

## DC/DC Converter

## THM 6 Series, 6 Watt

- Wide 2:1 input voltage 6 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



The THM-6 series is a range of medical 6 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 6-0510	4.5 – 9 VDC (5 VDC nominal)	3.3 VDC	1800 mA	81.5 %
THM 6-0511		5.0 VDC	1200 mA	86.0 %
THM 6-0512		12 VDC	500 mA	86.0 %
THM 6-0513		15 VDC	400 mA	87.5 %
THM 6-0515		24 VDC	250 mA	87.0 %
THM 6-0521		±5.0 VDC	±600 mA	84.0 %
THM 6-0522		±12 VDC	±250 mA	86.5 %
THM 6-0523		±15 VDC	±200 mA	87.5 %
THM 6-1210	9.0 – 18 VDC (12 VDC nominal)	3.3 VDC	1800 mA	83.5 %
THM 6-1211		5.0 VDC	1200 mA	86.0 %
THM 6-1212		12 VDC	500 mA	89.0 %
THM 6-1213		15 VDC	400 mA	88.5 %
THM 6-1215		24 VDC	250 mA	88.5 %
THM 6-1221		±5.0 VDC	±600 mA	85.0 %
THM 6-1222		±12 VDC	±250 mA	89.0 %
THM 6-1223		±15 VDC	±200 mA	88.0 %
THM 6-2410	18 – 36 VDC (24 VDC nominal)	3.3 VDC	1800 mA	83.0 %
THM 6-2411		5.0 VDC	1200 mA	86.0 %
THM 6-2412		12 VDC	500 mA	89.0 %
THM 6-2413		15 VDC	400 mA	89.0 %
THM 6-2415		24 VDC	250 mA	88.5 %
THM 6-2421		±5.0 VDC	±600 mA	85.0 %
THM 6-2422		±12 VDC	±250 mA	88.5 %
THM 6-2423		±15 VDC	±200 mA	88.5 %
THM 6-4810	36 – 75 VDC (48 VDC nominal)	3.3 VDC	1800 mA	82.5 %
THM 6-4811		5.0 VDC	1200 mA	86.5 %
THM 6-4812		12 VDC	500 mA	88.0 %
THM 6-4813		15 VDC	400 mA	88.5 %
THM 6-4815		24 VDC	250 mA	88.0 %
THM 6-4821		±5.0 VDC	±600 mA	85.0 %
THM 6-4822		±12 VDC	±250 mA	88.0 %
THM 6-4823		±15 VDC	±200 mA	87.0 %

\* 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:	20 mA typ.
	12 Vin models:	10 mA typ.
	24 Vin models:	6 mA typ.
	48 Vin models:	4 mA typ.
Surge voltage (3 s max.)	5 Vin models:	16 V max.
	12 Vin models:	25 V max.
	24 Vin models:	50 V max.
	48 Vin models:	100 V max.
Start-up voltage	5 Vin models:	4.5 VDC (or lower)
	12 Vin models:	9 VDC (or lower)
	24 Vin models:	18 VDC (or lower)
	48 Vin models:	36 VDC (or lower)
Startup time		30 ms
Under voltage shut down	5 Vin models:	4 VDC typ.
	12 Vin models:	8 VDC typ.
	24 Vin models:	16 VDC typ.
	48 Vin models:	33 VDC typ.
EMC emissions	– Conducted & Radiated input suppression	EN 55011 limits to IEC 60601-1-2 4th edition
	– Application note for filter class B proposal	EN 55032 class A (internal filter) <a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a>
EMC immunity	– Generic for Medical equipment	IEC/EN 60601-1-2 4th edition
	– ESD (electrostatic discharge)	EN 61000-4-2, air $\pm 8$ kV, contact $\pm 6$ kV, perf. criteria A
	– Radiated immunity	EN 61000-4-3, 10 V/m, perf. criteria A
	– Fast transient / surge (with external input capacitor / diode)	EN 61000-4-4, $\pm 2$ kV, perf. criteria A
		EN 61000-4-5, $\pm 2$ kV perf. criteria A
		5 Vin models: Nippon chemi-con KY 1000 $\mu$ F/ 25 V and reverse diode (Vishay V10P45) in parallel
		12 & 24 Vin models: Nippon chemi-con KY 470 $\mu$ F/ 50 V
		48 Vin models: Nippon chemi-con KY 330 $\mu$ F/ 100 V
	– Conducted immunity	EN 61000-4-6, 10 Vrms, perf. criteria A
	– Magnetic field immunity	EN 61000-4-8 100 A/m, continuous, perf. criteria A 1000 A/m, 1 sec., perf. criteria A
External input fuse required (recommended values, slow blow type)	5 Vin models:	2.5 A
	12 Vin models:	1.25 A
	24 Vin models:	0.63 A
	48 Vin models:	0.315 A

## Output Specifications

Voltage set accuracy		$\pm 1\%$ max.
Output voltage adjustment (for THM 6 -B2 / -B4 option models only)		
– Single output	15 & 24 Vout models:	$-10 / +20\%$
	other models:	$\pm 10\%$
– Dual output	5, 12 & 15 Vout models:	$\pm 10\%$
Regulation		
– 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%)
Minimum load		not required
Ripple and noise (20 MHz Bandwidth)		
	3.3 & 5.0 Vout models:	<b>30 mVp-p typ.</b> with cap. 10 $\mu$ F/25 V X7R MLCC
	12 & 15 Vout models:	<b>40 mVp-p typ.</b> with cap. 10 $\mu$ F/25 V X7R MLCC
	24 Vout models:	<b>50 mVp-p typ.</b> with cap. 4.7 $\mu$ F/50 V X7R MLCC
Transient response	– Recovery time (25% load step change)	<b>250 <math>\mu</math>s typ.</b>
Over load protection		<b>at 150 % typ. of Iout rated</b> (hiccup mode)
Short circuit protection		<b>Continuous, automatic recovery</b>
Over voltage protection		
– Single output	3.3 Vout models:	<b>3.7 – 5.0 VDC</b>
	5.0 Vout models:	<b>5.6 – 7.0 VDC</b>
	12 Vout models:	<b>13.5 – 16.0 VDC</b>
	15 Vout models:	<b>18.3 – 22.0 VDC</b>
	24 Vout models:	<b>29.1 – 34.5 VDC</b>
– Dual output	$\pm 5$ Vout models:	<b>5.6 – 7.0 VDC</b>
	$\pm 12$ Vout models:	<b>13.5 – 18.2 VDC</b>
	$\pm 15$ Vout models:	<b>17.0 – 22.0 VDC</b>

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

### General Specifications

Capacitive load	– Single output	3.3 Vout models: <b>2'100 µF max.</b> 5.0 Vout models: <b>1'500 µF max.</b> 12 Vout models: <b>260 µF max.</b> 15 Vout models: <b>210 µF max.</b> 24 Vout models: <b>75 µF max.</b>
	– Dual output	±5 Vout models: <b>860 µF max. (each output)</b> ±12 Vout models: <b>150 µF max. (each output)</b> ±15 Vout models: <b>110 µF max. (each output)</b>
Temperature ranges	– Operating (designed for) – Rated according to IEC/EN 60601-1 – Case temperature – Storage temperature	–40°C to +88°C (without derating) –40°C to +70°C (without derating) +105°C max. –55°C to +125°C
Thermal impedance		18 K/W
Humidity (non condensing)		5 % to 95 % rel H max.
Isolation voltage (50 Hz, 60 s)	– 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)		4'700'000 h
Switching frequency		250 kHz ±25 kHz (pulse width modulation)
Vibration and thermal shock resistance		according to MIL-STD-810F
Remote On/Off (for THM 6 -B3 / -B4 option models only)	– Off – On – Off idle current – Remote pin input current	2.2 – 12 VDC (referred to -Vin pin) open circuit or 0 – 1.2 VDC (referred to -Vin pin) 2.5 mA typ. –0.5 mA min. 1 mA max.
Safety standards/approvals	– Medical equipment  – Certification documents	ANSI/AAMI ES60601-1:2005/(R)2012, IEC/EN60601-1 3rd edition <a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a>
Environmental compliance	– Reach – RoHS	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> RoHS directive 2011/65/EU

### 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 (0.48 oz)
Soldering temperature	265°C / 10 s max.

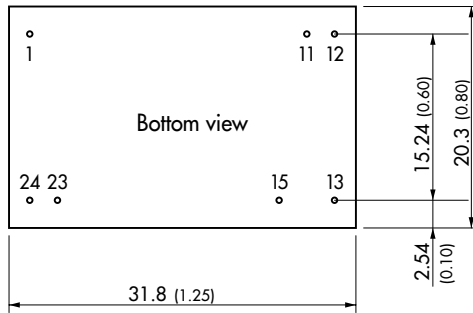


- The component is not be used in an oxygen rich environment.
- The component is not to be used in conjunction with flammable anaesthetics and agents.
- The component has to be disposed appropriately. Please refer to local regulations (Waste Electrical and Electronic Equipment).
- A modification of the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

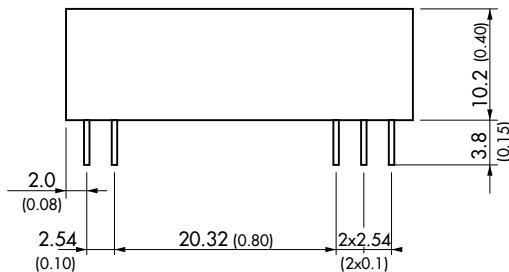
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### Outline Dimensions

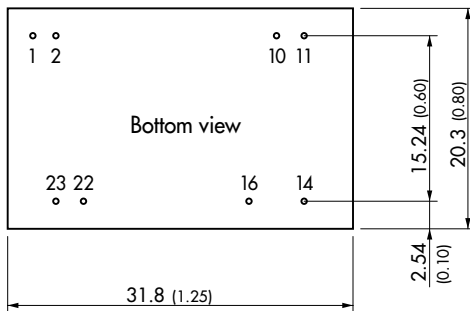
Standard pinning



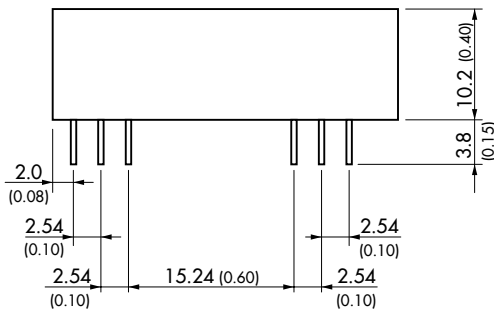
Standard Pinout		
Pin	Single	Dual
1	+Vin (Vcc)	+Vin (Vcc)
11	No pin	Common
12	-Vout	No pin
13	+Vout	-Vout
15	No pin	+Vout
23	-Vin (GND)	-Vin (GND)
24	-Vin (GND)	-Vin (GND)



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 6WI series by default. see [www.tracopower.com/overview/thm6wi](http://www.tracopower.com/overview/thm6wi)

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