

- Ultra wide 4:1 input voltage range up to 160 VDC
- I/O isolation voltage 4000 VACrms
- Reinforced insulation rated for working voltage 1000 VAC
- 2 x MOOP Medical safety according to ANSI/AAMI ES 60601-1:2005 and IEC/EN 60601-1 3rd edition
- Industrial safety to IEC/EN/UL 62368-1
- Operating temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$
- Input filter to meet EN 55011 & EN 55032, class A
- Low leakage current  $<2\mu\text{A}$
- 3-year product warranty



The THP 3 series is a new range of high performance 3W DC/DC converters in a low profile DIL-24 package with standard industry pin-out. The very high I/O-isolation system of these converters and input voltages up to 160 VDC make this product the best choice for many demanding applications in railroad and transportation systems, medical equipment, instrumentation, everywhere where high basic-, supplementary- or reinforced insulation is requested to meet specific safety standards. A high efficiency allows safe operation in a temperature range of  $-40\text{ }^{\circ}\text{C}$  to  $+70\text{ }^{\circ}\text{C}$  at full load. Full SMD-design with exclusive use of ceramic capacitors ensure a very high reliability and a long product lifetime.

### Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
THP 3-2411	9 - 40 VDC (24 VDC nom.)	5 VDC	600 mA			78 %
THP 3-2412		12 VDC	250 mA			83 %
THP 3-2422		+12 VDC	125 mA	-12 VDC	125 mA	83 %
THP 3-2423		+15 VDC	100 mA	-15 VDC	100 mA	83 %
THP 3-4811	18 - 80 VDC (48 VDC nom.)	5 VDC	600 mA			78 %
THP 3-4812		12 VDC	250 mA			83 %
THP 3-4822		+12 VDC	125 mA	-12 VDC	125 mA	83 %
THP 3-4823		+15 VDC	100 mA	-15 VDC	100 mA	83 %
THP 3-7211	36 - 160 VDC (110 VDC nom.)	5 VDC	600 mA			78 %
THP 3-7212		12 VDC	250 mA			83 %
THP 3-7222		+12 VDC	125 mA	-12 VDC	125 mA	83 %
THP 3-7223		+15 VDC	100 mA	-15 VDC	100 mA	83 %

## Input Specifications

Input Current	- At no load	24 Vin models: <b>20 mA typ.</b> 48 Vin models: <b>10 mA typ.</b> 110 Vin models: <b>5 mA typ.</b>
	- At full load	24 Vin models: <b>160 mA typ.</b> (5 Vout model) <b>151 mA typ.</b> (12 Vout model) <b>151 mA typ.</b> (12 / -12 Vout model) <b>151 mA typ.</b> (15 / -15 Vout model) 48 Vin models: <b>80 mA typ.</b> (5 Vout model) <b>75 mA typ.</b> (12 Vout model) <b>75 mA typ.</b> (12 / -12 Vout model) <b>75 mA typ.</b> (15 / -15 Vout model) 110 Vin models: <b>35 mA typ.</b> (5 Vout model) <b>33 mA typ.</b> (12 Vout model) <b>33 mA typ.</b> (12 / -12 Vout model) <b>33 mA typ.</b> (15 / -15 Vout model)
Surge Voltage		24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.) 110 Vin models: <b>180 VDC max.</b> (1 s max.)
Start-up Voltage		24 Vin models: <b>8 VDC min. / 8.5 VDC typ. / 9 VDC max.</b> 48 Vin models: <b>13 VDC min. / 15 VDC typ. / 17 VDC max.</b> 110 Vin models: <b>26 VDC min. / 30 VDC typ. / 34 VDC max.</b>
Under Voltage Lockout		24 Vin models: <b>8.5 VDC max.</b> 48 Vin models: <b>16 VDC max.</b> 110 Vin models: <b>32 VDC max.</b>
Reflected Ripple Current		24 Vin models: <b>15 mA typ.</b> 48 Vin models: <b>8 mA typ.</b> 110 Vin models: <b>3 mA typ.</b>
Recommended Input Fuse		24 Vin models: <b>1'000 mA</b> (slow blow) 48 Vin models: <b>600 mA</b> (slow blow) 110 Vin models: <b>300 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>
Short Circuit Input Power		<b>2 W max.</b>

## Output Specifications

Voltage Set Accuracy		<b>±1% max.</b>	
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.5% max.</b> dual output models: <b>0.5% max.</b>	
	- Load Variation (25 - 100%)	single output models: <b>1% max.</b> dual output models: <b>1% max.</b> (Output 1) <b>1% max.</b> (Output 2)	
	- Voltage Balance (symmetrical load)	dual output models: <b>2% max.</b>	
	Ripple and Noise (20 MHz Bandwidth)		
Ripple and Noise (20 MHz Bandwidth)	- single output	5 Vout models: <b>75 mVp-p typ.</b> 12 Vout models: <b>100 mVp-p typ.</b>	
	- dual output	12 / -12 Vout models: <b>100 / 100 mVp-p typ.</b> 15 / -15 Vout models: <b>100 / 100 mVp-p typ.</b>	
	- single output	5 Vout models: <b>100 mVp-p max.</b> 12 Vout models: <b>150 mVp-p max.</b>	
	- dual output	12 / -12 Vout models: <b>150 / 150 mVp-p max.</b> 15 / -15 Vout models: <b>150 / 150 mVp-p max.</b>	
			(To further reduce Ripple and Noise, a capacitor with 3.3 µF X7R is recommended.)

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

Capacitive Load	- single output	5 Vout models: 1'000 µF max. 12 Vout models: 470 µF max.
	- dual output	12 / -12 Vout models: 220 / 220 µF max. 15 / -15 Vout models: 220 / 220 µF max.
Minimum Load		15 % of Iout max. (Operation at lower load will not damage the converter, but it may not meet all specifications)
Temperature Coefficient		±0.05 %/K max.
Start-up Time		40 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Overload Protection		Foldback Mode
Output Current Limitation		120% min. of Iout max.
		150% typ. of Iout max.
Transient Response	- Response Deviation	3% typ. / 6% max. (25% Load Step)
	- Response Time	150 µs typ. / 500 µs max. (25% Load Step)

### Safety Specifications

Safety 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 CSA-C22.2, No 60601-1 2 x MOOP (Means Of Operator Protection) <a href="http://www.tracopower.com/overview/thp3">www.tracopower.com/overview/thp3</a>
	- Certification Documents	
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted 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)
	- 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) External filter proposal: <a href="http://www.tracopower.com/overview/thp3">www.tracopower.com/overview/thp3</a>
EMS Immunity	- Electrostatic Discharge	Air: EN 61000-4-2, ±8 kV, perf. criteria A
	- RF Electromagnetic Field	EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, ±2 kV, perf. criteria A
		EN 61000-4-5, ±1 kV, perf. criteria A
	- Conducted RF Disturbances	Ext. input component: 220 µF / 220 V EN 61000-4-6, 10 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous: EN 61000-4-8, 3 A/m, perf. criteria A

### General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +85°C
	- Case Temperature	+100°C max.
	- Storage Temperature	-50°C to +125°C
Power Derating	- High Temperature	3.33 %/K above 70°C
		See application note: <a href="http://www.tracopower.com/overview/thp3">www.tracopower.com/overview/thp3</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.

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

Switching Frequency		100 - 160 kHz (PWM) 150 kHz typ. (PWM)
Insulation System		Reinforced Insulation
Working Voltage (rated)		1'000 VAC
Isolation Test Voltage	- Input to Output, 60 s	4'000 VAC
Isolation Resistance	- Input to Output, 500 VDC	10'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	7 pF typ. 13 pF max.
Leakage Current	- Touch Current	2 μA max.
Reliability	- Calculated MTBF	1'000'000 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		Silicone (UL 94 V-0 rated)
Pin Material		Copper Alloy (C6801)
Pin Foundation Plating		Nickel (2.5 μm min.)
Pin Surface Plating		Gold (75 - 125 nm), glossy
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP24
Soldering Profile		Wave Soldering 260°C / 10 s max.
Weight		13.3 g
Thermal Impedance	- Case to Ambient	21.3 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: 7a (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	6167f88a-69f7-4c2c-8d65-9d492f6dc5a5

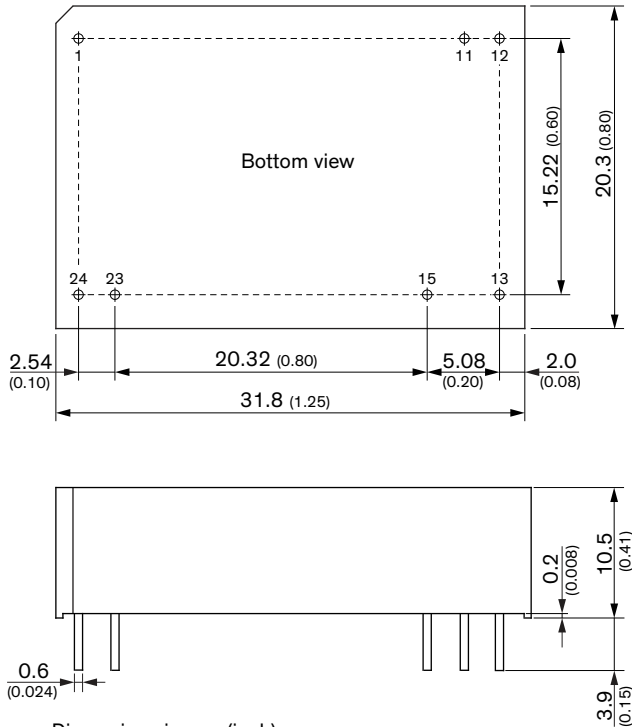
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/thp3](http://www.tracopower.com/overview/thp3)

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

**Outline Dimensions**



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

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