

## Evaluation Kit

### APPLICABLE PARTS (SOLD SEPARATELY)

- MP165

### INTRODUCTION

This easy to use kit provides a platform with good circuit board layout and grounding to evaluate the MP165 Power Amplifier. The evaluation board provides options to install a load capacitor and series resistor to evaluate the MP165 performance with a printhead. 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 50Ω.

**Figure 1: Circuit Configure Diagram**

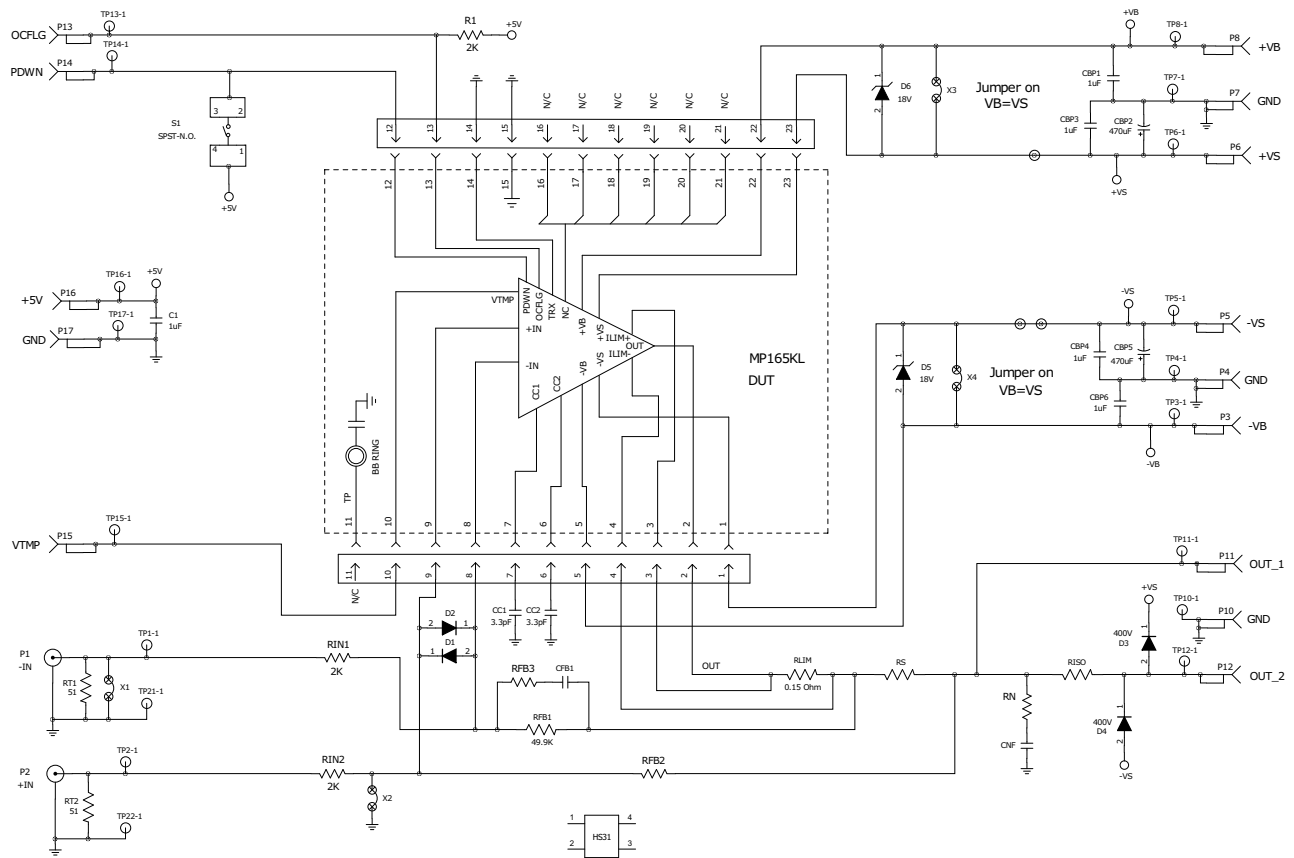
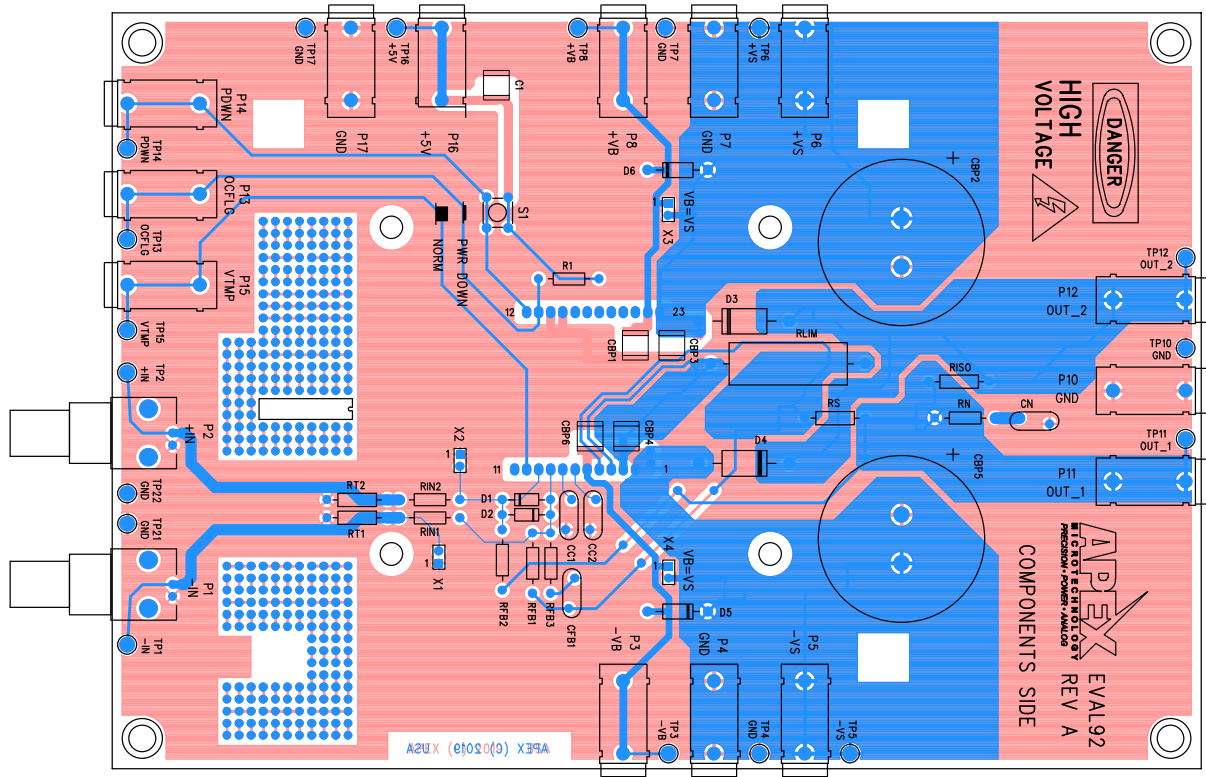


Figure 2: Circuit Board Layout



**PARTS LIST**

Reference	Manufacturer Part #	Description	QTY
<b><u>Resistors</u></b>			
RT1, RT2	PR01000105109JR500	51Ω, 1W, 5%	2
RIN1, RIN2	CMF552K0000FHEB	2kΩ, 1/2W, 1%	2
RFB1	CMF5549K900FHEB	49.9kΩ, 1/2W, 1%	2
RLIM	15FR150E	0.15Ω, 5W, 1%	1
<b><u>Diodes</u></b>			
D1, D2	1N4148TR	Diode, General Purpose	2
D3, D4	MUR440G	TVS diode, 400V	2
D5, D6	1N5931BRLG	Zener Diode, 18V	2
<b><u>Capacitors</u></b>			
C1, CBP1, CBP3, CBP4, CBP6	C5750X7R2E105K230KA	1μF, 250V, Film Cap	5
CBP2, CBP5	KMH450VN471M35X50T2	470μF, 450V, Electrolytic Cap	2
CC1, CC2	561R10TCCV33BA	3.3pF, 1kV, Ceramic Cap	2
<b><u>Hardware</u></b>			
	HS31	Heatsink for Amplifier	1
	MS11	Cage Jacks for Amplifier	1
	146510CJ	BNC Connector	2
	571-0100	Banana jacks, pc mount	14
	91735A190	Screw Pan head, #8	4
	90272A105	Screw Pan head, #4	2
	94997A350	Screw, Round head, #8	4
	2221	Standoff, hex, #8	4
	5007	Test Points	20
	SPC02SVJN-RC	Jumper, Slip On	10
	PRPC002SADN-RC	Header, Connector	10
<b><u>Miscellaneous</u></b>			
S1	VQ-PAC07K	SPST Push button Switch	1

## BEFORE YOU GET STARTED

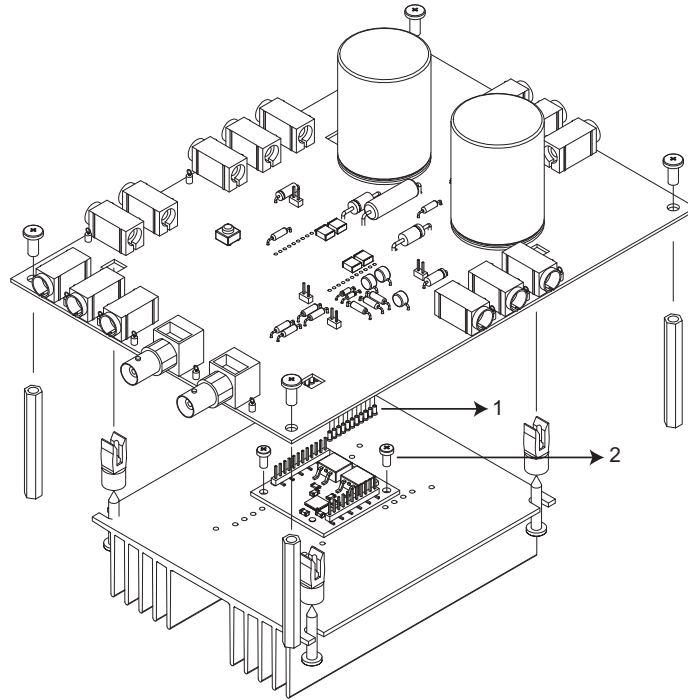
- All Apex Microtechnology amplifiers should be handled using proper ESD precautions.
- Always use the heatsink included in this kit.
- Always use adequate power supply bypassing.
- Do not change the connections while the circuit is powered.
- Initially set all power supplies to the minimum operation levels allowed on the device data sheet.
- Check for oscillations.
- Please refer to Application Note, AN01 for general operating conditions.

## ASSEMBLY INSTRUCTIONS

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

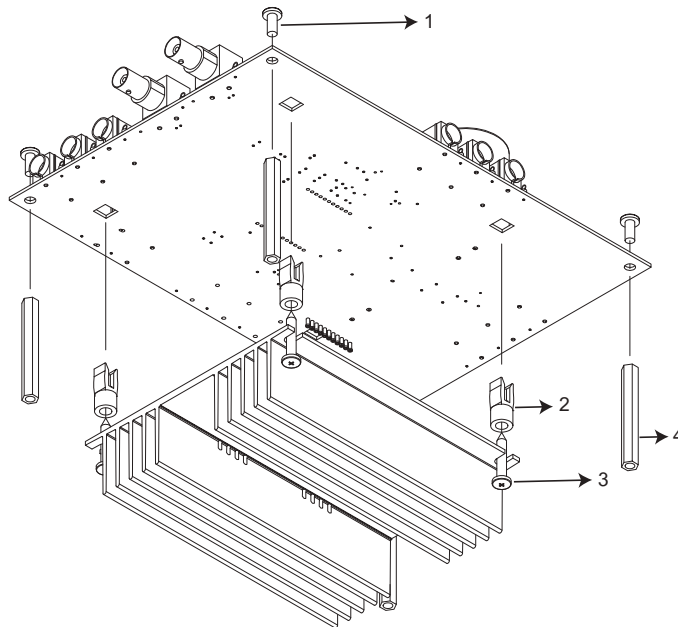
1. Note that each side of the circuit board is identified as either the component side or the DUT side. The component side has the designators printed on that side.
2. All through hole components (except the cage jacks) are installed on the component side of the board and soldered on the DUT side.
3. A pin receptacle is supplied with this evaluation kit. Break it into two strips 11 and 12 pins long. 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 C1, CBP1, CBP3, CBP4, CBP6, CC1 and CC2 on the component side of the board.
5. Install in X1, X2, X3 and X4.
6. Next, install all the smaller components on the board. This is done because it becomes difficult to install a small part on the board once all the larger components are installed.
7. Install diodes and capacitors CBP2 and CBP5 on the component side of the board. Ensure that the orientation of the components match the circuit schematic drawing.
8. 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 test points and S1 switch to complete your application circuit.
9. 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.
10. 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.
11. 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.
12. 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.
13. Use #8 sheet metal screws to mount the PCB to the heat sink at the four spacer-grommets.
14. #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.

**Figure 3: Evaluation Kit Assembly (Top View)**



- 1. 23 x MS11 Cage Jacks
- 2. 2 x #4 Screw, Pan Head

**Figure 4: Evaluation Kit Assembly (Bottom View)**



- 1. 4 x #8, 0.375" Screw
- 2. 4 x Spacer Grommets
- 3. 4 x #8, 0.98" Screw
- 4. 4 x #8 Standoffs

## TEST ASSEMBLY

### EQUIPMENT NEEDED

1. High Voltage Power Supply
2. Function Generators for PWM input or a microcontroller
3. Oscilloscope
4. Heatsink

## TEST SETUP

Connect the power supply to  $+V_S$  and  $-V_S$  ports. If you wish to use boost supply, connect boost voltage supplies to  $+V_B$  and  $-V_B$  ports. Otherwise, short  $+V_S$  to  $+V_B$  and  $-V_S$  or  $-V_B$ . Refer to the product data sheet for voltage specifications. Connect the BNC cable from the function generator to either P1 port for inverting configuration or to P2 for non-inverting configuration. Connect a 5V DC supply to P16 port for over current flag.

Do not plug in the MP165 yet. Now power on the input signal and power supplies. Measure voltages on all cage jacks on the DUT side to ensure that there is no short and to check if all the pins (cage jacks) read correct voltages.

Now, mount the MP165 on EVAL 92. If connecting a resistor load, connect between ports P11 and P10. 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 voltages.

Figure 5 and 6 show the input, output and over current flag waveforms when a MP165 is evaluated using the EK49 evaluation kit. The yellow waveform (channel 1) represents an input signal of  $4V_{p-p}$  and the cyan waveform (channel 2) represents an output signal of  $100V_{p-p}$ . The magenta waveform (channel 3) represents the over current flag.

During normal operation, the over current flag will remain high as shown in figure 5. When the amplifier starts operating in current limit mode, the over current flag becomes low as shown in figure 6.

Figure 5: Normal Operation

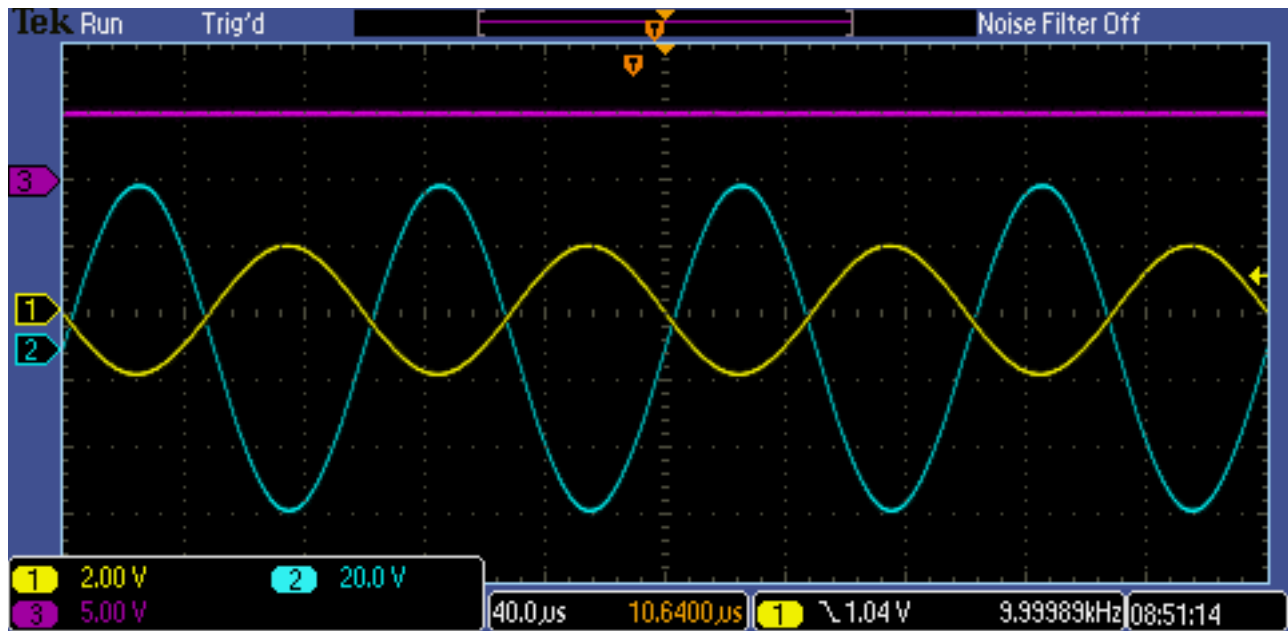
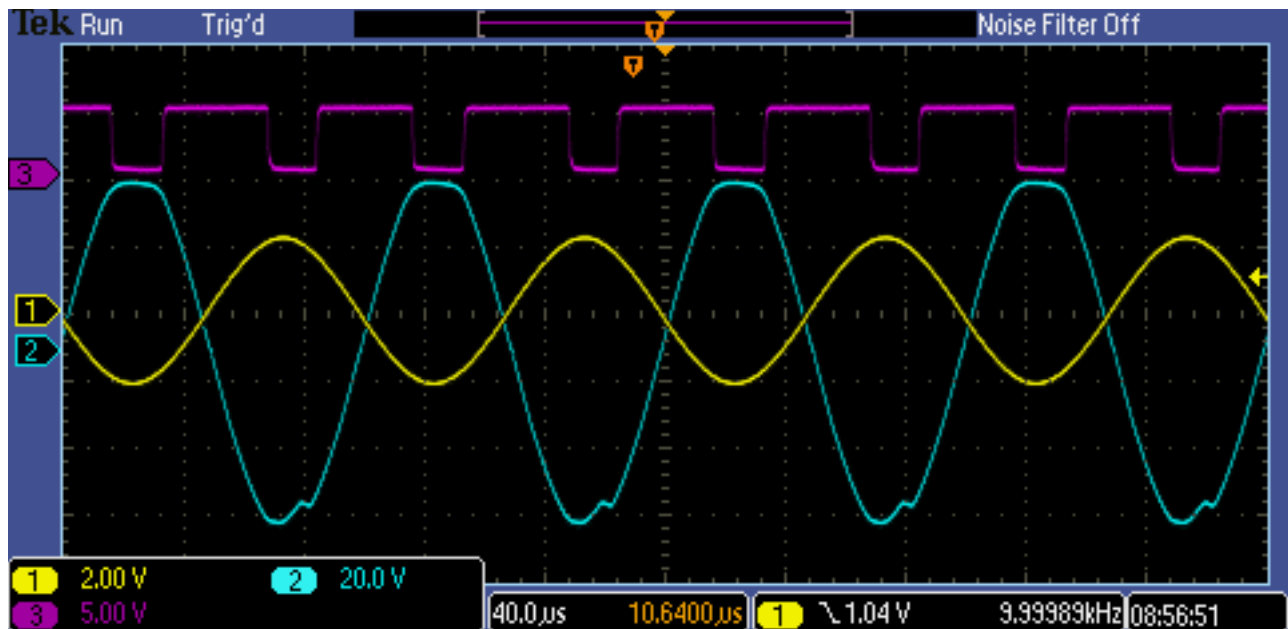


Figure 6: Current Limit Operation



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