DC/DC Railway Converter

- Compact metal package
- Ultra wide 4:1 input voltage ranges 9–36, 18–75, 43–160 VDC
- EN 50155 approval for railway applications
- Very high efficiency up to 93%
- No minimum load
- Soft start
- Adjustable output voltage +10/-20%
- Sense line
- Remote On/Off input
- Under voltage lock-out circuit

The TEP 100WIR Series is a family of isolated high performance DC/DC converter modules with ultra-wide 4:1 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 60°C. This temperature can be increased to 70°C with optional mounted heatsink or up to 85°C when mounted on an iron base plate. The very wide input voltage range makes these converters interesting solutions 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.

Models

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TEP 100-2411WIR</td>
<td>9 - 36 VDC (24 VDC nom.)</td>
<td>5 VDC</td>
<td>20'000 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TEP 100-2412WIR</td>
<td></td>
<td>12 VDC</td>
<td>8'400 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-2415WIR</td>
<td></td>
<td>24 VDC</td>
<td>4'200 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-2416WIR</td>
<td></td>
<td>28 VDC</td>
<td>3'600 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-2418WIR</td>
<td></td>
<td>48 VDC</td>
<td>2'100 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-4812WIR</td>
<td>18 - 75 VDC (45 VDC nom.)</td>
<td>12 VDC</td>
<td>8'400 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-4815WIR</td>
<td></td>
<td>24 VDC</td>
<td>4'200 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-4816WIR</td>
<td></td>
<td>28 VDC</td>
<td>3'600 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TEP 100-4818WIR</td>
<td></td>
<td>48 VDC</td>
<td>2'100 mA</td>
<td>91 %</td>
</tr>
<tr>
<td>TEP 100-7212WIR</td>
<td>43 - 160 VDC (110 VDC nom.)</td>
<td>12 VDC</td>
<td>8'400 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-7215WIR</td>
<td></td>
<td>24 VDC</td>
<td>4'200 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-7216WIR</td>
<td></td>
<td>28 VDC</td>
<td>3'600 mA</td>
<td>90 %</td>
</tr>
<tr>
<td>TEP 100-7218WIR</td>
<td></td>
<td>48 VDC</td>
<td>2'100 mA</td>
<td>91 %</td>
</tr>
</tbody>
</table>
### Input Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current</td>
<td>At no load: 24 Vin models: 20 mA typ. 48 Vin models: 15 mA typ. 110 Vin models: 10 mA typ.</td>
</tr>
<tr>
<td></td>
<td>Surge Voltage: 24 Vin models: 50 VDC max. (1 s max) 48 Vin models: 100 VDC max. (1 s max) 110 Vin models: 185 VDC max. (1 s max)</td>
</tr>
<tr>
<td></td>
<td>Under Voltage Lockout: 24 Vin models: 7.3 VDC min. / 7.5 VDC typ. / 8.1 VDC max. 48 Vin models: 15.5 VDC min. / 16 VDC typ. / 16.3 VDC max. 110 Vin models: 33 VDC min. / 34.5 VDC typ. / 36 VDC max.</td>
</tr>
<tr>
<td></td>
<td>Recommended Input Fuse: 24 Vin models: 20'000 mA (fast acting) 48 Vin models: 12'000 mA (fast acting) 110 Vin models: 5'000 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)</td>
</tr>
<tr>
<td></td>
<td>Input Filter: Internal Pi-Type</td>
</tr>
</tbody>
</table>

### Output Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Set Accuracy</td>
<td>±1% max.</td>
</tr>
<tr>
<td>Regulation</td>
<td>- Input Variation (Vmin - Vmax): 0.1% max.</td>
</tr>
<tr>
<td></td>
<td>- Load Variation (0 - 100%): 0.1% max.</td>
</tr>
<tr>
<td>Ripple and Noise (20 MHz Bandwidth)</td>
<td>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)</td>
</tr>
<tr>
<td>Capacitive Load</td>
<td>3.3 Vout models: 75'700 µF max. 5 Vout models: 40'000 µF max. 12 Vout models: 7'000 µF max. 15 Vout models: 4'460 µF max. 24 Vout models: 1'750 µF max. 28 Vout models: 1'280 µF max. 48 Vout models: 430 µF max.</td>
</tr>
<tr>
<td>Minimum Load</td>
<td>Not required</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>±0.02 %/K max.</td>
</tr>
</tbody>
</table>

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
Start-up Time | 75 ms typ.
---|---
Short Circuit Protection | Continuous, Automatic recovery
Output Current Limitation | 150% typ. of Iout max.
| (110 V<sub>in</sub> models)
| 120 - 150% (other models)
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
- Railway Applications
  | EN 50155
- Certification Documents
  | www.tracopower.com/overview/tep100wir

EMC Specifications

EMI Emissions
- Conducted Emissions
  | EN 55011 class B (with external filter)
  | EN 55032 class B (with external filter)
- Radiated Emissions
  | EN 55011 class B (with external filter)
  | EN 55032 class B (with external filter)
External filter proposal: www.tracopower.com/overview/tep100wir

EMS Immunity
- Electrostatic Discharge
  | Air: EN 61000-4-2, ±8 kV, perf. criteria A
  | Contact: EN 61000-4-2, ±16 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, ±8 kV, perf. criteria A
Ext. input component: 24 Vin models: 2 x KY 220 μF
| 48 Vin models: 2 x KY 220 μF
| 110 Vin models: 2 x KYJ 150 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
- PF Magnetic Field
  | EN 61000-4-8, 1000 A/m, perf. criteria A

General Specifications

Relative Humidity | 95% max. (non condensing)
Temperature Ranges
- Operating Temperature: 0°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/tep100wir
Over Temperature Protection Switch Off
- Protection Mode: 115°C typ. (Automatic recovery at 105°C typ.)
  | Base-Plate
Cooling System | Natural convection (20 LFM)
Sense Function | 10% max. of Vout nom.
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
  | 3 mA typ.
- Off Idle Input Current
  | -0.5 to 1.0 mA
  | (Optional models with inverse logic available)
- Remote Pin Input Current
Altitude During Operation
| 2'000 m max. (for reinforced insulation)
| 5'000 m max. (for functional insulation)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Switching Frequency
- 300 kHz typ. (PWM) (±10%, 110 Vin models)
- 250 kHz typ. (PWM) (±10%, other models)

### Insulation System
- Reinforced Insulation

### Working Voltage (rated)
- 177 VAC (110 Vin models)
- 145 VAC (24 and 48 Vin, 3.3 and 5 Vout models)
- 185 VAC (24 and 48 Vin, 48 Vout models)
- 172 VAC (24 and 48 Vin, other output models)

### Insulation Test Voltage
- Input to Output, 60 s: 3'000 VAC (110 Vin models)
- Input to Case, 60 s: 3'000 VDC (other models)
- Output to Case, 60 s: 1'500 VAC (110 Vin models)
- 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: 409'000 h (MIL-HDBK-217F, ground benign)

### Environment
- Vibration: MIL-STD-810F, EN 61373
- Mechanical Shock: MIL-STD-810F, EN 61373
- Thermal Shock: MIL-STD-810F, EN 50155

### Housing Material
- Alu base-plate w. metal case (24 and 48 Vin models)
- Alu base-plate w. plastic case (110 Vin models)

### Base Material
- Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)

### 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 (24 and 48 Vin models)
- Plastic Case (110 Vin models)

### Mounting Type
- PCB Mount

### Connection Type
- THD (Through-Hole Device)

### Footprint Type
- Half-Brick

### Weight
- 105 g

### Thermal Impedance
- 6.7 K/W
- 4.7 K/W (with Heat Sink)

### Environmental Compliance
- REACH Declaration: www.tracopower.com/info/reach-declaration.pdf
- REACH SVHC list compliant
- RoHS Declaration: Exemptions: 7a, 7c-t
(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/tep100wir

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

![Outline Dimensions Diagram]

**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 (24 and 48Vout models):
MAX 5.0kgf-cm/0.49N-m

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

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