

- 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  $\mu$ A
- Extended operating temperature range -40°C to 95°C.
- 5-year product warranty



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  $\mu$ A 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 typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
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: <b>80 mA typ.</b> 12 Vin models: <b>40 mA typ.</b> 24 Vin models: <b>25 mA typ.</b> 48 Vin models: <b>12 mA typ.</b>
Surge Voltage		9 Vin models: <b>15 VDC max.</b> (1 s max.) 12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Under Voltage Lockout		9 Vin models: <b>2 VDC min. / 3 VDC typ. / 4 VDC max.</b> 12 Vin models: <b>6 VDC min. / 7 VDC typ. / 8 VDC max.</b> 24 Vin models: <b>13 VDC min. / 15 VDC typ. / 17 VDC max.</b> 48 Vin models: <b>29 VDC min. / 32 VDC typ. / 35 VDC max.</b>
Recommended Input Fuse		9 Vin models: <b>1'000 mA</b> (slow blow) 12 Vin models: <b>500 mA</b> (slow blow) 24 Vin models: <b>315 mA</b> (slow blow) 48 Vin models: <b>160 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Capacitor</b>

## Output Specifications

Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b>
	- Load Variation (10 - 90%)	single output models: <b>0.5% max.</b> dual output models: <b>0.8% max.</b> (Output 1) <b>0.8% max.</b> (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>50 mVp-p typ.</b>
Capacitive Load	- single output	3.3 Vout models: <b>1'000 µF max.</b> 5 Vout models: <b>1'000 µF max.</b> 9 Vout models: <b>430 µF max.</b> 12 Vout models: <b>220 µF max.</b> 15 Vout models: <b>170 µF max.</b> 24 Vout models: <b>100 µF max.</b>
	- dual output	12 / -12 Vout models: <b>170 / 170 µF max.</b> 15 / -15 Vout models: <b>100 / 100 µF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>10 ms typ. / 20 ms max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Overload Protection		<b>Foldback Mode</b>
Overvoltage Protection		<b>104 - 197% of Vout nom.</b> (depending on model) <b>4 - 6.5 VDC</b> (3.3 Vout models) <b>6 - 8 VDC</b> (5 Vout models) <b>10 - 14 VDC</b> (9 Vout models) <b>13 - 19 VDC</b> (12 Vout models) <b>16 - 22 VDC</b> (15 Vout models) <b>25 - 35 VDC</b> (24 Vout models)
Transient Response	- Response Time	<b>500 µs typ.</b> (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 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	<a href="http://www.tracopower.com/overview/tim2sm">www.tracopower.com/overview/tim2sm</a>
	Pollution Degree	PD 2

## EMC Specifications

EMI Emissions	- Conducted Emissions	EN 60601-1-2 edition 4 (Medical Devices) EN 55011 class B (with external filter) EN 55032 class B (with external filter) FCC Part 18 class B (with external filter)	
	- Radiated Emissions	EN 55011 class B (with external filter) EN 55032 class B (with external filter) FCC Part 18 class B (with external filter)	
External filter proposal:		<a href="http://www.tracopower.com/overview/tim2sm">www.tracopower.com/overview/tim2sm</a>	
EMS Immunity	- Electrostatic Discharge	EN 60601-1-2 edition 4 (Medical Devices) 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 12 Vin models: KY 470 µF 24 Vin models: KY 470 µF 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:		<a href="http://www.tracopower.com/overview/tim2sm">www.tracopower.com/overview/tim2sm</a>
Cooling System		Natural convection (20 LFM)
Remote Control	- Current Controlled Remote	On: open circuit Off: 2 to 4 mA current (internal 1 kΩ resistor)
	- Off Idle Input Current	External circuit proposal: <a href="http://www.tracopower.com/info/current-remote.pdf">www.tracopower.com/info/current-remote.pdf</a> 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. 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 $\mu$ A 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 <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration - Mechanical Shock - Thermal Shock	MIL-STD-810F MIL-STD-810F 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 $\mu$ m)
Pin Surface Plating		Tin (7 - 12 $\mu$ m), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		SMD (Surface-Mount Device)
Footprint Type		SMD16
Soldering Profile		Lead-Free Reflow Soldering (acc. J-STD-020E)
Weight		7 g
Environmental Compliance	- REACH Declaration  - RoHS Declaration  - SCIP Reference Number	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) f17461b2-cd04-42f5-8ba9-89dfa697a6ff

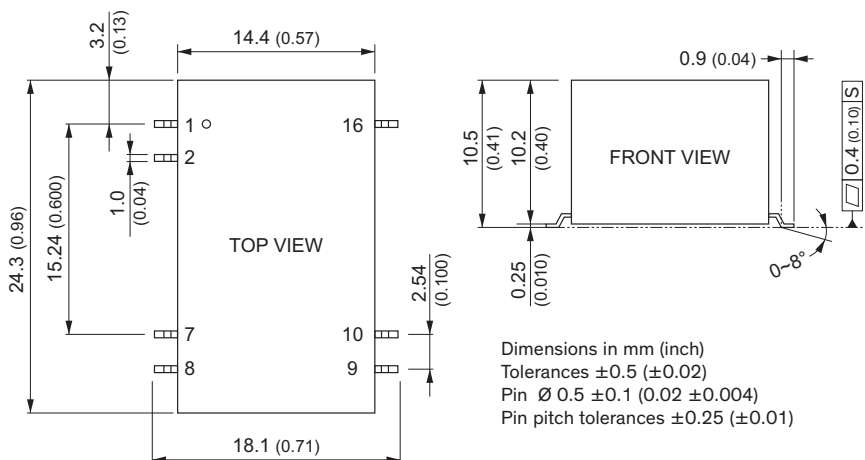
See application note: [www.tracopower.com/info/reflow-soldering.pdf](http://www.tracopower.com/info/reflow-soldering.pdf)

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tim2sm](http://www.tracopower.com/overview/tim2sm)

### Outline Dimensions



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

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**Recommended Solder Pad Layout**

