TRACO POWER

DC/DC Railway Converter — TEN 10WIRH Series, 10 Watt

- **Fully encapsulated DIP-24 package**
- **4000 VAC I/O isolation (reinforced)**
- **4:1 input voltage range: 36 – 160 VDC**
- **EN 50155 and EN 61373 certified**
- **Internal class A EMI filter**
- **-40°C up to +75°C without derating**
- **EN 45545-2 fire behavior**
- **Remote on/off function**
- **Undervoltage lockout (UVLO), short-circuit protection (SCP), overtemperature protection (OTP), and overvoltage protection (OVP)**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TEN 10WIRH is a series of 10 watt railway-certified DC/DC converters with reinforced I/O isolation for highest reliability in harsh environments. The proven and certified design guarantees highest resistance against thermal shocks, moisture, mechanical shocks, and vibration. The TEN 10WIRH comes with additional EN 62368-1 safety approvals for IT equipment and EN 45545-2 certification for fire behavior. Thanks to its favorable operating temperature range of -40°C to +75°C without derating (depending on the model), the TEN 10WIRH presents a first choice for demanding applications.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TEN 10-11010WIRH	36 - 160 VDC (110 VDC nom.)	3.3 VDC	2'500 mA			83 %
TEN 10-11011WIRH		5.1 VDC	2'000 mA			87 %
TEN 10-11012WIRH		12 VDC	830 mA			88 %
TEN 10-11013WIRH		15 VDC	670 mA			88 %
TEN 10-11015WIRH		24 VDC	416 mA			88 %
TEN 10-11021WIRH		+5 VDC	1'000 mA	–5 VDC	1'000 mA	84 %
TEN 10-11022WIRH		+12 VDC	416 mA	–12 VDC	416 mA	87 %
TEN 10-11023WIRH		+15 VDC	333 mA	–15 VDC	333 mA	87 %

Options

on demand (backorder with MOQ non stocking item)	- Optional models with adjustable output voltage

Input Specifications

Input Current	- At no load		6 mA typ.
Surge Voltage			200 VDC max. (1 s max.)
Input Inrush Current			35 A typ.
Start-up Voltage			36 VDC
Under Voltage Lockout			32 VDC min. / 34 VDC typ. / 35.8 VDC max.
Recommended Input Fuse			630 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Pi-Type

Output Specifications

Voltage Set Accuracy			±1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models:	0.2% max.
		dual output models:	0.5% max.
	- Load Variation (0 - 100%)	single output models:	0.2% max.
		dual output models:	1% max. (Output 1)
			1% max. (Output 2)
	- Voltage Balance (symmetrical load)	dual output models:	2% max.
	- Cross Regulation (25% / 100% asym. load)	dual output models:	5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models:	50 mVp-p typ. (w/ 10µF)
		5.1 Vout models:	50 mVp-p typ. (w/ 10µF)
		12 Vout models:	75 mVp-p typ. (w/ 10µF)
		15 Vout models:	75 mVp-p typ. (w/ 10µF)
		24 Vout models:	75 mVp-p typ. (w/ 4.7µF)
	- dual output	5 / -5 Vout models:	75 / 75 mVp-p typ. (w/ 10µF)
		12 / -12 Vout models:	75 / 75 mVp-p typ. (w/ 10µF)
		15 / -15 Vout models:	75 / 75 mVp-p typ. (w/ 10µF)
Capacitive Load	- single output	3.3 Vout models:	3'000 µF max.
		5.1 Vout models:	2'500 µF max.
		12 Vout models:	430 µF max.
		15 Vout models:	350 µF max.
		24 Vout models:	125 µF max.
	- dual output	5 / -5 Vout models:	1'440 / 1'440 µF max.
		12 / -12 Vout models:	250 / 250 µF max.
		15 / -15 Vout models:	180 / 180 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			30 ms typ. / 60 ms max.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			150% typ. of Iout max.
Overvoltage Protection			112 - 151% of Vout nom. (depending on model) 3.7 - 5 VDC (3.3 VDC model) 5.6 - 7 VDC (5 VDC model) 13.5 - 16 VDC (12 VDC model) 18.3 - 22 VDC (15 VDC model) 29.1 - 34.5 VDC (24 VDC model) 5.6 - 7 VDC (±5 VDC model) 13.5 - 18.2 VDC (±12 VDC model) 17 - 22 VDC (±15 VDC model)

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

Transient Response	- Peak Variation		320 mV typ. / 400 mV max. (75% to 100% Load Step)
	- Response Time		250 µs typ. / 300 µs max. (75% to 100% Load Step)

Safety Specifications

Safety Standards	- IT / Multimedia Equipment		EN 62368-1 IEC 62368-1 UL 62368-1
	- Railway Applications		EN 50155
	- Certification Documents		www.tracopower.com/overview/ten10wirh
Pollution Degree			PD 2
Over Voltage Category			OVC II

EMC Specifications

EMI Emissions			EN 50121-3-2 (EMC for Rolling Stock)
	- Conducted Emissions		EN 55032 class A (internal filter) EN 55032 class B (with external filter)
	- Radiated Emissions		EN 55032 class A (internal filter) EN 55032 class B (with external filter)
		External filter proposal:	www.tracopower.com/overview/ten10wirh
EMS Immunity			EN 50155 (Railway Applications) EN 50121-3-2 (EMC for Rolling Stock) EN 55024 (IT Equipment)
	- 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:	2x 220 µF, 200 V, KXJ // SMBJ220A
	- 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
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature	See application note:	www.tracopower.com/overview/ten10wirh
Cooling System			Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote		On: 3.0 to 12 VDC or open circuit On: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current		2.5 mA typ. / 3 mA max.
Altitude During Operation			5'000 m max.
Switching Frequency			270 - 330 kHz (PWM) 300 kHz typ. (PWM)
Insulation System			Reinforced Insulation
Working Voltage (rated)			189 VAC
Isolation Test Voltage	- Input to Output, 60 s		3'000 VAC
	- Input to Case, 60 s		3'000 VAC
	- Output to Case, 60 s		2'000 VAC
Creepage	- Input to Output		4.5 mm min.
Clearance	- Input to Output		4.5 mm min.
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.

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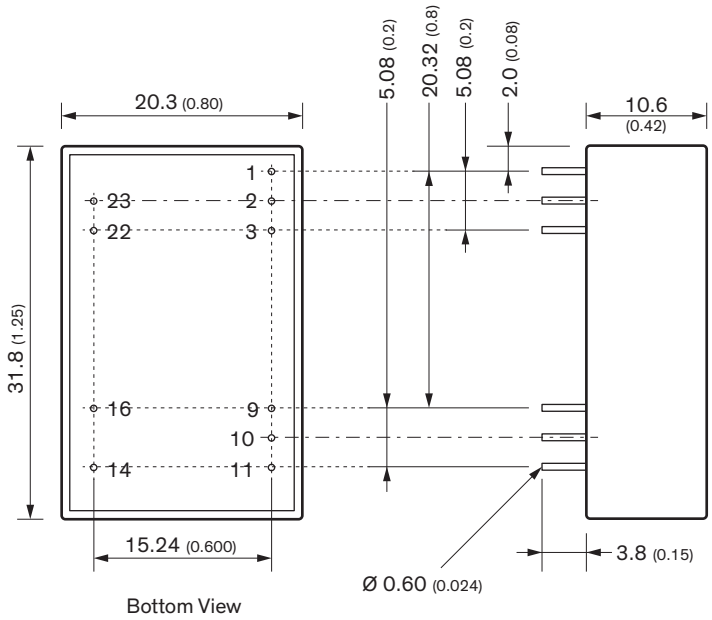
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	650 pF typ. 1'000 pF max.
Reliability	- Calculated MTBF	1'648'000 h (MIL-HDBK-217F, ground benign)
Washing Process		Allowed (hermetical product) Baking after washing: 100°C for 45 min
	See Cleaning Guideline:	www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F EN 61373
	- Mechanical Shock	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F EN 50155
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Base Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Tinned Copper
Pin Foundation Plating		Nickel (2 - 3 µm)
Pin Surface Plating		Tin (3 - 5 µm), matte
Soldering Profile		Wave Soldering 260°C / 6 s max.
Connection Type		THD (Through-Hole Device)
Weight		14 g
Thermal Impedance		8.3 K/W
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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)
	- Flammability (EN 45545-2)	www.tracopower.com/info/en45545-declaration.pdf

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/ten10wirh

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Outline Dimensions



Bottom View

All dimension in mm (inch)
Tolerance: X.X ±0.5 (X.XX ±0.02)
X.XX ±0.25 (X.XXX ±0.010)
Pin dimension tolerance ±0.10 (±0.004)

Pinout		
Pin	**SinIge**	**Dual**
1	Ctrl	Ctrl
2	- Vin	- Vin
3	- Vin	- Vin
9	NC	Common
10	No Pin / Trim (option)	No Pin / Trim (option)
11	NC	- Vout
14	+ Vout	+ Vout
16	- Vout	Common
22	+ Vin	+ Vin
23	+ Vin	+ Vin

NC = not connected

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