

## Unregulated DC/DC Converter

## TMH Series, 2 Watt

- 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 (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 (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 (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> 12 Vin models: <b>30 mA typ.</b> 24 Vin models: <b>15 mA typ.</b>
	- At full load	5 Vin models: <b>526 mA typ.</b> (5 Vout model) <b>495 mA typ.</b> (12 Vout model) <b>499 mA typ.</b> (15 Vout model) <b>519 mA typ.</b> (5 / -5 Vout model) <b>504 mA typ.</b> (12 / -12 Vout model) <b>501 mA typ.</b> (15 / -15 Vout model) 12 Vin models: <b>212 mA typ.</b> (5 Vout model) <b>200 mA typ.</b> (12 Vout model) <b>200 mA typ.</b> (15 Vout model) <b>210 mA typ.</b> (5 / -5 Vout model) <b>201 mA typ.</b> (12 / -12 Vout model) <b>200 mA typ.</b> (15 / -15 Vout model) 24 Vin models: <b>108 mA typ.</b> (5 Vout model) <b>101 mA typ.</b> (12 Vout model) <b>101 mA typ.</b> (15 Vout model) <b>105 mA typ.</b> (5 / -5 Vout model) <b>102 mA typ.</b> (12 / -12 Vout model) <b>100 mA typ.</b> (15 / -15 Vout model)
Surge Voltage		5 Vin models: <b>9 VDC max.</b> (1 s max.) 12 Vin models: <b>18 VDC max.</b> (1 s max.) 24 Vin models: <b>30 VDC max.</b> (1 s max.)
Recommended Input Fuse		5 Vin models: <b>1'000 mA</b> (slow blow) 12 Vin models: <b>500 mA</b> (slow blow) 24 Vin models: <b>200 mA</b> (slow blow) (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 (Unregulated)	- Input Variation (1% Vin step)	single output models: <b>1.5% max.</b> dual output models: <b>1.5% max.</b>
	- Load Variation - Voltage Balance (symmetrical load)	See application note: <a href="http://www.tracopower.com/overview/tmh">www.tracopower.com/overview/tmh</a> dual output models: <b>1% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>150 mVp-p max.</b> <b>100 mVp-p typ.</b> (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> 12 Vout models: <b>470 µF max.</b> 15 Vout models: <b>470 µF max.</b>
	- dual output	5 / -5 Vout models: <b>390 / 390 µF max.</b> 12 / -12 Vout models: <b>390 / 390 µF max.</b> 15 / -15 Vout models: <b>390 / 390 µF max.</b>
Minimum Load		See application note: <a href="http://www.tracopower.com/overview/tmh">www.tracopower.com/overview/tmh</a> (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.

## EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 55032 class A (with external filter)
	- Radiated Emissions	EN 55032 class A (internal filter)
External filter proposal: <a href="http://www.tracopower.com/overview/tmh">www.tracopower.com/overview/tmh</a>		

## General Specifications

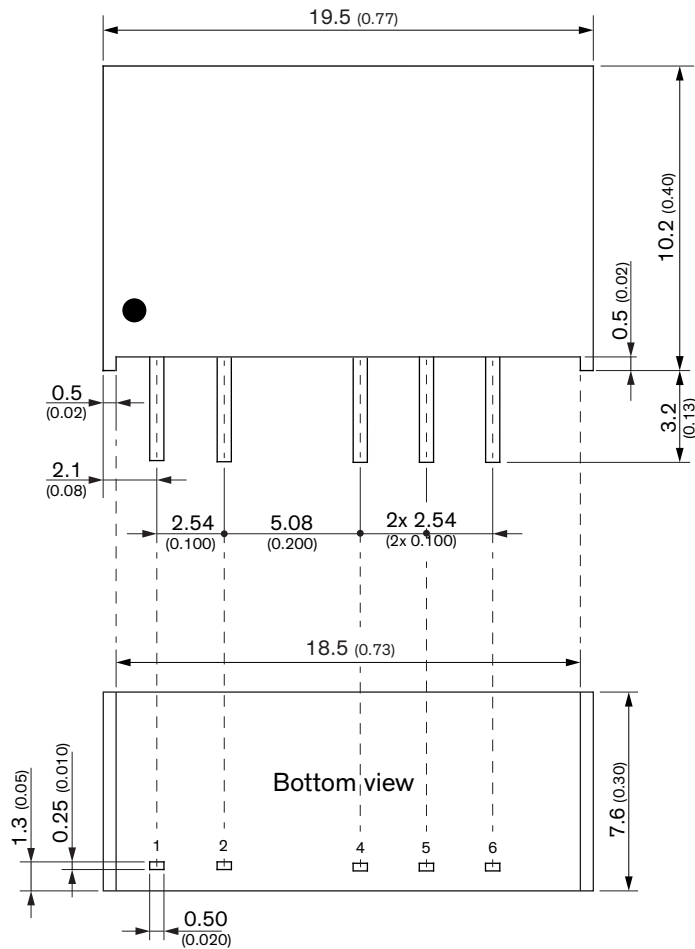
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +85°C
	- Case Temperature	+105°C max.
	- Storage Temperature	-50°C to +125°C
Power Derating	- High Temperature	2.86 %/K above 70°C
	See application note: <a href="http://www.tracopower.com/overview/tmh">www.tracopower.com/overview/tmh</a>	
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	1'000 VDC
	- Input to Output, 1 s	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 <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Base 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	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> 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

## 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>

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## Outline Dimensions



Dimensions in mm (inch)

Tolerance:  $x.x \pm 0.25$  ( $x.xx \pm 0.01$ )

$$x.xx \pm 0.13 \text{ (} x.xxx \pm 0.005 \text{)}$$

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	