

**SERIES:** PQA30-T | **DESCRIPTION:** DC-DC CONVERTER

**FEATURES**

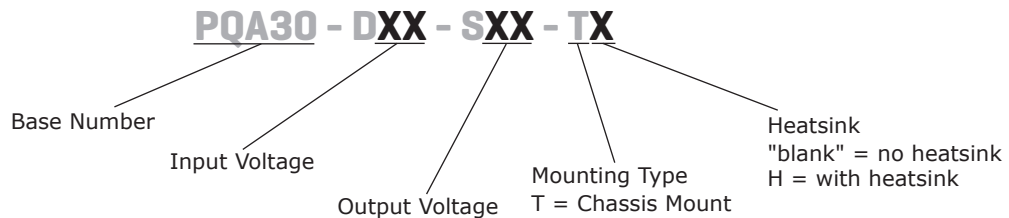
- up to 30 W isolated output
- 2:1 input range (18~36 Vdc, 36~75 Vdc)
- smaller package
- single, regulated output
- 1,500 Vdc isolation
- short circuit, over current, and over voltage protections
- inverse polarity protection
- remote on/off
- operating temperature range (-40~85°C)
- six sided metal shielding
- efficiency up to 87%



| MODEL           | input voltage |             | output voltage<br>(Vdc) | output current |         | output power<br>max (W) | ripple and noise <sup>1</sup><br>max (mVp-p) | efficiency<br>typ (%) |
|-----------------|---------------|-------------|-------------------------|----------------|---------|-------------------------|--|-----------------------|
|                 | typ (Vdc)     | range (Vdc) |                         | min (A)        | max (A) |                         |  |                       |
| PQA30-D24-S3-T  | 24            | 18~36       | 3.3                     | 0.60           | 6       | 20                      | 120  | 85                    |
| PQA30-D24-S5-T  | 24            | 18~36       | 5                       | 0.60           | 6       | 30                      | 120  | 86                    |
| PQA30-D24-S9-T  | 24            | 18~36       | 9                       | 0.333          | 3.333   | 30                      | 120  | 86                    |
| PQA30-D24-S12-T | 24            | 18~36       | 12                      | 0.25           | 2.5     | 30                      | 120  | 86                    |
| PQA30-D24-S15-T | 24            | 18~36       | 15                      | 0.20           | 2       | 30                      | 120  | 87                    |
| PQA30-D24-S24-T | 24            | 18~36       | 24                      | 0.125          | 1.25    | 30                      | 120  | 87                    |
| PQA30-D48-S3-T  | 48            | 36~75       | 3.3                     | 0.60           | 6       | 20                      | 120  | 85                    |
| PQA30-D48-S5-T  | 48            | 36~75       | 5                       | 0.60           | 6       | 30                      | 120  | 86                    |
| PQA30-D48-S12-T | 48            | 36~75       | 12                      | 0.25           | 2.5     | 30                      | 120  | 87                    |
| PQA30-D48-S15-T | 48            | 36~75       | 15                      | 0.20           | 2       | 30                      | 120  | 87                    |
| PQA30-D48-S24-T | 48            | 36~75       | 24                      | 0.125          | 1.25    | 30                      | 120  | 86                    |

Notes: 1. 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.

**PART NUMBER KEY**



**INPUT**

| parameter               | conditions/description                                      | min  | typ  | max | units |
|-------------------------|---|------|------|-----|-------|
| operating input voltage | 24 Vdc input models   | 18   | 24   | 36  | Vdc   |
|                         | 48 Vdc input models   | 36   | 48   | 75  | Vdc   |
| start-up voltage        | 24 Vdc input models   |      | 17.8 | 18  | Vdc   |
|                         | 48 Vdc input models   |      | 35.8 | 36  | Vdc   |
| under voltage shutdown  | 24 Vdc input models   | 16   |      |     | Vdc   |
|                         | 48 Vdc input models   | 32   |      |     | Vdc   |
| surge voltage           | for maximum of 1 second                                     |      |      |     |       |
|                         | 24 Vdc input models   | -0.7 |      | 50  | Vdc   |
|                         | 48 Vdc input models   | -0.7 |      | 100 | Vdc   |
| start-up time           | nominal input, constant load                                |      | 10   |     | ms    |
| CTRL <sup>1</sup>       | models ON (CTRL open or connect TTL high level, 2.5~12 Vdc) |      |      |     |       |
|                         | models OFF (CTRL connect GND or low level, 0~1.2 Vdc)       |      |      |     |       |
|                         | input current (models OFF)                                  |      | 1    |     | mA    |
| filter                  | 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              | 10% to 100% load                          |     | ±0.5  | ±1   | %     |
| voltage accuracy             |   |     | ±1    | ±3   | %     |
| adjustability                |   |     | ±10   |      | %     |
| switching frequency          | PWM mode                                  |     | 300   |      | kHz   |
| transient recovery time      | 25% load step change                      |     | 300   | 500  | µs    |
| transient response deviation | 25% load step change                      |     | ±3    | ±5   | %     |
| temperature coefficient      | 100% load                                 |     | ±0.02 |      | %/°C  |

**PROTECTIONS**

| parameter                | conditions/description     | min | typ  | max | units |
|--------------------------|----------------------------|-----|------|-----|-------|
| short circuit protection | hiccup, automatic recovery |     |      |     |       |
| over current protection  |                            | 120 | 130  | 150 | %     |
| over voltage protection  | 3.3 Vdc output models      |     | 3.96 |     | Vdc   |
|                          | 5 Vdc output models        |     | 6    |     | Vdc   |
|                          | 9 Vdc output models        |     | 10.8 |     | Vdc   |
|                          | 12 Vdc output models       |     | 15   |     | Vdc   |
|                          | 15 Vdc output models       |     | 18   |     | Vdc   |
|                          | 24 Vdc output models       |     | 28   |     | Vdc   |

## 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    |
| EMI/EMC                      | CE <sup>1</sup>  |           |     |     |       |
| conducted emissions          | CISPR22/EN55022 class A (no circuit required); class B (external circuit required, see Figure 1-b) |           |     |     |       |
| radiated emissions           | CISPR22/EN55022 class A (no circuit required); class B (external circuit required, see Figure 1-b) |           |     |     |       |
| ESD                          | IEC/EN61000-4-2 class B, contact ± 4kV   |           |     |     |       |
| radiated immunity            | IEC/EN61000-4-3 class A, 10V/m   |           |     |     |       |
| EFT/burst                    | IEC/EN61000-4-4 class B, ± 2kV (external circuit required, see Figure 1-a)                         |           |     |     |       |
| surge                        | IEC/EN61000-4-5 class B, ± 2kV (external circuit required, see Figure 1-a)                         |           |     |     |       |
| conducted immunity           | IEC/EN61000-4-6 class A, 3 Vr.m.s  |           |     |     |       |
| voltage dips & interruptions | IEC/EN61000-4-29 class B, 0%-70%   |           |     |     |       |
| MTBF                         | as per MIL-HDBK-217F @ 25°C  | 1,000,000 |     |     | hours |
| RoHS                         | 2011/65/EU   |           |     |     |       |

Note 1. CE mark is only on models without heatsink.

## ENVIRONMENTAL

| parameter             | conditions/description                          | min | typ | max | units |
|-----------------------|---|-----|-----|-----|-------|
| operating temperature | see derating curves                             | -40 |     | 85  | °C    |
| storage temperature   |   | -55 |     | 125 | °C    |
| storage humidity      | non-condensing                                  | 5   |     | 95  | %     |
| case temperature      | at full load, operating temperature curve range |     |     | 105 | °C    |
| vibration             | 10~55Hz, 30 min. along x, y, and z axis         |     |     | 10  | G     |

## MECHANICAL

| parameter     | conditions/description   | min | typ      | max | units    |
|---------------|--|-----|----------|-----|----------|
| dimensions    | chassis mount: 76.0 x 31.5 x 21.2<br>chassis mount with heatsink: 76.0 x 31.5 x 25.1 |     |          |     | mm<br>mm |
| case material | aluminum alloy   |     |          |     |          |
| weight        | chassis mount<br>chassis mount with heatsink   |     | 44<br>57 |     | g<br>g   |

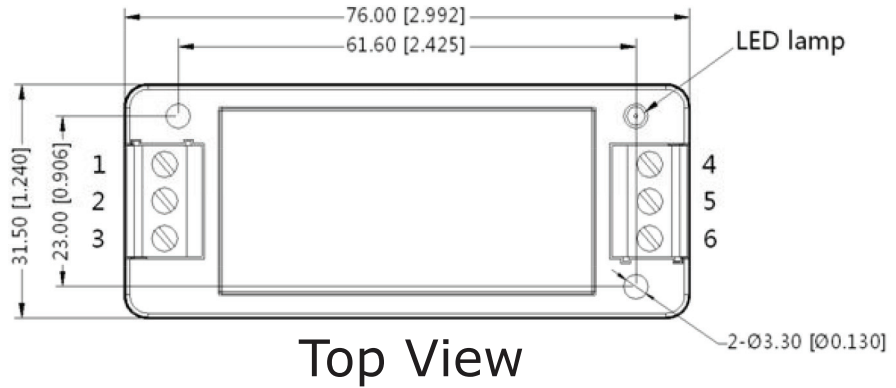
## MECHANICAL DRAWING

### CHASSIS MOUNT

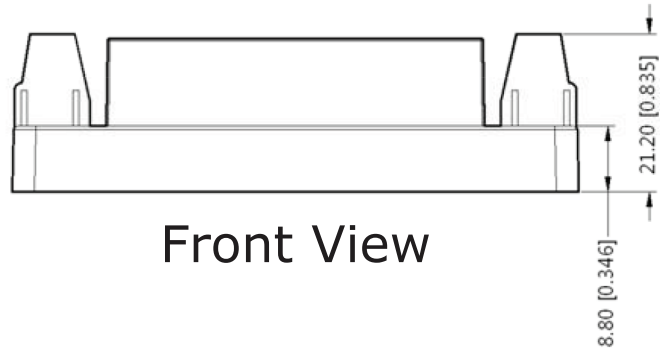
units: mm[inch]  
tolerance:  $\pm 0.50[\pm 0.020]$

wire range: 24~12 AWG

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



Top View



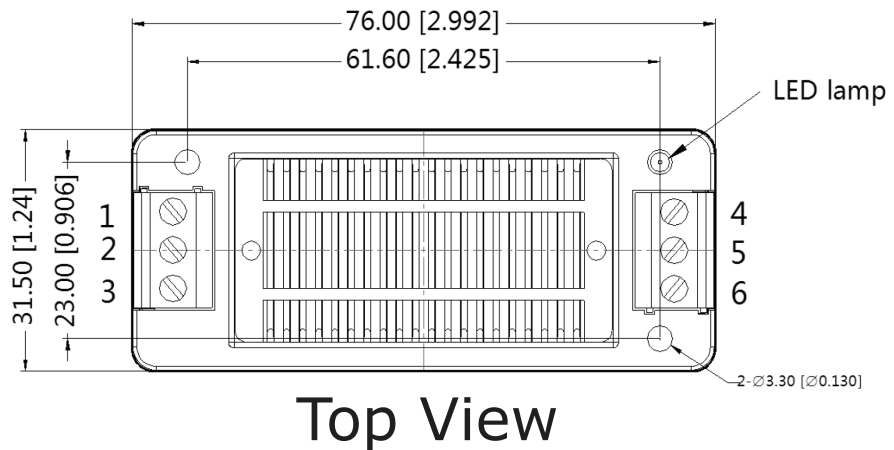
Front View

### CHASSIS MOUNT WITH HEATSINK

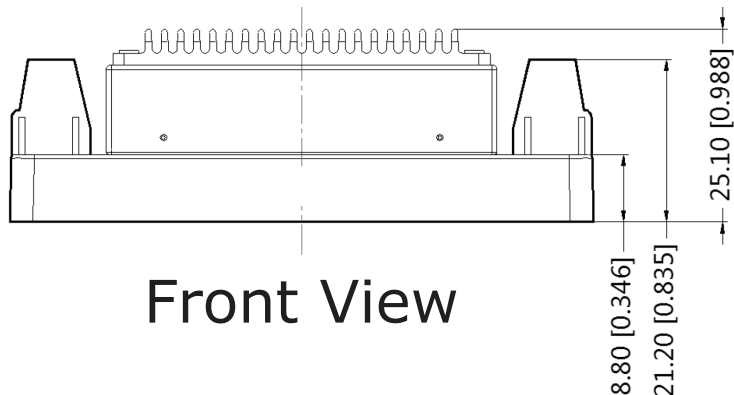
units: mm[inch]  
tolerance:  $\pm 0.50[\pm 0.020]$

wire range: 24~12 AWG

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

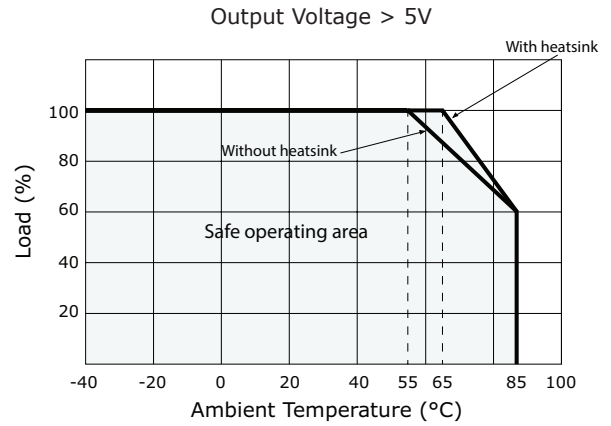
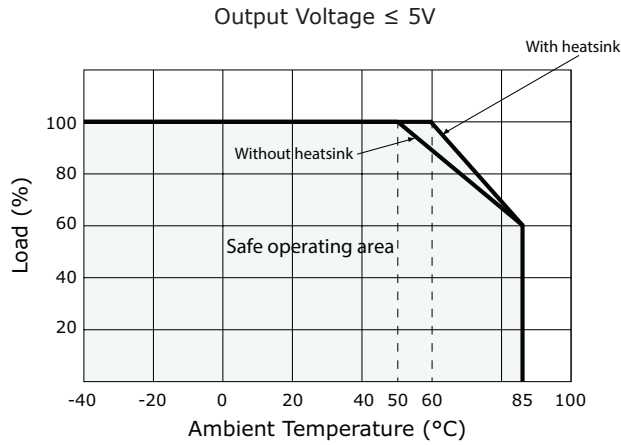


Top View



Front View

## DERATING CURVES



## EMC RECOMMENDED CIRCUIT

Figure 1

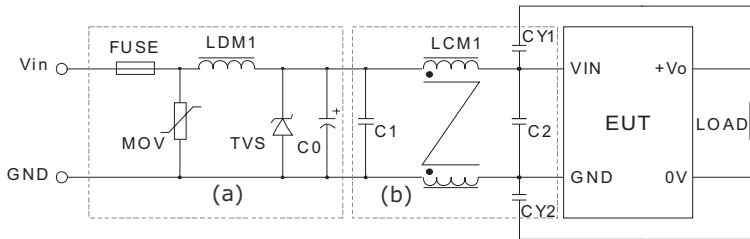


Table 1

| Recommended external circuit components |                                   |                  |
|---|-----------------------------------|------------------|
| Vin (Vdc)                               | 24                                | 48               |
| FUSE                                    | choose according to input current |                  |
| MOV                                     | S14K35                            | S14K60           |
| LDM1                                    | 56 $\mu$ H                        | 56 $\mu$ H       |
| TVS                                     | SMCJ48A                           | SMCJ90A          |
| C0                                      | 330 $\mu$ F/50V                   | 330 $\mu$ F/100V |
| C1, C2                                  | 4.7 $\mu$ F/50V                   | 2.2 $\mu$ F/100V |
| LCM1                                    | 1mH                               | 1mH              |
| CY1, CY2                                | 1nF/2kV                           | 1nF/2kV          |

## TEST CONFIGURATION

Figure 2

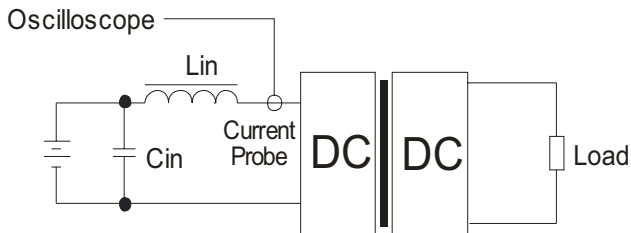


Table 2

| External components |  |
|---------------------|--|
| Lin                 | 4.7 $\mu$ H                                |
| Cin                 | 220 $\mu$ F, ESR < 1.0 $\Omega$ at 100 kHz |

Note: 1. Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.

## APPLICATION NOTES

### 1. Requirement on output load

To ensure this module can operate efficiently and reliably, the minimum output load cannot be less than 10% of the full load during operation. If the actual output power is small, please connect a resistor at the output end in parallel to increase the load.

### 2. Recommended circuit

This series has been tested according to the following recommended testing circuit before leaving the factory. This series should be tested under load (see Figure 3). If you want to further decrease the input/output ripple, you can increase capacitance properly or choose capacitors with low ESR (see Table 3). However, the capacitance must not exceed the maximum capacitive load or a start-up problem might arise (see Table 4).

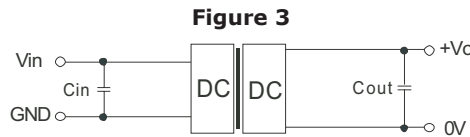


Figure 3

Table 3

| Vout (Vdc) | Cin (μF) | Cout (μF) |
|------------|----------|-----------|
| 3.3        | 100      | 220       |
| 5          | 100      | 220       |
| 9          | 100      | 100       |
| 12         | 100      | 100       |
| 15         | 100      | 100       |
| 24         | 100      | 47        |

Table 4

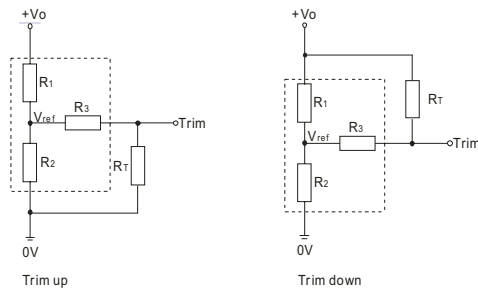
| Vout (Vdc) | Max. Capacitive Load (μF) |
|------------|---------------------------|
| 3.3        | 6800                      |
| 5          | 6800                      |
| 9          | 680                       |
| 12         | 680                       |
| 15         | 680                       |
| 24         | 470                       |

### 3. Output Voltage Trimming

Leave open if not used.

Figure 4

Application Circuit for Trim Pin  
(part in broken line is the interior of models)



Formula for Trim Resistor

$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \quad a = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \quad a = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$$

Note: Value for R1, R2, R3, and Vref (see Table 5)

R<sub>T</sub>: Trim Resistor

a: User-defined parameter, no actual meanings

V<sub>o'</sub>: The trim up/down voltage

Table 5

| Vout (Vdc) | R1 (kΩ) | R2 (kΩ) | R3 (kΩ) | Vref (V) |
|------------|---------|---------|---------|----------|
| 3.3        | 4.801   | 2.863   | 12      | 1.24     |
| 5          | 2.883   | 2.864   | 10      | 2.5      |
| 9          | 7.5     | 2.864   | 15      | 2.5      |
| 12         | 10.971  | 2.864   | 15      | 2.5      |
| 15         | 14.497  | 2.864   | 15      | 2.5      |
| 24         | 24.872  | 2.863   | 20      | 2.5      |

Notes: 1. Minimum load shouldn't be less than 10%, otherwise ripple may increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specifications listed.  
2. Maximum capacitive load is tested at input voltage range and full load.  
3. All specifications are measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.

## REVISION HISTORY

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| rev. | description     | date       |
|------|-----------------|------------|
| 1.0  | initial release | 07/08/2014 |

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



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