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.

<table>
<thead>
<tr>
<th>Models</th>
<th>Input Voltage Range</th>
<th>Output 1 Vnom</th>
<th>Output 1 Imax</th>
<th>Output 2 Vnom</th>
<th>Output 2 Imax</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>THM 6-0510WI</td>
<td>4.5 - 9 VDC (5 VDC nom.)</td>
<td>3.3 VDC</td>
<td>1'800 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>82 %</td>
</tr>
<tr>
<td>THM 6-0511WI</td>
<td>5 VDC</td>
<td>1'200 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-0512WI</td>
<td>12 VDC</td>
<td>500 mA</td>
<td>-15 VDC</td>
<td>200 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-0513WI</td>
<td>15 VDC</td>
<td>400 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-0515WI</td>
<td>24 VDC</td>
<td>250 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-0521WI</td>
<td>+5 VDC</td>
<td>600 mA</td>
<td>-15 VDC</td>
<td>200 mA</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-0522WI</td>
<td>+12 VDC</td>
<td>250 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>84 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-0523WI</td>
<td>+15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2410WI</td>
<td>9 - 36 VDC (24 VDC nom.)</td>
<td>3.3 VDC</td>
<td>1'800 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>83 %</td>
</tr>
<tr>
<td>THM 6-2411WI</td>
<td>5 VDC</td>
<td>1'200 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2412WI</td>
<td>12 VDC</td>
<td>500 mA</td>
<td>-15 VDC</td>
<td>200 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2413WI</td>
<td>15 VDC</td>
<td>400 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2415WI</td>
<td>24 VDC</td>
<td>250 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2421WI</td>
<td>+5 VDC</td>
<td>600 mA</td>
<td>-15 VDC</td>
<td>200 mA</td>
<td>85 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2422WI</td>
<td>+12 VDC</td>
<td>250 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-2423WI</td>
<td>+15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4810WI</td>
<td>18 - 75 VDC (48 VDC nom.)</td>
<td>3.3 VDC</td>
<td>1'800 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>83 %</td>
</tr>
<tr>
<td>THM 6-4811WI</td>
<td>5 VDC</td>
<td>1'200 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4812WI</td>
<td>12 VDC</td>
<td>500 mA</td>
<td>-15 VDC</td>
<td>200 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4813WI</td>
<td>15 VDC</td>
<td>400 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4815WI</td>
<td>24 VDC</td>
<td>250 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4821WI</td>
<td>+5 VDC</td>
<td>600 mA</td>
<td>-15 VDC</td>
<td>200 mA</td>
<td>85 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4822WI</td>
<td>+12 VDC</td>
<td>250 mA</td>
<td>-5 VDC</td>
<td>600 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>THM 6-4823WI</td>
<td>+15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>250 mA</td>
<td>87 %</td>
<td></td>
</tr>
</tbody>
</table>
### Options

| on demand        | - Optional models with alternative pinning  
|                  | - Optional models with adjustable output  
|                  | - Optional models with remote-control 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: 2500 mA (slow blow)  
|                  | 24 Vin models: 1250 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)  
|                          | ±1% (other 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) (Slow)  
|            | single output models: 0.2% max.  
|            | dual output models: 0.5% max.  
|            | - Load Variation (0 - 100%) (Slow)  
|            | single output models: 0.2% max.  
|            | dual output models: 1% max. (Output 1)  
|            | 1% max. (Output 2)  
|            | - Cross Regulation (25% / 100% asym. load) (Slow)  
|            | dual output models: 5% max.  
| 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)  
| 24 Vout models: 50 mVp-p typ. (w/ 4.7 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: 2100 µF max.  
| 5 Vout models: 1500 µF max.  
| 12 Vout models: 260 µF max.  
| 15 Vout models: 210 µF max.  
| 24 Vout models: 75 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.

Overvoltage Protection
112 - 152% of Vout nom. (depending on model)
3.7 - 5 VDC (3.3 VDC model)
5.6 - 7 VDC (5 VDC model)
13.5 - 18 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

Safety Standards
- IT / Multimedia Equipment
  EN 62368-1
  IEC 62368-1
  UL 62368-1
- Medical Equipment
  EN 60601-1
  IEC 60601-1
  ANSI/AAMI ES 60601-1
- Certification Documents
  2 x MOPP (Means Of Patient Protection)
  www.tracopower.com/overview/thm6wi

Pollution Degree
PD 2

Over Voltage Category
OVC II

EMC Specifications

EMI Emissions
- Conducted Emissions
  EN 60601-1-2 edition 4 (Medical Devices)
  EN 55011 class A (internal filter)
  EN 55011 class B (with external filter)
  EN 55032 class A (internal filter)
  EN 55032 class B (with external filter)
  FCC Part 18 class A (internal filter)
  FCC Part 18 class B (with external filter)
- Radiated Emissions
  EN 55011 class A (internal filter)
  EN 55011 class B (with external filter)
  EN 55032 class A (internal filter)
  EN 55032 class B (with external filter)
  FCC Part 18 class A (internal filter)
  FCC Part 18 class B (with external filter)

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

EMS Immunity
- Electrostatic Discharge
  Air: EN 61000-4-2, ±15 kV, perf. criteria A
  Contact: EN 61000-4-2, ±8 kV, perf. criteria A
- RF Electromagnetic Field
  EN 61000-4-3, 10 V/m, perf. criteria A
  EN 61000-4-4, ±2 kV, perf. criteria A
  EN 61000-4-5, ±2 kV, perf. criteria A

Ext. input component:
- 5 Vin models: KY 1000 µF // Vishay V10P45
- 24 Vin models: KY 470 µF
- 48 Vin models: KY 330 µF

- Conducted RF Disturbances
  Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
  1 s: EN 61000-4-8, 100 A/m, perf. criteria A

- PF Magnetic Field
  Continuous: EN 61000-4-8, 100 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 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Derating</strong></td>
<td>- High Temperature: 5.26 %/K above 86°C</td>
</tr>
<tr>
<td><strong>Cooling System</strong></td>
<td>Natural convection (20 LFM)</td>
</tr>
</tbody>
</table>
| **Remote Control**     | - Voltage Controlled Remote: On: 0 to 1.2 VDC or open circuit  
- Off Idle Input Current: 2.5 mA typ.  
- Remote Pin Input Current: -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.  
8 mm min. |
| **Clearance**          | - Input to Output: 8 mm min. |
| **Isolation Capacitance** | - Input to Output: 100 kHz, 1 V  
12 pF typ.  
17 pF max. |
| **Leakage Current**    | - Earth Leakage Current: 2 µA max. (240 VAC, 60 Hz) |
| **Reliability**        | - Calculated MTBF: 4*1000'000 h (MIL-HDBK-217F, ground benign) |
| **Washing Process**    | Allowed (hermetical product)  
| **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**  | 265°C / 10 s max. |
| **Weight**             | 14 g |
| **Thermal Impedance**  | 18 K/W |
| **Environmental Compliance** | - REACH Declaration: [www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)  
Exemptions: 7a  
(REACH SVHC list compliant  
REACH Annex XVII compliant  
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/thm6wi](http://www.tracopower.com/overview/thm6wi)
**Outline Dimensions**

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

Optional pinning

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**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>

NC: No connection

* 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 6 series by default.

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

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)

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