

- Compact DIP-24 plastic case
- I/O isolation 5000 VAC rated for 250 VAC working voltage
- Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2 x MOPP
- Risk management process according to ISO 14971
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- Low leakage current $<2 \mu\text{A}$
- Operating temperature -40°C to 95°C
- EMC compliance to IEC 60601-1-2 4th edition and EN55032 class A
- Operating up to 5000m altitude
- 5-year product warranty



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

The TIM 6 series is a cost efficient range of medical 6 Watt DC/DC converters in DIP-24 plastic package with wide 2:1 input voltage range. They provide a reinforced isolation system for 5000 VAC and a very low leakage current of less than $2 \mu\text{A}$. The units are approved to IEC/EN/ES 60601-1 3rd ed. for 2 x MOPP and come along with an ISO 14971 risk management file. Design and production conform to the quality management system ISO 13485. With a high efficiency of up to 89% and highest grade components the converters can reliably operate in an ambient temperature range of -40°C up to $+95^\circ\text{C}$. They constitute a reliable solution not only for medical equipment but also for demanding ranges of application such as transportation, control & measurement or IG-BT drivers.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
TIM 6-1211	9 - 18 VDC (12 VDC nom.)	5 VDC	1'200 mA			84 %
TIM 6-1212		12 VDC	500 mA			87 %
TIM 6-1213		15 VDC	400 mA			86 %
TIM 6-1221		+5 VDC	600 mA	-5 VDC	600 mA	83 %
TIM 6-1222		+12 VDC	250 mA	-12 VDC	250 mA	87 %
TIM 6-1223		+15 VDC	200 mA	-15 VDC	200 mA	86 %
TIM 6-2411	18 - 36 VDC (24 VDC nom.)	5 VDC	1'200 mA			84 %
TIM 6-2412		12 VDC	500 mA			87 %
TIM 6-2413		15 VDC	400 mA			87 %
TIM 6-2421		+5 VDC	600 mA	-5 VDC	600 mA	84 %
TIM 6-2422		+12 VDC	250 mA	-12 VDC	250 mA	86 %
TIM 6-2423		+15 VDC	200 mA	-15 VDC	200 mA	86 %
TIM 6-4811	36 - 75 VDC (48 VDC nom.)	5 VDC	1'200 mA			84 %
TIM 6-4812		12 VDC	500 mA			87 %
TIM 6-4813		15 VDC	400 mA			86 %
TIM 6-4821		+5 VDC	600 mA	-5 VDC	600 mA	83 %
TIM 6-4822		+12 VDC	250 mA	-12 VDC	250 mA	87 %
TIM 6-4823		+15 VDC	200 mA	-15 VDC	200 mA	85 %

Options

on demand (backorder with MOQ non stocking item)	- Optional models with alternative pinning - Optional models with alternative pinning and adjustable output voltage
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Input Specifications

Input Current	- At no load	48 Vin models:	4 mA typ.
		12 Vin models:	10 mA typ. (5 Vout model)
			10 mA typ. (12 Vout model)
			10 mA typ. (15 Vout model)
			15 mA typ. (5 / -5 Vout model)
			10 mA typ. (12 / -12 Vout model)
			14 mA typ. (15 / -15 Vout model)
		24 Vin models:	6 mA typ. (5 Vout model)
			6 mA typ. (12 Vout model)
			6 mA typ. (15 Vout model)
Surge Voltage		8 mA typ. (5 / -5 Vout model)	
		6 mA typ. (12 / -12 Vout model)	
		8 mA typ. (15 / -15 Vout model)	
	12 Vin models:	25 VDC max. (3 s max.)	
	24 Vin models:	50 VDC max. (3 s max.)	
	48 Vin models:	100 VDC max. (3 s max.)	
Under Voltage Lockout	12 Vin models:	7 VDC min. / 8 VDC typ. / 8.8 VDC max.	
	24 Vin models:	15 VDC min. / 16 VDC typ. / 17.5 VDC max.	
	48 Vin models:	31.5 VDC min. / 33 VDC typ. / 34.5 VDC max.	
Recommended Input Fuse	12 Vin models:	1'250 mA (slow blow)	
	24 Vin models:	630 mA (slow blow)	
	48 Vin models:	315 mA (slow blow)	
		(The need of an external fuse has to be assessed in the final application.)	
Input Filter		Internal Pi-Type	

Output Specifications

Output Voltage Adjustment			-10% to +20% (15 Vout single models) ±10% (other single and dual output models) (Only for optional models with adjustable output) (By external trim resistor)
			See application note: www.tracopower.com/overview/tim6 Output power must not exceed rated power!
Voltage Set Accuracy			±1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models:	0.2% max.
	- Load Variation (0 - 100%)	dual output models:	0.5% max.
		single output models:	0.2% max.
		dual output models:	1% max. (Output 1) 1% max. (Output 2)
	- Voltage Balance (symmetrical load)	dual output models:	2% max.
	- Cross Regulation (25% / 100% asym. load)	dual output models:	5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output	5 Vout models:	50 mVp-p typ. (w/ 10 µF)
		12 Vout models:	75 mVp-p typ. (w/ 10 µF)
		15 Vout models:	75 mVp-p typ. (w/ 10 µF)
	- dual output	5 / -5 Vout models:	50 / 50 mVp-p typ. (w/ 10 µF)
		12 / -12 Vout models:	75 / 75 mVp-p typ. (w/ 10 µF)
		15 / -15 Vout models:	75 / 75 mVp-p typ. (w/ 10 µF)
Capacitive Load	- single output	5 Vout models:	1'500 µF max.
		12 Vout models:	260 µF max.
		15 Vout models:	210 µF max.
	- dual output	5 / -5 Vout models:	860 / 860 µF max.
		12 / -12 Vout models:	150 / 150 µF max.
		15 / -15 Vout models:	110 / 110 µF max.
Minimum Load			Not required

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

Temperature Coefficient	±0.02 %/K max.
Start-up Time	35 ms typ. / 50 ms max.
Short Circuit Protection	Continuous, Automatic recovery
Output Current Limitation	150% typ. of I _{out} max.
Overvoltage Protection	112 - 147% of V _{out} nom. (depending on model) 5.6 VDC - 7 VDC (5 V _{out} single model) 13.5 VDC - 16 VDC (12 V _{out} single model) 18.3 VDC - 22 VDC (15 V _{out} single model) 5.6 VDC - 7 VDC (5 V _{out} dual model) 13.5 VDC - 18.2 VDC (12 V _{out} dual model) 17 VDC - 22 VDC (15 V _{out} dual model)
Transient Response	- Peak Variation 150 mV typ. / 300 mV max. (25% Load Step) (5.0 V _{out} models) 250 mV typ. / 350 mV max. (25% Load Step) (other models)
	- Response Time 250 µs typ. / 350 µs max. (25% Load Step)

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 2 x MOPP (Means Of Patient Protection)
	- Certification Documents	www.tracopower.com/overview/tim6
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 (internal filter) EN 55011 class B (with external filter) EN 55032 class A (internal filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55011 class A (internal filter) EN 55011 class B (with external filter) EN 55032 class A (internal filter) EN 55032 class B (with external filter)
	External filter proposal: www.tracopower.com/overview/tim6	
EMS (Immunity)	- Electrostatic Discharge	EN 60601-1-2 edition 4 (Medical Devices) EN 55035 (Multimedia) 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
	Ext. input component: 3300µF, 25V, KZN TVS 28V, 600W (12 Vin) 1200µF, 50V, KZN TVS 58V, 600W (24 Vin) 390µF, 100V, KZN TVS 120V, 600W (48 Vin)	
	- 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/tim6

General Specifications

Relative Humidity	95% max. (non condensing)
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All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Temperature Ranges	- Operating Temperature	-40°C to +95°C
	- Approved Ambient Temp.	+85°C max. (at nominal Vin)
		+80°C max. (at min. Vin or max. Vin)
		(for compliance to 62368-1 and 60601-1)
	- Case Temperature	+105°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	Depending on model
See application note: www.tracopower.com/overview/tim6		
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter
Switching Frequency		225 - 275 kHz (PWM)
		250 kHz typ. (PWM)
Insulation System		Reinforced Insulation
Working Voltage (rated)		250 VAC
Isolation Test Voltage	- Input to Output, 60 s	5'000 VAC
	- Input to Output, 1 s	7'000 VDC
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	15 pF typ.
		17 pF max.
Leakage Current	- Touch Current	2 µA max. (240 VAC / 60 Hz)
Distance Through Isolation		0.4 mm
Reliability	- Calculated MTBF	3'942'000 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		Tinned Copper
Pin Foundation Plating		Nickel (2 - 3 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP24
Soldering Profile		Lead-Free Wave Soldering
		260°C / 6 s max.
Weight		13.5 g
Thermal Impedance	- Case to Ambient	18 K/W typ.
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: 7a, 7c-I
		(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	0df049e7-17e8-4c52-9786-9f341de06a8e

Supporting Documents

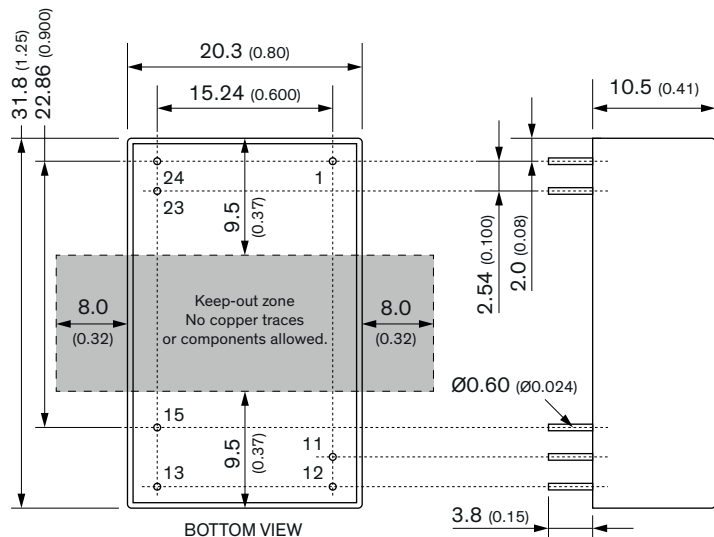
Overview Link (for additional Documents)

www.tracopower.com/overview/tim6

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

Outline Dimensions

Standard model

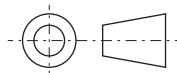


Dimensions in mm (inch)

Tolerances: x.x ± 0.5 (x.xx ± 0.02)

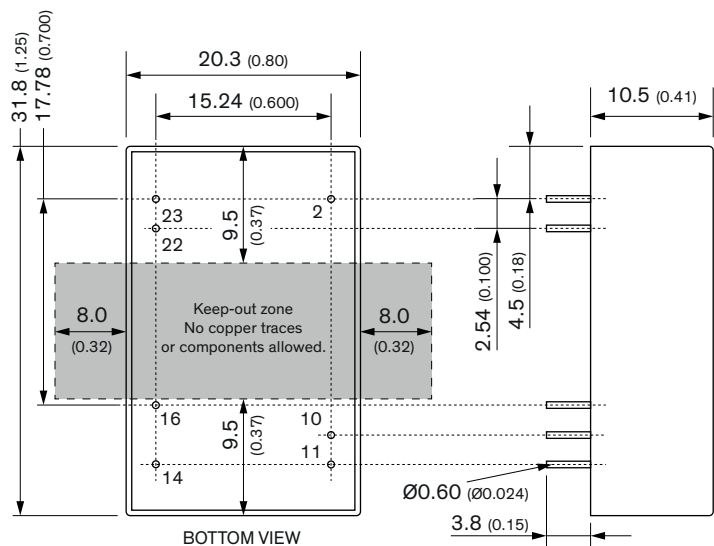
x.xx ± 0.25 (x.xxx ± 0.010)

Pin diameter tolerance: ± 0.10 (± 0.004)



Pinout		
Pin	Single	Dual
1	+Vin	
11	No pin	Common
12	-Vout	No pin
13	+Vout	-Vout
15	No pin	+Vout
23	-Vin	
24	-Vin	

Alternative pinning

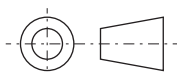


Dimensions in mm (inch)

Tolerances: x.x ± 0.5 (x.xx ± 0.02)

x.xx ± 0.25 (x.xxx ± 0.010)

Pin diameter tolerance: ± 0.10 (± 0.004)



Pinout		
(without Trim option)		
Pin	Single	Dual
2	-Vin	
10	No pin	
11	NC	-Vout
14	+Vout	
16	-Vout	Common
22	+Vin	
23	+Vin	

NC: Not connected

Pinout		
(with Trim option)		
Pin	Single	Dual
2	-Vin	
10	Trim	
11	No pin	-Vout
14	+Vout	
16	-Vout	Common
22	+Vin	
23	+Vin	

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