

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



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 typ.
		Vnom	I _{max}	Vnom	I _{max}	
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

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 mA_{p-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/overview/ten20wir Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (V _{min} - V _{max})	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 V _{out} models: 75 mV_{p-p} typ. (w/ 1 μ F, 50 V X7R) 5 V _{out} models: 75 mV_{p-p} typ. (w/ 1 μ F, 50 V X7R) 12 V _{out} models: 100 mV_{p-p} typ. (w/ 1 μ F, 50 V X7R) 15 V _{out} models: 100 mV_{p-p} typ. (w/ 1 μ F, 50 V X7R)
	- dual output	12 / -12 V _{out} models: 100 / 100 mV_{p-p} typ. (w/ 1 μ F, 50 V X7R) 15 / -15 V _{out} models: 100 / 100 mV_{p-p} typ. (w/ 1 μ F, 50 V X7R)
Capacitive Load	- single output	3.3 V _{out} models: 7'000 μF max. 5 V _{out} models: 5'000 μF max. 12 V _{out} models: 850 μF max. 15 V _{out} models: 700 μF max.
	- dual output	12 / -12 V _{out} models: 500 / 500 μF max. 15 / -15 V _{out} 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) 30 ms max.
Start-up Time		30 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		125 - 188% of I_{out} max. 150% typ. of I_{out} max.
Overvoltage Protection		110 - 165% of V_{out} 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.

Safety Specifications

Standards	- IT / Multimedia Equipment	EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1 EN 50155
	- Railway Applications	
	- Certification Documents	www.tracopower.com/overview/ten20wir
Pollution Degree		PD 2
Over Voltage Category		OVC I

EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 50121-3-2 (EMC for Rolling Stock) 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/overview/ten20wir (110 Vin models: external filter for class B)
EMS (Immunity)	- Electrostatic Discharge	EN 50121-3-2 (EMC for Rolling Stock) Air: EN 61000-4-2, ± 8 kV, perf. criteria A Contact: EN 61000-4-2, ± 6 kV, perf. criteria A EN 61000-4-3, 20 V/m, perf. criteria A EN 61000-4-4, ± 2 kV, perf. criteria A EN 61000-4-5, ± 2 kV, perf. criteria A
	- RF Electromagnetic Field	
	- EFT (Burst) / Surge	Ext. input component: 220 μ F, 100 V, KY (24 & 48 Vin models) 100 μ F, 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/overview/ten20wir

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +86°C
	- Case Temperature	-40°C to +91°C (with Heat Sink)
	- Storage Temperature	+105°C max.
Power Derating	- High Temperature	-55°C to +125°C
	See application note:	www.tracopower.com/overview/ten20wir
Cooling System		Depending on model
Remote Control	- Voltage Controlled Remote (passive = on)	Natural convection (20 LFM)
	- Off Idle Input Current	On: 3.0 to 15 VDC or open circuit
	- Remote Pin Input Current	Off: 0 to 1.2 VDC or short circuit
Altitude During Operation		Refers to 'Remote' and '-Vin' Pin
Regulator Topology		2.5 mA typ.
Switching Frequency		-0.5 to 1.0 mA
Insulation System		5'000 m max.
Isolation Test Voltage	- Input to Output, 60 s	Flyback Converter
	- Input to Case, 60 s	297 - 363 kHz (PWM)
Isolation Resistance	- Input to Output, 500 VDC	330 kHz typ. (PWM)
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	Functional Insulation
		2'250 VDC
		1'600 VDC
		1'000 M Ω min.
		3'000 pF max.

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

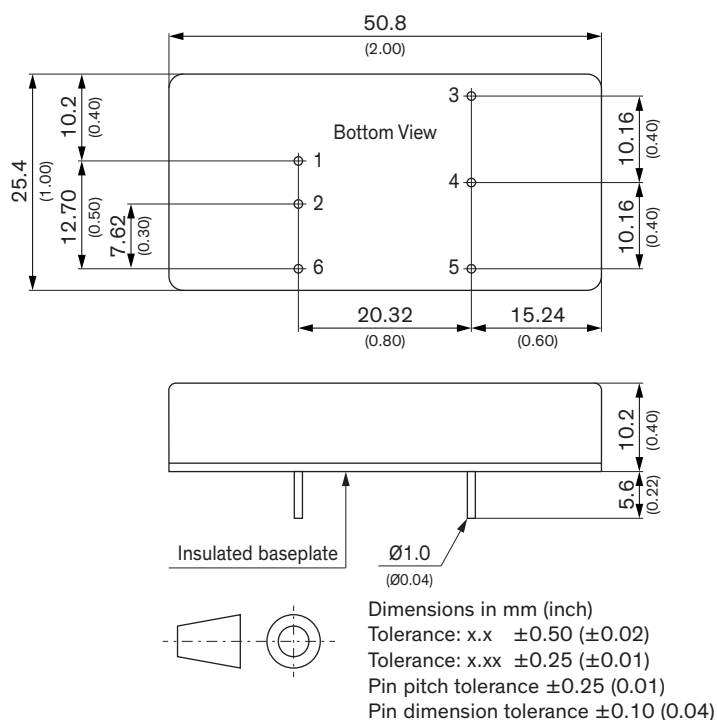
Reliability	- Calculated MTBF	1'500'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration - Mechanical Shock - Thermal Shock - Flammability	MIL-STD-810F EN 61373 MIL-STD-810F EN 61373 MIL-STD-810F EN 45545-2 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 K/W typ. 10 K/W typ. (with Heat Sink)
Environmental Compliance	- REACH Declaration - RoHS Declaration - SCIP Reference Number	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant 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).) 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

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Outline Dimensions



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