

SERIES: PRF20 | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

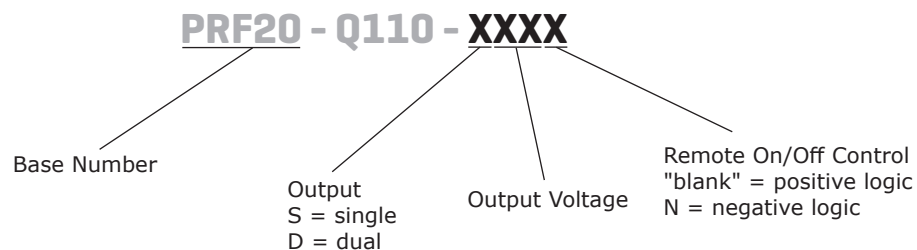
- up to 20 W isolated output
- 4:1 input range (43~160 V)
- smaller package
- single/dual regulated outputs
- meets European EN50155 railway standard
- 2,250 Vdc isolation
- continuous short circuit, over current protection, over voltage protection
- built-in remote on/off
- wide operating temperature range (-40~85°C)
- efficiency up to 90%



| MODEL | input voltage | | output voltage | output current | | output power | ripple and noise ¹ | efficiency |
|----------------|---------------|-------------|----------------|----------------|----------|--------------|-------------------------------|------------|
| | typ (Vdc) | range (Vdc) | (Vdc) | min (mA) | max (mA) | max (W) | max (mVp-p) | typ (%) |
| PRF20-Q110-S5 | 110 | 43~160 | 5 | 0 | 4000 | 20 | 75 | 88.5 |
| PRF20-Q110-S12 | 110 | 43~160 | 12 | 0 | 1670 | 20 | 100 | 90 |
| PRF20-Q110-S15 | 110 | 43~160 | 15 | 0 | 1330 | 20 | 100 | 89.5 |
| PRF20-Q110-D12 | 110 | 43~160 | ±12 | 0 | ±833 | 20 | 100 | 89 |
| PRF20-Q110-D15 | 110 | 43~160 | ±15 | 0 | ±667 | 20 | 100 | 88.5 |

Note: 1. Ripple and noise are measured at 20 MHz BW by and 1µF ceramic capacitor across each output.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|-------------------------|------------------------|---------------------------------|-----|-----|-------|
| operating input voltage | | 43 | 110 | 160 | Vdc |
| under voltage shutdown | power up | | 40 | | Vdc |
| | power down | | 38 | | Vdc |
| surge voltage | for maximum of 100 ms | | | 200 | Vdc |
| start-up time | single output models | | 15 | | ms |
| | dual output models | | 25 | | ms |
| remote ¹ | positive logic | models ON (open or 3.5~75 Vdc) | | | |
| | | models OFF (0~1.2 Vdc) | | | |
| | negative logic | models ON (0~1.2 Vdc) | | | |
| | | models OFF (open or 3.5~75 Vdc) | | | |
| filter | pi filter | | | | |

Note: 1. Open collector refer to -Vin.

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|----------------------------|---|-----|-----|-------|-------|
| maximum capacitive load | 5V output model | | | 5600 | μF |
| | 12V output model | | | 1000 | μF |
| | 15V output model | | | 1000 | μF |
| | ±12V output model | | | ±680 | μF |
| | ±15V output model | | | ±350 | μF |
| line regulation | from high line to low line | | | ±0.2 | % |
| load regulation | from full load to no load | | | ±0.5 | % |
| | single output models | | | ±1 | % |
| cross regulation | dual output models, load cross variation 10%/100% | | | ±5 | % |
| voltage accuracy | | | | ±1.5 | % |
| adjustability ² | | | ±10 | | % |
| switching frequency | | | 250 | | KHz |
| transient response | 25% load step change | | | 250 | μs |
| temperature coefficient | | | | ±0.03 | %/°C |

Note: 2. Output trimming available on single output models only

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|--------------------------|--|-----|-----|-----|-------|
| short circuit protection | continuous | | | | |
| over current protection | | 110 | | 160 | % |
| over voltage protection | protected by internal zener or TVS clamp | | | | |
| | 5V output model | | 6.2 | | Vdc |
| | 12V output model | | 15 | | Vdc |
| | 15V output model | | 18 | | Vdc |
| | ±12V output model | | ±15 | | Vdc |
| ±15V output model | | ±18 | | Vdc | |

SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|----------------------|--|-------|-----|-----|-------|
| isolation voltage | input to output for 1 minute | 2,250 | | | Vdc |
| isolation resistance | | 1000 | | | MΩ |
| safety approvals | UL60950-1 | | | | |
| EMI/EMC | EN55022 class A, EN50155 (external circuit required) | | | | |
| RoHS | 2011/65/EU | | | | |

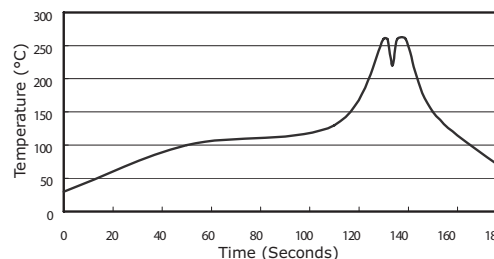
ENVIRONMENTAL

| parameter | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve | -40 | | 85 | °C |
| storage temperature | | -55 | | 125 | °C |
| humidity | non-condensing | | | 95 | % |
| case temperature | | | | 105 | °C |
| vibration | EN50155 (EN61373) | | | | |

SOLDERABILITY

| parameter | conditions/description | min | typ | max | units |
|----------------|----------------------------|-----|-----|-----|-------|
| wave soldering | see wave soldering profile | | | 260 | °C |

- Notes:
1. Soldering materials: Sn/Cu/Ni
 2. Ramp up rate during preheat: 1.4°C/s (from 50°C to 100°C)
 3. Soaking temperature: 0.5°C/s (from 100°C to 130°C), 60±20 seconds
 4. Peak temperature: 260°C, above 250°C for 3~6 seconds
 5. Ramp down rate during cooling: -10°C/s (from 260°C to 150°C)



MECHANICAL

| parameter | conditions/description | min | typ | max | units |
|---------------|--|-----|-----|-----|-------|
| dimensions | 2.00 x 1.00 x 0.40 (50.8 x 25.4 x 10.2 mm) | | | | inch |
| case material | black coated copper with non-conductive base | | | | |
| weight | | | 35 | | g |

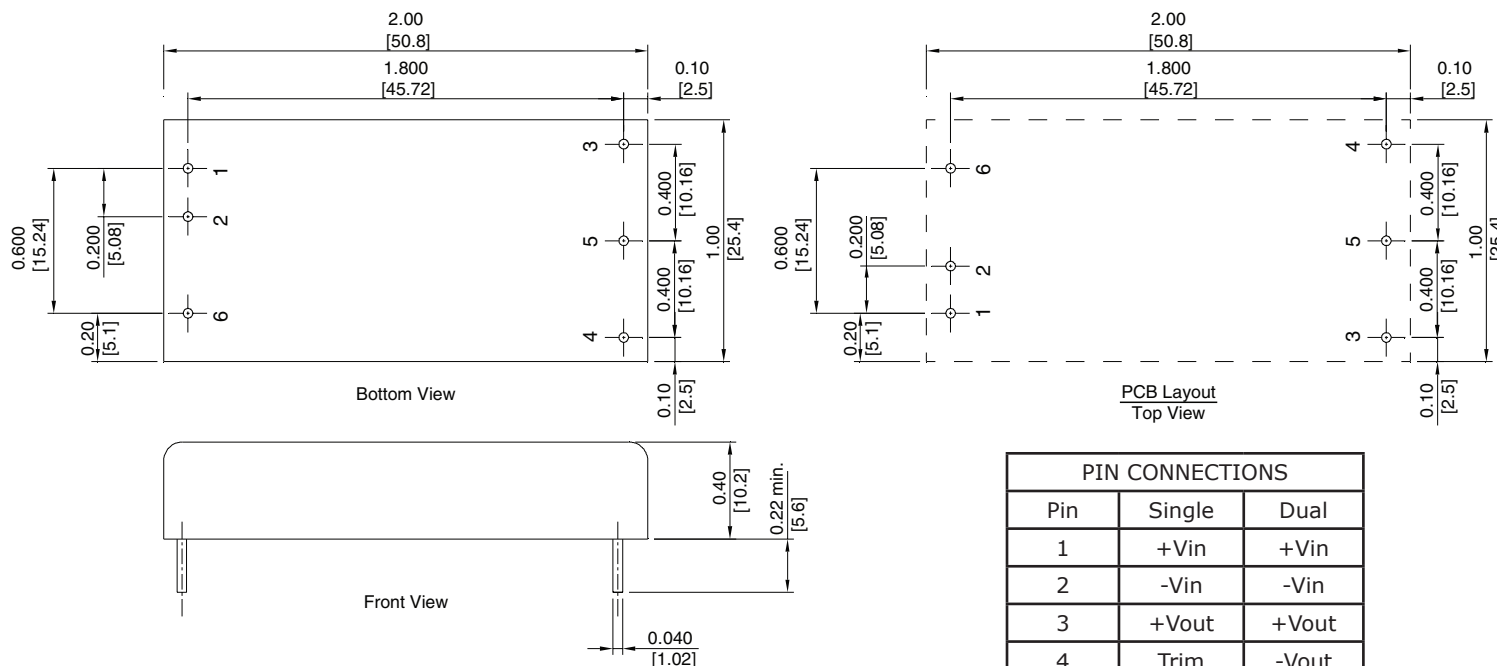
MECHANICAL DRAWING

units: inch[mm]

tolerance: X.XX = ±0.02[±0.5]

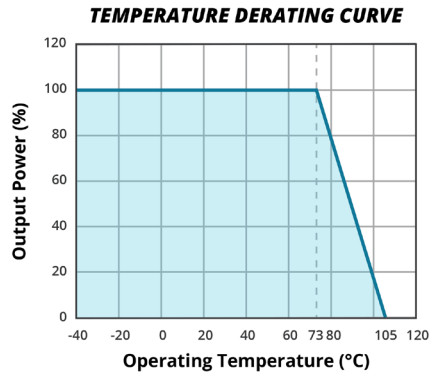
X.XXX = ±0.010[±0.25]

1.3 mm Plated Through hole
2.5 mm Pad Size



| PIN CONNECTIONS | | |
|-----------------|---------------|--------|
| Pin | Single | Dual |
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | +Vout | +Vout |
| 4 | Trim | -Vout |
| 5 | -Vout | common |
| 6 | Remote ON/OFF | |

DERATING CURVES



EMC RECOMMENDED CIRCUIT

EN50155[EN50121-3-2]

Figure 1

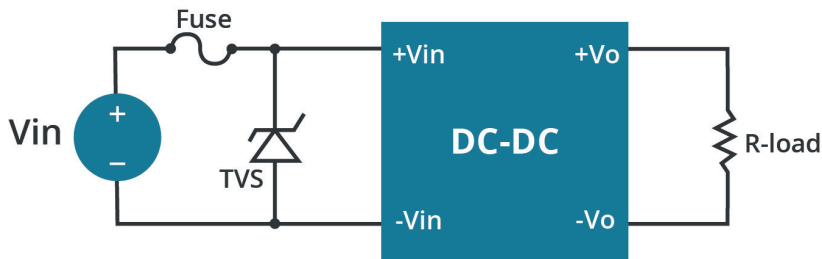


Table 1

| |
|---------------------|
| External components |
| 3A time delay fuse |
| TVS |

TEST CONFIGURATION

Figure 2

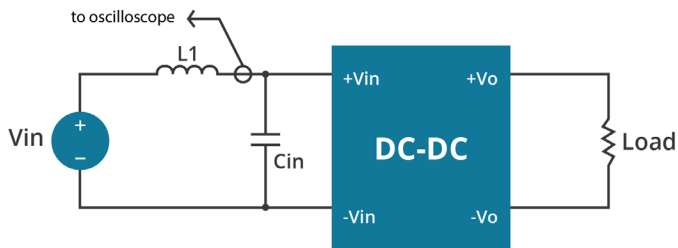


Table 2

| | |
|---------------------|-----------------------------|
| External components | |
| Lin | 12μH |
| Cin | 22μF, ESR < 0.2Ω at 100 KHz |

Note: Input reflected-ripple current is measured with an inductor L1 to simulate source impedance.

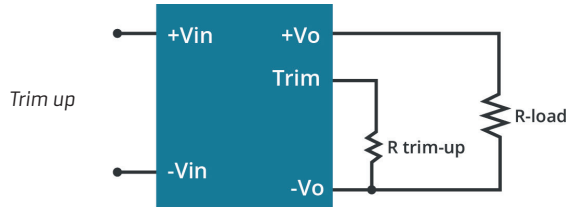
APPLICATION NOTES

Output Voltage Trimming

Leave open if not used.

Figure 3

Application Circuit for Trim pin

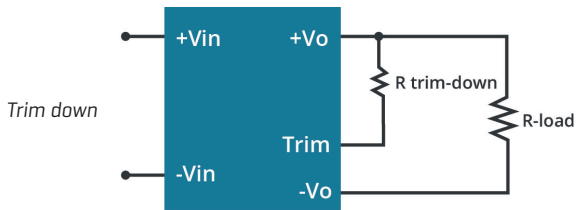


Formula for Trim Resistor

$$R_{trim - up} = \left(\frac{V_r \times R1 \times (R2 + R3)}{(V_o - V_{o, nom}) \times R2} \right) - R_t \text{ (K}\Omega\text{)}$$

$$R_{trim - down} = R1 \times \left(\frac{V_r \times R1}{(V_{o, nom} - V_o) \times R2} - 1 \right) - R_t \text{ (K}\Omega\text{)}$$

Note: $R_{trim-up}$ is the external resistor in $K\Omega$
 $R_{trim-down}$ is the external resistor in $K\Omega$
 $V_{o, nom}$ is the nominal output voltage
 V_o is the desired output voltage
 $R1, R2, R3, R_t,$ and V_r are internal (see table 3).



| Vout (Vdc) | R1 (KΩ) | R2 (KΩ) | R3 (KΩ) | Rt (KΩ) | Vr (V) |
|------------|---------|---------|---------|---------|--------|
| 5 | 2.32 | 2.32 | 0 | 8.2 | 2.5 |
| 12 | 6.8 | 2.4 | 2.32 | 22 | 2.5 |
| 15 | 8.06 | 2.4 | 3.9 | 27 | 2.5 |

Table 3

Note: 1. All specifications are measured at Ta=25°C, nominal input voltage and full output load unless otherwise specified.

REVISION HISTORY

| rev. | description | date |
|------|--|------------|
| 1.0 | initial release | 02/12/2014 |
| 1.01 | company logo updated | 02/16/2021 |
| 1.02 | derating curve and circuit figures updated | 08/23/2021 |
| 1.03 | input section updated | 03/10/2022 |

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



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