

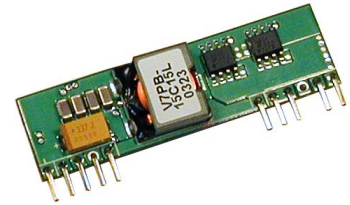
## NON-ISOLATED DC/DC CONVERTERS

3.3 V Input 0.9 V-2.5 V/15 A Output

**bel**  
POWER PRODUCTS

### V7PB-15C Series

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency (300 kHz)
- Low Cost
- Remote On/Off
- Industry Standard Footprint
- Over Temperature Protection
- Under-voltage Lockout (UVLO)
- OCP/SCP
- Industrial Temperature Range
- Remote Sense
- Active Low/High (option)



### Description

The Bel V7PB-15Cxxx is part of the low cost non-isolated dc/dc converter series. The modules use a SIP package for ease of layout and space savings. The output is closely regulated and the efficiency is typically 93% at 2.5 V output at full load. Typical features include remote on/off, under-voltage lockout, over-current protection and short circuit protection.

### Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Model Number Active Low | Model Number Active High |
|----------------|---------------|---------------------|-------------------|--------------------|-------------------------|--------------------------|
| 2.5 V          | 3.3 V         | 15 A                | 37.5 W            | 93%                | V7PB-15C25L             | V7PB-15C25S              |
| 1.8 V          | 3.3 V         | 15 A                | 27.0 W            | 90%                | V7PB-15C18L             | V7PB-15C18S              |
| 1.5 V          | 3.3 V         | 15 A                | 22.5 W            | 89%                | V7PB-15C15L             | V7PB-15C15S              |
| 1.2 V          | 3.3 V         | 15 A                | 18.0 W            | 86%                | V7PB-15C12L             | V7PB-15C12S              |
| 0.9 V          | 3.3 V         | 15 A                | 13.5 W            | 83%                | V7PB-15C09L             | V7PB-15C09S              |

**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)     | -0.3 V | -   | 4 V    |       |
| Output Enable Terminal Voltage | -0.3 V | -   | 6 V    |       |
| Ambient Temperature            | -40 °C | -   | 85 °C  |       |
| Storage Temperature            | -55 °C | -   | 125 °C |       |

### Input Specifications

| Parameter                 | Min | Typ    | Max    | Notes |
|---------------------------|-----|--------|--------|-------|
| Input Voltage             | 3 V | 3.3 V  | 3.6 V  |       |
| Input Current (full load) |     |        |        |       |
| Vo=2.5 V                  | -   | -      | 15 A   |       |
| Vo=1.8 V                  | -   | -      | 11.5 A |       |
| Vo=1.5 V                  | -   | -      | 9.5 A  |       |
| Vo=1.2 V                  | -   | -      | 8 A    |       |
| Vo=0.9 V                  | -   | -      | 6 A    |       |
| Input Current (no load)   |     |        |        |       |
| Vo=2.5 V                  | -   | 120 mA | 200 mA |       |
| Vo=1.8 V                  | -   | 140 mA | 200 mA |       |
| Vo=1.5 V                  | -   | 160 mA | 200 mA |       |
| Vo=1.2 V                  | -   | 170 mA | 200 mA |       |
| Vo=0.9 V                  | -   | 180 mA | 200 mA |       |

## NON-ISOLATED DC/DC CONVERTERS

3.3 V Input 0.9 V-2.5 V/15 A Output



### Input Specifications (continued)

| Parameter                                 | Min | Typ                    | Max                    | Notes                                                                                                                 |
|-------------------------------------------|-----|------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Off Input Current                  |     |                        |                        |                                                                                                                       |
| Vo=2.5 V                                  | -   | 12 mA                  | 20 mA                  |                                                                                                                       |
| Vo=1.8 V                                  | -   | 12 mA                  | 20 mA                  |                                                                                                                       |
| Vo=1.5 V                                  | -   | 17 mA                  | 20 mA                  |                                                                                                                       |
| Vo=1.2 V                                  | -   | 15 mA                  | 20 mA                  |                                                                                                                       |
| Vo=0.9 V                                  | -   | 15 mA                  | 20 mA                  |                                                                                                                       |
| Input Reflected Ripple Current (pk-pk)    |     |                        |                        |                                                                                                                       |
| Vo=2.5 V                                  | -   | 80 mA                  | 120 mA                 | Tested with simulated source impedance of 500nH and two 270uF/16V (P/N: 16SP270M SANYO) Oscon Capacitors at the input |
| Vo=1.8 V                                  | -   | 110 mA                 | 160 mA                 |                                                                                                                       |
| Vo=1.5 V                                  | -   | 130 mA                 | 180 mA                 |                                                                                                                       |
| Vo=1.2 V                                  | -   | 100 mA                 | 150 mA                 |                                                                                                                       |
| Vo=0.9 V                                  | -   | 85 mA                  | 135 mA                 |                                                                                                                       |
| Input Reflected Ripple Current (rms)      |     |                        |                        |                                                                                                                       |
| Vo=2.5 V                                  | -   | 25 mA                  | 40 mA                  |                                                                                                                       |
| Vo=1.8 V                                  | -   | 30 mA                  | 50 mA                  |                                                                                                                       |
| Vo=1.5 V                                  | -   | 40 mA                  | 60 mA                  |                                                                                                                       |
| Vo=1.2 V                                  | -   | 30 mA                  | 50 mA                  |                                                                                                                       |
| Vo=0.9 V                                  | -   | 25 mA                  | 40 mA                  |                                                                                                                       |
| I <sup>2</sup> t Inrush Current Transient |     |                        |                        |                                                                                                                       |
| Vo=2.5 V                                  | -   | 0.02 A <sup>2</sup> s  | 0.04 A <sup>2</sup> s  |                                                                                                                       |
| Vo=1.8 V                                  | -   | 0.015 A <sup>2</sup> s | 0.03 A <sup>2</sup> s  |                                                                                                                       |
| Vo=1.5 V                                  | -   | 0.01 A <sup>2</sup> s  | 0.02 A <sup>2</sup> s  |                                                                                                                       |
| Vo=1.2 V                                  | -   | 0.008 A <sup>2</sup> s | 0.016 A <sup>2</sup> s |                                                                                                                       |
| Vo=0.9 V                                  | -   | 0.008 A <sup>2</sup> s | 0.016 A <sup>2</sup> s |                                                                                                                       |
| Turn-on Voltage Threshold                 | -   | 2.8 V                  | -                      |                                                                                                                       |
| Turn-off Voltage Threshold                | -   | 2.5 V                  | -                      |                                                                                                                       |

### 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 condition:<br>Vin=3.3 V, Iout=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=0.9 V                                         | 0.882 V | 0.9 V | 0.918 V |                                              |
| Load Regulation                                  |         |       |         |                                              |
| Vo=2.5 V                                         | -       | 6 mV  | 12.5 mV |                                              |
| Vo=1.8 V                                         | -       | 5 mV  | 9.0 mV  |                                              |
| Vo=1.5 V                                         | -       | 4 mV  | 7.5 mV  |                                              |
| Vo=1.2 V                                         | -       | 3 mV  | 6.0 mV  |                                              |
| Vo=0.9 V                                         | -       | 3 mV  | 6.0 mV  |                                              |
| Line Regulation                                  |         |       |         |                                              |
| Vo=2.5 V                                         | -       | 4 mV  | 7.5 mV  |                                              |
| Vo=1.8 V                                         | -       | 3 mV  | 5.5 mV  |                                              |
| Vo=1.5 V                                         | -       | 3 mV  | 4.5 mV  |                                              |
| Vo=1.2 V                                         | -       | 2 mV  | 4.0 mV  |                                              |
| Vo=0.9 V                                         | -       | 2 mV  | 4.0 mV  |                                              |
| Regulation Over Temperature<br>(-40°C to +85 °C) |         |       |         |                                              |
| Vo=2.5 V                                         | -       | 30 mV | 50 mV   |                                              |
| Vo=1.8 V                                         | -       | 20 mV | 40 mV   |                                              |
| Vo=1.5 V                                         | -       | 15 mV | 30 mV   |                                              |
| Vo=1.2 V                                         | -       | 15 mV | 25 mV   |                                              |
| Vo=0.9 V                                         | -       | 10 mV | 20 mV   |                                              |

## NON-ISOLATED DC/DC CONVERTERS

3.3 V Input 0.9 V-2.5 V/15 A Output



### Output Specifications (continued)

| Parameter                                                                                   |          | Min                   | Typ                                       | Max                                       | Notes                                                                                                |                                                                                                            |
|---------------------------------------------------------------------------------------------|----------|-----------------------|-------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Output Current                                                                              |          | 0 A                   | -                                         | 15 A                                      |                                                                                                      |                                                                                                            |
| Current Limit Threshold                                                                     |          | 18 A                  | -                                         | 35 A                                      |                                                                                                      |                                                                                                            |
| Short Circuit Surge Transient                                                               |          | -                     | 0.2 A <sup>2</sup> s                      | 0.4 A <sup>2</sup> s                      |                                                                                                      |                                                                                                            |
| Turn on Time                                                                                |          | -                     | 6 mS                                      | 10 mS                                     |                                                                                                      |                                                                                                            |
| Overshoot at Turn on                                                                        |          | -                     | 0%                                        | 3%                                        |                                                                                                      |                                                                                                            |
| Output Capacitance                                                                          |          | -                     | -                                         | 6800 uF                                   |                                                                                                      |                                                                                                            |
| Output Ripple and Noise (pk-pk)<br>Vo=2.5 V<br>Vo=1.8 V<br>Vo=1.5 V<br>Vo=1.2 V<br>Vo=0.9 V |          | -<br>-<br>-<br>-<br>- | 20 mV<br>25 mV<br>30 mV<br>25 mV<br>20 mV | 50 mV<br>50 mV<br>60 mV<br>50 mV<br>50 mV | Test conditions:<br>0-20 MHz BW; 0.1 uF ceramic capacitor and 10 uF aluminum capacitor at the output |                                                                                                            |
| Output Ripple and Noise (rms)<br>Vo=2.5 V<br>Vo=1.8 V<br>Vo=1.5 V<br>Vo=1.2 V<br>Vo=0.9 V   |          | -<br>-<br>-<br>-<br>- | 5 mV<br>7 mV<br>8 mV<br>6 mV<br>5 mV      | 10 mV<br>10 mV<br>12 mV<br>10 mV<br>10 mV |                                                                                                      |                                                                                                            |
| Transient Response                                                                          |          |                       |                                           |                                           |                                                                                                      |                                                                                                            |
| 50% ~ 100% Max Load                                                                         | Vo=2.5 V | -                     | 110 mV                                    | 150 mV                                    |                                                                                                      | Test conditions:<br>di/dt = 0.5 A/uS; Vin = 3.3 V;<br>and with two 220 uF Tantalum capacitor at the output |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 100% ~ 50% Max Load                                                                         |          | -                     | 110 mV                                    | 150 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 50% ~ 100% Max Load                                                                         | Vo=1.8 V | -                     | 100 mV                                    | 130 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 100% ~ 50% Max Load                                                                         |          | -                     | 100 mV                                    | 130 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 50% ~ 100% Max Load                                                                         | Vo=1.5 V | -                     | 100 mV                                    | 130 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 100% ~ 50% Max Load                                                                         |          | -                     | 100 mV                                    | 130 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 50% ~ 100% Max Load                                                                         | Vo=1.2 V | -                     | 90 mV                                     | 120 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 100% ~ 50% Max Load                                                                         |          | -                     | 90 mV                                     | 120 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 50% ~ 100% Max Load                                                                         | Vo=0.9 V | -                     | 90 mV                                     | 120 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |
| 100% ~ 50% Max Load                                                                         |          | -                     | 90 mV                                     | 120 mV                                    |                                                                                                      |                                                                                                            |
| Settling Time                                                                               |          | -                     | 40 uS                                     | 80 uS                                     |                                                                                                      |                                                                                                            |

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

## NON-ISOLATED DC/DC CONVERTERS

3.3 V Input 0.9 V-2.5 V/15 A Output



### General Specifications

| Parameter                 | Min                 | Typ     | Max     | Notes                                                                                                          |
|---------------------------|---------------------|---------|---------|----------------------------------------------------------------------------------------------------------------|
| Efficiency                |                     |         |         |                                                                                                                |
| Vo=2.5 V                  | 91%                 | 93%     | -       | Measured at Vin=3.3 V, full load.                                                                              |
| Vo=1.8 V                  | 88%                 | 90%     | -       |                                                                                                                |
| Vo=1.5 V                  | 87%                 | 89%     | -       |                                                                                                                |
| Vo=1.2 V                  | 84%                 | 86%     | -       |                                                                                                                |
| Vo=0.9 V                  | 80%                 | 83%     | -       |                                                                                                                |
| Switching Frequency       | 250 kHz             | 300 kHz | 340 kHz |                                                                                                                |
| Output Voltage Trim Range |                     |         |         | The total output adjust range will not be higher than 105% Vo for 2.5 V module, and 110% Vo for other modules. |
| Vo=2.5 V                  | 90% Vo              | -       | 105% Vo |                                                                                                                |
| Vo=0.9 V-1.8 V            | 90% Vo              | -       | 110% Vo |                                                                                                                |
| Remote Sense Compensation |                     |         |         |                                                                                                                |
| Vo=2.5 V                  | -                   | -       | 5% Vo   |                                                                                                                |
| Vo=0.9 V-1.8 V            | -                   | -       | 10% Vo  |                                                                                                                |
| MTBF                      | 4,163,010 hours     |         |         | Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25°C)                                                      |
| Dimensions                |                     |         |         |                                                                                                                |
| Inches (L x W x H)        | 2.0 x 0.55 x 0.387  |         |         |                                                                                                                |
| Millimeters (L x W x H)   | 50.8 x 13.97 x 9.84 |         |         |                                                                                                                |
| Weight                    | -                   | 9.2 g   | -       |                                                                                                                |

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

### Control Specifications

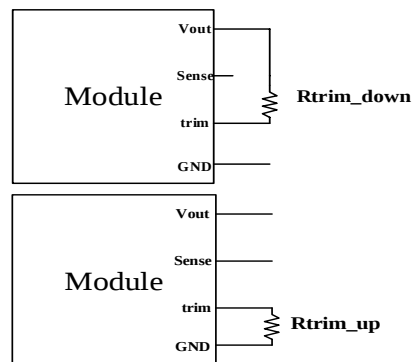
| Parameter              | Min    | Typ | Max   | Notes       |
|------------------------|--------|-----|-------|-------------|
| <b>Remote On/Off</b>   |        |     |       |             |
| Signal Low (Unit Off)  | -0.3 V | -   | 0.8 V | V7PB-15CxxS |
| Signal High (Unit On)  | 2.5 V  | -   | 5.5 V |             |
| Signal Low (Unit On)   | -0.3 V | -   | 0.8 V | V7PB-15CxxL |
| Signal High (Unit Off) | 2.5 V  | -   | 5.5 V |             |

### 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.

$$R_{trim\_down} = \frac{A(V_{adj} - 0.8)}{V_{nom} - V_{adj}} - B$$

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



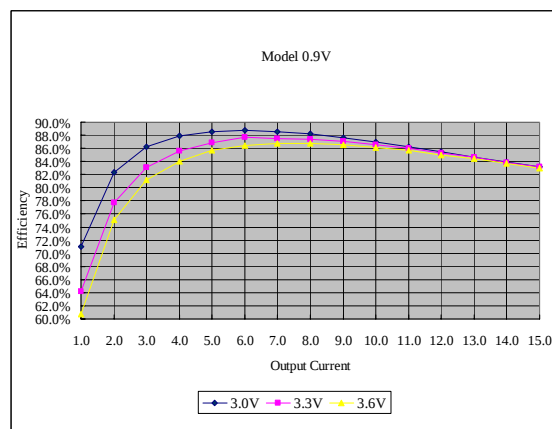
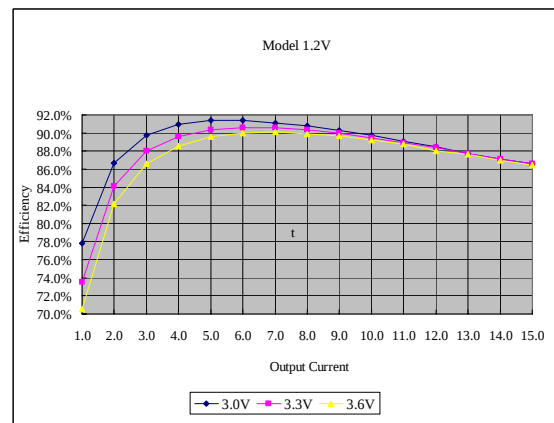
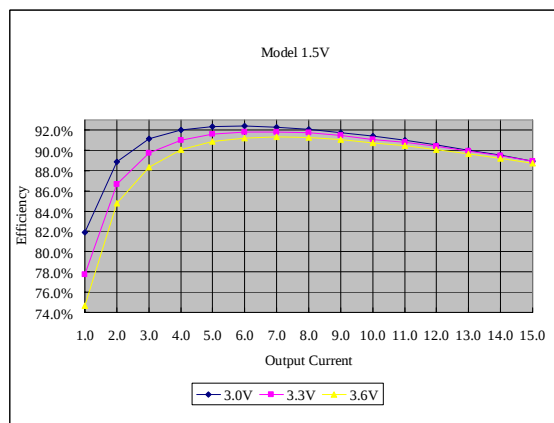
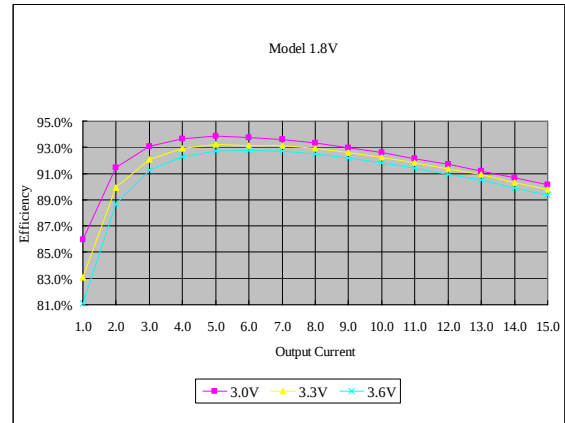
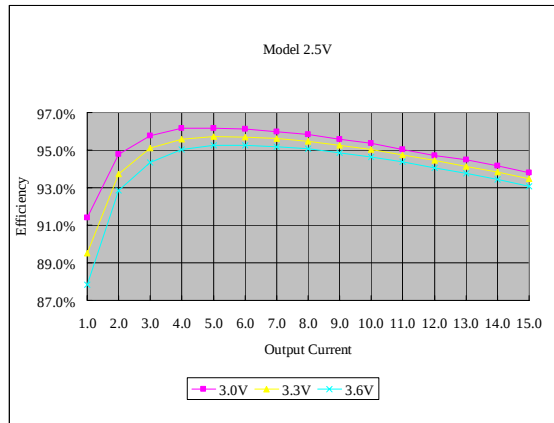
| Vnom  | A     | B     | C     | D     |
|-------|-------|-------|-------|-------|
| 2.5 V | 2.370 | 4.990 | 1.896 | 4.990 |
| 1.8 V | 2.370 | 4.990 | 1.896 | 4.990 |
| 1.5 V | 2.370 | 4.990 | 1.896 | 4.990 |
| 1.2 V | 2.490 | 2.370 | 1.992 | 2.370 |
| 0.9 V | 1.050 | 0.010 | 0.840 | 0.010 |

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3.3 V Input 0.9 V-2.5 V/15 A Output



### Efficiency Data

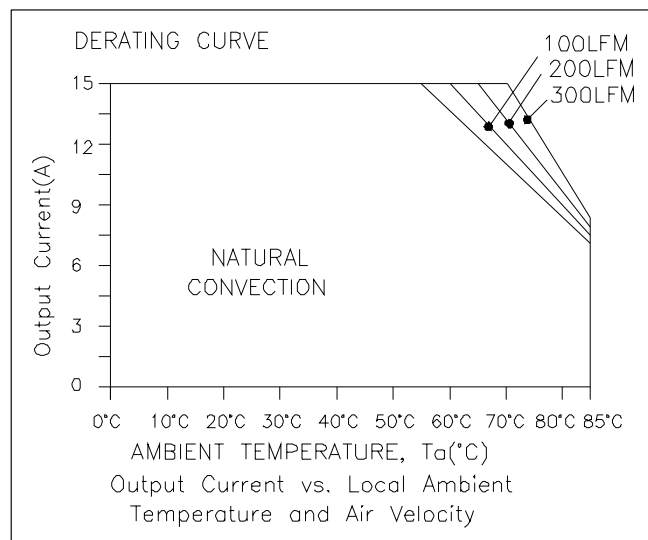


## NON-ISOLATED DC/DC CONVERTERS

3.3 V Input 0.9 V-2.5 V/15 A Output



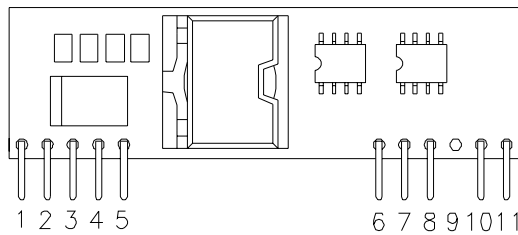
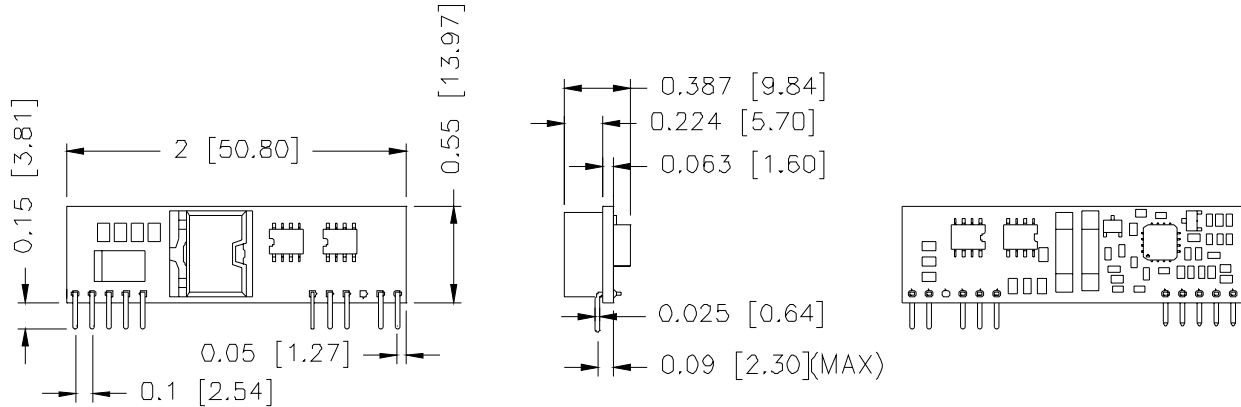
### Thermal Derating Curve



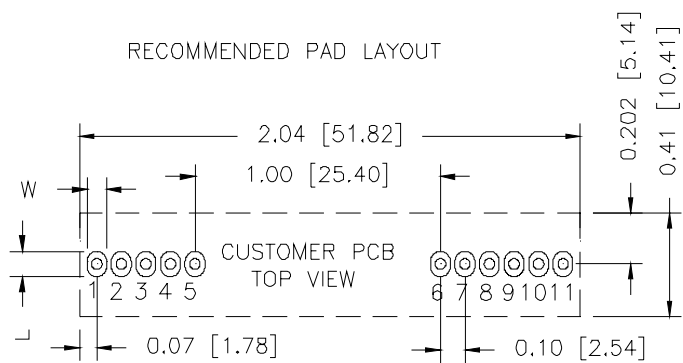
V7PB-15Cxxx

## NON-ISOLATED DC/DC CONVERTERS

3.3 V Input 0.9 V-2.5 V/15 A Output



### RECOMMENDED PAD LAYOUT



HOLE SIZE:  $\varnothing 0.043 \pm 0.003$  [1.08  $\pm$  0.08]

PAD SIZE: W  $0.063 \pm 0.002$  [1.63  $\pm$  0.05]

L  $0.10 \pm 0.004$  [2.54  $\pm$  0.10] BOTH SIDE

### Pin Connections

| Pin | Function              |
|-----|-----------------------|
| 1   | Vo+                   |
| 2   | Vo+                   |
| 3   | Opt. Remote Sense (+) |
| 4   | Vo+                   |
| 5   | Ground                |
| 6   | Ground                |
| 7   | Vin+                  |
| 8   | Vin+                  |
| 9   | Not used              |
| 10  | Trim                  |
| 11  | Remote On/Off         |

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