

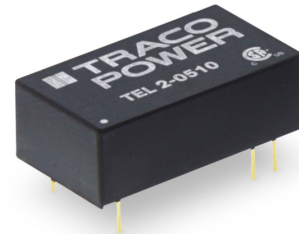


**THE DATASHEET OF  
TEL 2-2413**



#### Features

- ◆ Ultracompact DIP-16 plastic package
- ◆ Wide 2:1 input range
- ◆ Regulated output
- ◆ I/O isolation 1500V
- ◆ Input filter meets EN55032, class A without ext. components
- ◆ Low ripple and noise
- ◆ Indefinite shortcircuit protection
- ◆ Operating temperature range -40°C to +80°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 | 4.5 – 9 VDC<br>(nominal 5 VDC)  | 3.3 VDC        | 500 mA              | 70 %            |
| TEL 2-0511 |                                 | 5 VDC          | 400 mA              | 73 %            |
| TEL 2-0512 |                                 | 12 VDC         | 165 mA              | 75 %            |
| TEL 2-0513 |                                 | 15 VDC         | 135 mA              | 73 %            |
| TEL 2-0521 |                                 | ±5 VDC         | ±200 mA             | 64 %            |
| TEL 2-0522 |                                 | ±12 VDC        | ±85 mA              | 69 %            |
| TEL 2-0523 |                                 | ±15 VDC        | ±65 mA              | 71 %            |
| TEL 2-1210 | 9 – 18 VDC<br>(nominal 12 VDC)  | 3.3 VDC        | 500 mA              | 73 %            |
| TEL 2-1211 |                                 | 5 VDC          | 400 mA              | 77 %            |
| TEL 2-1212 |                                 | 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 | 18 – 36 VDC<br>(nominal 24 VDC) | 3.3 VDC        | 500 mA              | 72 %            |
| TEL 2-2411 |                                 | 5 VDC          | 400 mA              | 77 %            |
| TEL 2-2412 |                                 | 12 VDC         | 165 mA              | 80 %            |
| TEL 2-2413 |                                 | 15 VDC         | 135 mA              | 81 %            |
| TEL 2-2421 |                                 | ±5 VDC         | ±200 mA             | 74 %            |
| TEL 2-2422 |                                 | ±12 VDC        | ±85 mA              | 78 %            |
| TEL 2-2423 |                                 | ±15 VDC        | ±65 mA              | 80 %            |
| TEL 2-4810 | 36 – 75 VDC<br>(nominal 48 VDC) | 3.3 VDC        | 500 mA              | 71 %            |
| TEL 2-4811 |                                 | 5 VDC          | 400 mA              | 73 %            |
| TEL 2-4812 |                                 | 12 VDC         | 165 mA              | 79 %            |
| TEL 2-4813 |                                 | 15 VDC         | 135 mA              | 79 %            |
| TEL 2-4821 |                                 | ±5 VDC         | ±200 mA             | 71 %            |
| TEL 2-4822 |                                 | ±12 VDC        | ±85 mA              | 77 %            |
| TEL 2-4823 |                                 | ±15 VDC        | ±65 mA              | 77 %            |

### Input Specifications

|   |  |                      |
|---|--|----------------------|
| Input current at full load / no load<br>(nominal input) | 5 Vin models:                          | 600 mA / 40 mA typ.  |
|   | 12 Vin models:                         | 220 mA / 20 mA typ.  |
|   | 24 Vin models:                         | 110 mA / 10 mA typ.  |
|   | 48 Vin models:                         | 55 mA / 8 mA typ.    |
| Start-up voltage /<br>under voltage shut down           | 5 Vin models:                          | 4 VDC / 3.5 VDC typ. |
|   | 12 Vin models:                         | 7 VDC / 6.5 VDC typ. |
|   | 24 Vin models:                         | 12 VDC / 11 VDC typ. |
|   | 48 Vin models:                         | 24 VDC / 22 VDC typ. |
| Surge voltage (100 ms max.)                             | 5 Vin models:                          | 11 V max.            |
|   | 12 Vin models:                         | 25 V max.            |
|   | 24 Vin models:                         | 50 V max.            |
|   | 48 Vin models:                         | 100 V max.           |
| Conducted noise (input)                                 | EN 55032 class A, FCC part 15, level A |                      |

### Output Specifications

|                                     |  |   |
|-------------------------------------|--|---|
| Voltage set accuracy                | ±2 % max.  |   |
| Regulation                          | – Input variation Vin min. to Vin max.   | 0.5 % max.                                |
|                                     | – Load variation 25 – 100 %  | single output models: 0.75 % max.         |
|                                     |  | dual output models: 2.0 % (balanced load) |
| Ripple and noise (20 MHz Bandwidth) | 50 mVpk-pk 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:   | 2'200 µF max.                             |
|                                     | 5 VDC output models:   | 1'000 µF max.                             |
|                                     | 12 VDC output models:  | 170 µF max.                               |
|                                     | 15 VDC output models:  | 110 µF max.                               |
|                                     | ±5 VDC output models:  | 470 µF max.                               |
|                                     | ±12 VDC output models:   | 100 µF max.                               |
|                                     | ±15 VDC output models:   | 47 µF max.                                |

### General Specifications

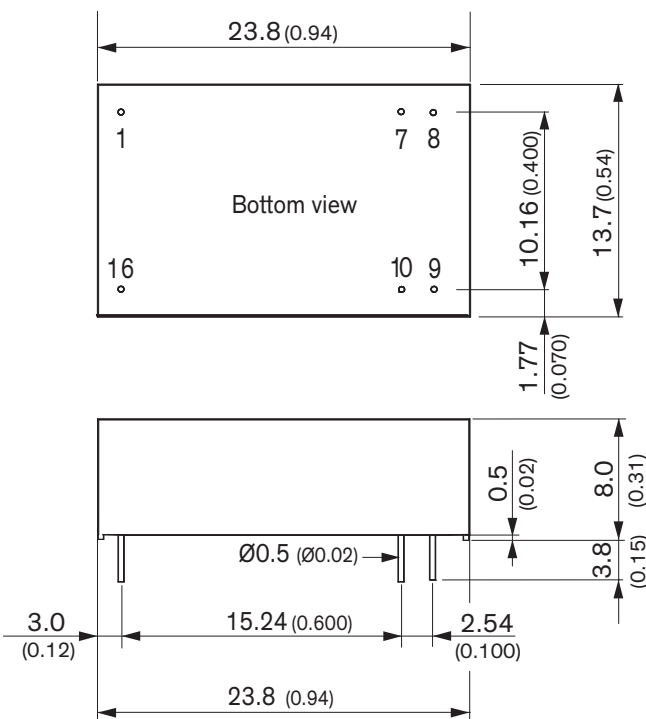
|   |                                |  |
|---|--------------------------------|--|
| Temperature ranges  | – Operating                    | –40°C to +80°C   |
|   | – Case                         | +100°C max.  |
|   | – Storage                      | –55°C to +105°C  |
| Derating  | 2.9 %/K above 65°C             |  |
| Humidity (non condensing)   | 95 % rel. H max.               |  |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >1.2 Mio h                     |  |
| Isolation voltage   | Input/Output (60 s)            | 1'500 VDC  |
| Isolation capacitance   | Input/Output                   | 250 pF max.  |
| Isolation resistance  | Input/Output (500 VDC)         | >1'000 MOhm  |
| Switching frequency   | 150 - 550 kHz (PFM)            |  |
|   | 300 kHz typ. (PFM)             |  |
| Safety standards  | UL/cUL 60950-1, IEC/EN 60950-1 |  |
| Safety approval   | CB 60950-1                     |  |
|   | – Certification documents      | <a href="http://www.tracopower.com/overview/tel2">www.tracopower.com/overview/tel2</a>                           |
| Environmental compliance  | – Reach                        | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> |
|   | – RoHS                         | RoHS directive 2011/65/EU  |

All specifications valid at nominal input voltage, full load and +25°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 | 265°C / 10 s max.      |

**Outline Dimensions mm (inches)**





| Pin-Out |            |            |
|---------|------------|------------|
| Pin     | Single     | Dual       |
| 1       | -Vin (GND) | -Vin (GND) |
| 7       | NC         | NC         |
| 8       | NC         | Common     |
| 9       | +Vout      | +Vout      |
| 10      | -Vout      | -Vout      |
| 16      | +Vin       | +Vin       |

NC = Not connected

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)

## Looking for pricing, stock, or lifecycle information?

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