

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) www.tracopower.com/overview/thm6 |
| EMC immunity | – Generic for Medical equipment | IEC/EN 60601-1-2 4th edition |
| | – ESD (electrostatic discharge) | EN 61000-4-2, air ± 8 kV, contact ± 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, ± 2 kV, perf. criteria A |
| | | EN 61000-4-5, ± 2 kV perf. criteria A |
| | | 5 Vin models: Nippon chemi-con KY 1000 μ F/ 25 V and reverse diode (Vishay V10P45) in parallel |
| | | 12 & 24 Vin models: Nippon chemi-con KY 470 μ F/ 50 V |
| | | 48 Vin models: Nippon chemi-con KY 330 μ 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: | 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 μ F/25 V X7R MLCC |
| | 12 & 15 Vout models: | 40 mVp-p typ. with cap. 10 μ F/25 V X7R MLCC |
| | 24 Vout models: | 50 mVp-p typ. with cap. 4.7 μ F/50 V X7R MLCC |
| Transient response | – Recovery time (25% load step change) | 250 μs typ. |
| Over load protection | | at 150 % typ. of Iout 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 | ± 5 Vout models: | 5.6 – 7.0 VDC |
| | ± 12 Vout models: | 13.5 – 18.2 VDC |
| | ± 15 Vout models: | 17.0 – 22.0 VDC |

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: 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 | – Industrial / Commercial rating – Medical IEC/EN 60601-1 rating – 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 www.tracopower.com/overview/thm6 |
| Environmental compliance | – Reach – RoHS | www.tracopower.com/info/reach-declaration.pdf 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. |

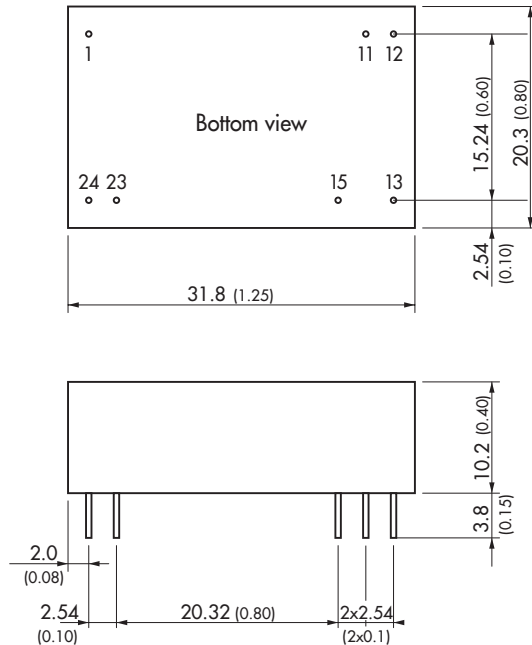


- The component is not be used in an oxygen rich environment.
- The component is not to be used in conjunction with flammable anaesthetics and agents.
- The component has to be disposed appropriately. Please refer to local regulations (Waste Electrical and Electronic Equipment).
- A modification of the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

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

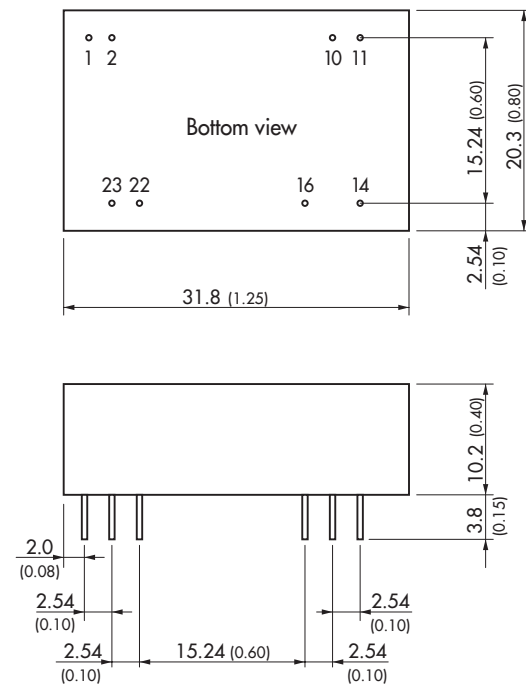
Outline Dimensions

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 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

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)