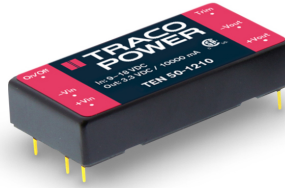


- **Highest power density:**  
50 W in 1" x 2" x 0.4" package
- **Excellent efficiency up to 92 %**
- **Operating temperature range**  
-40°C to +85°C
- **Output voltage adjustable**
- **Remote On/Off**
- **I/O isolation 1500 VDC**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TEN 50 Series is a range of isolated high performance DC/DC converter modules. Due to the very high efficiency of up to 92% and the use of highest reliable components these 50 W converters come with a footprint of only 1.0" x 2.0". The 12 models have a wide 2:1 input voltage range and a tight output voltage regulation. They do not need a minimum load and offer a high efficiency also at low load conditions. The output voltage is adjustable by external resistor. Remote On/Off and protection against overload and short circuit are standard features of these converters. Typical applications are in mobile equipment, instrumentation, distributed power architectures in communication and industrial electronics and everywhere where space on the PCB is critical.

| Models      |                              |                                  |                     |                 |
|-------------|------------------------------|----------------------------------|---------------------|-----------------|
| Order Code  | Input Voltage Range          | Output Voltage nom. (adjustable) | Output Current max. | Efficiency typ. |
| TEN 50-1210 | 9 - 18 VDC<br>(12 VDC nom.)  | 3.3 VDC (2.97 - 3.63 VDC)        | 10'000 mA           | 89 %            |
| TEN 50-1211 |                              | 5 VDC (4.5 - 5.5 VDC)            | 10'000 mA           | 90 %            |
| TEN 50-1212 |                              | 12 VDC (10.8 - 13.2 VDC)         | 4'170 mA            | 91 %            |
| TEN 50-1213 |                              | 15 VDC (13.5 - 16.5 VDC)         | 3'330 mA            | 91 %            |
| TEN 50-1215 |                              | 24 VDC (21.6 - 28.8 VDC)         | 2'080 mA            | 91 %            |
| TEN 50-2410 | 18 - 36 VDC<br>(24 VDC nom.) | 3.3 VDC (2.97 - 3.63 VDC)        | 10'000 mA           | 89 %            |
| TEN 50-2411 |                              | 5 VDC (4.5 - 5.5 VDC)            | 10'000 mA           | 92 %            |
| TEN 50-2412 |                              | 12 VDC (10.8 - 13.2 VDC)         | 4'170 mA            | 92 %            |
| TEN 50-2413 |                              | 15 VDC (13.5 - 16.5 VDC)         | 3'330 mA            | 92 %            |
| TEN 50-2415 |                              | 24 VDC (21.6 - 28.8 VDC)         | 2'080 mA            | 91 %            |
| TEN 50-4810 | 36 - 75 VDC<br>(48 VDC nom.) | 3.3 VDC (2.97 - 3.63 VDC)        | 10'000 mA           | 89 %            |
| TEN 50-4811 |                              | 5 VDC (4.5 - 5.5 VDC)            | 10'000 mA           | 92 %            |
| TEN 50-4812 |                              | 12 VDC (10.8 - 13.2 VDC)         | 4'170 mA            | 92 %            |
| TEN 50-4813 |                              | 15 VDC (13.5 - 16.5 VDC)         | 3'330 mA            | 92 %            |
| TEN 50-4815 |                              | 24 VDC (21.6 - 28.8 VDC)         | 2'080 mA            | 91 %            |

| Options |  |
|---------|--|
| TEN-HS6 | - Optional Heat Sink: <a href="http://www.tracopower.com/products/ten-hs6.pdf">www.tracopower.com/products/ten-hs6.pdf</a> |

## Input Specifications

|                          |                |  |
|--------------------------|----------------|--|
| Input Current            | - At no load   | 12 Vin models: <b>85 mA typ.</b> (3.3 Vout model)<br><b>110 mA typ.</b> (5 Vout model)<br><b>160 mA typ.</b> (12 Vout model)<br><b>160 mA typ.</b> (15 Vout model)<br><b>250 mA typ.</b> (24 Vout model)               |
|                          |                | 24 Vin models: <b>50 mA typ.</b> (3.3 Vout model)<br><b>70 mA typ.</b> (5 Vout model)<br><b>85 mA typ.</b> (12 Vout model)<br><b>85 mA typ.</b> (15 Vout model)<br><b>110 mA typ.</b> (24 Vout model)                  |
|                          |                | 48 Vin models: <b>35 mA typ.</b> (3.3 Vout model)<br><b>45 mA typ.</b> (5 Vout model)<br><b>50 mA typ.</b> (12 Vout model)<br><b>50 mA typ.</b> (15 Vout model)<br><b>60 mA typ.</b> (24 Vout model)                   |
|                          | - At full load | 12 Vin models: <b>3'090 mA typ.</b> (3.3 Vout model)<br><b>4'630 mA typ.</b> (5 Vout model)<br><b>4'580 mA typ.</b> (12 Vout model)<br><b>4'580 mA typ.</b> (15 Vout model)<br><b>4'570 mA typ.</b> (24 Vout model)    |
|                          |                | 24 Vin models: <b>1'550 mA typ.</b> (3.3 Vout model)<br><b>2'260 mA typ.</b> (5 Vout model)<br><b>2'260 mA typ.</b> (12 Vout model)<br><b>2'260 mA typ.</b> (15 Vout model)<br><b>2'290 mA typ.</b> (24 Vout model)    |
|                          |                | 48 Vin models: <b>770 mA typ.</b> (3.3 Vout model)<br><b>1'130 mA typ.</b> (5 Vout model)<br><b>1'130 mA typ.</b> (12 Vout model)<br><b>1'130 mA typ.</b> (15 Vout model)<br><b>1'150 mA typ.</b> (24 Vout model)      |
| Surge Voltage            |                | 12 Vin models: <b>25 VDC max.</b> (100 ms max.)<br>24 Vin models: <b>50 VDC max.</b> (100 ms max.)<br>48 Vin models: <b>100 VDC max.</b> (100 ms max.)   |
| Under Voltage Lockout    |                | 12 Vin models: <b>8.3 VDC typ.</b><br>24 Vin models: <b>16.5 VDC typ.</b><br>48 Vin models: <b>33 VDC typ.</b>   |
| Reflected Ripple Current |                | 12 Vin models: <b>50 mA<sub>p-p</sub> typ.</b><br>24 Vin models: <b>40 mA<sub>p-p</sub> typ.</b><br>48 Vin models: <b>30 mA<sub>p-p</sub> typ.</b>   |
| Recommended Input Fuse   |                | 12 Vin models: <b>10'000 mA</b> (slow blow)<br>24 Vin models: <b>5'000 mA</b> (slow blow)<br>48 Vin models: <b>2'500 mA</b> (slow blow)<br>(The need of an external fuse has to be assessed in the final application.) |
| Input Filter             |                | <b>Internal LC-Type</b>  |

## Output Specifications

|                           |                                 |   |
|---------------------------|---------------------------------|---|
| Output Voltage Adjustment |                                 | -10% to +20% (24 Vout models)<br>±10% (other single models)<br>(By external trim resistor)  |
|                           |                                 | See application note: <a href="http://www.tracopower.com/overview/ten50">www.tracopower.com/overview/ten50</a><br>Output power must not exceed rated power! |
| Voltage Set Accuracy      |                                 | ±1% max.  |
| Regulation                | - Input Variation (Vmin - Vmax) | 0.5% max.   |
|                           | - Load Variation (0 - 100%)     | 0.5% max.   |

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

|  |  |
|--|--|
| Ripple and Noise<br>(20 MHz Bandwidth) | 3.3 Vout models: <b>100 mVp-p max.</b> (w/ 1 $\mu$ F MLCC    10 $\mu$ F TC)<br>5 Vout models: <b>100 mVp-p max.</b> (w/ 1 $\mu$ F MLCC    10 $\mu$ F TC)<br>12 Vout models: <b>150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC    10 $\mu$ F TC)<br>15 Vout models: <b>150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC    10 $\mu$ F TC)<br>24 Vout models: <b>150 mVp-p max.</b> (w/ 1 $\mu$ F MLCC    10 $\mu$ F TC) |
| Capacitive Load                        | 3.3 Vout models: <b>25'800 <math>\mu</math>F max.</b><br>5 Vout models: <b>17'000 <math>\mu</math>F max.</b><br>12 Vout models: <b>2'900 <math>\mu</math>F max.</b><br>15 Vout models: <b>1'900 <math>\mu</math>F max.</b><br>24 Vout models: <b>750 <math>\mu</math>F max.</b>  |
| Minimum Load                           | <b>Not required</b>  |
| Temperature Coefficient                | <b><math>\pm 0.02</math> %/K max.</b>  |
| Start-up Time                          | <b>30 ms max.</b> (Power On)<br><b>30 ms max.</b> (Remote On)  |
| Short Circuit Protection               | <b>Continuous, Automatic recovery</b>  |
| Output Current Limitation              | <b>150% typ. of Iout max.</b>  |
| Transient Response                     | - Response Deviation <b>3% typ. / 5% max.</b> (75% to 100% Load Step)<br>- Response Time <b>250 <math>\mu</math>s typ.</b> (75% to 100% Load Step)   |

### 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/ten50">www.tracopower.com/overview/ten50</a>                     |
| Pollution Degree      |                             | PD 3   |
| Over Voltage Category |                             | Not mains connected  |

### EMC Specifications

|               |                             |   |
|---------------|-----------------------------|---|
| EMI Emissions | - Conducted Emissions       | EN 55032 class A (with external filter)<br>EN 55032 class B (with external filter)<br>FCC Part 15 class A (with external filter)  |
|               | - Radiated Emissions        | EN 55032 class A (with external filter)<br>FCC Part 15 class A (with external filter)   |
|               |                             | External filter proposal: <a href="http://www.tracopower.com/overview/ten50">www.tracopower.com/overview/ten50</a>  |
| EMS Immunity  | - Electrostatic Discharge   | EN 55024 (IT Equipment)<br>EN 55035 (Multimedia)  |
|               | - RF Electromagnetic Field  | Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A   |
|               | - EFT (Burst) / Surge       | 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 |
|               | - Conducted RF Disturbances | External filter proposal: <a href="http://www.tracopower.com/overview/ten50">www.tracopower.com/overview/ten50</a><br>EN 61000-4-6, 10 Vrms, perf. criteria A                             |

### General Specifications

|                    |  |  |
|--------------------|--|--|
| Relative Humidity  |  | <b>95% max.</b> (non condensing)   |
| Temperature Ranges | - Operating Temperature<br>- Case Temperature<br>- Storage Temperature | <b>-40°C to +85°C</b><br><b>+105°C max.</b><br><b>-50°C to +125°C</b>  |
| Power Derating     | - High Temperature   | Depending on model   |
|                    |  | See application note: <a href="http://www.tracopower.com/overview/ten50">www.tracopower.com/overview/ten50</a> |

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

|  |                                 |   |
|--|---------------------------------|---|
| Over Temperature Protection Switch Off | - Protection Mode               | 110°C typ.  |
| Cooling System                         |                                 | Natural convection (20 LFM)   |
| Remote Control                         | - Voltage Controlled Remote     | On: 3.5 to 12 VDC or open circuit<br>Off: 0 to 1.2 VDC or short circuit<br>Refers to 'Remote' and '-Vin' Pin  |
|  | - Off Idle Input Current        | 2.5 mA typ.   |
|  | - Remote Pin Input Current      | -0.5 to 0.5 mA  |
| Altitude During Operation              |                                 | 6'000 m max.  |
| Switching Frequency                    |                                 | 285 kHz typ. (PWM) (24 Vout models)<br>320 kHz typ. (PWM) (other models)  |
| Insulation System                      |                                 | Functional Insulation   |
| Isolation Test Voltage                 | - Input to Output, 60 s         | 1'500 VDC   |
|  | - 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 | 2'200 pF max.   |
| Reliability                            | - Calculated MTBF               | 220'000 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>   |
| Housing Material                       |                                 | Alu alloy, black anodized coating   |
| Base Material                          |                                 | Non-conductive FR4 (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                           |                                 | Metal Case  |
| Mounting Type                          |                                 | PCB Mount   |
| Connection Type                        |                                 | THD (Through-Hole Device)   |
| Footprint Type                         |                                 | 2" x 1"   |
| Soldering Profile                      |                                 | Lead-Free Wave Soldering<br>260°C / 10 s max.   |
| Weight                                 |                                 | 30 g  |
| Thermal Impedance                      | - Case to Ambient               | 12 K/W typ.<br>10 K/W typ. (with Heat Sink)   |
| Environmental Compliance               | - REACH Declaration             | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant   |
|  | - RoHS Declaration              | <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7a, 7c-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule)) |
|  | - SCIP Reference Number         | 5a2a420b-ee13-4969-bf97-1218c3094530  |

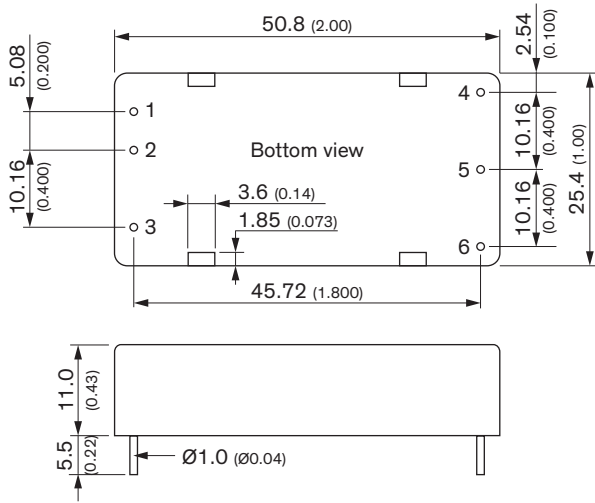
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten50](http://www.tracopower.com/overview/ten50)

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 ±0.25 (x.xx ±0.01)  
                   x.xx ±0.13 (x.xxx ±0.005)  
 Pin diameter tolerances: x.x ±0.05 (x.xx ±0.002)

| Pinout |               |
|--------|---------------|
| Pin    | Single        |
| 1      | +Vin (Vcc)    |
| 2      | -Vin (GND)    |
| 3      | Remote On/Off |
| 4      | +Vout         |
| 5      | -Vout         |
| 6      | Trim          |