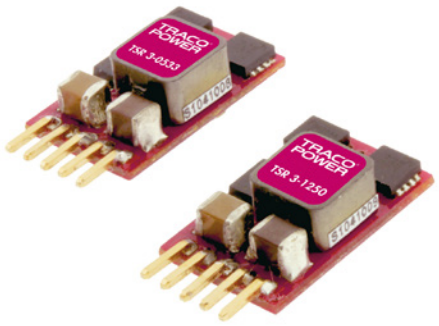
DC/DC Converters

TSR-3 Series, 3 A

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.
Togther 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.
	Positive output circuit			
TSR 3-0533	2.5 – 5,5 VDC 1)	0.6 – 3.3 VDC	3 A	95 % at 2.5 VDC
TSR 3-1250	4.5 – 14 VDC 2)	0.59 – 6.0 VDC		93 % at 3.3 VDC
TSR 3-2450	10 – 30 VDC 3)	3.0 – 6.0 VDC		91 % at 5.0 VDC
TSR 3-24150	10 – 30 VDC 3)	5.0 – 15 VDC		95 % at 12 VDC
	Negative output circuit			
TSR 3-1250	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

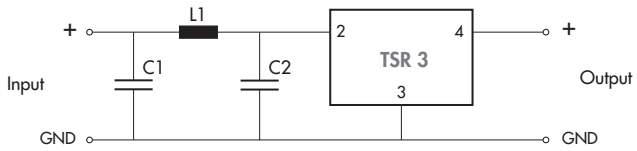
Temperature ranges	– Operating		–40°C to +85°C
	– Storage		–55°C to +125°C
Derating			1.5 %/K above +50°C
Thermal shock			acc. MIL-STD-810F
Humidity (non condensing)			95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)			>1'630'000 h
I/O isolation voltage			none
Switching 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

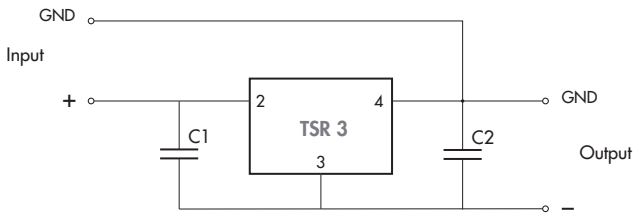
Input filter to reduce reflected ripple current

fig. 1 Positive output circuit



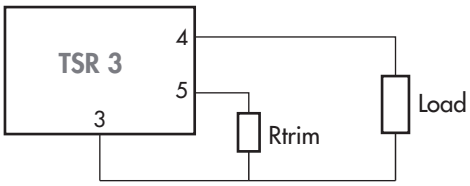
C1 = 220 µF, ESR <0.1 Ohm
C2 = 150 µF
L1 = 1 µH

fig. 2 Negative output circuit



C1, C2 =10 µF, MLCC

Output voltage adjustment (for negative and positive circuit)



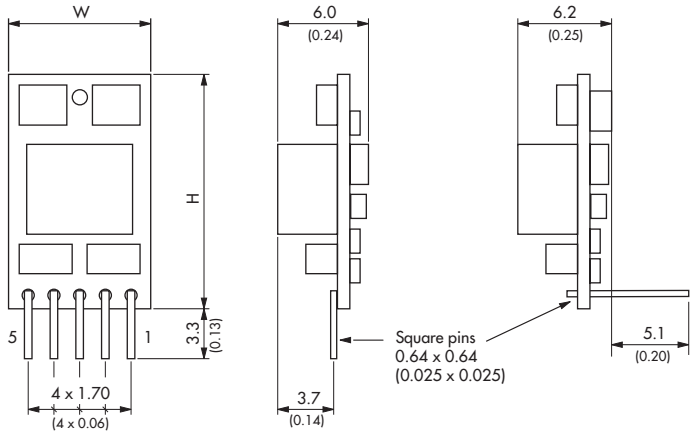
Model	R trim [KOhm] 1/16 W
TSR 3-0533	1.2/(|Vout| -0.6)-0.01
TSR 3-1250	1.18/(|Vout| -0.59)
TSR 3-2450	11.2/(|Vout| -3)
TSR 3-24150	8.4/(|Vout| -5)

(|Vout| = absolute value)

Outline Dimensions

Standard version

Angular Pin version (optional)



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)