

- Fully encapsulated DIP-24 package
- 3000 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 +85°C without derating
- EN 45545-2 fire behavior
- Remote on/off function
- Undervoltage lockout (UVLO), short-circuit protection (SCP), and overvoltage protection (OVP)
- 3-year product warranty



The TEN 6WIRH is a series of 6 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 6WIRH 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 +85°C without derating (depending on the model), the TEN 6WIRH 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 6-11010WIRH | 36 - 160 VDC (110 VDC nom.) | 3.3 VDC | 1'800 mA | | | 83 % |
| TEN 6-11011WIRH | | 5 VDC | 1'200 mA | | | 86 % |
| TEN 6-11012WIRH | | 12 VDC | 500 mA | | | 87 % |
| TEN 6-11013WIRH | | 15 VDC | 400 mA | | | 86 % |
| TEN 6-11015WIRH | | 24 VDC | 250 mA | | | 86 % |
| TEN 6-11021WIRH | | +5 VDC | 600 mA | -5 VDC | 600 mA | 83 % |
| TEN 6-11022WIRH | | +12 VDC | 250 mA | -12 VDC | 250 mA | 86 % |
| TEN 6-11023WIRH | | +15 VDC | 200 mA | -15 VDC | 200 mA | 86 % |

Options

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

Input Specifications

| | | |
|------------------------|--------------|---|
| Input Current | - At no load | 4 mA typ. |
| Surge Voltage | | 200 VDC max. (1 s max.) |
| Input Inrush Current | | 35 A typ. |
| Under Voltage Lockout | | 32 VDC min. / 34 VDC typ. / 35.8 VDC max. |
| Recommended Input Fuse | | 500 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/ 10 µF) |
| | | 5 Vout models: 50 mVp-p typ. (w/ 10 µF) |
| | | 12 Vout models: 75 mVp-p typ. (w/ 10 µF) |
| | | 15 Vout models: 75 mVp-p typ. (w/ 10 µF) |
| | | 24 Vout models: 75 mVp-p typ. (w/ 4.7 µF) |
| | - dual output | 5 / -5 Vout models: 75 / 75 mVp-p typ. (w/ 10 µF) 12 / -12 Vout models: 75 / 75 mVp-p typ. (w/ 10 µF) 15 / -15 Vout models: 75 / 75 mVp-p typ. (w/ 10 µF) |
| Capacitive Load | - single output | 3.3 Vout models: 2'100 µF max. |
| | | 5 Vout models: 1'500 µF max. |
| | | 12 Vout models: 260 µF max. |
| | | 15 Vout models: 210 µF max. |
| | - dual output | 24 Vout models: 75 µF max. |
| | | 5 / -5 Vout models: 860 / 860 µF max. 12 / -12 Vout models: 150 / 150 µF max. 15 / -15 Vout models: 110 / 110 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 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 | 170 mV typ. / 300 mV max. (75% to 100% Load Step) |
| | - Response Time | 250 μ s typ. / 300 μ s max. (75% to 100% Load Step) |

Safety Specifications

| | | |
|-----------------------|---|--|
| Standards | - IT / Multimedia Equipment | EN 62368-1 IEC 62368-1 UL 62368-1 |
| | - Railway Applications - Certification Documents | EN 50155 www.tracopower.com/overview/ten6wirh |
| 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/ten6wirh |
| EMS (Immunity) | - Electrostatic Discharge | EN 50121-3-2 (EMC for Rolling Stock) EN 55024 (IT Equipment) EN 55035 (Multimedia) Air: EN 61000-4-2, ± 8 kV, perf. criteria A Contact: EN 61000-4-2, ± 6 kV, perf. criteria A |
| | - RF Electromagnetic Field - EFT (Burst) / Surge | 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 |
| | - Conducted RF Disturbances - PF Magnetic Field | Ext. input component: 2x 220 μ F, 200 V, KXJ SMBJ220A Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A 1 s: EN 61000-4-8, 100 A/m, perf. criteria A EN 61000-4-8, 1000 A/m, perf. criteria A |
| | EMC / Environmental | - Certification Documents www.tracopower.com/overview/ten6wirh |

General Specifications

| | | |
|---------------------------|--|--|
| Relative Humidity | | 95% max. (non condensing) |
| Temperature Ranges | - Operating Temperature | -40°C to +90°C |
| | - 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/overview/ten6wirh |
| Cooling System | | Natural convection (20 LFM) |
| Remote Control | - Voltage Controlled Remote (passive = on) | 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. |
| Regulator Topology | | Flyback Converter |
| 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 |

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

| | | |
|--------------------------|---------------------------------|--|
| 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 M Ω min. |
| Isolation Capacitance | - Input to Output, 100 kHz, 1 V | 650 pF typ. 1'000 pF max. |
| Reliability | - Calculated MTBF | 3'036'000 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 | | 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 μ m) |
| Pin Surface Plating | | Tin (3 - 5 μ m), matte |
| Housing Type | | Plastic Case |
| Mounting Type | | PCB Mount |
| Connection Type | | THD (Through-Hole Device) |
| Footprint Type | | DIP24 |
| Soldering Profile | | Lead-Free Wave Soldering 260°C / 6 s max. |
| Weight | | 14 g |
| Thermal Impedance | - Case to Ambient | 18.9 K/W typ. |
| 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).) |
| | - SCIP Reference Number | ee945d31-c188-4cef-a42e-c4a4db3569ef |

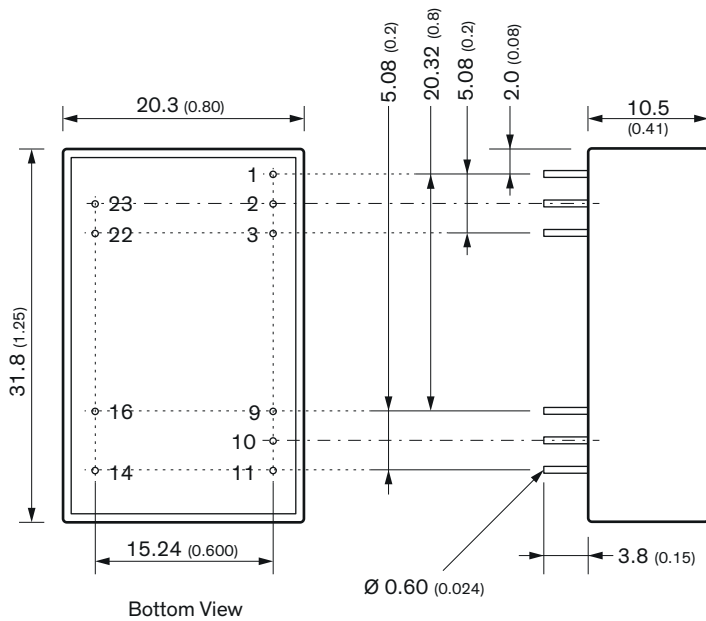
Supporting Documents

Overview Link (for additional Documents)

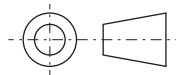
www.tracopower.com/overview/ten6wirh

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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 | Remote On/Off | |
| 2 | -Vin | |
| 3 | -Vin | |
| 9 | NC | Common |
| 10 | No pin / Trim (option) | |
| 11 | NC | -Vout |
| 14 | +Vout | |
| 16 | -Vout | Common |
| 22 | +Vin | |
| 23 | +Vin | |

NC: Not connected