ISOLATED DC-DC CONVERTER
CHB200 SERIES
APPLICATION NOTE

Approved By:

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Contents

CHB200 Series
Application Note V12 March 2020

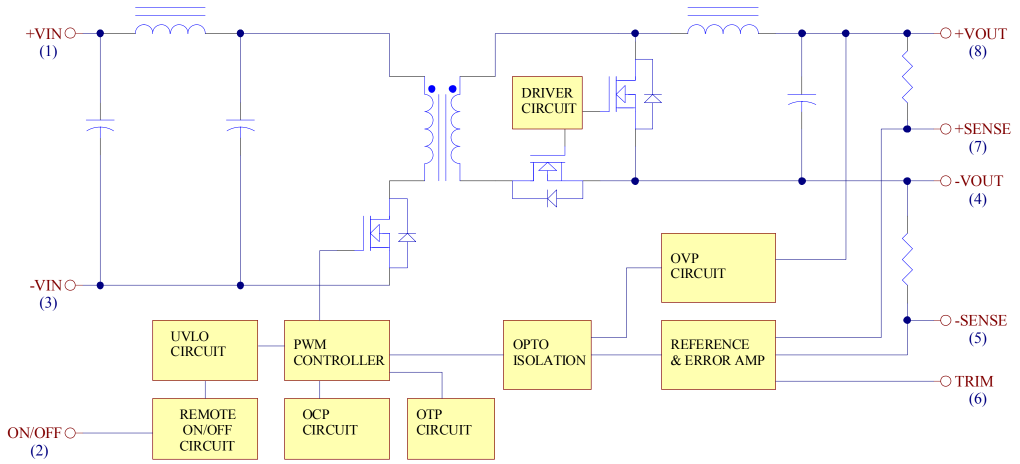
1. Introduction

This specification describes the features and functions of Cincon's CHB200 series of isolated DC-DC converters. These are highly efficient, reliable and compact, high power density, single output DC/DC converters. The modules can be used in the field of telecommunications, data communications, wireless communications, servers etc. The CHB200 series can deliver up to 50A output current and provide a precisely regulated output voltage over a wide range of 18-36 and 36-75VDC. The modules can achieve high efficiency up to 93%. The module offers direct cooling of dissipative components for excellent thermal performance. Standard features include remote on/off(positive or negative), remote sense, output voltage adjustment, over voltage, over current and over temperature protection.

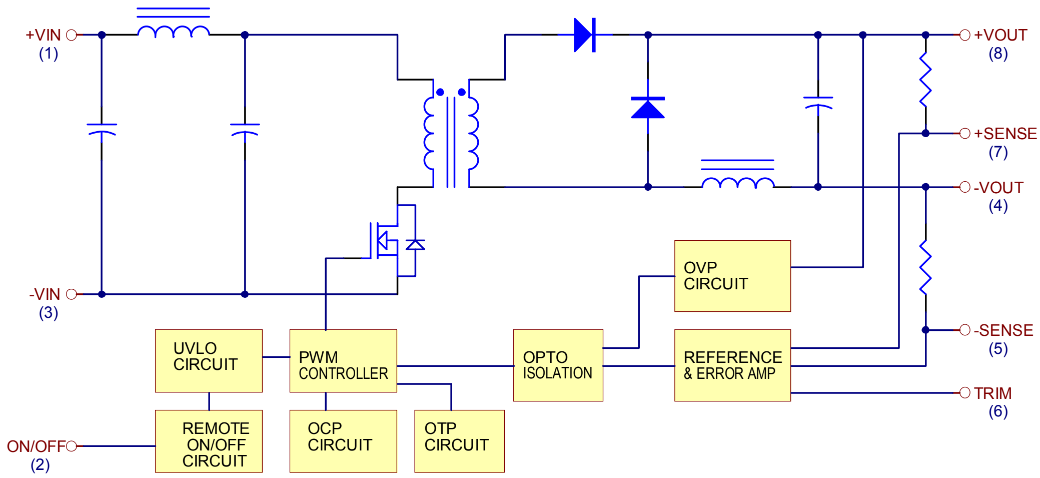
2. DC-DC Converter Features

- 165 - 200W Isolated Output
- Efficiency to 93%
- Fixed Switching Frequency
- Input under-voltage Protection
- Over Temperature Protection
- Over Voltage/Current Protection
- Remote On/Off
- Industry Standard Half-Brick Package
- Fully Isolated 1500VDC
- No Tantalum Capacitor Inside

3. Electrical Block Diagram



Electrical Block Diagram for 3.3Vout, 5Vout and 12Vout



Electrical Block Diagram for other modules

4. Technical Specifications

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

ABSOLUTE MAXIMUM RATINGS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input Voltage						
Continuous		24SXX	-0.3		36	V_{dc}
		48SXX	-0.3		75	
Transient	100ms	24SXX			50	V_{dc}
		48SXX			100	
Operating Case Temperature		All	-40		100	°C
Storage Temperature		All	-55		105	°C
Isolation Voltage	Input to Output, In to Case, Output to Case, 1 minute	All	1500			V_{dc}

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Operating Input Voltage		24SXX	18	24	36	V_{dc}
		48SXX	36	48	75	
Input Under Voltage Lockout						
Turn-On Voltage Threshold		24SXX	16	17	18	V_{dc}
		48SXX	34	35	36	
Turn-Off Voltage Threshold		24SXX	15	16	17	V_{dc}
		48SXX	32	33	35	
Lockout Hysteresis Voltage		24SXX		1		V_{dc}
		48SXX		2		
Maximum Input Current	100% Load, V_{in}=18V for 24SXX	24SXX		12.3		A
	100% Load, V_{in} =36V for 48SXX	48SXX		6.17		
No-Load Input Current	V_{in}=Nominal V_{in}	24S3V3		140		mA
		24S05		240		
		24S12		230		
		24S24		40		
		24S48		70		
		48S3V3		80		
		48S05		120		
		48S12		90		
		48S24		50		
		48S48		60		
Inrush Current (I^2t)		All			1	A^2s
Recommended Input Fuse	Fast blow type	48SXX		10		A
		24SXX		20		
Input Capacitance (External)	<0.7Ω ESR	48SXX	100			uF
		24SXX	220			

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}, Tc=25°C	Vo=3.3 V_{dc}	3.267	3.3	3.333	V_{dc}
		Vo=5.0 V_{dc}	4.95	5	5.05	
		Vo=12 V_{dc}	11.88	12	12.12	
		Vo=24 V_{dc}	23.76	24	24.24	
		Vo=48 V_{dc}	47.52	48	48.48	
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	Tc=-40°C to 100°C	All			±0.03	%/°C
Output Voltage Ripple and Noise (5Hz to 20MHz bandwidth)						
Peak-to-Peak	Full load, 10uF tantalum and 1.0uF ceramic capacitors	Vo= 3.3V_{dc}			100	mV
		Vo= 5.0V_{dc}			100	
		Vo=12V_{dc}			120	
		Vo=24V_{dc}			240	
		Vo=48V_{dc}			480	
RMS	Full load, 10uF solid tantalum and 1.0uF ceramic capacitors	Vo= 3.3V_{dc}			40	mV
		Vo= 5.0V_{dc}			40	
		Vo=12V_{dc}			60	
		Vo=24V_{dc}			100	
		Vo=48V_{dc}			200	
Operating Output Current Range		Vo= 3.3V_{dc}	0		50	A
		Vo= 5.0V_{dc}	0		40	
		Vo=12V_{dc}	0		16.7	
		Vo=24V_{dc}	0		8.3	
		Vo=48V_{dc}	0		4.2	
Output DC Current Limit Inception	Output Voltage=90% Nominal Output Voltage	All	105	125	140	%
Maximum Output Capacitance	Full load (resistive)	3.3-12V_{dc}			10000	uF
		24V_{dc}			2200	
		48V_{dc}	47		2000	

DYNAMIC CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Current Transient						
Step Change in Output Current	d_i/d_t=0.1A/us, Load change from 75% to 100% to 75% of Io,max	All			±5	%
Setting Time (within 1% Vout nominal)	d_i/d_t=0.1A/us	All			500	us
Turn-On Delay and Rise Time						
Turn-On Delay Time, From On/Off Control	$V_{on/off}$ to 90%V_{o_set}	All		35	55	ms
Turn-On Delay Time, From Input	V_{in_min} to 90%V_{o_set}	All		150	165	ms
Output Voltage Rise Time	10%V_{o_set} to 90%$_{Vo\_set}$	All		25	35	ms

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Efficiency	V_{in}=Nominal V_{in}, 100% Load	24S3V3		90		%
		24S05		91		
		24S12		92.5		
		24S24		91		
		24S48		91		
		48S3V3		90.5		
		48S05		91.5		
		48S12		93		
		48S24		91		
		48S48		91.5		

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input to Output	Input to Output, In to Case, Output to Case, 1 minute	All			1500	V_{dc}
Isolation Resistance		All	10			MΩ
Isolation Capacitance	Input to Output	All		1000		pF

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		Vo= 3.3V_{dc}		200		KHz
		Vo= 5.0V_{dc}		300		
		Vo=12V_{dc}		330		
		Vo=24V_{dc}		330		
		Vo=48V_{dc}		330		
On/Off Control, Positive Remote On/Off logic						
Logic Low (Module Off)		All	0		1.2	V
Logic High (Module On)		All	3.5 or Open Circuit		75	V
On/Off Control, Negative Remote On/Off logic						
Logic High (Module Off)		All	3.5 or Open Circuit		75	V
Logic High (Module On)		All	0		1.2	V
On/Off Current (for both remote on/off logic)	$I_{on/off}$ at $V_{on/off}$=0.0V	All			1	mA
Leakage Current (for both remote on/off logic)	Logic High, $V_{on/off}$=15V	All			1	mA
Off Converter Input Current	Shutdown input idle current	All		10	15	mA
Output Voltage Trim Range	P_{out}=max rated power	All	-10		+10	%
Output Over Voltage Protection		All	115	125	140	%
Over-Temperature Shutdown		All		110		°C

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		750		K hours
Weight		All		114		grams

5. Main Features and Functions

5.1 Operating Temperature Range

The CHB200 series converters can be operated within a wide case temperature range of -40°C to 100°C. Consideration must be given to the de-rating 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 is adjustable within the range of +10% to –10%.

5.3 Over Current Protection

The converter is protected against over current or short circuit conditions. At the instance of current-limit inception, the module enters a hiccup mode of operation, whereby it shuts down and automatically attempts to restart. While the fault condition exists, the module will remain in this hiccup mode, and can remain in this mode until the fault is cleared. The unit operates normally once the output current is reduced back into its specified range.

5.4 Output Over Voltage Protection

The converter is protected against output over voltage conditions. When the output voltage is higher than the specified range, the module enters a hiccup mode of operation. The operation is identical with over current protection.

5.5 Remote On/Off

The on/off input pin permits the user to turn the power module on or off via a system signal. Two remote on/off options are available. Positive logic turns the module on during a logic high voltage on the on/off pin, and off during a logic low. Negative logic remote On/Off turns the module off during a logic high and on during a logic low. The on/off pin is internally pulled up through a resistor. A properly de-bounced mechanical switch, open collector transistor, or FET can be used to drive the input of the on/off pin. If not using the remote on/off feature:
For positive logic, leave the on/off pin open.
For negative logic, short the on/off pin to VIN(-).

5.6 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard with this converter. At input voltages below the input under voltage lockout limit, the module operation is disabled.

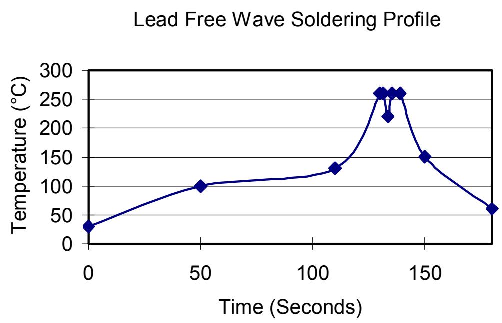
5.7 Over Temperature Protection

These modules have an over temperature protection circuit to safeguard against thermal damage. When the case temperature rises above over temperature shutdown threshold, the converter will shut down to protect it from overheating. The module will automatically restart after it cools down.

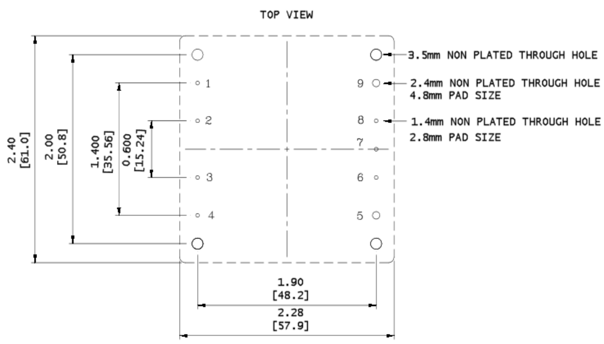
6. Applications

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.



Note：
1. Soldering Materials: Sn/Cu/Ni
2. Ramp up rate during preheat: 1.4 ℃/Sec (From 50℃ to 100℃)
3. Soaking temperature: 0.5 ℃/Sec (From 100℃ to 130℃), 60±20 seconds
4. Peak temperature: 260℃, above 250℃ 3~6 Seconds
5. Ramp up rate during cooling: -10.0 ℃/Sec (From 260℃ to 150℃)



6.2 Convection Requirements for Cooling

To predict the approximate cooling needed for the half brick module, refer to the power de-rating curves in section 6.4. These de-rating 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 being measured at the center of the top of the case (thus verifying proper cooling).

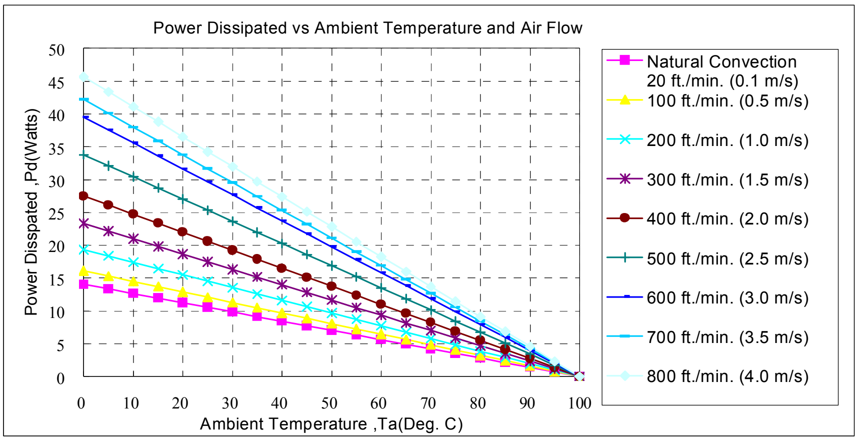
6.3 Thermal Considerations

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 test data 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 Power De-rating

The operating case temperature range of CHB200 series is -40°C to +100°C. When operating the CHB200 series, proper de-rating or cooling is needed. The maximum case temperature under any operating condition should not exceed 100°C.

The following curve is the de-rating curve of CHB200 series without heat sink.



AIR FLOW RATE	TYPICAL Rca
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 (without heatsink):

What is the minimum airflow necessary for a CHB200-48S3V3 operating at nominal line voltage, an output current of 50A, and a maximum ambient temperature of 40°C?

Solution:

Given:

Vin=48Vdc, Vo=3.3Vdc, Io=50A

Determine Power dissipation (Pd):

$Pd = Pi - Po = Po(1-\eta)/\eta$

$Pd = 3.3V \times 50A \times (1-0.9)/0.9 = 18.3Watts$

Determine airflow:

Given: Pd =18.3W and Ta=40°C

Check Power De-rating curve:

Minimum airflow= 500 ft./min.

Verify:

Maximum temperature rise is

$\Delta T = Pd \times Rca = 18.3W \times 2.96 = 54.2°C$.

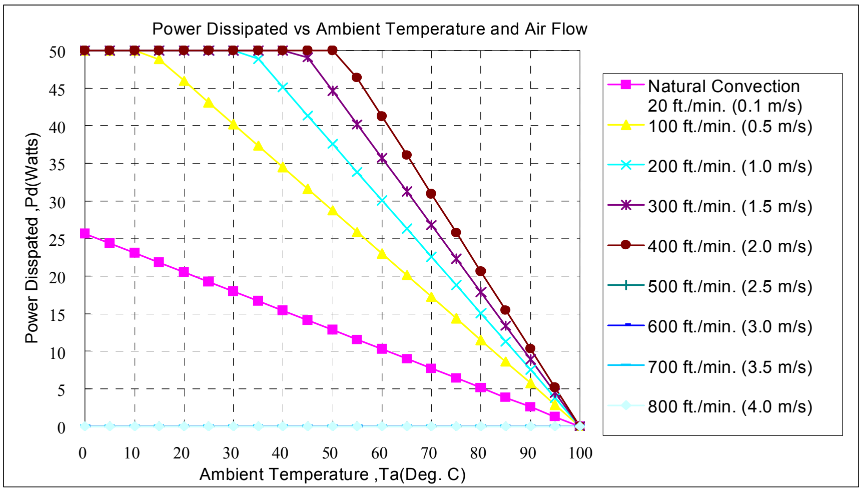
Maximum case temperature is

$Tc = Ta + \Delta T = 94.2°C < 100°C$.

Where:

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

T_a is ambient temperature and T_c is case temperature.



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	3.9 ℃/W
100 ft./min. (0.5m/s)	1.74 ℃/W
200 ft./min. (1.0m/s)	1.33 ℃/W
300 ft./min. (1.5m/s)	1.12 ℃/W
400 ft./min. (2.0m/s)	0.97 ℃/W

Example with heatsink HBL210 (M-C308):

What is the minimum airflow necessary for a CHB200-48S3V3 operating at nominal line voltage, an output current of 50A, and a maximum ambient temperature of 60°C?

Solution:

Given:

Vin=48Vdc, Vo=3.3Vdc, Io=50A

Determine Power dissipation (Pd):

Pd =Pi-Po=Po(1-η)/η

Pd =3.3V×50A×(1-0.9)/0.9=18.3Watts

Determine airflow:

Given: Pd =18.3W and Ta=60°C

Check Power De-rating curve:

Minimum airflow= 100 ft./min.

Verify:

Maximum temperature rise is

ΔT = Pd × Rca=18.3W×1.74=31.9°C.

Maximum case temperature is

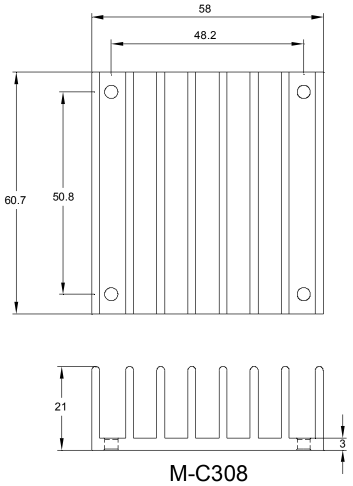
Tc=Ta+ΔT=91.9°C <100°C.

Where:

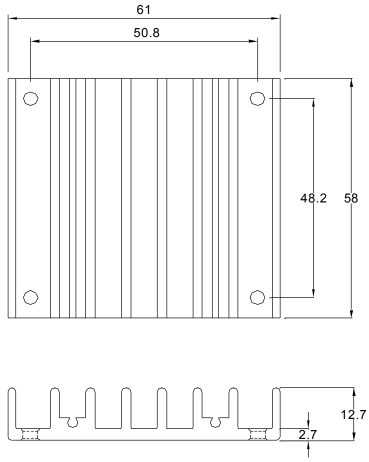
The R_{ca} is thermal resistance from case to ambient environment.

T_a is ambient temperature and T_c is case temperature.

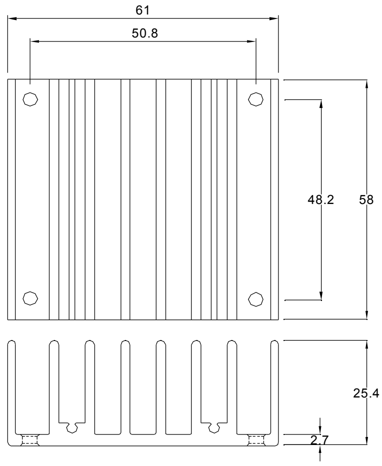
6.5 Half Brick Heat Sinks:



M-C308



M-C091



M-C092

HBL210 (M-C308) G6620400201
Longitudinal Heat Sink

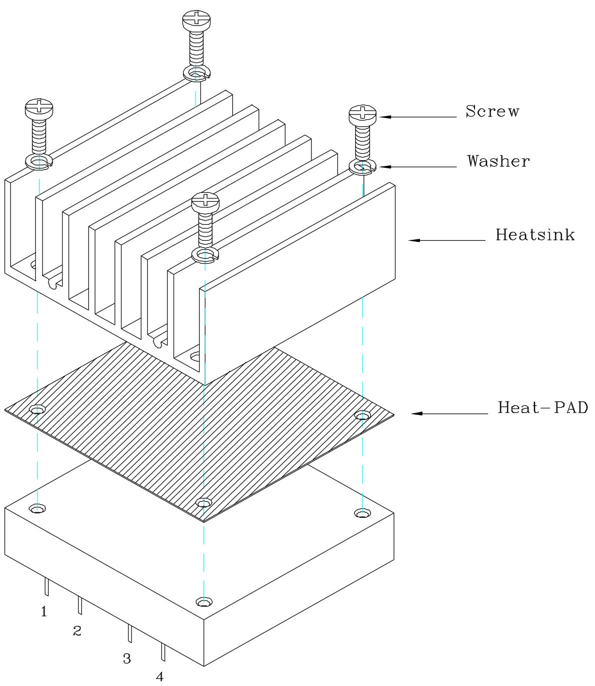
Rca:
3.90°C/W (typ.), natural convection
1.74°C/W (typ.), at 100LFM
1.33°C/W (typ.), at 200LFM
1.12°C/W (typ.), at 300LFM
0.97°C/W (typ.), at 400LFM

HBT127 (M-C091) G6610120402
Transverse Heat Sink

Rca:
4.70°C/W (typ.), natural convection
2.89°C/W (typ.), at 100LFM
2.30°C/W (typ.), at 200LFM
1.88°C/W (typ.), at 300LFM
1.59°C/W (typ.), at 400LFM

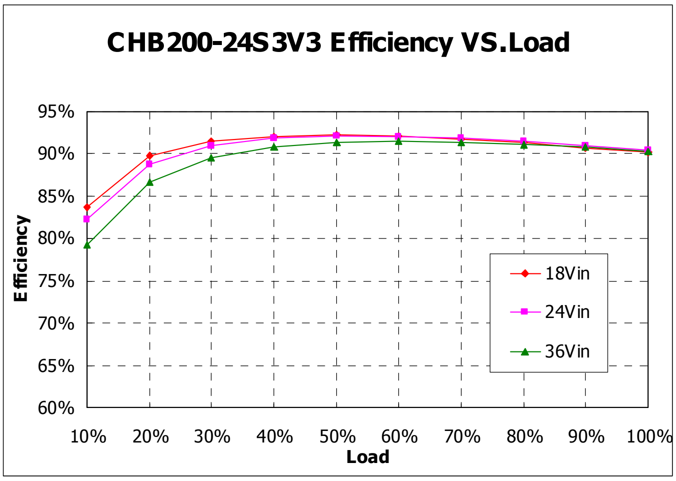
HBT254 (M-C092) G6610130402
Transverse Heat Sink

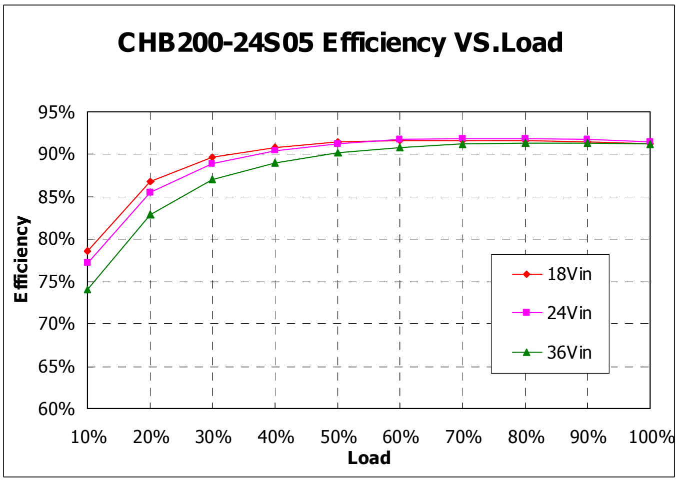
Rca:
3.00°C/W (typ.), natural convection
1.44°C/W (typ.), at 100LFM
1.17°C/W (typ.), at 200LFM
1.04°C/W (typ.), at 300LFM
0.95°C/W (typ.), at 400LFM

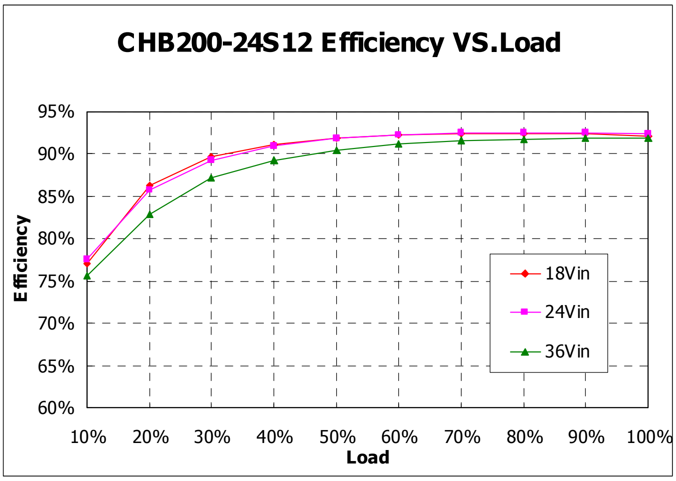


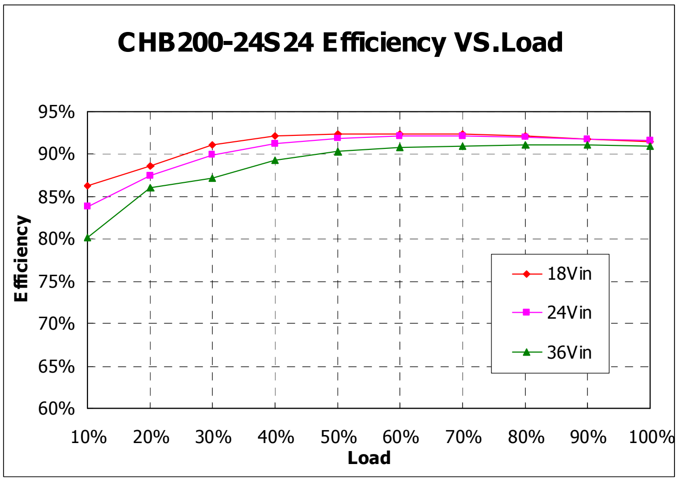
THERMAL PAD PH01: SZ 56.9*60*0.25 mm (G6135041091)
SCREW & Washer: M3*8L (G75A1300322) & WS3.2N (G75A47A0752)

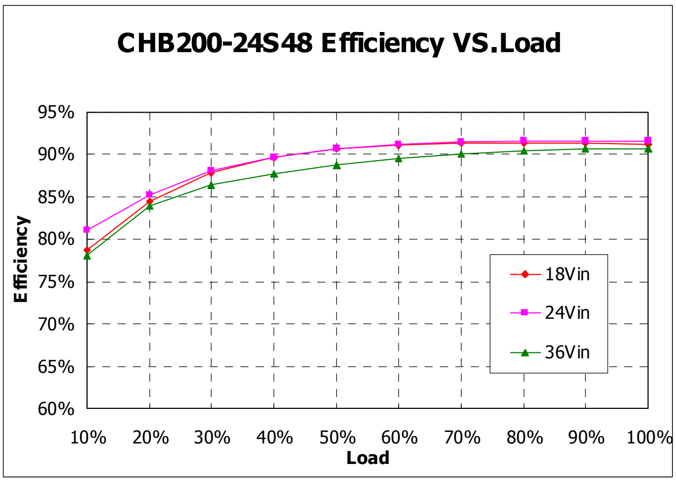
6.6 Efficiency VS. Load

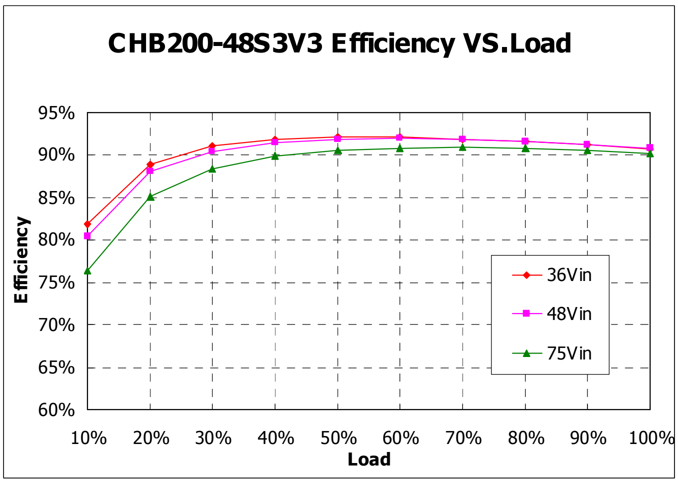


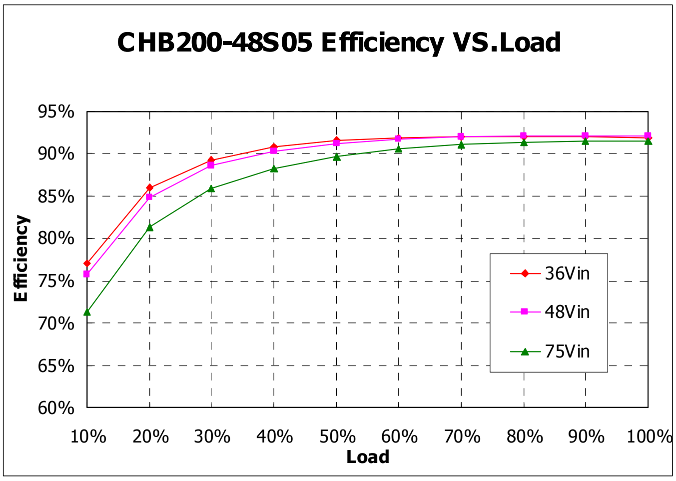


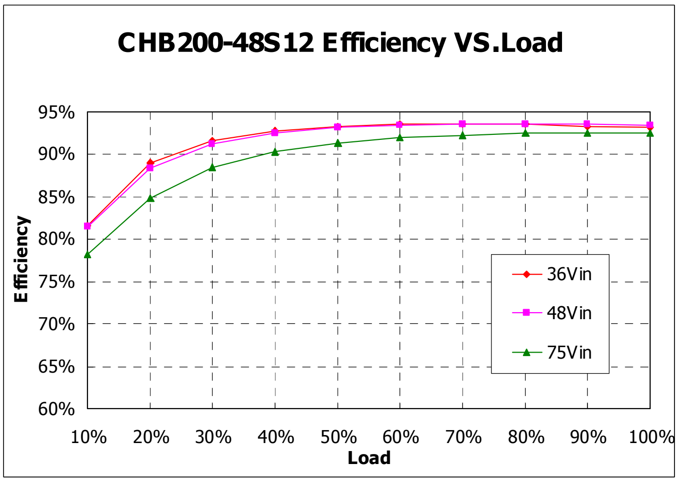


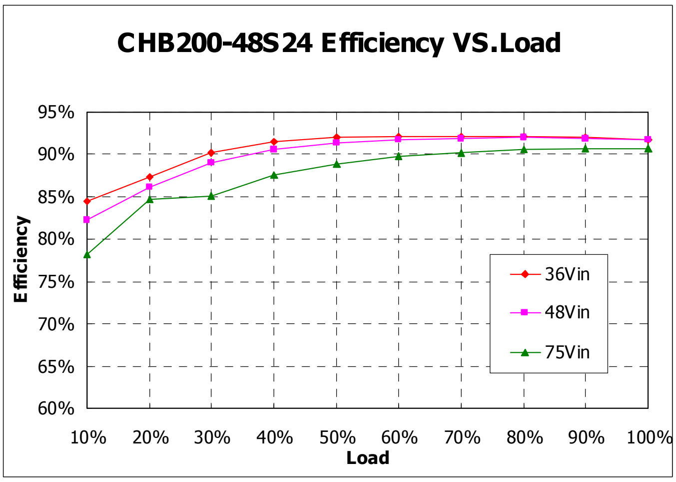


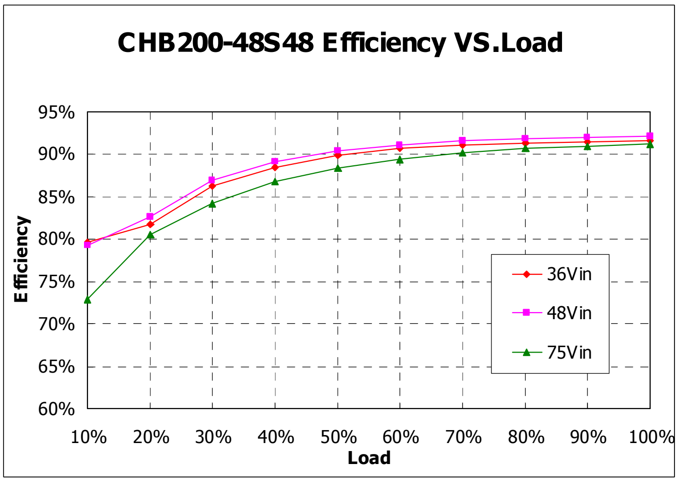




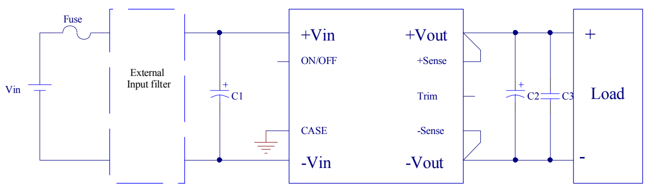

CHB200-48S05 Efficiency VS.Load
Efficiency
95%
90%
85%
80%
75%
70%
65%
60%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Load
36Vin
48Vin
75Vin


CHB200-48S12 Efficiency VS.Load
Efficiency
95%
90%
85%
80%
75%
70%
65%
60%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Load
36Vin
48Vin
75Vin

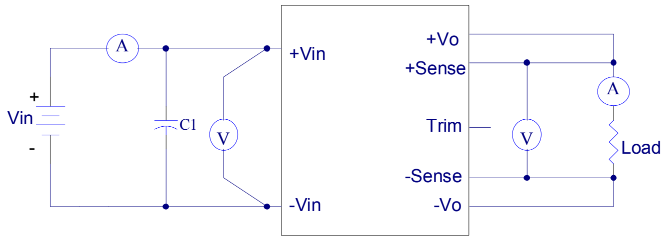

CHB200-48S24 Efficiency VS.Load
Efficiency
95%
90%
85%
80%
75%
70%
65%
60%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Load
36Vin
48Vin
75Vin


CHB200-48S48 Efficiency VS.Load
Efficiency
95%
90%
85%
80%
75%
70%
65%
60%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Load
36Vin
48Vin
75Vin

6.7 Test Set-Up



Typical electrical connection (Positive logic)



CHB200 Series Test Setup

For typical electrical connection, please refer to the connection above.

1. Put input capacitor, C1 more than 100uF for 48Vin models and more than 220uF for 24Vin models. If the ambient temperature is less than -20℃, use twice of the recommended capacitor above. If the impedance of input line is high, input capacitor must be more than above.
2. Put output capacitor C2 and C3 according to minimum and maximum capacitor recommendation on page 5. If the ambient temperature is less than -20℃,use at least 3 pieces of the recommended minimum capacitors.
3. Use external fuse for each unit.

The basic test set-up to measure parameters such as efficiency and load regulation 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:

$$\eta = \frac{Vo \times Io}{Vin \times Iin} \times 100\%$$

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

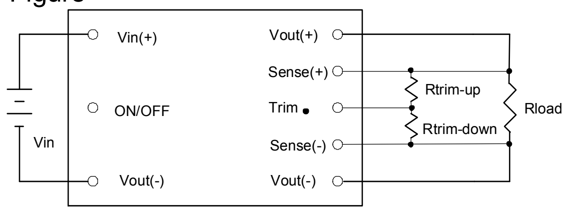
The value of line regulation is defined as:

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

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.

6.8 Output Voltage Adjustment

The Trim input permits the user to adjust the output voltage up or down 10%. This is accomplished by connecting an external resistor between the Trim pin and either the V_{out} (+) pin or the V_{out}(-) pin (COM pin), see Figure



Output voltage trim circuit configuration

The Trim pin should be left open if trimming is not being used. Connecting an external resistor ($R_{trim\text{-}down}$) between the Trim pin and the V_{out}(-) (or Sense(-)) pin decreases the output voltage. For 3.3V~24V models, the following equation determines the required external resistor value to obtain a down percentage output voltage change of Δ%

$$R_{trim-down} = \left[\frac{511}{\Delta\%} - 10.22\right] k\Omega$$

Where

$$\Delta\% = \left(\frac{V_{o,set} - V_{desired}}{V_{o,set}}\right) \times 100$$

For example, to trim-down the output voltage of 12V module(CHB200-48S12) by 5% to 11.4V, $R_{trim\text{-}down}$ is calculated as follow:

△%=5

$$R_{trim-down} = (\frac{511}{5} - 10.22) k\Omega$$

$$R_{trim-down} = 91.98 k\Omega$$

For 48V models, the following equation determines the required external resistor value to obtain a down percentage output voltage change of Δ%

$$R_{trim-down} = \left[\frac{2000}{\Delta\%} - 40\right] k\Omega$$

Where

$$\Delta\% = \left(\frac{V_{o,set} - V_{desired}}{V_{o,set}}\right) \times 100$$

For example, to trim-down the output voltage of 48V module(CHB200-48S48) by 8% to 44.16V, $R_{trim-down}$ is calculated as follow: △%=8

$$R_{trim-down} = (\frac{2000}{8} - 40)k\Omega$$

$$R_{trim-down} = 210k\Omega$$

Connecting an external resistor ($R_{trim-up}$) between the Trim pin and the V_{out} (+) (or Sense (+)) pin increases the output voltage. For 3.3V~24V models, the following equations determine the required external resistor value to obtain a up percentage output voltage change of Δ%

$$R_{trim-up} = \left[\frac{5.11V_{out}(100+\Delta\%)}{1.24\times\Delta\%} - \frac{511}{\Delta\%} - 10.22\right]k\Omega$$

Where

$$V_{out} = V_{o,set}\ ,\ \Delta\% = \left(\frac{V_{desired} - V_{o,set}}{V_{o,set}}\right)\times 100$$

For example, to trim-up the output voltage of 12V module (CHB200-48S12) by 5% to 12.6V, $R_{trim-up}$ is calculated as follow:
△%=5

$$R_{trim-up} = (\frac{5.11\times 12\times(100+5)}{1.24\times 5} - \frac{511}{5} - 10.22)k\Omega$$

$$R_{trim-up} = 924k\Omega$$

For 48V models, the following equations determine the required external resistor value to obtain a up percentage output voltage change of Δ%.

$$R_{trim-up} = \left[\frac{20V_{out}(100+\Delta\%)}{1.24\times\Delta\%} - \frac{2000}{\Delta\%} - 40\right]k\Omega$$

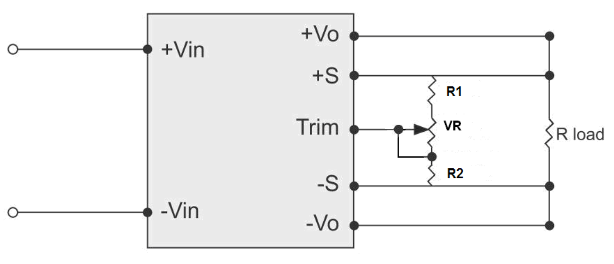
Where

$$V_{out} = V_{o,set}\ ,\ \Delta\% = \left(\frac{V_{desired} - V_{o,set}}{V_{o,set}}\right)\times 100$$

For example, to trim-up the output voltage of 48V module(CHB200-48S48) by 8% to 51.84V, $R_{trim-up}$ is calculated as follow: △%=8

$$R_{trim-up} = (\frac{20\times 48\times(100+8)}{1.24\times 8} - \frac{2000}{8} - 40)k\Omega$$

$$R_{trim-up} = 10161k\Omega$$



Output voltage trim circuit configuration with VR

Recommend Resistor Values:

V_{out} (V)	R1 (KΩ)	R2 (KΩ)	VR (KΩ)
3.3	9.1	7.5	10
5	13.7	5.6	10
12	30	4.3	20
15	36	3.9	20
24	43	2.7	20
48	68	2	20

For CHB200-xxS3V3, 05, 12, 15, 24

$$R1 + VR \geq \frac{37.543\times R2\times Vo - 40.88\times R2}{40.88 - R2}(K\Omega) \text{ .... (1)}$$

$$R1 \leq \frac{45.886\times R2\times Vo - 61.32\times R2}{61.32 + R2}(K\Omega) \text{ .... (2)}$$

$$VR \geq (1) - (2)$$

For CHB200-xxS48

$$R1 + VR \geq \frac{146.939\times R2\times Vo - 160\times R2}{160 - R2}(K\Omega) \text{ .... (1)}$$

$$R1 \leq \frac{179.592\times R2\times Vo - 240\times R2}{240 + R2}(K\Omega) \text{ .... (2)}$$

$$VR \geq (1) - (2)$$

Ex: CHB200-24S12
IF R2=4.3KΩ

$$R1 + VR \geq \frac{37.543\times 4.3\times 12 - 40.88\times 4.3}{40.88 - 4.3} = 48.153K\Omega$$

$$R1 \leq \frac{45.886\times 4.3\times 12 - 61.32\times 4.3}{61.32 + 4.3} = 32.064K\Omega$$

$$VR \geq 48.153 - 32.064 = 16.089K\Omega$$

R1 use 30K, VR use 20K

Ex: CHB200-24S48
IF R2=2KΩ

$$R1 + VR \geq \frac{146.939\times 2\times 48 - 160\times 2}{160 - 2} = 87.254K\Omega$$

$$R1 \leq \frac{179.592\times 2\times 48 - 240\times 2}{240 + 2} = 69.26K\Omega$$

$$VR \geq 87.254 - 69.26 = 17.994K\Omega$$

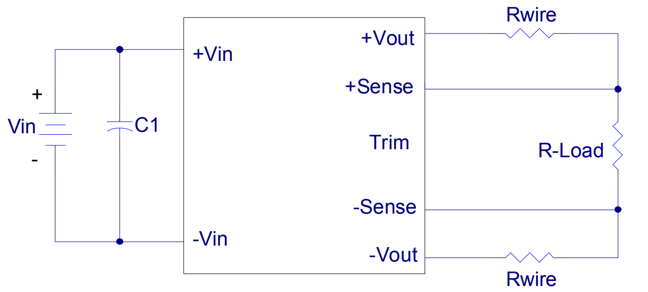
R1 use 68K, VR use 20K

6.9 Output Remote Sensing

The CHB200 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 CHB200 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:

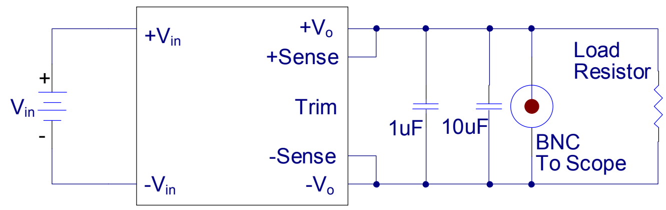
$[(+V_{out}) - (-V_{out})] – [(+Sense) – (-Sense)] \leqq 10\%$ of $V_{o\_nominal}$

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 +Vout pin at the module and the -Sense pin should be connected to the -Vout pin at the module.
This is shown in the schematic below.



Note: Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim. The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased and consequently increase the power output of the module if output current remains unchanged. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power (Maximum rated power = $V_{o,set}$ x $I_{o,max}$)

6.10 Output Ripple and Noise



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

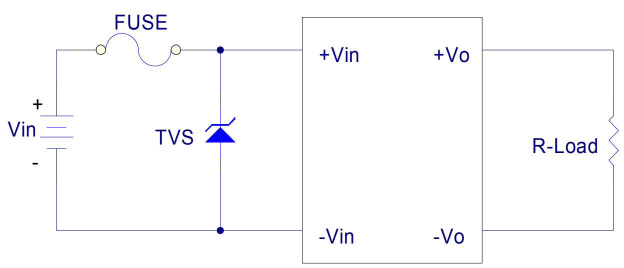
6.11 Output Capacitance

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. For absolute maximum value of CHB200 series' output capacitance, please refer to Page6-Maximum Output Capacitance .For values larger than this, please contact your local CINCON's representative.

7. Safety & EMC

7.1 Input Fusing and Safety Considerations

The CHB200 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 15A fast acting fuse for 24V_{in} models, and 8A for 48V_{in} 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).



8. Part Number

Format: CHB200 – II O XX L

Parameter	Series	Nominal Input Voltage	Number of Outputs	Output Voltage	Remote On/Off Logic
Symbol	CHB200	II	O	XX	L
Value	CHB200	24: 24 Volts 48: 48 Volts	S: Single	3V3: 3.3 Volts 05: 5 Volts 12: 12 Volts 24: 24 Volts 48: 48 Volts	None: Positive N: Negative

9. Mechanical Specifications

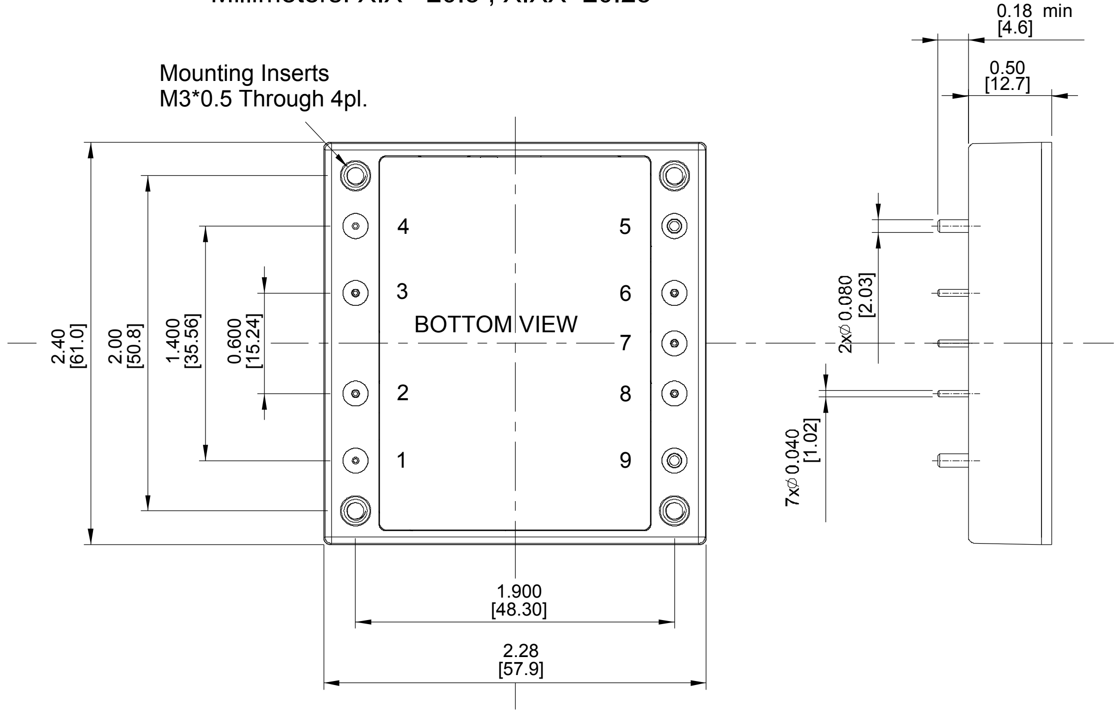
9.1 Mechanical Outline Diagrams

CASE HB

All Dimensions In Inches(mm)

Tolerances Inches: X.XX= ±0.02 , X.XXX= ±0.010

Millimeters: X.X= ±0.5 , X.XX=±0.25



Pin	Function
1	+V Input
2	On/Off
3	CASE
4	-V Input
5	-V Output
6	-Sense
7	Trim
8	+Sense
9	+V Output

CHB200 Mechanical Outline Diagram

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