THE DATASHEET OF

TSR 1-2450SM

TRACO POWER

Non-Isolated DC/DC Converter (POL) — TSR 1SM Series, 1 A

- **SMD-package**
- **Up to 96% efficiency**
- **No thermal layer required**
- **Built in filter capacitors**
- **Operation temp. range –40°C to +85°C**
- **Short circuit protection**
- **Wide input operating range**
- **Excellent line / load regulation**
- **Low standby current**
- **3-year product warranty**

The new TSR-1SM series models of step-down switching regulators have a high efficiency up to 96% which allows full load operation up to +65°C ambient temperature without the need of any heat transmission layer. Excellent output voltage accuracy (±2%) and low standby current (~1 µA) are features that distinguish these switching regulators from linear regulators.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSR 1-0512SM	1'000 mA	3 - 5.5 VDC (5 VDC nom.)	1.2 VDC	91 % (at Vin min.)
TSR 1-0515SM			1.5 VDC	92 % (at Vin min.)
TSR 1-0518SM			1.8 VDC	93 % (at Vin min.)
TSR 1-0525SM		3.8 - 5.5 VDC (5 VDC nom.)	2.5 VDC	95 % (at Vin min.)
TSR 1-2412SM		4.6 - 36 VDC (12 VDC nom.)	1.2 VDC	74 % (at Vin min.)
TSR 1-2415SM			1.5 VDC	79 % (at Vin min.)
TSR 1-2418SM			1.8 VDC	82 % (at Vin min.)
TSR 1-2425SM			2.5 VDC	87 % (at Vin min.)
TSR 1-2433SM		4.75 - 36 VDC (12 VDC nom.)	3.3 VDC	91 % (at Vin min.)
TSR 1-2450SM		6.5 - 36 VDC (12 VDC nom.)	5 VDC	94 % (at Vin min.)
TSR 1-2465SM		9 - 36 VDC (12 VDC nom.)	6.5 VDC	94 % (at Vin min.)
TSR 1-2490SM		12 - 36 VDC (24 VDC nom.)	9 VDC	95 % (at Vin min.)
TSR 1-24120SM		15 - 36 VDC (24 VDC nom.)	12 VDC	95 % (at Vin min.)
TSR 1-24150SM		18 - 36 VDC (24 VDC nom.)	15 VDC	96 % (at Vin min.)

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.
	- At full load	5 Vin models:	1'000 mA max.
		12 Vin models:	1'000 mA max.
		24 Vin models:	1'000 mA max.
			(at Vin min.)
Reflected Ripple Current			150 mAp-p typ.
Recommended Input Fuse		5 Vin models:	1'000 mA (slow blow)
		24 Vin models:	1'600 mA (slow blow)
	- 12 Vin input	1.2 Vout models:	800 mA (slow blow)
		1.5 Vout models:	800 mA (slow blow)
		1.8 Vout models:	800 mA (slow blow)
		2.5 Vout models:	1'250 mA (slow blow)
		3.3 Vout models:	1'250 mA (slow blow)
		5 Vout models:	1'250 mA (slow blow)
		6.5 Vout models:	1'250 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)		0.2% max.
	- Load Variation (0 - 100%)		0.6% 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			470 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.015 %/K max.
Start-up Time			5 ms typ.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			480% typ. of Iout max. (5 Vin models)
			250% typ. (other models)
Transient Response	- Peak Variation		200 mV typ. / 400 mV max. (50% Load Step)
	- Response Time		250 µs typ. / 350 µs max. (50% Load Step)

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
Power Derating	- High Temperature		2.5 %/K above 65°C
		See application note:	www.tracopower.com/overview/tsr1sm
Over Temperature Protection Switch Off	- Protection Mode		150°C typ. (Automatic recovery)
	- Measurement Point		Internal IC temperature
Cooling System			Natural convection (20 LFM)
Switching Frequency			1200 kHz typ. (PWM) (5 Vin models)
			500 kHz typ. (PWM) (other models)
Insulation System			Non-isolated
Reliability	- Calculated MTBF		12'000'000 h (MIL-HDBK-217F, ground benign)
Moisture Sensitivity (MSL)			Level 1 (J-STD-033C)

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

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)
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Epoxy (UL 94 V-0 rated) (Converter halfway potted on top of the PCB, not visible through vent hole)
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		SMD (Surface-Mount Device)
Footprint Type		SMD10
Soldering Profile		Lead-Free Reflow Soldering (acc. J-STD-020E) 245°C max. (Tp) 10 s max. (tp, at Tp - 5°C) 100 s max. (tL, time above 217°C) See application note: www.tracopower.com/info/reflow-soldering.pdf
Weight		1.7 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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	88c49d6d-d291-4109-a33e-aaca264fda7b

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tsr1sm

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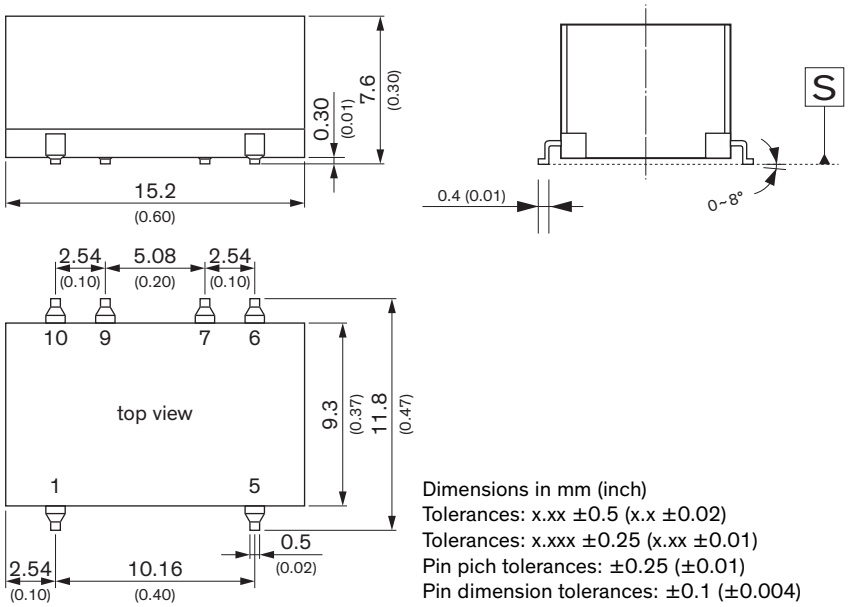
Outline Dimensions

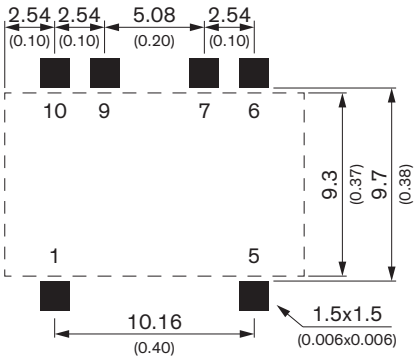


Dimensions in mm (inch)
Tolerances: x.xx ±0.5 (x.x ±0.02)
Tolerances: x.xxx ±0.25 (x.xx ±0.01)
Pin pich tolerances: ±0.25 (±0.01)
Pin dimension tolerances: ±0.1 (±0.004)

Pinout	
Pin	**Function**
1	+Vin
5	+Vout
6	NC
7	GND
9	GND
10	NC

NC: Not connected

Recommended Solder Pad Layout



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