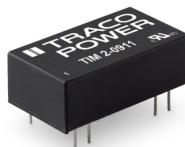


- Compact DIP-16-package
- I/O isolation 5000 VAC rated for 250 VAC working voltage
- Certification according to IEC/EN/ES 60601-1 3rd edition for 2xMOPP and operation to 5000 m altitude
- Low leakage current $< 2 \mu\text{A}$
- Extended operating temperature range -40°C to 95°C .
- 5-year product warranty



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

The TIM 2 series is a range of 2 Watt DC/DC converters in compact DIP-16 package with reinforced isolation of 5000 VAC for medical applications. With a low leakage current of less than $2 \mu\text{A}$ 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 ed. for 2xMOPP up to an altitude of 5000 m and come along with an ISO 14971 risk management file.

Models						
Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
TIM 2-0910	4.5 - 12 VDC (9 VDC nom.)	3.3 VDC	600 mA			75 %
TIM 2-0911		5 VDC	400 mA			78 %
TIM 2-0919		9 VDC	222 mA			78 %
TIM 2-0912		12 VDC	167 mA			82 %
TIM 2-0913		15 VDC	134 mA			82 %
TIM 2-0915		24 VDC	83 mA			82 %
TIM 2-0922		+12 VDC	83 mA	-12 VDC	83 mA	82 %
TIM 2-0923		+15 VDC	67 mA	-15 VDC	67 mA	80 %
TIM 2-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	600 mA			76 %
TIM 2-1211		5 VDC	400 mA			78 %
TIM 2-1219		9 VDC	222 mA			79 %
TIM 2-1212		12 VDC	167 mA			82 %
TIM 2-1213		15 VDC	134 mA			82 %
TIM 2-1215		24 VDC	83 mA			81 %
TIM 2-1222		+12 VDC	83 mA	-12 VDC	83 mA	81 %
TIM 2-1223		+15 VDC	67 mA	-15 VDC	67 mA	81 %
TIM 2-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	600 mA			76 %
TIM 2-2411		5 VDC	400 mA			79 %
TIM 2-2419		9 VDC	222 mA			80 %
TIM 2-2412		12 VDC	167 mA			81 %
TIM 2-2413		15 VDC	134 mA			81 %
TIM 2-2415		24 VDC	83 mA			81 %
TIM 2-2422		+12 VDC	83 mA	-12 VDC	83 mA	81 %
TIM 2-2423		+15 VDC	67 mA	-15 VDC	67 mA	81 %
TIM 2-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	600 mA			76 %
TIM 2-4811		5 VDC	400 mA			78 %
TIM 2-4819		9 VDC	222 mA			79 %
TIM 2-4812		12 VDC	167 mA			80 %
TIM 2-4813		15 VDC	134 mA			82 %
TIM 2-4815		24 VDC	83 mA			81 %
TIM 2-4822		+12 VDC	83 mA	-12 VDC	83 mA	81 %
TIM 2-4823		+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 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) www.tracopower.com/overview/tim2
	- Certification Documents	
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: www.tracopower.com/overview/tim2	
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 μ F // TVS SMDJ18A 12 Vin models: KY 470 μ F 24 Vin models: KY 470 μ F 48 Vin models: KY 220 μ F	
	- 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
Cooling System		Natural convection (20 LFM)
Remote Control	- Current Controlled Remote	On: open circuit Off: 2 to 4 mA current (internal 1 k Ω 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 M Ω min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	16 pF typ.
		20 pF max.
Leakage Current	- Touch Current	2 μ A max. (at 240 VAC / 60 Hz)

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

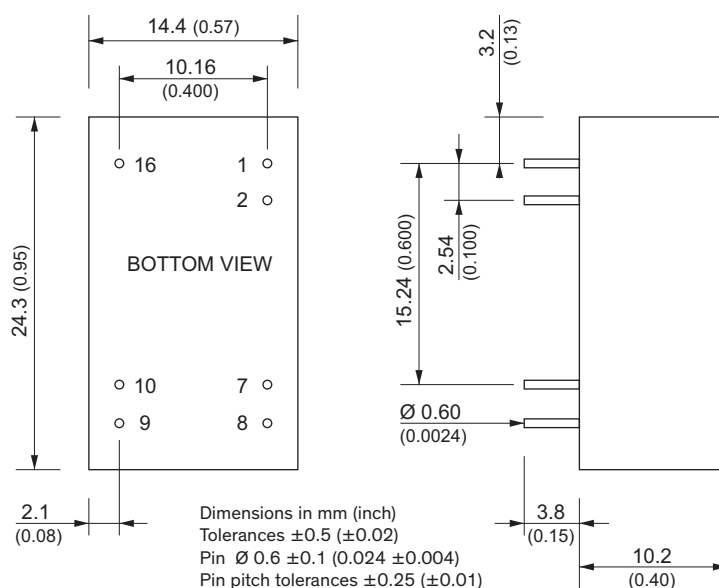
Reliability	- Calculated MTBF	6'809'000 h (MIL-HDBK-217F, ground benign)
Washing Process	See Cleaning Guideline:	Allowed (hermetical product) www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Mechanical Shock - Thermal Shock	MIL-STD-810F MIL-STD-810F MIL-STD-810F
Housing Material		Non-conductive 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 µm)
Pin Surface Plating		Tin (7 - 12 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP16
Soldering Profile		Wave Soldering 260°C / 10 s max.
Weight		7 g
Environmental Compliance	- REACH Declaration - RoHS Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant 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/tim2

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: No Connection