TRACO POWER

DC/DC Railway Converter — TEP 150UIR Series, 150 Watt

- **Compact half-brick housing**
- **Ultra-wide 12:1 input: 14–160 VDC**
- **–40°C to +105°C operating temperature**
- **Fully encapsulated**
- **Dedicated holdup capacitor connection**
- **EN 50155, EN 45545-2, and EN 61373 certifications**
- **Reinforced 3000VAC I/O isolation**
- **Remote on/off and trim function**
- **Protection against short-circuit (SCP), overvoltage (OVP), overtemperature (OTP)**
- **3-year product warranty**

UL 62368-1 IEC 62368-1

The TEP 150UIR is a series of railway-certified DC/DC converters designed for highest reliability in demanding applications. Its ultra-wide 12:1 input voltage range allows the application engineer to target an array of nominal system voltages with a single power supply design. Thanks to its dedicated holdup capacitor connection, the TEP 150UIR meets extended holdup-time requirements without the need for bulky input capacitors. The TEP 150UIR series is EN 50155 certified for applications on rolling stock. Additional certifications include EN 61373 for mechanical shock and vibration, EN 45545-2 for fire behavior and IEC/EN/UL 62368-1 for IT and general-purpose industrial applications.

Models

Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 150-7211UIR	14 - 160 VDC (72 VDC nom.)	5 VDC (4.0 - 5.5 VDC)	30'000 mA	91 %
TEP 150-7212UIR		12 VDC (9.6 - 13.2 VDC)	12'500 mA	93 %
TEP 150-7213UIR		15 VDC (12.0 - 16.5 VDC)	10'000 mA	92 %
TEP 150-7215UIR		24 VDC (19.2 - 26.4 VDC)	6'300 mA	89 %
TEP 150-7218UIR		48 VDC (38.4 - 52.8 VDC)	3'200 mA	93 %

Options

TEP-HS6	- Optional Heat Sink: www.tracopower.com/overview/tep-hs6
TEP-HS7	- Optional Heat Sink: www.tracopower.com/overview/tep-hs7
on demand (backorder with MOQ non stocking item)	- Optional model with 28 VDC and 5'400 mA Output, and 14 - 160 VDC Input - Optional model with 53 VDC and 2'900 mA Output, and 14 - 160 VDC Input - Optional models with inverse Remote On/Off function (passive = off)

Note - For optimal converter stability a capacitor 150 µF / 200 V must be connected between BUS pin and -Vin

Input Specifications

Input Current	- At no load	25 mA typ.
	- At full load	2'300 mA typ.
Surge Voltage		185 VDC max. (1 s max.)
Under Voltage Lockout		10 VDC min. / 11 VDC typ. / 12 VDC max. (Adjustable w/ external resistor - see application note)
Recommended Input Fuse		15 A (fast acting) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Capacitor

Output Specifications

Output Voltage Adjustment		−20% to +10% (By external trim resistor) See application note: www.tracopower.com/overview/tep150uir Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax)	0.2% max.
	- Load Variation (0 - 100%)	0.1% max.
Ripple and Noise (20 MHz Bandwidth)	5 Vout models:	75 mVp-p typ. (w/ 22 µF/25 V X7R MLCC || 22 µF/25 V POSCAP)
	12 Vout models:	150 mVp-p typ. (w/ 22 µF/25 V X7R MLCC || 22 µF/25 V POSCAP)
	15 Vout models:	150 mVp-p typ. (w/ 22 µF/25 V X7R MLCC || 22 µF/25 V POSCAP)
	24 Vout models:	200 mVp-p typ. (w/ 2.2 µF/50 V X7R MLCC)
	28 Vout models:	200 mVp-p typ. (w/ 2.2 µF/50 V X7R MLCC)
	48 Vout models:	300 mVp-p typ. (w/ 1 µF/100 V X7R MLCC)
	53 Vout models:	300 mVp-p typ. (w/ 1 µF/100 V X7R MLCC)
Capacitive Load	5 Vout models:	45'000 µF max.
	12 Vout models:	8'000 µF max.
	15 Vout models:	5'000 µF max.
	24 Vout models:	2'000 µF max.
	28 Vout models:	1'470 µF max.
	48 Vout models:	470 µF max.
	53 Vout models:	390 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/tep150uir)
Start-up Time		350 ms typ.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		120 - 150% of Iout max.
Overvoltage Protection		115 - 130% of Vout nom.
Transient Response	- 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/tep150uir
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

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

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/tep150uir
EMS (Immunity)			EN 50121-3-2 (EMC for Rolling Stock)
			EN 55024 (IT Equipment)
			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
		External filter proposal:	www.tracopower.com/overview/tep150uir
	- 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
EMC / Environmental	- Certification Documents		www.tracopower.com/overview/tep150uir

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +50°C
			–40°C to +75°C (with Heat Sink)
	- 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/tep150uir
Over Temperature Protection Switch Off	- Protection Mode		115°C typ. (Automatic recovery at 100°C typ.)
	- Measurement Point		Base-Plate
Cooling System			Natural convection (20 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 (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
	- Off Idle Input Current		15 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.
Regulator Topology			Soft switch half bridge Converter
Switching Frequency			189 - 231 kHz (PWM)
			210 kHz typ. (PWM)
Insulation System			Reinforced Insulation
Working Voltage (rated)			166 VAC
Isolation Test Voltage	- Input to Output, 60 s		3'000 VAC
	- Input to Case, 60 s		1'500 VAC (where case is the baseplate)
	- Output to Case, 60 s		1'500 VAC (where case is the baseplate)
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		1'000 pF typ.
Distance Through Isolation			0.4 mm
Reliability	- Calculated MTBF		309'300 h (MIL-HDBK-217F, ground benign)

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

Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F EN 61373 7.6 g, 3 axis, 60 min, 20-2000 Hz 7.7 g, 3 axis, random waveform, 60 min
	- Mechanical Shock	MIL-STD-810F EN 61373 50 g, 3 axis, terminal peak sawtooth, 11 ms
	- Thermal Shock	MIL-STD-810F -55°C to +125°C, 72 cycles, 30 min each
	- Flammability	EN 45545-2 www.tracopower.com/info/en45545-declaration.pdf
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		Tinned Copper
Pin Foundation Plating		Nickel (3 - 5 µm)
Pin Surface Plating		Tin (5 - 7 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		Half-Brick
Soldering Profile		Lead-Free Wave Soldering 260°C / 4 s max.
Weight		113 g
Thermal Impedance	- Case to Ambient	6.1 K/W typ. (without heatsink) 4.6 K/W (with heatsink TEP-HS6) 3.7 K/W (with heatsink TEP-HS7)
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	4e2f47b8-f873-45f8-a18d-5257e1271b39

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tep150uir

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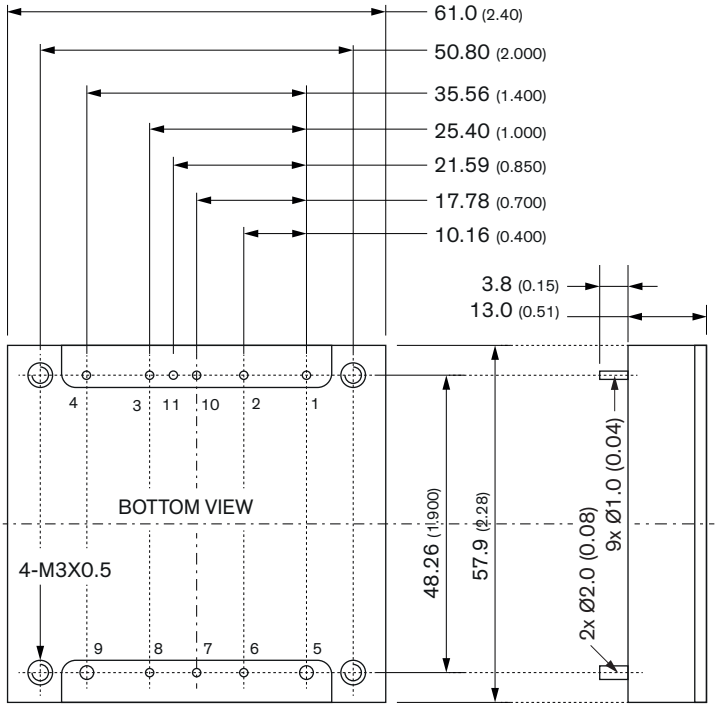
Outline Dimensions



Dimensions in mm (inch)
Tolerances: x.x ±0.50 (±0.02)
x.xx ±0.25 (±0.010)
Pin diameter tolerances: ±0.10 (±0.004)
Screw lock torque: Max. 0.34 N·m (3.5 kgf·cm)

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

Important: A capacitor 150 µF / 200 V must be connected between BUS pin and –Vin.

For more details regarding BUS Pin, Under Voltage Lockout (UVLO) and Pulse Out see application notes on www.tracopower.com .