

- Wide 2:1 input voltage
- 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
- Extended operating temperature range -40°C to 90°C.
- Input filter to meet EN55022 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  $\mu$ A. 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<br>(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<br>(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<br>(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<br>(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 sec. 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.                                                                          |
| Conducted noise             |                                         | EN55022 class A (internal filter)                                                    |
| EMC immunity                | – 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                | EN 61000-4-4, $\pm 2$ kV, perf. criteria A                                           |
|                             | (with external input capacitor / diode) | 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                                                   |

## Output Specifications

|                                     |                                        |                                                      |
|-------------------------------------|----------------------------------------|------------------------------------------------------|
| Voltage set accuracy                |                                        | $\pm 1$ % max.                                       |
| Regulation                          | – Input variation                      | single output: 0.2 % max.<br>dual output: 0.5 % max. |
|                                     | – Load variation 0 – 100 %             | single output: 0.2 % max.<br>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 VDC models:                  | 30 mVp-p typ. with cap. 10 $\mu$ F/25 V X7R MLCC     |
|                                     | 12 & 15 VDC models:                    | 40 mVp-p typ. with cap. 10 $\mu$ F/25 V X7R MLCC     |
|                                     | 24 VDC models:                         | 50 mVp-p typ. with cap. 4.7 $\mu$ F/50 V 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 VDC models: 3.7 – 5.0 VDC                        |
|                                     |                                        | 5.0 VDC models: 5.6 – 7.0 VDC                        |
|                                     |                                        | 12 VDC models: 13.5 – 16.0 VDC                       |
|                                     |                                        | 15 VDC models: 18.3 – 22.0 VDC                       |
|                                     |                                        | 24 VDC models: 29.1 – 34.5 VDC                       |
|                                     | –Dual output                           | $\pm 5$ VDC models: 5.6 – 7.0 VDC                    |
|                                     |                                        | $\pm 12$ VDC models: 13.5 – 18.2 VDC                 |
|                                     |                                        | $\pm 15$ VDC 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 VDC models: 2'100 µF max.<br>5.0 VDC models: 1'500 µF max.<br>12 VDC models: 260 µF max.<br>15 VDC models: 210 µF max.<br>24 VDC models: 75 µF max. |
|                                                                      | – Dual output                       | ±5 VDC models: 860 µF max. (each output)<br>±12 VDC models: 150 µF max. (each output)<br>±15 VDC 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<br>(50Hz, 60sec)                                   | – 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,<br>IEC/EN60601-1 3rd edition                                                                                          |
|                                                                      | – Certification documents           | <a href="http://www.tracopower.com/products/overview/thm6">www.tracopower.com/products/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 (0.48oz)                |
| Soldering temperature | max. 265°C / 10 sec          |

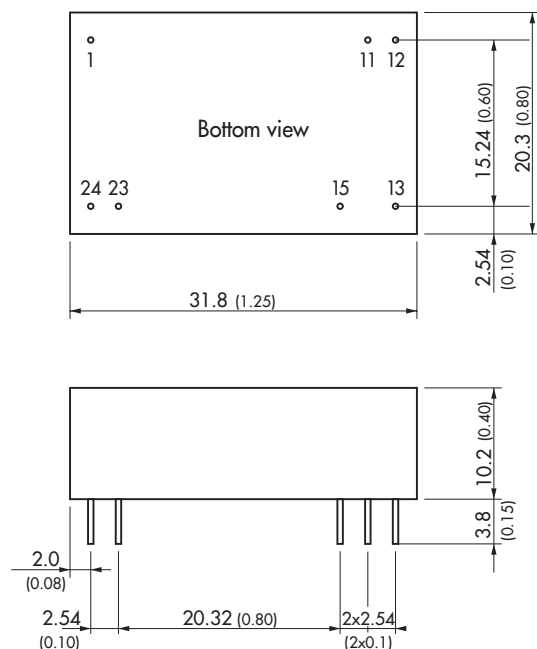


- The component is not be used in an oxygen rich environment.
- The component is not to be used in conjunction with flammable anaesthetics and agents.
- The component has to be disposed appropriately. Please refer to local regulations (Waste Electrical and Electronic Equipment).
- A modification of the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

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

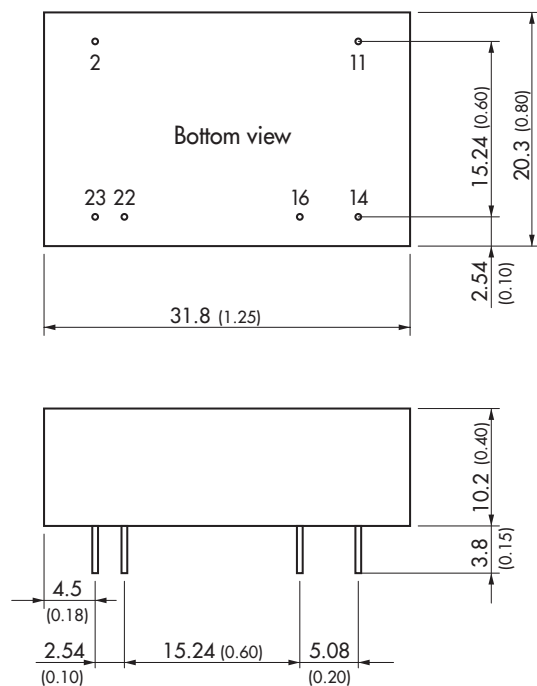
### Outline Dimensions

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

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