

150 Watts

- Wide 8:1 Input Range
- Single Output
- Industry Standard 1/2 Brick
- -40 °C to +100 °C Operation
- 1500 VDC Isolation
- Output Trim $\pm 10\%$
- Remote On/Off
- 3 Year Warranty



Dimensions:

QSB15048W:

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

Models & Ratings

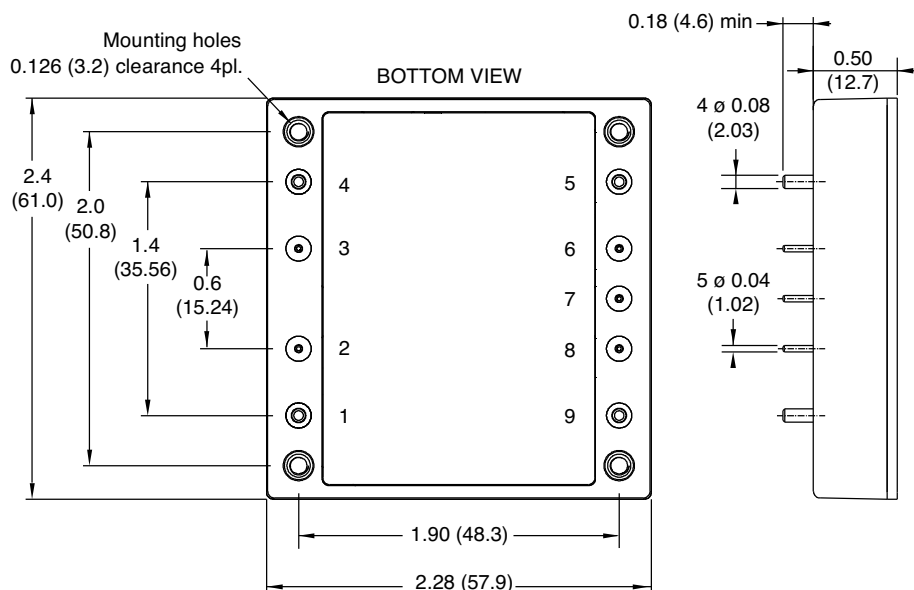
Input Voltage	Output Voltage	Output Current	Input Current ⁽¹⁾		Ripple & noise ⁽²⁾	Efficiency ⁽³⁾	Max. capacitive load	Model Number ⁽⁴⁾
			No Load	Full Load				
9-75 V	12 V	12.50 A	150 mA	4.53 A	120 mV	92.0%	5000 μ F	QSB15048WS12
	15 V	10.00 A	150 mA	4.50 A	120 mV	92.5%	5000 μ F	QSB15048WS15
	24 V	6.25 A	60 mA	4.66 A	280 mV	89.5%	2000 μ F	QSB15048WS24
	28 V	5.35 A	60 mA	4.62 A	280 mV	90.0%	1500 μ F	QSB15048WS28
	48 V	3.13 A	60 mA	4.64 A	480 mV	90.0%	1000 μ F	QSB15048WS48

Notes

1. Maximum output current is 24 A from 9 V to 12 V input
2. Measured at 20 MHz bandwidth and 10 μ F tant/1 μ F ceramic capacitors on output (10 μ F electrolytic/1 μ F ceramic capacitors for 48 V output)

3. Measured at 36 V input and full load
4. Minimum capacitive load of 100 μ F required to maintain regulation

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 ² s	
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			±1.5	%	At full load and 36 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 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	12 & 15 V
		2500			24, 28 & 48 V
Power Density			54	W/in ³	
Mean Time Between Failure		500		kHrs	12 & 15 V MIL-HDBK-217F, +25 °C GB
		800			24, 28 & 47 V MIL-HDBK-217F, +25 °C GB
Weight		0.24 (109.0)		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	
Humidity			95	%RH	Non-condensing
Cooling					Base plate cooled

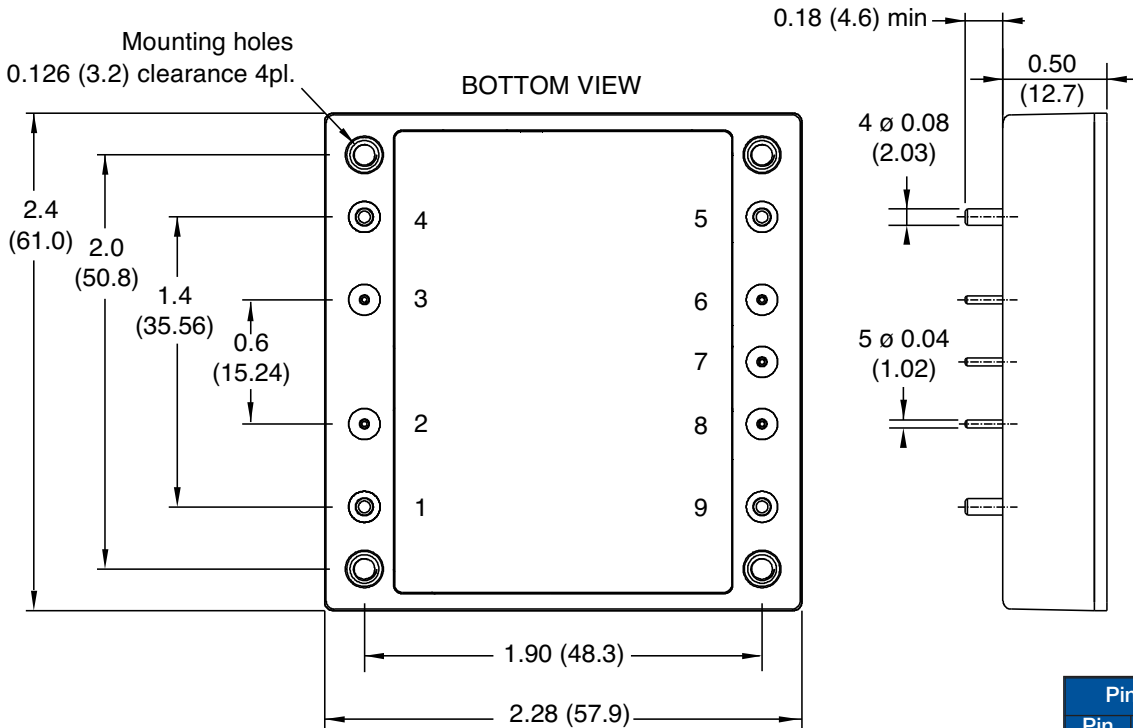
EMC: Emissions

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	

Mechanical Details



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Pin	Single
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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)

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 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 (R_D) 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%.

V_{out} = 12 & 15 V

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

V_{out} = 24 V

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

V_{out} = 28 V

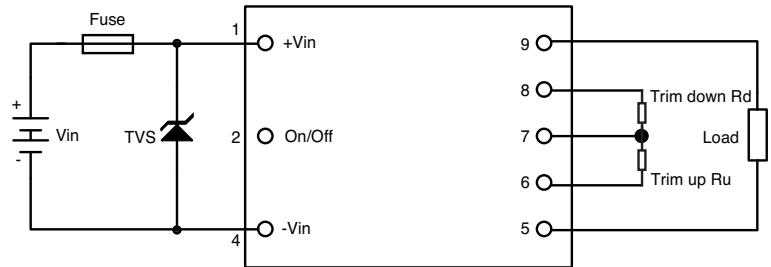
$$R_D = 23.7x \frac{(V_{o_set} - \Delta \% \times V_{o_set} - 2.5)}{\Delta \% \times V_{o_set}} - 150 \text{ k}\Omega$$

V_{out} = 48 V

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

Where

$$V_{out} = V_{o_set} \Delta \% = \left(\frac{V_{set} - V_{required}}{V_{o_set}} \right) \times 100$$



To Trim Up

Connecting an external resistor (R_U) 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%.

V_{out} = 12 V & 15 V

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

V_{out} = 24 V

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

V_{out} = 28 V

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

V_{out} = 48 V

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

$$V_{out} = V_{o_set} \Delta \% = \left(\frac{V_{required} - V_{o_set}}{V_{o_set}} \right) \times 100$$

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: $\Delta\%=5\%$

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

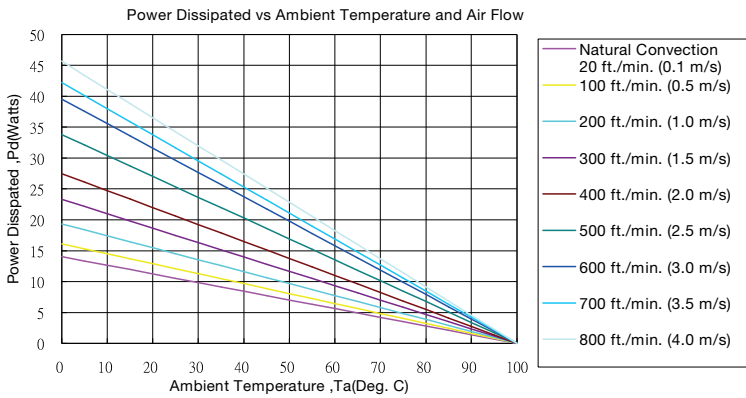
$$R_D = 238.3 \text{ k}\Omega$$

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

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

$$R_U = 29.1 \text{ k}\Omega$$

Thermal Resistance Information



Air Flow Rate	Typical Rca
Natural Convection	7.12 °C/W
20 ft/min (0.1 m/s)	6.21 °C/W
100 ft/min (0.5 m/s)	5.17 °C/W
200 ft/min (1.0 m/s)	4.29 °C/W
300 ft/min (1.5 m/s)	3.64 °C/W
400 ft/min (2.0 m/s)	2.96 °C/W
500 ft/min (2.5 m/s)	2.53 °C/W
600 ft/min (3.0 m/s)	2.37 °C/W
700 ft/min (3.5 m/s)	2.19 °C/W
800 ft/min (4.0 m/s)	

Airflow Derating Graph

Example (Without Heatsink)

To determine the minimum airflow necessary for a QS15048WS24 operating at an input voltage of 36V, an output current of 6.25 A, and a maximum ambient temperature of 30°C:

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

$P_d = 24 \text{ V} \times 6.25 \text{ A} \times (1-0.895)/0.895 = 17.6 \text{ Watts}$

Where P_i = Input power, P_o = Output Power and η = Efficiency

Determine airflow from airflow derating graph using data points for $P_d=19.5 \text{ W}$ and $T_a = 30 \text{ }^\circ\text{C}$

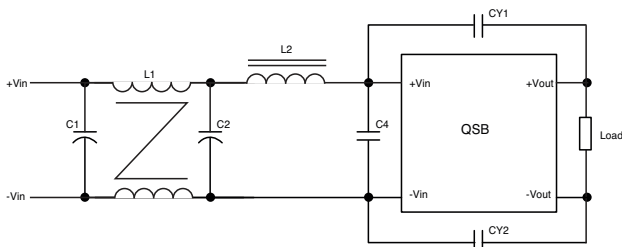
Minimum airflow= 400 ft./min.

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

Maximum temperature rise is
 $\Delta T = P_d \times R_{ca} = 17.6 \times 3.64 = 64 \text{ }^\circ\text{C}$.
 Maximum case temperature is
 $T_c = T_a + \Delta T = 94 \text{ }^\circ\text{C} < 100 \text{ }^\circ\text{C}$.

Where: R_{ca} is the thermal resistance from case to ambient environment. T_a is ambient temperature and T_c is case temperature.

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).