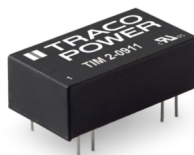


- Compact DIP-16-package
- I/O isolation 5000 VAC rated for 250 VAC working voltage
- Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2xMOPP and operation up to 5000 m altitude
- Low leakage current $< 2 \mu\text{A}$
- Extended operating temperature range -40°C to 95°C .
- 5-year product 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 edition 3.2 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

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
	- Certification Documents	2 x MOPP (Means Of Patient Protection) www.tracopower.com/overview/tim2
	Pollution Degree	PD 2
Over Voltage Category		OVC II (not mains connected)

EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 60601-1-2 edition 4 (Medical Devices) 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) FCC 47 Part 15 class A (with external filter) FCC 47 Part 18 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) FCC 47 Part 15 class A (with external filter) FCC 47 Part 18 class B (with external filter)
	External filter proposal: www.tracopower.com/overview/tim2	
	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 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
	- Approved Ambient Temp.	+85°C max. (for compliance to 60601-1)
	- 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/tim2	
Cooling System		Natural convection (20 LFM)
Remote Control	- Current Controlled Remote (passive = on)	On: open circuit Off: 2 to 4 mA current (internal 1 k Ω resistor) Refers to 'Remote' and '-Vin' Pin
		External circuit proposal: www.tracopower.com/info/current-remote.pdf
		2.5 mA typ.
	- Off Idle Input Current	
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter, RCC Converter

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

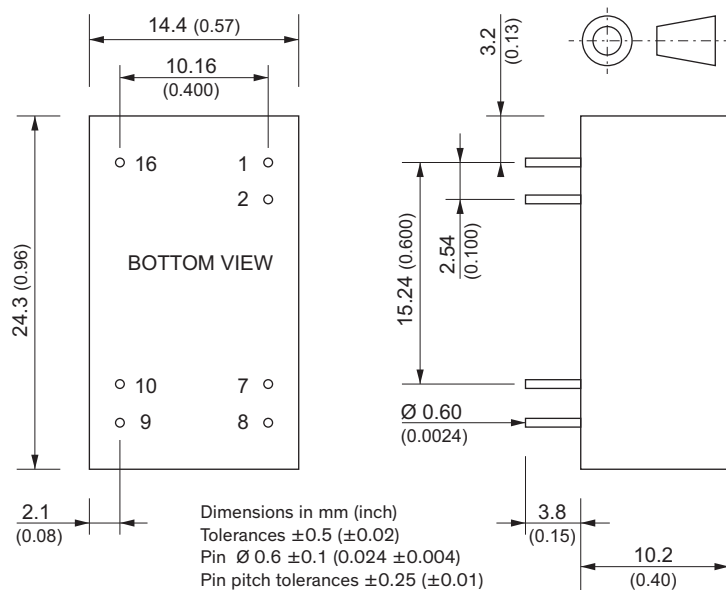
Switching Frequency	100 kHz min. (RCC)
Insulation System	Reinforced Insulation
Working Voltage (rated)	250 VAC
Isolation Test Voltage	- Input to Output, 60 s 5'000 VAC
Creepage	- Input to Output 8 mm min.
Clearance	- Input to Output 8 mm min.
Isolation Resistance	- Input to Output, 500 VDC 10'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V 16 pF typ. 20 pF max.
Leakage Current	- Touch Current 2 μA max. (at 240 VAC / 60 Hz)
Reliability	- Calculated MTBF 6'809'000 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)
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	Lead-Free Wave Soldering 260°C / 10 s max.
Weight	7 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: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) - SCIP Reference Number b0b10c00-0993-46b5-bf4c-c3885a5d658c

Additional Information

Supporting Documents	www.tracopower.com/overview/tim2
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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

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