

- 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 μ A
- Operating temperature -40°C to 90°C
- EMC compliance to IEC 60601-1-2 4th edition and EN55032 class A
- 5-year product warranty



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 μ A. 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 $+90^{\circ}\text{C}$. 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 typ.
		Vnom	I _{max}	Vnom	I _{max}	
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 %
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)	<ul style="list-style-type: none"> - 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
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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/overview/thm6 Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%) - Cross Regulation (25% / 100% asym. load)	single output models: 0.2% max. dual output models: 0.5% max. single output models: 0.2% max. dual output models: 1% max. (Output 1) 1% max. (Output 2) dual output models: 5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output - dual 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) 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)

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

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/overview/thm6
Pollution Degree	PD 2	
Over Voltage Category	OVC II	

EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 60601-1-2 edition 4 (Medical Devices) 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/overview/thm6

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EMS (Immunity)	<ul style="list-style-type: none"> - Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field 	EN 60601-1-2 edition 4 (Medical Devices) Air: EN 61000-4-2, ± 15 kV, perf. criteria A Contact: EN 61000-4-2, ± 8 kV, perf. criteria A EN 61000-4-3, 10 V/m, perf. criteria A 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 μ F / 25 V V10P45 12 & 24 Vin models: KY 470 μ F / 50 V 48 Vin models: KY 330 μ F / 100 V EN 61000-4-6, 10 V _{rms} , perf. criteria A 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/overview/thm6

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	<ul style="list-style-type: none"> - Operating Temperature - Approved Ambient Temp. - Case Temperature - Storage Temperature 	-40°C to +95°C +70°C max. (for compliance to 60601-1) +105°C max. -55°C to +125°C
Power Derating	- High Temperature	5.26 %/K above 86°C
	See application note:	www.tracopower.com/overview/thm6
Cooling System		Natural convection (20 LFM)
Remote Control	<ul style="list-style-type: none"> - Voltage Controlled Remote (passive = on) - Off Idle Input Current - Remote Pin Input Current 	On: 0 to 1.2 VDC or open circuit Off: 2.2 to 12 VDC Refers to 'Remote' and '-Vin' Pin 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		225 - 275 kHz (PWM) 250 kHz typ. (PWM)
Insulation System		Reinforced Insulation
Working Voltage (rated)		250 VAC
Isolation Test Voltage	<ul style="list-style-type: none"> - Input to Output, 60 s - Input to Output, 1 s 	5'000 VAC 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 μ A max. (240 VAC, 60 Hz)
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	<ul style="list-style-type: none"> - Vibration - Thermal Shock 	MIL-STD-810F 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 μ m)
Pin Surface Plating		Tin (3 - 5 μ m), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP24

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

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 REACH SVHC list compliant REACH Annex XVII compliant
- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7a, 7c-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

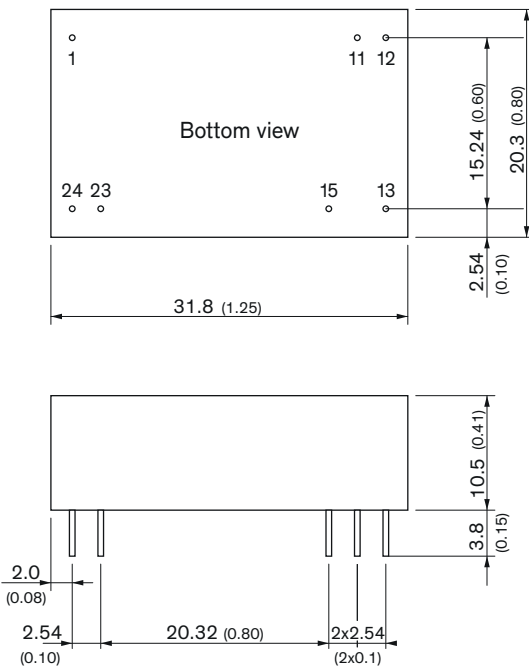
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/thm6

Outline Dimensions

Standard pinning

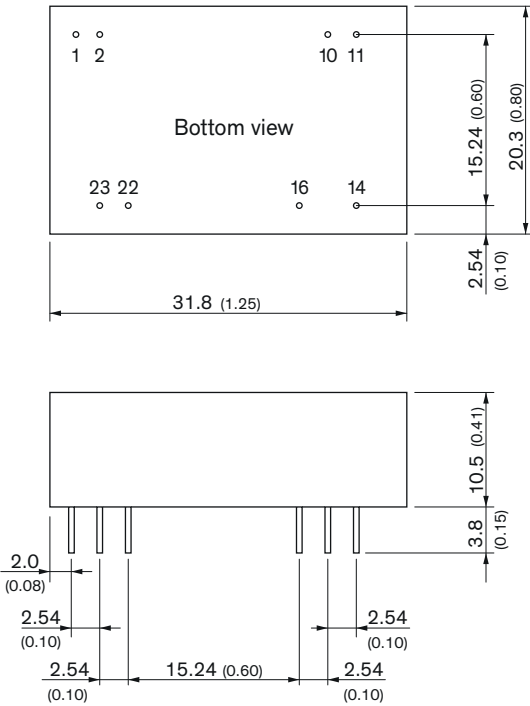


Pin	Pinout	
	Single Output	Dual Output
1	+Vin (Vcc)	+Vin (Vcc)
11	No pin	Common
12	-Vout	No pin
13	+Vout	-Vout
15	No pin	+Vout
23	-Vin (GND)	-Vin (GND)
24	-Vin (GND)	-Vin (GND)

Dimensions in mm (inch)
Tolerances ± 0.5 (± 0.02)
Pin $\varnothing 0.6 \pm 0.1$ (0.024 ± 0.004)
Pin pitch tolerances ± 0.25 (± 0.01)

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

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