DC/DC Medical Converter

TRV 2M Series, 2 Watt

- **I/O isolation 5000 VAC (reinforced)**
- **Wide 1.5:1 input voltage range**
- **Operating temperature range -40 to +80 °C without derating**
- **Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2xMOPP and IEC/EN/UL 62368-1**
- **Short circuit protection**
- **Regulated outputs**
- **Low leakage current < 2 µA**
- **Efficiency up to 84 %**
- **Operation up to 5000 m altitude**
- **5-year product warranty**

2MOPP cULus CB Scheme

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

The TRV 2M is a series of 2 Watt DC/DC converters in a compact SIP-9 package with reinforced isolation of 5000 VAC for medical and industrial applications. The series offers a 1.5:1 input voltage range with a nominal input ranging between 5 and 24 VDC. With a continuous short circuit protection and a low leakage current of less than 2 µA, this converter is especially suited to protect any connected interfaces or applied parts to patients. Featuring almost fully regulated outputs this series provides great level of regulation without affecting the cost efficiency. It is an ideal solution for applications where an unregulated DC/DC converter would not meet your regulation requirements but cost still is a critical factor. With an operating temperature range from -40 to +80°C without derating and certifications acc. 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 2-0510M	4.5 - 7 VDC (5 VDC nom.)	3.3 VDC	600 mA			78 %
TRV 2-0511M		5 VDC	400 mA			81 %
TRV 2-0512M		12 VDC	167 mA			83 %
TRV 2-0513M		15 VDC	134 mA			83 %
TRV 2-0521M		+5 VDC	200 mA	−5 VDC	200 mA	82 %
TRV 2-0522M		+12 VDC	83 mA	−12 VDC	83 mA	83 %
TRV 2-0523M		+15 VDC	67 mA	−15 VDC	67 mA	81 %
TRV 2-1210M	9.6 - 14.4 VDC (12 VDC nom.)	3.3 VDC	600 mA			79 %
TRV 2-1211M		5 VDC	400 mA			81 %
TRV 2-1212M		12 VDC	167 mA			84 %
TRV 2-1213M		15 VDC	134 mA			83 %
TRV 2-1221M		+5 VDC	200 mA	−5 VDC	200 mA	81 %
TRV 2-1222M		+12 VDC	83 mA	−12 VDC	83 mA	83 %
TRV 2-1223M		+15 VDC	67 mA	−15 VDC	67 mA	82 %
TRV 2-1510M	12 - 18 VDC (15 VDC nom.)	3.3 VDC	600 mA			79 %
TRV 2-1511M		5 VDC	400 mA			81 %
TRV 2-1512M		12 VDC	167 mA			84 %
TRV 2-1513M		15 VDC	134 mA			83 %
TRV 2-1521M		+5 VDC	200 mA	−5 VDC	200 mA	81 %
TRV 2-1522M		+12 VDC	83 mA	−12 VDC	83 mA	83 %
TRV 2-1523M		+15 VDC	67 mA	−15 VDC	67 mA	80 %
TRV 2-2410M	19.2 - 28.8 VDC (24 VDC nom.)	3.3 VDC	600 mA			78 %
TRV 2-2411M		5 VDC	400 mA			80 %
TRV 2-2412M		12 VDC	167 mA			82 %
TRV 2-2413M		15 VDC	134 mA			82 %
TRV 2-2421M		+5 VDC	200 mA	−5 VDC	200 mA	81 %
TRV 2-2422M		+12 VDC	83 mA	−12 VDC	83 mA	81 %
TRV 2-2423M		+15 VDC	67 mA	−15 VDC	67 mA	80 %

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:	**5 mA typ.** (3.3 Vout model)
			5 mA typ. (5 Vout model)
			20 mA typ. (12 Vout model)
			20 mA typ. (15 Vout model)
			5 mA typ. (5 / -5 Vout model)
			20 mA typ. (12 / -12 Vout model)
			25 mA typ. (15 / -15 Vout model)
		12 Vin models:	**4 mA typ.** (3.3 Vout model)
			4 mA typ. (5 Vout model)
			10 mA typ. (12 Vout model)
			10 mA typ. (15 Vout model)
			4 mA typ. (5 / -5 Vout model)
			10 mA typ. (12 / -12 Vout model)
			10 mA typ. (15 / -15 Vout model)
		15 Vin models:	**4 mA typ.** (3.3 Vout model)
			4 mA typ. (5 Vout model)
			8 mA typ. (12 Vout model)
			8 mA typ. (15 Vout model)
			4 mA typ. (5 / -5 Vout model)
			8 mA typ. (12 / -12 Vout model)
			8 mA typ. (15 / -15 Vout model)
		24 Vin models:	**3 mA typ.** (3.3 Vout model)
			3 mA typ. (5 Vout model)
			6 mA typ. (12 Vout model)
			6 mA typ. (15 Vout model)
			3 mA typ. (5 / -5 Vout model)
			6 mA typ. (12 / -12 Vout model)
			6 mA typ. (15 / -15 Vout model)
	- At full load	5 Vin models:	**510 mA typ.**
		12 Vin models:	**210 mA typ.**
		15 Vin models:	**170 mA typ.**
		24 Vin models:	**105 mA typ.**
Surge Voltage		5 Vin models:	**15 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:	**35 VDC max.** (1 s max.)
Recommended Input Fuse		5 Vin models:	**1'000 mA** (slow blow)
		12 Vin models:	**500 mA** (slow blow)
		15 Vin models:	**500 mA** (slow blow)
		24 Vin models:	**315 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.** (60% load: 3.3, 5, ±5 Vout models)
			±3% max. (90% load: other models)
Regulation (Unregulated)	- Input Variation (Vmin - Vmax)	single output models:	**2% max.**
		dual output models:	**2% max.**
	- Load Variation	See application note:	www.tracopower.com/overview/trv2m
	- Voltage Balance (symmetrical load)	dual output models:	**4% max.**
	- Cross Regulation (25% / 100% asym. load)	dual output models:	**4% max.**

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

Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models:	100 mVp-p typ.
		5 Vout models:	100 mVp-p typ.
		12 Vout models:	125 mVp-p typ.
		15 Vout models:	125 mVp-p typ.
	- dual output	5 / -5 Vout models:	100 / 100 mVp-p typ.
		12 / -12 Vout models:	125 / 125 mVp-p typ.
		15 / -15 Vout models:	125 / 125 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			Not required
Temperature Coefficient			±0.03 %/K max.
Start-up Time			20 ms 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/overview/trv2m
Pollution Degree		PD 2
Over Voltage Category		OVC II (not mains connected)

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/trv2m
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/overview/trv2m
	- 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)

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

Temperature Ranges	- Operating Temperature	–40°C to +95°C
	- 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/overview/trv2m
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter
Switching Frequency		180 - 400 kHz (PFM)
Insulation System		Reinforced Insulation
Working Voltage (rated)		250 VAC
Isolation Test Voltage	- Input to Output, 60 s	5'000 VAC
	- Input to Output, 1 s	7'000 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	10 pF typ. 20 pF max.
Leakage Current	- Touch Current	2 µA max. (264 VAC, 60 Hz)
Reliability	- Calculated MTBF	10'410'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F 7.6 g, 3 axis, 60 min, 20-2000 Hz
	- Mechanical Shock	MIL-STD-810F 50 g, 3 axis, 11 ms
	- Thermal Shock	MIL-STD-810F -55°C to +125°C, 72 cycles, 30 min each
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Tinned Copper
Pin Foundation Plating		Nickel (2 - 3 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	2dda669e-cfb2-4463-b721-ad8acc4e0fbd

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/trv2m

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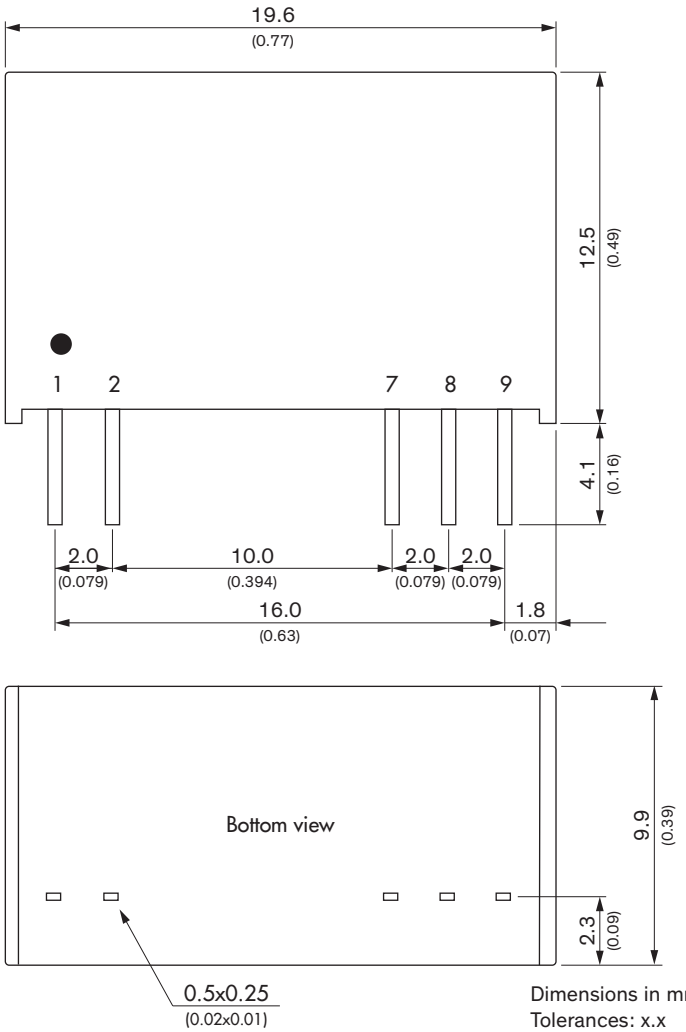
Outline Dimensions



Pinout		
Pin	**Single**	**Dual**
1	+Vin	+Vin
2	–Vin	–Vin
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)