BCQ1300-48S12B-4L

1300 W Quarter Brick Converter



PRODUCT DESCRIPTION

Advanced Energy's BCQ1300-48S12B-4L is a single output DC-DC converter with standard quarter-brick outline and pin configuration. It delivers up to 90 A output current with 9.6 V to 14.5 V output voltage. Ultra-high 97.7% efficiency and excellent thermal performance makes it an ideal choice for use in datacom and telecommunication applications and can work under -40^{O}C to +85^{O}C with air cooling.

AT A GLANCE

Total Power

1300 W

Input Voltage

40 to 60 VDC

# of Outputs

Single

RoHS

SPECIAL FEATURES

- Delivering up to 90A output
- Ultra-high efficiency 97.7% typ. at 50% load
- Startup Pre-bias:0%Vout to 8V
- Input range: 40V to 60V
- Excellent thermal performance
- No minimum load requirement
- RoHS 6 compliant
- Remote control function
- Input under voltage lockout
- Input over voltage lockout
- Parallel current sharing
- Output over current protection
- Over temperature protection
- Industry standard quarter-brick pin-out outline
- Baseplated
- Pin length option: 4.6mm

SAFETY

- IEC/EN/UL/CSA 60950 2nd
- 2006/95/EEC CE Mark
- GB4943
- UL/TUV
- UL94,V-0
- FCC/EN55022 Class A

TYPICAL APPLICATIONS

- Telecom
- Datacom

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Model Numbers

Standard	Output Voltage	Structure	Remote ON/OFF logic	ROHS
BCQ1300-48S12B-4L	9.6 to 14.5 VDC	Baseplated	Negative	R6

Order Information

BCQ1300	-	48	S	12	P	B	-	4	L
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	BCQ: High efficiency quarter brick series, 1300: output power 1300W
②	Input voltage	48: 40V to 60V input range, rated input voltage: 53V
③	Output number	S: single output
④	Rated output voltage	12: 12V output
⑤	Remote ON/OFF logic	Default: negative logic; P: positive logic
⑥	Baseplate	B: with baseplate; default: open frame
⑦	Pin length	4: 4.6mm ± 0.25mm pin length
⑧	RoHS status	Y: Rohs, R5; L: RoHS, R6

Options

None

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage Operating -Continuous Non-operating -100mS	All modules	$V_{IN,DC}$	- -	- -	60 75	VDC VDC
Maximum Output Power[1]	All modules	$P_{O,max}$	-	-	1300	W
Isolation Voltage[2] Input to outputs	All modules		-	-	1500	VDC
Ambient Operating Temperature	All modules	T_A	-40	-	+85	^{O}C
Storage Temperature	All modules	T_{STG}	-55	-	+125	^{O}C
Voltage at remote ON/OFF pin	All modules		-0.3	-	15	VDC
Humidity (non-condensing) Operating	All modules		-	-	95	%

Note 1 - Maximum power delivery happens at maximum input voltage. The maximum output power tends to decline when input voltage drops. The Maximum power at minimum input voltage is 864W

Note 2 - 1mA for 60s,slew rate of 1500V/10S

Electrical Specifications

Input Specifications

Table 2. Input Specifications

Parameter		Conditions[1]	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC		All	$V_{IN,DC}$	40	53	60	VDC
Input under-voltage lockout	Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	35.5	38	40	VDC
	Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	34.5	36	39	VDC
	Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1	-	3	VDC
Input over voltage lockout	Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	60	62	65	VDC
	Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	61	64	66	VDC
	Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1	-	3	VDC
Maximum Input Current ($I_O = I_{O,max}$)			$I_{IN,max}$	-	-	25	A
No Load Input Current		$V_{IN,DC}$ = 53Vdc	I_{IN}	-	150	-	mA
Standby Input Current		Remote Off	I_{IN}	-	2	-	mA
Recommended Input Fuse		Fast blow external fuse recommended		-	-	30	A
Recommended External Input Capacitance		Low ESR capacitor recommended	C_{IN}	470	-	-	uF
Input Ripple Current		Through 12uH inductor		-	70	-	mA
Input Filter Component Value(C\L)		Internal values		-	28.2\0.15	-	µF\µH
Operating Efficiency		T_A=25 °C Vin=53Vdc Airflow = 1000LFM $I_O = I_{O,max}$ $I_O = 70\%I_{O,max}$	η	- -	97.6 97.7	- -	% %

Note 1 - T_A= 25 °C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.

Electrical Specifications

Output Specifications

Table 3. Output Specifications

Parameter		Conditions[1]	Symbol	Min	Typ	Max	Unit
Factory Set Voltage		$V_{IN,DC}$ = 53Vdc $I_O=I_{O,min}$	V_O	13.00	13.13	13.26	VDC
Output Voltage Line Regulation		All	$\pm V_O$	-	-	-	mV
Output Voltage Load Regulation		All	$\pm V_O$	-	-	400	mV
Output Voltage Temperature Regulation		All	$\%V_O$	-	-	0.02	%/°C
Output Ripple, pk-pk		20MHz bandwidth	V_O	-	180	-	mV_{PK-PK}
Output Current		All	I_O	0	-	90	A
Output DC current-limit inception[2]			I_O	95	-	140	A
V_O Load Capacitance		All	C_O	470	-	6000	uF
V_O Dynamic Response	Peak Deviation	25%~50%, 50%~75% $I_{O,max}$ slew rate = 0.1A/us	$\pm V_O$ T_s	- -	200 400	- -	mV uSec
	Settling Time	25%~50%, 50%~75% $I_{O,max}$ slew rate = 1A/us	$\pm V_O$ T_s	- -	200 400	- -	mV uSec
Turn-on transient	Rise time	$I_O=I_{O,max}$	T_{rise}	-	20	50	mS
	Turn-on delay time	$I_O=I_{O,max}$	$T_{turn-on}$	-	20	50	mS
	Turn-On overshoot	I_O = 0		-	-	5	%Vo
Remote ON/OFF control (negative logic)	Off-state voltage			2.4		15	VDC
	On-state voltage			-0.3		0.8	VDC
Pre-bias			V_O	0	-	8	V
Output over-temperature protection[3]		All	T	100	-	130	°C
Over-temperature hysteresis		All	T	-	-	-	°C

Note 1 - T_A = 25 °C, airflow rate = 400 LFM, Vin = 53Vdc, nominal Vout unless otherwise noted.
Note 2 - Hiccup: auto-restart when over-current condition is removed.
Note 3 - Auto recovery; over-temperature protect(OTP) test point, See Figure 11 P1 test point.

Electrical Specifications

BCQ1300-48S12B-4L Performance Curves

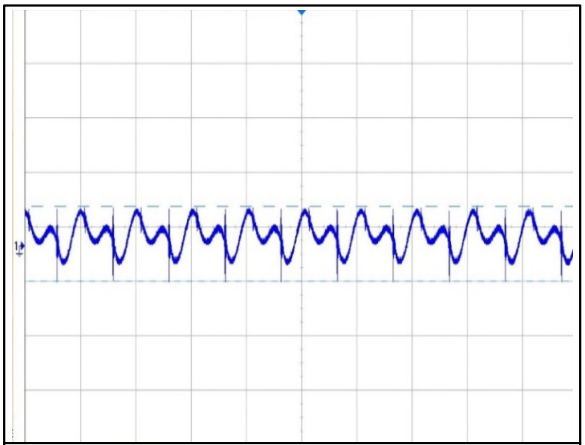


Figure 1: BCQ1300-48S12B-4L Input reflected ripple current wavefom
Ch 1: Vin (10us/div, 50mA/div)

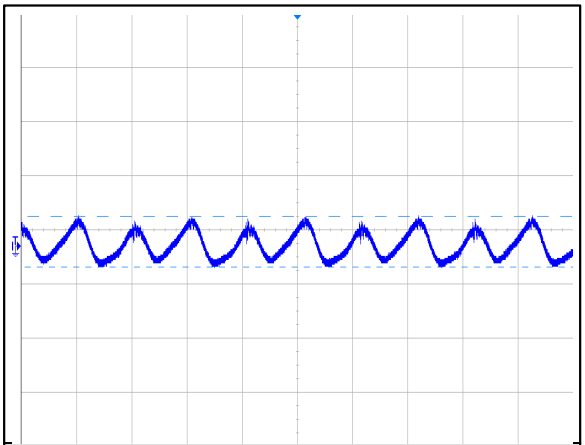


Figure 2: BCQ1300-48S12B-4L Ripple and Noise Measurement
Ch 1: Vo (5uS/div, 200mV/div)

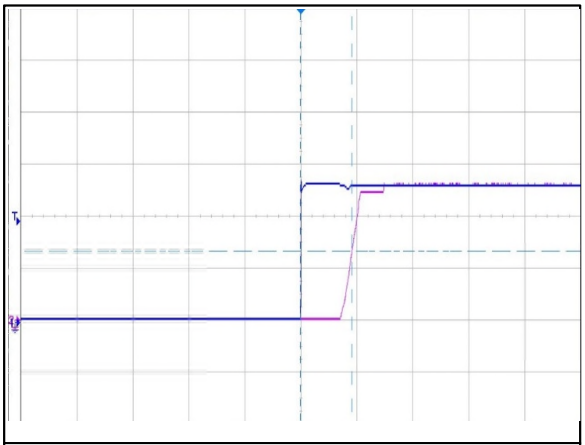


Figure 3: BCQ1300-48S12B-4L Output voltage Startup by Power On (20ms/div)
Ch 1: Vin (20V/div) Ch 2: Vo (5V/div)

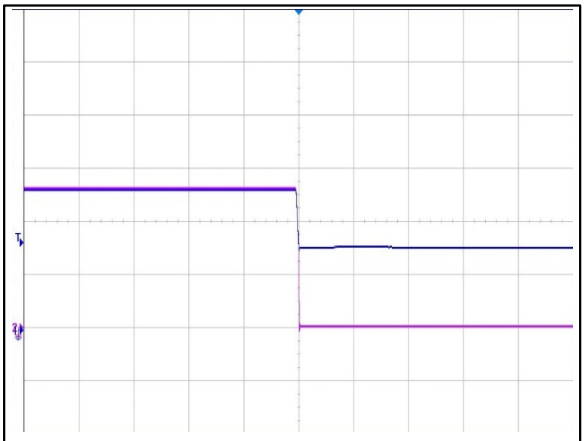


Figure 4: BCQ1300-48S12B-4L Output voltage Shutdown by Power Off (10ms/div)
Ch 1: Vin (20V/div) Ch 2: Vo (5V/div)

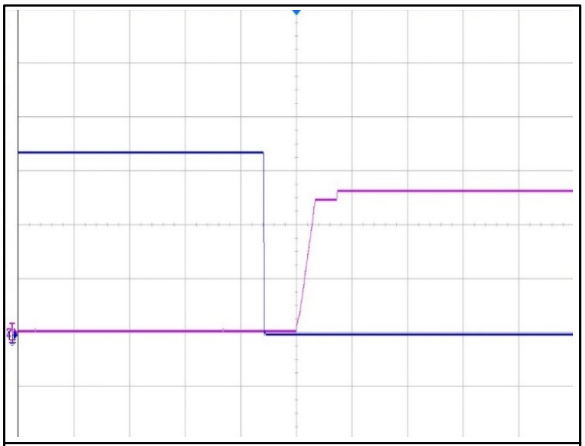


Figure 5: BCQ1300-48S12B-4L Output Startup by Remote On (20ms/div)
Ch 1: Remote ON (1V/div) Ch 2: Vo (5V/div)

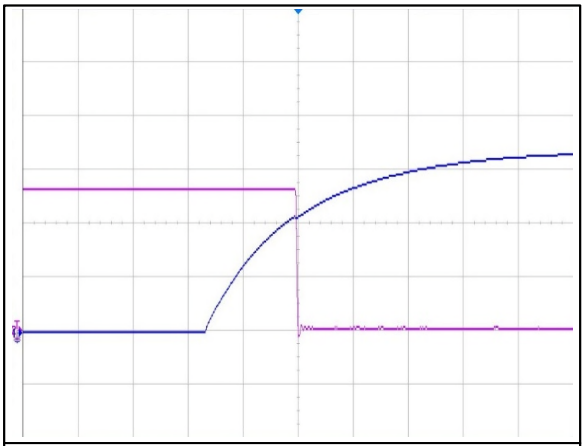


Figure 6: BCQ1300-48S12B-4L Output voltage Shutdown by Remote Off (5mS/div)
Ch 1: Remote OFF (1V/div) Ch 2: Vo (5V/div)

Electrical Specifications

BCQ1300-48S12B-4L Performance Curves

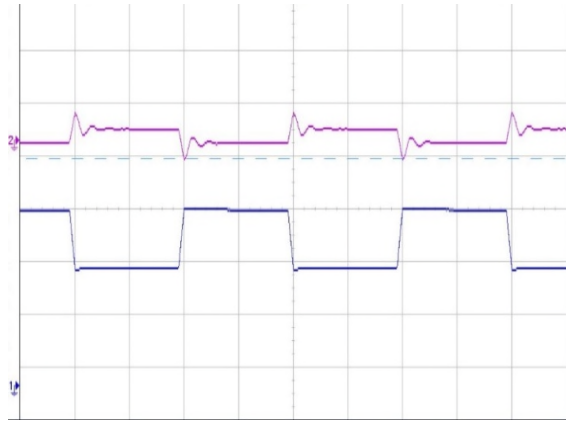


Figure 7: BCQ1300-48S12B-4L Transient Response (2mS/div)
25% load step(50%~75%~50%), 0.1A/μs slew rate
Ch 1: Io (20A/div) Ch 2: Vo (500mV/div)

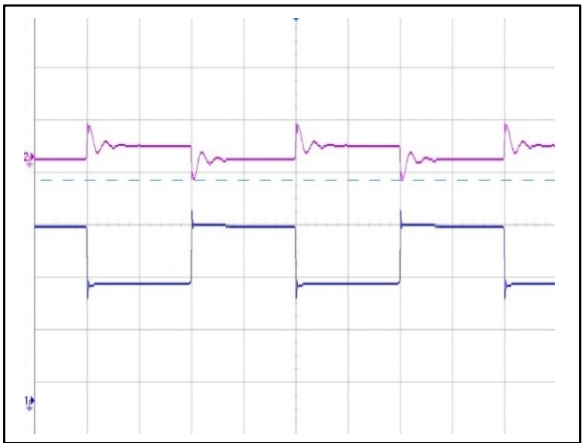


Figure 8: BCQ1300-48S12B-4L Transient Response (2mS/div)
50% load step(50%~75%~50%) , 1A/μs slew rate
Ch 1: Io (20A/div) Ch 2: Vo (500mV/div)

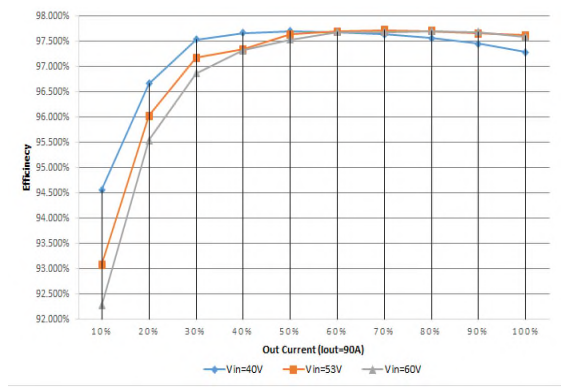


Figure 9: BCQ1300-48S12B-4L Efficiency Curves $Ta = 25℃$
Loading: Io = 10% increment to 90A

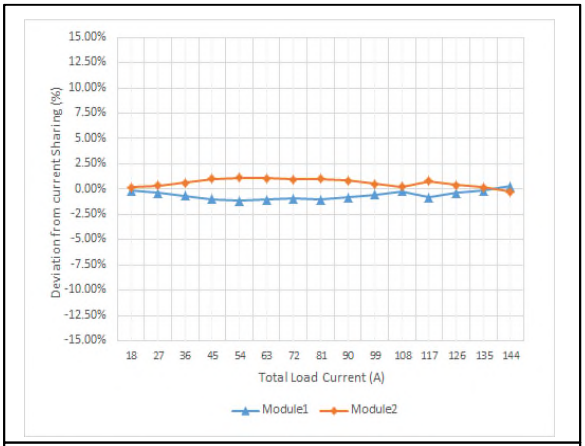


Figure 10: BCQ1300-48S12B-4L Current share performance of 2 paralleled modules

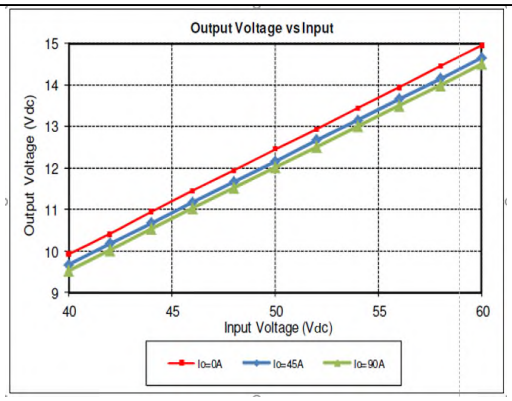
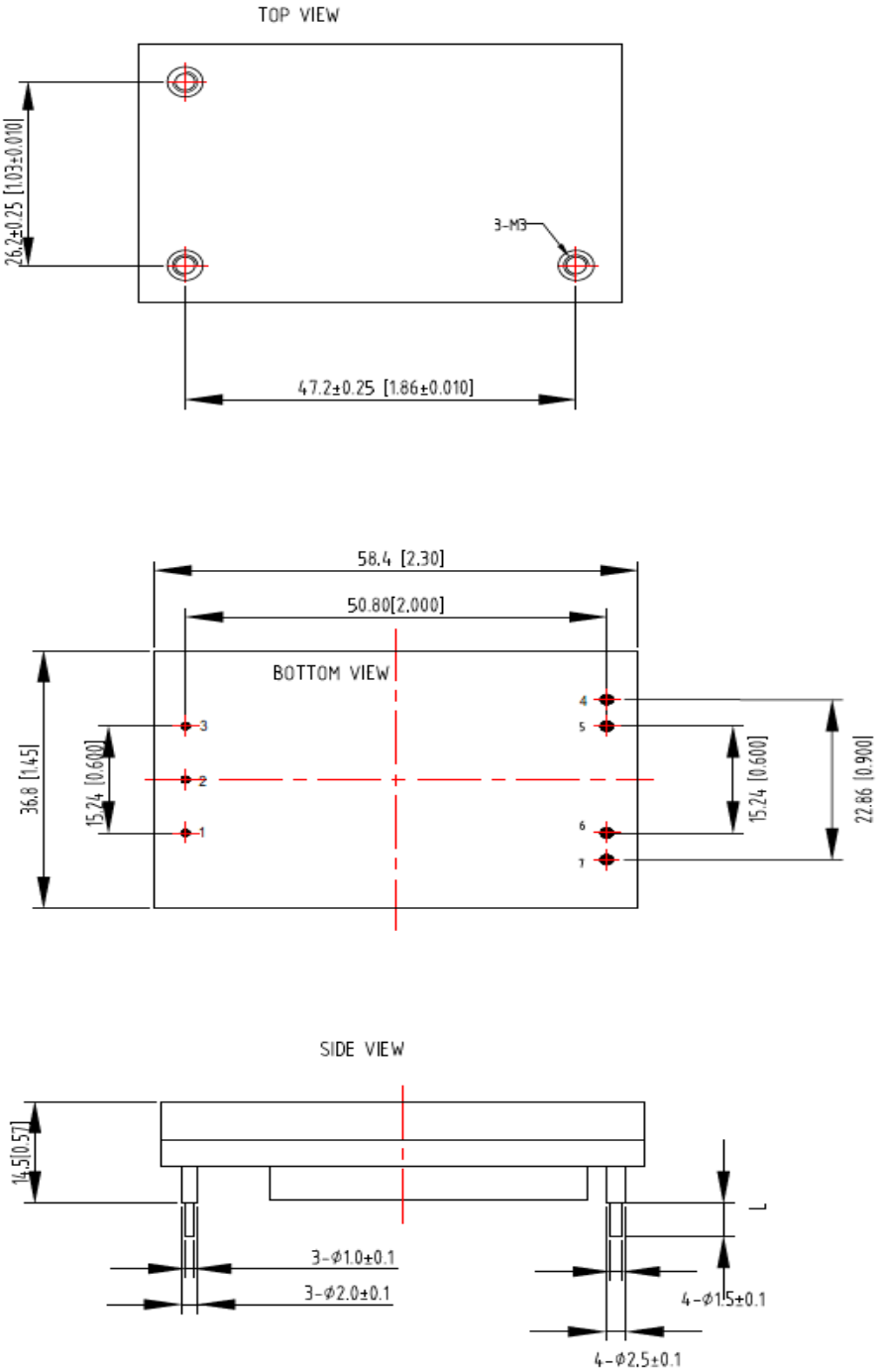


Figure 11: BCQ1300-48S12B-4L Output Characteristic Vout vs Vin

Mechanical Specifications

Mechanical Outlines – Baseplate Module



Unit: mm[inch] Bottom view: pin on upside
Tolerance: X.Xmm± 0.5mm[X.X in. ± 0.02in.]
X.XXmm± 0.25mm[X.XX in. ± 0.01in.]

Mechanical Specifications

Pin length option

Device code suffix	L
-4	4.6mm±0.25mm
-6	3.8mm±0.25mm
-8	2.8mm±0.25mm
None	5.8mm±0.25mm

Pin Designations

Pin No	Name	Function
1	Vin+	Positive input voltage
2	Remote ON/OFF	Remote control
3	Vin-	Negative input voltage
4 & 5	Vo-	Negative output voltage
6 & 7	Vo+	Positive output voltage

Environmental Specifications

EMC Immunity:

BCQ1300-48S12B-4L power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications		
Document	Description	Criteria
EN55032, Class B Limits	Conducted Emission Limits, DC input port	/
IEC/EN 61000-4-2, Level 3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Electrostatic discharge immunity test	B
IEC/EN 61000-4-4, Level3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Electrical Fast Transient. DC input port.	B
IEC/EN 61000-4-5	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Immunity to surges - 600V common mode and 600V differential mode for DC port	B
IEC/EN 61000-4-6, Level 2	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Continuous Conducted Interference. DC input port	A
EN61000-4-29	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Voltage Dips and short interruptions and voltage variations. DC input port	B

Criterion A: Normal performance during and after test.
Criterion B: For EFT and surges, low-voltage protection or reset is not allowed. Temporary output voltage fluctuation ceases after disturbances ceases, and from which the EUT recovers its normal performance automatically. For Dips and ESD, output voltage fluctuation or reset is allowed during the test, but recovers to its normal performance automatically after the disturbance ceases.
Criterion C: Temporary loss of output, the correction of which requires operator intervention.
Criterion D: Loss of output which is not recoverable, owing to damage to hardware

Recommended EMC Filter Configuration

See Figure22

Environmental Specifications

Safety Certifications

The BCQ1300-48S12B-4L power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product

Table 5. Safety Certifications for BCQ1300-48S12B-4L series module

Standard	Agency	Description
UL/CSA 62368-1		US and Canada Requirements
EN62368-1		European Requirements
IEC62368-1		International Requirements
CE		CE Marking
UL94		Materials meet V-0 flammability rating
TUV		International Requirements

Environmental Specifications

Operating Temperature

The BCQ1300-48S12B-4L power supply will start and operate within stated specifications at an ambient temperature from -40 °C to 85 °C under all load conditions. The storage temperature is -55 °C to 85 °C.

Thermal Considerations – Baseplate module (BCQ1300-48S12B-4L)

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling can be verified by measuring the temperature at the test points as shown in the figure 11. The temperature at these points should not exceed the max values in below table 6.

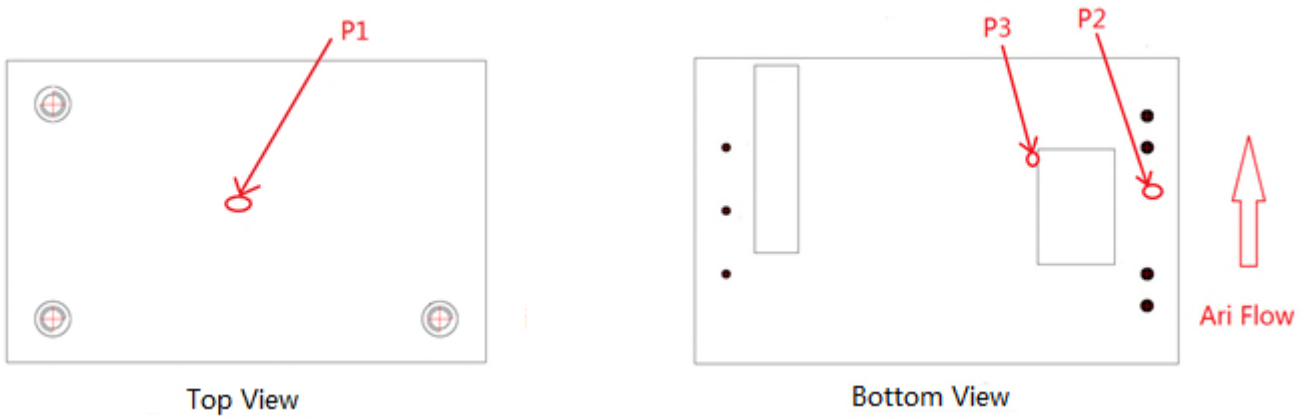


Figure 12 Temperature test point

Table 6. Temperature Limit of the test point	
Test Point	Temperature limit
P1	106 °C
P2	110 °C
P3	117 °C

Environmental Specifications

Base plate without heatsink unit Thermal Derating data

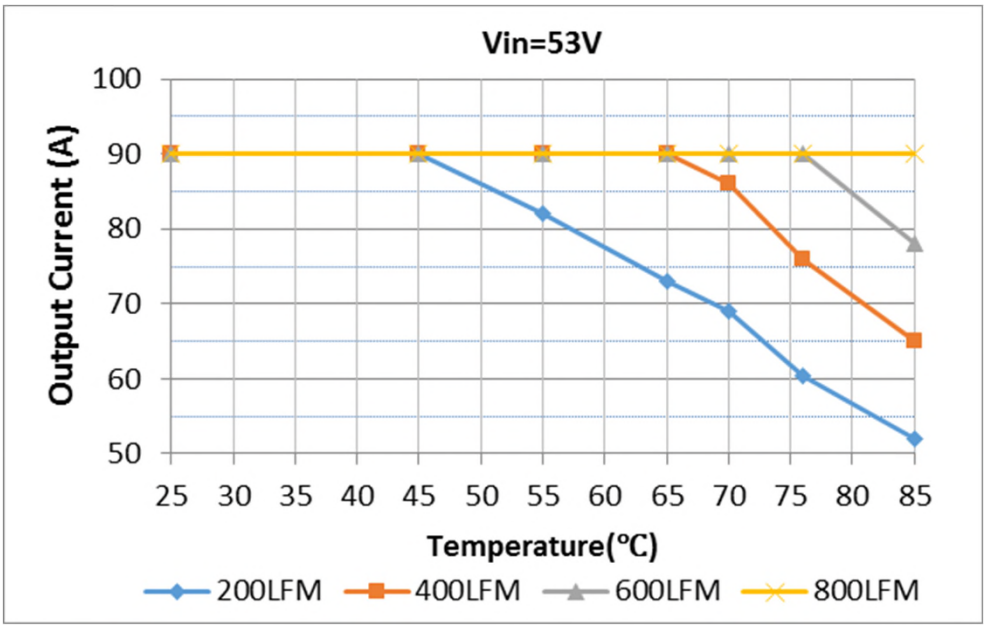


Figure 13 Output power derating, 53Vin, air flowing across the converter from Vin- to Vin+

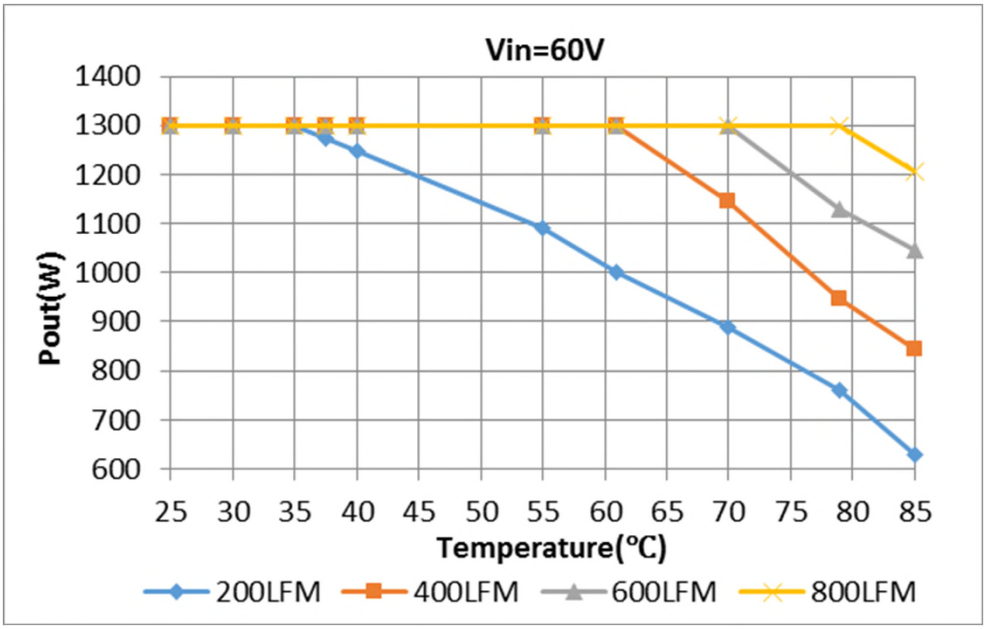


Figure 14 Output power derating, 60Vin, air flowing across the converter from Vin- to Vin+

Environmental Specifications

Thermal Considerations - Base plate Module (BCQ1300-48S12B-4L)

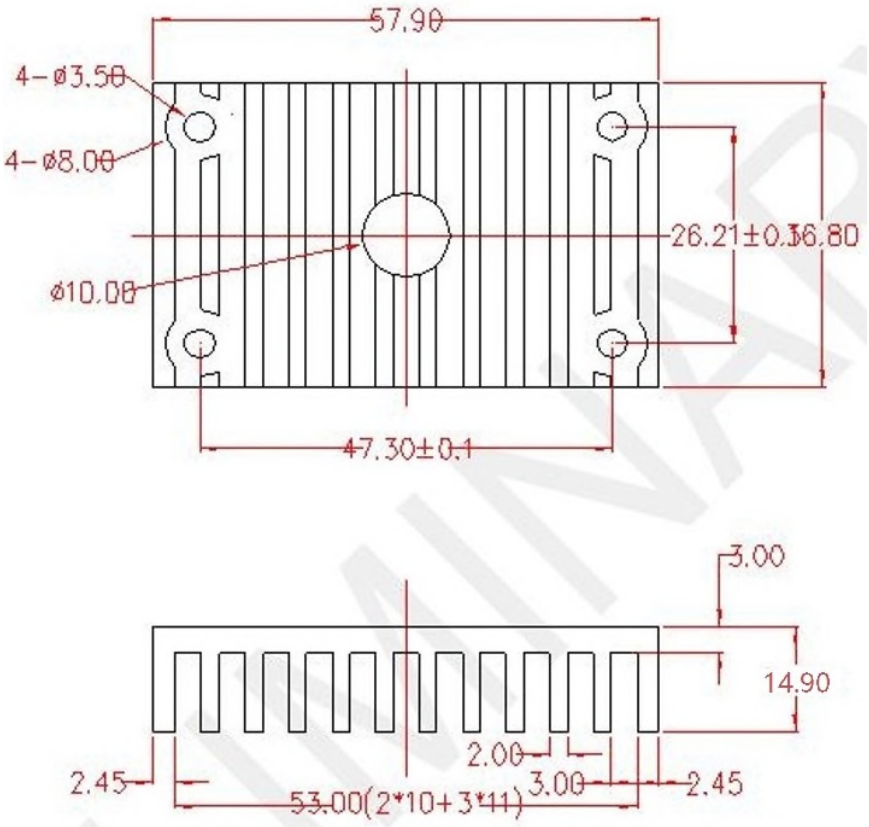


Figure 15 Typical test condition, heatsink

Baseplate with heatsink unit Thermal Derating data

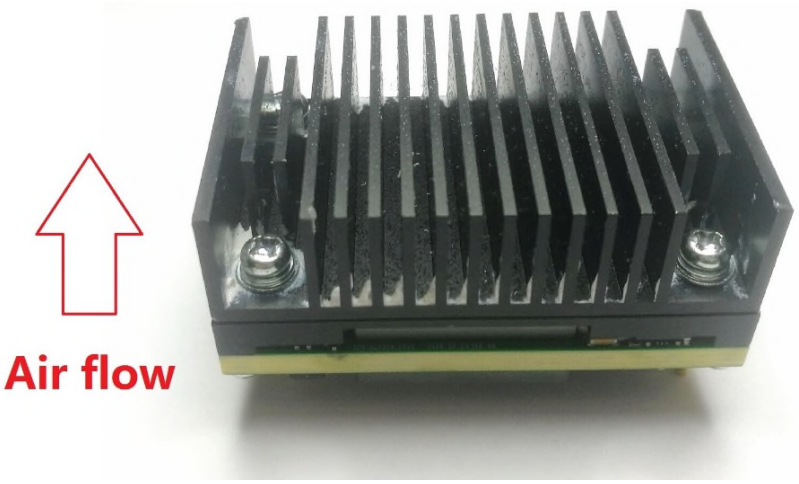


Figure 16 Typical test condition, heatsink

Environmental Specifications

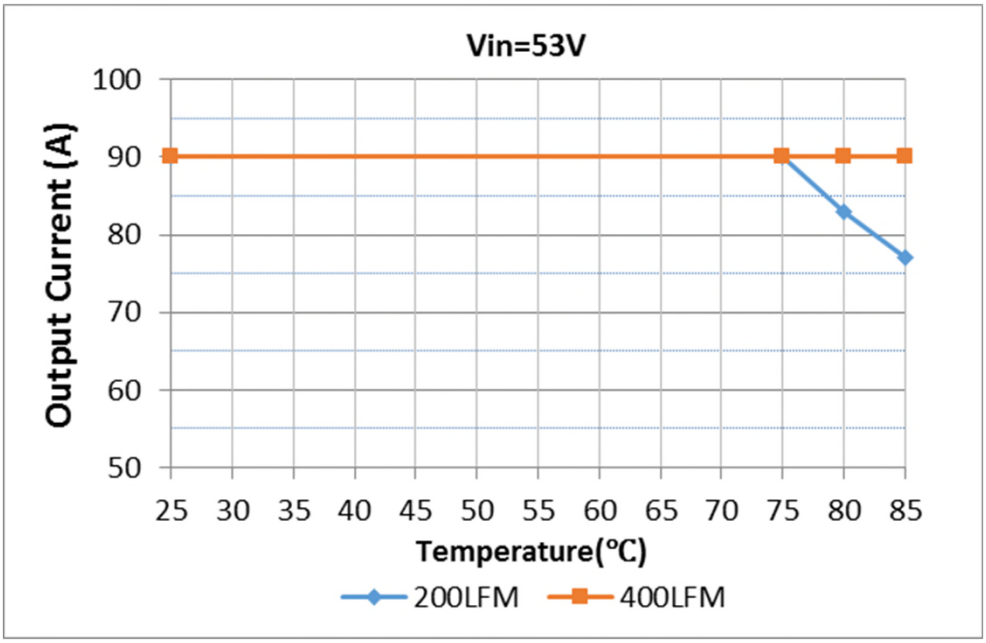


Figure 17 Output power derating, 53Vin, air flowing across the converter from Vin- to Vin+

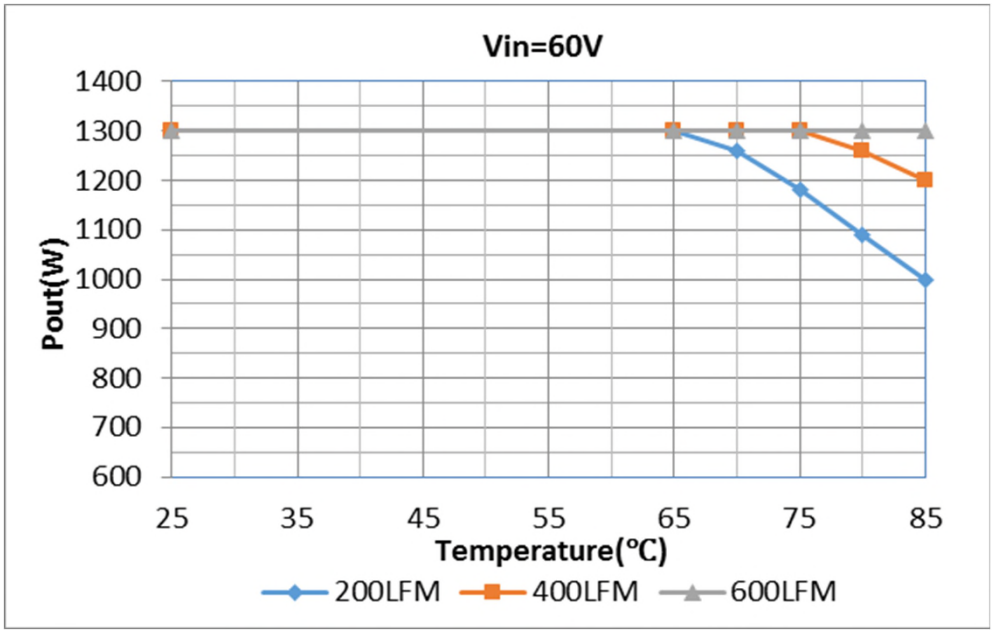


Figure 18 Output power derating, 60V_{in}, air flowing across the converter from Vin- to Vin

Environmental Specifications

Table 7. Qualification Testing		
Parameter	Unit (pcs)	Test condition
HALT test	2	Operating limit: Ta,min-20 ^{O}C to Ta,max+100 ^{O}C, 10 ^{O}C step, Vin = min to max, 0 ~ 100% load Vibration Limit: >30g.
Vibration	2	Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz, A.S.D: 1.0m2/s3, -3db/oct, axes of vibration: X/Y/Z. Time: 30min/axis, non operational
Mechanical Shock	2	Type: half sine, Acceleration: 30g, Duration: 6ms, Directions:6, Number of shock: 3times/face. Non Operational
Thermal Shock	3	-55 ^{O}C to 125 ^{O}C, Temp Dwell Time:30min, Temp change rate: 20 ^{O}C/min, Unit temperature 20cycles
Thermal Cycling	3	-40 ^{O}C to 85 ^{O}C, temperature change rate: 1 ^{O}C/min, cycles: 2cycles
Humidity	3	40 ^{O}C, 95%RH, 48h
MTBF		Telcordia, SR332 Method 1 Case 1; 1.5MHrs Typically

Application Notes

Typical Application

Below is the typical application of the BCQ1300-48S12B-4L series power supply.

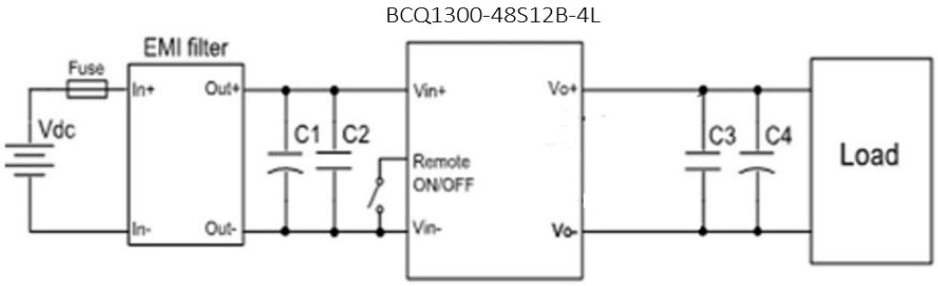


Figure 19 Typical application

C1: 470uF/100V electrolytic capacitor, P/N: UPJ2A471MHD (Nichicon) or equivalent caps

C2: 1uF/100V X7R ceramic capacitor, P/N: CGA5L2X7R2A105K160AA (TDK) or equivalent caps

C3: 4*10uF/25V X7R ceramic capacitor, P/N: C3216X7R1E106K160AB (TDK) or equivalent caps

C4: 560μF/25V electrolytic capacitor, P/N: PS561M025F115PTDZR (Oscon) or equivalent caps

Note: If ambient temperature is below -5 ^{O}C, double output capacitor (Low ESR, ESR≤100mΩ) is needed for output.

Fuse: External fast blow fuse with a rating of 30A/250Vac. The recommended fuse model is 0314030 MRP from Karwin Tech limited.

EMI filter: refer to Figure 22

Application Notes

Remote ON/OFF

Negative remote ON/OFF logic is available in BCQ1300-48S12B-4L. The logic is CMOS and TTL compatible.

Below is the detailed internal circuit and reference in BCQ1300-48S12B-4L.

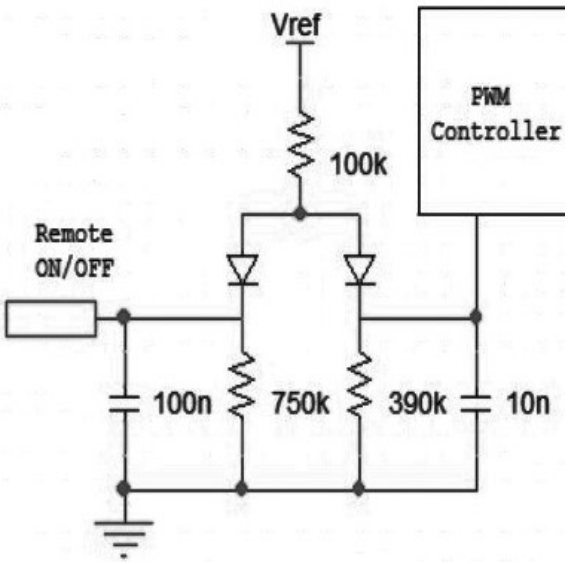


Figure 20 Remote ON/OFF internal diagram

Application Notes

Input Ripple, Output Ripple & Noise Test Configuration

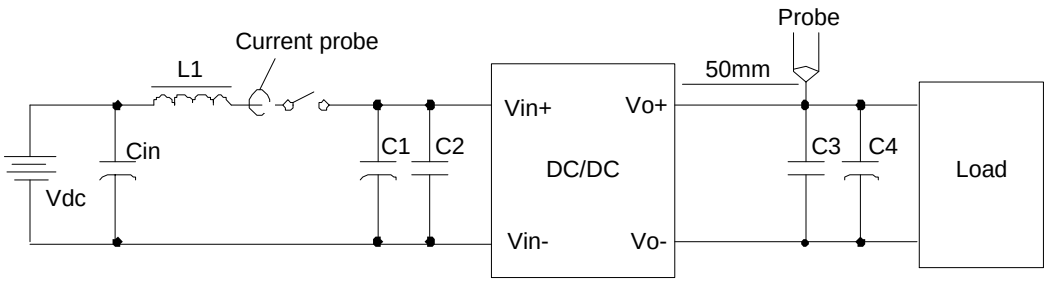


Figure 21 Input ripple, inrush current output ripple & noise test configuration

Vdc: DC power supply
L1: 12μH
Cin: 220μF/100V typical
C1 ~ C4: See Figure 16
Note: Using a coaxial cable with series 50Ω resistor and 0.68μF ceramic capacitor or a ground ring of probe to test output ripple & noise is recommended.

Application Notes

EMC Test Conditions

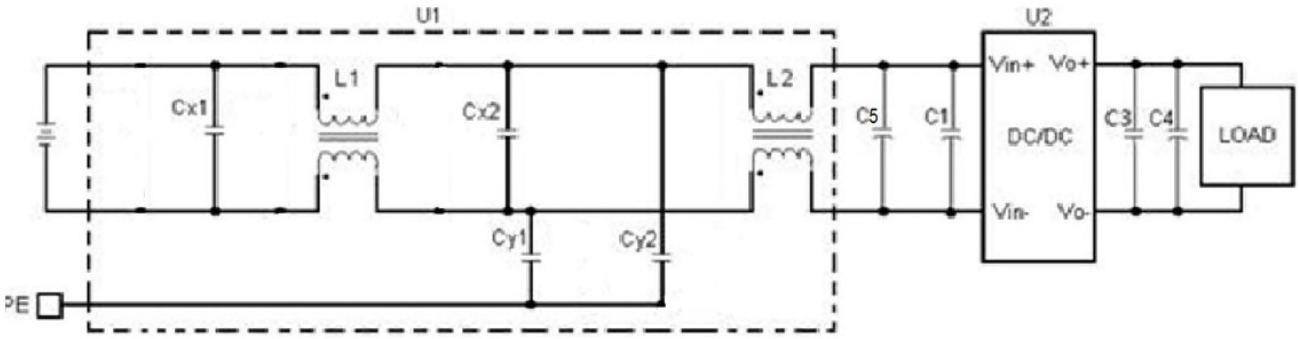


Figure 22 EMC Test Conditions

U1: Input EMC filter
U2: Module to test, BCQ1300-48S12B-4L
Cx1: 7*SMD ceramic-100V/4.7uF/X7R capacitor
Cx2: 4*SMD ceramic-100V/4.7uF/X7R capacitor
Cy1, Cy2: SMD ceramic-630V/0.22uF/X7R Y capacitor
C1: 470µF/100V electrolytic capacitor, P/N: Nichicon
C3: SMD ceramic- 10uF/25V/X7R capacitor
C4: 1000uF/25V/ electrolytic capacitor, P/N: Oscon or POSCAP
C5: SMD ceramic- 0.1uF/100V/X7R capacitor
L1: 650uH, common mode inductor
L2: 650uH, common mode inductor

Figure 20 Trim up curve at full power

Application Notes

Parallel Current Sharing

The module is capable of operating in parallel.

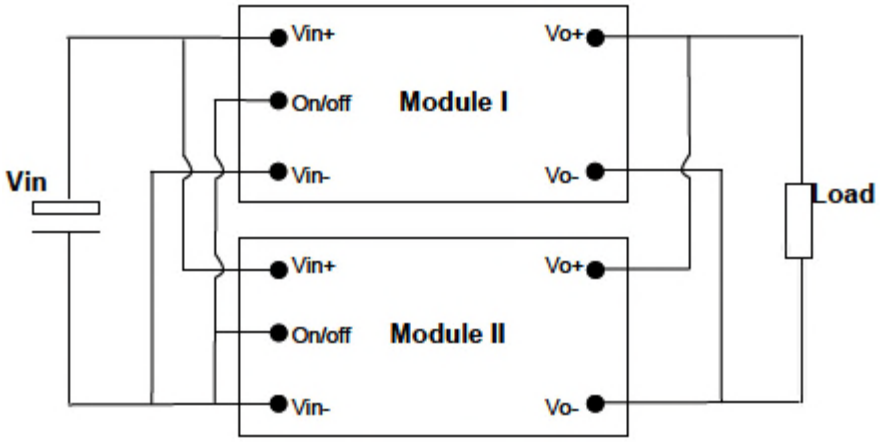


Figure 23 Parallel current sharing configuration for no redundancy requirement system

If system has no redundancy requirement, the module can be parallel directly for higher power without adding external oring-fet; whereas, if the redundancy function is required, the external oring-fet should be added.

For a normal parallel operation the following precautions must be observed:

1. The current sharing accuracy equation is:

X% = | Io – (Itotal / N) | / Irated,

Where, Io is the output current of per module; Itotal is the total load current; N is parallel module numbers; Irated is the rated full load current of per module.

2. To ensure a better steady current sharing accuracy, below design guideline should be followed:

a) The inputs of the converters must be connected to the same voltage source; and the PCB trace resistance from Input voltage source to Vin+ and Vin- of each converter should be equalized as much as possible.

b) The PCB trace resistance from each converter's output to the load should be equalized as much as possible.

c) For accurate current sharing accuracy test, the module should be soldered in order to avoid the unbalance of the touch resistance between the modules to the test board.

3. To ensure the parallel module can start up monotonically without trigging the OCP circuit, below design guideline should be followed:

a) Before all of the parallel modules finished start up, the total load current should be lower than the rated current of 1 module.

b) The ON/OFF pin of the converters should be connected together to keep the parallel modules start up at the same time.

c) The under voltage lockout point will slightly vary from unit to unit. The dv/dt of the rising edge of the input source voltage must be greater than 1V/ms to ensure that the parallel module start up at the same time.

4. If fault tolerance is desired in parallel applications, output ORing devices should be used to prevent a single module failure from collapsing the load bus

Application Notes

Soldering

The BCQ1300-48S12B-4L is intended for standard manual or wave soldering.

When wave soldering is used, the temperature on pins is specified to maximum 255 ^{O}C for maximum 7s.

When soldering by hand, the iron temperature should be maintained at 300 ^{O}C ~ 380 ^{O}C and applied to the converter pins for less than 10s. Longer exposure can cause internal damage to the converter.

Cleaning of solder joint can be performed with cleaning solvent IPA or simulative.

Application Notes

Hazardous Substances Announcement (RoHS China)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
BCQ1300-48S12XX-4L	x	x	x	x	x	x

x: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

√: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Advanced Energy has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. Solders (including high-temperature solder in parts) contain plumbum.
2. Glass of electric parts contains plumbum.
3. Copper alloy of pins contains plumbum

Record of Revision and Changes

Issue	Date	Description	Originators
1.0	06.10.2019	First Issue	K. Wang
1.1	06.10.2020	Add the Vout Vs Vin Curve	K. Wang
1.2	09.09.2024	Add PN for typical application cap	K. Wang

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