

- I/O isolation 5000 VAC (reinforced)
- Short circuit protection
- Semi-regulated outputs
- Input voltage ranges ($\pm 10\%$):
5, 12, 15, 24 VDC
- Operating temperature range
-40 to +85 °C without derating
- Certification according to IEC/EN/ES
60601-1 3rd edition for 2xMOPP and
IEC/EN/UL 62368-1
- Low leakage current $< 2 \mu\text{A}$
- Efficiency up to 85%
- Operation up to 5000 m altitude
- 5-year product warranty



ES 60601-1 IEC 60601-1
UL 62368-1 IEC 62368-1

The TRV 1M is a series of 1 Watt DC/DC converters in a compact SIP-9 package with reinforced isolation of 5000 VAC for medical and industrial applications. The series offers models with different input voltages ($\pm 10\%$) between 5 and 24 VDC. With a continuous short circuit protection and a low leakage current of less than $2 \mu\text{A}$, this converter series is especially suited to protect any connected interfaces or applied parts to patients. Featuring semi-regulated outputs this series provides a good level of regulation without affecting the cost efficiency. It is an ideal solution for applications where a completely unregulated DC/DC converter would not meet your regulation requirements and therefore opens up the overall application range of this series. Together with an operating temperature range from -40 to +85°C without derating and certifications according to IEC/EN/ES 60601-1 3rd ed. for 2xMOPP and IEC/EN/UL 62368-1 this series is suitable for many different applications where a medical isolation system and short circuit protection is needed.

Models						
Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
TRV 1-0510M	4.5 - 5.5 VDC (5 VDC nom.)	3.3 VDC	303 mA			80 %
TRV 1-0511M		5 VDC	200 mA			82 %
TRV 1-0512M		12 VDC	83 mA			85 %
TRV 1-0513M		15 VDC	67 mA			84 %
TRV 1-0521M		+5 VDC	100 mA	-5 VDC	100 mA	85 %
TRV 1-0522M		+12 VDC	42 mA	-12 VDC	42 mA	85 %
TRV 1-0523M		+15 VDC	34 mA	-15 VDC	34 mA	84 %
TRV 1-1210M	9.6 - 14.4 VDC (12 VDC nom.)	3.3 VDC	303 mA			80 %
TRV 1-1211M		5 VDC	200 mA			82 %
TRV 1-1212M		12 VDC	83 mA			84 %
TRV 1-1213M		15 VDC	67 mA			83 %
TRV 1-1221M		+5 VDC	100 mA	-5 VDC	100 mA	82 %
TRV 1-1222M		+12 VDC	42 mA	-12 VDC	42 mA	83 %
TRV 1-1223M		+15 VDC	34 mA	-15 VDC	34 mA	83 %
TRV 1-1510M	12 - 18 VDC (15 VDC nom.)	3.3 VDC	303 mA			79 %
TRV 1-1511M		5 VDC	200 mA			83 %
TRV 1-1512M		12 VDC	83 mA			84 %
TRV 1-1513M		15 VDC	67 mA			84 %
TRV 1-1521M		+5 VDC	100 mA	-5 VDC	100 mA	82 %
TRV 1-1522M		+12 VDC	42 mA	-12 VDC	42 mA	83 %
TRV 1-1523M		+15 VDC	34 mA	-15 VDC	34 mA	83 %
TRV 1-2410M	19.2 - 28.8 VDC (24 VDC nom.)	3.3 VDC	303 mA			78 %
TRV 1-2411M		5 VDC	200 mA			82 %
TRV 1-2412M		12 VDC	83 mA			83 %
TRV 1-2413M		15 VDC	67 mA			83 %
TRV 1-2421M		+5 VDC	100 mA	-5 VDC	100 mA	80 %
TRV 1-2422M		+12 VDC	42 mA	-12 VDC	42 mA	81 %
TRV 1-2423M		+15 VDC	34 mA	-15 VDC	34 mA	81 %

Note - 5 Vin models: If the input will be switched electromechanically, use an external 100 $\mu\text{F}/10 \text{ V E/C.}$ to avoid voltage transient.

Input Specifications

Input Current	- At no load	5 Vin models:	30 mA typ.
		12 Vin models:	30 mA typ.
		15 Vin models:	15 mA typ.
		24 Vin models:	10 mA typ.
Surge Voltage		5 Vin models:	6 VDC max. (1 s max.)
		12 Vin models:	25 VDC max. (1 s max.)
		15 Vin models:	25 VDC max. (1 s max.)
		24 Vin models:	40 VDC max. (1 s max.)
Recommended Input Fuse		5 Vin models:	500 mA (slow blow)
		12 Vin models:	315 mA (slow blow)
		15 Vin models:	315 mA (slow blow)
		24 Vin models:	160 mA (slow blow)
		(The need of an external fuse has to be assessed in the final application.)	

Output Specifications

Voltage Set Accuracy			±3.5% max. (60% load: 3.3, 5, ±5 Vout models) ±3.5% max. (90% load: other models)
Regulation	- Input Variation (1% Vin step)	single output models:	0.2% max.
		dual output models:	0.2% max.
	- Load Variation (10 - 100%)	single output models:	10% max. (3.3, 5 Vout models) 7% max. (other models)
		dual output models:	7% max. (Output 1) 7% max. (Output 2) (10% max. for ±5 Vout model)
	- Cross Regulation (25% / 100% asym. load)	dual output models:	6% max.
Ripple and Noise	- 20 MHz Bandwidth		75 mVp-p typ. 100 mVp-p max.
Capacitive Load	- single output	3.3 Vout models:	2'000 µF max.
		5 Vout models:	820 µF max.
		12 Vout models:	470 µF max.
		15 Vout models:	470 µF max.
	- dual output	5 / -5 Vout models:	470 / 470 µF max.
		12 / -12 Vout models:	220 / 220 µF max.
15 / -15 Vout models:		220 / 220 µF max.	
Minimum Load			Not required
Temperature Coefficient			±0.03 %/K max.
Short Circuit Protection			Continuous, Automatic recovery

Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 62368-1
	- Medical Equipment	EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1
	- Certification Documents	www.tracopower.com/overview/trv1m

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

EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55011 class A (with external filter) EN 55011 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55011 class A (with external filter) EN 55011 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter)
External filter proposal: www.tracopower.com/overview/trv1m		
EMS Immunity	- 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 - 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, ± 2 kV, perf. criteria A
External filter proposal: www.tracopower.com/overview/trv1m		
	- Conducted RF Disturbances	EN 61000-4-6, 10 Vrms, perf. criteria A
	- 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

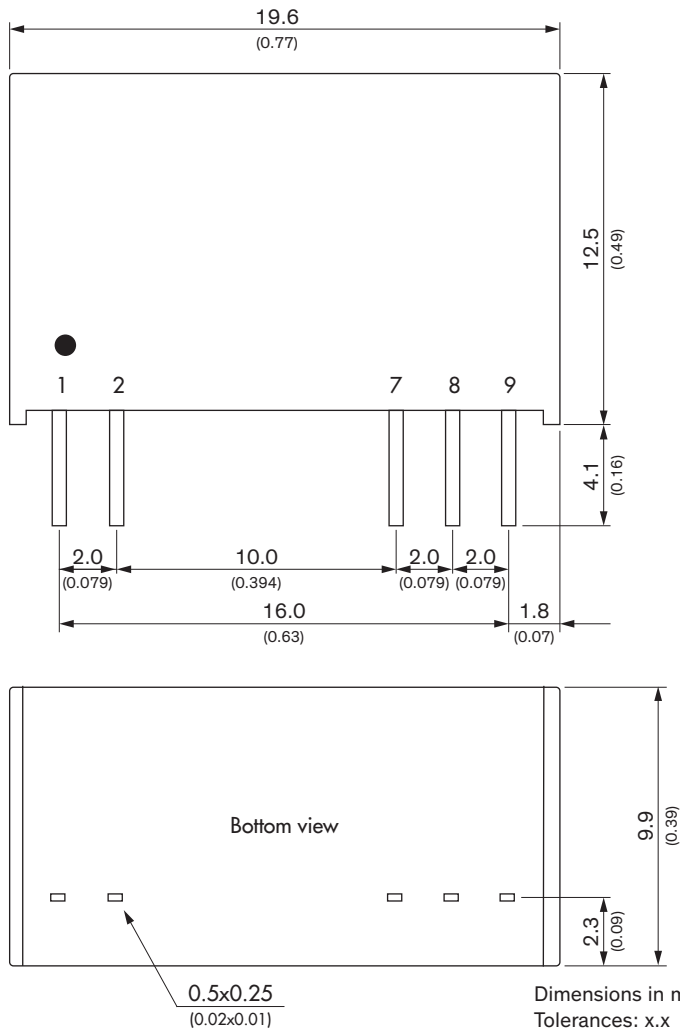
Relative Humidity	95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature
	-40°C to +85°C (without derating) +105°C max. -55°C to +125°C
Cooling System	Natural convection (20 LFM)
Altitude During Operation	5'000 m max.
Switching Frequency	220 - 380 kHz (PWM)
Insulation System	Reinforced Insulation
Isolation Test Voltage	- Input to Output, 60 s
Creepage	- Input to Output
Clearance	- Input to Output
Isolation Resistance	- Input to Output, 500 VDC
Isolation Capacitance	- Input to Output, 100 kHz, 1 V
	5'000 VAC 8 mm min. 8 mm min. 10'000 MΩ min. 15 pF typ. 20 pF max.
Leakage Current	- Touch Current
Reliability	- Calculated MTBF
Environment	- Vibration - Mechanical Shock - Thermal Shock
	2 μA max. 19'360'000 h (MIL-HDBK-217F, ground benign) MIL-STD-810F MIL-STD-810F MIL-STD-810F
Housing Material	Non-conductive Plastic (UL94 V-0 rated)
Potting Material	Silicone (UL 94 V-0 rated)
Pin Material	Brass
Pin Foundation Plating	Nickel (1 - 2 μm)
Pin Surface Plating	Tin (3 - 5 μm), matte
Connection Type	THD (Through-Hole Device)
Weight	4.8 g
Environmental Compliance	- Reach - RoHS
	www.tracopower.com/info/reach-declaration.pdf www.tracopower.com/info/rohs-declaration.pdf

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/trv1m
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All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.

Outline Dimensions



Pinout		
Pin	Single	Dual
1	+Vin (Vcc)	+Vin (Vcc)
2	-Vin (GND)	-Vin (GND)
7	-Vout	-Vout
8	No Pin	Common
9	+Vout	+Vout

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