

## DC/DC Converter

## TRN 3 Series, 3 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 +85°C
- Short circuit protection
- Designed to meet IEC/EN/UL 62368-1  
(not certified)
- 3-year product warranty



The TRN 3 Series comprises 3 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 65°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/UL 62368-1 (not certified) with a test voltage (60 s) of 1600 VDC.

### Models

| Order Code | Input Voltage Range            | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|------------|--------------------------------|----------|------------------|----------|------------------|-----------------|
|            |                                | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| TRN 3-0510 | 4.5 - 13.2 VDC<br>(9 VDC nom.) | 3.3 VDC  | 700 mA           |          |                  | 75 %            |
| TRN 3-0511 |                                | 5 VDC    | 600 mA           |          |                  | 78 %            |
| TRN 3-0512 |                                | 12 VDC   | 250 mA           |          |                  | 82 %            |
| TRN 3-0513 |                                | 15 VDC   | 200 mA           |          |                  | 80 %            |
| TRN 3-0515 |                                | 24 VDC   | 125 mA           |          |                  | 80 %            |
| TRN 3-0521 |                                | +5 VDC   | 300 mA           | -5 VDC   | 300 mA           | 77 %            |
| TRN 3-0522 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 80 %            |
| TRN 3-0523 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 80 %            |
| TRN 3-1210 | 9 - 18 VDC<br>(12 VDC nom.)    | 3.3 VDC  | 700 mA           |          |                  | 76 %            |
| TRN 3-1211 |                                | 5 VDC    | 600 mA           |          |                  | 79 %            |
| TRN 3-1212 |                                | 12 VDC   | 250 mA           |          |                  | 84 %            |
| TRN 3-1213 |                                | 15 VDC   | 200 mA           |          |                  | 83 %            |
| TRN 3-1215 |                                | 24 VDC   | 125 mA           |          |                  | 82 %            |
| TRN 3-1221 |                                | +5 VDC   | 300 mA           | -5 VDC   | 300 mA           | 78 %            |
| TRN 3-1222 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 82 %            |
| TRN 3-1223 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 81 %            |
| TRN 3-2410 | 18 - 36 VDC<br>(24 VDC nom.)   | 3.3 VDC  | 700 mA           |          |                  | 76 %            |
| TRN 3-2411 |                                | 5 VDC    | 600 mA           |          |                  | 78 %            |
| TRN 3-2412 |                                | 12 VDC   | 250 mA           |          |                  | 84 %            |
| TRN 3-2413 |                                | 15 VDC   | 200 mA           |          |                  | 84 %            |
| TRN 3-2415 |                                | 24 VDC   | 125 mA           |          |                  | 83 %            |
| TRN 3-2421 |                                | +5 VDC   | 300 mA           | -5 VDC   | 300 mA           | 79 %            |
| TRN 3-2422 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 83 %            |
| TRN 3-2423 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 82 %            |
| TRN 3-4810 | 36 - 75 VDC<br>(48 VDC nom.)   | 3.3 VDC  | 700 mA           |          |                  | 75 %            |
| TRN 3-4811 |                                | 5 VDC    | 600 mA           |          |                  | 79 %            |
| TRN 3-4812 |                                | 12 VDC   | 250 mA           |          |                  | 83 %            |
| TRN 3-4813 |                                | 15 VDC   | 200 mA           |          |                  | 83 %            |
| TRN 3-4815 |                                | 24 VDC   | 125 mA           |          |                  | 82 %            |
| TRN 3-4821 |                                | +5 VDC   | 300 mA           | -5 VDC   | 300 mA           | 77 %            |
| TRN 3-4822 |                                | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 82 %            |
| TRN 3-4823 |                                | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 80 %            |

## Input Specifications

|                          |              |                                                                                                                                                                                                                                  |
|--------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Current            | - At no load | 9 Vin models: 75 mA typ.<br>12 Vin models: 40 mA typ.<br>24 Vin models: 20 mA typ.<br>48 Vin models: 12 mA typ.                                                                                                                  |
| Surge Voltage            |              | 9 Vin models: 15 VDC max. (1 s max.)<br>12 Vin models: 25 VDC max. (1 s max.)<br>24 Vin models: 50 VDC max. (1 s max.)<br>48 Vin models: 100 VDC max. (1 s max.)                                                                 |
| Reflected Ripple Current |              | 9 Vin models: 100 mAp-p typ.<br>12 Vin models: 75 mAp-p typ.<br>24 Vin models: 75 mAp-p typ.<br>48 Vin models: 50 mAp-p typ.                                                                                                     |
| Recommended Input Fuse   |              | 9 Vin models: 1'600 mA (slow blow)<br>12 Vin models: 800 mA (slow blow)<br>24 Vin models: 500 mA (slow blow)<br>48 Vin models: 315 mA (slow blow)<br>(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.<br>dual output models: 0.2% max.                                                                                              |
|                           | - Load Variation (0 - 100%)                | single output models: 1% max.<br>dual output models: 1% max. (Output 1)<br>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: 4'400 µF max.<br>5 Vout models: 2'200 µF max.<br>12 Vout models: 1'000 µF max.<br>15 Vout models: 820 µF max.<br>24 Vout models: 330 µF max. |
|                           | - dual output                              | 5 / -5 Vout models: 1'200 / 1'200 µF max.<br>12 / -12 Vout models: 520 / 520 µF max.<br>15 / -15 Vout models: 440 / 440 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 |                                            | 180% typ. of Iout max.                                                                                                                                        |
| Transient Response        | - Response Deviation                       | 3% typ. (25% Load Step)                                                                                                                                       |
|                           | - Response Time                            | 500 µs typ. (25% Load Step)                                                                                                                                   |

## Safety Specifications

|           |                             |                                                |
|-----------|-----------------------------|------------------------------------------------|
| Standards | - IT / Multimedia Equipment | Designed for IEC/EN/UL 62368-1 (not certified) |
|-----------|-----------------------------|------------------------------------------------|

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

## 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:                | <a href="http://www.tracopower.com/overview/trn3">www.tracopower.com/overview/trn3</a> |  |
| EMS (Immunity)  |                             |                                          | EN 55024 (IT Equipment)                                                                |  |
|                 |                             |                                          | EN 55035 (Multimedia)                                                                  |  |
|                 | - Electrostatic Discharge   | Air:                                     | EN 61000-4-2, ±8 kV, perf. criteria A                                                  |  |
|                 |                             | Contact:                                 | EN 61000-4-2, ±6 kV, perf. criteria A                                                  |  |
|                 | - RF Electromagnetic Field  |                                          | EN 61000-4-3, 10 V/m, perf. criteria A                                                 |  |
|                 | - EFT (Burst) / Surge       |                                          | EN 61000-4-4, ±2 kV, perf. criteria A                                                  |  |
|                 |                             |                                          | EN 61000-4-5, ±1 kV, perf. criteria A                                                  |  |
|                 |                             | Ext. input component:                    | Nippon chemi-con KY 220 µF/ 100 V                                                      |  |
|                 | - Conducted RF Disturbances |                                          | EN 61000-4-6, 10 Vrms, perf. criteria A                                                |  |
|                 | - PF Magnetic Field         | Continuous:                              | EN 61000-4-8, 100 A/m, perf. criteria A                                                |  |
|                 | 1 s:                        | EN 61000-4-8, 1000 A/m, perf. criteria A |                                                                                        |  |

## General Specifications

|                        |                                 |                                                                                                                                   |
|------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Relative Humidity      |                                 | 95% max. (non condensing)                                                                                                         |
| Temperature Ranges     | - Operating Temperature         | -40°C to +85°C                                                                                                                    |
|                        | - Case Temperature              | +105°C max.                                                                                                                       |
|                        | - Storage Temperature           | -55°C to +125°C                                                                                                                   |
| Power Derating         | - High Temperature              | 2.5 %/K above 65°C                                                                                                                |
|                        |                                 | See application note: <a href="http://www.tracopower.com/overview/trn3">www.tracopower.com/overview/trn3</a>                      |
| Cooling System         |                                 | Natural convection (20 LFM)                                                                                                       |
| Regulator Topology     |                                 | RCC Converter                                                                                                                     |
| 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 M $\Omega$ min.                                                                                                             |
| Isolation Capacitance  | - Input to Output, 100 kHz, 1 V | 75 pF max.                                                                                                                        |
| Reliability            | - Calculated MTBF               | 4'400'000 h (MIL-HDBK-217F, ground benign)                                                                                        |
| Washing Process        |                                 | According to Cleaning Guideline<br><a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a> |
| 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 $\mu$ m)                                                                                                        |
| Pin Surface Plating    |                                 | Tin (5 - 6 $\mu$ m), matte                                                                                                        |
| Housing Type           |                                 | Plastic Case                                                                                                                      |
| Mounting Type          |                                 | PCB Mount                                                                                                                         |
| Connection Type        |                                 | THD (Through-Hole Device)                                                                                                         |
| Footprint Type         |                                 | SIP5                                                                                                                              |
| Soldering Profile      |                                 | Lead-Free Wave Soldering<br>260°C / 6 s max.                                                                                      |
| Weight                 |                                 | 2.1 g                                                                                                                             |

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](http://www.tracopower.com/info/reach-declaration.pdf)

- RoHS Declaration

REACH SVHC list compliant  
REACH Annex XVII compliant

[www.tracopower.com/info/rohs-declaration.pdf](http://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

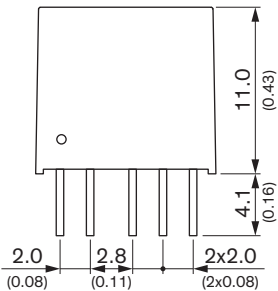
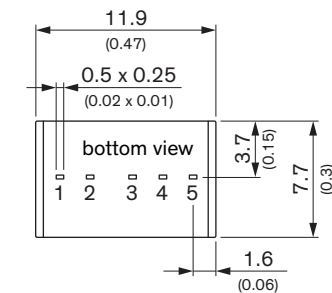
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Supporting Documents

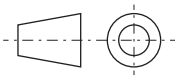
Overview Link (for additional Documents)

[www.tracopower.com/overview/trn3](http://www.tracopower.com/overview/trn3)

Outline Dimensions



Dimensions in mm (inch)  
Tolerances:  
x.x ±0.5 (±0.02)  
x.xx ±0.25 (±0.01)  
Pin pitch tolerance: ±0.25 (±0.01)  
Pin dimension tolerance: ±0.1 (±0.004)



| Pinout |            |            |
|--------|------------|------------|
| Pin    | Single     | Dual       |
| 1      | –Vin (GND) | –Vin (GND) |
| 2      | +Vin (Vcc) | +Vin (Vcc) |
| 3      | +Vout      | +Vout      |
| 4      | No pin     | Common     |
| 5      | –Vout      | –Vout      |