TRACO POWER

Unregulated DC/DC Medical Converter

TRV 1M Series, 1 Watt

- **I/O isolation 5000 VAC (reinforced)**
- **Short circuit protection**
- **Unregulated outputs**
- **Input voltage ranges (±10%): 5, 12, 15, 24 VDC**
- **Operating temperature range -40 to +95 °C without derating**
- **Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2xMOPP and IEC/EN/UL 62368-1**
- **Low leakage current < 2 µA**
- **Efficiency up to 85%**
- **Operation up to 5000 m altitude**
- **5-year product warranty**



2MOPP c UL us CB Scheme

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 (±10%) between 5 and 24 VDC. With a continuous short circuit protection and a low leakage current of less than 2 µA, this converter series is especially suited to protect any connected interfaces or applied parts to patients. Together with an operating temperature range from -40 to +95°C without derating and certifications according to IEC/EN/ES 60601-1 ed. 3.2 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
		Vnom	Imax	Vnom	Imax	typ.
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 model: If the input is switched electromechanically, use an external 100 µF/25 V E/C. to reduce voltage transient.
- Other models: If the input is switched electromechanically, use an external 47 µF/100 V E/C. to reduce 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 (Unregulated)	- Input Variation (1% Vin step)	single output models:	**0.2% max.**
		dual output models:	**0.2% max.**
	- Load Variation	See application note:	www.tracopower.com/trv1m-cc
	- Cross Regulation (25% / 100% asym. load)	dual output models:	**6% max.**
Ripple and Noise	- 20 MHz Bandwidth		**100 mVp-p max.**
			75 mVp-p typ.
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		See application note:	www.tracopower.com/trv1m-cc
Temperature Coefficient			**±0.03 %/K max.**
Short Circuit Protection			**Continuous, Automatic recovery**

Safety Specifications

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
		2 x MOPP (Means Of Patient Protection)
	- Certification Documents	www.tracopower.com/trv1m-safety-cert
Energy Source	- Output, acc. to 62368-1	ES1
Power Source	- Output, acc. to 62368-1	PS3
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)			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/trv1m-emc-filter
EMS (Immunity)			EN 60601-1-2 edition 4 (Medical Devices)
			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, ±2 kV, perf. criteria A
		External filter proposal:	www.tracopower.com/trv1m-emc-filter
	- 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
EMC / Environmental	- Certification Documents		www.tracopower.com/trv1m-emc-cert

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +95°C (without derating)
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/trv1m-cc
Cooling System			Natural convection (20 LFM)
Altitude During Operation			5'000 m max.
Regulator Topology			Flyback Converter
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 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		15 pF typ.
			20 pF max.
Leakage Current	- Touch Current		2 µA max.
Reliability	- Calculated MTBF		19'360'000 h (MIL-HDBK-217F, ground benign)
Washing Process			According to Cleaning Guideline
			www.tracopower.com/info/cleaning.pdf
Environment	- Vibration		MIL-STD-810F
	- Mechanical Shock		MIL-STD-810F
	- Thermal Shock		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 µm)
Pin Surface Plating			Tin (3 - 5 µm), matte

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

Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		SIP9
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
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: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	804cccb4-e301-4dbb-9ef4-8516768826e7

Additional Information

Supporting Documents	www.tracopower.com/overview/trv1m
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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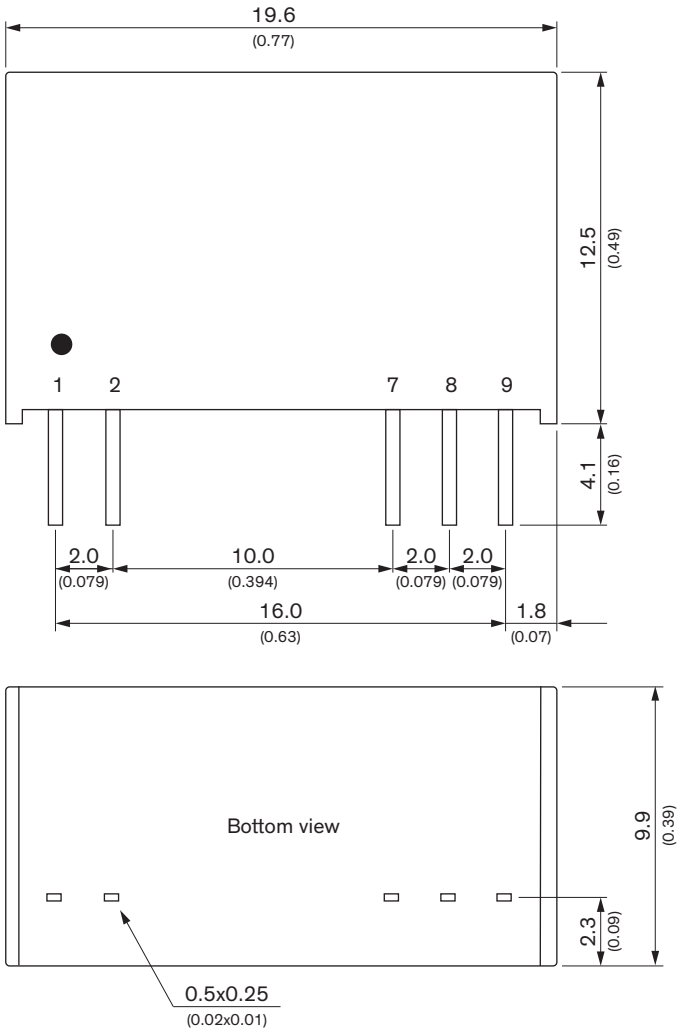
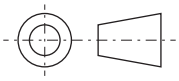
Outline Dimensions



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)



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