ISOLATED DC-DC CONVERTER
CHB50 SERIES
APPLICATION NOTE

Approved By:

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CHB50 33-50W Isolated DC-DC Converter Application Note V10

Contents

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1. Introduction

The CHB50 series offers 33-50 watts of output power with high power density in an industry standard half-brick package. The CHB50 series has wide (2:1) input voltage ranges of 9-18VDC, 18-36VDC, 36-75VDC and provides a precisely regulated output. This series has features such as high efficiency, 1500VDC isolation and a case operating temperature range of -40℃ to 100℃. The modules are fully protected against input UVLO (under voltage lock out), output short circuit, output over voltage and over temperature conditions. Furthermore, the standard control functions include remote on/off and output voltage trimming. All models are highly suited to telecommunications, distributed power architectures, battery operated equipment, industrial, and mobile equipment applications.

2. DC-DC Converter Features

- 33-50W Isolated Output
- Efficiency to 89%
- 300/400KHz Switching Frequency
- 2:1 Wide Input Range
- Regulated Outputs
- Continuous Short Circuit Protection
- Five-Sided Metal Case
- Half-Brick Size Meets Industrial Standard
- Safety Meets IEC/EN/UL 62368-1
- UL60950-1 Approval

3. Electrical Block Diagram

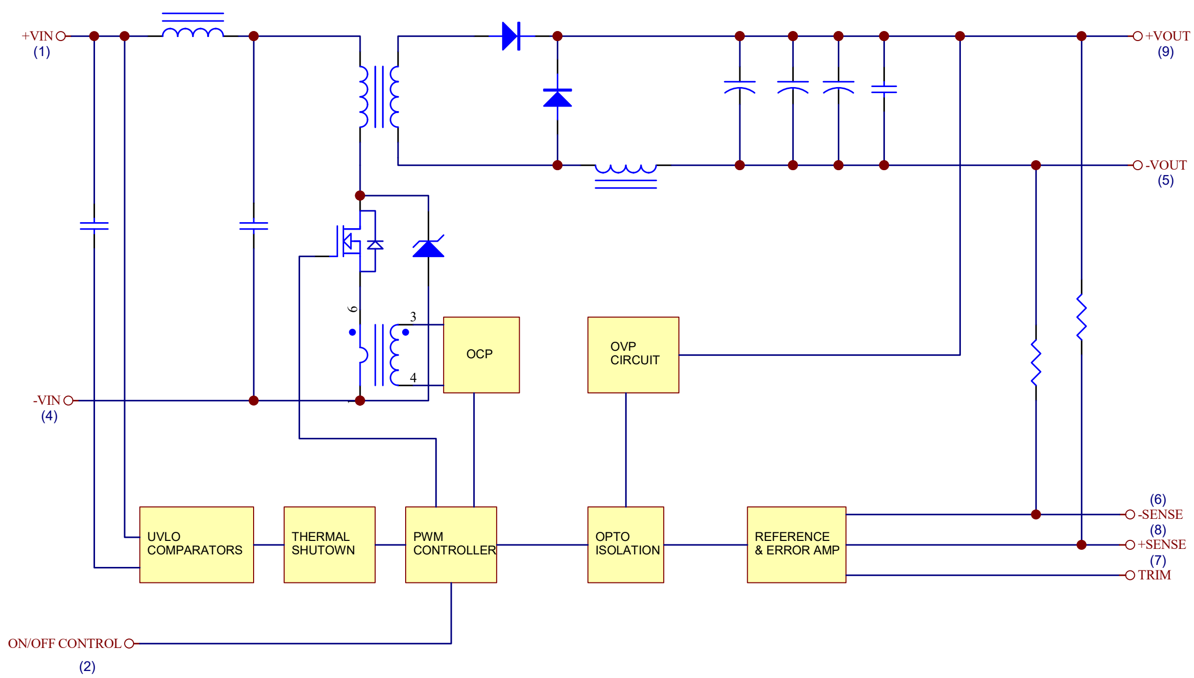


Figure 1 Electrical Block Diagram of CHB50 Series Module

4. Technical Specifications

(All specifications are typical at nominal input, full load at 25℃ unless otherwise noted.)

ABSOLUTE MAXIMUM RATINGS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input Voltage						
Continuous		12SXX	-0.3		18	V_{dc}
		24SXX	-0.3		36	
		48SXX	-0.3		75	
Transient	100ms	12SXX			25	V_{dc}
		24SXX			50	
		48SXX			100	
Operating Case Temperature		All	-40		100	℃
Storage Temperature		All	-40		105	℃
Isolation Voltage	1 Minute; input/output, input/case, output/case	All	1500			V_{dc}

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Operating Input Voltage		12SXX	9	12	18	V_{dc}
		24SXX	18	24	36	
		48SXX	36	48	75	
Input Under Voltage Lockout						
Turn-On Voltage Threshold		12SXX		8.8		V_{dc}
		24SXX		17		
		48SXX		34		
Turn-Off Voltage Threshold		12SXX		8		V_{dc}
		24SXX		16		
		48SXX		32.5		
Maximum Input Current	100% Load, V_{in}=9V	12SXX		7		A
	100% Load, V_{in}=18V	24SXX		3.5		
	100% Load, V_{in}=36V	48SXX		2		
No-Load Input Current		All		50		mA
Inrush Current (I^2t)		All			TBD	A^2s
Input Reflected Ripple Current	P-P thru 12uH inductor, 5Hz to 20MHz	All		TBD		mA

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	V_{in}=Nominal V_{in}, I_o = $I_{o\_max.}$, T_c=25℃	Vo=3.3V	3.267	3.3	3.333	V_{dc}
		Vo=5.0V	4.95	5	5.05	
		Vo=12V	11.88	12	12.12	
		Vo= 15V	14.85	15	15.15	
		Vo=24V	23.76	24	24.24	
Output Voltage Regulation						
Load Regulation	I_o=$I_{o\_min.}$ to $I_{o\_max.}$	All			±0.2	%
Line Regulation	V_{in}=Low line to high line	All			±0.2	%
Temperature Coefficient	T_C=-40℃ to 100℃	All			±0.03	%/℃

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Ripple and Noise						
Peak-to-Peak	5Hz to 20MHz bandwidth, full load 10uF tantalum and 1.0uF ceramic capacitors	Vo=3.3&5.0V			75	mV
		Vo=12&15V			100	
		Vo=24V			240	
RMS	5Hz to 20MHz bandwidth, full load, 10uF solid tantalum and 1.0uF ceramic capacitors	Vo=3.3&5.0V			20	mV
		Vo=12&15V			30	
		Vo=24V			100	
Operating Output Current Range		Vo= 3.3V	0		10	A
		Vo=5.0V	0		10	
		Vo=12V	0		4.16	
		Vo=15V	0		3.33	
		Vo=24V	0		2.08	
Output DC Current Limit Inception	Output voltage=90% nominal output voltage	All	110		150	%
Maximum Output Capacitance	Full load (resistive)	Vo= 3.3V	0		10000	uF
		Vo=5.0V	0		10000	
		Vo=12V	0		4000	
		Vo=15V	0		2000	
		Vo=24V	0		1500	

DYNAMIC CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Current Transient						
Step Change in Output Current	75% to 100% of $I_{o\_max.}$	All			±5	%
Setting Time (within 1% V_{out} Nominal)	d_i/d_t=0.1A/us	All			500	us
Turn-On Delay and Rise Time						
Turn-On Delay Time, From Input	$V_{in\_min.}$ to 10%V_{o_set}	12SXX		2		ms
		24SXX		2		
		48SXX		17		
Output Voltage Rise Time	10%V_{o_set} to 90%V_{o_set}	24S05 48S05		0.4		ms
		Others		3		

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
100% Load	V_{in}=Nominal V_{in}	12S33		79		%
		12S05		83		
		12S12		87		
		12S15		87		
		12S24		87		

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
100% Load	V_{in}=Nominal V_{in}	24S33		81		%
		24S05		85		
		24S12		88		
		24S15		88		
		24S24		88		
		48S33		81		
		48S05		84		
		48S12		88		
		48S15		88		
		48S24		89		

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Isolation Voltage	1 Minute; input/output, input/case, output/case	All			1500	V_{dc}
Isolation Resistance		All	10			MΩ
Isolation Capacitance		All		1000		pF

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		12SXX		400		KHz
		24SXX		400		
		48SXX		300		
On/Off Control, Positive Remote On/Off Logic						
Logic Low (Module Off)	$V_{on/off}$ at $I_{on/off}$=1.0mA (open collector circuit drive only)	All	0		0.8	V
Logic High (Module On)	$V_{on/off}$ at $I_{on/off}$=0.0uA	All		Open Circuit		V
On/Off Control, Negative Remote On/Off Logic						
Logic High (Module Off)	$V_{on/off}$ at $I_{on/off}$=0.0uA	All		Open Circuit		V
Logic Low (Module On)	$V_{on/off}$ at $I_{on/off}$=1.0mA	All	0		0.8	V
Off Converter Input Current	Shutdown input idle current	All			10	mA
Output Voltage Trim Range	P_{out}=max rated power	All	-10		+10	%
Output Over Voltage Protection	Zener or TVS Clamp	All	115	125	140	%
Over-Temperature Protection	Shutdown Case Temperature	All		100		℃
	Restart threshold Case Temperature	All		70		℃

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	I_o=100% of I_{o_max}; T_a=25°C per MIL-HDBK-217F	All		1000		K hours
Weight		All		88		grams

5. Main Features and Functions

5.1 Operating Temperature Range

The CHB50 series converters can be operated within a wide case temperature range of -40 ℃ to 100 ℃. Consideration must be given to the derating curves when ascertaining maximum power that can be drawn from the converter. The maximum power drawn from half brick models is influenced by usual factors, such as:

- Input voltage range
- Output load current
- Forced air or natural convection

5.2 Output Voltage Adjustment

Section 6.8 describes in detail how to trim the output voltage with respect to its set point. The output voltage on all models is adjustable within the range of +10% to -10%.

5.3 Over Current Protection

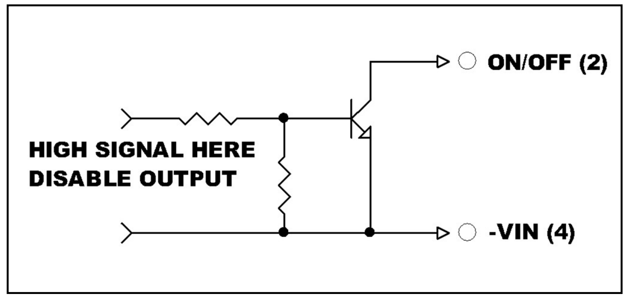
All models have internal over current and continuous short circuit protection. The unit operates normally once the fault condition is removed. At the point of current limit inception, the output voltage of converter will be going down into current limit and power fold-back protection.

5.4 Output Over Voltage Protection

The output over voltage protection consists of an zener diode or TVS. If more accurate output over voltage protection is required, an external circuit can be used via the remote **on/off** pin.

5.6 Remote On/Off

The CHB50 series allows the user to switch the module on and off electronically with the remote on/off feature. All models are available in “positive logic” and “negative logic” (optional) versions. The converter turns on if the remote **on/off** pin is open circuit. Setting the pin low (0 to <0.8Vdc) will turn the converter off (open collector circuit only). The signal level of the remote **on/off** input is defined with respect to ground. If not using the remote **on/off** pin, leave the pin open (converter will be on). Models with part number suffix “N” are the “negative logic” remote **on/off** version. The unit turns off if the remote **on/off** pin is open circuit. The converter turns on if the **on/off** pin input is low (0 to <0.8Vdc). Note that the converter is off by default.



5.7 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard on the CHB50 unit. The unit will shut down when the input voltage drops below a threshold, and the unit will operate when the input voltage goes above the upper threshold.

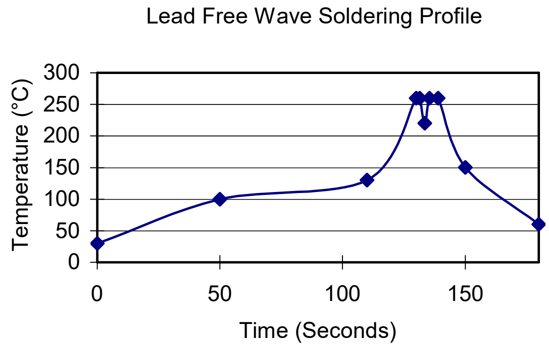
5.8 Over Temperature Protection

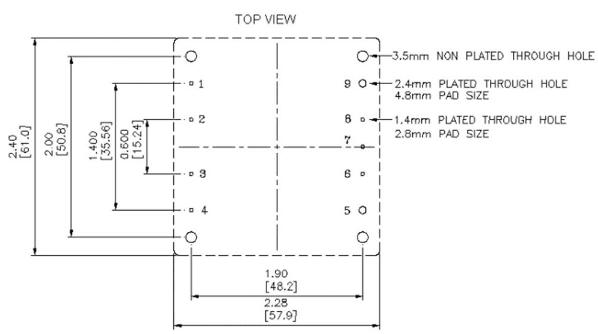
These modules have an over temperature protection circuit to safeguard against thermal damage. The module shuts down and latches off when the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below restart threshold.

6. Applications

6.1 Recommended Layout, PCB Footprint and Soldering Information

The system designer or end user must ensure that metal and other components in the vicinity of the converter meet the spacing requirements for which the system is approved. Low resistance and inductance PCB layout traces are the norm and should be used where possible. Due consideration must also be given to proper low impedance tracks between power module, input and output grounds. The recommended soldering profile and PCB layout are shown below.





6.2 Convection Requirements for Cooling

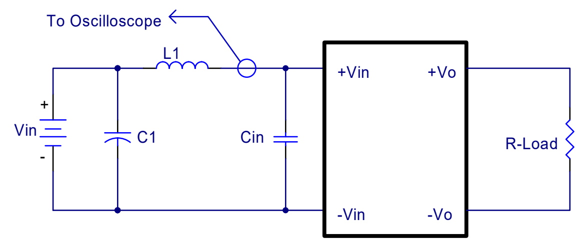
To predict the approximate cooling needed for the half brick module, refer to the power derating curves in section 6.4. These derating curves are approximations of the ambient temperatures and airflows required to keep the power module temperature below its maximum rating. Once the module is assembled in the actual system, the module's temperature should be monitored to ensure it does not exceed 100°C as measured at the center of the top of the case (thus verifying proper cooling).

6.3 Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The example is presented in section 6.4. The power output of the module should not be allowed to exceed rated power (V_{o_set} x $I_{o\_max.}$).

6.4 Input Capacitance at The Power Module

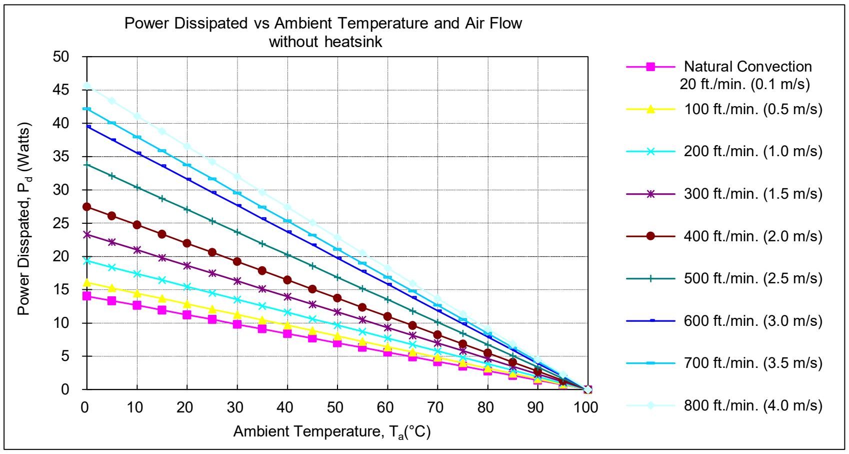
The converters must be connected to low AC source impedance. To avoid problems with loop stability source inductance should be low. Also, the input capacitors (Cin) should be placed close to the converter input pins to de-couple distribution inductance. However, the external input capacitors are chosen for suitable ripple handling capability. Low ESR capacitors are good choice. Circuit as shown as below represents typical measurement methods for reflected ripple current. C1 and L1 simulate a typical DC source impedance. The input reflected-ripple current is measured by current probe to oscilloscope with a simulated source Inductance (L1).



L1: TBD
C1: TBD
Cin: TBD
Input Reflected-Ripple Test Setup

6.5 Power Derating

The operating case temperature range of CHB50 series is -40℃ to +100℃. When operating the CHB50 series, proper derating or cooling is needed. The maximum case temperature under any operating condition should not exceed 100℃.



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	7.12 ℃/W
100 ft./min. (0.5m/s)	6.21 ℃/W
200 ft./min. (1.0m/s)	5.17 ℃/W
300 ft./min. (1.5m/s)	4.29 ℃/W
400 ft./min. (2.0m/s)	3.64 ℃/W
500 ft./min. (2.5m/s)	2.96 ℃/W
600 ft./min. (3.0m/s)	2.53 ℃/W
700 ft./min. (3.5m/s)	2.37 ℃/W
800 ft./min. (4.0m/s)	2.19 ℃/W

Example:

What is the minimum airflow necessary for a CHB50-48S12 operating at nominal line voltage, an output current of 4.16A, and a maximum ambient temperature of 50℃?

Solution:

Given:

V_{in}=48V_{dc}, V_o=12V_{dc}, I_o=4.16A

Determine power dissipation (P_d):

$P_d=P_i-P_o=P_o(1-\eta)/\eta$

$P_d=12\times4.16\times(1-0.88)/0.88=6.8$Watts

Determine airflow:

Given: P_d=6.8W and T_a=50℃

Check above power derating Curve:

Minimum airflow=100 ft./min.

Verify:

The maximum temperature rise

$\triangle T=P_d\times R_{ca}=6.8\times6.21=42.23$℃

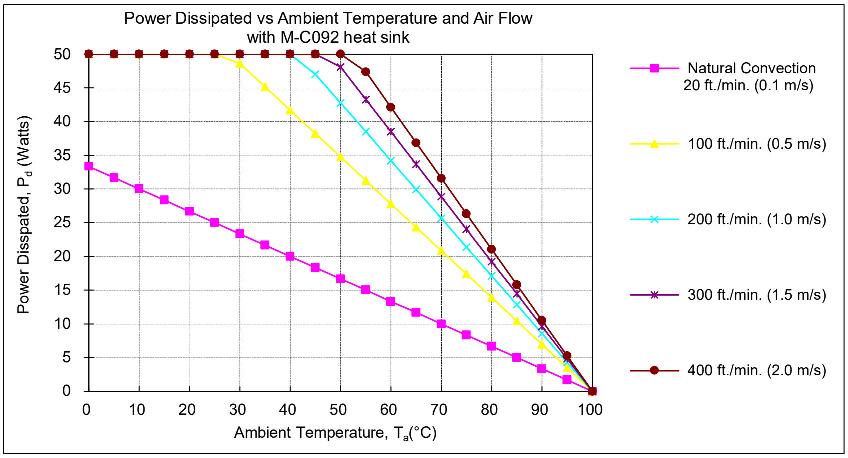
The maximum case temperature

$T_c=T_a+\triangle T=92.23$℃<100℃

Where:

The R_{ca} is thermal resistance from case to ambience

The T_a is ambient temperature and the T_c is case temperature



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	3 ℃/W
100 ft./min. (0.5m/s)	1.44 ℃/W
200 ft./min. (1.0m/s)	1.17 ℃/W
300 ft./min. (1.5m/s)	1.04 ℃/W
400 ft./min. (2.0m/s)	0.95 ℃/W

Example (with heatsink M-C092):

What is the minimum airflow necessary for a CHB50-48S12 operating at nominal line voltage, an output current of 4.16A, and a maximum ambient temperature of 70℃?

Solution:

Given:

V_{in}=48V_{dc}, V_o=12V_{dc}, I_o=4.16A

Determine power dissipation (Pd):

$P_d=P_i-P_o=P_o(1-\eta)/\eta$

$P_d=12\times4.16\times(1-0.88)/0.88=6.8$Watts

Determine airflow:

Given: P_d=6.8W and T_a=70℃

Check above power de-rating curve:

P_d<10W, Natural Convection

Verify:

Maximum temperature rise is $\triangle T=P_d\times R_{ca}=6.8\times3=20.4$℃

Maximum case temperature is $T_c=T_a+\triangle T=90.4$°C<100℃

Where:

The R_{ca} is thermal resistance from case to ambient environment

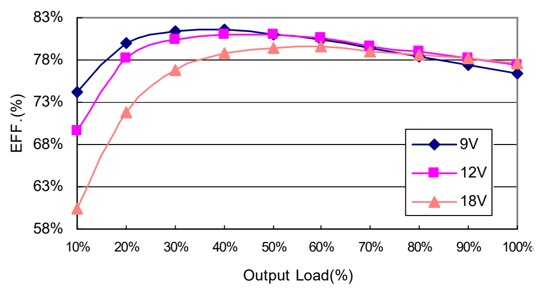
T_a is ambient temperature and T_c is case temperature

6.6 Half Brick Heat Sinks:

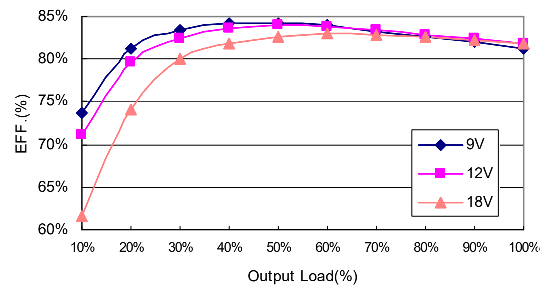
Heat sinks assembly **refer to Datasheet-Thermal**

6.7 Efficiency VS. Load

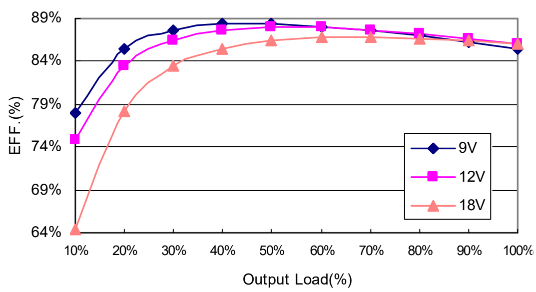
CHB50-12S33 Load VS EFF.



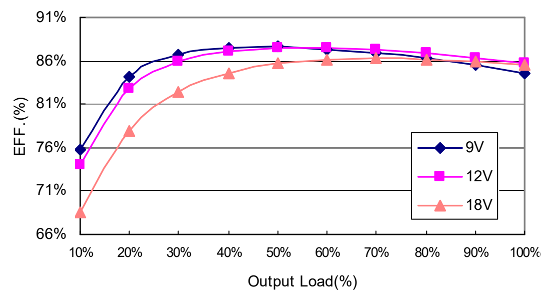
CHB50-12S05 Load VS EFF.



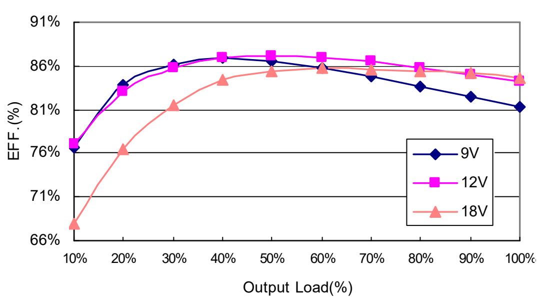
CHB50-12S12 Load VS EFF.



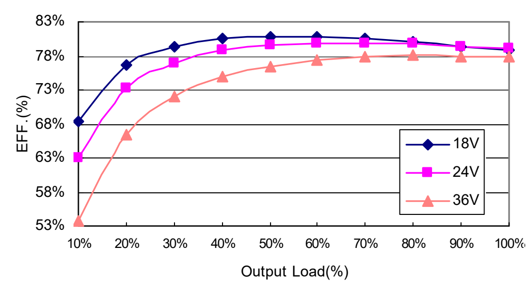
CHB50-12S15 Load VS EFF.



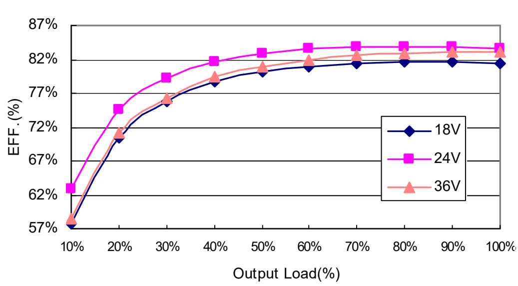
CHB50-12S24 Load VS EFF.



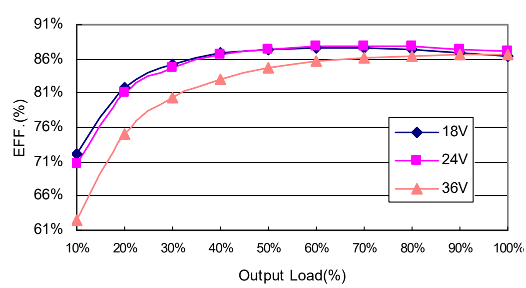
CHB50-24S33 Load VS EFF.

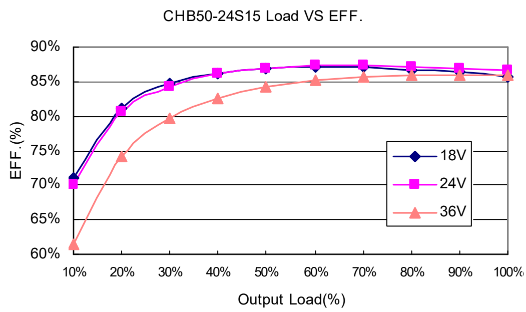


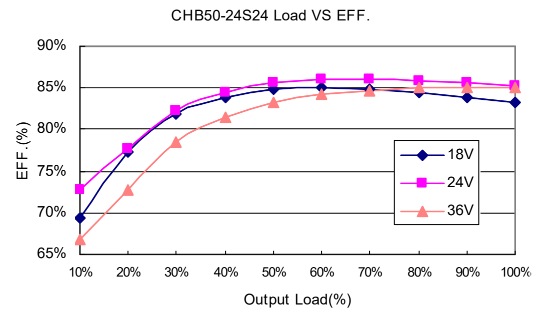
CHB50-24S05 Load VS EFF.

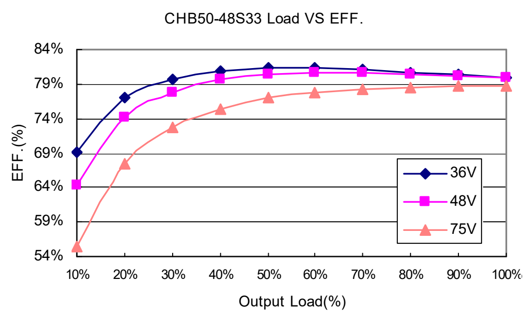


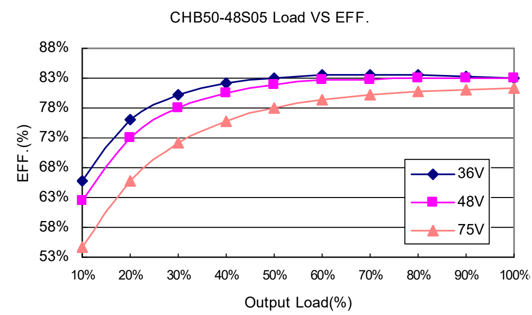
CHB50-24S12 Load VS EFF.

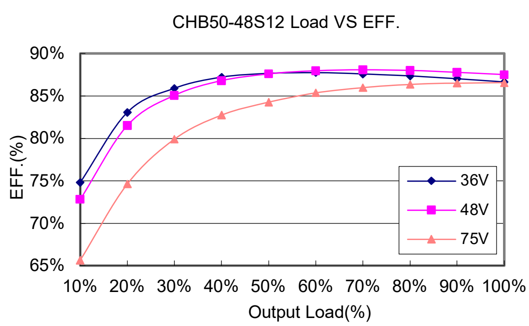


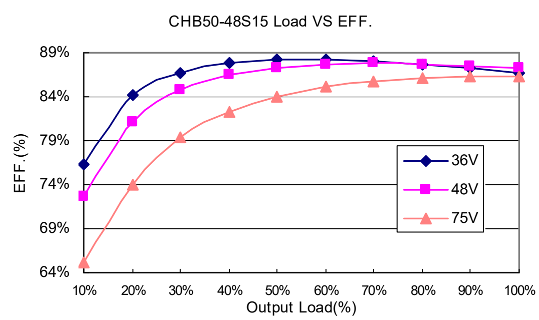

CHB50-24S15 Load VS EFF.
90%
85%
80%
75%
70%
65%
60%
EFF.(%)
18V
24V
36V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)

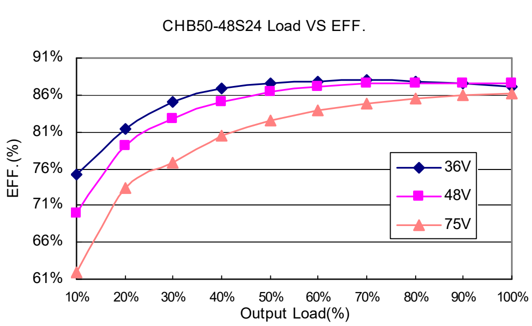

CHB50-24S24 Load VS EFF.
90%
85%
80%
75%
70%
65%
EFF.(%)
18V
24V
36V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)


CHB50-48S33 Load VS EFF.
84%
79%
74%
69%
64%
59%
54%
EFF.(%)
36V
48V
75V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)


CHB50-48S05 Load VS EFF.
88%
83%
78%
73%
68%
63%
58%
53%
EFF.(%)
36V
48V
75V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)


CHB50-48S12 Load VS EFF.
90%
85%
80%
75%
70%
65%
EFF.(%)
36V
48V
75V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)


CHB50-48S15 Load VS EFF.
89%
84%
79%
74%
69%
64%
EFF.(%)
36V
48V
75V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)


CHB50-48S24 Load VS EFF.
91%
86%
81%
76%
71%
66%
61%
EFF.(%)
36V
48V
75V
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Output Load(%)

6.8 Test Set-Up

The basic test set-up to measure parameters such as efficiency, load regulation and voltage accuracy is shown below. When testing the modules under any transient conditions please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate:

- Efficiency
- Load regulation and line regulation

The value of efficiency is defined as:

$$\eta = \frac{V_o \times I_o}{V_{in} \times I_{in}} \times 100\%$$

Where:

V_o is output voltage
I_o is output current
V_{in} is input voltage
I_{in} is input current

The value of load regulation is defined as:

$$Load.reg = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where:

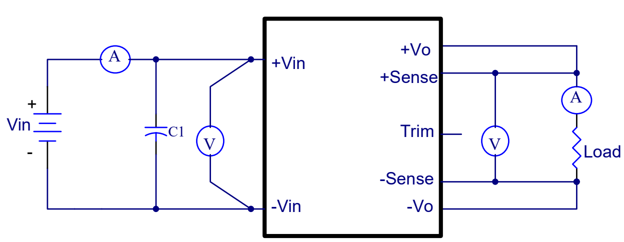
V_{FL} is the output voltage at full load
V_{NL} is the output voltage at no load

The value of line regulation is defined as:

$$Line.reg = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

Where:

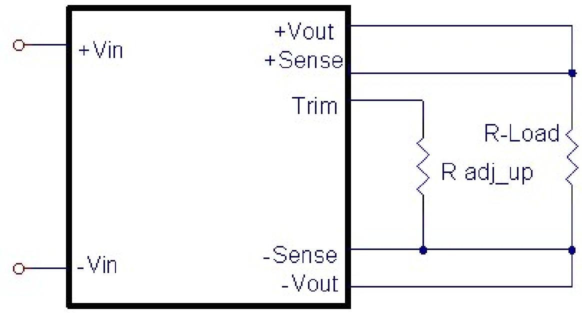
V_{HL} is the output voltage of maximum input voltage at full load.
V_{LL} is the output voltage of minimum input voltage at full load



CHB50 Series Test Setup

6.9 Output Voltage Adjustment

In order to trim the voltage up or down, one needs to connect the trim resistor either between the trim pin and -Vo for trim-up or between trim pin and +Vo for trim-down. The output voltage trim range is ±10%. This is shown:



T_{rim_up} Voltage Setup

The value of R_{adj_up} defined as:

$$Radj\_up = \frac{(R1 - R2 \times (V_o - Vo\_nom))}{(V_o - Vo\_nom)}\ (K\Omega)$$

Model Number	R1 (KΩ)	R2 (KΩ)
CHB50-12S33(N)	3.375	9.000
CHB50-24/48S33(N)	3.168	7.200
CHB50-XXS05(N)	5.800	8.250
CHB50-XXS12(N)	19.656	13.304
CHB50-XXS15(N)	25.474	14.760
CHB50-12S24(N)	41.968	13.968
CHB50-24/48S24(N)	42.215	16.923

Table of T_{rim_up} Resistor Values

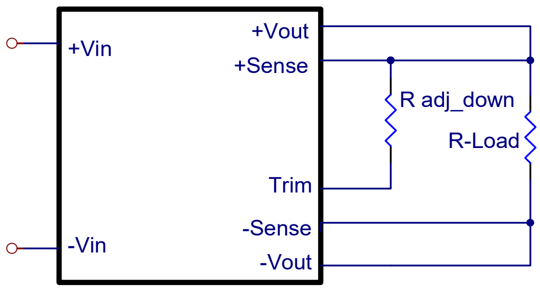
Where:

R_{adj_up} is the external resistor in KΩ
V_{o_nom} is the nominal output voltage
V_o is the desired output voltage
R1, R2 are internal components and are defined in the table of trim resistor values

For example, to T_{rim_up} the output voltage of 5V module (CHB50-48S05) by 8% to 5.4V, R_{adj_up} is calculated as follows:

$V_o - V_{o\_nom} = 5.4 - 5.0 = 0.4V$
R1=5.8 KΩ, R2=8.25 KΩ

$$Radj\_up = \frac{5.8 - 8.25 \times 0.4}{0.4} = 6.25\ (K\Omega)$$



T_{rim_down} Voltage Setup

The value of R_{adj_down} defined as:

$$Radj_{down} = \frac{R1 - R2 \times (Vo_{nom} - Vo)}{(Vo_{nom} - Vo)}\ (K\Omega)$$

Model Number	R1 (KΩ)	R2 (KΩ)
CHB50-XXS33(N)	6.18	15
CHB50-XXS05(N)	5.8	10.57
CHB50-XXS12(N)	86.45	60.1
CHB50-XXS15(N)	150	94
CHB50-XXS24(N)	430	130

Table of trim down resistor values

Where:

R_{adj_down} is the external resistor in KΩ.

V_{o_nom} is the nominal output voltage.

V_o is the desired output voltage.

R1, R2 are internal components.

For example: to trim-down the output voltage of 5V module (CHB50-48S05) by 8% to 4.6V, R_{adj_down} is calculated as follows:

$V_{o\_nom} – V_o$=5.0–4.6=0.4V

R1=5.8 KΩ, R2 =10.57 KΩ

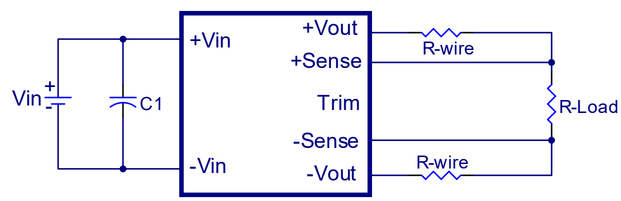
$$Radj\_down = \frac{5.8 - 10.57 \times 0.4}{0.4} = 3.93\ (K\Omega)$$

6.10 Output Remote Sensing

The CHB50 Series converter has the capability to remotely sense both lines of its output. This feature moves the effective output voltage regulation point from the output of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage of the CHB50 series in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load. The remote-sense voltage range is:

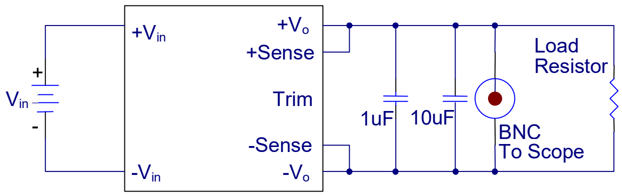
$[(+V_{out}) - (-V_{out})] – [(+Sense) – (-Sense)] \leqq 10\%$ of $V_{o\_nominal}$

If the remote sense feature is not to be used, the sense pins should be connected locally. The +Sense pin should be connected to the $+V_{out}$ pin at the module and the -Sense pin should be connected to the $-V_{out}$ pin at the module. This is shown in the schematic below.



Note: Although the output voltage can be varied (increased or decreased) by both remote sense and trim, the maximum variation for the output voltage is the larger of the two values not the sum of the values. The output power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. Using remote sense and trim can cause the output voltage to increase and consequently increase the power output of the module if output current remains unchanged. Always ensure that the output power of the module remains at or below the maximum rated power. Also be aware that if $V_{o.set}$ is below nominal value, $P_{out.max.}$ will also decrease accordingly because $I_{o.max.}$ is an absolute limit. Thus, $P_{out.max.} = V_{o.set} \times I_{o.max.}$ is also an absolute limit.

6.11 Output Ripple and Noise



Output ripple and noise is measured with 1.0uF ceramic and 10uF solid tantalum capacitors across the output.

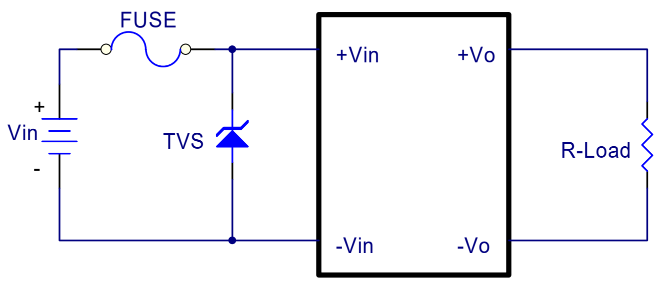
6.12 Output Capacitance

The CHB50 series converters provide unconditional stability with or without external capacitors. For good transient response, low ESR output capacitors should be located close to the point of load. PCB design emphasizes low resistance and inductance tracks in consideration of high current applications. Output capacitors with their associated ESR values have an impact on loop stability and bandwidth. Cincon's converters are designed to work with load capacitance to see technical specifications.

7. Safety & EMC

7.1 Input Fusing and Safety Considerations

The CHB50 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 8A fast acting fuse for 12Vin models, 4A for 24Vin models and 2.25A for 48Vin models. It is recommended that the circuit have a transient voltage suppressor diode (TVS) across the input terminal to protect the unit against surge or spike voltage and input reverse voltage (as shown).



7.2 EMC Considerations

Suggested Circuits for Conducted EMI Class A & Class B

(1) EMI and Conducted Noise Meet EN 55032 Class A&B Specifications:

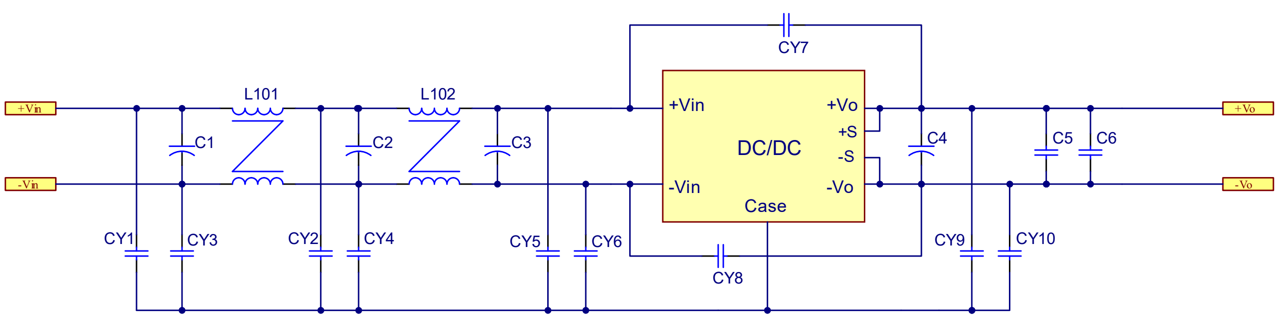
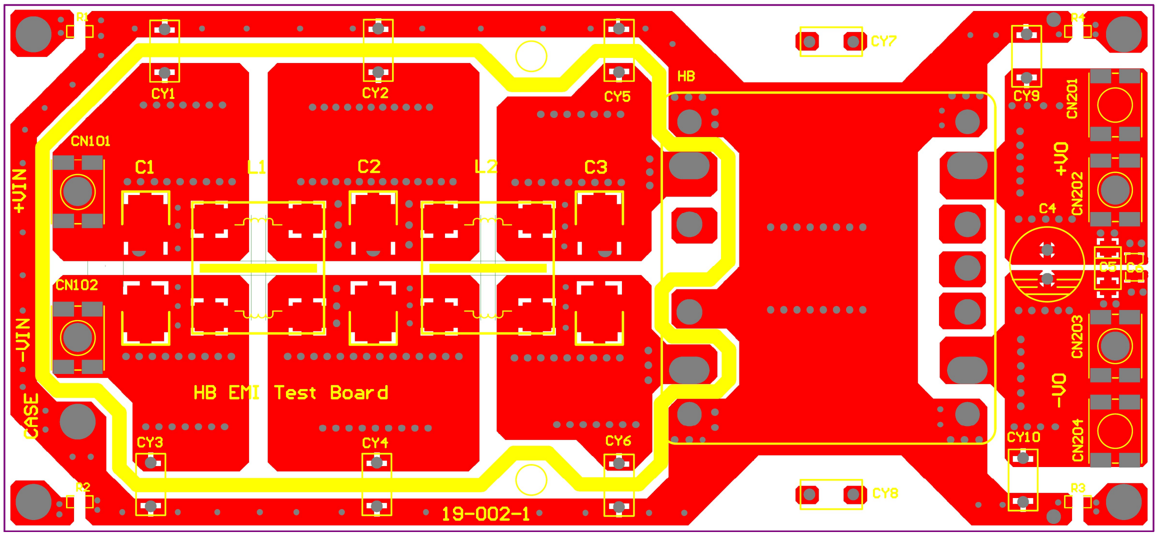
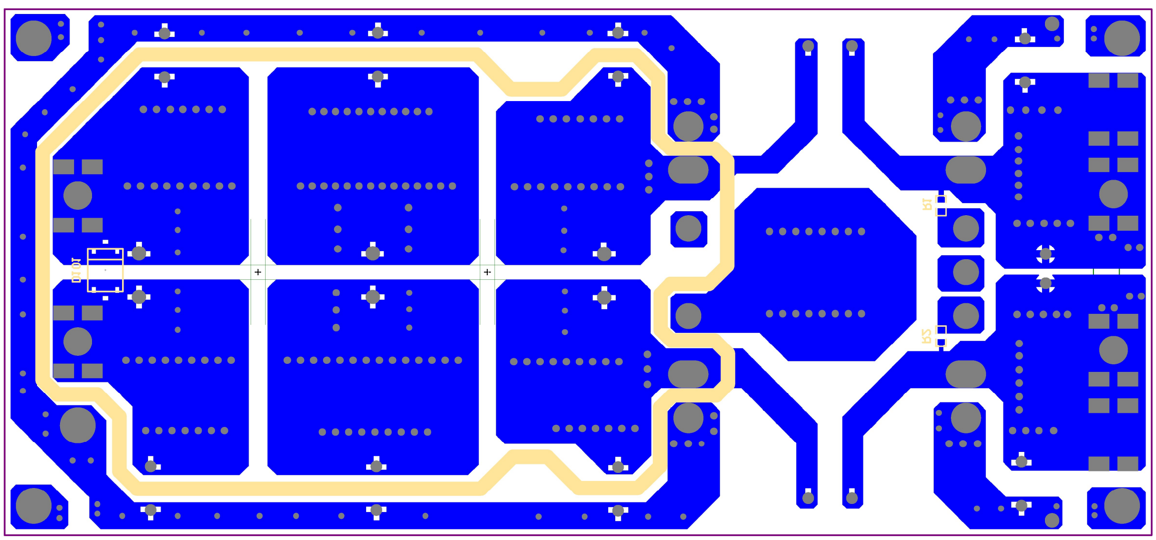


Figure1 Connection circuit for Conducted EMI Class A&B Testing



EMI Test Board Top Side



EMI Test Board Bottom Side

	Class A			
Model No.	C2	C3	CY6	L2
CHB50-24SXX	100uF/50V ESR < 0.17Ω	100uF/50V ESR < 0.17Ω	1500pF 1206	1.5uH
CHB50-48SXX	100uF/100V ESR < 0.12Ω	100uF/100V ESR < 0.12Ω	1500pF 1206	1.5uH

Note:

CHB50-24SXX C2, C3: EKY-500ELL101MHB5D NCC

CHB50-48SXX C2, C3: 100YXJ100M10X20 RUBYCON

CY6: MLCC Capacitor

L2: 7443552150 1.5uH 20% 17A WURTH

C1, C4, C5, C6, CY1, CY2, CY3, CY4, CY5, CY7, CY8, CY9, CY10, L1: NC

	Class B						
Model No.	C1	C2	C3	CY6	CY8	L1	L2
CHB50-24SXX	100uF/50V ESR < 0.17Ω	100uF/50V ESR < 0.17Ω	100uF/50V ESR < 0.17Ω	2200pF 1206	1500pF 1206	0.47mH	1.5uH
CHB50-48SXX	100uF/100V ESR < 0.12Ω	100uF/100V ESR < 0.12Ω	100uF/100V ESR < 0.12Ω	2200pF 1206	1500pF 1206	0.47mH	1.5uH

Note:

CHB50-24SXX C1, C2, C3: EKY-500ELL101MHB5D NCC

CHB50-48SXX C1, C2, C3: 100YXJ100M10X20 RUBYCON

CY6, CY8: MLCC Capacitor

L1: 744844471 0.47mH 9A WURTH

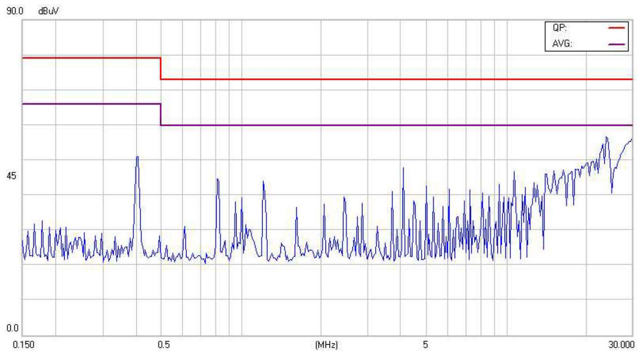
L2: 7443552150 1.5uH 20% 17A WURTH

C4, C5, C6, CY1, CY2, CY3, CY4, CY5, CY7, CY9, CY10: NC

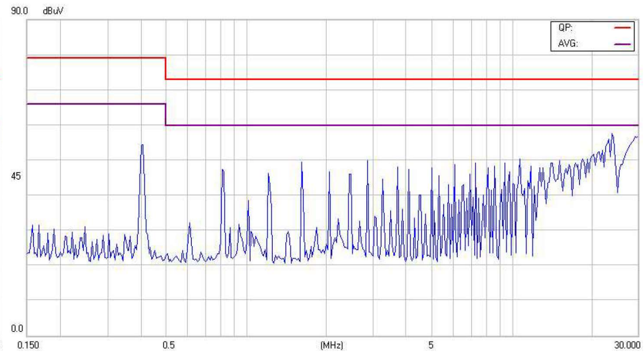
Conducted Class A

CHB50-24S12

Line

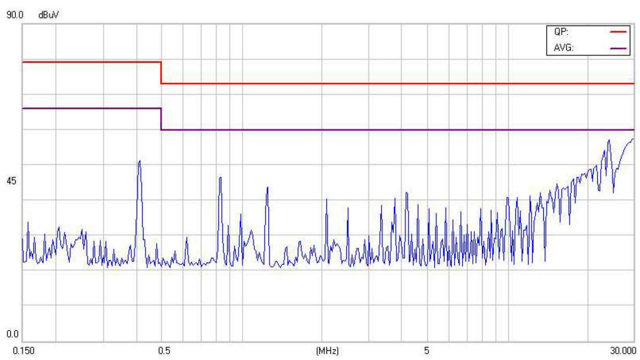


Neutral

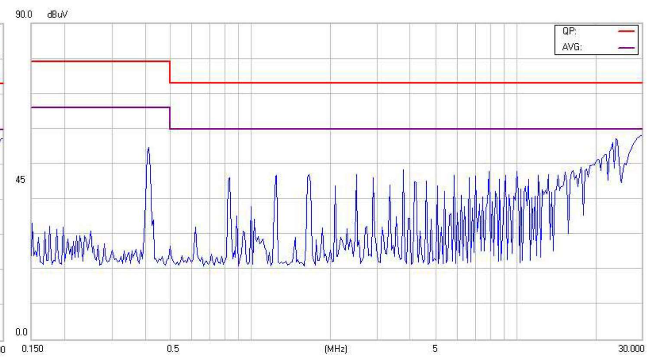


CHB50-24S15

Line

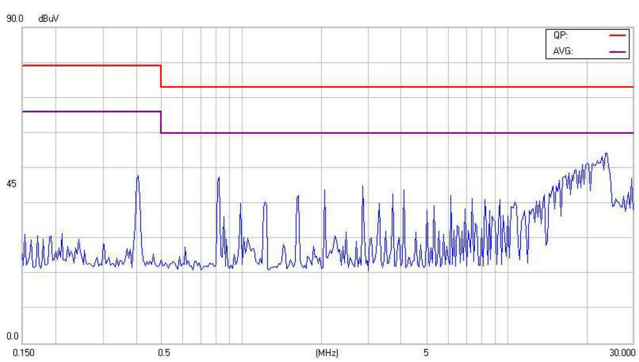


Neutral

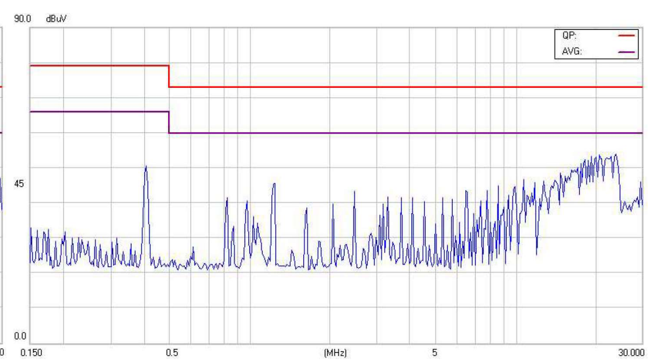


CHB50-24S24

Line

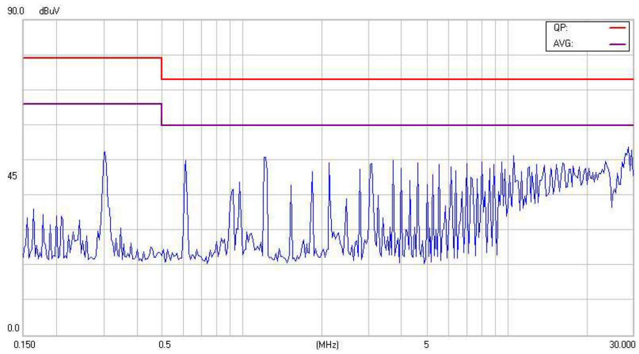


Neutral

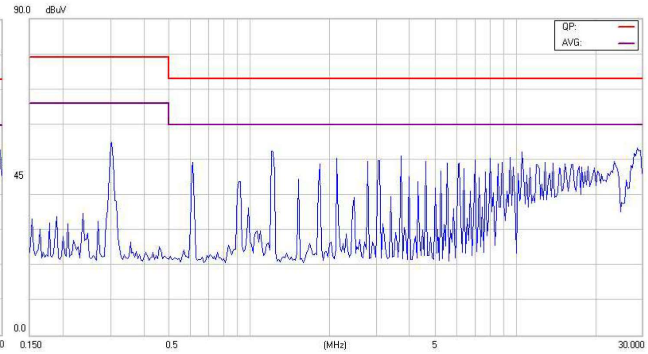


CHB50-48S33

Line

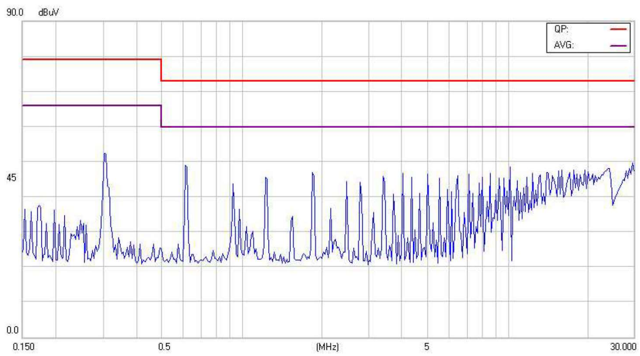


Neutral

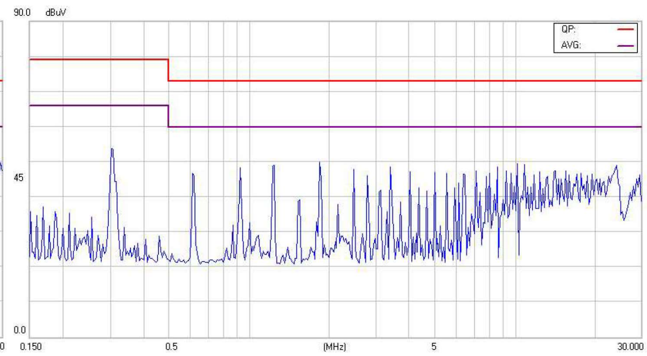


CHB50-48S05

Line



Neutral

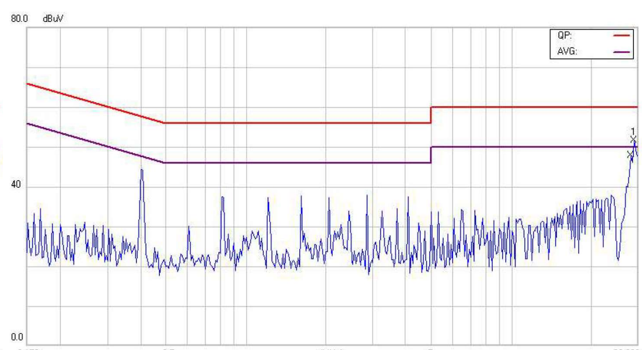


Conducted Class B

CHB50-24S12

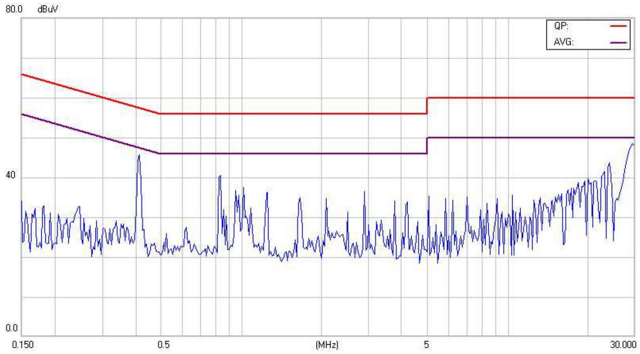
Line

Neutral

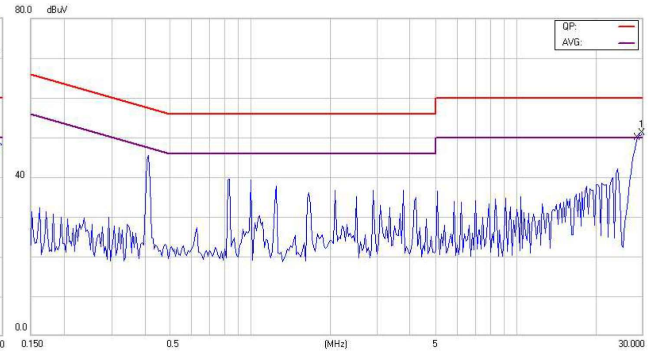


CHB50-24S15

Line

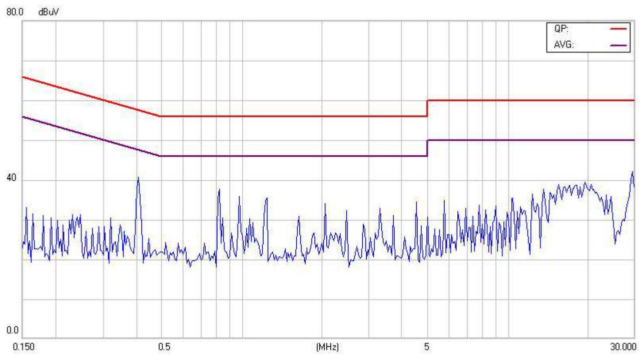


Neutral

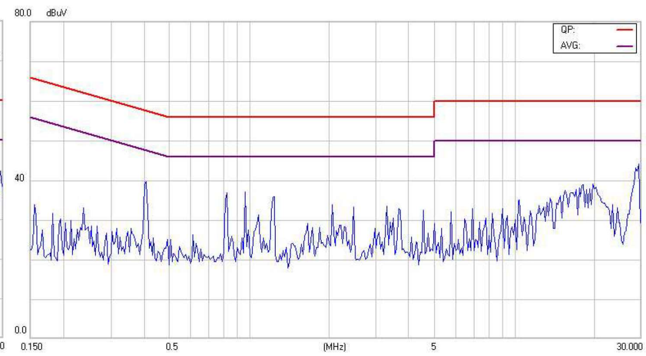


CHB50-24S24

Line

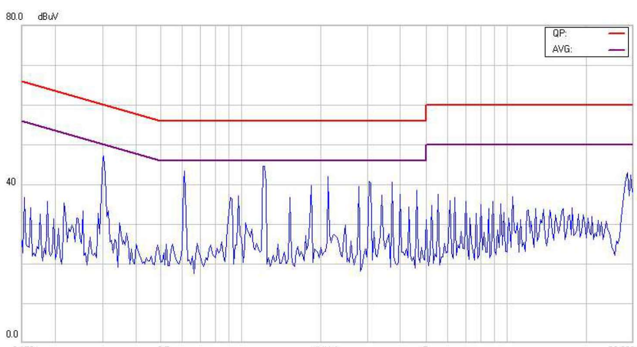


Neutral

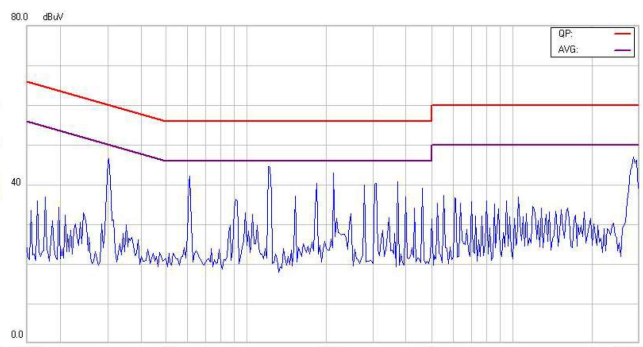


CHB50-48S33

Line

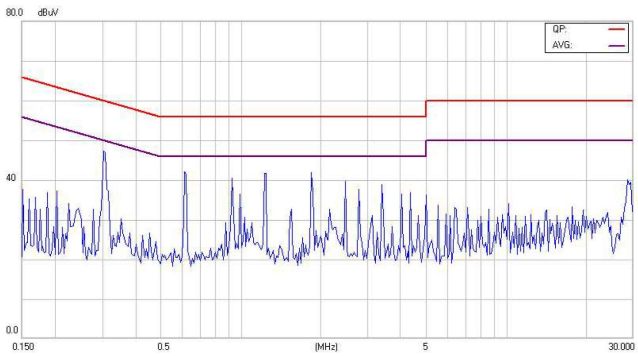


Neutral



CHB50-48S05

Line



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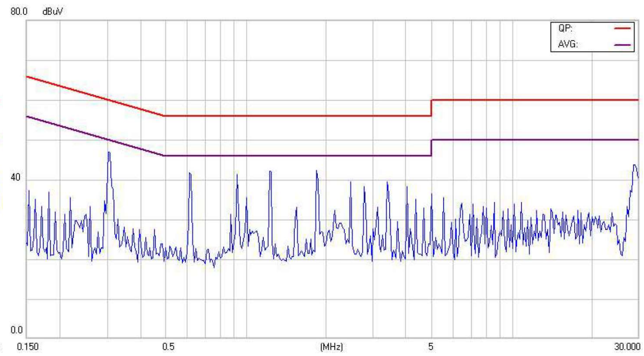

8. Part Number

Format: CHB50 – II O XX L Y

Parameter	Series	Nominal Input Voltage	Number of Outputs	Output Voltage	Remote On/Off Logic	Mounting Inserts
Symbol	CHB50	II	O	XX	L	Y (Option)
Value	CHB50	12 : 12 Volts 24 : 24 Volts 48 : 48 Volts	S : Single	33 : 3.3Volts 05 : 05Volts 12 : 12Volts 15 : 15Volts 24 : 24Volts	None : Positive N : Negative	-C : Clear Mounting Insert (3.2mm DIA.)

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