



### 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 +71°C
- ◆ Short-Circuit Protection
- ◆ Lead free Design, RoHS compliant
- ◆ 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 71°C at full load. 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	4.5 – 9.0 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	9 – 18 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	18 – 36 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	36 – 75 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

Input current at full load (nominal input)	5 Vin models: 600 mA typ. 12 Vin models: 220 mA typ. 24 Vin models: 110 mA typ. 48 Vin models: 55 mA typ.
Surge voltage (100 msec. max.)	5 Vin models: 11 V max. 12 Vin models: 25 V max. 24 Vin models: 50 V max. 48 Vin models: 100 V max.
Conducted noise (input)	EN 55022 level A, FCC part 15, level A

### Output Specifications

Voltage set accuracy	± 2 %
Regulation	– Input variation Vin min. to Vin max.      0.5 % max. – Load variation 25 – 100 %      0.75 % max. dual output models: 2.0% (balanced load)
Ripple and noise (20 MHz Bandwidth)	50 mVpk-pk max
Temperature coefficient	± 0.02 %/K
Short circuit protection	indefinite, automatic recovery
Minimum load	25% of rated max current (operation at lower load condition is safe but a higher output ripple will be experienced)
Capacitive load	3.3 VDC output models: 2'200 µF max. 5 VDC output models: 1'000 µF max. 12 VDC output models: 170 µF max. 15 VDC output models: 110 µF max. ± 5 VDC output models: 470 µF max. ± 12 VDC output models: 100 µF max. ± 15 VDC output models: 47 µF max.

### General Specifications

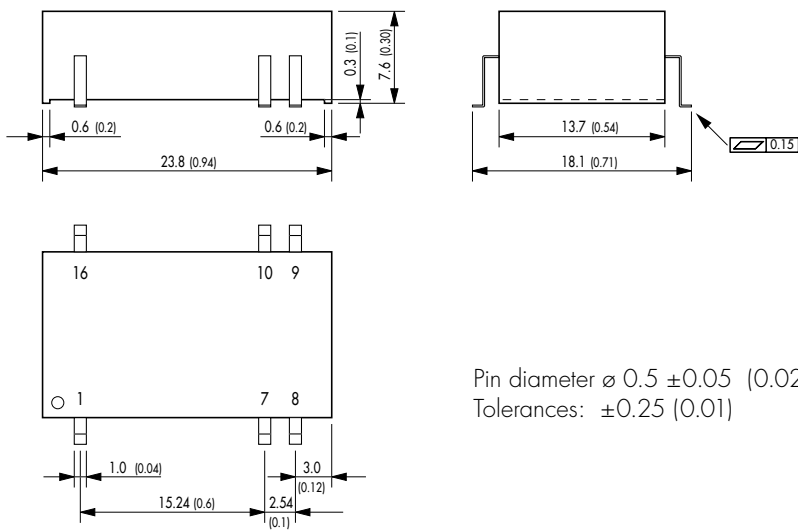
Temperature ranges	– Operating      – 40 °C ... + 71 °C (no derating) – Storage      – 55 °C ... + 125 °C
Derating	3.5 %/K above 71°C
Humidity (non condensing)	95 % rel. H max.
Reliability, calculated MTBF (MIL-HDBK-217F gound benign)	> 1.0 Mio h @ 25°C
Isolation voltage (60sec)	– Input/Output      1'500 VDC
Isolation capacity	– Input/Output      250 pF
Isolation resistance	– Input/Output (500 VDC)      > 1'000 M Ohm
Switching frequency	300 kHz (PFM)
Safety standards	UL 60950-1, EN 60950-1, IEC 60950-1
Safety approvals	CSA File No. 226037 <a href="http://directories.csa-international.org">http://directories.csa-international.org</a>

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

**General Specifications**

Case material	non conductive FR4
Weight	3.8 g (0.13oz)
Lead-free reflow solder process	as per <a href="#">IPC/JEDEC J-STD-020C</a> peak temp. 245°C (20 sec. max.)
Moisture sensitivity level (MSL)	level 1 testreport: <a href="#">single output models (PDF 2MB)</a> <a href="#">dual output models (PDF 2MB)</a>

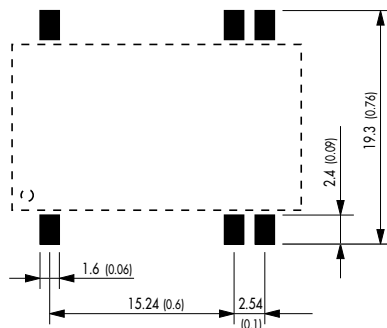
**Outline Dimensions mm (inches)**



Pin diameter  $\varnothing 0.5 \pm 0.05$  (0.02)  $\pm 0.002$   
Tolerances:  $\pm 0.25$  (0.01)

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

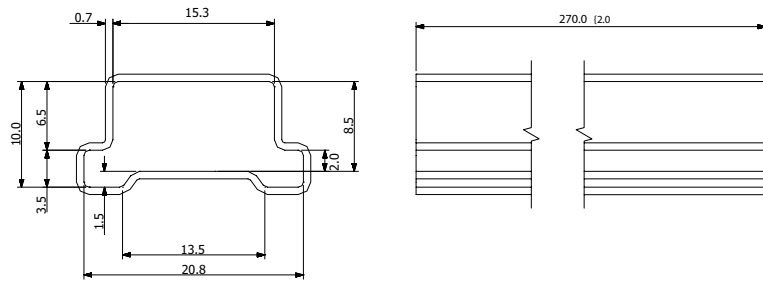
**Outline Dimensions mm (inches)**



**Packaging**

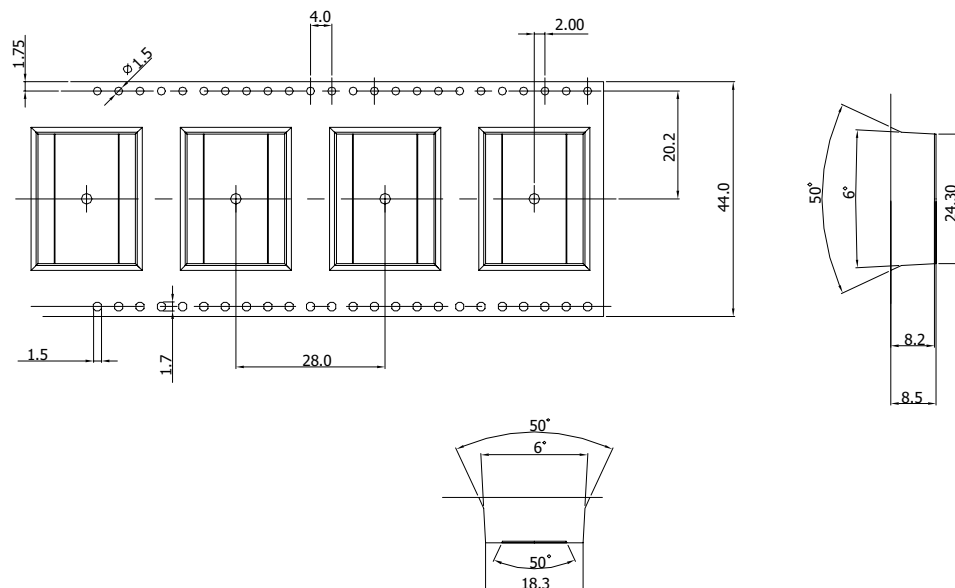
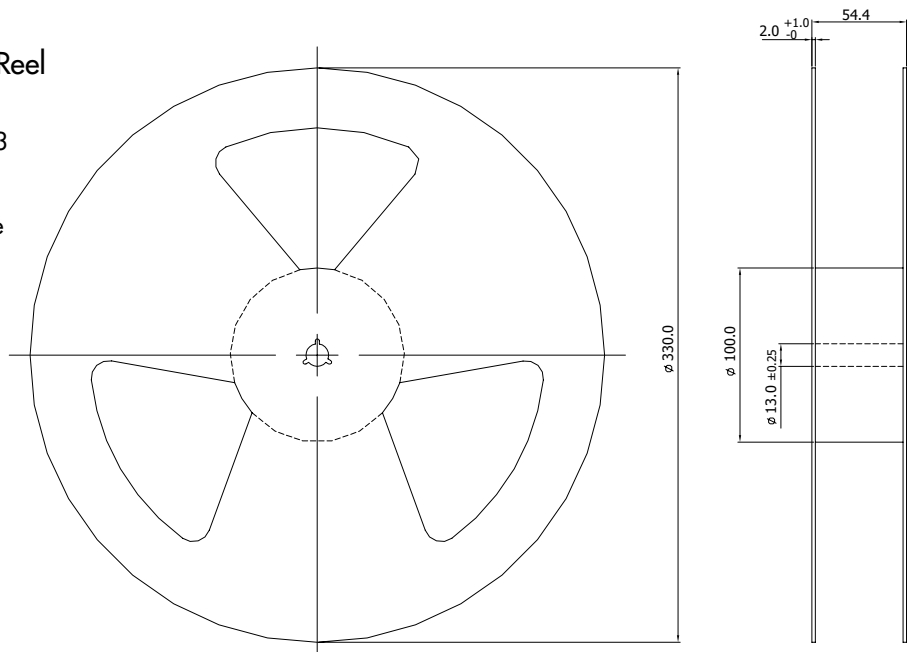
**Standard Packaging - Tube**

- 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