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TRACO POWER

Non-Isolated DC/DC Converter (POL)

TSR 2 Series, 2 A

- **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 (±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			1.8 VDC	92 %
TSR 2-0525		3.8 - 5.5 VDC (5 VDC nom.)	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		4.75 - 36 VDC (12 VDC nom.)	3.3 VDC	91 %
TSR 2-2450		6.5 - 36 VDC (12 VDC nom.)	5 VDC	94 %
TSR 2-2465		9 - 36 VDC (12 VDC nom.)	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 µF / 50 V electrolytic capacitor at the input is recommended (12 & 24 Vin models only)

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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		5 Vin models:	2'000 mA (slow blow)
		24 Vin models:	3'150 mA (slow blow)
	- 12 Vin input	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)		0.5% max.
	- Load Variation (0 - 100%)		1% max.
Ripple and Noise (20 MHz Bandwidth)		5 Vin models:	50 mVp-p typ.
		12 Vin models:	50 mVp-p typ.
		24 Vin models:	75 mVp-p typ.
Capacitive Load		1.2 Vout models:	2'500 µF max.
		1.5 Vout models:	2'000 µF max.
		1.8 Vout models:	1'600 µF max.
		2.5 Vout models:	1'200 µF max.
		3.3 Vout models:	900 µF max.
		5 Vout models:	600 µF max.
		6.5 Vout models:	470 µF max.
		9 Vout models:	330 µF max.
		12 Vout models:	270 µF max.
		15 Vout models:	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		300 mV typ. / 500 mV max. (50% Load Step) (24 Vin models)
			150 mV typ. / 250 mV max. (50% Load Step) (other models)
	- Response Time		150 µs typ. / 200 µs max. (50% Load Step)

Safety Specifications

Over Voltage Category			Not mains connected

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +85°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C

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

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Power Derating	- High Temperature	Depending on model
	See application note:	www.tracopower.com/tsr2-cc/
Over Temperature Protection Switch Off	- Protection Mode	150°C typ. (Automatic recovery)
	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Regulator Topology		Buck Converter
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		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F
	- Thermal Shock	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		Lead-Free Wave Soldering 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: 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	2baf39d9-abae-4a7c-9ae8-e00f0d4514fc

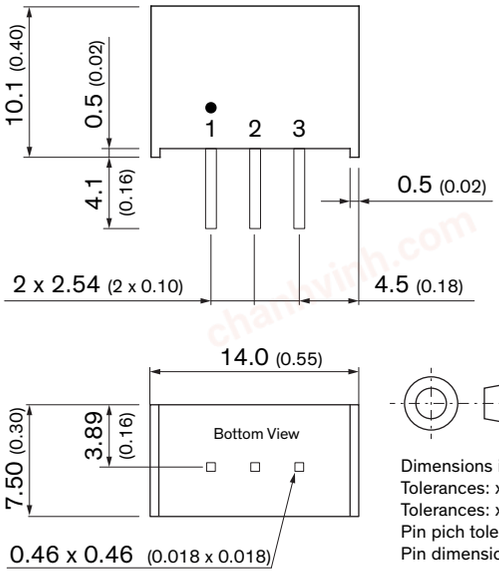
Additional Information

Supporting Documents	www.tracopower.com/overview/tsr2
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

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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 pich tolerances: ±0.25 (±0.01)
Pin dimension tolerance: ±0.1 (±0.004)

Pinout	
Pin	**Function**
1	+Vin
2	GND
3	+Vout

Avoid routing PCB traces under the converter.

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