Non-Isolated DC/DC Converter (POL)  

- 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 0.6A 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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TSR 1-4833WI</td>
<td>1'000 mA</td>
<td>9 - 72 VDC (48 VDC nom.)</td>
<td>3.3 VDC</td>
<td>83 % (at 24 Vin)</td>
</tr>
<tr>
<td>TSR 1-4850WI</td>
<td></td>
<td>14 - 72 VDC (48 VDC nom.)</td>
<td>5 VDC</td>
<td>87 % (at 24 Vin)</td>
</tr>
<tr>
<td>TSR 1-4865WI</td>
<td></td>
<td>17 - 72 VDC (48 VDC nom.)</td>
<td>6.5 VDC</td>
<td>88 % (at 24 Vin)</td>
</tr>
<tr>
<td>TSR 1-4890WI</td>
<td></td>
<td>21 - 72 VDC (48 VDC nom.)</td>
<td>9 VDC</td>
<td>90 % (at 24 Vin)</td>
</tr>
<tr>
<td>TSR 1-48120WI</td>
<td></td>
<td></td>
<td>12 VDC</td>
<td>93 % (at 24 Vin)</td>
</tr>
<tr>
<td>TSR 1-48150WI</td>
<td></td>
<td></td>
<td>15 VDC</td>
<td>93 % (at 24 Vin)</td>
</tr>
<tr>
<td>TSR 1-48240WI</td>
<td>700 mA</td>
<td>33 - 72 VDC (48 VDC nom.)</td>
<td>24 VDC</td>
<td>92 % (at 48 Vin)</td>
</tr>
</tbody>
</table>

### Options

- Horizontal mounting (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

<table>
<thead>
<tr>
<th>Input Current</th>
<th>12 mA typ.</th>
<th>3.3 Vout models: 1'000 mA (slow blow)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 Vout models: 1'250 mA (slow blow)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.5 Vout models: 1'600 mA (slow blow)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 Vout models: 1'600 mA (slow blow)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 Vout models: 1'600 mA (slow blow)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 Vout models: 1'600 mA (slow blow)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 Vout models: 1'250 mA (slow blow)</td>
<td></td>
</tr>
</tbody>
</table>

### 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)

### Input Filter
See application note: [www.tracopower.com/overview/tsr1wi](http://www.tracopower.com/overview/tsr1wi)

## Output Specifications

### Voltage Set Accuracy
- ±2% max.
- 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. (with 10 µF X7R)
- 5 Vout models: 50 mVp-p typ. (with 10 µF X7R)
- 6.5 Vout models: 50 mVp-p typ. (with 10 µF X7R)
- 9 Vout models: 50 mVp-p typ. (with 10 µF X7R)
- 12 Vout models: 50 mVp-p typ. (with 10 µF X7R)
- 15 Vout models: 50 mVp-p typ. (with 10 µF X7R)
- 24 Vout models: 75 mVp-p typ. (with 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)
  - 90 mV typ. / 180 mV max. (50% Load Step)
- Response Time
  - 200 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](http://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: [www.tracopower.com/overview/tsr1wi](http://www.tracopower.com/overview/tsr1wi)

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.
## Over Temperature Protection Switch Off
- Protection Mode
- Measurement Point

## Cooling System
- Natural convection (20 LFM)

## Switching Frequency
- Measurement Point Internal IC temperature
- **165°C** typ. (Automatic recovery)

<table>
<thead>
<tr>
<th>Switching Frequency</th>
<th>Description</th>
<th>Model Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>143 - 238 kHz (PWM)</td>
<td>(3.3 Vout model)</td>
<td></td>
</tr>
<tr>
<td>150 - 250 kHz (PWM)</td>
<td>(5 Vout model)</td>
<td></td>
</tr>
<tr>
<td>188 - 313 kHz (PWM)</td>
<td>(6.5 Vout model)</td>
<td></td>
</tr>
<tr>
<td>225 - 375 kHz (PWM)</td>
<td>(9 Vout model)</td>
<td></td>
</tr>
<tr>
<td>263 - 438 kHz (PWM)</td>
<td>(12 Vout model)</td>
<td></td>
</tr>
<tr>
<td>300 - 500 kHz (PWM)</td>
<td>(15 Vout model)</td>
<td></td>
</tr>
<tr>
<td>413 - 688 kHz (PWM)</td>
<td>(24 Vout model)</td>
<td></td>
</tr>
</tbody>
</table>

## Insulation System
- Non-isolated

## Reliability
- Calculated MTBF

<table>
<thead>
<tr>
<th>Environment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td>MIL-STD-810F</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>MIL-STD-810F</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>MIL-STD-810F</td>
</tr>
</tbody>
</table>

## 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

## Connection Type
- THD (Through-Hole Device)

## Weight
- 5.5 g

## Thermal Impedance
- 35 K/W

## Environmental Compliance
- Reach
- RoHS

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

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Outline Dimensions

Standard: Vertical mounting

Optional: Horizontal mounting

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+Vin</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>+Vout</td>
</tr>
<tr>
<td>4</td>
<td>Case pin</td>
</tr>
<tr>
<td>5</td>
<td>Case pin</td>
</tr>
</tbody>
</table>

Dimensions in mm (inch)

Tolerances: ±0.5 (±0.02)
Pin pitch tolerances: ±0.25 (±0.01)

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