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
- Reverse input voltage protection
- Over temperature protection

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.

### Models

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<tr>
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</thead>
<tbody>
<tr>
<td>TEP 160-2412</td>
<td>16.5 - 36 VDC (24 VDC nom.)</td>
<td>12 VDC (9.6 - 13.2 VDC)</td>
<td>13'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-2413</td>
<td></td>
<td>15 VDC (12.0 - 16.5 VDC)</td>
<td>10'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-2415</td>
<td></td>
<td>24 VDC (19.2 - 26.4 VDC)</td>
<td>6'500 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 160-2416</td>
<td></td>
<td>28 VDC (22.4 - 30.8 VDC)</td>
<td>5'500 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 160-2418</td>
<td></td>
<td>48 VDC (38.4 - 52.8 VDC)</td>
<td>3'300 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4812</td>
<td>33 - 75 VDC (48 VDC nom.)</td>
<td>12 VDC (9.6 - 13.2 VDC)</td>
<td>16'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4813</td>
<td></td>
<td>15 VDC (12.0 - 16.5 VDC)</td>
<td>13'000 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 160-4815</td>
<td></td>
<td>24 VDC (19.2 - 26.4 VDC)</td>
<td>8'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4816</td>
<td></td>
<td>28 VDC (22.4 - 30.8 VDC)</td>
<td>7'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4818</td>
<td></td>
<td>48 VDC (38.4 - 52.8 VDC)</td>
<td>4'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-48153</td>
<td></td>
<td>53 VDC (42.4 - 58.3 VDC)</td>
<td>3'700 mA</td>
<td>92 %</td>
</tr>
</tbody>
</table>
### Options

| Suffix -CMF | - Chassis mount models with filter to meet EN 55032 class A: [www.tracopower.com/products/tep160cmf.pdf](www.tracopower.com/products/tep160cmf.pdf) |

### 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.)

### Output Specifications

**Output Voltage Adjustment**

- Voltage Set Accuracy: ±1% max.
- Regulation: Input Variation (Vmin - Vmax) 0.1% max., Load Variation (0 - 100%) 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/ 22 µF X7R)
  - 53 Vout models: 300 mVp-p max. (w/ 22 µF X7R)

- Capacitive Load
  - 24 Vin input
    - 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.
  - 48 Vin input
    - 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

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

### Safety Specifications

#### Safety 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/overview/tep160

#### Pollution Degree

PD 2

#### Over Voltage Category

OVC II

### 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/overview/tep160

#### EMS Immunity

- 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
  - EN 61000-4-4, ±2 kV, perf. criteria A
  - EN 61000-4-5, ±2 kV, perf. criteria A

Ext. input component: 2× KY 200 µF

- Conducted RF Disturbances
  - Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
  - 1 s: EN 61000-4-8, 100 A/m, perf. criteria A
  - 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 +75°C
- Case Temperature
  - +115°C max.
- Storage Temperature
  - -55°C to +125°C

#### Power Derating

- High Temperature
  - See application note: www.tracopower.com/overview/tep160

#### Over Temperature Protection Switch Off

- Protection Mode
  - 120°C typ. (Automatic recovery at 105°C typ.)
- Measurement Point

#### Cooling System

Natural convection (20 LFM)

#### Sense Function

10% max. of Vout nom. (Sense line to be connected to the output either at the module or at the load under regard of polarity)

#### Remote Control

- Voltage Controlled Remote
  - On: 3.0 to 12 VDC or open circuit
  - Off: 0 to 1.2 VDC or short circuit
  - Refers to 'Remote' and '-Vin' Pin

- Off Idle Input Current
  - 3 mA typ.
- Remote Pin Input Current
  - -0.5 to 1.0 mA

#### Altitude During Operation

- 5'000 m max. (for basic insulation)
- 2'000 m max. (for reinforced insulation)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
Switching Frequency 225 - 275 kHz (PWM)
250 kHz typ. (PWM)

Insulation System Basic Insulation

Working Voltage (rated)
- Input to Output, 60 s 145 VAC (3.3 and 5 Vout models)
- Input to Case, 60 s 185 VAC (48 and 53 Vout models)
- Output to Case, 60 s 172 VAC (other output models)

Isolation Test Voltage
- Input to Output, 60 s 3'000 VAC
- Input to Case, 60 s 1'600 VDC
- Output to Case, 60 s 1'600 VDC

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 Allowed (hermetical product)


Environment
- Vibration MIL-STD-810F
- Thermal Shock 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

Weight 105 g

Thermal Impedance
- Case to Ambient 6.1 K/W typ.
- Case to Ambient with Heat Sink 4.6 K/W typ.

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: 7a, 7c-f
  (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).
  The SCIP number is provided on request.)

Supporting Documents
Overview Link (for additional Documents) www.tracopower.com/overview/tep160

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

Dimensions in mm (inch)
- Tolerances x.x±0.5 (x.xx±0.02)
- Tolerances x.xx±0.25 (x.xxx±0.01)
- Pin pitch tolerances ±0.25 (±0.01)
- Pin dimension tolerances ±0.1 (±0.004)

**Pinout**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Pin Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>−Vin (GND)</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>2</td>
<td>Case</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>3</td>
<td>Remote On/Off</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>4</td>
<td>+Vin (Vcc)</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>5</td>
<td>−Vout</td>
<td>2.0 mm (0.08 inch)</td>
</tr>
<tr>
<td>6</td>
<td>−Sense</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>7</td>
<td>Trim</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>8</td>
<td>+Sense</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
<tr>
<td>9</td>
<td>+Vout</td>
<td>2.0 mm (0.08 inch)</td>
</tr>
<tr>
<td>10</td>
<td>Sync (on demand)</td>
<td>1.0 mm (0.04 inch)</td>
</tr>
</tbody>
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The screw1 locked torque MAX 5.0 kgfcm / 0.49 Nm