DC/DC Medical Converter

THM 3WI Series, 3 Watt

- 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.

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1 Vnom</th>
<th>Imax</th>
<th>Output 2 Vnom</th>
<th>Imax</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>THM 3-0510WI</td>
<td>4.5 - 9 VDC (5 VDC nom.)</td>
<td>3.3 VDC</td>
<td>1’000 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
</tr>
<tr>
<td>THM 3-0511WI</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
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</tr>
<tr>
<td>THM 3-0512WI</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-0513WI</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-0515WI</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
<td>86 %</td>
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</tr>
<tr>
<td>THM 3-0521WI</td>
<td>+5 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-0522WI</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>86 %</td>
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</tr>
<tr>
<td>THM 3-0523WI</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-2410WI</td>
<td>9 - 36 VDC (24 VDC nom.)</td>
<td>3.3 VDC</td>
<td>1’000 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
</tr>
<tr>
<td>THM 3-2411WI</td>
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<td>600 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
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</tr>
<tr>
<td>THM 3-2412WI</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-2413WI</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>87 %</td>
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<tr>
<td>THM 3-2415WI</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-2421WI</td>
<td>+5 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
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</tr>
<tr>
<td>THM 3-2422WI</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-2423WI</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-4810WI</td>
<td>18 - 75 VDC (48 VDC nom.)</td>
<td>3.3 VDC</td>
<td>1’000 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
</tr>
<tr>
<td>THM 3-4811WI</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
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</tr>
<tr>
<td>THM 3-4812WI</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-4813WI</td>
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<td>200 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>87 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-4815WI</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-4821WI</td>
<td>+5 VDC</td>
<td>300 mA</td>
<td>-5 VDC</td>
<td>300 mA</td>
<td>83 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-4822WI</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>-12 VDC</td>
<td>125 mA</td>
<td>86 %</td>
<td></td>
</tr>
<tr>
<td>THM 3-4823WI</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>-15 VDC</td>
<td>100 mA</td>
<td>86 %</td>
<td></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: 1'600 mA (slow blow)  
| 24 Vin models: 800 mA (slow blow)  
| 48 Vin models: 500 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

| Voltage Set Accuracy | ±1% max.  
| 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)

| - single output | 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: 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.

www.tracopower.com

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**THM 3WI Series, 3 Watt**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up Time</td>
<td>30 ms typ.</td>
</tr>
<tr>
<td>Short Circuit Protection</td>
<td>Continuous, Automatic recovery</td>
</tr>
<tr>
<td>Output Current Limitation</td>
<td>150% typ. of Iout max.</td>
</tr>
<tr>
<td>Overvoltage Protection</td>
<td>112 - 152% of Vout nom.      (depending on model)</td>
</tr>
<tr>
<td></td>
<td>3.7 - 5 VDC (3.3 VDC model)</td>
</tr>
<tr>
<td></td>
<td>5.6 - 7 VDC (5 VDC model)</td>
</tr>
<tr>
<td></td>
<td>13.5 - 16 VDC (12 VDC model)</td>
</tr>
<tr>
<td></td>
<td>18.3 - 22 VDC (15 VDC model)</td>
</tr>
<tr>
<td></td>
<td>29.1 - 34.5 VDC (24 VDC model)</td>
</tr>
<tr>
<td></td>
<td>5.6 - 7 VDC (±0.5 VDC model)</td>
</tr>
<tr>
<td></td>
<td>13.5 - 18.2 VDC (±12 VDC model)</td>
</tr>
<tr>
<td></td>
<td>17 - 22 VDC (±15 VDC model)</td>
</tr>
<tr>
<td>Transient Response</td>
<td>- Response Time</td>
</tr>
<tr>
<td></td>
<td>250 µs typ. (25% Load Step)</td>
</tr>
</tbody>
</table>

### Safety Specifications

- **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
- **Pollution Degree**
  - PD 2
- **Over Voltage Category**
  - OVC II

### EMC Specifications

#### EMI Emissions
- Conducted 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)
- 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/thm3wi

#### EMS Immunity
- Electrostatic Discharge (Air)
  - EN 61000-4-2, ±15 kV, perf. criteria A
  - EN 61000-4-2, ±8 kV, perf. criteria A
- Electrostatic Discharge (Contact)
  - EN 61000-4-3, 10 V/m, perf. criteria A
  - EN 61000-4-4, ±2 kV, perf. criteria A
  - EN 61000-4-6, ±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
  - PF Magnetic Field
    - EN 61000-4-8, 100 A/m, perf. criteria A
    - 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.

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## Temperature Ranges
- **Operating Temperature**
  
  $-40^\circ C$ to $+100^\circ C$

- **Approved Ambient Temp.**
  
  $+80^\circ C$ max. (to comply with EN60601-1)

- **Case Temperature**
  
  $+105^\circ C$ max.

- **Storage Temperature**
  
  $-55^\circ C$ to $+125^\circ C$

- **Approved Ambient Temp.**
  
  $+80^\circ C$ max. (to comply with EN60601-1)

### Power Derating

- **High Temperature**
  
  See application note: [www.tracopower.com/overview/thm3wi](http://www.tracopower.com/overview/thm3wi)

- **10 %/K above 95°C (average)**

### Cooling System

- **Natural convection** (20 LFM)

### Remote Control

- **Voltage Controlled Remote**
  
  (passive = on)

  - **On**: 0 to 1.2 VDC or open circuit
  
  - **Off**: 2.2 to 12 VDC
  
  - **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

- **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

- **Input to Output, 1 s**
  
  10'000 VDC

### 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 pA 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 XVII compliant**
  

- **RoHS Declaration**

  - 7a, 7c-I

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

  - **SCIP Reference Number**
    
    8e30bae3-cce8-4d8a-835a-d07af1805b72

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### Supporting Documents

**Overview Link (for additional Documents)**

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

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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>

NC: Not connected

* No physical pin present for standard model (without Trim or Remote function)

** Pin with no function for standard model; No physical pin present if Trim function selected

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.
www.tracopower.com

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