

- Ultra compact SIP package 0.55 x 0.30 x 0.40 inch
- Up to 96% efficiency – No heat-sink required
- Pin compatible with LMxx linear regulators
- Built in filter capacitors
- Operating temperature range -40°C to +85°C
- Excellent line / load regulation
- Short circuit protection
- 3-year product warranty



The new TSR 2 series step-down switching regulators are drop-in replacement for inefficient LMxx linear regulators. A high efficiency up to 96% allows full load operation up to +67°C ambient temperature without the need of any heat-sink or forced cooling. The TSR 2 switching regulators provide other significant features over linear regulators, i.e. better output accuracy ($\pm 2\%$), lower standby current of 2 mA and no requirement of external capacitors. The high efficiency and low standby power consumption makes these regulators an ideal solution for many battery powered applications.

Models				
Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSR 2-0512	2'000 mA	3 - 5.5 VDC (5 VDC nom.)	1.2 VDC	90 %
TSR 2-0515			1.5 VDC	91 %
TSR 2-0518		3.8 - 5.5 VDC (5 VDC nom.)	1.8 VDC	92 %
TSR 2-0525			2.5 VDC	95 %
TSR 2-2412		4.6 - 36 VDC (12 VDC nom.)	1.2 VDC	84 %
TSR 2-2415			1.5 VDC	86 %
TSR 2-2418			1.8 VDC	87 %
TSR 2-2425			2.5 VDC	89 %
TSR 2-2433			3.3 VDC	91 %
TSR 2-2450			5 VDC	94 %
TSR 2-2465			6.5 VDC	94 %
TSR 2-2490		12 - 36 VDC (24 VDC nom.)	9 VDC	95 %
TSR 2-24120		15 - 36 VDC (24 VDC nom.)	12 VDC	95 %
TSR 2-24150		18 - 36 VDC (24 VDC nom.)	15 VDC	96 %

Note - If the input is switched electromechanically, a 22 μ F / 50 V electrolytic capacitor at the input is recommended (12 & 24 Vin models only)

Input Specifications

Input Current	- At no load	5 Vin models: 1 mA typ. 12 Vin models: 1 mA typ. 24 Vin models: 1 mA typ.
Recommended Input Fuse	- 12 Vin input	5 Vin models: 2'000 mA (slow blow) 24 Vin models: 3'150 mA (slow blow) 1.2 Vout models: 1'600 mA (slow blow) 1.5 Vout models: 1'600 mA (slow blow) 1.8 Vout models: 1'600 mA (slow blow) 2.5 Vout models: 2'500 mA (slow blow) 3.3 Vout models: 2'500 mA (slow blow) 5 Vout models: 2'500 mA (slow blow) 6.5 Vout models: 2'500 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Capacitor

Output Specifications

Voltage Set Accuracy		±2% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	0.5% max. 1% max.
Ripple and Noise (20 MHz Bandwidth)	5 Vin models: 12 Vin models: 24 Vin models:	50 mVp-p typ. 50 mVp-p typ. 75 mVp-p typ.
Capacitive Load	1.2 Vout models: 1.5 Vout models: 1.8 Vout models: 2.5 Vout models: 3.3 Vout models: 5 Vout models: 6.5 Vout models: 9 Vout models: 12 Vout models: 15 Vout models:	2'500 µF max. 2'000 µF max. 1'600 µF max. 1'200 µF max. 900 µF max. 600 µF max. 470 µF max. 330 µF max. 270 µF max. 200 µF max.
Minimum Load		Not required
Temperature Coefficient		±0.02 %/K max.
Start-up Time		5 ms typ.
Short Circuit Protection		Continuous, Automatic recovery
Overload Protection		Foldback Mode
Output Current Limitation		400% typ. of Iout max. (5 Vin models) 180% typ. (other input models)
Transient Response	- Peak Variation - Response Time	300 mV typ. / 500 mV max. (50% Load Step) (24 Vin models) 150 mV typ. / 250 mV max. (50% Load Step) (other models) 150 µs typ. / 200 µs max. (50% Load Step)

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +85°C +105°C max. -55°C to +125°C
Power Derating	- High Temperature	See application note: www.tracopower.com/overview/tsr2

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

Over Temperature	- Protection Mode	150°C typ. (Automatic recovery)
Protection Switch Off	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Switching Frequency		1200 kHz typ. (PWM) (5 Vin models) 410 kHz typ. (PWM) (other models)
Insulation System		Non-isolated
Reliability	- Calculated MTBF	13'520'000 h (MIL-HDBK-217F, ground benign)
Washing Process		Allowed (hermetical product)
	See Cleaning Guideline:	www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Thermal Shock	MIL-STD-810F MIL-STD-810F
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (2 - 3 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP3
Soldering Profile		260°C / 10 s max.
Weight		2.6 g
Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7c-I (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.)

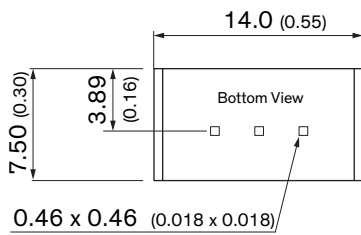
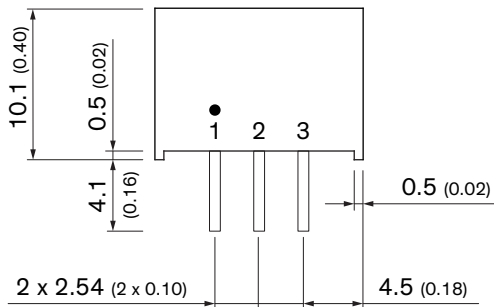
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/tsr2

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Outline Dimensions



Dimensions in mm (inch)
 Tolerances: x.xx ±0.5 (±0.02)
 Tolerances: x.xxx ±0.25 (±0.01)
 Pin pitch tolerances: ±0.25 (±0.01)
 Pin dimension tolerance: ±0.1 (±0.004)

Pinout

Pin	Function
1	+Vin
2	GND
3	+Vout