

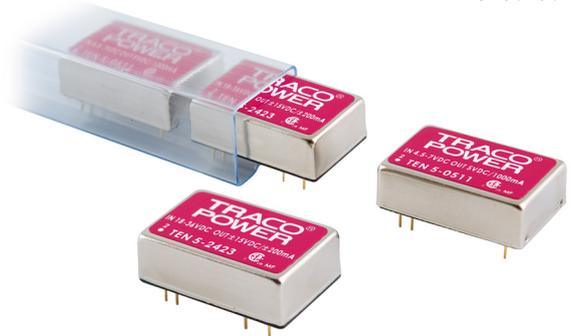
### Features

- Wide 2:1 input range
- Full SMD-design
- High efficiency up to 86%
- Extended operating temperature range  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- 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

*not recommended for new designs*



UL 60950-1



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	4.5 – 7 VDC (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		$\pm 5$ VDC	$\pm 500$ mA	79 %
TEN 5-0522		$\pm 12$ VDC	$\pm 250$ mA	82 %
TEN 5-0523		$\pm 15$ VDC	$\pm 200$ mA	82 %
TEN 5-1210	9 – 18 VDC (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		$\pm 5$ VDC	$\pm 500$ mA	81 %
TEN 5-1222		$\pm 12$ VDC	$\pm 250$ mA	84 %
TEN 5-1223		$\pm 15$ VDC	$\pm 200$ mA	84 %
TEN 5-2410	18 – 36 VDC (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		$\pm 5$ VDC	$\pm 500$ mA	83 %
TEN 5-2422		$\pm 12$ VDC	$\pm 250$ mA	86 %
TEN 5-2423		$\pm 15$ VDC	$\pm 200$ mA	86 %
TEN 5-4810	36 – 75 VDC (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		$\pm 5$ VDC	$\pm 500$ mA	83 %
TEN 5-4822		$\pm 12$ VDC	$\pm 250$ mA	86 %
TEN 5-4823		$\pm 15$ VDC	$\pm 200$ mA	86 %

### Input Specifications

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

### Output Specifications

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

### General Specifications

Temperature ranges	– Operating <b>–40°C to +85°C</b> – Case temperature <b>+90°C max.</b> – Storage <b>–50°C to +125°C</b>
Derating	<b>3.3 %/K</b> above 70°C
Humidity (non condensing)	<b>95 % rel H max.</b>
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)	<b>&gt;1 Mio. h</b>
Isolation voltage (60 sec.)	– Input/Output <b>1'500 VDC</b>
Isolation capacitance	– Input/Output <b>380 pF typ.</b>
Isolation resistance	– Input/Output <b>&gt;1'000 M Ohm</b> (500 VDC)
Switching frequency	<b>300 kHz typ.</b> (Pulse frequency modulation PFM)
Safety standards	<b>UL 60950-1, IEC/EN 60950-1</b>
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

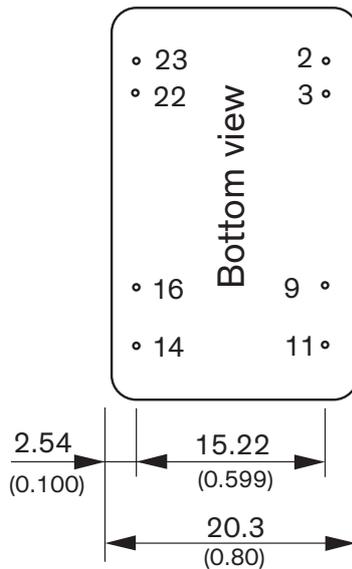
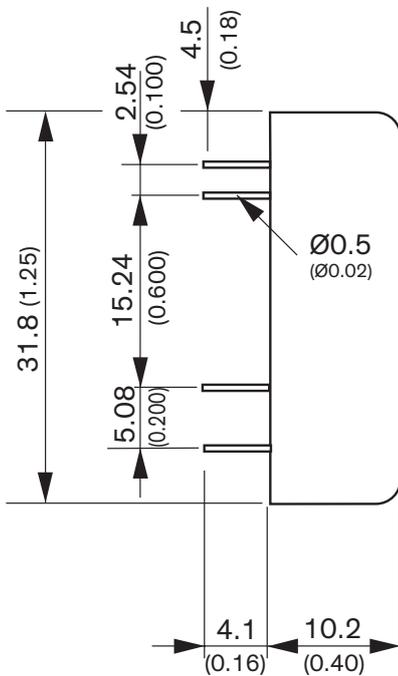
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

**Physical Specifications**

Casing material	steel, metal
Baseplate material	non conductive FR4
Potting material	Silicone (UL 94 V-0 rated) (5 Vin models) Epoxy (UL 94 V-0 rated) (other models)
Weight	16.9 g (0.59 oz)
Soldering temperature	max. 260°C / 10 sec.

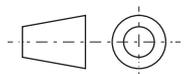
**Supporting documents:** [www.tracopower.com/overview/ten5](http://www.tracopower.com/overview/ten5)

**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 ±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)