



**THE DATASHEET OF
TRN 1-0513SM**



- Compact SMD package
11,9 x 11,3 x 8,0 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 1SM Series comprises 1 Watt fully regulated, high performance DC/DC converters. They come in a compact cubical package of only 1.07 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 1-0510SM	4.5 - 13.2 VDC (9 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-0511SM		5 VDC	200 mA			79 %
TRN 1-0512SM		12 VDC	90 mA			81 %
TRN 1-0513SM		15 VDC	70 mA			82 %
TRN 1-0515SM		24 VDC	45 mA			83 %
TRN 1-0521SM		+5 VDC	100 mA	-5 VDC	100 mA	79 %
TRN 1-0522SM		+12 VDC	45 mA	-12 VDC	45 mA	83 %
TRN 1-0523SM		+15 VDC	35 mA	-15 VDC	35 mA	80 %
TRN 1-1210SM	9 - 18 VDC (12 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-1211SM		5 VDC	200 mA			80 %
TRN 1-1212SM		12 VDC	90 mA			81 %
TRN 1-1213SM		15 VDC	70 mA			83 %
TRN 1-1215SM		24 VDC	45 mA			83 %
TRN 1-1221SM		+5 VDC	100 mA	-5 VDC	100 mA	79 %
TRN 1-1222SM		+12 VDC	45 mA	-12 VDC	45 mA	83 %
TRN 1-1223SM		+15 VDC	35 mA	-15 VDC	35 mA	80 %
TRN 1-2410SM	18 - 36 VDC (24 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-2411SM		5 VDC	200 mA			81 %
TRN 1-2412SM		12 VDC	90 mA			82 %
TRN 1-2413SM		15 VDC	70 mA			83 %
TRN 1-2415SM		24 VDC	45 mA			82 %
TRN 1-2421SM		+5 VDC	100 mA	-5 VDC	100 mA	79 %
TRN 1-2422SM		+12 VDC	45 mA	-12 VDC	45 mA	82 %
TRN 1-2423SM		+15 VDC	35 mA	-15 VDC	35 mA	80 %
TRN 1-4810SM	36 - 75 VDC (48 VDC nom.)	3.3 VDC	300 mA			77 %
TRN 1-4811SM		5 VDC	200 mA			78 %
TRN 1-4812SM		12 VDC	90 mA			80 %
TRN 1-4813SM		15 VDC	70 mA			81 %
TRN 1-4815SM		24 VDC	45 mA			81 %
TRN 1-4821SM		+5 VDC	100 mA	-5 VDC	100 mA	78 %
TRN 1-4822SM		+12 VDC	45 mA	-12 VDC	45 mA	81 %
TRN 1-4823SM		+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

Standards	- IT / Multimedia Equipment	Designed for IEC/EN/UL 62368-1 (not certified)
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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/trn1sm

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	Air: EN 61000-4-2, ± 8 kV, perf. criteria A
	- RF Electromagnetic Field	Contact: EN 61000-4-2, ± 6 kV, perf. criteria A
	- EFT (Burst) / Surge	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	Ext. input component: Nippon chemi-con KY 220 μ F/100 V
	- PF Magnetic Field	Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
		1 s: EN 61000-4-8, 100 A/m, perf. criteria A
		1 s: 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/overview/trn1sm
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)
Moisture Sensitivity (MSL)		Level 2 (J-STD-033C)
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		Epoxy (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		SMD (Surface-Mount Device)
Footprint Type		SMD10
Soldering Profile		Lead-Free Reflow Soldering (acc. J-STD-020E) 245°C max. (Tp) 30 s max. (tp, at Tp - 5°C) 90 s max. (tL, time above 217°C)
		See application note: www.tracopower.com/info/reflow-soldering.pdf
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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	a0e28475-72e6-4861-99e1-67f3154e0c90

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

Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/trn1sm

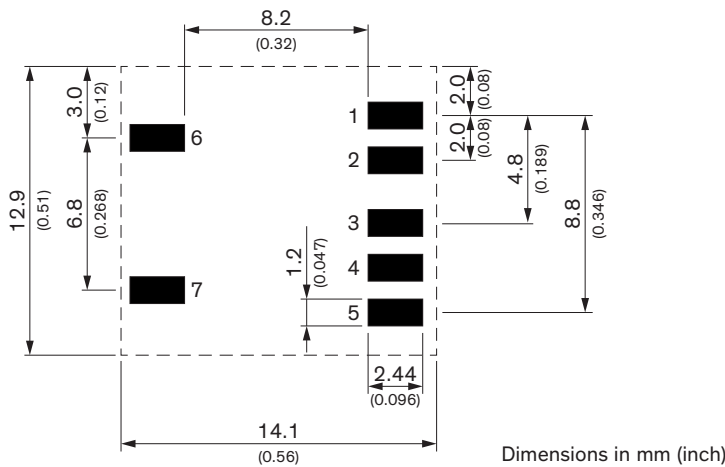
Outline Dimensions



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



NC: Not connected

Recommended Solder Pad Layout



Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

-  [View TRN 1-0513SM on WIN SOURCE](#)
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