

- 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 +95°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



The TEN 3WIRH is a series of 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 3WIRH 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 +95°C without derating (depending on the model), the TEN 3WIRH presents a first choice for demanding applications.

Models

| Order Code | Input Voltage Range | Output 1 | | Output 2 | | Efficiency typ. |
|-----------------|--------------------------------|----------|------------------|----------|------------------|-----------------|
| | | Vnom | I _{max} | Vnom | I _{max} | |
| TEN 3-11010WIRH | 36 - 160 VDC (110 VDC nom.) | 3.3 VDC | 1'000 mA | | | 80 % |
| TEN 3-11011WIRH | | 5 VDC | 600 mA | | | 82 % |
| TEN 3-11012WIRH | | 12 VDC | 250 mA | | | 85 % |
| TEN 3-11013WIRH | | 15 VDC | 200 mA | | | 84 % |
| TEN 3-11015WIRH | | 24 VDC | 125 mA | | | 85 % |
| TEN 3-11021WIRH | | +5 VDC | 300 mA | -5 VDC | 300 mA | 81 % |
| TEN 3-11022WIRH | | +12 VDC | 125 mA | -12 VDC | 125 mA | 84 % |
| TEN 3-11023WIRH | | +15 VDC | 100 mA | -15 VDC | 100 mA | 85 % |

Options

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

Input Specifications

| | | |
|------------------------|--------------|---|
| Input Current | - At no load | 3 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 | | 315 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 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: 1'050 µF max. |
| | | 5 Vout models: 750 µF max. |
| | | 12 Vout models: 130 µF max. |
| | | 15 Vout models: 100 µF max. |
| | - dual output | 24 Vout models: 39 µF max. |
| | | 5 / -5 Vout models: 430 / 430 µF max. 12 / -12 Vout models: 75 / 75 µF max. 15 / -15 Vout models: 56 / 56 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 | 125 mV typ. / 160 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 - Certification Documents | EN 50155 www.tracopower.com/overview/ten3wirh |
| Pollution Degree | | PD 2 |
| Over Voltage Category | | OVC II |

EMC Specifications

| | | |
|---------------|-----------------------------|---|
| EMI Emissions | - Conducted Emissions | EN 50121-3-2 (EMC for Rolling Stock) 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/ten3wirh |
| 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 |
| | - Conducted RF Disturbances | Ext. input component: 2x 220 µF, 200 V, KXJ // SMBJ220A 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 +95°C |
| | - Case Temperature | +105°C max. |
| | - Storage Temperature | -55°C to +125°C |
| Power Derating | - High Temperature | See application note: www.tracopower.com/overview/ten3wirh |
| Cooling System | | Natural convection (20 LFM) |
| Remote Control | - Voltage Controlled Remote | On: 3.0 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 2.5 mA typ. / 3 mA max. |
| | - Off Idle Input Current | |
| Altitude During Operation | | 5'000 m max. |
| Switching Frequency | | 215 - 265 kHz (PWM) |
| | | 240 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. |

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

| | | |
|--------------------------|---------------------------------|--|
| Isolation Capacitance | - Input to Output, 100 kHz, 1 V | 650 pF typ. 1'000 pF max. |
| Reliability | - Calculated MTBF | 5'069'000 h (MIL-HDBK-217F, ground benign) |
| Washing Process | | Allowed (hermetical product) Baking after washing: 100°C for 45 min 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 | | 19.2 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 |

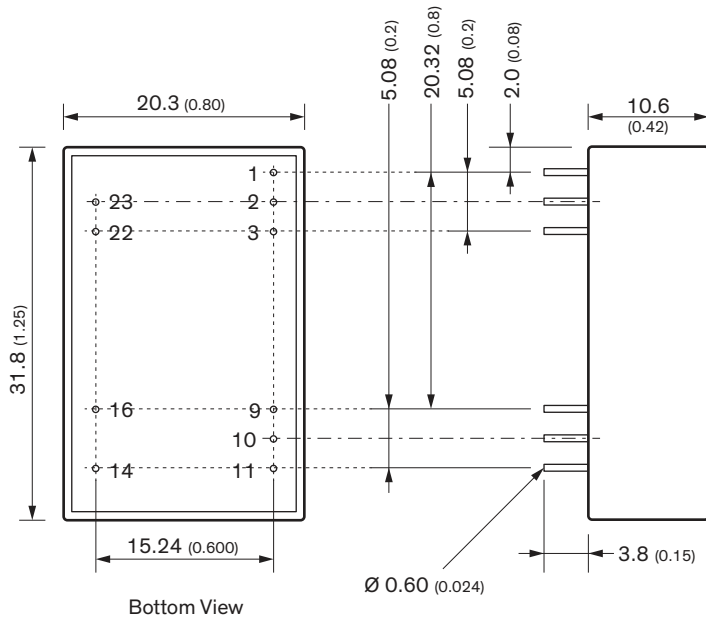
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/ten3wirh

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Outline Dimensions



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 | Single | 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