

- 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
- High efficiency up to 92%
- 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 40WIR series is a family of high performance 40 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 40-2410WIR | 9 - 36 VDC (24 VDC nom.) | 3.3 VDC | 10'000 mA | | | 90 % |
| TEN 40-2411WIR | | 5 VDC | 8'000 mA | | | 91 % |
| TEN 40-2412WIR | | 12 VDC | 3'333 mA | | | 92 % |
| TEN 40-2413WIR | | 15 VDC | 2'666 mA | | | 92 % |
| TEN 40-2415WIR | | 24 VDC | 1'666 mA | | | 91 % |
| TEN 40-2422WIR | | +12 VDC | 1'666 mA | -12 VDC | 1'666 mA | 90 % |
| TEN 40-2423WIR | | +15 VDC | 1'333 mA | -15 VDC | 1'333 mA | 90 % |
| TEN 40-2425WIR | | +24 VDC | 833 mA | -24 VDC | 833 mA | 91 % |
| TEN 40-4810WIR | 18 - 75 VDC (48 VDC nom.) | 3.3 VDC | 10'000 mA | | | 90 % |
| TEN 40-4811WIR | | 5 VDC | 8'000 mA | | | 91 % |
| TEN 40-4812WIR | | 12 VDC | 3'333 mA | | | 92 % |
| TEN 40-4813WIR | | 15 VDC | 2'666 mA | | | 92 % |
| TEN 40-4815WIR | | 24 VDC | 1'666 mA | | | 91 % |
| TEN 40-4822WIR | | +12 VDC | 1'666 mA | -12 VDC | 1'666 mA | 90 % |
| TEN 40-4823WIR | | +15 VDC | 1'333 mA | -15 VDC | 1'333 mA | 90 % |
| TEN 40-4825WIR | | +24 VDC | 833 mA | -24 VDC | 833 mA | 91 % |
| TEN 40-7210WIR | 43 - 160 VDC (110 VDC nom.) | 3.3 VDC | 10'000 mA | | | 88 % |
| TEN 40-7211WIR | | 5 VDC | 8'000 mA | | | 89 % |
| TEN 40-7212WIR | | 12 VDC | 3'333 mA | | | 91 % |
| TEN 40-7213WIR | | 15 VDC | 2'666 mA | | | 91 % |
| TEN 40-7215WIR | | 24 VDC | 1'666 mA | | | 90 % |
| TEN 40-7222WIR | | +12 VDC | 1'666 mA | -12 VDC | 1'666 mA | 89 % |
| TEN 40-7223WIR | | +15 VDC | 1'333 mA | -15 VDC | 1'333 mA | 89 % |
| TEN 40-7225WIR | | +24 VDC | 833 mA | -24 VDC | 833 mA | 91 % |

Options

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

Note - The outputs of the ±24 Vout models can also be used in serial circuit for 48 VDC operation. Free-wheeling diodes are not necessary but recommended for increased performance for start-up with inductive / capacitive load operation.

Input Specifications

| | | |
|--------------------------|--------------|--|
| Input Current | - At no load | 24 Vin models: 15 mA typ. 48 Vin models: 10 mA typ. 110 Vin models: 10 mA typ. |
| Surge Voltage | | 24 Vin models: 50 VDC max. (1 s max.) 48 Vin models: 100 VDC max. (1 s max.) 110 Vin models: 170 VDC max. (1 s max.) |
| Under Voltage Lockout | | 24 Vin models: 7.5 VDC min. / 8 VDC typ. / 8.8 VDC max. 48 Vin models: 15 VDC min. / 16 VDC typ. / 17.5 VDC max. 110 Vin models: 37 VDC min. / 40 VDC typ. / 42 VDC max. |
| Reflected Ripple Current | | 20 mA_{p-p} typ. |
| Recommended Input Fuse | | 24 Vin models: 8'000 mA (fast acting) 48 Vin models: 4'000 mA (slow blow) 110 Vin models: 3'150 mA (slow blow) (The need of an external fuse has to be assessed in the final application.) |
| Input Filter | | Internal Pi-Type |

Output Specifications

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| Output Voltage Adjustment | | -10% to +20% (15 & 24 Vout models) ±10% (other models) (single output models only) (By external trim resistor) See application note: www.tracopower.com/overview/ten40wir Output power must not exceed rated power! |
| Voltage Set Accuracy | | ±1% max. |
| Regulation | - Input Variation (Vmin - Vmax) - Load Variation (0 - 100%) - Cross Regulation (25% / 100% asym. load) | single output models: 0.2% max. dual output models: 0.2% max. single output models: 0.5% max. dual output models: 1% max. (Output 1) 1% max. (Output 2) dual output models: 5% max. |
| Ripple and Noise (20 MHz Bandwidth) | - single output - dual output - single output - dual output | 3.3 Vout models: 75 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 5 Vout models: 75 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 12 Vout models: 100 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 15 Vout models: 100 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 24 Vout models: 150 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 12 / -12 Vout models: 100 / 100 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 15 / -15 Vout models: 100 / 100 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 24 / -24 Vout models: 150 / 150 mVp-p typ. (w/ 0.1 µF, 50 V X7R) 3.3 Vout models: 100 mVp-p max. (w/ 0.1 µF, 50 V X7R) 5 Vout models: 100 mVp-p max. (w/ 0.1 µF, 50 V X7R) 12 Vout models: 125 mVp-p max. (w/ 0.1 µF, 50 V X7R) 15 Vout models: 125 mVp-p max. (w/ 0.1 µF, 50 V X7R) 24 Vout models: 200 mVp-p max. (w/ 0.1 µF, 50 V X7R) 12 / -12 Vout models: 125 / 125 mVp-p max. (w/ 0.1 µF, 50 V X7R) 15 / -15 Vout models: 125 / 125 mVp-p max. (w/ 0.1 µF, 50 V X7R) 24 / -24 Vout models: 200 / 200 mVp-p max. (w/ 0.1 µF, 50 V X7R) |
| Capacitive Load | - single output - dual output | 3.3 Vout models: 26'600 µF max. 5 Vout models: 20'000 µF max. 12 Vout models: 3'900 µF max. 15 Vout models: 2'600 µF max. 24 Vout models: 1'300 µF max. 12 / -12 Vout models: 2'600 / 2'600 µF max. 15 / -15 Vout models: 1'600 / 1'600 µF max. 24 / -24 Vout models: 650 / 650 µF max. |

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

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|---------------------------|---|
| 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 | 60 ms typ. |
| Short Circuit Protection | Continuous, Automatic recovery |
| Overload Protection | Indefinite Mode |
| Output Current Limitation | 125 - 210% of I _{out} max. 150% typ. of I _{out} max. |
| Overvoltage Protection | 125% typ. of V _{out} nom. (By Zener diode) |
| Transient Response | - Response Deviation - Response Time |
| | 10% max. (25% Load Step) 250 µs typ. (25% Load Step) |

Safety Specifications

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|------------------|--|--|
| Safety Standards | - IT / Multimedia Equipment - Railway Applications - Certification Documents | EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1 EN 50155 www.tracopower.com/overview/ten40wir |
| Pollution Degree | | PD 2 |

EMC Specifications

| | | |
|---------------|--|---|
| EMI Emissions | - Conducted Emissions - Radiated Emissions | EN 50121-3-2 (EMC for Rolling Stock) EN 55032 class A (with external filter) EN 55032 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter) |
| | | External filter proposal: www.tracopower.com/overview/ten40wir |
| EMS Immunity | - Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field | EN 50155 (Railway Applications) 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 Ext. input component: 220 µF, 100 V, KY SMDJ58A (24 Vin) 220 µF, 100 V, KY SMDJ120A (48 Vin) 2x 150 µF, 200 V, KXJ 2x SMDJ90A (110 Vin) EN 61000-4-6, 10 Vrms, perf. criteria A 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 -40°C to +90°C (with Heat Sink) |
| | - Case Temperature - Storage Temperature | +105°C max. -55°C to +125°C |
| Power Derating | - High Temperature | 2.5 %/K above 60°C 2.8 %/K above 65°C (with Heat Sink) |
| | | See application note: www.tracopower.com/overview/ten40wir |

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| | | |
|---------------------------|---------------------------------|---|
| Cooling System | | Natural convection (20 LFM) |
| Remote Control | - Voltage Controlled Remote | On: 3.5 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 3 mA max. |
| | - Off Idle Input Current | -0.5 to 0.5 mA |
| | - Remote Pin Input Current | |
| Altitude During Operation | | 5'000 m max. |
| Switching Frequency | | 225 - 275 kHz (PWM) 250 kHz typ. (PWM) |
| Insulation System | | Functional Insulation |
| Isolation Test Voltage | - Input to Output, 60 s | 3'000 VDC (110 Vin models) 1600 VDC (other models) |
| Isolation Resistance | - Input to Output, 500 VDC | 1'000 MΩ min. |
| Isolation Capacitance | - Input to Output, 100 kHz, 1 V | 1'500 pF max. |
| Reliability | - Calculated MTBF | 900'000 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 EN 50155 |
| Housing Material | | Copper |
| 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 | | 32 g |
| Thermal Impedance | - Case to Ambient | 10.8 K/W typ. (without heatsink) 10.3 W/K 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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule)) |
| | - SCIP Reference Number | 00c7ae30-3d8c-4682-88e1-0d2e69ce3142 |
| | - Flammability (EN 45545-2) | www.tracopower.com/info/en45545-declaration.pdf |

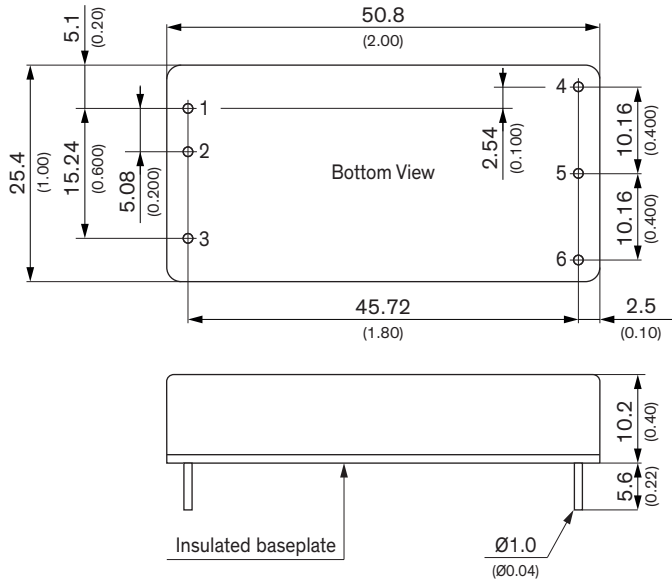
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/ten40wir

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

Outline Dimensions



| Pinout | | |
|--------|---------------|---------------|
| Pin | Single | Dual |
| 1 | +Vin (Vcc) | +Vin (Vcc) |
| 2 | -Vin (GND) | -Vin (GND) |
| 3 | Remote On/Off | Remote On/Off |
| 4 | +Vout | +Vout |
| 5 | -Vout | Common |
| 6 | Trim | -Vout |

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)