DC/DC Railway Converter

THN 20UIR Series, 20 Watt

- Compact 1"x1" housing
- Ultra-wide 12:1 input voltage range: 9–75, 14–160 VDC
- –40°C up to +70°C natural convection cooling without derating
- EN 50155, EN 45545-2 and EN 61373 certified
- Dedicated holdup capacitor connection
- Fully encapsulated
- Reinforced 3000VAC I/O isolation
- Remote on/off and trim function
- Protection against short-circuit (SCP), overvoltage (OVP) and overtemperature (OTP)
- 3-year product warranty

The THN 20UIR is a series of high-performance DC/DC converters with an ultra-wide 12:1 input voltage range and a power output of 20 watt. The THN 20UIR comes in a compact, fully encapsulated 1"x1" housing for highest reliability. The default variant features a pre-mounted heatsink for convection cooling up to +70°C without derating. Thanks to its dedicated holdup capacitor connection, the THN 20UIR meets extended holdup-time requirements without the need for bulky input capacitors. The THN 20UIR is EN 50155 certified for rolling stock applications, EN 61373 certified for resistance against mechanical shock and vibration and EN 45545-2 certified for fire behavior. The THN 20UIR also comes with IEC/EN/UL 62368-1 safety approvals for use in a wide range of demanding industrial applications.

Models

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1 Vnom</th>
<th>Imax</th>
<th>Output 2 Vnom</th>
<th>Imax</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>THN 20-3611UIR</td>
<td>9 - 75 VDC (36 VDC nom.)</td>
<td>5.1 VDC</td>
<td>4'000 mA</td>
<td>-12 VDC</td>
<td>833 mA</td>
<td>87 %</td>
</tr>
<tr>
<td>THN 20-3612UIR</td>
<td>12 VDC</td>
<td>1'670 mA</td>
<td>-15 VDC</td>
<td>667 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-3613UIR</td>
<td>15 VDC</td>
<td>1'330 mA</td>
<td>-12 VDC</td>
<td>833 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-3615UIR</td>
<td>24 VDC</td>
<td>835 mA</td>
<td>-15 VDC</td>
<td>667 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-3622UIR</td>
<td>+12 VDC</td>
<td>833 mA</td>
<td>-12 VDC</td>
<td>833 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-3623UIR</td>
<td>+15 VDC</td>
<td>667 mA</td>
<td>-15 VDC</td>
<td>667 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-7211UIR</td>
<td>14 - 160 VDC (72 VDC nom.)</td>
<td>5.1 VDC</td>
<td>4'000 mA</td>
<td>-12 VDC</td>
<td>833 mA</td>
<td>87 %</td>
</tr>
<tr>
<td>THN 20-7212UIR</td>
<td>12 VDC</td>
<td>1'670 mA</td>
<td>-15 VDC</td>
<td>667 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-7213UIR</td>
<td>15 VDC</td>
<td>1'330 mA</td>
<td>-12 VDC</td>
<td>833 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-7215UIR</td>
<td>24 VDC</td>
<td>835 mA</td>
<td>-15 VDC</td>
<td>667 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-7222UIR</td>
<td>+12 VDC</td>
<td>833 mA</td>
<td>-12 VDC</td>
<td>833 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THN 20-7223UIR</td>
<td>+15 VDC</td>
<td>667 mA</td>
<td>-15 VDC</td>
<td>667 mA</td>
<td>88 %</td>
<td></td>
</tr>
</tbody>
</table>

Options

- Optional model with 5 VDC / 4'000 mA Output and 9 - 75 VDC Input
- Optional model with 5 VDC / 4'000 mA Output and 14 - 160 VDC Input
- Optional models with inverse Remote On/Off function (passive = off)
- Optional models without adjustable UVLO and without BUS pin
- Optional models with adjustable UVLO but without BUS pin
- Optional models without heatsink

Note: 72 Vin models: If the input voltage exceeds 110 VDC, use an external 100 µF / 200 V capacitor between +Vin and -Vin to reduce voltage transient.
## Input Specifications

<table>
<thead>
<tr>
<th>Input Current</th>
<th>72 Vin models: 8 mA typ.</th>
<th>36 Vin models: 15 mA typ. (5 Vout model)</th>
<th>15 mA typ. (5.1 Vout model)</th>
<th>12 mA typ. (12 Vout model)</th>
<th>12 mA typ. (15 Vout model)</th>
<th>12 mA typ. (24 Vout model)</th>
<th>12 mA typ. (12 / -12 Vout model)</th>
<th>12 mA typ. (15 / -15 Vout model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge Voltage</td>
<td>36 Vin models: 100 VDC max. (1 s max)</td>
<td>72 Vin models: 200 VDC max. (1 s max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under Voltage Lockout</td>
<td>36 Vin models: 7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max.</td>
<td>72 Vin models: 10 VDC min. / 11 VDC typ. / 12 VDC max.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended Input Fuse</td>
<td>36 Vin models: 4'000 mA (slow blow)</td>
<td>72 Vin models: 3'150 mA (slow blow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output Specifications

#### Output Voltage Adjustment

- ±10% (12 Vout models)
- -10% to +20% (other models)
- (single output models only)
- (By external trim resistor)

See application note: [www.tracopower.com/overview/thn20uir](http://www.tracopower.com/overview/thn20uir)

Output power must not exceed rated power!

#### Voltage Set Accuracy

- ±1% max.

#### Regulation

- Input Variation (Vmin - Vmax) single output models: 0.2% max.
  dual output models: 0.5% max.
- Load Variation (0 - 100%) single output models: 0.2% max.
  dual output models: 1% max. (Output 1)
  1% max. (Output 2)
- Voltage Balance (symmetrical load) dual output models: 2% max.
- Cross Regulation (25% / 100% asym. load) dual output models: 5% max.

#### Ripple and Noise

(20 MHz Bandwidth)

- single output
  5 Vout models: 75 mVp-p typ. (w/ 22 µF)
  5.1 Vout models: 75 mVp-p typ. (w/ 22 µF)
  12 Vout models: 100 mVp-p typ. (w/ 22 µF)
  15 Vout models: 100 mVp-p typ. (w/ 22 µF)
  24 Vout models: 125 mVp-p typ. (w/ 4.7 µF)
- dual output
  12 / -12 Vout models: 100 / 100 mVp-p typ. (w/ 10 µF)
  15 / -15 Vout models: 100 / 100 mVp-p typ. (w/ 10 µF)

#### Capacitive Load

- single output
  5 Vout models: 5'000 µF max.
  5.1 Vout models: 5'000 µF max.
  12 Vout models: 850 µF max.
  15 Vout models: 700 µF max.
  24 Vout models: 220 µF max.
- dual output
  12 / -12 Vout models: 500 / 500 µF max.
  15 / -15 Vout models: 350 / 350 µF max.

#### Minimum Load

- Not required

#### Temperature Coefficient

- ±0.02 %/K max.

#### Hold-up Time

- 10 ms min. (acc. to EN 50155 Class S2, see application note for BUS connection: [www.tracopower.com/overview/thn20uir](http://www.tracopower.com/overview/thn20uir))

#### Start-up Time

- 30 ms typ. / 40 ms max.

#### Short Circuit Protection

- Continuous, Automatic recovery

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

155% typ. of Iout max.

### Overvoltage Protection

(depending on model)
- 6.3 - 7.4 VDC (5 Vout, 5.1 Vout model)
- 13.5 - 19.6 VDC (12 Vout model)
- 18.3 - 22 VDC (15 Vout model)
- 29.1 - 32.5 VDC (24 Vout model)

### Transient Response

- Response Deviation: 4% typ. (25% Load Step)
- Response Time: 250 µs typ. (25% Load Step)

### Safety Specifications

**Standards**
- IT / Multimedia Equipment: EN 62368-1
- IEC 62368-1
- UL 62368-1
- Railway Applications: EN 50155
- Certification Documents: www.tracopower.com/overview/thn20uir

(A BUS capacitor must be connected to meet EN 50155 requirements. See application note.)

**Pollution Degree**
- PD 2

**Over Voltage Category**
- OVC II

### EMC Specifications

**EMI Emissions**
- Conducted Emissions: EN 50121-3-2 (EMC for Rolling Stock)
  - 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/thn20uir

**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, ±2 kV, perf. criteria A
  - EN 61000-4-5, ±2 kV, perf. criteria A
- Conducted RF Disturbances
  - Ext. input component: 220µF, 100V, KY || TVS SMDJ120A (36 Vin)
    - 150µF, 200V, KY || TVS SMBJ220A (72 Vin)
- PF Magnetic Field
  - Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
  - 1 s: EN 61000-4-8, 100 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: Depending on model
  - See application note: www.tracopower.com/overview/thn20uir

**Over Temperature Protection Switch Off**
- Protection Mode: 115°C typ. (Automatic recovery at 103°C typ.)
- Measurement Point: Case

**Cooling System**
- Natural convection (20 LFM)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Remote Control
- **Voltage Controlled Remote**
  - Remote Control On: 3.0 to 15 VDC or open circuit
  - Remote On Idle Input Current: 0.5 to 1.0 mA typ.
  - Remote Pin Input Current: 0.5 to 1.0 mA typ.
  - (Optional models with inverse Remote On/Off function (passive = off))

### Altitude During Operation
5'000 m max.

### Switching Frequency
- Input to Output: 190 - 250 kHz (PWM)
- Input to Case: 220 kHz typ. (PWM)

### Insulation System
Functional Insulation

### Working Voltage (rated)
- Input to Output: 75 VDC (36 Vin models)
- Input to Case: 113 VDC (72 Vin models)

### Isolation Test Voltage
- Input to Output, 60 s: 3'000 VDC
- Input to Case, 60 s: 2'250 VDC

### Creepage
- Input to Output: 2 mm min.

### Clearance
- Input to Output: 2 mm min.

### Isolation Resistance
- Input to Output, 500 VDC: 1'000 MΩ min.

### Reliability
- Calculated MTBF: 1'208'000 h (MIL-HDBK-217F, ground benign)

### Washing Process
According to Cleaning Guideline
[www.tracopower.com/info/cleaning.pdf](http://www.tracopower.com/info/cleaning.pdf)

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

### Housing Material
Copper, Nickel plated

### Base Material
Non-conductive FR4 (UL 94 V-0 rated)

### Potting Material
Silicone (UL 94 V-0 rated)

### Pin Material
Tinned Copper

### Pin Foundation Plating
Nickel (2 - 3 µm)

### Pin Surface Plating
- Tin (3 - 5 µm), matte
- Metal Case

### Mounting Type
PCB Mount

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

### Footprint Type
1" x 1"

### Soldering Profile
Lead-Free Wave Soldering
260°C / 6 s max.

### Weight
17 g

### Thermal Impedance
- Case to Ambient: 11.5 K/W typ. (with standard Heatsink)
- K/W typ. (without Heatsink): 15.5 K/W typ. (within Heatsink)
- 10.4 K/W typ. (with Heatsink THN-HS3)
- 8.8 K/W typ. (with Heatsink THN-HS4)

### Environmental Compliance
- REACH Declaration: [www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)
- REACH SVHC list compliant
- REACH Annex XVII compliant
- Exemptions: 7a, 7c-I
(Refer to component concentration only, not to the overall concentration in the product (O5A rule))
- SCIP Reference Number: 25c603dd-08f8-4fe0-b89b-aa8c8d481ef2

---

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) September 27, 2023 Page 4 / 5
Outline Dimensions

Dimensions in mm (inch)
Tolerances: x.x  ±0.5 (x.xx ±0.02)
          x.xx  ±0.25 (x.xxx ±0.01)
Pin diameter tolerance: ±0.10 (±0.004)

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No pin* / BUS / UVLO**</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>+Vin</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-Vin</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Remote On/Off</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>+Vout</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Trim</td>
<td>Common</td>
</tr>
<tr>
<td>7</td>
<td>-Vout</td>
<td></td>
</tr>
</tbody>
</table>

* If neither BUS nor UVLO is present
** UVLO function is optional