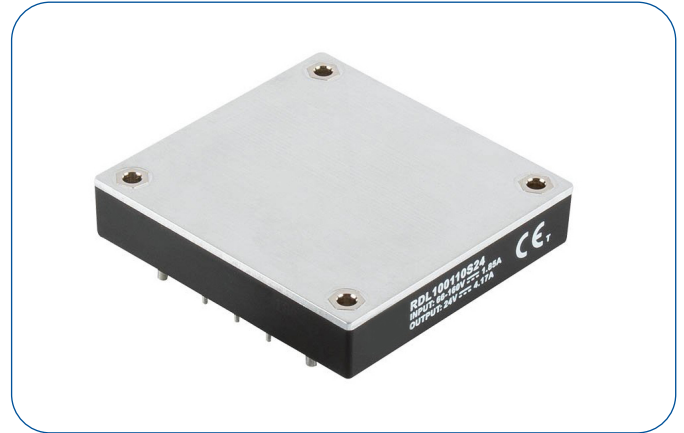


100 Watts

- Wide 3:1 Input Range
- Covers 110 VDC Nominal Input for Rail Applications
- Complies with EN50155
- Meets EN50121-3-2
- Meets EN4554-2 Fire & Smoke
- Single Output
- Industry Standard Half Brick
- -40 °C to +100 °C Operation
- Output Trim $\pm 10\%$
- Remote On/Off
- 3 Year Warranty



Dimensions:

RDL100:

2.4 x 2.28 x 0.5" (61.0 x 57.9 x 12.7 mm)

The RDL100 offers a cost effective solution meeting the railway standards for harsh environment applications. The half brick format is industry standard and features trim function and remote on/off functionality.

Models & Ratings

Input Voltage	Output Voltage	Output Current	Input Current		Ripple & noise ⁽¹⁾	Efficiency ⁽²⁾	Max. capacitive load	Model Number
			No Load	Full Load ⁽³⁾				
110 V (66-160 V)	12 V	8.30 A	3 mA	1.75 A	150 mV	86.5%	8300 μ F	RDL100110S12
	15 V	6.70 A	3 mA	1.04 A	150 mV	87.5%	4170 μ F	RDL100110S15
	24 V	4.17 A	3 mA	1.04 A	240 mV	87.5%	4170 μ F	RDL100110S24
	48 V	2.08 A	3 mA	1.02 A	480 mV	89.0%	1500 μ F	RDL100110S48

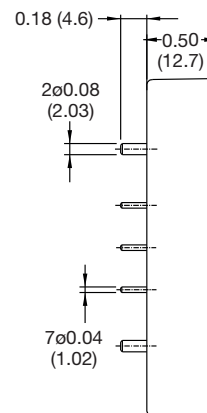
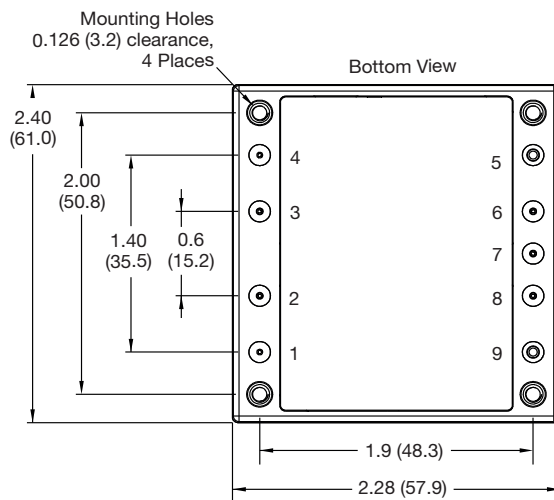
Notes

1. Measured at 20 MHz bandwidth pk-pk, full load, 10 μ F tantalum and 1.0 μ F ceramic capacitors for 12 V, 15 V & 24 V models, 47 μ F aluminium capacitor and 1.0 μ F ceramic capacitor for 48 V model.

2. Measured at 110 V input and full load.

3. Measured at 66 VDC input.

Mechanical Details



Pin	Function
1	+Vin
2	Remote On/Off
3	NC
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

Notes

1. All dimensions are in inches (mm)
2. Weight: 0.198 lbs (90 g) approx.

3. Tolerance: x.xx = ± 0.02 (x.x = ± 0.5)
x.xxx = ± 0.01 (x.xx = ± 0.25)

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage Range	66		160	VDC	110 V nominal input
Input Surge			180	VDC for 100 ms	
Undervoltage Lockout	On: >60 V	62	64	VDC	On
	Off: <54 V	56	58		Off
Lockout Hysteresis		6		VDC	
Idle Current		1.5	5	mA	When output is inhibited
Inrush Current			0.1	A ² s	
Input Reflected Ripple Current		50		mA pk-pk	Through 12 μH inductor
Recommended Input Fuse	T4.0A				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	12		48	VDC	See Models and Ratings table
Output Trim	-10		+10	%	See Application Note
Initial Set Accuracy			±1.5	%	At full load and 110 V input
Minimum Load	0			%	No minimum load required
Line Regulation			±0.2	%	From minimum to maximum input at full load
Load Regulation			±0.2	%	From 0% to full load
Transient Response		±3.0	±5.0	%	Maximum deviation, recovering to less than 1% in 500 μs for 25% step load change.
Start Up Time			120	ms	
Output Voltage Rise Time			15	ms	
Ripple & Noise				mV pk-pk	See models and ratings table
Overload Protection	110	130	160	%	
Short Circuit Protection					Continuous hiccup mode, with auto recovery
Maximum Capacitive Load					See Models and Ratings table
Temperature Coefficient			0.03	%/°C	
Overvoltage Protection	115	125	140	%	
Solder Profile	260 °C maximum, above 250 °C. 3-6 s. With iron, max 450 °C for <5s				
Case Material	Plastic DAP UL94V-0 rated with aluminium base				
Pin Material	Copper with nickel and matte tin plate				
Potting Material	Epoxy UL94V-0				
Fire and Smoke	Complies with EN45545-2				
Remote On/Off	Output is on if REM On/Off (pin 2) is open or high (3.5-75 VDC) WRT -Vin (positive logic) Output turns off if REM On/Off (pin 2) is low (<1.8 VDC max) WRT -Vin				

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		88		%	See Models and Ratings table
Isolation: Input to Output	3000			VAC	60 s qualification. Reinforced insulation.
Isolation: Input to Case	1500			VAC	60 s qualification. Basic insulation.
Isolation: Output to Case	500			VAC	60 s qualification. Basic insulation.
Isolation Resistance	10 ⁹			Ω	
Isolation Capacitance		500		pF	Input to output
Switching Frequency		250		kHz	Fixed
Power Density			36.5	W/in ³	
Mean Time Between Failure		830		kHrs	MIL-HDBK-217F, +25 °C GB
Solder Profile	260 °C maximum, above 250 °C. 3-6s, with iron max 450 °C for <5s				
Case Material	Plastic DAP UL94V-0 rated with aluminium base				
Pin Material	Copper with nickel and matte tin plate				
Potting Material	Epoxy UL94V-0				
Fire and Smoke	Complies with EN45545-2				
Weight		0.198 (90.0)		lb (g)	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Base Plate Temperature	-40		+100	°C	
Storage Temperature	-55		+105	°C	
Thermal Protection		+105		°C	Measured on baseplate. Module will auto-restart at 92°C typically
Humidity			95	%RH	Non-condensing
Cooling					Base plate cooled

Safety Approvals

Agency	Standard	Test Level	Notes & Conditions
UL	cUL60950-1		ITE
CE	LVD		Evaluated to EN62368-1
EN	EN50155		Railway

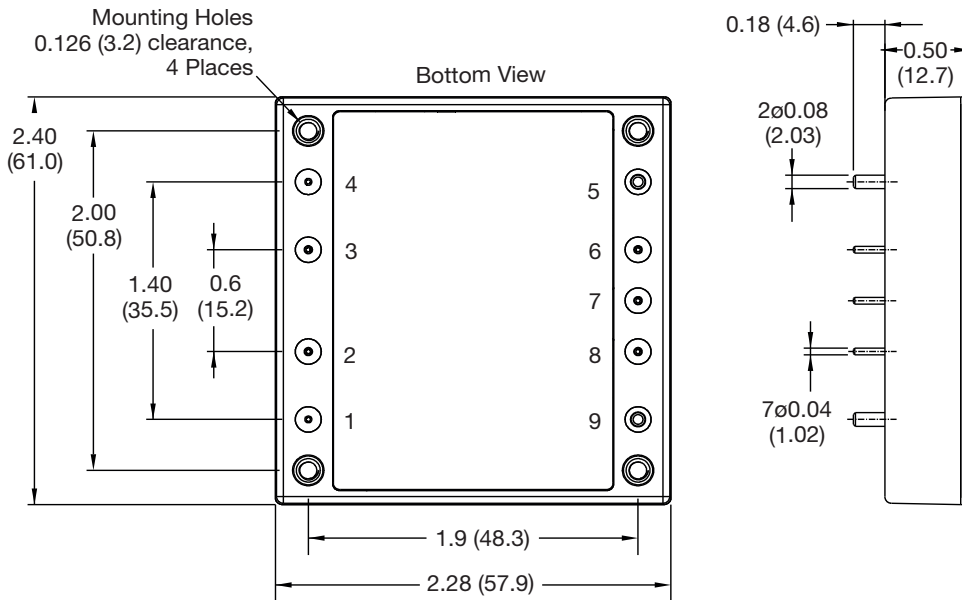
EMC: Emissions

Phenomenon	Standard	Test Level	Notes & Conditions
Conducted	EN50121-3-2		See Application Notes
Radiated	EN50121-3-2		See Application Notes

EMC: Immunity

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Railway Equipment	EN50121-3-2			See Application Note
ESD Immunity	EN61000-4-2	$\pm 6 \text{ kV}/\pm 8 \text{ kV}$	A	Contact Discharge/Air Discharge
Radiated Immunity	EN61000-4-3	10 V/m	A	
EFT/Burst	EN61000-4-4	2 kV	A	External capacitor required such as Rubycon 4XF Series, 220 $\mu\text{F}/200\text{V}$
Surge	EN61000-4-5	$\pm 1 \text{ kV}$	A	L-E/L-L, External TVS, 1.5 KE 180 A Littlefuse
Conducted Immunity	EN61000-4-6	10 V rms	A	

Mechanical Details



Pin	Function
1	+Vin
2	Remote On/Off
3	NC
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

Notes

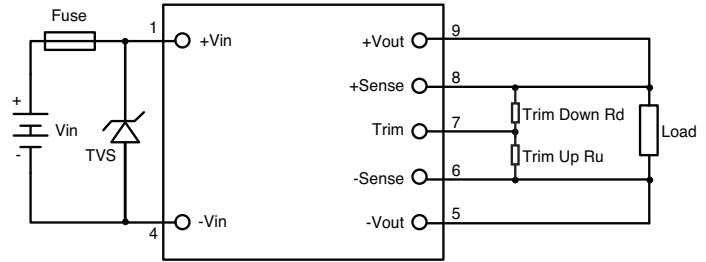
- All dimensions are in inches (mm)
- Weight: 0.22 lbs (100 g) approx.

- Tolerance: x.xx = ± 0.02 (x.x = ± 0.5)
x.xxx = ± 0.01 (x.xx = ± 0.25)

Application Notes

Input Fusing and Safety Considerations

The RDL100 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 4 A time delay fuse. It is recommended that the circuit has a transient voltage suppressor diode (TVS) across the input terminals to protect the unit against surge or spike voltages and input reverse voltage (as shown). A suitable part would be 1.5KE180A.



Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up or down by 10%. This is accomplished by connecting an external resistor between the Trim pin and either the +Sense pin or the -Sense pin.

To Trim Down

Connecting an external resistor (R_d) between the Trim pin and the +Sense pin decreases the output voltage. The following table can be used to determine the required external resistor value to obtain a percentage output voltage change of $\Delta\%$.

Trim Down %	12 V	15 V	24 V	48 V
	R _d (k Ω)			
1	660.32	932.00	1641.67	3500.43
2	300.11	432.00	745.83	1595.11
3	180.04	265.33	447.22	960.01
4	12.00	182.00	297.92	642.46
5	83.98	132.00	208.33	451.93
6	59.97	98.67	148.61	324.90
7	42.82	74.86	105.95	234.18
8	29.95	57.00	73.96	166.13
9	19.95	43.11	49.07	113.20
10	11.94	32.00	29.17	70.86

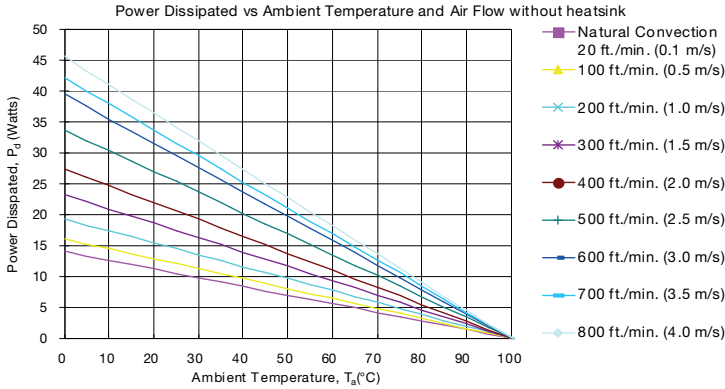
To Trim Up

Connecting an external resistor (R_u) between the +Vout pin and the -Sense pin increases the output voltage. The following table can be used to determine the required external resistor value to obtain a percentage output voltage change of $\Delta\%$.

Trim Up%	12 V	15 V	24 V	48 V
	R _u (k Ω)			
1	153.23	160.83	165.83	166.56
2	74.30	76.77	79.95	80.78
3	47.99	48.78	51.33	52.18
4	34.83	34.79	37.02	37.89
5	26.94	26.39	28.43	29.31
6	21.68	20.80	22.71	23.59
7	17.92	16.80	18.62	19.50
8	15.10	13.80	15.55	16.44
9	12.90	11.47	13.17	14.06
10	11.15	9.60	11.26	12.15

Application Notes

Thermal Resistance Information



Air Flow Rate	Typical Rca
Natural Convection 20 ft/min (0.1 m/s)	7.12 °C/W
100 ft/min (0.5 m/s)	6.21 °C/W
200 ft/min (1.0 m/s)	5.17 °C/W
300 ft/min (1.5 m/s)	4.29 °C/W
400 ft/min (2.0 m/s)	3.64 °C/W
500 ft/min (2.5 m/s)	2.96 °C/W
600 ft/min (3.0 m/s)	2.53 °C/W
700 ft/min (3.5 m/s)	2.37 °C/W
800 ft/min (4.0 m/s)	2.19 °C/W

Airflow Derating Graph

Example (Without Heatsink)

To determine the minimum airflow necessary for a RDL100110S12 operating at an input voltage of 110 V, an output current of 8.3 A, and a maximum ambient temperature of 40°C:

Determine Power dissipation (Pd): $P_d = P_i - P_o = P_o(1-\eta)/\eta$,

$P_d = 12\text{ V} \times 8.3\text{ A} \times (1-0.85)/0.85 = 17.58\text{ Watts}$

Where P_i = Input power, P_o = Output Power and η = Efficiency

Determine airflow from airflow derating graph using data points for $P_d=17.58\text{ W}$ and $T_a = 40\text{ °C}$

Minimum airflow= 500 ft./min.

To check that the maximum case temp of 100 °C is not exceeded:

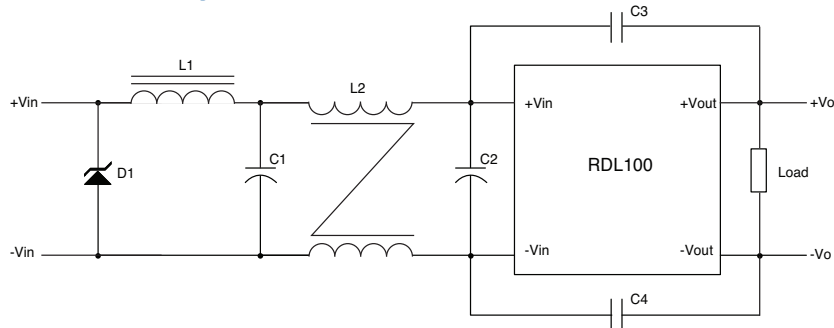
Maximum temperature rise is
 $\Delta T = P_d \times R_{ca} = 17.58 \times 2.96 = 52.2\text{ °C}$.

Maximum case temperature is
 $T_c = T_a + \Delta T = 92.2\text{ °C} < 100\text{ °C}$.

Where: R_{ca} is the thermal resistance from case to ambient environment. T_a is ambient temperature and T_c is case temperature.

Application Notes

EMC Filter - Emissions and Immunity



Model	D1	C1	C2	C3	C4	L1	L2
RDL100110S12	1.5KE180A	220 μ F/ 200 V, YXF	220 μ F/ 200 V, YXF	2200 pF	2200 pF	5 μ H	0.5 mH
RDL100110S15	1.5KE180A	220 μ F/ 200 V, YXF	220 μ F/ 200 V, YXF	2200 pF	2200 pF	5 μ H	0.5 mH
RDL100110S24	1.5KE180A	220 μ F/ 200 V, YXF	220 μ F/ 200 V, YXF	2200 pF	2200 pF	5 μ H	0.5 mH
RDL100110S48	1.5KE180A	220 μ F/ 200 V, YXF	220 μ F/ 200 V, YXF	2200 pF	2200 pF	5 μ H	0.5 mH

Note: C1, C2 Aluminium Capacitors and C3, C4 Ceramic Capacitor