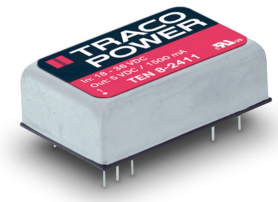
TRACO POWER

DC/DC Converter

TEN 8 Series, 8 Watt

- **DIP–24 package with industry standard footprint**
- **Wide 2:1 input voltage range**
- **Input filter meets EN 55032, class A**
- **Extended operating temperature range: -40°C to +85°C**
- **Remote On/Off**
- **Shielded metal casing with insulated baseplate**
- **Lead free design, RoHS compliant**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TEN 8 series is a family of high performance 8 Watt DC/DC-converter modules featuring wide 2:1 input voltage ranges in a DIP-24 package with industry standard footprint. A very high efficiency allows an operating temperature range of –40°C to +85°C. A built-in EMI input filter complies with EN 55032, class A without external components. Further standard features include remote On/Off and short circuit protection.
Typical applications for these converters are battery operated equipment, instrumentation, communication and industrial electronics, everywhere where isolated, tightly regulated voltages are required and space is limited on the PCB.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TEN 8-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	2'000 mA			80 %
TEN 8-1211		5 VDC	1'500 mA			83 %
TEN 8-1212		12 VDC	666 mA			88 %
TEN 8-1213		15 VDC	533 mA			87 %
TEN 8-1221		+5 VDC	800 mA	–5 VDC	800 mA	83 %
TEN 8-1222		+12 VDC	333 mA	–12 VDC	333 mA	87 %
TEN 8-1223		+15 VDC	267 mA	–15 VDC	267 mA	85 %
TEN 8-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	2'000 mA			80 %
TEN 8-2411		5 VDC	1'500 mA			83 %
TEN 8-2412		12 VDC	666 mA			86 %
TEN 8-2413		15 VDC	533 mA			85 %
TEN 8-2421		+5 VDC	800 mA	–5 VDC	800 mA	82 %
TEN 8-2422		+12 VDC	333 mA	–12 VDC	333 mA	86 %
TEN 8-2423		+15 VDC	267 mA	–15 VDC	267 mA	85 %
TEN 8-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	2'000 mA			80 %
TEN 8-4811		5 VDC	1'500 mA			83 %
TEN 8-4812		12 VDC	666 mA			86 %
TEN 8-4813		15 VDC	533 mA			86 %
TEN 8-4821		+5 VDC	800 mA	–5 VDC	800 mA	85 %
TEN 8-4822		+12 VDC	333 mA	–12 VDC	333 mA	87 %
TEN 8-4823		+15 VDC	267 mA	–15 VDC	267 mA	87 %

Input Specifications

Input Current	- At no load	12 Vin models:	**15 mA typ.**
		24 Vin models:	**15 mA typ.**
		48 Vin models:	**10 mA typ.**
	- At full load	12 Vin models:	**720 mA max.** (3.3 Vout model)
			800 mA max. (5 Vout model)
			800 mA max. (12 Vout model)
			800 mA max. (15 Vout model)
			800 mA max. (5 / -5 Vout model)
			800 mA max. (12 / -12 Vout model)
			800 mA max. (15 / -15 Vout model)
		24 Vin models:	**360 mA max.** (3.3 Vout model)
			400 mA max. (5 Vout model)
			400 mA max. (12 Vout model)
			400 mA max. (15 Vout model)
			400 mA max. (5 / -5 Vout model)
			400 mA max. (12 / -12 Vout model)
			400 mA max. (15 / -15 Vout model)
		48 Vin models:	**180 mA max.** (3.3 Vout model)
			200 mA max. (5 Vout model)
			200 mA max. (12 Vout model)
			200 mA max. (15 Vout model)
			200 mA max. (5 / -5 Vout model)
			200 mA max. (12 / -12 Vout model)
			200 mA max. (15 / -15 Vout model)
Surge Voltage		12 Vin models:	**36 VDC max.** (100 ms max.)
		24 Vin models:	**50 VDC max.** (100 ms max.)
		48 Vin models:	**100 VDC max.** (100 ms max.)
Recommended Input Fuse		12 Vin models:	**2'000 mA** (slow blow)
		24 Vin models:	**1'000 mA** (slow blow)
		48 Vin models:	**500 mA** (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Pi-Type

Output Specifications

Voltage Set Accuracy			**±1% max.**
Regulation	- Input Variation (Vmin - Vmax)	single output models:	**0.2% max.**
		dual output models:	**0.2% max.**
	- Load Variation (0 - 100%)	single output models:	**0.5% max.**
		dual output models:	**1% max.** (Output 1)
			1% max. (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models:	**5% max.**
Ripple and Noise	- 20 MHz Bandwidth		**50 mVp-p typ.**
Capacitive Load	- single output	3.3 Vout models:	**3'300 µF max.**
		5 Vout models:	**1'600 µF max.**
		12 Vout models:	**350 µF max.**
		15 Vout models:	**240 µF max.**
	- dual output	5 / -5 Vout models:	**1'000 / 1'000 µF max.**
		12 / -12 Vout models:	**160 / 160 µF max.**
		15 / -15 Vout models:	**100 / 100 µF max.**
Minimum Load			Not required
Temperature Coefficient			**±0.02 %/K max.**
Start-up Time			**700 ms typ.** (Power On)
			5 ms typ. (Remote On)
Short Circuit Protection			Continuous, Automatic recovery

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

Output Current Limitation		150% typ. of Iout max.
Transient Response	- Peak Variation	165 mV typ. / 264 mV max. (25% Load Step) (3.3 Vout models) 250 mV typ. / 400 mV max. (25% Load Step) (5 Vout models) 225 mV typ. / 450 mV max. (25% Load Step) (other models)
	- Response Time	200 µs typ. (25% Load Step)

Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Certification Documents	www.tracopower.com/overview/ten8
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

EMC Specifications

EMI Emissions	- Conducted Emissions		EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions		EN 55032 class A (with external filter) EN 55032 class B (with external filter)
		External filter proposal:	www.tracopower.com/overview/ten8
EMS Immunity			EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 kV, perf. criteria A
		Contact:	EN 61000-4-2, ±6 kV, perf. criteria A
	- RF Electromagnetic Field		EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge		EN 61000-4-4, ±2 kV, perf. criteria A EN 61000-4-5, ±1 kV, perf. criteria A
		Ext. input component:	Nippon chemi-con KY series, 220µF/100V
	- Conducted RF Disturbances		EN 61000-4-6, 10 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous:	EN 61000-4-8, 100 A/m, perf. criteria A
		1 s:	EN 61000-4-8, 1000 A/m, perf. criteria 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		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/overview/ten8
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 max.
	- Remote Pin Input Current		-0.5 to 0.5 mA
Altitude During Operation			4'000 m max.
Switching Frequency			270 - 330 kHz (PWM) 300 kHz typ. (PWM)
Insulation System			Functional Insulation

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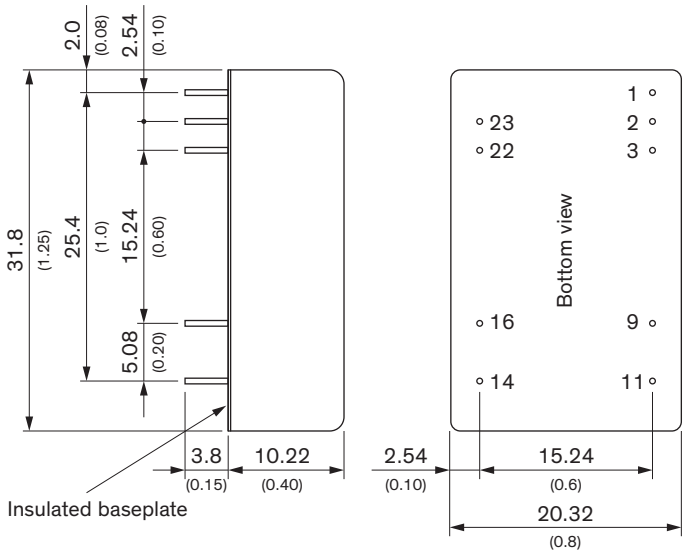
Isolation Test Voltage	- Input to Output, 60 s	1'600 VDC
	- Input to Case, 60 s	1'600 VDC
	- Output to Case, 60 s	1'600 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	300 pF max.
Reliability	- Calculated MTBF	3'500'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F
	- Thermal Shock	MIL-STD-810F
Housing Material		Copper, Nickel plated
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (2 - 3 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Housing Type		Metal Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP24
Weight		18 g
Thermal Impedance	- Case to Ambient	20 K/W typ.
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, 7c-I (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/ten8

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

Outline Dimensions



Dimensions in mm (inch)
Tolerances: x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)
Pin Ø 0.5 ±0.1 (0.02 ±0.004)

Pinout		
Pin	**Single**	**Dual**
1	Remote On/Off	Remote On/Off
2	–Vin (GND)	–Vin (GND)
3	–Vin (GND)	–Vin (GND)
9	NC	Common
11	NC	–Vout
14	+Vout	+Vout
16	–Vout	Common
22	+Vin (Vcc)	+Vin (Vcc)
23	+Vin (Vcc)	+Vin (Vcc)

NC: Not Connected