DC/DC Medical Converter

• Ultra wide 4:1 input voltage 3 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 3WI series is a range of medical 3 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</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vnom</td>
<td>Imax</td>
<td>Vnom</td>
<td>Imax</td>
</tr>
<tr>
<td>THM 3-0510WI</td>
<td>3.3 VDC</td>
<td>1000 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-0511WI</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-0512WI</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-0513WI</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>THM 3-0515WI</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>THM 3-0521WI</td>
<td>+5 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-0522WI</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>THM 3-0523WI</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>THM 3-2410WI</td>
<td>3.3 VDC</td>
<td>1000 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-2411WI</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-2412WI</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-2413WI</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>THM 3-2415WI</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>THM 3-2421WI</td>
<td>+5 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-2422WI</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>THM 3-2423WI</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>THM 3-4810WI</td>
<td>3.3 VDC</td>
<td>1000 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-4811WI</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-4812WI</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-4813WI</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>THM 3-4815WI</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>THM 3-4821WI</td>
<td>+5 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
</tr>
<tr>
<td>THM 3-4822WI</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>THM 3-4823WI</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
</tr>
</tbody>
</table>
## Options

<table>
<thead>
<tr>
<th>on demand (backorder with MOQ non stocking item)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Optional models with alternative pinning</td>
</tr>
<tr>
<td>- Optional models with adjustable output voltage</td>
</tr>
<tr>
<td>- Optional models with Remote On/Off function</td>
</tr>
<tr>
<td>- Optional models with adjustable output and remote-control function</td>
</tr>
</tbody>
</table>

## Input Specifications

<table>
<thead>
<tr>
<th>Input Current</th>
<th>- At no load</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Vin models</td>
<td>20 mA typ.</td>
</tr>
<tr>
<td>24 Vin models</td>
<td>6 mA typ.</td>
</tr>
<tr>
<td>48 Vin models</td>
<td>4 mA typ.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surge Voltage</th>
<th>- 5 Vin models: 16 VDC max. (3 s max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vin models</td>
<td>50 VDC max. (3 s max.)</td>
</tr>
<tr>
<td>48 Vin models</td>
<td>100 VDC max. (3 s max.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Under Voltage Lockout</th>
<th>- 5 Vin models: 3 VDC min. / 4 VDC typ. / 4.4 VDC max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vin models: 7 VDC min. / 8 VDC typ. / 8.8 VDC max.</td>
<td></td>
</tr>
<tr>
<td>48 Vin models: 15 VDC min. / 16 VDC typ. / 17.5 VDC max.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommended Input Fuse</th>
<th>- 5 Vin models: 1'600 mA (slow blow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vin models: 800 mA (slow blow)</td>
<td></td>
</tr>
<tr>
<td>48 Vin models: 500 mA (slow blow)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Input Filter</th>
<th>Internal Pi-Type</th>
</tr>
</thead>
</table>

## 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/thm3wi

Output power must not exceed rated power!

<table>
<thead>
<tr>
<th>Voltage Set Accuracy</th>
<th>±1% max.</th>
</tr>
</thead>
</table>

### Regulation

- Input Variation (Vmin - Vmax) single output models: 0.2% max.
  dual output models: 0.5% max.
- Load Variation (0 - 100%) single output models: 0.2% max.
  dual output models: 1% max. (Output 1)
  1% max. (Output 2)
- Cross Regulation (25% / 100% asym. load) dual output models: 5% max.

### Ripple and Noise (20 MHz Bandwidth)

<table>
<thead>
<tr>
<th>- single output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 Vout models: 30 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
<tr>
<td>5 Vout models: 30 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
<tr>
<td>12 Vout models: 40 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
<tr>
<td>15 Vout models: 40 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
<tr>
<td>24 Vout models: 50 mVp-p typ. (w/ 4.7 μF X7R)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>- dual output</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 / -5 Vout models: 30 / 30 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
<tr>
<td>12 / -12 Vout models: 40 / 40 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
<tr>
<td>15 / -15 Vout models: 40 / 40 mVp-p typ. (w/ 10 μF X7R)</td>
</tr>
</tbody>
</table>

### Capacitive Load

- single output
  3.3 Vout models: 1,050 μF max.
  5 Vout models: 750 μF max.
  12 Vout models: 130 μF max.
  15 Vout models: 100 μF max.
  24 Vout models: 39 μF max.
- dual output
  5 / -5 Vout models: 430 / 430 μF max.
  12 / -12 Vout models: 75 / 75 μF max.
  15 / -15 Vout models: 56 / 56 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 - 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)
- 17.2 - 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>
<th>IEC 62368-1</th>
<th>UL 62368-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>- IT / Multimedia Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Medical Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- ANSI/AAMI ES 60601-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IEC 60601-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2 x MOPP (Means Of Patient Protection)</td>
<td><a href="http://www.tracopower.com/overview/thm3wi">www.tracopower.com/overview/thm3wi</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pollution Degree
PD 2

### Over Voltage Category
OVC II

### EMC Specifications

#### EMI Emissions
- Conducted Emissions
  - EN 65011 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 65032 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/thm3wi

#### 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
  - 10 V/m, perf. criteria A
- EFT (Burst) / Surge
  - ±2 kV, perf. criteria A
  - ±5 kV, perf. criteria A
  - 48 VIn models: KY 330 µF
  - 48 VIn models: KY 470 µF
  - 5 Vin models: KY 1000 µF

- Conducted RF Disturbances
  - 10 Vrms, perf. criteria A
- PF Magnetic Field
  - 20 kA/m, 100 A/m, perf. criteria A
  - 20 kA/m, 100 A/m, perf. criteria A

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

**External filter proposal:**
- Medical Devices
- Medical Devices

### 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.
<table>
<thead>
<tr>
<th>Temperature Ranges</th>
<th>Operating Temperature</th>
<th>–40°C to +100°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Approved Ambient Temp.</td>
<td>+80°C max. (to comply with EN60601-1)</td>
</tr>
<tr>
<td></td>
<td>Case Temperature</td>
<td>+105°C max.</td>
</tr>
<tr>
<td></td>
<td>Storage Temperature</td>
<td>–55°C to +125°C</td>
</tr>
</tbody>
</table>

**Power Derating**

- High Temperature
  10 %/K above 95°C (average)
  
  See application note: [www.tracopower.com/overview/thm3wi](http://www.tracopower.com/overview/thm3wi)

**Cooling System**

- Natural convection (20 LFM)

**Remote Control**

- Voltage Controlled Remote
  
  On: 0 to 1.2 VDC or open circuit
  
  Off: 2.2 to 12 VDC

- 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**

- 135 - 165 kHz (PWM)
- 150 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.
  
  17 pF max.

**Leakage Current**

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

**Reliability**

- Calculated MTBF
  
  6,400,000 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)

- REACH SVHC list compliant

- REACH Annex XVI VII compliant
  

Exemptions: 7a, 7c-I

(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)

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**Supporting Documents**

**Overview Link** *(for additional Documents)*

[www.tracopower.com/overview/thm3wi](http://www.tracopower.com/overview/thm3wi)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
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 3 series by default.
see www.tracopower.com/overview/thm3

Specifications can be changed without notice.