



Polytron Power Supplies

DABURN

DC-DC CONVERTERS

REGULATED, 4:1 WIDE INPUT RANGE UP TO 15 WATTS

RAILWAY APPLICATIONS, MINIATURE, LOW PROFILE,
SINGLE & DUAL OUTPUT
RLPB15 SERIES

UL US CE CB



FEATURES

- 4:1 Wide Input Voltage Range
- High Efficiency Up to 91%
- Miniature and Low Profile Package:
1.0" × 1.0" × 0.39"
- 3000 VDC Isolation Voltage
- Internal EN55032 Class A Filter
- Low Standby Power
- High Reliability Power
- Remote ON/OFF
- Over Current Protection
- Over Voltage Protection
- Short Circuit Protection
- Under Voltage Protection
- Six Sided Continuous Shield
- EN50155 and EN45545-2 Railway Standard
- Safety Meets UL60950-1, EN60950-1, IEC60950-1,
UL62368-1, EN62368-1 and IEC62368-1
- CE Mark
- Compliant to RoHS & Reach

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	Maximum Capacitor Load µF
9 - 36	3.3	4500	12	88	RLPB15-24S33	5200
9 - 36	5	3000	12	90	RLPB15-24S5	3600
9 - 36	12	1300	12	89	RLPB15-24S12	600
9 - 36	15	1000	12	90	RLPB15-24S15	500
9 - 36	24	625	12	91	RLPB15-24S24	200
18 - 75	3.3	4500	10	88	RLPB15-48S33	5200
18 - 75	5	3000	10	90	RLPB15-48S5	3600
18 - 75	12	1300	10	89	RLPB15-48S12	600
18 - 75	15	1000	10	90	RLPB15-48S15	500
18 - 75	24	625	10	91	RLPB15-48S24	200
36 - 160	3.3	4500	8	88	RLPB15-110S33	5200
36 - 160	5	3000	8	89	RLPB15-110S5	3600
36 - 160	12	1300	8	89	RLPB15-110S12	600
36 - 160	15	1000	8	89	RLPB15-110S15	500
36 - 160	24	625	8	90	RLPB15-110S24	200
9 - 36	±5	±1500	12	87	RLPB15-24-5	±1500
9 - 36	±12	±625	12	90	RLPB15-24-12	±360
9 - 36	±15	±500	12	90	RLPB15-24-15	±250
9 - 36	±24	±315	10	91	RLPB15-24-24	±100
18 - 75	±5	±1500	10	87	RLPB15-48-5	±1500
18 - 75	±12	±625	10	90	RLPB15-48-12	±360
18 - 75	±15	±500	10	90	RLPB15-48-15	±250
18 - 75	±24	±315	10	90	RLPB15-48-24	±100
36 - 160	±5	±1500	8	86	RLPB15-110-5	±1500
36 - 160	±12	±625	8	89	RLPB15-110-12	±360
36 - 160	±15	±500	8	89	RLPB15-110-15	±250
36 - 160	±24	±315	8	90	RLPB15-110-24	±100

DABURN

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Ver 1.0



Input Specifications			Output Specifications		
Operating input voltage range, Vdc	9 Min., 24 Typ., 36 Max.	24Vin(nom)	Voltage accuracy, %	-1.0 Min., +1.0 Max	
	18 Min., 48 Typ., 75 Max.	48Vin(nom)		Line regulation, %	
	36 Min., 110 Typ., 160 Max.	110Vin(nom)	-0.2 Min., +0.2 Max.		Single
Start up voltage, Vdc	9 Max.	24Vin(nom)	Load regulation, %	-0.5 Min., +0.5 Max.	Dual
	18 Max.	48Vin(nom)		-0.2 Min., +0.2 Max.	No Load to Full Load, Single
	36 Max.	110Vin(nom)		-1.0 Min., +1.0 Max.	No Load to Full Load, Dual
Shutdown voltage, Vdc	7.5 Min., 8 Typ., 8.8 Max.	24Vin(nom)		-0.1 Min., +0.1 Max.	10% Load to 90% Load, Single
	15.5 Min., 16 Typ., 17.5 Max.	48Vin(nom)	Cross regulation, %	-0.8 Min., +0.8 Max.	10% Load to 90% Load, Dual
	32 Min., 34 Typ., 35.5 Max.	110Vin(nom)		-5.0 Min., +5.0 Max.	Asymmetrical load 25%/100%FL, Dual
Start up time, ms		Constant resistive load	Voltage and adjustability, %	-10 Min., +20 Max.	Single Output, 15Vout, 24Vout
	30 Typ., 40 Max.	Power up		-10 Min., +10 Max.	Others
	30 Typ., 40 Max.	Remote ON/OFF	Ripple and noise, mVp-p		Measured by 20MHz bandwidth
Input surge voltage, Vdc		1 second, max.		75 Typ.	Single, With a 10µF/6.3V X7R MLCC, 3.3Vout, 5Vout
	50 Max.	24Vin(nom)		100 Typ.	Single, With a 1µF/25V X7R MLCC, 12Vout, 15Vout
	100 Max.	48Vin(nom)		125 Typ.	Single, With a 2.2µF/50V X7R MLCC, 24Vout
	185 Max.	110Vin(nom)		75 Typ.	Dual, With a 10µF/6.3V X7R MLCC for each output, 5Vout
		100 Typ.		Dual, With a 1µF/25V X7R MLCC for each output, 12Vout, 15Vout	
		125 Typ.		Dual, With a 2.2µF/50V X7R MLCC for each output, 24Vout	
Input filter	Pi type		Temperature coefficient, %/°C	-0.02 Min., -0.02 Max.	
Remote ON/OFF		Referred to -Vin pin	Transient response recovery time, µs	250 Typ.	25% load step change
	Open or 3 - 15 Vdc	Positive logic, DC-DC ON	Over voltage protection, Vdc	3.7 Min., 5.4 Max.	3.3Vout
	Short or 0 - 1.2 Vdc	(Option), DC-DC OFF		5.6 Min., 7.0 Max.	5Vout
	Short or 0 - 1.2 Vdc	Negative logic, DC-DC ON		13.5 Min., 19.6 Max.	12Vout
	Open or 3 - 15 Vdc	(Standard), DC-DC OFF		18.3 Min., 22.0 Max.	15Vout
				29.1 Min., 32.5 Max.	24Vout
	-0.5 Min., 1 Max., mA	Input current of Ctrl pin		Over load protection, %	170 Typ.
	2.5 mA Typ.	Remote off input current	Short circuit protection	Continuous, automatics recovery	

General Specifications

Isolation voltage, Vdc	1 minute	Input to Output	3000 Min.		
		Input (Output) to Case	1600 Min.		
Isolation resistance, GΩ	500Vdc		1 Min.		
Isolation capacitance, pF					2000 Max.
Switching frequency, kHz		3.3Vout, 5Vout	220 Min.	245 Typ.	270 Max.
		Others	270 Min.	300 Typ.	330 Max.

Environmental Specifications

Operating ambient temperature, °C	Standard type, with derating	-40 Min.	+105 Max.
	M3 version, with derating	-55 Min.	+105 Max.
	RLPB15-XXXS33	Meet the railway TX temperature requirement as power derating to 7W output power	
	Others	Meet the railway TX temperature requirement as power derating to 10W output power	
Maximum case temperature, °C			+105 Max.
Storage temperature range, °C		-55 Min.	+125 Max.
Thermal impedance, °C/W	Without heat-sink		+17 Typ.
	With heat-sink		+15.3 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	UL60950-1, EN60950-1, IEC60950-1, UL62368-1, EN 62368-1, IEC 62368-1, EN50155, EN45545-2, UL:E193009, CB:UL(Demko)
Case material	Copper
Base material	FR4 PCB
Potting material	Silicone (UL94 V-0)
Weight	16.5g (0.58oz)
MTBF	1.672×10 ⁶ hrs, MIL-HDBK-217F, Full load

EMC Specifications

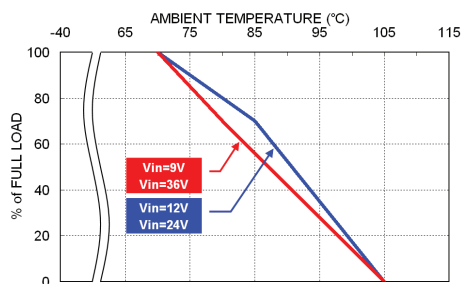
Specifications	Conditions	Level
EMI	EN55032, EN55011	Without external components
		With external components
ESD	EN61000-4-2	Air ±8kV and Contact ±6kV
Radiated immunity	EN61000-4-3	10V/m
Fast transient	EN61000-4-4	±2kV
	RLPB15-24XXX	With an aluminum electrolytic capacitor and a TVS in parallel
	RLPB15-48XXX	With an aluminum electrolytic capacitor
	RLPB15-110XXX	With an aluminum electrolytic capacitor and a TVS in parallel
Surge	EN61000-4-5	±1kV
	RLPB15-24XXX	With an aluminum electrolytic capacitor and a TVS in parallel
	RLPB15-48XXX	With an aluminum electrolytic capacitor
	RLPB15-110XXX	With an aluminum electrolytic capacitor and a TVS in parallel
Conducted immunity	EN61000-4-6	10 Vr.m.s
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second

Note:

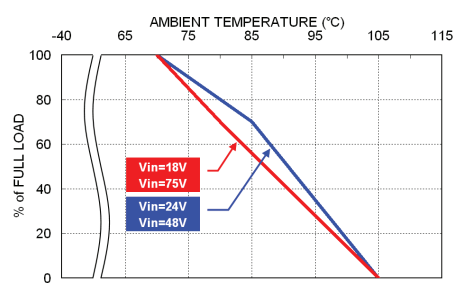
- Test by minimum input and constant resistive load.
- Trimming allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Vout pin or the -Vout pin.
- The standard modules meet EN55032 Class A and Class B with external components. For further information, please contact Polytron Devices.

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

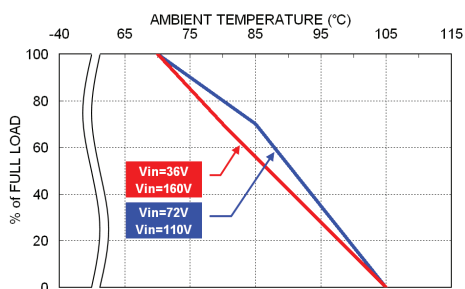
Characteristic Curve



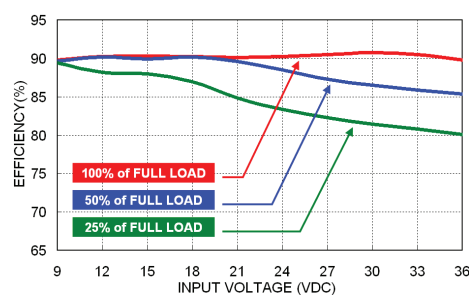
RLPB15-24XXX Derating Curve



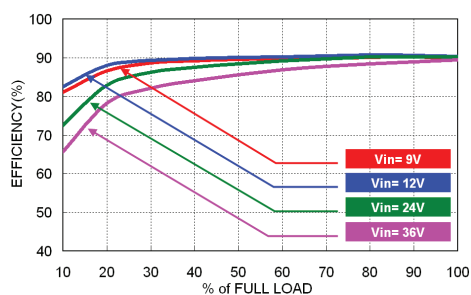
RLPB15-48XXX Derating Curve



RLPB15-110XXX Derating Curve



Efficiency vs. Input Voltage



Efficiency vs. Output Load

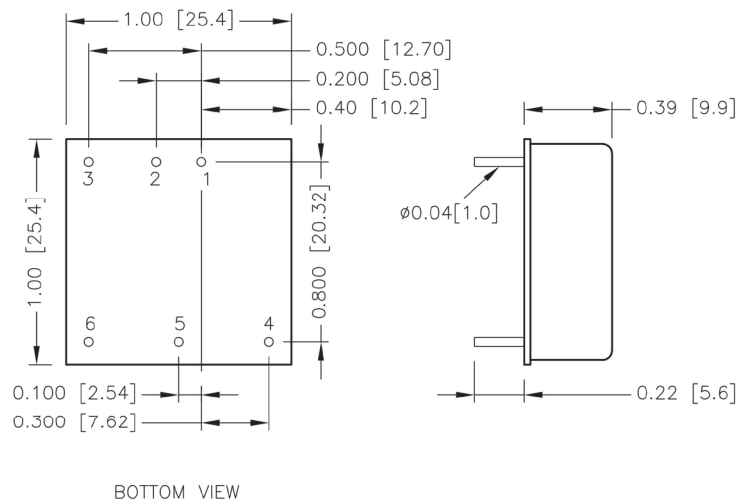
Fuse Consideration

Modules	Fuse Rating (A)	Fuse Type
RLPB15-24XXX	3.15	Slow-Blow
RLPB15-48XXX	1.6	Slow-Blow
RLPB15-110XXX	1.0	Slow-Blow

Note:

1. This power module is not internally fused. An input line fuse must always be used.
2. 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.
3. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.
4. The table is based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

Mechanical Drawing



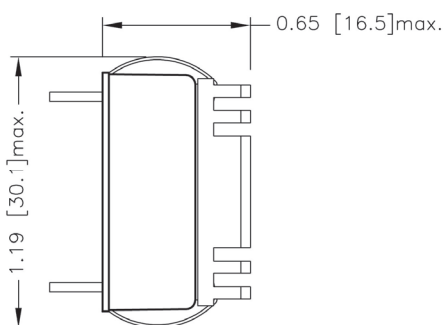
PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
3	Ctrl	Ctrl
4	+Vout	+Vout
5	Trim	Common
6	-Vout	-Vout

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

Heat-Sink Options

Heat Sink with clamps (Suffix "HC")

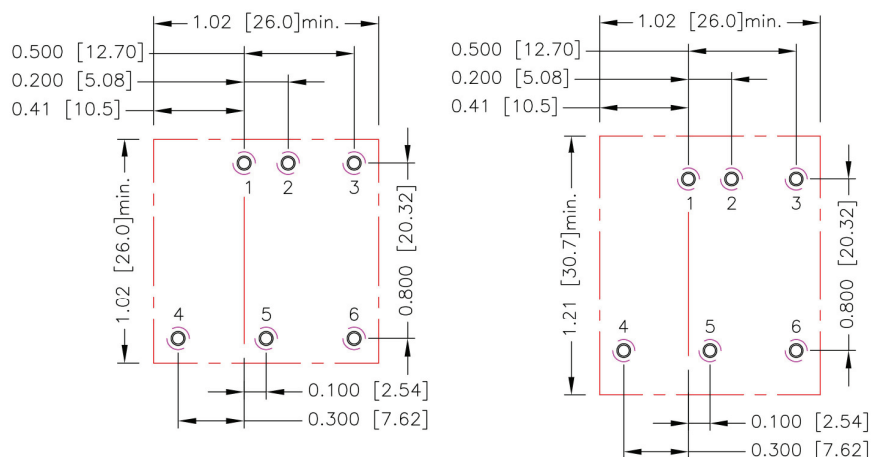


1. All dimensions in inch (mm)

Recommended Pad Layout

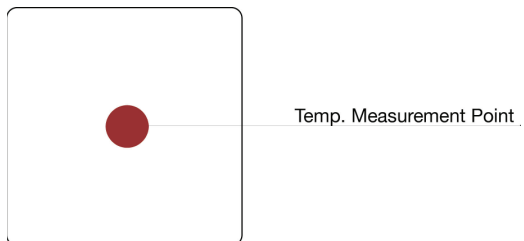
Standard

Heat Sink with clamps (Suffix "HC")



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



TOP VIEW

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

Output Voltage Adjustment

Trim Up Equation

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

Trim Down Equation

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

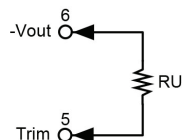
1. Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module.
2. This is accomplished by connecting an external resistor between the Trim pin and either the +Output or -Output pins.
3. With an external resistor between the Trim and -Output pin, the output voltage set point increases.
4. With an external resistor between the Trim and +Output pin, the output voltage set point decreases.
5. The external Trim resistor needs to be at least 0.0625 W of rated power.

TRIM CONSTRAINTS

MODULE	G	H	K	L
RLPB15-XXS33	5110	2050	0.8	2.5
RLPB15-XXS5	5110	2050	2.5	2.5
RLPB15-XXS12	10000	5110	9.5	2.5
RLPB15-XXS15	10000	5110	12.5	2.5
RLPB15-XXS24	56000	13000	21.5	2.5

Output Voltage Adjustment (cont.)
EXTERNAL OUTPUT TRIMMING

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


□□S33

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
RU (k Ω)	385.071	191.511	126.990	94.730	75.374	62.470	53.253	46.340	40.963	36.662

□□S5

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
RU (k Ω)	253.450	125.700	83.117	61.825	49.050	40.533	34.450	29.888	26.339	23.500

□□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)	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723

□□S15

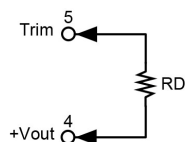
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU (k Ω)	161.557	78.223	50.446	36.557	28.223	22.668	18.700	15.723	13.409	11.557

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)	10.042	8.779	7.711	6.795	6.001	5.307	4.694	4.149	3.662	3.223

□□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)	570.333	278.667	181.444	132.833	103.667	84.222	70.333	59.917	51.815	45.333

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)	40.030	35.611	31.872	28.667	25.889	23.458	21.314	19.407	17.702	16.167


□□S33

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
RD (k Ω)	116.719	54.779	34.133	23.810	17.616	13.486	10.537	8.325	6.604	5.228

□□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)	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

□□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)	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

□□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)	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

□□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)	4947.667	2439.333	1603.222	1185.167	934.333	767.111	647.667	558.083	488.407	432.667