DC/DC Converter

- 10 Watt in 1” x 1” package
- Shielded metal case with isolated baseplate
- Wide 2:1 input voltage ranges
- Operating temp. range −40°C to +80°C and up to +85°C with heat-sink
- I/O isolation voltage 1500 VDC
- Input filter meets EN 55022 class A without external components
- Cost optimized design
- Industry standard pinout
- 3-year product warranty

The THL 10 is a series of industrial 10 Watt DC/DC-converters packed in the compact 1” x 1” case and is a pin to pin replacement for the popular 1” x 2” size products. The industrial standard pinout, the wide 2:1 input voltage range and the input filter that meets EN 55032 Class A (conducted) without external components make these converters easy to design in and suitable for to cost optimize many existing and new applications.

The models have short circuit and overvoltage protection and are applicable in temperature ranges of up to +80°C or +85°C with optional mounted heat sink. Typical applications are instrumentation, distributed power architectures in communication and industrial electronics.

### Models

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vnom</td>
<td>Imax</td>
<td>Vnom</td>
<td>Imax</td>
</tr>
<tr>
<td>THL 10-1210</td>
<td>3.3 VDC</td>
<td>2'500 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-1211</td>
<td>5.1 VDC</td>
<td>2'000 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-1212</td>
<td>12 VDC</td>
<td>830 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-1213</td>
<td>15 VDC</td>
<td>670 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-1221</td>
<td>+5 VDC</td>
<td>1'000 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-1222</td>
<td>+12 VDC</td>
<td>416 mA</td>
<td>-12 VDC</td>
<td>416 mA</td>
</tr>
<tr>
<td>THL 10-1223</td>
<td>+15 VDC</td>
<td>333 mA</td>
<td>-15 VDC</td>
<td>333 mA</td>
</tr>
<tr>
<td>THL 10-2410</td>
<td>3.3 VDC</td>
<td>2'500 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-2411</td>
<td>5.1 VDC</td>
<td>2'000 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
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<td>THL 10-2412</td>
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<td>830 mA</td>
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</tr>
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<td>670 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-2421</td>
<td>+5 VDC</td>
<td>1'000 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-2422</td>
<td>+12 VDC</td>
<td>416 mA</td>
<td>-12 VDC</td>
<td>416 mA</td>
</tr>
<tr>
<td>THL 10-2423</td>
<td>+15 VDC</td>
<td>333 mA</td>
<td>-15 VDC</td>
<td>333 mA</td>
</tr>
<tr>
<td>THL 10-4810</td>
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<td>2'500 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-4811</td>
<td>5.1 VDC</td>
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<td>-5 VDC</td>
<td>1'000 mA</td>
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<tr>
<td>THL 10-4812</td>
<td>12 VDC</td>
<td>830 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
</tr>
<tr>
<td>THL 10-4813</td>
<td>15 VDC</td>
<td>670 mA</td>
<td>-5 VDC</td>
<td>1'000 mA</td>
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<td>333 mA</td>
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<td>333 mA</td>
</tr>
</tbody>
</table>

### Options

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
</table>
# Input Specifications

## Input Current

<table>
<thead>
<tr>
<th></th>
<th>12 Vin models</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td>- At no load</td>
<td>15 mA typ.</td>
<td>12 mA typ.</td>
<td>10 mA typ.</td>
</tr>
<tr>
<td>- At full load</td>
<td>800 mA typ.</td>
<td>1000 mA typ.</td>
<td>1000 mA typ.</td>
</tr>
<tr>
<td></td>
<td>500 mA typ. (5.1 Vout model)</td>
<td>500 mA typ. (12 Vout model)</td>
<td>500 mA typ. (15 Vout model)</td>
</tr>
<tr>
<td></td>
<td>500 mA typ. (5.1 Vout model)</td>
<td>500 mA typ. (12 Vout model)</td>
<td>500 mA typ. (15 Vout model)</td>
</tr>
<tr>
<td></td>
<td>500 mA typ. (5 / -5 Vout model)</td>
<td>500 mA typ. (12 / -12 Vout model)</td>
<td>500 mA typ. (15 / -15 Vout model)</td>
</tr>
</tbody>
</table>

## Surge Voltage

<table>
<thead>
<tr>
<th></th>
<th>12 Vin models</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25 VDC max. (1 s max.)</td>
<td>50 VDC max. (1 s max.)</td>
<td>100 VDC max. (1 s max.)</td>
</tr>
</tbody>
</table>

## Under Voltage Lockout

<table>
<thead>
<tr>
<th></th>
<th>12 Vin models</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.5 VDC max.</td>
<td>17 VDC max.</td>
<td>34 VDC max.</td>
</tr>
</tbody>
</table>

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

## Recommended Input Fuse

<table>
<thead>
<tr>
<th></th>
<th>Internal Pi-Type</th>
</tr>
</thead>
</table>

## Output Specifications

### Voltage Set Accuracy

<table>
<thead>
<tr>
<th>Regulation</th>
<th>12 Vin models</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Input Variation (Vmin - Vmax)</td>
<td>1% max.</td>
<td>1% max.</td>
<td>1% max.</td>
</tr>
<tr>
<td>- Load Variation (0 - 100%)</td>
<td>0.5% max.</td>
<td>1% max. (Output 1)</td>
<td>1% max. (Output 2)</td>
</tr>
<tr>
<td>- Voltage Balance (symmetrical load)</td>
<td>2% max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cross Regulation (25% / 100% asym. load)</td>
<td>5% max.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ripple and Noise (20 MHz Bandwidth)

<table>
<thead>
<tr>
<th></th>
<th>12 Vin models</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td>- single output</td>
<td>3.3 Vout models: 80 mVp-p typ.</td>
<td>5.1 Vout models: 80 mVp-p typ.</td>
<td>15 Vout models: 100 mVp-p typ.</td>
</tr>
<tr>
<td></td>
<td>12 Vout models: 100 mVp-p typ.</td>
<td>15 Vout models: 100 mVp-p typ.</td>
<td></td>
</tr>
<tr>
<td>- dual output</td>
<td>5 / -5 Vout models: 80 / 80 mVp-p typ.</td>
<td>12 / -12 Vout models: 100 / 100 mVp-p typ.</td>
<td>15 / -15 Vout models: 100 / 100 mVp-p typ.</td>
</tr>
</tbody>
</table>

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

- single output
  3.3 Vout models: 4’700 µF max.
  5.1 Vout models: 2’200 µF max.
  12 Vout models: 330 µF max.
  15 Vout models: 220 µF max.

- dual output
  5 / -5 Vout models: 1’000 / 1’000 µF max.
  12 / -12 Vout models: 150 / 150 µF max.
  15 / -15 Vout models: 100 / 100 µF max.

Minimum Load
Not required

Temperature Coefficient
±0.02 %/K max.

Short Circuit Protection
Continuous, Automatic recovery

Output Current Limitation
110% min. of lout max.
150% typ. of lout max.

Transient Response
- Response Deviation
  3% typ. / 5% max. (75% to 100% Load Step)
- Response Time
  300 µs typ. (75% to 100% Load Step)

Safety Specifications

Standards
- IT / Multimedia Equipment: CSA-C22.2, No. 60950-1
- EN 60950-1
- EN 62368-1
- IEC 60950-1
- IEC 62368-1
- UL 60950-1
- UL 62368-1

Certification Documents
www.tracopower.com

Pollution Degree
PD 3

EMC Specifications

EMI Emissions
- Conducted Emissions: EN 55032 class A (with external filter)
  FCC Part 15 class A (with external filter)
- Radiated Emissions: EN 55032 class A (with external filter)
  FCC Part 15 class A (with external filter)

External filter proposal:
www.tracopower.com/overview/thl10

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, ±1 kV, perf. criteria A
- Conducted RF Disturbances
  - Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
- PF Magnetic Field
  - Continuous: EN 61000-4-8, 3 A/m, perf. criteria A

General Specifications

Relative Humidity
95% max. (non-condensing)

Temperature Ranges
- Operating Temperature
  -40°C to +80°C
- Case Temperature
  -40°C to +85°C (with Heat Sink)
- Storage Temperature
  +100°C max.
  -50°C to +125°C

Power Derating
- High Temperature
  2.5 %/K above 60°C
  3.3 %/K above 70°C (with Heat Sink)

Cooling System
Natural convection (20 LFM)

Altitude During Operation
6’000 m max.

Switching Frequency
330 kHz typ. (PWM)

Insulation System
Functional Insulation

Isolation Test Voltage
- Input to Output, 60 s
  1’500 VDC
- Input to Output, 1 s
  1’800 VDC

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 MΩ min.

**Isolation Capacitance**  - Input to Output, 100 kHz, 1 V
2'000 pF max.

**Reliability**  - Calculated MTBF
2'596'000 h (MIL-HDBK-217F, ground benign)

**Washing Process**
According to Cleaning Guideline
www.tracopower.com/info/cleaning.pdf

**Housing Material**
Alu alloy, black anodized coating

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

**Potting Material**
Epoxy (UL 94 V-0 rated)

**Pin Foundation Plating**
Nickel (2 - 4 µm)

**Pin Surface Plating**
Tin (5 - 7 µm), matte

**Housing Type**
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 / 10 s max.

**Weight**
15 g

**Thermal Impedance**  - Case to Ambient
21 K/W typ.
16 K/W typ. (with Heat Sink)

**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
  (RoHS exemptions not refer to the component concentration only, not to the overall concentration in the product (OE5 rule))
  357e6a24-290d-4d0d-9f6f-9a9b9c15b45d

**SCIP Reference Number**
357e6a24-290d-4d0d-9f6f-9a9b9c15b45d

**Supporting Documents**
Overview Link (for additional Documents)
www.tracopower.com/overview/thl10

**Outline Dimensions**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>2</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>3</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>4</td>
<td>No pin</td>
<td>Common</td>
</tr>
<tr>
<td>5</td>
<td>–Vout</td>
<td>–Vout</td>
</tr>
</tbody>
</table>

Pinout

Dimensions in mm (inch)
Tolerances: x.x ±0.5 (x.xx ±0.02)
Pin diameters: x.x ±0.25 (x.xxx ±0.001)
Pin pitch tolerances: ±0.25 (0.01)
Pin diameter tolerance: x.x ±0.5 (x.xx ±0.002)