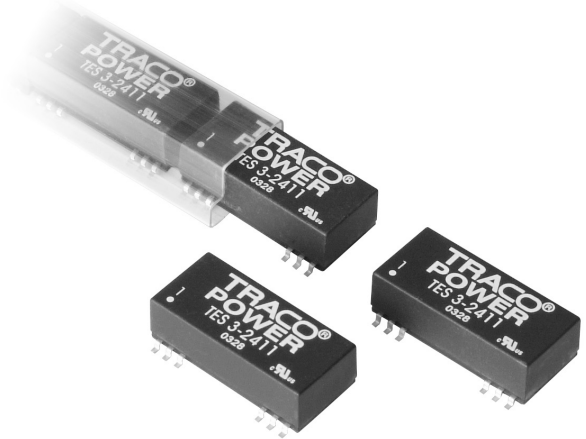


### Features

- ◆ SMD package
- ◆ Wide 2:1 input voltage range
- ◆ I/O isolation 1500VDC
- ◆ Under voltage lockout
- ◆ Operating temp. range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- ◆ Short circuit protection
- ◆ High accuracy of pin co-planarity
- ◆ Lead free design – RoHS compliant
- ◆ 3-years product warranty



The TES-3 series is a family of high performance 3W dc-dc converter modules featuring wide 2:1 input voltage ranges. The 15 models come in a low profile SMD package with dimensions of 32.3 x 14.8 x 10.2 mm. A high efficiency allows an operating temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  at full load. This product is qualified for soldering in a high temperature lead-free reflow solder process. Typical applications for the converters are battery operated equipment, instrumentation, communication and industrial electronics, everywhere where an isolated, tightly regulated voltage is required.

### Models

| Ordercode  | Input voltage range                    | Output voltage | Output current max. | Efficiency typ. |
|------------|----------------------------------------|----------------|---------------------|-----------------|
| TES 3-1210 | <b>9 – 18 VDC</b><br>(12 VDC nominal)  | 3.3 VDC        | 700 mA              | 75 %            |
| TES 3-1211 |                                        | 5 VDC          | 600 mA              | 79 %            |
| TES 3-1212 |                                        | 12 VDC         | 250 mA              | 82 %            |
| TES 3-1222 |                                        | $\pm 12$ VDC   | $\pm 125$ mA        | 81 %            |
| TES 3-1223 |                                        | $\pm 15$ VDC   | $\pm 100$ mA        | 81 %            |
| TES 3-2410 | <b>18 – 36 VDC</b><br>(24 VDC nominal) | 3.3 VDC        | 700 mA              | 76 %            |
| TES 3-2411 |                                        | 5 VDC          | 600 mA              | 80 %            |
| TES 3-2412 |                                        | 12 VDC         | 250 mA              | 83 %            |
| TES 3-2422 |                                        | $\pm 12$ VDC   | $\pm 125$ mA        | 82 %            |
| TES 3-2423 |                                        | $\pm 15$ VDC   | $\pm 100$ mA        | 82 %            |
| TES 3-4810 | <b>36 – 75 VDC</b><br>(48 VDC nominal) | 3.3 VDC        | 700 mA              | 76 %            |
| TES 3-4811 |                                        | 5 VDC          | 600 mA              | 80 %            |
| TES 3-4812 |                                        | 12 VDC         | 250 mA              | 83 %            |
| TES 3-4822 |                                        | $\pm 12$ VDC   | $\pm 125$ mA        | 82 %            |
| TES 3-4823 |                                        | $\pm 15$ VDC   | $\pm 100$ mA        | 82 %            |

## Input Specifications

|                                               |                                                                                                                 |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Input current no load / full load             | 12 Vin models: 20 mA / 300 mA typ.<br>24 Vin models: 5 mA / 150 mA typ.<br>48 Vin models: 3 mA / 75 mA typ.     |
| Start-up voltage /<br>under voltage shut down | 12 Vin models: 6 VDC / 8 VDC typ.<br>24 Vin models: 12 VDC / 16 VDC typ.<br>48 Vin models: 24 VDC / 32 VDC typ. |
| Surge voltage (1 sec. max.)                   | 12 Vin models: 25 V max.<br>24 Vin models: 50 V max.<br>48 Vin models: 100 V max.                               |
| Reverse voltage protection                    | 0.5 A max.                                                                                                      |
| Reflected input ripple current                | can be reduced by ext. 1–2.2 µF polyester film capacitor                                                        |
| Input filter                                  | Pi filter                                                                                                       |

## Output Specifications

|                          |                                                                                                                                                                                                                             |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Voltage set accuracy     | ±1 %                                                                                                                                                                                                                        |
| Regulation               | – Input variation Vin min. to Vin max.      0.3 % max.<br>– Load variation 10 – 100 %<br>single output models: 1.0 % max.<br>dual output models balanced load: 1.0 % max.<br>dual output models unbalanced load: 2.0 % max. |
| Ripple and noise         | 50 mVpk-pk max.                                                                                                                                                                                                             |
| Temperature coefficient  | ±0.02 %/°C                                                                                                                                                                                                                  |
| Current limitation       | >110 % of Iout max., continuous                                                                                                                                                                                             |
| Short circuit protection | hiccup mode, indefinite<br>(no automatic recovery)                                                                                                                                                                          |
| Capacitive load          | – single output models      4700 µF<br>– dual output models      180 µF (each input)                                                                                                                                        |

## General Specifications

|                                                                       |                                                                                                          |
|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Temperature ranges                                                    | – Operating      –40°C to +85°C<br>– Case temperature      +100°C max.<br>– Storage      –40°C to +125°C |
| Derating (convection cooling)                                         | 3.5 %/K above 70°C                                                                                       |
| Humidity (non condensing)                                             | 95 % rel H max.                                                                                          |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >1'000'000 h                                                                                             |
| Isolation voltage (60 sec.)                                           | – Input/Output      1'500 VDC                                                                            |
| Isolation capacitance                                                 | – Input/Output      65 pF typ.                                                                           |
| Isolation resistance                                                  | – Input/Output      >1'000 Mohm                                                                          |
| Switching frequency                                                   | 300 kHz typ. (frequency modulation PFM)                                                                  |
| Safety standards                                                      | UL 60950-1, IEC/EN 60950-1                                                                               |

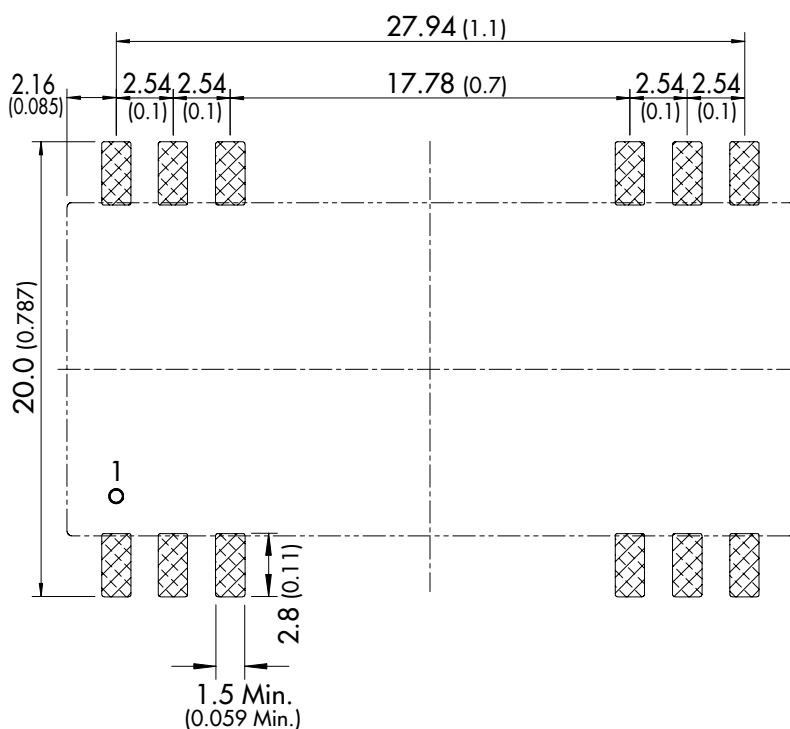
**Supporting documents:** [www.tracopower.com/overview/tes3](http://www.tracopower.com/overview/tes3)

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

|                                 |                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Casing material                 | non conductive black plastic<br>(UL 94V-0-rated)                                                                           |
| Pin material                    | Phosphor bronze                                                                                                            |
| Package weight                  | 8.8 g (0.31 oz)                                                                                                            |
| Lead-free reflow solder process | as per J-STD-020D.1 (to find at:<br><a href="http://www.jedec.org">www.jedec.org</a> - free registration required)         |
| Moisture sensivity level (MSL)  | level 2 as per J-STD-033B.1 (to find at:<br><a href="http://www.jedec.org">www.jedec.org</a> - free registration required) |
| Washing process                 | not recommended. Product non-hermetical.                                                                                   |

| Pin-Out |                                     |                                     |
|---------|-------------------------------------|-------------------------------------|
| Pin     | Single                              | Dual                                |
| 1       | -V <sub>in</sub> (GND)              | -V <sub>in</sub> (GND)              |
| 2       | -V <sub>in</sub> (GND)              | -V <sub>in</sub> (GND)              |
| 3       | NC                                  | NC                                  |
| 10      | NC                                  | Common                              |
| 11      | NC                                  | NC                                  |
| 12      | NC                                  | -V Output                           |
| 13      | +V Output                           | +V Output                           |
| 14      | NC                                  | NC                                  |
| 15      | -V Output                           | Common                              |
| 22      | NC                                  | NC                                  |
| 23      | +V <sub>in</sub> (V <sub>cc</sub> ) | +V <sub>in</sub> (V <sub>cc</sub> ) |
| 24      | +V <sub>in</sub> (V <sub>cc</sub> ) | +V <sub>in</sub> (V <sub>cc</sub> ) |

Dimensions in [mm], ( ) = Inch  
Tolerances  $\pm 0.25$  ( $\pm 0.01$ )  
Pin pitch tolerances  $\pm 0.05$  ( $\pm 0.002$ )

**Outline Dimensions mm (inches)**


Dimensions in [mm], ( ) = Inch  
 Tolerances  $\pm 0.25$  ( $\pm 0.01$ )  
 Pin pitch tolerances  $\pm 0.05$  ( $\pm 0.002$ )