DC/DC Railway Converter

TEP 100UIR Series, 100 Watt

- Ultra-wide 12:1 input voltage range: 9–75, 14–160 VDC
- EN 50155 and EN 61373 certified
- Encapsulated quarter-brick (2.3”x1.45”x0.5”) package
- Extended holdup time with lowest capacitor volume
- EN 45545-2 fire behavior
- –40°C to +85°C operating temperature
- Up to 3’000 VAC I/O-isolation
- Remote on/off and trim function
- Adjustable undervoltage lockout (UVLO), short-circuit protection (SCP), overvoltage protection (OVP) and overtemperature protection (OTP)
- 3-year product warranty

The TEP 100UIR is a series of high-performance 100 Watt DC/DC converters with an ultra-wide 12:1 input voltage range. The TEP 100UIR comes in a compact, fully encapsulated quarter-brick (2.3”x1.45”x0.5”) package for highest reliability. The ultra-wide input voltage range lets system builders reduce the number of design channels where otherwise multiple input voltage configurations would be required. Thanks to its dedicated holdup circuit, the TEP 100UIR complies with extended holdup-time requirements without the need for bulky capacitors. The TEP 100UIR is EN 50155 certified for rolling stock applications, EN 61373 certified for mechanical shock and vibration and EN 45545-2 certified for fire behavior. It comes with IEC/EN/UL 62368-1 safety approvals.

### Models

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>TEP 100-3611UIR</td>
<td>9 - 75 VDC (36 VDC nom.)</td>
<td>5 VDC</td>
<td>20'000 mA</td>
<td>88 %</td>
</tr>
<tr>
<td>TEP 100-3612UIR</td>
<td>12 VDC</td>
<td>8'350 mA</td>
<td>88 %</td>
<td></td>
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<tr>
<td>TEP 100-3613UIR</td>
<td>15 VDC</td>
<td>6'700 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEP 100-3615UIR</td>
<td>24 VDC</td>
<td>4'200 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TEP 100-3618UIR</td>
<td>48 VDC</td>
<td>2'100 mA</td>
<td>90 %</td>
<td></td>
</tr>
<tr>
<td>TEP 100-7211UIR</td>
<td>14 - 160 VDC (110 VDC nom.)</td>
<td>5 VDC</td>
<td>20'000 mA</td>
<td>88 %</td>
</tr>
<tr>
<td>TEP 100-7212UIR</td>
<td>12 VDC</td>
<td>8'350 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TEP 100-7213UIR</td>
<td>15 VDC</td>
<td>6'700 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TEP 100-7215UIR</td>
<td>24 VDC</td>
<td>4'200 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TEP 100-7218UIR</td>
<td>48 VDC</td>
<td>2'100 mA</td>
<td>89 %</td>
<td></td>
</tr>
</tbody>
</table>

### Options


- **on demand** (backorder with MOQ non stocking item)
  - Optional model with 28 VDC / 3’600 mA Output and 9 - 75 VDC Input
  - Optional model with 53 VDC / 1’920 mA Output and 9 - 75 VDC Input
  - Optional model with 28 VDC / 3’600 mA Output and 14 - 160 VDC Input
  - Optional model with 53 VDC / 1’920 mA Output and 14 - 160 VDC Input
### Input Specifications

**Input Current**
- At no load
  - 36 V Vin models: 20 mA typ.
  - 110 V Vin models: 15 mA typ.

**Surge Voltage**
- 36 V Vin models: 100 VDC max. (1 s max.)
- 110 V Vin models: 185 VDC max. (1 s max.)

**Start-up Voltage**
- 36 V Vin models: 8.1 VDC min. / 8.5 VDC typ. / 9 VDC max.
- 110 V Vin models: 12 VDC min. / 13.2 VDC typ. / 14 VDC max.

(These are the Start-up Voltage values without an external resistor between the UVLO and -Vin pin. With an external resistor between these pins, the Start-up Voltage can be widely adjusted, see application note: [www.tracopower.com/overview/tep100uir](http://www.tracopower.com/overview/tep100uir).)

**Under Voltage Lockout**
- 36 V Vin models: 7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max.
- 110 V Vin models: 10 VDC min. / 11 VDC typ. / 12 VDC max.

(These are the Shutdown Voltage values without an external resistor between the UVLO and -Vin pin. With an external resistor between these pins, the Shutdown Voltage can be widely adjusted, see application note: [www.tracopower.com/overview/tep100uir](http://www.tracopower.com/overview/tep100uir).)

**Recommended Input Fuse**
- 36 V Vin models: 20'000 mA (fast acting)
- 110 V Vin models: 13'000 mA (fast acting)

(The need of an external fuse has to be assessed in the final application.)

**Input Filter**
- Internal Pi-Type

(For the use of following input capacitor, the input ripple can be further reduced:
- 36 V Vin models: 220 µF / 100 V KY
- 110 V Vin models: 150 µF / 200 V KXJ)

### Output Specifications

**Output Voltage Adjustment**

See application note: [www.tracopower.com/overview/tep100uir](http://www.tracopower.com/overview/tep100uir)

Output power must not exceed rated power!

- 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)
- 5 Vout models: 75 mVp-p typ. (w/ 10 µF / 47 µF)
- 12 Vout models: 100 mVp-p typ. (w/ 22 µF)
- 15 Vout models: 100 mVp-p typ. (w/ 22 µF)
- 24 Vout models: 200 mVp-p typ. (w/ 4.7 µF)
- 28 Vout models: 200 mVp-p typ. (w/ 4.7 µF)
- 48 Vout models: 300 mVp-p typ. (w/ 2.2 µF)
- 53 Vout models: 300 mVp-p typ. (w/ 2.2 µF)

**Capacitive Load**
- 5 Vout models: 40'000 µF max.
- 12 Vout models: 7'000 µF max.
- 15 Vout models: 4'500 µF max.
- 24 Vout models: 1'800 µF max.
- 28 Vout models: 1'300 µF max.
- 48 Vout models: 430 µF max.
- 53 Vout models: 370 µF max.

**Minimum Load**
- Not required

**Temperature Coefficient**
- ±0.02 %/K max.

**Hold-up Time**
- 10 ms min. (with external capacitor, see application note for BUS connection: [www.tracopower.com/overview/tep100uir](http://www.tracopower.com/overview/tep100uir))

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

[www.tracopower.com](http://www.tracopower.com)
Continuous, Automatic recovery

Output Current Limitation
110 - 130% of Iout max.

Overvoltage Protection
120 - 135% of Vout nom.

Transient Response
- Response Deviation
  25% typ. (25% Load Step)
- Response Time
  250 µs typ. (25% Load Step)

Safety Specifications

Safety Standards
- IT / Multimedia Equipment
  EN 62368-1
  IEC 62386-1
  UL 62368-1
- Railway Applications
  EN 50155
- Certification Documents
  www.tracopower.com/overview/tep100uir

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/tep100uir

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
  - EFT (Burst) / Surge
    EN 61000-4-4, ±1 kV, perf. criteria A
  Ext. input component:
    220 µF / 100 V KY (36 Vin models)
    150 µF / 200 V KKJ (110 Vin models)
- Conducted RF Disturbances
  Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
- PF Magnetic Field
  Continuous: EN 61000-4-8, 100 A/m, perf. criteria A

  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 +105°C
- Case Temperature
  +105°C max.
- Storage Temperature
  -55°C to +125°C

Power Derating
- High Temperature
  See application note: www.tracopower.com/overview/tep100uir

Over Temperature Protection Switch Off
- Protection Mode
  110°C typ. (Automatic recovery at 95°C typ.)
- Measurement Point
  Base-Plate

Cooling System
Forced air cooling (with external fan, 400 LPM)

Sense Function
10% max. of Vout nom.
(if sense function is not used, sense pins must be connected to corresponding polarity output pins)

Remote Control
- Voltage Controlled Remote
  On: 3.0 to 12 VDC or open circuit
  Off: 0 to 1.2 VDC or short circuit
  3 mA typ.
- Off Idle Input Current
  -0.5 to 1.0 mA
- Remote Pin Input Current

Altitude During Operation
5'000 m max.

Switching Frequency
180 - 200 kHz (PWM)
180 kHz typ. (PWM)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
<table>
<thead>
<tr>
<th><strong>Insulation System</strong></th>
<th>Reinforced Insulation (110 Vin models)</th>
<th>Basic Insulation (36 Vin models)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working Voltage (rated)</strong></td>
<td>220 VAC</td>
<td></td>
</tr>
<tr>
<td><strong>Isolation Test Voltage</strong></td>
<td></td>
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</tr>
<tr>
<td>- Input to Output, 60 s</td>
<td>3'000 VAC (110 Vin models)</td>
<td></td>
</tr>
<tr>
<td>- Input to Case, 60 s</td>
<td>2'250 VDC (36 Vin models)</td>
<td></td>
</tr>
<tr>
<td>- Output to Case, 60 s</td>
<td>1'500 VAC (110 Vin models)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1'600 VDC (36 Vin models)</td>
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</tr>
<tr>
<td><strong>Creepage</strong></td>
<td>- Input to Output</td>
<td>3.2 mm min.</td>
</tr>
<tr>
<td><strong>Clearance</strong></td>
<td>- Input to Output</td>
<td>3 mm min.</td>
</tr>
<tr>
<td><strong>Isolation Resistance</strong></td>
<td>- Input to Output, 500 VDC</td>
<td>1'000 MΩ min.</td>
</tr>
<tr>
<td><strong>Isolation Capacitance</strong></td>
<td>- Input to Output, 100 kHz, 1 V</td>
<td>1'000 pF max.</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>- Calculated MTBF</td>
<td>420'800 h (MIL-HDBK-217F, ground benign)</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>- Vibration</td>
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<tr>
<td></td>
<td>MIL-STD-810F EN 61373</td>
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<td>7.6 g, 3 axis, 60 min, 20-2000 Hz</td>
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<td></td>
<td>MIL-STD-810F EN 61373</td>
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<tr>
<td></td>
<td>50 g, 3 axis, 11 ms</td>
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<tr>
<td></td>
<td>MIL-STD-810F</td>
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<td></td>
<td>+55°C to +125°C, 72 cycles, 30 min each</td>
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<td></td>
<td>EN 50155</td>
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<tr>
<td><strong>Housing Material</strong></td>
<td>Alu base-plate w. plastic case</td>
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<tr>
<td><strong>Isolation Frame Material</strong></td>
<td>Non-conductive Plastic (UL 94 V-0 rated)</td>
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<tr>
<td><strong>Potting Material</strong></td>
<td>Silicone (UL 94 V-0 rated)</td>
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<tr>
<td><strong>Pin Material</strong></td>
<td>Copper</td>
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<tr>
<td><strong>Pin Foundation Plating</strong></td>
<td>Copper (1 - 1.5 µm)</td>
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<tr>
<td><strong>Pin Surface Plating</strong></td>
<td>Nickel (4 - 6 µm), matte</td>
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<tr>
<td><strong>Housing Type</strong></td>
<td>Plastic Case</td>
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<tr>
<td><strong>Mounting Type</strong></td>
<td>PCB Mount</td>
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<tr>
<td><strong>Connection Type</strong></td>
<td>THD (Through-Hole Device)</td>
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<tr>
<td><strong>Footprint Type</strong></td>
<td>Quarter-Brick</td>
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<tr>
<td><strong>Weight</strong></td>
<td>64 g</td>
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<tr>
<td><strong>Thermal Impedance</strong></td>
<td>8.3 K/W</td>
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<tr>
<td><strong>Environmental Compliance</strong></td>
<td><a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a></td>
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<tr>
<td></td>
<td>REACH SVHC list compliant</td>
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<tr>
<td></td>
<td>REACH Annex XVII compliant</td>
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<tr>
<td></td>
<td><a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a></td>
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<tr>
<td></td>
<td>Exemptions: 7a, 7c-I</td>
<td></td>
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<tr>
<td></td>
<td>(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.)</td>
<td></td>
</tr>
</tbody>
</table>

Supporting Documents

Overview Link (for additional Documents) www.tracopower.com/overview/tep100uir

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 (±0.02)
x.xx ±0.25 (±0.01)

Pin (4, 8): 1.5 (0.06)
Pin (other): 1.0 (0.04)
Pin diameter ±0.1 (±0.004)
Screw lock torque: Max. 0.34 N·m (3.5 kgf·cm)

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>Remote On/Off</td>
</tr>
<tr>
<td>3</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>4</td>
<td>–Vout</td>
</tr>
<tr>
<td>5</td>
<td>–Sense</td>
</tr>
<tr>
<td>6</td>
<td>Trim</td>
</tr>
<tr>
<td>7</td>
<td>+Sense</td>
</tr>
<tr>
<td>8</td>
<td>+Vout</td>
</tr>
<tr>
<td>9</td>
<td>Bus</td>
</tr>
<tr>
<td>10</td>
<td>UVLO</td>
</tr>
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