DC/DC Medical Converter

- Ultra wide 4:1 input voltage 6 W DC/DC converter in a compact DIP-24 plastic case
- I/O isolation 5000 VAC rated for 250 VAC working voltage
- Certification according to IEC/EN/ES 60601-1 3rd edition 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 µA
- Operating temperature –40°C to 90°C
- EMC compliance to IEC 60601-1-2 4th edition and EN55032 class A
- Operating up to 5000m altitude
- 5-year product warranty

The THM 6WI series is a range of medical 6 Watt DC/DC converters in DIP-24 plastic package and with ultra-wide 4:1 input voltage range. They provide a reinforced isolation system for 5000 VAC isolation and a very low leakage current of less than 2 µA. The units are approved to IEC/EN/ES 60601-1 3rd edition 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 87% and highest grade components the converters can reliably operate in an ambient temperature range of –40°C up to +90°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

<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>THM 6-0510WI</td>
<td>3.3 VDC</td>
<td>1'800 mA</td>
<td></td>
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</tr>
<tr>
<td>THM 6-0511WI</td>
<td>5 VDC</td>
<td>1'200 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THM 6-0512WI</td>
<td>12 VDC</td>
<td>500 mA</td>
<td></td>
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</tr>
<tr>
<td>THM 6-0513WI</td>
<td>15 VDC</td>
<td>400 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THM 6-0515WI</td>
<td>24 VDC</td>
<td>250 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THM 6-0521WI</td>
<td>+5 VDC</td>
<td>600 mA</td>
<td>–5 VDC</td>
<td>600 mA</td>
</tr>
<tr>
<td>THM 6-0522WI</td>
<td>+12 VDC</td>
<td>250 mA</td>
<td>–12 VDC</td>
<td>250 mA</td>
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<tr>
<td>THM 6-0523WI</td>
<td>+15 VDC</td>
<td>200 mA</td>
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<td>200 mA</td>
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<tr>
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<td></td>
<td></td>
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<tr>
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<tr>
<td>THM 6-2423WI</td>
<td>+15 VDC</td>
<td>200 mA</td>
<td>–15 VDC</td>
<td>200 mA</td>
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<tr>
<td>THM 6-4810WI</td>
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<td>1'800 mA</td>
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<tr>
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<td>5 VDC</td>
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<tr>
<td>THM 6-4821WI</td>
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<td>–15 VDC</td>
<td>200 mA</td>
</tr>
</tbody>
</table>
## Options

| on demand (backorder with MOQ non stocking item) | - Optional models with alternative pinning  
- Optional models with adjustable output voltage  
- Optional models with Remote On/Off function  
- Optional models with adjustable output and remote-control function |

## Input Specifications

### Input Current
- At no load
  - 5 Vin models: 20 mA typ.  
  - 24 Vin models: 6 mA typ.  
  - 48 Vin models: 4 mA typ.

### Surge Voltage
- 5 Vin models: 16 VDC max. (3 s max.)  
- 24 Vin models: 50 VDC max. (3 s max.)  
- 48 Vin models: 100 VDC max. (3 s max.)

### Under Voltage Lockout
- 5 Vin models: 3 VDC min. / 4 VDC typ. / 4.4 VDC max.  
- 24 Vin models: 7 VDC min. / 8 VDC typ. / 8.8 VDC max.  
- 48 Vin models: 15 VDC min. / 16 VDC typ. / 17.5 VDC max.

### Recommended Input Fuse
- 5 Vin models: 2'500 mA (slow blow)  
- 24 Vin models: 1'250 mA (slow blow)  
- 48 Vin models: 630 mA (slow blow)

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

### Input Filter
- Internal Pi-Type

## Output Specifications

### Output Voltage Adjustment
- ±10% to ±20% (15 & 24 Vout single models)  
- ±10% (other single and dual output models)  
- (Only for optional models with adjustable output)  
- (By external trim resistor)

See application note: [www.tracopower.com/overview/thm6wi](http://www.tracopower.com/overview/thm6wi)

Output power must not exceed rated power!

### Voltage Set Accuracy
- ±1% max.

### Regulation
- Input Variation (Vmin - Vmax)
  - 3.3 Vout models: 0.2% max.  
  - 5 Vout models: 0.5% max.  
  - 12 Vout models: 0.2% max.  
  - 15 Vout models: 1% max. (Output 1)  
  - 24 Vout models: 5% max. (Output 2)

### Cross Regulation (25% / 100% asym. load)
- Dual output models:
  - 5 / -5 Vout models: 30 / 30 mVp-p typ. (w/ 10 µF X7R)  
  - 12 / -12 Vout models: 40 / 40 mVp-p typ. (w/ 10 µF X7R)  
  - 15 / -15 Vout models: 40 / 40 mVp-p typ. (w/ 10 µF X7R)

### Ripple and Noise (20 MHz Bandwidth)
- Single output
  - 3.3 Vout models: 30 mVp-p typ. (w/ 10 µF X7R)  
  - 5 Vout models: 30 mVp-p typ. (w/ 10 µF X7R)  
  - 12 Vout models: 40 mVp-p typ. (w/ 10 µF X7R)  
  - 15 Vout models: 40 mVp-p typ. (w/ 10 µF X7R)

- Dual output
  - 5 / -5 Vout models: 30 / 30 mVp-p typ. (w/ 10 µF X7R)  
  - 12 / -12 Vout models: 40 / 40 mVp-p typ. (w/ 10 µF X7R)  
  - 15 / -15 Vout models: 40 / 40 mVp-p typ. (w/ 10 µF X7R)

### Capacitive Load
- Single output
  - 3.3 Vout models: 2'100 µF max.  
  - 5 Vout models: 1'500 µF max.  
  - 12 Vout models: 260 µF max.  
  - 15 Vout models: 210 µF max.

- Dual output
  - 5 / -5 Vout models: 860 / 860 µF max.  
  - 12 / -12 Vout models: 150 / 150 µF max.  
  - 15 / -15 Vout models: 110 / 110 µF max.

### Minimum Load
- Not required

### Temperature Coefficient
- ±0.02 %/K max.

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

**Short Circuit Protection**
Continuous, Automatic recovery

**Output Current Limitation**
150% typ. of Iout max. (depending on model)

**Overvoltage Protection**
- 112 - 152% of Vout nom.
- 3.7 - 5 VDC (3.3 VDC model)
- 5.6 - 7 VDC (5 VDC model)
- 13.5 - 16 VDC (12 VDC model)
- 18.3 - 22 VDC (15 VDC model)
- 29.1 - 34.5 VDC (24 VDC model)
- 5.6 - 7 VDC (±5 VDC model)
- 13.5 - 18.2 VDC (±12 VDC model)
- 17 - 22 VDC (±15 VDC model)

**Transient Response**
- Response Time
250 µs typ. (25% Load Step)

### Safety Specifications

<table>
<thead>
<tr>
<th>Safety Standards</th>
<th>EN 62368-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>- IT / Multimedia Equipment</td>
<td>IEC 62368-1</td>
</tr>
<tr>
<td>- Medical Equipment</td>
<td>UL 62368-1</td>
</tr>
<tr>
<td></td>
<td>EN 60601-1</td>
</tr>
<tr>
<td></td>
<td>ANSI/AAMI ES 60601-1</td>
</tr>
</tbody>
</table>
|                           | 2 x MOPP (Means Of Patient Protection) | www.tracopower.com/overview/thm6wi

<table>
<thead>
<tr>
<th>Pollution Degree</th>
<th>PD 2</th>
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<tbody>
<tr>
<td>Over Voltage Category</td>
<td>OVC II</td>
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</tbody>
</table>

### EMC Specifications

<table>
<thead>
<tr>
<th>EMI Emissions</th>
<th>EN 60601-1-2 edition 4 (Medical Devices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Conducted Emissions</td>
<td>EN 55011 class A (internal filter)</td>
</tr>
<tr>
<td></td>
<td>EN 55011 class B (with external filter)</td>
</tr>
<tr>
<td></td>
<td>EN 55032 class A (internal filter)</td>
</tr>
<tr>
<td></td>
<td>EN 55032 class B (with external filter)</td>
</tr>
<tr>
<td></td>
<td>FCC Part 18 class A (internal filter)</td>
</tr>
<tr>
<td></td>
<td>FCC Part 18 class B (with external filter)</td>
</tr>
<tr>
<td>- Radiated Emissions</td>
<td>EN 55011 class A (internal filter)</td>
</tr>
<tr>
<td></td>
<td>EN 55011 class B (with external filter)</td>
</tr>
<tr>
<td></td>
<td>EN 55032 class A (internal filter)</td>
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<td>EN 55032 class B (with external filter)</td>
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<tr>
<td></td>
<td>FCC Part 18 class A (internal filter)</td>
</tr>
<tr>
<td></td>
<td>FCC Part 18 class B (with external filter)</td>
</tr>
</tbody>
</table>

**External filter proposal:** www.tracopower.com/overview/thm6wi

<table>
<thead>
<tr>
<th>EMS Immunity</th>
<th>EN 60601-1-2 edition 4 (Medical Devices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Electrostatic Discharge</td>
<td>Air: EN 61000-4-2, ±15 kV, perf. criteria A</td>
</tr>
<tr>
<td></td>
<td>Contact: EN 61000-4-2, ±8 kV, perf. criteria A</td>
</tr>
<tr>
<td>- RF Electromagnetic Field</td>
<td>EN 61000-4-3, 10 V/m, perf. criteria A</td>
</tr>
<tr>
<td>- EFT (Burst) / Surge</td>
<td>EN 61000-4-4, ±2 kV, perf. criteria A</td>
</tr>
<tr>
<td></td>
<td>EN 61000-4-5, ±2 kV, perf. criteria A</td>
</tr>
</tbody>
</table>

**Ext. input component:**
- 5 Vin models: KY 1000 µF || Vishay V10P4S
- 24 Vin models: KY 470 µF
- 48 Vin models: KY 330 µF

| - Conducted RF Disturbances | EN 61000-4-6, 10 Vrms, perf. criteria A |
| - PF Magnetic Field         | EN 61000-4-8, 100 A/m, perf. criteria A |
|                           | 1 s: EN 61000-4-8, 1000 A/m, perf. criteria A |

### General Specifications

| Relative Humidity | 95% max. (non condensing) |

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Temperature Ranges
- **Operating Temperature**: –40°C to +95°C
- **Approved Ambient Temp.**: +70°C max. (to comply with EN 60601-1)
- **Case Temperature**: +105°C max.
- **Storage Temperature**: –55°C to +125°C

### Power Derating
- **High Temperature**: 5.26 %/K above 86°C
  
  See application note: [www.tracopower.com/overview/thm6wi](http://www.tracopower.com/overview/thm6wi)

### Cooling System
- **Natural convection** (20 LFM)

### Remote Control
- **Voltage Controlled Remote**
- **Off Idle Input Current**
- **Remote Pin Input Current**
  
  - On: 0 to 1.2 VDC or open circuit
  - Off: 2.2 to 12 VDC
  - Refers to 'Remote' and '-Vin' Pin
  - 2.5 mA typ.
  - -0.5 to 1.0 mA
  
  (Only for optional models with remote-control)

### Altitude During Operation
- **5'000 m max.**

### Switching Frequency
- **225 - 275 kHz (PWM)**
- **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.

### Clearances
- **Input to Output**: 8 mm min.

### Isolation Capacitance
- **Input to Output**: 12 pF typ.
- **17 pF max.**

### Leakage Current
- **Earth Leakage Current**: 2 µA max. (240 VAC, 60 Hz)

### Reliability
- **Calculated MTBF**: 4'700'000 h (MIL-HDBK-217F; ground benign)

### Washing Process
- **According to Cleaning Guideline**
  
  [www.tracopower.com/info/cleaning.pdf](http://www.tracopower.com/info/cleaning.pdf)

### Environment
- **Vibration**: MIL-STD-810F
- **Thermal Shock**: 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 µm)

### Pin Surface Plating
- **Tin** (3 - 5 µm), matte

### Housing Type
- **Plastic Case**

### Mounting Type
- **PCB Mount**

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

### Footprint Type
- **DIP24**

### Soldering Profile
- **Lead-Free Wave Soldering**
- **265°C / 10 s max.**

### Weight
- **14 g**

### Thermal Impedance
- **Case to Ambient**: 18 K/W typ.

### Environmental Compliance
- **REACH Declaration**
  
  [www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)

- **RoHS Declaration**
  

- **Exemptions**: 7a
  
  (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))

- **SCIP Reference Number**
  
  ffbb141a-1df3-4321-ae20-4e79ad5ce0af

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

[www.tracopower.com](http://www.tracopower.com)  September 20, 2023
Outline Dimensions

Standard pinning with options: With adjustable output and/or remote-control function

Optional models with alternative pinning

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single Output</th>
<th>Dual Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No pin*/Remote</td>
<td>No pin*/Remote</td>
</tr>
<tr>
<td>2</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>10</td>
<td>No pin*/Trim</td>
<td>No pin*/Trim</td>
</tr>
<tr>
<td>11</td>
<td>No pin/NC **</td>
<td>–Vout</td>
</tr>
<tr>
<td>14</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>16</td>
<td>–Vout</td>
<td>Common</td>
</tr>
<tr>
<td>22</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>23</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
</tbody>
</table>

Dimensions in mm (inch)
Tolerances ±0.5 (±0.02)
Pin Ø 0.6 ± 0.1 (0.024 ± 0.004)
Pin pitch tolerances ±0.25 (±0.01)

Remark:
No alternative pinning for 5 Vin models.
Corresponding parts are with THM 6 series by default.
see www.tracopower.com/overview/thm6