

- I/O isolation 5000 VAC (reinforced)
- Short circuit protection
- Unregulated 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. 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 model: If the input is switched electromechanically, use an external 100 $\mu\text{F}/25 \text{ V E/C.}$ to reduce voltage transient.
 - Other models: If the input is switched electromechanically, use an external 47 $\mu\text{F}/100 \text{ V E/C.}$ 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) - 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 | 100 mVp-p max. 75 mVp-p typ. |
| 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

| | | |
|------------------|---|--|
| 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 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/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 |
| EMC / Environmental | - Certification Documents | www.tracopower.com/overview/trv1m |

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. |
| 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 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 | | 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 μ m) |
| Pin Surface Plating | | Tin (3 - 5 μ m), matte |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |

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

| | |
|--------------------------|--|
| 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 | www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant |
| - REACH Declaration | |
| - 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 | 804cccb4-e301-4dbb-9ef4-8516768826e7 |

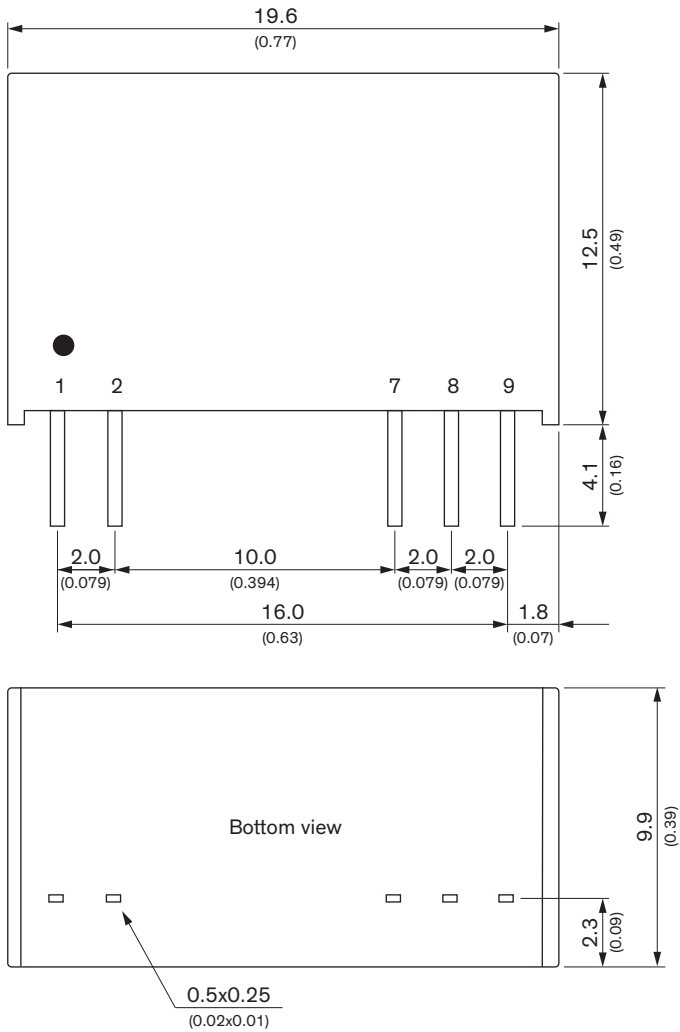
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/trv1m

All specifications valid at nominal voltage, resistive 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 |

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

