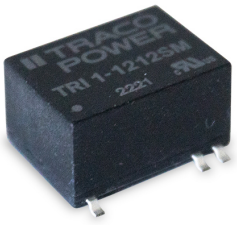
TRACO POWER

DC/DC Converter

TRI 1SM Series, 1 Watt

- **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 (±10%): 5, 12, 24 VDC**
- **Protection against overvoltage and short circuit**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The new TRI 1SM is a high isolation, regulated 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 ±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
		Vnom	Imax	Vnom	Imax	typ.
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:	50 mA typ. / 75 mA max.
		12 Vin models:	35 mA typ. / 53 mA max.
		24 Vin models:	20 mA typ. / 30 mA max.
	- At full load	5 Vin models:	267 mA max. (5 Vout model)
			249 mA max. (12 Vout model)
			246 mA max. (15 Vout model)
			249 mA max. (12 / -12 Vout model)
			239 mA max. (15 / -15 Vout model)
		12 Vin models:	111 mA max. (5 Vout model)
			108 mA max. (12 Vout model)
			106 mA max. (15 Vout model)
			108 mA max. (12 / -12 Vout model)
			102 mA max. (15 / -15 Vout model)
		24 Vin models:	56 mA max. (5 Vout model)
			53 mA max. (12 Vout model)
			54 mA max. (15 Vout model)
			53 mA max. (12 / -12 Vout model)
			52 mA max. (15 / -15 Vout model)
Surge Voltage		5 Vin models:	9 VDC max. (1 s max.)
		12 Vin models:	18 VDC max. (1 s max.)
		24 Vin models:	30 VDC max. (1 s max.)
Recommended Input Fuse		5 Vin models:	500 mA (slow blow)
		12 Vin models:	200 mA (slow blow)
		24 Vin models:	100 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			±3% max.
Regulation	- Input Variation (1% Vin step)	single output models:	1.5% max.
	- Load Variation	See application note:	www.tracopower.com/overview/tri1sm
	- Voltage Balance (symmetrical load)	dual output models:	1% max.
Ripple and Noise	- 20 MHz Bandwidth		100 mVp-p max.
Capacitive Load	- single output	5 Vout models:	220 µF max.
		12 Vout models:	220 µF max.
		15 Vout models:	220 µF max.
	- dual output	12 / -12 Vout models:	100 / 100 µF max.
		15 / -15 Vout models:	100 / 100 µF max.
Minimum Load			Not required
			(Higher regulation tolerance below 2% load.)
Temperature Coefficient			±0.02 %/K max.
Short Circuit Protection			Continuous, Automatic recovery

Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 62368-1
		IEC 62368-1
		UL 62368-1
	- Certification Documents	www.tracopower.com/overview/tri1sm
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

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:	www.tracopower.com/overview/tri1sm
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
		External filter proposal:	www.tracopower.com/overview/tri1sm
	- PF Magnetic Field	Continuous:	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 +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:	www.tracopower.com/overview/tri1sm
Cooling System			Natural convection (20 LFM)
Altitude During Operation			5'000 m max.
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
			www.tracopower.com/info/cleaning.pdf
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
Soldering Profile			Lead-Free Reflow Soldering (acc. J-STD-020E)
			245°C max. (Tp)
			10 s max. (tp, at Tp - 5°C)
		See application note:	www.tracopower.com/info/reflow-soldering.pdf

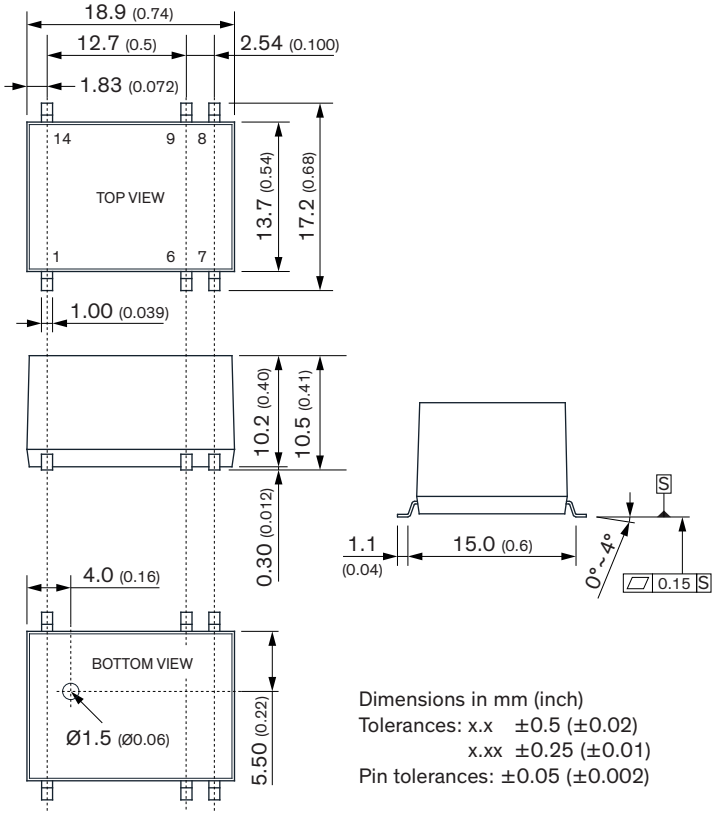
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Weight		4.1 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: No Exemptions

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tri1sm

Outline Dimensions



Dimensions in mm (inch)
Tolerances: x.x ±0.5 (±0.02)
x.xx ±0.25 (±0.01)
Pin tolerances: ±0.05 (±0.002)

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