

- High power density 25W converter  
Ultra compact design: 1.0" x 1.0" x 0.4"
- Shielded metal case with isolated baseplate
- Wide 2:1 input voltage ranges
- Very high efficiency up to 90%
- Output voltage adjustable
- Remote On/Off control
- Operating temp. range  $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$   
and up to  $+85^{\circ}\text{C}$  with heat-sink
- I/O isolation voltage 1500 VDC
- 3-year product warranty



The THL 25 series is a generation of DC-DC converter modules with high power density. The product achieves 25 Watt output power and comes in a metal case with small dimensions of only 1.0"x 1.0"x 0.4". All models have a wide 2:1 input voltage range and precisely regulated output voltages. High efficiency of up to 90% makes this product very reliable and applicable in temperature ranges of up to  $+80^{\circ}\text{C}$  or up to  $+85^{\circ}\text{C}$  with optional mounted heat sink. Typical applications are in mobile equipments, instrumentation, distributed power architectures in communication and industrial electronics and everywhere where space on the PCB is critical

### Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
THL 25-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	6'000 mA			87 %
THL 25-1211		5 VDC	5'000 mA			89 %
THL 25-1212		12 VDC	2'090 mA			89 %
THL 25-1213		15 VDC	1'670 mA			89 %
THL 25-1222		+12 VDC	1'040 mA	-12 VDC	1'040 mA	89 %
THL 25-1223		+15 VDC	840 mA	-15 VDC	840 mA	89 %
THL 25-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	6'000 mA			88 %
THL 25-2411		5 VDC	5'000 mA			90 %
THL 25-2412		12 VDC	2'090 mA			90 %
THL 25-2413		15 VDC	1'670 mA			90 %
THL 25-2422		+12 VDC	1'040 mA	-12 VDC	1'040 mA	89 %
THL 25-2423		+15 VDC	840 mA	-15 VDC	840 mA	89 %
THL 25-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	6'000 mA			88 %
THL 25-4811		5 VDC	5'000 mA			90 %
THL 25-4812		12 VDC	2'090 mA			90 %
THL 25-4813		15 VDC	1'670 mA			90 %
THL 25-4822		+12 VDC	1'040 mA	-12 VDC	1'040 mA	89 %
THL 25-4823		+15 VDC	840 mA	-15 VDC	840 mA	89 %

### Options

THL-HS1	- Optional Heat Sink: <a href="http://www.tracopower.com/products/thl-hs1.pdf">www.tracopower.com/products/thl-hs1.pdf</a>
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## Input Specifications

Input Current	- At no load	12 Vin models: <b>80 mA typ.</b> 24 Vin models: <b>55 mA typ.</b> 48 Vin models: <b>40 mA typ.</b>
	- At full load	12 Vin models: <b>1'900 mA typ.</b> (3.3 Vout model) <b>2'350 mA typ.</b> (5 Vout model) <b>2'350 mA typ.</b> (12 Vout model) <b>2'350 mA typ.</b> (15 Vout model) <b>2'350 mA typ.</b> (12 / -12 Vout model) <b>2'350 mA typ.</b> (15 / -15 Vout model) 24 Vin models: <b>950 mA typ.</b> (3.3 Vout model) <b>1'150 mA typ.</b> (5 Vout model) <b>1'150 mA typ.</b> (12 Vout model) <b>1'150 mA typ.</b> (15 Vout model) <b>1'150 mA typ.</b> (12 / -12 Vout model) <b>1'150 mA typ.</b> (15 / -15 Vout model) 48 Vin models: <b>450 mA typ.</b> (3.3 Vout model) <b>580 mA typ.</b> (5 Vout model) <b>580 mA typ.</b> (12 Vout model) <b>580 mA typ.</b> (15 Vout model) <b>580 mA typ.</b> (12 / -12 Vout model) <b>580 mA typ.</b> (15 / -15 Vout model)
Surge Voltage		12 Vin models: <b>25 VDC max.</b> (100 ms max.) 24 Vin models: <b>50 VDC max.</b> (100 ms max.) 48 Vin models: <b>100 VDC max.</b> (100 ms max.)
Reflected Ripple Current		12 Vin models: <b>80 mA<sub>p-p</sub> typ.</b> 24 Vin models: <b>50 mA<sub>p-p</sub> typ.</b> 48 Vin models: <b>30 mA<sub>p-p</sub> typ.</b>
Recommended Input Fuse		12 Vin models: <b>5'000 mA</b> (slow blow) 24 Vin models: <b>2'500 mA</b> (slow blow) 48 Vin models: <b>1'250 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal LC-Type</b>

## Output Specifications

Output Voltage Adjustment		<b>±10%</b> (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a> Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (V <sub>min</sub> - V <sub>max</sub> )	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>0.2% 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>
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>

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

<b>Ripple and Noise</b> (20 MHz Bandwidth)	- single output	3.3 Vout models: <b>100 mVp-p max.</b> (w/ 1 $\mu$ F MLCC // 10 $\mu$ F Tantalum)
		5 Vout models: <b>100 mVp-p max.</b> (w/ 1 $\mu$ F MLCC // 10 $\mu$ F Tantalum)
		12 Vout models: <b>150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC // 10 $\mu$ F Tantalum)
		15 Vout models: <b>150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC // 10 $\mu$ F Tantalum)
	- dual output	12 / -12 Vout models: <b>150 / 150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC // 10 $\mu$ F Tantalum)
		15 / -15 Vout models: <b>150 / 150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC // 10 $\mu$ F Tantalum)
<b>Capacitive Load</b>	- single output	3.3 Vout models: <b>10'300 <math>\mu</math>F max.</b>
		5 Vout models: <b>6'800 <math>\mu</math>F max.</b>
		12 Vout models: <b>1'200 <math>\mu</math>F max.</b>
		15 Vout models: <b>750 <math>\mu</math>F max.</b>
	- dual output	12 / -12 Vout models: <b>680 / 680 <math>\mu</math>F max.</b>
		15 / -15 Vout models: <b>380 / 380 <math>\mu</math>F max.</b>
<b>Minimum Load</b>		<b>Not required</b>
<b>Temperature Coefficient</b>		<b><math>\pm 0.02</math> %/K max.</b>
<b>Start-up Time</b>		<b>30 ms max.</b> (Power On) <b>30 ms max.</b> (Remote On)
<b>Short Circuit Protection</b>		<b>Continuous, Automatic recovery</b>
<b>Output Current Limitation</b>		<b>150% typ. of Iout max.</b>
<b>Overvoltage Protection</b>		<b>118 - 125% of Vout nom.</b> (depending on model) <b>3.9 VDC typ.</b> (3.3 Vout models) <b>6.2 VDC typ.</b> (5.1 Vout models) <b>15 VDC typ.</b> (12 Vout models) <b>18 VDC typ.</b> (15 Vout models)
<b>Transient Response</b>	- Response Deviation	<b>3% typ. / 5% max.</b> (75% to 100% Load Step)
	- Response Time	<b>250 <math>\mu</math>s typ.</b> (75% to 100% Load Step)

### Safety Specifications

<b>Safety Standards</b>	- IT / Multimedia Equipment	<b>CSA-C22.2, No. 60950-1</b> <b>EN 60950-1</b> <b>EN 62368-1</b> <b>IEC 60950-1</b> <b>IEC 62368-1</b> <b>UL 60950-1</b> <b>UL 62368-1</b>
	- Certification Documents	<a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a>

### EMC Specifications

<b>EMI Emissions</b>	- Conducted Emissions	<b>EN 55032 class A</b> (with external filter)
	- Radiated Emissions	<b>EN 55032 class A</b> (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a>
<b>EMS Immunity</b>	- Electrostatic Discharge	<b>EN 55024</b> (IT Equipment)
		Air: <b>EN 61000-4-2, <math>\pm 8</math> kV, perf. criteria A</b>
		Contact: <b>EN 61000-4-2, <math>\pm 6</math> kV, perf. criteria A</b>
	- RF Electromagnetic Field	<b>EN 61000-4-3, 10 V/m, perf. criteria A</b>
	- EFT (Burst) / Surge	<b>EN 61000-4-4, <math>\pm 2</math> kV, perf. criteria A</b> <b>EN 61000-4-5, <math>\pm 1</math> kV, perf. criteria A</b>
	- Conducted RF Disturbances	Ext. input component: <b>KY 220 <math>\mu</math>F, 100 V, ESR 48 mOhm</b> <b>EN 61000-4-6, 10 Vrms, perf. criteria A</b>

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

## General Specifications

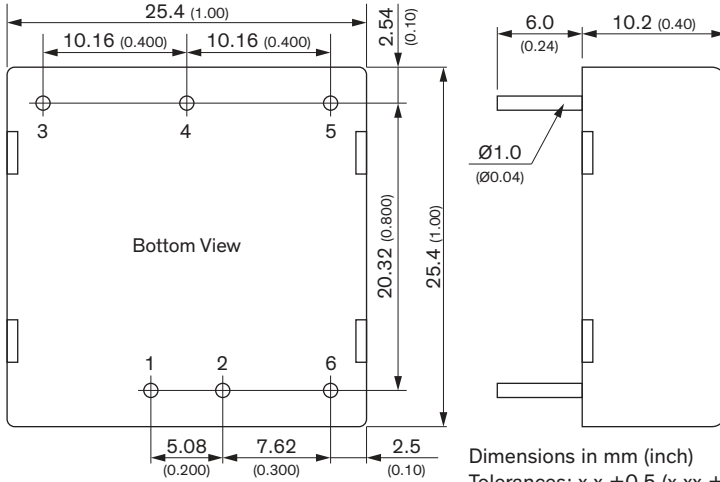
Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +80°C
	- Case Temperature	-40°C to +85°C (with Heat Sink)
	- Storage Temperature	+105°C max.
Power Derating	- High Temperature	-50°C to +125°C
		Depending on model Depending on model (with Heat Sink) See application note: <a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a>
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote	On: 3.5 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current	3 mA typ.
	- Remote Pin Input Current	-0.5 to 0.5 mA
Altitude During Operation		6'000 m max.
Switching Frequency		285 kHz typ. (PWM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s	1'500 VDC
	- Input to Output, 1 s	1'800 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	2'000 pF max.
Reliability	- Calculated MTBF	313'000 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		Alu alloy, black anodized coating
Base Material		Non-conductive FR4 (UL 94 V-0 rated)
Potting Material		Epoxy (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		Metal Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		1" x 1"
Soldering Profile		Wave Soldering
		260°C / 10 s max.
Weight		16.5 g
Thermal Impedance	- Case to Ambient	17.6 K/W typ.
		14.8 K/W typ. (with Heat Sink)
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). The SCIP number is provided on request.)

## Supporting Documents

Overview Link (for additional Documents) [www.tracopower.com/overview/thl25](http://www.tracopower.com/overview/thl25)

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)  
 Tolerances: x.x ±0.5 (x.xx ±0.02)  
 x.xx ± 0.25 (x.xxx ±0.01)  
 Pin tolerances: x.x ±0.05 (x.xx ±0.002)

Pinout		
Pin	Single	Dual
1	+Vin (Vcc)	+Vin (Vcc)
2	-Vin (GND)	-Vin (GND)
3	+Vout	+Vout
4	Trim	Common
5	-Vout	-Vout
6	Remote On/Off	Remote On/Off