DC/DC Converter TES 1 Series, 1 Watt

- I/O isolation 1500 VDC
- Unregulated device
- Single and dual output models
- Input voltage 5, 12 and 24 VDC
- High efficiency up to 80%
- Operating temperature range –40°C to +90°C
- High accuracy of pin co-planarity
- Qualified for leadfree reflow solder process according IPC/JEDEC J-STD-020C
- Available in tape and reel package
- 3-year product warranty

With their small footprint these 1 Watt DC/DC converters are an ideal and economical solution for many applications where an isolated voltage is required. Typical applications are ground loop elimination, noise reduction, voltage isolation in digital interfaces and voltage conversion in distributed power systems. With a new package design these converters are qualified for the higher temperatures requested by lead-free reflow solder processes. For automated SMD production lines the devices can be supplied in standard tape and reel package.

### Models

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1 Vnom</th>
<th>Imax</th>
<th>Output 2 Vnom</th>
<th>Imax</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TES 1-0510</td>
<td>4.5 - 5.5 VDC (5 VDC nom.)</td>
<td>3.3 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>100 mA</td>
<td>73 %</td>
</tr>
<tr>
<td>TES 1-0511</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-0519</td>
<td>9 VDC</td>
<td>110 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-0512</td>
<td>12 VDC</td>
<td>84 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-0513</td>
<td>15 VDC</td>
<td>67 mA</td>
<td>79 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-0521</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>74 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-0522</td>
<td>+12 VDC</td>
<td>42 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-0523</td>
<td>+15 VDC</td>
<td>33 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-1211</td>
<td>10.8 - 13.2 VDC (12 VDC nom.)</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>-5 VDC</td>
<td>100 mA</td>
<td>76 %</td>
</tr>
<tr>
<td>TES 1-1219</td>
<td>9 VDC</td>
<td>110 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-1212</td>
<td>12 VDC</td>
<td>84 mA</td>
<td>79 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-1213</td>
<td>15 VDC</td>
<td>67 mA</td>
<td>80 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-1221</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>74 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-1222</td>
<td>+12 VDC</td>
<td>42 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-1223</td>
<td>+15 VDC</td>
<td>33 mA</td>
<td>79 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-2411</td>
<td>21.6 - 26.4 VDC (24 VDC nom.)</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>-5 VDC</td>
<td>100 mA</td>
<td>78 %</td>
</tr>
<tr>
<td>TES 1-2419</td>
<td>9 VDC</td>
<td>110 mA</td>
<td>77 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-2412</td>
<td>12 VDC</td>
<td>84 mA</td>
<td>77 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-2413</td>
<td>15 VDC</td>
<td>67 mA</td>
<td>79 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-2421</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>73 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-2422</td>
<td>+12 VDC</td>
<td>42 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TES 1-2423</td>
<td>+15 VDC</td>
<td>33 mA</td>
<td>78 %</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Input Specifications**

<table>
<thead>
<tr>
<th>Input Current</th>
<th>5 Vin models: 30 mA typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 Vin models: 15 mA typ.</td>
</tr>
<tr>
<td></td>
<td>24 Vin models: 8 mA typ.</td>
</tr>
<tr>
<td>- At no load</td>
<td></td>
</tr>
<tr>
<td>- At full load</td>
<td>5 Vin models: 260 mA max.</td>
</tr>
<tr>
<td></td>
<td>12 Vin models: 110 mA max.</td>
</tr>
<tr>
<td></td>
<td>24 Vin models: 55 mA max.</td>
</tr>
</tbody>
</table>

**Surge Voltage**

| 5 Vin models: 9 VDC max. | 12 Vin models: 18 VDC max. | 24 Vin models: 30 VDC max. |

**Recommended Input Fuse**

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

**Input Filter**

Internal Capacitor

**Output Specifications**

**Voltage Set Accuracy**

±3% max. (at 60% load, 3.3 & 5 Vout models)

±3% max. (at 100% load, other output models)

**Regulation**

- Input Variation (1% Vin step) = 1.5% max.
- Load Variation = 1.5% max.
- Voltage Balance (symmetrical load) = See application note (1% max., www.tracopower.com/overview/tes1)

**Ripple and Noise**

- 20 MHz Bandwidth = 120 mVp-p max.

**Capacitive Load**

- 33 µF max.

**Minimum Load**

- 2% of load max.
- (Operation at lower load will not damage the converter, but it may not meet all specifications)

**Temperature Coefficient**

±0.02 %/K max.

**Start-up Time**

- 400 ms max.

**Short Circuit Protection**

- Limited 0.5 s max., Automatic recovery

**Safety Specifications**

**Safety Standards**

- IT / Multimedia Equipment
- Designed for EN 62368-1 (no certification)

**General Specifications**

**Relative Humidity**

- 95% max. (non-condensing)

**Temperature Ranges**

- Operating Temperature = -40°C to +90°C
- Case Temperature = +105°C max.
- Storage Temperature = -50°C to +125°C

**Power Derating**

- High Temperature = 3.3 %/K above 75°C

**Cooling System**

- Natural convection (20 LFM)

**Switching Frequency**

- 50 - 140 kHz (PFM)
- 100 kHz typ. (PFM)

**Insulation System**

- Functional Insulation

**Isolation Test Voltage**

- Input to Output, 60 s = 1'500 VDC
- Input to Output, 1 s = 1'800 VDC

**Isolation Resistance**

- Input to Output, 500 VDC = 1'000 MΩ min.

**Isolation Capacitance**

- Input to Output, 100 kHz, 1 V = 40 pF typ.
- 100 pF max.

**Reliability**

- Calculated MTBF = 2'000'000 h (MIL-HDBK-217F, ground benign)

**Moisture Sensitivity (MSL)**

- Level 2 (J-STD-033C)

**Washing Process**

- Not allowed (vent-hole without membrane)

**Housing Material**

- Non-conductive Plastic (UL 94 V-0 rated)

**Base Material**

- Non-conductive Plastic (UL 94 V-0 rated)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Pin Material
- Phosphor Bronze (C5191)

### Pin Foundation Plating
- Copper (1 - 3 µm)

### Pin Surface Plating
- Tin (7.5 µm min.), matte

### Housing Type
- Plastic Case

### Mounting Type
- PCB Mount

### Connection Type
- SMD (Surface-Mount Device)

### Footprint Type
- SMD8 (single output models)
- SMD10 (dual output models)

### Soldering Profile
- Reflow Soldering (J-STD-020E)
- 245°C max.

### Weight
- Single output: 1.7 g
- Dual output: 2 g

### Environmental Compliance
- REACH Declaration
  - www.tracopower.com/info/reach-declaration.pdf
  - REACH SVHC list compliant
  - REACH Annex XVII compliant
- RoHS Declaration
  - www.tracopower.com/info/rohs-declaration.pdf
  - Exemptions: No Exemptions

### Supporting Documents
- Overview Link (for additional Documents)
  - www.tracopower.com/overview/tes1

### Outline Dimensions

#### Single Output Models

**Dimensions in mm (inch)**

- Pin pitch tolerances: ±0.10 (±0.004)
- Other tolerances: ±0.25 (±0.01)

- Ø1.0 (Ø 0.04) vent hole
  - (for reflow soldering process)

**Pinout**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>4</td>
<td>–Vout</td>
</tr>
<tr>
<td>5</td>
<td>+Vout</td>
</tr>
<tr>
<td>8</td>
<td>NTC</td>
</tr>
</tbody>
</table>

NTC: Pin to be isolated from circuitry

---

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

### Recommended Solder Pad Layout

#### Single Output Models

#### Dual Output Models

### Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>4</td>
<td>Common</td>
</tr>
<tr>
<td>5</td>
<td>–Vout</td>
</tr>
<tr>
<td>7</td>
<td>+Vout</td>
</tr>
<tr>
<td>10</td>
<td>NTC</td>
</tr>
</tbody>
</table>

NTC: Pin to be isolated from circuitry

---

© Copyright 2022 Traco Electronic AG
Specifications can be changed without notice.

Rev. September 23, 2022
Page 4 / 4