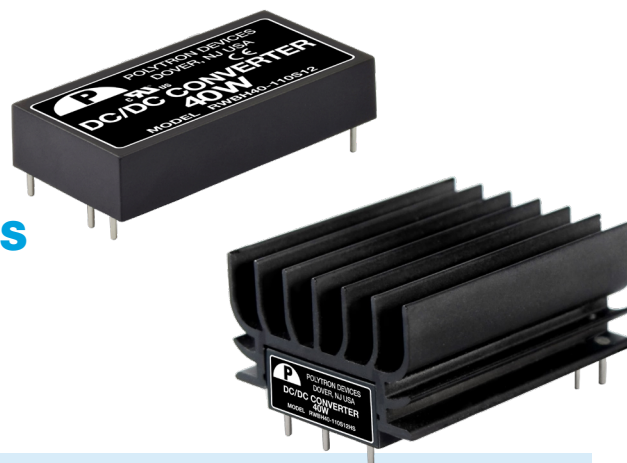


DC-DC CONVERTERS

4:1 WIDE INPUT RANGE, UP TO 40 WATTS

RAILWAY APPLICATIONS

RWBH40 SERIES



FEATURES

- 4:1 Wide Input Range
- Single and Dual Output
- 3,000Vac Isolation Voltage
- Low Standby Power
- No Minimum Load Required
- Remote ON/OFF
- Internal EN55032 Class A Filter
- Over Current Protection
- Over Temperature Protection
- Over Voltage Protection
- Short Circuit Protection
- Under Voltage Protection
- RoHS Compliant
- REACH Compliant
- UL, CB, CE Mark

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 (%)	Model Number*	Capacitor Load max. (μ F)
36 ~ 160	5	8	10	88	RWBH40-110S5	9,600
36 ~ 160	5.1	8	10	88	RWBH40-110S5.1	9,600
36 ~ 160	12	3.333	10	89	RWBH40-110S12	1,667
36 ~ 160	15	2.666	10	90	RWBH40-110S15	1,066
36 ~ 160	24	1.666	10	88.5	RWBH40-110S24	417
36 ~ 160	\pm 12	\pm 1.666	10	88	RWBH40-110-12	\pm 833
36 ~ 160	\pm 15	\pm 1.333	10	89	RWBH40-110-15	\pm 533

RWBH40 SERIES

Input Specifications			Output Specifications		
Operating input voltage range, Vdc	36 Min., 110 Typ., 160 Max.	110Vin(nom)	Voltage accuracy, %	-1 Min., 1 Max.	
Start up voltage, Vdc	36 Max.	110Vin(nom)	Line regulation, %	-0.2 Min., 0.2 Max. LL to HL at Full Load, Single -0.5 Min., 0.5 Max. Dual	
Shutdown voltage, Vdc	32 Min., 34 Typ., 35.8 Max.	110Vin(nom)	Load regulation, %	-0.5 Min., 0.5 Max. No Load to Full Load, Single -1 Min., 1 Max. Dual	
Start up time, ms	30 Typ., 60 Max.	Constant resistive load, Power up	Cross regulation, %	-5 Min., 5 Max. Asymmetrical Load 25%/100% FL, Dual	
	30 Typ., 60 Max.	Remote ON/OFF	Voltage adjustability, %	-10 Min., 10 Max. Single Output, Other -10 Min., 20 Max. 15, 24 Vout	
Input surge voltage, Vdc	200 Max.	1 second, Max., 110Vin(nom)	Ripple & noise, mVp-p	Measured by 20 MHz bandwidth, with a 1µF/50V X7R MLCC	
Input filter	Pi type	Referred to -Vin pin		75 Typ. 5, 5.1 Vout	
				100 Typ. 12, 15 Vout	
Remote ON/OFF	Open or 3 ~ 12Vdc	Positive logic, DC-DC ON	150 Typ. 24 Vout		
		Standard, DC-DC OFF	Temperature coefficient, %/°C		
	Short or 0 ~ 1.2Vdc	Standard, DC-DC OFF	-0.02 Min., 0.02 Max.		
	Short or 0 ~ 1.2Vdc	Negative logic, DC-DC ON	Transient response recovery time, µs		
	Open or 3 ~ 12Vdc	Option, DC-DC OFF	250 Typ. 25% load step change		
	-0.5 Min., 0.5 Max.	Input current of Ctrl pin	Zener Diode clamp		
	3 Typ.	Remote off input current	Over voltage protection, Vdc		
		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.

RWBH40 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	Natural Convection, Without Heat-sink		11.3 Typ.
	With Heat-sink		6.6 Typ.
Thermal shock		MIL-STD-810F	
Shock		EN61373, MIL-STD-810F	
Vibration		EN61373, MIL-STD-810F	
Relative humidity		5% to 95% RH	

Physical Specifications		EMC Specifications			
Design meet safety standard	IEC/ EN/ UL62368-1, EN50155, EN45545-2, UL:E193009	Specifications	Conditions	Level	
Case material	Non-conductive black plastic	EMI	EN55032, EN50121-3-2	Without external components	Class A
Base material	Non-conductive black plastic			With external components	Class B
Potting material	Silicon (UL94 V-0)	EMS	EN55024, EN50121-3-2		
Weight	32g (1.13oz)	ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Dimensions, in.	2.00 x 1.00 x 0.40 (50.8 x 25.4 x 10.2 mm)	Radiated immunity	EN61000-4-3	20V/m	Perf. Criteria A
MTBF	MIL-HDBK-217F, Full load, 1.253 x 10 ⁶ hrs	Fast transient ⁽¹⁾	EN61000-4-4	±2kV	Perf. Criteria A
		Surge ⁽¹⁾	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

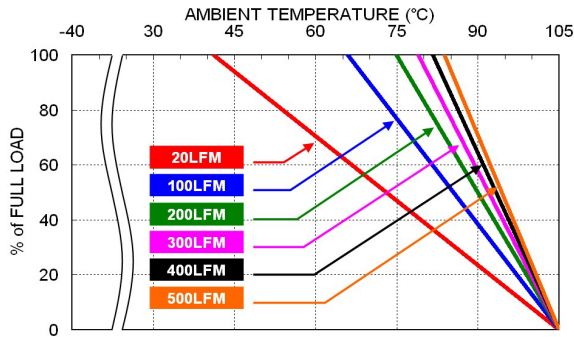
Note:

- The RWBH40-110 recommended 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/200V) and a TVS (SMDJ170A, 170V, 3,000Watt peak pulse power) in parallel.

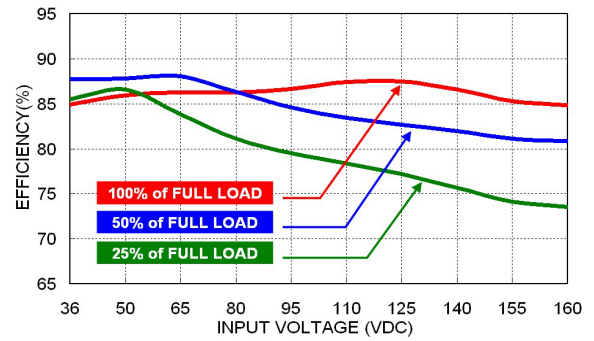
CAUTION: This power module is not internally fused. An input line fuse must always be used.

RWBH40 SERIES

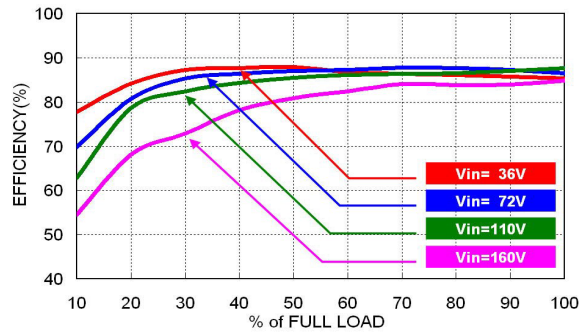
Characteristic Curve



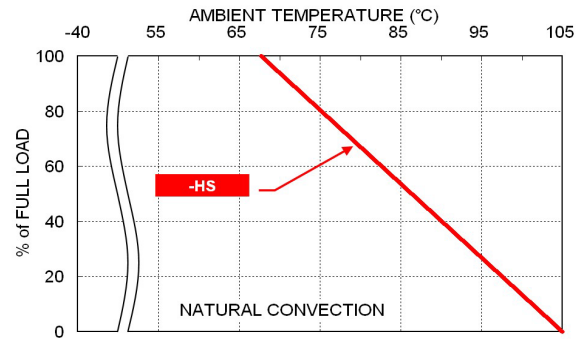
RWBH40-110S5 Derating Curve



RWBH40-110S5 Efficiency vs. Input Voltage



RWBH40-110S5 Efficiency vs. Output Load



RWBH40-110S5 Derating Curve with Heat Sink

Fuse Consideration

Model	Fuse Rating (A)	Fuse Type
RWBH40-110XXX	3.15	Slow-Blow

Note:

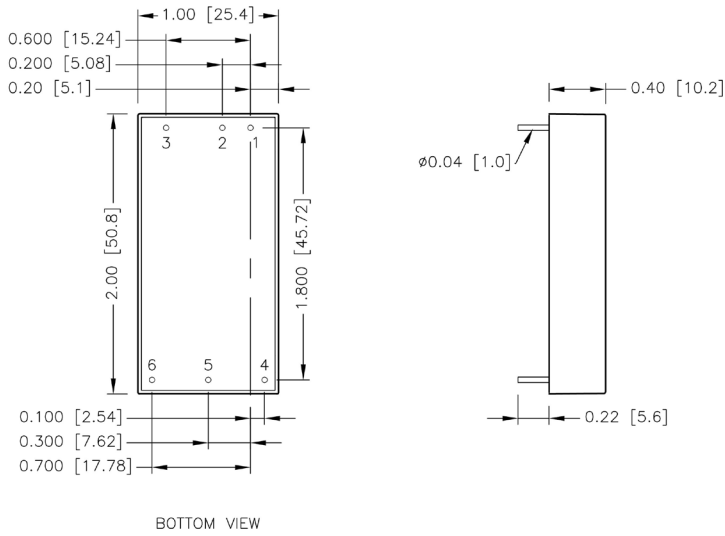
1. This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.
2. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always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

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

RWBH40 SERIES

Mechanical Drawing

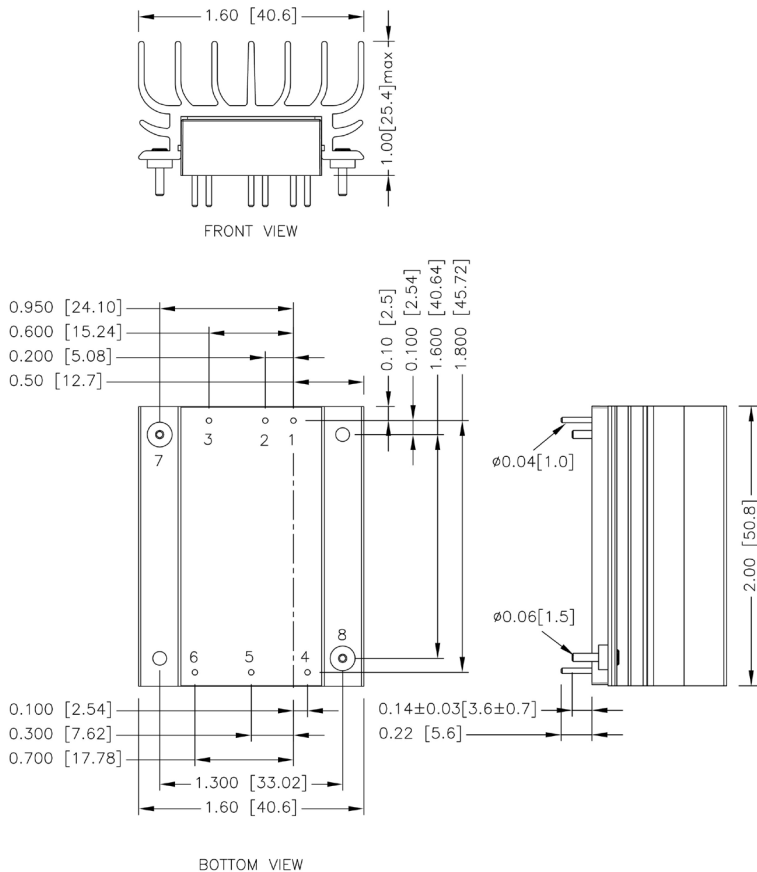
Standard, -HC1, -HC2, -HC3



PIN CONNECTION

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

-HS



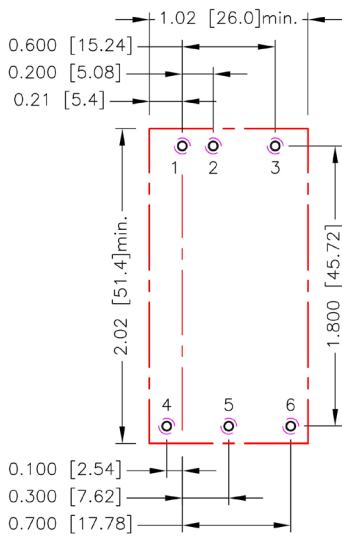
PIN CONNECTION

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

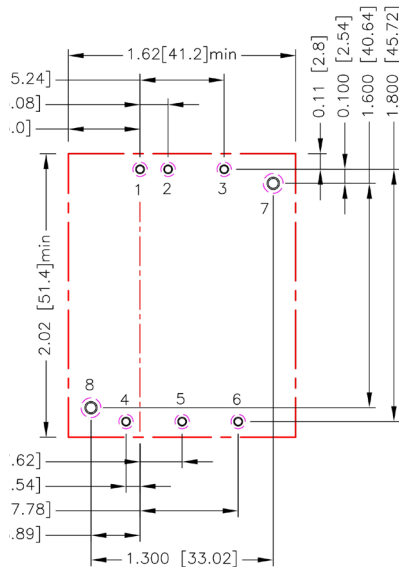
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

RWBH40 SERIES

Recommended Pad Layout



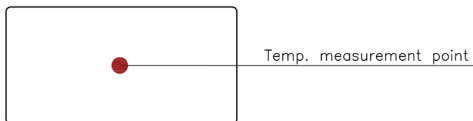
1. All dimensions in inch[mm]
2. Pad size(lead free recommended)
3. Through hole 1.2.3.4.5.6: $\varnothing 0.051[1.30]$
4. Top view pad 1.2.3.4.5.6: $\varnothing 0.064[1.63]$
5. Bottom view pad 1.2.3.4.5.6: $\varnothing 0.102[2.60]$



1. All dimensions in inch[mm]
2. Pad size(lead free recommended)
3. Through hole 1.2.3.4.5.6: $\varnothing 0.051[1.30]$
4. Through hole 7.8: $\varnothing 0.071[1.80]$
5. Top view pad 1.2.3.4.5.6: $\varnothing 0.064[1.63]$
6. Top view pad 7.8: $\varnothing 0.089[2.25]$
7. Bottom view pad 1.2.3.4.5.6: $\varnothing 0.102[2.60]$
8. Bottom view pad 7.8: $\varnothing 0.142[3.60]$

Thermal Considerations

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



1. The power module operates in a variety of thermal environments.
2. 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.
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".
7. You can limit this temperature to a lower value for extremely high reliability.
8. The unit will shutdown 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.

RWBH40 SERIES

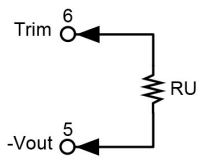
Output Voltage Adjustment

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



S5										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.0500	5.1000	5.1500	5.2000	5.2500	5.3000	5.3500	5.4000	5.4500	5.5000
RU (k Ω)	35.360	16.244	9.752	6.483	4.514	3.198	2.257	1.550	1.000	0.559

S5.1										
ΔV (%)	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 (k Ω)	36.753	16.700	10.001	6.649	4.637	3.295	2.337	1.618	1.059	0.611

S12										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU (k Ω)	392.864	172.175	101.446	66.591	45.837	32.068	22.264	14.929	9.234	4.685

S15										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU (k Ω)	413.163	198.115	125.754	89.445	67.618	53.050	42.636	34.820	28.739	23.872

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	16.650	16.800	16.950	17.100	17.250	17.400	17.550	17.700	17.850	18.000
RU (k Ω)	19.888	16.568	13.759	11.350	9.262	7.434	5.822	4.389	3.106	1.951

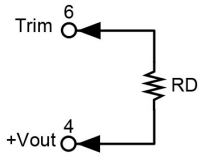
S24										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
RU (k Ω)	947.146	472.772	303.499	216.605	163.724	128.153	102.589	83.329	68.298	56.240

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	26.640	26.880	27.120	27.360	27.600	27.840	28.080	28.320	28.560	28.800
RU (k Ω)	46.353	38.099	31.104	25.101	19.892	15.330	11.302	7.718	4.509	1.619

RWBH40 SERIES

Output Voltage Adjustment (continued)

Trim Down



S5

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
RD (k Ω)	46.686	20.817	12.360	8.162	5.653	3.984	2.794	1.903	1.210	0.656

S5.1

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.049	4.998	4.947	4.8960	4.845	4.794	4.743	4.692	4.641	4.590
RD (k Ω)	47.801	21.688	13.003	8.663	6.061	4.326	3.088	2.159	1.436	0.859

S12

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
RD (k Ω)	435.294	201.116	120.429	79.573	54.894	38.371	26.535	17.639	10.709	5.157

S15

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
RD (k Ω)	302.154	132.978	78.547	51.685	35.680	25.055	17.489	11.826	7.429	3.916

S24

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	23.760	23.520	23.280	23.040	22.800	22.560	22.320	22.080	21.840	21.600
RD (k Ω)	736.063	326.672	192.473	125.790	85.913	59.383	40.459	26.282	15.263	6.454