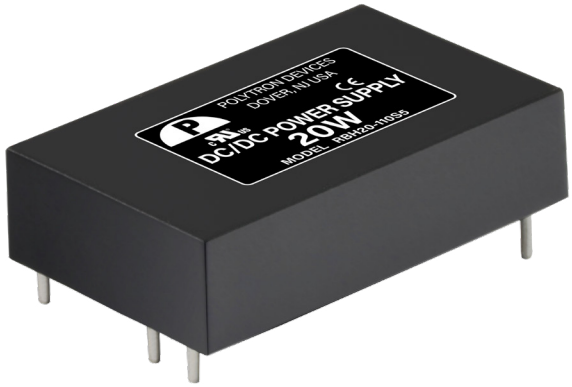
POLYTRON DEVICES

DATA SHEET



DC-DC CONVERTERS

4:1 WIDE INPUT RANGE, UP TO 20 WATTS

RAILWAY APPLICATIONS

RBH20 SERIES

FEATURES

- 3,000Vac Reinforced Insulation
- 4:1 Wide Input Range
- Low Standby Power
- Internal EN55032 Class A Filter
- No Minimum Load Required
- Remote ON/OFF
- Over Current Protection
- Over Voltage Protection
- Short Circuit Protection
- Over Temperature Protection
- Under Voltage Protection
- Safety Meets: IEC/ EN/ UL62368-1
- RoHS and REACH Compliant

SELECTION GUIDE All specifications are typical at nominal input, full load and 25°C, unless otherwise noted.

Input Voltage Range Vdc	Output Voltage Vdc	Output Current at Full Load mA	Input Current at No Load mA	Efficiency %	Maximum Capacitor Load µF	Model Number
36 ~ 160	5	4,000	10	90.5	5,000	RBH20-110S5
36 ~ 160	5.1	4,000	10	90.5	5,000	RBH20-110S5.1
36 ~ 160	12	1,670	10	88.5	850	RBH20-110S12
36 ~ 160	15	1,330	10	89.5	700	RBH20-110S15
36 ~ 160	24	833	10	88.5	220	RBH20-110S24
36 ~ 160	±5	±2,000	10	86	±2,500	RBH20-110-5
36 ~ 160	±12	±833	10	88.5	±500	RBH20-110-12
36 ~ 160	±15	±667	10	89.5	±350	RBH20-110-15

RBH20 SERIES

Input Specifications

Operating input voltage range, Vdc	36 Min., 110 Typ., 160 Max.	110Vin(nom)
Start up voltage, Vdc	36 Max.	110Vin(nom)
Shutdown voltage, Vdc	32 Min., 34 Typ., 35.8 Max.	110Vin(nom)
Start up time, ms	30 Typ., 60 Max.	Constant resistive load, Power up
	30 Typ., 60 Max.	Remote ON/OFF
Input surge voltage, Vdc	200 Max.	1 second, Max., 110Vin(nom)
Input filter	Pi type	
Remote ON/OFF		Referred to –Vin pin
	Open or 3 ~ 12Vdc	Positive logic, DC-DC ON
	Short or 0 ~ 1.2Vdc	Standard, DC-DC OFF
	Short or 0 ~ 1.2Vdc	Negative logic, DC-DC ON
	Open or 3 ~ 12Vdc	Option, DC-DC OFF
	-0.5 Min., 0.5 Max.	Input current of Ctrl pin
	3 Typ.	Remote off input current

Output Specifications

Voltage accuracy, %	-1 Min., 1 Max.	
Line regulation, %	-0.2 Min., 0.2 Max.	LL to HL at Full Load, Single
Load regulation, %	-0.5 Min., 0.5 Max.	No Load to Full Load, Single
	-1 Min., 1 Max.	Dual
Cross regulation, %	-5 Min., 5 Max.	Asymmetrical Load 25%/100% FL, Dual
Voltage adjustability, %	-10 Min., 10 Max.	Single Output, Other
	-10 Min., 20 Max.	15, 24 Vout
Ripple & noise, mVp-p	Measured by 20 MHz bandwidth, with a 1μF/50V X7R MLCC	
	75 Typ.	5, 5.1 Vout
	100 Typ.	12, 15 Vout
	150 Typ.	24 Vout
Temperature coefficient, %/°C	-0.02 Min., 0.02 Max.	
Transient response recovery time, μS	250 Typ.	25% load step change
Over voltage protection, Vdc		Zener Diode clamp
	6.2	5, 5.1 Vout
	15	12 Vout
	20	15 Vout
	30	24 Vout
Over Load Protection, %	Percent of Iout rated, Hiccup mode: 150	
Short Circuit Protection	Continuous, automatic recovery	

General Specifications

Isolation voltage, Vdc	1 minute (reinforced insulation)	Input to Output	3,000 Min.		
Isolation resistance, GΩ		500Vdc	1 Min.		
Isolation capacitance, pF					1,000 Max.
Switching frequency, kHz			250 Min.	275 Typ.	310 Max.

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RBH20 SERIES

Environmental Specifications

Operating ambient temperature, °C	With derating	-40 Min.		+105 Max.
Maximum case temperature, °C				+105 Max.
Over temperature protection, °C	Internal temperature sensor			
Storage temperature range, °C		-55 Min.		+125 Max.
Thermal impedance[1], °C/W			11.48 Typ.	
Thermal shock		MIL-STD-810F		
Shock		EN61373, MIL-STD-810F		
Vibration		EN61373, MIL-STD-810F		
Relative humidity		5% to 95% RH		

Physical Specifications

Design meet safety standard	IEC/ EN/ UL62368-1, EN50155, EN45545-2
Case material	Non-conductive black plastic
Base material	Non-conductive black plastic
Potting material	Silicon (UL94 V-0)
Weight	24g (0.85oz)
MTBF	MIL-HDBK-217F, Full load, 1.558 x 10^6 hrs

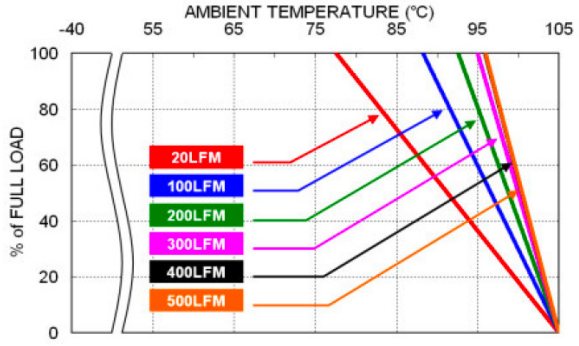
EMC Specifications

Specifications	Conditions		Level
EMI	EN55032, EN50121-3-2	Without external components	Class A
		With external components	Class B
EMS	EN55035, EN50121-3-2		
ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	20V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2kV	Perf. Criteria A
Surge	EN61000-4-5	±2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

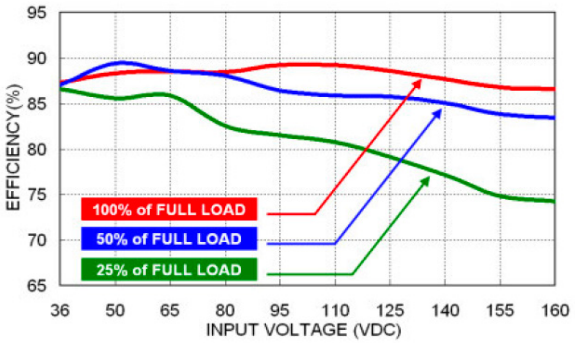
Note:

CAUTION: This power module is not internally fused. An input line fuse must always be used.

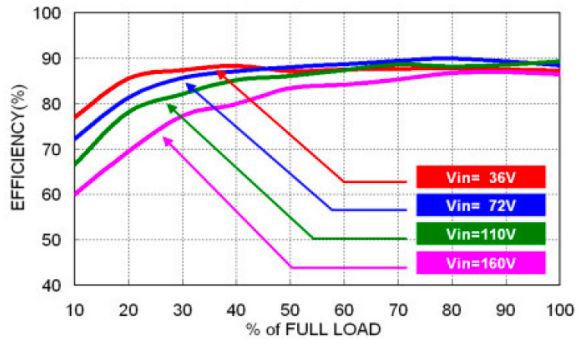
Characteristic Curve



RBH20-110S5 Derating Curve



RBH20-110S5 Efficiency vs. Input Voltage



RBH20-110S5 Efficiency vs. Output Load

Fuse Consideration

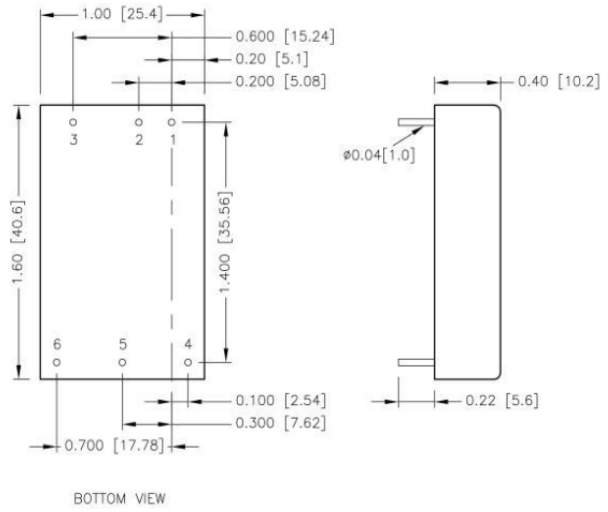
Model	Fuse Rating (A)	Fuse Type
RBH20-110XXX	1	Slow-Blow

Note:

1. This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.
2. To maximize flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

CAUTION: This power module is not internally fused. An input line fuse must always be used.

Mechanical Drawing

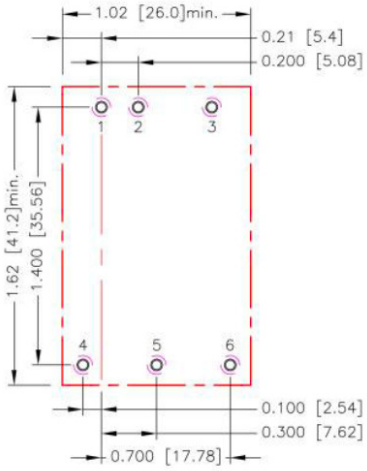


PIN CONNECTION

PIN	Single	Dual
1	+ Vin	+ Vin
2	- Vin	- Vin
3	Ctrl	Ctrl
4	+ Vout	+ Vout
5	- Vout	Com
6	Trim	- Vout

1. **All dimensions in inch (mm)**
2. **Tolerance :x.xx±0.02 (x.x±0.5) x.xxx±0.01 (x.xx±0.25)**
3. **Pin pitch tolerance ±0.01 (0.25)**

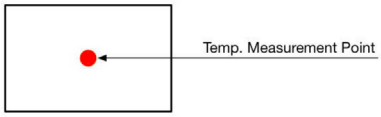
Recommended Pad Layout



1. **All dimensions in inch[mm]**
2. **Pad size(lead free recommended)**
3. **Through hole 1.2.3.4.5.6: ∅0.051[1.30]**
4. **Top view pad 1.2.3.4.5.6: ∅0.064[1.63]**
5. **Bottom view pad 1.2.3.4.5.6: ∅0.102[2.60]**

Thermal Considerations

Thermal test condition with vertical direction by natural convection (20LFM)



1. The power module operates in a variety of thermal environments.
2. However, sufficient cooling should be provided to help ensure reliable operation of the unit.
3. Heat is removed by conduction, convection, and radiation to the surrounding environment.
4. Proper cooling can be verified by measuring the point as in the figure at left.
5. The temperature at this location should not exceed “Maximum case temperature”.
6. When operating, adequate cooling must be provided to maintain the test point temperature at or below “Maximum case temperature”. You can limit this temperature to a lower value for extremely high reliability.
7. The unit will shut down if the thermal reference point exceeds 115°C (typical), but the thermal shutdown is not intended as a guarantee that the unit will survive temperature beyond its rating. The module will automatically restart after it cools down.
8. Thermal test condition with vertical direction by natural convection (20LFM).

Output Voltage Adjustment

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.

1. It allows the user to increase or decrease the output voltage of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Vout or -Vout pins.
2. With an external resistor between the Trim and -Vout pin, the output voltage increases.
3. With an external resistor between the Trim and +Vout pin, the output voltage decreases.
4. The external Trim resistor needs to be at least 1/8W of rated power.

TRIM UP EQUATION

$$R_U = \left[\frac{G \times L}{(V_{o,up} - L - K)} - H \right] \Omega$$

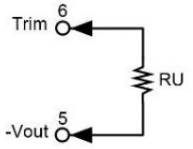
TRIM DOWN EQUATION

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H \right] \Omega$$

TRIM CONSTANTS

Module	G	H	K	L
RBH20-110S5	5100	2050	2.5	2.5
RBH20-110S5.1	5100	2050	2.6	2.5
RBH20-110S12	10000	5110	9.5	2.5
RBH20-110S15	10000	5110	12.5	2.5
RBH20-110S24	56000	13000	21.5	2.5

Trim Up



S5

△V (%)		1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.05	5.10	5.15	5.20	5.25	5.30	5.350	5.40	5.45	5.50
RU	(kΩ)	253.450	125.700	83.117	61.825	49.050	40.533	34.450	29.888	26.339	23.500

S5.1

△V (%)		1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.151	5.202	5.253	5.304	5.355	5.406	5.457	5.508	5.559	5.610
RU	(kΩ)	248.440	123.195	81.447	60.573	48.048	39.698	33.734	29.261	25.782	22.999

S12

△V (%)		1	2	3	4	5	6	7	8	9	10
Vout	(V)	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20
RU	(kΩ)	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723

S15

△V (%)		1	2	3	4	5	6	7	8	9	10
Vout	(V)	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50
RU	(kΩ)	161.557	78.223	50.446	36.557	28.223	22.668	18.700	15.723	13.409	11.557

△V	(%)	11	12	13	14	15	16	17	18	19	20
Vout	(V)	16.65	16.8	16.95	17.1	17.25	17.4	17.55	17.7	17.85	18
RU	(kΩ)	10.042	8.779	7.711	6.795	6.001	5.307	4.694	4.149	3.662	3.223

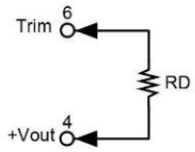
S24

△V (%)		1	2	3	4	5	6	7	8	9	10
Vout	(V)	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40
RU	(kΩ)	570.333	278.667	181.444	132.833	103.667	84.222	70.333	59.917	51.815	45.333

△V	(%)	11	12	13	14	15	16	17	18	19	20
Vout	(V)	26.64	26.88	27.12	27.36	27.60	27.84	28.08	28.32	28.56	28.80
RU	(kΩ)	40.030	35.611	31.872	28.667	25.889	23.458	21.314	19.407	17.702	16.167

Output Voltage Adjustment (continued)

Trim Down



S5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	4.95	4.90	4.85	4.80	4.75	4.70	4.65	4.60	4.55	4.50
RD	(kΩ)	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

S5.1

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.049	4.998	4.947	4.869	4.845	4.794	4.743	4.692	4.641	4.590
RD	(kΩ)	253.350	123.095	79.677	57.968	44.942	36.258	30.056	25.404	21.786	18.891

S12

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.80
RD	(kΩ)	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

S15

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	14.85	14.70	14.55	14.40	14.25	14.10	13.95	13.80	13.65	13.50
RD	(kΩ)	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

S24

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	23.76	23.52	23.28	23.04	22.80	22.56	22.32	22.08	21.84	21.60
RD	(kΩ)	4947.667	2439.333	1603.222	1185.167	934.333	767.111	647.667	558.083	488.407	432.667