

## DC/DC Converter

## TES 5WI Series, 5 Watt

- Compact SMD package
- 33.4 x 25.6 mm footprint
- Ultra-wide 4:1 input voltage range
- I/O isolation 1500 VDC
- Operating temp. range  
-40°C to +70°C
- Short circuit protection
- Input filter to meet EN 55032,  
conducted class A
- Remote On/Off
- High accuracy of pin co-planarity
- 3-year product warranty



The TES 5WI series is a family of high performance 5W DC/DC converter modules in a low profile SMD package with compact dimensions. The 14 modules feature ultrawide 4:1 input ranges with tightly regulated output voltage. High efficiency allows an operating temperature range of -40 to +70°C at full load. Further features are built-in EMI-filter to meet EN 55032 conducted class A without external components and remote On/Off control. The products comply with IPC J-STD-020D and are qualified for high temperature lead-free reflow solder process

### Models

| Order Code   | Input Voltage Range          | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|--------------|------------------------------|----------|------------------|----------|------------------|-----------------|
|              |                              | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| TES 5-2410WI | 9 - 36 VDC<br>(24 VDC nom.)  | 3.3 VDC  | 1'200 mA         |          |                  | 76 %            |
| TES 5-2411WI |                              | 5 VDC    | 1'000 mA         |          |                  | 80 %            |
| TES 5-2412WI |                              | 12 VDC   | 420 mA           |          |                  | 83 %            |
| TES 5-2413WI |                              | 15 VDC   | 335 mA           |          |                  | 83 %            |
| TES 5-2421WI |                              | +5 VDC   | 500 mA           | -5 VDC   | 500 mA           | 80 %            |
| TES 5-2422WI |                              | +12 VDC  | 210 mA           | -12 VDC  | 210 mA           | 83 %            |
| TES 5-2423WI |                              | +15 VDC  | 165 mA           | -15 VDC  | 165 mA           | 83 %            |
| TES 5-4810WI | 18 - 75 VDC<br>(48 VDC nom.) | 3.3 VDC  | 1'200 mA         |          |                  | 76 %            |
| TES 5-4811WI |                              | 5 VDC    | 1'000 mA         |          |                  | 80 %            |
| TES 5-4812WI |                              | 12 VDC   | 420 mA           |          |                  | 83 %            |
| TES 5-4813WI |                              | 15 VDC   | 335 mA           |          |                  | 83 %            |
| TES 5-4821WI |                              | +5 VDC   | 500 mA           | -5 VDC   | 500 mA           | 80 %            |
| TES 5-4822WI |                              | +12 VDC  | 210 mA           | -12 VDC  | 210 mA           | 83 %            |
| TES 5-4823WI |                              | +15 VDC  | 165 mA           | -15 VDC  | 165 mA           | 83 %            |

## Input Specifications

|                           |                |                                                                                                               |
|---------------------------|----------------|---------------------------------------------------------------------------------------------------------------|
| Input Current             | - At no load   | 24 Vin models: 20 mA typ.<br>48 Vin models: 10 mA typ.                                                        |
|                           | - At full load | 24 Vin models: 250 mA typ.<br>48 Vin models: 125 mA typ.                                                      |
| Surge Voltage             |                | 24 Vin models: 50 VDC max. (1 s max.)<br>48 Vin models: 100 VDC max. (1 s max.)                               |
| Start-up Voltage          |                | 24 Vin models: 7 VDC min. / 8 VDC typ. / 9 VDC max.<br>48 Vin models: 14 VDC min. / 16 VDC typ. / 18 VDC max. |
| Under Voltage Lockout     |                | 24 Vin models: 6 VDC min. / 7 VDC typ. / 8 VDC max.<br>48 Vin models: 13 VDC min. / 15 VDC typ. / 17 VDC max. |
| Reflected Ripple Current  |                | 24 Vin models: 10 mAp-p typ.<br>48 Vin models: 5 mAp-p typ.                                                   |
| Recommended Input Fuse    |                | (The need of an external fuse has to be assessed in the final application.)                                   |
| Short Circuit Input Power |                | 3 W max.                                                                                                      |

## Output Specifications

|                           |                                         |                                                                                                                              |
|---------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Voltage Set Accuracy      |                                         | ±2% max.                                                                                                                     |
| Regulation                | - Input Variation (Vmin - Vmax)         | single output models: 1% max.<br>dual output models: 1% max.                                                                 |
|                           | - Load Variation (10 - 100%)            | single output models: 1% max.<br>dual output models: 1% max. (Output 1)<br>1% max. (Output 2)                                |
|                           | - Voltage Balance<br>(symmetrical load) | dual output models: 3% max.                                                                                                  |
|                           |                                         |                                                                                                                              |
| Ripple and Noise          |                                         | - 20 MHz Bandwidth<br>85 mVp-p max.                                                                                          |
| Capacitive Load           | - single output                         | 3.3 Vout models: 2'000 µF max.<br>5 Vout models: 2'000 µF max.<br>12 Vout models: 470 µF max.<br>15 Vout models: 330 µF max. |
|                           | - dual output                           | 5 / -5 Vout models: 680 / 680 µF max.<br>12 / -12 Vout models: 330 / 330 µF max.<br>15 / -15 Vout models: 220 / 220 µF max.  |
|                           |                                         |                                                                                                                              |
|                           |                                         |                                                                                                                              |
|                           |                                         |                                                                                                                              |
|                           |                                         |                                                                                                                              |
| Minimum Load              |                                         | 10 % of Iout max.<br>(Operation at lower load will not damage the converter, but it may not meet all specifications)         |
| Temperature Coefficient   |                                         | ±0.02 %/K max.                                                                                                               |
| Start-up Time             |                                         | 10 ms max.                                                                                                                   |
| Short Circuit Protection  |                                         | Continuous, Automatic recovery                                                                                               |
| Overload Protection       |                                         | Foldback Mode                                                                                                                |
| Output Current Limitation |                                         | 115% min. of Iout max.                                                                                                       |
| Transient Response        | - Response Deviation                    | 2% typ. / 6% max. (25% Load Step)                                                                                            |
|                           | - Response Time                         | 250 µs typ. / 500 µs max. (25% Load Step)                                                                                    |

## Safety Specifications

|           |                             |                                                |
|-----------|-----------------------------|------------------------------------------------|
| Standards | - IT / Multimedia Equipment | Designed for IEC/EN/UL 62368-1 (not certified) |
|-----------|-----------------------------|------------------------------------------------|

## EMC Specifications

|                 |                       |                                                                                |
|-----------------|-----------------------|--------------------------------------------------------------------------------|
| EMI (Emissions) | - Conducted Emissions | EN 55032 class A (internal filter)<br>FCC 47 Part 15 class A (internal filter) |
|                 |                       |                                                                                |
|                 | - Radiated Emissions  | EN 55032 class A (internal filter)<br>FCC 47 Part 15 class A (internal filter) |
|                 |                       |                                                                                |

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

## General Specifications

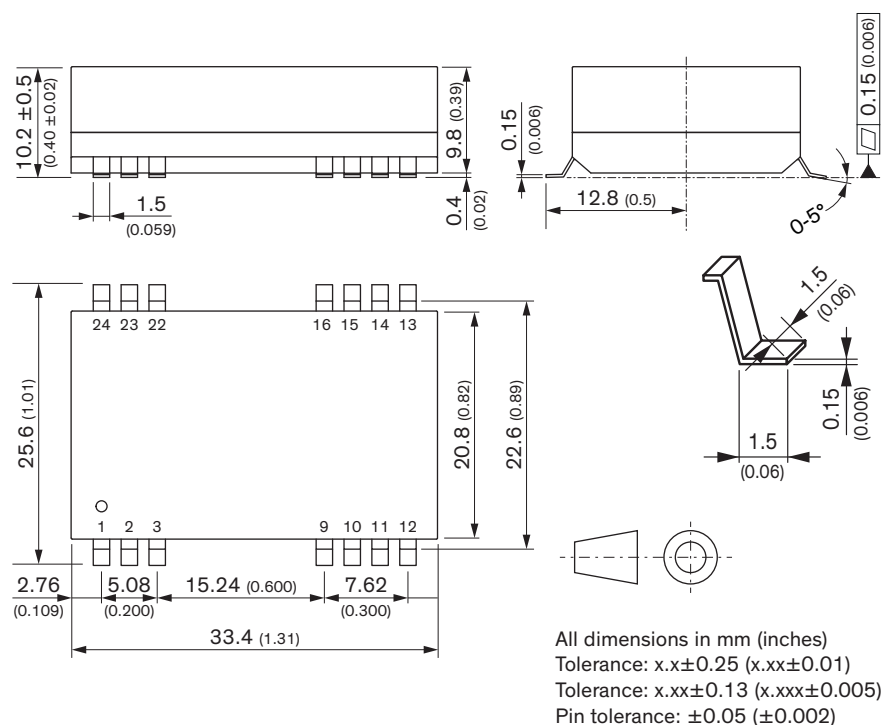
|                            |                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relative Humidity          |                                                                                                                                      | 95% max. (non condensing)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Temperature Ranges         | - Operating Temperature<br>- Case Temperature<br>- Storage Temperature                                                               | -40°C to +70°C (without derating)<br>+100°C max.<br>-50°C to +125°C                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Power Derating             | - High Temperature                                                                                                                   | 3.3 %/K above 70°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                            | See application note: <a href="http://www.tracopower.com/overview/tes5wi">www.tracopower.com/overview/tes5wi</a>                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Cooling System             |                                                                                                                                      | Natural convection (20 LFM)                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Remote Control             | - Voltage Controlled Remote (passive = on)<br><br>- Off Idle Input Current<br>- Remote Pin Input Current                             | On: 2.5 to 5.5 VDC or open circuit<br>Off: -0.7 to +0.8 VDC or short circuit<br>Refers to 'Remote' and '-Vin' Pin<br>10 mA max.<br>-0.7 mA max.                                                                                                                                                                                                                                                                                                                                       |
| Regulator Topology         |                                                                                                                                      | Push-Pull Converter                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Switching Frequency        |                                                                                                                                      | 210 - 350 kHz (PFM)<br>340 kHz typ. (PFM)                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Insulation System          |                                                                                                                                      | Functional Insulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Isolation Test Voltage     | - Input to Output, 60 s                                                                                                              | 1'500 VDC                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Isolation Resistance       | - Input to Output, 500 VDC                                                                                                           | 1'000 MΩ min.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Isolation Capacitance      | - Input to Output, 100 kHz, 1 V                                                                                                      | 650 pF typ.<br>750 pF max.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Reliability                | - Calculated MTBF                                                                                                                    | 1'000'000 h (MIL-HDBK-217F, ground benign)                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Moisture Sensitivity (MSL) |                                                                                                                                      | Level 2 (J-STD-033C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Washing Process            |                                                                                                                                      | Not allowed                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Housing Material           |                                                                                                                                      | Plastic resin (UL 94 V-0 rated)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Pin Material               |                                                                                                                                      | Phosphor Bronze (C5191)                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pin Foundation Plating     |                                                                                                                                      | Copper (1 - 3 μm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Pin Surface Plating        |                                                                                                                                      | Tin (7.5 μm min.), matte                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Housing Type               |                                                                                                                                      | Plastic Case                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Mounting Type              |                                                                                                                                      | PCB Mount                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Connection Type            |                                                                                                                                      | SMD (Surface-Mount Device)                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Footprint Type             |                                                                                                                                      | SMD24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Soldering Profile          |                                                                                                                                      | Lead-Free Reflow Soldering (acc. J-STD-020E)                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                            | See application note: <a href="http://www.tracopower.com/info/reflow-soldering.pdf">www.tracopower.com/info/reflow-soldering.pdf</a> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Weight                     |                                                                                                                                      | 14 g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Environmental Compliance   | - REACH Declaration<br><br>- RoHS Declaration<br><br>- SCIP Reference Number                                                         | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant<br><a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7(a)<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)<br>c77aae5d-5033-4d0d-826b-295f60f75778 |

## Additional Information

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| Supporting Documents       | <a href="http://www.tracopower.com/overview/tes5wi">www.tracopower.com/overview/tes5wi</a>     |
| Frequently Asked Questions | <a href="http://www.tracopower.com/glossary-faq">www.tracopower.com/glossary-faq</a>           |
| Glossary                   | <a href="http://www.tracopower.com/info/glossary.pdf">www.tracopower.com/info/glossary.pdf</a> |

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

### Outline Dimensions



| Pinout |               |               |
|--------|---------------|---------------|
| Pin    | Single        | Dual          |
| 1      | Remote On/Off | Remote On/Off |
| 2      | -Vin (GND)    | -Vin (GND)    |
| 3      | -Vin (GND)    | -Vin (GND)    |
| 9      | NC            | Common        |
| 10     | NC            | NC            |
| 11     | NC            | -Vout         |
| 12     | NC            | NC            |
| 13     | NC            | NC            |
| 14     | +Vout         | +Vout         |
| 15     | NC            | NC            |
| 16     | -Vout         | Common        |
| 22     | +Vin (Vcc)    | +Vin (Vcc)    |
| 23     | +Vin (Vcc)    | +Vin (Vcc)    |
| 24     | NC            | NC            |

NC: Not connected

### Recommended Solder Pad Layout

