

DC/DC Converter**TEN 40N Series, 40 Watt**

- **Highest power density:**
40 W in 1" x 2" x 0.4" package
- **Excellent efficiency up to 92 %**
- **Output voltage adjustable**
- **Remote On/Off**
- **Short circuit protection**
- **Over voltage protection**
- **I/O isolation 1500 VDC**
- **Operating temperature range**
-40°C to +80°C
- **Fully RoHS compliant**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TEN 40N Series is a new range of isolated high performance DC/DC converter modules. Due to the very high efficiency of up to 92% these 40 W converters come with a footprint of only 1.0" x 2.0". The 15 models have a wide 2:1 input voltage range and a tight output voltage regulation. The output voltage is adjustable by external resistor. Remote On/Off and protection against overpower and overvoltage are standard features of these converters. Typical applications are in mobile equipment, instrumentation, distributed power architectures in communication and industrial electronics and everywhere where space on the PCB is critical.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
TEN 40-1210N	9 - 18 VDC (12 VDC nom.)	3.3 VDC	8'000 mA			89 %
TEN 40-1211N		5 VDC	8'000 mA			89 %
TEN 40-1212N		12 VDC	3'330 mA			89 %
TEN 40-1213N		15 VDC	2'670 mA			90 %
TEN 40-1215N		24 VDC	1'670 mA			91 %
TEN 40-1222N		+12 VDC	1'670 mA	-12 VDC	1'670 mA	88 %
TEN 40-1223N		+15 VDC	1'330 mA	-15 VDC	1'330 mA	88 %
TEN 40-2410N	18 - 36 VDC (24 VDC nom.)	3.3 VDC	8'000 mA			90 %
TEN 40-2411N		5 VDC	8'000 mA			91 %
TEN 40-2412N		12 VDC	3'330 mA			91 %
TEN 40-2413N		15 VDC	2'670 mA			91 %
TEN 40-2415N		24 VDC	1'670 mA			91 %
TEN 40-2422N		+12 VDC	1'670 mA	-12 VDC	1'670 mA	89 %
TEN 40-2423N		+15 VDC	1'330 mA	-15 VDC	1'330 mA	89 %
TEN 40-4810N	36 - 75 VDC (48 VDC nom.)	3.3 VDC	8'000 mA			90 %
TEN 40-4811N		5 VDC	8'000 mA			91 %
TEN 40-4812N		12 VDC	3'330 mA			92 %
TEN 40-4813N		15 VDC	2'670 mA			92 %
TEN 40-4815N		24 VDC	1'670 mA			91 %
TEN 40-4822N		+12 VDC	1'670 mA	-12 VDC	1'670 mA	89 %
TEN 40-4823N		+15 VDC	1'330 mA	-15 VDC	1'330 mA	89 %

Options

TEN-HS4	- Optional Heat Sink: www.tracopower.com/products/ten-hs4.pdf
TEN-HS6	- Optional Heat Sink: www.tracopower.com/products/ten-hs6.pdf

Input Specifications

Input Current	- At no load	12 Vin models: 120 mA typ. (3.3 Vout model) 160 mA typ. (5 Vout model) 160 mA typ. (12 Vout model) 150 mA typ. (15 Vout model) 160 mA typ. (24 Vout model) 70 mA typ. (12 / -12 Vout model) 60 mA typ. (15 / -15 Vout model)
		24 Vin models: 75 mA typ. (3.3 Vout model) 80 mA typ. (5 Vout model) 85 mA typ. (12 Vout model) 75 mA typ. (15 Vout model) 85 mA typ. (24 Vout model) 50 mA typ. (12 / -12 Vout model) 45 mA typ. (15 / -15 Vout model)
		48 Vin models: 40 mA typ. (3.3 Vout model) 50 mA typ. (5 Vout model) 50 mA typ. (12 Vout model) 50 mA typ. (15 Vout model) 50 mA typ. (24 Vout model) 65 mA typ. (12 / -12 Vout model) 65 mA typ. (15 / -15 Vout model)
	- At full load	12 Vin models: 2'470 mA max. (3.3 Vout model) 3'750 mA max. (5 Vout model) 3'750 mA max. (12 Vout model) 3'700 mA max. (15 Vout model) 3'670 mA max. (24 Vout model) 3'790 mA max. (12 / -12 Vout model) 3'790 mA max. (15 / -15 Vout model)
		24 Vin models: 1'220 mA max. (3.3 Vout model) 1'830 mA max. (5 Vout model) 1'830 mA max. (12 Vout model) 1'830 mA max. (15 Vout model) 1'835 mA max. (24 Vout model) 1'870 mA max. (12 / -12 Vout model) 1'870 mA max. (15 / -15 Vout model)
		48 Vin models: 610 mA max. (3.3 Vout model) 920 mA max. (5 Vout model) 910 mA max. (12 Vout model) 910 mA max. (15 Vout model) 918 mA max. (24 Vout model) 940 mA max. (12 / -12 Vout model) 940 mA max. (15 / -15 Vout model)
Surge Voltage		12 Vin models: 25 VDC max. (100 ms max.) 24 Vin models: 50 VDC max. (100 ms max.) 48 Vin models: 100 VDC max. (100 ms max.)
Under Voltage Lockout		12 Vin models: 8.3 VDC typ. 24 Vin models: 16.5 VDC typ. 48 Vin models: 33 VDC typ.
Reflected Ripple Current		12 Vin models: 50 mAp-p typ. 24 Vin models: 30 mAp-p typ. 48 Vin models: 20 mAp-p typ.

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

Recommended Input Fuse	12 Vin models:	8'000 mA (slow blow)
	24 Vin models:	4'000 mA (slow blow)
	48 Vin models:	2'000 mA (slow blow)
	(The need of an external fuse has to be assessed in the final application.)	
Input Filter	Internal LC-Type	

Output Specifications

Output Voltage Adjustment			-10% to +20% (24 Vout single models) ±10% (other single models) (By external trim resistor) See application note: www.tracopower.com/overview/ten40n Output power must not exceed rated power!
Voltage Set Accuracy			±1% 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:	0.5% max.
		dual output models:	1% max. (Output 1) 1% max. (Output 2)
	- Voltage Balance (symmetrical load)	dual output models:	2% max.
	- Cross Regulation (25% / 100% asym. load)	dual output models:	5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models:	100 mVp-p typ. (w/ 1µF MC // 10 µF TC)
		5 Vout models:	100 mVp-p typ. (w/ 1µF MC // 10 µF TC)
		12 Vout models:	150 mVp-p typ. (w/ 1µF MC // 10 µF TC)
		15 Vout models:	150 mVp-p typ. (w/ 1µF MC // 10 µF TC)
		24 Vout models:	150 mVp-p typ. (w/ 1µF MC // 10 µF TC)
	- dual output	12 / -12 Vout models:	150 / 150 mVp-p typ. (w/ 1µF MC // 10 µF TC)
		15 / -15 Vout models:	150 / 150 mVp-p typ. (w/ 1µF MC // 10 µF TC)
Capacitive Load	- single output	3.3 Vout models:	21'000 µF max.
		5 Vout models:	13'600 µF max.
		12 Vout models:	2'400 µF max.
		15 Vout models:	1'500 µF max.
		24 Vout models:	600 µF max.
	- dual output	12 / -12 Vout models:	1'200 / 1'200 µF max.
		15 / -15 Vout models:	750 / 750 µF max.
Minimum Load	- single output	3.3 Vout models:	0 % of Iout max.
		5 Vout models:	0 % of Iout max.
		12 Vout models:	0 % of Iout max.
		15 Vout models:	0 % of Iout max.
		24 Vout models:	0 % of Iout max.
	- dual output	12 / -12 Vout models:	9 % of Iout max.
		15 / -15 Vout models:	8 % of Iout max.
Temperature Coefficient			±0.02 %/K max.
Start-up Time			30 ms max. (Power On) 30 ms max. (Remote On)
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			150% typ. of Iout max.
Overvoltage Protection			118 - 125% of Vout nom. (depending on model) 3.9 VDC typ. (3.3 VDC model) 6.2 VDC typ. (5 VDC model) 15 VDC typ. (12 VDC model) 18 VDC typ. (15 VDC model)
Transient Response	- Response Deviation		3% typ. / 5% max. (75% to 100% Load Step)
	- Response Time		250 µs typ. (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

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/ten40n
Pollution Degree		PD 3
Over Voltage Category		Not mains connected

EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55032 class A (with external filter)
	External filter proposal:	www.tracopower.com/overview/ten40n
EMS Immunity	- Electrostatic Discharge	EN 55024 (IT Equipment)
	- RF Electromagnetic Field	Air: EN 61000-4-2, ± 8 kV, perf. criteria B
	- EFT (Burst) / Surge	Contact: EN 61000-4-2, ± 6 kV, perf. criteria B EN 61000-4-3, 10 V/m, perf. criteria A EN 61000-4-4, ± 2 kV, perf. criteria A EN 61000-4-5, ± 1 kV, perf. criteria B
	Ext. input component:	KXG 330 μ F, 200 V
	- Conducted RF Disturbances	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 +80°C +105°C max. -50°C to +125°C
Power Derating	- High Temperature	See application note: www.tracopower.com/overview/ten40n
Over Temperature	- Protection Mode	110°C typ.
Protection Switch Off		
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote	On: 3.5 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current	2.5 mA typ.
	- Remote Pin Input Current	-0.5 to 0.5 mA
Altitude During Operation		6'000 m max.
Switching Frequency		285 kHz typ. (PWM) (24 Vout models) 320 kHz typ. (PWM) (other models)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s - Input to Output, 1 s	1'500 VDC 1'800 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M Ω min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'500 pF max.
Reliability	- Calculated MTBF	328'000 h (MIL-HDBK-217F, ground benign)
Washing Process		Allowed (hermetical product)
	See Cleaning Guideline:	www.tracopower.com/info/cleaning.pdf
Housing Material		Alu alloy, black anodized coating
Base Material		Non-conductive FR4 (UL 94 V-0 rated)
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Copper Alloy (C6801)
Pin Foundation Plating		Nickel (2.5 μ m min.)
Pin Surface Plating		Gold (75 - 125 nm), glossy

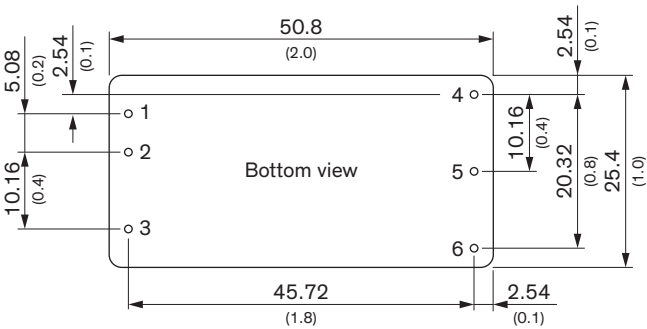
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Housing Type	Metal Case
Mounting Type	PCB Mount
Connection Type	THD (Through-Hole Device)
Footprint Type	2" x 1"
Soldering Profile	Wave Soldering 260°C / 10 s max.
Weight	30 g
Thermal Impedance	12 K/W 10 K/W (with Heat Sink)
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/ten40n

Outline Dimensions



Pinout		
Pin	Single	Dual
1	+Vin (Vcc)	+Vin (Vcc)
2	-Vin (GND)	-Vin (GND)
3	Remote On/Off	Remote On/Off
4	+Vout	+Vout
5	-Vout	Common
6	Trim	-Vout

h=11.0 (0.43) for 24 VDC output models
h=10.2 (0.40) for other models

Dimensions in mm (inch)
Pin diameter: 1.0 ±0.05 (0.04 ±0.002)
Tolerances: x.x ±0.25 (x.xx ±0.01)
x.xx ±0.13 (x.xxx ±0.005)