THE DATASHEET OF

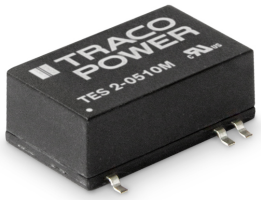
TES 2-0511M

TRACO POWER

Unregulated DC/DC Converter

TES 2M Series, 2 Watt

- **Supplementary and reinforced insulation**
- **I/O isolation 4000 VACrms rated for 300 Vrms working voltage**
- **Unregulated outputs**
- **2 x MOOP Medical safety**
- **Industrial safety to UL/IEC/EN 62368-1**
- **Ultracompact SMD-package**
- **Operating temp. range –25°C to +80°C**
- **Qualified for leadfree reflow solder process**
- **Available in tape & reel package**
- **3-year product warranty**



ES 60601-1 IEC 60601-1
UL 62368-1 IEC 62368-1

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

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
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 (Unregulated)	- 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		EN 60601-1-2 edition 4 (Medical Devices)
	- Conducted Emissions	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:	www.tracopower.com/overview/tes2m
EMS Immunity		EN 60601-1-2 edition 4 (Medical Devices)

General Specifications

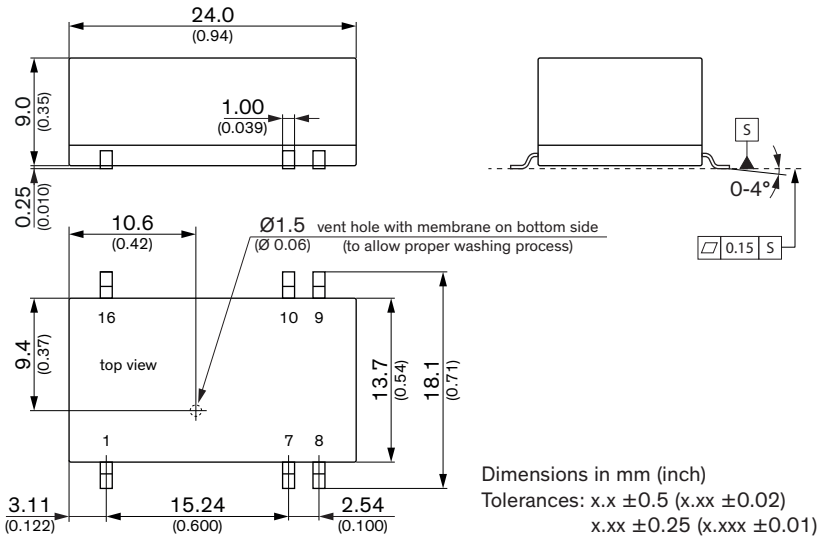
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	–25°C to +80°C
	- Case Temperature	+105°C max.
	- Storage Temperature	–50°C to +125°C
Power Derating	- High Temperature	2.22 %/K above 60°C
	See application note:	www.tracopower.com/overview/tes2m
Cooling System		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

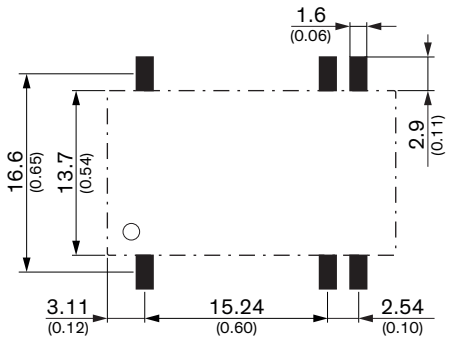


Dimensions in mm (inch)
Tolerances: x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)
Pin tolerances: ±0.05 (±0.002)

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



Dimensions in mm (inch)

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- Traco Power Information

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