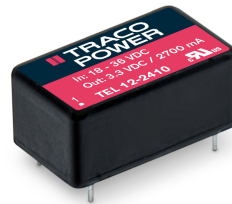


- Ultra compact 12 Watt converter in DIP-16 metal casing
- Highest power density of 3,61W/cm<sup>3</sup>
- 6-side shielded metal case with insulated baseplate
- Wide 2:1 input voltage range
- High efficiency (up to 88%) for low thermal loss
- Operating temperature range -40°C to +88°C
- Built-In EN 55032 class A filter
- Protection against short circuit
- 3-year product warranty



The TEL 12 is a 12 Watt DC/DC converter series which comes in an ultra compact DIP-16 metal package. The design purpose was to miniaturized low power DC/DC converters to the maximum without sacrificing high efficiency. They solidify the new standard for power density with 3,61 W/cm<sup>3</sup> and effectively double the power density compared to 12 Watt converters in DIP-24 package. The TEL 12 and 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 +65°C at full load and up to 85°C with 50% load. The converters also have an internal input filter to comply with conducted emission standard EN 55032 class A. Overall they feature an 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 typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TEL 12-1211	9 - 18 VDC (12 VDC nom.)	5.1 VDC	2'400 mA			83 %
TEL 12-1212		12 VDC	1'000 mA			87 %
TEL 12-1213		15 VDC	800 mA			88 %
TEL 12-1215		24 VDC	500 mA			88 %
TEL 12-1222		+12 VDC	500 mA	-12 VDC	500 mA	87 %
TEL 12-1223		+15 VDC	400 mA	-15 VDC	400 mA	87 %
TEL 12-2411	18 - 36 VDC (24 VDC nom.)	5.1 VDC	2'400 mA			83 %
TEL 12-2412		12 VDC	1'000 mA			87 %
TEL 12-2413		15 VDC	800 mA			88 %
TEL 12-2415		24 VDC	500 mA			88 %
TEL 12-2422		+12 VDC	500 mA	-12 VDC	500 mA	87 %
TEL 12-2423		+15 VDC	400 mA	-15 VDC	400 mA	87 %
TEL 12-4811	36 - 75 VDC (48 VDC nom.)	5.1 VDC	2'400 mA			83 %
TEL 12-4812		12 VDC	1'000 mA			87 %
TEL 12-4813		15 VDC	800 mA			88 %
TEL 12-4815		24 VDC	500 mA			88 %
TEL 12-4822		+12 VDC	500 mA	-12 VDC	500 mA	87 %
TEL 12-4823		+15 VDC	400 mA	-15 VDC	400 mA	87 %

### Input Specifications

Input Current	- At no load	12 Vin models: <b>20 mA typ.</b> 24 Vin models: <b>10 mA typ.</b> 48 Vin models: <b>7 mA typ.</b>
	- At full load	12 Vin models: <b>1'160 mA max.</b> 24 Vin models: <b>580 mA max.</b> 48 Vin models: <b>290 mA max.</b>
Surge Voltage		12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Under Voltage Lockout		12 Vin models: <b>8 VDC typ.</b> 24 Vin models: <b>16 VDC typ.</b> 48 Vin models: <b>34 VDC typ.</b>
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		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.8% max.</b> dual output models: <b>0.8% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>1% max.</b> dual output models: <b>1% max.</b> (Output 1) <b>1% max.</b> (Output 2)
	- Voltage Balance (symmetrical load)	dual output models: <b>2% max.</b>
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>70 mVp-p typ.</b> (w/ 2.2 µF, 50 V MLCC)
Capacitive Load	- single output	5.1 Vout models: <b>1'500 µF max.</b> 12 Vout models: <b>680 µF max.</b> 15 Vout models: <b>680 µF max.</b> 24 Vout models: <b>220 µF max.</b>
	- dual output	12 / -12 Vout models: <b>470 / 470 µF max.</b> 15 / -15 Vout models: <b>220 / 220 µF max.</b>
Minimum Load		Not required
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>30 ms typ.</b>
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		<b>160% typ. of Iout max.</b>
Transient Response	- Response Deviation	<b>5% max.</b> (75% to 100% Load Step)
	- Response Time	<b>500 µs typ.</b> (75% to 100% Load Step)

### Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 62368-1
	- Certification Documents	<a href="http://www.tracopower.com/overview/tel12">www.tracopower.com/overview/tel12</a>

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55032 class A (internal filter) FCC Part 15 class A (internal filter)
	- Radiated Emissions	EN 55032 class A (with external filter) FCC Part 15 class A (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/tel12">www.tracopower.com/overview/tel12</a>

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

EMS Immunity	<ul style="list-style-type: none"> <li>- Electrostatic Discharge</li> <li>- RF Electromagnetic Field</li> <li>- EFT (Burst) / Surge</li> <li>- Conducted RF Disturbances</li> <li>- PF Magnetic Field</li> </ul>	EN 55024 (IT Equipment) EN 55035 (Multimedia) Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A EN 61000-4-3, 20 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 2$ kV, perf. criteria A External filter proposal: <a href="http://www.tracopower.com/overview/tel12">www.tracopower.com/overview/tel12</a> EN 61000-4-6, 10 Vrms, 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
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## General Specifications

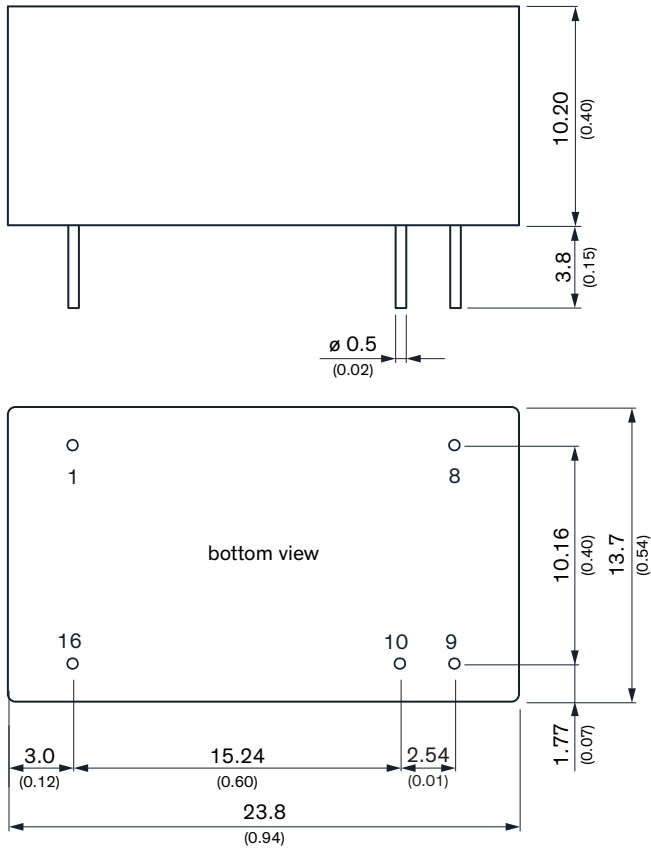
Relative Humidity		95% max. (non condensing)
Temperature Ranges	<ul style="list-style-type: none"> <li>- Operating Temperature</li> <li>- Case Temperature</li> <li>- Storage Temperature</li> </ul>	-40°C to +85°C +105°C max. -50°C to +125°C
Power Derating	- High Temperature	1.82 %/K above 50°C (5 Vout models) 2.5 %/K above 65°C (other models)
Cooling System		Natural convection (20 LFM)
Altitude During Operation		6'000 m max.
Switching Frequency		480 kHz typ.
Insulation System		Functional Insulation
Isolation Test Voltage	<ul style="list-style-type: none"> <li>- Input to Output, 60 s</li> <li>- Input to Output, 1 s</li> <li>- Input to Case, 60 s</li> <li>- Output to Case, 60 s</li> </ul>	1'500 VDC 1'800 VDC 1'000 VDC 1'000 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M $\Omega$ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	2'200 pF max.
Reliability	- Calculated MTBF	2'537'000 h (MIL-HDBK-217F, ground benign)
Housing Material		Alu alloy, black anodized coating
Pin Material		Copper Alloy (C6801)
Pin Foundation Plating		Nickel (2 - 4 $\mu$ m)
Pin Surface Plating		Tin (3 - 5 $\mu$ m), matte
Soldering Profile		Wave Soldering 260°C / 10 s max.
Connection Type		THD (Through-Hole Device)
Weight		8.6 g
Environmental Compliance	<ul style="list-style-type: none"> <li>- REACH Declaration</li> <li>- RoHS Declaration</li> </ul>	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a

## Supporting Documents

Overview Link (for additional Documents)	<a href="http://www.tracopower.com/overview/tel12">www.tracopower.com/overview/tel12</a>
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All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.

**Outline Dimensions**



Dimensions in mm (inch)  
 Tolerances: x.x ±0.5 (±0.02)  
 x.xx ±0.25 (±0.01)  
 Pin diameter  $\varnothing 0.5 \pm 0.05$  ( $\varnothing 0.02 \pm 0.002$ )

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

NC: Not connected