TRACO POWER

DC/DC Converter

TEN 6N Series, 6 Watt

- **2:1 input voltage range**
- **High efficiency**
- **Operating temperature range –40°C to +85°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
		Vnom	Imax	Vnom	Imax	typ.
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 %

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Input Specifications

Input Current	- At no load	12 Vin models:	**40 mA typ.**
		24 Vin models:	**20 mA typ.**
		48 Vin models:	**10 mA typ.**
	- At full load	12 Vin models:	**440 mA max.** (3.3 Vout model)
			610 mA max. (5 Vout model)
			610 mA max. (12 Vout model)
			610 mA max. (15 Vout model)
			610 mA max. (24 Vout model)
			530 mA max. (5 / -5 Vout model)
			610 mA max. (12 / -12 Vout model)
			610 mA max. (15 / -15 Vout model)
		24 Vin models:	**220 mA max.** (3.3 Vout model)
			300 mA max. (5 Vout model)
			300 mA max. (12 Vout model)
			300 mA max. (15 Vout model)
			300 mA max. (24 Vout model)
			260 mA max. (5 / -5 Vout model)
			300 mA max. (12 / -12 Vout model)
			300 mA max. (15 / -15 Vout model)
		48 Vin models:	**110 mA max.** (3.3 Vout model)
			150 mA max. (5 Vout model)
			150 mA max. (12 Vout model)
			150 mA max. (15 Vout model)
			150 mA max. (24 Vout model)
			130 mA max. (5 / -5 Vout model)
			150 mA max. (12 / -12 Vout model)
			150 mA max. (15 / -15 Vout model)
Surge Voltage		12 Vin models:	**25 VDC max.** (1 s max.)
		24 Vin models:	**50 VDC max.** (1 s max.)
		48 Vin models:	**100 VDC max.** (1 s max.)
Start-up Voltage		12 Vin models:	**7 VDC min. / 8 VDC typ. / 9 VDC max.**
		24 Vin models:	**14 VDC min. / 16 VDC typ. / 18 VDC max.**
		48 Vin models:	**32 VDC min. / 34 VDC typ. / 36 VDC max.**
Under Voltage Lockout		12 Vin models:	**8.5 VDC max.**
		24 Vin models:	**16 VDC max.**
		48 Vin models:	**35 VDC max.**
Reflected Ripple Current		12 Vin models:	**30 mA typ.**
		24 Vin models:	**20 mA typ.**
		48 Vin models:	**15 mA typ.**
Recommended Input Fuse		12 Vin models:	**1'500 mA** (slow blow)
		24 Vin models:	**700 mA** (slow blow)
		48 Vin models:	**350 mA** (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Pi-Type
Short Circuit Input Power			3 W max.

Output Specifications

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

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

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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.
		15 Vout models:	100 µF max.
		24 Vout models:	47 µF max.
	- dual output	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	www.tracopower.com/ten6n-safety-cert/
Energy Source	- Output, acc. to 62368-1	ES1
Power Source	- Output, acc. to 62368-1	PS1
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:	www.tracopower.com/ten6n-emc-filter/

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:	www.tracopower.com/ten6n-cc/
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)

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Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
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 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	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a) (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	72797e98-402f-4a39-ba0d-432ee696cc89

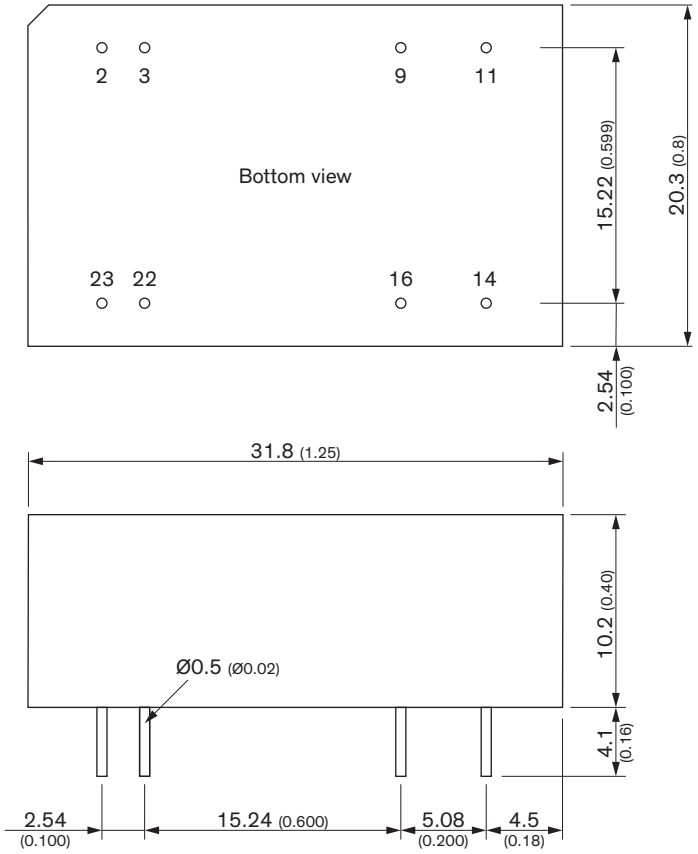
Additional Information

Supporting Documents	www.tracopower.com/overview/ten6n
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

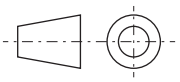
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Outline Dimensions



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)



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

Avoid routing PCB traces under the converter.

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