

- Compact SMD package
- Suitable for positive & negative output circuit
- Adjustable output voltage
- Wide input up to 42 VDC
- Remote On/Off input
- Built in filter capacitors
- Operation temp. range -40°C to $+85^{\circ}\text{C}$
- Excellent line/load regulation
- Low standby current
- 3-year product warranty



The new TSRN 1SM series are step-down non-isolated switching regulators in compact SMD package. They are an ideal solution to replace inefficient linear regulators. The high efficiency up to 95% allows full load operation up to $+55^{\circ}\text{C}$ ($+85^{\circ}\text{C}$ with derating) ambient temperature without the need of forced air cooling.

The TSRN-1SM switching regulators provide other significant features over linear regulators, i.e. better output accuracy ($\pm 2\%$), lower standby current of $\sim 4\text{ mA}$ and no requirement of external capacitors. They are suitable for positive or negative output circuits and offer a trim input for output voltage adjustment. The high efficiency, low standby power consumption and remote On/Off function make these regulators an ideal solution for energy sensitive applications.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom. (adjustable)	Efficiency typ.
TSRN 1-0525SM	1'000 mA	3 - 5.5 VDC (5 VDC nom.)	2.5 VDC (1.2 - 3.63 VDC)	96 %
TSRN 1-2433SM		4.6 - 42 VDC (12 VDC nom.)	3.3 VDC (1.5 - 5.5 VDC)	88 %
TSRN 1-2450SM		6.5 - 42 VDC (12 VDC nom.)	5 VDC (2.5 - 8.0 VDC)	92 %
TSRN 1-2490SM		10.5 - 42 VDC (12 VDC nom.)	9 VDC (4.5 - 12.6 VDC)	95 %
TSRN 1-24120SM		13.5 - 42 VDC (24 VDC nom.)	12 VDC (4.5 - 13.5 VDC)	95 %
TSRN 1-24150SM		16.5 - 42 VDC (24 VDC nom.)	15 VDC (4.5 - 15.5 VDC)	96 %

Note - For external circuit proposal for negative output voltage, refer to application note: www.tracopower.com/overview/tsrn1sm

Input Specifications

Input Current	- At no load	5 Vin models: 6 mA typ. 12 Vin models: 3 mA typ. 24 Vin models: 4 mA typ.
Reflected Ripple Current		100 mAp-p typ.
Recommended Input Fuse		5 Vin models: 2'000 mA (slow blow) 12 Vin models: 2'500 mA (slow blow) 24 Vin models: 1'600 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Capacitor

Output Specifications

Output Voltage Adjustment		2.5 Vout models: 1.2 - 3.63 VDC 3.3 Vout models: 1.5 - 5.5 VDC 5 Vout models: 2.5 - 8.0 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/tsrn1sm-adj
Voltage Set Accuracy		±2% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	0.2% max. 0.6% max.
Ripple and Noise (20 MHz Bandwidth)	5 Vin models: 24 Vin models: 3.3 Vout models: 5 Vout models: 9 Vout models:	50 mVp-p max. 75 mVp-p max. 50 mVp-p max. 50 mVp-p max. 75 mVp-p max.
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
Transient Response	- Peak Variation - Response Time	150 mV typ. / 250 mV max. (50% Load Step) 250 µs typ. / 350 µs max. (50% Load Step)

Safety Specifications

Over Voltage Category	Not mains connected
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EMC Specifications

EMI (Emissions)	- Conducted Emissions - Radiated Emissions	EN 55032 class A (with external filter) EN 55032 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter) External filter proposal: www.tracopower.com/tsrn1sm-emc-filter
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General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +85°C +105°C max. -55°C to +125°C
Power Derating	- High Temperature	Depending on model See application note: www.tracopower.com/tsrn1sm-cc

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

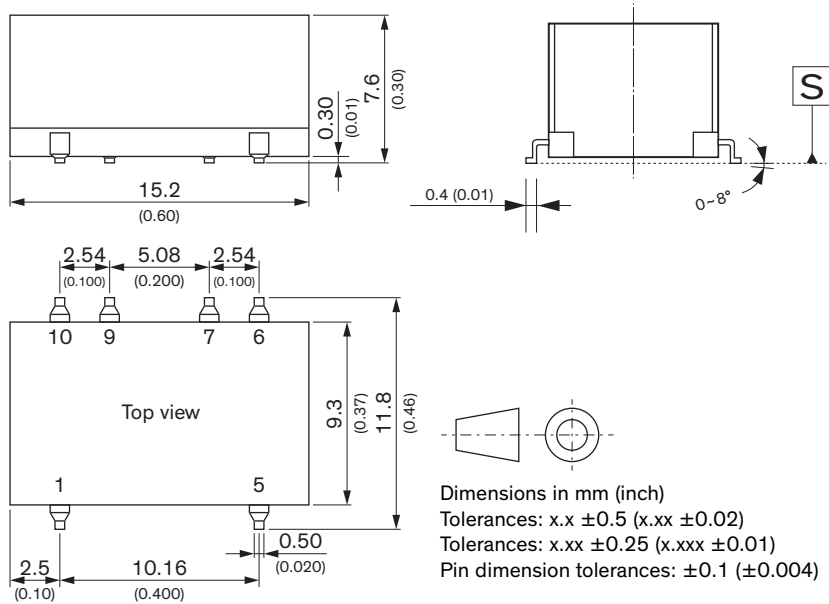
Over Temperature	- Protection Mode	170°C typ. (Automatic recovery)
Protection Switch Off	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on) - Off Idle Input Current	On: 2.0 to 5.0 VDC or open circuit Off: 0 to 0.8 VDC or short circuit Refers to 'Remote' and 'GND' Pin 1.2 mA typ.
Regulator Topology		Buck Converter
Switching Frequency		410 kHz typ. (PWM) (2.5 Vout models) 300 kHz typ. (PWM) (3.3 Vout models) 580 kHz typ. (PWM) (other models))
Insulation System		Non-isolated
Reliability	- Calculated MTBF	14'000'000 h (MIL-HDBK-217F, ground benign)
Moisture Sensitivity (MSL)		Level 1 (J-STD-033C)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Thermal Shock	MIL-STD-810F EN 61373 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 half way 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. (Tc) 30 s max. (tp, at Tp - 5°C) 65 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 - RoHS Declaration - SCIP Reference Number	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) c414b2ac-dba5-47f6-8505-84a60254272a

Additional Information

Supporting Documents	www.tracopower.com/overview/tsrn1sm
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

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

Outline Dimensions



Pinout	
Pin	Function
1	+Vin
5	+Vout
6	Trim
7	GND
9	GND
10	Remote On/Off

Recommended Solder Pad Layout

