

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

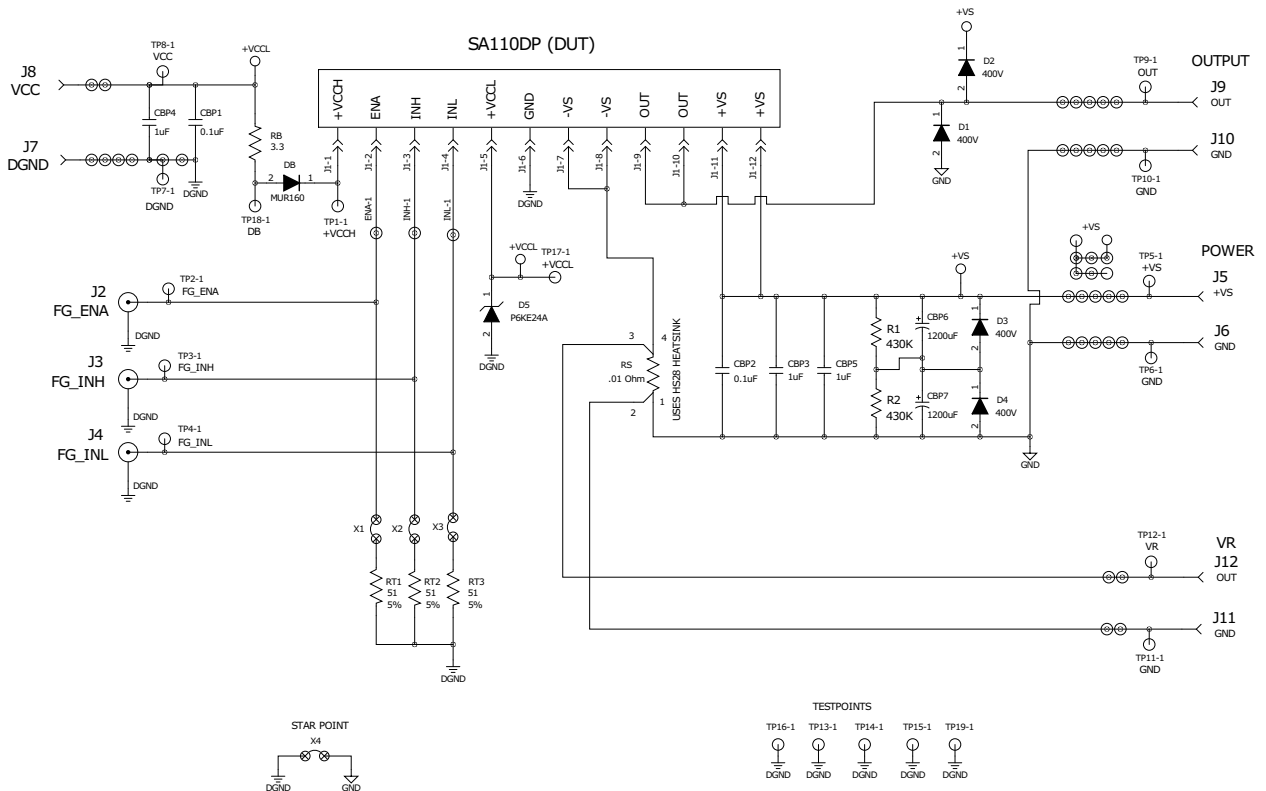


Figure 2: Board Layout Top Side

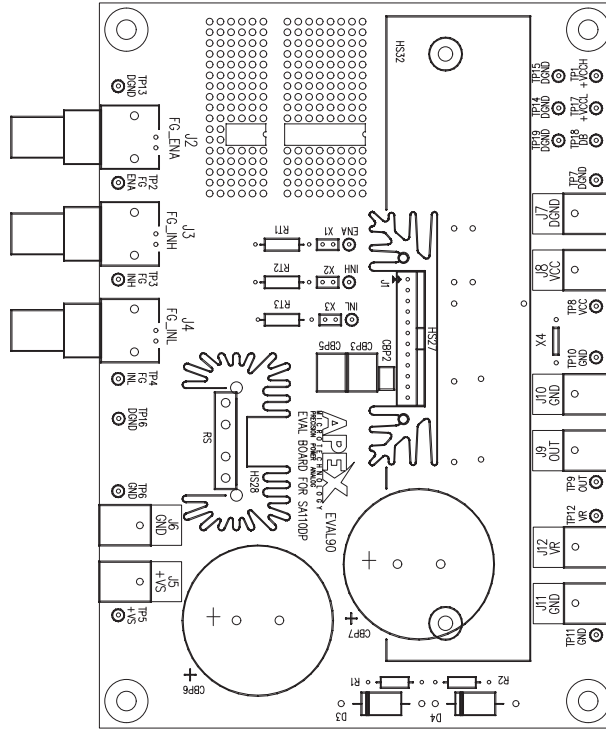
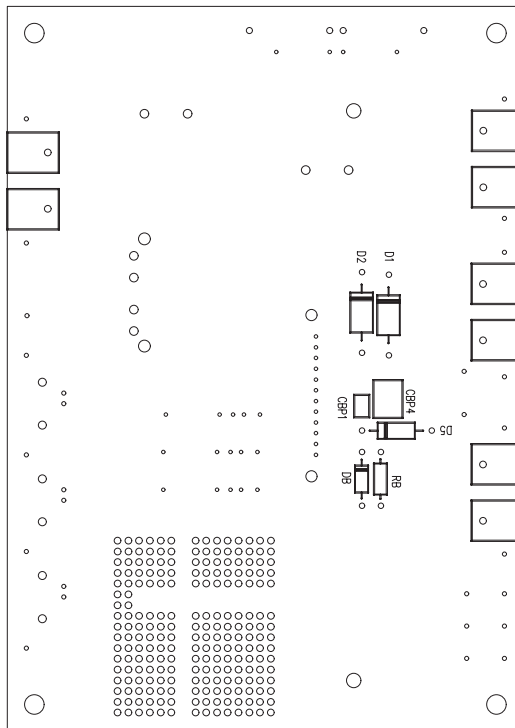


Figure 3: Board Layout Bottom Slide



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.

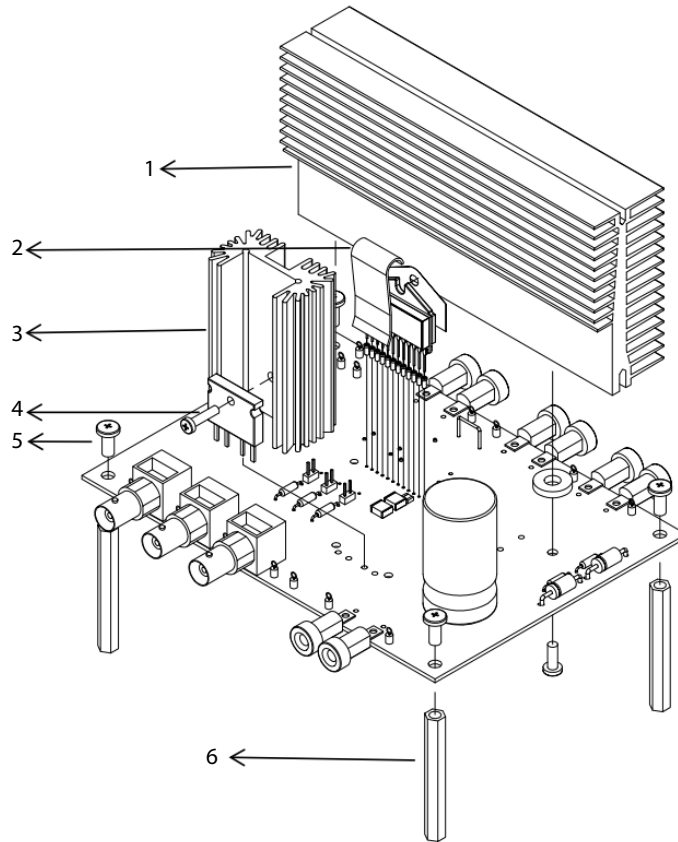
1. All through hole components (including the cage jacks) except RB, DB, D5, CBP4, CBP1, D1 and D2 are installed on the component side of the board and soldered on the bottom side. Do not solder CBP6 and CBP7 yet.
2. RB, DB, D5, CBP4, CBP1, D1 and D2 are installed on the bottom side and soldered on the 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.

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.

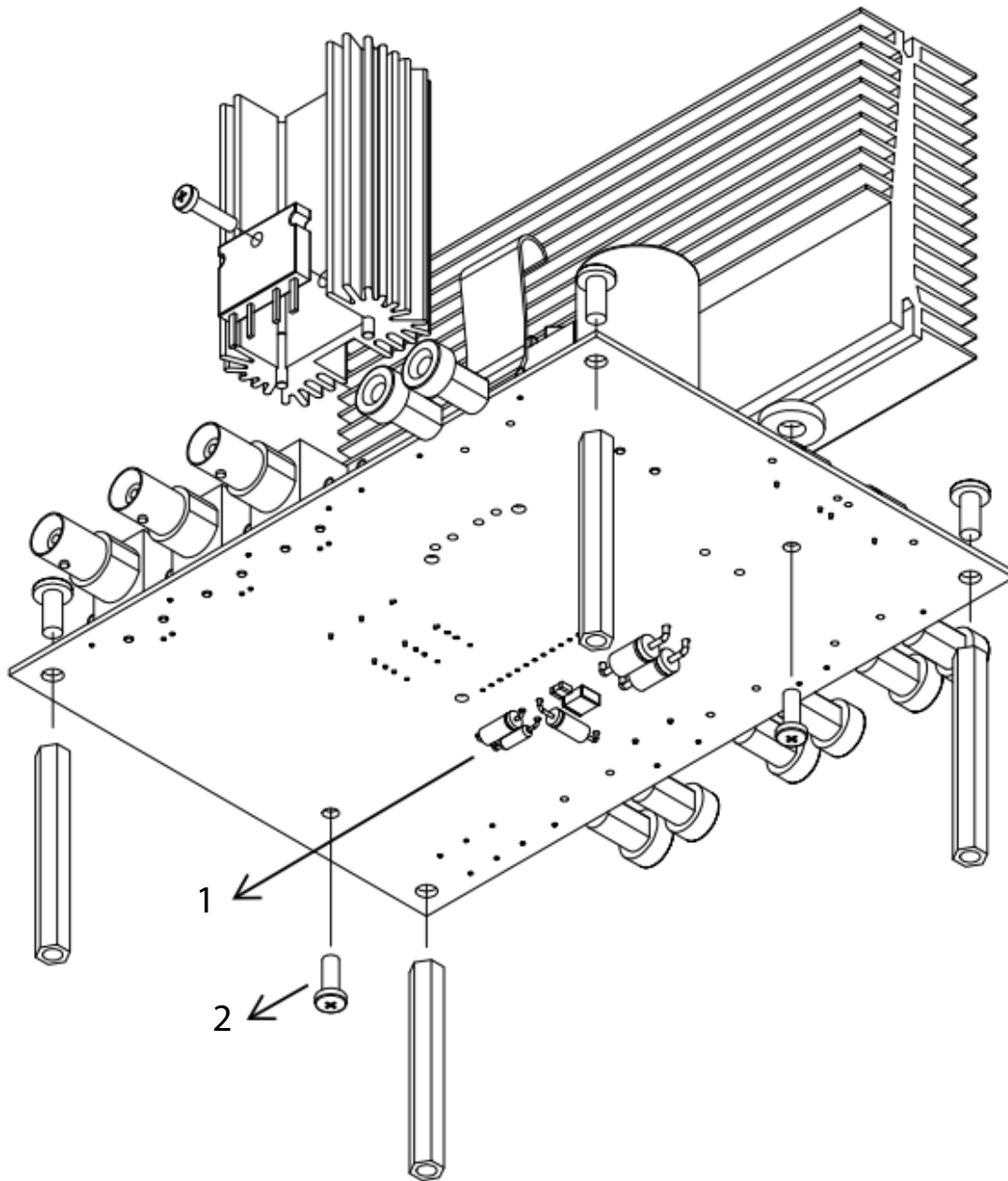
Test points $+V_{CCL}$ (TP17) and DB (TP18) are provided to probe boot strap circuit if needed. Output current can be measured through the current sense resistor.

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



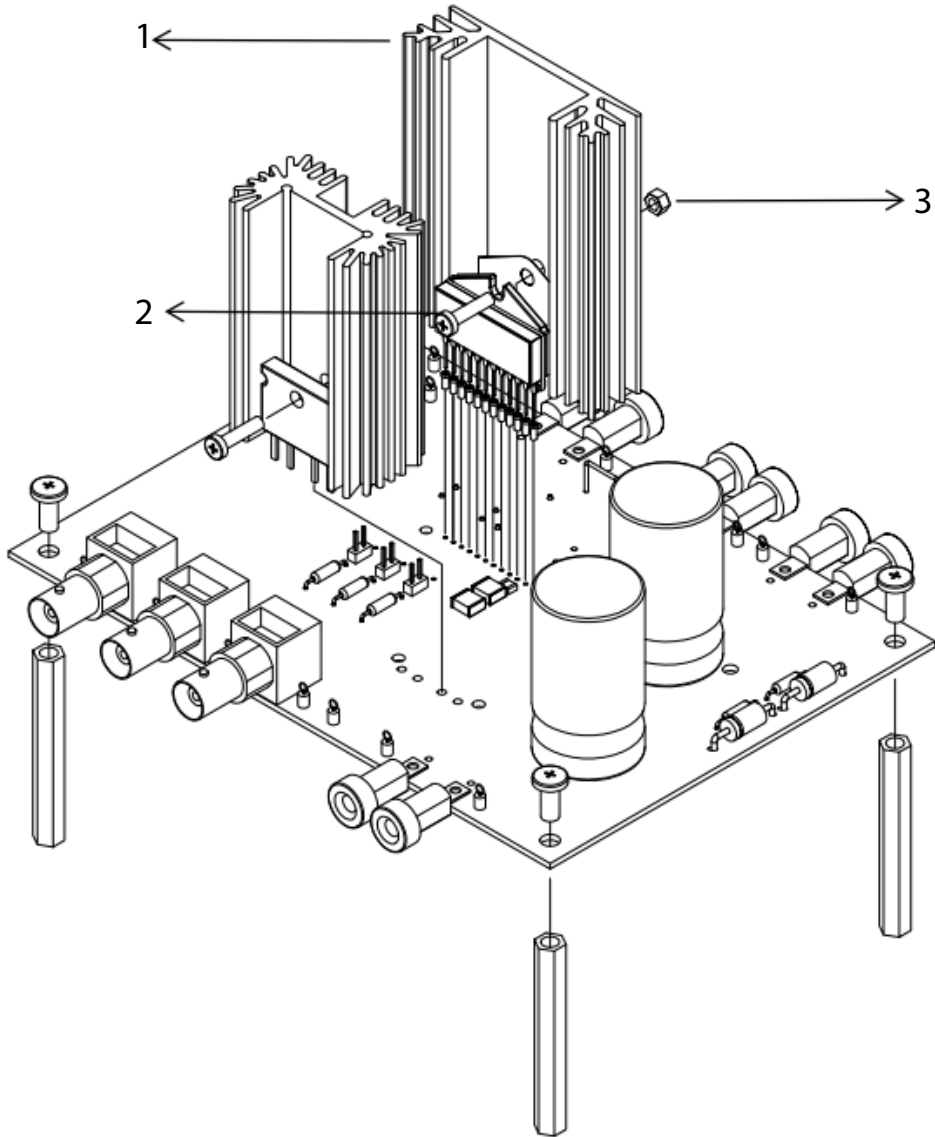
1. 1 x HS32 Heat Sink
2. 1 x CLAMP05 Clamp
3. 1 x HS28 Head Screws
4. 1 x #4 Pan Head Screws
5. 1 x #8 Pan Head Screws
6. 1 x #8 Hex Standoffs

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



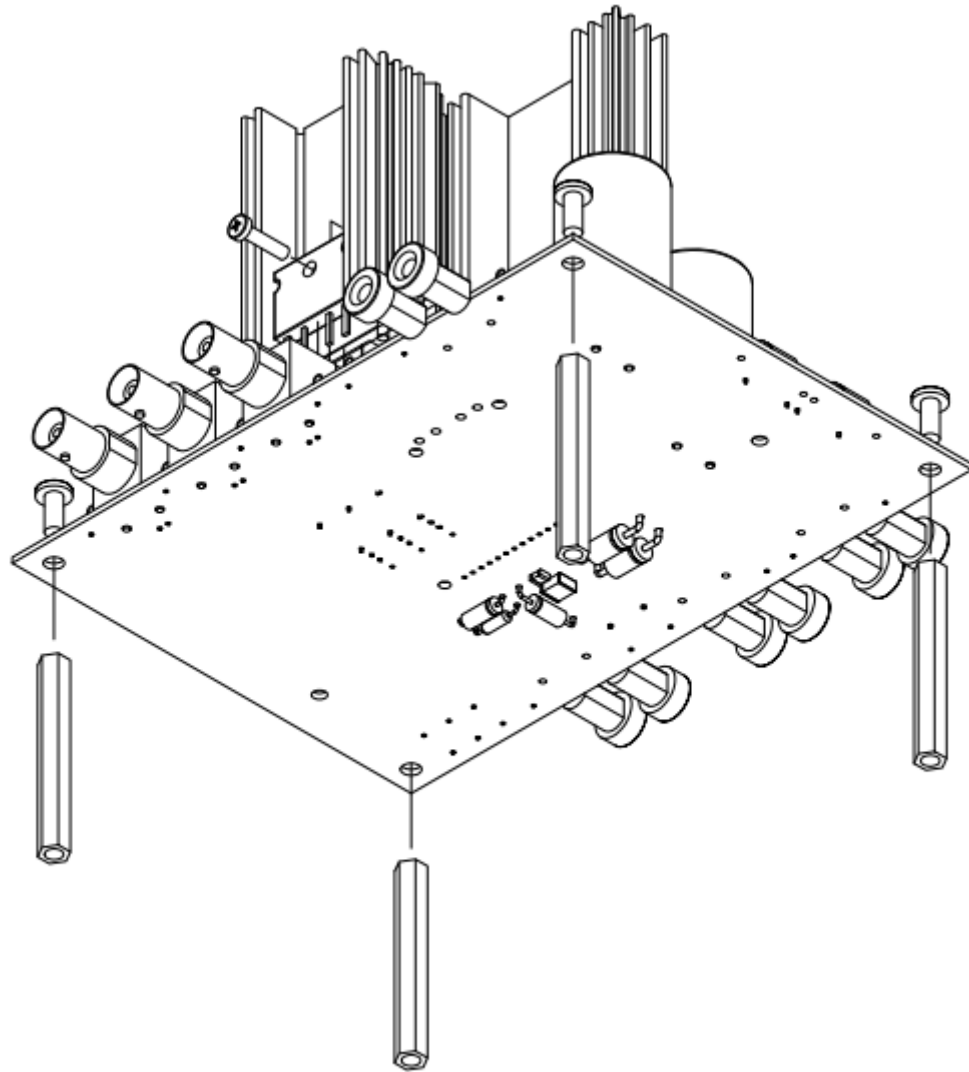
1. RB, DB, D1, D2, D5, CBP1, CBP4
2. 2 x Pan Head M4 Screws

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

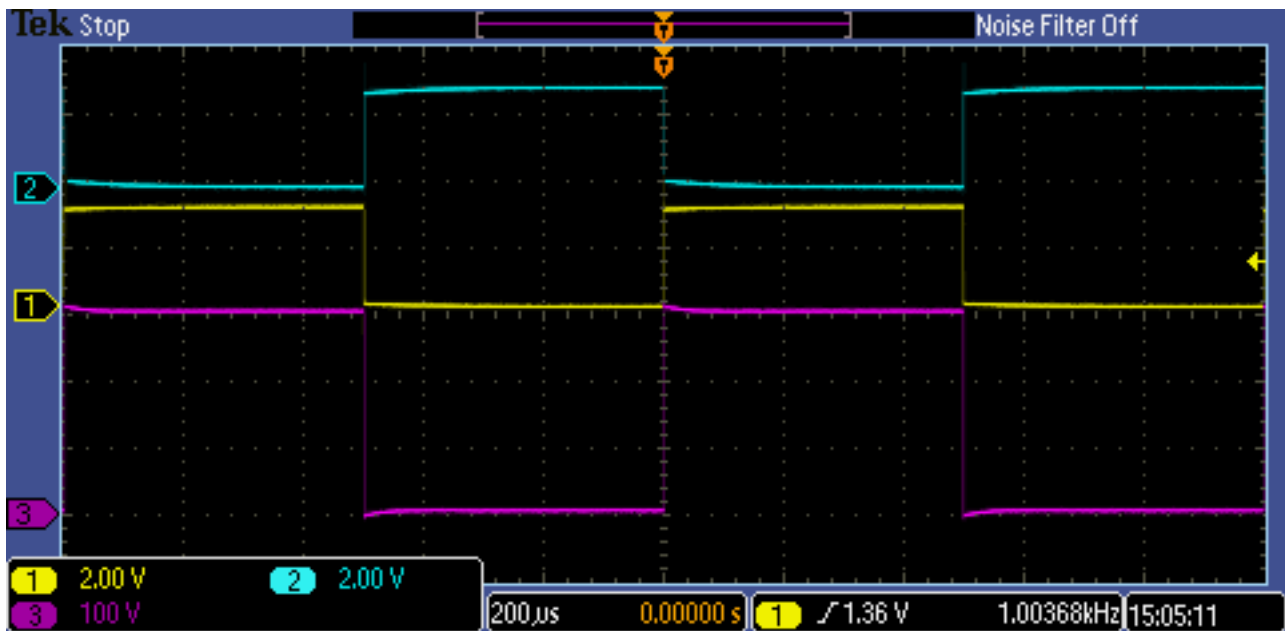
TEST SETUP

Connect the power supply to +V_S 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



NEED TECHNICAL HELP? CONTACT APEX SUPPORT!

For all Apex Microtechnology product questions and inquiries, call toll free 800-546-2739 in North America. For inquiries via email, please contact apex.support@apexanalog.com. International customers can also request support by contacting their local Apex Microtechnology Sales Representative. To find the one nearest to you, go to www.apexanalog.com

IMPORTANT NOTICE

Apex Microtechnology, Inc. has made every effort to insure the accuracy of the content contained in this document. However, the information is subject to change without notice and is provided "AS IS" without warranty of any kind (expressed or implied). Apex Microtechnology reserves the right to make changes without further notice to any specifications or products mentioned herein to improve reliability. This document is the property of Apex Microtechnology and by furnishing this information, Apex Microtechnology grants no license, expressed or implied under any patents, mask work rights, copyrights, trademarks, trade secrets or other intellectual property rights. Apex Microtechnology owns the copyrights associated with the information contained herein and gives consent for copies to be made of the information only for use within your organization with respect to Apex Microtechnology integrated circuits or other products of Apex Microtechnology. This consent does not extend to other copying such as copying for general distribution, advertising or promotional purposes, or for creating any work for resale.

APEX MICROTECHNOLOGY PRODUCTS ARE NOT DESIGNED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN PRODUCTS USED FOR LIFE SUPPORT, AUTOMOTIVE SAFETY, SECURITY DEVICES, OR OTHER CRITICAL APPLICATIONS. PRODUCTS IN SUCH APPLICATIONS ARE UNDERSTOOD TO BE FULLY AT THE CUSTOMER OR THE CUSTOMER'S RISK.

Apex Microtechnology, Apex and Apex Precision Power are trademarks of Apex Microtechnology, Inc. All other corporate names noted herein may be trademarks of their respective holders.