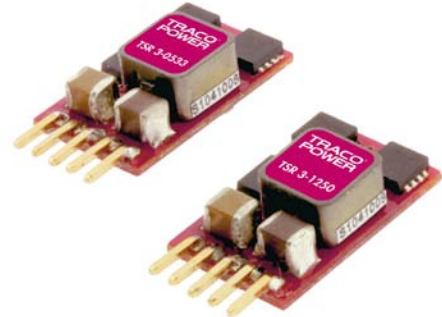


### Features

- ◆ High performance switching regulator
- ◆ High efficiency up to 95 %
- ◆ Low profile open frame design
- ◆ Adjustable output voltage
- ◆ Remote On/Off
- ◆ Wide input voltage ranges 2.5–5.5, 4.5–14 and 10–30 VDC
- ◆ Output voltages from 0.6 to 15 VDC
- ◆ Short circuit protection
- ◆ Low output ripple & noise
- ◆ 3-year product warranty



The new TSR-3 series dc/dc-converters are non-isolated step-down switching regulators for point of load applications. A high efficiency up to 95 % allows a full 3 A load operation up to +50°C ambient temperature without the need of any heat-sink or forced cooling.

The TSR-3 switching regulators provide a remote On/Off input and are the ideal solution for many battery powered applications.

### Models

Order code	Input voltage range	Output voltage adjustable <sup>4)</sup>	Output current max.	Efficiency typ.
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>	0.6 – 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

1) input voltage must be 0.5 V higher than output

2) input voltage must be 2.0 V higher than output

3) input voltage must be 3.0 V higher than output

4) open trim input = min. output voltage

### Input Specifications

Maximum input current (@ $V_{in}$ min. and 3 A output current)	TSR 3-0533: 3.0 A TSR 3-1250: 2.6 A TSR 3-2450: 1.6 A TSR 3-24150: 3.0 A
No load input current	25 mA typ.
Reflected ripple current	30 mA typ. (for TSR 3-2450 & TSR 3-24150 with ext. Pi-filter, see application note page 3)
Input filter	internal capacitors

### Output Specifications

Voltage set accuracy	$\pm 2\%$ (at full load)
Output voltage adjustment	see application note page 3
Regulation	<ul style="list-style-type: none"> <li>- Input variation &gt;2.5 <math>V_{out}</math>: 0.2 %, &lt;2.5 <math>V_{out}</math>: 5 mV</li> <li>- Load variation 0 – 100 % &gt;2.5 <math>V_{out}</math>: 0.8 %, &lt;2.5 <math>V_{out}</math>: 20 mV</li> <li>- Load variation 10 – 90 % &gt;2.5 <math>V_{out}</math>: 0.6 %, &lt;2.5 <math>V_{out}</math>: 15 mV</li> </ul>
Temperature coefficient	$\pm 0.015\%/^{\circ}\text{C}$ 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 $\mu\text{s}$ max. response time
Startup rise time 10 % to 90 % $V_{out}$	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	<ul style="list-style-type: none"> <li>- ESR &gt; 1 mOhm TSR 3-24150: 500 <math>\mu\text{F}</math> max. other models: 1000 <math>\mu\text{F}</math> max.</li> <li>- ESR &gt; 10 mOhm TSR 3-24150: 1200 <math>\mu\text{F}</math> max. other models: 3000 <math>\mu\text{F}</math> max.</li> </ul>

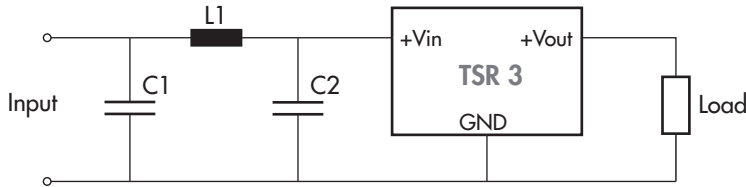
### General Specifications

Temperature ranges	<ul style="list-style-type: none"> <li>- Operating <math>-40^{\circ}\text{C}</math> to <math>+85^{\circ}\text{C}</math></li> <li>- Storage <math>-55^{\circ}\text{C}</math> to <math>+125^{\circ}\text{C}</math></li> </ul>
Derating	1.5 %/K above $+50^{\circ}\text{C}$
Thermal shock	acc. MIL-STD-810F
Humidity (non condensing)	95 % rel H max.
Reliability, calculated MTF (MIL-HDBK-217F, at $+25^{\circ}\text{C}$ , 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.
Safety standards (designed to meet)	UL 60950-1, IEC/EN 60950-1
Remote On/Off (pin 1 ref. to GND)	<ul style="list-style-type: none"> <li>- On TSR 3-0533: open or <math>V_{in}</math></li> <li>- Off other models: open or 1 to 12 VDC 0 to 0.3 VDC</li> </ul>
Environmental compliance	<ul style="list-style-type: none"> <li>- Reach <a href="http://www.tracopower.com/products/tsr3-reach.pdf">www.tracopower.com/products/tsr3-reach.pdf</a></li> <li>- RoHS RoHS directive 2002/95/EC</li> </ul>

All specifications valid at nominal input voltage, full load and  $+25^{\circ}\text{C}$  after warm-up time unless otherwise stated.

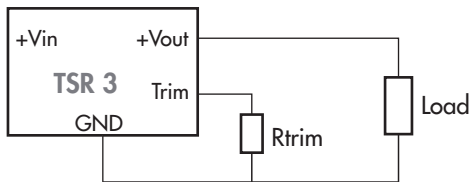
**Applications notes**

Input filter to reduce reflected ripple current for TSR 3-2450 & TSR 3-24150



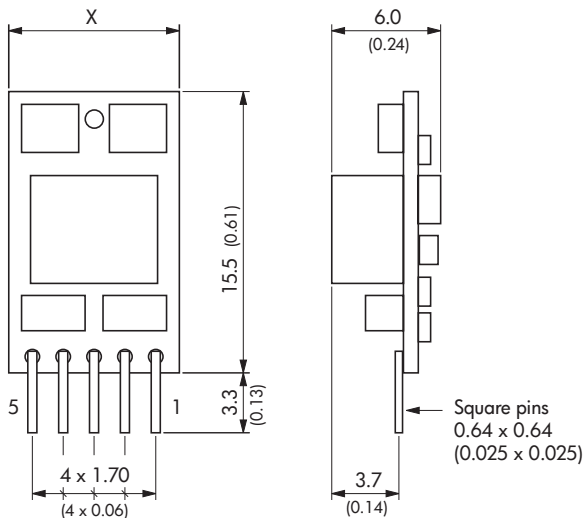
C1 = 220  $\mu$ F, ESR <0.1 Ohm  
C2 = 150  $\mu$ F min.  
L1 = 1  $\mu$ H

Output voltage adjustment



Model	R trim [KOhm]
TSR 3-0533	1.2/(Vout -0.6)
TSR 3-1250	1.18/(Vout -0.6)
TSR 3-2450	11.2/(Vout -3)
TSR 3-24150	8.4/(Vout -5)

**Outline Dimensions**



X = 9.4 (0.37) for TSR 3-0533 & TSR 3-1250  
10.4 (0.41) for other models

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

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

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 any time without notice.