

- Compact DIP-24 plastic case
- I/O isolation 5000 VAC rated for 250 VAC working voltage
- IEC 60601-1 certification for 2 x MOPP
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- Low leakage current <2 μ A
- Operating temperature -40°C to 90°C
- EMC compliance to IEC 60601-1-2 4th edition and EN55032 class A
- 5-year product warranty



ES 60601-1 IEC 60601-1
UL 62368-1 IEC 62368-1

The THM 6 series is a range of medical 6 Watt DC/DC converters in DIP-24 plastic package with wide 2:1 input voltage range. They provide a reinforced isolation system for 5000 VAC and a very low leakage current of less than 2 μ A. The units are approved to IEC/EN/ES 60601-1 3rd ed. for 2 x MOPP and come along with an ISO 14971 risk management file. Design and production conform to the quality management system ISO 13485. With a high efficiency of up to 89% and highest grade components the converters can reliably operate in an ambient temperature range of -40°C up to $+90^{\circ}\text{C}$. They constitute a reliable solution not only for medical equipment but also for demanding ranges of application such as transportation, control & measurement or IGBT drivers.

Models

| Order Code | Input Voltage Range | Output 1 | | Output 2 | | Efficiency typ. |
|------------|------------------------------|----------|------------------|----------|------------------|-----------------|
| | | Vnom | I _{max} | Vnom | I _{max} | |
| THM 6-0510 | 4.5 - 9 VDC (5 VDC nom.) | 3.3 VDC | 1'800 mA | | | 82 % |
| THM 6-0511 | | 5 VDC | 1'200 mA | | | 86 % |
| THM 6-0512 | | 12 VDC | 500 mA | | | 86 % |
| THM 6-0513 | | 15 VDC | 400 mA | | | 88 % |
| THM 6-0515 | | 24 VDC | 250 mA | | | 87 % |
| THM 6-0521 | | +5 VDC | 600 mA | -5 VDC | 600 mA | 84 % |
| THM 6-0522 | | +12 VDC | 250 mA | -12 VDC | 250 mA | 87 % |
| THM 6-0523 | | +15 VDC | 200 mA | -15 VDC | 200 mA | 88 % |
| THM 6-1210 | 9 - 18 VDC (12 VDC nom.) | 3.3 VDC | 1'800 mA | | | 84 % |
| THM 6-1211 | | 5 VDC | 1'200 mA | | | 86 % |
| THM 6-1212 | | 12 VDC | 500 mA | | | 89 % |
| THM 6-1213 | | 15 VDC | 400 mA | | | 89 % |
| THM 6-1215 | | 24 VDC | 250 mA | | | 89 % |
| THM 6-1221 | | +5 VDC | 600 mA | -5 VDC | 600 mA | 85 % |
| THM 6-1222 | | +12 VDC | 250 mA | -12 VDC | 250 mA | 89 % |
| THM 6-1223 | | +15 VDC | 200 mA | -15 VDC | 200 mA | 88 % |
| THM 6-2410 | 18 - 36 VDC (24 VDC nom.) | 3.3 VDC | 1'800 mA | | | 83 % |
| THM 6-2411 | | 5 VDC | 1'200 mA | | | 86 % |
| THM 6-2412 | | 12 VDC | 500 mA | | | 89 % |
| THM 6-2413 | | 15 VDC | 400 mA | | | 89 % |
| THM 6-2415 | | 24 VDC | 250 mA | | | 89 % |
| THM 6-2421 | | +5 VDC | 600 mA | -5 VDC | 600 mA | 85 % |
| THM 6-2422 | | +12 VDC | 250 mA | -12 VDC | 250 mA | 89 % |
| THM 6-2423 | | +15 VDC | 200 mA | -15 VDC | 200 mA | 89 % |
| THM 6-4810 | 36 - 75 VDC (48 VDC nom.) | 3.3 VDC | 1'800 mA | | | 83 % |
| THM 6-4811 | | 5 VDC | 1'200 mA | | | 87 % |
| THM 6-4812 | | 12 VDC | 500 mA | | | 88 % |
| THM 6-4813 | | 15 VDC | 400 mA | | | 89 % |
| THM 6-4815 | | 24 VDC | 250 mA | | | 88 % |
| THM 6-4821 | | +5 VDC | 600 mA | -5 VDC | 600 mA | 85 % |
| THM 6-4822 | | +12 VDC | 250 mA | -12 VDC | 250 mA | 88 % |
| THM 6-4823 | | +15 VDC | 200 mA | -15 VDC | 200 mA | 87 % |

Options

| | |
|---|---|
| on demand (backorder with MOQ non stocking item) | <ul style="list-style-type: none"> - Optional models with alternative pinning - Optional models with adjustable output voltage - Optional models with Remote On/Off function - Optional models with adjustable output and remote-control function |
|---|---|

Input Specifications

| | | |
|------------------------|--------------|---|
| Input Current | - At no load | 5 Vin models: 20 mA typ. 12 Vin models: 10 mA typ. 24 Vin models: 6 mA typ. 48 Vin models: 4 mA typ. |
| Surge Voltage | | 5 Vin models: 16 VDC max. (3 s max.) 12 Vin models: 25 VDC max. (3 s max.) 24 Vin models: 50 VDC max. (3 s max.) 48 Vin models: 100 VDC max. (3 s max.) |
| Under Voltage Lockout | | 5 Vin models: 3 VDC min. / 4 VDC typ. / 4.4 VDC max. 12 Vin models: 7 VDC min. / 8 VDC typ. / 8.8 VDC max. 24 Vin models: 15 VDC min. / 16 VDC typ. / 17.5 VDC max. 48 Vin models: 31.5 VDC min. / 33 VDC typ. / 34.5 VDC max. |
| Recommended Input Fuse | | 5 Vin models: 2'500 mA (slow blow) 12 Vin models: 1'250 mA (slow blow) 24 Vin models: 630 mA (slow blow) 48 Vin models: 315 mA (slow blow) (The need of an external fuse has to be assessed in the final application.) |
| Input Filter | | Internal Pi-Type |

Output Specifications

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|--|---|--|
| Output Voltage Adjustment | | -10% to +20% (15 & 24 Vout single models) ±10% (other single and dual output models) (Only for optional models with adjustable output) (By external trim resistor) See application note: www.tracopower.com/overview/thm6 Output power must not exceed rated power! |
| Voltage Set Accuracy | | ±1% max. |
| Regulation | - Input Variation (Vmin - Vmax) - Load Variation (0 - 100%) - Cross Regulation (25% / 100% asym. load) | single output models: 0.2% max. dual output models: 0.5% max. single output models: 0.2% max. dual output models: 1% max. (Output 1) 1% max. (Output 2) dual output models: 5% max. |
| Ripple and Noise (20 MHz Bandwidth) | - single output - dual output | 3.3 Vout models: 30 mVp-p typ. (w/ 10 µF X7R) 5 Vout models: 30 mVp-p typ. (w/ 10 µF X7R) 12 Vout models: 40 mVp-p typ. (w/ 10 µF X7R) 15 Vout models: 40 mVp-p typ. (w/ 10 µF X7R) 24 Vout models: 50 mVp-p typ. (w/ 4.7 µF X7R) 5 / -5 Vout models: 30 / 30 mVp-p typ. (w/ 10 µF X7R) 12 / -12 Vout models: 40 / 40 mVp-p typ. (w/ 10 µF X7R) 15 / -15 Vout models: 40 / 40 mVp-p typ. (w/ 10 µF X7R) |

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

| | | |
|---------------------------|---|---|
| Capacitive Load | - single output | 3.3 Vout models: 2'100 µF max. 5 Vout models: 1'500 µF max. 12 Vout models: 260 µF max. 15 Vout models: 210 µF max. 24 Vout models: 75 µF max. |
| | - dual output | 5 / -5 Vout models: 860 / 860 µF max. 12 / -12 Vout models: 150 / 150 µF max. 15 / -15 Vout models: 110 / 110 µF max. |
| Minimum Load | Not required | |
| Temperature Coefficient | ±0.02 %/K max. | |
| Start-up Time | 30 ms typ. | |
| Short Circuit Protection | Continuous, Automatic recovery | |
| Output Current Limitation | 150% typ. of Iout max. | |
| Overvoltage Protection | 112 - 152% of Vout nom. (depending on model) 3.7 - 5 VDC (3.3 VDC model) 5.6 - 7 VDC (5 VDC model) 13.5 - 16 VDC (12 VDC model) 18.3 - 22 VDC (15 VDC model) 29.1 - 34.5 VDC (24 VDC model) 5.6 - 7 VDC (±5 VDC model) 13.5 - 18.2 VDC (±12 VDC model) 17 - 22 VDC (±15 VDC model) | |
| Transient Response | - Response Time | 250 µs typ. (25% Load Step) |

Safety Specifications

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|-----------------------|-----------------------------|--|
| 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 |
| | - Certification Documents | 2 x MOPP (Means Of Patient Protection) www.tracopower.com/overview/thm6 |
| Pollution Degree | PD 2 | |
| Over Voltage Category | OVC II | |

EMC Specifications

| | | |
|---------------|-----------------------|---|
| EMI Emissions | - Conducted Emissions | EN 60601-1-2 edition 4 (Medical Devices) 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) FCC 47 Part 18 class A (internal filter) FCC 47 Part 18 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) FCC 47 Part 18 class A (internal filter) FCC 47 Part 18 class B (with external filter) |
| | | External filter proposal: www.tracopower.com/overview/thm6 |

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

| | | |
|--------------|--|---|
| EMS Immunity | <ul style="list-style-type: none"> - Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field | EN 60601-1-2 edition 4 (Medical Devices) Air: EN 61000-4-2, ± 15 kV, perf. criteria A Contact: EN 61000-4-2, ± 8 kV, perf. criteria A EN 61000-4-3, 10 V/m, perf. criteria A EN 61000-4-4, ± 2 kV, perf. criteria A EN 61000-4-5, ± 2 kV, perf. criteria A Ext. input component: 5 Vin models: KY 1000 μ F / 25 V V10P45 12 & 24 Vin models: KY 470 μ F / 50 V 48 Vin models: KY 330 μ F / 100 V EN 61000-4-6, 10 V _{rms} , perf. criteria A Continuous: EN 61000-4-8, 100 A/m, perf. criteria A 1 s: EN 61000-4-8, 1000 A/m, perf. criteria A |
|--------------|--|---|

General Specifications

| | | |
|---------------------------|--|--|
| Relative Humidity | | 95% max. (non condensing) |
| Temperature Ranges | <ul style="list-style-type: none"> - Operating Temperature - Approved Ambient Temp. - Case Temperature - Storage Temperature | -40°C to +95°C +70°C max. (to comply with EN 60601-1) +105°C max. -55°C to +125°C |
| Power Derating | <ul style="list-style-type: none"> - High Temperature | 5.26 %/K above 86°C See application note: www.tracopower.com/overview/thm6 |
| Cooling System | | Natural convection (20 LFM) |
| Remote Control | <ul style="list-style-type: none"> - Voltage Controlled Remote (passive = on) - Off Idle Input Current - Remote Pin Input Current | On: 0 to 1.2 VDC or open circuit Off: 2.2 to 12 VDC Refers to 'Remote' and '-Vin' Pin 2.5 mA typ. -0.5 to 1.0 mA (Only for optional models with remote-control) |
| Altitude During Operation | | 5'000 m max. |
| Switching Frequency | | 225 - 275 kHz (PWM) 250 kHz typ. (PWM) |
| Insulation System | | Reinforced Insulation |
| Working Voltage (rated) | | 250 VAC |
| Isolation Test Voltage | <ul style="list-style-type: none"> - Input to Output, 60 s - Input to Output, 1 s | 5'000 VAC 10'000 VDC |
| Creepage | - Input to Output | 8 mm min. |
| Clearance | - Input to Output | 8 mm min. |
| Isolation Capacitance | - Input to Output, 100 kHz, 1 V | 12 pF typ. 17 pF max. |
| Leakage Current | - Earth Leakage Current | 2 μ A max. (240 VAC, 60 Hz) |
| Reliability | - Calculated MTBF | 4'700'000 h (MIL-HDBK-217F, ground benign) |
| Washing Process | | According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf |
| Environment | <ul style="list-style-type: none"> - Vibration - Thermal Shock | MIL-STD-810F MIL-STD-810F |
| 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 |
| Pin Foundation Plating | | Nickel (2 - 3 μ m) |
| Pin Surface Plating | | Tin (3 - 5 μ m), matte |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |
| Connection Type | | THD (Through-Hole Device) |
| Footprint Type | | DIP24 |

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

| | |
|--|--|
| Soldering Profile | Lead-Free Wave Soldering 265°C / 10 s max. |
| Weight | 14 g |
| Thermal Impedance - Case to Ambient | 18 K/W typ. |
| 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).) |
| - SCIP Reference Number | 52a5f525-3ab7-40de-bc34-cf6114cc760f |

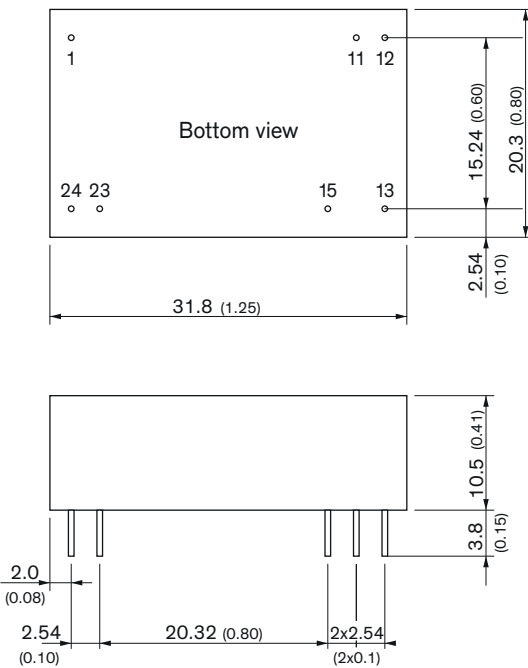
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/thm6

Outline Dimensions

Standard pinning

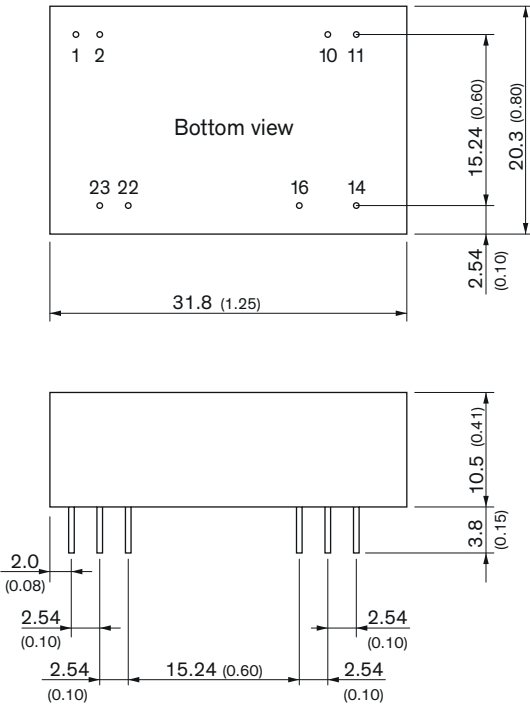


| Pin | Pinout | |
|-----|---------------|-------------|
| | Single Output | Dual Output |
| 1 | +Vin (Vcc) | +Vin (Vcc) |
| 11 | No pin | Common |
| 12 | -Vout | No pin |
| 13 | +Vout | -Vout |
| 15 | No pin | +Vout |
| 23 | -Vin (GND) | -Vin (GND) |
| 24 | -Vin (GND) | -Vin (GND) |

Dimensions in mm (inch)
 Tolerances ± 0.5 (± 0.02)
 Pin $\varnothing 0.6 \pm 0.1$ (0.024 ± 0.004)
 Pin pitch tolerances ± 0.25 (± 0.01)

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

Optional models with alternative pinning, adjustable output and/or remote-control function



| Pinout | | |
|--------|----------------|----------------|
| Pin | Single Output | Dual Output |
| 1 | No pin*/Remote | No pin*/Remote |
| 2 | -Vin (GND) | -Vin (GND) |
| 10 | No pin*/Trim | No pin*/Trim |
| 11 | No pin/NC ** | -Vout |
| 14 | +Vout | +Vout |
| 16 | -Vout | Common |
| 22 | +Vin (Vcc) | +Vin (Vcc) |
| 23 | +Vin (Vcc) | +Vin (Vcc) |

NC: Not connected

* If Remote or Trim is not selected there is no pin on corresponding number.

** If Trim is selected there is no pin on the corresponding pin number.

Remark:
 No optional pinning for 5 Vin models. Corresponding parts are with THM 6WI series by default.
 see www.tracopower.com/overview/thm6wi