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TRACO POWER

Non-Isolated DC/DC Converter (POL) — TSRN 1 Series, 1 A

- **SIP-package fits existing TO-220 footprint**
- **Suitable for positive & negative output circuit**
- **Pin compatible with LMxx linear regulators**
- **Built in filter capacitors**
- **Operation temp. range –40°C to +85°C**
- **No heat-sink required**
- **Over-temperature & short circuit protection**
- **Wide input range up to 36 VDC**
- **Excellent line/load regulation**
- **3-year product warranty**



The new TSRN 1 series step-down switching regulators are drop-in replacement for inefficient 78xx linear regulators. A high efficiency up to 95% allows full load operation up to +70°C (+85°C with derating) ambient temperature without the need of any heat-sink or forced air cooling.
The TSRN-1 switching regulators provide other significant features over linear regulators, i.e. better output accuracy (±2%), lower standby current of ~2 mA and no requirement of external capacitors. They are suitable for positive or negative output circuits. The high efficiency and low standby power consumption make these regulators an ideal solution for energy sensitive applications.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSRN 1-2415	1'000 mA	4.6 - 36 VDC (12 VDC nom.)	1.5 VDC	77 % (at Vin min.)
TSRN 1-2418			1.8 VDC	81 % (at Vin min.)
TSRN 1-2425			2.5 VDC	84 % (at Vin min.)
TSRN 1-2433			3.3 VDC	88 % (at Vin min.)
TSRN 1-2450		6.5 - 36 VDC (12 VDC nom.)	5 VDC	92 % (at Vin min.)
TSRN 1-2465		8 - 36 VDC (12 VDC nom.)	6.5 VDC	93 % (at Vin min.)
TSRN 1-2490		10.5 - 36 VDC (12 VDC nom.)	9 VDC	95 % (at Vin min.)
TSRN 1-24120		13.5 - 36 VDC (24 VDC nom.)	12 VDC	95 % (at Vin min.)
TSRN 1-24150		16.5 - 36 VDC (24 VDC nom.)	15 VDC	96 % (at Vin min.)

Options

Suffix A	- Optional models with angular pins (see outline dimensions)

Note - For external circuit proposal for negative output voltage, refer to application note: www.tracopower.com/overview/tsrn1

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Input Specifications

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

Output Specifications

Voltage Set Accuracy			±2% max.
Regulation	- Input Variation (Vmin - Vmax)		0.2% max.
	- Load Variation (10 - 100%)		0.6% max. (1.5 Vout models, straight pin vers.)
			1.2% max. (1.5 Vout models, angular pin vers.)
			0.4% max. (1.8 Vout models, straight pin vers.)
			1.2% max. (1.8 Vout models, angular pin vers.)
			0.4% max. (other output models, both pin vers.)
Ripple and Noise		24 Vin models:	75 mVp-p max.
(20 MHz Bandwidth)		1.5 Vout models:	50 mVp-p max.
		1.8 Vout models:	50 mVp-p max.
		2.5 Vout models:	50 mVp-p max.
		3.3 Vout models:	50 mVp-p max.
		5 Vout models:	50 mVp-p max.
		6.5 Vout models:	50 mVp-p max.
		9 Vout models:	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.
Start-up Overshoot Voltage			1% max.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			200% typ. of Iout max.
Transient Response	- Peak Variation		150 mV typ. / 250 mV max. (50% Load Step)
	- Response Time		250 µs typ. / 350 µs max. (50% Load Step)

Safety Specifications

Over Voltage Category			Not mains connected

EMC Specifications

EMI (Emissions)	- Conducted Emissions		EN 55032 class A (with external filter)
			EN 55032 class B (with external filter)
	- Radiated Emissions		EN 55032 class A (with external filter)
			EN 55032 class B (with external filter)
		External filter proposal:	www.tracopower.com/tsrn1-emc-filter/

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +85°C
	- Case Temperature		+100°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/tsrn1-cc/

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

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Over Temperature Protection Switch Off	- Protection Mode	170°C typ. (Automatic recovery)
	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Regulator Topology		Buck Converter
Switching Frequency		240 - 360 kHz (PWM) (1.5 - 3.3 Vout models) 464 - 696 kHz (PWM) (5 - 15 Vout models)
Insulation System		Non-isolated
Reliability	- Calculated MTBF	20'000'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F EN 61373
	- Mechanical Shock	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
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		THD (Through-Hole Device)
Footprint Type		SIP3
Soldering Profile		Lead-Free Wave Soldering 265°C / 10 s max.
Weight		1.9 g
Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	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).)
	- SCIP Reference Number	e4ce8d4a-97c4-4c02-aa67-5cdd9298da13

Additional Information

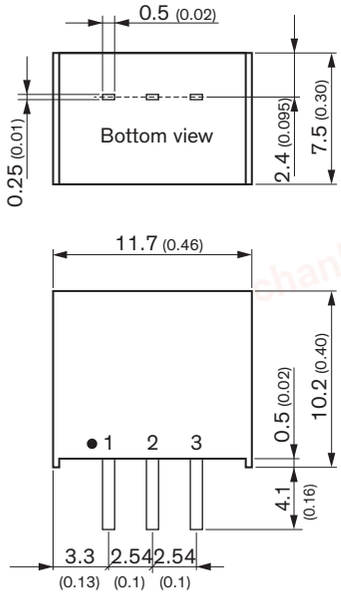
Supporting Documents	www.tracopower.com/overview/tsrn1
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

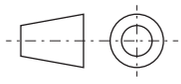
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

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Outline Dimensions

Straight pin version (Standard)



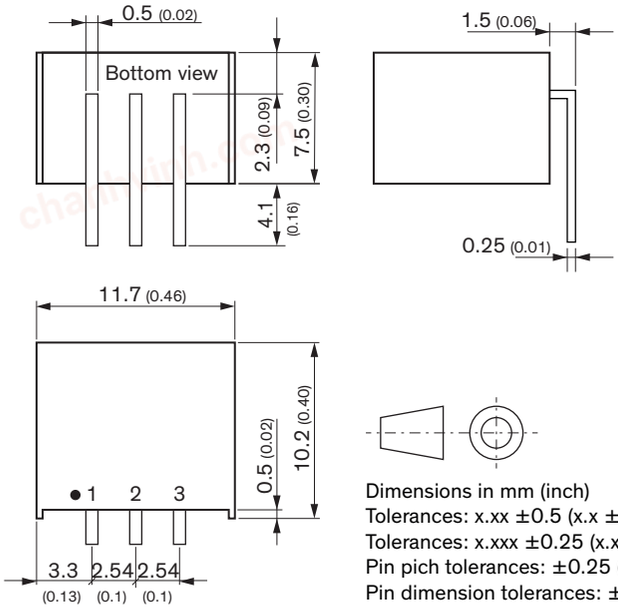


Dimensions in mm (inch)
Tolerances: x.xx ±0.5 (x.x ±0.02)
Tolerances: x.xxx ±0.25 (x.xx ±0.01)
Pin pich tolerances: ±0.25 (±0.01)
Pin dimension tolerances: ±0.1 (±0.004)

Pinout	
Pin	**Function**
1	+Vin
2	GND
3	+Vout

Avoid routing PCB traces under the converter.

Angular pin version (Suffix A)



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

Pinout	
Pin	**Function**
1	+Vin
2	GND
3	+Vout

Avoid routing PCB traces under the converter.

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