DC/DC Converters
TRA 1 Series, 1 Watt

Features
◆ Semi-regulated output (load)
◆ Industry standard pinout
◆ High efficiency up to 88.5%
◆ Single and dual output models
◆ I/O isolation voltage 1000 VDC
◆ Operationally reliable up to 5’000m altitude
◆ Operating temperature range –40°C to +95°C
◆ 3-year product warranty

The TRA 1 series are miniature, I/O-isolated 1W DC/DC-converters with a semi load regulation. They are the ideal solution to power drivers and circuits where unregulated DC/DC converters do not meet the input voltage range at load change.

<table>
<thead>
<tr>
<th>Order code</th>
<th>Input voltage</th>
<th>Output voltage</th>
<th>Output current max.</th>
<th>Load regulation max.</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRA 1-0511</td>
<td>5 VDC ±10%</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>6.5 %</td>
<td>84 %</td>
</tr>
<tr>
<td>TRA 1-0519</td>
<td>9 VDC</td>
<td>100 mA</td>
<td>5 %</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-0512</td>
<td>12 VDC</td>
<td>84 mA</td>
<td>5.2 %</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-0513</td>
<td>15 VDC</td>
<td>67 mA</td>
<td>5 %</td>
<td>87.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-0521</td>
<td>±5 VDC</td>
<td>±100 mA</td>
<td>5.2 %</td>
<td>84.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-0522</td>
<td>±12 VDC</td>
<td>±42 mA</td>
<td>4.6 %</td>
<td>86.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-0523</td>
<td>±15 VDC</td>
<td>±34 mA</td>
<td>4.5 %</td>
<td>86.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-1211</td>
<td>5 VDC ±10%</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>5 %</td>
<td>84 %</td>
</tr>
<tr>
<td>TRA 1-1219</td>
<td>9 VDC</td>
<td>110 mA</td>
<td>3.4 %</td>
<td>86.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-1212</td>
<td>12 VDC</td>
<td>84 mA</td>
<td>3.4 %</td>
<td>88.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-1213</td>
<td>15 VDC</td>
<td>67 mA</td>
<td>2.7 %</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-1221</td>
<td>±5 VDC</td>
<td>±100 mA</td>
<td>3.9 %</td>
<td>84.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-1222</td>
<td>±12 VDC</td>
<td>±42 mA</td>
<td>2.9 %</td>
<td>88.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-1223</td>
<td>±15 VDC</td>
<td>±34 mA</td>
<td>2.6 %</td>
<td>87.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-2411</td>
<td>5 VDC ±10%</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>3.7 %</td>
<td>84 %</td>
</tr>
<tr>
<td>TRA 1-2419</td>
<td>9 VDC</td>
<td>110 mA</td>
<td>2.5 %</td>
<td>86.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-2412</td>
<td>12 VDC</td>
<td>84 mA</td>
<td>2.4 %</td>
<td>87.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-2413</td>
<td>15 VDC</td>
<td>67 mA</td>
<td>2.3 %</td>
<td>87.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-2421</td>
<td>±5 VDC</td>
<td>±100 mA</td>
<td>3.7 %</td>
<td>83.5 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-2422</td>
<td>±12 VDC</td>
<td>±42 mA</td>
<td>2.4 %</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>TRA 1-2423</td>
<td>±15 VDC</td>
<td>±34 mA</td>
<td>2.3 %</td>
<td>87 %</td>
<td></td>
</tr>
</tbody>
</table>
### Input Specifications

<table>
<thead>
<tr>
<th>Input current no load / full load</th>
<th>5 Vin models</th>
<th>12 Vin models</th>
<th>24 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 mA / 240 mA typ.</td>
<td>12 mA / 100 mA typ.</td>
<td>11 mA / 50 mA typ.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surge voltage (1 s max.)</th>
<th>5 Vin models</th>
<th>12 Vin models</th>
<th>24 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9 V max.</td>
<td>18 V max.</td>
<td>30 V max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reflected input ripple current</th>
<th>12 Vin models</th>
<th>other models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 mA typ.</td>
<td>8 mA typ.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>internal capacitor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommended input fuse (slow blow type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Vin models</td>
</tr>
<tr>
<td>12 Vin models</td>
</tr>
<tr>
<td>24 Vin models</td>
</tr>
<tr>
<td>500 mA</td>
</tr>
<tr>
<td>200 mA</td>
</tr>
<tr>
<td>100 mA</td>
</tr>
</tbody>
</table>

### Output Specifications

<table>
<thead>
<tr>
<th>Voltage balance (dual output models, balanced loads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 % typ. / 1 % max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input variation (1 % change of Vin)</td>
</tr>
<tr>
<td>1.05 % typ. / 1.2 % max.</td>
</tr>
<tr>
<td>Load variation</td>
</tr>
<tr>
<td>see model table and graph 1 on page 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ripple and noise (20 MHz Bandwidth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 mVp-p max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>±0.01 %/K typ. / ±0.02 %/K max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>limited 0.5 s max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacitive load</th>
</tr>
</thead>
<tbody>
<tr>
<td>single output models: 220 µF max.</td>
</tr>
<tr>
<td>dual output models: 100 µF max. (each output)</td>
</tr>
</tbody>
</table>

### General Specifications

<table>
<thead>
<tr>
<th>Temperature ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
</tr>
<tr>
<td>-40°C to +95°C</td>
</tr>
<tr>
<td>Case temperature</td>
</tr>
<tr>
<td>+95°C max.</td>
</tr>
<tr>
<td>Storage</td>
</tr>
<tr>
<td>-50°C to +125°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Derating</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 %/K above +85°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity (non condensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 % rel H max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability, calculated MTBF (MIL-HDBK217F, at +25°C, ground benign)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2'000'000 h</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isolation voltage (60 s) Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'000 VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isolation capacitance Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 pF typ. / 120 pF max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isolation resistance Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1'000 MOhm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switching frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 to 120 kHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Altitude during operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 5'000 m approved</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety standards</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Safety approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB scheme</td>
</tr>
<tr>
<td>IEC 60950-1</td>
</tr>
<tr>
<td>CSA certification</td>
</tr>
<tr>
<td>UL 60950-1, CSA 60950-1-07</td>
</tr>
<tr>
<td>Certification documents</td>
</tr>
<tr>
<td><a href="http://www.tracopower.com/overview/tra1">www.tracopower.com/overview/tra1</a></td>
</tr>
</tbody>
</table>

All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.
### DC/DC Converters
#### TRA 1 Series 1 Watt

## Physical Specifications

**Casing material**
- Non-conductive plastic (UL 94V-0 rated)

**Weight**
- 5 & 12 Vin models: 2.2 g (0.07 oz)
- 24 Vin models: 2.6 g (0.09 oz)

**Soldering temperature**
- Max. 260°C, 10 s (1.5 mm from case)

**Environmental compliance**
- Reach
- RoHS
  - RoHS directive 2011/65/EU

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### Outline Dimensions

#### Pin-Out

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>2</td>
<td>-Vin (GND)</td>
<td>-Vin (GND)</td>
</tr>
<tr>
<td>4</td>
<td>-Vout</td>
<td>-Vout</td>
</tr>
<tr>
<td>5</td>
<td>No pin</td>
<td>Common</td>
</tr>
<tr>
<td>6</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
</tbody>
</table>

**Dimensions in [mm], () = Inch**
- Pin pitch tolerances: ±0.13 (±0.005)
- Case tolerances: ±0.25 (±0.01)

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### Supporting documents:
- [www.tracopower.com/overview/tra1](http://www.tracopower.com/overview/tra1)

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**Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)**