

- 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  $\mu$ A
- Operating temperature  $-40^{\circ}\text{C}$  to  $95^{\circ}\text{C}$
- 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  $\mu$ 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  $-40^{\circ}\text{C}$  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 IGBT drivers.

### Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
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

<b>on demand</b> (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: <b>4 mA typ.</b> 12 Vin models: <b>10 mA typ.</b> (5 Vout model) <b>10 mA typ.</b> (12 Vout model) <b>10 mA typ.</b> (15 Vout model) <b>15 mA typ.</b> (5 / -5 Vout model) <b>10 mA typ.</b> (12 / -12 Vout model) <b>14 mA typ.</b> (15 / -15 Vout model)
		24 Vin models: <b>6 mA typ.</b> (5 Vout model) <b>6 mA typ.</b> (12 Vout model) <b>6 mA typ.</b> (15 Vout model) <b>8 mA typ.</b> (5 / -5 Vout model) <b>6 mA typ.</b> (12 / -12 Vout model) <b>8 mA typ.</b> (15 / -15 Vout model)
Surge Voltage		12 Vin models: <b>25 VDC max.</b> (3 s max.) 24 Vin models: <b>50 VDC max.</b> (3 s max.) 48 Vin models: <b>100 VDC max.</b> (3 s max.)
Under Voltage Lockout		12 Vin models: <b>7 VDC min. / 8 VDC typ. / 8.8 VDC max.</b> 24 Vin models: <b>15 VDC min. / 16 VDC typ. / 17.5 VDC max.</b> 48 Vin models: <b>31.5 VDC min. / 33 VDC typ. / 34.5 VDC max.</b>
Recommended Input Fuse		12 Vin models: <b>1'250 mA</b> (slow blow) 24 Vin models: <b>630 mA</b> (slow blow) 48 Vin models: <b>315 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Pi-Type</b>

## Output Specifications

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

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 <sub>out</sub> max.
Overvoltage Protection		112 - 147% of V <sub>out</sub> nom. (depending on model) 5.6 VDC - 7 VDC (5 V <sub>out</sub> single model) 13.5 VDC - 16 VDC (12 V <sub>out</sub> single model) 18.3 VDC - 22 VDC (15 V <sub>out</sub> single model) 5.6 VDC - 7 VDC (5 V <sub>out</sub> dual model) 13.5 VDC - 18.2 VDC (12 V <sub>out</sub> dual model) 17 VDC - 22 VDC (15 V <sub>out</sub> dual model)
Transient Response	- Peak Variation	150 mV typ. / 300 mV max. (25% Load Step) (5.0 V <sub>out</sub> 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	<a href="http://www.tracopower.com/overview/tim6">www.tracopower.com/overview/tim6</a>
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: <a href="http://www.tracopower.com/overview/tim6">www.tracopower.com/overview/tim6</a>
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
	- Conducted RF Disturbances	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) EN 61000-4-6, 10 V <sub>rms</sub> , 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	<a href="http://www.tracopower.com/overview/tim6">www.tracopower.com/overview/tim6</a>

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

## General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Approved Ambient Temp.	-40°C to +95°C +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 - Storage Temperature	+105°C max. -55°C to +125°C
Power Derating	- High Temperature	Depending on model See application note: <a href="http://www.tracopower.com/overview/tim6">www.tracopower.com/overview/tim6</a>
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 - Input to Output, 1 s	5'000 VAC 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 <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		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  - 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).) Odf049e7-17e8-4c52-9786-9f341de06a8e

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

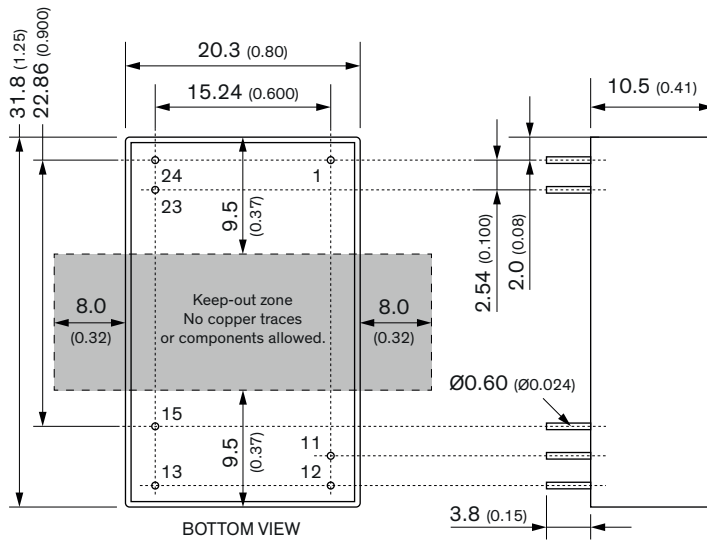
### Supporting Documents

[Overview Link](#) (for additional Documents)

[www.tracopower.com/overview/tim6](http://www.tracopower.com/overview/tim6)

### Outline Dimensions

#### Standard model



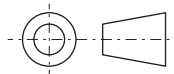
Pinout		
Pin	Single	Dual
1	+Vin	
11	No pin	Common
12	-Vout	No pin
13	+Vout	-Vout
15	No pin	+Vout
23	-Vin	
24	-Vin	

Dimensions in mm (inch)

Tolerances: x.x  $\pm 0.5$  (x.xx  $\pm 0.02$ )

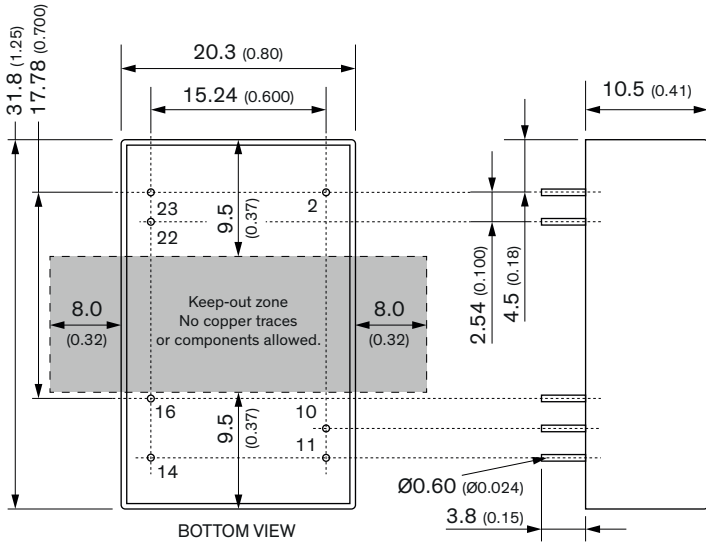
x.xx  $\pm 0.25$  (x.xxx  $\pm 0.010$ )

Pin diameter tolerance:  $\pm 0.10$  ( $\pm 0.004$ )



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

### Alternative pinning

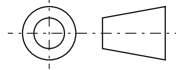


Dimensions in mm (inch)

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

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