

- 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

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	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

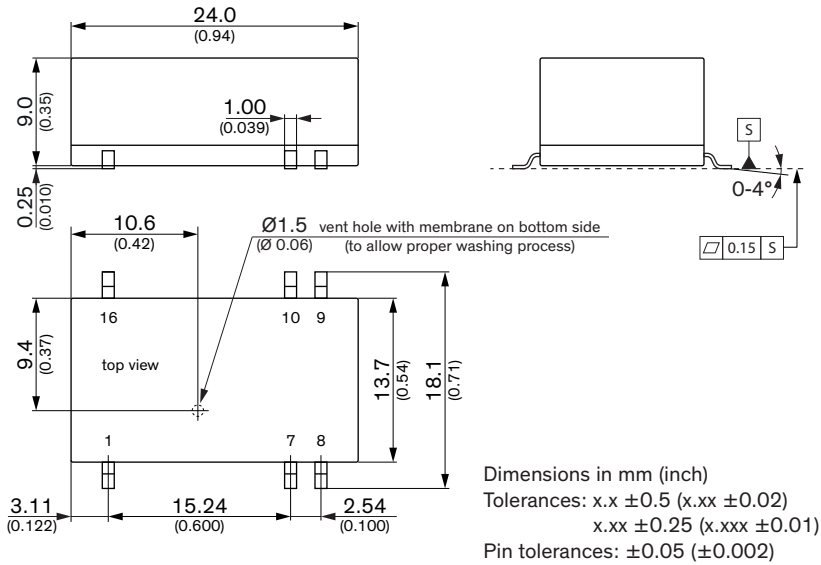
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-25°C to +80°C
	- Case Temperature	+105°C max.
	- Storage Temperature	-50°C to +125°C
Power Derating	- High Temperature	2.22 %/K above 60°C
		See application note: www.tracopower.com/overview/tes2m
Cooling System		Natural convection (20 LFM)
Altitude During Operation		4'000 m max.
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:	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		Reflow Soldering (J-STD-020E)
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). The SCIP number is provided on request.)

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tes2m
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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

