

- 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  $-25^{\circ}\text{C}$  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 <sub>max</sub>	Vnom	I <sub>max</sub>	
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: <b>90 mA typ.</b> 12 Vin models: <b>40 mA typ.</b> 24 Vin models: <b>30 mA typ.</b>
	- At full load	5 Vin models: <b>580 mA typ.</b> 12 Vin models: <b>240 mA typ.</b> 24 Vin models: <b>120 mA typ.</b>
Surge Voltage		5 Vin models: <b>9 VDC max.</b> (1 s max.) 12 Vin models: <b>18 VDC max.</b> (1 s max.) 24 Vin models: <b>30 VDC max.</b> (1 s max.)
Recommended Input Fuse		5 Vin models: <b>1'000 mA</b> (slow blow) 12 Vin models: <b>500 mA</b> (slow blow) 24 Vin models: <b>200 mA</b> (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		<b>±4% max.</b>	
Regulation	- Input Variation (1% Vin step)	single output models: <b>1.5% max.</b> dual output models: <b>1.5% max.</b>	
	- Load Variation	See application note: <a href="http://www.tracopower.com/overview/tes2m">www.tracopower.com/overview/tes2m</a>	
	- Voltage Balance (symmetrical load)	dual output models: <b>1% max.</b>	
Ripple and Noise	- 20 MHz Bandwidth	<b>150 mVp-p max.</b>	
Capacitive Load	- single output	5 Vout models: <b>330 µF max.</b> 12 Vout models: <b>330 µF max.</b> 15 Vout models: <b>330 µF max.</b>	
		- dual output	12 / -12 Vout models: <b>100 / 100 µF max.</b> 15 / -15 Vout models: <b>100 / 100 µF max.</b>
		Minimum Load	<b>2 % of Iout max.</b> (Operation at lower load will not damage the converter, but it may not meet all specifications)
Temperature Coefficient		<b>±0.02 %/K max.</b>	
Start-up Time		<b>500 ms max.</b>	
Short Circuit Protection		<b>Limited 0.5 s max., Automatic recovery</b>	

### Safety Specifications

Safety 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	<a href="http://www.tracopower.com/overview/tes2m">www.tracopower.com/overview/tes2m</a>
Pollution Degree		<b>PD 2</b>

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) EN 55011 class A (with external filter) EN 55032 class A (with external filter)
	- Radiated Emissions	EN 55011 class A (with external filter) EN 55032 class A (with external filter)
		External filter proposal: <a href="http://www.tracopower.com/overview/tes2m">www.tracopower.com/overview/tes2m</a>
EMS Immunity		EN 60601-1-2 edition 4 (Medical Devices)

## General Specifications

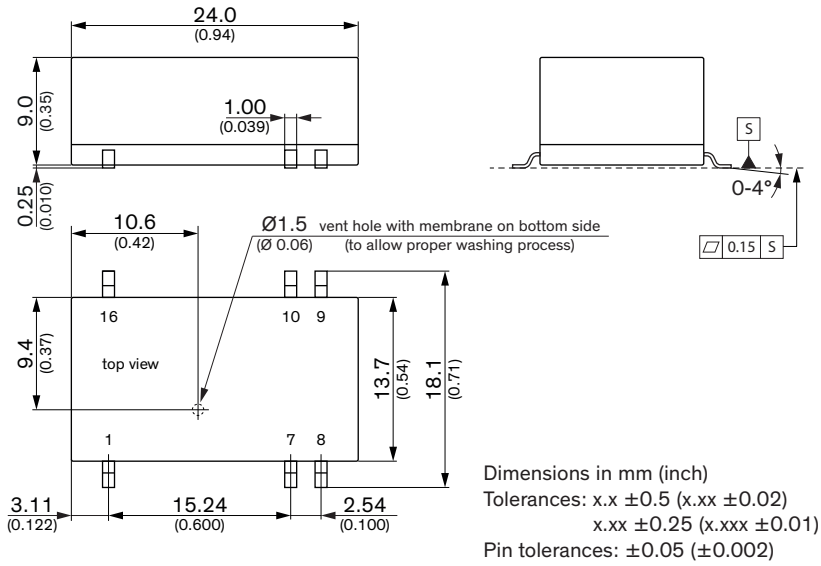
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-25°C to +80°C
	- Case Temperature	+105°C max.
	- Storage Temperature	-50°C to +125°C
Power Derating	- High Temperature	2.22 %/K above 60°C
Cooling System		Natural convection (20 LFM)
Altitude During Operation		4'000 m max.
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		Allowed (vent-hole with membrane)
	See Cleaning Guideline:	<a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
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		Reflow Soldering (J-STD-020E)
Weight		3.75 g
Environmental Compliance	- REACH Declaration	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)

## Supporting Documents

Overview Link (for additional Documents)	<a href="http://www.tracopower.com/overview/tes2m">www.tracopower.com/overview/tes2m</a>
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All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

**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**

