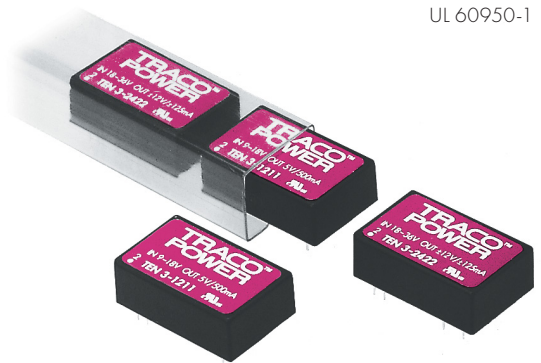


#### Features

- ◆ Wide 2 : 1 input range
- ◆ High efficiency up to 84%
- ◆ Full SMD-design
- ◆ Short circuit protection
- ◆ Extended operating temperature range  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- ◆ I/O isolation 1'500 VDC
- ◆ Input filter to meet EN 55022, Class A and FCC, level A without external components
- ◆ 24-pin DIP with industry standard pinout
- ◆ High reliability, MTBF >1.1 Mio. h
- ◆ 3-year product warranty



The TEN 3 series of DC/DC converters, comprising 28 models, has been designed for a wide range of applications in industrial and communication systems. High efficiency allows an operating temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . Other features of these converters are internal filtering according to EN 55022-A and FCC, level A. Full SMD-design guarantees a high reliability of this product.

#### Models

| Ordercode  | Input voltage range                     | Output voltage | Output current max. | Efficiency typ. |
|------------|-----------------------------------------|----------------|---------------------|-----------------|
| TEN 3-0510 | <b>4.5 – 9.0 VDC</b><br>(nominal 5 VDC) | 3.3 VDC        | 600 mA              | 70 %            |
| TEN 3-0511 |                                         | 5 VDC          | 500 mA              | 73 %            |
| TEN 3-0512 |                                         | 12 VDC         | 250 mA              | 77 %            |
| TEN 3-0513 |                                         | 15 VDC         | 200 mA              | 77 %            |
| TEN 3-0521 |                                         | $\pm 5$ VDC    | $\pm 250$ mA        | 72 %            |
| TEN 3-0522 |                                         | $\pm 12$ VDC   | $\pm 125$ mA        | 75 %            |
| TEN 3-0523 |                                         | $\pm 15$ VDC   | $\pm 100$ mA        | 75 %            |
| TEN 3-1210 | <b>9 – 18 VDC</b><br>(nominal 12 VDC)   | 3.3 VDC        | 600 mA              | 74 %            |
| TEN 3-1211 |                                         | 5 VDC          | 500 mA              | 78 %            |
| TEN 3-1212 |                                         | 12 VDC         | 250 mA              | 82 %            |
| TEN 3-1213 |                                         | 15 VDC         | 200 mA              | 82 %            |
| TEN 3-1221 |                                         | $\pm 5$ VDC    | $\pm 250$ mA        | 77 %            |
| TEN 3-1222 |                                         | $\pm 12$ VDC   | $\pm 125$ mA        | 80 %            |
| TEN 3-1223 |                                         | $\pm 15$ VDC   | $\pm 100$ mA        | 80 %            |
| TEN 3-2410 | <b>18 – 36 VDC</b><br>(nominal 24 VDC)  | 3.3 VDC        | 600 mA              | 76 %            |
| TEN 3-2411 |                                         | 5 VDC          | 500 mA              | 79 %            |
| TEN 3-2412 |                                         | 12 VDC         | 250 mA              | 84 %            |
| TEN 3-2413 |                                         | 15 VDC         | 200 mA              | 84 %            |
| TEN 3-2421 |                                         | $\pm 5$ VDC    | $\pm 250$ mA        | 79 %            |
| TEN 3-2422 |                                         | $\pm 12$ VDC   | $\pm 125$ mA        | 82 %            |
| TEN 3-2423 |                                         | $\pm 15$ VDC   | $\pm 100$ mA        | 82 %            |
| TEN 3-4810 | <b>36 – 75 VDC</b><br>(nominal 48 VDC)  | 3.3 VDC        | 600 mA              | 76 %            |
| TEN 3-4811 |                                         | 5 VDC          | 500 mA              | 79 %            |
| TEN 3-4812 |                                         | 12 VDC         | 250 mA              | 84 %            |
| TEN 3-4813 |                                         | 15 VDC         | 200 mA              | 84 %            |
| TEN 3-4821 |                                         | $\pm 5$ VDC    | $\pm 250$ mA        | 80 %            |
| TEN 3-4822 |                                         | $\pm 12$ VDC   | $\pm 125$ mA        | 84 %            |
| TEN 3-4823 |                                         | $\pm 15$ VDC   | $\pm 100$ mA        | 84 %            |

## Input Specifications

|                                               |                             |                                        |
|-----------------------------------------------|-----------------------------|----------------------------------------|
| Input current no load / full load             | 5 Vin models                | 40 mA / 800 mA typ.                    |
|                                               | 12 Vin models               | 20 mA / 300 mA typ.                    |
|                                               | 24 Vin models               | 5 mA / 150 mA typ.                     |
|                                               | 48 Vin models               | 3 mA / 75 mA typ.                      |
| Start-up voltage /<br>under voltage shut down | 5 Vin models                | 4 VDC / 3.5 VDC typ.                   |
|                                               | 12 Vin models               | 7 VDC / 6.5 VDC typ.                   |
|                                               | 24 Vin models               | 12 VDC / 11 VDC typ.                   |
|                                               | 48 Vin models               | 24 VDC / 22 VDC typ.                   |
| Surge voltage (1 sec. max.)                   | 5 Vin models                | 11 V max.                              |
|                                               | 12 Vin models               | 25 V max.                              |
|                                               | 24 Vin models               | 50 V max.                              |
|                                               | 48 Vin models               | 100 V max.                             |
| Conducted noise (input)                       | (5 V input models excluded) | EN 55022 level A, FCC part 15, level A |

## Output Specifications

|                                               |                                        |                                       |
|-----------------------------------------------|----------------------------------------|---------------------------------------|
| Voltage set accuracy                          |                                        | ±1 %                                  |
| Regulation                                    | – Input variation Vin min. to Vin max. | 0.5 % max.                            |
|                                               | – Load variation 10 – 100 %            |                                       |
|                                               | single output models                   | 0.5 % max.                            |
|                                               | dual output models balanced load       | 1.0 % max.                            |
|                                               | dual output models unbalanced load     | 2.0 % max.                            |
| Ripple and noise (20 MHz Bandwidth)           |                                        | 60 mVpk-pk max                        |
| Transiente response<br>(25% load step change) | – Recovery time                        | 500 µs max.                           |
|                                               | – Deviation                            | 5 % max.                              |
| Temperature coefficient                       |                                        | ±0.02 %/K                             |
| Current limitation                            |                                        | >110 % of Iout max., constant current |
| Short circuit protection                      |                                        | indefinite, automatic recovery        |
| Capacitive load                               | single output models                   | 4000 µF max.                          |
|                                               | dual output models                     | 1000 µF max. (each output)            |

## General Specifications

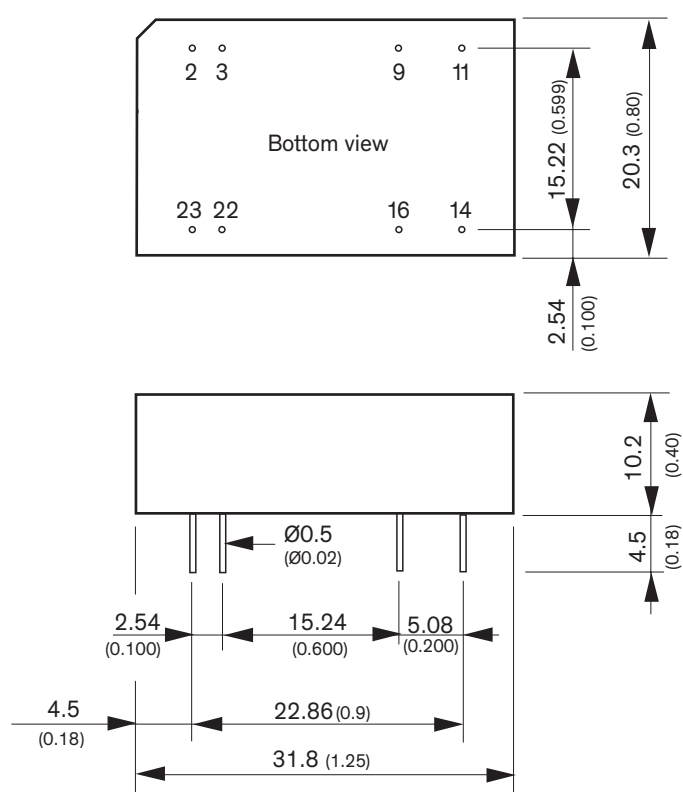
|                                                                        |                          |                                                                                                                  |
|------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------|
| Temperature ranges                                                     | – Operating              | –40°C to +85°C                                                                                                   |
|                                                                        | – Case temperature       | +100°C max.                                                                                                      |
|                                                                        | – Storage                | –55°C to +125°C                                                                                                  |
| Derating                                                               |                          | 3 %/K above 70°C                                                                                                 |
| Humidity (non condensing)                                              |                          | 95 % rel H max.                                                                                                  |
| Reliability, calculated MTBF (MIL-HDBK-217 F, at +25°C, ground benign) |                          | >1.1 Mio. h                                                                                                      |
| Isolation voltage (60 sec.)                                            | – Input/Output           | 1'500 VDC                                                                                                        |
| Isolation capacitance                                                  | – Input/Output           | 65 pF typ                                                                                                        |
| Isolation resistance                                                   | – Input/Output (500 VDC) | >1'000 M Ohm                                                                                                     |
| Switching frequency                                                    |                          | 300 kHz typ. (Pulse frequency modulation PFM)                                                                    |
| Safety standards                                                       |                          | cUL/UL 60950-1, IEC/EN 60950-1                                                                                   |
| Environmental compliance                                               | – Reach                  | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> |
|                                                                        | – 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       | non conductive FR4     |
| Potting material      | epoxy (UL 94V-0 rated) |
| Weight                | 12.4 g (0.44 oz)       |
| Soldering temperature | max. 265°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      | 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

Tolerances:  $x.x \pm 0.25$  ( $x.xx \pm 0.01$ )

$$x.xx \pm 0.13 \quad (x.xxx \pm 0.005)$$

Pin diameter tolerances:  $x.x \pm 0.5$  ( $x.xx \pm 0.002$ )