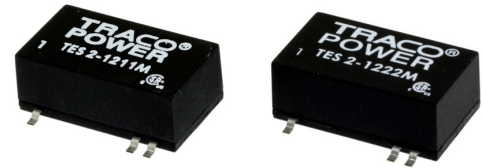


Features

- ◆ Supplementary and reinforced insulation
- ◆ I/O isolation 4000 VACrms rated for 300 Vrms working voltage
- ◆ 2 x MOOP Medical safety according to AAMI/ANSI ES 60601-1:2005(R) and IEC/EN 60601-1 3rd edition
- ◆ Industrial safety to UL/IEC/EN 60950-1
- ◆ Ultracompact SMD-package
- ◆ Operating temp. range -25°C to $+80^{\circ}\text{C}$
- ◆ Qualified for leadfree reflow solder process
- ◆ Available in tape & reel package
- ◆ 3-year product warranty

CB
 Scheme
 IEC 60950-1 UL 60950-1
 IEC 60601-1 ES 60601-1



The TES 2M series is range of compact 2W DC/DC-converters providing a high I/O-isolation voltage of 4000 VAC. With a reinforced I/O-isolation system this product is an economical solution for many applications in instrumentation, industrial controls, medical equipment and everywhere where supplementary- or reinforced insulation is required.

These converters are qualified for high solder temperature profiles in leadfree solder processes. For automated SMD production lines the devices can be supplied in tape & reel package. Full SMD-design with exclusive use of ceramic capacitors ensure a very high reliability and a long product lifetime.

Models

| Ordercode | Input voltage range | Output voltage | Output current max. | Efficiency typ. |
|-------------|---|----------------|---------------------|-----------------|
| TES 2-0511M | 5.0 VDC $\pm 10\%$ (nominal 05 VDC) | 5 VDC | 400 mA | 66 % |
| TES 2-0512M | | 12 VDC | 165 mA | 66 % |
| TES 2-0513M | | 15 VDC | 133 mA | 66 % |
| TES 2-0522M | | ± 12 VDC | ± 83 mA | 72 % |
| TES 2-0523M | | ± 15 VDC | ± 66 mA | 73 % |
| TES 2-1211M | 12.0 VDC $\pm 10\%$ (nominal 12 VDC) | 5 VDC | 400 mA | 66 % |
| TES 2-1212M | | 12 VDC | 165 mA | 66 % |
| TES 2-1213M | | 15 VDC | 133 mA | 66 % |
| TES 2-1222M | | ± 12 VDC | ± 83 mA | 74 % |
| TES 2-1223M | | ± 15 VDC | ± 66 mA | 75 % |
| TES 2-2411M | 24 VDC $\pm 10\%$ (nominal 24 VDC) | 5 VDC | 400 mA | 66 % |
| TES 2-2412M | | 12 VDC | 165 mA | 66 % |
| TES 2-2413M | | 15 VDC | 133 mA | 66 % |
| TES 2-2422M | | ± 12 VDC | ± 83 mA | 74 % |
| TES 2-2423M | | ± 15 VDC | ± 66 mA | 75 % |

Input Specifications

| | |
|------------------------------------|--|
| Input current no load | 5 Vin models: 60 mA typ. 12 Vin models: 30 mA typ. 24 Vin models: 15 mA typ. |
| Reverse voltage protection | 0.3 A max. |
| Recommended input fuse (slow blow) | 5 Vin models: 1.0 A 12 Vin models: 0.5 A 24 Vin models: 0.2 A |
| Surge voltage (1 sec. max.) | 5 Vin models: 9 V max. 12 Vin models: 18 V max. 24 Vin models: 30 V max. |
| Input filter | internal capacitors |

Output Specifications

| | |
|---------------------------------------|--|
| Voltage set accuracy | ±4 % |
| Voltage balance (dual output models) | 1 % max. |
| Regulation | - Input variation: 1.2 % / 1 % change of Vin - Load variation 20 – 100 %: 10 % max. 12 % max. for 5 Vout models. |
| Ripple and noise (0–20 MHz Bandwidth) | 150 mVp-p max. |
| Temperature coefficient | ±0.02 %/K |
| Short circuit protection | 0.5 sec. max. (automatic recovery) |
| Minimum load | 2 % of rated max current. |
| Capacitive load | single output models: 330 µF max. dual output models: 100 µF max. (each output) |

General Specifications

| | |
|--|--|
| Temperature ranges | - Operating: -25°C to +80°C - Storage: -55°C to +125°C - Case temperature: +90°C max. |
| Derating | 2.5 %/K above 60°C |
| Humidity (non condensing) | 95 % rel. H max. |
| Reliability, calculated MTBF (MIL-HDBK-217F at +25°C, ground benign) | >2.0 Mio h |
| Isolation voltage (50Hz, 60sec.) – Input/Output | 4000 VACrms (reinforced) |
| Isolation test voltage (1 sec.) | 6000 Vpk |
| Leakage current (at 240VAC, 60Hz) | 2 µA max. |
| Isolation capacitance – Input/Output | 20 pF max. (at 100kHz, 1V) |
| Isolation resistance – Input/Output | >10 Gohm (at 500VDC) |
| Safety standards | IEC/EN 60950-1, IEC/EN 60601-1 3rd Edition, ANSI/AAMI ES60601-1 and CAN/CSA-C22.2 No. 60601-1, Medical Electrical Equipment - Part 1: General Requirements for Basic Safety and Essential Performance |
| Safety approvals | - UL online certification to UL 60950-1 (entry pending) www.ul.com/database File: e188913 - QQQQ2 - UL online certification to ES 60601-1 www.ul.com/database File: e188913 - QQHM2 - Certification documents www.tracopower.com/overview/tes2m |
| Switching frequency | 50 – 100 kHz (PFM) |
| Environmental compliance | - Reach www.tracopower.com/overview/tes2m - RoHS directive 2011/65/EU |

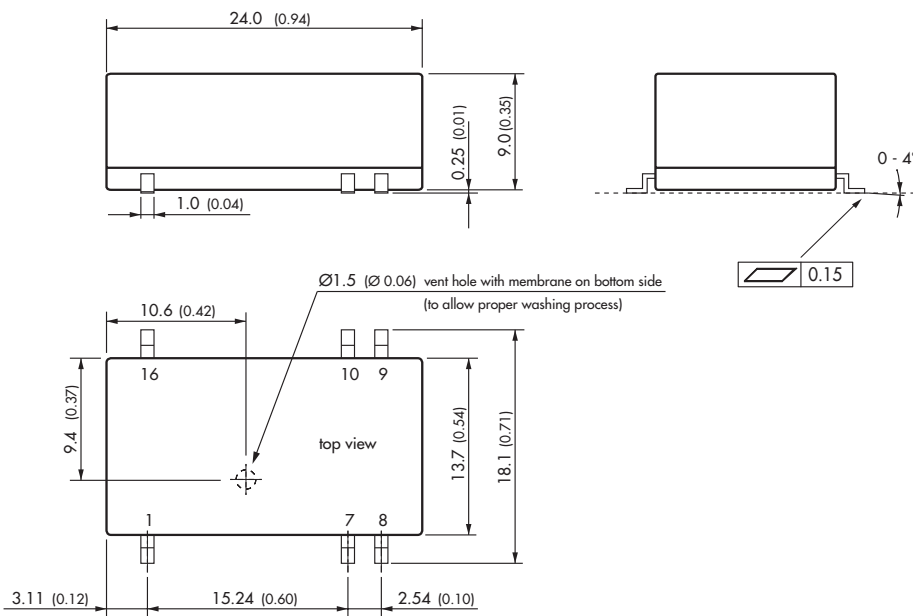
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

Physical Specifications

| | |
|----------------------------------|--|
| Casing material | plastic |
| Pin material | phosphor bronze |
| Weight | 3.8 g (0.13oz) |
| Lead-free reflow solder process | as per J-STD-020D.01 (to find at: www.jedec.org - free registration required) |
| Moisture sensitivity level (MSL) | level 2 as per J-STD-033B.01 (to find at: www.jedec.org - free registration required) |
| Packaging | www.tracopower.com/products/tes2m-pack.pdf |

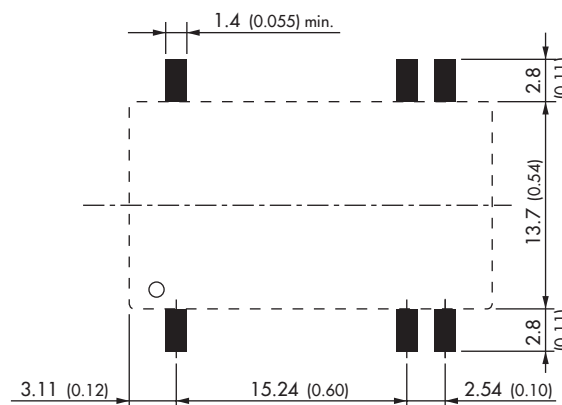
Application note: www.tracopower.com/products/tes2m-application.pdf

Outline Dimensions



| Pin-Out | | |
|---------|------------|------------|
| Pin | Single | Dual |
| 1 | -Vin (GND) | -Vin (GND) |
| 7 | No con. | No con. |
| 8 | No con. | Common |
| 9 | +Vout | +Vout |
| 10 | -Vout | -Vout |
| 16 | +Vin | +Vin |

Solder Pad Dimension



Dimensions in [mm], (I) = Inch
Tolerances ± 0.25 (± 0.01)
Pin pitch tolerances ± 0.05 (± 0.002)

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at www.tracopower.com