Non-Isolated DC/DC Converter (POL) TSR 3 Series, 3 A

- High performance 3 Amp. switching regulator
- Suitable for positive & negative output circuit
- High efficiency up to 95%
- Adjustable output voltages
- Wide input voltage ranges 2.5–5.5, 4.5–14 and 10–30 VDC
- Short circuit protection
- Remote On/Off input
- Low output ripple & noise
- 3-year product warranty

The TSR 3 models are non isolated step down switching regulators. Since production May 2013 they can also be operated with negative output voltage. They come in a very compact open frame package of 15.5 x 9.4 x 6.2mm. The high efficiency of up to 95% admits a full load operation up to 50°C and up to 85°C with 50% current reduction. A low standby current, a very wider input range and no requirement for heatsink give these switching regulators a significant advantage over linear regulators.

Together with a remote On/Off input and protection against short circuit the TSR 3 Series models are ideal point of load regulators for high reliable and energy critical applications.

### Models

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>TSR 3-0533</td>
<td>3’000 mA</td>
<td>2.5 - 5.5 VDC (5 VDC nom.)</td>
<td>0.6 VDC (0.6 - 3.3 VDC)</td>
<td>95% [at 2.5 Vout]</td>
</tr>
<tr>
<td>TSR 3-1250</td>
<td></td>
<td>4.5 - 14 VDC (12 VDC nom.)</td>
<td>0.6 VDC (0.6 - 6.0 VDC)</td>
<td>93% [at 3.3 Vout]</td>
</tr>
<tr>
<td>TSR 3-2450</td>
<td></td>
<td>10 - 30 VDC (24 VDC nom.)</td>
<td>3 VDC (3.0 - 6.0 VDC)</td>
<td>91% [at 5.0 Vout]</td>
</tr>
<tr>
<td>TSR 3-24150</td>
<td></td>
<td></td>
<td>5 VDC (5.0 - 15.0 VDC)</td>
<td>95% [at 12 Vout]</td>
</tr>
</tbody>
</table>

### Options

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

Note
- TSR 3-1250: max. 9 Vin if Vout <0.9 VDC
- For external circuit proposal for negative output voltage, refer to application note

www.tracopower.com

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## Input Specifications

### Input Current
- **At no load**
  - 5 Vin models: 20 mA typ.
  - 12 Vin models: 25 mA typ.
  - 24 Vin models: 25 mA typ.
  (at Vin nom.)
- **At full load**
  - 5 Vin models: 3'000 mA max.
  - 12 Vin models: 2'600 mA max.
  - 24 Vin models: 2'200 mA max.
  (3 Vout model)
  - 3'000 mA max. (5 Vout model)
  (at Vin min.)

### Reflected Ripple Current
- 5 Vin models: 30 mA p-p typ.
- 12 Vin models: 30 mA p-p typ.
- 24 Vin models: 30 mA p-p typ.
(24 Vin models: Ext. filter, see application note)

### Recommended Input Fuse
- 5 Vin models: 5'000 mA (slow blow)
- 12 Vin models: 5'000 mA (slow blow)
- 24 Vin models: 5'000 mA (slow blow)
(The need of an external fuse has to be assessed in the final application.)

### Input Filter
- Internal Capacitor

## Output Specifications

### Output Voltage Adjustment
- 0.6 Vout models: 0.6 - 3.3 VDC
- 0.6 - 6.0 VDC
- 3 Vout models: 3.0 - 6.0 VDC
- 5 Vout models: 5.0 - 15.0 VDC
(By external trim resistor)

See application note: [www.tracopower.com/overview/tsr3](www.tracopower.com/overview/tsr3)

### Voltage Set Accuracy
±2% max.

### Regulation
- **Input Variation (Vmin - Vmax)**
  - 0.2% max. (Vout > 2.5 VDC)
  - 5 mV typ. (Vout < 2.5 VDC)
- **Load Variation (10% - 90%)**
  - 0.8% max. (Vout > 2.5 VDC)
  - 15 mV typ. (Vout < 2.5 VDC)

### Ripple and Noise
(20 MHz Bandwidth)
- 0.6 Vout models: 50 mVp-p typ.
- 3 Vout models: 75 mVp-p typ.
- 5 Vout models: 150 mVp-p typ.

### Capacitive Load
- 0.6 Vout models: 1'000 µF max.
- 3 Vout models: 1'000 µF max.
- 5 Vout models: 500 µF max.
  (ESR > 1 mOhm)

### Minimum Load
Not required

### Temperature Coefficient
±1 %/K max.

### Start-up Overshoot Voltage
1% max.

### Short Circuit Protection
Continuous, Automatic recovery

### Output Current Limitation
- 280% typ. of Iout max.
  (5 Vin models)
- 220% typ. of Iout max. (other models)

### Transient Response
- **Peak Variation**
  - 250 mV typ. / 500 mV max. (50% Load Step)
  (5.0 Vout model)
  - 150 mV typ. / 250 mV max. (50% Load Step)
  (other models)
- **Response Time**
  - 120 µs typ. / 220 µs max. (50% Load Step)

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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Humidity</td>
<td>95% max. (non condensing)</td>
</tr>
<tr>
<td>Temperature Ranges</td>
<td>- Operating Temperature: -40°C to +85°C</td>
</tr>
<tr>
<td></td>
<td>- Storage Temperature: -55°C to +125°C</td>
</tr>
<tr>
<td>Power Derating</td>
<td>- High Temperature: 1.57 %/K above 50°C</td>
</tr>
<tr>
<td>Cooling System</td>
<td>Natural convection (20 LFM)</td>
</tr>
<tr>
<td>Remote Control</td>
<td>- Voltage Controlled Remote: On: 1 to 12 VDC or open circuit</td>
</tr>
<tr>
<td></td>
<td>- Off Idle Input Current: 1.5 mA typ. (0.6 Vout models)</td>
</tr>
<tr>
<td></td>
<td>- 6 mA typ. (other models)</td>
</tr>
<tr>
<td></td>
<td>(5 Vin model: 5.5 V or open circuit for On-state)</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>540 - 660 kHz (5 Vin &amp; 12 Vin models)</td>
</tr>
<tr>
<td></td>
<td>270 - 330 kHz (24 Vin models)</td>
</tr>
<tr>
<td>Insulation System</td>
<td>Non-isolated</td>
</tr>
<tr>
<td>Reliability</td>
<td>Calculated MTBF: 4'500'000 h (MIL-HDBK-217F, ground benign)</td>
</tr>
<tr>
<td>Environment</td>
<td>Thermal Shock: MIL-STD-810F</td>
</tr>
<tr>
<td>Pin Material</td>
<td>Copper</td>
</tr>
<tr>
<td>Pin Foundation Plating</td>
<td>Nickel (3 - 5 µm)</td>
</tr>
<tr>
<td>Pin Surface Plating</td>
<td>Gold (50 - 75 nm), matte</td>
</tr>
<tr>
<td>Connection Type</td>
<td>THD (Through-Hole Device)</td>
</tr>
<tr>
<td>Weight</td>
<td>- 5 Vin input: 1.7 g</td>
</tr>
<tr>
<td></td>
<td>- 12 Vin input: 1.7 g</td>
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<td>- 24 Vin input: 2.1 g</td>
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### Environmental Compliance
- Reach: [www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)

### Supporting Documents
- Overview Link: [www.tracopower.com/overview/tsr3](http://www.tracopower.com/overview/tsr3)

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

Standard version

Pinout

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<th>negative</th>
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<tr>
<td>1</td>
<td>Remote On/Off</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>+Vin (Vcc)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>–Vout</td>
</tr>
<tr>
<td>4</td>
<td>+Vout</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>Trim</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions in mm (inch)
- W: 4 x 1.70 (0.14) 3.7 (0.14)
- H: 6.0 (0.24)
- Square pins: 0.64 x 0.64 (0.025 x 0.025)

(TSR 3-0533 & TSR 3-1250: W=9.4 (0.37) H=15.5 (0.61)
TSR 3-2450 & TSR 3-24150: W=10.4 (0.41) H=16.5 (0.65)

(Component allocation is model specific)

Tolerances:
- ±0.5 (±0.02)
- Pin pitch Tolerance: ±0.25 (±0.01)
- Pin profile Tolerance: ±0.1 (±0.004)

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

TSR 3-0533 & TSR 3-1250: W=9.4 (0.37) H=15.5 (0.61)
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<td>GND –Vout</td>
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<td>+Vout GND</td>
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