DC/DC Converter

TMR 9 Series, 9 Watt

- Highest power density in SIP-8 metal package (optional plastic package)
- Wide 2:1 input voltage range
- Temperature range –40° to +85°C
- High efficiency up to 89%
- Indefinite short-circuit protection
- I/O isolation 1600 VDC
- Remote On/Off control
- Fully RoHS compliant
- 3-year product warranty

The TMR 9 series is a new family of isolated 9W DC/DC converter modules with regulated output, featuring wide 2:1 input voltage ranges. The product comes in a ultra-compact SIP-8 metal package with a small footprint occupying only 2.0 cm² (0.3 square inch) of board space. An excellent efficiency allows –40° to +60°C operation temperatures without derating. Further features include remote On/Off control and continuous short circuit protection. The very compact dimensions of these converters make them an ideal solution for many space critical applications in communication equipment, instrumentation and industrial electronics.

### Models

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vnom</td>
<td>I_max</td>
<td>Vnom</td>
<td>I_max</td>
</tr>
<tr>
<td>TMR 9-1210</td>
<td>3.3 VDC</td>
<td>2000 mA</td>
<td>-5 VDC</td>
<td>800 mA</td>
</tr>
<tr>
<td>TMR 9-1211</td>
<td>5 VDC</td>
<td>1600 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-1219</td>
<td>9 VDC</td>
<td>1000 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-1212</td>
<td>12 VDC</td>
<td>750 mA</td>
<td>-5 VDC</td>
<td>800 mA</td>
</tr>
<tr>
<td>TMR 9-1213</td>
<td>15 VDC</td>
<td>600 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-1215</td>
<td>24 VDC</td>
<td>375 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-1221</td>
<td>+5 VDC</td>
<td>800 mA</td>
<td>-10 VDC</td>
<td>400 mA</td>
</tr>
<tr>
<td>TMR 9-1222</td>
<td>+12 VDC</td>
<td>375 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-1223</td>
<td>+15 VDC</td>
<td>300 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-2410</td>
<td>3.3 VDC</td>
<td>2000 mA</td>
<td>-5 VDC</td>
<td>800 mA</td>
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<tr>
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</tr>
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<tr>
<td>TMR 9-2412</td>
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<td>800 mA</td>
</tr>
<tr>
<td>TMR 9-2413</td>
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<td>600 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-2415</td>
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<td>375 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-2421</td>
<td>+5 VDC</td>
<td>800 mA</td>
<td>-10 VDC</td>
<td>400 mA</td>
</tr>
<tr>
<td>TMR 9-2422</td>
<td>+12 VDC</td>
<td>375 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-2423</td>
<td>+15 VDC</td>
<td>300 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-4810</td>
<td>3.3 VDC</td>
<td>2000 mA</td>
<td>-5 VDC</td>
<td>800 mA</td>
</tr>
<tr>
<td>TMR 9-4811</td>
<td>5 VDC</td>
<td>1600 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-4819</td>
<td>9 VDC</td>
<td>1000 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-4812</td>
<td>12 VDC</td>
<td>750 mA</td>
<td>-5 VDC</td>
<td>800 mA</td>
</tr>
<tr>
<td>TMR 9-4813</td>
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<td>600 mA</td>
<td>-12 VDC</td>
<td>375 mA</td>
</tr>
<tr>
<td>TMR 9-4815</td>
<td>24 VDC</td>
<td>375 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>TMR 9-4821</td>
<td>+5 VDC</td>
<td>800 mA</td>
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<td>300 mA</td>
<td>-15 VDC</td>
<td>300 mA</td>
</tr>
</tbody>
</table>

### Options
- on demand (backorder with MOQ)
  - models with plastic case
- non stocking item

www.tracopower.com
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### Input Specifications

**Input Current**
- At no load
  - 12 Vin models: 11 mA typ.
  - 24 Vin models: 7 mA typ.
  - 48 Vin models: 3 mA typ.

**Surge Voltage**
- 12 Vin models: 36 VDC max. (1 s max)
- 24 Vin models: 50 VDC max. (1 s max)
- 48 Vin models: 100 VDC max. (1 s max)

**Recommended Input Fuse**
- 12 Vin models: 3'150 mA (slow blow)
- 24 Vin models: 2'500 mA (slow blow)
- 48 Vin models: 1'250 mA (slow blow)

*(The need of an external fuse has to be assessed in the final application)*

**Input Filter**
- Internal Capacitor

### Output Specifications

**Voltage Set Accuracy**
- ±1% max.

**Regulation**
- Input Variation (Vmin - Vmax)
  - single output models: 0.2% max.
  - dual output models: 0.2% max.
- Load Variation
  - single output models: 1% max.
  - dual output models: 1% max. (Output 1)
  - 1% max. (Output 2)
- Cross Regulation
  - (25% / 100% asym. load)
  - dual output models: 5% max.

**Ripple and Noise**
- (20 MHz Bandwidth)
  - single output
    - 3.3 Vout models: 50 mVp-p typ. (w/ 1 µF X7R)
    - 5 Vout models: 50 mVp-p typ. (w/ 1 µF X7R)
    - 9 Vout models: 50 mVp-p typ. (w/ 1 µF X7R)
    - 12 Vout models: 25 mVp-p typ. (w/ 1 µF X7R)
    - 15 Vout models: 15 mVp-p typ. (w/ 1 µF X7R)
    - 24 Vout models: 10 mVp-p typ. (w/ 1 µF X7R)
  - dual output
    - 5 / -5 Vout models: 50 / 50 mVp-p typ. (w/ 1 µF X7R)
    - 12 / -12 Vout models: 75 / 75 mVp-p typ. (w/ 1 µF X7R)
    - 15 / -15 Vout models: 75 / 75 mVp-p typ. (w/ 1 µF X7R)

**Capacitive Load**
- single output
  - 3.3 Vout models: 2'600 µF max.
  - 5 Vout models: 1'300 µF max.
  - 9 Vout models: 800 µF max.
  - 12 Vout models: 560 µF max.
  - 15 Vout models: 560 µF max.
  - 24 Vout models: 200 µF max.
- dual output
  - 5 / -5 Vout models: 800 / 800 µF max.
  - 12 / -12 Vout models: 390 / 390 µF max.
  - 15 / -15 Vout models: 200 / 200 µF max.

**Minimum Load**
- Not required

**Temperature Coefficient**
- ±0.02 %/K max.

**Start-up Time**
- 50 ms typ.

**Short Circuit Protection**
- Continuous, Automatic recovery

**Output Current Limitation**
- 180% typ. of Iout max.

**Transient Response**
- Response Time
  - 250 µs typ. (25% Load Step)

### Safety Specifications

**Safety Standards**
- IT / Multimedia Equipment
  - EN 60950-1
  - IEC 60950-1
  - UL 60950-1
  - www.tracopower.com/overview/tmr9

**Pollution Degree**
- PD 2

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.
# TRACO POWER

## TMR 9 Series, 9 Watt

### EMC Specifications

<table>
<thead>
<tr>
<th>EMI Emissions</th>
<th>Conducted Emissions</th>
<th>EN 55032 class A (with external filter)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radiated Emissions</td>
<td>EN 55032 class B (with external filter)</td>
</tr>
</tbody>
</table>

**External filter proposal:** [www.tracopower.com/overview/tmr9](http://www.tracopower.com/overview/tmr9)

<table>
<thead>
<tr>
<th>EMS Immunity</th>
<th>Electrostatic Discharge</th>
<th>Air: EN 61000-4-2, ±8 kV, perf. criteria A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RF Electromagnetic Field</td>
<td>Contact: EN 61000-4-2, ±6 kV, perf. criteria A</td>
</tr>
<tr>
<td></td>
<td>EFT (Burst) / Surge</td>
<td>EN 61000-4-3, 20 V/m, perf. criteria A</td>
</tr>
</tbody>
</table>

**Ext. input component:**
- 24 Vin models: KY 220 µF // SMDJ70A
- 48 Vin models: KY 220 µF // SMDJ120A

| Conducted RF Disturbances | EN 61000-4-6, 10 Vrms, perf. criteria A |
| PF Magnetic Field        | Continuous: EN 61000-4-8, 100 A/m, perf. criteria A |

### General Specifications

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>95% max. (non condensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Ranges</td>
<td>- Operating Temperature: -40°C to +85°C</td>
</tr>
<tr>
<td></td>
<td>- Case Temperature: +100°C max.</td>
</tr>
<tr>
<td></td>
<td>- Storage Temperature: -55°C to +125°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Derating</th>
<th>High Temperature</th>
<th>See application note: <a href="http://www.tracopower.com/overview/tmr9">www.tracopower.com/overview/tmr9</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Control</td>
<td>- Voltage Controlled Remote</td>
<td>On: 0 to 0.5 VDC or open circuit</td>
</tr>
<tr>
<td></td>
<td>- Off Idle Input Current</td>
<td>Off: 3 to 12 VDC</td>
</tr>
<tr>
<td></td>
<td>Off: 2.5 mA max.</td>
<td></td>
</tr>
</tbody>
</table>

| Switching Frequency | 400 kHz typ. (PWM) (single output models)  |
|                    | 500 kHz typ. (PWM) (dual output models)  |

<table>
<thead>
<tr>
<th>Insulation System</th>
<th>Functional Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation Test Voltage</td>
<td>- Input to Output, 60 s: 1'600 VDC</td>
</tr>
<tr>
<td></td>
<td>- Input to Case, 60 s: 1'000 VDC</td>
</tr>
<tr>
<td>Isolation Resistance</td>
<td>- Input to Output, 500 VDC: 1'000 MΩ min.</td>
</tr>
<tr>
<td>Isolation Capacitance</td>
<td>- Input to Output, 100 kHz, 1 V: 50 pF max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability</th>
<th>- Calculated MTBF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2'940'000 h (for standard version)</td>
</tr>
<tr>
<td></td>
<td>2'700'000 h (for plastic version)</td>
</tr>
<tr>
<td></td>
<td>(MIL-HDBK-217F, ground benign)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
<th>- Vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIL-STD-810F</td>
</tr>
<tr>
<td></td>
<td>- Thermal Shock</td>
</tr>
<tr>
<td></td>
<td>MIL-STD-810F</td>
</tr>
</tbody>
</table>

| Housing Material | Copper (for standard version) |
|                 | Non-conductive plastic (for plastic version) |

| Potting Material | Silicone (UL 94 V-0 rated) |

| Pin Material | Copper |

| Pin Foundation Plating | Nickel (2 – 3 µm) |
| Pin Surface Plating | Tin (3 – 5 µm), matte |

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>THD (Through-Hole Device)</th>
</tr>
</thead>
</table>

| Weight | 5.9 g (for standard version) |
|        | 4.8 g (for plastic version) |

<table>
<thead>
<tr>
<th>Environmental Compliance</th>
<th>Reach</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RoHS</td>
</tr>
</tbody>
</table>

### Supporting Documents

- **Overview Link** (for additional Documents): [www.tracopower.com/overview/tmr9](http://www.tracopower.com/overview/tmr9)

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.
Outline Dimensions

Metal package (standard)

Dimensions in mm (inch)

Tolerances:
- ±0.5 (±0.02)
- Pin pitch Tolerance   ±0.25 (±0.01)

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single Output</th>
<th>Dual Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>−Vin (GND)</td>
<td>−Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>3</td>
<td>Remote</td>
<td>Remote</td>
</tr>
<tr>
<td>6</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>7</td>
<td>−Vout</td>
<td>Common</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>−Vout</td>
</tr>
<tr>
<td>9</td>
<td>Case</td>
<td>Case</td>
</tr>
<tr>
<td>10</td>
<td>Stand Off</td>
<td>Stand Off</td>
</tr>
<tr>
<td>11</td>
<td>Stand Off</td>
<td>Stand Off</td>
</tr>
<tr>
<td>12</td>
<td>Case</td>
<td>Case</td>
</tr>
</tbody>
</table>

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.
Plastic package (option)

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single Output</th>
<th>Dual Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>3</td>
<td>Remote</td>
<td>Remote</td>
</tr>
<tr>
<td>6</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>7</td>
<td>–Vout</td>
<td>Common</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>–Vout</td>
</tr>
</tbody>
</table>

Dimensions in mm (inch)

- Tolerances: ±0.5 (±0.02)
- Pin pitch Tolerance: ±0.25 (±0.01)