

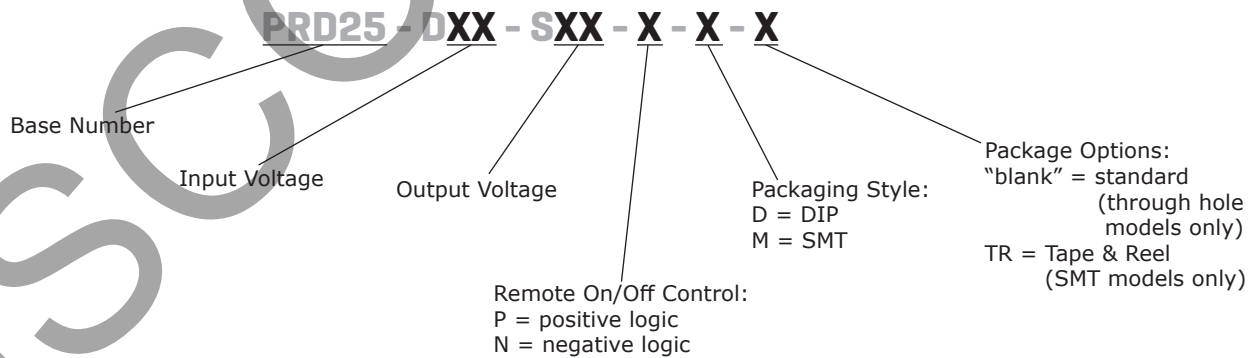
**SERIES: PRD25 | DESCRIPTION: DC-DC CONVERTER****FEATURES**

- up to 25 W isolated output
- industry standard 1" x 1" package
- 2:1 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 91%
- UL/cUL safety approval

**MODEL**

|               | input voltage |             | output voltage | output current |         | output power max | ripple & noise <sup>1</sup> max | efficiency |
|---------------|---------------|-------------|----------------|----------------|---------|------------------|---------------------------------|------------|
|               | typ (Vdc)     | range (Vdc) |                | min (A)        | max (A) |                  |                                 | typ (%)    |
| PRD25-D48-S3  | 48            | 36~75       | 3.3            | 0.75           | 7.5     | 25               | 80                              | 89.5       |
| PRD25-D48-S5  | 48            | 36~75       | 5              | 0              | 5       | 25               | 80                              | 91         |
| PRD25-D48-S12 | 48            | 36~75       | 12             | 0              | 2.1     | 25.2             | 120                             | 87.5       |

Notes: 1. At full load, nominal input, 20 MHz bandwidth oscilloscope, input terminated with a 4.7  $\mu$ F capacitor. Output terminated with 1  $\mu$ F and 10  $\mu$ F low ESR capacitors.  
 2. All specifications are measured at Ta=25°C, nominal input voltage, and rated output load unless otherwise specified. All models are tested and specified with a 4.7  $\mu$ F 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           |                                                                                 | 36                              | 48   | 75    | Vdc   |
| current                           | at nominal Vin                                                                  |                                 |      |       |       |
|                                   | 3.3 Vdc output models                                                           |                                 |      | 0.81  | A     |
|                                   | 5 Vdc output models                                                             |                                 |      | 0.79  | A     |
|                                   | 12 Vdc output models                                                            |                                 |      | 0.842 | A     |
| start-up voltage                  | rising input voltage                                                            |                                 |      |       |       |
|                                   | 3.3, 12 Vdc output models                                                       | 34                              | 35.2 | 36    | Vdc   |
|                                   | 5 Vdc output models                                                             | 34                              | 35   | 36    | Vdc   |
| under voltage shutdown            | falling input voltage                                                           |                                 |      |       |       |
|                                   | 3.3, 12 Vdc output models                                                       | 32                              | 34   | 35.2  | Vdc   |
|                                   | 5 Vdc output models                                                             | 32                              | 33.5 | 34.5  | Vdc   |
| remote on/off <sup>1</sup>        | 3.3 Vdc output models                                                           |                                 |      |       |       |
|                                   | positive logic                                                                  | ON (10~15 Vdc or open circuit)  |      |       |       |
|                                   |                                                                                 | OFF (-0.7~1.2 Vdc)              |      |       |       |
|                                   | negative logic                                                                  | ON (-0.7~1.2 Vdc)               |      |       |       |
|                                   |                                                                                 | OFF (10~15 Vdc or open circuit) |      |       |       |
|                                   | 5, 12 Vdc output models                                                         |                                 |      |       |       |
|                                   | positive logic                                                                  | ON (10~15 Vdc or open circuit)  |      |       |       |
|                                   |                                                                                 | OFF (-0.7~0.7 Vdc)              |      |       |       |
|                                   | negative logic                                                                  | ON (-0.7~0.8 Vdc)               |      |       |       |
|                                   |                                                                                 | OFF (10~15 Vdc or open circuit) |      |       |       |
| filter                            | 3.3, 5 Vdc output models: LC filter<br>12 Vdc output models: capacitance filter |                                 |      |       |       |
| input reverse polarity protection | no                                                                              |                                 |      |       |       |
| input fuse                        | recommended to add 1.5 A fast blow fuse                                         |                                 |      |       |       |

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

**OUTPUT**

| parameter               | conditions/description                   | min | typ        | max         | units           |
|-------------------------|------------------------------------------|-----|------------|-------------|-----------------|
| maximum capacitive load | low ESR <0.02 $\Omega$ , full load       |     |            |             |                 |
|                         | 3.3, 5 Vdc output models                 |     |            | 2,000       | $\mu$ F         |
|                         | 12 Vdc output models                     |     |            | 470         | $\mu$ F         |
| line regulation         | 50% load, input voltage from low to high |     |            | $\pm 0.1$   | %               |
|                         | 3.3, 5 Vdc output models                 |     |            | $\pm 0.075$ | %               |
|                         | 12 Vdc output models                     |     |            |             |                 |
| load regulation         | at nominal Vin, 0~100% load              |     |            |             |                 |
|                         | 3.3, 5 Vdc output models                 |     |            | $\pm 0.2$   | %               |
|                         | 12 Vdc output models                     |     |            | $\pm 0.05$  | %               |
| voltage accuracy        | at 50% load                              |     | $\pm 1$    |             | %               |
| start-up time           |                                          |     |            | 50          | ms              |
| adjustability           | see application notes                    |     | $\pm 10$   |             | %               |
| switching frequency     | 3.3, 5 Vdc output models                 | 300 | 330        | 360         | kHz             |
|                         | 12 Vdc output models                     | 295 | 325        | 355         | kHz             |
| dynamic load response   | 50-75-50% load change to 2% Vout         |     |            |             |                 |
|                         | 3.3 Vdc output models                    |     | 180        | 250         | $\mu$ s         |
|                         | 5 Vdc output models                      |     | 200        |             | $\mu$ s         |
|                         | 50-75-50% load change to 1% Vout         |     |            |             |                 |
|                         | 12 Vdc output models                     |     | 100        | 200         | $\mu$ s         |
| temperature coefficient |                                          |     | $\pm 0.02$ |             | %/ $^{\circ}$ C |

## PROTECTIONS

| parameter                   | conditions/description                | min | typ | max | units |
|-----------------------------|---------------------------------------|-----|-----|-----|-------|
| over voltage protection     | via magnetic feedback                 |     |     |     |       |
|                             | 3.3 Vdc output models                 | 4.2 | 5   | 5.7 | Vdc   |
|                             | 5 Vdc output models                   | 6   | 6.5 | 7.5 | Vdc   |
|                             | 12 Vdc output models                  | 14  | 19  | 22  | Vdc   |
| over current protection     | current limiting                      |     |     |     |       |
|                             | 3.3 Vdc output models                 | 8.5 | 10  | 11  | A     |
|                             | 5 Vdc output models                   | 5.3 | 6.8 | 7.3 | A     |
|                             | 12 Vdc output models                  | 2.3 | 3   | 3.4 | A     |
| short circuit protection    | current limiting, hiccup auto restart |     | 0.3 |     | A     |
| over temperature protection | 3.3, 5 Vdc output models              | 110 | 115 | 120 | °C    |
|                             | 12 Vdc output models                  | 130 | 135 | 150 | °C    |

## SAFETY AND COMPLIANCE

| parameter                        | conditions/description                                                        | min       | typ   | max | units |
|----------------------------------|-------------------------------------------------------------------------------|-----------|-------|-----|-------|
| isolation voltage                | input to output, continuous, basic insulation                                 | 2,250     |       |     | Vdc   |
| isolation resistance             |                                                                               | 10        |       |     | MΩ    |
| isolation capacitance            | 3.3 Vdc output models                                                         |           | 1,000 |     | pF    |
|                                  | 5 Vdc output models                                                           |           | 2,000 |     | pF    |
|                                  | 12 Vdc output models                                                          |           | 1,700 |     | pF    |
| safety approvals                 | UL 60950-1, 2nd Edition                                                       |           |       |     |       |
| LVD                              | 2006/95/EC (CE mark)                                                          |           |       |     |       |
| conducted emissions <sup>1</sup> | EN55022/CISPR22, Class B<br>(external circuit required, see Figure 3)         |           |       |     |       |
| radiated emissions <sup>1</sup>  | EN55022/CISPR22, Class B<br>(external circuit required, see Figure 3)         |           |       |     |       |
| MTBF                             | as per Telcordia SR-332 Method 1, Case 3, ground<br>fixed conditions, Ta=40°C | 2,000,000 |       |     | hours |
| RoHS                             | 2011/65/EU                                                                    |           |       |     |       |

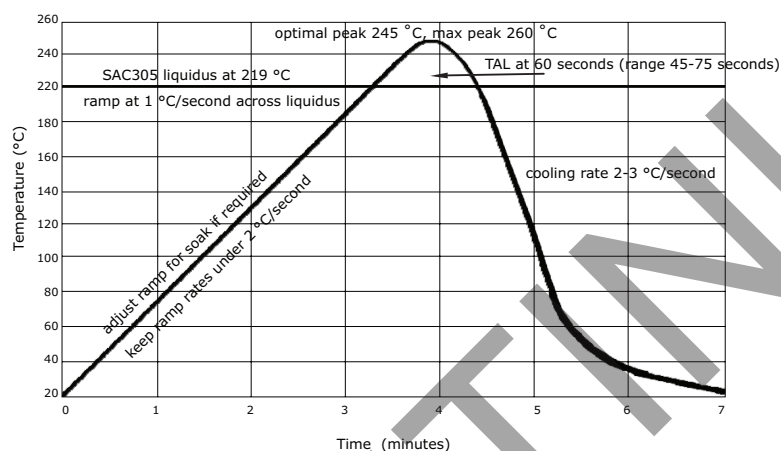
Notes: 1. Layout and the environment play an influential role with the filter's performance. Performance will depend on the user's PCB layout, the chassis shielding environment, choice of external components, and other circuits present.

## ENVIRONMENTAL

| parameter             | conditions/description | min  | typ | max    | units |
|-----------------------|------------------------|------|-----|--------|-------|
| operating temperature | see derating curves    | -40  |     | 85     | °C    |
| storage temperature   |                        | -55  |     | 125    | °C    |
| operating humidity    | non-condensing         | 10   |     | 90     | %     |
| altitude              | derates 1% /1000 ft    | -500 |     | 10,000 | ft    |
|                       |                        | -152 |     | 3048   | m     |

**SOLDERABILITY**

| parameter        | conditions/description                                                                                                      | min | typ | max             | units         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------|-----|-----|-----------------|---------------|
| wave soldering   | for Sn/Ag/Cu based solders (for through hole models):<br>preheat temperature<br>solder pot temperature<br>solder dwell time |     |     | 115<br>270<br>7 | °C<br>°C<br>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]<br>surface mount: 1.10 x 0.96 x 0.33 [27.9 x 24.4 x 8.4 mm] |     |      |     | inches<br>inches |
| weight     |                                                                                                                     |     | 9.07 |     | g                |

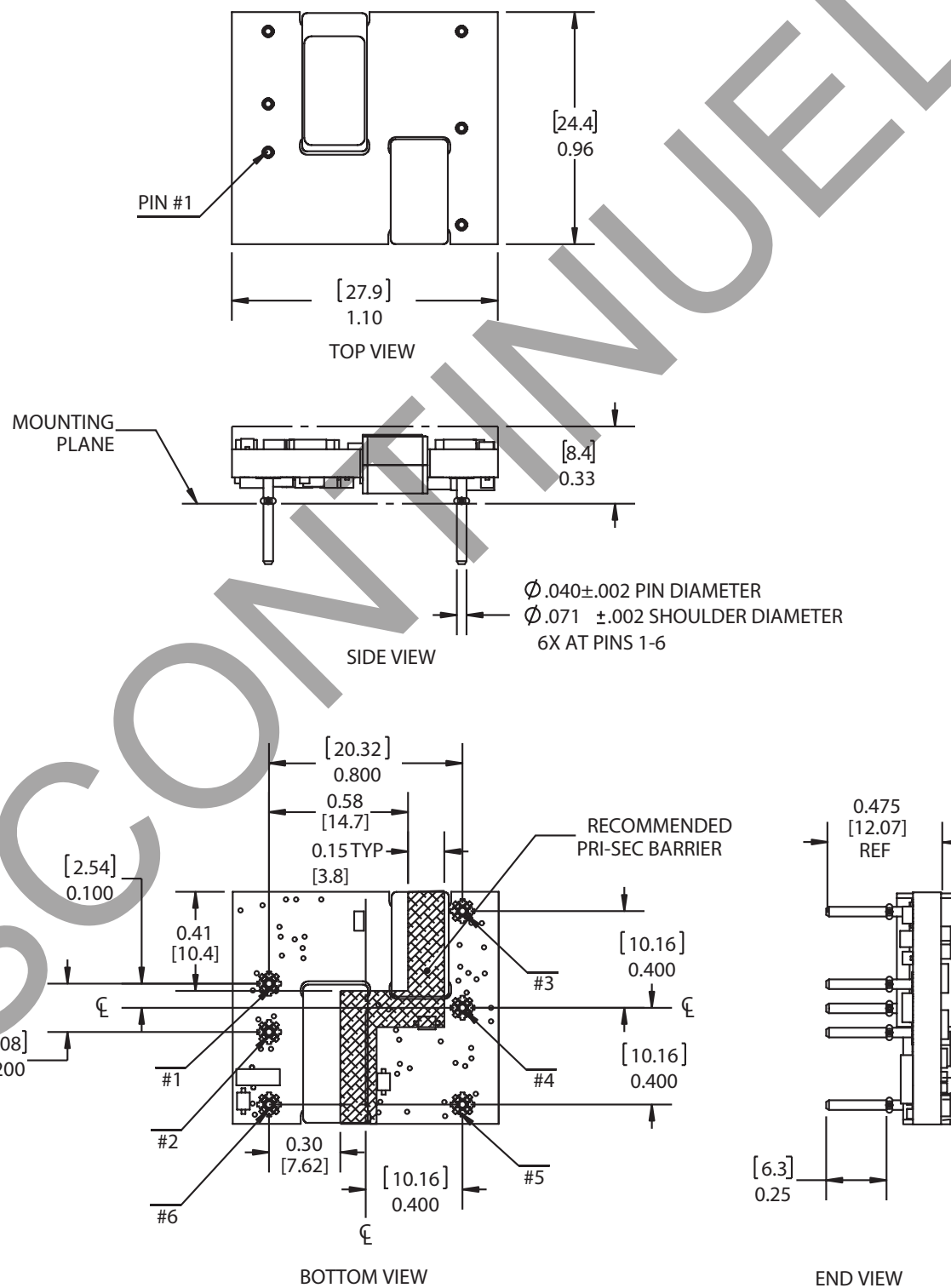
**MECHANICAL DRAWING (THROUGH HOLE)**

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 |



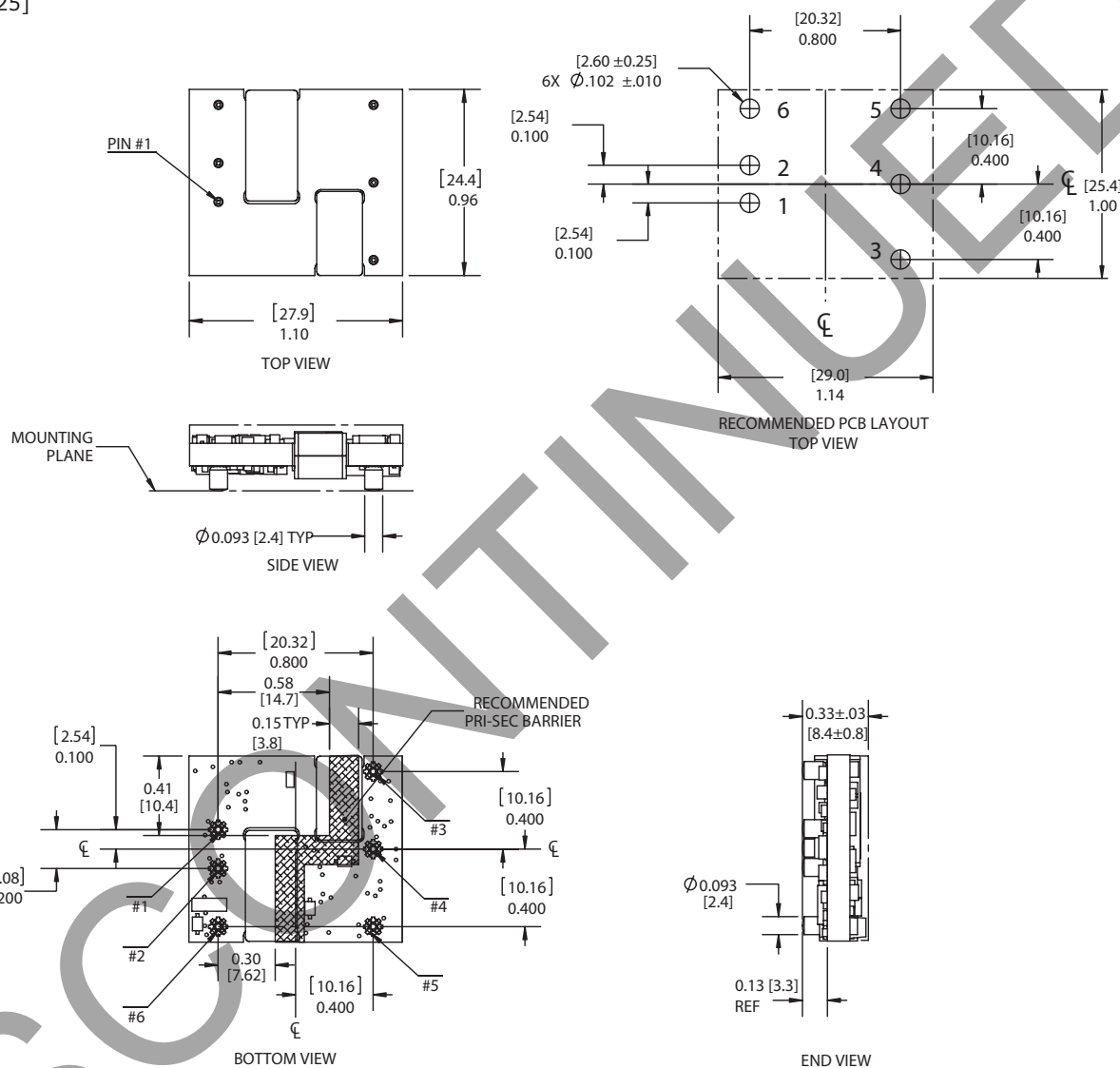
## MECHANICAL DRAWING (SURFACE MOUNT)

units: inches [mm]

tolerance: X.XX ±0.02 [0.5]

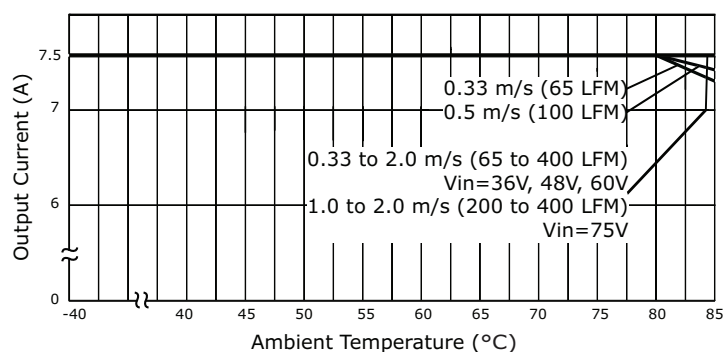
X.XXX ±0.010 [0.25]

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

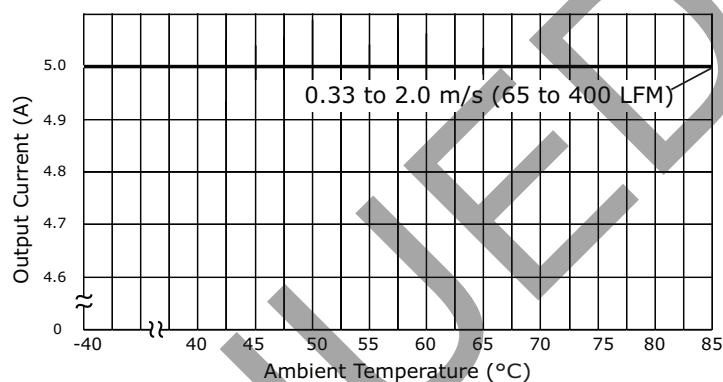


## DERATING CURVES

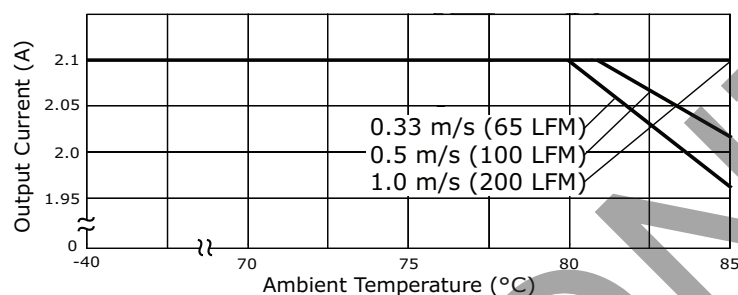
PRD25-D48-S3 Derating Curves @ Sea Level  
(airflow from input to output)



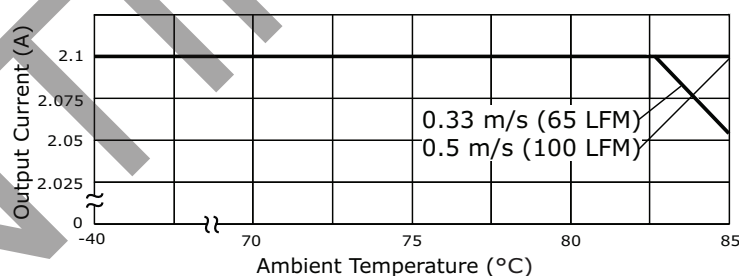
PRD25-D48-S5 Derating Curves @ Sea Level  
(airflow from input to output)



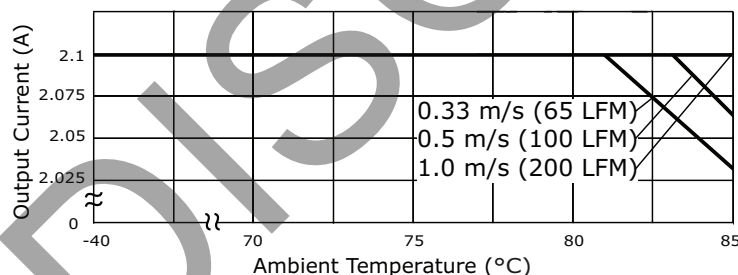
PRD25-D48-S12 Derating Curves @ Sea Level  
(Vin=36V, airflow from input to output)



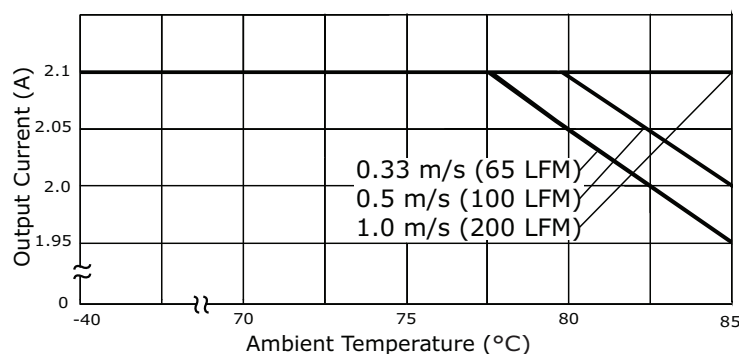
PRD25-D48-S12 Derating Curves @ Sea Level  
(Vin=48V, airflow from input to output)



PRD25-D48-S12 Derating Curves @ Sea Level  
(Vin=60V, airflow from input to output)

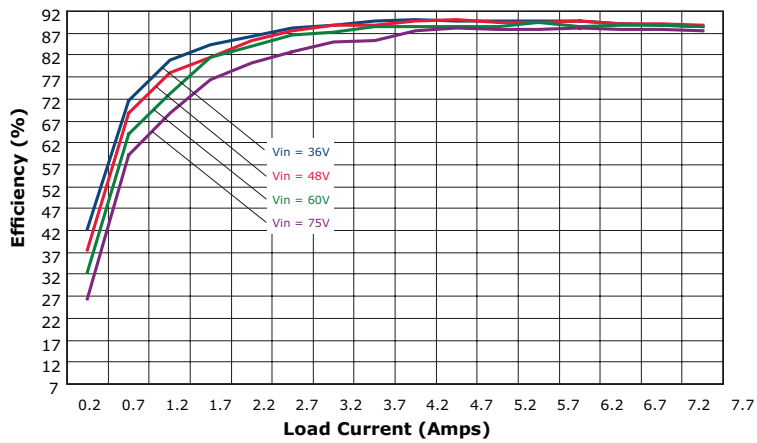


PRD25-D48-S12 Derating Curves @ Sea Level  
(Vin=75V, airflow from input to output)

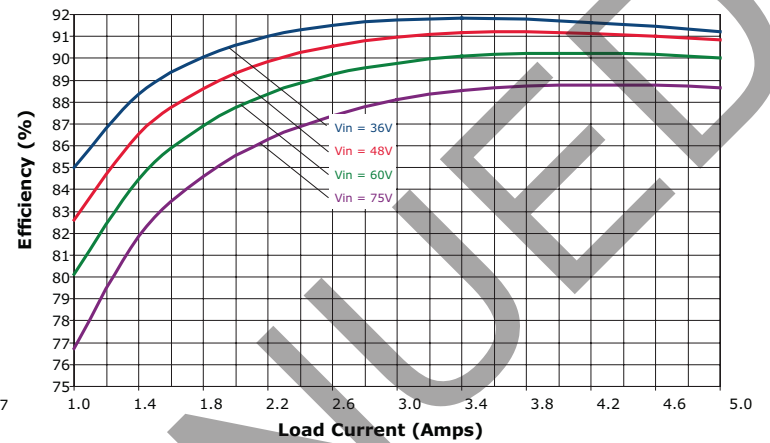


## EFFICIENCY CURVES

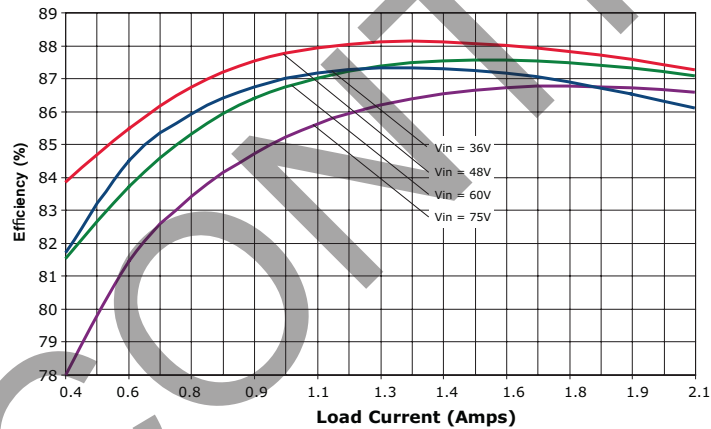
PRD25-D48-S3 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



PRD25-D48-S5 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



PRD25-D48-S12 Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current @ 25°C)



## PACKAGING (THROUGH HOLE)

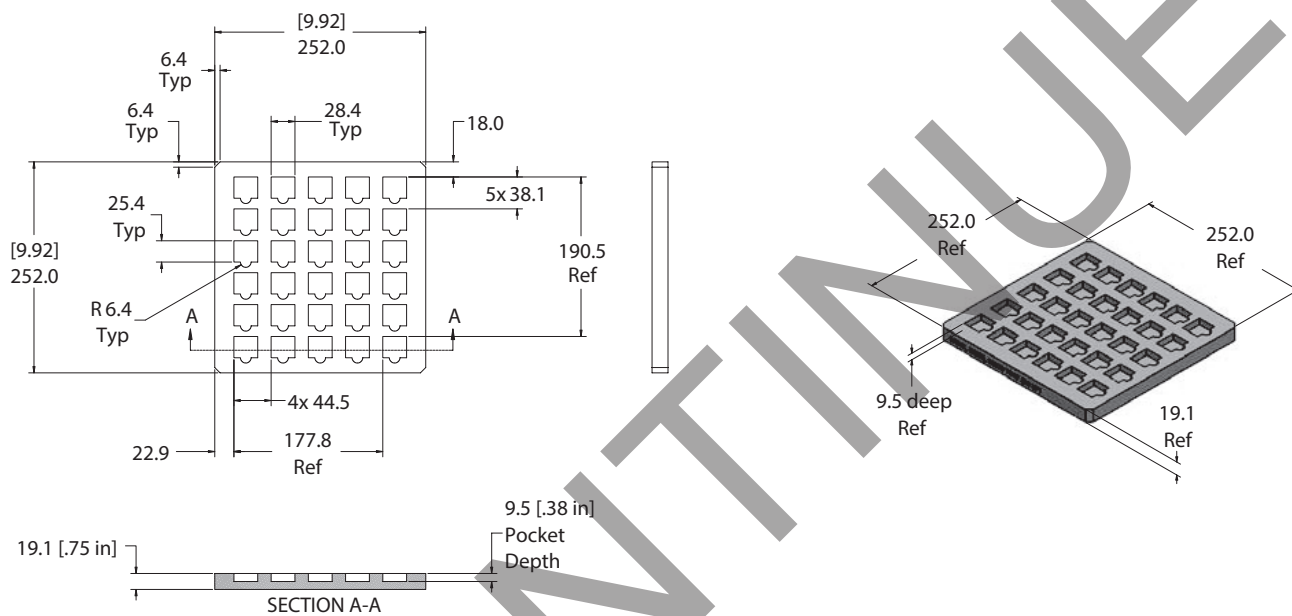
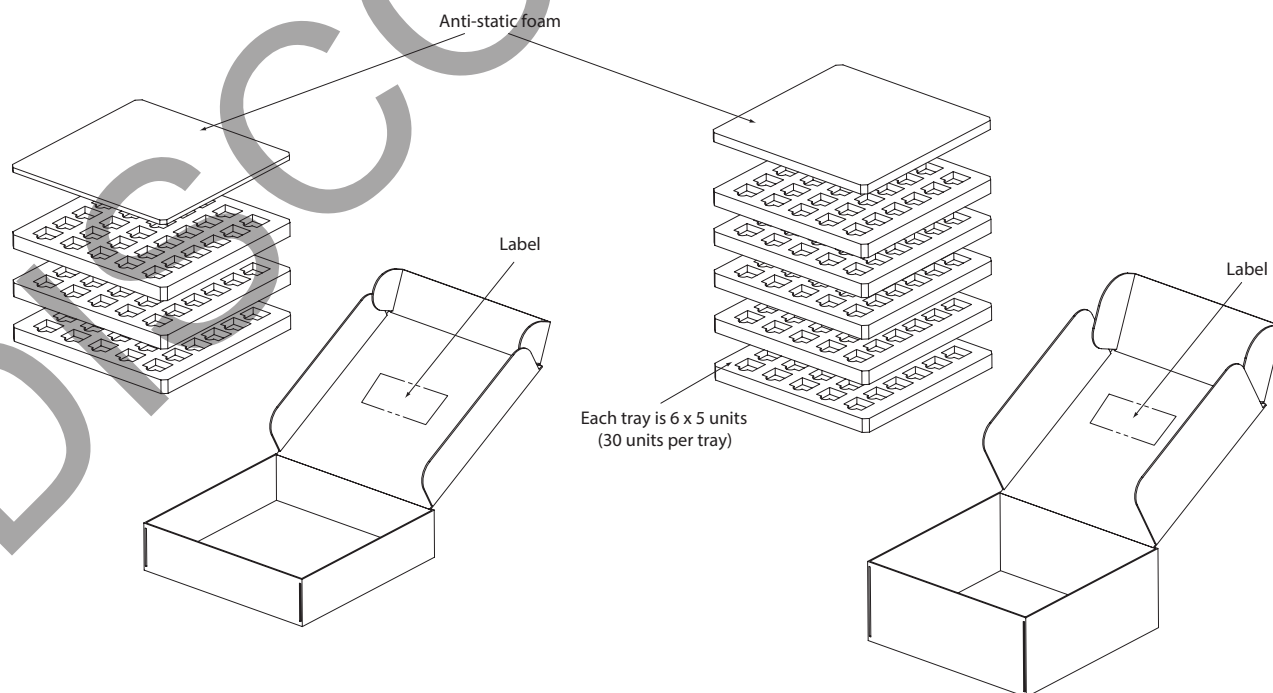
units: mm [inches]

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)

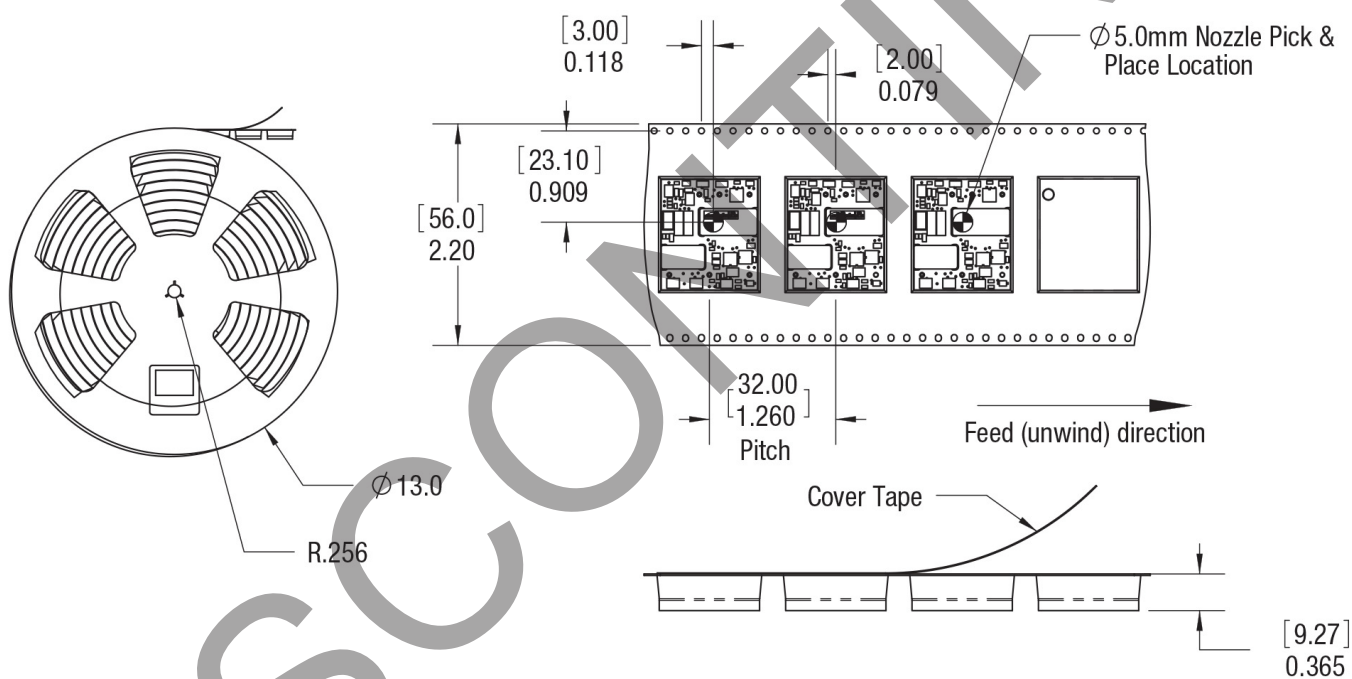
units: inches [mm]

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**

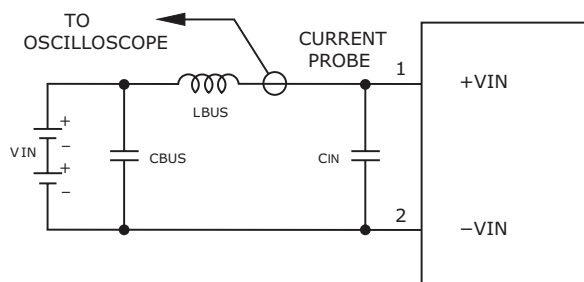


**Table 1**

|           |                                           |
|-----------|-------------------------------------------|
| $C_{IN}$  | 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)**

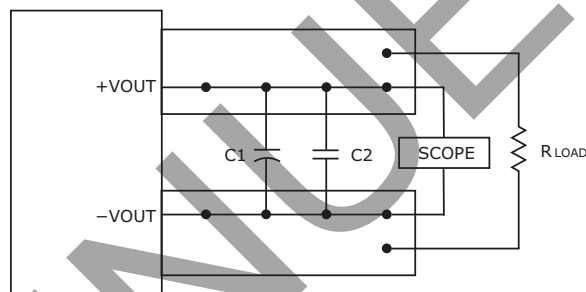


**Table 2**

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

## EMC RECOMMENDED CIRCUIT

**Figure 3 Conducted Emissions Test Circuit**

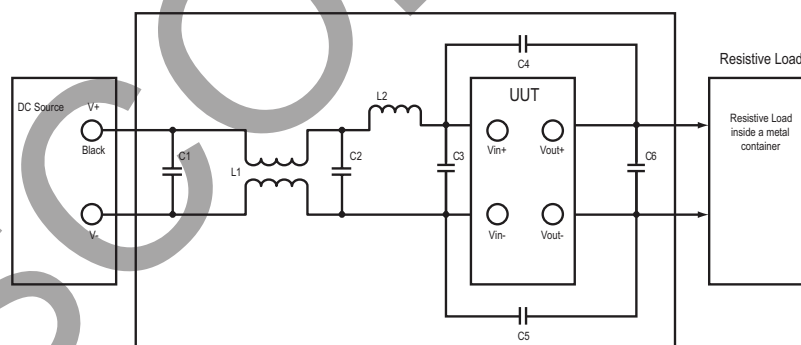


**Table 3**

| Recommended External Circuit Components |                                                    |
|-----------------------------------------|----------------------------------------------------|
| L1                                      | 1 mH, 6 A                                          |
| L2                                      | 4.7 $\mu$ H, 3.6 A                                 |
| C1, C2                                  | Electrolytic Capacitor 22 $\mu$ fd, 100 V          |
| C3                                      | Qty. 2 - Electrolytic Capacitor 22 $\mu$ fd, 100 V |
| C4, C5                                  | 3.3 nF, 1500 V                                     |
| C6                                      | Electrolytic Capacitor 22 $\mu$ fd, 100 V          |

## APPLICATION NOTES

### Output Voltage Trimming

The output voltage can be adjusted by using the trim pin and a single fixed resistor (see Figures 4 & 5). Trimming resistors should have a low temperature coefficient ( $\pm 100$  ppm/ $^{\circ}\text{C}$  or less) and be mounted close to the converter. If the trim function is not needed, leave the trim pin open.

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

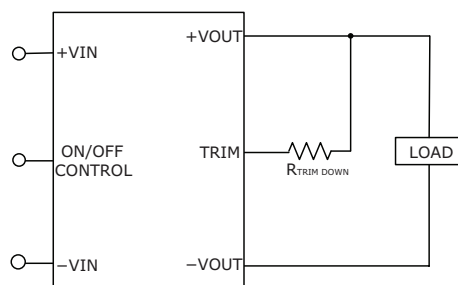
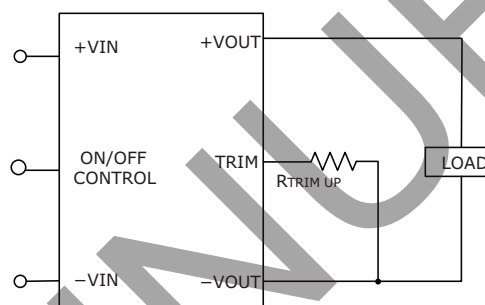


**Figure 5 Trim Adjustments To Increase Output Voltage Using A Fixed Resistor**



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

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

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

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

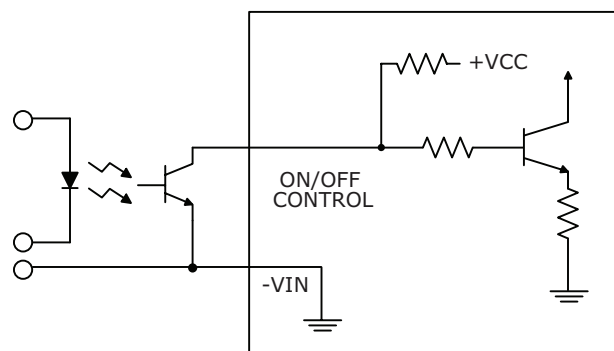
### Remote On/Off Control

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 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     | 05/20/2016 |
| 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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