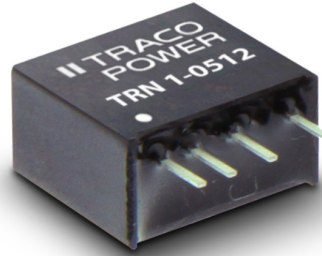


## DC/DC Converter

## TRN 1 Series, 1 Watt

- Compact SIP package  
11,9 × 7,7 × 11,0 mm
- Fully regulated outputs
- Input Voltage range  
4.5-13.2, 9-18, 18-36, 36-75 VDC
- I/O-isolation 1'600 VDC
- Operating temperature range  
-40°C to +90°C without derating
- Short circuit protection
- 3-year product warranty
- Designed to meet UL 62368-1  
(UL 60950-1)



The TRN 1 Series comprises 1 Watt fully regulated, high performance DC/DC converters. They come in a compact cubical package of only 1.00 cm<sup>3</sup>. Full load operation is reliable up to 90°C environment temperature. With 1'600 VDC I/O-isolation voltage, and short current protection they cover a wide range of application when space is limited. The input of the converters is designed for a wide voltage range (2:1) and minimum load is not required. The functional I/O-isolation system is designed to meet IEC/EN 62368-1 with a test voltage (60 s) of 1600 VDC.

| Models     |                                   |                |                     |                 |
|------------|-----------------------------------|----------------|---------------------|-----------------|
| Order code | Input voltage                     | Output voltage | Output current max. | Efficiency typ. |
| TRN 1-0510 | 4.5 – 13.2 VDC<br>(9 VDC nominal) | 3.3 VDC        | 300 mA              | 77 %            |
| TRN 1-0511 |                                   | 5.0 VDC        | 200 mA              | 79 %            |
| TRN 1-0512 |                                   | 12 VDC         | 90 mA               | 81 %            |
| TRN 1-0513 |                                   | 15 VDC         | 70 mA               | 82 %            |
| TRN 1-0515 |                                   | 24 VDC         | 45 mA               | 83 %            |
| TRN 1-0521 |                                   | ± 5.0 VDC      | ±100 mA             | 79 %            |
| TRN 1-0522 |                                   | ±12 VDC        | ±45 mA              | 83 %            |
| TRN 1-0523 |                                   | ±15 VDC        | ±35 mA              | 80 %            |
| TRN 1-1210 | 9 – 18 VDC<br>(12 VDC nominal)    | 3.3 VDC        | 300 mA              | 77 %            |
| TRN 1-1211 |                                   | 5.0 VDC        | 200 mA              | 80 %            |
| TRN 1-1212 |                                   | 12 VDC         | 90 mA               | 81 %            |
| TRN 1-1213 |                                   | 15 VDC         | 70 mA               | 83 %            |
| TRN 1-1215 |                                   | 24 VDC         | 45 mA               | 83 %            |
| TRN 1-1221 |                                   | ± 5.0 VDC      | ±100 mA             | 79 %            |
| TRN 1-1222 |                                   | ±12 VDC        | ±45 mA              | 83 %            |
| TRN 1-1223 |                                   | ±15 VDC        | ±35 mA              | 80 %            |
| TRN 1-2410 | 18 – 36 VDC<br>(24 VDC nominal)   | 3.3 VDC        | 300 mA              | 77 %            |
| TRN 1-2411 |                                   | 5.0 VDC        | 200 mA              | 81 %            |
| TRN 1-2412 |                                   | 12 VDC         | 90 mA               | 82 %            |
| TRN 1-2413 |                                   | 15 VDC         | 70 mA               | 83 %            |
| TRN 1-2415 |                                   | 24 VDC         | 45 mA               | 82 %            |
| TRN 1-2421 |                                   | ± 5.0 VDC      | ±100 mA             | 79 %            |
| TRN 1-2422 |                                   | ±12 VDC        | ±45 mA              | 82 %            |
| TRN 1-2423 |                                   | ±15 VDC        | ±35 mA              | 80 %            |
| TRN 1-4810 | 36 – 75 VDC<br>(48 VDC nominal)   | 3.3 VDC        | 300 mA              | 77 %            |
| TRN 1-4811 |                                   | 5.0 VDC        | 200 mA              | 78 %            |
| TRN 1-4812 |                                   | 12 VDC         | 90 mA               | 80 %            |
| TRN 1-4813 |                                   | 15 VDC         | 70 mA               | 81 %            |
| TRN 1-4815 |                                   | 24 VDC         | 45 mA               | 81 %            |
| TRN 1-4821 |                                   | ± 5.0 VDC      | ±100 mA             | 78 %            |
| TRN 1-4822 |                                   | ±12 VDC        | ±45 mA              | 81 %            |
| TRN 1-4823 |                                   | ±15 VDC        | ±35 mA              | 79 %            |

## Input Specifications

|                          |   |   |
|--------------------------|---|---|
| Input current no load    |   | 9 Vin models: 35 mA typ<br>12 Vin models: 20 mA typ.<br>24 Vin models: 10 mA typ.<br>48 Vin models: 5 mA typ.   |
| Surge voltage (1 s max.) |   | 9 Vin models: 15 V max.<br>12 Vin models: 25 V max.<br>24 Vin models: 50 V max.<br>48 Vin models: 100 V max.  |
| Reflected ripple current |   | 30 mA <sub>p-p</sub> typ.   |
| Conducted noise          | – conducted input emission  | EN 55032 class A or B with external components  |
| EMC immunity             | – ESD (electrostatic discharge)<br>– Radiated immunity<br>– Fast transient / surge (with external input capacitor)<br>– Conducted immunity<br>– Magnetic field immunity | EN 61000-4-2, air ±8 kV, contact ±6 kV, perf. criteria A<br>EN 61000-4-3, 10 V/m, perf. criteria A<br>EN 61000-4-4, ±2 kV, perf. criteria A<br>EN 61000-4-5, ±1 kV perf. criteria A<br>Nippon chemi-con KY 220 µF/ 100 V<br>EN 61000-4-6, 10 V <sub>rms</sub> , perf. criteria A<br>EN 61000-4-8<br>100 A/m, continuous, perf. criteria A<br>1000 A/m, 1 sec., perf. criteria A |
| Input filter             |   | capacitor type  |

## Output Specifications

|   |  |   |
|---|--|---|
| Voltage set accuracy                      |  | ±1 % max.   |
| Regulation                                | – Input variation<br>– Load variation 0 – 100 %<br>– Cross regulation - dual output: | 0.2 % max.<br>1 % max.<br>5 % max. (asymmetrical load 25 % / 100 %)   |
| Temperature coefficient                   |  | ±0.02 %/K typ.  |
| Ripple and noise (20 MHz Bandwidth)       |  | 50 mV <sub>p-p</sub> typ.   |
| Start-up time                             |  | 15 ms max. (5 ms typ.)  |
| Transient response (25% load step change) |  | 500 µs typ.   |
| Short circuit protection                  |  | continuous, automatic recovery  |
| Capacitive load                           | – Single output<br>– Dual output   | 3.3 VDC models: 1680 µF max.<br>5.0 VDC models: 820 µF max.<br>12 VDC models: 470 µF max.<br>15 VDC models: 330 µF max.<br>24 VDC models: 160 µF max.<br>±5.0 VDC models: 470 µF max. (each output)<br>±12 VDC models: 330 µF max. (each output)<br>+15 VDC models: 220 µF max. (each output) |

## General Specifications

|                                  |   |  |
|----------------------------------|---|--|
| Temperature ranges               | – Operating (convection cooling 20LFM, 0.1m/s)<br>– Case temperature<br>– Storage temperature | –40°C to +90°C (without derating)<br>+95°C max.<br>–55°C to +125°C |
| Derating                         |   | 6.7%/K above 90°C  |
| Humidity (non condensing)        |   | 5 – 95 % rel H max.  |
| Isolation voltage                | – I/O isolation voltage (60 s)  | 1'600 VDC  |
| Isolation capacitance            |   | 75 pF max.   |
| Isolation resistance (@ 500 VDC) |   | >1 Gohm  |

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

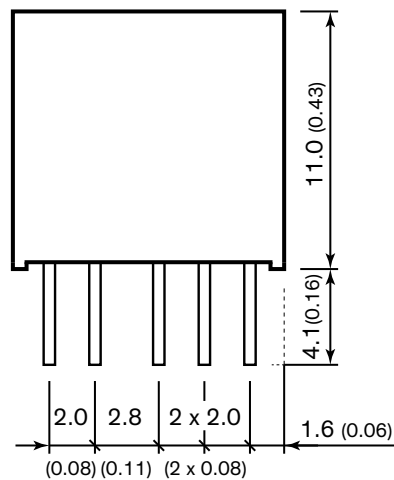
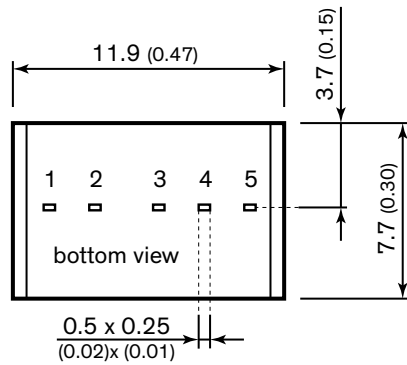
**General Specifications**

|  |   |
|--|---|
| Reliability, calculated MTBF (MIL-HDBK-217F at +25°C, ground benign) | 7'400'000 h   |
| Switching frequency  | 100 kHz min. Pulse frequency modulation.                            |
| Thermal shock & vibration  | MIL-STD-810F  |
| Safety standards   | - Designed to meet (no certification) IEC/EN/UL 62368-1, UL 60950-1 |
| Environmental compliance   | - Reach<br>- RoHS RoHS directive 2011/65/EU                         |

**Physical Specifications**

|                       |                              |
|-----------------------|------------------------------|
| Casing material       | non-conductive black plastic |
| Potting material      | silicone (UL 94V-0 rated)    |
| Package weight        | 2.1 g (0.07 oz)              |
| Soldering temperature | 260°C / 6 s max.             |

**Outline Dimensions**



| Pin-Out |            |            |
|---------|------------|------------|
| Pin     | Single     | Dual       |
| 1       | -Vin (GND) | -Vin (GND) |
| 2       | +Vin (Vcc) | +Vin (Vcc) |
| 3       | +Vout      | +Vout      |
| 4       | no pin     | common     |
| 5       | -Vout      | -Vout      |

Dimensions in [mm], () = Inch

Tolerances: x.x ±0.5 (±0.02)

x.xx ±0.25 (±0.01)

Pin pitch tolerances ±0.25 (±0.01)

Pin dimension tolerance ±0.1 (±0.004)