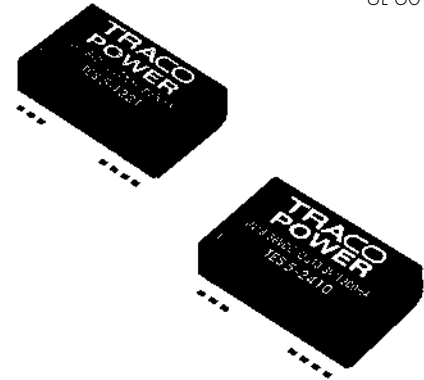




### Features

- ◆ Compact low Profile SMD Package
- ◆ Wide 2:1 Input Voltage Range
- ◆ I/O Isolation 1500VDC
- ◆ Operating Temp. Range -40°C to 85°C max.
- ◆ Short Circuit Protection
- ◆ Remote On/Off
- ◆ High Accuracy of Pin Co-Planarity
- ◆ Lead free Design – RoHS compliant
- ◆ 3 Years Product Warranty



The TES-5 series is a new range of high performance 5W dc-dc converter modules in low profile SMD package with compact dimensions of only 33.4 x 20.6 x 10.2 mm. The 18 available models feature wide 2:1 input voltage range and tightly regulated output voltage. High efficiency allows operating temperatures up to 71°C at full load.

Further features are built-in EMI-filter to meet EN 55022, class A and FCC, level A without additional components and remote On/Off control. The products are qualified for soldering in a high temperature lead-free reflow solder process. Typical applications for these converters are battery powered equipment, instrumentation, communication systems and industrial controls.

### Models

| Ordercode  | Input voltage range             | Output voltage | Output current max. | Efficiency typ. |
|------------|---------------------------------|----------------|---------------------|-----------------|
| TES 5-1210 | 9 – 18 VDC<br>(12 VDC nominal)  | 3.3 VDC        | 1200 mA             | 76 %            |
| TES 5-1211 |                                 | 5 VDC          | 1000 mA             | 80 %            |
| TES 5-1212 |                                 | 12 VDC         | 420 mA              | 83 %            |
| TES 5-1213 |                                 | 15 VDC         | 335 mA              | 83 %            |
| TES 5-1221 |                                 | ± 5 VDC        | ± 500 mA            | 80 %            |
| TES 5-1222 |                                 | ± 12 VDC       | ± 210 mA            | 83 %            |
| TES 5-1223 |                                 | ± 15 VDC       | ± 165 mA            | 83 %            |
| TES 5-2410 | 18 – 36 VDC<br>(24 VDC nominal) | 3.3 VDC        | 1200 mA             | 78 %            |
| TES 5-2411 |                                 | 5 VDC          | 1000 mA             | 82 %            |
| TES 5-2412 |                                 | 12 VDC         | 420 mA              | 85 %            |
| TES 5-2413 |                                 | 15 VDC         | 335 mA              | 85 %            |
| TES 5-2421 |                                 | ± 5 VDC        | ± 500 mA            | 82 %            |
| TES 5-2422 |                                 | ± 12 VDC       | ± 210 mA            | 85 %            |
| TES 5-2423 |                                 | ± 15 VDC       | ± 165 mA            | 85 %            |
| TES 5-4810 | 36 – 75 VDC<br>(48 VDC nominal) | 3.3 VDC        | 1200 mA             | 78 %            |
| TES 5-4811 |                                 | 5 VDC          | 1000 mA             | 82 %            |
| TES 5-4812 |                                 | 12 VDC         | 420 mA              | 85 %            |
| TES 5-4813 |                                 | 15 VDC         | 335 mA              | 85 %            |
| TES 5-4821 |                                 | ± 5 VDC        | ± 500 mA            | 82 %            |
| TES 5-4822 |                                 | ± 12 VDC       | ± 210 mA            | 85 %            |
| TES 5-4823 |                                 | ± 15 VDC       | ± 165 mA            | 85 %            |

**Input Specifications**

|   |  |                      |
|---|--|----------------------|
| Input current no load                         | 12 Vin models                          | 20 mA                |
|   | 24 Vin models                          | 5 mA                 |
|   | 48 Vin models                          | 3 mA                 |
| Input current full load                       | 12 Vin models                          | 500 mA typ.          |
|   | 24 Vin models                          | 250 mA typ.          |
|   | 48 Vin models                          | 125 mA typ.          |
| Start-up voltage /<br>under voltage shut down | 12 Vin models                          | 8 VDC / 7 VDC typ.   |
|   | 24 Vin models                          | 16 VDC / 15 VDC typ. |
|   | 48 Vin models                          | 33 VDC / 31 VDC typ. |
| Surge voltage (1 sec. max.)                   | 12 Vin models                          | 25 V max.            |
|   | 24 Vin models                          | 50 V max.            |
|   | 48 Vin models                          | 100 V max.           |
| Reverse voltage protection                    | 1.0 A max.                             |                      |
| Conducted noise (input)                       | EN 55022 level A, FCC part 15, class A |                      |

**Output Specifications**

|                                     |  |                           |
|-------------------------------------|--|---------------------------|
| Voltage set accuracy                | ± 1 %  |                           |
| Regulation                          | - Input variation Vin min. to Vin max.           | 0.3 % max.                |
|                                     | - Load variation 20 – 100 % single output models | 1 % max.                  |
|                                     | dual output models balanced load                 | 2 % max.                  |
| Ripple and noise (20 MHz Bandwidth) | 85 mVpk-pk max.                                  |                           |
| Temperature coefficient             | ± 0.02 % / °C                                    |                           |
| Output current limitation           | >115 % of Iout max., constant current            |                           |
| Short circuit protection            | indefinite, automatic recovery                   |                           |
| Capacitive load                     | single output models                             | 680 µF max.               |
|                                     | dual output models                               | 100 µF max. (esch output) |

**General Specifications**

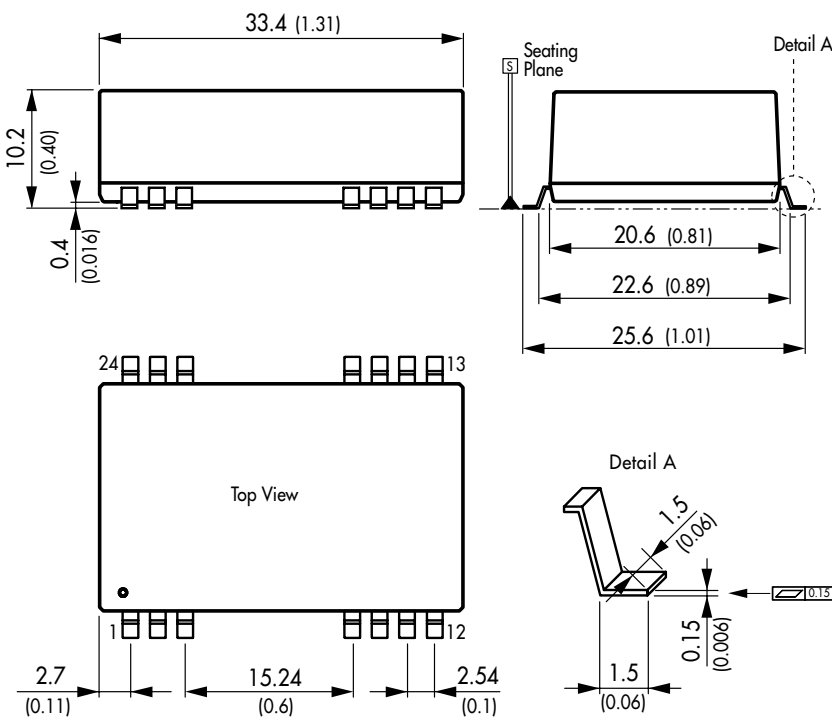
|  |                                      |  |
|--|--------------------------------------|--|
| Temperature ranges   | - Operating                          | - 40°C ... + 85 °C                               |
|  | - Case temperature                   | + 100°C max.                                     |
|  | - Storage                            | - 40°C ... + 125 °C                              |
| Derating   | 3.5%/K above 70°C                    |  |
| Humidity (non condensing)                                  | 95 % rel H max.                      |  |
| Reliability, calculated MTBF (MIL-HDBK-217F ground benign) | >1 Mio. h @ + 25 °C                  |  |
| Isolation voltage (60sec.)                                 | - Input/Output                       | 1'500 VDC  |
| Isolation capacity   | - Input/Output                       | 650 pF typ.                                      |
| Isolation resistance                                       | - Input/Output (500 VDC)             | >1'000 MOhm                                      |
| Switching frequency  | 260 kHz typ.                         |  |
| Safety standards   | UL 60950-1 , IEC 60950-1, EN 60950-1 |  |
| Safety approvals   | CSA (pending)                        |  |
| Remote On/Off  | - On:                                | 2.5 ... 5.5 VDC or open circuit                  |
|  | - Off:                               | -0.7 ... 0.8 VDC or short circuit pin 1 and 2(3) |
|  | - Off idle current:                  | 10 mA  |

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

**Physical Specifications**

|                          |  |
|--------------------------|--|
| Case material            | non conductive plastic   |
| Potting material         | epoxy (UL 94V-0 rated)   |
| Weight                   | 14 g (0.55 oz)   |
| Reflow soldering profile | as per IPC/JEDEC J-STD-020C<br>peak temp. 245°C (+0°C) for 20sec. max. |

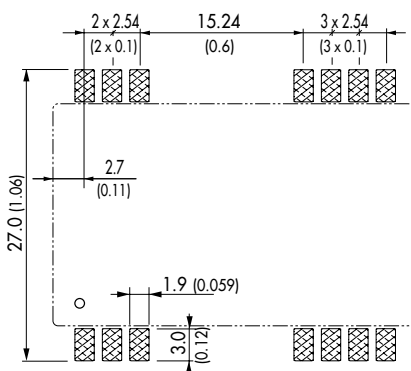
**Outline Dimensions**



| Pin-Out |               |               |
|---------|---------------|---------------|
| Pin     | Single        | Dual          |
| 1       | Remote On/Off | Remote On/Off |
| 2       | -Vin (GND)    | -Vin (GND)    |
| 3       | -Vin (GND)    | -Vin (GND)    |
| 9       | No con.       | Common        |
| 10      | No con.       | No con.       |
| 11      | No con.       | -Vout         |
| 12      | No con.       | No con.       |
| 13      | No con.       | No con.       |
| 14      | +Vout         | +Vout         |
| 15      | No con.       | No con.       |
| 16      | -Vout         | Common        |
| 22      | +Vin (Vcc)    | +Vin (Vcc)    |
| 23      | +Vin (Vcc)    | +Vin (Vcc)    |
| 24      | No con.       | No con.       |

Dimensions in [mm], ( ) = Inch  
Tolerances ±0.25 (0.02)  
Pin pitch tolerances ±0.13 (0.005)

**Pin Patterns:**



Specifications can be changed any time without notice