

- Compact SMD-16-package
- I/O isolation 5000 VACrms rated for 250 VACrms working voltage
- Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2xMOPP and operation to 5000 m altitude
- Low leakage current < 2 μ 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 × 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 _{max}	Vnom	I _{max}	
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: 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.
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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

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/tim3-5sm
Pollution Degree		PD 2
Over Voltage Category		OVC II (not mains connected)

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

EMC Specifications

EMI (Emissions)		EN 60601-1-2 edition 4 (Medical Devices)
- Conducted Emissions		EN 55011 class A (with external filter) EN 55011 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter) FCC 47 Part 15 class A (with external filter) FCC 47 Part 18 class B (with external filter)
- Radiated Emissions		EN 55011 class A (with external filter) EN 55011 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter) FCC 47 Part 15 class A (with external filter) FCC 47 Part 18 class B (with external filter)
	External filter proposal:	www.tracopower.com/overview/tim3-5sm
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 EN 61000-4-3, 10 V/m, perf. criteria A EN 61000-4-4, ± 2 kV, perf. criteria A EN 61000-4-5, ± 1 kV, perf. criteria A
- RF Electromagnetic Field	Ext. input component:	9 Vin models: KY 1000 μ F TVS SMDJ18A 12 Vin models: KY 470 μ F 24 Vin models: KY 470 μ F 48 Vin models: KY 220 μ F
- EFT (Burst) / Surge	Continuous:	EN 61000-4-6, 10 Vrms, perf. criteria A EN 61000-4-8, 100 A/m, perf. criteria A 1 s: EN 61000-4-8, 1000 A/m, perf. criteria A
- Conducted RF Disturbances		
- PF Magnetic Field		

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +90°C
	- Approved Ambient Temp.	+75°C max. (for compliance to 60601-1)
	- 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/tim3-5sm
Cooling System		Natural convection (20 LFM)
Remote Control	- Current Controlled Remote (passive = on)	On: open circuit Off: 2 to 4 mA current (internal 1 k Ω resistor) Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current	External circuit proposal: www.tracopower.com/info/current-remote.pdf 2.5 mA typ.
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter, RCC Converter
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 M Ω min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	16 pF typ. 20 pF max.
Leakage Current	- Touch Current	2 μ A max. (at 240 VAC / 60 Hz)
Reliability	- Calculated MTBF	5'041'000 h (MIL-HDBK-217F, ground benign)

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Moisture Sensitivity (MSL)	Level 2 (J-STD-033C)
Washing Process	According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	MIL-STD-810F
- 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	SMD (Surface-Mount Device)
Footprint Type	SMD16
Soldering Profile	Lead-Free Reflow Soldering (acc. J-STD-020E) 245°C max. (Tp) 10 s max. (tp, at Tp - 5°C) 85 s max. (tL, time above 217°C) See application note: www.tracopower.com/info/reflow-soldering.pdf
Weight	7 g
Environmental Compliance	www.tracopower.com/info/reach-declaration.pdf
- REACH Declaration	REACH SVHC list compliant REACH Annex XVII compliant
- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
- SCIP Reference Number	37df0294-b078-4c7a-97f0-3a6b42691f25

Additional Information

Supporting Documents	www.tracopower.com/overview/tim3-5sm
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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