Features

- +115°C Maximum Case Temperature
- -45°C Minimum Case Temperature
- Baseplate Case Style
- 1.5kVAC Isolation
- Wide 4:1 Input Voltage Range
- EN50155 & EN50121-3-2 Certified

ICE Technology*

RECOM

DC/DC Converter

RPR30-11005S-B

30 Watt 4:1 2“ x 1.6“ Baseplate Style Single Output

5 YEAR Warranty

Description

The RPR30 series DC/DC converters are designed for railway rolling stock applications. Besides covering all the input voltages from 40VDC up to 160VDC, the converters have a very wide operating temperature range of -45°C to +115°C. The RPR30 has a baseplate case for high vibration or bulkhead-mounting applications. It is EN-50155 and EN-50121-3-2 certified.

Selection Guide

Part Number	Input Voltage Range [VDC]	Input Current [mA]	Output Voltage [VDC]	Output Current [mA]	Efficiency typ. [%]	Max. Capacitive Load [µF]
RPR30-11005S-B	40-160	310	5	6000	90	2200

Notes:

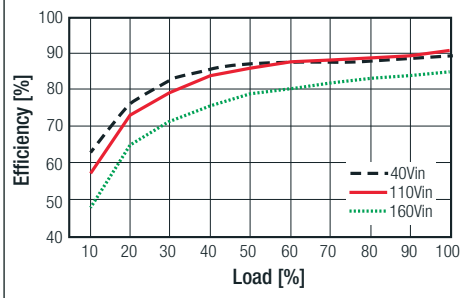
Note1: values at nominal input voltage and full load.

EN50155 Certified
IEC/EN60950-1 Certified

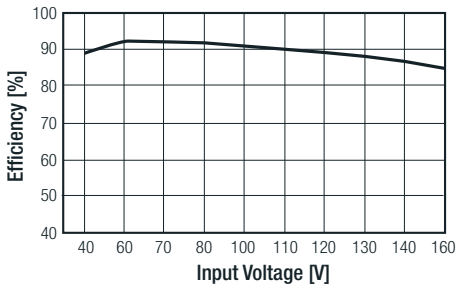
Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

BASIC CHARACTERISTICS				
Parameter	**Condition**	**Min.**	**Typ.**	**Max.**
Input Voltage Range	nom. Vin= 110VDC	40VDC	110VDC	160VDC
Input Filter				Built-in Pi-Type Filter
Transient Input Voltage	≤100ms			180VDC
Inrush Current	with EMC Filter without EMC Filter			50A 40A
Under Voltage Lockout	DC-DC ON DC-DC OFF	39VDC		 36VDC
Remote ON/OFF Remote OFF Input Voltage	ON / high logic OFF / low logic nominal input	Open, 8V Short, 0V	 5mA	60V 1.2V
Start Up Time	when use CTRL function		20ms	
Operating Frequency Range		220kHz	260kHz	300kHz
Output Trimming Voltage			±10%	
Efficiency	typ. Vin, full load	89%	90%	
Minimum Load		0%		
Output Ripple and Noise	20MHz limited, 1µF output MLCC		50mVp-p	100mVp-p

Efficiency vs. Load



Efficiency vs. Input Voltage



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*** ICE Technology**

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum.

SURGE PROTECTOR available

https://www.recom-power.com/pdf/Powerline_DC-DC/RSPxxx-168.pdf

RPR30-11005S-B Series

Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

Trimming Output Voltage

Only the single output converters have a trim function that allows users to adjust the output voltage from +10% to -10%, please refer to the trim table that follow for details. Adjustment to the output voltage can be used with a simple fixed resistor as shown in Figures 1 and 2. A single fixed resistor can increase or decrease the output voltage depending on its connection. Resistor should be located close to the converter. If the trim function is not used, leave the trim pin open.

Trim adjustments higher than the specified range can have an adverse effect on the converter´s performance and are not recommended. Excessive voltage differences between output voltage sense voltage, in conjunction with trim adjustment of the output voltage; can cause the OVP circuitry to activate. Thermal derating is based on maximum output current and voltage at the converter´s output pins. Use of the trim and sense function can cause output voltages to increase, thereby increasing output power beyond the converter´s specified rating. Therefore: (Vout at Pins) X (Iout) ≤ rated output power.

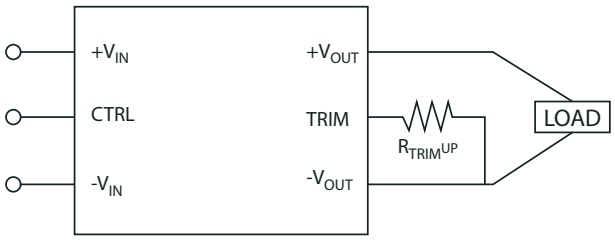


Figure 1. Trim connections to increase output voltage using fixed resistors

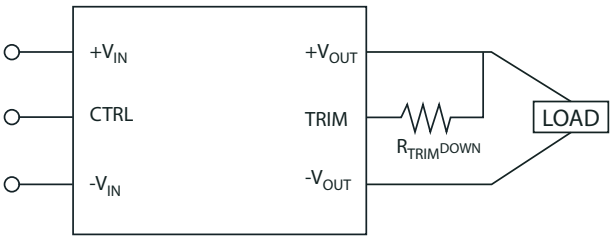


Figure 2. Trim connections to decrease output voltage using fixed resistors

	Trim up resistor value (KΩ)									
Vout	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
5VDC	102.6	49.3	27.5	18.2	11.7	8.0	5.2	3.1	1.4	0

	Trim down resistor value (KΩ)									
Vout	-1%	-2%	-3%	-4%	-5%	-6%	-7%	-8%	-9%	-10%
5VDC	139.6	61.1	36	22.6	15.5	10.5	6.7	4.1	2.0	0.3

REGULATIONS

Parameter	Condition	Value
Output Voltage Accuracy	50% load	±1.5% max.
Line Voltage Regulation	low line to high line	±0.3% max.
Load Voltage Regulation	10% to 100% load	±0.5% max.
Transient Recovery Time	25% load step change, Δlo/Δt=2.5A/us	800µs typ.
Transient Peak Deviation	25% load step change, Δlo/Δt=2.5A/us	±2%Vout max.

PROTECTIONS

Parameter	Condition	Value
Surge Resistance	≤10ms	250VDC
Output Power Protection (OPP)		120% typ., Hiccup Mode
Over Voltage Protection (OVP)		N/A
Over Temperature Protection (OTP)	case temperature	120°C, auto-recovery
Isolation Voltage	I/P to O/P, at 70% RH I/P to Case, O/P to Case	2250VDC / 1 Minute 1500VDC / 1 Minute
Isolation Resistance	I/P to O/P , at 70% RH	100MΩ min.
Isolation Capacitance	I/P to O/P	1500pF typ.

Notes:

Note2: This Power Module is not internally fused. A input fuse must be always used. Recommended Fuse: T1.25A

RPR30-11005S-B Series

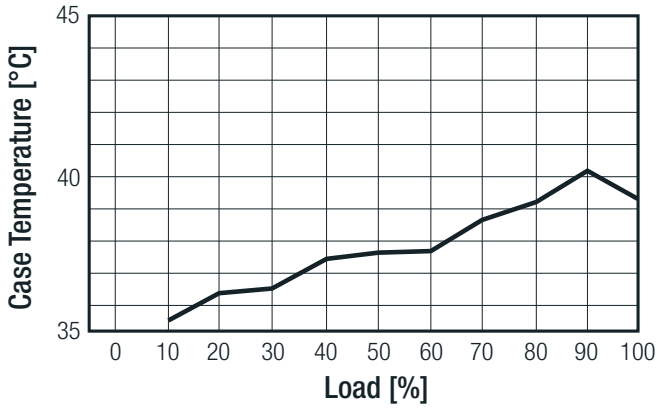
Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

ENVIRONMENTAL

Parameter	Condition		Value
Operating Case Temperature Range	start up by -45°C		-45°C to (see calculation)
Temperature Coefficient			±0.04% / °C max.
Thermal Impedance	natural convection mounting at FR4 (254x254mm) PCB	vertical horizontal	4.8°C/W 7°C/W
Humidity			95%, non condensing
MTBF	according to MIL-HDBK-217F (+50°C G.B.) according to BellCore-TR-332 (+50°C G.B.)		610 x 10^3 hours 1540 x 10^3 hours

Derating Graph

(Ta= +25°C, natural convection, typ. Vin and vertical mounting)



Calculation

$R_{thcase\text{-}ambient}$ = 4.8°C/W (vertical)
$R_{thcase\text{-}ambient}$ = 7°C/W (horizontal)

$$R_{thcase\text{-}ambient} = \frac{T_{case} - T_{ambient}}{P_{dissipation}}$$

$$P_{dissipation} = P_{IN} - P_{OUT} = \frac{P_{OUTapp}}{\eta} - P_{OUTapp}$$

T_{case} = Case Temperature
$T_{ambient}$ = Environment Temperature
$P_{dissipation}$ = Internal losses
P_{IN} = Input Power
P_{OUT} = Output Power
η = Efficiency under given Operating Conditions
$R_{thcase\text{-}ambient}$ = Thermal Impedance

Practical Example:

Take the RPR30-11005S-B with 50% load. What is the maximum ambient operating temperature? Use converter vertical in application.

Eff_{min} = 89% @ V_{nom}
P_{OUT} = 30W
P_{OUTapp} = 30 x 0.5 = 15W

$$P_{dissipation} = \frac{P_{OUTapp}}{\eta} - P_{OUTapp}$$

η = ~86% (from Eff vs Load Graph)

$$P_{dissipation} = \frac{15}{0.86} - 15 = 2.44W$$

$$R_{th} = \frac{T_{casemax} - T_{ambient}}{P_{dissipation}} \text{ --> } 4.8°C/W = \frac{115°C - T_{ambient}}{2.44W}$$

$T_{ambientmax}$ = 103.3°C

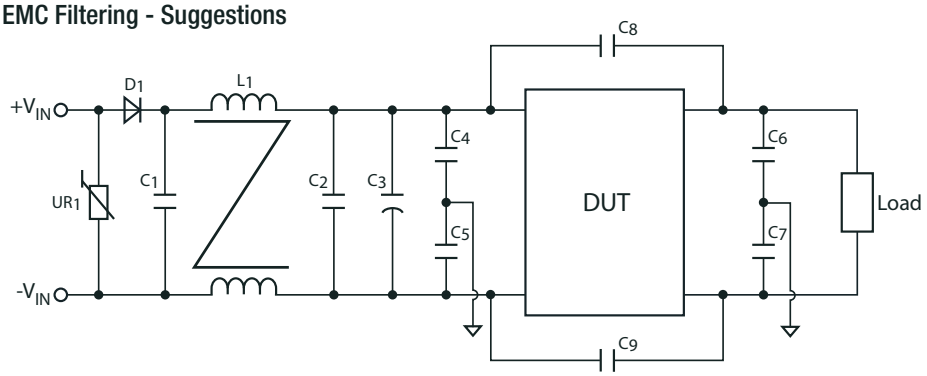
RPR30-11005S-B Series

Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

SAFETY AND CERTIFICATIONS

Certificate Type	Report / File Number	Standard / Edition
IEC/EN General Safety	LVD-2006/95/EC	IEC60950-1 2nd Edition: 2005 EN60950-1: 2006
Railway	CE120326E01C	EN50155:2007
Certificate Type (Environmental)	**Conditions**	**Standard / Criterion**
EMI	with external Filter	EN50121-1, EN50121-3-2, EN55011, Class A
ESD	±8kV Air Discharge, ±6kV Contact Discharge	EN61000-4-2, Criteria B
Radiated Immunity	Level 3, 10V/m	EN61000-4-3, Criteria A
Fast Transient	±4kV Applied	EN61000-4-4, Criteria B
Surge	±4kV Applied	EN61000-4-5, Criteria B
Conducted Immunity	Level 3, 10V rms	EN61000-4-6, Criteria A
Vibration	50-150Hz, along X,Y and Z	EN60068-2-6
Thermal Cycling (complies with MIL-STD-810F)	12 cycles	EN60068-2-14
Shock	5g / 30ms	EN60068-2-27

EMC Filtering - Suggestions



It is recommended to add UR1 and D1 in railway application. C1, C2, C3 & L1 can be modified for required EMI standards. To meet EN61000-4-2, module case should be earth grounded. We offer independent case pin option on request, the location is between pin 2 and pin 6.

Standard	UR1	D1	C1	L1	C2	C3	C4, C5, C6, C7	C8, C9
EN55022 Class A	MOV 14D361K	250V / 3A	1.5µF/250V	1200µH ±20%	470nF/250V	680µF/250V	0.47nF (Y1 CAP)	1nF (Y1 CAP)
EN61000-4-2, 3, 4, 5, 6			N/A					

Soldering

Hand Soldering

Hand Soldering is the least preferred method because the amount of solder applied, the time the soldering iron is held on the joint, the temperature of the iron and the temperature of the solder joint are variable.

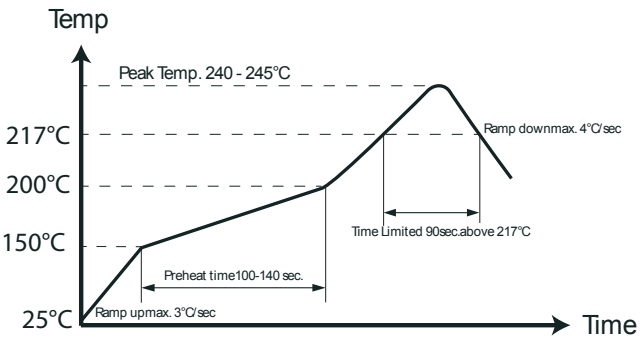
The recommended hand soldering guideline is listed in Table 1. The suggested soldering process must keep the power module's internal temperature below the critical temprature of 217°C continuously.

Wave Soldering

High temperature and long soldering time will result in IMC layer increasing in thickness and thereby shorten the solder joint lifetime. Therefore the peak temperature over 245°C is not suggested due to the potential reliability risk of components under continuous high-temperature. In the meanwhile, the soldering time of temperature above 217°C should be less than 90 seconds. Please refer to the soldering profile below for recommended temperature profile parameters.

Table 1 Hand-Soldering Guideline

Parameter	Single-side Circuit Boad	Double-side Circuit Board	Multi-layers Circuit Board
Soldering Iron Wattage	90W	90W	90W
Tip Temperature	385 ±10°C	420 ±10°C	420 ±10°C
Soldering Time	2-6 seconds	4-10 seconds	4-10 seconds



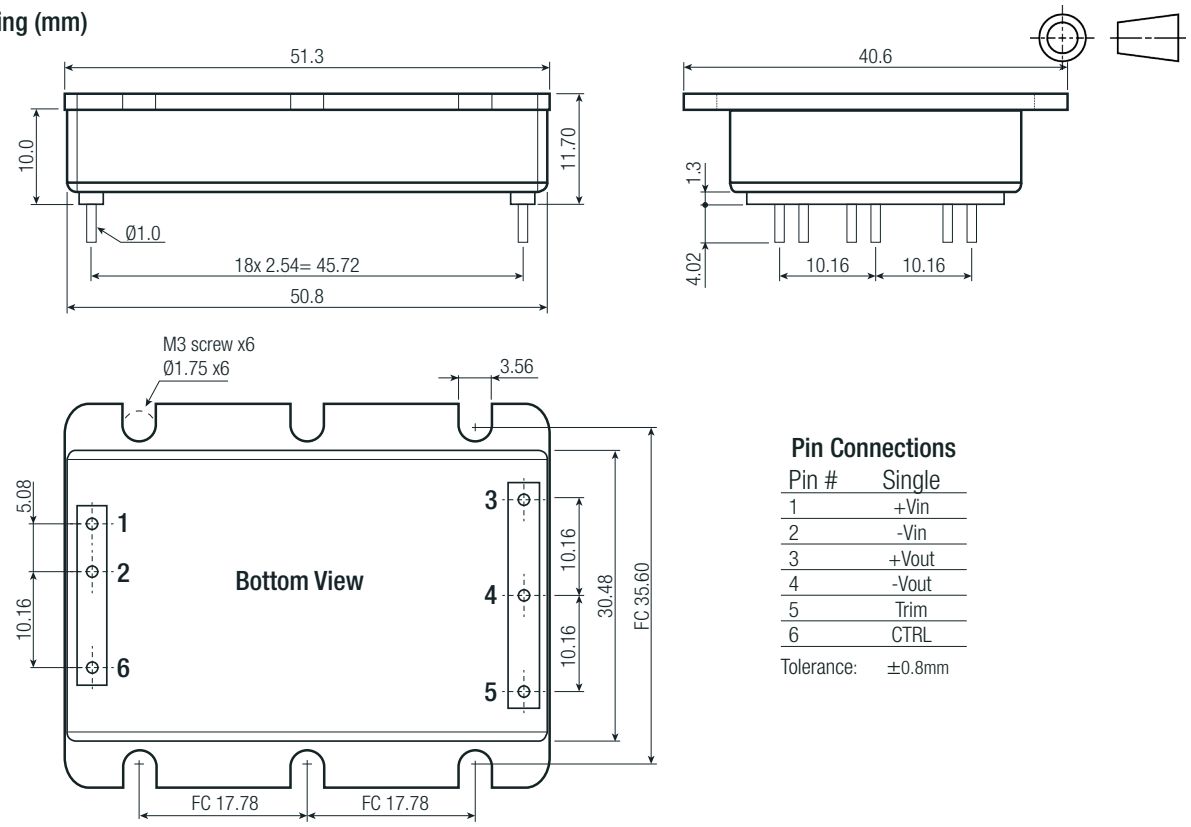
RPR30-11005S-B Series

Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

DIMENSION AND PHYSICAL CHARACTERISTICS

Parameter	Value
Case Material	Aluminium
Package Dimension (LxWxH)	51.3 x 40.6 x 11.7mm
Package Weight	40g

Dimension Drawing (mm)



Pin Connections

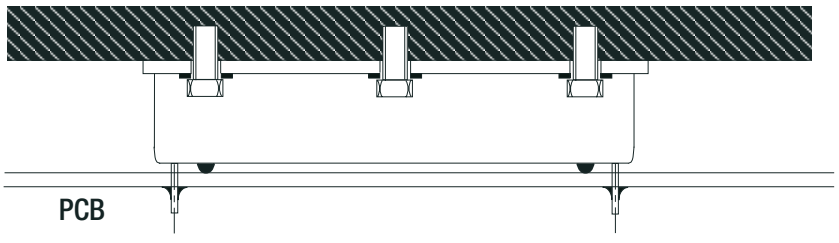
Pin #	Single
1	+Vin
2	-Vin
3	+Vout
4	-Vout
5	Trim
6	CTRL

Tolerance: ±0.8mm

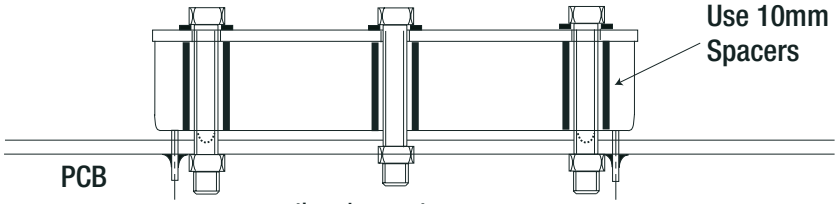
INSTALLATION and APPLICATION

Mounting Instruction

Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



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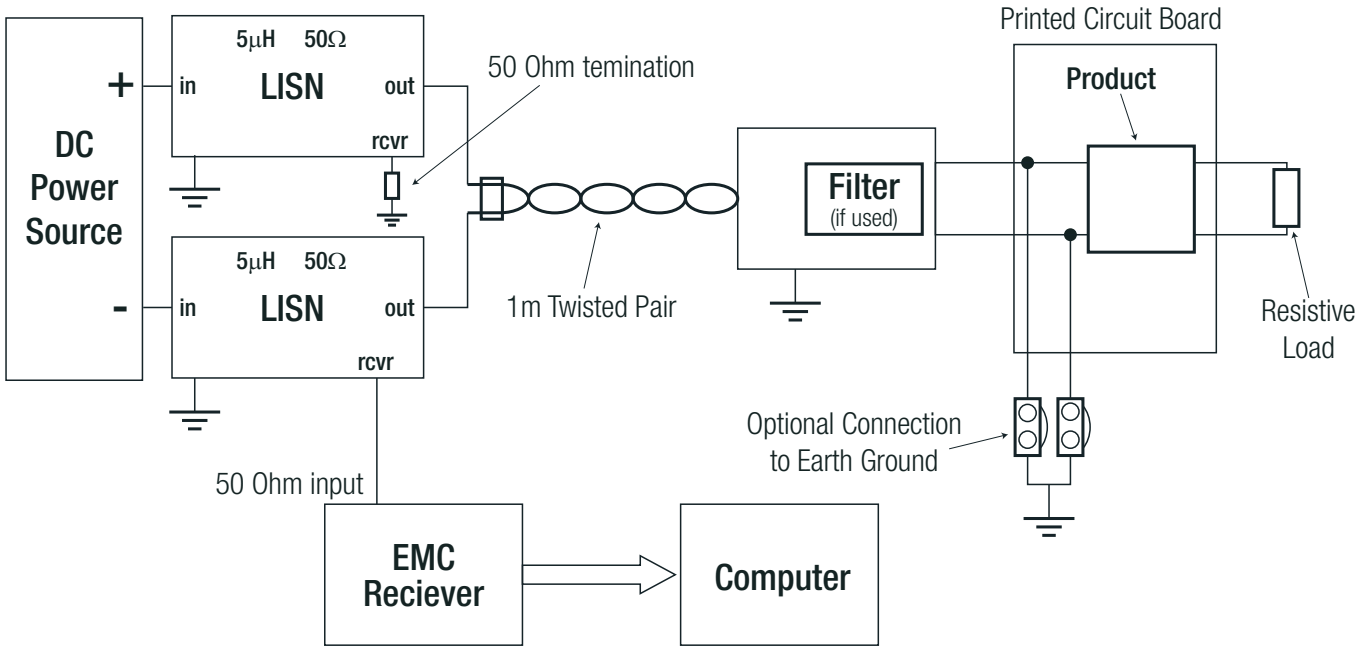
RPR30-11005S-B Series

Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

Test Set-up



PACKAGING INFORMATION		
Parameter	**Type**	**Value**
Packaging Dimension (LxWxH)	Tube	200.0 x 55.0 x 20.0mm
Packaging Quantity		4pcs
Storage Temperature Range		-55°C to +125°C

Mouser Electronics

Authorized Distributor

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RECOM:

RPR30-11005S-B