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

- 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.

<table>
<thead>
<tr>
<th>on demand (on demand (backorder with MOQ, non stocking item) non stocking item)</th>
<th>- Optional models with angular pins (see outline dimensions)</th>
</tr>
</thead>
</table>

Input Specifications

<table>
<thead>
<tr>
<th>Recommended Input Fuse</th>
<th>VDC model: 1'000 mA (slow blow) 1'250 mA (slow blow) 1'600 mA (slow blow) 1'250 mA (slow blow)</th>
</tr>
</thead>
</table>

(The need of an external fuse has to be assessed in the final application)

Output Specifications

<table>
<thead>
<tr>
<th>Voltage Set Accuracy</th>
<th>±2% max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation - Input Variation (Vmin - Vmax)</td>
<td>0.5% max.</td>
</tr>
<tr>
<td>- Load Variation (0 - 100%)</td>
<td>0.6% max.</td>
</tr>
</tbody>
</table>

www.tracopower.com September 20, 2023 Page 1 / 4
Ripple and Noise
(20 MHz Bandwidth)

<table>
<thead>
<tr>
<th>Voltage Model</th>
<th>Ripple and Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 VDC</td>
<td>50 mVp-p typ. (w/ 10 µF X7R)</td>
</tr>
<tr>
<td>5 VDC</td>
<td>50 mVp-p typ. (w/ 10 µF X7R)</td>
</tr>
<tr>
<td>6.5 VDC</td>
<td>50 mVp-p typ. (w/ 10 µF X7R)</td>
</tr>
<tr>
<td>9 VDC</td>
<td>50 mVp-p typ. (w/ 10 µF X7R)</td>
</tr>
<tr>
<td>12 VDC</td>
<td>50 mVp-p typ. (w/ 10 µF X7R)</td>
</tr>
<tr>
<td>15 VDC</td>
<td>50 mVp-p typ. (w/ 10 µF X7R)</td>
</tr>
<tr>
<td>24 VDC</td>
<td>75 mVp-p typ. (w/ 4.7 µF X7R)</td>
</tr>
</tbody>
</table>

Capacitive Load

<table>
<thead>
<tr>
<th>Voltage Model</th>
<th>Capacitive Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 VDC</td>
<td>2'400 µF max.</td>
</tr>
<tr>
<td>5 VDC</td>
<td>1'580 µF max.</td>
</tr>
<tr>
<td>6.5 VDC</td>
<td>1'200 µF max.</td>
</tr>
<tr>
<td>9 VDC</td>
<td>880 µF max.</td>
</tr>
<tr>
<td>12 VDC</td>
<td>660 µF max.</td>
</tr>
<tr>
<td>15 VDC</td>
<td>530 µF max.</td>
</tr>
<tr>
<td>24 VDC</td>
<td>330 µF max.</td>
</tr>
</tbody>
</table>

Minimum Load

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Coefficient</td>
<td>±0.02 %/K</td>
</tr>
<tr>
<td>Short Circuit Protection</td>
<td>Continuous, Automatic recovery</td>
</tr>
<tr>
<td>Output Current Limitation</td>
<td>180% typ. of Iout max.</td>
</tr>
<tr>
<td>Transient Response</td>
<td>- Peak Variation 125 mV typ. / 250 mV max. (50% Load Step) (24 Vout model) with external 4.7 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>- Response Time 150 µs typ. / 250 µs max. (50% Load Step)</td>
</tr>
</tbody>
</table>

Safety Specifications

Safety Standards

Safety Standards - Certification Documents

www.tracopower.com/overview/tsr1wi

EMC Specifications

EMI Emissions

- Conducted Emissions
  - EN 55032 class A (with external filter)

- Radiated Emissions
  - 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

Power Derating

- High Temperature

See application note: See application note

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

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
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
Weight 5.5 g
Thermal Impedance - Case to Ambient 35 K/W typ.

Environmental Compliance - REACH Declaration
REACH SVHC list compliant
REACH Annex XVII compliant
- RoHS Declaration
www.tracopower.com/info/rohs-declaration.pdf
Exemptions: 7a, 7c-1
(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

Outline Dimensions

Straight pin version

Pinout

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

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

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

Pinout

1 +Vin
2 GND
3 +Vout
4 Case pin

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)