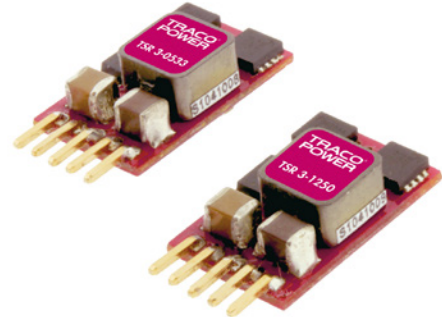


### Features

- ◆ 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 and over temperature the TSR 3 Series models are ideal point of load regulators for high reliable and energy critical applications.

| Models                  |                             |   |  |                  |
|-------------------------|-----------------------------|---|--|------------------|
| Order code *            | Input voltage range         | Output voltage adjustable <sup>6)</sup> | Output current max.                                  | Efficiency typ.  |
| Positive output circuit |                             |   |  |                  |
| TSR 3-0533              | 2.5 – 5,5 VDC <sup>1)</sup> | 0.6 – 3.3 VDC                           | 3 A  | 95 % at 2.5 VDC  |
| TSR 3-1250              | 4.5 – 14 VDC <sup>2)</sup>  | 0.59 – 6.0 VDC                          |  | 93 % at 3.3 VDC  |
| TSR 3-2450              | 10 – 30 VDC <sup>3)</sup>   | 3.0 – 6.0 VDC                           |  | 91 % at 5.0 VDC  |
| TSR 3-24150             | 10 – 30 VDC <sup>3)</sup>   | 5.0 – 15 VDC                            |  | 95 % at 12 VDC   |
| Negative output circuit |                             |   |  |                  |
| TSR 3-1250              | 4.7 – 13 VDC <sup>4)</sup>  | -0.59 – -6.0 VDC                        | 1.5 A at  Vout  >3.3 VDC<br>2.2 A at  Vout  <3.3 VDC | 90 % at -3.3 VDC |
| TSR 3-2450              | 10 – 27 VDC <sup>5)</sup>   | -3.0 – -6.0 VDC                         | 2.2 A  | 90 % at -5.0 VDC |
| TSR 3-24150             | 10 – 25 VDC <sup>5)</sup>   | -5.0 – -15 VDC                          | 1.2 A  | 91 % at -12 VDC  |

\* Suffix A for models with angular pins (see dimensions), availability on demand, no stocking item.

1) input voltage must be at least 0.5 V higher than output voltage

2) input voltage must be at least 2.0 V higher than output voltage, max. 9 VDC if output is <0.9 VDC

3) input voltage must be at least 3.0 V higher than output voltage

4) max. input voltage = 14-|Vout|

5) max. input voltage = 30-|Vout|

6) open trim input = min. output voltage

### Input Specifications

|   |   |
|---|---|
| Maximum input current (@ Vin min. and 3 A output current) | TSR 3-0533: 3.0 A<br>TSR 3-1250: 2.6 A<br>TSR 3-2450: 2.2 A<br>TSR 3-24150: 3.0 A   |
| No load input current                                     | – positive output circuit: 25 mA typ.<br>– negative output circuit: 35 mA typ., 60 mA typ. for TSR 3-24150  |
| Reflected ripple current                                  | – positive output circuit: TSR 3-0533 and TSR 3-1250: 30 mA typ.<br>TSR 3-2450 & TSR 3-24150: 30 mA typ. with ext. filter, see fig. 1 page 3<br>– negative output circuit: all models: 30 mA typ. with ext. filter, see fig. 2 page 3 |
| Input filter  | internal capacitors   |

### Output Specifications

|   |  |
|---|--|
| Voltage set accuracy                                | ±2 % (at full load)  |
| Output voltage adjustment                           | see application note page 3  |
| Regulation  | – Input variation: >2.5 Vout: 0.2 %, <2.5 Vout: 5 mV<br>– Load variation 0 – 100 %: >2.5 Vout: 0.8 %, <2.5 Vout: 20 mV<br>– Load variation 10 – 90 %: >2.5 Vout: 0.6 %, <2.5 Vout: 15 mV   |
| Temperature coefficient                             | ±1 %/°C max.   |
| Overshoot startup voltage                           | 1.0 % max.   |
| Minimum load  | not required   |
| Ripple and noise (20 MHz Bandwidth)                 | TSR 3-0533: 30 mVp-p<br>TSR 3-1250: 60 mVp-p<br>TSR 3-2450: 75 mVp-p<br>TSR 3-24150: 150 mVp-p   |
| Dynamic load response 50 % load change (upper half) | 150 mV max. peak variation<br>(250 mV max. for TSR 3-24150)<br>120 µs max. response time   |
| Startup rise time 10 % to 90 % Vout                 | TSR 3-0533 & TSR 3-1250: 6 ms<br>TSR 3-2450 & TSR 3-24150: 10 ms   |
| Short circuit protection                            | continuous, automatic recovery   |
| Current limitation                                  | TSR 3-0533: 280 % typ.<br>other models: 220 % typ.   |
| Capacitive load                                     | – positive output; ESR > 1 mOhm: TSR 3-24150: 500 µF max.<br>other models: 1000 µF max.<br>– positive output; ESR > 10 mOhm: TSR 3-24150: 1200 µF max.<br>other models: 3000 µF max.<br>– negative output: TSR 3-1250: 780 µF max.<br>TSR 3-2450: 2200 µF max.<br>TSR 3-24150: 580 µF max. |

### General Specifications

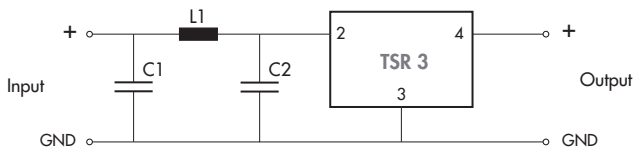
|   |  |
|---|--|
| Temperature ranges  | – Operating (natural convection cooling 20 LFM): –40°C to +85°C<br>– Storage: –55°C to +125°C  |
| Derating  | 1.5 %/K above +50°C  |
| Thermal shock   | acc. MIL-STD-810F  |
| Humidity (non condensing)   | 5 % to 95 % rel H max.   |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >4'500'000 h   |
| Isolation voltage   | none   |
| Switching frequency   | TSR 3-0533 & TSR 3-1250: 600 kHz typ.<br>TSR 3-2450 & TSR 3-24150: 300 kHz typ.  |
| Remote On/Off (pin 1 ref. to GND)                                     | – On: TSR 3-0533: open or Vin<br>other models: open or 1 to 12 VDC<br>– Off: 0 to 0.3 VDC<br>– Off idle current: TSR 3-0533 & TSR 3-1250: 1.5 mA typ.<br>TSR 3-2450 & TSR 3-24150: 6 mA typ. |
| Environmental compliance  | – Reach: <a href="http://www.tracopower.com/overview/tsr3">www.tracopower.com/overview/tsr3</a><br>– RoHS: RoHS directive 2011/65/EU   |

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

**Applications notes**

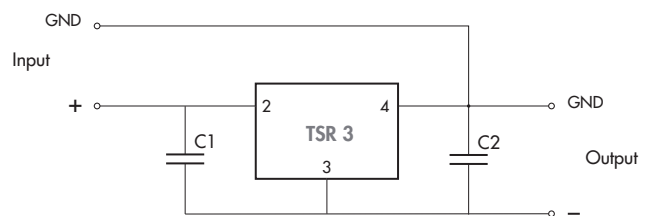
Input filter to reduce reflected ripple current

fig. 1 Positive output circuit



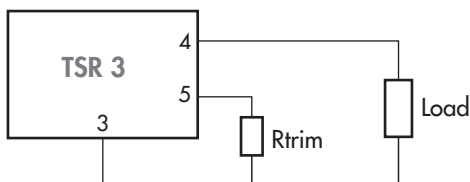
C1 = 220  $\mu$ F, ESR <0.1 Ohm  
C2 = 150  $\mu$ F  
L1 = 8.2  $\mu$ H

fig. 2 Negative output circuit



C1, C2 = 10  $\mu$ F, MLCC

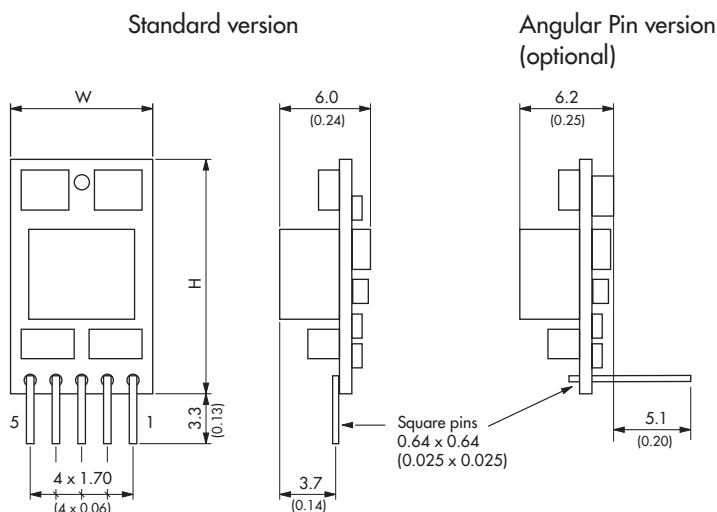
Output voltage adjustment (for negative and positive circuit)



| Model       | R trim [KOhm] 1/16 W           |
|-------------|--------------------------------|
| TSR 3-0533  | $1.2/( V_{out}  - 0.6) - 0.01$ |
| TSR 3-1250  | $1.18/( V_{out}  - 0.59)$      |
| TSR 3-2450  | $11.2/( V_{out}  - 3)$         |
| TSR 3-24150 | $8.4/( V_{out}  - 5)$          |

(|Vout| = absolute value)

**Outline Dimensions**



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)

Weight TSR 3-0533 & TSR 3-1250: 1.7 g  
TSR 3-2450 & TSR 3-24150: 2.1 g

| Pin-Out |               |          |
|---------|---------------|----------|
|         | positive      | negative |
| 1       | Remote On/Off |          |
| 2       | +Vin (Vcc)    |          |
| 3       | GND           | -Vout    |
| 4       | +Vout         | GND      |
| 5       | Trim          |          |

Dimensions in [mm], ( ) = Inch  
Pin pitch tolerances:  $\pm 0.25$  ( $\pm 0.01$ )  
Pin profile tolerance:  $\pm 0.1$  ( $\pm 0.004$ )  
Other tolerances:  $\pm 0.5$  ( $\pm 0.02$ )