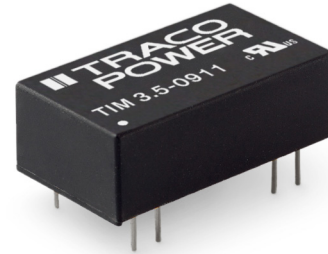


## DC/DC Converter

## 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 2XMOPP and operation to 5000 m altitude
- Low leakage current < 2  $\mu$ A 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  $\mu$ 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 3rd edition for 2XMOPP 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		$\pm$ 12 VDC	$\pm$ 146 mA	81 %
TIM 3.5-0923		$\pm$ 15 VDC	$\pm$ 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		$\pm$ 12 VDC	$\pm$ 146 mA	82 %
TIM 3.5-1223		$\pm$ 15 VDC	$\pm$ 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		$\pm$ 12 VDC	$\pm$ 146 mA	82 %
TIM 3.5-2423		$\pm$ 15 VDC	$\pm$ 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		$\pm$ 12 VDC	$\pm$ 146 mA	81 %
TIM 3.5-4823		$\pm$ 15 VDC	$\pm$ 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 – ESD (electrostatic discharge)  – Radiated immunity – Fast transient / surge (with external input capacitor / diode)  – Conducted immunity – Magnetic field immunity  IEC/EN 60601-1-2 4th edition EN 61000-4-2, air $\pm 15$ kV, contact $\pm 8$ kV, perf. criteria A EN 61000-4-3, 10 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 1$ kV perf. criteria A 9 Vin models: Nippon chemi-con KY 1000 $\mu$ F / 25 V TVS - SMAJ18A, 18 V, 400 W 12 & 24 Vin models: Nippon chemi-con KY 470 $\mu$ F / 50 V 48 Vin models: Nippon chemi-con KY 220 $\mu$ F / 100 V EN 61000-4-6, 10 Vrms, perf. criteria A 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	$\pm 1$ % 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, $\pm 12$ & $\pm 15$ Vout models: 75 mVp-p typ.
Transient response (25% load step change)	– Recovery time 500 $\mu$ s 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

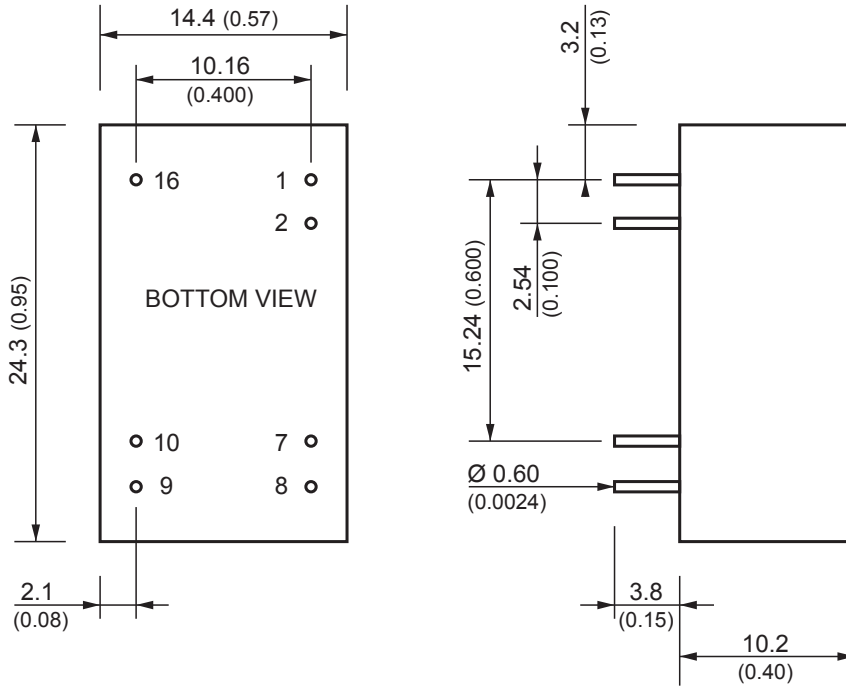
Overvoltage protection		5.0 VDC models: 6 - 8 VDC 9.0 VDC models: 10 - 14 VDC 12 VDC models: 13 - 19 VDC 15 VDC models: 16 - 22 VDC 24 VDC models: 25 - 35 VDC
Capacitive load	– Single output	5.0 VDC models: 1'470 µF max. 9.0 VDC models: 680 µF max. 12 VDC models: 470 µF max. 15 VDC models: 330 µF max. 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) – Case temperature – Storage temperature	–40°C to +90°C +105°C max. –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: – Off: – Off idle current:	open circuit or high impedance 2 – 4 mA current applied via 1kOhm resistor 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	RoHS directive 2011/65/EU

## 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  $\pm 0.5$  ( $\pm 0.02$ )  
 Pin  $\varnothing 0.6 \pm 0.1$  ( $0.024 \pm 0.004$ )  
 Pin pitch tolerances  $\pm 0.25$  ( $\pm 0.01$ )