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TRACO POWER

DC/DC Converter

TRI 3 Series, 3.5 Watt

- **Reinforced I/O-isolation 5000 VAC rated for 1000 VAC working voltage**
- **Ultra-high isolation peak voltage 9000 VDC (1s)**
- **Operating temperature range -40 to +90°C**
- **Low no-load power consumption 96 – 192 mW**
- **Internal EN 55032 class A filter**
- **High efficiency up to 87%**
- **2:1 input voltage range: 4.5-9, 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 3 is a high isolation, regulated 3.5 Watt DC/DC converter series which comes in a compact DIP-24 package. The core characteristic of the TRI 3 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). 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 87% allow safe operation from –40°C to +90°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 3 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 3-0511	4.5 - 9 VDC (5 VDC nom.)	5 VDC	700 mA			82 %
TRI 3-0512		12 VDC	290 mA			83 %
TRI 3-0513		15 VDC	235 mA			84 %
TRI 3-0515		24 VDC	146 mA			83 %
TRI 3-0522		+12 VDC	145 mA	–12 VDC	145 mA	84 %
TRI 3-0523		+15 VDC	115 mA	–15 VDC	115 mA	84 %
TRI 3-1211	9 - 18 VDC (12 VDC nom.)	5 VDC	700 mA			82 %
TRI 3-1212		12 VDC	290 mA			86 %
TRI 3-1213		15 VDC	235 mA			87 %
TRI 3-1215		24 VDC	146 mA			86 %
TRI 3-1222		+12 VDC	145 mA	–12 VDC	145 mA	87 %
TRI 3-1223		+15 VDC	115 mA	–15 VDC	115 mA	87 %
TRI 3-2411	18 - 36 VDC (24 VDC nom.)	5 VDC	700 mA			82 %
TRI 3-2412		12 VDC	290 mA			85 %
TRI 3-2413		15 VDC	235 mA			87 %
TRI 3-2415		24 VDC	146 mA			86 %
TRI 3-2422		+12 VDC	145 mA	–12 VDC	145 mA	87 %
TRI 3-2423		+15 VDC	115 mA	–15 VDC	115 mA	86 %
TRI 3-4811	36 - 75 VDC (48 VDC nom.)	5 VDC	700 mA			82 %
TRI 3-4812		12 VDC	290 mA			85 %
TRI 3-4813		15 VDC	235 mA			85 %
TRI 3-4815		24 VDC	146 mA			83 %
TRI 3-4822		+12 VDC	145 mA	–12 VDC	145 mA	84 %
TRI 3-4823		+15 VDC	115 mA	–15 VDC	115 mA	84 %

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Input Specifications

Input Current	- At no load	5 Vin models:	30 mA typ.
		12 Vin models:	10 mA typ.
		24 Vin models:	6 mA typ.
		48 Vin models:	4 mA typ.
	- At full load	5 Vin models:	838 mA typ.
		12 Vin models:	339 mA typ.
		24 Vin models:	170 mA typ.
		48 Vin models:	87 mA typ.
Surge Voltage		5 Vin models:	15 VDC max. (1 s max.)
		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		5 Vin models:	4 VDC typ.
		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:	0.5% max. (Output 1)
			0.5% 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:	750 µF max.
		12 Vout models:	130 µF max.
		15 Vout models:	100 µF max.
		24 Vout models:	39 µF max.
	- dual output	12 / -12 Vout models:	75 / 75 µF max.
		15 / -15 Vout models:	56 / 56 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.
Overvoltage Protection			125% typ. of Vout nom.
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 IEC 62368-1 UL 62368-1
	- Certification Documents	www.tracopower.com/tri3-safety-cert/
Energy Source	- Output, acc. to 62368-1	ES1
Power Source	- Output, acc. to 62368-1	PS1

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

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Pollution Degree			PD 2
Over Voltage Category			Not mains connected

EMC Specifications

EMI (Emissions)	- Conducted Emissions		EN 55032 class A (internal filter)
			EN 55032 class B (with external filter)
			FCC 47 Part 15 class A (internal filter)
	- Radiated Emissions		EN 55032 class A (with external filter)
		External filter proposal:	www.tracopower.com/tri3-emc-filter/
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, ±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, ±2 kV, perf. criteria A
			EN 61000-4-5, ±2 kV, perf. criteria A
		Ext. input component:	5 Vin models: KY 1000 µF / 35 V || V10P45
			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
EMC / Environmental	- Certification Documents		www.tracopower.com/tri3-emc-cert/

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +96°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–40°C to +125°C
Power Derating	- High Temperature		8.3 %/K above 90°C
		See application note:	www.tracopower.com/tri3-cc/
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 (1'414 VDC)
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.
Reliability	- Calculated MTBF		5'815'000 h (MIL-HDBK-217F, ground benign)
Washing Process			According to Cleaning Guideline
			www.tracopower.com/info/cleaning.pdf
Housing Material			Plastic (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
			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.

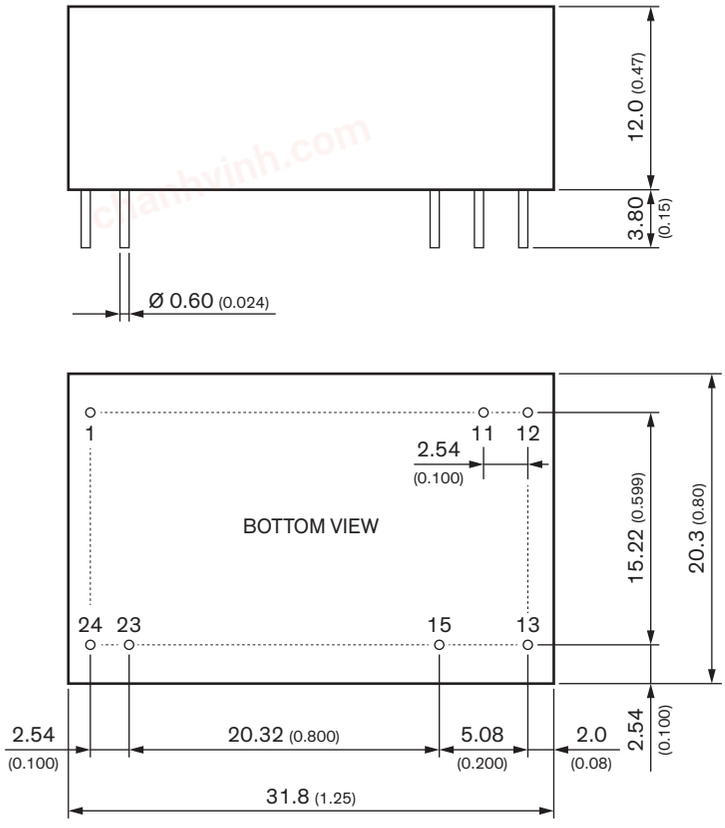
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Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf
		REACH SVHC list compliant
		REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf
		Exemptions: 7(a)
		(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	9de5e87a-9afd-492a-a959-e860f0fb75f6

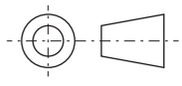
Additional Information

Supporting Documents	www.tracopower.com/overview/tri3
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

Outline Dimensions



Dimensions in mm (inch)
Tolerances: X.X ±0.5 (X.XX ±0.02)
X.XX ±0.25 (X.XXX ±0.010)
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)

Avoid routing PCB traces under the converter.

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