

- Compact SMD-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
- 5-year product warranty



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

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

### Models

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

## Input Specifications

Input Current	- At no load	9 Vin models: <b>90 mA typ.</b> 12 Vin models: <b>50 mA typ.</b> 24 Vin models: <b>50 mA typ.</b> 48 Vin models: <b>13 mA typ.</b>
Surge Voltage		9 Vin models: <b>15 VDC max.</b> (1 s max.) 12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Under Voltage Lockout		9 Vin models: <b>2 VDC min. / 3 VDC typ. / 4 VDC max.</b> 12 Vin models: <b>6 VDC min. / 7 VDC typ. / 8 VDC max.</b> 24 Vin models: <b>13 VDC min. / 15 VDC typ. / 17 VDC max.</b> 48 Vin models: <b>29 VDC min. / 32 VDC typ. / 35 VDC max.</b>
Recommended Input Fuse		9 Vin models: <b>1'600 mA</b> (slow blow) 12 Vin models: <b>800 mA</b> (slow blow) 24 Vin models: <b>500 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 Capacitor</b>

## Output Specifications

Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b>
	- Load Variation (10 - 90%)	single output models: <b>0.5% max.</b> dual output models: <b>0.8% max.</b> (Output 1) <b>0.8% max.</b> (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>
Ripple and Noise (20 MHz Bandwidth)	- single output	5 Vout models: <b>50 mVp-p typ.</b> 9 Vout models: <b>50 mVp-p typ.</b> 12 Vout models: <b>50 mVp-p typ.</b> 15 Vout models: <b>50 mVp-p typ.</b> 24 Vout models: <b>75 mVp-p typ.</b>
	- dual output	12 / -12 Vout models: <b>75 / 75 mVp-p typ.</b> 15 / -15 Vout models: <b>75 / 75 mVp-p typ.</b>
Capacitive Load	- single output	5 Vout models: <b>1'470 µF max.</b> 9 Vout models: <b>680 µF max.</b> 12 Vout models: <b>470 µF max.</b> 15 Vout models: <b>330 µF max.</b> 24 Vout models: <b>170 µF max.</b>
	- dual output	12 / -12 Vout models: <b>220 / 220 µF max.</b> 15 / -15 Vout models: <b>160 / 160 µF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>10 ms typ. / 20 ms max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Overvoltage Protection		<b>104 - 160% of Vout nom.</b> (depending on model) <b>6 - 8 VDC</b> (5 VDC model) <b>10 - 14 VDC</b> (9 VDC model) <b>13 - 19 VDC</b> (12 VDC model) <b>16 - 22 VDC</b> (15 VDC model) <b>25 - 35 VDC</b> (24 VDC model)
Transient Response	- Response Time	<b>500 µs typ.</b> (25% Load Step)

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

## 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	<a href="http://www.tracopower.com/overview/tim3-5sm">www.tracopower.com/overview/tim3-5sm</a>
Pollution Degree		PD 2

## EMC Specifications

EMI Emissions	- Conducted Emissions	EN 60601-1-2 edition 4 (Medical Devices) 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: <a href="http://www.tracopower.com/overview/tim3-5sm">www.tracopower.com/overview/tim3-5sm</a>
EMS Immunity	- Electrostatic Discharge	EN 60601-1-2 edition 4 (Medical Devices) 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
	- Conducted RF Disturbances	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
	- 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
Cooling System		Natural convection (20 LFM)
Remote Control	- Current Controlled Remote	On: open circuit Off: 2 to 4 mA current (internal 1 kΩ resistor)
	- Off Idle Input Current	External circuit proposal: <a href="http://www.tracopower.com/info/current-remote.pdf">www.tracopower.com/info/current-remote.pdf</a> 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)

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

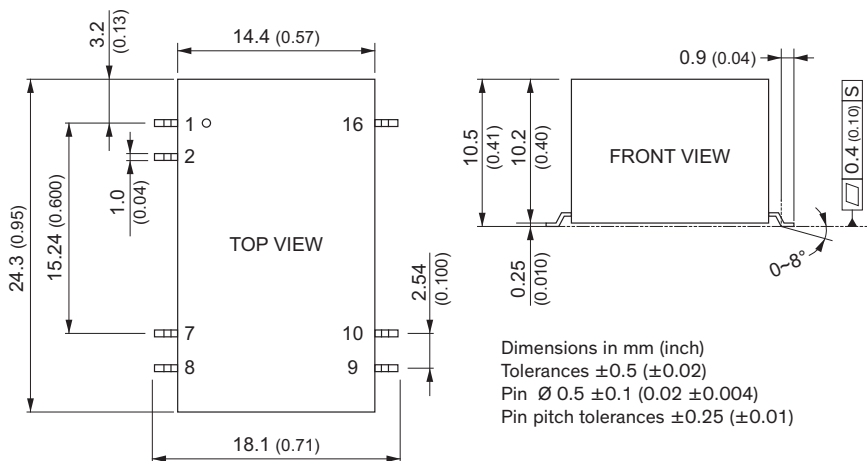
Reliability	- Calculated MTBF	5'041'000 h (MIL-HDBK-217F, ground benign)
Moisture Sensitivity (MSL)		Level 2 (J-STD-033C)
Environment	- Vibration - Mechanical Shock - Thermal Shock	MIL-STD-810F MIL-STD-810F MIL-STD-810F
Housing Material		Non-conductive Plastic (UL94 V-0 rated)
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (1 - 3 $\mu\text{m}$ )
Pin Surface Plating		Tin (7 - 12 $\mu\text{m}$ ), matte
Soldering Profile		Reflow Soldering (J-STD-020E)
Connection Type		SMD (Surface-Mount Device)
Weight		7 g
Environmental Compliance	- Reach - RoHS	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tim3-5sm](http://www.tracopower.com/overview/tim3-5sm)

### Outline Dimensions

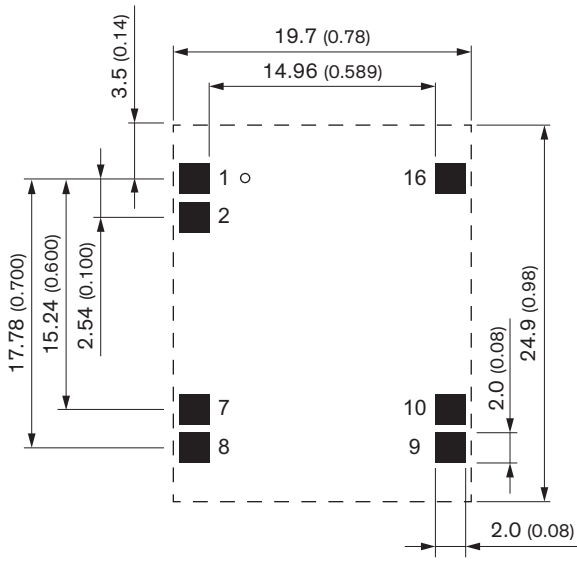


Pinout		
Pin	Single Output	Dual Output
1	-Vin (GND)	-Vin (GND)
2	Remote	Remote
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin (Vcc)	+Vin (Vcc)

NC: No Connection

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

### Recommended Solder Pad Layout



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