

SERIES: PQAE50 | **DESCRIPTION: DC-DC CONVERTER**

FEATURES

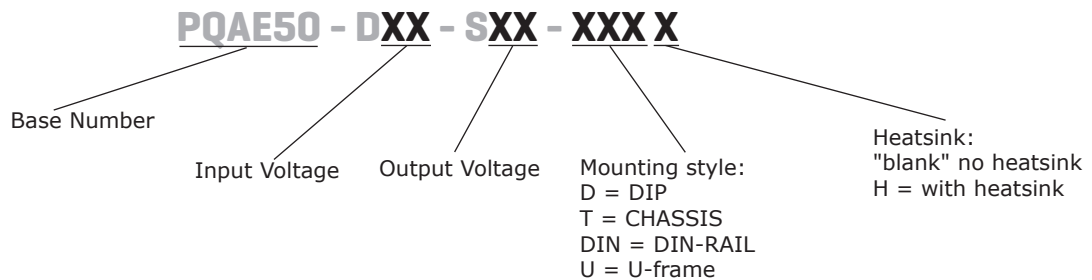
- up to 50 W isolated output
- 2:1 input range (18~36 Vdc, 36~75 Vdc)
- single, regulated output
- 1,500 Vdc isolation
- short circuit, over current, and over voltage protection
- input under voltage protection
- remote on/off
- wide operating temperature range -40~105°C
- efficiency up to 92%
- EN/BS EN 62368 certified



| MODEL | input voltage | | output voltage (Vdc) | output current | | output power max (W) | ripple and noise ² max (mVp-p) | efficiency ³ typ (%) |
|-----------------------------|---------------|--------------------------|-------------------------|----------------|---------|-------------------------|--|------------------------------------|
| | typ (Vdc) | range ¹ (Vdc) | | min (A) | max (A) | | | |
| PQAE50-D24-S3 ⁴ | 24 | 18~36 | 3.3 | 0.5 | 10.0 | 33 | 200 | 91 |
| PQAE50-D24-S5 ⁴ | 24 | 18~36 | 5 | 0.5 | 10.0 | 50 | 200 | 91 |
| PQAE50-D24-S12 ⁴ | 24 | 18~36 | 12 | 0.208 | 4.167 | 50 | 250 | 91 |
| PQAE50-D24-S15 ⁴ | 24 | 18~36 | 15 | 0.167 | 3.333 | 50 | 250 | 91 |
| PQAE50-D24-S24 ⁴ | 24 | 18~36 | 24 | 0.104 | 2.083 | 50 | 300 | 91 |
| PQAE50-D48-S3 | 48 | 36~75 | 3.3 | 0 | 10.0 | 33 | 200 | 91 |
| PQAE50-D48-S5 | 48 | 36~75 | 5 | 0 | 10.0 | 50 | 200 | 91 |
| PQAE50-D48-S12 | 48 | 36~75 | 12 | 0 | 4.167 | 50 | 250 | 92 |
| PQAE50-D48-S15 | 48 | 36~75 | 15 | 0 | 3.333 | 50 | 250 | 92 |
| PQAE50-D48-S24 | 48 | 36~75 | 24 | 0 | 2.083 | 50 | 350 | 92 |

- Notes:
1. Minimum input voltage is 1V greater for DIN rail and chassis mount models.
 2. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.
 3. Measured at nominal input voltage and full load.
 4. Model is not CE & UKCA certified.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|-----------------------------|---|----------------------|---------|--------|-------|
| input voltage | 24 Vdc input models | 18 | 24 | 40 | Vdc |
| | 48 Vdc input models | 36 | 48 | 80 | Vdc |
| current (full load/no load) | 24 Vdc input models | 3.3 Vdc output model | 1511/2 | 1545/- | mA |
| | | 5 Vdc output model | 2289/3 | 2341/- | mA |
| | | 12 Vdc output model | 2289/5 | 2341/- | mA |
| | | 15 Vdc output model | 2289/11 | 2341/- | mA |
| | 48 Vdc input models | 24 Vdc output model | 2289/4 | 2341/- | mA |
| | | 3.3 Vdc output model | 756/1 | 773/- | mA |
| | | 5 Vdc output model | 1145/2 | 1171/- | mA |
| | | 12 Vdc output model | 1133/4 | 1158/- | mA |
| start-up voltage | 24 Vdc input models | 15 Vdc output model | 1133/4 | 1158/- | mA |
| | | 24 Vdc output model | 1133/3 | 1158/- | mA |
| | 48 Vdc input models | 18 | | Vdc | |
| | | 36 | | Vdc | |
| under voltage protection | 24 Vdc input models | 11 | 13 | | Vdc |
| | 48 Vdc input models | 26 | 30 | | Vdc |
| surge voltage | for maximum of 1 second | | | | |
| | 24 Vdc input models | -0.7 | | 50 | Vdc |
| start-up time | 48 Vdc input models | -0.7 | | 80 | Vdc |
| | nominal input, constant load | | 10 | 120 | ms |
| CTRL ¹ | models ON (CTRL open or connect high level, 3~12 Vdc) | | | | |
| | models OFF (CTRL connect GND or low level, 0~1.2 Vdc) | | | | |
| | input current (models OFF) | | | | |
| filter | 24 Vdc input models | | 6 | 12 | mA |
| | 48 Vdc input models | | 2 | 12 | mA |
| pi filter | | | | | |

Note 1. CTRL pin voltage is referenced to GND.

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|------------------------------|---|-----|------|-------|-------|
| 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 | PWM mode | | 300 | | kHz |
| transient recovery time | 25% load step change | | 250 | 500 | µs |
| transient response deviation | 25% load step change | | ±3 | ±8 | % |
| | 3.3 & 5 Vdc output models | | ±3 | ±5 | % |
| temperature coefficient | other output models | | | | |
| trim | 100% load | | | ±0.03 | %/°C |
| | | | ±10 | | % |

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|--------------------------|-----------------------------------|-----|-----|-----|-------|
| over voltage protection | | 110 | 140 | 160 | % |
| over current protection | | 110 | 140 | 200 | % |
| short circuit protection | continuous, auto recovery, hiccup | | | | |

SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|-----------------------|--|-----------|-------|-----|-------|
| isolation voltage | input to output at 1 mA for 1 minute | 1,500 | | | Vdc |
| | input or output to housing at 1 mA for 1 minute | 1,000 | | | Vdc |
| isolation resistance | input to output at 500 Vdc | 100 | | | MΩ |
| isolation capacitance | input to output at 100 kHz, 0.1 Vdc | | 2,200 | | pF |
| safety approvals | certified to 62368: EN, IEC, BS EN | | | | |
| conducted emissions | CISPR32/EN55032 CLASS B (see Fig.2 for recommended circuit) | | | | |
| radiated emissions | CISPR32/EN55032 CLASS B (see Fig.2 for recommended circuit) | | | | |
| ESD | IEC/EN61000-4-2 Contact ±4KV (for 18~36 Vdc) ±6KV (for 36~75 Vdc) perf. Criteria B | | | | |
| radiated immunity | IEC/EN61000-4-3 10V/m perf. Criteria A | | | | |
| EFT/burst | IEC/EN61000-4-4 100KHz ±2KV (see Fig.2 for recommended circuit) perf. Criteria B | | | | |
| surge | IEC/EN61000-4-5 line to line ±2KV (see Fig.2 for recommended circuit) perf. Criteria B | | | | |
| conducted immunity | IEC/EN61000-4-6 10 Vr.m.s 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 | | 105 | °C |
| storage temperature | | -55 | | 125 | °C |
| storage humidity | non-condensing | 5 | | 95 | % |
| vibration | 10 ~ 150Hz, 5G, 0.75mm. along X, Y and Z | | | 5 | G |

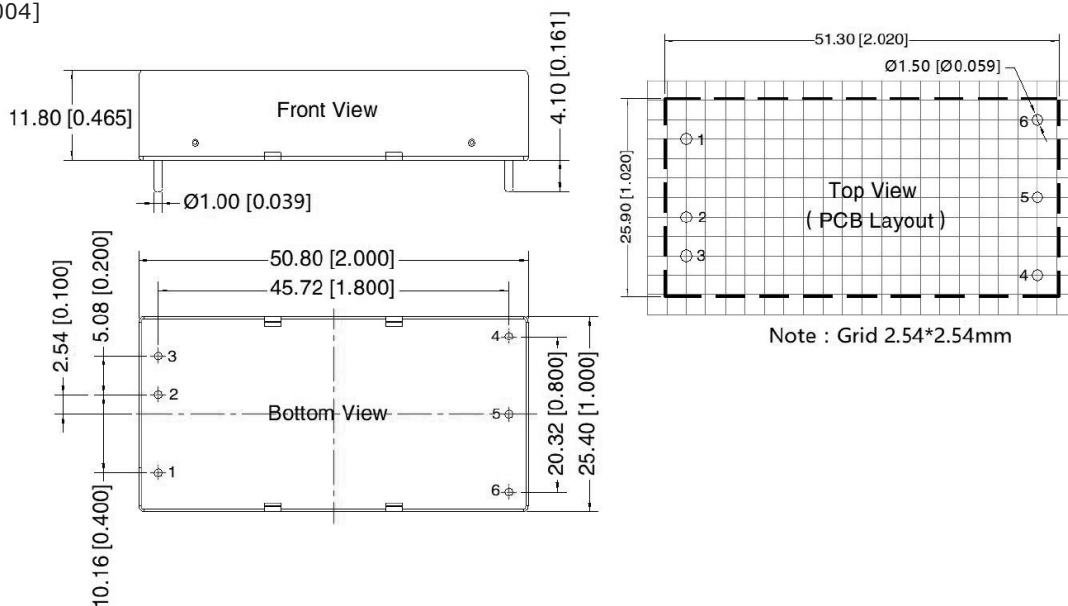
MECHANICAL

| parameter | conditions/description | min | typ | max | units | |
|-------------------|--|--------------------|-----|-----|-------|---|
| dimensions | without heatsink: | | | | | |
| | horizontal package 50.80 × 25.40 × 11.80 | | | | mm | |
| | chassis mount 76.00 × 31.50 × 21.20 | | | | mm | |
| | DIN-Rail mounting 76.00 × 31.50 × 25.80 | | | | mm | |
| | U-frame mounting 55.00 × 52.30 × 19.00 | | | | mm | |
| | with heatsink: | | | | | |
| weight | horizontal package 51.40 × 26.20 × 16.50 | | | | mm | |
| | chassis mount 76.00 × 31.50 × 25.30 | | | | mm | |
| | DIN-Rail mounting 76.00 × 31.50 × 29.90 | | | | mm | |
| | case material | aluminum alloy | | | | |
| | weight | without heatsink: | | | | |
| | | horizontal package | | 42 | | g |
| chassis mounting | | | 65 | | g | |
| DIN-Rail mounting | | | 85 | | g | |
| U-frame mounting | | | 70 | | g | |
| with heatsink: | | | | | | |
| weight | horizontal package | | 50 | | g | |
| | chassis mounting | | 73 | | g | |
| | DIN-Rail mounting | | 93 | | g | |

MECHANICAL DRAWING

units: mm[inch]
 pin diameter tolerance: $\pm 0.10[\pm 0.004]$
 general tolerance: $\pm 0.50[\pm 0.020]$

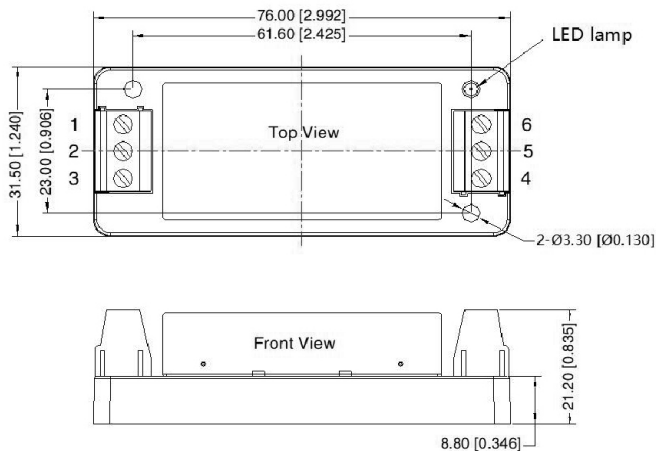
| PIN CONNECTIONS | |
|-----------------|----------|
| PIN | Function |
| 1 | CTRL |
| 2 | GND |
| 3 | Vin |
| 4 | +Vo |
| 5 | 0V |
| 6 | Trim |



CHASSIS MOUNT

units: mm[inch]
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

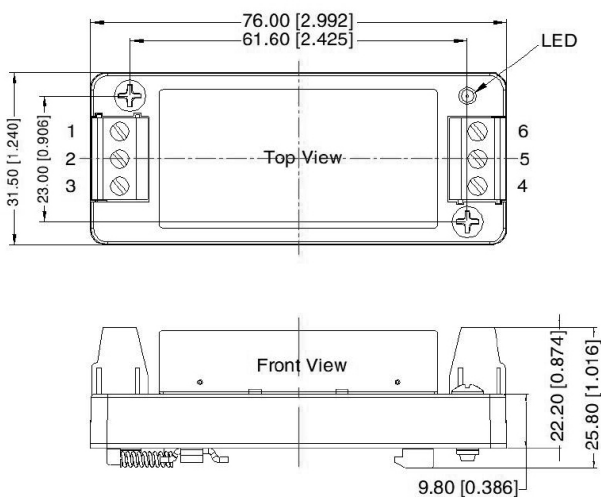
| PIN OUT | |
|---------|----------|
| PIN | Function |
| 1 | CTRL |
| 2 | GND |
| 3 | Vin |
| 4 | +Vo |
| 5 | 0V |
| 6 | Trim |



DIN-RAIL MOUNT

units: mm[inch]
 mounting rail: TS35
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

| PIN OUT | |
|---------|----------|
| PIN | Function |
| 1 | CTRL |
| 2 | GND |
| 3 | Vin |
| 4 | +Vo |
| 5 | 0V |
| 6 | Trim |

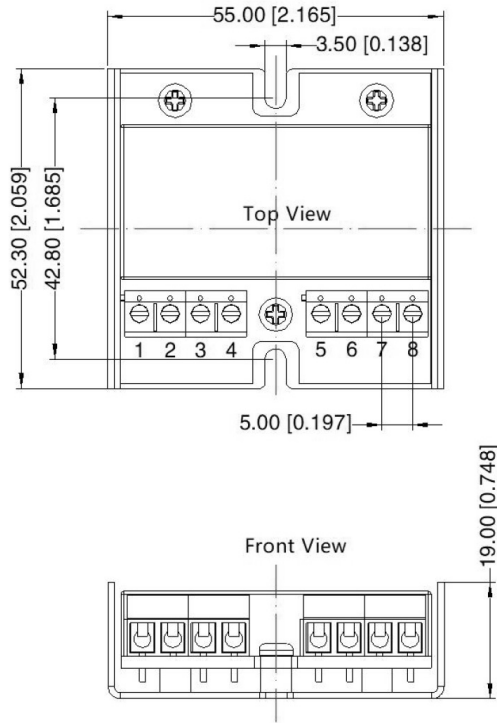


MECHANICAL DRAWING (CONTINUED)

U-FRAME

units: mm[inch]
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

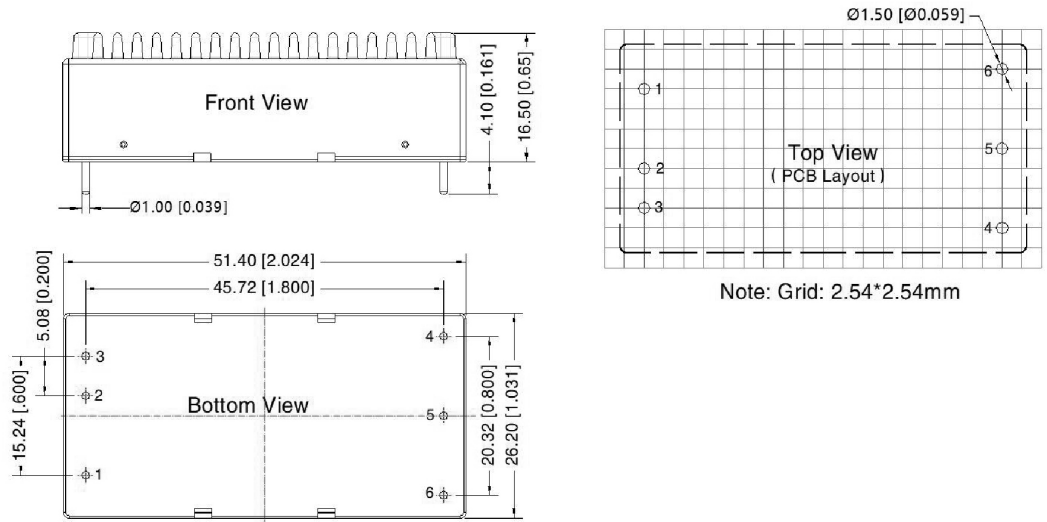
| PIN CONNECTIONS | |
|-----------------|----------|
| PIN | Function |
| 1 | GND |
| 2 | Vin |
| 3 | CTRL |
| 4 | Case |
| 5 | NC |
| 6 | +Vo |
| 7 | 0V |
| 8 | Trim |



WITH HEATSINK

units: mm[inch]
 pin diameter tolerance: $\pm 0.10[\pm 0.004]$
 general tolerance: $\pm 0.50[\pm 0.020]$

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



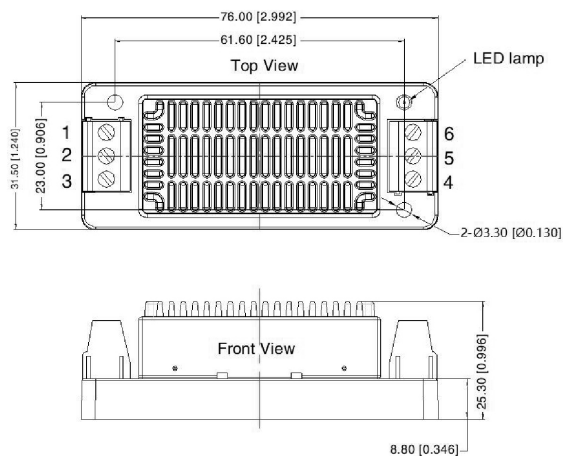
Note: Grid: 2.54*2.54mm

MECHANICAL DRAWING (CONTINUED)

CHASSIS MOUNT WITH HEATSINK

units: mm[inch]
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

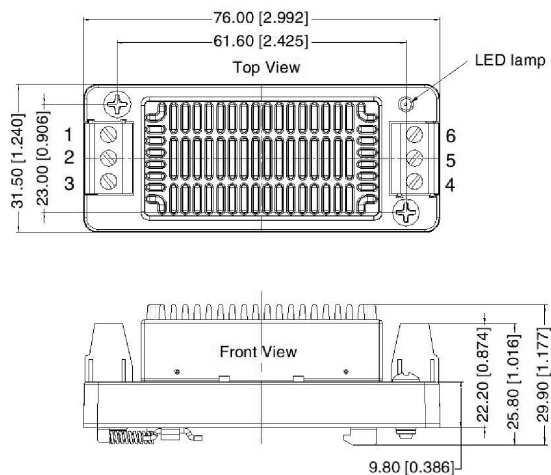
| PIN OUT | |
|---------|----------|
| PIN | Function |
| 1 | CTRL |
| 2 | GND |
| 3 | Vin |
| 4 | +Vo |
| 5 | 0V |
| 6 | Trim |



DIN-RAIL MOUNT WITH HEATSINK

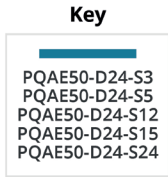
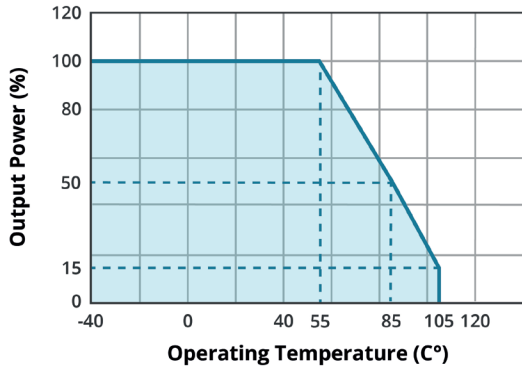
units: mm[inch]
 mounting rail: TS35
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

| PIN OUT | |
|---------|----------|
| PIN | Function |
| 1 | CTRL |
| 2 | GND |
| 3 | Vin |
| 4 | +Vo |
| 5 | 0V |
| 6 | Trim |

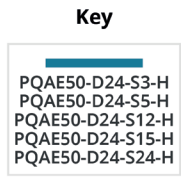
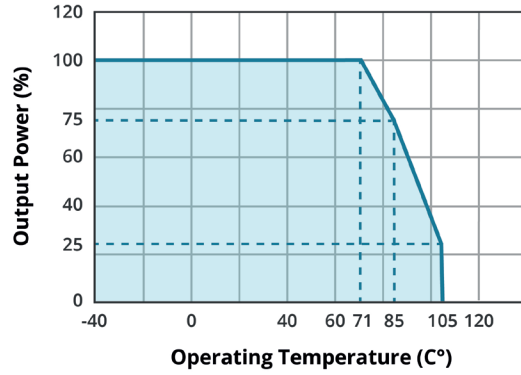


DERATING CURVES

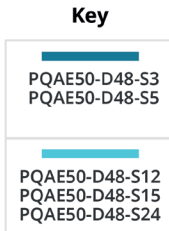
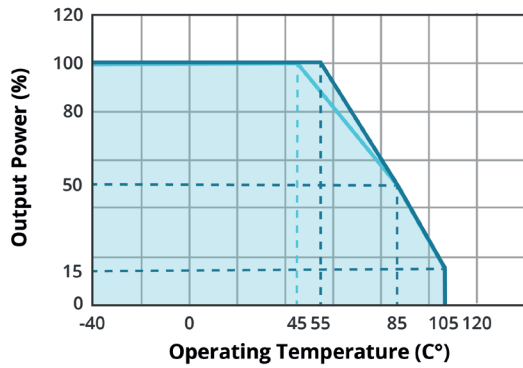
TEMPERATURE DERATING CURVE
without heatsink



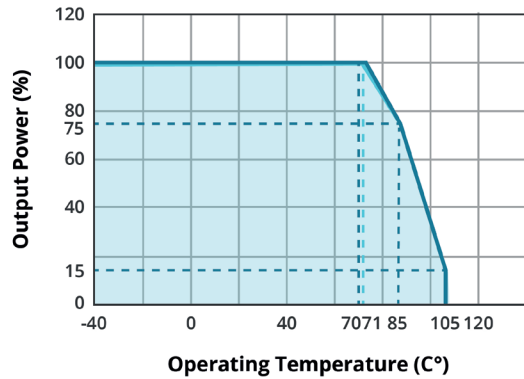
TEMPERATURE DERATING CURVE
with heatsink



TEMPERATURE DERATING CURVE
without heatsink



TEMPERATURE DERATING CURVE
with heatsink



APPLICATION DESIGN REFERENCE

If you want to further reduce the input and output ripple, a filter capacitor may be connected to the input and output terminals (Figure 1) provided that the capacitance is less than the maximum capacitive load of the model, otherwise start-up problems may be caused if the capacitance is too large.

Figure 1

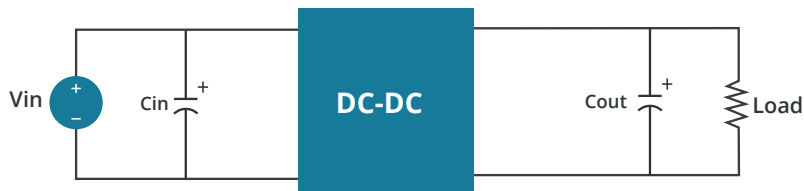


Table 1

| Vin (Vdc) | Vout (Vdc) | Cin (μF) | Cout (μF) |
|-----------|------------|----------|-----------|
| 24/48 | 3.3 | 100μF | 470μF/10V |
| | 5 | | 470μF/10V |
| | 12 | | 100μF/25V |
| | 15 | | 100μF/25V |
| | 24 | | 47μF/50V |

EMC RECOMMENDED CIRCUIT

Figure 2

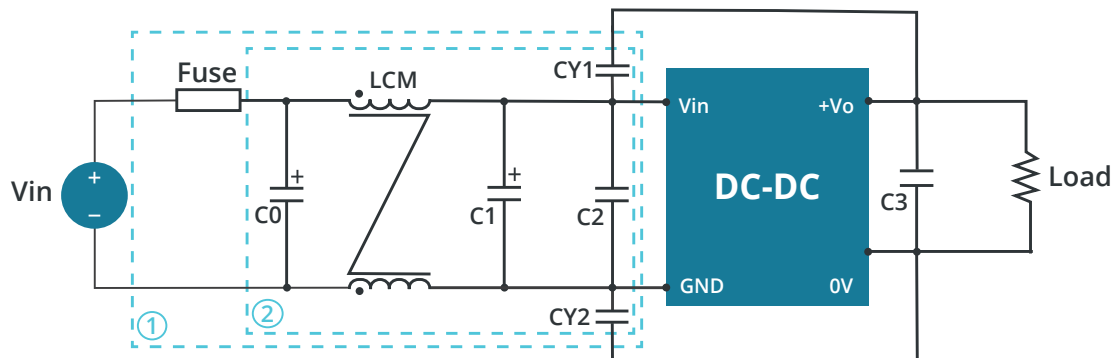


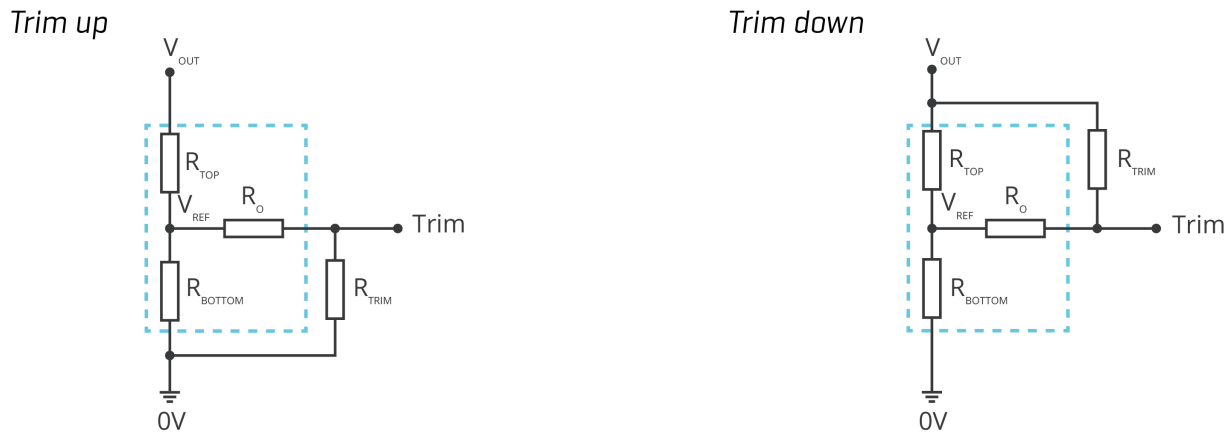
Table 2

| MODEL | Vin: 24V | Vin: 48V |
|----------|-------------------------------------|-------------------------------------|
| FUSE | T/4A/250Vac | T/2A/250Vac |
| C0 | 680μF/50V | 330μF/100V |
| LCM | 2.2mH | 2.2mH |
| C1 | 330μF/50V | 330μF/100V |
| C2 | 4.7μF/50V | 2.2μF/100V |
| CY1, CY2 | Y1 Safety capacitor 2.2nF/250Vac | Y1 Safety capacitor 3.3nF/250Vac |
| C3 | refer to Cout in Table 1 | refer to Cout in Table 1 |

APPLICATION DESIGN REFERENCE (CONTINUED)

TRIM FUNCTION FOR OUTPUT VOLTAGE ADJUSTMENT (OPEN IF UNUSED)

Figure 3



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

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

Note: Trim resistor connection (dashed line shows internal resistor network).

Table 3

| Model number | Vout adjustable value (V) | RT (KΩ) | R1 (KΩ) | R2 (KΩ) | R3 (KΩ) | Vref (V) |
|----------------|---------------------------|---------------|----------------|--------------|------------|--------------|
| PQAE50-D24-S3 | Up: 3.63 Down: 2.97 | 15.0 18.7 | 4.83 4.83 | 2.87 2.87 | 4.7 4.7 | 1.24 1.24 |
| PQAE50-D24-S5 | Up: 5.5 Down: 4.5 | 13.3 5.4 | 2.97 2.97 | 2.87 2.87 | 4.7 4.7 | 2.5 2.5 |
| PQAE50-D24-S12 | Up: 13.2 Down: 10.8 | 7.6 60.7 | 10.90 10.90 | 2.87 2.87 | 15 15 | 2.5 2.5 |
| PQAE50-D24-S15 | Up: 16.5 Down: 13.5 | 8.9 90.2 | 14.35 14.35 | 2.87 2.87 | 15 15 | 2.5 2.5 |
| PQAE50-D24-S24 | Up: 26.4 Down: 21.6 | 21.6 185.9 | 24.77 24.77 | 2.87 2.87 | 5.1 5.1 | 2.5 2.5 |
| PQAE50-D48-S3 | Up: 3.63 Down: 2.97 | 10 13.5 | 4.83 4.83 | 2.87 2.87 | 10 10 | 1.24 1.24 |
| PQAE50-D48-S5 | Up: 5.5 Down: 4.5 | 4.3 1.5 | 2.87 2.87 | 2.87 2.87 | 10 10 | 2.5 2.5 |
| PQAE50-D48-S12 | Up: 13.2 Down: 10.8 | 7.6 60.7 | 10.90 10.90 | 2.87 2.87 | 15 15 | 2.5 2.5 |
| PQAE50-D48-S15 | Up: 16.5 Down: 13.5 | 8.9 90.2 | 14.35 14.35 | 2.87 2.87 | 15 15 | 2.5 2.5 |
| PQAE50-D48-S24 | Up: 26.4 Down: 21.6 | 21.6 185.9 | 48.77 48.77 | 2.87 2.87 | 5.1 5.1 | 2.5 2.5 |

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_{OUT} : Nominal output voltage

REVISION HISTORY

| rev. | description | date |
|------|--|------------|
| 1.0 | initial release | 11/16/2020 |
| 1.01 | part number key updated | 12/14/2020 |
| 1.02 | mechanical drawings updated | 01/12/2021 |
| 1.03 | datasheet updated | 07/29/2021 |
| 1.04 | updated notes in model table | 10/01/2021 |
| 1.05 | application design reference section updated | 02/24/2022 |
| 1.06 | protections updated, application design reference section updated | 07/22/2022 |
| 1.07 | U-frame option added, CE certification updated for 24V models | 10/24/2022 |
| 1.08 | PN key updated | 03/01/2023 |

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



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