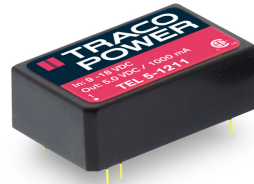


- **Wide 2:1 input range**
- **Cost efficient design**
- **High power density**
- **High efficiency up to 86%**
- **Built-in EN 55032 class A filter**
- **I/O isolation 1'500 VDC**
- **Regulated outputs**
- **Continuous short-circuit protection**
- **High reliability, MTBF >1 Mio. h**
- **3-year product warranty**



The TEL 5 Series is a range of DC/DC-converter modules with wide input range of 2:1. State of the art SMD-technology guarantees a product with very high reliability and excellent cost / performance ratio. High efficiency allows an operating temperature range of -40°C to $+85^{\circ}\text{C}$ at full load. This product series provides an economical solution for many cost critical applications in industrial and consumer electronics.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
TEL 5-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	1'200 mA			77 %
TEL 5-1211		5 VDC	1'000 mA			81 %
TEL 5-1212		12 VDC	500 mA			84 %
TEL 5-1222		+12 VDC	250 mA	-12 VDC	250 mA	84 %
TEL 5-1223		+15 VDC	200 mA	-15 VDC	200 mA	84 %
TEL 5-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	1'200 mA			79 %
TEL 5-2411		5 VDC	1'000 mA			83 %
TEL 5-2412		12 VDC	500 mA			86 %
TEL 5-2422		+12 VDC	250 mA	-12 VDC	250 mA	86 %
TEL 5-2423		+15 VDC	200 mA	-15 VDC	200 mA	86 %

Input Specifications

Input Current	- At no load	12 Vin models: 20 mA typ. 24 Vin models: 5 mA typ.
	- At full load	12 Vin models: 429 mA typ. (3.3 Vout model) 514 mA typ. (5 Vout model) 595 mA typ. (12 Vout model) 595 mA typ. (12 / -12 Vout model) 595 mA typ. (15 / -15 Vout model) 24 Vin models: 209 mA typ. (3.3 Vout model) 251 mA typ. (5 Vout model) 291 mA typ. (12 Vout model) 291 mA typ. (12 / -12 Vout model) 291 mA typ. (15 / -15 Vout model)
Surge Voltage		12 Vin models: 25 VDC max. (1 s max.) 24 Vin models: 50 VDC max. (1 s max.)
Start-up Voltage		12 Vin models: 4.5 VDC min. / 6 VDC typ. / 8 VDC max. 24 Vin models: 8 VDC min. / 12 VDC typ. / 16 VDC max.
Under Voltage Lockout		12 Vin models: 8 VDC max. 24 Vin models: 16 VDC max.
Reflected Ripple Current		12 Vin models: 25 mA typ. 24 Vin models: 15 mA typ.
Recommended Input Fuse		12 Vin models: 1'250 mA (slow blow) 24 Vin models: 1'250 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Pi-Type
Short Circuit Input Power		3 W max.

Output Specifications

Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models: 0.3% max. dual output models: 0.3% max.
	- Load Variation (20 - 100%)	single output models: 1% max. dual output models: 1% max. (Output 1) 1% max. (Output 2)
	- Voltage Balance (symmetrical load)	dual output models: 2% max.
	- 20 MHz Bandwidth	50 mVp-p typ. 75 mVp-p max. (To further reduce Ripple and Noise, a capacitor with 3.3 µF X7R is recommended.)
Capacitive Load	- single output	3.3 Vout models: 6'800 µF max. 5 Vout models: 6'800 µF max. 12 Vout models: 6'800 µF max.
	- dual output	12 / -12 Vout models: 1'000 / 1'000 µF max. 15 / -15 Vout models: 1'000 / 1'000 µF max.
Minimum Load		5 % of Iout max. (Operation at lower load will not damage the converter, but it may not meet all specifications)
Temperature Coefficient		±0.02 %/K max.
Start-up Time		37 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Overload Protection		Foldback Mode
Output Current Limitation		120% min. of Iout max.
		150% 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 - Response Time	6% max. (25% Load Step) 150 µs typ. / 300 µs max. (25% Load Step)
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Safety Specifications

Safety Standards	- IT / Multimedia Equipment - Certification Documents	CSA-C22.2, No. 60950-1 Designed for EN 62368-1 (no certification) EN 60950-1 IEC 60950-1 UL 60950-1 www.tracopower.com/overview/tel5
Pollution Degree		PD 2

EMC Specifications

EMI Emissions	- Conducted Emissions - Radiated Emissions	EN 55032 class A (internal filter) EN 55032 class A (internal filter)
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General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +85°C +90°C max. -50°C to +125°C
Power Derating	- High Temperature	3.33 %/K above 70°C See application note: www.tracopower.com/overview/tel5
Cooling System		Natural convection (20 LFM)
Switching Frequency		200 kHz min. (PFM) 300 kHz typ. (PFM)
Insulation System		Functional Insulation
Working Voltage (rated)		120 VAC
Isolation Test Voltage	- Input to Output, 60 s - Input to Output, 1 s	1'500 VDC 1'800 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	380 pF typ. 500 pF max.
Reliability	- Calculated MTBF	1'000'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Phosphor Bronze (C5191)
Pin Foundation Plating		Nickel (2 - 4 µm)
Pin Surface Plating		Gold (75 - 125 nm), glossy
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP24
Soldering Profile		Wave Soldering 260°C / 10 s max.
Weight		16.9 g
Thermal Impedance	- Case to Ambient	15.34 K/W typ.

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

Environmental Compliance - REACH Declaration

www.tracopower.com/info/reach-declaration.pdf

- RoHS Declaration

REACH SVHC list compliant

REACH Annex XVII compliant

www.tracopower.com/info/rohs-declaration.pdf

Exemptions: 7a, 7c-I

(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))

- SCIP Reference Number

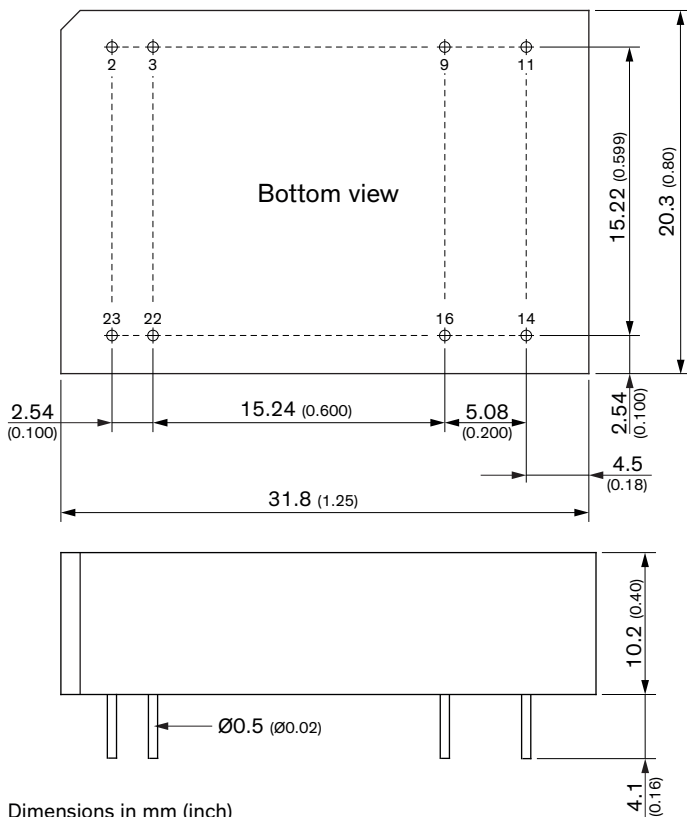
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Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/tel5

Outline Dimensions



Dimensions in mm (inch)

Tolerance: $x.x \pm 0.25$ ($x.xx \pm 0.01$)

$x.xx \pm 0.13$ ($x.xxx \pm 0.005$)

Pin diameter tolerance: $x.x \pm 0.05$ ($x.xx \pm 0.002$)

Pinout

Pin	Single	Dual
2	-Vin (GND)	
3	-Vin (GND)	
9	No pin	Common
11	NC	-Vout
14	+Vout	
16	-Vout	Common
22	+Vin (VCC)	
23	+Vin (VCC)	

NC: Not connected