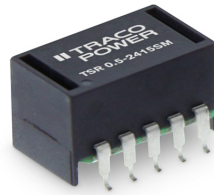


- Compact SMD package
- Very high efficiency up to 97%
- Excellent line / load regulation
- Low standby current
- Operating temperature range  $-40$  to  $90^{\circ}\text{C}$
- Over-temperature and short circuit protection
- Remote On/Off input
- Adjustable output voltage
- Moisture sensitivity level 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  $\mu\text{F}$  is required

### Input Specifications

Input Current	- At no load	5 mA typ.
Surge Voltage		34 VDC max. (1 s max.)
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: <a href="http://www.tracopower.com/overview/tsr0-5sm">www.tracopower.com/overview/tsr0-5sm</a>
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
	- Radiated Emissions	EN 55032 class B (internal filter) FCC Part 15, class B
		External filter proposal: <a href="http://www.tracopower.com/overview/tsr0-5sm">www.tracopower.com/overview/tsr0-5sm</a>
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

### General Specifications

Relative Humidity		95% max. (non condensing)
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All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.

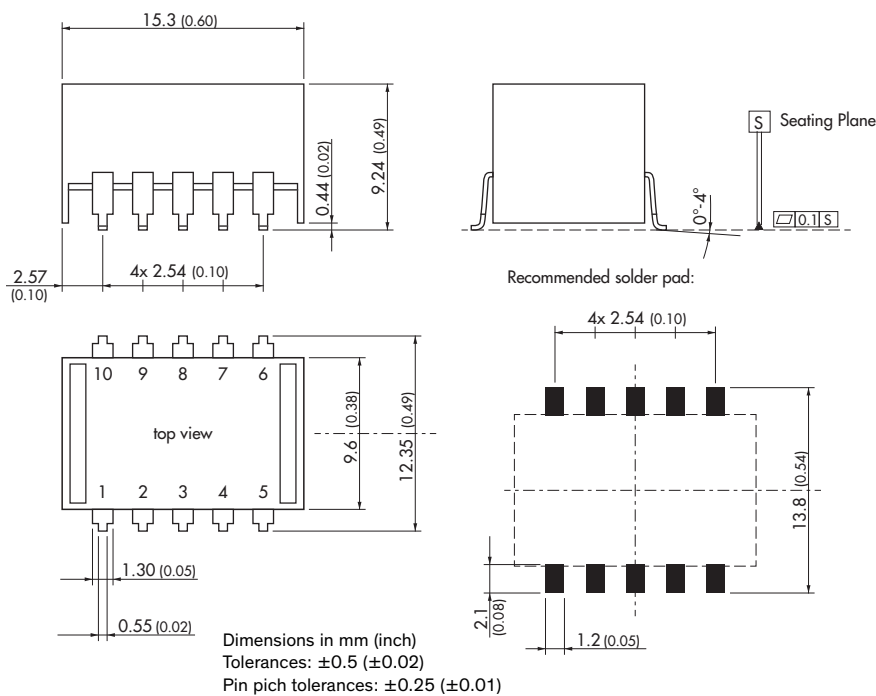
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +90°C +100°C max. -55°C to +125°C
Power Derating	- High Temperature	5 %/K above 80°C
Over Temperature Protection Switch Off	- Protection Mode - Measurement Point	160°C typ. (Automatic recovery) Internal IC temperature
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote  - Off Idle Input Current	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 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		Baking after washing: 100°C for 30 min
Housing Material		Non-conductive Plastic (UL94 V-0 rated)
Pin Material		Phosphor Bronze
Soldering Profile		Reflow Soldering (J-STD-020E)
Connection Type		SMD (Surface-Mount Device)
Weight		1.7 g
Environmental Compliance	- Reach - RoHS	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tsr0-5sm](http://www.tracopower.com/overview/tsr0-5sm)

### 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