

DC/DC Converter

TEP 160 Series, 160 Watt

- Compact metal package
- Wide 2:1 input voltage ranges 16.5–36, 33–75 VDC
- Very high efficiency up to 93%
- No minimum load
- Soft start
- Adjustable output voltage +10/-20%
- Sense line
- Remote On/Off input
- Over temperature protection
- 3-year product warranty



The TEP 160 Series is a family of isolated high performance DC/DC converter modules with wide 2:1 input voltage ranges which come in a rugged, sealed industry standard half brick package.

A very high efficiency allows full power operation without forced air cooling at 25°C. This temperature can be increased to 40°C with optional mounted heatsink or up to 60°C when mounted on an iron base plate. The very wide input voltage range makes these converters an interesting solution for battery operated systems. Typical applications are in telecom/datacom and industry control systems for on board power distribution. These series is available in many optional designs on demand --> see options.

Models				
Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 160-2412	16.5 - 36 VDC (24 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	13'000 mA	92 %
TEP 160-2413		15 VDC (12.0 - 16.5 VDC)	10'000 mA	92 %
TEP 160-2415		24 VDC (19.2 - 26.4 VDC)	6'500 mA	93 %
TEP 160-2416		28 VDC (22.4 - 30.8 VDC)	5'500 mA	93 %
TEP 160-2418		48 VDC (38.4 - 52.8 VDC)	3'300 mA	92 %
TEP 160-4812	33 - 75 VDC (48 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	16'000 mA	92 %
TEP 160-4813		15 VDC (12.0 - 16.5 VDC)	13'000 mA	93 %
TEP 160-4815		24 VDC (19.2 - 26.4 VDC)	8'000 mA	92 %
TEP 160-4816		28 VDC (22.4 - 30.8 VDC)	7'000 mA	92 %
TEP 160-4818		48 VDC (38.4 - 52.8 VDC)	4'000 mA	92 %
TEP 160-48153		53 VDC (42.4 - 58.3 VDC)	3'700 mA	92 %

Options	
Suffix CM	- Chassis mount models w/o filter: www.tracopower.com/overview/tep160cm
Suffix CMF	- Chassis mount models w/ filter to meet EN 55032 class A: www.tracopower.com/overview/tep160cmf
TEP-HS1	- Optional Heat Sink: www.tracopower.com/overview/tep-hs1
on demand (backorder with MOQ non stocking item)	- Optional model with 3.3 VDC and 40'000 mA Output, and 16.5 - 36 VDC Input - Optional model with 5 VDC and 30'000 mA Output, and 16.5 - 36 VDC Input - Optional model with 3.3 VDC and 45'000 mA Output, and 33 - 75 VDC Input - Optional model with 5 VDC and 34'000 mA Output, and 33 - 75 VDC Input - Optional models with Sync pin to synchronize switching frequency of up to 3 units (EMC reason)

Input Specifications

Input Current	- At no load	24 Vin models: 35 mA typ. 48 Vin models: 25 mA typ.
Surge Voltage		24 Vin models: 50 VDC max. (1 s max.) 48 Vin models: 100 VDC max. (1 s max.)
Under Voltage Lockout		24 Vin models: 15.5 VDC min. / 16 VDC typ. / 16.3 VDC max. 48 Vin models: 31.6 VDC min. / 32 VDC typ. / 32.5 VDC max.
Recommended Input Fuse		24 Vin models: 15'000 mA (fast acting) 48 Vin models: 10'000 mA (fast acting) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Pi-Type

Output Specifications

Output Voltage Adjustment		-20% to +10% (By external trim resistor) See application note: www.tracopower.com/tep160-adj Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	0.1% max. 0.1% max.
Ripple and Noise (20 MHz Bandwidth)		3.3 Vout models: 75 mVp-p max. (w/ 1 µF X7R 22 µF poscap) 5 Vout models: 75 mVp-p max. (w/ 1 µF X7R 22 µF poscap) 12 Vout models: 100 mVp-p max. (w/ 1 µF X7R 22 µF poscap) 15 Vout models: 100 mVp-p max. (w/ 1 µF X7R 22 µF poscap) 24 Vout models: 200 mVp-p max. (w/ 4.7 µF X7R) 28 Vout models: 200 mVp-p max. (w/ 4.7 µF X7R) 48 Vout models: 300 mVp-p max. (w/ 2.2 µF X7R) 53 Vout models: 300 mVp-p max. (w/ 2.2 µF X7R)
Capacitive Load	- 24 Vin input - 48 Vin input	53 Vout models: 690 µF max. 3.3 Vout models: 121'000 µF max. 5 Vout models: 60'000 µF max. 12 Vout models: 10'800 µF max. 15 Vout models: 6'600 µF max. 24 Vout models: 2'700 µF max. 28 Vout models: 1'900 µF max. 48 Vout models: 680 µF max. 3.3 Vout models: 136'000 µF max. 5 Vout models: 68'000 µF max. 12 Vout models: 13'300 µF max. 15 Vout models: 8'600 µF max. 24 Vout models: 3'300 µF max. 28 Vout models: 2'500 µF max. 48 Vout models: 830 µF max.
Minimum Load		Not required
Temperature Coefficient		±0.02 %/K max.
Start-up Time		75 ms typ.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		120 - 150% of Iout max.
Overvoltage Protection		115 - 130% of Vout nom.
Transient Response	- Response Time	200 µs typ. / 250 µs max. (25% Load Step)

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

Safety Specifications

Standards	- IT / Multimedia Equipment	EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Certification Documents	www.tracopower.com/tep160-safety-cert
Energy Source	- Output, acc. to 62368-1	ES2 (48 & 53 Vout models) ES1
Power Source	- Output, acc. to 62368-1	PS3
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	External filter proposal:	www.tracopower.com/tep160-emc-filter
EMS (Immunity)		EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air: EN 61000-4-2, ± 8 kV, perf. criteria A Contact: EN 61000-4-2, ± 6 kV, perf. criteria A
	- RF Electromagnetic Field	EN 61000-4-3, 20 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, ± 2 kV, perf. criteria A EN 61000-4-5, ± 2 kV, perf. criteria A
		Ext. input component: 2x KY 200 μ F
	- 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 - Case Temperature - Storage Temperature	-40°C to +75°C +115°C max. -55°C to +125°C
Power Derating	- High Temperature	Depending on model
	See application note:	www.tracopower.com/tep160-cc
Over Temperature Protection Switch Off	- Protection Mode - Measurement Point	120°C typ. (Automatic recovery at 105°C typ.) Base-Plate
Cooling System		Natural convection (20 LFM)
Sense Function		10% max. of Vout nom. (If sense function is not used, sense pins must be connected to corresponding polarity output pins.)
	See application note:	www.tracopower.com/tep160-sense
Remote Control	- Voltage Controlled Remote (passive = on) - Off Idle Input Current - Remote Pin Input Current	On: 3.0 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 3 mA typ. -0.5 to 1.0 mA
Altitude During Operation		5'000 m max. (for basic insulation) 2'000 m max. (for reinforced insulation)
Regulator Topology		Forward Converter
Switching Frequency		225 - 275 kHz (PWM) 250 kHz typ. (PWM)

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

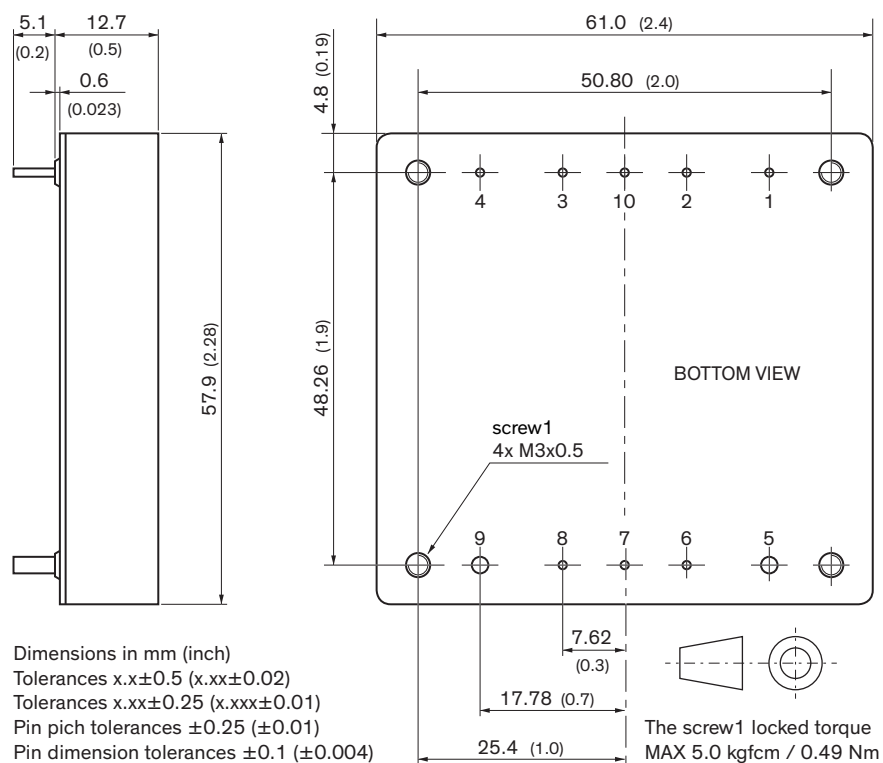
Insulation System	Reinforced Insulation
Working Voltage (rated)	145 VAC (3.3/5 Vout models) 185 VAC (48/53 Vout models) 172 VAC (other Vout models)
Isolation Test Voltage	- Input to Output, 60 s - Input to Case, 60 s - Output to Case, 60 s
	3'000 VAC 1'600 VAC 1'600 VAC
Isolation Resistance	- Input to Output, 500 VDC
	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V
	2'500 pF max.
Reliability	- Calculated MTBF
	380'000 h (MIL-HDBK-217F, ground benign)
Washing Process	According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Thermal Shock
	MIL-STD-810F MIL-STD-810F
Housing Material	Metal
Base Material	Non-conductive FR4 (UL 94 V-0 rated)
Potting Material	Silicone (UL 94 V-0 rated)
Pin Material	Copper
Pin Foundation Plating	Nickel (2 - 3 μm)
Pin Surface Plating	Tin (3 - 5 μm), matte
Housing Type	Metal Case
Mounting Type	PCB Mount
Connection Type	THD (Through-Hole Device)
Footprint Type	Half-Brick
Soldering Profile	Lead-Free Wave Soldering 260°C / 6 s max.
Weight	105 g
Thermal Impedance	- Case to Ambient
	6.1 K/W typ. 4.6 K/W typ. (with heatsink TEP-HS1)
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: 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
	931b6944-928b-4cea-8bfa-21644d000430

Additional Information

Supporting Documents	www.tracopower.com/overview/tep160
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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Outline Dimensions



Pinout		
Pin	Single	Pin Diameter
1	-Vin (GND)	1.0 mm (0.04 inch)
2	Case	1.0 mm (0.04 inch)
3	Remote On/Off	1.0 mm (0.04 inch)
4	+Vin (Vcc)	1.0 mm (0.04 inch)
5	-Vout	2.0 mm (0.08 inch)
6	-Sense	1.0 mm (0.04 inch)
7	Trim	1.0 mm (0.04 inch)
8	+Sense	1.0 mm (0.04 inch)
9	+Vout	2.0 mm (0.08 inch)
10	Sync (on demand)	1.0 mm (0.04 inch)