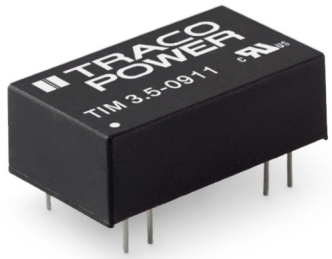
DC/DC Converter

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 2×MOPP and opperation to 5000 m altitude**
- **Low leakage current < 2 µA for BF-applications**
- **Extended operating temperature range −40°C to 90°C.**
- **EMC compliance to IEC 60601-1-2 4th edition and EN55032 class A**
- **5-year product warranty**



The TIM 3.5 series is a range of 3.5 Watt DC/DC converters in compact DIP-16 package and with reinforced isolation of 5000 VACrms for medical applications. With a low leakage current of less than 2 µA 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 edition for 2×MOPP up to an altitude of 5000m and come along with an ISO 14971 risk management file.

Models

Order code	Input voltage range	Output voltage	Output current max.	Efficiency typ.
TIM 3.5-0911	4.5 – 12 VDC (9 VDC nominal)	5.0 VDC	700 mA	77 %
TIM 3.5-0919		9.0 VDC	389 mA	78 %
TIM 3.5-0912		12 VDC	292 mA	81 %
TIM 3.5-0913		15 VDC	234 mA	81 %
TIM 3.5-0915		24 VDC	146 mA	81 %
TIM 3.5-0922		±12 VDC	±146 mA	81 %
TIM 3.5-0923		±15 VDC	±117 mA	81 %
TIM 3.5-1211	9.0 – 18 VDC (12 VDC nominal)	5.0 VDC	700 mA	79 %
TIM 3.5-1219		9.0 VDC	389 mA	80 %
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	82 %
TIM 3.5-1223		±15 VDC	±117 mA	82 %
TIM 3.5-2411	18 – 36 VDC (24 VDC nominal)	5.0 VDC	700 mA	79 %
TIM 3.5-2419		9.0 VDC	389 mA	80 %
TIM 3.5-2412		12 VDC	292 mA	82 %
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	82 %
TIM 3.5-2423		±15 VDC	±117 mA	83 %
TIM 3.5-4811	36 – 75 VDC (48 VDC nominal)	5.0 VDC	700 mA	79 %
TIM 3.5-4819		9.0 VDC	389 mA	80 %
TIM 3.5-4812		12 VDC	292 mA	81 %
TIM 3.5-4813		15 VDC	234 mA	82 %
TIM 3.5-4815		24 VDC	146 mA	81 %
TIM 3.5-4822		±12 VDC	±146 mA	81 %
TIM 3.5-4823		±15 VDC	±117 mA	82 %

Input Specifications

Input current no load		9 Vin models:	90 mA typ.
		12 Vin models:	50 mA typ.
		24 Vin models:	30 mA typ.
		48 Vin models:	13 mA typ.
Surge voltage (1 s max.)		9 Vin models:	15 V max.
		12 Vin models:	25 V max.
		24 Vin models:	50 V max.
		48 Vin models:	100 V max.
Start-up voltage		9 Vin models:	4.5 VDC (or lower)
		12 Vin models:	9.0 VDC (or lower)
		24 Vin models:	18 VDC (or lower)
		48 Vin models:	36 VDC (or lower)
Startup time			10 ms typ. / 20 ms max.
Under voltage shut down		9 Vin models:	2 - 4 VDC
		12 Vin models:	6 - 8 VDC
		24 Vin models:	13 - 17 VDC
		48 Vin models:	29 - 35 VDC
Input filter			capacitor type
Conducted noise	– Conducted & Radiated input suppression		EN 55011 limits to IEC/EN 60601-1-2 4th edit. EN 55032 class A or B with external components
EMC immunity	– Generic for Medical equipment		IEC/EN 60601-1-2 4th edition
	– ESD (electrostatic discharge)		EN 61000-4-2, air ±15 kV, contact ±8 kV, perf. criteria A
	– Radiated immunity		EN 61000-4-3, 10 V/m, perf. criteria A
	– Fast transient / surge		EN 61000-4-4, ±2 kV, perf. criteria A
	(with external input capacitor / diode)		EN 61000-4-5, ±1 kV perf. criteria A
		9 Vin models:	Nippon chemi-con KY 1000 µF / 25 V TVS - SMAJ18A, 18 V, 400 W
		12 & 24 Vin models:	Nippon chemi-con KY 470 µF / 50 V
		48 Vin models:	Nippon chemi-con KY 220 µF / 100 V
	– Conducted immunity		EN 61000-4-6, 10 Vrms, perf. criteria A
	– Magnetic field immunity		EN 61000-4-8 100 A/m, continuous, perf. criteria A 1000 A/m, 1 sec., perf. criteria A
External input fuse required		9 Vin models:	1.6 A (slow blow)
		12 Vin models:	0.8 A (slow blow)
		24 Vin models:	0.5 A (slow blow)
		48 Vin models:	0.315 A (slow blow)

Output Specifications

Voltage set accuracy			±1 % max.
Regulation	– Input variation (Vin min. to Vin max.)		0.2 % max.
	– Load variation (0 – 100 %)		1 % max.
	– Load variation (10 – 90 %)	single output:	0.5 % max.
		dual output:	0.8 % max.
	– Cross regulation	dual output:	5.0 % max. (asymmetrical load 25 / 100 %)
Minimum load			not required
Ripple and noise (20 MHz Bandwidth)		5 - 15 Vout models:	50 mVp-p typ.
		24, ±12 & ±15 Vout models:	75 mVp-p typ.
Transient response (25% load step change)			
	– Recovery time		500 µs typ.
Short circuit protection			Continuous, automatic recovery

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

General Specifications

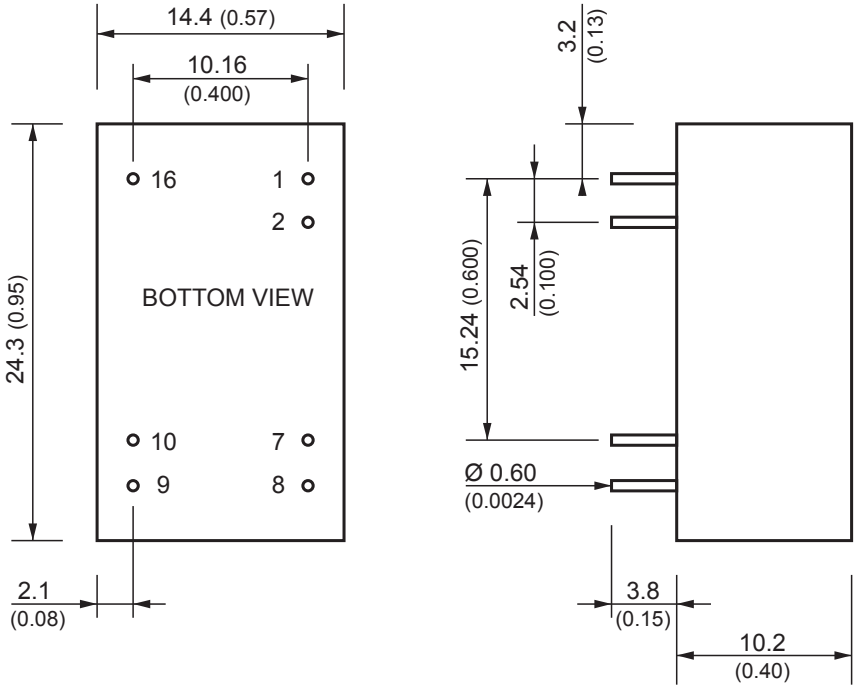
Overvoltage protection		5.0 VDC models:	6 - 8 VDC
		9.0 VDC models:	10 - 14 VDC
		12 VDC models:	13 - 19 VDC
		15 VDC models:	16 - 22 VDC
		24 VDC models:	25 - 35 VDC
Capacitive load	– Single output	5.0 VDC models:	1‘470 µF max.
		9.0 VDC models:	680 µF max.
		12 VDC models:	470 µF max.
		15 VDC models:	330 µF max.
		24 VDC models:	170 µF max.
	– Dual output	±12 VDC models:	220 µF max. (each output)
		±15 VDC models:	160 µF max. (each output)
Temperature ranges	– Operating (natural convection: 20 LFM, 0.1 m/s)		–40°C to +90°C
	– Case temperature		+105°C max.
	– Storage temperature		–55°C to +125°C
Derating			3.3 %/K above 75°C
Humidity (non condensing)			5 % to 95 % rel H max.
Isolation voltage (50 Hz, 60 s)			5000 VAC (reinforced insulation)
Working voltage			250 VAC, 2 × MOPP
Isolation capacitance			20 pF max.
Clearance/creepage			8 mm min.
Leakage current (at 240 VAC, 60 Hz)			2 µA max.
Altitude during operation			5000 m max.
Temperature coefficient			±0.02 %/K max.
Reliability, calculated MTBF (MIL-HDBK-217F at +25°C, ground benign)			5‘041‘000 h
Switching frequency			100 kHz min. (frequency modulated)
Shock, vibration and thermal shock resistance			according to MIL-STD-810F
Remote On/Off	– On:		open circuit or high impedance
	– Off:		2 – 4 mA current applied via 1kOhm resistor
	– Off idle current:		2.5 mA typ.
Safety standards/approvals	– Medical equipment		ANSI/AAMI ES60601-1:2005/(R)2012, IEC/EN60601-1 3rd edition
Environmental compliance	– Reach		RoHS directive 2011/65/EU
	– RoHS		

Physical Specifications

Casing material	non-conductive black plastic
Base material	non-conductive black plastic
Potting material	silicone (UL94 V-0)
Package weight	7.0 g (0.24 oz)
Soldering temperature	260°C / 10 s max.

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

Outline Dimensions



Standard Pinout		
Pin	**Single**	**Dual**
1	–Vin (GND)	–Vin (GND)
2	On/Off	On/Off
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	–Vout	–Vout
16	+Vin (Vcc)	+Vin (Vcc)

Dimensions in mm (inch)
Tolerances ±0.5 (±0.02)
Pin ø 0.6 ±0.1 (0.024 ±0.004)
Pin pitch tolerances ±0.25 (±0.01)