QHL300 Series

DC-DC Converter

XP Power

300 Watts

- 180 - 425 VDC Input Range
- Regulated Single Output
- Industry Standard Half Brick
- -40 °C to +100 °C Operation
- 3000 VAC Isolation
- Output Trim -20% to +10%
- Remote On/Off
- Overtemperature Protection
- 3 Year Warranty

The QHL300 series offers a compact 300W DC-DC solution in an industry standard half brick package. This series of modules enables effective construction of distributed power architectures from AC front ends, PFC front ends and battery systems.

Dimensions:

QHL300:
2.4 x 2.28 x 0.5" (61.0 x 57.9 x 12.7 mm)

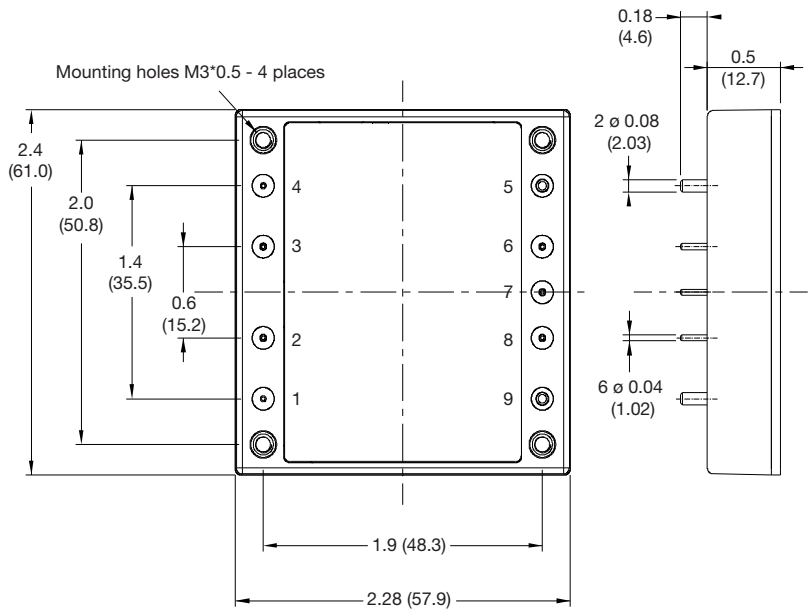
Models & Ratings

Input Voltage	Output Voltage	Output Current	Input Current[1]		Ripple & noise pk-pk	Efficiency Vin Nominal with full load	Maximum Capacitive Load µF	Model Number
			No Load	Full Load Vin Nominal				
300V (180-425V)	5V	60A	10mA	1.92A	120mV	89%	10000	QHL300300S05
	12V	25A		1.92A	150mV	88%	10000	QHL300300S12
	24V	12.5A		1.87A	240mV	90%	6000	QHL300300S24
	28V	10.7A		1.87A	280mV	90%	6000	QHL300300S28
	48V	6.25A		1.87A	480mV	90%	3000	QHL300300S48

Notes

1. Measured at 300 VDC input.
2. Peak to peak measured at 20MHz bandwidth and i) 47µF tantalum and 1µF ceramic capacitor across output for 5V model
ii) 10µF al. and 1µF ceramic capacitor across output for 48V model
iii) 10µF tantalum and 1µF ceramic capacitor across output for 12V, 24V and 28V models
3. Minimum capacitive load of 470 µF required to maintain regulation.

Mechanical Details



Pin Connections	
Pin	Function
1	+Vin
2	REM
3	NP
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	180		425	VDC	
Input Current	1.87		1.92	A	425-180 VDC input
Undervoltage Lockout		170		VDC	On
		160			Off
Lockout Hysteresis		10		VDC	
Input Transient Voltage			500	VDC	For 100 ms
Idle Current		10		mA	No load
Standby Mode		3		mA	When module inhibited
Inrush Current			0.1	A^2s	ETS300 132-2
Recommended Input Fuse		5		A	Time delay type, see application note
Input Reflected Ripple Current			50	mA pk-pk	Through 10 µH inductor

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	5		48	VDC	See Models and Ratings table
Output Trim	-20		+10	%	See Application Note of nominal output voltage
Initial Set Accuracy			±1	%	At full load
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		300		ms	
Output Voltage Rise Time		10		ms	
Ripple & Noise				mV pk-pk	See models and ratings table
Overload Protection	110	125	140	%	
Short Circuit Protection					Continuous hiccup mode, with auto recovery
Maximum Capacitive Load					See Models and Ratings table. Minimum capacitance of 330 µF required to meet specified regulations
Temperature Coefficient			±0.02	%/°C	
Overvoltage Protection	115	125	140	%	Of nominal input voltage
Remote On/Off	Ouput is on if REM (pin 2) is open or high (3.5-75 VDC) with respect to pin 4 or -Vin (positive logic) Output turns off if REM (pin 2) is low (<1.2 VDC max) with respect to pin 4 or -Vin				

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		90		%	See Models and Ratings table
Isolation: Input to Output	3000			VAC	60 s reinforced
Isolation: Input to Case	2500			VAC	60 s
Isolation: Output to Case	500			VAC	60 s
Switching Frequency	270	300	330	kHz	Fixed PWM
Isolation Resistance	100			MΩ	
Case Material	Plastic (DAP) with aluminium base plate. UL94V-0 rated.				
Potting Material	Epoxy UL94V-0				
Pin Material	Copper with nickel and matte tin plate				
Solder Profile	260 °C max, 1.5mm from case 10s max				With iron 450°C, 5s max
Water Wash	Use deionized water, do not soak. Dry thoroughly				
Power Density			109	W/in^3	
Mean Time Between Failure	470			kHrs	5V models, MIL-HDBK-217F, +25 °C GB, full load
	590				12V models, MIL-HDBK-217F, +25 °C GB, full load
	660				Others, MIL-HDBK-217F, +25 °C GB, full load
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	Auto recovery at 95 °C typical
Humidity			95	%RH	Non-condensing
Cooling					Baseplate-cooled
Altitude			2000	m	Operating. Storage to 12000 m
Shock and Vibration					EN61373/MIL-STD-810F

Safety Approvals

Agency	Standard	Notes & Conditions
UL	cUL60950-1	ITE

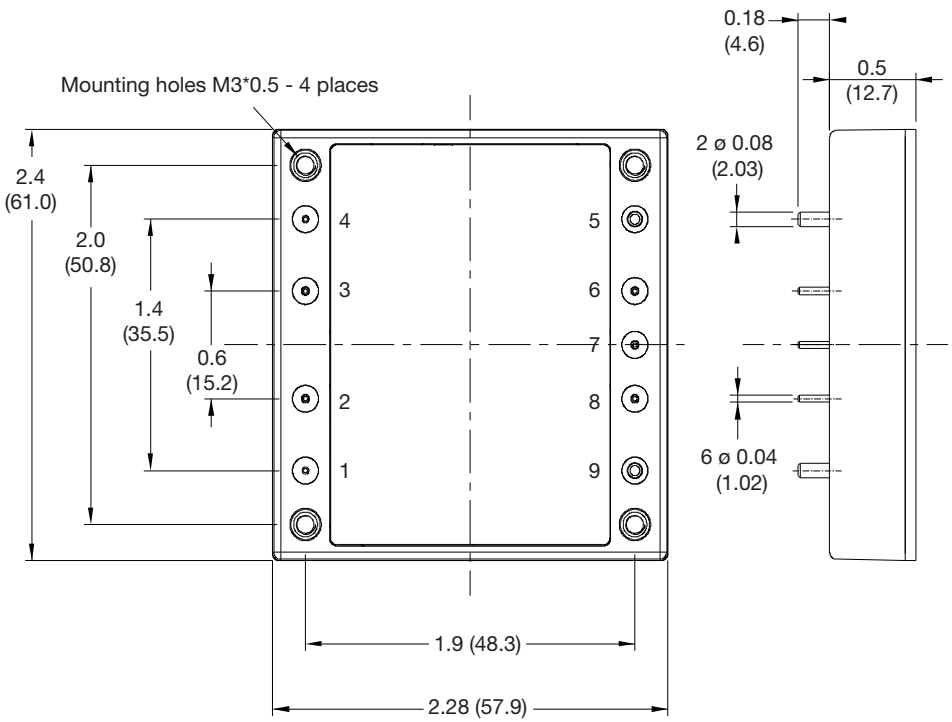
EMC: Emissions

Phenomenon	Standard	Test Level	Notes & Conditions
Conducted	EN55032	Class A	See Application Notes
Radiated	EN55032	Class A	See Application Notes

EMC: Immunity

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
ESD Immunity	EN61000-4-2	±6kV/±8kV	A	Contact Discharge/Air Discharge
Radiated Immunity	EN61000-4-3	20v/m	A	
EFT/Burst	EN61000-4-4	±2kV	A	See application note
Surge	EN61000-4-5	±2kV	A	See application note
Conducted Immunity	EN61000-4-6	10Vrms	A	
Magnetic Fields	EN61000-4-8	3A/m	A	

Mechanical Details



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Notes

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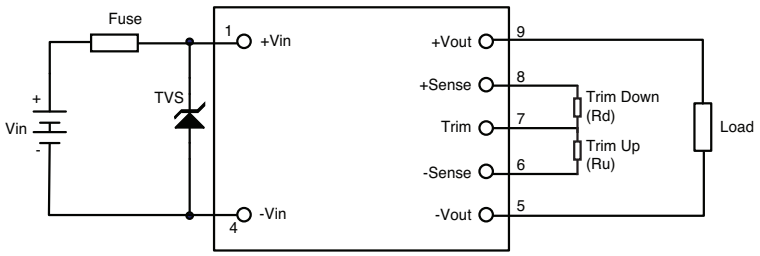
   x.xxx = ±0.01 (x.xx = ±0.25)

Application Notes

Input Fusing and Safety Considerations

The QHL300 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 5.0A 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 SMCJ440A.



Suggested Basic Layout

Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up by 10% or down by 20%. This is accomplished by connecting an external resistor between the Trim pin and -sense to trim up, or between the trim pin and +sense to trim down.

To Trim Down (Rd)

Trim Down %	5V	12V	24V	28V	48V
	Rd KΩ				
1	111.9	687.3	1704	2067	3295
2	53.88	327.1	807.8	987.5	1588
3	34.55	207	509.2	627.8	1020
4	24.88	147	359.9	447.9	735.1
5	19.08	111	270.3	340	564.5
6	15.21	86.97	210.6	268	450.8
7	12.45	69.82	168	216.6	369.5
8	10.38	56.95	136	178.1	308.6
9	8.77	46.95	111.1	148.1	261.2
10	7.48	38.94	91.17	124.1	223.3
11	6.425	32.39	74.88	104.5	192.2
12	5.547	26.93	61.31	88.17	166.4
13	4.803	22.32	49.82	74.33	144.5
14	4.166	18.36	39.98	62.47	125.8
15	3.613	14.93	31.44	52.19	109.5
16	3.13	11.93	23.98	43.2	95.28
17	2.704	9.277	17.39	35.26	82.74
18	2.324	6.923	11.54	28.21	71.58
19	1.985	4.817	6.298	21.9	61.61
20	1.68	2.921	1.583	16.22	52.63

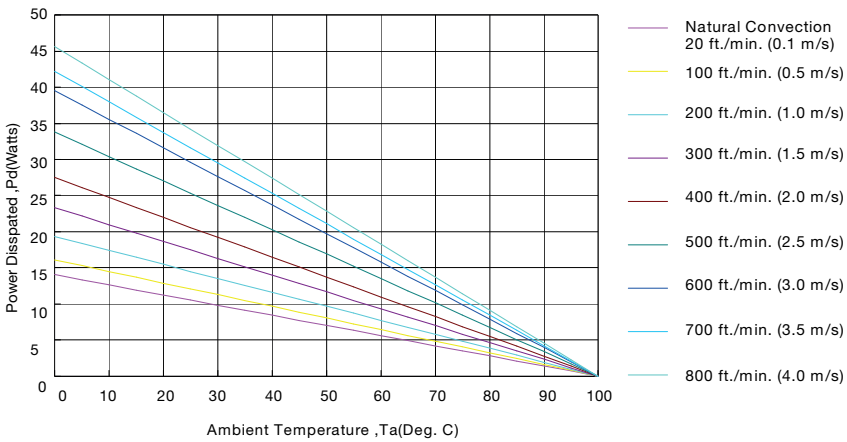
To Trim Up (Ru)

Trim Up %	5V	12V	24V	28V	48V
	Ru KΩ				
1	114.2	154.1	164.1	167.1	147.4
2	56.2	74.95	78.65	80.73	71.3
3	36.87	48.56	50.18	51.93	45.93
4	27.2	35.37	35.95	37.52	33.25
5	21.4	27.46	27.41	28.88	25.64
6	17.53	22.18	21.71	23.12	20.56
7	14.77	18.41	17.65	19.01	16.94
8	12.7	15.58	14.6	15.92	14.22
9	11.09	13.38	12.22	13.52	12.11
10	9.8	11.63	10.33	11.6	10.42

Application Notes

Thermal Resistance Information

Airflow Derating Graph – Without Heatsink



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

Example (Without Heatsink)

To determine the minimum airflow necessary for a QHL300300S12 operating at an input voltage of 300 V, an output current of 20A, and a maximum ambient temperature of 40°C:

Determine Power dissipation (Pd): Pd = Pi-Po = Po(1-η)/η,

Pd = 12V × 20 A × (1-0.89) / 0.89 = 33

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

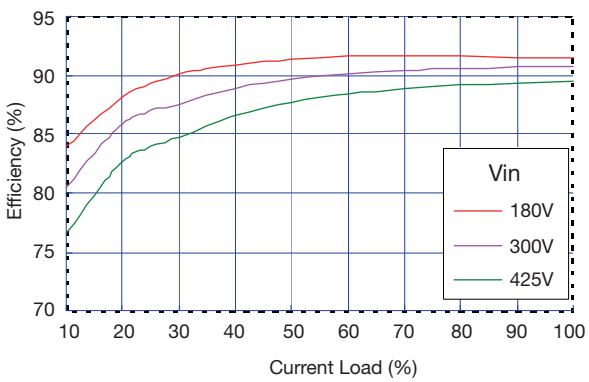
Determine airflow from airflow derating graph using data points for Pd = 33 W and Ta = 40 °C

Minimum airflow = 700 ft./min.

To check that the maximum case temp of 100 °C is not exceeded:
Maximum temperature rise is
ΔT = Pd × Rca= 33 x 1.5 = 49.5°C.
Maximum case temperature is
Tc = Ta + Δ T = 40 + 49.5°C = 90°C <100°C.
Where: Rca is the thermal resistance from case to ambient environment. Ta is ambient temperature and Tc is case temperature.

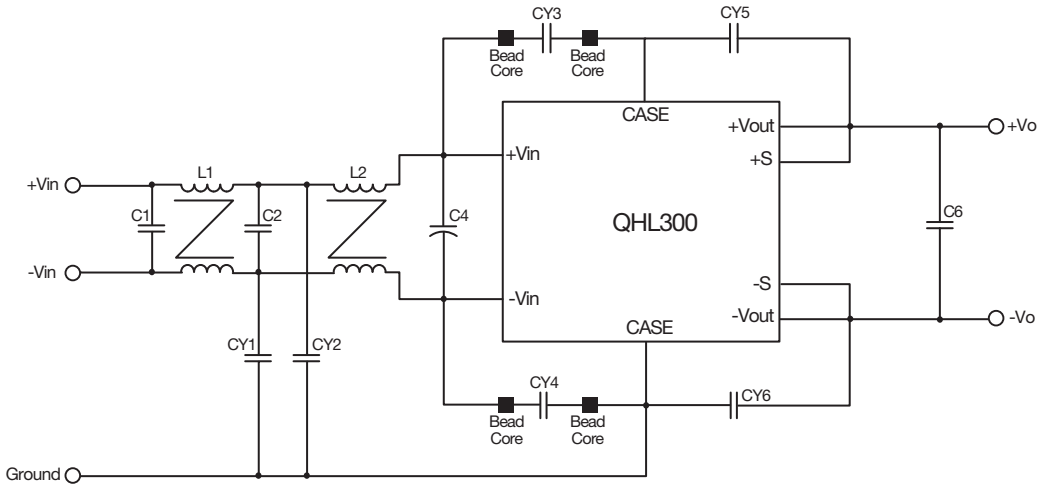
Example Efficiency Curve

Example based on QHL300300S28



Application Notes

Conducted and Radiated Emissions – Class A



Model Number	C1	C2	C4	C6	CY1	CY2	CY3*	CY4*	CY5*	CY6	L1	L2	Bead Core**
QHL300300Sxx	0.22 µF/ 630 V	0.22 µF/ 630 V	150 µF/ 450 V	4.7µF/ 100V	100 pF	2200 pF	1000 pF	2200 pF	2200 pF	2200 pF	5.5 mH/ 5A	5.5 mH/ 5A	N/C

* QHL300300S05, CY3/4/5: 2200pF
**QHL300300S05, Bead Core: BRI 4.0*1.5*2.0

Notes

C1, C2, C6, CY1, CY2, CY3, CY4, CY5, CY6: Ceramic capacitors, C4 aluminum capacitors.

C4: 150uF/450V (NIPPON CHEMI-CON EKXG-451E 151MM45S) or equivalent.

CY1, CY2, CY3, CY4, CY5, CY6:
100pF (MURATA KX Series DE1B3KX101MA4BN01F) or equivalent.
1000pF (MURATA KX Series DE1B3KX102MA4BN01F)or equivalent.
2200pF (MURATA KX Series DC1B3KX222MA4BN01F)or equivalent.

L1, L2: 5.5mH /5A (BULL WILL URT24-050055H) or equivalent.

BEAD CORE: BRI 4.0*1.5*2.0mm CHILISIN

Safety Considerations

The use of a fuse on the input line is recommended for good practice. Additional protection for surges and reverse voltage are also recommended. Transient voltage suppressors and gas discharge devices can be fitted across the input terminals.