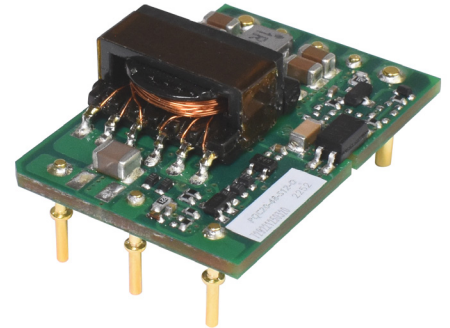


SERIES: PQC20-0 | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

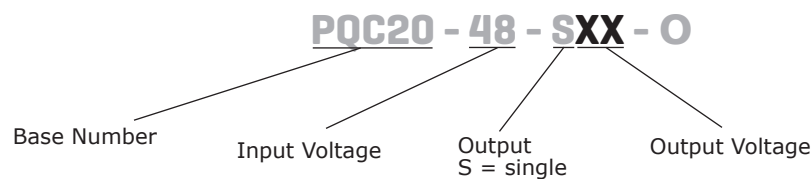
- 20 W isolated output
- 2:1 input range (36~60 Vdc)
- single regulated outputs
- industry standard 1/16th brick
- over-current, input under-voltage, over-voltage and output short-circuit protection



| MODEL | input voltage | | output voltage (Vdc) | output current | | output power max (W) | ripple and noise ¹ max (mVp-p) | efficiency ² typ (%) |
|----------------|---------------|----------------|-------------------------|----------------|-------------|----------------------------|---|---------------------------------------|
| | typ (Vdc) | range (Vdc) | | min (mA) | max (mA) | | | |
| PQC20-48-S3-O | 48 | 36~75 | 3.3 | 0 | 5,000 | 16.5 | 150 | 86 |
| PQC20-48-S5-O | 48 | 36~75 | 5 | 0 | 4,000 | 20 | 150 | 88 |
| PQC20-48-S12-O | 48 | 36~75 | 12 | 0 | 1,667 | 20 | 150 | 89 |
| PQC20-48-S15-O | 48 | 36~75 | 15 | 0 | 1,333 | 20 | 150 | 89 |
| PQC20-48-S24-O | 48 | 36~75 | 24 | 0 | 833 | 20 | 150 | 90 |
| PQC20-48-S28-O | 48 | 36~75 | 28 | 0 | 714 | 20 | 150 | 90 |

Notes: 1. Ripple and noise are measured at 20 MHz BW, 5%~100% load by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.
2. Efficiency is measured at nominal input voltage and rated output load.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|--------------------------------------|---|------|--------|--------|-------|
| operating input voltage ³ | | 36 | 48 | 75 | Vdc |
| current (full load/no load) | at nominal input voltage | | 474/15 | 485/30 | mA |
| reflected ripple current | at nominal input voltage | | 50 | | mA |
| start-up voltage | | | | 36 | Vdc |
| under-voltage protection | | 26 | 29 | | Vdc |
| start-up time | at nominal input voltage & constant resistance load | | | 100 | ms |
| surge voltage | for maximum of 1 second | -0.7 | | 100 | Vdc |
| CTRL ⁴ | module on (CTRL pin open or pulled high (TTL 3.5~12Vdc) | | | | |
| | module off (CTRL pin pulled low to GND (0~1.2Vdc) | | | | |
| | input current when off | | 6 | 10 | mA |
| filter | C filter | | | | |

Notes: 3. Input must be supplied by ES1 source to conform to CE regulations.
4. The CTRL pin voltage is referenced to input GND.

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|----------------------------------|---|-----|------|-------|-------|
| maximum capacitive load | 3.3 & 5 Vdc output | | | 7,200 | μF |
| | 12 Vdc output | | | 1,600 | μF |
| | 15 Vdc output | | | 1,000 | μF |
| | 24 & 28 Vdc output | | | 470 | μF |
| line regulation | full load, input voltage from low to high | | ±0.2 | ±0.5 | % |
| load regulation | 5% to 100% load | | ±0.5 | ±1 | % |
| voltage accuracy | 5% to 100% load | | ±1 | ±3 | % |
| switching frequency ⁵ | PWM mode | | 230 | | kHz |
| transient recovery time | 25% load step change | | 300 | 500 | μs |
| transient response deviation | 25% load step change | | ±5 | ±8 | % |
| | 3.3 & 5 Vdc output voltage all other output models | | ±3 | ±5 | % |
| temperature coefficient | full load | | | ±0.03 | %/°C |

Notes: 5. Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|--------------------------|---------------------------|-----|-----|-----|-------|
| over voltage protection | | 110 | | 160 | % |
| over current protection | | 110 | 140 | 190 | % |
| short circuit protection | auto recovery, continuous | | | | |

SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|-----------------------|---|-------|-------|-----|-------|
| isolation voltage | input to output for 1 minute at 1 mA max. | 1,500 | | | Vdc |
| isolation resistance | input to output at 500 Vdc | 1,000 | | | MΩ |
| isolation capacitance | input to output at 100kHz/0.1V | | 1,000 | | pF |
| vibration | 10-150Hz, 5G, 0.75mm. along X, Y and Z | | | | |
| safety approvals | certified to 62368: EN, BS EN | | | | |
| conducted emissions | CISPR/EN 55032 Class B (see fig. 2-1 for recommended circuit) | | | | |
| radiated emissions | CISPR/EN 55032 Class B (see fig. 2-1 for recommended circuit) | | | | |
| ESD | IEC/EN 61000-4-2 Contact ±4kV, perf. Criteria B | | | | |
| radiated immunity | IEC/EN 61000-4-3 10 V/m, perf. Criteria A | | | | |

SAFETY AND COMPLIANCE (CONTINUED)

| parameter | conditions/description | min | typ | max | units |
|--------------------|--|-----------|-----|-----|-------|
| EFT/burst | IEC/EN 61000-4-4 ±2kV (see fig. 2 for recommended circuit), perf. Criteria B | | | | |
| surge | IEC/EN 61000-4-5 line to line±2kV (see fig. 2 for recommended circuit), perf. Criteria B | | | | |
| conducted immunity | IEC/EN 61000-4-6 3Vrms, perf. Criteria A | | | | |
| MTBF | as per MIL-HDBK-217F @ 25°C | 1,000,000 | | | hours |
| RoHS | yes | | | | |

ENVIRONMENTAL

| parameter | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve | -40 | | 85 | °C |
| storage temperature | | -55 | | 125 | °C |
| storage humidity | non-condensing | 5 | | 95 | % |

MECHANICAL

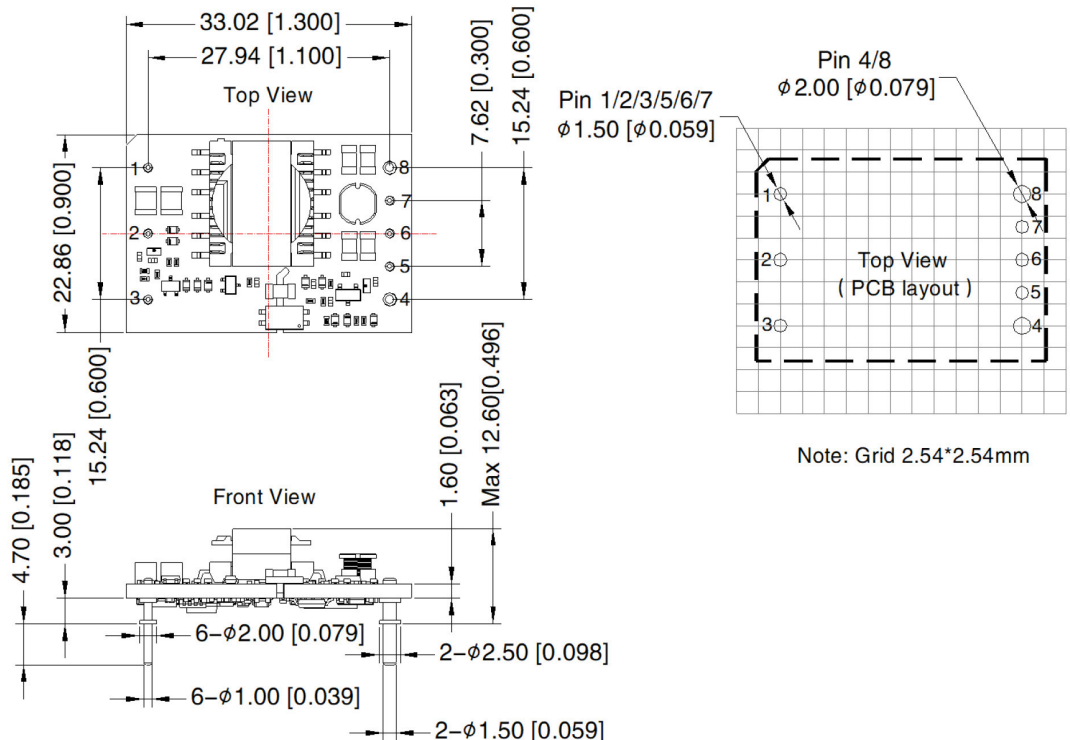
| parameter | conditions/description | min | typ | max | units |
|----------------|---|-----|-----|-----|-------|
| dimensions | 33.02 x 22.86 x 12.6 [1.300 x 0.900 x 0.496 inch] | | | | mm |
| weight | | | 8.2 | | g |
| cooling method | natural convection | | | | |

MECHANICAL DRAWING

units: mm[inch]
 tolerance: ±0.50[±0.020]
 pin section tolerance: ±0.10[±0.004]
 pin 1,2,3,5,6,7: Ø1.0mm
 pin 4,8: Ø1.5mm

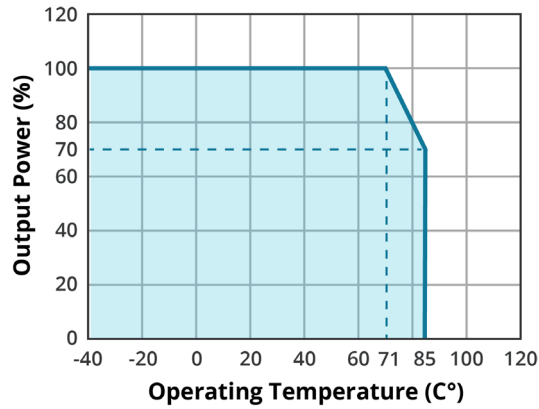
Note: The layout of the device is for reference only, please refer to the actual product.

| PIN CONNECTIONS | |
|-----------------|----------|
| PIN | Function |
| 1 | Vin |
| 2 | CTRL |
| 3 | GND |
| 4 | 0V |
| 5 | Sense- |
| 6 | Trim |
| 7 | Sense+ |
| 8 | +Vo |



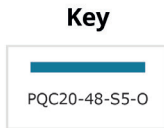
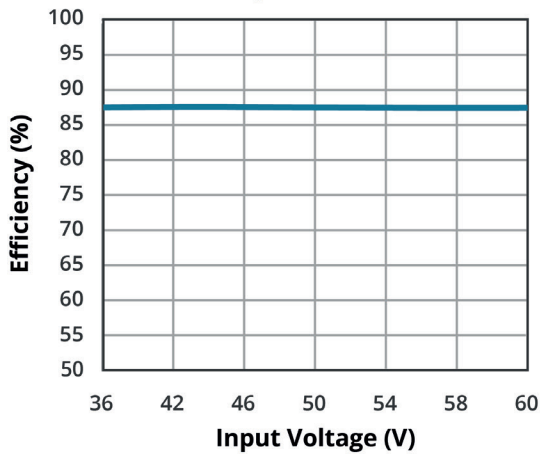
DERATING CURVE

TEMPERATURE DERATING CURVE

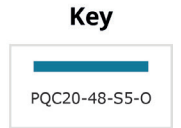
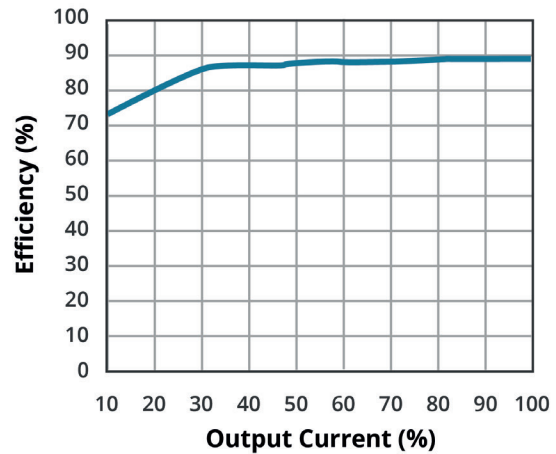


EFFICIENCY CURVES

**EFFICIENCY VS INPUT VOLTAGE
(full load)**



**EFFICIENCY VS OUTPUT LOAD
(Vin = 48V)**



APPLICATION NOTES

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 1. Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values C_{in} and C_{out} and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product. The products do not support parallel connection of their output.

Figure 1

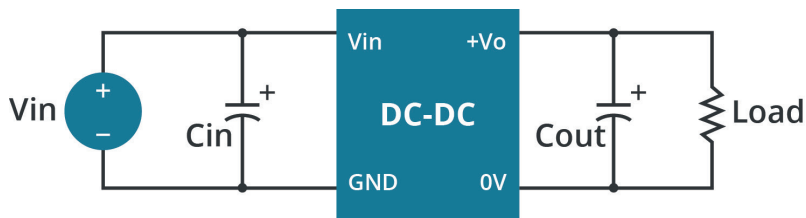
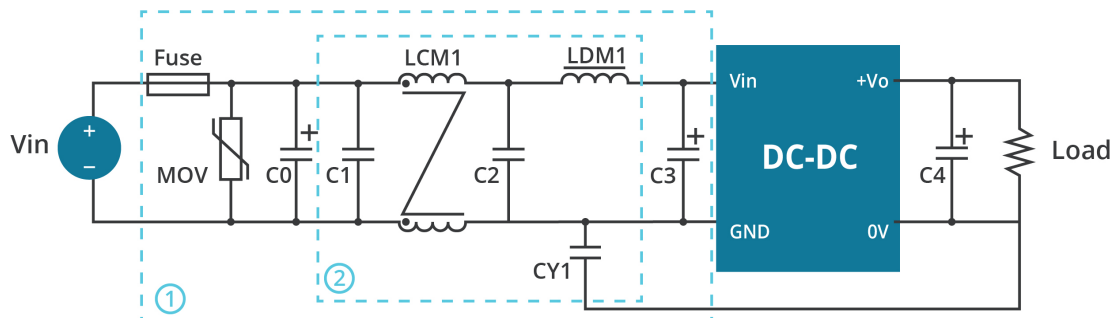


Table 1

| Vin (Vdc) | Vout (Vdc) | Cin (μF/V) | Cout (μF) |
|-----------|------------|------------|-----------|
| 48 | 5 | 100μF/100V | 10μF/16V |
| | 12/15 | | 10μF/25V |
| | 24 | | 10μF/50V |

EMC RECOMMENDED CIRCUIT

Figure 2



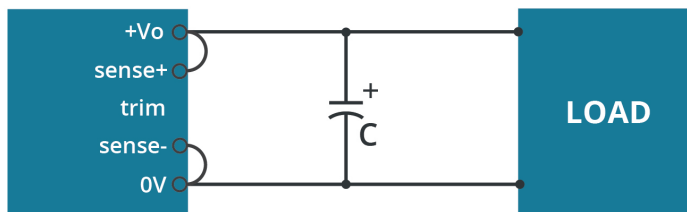
Notes: For EMC tests we use Part 1 in Fig. 2 for immunity and part 2 for emissions test. Selecting based on needs.

Table 2

| Recommended external circuit components | |
|---|-----------------------------|
| FUSE | T/1.25A/300Vac |
| MOV | S14K60 |
| C0 | 680μF/100V |
| C1/C2 | 22μF/100V |
| C3 | 330μF/100V |
| C4 | refer to the Cout in Fig. 1 |
| LCM1 | 4.7mH |
| LDM1 | 22μH |
| CY1/CY2 | 2.2nF/2kV |

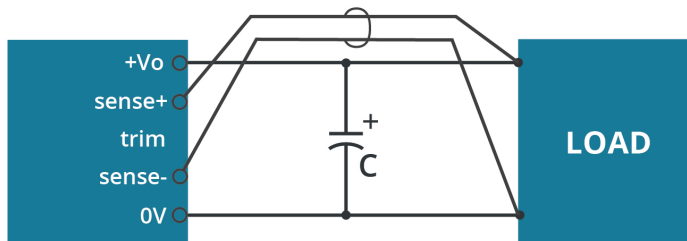
REMOTE SENSE APPLICATION

Figure 3
REMOTE SENSE CONNECTION
IF NOT USED



- Note:
1. Lines must be kept as short as possible.
 2. If the sense function is not used for remote regulation the user must connect the +Sense to +Vo and -Sense to 0V.
 3. The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

REMOTE SENSE CONNECTION
USED FOR COMPENSATION

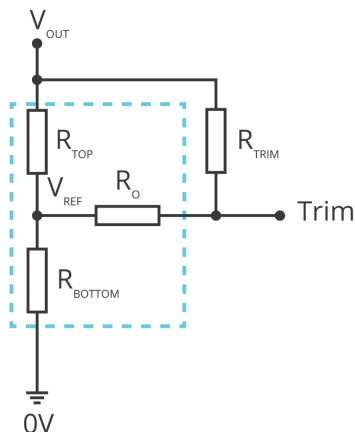


- Note:
1. In cables and discrete wiring applications, twisted pair or other techniques should be implemented.
 2. PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wires are suggested for remote compensation and must be kept as short as possible.
 3. We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range.
 4. Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation.

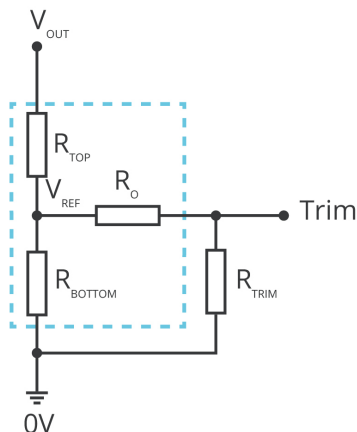
APPLICATION NOTES

Figure 4

Trim up



Trim down



$$R_{TRIM} = \left(\frac{5.11 \cdot V_{NOM} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{511}{\Delta\%} - 10.22 \right) (K\Omega)$$

Formula for Trim up

$$R_{TRIM} = \left(\frac{511}{\Delta\%} \right) - 10.22 (K\Omega)$$

Formula for Trim down

Note: R_{TRIM} : Trim resistance

$$\Delta\%: \Delta\% = \left| \frac{V_{NOM} - V_{OUT}}{V_{NOM}} \right| \times 100$$

V_{NOM} : Nominal output voltage

V_{OUT} : Target output voltage

SAFETY SPECIFICATIONS

The input is considered as safety extra low voltage (ES1/SELV) if one of the following conditions is met.

1. The input source provides double or reinforced insulation from the AC mains according to IEC/EN/UL 62368-1.
2. The input source provides basic or supplementary insulation from the AC mains and product's output is reliably connected to protective earth according to IEC/EN/UL 62368-1.
3. The input source is reliably connected to protective earth and provides basic or supplementary insulation according to IEC/EN/UL 62368-1 and the maximum input source voltage is 60 Vdc.

- Note:
1. Maximum capacitive load is tested at input voltage range and full load.
 2. All specifications are measured at $T_a=25^\circ\text{C}$, humidity < 75%, nominal input voltage and rated output load unless otherwise specified.

REVISION HISTORY

| rev. | description | date |
|------|-----------------------------|------------|
| 1.0 | initial release | 01/17/2023 |
| 1.01 | safety specifications added | 04/26/2023 |

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



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