

- 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 UL 62368-1 (UL 60950-1)
- 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 62368-1 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 mA_{p-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 (V _{min} - V _{max})	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 mV_{p-p} typ.
Capacitive Load	- single output	3.3 V _{out} models: 1'680 μF max. 5 V _{out} models: 820 μF max. 12 V _{out} models: 470 μF max. 15 V _{out} models: 330 μF max. 24 V _{out} models: 160 μF max.
	- dual output	5 / -5 V _{out} models: 470 / 470 μF max. 12 / -12 V _{out} models: 330 / 330 μF max. 15 / -15 V _{out} 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 I_{out} max.
Transient Response	- Response Deviation	3% typ. (25% Load Step)
	- Response Time	500 μs typ. (25% Load Step)

Safety Specifications

Safety Standards	- IT / Multimedia Equipment	Designed for EN 62368-1 (no certification)
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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/overview/trn1

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

EMS Immunity	<ul style="list-style-type: none"> - Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field 	Air: EN 55024 (IT Equipment) Contact: EN 61000-4-2, ±8 kV, perf. criteria A 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 Ext. input component: Nippon chemi-con KY 220 µF/100 V Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A EN 61000-4-8, 100 A/m, perf. criteria A 1 s: EN 61000-4-8, 1000 A/m, perf. criteria A
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General Specifications

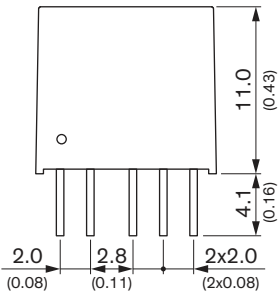
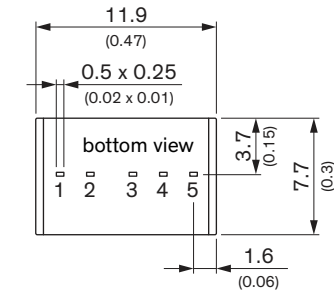
Relative Humidity		95% max. (non condensing)
Temperature Ranges	<ul style="list-style-type: none"> - Operating Temperature - Case Temperature - Storage Temperature 	-40°C to +90°C (without derating) +105°C max. -55°C to +125°C
Power Derating	<ul style="list-style-type: none"> - High Temperature 	6.7 %/K above 90°C See application note: www.tracopower.com/overview/trn1
Cooling System		Natural convection (20 LFM)
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 MΩ 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	See Cleaning Guideline:	Allowed (hermetical product) www.tracopower.com/info/cleaning.pdf
Environment	<ul style="list-style-type: none"> - Vibration - Thermal Shock 	MIL-STD-810F 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 µm)
Pin Surface Plating		Tin (5 - 6 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP5
Soldering Profile		Wave Soldering 260°C / 6 s max.
Weight		2.1 g
Environmental Compliance	<ul style="list-style-type: none"> - REACH Declaration - RoHS Declaration 	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/trn1
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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