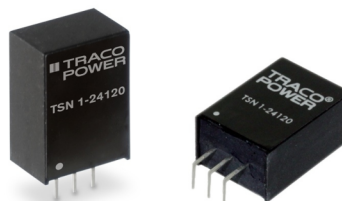


Non-Isolated DC/DC Converter (POL)

TSN 1 Series, 1 A

Not recommended for new designs

- Non-isolated converter for negative output
- Small size and low profile
- Pin compatible with LM79xx linear regulators
- No heatsink required
- High efficiency up to 96%
- Operation temp. range -40°C to $+85^{\circ}\text{C}$
- Protection against overload, short circuit and over-temperature
- Fixed switching frequency
- Wide input range up to -32 VDC
- Excellent line / load regulation
- 3-year product warranty



The new TSN 1 series step-down switching regulators are drop-in replacement for inefficient LM79xx linear regulators. A high efficiency up to 96 % allows full load operation up to $+70^{\circ}\text{C}$ ($+85^{\circ}\text{C}$ with derating) ambient temperature without the need of any heat-sink or forced air cooling. The TSN 1 switching regulators provide other significant features over linear regulators, i.e. better output accuracy ($\pm 2\%$), lower standby current of $\sim 2\text{ mA}$ and no requirement of external capacitors. They are suitable for 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.
TSN 1-2450 *	1'000 mA	$-7\text{ to }-32\text{ VDC}$ (-12 VDC nom.)	-5 VDC	88 %
TSN 1-2452 *			-5.2 VDC	89 %
TSN 1-2460 *		$-8\text{ to }-32\text{ VDC}$ (-12 VDC nom.)	-6 VDC	90 %
TSN 1-2480 *		$-10.5\text{ to }-32\text{ VDC}$ (-12 VDC nom.)	-8 VDC	92 %
TSN 1-2490 *		$-11.5\text{ to }-32\text{ VDC}$ (-24 VDC nom.)	-9 VDC	93 %
TSN 1-24120 *		$-15\text{ to }-32\text{ VDC}$ (-24 VDC nom.)	-12 VDC	94 %
TSN 1-24150 *		$-18\text{ to }-32\text{ VDC}$ (-24 VDC nom.)	-15 VDC	95 %

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

Note * Not recommended for new designs

Input Specifications

Input Current	- At no load	-12 Vin models: 3 mA typ. -24 Vin models: 3 mA typ.
Reflected Ripple Current		100 mAp-p typ.
Recommended Input Fuse		-12 Vin models: 1'600 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

Voltage Set Accuracy		±2% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (10 - 100%)	1% max. 0.6% max.
Ripple and Noise (20 MHz Bandwidth)	-24 Vin models: -5 Vout models: -5.2 Vout models: -6 Vout models: -8 Vout models:	75 mVp-p max. 50 mVp-p max. 50 mVp-p max. 75 mVp-p max. 75 mVp-p max.
Capacitive Load	-5 Vout models: -5.2 Vout models: -6 Vout models: -8 Vout models: -9 Vout models: -12 Vout models: -15 Vout models:	1'600 µF max. 1'600 µF max. 1'000 µF max. 1'000 µF max. 1'000 µF max. 470 µF max. 470 µF max.
Minimum Load		10 % of Iout max.
Temperature Coefficient		±0.015 %/K max.
Start-up Time		15 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Transient Response	- Response Deviation - Response Time	5% typ. / 7% max. (50% to 100% Load Step) 250 µs typ. / 350 µs max. (50% to 100% 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/tsn1-emc-filter/

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Storage Temperature	-40°C to +85°C -55°C to +125°C
Power Derating	- High Temperature	Depending on model
See application note:		www.tracopower.com/tsn1-cc/

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

Over Temperature	- Protection Mode	165°C typ. (Latch off)
Protection Switch Off	- Measurement Point	Internal IC temperature Operation at lower load will not damage the converter, but it may not meet all specifications listed
Cooling System		Natural convection (20 LFM)
Regulator Topology		Buck Converter
Switching Frequency		323 - 437 kHz (PWM) (380 kHz typ.) (5 & 5.2 Vout models) 425 - 575 kHz (PWM) (500 kHz typ.) (other Vout models)
Insulation System		Non-isolated
Reliability	- Calculated MTBF	8'475'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Mechanical Shock - Thermal Shock	MIL-STD-810F MIL-STD-810F MIL-STD-810F
Housing Material		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		3.1 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	4fb36516-9b37-46c7-a5b7-e0d667b02022

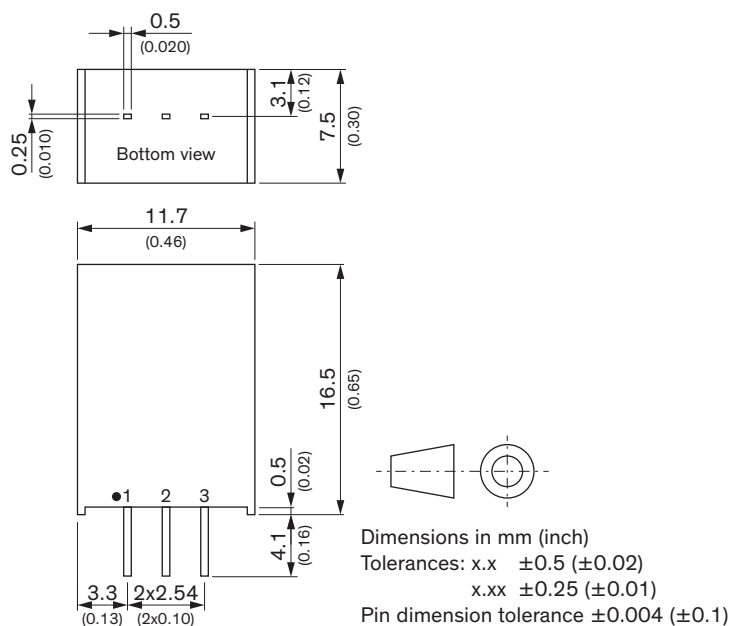
Additional Information

Supporting Documents	www.tracopower.com/overview/tsn1
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

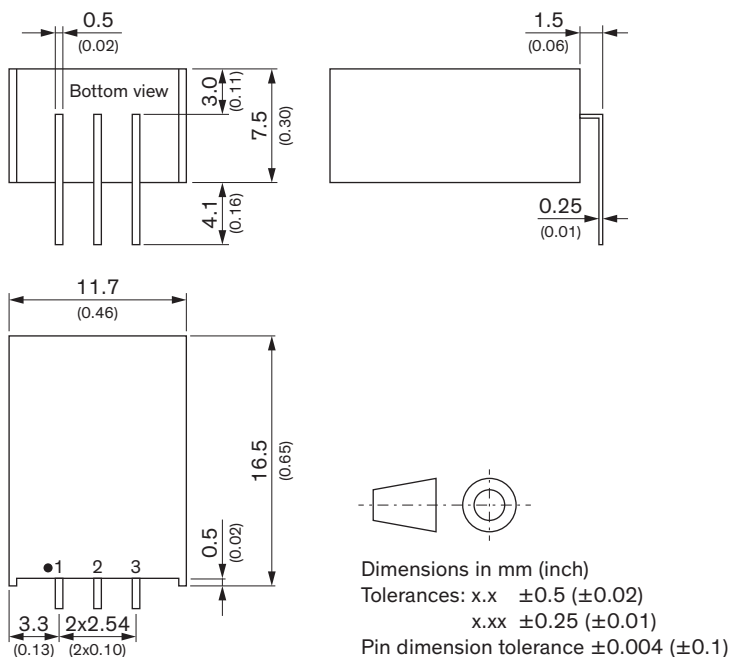
Straight pin version



Pinout	
Pin	Single
1	GND
2	–Vin
3	–Vout

Avoid routing PCB traces under the converter.

Angular pin version (suffix A)



Pinout	
Pin	Single
1	GND
2	–Vin
3	–Vout

Avoid routing PCB traces under the converter.