TRACO POWER

Non-Isolated DC/DC Converter (POL) — TSR 2 Series, 2 A

- **Ultra compact SIP package 0.55 x 0.30 x 0.40 inch**
- **Up to 96% efficiency – No heat-sink required**
- **Pin compatible with LMxx linear regulators**
- **Built in filter capacitors**
- **Operating temperature range -40°C to +85°C**
- **Excellent line / load regulation**
- **Short circuit protection**
- **3-year product warranty**

The new TSR 2 series step-down switching regulators are drop-in replacement for inefficient LMxx linear regulators. A high efficiency up to 96% allows full load operation up to +67°C ambient temperature without the need of any heat-sink or forced cooling. The TSR 2 switching regulators provide other significant features over linear regulators, i.e. better output accuracy (±2%), lower standby current of 2 mA and no requirement of external capacitors. The high efficiency and low standby power consumption makes these regulators an ideal solution for many battery powered applications.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSR 2-0512	2'000 mA	3 - 5.5 VDC (5 VDC nom.)	1.2 VDC	90 %
TSR 2-0515			1.5 VDC	91 %
TSR 2-0518			1.8 VDC	92 %
TSR 2-0525		3.8 - 5.5 VDC (5 VDC nom.)	2.5 VDC	95 %
TSR 2-2412		4.6 - 36 VDC (12 VDC nom.)	1.2 VDC	84 %
TSR 2-2415			1.5 VDC	86 %
TSR 2-2418			1.8 VDC	87 %
TSR 2-2425			2.5 VDC	89 %
TSR 2-2433		4.75 - 36 VDC (12 VDC nom.)	3.3 VDC	91 %
TSR 2-2450		6.5 - 36 VDC (12 VDC nom.)	5 VDC	94 %
TSR 2-2465		9 - 36 VDC (12 VDC nom.)	6.5 VDC	94 %
TSR 2-2490		12 - 36 VDC (24 VDC nom.)	9 VDC	95 %
TSR 2-24120		15 - 36 VDC (24 VDC nom.)	12 VDC	95 %
TSR 2-24150		18 - 36 VDC (24 VDC nom.)	15 VDC	96 %

Note - If the input is switched electromechanically, a 22 µF / 50 V electrolytic capacitor at the input is recommended (12 & 24 Vin models only)

Input Specifications

Input Current	- At no load	5 Vin models:	1 mA typ.
		12 Vin models:	1 mA typ.
		24 Vin models:	1 mA typ.
Recommended Input Fuse		5 Vin models:	2'000 mA (slow blow)
		24 Vin models:	3'150 mA (slow blow)
	- 12 Vin input	1.2 Vout models:	1'600 mA (slow blow)
		1.5 Vout models:	1'600 mA (slow blow)
		1.8 Vout models:	1'600 mA (slow blow)
		2.5 Vout models:	2'500 mA (slow blow)
		3.3 Vout models:	2'500 mA (slow blow)
		5 Vout models:	2'500 mA (slow blow)
		6.5 Vout models:	2'500 mA (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Capacitor

Output Specifications

Voltage Set Accuracy			±2% max.
Regulation	- Input Variation (Vmin - Vmax)		0.5% max.
	- Load Variation (0 - 100%)		1% max.
Ripple and Noise (20 MHz Bandwidth)		1.2 Vout models:	50 mVp-p typ.
		1.5 Vout models:	50 mVp-p typ.
		1.8 Vout models:	50 mVp-p typ.
		2.5 Vout models:	50 mVp-p typ.
		3.3 Vout models:	50 mVp-p typ.
		5 Vout models:	50 mVp-p typ.
		6.5 Vout models:	50 mVp-p typ.
		9 Vout models:	75 mVp-p typ.
		12 Vout models:	75 mVp-p typ.
		15 Vout models:	75 mVp-p typ.
Capacitive Load		1.2 Vout models:	2'500 µF max.
		1.5 Vout models:	2'000 µF max.
		1.8 Vout models:	1'600 µF max.
		2.5 Vout models:	1'200 µF max.
		3.3 Vout models:	900 µF max.
		5 Vout models:	600 µF max.
		6.5 Vout models:	470 µF max.
		9 Vout models:	330 µF max.
		12 Vout models:	270 µF max.
		15 Vout models:	200 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			5 ms typ.
Short Circuit Protection			Continuous, Automatic recovery
Overload Protection			Foldback Mode
Output Current Limitation			400% typ. of Iout max. (5 Vin models) 180% typ. (other input models)
Transient Response	- Peak Variation		300 mV typ. / 500 mV max. (50% Load Step) (24 Vin models) 150 mV typ. / 250 mV max. (50% Load Step) (other models)
	- Response Time		150 µs typ. / 200 µs max. (50% Load Step)

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.

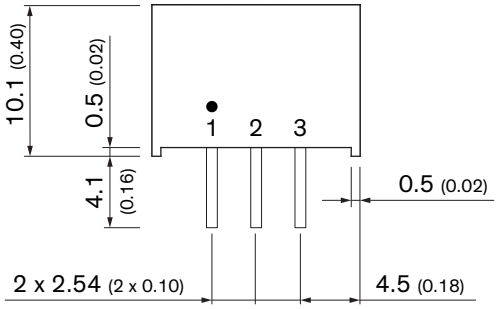
General Specifications

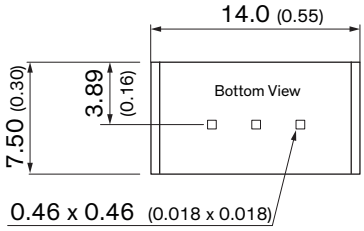
Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +85°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature	See application note:	www.tracopower.com/overview/tsr2
Over Temperature Protection Switch Off	- Protection Mode		150°C typ. (Automatic recovery)
	- Measurement Point		Internal IC temperature
Cooling System			Natural convection (20 LFM)
Switching Frequency			1200 kHz typ. (PWM) (5 Vout models) 410 kHz typ. (PWM) (other models)
Insulation System			Non-isolated
Reliability	- Calculated MTBF		13'520'000 h (MIL-HDBK-217F, ground benign)
Environment	- Vibration		MIL-STD-810F
	- Thermal Shock		MIL-STD-810F
Housing Material			Non-conductive Plastic (UL94 V-0 rated)
Potting Material			Silicone (UL 94 V-0 rated)
Pin Material			Copper
Pin Foundation Plating			Nickel (2 - 3 µm)
Pin Surface Plating			Tin (3 - 5 µm), matte
Soldering Profile			260°C / 10 s max.
Connection Type			THD (Through-Hole Device)
Weight			2.6 g
Environmental Compliance	- Reach		www.tracopower.com/info/reach-declaration.pdf
	- RoHS		www.tracopower.com/info/rohs-declaration.pdf

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tsr2

Outline Dimensions





Dimensions in mm (inch)
Tolerances: x.xx ±0.5 (±0.02)
Tolerances: x.xxx ±0.25 (±0.01)
Pin pich tolerances: ±0.25 (±0.01)
Pin dimension tolerance: ±0.1 (±0.004)

Pinout

Pin	Function
1	+Vin
2	GND
3	+Vout

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TRACO Power:

TSR 2-0512 TSR 2-2433 TSR 2-0515 TSR 2-2412 TSR 2-2415 TSR 2-0525 TSR 2-24150 TSR 2-2450 TSR 2-0518 TSR 2-2418 TSR 2-2490 TSR 2-2465 TSR 2-24120 TSR 2-2425