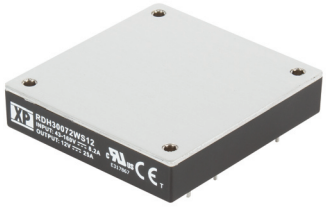
RDH300 Series

DC-DC Converter

XP Power

300 Watts

- Wide 4:1 Input Range
- 72 & 110 VDC Nominal Inputs for Rail Applications
- Complies with EN50155
- Meets EN50121-3-2
- Single Output
- Industry Standard 1/2 Brick
- -40 °C to +100 °C Operation
- 3000 VDC Isolation
- Output Trim ±10%
- Remote On/Off and Remote Sense
- 3 Year Warranty



Dimensions:

RDH300:
2.4 x 2.28 x 0.5" (61.0 x 57.9 x 12.7 mm)

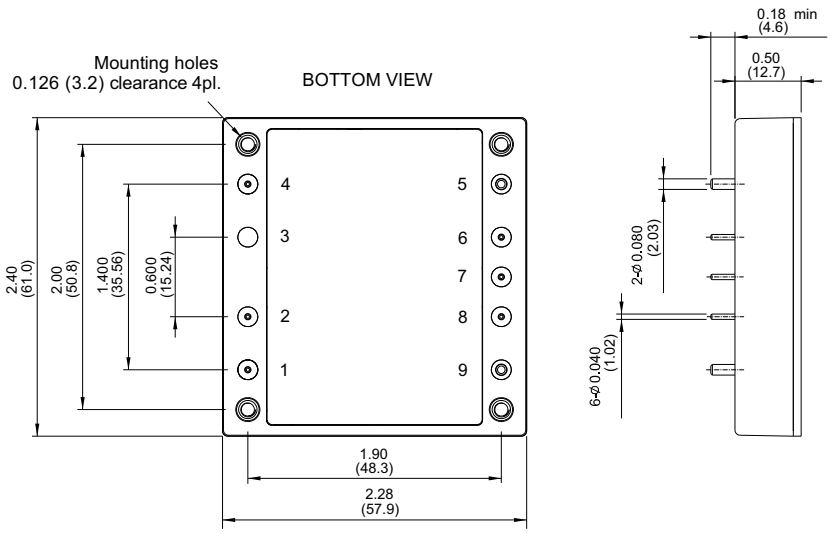
Models & Ratings

Input Voltage	Output Voltage	Output Current	Input Current		Ripple & noise[1]	Efficiency[2]	Max. capacitive load	Model Number
			No Load	Full Load				
43-160 V	5 V	60.00 A	10 mA	3.100 A	120 mV	88%	10000 µF	RDH30072WS05
	12 V	25.00 A	10 mA	3.030 A	150 mV	90%	8800 µF	RDH30072WS12
	24 V	12.50 A	10 mA	3.064 A	240 mV	89%	4700 µF	RDH30072WS24
	28 V	10.70 A	10 mA	3.064 A	280 mV	89%	3300 µF	RDH30072WS28
	48 V	6.25 A	10 mA	3.064 A	480 mV	89%	2200 µF	RDH30072WS48

Notes

1. *Measured at 20 MHz bandwidth pk-pk, full load, 10 µF aluminum solid and 1.0 µF ceramic capacitors.(5 V uses 47 µF polymer tantalum and 10 µF ceramic capacitor)*
2. *Measured at 110 V input and full load.*

Mechanical Details



Pin Connections	
Pin	Single
1	+Vin
2	Remote On/Off
3	No Pin
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

Notes

1. All dimensions are in inches (mm)
2. Weight: 0.25lbs (114 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			200	VDC for 100 ms	
Undervoltage Lockout	On: >40 V	42	43	VDC	On
	Off: <37 V	39	40		Off
Lockout Hysteresis		1		VDC	
Idle Current		3	5	mA	When output is inhibited
Inrush Current			0.1	A^2s	
Input Reflected Ripple Current		40		mA pk-pk	Through 12 µH inductor
Recommended Input Fuse	T10.0A				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	5		48	VDC	See Models and Ratings table
Output Trim	±10			%	See Application Note
Initial Set Accuracy			±1.0	%	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			±5.0	%	Maximum deviation, recovering to less than 1% in 250 µs for 25% step load change.
Start Up Time		35		ms	
Output Voltage Rise Time		15		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 remote on/off (pin 2) is open or high (3.5-160 VDC) Output turns off if remote on/off (pin 2) is low (<1.2 VDC max)				

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		89		%	See Models and Ratings table
Isolation: Input to Output	3000			VDC	60 s
Isolation: Input to Case	3000			VDC	60 s
Isolation: Output to Case	500			VAC	60 s
Isolation Resistance	10^8			Ω	
Isolation Capacitance		3000		pF	Input to output
Switching Frequency	270	300	330	kHz	Fixed
Power Density			109	W/in^3	
Mean Time Between Failure		600		kHrs	5, 12, 24 & 28 V MIL-HDBK-217F, +25 °C GB
		900			48 V MIL-HDBK-217F, +25 °C GB
Weight		0.25 (114.0)		lb (g)	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Base Plate Temperature	-40		+100	°C	
Storage Temperature	-55		+125	°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
	EN62368-1		Evaluated to EN62368-1
CE	Meets all applicable directives		
UKCA	Meets all applicable legislation		

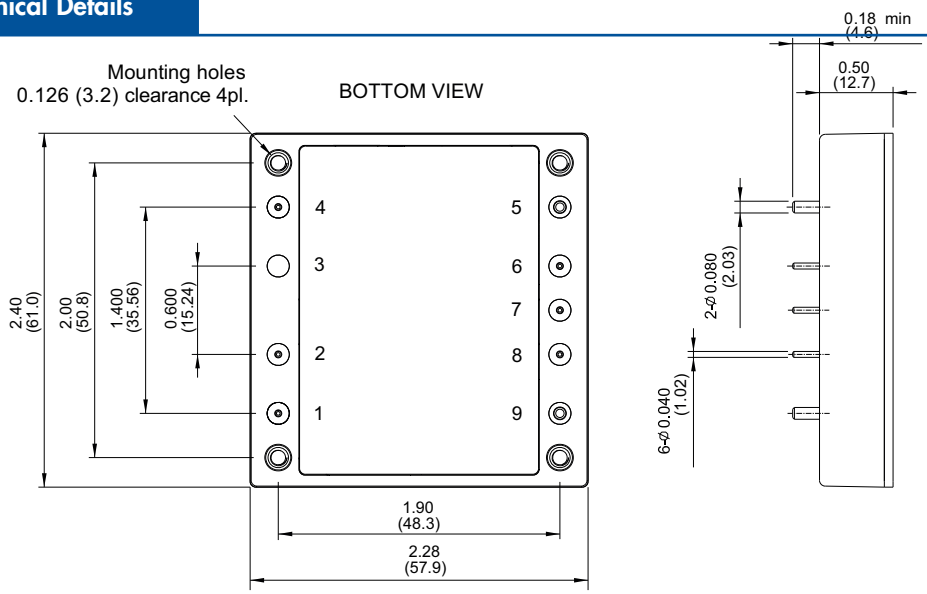
EMC: Emissions

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 Notes
ESD Immunity	EN61000-4-2	±6 kV/±8 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 µF/200V
Surge	EN61000-4-5	±4 kV/±2 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



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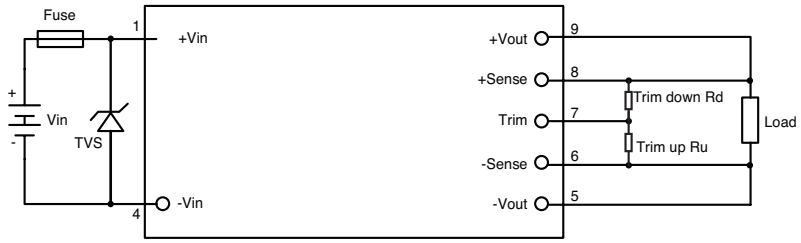
Notes

1. All dimensions are in inches (mm)
2. Weight: 0.25 lbs (114 g) approx.
3. 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 RDH300 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 10 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 Littlefuse.



Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up by 10% 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 (Rd) 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 Δ%.

Trim Down %	5 V	12 V	24 V	28 V	48 V
	Rd (kΩ)				
1	110.4	660.3	1671	1984	3106
2	52.38	300.1	775.8	905.5	1400
3	33.05	180.0	477.2	545.8	831.5
4	23.38	120.0	327.9	365.9	547.1
5	17.58	83.98	238.3	258.0	376.5
6	13.71	59.97	178.6	186.0	262.8
7	10.95	42.82	136.0	134.6	181.5
8	8.880	29.95	104.0	96.10	120.6
9	7.269	19.95	79.07	66.12	73.17
10	5.980	11.94	59.17	42.14	35.25

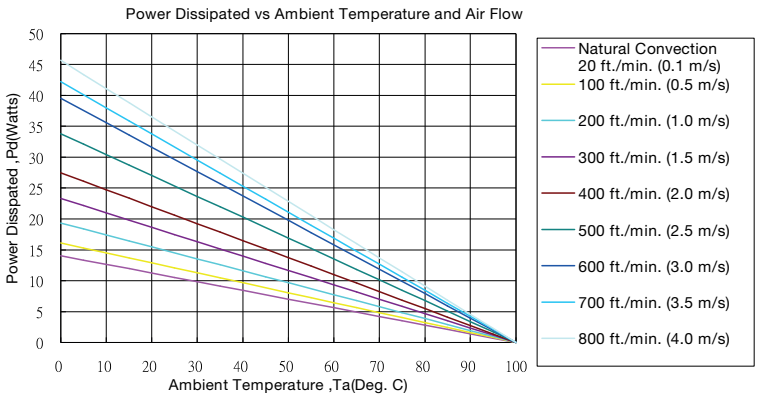
To Trim Up

Connecting an external resistor (Ru) between the Trim 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 Δ%.

Trim Up %	5 V	12 V	24 V	28 V	48 V
	Ru (kΩ)				
1	112.7	153.2	165.7	168.3	148.6
2	54.70	74.30	79.36	81.16	71.81
3	35.37	47.99	50.58	52.12	46.21
4	25.70	34.83	36.19	37.60	33.40
5	19.90	26.94	27.56	28.86	25.72
6	16.03	21.68	21.80	23.08	20.60
7	13.27	17.92	17.69	18.93	16.94
8	11.20	15.10	14.61	15.82	14.20
9	9.589	12.91	12.21	13.40	12.07
10	8.300	11.15	10.29	11.47	10.36

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 (2.5 m/s)	2.53 °C/W
700 ft/min (2.5 m/s)	2.37 °C/W
800 ft/min (2.5 m/s)	2.19 °C/W

Airflow Derating Graph

Example (Without Heatsink)

To determine the minimum airflow necessary for a RDH30072WS24 operating at an input voltage of 72 V, an output current of 12.5 A, and a maximum
ambient temperature of 20°C:

Determine Power dissipation (Pd): $Pd = Pi-Po = Po(1-\eta)/\eta$,

$Pd = 24\,V \times 12.5\,A \times (1-0.894)/0.894 = 35.57$ Watts

Where Pi = Input power, Po = Output Power and η = Efficiency

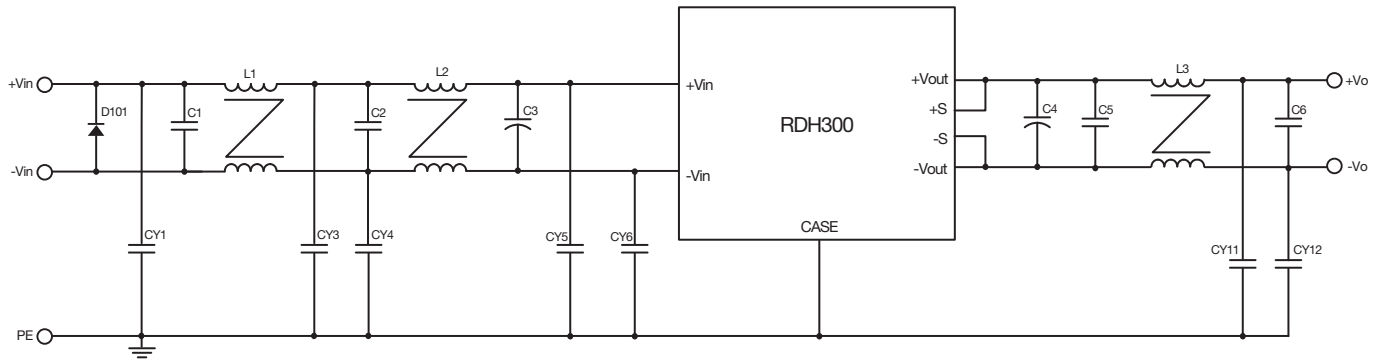
Determine airflow from airflow derating graph using data points for Pd=35.57 W and Ta = 20 °C

Minimum airflow= 800 ft./min.

To check that the maximum case temp of 100 °C is not exceeded:
Maximum temperature rise is
$\Delta T = Pd \times Rca = 35.57 \times 2.19 = 77.9°C$.
Maximum case temperature is
$Tc = Ta + \Delta T = 97.9°C < 100°C$.
Where: Rca is the thermal resistance from case to ambient environment. Ta is ambient temperature and Tc is case temperature.

Application Notes

EMC Filter – Emissions and Immunity



	RDH30072WS05	RDH30072WS12	RDH30072WS24	RDH30072WS28	RDH30072WS48
C1, C2	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812
C3	220 µF/200 V Aluminum cap. YXF series	220 µF/200 V Aluminum cap. YXF series	220 µF/200 V Aluminum cap. YXF series	220 µF/200 V Aluminum cap. YXF series	220 µF/200 V Aluminum cap. YXF series
C4	47 µF/20 V Polymer tantalum cap.	10 µF/50 V X57R 1210	10 µF/50 V X57R 1210	10 µF/50 V X57R 1210	22 µF/100 V Aluminum solid cap.
C5	1 µF/100 V X7R 1206	1 µF/100 V X7R 1206	1 µF/100 V X7R 1206	1 µF/100 V X7R 1206	1 µF/100 V X7R 1206
C6					
CY1	NC	NC	1000 pF/Y2	NC	NC
CY3	220 pF/Y2	220 pF/Y2	220 pF/Y2	220 pF/Y2	220 pF/Y2
CY4	4700 pF/Y2	4700 pF/Y2	4700 pF/Y2	4700 pF/Y2	4700 pF/Y2
CY5	2200 pF/Y2	2200 pF/Y2	2200 pF/Y2	2200 pF/Y2	2200 pF/Y2
CY6	1000 pF/Y2	1000 pF/Y2	1000 pF/Y2	1000 pF/Y2	1000 pF/Y2
CY11	10000 pF/Y2	10000 pF/Y2	10000 pF/Y2	10000 pF/Y2	10000 pF/Y2
CY12					
D101	1.5 KE 180 A	1.5 KE 180 A	1.5 KE 180 A	1.5 KE 180 A	1.5 KE 180 A
L1, L2	ACME A10 T25*15*15C 3.5mH, ø1.0mm*1/16T	ACME A10 T25*15*15C 3.5mH, ø1.0mm*1/16T	ACME A10 T25*15*15C 3.5mH, ø1.0mm*1/16T	ACME A10 T25*15*15C 3.5mH, ø1.0mm*1/16T	ACME A10 T25*15*15C 3.5mH, ø1.0mm*1/16T
L3	FERROXCUBE T29/19/15-3E6 0.17mH, ø1.0mm*4/4T	VAKOS R10K T22*16*6.5C 0.28mH, ø1.0mm*2/7T	VAKOS R12K T18*12*6C 0.28mH, ø1.0mm*1/7T	VAKOS R12K T18*12*6C 0.28mH, ø1.0mm*1/7T	VAKOS R12K T18*12*6C 0.28mH, ø1.0mm*1/7T

Notes

C3 is RUBYCON YXF series aluminium capacitors or equivalent, CYxx is MURATA Y2 capacitor or equivalent.