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%

MODEL

<table>
<thead>
<tr>
<th>MODEL</th>
<th>input voltage typ (Vdc)</th>
<th>input voltage range (Vdc)</th>
<th>output voltage (Vdc)</th>
<th>output current min (mA)</th>
<th>output current max (mA)</th>
<th>output power max (W)</th>
<th>ripple and noise1 typ (mVp-p)</th>
<th>efficiency typ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQM1-S5-S3-M</td>
<td>5</td>
<td>4.75~5.25</td>
<td>3.3</td>
<td>25</td>
<td>243</td>
<td>0.8</td>
<td>50</td>
<td>58</td>
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<td>PQM1-S5-S5-M</td>
<td>5</td>
<td>4.75~5.25</td>
<td>5</td>
<td>20</td>
<td>200</td>
<td>1</td>
<td>50</td>
<td>72</td>
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<td>PQM1-S5-S9-M</td>
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<td>4.75~5.25</td>
<td>9</td>
<td>12</td>
<td>111</td>
<td>1</td>
<td>50</td>
<td>74</td>
</tr>
<tr>
<td>PQM1-S5-S12-M</td>
<td>5</td>
<td>4.75~5.25</td>
<td>12</td>
<td>9</td>
<td>84</td>
<td>1</td>
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<td>73</td>
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<tr>
<td>PQM1-S5-S15-M</td>
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<td>4.75~5.25</td>
<td>15</td>
<td>7</td>
<td>67</td>
<td>1</td>
<td>50</td>
<td>74</td>
</tr>
<tr>
<td>PQM1-S12-S5-M</td>
<td>12</td>
<td>11.4~12.6</td>
<td>5</td>
<td>20</td>
<td>200</td>
<td>1</td>
<td>50</td>
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<tr>
<td>PQM1-S12-S9-M</td>
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<td>11.4~12.6</td>
<td>9</td>
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<tr>
<td>PQM1-S12-S12-M</td>
<td>12</td>
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<td>9</td>
<td>84</td>
<td>1</td>
<td>50</td>
<td>73</td>
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<tr>
<td>PQM1-S12-S15-M</td>
<td>12</td>
<td>11.4~12.6</td>
<td>15</td>
<td>7</td>
<td>67</td>
<td>1</td>
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<td>75</td>
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<tr>
<td>PQM1-S24-S5-M</td>
<td>24</td>
<td>22.8~25.2</td>
<td>5</td>
<td>20</td>
<td>200</td>
<td>1</td>
<td>50</td>
<td>73</td>
</tr>
<tr>
<td>PQM1-S24-S9-M</td>
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<td>22.8~25.2</td>
<td>9</td>
<td>12</td>
<td>111</td>
<td>1</td>
<td>50</td>
<td>74</td>
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<tr>
<td>PQM1-S24-S12-M</td>
<td>24</td>
<td>22.8~25.2</td>
<td>12</td>
<td>9</td>
<td>84</td>
<td>1</td>
<td>50</td>
<td>73</td>
</tr>
<tr>
<td>PQM1-S24-S15-M</td>
<td>24</td>
<td>22.8~25.2</td>
<td>15</td>
<td>7</td>
<td>67</td>
<td>1</td>
<td>50</td>
<td>74</td>
</tr>
</tbody>
</table>

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.

PART NUMBER KEY

PQM1 - SXX - SXX - M - X

- Base Number
- Input Voltage
- Output Voltage S = single
- Output Voltage
- Packaging Style “blank” = tube
  TR = tape & reel

Additional Resources: Product Page | 3D Model | PCB Footprint
### INPUT

<table>
<thead>
<tr>
<th>parameter</th>
<th>conditions/description</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>operating input voltage</td>
<td>5 Vdc input models</td>
<td>4.75</td>
<td>5</td>
<td>5.25</td>
<td>Vdc</td>
</tr>
<tr>
<td></td>
<td>12 Vdc input models</td>
<td>11.4</td>
<td>12</td>
<td>12.6</td>
<td>Vdc</td>
</tr>
<tr>
<td></td>
<td>24 Vdc input models</td>
<td>22.8</td>
<td>24</td>
<td>25.2</td>
<td>Vdc</td>
</tr>
<tr>
<td>surge voltage</td>
<td>for maximum of 1 second</td>
<td>-0.7</td>
<td>9</td>
<td></td>
<td>Vdc</td>
</tr>
<tr>
<td></td>
<td>5 Vdc input models</td>
<td>-0.7</td>
<td>18</td>
<td></td>
<td>Vdc</td>
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<tr>
<td></td>
<td>12 Vdc input models</td>
<td>-0.7</td>
<td>30</td>
<td></td>
<td>Vdc</td>
</tr>
<tr>
<td>filter</td>
<td>capacitance filter</td>
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### OUTPUT

<table>
<thead>
<tr>
<th>parameter</th>
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<th>typ</th>
<th>max</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>line regulation</td>
<td>for Vin change of 1%</td>
<td>±0.25</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>load regulation</td>
<td>measured from 10% load to full load</td>
<td>3</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>3.3 Vdc output models</td>
<td>1</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>all other models</td>
<td></td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>voltage accuracy</td>
<td>at 100% load</td>
<td>±3</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>switching frequency</td>
<td>at 100% load, nominal input voltage</td>
<td>100</td>
<td>300</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>temperature coefficient</td>
<td>at 100% load</td>
<td>±0.03</td>
<td></td>
<td></td>
<td>%/°C</td>
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### PROTECTIONS

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<th>units</th>
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<tbody>
<tr>
<td>short circuit protection</td>
<td>continuous, automatic recovery</td>
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### SAFETY AND COMPLIANCE

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<th>typ</th>
<th>max</th>
<th>units</th>
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</thead>
<tbody>
<tr>
<td>isolation voltage</td>
<td>input to output for 1 minute at 1 mA max.</td>
<td>1,500</td>
<td></td>
<td></td>
<td>Vdc</td>
</tr>
<tr>
<td>isolation resistance</td>
<td>input to output at 500 Vdc</td>
<td>1,000</td>
<td></td>
<td></td>
<td>MΩ</td>
</tr>
<tr>
<td>conducted emissions</td>
<td>CISPR22/EN55022 class B (external circuit required, see Figure 1)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>radiated emissions</td>
<td>CISPR22/EN55022 class B (external circuit required, see Figure 1)</td>
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<td></td>
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<tr>
<td>ESD</td>
<td>IEC/EN61000-4-2, class B, contact ± 8kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTBF</td>
<td>as per MIL-HDBK-217F @ 25°C</td>
<td>3,500,000</td>
<td></td>
<td></td>
<td>hours</td>
</tr>
<tr>
<td>RoHS</td>
<td>2011/65/EU</td>
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### ENVIRONMENTAL

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<th>units</th>
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</thead>
<tbody>
<tr>
<td>operating temperature</td>
<td>see derating curve</td>
<td>-40</td>
<td>85</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>storage temperature</td>
<td></td>
<td>-55</td>
<td>125</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>storage humidity</td>
<td>non-condensing</td>
<td></td>
<td></td>
<td>95</td>
<td>%</td>
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<tr>
<td>temperature rise</td>
<td>at full load, Ta = 25°C</td>
<td></td>
<td></td>
<td>25</td>
<td>°C</td>
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SOLDERABILITY

<table>
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<th>min</th>
<th>typ</th>
<th>max</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>hand soldering</td>
<td>1.5 mm from case for 10 seconds</td>
<td>300</td>
<td></td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>reflow soldering</td>
<td>see reflow soldering profile</td>
<td>245</td>
<td></td>
<td></td>
<td>°C</td>
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MECHANICAL

<table>
<thead>
<tr>
<th>parameter</th>
<th>conditions/description</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>dimensions</td>
<td>15.24 x 11.20 x 7.25 (0.600 x 0.441 x 0.285 inch)</td>
<td></td>
<td></td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>case material</td>
<td>epoxy resin (UL94-V0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weight</td>
<td></td>
<td>2.0</td>
<td></td>
<td></td>
<td>g</td>
</tr>
</tbody>
</table>

MECHANICAL DRAWING

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

- NC: No Connection

Note: Grid 2.54*2.54mm

Top View
- 15.24±0.50 [0.600±0.020]
- 10.16±0.400 [0.400]

Top View
- 2.54 [0.100]
- 1.00 [0.039]

Top View
- 12.20 [0.480]
- 2.10 [0.083]

Front View
- 2.54 [0.100]
- 10.16 [0.400]

Side View
- 7.25 [0.285]
- 7.00 [0.276]

- Note: Grid 2.54*2.54mm
- 0.60 [0.024]
- 0.50 [0.020]
- 2.54 [0.100]
- 1.00 [0.039]
DERATING CURVE

Temperature Derating Curve

![Temperature Derating Curve](image)

EMC RECOMMENDED CIRCUIT

**Figure 1**

![DC-DC Converter Circuit](image)

**Table 1**

<table>
<thead>
<tr>
<th>Vout (Vdc)</th>
<th>C1</th>
<th>C2</th>
<th>LDM</th>
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<tbody>
<tr>
<td>3.3</td>
<td>4.7μF/50V</td>
<td>10μF</td>
<td>6.8μH</td>
</tr>
<tr>
<td>5</td>
<td>4.7μF/50V</td>
<td>10μF</td>
<td>6.8μH</td>
</tr>
<tr>
<td>9</td>
<td>4.7μF/50V</td>
<td>4.7μF</td>
<td>6.8μH</td>
</tr>
<tr>
<td>12</td>
<td>4.7μF/50V</td>
<td>2.2μF</td>
<td>6.8μH</td>
</tr>
<tr>
<td>15</td>
<td>4.7μF/50V</td>
<td>1μF</td>
<td>6.8μH</td>
</tr>
</tbody>
</table>
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](image)

<table>
<thead>
<tr>
<th>Vin (Vdc)</th>
<th>Cin (μF)</th>
<th>Vo (Vdc)</th>
<th>Cout (μF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4.7</td>
<td>3.3</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>2.2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>9</td>
<td>4.7</td>
</tr>
<tr>
<td>--</td>
<td>--</td>
<td>12</td>
<td>2.2</td>
</tr>
<tr>
<td>--</td>
<td>--</td>
<td>15</td>
<td>1</td>
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</table>

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

---

### Table 2

<table>
<thead>
<tr>
<th>Vout (Vdc)</th>
<th>Max. Capacitive Load (μF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>220</td>
</tr>
<tr>
<td>5</td>
<td>220</td>
</tr>
<tr>
<td>9</td>
<td>220</td>
</tr>
<tr>
<td>12</td>
<td>220</td>
</tr>
<tr>
<td>15</td>
<td>220</td>
</tr>
</tbody>
</table>

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

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<thead>
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<th>rev.</th>
<th>description</th>
<th>date</th>
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<tbody>
<tr>
<td>1.0</td>
<td>initial release</td>
<td>04/08/2014</td>
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The revision history provided is for informational purposes only and is believed to be accurate.