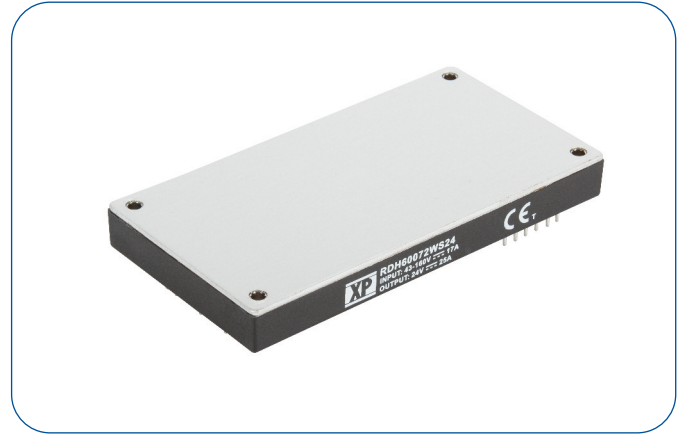


### 600 Watts

- Wide 4:1 Input Range
- Covers 72 & 110 VDC for Rail Applications
- Complies with EN50155
- Meets EN50121-3-2
- Single Output
- Industry Standard Full Brick
- -40 °C to +100 °C Operation
- Output Trim 60-110%
- Remote On/Off
- 3 Year Warranty



#### Dimensions:

**RDH600:**  
2.4 x 4.6 x 0.5" (61.0 x 116.8 x 12.7 mm)

### 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>				
43-160 V	12 V	50.0 A	25 mA	16.00 A	120 mV	87%	10000 µF	RDH60072WS12
	24 V	25.0 A	25 mA	15.85 A	240 mV	88%	5000 µF	RDH60072WS24
	28 V	21.4 A	25 mA	15.85 A	280 mV	88%	5000 µF	RDH60072WS28
	48 V	12.5 A	25 mA	15.85 A	480 mV	88%	5000 µF	RDH60072WS48

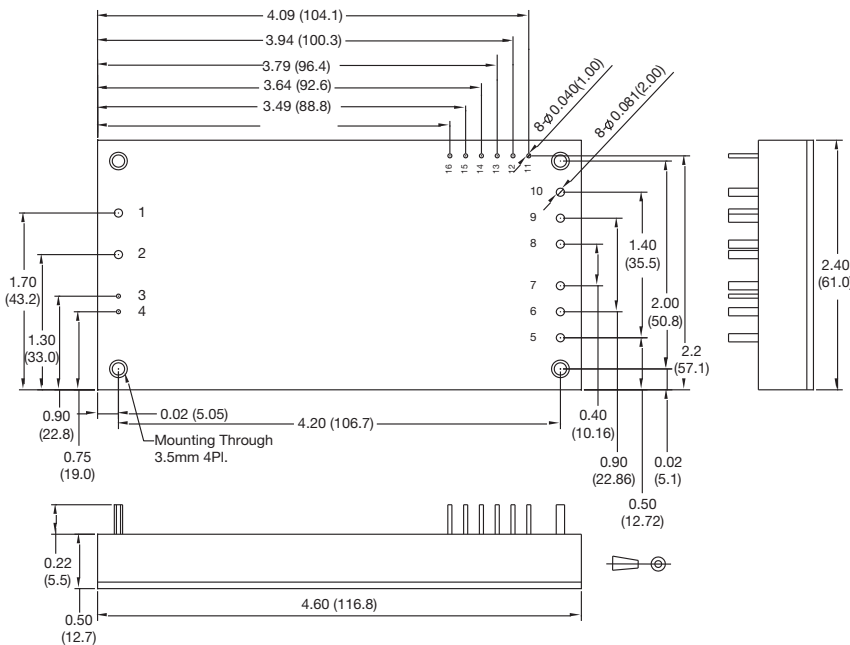
### Notes

1. Measured at 20 MHz bandwidth pk-pk, full load, 10 µF aluminum solid and 1.0 µF ceramic capacitors.

2. Measured at 110 V input and full load.

3. Measured at 43 VDC input.

### Mechanical Details



Pin	Function
1	-Vin
2	+Vin
3	REM-
4	REM+
5-7	+Vout
8-10	-Vout
11	-Sense
12	+Sense
13	Trim
14	Current Share
15	Power Good
16	Auxilliary, 7-13 V/20 mA

### Notes

1. All dimensions are in inches (mm)  
2. Weight: 0.485 lbs (220 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	43		160	VDC	72/110 V nominal inputs
Input Surge			180	VDC for 100 ms	
Undervoltage Lockout	On: >41 V	42	43	VDC	On
	Off: <39 V	40	41		Off
Lockout Hysteresis		2		VDC	
Idle Current	1		10	mA	When output is inhibited
Inrush Current			1	A <sup>2</sup> s	
Recommended Input Fuse		20		A	Time delay
Input Reflected Ripple Current		40		mA pk-pk	Through 12 µH inductor

### Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	12		48	VDC	See Models and Ratings table
Output Trim	-40		+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			±0.5	%	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			250	ms	
Output Voltage Rise Time			50	ms	
Ripple & Noise				mV pk-pk	See models and ratings table
Overload Protection	110	125	160	%	
Short Circuit Protection					Continuous hiccup mode, with auto recovery
Maximum Capacitive Load					See Models and Ratings table
Temperature Coefficient			0.02	%/°C	
Overvoltage Protection	115	125	140	%	
Remote On/Off	Output is on if REM+ (pin 4) is open or high (3.5-75 VDC) WRT REM- (pin 3) or -Vin Output turns off if REM+ (pin 4) is low (<1.2 VDC max) WRT REM- (pin 3) or -Vin				

### General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		88		%	See Models and Ratings table
Isolation: Input to Output	2250			VDC	60 s
Isolation: Input to Case	2250			VDC	60 s
Isolation: Output to Case	1500			VDC	60 s
Isolation Resistance	10 <sup>7</sup>			Ω	
Isolation Capacitance		4000		pF	Input to output
Switching Frequency		250		kHz	
Power Density			109	W/in <sup>3</sup>	
Mean Time Between Failure		450		kHrs	MIL-HDBK-217F, +25 °C GB
Weight		0.485 (220.0)		lb (g)	

### Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Base Plate Temperature	-40		+100	°C	
Storage Temperature	-55		+105	°C	
Thermal Protection		+110		°C	Measured on baseplate
Humidity			95	%RH	Non-condensing
Cooling					Base plate cooled

### Safety Approvals

Agency	Standard	Test Level	Notes & Conditions
UL	cUL60950-1		ITE
EN	EN50155		Railway

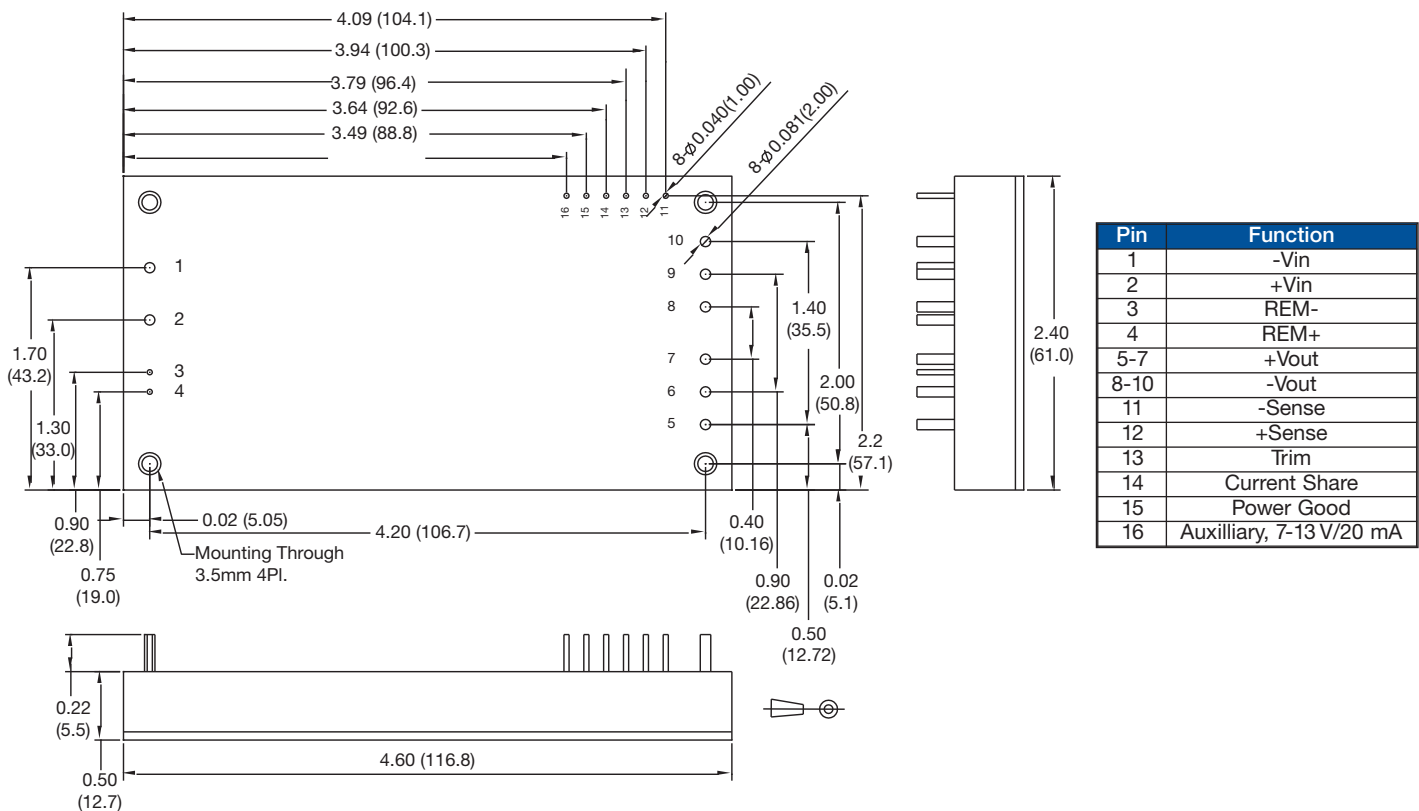
### EMC: Emissions

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	20 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	$\pm 2 \text{ kV}/\pm 1 \text{ kV}$	B	L-E/L-L, External TVS, 1.5 KE 180 A Littlefuse
Conducted Immunity	EN61000-4-6	10V rms	A	

### Mechanical Details



### Notes

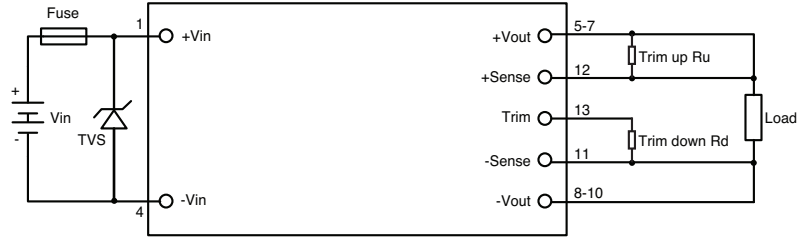
- All dimensions are in inches (mm)
- Weight: 0.485 lbs (220 g) approx.

- 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 RDH600 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommend a 20 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 1.5 KE180 A Littelfuse.



#### Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up by 10% or down by 40%. 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	24 V	28 V	48 V
	R <sub>d</sub> (k $\Omega$ )			
1	387.92	396.61	603.07	387.92
2	235.74	238.95	301.84	235.74
3	168.34	169.98	199.92	168.34
4	130.30	131.30	148.68	130.30
5	105.88	106.54	117.84	105.88
6	88.87	89.34	97.24	88.87
7	76.34	76.69	82.50	76.34
8	66.73	67.00	71.44	66.73
9	59.12	59.33	62.83	59.12
10	52.95	53.12	55.94	52.95
11	47.84	47.99	50.30	47.84
12	43.55	43.67	45.60	43.55
13	39.88	39.99	41.62	39.88
14	36.72	36.81	38.21	36.72
15	33.97	34.04	35.25	33.97
16	31.54	31.61	32.66	31.54
17	29.40	29.46	30.38	29.40
18	27.48	27.53	28.35	27.48
19	25.76	25.81	26.53	25.76
20	24.21	24.25	24.89	24.21
21	22.80	22.83	23.41	22.80
22	21.51	21.54	22.07	21.51
23	20.34	20.37	20.84	20.34
24	19.26	19.28	19.71	19.26
25	18.26	18.28	18.67	18.26
26	17.34	17.36	17.72	17.34
27	16.48	16.50	16.83	16.48
28	15.69	15.71	16.01	15.69
29	14.95	14.97	15.24	14.95
30	14.26	14.27	14.53	14.26
31	13.61	13.62	13.86	13.61
32	13.00	13.01	13.23	13.00
33	12.43	12.44	12.64	12.43
34	11.89	11.90	12.09	11.89
35	11.38	11.39	11.56	11.38
36	10.90	10.91	11.07	10.90
37	10.44	10.45	10.60	10.44
38	10.01	10.02	10.16	10.01
39	9.599	9.608	9.739	9.599
40	9.209	9.217	9.34	9.209

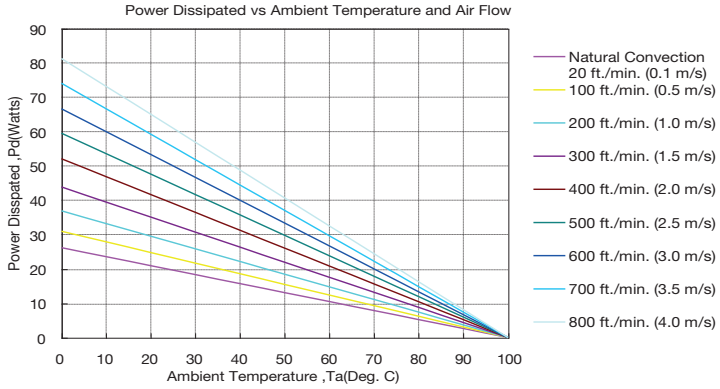
#### To Trim Up

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	24 V	28 V	48 V
	R <sub>u</sub> (k $\Omega$ )			
1	0.049	0.106	0.272	0.196
2	0.168	0.345	0.55	0.673
3	0.288	0.583	0.829	1.15
4	0.407	0.822	1.107	1.627
5	0.526	1.061	1.385	2.104
6	0.645	1.299	1.664	2.582
7	0.765	1.538	1.942	3.059
8	0.884	1.776	2.221	3.536
9	1.003	2.015	2.499	4.013
10	1.123	2.253	2.777	4.49

### Application Notes

#### Thermal Resistance Information



Air Flow Rate	Typical Rca
Natural Convection 20 ft/min (0.1 m/s)	3.82 °C/W
100 ft/min (0.5 m/s)	3.23 °C/W
200 ft/min (1.0 m/s)	2.71 °C/W
300 ft/min (1.5 m/s)	2.28 °C/W
400 ft/min (2.0 m/s)	1.92 °C/W
500 ft/min (2.5 m/s)	1.68 °C/W
600 ft/min (3.0 m/s)	1.50 °C/W
700 ft/min (3.5 m/s)	1.35 °C/W
800 ft/min (4.0 m/s)	1.23 °C/W

#### Airflow Derating Graph

##### Example (Without Heatsink)

To determine the minimum airflow necessary for a RDH60072WS12 operating at an input voltage of 110 V, an output current of 30 A, and a maximum ambient temperature of 30°C:

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

$P_d = 12 V \times 30 A \times (1-0.87)/0.87 = 54 \text{ Watts}$

Where  $P_i$  = Input power,  $P_o$  = Output Power and  $\eta$  = Efficiency

Determine airflow from airflow derating graph using data points for  $P_d=54 \text{ W}$  and  $T_a = 30 \text{ °C}$

Minimum airflow= 800 ft./min.

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

Maximum temperature rise is  
 $\Delta T = P_d \times R_{ca} = 54.0 \times 1.23 = 66.42 \text{ °C}$ .

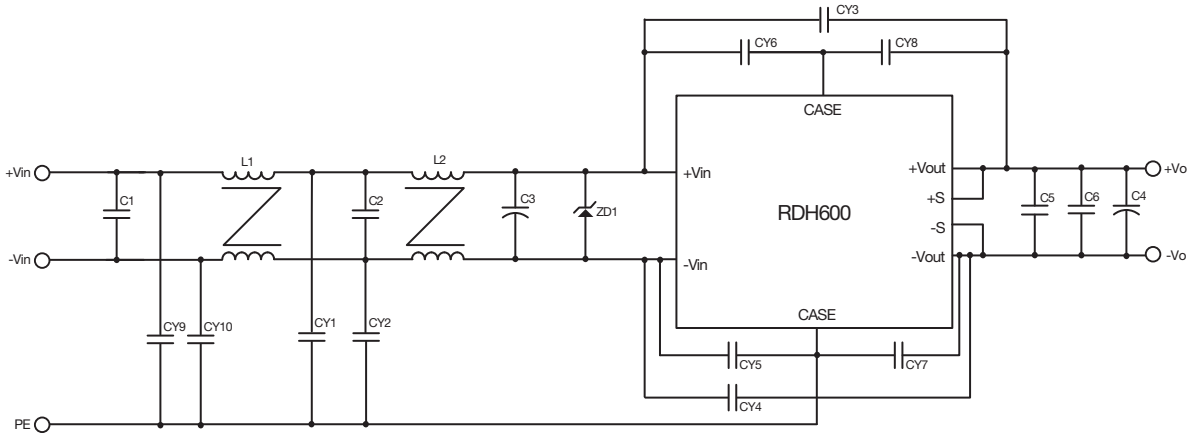
Maximum case temperature is

$T_c = T_a + \Delta T = 96.42 \text{ °C} < 100 \text{ °C}$ .

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	C1	C2	C3	C4	C5	C6	CY1	CY2	CY3	CY4
RDH60072WS12 RDH60072WS24	X2 CAP, 0.47 $\mu$ F	X2 CAP, 0.47 $\mu$ F	220 $\mu$ F/ 200 V, YXF	470 $\mu$ F/ 50 V, KY	10 $\mu$ F/50 V	1 $\mu$ F/50 V	Y1 CAP, 470 pF	Y1 CAP, 470 pF	Y1 CAP, 2200 pF	Y1 CAP, 2200 pF
	<b>CY5</b>	<b>CY6</b>	<b>CY7</b>	<b>CY8</b>	<b>CY9</b>	<b>CY10</b>	<b>L1</b>	<b>L2</b>	<b>ZD1</b>	
	Y1 CAP, 4700 pF	Y1 CAP, 4700 pF	Y1 CAP, 10000 pF	Y1 CAP, 10000 pF	NC	NC	3.8 mH	3.8 mH	1.5KE180A	
RDH60072WS28	X2 CAP, 0.47 $\mu$ F	X2 CAP, 0.47 $\mu$ F	220 $\mu$ F/ 200 V, YXF	470 $\mu$ F/ 50 V, KY	10 $\mu$ F/50 V	1 $\mu$ F/50 V	Y1 CAP, 470 pF	Y1 CAP, 470 pF	Y1 CAP, 1000 pF	Y1 CAP, 1000 pF
	<b>CY5</b>	<b>CY6</b>	<b>CY7</b>	<b>CY8</b>	<b>CY9</b>	<b>CY10</b>	<b>L1</b>	<b>L2</b>	<b>ZD1</b>	
	Y1 CAP, 4700 pF	Y1 CAP, 4700 pF	Y1 CAP, 10000 pF	Y1 CAP, 10000 pF	NC	NC	3.8 mH	3.8 mH	1.5KE180A	
RDH60072WS48	X2 CAP, 0.47 $\mu$ F	X2 CAP, 0.47 $\mu$ F	220 $\mu$ F/ 200 V, YXF	470 $\mu$ F/ 63 V, KY	4.7 $\mu$ F/ 100 V	1 $\mu$ F/100 V	Y1 CAP, 470 pF	Y1 CAP, 470 pF	Y1 CAP, 1000 pF	Y1 CAP, 1000 pF
	<b>CY5</b>	<b>CY6</b>	<b>CY7</b>	<b>CY8</b>	<b>CY9</b>	<b>CY10</b>	<b>L1</b>	<b>L2</b>	<b>ZD1</b>	
	Y1 CAP, 4700 pF	Y1 CAP, 4700 pF	Y1 CAP, 10000 pF	Y1 CAP, 10000 pF	Y1 CAP, 4700 pF	Y1 CAP, 4700 pF	3.8 mH	3.8 mH	1.5KE180A	