TRACO POWER

DC/DC Railway Converter

TEP 40UIR Series, 40 Watt

- **Ultra-wide 12:1 input voltage range 9–75, 14–160 VDC**
- **Compact 2.3”x1.45”x0.5” standard package (quarter brick)**
- **Bus pin to easily extend hold-up time**
- **EN 50155 and EN 61373 approval for railway applications**
- **Qualification for fire behavior according to EN 45545-2**
- **Operating temperature range –40°C to +85°C**
- **I/O-isolation 3‘000 VAC**
- **High efficiency up to 91%**
- **Adjustable output voltage, Remote On/Off and adjustable under voltage lockout**
- **3-year product warranty**

UL 62368-1 IEC 62368-1

The TEP 40UIR is a series of high performance 40 Watt railway DC/DC converters with ultra wide 12:1 input voltage range featuring a compact ¼ brick (2.3”x1.45”x0.5”) metal package. The ultra wide input allows the converter to act as an all-in-one solution if different voltage ranges have to be covered in the same application, resolving the issue of having multiple different converters installed. An internal circuit implemented in these modules helps to extend the hold-up time with ease as it eliminates the need of expensive high voltage capacitors to cover the full input range. With only a 25V capacitor (independent of the input voltage) the whole input range can be covered effectively reducing cost, size and inrush current. All models are approved for railway applications according to EN 50155, EN 61373, EN 45545-2 and offer standard features such as high efficiency up to 91%, an operating temperature range of -40° to +85°C and an I/O-isolation voltage of 3’000 VAC. An adjustable under voltage lockout function, remote on/off and adjustable outputs round out the features and ensure that these converter modules fit in any application setup.

Models

Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 40-3611UIR	9 - 75 VDC (36 VDC nom.)	5 VDC (4.0 - 5.5 VDC)	8'000 mA	89 %
TEP 40-3612UIR		12 VDC (9.6 - 13.2 VDC)	3'330 mA	91 %
TEP 40-3613UIR		15 VDC (12.0 - 16.5 VDC)	2'670 mA	91 %
TEP 40-3615UIR		24 VDC (19.2 - 26.4 VDC)	1'670 mA	90 %
TEP 40-3618UIR		48 VDC (38.4 - 52.8 VDC)	830 mA	91 %
TEP 40-7211UIR	14 - 160 VDC (72 VDC nom.)	5 VDC (4.0 - 5.5 VDC)	8'000 mA	89 %
TEP 40-7212UIR		12 VDC (9.6 - 13.2 VDC)	3'330 mA	91 %
TEP 40-7213UIR		15 VDC (12.0 - 16.5 VDC)	2'670 mA	91 %
TEP 40-7215UIR		24 VDC (19.2 - 26.4 VDC)	1'670 mA	90 %
TEP 40-7218UIR		48 VDC (38.4 - 52.8 VDC)	830 mA	90 %

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 / 1'430 mA Output and 9 - 75 VDC Input - Optional model with 53 VDC / 750 mA Output and 9 - 75 VDC Input - Optional model with 28 VDC / 1'430 mA Output and 14 - 160 VDC Input - Optional model with 53 VDC / 750 mA Output and 14 - 160 VDC Input - Optional models with inverse Remote On/Off function (passive = off)

Input Specifications

Input Current	- At no load	36 Vin models:	24 mA typ.
		72 Vin models:	17 mA typ.
Surge Voltage		36 Vin models:	100 VDC max. (1 s max.)
		72 Vin models:	185 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. (The Start-up voltage as well as the Shutdown voltage can be adjusted by a resistor between UVLO and -Vin pins. See application note: www.tracopower.com/overview/tep40uir)
Recommended Input Fuse		36 Vin models:	8'000 mA (fast acting)
		72 Vin models:	5'000 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			−20% to +10% (By external trim resistor)
		See application note:	www.tracopower.com/overview/tep40uir
			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 (20 MHz Bandwidth)		5 Vout models:	75 mVp-p typ. (w/ 1 µF X7R || 22 µF poscap)
		12 Vout models:	100 mVp-p typ. (w/ 22 µF X7R)
		15 Vout models:	100 mVp-p typ. (w/ 22 µF X7R)
		24 Vout models:	200 mVp-p typ. (w/ 4.7 µF X7R)
		28 Vout models:	200 mVp-p typ. (w/ 4.7 µF X7R)
		48 Vout models:	300 mVp-p typ. (w/ 2.2 µF X7R)
		53 Vout models:	300 mVp-p typ. (w/ 2.2 µF X7R)
Capacitive Load		5 Vout models:	16'000 µF max.
		12 Vout models:	2'800 µF max.
		15 Vout models:	1'800 µF max.
		24 Vout models:	720 µF max.
		28 Vout models:	520 µF max.
		48 Vout models:	180 µF max.
		53 Vout models:	150 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/tep40uir)

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

Start-up Time		75 ms typ. / 100 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		120 - 140% of Iout max.
Overvoltage Protection		120 - 135% 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/tep40uir
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/tep40uir
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 B
		Contact:	EN 61000-4-2, ±6 kV, perf. criteria B
	- 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 B
		Ext. input component:	36 Vin models: 2 x KY 220 µF
			72 Vin models: 2 x KXJ 150 µF
	- 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 +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/tep40uir
Over Temperature Protection Switch Off	- Protection Mode	110°C typ. (Automatic recovery at 95°C typ.)
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	3 mA typ.
	- Remote Pin Input Current	-0.5 to 1.0 mA
		(Optional models with inverse Remote On/Off function (passive = off))

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

Altitude During Operation		5'000 m max.
Switching Frequency		160 - 200 kHz (PWM) 180 kHz typ. (PWM)
Insulation System		Reinforced Insulation (72 Vin models) Basic Insulation (36 Vin models)
Working Voltage (rated)		220 VAC
Isolation Test Voltage	- Input to Output, 60 s	3'000 VAC (72 Vin models) 2'250 VDC (36 Vin models)
	- Input to Case, 60 s	1'500 VAC (72 Vin models) 1'600 VDC (36 Vin models)
	- Output to Case, 60 s	1'500 VAC (72 Vin models) 1'600 VDC (36 Vin models)
Isolation Resistance	- Input to Output, 500 VDC	1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'000 pF max.
Reliability	- Calculated MTBF	830'000 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	EN 61373
	- Thermal Shock	MIL-STD-810F
	- Flammability	EN 45545-2 www.tracopower.com/info/en45545-declaration.pdf
Housing Material		Alu base-plate w. plastic case
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		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		Quarter-Brick
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
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).)
	- SCIP Reference Number	ef2acbf3-5bb8-4ba9-93b2-e1dd19affd17

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tep40uir

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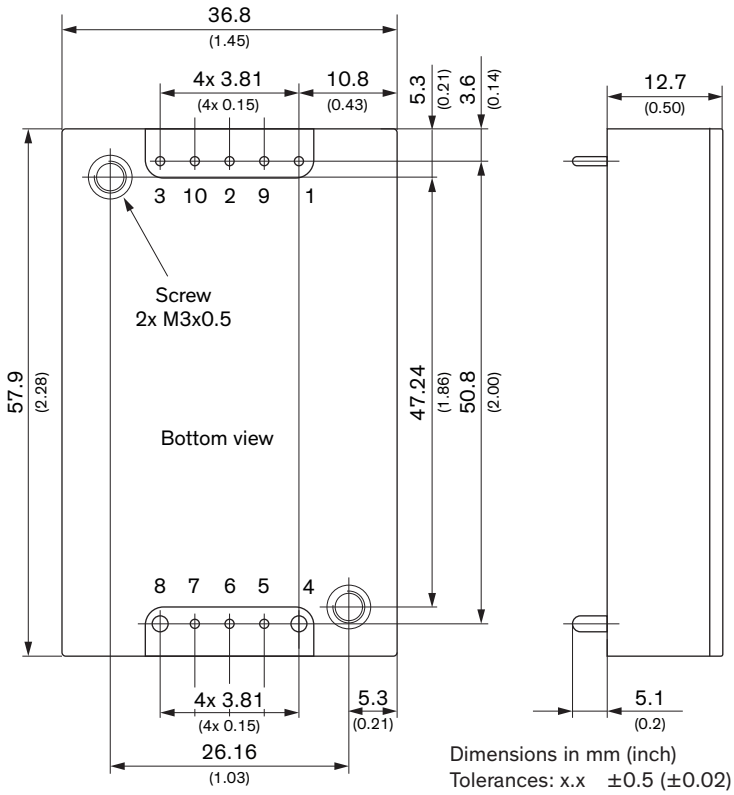
Outline Dimensions



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