TRACO POWER

DC/DC Converter

TEN 40 Series, 40 Watt

Not recommended for new designs

- **40 Watt in a 2”x2” package**
- **Wide 2:1 input voltage range**
- **Extended operating temperature range: –40°C to +75°C**
- **Over temperature protection, under voltage lockout and Remote On/Off**
- **Shielded metal case with insulated baseplate**
- **3-year product warranty**

UL 62368-1 IEC 62368-1

The TEN 40 series is a family of high performance 40W DC/DC converter modules featuring a wide 2:1 input voltage range in a 2"x2" package. Typical applications for these products are battery operated equipment and distributed power architectures in communication and industrial electronics.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Output 3		Efficiency
		Vnom	Imax	Vnom	Imax	Vnom	Imax	typ.
TEN 40-1210 *	9 - 18 VDC (12 VDC nom.)	3.3 VDC	8'000 mA					86 %
TEN 40-1211 *		5 VDC	8'000 mA					86 %
TEN 40-1212 *		12 VDC	3'300 mA					86 %
TEN 40-1220 *		+3.3 VDC	8'000 mA	+5 VDC	8'000 mA			85 %
TEN 40-1222 *		+12 VDC	1'800 mA	–12 VDC	1'800 mA			85 %
TEN 40-1223 *		+15 VDC	1'400 mA	–15 VDC	1'400 mA			85 %
TEN 40-1233 *		+3.3 VDC	6'000 mA	+12 VDC	400 mA	–12 VDC	400 mA	84 %
TEN 40-1234 *		+3.3 VDC	6'000 mA	+15 VDC	300 mA	–15 VDC	300 mA	84 %
TEN 40-1231 *		+5 VDC	6'000 mA	+12 VDC	400 mA	–12 VDC	400 mA	86 %
TEN 40-1232 *		+5 VDC	6'000 mA	+15 VDC	300 mA	–15 VDC	300 mA	86 %
TEN 40-2410 *	18 - 36 VDC (24 VDC nom.)	3.3 VDC	8'000 mA					87 %
TEN 40-2411 *		5 VDC	8'000 mA					89 %
TEN 40-2412 *		12 VDC	3'300 mA					88 %
TEN 40-2420 *		+3.3 VDC	8'000 mA	+5 VDC	8'000 mA			86 %
TEN 40-2422 *		+12 VDC	1'800 mA	–12 VDC	1'800 mA			87 %
TEN 40-2423 *		+15 VDC	1'400 mA	–15 VDC	1'400 mA			87 %
TEN 40-2433 *		+3.3 VDC	6'000 mA	+12 VDC	400 mA	–12 VDC	400 mA	85 %
TEN 40-2434 *		+3.3 VDC	6'000 mA	+15 VDC	300 mA	–15 VDC	300 mA	85 %
TEN 40-2431 *		+5 VDC	6'000 mA	+12 VDC	400 mA	–12 VDC	400 mA	87 %
TEN 40-2432 *		+5 VDC	6'000 mA	+15 VDC	300 mA	–15 VDC	300 mA	87 %
TEN 40-4810 *	36 - 75 VDC (48 VDC nom.)	3.3 VDC	8'000 mA					88 %
TEN 40-4811 *		5 VDC	8'000 mA					90 %
TEN 40-4812 *		12 VDC	3'300 mA					89 %
TEN 40-4820 *		+3.3 VDC	8'000 mA	+5 VDC	8'000 mA			88 %
TEN 40-4822 *		+12 VDC	1'800 mA	–12 VDC	1'800 mA			87 %
TEN 40-4823 *		+15 VDC	1'400 mA	–15 VDC	1'400 mA			87 %
TEN 40-4833 *		+3.3 VDC	6'000 mA	+12 VDC	400 mA	–12 VDC	400 mA	86 %
TEN 40-4834 *		+3.3 VDC	6'000 mA	+15 VDC	300 mA	–15 VDC	300 mA	86 %
TEN 40-4831 *		+5 VDC	6'000 mA	+12 VDC	400 mA	–12 VDC	400 mA	88 %
TEN 40-4832 *		+5 VDC	6'000 mA	+15 VDC	300 mA	–15 VDC	300 mA	88 %

Options

TEN-HS3	- Optional Heat Sink: www.tracopower.com/overview/ten-hs3

Note - TEN 40-xx20: Dynamic current allocation, 8 A total output current for both outputs together

* Not recommended for new designs

Input Specifications

Input Current	- At no load	12 Vin models:	**200 mA typ.**
		24 Vin models:	**80 mA typ.**
		48 Vin models:	**50 mA typ.**
	- At full load	12 Vin models:	**2'680 mA typ.** (3.3 Vout model)
			4'065 mA typ. (5 Vout model)
			4'065 mA typ. (12 Vout model)
			3'415 mA typ. (3.3 / 5 Vout model)
			4'400 mA typ. (12 / -12 Vout model)
			4'400 mA typ. (15 / -15 Vout model)
			3'000 mA typ. (3.3 / 12 / -12 Vout model)
			3'000 mA typ. (3.3 / 15 / -15 Vout model)
			4'000 mA typ. (5 / 12 / -12 Vout model)
			4'000 mA typ. (5 / 15 / -15 Vout model)
		24 Vin models:	**1'325 mA typ.** (3.3 Vout model)
			2'000 mA typ. (5 Vout model)
			2'000 mA typ. (12 Vout model)
			1'685 mA typ. (3.3 / 5 Vout model)
			2'100 mA typ. (12 / -12 Vout model)
			2'100 mA typ. (15 / -15 Vout model)
			1'500 mA typ. (3.3 / 12 / -12 Vout model)
			1'500 mA typ. (3.3 / 15 / -15 Vout model)
			1'990 mA typ. (5 / 12 / -12 Vout model)
			1'990 mA typ. (5 / 15 / -15 Vout model)
		48 Vin models:	**655 mA typ.** (3.3 Vout model)
			1'000 mA typ. (5 Vout model)
			1'000 mA typ. (12 Vout model)
			825 mA typ. (3.3 / 5 Vout model)
			1'050 mA typ. (12 / -12 Vout model)
			1'050 mA typ. (15 / -15 Vout model)
			750 mA typ. (3.3 / 12 / -12 Vout model)
			750 mA typ. (3.3 / 15 / -15 Vout model)
			980 mA typ. (5 / 12 / -12 Vout model)
			980 mA typ. (5 / 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.)
Under Voltage Lockout		12 Vin models:	**7 VDC min. / 8 VDC typ. / 8.8 VDC max.**
		24 Vin models:	**15 VDC min. / 16 VDC typ. / 17.5 VDC max.**
		48 Vin models:	**32.5 VDC min. / 34 VDC typ. / 35.5 VDC max.**
Recommended Input Fuse		12 Vin models:	**8'000 mA** (fast acting)
		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%** (single output and dual symmetric output models only) (By external trim resistor)
	See application note:	www.tracopower.com/ten40-adj Output power must not exceed rated power!
Voltage Set Accuracy		**±1% max.** (±5% for triple models, (aux))

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

Regulation	- Input Variation (Vmin - Vmax)	single output models:	0.5% max.
		dual output models:	0.5% max.
		triple output models:	1% max.
			5% max. (aux)
	- Load Variation (0 - 100%)	single output models:	0.5% max.
		dual output models:	1% max. (Output 1)
			1% max. (Output 2)
		triple output models:	2% max. (Output 1)
			5% max. (Output 2)
			5% max. (Output 3)
	- Cross Regulation (25% / 100% asym. load)	dual output models:	5% max.
		triple output models:	1% max.
			5% max. (aux)
Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout:	50 mVp-p typ. (w/ 0.1 µF MLCC)
		5 Vout:	50 mVp-p typ. (w/ 0.1 µF MLCC)
		12 Vout:	75 mVp-p typ. (w/ 0.1 µF MLCC)
	- dual output	3.3 / 5 Vout:	100 / 100 mVp-p typ. (w/ 1 uF MLCC)
		12 / -12 Vout:	120 / 120 mVp-p typ. (w/ 0.1 µF MLCC)
		15 / -15 Vout:	150 / 150 mVp-p typ. (w/ 0.1 µF MLCC)
	- triple output	3.3 / 12 / -12 Vout:	50 / 75 / 75 mVp-p typ. (w/ 0.1 µF MLCC)
		3.3 / 15 / -15 Vout:	50 / 75 / 75 mVp-p typ. (w/ 0.1 µF MLCC)
		5 / 12 / -12 Vout:	50 / 75 / 75 mVp-p typ. (w/ 0.1 µF MLCC)
		5 / 15 / -15 Vout:	50 / 75 / 75 mVp-p typ. (w/ 0.1 µF MLCC)
Capacitive Load	- single output	3.3 Vout:	21'000 µF max.
		5 Vout:	13'600 µF max.
		12 Vout:	2'360 µF max.
	- dual output	3.3 / 5 Vout:	11'000 / 6'800 µF max.
		12 / -12 Vout:	1'200 / 1'200 µF max.
		15 / -15 Vout:	750 / 750 µF max.
	- triple output	3.3 / 12 / -12 Vout:	13'000 / 330 / 330 µF max.
		3.3 / 15 / -15 Vout:	13'000 / 110 / 110 µF max.
		5 / 12 / -12 Vout:	6'800 / 330 / 330 µF max.
		5 / 15 / -15 Vout:	6'800 / 110 / 110 µF max.
Minimum Load	- single output	3.3 Vout:	0 % of Iout max.
		5 Vout:	0 % of Iout max.
		12 Vout:	0 % of Iout max.
	- dual output	3.3 / 5 Vout:	0 % of Iout max.
		12 / -12 Vout:	8 % of Iout max.
		15 / -15 Vout:	8 % of Iout max.
	- triple output	3.3 / 12 / -12 Vout:	10 % of Iout max.
		3.3 / 15 / -15 Vout:	10 % of Iout max.
		5 / 12 / -12 Vout:	10 % of Iout max.
		5 / 15 / -15 Vout:	10 % of Iout max.
Temperature Coefficient			±0.02 %/K max.
Start-up Time			25 ms typ. (Power On)
			25 ms typ. (Remote On)
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			150% max. of Iout max.
Overvoltage Protection			118 - 125% of Vout nom. (depending on model)
			3.9 VDC typ. (3.3 VDC outputs)
			6.2 VDC typ. (5 VDC outputs)
			15 VDC typ. (12 VDC outputs)
			18 VDC typ. (15 VDC outputs)
			(By Zener diode)
Transient Response	- Response Time		250 µs typ. (25% Load Step)

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

Safety Specifications

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/ten40-safety-cert
Energy Source	- Output, acc. to 62368-1		ES1
Power Source	- Output, acc. to 62368-1		PS3
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/ten40-emc-filter
EMS (Immunity)			EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 kV, perf. criteria B
		Contact:	EN 61000-4-2, ±6 kV, perf. criteria B
	- RF Electromagnetic Field		EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge		EN 61000-4-4, ±2 kV, perf. criteria B EN 61000-4-5, ±1 kV, perf. criteria B
		Ext. input component:	220 µF / 100 V / KY
	- 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 +75°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/ten40-cc
Over Temperature Protection Switch Off	- Protection Mode		115°C typ.
Cooling System			Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on)		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			5'000 m max.
Switching Frequency			450 - 550 kHz (PWM) (500 kHz typ.) (Dual models, 3.3 VDC output) 270 - 330 kHz (PWM) (300 kHz typ.) (other models / outputs)
Insulation System			Functional Insulation
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.

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Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'000 pF max.
Reliability	- Calculated MTBF	920'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F 7.6 g, 3 axis, 60 min, 20-2000 Hz
	- Mechanical Shock	MIL-STD-810F 40 g, 3 axis, half sine, 11 ms
	- Thermal Shock	MIL-STD-810F
Housing Material		Copper, Nickel plated
Base Material		Non-conductive FR4 (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		2" x 2"
Soldering Profile		Lead-Free Wave Soldering 265°C / 10 s max.
Weight		60 g
Thermal Impedance	- Case to Ambient	9.2 K/W typ. 7.6 K/W typ. (with heatsink TEN-HS3)
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), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	59d98b0b-fdf8-4da8-a96c-627ba766180b

Additional Information

Supporting Documents	www.tracopower.com/overview/ten40
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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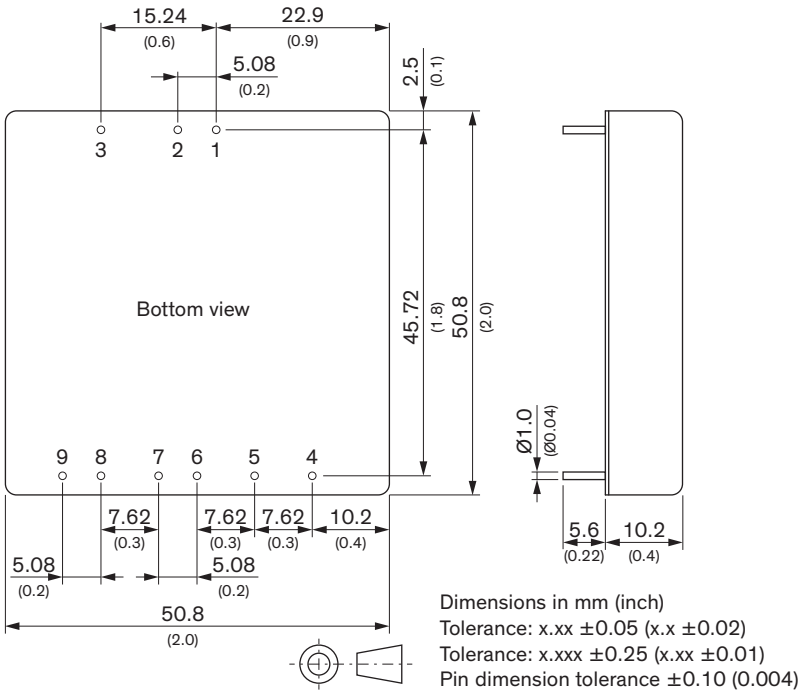
Outline Dimensions



Dimensions in mm (inch)
Tolerance: x.xx ±0.05 (x.x ±0.02)
Tolerance: x.xxx ±0.25 (x.xx ±0.01)
Pin dimension tolerance ±0.10 (0.004)

Pinout				
Pin	**Single**	**Dual** symmetric	**Dual** asymmetric	**Triple**
1	+Vin (Vcc)	+Vin (Vcc)	+Vin (Vcc)	+Vin (Vcc)
2	–Vin (GND)	–Vin (GND)	–Vin (GND)	–Vin (GND)
3	Remote On/Off			
4	NC	No pin	Vout 1	Vout 2
5	–Sense*	Vout 1	Common	Common
6	+Sense*	Common	NC	Vout 3
7	+Vout	Common	NC	Vout 1
8	–Vout	Vout 2	Vout 2	Common
9	Trim	Trim	Common	NC

NC: Not connected
*Sense line to be connected to the output under regard of polarity