

EVM User's Guide: TRF3302EVM

EVM User's Guide for TRF3302EVM

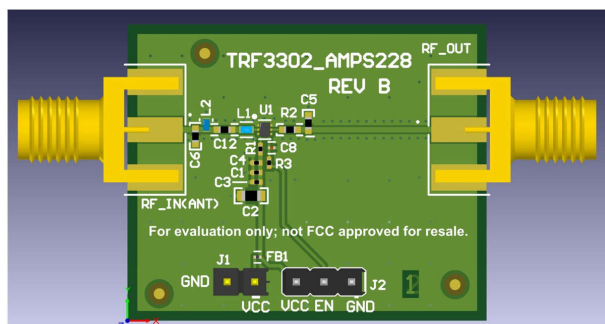


Description

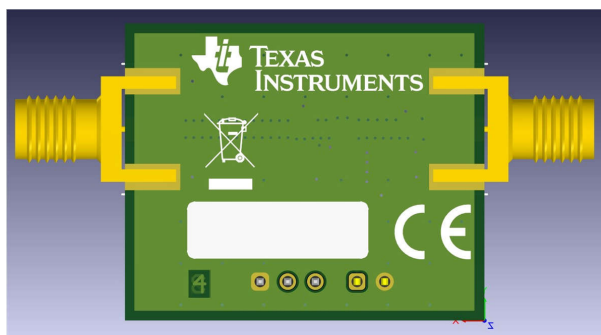
The TRF3302EVM (EVM) is designed to provide a quick way to evaluate the TRF3302 low-noise amplifiers. The EVM is default tuned 1300MHz to 1630MHz (L1 band) operation, with a single inductor change, the EVM can be optimized for 1165MHz to 1320MHz (L2/L5 bands). With four component changes, the EVM can operate wideband simultaneously covering 1165MHz to 1630MHz (all GPS/GNSS bands).

Features

- Reconfigurable input matching
- On-chip broadband output match supporting 1165MHz to 1630GHz



TRF3302EVM top view



TRF3302EVM bottom view

1 Evaluation Module Overview

1.1 Introduction

This EVM user's guide is for evaluating the TRF3302. This EVM users guide includes: the schematic diagram, bill of materials (BOM), printed-circuit board (PCB) layouts, and test setup diagrams. The EVM is compatible with both the industrial version (TRF3302) as well as Automotive AEC-Q100 (TRF3302-Q1).

1.2 Kit Contents

[Table 1-1](#) lists the contents of the EVM kit. The EVM default is tuned to 1300MHz to 1630MHz (L1 band) and includes parts to reconfigure the EVM to 1165MHz to 1320MHz (L2/L5 band). Contact the [Texas Instruments Customer support center](#) if any components are missing.

Table 1-1. EVM Contents

Item	Description	Quantity
TRF3302EVM	Evaluation board	1
0402DC-11NXGRW	11nH inductor	3

1.3 Specification

Connector	Parameter	Value
RF_IN(ANT)	RF input port from antenna	Max 10dBm
RF_OUT	Output RF port	
J1	J1.1 VCC J1.2 GND	Voltage supply range from 1.8V to 3.3V
J2	J2.1 GND J2.2 ENABLE J2.3 VCC	Connect J2.2 to J2.3 for operation mode and connect J2.2 to J2.1 for shutdown mode. A potential must be forced on J2.2, and non-operational if left open.

1.4 Device Information

See the [TRF3302 1165MHz to 1630MHz, Multiband, GPS and GNSS Low-Noise Amplifier](#) data sheet for detailed device information.

2 Hardware

This section provides general usage information for the EVM.

1. Power up procedure:
 - a. Set the current limit of the DC power supply to 50mA.
 - b. Set the voltage of the DC power supply between 1.8V and 3.3V.
 - c. Verify that the supply is turned off.
 - d. Connect the power supply cables to the J1 connector of the EVM.
 - i. The positive supply rail from the DC power supply is connected to pin 1 of J1.
 - ii. Ground of DC output power supply is connected to pin 2 of J1.
 - e. Connect a jumper between pins 2 and 3 of J2 to enable the TRF3302.
 - f. Now turn on the DC power supply.
 - i. The supply current (I_{CC}) drawn from the power supply is approximately 4mA to 5mA.
 - g. If the supply current is below 1mA, then verify that the device is not disabled with jumper at J2 connected between pins 1 and 2.
2. Power-down procedure:
 - a. Turn off the DC power supply.

See [Figure 2-1](#) for a general single tone test setup diagram instruction. Note some components, such as supply bypass capacitors, are omitted for clarity.

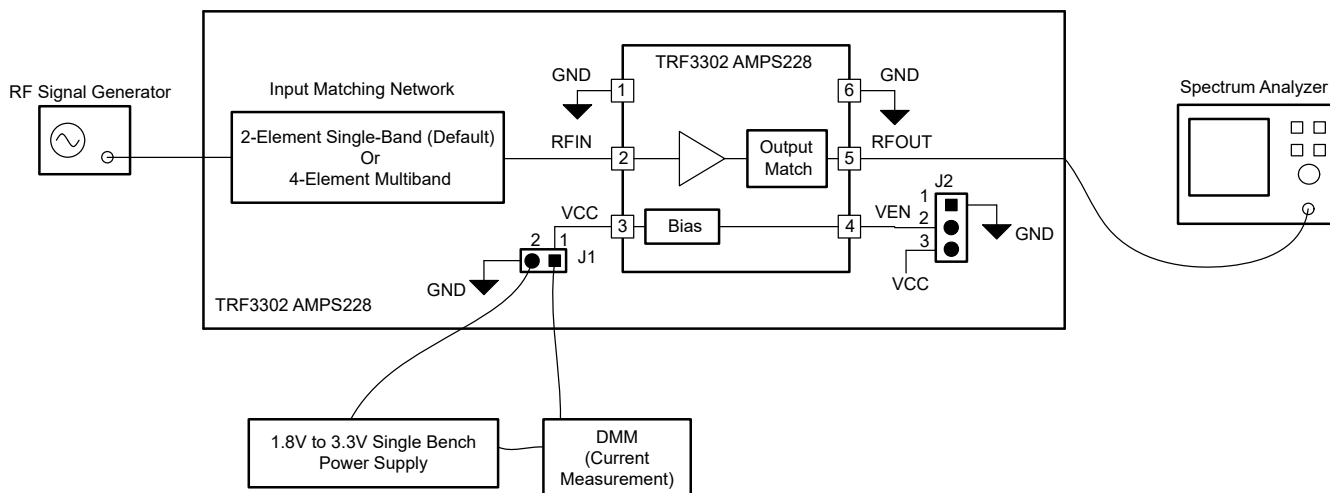


Figure 2-1. Single Tone Setup for TRF3302EVM for Gain and Output P1dB

1. Single tone measurement setup recommendation:
 - a. RF signal generator signal connected to the RF_IN(ANT) SMA connector of the EVM. Also, connect spectrum analyzer or RF power meter to RF_OUT SMA connector of the EVM.
 - b. The RF signal generator used must support up to 1.6GHz signal frequency for testing out the EVM.
 - c. The maximum input power to the TRF3302 is 10dBm at the RF_IN (ANT) SMA connector reference plane.
 - d. Properly characterize and account for the insertion loss of RF coaxial (coax) cables to accurately measure the device's gain, NF, and linearity performance.

3 Hardware Design Files

3.1 Schematics

Figure 3-1 shows the EVM schematic.

1. FB1, C2 and C3 are optional in the BOM. FB1 can be replaced by 0ohm 0201 resistor is sufficient for the DC operation of the TRF3302.
2. The EVM has input capacitor C12 installed for DC blocking and RF signal coupling while L1 inductor is tuned to support 1300 to 1630MHz (L1 band) by default.
3. Additional three L1 = 11nH inductors are provided with the EVM kit to replace L1 and optimize the TRF3302 to support 1165 to 1320MHz (L2/L5 band) as shown in Figure 3-2.
4. Replace C6, C12, L1, and L2 with 3.6pF, 12pF, 7.8nH and 2.8nH to optimize performance across 1165 to 1630MHz (all GPS/GNSS bands) as shown in Figure 3-3. R2 has to be replaced with capacitor value 4.7pF and C5 has to be replaced with inductor value 8.5nH to achieve gain flatness and a slight improvement in output matching.

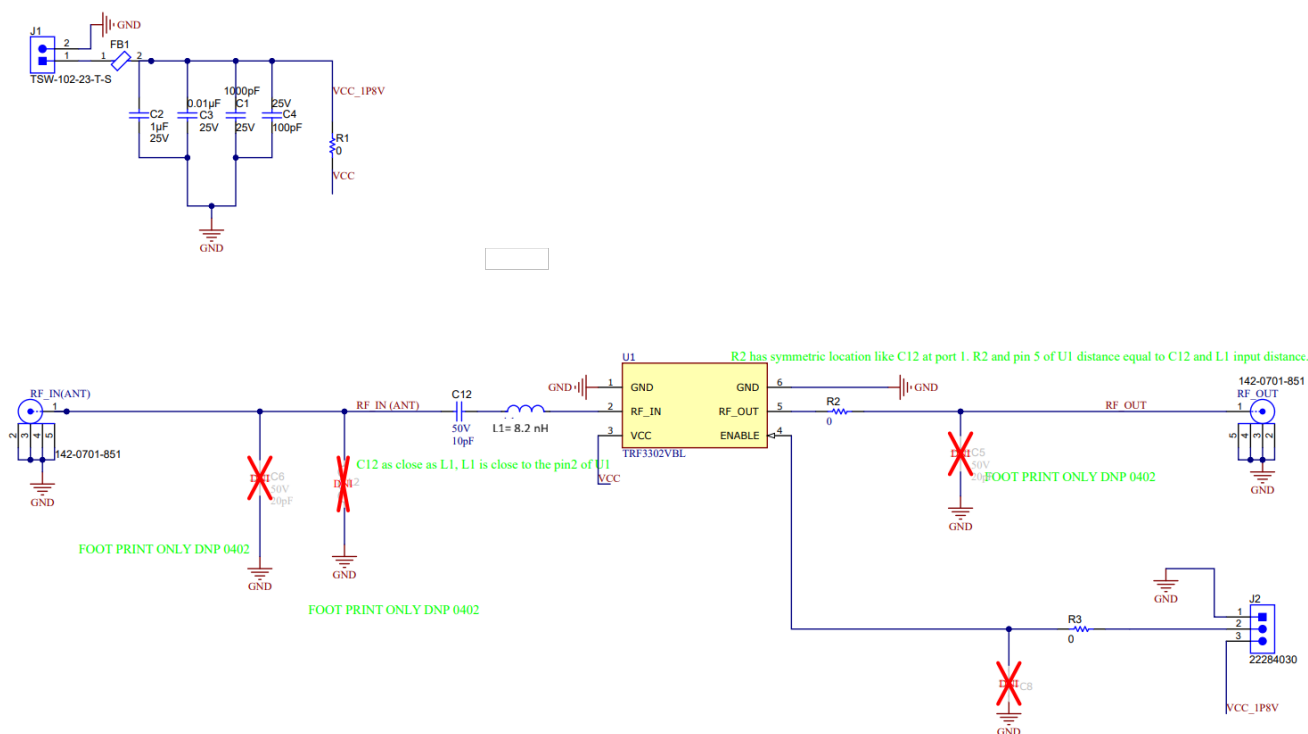


Figure 3-1. TRF3302EVM Schematic for L1 Band

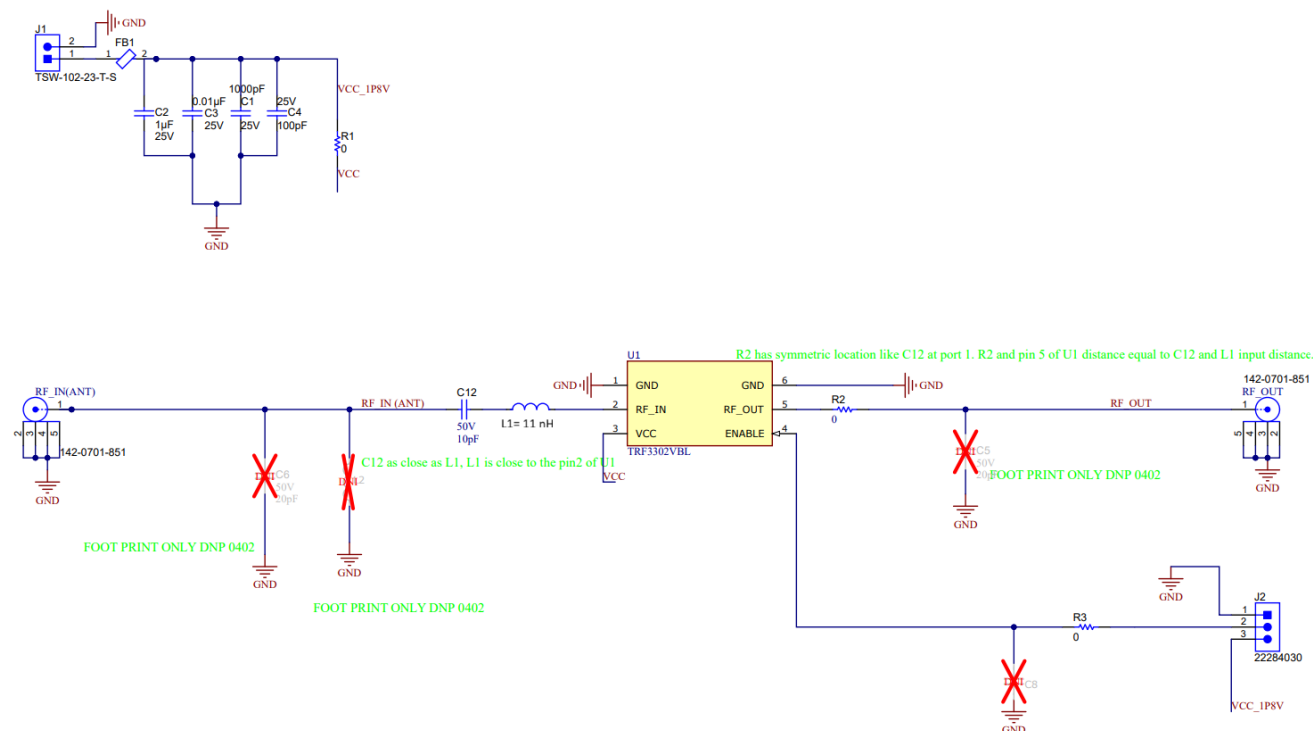


Figure 3-2. TRF3302EVM Schematic for L2/L5 Bands

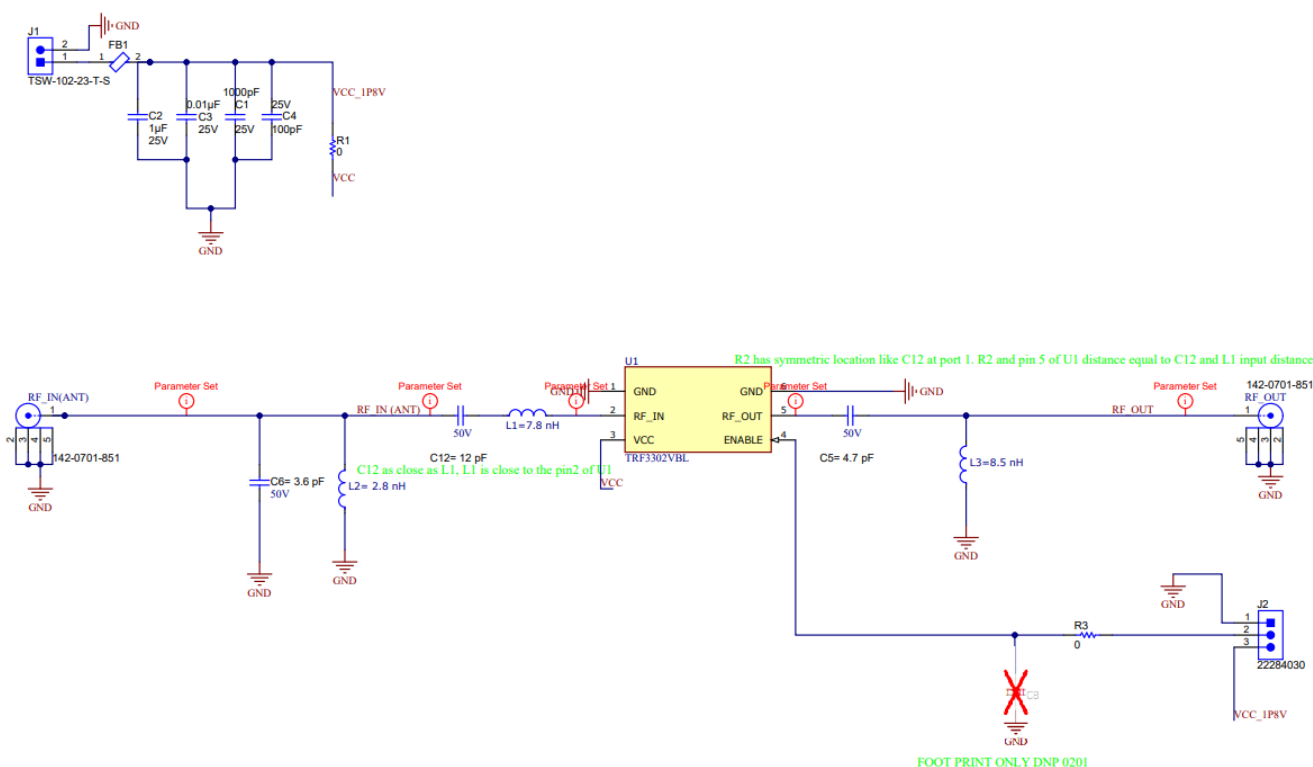


Figure 3-3. TRF3302EVM Schematic for All GPS/GNSS Bands

3.2 PCB Layouts

Figure 3-4 through Figure 3-7 illustrate the PCB layers for this EVM.

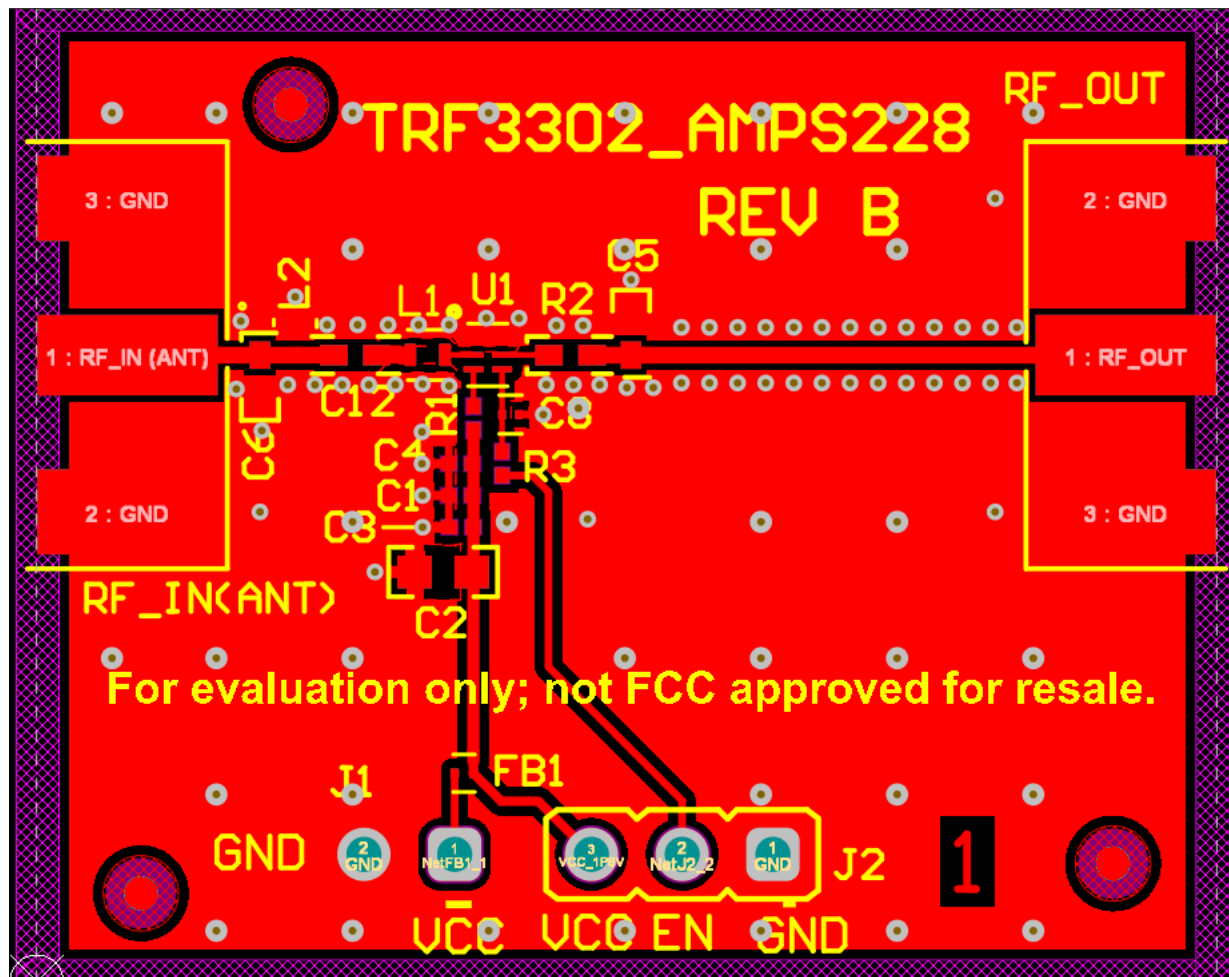


Figure 3-4. Top Layer

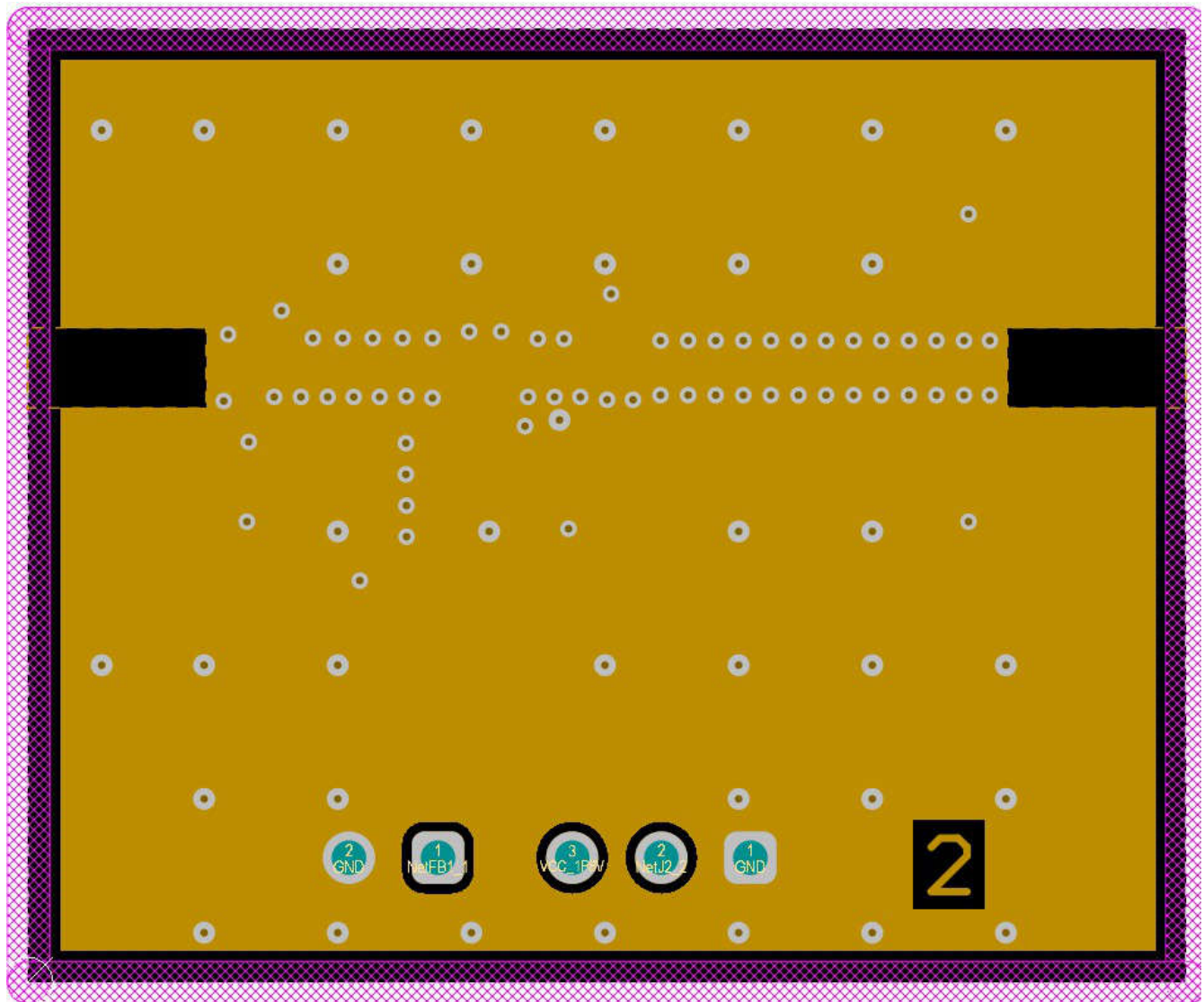


Figure 3-5. Layer 2

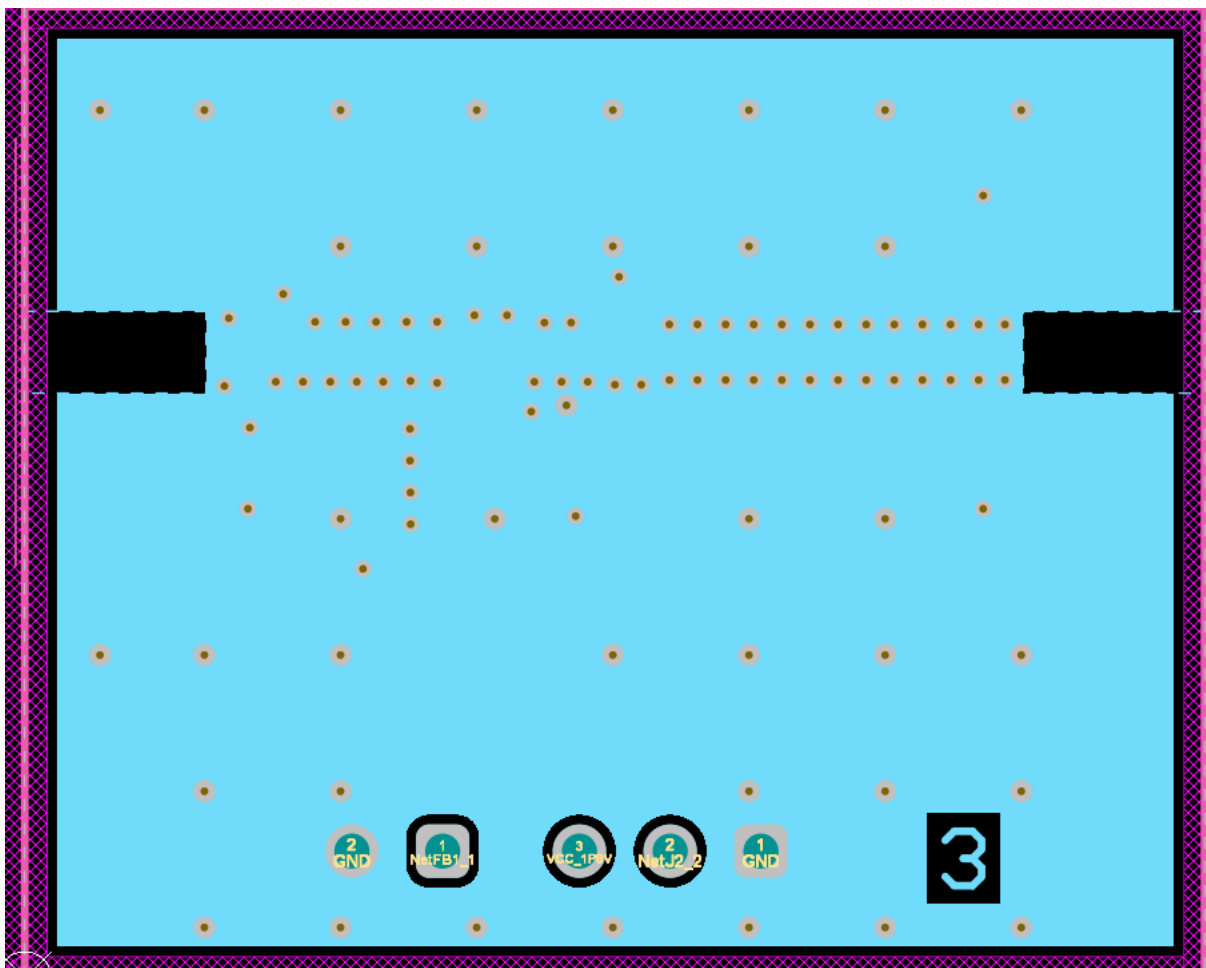


Figure 3-6. Layer 3

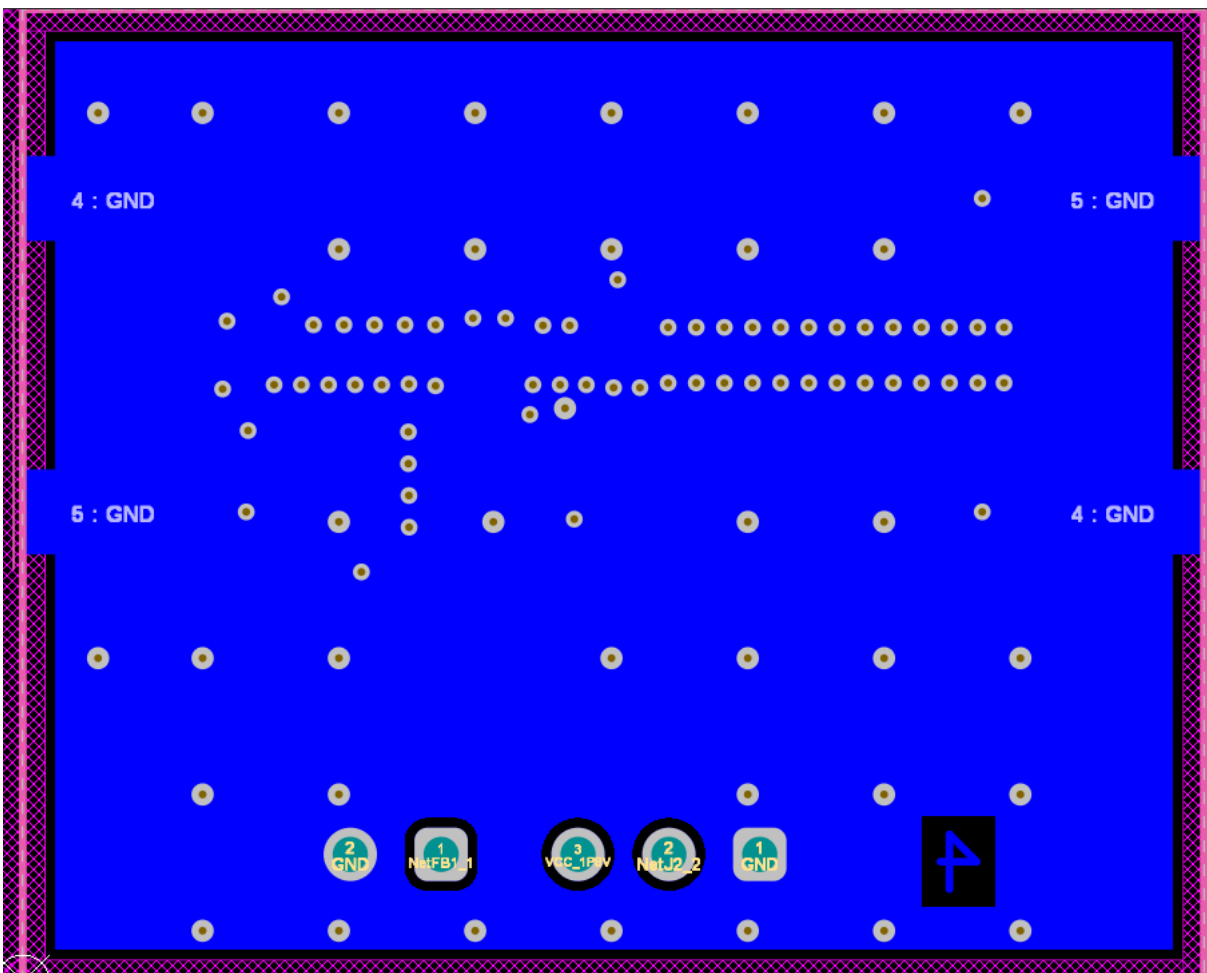


Figure 3-7. Bottom Layer

3.2.1 PCB Stack-Up and Material

The EVM board dimensions are 1300 mil by 1070 mil, thickness is 60.5-mil, 4-layer board with material type Isola® 370HR as shown in Figure 3-8. The top layer routes the power, ground, and signals between SMA connectors and the device. Second layer is the reference RF ground layer. The signal trace impedance is targeted at nominal 50Ω. The bottom three layers are ground layers.

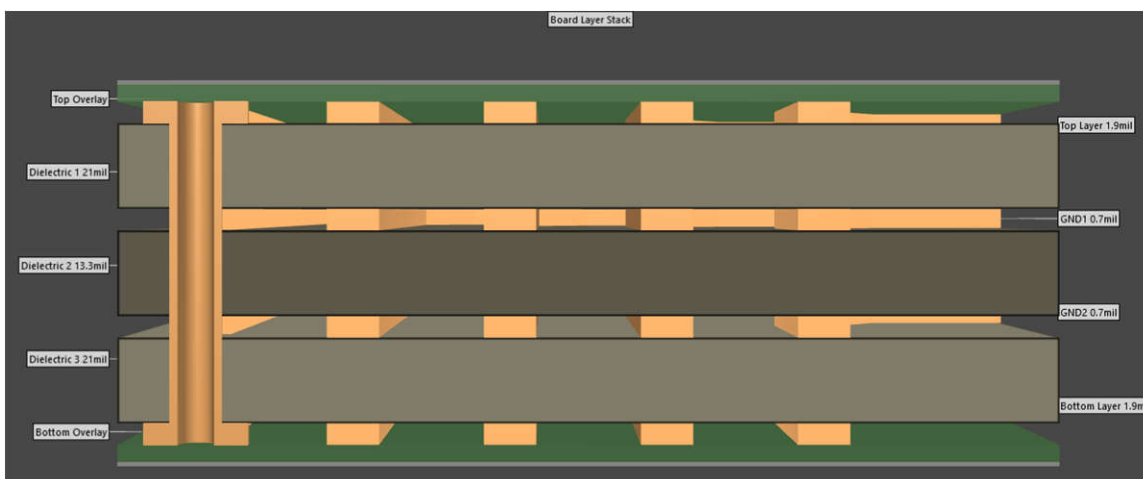


Figure 3-8. EVM Stack-Up (Units in Mils)

3.3 Bill of Materials (BOM)

Table 3-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB	1		Printed Circuit Board		AMPS228	Any
C1	1	1000pF	CAP, CERM, 1000pF, 25V, +/- 10%, X7R, 0201	0201	GRM033R71E102KA01D	MuRata
C2	1	1uF	CAP, CERM, 1uF, 25V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71E105KA64D	MuRata
C3	1	0.01uF	CAP, CERM, 0.01 μ F, 25V, +/- 10%, X7R, 0201	0201	GRM033R71E103KE14D	MuRata
C4	1	100pF	CAP, CERM, 100pF, 25V, +/- 10%, X7R, 0201	0201	GRM033R71E101KA01D	MuRata
C12	1	10pF	CAP, CERM, 10pF, 50V, +/- 5%, C0G/NP0, 0402	0402	GJM1555C1H100JB01	MuRata
FB1	1		Ferrite Bead, 0201, 120 Ω @ 100MHz, 25%, 0.23 Ω , 450mA	0201	BLM03AX121SN1D	Murata
J1	1		Header, 2.54mm, 2x1, Tin, TH	Header, 2.54mm, 2x1, TH	TSW-102-23T-S	Samtec
J2	1		Header, 2.54mm, 3x1, Tin, TH	Header, 2.54mm, 3x1, Tin, TH	22284030	Molex
L1	1	8.2nH	8.2nH Unshielded Wirewound Inductor 1.6A 70mOhm Max 0402 (1005 Metric)	0402	0402DC-8N2XGRW	Coilcraft
R1, R3	2	0	RES, 0, 5%, 0.05W, 0201	0201	CRCW02010000Z0ED	Vishay-Dale
R2	1	0	RES, 0, 5%, 0.063W, 0402	0402	CRCW04020000Z0ED	Vishay-Dale
RF_IN(ANT), RF_OUT	2		Connector, End launch SMA, 50ohm, SMT	SMA End Launch	142-0701-851	Cinch Connectivity
U1	1		TRF3302	WSO-FCRLF-6	TRF3302VBLR	Texas Instruments
C5, C6	0	20pF	CAP, CERM, 20pF, 50V, +/- 5%, C0G/NP0, 0402	0402	C0402C200J5GACTU	Kemet
C8	0	1nF	Chip Multilayer Ceramic Capacitors for General Purpose, 0201, 1000pF, C0G, 30ppm/ $^{\circ}$ C, 5%, 25V	0201	GRM0335C1E102JA01D	Murata
L2	0	7.2nH	Chip Inductors 7.2nH 1500mA 0.055 Ohm	0402	0402HP-6N8XGLW	Coilcraft

4 Additional Information

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