



# THE DATASHEET OF TEN 6-1212N



- 2:1 input voltage range
- High efficiency
- Operating temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Input filter meets EN 55032, class A
- Overload protection
- I/O-isolation 1'500 VDC
- DIP-24 plastic package
- Industry standard pinout
- 3-year product warranty



UL 62368-1 IEC 62368-1

The TEN 6N series is designed for an optimized cost/performance ratio of DC/DC converters with output power of 6 Watt.

General features like no minimum load requirement, overload protection, internal filter for EN55032 class A and high efficiency make these converters easy to design in. With the popular DIP-24 standard package they are also a drop in replacement for many cost critical applications.

Models						
Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TEN 6-1210N	9 - 18 VDC (12 VDC nom.)	3.3 VDC	1'200 mA			75 %
TEN 6-1211N		5 VDC	1'200 mA			78 %
TEN 6-1212N		12 VDC	500 mA			82 %
TEN 6-1213N		15 VDC	400 mA			82 %
TEN 6-1215N		24 VDC	250 mA			84 %
TEN 6-1221N		+5 VDC	500 mA	-5 VDC	500 mA	78 %
TEN 6-1222N		+12 VDC	250 mA	-12 VDC	250 mA	82 %
TEN 6-1223N		+15 VDC	200 mA	-15 VDC	200 mA	82 %
TEN 6-2410N	18 - 36 VDC (24 VDC nom.)	3.3 VDC	1'200 mA			77 %
TEN 6-2411N		5 VDC	1'200 mA			80 %
TEN 6-2412N		12 VDC	500 mA			84 %
TEN 6-2413N		15 VDC	400 mA			84 %
TEN 6-2415N		24 VDC	250 mA			84 %
TEN 6-2421N		+5 VDC	500 mA	-5 VDC	500 mA	80 %
TEN 6-2422N		+12 VDC	250 mA	-12 VDC	250 mA	84 %
TEN 6-2423N		+15 VDC	200 mA	-15 VDC	200 mA	84 %
TEN 6-4810N	36 - 75 VDC (48 VDC nom.)	3.3 VDC	1'200 mA			77 %
TEN 6-4811N		5 VDC	1'200 mA			80 %
TEN 6-4812N		12 VDC	500 mA			84 %
TEN 6-4813N		15 VDC	400 mA			84 %
TEN 6-4815N		24 VDC	250 mA			84 %
TEN 6-4821N		+5 VDC	500 mA	-5 VDC	500 mA	80 %
TEN 6-4822N		+12 VDC	250 mA	-12 VDC	250 mA	84 %
TEN 6-4823N		+15 VDC	200 mA	-15 VDC	200 mA	84 %

## Input Specifications

Input Current	- At no load	12 Vin models: <b>40 mA typ.</b> 24 Vin models: <b>20 mA typ.</b> 48 Vin models: <b>10 mA typ.</b>
	- At full load	12 Vin models: <b>440 mA max.</b> (3.3 Vout model) <b>610 mA max.</b> (5 Vout model) <b>610 mA max.</b> (12 Vout model) <b>610 mA max.</b> (15 Vout model) <b>610 mA max.</b> (24 Vout model) <b>530 mA max.</b> (5 / -5 Vout model) <b>610 mA max.</b> (12 / -12 Vout model) <b>610 mA max.</b> (15 / -15 Vout model) 24 Vin models: <b>220 mA max.</b> (3.3 Vout model) <b>300 mA max.</b> (5 Vout model) <b>300 mA max.</b> (12 Vout model) <b>300 mA max.</b> (15 Vout model) <b>300 mA max.</b> (24 Vout model) <b>260 mA max.</b> (5 / -5 Vout model) <b>300 mA max.</b> (12 / -12 Vout model) <b>300 mA max.</b> (15 / -15 Vout model) 48 Vin models: <b>110 mA max.</b> (3.3 Vout model) <b>150 mA max.</b> (5 Vout model) <b>150 mA max.</b> (12 Vout model) <b>150 mA max.</b> (15 Vout model) <b>150 mA max.</b> (24 Vout model) <b>130 mA max.</b> (5 / -5 Vout model) <b>150 mA max.</b> (12 / -12 Vout model) <b>150 mA max.</b> (15 / -15 Vout model)
Surge Voltage		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.)
Start-up Voltage		12 Vin models: <b>7 VDC min. / 8 VDC typ. / 9 VDC max.</b> 24 Vin models: <b>14 VDC min. / 16 VDC typ. / 18 VDC max.</b> 48 Vin models: <b>32 VDC min. / 34 VDC typ. / 36 VDC max.</b>
Under Voltage Lockout		12 Vin models: <b>8.5 VDC max.</b> 24 Vin models: <b>16 VDC max.</b> 48 Vin models: <b>35 VDC max.</b>
Reflected Ripple Current		12 Vin models: <b>30 mA typ.</b> 24 Vin models: <b>20 mA typ.</b> 48 Vin models: <b>15 mA typ.</b>
Recommended Input Fuse		12 Vin models: <b>1'500 mA</b> (slow blow) 24 Vin models: <b>700 mA</b> (slow blow) 48 Vin models: <b>350 mA</b> (slow blow) (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>3 W max.</b>

## Output Specifications

Voltage Set Accuracy		<b>±2% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.5% max.</b> dual output models: <b>0.5% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>1.2% max.</b> dual output models: <b>1.2% max.</b> (Output 1) <b>1.2% max.</b> (Output 2)
	- Voltage Balance (symmetrical load)	dual output models: <b>2% max.</b>

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

Ripple and Noise	- 20 MHz Bandwidth	80 mVp-p max.
Capacitive Load	- single output	3.3 Vout models: 470 µF max.
		5 Vout models: 470 µF max.
		12 Vout models: 100 µF max.
	- dual output	15 Vout models: 100 µF max.
		24 Vout models: 47 µF max.
		5 / -5 Vout models: 100 / 100 µF max.
	12 / -12 Vout models: 100 / 100 µF max.	
	15 / -15 Vout models: 100 / 100 µF max.	
Minimum Load		Not required
Temperature Coefficient		±0.02 %/K max.
Short Circuit Protection		Continuous, Automatic recovery
Overload Protection		Foldback Mode
Output Current Limitation		110% min. of Iout max.
		145% typ. of Iout max.
Transient Response	- Response Deviation	3% typ. / 5% max. (75% to 100% Load Step)
	- Response Time	300 µs typ. / 600 µs max. (75% to 100% Load Step)

### 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/ten6n">www.tracopower.com/overview/ten6n</a>
Pollution Degree		PD 3
Over Voltage Category		Not mains connected

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55032 class A (internal filter)
	- Radiated Emissions	EN 55032 class A (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/ten6n">www.tracopower.com/overview/ten6n</a>

### General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +85°C
	- Case Temperature	+100°C max.
	- Storage Temperature	-50°C to +125°C
Power Derating	- High Temperature	2.5 %/K above 60°C (3.3 & 5.0 Vout models)
		3.3 %/K above 70°C (other models)
	See application note:	<a href="http://www.tracopower.com/overview/ten6n">www.tracopower.com/overview/ten6n</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		6'000 m max.
Switching Frequency		330 kHz typ. (PWM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s	1'500 VDC
	- Input to Output, 1 s	1'800 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'000 pF typ.
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)

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

Potting Material	Epoxy (UL 94 V-0 rated)
Pin Material	Copper Alloy (C6801)
Pin Foundation Plating	Nickel (2.5 µm 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	12.7 g
Environmental Compliance	<p>- REACH Declaration <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a></p> <p>- RoHS Declaration <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a></p> <p>- SCIP Reference Number <b>72797e98-402f-4a39-ba0d-432ee696cc89</b></p> <p>REACH SVHC list compliant REACH Annex XVII compliant</p> <p>Exemptions: 7a (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))</p>

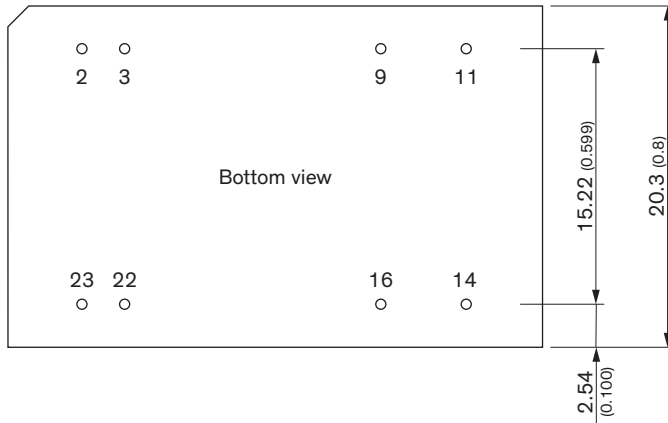
### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten6n](http://www.tracopower.com/overview/ten6n)

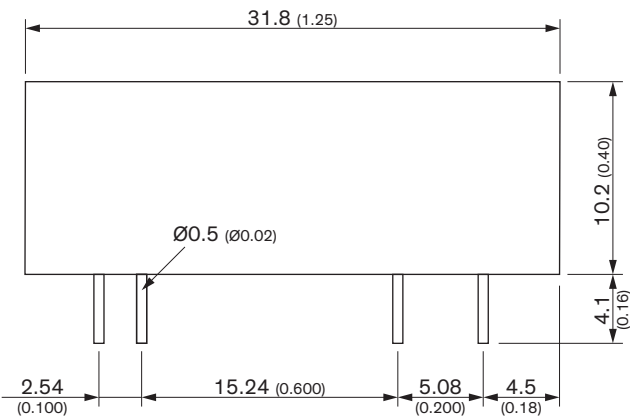
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**Outline Dimensions**



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 ±0.25 (x.xx ±0.01)

x.xx ±0.13 (x.xxx ±0.005)

Pin diameter tolerance: x.x ±0.05 (x.xx ±0.002)

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

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