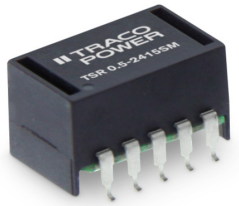
DC/DC Converters

TSR 0.5SM Series, 0.5 A Switching Regulator

Features

- 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 protection
- Remote On/Off input
- Adjustable output voltage
- Short circuit protection
- Moisture sensitivity level 2 as per IPC J-STD-020D.1
- 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 aircooling.
Excellent output voltage accuracy and low standby current are other features that distinguish switching regulators from linear regulators.

Models

Order code	Input voltage range [1]	Output voltage		Output current	Efficiency typ.	
		nominal	trim range [2]	max.	@ Vin min.	@ Vin 32VDC
TSR 0.5-2415SM	4.75 – 32 VDC	1.5 VDC	1.4 – 2.5 VDC	0.5 A	73 %	63 %
TSR 0.5-2418SM		1.8 VDC	1.5 – 3.0 VDC		82 %	71 %
TSR 0.5-2425SM		2.5 VDC	1.5 – 3.0 VDC		87 %	77 %
TSR 0.5-2433SM		3.3 VDC	3.0 – 5.5 VDC		91 %	81 %
TSR 0.5-2450SM	6.5 – 32 VDC	5.0 VDC	3.0 – 8.0 VDC		94 %	86 %
TSR 0.5-2465SM	8 – 32 VDC	6.5 VDC	3.3 – 11.0 VDC		95 %	88 %
TSR 0.5-2490SM	11 – 32 VDC	9.0 VDC	4.5 – 12.6 VDC		96 %	92 %
TSR 0.5-24120SM	15 – 32 VDC	12 VDC	4.5 – 13.5 VDC		97 %	94 %
TSR 0.5-24150SM	18 – 32 VDC	15 VDC	4.5 – 15.5 VDC		97 %	95 %

1) For input voltage higher 24 VDC an input capacitor 22 µF/ 50 V is required
2) Input voltage must be higher than output voltage set:>1.5 V for 3.3–5.0V and >3 V for 6.5–15.0V

Input Specifications

No load input current (at 24Vin)			5 mA typ.
Short circuit input power			1.5 W max.
Surge voltage			–0.3 / 34 VDC max.
Input filter			internal capacitor, see filter suggestion page 3 for to meet EN55022 class A, class B
ESD (electrostatic discharge)			EN 61000-4-2, air ±8 kV, perf. criteria A
Radiated immunity			EN 61000-4-3 3 V/m, perf. criteria A
Fast transient			EN 61000-4-4, ±0.5 kV, perf. criteria A with external input capacitor e.g. Nippon chemi-con KY 330 µF, 100 V
Conducted immunity			EN 61000-4-6, 3 Vrms, perf. criteria A
Magnetic field immunity			EN 61000-4-8, 3 A/m, perf. criteria A

Output Specifications

Voltage set accuracy			±3 % (at full load)
Regulation	– Input variation	1.5 to 6.5 Vin models: other models:	0.4 % 0.2 %
	– Load variation (10 – 100 %)	1.5 to 6.5 Vin models: other models:	0.6 % 0.4 %
Minimum load			not required
Ripple and noise		1.5 to 6.5 Vin models: other models:	30 mVp-p max. 40 mVp-p max.
Temperature coefficient			±0.015 %/K max.
Dynamic load (50% load step change)	– Peak variation – Response time		±2 % max. 100 µS max.
Short circuit protection			continuous, automatic recovery
Capacitive load			220 µF max.

General Specifications

Temperature ranges	– Operating – Case temperature – Storage	–40°C to +90°C +100°C. max. –55°C to +125°C
Derating	– positive output circuit	5 %/K above +80°C
Overtemperature protection		at +160°C (on internal IC)
Humidity (non condensing)		95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)		>2'000'000 h
Isolation voltage		none
Switching frequency		330 kHz ±50 kHz (pulse width modulation)
Remote On/Off	– On: – Off: – Off idle current (at 24 Vin):	2.4 – 5.0 VDC (ref. to GND) or open circuit. 0 – 1.6 VDC (ref. to GND) or connect. to GND 35 µA max.
Environmental compliance	– Reach – RoHS	www.tracopower.com/info/reach-declaration.pdf RoHS directive 2011/65/EU

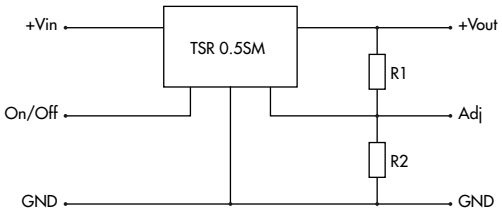
Physical Specifications

Casing material	non-conductive plastic (UL94V-0 rated)
Pin material	phosphor bronce
Weight	1.7 g (0.6 oz)
Lead-free reflow solder process	as per J-STD-020D.01
Moisture sensitivity level (MSL)	level 2 as per IPC J-STD-020D.1
Washing	baking after washing: 100°C for 30 min.

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

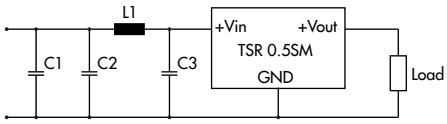
Applications notes

Output voltage adjustment



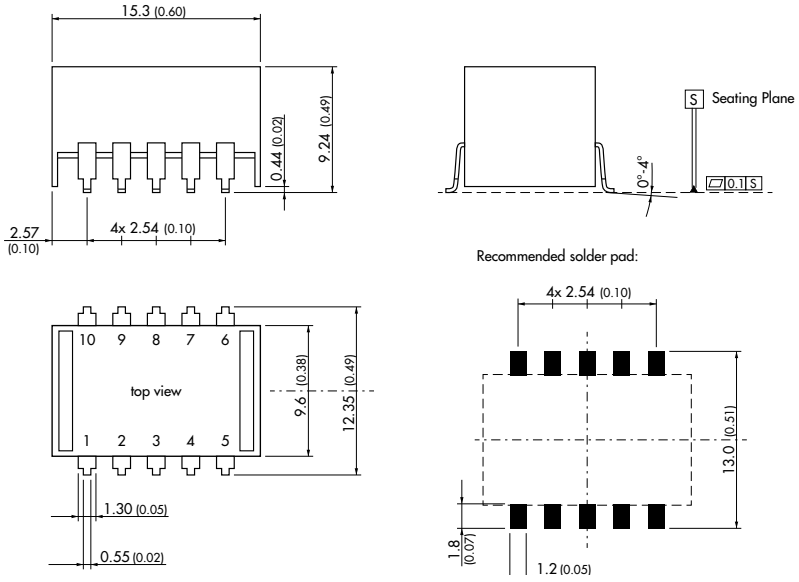
	R1 <----------		open		----------> R2
	[KOhm]	Min.	Nominal	Max.	[KOhm]
TSR 0.5-2415SM	1.0	1.4 VDC	1.5 VDC	2.5 VDC	0.47
TSR 0.5-2418SM	3	1.5 VDC	1.8 VDC	3.0 VDC	4.64
TSR 0.5-2425SM	0.2	1.5 VDC	2.5 VDC	3.0 VDC	44.2
TSR 0.5-2433SM	88.4	3.0 VDC	3.3 VDC	5.5 VDC	3.9
TSR 0.5-2450SM	17	3.0 VDC	5.0 VDC	8.0 VDC	2.32
TSR 0.5-2465SM	15	3.3 VDC	6.5 VDC	11 VDC	0.825
TSR 0.5-2490SM	26	4.5 VDC	9.0 VDC	12.6 VDC	0
TSR 0.5-24120SM	17	4.5 VDC	12 VDC	13.5 VDC	57.6
TSR 0.5-24150SM	10.5	4.5 VDC	15 VDC	15.5 VDC	300

EMI filter for EN 55022 class A & B



Class	C1	C2 & C3	L1 value	order code (SMD type)	datasheet:
A	–	4.7 µF / 50 V 1206 MLCC	3.3 µH	**TCK-044**	www.tracopower.com/products/tck044.pdf
B	4.7 µF / 50 V 1206 MLCC		10 µH	**TCK-047**	www.tracopower.com/products/tck047.pdf

Outline Dimensions



Pinout	
1	+Vin
2	+Vin
3	GND
4	+Vout
5	+Vout
6	adj.
7	GND
8	GND
9	GND
10	On/Off

Dimensions in [mm], () = Inch
Tolerances: ±0.5 (±0.02)
Pin pich tolerances: ±0.25 (±0.01)