

SERIES: PRC60 | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

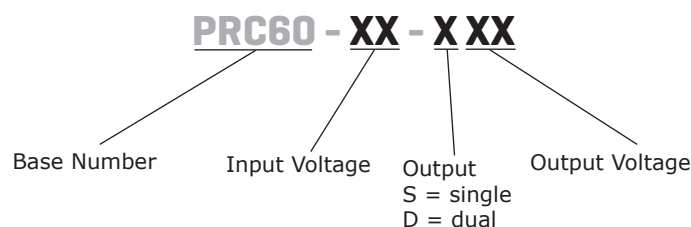
- up to 60 W continuous power
- single and dual regulated outputs
- 4:1 input range, 9~36 Vdc and 18~75 Vdc input voltage options
- certified to EN/IEC 62368-1
- meets EN 50155
- wide operating temperature range (-40 ~ +105°C)
- short circuit, over current, over temperature, and over voltage protection
- remote ON/OFF, output voltage trim



| MODEL | input voltage | | output voltage | output current ¹ | output power | ripple & noise ² | efficiency ³ |
|--------------|---------------|-------------|----------------|-----------------------------|--------------|-----------------------------|-------------------------|
| | typ (Vdc) | range (Vdc) | (Vdc) | max (mA) | max (W) | max (mVp-p) | typ (%) |
| PRC60-24-S3 | 24 | 9 ~ 36 | 3.3 | 12,000 | 39.6 | 100 | 89 |
| PRC60-24-S5 | 24 | 9 ~ 36 | 5 | 12,000 | 60 | 100 | 91 |
| PRC60-24-S12 | 24 | 9 ~ 36 | 12 | 5,000 | 60 | 125 | 91 |
| PRC60-24-S15 | 24 | 9 ~ 36 | 15 | 4,000 | 60 | 125 | 92 |
| PRC60-24-S24 | 24 | 9 ~ 36 | 24 | 2,500 | 60 | 200 | 92 |
| PRC60-24-D12 | 24 | 9 ~ 36 | ±12 | ±2,500 | 60 | 125 | 91 |
| PRC60-24-D15 | 24 | 9 ~ 36 | ±15 | ±2,000 | 60 | 125 | 91 |
| PRC60-24-D24 | 24 | 9 ~ 36 | ±24 | ±1,250 | 60 | 200 | 90 |
| PRC60-48-S3 | 48 | 18 ~ 75 | 3.3 | 12,000 | 39.6 | 100 | 89 |
| PRC60-48-S5 | 48 | 18 ~ 75 | 5 | 12,000 | 60 | 100 | 91 |
| PRC60-48-S12 | 48 | 18 ~ 75 | 12 | 5,000 | 60 | 125 | 92 |
| PRC60-48-S15 | 48 | 18 ~ 75 | 15 | 4,000 | 60 | 125 | 92 |
| PRC60-48-S24 | 48 | 18 ~ 75 | 24 | 2,500 | 60 | 200 | 92 |
| PRC60-48-D12 | 48 | 18 ~ 75 | ±12 | ±2,500 | 60 | 125 | 90 |
| PRC60-48-D15 | 48 | 18 ~ 75 | ±15 | ±2,000 | 60 | 125 | 90 |
| PRC60-48-D24 | 48 | 18 ~ 75 | ±24 | ±1,250 | 60 | 200 | 90 |

Notes: 1. At full load.
2. Measured with 20MHz bandwidth and 1µF ceramic capacitor.
3. The efficiency is test by nominal input and full load at 25°C.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|----------------------------|--|-----|-----|-----|-------|
| operating input voltage | 24 Vdc input | 9 | 24 | 36 | Vdc |
| | 48 Vdc input | 18 | 48 | 75 | Vdc |
| surge voltage | 24 Vdc input | | | 50 | Vdc |
| | 48 Vdc input | | | 100 | Vdc |
| input undervoltage lockout | 0% ~ 100% load | | | | |
| | 24 Vdc input | | 8 | | Vdc |
| | 48 Vdc input | | 16 | | Vdc |
| no load input current | at nominal input voltage | | | 15 | mA |
| input filter | Pi filter | | | | |
| start-up time | | | | 50 | ms |
| start-up voltage | 0% ~ 100% load | | | | |
| | 24 Vdc input | | | 9 | Vdc |
| | 48 Vdc input | | | 18 | Vdc |
| remote ON/OFF | module on: CTRL pin open or pulled high (3~12 Vdc) module off: CTRL pin pulled low to GND (0~1.2 Vdc) | | | | |

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|-------------------------|--|-----|-------|--------|-------|
| maximum capacitive load | 3.3 & 5 Vdc output | | | 28,000 | μF |
| | 12 Vdc output | | | 5,850 | μF |
| | 15 Vdc output | | | 3,900 | μF |
| | 24 Vdc output | | | 2,000 | μF |
| | ±12 Vdc output | | | ±3,900 | μF |
| | ±15 Vdc output | | | ±2,400 | μF |
| | ±24 Vdc output | | | ±1,000 | μF |
| voltage accuracy | at full load, nominal input | | ±1 | | % |
| voltage adjustability | | | ±10 | | % |
| line regulation | low line to high line at full load | | | | |
| | single output | | ±0.2 | | % |
| | dual output | | ±0.5 | | % |
| load regulation | 0% ~ 100% load | | | | |
| | single output | | ±0.5 | | % |
| | dual output | | ±1 | | % |
| cross regulation | asymmetrical load 25%/100%, dual output models | | ±5 | | % |
| operating frequency | at full load, nominal input | | 250 | | kHz |
| transient recovery time | 75% to 100% load step change | | 500 | | μs |
| temperature coefficient | | | ±0.05 | | %/°C |

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|-----------------------------|---------------------------|-------|-----|-------|-------|
| over voltage protection | zener diode clamp | | | | |
| | 3.3 Vdc output | 3.7 | | 5.3 | Vdc |
| | 5 Vdc output | 5.6 | | 8.0 | Vdc |
| | 12 Vdc output | 13.4 | | 19.2 | Vdc |
| | 15 Vdc output | 16.8 | | 24.0 | Vdc |
| | 24 Vdc output | 26.9 | | 38.4 | Vdc |
| | ±12 Vdc output | ±13.4 | | ±19.2 | Vdc |
| | ±15 Vdc output | ±16.8 | | ±24.0 | Vdc |
| | ±24 Vdc output | ±26.9 | | ±38.4 | Vdc |
| over current protection | | | 175 | | % |
| short circuit protection | continuous, auto recovery | | | | |
| over temperature protection | | | | 115 | °C |

SAFETY AND COMPLIANCE (CONTINUED)

| parameter | conditions/description | min | typ | max | units |
|-----------------------------|---|-------|---------|-----|-------|
| isolation voltage | input to output, for 1 minute | 1,600 | | | Vdc |
| isolation resistance | at 500 Vdc | 1,000 | | | MΩ |
| isolation capacitance | | | 1,500 | | pF |
| safety approvals | certified to 62368-1: EN, BS EN | | | | |
| EMI | EN 55032 Class A, Class B (external circuit required, see Figure 3) | | | | |
| ESD | EN 61000-4-2, Air ± 8kV, Contact ± 6kV, perf. Criteria A | | | | |
| fast transient ⁴ | EN 61000-4-4, ±2kV, perf. Criteria A | | | | |
| surge ⁴ | EN 61000-4-5, ±2kV, perf. Criteria A | | | | |
| conducted immunity | EN 61000-4-6, 10 Vrms, perf. Criteria A | | | | |
| magnetic field immunity | EN 61000-4-8, 10 A/m, perf. Criteria A | | | | |
| MTBF | at 25°C | | 205,000 | | hours |
| RoHS | yes | | | | |

Notes: 4. External 680µF/100V capacitor required.

ENVIRONMENTAL

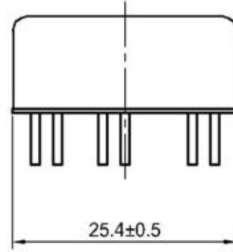
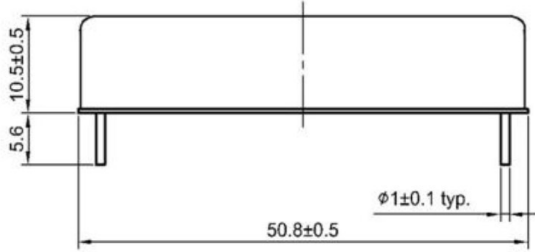
| parameter | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve | -40 | | 105 | °C |
| storage temperature | | -55 | | 125 | °C |
| humidity | non-condensing | 5 | | 95 | % |
| max. case temperature | | | | 110 | °C |

MECHANICAL

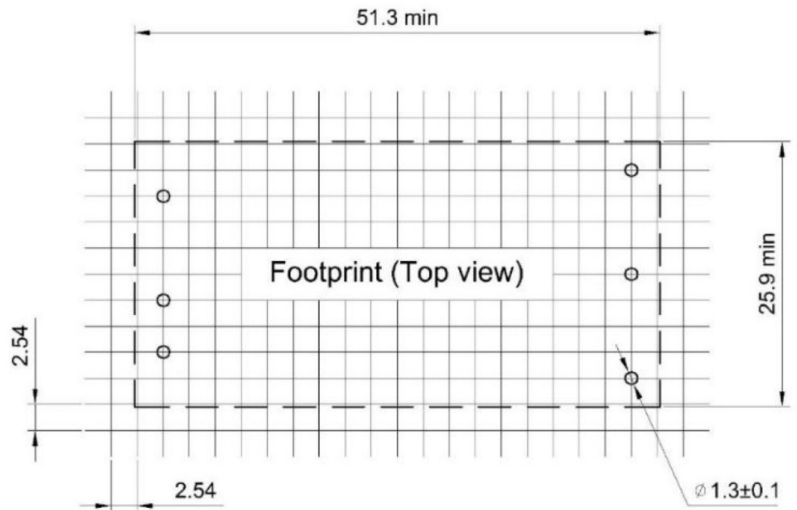
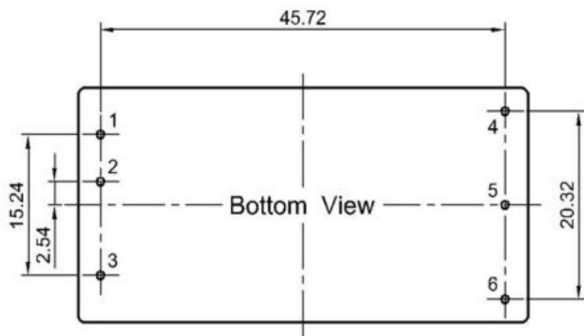
| parameter | conditions/description | min | typ | max | units |
|------------------|------------------------|-----|------|-----|-------|
| dimensions | 50.80 x 25.40 x 10.50 | | | | mm |
| weight | | | 37.6 | | g |
| case material | metal case | | | | |
| potting material | silicone (UL94V-0) | | | | |
| cooling method | natural convection | | | | |

MECHANICAL DRAWING

units: inch [mm]
 general tolerance: $\pm 0.35\text{mm}$

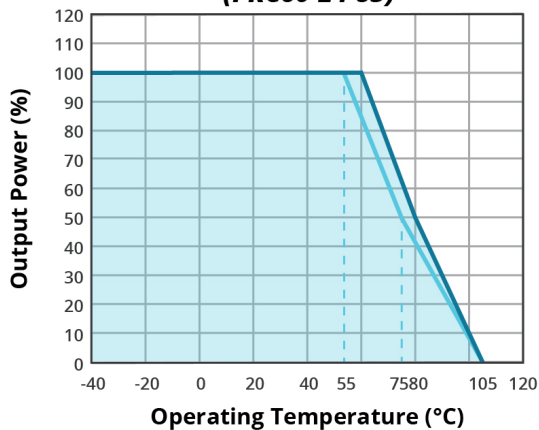


| Pin Out | | |
|---------|----------------|--------------|
| PIN | Single outputs | Dual outputs |
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | CTRL | CTRL |
| 4 | +Vout | +Vout |
| 5 | -Vout | 0V |
| 6 | Trim | -Vout |

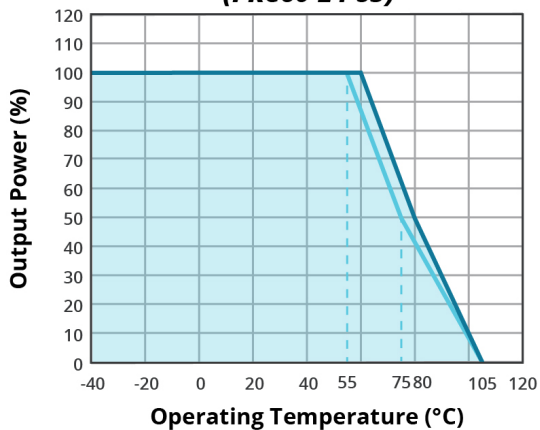


DERATING CURVES

TEMPERATURE DERATING CURVE
 (PRC60-24-S3)

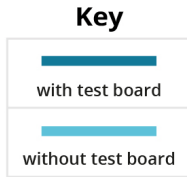
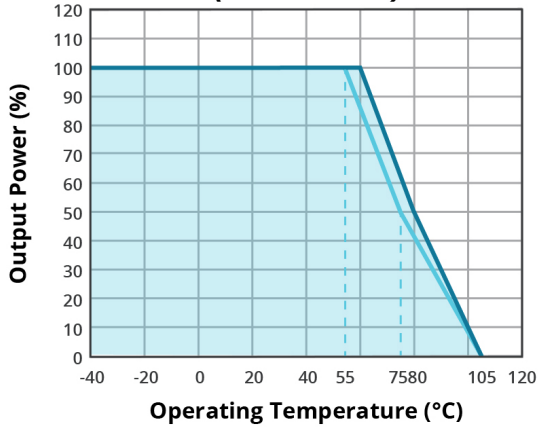


TEMPERATURE DERATING CURVE
 (PRC60-24-S5)

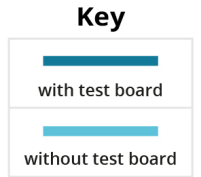
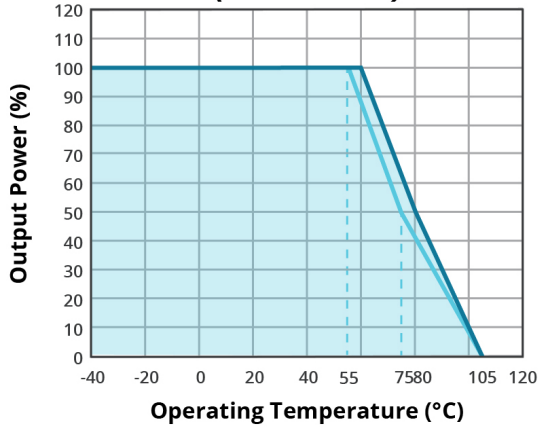


DERATING CURVES (CONTINUED)

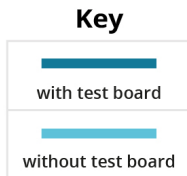
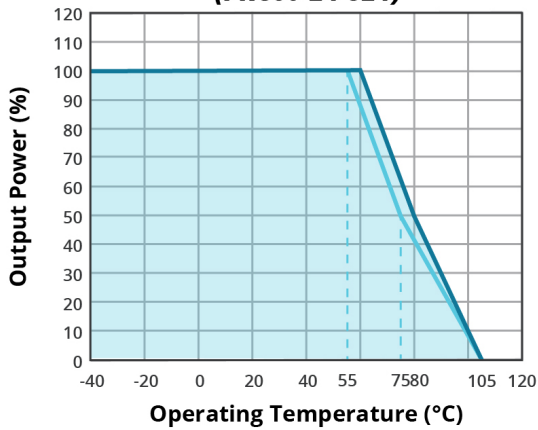
**TEMPERATURE DERATING CURVE
(PRC60-24-S12)**



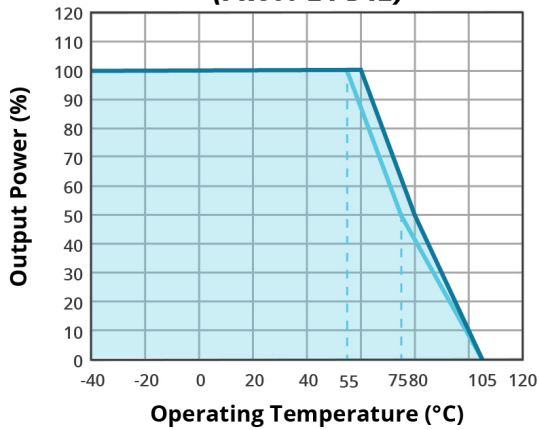
**TEMPERATURE DERATING CURVE
(PRC60-24-S15)**



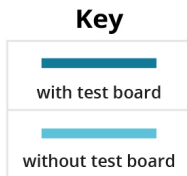
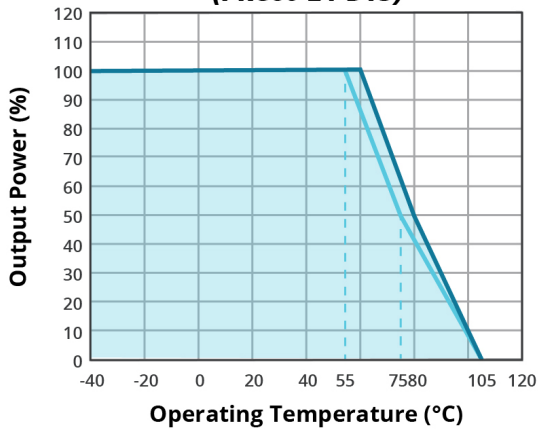
**TEMPERATURE DERATING CURVE
(PRC60-24-S24)**



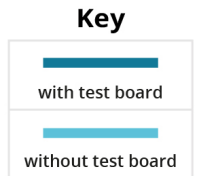
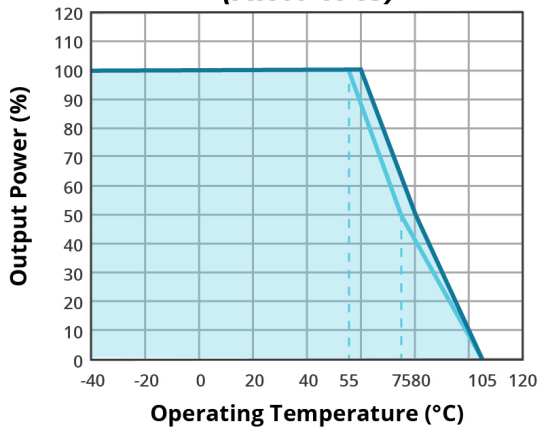
**TEMPERATURE DERATING CURVE
(PRC60-24-D12)**



**TEMPERATURE DERATING CURVE
(PRC60-24-D15)**

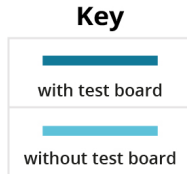
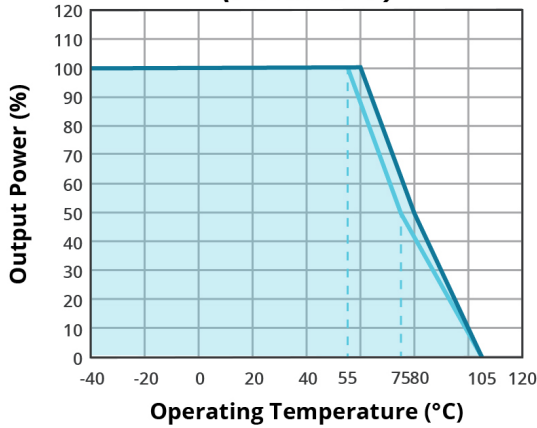


**TEMPERATURE DERATING CURVE
(PRC60-48-S3)**

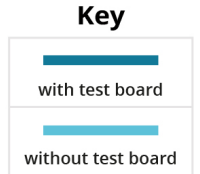
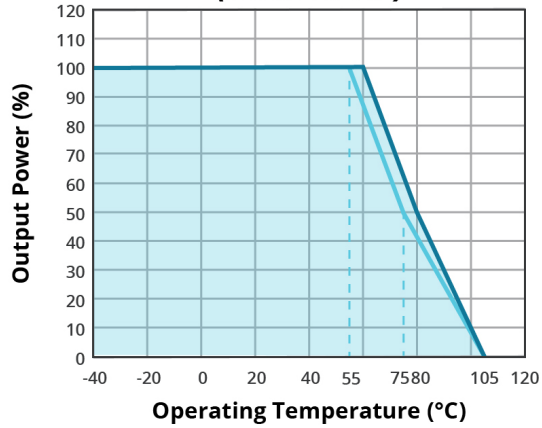


DERATING CURVES (CONTINUED)

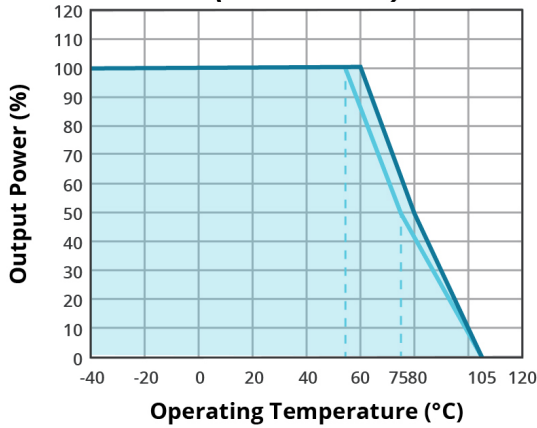
**TEMPERATURE DERATING CURVE
(PRC60-48-S5)**



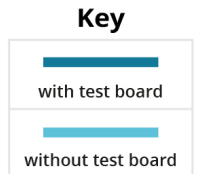
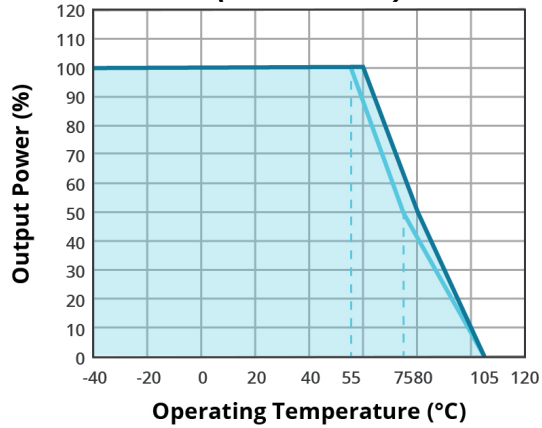
**TEMPERATURE DERATING CURVE
(PRC60-24-S12)**



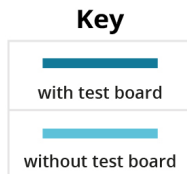
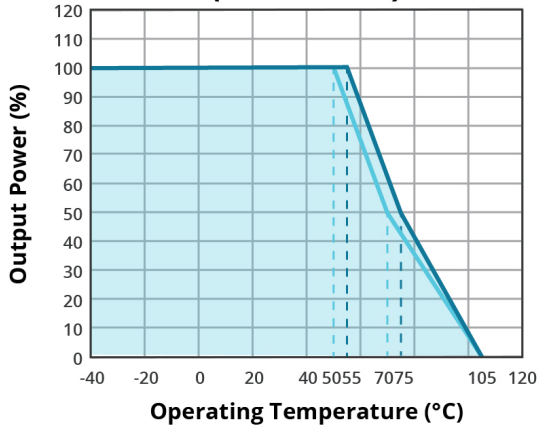
**TEMPERATURE DERATING CURVE
(PRC60-48-S15)**



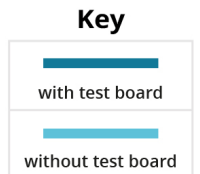
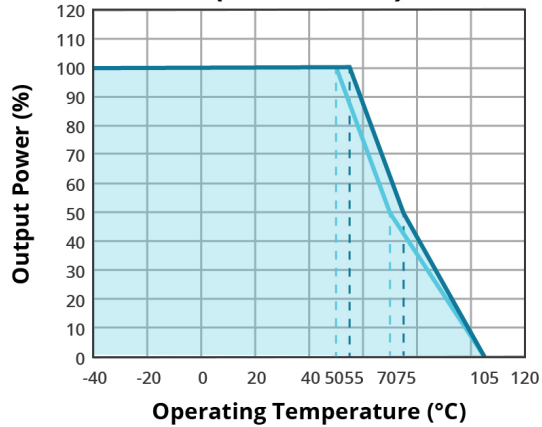
**TEMPERATURE DERATING CURVE
(PRC60-48-S24)**



**TEMPERATURE DERATING CURVE
(PRC60-48-D12)**



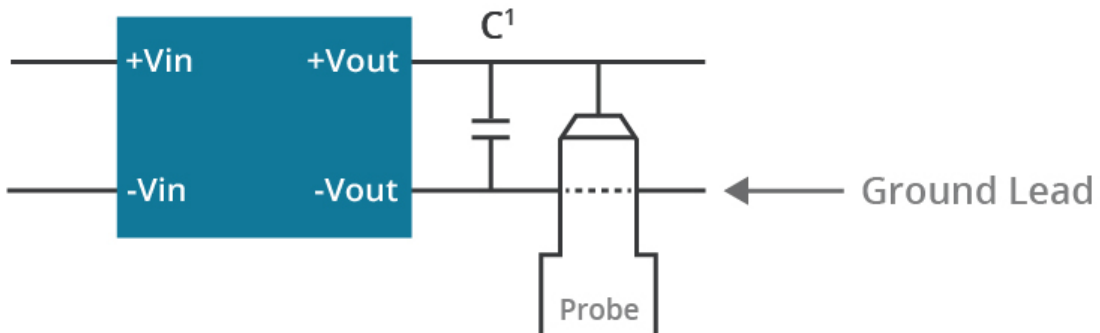
**TEMPERATURE DERATING CURVE
(PRC60-48-D15)**



Note: — The derating curve was measured at nominal V_{in} in chamber with nature convection.
— The derating curve was measured with nominal line. Mounted test board 90 x 80 mm and each power pin with 43 x 40 mm, 2oz double layer.

RIPPLE AND NOISE MEASURE METHOD

Figure 1



Note: 1. Measured with 20MHz bandwidth, input voltage range 0~100%, and 1 μ F ceramic capacitor.

EMI RECOMMENDED CIRCUIT

Figure 2
EN55032 CLASS A



Figure 3

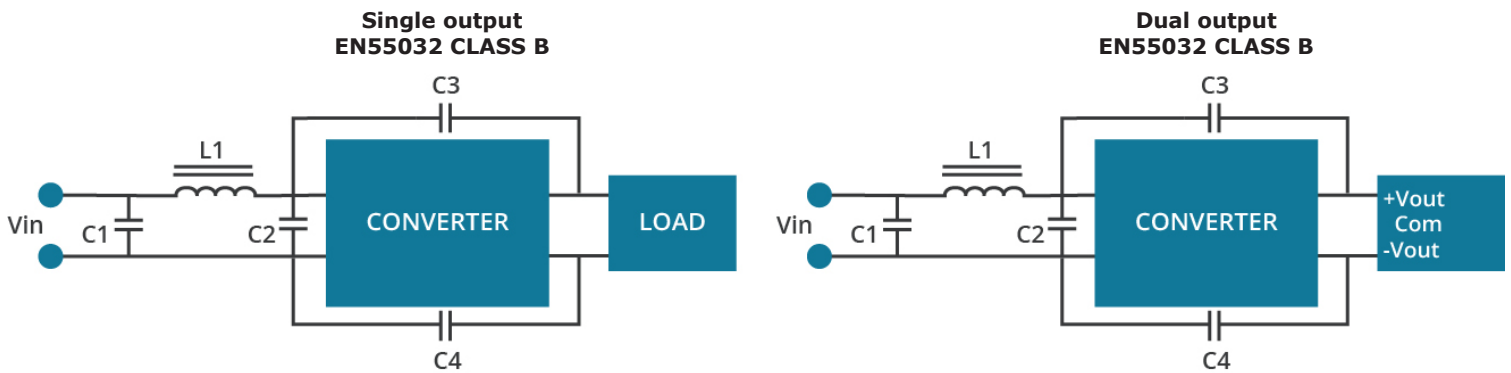


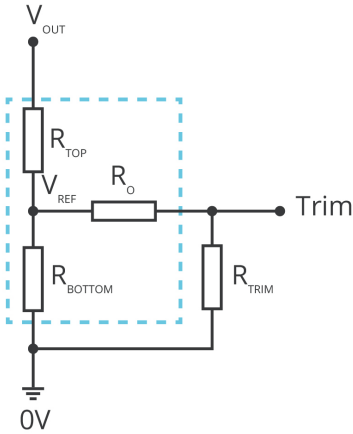
Table 2

| Vin | C1 | L1 | C2 | C3 | C4 |
|-----|-------------|-------------|-------------|--------|--------|
| 24V | 10 μ F | 1.5 μ H | 10 μ F | 2200pF | 2200pF |
| 48V | 4.7 μ F | 3.3 μ H | 4.7 μ F | 2200pF | 2200pF |

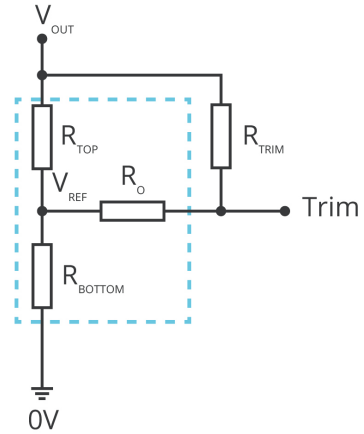
APPLICATION NOTES

Figure 4

Trim up



Trim down



$$R_{TRIM} = \frac{a \cdot R_{BOTTOM}}{R_{BOTTOM} - a} - R_O \quad a = \frac{V_{REF}}{V_{OUT} - V_{REF}} \cdot R_{TOP}$$

Formula for Trim up

$$R_{TRIM} = \frac{a \cdot R_{TOP}}{R_{TOP} - a} - R_O \quad a = \frac{V_{OUT} - V_{REF}}{V_{REF}} \cdot R_{BOTTOM}$$

Formula for Trim down

Table 3

| V _{IN} (Vdc) | V _{NOM} (Vdc) | R _{TOP} (kΩ) | R _{BOTTOM} (kΩ) | R _O (kΩ) | V _{REF} (V) |
|--------------------------|---------------------------|--------------------------|-----------------------------|------------------------|-------------------------|
| 24 | 3.3 | 8.5 | 5.1 | 27.0 | 1.24 |
| 24 | 5 | 10.0 | 10.0 | 35.7 | 2.50 |
| 24 | 12 | 38.0 | 10.0 | 68.0 | 2.50 |
| 24 | 15 | 50.0 | 10.0 | 73.2 | 2.50 |
| 24 | 24 | 86.0 | 10.0 | 75.0 | 2.50 |
| 48 | 3.3 | 8.5 | 5.1 | 27.0 | 1.24 |
| 48 | 5 | 15.47 | 5.1 | 33.0 | 1.24 |
| 48 | 12 | 38.0 | 10.0 | 68.0 | 2.50 |
| 48 | 15 | 50.0 | 10.0 | 73.2 | 2.50 |
| 48 | 24 | 86.0 | 10.0 | 75.0 | 2.50 |

Note: Value for R_{TOP}, R_{BOTTOM}, R_O, and V_{REF} refer to Table 3 (fixed internal values).

R_{TRIM}: Trim resistance

a: User-defined parameter, no actual meanings

V_{NOM}: Nominal output voltage

V_{OUT}: Target output voltage

REVISION HISTORY

| rev. | description | date |
|------|-----------------|------------|
| 1.0 | initial release | 06/15/2023 |

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



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