

DC/DC Railway Converter

THN 10UIR Series, 10 Watt

- Compact 1"x1" housing
- Ultra-wide 12:1 input range: 9-75, 14-160 VDC
- -40°C up to 80°C natural convection cooling without derating
- EN 50155, EN 45545-2 and EN 61373 certified
- Dedicated holdup capacitor connection
- Fully encapsulated
- 3000 VDC I/O isolation
- Remote on/off and trim function
- Protection against short-circuit, overvoltage and overtemperature
- 3-year product warranty



The THN 10UIR is a series of high-performance DC/DC converters with an ultra-wide 12:1 input voltage range and a power output of 10 watt. The THN 10UIR comes in a compact, fully encapsulated 1"x1" housing for highest reliability and effective cooling. Thanks to its dedicated holdup capacitor connection, the THN 10UIR meets extended holdup-time requirements without the need for bulky input capacitors. The THN 10UIR is EN 50155 certified for rolling stock applications, EN 61373 certified for resistance against mechanical shock and vibration and EN 45545-2 certified for fire behavior. The THN 10UIR also comes with IEC/EN/UL 62368-1 safety approvals for use in a wide range of demanding industrial applications.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I _{max}	Vnom	I _{max}	
THN 10-3610UIR	9 - 75 VDC (36 VDC nom.)	3.3 VDC	3'000 mA			85 %
THN 10-3611UIR		5.1 VDC	2'000 mA			86 %
THN 10-3612UIR		12 VDC	830 mA			88 %
THN 10-3613UIR		15 VDC	670 mA			88 %
THN 10-3615UIR		24 VDC	420 mA			88 %
THN 10-3621UIR		+5 VDC	1'000 mA	-5 VDC	1'000 mA	83 %
THN 10-3622UIR		+12 VDC	416 mA	-12 VDC	416 mA	87 %
THN 10-3623UIR		+15 VDC	333 mA	-15 VDC	333 mA	87 %
THN 10-7210UIR	14 - 160 VDC (72 VDC nom.)	3.3 VDC	3'000 mA			86 %
THN 10-7211UIR		5.1 VDC	2'000 mA			88 %
THN 10-7212UIR		12 VDC	830 mA			88 %
THN 10-7213UIR		15 VDC	670 mA			89 %
THN 10-7215UIR		24 VDC	420 mA			87 %
THN 10-7221UIR		+5 VDC	1'000 mA	-5 VDC	1'000 mA	84 %
THN 10-7222UIR		+12 VDC	416 mA	-12 VDC	416 mA	87 %
THN 10-7223UIR		+15 VDC	333 mA	-15 VDC	333 mA	88 %

Options

THN-HS2	- Optional Heat Sink: www.tracopower.com/overview/thn-hs2
on demand (backorder with MOQ non stocking item)	- Optional Heat Sink: www.tracopower.com/overview/thn-hs3 - Optional Heat Sink: www.tracopower.com/overview/thn-hs4 - Optional models with inverse Remote On/Off function (passive = off) - Optional models without adjustable UVLO and without BUS pin - Optional models with adjustable UVLO but without BUS pin

Note - 72 Vin models: If the input voltage exceeds 110 VDC, use an external 100 µF / 200 V capacitor between +Vin and -Vin to reduce voltage transient.

Input Specifications

Input Current	- At no load	8 mA typ.
Surge Voltage	36 Vin models: 100 VDC max. (1 s max.) 72 Vin models: 200 VDC max. (1 s max.)	
Under Voltage Lockout	36 Vin models: 7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max. 72 Vin models: 10 VDC min. / 11 VDC typ. / 12 VDC max.	
Recommended Input Fuse	36 Vin models: 2'000 mA (slow blow) 72 Vin models: 1'600 mA (slow blow) (The need of an external fuse has to be assessed in the final application.)	
Input Filter	Internal Pi-Type	

Output Specifications

Output Voltage Adjustment		±10% (3.3 & 12 Vout single output models) -10% to +20% (other single output models) (By external trim resistor) See application note: www.tracopower.com/overview/thn10uir Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%) - Voltage Balance (symmetrical load) - Cross Regulation (25% / 100% asym. load)	single output models: 0.2% max. dual output models: 0.5% max. single output models: 0.2% max. dual output models: 1% max. (Output 1) 1% max. (Output 2) dual output models: 2% max. dual output models: 5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output - dual output	3.3 Vout models: 75 mVp-p typ. (w/ 10 uF) 5.1 Vout models: 75 mVp-p typ. (w/ 10 uF) 12 Vout models: 100 mVp-p typ. (w/ 10 uF) 15 Vout models: 100 mVp-p typ. (w/ 10 uF) 24 Vout models: 100 mVp-p typ. (w/ 4.7 uF) 5 / -5 Vout models: 75 / 75 mVp-p typ. (w/ 10 uF) 12 / -12 Vout models: 100 / 100 mVp-p typ. (w/ 10 uF) 15 / -15 Vout models: 100 / 100 mVp-p typ. (w/ 10 uF)
Capacitive Load	- single output - dual output	3.3 Vout models: 3'500 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. 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.
Hold-up Time		10 ms min. (acc. to EN 50155 Class S2, see application note for BUS connection: www.tracopower.com/overview/thn10uir)
Start-up Time		30 ms typ. / 40 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		160% typ. of Iout max.

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

Overvoltage Protection		134% typ. of Vout nom. (depending on model) 3.7 - 5.4 VDC (3.3 Vout model) 6.3 - 7.4 VDC (5.1 Vout model) 13.5 - 19.6 VDC (12 Vout model) 18.3 - 22 VDC (15 Vout model) 29.1 - 32.5 VDC (24 Vout model)
Transient Response	- Response Deviation - Response Time	4% typ. (75% to 100% Load Step) 250 µs typ. (75% to 100% Load Step)

Safety Specifications

Standards	- IT / Multimedia Equipment - Railway Applications - Certification Documents	EN 62368-1 IEC 62368-1 UL 62368-1 EN 50155 www.tracopower.com/overview/thn10uir (A BUS capacitor must be connected to meet EN 50155 requirements. See application note.)
Pollution Degree		PD 2
Over Voltage Category		OVC II (not mains connected)

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/thn10uir
EMS (Immunity)	- Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field	EN 50121-3-2 (EMC for Rolling Stock) EN 55035 (Multimedia) 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: 36 Vin models: 220 µF, 100 V, KXJ SMDJ120A 72 Vin models: 150 µF, 200 V, KXJ SMDJ170A 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/thn10uir

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature - Approved Ambient Temp. - Case Temperature - Storage Temperature	-40°C to +95°C +75°C max. (for compliance to 62368-1) +105°C max. -55°C to +125°C
Power Derating	- High Temperature	Depending on model See application note: www.tracopower.com/overview/thn10uir
Over Temperature Protection Switch Off	- Protection Mode - Measurement Point	115°C typ. (Automatic recovery at 103°C typ.) Case
Cooling System		Natural convection (20 LFM)

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Remote Control	- Voltage Controlled Remote (passive = on) - Off Idle Input Current - Remote Pin Input Current	On: 3.0 to 15 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 1.5 mA typ. -0.5 to 1.0 mA (Optional models with inverse Remote On/Off function (passive = off))
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter
Switching Frequency		220 - 280 kHz (PWM) (250 kHz typ.) (3.3 & 5.1 Vout models) 200 - 260 kHz (PWM) (230 kHz typ.) (other Vout models)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s - Input to Case, 60 s - Output to Case, 60 s	3'000 VDC 2'250 VDC 2'250 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	400 pF typ. 600 pF max.
Reliability	- Calculated MTBF	1'928'000 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		Tinned 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		1" x 1"
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
Weight		16.1 g
Thermal Impedance	- Case to Ambient	13.7 K/W typ. (without Heatsink) 12.9 K/W typ. (with Heatsink THN-HS2) 10.8 K/W typ. (with Heatsink THN-HS3) 9.3 K/W typ. (with Heatsink THN-HS4)
Environmental Compliance	- REACH Declaration - RoHS Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant www.tracopower.com/info/rohs-declaration.pdf Exemptions: No Exemptions

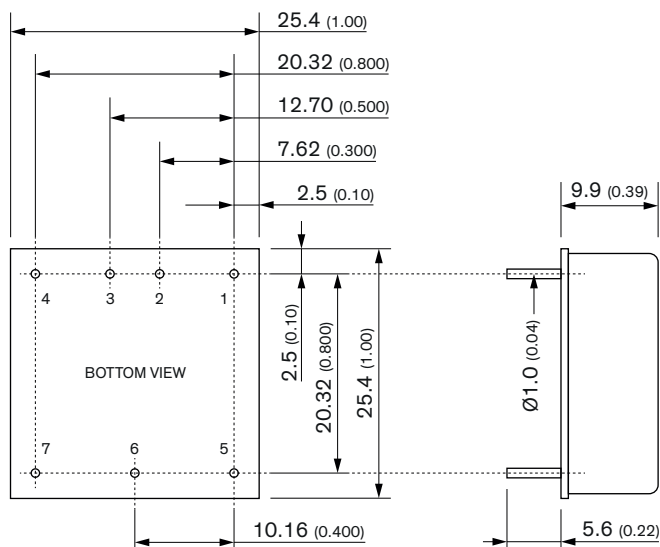
Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/thn10Uir

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Outline Dimensions

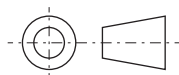


Dimensions in mm (inch)

Tolerances: x.x ± 0.5 (x.xx ± 0.02)

x.xx ± 0.25 (x.xxx ± 0.01)

Pin diameter tolerance: ± 0.10 (± 0.004)



Pinout		
Pin	Single	Dual
1	No pin* / BUS / UVLO**	
2	+Vin	
3	-Vin	
4	Remote On/Off	
5	+Vout	
6	Trim	Common
7	-Vout	

* If neither BUS nor UVLO is present

** UVLO function is optional