

- Compact DIP-24 plastic case
- I/O isolation 5000 VAC rated for 250 VAC working voltage
- IEC 60601-1 certification for 2 x MOPP
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- Low leakage current <2  $\mu$ A
- Operating temperature  $-40^{\circ}\text{C}$  to  $90^{\circ}\text{C}$
- EMC compliance to IEC 60601-1-2 4th edition and EN55032 class A
- 5-year product warranty



ES 60601-1 IEC 60601-1  
UL 62368-1 IEC 62368-1

The THM 6 series is a range of medical 6 Watt DC/DC converters in DIP-24 plastic package with wide 2:1 input voltage range. They provide a reinforced isolation system for 5000 VAC and a very low leakage current of less than 2  $\mu$ A. The units are approved to IEC/EN/ES 60601-1 3rd ed. for 2 x MOPP and come along with an ISO 14971 risk management file. Design and production conform to the quality management system ISO 13485. With a high efficiency of up to 89% and highest grade components the converters can reliably operate in an ambient temperature range of  $-40^{\circ}\text{C}$  up to  $+90^{\circ}\text{C}$ . They constitute a reliable solution not only for medical equipment but also for demanding ranges of application such as transportation, control & measurement or IGBT drivers.

### Models

| Order Code | Input Voltage Range          | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|------------|------------------------------|----------|------------------|----------|------------------|-----------------|
|            |                              | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| THM 6-0510 | 4.5 - 9 VDC<br>(5 VDC nom.)  | 3.3 VDC  | 1'800 mA         |          |                  | 82 %            |
| THM 6-0511 |                              | 5 VDC    | 1'200 mA         |          |                  | 86 %            |
| THM 6-0512 |                              | 12 VDC   | 500 mA           |          |                  | 86 %            |
| THM 6-0513 |                              | 15 VDC   | 400 mA           |          |                  | 88 %            |
| THM 6-0515 |                              | 24 VDC   | 250 mA           |          |                  | 87 %            |
| THM 6-0521 |                              | +5 VDC   | 600 mA           | -5 VDC   | 600 mA           | 84 %            |
| THM 6-0522 |                              | +12 VDC  | 250 mA           | -12 VDC  | 250 mA           | 87 %            |
| THM 6-0523 |                              | +15 VDC  | 200 mA           | -15 VDC  | 200 mA           | 88 %            |
| THM 6-1210 | 9 - 18 VDC<br>(12 VDC nom.)  | 3.3 VDC  | 1'800 mA         |          |                  | 84 %            |
| THM 6-1211 |                              | 5 VDC    | 1'200 mA         |          |                  | 86 %            |
| THM 6-1212 |                              | 12 VDC   | 500 mA           |          |                  | 89 %            |
| THM 6-1213 |                              | 15 VDC   | 400 mA           |          |                  | 89 %            |
| THM 6-1215 |                              | 24 VDC   | 250 mA           |          |                  | 89 %            |
| THM 6-1221 |                              | +5 VDC   | 600 mA           | -5 VDC   | 600 mA           | 85 %            |
| THM 6-1222 |                              | +12 VDC  | 250 mA           | -12 VDC  | 250 mA           | 89 %            |
| THM 6-1223 |                              | +15 VDC  | 200 mA           | -15 VDC  | 200 mA           | 88 %            |
| THM 6-2410 | 18 - 36 VDC<br>(24 VDC nom.) | 3.3 VDC  | 1'800 mA         |          |                  | 83 %            |
| THM 6-2411 |                              | 5 VDC    | 1'200 mA         |          |                  | 86 %            |
| THM 6-2412 |                              | 12 VDC   | 500 mA           |          |                  | 89 %            |
| THM 6-2413 |                              | 15 VDC   | 400 mA           |          |                  | 89 %            |
| THM 6-2415 |                              | 24 VDC   | 250 mA           |          |                  | 89 %            |
| THM 6-2421 |                              | +5 VDC   | 600 mA           | -5 VDC   | 600 mA           | 85 %            |
| THM 6-2422 |                              | +12 VDC  | 250 mA           | -12 VDC  | 250 mA           | 89 %            |
| THM 6-2423 |                              | +15 VDC  | 200 mA           | -15 VDC  | 200 mA           | 89 %            |
| THM 6-4810 | 36 - 75 VDC<br>(48 VDC nom.) | 3.3 VDC  | 1'800 mA         |          |                  | 83 %            |
| THM 6-4811 |                              | 5 VDC    | 1'200 mA         |          |                  | 87 %            |
| THM 6-4812 |                              | 12 VDC   | 500 mA           |          |                  | 88 %            |
| THM 6-4813 |                              | 15 VDC   | 400 mA           |          |                  | 89 %            |
| THM 6-4815 |                              | 24 VDC   | 250 mA           |          |                  | 88 %            |
| THM 6-4821 |                              | +5 VDC   | 600 mA           | -5 VDC   | 600 mA           | 85 %            |
| THM 6-4822 |                              | +12 VDC  | 250 mA           | -12 VDC  | 250 mA           | 88 %            |
| THM 6-4823 |                              | +15 VDC  | 200 mA           | -15 VDC  | 200 mA           | 87 %            |

### Options

|   |  |
|---|--|
| <b>on demand</b><br>(backorder with MOQ<br>non stocking item) | <ul style="list-style-type: none"> <li>- Optional models with alternative pinning</li> <li>- Optional models with adjustable output</li> <li>- Optional models with remote-control function</li> <li>- Optional models with adjustable output and remote-control function</li> </ul> |
|---|--|

### Input Specifications

|                        |              |   |
|------------------------|--------------|---|
| Input Current          | - At no load | 5 Vin models: <b>20 mA typ.</b><br>12 Vin models: <b>10 mA typ.</b><br>24 Vin models: <b>6 mA typ.</b><br>48 Vin models: <b>4 mA typ.</b>   |
| Surge Voltage          |              | 5 Vin models: <b>16 VDC max.</b> (3 s max.)<br>12 Vin models: <b>25 VDC max.</b> (3 s max.)<br>24 Vin models: <b>50 VDC max.</b> (3 s max.)<br>48 Vin models: <b>100 VDC max.</b> (3 s max.)  |
| Under Voltage Lockout  |              | 5 Vin models: <b>3 VDC min. / 4 VDC typ. / 4.4 VDC max.</b><br>12 Vin models: <b>7 VDC min. / 8 VDC typ. / 8.8 VDC max.</b><br>24 Vin models: <b>15 VDC min. / 16 VDC typ. / 17.5 VDC max.</b><br>48 Vin models: <b>31.5 VDC min. / 33 VDC typ. / 34.5 VDC max.</b> |
| Recommended Input Fuse |              | 5 Vin models: <b>2'500 mA</b> (slow blow)<br>12 Vin models: <b>1'250 mA</b> (slow blow)<br>24 Vin models: <b>630 mA</b> (slow blow)<br>48 Vin models: <b>315 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>   |

### Output Specifications

|  |   |  |
|--|---|--|
| Output Voltage Adjustment              |   | <b>-10% to +20%</b> (15 & 24 Vout single models)<br><b>±10%</b> (other models)<br>(Only for optional models with adjustable output)<br>(By external trim resistor)<br>See application note: <a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a><br>Output power must not exceed rated power!  |
| Voltage Set Accuracy                   |   | <b>±1% max.</b>  |
| Regulation                             | - Input Variation (Vmin - Vmax)<br>- Load Variation (0 - 100%)<br>- Cross Regulation<br>(25% / 100% asym. load) | single output models: <b>0.2% max.</b><br>dual output models: <b>0.5% max.</b><br>single output models: <b>0.2% max.</b><br>dual output models: <b>1% max.</b> (Output 1)<br><b>1% max.</b> (Output 2)<br>dual output models: <b>5% max.</b>   |
| Ripple and Noise<br>(20 MHz Bandwidth) | - single output<br>- dual output  | 3.3 Vout models: <b>30 mVp-p typ.</b> (w/ 10 µF X7R)<br>5 Vout models: <b>30 mVp-p typ.</b> (w/ 10 µF X7R)<br>12 Vout models: <b>40 mVp-p typ.</b> (w/ 10 µF X7R)<br>15 Vout models: <b>40 mVp-p typ.</b> (w/ 10 µF X7R)<br>24 Vout models: <b>50 mVp-p typ.</b> (w/ 4.7 µF X7R)<br>5 / -5 Vout models: <b>30 / 30 mVp-p typ.</b> (w/ 10 µF X7R)<br>12 / -12 Vout models: <b>40 / 40 mVp-p typ.</b> (w/ 10 µF X7R)<br>15 / -15 Vout models: <b>40 / 40 mVp-p typ.</b> (w/ 10 µF X7R) |

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: <b>2'100 µF max.</b><br>5 Vout models: <b>1'500 µF max.</b><br>12 Vout models: <b>260 µF max.</b><br>15 Vout models: <b>210 µF max.</b><br>24 Vout models: <b>75 µF max.</b> |
|                           | - dual output   | 5 / -5 Vout models: <b>860 / 860 µF max.</b><br>12 / -12 Vout models: <b>150 / 150 µF max.</b><br>15 / -15 Vout models: <b>110 / 110 µF max.</b>  |
| Minimum Load              | Not required  |   |
| Temperature Coefficient   | ±0.02 %/K max.  |   |
| Start-up Time             | 30 ms typ.  |   |
| Short Circuit Protection  | Continuous, Automatic recovery  |   |
| Output Current Limitation | 150% typ. of Iout max.  |   |
| Overvoltage Protection    | 112 - 152% of Vout nom.<br>(depending on model)<br>3.7 - 5 VDC (3.3 VDC model)<br>5.6 - 7 VDC (5 VDC model)<br>13.5 - 16 VDC (12 VDC model)<br>18.3 - 22 VDC (15 VDC model)<br>29.1 - 34.5 VDC (24 VDC model)<br>5.6 - 7 VDC (±5 VDC model)<br>13.5 - 18.2 VDC (±12 VDC model)<br>17 - 22 VDC (±15 VDC model) |   |
| Transient Response        | - Response Time   | 250 µs typ. (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  |
|                       | - Certification Documents   | 2 x MOPP (Means Of Patient Protection)<br><a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a> |
| 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 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>FCC Part 18 class A (internal filter)<br>FCC Part 18 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>FCC Part 18 class A (internal filter)<br>FCC Part 18 class B (with external filter)   |
|               |                       | External filter proposal: <a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a>  |

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

|              |  |   |
|--------------|--|---|
| EMS Immunity | <ul style="list-style-type: none"> <li>- Electrostatic Discharge</li> <li>- RF Electromagnetic Field</li> <li>- EFT (Burst) / Surge</li> <li>- Conducted RF Disturbances</li> <li>- PF Magnetic Field</li> </ul> | EN 60601-1-2 edition 4 (Medical Devices)<br>Air: EN 61000-4-2, $\pm 15$ kV, perf. criteria A<br>Contact: EN 61000-4-2, $\pm 8$ kV, perf. criteria A<br>EN 61000-4-3, 10 V/m, perf. criteria A<br>EN 61000-4-4, $\pm 2$ kV, perf. criteria A<br>EN 61000-4-5, $\pm 2$ kV, perf. criteria A<br>Ext. input component: 5 Vin models: KY 1000 $\mu$ F    Vishay V10P45<br>12 Vin models: KY 470 $\mu$ F<br>24 Vin models: KY 470 $\mu$ F<br>48 Vin models: KY 330 $\mu$ F<br>EN 61000-4-6, 10 Vrms, perf. criteria A<br>Continuous: EN 61000-4-8, 100 A/m, perf. criteria A<br>1 s: EN 61000-4-8, 1000 A/m, perf. criteria A |
|--------------|--|---|

## General Specifications

|                           |  |  |
|---------------------------|--|--|
| Relative Humidity         |  | 95% max. (non condensing)  |
| Temperature Ranges        | <ul style="list-style-type: none"> <li>- Operating Temperature</li> <li>- Approved Ambient Temp.</li> <li>- Case Temperature</li> <li>- Storage Temperature</li> </ul> | -40°C to +95°C<br>+70°C max. (to comply with EN 60601-1)<br>+105°C max.<br>-55°C to +125°C   |
| Power Derating            | <ul style="list-style-type: none"> <li>- High Temperature</li> </ul>   | 5.26 %/K above 86°C<br>See application note: <a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a>  |
| Cooling System            |  | Natural convection (20 LFM)  |
| Remote Control            | <ul style="list-style-type: none"> <li>- Voltage Controlled Remote</li> <li>- Off Idle Input Current</li> <li>- Remote Pin Input Current</li> </ul>                    | On: 0 to 1.2 VDC or open circuit<br>Off: 2.2 to 12 VDC<br>Refers to 'Remote' and '-Vin' Pin<br>2.5 mA typ.<br>-0.5 to 1.0 mA<br>(Only for optional models with remote-control) |
| Altitude During Operation |  | 5'000 m max.   |
| Switching Frequency       |  | 225 - 275 kHz (PWM)<br>250 kHz typ. (PWM)  |
| Insulation System         |  | Reinforced Insulation  |
| Working Voltage (rated)   |  | 250 VAC  |
| Isolation Test Voltage    | - Input to Output, 60 s  | 5'000 VAC  |
| Creepage                  | - Input to Output  | 8 mm min.  |
| Clearance                 | - Input to Output  | 8 mm min.  |
| Isolation Capacitance     | - Input to Output, 100 kHz, 1 V  | 12 pF typ.<br>17 pF max.   |
| Leakage Current           | - Earth Leakage Current  | 2 $\mu$ A max. (240 VAC, 60 Hz)  |
| Reliability               | - Calculated MTBF  | 4'700'000 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>  |
| Environment               | <ul style="list-style-type: none"> <li>- Vibration</li> <li>- Thermal Shock</li> </ul>   | MIL-STD-810F<br>MIL-STD-810F   |
| 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   |
| Pin Foundation Plating    |  | Nickel (2 - 3 $\mu$ m)   |
| Pin Surface Plating       |  | Tin (3 - 5 $\mu$ m), matte   |
| Housing Type              |  | Plastic Case   |
| Mounting Type             |  | PCB Mount  |
| Connection Type           |  | THD (Through-Hole Device)  |
| Footprint Type            |  | DIP24  |
| Soldering Profile         |  | 265°C / 10 s max.  |

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

|  |  |
|--|--|
| Weight                                       | 14 g   |
| Thermal Impedance - Case to Ambient          | 18 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>         |
|  | REACH SVHC list compliant  |
|  | REACH Annex XVII compliant   |
| - RoHS Declaration                           | <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>           |
|  | Exemptions: 7a, 7c-1   |
|  | (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) |
| - SCIP Reference Number                      | 52a5f525-3ab7-40de-bc34-cf6114cc760f   |

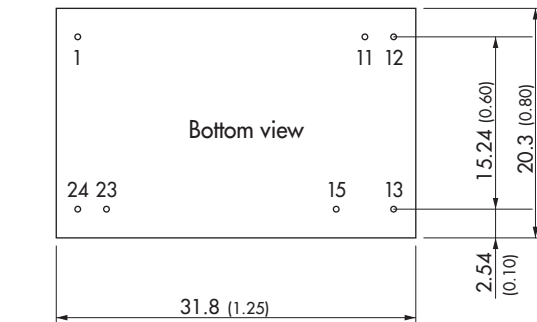
### Supporting Documents

Overview Link (for additional Documents)

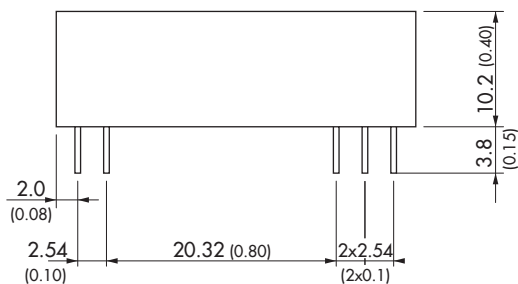
[www.tracopower.com/overview/thm6](http://www.tracopower.com/overview/thm6)

### Outline Dimensions

#### Standard pinning



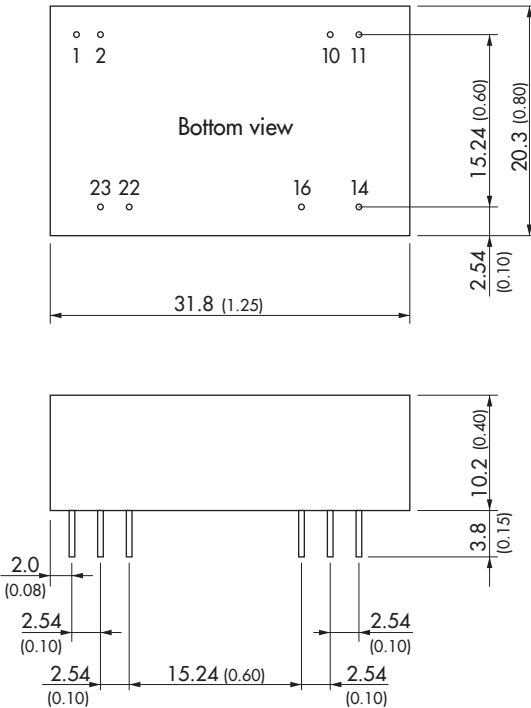
| Pinout |               |             |
|--------|---------------|-------------|
| Pin    | Single Output | Dual Output |
| 1      | +Vin (Vcc)    | +Vin (Vcc)  |
| 11     | No pin        | Common      |
| 12     | -Vout         | No pin      |
| 13     | +Vout         | -Vout       |
| 15     | No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



Dimensions in mm (inch)  
Tolerances  $\pm 0.5$  ( $\pm 0.02$ )  
Pin  $\varnothing 0.6 \pm 0.1$  ( $0.024 \pm 0.004$ )  
Pin pitch tolerances  $\pm 0.25$  ( $\pm 0.01$ )

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

### Optional models with alternative pinning, adjustable output and/or remote-control function



Dimensions in mm (inch)  
 Tolerances  $\pm 0.5$  ( $\pm 0.02$ )  
 Pin  $\varnothing 0.6 \pm 0.1$  ( $0.024 \pm 0.004$ )  
 Pin pitch tolerances  $\pm 0.25$  ( $\pm 0.01$ )

| Pinout |                |                |
|--------|----------------|----------------|
| Pin    | Single Output  | Dual Output    |
| 1      | No pin*/Remote | No pin*/Remote |
| 2      | -Vin (GND)     | -Vin (GND)     |
| 10     | No pin*/Trim   | No pin*/Trim   |
| 11     | No pin/NC **   | -Vout          |
| 14     | +Vout          | +Vout          |
| 16     | -Vout          | Common         |
| 22     | +Vin (Vcc)     | +Vin (Vcc)     |
| 23     | +Vin (Vcc)     | +Vin (Vcc)     |

NC: Not connected

\* If Remote or Trim is not selected there is no pin on corresponding number.

\*\* If Trim is selected there is no pin on the corresponding pin number.

Remark:  
 No optional pinning for 5 Vin models. Corresponding parts are with THM 6WI series by default.  
 see [www.tracopower.com/overview/thm6wi](http://www.tracopower.com/overview/thm6wi)