



ABSTRACT

The LMH5485-SP-EVM is a generic, unpopulated printed circuit board (PCB) designed to provide an optimized layout when evaluating the LMH5485-SP in a HKX (CFP-8) package. Only a few components are needed to begin evaluation, [Figure 8-1](#) displays a recommended default schematic. To avoid parasitic component inductance, the board only accepts surface mount resistors and capacitors. The EVM is designed for use with 50-Ω laboratory equipment at the input and output, along with balun footprints at the input and output for simple conversion between single-ended and differential signals. For further information on this device and good PCB layout techniques, see [LMH5485-SP Radiation Hardened Assured \(RHA\) Negative Rail Input, Rail-to-Rail Output, Precision, 850-MHz Fully Differential Amplifier](#).

Table of Contents

1 LMH5485-SP-EVM	2
2 Features	2
3 EVM Specifications	2
4 Power Connections	2
5 Split-Supply Operation	2
6 Single-Supply Operation	2
7 Input and Output Connections	3
7.1 V _{OCM} Input Connections.....	3
7.2 \overline{PD} Input Connections.....	3
7.3 Using the Optional Differential Outputs (J6 and J7).....	3
8 LMH5485-SP Schematic and Layout	4
8.1 LMH5485-SP-EVM Layout.....	5
9 Related Documentation	7

List of Figures

Figure 1-1. LMH5485-SP-EVM Board (Top Side).....	2
Figure 8-1. LMH5485-SP Recommended Default Schematic.....	4
Figure 8-2. LMH5485-SP-EVM Top Layer, Signal.....	5
Figure 8-3. LMH5485-SP-EVM Layer 2.....	5
Figure 8-4. LMH5485-SP-EVM Layer 3.....	6
Figure 8-5. LMH5485-SP-EVM Bottom Layer.....	6

List of Tables

Table 3-1. EVM Specifications.....	2
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1 LMH5485-SP-EVM

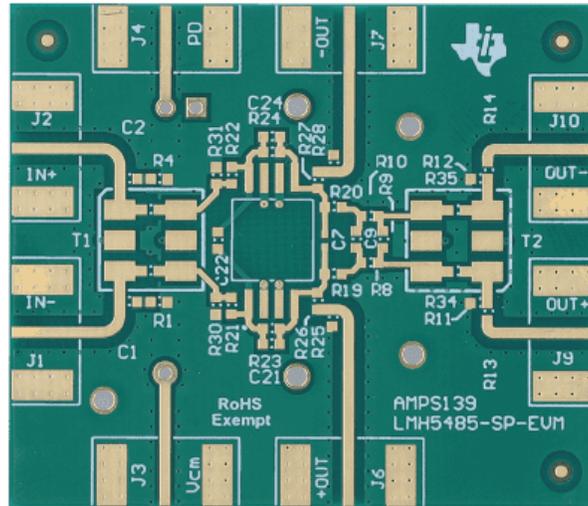


Figure 1-1. LMH5485-SP-EVM Board (Top Side)

2 Features

This EVM supports the following features:

- Can be configured for either split-supply or single-supply operation
- Easily configurable for various gain options
- Designed for easy connection to standard 50- Ω input and output impedance test equipment

3 EVM Specifications

Table 3-1 lists the EVM specifications when used in the recommended configuration:

Table 3-1. EVM Specifications

		Value
	Single-supply voltage range ($V_- = \text{GND}$)	2.7-V to 5.1-V
V_{\pm}	Split-supply voltage range	$\pm 1.35\text{-V}$ to $\pm 2.55\text{-V}$
$I_{S\pm}$	Supply current (no load)	10.1-mA
I_{OUT}	Output drive	$\pm 100\text{-mA}$

4 Power Connections

The LMH5485-SP-EVM has test point footprints for easy connection of power. The positive supply input is labeled V_+ . The negative supply input is labeled V_- . The ground input is labeled GND.

5 Split-Supply Operation

To operate at split supply, apply the positive supply voltage to V_+ , negative supply voltage to V_- , and the ground reference from supply to GND.

6 Single-Supply Operation

To operate as single supply, connect the V_- connector and GND connector to ground and apply the positive supply voltage to V_+ . Inputs and outputs must be biased per data sheet specifications for proper operation. The LMH5485-SP output common-mode voltage defaults to mid-supply if the V_{cm} connector is left floating.

7 Input and Output Connections

The LMH5485-SP-EVM is equipped with SMA connector footprints for easy connection of signal generators and analysis equipment. The EVM can either be for single-ended or differential input or output with 50- Ω termination. For best results, signals must be routed to and from the EVM with cables having 50- Ω characteristic impedance. Either IN+ (J2) or IN- (J1) can be used for single-ended input. The unused connector should be terminated with a 50- Ω resistive SMA load. If no SMA load is available, then the spaces marked C1 or C2 can be loaded with a 0- Ω resistor, and the spaces marked R1 or R4 can be loaded with a 50- Ω to terminate the unused input. Use both IN+ (J2) and IN- (J1) for differential input.

OUT+ (J9) is the output connector for single-ended output signals. The amplifier converts the single-ended or differential input to a differential signal at its output pins. A resistor network (R8, R9, and R10) and transformer on the output of the amplifier (T2) convert the differential output signal to single-ended and provides a 500- Ω load to the amplifier when terminated in 50- Ω . A 50- Ω line-impedance match at OUT+ should be preserved. This results in an output measurement loss, and the overall gain is approximately -20-dB. For more details, see the Applications and Layout Guidelines in the [LMH5485-SP Radiation Hardened Assured \(RHA\) Negative Rail Input, Rail-to-Rail Output, Precision, 850-MHz Fully Differential Amplifier](#) data sheet.

7.1 VOCM Input Connections

The Vcm input (J3) is optional and sets the common mode of the output pins. The LMH5485-SP will automatically self-bias the output common-mode voltage to the mid-supply voltage if the Vcm pin is not connected. This is the optimal voltage for maximum output swing and best linearity.

The valid range of the Vcm is 0.94-V above the negative supply to 1.2-V below the positive supply. For example, on a ± 2.5 -V split supply, the Vcm pin can be set anywhere from -1.56-V to 1.3-V. With a single 5-V supply the valid range would be 0.94-V to 3.8-V. Remember, the outputs of the LMH5485-SP can swing from rail to rail; the maximum output swing available, however, is reduced when the Vcm pin is set to a voltage other than mid-supply.

If providing 50- Ω termination for the Vcm input signal source is desired, C6 can be populated with a 0- Ω resistor and R5 populated with a 50- Ω resistor.

7.2 $\overline{\text{PD}}$ Input Connections

Adding a header and jumper at J5 allows for simple disabling of the LMH5485-SP. An SMA connector can also be loaded at J4 to allow for a power-down signal to be applied for high-speed testing. Normally the J5 jumper is used to enable or disable (power-down) the amplifier. When jumper J5 is open, the amplifier is *not* powered down, so it is enabled. When the shorting block is connected and J5 is closed, the amplifier is powered down.

For high-speed testing, a 0- Ω resistor can be placed at C4 and a 50- Ω resistor at R6 to terminate the PD SMA input. The shorting block should be removed from J5 during high-speed testing. This is because 0- Ω at C4 terminates to the ground and not to the supplies. The state of the amplifier will be undefined when the signal source is disconnected. For this reason, 0- Ω at C4 should only be used when driving the SMA connector with a high speed, controlled impedance source.

7.3 Using the Optional Differential Outputs (J6 and J7)

[Figure 8-1](#) shows a recommended schematic configuration where balun T2 is used to convert the output to single-ended. To reconfigure the LMH5485-SP-EVM for fully-differential outputs, remove resistors R19 and R20 to disconnect the balun from the amplifier output. If 50- Ω resistors are loaded in the R26 and R27 resistor positions, and SMA connectors are loaded in the J6 and J7 connector positions, then J6 and J7 can be used for fully-differential output signals. If 50- Ω test equipment is connected to J6 and J7, then the total load to the amplifier is 200- Ω . The data sheet specifications were produced with a 500- Ω load. To match a 500- Ω load, load R26 and R27 with 221- Ω resistors and then load R25 and R28 with 60.4- Ω resistors.

8 LMH5485-SP Schematic and Layout

Figure 8-1 illustrates a recommended default schematic configuration. The LMH5485-SP-EVM is an unpopulated board and does not come with pre-installed components.

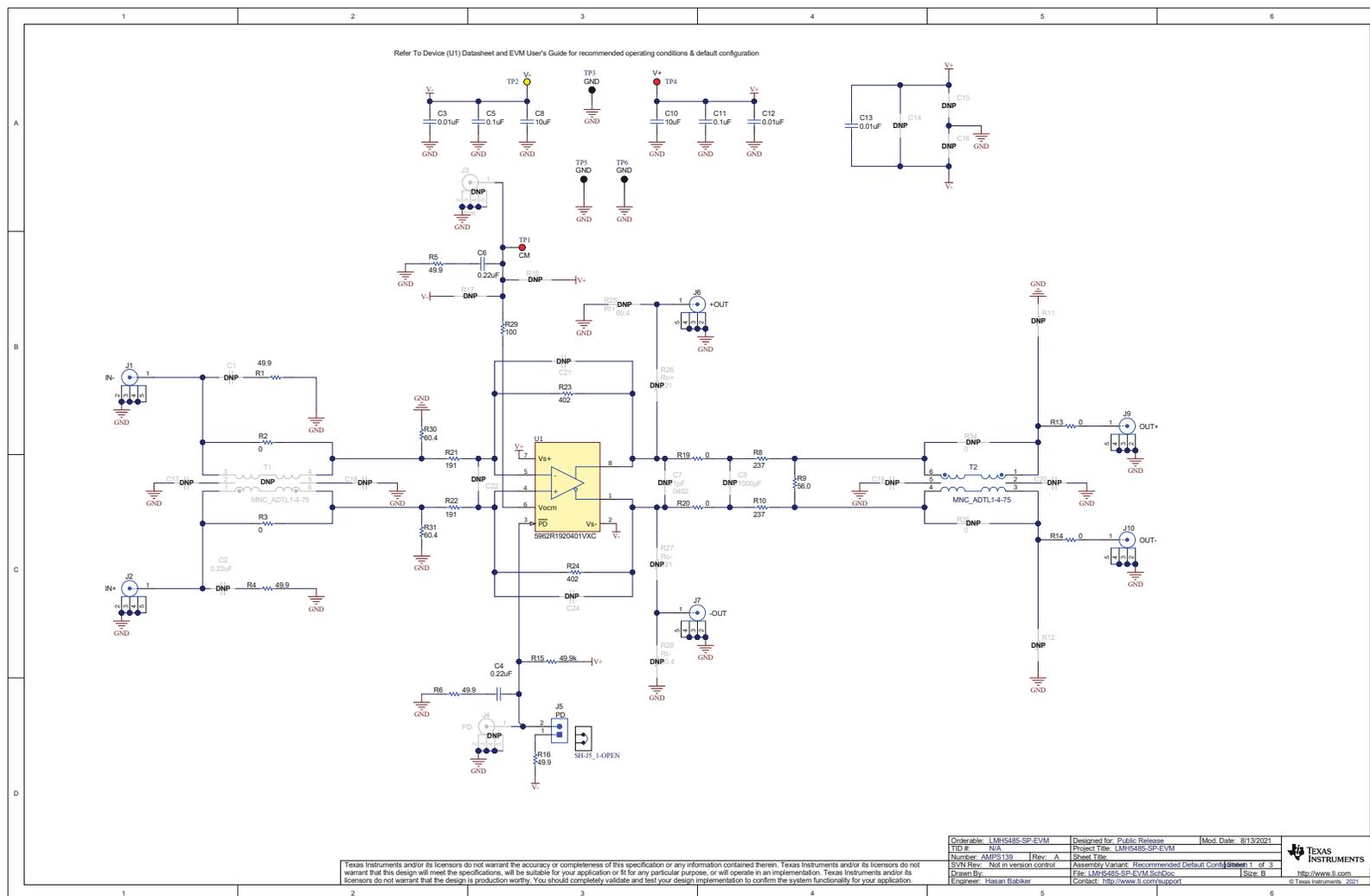


Figure 8-1. LMH5485-SP Recommended Default Schematic

8.1 LMH5485-SP-EVM Layout

Figure 8-2 through Figure 8-5 show the LMH5485-SP-EVM layers.

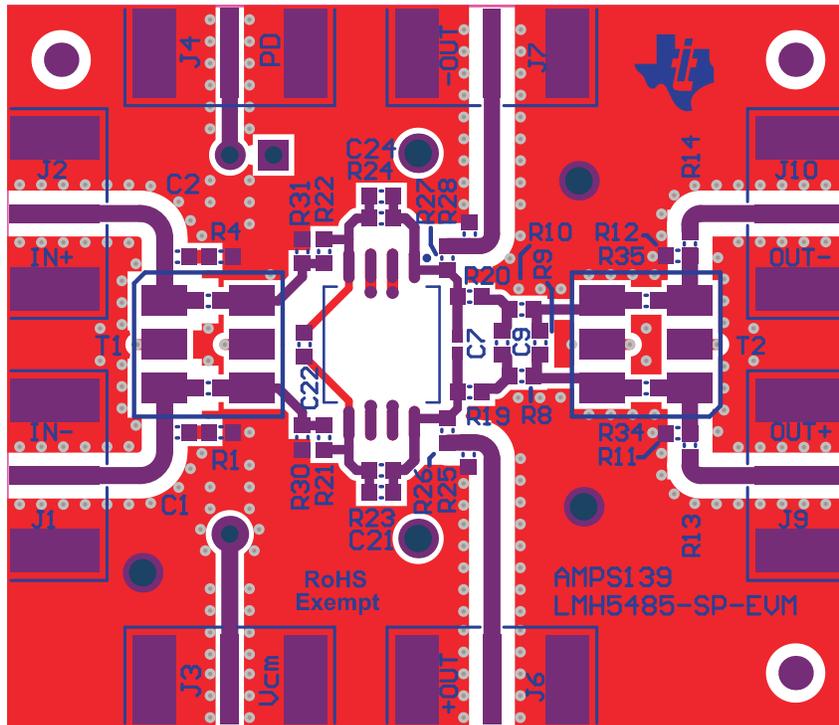


Figure 8-2. LMH5485-SP-EVM Top Layer, Signal

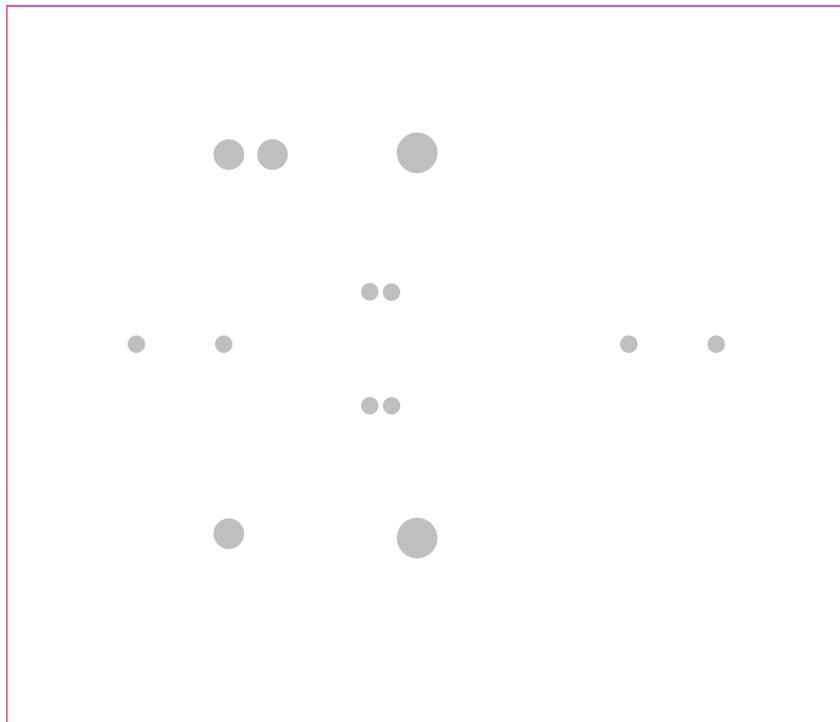


Figure 8-3. LMH5485-SP-EVM Layer 2

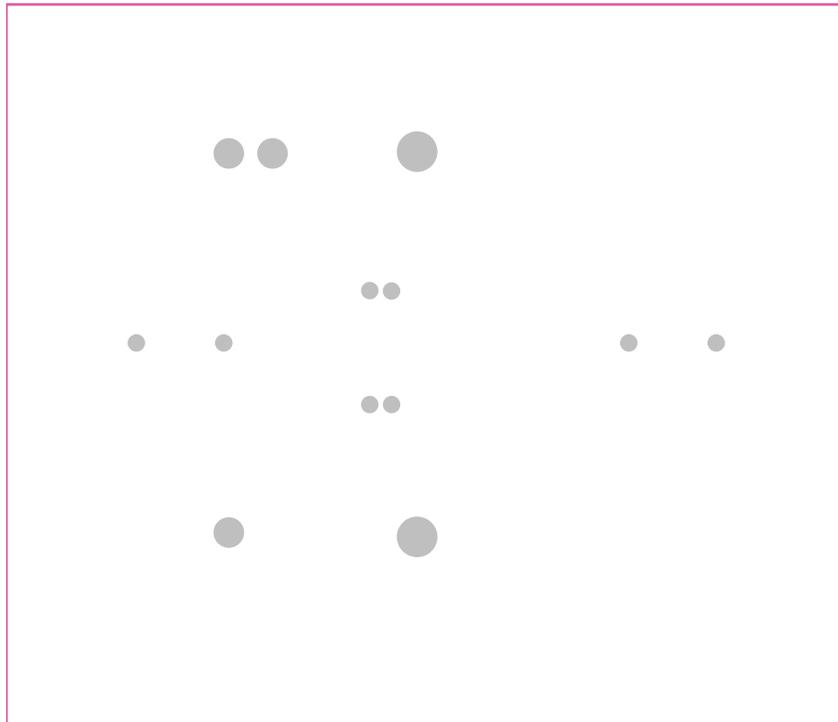


Figure 8-4. LMH5485-SP-EVM Layer 3

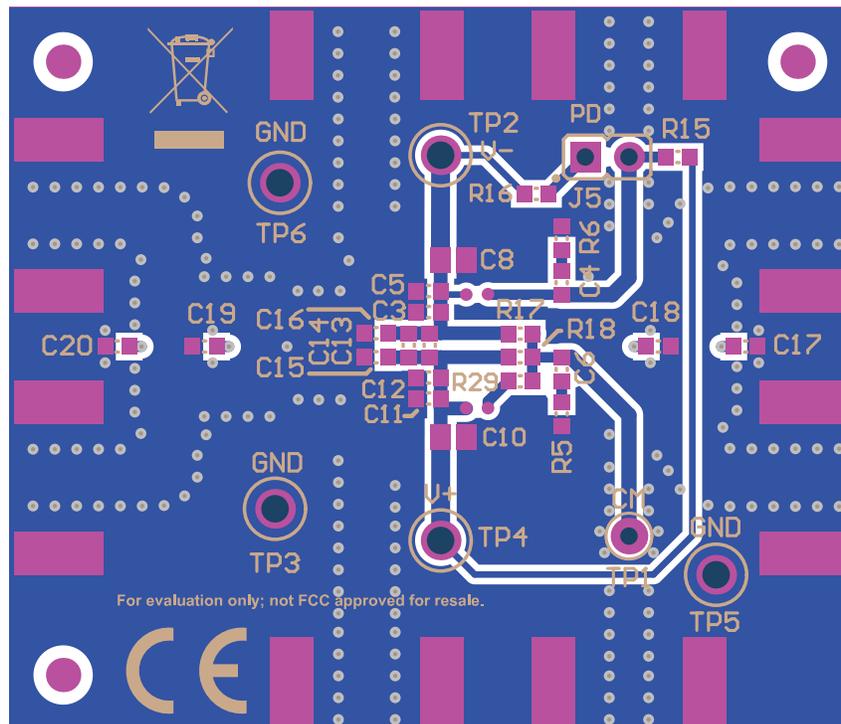


Figure 8-5. LMH5485-SP-EVM Bottom Layer

9 Related Documentation

For related documentation, see the following:

- Texas Instruments, [LMH5485-SP Radiation Hardened Assured \(RHA\) Negative Rail Input, Rail-to-Rail Output, Precision, 850-MHz Fully Differential Amplifier data sheet](#)

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