



**THE DATASHEET OF  
TEN 3-2412N**



- Wide 2:1 input range
- Input filter to meet EN 55032, class A and FCC, level A without external components
- Extended operating temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Models with 1'500 VDC and 3'000 VDC I/O isolation (functional insulation)
- High reliability, MTBF >1.0 Mio. h
- 3-year product warranty



The TEN 3N Series is a drop in replacement of the prevalent TEN 3 Series. The up-to date design enables a cost reduction without any compromise to reliability and function. They come with an internal filter to meet EN55032 class A without external components. Increased EMC immunity and extended operating temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  make these converters an ideal solution for cost critical but demanding applications. With the standard pinning it is a drop in replacement for common 3 Watt converters in DIP24 package.

Models						
Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TEN 3-0510N	4.5 - 9 VDC (5 VDC nom.)	3.3 VDC	750 mA			77 %
TEN 3-0511N		5 VDC	600 mA			80 %
TEN 3-0512N		12 VDC	250 mA			82 %
TEN 3-0513N		15 VDC	200 mA			82 %
TEN 3-0515N		24 VDC	125 mA			81 %
TEN 3-0521N		+5 VDC	250 mA	-5 VDC	250 mA	80 %
TEN 3-0522N		+12 VDC	125 mA	-12 VDC	125 mA	82 %
TEN 3-0523N		+15 VDC	100 mA	-15 VDC	100 mA	82 %
TEN 3-1210N	9 - 18 VDC (12 VDC nom.)	3.3 VDC	750 mA			79 %
TEN 3-1211N		5 VDC	600 mA			81 %
TEN 3-1212N		12 VDC	250 mA			85 %
TEN 3-1213N		15 VDC	200 mA			85 %
TEN 3-1215N		24 VDC	125 mA			84 %
TEN 3-1221N		+5 VDC	250 mA	-5 VDC	250 mA	80 %
TEN 3-1222N		+12 VDC	125 mA	-12 VDC	125 mA	84 %
TEN 3-1223N		+15 VDC	100 mA	-15 VDC	100 mA	84 %
TEN 3-2410N	18 - 36 VDC (24 VDC nom.)	3.3 VDC	750 mA			79 %
TEN 3-2411N		5 VDC	600 mA			81 %
TEN 3-2412N		12 VDC	250 mA			85 %
TEN 3-2413N		15 VDC	200 mA			85 %
TEN 3-2415N		24 VDC	125 mA			84 %
TEN 3-2421N		+5 VDC	250 mA	-5 VDC	250 mA	80 %
TEN 3-2422N		+12 VDC	125 mA	-12 VDC	125 mA	84 %
TEN 3-2423N		+15 VDC	100 mA	-15 VDC	100 mA	84 %
TEN 3-4810N	36 - 75 VDC (48 VDC nom.)	3.3 VDC	750 mA			79 %
TEN 3-4811N		5 VDC	600 mA			81 %
TEN 3-4812N		12 VDC	250 mA			85 %
TEN 3-4813N		15 VDC	200 mA			85 %
TEN 3-4815N		24 VDC	125 mA			84 %
TEN 3-4821N		+5 VDC	250 mA	-5 VDC	250 mA	80 %
TEN 3-4822N		+12 VDC	125 mA	-12 VDC	125 mA	84 %
TEN 3-4823N		+15 VDC	100 mA	-15 VDC	100 mA	84 %

Options	
Suffix -HI	- 5 Vin models (except 3.3 Vout) with high iso. (3000 VDC), other Vin: <a href="http://www.tracopower.com/overview/ten3win">www.tracopower.com/overview/ten3win</a>

## Input Specifications

Input Current	- At no load	5 Vin models: <b>65 mA typ.</b> 12 Vin models: <b>35 mA typ.</b> 24 Vin models: <b>20 mA typ.</b> 48 Vin models: <b>15 mA typ.</b>
	- At full load	5 Vin models: <b>700 mA typ.</b> 12 Vin models: <b>300 mA typ.</b> 24 Vin models: <b>150 mA typ.</b> 48 Vin models: <b>75 mA typ.</b>
Surge Voltage		5 Vin models: <b>11 VDC max.</b> (1 s max.) 12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Under Voltage Lockout		5 Vin models: <b>4 VDC max.</b> 12 Vin models: <b>8.5 VDC max.</b> 24 Vin models: <b>17.5 VDC max.</b> 48 Vin models: <b>35.5 VDC max.</b>
Reflected Ripple Current		5 Vin models: <b>100 mA<sub>p-p</sub> typ.</b> 12 Vin models: <b>30 mA<sub>p-p</sub> typ.</b> 24 Vin models: <b>15 mA<sub>p-p</sub> typ.</b> 48 Vin models: <b>10 mA<sub>p-p</sub> typ.</b>
Recommended Input Fuse		(The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Pi-Type</b>
Short Circuit Input Power		<b>2 W max.</b>

## Output Specifications

Voltage Set Accuracy		<b>±2% max.</b>
Regulation	- Input Variation (V <sub>min</sub> - V <sub>max</sub> )	single output models: <b>1% max.</b> dual output models: <b>1% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>1% max.</b> dual output models: <b>1% max.</b> (Output 1) <b>1% max.</b> (Output 2)
	- Voltage Balance (symmetrical load)	dual output models: <b>2% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>70 mV<sub>p-p</sub> max.</b>
Capacitive Load	- single output	3.3 V <sub>out</sub> models: <b>680 μF max.</b> 5 V <sub>out</sub> models: <b>470 μF max.</b> 12 V <sub>out</sub> models: <b>330 μF max.</b> 15 V <sub>out</sub> models: <b>220 μF max.</b> 24 V <sub>out</sub> models: <b>100 μF max.</b>
	- dual output	5 / -5 V <sub>out</sub> models: <b>220 / 220 μF max.</b> 12 / -12 V <sub>out</sub> models: <b>150 / 150 μF max.</b> 15 / -15 V <sub>out</sub> models: <b>100 / 100 μF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Overload Protection		<b>Foldback Mode</b>
Output Current Limitation		<b>120% min. of I<sub>out</sub> max.</b>
		<b>150% typ. of I<sub>out</sub> max.</b>
Transient Response	- Response Deviation	<b>3% typ. / 5% max.</b> (75% to 100% Load Step)
	- Response Time	<b>300 μs typ. / 500 μs max.</b> (75% to 100% Load Step)

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

## Safety Specifications

Standards	- IT / Multimedia Equipment	CSA-C22.2, No. 60950-1 EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Certification Documents	<a href="http://www.tracopower.com/overview/ten3n">www.tracopower.com/overview/ten3n</a>
Pollution Degree		PD 3
Over Voltage Category		Not mains connected

## EMC Specifications

EMI Emissions	- Conducted Emissions - Radiated Emissions	EN 55032 class A (internal filter) EN 55032 class A (internal filter)
EMS Immunity	- Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances	EN 55024 (IT Equipment) EN 55035 (Multimedia) Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A EN 61000-4-3, 10 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 1$ kV, perf. criteria A Ext. input component: 200 $\mu$ F, 100 V, ESR 48 m $\Omega$ EN 61000-4-6, 10 Vrms, perf. criteria A

## General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +85°C +100°C max. -55°C to +125°C
Power Derating	- High Temperature	3.3 %/K above 70°C
	See application note:	<a href="http://www.tracopower.com/overview/ten3n">www.tracopower.com/overview/ten3n</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		6'000 m max.
Switching Frequency		80 kHz min. (PFM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s - Input to Output, 1 s	1'500 VDC (Standard models) 3'000 VDC (Suffix -HI) 1'800 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M $\Omega$ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	300 pF max.
Reliability	- Calculated MTBF	1'000'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Copper Alloy (C6801)
Pin Foundation Plating		Nickel (2.5 $\mu$ m min.)
Pin Surface Plating		Gold (75 - 125 nm), glossy
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP24
Soldering Profile		Lead-Free Wave Soldering 260°C / 10 s max.
Weight		12.8 g

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

Environmental Compliance - REACH Declaration

[www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)

- RoHS Declaration

REACH SVHC list compliant

REACH Annex XVII compliant

[www.tracopower.com/info/rohs-declaration.pdf](http://www.tracopower.com/info/rohs-declaration.pdf)

Exemptions: 7a

(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))

- SCIP Reference Number

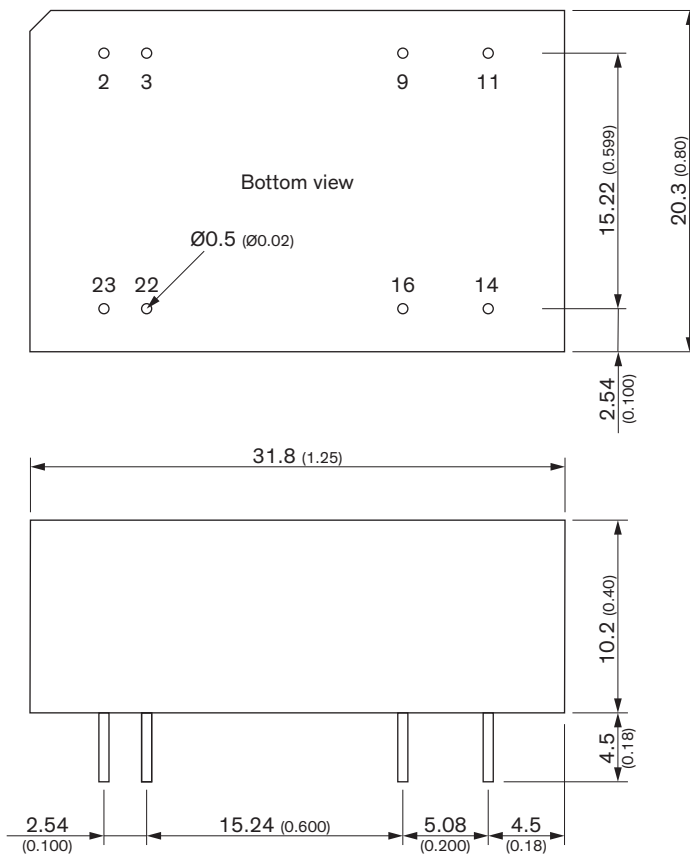
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### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten3n](http://www.tracopower.com/overview/ten3n)

### Outline Dimensions



Pinout		
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  $\pm 0.5$  (x.xx  $\pm 0.02$ )

x.xx  $\pm 0.25$  (x.xxx  $\pm 0.01$ )

Pin tolerances: x.x  $\pm 0.05$  (x.xx  $\pm 0.002$ )

## Looking for pricing, stock, or lifecycle information?

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