

- Supplementary and reinforced insulation
- I/O isolation 4000 VACrms rated for 300 Vrms working voltage
- Unregulated device
- 2 x MOOP Medical safety
- Industrial safety to UL/IEC/EN 62368-1
- 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



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

| Order Code | Input Voltage Range | Output 1 | | Output 2 | | Efficiency typ. |
|-------------|----------------------------------|----------|------------------|----------|------------------|-----------------|
| | | Vnom | I _{max} | Vnom | I _{max} | |
| TES 2-0511M | 4.5 - 5.5 VDC (5 VDC nom.) | 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 | -12 VDC | 83 mA | 72 % |
| TES 2-0523M | | +15 VDC | 66 mA | -15 VDC | 66 mA | 73 % |
| TES 2-1211M | 10.8 - 13.2 VDC (12 VDC nom.) | 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 | -12 VDC | 83 mA | 74 % |
| TES 2-1223M | | +15 VDC | 66 mA | -15 VDC | 66 mA | 75 % |
| TES 2-2411M | 21.6 - 26.4 VDC (24 VDC nom.) | 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 | -12 VDC | 83 mA | 74 % |
| TES 2-2423M | | +15 VDC | 66 mA | -15 VDC | 66 mA | 75 % |

Input Specifications

| | | |
|------------------------|----------------|--|
| Input Current | - At no load | 5 Vin models: 90 mA typ. 12 Vin models: 40 mA typ. 24 Vin models: 30 mA typ. |
| | - At full load | 5 Vin models: 580 mA typ. 12 Vin models: 240 mA typ. 24 Vin models: 120 mA typ. |
| Surge Voltage | | 5 Vin models: 9 VDC max. (1 s max.) 12 Vin models: 18 VDC max. (1 s max.) 24 Vin models: 30 VDC max. (1 s max.) |
| Recommended Input Fuse | | 5 Vin models: 1'000 mA (slow blow) 12 Vin models: 500 mA (slow blow) 24 Vin models: 200 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 | | ±4% max. | |
| Regulation | - Input Variation (1% Vin step) | single output models: 1.5% max. dual output models: 1.5% max. | |
| | - Load Variation | See application note: www.tracopower.com/overview/tes2m | |
| | - Voltage Balance (symmetrical load) | dual output models: 1% max. | |
| Ripple and Noise | - 20 MHz Bandwidth | 150 mVp-p max. | |
| Capacitive Load | - single output | 5 Vout models: 330 µF max. 12 Vout models: 330 µF max. 15 Vout models: 330 µF max. | |
| | | - dual output | 12 / -12 Vout models: 100 / 100 µF max. 15 / -15 Vout models: 100 / 100 µF max. |
| | | Minimum Load | 2 % of Iout 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 | | 500 ms max. | |
| Short Circuit Protection | | Limited 0.5 s max., Automatic recovery | |

Safety Specifications

| | | |
|------------------|-----------------------------|---|
| Standards | - IT / Multimedia Equipment | EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1 |
| | - Medical Equipment | EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 CSA-C22.2, No 60601-1 2 x MOOP (Means Of Operator Protection) MOPP (Means Of Patient Protection) |
| | - Certification Documents | www.tracopower.com/overview/tes2m |
| Pollution Degree | | PD 2 |

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

EMC Specifications

| | | |
|---------------|-----------------------|--|
| EMI Emissions | - Conducted Emissions | EN 60601-1-2 edition 4 (Medical Devices) |
| | - Radiated Emissions | EN 55011 class A (with external filter) EN 55032 class A (with external filter) EN 55011 class A (with external filter) EN 55032 class A (with external filter) |
| | | External filter proposal: www.tracopower.com/overview/tes2m |
| EMS Immunity | | EN 60601-1-2 edition 4 (Medical Devices) |

General Specifications

| | | |
|----------------------------|---------------------------------|--|
| Relative Humidity | | 95% max. (non condensing) |
| Temperature Ranges | - Operating Temperature | -25°C to +80°C |
| | - Case Temperature | +105°C max. |
| | - Storage Temperature | -50°C to +125°C |
| Power Derating | - High Temperature | 2.22 %/K above 60°C |
| | | See application note: www.tracopower.com/overview/tes2m |
| Cooling System | | Natural convection (20 LFM) |
| Altitude During Operation | | 4'000 m max. |
| Regulator Topology | | Push-Pull Converter |
| Switching Frequency | | 50 - 100 kHz (PFM) 80 kHz typ. (PFM) |
| Insulation System | | Reinforced Insulation |
| Working Voltage (rated) | | 300 VAC |
| Isolation Test Voltage | - Input to Output, 60 s | 4'000 VAC |
| | - Input to Output, 1 s | 6'000 VAC |
| Isolation Resistance | - Input to Output, 500 VDC | 10'000 MΩ min. |
| Isolation Capacitance | - Input to Output, 100 kHz, 1 V | 15 pF typ. 20 pF max. |
| Leakage Current | - Touch Current | 2 μA max. |
| Reliability | - Calculated MTBF | 2'000'000 h (MIL-HDBK-217F, ground benign) |
| Moisture Sensitivity (MSL) | | Level 2 (J-STD-033C) |
| Washing Process | | According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf |
| Housing Material | | Non-conductive Plastic (UL 94 V-0 rated) |
| Pin Material | | Phosphor Bronze (C5191) |
| Pin Foundation Plating | | Nickel (5 - 7 μm) |
| Pin Surface Plating | | Tin (5 - 7 μm), matte |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |
| Connection Type | | SMD (Surface-Mount Device) |
| Footprint Type | | SMD16 |
| Soldering Profile | | Lead-Free Reflow Soldering (acc. J-STD-020E) |
| | | See application note: www.tracopower.com/info/reflow-soldering.pdf |
| Weight | | 3.75 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: 7a (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule.)) |
| | - SCIP Reference Number | fbb30ad2-edff-45f0-9c69-c10e6eb7222d |

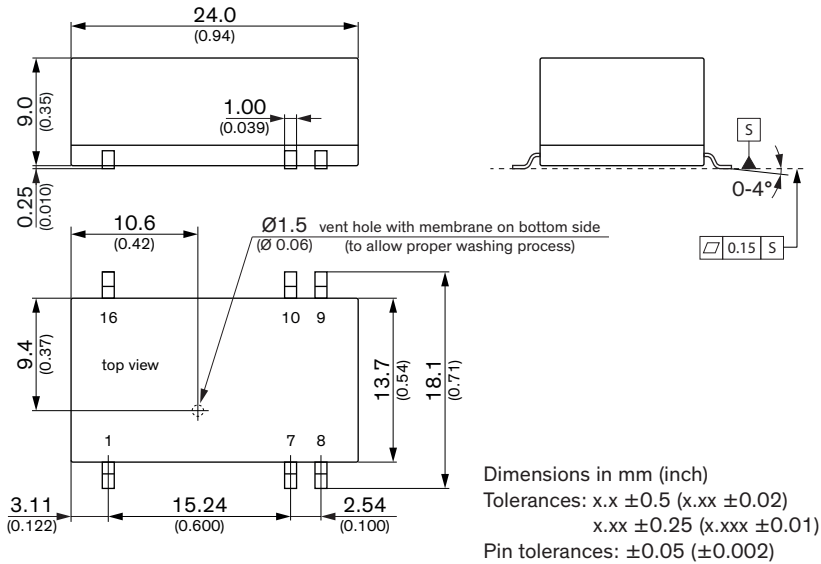
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/tes2m

Outline Dimensions



| Pinout | | |
|--------|------------|------------|
| Pin | Single | Dual |
| 1 | -Vin (GND) | -Vin (GND) |
| 7 | NC | NC |
| 8 | NC | Common |
| 9 | +Vout | +Vout |
| 10 | -Vout | -Vout |
| 16 | +Vin (Vcc) | +Vin (Vcc) |

NC: Not connected

Recommended Solder Pad Layout

