Evaluating the ADCA5191 5 MHz to 1800 MHz Broadband CATV Amplifier

FEATURES

- 2-layer evaluation board with heat sink
- 75 Ω N-type RF male connectors

EVALUATION KIT CONTENTS

- ADCA5191-EVALZ evaluation board

EQUIPMENT NEEDED

- RF signal generator
- RF spectrum analyzer
- DOCSIS signal generator
- DOCSIS signal analyzer
- RF network analyzer
- 8 V, 500 mA power supply

GENERAL DESCRIPTION

The ADCA5191-EVALZ evaluation board consists of a 2-layer printed circuit board (PCB) fabricated from a 62 mil laminate mounted to an aluminum heat sink. The heat sink assists in providing thermal relief to the device as well as mechanical support to the PCB. Mounting holes on the heat sink allow attachment to larger heat sinks for improved thermal management.

The ADCA5191-EVALZ is populated with components to interface the IC to a typical CATV application. J1 (RF_IN) and J2 (RF_OUT) are 75 Ω, N type, male coaxial connectors. The respective RF traces of the ports have a 75 Ω characteristic impedance. The ADCA5191-EVALZ is populated with components suitable for use over the −40 °C to +100 °C operating temperature range of the ADCA5191.

Access to the supply voltage (VDD) and GND is through a 3-pin header (P1) on the ADCA5191-EVALZ.

RF traces are 75 Ω microstrip at the input and output RF connectors. The package ground leads and the exposed paddle connect directly to the ground plane. Multiple vias connect the LFCSP ground paddle to the bottom ground plane to provide adequate electrical conduction and thermal conduction to the heat sink. The transfer of heat from the ADCA5191-EVALZ ground to the heat sink is further facilitated by the insertion of a piece of indium approximately the footprint of the LFCSP between the ADCA5191-EVALZ bottom and the heat sink. There are no components on the bottom side of the PCB.

Consult the ADCA5191 data sheet in conjunction with this user guide when using the ADCA5191-EVALZ evaluation board.

ADCA5191-EVALZ PHOTOGRAPH (TOP SIDE)

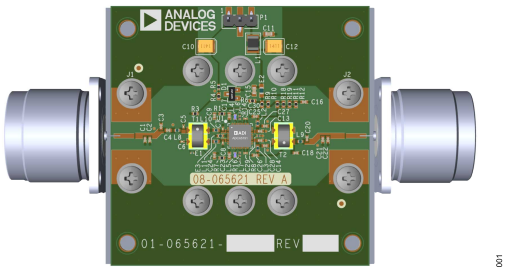

Figure 1.

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REVISION HISTORY

5/2022—Revision 0: Initial Version

OPERATING THE ADCA5191-EVALZ

An 8 V, 500 mA power supply is required to provide the bias to the ADCA5191 on the ADCA5191-EVALZ. Connect the positive terminal of the 8 V power supply to the VDD pin on P1 and the ground terminal to the GND pin.

See the ADCA5191 data sheet for the typical dc supply current to expect when powering up the V_{DD} supply. Consult the product data sheet for adjusting the bias current (I_{DD}) by replacing R9 and R10.

RECOMMENDED BIAS SEQUENCES

During Power-Up

The recommended bias sequence during power-up follows:

1. Set VDD to 8.0 V.
2. Apply the RF signal.

During Power-Down

The recommended bias sequence during power-down follows:

1. Turn off the RF signal.
2. Set VDD to 0 V.

Table 1. Header Connections to the ADCA5191

Connector	Header Pin	ADCA5191 Pin
P1	1	Not used
	2	GND
	3	VDD

RF Measurements

To evaluate the ADCA5191, connect a 75 Ω RF signal source to the N-type, male connector (J1), which can be a single-tone or multitone source for distortion measurements, or a wideband data over cable service interface specification (DOCSIS) signal source for analyzing modulation error ratio (MER) or bit error rate (BER) measurements. The input power must be <45 dBmV to produce an output power of <70 dBmV to support DOCSIS 3.0, DOCSIS 3.1, and DOCSIS 4.0 applications. The 75 Ω RF output signal is available on the N-type, male connector (J2) and can be interfaced directly to instruments (such as a spectrum analyzer or vector network analyzer) with a 75 Ω input impedance.

EVALUATION BOARD SCHEMATIC AND ASSEMBLY DRAWINGS

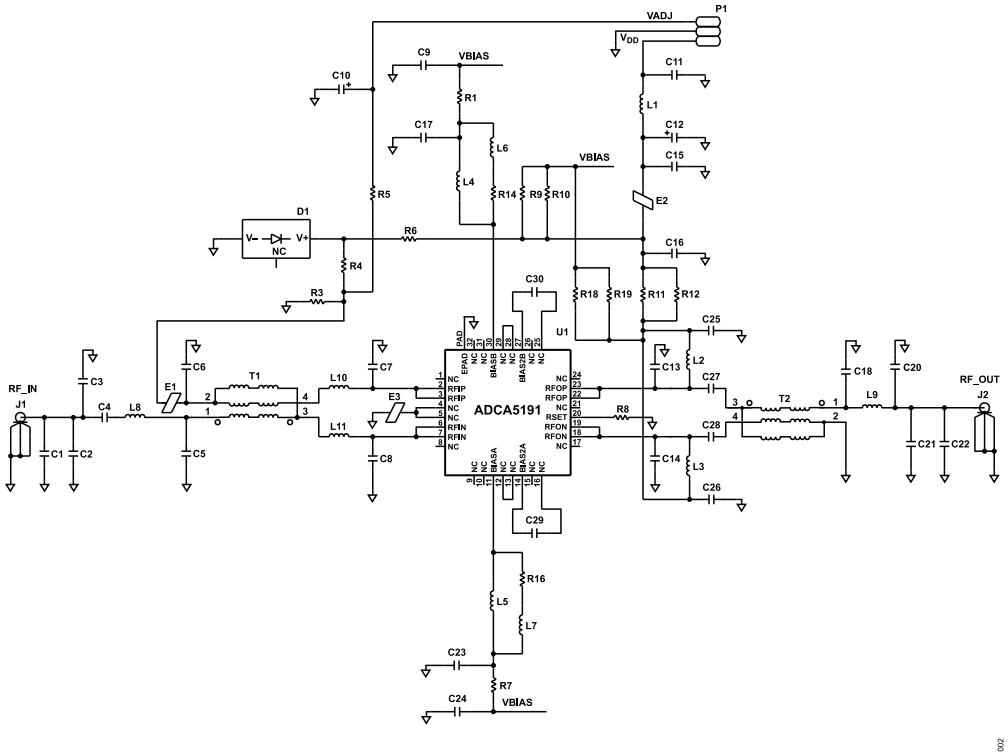

Figure 2. ADCA5191-EVALZ Evaluation Board Schematic

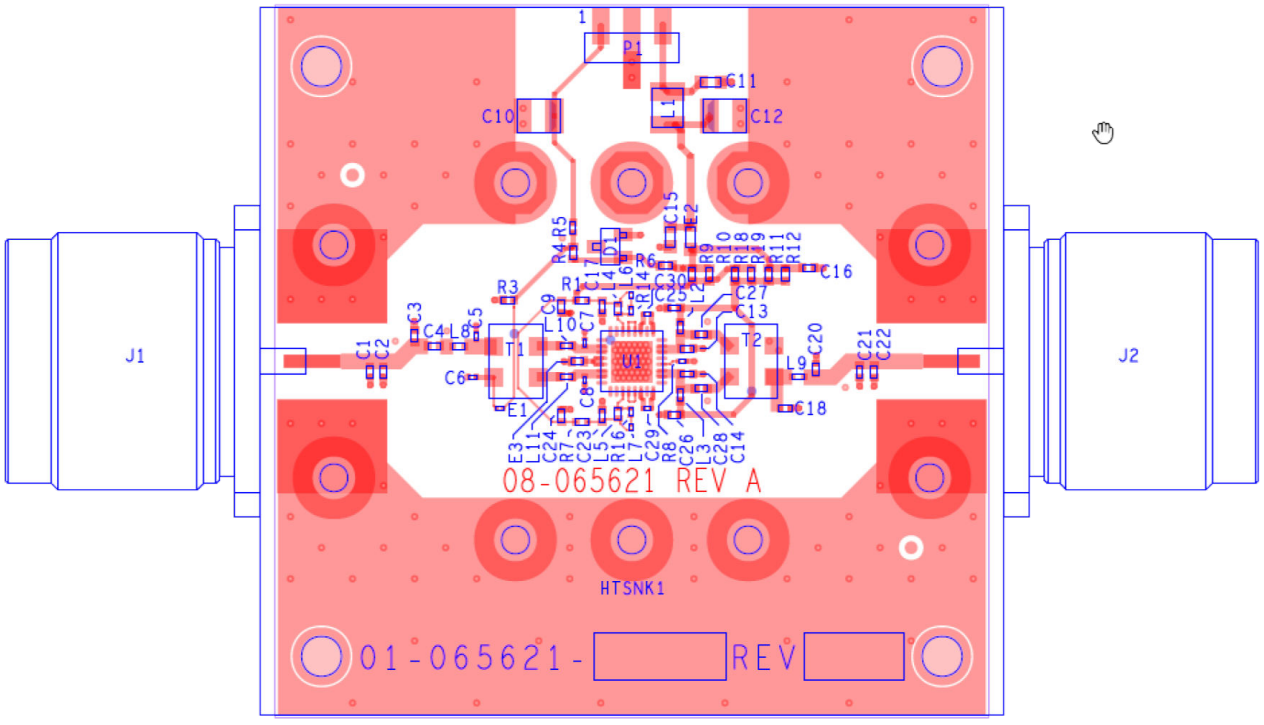

Figure 3. ADCA5191-EVALZ Assembly Drawing (Top Side)

EVALUATION BOARD SCHEMATIC AND ASSEMBLY DRAWINGS

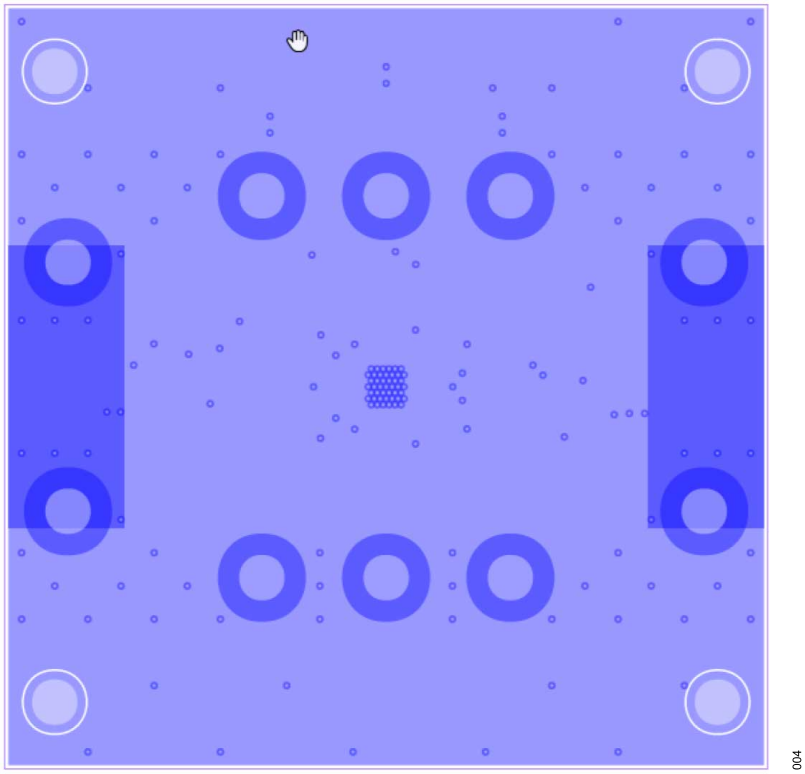

Figure 4. ADCA5191-EVALZ Assembly Drawing (Bottom Side, No Components)

EVALUATION BOARD SCHEMATIC AND ASSEMBLY DRAWINGS

ADCA5191-EVALZ ASSEMBLY INFORMATION

The PCB for the ADCA5191-EVALZ is assembled using normal manufacturing practices, excluding the J1 and J2 connectors, and the custom external aluminum heat sink. Once the PCB is assembled, it is mounted with 10 screws to the external heat sink as shown in Figure 5. The transfer of heat from the ADCA5191-EVALZ ground to the heat sink is enhanced by the insertion of a thin sheet of indium cut to approximately the footprint of the ADCA5191 and located between the via array on the bottom of the PCB (underneath the ADCA5191) and the heat sink. The J1 and J2 connectors are then mounted to the heat sink using two screws for each (see Figure 6). Then, the center conductor for the RF connectors is soldered to the PCB. Once complete, the ADCA5191-EVALZ is ready for testing.

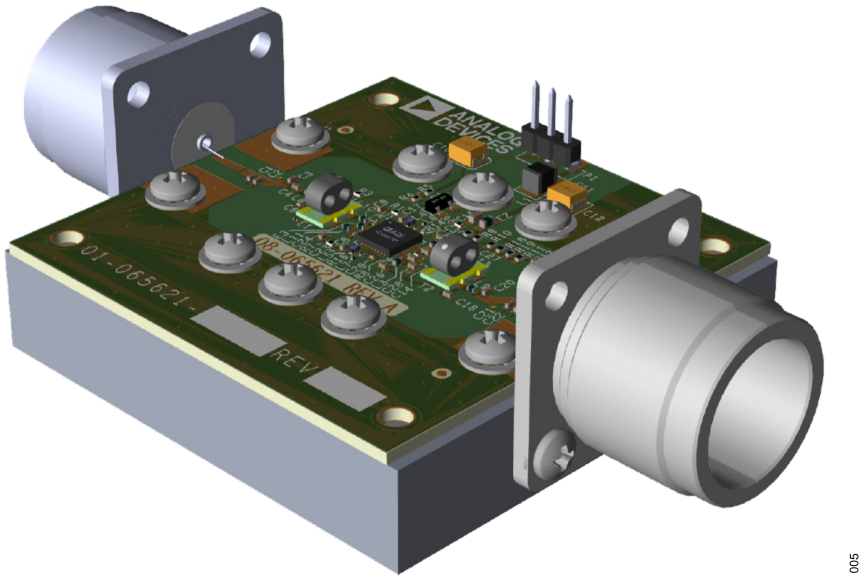

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Figure 5. ADCA5191-EVALZ Top Side, Fully Assembled

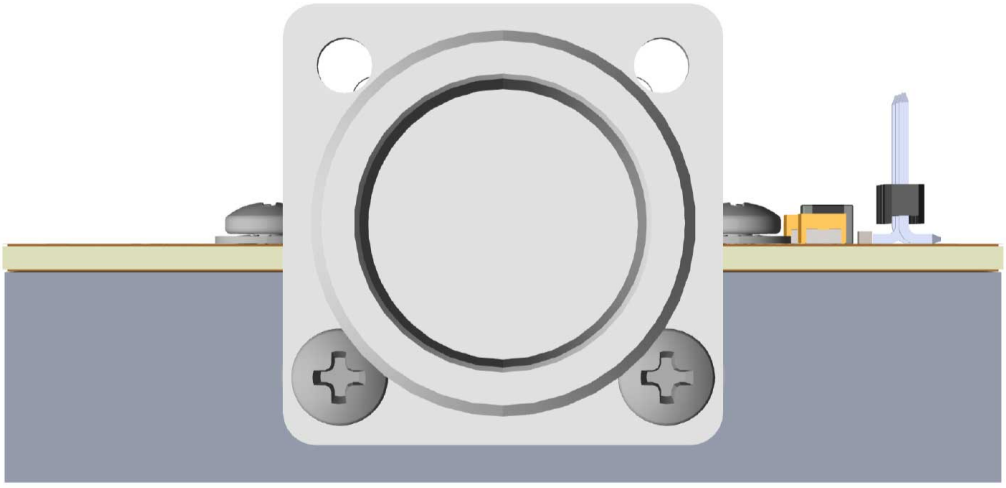

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Figure 6. ADCA5191-EVALZ Side View

ORDERING INFORMATION

BILL OF MATERIALS

Table 2. Bill of Materials[1]

Reference Designator	Value	Tolerance	Minimum Rating	Footprint	Suggested Vendor	Suggested Part Number
C3	0.4 pF	±0.1 pF	50 V	0402	Murata	GRM1555C2AR40BA1D
C5	0.6 pF	±0.1 pF	100 V	0201	Murata	GRM0335C2AR60BA01D
C6	0.01 µF	10%	50 V	0201	Taiyo Yuden	UMK063BJ103KP-F
C7, C8	0.5 pF	±0.1 pF	100 V	0402	Murata	GRM1555C2AR50BA01D
C11	0.01 µF	20%	100 V	0603	TDK	C1608X7R2A103M080AA
C12	2.2 µF	10%	50 V	1210	Kyocera AVX	TAJB225K050RNJ
C13, C14	0.6 pF	±0.1 pF	100 V	0402	Murata	GRM1555C2AR60BA01D
C15	0.047 µF	10%	50 V	0603	TDK	06035C473KAT4A
C27, C28	160 pF	1%	50 V	0402	Murata	GRT1555C1H161FA02D
C4, C9, C16, C17, C23, C24, C25, C26	0.01 µF	10%	100 V	0402	TDK	810-C1005X7S2A103K
E1	1000 Ω ferrite	25%	170 mA	0201	Murata	BLM03BX102SN1D
E2	220 Ω ferrite	25%	1.8 A	0603	Taiyo Yuden	FBMH1608HM221-T
J1, J2	75 Ω	N/A	N/A	N/A	Pasternack	PE4503
L1	2.2 uH	20%	1.6 A	1210	Taiyo Yuden	BRL3225T2R2M
L2, L3	270 nH	5%	590 mA	0402	Coilcraft	0402DF-271XJRW
L4, L5	470 nH	5%	610 mA	0603	Coilcraft	0603AF-471XJEW
L6, L7	10 nH	3%	250 mA	0201	Murata	LQP03TN10NH02D
L8	5.6 nH	0.2 nH	800 mA	0402	Murata	LQW15AN5N6C10D
L9, L10, L11, R11, R12	0 Ω	N/A	0.1 W	0402	Panasonic	ERJ-2GE0R00X
R1, R7	10 Ω	1%	0.1 W	0402	Panasonic	ERJ-2RKF10R0X
R4, R6	365 Ω	1%	62.5 mW	0402	Yageo	RC0402FR-07365RL
R8	2 kΩ	1%	50 mW	0201	Panasonic	ERJ-1GNF2001C
R9, R10	33 Ω	1%	200 mW	0402	Vishay	CRCW040233R0FKEDHP
R14, R16	120 Ω	1%	50 mW	0201	Panasonic	ERJ-1GNF1200C
T1, T2	1:1 transformer	N/A	N/A	99-01-1618-2	Mini-Circuits	TRS1-182-75-3+
U1	CATV amplifier	N/A	N/A	5 mm × 5 mm, 32-lead LFSCP	Analog Devices, Inc.	ADCA5191
P1	3 pin header	N/A	N/A	0.100"	Molex	087898-0306
C1, C2, C9, C10, C17, C18, C20, C21, C22, C23, C24, C29, C30, D1, E3, R1, R3, R5, R7, R14, R16, R18, R19	Do not install	N/A	N/A	N/A	N/A	N/A

[1] N/A means not applicable.

ORDERING INFORMATION

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.