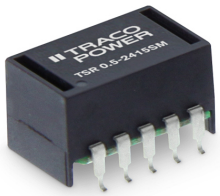
TRACO POWER

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

- **Compact SMD package**
- **Very high efficiency up to 97%**
- **Excellent line / load regulation**
- **Low standby current**
- **Operating temperature range –40 to 90°C**
- **Over-temperature and short circuit protection**
- **Remote On/Off input**
- **Adjustable output voltage**
- **Moisture sensitivity level 2 as per IPC J-STD-033C**
- **3-year product warranty**



TSR 0.5SM is a series of step-down non-isolated switching regulators in compact SIP package. These converters are an ideal alternative 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. (adjustable)	Efficiency typ.
TSR 0.5-2415SM	500 mA	4.75 - 32 VDC (24 VDC nom.)	1.5 VDC (1.4 - 2.5 VDC)	73 % (at Vin min.)
TSR 0.5-2418SM			1.8 VDC (1.5 - 3.0 VDC)	82 % (at Vin min.)
TSR 0.5-2425SM			2.5 VDC (1.5 - 3.0 VDC)	87 % (at Vin min.)
TSR 0.5-2433SM			3.3 VDC (3.0 - 5.5 VDC)	91 % (at Vin min.)
TSR 0.5-2450SM		6.5 - 32 VDC (24 VDC nom.)	5 VDC (3.0 - 8.0 VDC)	94 % (at Vin min.)
TSR 0.5-2465SM		8 - 32 VDC (24 VDC nom.)	6.5 VDC (3.3 - 11.0 VDC)	95 % (at Vin min.)
TSR 0.5-2490SM		11 - 32 VDC (24 VDC nom.)	9 VDC (4.5 - 12.6 VDC)	96 % (at Vin min.)
TSR 0.5-24120SM		15 - 32 VDC (24 VDC nom.)	12 VDC (4.5 - 13.5 VDC)	97 % (at Vin min.)
TSR 0.5-24150SM		18 - 32 VDC (24 VDC nom.)	15 VDC (4.5 - 15.5 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

Output Voltage Adjustment		1.5 Vout models:	1.4 - 2.5 VDC
		1.8 Vout models:	1.5 - 3.0 VDC
		2.5 Vout models:	1.5 - 3.0 VDC
		3.3 Vout models:	3.0 - 5.5 VDC
		5 Vout models:	3.0 - 8.0 VDC
		6.5 Vout models:	3.3 - 11.0 VDC
		9 Vout models:	4.5 - 12.6 VDC
		12 Vout models:	4.5 - 13.5 VDC
		15 Vout models:	4.5 - 15.5 VDC
			(By external trim resistor)
		See application note:	www.tracopower.com/overview/tsr0-5sm
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 B (with external filter)
			FCC Part 15 class B (with external filter)
	- Radiated Emissions		EN 55032 class B (internal filter)
			FCC Part 15 class B (internal filter)
		External filter proposal:	www.tracopower.com/overview/tsr0-5sm
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, 100 V
	- 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

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

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/overview/tsr0-5sm
Over Temperature Protection Switch Off	- Protection Mode	160°C typ. (Automatic recovery)
	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote	On: 2.4 to 5.0 VDC or open circuit Off: 0 to 1.6 VDC or short circuit Refers to 'Remote' and 'GND' Pin
	- Off Idle Input Current	0.035 mA max.
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)
Moisture Sensitivity (MSL)		Level 2 (J-STD-033C)
Washing Process		Allowed (open product)
	See Cleaning Guideline:	www.tracopower.com/info/cleaning.pdf
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Pin Material		Phosphor Bronze (C5191)
Pin Foundation Plating		Copper (1 - 3 µm)
Pin Surface Plating		Tin (7.5 µm min.), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		SMD (Surface-Mount Device)
Footprint Type		SMD10
Soldering Profile		Reflow Soldering (J-STD-020E)
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 (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/tsr0-5sm

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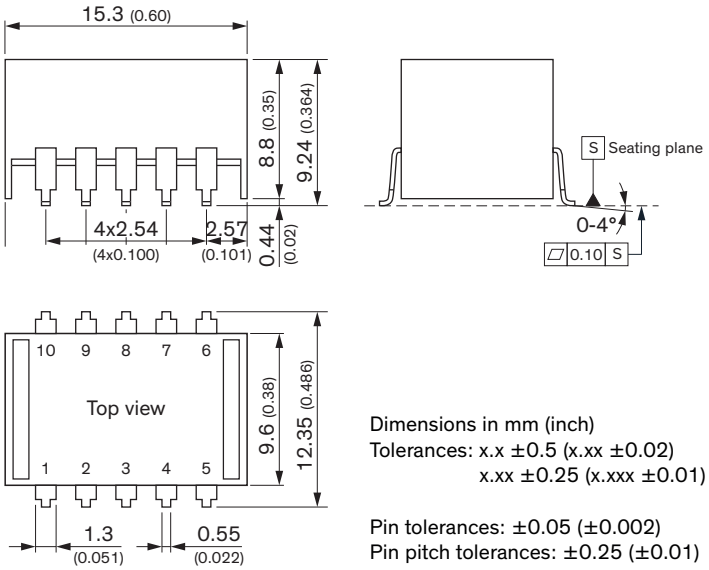
Outline Dimensions



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

Pin tolerances: ±0.05 (±0.002)
Pin pitch tolerances: ±0.25 (±0.01)

Pinout	
Pin	**Function**
1	+Vin
2	+Vin
3	GND
4	+Vout
5	+Vout
6	Trim
7	GND
8	GND
9	GND
10	Remote On/Off

Recommended Solder Pad Layout