

- I/O isolation 3000 VACrms rated for 1000 Vrms (1410 Vpk) working voltage
- Medical safety to UL 60601-1 and IEC/EN 60601-1 3rd edition, 2 x MOOP
- Ultra compact DIP-24 package
- Wide 2:1 input voltage ranges
- Operating temperature range  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$
- Low leakage current
- Short circuit protection
- Input filter to meet EN 55022, Class A
- 3-year product warranty



ES 60601-1 IEC 60601-1  
UL 60950-1 IEC 60950-1

The THB 6 series is a new range of high performance, regulated DC/DC converters in a DIP-24 plastic package. A reinforced I/O-isolation system and a wide 2:1 input voltage range make this product the best choice for many demanding applications like transportation systems, industrial controls, medical equipment, instrumentation, everywhere where high basic-, supplementary- or reinforced insulation is required to meet requested safety standards. A high efficiency allows safe operation in a temperature range of  $-40^{\circ}\text{C}$  to  $+71^{\circ}\text{C}$ . Other features of this product are over voltage protection and internal EMI-input filter to meet EN 55022 class A without additional components. Full SMD-design with exclusive use of ceramic capacitors ensures 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>	
THB 6-1211	9 - 18 VDC (12 VDC nom.)	5 VDC	1'000 mA			75 %
THB 6-1212		12 VDC	500 mA			78 %
THB 6-1222		+12 VDC	250 mA	-12 VDC	250 mA	78 %
THB 6-1223		+15 VDC	200 mA	-15 VDC	200 mA	78 %
THB 6-2411	18 - 36 VDC (24 VDC nom.)	5 VDC	1'000 mA			77 %
THB 6-2412		12 VDC	500 mA			80 %
THB 6-2422		+12 VDC	250 mA	-12 VDC	250 mA	80 %
THB 6-2423		+15 VDC	200 mA	-15 VDC	200 mA	80 %
THB 6-4811	36 - 75 VDC (48 VDC nom.)	5 VDC	1'000 mA			77 %
THB 6-4812		12 VDC	500 mA			80 %
THB 6-4822		+12 VDC	250 mA	-12 VDC	250 mA	80 %
THB 6-4823		+15 VDC	200 mA	-15 VDC	200 mA	80 %

## Input Specifications

Input Current	- At no load	12 Vin models: <b>30 mA typ.</b> 24 Vin models: <b>20 mA typ.</b> 48 Vin models: <b>10 mA typ.</b>
	- At full load	12 Vin models: <b>570 mA typ.</b> (5 Vout model) <b>640 mA typ.</b> (12 Vout model) <b>640 mA typ.</b> (12 / -12 Vout model) <b>640 mA typ.</b> (15 / -15 Vout model) 24 Vin models: <b>280 mA typ.</b> (5 Vout model) <b>315 mA typ.</b> (12 Vout model) <b>315 mA typ.</b> (12 / -12 Vout model) <b>315 mA typ.</b> (15 / -15 Vout model) 48 Vin models: <b>140 mA typ.</b> (5 Vout model) <b>155 mA typ.</b> (12 Vout model) <b>155 mA typ.</b> (12 / -12 Vout model) <b>155 mA typ.</b> (15 / -15 Vout model)
Surge Voltage		12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Start-up Voltage		12 Vin models: <b>7 VDC min. / 8 VDC typ. / 9 VDC max.</b> 24 Vin models: <b>13 VDC min. / 15 VDC typ. / 18 VDC max.</b> 48 Vin models: <b>30 VDC min. / 33 VDC typ. / 36 VDC max.</b>
Under Voltage Lockout		12 Vin models: <b>8.5 VDC max.</b> 24 Vin models: <b>16 VDC max.</b> 48 Vin models: <b>34 VDC max.</b>
Reflected Ripple Current		12 Vin models: <b>60 mA typ.</b> 24 Vin models: <b>30 mA typ.</b> 48 Vin models: <b>15 mA typ.</b>
Recommended Input Fuse		12 Vin models: <b>1'200 mA</b> (slow blow) 24 Vin models: <b>600 mA</b> (slow blow) 48 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>3 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)
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>
Capacitive Load	- single output	5 Vout models: <b>1'000 µF max.</b> 12 Vout models: <b>470 µF max.</b>
	- dual output	12 / -12 Vout models: <b>220 / 220 µF max.</b> 15 / -15 Vout models: <b>220 / 220 µF max.</b>

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

Minimum Load		20 % of lout max. (Operation at lower load will not damage the converter, but it may not meet all specifications)
Temperature Coefficient		±0.05 %/K max.
Short Circuit Protection		Continuous, Automatic recovery
Overload Protection		Foldback Mode
Output Current Limitation		120% min. of lout max. 150% typ. of lout max.
Transient Response	- Response Deviation - Response Time	3% typ. / 6% max. (75% to 100% Load Step) 300 µs typ. / 500 µs max. (75% to 100% Load Step)

### Safety Specifications

Safety Standards	- IT / Multimedia Equipment  - Medical Equipment  - Certification Documents	CSA-C22.2, No. 60950-1 Designed for EN 62368-1 (no certification) EN 60950-1 IEC 60950-1 UL 60950-1 EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 CSA-C22.2, No 60601-1 2 x MOOP (Means Of Operator Protection) MOPP (Means Of Patient Protection) <a href="http://www.tracopower.com/overview/thb6">www.tracopower.com/overview/thb6</a>
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted Emissions  - Radiated Emissions	EN 60601-1-2 edition 4 (Medical Devices) EN 55032 class A (internal filter) EN 55032 class B (with external filter) FCC Part 15 class A (internal filter) FCC Part 15 class B (with external filter) EN 55032 class A (internal filter) EN 55032 class B (with external filter) FCC Part 15 class A (internal filter) FCC Part 15 class B (with external filter)  External filter proposal: <a href="http://www.tracopower.com/overview/thb6">www.tracopower.com/overview/thb6</a>
EMS Immunity		EN 60601-1-2 edition 4 (Medical Devices)

### General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +75°C +95°C max. -50°C to +125°C
Power Derating	- High Temperature	2.5 %/K above 55°C See application note: <a href="http://www.tracopower.com/overview/thb6">www.tracopower.com/overview/thb6</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.
Switching Frequency		150 kHz typ. (PWM)
Insulation System		Reinforced Insulation
Working Voltage (rated)		1'000 VAC
Isolation Test Voltage	- Input to Output, 60 s	4'000 VDC
Isolation Resistance	- Input to Output, 500 VDC	10'000 MΩ min.

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

Isolation Capacitance	- Input to Output, 100 kHz, 1 V	7 pF typ. 13 pF max.
Leakage Current	- Earth Leakage Current	2 µA max.
Reliability	- Calculated MTBF	1'000'000 h (MIL-HDBK-217F, ground benign)
Washing Process		Allowed (hermetical product)
	See 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)
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		18 g
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> <b>Exemptions: 7a, 7c-I</b> (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)

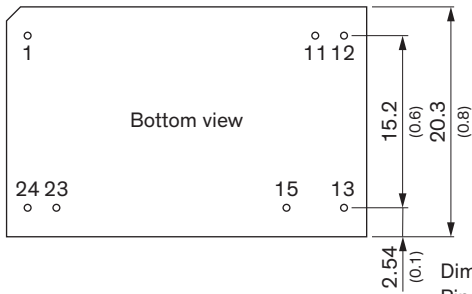
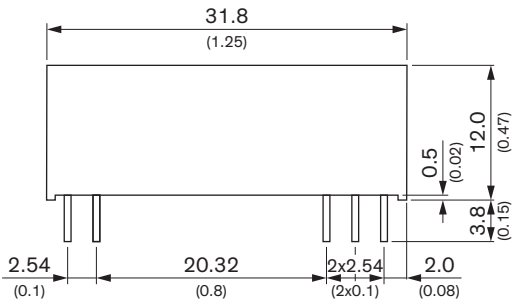
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/thb6](http://www.tracopower.com/overview/thb6)

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

**Outline Dimensions**



Dimensions in mm (inch)  
 Pin diameter  $\varnothing 0.6 \pm 0.05$  (0.024  $\pm$  0.002)  
 Tolerances  $\pm 0.25$  ( $\pm 0.01$ )  
 Pin pitch tolerances  $\pm 0.13$  ( $\pm 0.005$ )

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)