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Differential Amplifier Evaluation Board for Single 8-lead LFCSP Packages

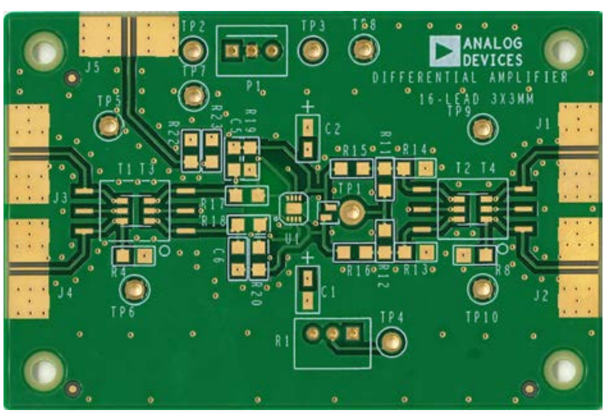
FEATURES

Flexible board layout
Accommodates the AD8137 and AD8139
Accommodates various circuit configurations
Enables quick breadboarding/prototyping
Edge-mounted circuit configuration
Easy connection to test equipment and other circuits
RoHS compliant

GENERAL DESCRIPTION

The Analog Devices, Inc., differential driver evaluation board makes it easy for designers to obtain quick performance results for their particular differential driver application circuits. The board layout is very flexible and allows for many circuit configurations, including traditional four-resistor circuits, circuits with two different feedback loops, circuits with input and output transformers, filters, and many others. Most resistors and capacitors use 1206 packages.

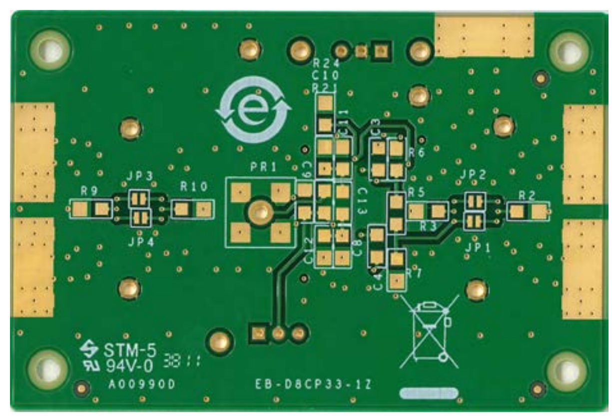
The board accommodates the AD8137 and AD8139. The data sheets for these devices should be consulted in conjunction with this evaluation board user guide.



NOTES
1. THE EVALUATION BOARD PART NUMBER ON YOUR BOARD MAY APPEAR DIFFERENT THAN WHAT IS SHOWN ON THE BOARD PICTURED HERE.

09336-002

Figure 1. Board Photograph Component Side



09336-003

Figure 2. Board Photograph Circuit Side

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10/12—Rev. 0 to Rev. A

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9/10—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

Power is applied to the board through P1, a Molex® 3-pin header, Part Number 22-11-2032 (see Figure 1 and Figure 3). Pin 1 (square footprint) is for the positive supply, Pin 3 is for the negative supply, and Pin 2 is connected to the ground plane of the board. Alternatively, looped test points can be used. TP2 connects to the positive supply, TP3 connects to the negative supply, and TP5 through TP10 connect to the ground plane.

The board accommodates single or dual supplies. For single-supply operation, connect the negative supply to the ground plane.

It is very important that the power supply pins of the device under test (DUT) have broadband decoupling circuitry. The board layout facilitates this with footprints for two 1206 ceramic capacitors on each supply. At frequencies beyond the resonant frequency of the first capacitor and its associated internal and external inductance, the second capacitor provides the required low impedance return current path. For optimum performance, place the smaller of the two capacitances closest to the DUT, in the C8 and C11 positions (see Figure 3). C10 and C12 can also be used for additional power supply bypassing. C13 provides the user with the option of adding differential decoupling between the supplies. Bulk decoupling is provided by C1 and C2; 10 μF tantalum capacitors are recommended.

FEEDBACK NETWORKS AND INPUT/OUTPUT TERMINATIONS

R19 and R17 compose the upper resistive feedback loop (see Figure 3), and R20 and R18 compose the lower feedback loop. C3 and C4 are included across the feedback resistors to provide frequency-dependent feedback, typically used to introduce a real-axis pole in the closed-loop frequency response.

To minimize summing node capacitances, the ground plane under and around Pin 1 and Pin 8 of the DUT and the copper that connects to them have been removed.

R6 and R7 are included as input termination resistors for applications that have single-ended inputs. Having a place for a shunt resistor on each input makes it simple to match the two feedback factors. A common example of how this is used is when the input signal originates from an unbalanced 50 Ω source. In this case, the single-ended termination resistance is 50 Ω, and the Thevenin equivalent resistance seen looking back to the source is 25 Ω. For the traditional four-resistor configuration, where R19 = R20 and R17 = R18, the feedback networks are matched by making the shunt resistor on the input leg opposite the termination resistor equal to 25 Ω. R5 is provided for differential termination.

R15 and R16 series termination resistors are provided on each of the outputs for impedance matching, analog-to-digital converter (ADC) driving, and other system requirements.

V_{OCM} INPUT

The V_{OCM} input can be set to a dc level by adjusting the R1 potentiometer that spans the power supplies. For the dc case, C9 is provided at the wiper for decoupling.

An external voltage can be applied to V_{OCM} via TP4 (referenced to the ground plane of the board). In ADC driving applications, it is convenient to apply the ADC dc reference voltage output directly to TP4.

It is also possible to drive the V_{OCM} input from an external ac source. In this case, omit C9 or reduce it to a value that allows the desired signal to be passed. For high frequency signals on V_{OCM}, connect the center conductor of a coaxial cable to TP4 and ground its shield at TP10.

R21 is provided for the high common-mode output impedance application illustrated in the AD8132 data sheet.

MEASURING OUTPUT COMMON-MODE VOLTAGE

The internal common-mode feedback loop used in the differential drivers forces the output common-mode voltage to be equal to the voltage applied to the V_{OCM} input, thereby providing excellent output balance. R11 and R12 form a voltage divider across the differential output, and the voltage at the divider tap is equal to the output common-mode voltage, provided that R11 and R12 are exactly matched in value. If R11 and R12 are used to evaluate the output common-mode voltage, they should be measured and matched to better than 300 ppm to obtain results commensurate with the DUT output balance error performance of −70 dB. Test Point PR1 accepts coaxial-type oscilloscope test points, such as the Berg Electronics 33JR135-1.

INPUT/OUTPUT TRANSFORMERS

The board has the added flexibility of allowing the user to incorporate transformers on its input and output. This capability can be especially useful when connecting to single-ended test equipment. Because both input and output transformers have dual, nested footprints, the user can select from a wide array of transformers available from companies such as Mini-Circuits® and Coilcraft®. The layout provides footprints for connecting resistors to ground on the primary and secondary transformer center taps, offering the user a number of options with regard to the common-mode properties of the evaluation circuit.

JP1, JP2, JP3, and JP4 are jumpers on the back side of the board that provide direct shunts across their associated transformers. When not using a transformer, bypassing the transformer is a simple matter of shorting the appropriate jumpers. When using a transformer, it is a good idea to verify that the associated jumpers are open.

SMA INPUT/OUTPUT CONNECTORS

The inputs and outputs have edge-mounted Subminiature A (SMA) connectors for straightforward connection to coaxial cables. The recommended connector type is Johnson Components™, Part Number 142-0701-801 or equivalent.

OTHER COMPONENTS

The components described in this user guide pertain mostly to traditional amplifier topologies. Footprints are provided for a number of other components on the board to allow the user to be more creative than the traditional designs. A component labeled as a capacitor need not be a capacitor provided that it fits the user's application circuit and the footprint on the board.

In application circuits where footprints for desired components are not available on the board, the user is encouraged to find ways to include them. For example, if an additional shunt element is required, the user can scrape some solder mask away from the ground plane and trace (if necessary) to make a place for the additional part. Furthermore, 1206 elements can be stacked on top of each other to implement a parallel circuit. An example of this includes stacking capacitors across R17 and R18 to realize a zero in the closed-loop transfer function. This is one way to insert pre-emphasis in a line-driver application.

EVALUATION BOARD SCHEMATIC AND LAYOUT

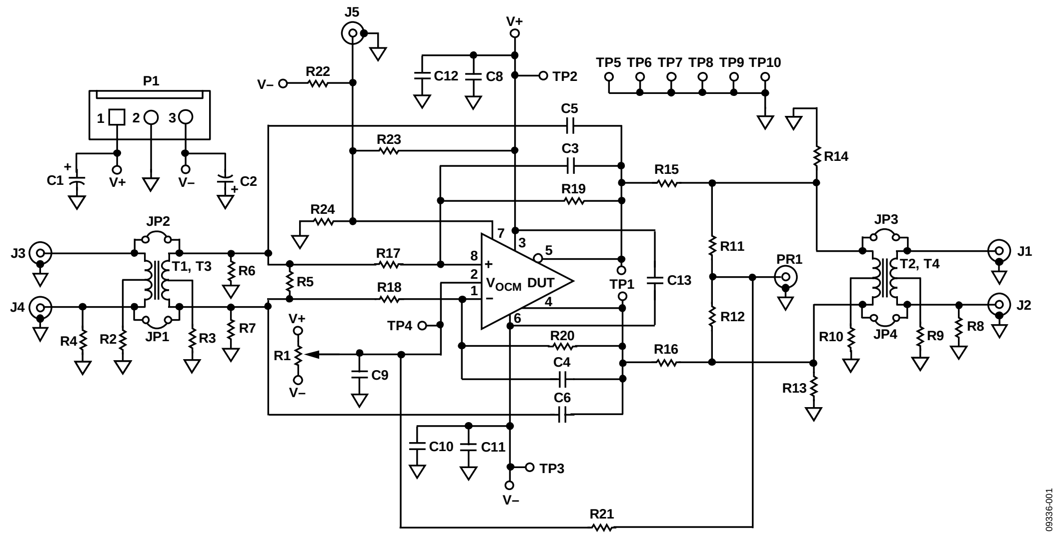

Figure 3. Evaluation Board Schematic

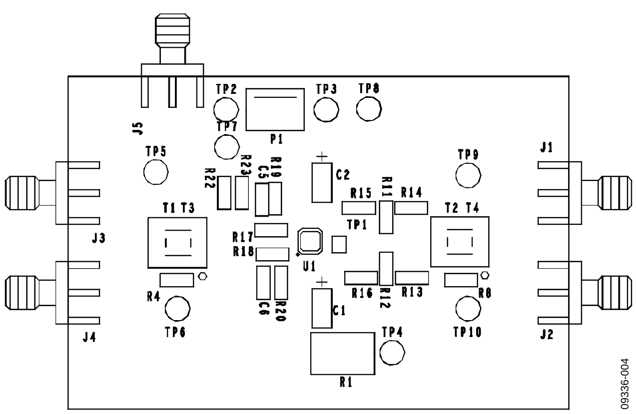

Figure 4. Assembly Drawing, Component Side

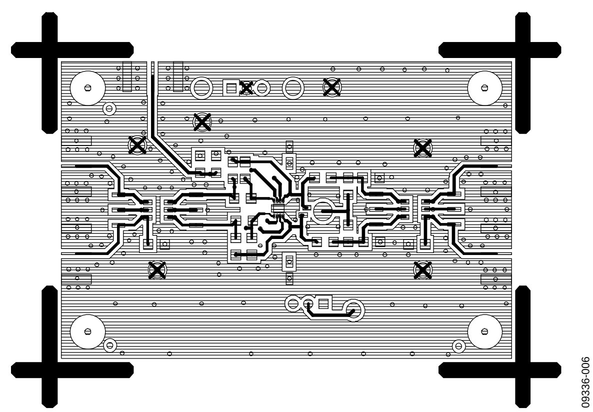

Figure 6. Metallization, Component Side

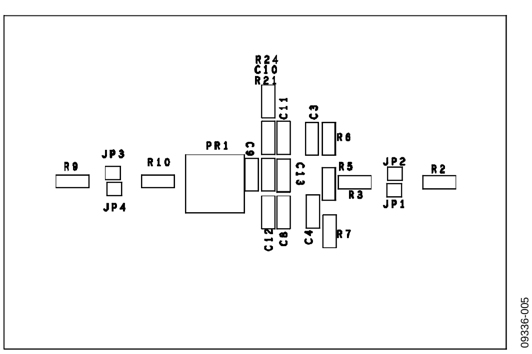

Figure 5. Assembly Drawing, Circuit Side (LFCSP)

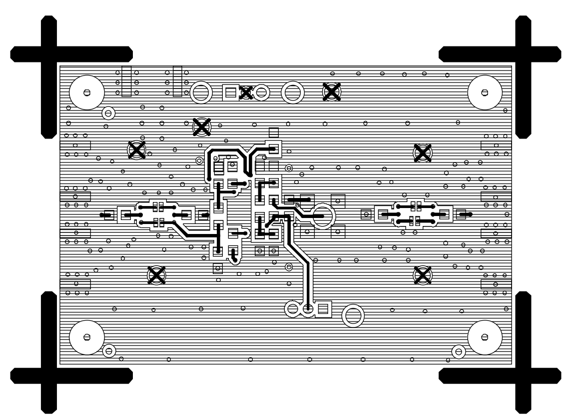

Figure 7. Metallization, Circuit Side

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Qty	Reference Designator	Description	Package
2	C1, C2	10 µF capacitor	3216
10	C3 to C6, C8 to C13	Capacitor, user-defined value	C1206
5	J1 to J5	SMA connector	SMASMT
4	JP1 to JP4	Jumper	JPRSLD02
1	P1	3-pin header, Molex Part 22-11-2032	PWR_CONN_6-9-2
1	PR1	SMA connector	SMACON
1	R1	1 kΩ potentiometer	3299W
23	R2 to R24	Resistor, user defined value	R1206
2	T1, T2	Transformer	ETC1-6
2	T3, T4	Transformer	KK81
1	TP1	Test point	TP
9	TP2 to TP10	Test point	TP104
1	U1	Device under test	8-lead LFCSP
1		PC board	

RELATED LINKS

Resource	Description
AD8137	Product page, AD8137 low cost, low power differential ADC driver
AD8139	Product page, AD8139 low noise, rail-to-rail, differential ADC driver

NOTES

NOTES

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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