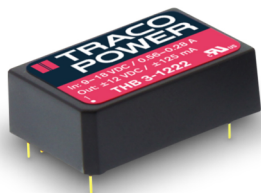


- Supplementary and reinforced insulation
- I/O isolation 4800 VACrms rated for 1000 Vrms (1410 Vpk) working voltage
- Medical safety to ES 60601-1 and IEC/EN 60601-1 3rd edition, 2 x MOOP
- Isolation test voltage 6000 Vpk
- Wide 2:1 input voltage ranges
- Extended operating temperature range –40°C to 85°C max.
- Input filter meets EN55022, class A
- Continuous short-circuit protection
- High reliability
- 3-year product warranty



ES 60601-1 IEC 60601-1  
UL 60950-1 IEC 60950-1

The THB 3 series is a 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 equipments, instrumentations, 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 +85°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 ensure a very high reliability and a long product lifetime.

### Models

| Order Code | Input Voltage Range          | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|------------|------------------------------|----------|------------------|----------|------------------|-----------------|
|            |                              | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| THB 3-0511 | 4.5 - 9 VDC<br>(5 VDC nom.)  | 5 VDC    | 600 mA           |          |                  | 70 %            |
| THB 3-0512 |                              | 12 VDC   | 250 mA           |          |                  | 75 %            |
| THB 3-0515 |                              | 24 VDC   | 125 mA           |          |                  | 76 %            |
| THB 3-0522 |                              | +12 VDC  | 125 mA           | –12 VDC  | 125 mA           | 75 %            |
| THB 3-0523 |                              | +15 VDC  | 100 mA           | –15 VDC  | 100 mA           | 75 %            |
| THB 3-1211 | 9 - 18 VDC<br>(12 VDC nom.)  | 5 VDC    | 600 mA           |          |                  | 74 %            |
| THB 3-1212 |                              | 12 VDC   | 250 mA           |          |                  | 80 %            |
| THB 3-1215 |                              | 24 VDC   | 125 mA           |          |                  | 81 %            |
| THB 3-1222 |                              | +12 VDC  | 125 mA           | –12 VDC  | 125 mA           | 80 %            |
| THB 3-1223 |                              | +15 VDC  | 100 mA           | –15 VDC  | 100 mA           | 80 %            |
| THB 3-2411 | 18 - 36 VDC<br>(24 VDC nom.) | 5 VDC    | 600 mA           |          |                  | 78 %            |
| THB 3-2412 |                              | 12 VDC   | 250 mA           |          |                  | 83 %            |
| THB 3-2415 |                              | 24 VDC   | 125 mA           |          |                  | 84 %            |
| THB 3-2422 |                              | +12 VDC  | 125 mA           | –12 VDC  | 125 mA           | 83 %            |
| THB 3-2423 |                              | +15 VDC  | 100 mA           | –15 VDC  | 100 mA           | 83 %            |
| THB 3-4811 | 36 - 75 VDC<br>(48 VDC nom.) | 5 VDC    | 600 mA           |          |                  | 78 %            |
| THB 3-4812 |                              | 12 VDC   | 250 mA           |          |                  | 83 %            |
| THB 3-4815 |                              | 24 VDC   | 125 mA           |          |                  | 84 %            |
| THB 3-4822 |                              | +12 VDC  | 125 mA           | –12 VDC  | 125 mA           | 83 %            |
| THB 3-4823 |                              | +15 VDC  | 100 mA           | –15 VDC  | 100 mA           | 83 %            |

## Input Specifications

|                           |                |                                                                                                                                                                                                                                     |
|---------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Current             | - At no load   | 5 Vin models: 40 mA typ.<br>12 Vin models: 30 mA typ.<br>24 Vin models: 20 mA typ.<br>48 Vin models: 10 mA typ.                                                                                                                     |
|                           | - At full load | 5 Vin models: 825 mA typ.<br>12 Vin models: 325 mA typ.<br>24 Vin models: 150 mA typ.<br>48 Vin models: 75 mA typ.                                                                                                                  |
| Surge Voltage             |                | 5 Vin models: 11 VDC max. (1 s max.)<br>12 Vin models: 25 VDC max. (1 s max.)<br>24 Vin models: 50 VDC max. (1 s max.)<br>48 Vin models: 100 VDC max. (1 s max.)                                                                    |
| Start-up Voltage          |                | 5 Vin models: 3.7 VDC min. / 4 VDC typ. / 4.5 VDC max.<br>12 Vin models: 8 VDC min. / 8.5 VDC typ. / 9 VDC max.<br>24 Vin models: 15 VDC min. / 17 VDC typ. / 18 VDC max.<br>48 Vin models: 30 VDC min. / 33 VDC typ. / 36 VDC max. |
| Under Voltage Lockout     |                | 5 Vin models: 4 VDC max.<br>12 Vin models: 8.5 VDC max.<br>24 Vin models: 17 VDC max.<br>48 Vin models: 34 VDC max.                                                                                                                 |
| Reflected Ripple Current  |                | 5 Vin models: 60 mA typ.<br>12 Vin models: 30 mA typ.<br>24 Vin models: 15 mA typ.<br>48 Vin models: 10 mA typ.                                                                                                                     |
| Recommended Input Fuse    |                | 5 Vin models: 2'000 mA (slow blow)<br>12 Vin models: 1'000 mA (slow blow)<br>24 Vin models: 500 mA (slow blow)<br>48 Vin models: 250 mA (slow blow)<br>(The need of an external fuse has to be assessed in the final application.)  |
| Input Filter              |                | Internal Pi-Type                                                                                                                                                                                                                    |
| Short Circuit Input Power |                | 2 W max.                                                                                                                                                                                                                            |

## Output Specifications

|                                        |                                 |                                                                                                   |
|----------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------|
| Voltage Set Accuracy                   |                                 | ±1% max.                                                                                          |
| Regulation                             | - Input Variation (Vmin - Vmax) | single output models: 0.5% max.<br>dual output models: 0.5% max.                                  |
|                                        | - Load Variation (25 - 100%)    | single output models: 1% max.<br>dual output models: 2% max. (Output 1)<br>2% max. (Output 2)     |
| Ripple and Noise<br>(20 MHz Bandwidth) | - single output                 | 5 Vout models: 100 mVp-p max.<br>12 Vout models: 150 mVp-p max.<br>24 Vout models: 150 mVp-p max. |
|                                        | - dual output                   | 12 / -12 Vout models: 150 / 150 mVp-p max.<br>15 / -15 Vout models: 150 / 150 mVp-p max.          |
|                                        | - single output                 | 5 Vout models: 75 mVp-p typ.<br>12 Vout models: 100 mVp-p typ.<br>24 Vout models: 100 mVp-p typ.  |
|                                        | - dual output                   | 12 / -12 Vout models: 100 / 100 mVp-p typ.<br>15 / -15 Vout models: 100 / 100 mVp-p typ.          |
|                                        | - single output                 | 5 Vout models: 1'000 µF max.<br>12 Vout models: 470 µF max.<br>24 Vout models: 470 µF max.        |
|                                        | - dual output                   | 12 / -12 Vout models: 220 / 220 µF max.<br>15 / -15 Vout models: 220 / 220 µF max.                |

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

|                           |                                                                                                                                  |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Minimum Load              | 15 % of I <sub>out</sub> max.<br>(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 I <sub>out</sub> max.<br>150% typ. of I <sub>out</sub> max.                                                         |
| Transient Response        | - Response Deviation<br>- Response Time                                                                                          |
|                           | 3% typ. / 6% max. (75% to 100% Load Step)<br>150 µs typ. / 500 µs max. (75% to 100% Load Step)                                   |

## Safety Specifications

|                       |                             |                                                                                                                                                                                                                                                       |
|-----------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standards             | - IT / Multimedia Equipment | CSA-C22.2, No. 60950-1<br>Designed for IEC/EN/UL 62368-1 (not certified)<br>EN 60950-1<br>IEC 60950-1<br>UL 60950-1                                                                                                                                   |
|                       | - Medical Equipment         | EN 60601-1<br>IEC 60601-1<br>ANSI/AAMI ES 60601-1<br>CSA-C22.2, No 60601-1<br>2 x MOOP (Means Of Operator Protection)<br>MOPP (Means Of Patient Protection)<br><a href="http://www.tracopower.com/overview/thb3">www.tracopower.com/overview/thb3</a> |
|                       | - Certification Documents   |                                                                                                                                                                                                                                                       |
| Pollution Degree      |                             | PD 2                                                                                                                                                                                                                                                  |
| Over Voltage Category |                             | OVC II                                                                                                                                                                                                                                                |

## EMC Specifications

|                 |                       |                                                                                                                                                                                                                        |
|-----------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EMI (Emissions) | - Conducted Emissions | EN 60601-1-2 edition 4 (Medical Devices)<br>EN 55032 class A (internal filter)<br>EN 55032 class B (with external filter)<br>FCC 47 Part 15 class A (internal filter)<br>FCC 47 Part 15 class B (with external filter) |
|                 | - Radiated Emissions  | EN 55032 class A (internal filter)<br>EN 55032 class B (with external filter)<br>FCC 47 Part 15 class A (internal filter)<br>FCC 47 Part 15 class B (with external filter)                                             |
|                 |                       | External filter proposal: <a href="http://www.tracopower.com/overview/thb3">www.tracopower.com/overview/thb3</a>                                                                                                       |
| EMS (Immunity)  |                       | EN 60601-1-2 edition 4 (Medical Devices)                                                                                                                                                                               |

## General Specifications

|                           |                                                                        |                                                                                                              |
|---------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Relative Humidity         |                                                                        | 95% max. (non condensing)                                                                                    |
| Temperature Ranges        | - Operating Temperature<br>- Case Temperature<br>- Storage Temperature | -40°C to +85°C<br>+100°C max.<br>-50°C to +125°C                                                             |
| Power Derating            | - High Temperature                                                     | 3.3 %/K above 70°C                                                                                           |
|                           |                                                                        | See application note: <a href="http://www.tracopower.com/overview/thb3">www.tracopower.com/overview/thb3</a> |
| 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                                                                                                    |
| Isolation Resistance      | - 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.

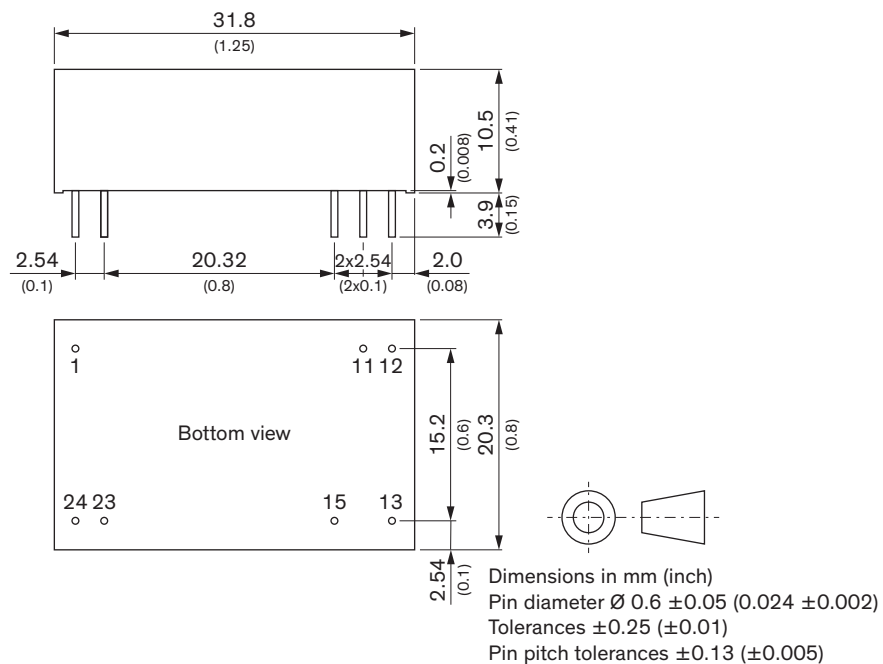
|                          |                                 |                                                                                                                                                                                                                                                                |
|--------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Isolation Capacitance    | - Input to Output, 100 kHz, 1 V | 7 pF typ.<br>13 pF max.                                                                                                                                                                                                                                        |
| Leakage 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<br><a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>                                                                                                                              |
| 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<br>260°C / 6 s max.                                                                                                                                                                                                                   |
| Weight                   |                                 | 13 g                                                                                                                                                                                                                                                           |
| Environmental Compliance | - REACH Declaration             | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant                                                                                    |
|                          | - RoHS Declaration              | <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7(a)<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) |
|                          | - SCIP Reference Number         | bfebbff7-4ff9-4d1b-bd08-c85cccdbc535                                                                                                                                                                                                                           |

### Additional Information

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| Supporting Documents       | <a href="http://www.tracopower.com/overview/thb3">www.tracopower.com/overview/thb3</a>         |
| Frequently Asked Questions | <a href="http://www.tracopower.com/glossary-faq">www.tracopower.com/glossary-faq</a>           |
| Glossary                   | <a href="http://www.tracopower.com/info/glossary.pdf">www.tracopower.com/info/glossary.pdf</a> |

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

## Outline Dimensions



| Pinout |            |            |
|--------|------------|------------|
| Pin    | Single     | Dual       |
| 1      | +Vin (Vcc) | +Vin (Vcc) |
| 11     | No pin     | Common     |
| 12     | -Vout      | No pin     |
| 13     | +Vout      | -Vout      |
| 15     | No pin     | +Vout      |
| 23     | -Vin (GND) | -Vin (GND) |
| 24     | -Vin (GND) | -Vin (GND) |