

- **Highly cost efficient design**
- **Pin compatible with LMxx linear regulators**
- **Operation temperature. range -40°C to $+85^{\circ}\text{C}$**
- **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 $+60^{\circ}\text{C}$ 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) 0.75% max. - Load Variation (10 - 100%) 1.5% max.
Ripple and Noise	- 20 MHz Bandwidth 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.
Transient Response	- Peak Variation 80 mV max. (50% to 100% Load Step) (3.3 Vout model) 100 mV max. (50% to 100% Load Step) (5 Vout model) - Response Time 200 µs max. (50% to 100% Load Step)

Safety Specifications

Over Voltage Category	Not mains connected
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EMC Specifications

EMI (Emissions)	- Conducted Emissions EN 55032 class A (internal filter) EN 55032 class B (with external filter) - Radiated Emissions EN 55032 class A (internal filter) EN 55032 class B (with external filter)
External filter proposal: www.tracopower.com/tsr1e-emc-filter/	

General Specifications

Relative Humidity	95% max. (non condensing)
Temperature Ranges	- Operating Temperature -40°C to +85°C - Case Temperature +105°C max. - Storage Temperature -50°C to +125°C
Power Derating	- High Temperature 4.17 %/K above 61°C See application note: www.tracopower.com/tsr1e-cc/
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

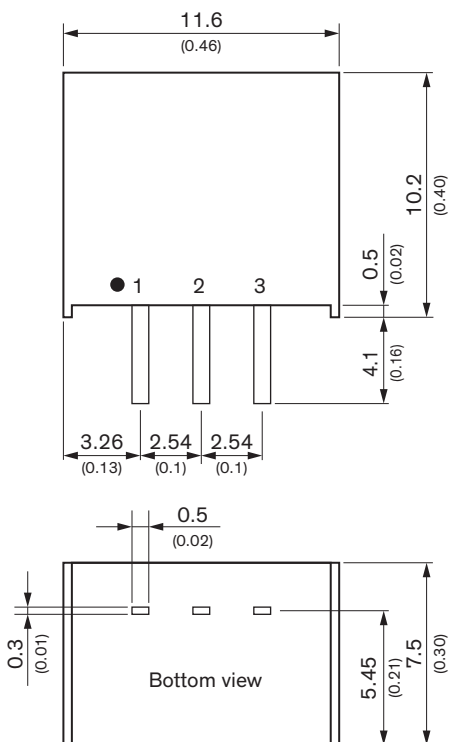
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Soldering Profile	Lead-Free Wave Soldering 265 °C / 5 s max.
Weight	1.6 g
Environmental Compliance	- REACH Declaration www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) - RoHS Declaration - SCIP Reference Number 3880b865-22ea-4c73-9bb3-931a3f09253d

Additional Information

Supporting Documents	www.tracopower.com/overview/tsr1e
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

Outline Dimensions

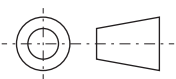


Dimensions in mm (inch)

Tolerances: x.x ±0.5 (±0.02)

x.xx ±0.25 (±0.01)

Pin dimension tolerance: ±0.1 (±0.04)



Pinout

Pin	Function
1	+Vin
2	GND
3	+Vout

Avoid routing PCB traces under the converter.