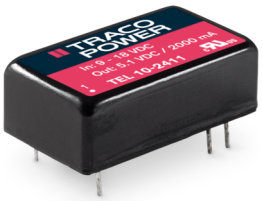
TRACO POWER

DC/DC Converter

TEL 10 Series, 10 Watt

- **Most compact 10 Watt converter in DIP-16 metal casing**
- **Highest power density of 3.83 W/cm³**
- **6-side shielded metal case with insulated base plate**
- **Wide 2:1 input voltage range**
- **High efficiency for low thermal loss**
- **Operating temperature range of -40°C to +88°C**
- **Built-in EN 55032 class A filter**
- **Current limitation and protection against short circuit**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TEL 10 series is a range of isolated 10 Watt DC/DC converters which come in a ultra compact DIP-16 metal package. The design purpose of these series was to miniaturized low power DC/DC converters to the maximum without sacrificing high efficiency. The TEL 10 series sets the new standart for power density with 3.83 W/cm³.
The TEL 10 series offers a wide 2:1 input voltage range and features a high efficiency of up to 88% which enables an operation temperature of up to +70°C at full load and up to 85°C with 50% load.
The converters have an internal input filter to comply with conducted emission EN 55032 class A. The TEL 10 Series models feature an overall economical solution for space critical and cost sensitive applications in instrumentation, IT and industrial electronics.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TEL 10-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	2'700 mA			79 %
TEL 10-1211		5.1 VDC	2'000 mA			82 %
TEL 10-1212		12 VDC	833 mA			86 %
TEL 10-1213		15 VDC	666 mA			87 %
TEL 10-1215		24 VDC	416 mA			87 %
TEL 10-1222		+12 VDC	416 mA	−12 VDC	416 mA	86 %
TEL 10-1223		+15 VDC	333 mA	−15 VDC	333 mA	86 %
TEL 10-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	2'700 mA			80 %
TEL 10-2411		5.1 VDC	2'000 mA			83 %
TEL 10-2412		12 VDC	833 mA			87 %
TEL 10-2413		15 VDC	666 mA			88 %
TEL 10-2415		24 VDC	416 mA			88 %
TEL 10-2422		+12 VDC	416 mA	−12 VDC	416 mA	87 %
TEL 10-2423		+15 VDC	333 mA	−15 VDC	333 mA	87 %
TEL 10-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	2'700 mA			80 %
TEL 10-4811		5.1 VDC	2'000 mA			83 %
TEL 10-4812		12 VDC	833 mA			87 %
TEL 10-4813		15 VDC	666 mA			88 %
TEL 10-4815		24 VDC	416 mA			88 %
TEL 10-4822		+12 VDC	416 mA	−12 VDC	416 mA	87 %
TEL 10-4823		+15 VDC	333 mA	−15 VDC	333 mA	87 %

Input Specifications

Input Current	- At no load	12 Vin models:	20 mA typ.
		24 Vin models:	10 mA typ.
		48 Vin models:	8 mA typ.
	- At full load	12 Vin models:	970 mA typ.
		24 Vin models:	480 mA typ.
		48 Vin models:	240 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:	7 VDC min. / 8 VDC typ.
		24 Vin models:	15 VDC min. / 16 VDC typ.
		48 Vin models:	31 VDC min. / 34 VDC typ.
Recommended Input Fuse		12 Vin models:	2'000 mA (slow blow)
		24 Vin models:	1'000 mA (slow blow)
		48 Vin models:	500 mA (slow blow)
			(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:	0.8% max.
		dual output models:	0.8% max.
	- Load Variation (0 - 100%)	single output models:	1% max.
		dual output models:	2% max. (Output 1)
			2% max. (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models:	5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models:	72 mVp-p max.
		5.1 Vout models:	72 mVp-p max.
		12 Vout models:	96 mVp-p max.
		15 Vout models:	96 mVp-p max.
		24 Vout models:	96 mVp-p max.
	- dual output	12 / -12 Vout models:	96 / 96 mVp-p max.
		15 / -15 Vout models:	96 / 96 mVp-p max.
	- single output	3.3 Vout models:	60 mVp-p typ.
		5.1 Vout models:	60 mVp-p typ.
		12 Vout models:	80 mVp-p typ.
		15 Vout models:	80 mVp-p typ.
		24 Vout models:	80 mVp-p typ.
	- dual output	12 / -12 Vout models:	80 / 80 mVp-p typ.
		15 / -15 Vout models:	80 / 80 mVp-p typ.
Capacitive Load	- single output	3.3 Vout models:	2'600 µF max.
		5.1 Vout models:	1'300 µF max.
		12 Vout models:	560 µF max.
		15 Vout models:	560 µF max.
		24 Vout models:	200 µF max.
	- dual output	12 / -12 Vout models:	390 / 390 µF max.
		15 / -15 Vout models:	200 / 200 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			30 ms typ. / 60 ms max.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			192% max. of Iout max.
			160% typ. of Iout max.

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

Transient Response	- Response Deviation		5% max. (25% Load Step)
	- Response Time		500 µs max. (25% Load Step)

Safety Specifications

Standards	- IT / Multimedia Equipment		EN 62368-1 IEC 62368-1 UL 62368-1
	- Certification Documents		www.tracopower.com/tel10-safety-cert
Energy Source	- Output, acc. to 62368-1		ES1
Power Source	- Output, acc. to 62368-1		PS2
Pollution Degree			PD 3
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)
	- Radiated Emissions		EN 55032 class A (with external filter) EN 55032 class B (with external filter)
		External filter proposal:	www.tracopower.com/tel10-emc-filter
EMS (Immunity)			EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- 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, 20 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
		External filter proposal:	www.tracopower.com/tel10-emc-filter
	- 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
EMC / Environmental	- Certification Documents		www.tracopower.com/tel10-emc-cert

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +85°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–50°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/tel10-cc
Cooling System			Natural convection (20 LFM)
Altitude During Operation			6'000 m max.
Switching Frequency			357 - 483 kHz (PWM) 420 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
	- Input to Case, 60 s		1'000 VDC
	- Output to Case, 60 s		1'000 VDC
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		1'500 pF max.
Reliability	- Calculated MTBF		1'800'000 h (MIL-HDBK-217F, ground benign)
Washing Process			According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Housing Material			Alu alloy, black anodized coating
Potting Material			Epoxy (UL 94 V-0 rated)

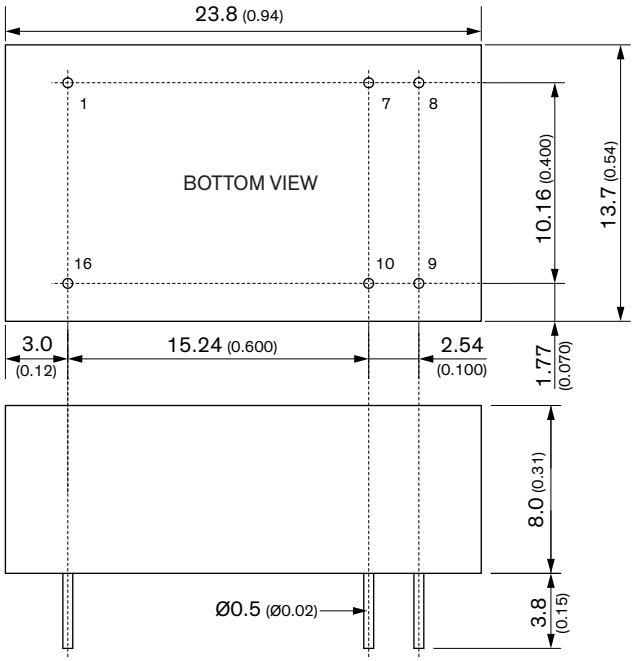
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Pin Material		Copper Alloy (C6801)
Pin Foundation Plating		Nickel (2 - 4 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Housing Type		Metal Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP16
Soldering Profile		Lead-Free Wave Soldering 260°C / 10 s max.
Weight		6.5 g
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	c1447b21-5486-495a-bbc2-a25a5dae8cae

Additional Information

Supporting Documents	www.tracopower.com/overview/tel10
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

Outline Dimensions



Dimensions in mm (inch)
Tolerances: x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)
Pin diameter tolerances: x.x ±0.05 (x.xx ±0.002)

Pinout

Pin	Single	Dual
1	–Vin (GND)	–Vin (GND)
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	–Vout	–Vout
16	+Vin (Vcc)	+Vin (Vcc)

NC: Not connected

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