DC/DC Converter

- 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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TEP 160-2410-CM</td>
<td>16.5 - 36 VDC</td>
<td>3.3 VDC</td>
<td>40'000 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 160-2411-CM</td>
<td>16.5 - 36 VDC</td>
<td>5 VDC</td>
<td>30'000 mA</td>
<td>91 %</td>
</tr>
<tr>
<td>TEP 160-2412-CM</td>
<td>16.5 - 36 VDC</td>
<td>12 VDC</td>
<td>13'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-2413-CM</td>
<td>16.5 - 36 VDC</td>
<td>15 VDC</td>
<td>10'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-2415-CM</td>
<td>16.5 - 36 VDC</td>
<td>24 VDC</td>
<td>6'500 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 160-2416-CM</td>
<td>16.5 - 36 VDC</td>
<td>28 VDC</td>
<td>5'500 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 160-2418-CM</td>
<td>16.5 - 36 VDC</td>
<td>48 VDC</td>
<td>3'300 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4810-CM</td>
<td>33 - 75 VDC</td>
<td>3.3 VDC</td>
<td>45'000 mA</td>
<td>91 %</td>
</tr>
<tr>
<td>TEP 160-4811-CM</td>
<td>33 - 75 VDC</td>
<td>5 VDC</td>
<td>34'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4812-CM</td>
<td>33 - 75 VDC</td>
<td>12 VDC</td>
<td>16'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4813-CM</td>
<td>33 - 75 VDC</td>
<td>15 VDC</td>
<td>13'000 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 160-4815-CM</td>
<td>33 - 75 VDC</td>
<td>24 VDC</td>
<td>8'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4816-CM</td>
<td>33 - 75 VDC</td>
<td>28 VDC</td>
<td>7'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-4818-CM</td>
<td>33 - 75 VDC</td>
<td>48 VDC</td>
<td>4'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 160-48153-CM</td>
<td>33 - 75 VDC</td>
<td>53 VDC</td>
<td>3'700 mA</td>
<td>92 %</td>
</tr>
</tbody>
</table>

Options


- Sync pin to synchronize switching frequency of up to 3 units (EMC reason)
### Input Specifications

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

### Output Specifications

**Output Voltage Adjustment**

See application note: -20% to +10% (By external trim resistor)

- 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: 690 µF max.
  - 5 Vout models: 121’000 µF max.
  - 12 Vout models: 60’000 µF max.
  - 15 Vout models: 10’800 µF max.
  - 24 Vout models: 6’600 µF max.
  - 28 Vout models: 2’700 µF max.
  - 48 Vout models: 1’900 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

**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 nom.

**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, full load and +25°C after warm-up time unless otherwise stated.

www.tracopower.com August 5, 2021
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

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/tep160cm

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
- EFT (Burst) / Surge
  EN 61000-4-5, ±2 kV, perf. criteria A

Ext. input component: 2x KY 220 µF

- Conducted RF Disturbances
  Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
  1 s: EN 61000-4-6, 1000 A/m, perf. criteria A
- PF Magnetic Field

General Specifications

Relative Humidity
95% max. (non condensing)

Temperature Ranges
- Operating Temperature
  -40°C to +75°C
- Case Temperature
  +105°C max.
- Storage Temperature
  -55°C to +125°C

Power Derating
- High Temperature
  See application note: www.tracopower.com/overview/tep160cm

Over Temperature Protection Switch Off
- Protection Mode
  115°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)
5'000 m max. (for functional insulation)

Switching Frequency
225 - 275 kHz (PWM)
250 kHz typ. (PWM)

Insulation System
Basic Insulation

Working Voltage (rated)
145 VAC (33 and 5 Vout models)
185 VAC (48 and 53 Vout models)
172 VAC (other output models)

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

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

### Housing Material
- Metal

### Base Material
- Non-conductive FR4 (UL94 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

### Connection Type
- Screw Terminal

### Weight
- 235 g

### Thermal Impedance
- 6.1 K/W

### 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-I
  (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.)

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**Supporting Documents**

**Overview Link** (for additional Documents): www.tracopower.com/overview/tep160cm

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

Dimensions in mm (inch)
Tolerances x.xx±0.5 (±0.02)
Mounting hole pitch tolerances ±0.25 (±0.01)

Screw 3:
Type M5
Head diameter 8.9 (0.350)
Rated current: 65 A

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>Case</td>
</tr>
<tr>
<td>3</td>
<td>Remote</td>
</tr>
<tr>
<td>4</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>5</td>
<td>–Vout</td>
</tr>
<tr>
<td>6</td>
<td>–Sense</td>
</tr>
<tr>
<td>7</td>
<td>Trim</td>
</tr>
<tr>
<td>8</td>
<td>+Sense</td>
</tr>
<tr>
<td>9</td>
<td>+Vout</td>
</tr>
</tbody>
</table>

The screw 1 locked torque:
MAX 11.2kgf-cm/1.14N-m

The screw 2 locked torque:
MAX 5.2kgf-cm/0.51N-m

The screw 3 locked torque:
MAX 12.0kgf-cm/1.18N-m