

PowerAmp Design

EVALUATION KIT FOR PAD159 POWER BOOSTER

EVAL159

Rev B

INTRODUCTION

The EVAL159 assembled evaluation kit provides a convenient method to become familiar with the operation of the combined PAD157 amplifier and PAD159 power booster before your application circuit is committed to production. The EVAL159 is only suitable for the combination of the PAD157-PAD159 amplifiers working together. Some assembly is required since some user selections are needed depending on the application. For example, a current limit resistor value needs to be selected by the user. Also, there are several PCB mounting options available. The PAD157 amplifier and PAD159 power booster and accessory modules are purchased separately.

Critical connections for power supply bypassing, compensation, and interconnections between PAD157 and PAD159 are pre-wired. Connections are also provided for implementing fold-over current limit as well as standard current limit and also with the optional PAD125 Current Limit Accessory Module (highly recommended). Connections for the optional PAD131 fan control accessory modules are also provided. Fold-over current limit components are not provided since each application will have different requirements. Diode clamps on each power supply and the output connections are provided for those applications in which significant inductive kickback may be found. Terminal strips are also provided for input and output signals and power.

ASSEMBLY STEPS

Please note that the #1 cause of problems for evaluation kit users is not reading and following the directions (all of them). The #2 cause of problems is poor solder joints (cold or bridging). Don't become a statistic. ✓ each step.

Refer to the Illustrated Parts List for the components mentioned in each assembly step. The PCB is a four-layer board and consequently some steps may require a soldering temperature higher than normal and/or a larger soldering iron tip to make sure solder goes all the way through the board. These steps are marked with an *.

□ 1. Notice that the printed circuit board (PCB) is labeled on one side as the "DUT SIDE" and the other side as "CIRCUIT SIDE".

□ 2. As shown in the illustrated parts list, one or more of PAD's accessory cage jack strip CJS01 was used in the assembly of this kit. It may be advisable to use the cage jack strips in your production circuit board as well. The CJS01 cage jack sockets provide a convenient and inexpensive socket. Soldering and/or de-soldering the amplifier from the circuit board can be extremely difficult due to the high thermal conductivity of the amplifier's pins and substrate. You can find



Assembled EVAL159 with PAD157 and PAD159 mounted. Optional PAD125 and PAD131s also shown.

the datasheet for the CJS01 on the PAD website under the "Accessory Modules" tab.

□ 3. Refer to "Jumper Selection" below the Circuit Diagram for the EVAL159 on page 4. Install the required jumpers at the locations indicated depending on the options you have chosen. Refer to the data sheet for the PAD125 for complete information on current limit options.

□ 4.* This step may require a soldering temperature higher than normal and/or a larger soldering iron tip. Three 10mΩ current sense resistors, Rs, are provided. The three slots for Rs in the board are in parallel. You may use 1, 2, or all three, yielding a total Rs value of 10mΩ, 5mΩ or 3.3mΩ respectively. Although the PAD157 has on-board components for current limit, when the PAD159 is added to the overall circuit it may not be practical to use the PAD157 on-board current limit circuit as the power dissipation in Rs would likely be much too high. Instead, the PAD125 current limit accessory module is needed. Refer to the datasheets for the PAD157 and PAD125 to determine which resistor value best fits your application. In addition, the current limit set point can be fine-tuned using additional resistor components. See application note AN-38, available on the web site. Solder the resistor(s) from the "CIRCUIT SIDE" of the PCB making sure that the holes are completely filled with solder. It would be helpful to add liquid flux to the holes to help the solder pass all the way through the board.

□ 5. D3 and D5 are transient voltage suppressor diodes and are not supplied since the type (breakdown voltage) varies with the application. They are not necessary for every application. They are most commonly used in application circuits where kickback from an inductive load may force the supply voltage above the limits of the amplifier.

❑ **6.** The evaluation kit PCB can be mounted in several ways.
Option 1- Chassis mount. Use #6 x 1/4" M/F hex standoffs, #6 X 1/4" screw and #6 nut (not supplied) attached to the PCB at the ten locations on the PCB and the chassis. Use two of the rubber bumpers supplied at the indicated place at the centers of the amplifiers on the "CIRCUIT SIDE" of the PCB.

Option 2- Bench-top mount. Use the six rubber bumpers supplied. These are "stick-on" components. Remove the release paper from each bumper and apply the bumper to the square outlines on the "CIRCUIT SIDE" of the PCB.

Option 3- DIN rail mount. The PCB can be mounted on two or three DIN rails. Press the plastic DIN rail adaptors into the PCB in the holes at the edges of the PCB at locations 1 through 6 from the "CIRCUIT SIDE" of the PCB. Make sure that the plastic tines have fully spread out on the "DUT SIDE" of the PCB.

❑ **7.** Components for locations R1-R7, D1, D2 are for the optional fold-over current limiting and are not supplied. Refer to the data sheet of the PAD157 to find out how to apply circuits that require these components.

❑ **8.** Remove the 4 hex nuts from the mounting spacers of the PAD157 and PAD159.

❑ **9.** Align the 4 studs of the mounting spacers on each amplifier with the mounting holes in the PCB. Be sure that the amplifier's pin 1 aligns with pin 1 on the PCB. Slowly lower the amplifier into the PCB, making sure that the pins of the amplifier and the cage-jacks mate. Push the amplifier into the PCB until the mounting spacers meet the PCB. **Make doubly sure that each amplifier is installed in its correct location on the PCB. It is possible to install either amplifier in either location. To avoid damage to the amplifiers, each must be installed in its correct location.**

❑ **10.** Fasten the amplifiers to the PCB with the 4 hex nuts previously removed. Do not over-tighten the nuts as this may strip the mounting studs. The provided plastic nut starter can assist you here.

❑ **11.** Strip 1/8" of insulation from the wires connected to the fan of each amplifier. Twist and tin the wire ends (this may already be done). Insert the red wires into JP3 and JP4 labeled "+" and the black or blue wire into "-" at the location marked "FAN". Or, if you plan to use the PAD131 Fan Controller Accessory Modules, insert the fan wires similarly into the "+" and "-" cage jacks at the locations marked "Fan Control". Each amplifier has its own temperature sensor and so two PAD131 accessory modules must be used to control the fans of the two amplifiers.

❑ **12.** Add components as necessary to evaluate your application circuit. You can utilize the evaluation kit schematic and PCB views to map out your circuit and components. **Remember, if you are using the PAD125 Current Limit Accessory Module additional components will be needed to**

program the operation of the module. See the PAD125 datasheet.

❑ **13.** The PAD157 **must** be compensated to operate correctly. See EXTERNAL CONNECTIONS DIAGRAM on page 2 of the datasheet for the PAD157. A table is provided relating the required compensation capacitor value for various circuit gains. Your selected phase compensation capacitor will be installed at "C_c" on the evaluation kit PCB. A 470pF compensation capacitor has already been installed in the kit, but this value may not be the best value for your application. A 100pF capacitor is also provided. Remove and replace the capacitor as necessary.

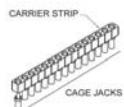



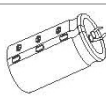












❑ **14.** If you have chosen to use the PAD125 accessory module install it at this time making sure that pin 1 on the module is aligned with the pin 1 marking on the PCB.

❑ **15.** If you have chosen to use the PAD131 Fan Controller Accessory Modules install them at this time making sure that pin 1 on the module is aligned with the pin 1 marking on the PCB. Double check that the wires from the fan are inserted into JP3 and JP4 at the "Fan Control" locations.

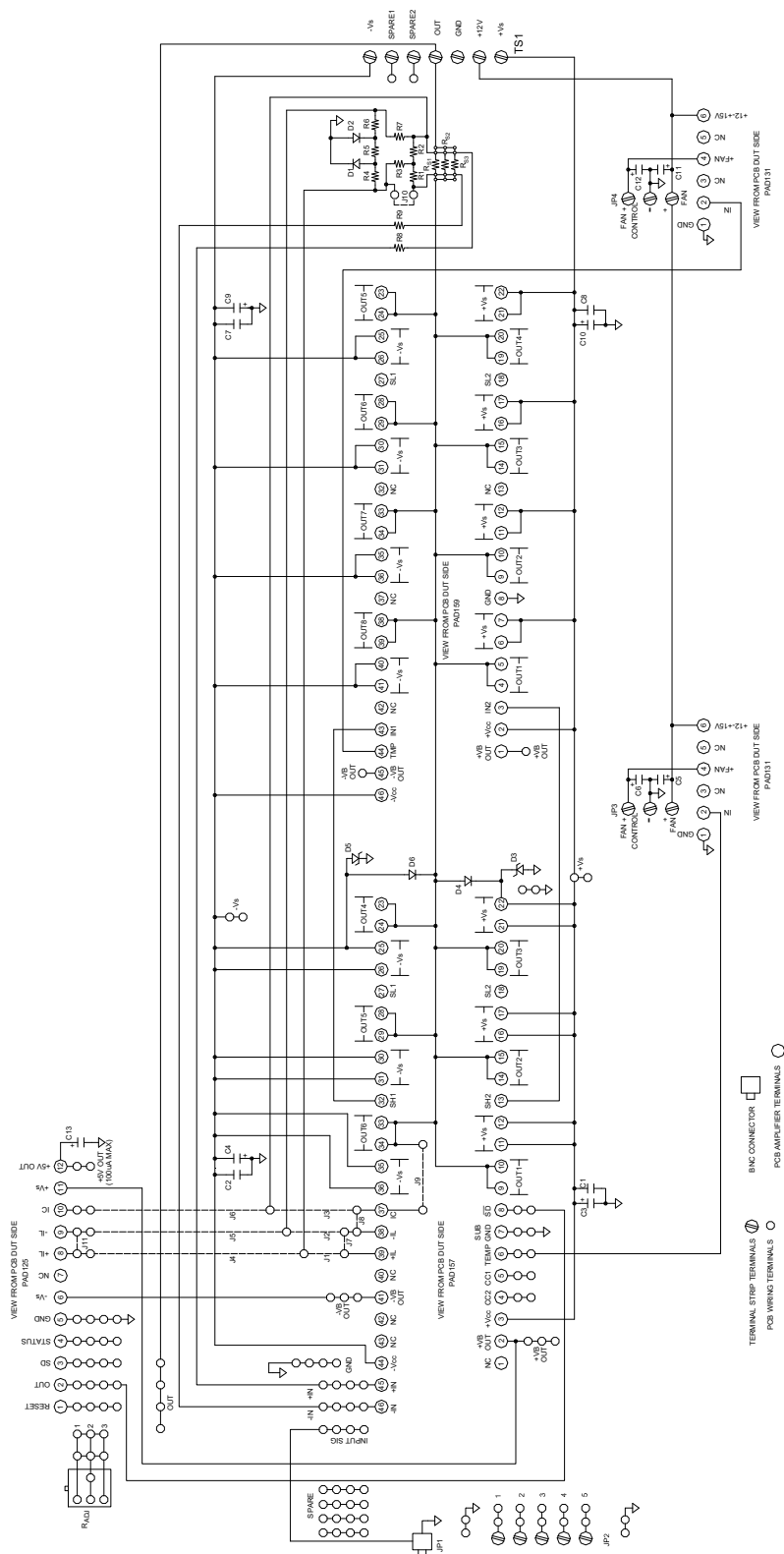
❑ **16.** The evaluation kit assembly is complete. Be sure you have read and followed all the assembly steps. Do not forget any jumpers that need to be installed. Inspect the circuit board for solder shorts or poor solder joints. An illuminated magnifier is helpful.

❑ **17.** **Before applying power to your circuit set the power supply for ±15V and set the power supply current limit to approximately 500mA. Use little or no load at first. Apply an input signal and check the output with an oscilloscope to verify proper functionality. This step can prevent damaging the amplifiers or the circuit board should there be some mistake in assembly.**

Note that the PAD157, PAD159, PAD125 and PAD131 are purchased separately.

✓	Ref	Qty	Description	Mfg/Distributor	Mfg. Part Number	Illustration (not to scale)
<input type="checkbox"/>	Amplifier Pins 1-46 + TP's	6	Cage Jacks w/carrier strip 32 wide	Power Amp Design	CJS01	
<input type="checkbox"/>	C5,6,11,12	4	35V Electrolytic Capacitor, 47µf	Panasonic/Digi-Key	EEU-FC1V470	
<input type="checkbox"/>	C13	1	6.3V Electrolytic Capacitor, 100µf	Panasonic/Digi-Key	ECA-0JHG101	
<input type="checkbox"/>	C7,8,14,15,16,17, 18,19,20,21,22,23, 24,25	14	Capacitor, 1µf 100V	Murata/Mouser	RDER72A105K2M1H03A	
<input type="checkbox"/>	C3,4,9,10	4	100V Electrolytic Capacitor, 3300uF	Nichicon/Digi-Key	LLS2A332MELA	
<input type="checkbox"/>	C _C	1	Ceramic Capacitor, 100pF	Kemet/Mouser	C322C101J2G5HA	
<input type="checkbox"/>	C _C	1	Ceramic Capacitor, 470pF	Kemet/Mouser	C322C471J2G5HA	
<input type="checkbox"/>	JP1	1	BNC Jack	AMP/Digi-Key	5221123-2	
<input type="checkbox"/>	JP2	1	Terminal Block	Phoenix/Digi-Key	1729157	
<input type="checkbox"/>	JP3,4	1	Terminal Block	Phoenix/Digi-Key	1729131	
<input type="checkbox"/>	TS1	1	Terminal Strip	Molex/Newark	38660-7807	
<input type="checkbox"/>	R _{S1-3}	3	Sense Resistor	Omite	CS3FR010E (10mΩ)	
<input type="checkbox"/>	D4,6	2	Diode, Fast Recovery	ON Semi/Digi-Key	MUR460RL	
<input type="checkbox"/>	NA	6	Rubber Bumper	3M/Digi-Key	SJ5518	
<input type="checkbox"/>	NA	1	Nut Starter	Menda/Jensen Tool	200	
<input type="checkbox"/>	NA	20 (5ea)	Jumper	3M/Mouser	923345-01-C (0.1 in) 923345-02-C (0.2 in) 923345-03-C (0.3 in) 923345-04-C (0.4 in)	
<input type="checkbox"/>	NA	6	35mm DIN Rail Adaptor	Scidyne	121-0014	
<input type="checkbox"/>	NA	1	PCB	Power Amp Design	EVAL159	NA

CIRCUIT DIAGRAM



JUMPER SELECTION

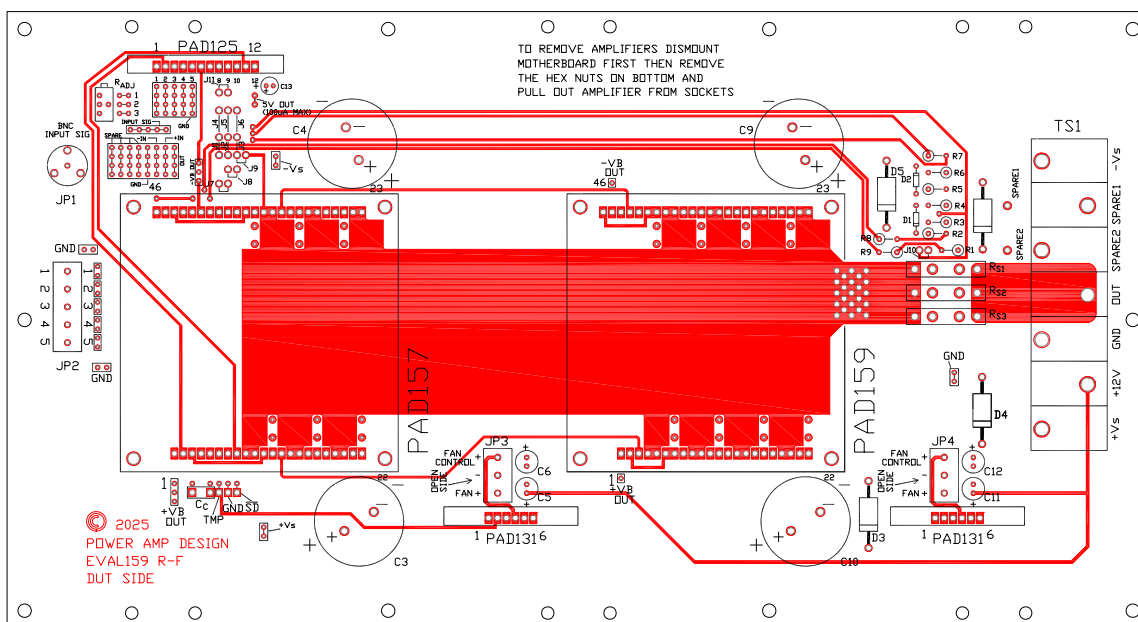
To use the PAD157-159 and PAD125 together **without** fold-over current limit insert jumpers J4, 6, 7, 8, 9, 10, 11 only. The EVAL159 comes wired for this option.

To use the PAD157-159 and PAD125 together **with** fold-over current limit insert jumpers J4, 5, 6, 7, 8, 9 only.

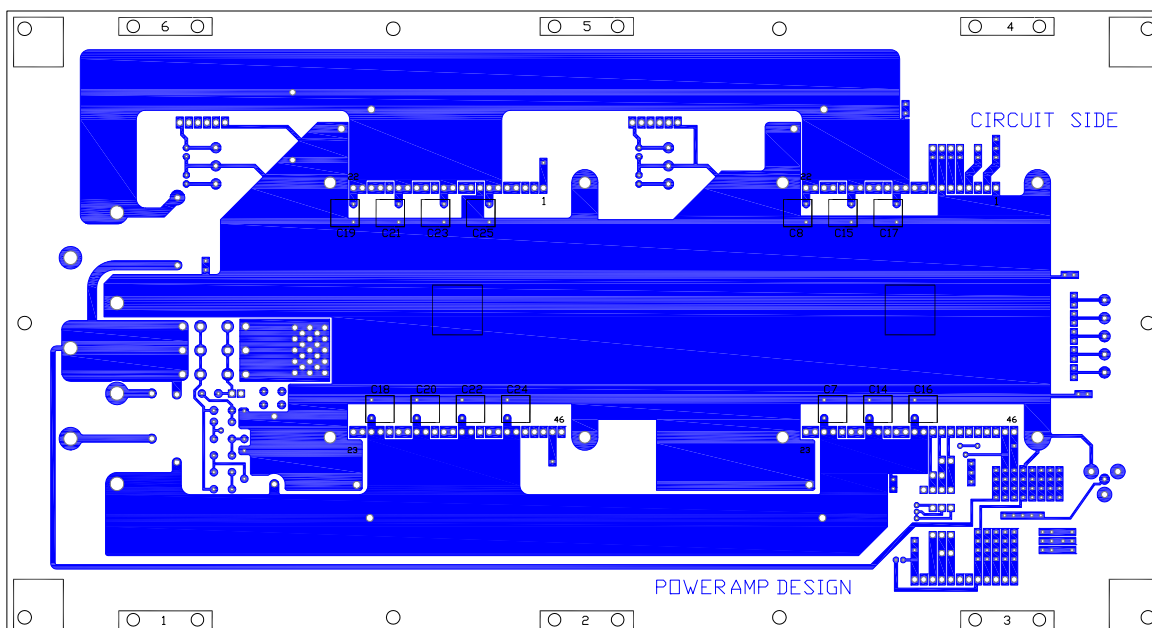
To use the PAD157-159 with internal current limit (**not recommended**) and **without** fold-over current limit insert jumpers J1, 3, 7, 10.

To use the PAD157-159 with internal current limit (**not recommended**) and **with** fold-over current limit insert jumpers J1, 2, 3 only.

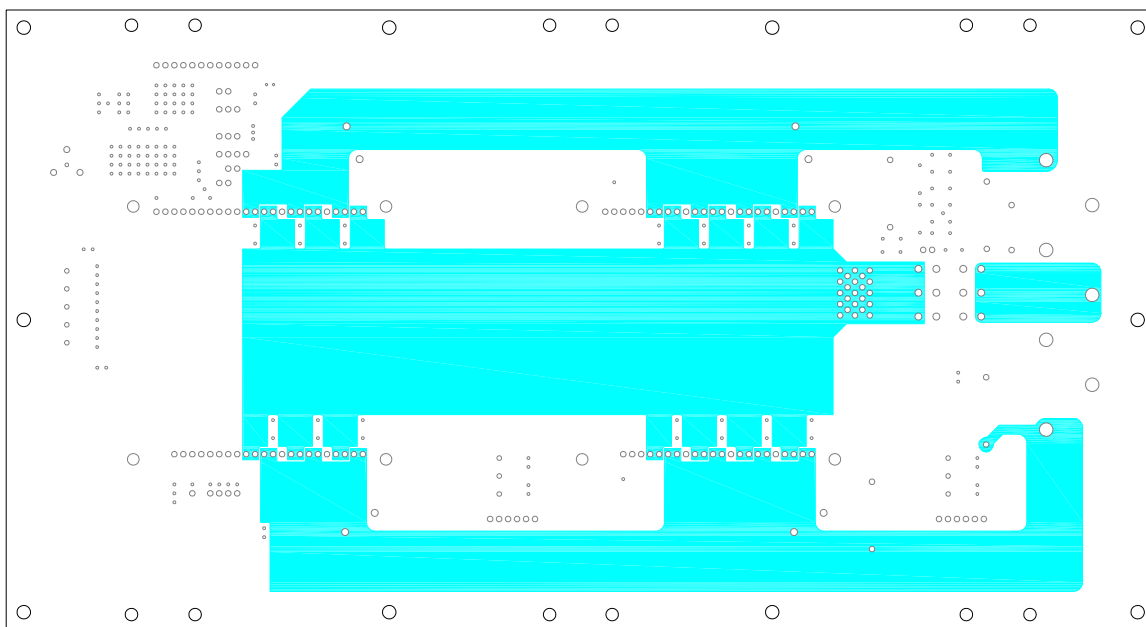
TOP VIEW



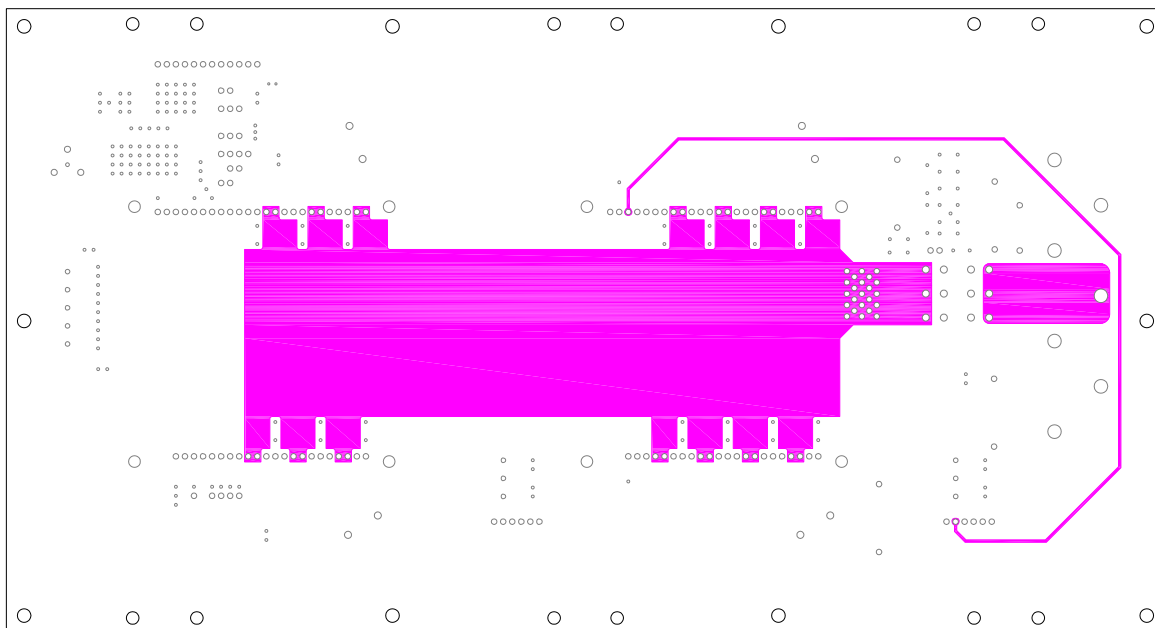
BOTTOM VIEW



INNER LAYER 2



INNER LAYER 3



EVAL159 with PAD157-159 installed. Optional PAD125 and PAD131s also shown installed.



MECHANICAL DRAWING OF EVAL159 R-F DUT SIDE (POWER AMP DESIGN).

Dimensions (IN [MM]):

- Overall Width: 12.800 [325.12]
- Overall Height: 6.900 [175.26]
- Top Section Width: 12.408 [315.16]
- Top Section Height: 8.533 [216.74]
- Left Section Width: 4.267 [108.38]
- Bottom Section Width: 4.652 [118.16]
- Bottom Section Height: 6.402 [162.61]
- Right Section Width: 9.300 [236.22]
- Left Section Height: 3.254 [82.65]
- Right Section Height: 3.254 [82.65]

Key Features and Components:

- Power Amp Design:** EVAL159 R-F DUT SIDE.
- Components:** PADI125, PADI157, PADI159, PADI1316, C4, C9, C12, C11, C10, C3, C5, C6, R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R176, R177, R178, R179, R180, R181, R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, R199, R200, R201, R202, R203, R204, R205, R206, R207, R208, R209, R210, R211, R212, R213, R214, R215, R216, R217, R218, R219, R220, R221, R222, R223, R224, R225, R226, R227, R228, R229, R230, R231, R232, R233, R234, R235, R236, R237, R238, R239, R240, R241, R242, R243, R244, R245, R246, R247, R248, R249, R250, R251, R252, R253, R254, R255, R256, R257, R258, R259, R260, R261, R262, R263, R264, R265, R266, R267, R268, R269, R270, R271, R272, R273, R274, R275, R276, R277, R278, R279, R280, R281, R282, R283, R284, R285, R286, R287, R288, R289, R290, R291, R292, R293, R294, R295, R296, R297, R298, R299, R300, R301, R302, R303, R304, R305, R306, R307, R308, R309, R310, R311, R312, R313, R314, R315, R316, R317, R318, R319, R320, R321, R322, R323, R324, R325, R326, R327, R328, R329, R330, R331, R332, R333, R334, R335, R336, R337, R338, R339, R340, R341, R342, R343, R344, R345, R346, R347, R348, R349, R350, R351, R352, R353, R354, R355, R356, R357, R358, R359, R360, R361, R362, R363, R364, R365, R366, R367, R368, R369, R370, R371, R372, R373, R374, R375, R376, R377, R378, R379, R380, R381, R382, R383, R384, R385, R386, R387, R388, R389, R390, R391, R392, R393, R394, R395, R396, R397, R398, R399, R400, R401, R402, R403, R404, R405, R406, R407, R408, R409, R410, R411, R412, R413, R414, R415, R416, R417, R418, R419, R420, R421, R422, R423, R424, R425, R426, R427, R428, R429, R430, R431, R432, R433, R434, R435, R436, R437, R438, R439, R440, R441, R442, R443, R444, R445, R446, R447, R448, R449, R450, R451, R452, R453, R454, R455, R456, R457, R458, R459, R460, R461, R462, R463, R464, R465, R466, R467, R468, R469, R470, R471, R472, R473, R474, R475, R476, R477, R478, R479, R480, R481, R482, R483, R484, R485, R486, R487, R488, R489, R490, R491, R492, R493, R494, R495, R496, R497, R498, R499, R500, R501, R502, R503, R504, R505, R506, R507, R508, R509, R510, R511, R512, R513, R514, R515, R516, R517, R518, R519, R520, R521, R522, R523, R524, R525, R526, R527, R528, R529, R530, R531, R532, R533, R534, R535, R536, R537, R538, R539, R540, R541, R542, R543, R544, R545, R546, R547, R548, R549, R550, R551, R552, R553, R554, R555, R556, R557, R558, R559, R560, R561, R562, R563, R564, R565, R566, R567, R568, R569, R570, R571, R572, R573, R574, R575, R576, R577, R578, R579, R580, R581, R582, R583, R584, R585, R586, R587, R588, R589, R590, R591, R592, R593, R594, R595, R596, R597, R598, R599, R600, R601, R602, R603, R604, R605, R606, R607, R608, R609, R610, R611, R612, R613, R614, R615, R616, R617, R618, R619, R620, R621, R622, R623, R624, R625, R626, R627, R628, R629, R630, R631, R632, R633, R634, R635, R636, R637, R638, R639, R640, R641, R642, R643, R644, R645, R646, R647, R648, R649, R650, R651, R652, R653, R654, R655, R656, R657, R658, R659, R660, R661, R662, R663, R664, R665, R666, R667, R668, R669, R670, R671, R672, R673, R674, R675, R676, R677, R678, R679, R680, R681, R682, R683, R684, R685, R686, R687, R688, R689, R690, R691, R692, R693, R694, R695, R696, R697, R698, R699, R700, R701, R702, R703, R704, R705, R706, R707, R708, R709, R710, R711, R712, R713, R714, R715, R716, R717, R718, R719, R720, R721, R722, R723, R724, R725, R726, R727, R728, R729, R730, R731, R732, R733, R734, R735, R736, R737, R738, R739, R740, R741, R742, R743, R744, R745, R746, R747, R748, R749, R750, R751, R752, R753, R754, R755, R756, R757, R758, R759, R760, R76