

## **DC/DC Converters**

TEL 2 Series, 2 Watt

## **Features**

- Ultracompact DIP-16 plastic package
- ♦ Wide 2:1 input range
- Regulated output
- ♦ I/O isolation 1500V
- Input filter meets EN55022, class A without ext. components
- Low ripple and noise
- ♦ Indefinite shortcircuit protection
- Operating temperature range -40°C to +75°C
- ◆ Lead free design, RoHS compliant
- 3-year product warranty



The TEL-2 series, comprising 28 models, is a range of isolated 2 Watt converters in a low profile DIP-16 package. Requiring only 3.25 cm<sup>2</sup> of space on the PCB they provide a complete DC/DC converter without need of any external components. Wide input range and tightly regulated output voltage qualifies these converters for many cost critical applications in industrial and consumer electronics.

Models				
Ordercode	Input voltage range	Output voltage	Output current max.	Efficiency typ.
TEL 2-0510		3.3 VDC	500 mA	70 %
TEL 2-0511		5 VDC	400 mA	73 %
TEL 2-0512	4.5. 0.1/00	12 VDC	165 mA	75 %
TEL 2-0513	<b>4.5 - 9 VDC</b> (nominal 5 VDC)	15 VDC	135 mA	73 %
TEL 2-0521	(nonlinar 5 vbc)	±5 VDC	±200 mA	64 %
TEL 2-0522		±2 VDC	±85 mA	69 %
TEL 2-0523		±15 VDC	±65 mA	71 %
TEL 2-1210		3.3 VDC	500 mA	73 %
TEL 2-1211		5 VDC	400 mA	77 %
TEL 2-1212	<b>9 – 18 VDC</b> (nominal 12 VDC)	12 VDC	165 mA	80 %
TEL 2-1213		15 VDC	135 mA	80 %
TEL 2-1221		±5 VDC	±200 mA	73 %
TEL 2-1222		±12 VDC	±85 mA	78 %
TEL 2-1223		±15 VDC	±65 mA	78 %
TEL 2-2410		3.3 VDC	500 mA	72 %
TEL 2-2411		5 VDC	400 mA	77 %
TEL 2-2412	18 – 36 VDC	12 VDC	165 mA	80 %
TEL 2-2413	(nominal 24 VDC)	15 VDC	135 mA	81 %
TEL 2-2421	(nominal 24 VDC)	±5 VDC	±200 mA	74 %
TEL 2-2422		±12 VDC	±85 mA	78 %
TEL 2-2423		±15 VDC	±65 mA	80 %
TEL 2-4810		3.3 VDC	500 mA	71 %
TEL 2-4811		5 VDC	400 mA	73 %
TEL 2-4812	36 – 75 VDC	12 VDC	165 mA	79 %
TEL 2-4813	(nominal 48 VDC)	15 VDC	135 mA	79 %
TEL 2-4821	(nominal 40 VDC)	±5 VDC	±200 mA	71 %
TEL 2-4822		±12 VDC	±85 mA	77 %
TEL 2-4823		±15 VDC	±65 mA	77 %



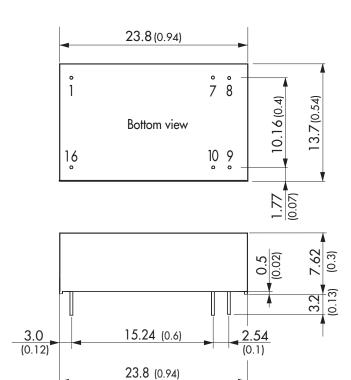
Capacitive load  3.3 VDC output models: 5 VDC output models: 12 VDC output models: 15 VDC output models: 15 VDC output models: 15 VDC output models: 15 VDC output models: 16 VDC output models: 170 μF max. 110 μF max. 110 μF max. 110 μF max. 110 μF max. 470	Input Specifications			
under voltage shut down	•	full load	12 Vin models: 24 Vin models:	220 mA / 20 mA typ. 110 mA / 10 mA typ.
Surge voltage (100 msec. max.)  Surge voltage (100 msec. max.)  10 Vin models: 25 V max. 24 Vin models: 25 V max. 26 Vin max. 26 Vin max. 27 Vin models: 20 V max. 28 Vin models: 20 V max. 29 Vin models: 20 V max. 29 Vin models: 20 Vin max. 20 Vin	under voltage shut down		12 Vin models. 24 Vin models:	7 VDC / 6.5 VDC typ. 12 VDC / 11 VDC typ.
Conducted noise [input]  Output Specifications  Voltage set accuracy  Regulation  - Input variation Vin min. to Vin max Load variation 25 - 100 % single output models: 0.75 % max. 2.0 % (balanced load)  Ripple and noise (20 MHz Bandwidth)  Short circuit protection  Minimum load  Capacitive load  Capacitive load  Capacitive load  Capacitive ranges  - Capacitive load  Capaciti		max.)	5 Vin models: 12 Vin models: 24 Vin models:	11 V max. 25 V max. 50 V max.
Output Specifications         Voltage set accuracy       ±2 % max.         Regulation       - Input variation Vin min. to Vin max Load variation 25 - 100 % single output models: odual output o	Reverse voltage protection			1.0 A max.
Voltage set accuracy  Regulation - Input variation Vin min. to Vin max Load variation 25 – 100 % single output models: adual output models: 20 % (balanced load)  Ripple and noise (20 MHz Bandwidth)  Temperature coefficient Short circuit protection  Minimum load  Capacitive load  Capacitive load  Capacitive load  Capacitive ranges - Operating - Storage  Storage  Humidity (non condensing)  Reliability, calculated MTBF (MILHDBK:217F, @ +25°C, ground benign)  Soldtion resistance Input/Output (500 VDC)  Safety standards  10 0 05 % max. 0.75 % max. 0.70 % max. 0.10 µ f	Conducted noise (input)			EN 55022 level A, FCC part 15, level A
Regulation	Output Specification	s		
Ripple and noise [20 MHz Bandwidth]  Ripple and noise [20 MHz Bandwidth]  So mVpk-pk max  ### ### ### ### ### ### ### ### ### #	Voltage set accuracy			±2 % max.
Temperature coefficient ±0.02 %/K Short circuit protection indefinite, automatic recovery  Minimum load 25 % of rated max current (operation at lower load condition is safe but a higher output ripple will be experienced)  Capacitive load 3.3 VDC output models: 5 VDC output models: 12 VDC output models: 15 VDC output models: 15 VDC output models: 15 VDC output models: 12 VDC output models: 12 VDC output models: 142 VDC output models: 142 VDC output models: 142 VDC output models: 143 VDC output models: 145 VDC output models: 145 VDC output models: 145 VDC output models: 150 VDC output models: 165 VDC output models: 170 VPF max. 170 VPF	Regulation		single output models:	0.75 % max.
Short circuit protection indefinite, automatic recovery  Minimum load 25 % of rated max current (operation at lower load condition is safe but a higher output ripple will be experienced)  Capacitive load 3.3 VDC output models: 5 VDC output models: 12 VDC output models: 15 VDC output models: 15 VDC output models: 170 µF max. 170 µF max. 170 µF max. 170 µF max. 100	Ripple and noise (20 MHz	z Bandwidth)		50 mVpk-pk max
Minimum load  Capacitive load  Capacitive load  An an an analyse standards  Minimum load  Capacitive load  An analyse standards  An an analyse standards  An an analyse standards  An an analyse standards  An an an analyse standards  An an an analyse standards  An an an an an analyse standards  An	Temperature coefficient			±0.02 %/K
Capacitive load   3.3 VDC output models: 5 VDC output models: 170 µF max. 170 µF max. 170 µF max. 110 µF max. 11	Short circuit protection			indefinite, automatic recovery
S VDC output models: 1700 pF max. 170 pF max. 110 pF	Minimum load			load condition is safe but a higher output ripple
Temperature ranges - Operating - Storage 40°C to +75°C (no derating) - 55°C to +125°C  Humidity (non condensing) 95 % rel. H max.  Reliability, calculated MTBF (MIL-HDBK-217F, @ +25°C, ground benign) >1.2 Mio h  Isolation voltage Input/Output (60 sec.) 1'500 VDC  Isolation capacity Input/Output (500 VDC) >1'000 M Ohm  Switching frequency 300 kHz (PFM)  Safety standards UL/cUL 60950-1 , IEC/EN 60950-1	Capacitive load	£	5 VDC output models: 12 VDC output models: 15 VDC output models: ±5 VDC output models: 12 VDC output models:	1′000 µF max. 170 µF max. 110 µF max. 470 µF max. 100 µF max.
— Storage       —55°C to +125°C         Humidity (non condensing)       95 % rel. H max.         Reliability, calculated MTBF (MIL-HDBK-217F, @ +25°C, ground benign)       >1.2 Mio h         Isolation voltage       Input/Output (60 sec.)       1′500 VDC         Isolation capacity       Input/Output       250 pF max.         Isolation resistance       Input/Output (500 VDC)       >1′000 M Ohm         Switching frequency       300 kHz (PFM)         Safety standards       UL/cUL 60950-1 , IEC/EN 60950-1	General Specification	ns		
Reliability, calculated MTBF (MIL-HDBK-217F, @ +25°C, ground benign) >1.2 Mio h  Isolation voltage Input/Output (60 sec.) 1'500 VDC  Isolation capacity Input/Output (500 VDC) 250 pF max.  Isolation resistance Input/Output (500 VDC) >1'000 M Ohm  Switching frequency 300 kHz (PFM)  Safety standards UL/cUL 60950-1 , IEC/EN 60950-1	Temperature ranges	1 0		
Isolation voltage     Input/Output (60 sec.)     1'500 VDC       Isolation capacity     Input/Output     250 pF max.       Isolation resistance     Input/Output (500 VDC)     >1'000 M Ohm       Switching frequency     300 kHz (PFM)       Safety standards     UL/cUL 60950-1 , IEC/EN 60950-1	Humidity (non condensing)			95 % rel. H max.
Isolation capacity     Input/Output     250 pF max.       Isolation resistance     Input/Output (500 VDC)     >1'000 M Ohm       Switching frequency     300 kHz (PFM)       Safety standards     UL/cUL 60950-1 , IEC/EN 60950-1	Reliability, calculated MTBF (MIL+HDBK-217F, @ +25°C, ground benign)			>1.2 Mio h
Isolation resistanceInput/Output (500 VDC)>1'000 M OhmSwitching frequency300 kHz (PFM)Safety standardsUL/cUL 60950-1 , IEC/EN 60950-1	Isolation voltage	Input/Output (60 sec.)		1′500 VDC
Switching frequency300 kHz (PFM)Safety standardsUL/cUL 60950-1 , IEC/EN 60950-1	Isolation capacity	Input/Output		250 pF max.
Safety standards  UL/cUL 60950-1 , IEC/EN 60950-1	Isolation resistance	Input/Output (500 VDC)		>1′000 M Ohm
•	Switching frequency			300 kHz (PFM)
Safety approval CSA 60950-1-03 (File no. 226037)	Safety standards			UL/cUL 60950-1 , IEC/EN 60950-1
www.tracopower.com/products/tel2-csa.pdf	Safety approval			CSA 60950-1-03 (File no. 226037) www.tracopower.com/products/tel2-csa.pdf

All specifications valid at nominal input voltage, full load and  $+25^{\circ}\text{C}$  after warm-up time unless otherwise stated.



Physical Specifications	
Casing material	non conductive FR4
Potting material	epoxy, UL94V-0 - rated
Weight	5.1 g (0.17oz)
Soldering temperature	max. 265°C / 10 sec.

## Outline Dimensions mm (inches)



Pin-Out					
Pin	Single	Dual			
1	-Vin (GND)	-Vin (GND)			
7	No con.	No con.			
8	No con.	Common			
9	+Vout	+Vout			
10	-Vout	-Vout			
16	+Vin	+Vin			

Pin diameter ø 0.5  $\pm$ 0.05 (0.02)  $\pm$ 0.002 Tolerances  $\pm$ 0.25 ( $\pm$ 0.01)

Specifications can be changed any time without notice.

