

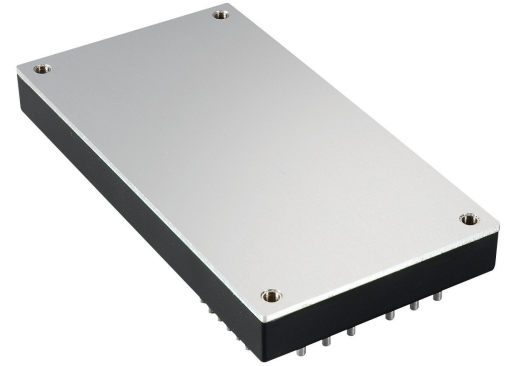
400W Baseplate cooled

DC-DC converters

The QSB400 series offers a compact 400W DC-DC converter solution in an industry standard full brick package, with integral baseplate for conduction cooling. Available in two input ranges, covering 9V to 36VDC & 18V to 75VDC.

Standard features are: output voltage trim, remote sense, remote On/Off, a wide operating temperature range and includes protection for over current, over temperature and over voltage.

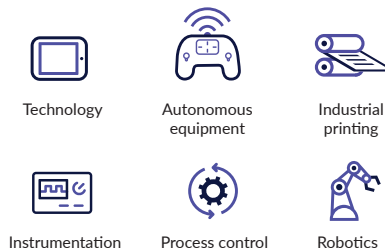
The QSB400 is highly suited to telecommunications, distributed power architectures, battery operated equipment, industrial electronics, mobile equipment and many other applications.



Features

- ▶ Regulated single outputs 5V to 48VDC
- ▶ 4:1 input ranges 9V to 36VDC & 18V to 75VDC
- ▶ Baseplate cooled full brick package
- ▶ 1.5kVDC isolation
- ▶ Output trim $\pm 10\%$
- ▶ Remote sense
- ▶ Remote On/Off
- ▶ -40°C to $+100^{\circ}\text{C}$ operating temperature
- ▶ 3 year warranty

Applications



Dimensions

116.8 x 61.0 x 12.7 mm (4.6" x 2.5" x 0.5")
Full brick package

Models & ratings

Model number ⁽¹⁾	Input voltage	Output voltage ⁽²⁾	Output current	Input current		Efficiency	Max. capacitive load
				No load	Full load		
QSB40024S05	9-36VDC	5.0VDC	80.0A	600mA	19.05A	87.5%	10000 μ F
QSB40024S12		12.0VDC	33.3A	120mA	19.36A	86.0%	10000 μ F
QSB40024S24		24.0VDC	16.6A	120mA	19.19A	87.0%	4700 μ F
QSB40024S28		28.0VDC	14.3A	120mA	19.19A	87.0%	4700 μ F
QSB40024S48		48.0VDC	8.30A	120mA	19.19A	86.5%	2200 μ F
QSB40048S05	18-75VDC	5.0VDC	80.0A	300mA	9.36A	89.0%	10000 μ F
QSB40048S12		12.0VDC	33.3A	60mA	9.41A	88.5%	10000 μ F
QSB40048S24		24.0VDC	16.6A	60mA	9.28A	90.0%	4700 μ F
QSB40048S28		28.0VDC	14.3A	60mA	9.27A	90.0%	4700 μ F
QSB40048S48		48.0VDC	8.30A	60mA	9.27A	89.5%	2200 μ F

Notes:

1. Add suffix 'P' to the model number to receive the unit with positive logic. Module on: $<1\text{mA}$ or open circuit, module off: 1-10mA
2. Minimum of 330 μ F capacitance required on output to maintain regulation. Except S05 models which require 680 μ F

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Input voltage range	9		36	VDC	24VDC
	18		75		48VDC
Input current	See models and ratings table				
Idle current		50		mA	
Input reverse voltage protection	None				
Input filter	Pi network				
Undervoltage lockout	On: 8.5		Off: 7.5	VDC	24Vin
	On: 17.0		Off: 15.5		48Vin
Overvoltage lockout	On: 40.0		Off: 42.0	VDC	24Vin
	On: 80.0		Off: 83.0		48Vin

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Output voltage trim	-20		+10	%	Of nominal output, see application notes
Initial set accuracy			±1.5	%	
Minimum load	No minimum load				
Start up time		120		ms	
Line regulation			±0.2	%	Measured from high line to low line
Load regulation			±0.5	%	Measured from 0-100% load
Transient response			±5	%	Deviation, recovery to within 1% in 500 μs, 25% step load change
Ripple and noise		100		mV pk-pk	5V models
		1		% pk-pk	Other models, 1% pk-pk 20MHz bandwidth, measured with 10μF tantalum and 1μF ceramic capacitor across output.
Overvoltage protection	115		140	%	
Overload protection	110		150	%	Nominal output
Short circuit protection	Continuous, constant current				
Thermal shutdown		110		°C	Case temperature
Temperature coefficient		±0.03		%/°C	

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Efficiency	86		90	%	See models & ratings table
Isolation: input to output			1500	VDC	
Isolation: input to case			1500	VDC	
Isolation: output to case			1500	VDC	
Isolation resistance		10		Ω	
Isolation capacitance		4000		pF	
Switching frequency		230		kHz	
Power density		4.8 (79)		W/cm ² (W/in ²)	
Mean time between failure		340		khrs	MIL-HDBK-217F, +25°C GB
Case Material	Plastic (DAP) UL94V-0 with aluminium base plate				
Potting Material	Epoxy UL94V-0				
Pin Material	Copper with nickel and matte tin plating				
Solder Profile	Peak temperature 260°C, above 250°C for 3-6 s. With iron 450°C for < 5s				
Weight		220 (0.485)		g (lb)	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Operating base plate temperature	-40		+100	°C	
Storage temperature	-55		+105	°C	
Shock		75		g/pk	Sawtooth wave for 10ms, 3 pulses per face, all 6 faces tested on all 3 axes
Operating humidity			95	%RH	Non-condensing
Cooling	Baseplate cooled				

Signals and controls

Phenomenon	Standard	Test level	Notes & conditions
Remote on/off	Reference to -ve input, Module on: 1-10mA, Module off: <1mA or open circuit		
Remote sense	Compensates up to 10% of Vout nominal, total of output trim and remote sense		
DC OK	DC OK open collector signal, open collector signal is pulled low when DC is OK, floating when DC is NOT OK with regards to Sense pin. Maximum current is 20mA		
Current Share	Parallel up to 4 modules using the parallel pin \pm 10% load share accuracy from 50% to 100% load.		
Auxilliary Output	10V \pm 3V/20mA max, auxilliary return is -Sense pin		

Safety approvals

Safety agency	Standard	Test level	Notes & conditions
UL	cUL62368-1		
EN	EN62368-1		
CE	Meets all applicable directives		
UKCA	Meets all applicable legislation		

EMC: emissions

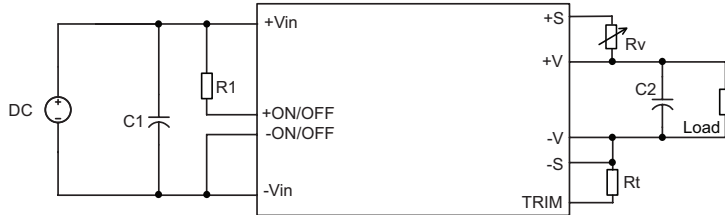
Phenomenon	Standard	Test level	Notes & conditions
Conducted	EN55032	A	With external components, see application notes

Application notes

Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up or down according to the trim range specification (80% 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:

Note: Both Rv and Rt must be fitted.



C1 = 1000 μ F / 50V for Vin = 24V, 330 μ F / 100V for Vin = 48V
For C2 see note 2 or max capacitive load in Models and Ratings table.
Low ESR electrolytic capacitors are recommended.

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 6.8k Ω therefore Vf = 0.525

Recommended Value of Rt is 6.8k Ω , therefore Vf = 0.525

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

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

Examples

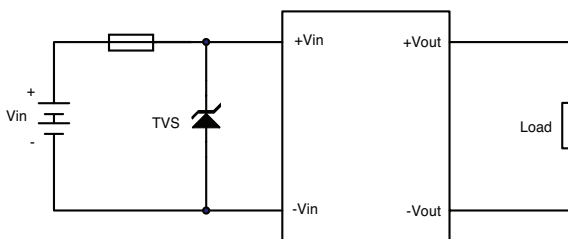
1. To trim 12 V unit up by 10%

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

2. To trim 24 V unit down by 20%

$$R_v = \frac{19.2}{0.525} - 24 = 12.57k\Omega$$

Input Fusing and Safety Considerations

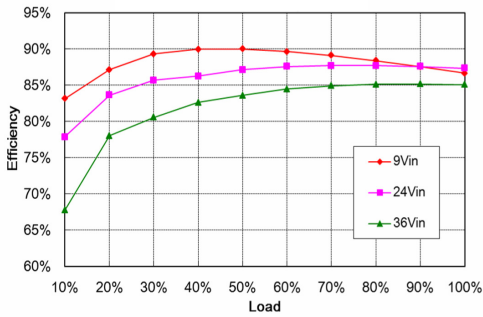


The QSB400 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 60A time delay fuse for 24Vin models, and 30A for 48Vin models. It is recommended that the circuit have a transient voltage suppressor diode TVS (24 Vin SMCJ40A; 48 Vin, SMCJ78A) across the input terminal to protect the unit against surge or spike voltage and input reverse voltage (as shown).

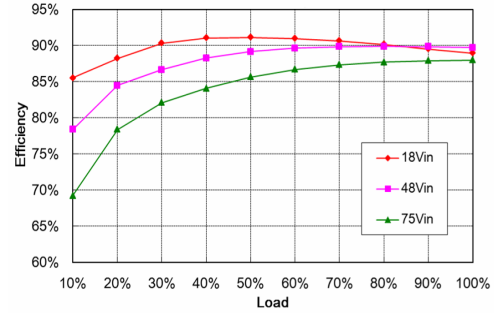
Application notes

Efficiency vs load

QSB40024S28



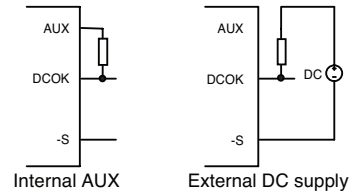
QSB40048S28



DC OK signal

Normal and abnormal operation of the converter can be monitored by using the DC OK signal. The signal is located at the secondary side and is an open collector referenced to the -Sense pin. The internal aux power supply or an external DC supply can be used as a pull up voltage. Max current is 20mA.

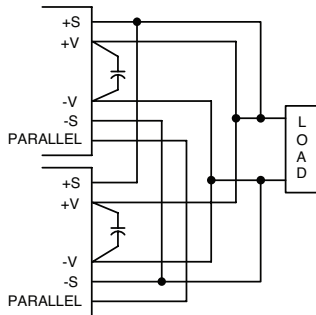
This signal is LOW when the converter is operating normally and HIGH when the converter is disabled or when the converter is operating abnormally.



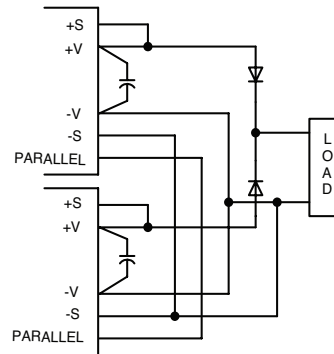
Parallel operation

The QSB400 series are designed for parallel operation. When paralleled, the load current can be equally shared between the modules by connecting the Parallel pins together. The 5V output models cannot be paralleled. There are two different parallel operations for QSB400 series, one is parallel operation when load can't be supplied by only one power unit; the other is for N+1 redundant operation.

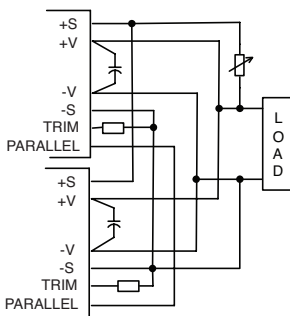
Parallel operation



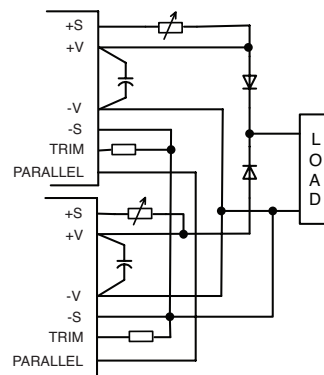
N+1 redundant connection



Parallel operation with adjustable output



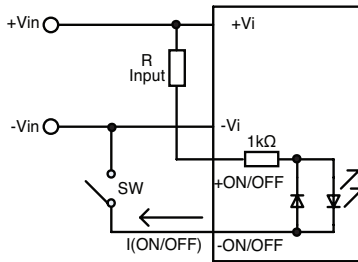
N+1 redundant connection adjustable output voltage



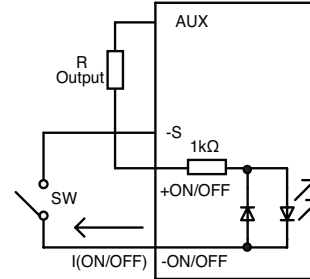
Application notes

Remote On/Off

The converter's output ON/OFF function can be controlled from the input side or the output side. Output voltage turns on when current flows through the ON/OFF pins by closing the switch. The maximum current through the ON/OFF pin is 10mA, and is determined by current limit resistor R.

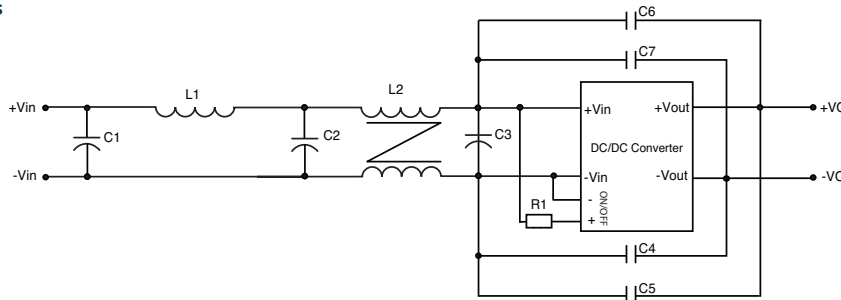


Turning output ON and OFF from the input side, recommended R value is 12k (1.0W) for 48V_{in} and 6K (0.5W) for 24V_{in}.



Turning output ON and OFF from the output side, recommended R value is 4.3k (0.1W).

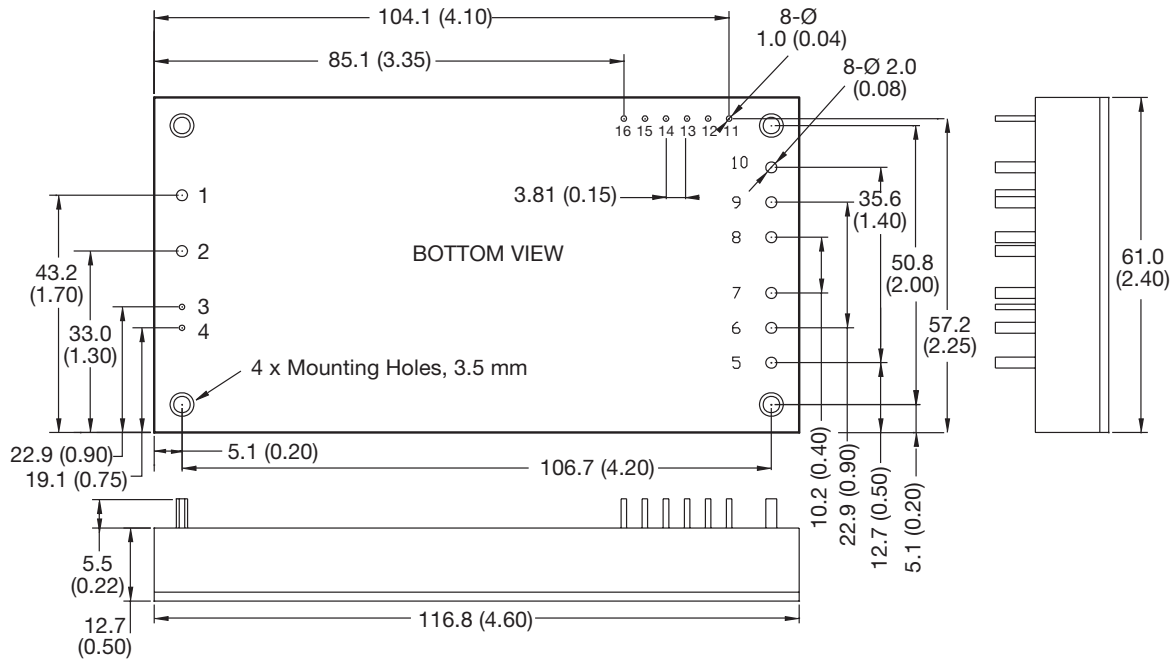
EMC considerations



Model	C1	C2	C3	C4	C5	C6	C7	L1	L2	R1
QSB40024Sxx	NC	470μF/50V	1000μF/50V	2200pF/2kV	NC	NC	NC	Short	200μH, RM8 SM100	9.1k
QSB40048Sxx	330μF/100V	330μF/100V	330μF/100V	NC	NC	NC	NC	1μH SPI-13050-1R0	1.5mH, CM20*12*10	9.1k

470μF/50V, 1000μF/50V NIPPON CHEMI-CON KY series aluminum capacitors, 330uF/100V NIPPON, CHEMI-CON KMF series aluminum capacitors and C4 ceramic capacitors.

Mechanical details



Pin connections	
Pin	Function
1	-Vin
2	+Vin
3	-On/Off
4	+On/Off
5-7	+Vout
8-10	-Vout
11	-Sense
12	+Sense
13	Trim
14	Parallel
15	DC OK
16	Aux

Notes:

- All dimensions are in mm (inches)
- Weight: 220g (0.49lbs) approx
- Tolerances: x.xx (x.x) = ± 0.5 (± 0.02), x.xxx (x.xx) = ± 0.25 (± 0.01)
- Small or large pin diameter: ± 0.1 (± 0.004)
- Small pin pitch: 3.81 (0.15)

Specifications subject to change without notice.