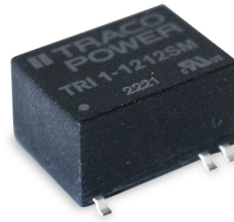


- Reinforced I/O-isolation 3000 VAC rated for 480 VAC working voltage
- Ultra-high isolation peak voltage 8000 VDC (1s)
- Operating temperature range -40 to +85°C without derating
- High efficiency up to 84%
- Input voltage range ( $\pm 10\%$ ): 5, 12, 24 VDC
- Protection against overvoltage and short circuit
- 3-year product warranty



The new TRI 1SM is a high isolation, unregulated DC/DC converter series which comes in a compact SMD-14 package. The core characteristic of the TRI 1SM series is a sophisticated reinforced isolation system which is able to withstand high test voltages (8000 VDC for 1s and 3000 VAC for 60s) and working voltages (480 VACrms). Efficiencies up to 84% allow safe operation from -40°C to +85°C without derating. All models have a  $\pm 10\%$  input voltage range and precisely regulated, isolated output voltages. With the latest IT safety certifications (IEC/EN/UL 62368-1) the TRI 1SM series is the perfect choice for many demanding low power applications in the industrial, transportation and instrumentation sectors.

### Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TRI 1-0511SM	4.5 - 5.5 VDC (5 VDC nom.)	5 VDC	200 mA			76 %
TRI 1-0512SM		12 VDC	84 mA			80 %
TRI 1-0513SM		15 VDC	68 mA			83 %
TRI 1-0522SM		+12 VDC	42 mA	-12 VDC	42 mA	80 %
TRI 1-0523SM		+15 VDC	33 mA	-15 VDC	33 mA	84 %
TRI 1-1211SM	10.8 - 13.2 VDC (12 VDC nom.)	5 VDC	200 mA			76 %
TRI 1-1212SM		12 VDC	84 mA			79 %
TRI 1-1213SM		15 VDC	68 mA			80 %
TRI 1-1222SM		+12 VDC	42 mA	-12 VDC	42 mA	79 %
TRI 1-1223SM		+15 VDC	33 mA	-15 VDC	33 mA	80 %
TRI 1-2411SM	21.6 - 26.4 VDC (24 VDC nom.)	5 VDC	200 mA			76 %
TRI 1-2412SM		12 VDC	84 mA			80 %
TRI 1-2413SM		15 VDC	68 mA			80 %
TRI 1-2422SM		+12 VDC	42 mA	-12 VDC	42 mA	80 %
TRI 1-2423SM		+15 VDC	33 mA	-15 VDC	33 mA	80 %

### Input Specifications

Input Current	- At no load	5 Vin models: <b>50 mA typ. / 75 mA max.</b> 12 Vin models: <b>35 mA typ. / 53 mA max.</b> 24 Vin models: <b>20 mA typ. / 30 mA max.</b>
	- At full load	5 Vin models: <b>267 mA max.</b> (5 Vout model) <b>249 mA max.</b> (12 Vout model) <b>246 mA max.</b> (15 Vout model) <b>249 mA max.</b> (12 / -12 Vout model) <b>239 mA max.</b> (15 / -15 Vout model) 12 Vin models: <b>111 mA max.</b> (5 Vout model) <b>108 mA max.</b> (12 Vout model) <b>106 mA max.</b> (15 Vout model) <b>108 mA max.</b> (12 / -12 Vout model) <b>102 mA max.</b> (15 / -15 Vout model) 24 Vin models: <b>56 mA max.</b> (5 Vout model) <b>53 mA max.</b> (12 Vout model) <b>54 mA max.</b> (15 Vout model) <b>53 mA max.</b> (12 / -12 Vout model) <b>52 mA max.</b> (15 / -15 Vout model)
Surge Voltage		5 Vin models: <b>9 VDC max.</b> (1 s max.) 12 Vin models: <b>18 VDC max.</b> (1 s max.) 24 Vin models: <b>30 VDC max.</b> (1 s max.)
Recommended Input Fuse		5 Vin models: <b>500 mA</b> (slow blow) 12 Vin models: <b>200 mA</b> (slow blow) 24 Vin models: <b>100 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>±3% max.</b>
Regulation (Unregulated)	- Input Variation (1% Vin step) - Load Variation - Voltage Balance (symmetrical load)	single output models: <b>1.5% max.</b> See application note: <a href="http://www.tracopower.com/overview/tri1sm">www.tracopower.com/overview/tri1sm</a> dual output models: <b>1% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>100 mVp-p max.</b>
Capacitive Load	- single output  - dual output	5 Vout models: <b>220 µF max.</b> 12 Vout models: <b>220 µF max.</b> 15 Vout models: <b>220 µF max.</b> 12 / -12 Vout models: <b>100 / 100 µF max.</b> 15 / -15 Vout models: <b>100 / 100 µF max.</b>
Minimum Load		<b>Not required</b> (Higher regulation tolerance below 2% load.)
Temperature Coefficient		<b>±0.02 %/K max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>

### Safety Specifications

Standards	- IT / Multimedia Equipment  - Certification Documents	<b>EN 62368-1</b> <b>IEC 62368-1</b> <b>UL 62368-1</b> <a href="http://www.tracopower.com/overview/tri1sm">www.tracopower.com/overview/tri1sm</a>
Pollution Degree		<b>PD 2</b>
Over Voltage Category		<b>Not mains connected</b>

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

## 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 (internal filter) EN 55032 class B (internal filter)
		External filter proposal: <a href="http://www.tracopower.com/overview/tri1sm">www.tracopower.com/overview/tri1sm</a>
EMS (Immunity)		EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air: EN 61000-4-2, ±15 kV, perf. criteria A Contact: EN 61000-4-2, ±8 kV, perf. criteria A
	- RF Electromagnetic Field	EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, ±2 kV, perf. criteria A EN 61000-4-5, ±1 kV, perf. criteria A
	- PF Magnetic Field	External filter proposal: <a href="http://www.tracopower.com/overview/tri1sm">www.tracopower.com/overview/tri1sm</a> Continuous: EN 61000-4-8, 100 A/m, perf. criteria A 1 s: EN 61000-4-8, 1000 A/m, perf. criteria A
EMC / Environmental	- Certification Documents	<a href="http://www.tracopower.com/overview/tri1sm">www.tracopower.com/overview/tri1sm</a>

## General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +95°C
	- Case Temperature	+105°C max.
	- Storage Temperature	-50°C to +125°C
Power Derating	- High Temperature	5 %/K above 85°C
		See application note: <a href="http://www.tracopower.com/overview/tri1sm">www.tracopower.com/overview/tri1sm</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.
Regulator Topology		Push-Pull Converter
Switching Frequency		30 - 100 kHz (Royer)
		55 kHz typ. (Royer)
Insulation System		Reinforced Insulation
Working Voltage (rated)		480 VAC (679 VDC)
Isolation Test Voltage	- Input to Output, 60 s	3'000 VAC (4242 VDC)
	- Input to Output, 1 s	8'000 VDC
Creepage	- Input to Output	8 mm min.
Clearance	- Input to Output	8 mm min.
Isolation Resistance	- Input to Output, 500 VDC	10'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	20 pF typ.
Reliability	- Calculated MTBF	4'700'000 h (MIL-HDBK-217F, ground benign)
Moisture Sensitivity (MSL)		Level 2 (J-STD-033C)
Washing Process		According to Cleaning Guideline <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration	IPC-9592B
	- Mechanical Shock	IPC-9592B
	- Thermal Shock	IPC-9592B
Housing Material		Plastic resin (UL 94 V-0 rated)
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Pin Material		Phosphor Bronze (C5191)
Pin Foundation Plating		Copper (1 - 3 μm)
Pin Surface Plating		Tin (7.5 μm min.), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		SMD (Surface-Mount Device)
Footprint Type		SMD14

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

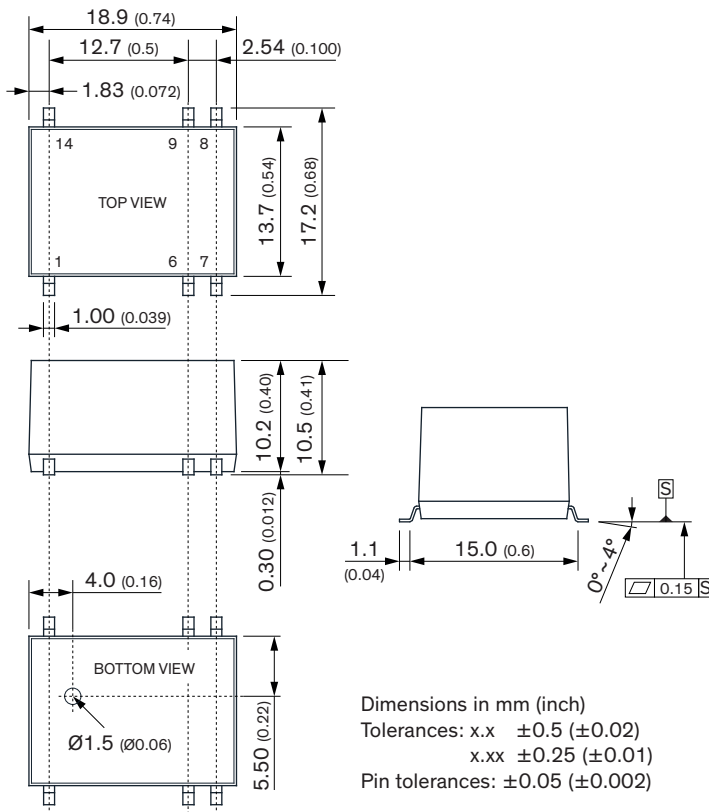
Soldering Profile	Lead-Free Reflow Soldering (acc. J-STD-020E) 245°C max. (Tp) 10 s max. (tp, at Tp - 5°C)
Weight	4.1 g
Environmental Compliance	- REACH Declaration <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant - RoHS Declaration <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: No Exemptions

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tri1sm](http://www.tracopower.com/overview/tri1sm)

### Outline Dimensions



Pinout		
Pin	Single	Dual
1		-Vin
6	NC	Common
7	NC	-Vout
8	+Vout	+Vout
9	-Vout	Common
14	+Vin	+Vin

NC: Not connected

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

**Recommended Solder Pad Layout**

