DC/DC Converter

TEN 3WIN Series, 3 Watt

- Ultra wide 4:1 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)
- DIP-24 package
- High reliability, MTBF >1.0 Mio.
- 3-year product warranty

The TEN 3Win Series is a drop in replacement of the prevalent TEN 3Wi 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>TEN 3-2410WIN</td>
<td>9 - 36 VDC (24 VDC nom.)</td>
<td>3.3 VDC 750 mA</td>
<td>3.3 VDC 77 %</td>
<td></td>
</tr>
<tr>
<td>TEN 3-2411WIN</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>5 VDC</td>
<td>79 %</td>
</tr>
<tr>
<td>TEN 3-2412WIN</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>12 VDC</td>
<td>82 %</td>
</tr>
<tr>
<td>TEN 3-2413WIN</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>15 VDC</td>
<td>83 %</td>
</tr>
<tr>
<td>TEN 3-2415WIN</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>24 VDC</td>
<td>81 %</td>
</tr>
<tr>
<td>TEN 3-2421WIN</td>
<td>+5 VDC</td>
<td>250 mA</td>
<td>+5 VDC</td>
<td>80 %</td>
</tr>
<tr>
<td>TEN 3-2422WIN</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>–12 VDC</td>
<td>82 %</td>
</tr>
<tr>
<td>TEN 3-2423WIN</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>–15 VDC</td>
<td>82 %</td>
</tr>
<tr>
<td>TEN 3-4810WIN</td>
<td>18 - 75 VDC (48 VDC nom.)</td>
<td>3.3 VDC 750 mA</td>
<td>3.3 VDC</td>
<td>77 %</td>
</tr>
<tr>
<td>TEN 3-4811WIN</td>
<td>5 VDC</td>
<td>600 mA</td>
<td>5 VDC</td>
<td>80 %</td>
</tr>
<tr>
<td>TEN 3-4812WIN</td>
<td>12 VDC</td>
<td>250 mA</td>
<td>12 VDC</td>
<td>83 %</td>
</tr>
<tr>
<td>TEN 3-4813WIN</td>
<td>15 VDC</td>
<td>200 mA</td>
<td>15 VDC</td>
<td>84 %</td>
</tr>
<tr>
<td>TEN 3-4815WIN</td>
<td>24 VDC</td>
<td>125 mA</td>
<td>24 VDC</td>
<td>82 %</td>
</tr>
<tr>
<td>TEN 3-4821WIN</td>
<td>+5 VDC</td>
<td>250 mA</td>
<td>+5 VDC</td>
<td>80 %</td>
</tr>
<tr>
<td>TEN 3-4822WIN</td>
<td>+12 VDC</td>
<td>125 mA</td>
<td>–12 VDC</td>
<td>82 %</td>
</tr>
<tr>
<td>TEN 3-4823WIN</td>
<td>+15 VDC</td>
<td>100 mA</td>
<td>–15 VDC</td>
<td>82 %</td>
</tr>
</tbody>
</table>

Options

- Suffix -HI - Models with high isolation (3000 VDC), except 3.3 Vout models
### Input Specifications

**Input Current**
- **At no load**
  - 24Vin models: 30 mA typ.
  - 48Vin models: 20 mA typ.
- **At full load**
  - 24Vin models: 150 mA typ.
  - 48Vin models: 75 mA typ.

**Surge Voltage**
- 24Vin models: 50 VDC max. (1 s max.)
- 48Vin models: 100 VDC max. (1 s max.)

**Under Voltage Lockout**
- 24Vin models: 8.5 VDC max.
- 48Vin models: 17.5 VDC max.

**Reflected Ripple Current**
- 48Vin models: 10 mAp-p typ.

**Recommended Input Fuse**
(1 s max.)

- 24Vin models: 50 VDC max.
- 48Vin models: 100 VDC max.

**Under Voltage Lockout**
- 24Vin models: 8.5 VDC max.
- 48Vin models: 17.5 VDC max.

**Surge Voltage**
- 24Vin models: 50 VDC max. (1 s max.)
- 48Vin models: 100 VDC max. (1 s max.)

**Input Filter**
- Internal Pi-Type

**Short Circuit Input Power**
- 2 W max.

### Output Specifications

**Voltage Set Accuracy**
- Input Variation (Vmin - Vmax)
  - single output models: ±1% max.
  - dual output models: ±1% max.
- Load Variation (0 - 100%)
  - single output models: ±1% max.
  - dual output models: ±1% max. (Output 1)
  - ±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
  - 3.3Vout models: 680 µF max.
  - 5Vout models: 470 µF max.
  - 12Vout models: 330 µF max.
  - 15Vout models: 220 µF max.
  - 24Vout models: 100 µF max.
- Dual output
  - 5/-5Vout models: 220 / 220 µF max.
  - 12/-12Vout models: 150 / 150 µF max.
  - 15/-15Vout models: 100 / 100 µF max.

**Minimum Load**
- Not required

**Temperature Coefficient**
- ±0.02 %/K max.

**Overload Protection**
- Continuous, Automatic recovery

**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
  - ±200 µs typ. / ±500 µs max. (75% to 100% Load Step)

### 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/ten3win

**Pollution Degree**
- PD 3

**Over Voltage Category**
- Not mains connected

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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 (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
    - 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
  - Conducted RF Disturbances
    - Ext. input component: 200 µF, 100 V, ESR 48 mΩ
    - 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: 3.3 %/K above 70°C

  **Cooling System**
  - Natural convection (20 LFM)

  **Altitude During Operation**
  - 6'000 m max.

  **Switching Frequency**
  - 90 kHz min. (PFM)

  **Insulation System**
  - Functional Insulation

  **Isolation Test Voltage**
  - Input to Output: 60 s
    - 1'500 VDC (Standard models)
    - 3'000 VDC (suffix -HI, except 3.3 Vout models)
  - Input to Output: 1 s
    - 1'800 VDC

  **Isolation Resistance**
  - Input to Output: 500 VDC
    - 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**
  - Allowed (hermetical product)

  **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**
  - Wave Soldering
    - 260°C / 10 s max.

  **Weight**
  - 12.8 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

Supporting Documents

**Overview Link** (for additional Documents)
- www.tracopower.com/overview/ten3win

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)
Pin diameter Ø 0.5 ±0.05 (Ø 0.02 ±0.002)
Tolerances x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)

**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

Specifications can be changed without notice.

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