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TRACO POWER

DC/DC Medical Converter

THM 6 Series, 6 Watt

- **Compact DIP-24 plastic case**
- **I/O isolation 5000 VAC rated for 250 VAC working voltage**
- **IEC 60601-1 certification edition 3.2 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**
- **5-year product warranty**



2MOPP cULus CB Scheme

ES 60601-1 IEC 60601-1
UL 62368-1 IEC 62368-1

The THM 6 series is a range of medical 6 Watt DC/DC converters in DIP-24 plastic package with wide 2:1 input voltage range. They provide a reinforced isolation system for 5000 VAC and a very low leakage current of less than 2 µA. The units are approved to IEC/EN/ES 60601-1 ed. 3.2 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 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 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
THM 6-0510	4.5 - 9 VDC (5 VDC nom.)	3.3 VDC	1'800 mA			82 %
THM 6-0511		5 VDC	1'200 mA			86 %
THM 6-0512		12 VDC	500 mA			86 %
THM 6-0513		15 VDC	400 mA			88 %
THM 6-0515		24 VDC	250 mA			87 %
THM 6-0521		+5 VDC	600 mA	–5 VDC	600 mA	84 %
THM 6-0522		+12 VDC	250 mA	–12 VDC	250 mA	87 %
THM 6-0523		+15 VDC	200 mA	–15 VDC	200 mA	88 %
THM 6-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	1'800 mA			84 %
THM 6-1211		5 VDC	1'200 mA			86 %
THM 6-1212		12 VDC	500 mA			89 %
THM 6-1213		15 VDC	400 mA			89 %
THM 6-1215		24 VDC	250 mA			89 %
THM 6-1221		+5 VDC	600 mA	–5 VDC	600 mA	85 %
THM 6-1222		+12 VDC	250 mA	–12 VDC	250 mA	89 %
THM 6-1223		+15 VDC	200 mA	–15 VDC	200 mA	88 %
THM 6-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	1'800 mA			83 %
THM 6-2411		5 VDC	1'200 mA			86 %
THM 6-2412		12 VDC	500 mA			89 %
THM 6-2413		15 VDC	400 mA			89 %
THM 6-2415		24 VDC	250 mA			89 %
THM 6-2421		+5 VDC	600 mA	–5 VDC	600 mA	85 %
THM 6-2422		+12 VDC	250 mA	–12 VDC	250 mA	89 %
THM 6-2423		+15 VDC	200 mA	–15 VDC	200 mA	89 %

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THM 6-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	1'800 mA			83 %
THM 6-4811		5 VDC	1'200 mA			87 %
THM 6-4812		12 VDC	500 mA			88 %
THM 6-4813		15 VDC	400 mA			89 %
THM 6-4815		24 VDC	250 mA			88 %
THM 6-4821		+5 VDC	600 mA	−5 VDC	600 mA	85 %
THM 6-4822		+12 VDC	250 mA	−12 VDC	250 mA	88 %
THM 6-4823		+15 VDC	200 mA	−15 VDC	200 mA	87 %

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.
		12 Vin models:	10 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.)
		12 Vin models:	25 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.
		12 Vin models:	7 VDC min. / 8 VDC typ. / 8.8 VDC max.
		24 Vin models:	15 VDC min. / 16 VDC typ. / 17.5 VDC max.
		48 Vin models:	31.5 VDC min. / 33 VDC typ. / 34.5 VDC max.
Recommended Input Fuse		5 Vin models:	2'500 mA (slow blow)
		12 Vin models:	1'250 mA (slow blow)
		24 Vin models:	630 mA (slow blow)
		48 Vin models:	315 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			−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/thm6-adj/ Output power must not exceed rated power!
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.

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

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Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models:	**30 mVp-p typ.** (w/ 10 µF X7R)
		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:	**2'100 µF max.**
		5 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 / -5 Vout models:	**860 / 860 µF max.**
		12 / -12 Vout models:	**150 / 150 µF max.**
		15 / -15 Vout models:	**110 / 110 µF max.**
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
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 - 22 VDC** (±15 VDC model)
Transient Response	- Response Time		**250 µs typ.** (25% Load Step)

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 **2 x MOPP** (Means Of Patient Protection)
	- Certification Documents	www.tracopower.com/thm6-safety-cert/
Energy Source	- Output, acc. to 62368-1	ES1
Power Source	- Output, acc. to 62368-1	PS3
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

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

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EMC Specifications

EMI (Emissions)			EN 60601-1-2 edition 4 (Medical Devices)
	- 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 47 Part 18 class A (internal filter) FCC 47 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 47 Part 18 class A (internal filter) FCC 47 Part 18 class B (with external filter)
		External filter proposal:	www.tracopower.com/thm6-emc-filter/
EMS (Immunity)			EN 60601-1-2 edition 4 (Medical Devices)
	- 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		EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge		EN 61000-4-4, ±2 kV, perf. criteria A
			EN 61000-4-5, ±2 kV, perf. criteria A
		Ext. input component:	5 Vin models: KY 1000 µF / 25 V || V10P45 12 & 24 Vin models: KY 470 µF / 50 V 48 Vin models: KY 330 µF / 100 V
	- Conducted RF Disturbances		EN 61000-4-6, 10 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous:	EN 61000-4-8, 100 A/m, perf. criteria A
		1 s:	EN 61000-4-8, 1000 A/m, perf. criteria A
EMC / Environmental	- Certification Documents		www.tracopower.com/thm6-emc-cert/

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +95°C
	- Approved Ambient Temp.	62368-1:	+70°C max.
		60601-1:	+70°C max.
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		5.26 %/K above 86°C
		See application note:	www.tracopower.com/thm6-cc/
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 Refers to 'Remote' and '-Vin' Pin
	- 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			225 - 275 kHz (PWM) 250 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.

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

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Reliability	- Calculated MTBF	4'700'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline 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	18.0 K/W typ.
Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	52a5f525-3ab7-40de-bc34-cf6114cc760f

Additional Information

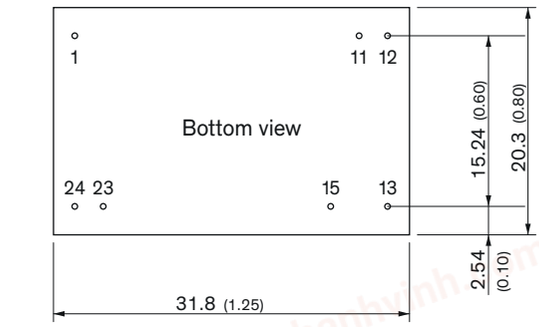
Supporting Documents	www.tracopower.com/overview/thm6
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

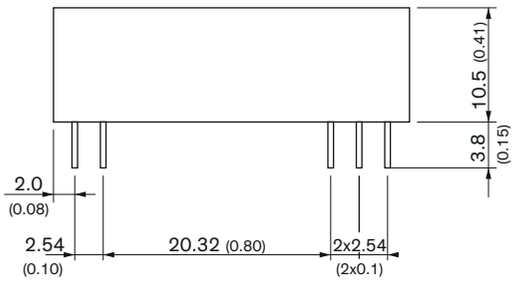
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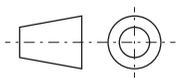
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Outline Dimensions

Standard pinning





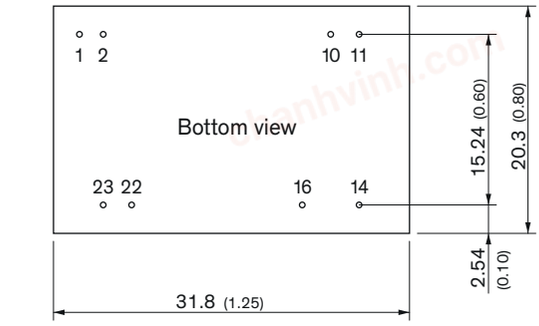


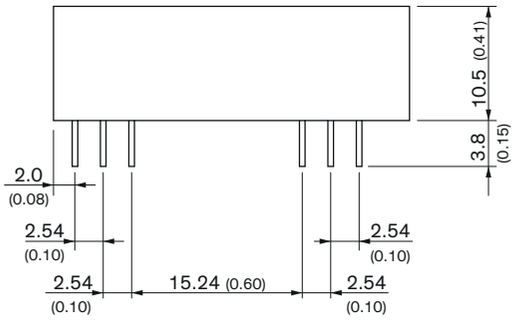
Pinout		
Pin	**Single Output**	**Dual Output**
1	+Vin (Vcc)	+Vin (Vcc)
11	No pin	Common
12	–Vout	No pin
13	+Vout	–Vout
15	No pin	+Vout
23	–Vin (GND)	–Vin (GND)
24	–Vin (GND)	–Vin (GND)

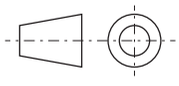
Avoid routing PCB traces under the converter.

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)

Optional models with alternative pinning, adjustable output and/or remote-control function







Pinout		
Pin	**Single Output**	**Dual Output**
1	No pin*/Remote	No pin*/Remote
2	–Vin (GND)	–Vin (GND)
10	No pin*/Trim	No pin*/Trim
11	No pin/NC **	–Vout
14	+Vout	+Vout
16	–Vout	Common
22	+Vin (Vcc)	+Vin (Vcc)
23	+Vin (Vcc)	+Vin (Vcc)

NC: Not connected

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

** If Trim is selected there is no pin on the corresponding pin number.

Remark:
No optional pinning for 5 Vin models. Corresponding parts are with THM 6WI series by default.
see www.tracopower.com/overview/thm6wi

Avoid routing PCB traces under the converter.

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)

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