TRN 1 Series, 1 Watt

- Compact SIP package
  11,9 x 7,7 x 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
- Designed to meet UL 62368-1 (UL 60950-1)
- 3-year product warranty

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 cm³. Full load operation is reliable up tp 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 1800 VDC.

<table>
<thead>
<tr>
<th>Models</th>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1 Vnom</th>
<th>Imax</th>
<th>Output 2 Vnom</th>
<th>Imax</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRN 1-0510</td>
<td>4.5 - 13.2 VDC (9 VDC nom.)</td>
<td>3.3 VDC</td>
<td>300 mA</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>77 %</td>
<td></td>
</tr>
<tr>
<td>TRN 1-0511</td>
<td>12 VDC</td>
<td>90 mA</td>
<td>15 VDC</td>
<td>70 mA</td>
<td>82 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-0512</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>–5 VDC</td>
<td>100 mA</td>
<td>79 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-0513</td>
<td>+12 VDC</td>
<td>45 mA</td>
<td>–12 VDC</td>
<td>45 mA</td>
<td>83 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-0515</td>
<td>+15 VDC</td>
<td>35 mA</td>
<td>–15 VDC</td>
<td>35 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-1210</td>
<td>9 - 18 VDC (12 VDC nom.)</td>
<td>3.3 VDC</td>
<td>300 mA</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>77 %</td>
<td></td>
</tr>
<tr>
<td>TRN 1-1211</td>
<td>12 VDC</td>
<td>90 mA</td>
<td>15 VDC</td>
<td>70 mA</td>
<td>83 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-1212</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>–5 VDC</td>
<td>100 mA</td>
<td>79 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-1213</td>
<td>+12 VDC</td>
<td>45 mA</td>
<td>–12 VDC</td>
<td>45 mA</td>
<td>83 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-1215</td>
<td>+15 VDC</td>
<td>35 mA</td>
<td>–15 VDC</td>
<td>35 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-2410</td>
<td>18 - 36 VDC (24 VDC nom.)</td>
<td>3.3 VDC</td>
<td>300 mA</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>77 %</td>
<td></td>
</tr>
<tr>
<td>TRN 1-2411</td>
<td>12 VDC</td>
<td>90 mA</td>
<td>15 VDC</td>
<td>70 mA</td>
<td>83 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-2412</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>–5 VDC</td>
<td>100 mA</td>
<td>79 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-2413</td>
<td>+12 VDC</td>
<td>45 mA</td>
<td>–12 VDC</td>
<td>45 mA</td>
<td>82 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-2415</td>
<td>+15 VDC</td>
<td>35 mA</td>
<td>–15 VDC</td>
<td>35 mA</td>
<td>80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-4810</td>
<td>36 - 75 VDC (48 VDC nom.)</td>
<td>3.3 VDC</td>
<td>300 mA</td>
<td>5 VDC</td>
<td>200 mA</td>
<td>77 %</td>
<td></td>
</tr>
<tr>
<td>TRN 1-4811</td>
<td>12 VDC</td>
<td>90 mA</td>
<td>15 VDC</td>
<td>70 mA</td>
<td>81 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-4812</td>
<td>+5 VDC</td>
<td>100 mA</td>
<td>–5 VDC</td>
<td>100 mA</td>
<td>78 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-4813</td>
<td>+12 VDC</td>
<td>45 mA</td>
<td>–12 VDC</td>
<td>45 mA</td>
<td>81 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRN 1-4815</td>
<td>+15 VDC</td>
<td>35 mA</td>
<td>–15 VDC</td>
<td>35 mA</td>
<td>79 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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## Input Specifications

<table>
<thead>
<tr>
<th>Input Current</th>
<th>9 Vin models: 35 mA typ.</th>
<th>12 Vin models: 20 mA typ.</th>
<th>24 Vin models: 10 mA typ.</th>
<th>48 Vin models: 5 mA typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge Voltage</td>
<td>9 Vin models: 15 VDC max. (1 s max.)</td>
<td>12 Vin models: 25 VDC max. (1 s max.)</td>
<td>24 Vin models: 50 VDC max. (1 s max.)</td>
<td>48 Vin models: 100 VDC max. (1 s max.)</td>
</tr>
<tr>
<td>Reflected Ripple Current</td>
<td>30 mA p-p typ.</td>
<td>500 mA (slow blow)</td>
<td>315 mA (slow blow)</td>
<td>160 mA (slow blow)</td>
</tr>
</tbody>
</table>

### Recommended Input Fuse

- 9 Vin models: 500 mA (slow blow)
- 12 Vin models: 315 mA (slow blow)
- 24 Vin models: 160 mA (slow blow)
- 48 Vin models: 160 mA (slow blow)

*(The need of an external fuse has to be assessed in the final application.)*

### Input Filter

- Internal Capacitor

## Output Specifications

### Voltage Set Accuracy

- ±1% max.

### Regulation

- Input Variation (Vmin - Vmax)
  - single output models: 0.2% max.
  - dual output models: 0.2% max.
- Load Variation (0 - 100%)
  - single output models: 1% max.
  - dual output models: 1% max. (Output 1)
  - 1% max. (Output 2)
- Cross Regulation (25% / 100% asym. load)
  - dual output models: 5% max.

### Ripple and Noise

- 20 MHz Bandwidth
  - 50 mVp-p typ.

### Capacitive Load

- Single output
  - 3.3 Vout models: 1'680 µF max.
  - 5 Vout models: 820 µF max.
  - 12 Vout models: 470 µF max.
  - 15 Vout models: 330 µF max.
  - 24 Vout models: 160 µF max.
- Dual output
  - 5 / -5 Vout models: 470 / 470 µF max.
  - 12 / -12 Vout models: 330 / 330 µF max.
  - 15 / -15 Vout models: 220 / 220 µF max.

### Minimum Load

- Not required

### Temperature Coefficient

- ±0.02 %/°K max.

### Start-up Time

- 5 ms typ. / 15 ms max.

### Short Circuit Protection

- Continuous, Automatic recovery

### Output Current Limitation

- 200% typ. of Iout max.

### Transient Response

- Response Deviation: 3% typ. (25% Load Step)
- Response Time: 500 μs typ. (25% Load Step)

## Safety Specifications

### Safety Standards

- IT / Multimedia Equipment
  - Designed for EN 62368-1 (no certification)

## EMC Specifications

### EMI Emissions

- Conducted Emissions
  - EN 55032 class A (with external filter)
  - EN 55032 class B (with external filter)
- Radiated Emissions
  - EN 55032 class A (with external filter)
  - EN 55032 class B (with external filter)

*External filter proposal: [www.tracopower.com/overview/trn1](http://www.tracopower.com/overview/trn1)*

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

- Electrostatic Discharge
  - Air: EN 61000-4-2, ±8 kV, perf. criteria A
  - Contact: EN 61000-4-2, ±8 kV, perf. criteria A

- RF Electromagnetic Field
  - EFT (Burst) / Surge
    - Ext. input component: Nippon chemi-con KY 220 µF/100 V

- Conducted RF Disturbances
  - Continuous: EN 61000-4-8, 100 A/m, perf. criteria A

- PF Magnetic Field
  - Continuous: EN 61000-4-8, 100 A/m, perf. criteria A

- Relative Humidity
  - 95% max. (non-condensing)

- Temperature Ranges
  - Operating Temperature: −40°C to +90°C (without derating)
  - Case Temperature: +105°C max.
  - Storage Temperature: −55°C to +125°C

- Power Derating
  - High Temperature: 6.7 %/K above 90°C

- Cooling System
  - Natural convection (20 LFM)

- Switching Frequency
  - 100 kHz min. (PFM)

- Insulation System
  - Functional Insulation

- Isolation Test Voltage
  - Input to Output, 60 s: 1'600 VDC

- Isolation Resistance
  - Input to Output, 500 VDC: 1'000 MΩ min.

- Isolation Capacitance
  - Input to Output, 100 kHz, 1 V: 75 pF max.

- Reliability
  - Calculated MTBF: 7'400'000 h (MIL-HDBK-217F, ground benign)

- Washing Process
  - Allowed (hermetical product)

- Environment
  - Vibration: MIL-STD-810F
  - Thermal Shock: MIL-STD-810F

- Housing Material
  - Non-conductive Plastic (UL 94 V-0 rated)

- Potting Material
  - Silicone (UL 94 V-0 rated)

- Pin Material
  - Copper

- Pin Foundation Plating
  - Nickel (0.3 – 0.9 µm)

- Pin Surface Plating
  - Tin (5 – 6 µm), matte

- Housing Type
  - Plastic Case

- Mounting Type
  - PCB Mount

- Connection Type
  - THD (Through-Hole Device)

- Footprint Type
  - SIP5

- Soldering Profile
  - Wave Soldering
    - 260°C / 6 s max.

- Weight
  - 2.1 g

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-1
    (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).
    The SCIP number is provided on request.)

Supporting Documents
- Overview Link: www.tracopower.com/overview/trn1
  
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
Outline Dimensions

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)

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>3</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>4</td>
<td>no pin</td>
<td>Common</td>
</tr>
<tr>
<td>5</td>
<td>–Vout</td>
<td>–Vout</td>
</tr>
</tbody>
</table>

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