300 Watts
QSB Series



- Wide Input Range
- 350 W Peak Power
- High Efficiency
- High Power Density
- Baseplate–cooled
- Remote On/Off & Remote Sense
- 3 Year Warranty

Specification

Input

Input Voltage Range	• 24 V (9-36 V), 48 V (18-75 V), (see note 3)
Input Current	• See table
Input Reverse Voltage Protection	• None
Input Filter	• Pi network
Input Surge	• 24 V: 50 VDC for 100 ms 48 V: 100 VDC for 100 ms
Undervoltage Lockout	• 24 V: On ≥8.8 V, Off ≤8.0 V 48 V: On ≥17.0 V, Off ≤16.0 V

Output

Output Voltage Trim	• ±10%, see application notes
Initial Set Accuracy	• ±1.5% max at full load
Line Regulation	• ±0.2% max measured from high line to low line
Load Regulation	• ±0.2% max measured from 0-100% load
Start Up Time	• 120 ms typical
Transient Response	• 5% max deviation, recovery to within 1% in 500 µs, 25% step load change
Ripple & Noise	• 3.3 & 5 V models: 100 mV pk-pk 12 & 15 V models: 150 mV pk-pk 24 & 28 V models: 280 mV pk-pk 20 MHz bandwidth (see note 1)
Overvoltage Protection	• 115-140%
Short Circuit Protection	• Continuous
Thermal Shutdown	• Case temperature >105 °C
Temperature Coefficient	• ±0.03%/°C
Current Limit	• 115-140% nominal output
Remote On/Off	• See note 2. Output is off if Pin 2 is low (<1.8 V) WRT -VIN, Pin 4.
Remote Sense	• Compensates up to 10% of Vout nominal, total of output trim and remote sense

General

Efficiency	• See table
Isolation Voltage	• 1500 VDC Input to Output 1500 VDC Input to Case 1500 VDC Output to Case
Isolation Resistance	• $10^7\Omega$
Isolation Capacitance	• 2000 pF typical
Switching Frequency	• 220 kHz typical
Power Density	• 109 W/in^3
MTBF	• 300 kHrs typical to MIL-HDBK-217F at 25 °C, GB

Environmental

Operating Base Plate Temperature	• -40 °C to +100 °C, see derating curve
Storage Temperature	• -55 °C to +105 °C
Operating Humidity	• Up to 90% non-condensing
Cooling	• Baseplate-cooled, see derating curve
Shock	• 30 g pk, halfsink wave for 18 ms 3 pulses per face, all 6 faces tested
Vibration	• 5-500 Hz st 3 g, 10 mins per axis

EMC & Safety

Emissions	• EN55022, level A conducted, with external components. See application note.
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

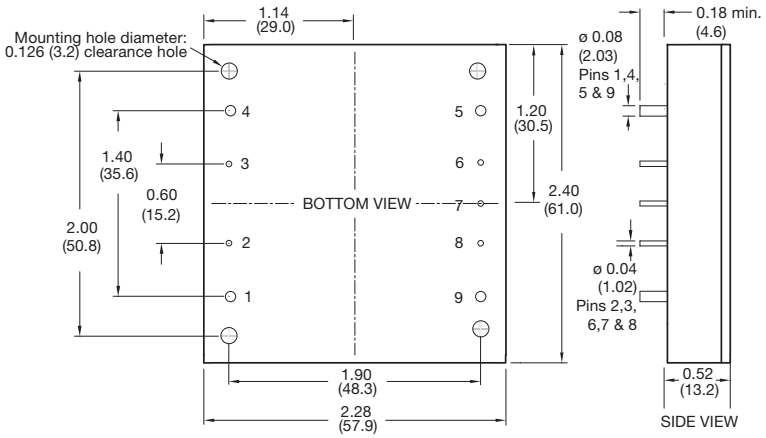
Models & Ratings

Input Voltage	Output Voltage	Output Current		Input Current		Efficiency[4]	Max. Capacitive Load	Model Number[2]
		Nom.	Peak[5]	No Load	Full Load			
9-36 V	5.0 V	60.0 A	70.00 A	200 mA	14.21 A	88.0%	10000 µF	QSB30024S05
	12.0 V	25.0 A	29.16 A	200 mA	13.89 A	90.0%	10000 µF	QSB30024S12
	24.0 V	12.5 A	14.58 A	100 mA	14.21 A	88.0%	4700 µF	QSB30024S24
	28.0 V	10.7 A	12.50 A	100 mA	14.11 A	98.0%	4700 µF	QSB30024S28
	48.0 V	6.25 A	7.29 A	100 mA	14.37 A	87.0%	2200 µF	QSB30024S48[6]
18-75 V	5.0 V	60.0 A	70.00 A	100 mA	6.94 A	90.0%	10000 µF	QSB30048S05
	12.0 V	25.0 A	29.16 A	100 mA	6.94 A	90.0%	10000 µF	QSB30048S12
	24.0 V	12.5 A	14.58 A	80 mA	6.98 A	89.0%	4700 µF	QSB30048S24
	28.0 V	10.7 A	12.50 A	80 mA	6.94 A	90.0%	4700 µF	QSB30048S28
	48.0 V	6.25 A	7.29 A	80 mA	7.02 A	89.0%	2200 µF	QSB30048S48[6]

Notes

1. *Output Ripple and Noise measured with 10 µF tantalum and 1 µF ceramic capacitor across output.*
2. *Add suffix 'N' to the model number to receive the unit with negative logic Remote On/Off.*
3. *Minimum of 220 µF required on input.*
4. *Measured at nominal input voltage.*
5. *Peak Current is for max duration of 3s with 10% duty cycle. Average output power not to exceed 300W.*
6. *48 V output models require minimum 220 µF capacitor across output rails to maintain regulation.*

Mechanical Details



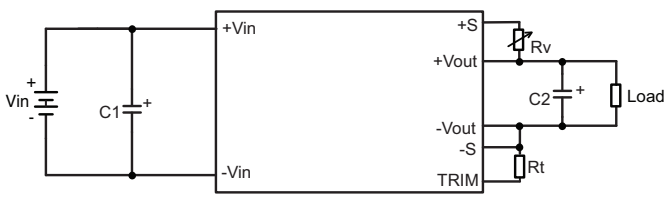
PIN CONNECTIONS	
Pin	Function
1	+Vin
2	Remote On/Off
3	Case
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

Notes

1. All dimensions are in inches (mm)
2. Weight: 0.57 lbs (260 g) approx
3. Tolerances: X.XX = ±0.02 (X.X = ±0.5)
   X.XXX = ±0.01 (X.XX = ±0.25)

Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up or down according to the trim range specification (90% to 110% of nominal output). This is accomplished by connecting an external resistor between the +Vout and +Sense pin for trim up and between the TRIM and -Sense pin for trim down, see figure:



The Trim pin should be left open if trimming is not being used. The output voltage can be determined by the following equations:

$$Vf = \frac{1.24 \times \left(\frac{Rt \times 33}{Rt + 33} \right)}{7.68 + \frac{Rt \times 33}{Rt + 33}}$$

Recommended Value of Rt is 6.8kΩ, therefore Vf = 0.525

$$Vout = (Vnom + Rv) \times Vf$$

$$Rv = \frac{Vout}{Vf} - Vnom$$

Examples:

1. To trim 12 V unit up by 10%

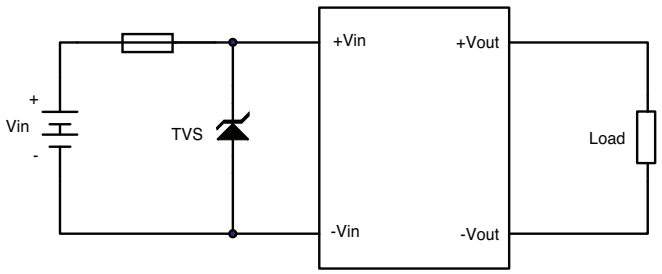
$$Rv = \frac{13.2}{0.525} - 12 = 13.145k\Omega$$

2. To trim 24 V unit down by 10%

$$Rv = \frac{19.2}{0.525} - 24 = 17.14k\Omega$$

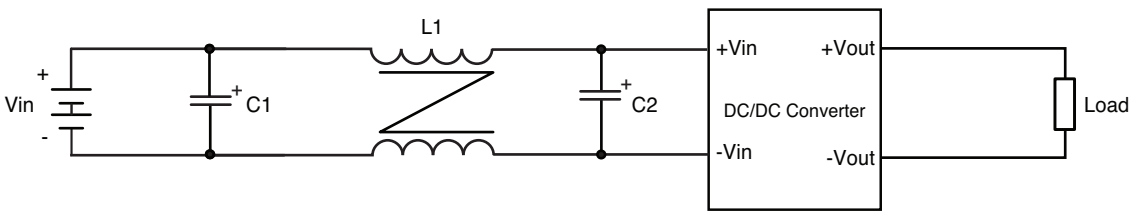
Input Fusing and Safety Considerations

The QSB300 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 60 A time delay fuse for 24 Vin models and 30A for 48Vin models. It is recommended that the circuit have a transient voltage suppressor diode ((TVS), Type SMCJ78A 1500 W or above) across the input terminal to protect the unit against surge or spike voltage and input reverse voltage (as shown).



EMC Considerations

Suggested Circuits for Conducted EMI Class A



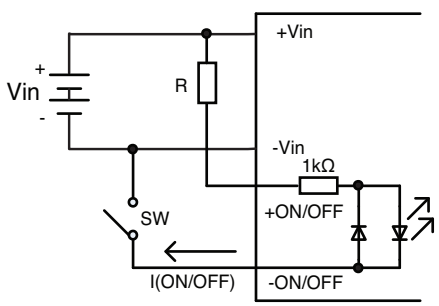
C1	C2	L1
220uF/100V	220uF/100V	1.5mH, Core: SM CM20 x 12 x 10

Remote ON/OFF Control

The converter's output ON/OFF function can be controlled via Pin 2, Remote ON/OFF

Output voltage turns off when current flows through ON/OFF pins by opening or closing the switch. The maximum current through the ON/OFF pin is 10mA, and is determined by current limit resistor R.

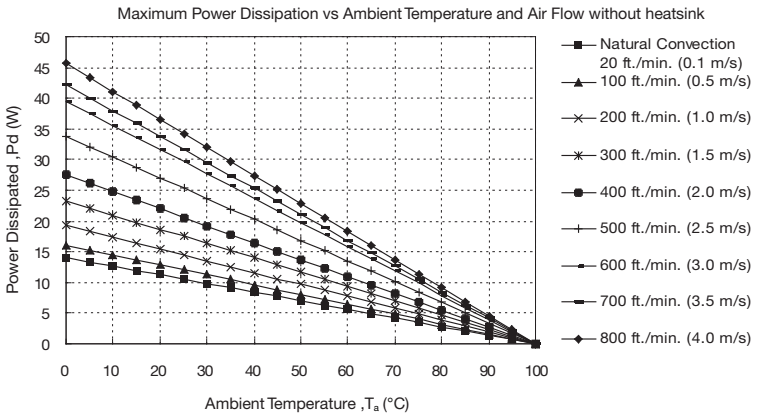
Recommended value for R is 15k (0.25W) for 24 Vin and 30k (0.5W) for 48Vin



Application Notes

Thermal Resistance Information

Derating Curve



Air Flow Rate	Typical R_{ca}
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_{ca} = Thermal resistance from case to ambient

Example

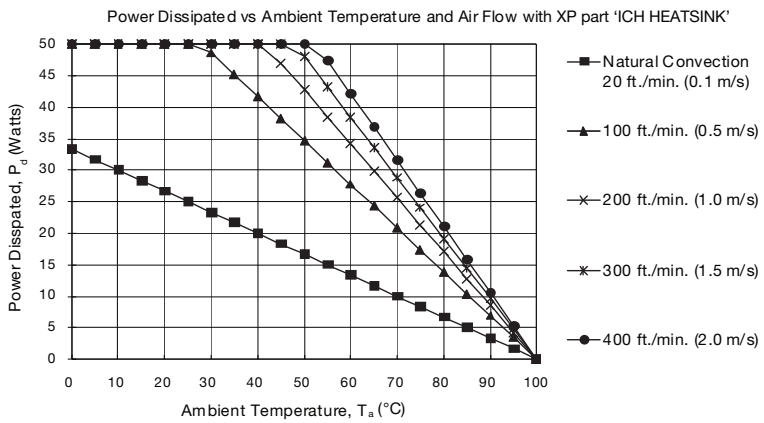
Airflow required for QSB30048S05 at 45A output current and 35°C ambient

1.Calculate power dissipated
= [Power in – Power out] = [(5V*45A)/90% efficiency – 5V*45A] = 25 W

2.Use de-rating curve to establish airflow
Using 25 W dissipated power and 35 °C ambient, airflow is 600 ft/min (3.0 m/s)

3.Use table to establish typical thermal resistance Rca
Airflow of 600ft/min gives typical Rca of 2.53 °C/W

4.Check that airflow is adequate to limit case temperature to 100 °C maximum
Case temperature = Temperature rise + Ambient temperature
Temperature rise = Power dissipated * Typical thermal resistance Rca
= 25 W* 2.53 °C/W = 63.25 °C
Case temperature = 63.25 °C + 35 °C = 98.25 °C i.e. <100 °C



Air Flow Rate	Typical R_{ca}
Natural Convection 20 ft. / min (0.1 ms)	3.00 °C/W
100 ft./min (0.5 ms)	1.44 °C/W
200 ft./min (1.0 ms)	1.17 °C/W
300 ft./min (1.5 ms)	1.04 °C/W
400 ft./min (2.0 ms)	0.95 °C/W

Example

Airflow required for QSB30048S12 at 20A output current and 65 °C ambient

1.Calculate power dissipated
= [Power in – Power out] = [(12V*20A)/90% efficiency – 12V*20A]
= 26.27 W

2.Use de-rating curve to establish airflow
Using 26.27 W dissipated power and 65 °C ambient, airflow is 200 ft/min (1.0 m/s)

3.Use table to establish typical thermal resistance Rca
Airflow if 200 ft/min gives typical Rca of 1.17 °C/W

4.Check that airflow is adequate to limit case temperature to 100 °C maximum
Case temperature = Temperature rise + Ambient temperature
Temperature rise = Power dissipated * Typical thermal resistance Rca
= 26.67 W* 1.17 °C/W = 31.2 °C
Case temperature = 31.2 °C + 65 °C = 96.2 °C i.e. <100 °C