# TRACO POWER

## DC/DC Medical Converter

## TIM 2SM Series, 2 Watt

- **Compact SMD-16-package**
- **I/O isolation 5000 VAC rated for 250 VAC working voltage**
- **Certification according to IEC/EN/ES 60601-1 3rd edition for 2xMOPP and operation up to 5000 m altitude**
- **Low leakage current < 2 µA**
- **Extended operating temperature range –40°C to 95°C.**
- **5-year product warranty**

2MOPP c UL us CB Scheme

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

The TIM 2SM series is a range of 2 Watt DC/DC converters in compact SMD package and with reinforced isolation of 5000 VACrms for medical applications. With a low leakage current of less than 2 µA the converters are predestined to insulate electrical equipment from the applied parts to patient (BF classification). The models are approved to IEC/EN/ES 60601-1 3rd edition for 2xMOPP up to an altitude of 5000m and come along with an ISO 14971 risk management file.

## Models

| Order Code | Input Voltage Range | Output 1 | | Output 2 | | Efficiency |
|---|---|---|---|---|---|---|
| | | Vnom | Imax | Vnom | Imax | typ. |
| **TIM 2-0910SM** | 4.5 - 12 VDC (9 VDC nom.) | 3.3 VDC | 600 mA | | | 75 % |
| **TIM 2-0911SM** | | 5 VDC | 400 mA | | | 78 % |
| **TIM 2-0919SM** | | 9 VDC | 222 mA | | | 78 % |
| **TIM 2-0912SM** | | 12 VDC | 167 mA | | | 82 % |
| **TIM 2-0913SM** | | 15 VDC | 134 mA | | | 82 % |
| **TIM 2-0915SM** | | 24 VDC | 83 mA | | | 82 % |
| **TIM 2-0922SM** | | +12 VDC | 83 mA | –12 VDC | 83 mA | 82 % |
| **TIM 2-0923SM** | | +15 VDC | 67 mA | –15 VDC | 67 mA | 80 % |
| **TIM 2-1210SM** | 9 - 18 VDC (12 VDC nom.) | 3.3 VDC | 600 mA | | | 76 % |
| **TIM 2-1211SM** | | 5 VDC | 400 mA | | | 78 % |
| **TIM 2-1219SM** | | 9 VDC | 222 mA | | | 79 % |
| **TIM 2-1212SM** | | 12 VDC | 167 mA | | | 82 % |
| **TIM 2-1213SM** | | 15 VDC | 134 mA | | | 82 % |
| **TIM 2-1215SM** | | 24 VDC | 83 mA | | | 81 % |
| **TIM 2-1222SM** | | +12 VDC | 83 mA | –12 VDC | 83 mA | 81 % |
| **TIM 2-1223SM** | | +15 VDC | 67 mA | –15 VDC | 67 mA | 81 % |
| **TIM 2-2410SM** | 18 - 36 VDC (24 VDC nom.) | 3.3 VDC | 600 mA | | | 76 % |
| **TIM 2-2411SM** | | 5 VDC | 400 mA | | | 79 % |
| **TIM 2-2419SM** | | 9 VDC | 222 mA | | | 80 % |
| **TIM 2-2412SM** | | 12 VDC | 167 mA | | | 81 % |
| **TIM 2-2413SM** | | 15 VDC | 134 mA | | | 81 % |
| **TIM 2-2415SM** | | 24 VDC | 83 mA | | | 81 % |
| **TIM 2-2422SM** | | +12 VDC | 83 mA | –12 VDC | 83 mA | 81 % |
| **TIM 2-2423SM** | | +15 VDC | 67 mA | –15 VDC | 67 mA | 81 % |
| **TIM 2-4810SM** | 36 - 75 VDC (48 VDC nom.) | 3.3 VDC | 600 mA | | | 76 % |
| **TIM 2-4811SM** | | 5 VDC | 400 mA | | | 78 % |
| **TIM 2-4819SM** | | 9 VDC | 222 mA | | | 79 % |
| **TIM 2-4812SM** | | 12 VDC | 167 mA | | | 80 % |
| **TIM 2-4813SM** | | 15 VDC | 134 mA | | | 82 % |
| **TIM 2-4815SM** | | 24 VDC | 83 mA | | | 81 % |
| **TIM 2-4822SM** | | +12 VDC | 83 mA | –12 VDC | 83 mA | 81 % |
| **TIM 2-4823SM** | | +15 VDC | 67 mA | –15 VDC | 67 mA | 81 % |

## Input Specifications

| | | | |
|---|---|---|---|
| Input Current | - At no load | 9 Vin models: | 80 mA typ. |
| | | 12 Vin models: | 40 mA typ. |
| | | 24 Vin models: | 25 mA typ. |
| | | 48 Vin models: | 12 mA typ. |
| Surge Voltage | | 9 Vin models: | 15 VDC max. (1 s max.) |
| | | 12 Vin models: | 25 VDC max. (1 s max.) |
| | | 24 Vin models: | 50 VDC max. (1 s max.) |
| | | 48 Vin models: | 100 VDC max. (1 s max.) |
| Under Voltage Lockout | | 9 Vin models: | 2 VDC min. / 3 VDC typ. / 4 VDC max. |
| | | 12 Vin models: | 6 VDC min. / 7 VDC typ. / 8 VDC max. |
| | | 24 Vin models: | 13 VDC min. / 15 VDC typ. / 17 VDC max. |
| | | 48 Vin models: | 29 VDC min. / 32 VDC typ. / 35 VDC max. |
| Recommended Input Fuse | | 9 Vin models: | 1'000 mA (slow blow) |
| | | 12 Vin models: | 500 mA (slow blow) |
| | | 24 Vin models: | 315 mA (slow blow) |
| | | 48 Vin models: | 160 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 | | | ±1% max. |
| Regulation | - Input Variation (Vmin - Vmax) | single output models: | 0.2% max. |
| | | dual output models: | 0.2% max. |
| | - Load Variation (10 - 90%) | single output models: | 0.5% max. |
| | | dual output models: | 0.8% max. (Output 1) |
| | | | 0.8% max. (Output 2) |
| | - Cross Regulation (25% / 100% asym. load) | dual output models: | 5% max. |
| Ripple and Noise | - 20 MHz Bandwidth | | 50 mVp-p typ. |
| Capacitive Load | - single output | 3.3 Vout models: | 1'000 µF max. |
| | | 5 Vout models: | 1'000 µF max. |
| | | 9 Vout models: | 430 µF max. |
| | | 12 Vout models: | 220 µF max. |
| | | 15 Vout models: | 170 µF max. |
| | | 24 Vout models: | 100 µF max. |
| | - dual output | 12 / -12 Vout models: | 170 / 170 µF max. |
| | | 15 / -15 Vout models: | 100 / 100 µF max. |
| Minimum Load | | | Not required |
| Temperature Coefficient | | | ±0.02 %/K max. |
| Start-up Time | | | 10 ms typ. / 20 ms max. |
| Short Circuit Protection | | | Continuous, Automatic recovery |
| Overload Protection | | | Foldback Mode |
| Overvoltage Protection | | | 104 - 197% of Vout nom. (depending on model) |
| | | | 4 - 6.5 VDC (3.3 Vout models) |
| | | | 6 - 8 VDC (5 Vout models) |
| | | | 10 - 14 VDC (9 Vout models) |
| | | | 13 - 19 VDC (12 Vout models) |
| | | | 16 - 22 VDC (15 Vout models) |
| | | | 25 - 35 VDC (24 Vout models) |
| Transient Response | - Response Time | | 500 µs typ. (25% Load Step) |

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

## Safety Specifications

| | | |
|---|---|---|
| Safety Standards | - IT / Multimedia Equipment | EN 62368-1<br>IEC 62368-1<br>UL 62368-1 |
| | - Medical Equipment | EN 60601-1<br>IEC 60601-1<br>ANSI/AAMI ES 60601-1<br>2 x MOPP (Means Of Patient Protection) |
| | - Certification Documents | www.tracopower.com/overview/tim2sm |
| Pollution Degree | | PD 2 |

## EMC Specifications

| | | | |
|---|---|---|---|
| EMI Emissions | | | EN 60601-1-2 edition 4 (Medical Devices) |
| | - Conducted Emissions | | EN 55011 class B (with external filter)<br>EN 55032 class B (with external filter)<br>FCC Part 18 class B (with external filter) |
| | - Radiated Emissions | | EN 55011 class B (with external filter)<br>EN 55032 class B (with external filter)<br>FCC Part 18 class B (with external filter) |
| | | External filter proposal: | www.tracopower.com/overview/tim2sm |
| EMS Immunity | | | 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, ±1 kV, perf. criteria A |
| | | Ext. input component: | 9 Vin models: KY 1000 µF \|\| TVS SMDJ18A<br>12 Vin models: KY 470 µF<br>24 Vin models: KY 470 µF<br>48 Vin models: KY 220 µF |
| | - 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 |
| | - Case Temperature | +105°C max. |
| | - Storage Temperature | –55°C to +125°C |
| Power Derating | - High Temperature | 6.67 %/K above 90°C |
| | See application note: | www.tracopower.com/overview/tim2sm |
| Cooling System | | Natural convection (20 LFM) |
| Remote Control | - Current Controlled Remote | On: open circuit<br>Off: 2 to 4 mA current (internal 1 kΩ resistor) |
| | External circuit proposal: | www.tracopower.com/info/current-remote.pdf |
| | - Off Idle Input Current | 2.5 mA typ. |
| Altitude During Operation | | 5'000 m max. |
| Switching Frequency | | 100 kHz min. (RCC) |
| 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 | 16 pF typ.<br>20 pF max. |

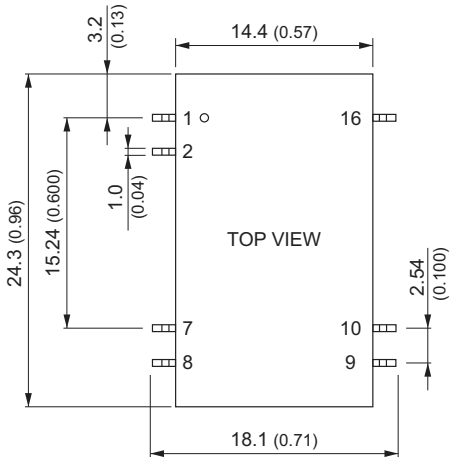
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

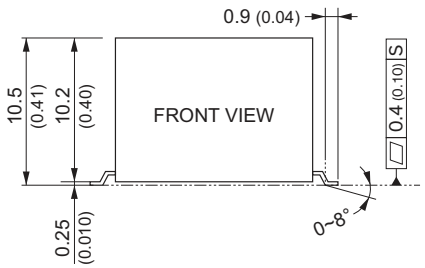
| | | |
|---|---|---|
| Leakage Current | - Touch Current | 2 µA max. (at 240 VAC / 60 Hz) |
| Reliability | - Calculated MTBF | 6'809'000 h (MIL-HDBK-217F, ground benign) |
| Moisture Sensitivity (MSL) | | Level 2 (J-STD-033C) |
| Washing Process | | According to Cleaning Guideline<br>www.tracopower.com/info/cleaning.pdf |
| 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) |
| Base Material | | Non-conductive Plastic (UL 94 V-0 rated) |
| Potting Material | | Silicone (UL 94 V-0 rated) |
| Pin Material | | Copper |
| Pin Foundation Plating | | Nickel (1 - 3 µm) |
| Pin Surface Plating | | Tin (7 - 12 µm), matte |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |
| Connection Type | | SMD (Surface-Mount Device) |
| Footprint Type | | SMD16 |
| Soldering Profile | | Reflow Soldering (J-STD-020E) |
| Weight | | 7 g |
| Environmental Compliance | - REACH Declaration | www.tracopower.com/info/reach-declaration.pdf<br>REACH SVHC list compliant<br>REACH Annex XVII compliant |
| | - RoHS Declaration | www.tracopower.com/info/rohs-declaration.pdf<br>Exemptions: 7a, 7c-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) |
| | - SCIP Reference Number | f17461b2-cd04-42f5-8ba9-89dfa697a6ff |

## Supporting Documents

| | |
|---|---|
| Overview Link (for additional Documents) | www.tracopower.com/overview/tim2sm |

## Outline Dimensions




Dimensions in mm (inch)
Tolerances ±0.5 (±0.02)
Pin Ø 0.5 ±0.1 (0.02 ±0.004)
Pin pitch tolerances ±0.25 (±0.01)

**Pinout**

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | –Vin (GND) | –Vin (GND) |
| 2 | Remote | Remote |
| 7 | NC | NC |
| 8 | NC | Common |
| 9 | +Vout | +Vout |
| 10 | –Vout | –Vout |
| 16 | +Vin (Vcc) | +Vin (Vcc) |

NC: Not connected

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

**Recommended Solder Pad Layout**