TRACO POWER

Non-Isolated DC/DC Converter (POL) — TSR 0.5 Series, 0.5 A

- **Compact SIP package**
- **Very high efficiency up to 97%**
- **Excellent line / load regulation**
- **Low standby current**
- **Operating temperature range –40 to 90°C**
- **Over-temperature protection**
- **Short circuit protection**
- **3-year product warranty**

TSR 0.5 is a series of step-down non-isolated switching regulators in compact SIP package. These converters are an ideal drop-in replacement to LM78 linear regulators when energy efficiency is a parameter of the design. The high efficiency up to 97% allows full load operation up to +80°C (+90°C with 50% load) ambient temperature without the need of forced air cooling.
Excellent output voltage accuracy and low standby current are other features that distinguish switching regulators from linear regulators.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSR 0.5-2415	500 mA	4.75 - 32 VDC (24 VDC nom.)	1.5 VDC	73 % (at Vin min.)
TSR 0.5-2418			1.8 VDC	82 % (at Vin min.)
TSR 0.5-2425			2.5 VDC	87 % (at Vin min.)
TSR 0.5-2433			3.3 VDC	91 % (at Vin min.)
TSR 0.5-2450		6.5 - 32 VDC (24 VDC nom.)	5 VDC	94 % (at Vin min.)
TSR 0.5-2465		8 - 32 VDC (24 VDC nom.)	6.5 VDC	95 % (at Vin min.)
TSR 0.5-2490		11 - 32 VDC (24 VDC nom.)	9 VDC	96 % (at Vin min.)
TSR 0.5-24120		15 - 32 VDC (24 VDC nom.)	12 VDC	97 % (at Vin min.)
TSR 0.5-24150		18 - 32 VDC (24 VDC nom.)	15 VDC	97 % (at Vin min.)

Note - For input voltage higher 28 VDC an input capacitor of 22 µF is required

Input Specifications

Input Current	- At no load		5 mA typ.
Surge Voltage			34 VDC max. (1 s max.)
Recommended Input Fuse			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Capacitor
Short Circuit Input Power			1.5 W max.

Output Specifications

Voltage Set Accuracy			±3% max.
Regulation	- Input Variation (Vmin - Vmax)		0.2% max. (9, 12 & 15 Vout models) 0.4% max. (other models)
	- Load Variation (10 - 100%)		0.4% max. (9, 12 & 15 Vout models) 0.6% max. (other models)
Ripple and Noise (20 MHz Bandwidth)		1.5 Vout models:	30 mVp-p max.
		1.8 Vout models:	30 mVp-p max.
		2.5 Vout models:	30 mVp-p max.
		3.3 Vout models:	30 mVp-p max.
		5 Vout models:	30 mVp-p max.
		6.5 Vout models:	30 mVp-p max.
		9 Vout models:	40 mVp-p max.
		12 Vout models:	40 mVp-p max.
		15 Vout models:	40 mVp-p max.
Capacitive Load			220 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.015 %/K max.
Short Circuit Protection			Continuous, Automatic recovery
Transient Response	- Response Deviation		2% max. (50% Load Step)
	- Response Time		100 µs max. (50% Load Step)

EMC Specifications

EMI (Emissions)	- Conducted Emissions		EN 55032 class A (with external filter) EN 55032 class B (with external filter) FCC 47 Part 15 class A (with external filter) FCC 47 Part 15 class B (with external filter)
	- Radiated Emissions		EN 55032 class A (internal filter) EN 55032 class B (internal filter) FCC 47 Part 15 class A (internal filter) FCC 47 Part 15 class B (internal filter)
		External filter proposal:	www.tracopower.com/tsr0-5-emc-filter
EMS (Immunity)	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 kV, perf. criteria A
	- RF Electromagnetic Field		EN 61000-4-3, 3 V/m, perf. criteria A
	- EFT (Burst)		EN 61000-4-4, ±0.5 kV, perf. criteria A
		Ext. input component:	Nippon chemi-con KY 330 µF
	- Conducted RF Disturbances		EN 61000-4-6, 3 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous:	EN 61000-4-8, 3 A/m, perf. criteria A

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +90°C
	- Case Temperature		+100°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		5 %/K above 80°C
		See application note:	www.tracopower.com/tsr0-5-cc

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

Over Temperature Protection Switch Off	- Protection Mode	160°C typ. (Automatic recovery)
	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Switching Frequency		280 - 380 kHz (PWM) 330 kHz typ. (PWM)
Insulation System		Non-isolated
Reliability	- Calculated MTBF	2'000'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Housing Material		Non-conductive 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 - 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		1.95 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(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	575248ee-a8c4-4c66-9627-4c039ce860d0

Additional Information

Supporting Documents	www.tracopower.com/overview/tsr0-5
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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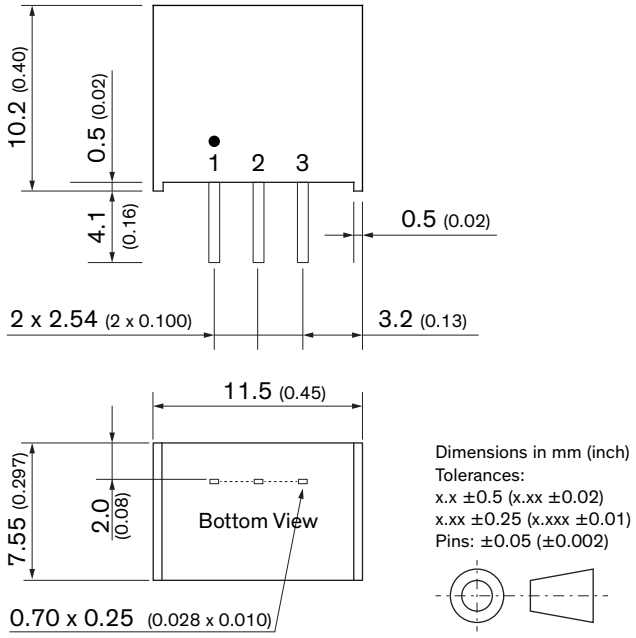
Outline Dimensions



Dimensions in mm (inch)
Tolerances:
x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)
Pins: ±0.05 (±0.002)

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