TRACO POWER

DC/DC Converter

TEC 2 Series, 2 Watt

- **Compact SIP-8 package**
- **I/O-isolation voltage 1‘600 VDC**
- **Fully regulated outputs**
- **Operating temp range –40°C to +95°C**
- **Continuous short circuit protection**
- **Remote On/Off**
- **Designed to meet IEC/EN/UL 62368-1 (not certified)**
- **3-year product warranty**



TEC 2 is a new series with the design purpose to improve the prevalent 2 Watt SIP-8 DC/DC converters in terms of cost, efficiency and performance. The latest technology and components enable an increase in efficiency by more than 20%. With the reduction of thermal loss, the operating temperature range can be expanded from -40°C to +95°C. The converters are fully regulated over 0 - 100% load (no minimum load is required). The low input range is extended from 4.5 to 13.2 VDC while models are also available with the standard 2:1 input ranges (see TEC 2WI series for 4:1 input ranges). The functional isolation system is designed to meet IEC/EN/UL 62368-1 (not certified) with 1600 VDC test voltage.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TEC 2-0910	4.5 - 13.2 VDC (9 VDC nom.)	3.3 VDC	500 mA			78 %
TEC 2-0911		5 VDC	400 mA			81 %
TEC 2-0919		9 VDC	222 mA			84 %
TEC 2-0912		12 VDC	167 mA			84 %
TEC 2-0913		15 VDC	134 mA			84 %
TEC 2-0915		24 VDC	83 mA			85 %
TEC 2-0921		+5 VDC	200 mA	–5 VDC	200 mA	81 %
TEC 2-0922		+12 VDC	83 mA	–12 VDC	83 mA	85 %
TEC 2-0923		+15 VDC	67 mA	–15 VDC	67 mA	84 %
TEC 2-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	500 mA			78 %
TEC 2-1211		5 VDC	400 mA			82 %
TEC 2-1219		9 VDC	222 mA			84 %
TEC 2-1212		12 VDC	167 mA			85 %
TEC 2-1213		15 VDC	134 mA			85 %
TEC 2-1215		24 VDC	83 mA			85 %
TEC 2-1221		+5 VDC	200 mA	–5 VDC	200 mA	82 %
TEC 2-1222		+12 VDC	83 mA	–12 VDC	83 mA	85 %
TEC 2-1223		+15 VDC	67 mA	–15 VDC	67 mA	84 %
TEC 2-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	500 mA			78 %
TEC 2-2411		5 VDC	400 mA			83 %
TEC 2-2419		9 VDC	222 mA			85 %
TEC 2-2412		12 VDC	167 mA			86 %
TEC 2-2413		15 VDC	134 mA			85 %
TEC 2-2415		24 VDC	83 mA			85 %
TEC 2-2421		+5 VDC	200 mA	–5 VDC	200 mA	83 %
TEC 2-2422		+12 VDC	83 mA	–12 VDC	83 mA	85 %
TEC 2-2423		+15 VDC	67 mA	–15 VDC	67 mA	86 %
TEC 2-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	500 mA			76 %
TEC 2-4811		5 VDC	400 mA			80 %
TEC 2-4819		9 VDC	222 mA			82 %
TEC 2-4812		12 VDC	167 mA			84 %
TEC 2-4813		15 VDC	134 mA			85 %
TEC 2-4815		24 VDC	83 mA			85 %
TEC 2-4821		+5 VDC	200 mA	–5 VDC	200 mA	80 %
TEC 2-4822		+12 VDC	83 mA	–12 VDC	83 mA	85 %
TEC 2-4823		+15 VDC	67 mA	–15 VDC	67 mA	83 %

Input Specifications

Input Current	- At no load	9 Vin models:	45 mA typ.
		12 Vin models:	25 mA typ.
		24 Vin models:	10 mA typ.
		48 Vin models:	8 mA typ.
Surge Voltage		9 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		9 Vin models:	2 VDC min. / 3 VDC typ. / 4 VDC max.
		12 Vin models:	6 VDC min. / 7 VDC typ. / 8 VDC max.
		24 Vin models:	13 VDC min. / 15 VDC typ. / 17 VDC max.
		48 Vin models:	29 VDC min. / 32 VDC typ. / 35 VDC max.
Recommended Input Fuse		9 Vin models:	1'000 mA (slow blow)
		12 Vin models:	500 mA (slow blow)
		24 Vin models:	315 mA (slow blow)
		48 Vin models:	160 mA (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Capacitor

Output Specifications

Voltage Set Accuracy			±1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models:	0.2% max.
		dual output models:	0.2% max.
	- Load Variation (0 - 100%)	single output models:	1% max.
		dual output models:	1% max. (Output 1)
			1% max. (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models:	5% max.
Ripple and Noise	- 20 MHz Bandwidth		75 mVp-p typ.
Capacitive Load	- single output	3.3 Vout models:	3'300 µF max.
		5 Vout models:	1'680 µF max.
		9 Vout models:	1'000 µF max.
		12 Vout models:	820 µF max.
		15 Vout models:	680 µF max.
		24 Vout models:	220 µF max.
	- dual output	5 / -5 Vout models:	1'000 / 1'000 µF max.
		12 / -12 Vout models:	470 / 470 µF max.
		15 / -15 Vout models:	330 / 330 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			10 ms typ. / 20 ms max.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			140 - 240% of Iout max.
			180% typ. of Iout max.
Transient Response	- Response Time		500 µs typ. (25% Load Step)

Safety Specifications

Standards	- IT / Multimedia Equipment	Designed for IEC/EN/UL 62368-1 (not certified)
Over Voltage Category		Not mains connected

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

EMC Specifications

EMI (Emissions)	- Conducted Emissions		EN 55032 class A (with external filter)
			EN 55032 class B (with external filter)
	- Radiated Emissions		EN 55032 class A (with external filter)
			EN 55032 class B (with external filter)
		External filter proposal:	www.tracopower.com/tec2-emc-filter
EMS (Immunity)	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 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, ±1 kV, perf. criteria A
		Ext. input component:	KY 220 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
		1 s:	EN 61000-4-8, 1000 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		–55°C to +125°C
Power Derating	- High Temperature		5.9 %/K above 88°C
		See application note:	www.tracopower.com/tec2-cc
Cooling System			Natural convection (20 LFM)
Remote Control	- Current Controlled Remote (passive = on)		On: open circuit
			Off: 2 to 4 mA current (internal 1 kΩ resistor)
			Refers to 'Remote' and '-Vin' Pin
		External circuit proposal:	www.tracopower.com/info/current-remote.pdf
	- Off Idle Input Current		2.5 mA typ.
Regulator Topology			RCC Converter
Switching Frequency			100 kHz min. (PFM)
Insulation System			Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s		1'600 VDC
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		50 pF max.
Reliability	- Calculated MTBF		6'620'000 h (MIL-HDBK-217F, ground benign)
Washing Process			According to Cleaning Guideline
			www.tracopower.com/info/cleaning.pdf
Environment	- Vibration		MIL-STD-810F
	- Mechanical Shock		MIL-STD-810F
	- Thermal Shock		MIL-STD-810F
Housing Material			Non-conductive Plastic (UL 94 V-0 rated)
Potting Material			Silicone (UL 94 V-0 rated)
Pin Material			Copper
Pin Foundation Plating			Nickel (1 - 2 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			SIP8
Soldering Profile			Lead-Free Wave Soldering
			260°C / 10 s max.
Weight			4.5 g

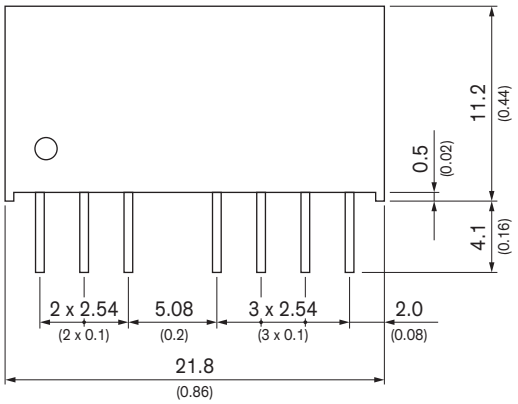
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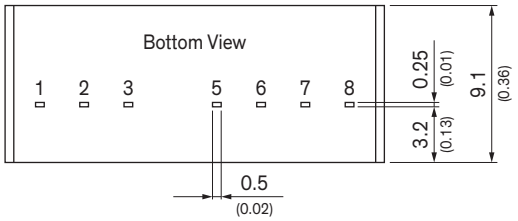
Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	da94c2df-8904-4ee5-be5d-0f554899272b

Additional Information

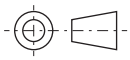
Supporting Documents	www.tracopower.com/overview/tec2
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

Outline Dimensions





Dimensions in mm (inch)
Tolerances: ±0.5 (±0.02)
Pin pitch tolerances ±0.25 (±0.01)
Pin dimension tolerance ±0.1 (0.004)



Pinout		
Pin	**Single**	**Dual**
1	–Vin (GND)	–Vin (GND)
2	+Vin (Vcc)	+Vin (Vcc)
3	Remote On/Off	Remote On/Off
5	NC	NC
6	+Vout	+Vout
7	–Vout	Common
8	NC	–Vout

NC: Not connected

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