

**Evaluation Kit**

**APPLICABLE PARTS (SOLD SEPARATELY)**

- MP104 Power Amplifier

**INTRODUCTION**

This easy to use kit provides a platform with good circuit board layout and grounding to evaluate MP104 Power Amplifier. With additional prototype area, it is flexible enough to analyze a multitude of standard or proprietary circuit configurations. All necessary components are provided with the 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 50 Ω.

**Figure 1: EK37 Schematic**

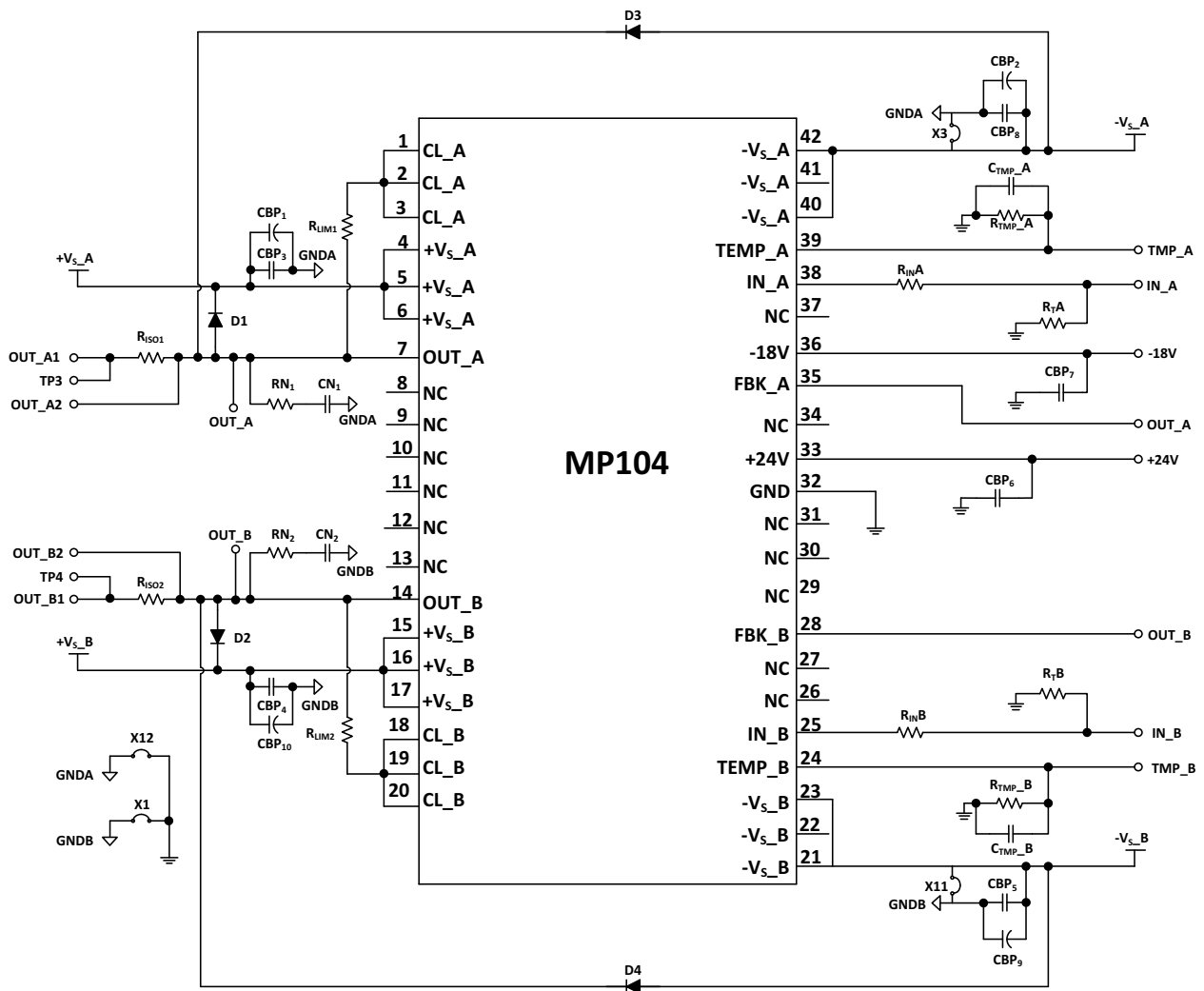
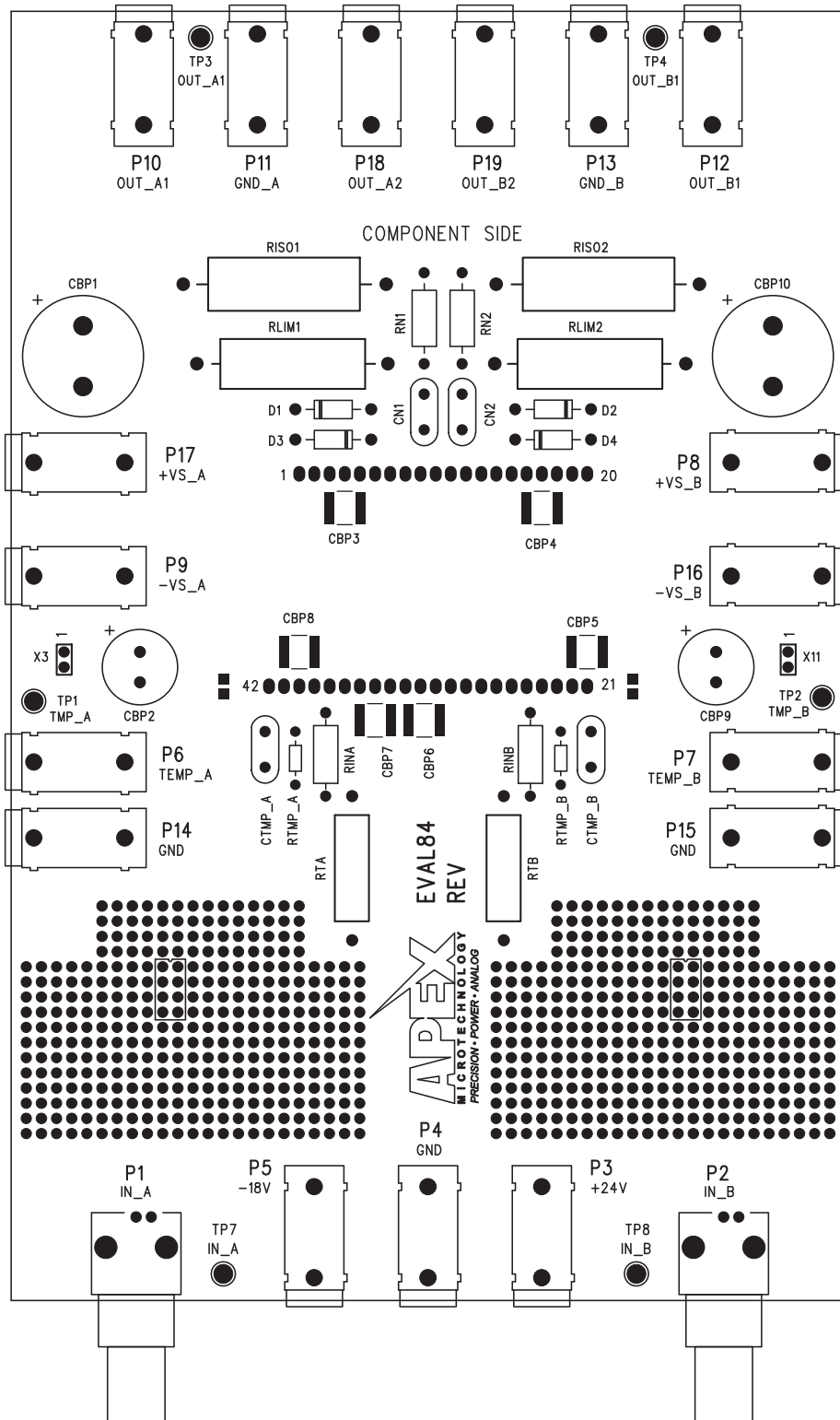


Figure 2: EVAL 76 PCB Layout



**PARTS LIST**

| Reference                            | Manufacturer Part # | Description                 | QTY |
|--------------------------------------|---------------------|-----------------------------|-----|
| <b><u>Resistors</u></b>              |                     |                             |     |
| RINA, RINB                           | CFR-50JB-52-160R    | 160 Ω, ½W                   | 2   |
| RTA, RTB                             | PR03000205109JAC00  | 51 Ω, 3W, 5%                | 2   |
| RN1, RN2                             | CMF5510K000FKEA     | 10 kΩ, 1/4W, 1%             | 2   |
| RTMP_A, RTMP_B                       | CMF5030K100FHEB     | 30.1 kΩ, 1/4W               | 2   |
| RLIMA, RLIMB                         | 15FR100E-ND         | 0.1 Ω, 5W, Metal            | 2   |
| RISO1, RISO2                         | ERX-5SJ1R5          | 1.5 Ω, 5W, Metal Film       | 2   |
| <b><u>Printed Circuit Boards</u></b> |                     |                             |     |
| EVAL 84                              | EVAL84              | Printed Circuit Board       | 1   |
| <b><u>Capacitors</u></b>             |                     |                             |     |
| CN1, CN2                             | RDER72E472K1M1H03A  | Ceramic, 4.7nF, 200V        | 2   |
| CBP1, CBP10                          | LGU2D221MELY        | Alum, 220uF, 200V           | 2   |
| CBP3, CBP4                           | C5750X7R2E105K230KA | Film, 1uF, 250V             | 2   |
| CBP5, CBP6                           | C5750X7R2E105K230KA | Film, 1uF, 250V             | 2   |
| CBP7, CBP8                           | C5750X7R2E105K230KA | Film, 1uF, 250V             | 2   |
| <b><u>Diodes</u></b>                 |                     |                             |     |
| D1, D2, D3, D4                       | MUR160RLG           | Rectifier, Ultra-fast       | 4   |
| <b><u>Hardware</u></b>               |                     |                             |     |
|                                      | HS31                | Heat Sink For Amplifier     | 1   |
|                                      | MS11                | Cage Jacks                  | 42  |
|                                      | 146510CJ            | Bnc Connector, PC Mount     | 2   |
|                                      | 571-0100            | Banana Jacks, PC Mount      | 17  |
|                                      | 91735A192           | Screw, Panhead, #8 X 0.375" | 4   |
|                                      | 60SPG00004          | Spacer Grommets             | 4   |
|                                      | 2221                | Standoff, Hex, #8 X 2.00"   | 4   |
|                                      | 92325A313           | Screw, Panhead, #8 x 0.625" | 4   |
|                                      | 90272A105           | Screw, Panhead, #4 x 0.625" | 4   |
| <b><u>Miscellaneous</u></b>          |                     |                             |     |
|                                      | SPC02SVJN-RC        | Jumper, Slip On             | 10  |
|                                      | PRPC002SADN-RC      | Header, Connector           | 10  |
|                                      | 5001                | Test Point, PC Mini         | 10  |

## BEFORE YOU GET STARTED

- All Apex amplifiers should be handled using proper ESD precautions.
- Always use the heat sink and thermal washers 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 operation levels allowed in the device data sheet.
- Check for oscillations.
- Please refer to Application note, AN01 for general operating conditions.

## ASSEMBLY

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

1. Note that each side of the circuit board is identified as either the component side or the DUT side. The component side has the designators printed on that side.
2. All through hole components (except the cage jacks) are installed on the component side of the board and soldered on the DUT side.
3. 42 pin receptacles are supplied with this evaluation kit. Insert the carrier strip through the DUT side, and solder the cage jacks on the component side. Once the cage jacks are soldered, remove the carrier strip, leaving only cage jacks soldered on the board.
4. Install CBP3, CBP4, CBP5, CBP6, CBP7 and CBP8 on the component side of the board.
5. Install diodes, D1, D2, D3, D4 and capacitors CBP1, CBP10 on the component side of the board. Ensure that the orientation of the components match the circuit schematic drawing.
6. Next install all the smaller components on the board. This is done because it becomes difficult to install a smaller part on the board once all the larger components are installed.
7. Mount the BNC connector provided with the kit (146510CJ) and solder it to the board. Also mount the banana jacks on the board. Install other miscellaneous components like jumpers and test points to complete your application circuit.
8. From the DUT side of the PCB, snap the spacer-grommets into the holes at the four corners of the PCB. Notice that the holes are slightly rectangular and match the spacer-grommets long and short sides to the holes in the PCB.
9. Apply a thin, uniform layer of thermal grease to the amplifier; a straight edge may be useful here. Position the amplifier over the mounting holes in the heatsink. Firmly push the amplifier onto the heatsink while slightly rotating the amplifier back and forth, ending with the mounting holes of the amplifier over the mounting holes in the heatsink.
10. Use 4-40x $\frac{1}{4}$ " machine screws to mount the amplifier to the heatsink. Do not over-tighten the screws as this provides no thermal benefit and may break the hardware.
11. Place the PCB assembly on the heatsink/amplifier assembly so that the hex spacers come through the aligning holes near the corners of the amplifier location in the PCB. Carefully lower the PCB assembly until the pins of the amplifier engage the cage jacks and then continue pushing the PCB assembly in the area between the amplifier's pins until the four spacer grommets at the four corners of the PCB touch the heatsink. At this point the PCB should not be bowed.
12. Use #8 X 1" sheet metal screws to mount the PCB to the heat sink at the four spacer-grommets.
13. #8 hex stand offs (91841A009) are also provided with the kit. Install the # 8 x 0.375" screws (91735A190), provided with the kit, from the component side. Attach the standoffs to these screws on the corners of the board. Refer to the assembly drawings while installing the standoffs.
14. Connect the external connections via the BNC connector and terminal strip. Hook up power supply and signals as necessary. The amplifier is now ready for testing.

**Figure 3: Top View**

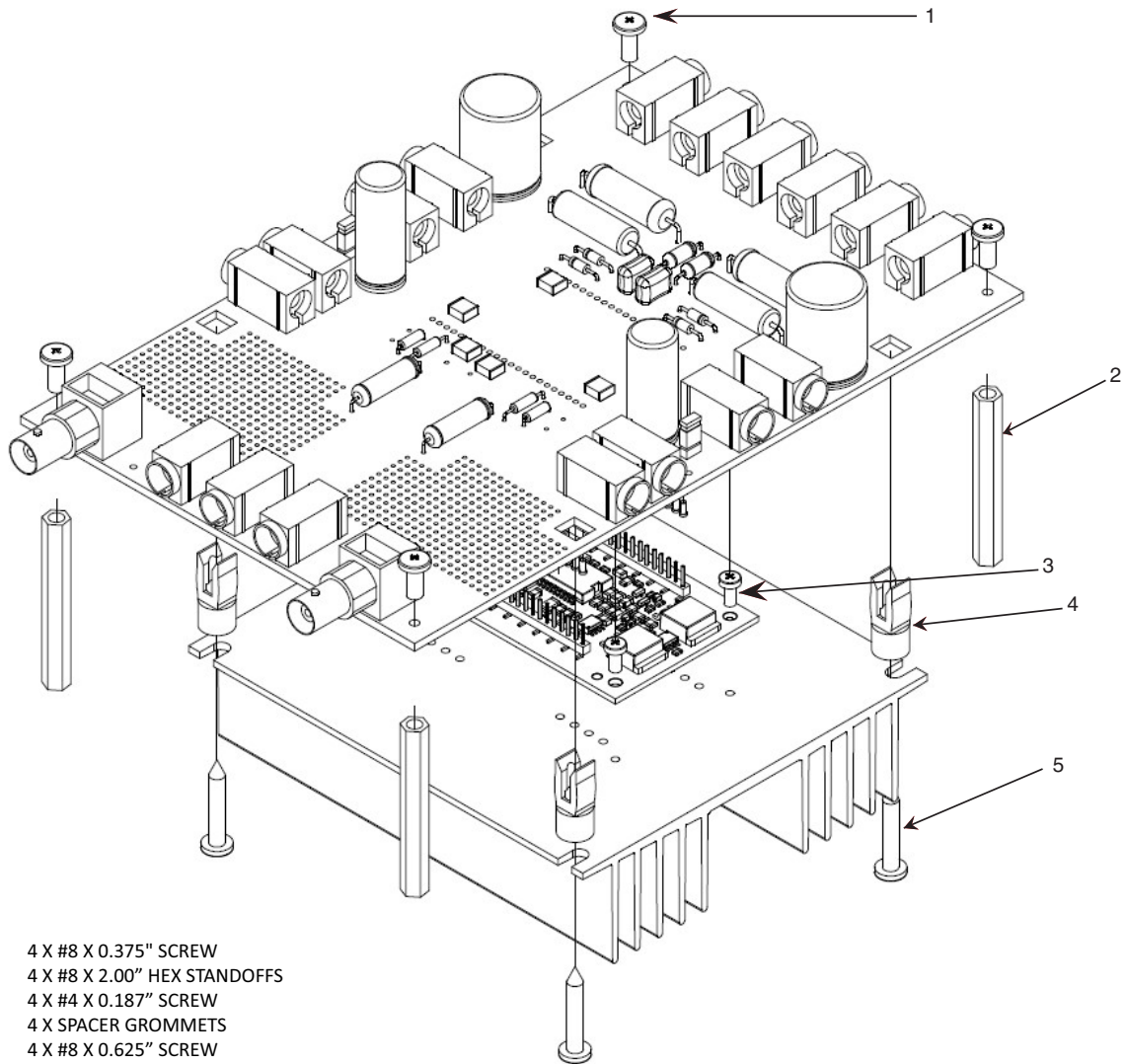
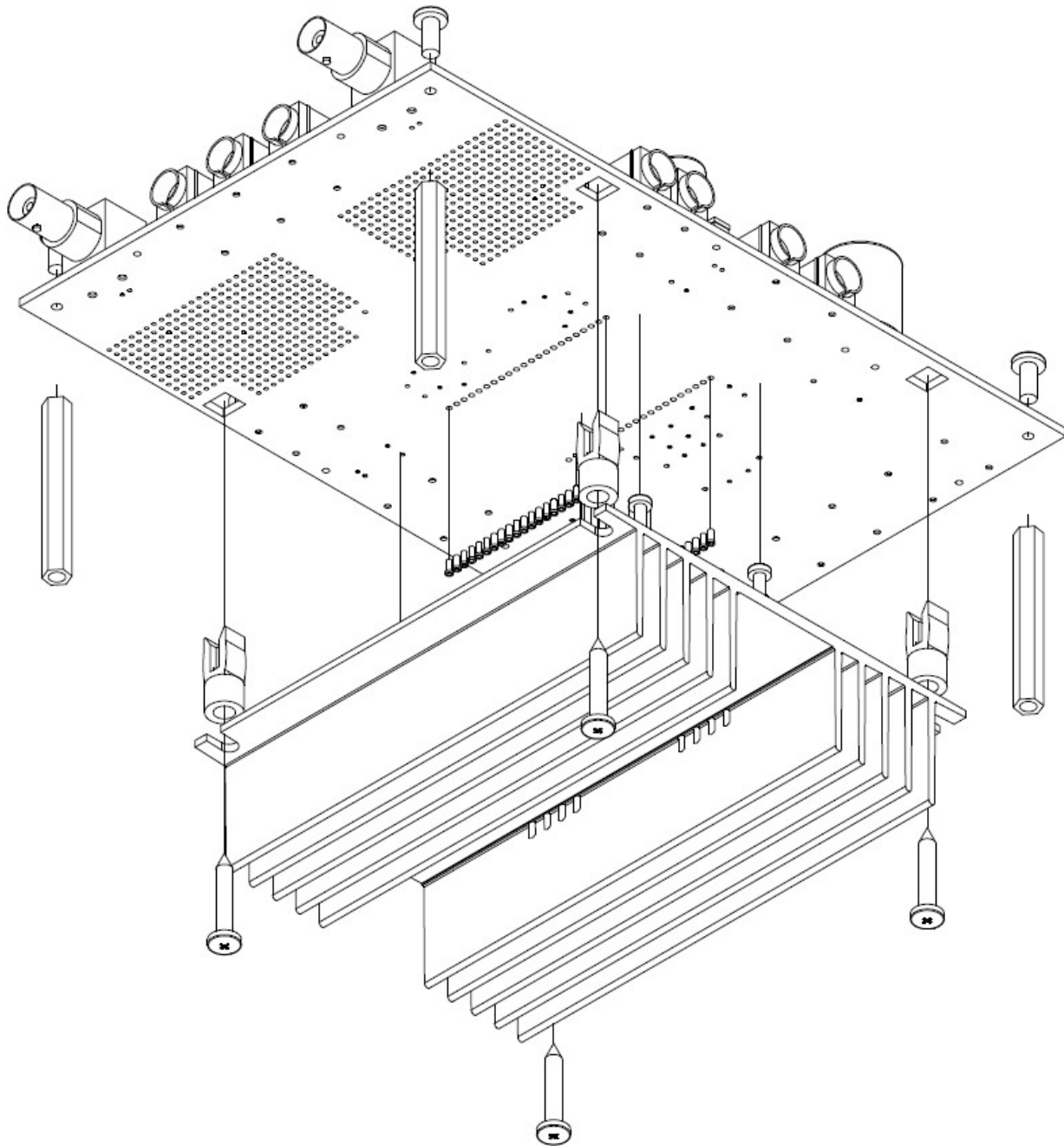


Figure 4: Bottom View



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## TEST ASSEMBLY

### ***EQUIPMENT NEEDED***

1. Power supply
2. Function Generator
3. Oscilloscope
4. Proper heat sinking system (if operating at high current)

### **TEST SETUP**

Connect the positive power supply to banana jacks P8 and P17. Since the negative supply is grounded, connect the ground connection of the positive supply to jacks P9 and P16. Connect the auxiliary supply to jacks P3, P4 and P5. Connect the BNC cable from the function generator to the BNC connector IN\_A and/or IN\_B based on the required channel to be used. If using a reactive load, connect the RISO resistor to banana jack Out\_A1/Out\_B1. If using a resistive load, connect the load to banana jack Out\_A2/Out\_B2. Out\_A2 and Out\_B2 are shorted across the RISO resistor (refer figure 1). Refer to the amplifier datasheet for typical values of input voltage, frequency and supply voltage. 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 input and supply voltage. Volt meters can be connected to banana jacks P6, P14 and P7, P15 to monitor the temperature of each channel of the MP104.

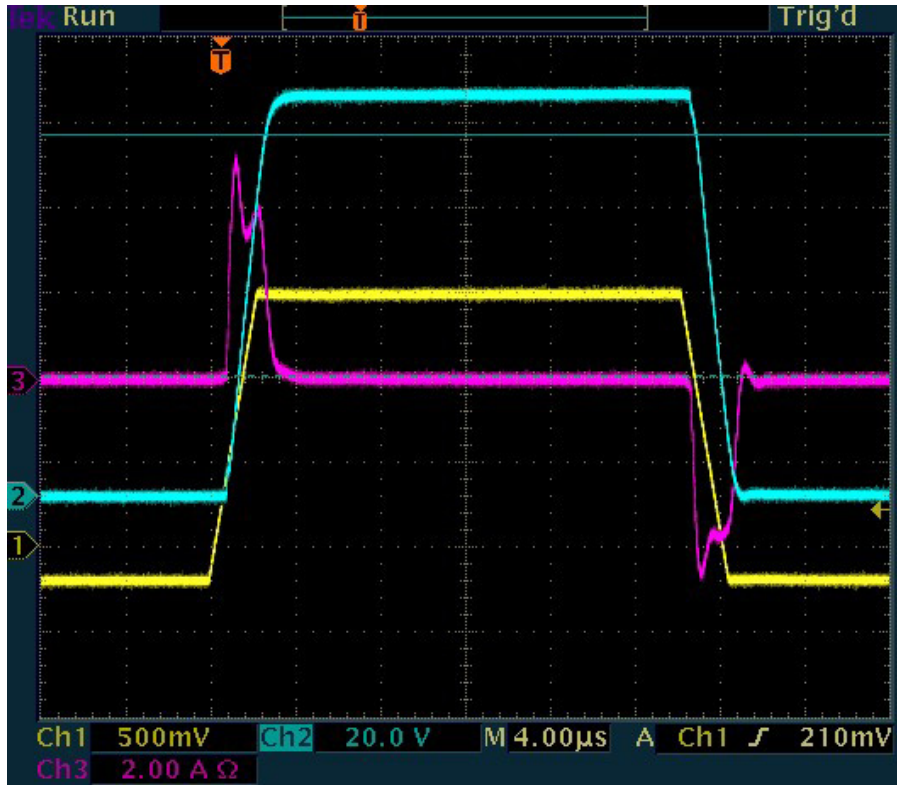
**Note:** For added precaution, power on the circuit with the amplifier removed. Check the voltage at each cage jack without the DUT, for correct voltage / signal at each respective pin. Once this is done, plug in the DUT and check for the correct signal

### **TEST RESULTS:**

For the test, an 80nF capacitive load was used. The input is set to 1.5V, with a -200mV offset, and the output is 97.5V. The test results can be seen in figure 5. The input of the amplifier is shown in Yellow color and the output of the amplifier is shown in Blue color. The input of the amplifier is set with a fixed rising edge and falling edge slew rate. The output is 65 times that of the input. The output current flowing through the capacitor is shown by the magenta colored waveform.



Figure 5: Test Results



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