QSB15048W Series

DC-DC Converter

XP Power

150 Watts

- Wide 8:1 Input Range
- Regulated Single Output
- Industry Standard 1/2 Brick
- -40 °C to +100 °C Operation
- 1.5kVDC Isolation
- Output Trim ±10%
- Remote On/Off
- Overtemperature Protection
- 3 Year Warranty



Dimensions:

QSB15048W:
2.4 x 2.28 x 0.5" (61.0 x 57.9 x 12.7 mm)

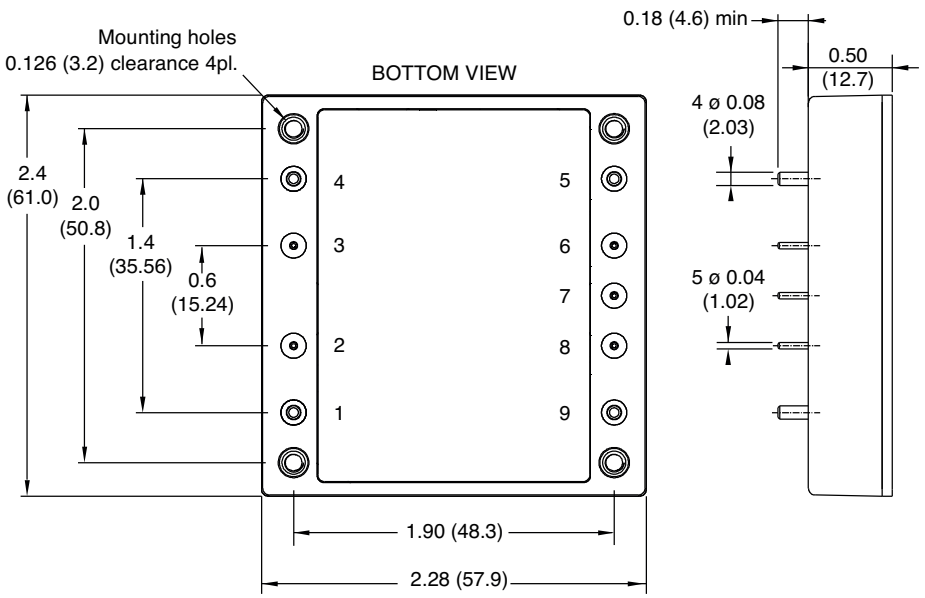
Models & Ratings

Input Voltage	Output Voltage	Output Current	Input Current[1]		Ripple & noise[2] pk-pk	Efficiency[3]	Max. capacitive load	Model Number[4]
			No Load	Full Load				
9-75 V	12 V	12.50 A	60 mA	4.53 A	120 mV	89.0%	5000 µF	QSB15048WS12
	15 V	10.00 A	60 mA	4.50 A	120 mV	90.0%	5000 µF	QSB15048WS15
	24 V	6.25 A	60 mA	4.66 A	280 mV	89.5%	2000 µF	QSB15048WS24
	28 V	5.35 A	60 mA	4.62 A	280 mV	90.0%	1500 µF	QSB15048WS28
	48 V	3.13 A	60 mA	4.64 A	480 mV	90.0%	1000 µF	QSB15048WS48

Notes

1. Maximum input current is 20A at 9V full load
2. Measured at 2 MHz bandwidth and 10µF tant/ µF ceramic capacitors on output (10 µF electrolytic/1 µF ceramic capacitors for 48 V output)
3. Measured at 36V input and full load
4. Minimum capacitive load of 100µF required to maintain regulation
5. Add suffix -T for threaded baseplate fixing and suffix -N for negative logic control

Mechanical Details



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

Notes

1. All dimensions are in inches (mm)
2. Weight: 0.24 lbs (109 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	9		75	VDC	
Input Surge			100	VDC for 100 ms	
Undervoltage Lockout	On: >8.5 V	9.0	9.5	VDC	On
	Off: <7.5 V	8.0	8.5		Off
Lockout Hysteresis		1.0		VDC	
Idle Current		12	18	mA	When output is remotely turned off
Inrush Current			1	A^2s	
Recommended Input Fuse		30		A	Fact acting type
Input Reflected Ripple Current			50	mA pk-pk	Through 10 µH inductor

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	12		48	VDC	See Models and Ratings table
Output Trim	±10			%	See Application Note (28 Vout at 9-13 Vin Trim: +0/-10%)
Initial Set Accuracy			±1.0	%	At full load and 36 V input, 25°C
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 for single/dual output
Transient Response			±5.0	%	Maximum deviation, recovering to less than 1% in 500 µs for 25% step load change. For 5V output, add 1000 µF cap, for others add 100 µF
Start Up Time		100	150	ms	
Output Voltage Rise Time		30	50	ms	
Ripple & Noise				mV pk-pk	See models and ratings table
Overload Protection	105	160	200	%	
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		140	%	
Remote On/Off	Output is on if remote on/off (pin 2) is open or high (3.5-75 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		90		%	See Models and Ratings table
Isolation: Input to Output	1500			VDC	60 s
Isolation: Input and output to Case	1500			VDC	60 s
Switching Frequency		200		kHz	
Isolation Resistance	10^9			Ω	
Isolation Capacitance		3500		pF	Others
		2500			48 V output
Power Density			54	W/in^3	
Mean Time Between Failure		800		kHrs	MIL-HDBK-217F, +25 °C GB
Weight		0.24 (109.0)		lb (g)	
Solder Profile			260	°C	With iron 450°C 5s max 1.5mm from case 10s max
Case material	Plastic (DAP) with aluminum base plate. UL94V-0 rated.				
Potting Material	Epoxy UL94V-0				
Pin Material	Copper , nickel plated matte tin				

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Base Plate Temperature	-40		+100	°C	
Storage Temperature	-55		+105	°C	
Thermal Protection		+105		°C	Non latching, recovery at 95°C center baseplate
Humidity			95	%RH	Non-condensing
Altitude			2000	m	Storage to 12000m
Cooling	Base plate cooled				

EMC: Emissions

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

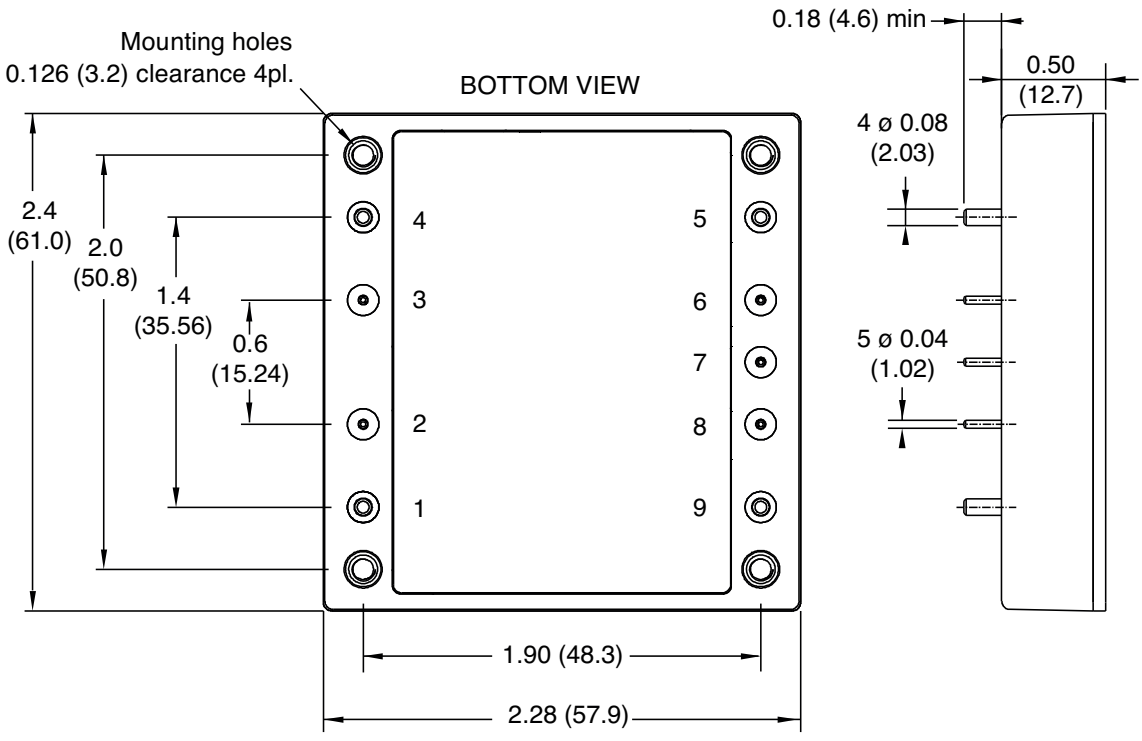
EMC: Immunity

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
ESD Immunity	EN61000-4-2	±4 kV/±8 kV	A	Contact Discharge/Air Discharge
Radiated Immunity	EN61000-4-3	3 V rms	A	
EFT/Burst	EN61000-4-4	1 kV	A	
Surge	EN61000-4-5	0.5 kV	A	External TVS, SMCJ78A
Conducted Immunity	EN61000-4-6	3 V rms	A	
Magnetic Fields	EN61000-4-8	3 A/m	A	

Safety Approvals

Agency	Standard	Notes & Conditions
UL	UL60950-1 & CAN/CSA C22.2 No.60950-1	ITE
EN	EN62368-1	Evaluated to EN62368-1
CE	Meets all applicable directives	
UKCA	Meets all applicable legislation	

Mechanical Details



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9	+Vout

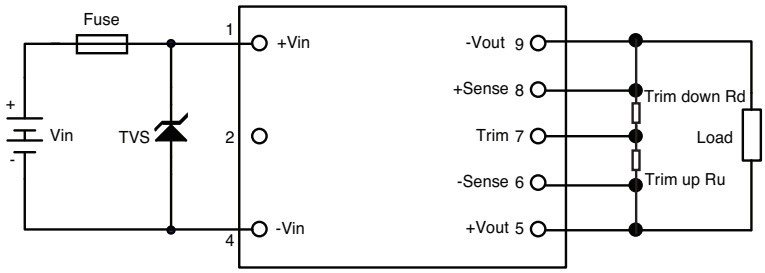
Notes

1. All dimensions are in inches (mm)
2. Weight: 0.24 lbs (109 g) approx.
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   x.xxx = ±0.01 (x.xx = ±0.25)

Application Notes

Input Fusing and Safety Considerations

The QSB15048W series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 30 A fast acting 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 SMCJ78A.



Output Voltage Sensing

The module will automatically trim the output voltage via the sense pins to the default values either locally or at the load. If not required, the sense pins should be connected locally as indicated in the example EMC circuit.

Output Voltage Adjustment

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

To Trim Down

Connecting an external resistor (Rd) between the Trim pin and the Vout (+) (or Sense (+)) pin decreases the output voltage. The following equations determine the required external resistor value to obtain a percentage output voltage change of Δ%.

Vout = 12 & 15 V

$$R_D = 20x \frac{(Vo_set - \Delta\% \times Vo_set - 1.24)}{\Delta\% \times Vo_set} - 100\ k\Omega$$

Vout = 24 V

$$R_D = 20x \frac{(Vo_set - \Delta\% \times Vo_set - 2.5)}{\Delta\% \times Vo_set} - 100\ k\Omega$$

Vout = 28 V

$$R_D = 23.7x \frac{(Vo_set - \Delta\% \times Vo_set - 2.5)}{\Delta\% \times Vo_set} - 150\ k\Omega$$

Vout = 48 V

$$R_D = 30x \frac{(Vo_set - \Delta\% \times Vo_set - 2.5)}{\Delta\% \times Vo_set} - 200\ k\Omega$$

Where

$$Vout = Vo, set\ \Delta\% = \left(\frac{Vset - Vrequired}{Vo_set}\right) \times 100$$

To Trim Up

Connecting an external resistor (Ru) between the Trim pin and the Vout (-) (or Sense (-)) pin increases the output voltage. The following equations determine the required external resistor value to obtain a percentage output voltage change of Δ%.

Vout = 12 V & 15 V

$$R_U = 20x \frac{\left(1.24 - \frac{0.46 \times 100}{100 + 4.3}\right)}{\Delta\% \times Vo_set} - \frac{4.3 \times 100}{100 + 4.3}\ k\Omega$$

Vout = 24 V

$$R_U = 20x \frac{\left(2.5 - \frac{0.46 \times 100}{100 + 5.6}\right)}{\Delta\% \times Vo_set} - \frac{5.6 \times 100}{100 + 5.6}\ k\Omega$$

Vout = 28 V

$$R_U = 23.7x \frac{\left(2.5 - \frac{0.46 \times 100}{100 + 5.6}\right)}{\Delta\% \times Vo_set} - \frac{5.6 \times 150}{150 + 5.6}\ k\Omega$$

Vout = 48 V

$$R_U = 36x \frac{\left(2.5 - \frac{0.46 \times 200}{200 + 5.1}\right)}{\Delta\% \times Vo_set} - \frac{5.1 \times 200}{200 + 5.1}\ k\Omega$$

$$Vout = Vo_set\ \Delta\% = \left(\frac{Vrequired - Vo_set}{Vo_set}\right) \times 100$$

Output Voltage Adjustment Examples

As an example, to trim-down the output voltage of 24 V module (QS15048WS24) by 5% to 22.8 V, Rd resistor is calculated as follows: Δ%=5%

$$R_D = 20x \frac{(24 - 5\% \times 24 - 2.5)}{5\% \times 24} - 100\ k\Omega$$

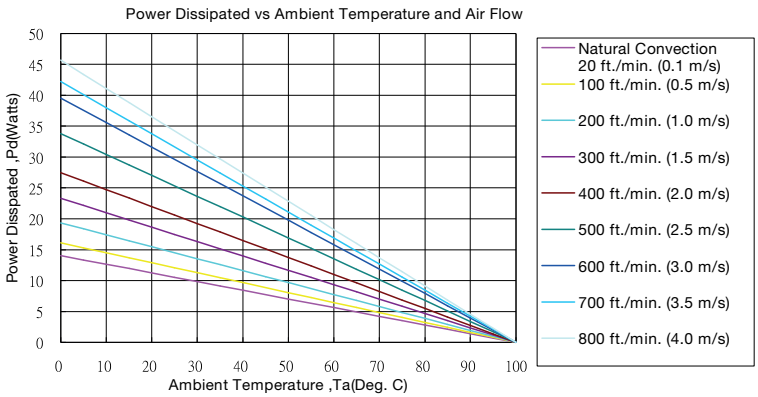
$$R_D = 238.3\ k\Omega$$

And, to trim-up the output voltage of 24 V module (QS15048WS24) by 5% to 25.2 V, Ru resistor is calculated as follows: Δ%=5%

$$R_U = 20x \frac{(2.5 - \frac{0.46 \times 100}{100 + 5.6}}{5\% \times 24} - \frac{5.6 \times 100}{100 + 5.6}\ k\Omega$$

$$R_U = 29.1\ k\Omega$$

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 QS15048WS24 operating at an input voltage of 36 V, an output current of 6.25 A, and a maximum ambient temperature of 30°C:

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

Pd =24 V× 6.25 A×(1-0.895)/0.895=17.6Watts

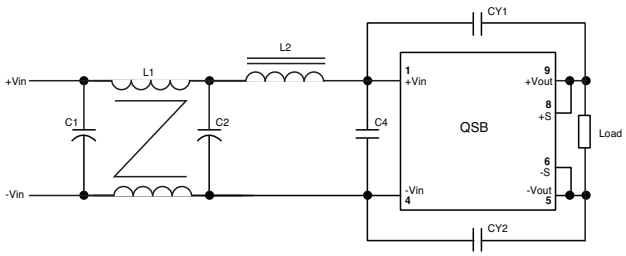
Where Pi = Input power, Po = Output Power and η = Efficiency

Determine airflow from airflow derating graph using data points for Pd=19.5 W and Ta = 30 °C

Minimum airflow= 400 ft./min.

To check that the maximum case temp of 100 °C is not exceeded:
Maximum temperature rise is
ΔT = Pd × Rca=17.6×3.64=64°C.
Maximum case temperature is
Tc=Ta+ΔT=94°C <100°C.
Where: Rca is the thermal resistance from case to ambient environment. Ta is ambient temperature and Tc is case temperature.

Conducted Emissions



Model Number	C1	C2	CY1	CY2	L1	L2
QSB15048WS12	220 µF/100 V	220 µF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS15	220 µF/100 V	220 µF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS24	220 µF/100 V	220 µF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS28	220 µF/100 V	220 µF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS48	220 µF/100 V	220 µF/100 V	1500 pF	1500 pF	0.2 mH	Short

Note: C1, C2 NICHICON PW series aluminum capacitors, CY1, CY2 are ceramic capacitors, L1 Core use SM CM20*12*10 Winding 5 turns (double wire).