

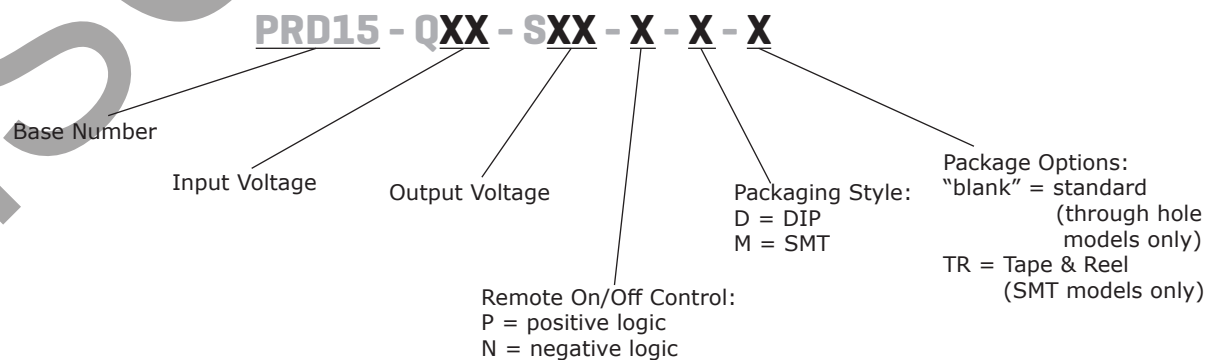
**SERIES: PRD15 | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- up to 15 W isolated output
- industry standard 1" x 1" package
- 4:1 input range
- low ripple & noise
- over voltage, over current, short circuit, and over temperature protections
- remote on/off control
- output trim
- -40 to 85°C temperature range
- efficiency up to 89%
- UL/cUL safety approval


**MODEL**

|               | input voltage |             | output voltage | output current |         | output power max | ripple & noise <sup>1</sup> max | efficiency typ |
|---------------|---------------|-------------|----------------|----------------|---------|------------------|---------------------------------|----------------|
|               | typ (Vdc)     | range (Vdc) |                | min (A)        | max (A) |                  |                                 |                |
| PRD15-Q24-S3  | 24            | 9~36        | 3.3            | 0.45           | 4.5     | 14.85            | 90                              | 89             |
| PRD15-Q24-S5  | 24            | 9~36        | 5              | 0.3            | 3       | 15               | 125                             | 87.3           |
| PRD15-Q24-S12 | 24            | 9~36        | 12             | 0.13           | 1.3     | 15.6             | 150                             | 84.5           |
| PRD15-Q24-S15 | 24            | 9~36        | 15             | 0.11           | 1.1     | 16.5             | 175                             | 85             |
| PRD15-Q48-S3  | 48            | 18~75       | 3.3            | 0.5            | 5       | 16.5             | 90                              | 88             |
| PRD15-Q48-S5  | 48            | 18~75       | 5              | 0.3            | 3       | 15               | 95                              | 86             |
| PRD15-Q48-S12 | 48            | 18~75       | 12             | 0.13           | 1.3     | 15.6             | 120                             | 85             |
| PRD15-Q48-S15 | 48            | 18~75       | 15             | 0.11           | 1.1     | 16.5             | 120                             | 85.3           |

Notes: 1. At full load, nominal input, 20 MHz bandwidth oscilloscope, input terminated with a 100  $\mu$ F capacitor for 24 Vdc input models and a 4.7  $\mu$ F capacitor for 48 Vdc input models. Output terminated with 1  $\mu$ F and 10  $\mu$ F low ESR capacitors.  
 2. All specifications are measured at  $T_a=25^\circ\text{C}$ , nominal input voltage, and rated output load unless otherwise specified. All models are tested and specified with a 100  $\mu$ F capacitor for 24 Vdc input models and a 4.7  $\mu$ F capacitor for 48 Vdc input models on the input, and with 1  $\mu$ F and 10  $\mu$ F low ESR capacitors on the output.

**PART NUMBER KEY**


**INPUT**

| parameter                         | conditions/description                                                                                                                                               | min                                    | typ  | max | units |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------|-----|-------|
| operating input voltage           | 24 Vdc input models                                                                                                                                                  | 9                                      | 24   | 36  | Vdc   |
|                                   | 48 Vdc input models                                                                                                                                                  | 18                                     | 48   | 75  | Vdc   |
| current                           | 24 Vdc input models                                                                                                                                                  |                                        |      | 2.1 | A     |
|                                   | 48 Vdc input models                                                                                                                                                  |                                        |      | 1.1 | A     |
| start-up voltage                  | 24 Vdc input models                                                                                                                                                  | 8.8                                    |      |     | Vdc   |
|                                   | 48 Vdc input models                                                                                                                                                  |                                        | 16.7 |     | Vdc   |
| under voltage shutdown            | PRD15-Q24-S3                                                                                                                                                         |                                        | 8.6  |     | Vdc   |
|                                   | PRD15-Q24-S5                                                                                                                                                         |                                        | 8.5  |     | Vdc   |
|                                   | PRD15-Q24-S12, PRD15-Q24-S15                                                                                                                                         |                                        | 8.4  |     | Vdc   |
|                                   | PRD15-Q48-S15                                                                                                                                                        |                                        | 16.2 |     | Vdc   |
|                                   | all other models                                                                                                                                                     |                                        | 15.6 |     | Vdc   |
| remote on/off <sup>1</sup>        | positive logic                                                                                                                                                       | models ON (10~15 Vdc or open circuit)  |      |     |       |
|                                   |                                                                                                                                                                      | models OFF (-0.7~0.7 Vdc)              |      |     |       |
|                                   | negative logic                                                                                                                                                       | models ON (-0.7~0.8 Vdc)               |      |     |       |
|                                   |                                                                                                                                                                      | models OFF (10~15 Vdc or open circuit) |      |     |       |
| filter                            | PRD15-Q48-S5: inductance filter<br>all other models: capacitance filter                                                                                              |                                        |      |     |       |
| input reverse polarity protection | no                                                                                                                                                                   |                                        |      |     |       |
| input fuse                        | recommended to add fuse:<br>4 A fast blow fuse for 24 Vdc input models<br>2 A fast blow fuse for 48 Vdc input models<br>1.5 A fast blow fuse for PRD15-Q48-S12 model |                                        |      |     |       |

Notes: 1. On/Off current is 1 mA.

**OUTPUT**

| parameter                  | conditions/description                                   | min | typ        | max         | units              |
|----------------------------|----------------------------------------------------------|-----|------------|-------------|--------------------|
| maximum capacitive load    | low ESR <0.02 $\Omega$                                   |     |            | 1,000       | $\mu$ F            |
|                            | PRD15-Q24-S3, S5, S12 & PRD15-Q48-S3<br>all other models |     |            | 470         | $\mu$ F            |
| line regulation            | PRD15-Q48-S3                                             |     |            | $\pm 0.2$   | %                  |
|                            | PRD15-Q48-S12                                            |     |            | $\pm 0.075$ | %                  |
|                            | all other models                                         |     |            | $\pm 0.05$  | %                  |
| load regulation            | PRD15-Q24-S3                                             |     |            | $\pm 0.1$   | %                  |
|                            | PRD15-Q24-S5                                             |     |            | $\pm 0.075$ | %                  |
|                            | PRD15-Q48-S3                                             |     |            | $\pm 0.2$   | %                  |
|                            | PRD15-Q48-S5                                             |     |            | $\pm 0.06$  | %                  |
|                            | all other models                                         |     |            | $\pm 0.05$  | %                  |
| voltage accuracy           | at 50% load                                              |     | $\pm 1$    |             | %                  |
| start-up time              |                                                          |     |            | 50          | ms                 |
| adjustability <sup>2</sup> | see application notes                                    |     | $\pm 10$   |             | %                  |
| switching frequency        | PRD15-Q24-S12, PRD15-Q24-S15                             |     | 340        |             | kHz                |
|                            | PRD15-Q48-S5                                             |     | 375        |             | kHz                |
|                            | PRD15-Q48-S15                                            |     | 380        |             | kHz                |
|                            | all other models                                         |     | 350        |             | kHz                |
| dynamic load response      | 50-75-50% load change to 1% Vout                         |     |            |             |                    |
|                            | PRD15-Q24-S3, PRD15-Q24-S12<br>all other models          |     | 150<br>100 |             | $\mu$ s<br>$\mu$ s |
| temperature coefficient    |                                                          |     | $\pm 0.02$ |             | %/ $^{\circ}$ C    |

Note: 2. For input voltage &lt; 20 Vdc, PRD15-Q48-S5 can only be trimmed down.

## PROTECTIONS

| parameter                   | conditions/description                | min | typ  | max | units |
|-----------------------------|---------------------------------------|-----|------|-----|-------|
| over voltage protection     | auto restart                          |     |      |     |       |
|                             | PRD15-Q24-S3                          |     | 4.5  |     | Vdc   |
|                             | PRD15-Q24-S5                          |     | 5.9  |     | Vdc   |
|                             | PRD15-Q24-S12                         |     | 14.1 |     | Vdc   |
|                             | PRD15-Q24-S15                         |     | 19.5 |     | Vdc   |
|                             | PRD15-Q48-S3                          |     | 3.9  |     | Vdc   |
|                             | PRD15-Q48-S5                          |     | 5.9  |     | Vdc   |
|                             | PRD15-Q48-S12                         |     | 15   |     | Vdc   |
|                             | PRD15-Q48-S15                         |     | 20   |     | Vdc   |
| over current protection     | current limiting, auto restart        |     |      |     |       |
|                             | PRD15-Q24-S3                          |     | 6.0  |     | A     |
|                             | PRD15-Q24-S5                          |     | 4.6  |     | A     |
|                             | PRD15-Q24-S12                         |     | 2.0  |     | A     |
|                             | PRD15-Q24-S15                         |     | 1.6  |     | A     |
|                             | PRD15-Q48-S3                          |     | 7.2  |     | A     |
|                             | PRD15-Q48-S5                          |     | 4.5  |     | A     |
|                             | PRD15-Q48-S12                         |     | 1.8  |     | A     |
|                             | PRD15-Q48-S15                         |     | 1.7  |     | A     |
| short circuit protection    | current limiting, hiccup auto restart |     | 0.3  |     | A     |
| over temperature protection | PRD15-Q48-S12                         |     | 135  |     | °C    |
|                             | all other models                      |     | 115  |     | °C    |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                                                                                  | min       | typ   | max | units |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------|-----------|-------|-----|-------|
| isolation voltage     | input to output, basic insulation                                                                                       |           |       |     |       |
|                       | 24 Vdc input models                                                                                                     |           | 2,000 |     | Vdc   |
|                       | 48 Vdc input models                                                                                                     |           | 2,250 |     | Vdc   |
| isolation resistance  |                                                                                                                         | 10        |       |     | MΩ    |
| isolation capacitance | PRD15-Q24-S5, PRD15-Q24-S15, PRD15-Q48-S3                                                                               |           | 1,500 |     | pF    |
|                       | all other models                                                                                                        |           | 1,000 |     | pF    |
| safety approvals      | UL 60950-1, 2nd Edition                                                                                                 |           |       |     |       |
| LVD <sup>1</sup>      | 2006/95/EC (CE mark)                                                                                                    |           |       |     |       |
| MTBF                  | as per Telcordia SR-332 Method 1, Case 3, ground fixed conditions, Tpcboard = 25 °C, full load, natural air convection. | 2,000,000 |       |     | hours |
| RoHS                  | 2011/65/EU                                                                                                              |           |       |     |       |

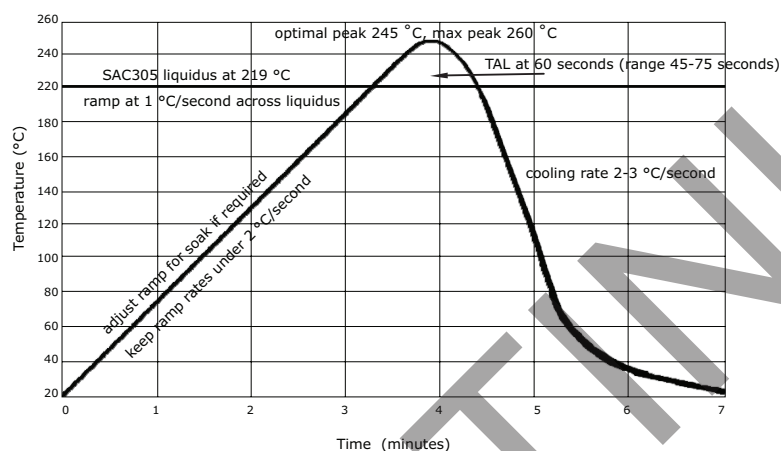
Note: 1. CE mark only on 48 Vdc input models.

## ENVIRONMENTAL

| parameter             | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curves    | -40 |     | 85  | °C    |
| storage temperature   |                        | -55 |     | 125 | °C    |

## SOLDERABILITY

| parameter        | conditions/description                                                                               | min | typ | max | units |
|------------------|------------------------------------------------------------------------------------------------------|-----|-----|-----|-------|
| wave soldering   | for Sn/Ag/Cu based solders (for through hole models):                                                |     |     |     |       |
|                  | preheat temperature                                                                                  |     |     | 115 | °C    |
|                  | solder pot temperature                                                                               |     |     | 270 | °C    |
|                  | solder dwell time                                                                                    |     |     | 7   | s     |
| reflow soldering | reflow solder profile below is suitable for SAC305 type lead-free solders (for surface mount models) |     | 245 | 260 | °C    |



## MECHANICAL

| parameter  | conditions/description                                   | min | typ  | max | units  |
|------------|----------------------------------------------------------|-----|------|-----|--------|
| dimensions | through hole: 1.10 x 0.96 x 0.33 [27.9 x 24.4 x 8.4 mm]  |     |      |     | inches |
|            | surface mount: 1.10 x 0.96 x 0.33 [27.9 x 24.4 x 8.4 mm] |     |      |     | inches |
| weight     | through hole mount models                                |     | 10   |     | g      |
|            | surface mount models                                     |     | 10.2 |     | g      |

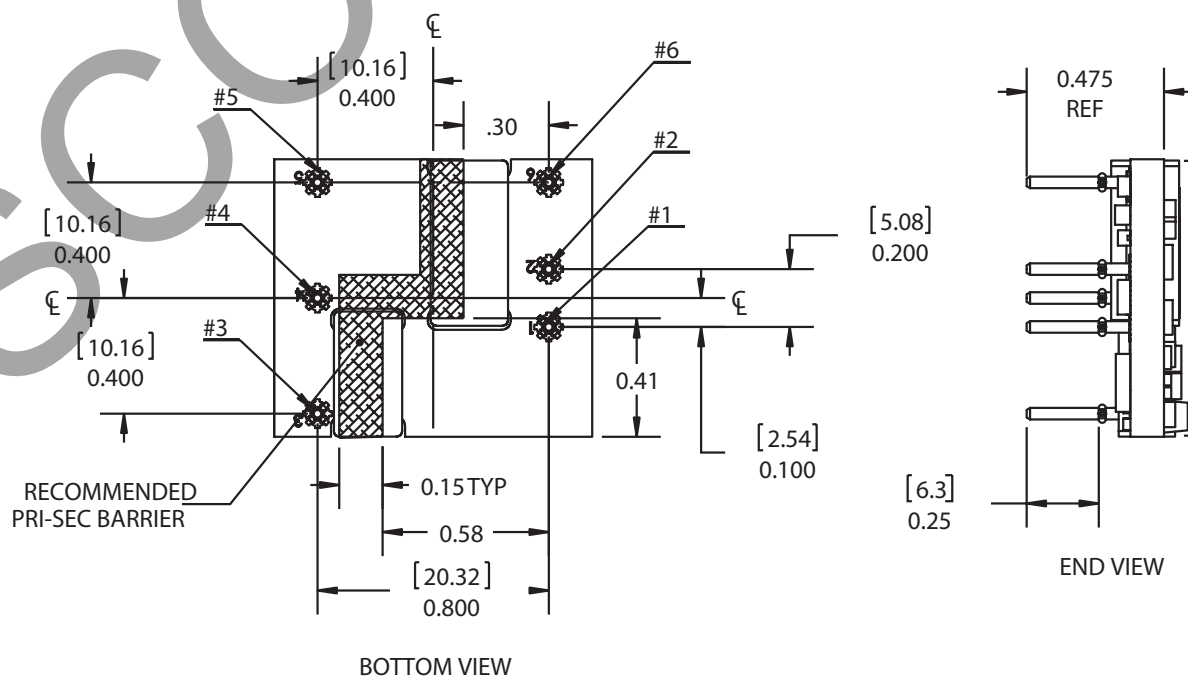
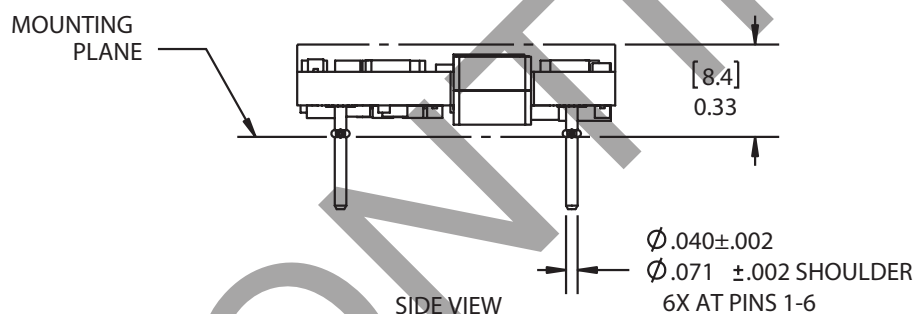
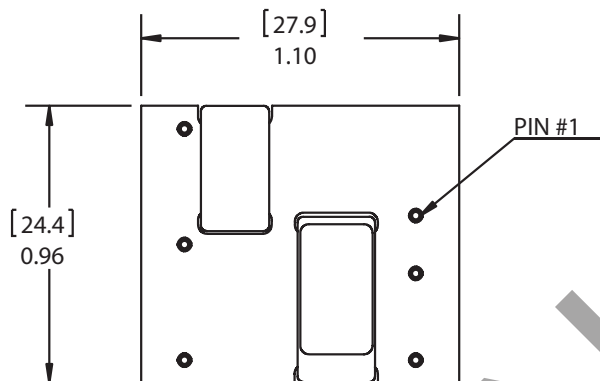
**MECHANICAL DRAWING (THROUGH HOLE)**

units: inches [mm]

tolerance: X.XX ±0.02 [0.5]

X.XXX ±0.010 [0.25]

| PIN CONNECTIONS |                |
|-----------------|----------------|
| PIN             | Function       |
| 1               | +Vin           |
| 2               | -Vin           |
| 3               | +Vout          |
| 4               | output trim    |
| 5               | -Vout          |
| 6               | on/off control |



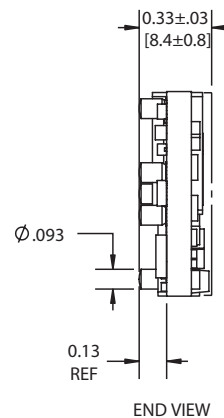
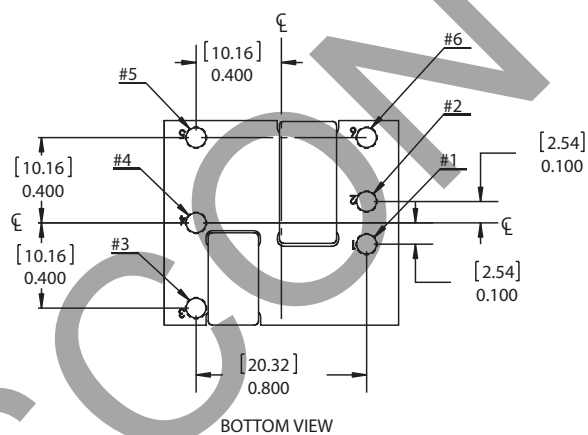
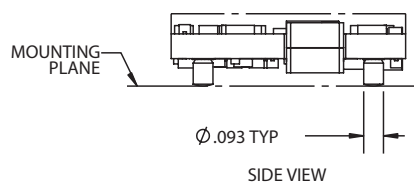
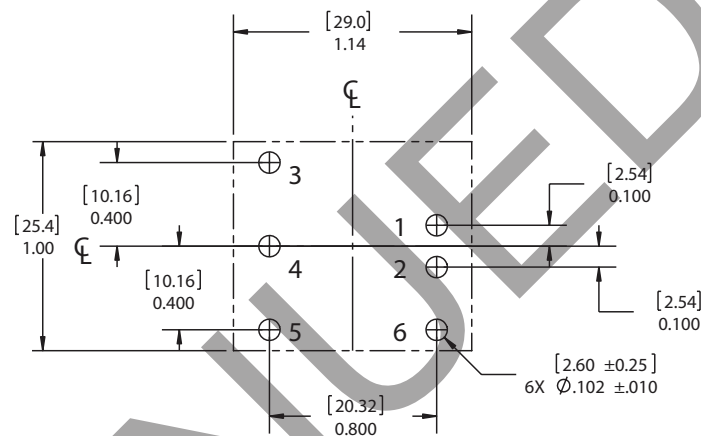
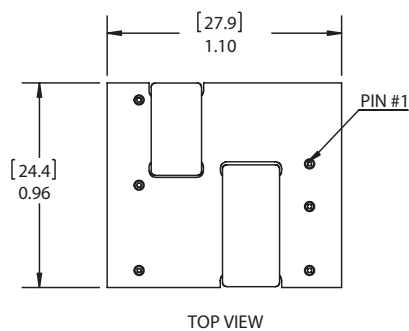
## MECHANICAL DRAWING (SURFACE MOUNT)

units: inches [mm]

tolerance: X.XX ±0.02 [0.5]

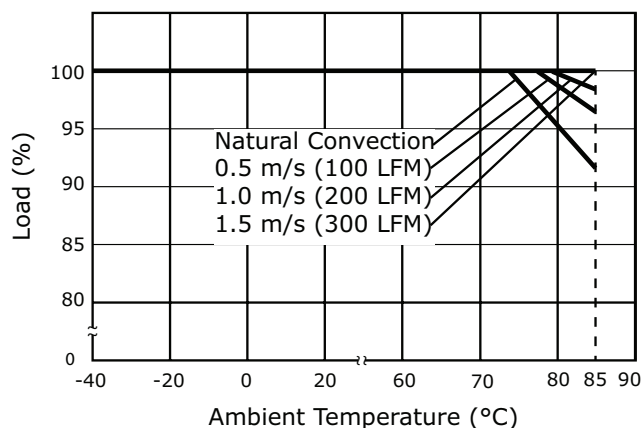
X.XXX ±0.010 [0.25]

| PIN CONNECTIONS |                |
|-----------------|----------------|
| PIN             | Function       |
| 1               | +Vin           |
| 2               | -Vin           |
| 3               | +Vout          |
| 4               | output trim    |
| 5               | -Vout          |
| 6               | on/off control |

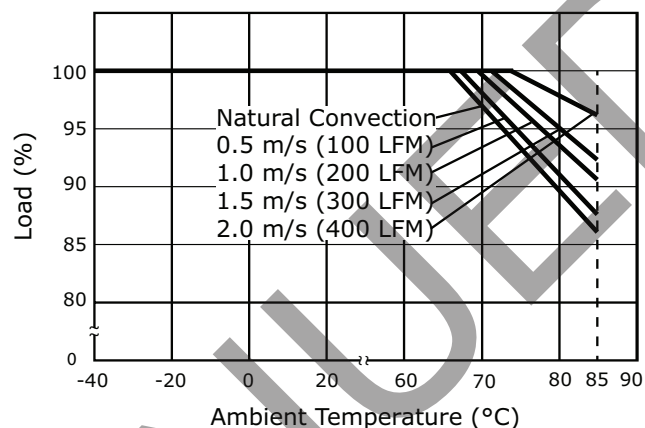


## DERATING CURVES

PRD15-Q48-S3 Derating Curves @ Sea Level  
(Vin=24, airflow from input to output)



PRD15-Q48-S3 Derating Curves @ Sea Level  
(Vin=48, airflow from input to output)



All other models, Derating Curves @ Sea Level  
(See conditions in Table 1)

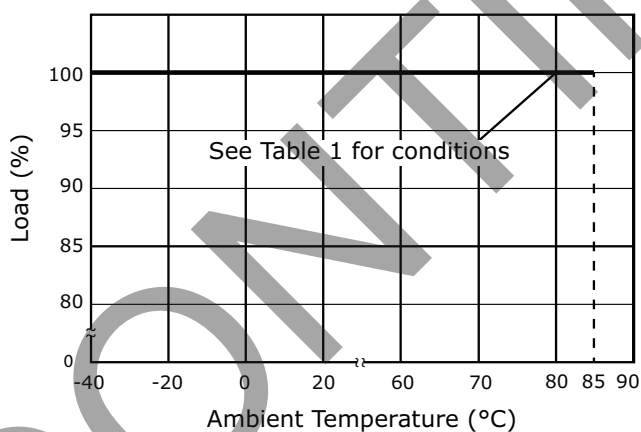
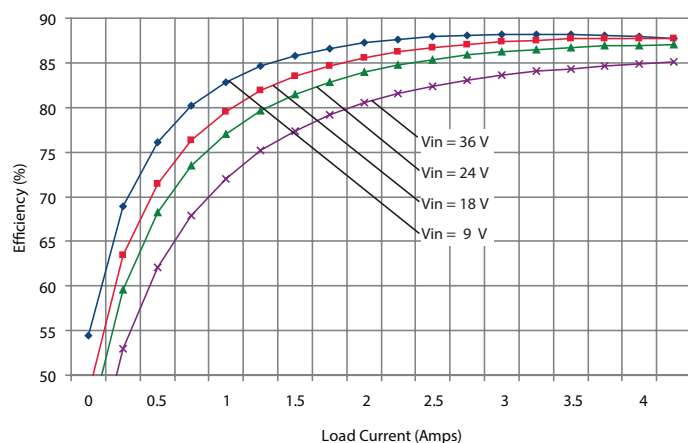


Table 1

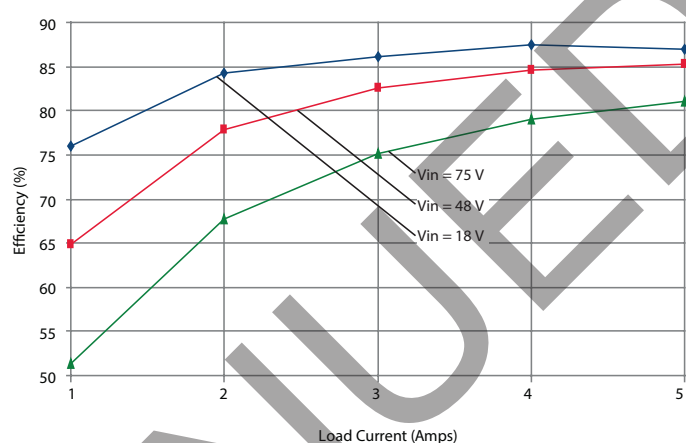
| Model         | Input (Vdc) | Direction of airflow | Airflow            |
|---------------|-------------|----------------------|--------------------|
| PRD15-Q24-S3  | 12/24       | Input to output      | Natural Convection |
| PRD15-Q24-S5  | 24          | Input to output      | 0.33 m/s (65 LFM)  |
| PRD15-Q24-S12 | 24          | Input to output      | 0.33 m/s (65 LFM)  |
| PRD15-Q24-S15 | 12/24       | Input to output      | Natural Convection |
| PRD15-Q48-S5  | 24/48       | Input to output      | Natural Convection |
| PRD15-Q48-S12 | 24/48       | Pin 2 to Pin 1       | Natural Convection |
| PRD15-Q48-S15 | 24/48       | Input to output      | Natural Convection |

## EFFICIENCY CURVES

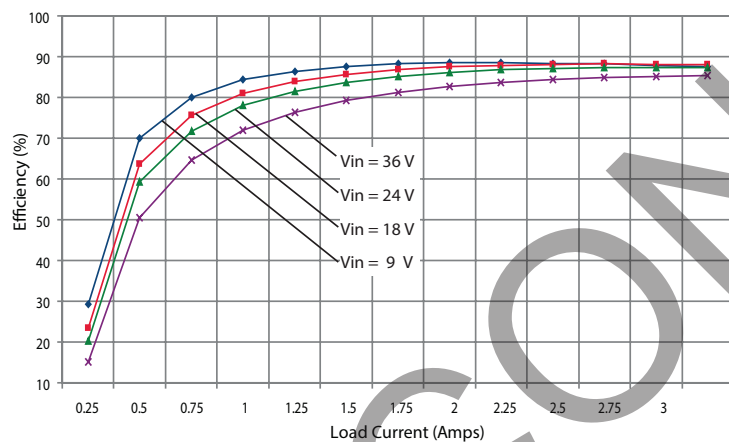
PRD15-Q24-S3 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



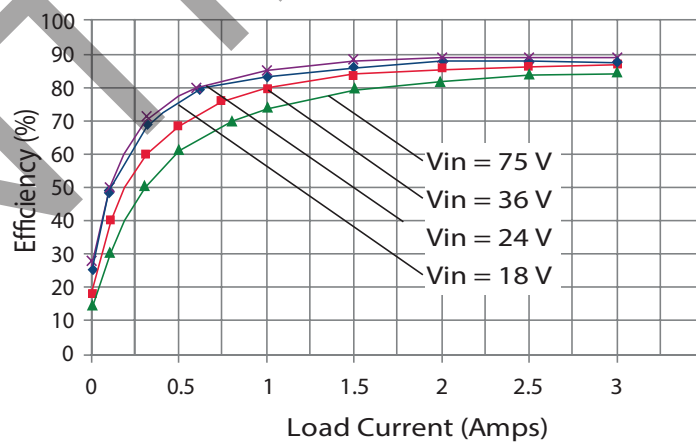
PRD15-Q48-S3 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



PRD15-Q24-S5 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)

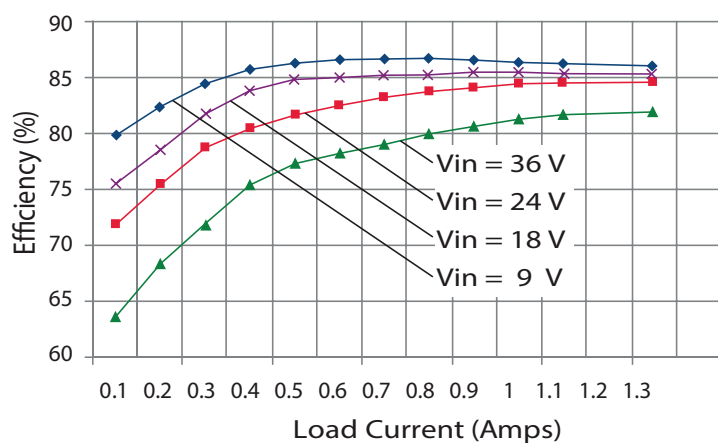


PRD15-Q48-S5 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)

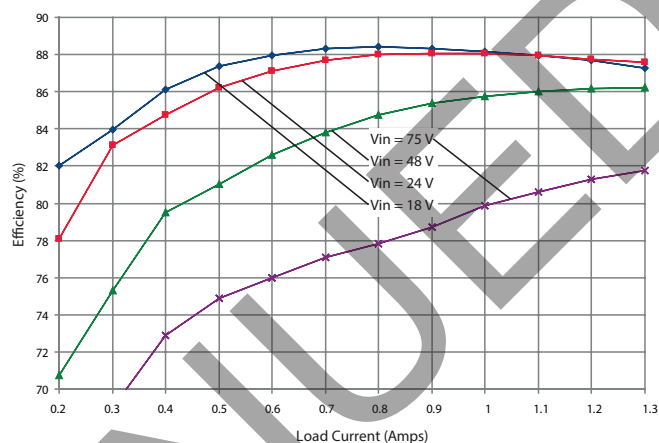


## EFFICIENCY CURVES (CONTINUED)

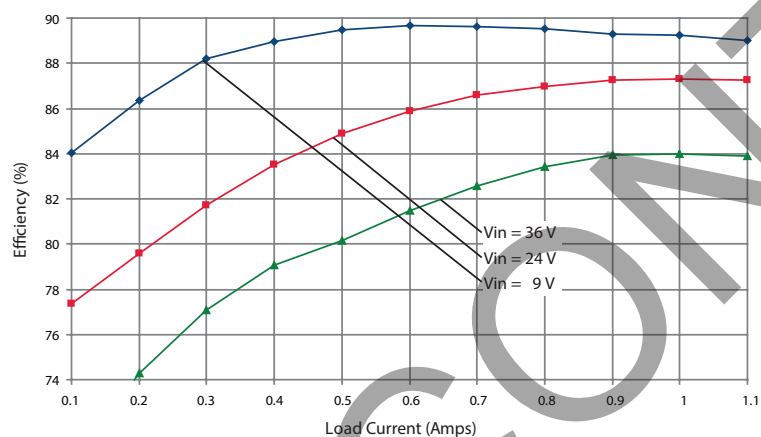
PRD15-Q24-S12 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



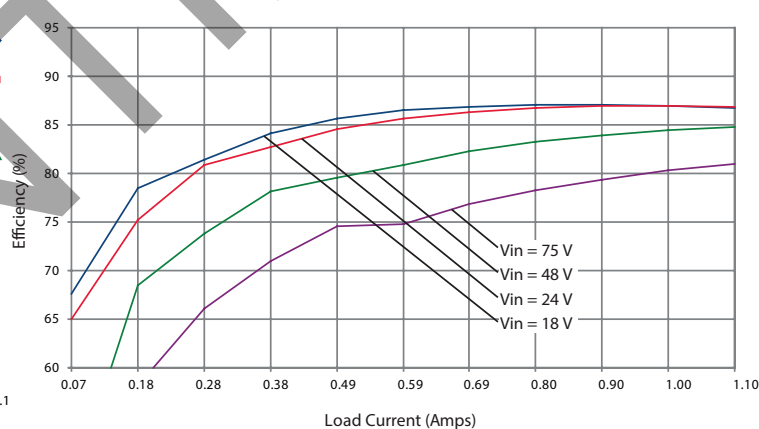
PRD15-Q48-S12 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



PRD15-Q24-S15 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



PRD15-Q48-S15 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



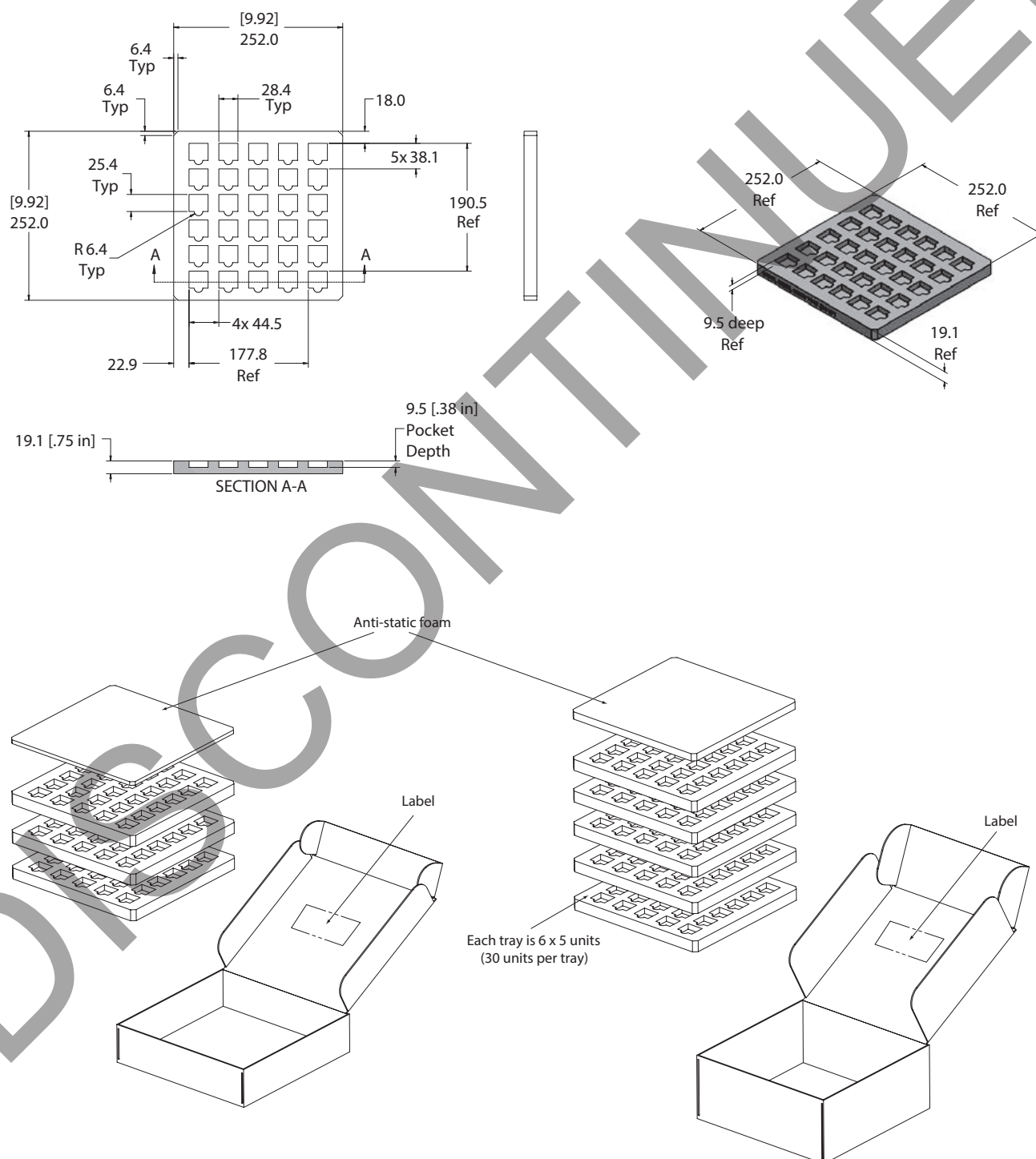
## PACKAGING (THROUGH HOLE)

units: mm [inches]  
tolerance: +1/-0 mm

Tray Material: Dow 220 anti-static ethafoam

Tray Size: 252 x 252 x 19.1 mm

QTY: 30 pcs per tray (6 x 5)



## PACKAGING (SURFACE MOUNT)

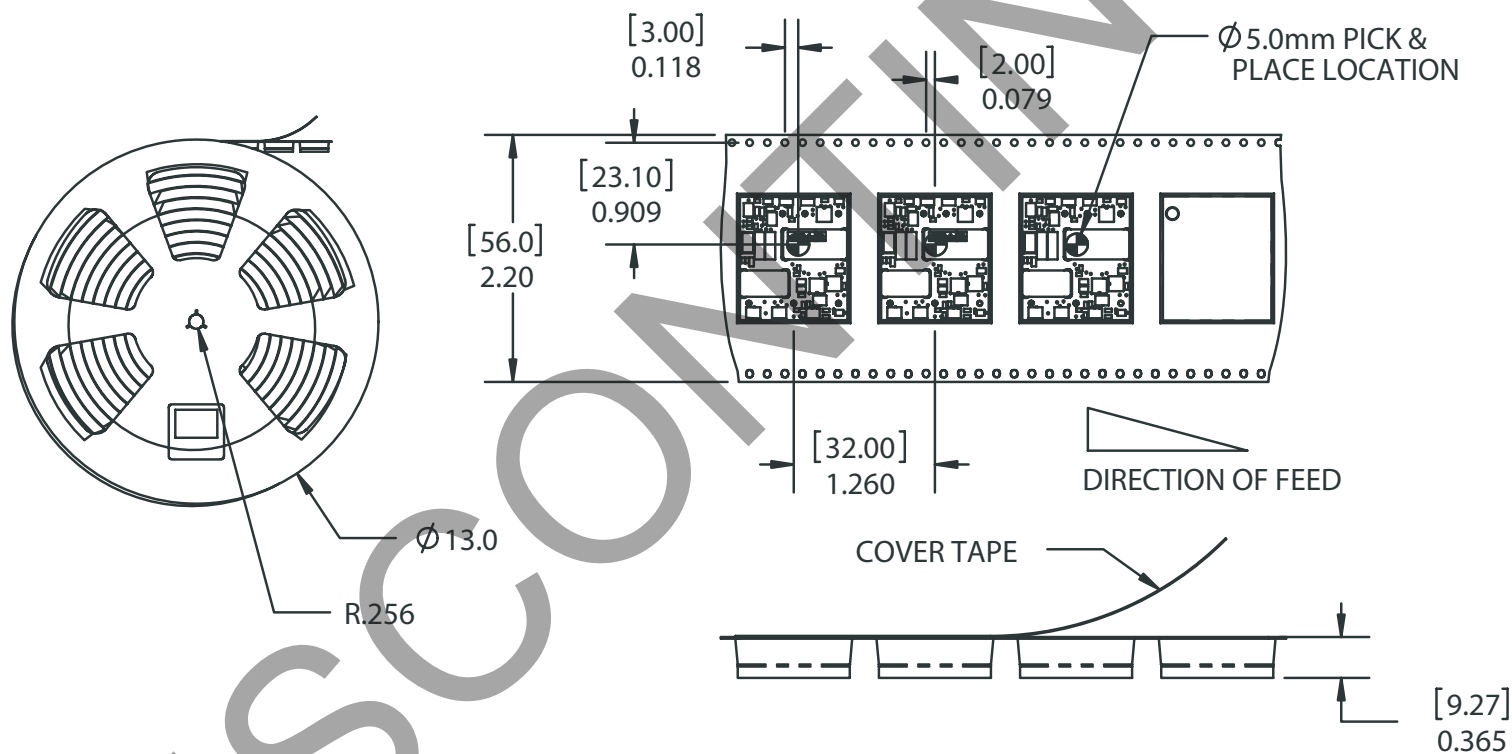
units: inches [mm]

Tape & Reel: Conforms to EIA-481

Reel Size: Ø13"

QTY: 100 pcs per reel

Note: The SMT package has an MSL 2 rating

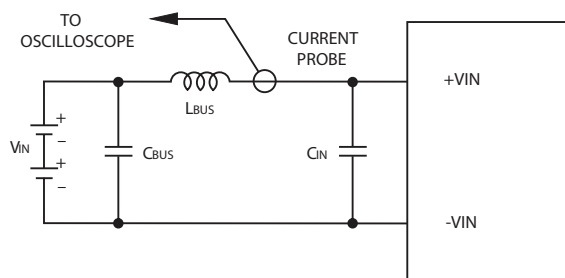


## TEST CONFIGURATIONS

### Input Ripple Current & Output Noise

All models are tested and specified for input reflected ripple current and output noise as per layouts shown in Figures 1 & 2. The Cbus and Lbus components simulate a typical DC voltage bus. However, your specific system configuration may require additional considerations.

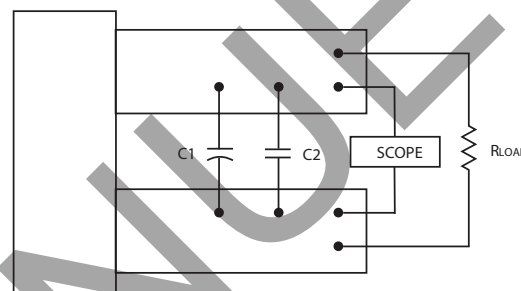
**Figure 1 Measuring Input Ripple Current**



**Table 1**

|           |                                           |
|-----------|-------------------------------------------|
| $C_{IN}$  | 33 $\mu$ F, ESR < 700m $\Omega$ @ 100kHz  |
| $C_{BUS}$ | 220 $\mu$ F, ESR < 100m $\Omega$ @ 100kHz |
| $L_{BUS}$ | 12 $\mu$ H                                |

**Figure 2 Measuring Output Ripple and noise (PARD)**



**Table 2**

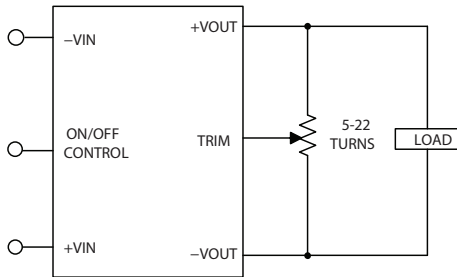
|                                       |            |
|---------------------------------------|------------|
| $C1$                                  | 1 $\mu$ F  |
| $C2$                                  | 10 $\mu$ F |
| load 2-3 inches (51-76mm) from module |            |

## APPLICATION NOTES

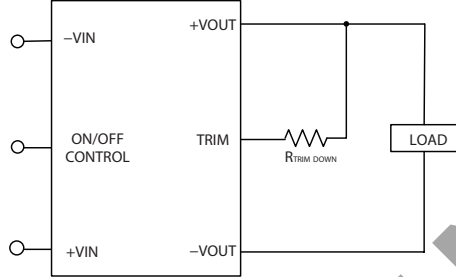
### Output Voltage Trimming

The output voltage can be adjusted by using the trim pin and the use of either an external trimpot or the use of a single fixed resistor (See Figures 3~5 below). Trimming resistors should have a low temperature coefficient ( $\pm 100$  ppm/ $^{\circ}\text{C}$  or less) and be mounted close to the converter. For input voltage  $< 20$  Vdc, PRD15-Q48-S5 can only be trimmed down. If the trim function is not needed, leave the trim pin open.

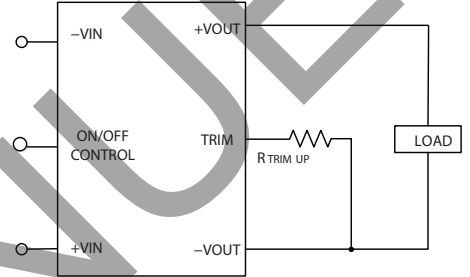
**Figure 3 Trim Adjustments Using A Trimpot**



**Figure 4 Trim Adjustments To Decrease Output Voltage Using A Fixed Resistor**



**Figure 5 Trim Adjustments To Increase Output Voltage Using A Fixed Resistor**



Note:  $R_{\text{trim-up}}$  is the external resistor in  $\Omega$   
 $R_{\text{trim-down}}$  is the external resistor in  $\Omega$   
 $V_{o, \text{nom}}$  is the nominal output voltage  
 $V_o$  is the desired output voltage

$$R_{\text{trim-up}} = \frac{A}{V_o - V_{o, \text{nom}}} - B$$

$$R_{\text{trim-down}} = \frac{C(V_o - 2.5)}{V_{o, \text{nom}} - V_o} - B$$

| Vout | A     | B    | C     |
|------|-------|------|-------|
| 3.3  | 12775 | 2050 | 5110  |
| 5    | 12775 | 2050 | 5110  |
| 12   | 25000 | 5110 | 10000 |
| 15   | 25000 | 5110 | 10000 |

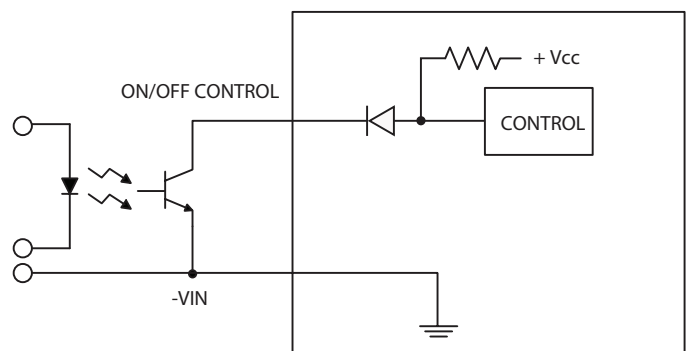
### Remote On/Off Control

The DC-DC converter can be ordered with either positive or negative logic. See page 2 for enable/disable details for both positive and negative logic options. Dynamic control of the On/Off function should be able to sink appropriate signal current when brought low and withstand appropriate voltage when brought high. Be aware that there is a finite time in milliseconds between the the time of On/Off control activation and stable, regulated output. This time will vary slightly with output load type and current and input conditions.

Cautions when using the On/Off control:

1. To retain full output circuit isolation, control the On/Off from the input side only.
2. While it is possible to control the On/Off with external logic if you carefully observe the voltage levels, the preferred circuit is either an open drain/open collector transistor, a switch, or a relay.
3. Do not apply voltages to the On/Off pin when there is no input power voltage, otherwise the converter may be permanently damaged.

**Figure 6. Driving The On/Off Control Pin (Suggested Circuit)**



## REVISION HISTORY

| rev. | description         | date       |
|------|---------------------|------------|
| 1.0  | initial release     | 03/28/2016 |
| 1.01 | company logo update | 10/26/2020 |

The revision history provided is for informational purposes only and is believed to be accurate.



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CUI offers a two (2) year limited warranty. Complete warranty information is listed on our website.

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