

## DC/DC Converter

## THM 10 Series, 10 Watt

- Wide 2:1 input voltage 10 W DC/DC converter in a compact DIP-24 plastic case
- I/O isolation 5000 VACrms rated for 250 VACrms working voltage
- Certification according to IEC/EN/ES 60601-1 3rd edition for 2xMOPP
- Risk management process according to ISO 14971 including risk management file
- Acceptance criteria for electronic assemblies according to IPC-A-610 Level 3
- Low leakage current < 2µA
- Extended operating temperature range -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



CB  
Scheme  
IEC 606010-1 ES 60601-1

**UL**  
us

The THM-10 series is a range of medical 10 Watt DC/DC converters in DIP-24 plastic package and with wide 2:1 input voltage range. They provide a reinforced isolation system for 5000 VACrms 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 (Means Of Patient Protection) 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°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

Order code*	Input voltage range	Output voltage	Output current max.	Efficiency typ.
THM 10-0510	4.5 – 9 VDC (5 VDC nominal)	3.3 VDC	2500 mA	80.0 %
THM 10-0511		5.0 VDC	2000 mA	84.0 %
THM 10-0512		12 VDC	830 mA	86.5 %
THM 10-0513		15 VDC	670 mA	87.0 %
THM 10-0515		24 VDC	416 mA	85.5 %
THM 10-0521		±5.0 VDC	±1000 mA	83.0 %
THM 10-0522		±12 VDC	±416 mA	85.5 %
THM 10-0523		±15 VDC	±333 mA	86.5 %
THM 10-1210	9.0 – 18 VDC (12 VDC nominal)	3.3 VDC	2500 mA	83.0 %
THM 10-1211		5.0 VDC	2000 mA	85.5 %
THM 10-1212		12 VDC	830 mA	88.0 %
THM 10-1213		15 VDC	670 mA	89.0 %
THM 10-1215		24 VDC	416 mA	89.0 %
THM 10-1221		±5.0 VDC	±1000 mA	84.0 %
THM 10-1222		±12 VDC	±416 mA	89.0 %
THM 10-1223		±15 VDC	±333 mA	88.0 %
THM 10-2410	18 – 36 VDC (24 VDC nominal)	3.3 VDC	2500 mA	83.0 %
THM 10-2411		5.0 VDC	2000 mA	86.5 %
THM 10-2412		12 VDC	830 mA	89.0 %
THM 10-2413		15 VDC	670 mA	89.0 %
THM 10-2415		24 VDC	416 mA	89.0 %
THM 10-2421		±5.0 VDC	±1000 mA	85.0 %
THM 10-2422		±12 VDC	±416 mA	89.0 %
THM 10-2423		±15 VDC	±333 mA	88.0 %
THM 10-4810	36 – 75 VDC (48 VDC nominal)	3.3 VDC	2500 mA	82.5 %
THM 10-4811		5.0 VDC	2000 mA	86.5 %
THM 10-4812		12 VDC	830 mA	89.0 %
THM 10-4813		15 VDC	670 mA	89.0 %
THM 10-4815		24 VDC	416 mA	88.5 %
THM 10-4821		±5.0 VDC	±1000 mA	85.0 %
THM 10-4822		±12 VDC	±416 mA	88.0 %
THM 10-4823		±15 VDC	±333 mA	88.0 %

\* suffix **-B2** for trim option with adjustable output  
 suffix **-B3** for remote control option  
 suffix **-B4** for trim + remote-control option

## Input Specifications

Input current no load	5 Vin models: <b>20 mA typ.</b> 12 Vin models: <b>10 mA typ.</b> 24 Vin models: <b>6 mA typ.</b> 48 Vin models: <b>4 mA typ.</b>
Surge voltage (3 s max.)	5 Vin models: <b>16 V max.</b> 12 Vin models: <b>25 V max.</b> 24 Vin models: <b>50 V max.</b> 48 Vin models: <b>100 V max.</b>
Start-up voltage	5 Vin models: <b>4.5 VDC</b> (or lower) 12 Vin models: <b>9 VDC</b> (or lower) 24 Vin models: <b>18 VDC</b> (or lower) 48 Vin models: <b>36 VDC</b> (or lower)
Startup time	<b>30 ms typ.</b>
Under voltage shut down	5 Vin models: <b>3 – 4.4 VDC</b> 12 Vin models: <b>7 – 8.8 VDC</b> 24 Vin models: <b>15 – 17.5 VDC</b> 48 Vin models: <b>31 – 34.5 VDC</b>
Conducted noise	– Conducted & Radiated input suppression – Filter proposal for complying to EN 55032 class B <b>EN 55011 limits to IEC 60601-1-2 4th edition</b> <b>EN 55032 class A</b> (internal filter) <b>EN 55032 class B</b> (with external components) <a href="http://www.tracopower.com/overview/thm10">www.tracopower.com/overview/thm10</a>
EMC immunity	– Generic for Medical equipment – ESD (electrostatic discharge) – Radiated immunity – Fast transient / surge (with external input capacitor / diode) – Conducted immunity – Magnetic field immunity <b>IEC/EN 60601-1-2 4th edition</b> <b>EN 61000-4-2, air ±8 kV, contact ±6 kV, perf. criteria A</b> <b>EN 61000-4-3, 10 V/m, perf. criteria A</b> <b>EN 61000-4-4, ±2 kV, perf. criteria A</b> <b>EN 61000-4-5, ±2 kV perf. criteria A</b> 5 Vin models: Nippon chemi-con KY 1000 µF/ 25 V and reverse diode (Vishay V10P45) in parallel 12 & 24 Vin models: Nippon chemi-con KY 470 µF/ 50 V 48 Vin models: Nippon chemi-con KY 330 µF/ 100 V <b>EN 61000-4-6, 10 Vrms, perf. criteria A</b> <b>EN 61000-4-8</b> <b>100 A/m, continuous, perf. criteria A</b> <b>1000 A/m, 1 sec., perf. criteria A</b>
External input fuse required (recommended values, slow blow type)	5 Vin models: <b>5 A</b> 12 Vin models: <b>2 A</b> 24 Vin models: <b>1 A</b> 48 Vin models: <b>0.5 A</b>

## Output Specifications

<b>Voltage set accuracy</b>		<b>±1 % max.</b>
<b>Output voltage adjustment</b> (for THM 10 -B2 / -B4 option models only)		
– Single output	15 & 24 Vout models:	<b>–10 / +20%</b>
	other models:	<b>±10%</b>
– Dual output	5, 12 & 15 Vout models:	<b>±10%</b>
<b>Regulation</b>		
– Input variation	single output:	<b>0.2 % max.</b>
	dual output:	<b>0.5 % max.</b>
– Load variation 0 – 100 %	single output:	<b>0.2 % max.</b>
	dual output:	<b>1.0 % max.</b>
– Cross regulation	dual output:	<b>5.0 % max.</b> (asymmetrical load 25/100%)
<b>Minimum load</b>		<b>not required</b>
<b>Ripple and noise</b> (20 MHz Bandwidth)		
	3.3 & 5.0 VDC models:	<b>30 mVp-p typ.</b> with cap. 10 µF/25 V X7R MLCC
	12 & 15 VDC models:	<b>40 mVp-p typ.</b> with cap. 10 µF/25 V X7R MLCC
	24 VDC models:	<b>50 mVp-p typ.</b> with cap. 4.7 µF/50 V X7R MLCC
<b>Transient response</b> (25% load step change)		
– Recovery time		<b>250 µs typ.</b>
<b>Over current limitation</b>		<b>at 150 % typ. of Iout rated</b> (hiccup mode)
<b>Short circuit protection</b>		<b>Continuous, automatic recovery</b>
<b>Over voltage protection</b>		
–Single output	3.3 VDC models:	<b>3.7 – 5.0 VDC</b>
	5.0 VDC models:	<b>5.6 – 7.0 VDC</b>
	12 VDC models:	<b>13.5 – 16.0 VDC</b>
	15 VDC models:	<b>18.3 – 22.0 VDC</b>
	24 VDC models:	<b>29.1 – 34.5 VDC</b>
–Dual output	±5 VDC models:	<b>5.6 – 7.0 VDC</b>
	±12 VDC models:	<b>13.5 – 18.2 VDC</b>
	±15 VDC models:	<b>17.0 – 22.0 VDC</b>
<b>Capacitive load</b>		
–Single output	3.3 VDC models:	<b>3'000 µF max.</b>
	5.0 VDC models:	<b>2'500 µF max.</b>
	12 VDC models:	<b>430 µF max.</b>
	15 VDC models:	<b>350 µF max.</b>
	24 VDC models:	<b>125 µF max.</b>
–Dual output	±5 VDC models:	<b>1'440 µF max.</b> (each output)
	±12 VDC models:	<b>250 µF max.</b> (each output)
	±15 VDC models:	<b>180 µF max.</b> (each output)

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

### General Specifications

Temperature ranges	<ul style="list-style-type: none"> <li>- Operating</li> <li>- Rated according to IEC/EN 60601-1</li> <li>- Case temperature</li> <li>- Storage temperature</li> </ul>	<ul style="list-style-type: none"> <li>-40°C to +90°C (with derating)</li> <li>-40°C to +50°C (without derating)</li> <li>+105°C max.</li> <li>-55°C to +125°C</li> </ul>
Derating		3.5 %/K above 75°C
Thermal impedance		18 K/W typ.
Humidity (non condensing)		5 % to 95 % rel H max.
Isolation voltage (50Hz, 60sec)	- to meet ES/IEC/EN 60601-1	5000 VACrms, rated for 250 VACrms working voltage, 2 × MOPP
Clearance/creepage		8 mm min.
Leakage current (at 240VAC, 60Hz)		2 µA max.
Isolation capacitance (input/output)		17 pF max.
Altitude during operation		5000 m
Temperature coefficient		±0.02 %/K typ.
Reliability, calculated MTBF (MIL-HDBK-217F at +25°C, ground benign)		3'850'000 h
Switching frequency		300 kHz ±30 kHz (pulse width modulation)
Vibration and thermal shock resistance		according to MIL-STD-810F
Remote On/Off (for THM 10 -B3 / -B4 option models only)	<ul style="list-style-type: none"> <li>- Off</li> <li>- On</li> <li>- Off idle current</li> <li>- Remote pin input current</li> </ul>	<ul style="list-style-type: none"> <li>2.2 – 12 VDC (referred to -Vin pin)</li> <li>open circuit or 0 – 1.2 VDC (referred to -Vin pin)</li> <li>2.5 mA typ.</li> <li>-0.5 mA min.</li> <li>1 mA max.</li> </ul>
Safety standards/approvals	<ul style="list-style-type: none"> <li>- Medical equipment</li> <li>- Certification documents</li> </ul>	<ul style="list-style-type: none"> <li>ANSI/AAMI ES60601-1:2005/(R)2012,</li> <li>IEC/EN60601-1 3rd edition</li> <li><a href="http://www.tracopower.com/overview/thm10">www.tracopower.com/overview/thm10</a></li> </ul>
Environmental compliance	<ul style="list-style-type: none"> <li>- Reach</li> <li>- RoHS</li> </ul>	<ul style="list-style-type: none"> <li><a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a></li> <li>RoHS directive 2011/65/EU</li> </ul>

### Physical Specifications

Casing material	non-conductive black plastic
Base material	non-conductive black plastic
Potting material	silicone (UL94 V-0 rated)
Package weight	14 g (0.48oz)
Soldering temperature	max. 265°C / 10 sec

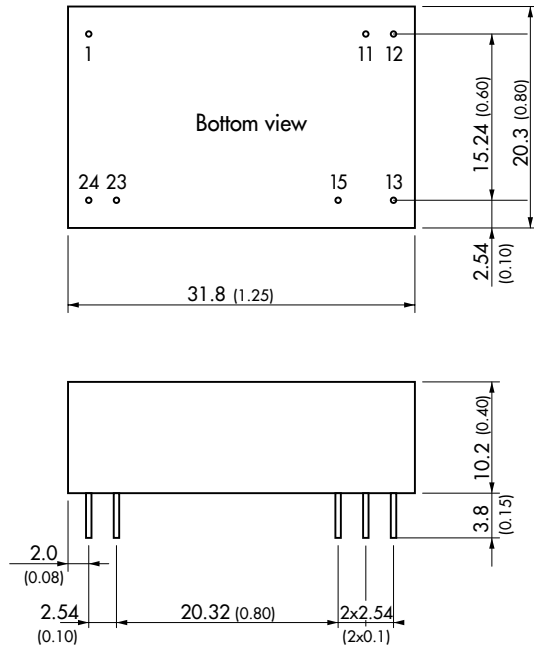


- The component is not be used in an oxygen rich environment.
- The component is not to be used in conjunction with flammable anaesthetics and agents.
- The component has to be disposed appropriately. Please refer to local regulations (Waste Electrical and Electronic Equipment).
- A modification of the component is not allowed.

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

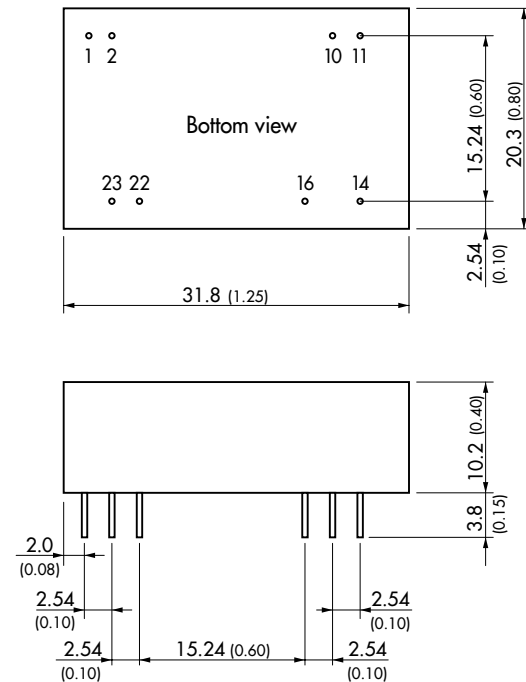
### Outline Dimensions

Standard pinning



Standard Pinout		
Pin	Single	Dual
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)

Optional pinning with options: suffix **-B1** (alternative pinning); **-B2** (with Trim); **-B3** (with Remote); **-B4** (with Trim and Remote)



Optional Pinout		
Pin	Single	Dual
1	No Pin*/Remote	No Pin*/Remote
2	-Vin (GND)	-Vin (GND)
10	No Pin*/Trim	No Pin*/Trim
11	No con.	-Vout
14	+Vout	+Vout
16	-Vout	Common
22	+Vin (Vcc)	+Vin (Vcc)
23	+Vin (Vcc)	+Vin (Vcc)

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

Remark: No suffix **-Bx** for 5 Vin models. Corresponding parts are with THM 10WI series by default. see [www.tracopower.com/overview/thm10wi](http://www.tracopower.com/overview/thm10wi)

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  $\pm 0.25$  ( $\pm 0.01$ )

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