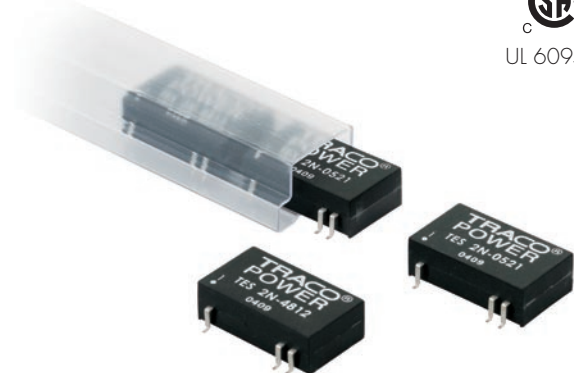


#### Features

- ◆ 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-020C
- ◆ Available in tape and reel package
- ◆ 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><br>(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><br>(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><br>(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 |                                         | ±5 VDC         | ±65 mA              | 80 %            |
| TES 2N-4810 | <b>36 – 75 VDC</b><br>(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.<br>12 Vin models: 220 mA typ.<br>24 Vin models: 110 mA typ.<br>48 Vin models: 55 mA typ. |
| Surge voltage (100 msec. max.)             | 5 Vin models: 11 V max.<br>12 Vin models: 25 V max.<br>24 Vin models: 50 V max.<br>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.<br>– Load variation 25 – 100 % 0.75 % max.<br>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.<br>5 VDC output models: 1'000 µF max.<br>12 VDC output models: 170 µF max.<br>15 VDC output models: 110 µF max.<br>±5 VDC output models: 470 µF max.<br>±12 VDC output models: 100 µF max.<br>±15 VDC output models: 47 µF max. |

## General Specifications

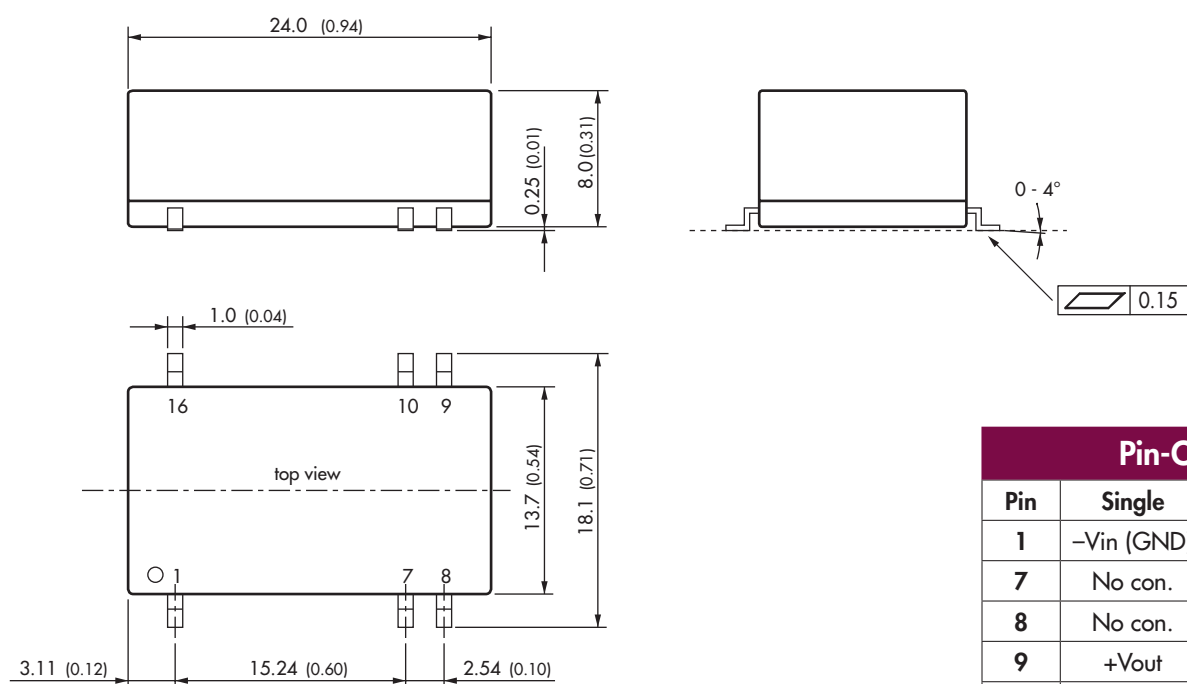
|                                                                      |                                                                                                                        |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Temperature ranges                                                   | – Operating –40°C to +85°C<br>– Storage –55°C to +125°C                                                                |
| Derating                                                             | 3.5 %/K above +71°C                                                                                                    |
| Humidity (non condensing)                                            | 95 % rel. H max.                                                                                                       |
| Reliability, calculated MTTF (MIL-HDBK-217F, @ +25°C, ground benign) | >1.0 Mio h                                                                                                             |
| 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, IEC/EN 60950-1                                                                                             |
| Safety approvals                                                     | CSA File No. 226037<br><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.

## Physical Specifications

|                                  |                                                                                                                             |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Casing material                  | DAP (UL94V-0 rated)                                                                                                         |
| Weight                           | 3.8 g (0.13oz)                                                                                                              |
| Lead-free reflow solder process  | as per J-STD-020D.01 (to find at:<br><a href="http://www.jedec.org">www.jedec.org</a> - free registration required)         |
| Moisture sensitivity level (MSL) | level 2 as per J-STD-033B.01 (to find at:<br><a href="http://www.jedec.org">www.jedec.org</a> - free registration required) |
| Washing process                  | <a href="http://www.tracopower.com/products/smd-wash.pdf">www.tracopower.com/products/smd-wash.pdf</a>                      |
| Packaging                        | <a href="http://www.tracopower.com/products/tes2n-pack.pdf">www.tracopower.com/products/tes2n-pack.pdf</a>                  |

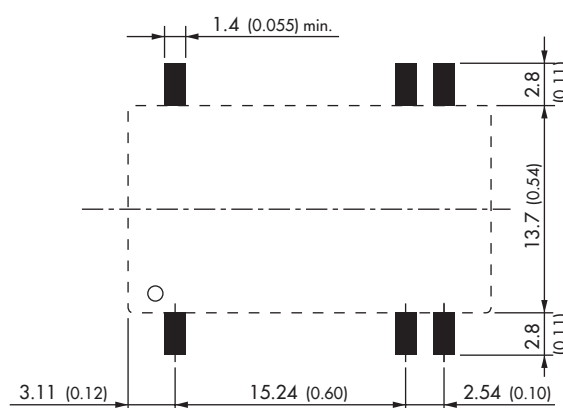
## Outline Dimensions



### 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  $\pm 0.25$  ( $\pm 0.01$ )  
Pin pitch tolerances  $\pm 0.05$  ( $\pm 0.002$ )

Specifications can be changed any time without notice