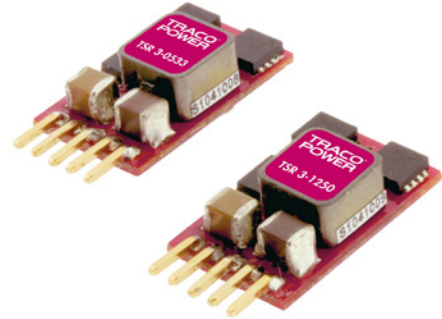


### Features

- ◆ 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.
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 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 TSR 3-1250: 2.6 A TSR 3-2450: 2.2 A TSR 3-24150: 3.0 A
No load input current	– positive output circuit – negative output circuit	25 mA typ. 35 mA typ., 60 mA typ. for TSR 3-24150
Reflected ripple current	– positive output circuit – negative output circuit	TSR 3-0533 and TSR 3-1250: 30 mA typ. TSR 3-2450 & TSR 3-24150: 30 mA typ. with ext. filter, see fig. 1 page 3 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 – Load variation 0 – 100 % – Load variation 10 – 90 %	>2.5 Vout: 0.2 %, <2.5 Vout: 5 mV >2.5 Vout: 0.8 %, <2.5 Vout: 20 mV >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 TSR 3-1250: 60 mVp-p TSR 3-2450: 75 mVp-p TSR 3-24150: 150 mVp-p
Dynamic load response 50 % load change (upper half)		150 mV max. peak variation (250 mV max. for TSR 3-24150) 250 µS max. response time
Startup rise time 10 % to 90 % Vout		TSR 3-0533 & TSR 3-1250: 7 mS TSR 3-2450 & TSR 3-24150: 10 mS
Short circuit protection		indefinite, automatic recovery
Current limitation		TSR 3-0533: 280 % typ. other models: 220 % typ.
Capacitive load	– ESR > 1 mOhm – ESR > 10 mOhm	TSR 3-24150: 500 µF max. other models: 1000 µF max. TSR 3-24150: 1200 µF max. other models: 3000 µF max.

### General Specifications

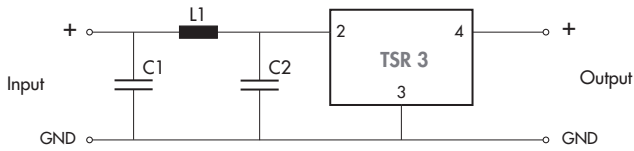
Temperature ranges	– Operating (natural convection cooling 20 LFM) – Storage	–40°C to +85°C –55°C to +125°C
Derating		1.5 %/K above +50°C
Thermal shock		acc. MIL-STD-810F
Humidity (non condensing)		95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)		>1'630'000 h
Isolation voltage		none
Switching frequency		TSR 3-0533 & TSR 3-1250: 600 kHz typ. TSR 3-2450 & TSR 3-24150: 300 kHz typ.
Remote On/Off (pin 1 ref. to GND)	– On – Off – Off idle current:	TSR 3-0533: open or Vin other models: open or 1 to 12 VDC 0 to 0.3 VDC TSR 3-0533 & TSR 3-1250: 1.5 mA typ. TSR 3-2450 & TSR 3-24150: 6 mA typ.
Environmental compliance	– Reach – RoHS	<a href="http://www.tracopower.com/overview/tsr3">www.tracopower.com/overview/tsr3</a> 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

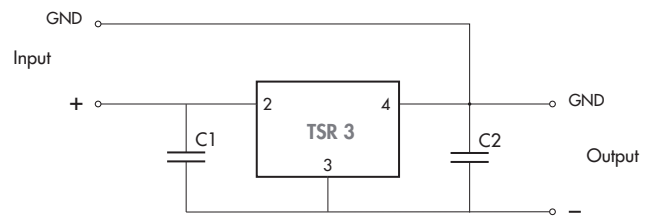
Input filter to reduce reflected ripple current

fig. 1 Positive output circuit



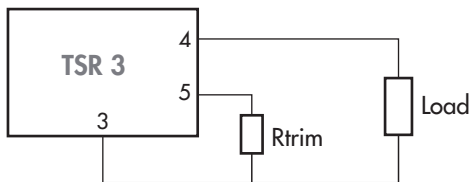
C1 = 220  $\mu$ F, ESR <0.1 Ohm  
C2 = 150  $\mu$ F  
L1 = 8.2  $\mu$ H

fig. 2 Negative output circuit



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

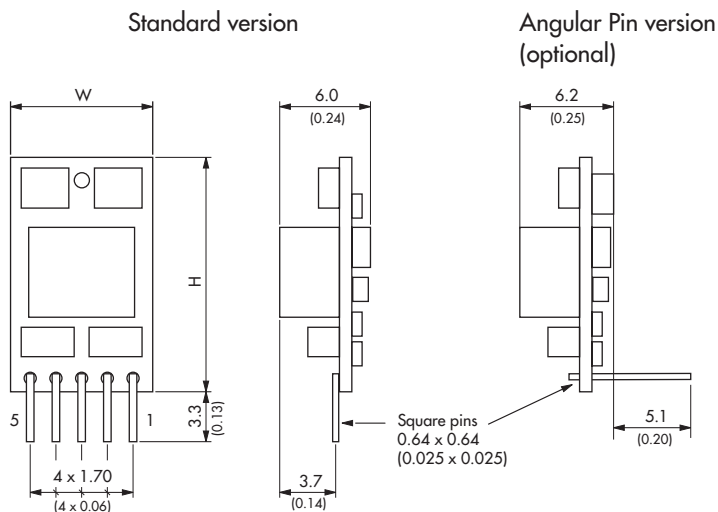
Output voltage adjustment (for negative and positive circuit)



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

( $|V_{out}|$  = 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:  $\pm 0.5$  ( $\pm 0.02$ )