                                                  |
|                          | Vo=1.8V       | -       | 45mV | 70mV   |                                                                                                             |                                                                                                  |
|                          | Vo=1.5V       | -       | 45mV | 70mV   |                                                                                                             |                                                                                                  |
|                          | Vo=1.2V       | -       | 45mV | 70mV   |                                                                                                             |                                                                                                  |
|                          | Vo=0.9V       | -       | 45mV | 70mV   |                                                                                                             |                                                                                                  |
| Turn on Time             |               | -       | 7mS  | 15mS   |                                                                                                             |                                                                                                  |
| Overshoot at Turn on     |               | -       | 0%   | 1%     |                                                                                                             |                                                                                                  |
| Output Capacitance       |               | 0uF     | -    | 1200uF |                                                                                                             |                                                                                                  |
| Transient Response       |               |         |      |        |                                                                                                             |                                                                                                  |
| 50% ~ 100%<br>Max Load   | Overshoot     | Vo=2.5V | -    | 100mV  | 130mV                                                                                                       | Test conditions:<br>di/dt=0.5A/us, Vin=3.3V,<br>without any external<br>capacitor at the output. |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 100% ~ 50%<br>Max Load   | Overshoot     |         | -    | 100mV  | 130mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 50% ~ 100%<br>Max Load   | Overshoot     | Vo=1.8V | -    | 100mV  | 130mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 100% ~ 50%<br>Max Load   | Overshoot     |         | -    | 100mV  | 130mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 50% ~ 100%<br>Max Load   | Overshoot     | Vo=1.5V | -    | 90mV   | 120mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 100% ~ 50%<br>Max Load   | Overshoot     |         | -    | 90mV   | 120mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 50% ~ 100%<br>Max Load   | Overshoot     | Vo=1.2V | -    | 90mV   | 120mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 100% ~ 50%<br>Max Load   | Overshoot     |         | -    | 90mV   | 120mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 50% ~ 100%<br>Max Load   | Overshoot     | Vo=0.9V | -    | 90mV   | 120mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |
| 100% ~ 50%<br>Max Load   | Overshoot     |         | -    | 90mV   | 120mV                                                                                                       |                                                                                                  |
|                          | Settling Time |         | -    | 30uS   | 60uS                                                                                                        |                                                                                                  |

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

## NON-ISOLATED DC/DC CONVERTERS

3.3V Input 0.9V-2.5V/3A Output



### General Specifications

| Parameter                                                                   | Min                                         | Typ                             | Max                   | Notes                                       |                                                           |
|-----------------------------------------------------------------------------|---------------------------------------------|---------------------------------|-----------------------|---------------------------------------------|-----------------------------------------------------------|
| Efficiency<br>Vo=2.5V<br>Vo=1.8V<br>Vo=1.5V<br>Vo=1.2V<br>Vo=0.9V           | 90%<br>86%<br>84%<br>81%<br>78%             | 93%<br>89%<br>87%<br>84%<br>81% | -<br>-<br>-<br>-<br>- | Measured at Vin=3.3V, full load and Ta=25°C |                                                           |
| Switching Frequency                                                         | 250KHz                                      | 300KHz                          | 340KHz                |                                             |                                                           |
| Output Trim Range (wide trim)                                               | 0                                           | -                               | 292%Vo                |                                             | Vo=0.9V                                                   |
| Output Trim Range (narrow trim)<br>Vo=1.2V-2.5V<br>Vo=0.9V                  | 90%Vo<br>-                                  | -<br>-                          | 110%Vo<br>110%Vo      |                                             |                                                           |
| MTBF                                                                        | 3,131,719 hours                             |                                 |                       |                                             | Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25°C) |
| Dimensions (surface mount)<br>Inches (L × W × H)<br>Millimeters (L × W × H) | 0.78 x 0.70 x 0.32<br>19.81 x 17.78 x 8.13  |                                 |                       |                                             |                                                           |
| Dimensions (vertical)<br>Inches (L × W × H)<br>Millimeters (L × W × H)      | 0.70 x 0.308 x 0.65<br>17.78 x 7.82 x 16.51 |                                 |                       |                                             |                                                           |
| Weight                                                                      | -                                           | 5g                              | -                     |                                             |                                                           |

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

### Control Specifications

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

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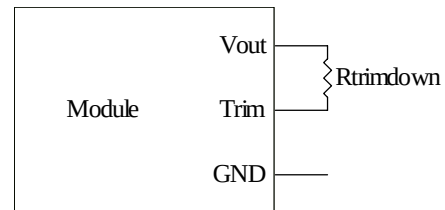
3.3V Input 0.9V-2.5V/3A Output



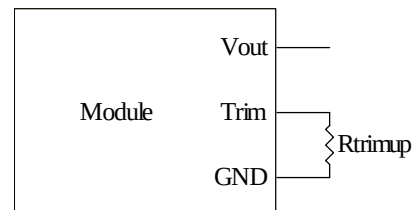
### Output Trim Equations

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.

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



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



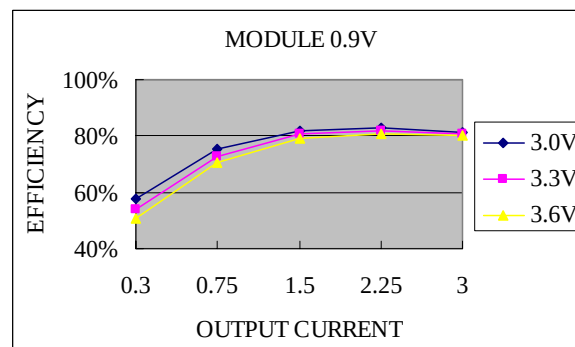
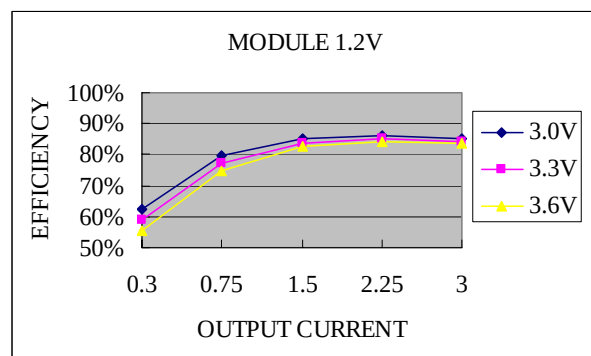
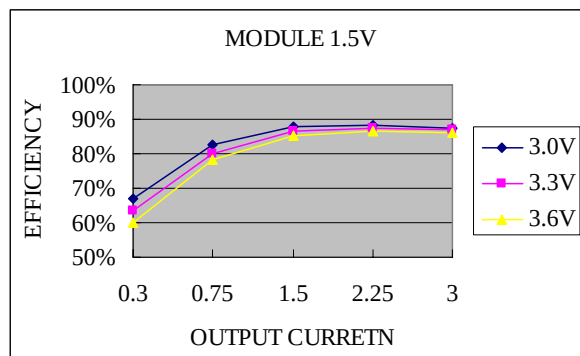
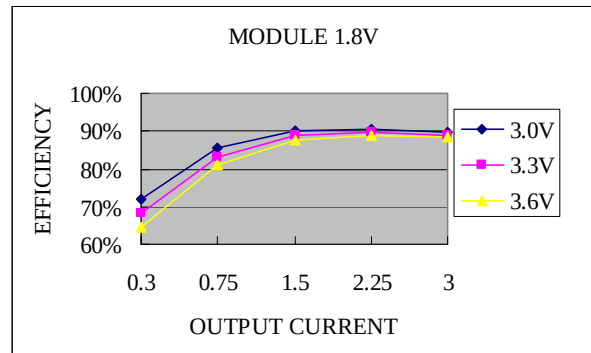
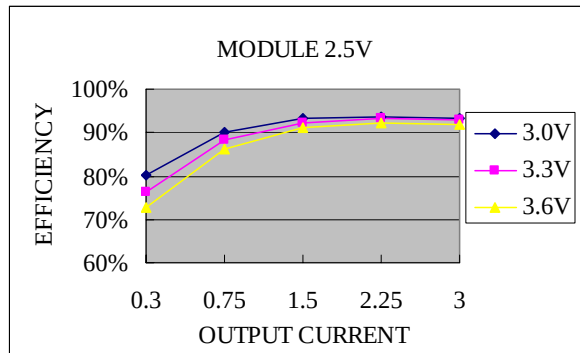
| Vnom      | A      | B     | C     | D    | Notes                        |
|-----------|--------|-------|-------|------|------------------------------|
| 0.9 – 2.5 | N/A    | N/A   | 3.712 | 1.54 | Vo=0.9V when Rtrim is open   |
| 2.5       | 7.9117 | 16.14 | 3.712 | 11.5 | Vo=2.505V when Rtrim is open |
| 1.8       | 4.6538 | 20.84 | 3.712 | 16.2 | Vo=1.803V when Rtrim is open |
| 1.5       | 3.2633 | 16.14 | 3.712 | 11.5 | Vo=1.503V when Rtrim is open |
| 1.2       | 1.8699 | 11.45 | 3.712 | 6.81 | Vo=1.203V when Rtrim is open |
| 0.9       | N/A    | N/A   | 3.712 | 33.2 | Vo=0.903V when Rtrim is open |

## NON-ISOLATED DC/DC CONVERTERS

3.3V Input 0.9V-2.5V/3A Output



### Efficiency Data

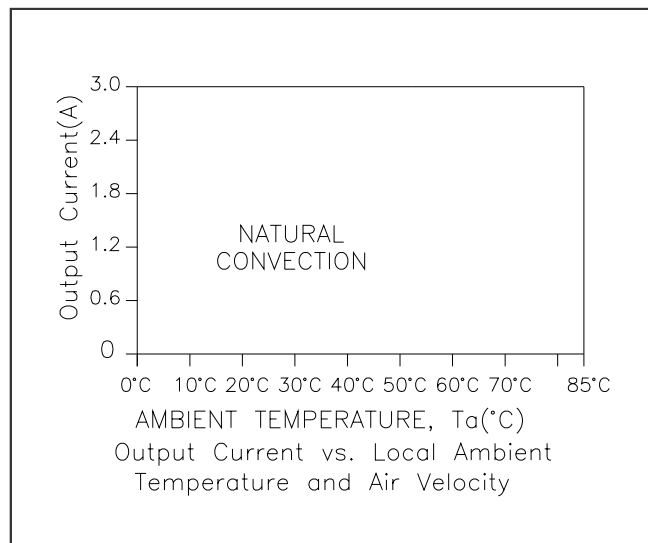


## NON-ISOLATED DC/DC CONVERTERS

3.3V Input 0.9V-2.5V/3A Output



### Thermal Derating Curve

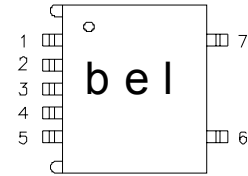
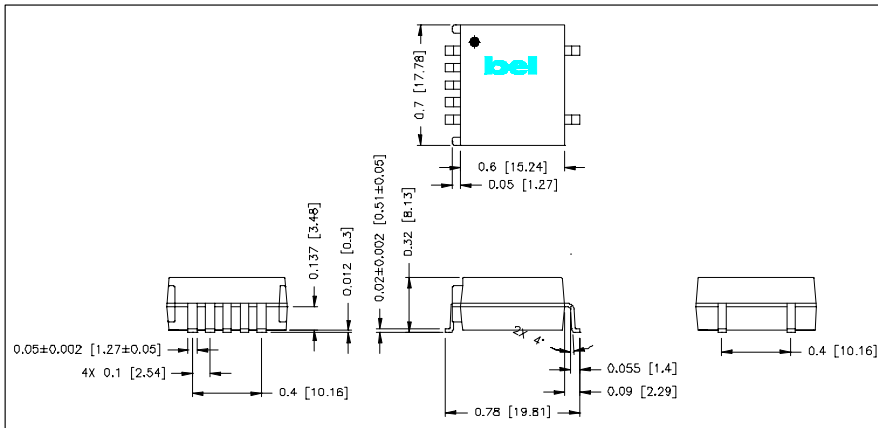


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3.3V Input 0.9V-2.5V/3A Output



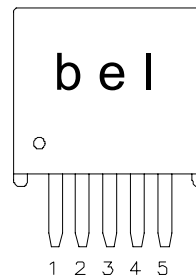
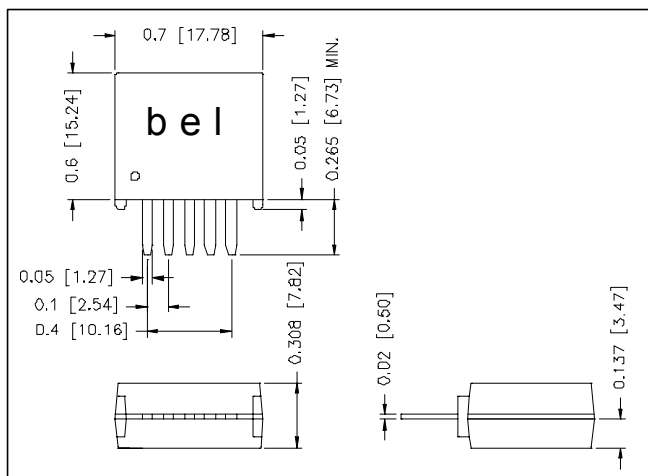
## S7AH-03C1A0



### Pin Connections

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

## V7AH-03C1A0



### Pin

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

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