

#### Features

- ◆ 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
- ◆ No minimum load required
- ◆ Output voltage adjustable
- ◆ Remote On/Off
- ◆ I/O isolation 1500 VDC
- ◆ 3-year product warranty



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 | Output current max. | Efficiency |
|-------------|----------------------------------------|----------------|---------------------|------------|
| TEN 50-1210 | <b>9 – 18 VDC</b><br>(nominal 12 VDC)  | 3.3 VDC        | 10'000 mA           | 89 %       |
| TEN 50-1211 |                                        | 5.0 VDC        | 10'000 mA           | 90 %       |
| TEN 50-1212 |                                        | 12 VDC         | 4'167 mA            | 91 %       |
| TEN 50-1213 |                                        | 15 VDC         | 3'333 mA            | 91 %       |
| TEN 50-1215 |                                        | 24 VDC         | 2'080 mA            | 91 %       |
| TEN 50-2410 | <b>18 – 36 VDC</b><br>(nominal 24 VDC) | 3.3 VDC        | 10'000 mA           | 89 %       |
| TEN 50-2411 |                                        | 5.0 VDC        | 10'000 mA           | 92 %       |
| TEN 50-2412 |                                        | 12 VDC         | 4'167 mA            | 92 %       |
| TEN 50-2413 |                                        | 15 VDC         | 3'333 mA            | 92 %       |
| TEN 50-2415 |                                        | 24 VDC         | 2'080 mA            | 91 %       |
| TEN 50-4810 | <b>36 – 75 VDC</b><br>(nominal 48 VDC) | 3.3 VDC        | 10'000 mA           | 89 %       |
| TEN 50-4811 |                                        | 5.0 VDC        | 10'000 mA           | 92 %       |
| TEN 50-4812 |                                        | 12 VDC         | 4'167 mA            | 92 %       |
| TEN 50-4813 |                                        | 15 VDC         | 3'333 mA            | 92 %       |
| TEN 50-4815 |                                        | 24 VDC         | 2'080 mA            | 91 %       |

## Input Specifications

|                                                     |                                                                                     |                                  |
|-----------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------|
| Input current at no load<br>(nominal input voltage) | 12 V; 3.3 & 5.0 VDC models:                                                         | 85 mA typ. / 110 mA typ.         |
|                                                     | 12 V; 12 & 15 VDC models:                                                           | 160 mA typ.                      |
|                                                     | 12 V; 24 VDC models:                                                                | 250 mA typ.                      |
|                                                     | 24 V; 3.3 & 5.0 VDC models:                                                         | 50 mA typ. / 70 mA typ.          |
|                                                     | 24 V; 12 & 15 VDC output models:                                                    | 85 mA typ.                       |
|                                                     | 24 V; 24 VDC models:                                                                | 110 mA typ.                      |
|                                                     | 48 V; 3.3 & 5.0 VDC models:                                                         | 35 mA typ. / 45 mA typ.          |
| Surge voltage (100 msec. max.)                      | 48 V; 12 & 15 VDC models:                                                           | 50 mA typ.                       |
|                                                     | 48 V; 24 VDC models:                                                                | 60 mA typ.                       |
|                                                     | 12 V models:                                                                        | 25 V max.                        |
| Reflected input ripple current                      | 24 V models:                                                                        | 50 V max.                        |
|                                                     | 48 V models:                                                                        | 100 V max.                       |
|                                                     | 12 V models:                                                                        | 50 mA typ.                       |
| Conducted noise (input)                             | 24 V models:                                                                        | 40 mA typ.                       |
|                                                     | 48 V models:                                                                        | 30 mA typ.                       |
|                                                     | EN 55022 class A, FCC part 15 level A<br>with external input capacitor (1210 MLCC): |                                  |
|                                                     | 12 V models:                                                                        | 22 $\mu$ F /25 V                 |
| Start-up voltage / under voltage shut down          | 24 V models:                                                                        | 3.3 $\mu$ F /50 V                |
|                                                     | 48 V models:                                                                        | 2.2 $\mu$ F /100 V               |
|                                                     | 12 V models:                                                                        | 9.0 VDC max./ 8.3 VDC (or lower) |
| Recommended input fuse (slow blow)                  | 24 V models:                                                                        | 18 VDC max./ 16.5 VDC (or lower) |
|                                                     | 48 V models:                                                                        | 36 VDC max./ 33 VDC (or lower)   |
|                                                     | 12 V models:                                                                        | 10 A                             |
|                                                     | 24 V models:                                                                        | 5 A                              |
|                                                     | 48 V models:                                                                        | 2.5 A                            |

## Output Specifications

|                                                                                                           |                                                  |                                                |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------|
| Voltage set accuracy                                                                                      |                                                  | $\pm 1.0$ %                                    |
| Output voltage adjustment range                                                                           | 24 VDC models:                                   | +20 / -10 %                                    |
|                                                                                                           | other models:                                    | $\pm 10$ % with external resistor (see page 3) |
| Regulation                                                                                                | – Input variation $V_{in}$ min. to $V_{in}$ max. | 0.5 % max.                                     |
|                                                                                                           | – Load variation 0 – 100 %                       | 0.5 % max.                                     |
| Minimum load                                                                                              |                                                  | not required                                   |
| Temperature coefficient                                                                                   |                                                  | $\pm 0.02$ %/K                                 |
| Ripple and noise (20 MHz Bandwidth)<br>(measured with 1 $\mu$ F MLCC and a 10 $\mu$ F tantalum capacitor) | 3.3 & 5.0 VDC models:                            | 100 mVpk-pk. typ.                              |
|                                                                                                           | 12, 15 & 24 VDC models:                          | 150 mVpk-pk typ.                               |
| Transient response (alignment to 1% at load step change 75% to 100% )                                     |                                                  | 250 $\mu$ s typ.                               |
| Output current limitation                                                                                 |                                                  | at 150% of $I_{out}$ max.                      |
| Short circuit protection                                                                                  | 24 VDC models:                                   | 0.3 Hz. typ.                                   |
|                                                                                                           | other models:                                    | hiccup mode 1.5 Hz, automatic recovery         |
| Capacitive load                                                                                           | 3.3 VDC models:                                  | 25'800 $\mu$ F max.                            |
|                                                                                                           | 5.0 VDC models:                                  | 17'000 $\mu$ F max.                            |
|                                                                                                           | 12.0 VDC models:                                 | 2'900 $\mu$ F max.                             |
|                                                                                                           | 15.0 VDC models:                                 | 1'900 $\mu$ F max.                             |
|                                                                                                           | 24.0 VDC models:                                 | 750 $\mu$ F max.                               |

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

## General Specifications

|                                                                       |                                                                                                                                                  |                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature ranges                                                    | <ul style="list-style-type: none"> <li>– Operating (natural convection cooling 20 LFM)</li> <li>– Case temperature</li> <li>– Storage</li> </ul> | –40°C to +85°C (see load derating)<br>+105°C max.<br>–50°C to +125°C                                                                                                                                               |
| Load derating                                                         | <ul style="list-style-type: none"> <li>– without heatsink</li> <li>– with heatsink</li> </ul>                                                    | 1.1 %/K above 50°C<br>1.3 %/K above 60°C                                                                                                                                                                           |
| Thermal impedance                                                     | <ul style="list-style-type: none"> <li>– Natural convection 20 LFM</li> <li>– Natural convection 20 LFM with heatsink</li> </ul>                 | 12°C/W<br>10°C/W                                                                                                                                                                                                   |
| Humidity (non condensing)                                             |                                                                                                                                                  | 95 % rel H max.                                                                                                                                                                                                    |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) |                                                                                                                                                  | >220'000 h                                                                                                                                                                                                         |
| Isolation voltage (60 sec.)                                           | – Input/Output                                                                                                                                   | 1500 VDC                                                                                                                                                                                                           |
| Isolation capacitance                                                 | – Input/Output                                                                                                                                   | 2200 pF max. (100 kHz, 1 V)                                                                                                                                                                                        |
| Isolation resistance                                                  | – Input/Output                                                                                                                                   | >1000 Mohm (500 VDC)                                                                                                                                                                                               |
| Switching frequency                                                   | 24 VDC models:<br>other models:                                                                                                                  | 285 kHz typ.<br>320 kHz typ. (pulse width modulation PWM)                                                                                                                                                          |
| Remote On/Off                                                         | <ul style="list-style-type: none"> <li>– On:</li> <li>– Off:</li> <li>– Off idle current:</li> </ul>                                             | 3.5 to 12 VDC to -Vin or open circuit.<br>0 to +1.2 VDC or short circuit to -Vin<br>2.5 mA typ.                                                                                                                    |
| Safety standards                                                      |                                                                                                                                                  | UL/cUL 60950-1 2nd edition, IEC/EN 60950-1                                                                                                                                                                         |
| Safety approvals                                                      | <ul style="list-style-type: none"> <li>– CSA certificate (UL/cUL 60950-1 2nd edition)</li> <li>– CB test certificate (IEC/EN 60950-1)</li> </ul> | <a href="http://www.tracopower.com/products/ten50-csa.pdf">www.tracopower.com/products/ten50-csa.pdf</a><br><a href="http://www.tracopower.com/products/ten50-cb.pdf">www.tracopower.com/products/ten50-cb.pdf</a> |

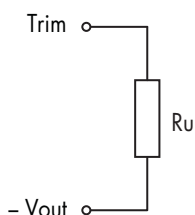
## Physical Specifications

|                          |                                                                           |                                                                                                                                      |
|--------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Casing material          |                                                                           | aluminium alloy, 6-side shielded, insulating baseplate                                                                               |
| Potting material         |                                                                           | epoxy (UL 94V-0 rated)                                                                                                               |
| Weight                   |                                                                           | 30 g (1.05 oz)                                                                                                                       |
| Soldering temperature    |                                                                           | max. 260°C / 10 sec. (1.5 mm from casing)                                                                                            |
| Environmental compliance | <ul style="list-style-type: none"> <li>– Reach</li> <li>– RoHS</li> </ul> | <a href="http://www.tracopower.com/products/ten50-reach.pdf">www.tracopower.com/products/ten50-reach.pdf</a><br>directive 2011/65/EU |

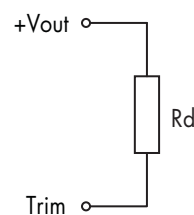
**Application note:** [www.tracopower.com/products/ten50-application.pdf](http://www.tracopower.com/products/ten50-application.pdf)

## Output Voltage Adjustment

### Trim up

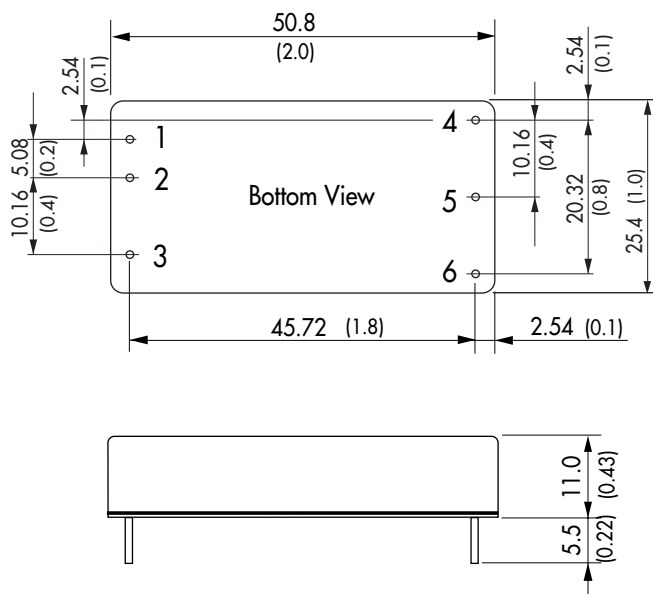


### Trim down



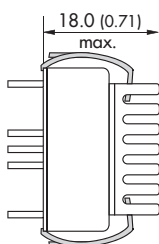
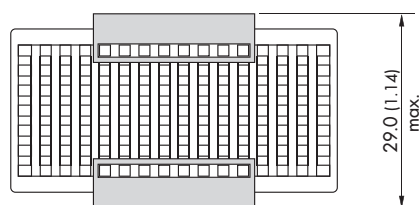
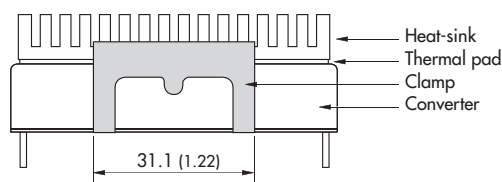
for resistor values see application note

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

**Outline Dimensions**


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

Dimensions in [mm], ( ) = Inch  
Pin diameter: 1.0 ±0.05 (0.04 ±0.002)  
Pin pitch tolerance: ±0.13 (±0.005)  
Case tolerances: ±0.25 (±0.01)

**Heat-sink TEN-HS4 (optional)**

**Order code: TEN-HS4**

(cont.: heat-sink, thermal pad, 2 clamps)

**Material:** Aluminum

**Finish:** Anodic treatment (black)

**Weight:** 17 g (0.60oz) without converter

Thermal impedance after assembling: 10 K/W

**Note:**

Before attaching the heatsink, the product label on converter has to be removed for optimal performance.

For volume orders we can supply the converters with heatsink already mounted. Please contact us for a relative quotation.

Specifications can be changed any time without notice.