

- 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 %

## 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 – Application note for filter class B proposal EN 55011 limits to IEC 60601-1-2 4th edition 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 – ESD (electrostatic discharge) – Radiated immunity – Fast transient / surge (with external input capacitor / diode) – Conducted immunity – Magnetic field immunity IEC/EN 60601-1-2 4th edition EN 61000-4-2, air $\pm 8$ kV, contact $\pm 6$ kV, perf. criteria A EN 61000-4-3, 10 V/m, perf. criteria A 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 EN 61000-4-6, 10 Vrms, perf. criteria A EN 61000-4-8 100 A/m, continuous, perf. criteria A 1000 A/m, 1 sec., perf. criteria A

## Output Specifications

Voltage set accuracy	$\pm 1$ % max.
Regulation	– Input variation single output: 0.2 % max. dual output: 0.5 % max. – Load variation (0 – 100 %) single output: 0.2 % max. dual output: 1.0 % max. – Cross regulation dual output: 5.0 % max. (asymmetrical load 25/100%)
Minimum load	not required
Ripple and noise (20 MHz Bandwidth)	3.3 & 5.0 Vout models: 30 mVp-p typ. with cap. 10 $\mu$ F/25V X7R MLCC 12 & 15 Vout models: 40 mVp-p typ. with cap. 10 $\mu$ F/25V X7R MLCC 24 Vout models: 50 mVp-p typ. with cap. 4.7 $\mu$ F/50V X7R MLCC
Transient response	– Recovery time (25% load step change) 250 $\mu$ s typ.
Over load protection	at 150 % typ. of lout rated (hiccup mode)
Short circuit protection	Continuous, automatic recovery
Over voltage protection	– Single output 3.3 Vout models: 3.7 – 5.0 VDC 5.0 Vout models: 5.6 – 7.0 VDC 12 Vout models: 13.5 – 16.0 VDC 15 Vout models: 18.3 – 22.0 VDC 24 Vout models: 29.1 – 34.5 VDC – Dual output $\pm 5$ Vout models: 5.6 – 7.0 VDC $\pm 12$ Vout models: 13.5 – 18.2 VDC $\pm 15$ Vout models: 17.0 – 22.0 VDC

### General Specifications

Capacitive load	– Single output	3.3 Vout models:	2'100 µF max.
		5.0 Vout models:	1'500 µF max.
		12 Vout models:	260 µF max.
		15 Vout models:	210 µF max.
		24 Vout models:	75 µF max.
– Dual output	±5 Vout models:	860 µF max. (each output)	
	±12 Vout models:	150 µF max. (each output)	
	±15 Vout models:	110 µF max. (each output)	
Temperature ranges	– Operating (designed for)	–40°C to +88°C (without derating)	
	– Rated according to IEC/EN 60601-1	–40°C to +70°C (without derating)	
	– Case temperature	+105°C max.	
	– Storage temperature	–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	
Safety standards/approvals – Medical equipment		ANSI/AAMI ES60601-1:2005/(R)2012, IEC/EN60601-1 3rd edition	
	– Certification documents	<a href="http://www.tracopower.com/overview/thm6">www.tracopower.com/overview/thm6</a>	
Environmental compliance	– Reach	<a href="http://www.tracopower.com/products/reach-declaration.pdf">www.tracopower.com/products/reach-declaration.pdf</a>	
	– RoHS	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.

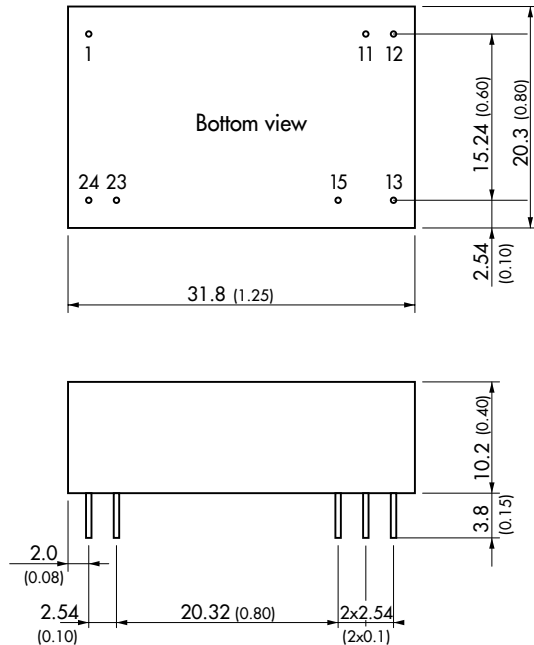


- The component is not be used in an oxygen rich environment.
- The component is not to be used in conjunction with flammable anaesthetics and agents.
- The component has to be disposed appropriately. Please refer to local regulations (Waste Electrical and Electronic Equipment).
- A modification of the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

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

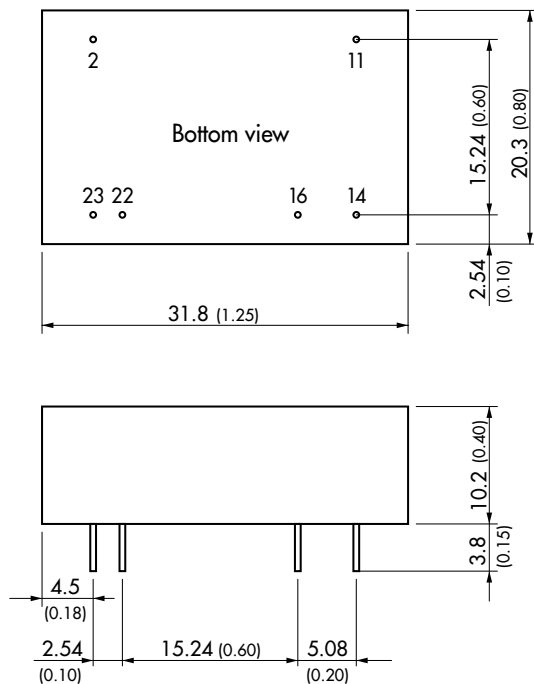
### Outline Dimensions

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: suffix **-B1**



Optional Pinout		
Pin	Single	Dual
2	-Vin (GND)	-Vin (GND)
11	No con.	-Vout
14	+Vout	+Vout
16	-Vout	Common
22	+Vin (Vcc)	+Vin (Vcc)
23	+Vin (Vcc)	+Vin (Vcc)

Remark: No suffix **-B1** 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  $\pm 0.25$  ( $\pm 0.01$ )