

## DC/DC Converter

## TEN 40WI Series, 40 Watt

Not recommended for new designs

- High power density: 40W in 2"x2"x0.4" metal package
- Ultra wide 4:1 input voltage range
- Very high efficiency up to 89 %
- No minimum load required for single output models
- Over temperature protection
- Under voltage lockout
- Remote On/Off
- Shielded metal case with insulated baseplate
- Optional heat-sink
- 3-year product warranty



The TEN 40WI series is a family of high performance 40W DC/DC converter modules featuring ultra wide 4:1 input voltage ranges in a compact low profile case with industry-standard footprint. A very high efficiency allows an operating temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . Further standard features include remote On/Off, output voltage trimming, over voltage protection, under voltage lockout, over temperature and short circuit protection. Typical applications for these products are battery operated equipment and distributed power architectures in 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 typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TEN 40-2410WI *	9 - 36 VDC (24 VDC nom.)	3.3 VDC	10'000 mA			87 %
TEN 40-2411WI *		5 VDC	8'000 mA			88 %
TEN 40-2412WI *		12 VDC	3'330 mA			87 %
TEN 40-2413WI *		15 VDC	2'670 mA			87 %
TEN 40-2422WI *		+12 VDC	1'670 mA	-12 VDC	1'670 mA	86 %
TEN 40-2423WI *		+15 VDC	1'330 mA	-15 VDC	1'330 mA	86 %
TEN 40-4810WI *	18 - 75 VDC (48 VDC nom.)	3.3 VDC	10'000 mA			87 %
TEN 40-4811WI *		5 VDC	8'000 mA			89 %
TEN 40-4812WI *		12 VDC	3'330 mA			87 %
TEN 40-4813WI *		15 VDC	2'670 mA			88 %
TEN 40-4822WI *		+12 VDC	1'670 mA	-12 VDC	1'670 mA	87 %
TEN 40-4823WI *		+15 VDC	1'330 mA	-15 VDC	1'330 mA	86 %

### Options

TEN-HS3	- Optional Heat Sink: <a href="http://www.tracopower.com/overview/ten-hs3">www.tracopower.com/overview/ten-hs3</a>
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Note \* Not recommended for new designs

## Input Specifications

Input Current	- At no load	24 Vin models: <b>75 mA typ.</b> (3.3 Vout model) <b>95 mA typ.</b> (5 Vout model) <b>50 mA typ.</b> (12 Vout model) <b>50 mA typ.</b> (15 Vout model) <b>60 mA typ.</b> (12 / -12 Vout model) <b>70 mA typ.</b> (15 / -15 Vout model)
	- At full load	48 Vin models: <b>55 mA typ.</b> (3.3 Vout model) <b>60 mA typ.</b> (5 Vout model) <b>30 mA typ.</b> (12 Vout model) <b>25 mA typ.</b> (15 Vout model) <b>30 mA typ.</b> (12 / -12 Vout model) <b>30 mA typ.</b> (15 / -15 Vout model)
Surge Voltage		24 Vin models: <b>50 VDC max.</b> (100 ms max.) 48 Vin models: <b>100 VDC max.</b> (100 ms max.)
Under Voltage Lockout		24 Vin models: <b>7 VDC min. / 8 VDC typ. / 8.8 VDC max.</b> 48 Vin models: <b>15 VDC min. / 16 VDC typ. / 17.5 VDC max.</b>
Recommended Input Fuse		24 Vin models: <b>8'000 mA</b> (fast acting) 48 Vin models: <b>4'000 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Pi-Type</b>

## Output Specifications

Output Voltage Adjustment		<b>±10%</b> (By external trim resistor) See application note: <a href="http://www.tracopower.com/ten40wi-adj">www.tracopower.com/ten40wi-adj</a> Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>0.5% max.</b> dual output models: <b>1% max.</b> (Output 1) <b>1% max.</b> (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>
Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models: <b>50 mVp-p typ.</b> 5 Vout models: <b>50 mVp-p typ.</b> 12 Vout models: <b>75 mVp-p typ.</b> 15 Vout models: <b>75 mVp-p typ.</b>
	- dual output	12 / -12 Vout models: <b>120 / 120 mVp-p typ.</b> 15 / -15 Vout models: <b>150 / 150 mVp-p typ.</b>

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

Capacitive Load	- single output	3.3 Vout models: 25'750 µF max. 5 Vout models: 13'600 µF max. 12 Vout models: 2'360 µF max. 15 Vout models: 1'510 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: 1.5 % of Iout max. 15 Vout models: 2 % of Iout max.
	- dual output	12 / -12 Vout models: 4 % of Iout max. 15 / -15 Vout models: 4 % of Iout max.
Temperature Coefficient		±0.02 %/K max.
Start-up Time		20 ms max. (Power On) 20 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 single model) 6.2 VDC typ. (5 VDC single model) 15 VDC typ. (12 VDC single model) 18 VDC typ. (15 VDC single model) (By Zener diode)
Transient Response	- Response Time	250 µs typ. (25% Load Step)

### 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	<a href="http://www.tracopower.com/ten40wi-safety-cert">www.tracopower.com/ten40wi-safety-cert</a>
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:	<a href="http://www.tracopower.com/ten40wi-emc-filter">www.tracopower.com/ten40wi-emc-filter</a>
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 B EN 61000-4-5, ±1 kV, perf. criteria A
	- Conducted RF Disturbances	Ext. input component: 220 µF / 100 V / KY 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

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

## General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Case Temperature - Storage Temperature	-40°C to +85°C +105°C max. -55°C to +125°C
Power Derating	- High Temperature	Depending on model See application note: <a href="http://www.tracopower.com/ten40wi-cc">www.tracopower.com/ten40wi-cc</a>
Over Temperature Protection Switch Off	- Protection Mode	110°C typ.
Cooling System		Natural convection (20 LFM)
Sense Function		10% max. of Vout nom. (if sense function is not used, sense pins must be connected to corresponding polarity output pins.)
Remote Control	- Voltage Controlled Remote (passive = on)  - Off Idle Input Current  - Remote Pin Input Current	On: 3.0 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 10 mA typ. (24 Vin models) 5 mA (48 Vin models) -0.5 to 0.5 mA
Altitude During Operation		2'000 m max.
Switching Frequency		270 - 330 kHz (PWM) 300 kHz typ. (PWM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s - Input to Case, 60 s - Output to Case, 60 s	1'600 VDC 1'600 VDC 1'600 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	2'500 pF typ.
Reliability	- Calculated MTBF	660'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration  - Mechanical Shock  - Thermal Shock	MIL-STD-810F 7.6 g, 3 axis, 60 min, 20-2000 Hz MIL-STD-810F 40 g, 3 axis, half sine, 11 ms 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)

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Environmental Compliance - REACH Declaration

[www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)

- RoHS Declaration

REACH SVHC list compliant

REACH Annex XVII compliant

[www.tracopower.com/info/rohs-declaration.pdf](http://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

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### Additional Information

Supporting Documents

[www.tracopower.com/overview/ten40wi](http://www.tracopower.com/overview/ten40wi)

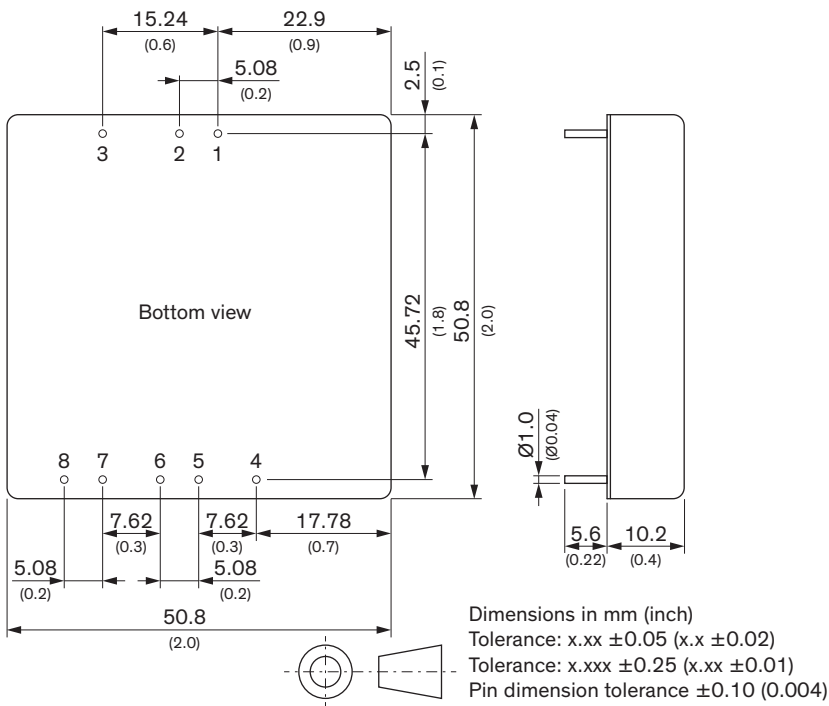
Frequently Asked Questions

[www.tracopower.com/glossary-faq](http://www.tracopower.com/glossary-faq)

Glossary

[www.tracopower.com/info/glossary.pdf](http://www.tracopower.com/info/glossary.pdf)

### Outline Dimensions



### Pinout

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

\*Sense line to be connected to the output either at the module or at the load under regard of polarity.