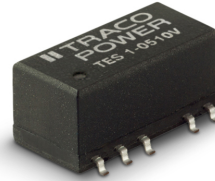


- Small SMD package with standard footprint
- I/O isolation voltage 3000 VDC
- Unregulated outputs
- Single- and dual output models
- High efficiency up to 80%
- Operating temperature range -40°C to +90°C
- High accuracy of pin co-planarity
- Qualified for leadfree reflow solder process according IPC/JEDEC J-STD-020E
- Available in tape and reel package
- 3-year product warranty



The TES 1V series are miniature, 1W DC/DC-converters with high isolation in a SMD package. With a new package design these converters are qualified for the higher temperatures requested by lead-free reflow solder processes. With the small footprint, these converters are the ideal solution for board level power distribution, mainly for applications in the industrial- and telecom field. For automated SMD production lines the devices can be supplied in standard tape and reel package.

### Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TES 1-0510V	4.5 - 5.5 VDC (5 VDC nom.)	3.3 VDC	260 mA			72 %
TES 1-0511V		5 VDC	200 mA			75 %
TES 1-0512V		12 VDC	84 mA			79 %
TES 1-0513V		15 VDC	67 mA			80 %
TES 1-0521V		+5 VDC	100 mA	-5 VDC	100 mA	75 %
TES 1-0522V		+12 VDC	42 mA	-12 VDC	42 mA	79 %
TES 1-0523V		+15 VDC	34 mA	-15 VDC	34 mA	80 %
TES 1-1210V	10.8 - 13.2 VDC (12 VDC nom.)	3.3 VDC	260 mA			73 %
TES 1-1211V		5 VDC	200 mA			76 %
TES 1-1212V		12 VDC	84 mA			80 %
TES 1-1213V		15 VDC	67 mA			81 %
TES 1-1221V		+5 VDC	100 mA	-5 VDC	100 mA	76 %
TES 1-1222V		+12 VDC	42 mA	-12 VDC	42 mA	80 %
TES 1-1223V		+15 VDC	34 mA	-15 VDC	34 mA	80 %
TES 1-2410V	21.6 - 26.4 VDC (24 VDC nom.)	3.3 VDC	260 mA			70 %
TES 1-2411V		5 VDC	200 mA			73 %
TES 1-2412V		12 VDC	84 mA			79 %
TES 1-2413V		15 VDC	67 mA			79 %
TES 1-2421V		+5 VDC	100 mA	-5 VDC	100 mA	73 %
TES 1-2422V		+12 VDC	42 mA	-12 VDC	42 mA	79 %
TES 1-2423V		+15 VDC	34 mA	-15 VDC	34 mA	79 %

### Input Specifications

Input Current	- At no load	5 Vin models: <b>30 mA typ.</b> 12 Vin models: <b>15 mA typ.</b> 24 Vin models: <b>8 mA typ.</b>
	- At full load	5 Vin models: <b>260 mA max.</b> 12 Vin models: <b>110 mA max.</b> 24 Vin models: <b>55 mA max.</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		(The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Capacitor

### Output Specifications

Voltage Set Accuracy		<b>±3% max.</b> (at 60% load, 3.3 & 5 Vout models) <b>±3% max.</b> (at 100% load, other output models)
Regulation (Unregulated)	- Input Variation (1% Vin step) - Load Variation - Voltage Balance (symmetrical load)	single output models: <b>1.5% max.</b> dual output models: <b>1.5% max.</b> See application note: <a href="http://www.tracopower.com/overview/tes1v">www.tracopower.com/overview/tes1v</a> dual output models: <b>1% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>100 mVp-p max.</b>
Capacitive Load	- single output	3.3 Vout models: <b>33 µF max.</b> 5 Vout models: <b>33 µF max.</b> 12 Vout models: <b>4.7 µF max.</b> 15 Vout models: <b>4.7 µF max.</b>
	- dual output	5 / -5 Vout models: <b>10 / 10 µF max.</b> 12 / -12 Vout models: <b>2.2 / 2.2 µF max.</b> 15 / -15 Vout models: <b>2.2 / 2.2 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>400 ms max.</b>
Short Circuit Protection		Limited 0.5 s max., Automatic recovery

### EMC Specifications

EMI Emissions	- Conducted Emissions	<b>EN 55032 class A</b> (with external filter)
	- Radiated Emissions	<b>EN 55032 class A</b> (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/tes1v">www.tracopower.com/overview/tes1v</a>

### General Specifications

Relative Humidity		<b>95% max.</b> (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	<b>-40°C to +90°C</b> <b>+105°C max.</b> <b>-50°C to +125°C</b>
Power Derating	- High Temperature	<b>3.3 %/K above 75°C</b> See application note: <a href="http://www.tracopower.com/overview/tes1v">www.tracopower.com/overview/tes1v</a>
Cooling System		<b>Natural convection</b> (20 LFM)
Regulator Topology		<b>Push-Pull Converter</b>
Switching Frequency		<b>50 - 150 kHz</b> (PFM) <b>100 kHz typ.</b> (PFM)
Insulation System		<b>Functional Insulation</b>
Isolation Test Voltage	- Input to Output, 60 s	<b>3'000 VDC</b>

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

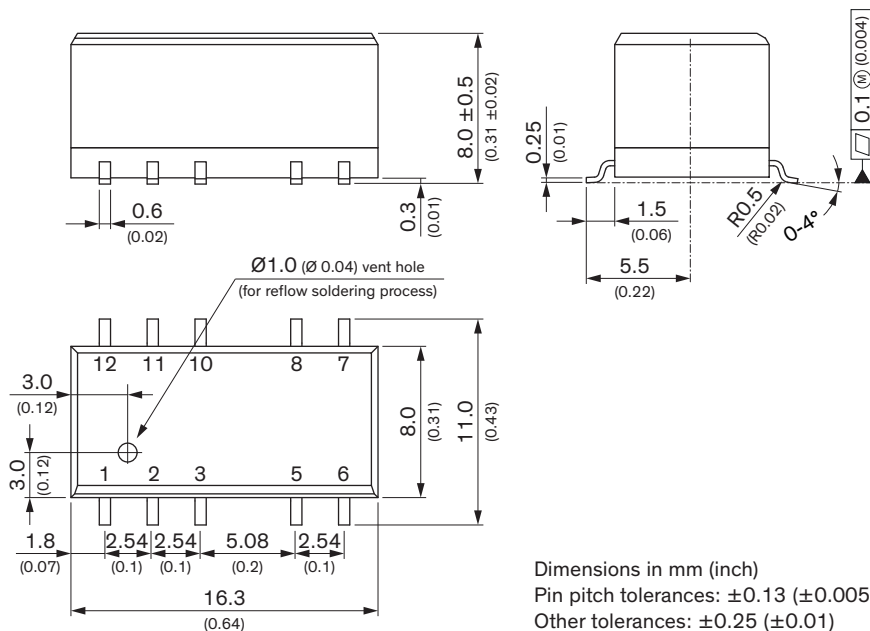
Isolation Resistance	- Input to Output, 500 VDC	10'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	60 pF typ. 100 pF max.
Reliability	- Calculated MTBF	2'000'000 h (MIL-HDBK-217F, ground benign)
Moisture Sensitivity (MSL)		Level 2 (J-STD-033C)
Washing Process		Not allowed
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Pin Material		Phosphor Bronze (C5191)
Pin Foundation Plating		Copper (1 - 3 μm)
Pin Surface Plating		Tin (7.5 μm min.), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		SMD (Surface-Mount Device)
Footprint Type		SMD12
Soldering Profile		Lead-Free Reflow Soldering (acc. J-STD-020E)
		See application note: <a href="http://www.tracopower.com/info/reflow-soldering.pdf">www.tracopower.com/info/reflow-soldering.pdf</a>
Weight		2 g
Environmental Compliance	- REACH Declaration	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a>
	- RoHS Declaration	REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: No Exemptions

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tes1v](http://www.tracopower.com/overview/tes1v)

### Outline Dimensions

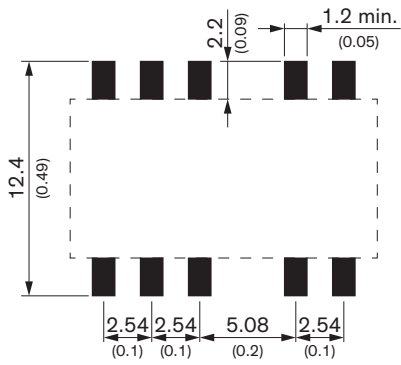


Pinout		
Pin	Single	Dual
1	-Vin (GND)	-Vin (GND)
2	+Vin (Vcc)	+Vin (Vcc)
3	NTC	NTC
5	-Vout	Common
6	NTC	-Vout
7	NTC	NTC
8	+Vout	+Vout
10	NTC	NTC
11	NTC	NTC
12	NTC	NTC

NTC: Not to connect

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

**Recommended Solder Pad Layout**



Dimensions in mm (inch)