

- **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°C to +80°C and up to +85°C with heat-sink**
- **I/O isolation voltage 1500 VDC**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

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°C or up to +85°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<br>(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<br>(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<br>(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/overview/thl-hs1">www.tracopower.com/overview/thl-hs1</a> |
|---------|--------------------------------------------------------------------------------------------------------------------|

## Input Specifications

|                          |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Current            | - At no load   | 12 Vin models: <b>80 mA typ.</b><br>24 Vin models: <b>55 mA typ.</b><br>48 Vin models: <b>40 mA typ.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                          | - At full load | 12 Vin models: <b>1'900 mA typ.</b> (3.3 Vout model)<br><b>2'350 mA typ.</b> (5 Vout model)<br><b>2'350 mA typ.</b> (12 Vout model)<br><b>2'350 mA typ.</b> (15 Vout model)<br><b>2'350 mA typ.</b> (12 / -12 Vout model)<br><b>2'350 mA typ.</b> (15 / -15 Vout model)<br>24 Vin models: <b>950 mA typ.</b> (3.3 Vout model)<br><b>1'150 mA typ.</b> (5 Vout model)<br><b>1'150 mA typ.</b> (12 Vout model)<br><b>1'150 mA typ.</b> (15 Vout model)<br><b>1'150 mA typ.</b> (12 / -12 Vout model)<br><b>1'150 mA typ.</b> (15 / -15 Vout model)<br>48 Vin models: <b>450 mA typ.</b> (3.3 Vout model)<br><b>580 mA typ.</b> (5 Vout model)<br><b>580 mA typ.</b> (12 Vout model)<br><b>580 mA typ.</b> (15 Vout model)<br><b>580 mA typ.</b> (12 / -12 Vout model)<br><b>580 mA typ.</b> (15 / -15 Vout model) |
| Surge Voltage            |                | 12 Vin models: <b>25 VDC max.</b> (100 ms max.)<br>24 Vin models: <b>50 VDC max.</b> (100 ms max.)<br>48 Vin models: <b>100 VDC max.</b> (100 ms max.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Reflected Ripple Current |                | 12 Vin models: <b>80 mAp-p typ.</b><br>24 Vin models: <b>50 mAp-p typ.</b><br>48 Vin models: <b>30 mAp-p typ.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Recommended Input Fuse   |                | 12 Vin models: <b>5'000 mA</b> (slow blow)<br>24 Vin models: <b>2'500 mA</b> (slow blow)<br>48 Vin models: <b>1'250 mA</b> (slow blow)<br>(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)<br>See application note: <a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a><br>Output power must not exceed rated power! |
| Voltage Set Accuracy      |                                            | <b>±1% max.</b>                                                                                                                                                                                        |
| Regulation                | - Input Variation (Vmin - Vmax)            | single output models: <b>0.2% max.</b><br>dual output models: <b>0.2% max.</b>                                                                                                                         |
|                           | - Load Variation (0 - 100%)                | single output models: <b>0.2% max.</b><br>dual output models: <b>1% max.</b> (Output 1)<br><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.

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

## Safety Specifications

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

## EMC Specifications

|                           |                             |                                                                                          |
|---------------------------|-----------------------------|------------------------------------------------------------------------------------------|
| EMI (Emissions)           | - Conducted Emissions       | EN 55032 class A (with external filter)                                                  |
|                           | - Radiated Emissions        | EN 55032 class A (with external filter)                                                  |
| External filter proposal: |                             | <a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a> |
| EMS (Immunity)            |                             | EN 55024 (IT Equipment)                                                                  |
|                           |                             | EN 55035 (Multimedia)                                                                    |
|                           | - Electrostatic Discharge   | Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A                                          |
|                           |                             | Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A                                      |
|                           | - RF Electromagnetic Field  | EN 61000-4-3, 10 V/m, perf. criteria A                                                   |
|                           | - EFT (Burst) / Surge       | EN 61000-4-4, $\pm 2$ kV, perf. criteria A                                               |
|                           |                             | EN 61000-4-5, $\pm 1$ kV, perf. criteria A                                               |
|                           |                             | Ext. input component: KY 220 $\mu$ F, 100 V, ESR 48 mOhm                                 |
|                           | - Conducted RF Disturbances | EN 61000-4-6, 10 Vrms, perf. criteria A                                                  |
|                           | - PF Magnetic Field         | Continuous: EN 61000-4-8, 3 A/m, perf. criteria A                                        |
| EMC / Environmental       | - Certification Documents   | <a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a> |

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

## General Specifications

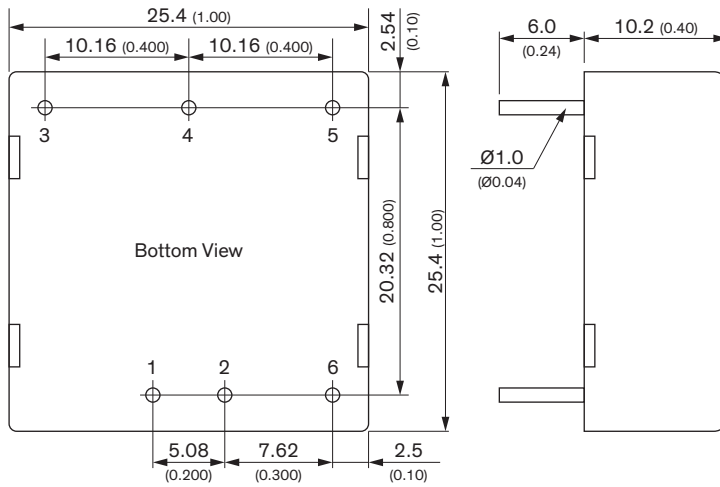
|                           |                                                                                                                |                                                                                                                          |
|---------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                              |
|                           | - High Temperature                                                                                             | -50°C to +125°C                                                                                                          |
| Power Derating            |                                                                                                                | Depending on model                                                                                                       |
|                           | 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 (passive = on)                                                                     | On: 3.5 to 12 VDC or open circuit                                                                                        |
|                           | - Off Idle Input Current                                                                                       | Off: 0 to 1.2 VDC or short circuit                                                                                       |
|                           | - Remote Pin Input Current                                                                                     | Refers to 'Remote' and '-Vin' Pin                                                                                        |
|                           |                                                                                                                | 3 mA typ.                                                                                                                |
|                           |                                                                                                                | -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           |                                                                                                                | According to 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         |                                                                                                                | Lead-Free 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>         |
|                           | - RoHS Declaration                                                                                             | REACH SVHC list compliant                                                                                                |
|                           |                                                                                                                | REACH Annex XVII compliant                                                                                               |
|                           |                                                                                                                | <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                                                                                        | 417b0817-1715-4eb8-b5e7-d3a799dc1fad                                                                                     |

## Supporting Documents

|                                          |                                                                                          |
|------------------------------------------|------------------------------------------------------------------------------------------|
| Overview Link (for additional Documents) | <a href="http://www.tracopower.com/overview/thl25">www.tracopower.com/overview/thl25</a> |
|------------------------------------------|------------------------------------------------------------------------------------------|

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## Outline Dimensions

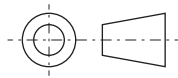


Dimensions in mm (inch)

Tolerances: x.x  $\pm 0.5$  (x.xx  $\pm 0.02$ )

x.xx  $\pm 0.25$  (x.xxx  $\pm 0.01$ )

Pin tolerances: x.x  $\pm 0.05$  (x.xx  $\pm 0.002$ )



## 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 |

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