

DC/DC Converter

THB 6 Series, 6 Watt

- 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°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°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 _{max}	Vnom	I _{max}	
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: 30 mA typ. 24 Vin models: 20 mA typ. 48 Vin models: 10 mA typ.
	- At full load	12 Vin models: 570 mA typ. (5 Vout model) 640 mA typ. (12 Vout model) 640 mA typ. (12 / -12 Vout model) 640 mA typ. (15 / -15 Vout model) 24 Vin models: 280 mA typ. (5 Vout model) 315 mA typ. (12 Vout model) 315 mA typ. (12 / -12 Vout model) 315 mA typ. (15 / -15 Vout model) 48 Vin models: 140 mA typ. (5 Vout model) 155 mA typ. (12 Vout model) 155 mA typ. (12 / -12 Vout model) 155 mA typ. (15 / -15 Vout model)
Surge Voltage		12 Vin models: 25 VDC max. (1 s max.) 24 Vin models: 50 VDC max. (1 s max.) 48 Vin models: 100 VDC max. (1 s max.)
Start-up Voltage		12 Vin models: 7 VDC min. / 8 VDC typ. / 9 VDC max. 24 Vin models: 13 VDC min. / 15 VDC typ. / 18 VDC max. 48 Vin models: 30 VDC min. / 33 VDC typ. / 36 VDC max.
Under Voltage Lockout		12 Vin models: 8.5 VDC max. 24 Vin models: 16 VDC max. 48 Vin models: 34 VDC max.
Reflected Ripple Current		12 Vin models: 60 mA typ. 24 Vin models: 30 mA typ. 48 Vin models: 15 mA typ.
Recommended Input Fuse		12 Vin models: 1'200 mA (slow blow) 24 Vin models: 600 mA (slow blow) 48 Vin models: 300 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Pi-Type
Short Circuit Input Power		3 W max.

Output Specifications

Voltage Set Accuracy		± 1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models: 0.5% max. dual output models: 0.5% max.
	- Load Variation (25 - 100%)	single output models: 1% max. dual output models: 1% max. (Output 1) 1% max. (Output 2)
Ripple and Noise (20 MHz Bandwidth)	- single output	5 Vout models: 75 mVp-p typ. 12 Vout models: 100 mVp-p typ.
	- dual output	12 / -12 Vout models: 100 / 100 mVp-p typ. 15 / -15 Vout models: 100 / 100 mVp-p typ.
	- single output	5 Vout models: 100 mVp-p max. 12 Vout models: 150 mVp-p max.
	- dual output	12 / -12 Vout models: 150 / 150 mVp-p max. 15 / -15 Vout models: 150 / 150 mVp-p max.
	- 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.

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

Minimum Load	20 % of I _{out} 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 I _{out} max. 150% typ. of I _{out} 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	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) www.tracopower.com/overview/thb6
	- Medical Equipment	
	- Certification Documents	
Pollution Degree		PD 2
Over Voltage Category		OVC II

EMC Specifications

EMI Emissions	- Conducted 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)
	- Radiated Emissions	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:	www.tracopower.com/overview/thb6
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
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.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	7 pF typ. 13 pF max.

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

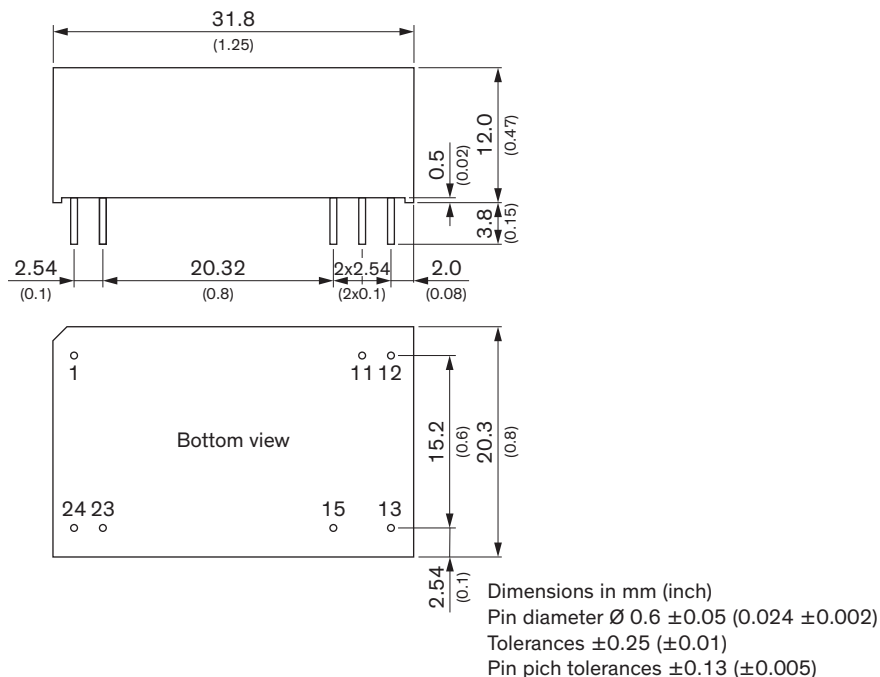
Leakage Current	- Earth Leakage Current	2 μ A max.
Reliability	- Calculated MTBF	1'000'000 h (MIL-HDBK-217F, ground benign)
Washing Process	See Cleaning Guideline:	Allowed (hermetical product)
		www.tracopower.com/info/cleaning.pdf
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper Alloy (C6801)
Pin Foundation Plating		Nickel (2.5 μ m 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	www.tracopower.com/info/reach-declaration.pdf
		REACH SVHC list compliant
		REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf
		Exemptions: 7a, 7c-I
		(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

Outline Dimensions



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)