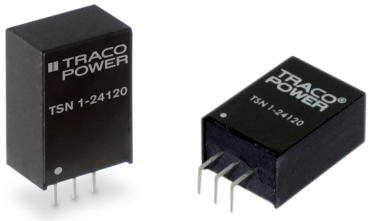
Non-Isolated DC/DC Converter (POL)

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°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°C (+85°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 (±2 %), lower standby current of ~2 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 to –32 VDC (–12 VDC nom.)	–5 VDC	88 %
TSN 1-2452 *			–5.2 VDC	89 %
TSN 1-2460 *		–8 to –32 VDC (–12 VDC nom.)	–6 VDC	90 %
TSN 1-2480 *		–10.5 to –32 VDC (–12 VDC nom.)	–8 VDC	92 %
TSN 1-2490 *		–11.5 to –32 VDC (–24 VDC nom.)	–9 VDC	93 %
TSN 1-24120 *		–15 to –32 VDC (–24 VDC nom.)	–12 VDC	94 %
TSN 1-24150 *		–18 to –32 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)		1% max.
	- Load Variation (10 - 100%)		0.6% max.
Ripple and Noise (20 MHz Bandwidth)		-24 Vin models:	75 mVp-p max.
		-5 Vout models:	50 mVp-p max.
		-5.2 Vout models:	50 mVp-p max.
		-6 Vout models:	75 mVp-p max.
		-8 Vout models:	75 mVp-p max.
Capacitive Load		-5 Vout models:	1'600 µF max.
		-5.2 Vout models:	1'600 µF max.
		-6 Vout models:	1'000 µF max.
		-8 Vout models:	1'000 µF max.
		-9 Vout models:	1'000 µF max.
		-12 Vout models:	470 µF max.
		-15 Vout models:	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		5% typ. / 7% max. (50% to 100% Load Step)
	- Response Time		250 µs typ. / 350 µs max. (50% to 100% Load Step)

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/overview/tsn1

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +85°C
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/overview/tsn1
Over Temperature Protection Switch Off	- Protection Mode		165°C typ. (Latch 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

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

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	MIL-STD-810F
	- Mechanical Shock	MIL-STD-810F
	- Thermal Shock	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

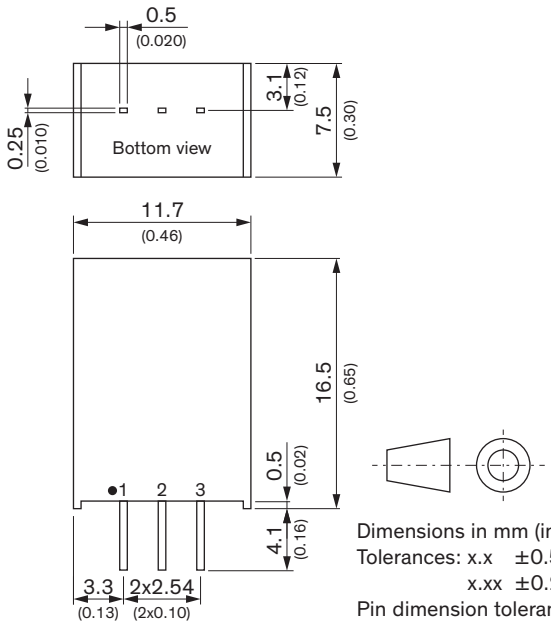
Additional Information

Supporting Documents	www.tracopower.com/overview/tsn1
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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

Outline Dimensions

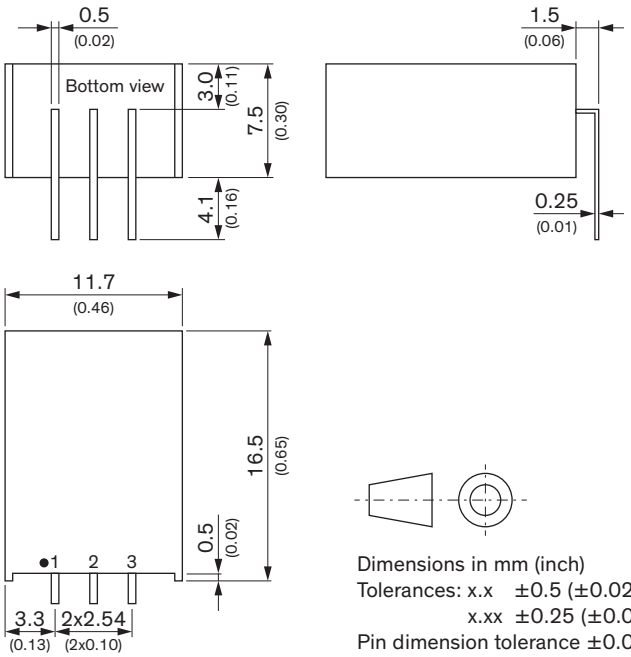
Straight pin version



Pinout	
Pin	**Single**
1	GND
2	–Vin
3	–Vout

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

Angular pin version (suffix A)



Pinout	
Pin	**Single**
1	GND
2	–Vin
3	–Vout

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