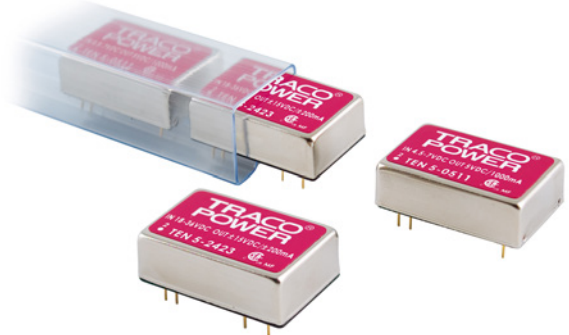


#### Features

- ◆ Wide 2:1 input range
- ◆ Full SMD-design
- ◆ High efficiency up to 86%
- ◆ Extended operating temperature range -40°C to 85°C
- ◆ I/O isolation 1'500 VDC
- ◆ Indefinite short circuit protection
- ◆ Input filter to meet EN 55022, class A and FCC, level A without external components
- ◆ Shielded metal case with insulated baseplate
- ◆ 24-pin DIP with industry standard pinout
- ◆ High reliability, MTBF >1 Mio. h
- ◆ 3-year product warranty



The TEN 5 Series is a range of DC/DC-converter modules with wide input range of 2:1. State of the art SMD-technology guarantees a product with very high reliability and good cost /performance ratio. I/O-isolation of 1'500 VDC together with conducted noise compliance to EN 55022-A and FCC level A makes these converters ideal for a wide range of applications in communications, mobile battery powered equipments and industrial systems.

#### Models

| Ordercode  | Input voltage range                    | Output voltage | Output current max. | Efficiency typ. |
|------------|----------------------------------------|----------------|---------------------|-----------------|
| TEN 5-0510 | <b>4.5 – 7 VDC</b><br>(5 VDC nominal)  | 3.3 VDC        | 1200 mA             | 75 %            |
| TEN 5-0511 |                                        | 5 VDC          | 1000 mA             | 79 %            |
| TEN 5-0512 |                                        | 12 VDC         | 500 mA              | 82 %            |
| TEN 5-0513 |                                        | 15 VDC         | 400 mA              | 82 %            |
| TEN 5-0521 |                                        | ±5 VDC         | ±500 mA             | 79 %            |
| TEN 5-0522 |                                        | ±12 VDC        | ±250 mA             | 82 %            |
| TEN 5-0523 |                                        | ±15 VDC        | ±200 mA             | 82 %            |
| TEN 5-1210 | <b>9 – 18 VDC</b><br>(12 VDC nominal)  | 3.3 VDC        | 1200 mA             | 77 %            |
| TEN 5-1211 |                                        | 5 VDC          | 1000 mA             | 81 %            |
| TEN 5-1212 |                                        | 12 VDC         | 500 mA              | 84 %            |
| TEN 5-1213 |                                        | 15 VDC         | 400 mA              | 84 %            |
| TEN 5-1221 |                                        | ±5 VDC         | ±500 mA             | 81 %            |
| TEN 5-1222 |                                        | ±12 VDC        | ±250 mA             | 84 %            |
| TEN 5-1223 |                                        | ±15 VDC        | ±200 mA             | 84 %            |
| TEN 5-2410 | <b>18 – 36 VDC</b><br>(24 VDC nominal) | 3.3 VDC        | 1200 mA             | 79 %            |
| TEN 5-2411 |                                        | 5 VDC          | 1000 mA             | 83 %            |
| TEN 5-2412 |                                        | 12 VDC         | 500 mA              | 86 %            |
| TEN 5-2413 |                                        | 15 VDC         | 400 mA              | 86 %            |
| TEN 5-2421 |                                        | ±5 VDC         | ±500 mA             | 83 %            |
| TEN 5-2422 |                                        | ±12 VDC        | ±250 mA             | 86 %            |
| TEN 5-2423 |                                        | ±15 VDC        | ±200 mA             | 86 %            |
| TEN 5-4810 | <b>36 – 75 VDC</b><br>(48 VDC nominal) | 3.3 VDC        | 1200 mA             | 79 %            |
| TEN 5-4811 |                                        | 5 VDC          | 1000 mA             | 83 %            |
| TEN 5-4812 |                                        | 12 VDC         | 500 mA              | 86 %            |
| TEN 5-4813 |                                        | 15 VDC         | 400 mA              | 86 %            |
| TEN 5-4821 |                                        | ±5 VDC         | ±500 mA             | 83 %            |
| TEN 5-4822 |                                        | ±12 VDC        | ±250 mA             | 86 %            |
| TEN 5-4823 |                                        | ±15 VDC        | ±200 mA             | 86 %            |

## Input Specifications

|                                               |                                                                                                                                                                                                                                                                  |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input current no load                         | 5 Vin models: 80 mA typ.<br>12 Vin models: 30 mA typ.<br>24 Vin models: 15 mA typ.<br>48 Vin models: 8 mA typ.                                                                                                                                                   |
| Start-up voltage /<br>under voltage shut down | 5 Vin models: 4.4 VDC / 4.0 VDC (or lower)<br>12 Vin models: 8.0 VDC / 8.0 VDC (or lower)<br>24 Vin models: 16.0 VDC / 16.0 VDC (or lower)<br>48 Vin models: 32.0 VDC / 32.0 VDC (or lower)<br>long term operation at undervoltage will<br>damage the converter! |
| Surge voltage (1 sec. max.)                   | 5 Vin models: 10 V max.<br>12 Vin models: 25 V max.<br>24 Vin models: 50 V max.<br>48 Vin models: 100 V max.                                                                                                                                                     |
| Reverse voltage protection                    | 1.0 A max.                                                                                                                                                                                                                                                       |
| Conducted noise (input)                       | EN 55022 class A, FCC part 15, level A                                                                                                                                                                                                                           |

## Output Specifications

|                                                         |                                                                                                                                                                                                                                       |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Voltage set accuracy                                    | 1.0 %                                                                                                                                                                                                                                 |
| Regulation                                              | – Input variation Vin min. to Vin max. 0.3 % max.<br>– Load variation 20 – 100 %<br>single output models: 1.0 % max.<br>dual output models balanced load: 2.0 % max.<br>dual output models unbalanced load: 5.0 % max. (25 % / 100 %) |
| Minimum load                                            | 5 % of rated max current (operation at lower<br>load condition is safe but a higher output ripple<br>will be experienced)                                                                                                             |
| Ripple and noise (20 MHz Bandwidth)                     | 50 mVpk-pk typ., 75 mVpk-pk max.                                                                                                                                                                                                      |
| Temperature coefficient                                 | ±0.02 %/K                                                                                                                                                                                                                             |
| Output current limitation                               | >120 % of Iout max., foldback                                                                                                                                                                                                         |
| Short-circuit protection                                | indefinite (automatic recovery)                                                                                                                                                                                                       |
| Start up time (nominal Vin and constant resistive load) | 10 ms typ. (for power on and remote on)                                                                                                                                                                                               |
| Capacitive load                                         | single output models: 6800 µF max.<br>dual output models: 1000 µF max. (each output)                                                                                                                                                  |

## General Specifications

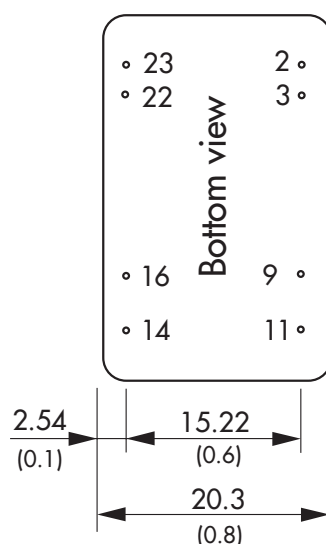
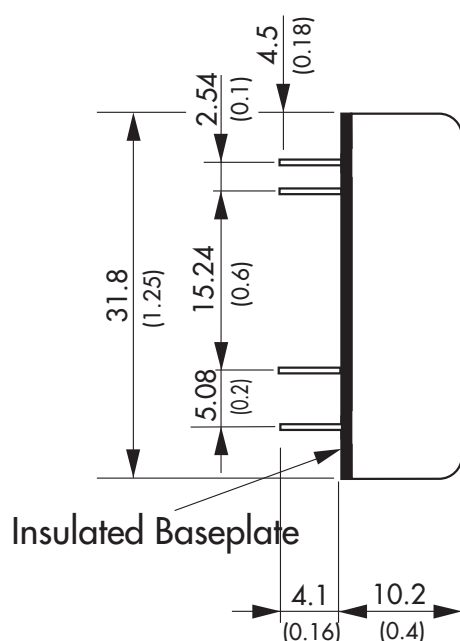
|                                                                       |                                                                                                                                                   |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature ranges                                                    | – Operating –40°C to +85°C<br>– Case temperature +90°C max.<br>– Storage –50°C to +125°C                                                          |
| Derating                                                              | 3.3 %/K above 70°C                                                                                                                                |
| Humidity (non condensing)                                             | 95 % rel H max.                                                                                                                                   |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >1 Mio. h                                                                                                                                         |
| Isolation voltage (60 sec.) – Input/Output                            | 1'500 VDC                                                                                                                                         |
| Isolation capacitance – Input/Output                                  | 380 pF typ.                                                                                                                                       |
| Isolation resistance – Input/Output                                   | >1'000 M Ohm (500 VDC)                                                                                                                            |
| Switching frequency                                                   | 300 kHz typ. (Pulse frequency modulation PFM)                                                                                                     |
| Safety standards                                                      | UL 60950-1, IEC/EN 60950-1                                                                                                                        |
| Safety approval                                                       | CSA File No. 226037<br><a href="http://directories.csa-international.org">http://directories.csa-international.org</a>                            |
| Environmental compliance                                              | – Reach <a href="http://www.tracopower.com/products/ten5-reach.pdf">www.tracopower.com/products/ten5-reach.pdf</a><br>– RoHS directive 2011/65/EU |

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

## Physical Specifications

|                       |                        |
|-----------------------|------------------------|
| Casing material       | steel, metal           |
| Baseplate material    | non conductive FR4     |
| Potting material      | epoxy (UL 94V-0 rated) |
| Weight                | 16.9 g (0.59 oz)       |
| Soldering temperature | max. 260°C / 10 sec.   |

## Outline Dimensions



| Pin-Out |            |            |
|---------|------------|------------|
| Pin     | Single     | Dual       |
| 2       | -Vin (GND) | -Vin (GND) |
| 3       | -Vin (GND) | -Vin (GND) |
| 9       | No pin     | Common     |
| 11      | No con.    | -Vout      |
| 14      | +Vout      | +Vout      |
| 16      | -Vout      | Common     |
| 22      | +Vin (Vcc) | +Vin (Vcc) |
| 23      | +Vin (Vcc) | +Vin (Vcc) |

Dimensions in [mm], ( ) = Inch  
Pin diameter  $\varnothing 0.5 \pm 0.05$  ( $0.02 \pm 0.002$ )  
Tolerances  $\pm 0.25$  ( $\pm 0.01$ )  
Pin pitch tolerances  $\pm 0.13$  ( $\pm 0.005$ )