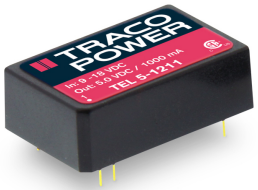
TRACO POWER

DC/DC Converter

TEL 5 Series, 5 Watt

- **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**



UL 60950-1 IEC 60950-1

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°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
		Vnom	Imax	Vnom	Imax	typ.
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.
Ripple and Noise	- 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	6% max. (25% Load Step)
	- Response Time	150 µs typ. / 300 µs max. (25% Load Step)

Safety Specifications

Standards	- IT / Multimedia Equipment	CSA-C22.2, No. 60950-1 Designed for IEC/EN/UL 62368-1 (not certified) EN 60950-1 IEC 60950-1 UL 60950-1
	- Certification Documents	www.tracopower.com/overview/tel5
Pollution Degree		PD 2

EMC Specifications

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

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	–40°C to +85°C
	- Case Temperature	+90°C max.
	- Storage Temperature	–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	1'500 VDC
	- Input to Output, 1 s	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		Lead-Free Wave Soldering 260°C / 10 s max.
Weight		16.9 g
Thermal Impedance	- Case to Ambient	15.34 K/W typ.

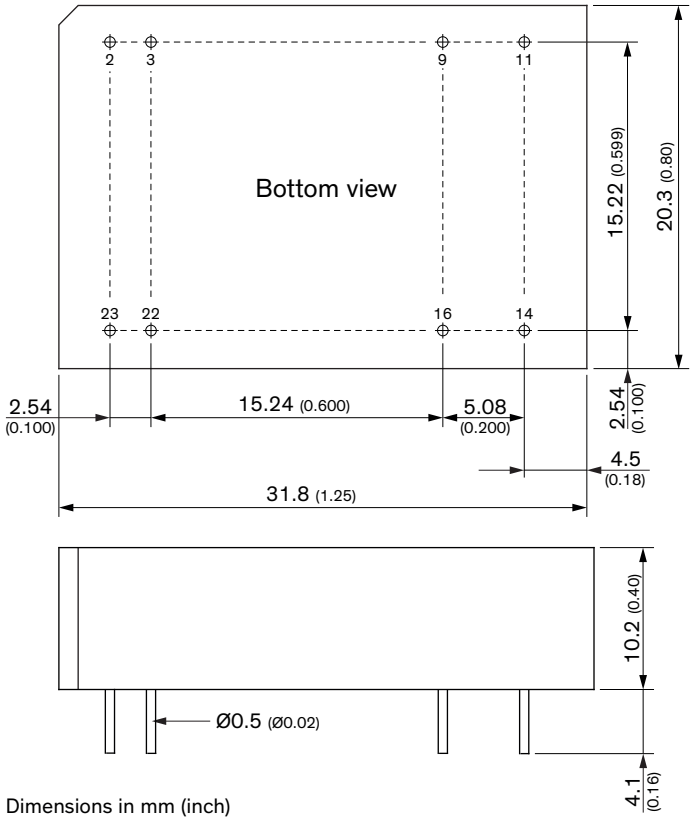
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	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	e533bdba-1560-450b-b30c-74fbf8df5fbc

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tel5

Outline Dimensions



Dimensions in mm (inch)
Tolerance: x.x ±0.25 (x.xx ±0.01)
x.xx ±0.13 (x.xxx ±0.005)
Pin diameter tolerance: x.x ±0.05 (x.xx ±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