

- **Highly cost efficient design**
- **Pin compatible with LMxx linear regulators**
- **Operation temperature. range -40°C to +85°C**
- **Efficiency up to 92%**
- **Wide input operating range 6-36 VDC**
- **Short circuit protection**
- **Excellent line / load regulation**
- **3-year product warranty**



The TSR 1E is a 1 Ampere step-down switching regulator series and a drop-in replacement for inefficient 78xx linear regulators. This series comes in a standard plastic SIP-3 case and complements our existing POL portfolio with a series focusing strongly on a cost efficient design while maintaining our quality standards. The effective design allows full load operation up to +60°C ambient temperature without the need of any heat sink or forced cooling. The TSR 1E switching regulators provide other significant features over linear regulators, i.e. better output accuracy, lower standby current and no requirement of external capacitors. The TSR 1E series offers a broad application range in many environments and is especially suited for high volume projects where the series will help to reduce production cost by delivering not only a highly cost efficient but also reliable solution.

| Models      |                     |                          |                     |                 |
|-------------|---------------------|--------------------------|---------------------|-----------------|
| Order Code  | Output Current max. | Input Voltage Range      | Output Voltage nom. | Efficiency typ. |
| TSR 1-2433E | 1'000 mA            | 6 - 36 VDC (24 VDC nom.) | 3.3 VDC             | 88 %            |
| TSR 1-2450E |                     | 7 - 36 VDC (24 VDC nom.) | 5 VDC               | 92 %            |

### Input Specifications

|                        |   |
|------------------------|---|
| Recommended Input Fuse | (The need of an external fuse has to be assessed in the final application.) |
| Input Filter           | Internal Capacitor  |

### Output Specifications

|                           |  |
|---------------------------|--|
| Voltage Set Accuracy      | ±4% max.   |
| Regulation                | - Input Variation (Vmin - Vmax)<br>- Load Variation (10 - 100%)<br>0.75% max.<br>1.5% max. |
| Ripple and Noise          | - 20 MHz Bandwidth<br>80 mVp-p typ.  |
| Capacitive Load           | 1'000 µF max.  |
| Minimum Load              | Not required   |
| Temperature Coefficient   | ±0.03 %/K max.   |
| Short Circuit Protection  | Continuous, Automatic recovery   |
| Output Current Limitation | 350% max. of Iout max.   |

### EMC Specifications

|               |   |  |
|---------------|---|--|
| EMI Emissions | - Conducted Emissions<br>- Radiated Emissions | EN 55032 class B (with external filter)<br>EN 55032 class B (with external filter)                                 |
|               |   | External filter proposal: <a href="http://www.tracopower.com/overview/tsr1e">www.tracopower.com/overview/tsr1e</a> |

### General Specifications

|  |  |   |
|--|--|---|
| Relative Humidity                      |  | 95% max. (non condensing)   |
| Temperature Ranges                     | - Operating Temperature<br>- Case Temperature<br>- Storage Temperature | -40°C to +85°C<br>+105°C max.<br>-50°C to +125°C  |
| Power Derating                         | - High Temperature   | 4.17 %/K above 61°C   |
| Over Temperature Protection Switch Off | - Protection Mode  | 150°C typ. (Latch off)  |
| Cooling System                         |  | Natural convection (20 LFM)   |
| Switching Frequency                    |  | 520 kHz typ. (PWM)  |
| Insulation System                      |  | Non-isolated  |
| Reliability                            | - Calculated MTBF  | 7'000'000 h (MIL-HDBK-217F, ground benign)  |
| Washing Process                        |  | Not allowed   |
| Housing Material                       |  | Plastic (UL 94 V-0 rated)   |
| Potting Material                       |  | Epoxy (UL 94 V-0 rated)   |
| Pin Material                           |  | Phosphor Bronze (C5191)   |
| Pin Foundation Plating                 |  | Nickel (1 µm min.)  |
| Pin Surface Plating                    |  | Tin (3 µm min.), bright   |
| Housing Type                           |  | Plastic Case  |
| Mounting Type                          |  | PCB Mount   |
| Connection Type                        |  | THD (Through-Hole Device)   |
| Footprint Type                         |  | SIP3  |
| Weight                                 |  | 1.6 g   |
| Environmental Compliance               | - REACH Declaration<br><br>- RoHS Declaration                          | <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: 7a, 7c-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.) |

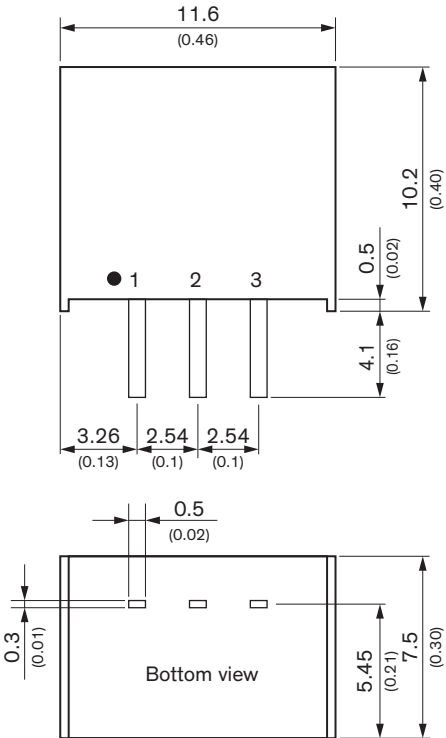
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

**Supporting Documents**

Overview Link (for additional Documents)

[www.tracopower.com/overview/tsr1e](http://www.tracopower.com/overview/tsr1e)

**Outline Dimensions**



| Pinout |          |
|--------|----------|
| Pin    | Function |
| 1      | +Vin     |
| 2      | GND      |
| 3      | +Vout    |

Dimensions in mm (inch)  
 Tolerances: x.x ±0.5 (±0.02)  
 x.xx ±0.25 (±0.01)