

- 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  $-40^{\circ}\text{C}$  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  $\sim 4$  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](http://www.tracopower.com/overview/tsrn1sm)

### Input Specifications

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

### Output Specifications

Output Voltage Adjustment		2.5 Vout models: <b>1.2 - 3.63 VDC</b> 3.3 Vout models: <b>1.5 - 5.5 VDC</b> 5 Vout models: <b>2.5 - 8.0 VDC</b> 9 Vout models: <b>4.5 - 12.6 VDC</b> 12 Vout models: <b>4.5 - 13.5 VDC</b> 15 Vout models: <b>4.5 - 15.5 VDC</b> (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/tsrn1sm">www.tracopower.com/overview/tsrn1sm</a>
Voltage Set Accuracy		<b>±2% max.</b>
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	<b>0.2% max.</b> <b>0.6% max.</b>
Ripple and Noise (20 MHz Bandwidth)		5 Vin models: <b>50 mV<sub>p-p</sub> max.</b> 24 Vin models: <b>75 mV<sub>p-p</sub> max.</b> 3.3 Vout models: <b>50 mV<sub>p-p</sub> max.</b> 5 Vout models: <b>50 mV<sub>p-p</sub> max.</b> 9 Vout models: <b>75 mV<sub>p-p</sub> max.</b>
Capacitive Load		<b>470 µF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.015 %/K max.</b>
Start-up Time		<b>5 ms typ.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Transient Response	- Peak Variation - Response Time	<b>150 mV typ. / 250 mV max.</b> (50% Load Step) <b>250 µs typ. / 350 µs max.</b> (50% Load Step)

### General Specifications

Relative Humidity		<b>95% max.</b> (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	<b>-40°C to +85°C</b> <b>+105°C max.</b> <b>-55°C to +125°C</b>
Power Derating	- High Temperature	<b>Depending on model</b> See application note: <a href="http://www.tracopower.com/overview/tsrn1sm">www.tracopower.com/overview/tsrn1sm</a>
Over Temperature Protection Switch Off	- Protection Mode - Measurement Point	<b>170°C typ.</b> (Automatic recovery) <b>Internal IC temperature</b>
Cooling System		<b>Natural convection</b> (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on) - Off Idle Input Current	<b>On: 2.0 to 5.0 VDC or open circuit</b> <b>Off: 0 to 0.8 VDC or short circuit</b> <b>Refers to 'Remote' and 'GND' Pin</b> <b>1.2 mA typ.</b>
Switching Frequency		<b>410 kHz typ.</b> (PWM) (2.5 Vout models) <b>300 kHz typ.</b> (PWM) (3.3 Vout models) <b>580 kHz typ.</b> (PWM) (other models))
Insulation System		<b>Non-isolated</b>

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

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 <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration	MIL-STD-810F EN 61373
	- Thermal Shock	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 halfway 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. (Tp) 10 s max. (tp, at Tp - 5°C)
		See application note: <a href="http://www.tracopower.com/info/reflow-soldering.pdf">www.tracopower.com/info/reflow-soldering.pdf</a>
Weight		1.7 g
Environmental Compliance	- REACH Declaration	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))
	- SCIP Reference Number	c414b2ac-dba5-47f6-8505-84a60254272a

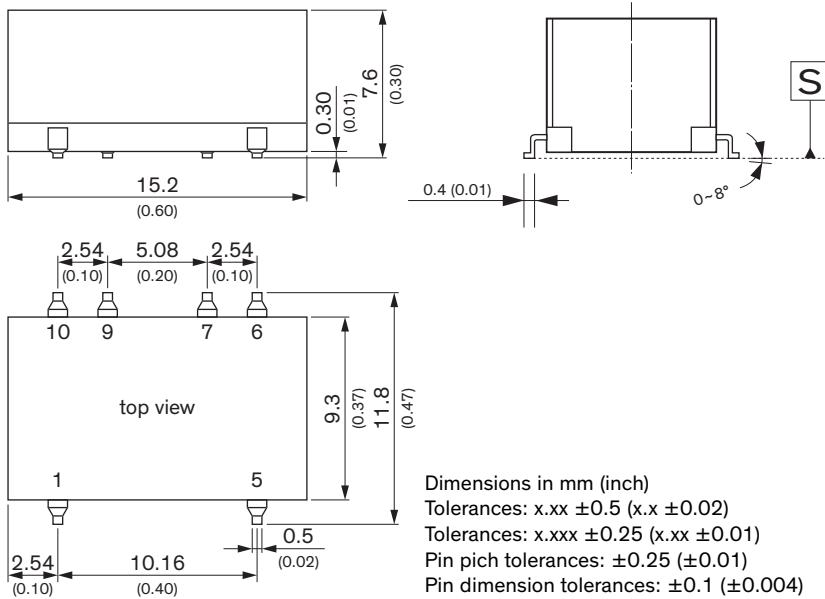
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tsrn1sm](http://www.tracopower.com/overview/tsrn1sm)

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### Outline Dimensions



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

### Recommended Solder Pad Layout

