

## SERIES: PQM1-M | DESCRIPTION: DC-DC CONVERTER

### FEATURES

- 1 W isolated output
- smaller package
- single regulated output
- 1,500 Vdc isolation
- continuous short circuit protection
- extended temperature range (-40~85°C)
- high efficiency at light load
- efficiency up to 75%
- designed to meet EN/BS EN 62368-1

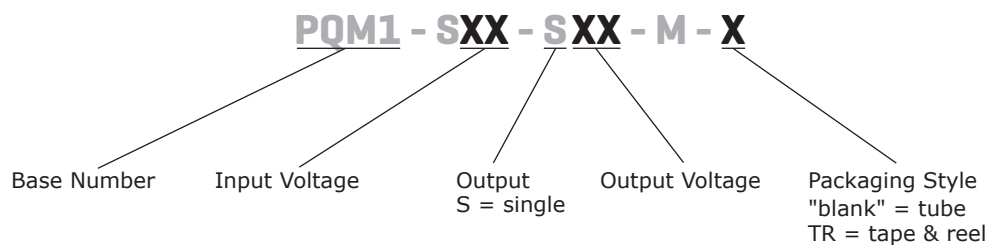


### MODEL

| MODEL           | input voltage |             | output voltage | output current |          | output power | ripple and noise <sup>1</sup> | efficiency |
|-----------------|---------------|-------------|----------------|----------------|----------|--------------|-------------------------------|------------|
|                 | typ (Vdc)     | range (Vdc) | (Vdc)          | min (mA)       | max (mA) | max (W)      | typ (mVp-p)                   | typ (%)    |
| PQM1-S5-S3-M*   | 5             | 4.75~5.25   | 3.3            | 25             | 243      | 0.8          | 50                            | 58         |
| PQM1-S5-S5-M*   | 5             | 4.75~5.25   | 5              | 20             | 200      | 1            | 50                            | 72         |
| PQM1-S5-S9-M*   | 5             | 4.75~5.25   | 9              | 12             | 111      | 1            | 50                            | 74         |
| PQM1-S5-S12-M*  | 5             | 4.75~5.25   | 12             | 9              | 84       | 1            | 50                            | 73         |
| PQM1-S5-S15-M*  | 5             | 4.75~5.25   | 15             | 7              | 67       | 1            | 50                            | 74         |
| PQM1-S12-S5-M*  | 12            | 11.4~12.6   | 5              | 20             | 200      | 1            | 50                            | 73         |
| PQM1-S12-S9-M   | 12            | 11.4~12.6   | 9              | 12             | 111      | 1            | 50                            | 74         |
| PQM1-S12-S12-M* | 12            | 11.4~12.6   | 12             | 9              | 84       | 1            | 50                            | 73         |
| PQM1-S12-S15-M* | 12            | 11.4~12.6   | 15             | 7              | 67       | 1            | 50                            | 75         |
| PQM1-S24-S5-M*  | 24            | 22.8~25.2   | 5              | 20             | 200      | 1            | 50                            | 65         |
| PQM1-S24-S9-M   | 24            | 22.8~25.2   | 9              | 12             | 111      | 1            | 50                            | 74         |
| PQM1-S24-S12-M* | 24            | 22.8~25.2   | 12             | 9              | 84       | 1            | 50                            | 73         |
| PQM1-S24-S15-M* | 24            | 22.8~25.2   | 15             | 7              | 67       | 1            | 50                            | 74         |

Note: 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.  
2. \* Discontinued model.

### PART NUMBER KEY



## INPUT

| parameter               | conditions/description  | min  | typ | max  | units |
|-------------------------|-------------------------|------|-----|------|-------|
| operating input voltage | 5 Vdc input models      | 4.75 | 5   | 5.25 | Vdc   |
|                         | 12 Vdc input models     | 11.4 | 12  | 12.6 | Vdc   |
|                         | 24 Vdc input models     | 22.8 | 24  | 25.2 | Vdc   |
| surge voltage           | for maximum of 1 second |      |     |      |       |
|                         | 5 Vdc input models      | -0.7 |     | 9    | Vdc   |
|                         | 12 Vdc input models     | -0.7 |     | 18   | Vdc   |
|                         | 24 Vdc input models     | -0.7 |     | 30   | Vdc   |
| filter                  | capacitance filter      |      |     |      |       |

## OUTPUT

| parameter               | conditions/description              | min | typ | max   | units |
|-------------------------|-------------------------------------|-----|-----|-------|-------|
| line regulation         | for Vin change of 1%                |     |     | ±0.25 | %     |
| load regulation         | measured from 10% load to full load |     |     |       |       |
|                         | 3.3 Vdc output models               |     | 3   |       | %     |
|                         | all other models                    |     | 1   |       | %     |
| voltage accuracy        | at 100% load                        |     |     | ±3    | %     |
| switching frequency     | at 100% load, nominal input voltage |     | 100 | 300   | kHz   |
| temperature coefficient | at 100% load                        |     |     | ±0.03 | %/°C  |

## PROTECTIONS

| parameter                | conditions/description         | min | typ | max | units |
|--------------------------|--------------------------------|-----|-----|-----|-------|
| short circuit protection | continuous, automatic recovery |     |     |     |       |

## SAFETY AND COMPLIANCE

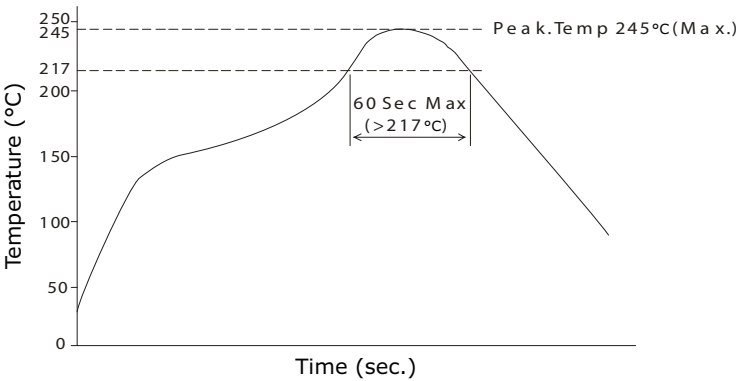
| parameter            | conditions/description                                            | min       | typ | max | units |
|----------------------|-------------------------------------------------------------------|-----------|-----|-----|-------|
| isolation voltage    | input to output for 1 minute at 1 mA max.                         | 1,500     |     |     | Vdc   |
| isolation resistance | input to output at 500 Vdc                                        | 1,000     |     |     | MΩ    |
| safety approvals     | designed to meet 62368-1: EN, BS EN                               |           |     |     |       |
| conducted emissions  | CISPR22/EN55022 class B (external circuit required, see Figure 1) |           |     |     |       |
| radiated emissions   | CISPR22/EN55022 class B (external circuit required, see Figure 1) |           |     |     |       |
| ESD                  | IEC/EN61000-4-2, class B, contact ± 8kV                           |           |     |     |       |
| MTBF                 | as per MIL-HDBK-217F @ 25°C                                       | 3,500,000 |     |     | hours |
| 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    |
| storage humidity      | non-condensing          |     |     | 95  | %     |
| temperature rise      | at full load, Ta = 25°C |     | 25  |     | °C    |

SOLDERABILITY

| parameter        | conditions/description          | min | typ | max | units |
|------------------|---------------------------------|-----|-----|-----|-------|
| hand soldering   | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |
| reflow soldering | see reflow soldering profile    |     |     | 245 | °C    |



MECHANICAL

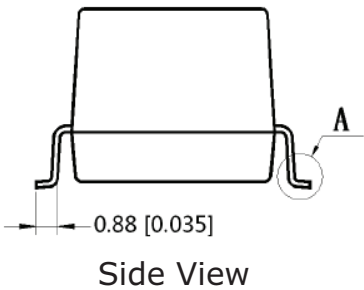
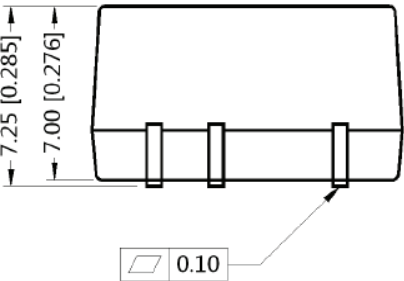
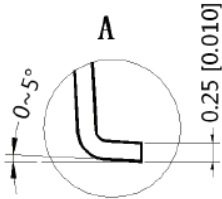
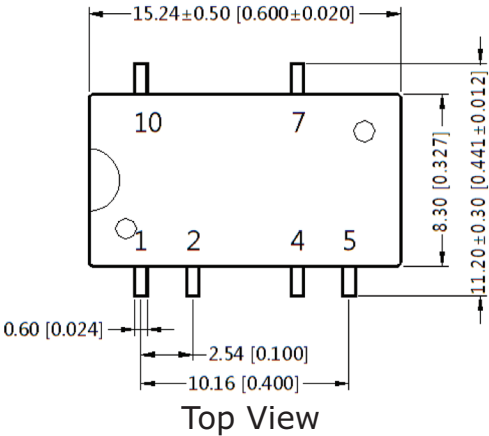
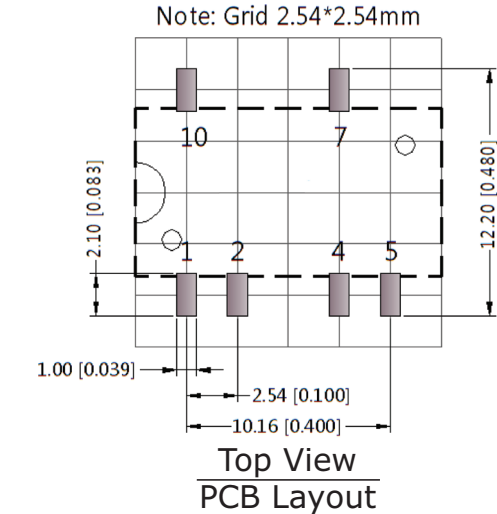
| parameter     | conditions/description                            | min | typ | max | units |
|---------------|---------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 15.24 x 11.20 x 7.25 (0.600 x 0.441 x 0.285 inch) |     |     |     | mm    |
| case material | epoxy resin (UL94-V0)                             |     |     |     |       |
| weight        |                                                   |     | 2.0 |     | g     |

MECHANICAL DRAWING

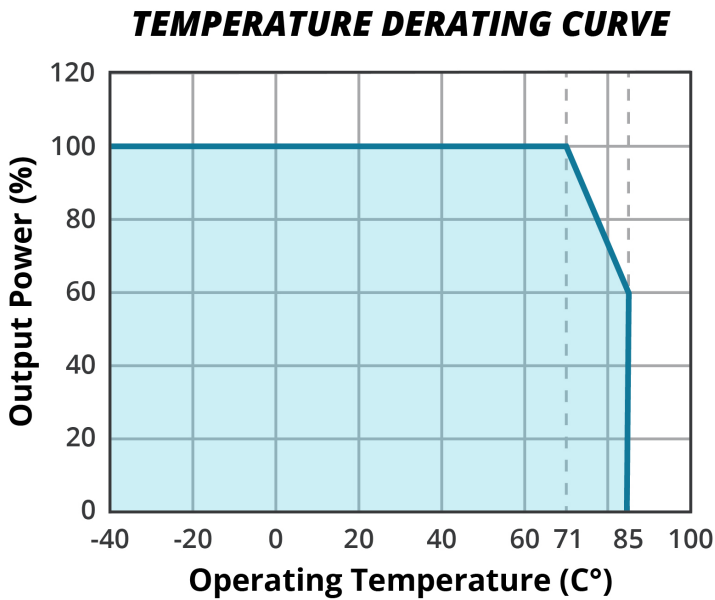
units: mm[inch]  
tolerance:  $\pm 0.25[\pm 0.010]$   
pin section tolerance:  $\pm 0.10[\pm 0.004]$

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | FUNCTION |
| 1               | GND      |
| 2               | Vin      |
| 4/5             | 0V       |
| 7               | +Vo      |
| 10              | NC       |

NC: No Connection



DERATING CURVE



EMC RECOMMENDED CIRCUIT

Figure 1

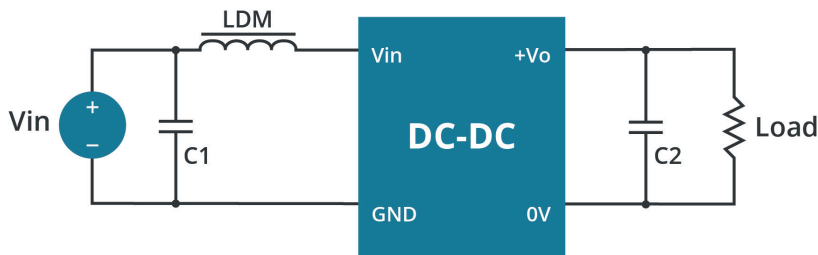


Table 1

| Recommended external circuit components |           |       |       |
|-----------------------------------------|-----------|-------|-------|
| Vout (Vdc)                              | C1        | C2    | LDM   |
| 3.3                                     | 4.7µF/50V | 10µF  | 6.8µH |
| 5                                       | 4.7µF/50V | 10µF  | 6.8µH |
| 9                                       | 4.7µF/50V | 4.7µF | 6.8µH |
| 12                                      | 4.7µF/50V | 2.2µF | 6.8µH |
| 15                                      | 4.7µF/50V | 1µF   | 6.8µH |

APPLICATION NOTES

1. **Output load requirement**  
To ensure this module can operate efficiently and reliably, the minimum output load may not be less than 10% of the full load during operation. If the actual output power is low, connect a resistor at the output end in parallel to increase the load.
2. **Overload Protection**  
Under normal operating conditions, the output circuit of this product has no protection against overload. The simplest method to add this is to add a circuit breaker to the circuit.
3. **Recommended circuit**  
If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR (see Figure 2 & Table 2). However, the capacitance of the output filter capacitor must be appropriate. If the capacitance is too high, a startup problem might arise. For every channel of the output, to ensure safe and reliable operation, the maximum capacitance must be less than the maximum capacitive load (see Table 3).

Figure 2

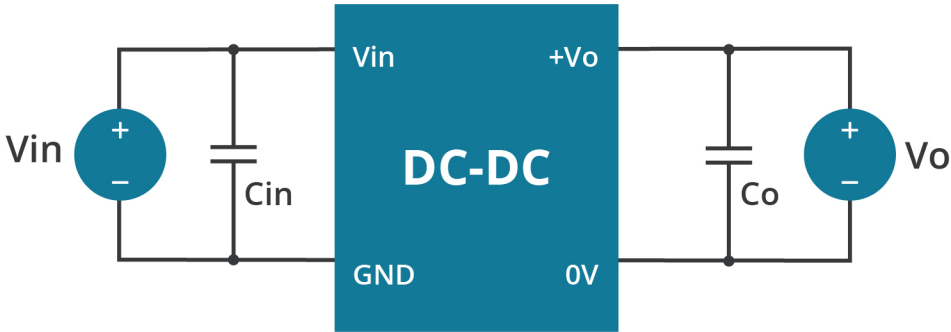


Table 2

| Vin<br>(Vdc) | Cin<br>(μF) | Vo<br>(Vdc) | Cout<br>(μF) |
|--------------|-------------|-------------|--------------|
| 5            | 4.7         | 3.3         | 10           |
| 12           | 2.2         | 5           | 10           |
| 24           | 1           | 9           | 4.7          |
| --           | --          | 12          | 2.2          |
| --           | --          | 15          | 1            |

Note: It's not recommended to connect any external capacitors in applications with less than 0.5 watt output.

Table 3

| Vout<br>(Vdc) | Max. Capacitive Load<br>(μF) |
|---------------|------------------------------|
| 3.3           | 220                          |
| 5             | 220                          |
| 9             | 220                          |
| 12            | 220                          |
| 15            | 220                          |

Note:

1. Operation under minimum load will not damage the converter; however, they may not meet all specifications listed.

2. Max. capacitive load tested at input voltage range and full load.

3. All specifications measured at: Ta=25°C, humidity<75%, nominal input voltage and rated output load, unless otherwise specified.

## REVISION HISTORY

| rev. | description                                                                                                               | date       |
|------|---------------------------------------------------------------------------------------------------------------------------|------------|
| 1.0  | initial release                                                                                                           | 04/08/2014 |
| 1.01 | safeties updated in features and safety approvals line                                                                    | 01/19/2021 |
| 1.02 | product image updated                                                                                                     | 05/19/2021 |
| 1.03 | updated derating curve and circuit figures                                                                                | 06/09/2021 |
| 1.04 | discontinued model PQM1-S5-S15-M                                                                                          | 09/08/2021 |
| 1.05 | efficiency updated for PQM1-S24-S5-M                                                                                      | 08/03/2022 |
| 1.06 | discontinued models PQM1-S5-S12-M, PQM1-S5-S3-M & PQM1-S5-S5-M                                                            | 11/11/2022 |
| 1.07 | CE removed                                                                                                                | 11/16/2022 |
| 1.08 | discontinued model PQM1-S12-S5-M                                                                                          | 02/02/2023 |
| 1.09 | discontinued model PQM1-S5-S5-M-TR                                                                                        | 07/11/2023 |
| 1.10 | discontinued model PQM1-S24-S12-M, PQM1-S24-S12-M-TR, PQM1-S24-S15-M, PQM1-S24-S15-M-TR, PQM1-S24-S5-M & PQM1-S24-S5-M-TR | 09/26/2023 |
| 1.11 | discontinued model PQM1-S12-S12-M, PQM1-S12-S12-M-TR, PQM1-S12-S15-M, PQM1-S12-S15-M-TR, PQM1-S5-S9-M & PQM1-S5-S9-M-TR   | 01/12/2024 |
| 1.12 | discontinued model PQM1-S5-S15-M-TR                                                                                       | 07/23/2024 |

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



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