

TABLE OF CONTENTS

Features	1	Installing the Software	6
Evaluation Kit Contents.....	1	Initial Setup	6
Documents Needed	1	Block Diagram and Description.....	8
Equipment Needed	1	Memory Map	9
General Description	1	Measurement.....	10
Revision History	2	Network Analyzer Calibration Procedure	12
Evaluation Board Connection Diagram.....	3	Handling Guidelines	13
Evaluation Board Hardware.....	4	Evaluation Board Schematic and Artwork.....	14
Power Supply.....	4	Ordering Information.....	19
RF Connectors	4	Bill of Materials.....	19
Switch Control Connectors.....	4		
Evaluation Board Software for SPI Interface	6		

REVISION HISTORY

1/2020—Revision 0: Initial Version

Table 4. P1 to P4 and IN1 to IN4 Link Settings for Parallel Interface

Controlled RF Switch	RF Switch Status	Link Name	Link Position
RF1 to RFC	On	P1 IN1	D_IN1 On
	Off	P1 IN1	D_IN1 (default) Off (default)
RF2 to RFC	On	P2 IN2	D_IN2 On
	Off	P2 IN2	D_IN2 (default) Off (default)
RF3 to RFC	On	P3 IN3	D_IN3 On
	Off	P3 IN3	D_IN3 (default) Off (default)
RF4 to RFC	On	P4 IN4	D_IN4 On
	Off	P4 IN4	D_IN4 (default) Off (default)

MEMORY MAP

All registers are fully accessible from the **ADGM1304 Memory Map** tab, and can be edited at a bit level (see Figure 6). The bits in dark gray are read-only bits and cannot be accessed from the **ACE** software. All other bits are toggled. The **Apply Changes** button transfers data to the device. All changes made in this tab correspond to the block diagram.

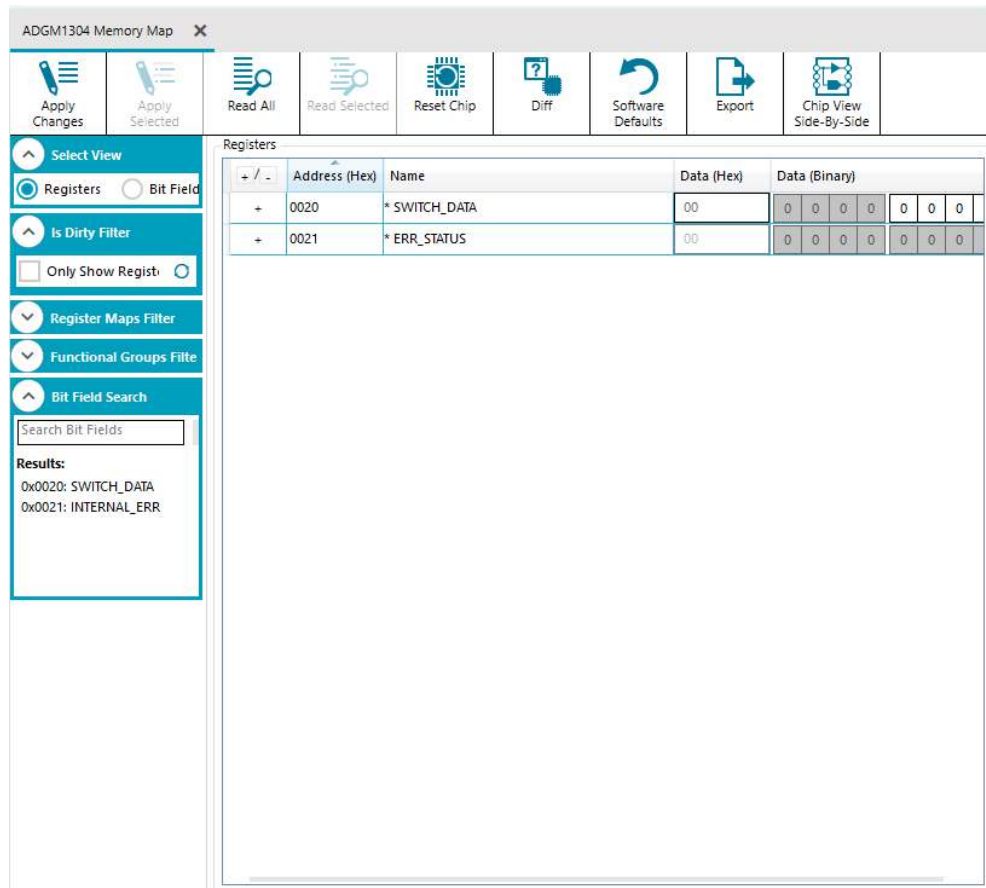


Figure 6. ADGM1304 Memory Map

Figure 9 shows the ADGM1304 switch insertion loss (network analyzer two port S(2,1) measurement) measurement results that were de-embedded with respect to the PCB transmission line losses. The blue trace is the RF2 to RFC switch channel and the red trace is the RF1 to RFC switch channel. The dashed traces are the respective return loss traces. The performance of the RF2 switch is identical to the RF3 switch, and the performance of the RF1 switch is identical to the RF4 switch.

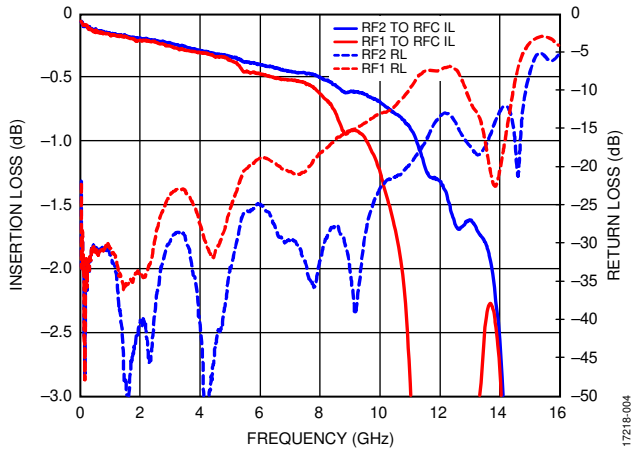


Figure 9. ADGM1304 Insertion Loss Performance, PCB De-Embedded

Figure 10 shows the ADGM1304 switch off isolation performance measurement results for two channels. The blue trace is the RF2 to RFC switch channel, and the red trace is the RF1 to RFC switch channel. The performance of the RF2 switch is identical to the RF3 switch, and the performance of the RF1 switch is identical to the RF4 switch.

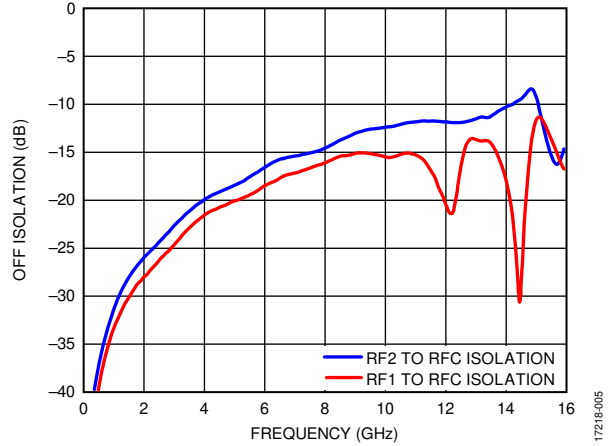


Figure 10. ADGM1304 Off-Isolation Performance

NETWORK ANALYZER CALIBRATION PROCEDURE

Use the following procedure in conjunction with the EVAL-ADGM1304SDZ evaluation board for two port measurements.

Two port measurements require the user to have a set of manual calibration standards or an electric calibration type unit to perform a short, load, open, through (SLOT) calibration of the network analyzer. The maximum value of the network analyzer frequency sweep for the EVAL-ADGM1304SDZ PCB can be up to 16 GHz.

1. Perform a full, two-port standard SLOT calibration of the network analyzer.
2. Connect the CALIBRATION THRU calibration line (Connector RF5 and Connector RF6) to the analyzer and measure its insertion loss $S(2, 1)$.
3. Save the measured data to the network analyzer memory for later use.
4. Configure the EVAL-ADGM1304SDZ links and power up the EVAL-ADGM1304SDZ with a 3.3 V dc power supply.
5. Connect the network analyzer to the desired MEMS switch RF connectors and apply the external control signals, if needed.
6. Measure the complete insertion loss of the EVAL-ADGM1304SDZ. Include the insertion loss of the MEMS switch and test fixture (PCB transmission lines and RF connectors).
7. De-embed the PCB losses from the complete evaluation board measurement using the data saved at Step 3 and the measured data at Step 6. The extraction method is dependent on the network analyzer, so the user must consult the documentation of the network analyzer in use before performing the extraction. Typically, the divide function is used to divide the complete $S(2, 1)$ measurement data by the CALIBRATION THRU line $S(2, 1)$ data stored in memory.
8. Use the network analyzer port extension function to de-embed the phase offset introduced by the PCB transmission lines. The port extension method uses time delay offset values to correct for phase. Enter the time delay values into the port extension menu on the network analyzer for each RF edged connector to switch the pin path equal to the electrical length of the calibration line divided by two.

HANDLING GUIDELINES

Adhere to the following handling guidelines when using the EVAL-ADGM1304SDZ:

- Always treat the [ADGM1304](#) as a static sensitive device and observe normal handling precautions, including working only on static dissipative surfaces, wearing wrist straps, and using other electrostatic discharge (ESD) control devices.
- Take care when connecting signals. Hold the EVAL-ADGM1304SDZ from the edges to avoid any damage to the device under test (DUT).
- Avoid connecting live signal sources to the EVAL-ADGM1304SDZ. Ensure that outputs are switched off (preferably grounded) before connecting to the DUT. Ensure that all instrumentation shares a common chassis ground.
- Avoid running measurement instruments such as digital multimeters (DMMs) in autorange modes. Some instruments generate large transient compliance voltages when switching ranges.
- Use the highest practical range (lowest resolution) setting for resistance measurements to minimize compliance voltages.
- Physically handle the EVAL-ADGM1304SDZ with care.

EVALUATION BOARD SCHEMATIC AND ARTWORK

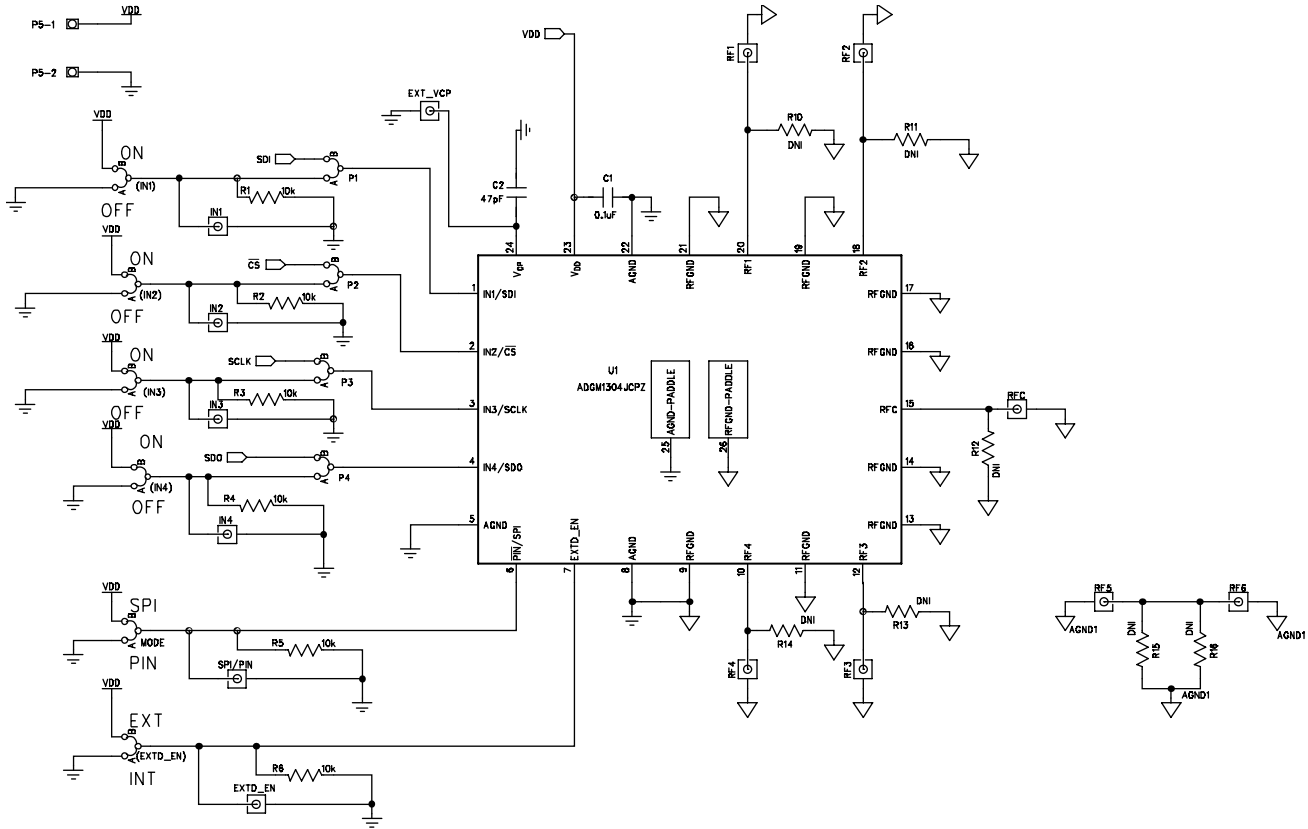


Figure 11. Schematic of the EVAL-ADGM1304SDZ

17218-010

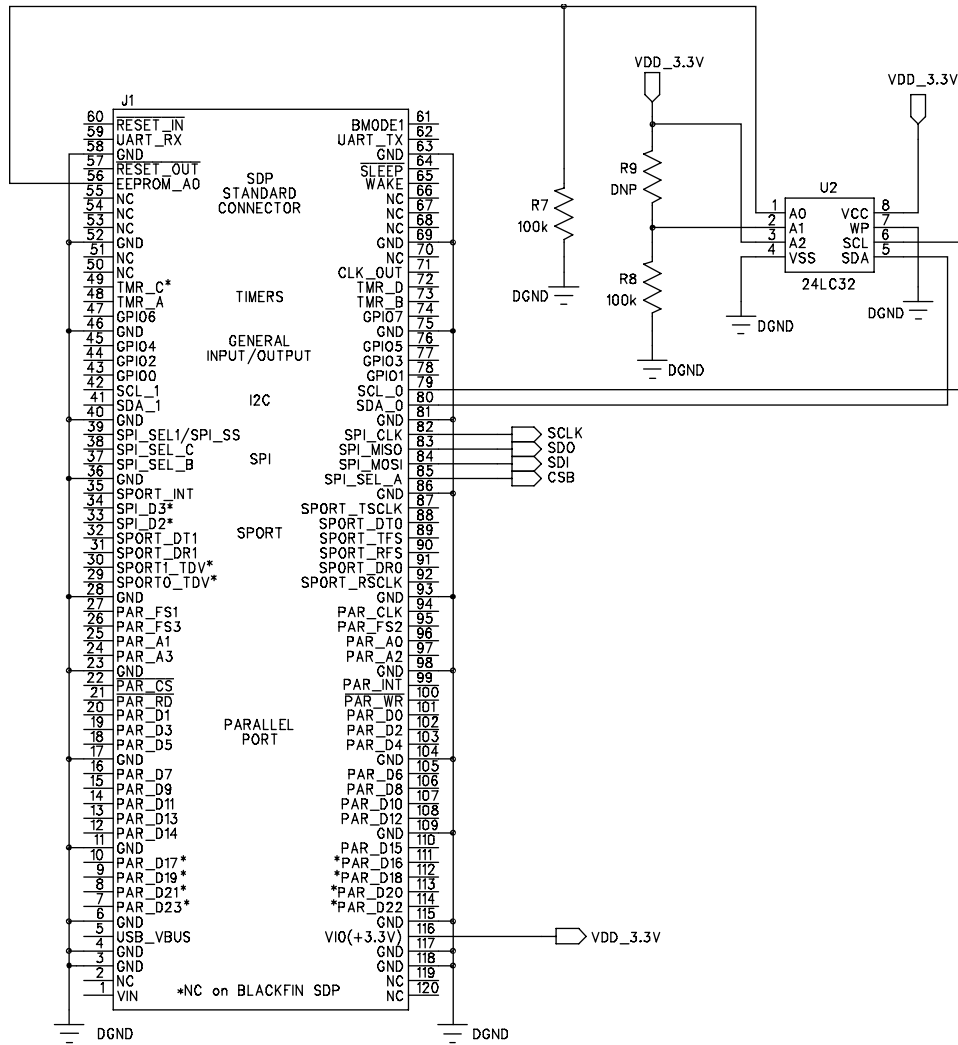
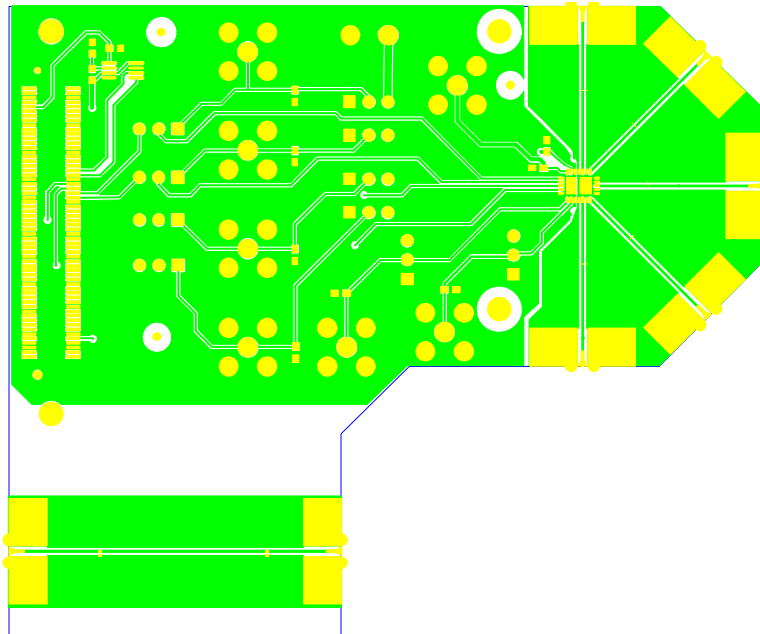


Figure 12. Schematic of the EVAL-ADGM1304SDZ Showing SDP Connector

172/18-011



17218-013

Figure 13. EVAL-ADGM1304SDZ Component Side PCB Drawing (Layer 1)



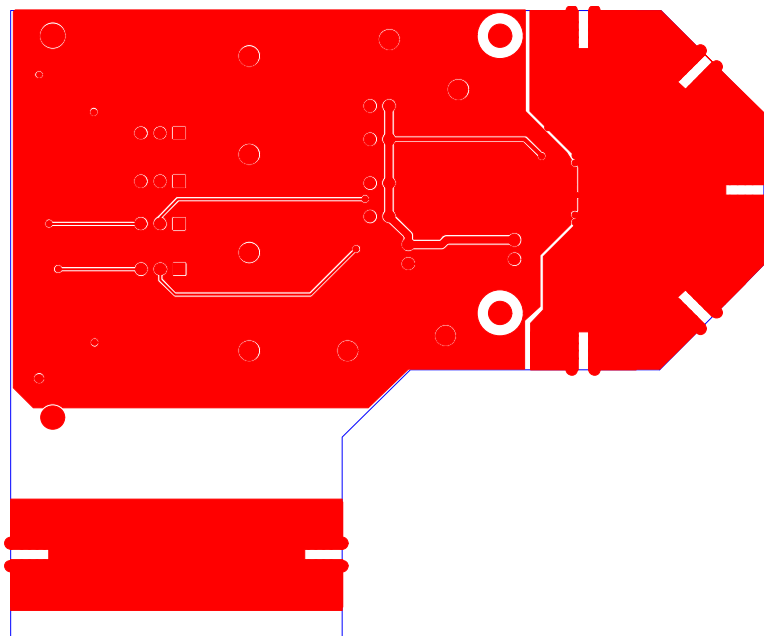
17218-014

Figure 14. EVAL-ADGM1304SDZ Component Side Ground Plane PCB Drawing (Layer 2)



17218-015

Figure 15. EVAL-ADGM1304SDZ Component Side Ground Plane PCB Drawing (Layer 3)



17218-016

Figure 16. EVAL-ADGM1304SDZ Component Side, Bottom Side PCB Drawing (Layer 4)

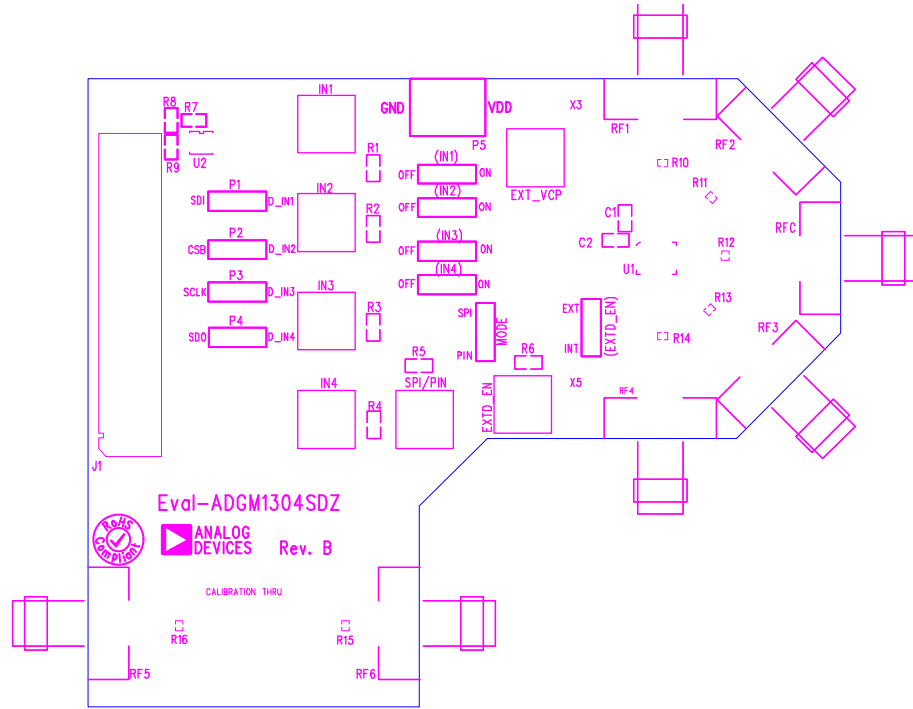


Figure 17. EVAL-ADGM1304SDZ Component Side Silkscreen PCB Drawing (Top)

Metal 1	Finished Copper Plating: 1.5 oz (2.1 thou/53 μ m) Rogers RO4003C: 8 thou laminate, Er 3.38 starting copper weight 0.5 oz/0.5 oz
Metal 2	Copper Weight: 1 oz (1.4 thou/35 μ m)

~37.2 thou FR4

Metal 3	Copper Weight: 1 oz (1.4 thou/35 μ m) Rogers RO4003C: 8 thou laminate, Er 3.38 starting copper weight 0.5 oz/0.5 oz
----------------	---

Metal 4 Finished Copper Plating: 1.5 oz (2.1 thou/53 μ m)

CPWG RF trace width:	15 thou
CPWG RF trace to ground gap:	12.2 thou
Final overall PCB thickness:	62 thou
Final copper plating thickness on top and bottom layers:	1.5 oz

Figure 18. EVAL-ADGM1304SDZ PCB Stack Up with Coplanar Waveguide with Ground (CPWG) Dimensions

ORDERING INFORMATION

BILL OF MATERIALS

Table 7.

Quantity	Reference Designator	Description	Part Number	Manufacturer
1	C1	0.1 μF, 0603 package, 16 V, X7R, surface mount device (SMD) ceramic capacitor	MCB0603R104KCT	Multicomp Pro
1	C2	47 pF, 0603 package, 100 V, COG/NP0 capacitor	06031A470JAT2A	AVX Corporation
7	IN1 to IN4, EXT_EN, EXT_VCP, SPI/PIN	50 Ω SMB connector through holes	SMB1251B1-3GT30G-50	Amphenol
6	(IN1) to (IN4), (EXTD_EN), MODE, P1 to P4	3-pin silicone headers and shorting links	M20-9990345 and M7566-05	Harwin
1	P5	2-pin terminal block (5 mm pitch)	KRM 02	Lumberg
1	J4	FX8-120S-SV(21), 120-way connector, 0.6 mm pitch	FX8-120S-SV(21)	Hirose(HRS)
6	R1 to R6	10 kΩ (0603 package) SMD resistors	MC0063W0603110K	Multicomp
2	R7 to R8	100 kΩ (0603 package) SMD resistors	MC0063W06031100K	Multicomp Pro
1	R9	Not populated	Not applicable	Not applicable
7	R10 to R16	10 MΩ (0201 package) SMD resistors, not populated	Not applicable	Not applicable
9	RF1 to RF6, RFC	50 Ω side launch SMA connectors	32K243-40ML5	Rosenberger
1	U1	0 Hz/dc to 14 GHz, single-pole, four-throw MEMS switch with integrated driver	ADGM1304	Analog Devices
1	U2	24LC32A-I/MS, 32 kΩ, I ² C serial electronically erasable programmable read-only memory (EEPROM)	24LC32A-I/MS	Microchip
3	Not applicable ¹	Wideband 50 Ω termination SMA loads	PE6081	Pasternack

¹ Screwed on at measurement time (see Figure 1).

I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).



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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100,000). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

