TRACO POWER

DC/DC Converter

TEN 40WIR Series, 40 Watt

- **2" x 1" x 0.4" metal package**
- **Ultra wide 4:1 input voltage range 9–36, 18–75, 43–160 VDC**
- **EN 50155 approval for railway applications**
- **Thermal shock and vibration resistant according EN 61373**
- **High efficiency up to 92%**
- **Operating temperature range –40°C to +85°C**
- **Under voltage lock-out circuit**
- **Remote On/Off and Output voltage adjustable**
- **3-year product warranty**

UL 60950-1 IEC 60950-1

The TEN 40WIR series is a family of high performance 40 Watt DC/DC converter modules featuring ultra wide 4:1 input voltage ranges in a 2" x 1" x 0.4" package with industry-standard footprint. Input voltages up to 160 VDC, excellent EMC characteristics and EN 50155 approval make this product the best choice for many demanding applications in railroad and transportation systems. Further standard features include remote On/Off, over voltage protection, under voltage lockout and short circuit protection. Low input current characteristics at minimal load make these converters also the ideal solution for battery-operated systems. Typical applications are in wireless networks, telecom/-datacom, industry control systems and measurement equipment.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TEN 40-2410WIR	9 - 36 VDC (24 VDC nom.)	3.3 VDC	10'000 mA			90 %
TEN 40-2411WIR		5 VDC	8'000 mA			91 %
TEN 40-2412WIR		12 VDC	3'333 mA			92 %
TEN 40-2413WIR		15 VDC	2'666 mA			92 %
TEN 40-2415WIR		24 VDC	1'666 mA			91 %
TEN 40-2422WIR		+12 VDC	1'666 mA	–12 VDC	1'666 mA	90 %
TEN 40-2423WIR		+15 VDC	1'333 mA	–15 VDC	1'333 mA	90 %
TEN 40-2425WIR		+24 VDC	833 mA	–24 VDC	833 mA	91 %
TEN 40-4810WIR	18 - 75 VDC (48 VDC nom.)	3.3 VDC	10'000 mA			90 %
TEN 40-4811WIR		5 VDC	8'000 mA			91 %
TEN 40-4812WIR		12 VDC	3'333 mA			92 %
TEN 40-4813WIR		15 VDC	2'666 mA			92 %
TEN 40-4815WIR		24 VDC	1'666 mA			91 %
TEN 40-4822WIR		+12 VDC	1'666 mA	–12 VDC	1'666 mA	90 %
TEN 40-4823WIR		+15 VDC	1'333 mA	–15 VDC	1'333 mA	90 %
TEN 40-4825WIR		+24 VDC	833 mA	–24 VDC	833 mA	91 %
TEN 40-7210WIR	43 - 160 VDC (110 VDC nom.)	3.3 VDC	10'000 mA			88 %
TEN 40-7211WIR		5 VDC	8'000 mA			89 %
TEN 40-7212WIR		12 VDC	3'333 mA			91 %
TEN 40-7213WIR		15 VDC	2'666 mA			91 %
TEN 40-7215WIR		24 VDC	1'666 mA			90 %
TEN 40-7222WIR		+12 VDC	1'666 mA	–12 VDC	1'666 mA	89 %
TEN 40-7223WIR		+15 VDC	1'333 mA	–15 VDC	1'333 mA	89 %
TEN 40-7225WIR		+24 VDC	833 mA	–24 VDC	833 mA	91 %

Options

TEN-HS1	- Optional Heat Sink: www.tracopower.com/products/ten-hs1.pdf

Note - The outputs of the ±24 Vout models can also be used in serial circuit for 48 VDC operation. Free-wheeling diodes are not necessary but recommended for increased performance for start-up with inductive / capacitive load operation.

Input Specifications

Input Current	- At no load	24 Vin models:	**15 mA typ.**
		48 Vin models:	**10 mA typ.**
		110 Vin models:	**10 mA typ.**
Surge Voltage		24 Vin models:	**50 VDC max.** (1 s max.)
		48 Vin models:	**100 VDC max.** (1 s max.)
		110 Vin models:	**170 VDC max.** (1 s max.)
Under Voltage Lockout		24 Vin models:	**7.5 VDC min. / 8 VDC typ. / 8.8 VDC max.**
		48 Vin models:	**15 VDC min. / 16 VDC typ. / 17.5 VDC max.**
		110 Vin models:	**37 VDC min. / 40 VDC typ. / 42 VDC max.**
Reflected Ripple Current		24 Vin models:	**20 mAp-p typ.**
		48 Vin models:	**20 mAp-p typ.**
		110 Vin models:	**20 mAp-p typ.**
Recommended Input Fuse		24 Vin models:	**8'000 mA** (fast acting)
		48 Vin models:	**4'000 mA** (slow blow)
		110 Vin models:	**3'150 mA** (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			**Internal Pi-Type**

Output Specifications

Output Voltage Adjustment			**–10% to +20%** (15 & 24 Vout models)
			±10% (other models)
			(single output models only)
			(By external trim resistor)
		See application note:	www.tracopower.com/overview/ten40wir
			Output power must not exceed rated power!
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)	- single output	3.3 Vout models:	**75 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
		5 Vout models:	**75 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
		12 Vout models:	**100 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
		15 Vout models:	**100 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
		24 Vout models:	**150 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
	- dual output	12 / -12 Vout models:	**100 / 100 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
		15 / -15 Vout models:	**100 / 100 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
		24 / -24 Vout models:	**150 / 150 mVp-p typ.** (w/ 0.1 µF, 50 V X7R)
	- single output	3.3 Vout models:	**100 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
		5 Vout models:	**100 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
		12 Vout models:	**125 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
		15 Vout models:	**125 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
		24 Vout models:	**200 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
	- dual output	12 / -12 Vout models:	**125 / 125 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
		15 / -15 Vout models:	**125 / 125 mVp-p max.** (w/ 0.1 µF, 50 V X7R)
		24 / -24 Vout models:	**200 / 200 mVp-p max.** (w/ 0.1 µF, 50 V X7R)

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

Capacitive Load	- single output	3.3 Vout models:	26'600 µF max.
		5 Vout models:	20'000 µF max.
		12 Vout models:	3'900 µF max.
		15 Vout models:	2'600 µF max.
		24 Vout models:	1'300 µF max.
	- dual output	12 / -12 Vout models:	2'600 / 2'600 µF max.
		15 / -15 Vout models:	1'600 / 1'600 µF max.
		24 / -24 Vout models:	650 / 650 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			60 ms typ.
Short Circuit Protection			Continuous, Automatic recovery
Overload Protection			Indefinite Mode
Output Current Limitation			125 - 210% of Iout max. 150% typ. of Iout max.
Overvoltage Protection			125% typ. of Vout nom. (By Zener diode)
Transient Response	- Response Deviation		10% max. (25% Load Step)
	- Response Time		250 µs typ. (25% Load Step)

Safety Specifications

Safety Standards	- IT / Multimedia Equipment		EN 60950-1 IEC 60950-1 UL 60950-1
	- Railway Applications		EN 50155
	- Certification Documents		www.tracopower.com/overview/ten40wir
Pollution Degree			PD 2

EMC Specifications

EMI Emissions			EN 50121-3-2 (EMC for Rolling Stock)
	- 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/ten40wir
EMS Immunity			EN 50155 (Railway Applications) EN 50121-3-2 (EMC for Rolling Stock)
	- 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, 20 V/m, perf. criteria A
	- EFT (Burst) / Surge		EN 61000-4-4, ±2 kV, perf. criteria A EN 61000-4-5, ±2 kV, perf. criteria A
		Ext. input component:	220 µF, 100 V, KY// SMDJ58A (24 Vin) 220 µF, 100 V, KY // SMDJ120A (48 Vin) 2x 150 µF, 200 V, KXJ // 2x SMDJ90A (110 Vin)
	- 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 –40°C to +90°C (with Heat Sink)
	- Case Temperature	+105°C max.
	- Storage Temperature	–55°C to +125°C

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Power Derating	- High Temperature	2.5 %/K above 60°C 2.8 %/K above 65°C (with Heat Sink)
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	3 mA max.
	- Remote Pin Input Current	-0.5 to 0.5 mA
Altitude During Operation		2'000 m max.
Switching Frequency		225 - 275 kHz (PWM) 250 kHz typ. (PWM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s	3'000 VDC (110 Vin models) 1600 VDC (other models)
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'500 pF max.
Reliability	- Calculated MTBF	900'000 h (MIL-HDBK-217F, ground benign)
Environment	- Vibration	MIL-STD-810F EN 61373
	- Mechanical Shock	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F EN 50155
Housing Material		Copper
Base Material		Non-conductive FR4 (UL94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (2 - 3 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Soldering Profile		Wave Soldering 265°C / 10 s max.
Connection Type		THD (Through-Hole Device)
Weight		32 g
Thermal Impedance		10.8 K/W 10.3 K/W (with Heat Sink)
Environmental Compliance	- Reach	www.tracopower.com/info/reach-declaration.pdf
	- RoHS	www.tracopower.com/info/rohs-declaration.pdf
	- Flammability (EN 45545-2)	www.tracopower.com/info/en45545-declaration.pdf

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/ten40wir

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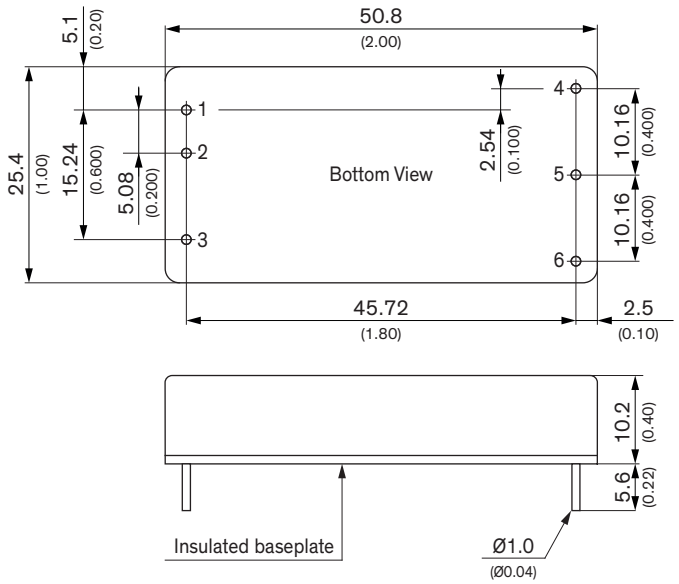
Outline Dimensions



Dimensions in mm (inch)
Tolerance: x.x ±0.50 (±0.02)
Tolerance: x.xx ±0.25 (±0.01)
Pin pitch tolerance ±0.25 (0.01)
Pin dimension tolerance ±0.10 (0.04)

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