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 %

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.

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

Safety 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/overview/ten6n
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/overview/ten6n

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 VDC models) 3.3 %/K above 70°C (other models)
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		Allowed (hermetical product)
	See Cleaning Guideline:	www.tracopower.com/info/cleaning.pdf
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)

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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		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: 7a (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/ten6n

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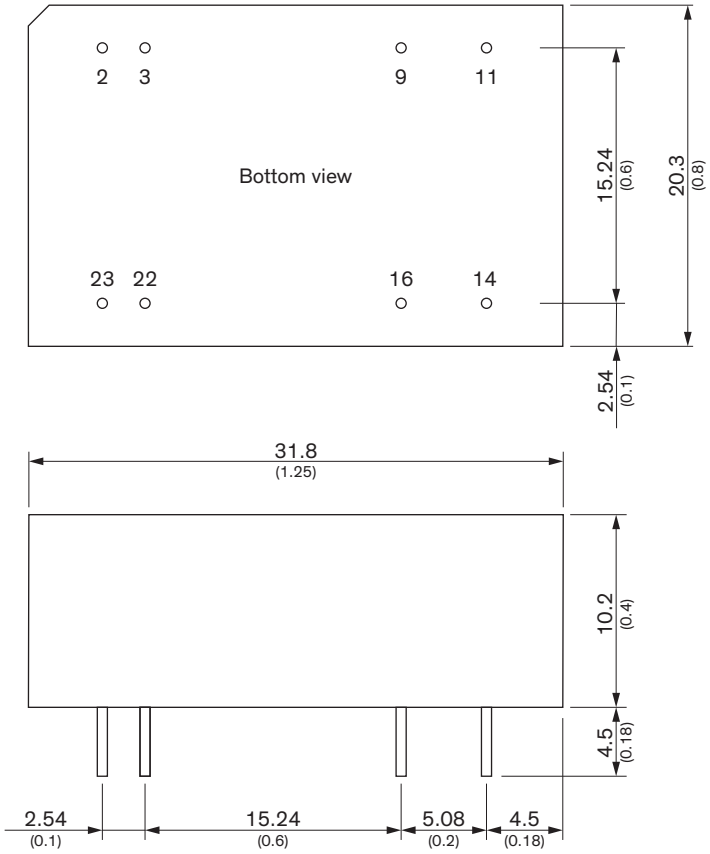
Outline Dimensions



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)
Pin diameter Ø 0.5 ±0.05 (Ø 0.02 ±0.002)
Tolerances x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)