

- Industry standard pinout
- Unregulated outputs
- Operating temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- I/O isolation voltage 1000 VDC
- Efficiency up to 83 %
- 3-year product warranty



The TMH series are ultra miniature, isolated 2 Watt DC/DC-converters in a Single-in-Line package (SIP). Requiring only 1.5 cm<sup>2</sup> board space they offer the ideal solution in many space critical applications for board level power distribution. The use of SMD-technology makes it possible to offer a product with high performance at low cost.

| Models     |                                  |          |                  |          |                  |                 |
|------------|----------------------------------|----------|------------------|----------|------------------|-----------------|
| Order Code | Input Voltage Range              | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|            |                                  | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| TMH 0505S  | 4.5 - 5.5 VDC<br>(5 VDC nom.)    | 5 VDC    | 400 mA           |          |                  | 76 %            |
| TMH 0512S  |                                  | 12 VDC   | 165 mA           |          |                  | 80 %            |
| TMH 0515S  |                                  | 15 VDC   | 133 mA           |          |                  | 80 %            |
| TMH 0505D  |                                  | +5 VDC   | 200 mA           | -5 VDC   | 200 mA           | 77 %            |
| TMH 0512D  |                                  | +12 VDC  | 83 mA            | -12 VDC  | 83 mA            | 79 %            |
| TMH 0515D  |                                  | +15 VDC  | 66 mA            | -15 VDC  | 66 mA            | 79 %            |
| TMH 1205S  | 10.8 - 13.2 VDC<br>(12 VDC nom.) | 5 VDC    | 400 mA           |          |                  | 78 %            |
| TMH 1212S  |                                  | 12 VDC   | 165 mA           |          |                  | 82 %            |
| TMH 1215S  |                                  | 15 VDC   | 133 mA           |          |                  | 83 %            |
| TMH 1205D  |                                  | +5 VDC   | 200 mA           | -5 VDC   | 200 mA           | 79 %            |
| TMH 1212D  |                                  | +12 VDC  | 83 mA            | -12 VDC  | 83 mA            | 82 %            |
| TMH 1215D  |                                  | +15 VDC  | 66 mA            | -15 VDC  | 66 mA            | 82 %            |
| TMH 2405S  | 21.6 - 26.4 VDC<br>(24 VDC nom.) | 5 VDC    | 400 mA           |          |                  | 77 %            |
| TMH 2412S  |                                  | 12 VDC   | 165 mA           |          |                  | 81 %            |
| TMH 2415S  |                                  | 15 VDC   | 133 mA           |          |                  | 82 %            |
| TMH 2405D  |                                  | +5 VDC   | 200 mA           | -5 VDC   | 200 mA           | 79 %            |
| TMH 2412D  |                                  | +12 VDC  | 83 mA            | -12 VDC  | 83 mA            | 81 %            |
| TMH 2415D  |                                  | +15 VDC  | 66 mA            | -15 VDC  | 66 mA            | 82 %            |

## Input Specifications

|                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Current          | - At no load   | 5 Vin models: <b>60 mA typ.</b><br>12 Vin models: <b>30 mA typ.</b><br>24 Vin models: <b>15 mA typ.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                        | - At full load | 5 Vin models: <b>526 mA typ.</b> (5 Vout model)<br><b>495 mA typ.</b> (12 Vout model)<br><b>499 mA typ.</b> (15 Vout model)<br><b>519 mA typ.</b> (5 / -5 Vout model)<br><b>504 mA typ.</b> (12 / -12 Vout model)<br><b>501 mA typ.</b> (15 / -15 Vout model)<br>12 Vin models: <b>212 mA typ.</b> (5 Vout model)<br><b>200 mA typ.</b> (12 Vout model)<br><b>200 mA typ.</b> (15 Vout model)<br><b>210 mA typ.</b> (5 / -5 Vout model)<br><b>201 mA typ.</b> (12 / -12 Vout model)<br><b>200 mA typ.</b> (15 / -15 Vout model)<br>24 Vin models: <b>108 mA typ.</b> (5 Vout model)<br><b>101 mA typ.</b> (12 Vout model)<br><b>101 mA typ.</b> (15 Vout model)<br><b>105 mA typ.</b> (5 / -5 Vout model)<br><b>102 mA typ.</b> (12 / -12 Vout model)<br><b>100 mA typ.</b> (15 / -15 Vout model) |
| Surge Voltage          |                | 5 Vin models: <b>9 VDC max.</b> (1 s max.)<br>12 Vin models: <b>18 VDC max.</b> (1 s max.)<br>24 Vin models: <b>30 VDC max.</b> (1 s max.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Recommended Input Fuse |                | 5 Vin models: <b>1'000 mA</b> (slow blow)<br>12 Vin models: <b>500 mA</b> (slow blow)<br>24 Vin models: <b>200 mA</b> (slow blow)<br>(The need of an external fuse has to be assessed in the final application.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Input Filter           |                | <b>Internal Pi-Type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Output Specifications

|                             |                                                             |                                                                                                                                                                                                     |
|-----------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Voltage Set Accuracy        |                                                             | <b>±3% max.</b>                                                                                                                                                                                     |
| Regulation<br>(Unregulated) | - Input Variation (1% Vin step)                             | single output models: <b>1.5% max.</b><br>dual output models: <b>1.5% max.</b>                                                                                                                      |
|                             | - Load Variation<br>- Voltage Balance<br>(symmetrical load) | See application note: <a href="http://www.tracopower.com/tmh-cc/">www.tracopower.com/tmh-cc/</a><br>dual output models: <b>1% max.</b>                                                              |
| Ripple and Noise            | - 20 MHz Bandwidth                                          | <b>150 mVp-p max.</b><br><b>100 mVp-p typ.</b><br>(To further reduce Ripple and Noise, a capacitor with 1.5 µF X7R is recommended.)                                                                 |
| Capacitive Load             | - single output                                             | 5 Vout models: <b>470 µF max.</b><br>12 Vout models: <b>470 µF max.</b><br>15 Vout models: <b>470 µF max.</b>                                                                                       |
|                             | - dual output                                               | 5 / -5 Vout models: <b>390 / 390 µF max.</b><br>12 / -12 Vout models: <b>390 / 390 µF max.</b><br>15 / -15 Vout models: <b>390 / 390 µF max.</b>                                                    |
| Minimum Load                |                                                             | See application note: <a href="http://www.tracopower.com/tmh-cc/">www.tracopower.com/tmh-cc/</a><br>(Operation at lower load will not damage the converter, but it may not meet all specifications) |
| Temperature Coefficient     |                                                             | <b>±0.02 %/K max.</b>                                                                                                                                                                               |
| Start-up Time               |                                                             | <b>260 ms max.</b>                                                                                                                                                                                  |
| Short Circuit Protection    |                                                             | <b>Limited 0.5 s max., Automatic recovery</b>                                                                                                                                                       |

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

## Safety Specifications

Over Voltage Category

Not mains connected

## EMC Specifications

EMI (Emissions)

- Conducted Emissions
- Radiated Emissions

EN 55032 class A (with external filter)

EN 55032 class A (internal filter)

External filter proposal: [www.tracopower.com/tmh-emc-filter/](http://www.tracopower.com/tmh-emc-filter/)

## General Specifications

Relative Humidity

95% max. (non condensing)

Temperature Ranges

- Operating Temperature
- Case Temperature
- Storage Temperature

-40°C to +85°C

+105°C max.

-50°C to +125°C

Power Derating

- High Temperature

2.86 %/K above 70°C

See application note: [www.tracopower.com/tmh-cc/](http://www.tracopower.com/tmh-cc/)

Cooling System

Natural convection (20 LFM)

Regulator Topology

Push-Pull Converter

Switching Frequency

50 - 100 kHz (PFM)

80 kHz typ. (PFM)

Insulation System

Functional Insulation

Isolation Test Voltage

- Input to Output, 60 s
- Input to Output, 1 s

1'000 VDC

1'200 VDC

Isolation Resistance

- Input to Output, 500 VDC

1'000 MΩ min.

Isolation Capacitance

- Input to Output, 100 kHz, 1 V

80 pF typ.

120 pF max.

Reliability

- Calculated MTBF

2'000'000 h (MIL-HDBK-217F, ground benign)

Washing Process

According to Cleaning Guideline

[www.tracopower.com/info/cleaning.pdf](http://www.tracopower.com/info/cleaning.pdf)

Housing Material

Non-conductive Plastic (UL 94 V-0 rated)

Potting Material

Epoxy (UL 94 V-0 rated)

Pin Material

Nickel-Iron (Alloy 42)

Pin Foundation Plating

Nickel (1 μm min.)

Pin Surface Plating

Tin (3 - 5 μm), matte

Housing Type

Plastic Case

Mounting Type

PCB Mount

Connection Type

THD (Through-Hole Device)

Footprint Type

SIP7

Soldering Profile

Lead-Free Wave Soldering

260°C / 10 s max.

Weight

2.7 g

Thermal Impedance

- Case to Ambient

52.5 K/W typ.

Environmental Compliance

- REACH Declaration

[www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)

REACH SVHC list compliant

REACH Annex XVII compliant

- RoHS Declaration

[www.tracopower.com/info/rohs-declaration.pdf](http://www.tracopower.com/info/rohs-declaration.pdf)

Exemptions: 7(a)

(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)

- SCIP Reference Number

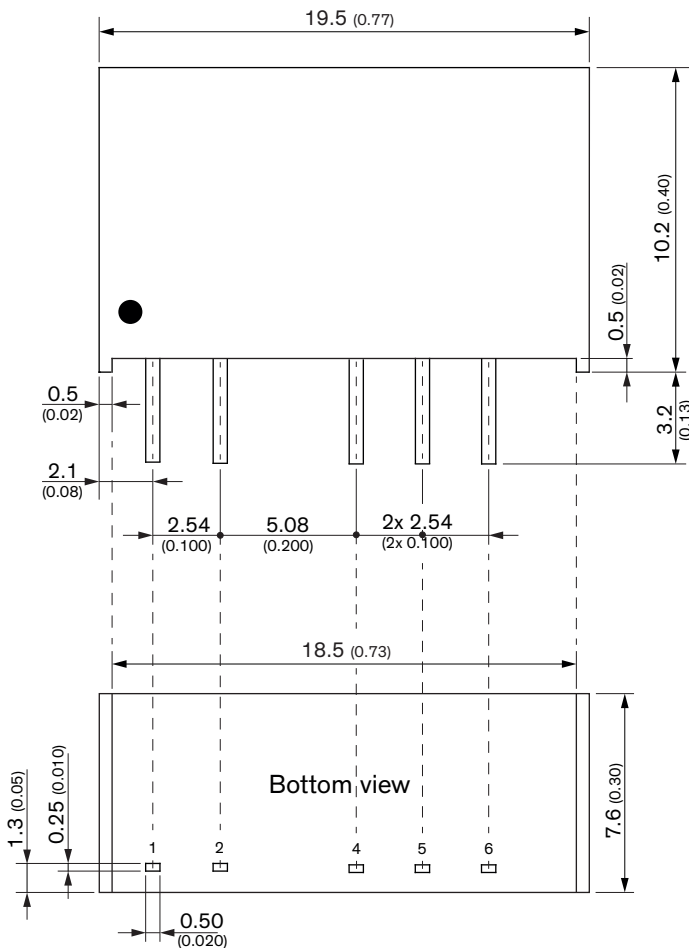
13224883-cead-4b7f-b9ea-fc07cfac2927

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

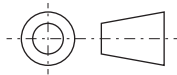
## Additional Information

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| Supporting Documents       | <a href="http://www.tracopower.com/overview/tmh">www.tracopower.com/overview/tmh</a>           |
| Frequently Asked Questions | <a href="http://www.tracopower.com/glossary-faq">www.tracopower.com/glossary-faq</a>           |
| Glossary                   | <a href="http://www.tracopower.com/info/glossary.pdf">www.tracopower.com/info/glossary.pdf</a> |
| Service Portal             | <a href="http://www.tracoserviceportal.com">www.tracoserviceportal.com</a>                     |

## Outline Dimensions



Dimensions in mm (inch)  
Tolerance: x.x  $\pm 0.25$  (x.xx  $\pm 0.01$ )  
                  x.xx  $\pm 0.13$  (x.xxx  $\pm 0.005$ )  
Pin tolerance:  $\pm 0.05$  ( $\pm 0.002$ )



## Pinout

| Pin | Single     | Dual   |
|-----|------------|--------|
| 1   | +Vin (Vcc) |        |
| 2   | -Vin (GND) |        |
| 4   | -Vout      |        |
| 5   | No pin     | Common |
| 6   | +Vout      |        |

Avoid routing PCB traces under the converter.