

- 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 $+80^{\circ}\text{C}$ ($+90^{\circ}\text{C}$ 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 V_{in} min.)
TSR 0.5-2418SM			1.8 VDC (1.5 - 3.0 VDC)	82 % (at V_{in} min.)
TSR 0.5-2425SM			2.5 VDC (1.5 - 3.0 VDC)	87 % (at V_{in} min.)
TSR 0.5-2433SM			3.3 VDC (3.0 - 5.5 VDC)	91 % (at V_{in} min.)
TSR 0.5-2450SM			5 VDC (3.0 - 8.0 VDC)	94 % (at V_{in} min.)
TSR 0.5-2465SM			6.5 VDC (3.3 - 11.0 VDC)	95 % (at V_{in} min.)
TSR 0.5-2490SM			9 VDC (4.5 - 12.6 VDC)	96 % (at V_{in} min.)
TSR 0.5-24120SM			12 VDC (4.5 - 13.5 VDC)	97 % (at V_{in} min.)
TSR 0.5-24150SM	15 VDC (4.5 - 15.5 VDC)	97 % (at V_{in} 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 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/overview/tsr0-5sm

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

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
	- Conducted RF Disturbances	Ext. input component: Nippon chemi-con KY 330 μ F, 100 V
	- PF Magnetic Field	Continuous: EN 61000-4-6, 3 Vrms, perf. criteria A
		Continuous: EN 61000-4-8, 3 A/m, perf. criteria A

General Specifications

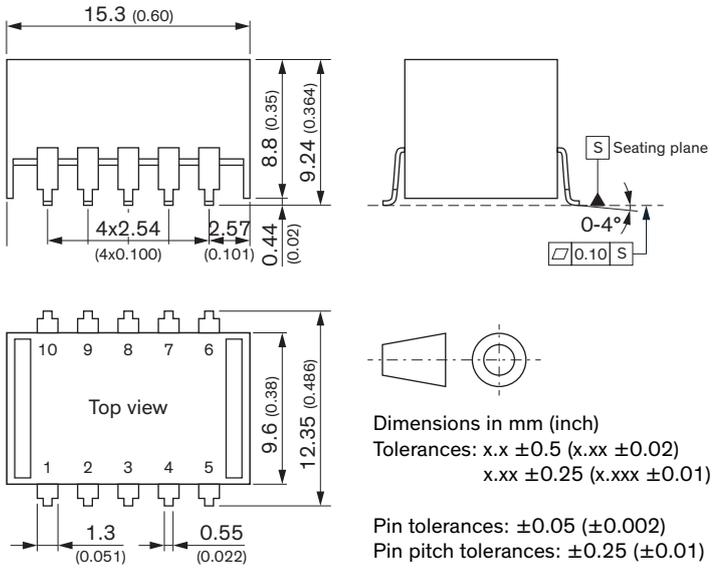
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +90°C
	- Case Temperature	+100°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	5 %/K above 80°C
		See application note: www.tracopower.com/overview/tsr0-5sm
Over Temperature 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 (passive = on)	On: 2.4 to 5.0 VDC or open circuit
	- Off Idle Input Current	Off: 0 to 1.6 VDC or short circuit
		Refers to 'Remote' and 'GND' Pin
		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		According to 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 μ m)
Pin Surface Plating		Tin (7.5 μ m min.), 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)
		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
	- RoHS Declaration	REACH SVHC list compliant
		REACH Annex XVII compliant
		www.tracopower.com/info/rohs-declaration.pdf
		Exemptions: 7(a)
		(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))
	- SCIP Reference Number	e0a18ff4-ad10-4a4c-9291-ed6dcd37c4d5

Additional Information

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

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Outline Dimensions



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

