

#### Features

- ◆ Small SMD-package
- ◆ I/O-Isolation voltage of 4000 VACrms
- ◆ Supplementary & reinforced insulation for working voltages up to 300 VAC
- ◆ Industrial & medical safety approval
- ◆ 5, 12 and 24 VDC input
- ◆ Single- and dual-output models
- ◆ Operating temp. range  $-25^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$
- ◆ Qualified for lead free reflow solder process according IPC-J-STD-020C
- ◆ Available in tape & reel package
- ◆ 3-year product warranty



The TES-2M series is a new range of ultra-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 to meet requested safety standards.

With a new package design these converters are qualified for the higher 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 $\pm 10\%$	5 VDC	400 mA	66 %
TES 2-0512M		12VDC	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 $\pm 10\%$	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 $\pm 10\%$	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	74 %

### Input Specifications

Input current no load /full load	5 Vin models: 60 mA / 600 mA typ. 12 Vin models: 30 mA / 250 mA typ. 24 Vin models: 15 mA / 125 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 Vin – Load variation 20 – 100 %      10 % max.
Ripple and noise (20 MHz Bandwidth)	150 mVpk-pk 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

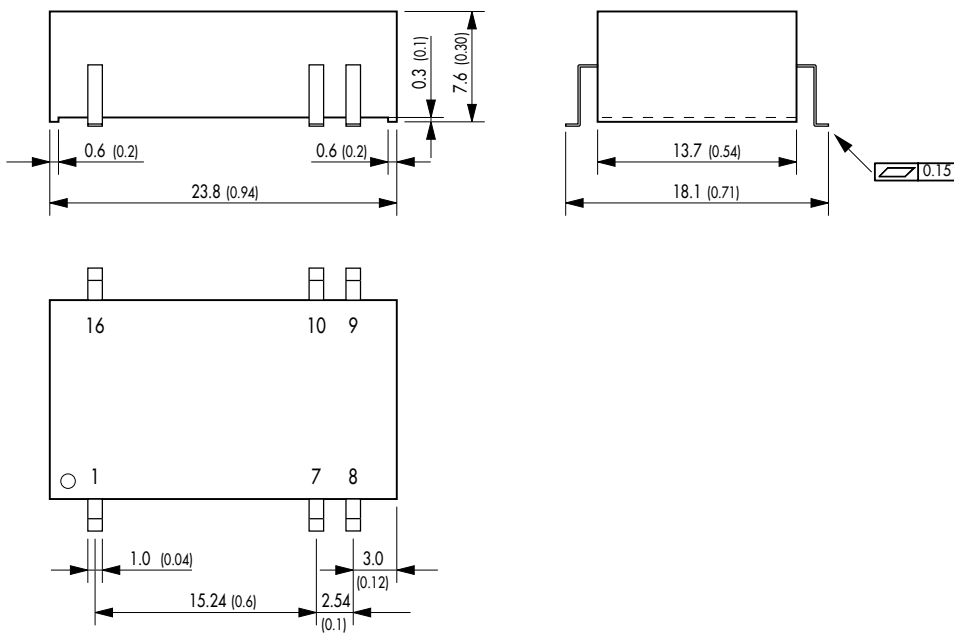
Temperature ranges	– Operating      – 25 °C to + 75 °C – Storage      – 55 °C to + 125 °C – Case      + 110 °C max.
Derating	2.5 %/K above 60°C
Humidity (non condensing)	95 % rel. H max.
Reliability, calculated MTBF (MIL-HDBK-217F gound benign)	> 2.0 Mio h @ 25°C
Isolation voltage (50Hz, 60sec) – Input/Output	4000 VACrms
Isolation test voltage (1 sec.)	6000 Vpk
Leakage current (at 240VAC, 60Hz)	2 µA max.
Isolation capacity – Input/Output	20 pF max. (at 100KHz, 1V)
Isolation resistance – Input/Output	>10 Gohm (at 500VDC)
Switching frequency	50 – 100 kHz (PFM)
Safety standards	IEC/EN 60950-1, UL 60950-1 CSA C22.2 No. 60950-1-03 IEC/EN 60601-1, UL 60601-1, CSA C22.2 No. 601-1
Safety approvals	CB-report, CSA File No.: pending

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

**General Specifications**

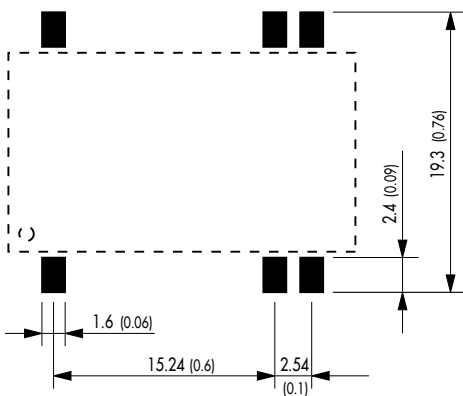
Case material	plastic
Weight	3.8 g (0.13oz)
Lead-free reflow solder process	as per IPC J-STD-020C

**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**

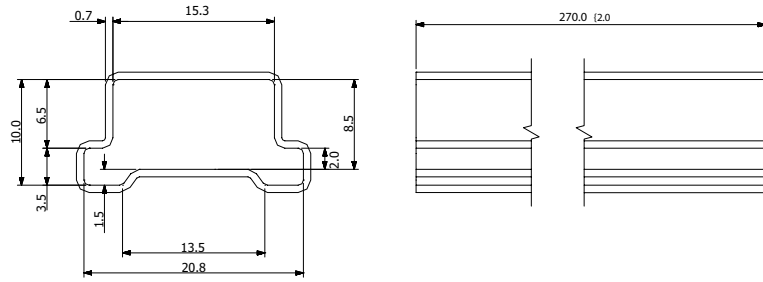


Dimensions in [mm], ( ) = Inch  
 Tolerances ±0.25 (0.01)  
 Pin pitch tolerances ±0.05 (0.002)

**Packaging**

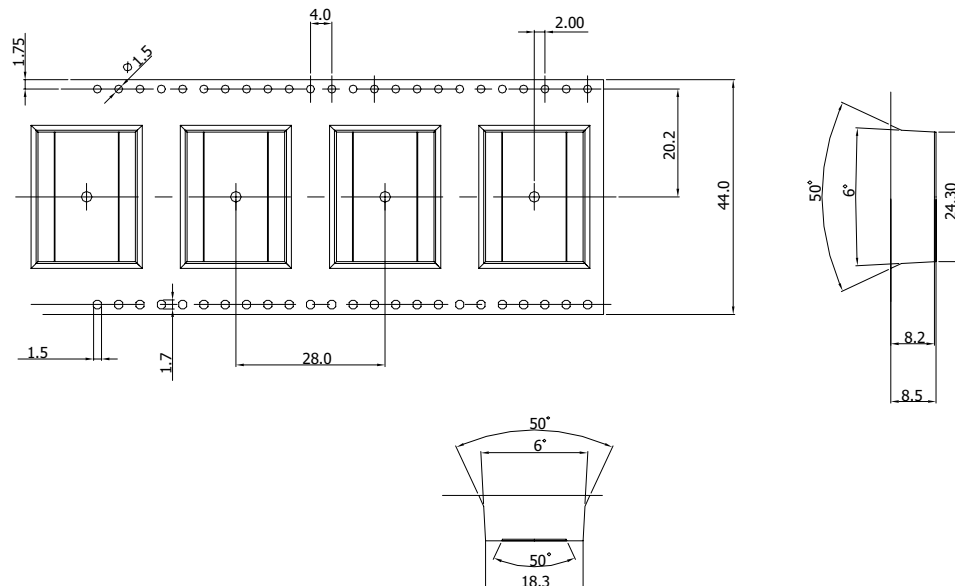
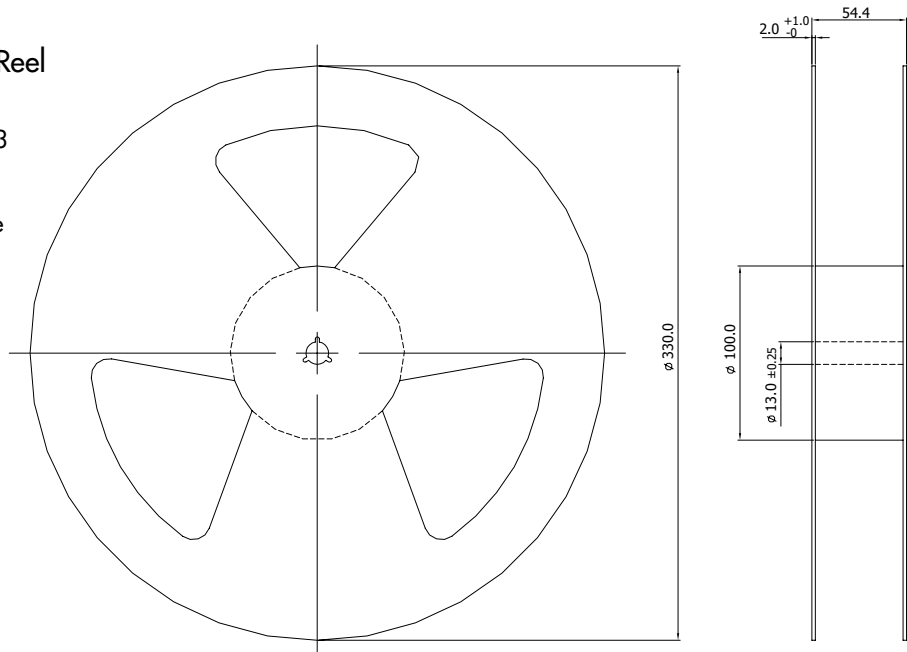
**Standard Packaging - Tube**

- 1 Tube contains 10 converters



**Optional Packaging - Tape & Reel**

- Specifications according IEC 286-3
- 1 Reel contains 350 Converters
- Use appendix «-TR» on order code



Specifications can be changed any time without notice.

Dimensions in [mm], Tolerance ±0.1mm