# DC/DC Converters

## TES 2N Series, 2 Watt

CB Scheme

C SP US UL 60950-1

### 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 $cm^2$ 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 | 4.5 – 9.0 VDC (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 | 9 – 18 VDC (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 | 18 – 36 VDC (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 | 36 – 75 VDC (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

| | | | |
|---|---|---|---|
| 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. |
| Start-up voltage / under voltage shut down | | 5 Vin models: | 4.5 VDC / 4.0 VDC typ. (or lower) |
| | | 12 Vin models: | 9.0 VDC / 8.5 VDC typ. (or lower) |
| | | 24 Vin models: | 18 VDC / 17 VDC typ. |
| | | 48 Vin models: | 36 VDC / 34 VDC 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 |
| Input fuse | | | recommended, required for compliance with CB |
| | – recommended min. fuse rating | 5 V models: | 500 mA |
| | | 12 V models: | 200 mA |

## 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. |
| Transient response (25 % load step change) | | | |
| | – Recovery time | | 300 µs typ. |
| | – Deviation | | ±5 % |
| 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: | 2200 µF max. |
| | | 5 VDC output models: | 1000 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 to +85°C |
| | – Case temperatures | +90°C |
| | – Storage | –50°C to +125°C |
| Derating | | 3.5 %/K above +71°C |
| Humidity (non condensing) | | 95 % rel. H max. |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | | >1.0 Mio h |
| Isolation voltage (60sec.) | – Input/Output | 1500 VDC |
| Isolation capacitance | – Input/Output | 250 pF |
| Isolation resistance | – Input/Output (500 VDC) | >1000 M Ohm |
| Switching frequency | | 300 kHz (PFM) |

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

## General Specifications

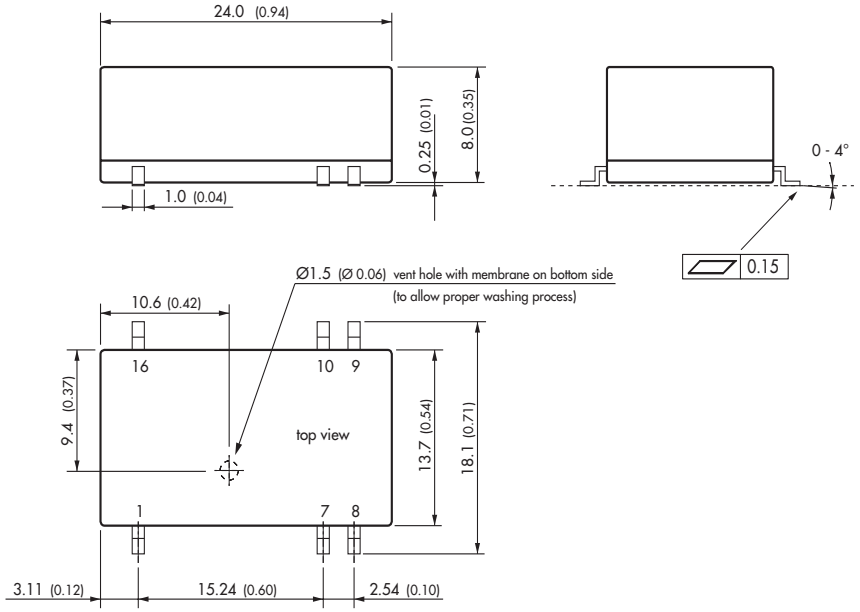
| | | |
|---|---|---|
| Safety approvals | | UL 60950-1, IEC/EN 60950-1 |
| | – Certification documents | www.tracopower.com/overview/tes2n |
| Environmental compliance | – Reach | www.tracopower.com/products/reach-declaration.pdf |
| | – RoHS | RoHS directive 2011/65/EU |

## Physical Specifications

| | |
|---|---|
| Casing material | DAP (UL94V-0 rated) |
| Pin material | Phosphor bronze |
| Weight | 5.1 g (0.17oz) |
| Moisture sensivity level (MSL) | level 2 as per J-STD-020D.1 (to find at: www.jedec.org - free registration required) |
| Soldering temperature | max. 260°C / 10 sec. |

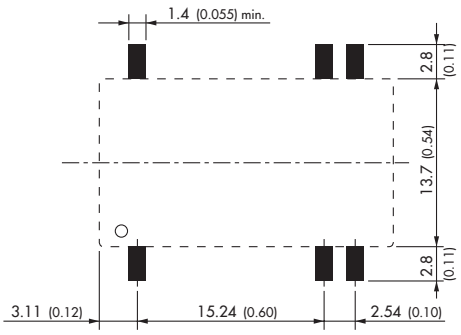
## Supporting documents: www.tracopower.com/overview/tes2n

## 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)