TRACO POWER

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

- **Ultra wide 8:1 input voltage range: 9-72 VDC**
- **Covers a majority of standard bus- and battery voltages**
- **Up to 93% efficiency - No heatsink required**
- **Pin compatible with LMxx linear regulators (SIP-3)**
- **Operating temperature range -40 to +80°C**
- **Low standby current**
- **Excellent line/load regulation**
- **Protection against short circuit, overvoltage and overtemperature**
- **3-year product warranty**

The TSR 1WI is a non-isolated POL converter series with an ultra wide 8:1 input voltage range which comes in a standard SIP-3 package. Covering the majority of standard bus- and battery voltages this POL converter is a versatile solution for many applications in distributed power systems where different input voltages have to be handled. Being able to use the same converter in many different situations effectively reduces the bill of material (BOM) of a given application. A high efficiency of up to 93% allows for an operating temperature range of -40 to +80°C (up to 50°C without derating) and makes them excellent drop-in replacements for less efficient LMxx linear regulators. With 1.0 A max. output current and standard features such as low standby current, precise regulation and protection against short circuit, overvoltage and overload the TSR 1WI is suitable for many battery and distributed power applications.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSR 1-4833WI	1'000 mA	9 - 72 VDC (48 VDC nom.)	3.3 VDC	83 % (at 24 Vin)
TSR 1-4850WI			5 VDC	87 % (at 24 Vin)
TSR 1-4865WI			6.5 VDC	88 % (at 24 Vin)
TSR 1-4890WI		14 - 72 VDC (48 VDC nom.)	9 VDC	90 % (at 24 Vin)
TSR 1-48120WI		17 - 72 VDC (48 VDC nom.)	12 VDC	93 % (at 24 Vin)
TSR 1-48150WI		21 - 72 VDC (48 VDC nom.)	15 VDC	93 % (at 24 Vin)
TSR 1-48240WI	700 mA	33 - 72 VDC (48 VDC nom.)	24 VDC	92 % (at 48 Vin)

Options

on demand (backorder with MOQ non stocking item)	- Optional models with angular pins (see outline dimensions)

Note - It is recommended to use an external input filter, please refer to application note: www.tracopower.com/overview/tsr1wi

Input Specifications

Input Current	- At no load		12 mA typ.
Recommended Input Fuse		3.3 Vout models:	1'000 mA (slow blow)
		5 Vout models:	1'250 mA (slow blow)
		6.5 Vout models:	1'600 mA (slow blow)
		9 Vout models:	1'600 mA (slow blow)
		12 Vout models:	1'600 mA (slow blow)
		15 Vout models:	1'600 mA (slow blow)
		24 Vout models:	1'250 mA (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter		See application note:	www.tracopower.com/overview/tsr1wi
			(Recommended external input filter proposal)

Output Specifications

Voltage Set Accuracy			±2% max.
Regulation	- Input Variation (Vmin - Vmax)		0.5% max.
	- Load Variation (0 - 100%)		0.6% max.
Ripple and Noise (20 MHz Bandwidth)		3.3 Vout models:	50 mVp-p typ. (w/ 10 µF X7R)
		5 Vout models:	50 mVp-p typ. (w/ 10 µF X7R)
		6.5 Vout models:	50 mVp-p typ. (w/ 10 µF X7R)
		9 Vout models:	50 mVp-p typ. (w/ 10 µF X7R)
		12 Vout models:	50 mVp-p typ. (w/ 10 µF X7R)
		15 Vout models:	50 mVp-p typ. (w/ 10 µF X7R)
		24 Vout models:	75 mVp-p typ. (w/ 4.7 µF X7R)
Capacitive Load		3.3 Vout models:	2'400 µF max.
		5 Vout models:	1'580 µF max.
		6.5 Vout models:	1'200 µF max.
		9 Vout models:	880 µF max.
		12 Vout models:	660 µF max.
		15 Vout models:	530 µF max.
		24 Vout models:	330 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			25 ms typ.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			180% typ. of Iout max.
Transient Response	- Peak Variation		125 mV typ. / 250 mV max. (50% Load Step) (24 Vout model, with external 4.7 µF X7R)
			90 mV typ. / 180 mV max. (50% Load Step) (other models, with external 10 µF X7R)
	- Response Time		150 µs typ. / 250 µs max. (50% 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/tsr1wi

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	–40°C to +80°C
	- Case Temperature	+105°C max.
	- Storage Temperature	–55°C to +125°C

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

Power Derating	- High Temperature	Depending on model
	See application note:	www.tracopower.com/overview/tsr1wi
Over Temperature Protection Switch Off	- Protection Mode	165°C typ. (Automatic recovery)
	- Measurement Point	Internal IC temperature
Cooling System		Natural convection (20 LFM)
Switching Frequency		143 - 238 kHz (PWM) (3.3 Vout model) 150 - 250 kHz (PWM) (5 Vout model) 188 - 313 kHz (PWM) (6.5 Vout model) 225 - 375 kHz (PWM) (9 Vout model) 263 - 438 kHz (PWM) (12 Vout model) 300 - 500 kHz (PWM) (15 Vout model) 413 - 688 kHz (PWM) (24 Vout model)
Insulation System		Non-isolated
Reliability	- Calculated MTBF	8'215'000 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		Metal
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Brass
Pin Foundation Plating		Nickel (1 - 2 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Housing Type		Metal Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP3
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
Weight		5.5 g
Thermal Impedance	- Case to Ambient	35 K/W typ.
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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	c99571d7-5cd4-40ad-b21e-7f68ac374873

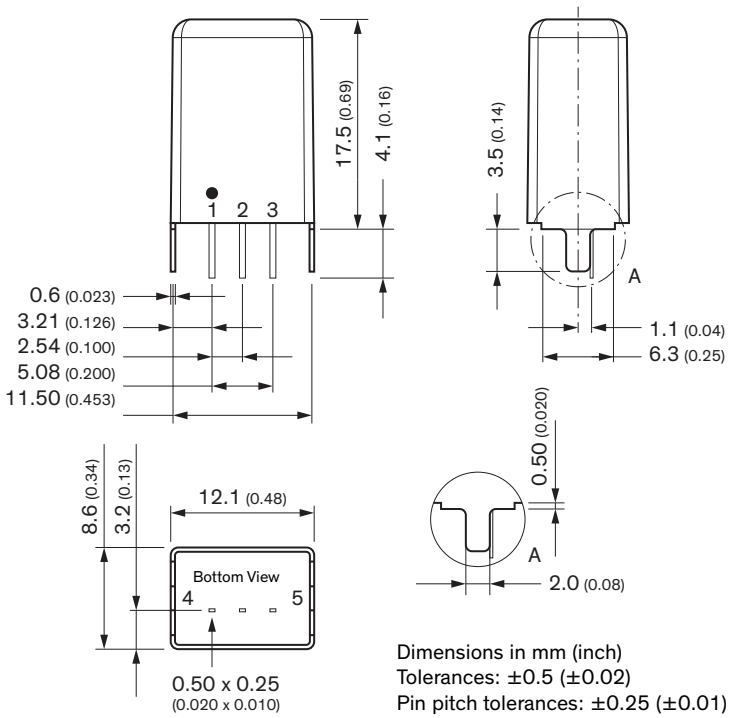
Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tsr1wi

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

Outline Dimensions

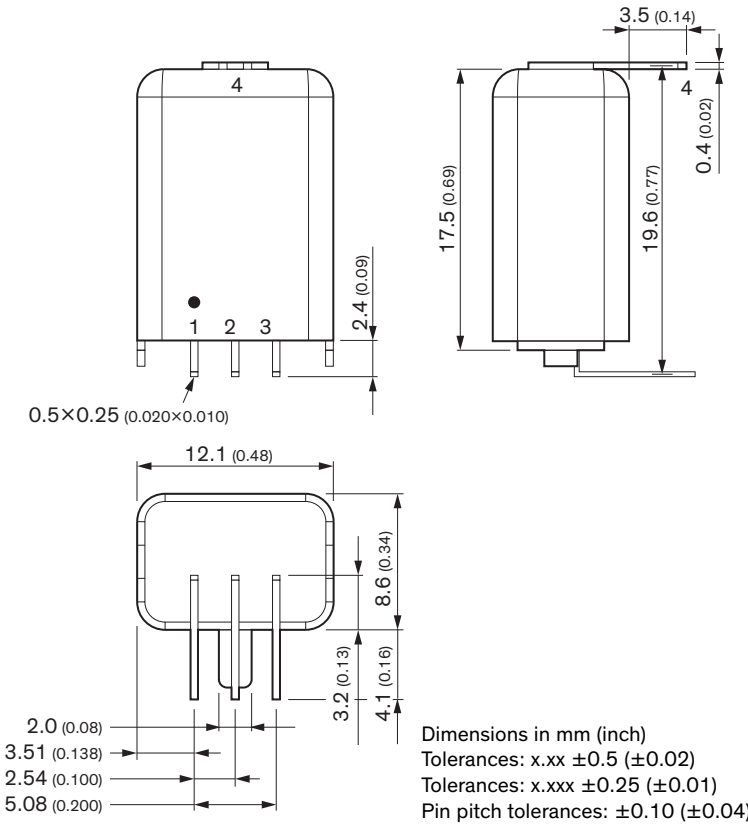
Straight pin version



Dimensions in mm (inch)
Tolerances: ±0.5 (±0.02)
Pin pitch tolerances: ±0.25 (±0.01)

Pinout	
1	+Vin
2	GND
3	+Vout
4	Case pin
5	Case pin

Angular pin version



Dimensions in mm (inch)
Tolerances: x.xx ±0.5 (±0.02)
Tolerances: x.xxx ±0.25 (±0.01)
Pin pitch tolerances: ±0.10 (±0.04)

Pinout	
1	+Vin
2	GND
3	+Vout
4	Case pin