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# TRACO POWER

## DC/DC Converter

## TRI 6 Series, 6 Watt

- **Reinforced I/O-isolation 5000 VAC rated for 1000 VAC working voltage**
- **Ultra-high isolation peak voltage 9000 VDC (1s)**
- **Common Mode Transient Immunity (dv/dt) 15 kV/µs**
- **Operating temperature range -40 to +85°C**
- **Low no-load power consumption 120 – 240 mW**
- **Internal EN 55032 class A filter**
- **High efficiency up to 89%**
- **2:1 input voltage range: 9-18, 18-36, 36-75 VDC**
- **Protection against overload, overvoltage and short circuit**
- **3-year product warranty**




UL 62368-1 IEC 62368-1

The new TRI 6 is a high isolation, regulated 6 Watt DC/DC converter series which comes in a compact DIP-24 package. The core characteristic of the TRI 6 series is a sophisticated reinforced isolation system which is able to withstand high test voltages (9000 VDC for 1s and 5000 VAC for 60s) and working voltages (1000 VACrms). Complementing this isolation characteristic is a high Common Mode Transient Immunity of 15 kV/µs. The new design allows to fully integrate an EN 55032 class A filter and greatly reduces the no-load power consumption. High efficiencies up to 89% allow safe operation from –40°C to +85°C without derating. All models have a wide 2:1 input voltage range and precisely regulated, isolated output voltages. With the latest IT safety certifications (IEC/EN/UL 62368-1) the TRI 6 series is the perfect choice for many demanding applications in the industrial, transportation and instrumentation sectors.

## Models

| Order Code | Input Voltage Range | Output 1 | | Output 2 | | Efficiency |
|---|---|---|---|---|---|---|
| | | Vnom | Imax | Vnom | Imax | typ. |
| **TRI 6-1211** | 9 - 18 VDC (12 VDC nom.) | 5 VDC | 1'200 mA | | | 83 % |
| **TRI 6-1212** | | 12 VDC | 500 mA | | | 86 % |
| **TRI 6-1213** | | 15 VDC | 400 mA | | | 86 % |
| **TRI 6-1215** | | 24 VDC | 250 mA | | | 86 % |
| **TRI 6-1222** | | +12 VDC | 250 mA | –12 VDC | 250 mA | 87 % |
| **TRI 6-1223** | | +15 VDC | 200 mA | –15 VDC | 200 mA | 87 % |
| **TRI 6-2411** | 18 - 36 VDC (24 VDC nom.) | 5 VDC | 1'200 mA | | | 83 % |
| **TRI 6-2412** | | 12 VDC | 500 mA | | | 86 % |
| **TRI 6-2413** | | 15 VDC | 400 mA | | | 87 % |
| **TRI 6-2415** | | 24 VDC | 250 mA | | | 85 % |
| **TRI 6-2422** | | +12 VDC | 250 mA | –12 VDC | 250 mA | 86 % |
| **TRI 6-2423** | | +15 VDC | 200 mA | –15 VDC | 200 mA | 87 % |
| **TRI 6-4811** | 36 - 75 VDC (48 VDC nom.) | 5 VDC | 1'200 mA | | | 83 % |
| **TRI 6-4812** | | 12 VDC | 500 mA | | | 86 % |
| **TRI 6-4813** | | 15 VDC | 400 mA | | | 89 % |
| **TRI 6-4815** | | 24 VDC | 250 mA | | | 86 % |
| **TRI 6-4822** | | +12 VDC | 250 mA | –12 VDC | 250 mA | 87 % |
| **TRI 6-4823** | | +15 VDC | 200 mA | –15 VDC | 200 mA | 88 % |

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## Input Specifications

| | | | |
|---|---|---|---|
| Input Current | - At no load | 12 Vin models: | 10 mA typ. |
| | | 24 Vin models: | 8 mA typ. |
| | | 48 Vin models: | 5 mA typ. |
| | - At full load | 12 Vin models: | 583 mA typ. |
| | | 24 Vin models: | 291 mA typ. |
| | | 48 Vin models: | 144 mA typ. |
| 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.) |
| Under Voltage Lockout | | 12 Vin models: | 8 VDC typ. |
| | | 24 Vin models: | 16 VDC typ. |
| | | 48 Vin models: | 34 VDC typ. |
| Recommended Input Fuse | | | (The need of an external fuse has to be assessed in the final application.) |
| Input Filter | | | Internal Pi-Type |

## 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 (0 - 100%) | single output models: | 0.5% max. |
| | | dual output models: | 1% max. (Output 1) |
| | | | 1% max. (Output 2) |
| | - Voltage Balance (symmetrical load) | dual output models: | 2% max. |
| | - Cross Regulation (25% / 100% asym. load) | dual output models: | 5% max. |
| Ripple and Noise | - 20 MHz Bandwidth | | 70 mVp-p max. (w/ 1 µF MLCC) |
| Capacitive Load | - single output | 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 | 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 max. |
| Short Circuit Protection | | | Continuous, Automatic recovery |
| Output Current Limitation | | | 150% typ. of Iout max. |
| Transient Response | - Response Deviation | | 5% max. (75% to 100% Load Step) |
| | - Response Time | | 300 µs typ. (75% to 100% Load Step) |

## Safety Specifications

| | | |
|---|---|---|
| Standards | - IT / Multimedia Equipment | EN 62368-1<br>IEC 62368-1<br>UL 62368-1 |
| | - Certification Documents | www.tracopower.com/overview/tri6 |
| Pollution Degree | | PD 2 |
| Over Voltage Category | | OVC II |

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

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## EMC Specifications

| | | | |
|---|---|---|---|
| EMI Emissions | - Conducted Emissions | | EN 55032 class A (internal filter) |
| | | | EN 55032 class B (with external filter) |
| | | | FCC Part 15 class A (internal filter) |
| | - Radiated Emissions | | EN 55032 class A (with external filter) |
| | | External filter proposal: | www.tracopower.com/overview/tri6 |
| EMS Immunity | | | EN 55024 (IT Equipment) |
| | | | EN 55035 (Multimedia) |
| | - Electrostatic Discharge | Air: | EN 61000-4-2, ±15 kV, perf. criteria A |
| | | Contact: | EN 61000-4-2, ±8 kV, perf. criteria A |
| | - RF Electromagnetic Field | | EN 61000-4-3, 10 V/m, perf. criteria A |
| | - EFT (Burst) / Surge | | EN 61000-4-4, ±2 kV, perf. criteria A |
| | | | EN 61000-4-5, ±2 kV, perf. criteria A |
| | | Ext. input component: | 12 Vin models: KY 560 µF / 50 V |
| | | | 24 Vin models: KY 470 µF / 50 V |
| | | | 48 Vin models: KY 330 µF / 100 V |
| | - Conducted RF Disturbances | | EN 61000-4-6, 10 Vrms, perf. criteria A |
| | - PF Magnetic Field | Continuous: | EN 61000-4-8, 100 A/m, perf. criteria A |

## General Specifications

| | | |
|---|---|---|
| Relative Humidity | | 95% max. (non condensing) |
| Temperature Ranges | - Operating Temperature | –40°C to +95°C |
| | - Case Temperature | +105°C max. |
| | - Storage Temperature | –50°C to +125°C |
| Power Derating | - High Temperature | 5 %/K above 85°C |
| | See application note: | www.tracopower.com/overview/tri6 |
| Cooling System | | Natural convection (20 LFM) |
| Altitude During Operation | | 5'000 m max. |
| Switching Frequency | | 330 kHz typ. (PWM) |
| Insulation System | | Reinforced Insulation |
| Working Voltage (rated) | | 1'000 VAC |
| Isolation Test Voltage | - Input to Output, 60 s | 5'000 VAC |
| | - Input to Output, 1 s | 9'000 VDC |
| Isolation Resistance | - Input to Output, 500 VDC | 10'000 MΩ min. |
| Isolation Capacitance | - Input to Output, 100 kHz, 1 V | 40 pF max. |
| Common Mode Transient Immunity | | 15 kV/µs min. |
| Reliability | - Calculated MTBF | 4'612'000 h (MIL-HDBK-217F, ground benign) |
| Washing Process | | According to Cleaning Guideline<br>www.tracopower.com/info/cleaning.pdf |
| Housing Material | | Plastic resin (UL 94 V-0 rated) |
| Potting Material | | Silicone (UL 94 V-0 rated) |
| Pin Material | | Copper Alloy (C6801) |
| Pin Foundation Plating | | Nickel (2 - 4 µm) |
| Pin Surface Plating | | Tin (3 - 5 µm), matte |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |
| Connection Type | | THD (Through-Hole Device) |
| Footprint Type | | DIP24 |
| Soldering Profile | | Lead-Free Wave Soldering<br>260°C / 10 s max. |
| Weight | | 15.5 g |

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

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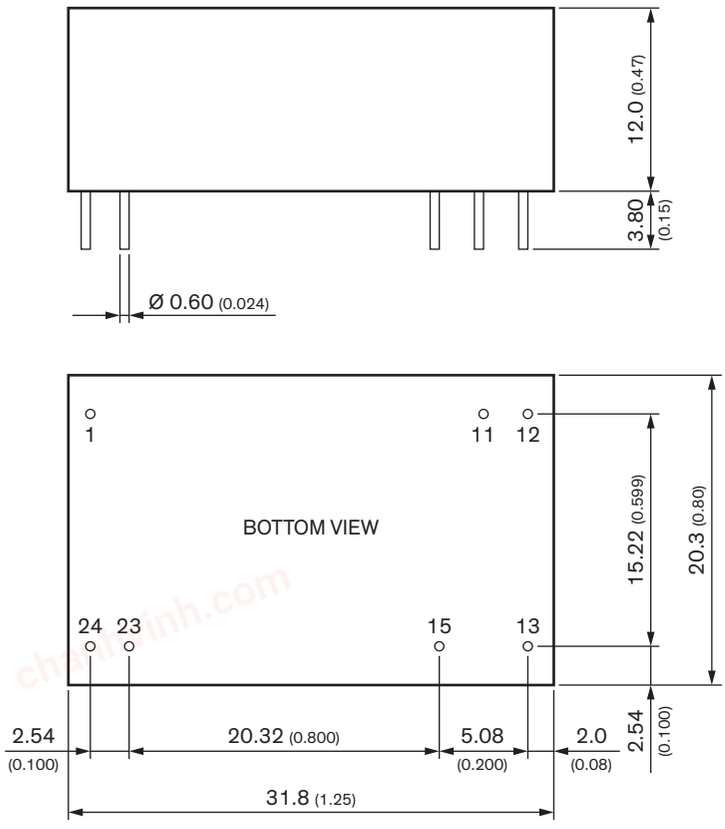


| | | |
|---|---|---|
| Environmental Compliance | - REACH Declaration | www.tracopower.com/info/reach-declaration.pdf |
| | | REACH SVHC list compliant |
| | | REACH Annex XVII compliant |
| | - RoHS Declaration | www.tracopower.com/info/rohs-declaration.pdf |
| | | Exemptions: 7a |
| | | (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) |
| | - SCIP Reference Number | b4f15eb3-904e-4f8b-b689-5df90cbb9fb8 |

## Supporting Documents

| | |
|---|---|
| Overview Link (for additional Documents) | www.tracopower.com/overview/tri6 |

## Outline Dimensions




Dimensions in mm (inch)
Tolerances: X.X ±0.5 (X.XX ±0.02)
X.XX ±0.25 (X.XXX ±0.01)
Pin Ø 0.6 ±0.05 (0.02 ±0.002)

**Pinout**

| Pin | 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) |

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