DC2847A-KIT User Guide
UG-1690

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Evaluating the ADL5920 Arduino Shield

FEATURES

- **Full featured evaluation kit for the ADL5920, specified from 9 kHz to 7 GHz**
- **Integrated bidirectional bridge that measures forward and reverse power**
- **Integrated dual channel rms power detector that measures forward and reverse RF power**
- **PC-based GUI that provides instant forward power, reverse power, and return loss information**

EVALUATION KIT CONTENTS

- **EVAL-ADL5920-ARDZ**
- **DC2026C Linduino board**
- **ADL5920**
- **9 V wall power adapter**

EQUIPMENT NEEDED

- **DC2847A-KIT**
- **PC running Windows 10, or higher**
- **USB cable for a PC**
- **Signal generator**

DOCUMENTS NEEDED

- **ADL5920 data sheet**

SOFTWARE NEEDED

- **QuikEval software**

GENERAL DESCRIPTION

The demonstration circuit (DC2847A) is a dual rms power detector with an integrated bidirectional bridge featuring the ADL5920 IC. The Arduino shield evaluates the ADL5920 with the Linduino board (DC2026C). The graphical user interface (GUI) allows the PC to measure and to monitor the forward and reverse power. Return loss is calculated and displayed on the PC.

The ADL5920 simultaneously measures forward and reverse rms power up to 7 GHz and provides return loss results. The ADL5920 detector has 50 dB of dynamic range at 1 GHz. The DC2847A-KIT requires an external power supply that connects to the DC2026C by setting Jumper JP1.

DC2847A-KIT CONNECTION DIAGRAM

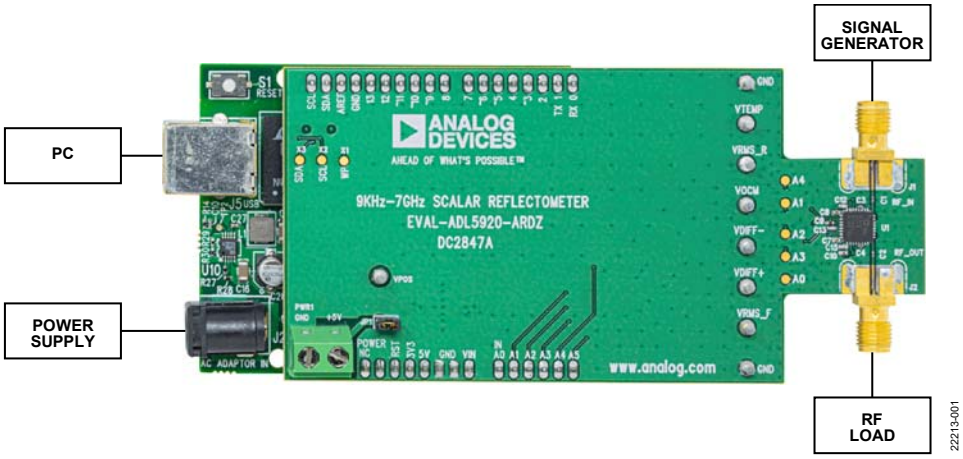

Figure 1.

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REVISION HISTORY

1/2020—Revision 0: Initial Version

DC2847A-KIT EVALUATION HARDWARE

POWER SUPPLIES

A wall power adapter for the DC2847A-KIT is included with the kit. If the wall power adapter is not available, a 5 V, 200 mA supply can power the ADL5920 shield through the screw terminal block, PWR1.

INPUT SIGNALS

Signal Generator

The RF input source is a signal generator capable of generating a continuous wave (CW) signal up to 7 GHz.

RF Load

The RF load is connected to the RF_OUT port on the DC2847A-KIT. RF power is delivered to RF_OUT. The ADL5920 measures the magnitude of the forward and reflected power from the impedance mismatch between the integrated bridge and the RF load.

OUTPUT SIGNALS

A PC is required to run the QuikEval software. After the DC2847A-KIT is plugged into the PC with a USB cable, the QuikEval software opens and runs the GUI, as shown in Figure 2.

FILTER CAPACITORS

The C3 and C4 capacitors on the EVAL-ADL5920-ARDZ are high-pass filter capacitors for the internal offset compensation loop. These capacitors are required for low frequency operation. When the RF input signal (RFIN) is above 2 GHz, remove these capacitors to improve directivity.

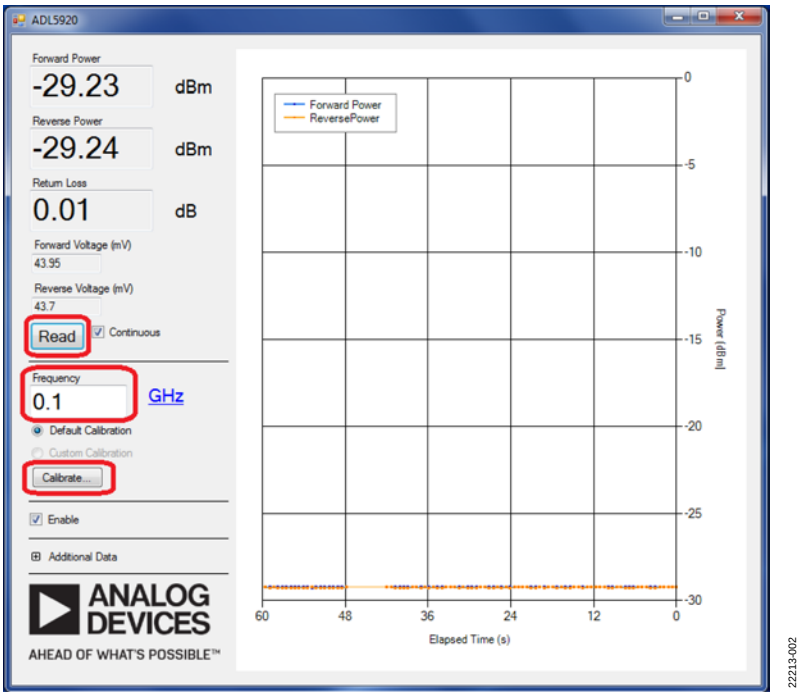

Figure 2. QuikEval GUI Window

DC2847A-KIT SETUP PROCEDURES

CONFIGURING THE DC2847A-KIT

The DC2847A-KIT provides the necessary hardware to evaluate the ADL5920 functionality with the QuikEval software. Download the QuikEval software from the Analog Devices, Inc., website by taking the following steps:

1. Go to www.analog.com. Search for QuikEval and click the QuikEval entry, which prompts the user to run **ltcqev.exe**. Click the **Save** button to download and install the software.
2. Short JP1 and connect the wall power supply included in the evaluation kit to the DC2847A-KIT. See Figure 1 for connection details.
3. Connect the PC to the DC2847A-KIT with a USB cable. See Figure 1 for connection details.
4. Connect the signal generator to RFIN (J1) on the DC2847A-KIT. Set the signal generator frequency between 9 kHz to 7 GHz. Set the signal generator power to 0 dBm to begin measurements. See Figure 2 for GUI usage details.
5. Connect the RF load to RF_OUT on the DC2847A-KIT. For a minimal reflection condition, the 50 Ω RF load is matched to the ADL5920 output. See Figure 1 connection details.

USING THE QUIKEVAL SOFTWARE FOR TESTING

The QuikEval software measures the reflections from the RF load. Forward power and reverse power are measured and displayed on the PC using the GUI by taking the following steps:

1. Open the downloaded QuikEval software.
2. Use the GUI window that opens and click **Read** to measure the forward and reverse rms power with the default calibration shown in Figure 2.
3. Set the **Frequency** box to match the RF signal being measured under **Forward Power** and **Reverse Power**. Ensure **Default Calibration** is selected to use the typical slope and intercept stored in the GUI. Default calibration uses the typical slope and intercept values listed in the ADL5920 data sheet. However, using the default calibration settings introduces errors due to the part to part variations of the ADL5920.
4. Click **Calibrate…** to perform user calibration to improve the accuracy of the measured rms power. Taking this step calibrates the DC2847A-KIT across the RF input frequency from 1 MHz to 7 GHz using 3-point calibration.

The QuikEval software uses linear interpolation to calculate the rms power being measured through the bidirectional bridge by calculating the slope and intercept for frequencies between the calibration points. The calibration coefficients are stored in the GUI and can be reused later. See Figure 3 for calibration details.

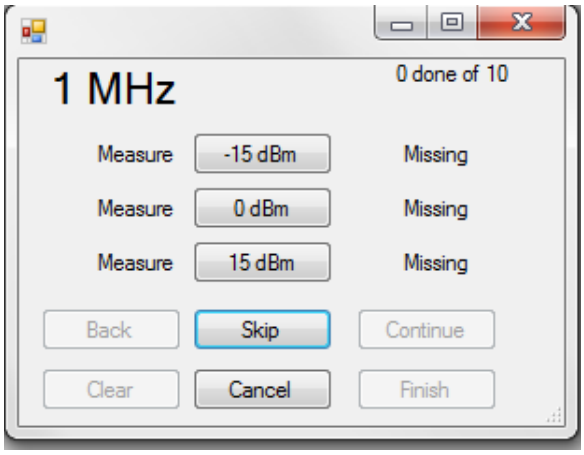

Figure 3. Calibration Details to Improve Measurement Accuracy

Voltage Standing Wave Ratio

The measurements provided by the QuikEval software assists users with obtaining the voltage standing wave ratio (VSWR). The following equations detail how the VSWR is derived using the DC2847A-KIT reflection measurements:

$$RL = (P_{FORWARD} - P_{REVERSE}) + IL$$

where:
RL is the return loss.
$P_{FORWARD}$ is the RF load forward power.
$P_{REVERSE}$ is the RF load reverse power.
IL is the insertion loss. Note that insertion loss has a negative sign for a passive load.

From the RL calculation, use the following equation to obtain the VSWR:

$$VSWR = \frac{(1+(10^{(\frac{-RL}{20})}))}{(1-(10^{(\frac{-RL}{20})}))}$$

DC2847A-KIT SCHEMATIC AND ARTWORK

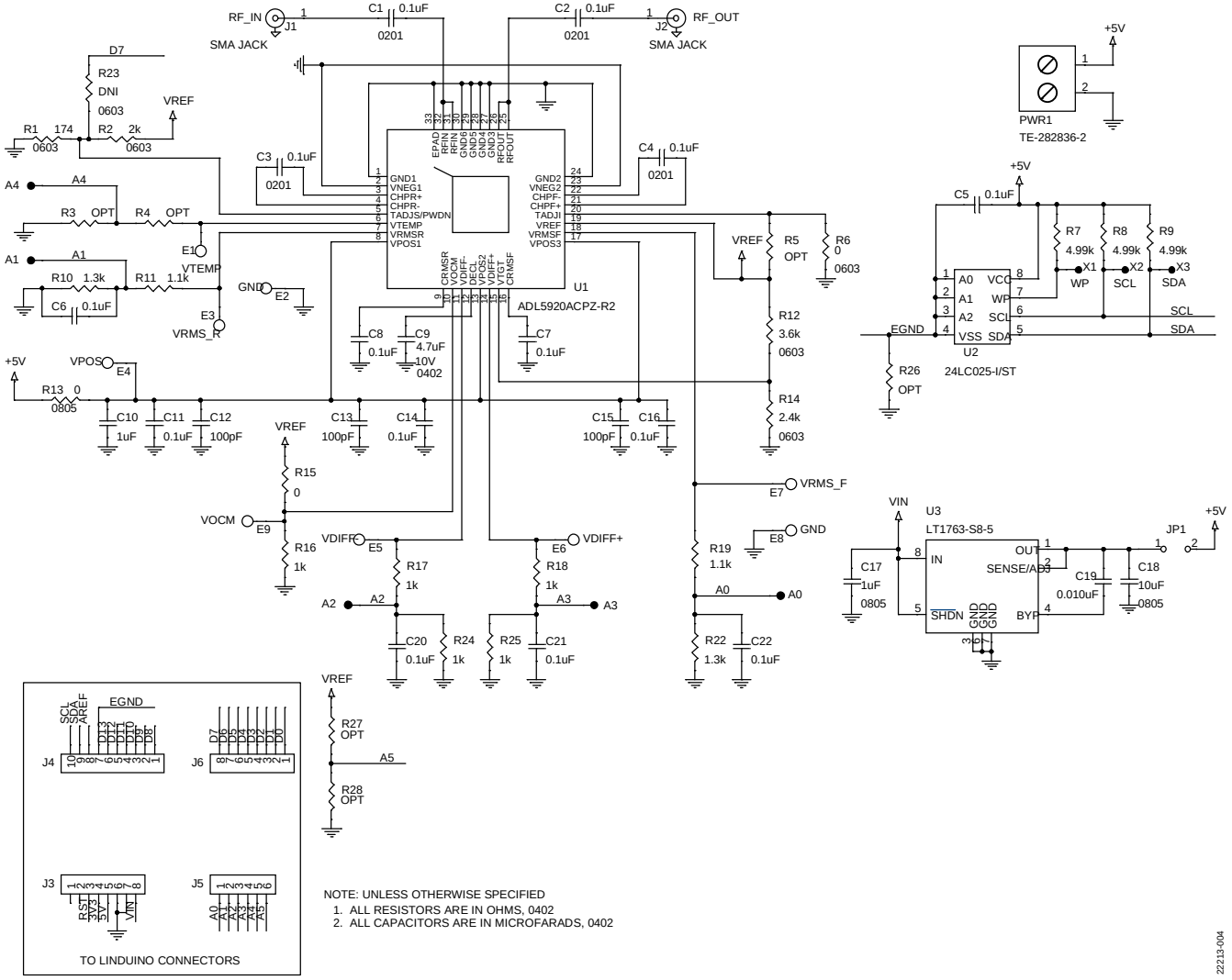

Figure 4. DC2847A-KIT Schematic

Figure 5. Layer 1 of the EVAL-ADL5920-ARDZ (DC2847A)

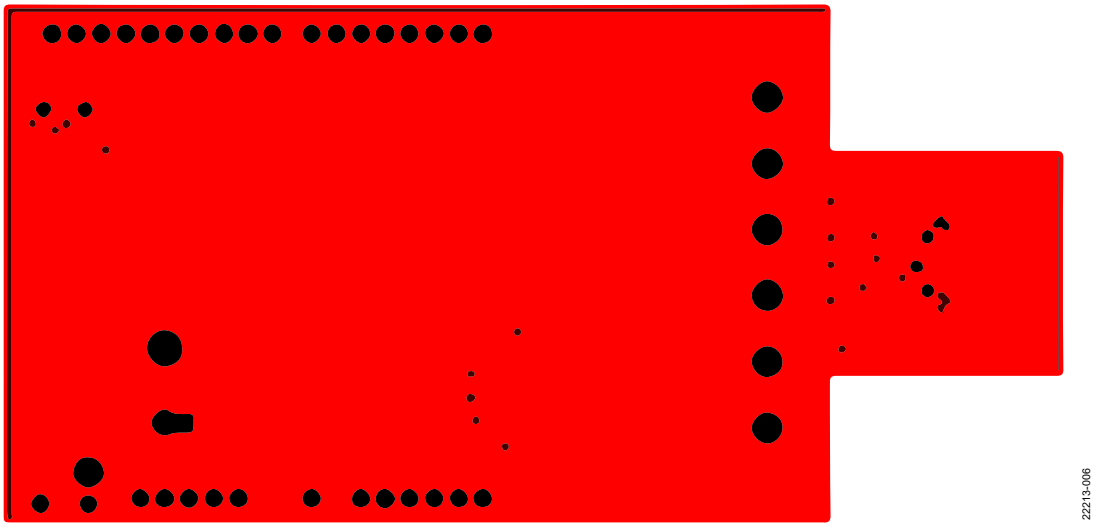

Figure 6. Layer 2 of the EVAL-ADL5920-ARDZ (DC2847A)

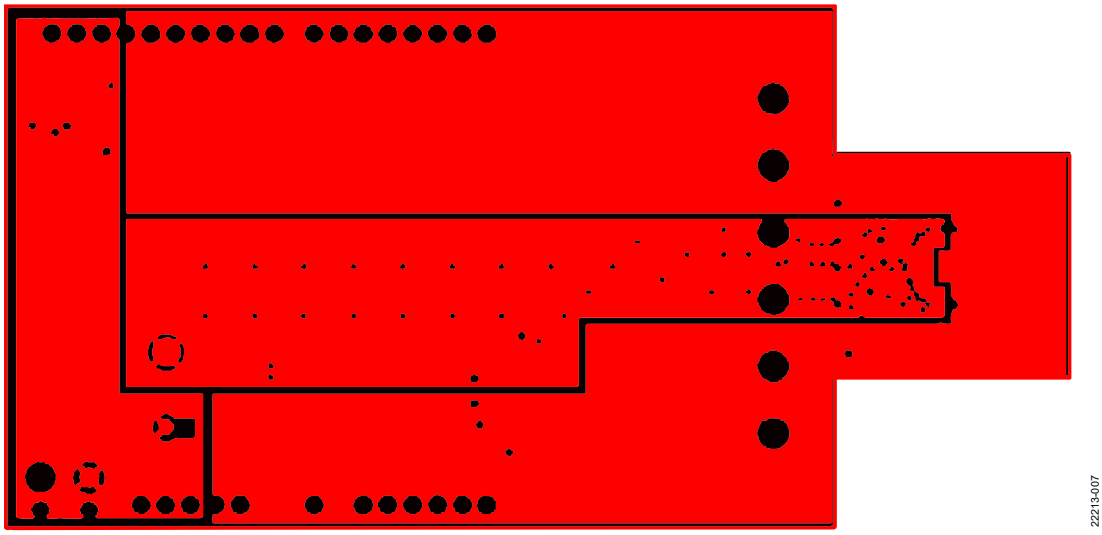

Figure 7. Layer 3 of the EVAL-ADL5920-ARDZ (DC2847A)

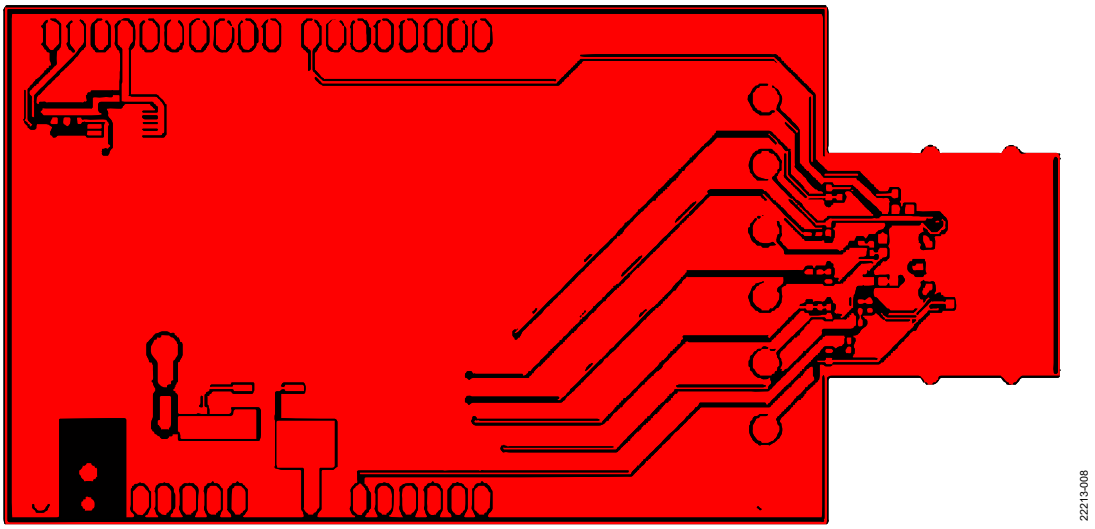

Figure 8. Layer 4 of the EVAL-ADL5920-ARDZ (DC2847A)

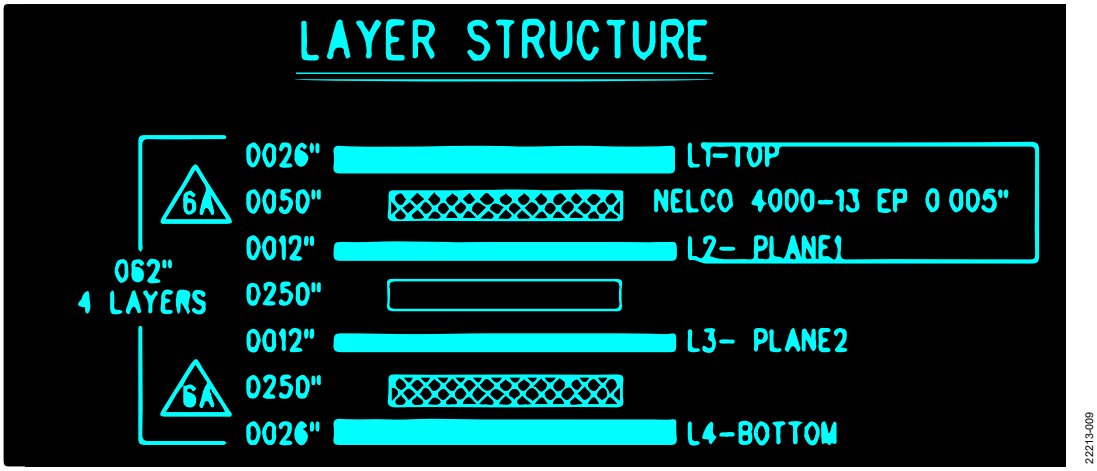

Figure 9. Layer Structure of the EVAL-ADL5920-ARDZ (DC2847A)

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Quantity	Reference Designator	Description	Manufacturer	Part Number
4	C1 to C4	0.1 µF, broadband RF capacitors, 0201, 16 V, 10%, 0201, 10%, 16 kHz to 50 GHz	Passive Plus, Inc.	0201BB104KW160
7	C5 to C8, C11, C14, C16	0.1 µF, 0402, capacitors, 50 V, 10%, X5R	AVX	04025D104KAT2A
1	C9	4.7 µF, 0402, capacitor, 10 V, 10%, X5R	TDK	C1005X5R1A475K050BC
1	C10	1 µF, 0402, capacitor, 10 V, 10%, X5R	Murata	GRM155R61A105KE15D
3	C12, C13, C15	100 pF, 0402, capacitors, 50 V, 10%, X7R	AVX	04025C101KAT2A
1	C17	1 µF,0805, capacitor, 10 V, 10%, X7R	AVX	0805ZC105KAT2A
1	C18	10 µF, 0805, capacitor, 10 V, 10%, X5R	Murata	GRM21BR61A106KE19L
1	C19	0.010 µF, 0402, capacitor, 25 V, 10%, X7R	Kemet	C0402C103K3RACTU
3	C20 to C22	0.1 µF,0402, capacitors, 50 V, 10%, X5R	Murata	GRM155R61H104KE14D
9	E1 to E9	Turrets, 0.064 inches	Mill-Max	2308-2-00-80-00-00-07-0
2	J1 and J2	50 Ω, Connected Subminiature Version A (SMA) jacks, female end launch connector	Cinch Connectivity	142-0761-871
2	J3, J6	Socket headers receptacle, 1 × 8	Samtec	SSQ-108-03-G-S
1	J4	Connected socket header receptacle, 1 × 10	Samtec	SSQ-110-03-G-S
1	J5	Connected socket header, receptacles, 1 × 6, 1 row × 6 holes	Samtec	SSQ-106-03-G-S
1	JP1	Connected male header, 1 × 2 pins	Samtec	TMM-102-02-L-S
1	MP1	AC/dc adapter, 9 V output, 1.4 A, 12.6 W, dc plug, 5.5 mm × 2.1 mm × 9.5 mm	CUI, Inc.	SWI15-9-N-P5
1	PCB1	Printed circuit board (PCB), DC2847A	Gorilla Circuits	600-DC2847A
1	PWR1	Connected terminal block	TE Connectivity	282836-2
1	R1	174 Ω, 0603, resistor, 1%, 1/10 W, AEC-Q200	Panasonic	ERJ3EKF1740V
1	R2	2 kΩ, 0603, resistor, 1%,1/10 W	NIC, Inc.	NRC06F2001TRF
6	R3 to R5, R26 to R28	0402, optional	Not installed	Not installed
1	R6	0 Ω, 0603, resistor, 1/10 W	Yageo	RC0603FR-070RL
3	R7 to R9	4.99 kΩ, 0402, resistors, 1%, 1/16 W, 0402	NIC, Inc.	NRC04F4991TRF
2	R10 and R22	1.3 kΩ, 0402, resistors, 1%, 1/16 W, AEC-Q200	NIC, Inc.	NRC04F1301TRF
2	R11 and R19	1.1 kΩ, 0104, resistors, 1%, 1/16 W, AEC-Q200	NIC, Inc.	NRC04F1101TRF
1	R12	3.6 kΩ, 0603, resistor, 1%, 1/10 W, AEC-Q200	Panasonic	ERJ3EKF3601V
1	R13	0 Ω, 0805, resistor, 1/8 W	Yageo	RC0805JR-070RL
1	R14	2.4 kΩ, 0603, resistor, 1%, 1/10 W, AEC-Q200	Panasonic	ERJ3EKF2401V
1	R15	0 Ω, 0402, resistor, 1/16 W	NIC, Inc.	NRC04ZOTRF
5	R16 to R18, R24, R25	1 kΩ, 0402, resistors, 1%, 1/16 W	NIC, Inc.	NRC04F1001TRF
1	R23	0603, optional	Do not install	Do not install
1	STNCL1	Stencil tool	Analog Devices	830-DC2847A
1	U1	9 kHz to 7 GHz, bidirectional rms and VSWR detector	Analog Devices	ADL5920ACPZ-R2
1	U2	IC, memory, electronically erasable programmable read-only memory (EEPROM), 2 kB TSSOP-8, 400 kHz	Microchip Technology	24LC025-I/ST
1	U3	500 mA, low noise, LDO micropower regulator	Linear Technology	LT1763CS8-5#PBF

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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ANALOG DEVICES

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