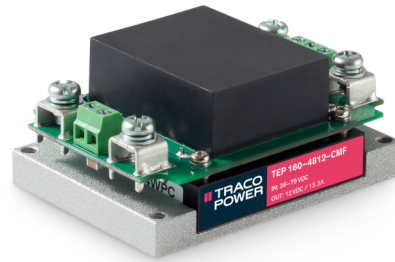


- Compact metal package
- Wide 2:1 input voltage ranges 16.5–36, 33–75 VDC
- Very high efficiency up to 93%
- No minimum load
- Soft start
- Adjustable output voltage +10/-20%
- Sense line
- Remote On/Off input
- Over temperature protection
- 3-year product warranty



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 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 160-2410-CMF  | 16.5 - 36 VDC<br>(24 VDC nom.) | 3.3 VDC (2.64 - 3.63 VDC)        | 40'000 mA           | 90 %            |
| TEP 160-2411-CMF  |                                | 5 VDC (4.0 - 5.5 VDC)            | 30'000 mA           | 91 %            |
| TEP 160-2412-CMF  |                                | 12 VDC (9.6 - 13.2 VDC)          | 13'000 mA           | 92 %            |
| TEP 160-2413-CMF  |                                | 15 VDC (12.0 - 16.5 VDC)         | 10'000 mA           | 92 %            |
| TEP 160-2415-CMF  |                                | 24 VDC (19.2 - 26.4 VDC)         | 6'500 mA            | 93 %            |
| TEP 160-2416-CMF  |                                | 28 VDC (22.4 - 30.8 VDC)         | 5'500 mA            | 93 %            |
| TEP 160-2418-CMF  |                                | 48 VDC (38.4 - 52.8 VDC)         | 3'300 mA            | 92 %            |
| TEP 160-4810-CMF  | 33 - 75 VDC<br>(48 VDC nom.)   | 3.3 VDC (2.64 - 3.63 VDC)        | 45'000 mA           | 91 %            |
| TEP 160-4811-CMF  |                                | 5 VDC (4.0 - 5.5 VDC)            | 34'000 mA           | 92 %            |
| TEP 160-4812-CMF  |                                | 12 VDC (9.6 - 13.2 VDC)          | 16'000 mA           | 92 %            |
| TEP 160-4813-CMF  |                                | 15 VDC (12.0 - 16.5 VDC)         | 13'000 mA           | 93 %            |
| TEP 160-4815-CMF  |                                | 24 VDC (19.2 - 26.4 VDC)         | 8'000 mA            | 92 %            |
| TEP 160-4816-CMF  |                                | 28 VDC (22.4 - 30.8 VDC)         | 7'000 mA            | 92 %            |
| TEP 160-4818-CMF  |                                | 48 VDC (38.4 - 52.8 VDC)         | 4'000 mA            | 92 %            |
| TEP 160-48153-CMF |                                | 53 VDC (42.4 - 58.3 VDC)         | 3'700 mA            | 92 %            |

| Options   |  |
|---|--|
| TEP-MK1   | - Optional DIN-Rail Mounting Kit: <a href="http://www.tracopower.com/overview/tep-mk1">www.tracopower.com/overview/tep-mk1</a> |
| on demand<br>(backorder with MOQ non stocking item) | - 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: <b>35 mA typ.</b><br>48 Vin models: <b>25 mA typ.</b>  |
| Surge Voltage          |              | 24 Vin models: <b>50 VDC max.</b> (1 s max.)<br>48 Vin models: <b>100 VDC max.</b> (1 s max.)   |
| Under Voltage Lockout  |              | 24 Vin models: <b>15.5 VDC min. / 16 VDC typ. / 16.3 VDC max.</b><br>48 Vin models: <b>31.6 VDC min. / 32 VDC typ. / 32.5 VDC max.</b>  |
| Recommended Input Fuse |              | 24 Vin models: <b>15'000 mA</b> (fast acting)<br>48 Vin models: <b>10'000 mA</b> (fast acting)<br>(The need of an external fuse has to be assessed in the final application.) |
| Input Filter           |              | <b>Internal Pi-Type</b>   |

### Output Specifications

|  |  |  |
|--|--|--|
| Output Voltage Adjustment              |  | <b>-20% to +10%</b> (By external trim resistor)<br>See application note: <a href="http://www.tracopower.com/overview/tep160cmf">www.tracopower.com/overview/tep160cmf</a><br>Output power must not exceed rated power!   |
| Voltage Set Accuracy                   |  | <b>±1% max.</b>  |
| Regulation                             | - Input Variation (Vmin - Vmax)<br>- Load Variation (0 - 100%) | <b>0.1% max.</b><br><b>0.1% max.</b>   |
| Ripple and Noise<br>(20 MHz Bandwidth) |  | 3.3 Vout models: <b>75 mVp-p max.</b> (w/ 1 µF X7R    22 µF poscap)<br>5 Vout models: <b>75 mVp-p max.</b> (w/ 1 µF X7R    22 µF poscap)<br>12 Vout models: <b>100 mVp-p max.</b> (w/ 1 µF X7R    22 µF poscap)<br>15 Vout models: <b>100 mVp-p max.</b> (w/ 1 µF X7R    22 µF poscap)<br>24 Vout models: <b>200 mVp-p max.</b> (w/ 4.7 µF X7R)<br>28 Vout models: <b>200 mVp-p max.</b> (w/ 4.7 µF X7R)<br>48 Vout models: <b>300 mVp-p max.</b> (w/ 2.2 µF X7R)<br>53 Vout models: <b>300 mVp-p max.</b> (w/ 2.2 µF X7R)   |
| Capacitive Load                        | - 24 Vin input<br><br>- 48 Vin input                           | 53 Vout models: <b>690 µF max.</b><br>3.3 Vout models: <b>121'000 µF max.</b><br>5 Vout models: <b>60'000 µF max.</b><br>12 Vout models: <b>10'800 µF max.</b><br>15 Vout models: <b>6'600 µF max.</b><br>24 Vout models: <b>2'700 µF max.</b><br>28 Vout models: <b>1'900 µF max.</b><br>48 Vout models: <b>680 µF max.</b><br>3.3 Vout models: <b>136'000 µF max.</b><br>5 Vout models: <b>68'000 µF max.</b><br>12 Vout models: <b>13'300 µF max.</b><br>15 Vout models: <b>8'600 µF max.</b><br>24 Vout models: <b>3'300 µF max.</b><br>28 Vout models: <b>2'500 µF max.</b><br>48 Vout models: <b>830 µF max.</b> |
| Minimum Load                           |  | <b>Not required</b>  |
| Temperature Coefficient                |  | <b>±0.02 %/K max.</b>  |
| Start-up Time                          |  | <b>75 ms typ.</b>  |
| Short Circuit Protection               |  | <b>Continuous, Automatic recovery</b>  |
| Output Current Limitation              |  | <b>120 - 150% of Iout max.</b>   |
| Overvoltage Protection                 |  | <b>115 - 130% of Vout nom.</b>   |
| Transient Response                     | - Response Time  | <b>200 µs typ. / 250 µs max.</b> (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<br>EN 62368-1<br>IEC 60950-1<br>IEC 62368-1<br>UL 60950-1<br>UL 62368-1               |
|                       | - Certification Documents   | <a href="http://www.tracopower.com/overview/tep160cmf">www.tracopower.com/overview/tep160cmf</a> |
| Pollution Degree      |                             | PD 2   |
| Over Voltage Category |                             | OVC II   |

### EMC Specifications

|                 |                             |  |
|-----------------|-----------------------------|--|
| EMI (Emissions) | - Conducted Emissions       | EN 55032 class A (internal filter)   |
|                 | - Radiated Emissions        | EN 55032 class A (internal filter)   |
| EMS (Immunity)  |                             | EN 55024 (IT Equipment)<br>EN 55035 (Multimedia)   |
|                 | - Electrostatic Discharge   | Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A<br>Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A<br>EN 61000-4-3, 20 V/m, perf. criteria A<br>EN 61000-4-4, $\pm 2$ kV, perf. criteria A<br>EN 61000-4-5, $\pm 2$ kV, perf. criteria A |
|                 | - RF Electromagnetic Field  |  |
|                 | - EFT (Burst) / Surge       | Ext. input component: 2x KY 220 $\mu$ 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<br>1 s: 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                         | Depending on model  |
|  |  | See application note: <a href="http://www.tracopower.com/overview/tep160cmf">www.tracopower.com/overview/tep160cmf</a>        |
| Over Temperature Protection Switch Off | - Protection Mode                          | 120°C typ. (Automatic recovery at 105°C typ.)   |
|  | - Measurement Point                        | Case  |
| Cooling System                         |  | Natural convection (20 LFM)   |
| Sense Function                         |  | 10% max. of Vout nom.<br>(If sense function is not used, sense pins must be connected to corresponding polarity output pins.) |
| Remote Control                         | - Voltage Controlled Remote (passive = on) | On: 3.0 to 12 VDC or open circuit<br>Off: 0 to 1.2 VDC or short circuit<br>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)<br>2'000 m max. (for reinforced insulation)   |
| Regulator Topology                     |  | Forward Converter   |
| Switching Frequency                    |  | 225 - 275 kHz (PWM)<br>250 kHz typ. (PWM)   |
| Insulation System                      |  | Reinforced Insulation   |
| Working Voltage (rated)                |  | 145 VAC (3.3 and 5 Vout models)<br>185 VAC (4.8 and 5.3 Vout models)<br>172 VAC (other output models)                         |
| Isolation Test Voltage                 | - Input to Output, 60 s                    | 3'000 VAC   |
|  | - Input to Case, 60 s                      | 1'600 VAC   |
|  | - Output to Case, 60 s                     | 1'600 VAC   |

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

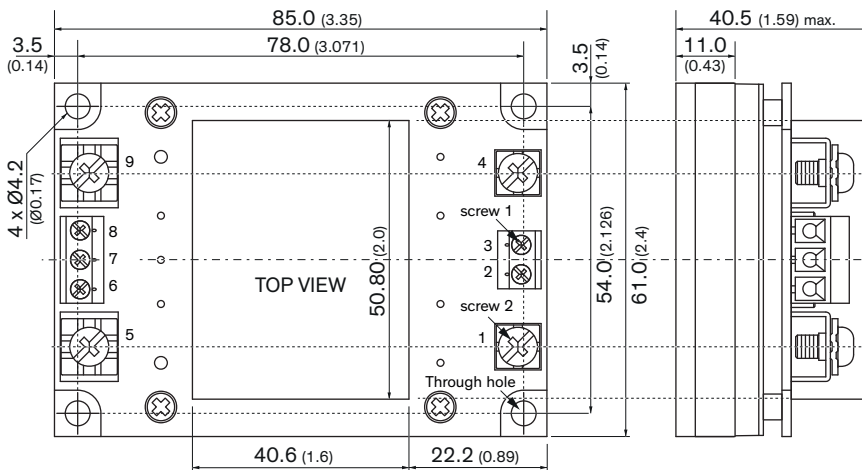
|                          |                                 |  |
|--------------------------|---------------------------------|--|
| Isolation Resistance     | - Input to Output, 500 VDC      | 1'000 M $\Omega$ min.  |
| Isolation Capacitance    | - Input to Output, 100 kHz, 1 V | 2'500 pF max.  |
| Reliability              | - Calculated MTBF               | 380'000 h (MIL-HDBK-217F, ground benign)   |
| Environment              | - Vibration<br>- Thermal Shock  | MIL-STD-810F<br>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 $\mu$ m)   |
| Pin Surface Plating      |                                 | Tin (3 - 5 $\mu$ m), matte   |
| Housing Type             |                                 | Metal Case   |
| Mounting Type            |                                 | Chassis Mount  |
| Connection Type          |                                 | Screw Terminal   |
| Weight                   |                                 | 287 g  |
| Thermal Impedance        | - Case to Ambient               | 6.1 K/W typ.   |
| Environmental Compliance | - REACH Declaration             | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant  |
|                          | - RoHS Declaration              | <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7(a), 7(c)-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) |
|                          | - SCIP Reference Number         | 50980e87-b3bd-4fd0-97ad-bc2aa4f1d70a   |

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tep160cmf](http://www.tracopower.com/overview/tep160cmf)

### Outline Dimensions



| Pinout |               |
|--------|---------------|
| Pin    | Single        |
| 1      | -Vin (GND)    |
| 2      | Case          |
| 3      | Remote On/Off |
| 4      | +Vin (Vcc)    |
| 5      | -Vout         |
| 6      | -Sense        |
| 7      | Trim          |
| 8      | +Sense        |
| 9      | +Vout         |

Dimensions in mm (inch)  
Tolerances x.x  $\pm$ 0.5 (x.xx  $\pm$ 0.02)  
x.xx  $\pm$ 0.25 (x.xxx  $\pm$ 0.01)  
Mounting hole pitch tolerances  $\pm$ 0.25 ( $\pm$ 0.01)

Screw 2:  
Type M5  
Head diameter 8.9 (0.350)  
Rated current: 65 A

Wire gauge range:  
AWG 14 - 26

The screw 1 locked torque: max. 5.2 kgfcm / 0.51 Nm  
The screw 2 locked torque: max. 16.5 kgfcm / 1.65 Nm

Mounting screw locked torque: max. 11.2 kgfcm / 1.10 Nm