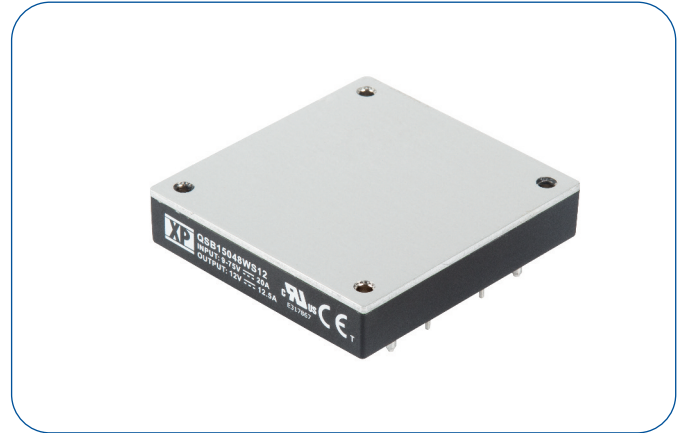


### 150 Watts

- 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

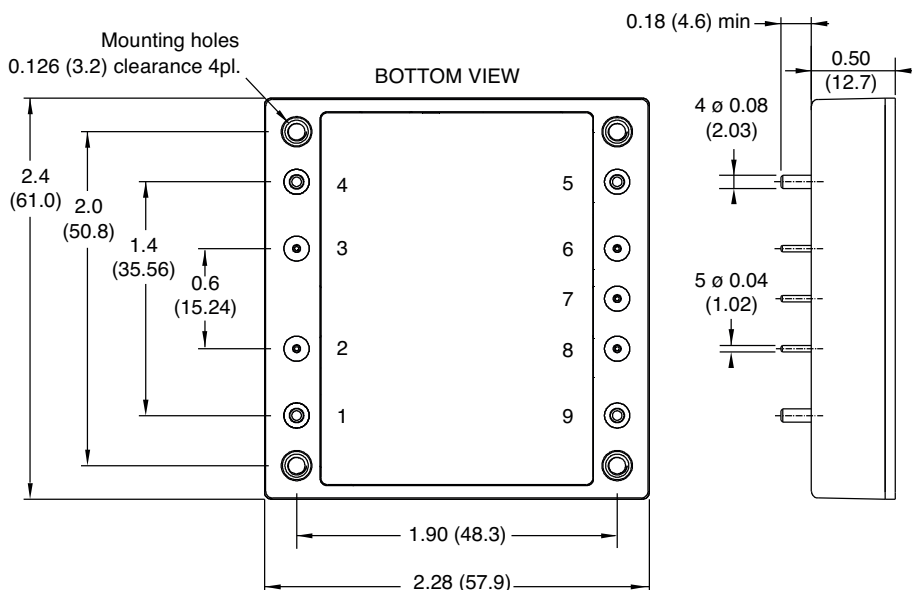
Input Voltage	Output Voltage	Output Current	Input Current <sup>(1)</sup>		Ripple & noise <sup>(2)</sup>	Efficiency <sup>(3)</sup>	Max. capacitive load	Model Number
			No Load	Full Load				
9-75 V	12 V	12.50 A	150 mA	4.53 A	120 mV	92.0%	5000 $\mu$ F	QSB15048WS12
	15 V	10.00 A	150 mA	4.50 A	120 mV	92.5%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

### Notes

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

3. Measured at 36 V input and full load
4. Minimum capacitive load of 100  $\mu$ 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 =  $\pm 0.02$  (x.x =  $\pm 0.5$ )  
x.xxx =  $\pm 0.01$  (x.xx =  $\pm 0.25$ )

### 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 <sup>2</sup> 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 <sup>9</sup>			Ω	
Isolation Capacitance		3500		pF	12 & 15 V
		2500			24, 28 & 48 V
Power Density			54	W/in <sup>3</sup>	
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

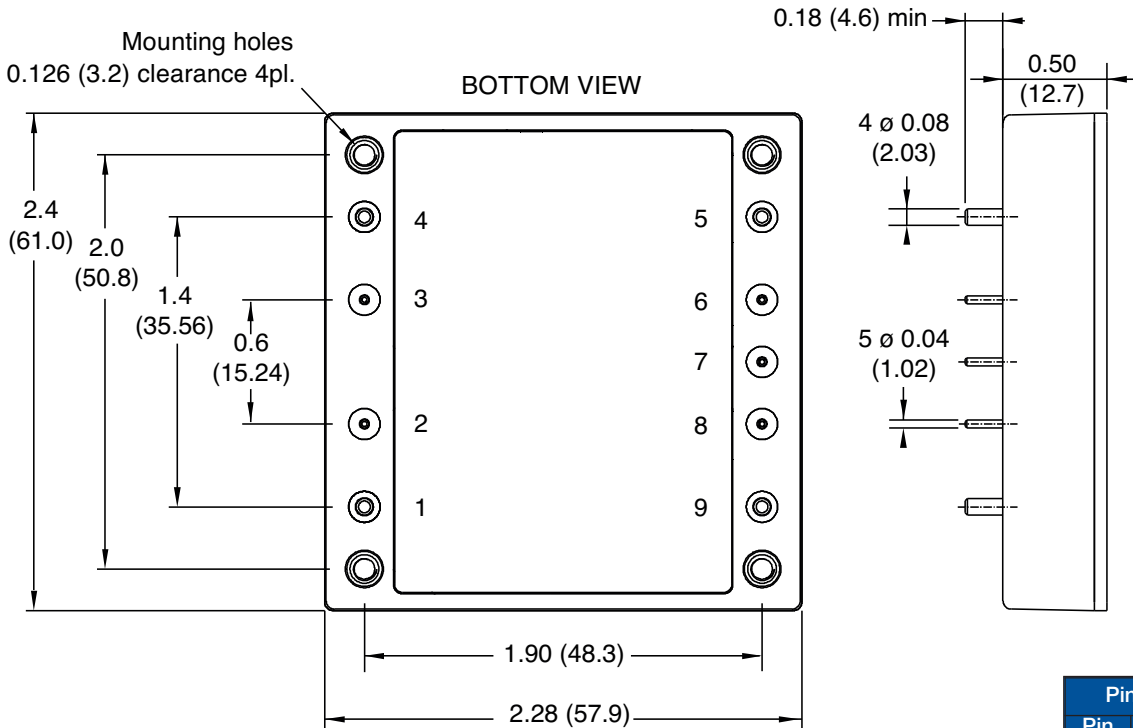
### EMC: Emissions

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



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

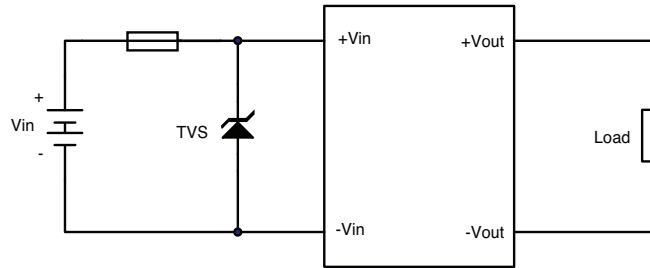
- All dimensions are in inches (mm)
- Weight: 0.24 lbs (109 g) approx.

- Tolerance: x.xx = ±0.02 (x.x = ±0.5)  
x.xxx = ±0.01 (x.xx = ±0.25)

### Application Notes

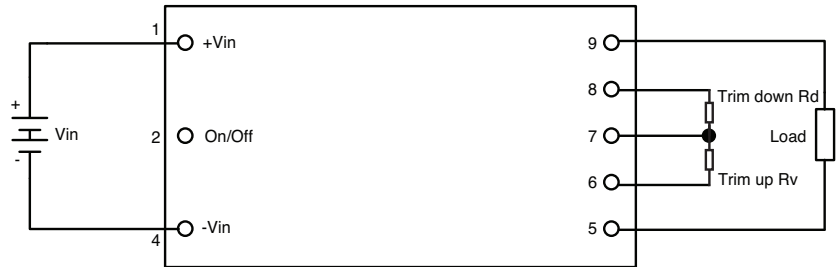
#### Input Fusing and Safety Considerations

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  $\Delta\%$ .

$$V_{out} = 12, 15\text{ V}$$

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

$$V_{out} = 24\text{ V}$$

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

$$V_{out} = 28\text{ V}$$

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

$$V_{out} = 48\text{ V}$$

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

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  $\Delta\%$ .

$$V_{out} = 12\text{ V}$$

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

$$V_{out} = 24\text{ V}$$

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

$$V_{out} = 28\text{ V}$$

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

$$V_{out} = 48\text{ V}$$

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

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

### 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:  $\Delta\%=5\%$

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

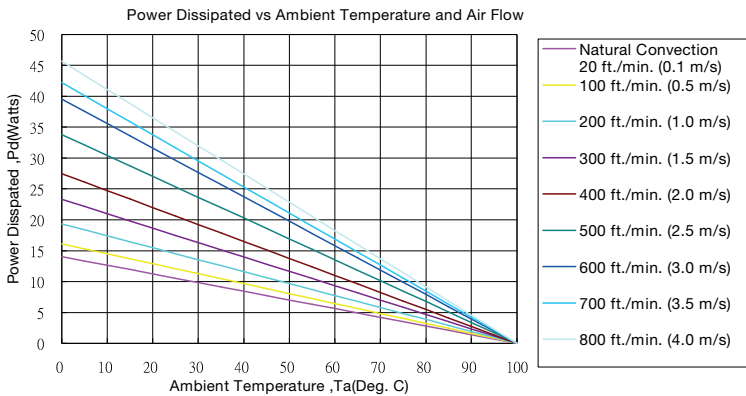
$$R_D = 238.3 \text{ k}\Omega$$

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

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

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

### Thermal Resistance Information



Air Flow Rate	Typical Rca
Natural Convection 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 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  $\eta$  = 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:

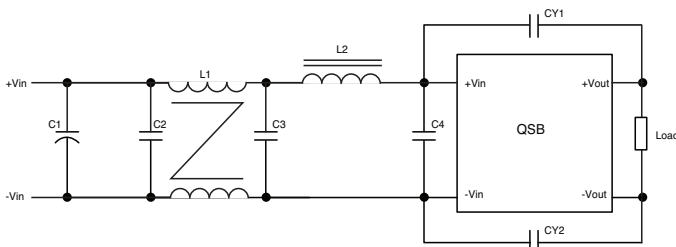
Maximum temperature rise is  $\Delta T = P_d \times R_{ca} = 17.6 \times 3.64 = 64 \text{ }^\circ\text{C}$ .

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	C3	CY1	CY2	L1	L2
QSB15048WS12	N/C	220 μF/100 V	220 μF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS15	N/C	220 μF/100 V	220 μF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS24	N/C	220 μF/100 V	220 μF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS28	N/C	220 μF/100 V	220 μF/100 V	1500 pF	1500 pF	0.2 mH	Short
QSB15048WS48	N/C	220 μF/100 V	220 μF/100 V	1500 pF	1500 pF	0.2 mH	Short

Note: C2, C3 NICHICON PW series aluminum capacitors, CY1, CY2 is ceramic capacitors, L1 Core use SM CM20\*12\*10 Winding 5 turns (double wire).