DC/DC Railway Converter

THN 20UIR Series, 20 Watt

- **Compact 1”x1” housing**
- **Ultra-wide 12:1 input voltage range: 9–75, 14–160 VDC**
- **–40°C up to +70°C natural convection cooling without derating**
- **EN 50155, EN 45545-2 and EN 61373 certified**
- **Dedicated holdup capacitor connection**
- **Fully encapsulated**
- **Reinforced 3000VAC I/O isolation**
- **Remote on/off and trim function**
- **Protection against short-circuit (SCP), overvoltage (OVP) and overtemperature (OTP)**
- **3-year product warranty**

UL 62368-1 IEC 62368-1

The THN 20UIR is a series of high-performance DC/DC converters with an ultra-wide 12:1 input voltage range and a power output of 20 watt. The THN 20UIR comes in a compact, fully encapsulated 1”x1” housing for highest reliability. The default variant features a pre-mounted heatsink for convection cooling up to +70°C without derating. Thanks to its dedicated holdup capacitor connection, the THN 20UIR meets extended holdup-time requirements without the need for bulky input capacitors. The THN 20UIR 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 20UIR 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
		Vnom	Imax	Vnom	Imax	typ.
THN 20-3611UIR	9 - 75 VDC (36 VDC nom.)	5.1 VDC	4'000 mA			87 %
THN 20-3612UIR		12 VDC	1'670 mA			88 %
THN 20-3613UIR		15 VDC	1'330 mA			88 %
THN 20-3615UIR		24 VDC	835 mA			88 %
THN 20-3622UIR		+12 VDC	833 mA	–12 VDC	833 mA	88 %
THN 20-3623UIR		+15 VDC	667 mA	–15 VDC	667 mA	88 %
THN 20-7211UIR	14 - 160 VDC (72 VDC nom.)	5.1 VDC	4'000 mA			87 %
THN 20-7212UIR		12 VDC	1'670 mA			88 %
THN 20-7213UIR		15 VDC	1'330 mA			88 %
THN 20-7215UIR		24 VDC	835 mA			88 %
THN 20-7222UIR		+12 VDC	833 mA	–12 VDC	833 mA	88 %
THN 20-7223UIR		+15 VDC	667 mA	–15 VDC	667 mA	88 %

Options

on demand (backorder with MOQ non stocking item)	- Optional Heat Sink: www.tracopower.com/products/thn-hs3.pdf - Optional Heat Sink: www.tracopower.com/products/thn-hs4.pdf - Optional model with 5 VDC / 4'000 mA Output and 9 - 75 VDC Input - Optional model with 5 VDC / 4'000 mA Output and 14 - 160 VDC Input - 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 - Optional models without heatsink

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	72 Vin models:	8 mA typ.
		36 Vin models:	15 mA typ. (5 Vout model)
			15 mA typ. (5.1 Vout model)
			12 mA typ. (12 Vout model)
			12 mA typ. (15 Vout model)
			12 mA typ. (24 Vout model)
			12 mA typ. (12 / -12 Vout model)
			12 mA typ. (15 / -15 Vout model)
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:	4'000 mA (slow blow)
		72 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

Output Voltage Adjustment			±10% (12 Vout models)
			−10% to +20% (other models)
			(single ouput models only)
			(By external trim resistor)
		See application note:	www.tracopower.com/overview/thn20uir
			Output power must not exceed rated power!
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	5 Vout models:	75 mVp-p typ. (w/ 22 µF)
		5.1 Vout models:	75 mVp-p typ. (w/ 22 µF)
		12 Vout models:	100 mVp-p typ. (w/ 22 µF)
		15 Vout models:	100 mVp-p typ. (w/ 22 µF)
		24 Vout models:	125 mVp-p typ. (w/ 4.7 µF)
	- dual output	12 / -12 Vout models:	100 / 100 mVp-p typ. (w/ 10 µF)
		15 / -15 Vout models:	100 / 100 mVp-p typ. (w/ 10 µF)
Capacitive Load	- single output	5 Vout models:	5'000 µF max.
		5.1 Vout models:	5'000 µF max.
		12 Vout models:	850 µF max.
		15 Vout models:	700 µF max.
		24 Vout models:	220 µF max.
	- dual output	12 / -12 Vout models:	500 / 500 µF max.
		15 / -15 Vout models:	350 / 350 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/thn20uir)
Start-up Time			30 ms typ. / 40 ms max.
Short Circuit Protection			Continuous, Automatic recovery

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

Output Current Limitation		155% typ. of Iout max.
Overvoltage Protection		(depending on model) 6.3 - 7.4 VDC (5 Vout, 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	4% typ. (25% Load Step)
	- Response Time	250 µs typ. (25% Load Step)

Safety Specifications

Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 62368-1
	- Railway Applications	EN 50155
	- Certification Documents	www.tracopower.com/overview/thn20uir (A BUS capacitor must be connected to meet EN 50155 requirements. See application note.)
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 (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	External filter proposal:	www.tracopower.com/overview/thn20uir
EMS Immunity		EN 50121-3-2 (EMC for Rolling Stock) EN 55035 (Multimedia)
	- 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:	220µF, 100V, KY || TVS SMDJ120A (36 Vin) 150µF, 200V, KXJ || TVS SMBJ220A (72 Vin)
	- 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 +105°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/thn20uir
Over Temperature Protection Switch Off	- Protection Mode	115°C typ. (Automatic recovery at 103°C typ.)
	- Measurement Point	Case
Cooling System		Natural convection (20 LFM)

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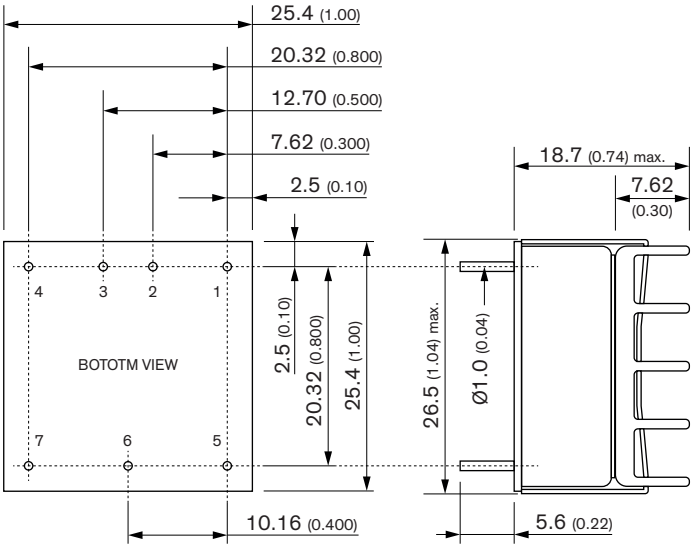
Remote Control	- Voltage Controlled Remote	On: 3.0 to 15 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current	2.5 mA typ.
	- Remote Pin Input Current	-0.5 to 1.0 mA (Optional models with inverse Remote On/Off function (passive = off))
Altitude During Operation		5'000 m max.
Switching Frequency		190 - 250 kHz (PWM) 220 kHz typ. (PWM)
Insulation System		Functional Insulation
Working Voltage (rated)		75 VDC (36 Vin models) 113 VDC (72 Vin models)
Isolation Test Voltage	- Input to Output, 60 s	3'000 VDC
	- Input to Case, 60 s	2'250 VDC
	- Output to Case, 60 s	2'250 VDC
Creepage	- Input to Output	2 mm min.
Clearance	- Input to Output	2 mm min.
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	2'000 pF max.
Reliability	- Calculated MTBF	1'208'000 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		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		17 g
Thermal Impedance	- Case to Ambient	11.5 K/W typ. (with standard Heatsink) 15.5 K/W typ. (without Heatsink) 10.4 K/W typ. (with Heatsink THN-HS3) 8.8 K/W typ. (with Heatsink THN-HS4)
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	25c603dd-08f8-4fe0-b89b-aa8c8d481ef2

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

Supporting Documents

Overview Link (for additional Documents) www.tracopower.com/overview/thn20uir

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