

- 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 cm<sup>3</sup>. 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 <sub>max</sub>	Vnom	I <sub>max</sub>	
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: <b>35 mA typ.</b> 12 Vin models: <b>20 mA typ.</b> 24 Vin models: <b>10 mA typ.</b> 48 Vin models: <b>5 mA typ.</b>
Surge Voltage		9 Vin models: <b>15 VDC max.</b> (1 s max.) 12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Reflected Ripple Current		<b>30 mA<sub>p-p</sub> typ.</b>
Recommended Input Fuse		9 Vin models: <b>500 mA</b> (slow blow) 12 Vin models: <b>315 mA</b> (slow blow) 24 Vin models: <b>160 mA</b> (slow blow) 48 Vin models: <b>160 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Capacitor</b>

## Output Specifications

Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (V <sub>min</sub> - V <sub>max</sub> )	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>1% max.</b> dual output models: <b>1% max.</b> (Output 1) <b>1% max.</b> (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>50 mV<sub>p-p</sub> typ.</b>
Capacitive Load	- single output	3.3 V <sub>out</sub> models: <b>1'680 μF max.</b> 5 V <sub>out</sub> models: <b>820 μF max.</b> 12 V <sub>out</sub> models: <b>470 μF max.</b> 15 V <sub>out</sub> models: <b>330 μF max.</b> 24 V <sub>out</sub> models: <b>160 μF max.</b>
	- dual output	5 / -5 V <sub>out</sub> models: <b>470 / 470 μF max.</b> 12 / -12 V <sub>out</sub> models: <b>330 / 330 μF max.</b> 15 / -15 V <sub>out</sub> models: <b>220 / 220 μF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>5 ms typ. / 15 ms max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Output Current Limitation		<b>200% typ. of I<sub>out</sub> max.</b>
Transient Response	- Response Deviation	<b>3% typ.</b> (25% Load Step)
	- Response Time	<b>500 μs typ.</b> (25% Load Step)

## Safety Specifications

Safety Standards	- IT / Multimedia Equipment	<b>Designed for EN 62368-1</b> (no certification)
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## EMC Specifications

EMI Emissions	- Conducted Emissions	<b>EN 55032 class A</b> (with external filter)
		<b>EN 55032 class B</b> (with external filter)
	- Radiated Emissions	<b>EN 55032 class A</b> (with external filter)
		<b>EN 55032 class B</b> (with external filter)
		External filter proposal: <a href="http://www.tracopower.com/overview/trn1">www.tracopower.com/overview/trn1</a>

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"> <li>- Electrostatic Discharge</li> <li>- RF Electromagnetic Field</li> <li>- EFT (Burst) / Surge</li> <li>- Conducted RF Disturbances</li> <li>- PF Magnetic Field</li> </ul>	EN 55024 (IT Equipment) Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A EN 61000-4-3, 10 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 1$ kV, perf. criteria A Ext. input component: Nippon chemi-con KY 220 $\mu$ F/100 V EN 61000-4-6, 10 Vrms, perf. criteria A Continuous: 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

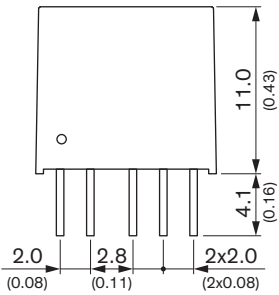
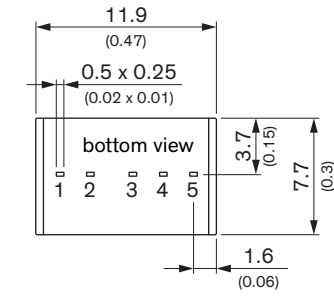
Relative Humidity		95% max. (non condensing)
Temperature Ranges	<ul style="list-style-type: none"> <li>- Operating Temperature</li> <li>- Case Temperature</li> <li>- Storage Temperature</li> </ul>	-40°C to +90°C (without derating) +105°C max. -55°C to +125°C
Power Derating	<ul style="list-style-type: none"> <li>- High Temperature</li> </ul>	6.7 %/K above 90°C See application note: <a href="http://www.tracopower.com/overview/trn1">www.tracopower.com/overview/trn1</a>
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 M $\Omega$ 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) <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	<ul style="list-style-type: none"> <li>- Vibration</li> <li>- Thermal Shock</li> </ul>	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 $\mu$ m)
Pin Surface Plating		Tin (5 - 6 $\mu$ m), 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"> <li>- REACH Declaration</li> <li>- RoHS Declaration</li> </ul>	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> 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)	<a href="http://www.tracopower.com/overview/trn1">www.tracopower.com/overview/trn1</a>
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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