TRACO POWER

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

- **Highly cost-efficient design**
- **Compact SIP-3 package: 14 x 7.6 x 10.2 mm**
- **Pin compatible with TO-220 package linear regulators**
- **Excellent thermal capabilities**
- **Operation temperature. range –40°C to +95°C**
- **Efficiency up to 95%**
- **Wide input operating range 4.6-36 VDC**
- **Short circuit protection, current limitation and under voltage lockout features**
- **Excellent line / load regulation**
- **3-year product warranty**



The TSR 2N is a 2 Amp step-down switching regulator series and a drop-in replacement for any TO-220 package linear regulators. It comes in a compact SIP-3 plastic package and complements our new generation of POL converters focusing strongly on a cost-efficient design while also improving on critical electrical specifications. The Input ranges from 4.6 to 36 VDC and output voltages are available between 1.2 and 15VDC. Depending on the model, the efficient design allows full load operation up to +95°C ambient temperature (at nominal Vin) without the need of any heat sink or forced cooling. The TSR 2N series provides other significant features like short circuit protection, current limitation and under voltage lockout. Overall, it offers a broad application range in many environments and is especially suited for high volume projects where the series will help to reduce production cost by delivering not only a highly cost efficient but also reliable solution.

Models

Order Code	Output Current max.	Input Voltage Range	Output Voltage nom.	Efficiency typ.
TSR 2-2412N	2'000 mA	4.6 - 28 VDC (12 VDC nom.)	1.2 VDC	85 %
TSR 2-2415N		4.6 - 32 VDC (12 VDC nom.)	1.5 VDC	87 %
TSR 2-2418N		4.6 - 36 VDC (12 VDC nom.)	1.8 VDC	88 %
TSR 2-2425N			2.5 VDC	90 %
TSR 2-2433N			3.3 VDC	91 %
TSR 2-2450N		6.5 - 36 VDC (12 VDC nom.)	5 VDC	93 %
TSR 2-2465N		9 - 36 VDC (12 VDC nom.)	6.5 VDC	94 %
TSR 2-2490N		11 - 36 VDC (24 VDC nom.)	9 VDC	93 %
TSR 2-24120N		15 - 36 VDC (24 VDC nom.)	12 VDC	94 %
TSR 2-24150N		18 - 36 VDC (24 VDC nom.)	15 VDC	95 %

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Input Specifications

Input Current	- At no load	12 Vin models:	1 mA typ.
		24 Vin models:	1 mA typ.
	- At full load	12 Vin models:	240 mA typ. / 607 mA max. (1.2 Vout model)
			293 mA typ. / 746 mA max. (1.5 Vout model)
			347 mA typ. / 885 mA max. (1.8 Vout model)
			471 mA typ. / 1'203 mA max. (2.5 Vout model)
			615 mA typ. / 1'571 mA max. (3.3 Vout model)
			912 mA typ. / 1'658 mA max. (5 Vout model)
			1'173 mA typ. / 1'548 mA max. (6.5 Vout model)
		24 Vin models:	821 mA typ. / 1'745 mA max. (9 Vout model)
			1'083 mA typ. / 1'697 mA max. (12 Vout model)
			1'340 mA typ. / 1'768 mA max. (15 Vout model)
Under Voltage Lockout		12 Vin models:	2.2 VDC min.
		24 Vin models:	2.2 VDC min.
Recommended Input Fuse		24 Vin models:	7'000 mA (fast acting)
	- 12 Vin input	1.2 Vout models:	3'000 mA (fast acting)
		1.5 Vout models:	3'500 mA (fast acting)
		1.8 Vout models:	4'000 mA (fast acting)
		2.5 Vout models:	5'000 mA (fast acting)
		3.3 Vout models:	7'000 mA (fast acting)
		5 Vout models:	7'000 mA (fast acting)
		6.5 Vout models:	7'000 mA (fast acting)
			(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%)		2% max.
Ripple and Noise (20 MHz Bandwidth)		24 Vin models:	75 mVp-p typ. (w/ 10 µF)
		1.2 Vout models:	50 mVp-p typ. (w/ 10 µF)
		1.5 Vout models:	50 mVp-p typ. (w/ 10 µF)
		1.8 Vout models:	50 mVp-p typ. (w/ 10 µF)
		2.5 Vout models:	50 mVp-p typ. (w/ 10 µF)
		3.3 Vout models:	50 mVp-p typ. (w/ 10 µF)
		5 Vout models:	50 mVp-p typ. (w/ 10 µF)
		6.5 Vout models:	75 mVp-p typ. (w/ 10 µF)
Capacitive Load		1.2 Vout models:	2'200 µF max.
		1.5 Vout models:	2'200 µF max.
		1.8 Vout models:	1'500 µF max.
		2.5 Vout models:	1'500 µF max.
		3.3 Vout models:	1'200 µF max.
		5 Vout models:	820 µF max.
		6.5 Vout models:	620 µF max.
		9 Vout models:	620 µF max.
		12 Vout models:	470 µF max.
		15 Vout models:	470 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			20 ms typ.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			400% typ. of Iout max. (1.2 - 3.3 Vout models)
			360% typ. (other Vout models)

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

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Safety Specifications

Standards	- IT / Multimedia Equipment	Designed for IEC/EN/UL 62368-1 (not certified)
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 55032 class A (with external filter)
		EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55032 class A (with external filter)
		EN 55032 class B (with external filter)
	External filter proposal:	www.tracopower.com/tsr2n-emc-filter/
EMS (Immunity)	- EFT (Burst) / Surge	EN 61000-4-4, ±2 kV, perf. criteria A
		EN 61000-4-5, ±2 kV, perf. criteria A
	Ext. input component:	1500 µF / 100 V

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	–40°C to +90°C
	- Case Temperature	+110°C max.
	- Storage Temperature	–55°C to +125°C
Power Derating	- High Temperature	Depending on model
	See application note:	www.tracopower.com/tsr2n-cc/
Cooling System		Natural convection (20 LFM)
Regulator Topology		Buck Converter
Switching Frequency		380 kHz typ. (PWM) (1.2-2.5 Vout models)
		850 kHz typ. (PWM) (3.3-6.5 Vout models)
		1000 kHz typ. (PWM) (9-15 Vout models)
Insulation System		Non-isolated
Reliability	- Calculated MTBF	3'200'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline
		www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F
		MIL-STD-202
Housing Material		Plastic (UL 94 V-0 rated)
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP3
Soldering Profile		Lead-Free Wave Soldering
		260°C / 5 s max.
Weight		2.6 g
Thermal Impedance	- Case to Ambient	40.0 K/W typ.
Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf
		REACH SVHC list compliant
		REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf
		Exemptions: No Exemptions

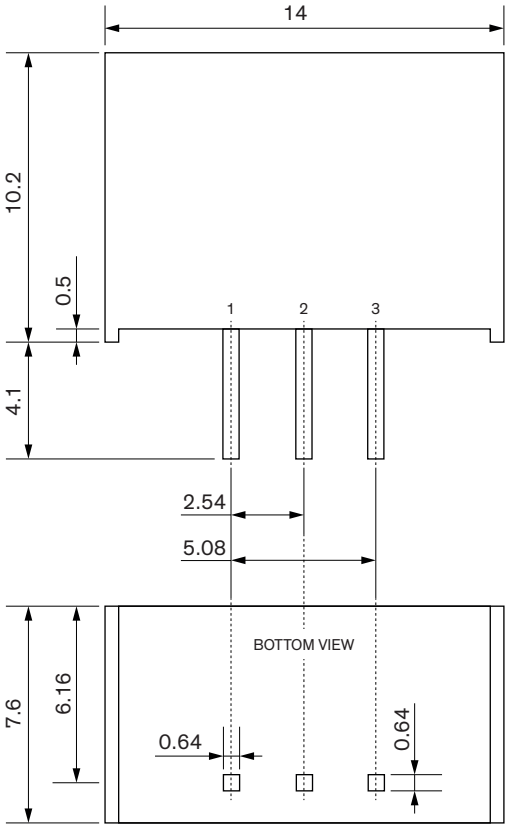
Additional Information

Supporting Documents	www.tracopower.com/overview/tsr2n
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

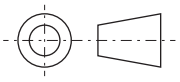
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Outline Dimensions



Dimensions in mm
General tolerances: ±0.5
Pin tolerances: ±0.1



Pinout	
Pin	**Function**
1	+Vin
2	Ground
3	+Vout

Avoid routing PCB traces under the converter.

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