DC/DC Converter THB 6 Series, 6 Watt

- I/O isolation 3000 VACrms rated for 1000 Vrms (1410 Vpk) working voltage
- Medical safety to UL 60601-1 and IEC/EN 60601-1 3rd edition, 2 x MOOP
- Ultra compact DIP-24 package
- Wide 2:1 input voltage ranges
- Operating temperature range –40°C to +75°C
- Low leakage current
- Short circuit protection
- Input filter to meet EN 55022, Class A
- 3-year product warranty

The THB 6 series is a new range of high performance, regulated DC/DC converters in a DIP-24 plastic package. A reinforced I/O-isolation system and a wide 2:1 input voltage range make this product the best choice for many demanding applications like transportation systems, industrial controls, medical equipment, instrumentation, everywhere where high basic-, supplementary- or reinforced insulation is required to meet requested safety standards. A high efficiency allows safe operation in a temperature range of –40°C to +71°C. Other features of this product are over voltage protection and internal EMI-input filter to meet EN 55022 class A without additional components. Full SMD-design with exclusive use of ceramic capacitors ensures a very high reliability and a long product lifetime.

**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></td>
<td>Vnom</td>
<td>Imax</td>
<td>Vnom</td>
</tr>
<tr>
<td>THB 6-1211</td>
<td>9 - 18 VDC (12 VDC nom.)</td>
<td>5 VDC</td>
<td>1'000 mA</td>
<td>–12 VDC</td>
</tr>
<tr>
<td>THB 6-1212</td>
<td>12 VDC</td>
<td>1000 mA</td>
<td>78 %</td>
<td></td>
</tr>
<tr>
<td>THB 6-1222</td>
<td>1000 mA</td>
<td>78 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THB 6-1223</td>
<td>1000 mA</td>
<td>78 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THB 6-2411</td>
<td>18 - 36 VDC (24 VDC nom.)</td>
<td>5 VDC</td>
<td>1'000 mA</td>
<td>–12 VDC</td>
</tr>
<tr>
<td>THB 6-2412</td>
<td>12 VDC</td>
<td>1000 mA</td>
<td>80 %</td>
<td></td>
</tr>
<tr>
<td>THB 6-2422</td>
<td>500 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THB 6-2423</td>
<td>250 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THB 6-4811</td>
<td>36 - 75 VDC (48 VDC nom.)</td>
<td>5 VDC</td>
<td>1'000 mA</td>
<td>–12 VDC</td>
</tr>
<tr>
<td>THB 6-4812</td>
<td>12 VDC</td>
<td>1000 mA</td>
<td>80 %</td>
<td></td>
</tr>
<tr>
<td>THB 6-4822</td>
<td>500 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THB 6-4823</td>
<td>250 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Input Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>12 Vin models</th>
<th>24 Vin models</th>
<th>48Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Current</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At no load</td>
<td>30 mA typ.</td>
<td>20 mA typ.</td>
<td>10 mA typ.</td>
</tr>
<tr>
<td>- At full load</td>
<td>570 mA typ. (5 Vout model)</td>
<td>640 mA typ. (12 Vout model)</td>
<td>280 mA typ. (5 Vout model)</td>
</tr>
<tr>
<td>Voltage</td>
<td>640 mA typ. (12 / -12 Vout model)</td>
<td>315 mA typ. (12 Vout model)</td>
<td>140 mA typ. (5 Vout model)</td>
</tr>
<tr>
<td>Voltage</td>
<td>640 mA typ. (15 / -15 Vout model)</td>
<td>315 mA typ. (12 / -12 Vout model)</td>
<td>155 mA typ. (12 Vout model)</td>
</tr>
<tr>
<td>Voltage</td>
<td>315 mA typ. (15 / -15 Vout model)</td>
<td>315 mA typ. (12 / -12 Vout model)</td>
<td>155 mA typ. (12 / -12 Vout model)</td>
</tr>
<tr>
<td>Voltage</td>
<td>315 mA typ. (15 / -15 Vout model)</td>
<td>155 mA typ. (12 / -12 Vout model)</td>
<td>155 mA typ. (15 / -15 Vout model)</td>
</tr>
<tr>
<td><strong>Surge Voltage</strong></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>
<tr>
<td><strong>Start-up Voltage</strong></td>
<td>7 VDC min. / 8 VDC typ. / 9 VDC max.</td>
<td>13 VDC min. / 15 VDC typ. / 18 VDC max.</td>
<td>30 VDC min. / 33 VDC typ. / 36 VDC max.</td>
</tr>
<tr>
<td><strong>Under Voltage Lockout</strong></td>
<td>8.5 VDC max.</td>
<td>16 VDC max.</td>
<td>34 VDC max.</td>
</tr>
<tr>
<td><strong>Reflected Ripple Current</strong></td>
<td>60 mA typ.</td>
<td>30 mA typ.</td>
<td>15 mA typ.</td>
</tr>
<tr>
<td><strong>Recommended Input Fuse</strong></td>
<td>1’200 mA (slow blow)</td>
<td>600 mA (slow blow)</td>
<td>300 mA (slow blow)</td>
</tr>
<tr>
<td><strong>Input Filter</strong></td>
<td>Internal Pi-Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Short Circuit Input Power</strong></td>
<td>3 W max.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>±1% max.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage Set Accuracy</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Regulation</strong></td>
<td></td>
</tr>
<tr>
<td>- Input Variation (Vmin - Vmax)</td>
<td>0.5% max.</td>
</tr>
<tr>
<td>- Load Variation (25 - 100%)</td>
<td>1% max.</td>
</tr>
<tr>
<td><strong>Ripple and Noise</strong></td>
<td></td>
</tr>
<tr>
<td>(20 MHz Bandwidth)</td>
<td></td>
</tr>
<tr>
<td>- single output</td>
<td>5 Vout models: 75 mVp-p typ.</td>
</tr>
<tr>
<td>- dual output</td>
<td>12 / -12 Vout models: 100 / 100 mVp-p typ.</td>
</tr>
<tr>
<td><strong>Capacitive Load</strong></td>
<td></td>
</tr>
<tr>
<td>- single output</td>
<td>5 Vout models: 1’000 µF max.</td>
</tr>
<tr>
<td>- dual output</td>
<td>12 / -12 Vout models: 220 / 220 µF max.</td>
</tr>
</tbody>
</table>

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
Minimum Load 20 % of Iout max.
(Operation at lower load will not damage the converter, but it may not meet all specifications)

Temperature Coefficient ±0.05 %/K max.

Short Circuit Protection Continuous, Automatic recovery

Overload Protection Foldback Mode

Output Current Limitation 120% min. of Iout max.
150% typ. of Iout max.

Transient Response - Response Deviation 3% typ. / 6% max. (75% to 100% Load Step)
- Response Time 300 µs typ. / 500 µs max. (75% to 100% Load Step)

Safety Specifications

Standards - IT / Multimedia Equipment CSA-C22.2, No. 60950-1
Designated for IEC/EN/UL 62368-1 (not certified)
EN 60950-1
IEC 60950-1
UL 60950-1
EN 60601-1
IEC 60601-1
ANSI/AAMI ES 60601-1
CSA-C22.2, No 60601-1
2 x MOOP (Means Of Operator Protection)
MOPP (Means Of Patient Protection)
www.tracopower.com/overview/thb6

Pollution Degree PD 2

Over Voltage Category OVC II

EMC Specifications

EMI Emissions - Conducted Emissions EN 60601-1-2 edition 4 (Medical Devices)
EN 55032 class A (internal filter)
EN 55032 class B (with external filter)
FCC Part 15 class A (internal filter)
FCC Part 15 class B (with external filter)
EN 55032 class A (internal filter)
EN 55032 class B (with external filter)
FCC Part 15 class A (internal filter)
FCC Part 15 class B (with external filter)
External filter proposal: www.tracopower.com/overview/thb6

Radiated Emissions EN 60601-1-2 edition 4 (Medical Devices)
EN 55032 class A (with external filter)
FCC Part 15 class A (with external filter)
FCC Part 15 class B (with external filter)

EMS Immunity EN 60601-1-2 edition 4 (Medical Devices)

General Specifications

Relative Humidity 95% max. (non-condensing)

Temperature Ranges - Operating Temperature -40°C to +75°C
- Case Temperature +95°C max.
- Storage Temperature -50°C to +125°C

Power Derating - High Temperature 2.5 %/K above 55°C
See application note: www.tracopower.com/overview/thb6

Cooling System Natural convection (20 LFM)

Altitude During Operation 5'000 m max.

Switching Frequency 150 kHz typ. (PWM)

Insulation System Reinforced Insulation

Working Voltage (rated) 1'000 VAC

Isolation Test Voltage - Input to Output, 60 s 4'000 VDC
- Input to Output, 500 VDC 10'000 MΩ min.

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

### Isolation Capacitance
- Input to Output, 100 kHz, 1 V
  - 7 pF typ.
  - 13 pF max.

### Leaksage Current
- Earth Leakage Current
  - 2 µA max.

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

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

### Housing Material
- Non-conductive Plastic (UL 94 V-0 rated)

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

### Pin Material
- Copper Alloy (C6801)

### Pin Foundation Plating
- Nickel (2.5 µm min.)

### Pin Surface Plating
- Gold (75 - 125 nm), glossy

### Housing Type
- Plastic Case

### Mounting Type
- PCB Mount

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

### Footprint Type
- DIP24

### Soldering Profile
- Lead-Free Wave Soldering
  - 260°C / 10 s max.

### Weight
- 18 g

### 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, 7c-I
  - (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (OE5A rule))

- SCIP Reference Number
  - b96497e2-5138-4c12-9ba3-0f6e5882b328

### Supporting Documents

<table>
<thead>
<tr>
<th>Overview Link</th>
<th>Supporting Documents</th>
<th><a href="http://www.tracopower.com/overview/thb6">www.tracopower.com/overview/thb6</a></th>
</tr>
</thead>
</table>

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)
- Pin diameter Ø 0.6 ±0.05 (0.024 ±0.002)
- Tolerances ±0.25 (±0.01)
- Pin pitch tolerances ±0.13 (±0.005)

<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>11</td>
<td>No pin</td>
<td>Common</td>
</tr>
<tr>
<td>12</td>
<td>–Vout</td>
<td>No pin</td>
</tr>
<tr>
<td>13</td>
<td>+Vout</td>
<td>–Vout</td>
</tr>
<tr>
<td>15</td>
<td>No pin</td>
<td>+Vout</td>
</tr>
<tr>
<td>23</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>24</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
</tbody>
</table>

Dimensions in mm (inch)
- Pin diameter Ø 0.6 ±0.05 (0.024 ±0.002)
- Tolerances ±0.25 (±0.01)
- Pin pitch tolerances ±0.13 (±0.005)