

DC/DC Converter

TRN 1 Series, 1 Watt

- Compact SIP package
11,9 x 7,7 x 11,0 mm
- Fully regulated outputs
- Input Voltage range
4.5-13.2, 9-18, 18-36, 36-75 VDC
- I/O-isolation 1'600 VDC
- Operating temperature range
-40°C to +90°C without derating
- Short circuit protection
- Designed to meet IEC/EN/UL 62368-1
(not certified)
- 3-year product warranty



The TRN 1 Series comprises 1 Watt fully regulated, high performance DC/DC converters. They come in a compact cubical package of only 1.00 cm³. Full load operation is reliable up to 90°C environment temperature. With 1'600 VDC I/O isolation voltage, and short current protection they cover a wide range of application when space is limited. The input of the converters is designed for a wide voltage range (2:1) and minimum load is not required. The functional I/O-isolation system is designed to meet IEC/EN/UL 62368-1 (not certified) with a test voltage (60 s) of 1600 VDC.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
TRN 1-0510	4.5 - 13.2 VDC (9 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-0511		5 VDC	200 mA			79 %
TRN 1-0512		12 VDC	90 mA			81 %
TRN 1-0513		15 VDC	70 mA			82 %
TRN 1-0515		24 VDC	45 mA			83 %
TRN 1-0521		+5 VDC	100 mA	-5 VDC	100 mA	79 %
TRN 1-0522		+12 VDC	45 mA	-12 VDC	45 mA	83 %
TRN 1-0523		+15 VDC	35 mA	-15 VDC	35 mA	80 %
TRN 1-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-1211		5 VDC	200 mA			80 %
TRN 1-1212		12 VDC	90 mA			81 %
TRN 1-1213		15 VDC	70 mA			83 %
TRN 1-1215		24 VDC	45 mA			83 %
TRN 1-1221		+5 VDC	100 mA	-5 VDC	100 mA	79 %
TRN 1-1222		+12 VDC	45 mA	-12 VDC	45 mA	83 %
TRN 1-1223		+15 VDC	35 mA	-15 VDC	35 mA	80 %
TRN 1-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-2411		5 VDC	200 mA			81 %
TRN 1-2412		12 VDC	90 mA			82 %
TRN 1-2413		15 VDC	70 mA			83 %
TRN 1-2415		24 VDC	45 mA			82 %
TRN 1-2421		+5 VDC	100 mA	-5 VDC	100 mA	79 %
TRN 1-2422		+12 VDC	45 mA	-12 VDC	45 mA	82 %
TRN 1-2423		+15 VDC	35 mA	-15 VDC	35 mA	80 %
TRN 1-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-4811		5 VDC	200 mA			78 %
TRN 1-4812		12 VDC	90 mA			80 %
TRN 1-4813		15 VDC	70 mA			81 %
TRN 1-4815		24 VDC	45 mA			81 %
TRN 1-4821		+5 VDC	100 mA	-5 VDC	100 mA	78 %
TRN 1-4822		+12 VDC	45 mA	-12 VDC	45 mA	81 %
TRN 1-4823		+15 VDC	35 mA	-15 VDC	35 mA	79 %

Input Specifications

Input Current	- At no load	9 Vin models: 35 mA typ. 12 Vin models: 20 mA typ. 24 Vin models: 10 mA typ. 48 Vin models: 5 mA typ.
Surge Voltage		9 Vin models: 15 VDC max. (1 s max.) 12 Vin models: 25 VDC max. (1 s max.) 24 Vin models: 50 VDC max. (1 s max.) 48 Vin models: 100 VDC max. (1 s max.)
Reflected Ripple Current		30 mAp-p typ.
Recommended Input Fuse		9 Vin models: 500 mA (slow blow) 12 Vin models: 315 mA (slow blow) 24 Vin models: 160 mA (slow blow) 48 Vin models: 160 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		±1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models: 0.2% max. dual output models: 0.2% max.
	- Load Variation (0 - 100%)	single output models: 1% max. dual output models: 1% max. (Output 1) 1% max. (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models: 5% max.
Ripple and Noise	- 20 MHz Bandwidth	50 mVp-p typ.
Capacitive Load	- single output	3.3 Vout models: 1'680 µF max. 5 Vout models: 820 µF max. 12 Vout models: 470 µF max. 15 Vout models: 330 µF max. 24 Vout models: 160 µF max.
	- dual output	5 / -5 Vout models: 470 / 470 µF max. 12 / -12 Vout models: 330 / 330 µF max. 15 / -15 Vout models: 220 / 220 µF max.
Minimum Load		Not required
Temperature Coefficient		±0.02 %/K max.
Start-up Time		5 ms typ. / 15 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		200% typ. of Iout max.
Transient Response	- Response Deviation	3% typ. (25% Load Step)
	- Response Time	500 µs typ. (25% Load Step)

Safety Specifications

Standards	- IT / Multimedia Equipment	Designed for IEC/EN/UL 62368-1 (not certified)
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/trn1-emc-filter/

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

EMS (Immunity)		EN 55024 (IT Equipment)
		EN 55035 (Multimedia)
- Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge	Air:	EN 61000-4-2, ± 8 kV, perf. criteria A
	Contact:	EN 61000-4-2, ± 6 kV, perf. criteria A
		EN 61000-4-3, 10 V/m, perf. criteria A
		EN 61000-4-4, ± 2 kV, perf. criteria A
		EN 61000-4-5, ± 1 kV, perf. criteria A
- Conducted RF Disturbances - PF Magnetic Field	Ext. input component:	Nippon chemi-con KY 220 μ F/100 V
	Continuous:	EN 61000-4-6, 10 Vrms, perf. criteria A
	1 s:	EN 61000-4-8, 100 A/m, perf. criteria A
		EN 61000-4-8, 1000 A/m, perf. criteria A

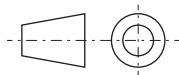
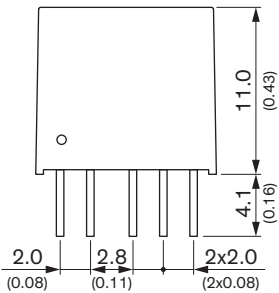
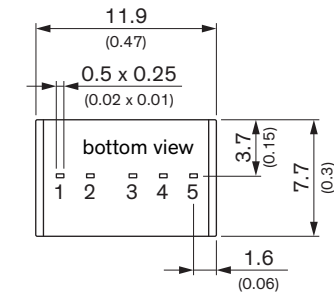
General Specifications		
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +90°C (without derating)
	- Case Temperature	+105°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	6.7 %/K above 90°C
	See application note: www.tracopower.com/trn1-cc/	
Cooling System		Natural convection (20 LFM)
Regulator Topology		RCC Converter
Switching Frequency		100 kHz min. (PFM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s	1'600 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M Ω min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	75 pF max.
Reliability	- Calculated MTBF	7'400'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F
	- Thermal Shock	MIL-STD-810F
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (0.3 - 0.9 μ m)
Pin Surface Plating		Tin (5 - 6 μ m), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP5
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
Weight		2.1 g
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: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	a2f33c9f-48fb-4658-a064-e1a6a36640e6

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Additional Information

Supporting Documents	www.tracopower.com/overview/trn1
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

Outline Dimensions



Dimensions in [mm], () = Inch
Tolerances: x.x ± 0.5 (± 0.02)
x.xx ± 0.25 (± 0.01)
Pin pitch tolerances ± 0.25 (± 0.01)
Pin dimension tolerance ± 0.1 (± 0.004)

Pinout

Pin	Single	Dual
1	-Vin (GND)	-Vin (GND)
2	+Vin (Vcc)	+Vin (Vcc)
3	+Vout	+Vout
4	No pin	Common
5	-Vout	-Vout

Avoid routing PCB traces under the converter.