Features

Regulated Converter

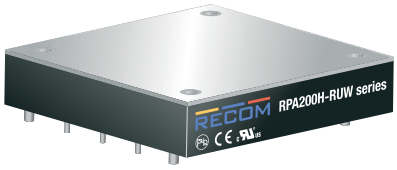
- 10:1 ultra wide input voltage range
- 4.242kVDC/1 minute reinforced insulation
- UL/IEC/EN60950-1 certified
- CE marked, CB report
- Efficiency up to 93%
- -40°C to +100°C baseplate temperature range

RECOM
DC/DC Converter

RPA200H-RUW

200 Watt Half Brick Single Output

YEAR 5 warranty



c UL us E224736

UL60950-1 certified
CAN/CSA No. 60950-1-07 certified
IEC/EN60950-1 certified
EN50155 compliant
CB report

Description

The half-brick RPA200H series DC/DC converter is designed for railway rolling stock and high voltage battery applications. It has a 10:1 input voltage range to cover all input voltages from nominal 24VDC up to 110VDC in a single product (including EN50155 transients) and offers isolated and regulated 12V, 15V, 24V or 48VDC outputs. The converter has a consistently high efficiency over the entire input voltage range and comes with a metal baseplate to permit a wide operating temperature range from -40°C to +93.5°C (when baseplate cooled). The case is fitted with threaded inserts to allow secure mounting to the PCB or bulkhead for use in high shock and vibration environments. The converter is certified to UL/IEC/EN60950 and comes with a three year warranty.

Selection Guide

Part Number	Input Voltage Range (1) [VDC]	Output Voltage [VDC]	Output Current [A]	Efficiency typ.(2) [%]	Max. Capacitive Load (3) [µF]
RPA200H-11012SRUW(4)	16.5-140	12	16.7	90	2200
RPA200H-11015SRUW(4)	16.5-140	15	13.5	93	2200
RPA200H-11024SRUW(4)	16.5-140	24	8.5	88	1000
RPA200H-11048SRUW(4)	16.5-140	48	4.2	90	100

Notes:

Note1: Refer to "Input Voltage Range"
Note2: Efficiency is tested at nominal input (110V) and full load at +25°C ambient
Note3: Max. Cap Load is tested at nominal input and full resistive load

Model Numbering

RPA200H-__ __ SRUW/_

- Input Voltage
- Output Voltage
- Single
- CTRL Logic(4)
- Railway Ultra Wide Input

Ordering Examples

RPA200H-11012SRUW/P = 110V Input, 12V Output, Single, Pos. CTRL function
RPA200H-11012SRUW/N = 110V Input, 12V Output, Single, Neg. CTRL function

Notes:

Note4: add suffix "P" for positive logic (1=ON, 0=OFF) or add suffix "N" instead for negative logic (0=ON, 1=OFF)

Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

BASIC CHARACTERISTICS

Parameter	Condition		Min.	Typ.	Max.
Internal Input Filter					Pi-Type
Input Voltage Range			16.5VDC	110VDC	140VDC
Input Surge Voltage	<1s				156VDC
Under Voltage Lockout (UVLO) (5)	DC-DC ON DC-DC OFF		15.6VDC 13.6VDC	16.0VDC 14.0VDC	16.4VDC 14.4VDC
Over Voltage Lockout (OVLO)	DC-DC ON DC-DC OFF		142VDC 154VDC	146VDC 156VDC	150VDC 160VDC
Input Current Range	Vin = 16.5VDC	12, 15Vout 24, 48Vout	13.5A 14A	14A 14.5A	14.5A 15A

Notes:

Note5: Refer to "UNDER VOLTAGE LOCKOUT ADJUSTABILITY" for detail information

continued on next page

SURGE PROTECTOR available

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

sales@prom-elec.com / ООО ПРОМЭЛЕКТРОНИКА

Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

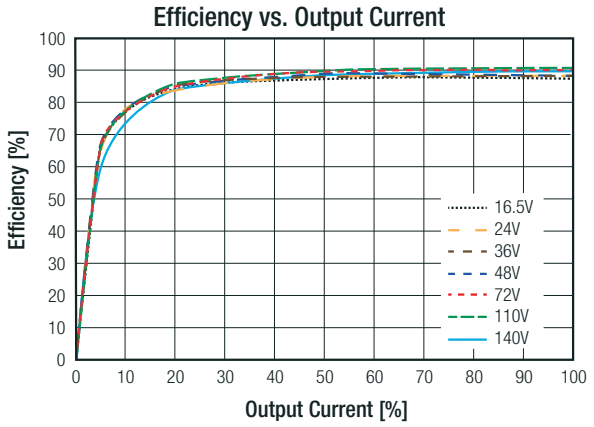
BASIC CHARACTERISTICS

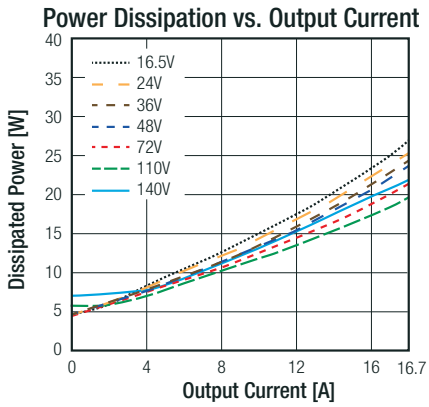
Parameter	Condition		Min.	Typ.	Max.
Quiescent Current	Vin = 110VDC	12, 15, 24Vout 48Vout	30mA 50mA	60mA 80mA	90mA 150mA
Output Voltage Trimming			-20%		+10%
Minimum Load			0%		
Start-up time			200ms		460ms
Rise Time	Vout from 10% to 90%			50ms	100ms
ON/OFF Control (6)	Positive Logic	DC-DC ON DC-DC OFF	Open or 3 < Vr < 5VDC Short or 0 < Vr < 0.4VDC		
	Negative Logic	DC-DC ON DC-DC OFF	Short or 0 < Vr < 0.4VDC Open or 3 < Vr < 5VDC		
Input Current of CTRL pin	DC-DC ON DC-DC OFF			0.1mA 0.1mA	0.2mA 0.2mA
Standby Current				20mA	
Internal Operating Frequency				140kHz	
Output Ripple and Noise	20MHz BW limited			350mVp-p	
Remote Sense (7)					±10%

Notes:

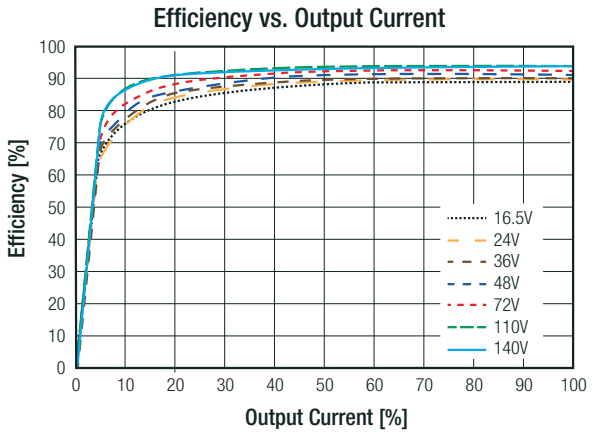
Note6: For detail information refer to "ON/OFF CONTROL" or "REMOTE SENSE"

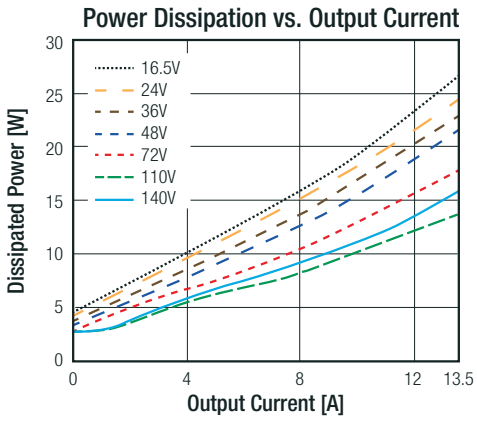
RPA200H-11012SRUW





RPA200H-11015SRUW





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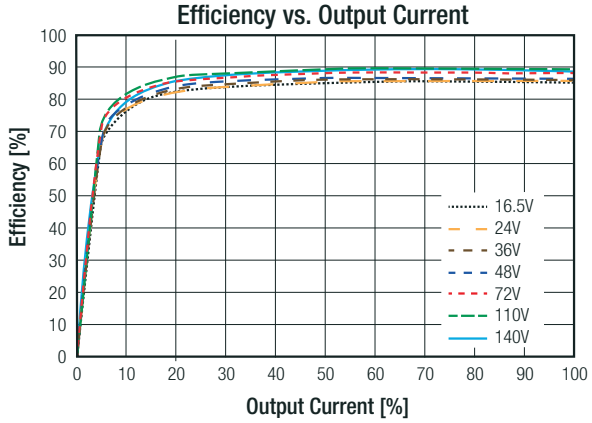
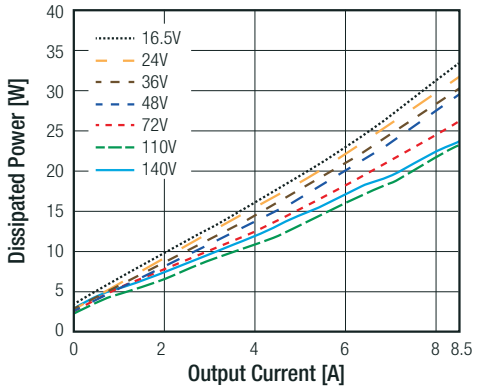
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

RPA200H-11024SRUW

Efficiency vs. Output Current

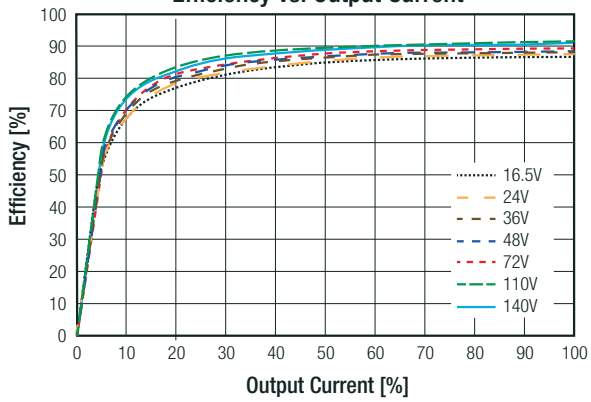


Power Dissipation vs. Output Current

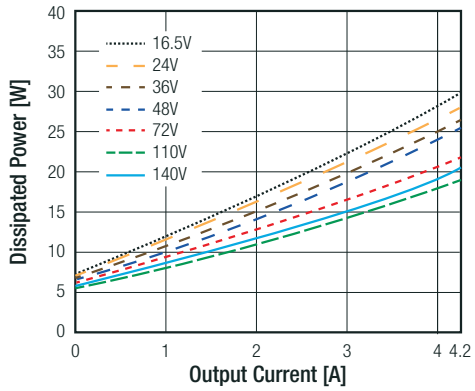


RPA200H-11048SRUW

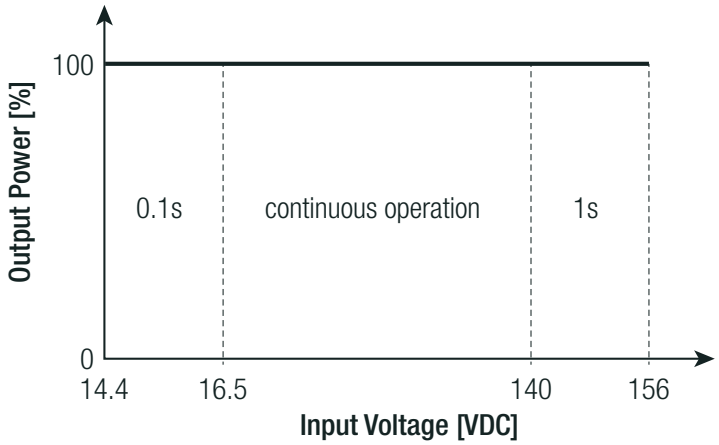
Efficiency vs. Output Current



Power Dissipation vs. Output Current

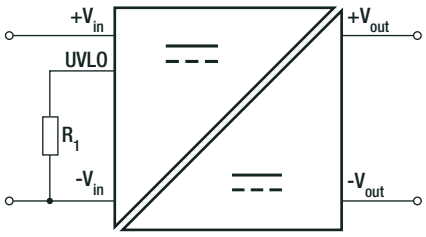


Input Voltage Range



Continuous full power operation is rated between 16.5V and 140V, including full load start-up.
Once running, the converter will operate for short periods of time over an extended input voltage range down to 14.4V and up to 156V, thus covering all EN50155 under-voltage and over-voltage transient conditions.

UNDER VOLTAGE LOCKOUT ADJUSTABILITY



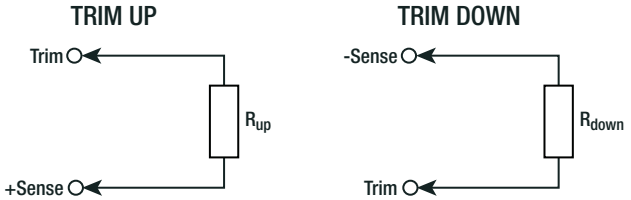
The RPA200H series has an adjustable under voltage lockout which will shut down the converter according to following settings.

Nom. Input Voltage [VDC]	24	36	48	72	110
Turn Off Threshold [VDC]	14±0.4V	21±0.5V	28.5±0.5V	43±1V	65.5±2V
Turn On Threshold [VDC]	16±0.4V	24.5±0.5V	33.5±0.5V	50.5±1V	77±2V
Resistor R1 [kΩ]	open	24.9	12.4	6.19	3.48

OUTPUT VOLTAGE TRIMMING

Output Voltage Trimming

RPA200H-RUW converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary; they also can be calculated with below shown equation.



$Vout_{nom}$	= nominal output voltage	[VDC]
$\Delta Vout$	= output voltage change	[%]
V_{ref}	= reference voltage	[VDC]
R_{up}	= trim up resistor	[Ω]
R_{down}	= trim down resistor	[Ω]
R_1 - R_3	= internal resistors	[Ω]

$Vout_{nom}$	R_1	R_2	R_3	V_{ref}
12VDC	10k2Ω	45kΩ	40kΩ	5.11VDC
15VDC		57k4Ω	52k3Ω	
24VDC		95kΩ	90kΩ	
48VDC		195kΩ	190kΩ	

Calculation:

$$R_{up} = \left[\frac{R_2}{\Delta Vout}\right] - R_3$$

$$R_{down} = \left[\frac{V_{ref}}{\Delta Vout}\right] - R_1$$

Practical Example RPA200H-12SRUW trim up +10%

$$R_{up} = \left[\frac{45k}{0.1}\right] + 40k = \mathbf{490k\Omega}$$

R_{up} according to E96 ≈ **487kΩ**

Practical Example RPA200H-12SRUW trim down -8%

$$R_{down} = \left[\frac{5.11}{0.08}\right] - 10k2 = \mathbf{53k6\Omega}$$

R_{down} according to E96 ≈ **53k6Ω**

RPA200H-11012SRUW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
$Vout_{set}$ =	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	[VDC]
R_{up} (E96) ≈	4M53	2M32	1M54	1M15	931k	787k	681k	604	536k	487k	[Ω]

RPA200H-11015SRUW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
$Vout_{set}$ =	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	[VDC]
R_{up} (E96) ≈	5M76	2M94	1M96	1M50	1M21	1M01	866k	768k	681k	619k	[Ω]

RPA200H-11024SRUW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
$Vout_{set}$ =	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40	[VDC]
R_{up} (E96) ≈	9M53	4M87	3M24	2M49	2M	1M69	1M43	1M27	1M15	1M50	[Ω]

RPA200H-11048SRUW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
$Vout_{set}$ =	48.48	48.96	49.44	49.92	50.40	50.88	51.36	51.84	52.32	52.80	[VDC]
R_{up} (E96) ≈	19M60	9M88	6M65	5M11	4M12	3M48	3M10	2M61	2M37	2M15	[Ω]

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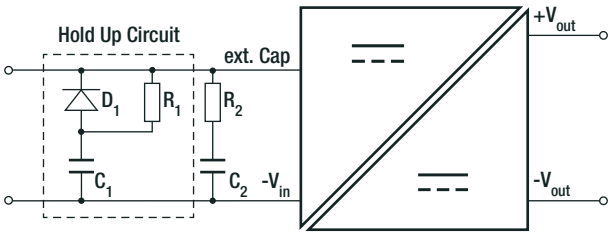
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

Trim down RPA200H series

Trim down	1	2	3	4	5	6	7	8	9	10	[%]
R_{down} (E96) ≈	499k	243k	162k	118k	90k9	75k	63k4	53k6	46k4	41k2	[Ω]
Trim down	11	12	13	14	15	16	17	18	19	20	[%]
R_{down} (E96) ≈	36k5	32k4	28k7	26k1	23k7	22k1	20k	18k2	16k5	15k4	[Ω]

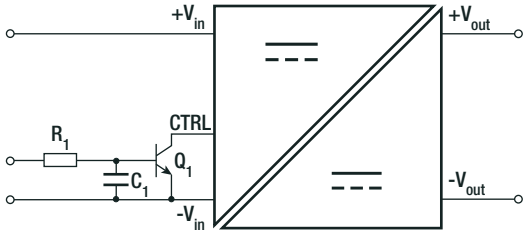
EXTERNAL CAPACITOR



A 240µF/200V capacitor (C2) is required for normal operation.
To meet power supply interruptions, an external circuit comprised of a capacitor (C1), a 100Ω/1W resistor (R1), a 200V/3A diode (D1) and a 3R/1W resistor (R2) is required.

C1	24Vin	36Vin	48Vin	72Vin	96Vin	110Vin
For 10ms	3600µF	3600µF	3600µF	3600µF	1000µF	600µF
For 30ms	10800µF	10800µF	10800µF	10800µF	3000µF	1800µF

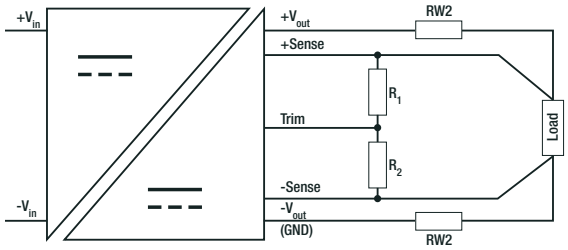
ON/OFF CONTROL



For negative logic, if the remote on/off feature is not used, short the on/off pin to -Vin.

For positive logic, if the remote on/off feature is not used, leave the on/off pin floating.

REMOTE SENSE



The output voltage can be adjusted by both trim and remote sense. The maximum combined adjustment range is ±10%. Derate the maximum output power if using the trim or sense function to increase the output voltage.

R_{W1} ... wire losses +
R_{W2} ... wire losses -
R_1 ... trim up resistor
R_2 ... trim down resistor

REGULATION

Parameter	Condition		Value
Output Accuracy			±1.0% max.
Line Regulation	Vin = 16.5 to 140V, Io = full load		±0.01% typ. to ±0.2% max.
Load Regulation	10 - 90% load		0.05% typ. to 0.2% max.
Transient Response	25% load step change	12Vout	450mV/40µs typ.
		15Vout	450mV/30µs typ.
		24Vout	500mV/20µs typ.
		48Vout	600mV/10µs typ.

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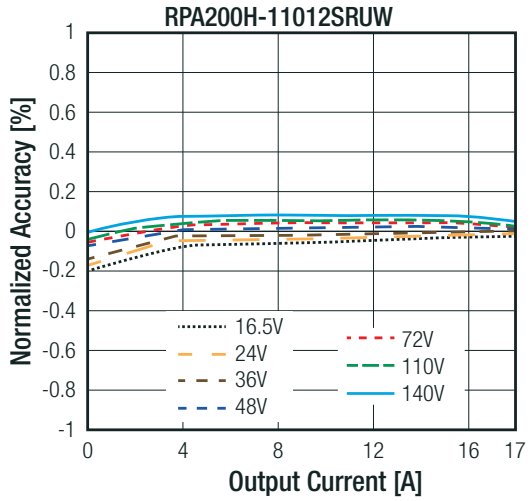
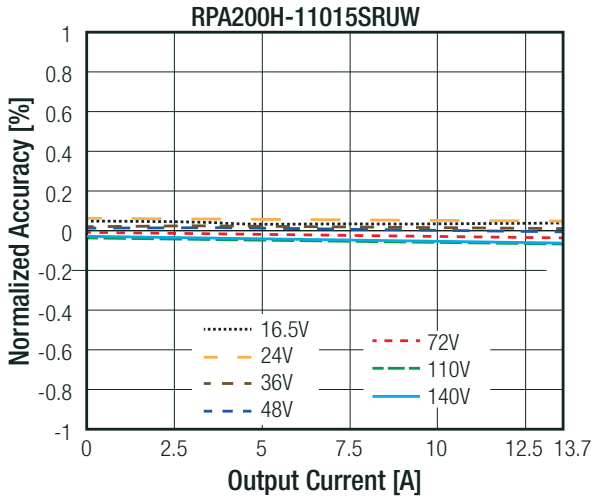
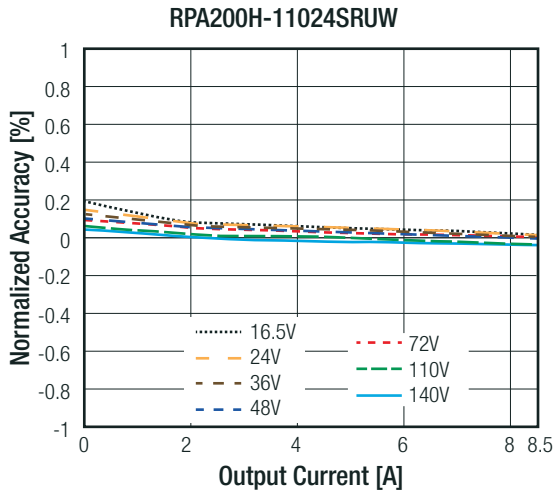
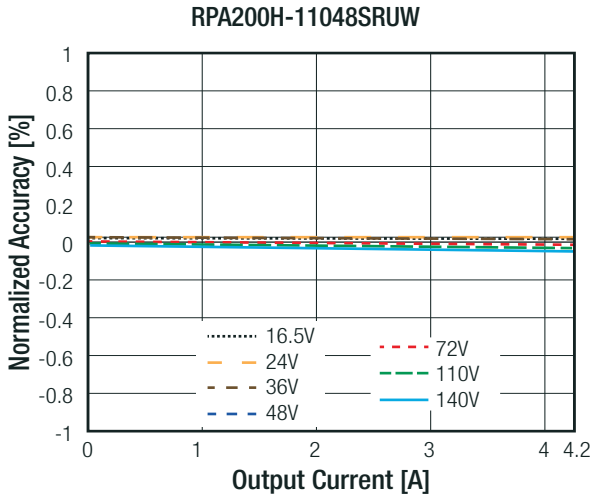
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

Accuracy vs. Load









PROTECTION

Parameter	Condition		Value
Over Voltage Protection (OVP)			110-130%, automatic recovery
Over Current Protection (OCP)			hiccup mode, automatic recovery
Over Temperature Protection (OTP)	@ tc point		+105°C, automatic recovery after cooling down
Isolation Voltage (7)	I/P to O/P, O/P to baseplate	rated for 1 minute	4.242kVDC 4.242kVDC
Isolation Resistance			10MΩ typ.
Isolation Capacitance			500pF
Leakage Current			0.42mA
Insulation Grade			reinforced

Notes:

Note7: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note8: Refer to local safety regulations if input over-current protection is also required. Recommended fuse T40A slow blow type

Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

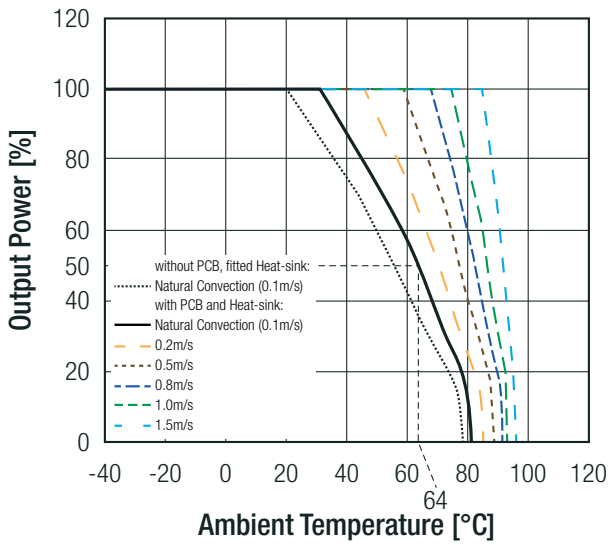
ENVIRONMENTAL		
Parameter	**Condition**	**Value**
Operating Temperature Range		refer to derating graphs
Maximum Baseplate Temperature	measured @ tc point	+100°C
Temperature Coefficient		0.007%/°C
Thermal Impedance		refer to Rth tables
Operating Altitude		5000m
Operating Humidity		5%-95% RH
Pollution Degree (PD)		PD2
Fire protection on Railway Vehicles	refer to page 9	according to EN45545-2 standard
MTBF	according to Telcordia SR332 Issue 2 Method I, 25°C	1480 x 10^3 hours

Notes:

Note9: Following calculations are made with RPA200H-11012SRUW/P.
Test PCB: Eurocard 160x100mm 105µm copper, double layer

Thermal Derating with Fan Cooling, Double Layer PCB and Heat-sink

Thermal Impedance	
airflow [m/s]	**Rth** [°C/W]
0.1	3.3
0.2	2.62
0.5	2.0
0.8	1.57
1.0	1.22
1.5	0.75



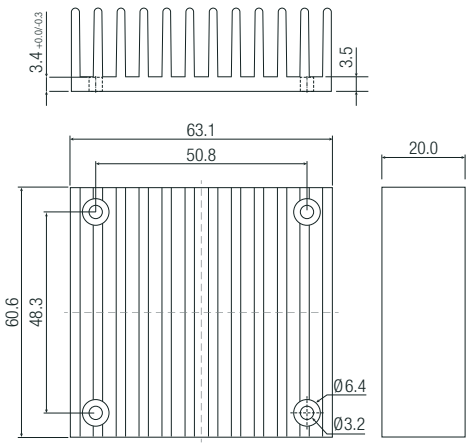
Thermal Calculation Example

Iout = 50%
R_{th} = 3.3°C/W
P_{DISS} = 10.94W
T_{ICmax} = 100°C

$T_{OVER} = R_{th} \times P_{Diss} = 3.3°C/W \times 10.94W = +36°C$

$T_{AMBmax} = T_{ICmax} - T_{OVER} = 100°C - 36°C = +64°C$

Dimension Drawing Heat-sink (mm)



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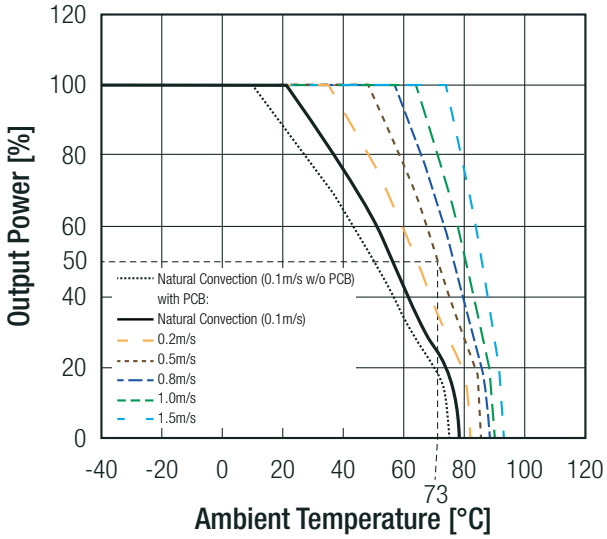
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

Thermal Derating with Fan Cooling and Double Layer PCB

Thermal Impedance	
airflow [m/s]	Rth [°C/W]
0.1	3.8
0.2	3.12
0.5	2.5
0.8	2.07
1.0	1.72
1.5	1.25



Thermal Calculation Example

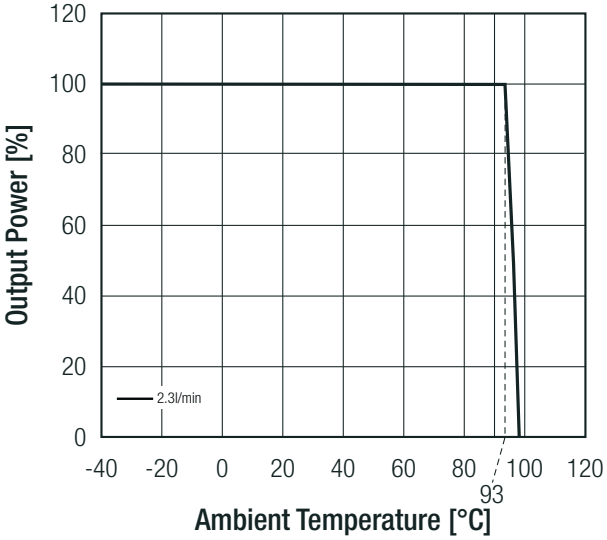
Iout = 50%
R_{th} = 2.5°C/W
P_{DISS} = 10.94W
T_{ICmax} = 100°C

T_{OVER} = R_{th} x P_{Diss} = 2.5°C/W x 10.94W = +27.4°**C**

T_{AMBmax} = T_{ICmax} - T_{OVER} = 100°C - 27.4°C = +**73°C**

Thermal Derating with Water Cooling

Thermal Impedance	
liquid flow [l/min]	Rth [°C/W]
2.3	0.31



Thermal Calculation Example

Iout = 100%
R_{th} = 0.31°C/W
P_{DISS} = 20.79W
T_{ICmax} = 100°C

T_{OVER} = R_{th} x P_{Diss} = 0.31°C/W x 20.79W = +**6.5°C**

T_{AMBmax} = T_{ICmax} - T_{OVER} = 100°C - 6.5°C = +**93.5°C**

Notes:

Note10: For further details please contact our Tech Support Team techsupportAT@recom-power.com

SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report / File Number	Standard
Information Technology Equipment, General Requirements for Safety	E224736-A54-UL and E224736-A57-UL	UL60950-1, 2nd Edition: 2014 CAN/CSA-C22.2 No. 60950-1-07, 2nd Edition: 2014
IEC/EN Information Technology Equipment - General Requirements for Safety (CB Scheme)	E224736-A54-CB-1 and E224736-A57-CB-1	IEC60950-1: 2005, 2nd Edition + AM2: 2013
IEC/EN Information Technology Equipment - General Requirements for Safety		EN60950-1: 2006 + A2: 2013

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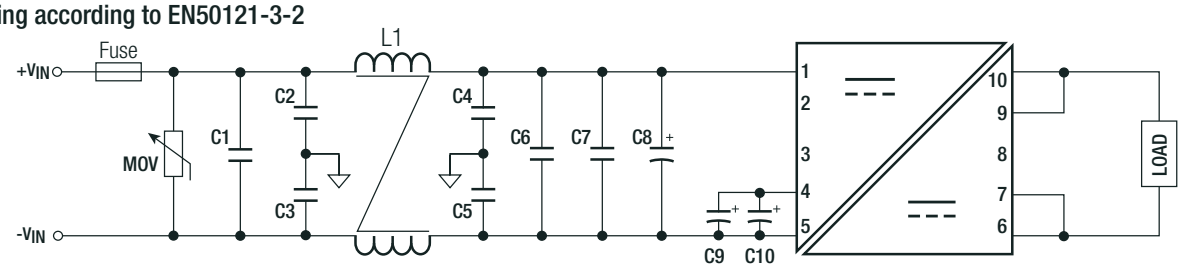
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

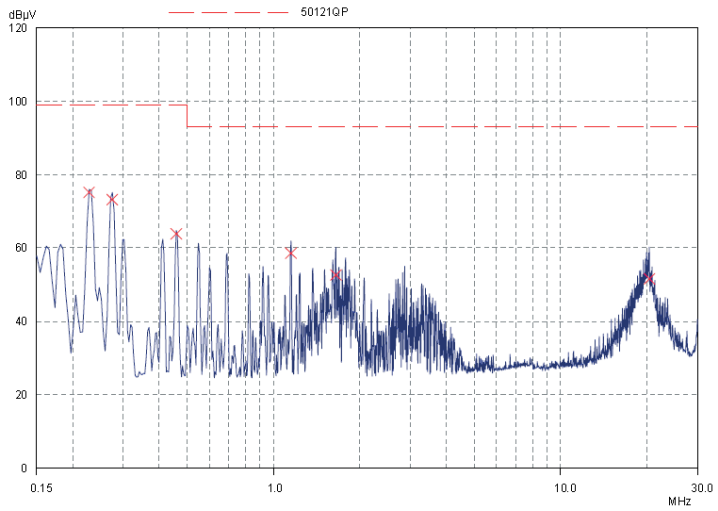
Fire hazard testing - Part 11-10: Test flames - 50W horizontal and vertical flame test methods	Vertical Flame Test	EN60695-11-10: 2013, HL1, HL2, HL3, V-0
Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods; Glow-wire flammability test method for end-products	Glow-Wire Flammability Test 30s ta, 850°C	EN60695-2-11:2000, HL1, HL2, HL3
Plastics - Determination of burning behaviour by oxygen index - Part 2: Ambient-temperature test	OI% (min) 42.6% OI% (min) 36.8%	EN ISO 4589-2:2006, HL1, HL2, HL3 EN ISO 4589-2:1999 + A1:2006, HL1, HL2, HL3
Railway Applications - Electrical Equipment used on rolling stock		EN50155: 2007
Railway applications - Fire protection on railway vehicles Part 2: Requirements for fire behaviour of materials and components		EN45545-2:2013 + A1:2015
EAC	RU-AT.49.09571	TP TC 004/2011
RoHS2		RoHS 2011/65/EU + AM2015/863

EMC Compliance	Condition	Standard / Criterion
Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus	with external components	EN50121-3-2:2015
ESD Electrostatic discharge immunity test	Air ±8kV, Contact ±6kV	EN61000-4-2, Criteria B
Radiated, radio-frequency, electromagnetic field immunity test	80-1000MHz, 20V/m 800-1000MHz, 20V/m 1400-2100MHz, 10V/m 2100-2500MHz, 5V/m	EN61000-4-3, Criteria A
Fast Transient and Burst Immunity	±2kV	EN61000-4-4, Criteria A
Surge Immunity	±1kV (diff), ±2kV (com)	EN61000-4-5, Criteria B
Immunity to conducted disturbances, induced by radio-frequency fields	10V	EN61000-4-6, Criteria A
Electromagnetic compatibility of multimedia equipment - Emission requirements	with external components	EN55032, Class B

EMC Filtering according to EN50121-3-2



MOV	C1	C2, C3, C4, C5	L1	C6, C7	C8	C9, C10
EPCOS B72207S0131K101	100nF 275VAC	1000pF, 300VAC	1mH CMC	0.47µF 250V	100µF 200V	120µF 200V



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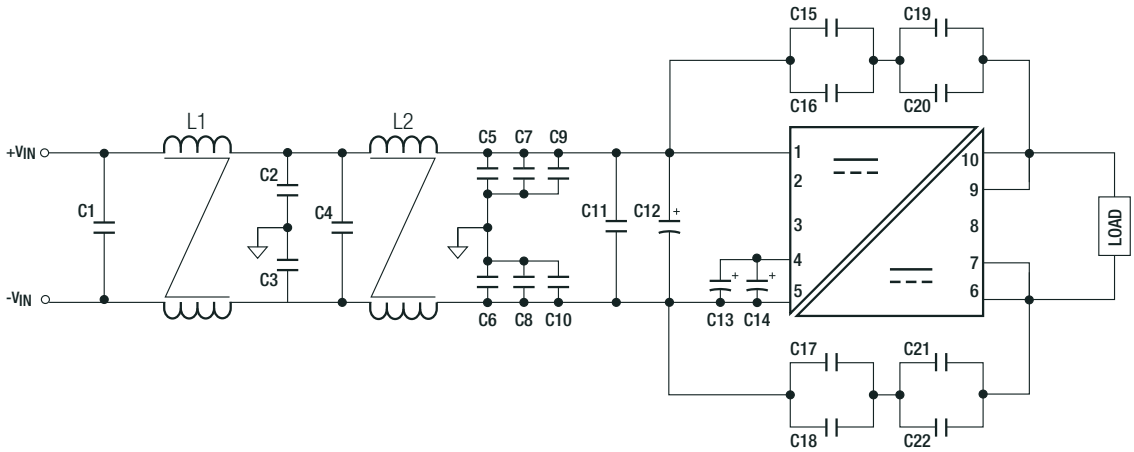
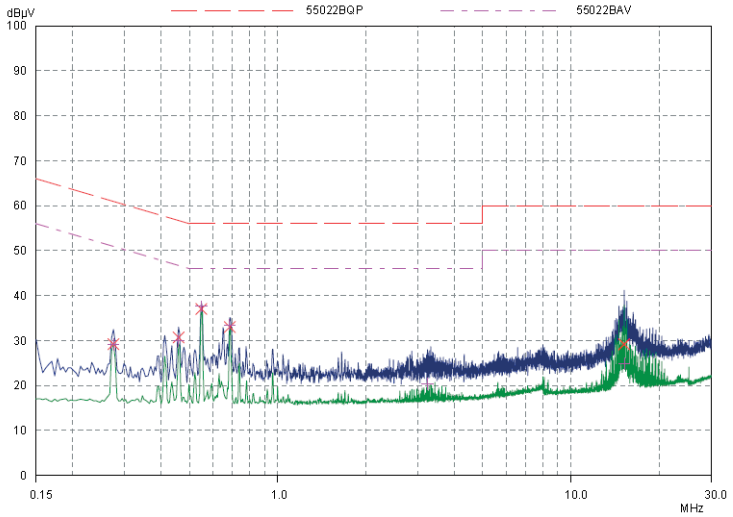
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

EMC Filtering according to EN55032 Class B



C1, C4, C11	L1, L2	C2, C3, C5, C6, C7, C8, C9, C10	C12	C13 C14	C15, C16, C17, C18, C19, C20, C21, C22,
0.47µF, 250V MLCC	1mH CMC	1.5nF, 3kV	100µF 200V	120µF 200V	6.8nF, 2kV



DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	baseplate case potting	aluminum plastic (UL94V-2) low smoke silicone (UL94V-0)
Package Dimensions (LxWxH)		60.6 x 63.1 x 13.0mm
Package Weight		125.0g typ.

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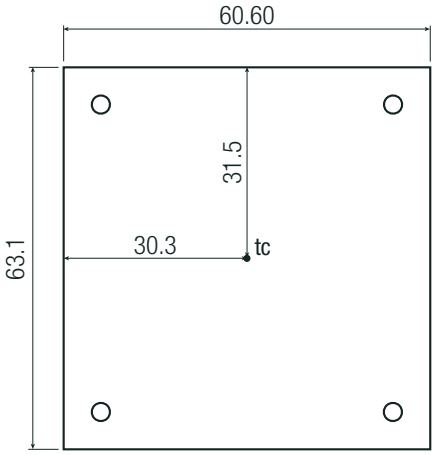
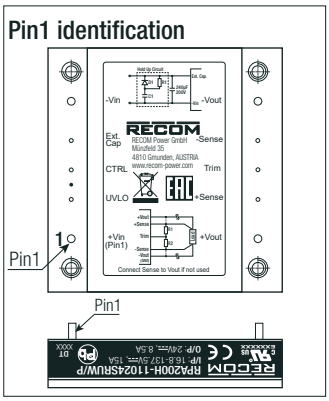
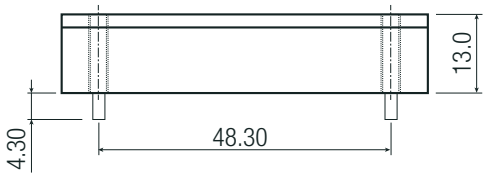
RPA200H-RUW Series

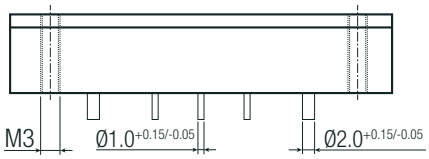
Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

Dimension Drawing (mm)





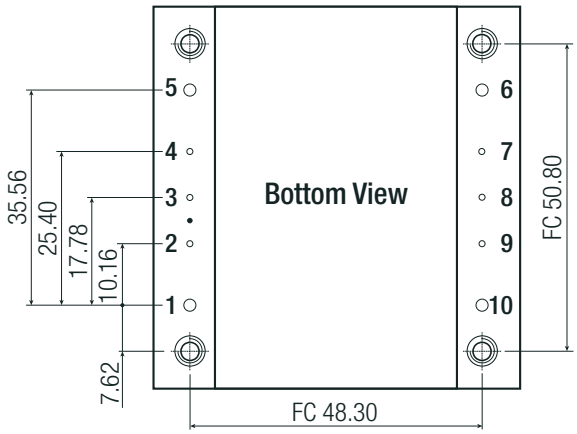




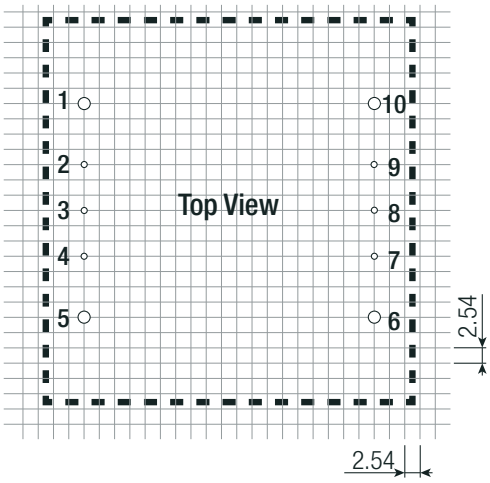
Pin Connections

Pin #	Single
1	+Vin
2	UVLO
3	CTRL
4	Ext. Cap.
5	-Vin
6	-Vout
7	-Sense
8	Trim
9	+Sense
10	+Vout

XX.X ± 0.5mm
XX.XX ± 0.25mm
FC= fixing center

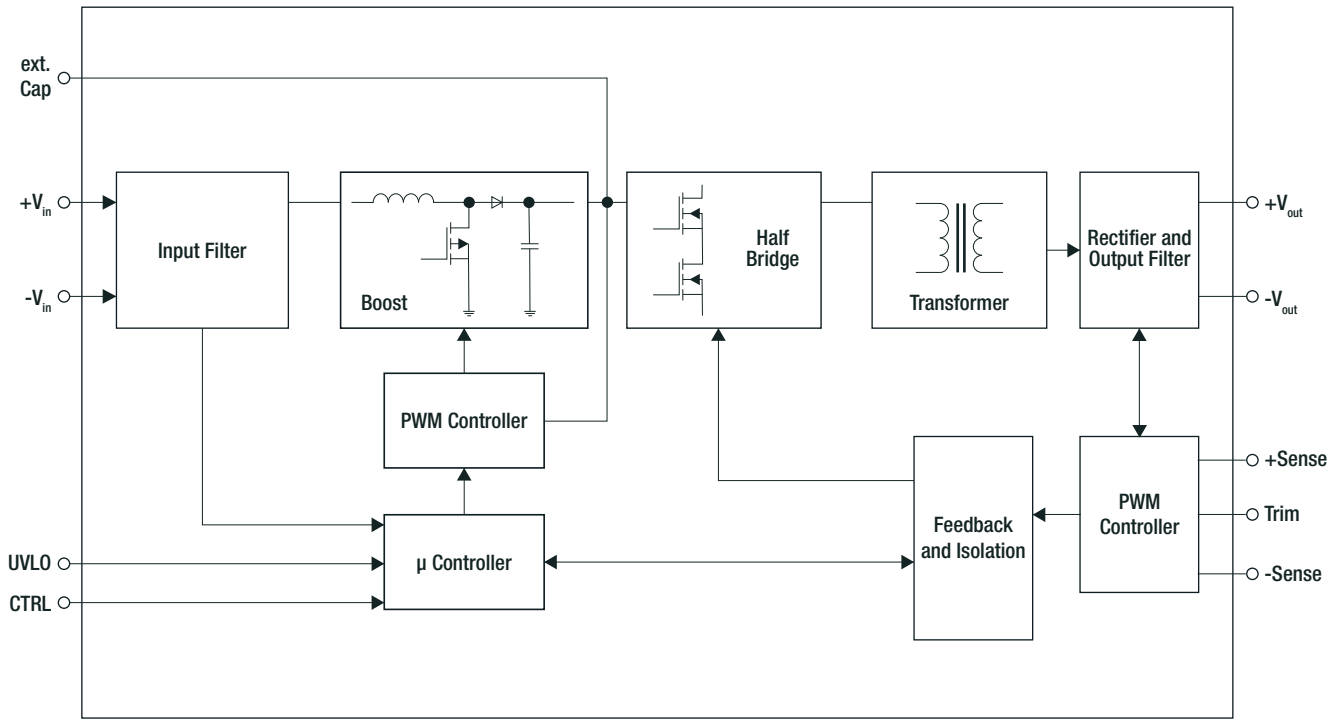


Recommended Footprint Details



Specifications (measured @ Ta = 25°C, nom. Vin (110V), full load and after warm-up unless otherwise stated)

BLOCK DIAGRAMM



PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimensions (LxWxH)	tube	355.0 x 63.5 x 20.6mm
Packaging Quantity		5pcs
Storage Temperature Range		-55°C to +125°C
Storage Humidity		95% RH

The product information and specifications may be subject to changes even without prior written notice.The product has been designed for various applications; its suitability lies in the responsibility of each customer. The products are not authorized for use in safety-critical applications without RECOM's explicit written consent. A safety-critical application is an application where a failure may reasonably be expected to endanger or cause loss of life, inflict bodily harm or damage property. The applicant shall indemnify and hold harmless RECOM, its affiliated companies and its representatives against any damage claims in connection with the unauthorized use of RECOM products in such safety-critical applications.