

- Wide 2:1 input range
- Input filter to meet EN 55032, class A and FCC, level A without external components
- Extended operating temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 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  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  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      |                              |          |                  |          |                  |                 |
|-------------|------------------------------|----------|------------------|----------|------------------|-----------------|
| Order Code  | Input Voltage Range          | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|             |                              | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| TEN 3-0510N | 4.5 - 9 VDC<br>(5 VDC nom.)  | 3.3 VDC  | 750 mA           |          |                  | 77 %            |
| TEN 3-0511N |                              | 5 VDC    | 600 mA           |          |                  | 80 %            |
| TEN 3-0512N |                              | 12 VDC   | 250 mA           |          |                  | 82 %            |
| TEN 3-0513N |                              | 15 VDC   | 200 mA           |          |                  | 82 %            |
| TEN 3-0515N |                              | 24 VDC   | 125 mA           |          |                  | 81 %            |
| TEN 3-0521N |                              | +5 VDC   | 250 mA           | -5 VDC   | 250 mA           | 80 %            |
| TEN 3-0522N |                              | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 82 %            |
| TEN 3-0523N |                              | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 82 %            |
| TEN 3-1210N | 9 - 18 VDC<br>(12 VDC nom.)  | 3.3 VDC  | 750 mA           |          |                  | 79 %            |
| TEN 3-1211N |                              | 5 VDC    | 600 mA           |          |                  | 81 %            |
| TEN 3-1212N |                              | 12 VDC   | 250 mA           |          |                  | 85 %            |
| TEN 3-1213N |                              | 15 VDC   | 200 mA           |          |                  | 85 %            |
| TEN 3-1215N |                              | 24 VDC   | 125 mA           |          |                  | 84 %            |
| TEN 3-1221N |                              | +5 VDC   | 250 mA           | -5 VDC   | 250 mA           | 80 %            |
| TEN 3-1222N |                              | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 84 %            |
| TEN 3-1223N |                              | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 84 %            |
| TEN 3-2410N | 18 - 36 VDC<br>(24 VDC nom.) | 3.3 VDC  | 750 mA           |          |                  | 79 %            |
| TEN 3-2411N |                              | 5 VDC    | 600 mA           |          |                  | 81 %            |
| TEN 3-2412N |                              | 12 VDC   | 250 mA           |          |                  | 85 %            |
| TEN 3-2413N |                              | 15 VDC   | 200 mA           |          |                  | 85 %            |
| TEN 3-2415N |                              | 24 VDC   | 125 mA           |          |                  | 84 %            |
| TEN 3-2421N |                              | +5 VDC   | 250 mA           | -5 VDC   | 250 mA           | 80 %            |
| TEN 3-2422N |                              | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 84 %            |
| TEN 3-2423N |                              | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 84 %            |
| TEN 3-4810N | 36 - 75 VDC<br>(48 VDC nom.) | 3.3 VDC  | 750 mA           |          |                  | 79 %            |
| TEN 3-4811N |                              | 5 VDC    | 600 mA           |          |                  | 81 %            |
| TEN 3-4812N |                              | 12 VDC   | 250 mA           |          |                  | 85 %            |
| TEN 3-4813N |                              | 15 VDC   | 200 mA           |          |                  | 85 %            |
| TEN 3-4815N |                              | 24 VDC   | 125 mA           |          |                  | 84 %            |
| TEN 3-4821N |                              | +5 VDC   | 250 mA           | -5 VDC   | 250 mA           | 80 %            |
| TEN 3-4822N |                              | +12 VDC  | 125 mA           | -12 VDC  | 125 mA           | 84 %            |
| TEN 3-4823N |                              | +15 VDC  | 100 mA           | -15 VDC  | 100 mA           | 84 %            |

| Options    |  |
|------------|--|
| Suffix -HI | - 5 Vin models with high isolation (3000 VDC), for other inputs see <a href="http://www.tracopower.com/overview/ten3win">www.tracopower.com/overview/ten3win</a> |

## Input Specifications

|                           |                |  |
|---------------------------|----------------|--|
| Input Current             | - At no load   | 5 Vin models: <b>65 mA typ.</b><br>12 Vin models: <b>35 mA typ.</b><br>24 Vin models: <b>20 mA typ.</b><br>48 Vin models: <b>15 mA typ.</b>  |
|                           | - At full load | 5 Vin models: <b>700 mA typ.</b><br>12 Vin models: <b>300 mA typ.</b><br>24 Vin models: <b>150 mA typ.</b><br>48 Vin models: <b>75 mA typ.</b>   |
| Surge Voltage             |                | 5 Vin models: <b>11 VDC max.</b> (1 s max.)<br>12 Vin models: <b>25 VDC max.</b> (1 s max.)<br>24 Vin models: <b>50 VDC max.</b> (1 s max.)<br>48 Vin models: <b>100 VDC max.</b> (1 s max.)         |
| Under Voltage Lockout     |                | 5 Vin models: <b>4 VDC max.</b><br>12 Vin models: <b>8.5 VDC max.</b><br>24 Vin models: <b>17.5 VDC max.</b><br>48 Vin models: <b>35.5 VDC max.</b>  |
| Reflected Ripple Current  |                | 5 Vin models: <b>100 mA<sub>p-p</sub> typ.</b><br>12 Vin models: <b>30 mA<sub>p-p</sub> typ.</b><br>24 Vin models: <b>15 mA<sub>p-p</sub> typ.</b><br>48 Vin models: <b>10 mA<sub>p-p</sub> typ.</b> |
| Recommended Input Fuse    |                | (The need of an external fuse has to be assessed in the final application.)  |
| Input Filter              |                | <b>Internal Pi-Type</b>  |
| Short Circuit Input Power |                | <b>2 W max.</b>  |

## Output Specifications

|                           |  |  |
|---------------------------|--|--|
| Voltage Set Accuracy      |  | <b>±2% max.</b>  |
| Regulation                | - Input Variation (V <sub>min</sub> - V <sub>max</sub> ) | single output models: <b>1% max.</b><br>dual output models: <b>1% max.</b>   |
|                           | - Load Variation (0 - 100%)                              | single output models: <b>1% max.</b><br>dual output models: <b>1% max.</b> (Output 1)<br><b>1% max.</b> (Output 2)   |
|                           | - Voltage Balance (symmetrical load)                     | dual output models: <b>2% max.</b>   |
|                           |  |  |
| Ripple and Noise          | - 20 MHz Bandwidth                                       | <b>70 mV<sub>p-p</sub> max.</b>  |
| Capacitive Load           | - single output  | 3.3 V <sub>out</sub> models: <b>680 μF max.</b><br>5 V <sub>out</sub> models: <b>470 μF max.</b><br>12 V <sub>out</sub> models: <b>330 μF max.</b><br>15 V <sub>out</sub> models: <b>220 μF max.</b><br>24 V <sub>out</sub> models: <b>100 μF max.</b> |
|                           | - dual output  | 5 / -5 V <sub>out</sub> models: <b>220 / 220 μF max.</b><br>12 / -12 V <sub>out</sub> models: <b>150 / 150 μF max.</b><br>15 / -15 V <sub>out</sub> models: <b>100 / 100 μF max.</b>   |
| Minimum Load              |  | <b>Not required</b>  |
| Temperature Coefficient   |  | <b>±0.02 %/K max.</b>  |
| Short Circuit Protection  |  | <b>Continuous, Automatic recovery</b>  |
| Overload Protection       |  | <b>Foldback Mode</b>   |
| Output Current Limitation |  | <b>120% min. of I<sub>out</sub> max.</b>   |
|                           |  | <b>150% typ. of I<sub>out</sub> max.</b>   |
| Transient Response        | - Response Deviation                                     | <b>3% typ. / 5% max.</b> (75% to 100% Load Step)   |
|                           | - Response Time  | <b>300 μs typ. / 500 μs max.</b> (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<br>EN 60950-1<br>EN 62368-1<br>IEC 60950-1<br>IEC 62368-1<br>UL 60950-1<br>UL 62368-1 |
|                       | - Certification Documents   | <a href="http://www.tracopower.com/overview/ten3n">www.tracopower.com/overview/ten3n</a>                     |
| Pollution Degree      |                             | PD 3   |
| Over Voltage Category |                             | Not mains connected  |

## EMC Specifications

|               |   |   |
|---------------|---|---|
| EMI Emissions | - Conducted Emissions<br>- Radiated Emissions   | EN 55032 class A (internal filter)<br>EN 55032 class A (internal filter)  |
| EMS Immunity  | - Electrostatic Discharge<br>- RF Electromagnetic Field<br>- EFT (Burst) / Surge<br>- Conducted RF Disturbances | EN 55024 (IT Equipment)<br>Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A<br>Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A<br>EN 61000-4-3, 10 V/m, perf. criteria A<br>EN 61000-4-4, $\pm 2$ kV, perf. criteria A<br>EN 61000-4-5, $\pm 1$ kV, perf. criteria A<br>Ext. input component: 200 $\mu$ F, 100 V, ESR 48 m $\Omega$<br>EN 61000-4-6, 10 Vrms, perf. criteria A |

## General Specifications

|                           |  |  |
|---------------------------|--|--|
| Relative Humidity         |  | 95% max. (non condensing)  |
| Temperature Ranges        | - Operating Temperature<br>- Case Temperature<br>- Storage Temperature | -40°C to +85°C<br>+100°C max.<br>-55°C to +125°C   |
| Power Derating            | - High Temperature   | 3.3 %/K above 70°C   |
| 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<br>- Input to Output, 1 s                      | 1'500 VDC (Standard models)<br>3'000 VDC (suffix -HI, only 5 Vin models)<br>1'800 VDC  |
| Isolation Resistance      | - Input to Output, 500 VDC   | 1'000 M $\Omega$ 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           |  | Allowed (hermetical product)<br>See Cleaning Guideline: <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a> |
| 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 $\mu$ m 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         |  | Wave Soldering<br>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

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

REACH SVHC list compliant

REACH Annex XVII compliant

- RoHS Declaration

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

Exemptions: 7a

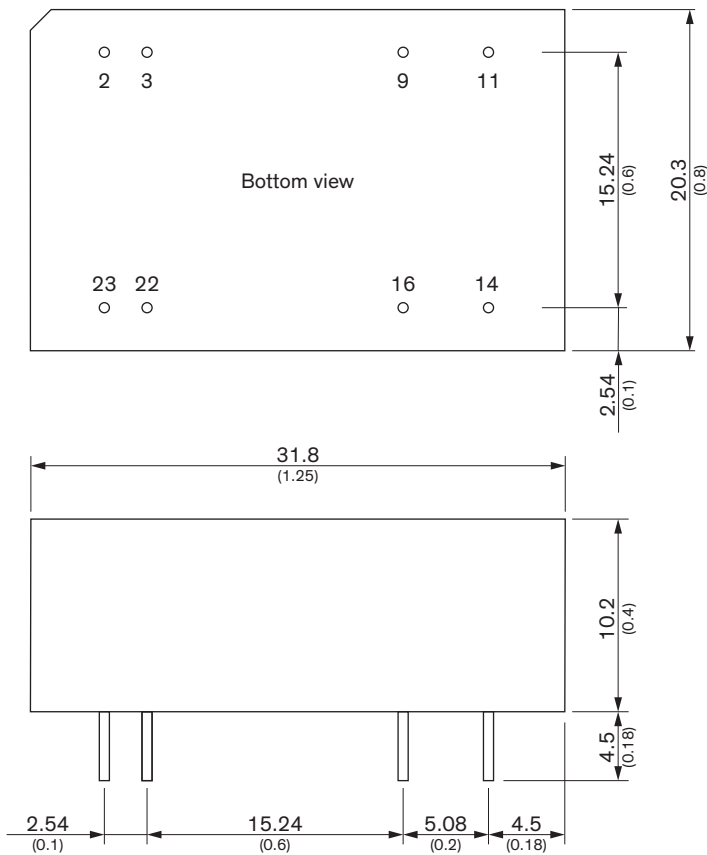
(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).  
The SCIP number is provided on request.)

### Supporting Documents

[Overview Link](#) (for additional Documents)

[www.tracopower.com/overview/ten3n](http://www.tracopower.com/overview/ten3n)

### Outline Dimensions



| Pinout |            |            |
|--------|------------|------------|
| Pin    | Single     | Dual       |
| 2      | -Vin (GND) | -Vin (GND) |
| 3      | -Vin (GND) | -Vin (GND) |
| 9      | no Pin     | Common     |
| 11     | NC         | -Vout      |
| 14     | +Vout      | +Vout      |
| 16     | -Vout      | Common     |
| 22     | +Vin (Vcc) | +Vin (Vcc) |
| 23     | +Vin (Vcc) | +Vin (Vcc) |

NC: Not connected

Dimensions in mm (inch)

Pin diameter  $\varnothing 0.5 \pm 0.05$  ( $\varnothing 0.02 \pm 0.002$ )

Tolerances  $x.x \pm 0.5$  ( $x.xx \pm 0.02$ )

$x.xx \pm 0.25$  ( $x.xxx \pm 0.01$ )

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