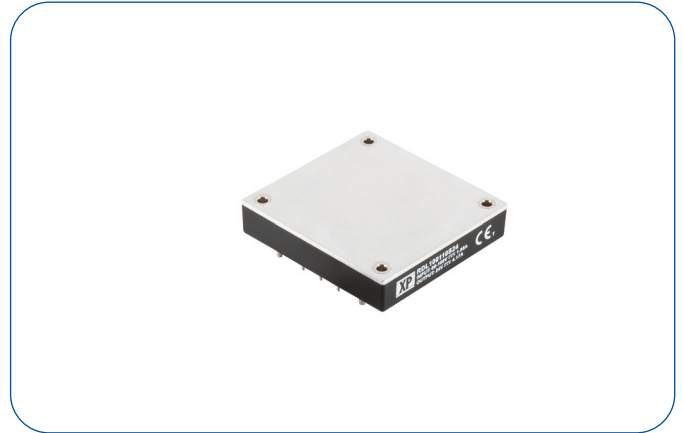


### 100 Watts

- 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 <sup>(1)</sup>	Efficiency <sup>(2)</sup>	Max. capacitive load	Model Number
			No Load	Full Load <sup>(3)</sup>				
110 V (66-160 V)	12 V	8.30 A	3 mA	1.75 A	150 mV	86.5%	8300 $\mu$ F	RDL100110S12
	15 V	6.70 A	3 mA	1.04 A	150 mV	87.5%	4170 $\mu$ F	RDL100110S15
	24 V	4.17 A	3 mA	1.04 A	240 mV	87.5%	4170 $\mu$ F	RDL100110S24
	48 V	2.08 A	3 mA	1.02 A	480 mV	89.0%	1500 $\mu$ F	RDL100110S48

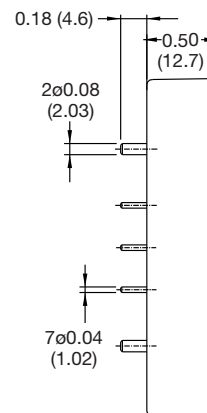
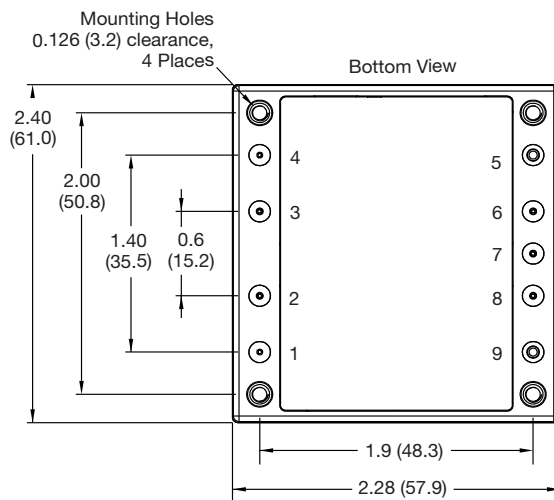
### Notes

1. Measured at 20 MHz bandwidth pk-pk, full load, 10  $\mu$ F tantalum and 1.0  $\mu$ F ceramic capacitors for 12 V, 15 V & 24 V models, 47  $\mu$ F aluminium capacitor and 1.0  $\mu$ 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 =  $\pm 0.02$  (x.x =  $\pm 0.5$ )  
x.xxx =  $\pm 0.01$  (x.xx =  $\pm 0.25$ )

### 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 <sup>2</sup> 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 <sup>9</sup>			Ω	
Isolation Capacitance		500		pF	Input to output
Switching Frequency		250		kHz	Fixed
Power Density			36.5	W/in <sup>3</sup>	
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
EN	EN50155		Railway
	EN62368-1		Evaluated to EN62368-1
CE	Meets all applicable directives		
UKCA	Meets all applicable legislation		

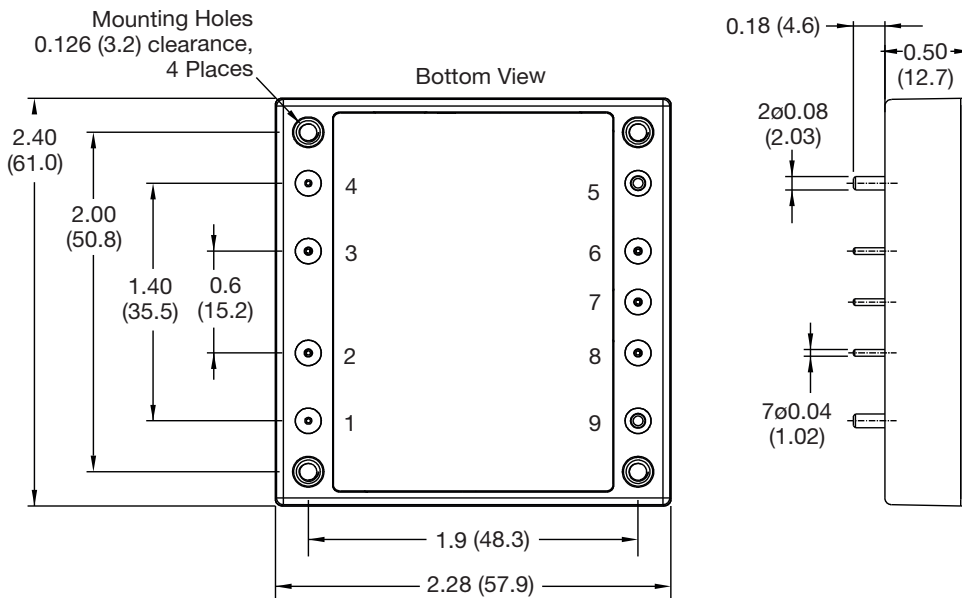
### EMC: Emissions

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	$\pm 6$ kV/ $\pm 8$ 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 $\mu$ F/200V
Surge	EN61000-4-5	$\pm 1$ kV	A	L-E/L-L, External TVS, 1.5 KE 180 A Littelfuse
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

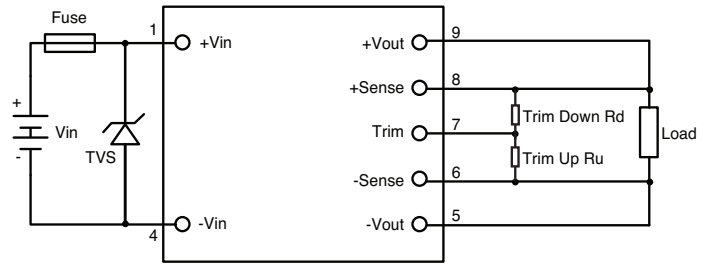
- All dimensions are in inches (mm)
- Weight: 0.22 lbs (100 g) approx.

- Tolerance: x.xx =  $\pm 0.02$  (x.x =  $\pm 0.5$ )  
x.xxx =  $\pm 0.01$  (x.xx =  $\pm 0.25$ )

### 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 recommend 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 <sub>d</sub> (k $\Omega$ )			
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

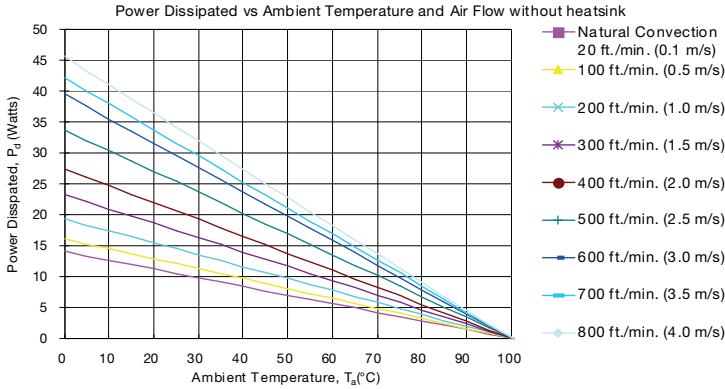
#### To Trim Up

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 <sub>u</sub> (k $\Omega$ )			
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  $\eta$  = 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  
 $\Delta T = P_d \times R_{ca} = 17.58 \times 2.96 = 52.2\text{ °C}$ .

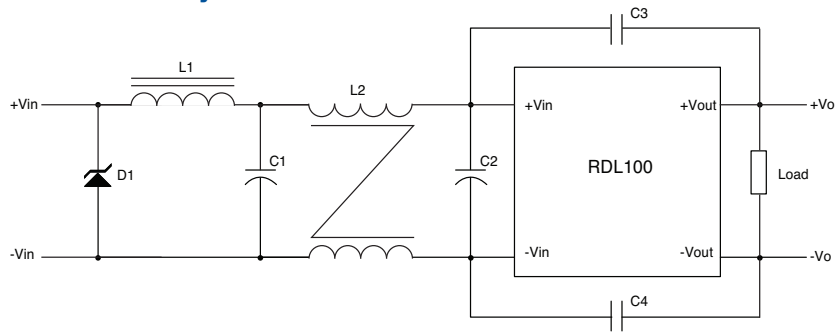
Maximum case temperature is

$$T_c = T_a + \Delta T = 92.2\text{ °C} < 100\text{ °C}$$

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 $\mu$ F/ 200 V, YXF	220 $\mu$ F/ 200 V, YXF	2200 pF	2200 pF	5 $\mu$ H	0.5 mH
RDL100110S15	1.5KE180A	220 $\mu$ F/ 200 V, YXF	220 $\mu$ F/ 200 V, YXF	2200 pF	2200 pF	5 $\mu$ H	0.5 mH
RDL100110S24	1.5KE180A	220 $\mu$ F/ 200 V, YXF	220 $\mu$ F/ 200 V, YXF	2200 pF	2200 pF	5 $\mu$ H	0.5 mH
RDL100110S48	1.5KE180A	220 $\mu$ F/ 200 V, YXF	220 $\mu$ F/ 200 V, YXF	2200 pF	2200 pF	5 $\mu$ H	0.5 mH

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