

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 | • $\pm 10\%$, see application notes |
| Initial Set Accuracy | • $\pm 1.5\%$ max at full load |
| Line Regulation | • $\pm 0.2\%$ max measured from high line to low line |
| Load Regulation | • $\pm 0.2\%$ max measured from 0-100% load |
| Start Up Time | • 120 ms typical |
| Transient Response | • 5% max deviation, recovery to within 1% in 500 μ 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 & 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 | • $\pm 0.03\%/^{\circ}\text{C}$ |
| 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, halfsine 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 |

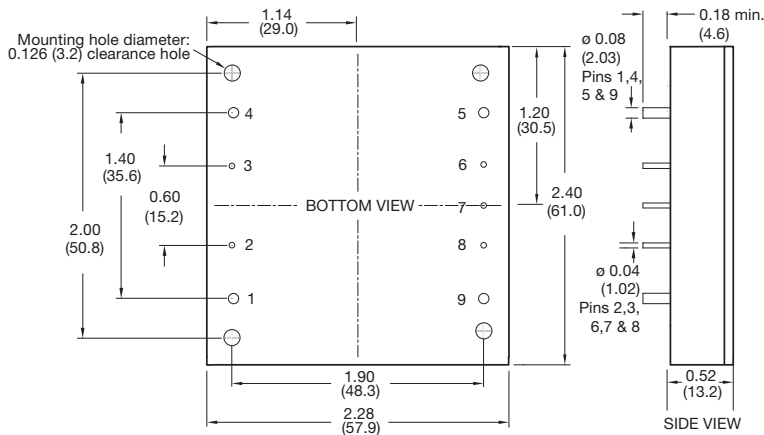
Models & Ratings

| 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 | 88.0% | 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



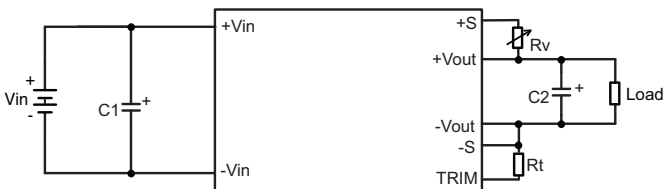
| PIN CONNECTIONS | |
|-----------------|---------------|
| Pin | Function |
| 1 | +Vin |
| 2 | Remote On/Off |
| 3 | Case |
| 4 | -Vin |
| 5 | -Vout |
| 6 | -Sense |
| 7 | Trim |
| 8 | +Sense |
| 9 | +Vout |

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:

$$V_f = \frac{1.24 \times \left(\frac{R_t \times 33}{R_t + 33} \right)}{7.68 + \frac{R_t \times 33}{R_t + 33}}$$

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

$$V_{out} = (V_{nom} + R_v) \times V_f$$

$$R_v = \frac{V_{out}}{V_f} - V_{nom}$$

Examples:

1. To trim 12 V unit up by 10%

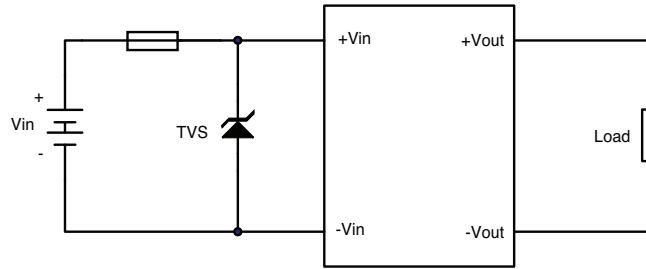
$$R_v = \frac{13.2}{0.525} - 12 = 13.145k\Omega$$

2. To trim 24 V unit down by 10%

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

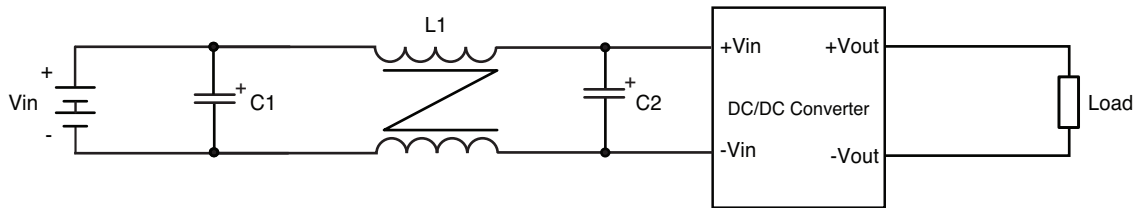
Input Fusing and Safety Considerations

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



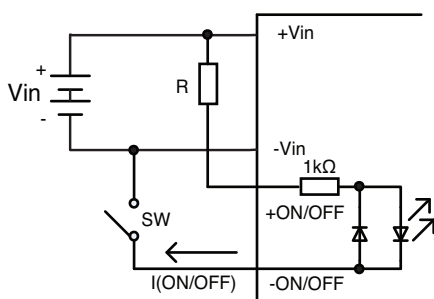
| C1 | C2 | L1 |
|------------|------------|--------------------------------|
| 220uF/100V | 220uF/100V | 1.5mH, Core: SM CM20 x 12 x 10 |

Remote ON/OFF Control

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

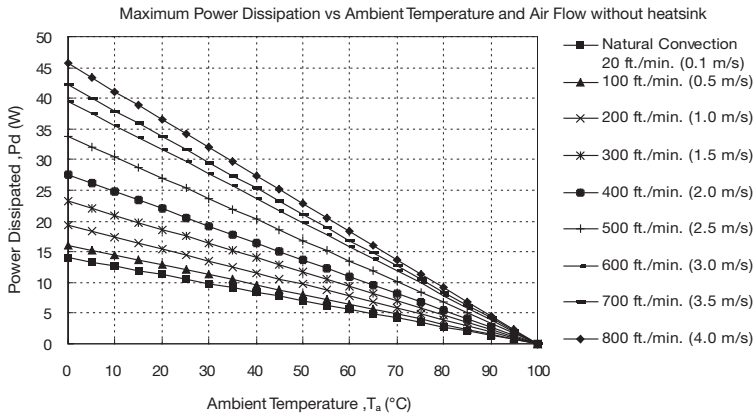
Output voltage turns off when current flows through ON/OFF pins by opening or closing the switch. The maximum current through the ON/OFF pin is 10mA, and is determined by current limit resistor R.

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



Thermal Resistance Information

Derating Curve



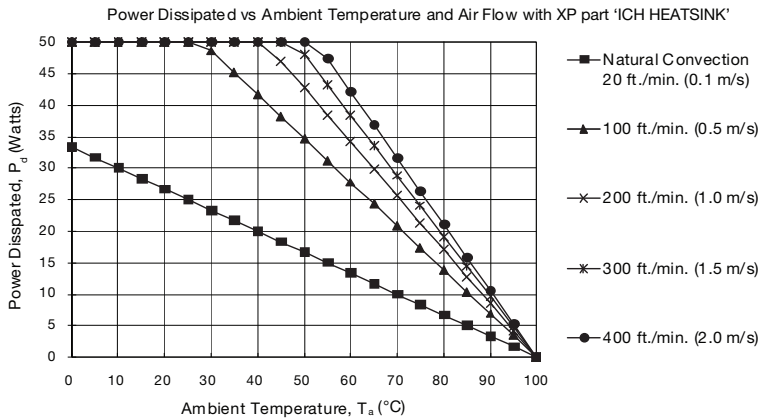
| Air Flow Rate | Typical Rca |
|---|-------------|
| Natural Convection 20 ft. / min (0.1 ms) | 7.12 °C/W |
| 100 ft./min (0.5 ms) | 6.21 °C/W |
| 200 ft./min (1.0 ms) | 5.17 °C/W |
| 300 ft./min (1.5 ms) | 4.29 °C/W |
| 400 ft./min (2.0 ms) | 3.64 °C/W |
| 500 ft./min (2.5 ms) | 2.96 °C/W |
| 600 ft./min (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 |

Rca = 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 Rca |
|---|-------------|
| 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