



**THE DATASHEET OF  
TES 2N-0512**



### Features

- ◆ Low profile SMD-package
- ◆ Wide 2:1 input voltage range
- ◆ I/O isolation 1500 VDC
- ◆ Input filter meets EN55022, class A
- ◆ Operating temperature range  
-40°C to +85°C
- ◆ Short-circuit protection
- ◆ Qualified for leadfree reflow solder process according IPC J-STD-020D.1
- ◆ Available in tape and reel package
- ◆ Bears washing process
- ◆ 3-year product warranty



The TES-2N series is a family of high performance 2W DC/DC converter modules featuring wide 2:1 input voltage ranges. The 28 models come in a low profile SMD package which requires just 3 cm<sup>2</sup> space on the PCB. A high efficiency allows an operating temperature range of -40°C to +85°C. A built-in EMI input filter complies with EN 55022, class A. Typical applications for these converters are battery operated equipment, instrumentation, communication and industrial electronics, everywhere where isolated, tightly regulated voltages are required.

### Models

Ordercode	Input voltage range	Output voltage	Output current max.	Efficiency typ.
TES 2N-0510	<b>4.5 – 9.0 VDC</b> (nominal 5 VDC)	3.3 VDC	500 mA	70 %
TES 2N-0511		5 VDC	400 mA	73 %
TES 2N-0512		12VDC	165 mA	75 %
TES 2N-0513		15 VDC	135 mA	73 %
TES 2N-0521		± 5 VDC	±200 mA	64 %
TES 2N-0522		±12 VDC	±85 mA	69 %
TES 2N-0523		±15 VDC	±65 mA	71 %
TES 2N-1210	<b>9 – 18 VDC</b> (nominal 12 VDC)	3.3 VDC	500 mA	73 %
TES 2N-1211		5 VDC	400 mA	77 %
TES 2N-1212		12 VDC	165 mA	80 %
TES 2N-1213		15 VDC	135 mA	80 %
TES 2N-1221		±5 VDC	±200 mA	73 %
TES 2N-1222		±12 VDC	±85 mA	78 %
TES 2N-1223		±15 VDC	±65 mA	78 %
TES 2N-2410	<b>18 – 36 VDC</b> (nominal 24 VDC)	3.3 VDC	500 mA	72 %
TES 2N-2411		5 VDC	400 mA	77 %
TES 2N-2412		12 VDC	165 mA	80 %
TES 2N-2413		15 VDC	135 mA	81 %
TES 2N-2421		±5 VDC	±200 mA	74 %
TES 2N-2422		±12 VDC	±85 mA	78 %
TES 2N-2423		±15 VDC	±65 mA	80 %
TES 2N-4810	<b>36 – 75 VDC</b> (nominal 48 VDC)	3.3 VDC	500 mA	71 %
TES 2N-4811		5 VDC	400 mA	73 %
TES 2N-4812		12 VDC	165 mA	79 %
TES 2N-4813		15 VDC	135 mA	79 %
TES 2N-4821		± 5 VDC	±200 mA	71 %
TES 2N-4822		±12 VDC	±85 mA	77 %
TES 2N-4823		±15 VDC	±65 mA	77 %

### Input Specifications

<b>Input current at full load</b> (nominal input)	5 Vin models: <b>600 mA typ.</b> 12 Vin models: <b>220 mA typ.</b> 24 Vin models: <b>110 mA typ.</b> 48 Vin models: <b>55 mA typ.</b>
<b>Start-up voltage</b>	5 Vin models: <b>4.5 VDC</b> 12 Vin models: <b>9.0 VDC</b> 24 Vin models: <b>18 VDC</b> 48 Vin models: <b>36 VDC</b>
<b>Surge voltage</b> (100 msec. max.)	5 Vin models: <b>11 V max.</b> 12 Vin models: <b>25 V max.</b> 24 Vin models: <b>50 V max.</b> 48 Vin models: <b>100 V max.</b>
<b>Conducted noise</b> (input)	<b>EN 55022 level A, FCC part 15, level A</b>
<b>Input fuse</b> – recommended min. fuse rating	recommended, required for compliance with CB 5 V models: <b>500 mA</b> 12 V models: <b>200 mA</b>

### Output Specifications

<b>Voltage set accuracy</b>	<b>±2 %</b>
<b>Regulation</b> – Input variation Vin min. to Vin max. – Load variation 25 – 100 %	<b>0.5 % max.</b> <b>0.75 % max.</b> dual output models: <b>2.0 % (balanced load)</b>
<b>Ripple and noise</b> (20 MHz Bandwidth)	<b>50 mVpk-pk max.</b>
<b>Transient response</b> (25 % load step change) – Recovery time – Deviation	<b>300 µs typ.</b> <b>±5 %</b>
<b>Temperature coefficient</b>	<b>±0.02 %/K</b>
<b>Short circuit protection</b>	<b>indefinite, automatic recovery</b>
<b>Minimum load</b>	<b>25 % of rated max current</b> (operation at lower load condition is safe but a higher output ripple will be experienced)
<b>Capacitive load</b>	3.3 VDC output models: <b>2200 µF max.</b> 5 VDC output models: <b>1000 µF max.</b> 12 VDC output models: <b>170 µF max.</b> 15 VDC output models: <b>110 µF max.</b> ±5 VDC output models: <b>470 µF max.</b> ±12 VDC output models: <b>100 µF max.</b> ±15 VDC output models: <b>47 µF max.</b>

### General Specifications

<b>Temperature ranges</b> – Operating – Case temperatures – Storage	<b>–40°C to +85°C</b> <b>+90°C</b> <b>–50°C to +125°C</b>
<b>Derating</b>	<b>3.5 %/K above +71°C</b>
<b>Humidity</b> (non condensing)	<b>95 % rel. H max.</b>
<b>Reliability, calculated MTBF</b> (MIL-HDBK-217F, at +25°C, ground benign)	<b>&gt;1.0 Mio h</b>
<b>Isolation voltage</b> (60sec.) – Input/Output	<b>1500 VDC</b>
<b>Isolation capacitance</b> – Input/Output	<b>250 pF</b>
<b>Isolation resistance</b> – Input/Output (500 VDC)	<b>&gt;1000 M Ohm</b>
<b>Switching frequency</b>	<b>300 kHz (PFM)</b>

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

**General Specifications**

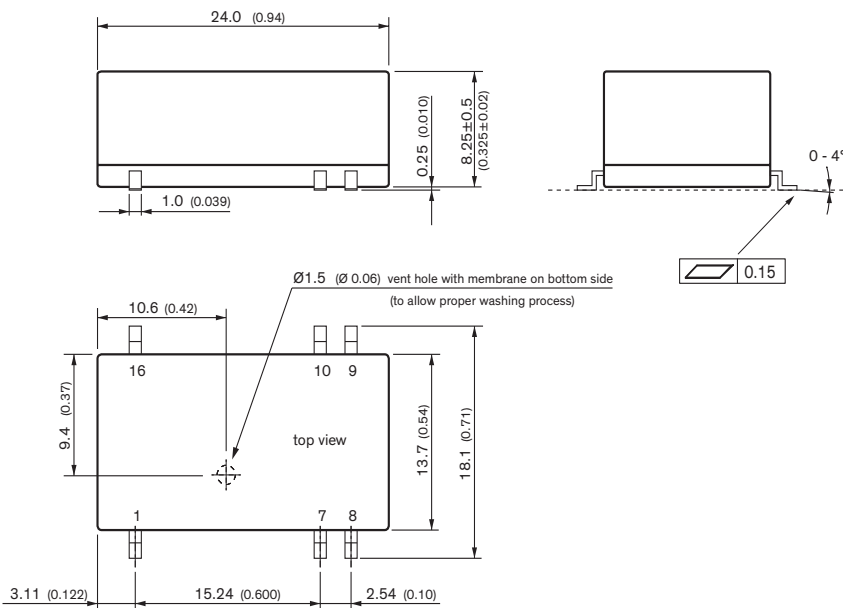
Safety approvals	- Certification documents	UL 60950-1, IEC/EN 60950-1 <a href="http://www.tracopower.com/overview/tes2n">www.tracopower.com/overview/tes2n</a>
Environmental compliance	- Reach - RoHS	<a href="http://www.tracopower.com/products/reach-declaration.pdf">www.tracopower.com/products/reach-declaration.pdf</a> RoHS directive 2011/65/EU

**Physical Specifications**

Casing material	DAP (UL94V-0 rated)
Pin material	Phosphor bronze
Weight	5.1 g (0.17oz)
Moisture sensitivity level (MSL)	level 2 as per J-STD-020D.1 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required)
Soldering temperature	max. 245°C / 10 sec.

**Supporting documents:** [www.tracopower.com/overview/tes2n](http://www.tracopower.com/overview/tes2n)

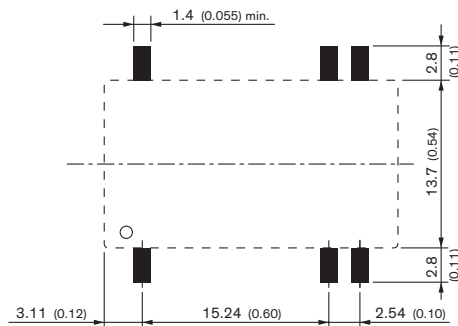
**Outline Dimensions**



Pin-Out		
Pin	Single	Dual
1	-Vin (GND)	-Vin (GND)
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

NC = Not connected

**Solder Pad Dimension**





Dimensions in mm (inch)  
Tolerances  $x.xx \pm 0.25$  ( $x.xx \pm 0.01$ )  
 $x.xx \pm 0.13$  ( $x.xxx \pm 0.005$ )  
Pin tolerances  $\pm 0.05$  ( $\pm 0.002$ )

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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