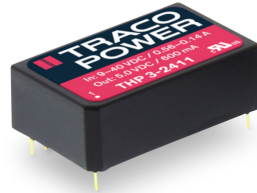


- Ultra wide 4:1 input voltage range up to 160 VDC
- I/O isolation voltage 4000 VACrms
- Reinforced insulation rated for working voltage 1000 VAC
- 2 x MOOP Medical safety according to ANSI/AAMI ES 60601-1:2005 and IEC/EN 60601-1 3rd edition
- Industrial safety to IEC/EN/UL 62368-1
- Operating temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$
- Input filter to meet EN 55011 & EN 55032, class A
- Low leakage current  $<2\mu\text{A}$
- 3-year product warranty



The THP 3 series is a new range of high performance 3W DC/DC converters in a low profile DIL-24 package with standard industry pin-out. The very high I/O-isolation system of these converters and input voltages up to 160 VDC make this product the best choice for many demanding applications in railroad and transportation systems, medical equipment, instrumentation, everywhere where high basic-, supplementary- or reinforced insulation is requested to meet specific safety standards. A high efficiency allows safe operation in a temperature range of  $-40\text{ }^{\circ}\text{C}$  to  $+70\text{ }^{\circ}\text{C}$  at full load. 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> |                 |
| THP 3-2411 | 9 - 40 VDC<br>(24 VDC nom.)    | 5 VDC    | 600 mA           |          |                  | 78 %            |
| THP 3-2412 |                                | 12 VDC   | 250 mA           |          |                  | 83 %            |
| THP 3-2422 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 83 %            |
| THP 3-2423 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 83 %            |
| THP 3-4811 | 18 - 80 VDC<br>(48 VDC nom.)   | 5 VDC    | 600 mA           |          |                  | 78 %            |
| THP 3-4812 |                                | 12 VDC   | 250 mA           |          |                  | 83 %            |
| THP 3-4822 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 83 %            |
| THP 3-4823 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 83 %            |
| THP 3-7211 | 36 - 160 VDC<br>(110 VDC nom.) | 5 VDC    | 600 mA           |          |                  | 78 %            |
| THP 3-7212 |                                | 12 VDC   | 250 mA           |          |                  | 83 %            |
| THP 3-7222 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 83 %            |
| THP 3-7223 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 83 %            |

## Input Specifications

|                           |                |   |
|---------------------------|----------------|---|
| Input Current             | - At no load   | 24 Vin models: <b>20 mA typ.</b><br>48 Vin models: <b>10 mA typ.</b><br>110 Vin models: <b>5 mA typ.</b>  |
|                           | - At full load | 24 Vin models: <b>160 mA typ.</b> (5 Vout model)<br><b>151 mA typ.</b> (12 Vout model)<br><b>151 mA typ.</b> (12 / -12 Vout model)<br><b>151 mA typ.</b> (15 / -15 Vout model)<br>48 Vin models: <b>80 mA typ.</b> (5 Vout model)<br><b>75 mA typ.</b> (12 Vout model)<br><b>75 mA typ.</b> (12 / -12 Vout model)<br><b>75 mA typ.</b> (15 / -15 Vout model)<br>110 Vin models: <b>35 mA typ.</b> (5 Vout model)<br><b>33 mA typ.</b> (12 Vout model)<br><b>33 mA typ.</b> (12 / -12 Vout model)<br><b>33 mA typ.</b> (15 / -15 Vout model) |
| Surge Voltage             |                | 24 Vin models: <b>50 VDC max.</b> (1 s max.)<br>48 Vin models: <b>100 VDC max.</b> (1 s max.)<br>110 Vin models: <b>180 VDC max.</b> (1 s max.)   |
| Start-up Voltage          |                | 24 Vin models: <b>8 VDC min. / 8.5 VDC typ. / 9 VDC max.</b><br>48 Vin models: <b>13 VDC min. / 15 VDC typ. / 17 VDC max.</b><br>110 Vin models: <b>26 VDC min. / 30 VDC typ. / 34 VDC max.</b>   |
| Under Voltage Lockout     |                | 24 Vin models: <b>8.5 VDC max.</b><br>48 Vin models: <b>16 VDC max.</b><br>110 Vin models: <b>32 VDC max.</b>   |
| Reflected Ripple Current  |                | 24 Vin models: <b>15 mA typ.</b><br>48 Vin models: <b>8 mA typ.</b><br>110 Vin models: <b>3 mA typ.</b>   |
| Recommended Input Fuse    |                | 24 Vin models: <b>1'000 mA</b> (slow blow)<br>48 Vin models: <b>600 mA</b> (slow blow)<br>110 Vin models: <b>300 mA</b> (slow blow)<br>(The need of an external fuse has to be assessed in the final application.)  |
| Input Filter              |                | <b>Internal Pi-Type</b>   |
| Short Circuit Input Power |                | <b>2 W max.</b>   |

## Output Specifications

|                                     |                                      |  |   |
|-------------------------------------|--------------------------------------|--|---|
| Voltage Set Accuracy                |                                      | <b>±1% max.</b>  |   |
| Regulation                          | - Input Variation (Vmin - Vmax)      | single output models: <b>0.5% max.</b><br>dual output models: <b>0.5% max.</b>                                     |   |
|                                     | - Load Variation (25 - 100%)         | single output models: <b>1% max.</b><br>dual output models: <b>1% max.</b> (Output 1)<br><b>1% max.</b> (Output 2) |   |
|                                     | - Voltage Balance (symmetrical load) | dual output models: <b>2% max.</b>   |   |
|                                     | Ripple and Noise (20 MHz Bandwidth)  |  |   |
| Ripple and Noise (20 MHz Bandwidth) | - single output                      | 5 Vout models: <b>75 mVp-p typ.</b><br>12 Vout models: <b>100 mVp-p typ.</b>                                       |   |
|                                     | - dual output                        | 12 / -12 Vout models: <b>100 / 100 mVp-p typ.</b><br>15 / -15 Vout models: <b>100 / 100 mVp-p typ.</b>             |   |
|                                     | - single output                      | 5 Vout models: <b>100 mVp-p max.</b><br>12 Vout models: <b>150 mVp-p max.</b>                                      |   |
|                                     | - dual output                        | 12 / -12 Vout models: <b>150 / 150 mVp-p max.</b><br>15 / -15 Vout models: <b>150 / 150 mVp-p max.</b>             |   |
|                                     |                                      |  | (To further reduce Ripple and Noise, a capacitor with 3.3 µF X7R is recommended.) |
|                                     |                                      |  |   |

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

|                           |                         |  |
|---------------------------|-------------------------|--|
| Capacitive Load           | - single output         | 5 Vout models: 1'000 µF max.<br>12 Vout models: 470 µF max.  |
|                           | - dual output           | 12 / -12 Vout models: 220 / 220 µF max.<br>15 / -15 Vout models: 220 / 220 µF max.                                   |
|                           | Minimum Load            | 15 % of Iout max.<br>(Operation at lower load will not damage the converter, but it may not meet all specifications) |
|                           | Temperature Coefficient | ±0.05 %/K max.   |
| Start-up Time             |                         | 40 ms max.   |
| Short Circuit Protection  |                         | Continuous, Automatic recovery   |
| Overload Protection       |                         | Foldback Mode  |
| Output Current Limitation |                         | 120% min. of Iout max.<br>150% typ. of Iout max.   |
| Transient Response        | - Response Deviation    | 3% typ. / 6% max. (25% Load Step)  |
|                           | - Response Time         | 150 µs typ. / 500 µs max. (25% Load Step)  |

### Safety Specifications

|                       |                             |   |
|-----------------------|-----------------------------|---|
| Safety Standards      | - IT / Multimedia Equipment | EN 62368-1<br>IEC 62368-1<br>UL 62368-1   |
|                       | - 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><a href="http://www.tracopower.com/overview/thp3">www.tracopower.com/overview/thp3</a> |
|                       | - Certification Documents   |   |
| Pollution Degree      |                             | PD 2  |
| Over Voltage Category |                             | OVC II  |

### EMC Specifications

|               |                             |  |
|---------------|-----------------------------|--|
| EMI Emissions | - Conducted Emissions       | EN 55011 class A (internal filter)<br>EN 55011 class B (with external filter)<br>EN 55032 class A (internal filter)<br>EN 55032 class B (with external filter)   |
|               | - Radiated Emissions        | EN 55011 class A (internal filter)<br>EN 55011 class B (with external filter)<br>EN 55032 class A (internal filter)<br>EN 55032 class B (with external filter)<br>External filter proposal: <a href="http://www.tracopower.com/overview/thp3">www.tracopower.com/overview/thp3</a> |
| EMS Immunity  | - Electrostatic Discharge   | Air: EN 61000-4-2, ±8 kV, perf. criteria A   |
|               | - RF Electromagnetic Field  | EN 61000-4-3, 10 V/m, perf. criteria A   |
|               | - EFT (Burst) / Surge       | EN 61000-4-4, ±2 kV, perf. criteria A<br>EN 61000-4-5, ±1 kV, perf. criteria A   |
|               | - Conducted RF Disturbances | Ext. input component: 220 µF / 220 V<br>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 +85°C  |
|                           | - Case Temperature      | +100°C max.   |
|                           | - Storage Temperature   | -50°C to +125°C   |
| Power Derating            | - High Temperature      | 3.33 %/K above 70°C<br>See application note: <a href="http://www.tracopower.com/overview/thp3">www.tracopower.com/overview/thp3</a> |
| Cooling System            |                         | Natural convection (20 LFM)   |
| Altitude During Operation |                         | 5'000 m max.  |

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

|                          |                                 |   |
|--------------------------|---------------------------------|---|
| Switching Frequency      |                                 | 100 - 160 kHz (PWM)<br>150 kHz typ. (PWM)   |
| Insulation System        |                                 | Reinforced Insulation   |
| Working Voltage (rated)  |                                 | 1'000 VAC   |
| Isolation Test Voltage   | - Input to Output, 60 s         | 4'000 VAC   |
| Isolation Resistance     | - Input to Output, 500 VDC      | 10'000 MΩ min.  |
| Isolation Capacitance    | - Input to Output, 100 kHz, 1 V | 7 pF typ.<br>13 pF max.   |
| Leakage Current          | - Touch Current                 | 2 μA max.   |
| Reliability              | - Calculated MTBF               | 1'000'000 h (MIL-HDBK-217F, ground benign)  |
| Washing Process          |                                 | Allowed (hermetical product)  |
|                          | See Cleaning Guideline:         | <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)  |
| Base 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        |                                 | Wave Soldering<br>260°C / 10 s max.   |
| Weight                   |                                 | 13.3 g  |
| Thermal Impedance        | - Case to Ambient               | 21.3 K/W typ.   |
| 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><b>Exemptions: 7a</b><br>(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.) |

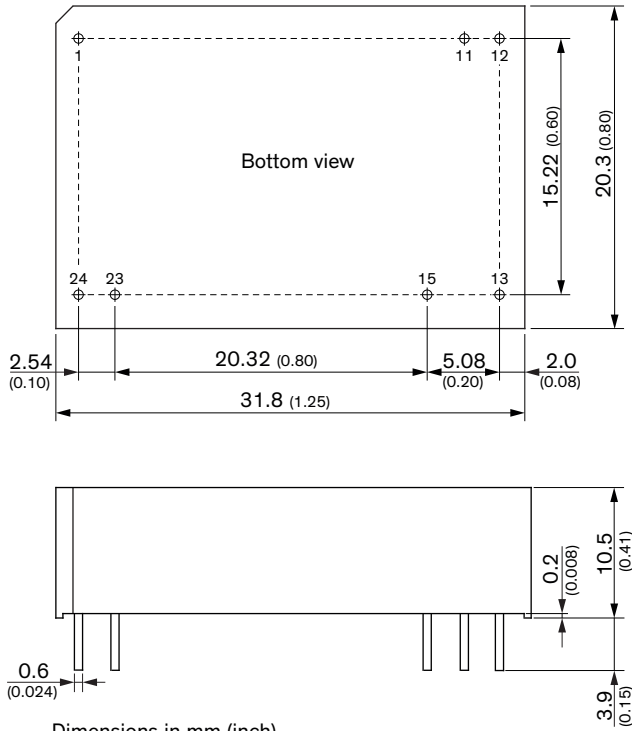
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/thp3](http://www.tracopower.com/overview/thp3)

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) |        |
| 11     | No Pin     | Common |
| 12     | -Vout      | No Pin |
| 13     | +Vout      | -Vout  |
| 15     | No Pin     | +Vout  |
| 23     | -Vin (GND) |        |
| 24     | -Vin (GND) |        |

Dimensions in mm (inch)  
 Pin diameter:  $\pm 0.05$  ( $\pm 0.002$ )  
 Tolerance: x.x  $\pm 0.25$  (x.xx  $\pm 0.01$ )  
 x.xx  $\pm 0.13$  (x.xxx  $\pm 0.005$ )