

## Non-Isolated DC/DC Converter (POL)

## TSRN 1SM Series, 1 A

- 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°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°C (+85°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 ~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 p-p 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		Internal Capacitor

## 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)
Voltage Set Accuracy	<b>±2% max.</b>
Regulation	- Input Variation (Vmin - Vmax) <b>0.2% max.</b> - Load Variation (0 - 100%) <b>0.6% max.</b>
Ripple and Noise (20 MHz Bandwidth)	5 Vin models: <b>50 mVp-p max.</b> 24 Vin models: <b>75 mVp-p max.</b> 3.3 Vout models: <b>50 mVp-p max.</b> 5 Vout models: <b>50 mVp-p max.</b> 9 Vout models: <b>75 mVp-p 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 <b>150 mV typ. / 250 mV max.</b> (50% Load Step) - Response Time <b>250 µs typ. / 350 µs max.</b> (50% Load Step)

## EMC Specifications

EMI (Emissions)	- Conducted Emissions	<b>EN 55032 class A</b> (with external filter)
	- Radiated Emissions	<b>EN 55032 class B</b> (with external filter)
		<b>EN 55032 class A</b> (with external filter)
		<b>EN 55032 class B</b> (with external filter)

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

## General Specifications

Relative Humidity		<b>95% max. (non condensing)</b>
Temperature Ranges	- Operating Temperature	<b>-40°C to +85°C</b>
	- Case Temperature	<b>+105°C max.</b>
	- Storage Temperature	<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	<b>170°C typ. (Automatic recovery)</b>
	- Measurement Point	<b>Internal IC temperature</b>
Cooling System		<b>Natural convection (20 LFM)</b>

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

<b>Remote Control</b>	- Voltage Controlled Remote (passive = on)	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.
<b>Regulator Topology</b>		Buck Converter
<b>Switching Frequency</b>		410 kHz typ. (PWM) (2.5 Vout models) 300 kHz typ. (PWM) (3.3 Vout models) 580 kHz typ. (PWM) (other models)
<b>Insulation System</b>		Non-isolated
<b>Reliability</b>	- Calculated MTBF	14'000'000 h (MIL-HDBK-217F, ground benign)
<b>Moisture Sensitivity (MSL)</b>		Level 1 (J-STD-033C)
<b>Washing Process</b>		According to Cleaning Guideline <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
<b>Environment</b>	- Vibration	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F
<b>Housing Material</b>		Non-conductive Plastic (UL 94 V-0 rated)
<b>Base Material</b>		Non-conductive Plastic (UL 94 V-0 rated)
<b>Potting Material</b>		Epoxy (UL 94 V-0 rated) (Converter halfway potted on top of the PCB, not visible through vent hole)
<b>Pin Material</b>		Copper
<b>Pin Foundation Plating</b>		Nickel (2 - 3 µm)
<b>Pin Surface Plating</b>		Tin (3 - 5 µm), matte
<b>Housing Type</b>		Plastic Case
<b>Mounting Type</b>		PCB Mount
<b>Connection Type</b>		SMD (Surface-Mount Device)
<b>Footprint Type</b>		SMD10
<b>Soldering Profile</b>		Lead-Free Reflow Soldering (acc. J-STD-020E) 245°C max. (Tp) 10 s max. (tp, at Tp - 5°C) 100 s max. (tL, time above 217°C )
<b>Weight</b>		See application note: <a href="http://www.tracopower.com/info/reflow-soldering.pdf">www.tracopower.com/info/reflow-soldering.pdf</a>
<b>Environmental Compliance</b>	- REACH Declaration	1.7 g <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a>
	- RoHS Declaration	REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>
	- SCIP Reference Number	Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (Q5A rule).) c414b2ac-dba5-47f6-8505-84a60254272a

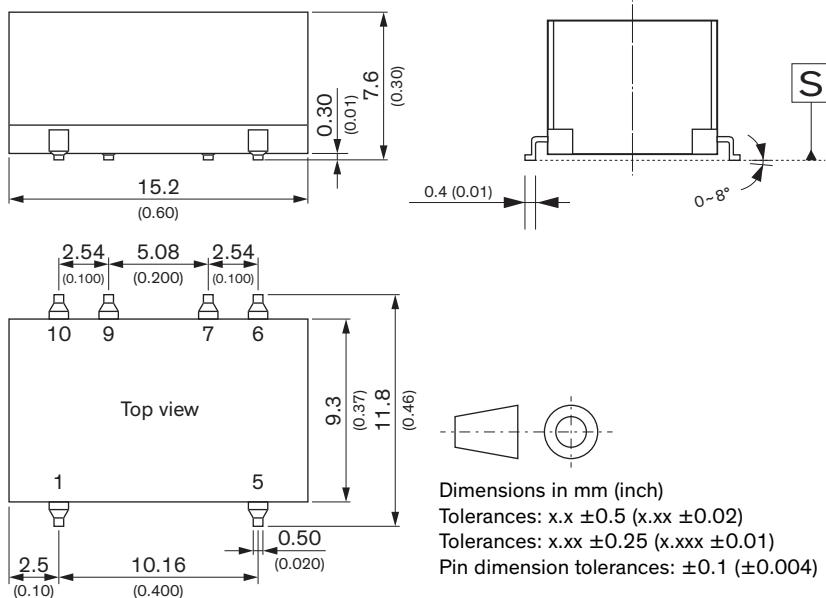
## Supporting Documents

Overview Link (for additional Documents)

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

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

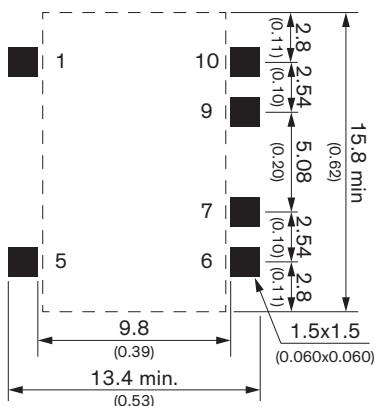
## Outline Dimensions



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

Dimensions in mm (inch)  
 Tolerances: x.x  $\pm 0.5$  (x.xx  $\pm 0.02$ )  
 Tolerances: x.xx  $\pm 0.25$  (xxx  $\pm 0.01$ )  
 Pin dimension tolerances:  $\pm 0.1$  ( $\pm 0.004$ )

## Recommended Solder Pad Layout



Dimensions in mm (inch)