

### Features

- ◆ 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
- ◆ Reverse input voltage protection
- ◆ Over temperature protection
- ◆ Optional Heatsink
- ◆ 3-year product warranty



(Models pictured with optional heatsink)

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 and reverse input voltage protection make these converters interesting solution for battery operated systems. Typical applications are in telecom/datacom, industry control and railway systems for on board power distribution.

These series is available in many optional designs on demand --> see options.

### Standard Models

Order code	Input voltage	Output voltage	Output current max.	Efficiency typ.
TEP 160-2412	<b>16.5 – 36 VDC</b> (24 VDC nominal)	12 VDC	13 A	92 %
TEP 160-2413		15 VDC	10 A	92 %
TEP 160-2415		24 VDC	6.5 A	93 %
TEP 160-2416		28 VDC	5.5 A	93 %
TEP 160-2418		48 VDC	3.3 A	92 %
TEP 160-4812	<b>33 – 75 VDC</b> (48 VDC nominal)	12 VDC	16 A	92 %
TEP 160-4813		15 VDC	13 A	93 %
TEP 160-4815		24 VDC	8 A	92 %
TEP 160-4816		28 VDC	7 A	92 %
TEP 160-4818		48 VDC	4 A	92 %
TEP 160-48153		53 VDC	3.7 A	92 %

### Options

TEP-HS1	Heat-sink for standard version (incl. mounting screws and thermal pad)
TCK-xxx	Common mode chokes for filter proposals to meet EN55032 class A/B --> see application note
on demand	Models with 3.3 VDC/~ 40 A or 5.0 VDC/~ 30 A output
	Negative (passive = Off) Remote On/Off function (standard is passive = On)
	Sync pin to synchronize switching frequency of up to 3 units (EMC reason)

### Input Specifications

Input current at no load (nominal input voltage)	24 V models: 35 mA typ. 48 V models: 25 mA typ.
Start-up voltage	24 V models: 18 VDC max. 48 V models: 34 VDC max.
Under voltage shut down	24 V models: 15.5 – 16.3 VDC 48 V models: 31.6 – 32.5 VDC
Surge voltage (1 sec. max.)	24 V models: 50 VDC 48 V models: 100 VDC
Conducted noise	EN 55032 class A/B with external components see application note
EMC immunity	EN 50121-3-2 EN 61000-4-2, air $\pm 8$ kV, contact $\pm 6$ kV, perf. criteria A EN 61000-4-3, 20 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 2$ kV perf. criteria A 24 / 48V models: chemi-con KY 220 $\mu$ F, 100 V, ESR 48 mOhm EN 61000-4-6, 10 Vrms, perf. criteria A
Reverse voltage protection	parallel diode

### Output Specifications

Voltage set accuracy (at full load, nominal input)	$\pm 1$ %
Output voltage adjustment	+10 % / -20 % by external resistor see application note
Regulation	- Input variation $V_{in \text{ min.}}$ to $V_{in \text{ max.}}$ - Load variation (0 – 100 %) 0.1 % max. 0.1 % max.
Temperature coefficient	$\pm 0.02$ %/K
Minimum load	not required
Remote sense	10 % max. of $V_{out \text{ nom.}}$ (trim up value to subtract)
Ripple and noise (20 MHz Bandwidth)	12 – 15 VDC models: 100 mVp-p typ. 24 – 28 VDC models: 200 mVp-p typ. 48 – 53 VDC models: 300 mVp-p typ.
Start up time (nominal $V_{in}$ and constant resistive load)	75 ms typ. (at power On or remote On)
Transient response (25 % load step change)	250 $\mu$ s typ.
Output current limitation	at 120 – 150 % of $I_{out \text{ max.}}$
Over voltage protection	at 115 – 130 % of $V_{out \text{ nom.}}$
Short circuit protection	indefinite, automatic recovery.
Capacitive load	12 VDC models: 10'800 / 13'300 $\mu$ f 15 VDC models: 6'600 / 8'600 $\mu$ f 24 VDC models: 2'700 / 3'300 $\mu$ f 28 VDC models: 1'900 / 2'500 $\mu$ f 48 VDC models: 680 / 830 $\mu$ f 53 VDC model: 690 $\mu$ f

**General Specifications**

Temperature ranges	<ul style="list-style-type: none"> <li>- Operating</li> <li>- Case temperature</li> <li>- Storage</li> </ul>	<ul style="list-style-type: none"> <li>-40°C to +75°C</li> <li>+115°C max.</li> <li>-55°C to +125°C</li> </ul>
Thermal impedance	<ul style="list-style-type: none"> <li>- without heat-sink</li> <li>- with heat-sink</li> </ul>	<ul style="list-style-type: none"> <li>6.1°C/W</li> <li>5.1°C/W</li> </ul>
Power derating	<ul style="list-style-type: none"> <li>- without heat-sink</li> <li>- with heat-sink</li> <li>- with iron base plate (1.9" x 3.5" x 0.063")</li> </ul>	<ul style="list-style-type: none"> <li>depending on installation!</li> <li>1.5 %/K above +25°C</li> <li>1.5 %/K above +40°C</li> <li>1.8 %/K above +60°C</li> <li>please refer to application note for temperature measure point that should not exceed 115°C.</li> </ul>
Over temperature protection		at +120°C
Thermal shock		MIL-STD-810F
Humidity (non condensing)		95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +70°C, ground benign)		380'000 h
Isolation voltage (60 s)	<ul style="list-style-type: none"> <li>- Input to output</li> <li>- Input/output to case</li> </ul>	<ul style="list-style-type: none"> <li>2'250 VDC (basic insulation)</li> <li>1'600 VDC</li> </ul>
Isolation capacitance	- Input to output	2500 pF max.
Isolation resistance	- Input to output (500 VDC)	>1 GOhm min.
Switching frequency		250 kHz typ. (puls width modulation)
Safety standards	<ul style="list-style-type: none"> <li>- Certification documents</li> </ul>	<ul style="list-style-type: none"> <li>UL 60950-1, IEC/EN 60950-1</li> <li><a href="http://www.tracopower.com/overview/tep160">www.tracopower.com/overview/tep160</a></li> </ul>
Remote On/Off	<ul style="list-style-type: none"> <li>- positive logic (standard)</li> <li>- negative logic (option)</li> <li>- Off idle current:</li> </ul>	<ul style="list-style-type: none"> <li>- On: 3 to 12 VDC or open circuit</li> <li>- Off: 0 to 1.2 VDC or short circuit pin 1 and 3</li> <li>- On: 0 to 1.2 VDC or short circuit pin 1 and 3</li> <li>- Off: 3 to 12 VDC or open circuit</li> <li>3 mA</li> </ul>
Environmental compliance	<ul style="list-style-type: none"> <li>- Reach</li> <li>- RoHS</li> </ul>	<ul style="list-style-type: none"> <li><a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a></li> <li>RoHS directive 2011/65/EU</li> </ul>

**General Specifications**

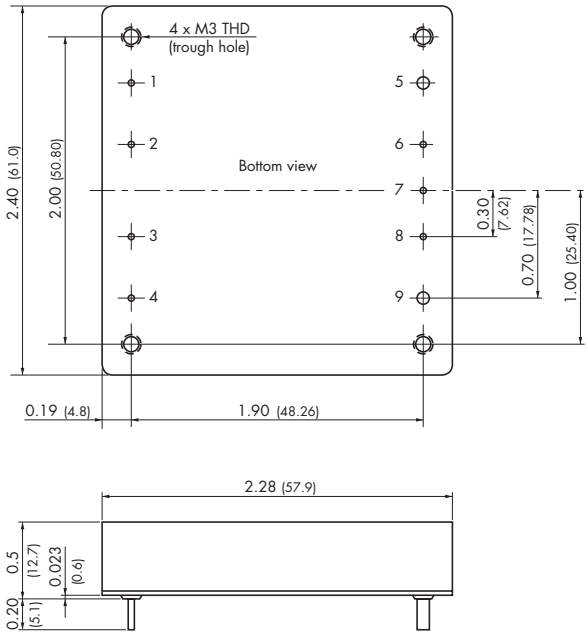
Casing material	metal
Potting material	silicone (UL94V-0 rated)
Base material	FR4
Vibration	MIL-STD-810F

**Application note:** [www.tracopower.com/overview/tep160](http://www.tracopower.com/overview/tep160)

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

**Dimensions**

TEP 160 module



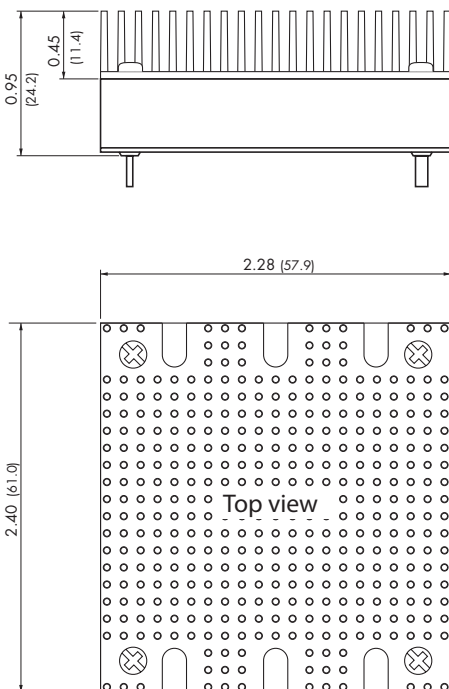
Pin-Out	
Pin	
1	- Vin
2	NC
3	Remote On/Off
4	+ Vin
5	- Vout
6	- Sense*
7	Trim
8	+ Sense*
9	+ Vout

Pin diameter pin 5 & 9: 0.08 (2.0)  
 Pin diameter other pins: 0.04 (1.0)

Weight: 105g (3.70oz)

\*Sense line to be connected to the output either at the module or at the load under regard of polarity.

**TEP-HS1 Heatsink (pictured with heatsink mounted)**



Order code: TEP-HS1

Includes heatsink with thermal pad and mounting screws  
 To order modules with mounted heatsink ask factory.

Weight: 142 g (5.01oz)  
 (Heatsink + Converter)

Dimensions in Inch, ( ) = mm  
 Tolerances  $\pm 0.02$  ( $\pm 0.5$ )  
 Pin pitch tolerances  $\pm 0.01$  ( $\pm 0.25$ )  
 Mounting hole pitch tolerances  $\pm 0.01$  ( $\pm 0.25$ )

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)