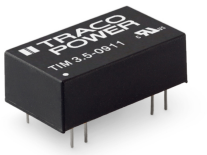
TRACO POWER

DC/DC Medical Converter

TIM 3.5 Series, 3.5 Watt

- **Compact DIP-16-package**
- **I/O isolation 5000 VACrms rated for 250 VACrms working voltage**
- **Certification according to IEC/EN/ES 60601-1 3rd edition for 2xMOPP and operation to 5000 m altitude**
- **Low leakage current < 2 µA for BF-applications**
- **Extended operating temperature range −40°C to 90°C**
- **5-year product warranty**



2MOPP cULus CB Scheme

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

The TIM 3.5 series is a range of high performance, regulated 3.5 Watt DC/DC converters in a DIP-16 plastic package. The reinforced I/O-isolation system complies with the medical safety requirements for 2 × MOPP (Means Of Patient Protection). The converters constitute also a reliable solution for many demanding applications such as transportation systems, industrial control equipment, measurement equipment, and some IGBT driver applications.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TIM 3.5-0911	4.5 - 12 VDC (9 VDC nom.)	5 VDC	700 mA			77 %
TIM 3.5-0919		9 VDC	389 mA			78 %
TIM 3.5-0912		12 VDC	292 mA			82 %
TIM 3.5-0913		15 VDC	234 mA			82 %
TIM 3.5-0915		24 VDC	146 mA			82 %
TIM 3.5-0922		+12 VDC	146 mA	−12 VDC	146 mA	82 %
TIM 3.5-0923		+15 VDC	117 mA	−15 VDC	117 mA	81 %
TIM 3.5-1211	9 - 18 VDC (12 VDC nom.)	5 VDC	700 mA			79 %
TIM 3.5-1219		9 VDC	389 mA			79 %
TIM 3.5-1212		12 VDC	292 mA			82 %
TIM 3.5-1213		15 VDC	234 mA			82 %
TIM 3.5-1215		24 VDC	146 mA			82 %
TIM 3.5-1222		+12 VDC	146 mA	−12 VDC	146 mA	82 %
TIM 3.5-1223		+15 VDC	117 mA	−15 VDC	117 mA	82 %
TIM 3.5-2411	18 - 36 VDC (24 VDC nom.)	5 VDC	700 mA			79 %
TIM 3.5-2419		9 VDC	389 mA			80 %
TIM 3.5-2412		12 VDC	292 mA			83 %
TIM 3.5-2413		15 VDC	234 mA			83 %
TIM 3.5-2415		24 VDC	146 mA			82 %
TIM 3.5-2422		+12 VDC	146 mA	−12 VDC	146 mA	82 %
TIM 3.5-2423		+15 VDC	117 mA	−15 VDC	117 mA	82 %
TIM 3.5-4811	36 - 75 VDC (48 VDC nom.)	5 VDC	700 mA			79 %
TIM 3.5-4819		9 VDC	389 mA			80 %
TIM 3.5-4812		12 VDC	292 mA			82 %
TIM 3.5-4813		15 VDC	234 mA			82 %
TIM 3.5-4815		24 VDC	146 mA			82 %
TIM 3.5-4822		+12 VDC	146 mA	−12 VDC	146 mA	82 %
TIM 3.5-4823		+15 VDC	117 mA	−15 VDC	117 mA	82 %

Input Specifications

Input Current	- At no load	9 Vin models:	**80 mA typ.**
		12 Vin models:	**45 mA typ.**
		24 Vin models:	**27 mA typ.**
		48 Vin models:	**13 mA typ.**
	- At full load	9 Vin models:	**927 mA max.** (5 Vout model)
			917 mA max. (9 Vout model)
			872 mA max. (12 Vout model)
			872 mA max. (15 Vout model)
			872 mA max. (24 Vout model)
			872 mA max. (12 / -12 Vout model)
			883 mA max. (15 / -15 Vout model)
		12 Vin models:	**376 mA max.** (5 Vout model)
			377 mA max. (9 Vout model)
			360 mA max. (12 Vout model)
			361 mA max. (15 Vout model)
			364 mA max. (24 Vout model)
			364 mA max. (12 / -12 Vout model)
			362 mA max. (15 / -15 Vout model)
		24 Vin models:	**186 mA max.** (5 Vout model)
			186 mA max. (9 Vout model)
			179 mA max. (12 Vout model)
			179 mA max. (15 Vout model)
			182 mA max. (24 Vout model)
			182 mA max. (12 / -12 Vout model)
			182 mA max. (15 / -15 Vout model)
		48 Vin models:	**93 mA max.** (5 Vout model)
			93 mA max. (9 Vout model)
			90 mA max. (12 Vout model)
			90 mA max. (15 Vout model)
			91 mA max. (24 Vout model)
			91 mA max. (12 / -12 Vout model)
			90 mA max. (15 / -15 Vout model)
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:	**1'600 mA** (slow blow)
		12 Vin models:	**800 mA** (slow blow)
		24 Vin models:	**500 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 Capacitor

Output Specifications

Voltage Set Accuracy	±1% max.

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

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)	- single output	5 Vout models:	50 mVp-p typ.
		9 Vout models:	50 mVp-p typ.
		12 Vout models:	50 mVp-p typ.
		15 Vout models:	50 mVp-p typ.
		24 Vout models:	75 mVp-p typ.
	- dual output	12 / -12 Vout models:	75 / 75 mVp-p typ.
		15 / -15 Vout models:	75 / 75 mVp-p typ.
Capacitive Load	- single output	5 Vout models:	1'470 µF max.
		9 Vout models:	680 µF max.
		12 Vout models:	470 µF max.
		15 Vout models:	330 µF max.
		24 Vout models:	170 µF max.
	- dual output	12 / -12 Vout models:	220 / 220 µF max.
		15 / -15 Vout models:	160 / 160 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
Overvoltage Protection			104 - 160% of Vout nom. (depending on model) 6 - 8 VDC (5 VDC model) 10 - 14 VDC (9 VDC model) 13 - 19 VDC (12 VDC model) 16 - 22 VDC (15 VDC model) 25 - 35 VDC (24 VDC model)
Transient Response	- Response Time		500 µs typ. (25% Load Step)

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	www.tracopower.com/overview/tim3-5
Pollution Degree		PD 2

EMC Specifications

EMI Emissions		EN 60601-1-2 edition 4 (Medical Devices)
	- Conducted Emissions	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/tim3-5

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

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 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 +90°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		3.3 %/K above 75°C
		See application note:	www.tracopower.com/overview/tim3-5
Cooling System			Natural convection (20 LFM)
Remote Control	- Current Controlled Remote		On: open circuit Off: 2 to 4 mA current (internal 1 kΩ 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 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		5'041'000 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			Wave Soldering 260°C / 10 s max.
Weight			7 g

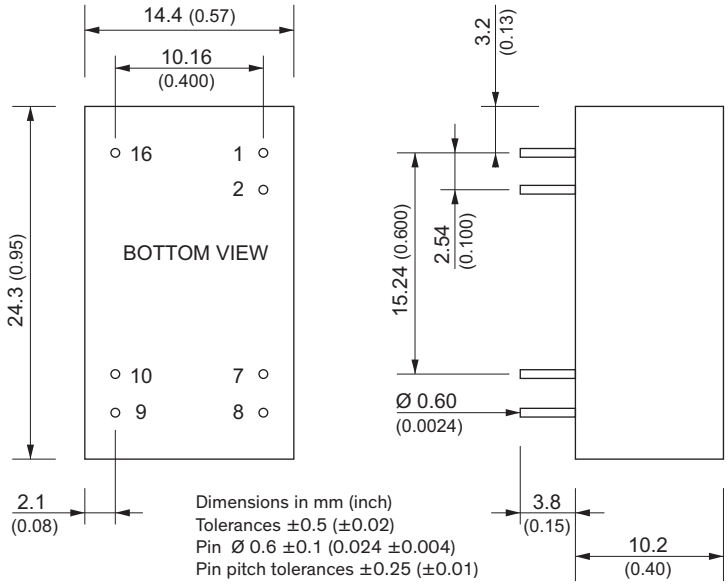
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

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	0d290e44-e78c-4de4-aff6-70ee45b90620

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tim3-5

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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