# TRACO POWER

## DC/DC Medical Converter

## TRV 1M Series, 1 Watt

- **I/O isolation 5000 VAC (reinforced)**
- **Short circuit protection**
- **Semi-regulated 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 3rd edition 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. 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 you 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 |
|---|---|---|---|---|---|---|
| | | 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 models: If the input will be switched electromechanically, use an external 100 µF/10 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 | See application note: | www.tracopower.com/overview/trv1m |
| | - 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 |
| | | 2 x MOPP (Means Of Patient Protection) |
| | - Certification Documents | 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) |
| | | | EN 55035 (Multimedia) |
| | | | EN 60601-1-2 edition 4 (Medical Devices) |
| | - 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/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 | –40°C to +95°C (without derating) |
| | - Case Temperature | +105°C max. |
| | - Storage Temperature | –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 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 |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |
| Connection Type | | THD (Through-Hole Device) |
| Footprint Type | | SIP9 |

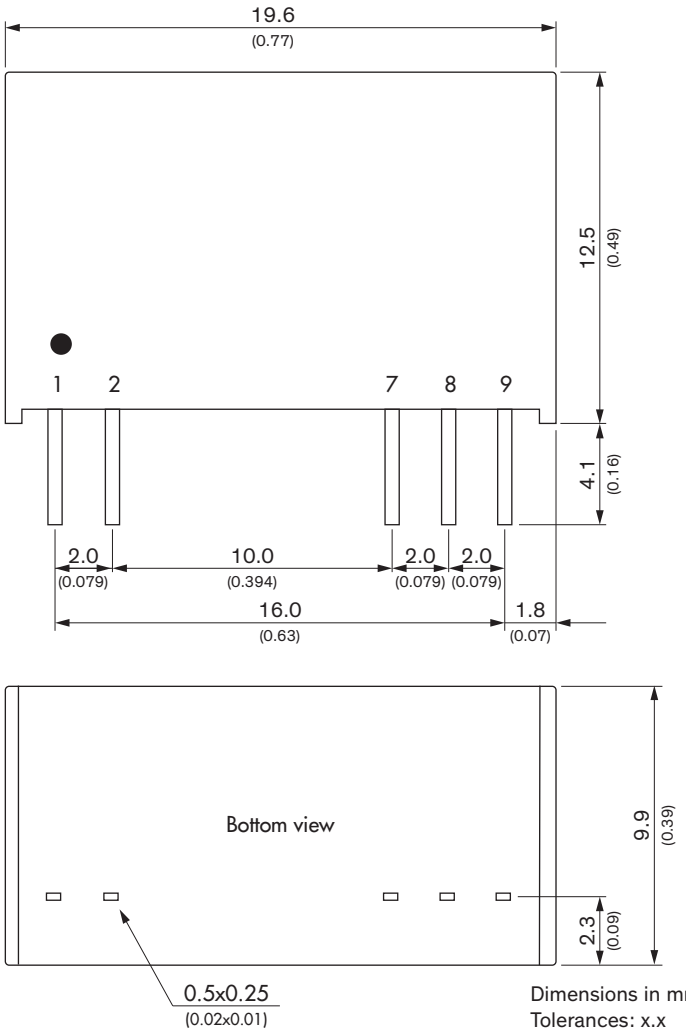
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

| | | |
|---|---|---|
| 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-I |
| | | (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




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

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