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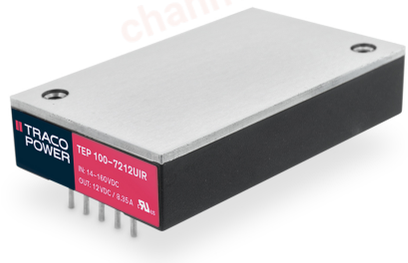
TRACO POWER

DC/DC Railway Converter

TEP 100UIR Series, 100 Watt

- **Ultra-wide 12:1 input voltage range: 9–75, 14–160 VDC**
- **EN 50155 and EN 61373 certified**
- **Encapsulated quarter-brick (2.3”x1.45”x0.5”) package**
- **Extended holdup time with lowest capacitor volume**
- **EN 45545-2 fire behavior**
- **–40°C to +85°C operating temperature**
- **Up to 3‘000 VAC I/O-isolation**
- **Remote on/off and trim function**
- **Adjustable undervoltage lockout (UVLO), short-circuit protection (SCP), overvoltage protection (OVP) and overtemperature protection (OTP)**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TEP 100UIR is a series of high-performance 100 Watt DC/DC converters with an ultra-wide 12:1 input voltage range. The TEP 100UIR comes in a compact, fully encapsulated quarter-brick (2.3”x1.45”x0.5”) package for highest reliability. The ultra-wide input voltage range lets system builders reduce the number of design channels where otherwise multiple input voltage configurations would be required. Thanks to its dedicated holdup circuit, the TEP 100UIR complies with extended holdup-time requirements without the need for bulky capacitors. The TEP 100UIR is EN 50155 certified for rolling stock applications, EN 61373 certified for mechanical shock and vibration and EN 45545-2 certified for fire behavior. It comes with IEC/EN/UL 62368-1 safety approvals.

Models

Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 100-3611UIR	9 - 75 VDC (36 VDC nom.)	5 VDC (4.0 - 5.5 VDC)	20'000 mA	88 %
TEP 100-3612UIR		12 VDC (9.6 - 13.2 VDC)	8'350 mA	88 %
TEP 100-3613UIR		15 VDC (12.0 - 16.5 VDC)	6'700 mA	89 %
TEP 100-3615UIR		24 VDC (19.2 - 26.4 VDC)	4'200 mA	88 %
TEP 100-3618UIR		48 VDC (38.4 - 52.8 VDC)	2'100 mA	90 %
TEP 100-7211UIR	14 - 160 VDC (110 VDC nom.)	5 VDC (4.0 - 5.5 VDC)	20'000 mA	88 %
TEP 100-7212UIR		12 VDC (9.6 - 13.2 VDC)	8'350 mA	88 %
TEP 100-7213UIR		15 VDC (12.0 - 16.5 VDC)	6'700 mA	88 %
TEP 100-7215UIR		24 VDC (19.2 - 26.4 VDC)	4'200 mA	88 %
TEP 100-7218UIR		48 VDC (38.4 - 52.8 VDC)	2'100 mA	89 %

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Options

TEP-HS2	- Optional Heat Sink: www.tracopower.com/products/tep-hs2.pdf
TEP-HS4	- Optional Heat Sink: www.tracopower.com/products/tep-hs4.pdf
on demand (backorder with MOQ non stocking item)	- Optional Heat Sink with large profile: www.tracopower.com/products/tep-hs3.pdf - Optional Heat Sink with large profile: www.tracopower.com/products/tep-hs5.pdf - Optional model with 28 VDC / 3'600 mA Output and 9 - 75 VDC Input - Optional model with 53 VDC / 1'920 mA Output and 9 - 75 VDC Input - Optional model with 28 VDC / 3'600 mA Output and 14 - 160 VDC Input - Optional model with 53 VDC / 1'920 mA Output and 14 - 160 VDC Input - Optional models with Remote On/Off function with inverse logic

Input Specifications

Input Current	- At no load	36 Vin models:	**20 mA typ.** (5 Vout model)
			30 mA typ. (12 Vout model)
			30 mA typ. (15 Vout model)
			20 mA typ. (24 Vout model)
			20 mA typ. (28 Vout model)
			20 mA typ. (48 Vout model)
			20 mA typ. (53 Vout model)
		110 Vin models:	**15 mA typ.** (5 Vout model)
			20 mA typ. (12 Vout model)
			20 mA typ. (15 Vout model)
			15 mA typ. (24 Vout model)
			15 mA typ. (28 Vout model)
			15 mA typ. (48 Vout model)
			15 mA typ. (53 Vout model)
Surge Voltage		36 Vin models:	**100 VDC max.** (1 s max.)
		110 Vin models:	**185 VDC max.** (1 s max.)
Start-up Voltage		36 Vin models:	**8.1 VDC min. / 8.5 VDC typ. / 9 VDC max.**
		110 Vin models:	**12 VDC min. / 13.2 VDC typ. / 14 VDC max.**
			(These are the Start-up Voltage values without an external resistor between the UVLO and -Vin pin. With an external resistor between these pins, the Start-up Voltage can be widely adjusted, see application note: www.tracopower.com/overview/tep100uir)
Under Voltage Lockout		36 Vin models:	**7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max.**
		110 Vin models:	**10 VDC min. / 11 VDC typ. / 12 VDC max.**
			(These are the Shutdown Voltage values without an external resistor between the UVLO and -Vin pin. With an external resistor between these pins, the Shutdown Voltage can be widely adjusted, see application note: www.tracopower.com/overview/tep100uir)
Recommended Input Fuse		36 Vin models:	**20'000 mA** (fast acting)
		110 Vin models:	**13'000 mA** (fast acting)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			**Internal Pi-Type** (By the use of following input capacitor, the input ripple can be further reduced: 36 Vin models: 220 µF / 100 V KY 110 Vin models: 150 µF / 200 V KXJ)

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

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Output Specifications

Output Voltage Adjustment			–20% to +10% (By external trim resistor)
		See application note:	www.tracopower.com/overview/tep100uir
			Output power must not exceed rated power!
Voltage Set Accuracy			±1% max.
Regulation	- Input Variation (Vmin - Vmax)		0.1% max.
	- Load Variation (0 - 100%)		0.1% max.
Ripple and Noise		5 Vout models:	75 mVp-p typ. (w/ 10 µF || 47 µF)
(20 MHz Bandwidth)		12 Vout models:	100 mVp-p typ. (w/ 22 µF)
		15 Vout models:	100 mVp-p typ. (w/ 22 µF)
		24 Vout models:	200 mVp-p typ. (w/ 4.7 µF)
		28 Vout models:	200 mVp-p typ. (w/ 4.7 µF)
		48 Vout models:	300 mVp-p typ. (w/ 2.2 µF)
		53 Vout models:	300 mVp-p typ. (w/ 2.2 µF)
Capacitive Load		5 Vout models:	40'000 µF max.
		12 Vout models:	7'000 µF max.
		15 Vout models:	4'500 µF max.
		24 Vout models:	1'800 µF max.
		28 Vout models:	1'300 µF max.
		48 Vout models:	430 µF max.
		53 Vout models:	370 µF max.
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Hold-up Time			10 ms min. (with external capacitor, see application note for BUS connection: www.tracopower.com/overview/tep100uir)
Start-up Time			75 ms typ. / 100 ms max.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			110 - 130% of Iout max.
Overvoltage Protection			120 - 135% of Vout nom.
Transient Response	- Response Deviation		25% typ. (25% Load Step)
	- Response Time		250 µs typ. (25% Load Step)

Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 62368-1
	- Railway Applications	EN 50155
	- Certification Documents	www.tracopower.com/overview/tep100uir
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/tep100uir

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EMS Immunity			EN 50155 (Railway Applications) EN 50121-3-2 (EMC for Rolling Stock) EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air: Contact:	EN 61000-4-2, ±8 kV, perf. criteria A 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, ±1 kV, perf. criteria A
		Ext. input component:	220 µF / 100 V KY (36 Vin models) 150 µF / 200 V KXJ (110 Vin models)
	- Conducted RF Disturbances		EN 61000-4-6, 10 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous: 1 s:	EN 61000-4-8, 100 A/m, perf. criteria A 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
	- 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/tep100uir
Over Temperature Protection Switch Off	- Protection Mode		110°C typ. (Automatic recovery at 95°C typ.)
	- Measurement Point		Base-Plate
Cooling System			Forced air cooling (with external fan, 400 LFM)
Sense Function			10% max. of Vout nom. (If sense function is not used, sense pins must be connected to corresponding polarity output pins)
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
	- Off Idle Input Current		3 mA typ.
	- Remote Pin Input Current		-0.5 to 1.0 mA
Altitude During Operation			5'000 m max.
Switching Frequency			160 - 200 kHz (PWM) 180 kHz typ. (PWM)
Insulation System			Reinforced Insulation (110 Vin models) Basic Insulation (36 Vin models)
Working Voltage (rated)			220 VAC
Isolation Test Voltage	- Input to Output, 60 s		3'000 VAC (110 Vin models) 2'250 VDC (36 Vin models)
	- Input to Case, 60 s		1'500 VAC (110 Vin models) 1'600 VDC (36 Vin models)
	- Output to Case, 60 s		1'500 VAC (110 Vin models) 1'600 VDC (36 Vin models)
Creepage	- Input to Output		3.2 mm min.
Clearance	- Input to Output		3 mm min.
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		1'000 pF max.
Distance Through Isolation			0.4 mm
Reliability	- Calculated MTBF		420'800 h (MIL-HDBK-217F, ground benign)
Washing Process			According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf

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Environment	- Vibration	MIL-STD-810F EN 61373 7.6 g, 3 axis, 60 min, 20-2000 Hz
	- Mechanical Shock	MIL-STD-810F EN 61373 50 g, 3 axis, 11 ms
	- Thermal Shock	MIL-STD-810F -55°C to +125°C, 72 cycles, 30 min each EN 50155
Housing Material		Alu base-plate w. plastic case
Isolation Frame Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Copper (1 - 1.5 µm)
Pin Surface Plating		Nickel (4 - 6 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		Quarter-Brick
Weight		64 g
Thermal Impedance	- Case to Ambient	8.3 K/W typ. (without heatsink) 7.4 K/W typ. (with heatsink TEP-HS2) 7.4 K/W typ. (with heatsink TEP-HS4) 6.2 K/W typ. (with heatsink TEP-HS3) 6.2 K/W typ. (with heatsink TEP-HS5)
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/tep100uir

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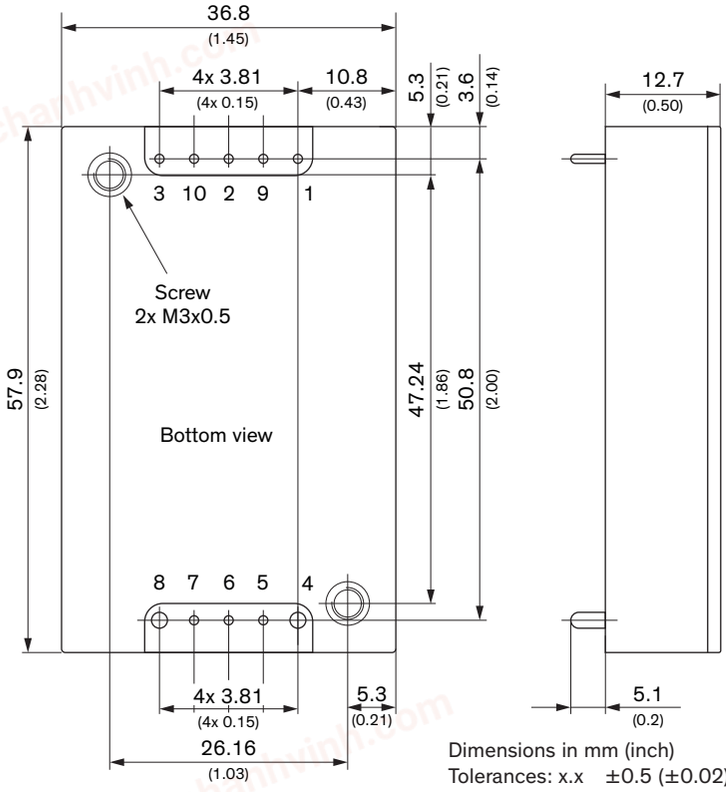
Outline Dimensions



Pin (4, 8): 1.5 (0.06)
Pin (other): 1.0 (0.04)

Dimensions in mm (inch)
Tolerances: x.x ±0.5 (±0.02)
x.xx ±0.25 (±0.01)
Pin diameter ±0.1 (±0.004)
Screw lock torque: Max. 0.34 N·m (3.5 kgf·cm)

Pinout	
Pin	**Function**
1	–Vin (GND)
2	Remote On/Off
3	+Vin (Vcc)
4	–Vout
5	–Sense
6	Trim
7	+Sense
8	+Vout
9	Bus
10	UVLO

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