

### 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  $-25^{\circ}\text{C}$  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 0.5 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		$\pm 12$ VDC	$\pm 83$ mA	72 %
TES 2-0523M		$\pm 15$ VDC	$\pm 66$ mA	73 %
TES 2-1211M	12.0 VDC $\pm 10\%$ (nominal 1.2 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		$\pm 12$ VDC	$\pm 83$ mA	74 %
TES 2-1223M		$\pm 15$ VDC	$\pm 66$ mA	75 %
TES 2-2411M	24 VDC $\pm 10\%$ (nominal 2.4 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		$\pm 12$ VDC	$\pm 83$ mA	74 %
TES 2-2423M		$\pm 15$ VDC	$\pm 66$ 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 (20 MHz Bandwidth)	150 mVp-p max.
Temperature coefficient	±0.02 %/K
Short circuit protection	0.5 sec. max.
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
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	- CB test certificate according IEC 60950-1: <a href="http://www.tracopower.com/products/tes2m-cb60950.pdf">www.tracopower.com/products/tes2m-cb60950.pdf</a> - CB test certificate according IEC 60601-1: <a href="http://www.tracopower.com/products/tes2m-cb60601.pdf">www.tracopower.com/products/tes2m-cb60601.pdf</a> - UL online certification to UL 60950-1 (entry pending): <a href="http://www.ul.com/database">www.ul.com/database</a> File: e188913 - QGGQ2 - UL online certification to ES 60601-1: <a href="http://www.ul.com/database">www.ul.com/database</a> File: e188913 - QQHM2
Switching frequency	50 – 100 kHz (PFM)
Environmental compliance	- Reach: <a href="http://www.tracopower.com/products/tes2m-reach.pdf">www.tracopower.com/products/tes2m-reach.pdf</a> - RoHS: directive 2011/65/EU

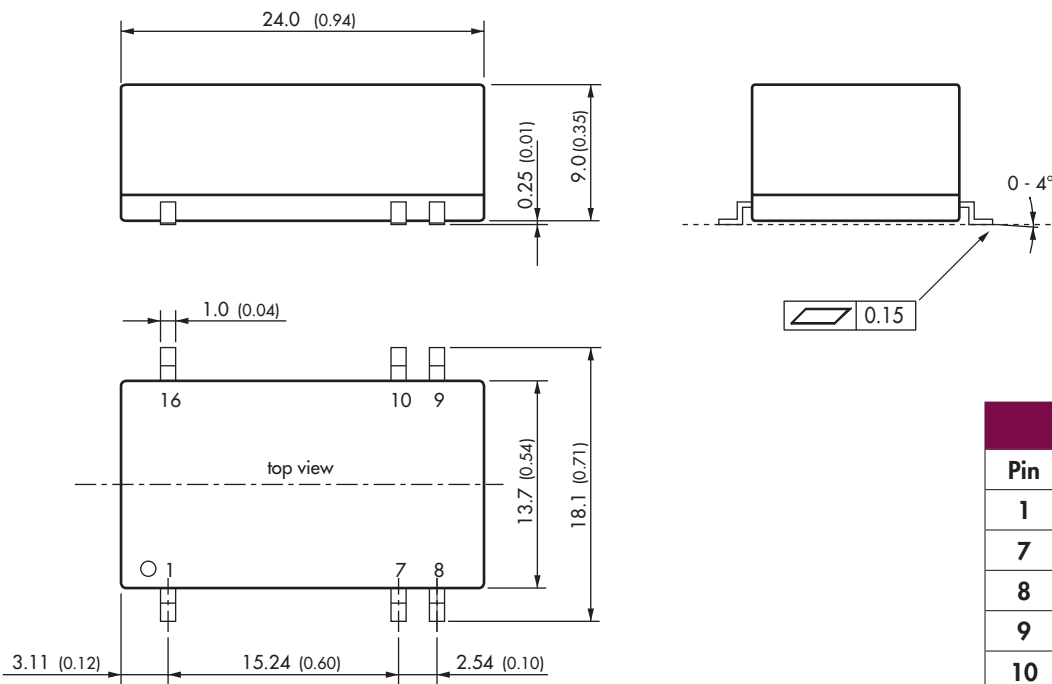
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

**Physical Specifications**

Casing material	plastic
Weight	3.8 g (0.13oz)
Lead-free reflow solder process	as per J-STD-020D.01 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required)
Moisture sensitivity level (MSL)	level 2 as per J-STD-033B.01 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required)
Washing process	<a href="http://www.tracopower.com/products/smd-wash.pdf">www.tracopower.com/products/smd-wash.pdf</a>
Packaging	<a href="http://www.tracopower.com/products/tes2m-pack.pdf">www.tracopower.com/products/tes2m-pack.pdf</a>

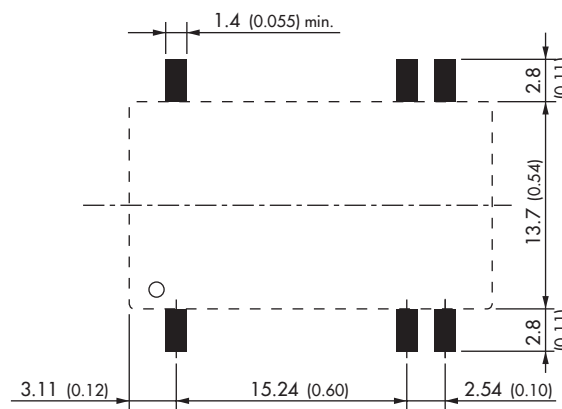
**Application note:** [www.tracopower.com/products/tes2m-application.pdf](http://www.tracopower.com/products/tes2m-application.pdf)

**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], ( ) = 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](http://www.tracopower.com)

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