DC/DC Converter

**TEN 3N Series, 3 Watt**

- Wide 2:1 input range
- Input filter to meet EN 55032, class A and FCC, level A without external components
- Extended operating temperature range –40°C to +85°C
- Models with 1’500 VDC and 3’000 VDC I/O isolation (functional insulation)
- High reliability, MTBF >1.0 Mio. h
- 3-year product warranty

The TEN 3N Series is a drop in replacement of the prevalent TEN 3 Series. The up-to-date design enables a cost reduction without any compromise to reliability and function. They come with an internal filter to meet EN55032 class A without external components. Increased EMC immunity and extended operating temperature range of –40°C to +85°C make these converters an ideal solution for cost critical but demanding applications. With the standard pinning it is a drop in replacement for common 3 Watt converters in DIP24 package.

### Models

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Input Voltage Range</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vnom</td>
<td>Imax</td>
<td>Vnom</td>
<td>Imax</td>
</tr>
<tr>
<td>TEN 3-0510N</td>
<td>3.3 VDC</td>
<td>750 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-0511N</td>
<td>5 VDC</td>
<td>600 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-0512N</td>
<td>12 VDC</td>
<td>250 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-0513N</td>
<td>15 VDC</td>
<td>200 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-0515N</td>
<td>24 VDC</td>
<td>125 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-0521N</td>
<td>+5 VDC</td>
<td>250 mA</td>
<td>–5 VDC</td>
<td>250 mA</td>
</tr>
<tr>
<td>TEN 3-0522N</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>–12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>TEN 3-0523N</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>–15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>TEN 3-1210N</td>
<td>3.3 VDC</td>
<td>750 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-1211N</td>
<td>5 VDC</td>
<td>600 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-1212N</td>
<td>12 VDC</td>
<td>250 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-1213N</td>
<td>15 VDC</td>
<td>200 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-1215N</td>
<td>24 VDC</td>
<td>125 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-1221N</td>
<td>+5 VDC</td>
<td>250 mA</td>
<td>–5 VDC</td>
<td>250 mA</td>
</tr>
<tr>
<td>TEN 3-1222N</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>–12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>TEN 3-1223N</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>–15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>TEN 3-2410N</td>
<td>3.3 VDC</td>
<td>750 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-2411N</td>
<td>5 VDC</td>
<td>600 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-2412N</td>
<td>12 VDC</td>
<td>250 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-2413N</td>
<td>15 VDC</td>
<td>200 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-2415N</td>
<td>24 VDC</td>
<td>125 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-2421N</td>
<td>+5 VDC</td>
<td>250 mA</td>
<td>–5 VDC</td>
<td>250 mA</td>
</tr>
<tr>
<td>TEN 3-2422N</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>–12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>TEN 3-2423N</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>–15 VDC</td>
<td>100 mA</td>
</tr>
<tr>
<td>TEN 3-4810N</td>
<td>3.3 VDC</td>
<td>750 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-4811N</td>
<td>5 VDC</td>
<td>600 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-4812N</td>
<td>12 VDC</td>
<td>250 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-4813N</td>
<td>15 VDC</td>
<td>200 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-4815N</td>
<td>24 VDC</td>
<td>125 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN 3-4821N</td>
<td>+5 VDC</td>
<td>250 mA</td>
<td>–5 VDC</td>
<td>250 mA</td>
</tr>
<tr>
<td>TEN 3-4822N</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>–12 VDC</td>
<td>125 mA</td>
</tr>
<tr>
<td>TEN 3-4823N</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>–15 VDC</td>
<td>100 mA</td>
</tr>
</tbody>
</table>

### Options

- Suffix -HI - 5 Vin models (except 3.3 Vout) with high iso. (3000 VDC), other Vin: www.tracopower.com/overview/ten3win

www.tracopower.com September 20, 2023
Input Specifications

Input Current
- At no load
  5 Vin models: 65 mA typ.
  12 Vin models: 35 mA typ.
  24 Vin models: 20 mA typ.
  48 Vin models: 15 mA typ.
- At full load
  5 Vin models: 700 mA typ.
  12 Vin models: 300 mA typ.
  24 Vin models: 150 mA typ.
  48 Vin models: 75 mA typ.

Surge Voltage
- 5 Vin models: 11 VDC max. (1 s max.)
- 12 Vin models: 25 VDC max. (1 s max.)
- 24 Vin models: 50 VDC max. (1 s max.)
- 48 Vin models: 100 VDC max. (1 s max.)

Under Voltage Lockout
- 5 Vin models: 4 VDC max.
- 12 Vin models: 8.5 VDC max.
- 24 Vin models: 17.5 VDC max.
- 48 Vin models: 35.5 VDC max.

Reflected Ripple Current
- 5 Vin models: 100 mAp-p typ.
- 12 Vin models: 30 mAp-p typ.
- 48 Vin models: 10 mAp-p typ.

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

Input Filter
- Internal Pi-Type

Short Circuit Input Power
- 2 W max.

Output Specifications

Voltage Set Accuracy
±2% max.

Regulation
- Input Variation (Vmin - Vmax)
  - single output models: 1% max.
  - dual output models: 1% max.
- Load Variation (0 - 100%)
  - single output models: 1% max. (Output 1)
  - dual output models: 1% max. (Output 2)
- Voltage Balance (symmetrical load)
  - dual output models: 2% max.

Ripple and Noise
- 20 MHz Bandwidth
  70 mVp-p max.

Capacitive Load
- single output
  3.3 Vout models: 680 µF max.
  5 Vout models: 470 µF max.
  12 Vout models: 330 µF max.
  15 Vout models: 220 µF max.
  24 Vout models: 100 µF max.
- dual output
  5 / -5 Vout models: 220 / 220 µF max.
  12 / -12 Vout models: 150 / 150 µF max.
  15 / -15 Vout models: 100 / 100 µF max.

Minimum Load
Not required

Temperature Coefficient
±0.02 %/K max.

Short Circuit Protection
Continuous, Automatic recovery

Overload Protection
Foldback Mode

Output Current Limitation
120% min. of Iout max.
150% typ. of Iout max.

Transient Response
- Response Deviation
  - 3% typ. / 5% max. (75% to 100% Load Step)
- Response Time
  - 300 µs typ. / 500 µs max. (75% to 100% Load Step)

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

Safety Standards
- IT / Multimedia Equipment
  CSA-C22.2, No. 60950-1
  EN 60950-1
  EN 62368-1
  IEC 60950-1
  IEC 62368-1
  UL 60950-1
  UL 62368-1
- Certification Documents
  www.tracopower.com/overview/ten3n

Pollution Degree
PD 3

Over Voltage Category
Not mains connected

EMC Specifications

EMI Emissions
- Conducted Emissions
  EN 55032 class A (internal filter)
- Radiated Emissions
  EN 55032 class A (internal filter)

EMS Immunity
- 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
  EFT (Burst) / Surge
  EN 61000-4-4, ±2 kV, perf. criteria A
  EN 61000-4-5, ±1 kV, perf. criteria A
  Ext. input component: 200 µF, 100 V, ESR 48 mΩ

- Conducted RF Disturbances
  EN 61000-4-6, 10 Vrms, perf. criteria A

General Specifications

Relative Humidity
95% max. (non condensing)

Temperature Ranges
- Operating Temperature
  –40°C to +85°C
- Case Temperature
  +100°C max.
- Storage Temperature
  –55°C to +125°C

Power Derating
High Temperature
See application note: www.tracopower.com/overview/ten3n

Cooling System
Natural convection (20 LFM)

Altitude During Operation
6'000 m max.

Switching Frequency
80 kHz min. (PFM)

Insulation System
Functional Insulation

Isolation Test Voltage
- Input to Output, 60 s
  1'500 VDC (Standard models)
- Input to Output, 1 s
  3'000 VDC (Suffix -HI)
- Input to Output, 1000 VDC
  1'800 VDC

Isolation Resistance
- Input to Output
  1'000 MΩ min.

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

Reliability
- Calculated MTBF
  1’000’000 h (MIL-HDBK-217F, ground benign)

Washing Process
According to Cleaning Guideline
www.tracopower.com/info/cleaning.pdf

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

Potting Material
Epoxy (UL 94 V-0 rated)

Pin Material
Copper Alloy (C6801)

Pin Foundation Plating
Nickel (2.5 µm min.)

Pin Surface Plating
Gold (75 - 125 nm), glossy

Housing Type
Plastic Case

Mounting Type
PCB Mount

Connection Type
THD (Through-Hole Device)

Footprint Type
DIP24

Soldering Profile
Lead-Free Wave Soldering
260°C / 10 s max.

Weight
12.8 g

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
Environmental Compliance - REACH Declaration
REACH SVHC list compliant
REACH Annex XVII compliant
www.tracopower.com/info/reach-declaration.pdf

- RoHS Declaration
Exemptions: 7a
(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))
dabea3dc-e870-4d0b-8ad2-5c658ef22c35

- SCIP Reference Number
Supporting Documents
Overview Link (for additional Documents) www.tracopower.com/overview/ten3n

Outline Dimensions

**Pinout**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>−Vin (GND)</td>
<td>−Vin (GND)</td>
</tr>
<tr>
<td>3</td>
<td>−Vin (GND)</td>
<td>−Vin (GND)</td>
</tr>
<tr>
<td>9</td>
<td>No pin</td>
<td>Common</td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td>−Vout</td>
</tr>
<tr>
<td>14</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>16</td>
<td>−Vout</td>
<td>Common</td>
</tr>
<tr>
<td>22</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>23</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
</tbody>
</table>
NC: Not connected

Dimensions in mm (inch)
Tolerances x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)
Pin tolerances: x.x ±0.05 (x.xx ±0.002)