

- 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 +95 °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 +95°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) - Load Variation - Cross Regulation (25% / 100% asym. load)	single output models: 0.2% max. dual output models: 0.2% max. See application note: www.tracopower.com/overview/trv1m dual output models: 6% max.
Ripple and Noise	- 20 MHz Bandwidth	75 mVp-p typ. 100 mVp-p max.
Capacitive Load	- single output - dual 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. 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 - Medical Equipment - Certification Documents	EN 62368-1 IEC 62368-1 UL 62368-1 EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 2 x MOPP (Means Of Patient Protection) www.tracopower.com/overview/trv1m
Pollution Degree		PD 2

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

EMC Specifications

EMI Emissions		EN 60601-1-2 edition 4 (Medical Devices)
- 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		EN 55024 (IT Equipment)
- Electrostatic Discharge		EN 60601-1-2 edition 4 (Medical Devices)
- RF Electromagnetic Field		Air: EN 61000-4-2, ± 15 kV, perf. criteria A
- EFT (Burst) / Surge		Contact: EN 61000-4-2, ± 8 kV, perf. criteria A 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
- Conducted RF Disturbances		External filter proposal: www.tracopower.com/overview/trv1m
- PF Magnetic Field		Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A 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 +95°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
Working Voltage (rated)		250 VAC
Isolation Test Voltage	- Input to Output, 60 s	5'000 VAC
Creepage	- Input to Output	8 mm min.
Clearance	- Input to Output	8 mm min.
Isolation Resistance	- Input to Output, 500 VDC	10'000 M Ω min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	15 pF typ. 20 pF max.
Leakage Current	- Touch Current	2 μ A max.
Reliability	- Calculated MTBF	19'360'000 h (MIL-HDBK-217F, ground benign)
Washing Process		Allowed (hermetical product)
	See Cleaning Guideline:	www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Mechanical Shock - Thermal Shock	MIL-STD-810F 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		Brass
Pin Foundation Plating		Nickel (1 - 2 μ m)
Pin Surface Plating		Tin (3 - 5 μ m), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP9

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

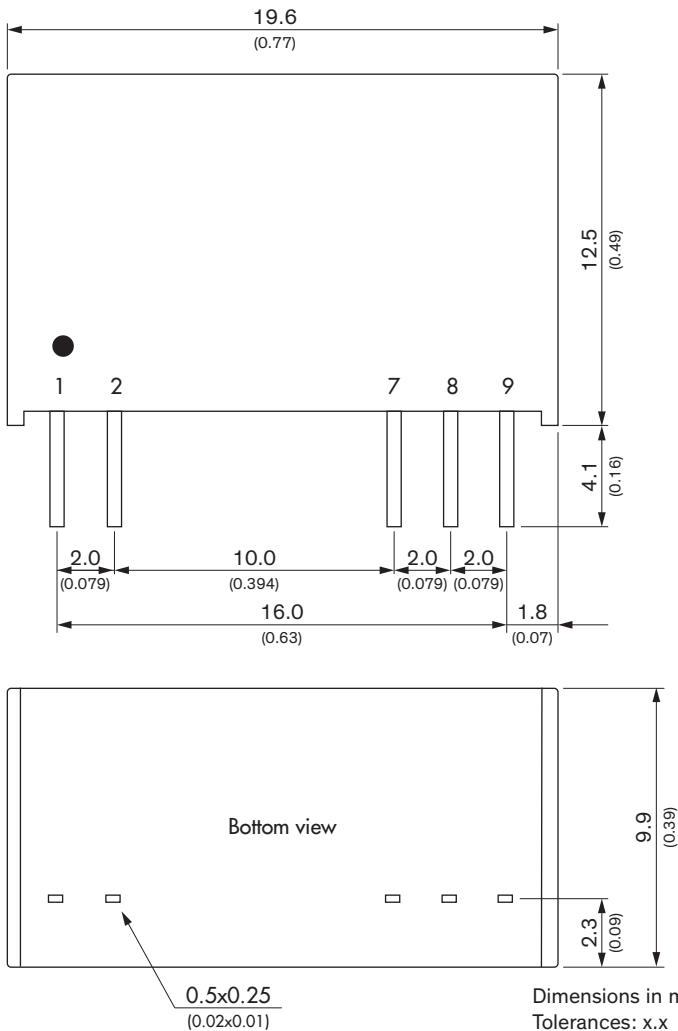
Weight	4.8 g
Environmental Compliance - REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7a, 7c-1 (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)

Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/trv1m

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

Dimensions in mm (inch)
Tolerances: x.x ±0.5 (±0.02)
x.xx ±0.25 (±0.01)
Pin diameter ±0.1 (±0.004)