

## Evaluation Kit

### APPLICABLE PARTS (SOLD SEPARATELY)

- SA110

### INTRODUCTION

This easy to use kit provides a platform with good circuit board layout and grounding to evaluate the SA110. The evaluation board provides a flexible prototyping area which can be used to connect the SA110 to additional external circuitry for providing input PWM to the SA110. All necessary components are provided with the evaluation kit. External connections to the evaluation kit can be made through the connectors at the edges of the circuit. The circuit provides a line termination of 50Ω for input signals provided through a function generator.

Figure 1: Circuit Configuration Diagram

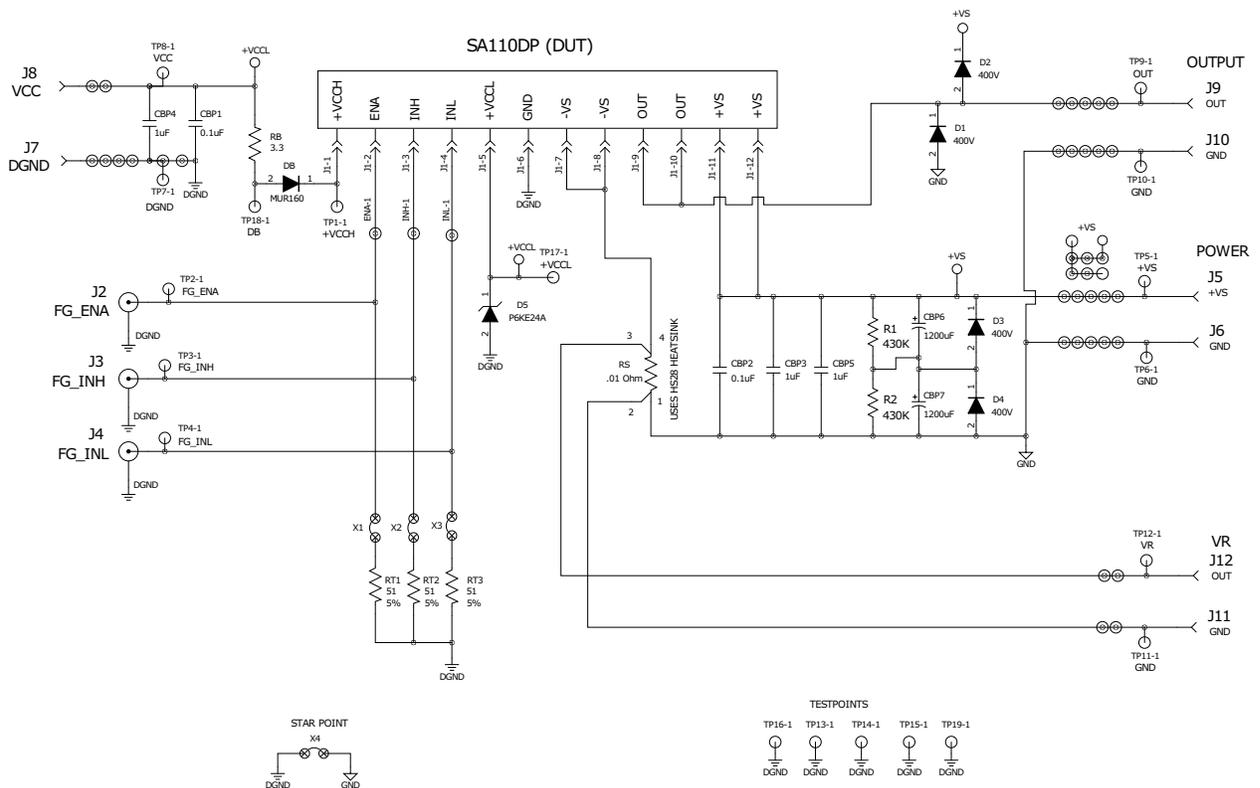
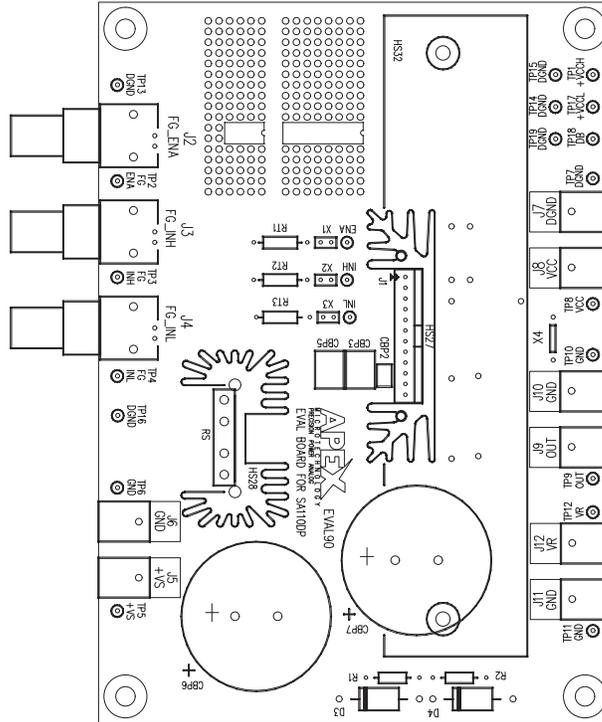
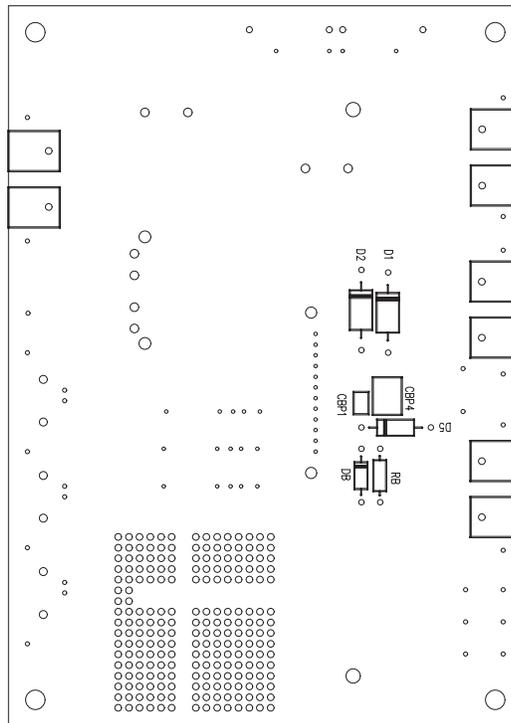


Figure 2: Board Layout Top Side



**Figure 3: Board Layout Bottom Slide**



## PARTS LIST

### RESISTORS

Reference	Manufacturer Part #	Description/Vendor	QTY
RT1, RT2, RT3	PR01000105109JR500	51Ω, 1W, 5%	3
RB	NFR25H0003308JR500	3.3Ω, 1/2W, 5%	1
R1, R2	MBB02070C4303FCT00	430kΩ, 0.6W, 1%	2
RS	PBV-R010-1	0.01Ω, 16W, 5%	1

### DIODES

Reference	Manufacturer Part #	Description/Vendor	QTY
D1, D2, D3, D4	MUR440G	Diode, 400V, 1A	4
D5	P6KE24A	TVS diode, 20V	2
DB	MUR160RLG	Diode, 600V, 1A	1

### CAPACITORS

Reference	Manufacturer Part #	Description/Vendor	QTY
CBP1, CBP2	C1210V104KCRCTU	0.1μF, 500V Ceramic Cap	2
CBP3, CBP4, CBP5	C5750X7T2W105K250KA	1μF, 450V, Ceramic Cap	3
CBP6, CBP7	380LX122M400A082	1200μF, 400V, Electrolytic	2

**HARDWARE**

Manufacturer Part #	Description/Vendor	QTY
HS27	Heatsink for Amplifier	1
HS32	Heatsink for Amplifier	1
HS28	Heatsink for Current resistor	1
8637-0-15-15-21-27-10-0	Cage Jacks for amplifier	16
146510CJ	BNC Connector	3
571-0100	Banana jacks, pc mount	8
92005A218	Screw for HS32, Panhead, M4	2
91735A190	Screw Pan head, #8	4
91735A148	Screw Pan head, #6	2
91772A110	Screw Pan head, #4	2
96537A130	18-8 stainless steel Hex Nut	2
96537A120	Black Oxide steel washer, 4-40	2
98035A102	Black Oxide steel washer, 6-32	2
CLAMP05	Clamp for HS32	2
2219	Standoff, hex, #8	4
TW07	Thermal washer for Amplifier	1
5001	Test Points	20
SPC02SVJN-RC	Jumper, Slip On	6
PRPC002SADN-RC	Header, Connector	6

**BEFORE YOU GET STARTED**

- All Apex Microtechnology amplifiers should be handled using proper ESD precautions.
- Always use the heat sink included in this kit.
- Always use adequate power supply bypassing.
- Do not change the connections while the circuit is powered.
- Initially set all power supplies to the minimum operations levels allowed in the device data sheet.
- Check for oscillations.

Please refer to Application Note, AN01 for general operating conditions.

## ASSEMBLY INSTRUCTIONS

The EK43 Evaluation kit comes with 2 different heatsinks for the SA110, HS32 (big heat sink) and HS27 (smaller heat sink). If the user wants to drive the SA110 at higher currents and at high switching frequencies, it is recommended to use the HS32. However, the HS27 heat sink can be used if the SA110 is driven at 400V, but at slower frequencies while driving average current of around 8A. Please refer to figure 4, figure 5, figure 6 and figure 7 for exploded view drawings of the evaluation kit with both heat sinks.

During the assembly, please refer to the circuit schematics, assembly drawings, and the datasheet of the part being used on the evaluation kit.

1. All through hole components (including the cage jacks) except RB, DB, D5, CBP4, CBP1, D1 and D2 are installed on the component side of the board and soldered on the bottom side. Do not solder CBP6 and CBP7 yet.
2. RB, DB, D5, CBP4, CBP1, D1 and D2 are installed on the bottom side and soldered on the DUT side of the board.
3. Insert the cage jacks on the DUT side of the board. Once they are inserted, solder the cage jacks from the bottom side of the board.
4. Install all small through hole components like capacitors, resistors, and test points on the evaluation board. This is done because it becomes difficult to install a smaller part on the board once all the larger components are installed.
5. Install diodes D1, D2, D3, D4 and D5 on the evaluation board. Ensure that the orientation of the components match the circuit schematic drawing.
6. Mount the BNC connectors provided with the kit (146510CJ) and solder it to the board. Also mount the banana jacks on the board.
7. From the DUT side of the PCB, insert #8 panhead screws into the holes at the four corners of the PCB. Connect the hexagonal standoffs from the bottom side of the board.
8. Mount the current sense resistor RS on heat sink HS28 using #4 round head screw and 4-40 hex nut. Install the heatsink + resistor assembly on the PCB.
9. When using the small heat sink (HS27) -
  - Mount electrolytic capacitors CBP6 and CBP7 on the DUT side of the board.
  - Mount the amplifier on the heat sink using #6 round head screw and 6-32 hex nut. Insert the TW07 thermal washer between the amplifier and the heatsink.
  - Insert the amplifier + heat sink assembly on the PCB.
10. When using the bigger heat sink (HS32) -
  - Mount only CBP6 on the DUT side of the board. In this case, short the through hole connections for CBP7.
  - Mount the amplifier on the heatsink using CLAMP05 as shown in the exploded view drawings figure 4. Insert TW07 thermal washer between the amplifier and the heatsink.
  - Install amplifier + heat sink assembly on the PCB. Use M4 screws to mount the heatsink on the PCB.
11. Connect the external connections via the BNC connector and banana jacks. Hook up power supplies and signals as necessary. The amplifier is now ready for evaluation.

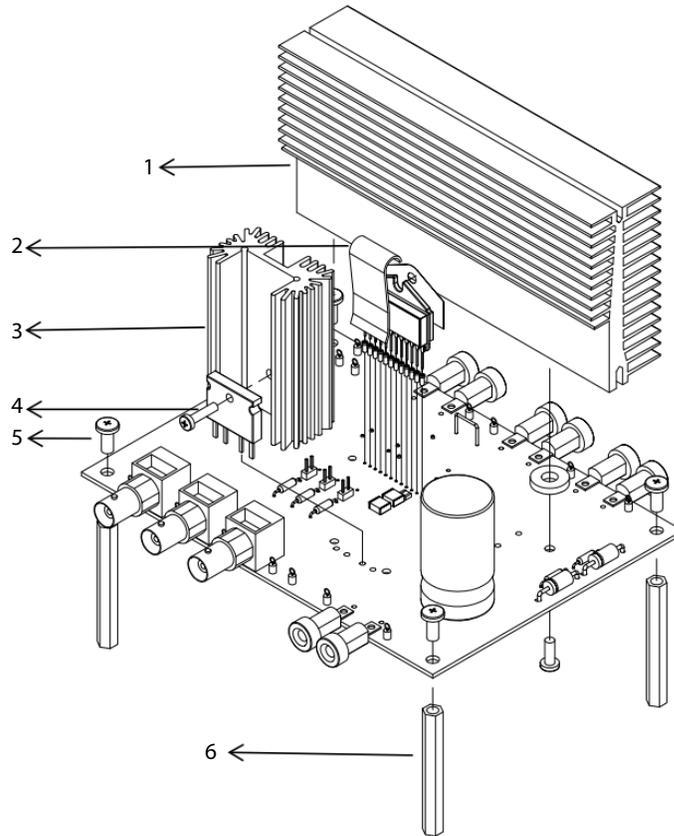
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## **CIRCUIT DESCRIPTION**

The EK43 evaluation kit is designed to drive the SA110 in a singly supply operation where the  $-V_S$  pin is connected to ground through a current sense resistor. Input pulses can be provided via BNC connectors on the edge of the board. However, one can use a microcontroller to provide input PWM pulses to the EK43 evaluation kit. The flexible prototyping area can be used in this case. Connections from the microcontroller can be made through the INH, INL and ENA through holes provided on the board. If a microcontroller is used, remove jumpers X1, X2 and X3 so that the termination resistors do not load the microcontroller.

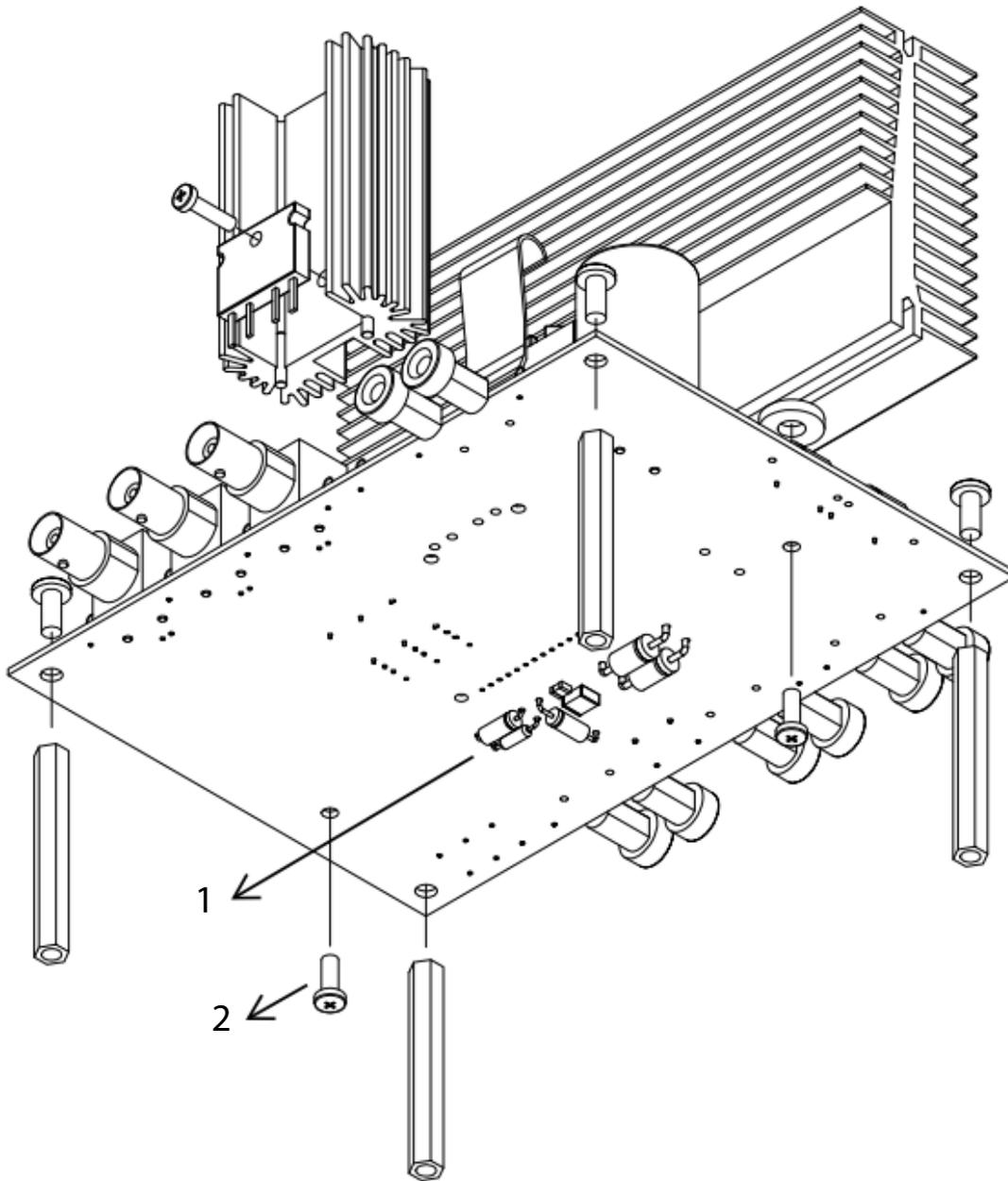
Test points  $+V_{CCL}$  (TP17) and DB (TP18) are provided to probe boot strap circuit if needed. Output current can be measured through the current sense resistor.

Figure 4: Evaluation Kit Assembly- Using HS32 Heatsink Top View



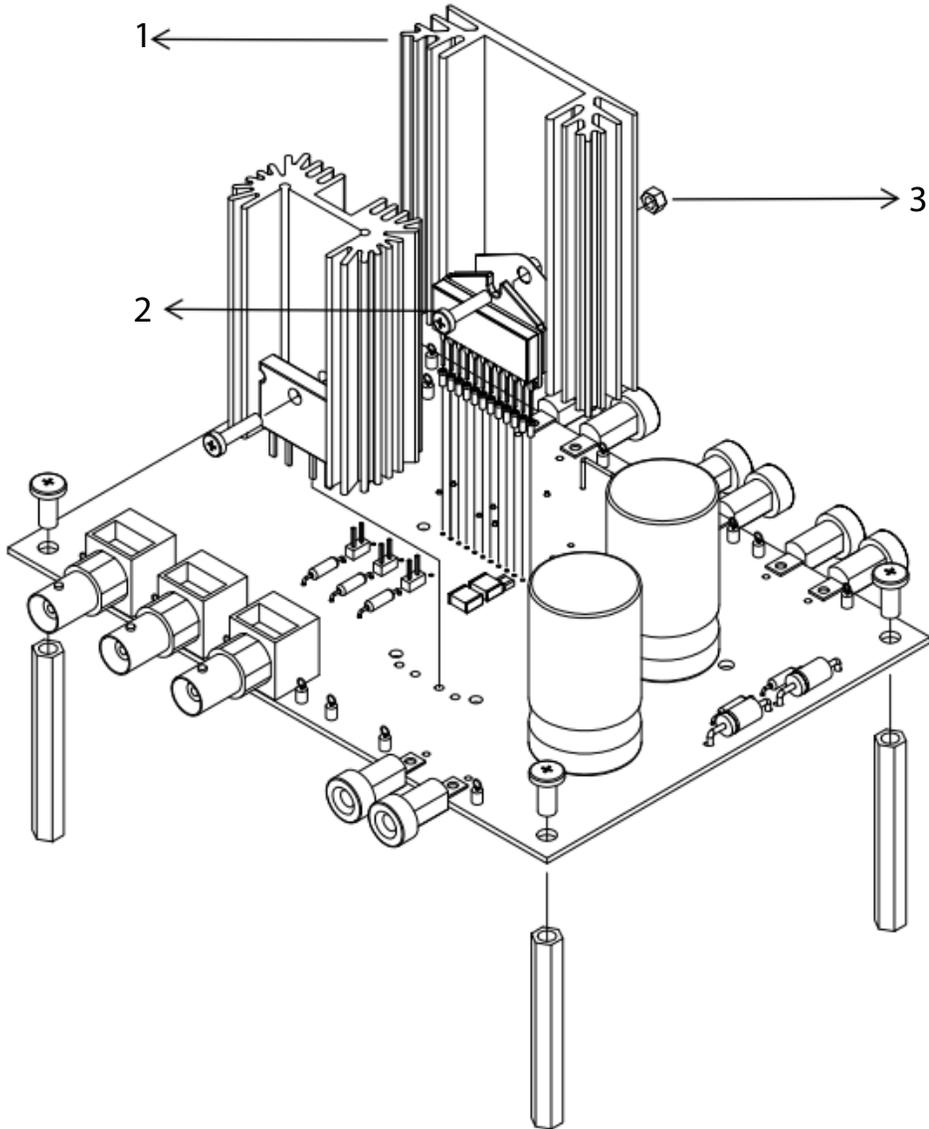
1. 1 x HS32 Heat Sink
2. 1 x CLAMP05 Clamp
3. 1 x HS28 Head Screws
4. 1 x #4 Pan Head Screws
5. 1 x #8 Pan Head Screws
6. 1 x #8 Hex Standoffs

Figure 5: Evaluation Kit Assembly- Using HS32 Heatsink Bottom View



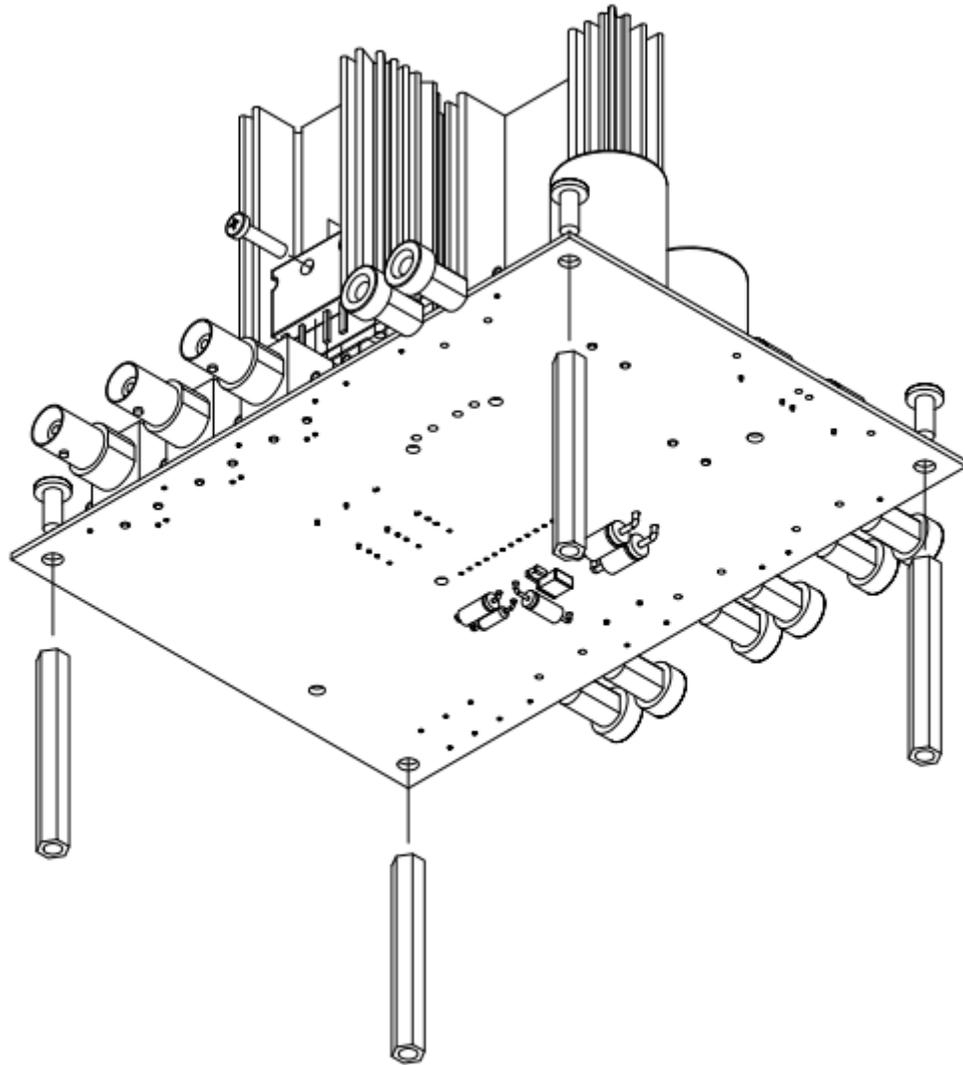
1. RB, DB, D1, D2, D5, CBP1, CBP4
2. 2 x Pan Head M4 Screws

Figure 6: Evaluation Kit Assembly- Using HS27 Heatsink Top View



- 1. 1 x HS27 Heat Sink
- 2. 1 x #6 Pan Head Screws
- 3. 1 x 6-32 Stainless Steel Hex Nut

**Figure 7: Evaluation Kit Assembly- Using HS27 Heatsink Bottom View**



## TEST ASSEMBLY

### EQUIPMENT NEEDED

1. High Voltage Power Supply and 15 V Power Supply
2. 5V power supply for ENA
3. Function Generators for PWM input or a microcontroller
4. Oscilloscope
5. Heatsink

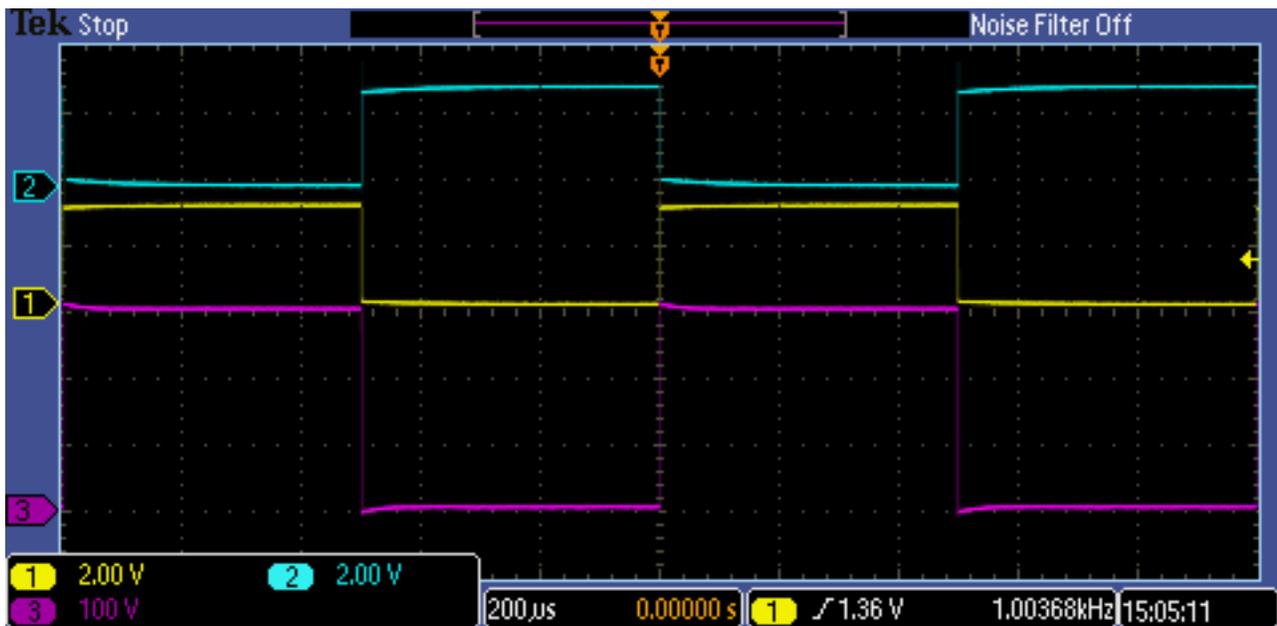
### TEST SETUP

Connect the power supply to +V<sub>S</sub> port. Refer to product datasheet for voltage specifications. Connect BNC cables from the function generators or connect a micro controller to the inputs of the SA110. Connect a 5V power supply to the ENA input connection. Do not insert the part yet. Next, power on the input signal and power supplies. Measure voltages on all pins on the DUT side to ensure that there is not short and to check that all the pins read correct voltages. Next, mount the amplifier + Heatsink assembly on the PC board.

Input and output waveforms can be checked on an Oscilloscope by connecting it to the test points mounted on the board. Begin the test with minimum values of switching frequency and supply voltages.

Figure 8 shows output voltage and input pulses provided to the SA110. Channel 1 (Yellow waveform) and channel 2 (blue waveform) are the input PWM pulses provided to the INH and INL pins. Channel 3 (Magenta waveform) is the output waveform of the SA110.

Figure 8: Output Waveforms



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## **NEED TECHNICAL HELP? CONTACT APEX SUPPORT!**

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