ISOLATED DC-DC CONVERTER CHB300W-110S SERIES APPLICATION NOTE

Approved By:

Department	Approved By	Checked By	Written By
Research and Development Department	Jacky	Danny/Louis	Joyce
Design Quality Department	Benny	JoJo	

Contents

CHB300W-110S Series
Application Note V14

1. Introduction

The CHB300W-110S series of DC-DC converters offers 198-300 watts of output power @ single output voltages of 3.3, 05, 12, 24, 28, 48VDC with industry standard half -brick. It has a wide (4:1) input voltage range of 43 to 160VDC (110VDC nominal) and 3000VDC basic isolation.

Compliant with EN 50155, EN 45545-2, EN 50121-3-2. High efficiency up to 91%, allowing case operating temperature range of -40℃ to 100℃. An optional heat sink is available to extend the full power range of the unit. Very low no load power consumption (10mA), an ideal solution for energy critical systems.

The standard control functions include remote on/off (positive or negative) and +10%, -10% adjustable output voltage.

Fully protected against input UVLO (under voltage lock out), output over-current, output over-voltage and over-temperature and continuous short circuit conditions.

CHB300W-110S series is designed primarily for common railway applications of 72V, 96V, 110V nominal voltage and also suitable for distributed power architectures, telecommunications, battery operated equipment, industrial and mobile equipment application.

2. Pin Function Description

BOTTOM VIEW   4FG
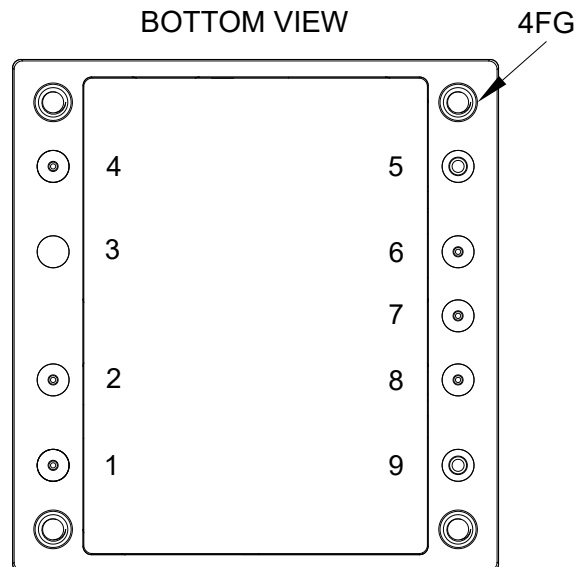
| No	Label	Function	Description	Reference
1	+Vin	+V Input	Positive Supply Input	**Section 7.1**
2	ON/OFF	On/Off	External Remote On/Off Control	**Section 6.5**
3	NP	NP	No Pin	
4	-Vin	-V Input	Negative Supply Input	**Section 7.1**
5	-Vo	-V Output	Negative Power Output	**Section 7.3/7.4**
6	-Sen	-Sense	Negative Output Remote Sense	**Section 6.6**
7	Trim	Trim	External Output Voltage Adjustment	**Section 6.7**
8	+Sen	+Sense	Positive Output Remote Sense	**Section 6.6**
9	+Vo	+V Output	Positive Power Output	**Section 7.3/7.4**
--	--	Mounting Insert	Mounting Insert (FG)	**Section 9.5**

Note: Base plate can be connected to FG through M3 threaded mounting insert. Recommended torque 3Kgf-cm.

3. Connection for Standard Use

The connection for standard use is shown below. An external input capacitor (C1) 220uF for all models is recommended to reduce input ripple voltage. External output capacitors (C2, C3) are recommended to reduce output ripple and noise, 47uF T521 KO capacitor and 1uF ceramic capacitor for 3.3V & 5Vout, and 10uF aluminum and 1uF ceramic capacitor for other models.
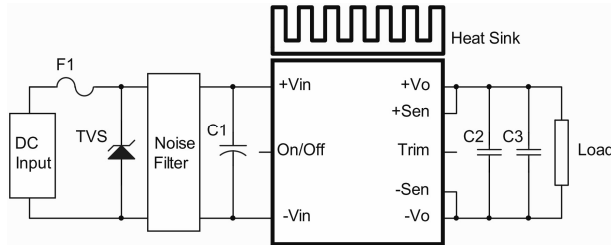
Symbol	Component	Reference
F1, TVS	Input fuse, TVS	**Section 10.1**
C1	External capacitor on input side	**Note Section 7.1**
C2, C3	External capacitor on the output side	**Section 7.3/7.4**
Noise Filter	External input noise filter	**Section 10.2**
Remote On/Off	External Remote On/Off control	**Section 6.5**
Trim	External output voltage adjustment	**Section 6.7**
Heat Sink	External heat sink	**Section 9.2/9.3/9.4/9.5**
+Sense/-Sense	--	**Section 6.6**

Note:
If the impedance of input line is high, C1 capacitance must be more than above. Use more than two recommended capacitor above in parallel when ambient temperature becomes lower than -20℃.

4. Test Set-Up

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:

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

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:

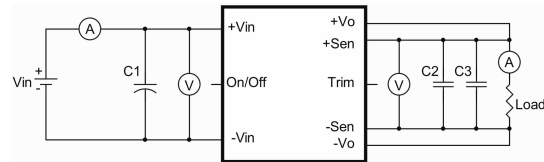$$Load\ reg. = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

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

CHB300W-110S series Test Setup

C1: 220uF/200V ESR<0.14Ω
C2: 1uF/1210 ceramic capacitor
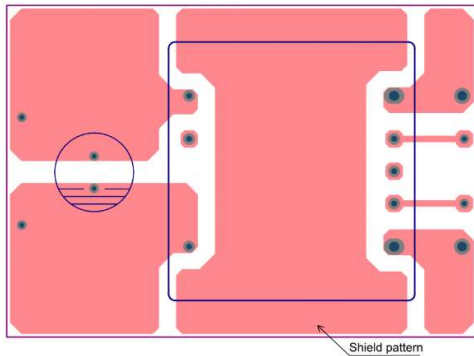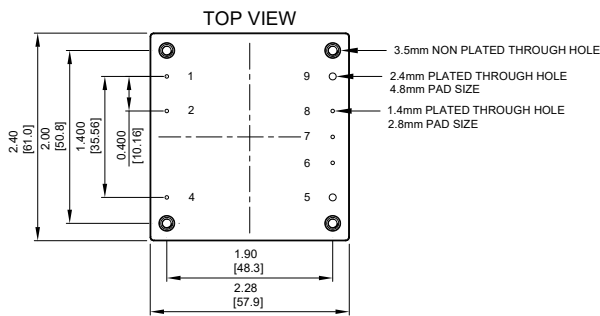C3: 10uF aluminum solid capacitor for other models
    47uF T521 KO CAP. <55mR for 3.3V&5Vout

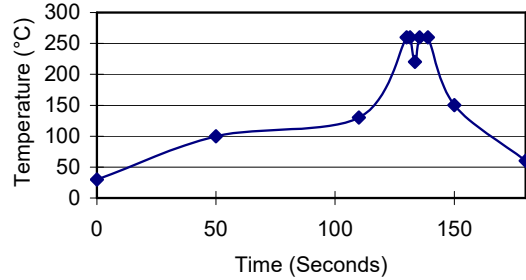## 5. Recommend Layout, PCB Footprint and Soldering Information

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.

Lead Free Wave Soldering Profile

TOP VIEW

- 3.5mm NON PLATED THROUGH HOLE
- 2.4mm PLATED THROUGH HOLE 4.8mm PAD SIZE
- 1.4mm PLATED THROUGH HOLE 2.8mm PAD SIZE

Shield pattern

Clean the soldered side of the module with a brush, prevent liquid from getting into the module. Do not clean by soaking the module into liquid. Do not allow solvent to come in contact with product labels or resin case as this may changed the color of the resin case or cause deletion of the letters printed on the product label. After cleaning, dry the modules well.

The suggested soldering iron is 450℃ for up to 5seconds (less than 90W). Furthermore, the recommended soldering profile is shown below.
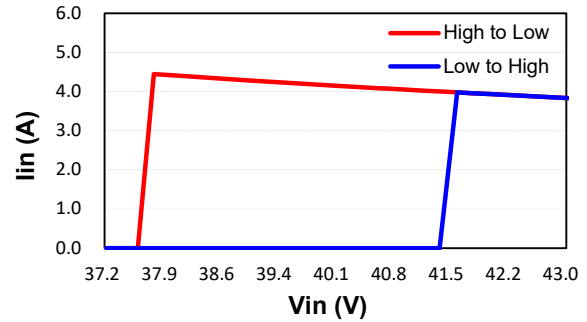
6. Features and Functions

6.1 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard on the CHB300W-110S series 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.
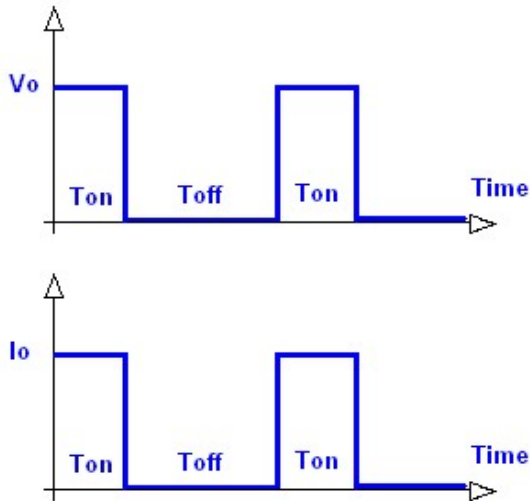
Vin Vs Iin

6.2 Over Current/Short Circuit 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 converter will go into hiccup mode protection.


6.3 Output Over Voltage Protection

The output over voltage protection consists of circuitry that internally limits the output voltage. If more accurate output over voltage protection is required, then an external circuit can be used via the remote **on/off** pin.

Note: Please note that device inside the power supply might fail when voltage more than rate output voltage is applied to output pin. This could happen when the customer tests the over voltage protection of unit. OVP can be tested by using the TRIM UP function. Consult us for more information.

6.4 Over Temperature Protection

These modules have an over temperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below over temperature recovery threshold. Please measure case temperature of the center part of aluminum base plate.
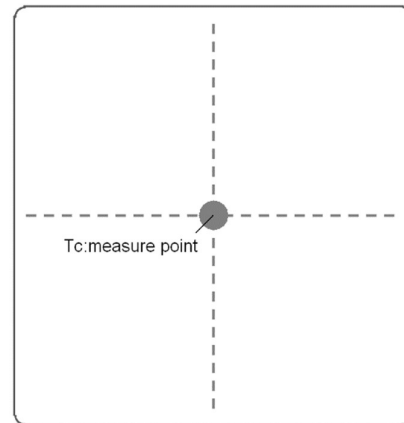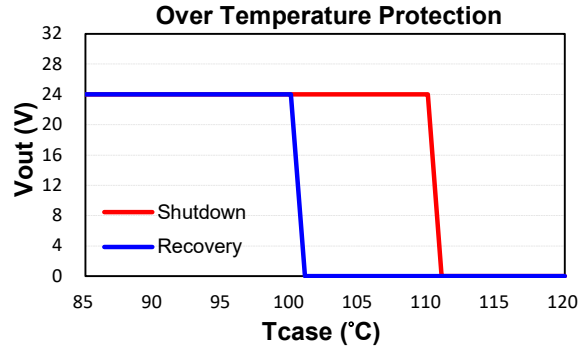
6.5 Remote On/Off

The CHB300W-110S 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 high (>3.5Vdc to 160Vdc or open circuit). Setting the pin low (0 to<1.2Vdc) will turn the converter off. 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 high (>3.5Vdc to 160Vdc or open circuit). The converter turns on if the **on/off** pin input is low (0 to<1.2Vdc). Note that the converter is off by default.

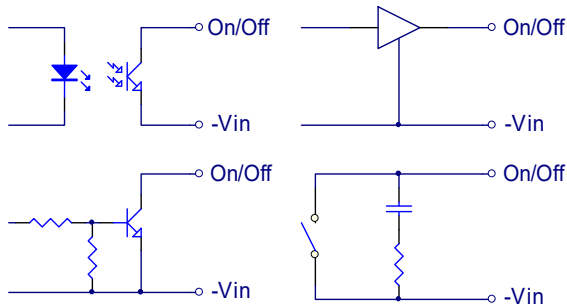| Logic State (Pin 2)	Negative Logic	Positive Logic
Logic Low	Module on	Module off
Logic High	Module off	Module on

The converter remote **on/off** circuit built-in on input side. The ground pin of input side remote **on/off** circuit is -Vin pin. Inside connection sees below.
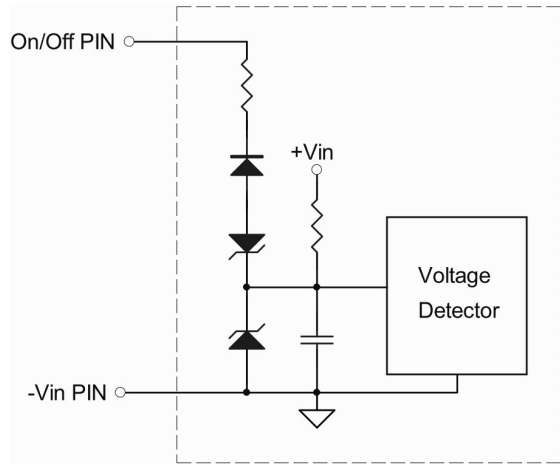

Connection examples see below

Remote On/Off Connection Example

6.6 Output Remote Sensing

The CHB300W-110S 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 CHB300W-110S 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 $V_{o\_nominal}$

When remote sense is in use, the sense should be connected by twisted-pair wire or shield wire. If the sensing patterns short, heave current flows and the pattern may be damaged. Output voltage might become unstable because of impedance of wiring and load condition when length of wire is exceeding 400mm. This is shown in the schematic below.

Wire as close as passible
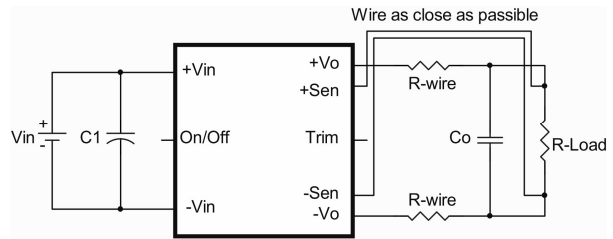
If the remote sense feature is not to be used, the sense pins should be connected locally. The +Sense pin should be connected to the +Vout pin at the module and the -Sense pin should be connected to the -Vout pin at the module. Wire between +Sense and +Vout and between -Sense and -Vout as short as possible. Loop wiring should be avoided. The converter might become unstable by noise coming from poor wiring. This is shown in the schematic below.


Short at pin root
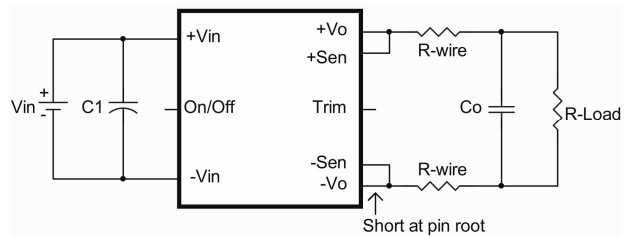
Note:
Although the output voltage can be varied (increased or decreased) by both remote sense and trim, the maximum variation for the output voltage is the larger of the two values not the sum of the values. The output power delivered by the module is defined as the voltage at the output terminals multiplied 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.

6.7 Output Voltage Adjustment

Output may be externally trimmed (±10%) with a fixed resistor or an external trim pot as shown (optional). Model specific formulas for calculating trim resistors are available upon request as a separate document.
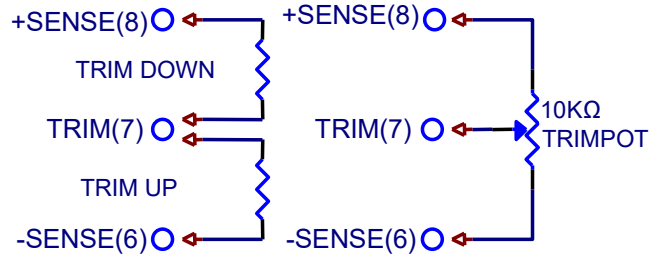
In order to trim the voltage up or down, one needs to connect the trim resistor either between the trim pin and -Sense for trim-up or between trim pin and +Sense for trim-down. The output voltage trim range is (±10%). This is shown:
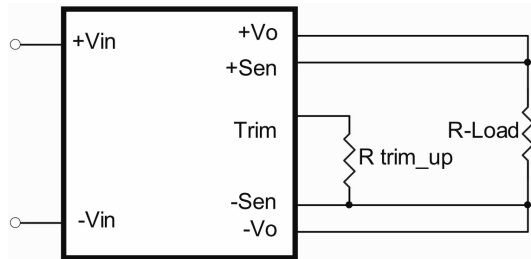
Trim-up Voltage Setup
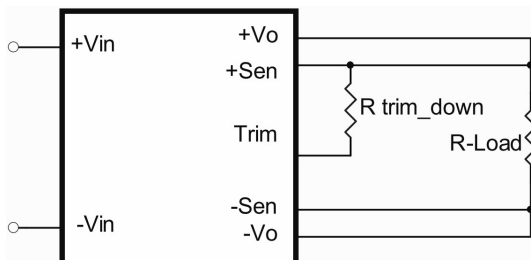
Trim-down Voltage Setup

Table 1 – Trim up and Trim down Resistor Values

Model Number	Output Voltage(V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vr (V)	Vf (V)
CHB300W-110S3V3	3.3	3.0	12	4.3	1.24	0.46
CHB300W-110S05	5	2.32	3.3	0	2.5	0
CHB300W-110S12	12	9.1	51	5.1	2.5	0.46
CHB300W-110S24	24	20	100	7.5	2.5	0.46
CHB300W-110S28	28	23.7	150	6.2	2.5	0.46
CHB300W-110S48	48	36	270	5.1	2.5	0.46

The value of R_{trim_up} defined as:

For Vo=5V Rtrim_up decision:

$$Rtrim\_up = \frac{R1Vr}{Vo - Vo\_nom} - R_2 \ (K\Omega)$$

For others Rtrim_up decision:

$$Rtrim\_up = (\frac{R1(Vr - Vf(\frac{R2}{R2 + R3}))}{Vo - Vo\_nom}) - \frac{R2R3}{R2 + R3} \ (K\Omega)$$

Where:

R_{trim_up} is the external resistor in KΩ

V_{o_nom} is the nominal output voltage

V_o is the desired output voltage

R1, R2, R3 and V_r are internal components

For example, to trim-up the output voltage of 12V module (CHB300W-110S12) by 5% to 12.6V, R_{trim_up} is calculated as follows:

$V_o - V_{o\_nom}$ = 12.6 – 12 = 0.6V

R1 = 9.1 KΩ

R2 = 51 KΩ

R3 = 5.1KΩ

V_r= 2.5 V, V_f=0.46 V

$$Rtrim\_up = \frac{18.944}{0.6} - 4.636 = 26.94 \ (K\Omega)$$

The typical value of R_{trim_up}

Trim up (%)	3.3V	5V	12V	24V	28V	48V
	R_{trim_up} (KΩ)					
1%	78.78	112.7	153.2	165.7	168.3	148.6
2%	37.80	54.70	74.30	79.36	81.16	71.81
3%	24.15	35.37	47.99	50.58	52.12	46.21
4%	17.32	25.70	34.83	36.19	37.60	33.40
5%	13.22	19.90	26.94	27.56	28.86	25.72
6%	10.49	16.03	21.68	21.80	23.08	20.60
7%	8.54	13.27	17.92	17.69	18.93	16.94
8%	7.08	11.20	15.10	14.61	15.82	14.20
9%	5.94	9.589	12.91	12.21	13.40	12.07
10%	5.03	8.300	11.15	10.29	11.47	10.36

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The value of R$_{trim\_down}$ defined as:

$$Rtrim\_down = \frac{R1 \times (Vo - Vr)}{Vo\_nom - Vo} - R2 \ (K\Omega)$$

Where:

R$_{trim\_down}$ is the external resistor in KΩ

V$_{o\_nom}$ is the nominal output voltage

V$_o$ is the desired output voltage

R1, R2, R3 and V$_r$ are internal components

For example: to trim-down the output voltage of 12V module (CHB300W-110S12) by 5% to 11.4V, R$_{trim\_down}$ is calculated as follows:

V$_{o\_nom}$ − V$_o$ = 12 − 11.4 = 0.6 V
R1 = 9.1 KΩ
R2 = 51 KΩ
V$_r$ = 2.5 V

$$Rtrim\_down = \frac{9.1 \times (11.4 - 2.5)}{0.6} - 51 = 83.98 \ (K\Omega))$$

The typical value of R$_{trim\_down}$

Trim down (%)	3.3V	5V	12V	24V	28V	48V
	R$_{trim\_down}$ (KΩ)					
1%	172.3	110.4	660.3	1671	1984	3106
2%	78.64	52.38	300.1	775.8	905.5	1400
3%	47.42	33.05	180.0	477.2	545.8	831.5
4%	31.82	23.38	120.0	327.9	365.9	547.1
5%	22.45	17.58	83.98	238.3	258.0	376.5
6%	16.21	13.71	59.97	178.6	186.0	262.8
7%	11.75	10.95	42.82	136.0	134.6	181.5
8%	8.41	8.880	29.95	104.0	96.10	120.6
9%	5.81	7.269	19.95	79.07	66.12	73.17
10%	3.73	5.980	11.94	59.17	42.14	35.25

7. Input / Output Considerations

7.1 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).
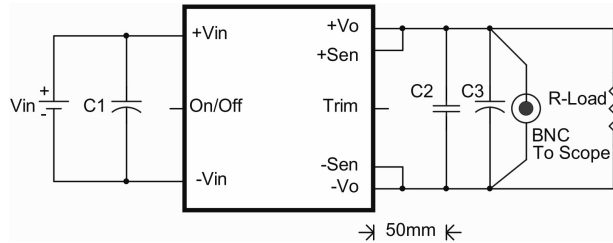
L1: 12uH
C1: 220uF ESR<0.14ohm @100KHz
Cin: 220uF ESR<0.14ohm @100KHz

7.2 Hold up Time

Hold up time is defined as the duration of time that DC/DC converter output will remain active following a loss of input power. To meet power supply interruptions, an external circuit is required, shown below.

D1:200V/10A
R1:100Ω/10W
C1:220uF/200V ESR<0.140Ω

| C2	72Vin	96Vin	110Vin
Hold up time for 10ms	2700uF	1000uF	700uF
Hold up time for 30ms	8000uF	3400uF	2400uF
Hold up time for 10ms (Vo: 3.3V)	1600uF	600uF	400uF
Hold up time for 30ms (Vo: 3.3V)	5100uF	2200uF	1500uF

7.3 Output Ripple and Noise

C1: 220uF/200V ESR<0.14Ω
C2: 1uF/ 1210 ceramic capacitor
C3: 10uF aluminum solid capacitor for other models.
    47uF T521 KO CAP. <55mR for 3.3V&5Vout

Output ripple and noise measured with 47uF T521 KO CAP. <55mR capacitor and 1uF ceramic capacitor across output for 3.3V&5Vout and 10uF aluminum solid and 1uF ceramic capacitor for other models. A 20 MHz bandwidth oscilloscope is normally used for the measurement.

The conventional ground clip on an oscilloscope probe should never be used in this kind of measurement. This clip, when placed in a field of radiated high frequency energy, acts as an antenna or inductive pickup loop, creating an extraneous voltage that is not part of the output noise of the converter.

Ground Clip
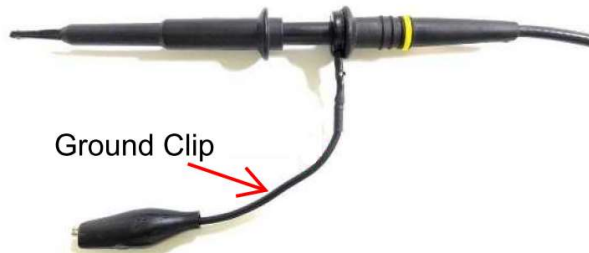
Another method is shown in below, in case of coaxial-cable/BNC is not available. The noise pickup is eliminated by pressing scope probe ground ring directly against the -Vout terminal while the tip contacts the +Vout terminal. This makes the shortest possible connection across the output terminals.
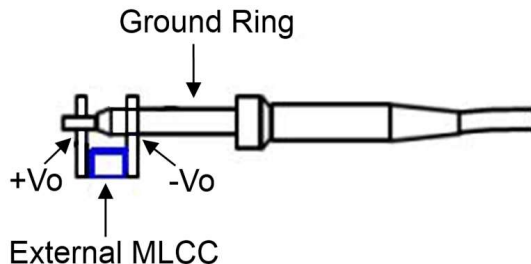
7.4 Output Capacitance

The CHB300W-110S 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 (<100mm). 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 specifications.

8. Series and Parallel Operation

8.1 Series Operation

Series operation is possible by connecting the outputs two or more units. Connection is shown in below. The output current in series connection should be lower than the lowest rate current in each power module.
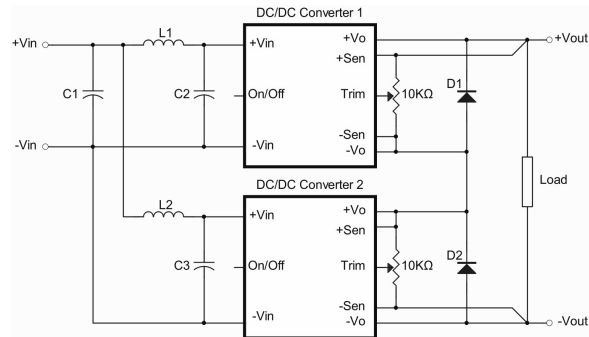
Simple Series Operation Connect Circuit

L1, L2: 1.0uH
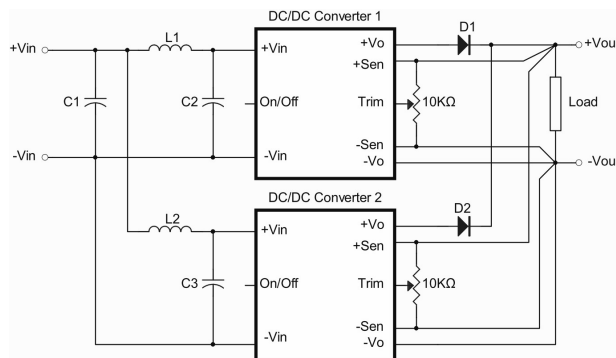C1, C2, C3: 220uF/200V ESR<0.14Ω

Note:
1. If the impedance of input line is high, C1, C2, C3 capacitance must be more than above. Use more than two recommended capacitor above in parallel when ambient temperature becomes lower than -20℃.

2. Recommend schottky diode (D1, D2) be connected across the output of each series connected converter, so that if one converter shuts down for any reason, then the output stage won't be thermally overstressed. Without this external diode, the output stage of the shut-down converter could carry the load current provided by the other series converters, with its MOSFETs conducting through the body diodes. The MOSFETs could then be overstressed and fail. The external diode should be capable of handling the full load current for as long as the application is expected to run with any unit shut down.

Series for ±output operation is possible by connecting the outputs two units, as shown in the schematic below.
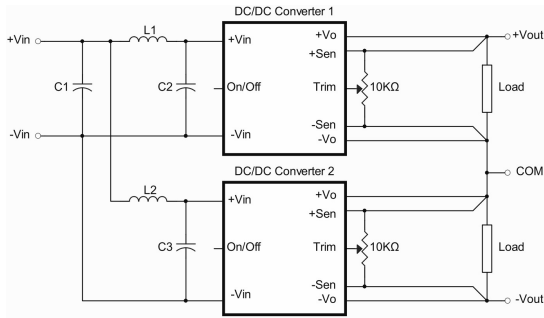
L1, L2: 1.0uH
C1, C2, C3: 220uF/200V ESR<0.14Ω

Note:
If the impedance of input line is high, C1, C2, C3 capacitance must be more than above. Use more than two recommended capacitor above in parallel when ambient temperature becomes lower than -20℃.

Note:
If the impedance of input line is high, C1, C2, C3 capacitance must be more than above. Use more than two recommended capacitor above in parallel when ambient temperature becomes lower than -20℃.

8.2 Parallel Operation

The CHB300W-110S series parallel operation is **not** possible.

8.3 Redundant Operation

Parallel for redundancy operation is possible by connecting the units as shown in the schematic below. The current of each converter become unbalance by a slight difference of the output voltage. Make sure that the output voltage of units of equal value and the output current from each power supply does not exceed the rate current. Suggest use an external potentiometer to adjust output voltage from each power supply.

Simple Redundant Operation Connect Circuit
L1, L2: 1.0uH
C1, C2, C3: 220uF/200V ESR<0.14Ω

9. Thermal Design

9.1 Operating Temperature Range

The CHB300W-110S 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 open quarter brick models is influenced by usual factors, such as:

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

9.2 Convection Requirements for Cooling

To predict the approximate cooling needed for the half brick module, refer to the power derating curves in **section 9.4**. 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℃ as measured at the center of the top of the case (thus verifying proper cooling).

9.3 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 9.4**. The power output of the module should not be allowed to exceed rated power (V_{o_set} x $I_{o\_max.}$).

9.4 Power Derating

The operating case temperature range of CHB300W-110S series is -40℃ to +100℃. When operating the CHB300W-110S series, proper derating or cooling is needed. The maximum case temperature under any operating condition should not exceed 100℃.

The following curve is the de-rating curve of CHB300W-110S series without heat sink.
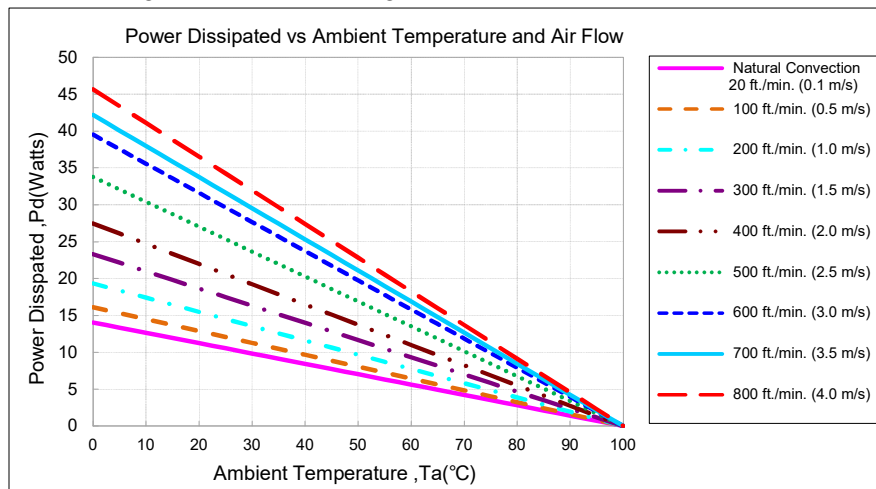
AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	7.12 ℃/W
100 ft./min. (0.5m/s)	6.21 ℃/W
200 ft./min. (1.0m/s)	5.17 ℃/W
300 ft./min. (1.5m/s)	4.29 ℃/W
400 ft./min. (2.0m/s)	3.64 ℃/W
500 ft./min. (2.5m/s)	2.96 ℃/W
600 ft./min. (3.0m/s)	2.53 ℃/W
700 ft./min. (3.5m/s)	2.37 ℃/W
800 ft./min. (4.0m/s)	2.19 ℃/W

Example:

What is the minimum airflow necessary for a CHB300W-110S24 operating at nominal line voltage, an output current of 12.5A, and a maximum ambient temperature of 15℃?

Solution:

Given: V_{in}=110V_{dc}, V_o=24V_{dc}, I_o=12.5A

Determine Power dissipation (P_d): P_d=P_i-P_o= P_o(1-η)/η, P_d=24×12.5×(1-0.89)/0.89=37.08Watts

Determine airflow: Given: P_d=37.08W and T_a=15℃

Check *Power Derating* curve: Minimum airflow=800 ft./min.

Verify:

Maximum temperature rise is ΔT= P_d × R_{ca}=37.08×2.19=81.2℃

Maximum case temperature is T_c = T_a +ΔT=96.2℃<100℃

Where:

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

T_a is ambient temperature and T_c is case temperature.

Power Dissipated vs Ambient Temperature and Air Flow with HBT254(M-C092) heat sink
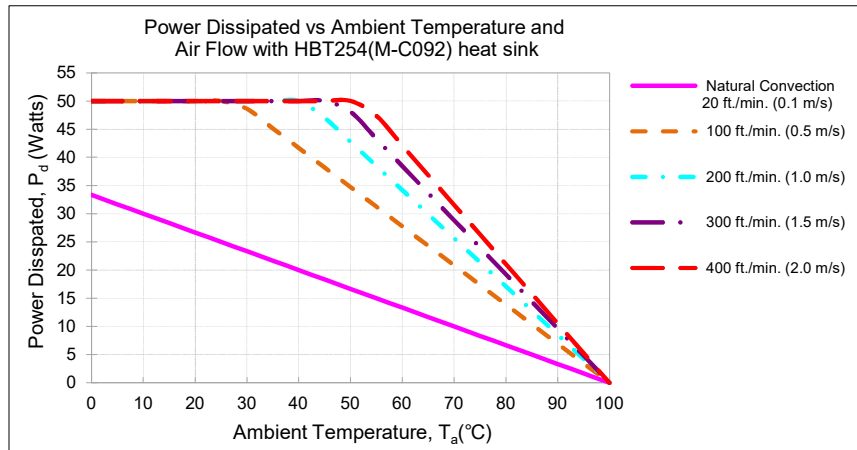
AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	3.00 ℃/W
100 ft./min. (0.5m/s)	1.44 ℃/W
200 ft./min. (1.0m/s)	1.17 ℃/W
300 ft./min. (1.5m/s)	1.04 ℃/W
400 ft./min. (2.0m/s)	0.95 ℃/W

Example with heat sink HBT254 (M-C092):

What is the minimum airflow necessary for a CHB300W-110S24 operating at nominal line voltage, an output current of 12.5A, and a maximum ambient temperature of 45℃?

Solution:

Given: V_{in}=110Vdc, V_o=24V_{dc}, I_o=12.5A

Determine Power dissipation (P_d): P_d=Pi-Po=Po(1-η)/η, P_d=24×12.5×(1-0.89)/0.89=37.08Watts

Determine airflow: Given: P_d=37.08W and T_a=45℃

Check above Power de-rating curve: Minimum airflow=100 ft./min

Verify:

Maximum temperature rise is ΔT= P_d × R_{ca}=37.08×1.44=53.40℃

Maximum case temperature is T_c= T_a +ΔT=98.40℃<100℃

Where:

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

T_a is ambient temperature and T_c is case temperature.

9.5 Half Brick Heat Sinks:
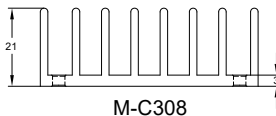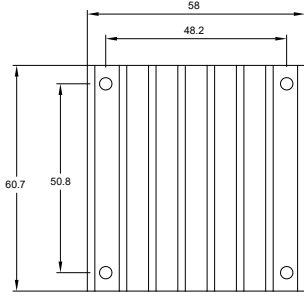
M-C308

HBL210(M-C308) G6620400201
Longitudinal Heat Sink

Rca:
3.90 ℃/W (typ.), natural convection
1.74 ℃/W (typ.), at 100LFM
1.33 ℃/W (typ.), at 200LFM
1.12 ℃/W (typ.), at 300LFM
0.97 ℃/W (typ.), at 400LFM
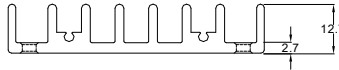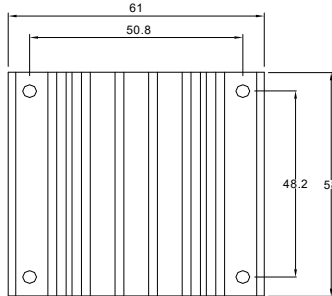
M-C091

HBT127 (M-C091) G6610120402
Transverse Heat Sink

Rca:
4.70 ℃/W (typ.), natural convection
2.89 ℃/W (typ.), at 100LFM
2.30 ℃/W (typ.), at 200LFM
1.88 ℃/W (typ.), at 300LFM
1.59 ℃/W (typ.), at 400LFM
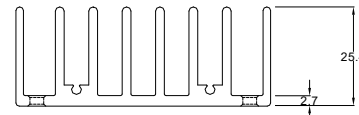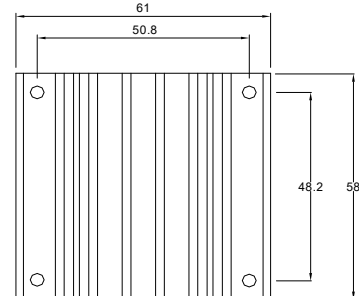
M-C092

HBT254 (M-C092) G6610130402
Transverse Heat Sink

Rca:
3.00 ℃/W (typ.), natural convection
1.44 ℃/W (typ.), at 100LFM
1.17 ℃/W (typ.), at 200LFM
1.04 ℃/W (typ.), at 300LFM
0.95 ℃/W (typ.), at 400LFM
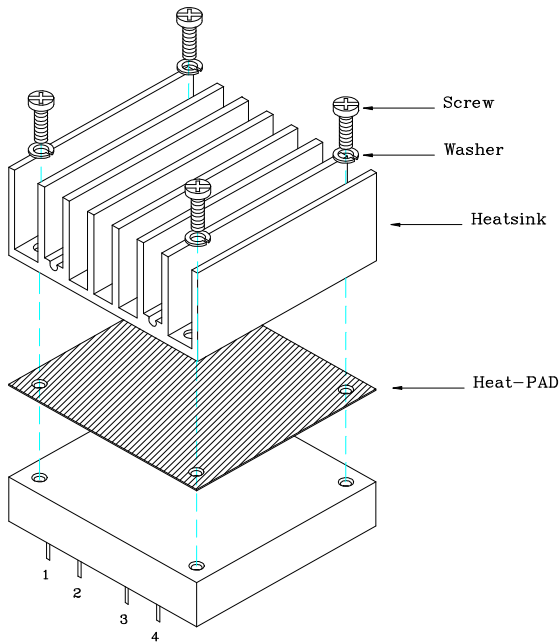
THERMAL PAD PH01: SZ 56.9*60*0.25 mm (G6135041091)
SCREW K308W: SMP+SW M3*8L (G75A1300322)

10. Safety & EMC

10.1 Input Fusing and Safety Considerations

The CHB300W-110S 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 time delay fuse for 3.3Vout and 10A for Others 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).
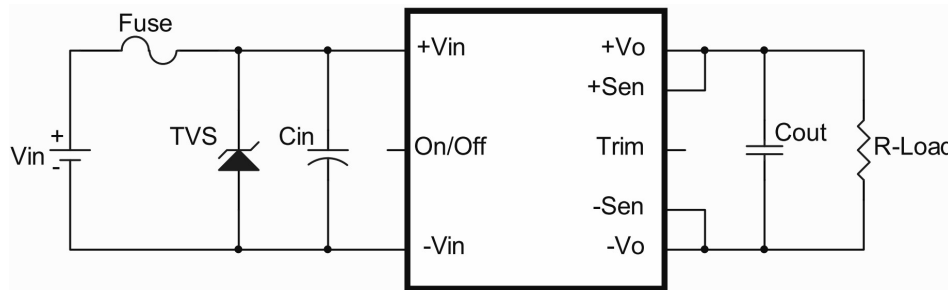
The external input capacitor (Cin) and transient voltage suppressor diode (TVS) are required if CHB300W-110S series has to meet EN61000-4-4, EN61000-4-5.

The Cin recommended a 220uF/200V (RUBYCON YXF series) aluminum capacitor. And the TVS recommended 1.5KE180A (Littelfuse) for all models.

10.2 EMC Considerations

EMI Test standard: EN 50121-3-2 Conducted & Radiated Emission
Test Condition: Input Voltage: 110Vdc, Output Load: Full Load

(1) EMI meet EN 50121-3-2:
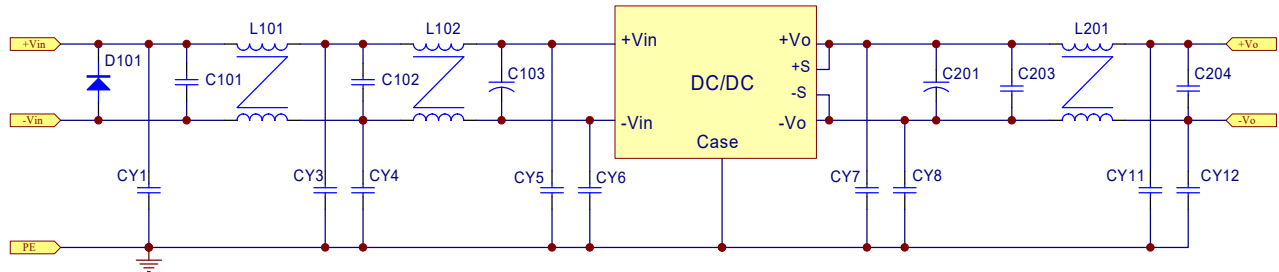
Connection circuit for EMI testing

	Model Number					
	CHB300W-110S3V3	CHB300W-110S05	CHB300W-110S12	CHB300W-110S24	CHB300W-110S28	CHB300W-110S48
C101	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812	1uF/250V X7R 1812
C102						
C103	220uF/200V Aluminum cap. YXF series	220uF/200V Aluminum cap. YXF series	220uF/200V Aluminum cap. YXF series	220uF/200V Aluminum cap. YXF series	220uF/200V Aluminum cap. YXF series	220uF/200V Aluminum cap. YXF series
C201	47uF/20V Polymer tantalum cap.	47uF/20V Polymer tantalum cap.	10uF/50V X5R 1210	10uF/50V X5R 1210	10uF/50V X5R 1210	22uF/100V Aluminum solid cap.
C203	1uF/100V X7R 1206	1uF/100V X7R 1206	1uF/100V X7R 1206	1uF/100V X7R 1206	1uF/100V X7R 1206	1uF/100V X7R 1206
C204						
CY1	NC	NC	NC	1000pF/Y2	NC	NC
CY3	220pF/Y2	220pF/Y2	220pF/Y2	220pF/Y2	220pF/Y2	220pF/Y2
CY4	4700pF/Y2	4700pF/Y2	4700pF/Y2	4700pF/Y2	4700pF/Y2	4700pF/Y2
CY5	2200pF/Y2	2200pF/Y2	2200pF/Y2	2200pF/Y2	2200pF/Y2	2200pF/Y2
CY6	1000pF/Y2	1000pF/Y2	1000pF/Y2	1000pF/Y2	1000pF/Y2	1000pF/Y2
CY7	10000pF/Y2	NC	NC	NC	NC	NC
CY8						
CY11	10000pF/Y2	10000pF/Y2	10000pF/Y2	10000pF/Y2	10000pF/Y2	10000pF/Y2
CY12						
D101	1.5KE180A Littelfuse	1.5KE180A Littelfuse	1.5KE180A Littelfuse	1.5KE180A Littelfuse	1.5KE180A Littelfuse	1.5KE180A Littelfuse
L101	CMK-01 CINCON	CMK-01 CINCON	CMK-01 CINCON	CMK-01 CINCON	CMK-01 CINCON	CMK-01 CINCON
L102						
L201	FERROXCUBE T29/19/15-3E6 0.17mH, Φ1.0mm*4/4T	FERROXCUBE T29/19/15-3E6 0.17mH, Φ1.0mm*4/4T	VAKOS R10K T22*16*6.5C 0.28mH, Φ1.0mm*2/7T	VAKOS R12K T18*12*6C 0.28mH, Φ1.0mm*1/7T	VAKOS R12K T18*12*6C 0.28mH, Φ1.0mm*1/7T	VAKOS R12K T18*12*6C 0.28mH, Φ1.0mm*1/7T
Common Mode Choke Link					COMMON MODE CHOKE	

Note:

C103 is RUBYCON YXF series aluminum capacitors or equivalent, CYxx is MURATA Y2 capacitor or equivalent

Conducted Emission (Input):

CHB300W-110S05

Line
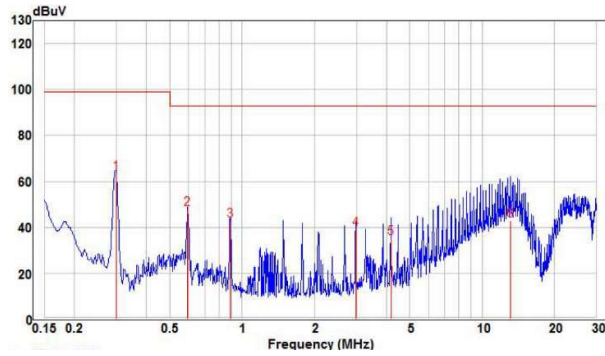
Neutral
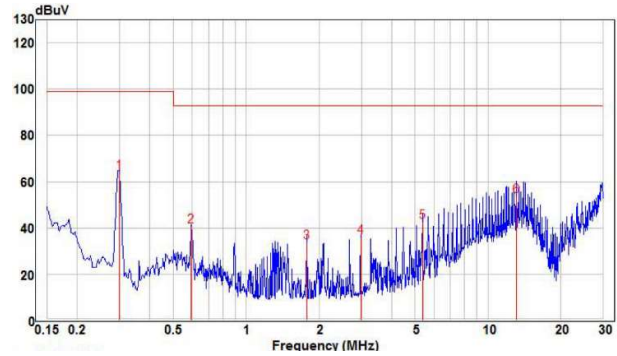
CHB300W-110S12

Line
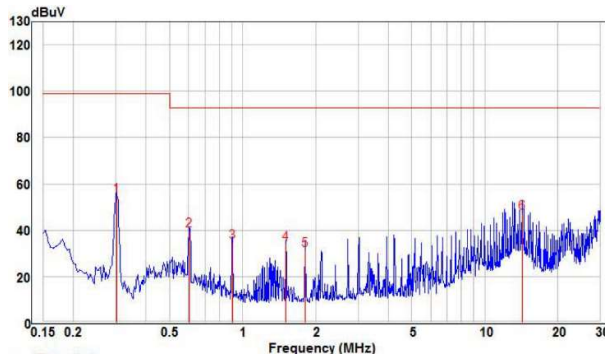
Neutral
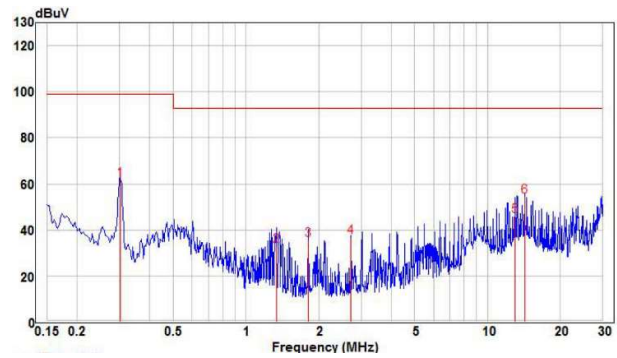
CHB300W-110S24

Line
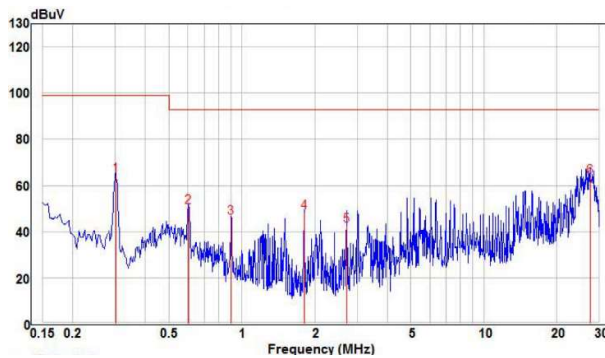
Neutral
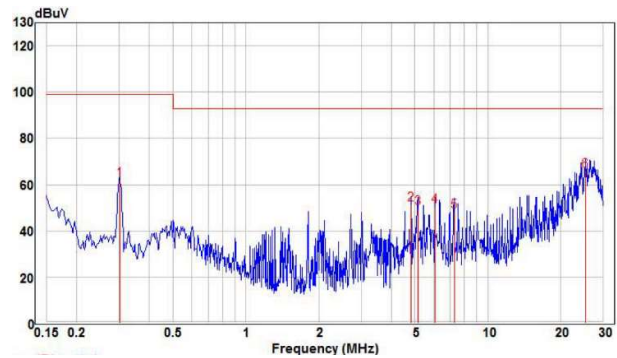
CHB300W-110S28
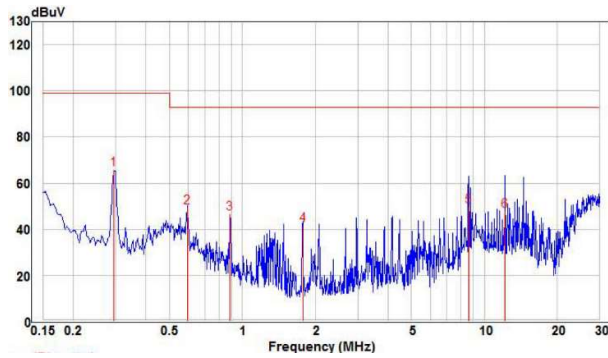
Line

Neutral
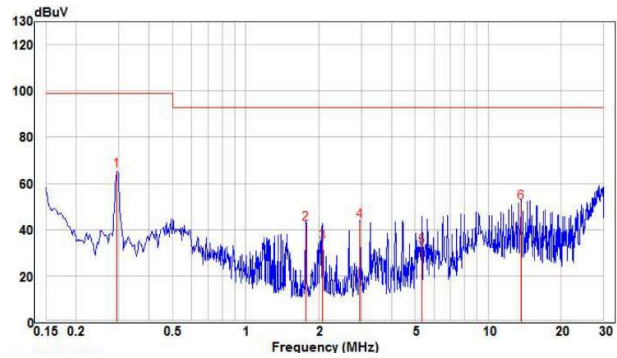
CHB300W-110S48

Line
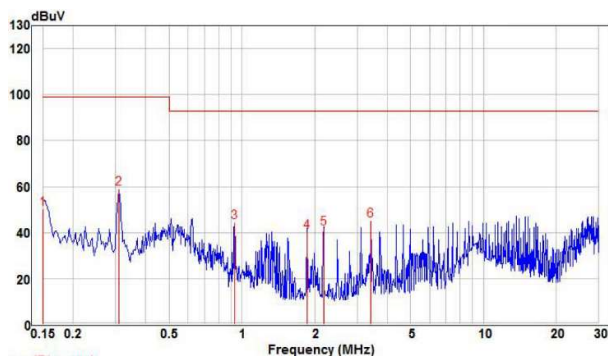
Neutral
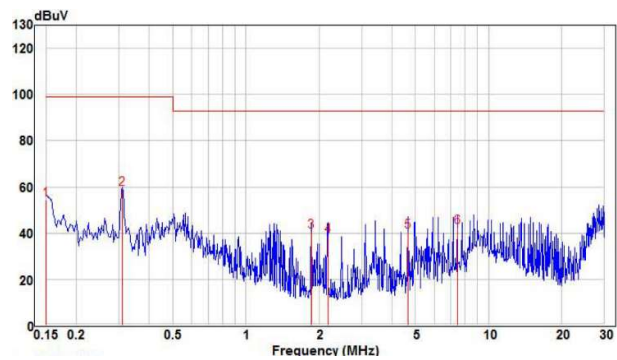
Conducted Emission (Output):
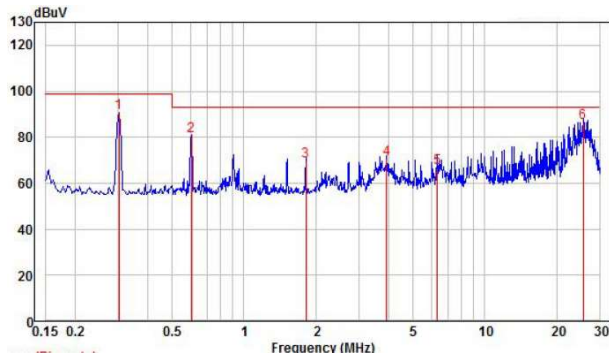
CHB300W-110S05
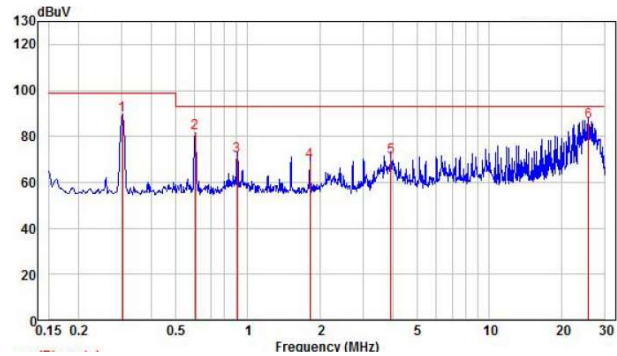
Positive
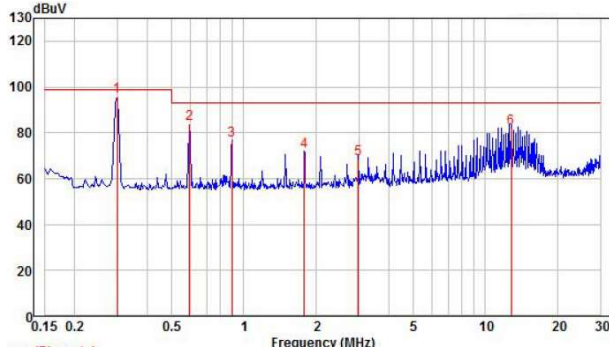
Negative
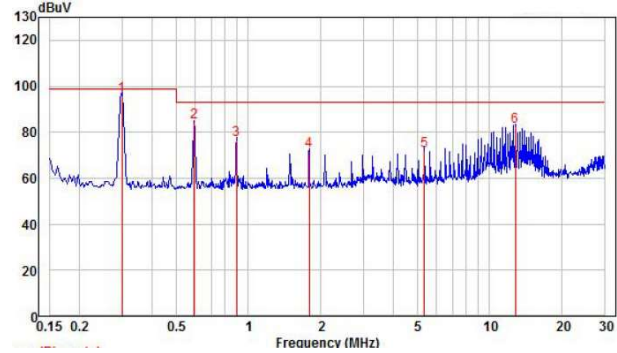
CHB300W-110S12
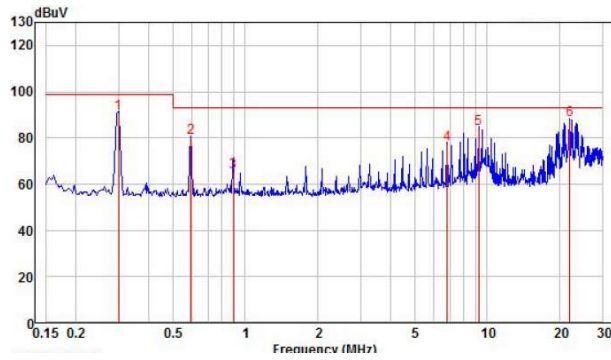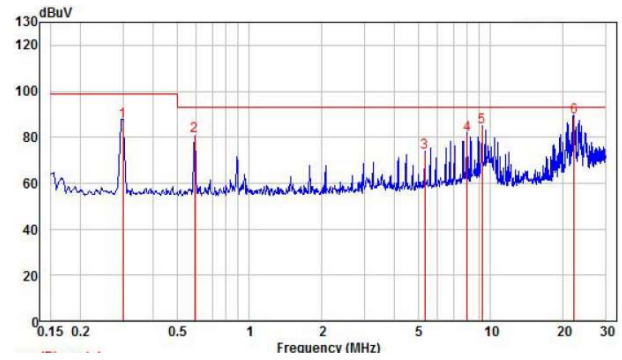
Positive
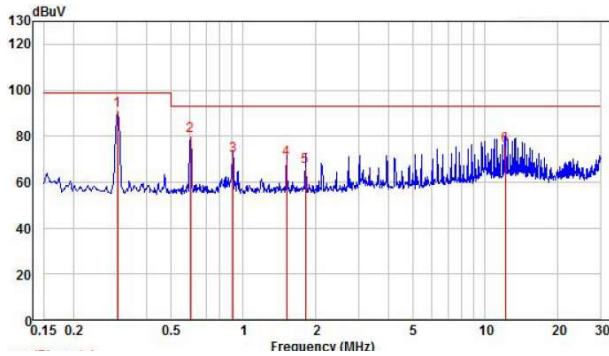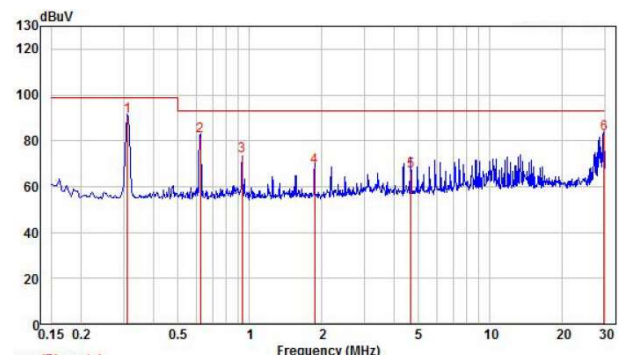

Negative
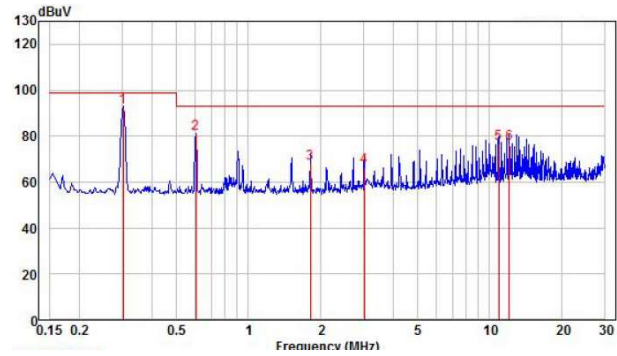
CHB300W-110S24

Positive

Negative

CHB300W-110S28

Positive

Negative

CHB300W-110S48

Positive
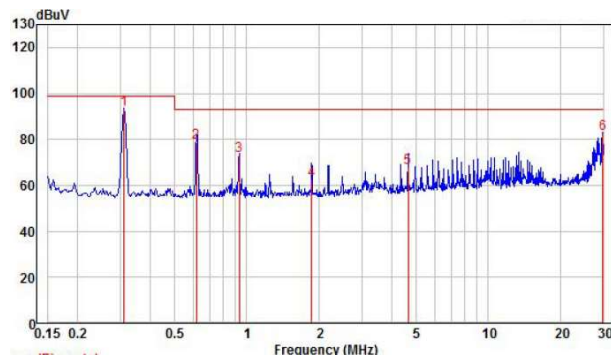
Negative

Radiated Emission:

CHB300W-110S05

Horizontal
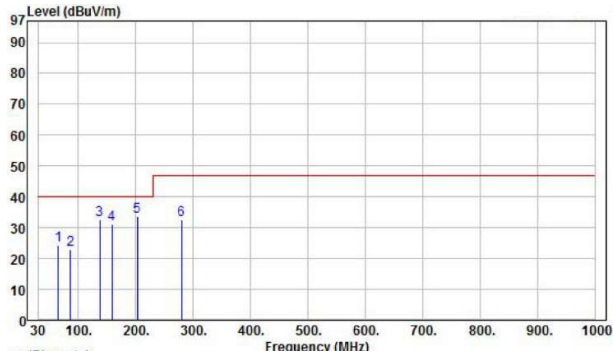
Vertical
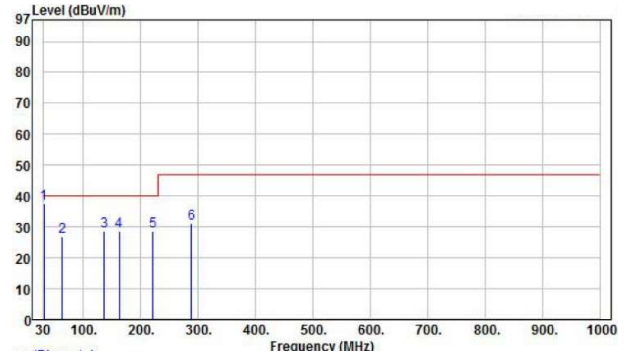
CHB300W-110S12

Horizontal
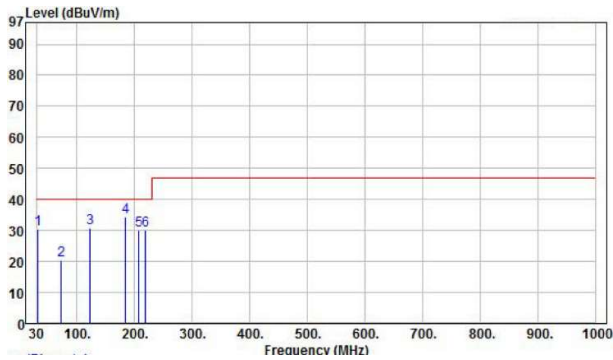
Vertical
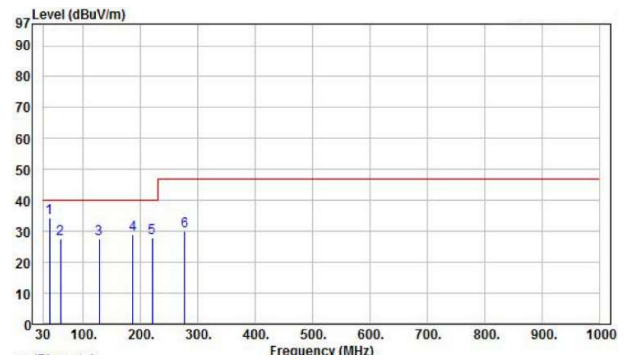
CHB300W-110S24

Horizontal
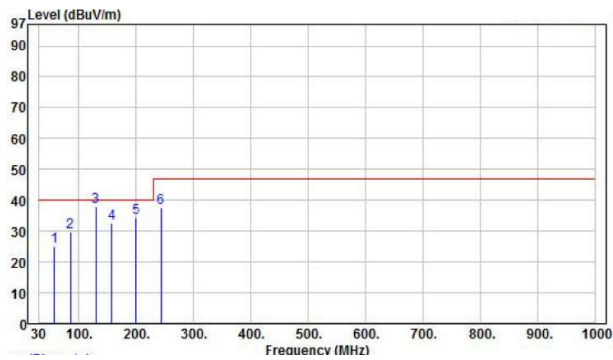
Vertical
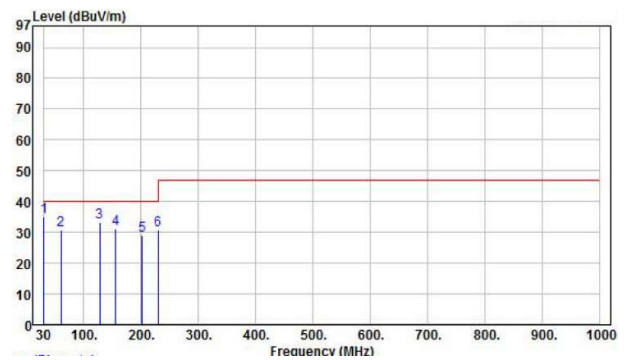
CHB300W-110S28

Horizontal
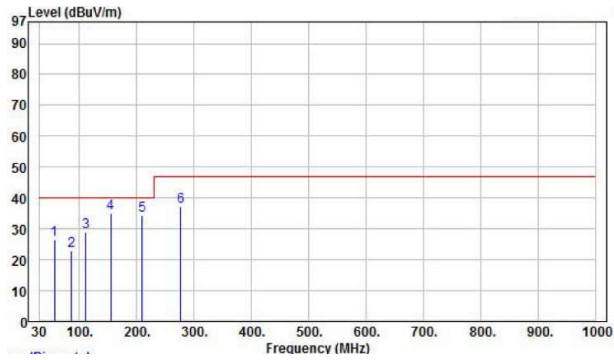
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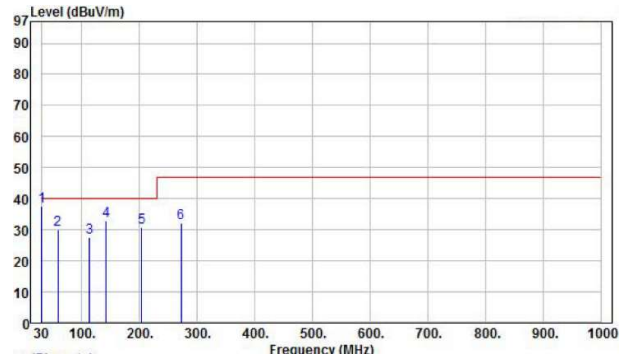
CHB300W-110S48

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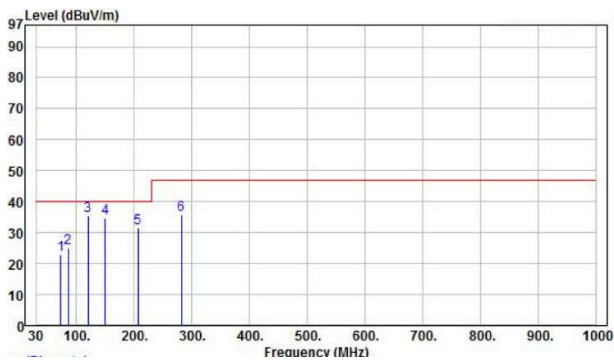
Vertical
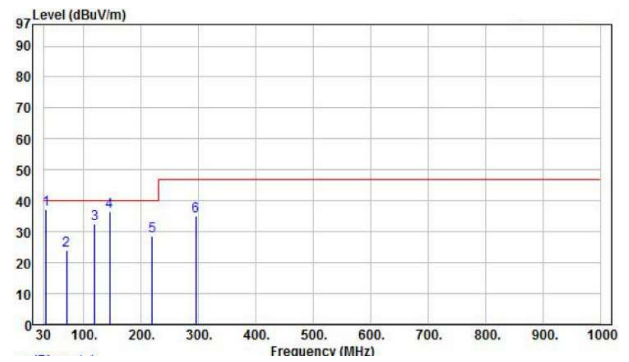
10.3 Suggested Configuration for RIA12 Surge Test
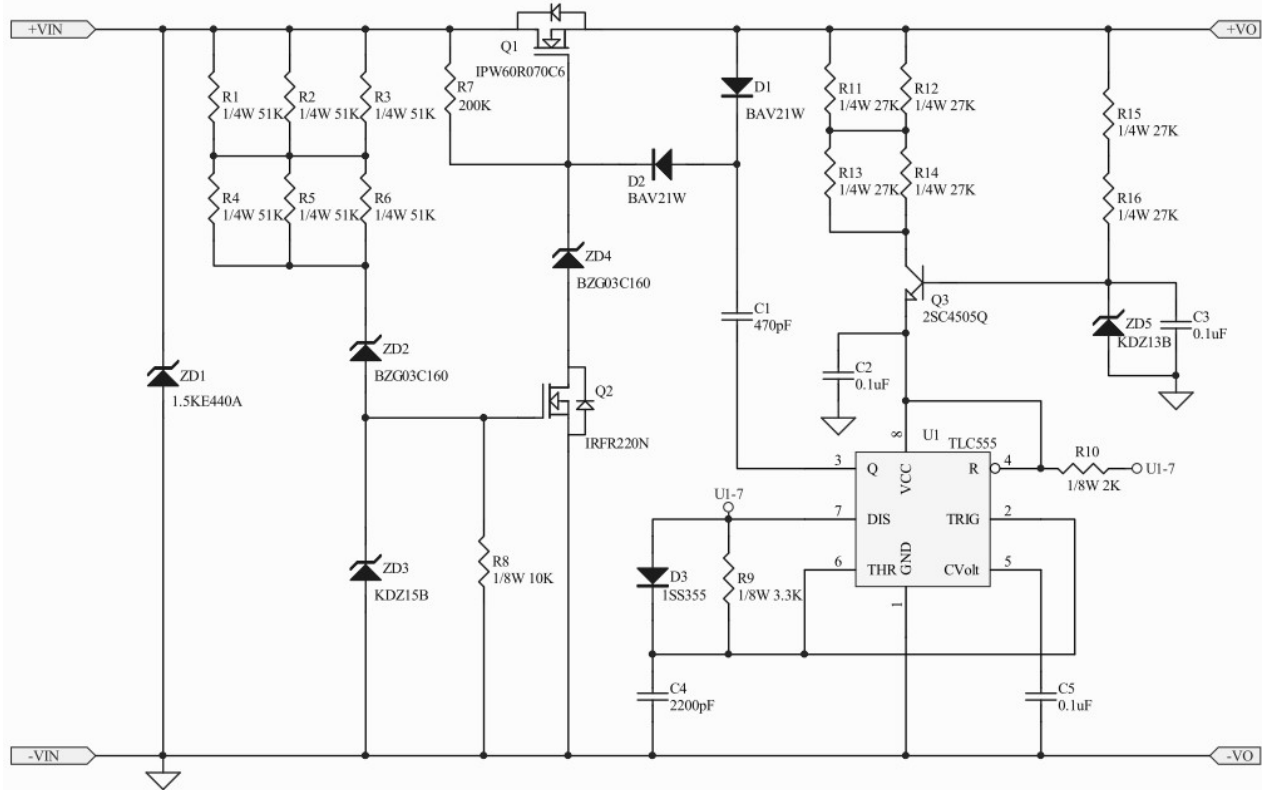
Note: Q1 suggest use Infineon IPW60R070C6 or equivalent and provide good heat dissipation conditions