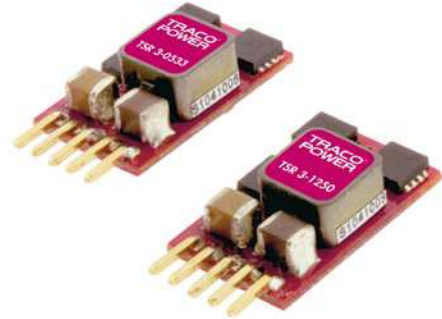


Features

- ◆ 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 ⁶⁾	Output current max.	Efficiency typ.
TSR 3-0533 TSR 3-1250 TSR 3-2450 TSR 3-24150	Positive output circuit			
	2.5 – 5,5 VDC ¹⁾	0.6 – 3.3 VDC	3 A	95 % at 2.5 VDC
	4.5 – 14 VDC ²⁾	0.59 – 6.0 VDC		93 % at 3.3 VDC
	10 – 30 VDC ³⁾	3.0 – 6.0 VDC		91 % at 5.0 VDC
	10 – 30 VDC ³⁾	5.0 – 15 VDC		95 % at 12 VDC
TSR 3-1250	Negative output circuit			
	4.7 – 13 VDC ⁴⁾	-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 ⁵⁾	-3.0 – -6.0 VDC	2.2 A	90 % at -5.0 VDC
TSR 3-24150	10 – 25 VDC ⁵⁾	-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: 25 mA typ. – 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. TSR 3-2450 & TSR 3-24150: 30 mA typ. with ext. filter, see fig. 1 page 3 – 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 – Load variation 0 – 100 %: >2.5 Vout: 0.8 %, <2.5 Vout: 20 mV – 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 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: TSR 3-24150: 500 µF max. other models: 1000 µF max. – ESR > 10 mOhm: TSR 3-24150: 1200 µF max. other models: 3000 µF max.

General Specifications

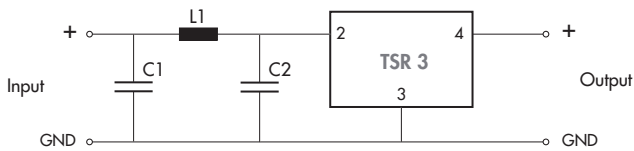
Temperature ranges	– Operating (natural convection cooling 20 LFM): –40°C to +85°C – Storage: –55°C to +125°C
Derating	1.5 %/K above +50°C
Thermal shock	acc. MIL-STD-810F
Humidity (non condensing)	95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)	>1'630'000 h
Isolation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

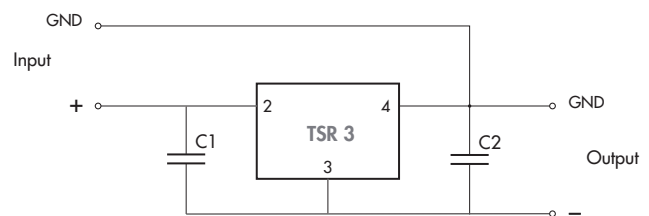
Input filter to reduce reflected ripple current

fig. 1 Positive output circuit



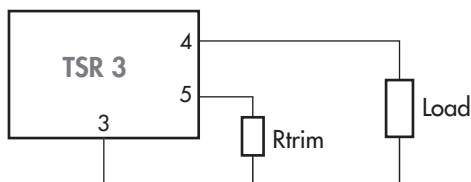
$C1 = 220 \mu\text{F}$, ESR < 0.1 Ohm
 $C2 = 150 \mu\text{F}$
 $L1 = 1 \mu\text{H}$

fig. 2 Negative output circuit



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

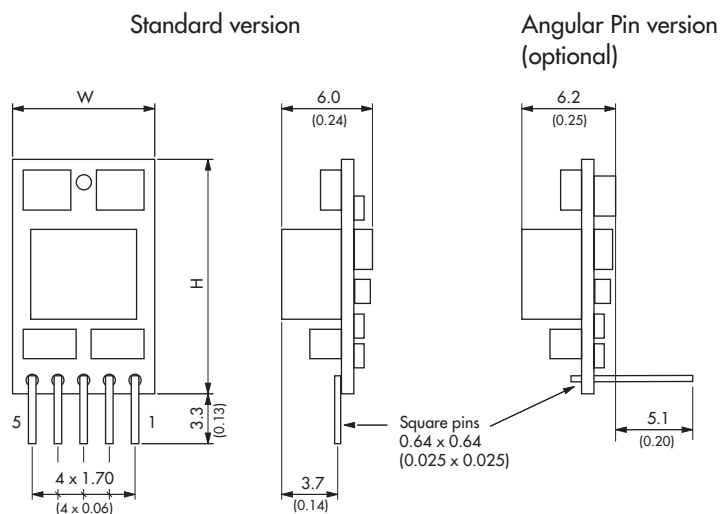
Output voltage adjustment (for negative and positive circuit)



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: ± 0.25 (± 0.01)
 Pin profile tolerance: ± 0.1 (± 0.004)
 Other tolerances: ± 0.5 (± 0.02)