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TRACO POWER

DC/DC Railway Converter

TEN 20WIR Series, 20 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**
- **Input filter meets EN 55032 class B without external components**
- **High efficiency up to 89%**
- **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 62368-1 IEC 62368-1

The TEN 20WIR series is a family of high performance 20 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 20-2410WIR	9 - 36 VDC (24 VDC nom.)	3.3 VDC	4'500 mA			85 %
TEN 20-2411WIR		5 VDC	4'000 mA			88 %
TEN 20-2412WIR		12 VDC	1'670 mA			89 %
TEN 20-2413WIR		15 VDC	1'330 mA			88 %
TEN 20-2422WIR		+12 VDC	833 mA	−12 VDC	833 mA	88 %
TEN 20-2423WIR		+15 VDC	667 mA	−15 VDC	667 mA	89 %
TEN 20-4810WIR	18 - 75 VDC (48 VDC nom.)	3.3 VDC	4'500 mA			85 %
TEN 20-4811WIR		5 VDC	4'000 mA			88 %
TEN 20-4812WIR		12 VDC	1'670 mA			89 %
TEN 20-4813WIR		15 VDC	1'330 mA			89 %
TEN 20-4822WIR		+12 VDC	833 mA	−12 VDC	833 mA	88 %
TEN 20-4823WIR		+15 VDC	667 mA	−15 VDC	667 mA	89 %
TEN 20-7210WIR	43 - 160 VDC (110 VDC nom.)	3.3 VDC	4'500 mA			85 %
TEN 20-7211WIR		5 VDC	4'000 mA			87 %
TEN 20-7212WIR		12 VDC	1'670 mA			88 %
TEN 20-7213WIR		15 VDC	1'330 mA			88 %
TEN 20-7222WIR		+12 VDC	833 mA	−12 VDC	833 mA	88 %
TEN 20-7223WIR		+15 VDC	667 mA	−15 VDC	667 mA	89 %

Options

TEN-HS1	- Optional Heat Sink with Height = 0.22 inch: www.tracopower.com/overview/ten-hs1

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Input Specifications

Input Current	- At no load	24 Vin models:	6 mA typ.
		48 Vin models:	4 mA typ.
		110 Vin models:	3 mA typ.
Surge Voltage		24 Vin models:	50 VDC max. (100 ms max.)
		48 Vin models:	100 VDC max. (100 ms max.)
		110 Vin models:	170 VDC max. (100 ms max.)
Under Voltage Lockout		24 Vin models:	7.5 VDC min. / 8 VDC typ. / 8.8 VDC max.
		48 Vin models:	15.5 VDC min. / 16 VDC typ. / 17.5 VDC max.
		110 Vin models:	38.5 VDC min. / 40 VDC typ. / 42 VDC max.
Reflected Ripple Current			30 mAp-p typ.
Recommended Input Fuse		24 Vin models:	4'000 mA (slow blow)
		48 Vin models:	2'000 mA (slow blow)
		110 Vin models:	1'000 mA (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Pi-Type (110 Vin models) Common Choke (other models)

Output Specifications

Output Voltage Adjustment			±10% (single output models only) (By external trim resistor)
		See application note:	www.tracopower.com/ten20wir-adj/
			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:	0.5% max.
	- Load Variation (10 - 90%)	single output models:	0.1% max.
		dual output models:	0.8% max. (Output 1)
			0.8% 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/ 1 µF, 50 V X7R)
		5 Vout models:	75 mVp-p typ. (w/ 1 µF, 50 V X7R)
		12 Vout models:	100 mVp-p typ. (w/ 1 µF, 50 V X7R)
		15 Vout models:	100 mVp-p typ. (w/ 1 µF, 50 V X7R)
	- dual output	12 / -12 Vout models:	100 / 100 mVp-p typ. (w/ 1 µF, 50 V X7R)
		15 / -15 Vout models:	100 / 100 mVp-p typ. (w/ 1 µF, 50 V X7R)
Capacitive Load	- single output	3.3 Vout models:	7'000 µF max.
		5 Vout models:	5'000 µF max.
		12 Vout models:	850 µF max.
		15 Vout models:	700 µF max.
	- dual output	12 / -12 Vout models:	500 / 500 µF max.
		15 / -15 Vout models:	350 / 350 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Hold-up Time			10 ms min. (acc. to EN 50155 Class S2, see application note for ext. capacitor calculation: www.tracopower.com/info/holdup_en50155.pdf)
Start-up Time			30 ms max.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			125 - 188% of Iout max. 150% typ. of Iout max.
Overvoltage Protection			110 - 165% of Vout nom.
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.

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Safety Specifications

Standards	- IT / Multimedia Equipment		EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Railway Applications		EN 50155
	- Certification Documents		www.tracopower.com/ten20wir-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)			EN 50121-3-2 (EMC for Rolling Stock)
	- Conducted Emissions		EN 55032 class A (internal filter) EN 55032 class B (internal filter)
	- Radiated Emissions		EN 55032 class A (internal filter) EN 55032 class B (internal filter)
		External filter proposal:	www.tracopower.com/ten20wir-emc-filter/ (110 Vin models: external filter for class B)
EMS (Immunity)			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 (24 & 48 Vin models) 100 µF, 250 V, BXF (110 Vin model)
	- 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
EMC / Environmental	- Certification Documents		www.tracopower.com/ten20wir-emc-cert/

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +86°C –40°C to +91°C (with heatsink TEN-HS1)
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/ten20wir-cc/
Cooling System			Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on)		On: 3.0 to 15 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 1.0 mA
Altitude During Operation			5'000 m max.
Regulator Topology			Flyback Converter
Switching Frequency			297 - 363 kHz (PWM) 330 kHz typ. (PWM)
Insulation System			Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s		2'250 VDC
	- Input to Case, 60 s		1'600 VDC

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

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Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	3'000 pF max.
Reliability	- Calculated MTBF	1'500'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F EN 61373
	- Mechanical Shock	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F
	- Flammability	EN 45545-2 www.tracopower.com/info/en45545-declaration.pdf
Housing Material		Copper, Nickel plated
Base Material		Non-conductive FR4 (UL 94 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
Housing Type		Metal Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		2" x 1"
Soldering Profile		Lead-Free Wave Soldering 265°C / 10 s max.
Weight		30 g
Thermal Impedance	- Case to Ambient	12.0 K/W typ. 10.0 K/W typ. (with heatsink TEN-HS1)
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	adacaa16-264a-497b-ab20-9b54c430be79

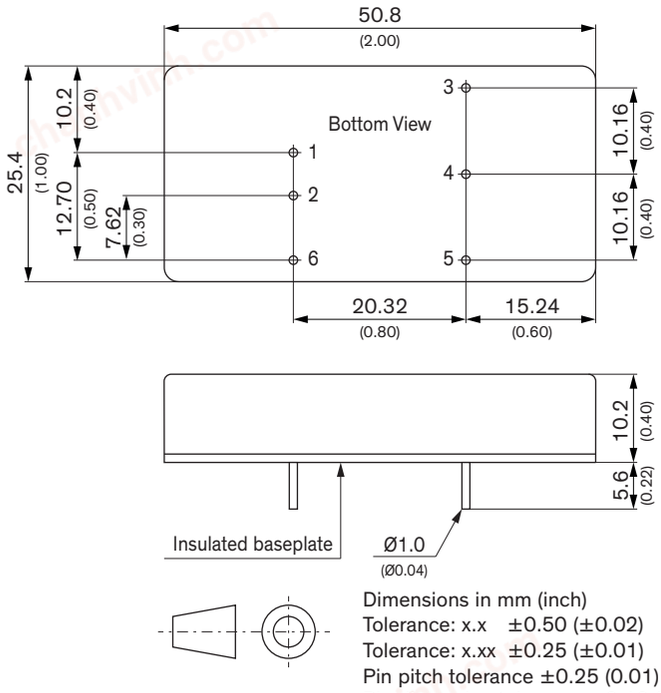
Additional Information

Supporting Documents	www.tracopower.com/overview/ten20wir
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf
Service Portal	www.tracoserviceportal.com

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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	+Vout	+Vout
4	Trim	Common
5	–Vout	–Vout
6	Remote On/Off	Remote On/Off

Avoid routing PCB traces under the converter.

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