

## QSB Series



- Wide Input Range
- Industry Standard Packages
- -40 °C to +100 °C Operating Temperature
- High Power Density
- Base Plate Cooled
- Remote On/Off & Remote Sense
- 3 Year Warranty

## Specification

### Input

Input Voltage Range	• See tables
Input Current	• See tables
Input Reverse Voltage Protection	• None
Input Filter	• Pi network
Undervoltage Lockout	• QSB75-150: 24 Vin - turn on 8.8 V, turn off 8.0 V for 9-36 V, QSB200: 24 Vin - turn on 9.6 V, turn off 8.8 V, QSB75-200: 48 Vin - turn on 17.0 V, turn off 16.0 V, QSB350: 24 Vin - turn on 17.0 V, turn off 16.0 V, QSB350: 48 Vin - turn on 35.0 V, turn off 33.0 V
Input Surge	• 24 Vin: 50 VDC for 100 ms 48 Vin: 100 VDC for 100 ms

### Output

Output Voltage Trim	• $\pm 10\%$ , see application notes
Initial Set Accuracy	• $\pm 1.5\%$ max
Line Regulation	• $\pm 0.2\%$ max measured from high line to low line
Load Regulation	• $\pm 0.2\%$ max measured from 0-100% load
Transient Response	• 5% max deviation, recovery to within 1% in 500 $\mu$ s, 25% step load change
Ripple & Noise	• 3.3 & 5 V models: 100 mV pk-pk 12 & 15 V models: 150 mV pk-pk 24 V & 28 V models: 280 mV max pk-pk 20 MHz bandwidth (see note 1)
Overvoltage Protection	• 115-140%
Short Circuit Protection	• Continuous
Thermal Shutdown	• Baseplate temperature $> 100^\circ\text{C}$ , Restart $< 70^\circ\text{C}$
Temperature Coefficient	• $\pm 0.03\%/^\circ\text{C}$
Current Limit	• 110-140% nominal output for 75 & 150 W 110-160% nominal output for 100 W 110-150% nominal output for 200 W 105-140% nominal output for 350 W
Remote On/Off	• See notes 2 & 3
Remote Sense	• Compensates up to 10% of Vout nominal, total of output trim and remote sense

### General

Efficiency	• See tables
Isolation Voltage	• 1500 VDC Input to Output 1500 VDC Input to Case 1500 VDC Output to Case
Isolation Resistance	• $10^7 \Omega$
Isolation Capacitance	• QSB75-200: 100 pF typical, QSB350: 1000 pF typical
Switching Frequency	• QSB75: 300 kHz typical QSB100, 150 & 200: 250 kHz typical QSB350 (3V3 & 5 V): 300 kHz typical QSB350 (12, 24 & 28 V): 330 kHz typical
Power Density	• QSB75: 45.4 W/in <sup>3</sup> , QSB100: 60.5 W/in <sup>3</sup> , QSB150: 57.2 W/in <sup>3</sup> , QSB200: 70.3 W/in <sup>3</sup> , QSB350: 123.0 W/in <sup>3</sup>
MTBF	• QSB75 & 100: 730 kHrs QSB150 & 200: 1 MHrs QSB350: 658 kHrs typical to MIL-HDBK-217F at 25 °C, GB

### Environmental

Operating Base Plate Temperature	• -40 °C to +100 °C, see derating curves
Storage Temperature	• -55 °C to +105 °C
Operating Humidity	• Up to 90% non-condensing
Cooling	• Base plate cooled, see derating curves

### EMC & Safety

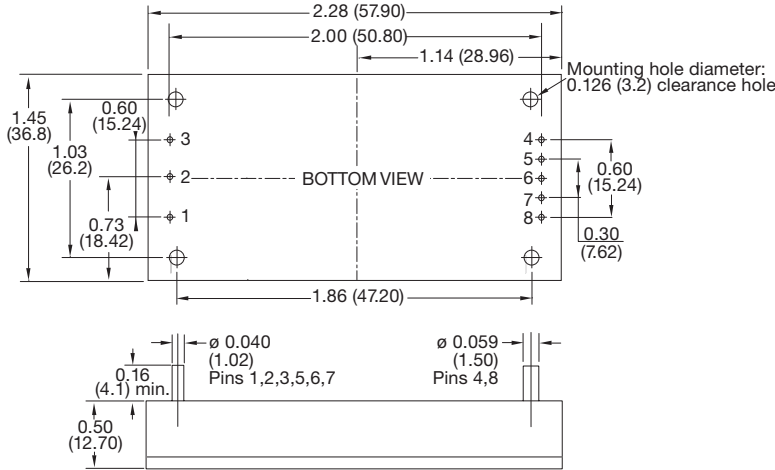
Emissions	• EN55022, level A conducted with external components, see test reports for further details
ESD Immunity	• EN61000-4-2, level 2, Perf Criteria B
Radiated Immunity	• EN61000-4-3, 3 V/m, Perf Criteria A
EFT/Burst	• EN61000-4-4, level 1, Perf Criteria A
Surge	• EN61000-4-5, level 1, Perf Criteria A
Conducted Immunity	• EN61000-4-6, 3 V rms Perf Criteria A
Safety Approvals	• UL60950-1, Evaluated to EN62368-1, CE & UKCA meets all applicable directives & legislation

Input Voltage	Output Voltage	Output Current	Input Current <sup>(4)</sup>		Efficiency	Model Number <sup>(3)</sup>
			No Load	Full Load		
9-36 VDC (24 V nominal)	3.3 V	12.00 A	50 mA	2.04 A	81.0%	QSB7524S3V3
	5.0 V	12.00 A	50 mA	2.98 A	84.0%	QSB7524S05
	12.0 V	6.25 A	50 mA	3.64 A	86.0%	QSB7524S12
	15.0 V	5.00 A	50 mA	3.64 A	86.0%	QSB7524S15
	24.0 V	3.12 A	50 mA	3.63 A	86.0%	QSB7524S24
18-75 VDC (48 V nominal)	3.3 V	12.00 A	30 mA	1.10 A	82.0%	QSB7548S3V3
	5.0 V	12.00 A	30 mA	1.47 A	85.0%	QSB7548S05
	12.0 V	6.25 A	30 mA	1.82 A	86.0%	QSB7548S12
	15.0 V	5.00 A	30 mA	1.80 A	87.0%	QSB7548S15
	24.0 V	3.12 A	30 mA	1.80 A	87.0%	QSB7548S24
9-36 VDC (24 V nominal)	3.3 V	30.00 A	120 mA	4.80 A	86.0%	QSB10024S3V3
	5.0 V	20.00 A	120 mA	4.82 A	86.5%	QSB10024S05
	12.0 V	8.30 A	80 mA	4.80 A	86.5%	QSB10024S12
	15.0 V	6.70 A	80 mA	4.84 A	86.5%	QSB10024S15
	24.0 V	4.17 A	80 mA	4.79 A	87.0%	QSB10024S24
18-75 VDC (48 V nominal)	3.3 V	30.00 A	60 mA	2.37 A	88.0%	QSB10048S3V3
	5.0 V	20.00 A	60 mA	2.37 A	88.0%	QSB10048S05
	12.0 V	8.30 A	30 mA	2.36 A	88.0%	QSB10048S12
	15.0 V	6.70 A	30 mA	2.38 A	88.0%	QSB10048S15
	24.0 V	4.17 A	30 mA	2.37 A	88.0%	QSB10048S24

**Notes**

- Ripple & noise is measured with a 10 μF tantalum capacitor and 1.0 μF ceramic capacitor across output.
- Logic compatibility: Ref to -ve input. Module On = open circuit. Module Off = <0.8 VDC.
- Add suffix 'N' to the model number to receive the unit with negative logic Remote On/Off.
- Input current specified at 24 V for 9-36 VDC and 48 V for 18-75 VDC models.

**Mechanical Details**



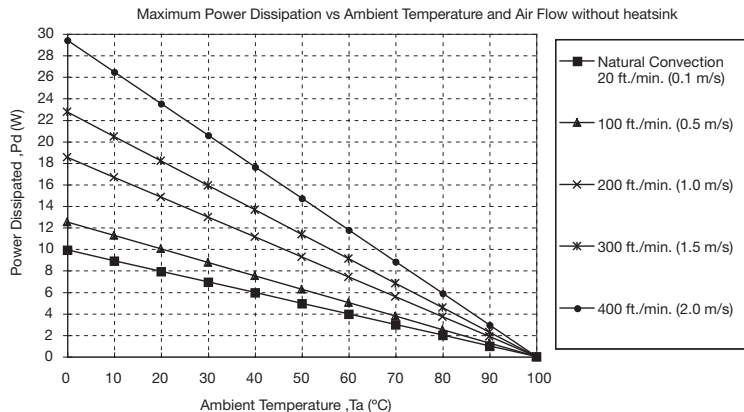
PIN CONNECTIONS	
Pin	Function
1	+Vin
2	Remote On/Off
3	-Vin
4	-Vout
5	-Sense
6	Trim
7	+Sense
8	+Vout

**Notes**

- Dimensions are in inches (mm)
- Tolerances: X.XX = ±0.02 (X.X = ±0.5)  
X.XXX = ±0.01 (X.XX = ±0.25)
- Weight: 0.15 lbs (66 g) approx

**Thermal Resistance Information**

**Derating Curve**



Air Flow Rate	Typical R <sub>ca</sub>
Natural Convection 20 ft. / min (0.1 ms)	10.1 °C/W
100 ft./min (0.5 ms)	8.0 °C/W
200 ft./min (1.0 ms)	5.4 °C/W
300 ft./min (1.5 ms)	4.4 °C/W
400 ft./min (2.0 ms)	3.4 °C/W

R<sub>ca</sub> = Thermal resistance case to ambient

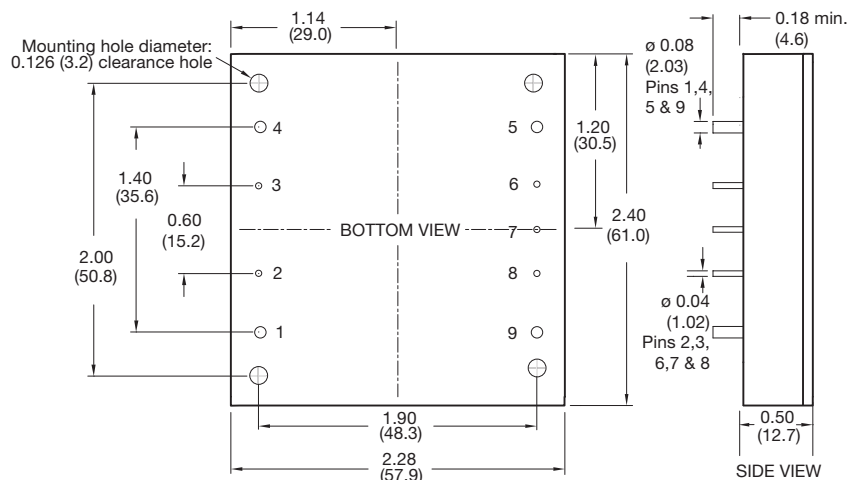
## Models & Ratings

Input Voltage	Output Voltage	Output Current	Input Current <sup>(4)</sup>		Efficiency	Model Number <sup>(3)</sup>
			No Load	Full Load		
9-36 VDC (24 V nominal)	3.3 V	30.00 A	200 mA	4.75 A	87.0%	QSB15024S3V3
	5.0 V	30.00 A	200 mA	7.19 A	87.0%	QSB15024S05
	12.0 V	12.50 A	100 mA	7.10 A	88.0%	QSB15024S12
	15.0 V	10.00 A	100 mA	7.19 A	87.0%	QSB15024S15
	24.0 V	6.50 A	100 mA	7.34 A	88.0%	QSB15024S24
18-75 VDC (48 V nominal)	3.3 V	30.00 A	100 mA	2.34 A	88.0%	QSB15048S3V3
	5.0 V	30.00 A	100 mA	3.47 A	90.0%	QSB15048S05
	12.0 V	12.50 A	50 mA	3.44 A	91.0%	QSB15048S12
	15.0 V	10.00 A	50 mA	3.47 A	90.0%	QSB15048S15
	24.0 V	6.50 A	50 mA	3.61 A	90.0%	QSB15048S24
10-36 VDC (24 V nominal)	3.3 V	50.00 A	150 mA	7.90 A	87.0%	QSB20024S3V3
	5.0 V	40.00 A	150 mA	9.58 A	87.0%	QSB20024S05
	12.0 V	16.70 A	100 mA	9.71 A	86.0%	QSB20024S12
	15.0 V	13.30 A	100 mA	9.67 A	86.0%	QSB20024S15
	24.0 V	8.30 A	100 mA	9.54 A	87.0%	QSB20024S24
	48.0 V	4.20 A	60 mA	9.77 A	86.0%	QSB20024S48
18-75 VDC (48 V nominal)	3.3 V	40.00 A	80 mA	3.13 A	88.0%	QSB20048S3V3
	5.0 V	40.00 A	80 mA	4.69 A	89.0%	QSB20048S05
	12.0 V	16.70 A	60 mA	4.74 A	88.0%	QSB20048S12
	15.0 V	13.30 A	60 mA	4.72 A	88.0%	QSB20048S15
	24.0 V	8.30 A	60 mA	7.72 A	88.0%	QSB20048S24
	48.0 V	4.20 A	50 mA	4.83 A	87.0%	QSB20048S48
18-36 VDC (24 V nominal)	3.3 V	70.0 A	130 mA	10.94 A	88.0 %	QSB35024S3V3
	5.0 V	70.0 A	250 mA	16.29 A	89.5 %	QSB35024S05
	12.0 V	29.2 A	220 mA	15.96 A	91.5%	QSB35024S12
	24.0 V	14.6 A	40 mA	16.22 A	90.0%	QSB35024S24
	28.0 V	12.5 A	50 mA	16.03 A	91.0%	QSB35024S28 <sup>(6)</sup>
	48.0 V	7.3 A	60 mA	16.22 A	90.0%	QSB35024S48 <sup>(6)</sup>
36-75 VDC (48 V nominal)	3.3 V	70.0 A	80 mA	5.41 A	89.0%	QSB35048S3V3
	5.0 V	70.0 A	120 mA	8.01 A	91.0%	QSB35048S05
	12.0 V	29.2 A	100 mA	7.89 A	92.5%	QSB35048S12
	24.0 V	14.6 A	40 mA	7.98 A	91.5%	QSB35048S24
	28.0 V	12.5 A	30 mA	7.88 A	92.5%	QSB35048S28 <sup>(6)</sup>
	48.0 V	7.3 A	60 mA	7.93 A	92.0%	QSB35048S48 <sup>(6)</sup>

### Notes

- Ripple & noise is measured with a 10  $\mu$ F tantalum capacitor and 1.0  $\mu$ F ceramic capacitor across output.
- Logic compatibility: Ref to -ve input. Module On = open circuit. Module Off = <0.8 VDC.
- Add suffix 'N' to the model number to receive the unit with negative logic Remote On/Off.
- Input current specified at 24 V for 10-36 VDC models and 48 V for 18-75 VDC models.
- Add an external capacitor of 100  $\mu$ F minimum to the output terminals, in order to maintain the specified regulation.

### Mechanical Details



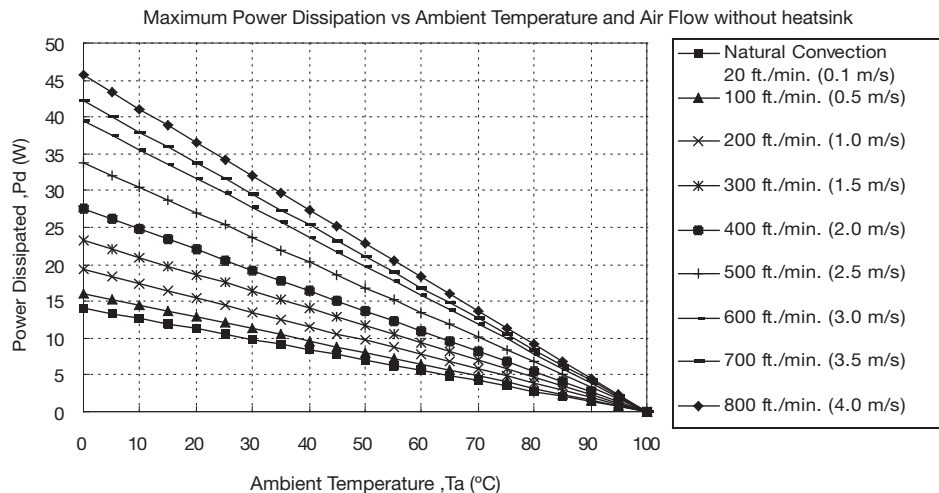
PIN CONNECTIONS	
Pin	Function
1	+Vin
2	Remote On/Off
3	Case
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

### Notes

- Dimensions are in inches (mm)
- Tolerances: X.XX =  $\pm 0.02$  (X.X =  $\pm 0.5$ )  
X.XXX =  $\pm 0.01$  (X.XX =  $\pm 0.25$ )
- Weight: 0.25 lbs (114 g) approx

## Thermal Resistance Information

### Derating Curve



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

R<sub>ca</sub> = Thermal resistance case to ambient

## Application Notes

### Output Voltage Trim - QSB75 & QSB150 Series

#### Voltage trim up

Connect trim resistor R<sub>trim</sub> between Trim pin and -Sense pin.

$$R \text{ trim up} = \left( \frac{R1 \left( V_r - V_f \left( \frac{R2}{R2 + R3} \right) \right)}{V_{des} - V_{nom}} \right) - \frac{R2 \times R3}{R2 + R3} \text{ (k}\Omega\text{)}$$

#### Voltage trim down

Connect trim resistor R<sub>trim</sub> between Trim pin and +Sense pin

$$R \text{ trim down} = \frac{R1 \times (V_{des} - V_r)}{V_{nom} - V_{des}} - R2 \text{ (k}\Omega\text{)}$$

**Where:** R trim up/down is the external resistor in kΩ. V<sub>nom</sub> is the nominal output voltage. V<sub>des</sub> is the desired output voltage. R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> and V<sub>r</sub> are internal to the unit and are defined in the table below.

Output Voltage (V)	R1 (kΩ)	R2 (kΩ)	R3 (kΩ)	V <sub>r</sub> (V)	V <sub>f</sub> (V)
3.3V	3.00	12.0	4.3	1.24	0.46
5.0V	2.32	3.3	0.0	2.5	0.0
12.0V	9.10	51.0	5.1	2.5	0.46
15.0V	12.0	56.0	8.25	2.5	0.46
24.0V	20.0	100.0	7.5	2.5	0.46

### Output Voltage Trim - QSB100, QSB200 & QSB350 Series

**Voltage trim down** - Connect trim resistor R<sub>trim</sub> between Trim pin and -Sense pin

$$R \text{ trim down} = \left( \frac{511}{\Delta\%} - 10.22 \right) \text{ k}\Omega$$

For V<sub>o</sub>: 48 V

$$R \text{ trim down} = \left( \frac{200}{\Delta\%} - 40 \right) \text{ k}\Omega$$

Where:  $\Delta\% = \left( \frac{V_{nom} - V_{des}}{V_{nom}} \right) \times 100$

**Voltage trim up** - Voltage trim up, Connect trim resistor R<sub>trim</sub> between Trim pin and +Sense pin.

$$R \text{ trim up} = \left( \frac{5.11 V_{nom} (100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{511}{\Delta\%} - 10.22 \right) \text{ k}\Omega$$

For V<sub>o</sub>: 48 V

$$R \text{ trim up} = \left( \frac{20 V_{nom} (100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{2000}{\Delta\%} - 40 \right) \text{ k}\Omega$$

Where:  $\Delta\% = \left( \frac{V_{des} - V_{nom}}{V_{nom}} \right) \times 100$

Value	QSB100/200	QSB350
k	1.225	1.24