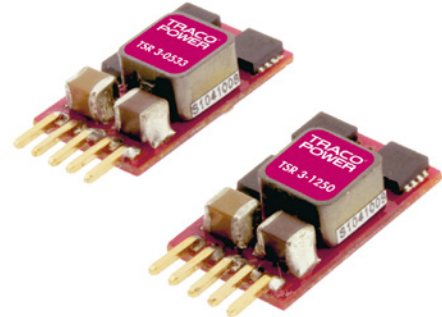


### Features

- ◆ 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
- ◆ Over-temperature protection
- ◆ 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.  |
| TSR 3-0533<br>TSR 3-1250<br>TSR 3-2450<br>TSR 3-24150 | Positive output circuit     |                                         |                                                      |                  |
|                                                       | 2.5 – 5,5 VDC <sup>1)</sup> | 0.6 – 3.3 VDC                           | 3 A                                                  | 95 % at 2.5 VDC  |
|                                                       | 4.5 – 14 VDC <sup>2)</sup>  | 0.59 – 6.0 VDC                          |                                                      | 93 % at 3.3 VDC  |
|                                                       | 10 – 30 VDC <sup>3)</sup>   | 3.0 – 6.0 VDC                           |                                                      | 91 % at 5.0 VDC  |
|                                                       | 10 – 30 VDC <sup>3)</sup>   | 5.0 – 15 VDC                            |                                                      | 95 % at 12 VDC   |
| TSR 3-1250<br>TSR 3-2450<br>TSR 3-24150               | Negative output circuit     |                                         |                                                      |                  |
|                                                       | 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 |
|                                                       | 10 – 27 VDC <sup>5)</sup>   | -3.0 – -6.0 VDC                         | 2.2 A                                                | 90 % at -5.0 VDC |
|                                                       | 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                             | ±0.015 %/°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>250 µs max. response time                                                                                                 |
| Startup rise time 10 % to 90 % Vout                 | TSR 3-0533 & TSR 3-1250: 7 mS<br>TSR 3-2450 & TSR 3-24150: 10 mS                                                                                                                         |
| Short circuit protection                            | indefinite, automatic recovery                                                                                                                                                           |
| Current limitation                                  | TSR 3-0533: 280 % typ.<br>other models: 220 % typ.                                                                                                                                       |
| Capacitive load                                     | – ESR > 1 mOhm: TSR 3-24150: 500 µF max.<br>other models: 1000 µF max.<br>– ESR > 10 mOhm: TSR 3-24150: 1200 µF max.<br>other models: 3000 µF max.                                       |

## General Specifications

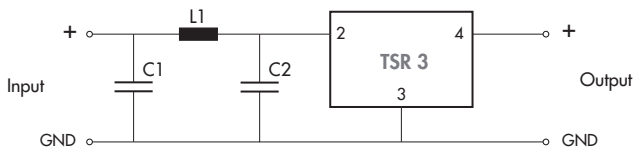
|                                                                       |                                                                                                                                                                                              |
|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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)                                             | 95 % rel H max.                                                                                                                                                                              |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >1'630'000 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

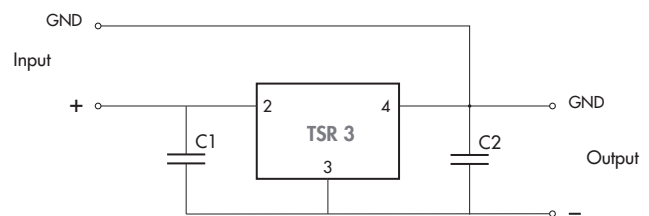
Input filter to reduce reflected ripple current

fig. 1 Positive output circuit



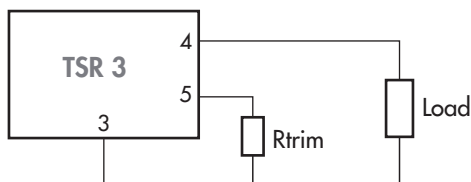
$C1 = 220 \mu\text{F}$ , ESR < 0.1 Ohm  
 $C2 = 150 \mu\text{F}$   
 $L1 = 8.2 \mu\text{H}$

fig. 2 Negative output circuit



$C1, C2 = 10 \mu\text{F}$ , MLCC

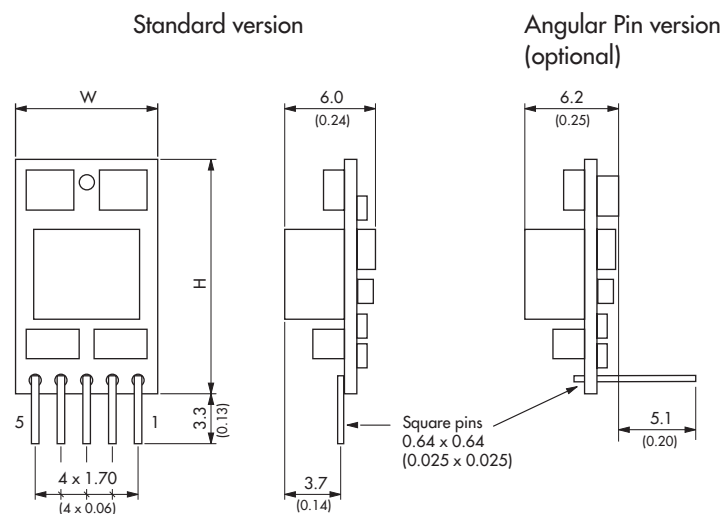
Output voltage adjustment (for negative and positive circuit)



| 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 | $8.4/( V_{out}  - 5)$          |

( $|V_{out}|$  = 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)

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:  $\pm 0.5$  ( $\pm 0.02$ )

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)

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