MAXIM

MAX2651/MAX2652/MAX2653 Evaluation Kits

General Description

The MAX2651/MAX2652/MAX2653 evaluation kits (EV kits) simplify evaluation of the MAX2651/MAX2652/MAX2653 low-noise amplifiers (LNAs). The kits enable testing of the devices' RF performance and require no additional support circuitry. The signal inputs and outputs use SMA connectors to facilitate the connection of RF test equipment.

The MAX2651/MAX2652 EV kits are assembled with a MAX2651/MAX2652 and incorporate input and output matching components optimized for RF frequencies of 925MHz to 960MHz (GSM band) and 1805MHz to 1880MHz (DCS band). The MAX2653 EV kit is assembled with a MAX2653 and incorporates input and output matching components optimized for the DCS band.

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX2651EVKIT	-40°C to +85°C	10 µMAX
MAX2652EVKIT	-40°C to +85°C	10 µMAX
MAX2653EVKIT	-40°C to +85°C	8 µMAX

Features

♦ **Easy Evaluation of MAX2651/MAX2652/MAX2653**

♦ **+2.7V to +3.3V Single-Supply Operation**

♦ **GSM RF Input/Output Matched to 50Ω at 925MHz to 960MHz (MAX2651/MAX2652)**

♦ **DCS RF Input/Output Matched to 50Ω at 1805MHz to 1880MHz**

♦ **All Peripheral Components Included**

Component Suppliers

SUPPLIER	PHONE	FAX	WEB
Coilcraft	847-639-6400	847-639-1469	www.coilcraft.com
EF Johnson	800-368-4923	507-835-8356	www.efjohnson.com
Kamaya	219-489-1533	219-489-2261	www.kamaya.com
Murata Electronics	800-241-6574	770-436-3030	www.murata.com
Taiyo Yuden	408-573-4150	408-573-4159	www.T-Yuden.com

MAX2651 EV Kit Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	68pF ±5% ceramic capacitor (0603) Murata GRM39COG680J50
C2	1	15pF ±5% ceramic capacitor (0603) Murata GRM39COG150J50
C3	1	1.5pF ±0.1pF ceramic capacitor (0603) Murata GRM39COG1R5B50
C4, C5, C11	3	220pF ±5% ceramic capacitors (0603) Murata GRM39COG221J50
C6	1	1.2pF ±0.1pF ceramic capacitor (0603) Murata GRM39COG1R2B50
C7, C8	0	Not installed
C9	1	2.2pF ±0.1pF ceramic capacitor (0603) Murata GRM39COG2R2B50
C10	1	100pF ±5% ceramic capacitor (0603) Murata GRM39COG101J50V
C12	1	0.01µF ±10% ceramic cap (0805)
C13	1	47pF ±5% ceramic capacitor (0603) Murata GRM39COG470J50
DCSIN, DCSOUT, GSMIN, GSMOUT	4	SMA connectors (PC edge mount) EF Johnson 142-0701-801

DESIGNATION	QTY	DESCRIPTION
L1, L5	2	8.2nH ±5% air-core inductors (0603) Murata LQG11A8N2J00
L2	1	3.9nH ±0.3nH inductor (0603) Murata LQG11A3N9S00
L4	1	2.2nH ±0.3nH inductor (0603) Murata LQG11A2N2S00
R1, R4	2	910Ω ±5% resistors (0603) Kamaya RMC16911JT
R2	1	330Ω ±5% resistor (0603) Kamaya RMC16331JT
R3	1	180Ω ±5% resistor (0603) Kamaya RMC16181JT
R5	1	0Ω resistor (0402) Kamaya RMC16S000JT
U1	1	MAX2651EUB
None	1	MAX2651 EV kit PC board
None	1	MAX2651 data sheet
None	1	MAX2651 EV kit data sheet

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DESIGNATION	QTY	DESCRIPTION
BAND, GAIN, GND, SHDN, VCC,	5	Test points Mouser 151-203
C1, C5, C6, C12	4	220pF ±5% ceramic capacitors (0603) Murata GRM39COG221J050 or Taiyo Yuden UMK107CH221JZ
C2	1	68pF ±5% ceramic capacitor (0603) Murata GRM39COG680J050 or Taiyo Yuden UMK107CH680JZ
C3	1	5.6pF ±0.25pF ceramic capacitor (0603) Murata GRM39COG5R6C050
C4	1	1.1pF ±0.1pF ceramic capacitor (0603) Murata GRM40X7R105K010
C7	1	1.2pF ±0.1pF ceramic capacitor (0603) Murata GRM39COG1R2B050
C8, C13	0	Not installed
C9	1	1µF ±10% MAX ceramic capacitor (0805) Murata GRM39COG2R2B50 or Taiyo Yuden LMK212BJ105KG
C10	1	2.2pF ±0.1pF ceramic capacitor (0603) Murata GRM39COG2R2B050
C11	1	100pF ±5% ceramic capacitor (0603) Murata GRM39COG101J050 or Taiyo Yuden UMK107CH101JZ

MAX2652 EV Kit Component List

DESIGNATION	QTY	DESCRIPTION
C14	1	47pF ±5% ceramic capacitor (0603) Murata GRM39COG470J050 or Taiyo Yuden UMK107CH470JZ
DCSIN, DCSOUT, GSMIN, GSMOUT	4	SMA connectors (PC edge mount) EF Johnson 142-0701-801 or Digi-Key J502-ND
JU1, JU2, JU3	3	3-pin headers
L1	1	6.8nH ±5% inductor (0603) Murata LQG11A6N8J00
L2	1	3.3nH ±0.3nH inductor (0603) Murata LQG11A3N3S00
L4	1	2.2nH ±0.3nH inductor (0603) Murata LQG11A2N2S00
L5	1	8.2nH ±5% inductor (0603) Murata LQG11A8N2J00
R1, R2, R5	3	910Ω ±5% resistors (0603)
R3	0	Not installed
R4	1	240Ω ±5% resistor (0603)
R6	1	0Ω ±5% resistor (0402)
U1	1	MAX2652EUB (10 µMAX)
None	3	Shunts (JU1, JU2, JU3)
None	1	MAX2652 EV kit PC board
None	1	MAX2652 data sheet
None	1	MAX2652 EV kit data sheet

DESIGNATION	QTY	DESCRIPTION
C1, C7	2	100pF ±5% ceramic capacitors (0603) Murata GRM39COG101J50
C2	1	1.5pF ±0.1pF ceramic capacitor (0603) Murata GRM39COG1R5B50
C3	1	47pF ±5% ceramic capacitor (0603) Murata GRM39COG470J50
C4	1	1.0pF±0.1pF ceramic capacitor (0603) Murata GRM39COG010B50
C5, C8	0	Not installed
C6	1	150pF ±5% ceramic capacitor (0805) Murata GRM40COG151J50
C9	1	2200pF ±5% ceramic capacitor (0603) Murata GRM39X7R222J50
C10	1	0.01µF ±5% ceramic capacitor (0603) Murata GRM39X7R103J50

MAX2653 EV Kit Component List

DESIGNATION	QTY	DESCRIPTION
DCSIN, DCSOUT	1	SMA connector (PC edge mount) EF Johnson 142-0701-801
L1	1	3.3nH ±0.3nH inductor (0603) Murata LQG11A3N3S00
L3	1	2.7nH ±0.3nH inductor (0603) Murata LQG11A2N7S00
R1, R3	2	1kΩ ±5% resistors (0603) Kamaya RMC16102JT
R2	1	330Ω ±5% resistor (0603) Kamaya RMC16331JT
R4	1	0Ω resistor (0603) Kamaya RMC16000JT
U1	1	MAX2653EUA
None	1	MAX2653 EV kit PC board
None	1	MAX2653 data sheet
None	1	MAX2653 EV kit data sheet

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_____Test Equipment Required

This section lists the required test equipment to verify operation of the MAX2651/MAX2652/MAX2653. It is intended as a guide only; some substitutions are possible.

- An RF signal generator capable of delivering at least 0dBm of output power up to 2.5GHz (HP 8648C or equivalent)

- An RF spectrum analyzer that covers the operating frequency range plus a few harmonics (HP 8561E, for example)

- A power supply capable of up to 25mA at +2.7V to +3.3V

- An optional ammeter for measuring the supply current

- Two 50Ω SMA cables

- A noise-figure meter (HP 8970B, for example) to measure noise figure (optional)

- A network analyzer (HP 8753D, for example) to measure return loss and gain (optional)

_____Connections and Setup

The MAX2651/MAX2652/MAX2653 EV kits are fully assembled and factory tested. This section provides a step-by-step guide to operating the EV kits and testing the devices' functions. **Do not turn on the DC power or RF signal generator until all connections are made.**

Checking Power Gain (DCS Band)

For the MAX2651/MAX2652 EV kits, ensure that the GSMIN and GSMOUT ports are terminated into 50Ω.

High-Gain Mode

1) Connect a +3VDC supply (through an ammeter if desired) to the EV kit's VCC and GND terminals. Do not turn on the supply.

2) Connect an RF signal generator to the DCSIN SMA connector; do not turn on the generator's output. Set the generator for an output frequency of 1850MHz at a power level of -30dBm.

3) Connect a spectrum analyzer to the EV kit's DCSOUT SMA connector. Set the analyzer to a center frequency of 1850MHz, a total span of 200MHz, and a reference level of 0dBm.

4) Connect a jumper wire between the EV kit's GAIN input and VCC (high-gain mode).

5) For the MAX2651/MAX2652 EV kits only, connect a jumper wire between the EV kit's BAND input and VCC (DCS mode).

6) Turn on the DC supply. If using an ammeter, the supply current should read approximately 5.7mA for the MAX2651, 7.0mA for the MAX2652, and 5.4mA for the MAX2653.

7) Activate the RF generator's output. A signal on the spectrum analyzer's display should indicate a typical gain of 18dB for the MAX2651/MAX2653 and 17dB for the MAX2652 after accounting for cable, board, and connector losses. (Board and connector loss correction is typically 0.3dB for the DCS gain test.)

Low-Gain Mode

8) Deactivate the signal generator's output. Remove the jumper wire between the GAIN input and VCC, and reconnect the jumper wire between the GAIN input and ground (low-gain mode). If using a current meter, the supply current should now read approximately 2.2mA

9) Activate the RF generator's output. A signal on the spectrum analyzer's display should indicate a typical gain of -2dB after accounting for cable and board losses.

10) Another method for determining gain is to use a network analyzer. This has the advantage of displaying gain over a swept frequency band, in addition to displaying input and output return loss. Refer to the network analyzer manufacturer's user manual for setup details (optional).

Checking Power Gain (GSM Band, MAX2651/MAX2652 EV Kits Only)

Ensure that the DCSIN and DCSOUT ports are terminated into 50Ω.

High-Gain Mode

1) Connect a +3VDC supply (through a current meter if desired) to the EV kit's VCC and GND terminals. Do not turn on the supply.

2) Connect an RF signal generator to the GSMIN SMA connector; do not turn on the generator's output. Set the generator for an output frequency of 945MHz at a power level of -30dBm.

3) Connect a spectrum analyzer to the EV kit's GSMOUT SMA connector. Set the analyzer to a center frequency of 945MHz, a total span of 200MHz, and a reference level of 0dBm.

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4) Connect a jumper wire between the EV kit's GAIN input and VCC (high-gain mode).

5) Connect a jumper wire between the EV kit's BAND input and ground (GSM mode).

6) Turn on the DC supply. If using an ammeter, the supply current should read approximately 5.9mA for the MAX2651 and 7.2mA for the MAX2652.

7) Activate the RF generator's output. A signal on the spectrum analyzer's display should indicate a typical gain of 18dB after accounting for cable and board losses. (Board and connector loss correction is typically 0.3dB for the GSM gain test.)

Low-Gain Mode

8) Deactivate the signal generator's output. Remove the jumper wire between the GAIN input and VCC, and reconnect the jumper wire between the GAIN input and ground (low-gain mode). If using a current meter, the supply current should now read approximately 2.2mA for the MAX2651 and 2.4mA for the MAX2652.

9) Activate the RF generator's output. A signal on the spectrum analyzer's display should indicate a typical gain of -2dB after accounting for cable and board losses.

10) Another method for determining gain is to use a network analyzer. This has the advantage of displaying gain over a swept frequency band, in addition to displaying input and output return loss. Refer to the network analyzer manufacturer's user manual for setup details (optional).

Checking Noise Figure

Noise-figure measurements on low-noise devices are extremely sensitive to board and lab setup losses/parasitics. The specified MAX2651/MAX2652/MAX2653 noise-figure values (refer to the MAX2651/MAX2652/MAX2653 data sheet) have board and connector losses subtracted out. (Board and connector loss correction is typically 0.1dB for the DCS band noise figure test and is negligible for GSM.) There are many techniques/precautions for measuring a noise figure. A detailed explanation of these items goes beyond the scope of this document. For more information on how to perform this level of noise-figure measurement, refer to the noise-figure meter's operating manual as well as Hewlett Packard Application Note #57-1.

_____*Layout Considerations*

A good PC board is an essential part of an RF circuit design. The EV kit PC board can serve as a guide for laying out a board using the MAX2651/MAX2652/MAX2653. Each VCC node on the PC board should have its own decoupling capacitor. This minimizes supply coupling from one section of the IC to another. A star topology for the supply layout, in which each VCC node on the circuit has a separate connection to a central VCC node, can further minimize coupling between sections of the IC.

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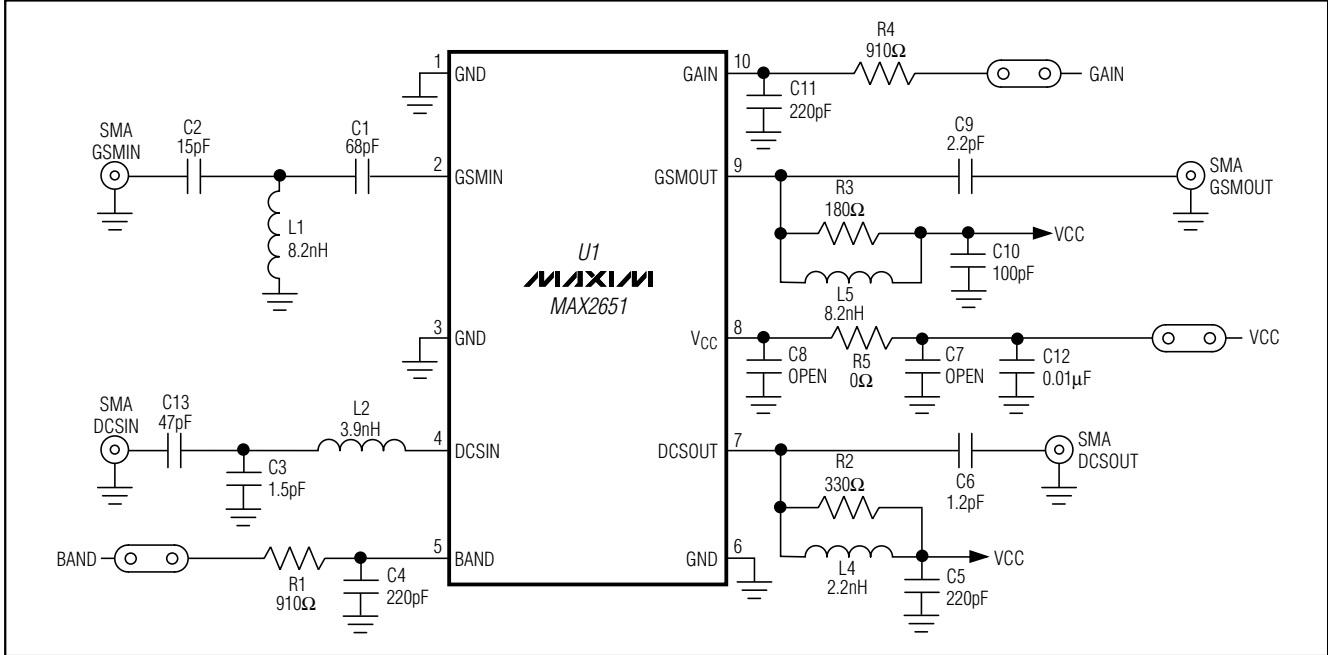
Figure 1. MAX2651 EV Kit Schematic
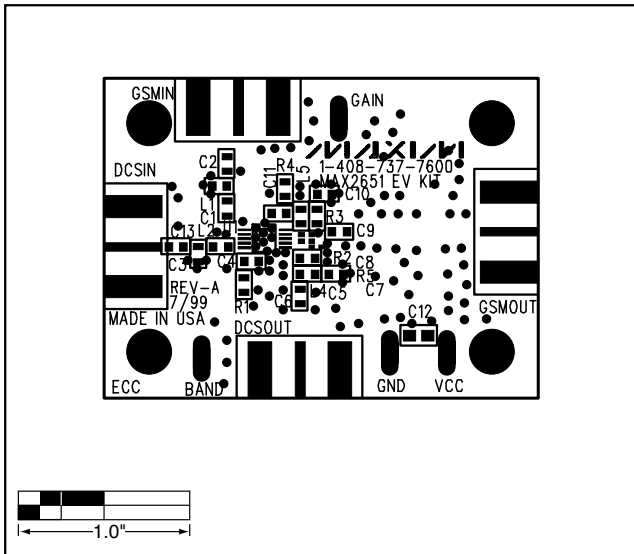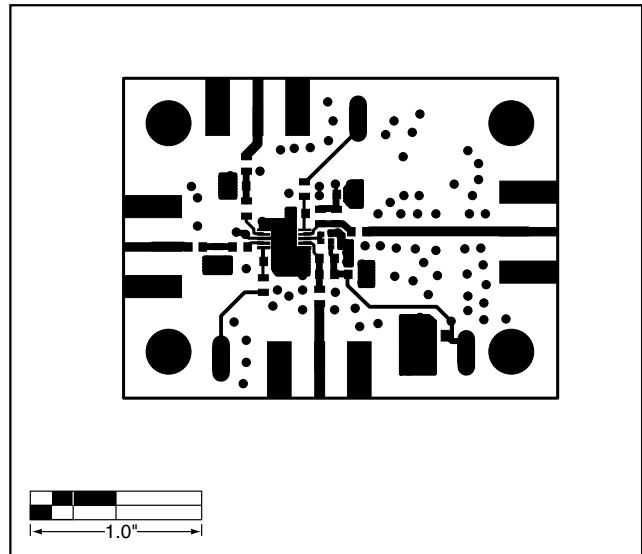

Figure 2. MAX2651 EV Kit Component Placement Guide

Figure 3. MAX2651 EV Kit PC Board Layout—Component Side
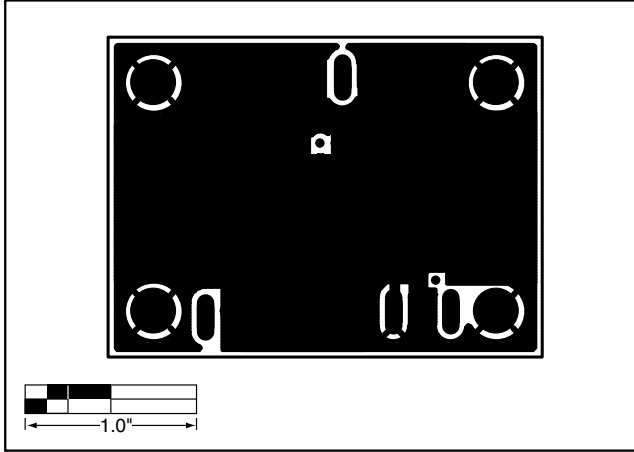
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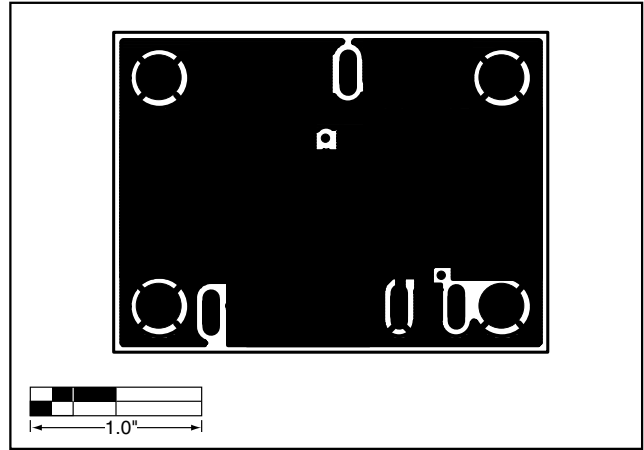Figure 4. MAX2651 EV Kit PC Board Layout—Ground Plane 1
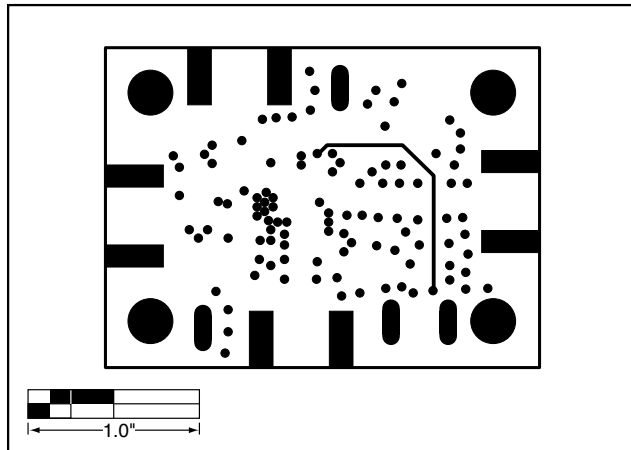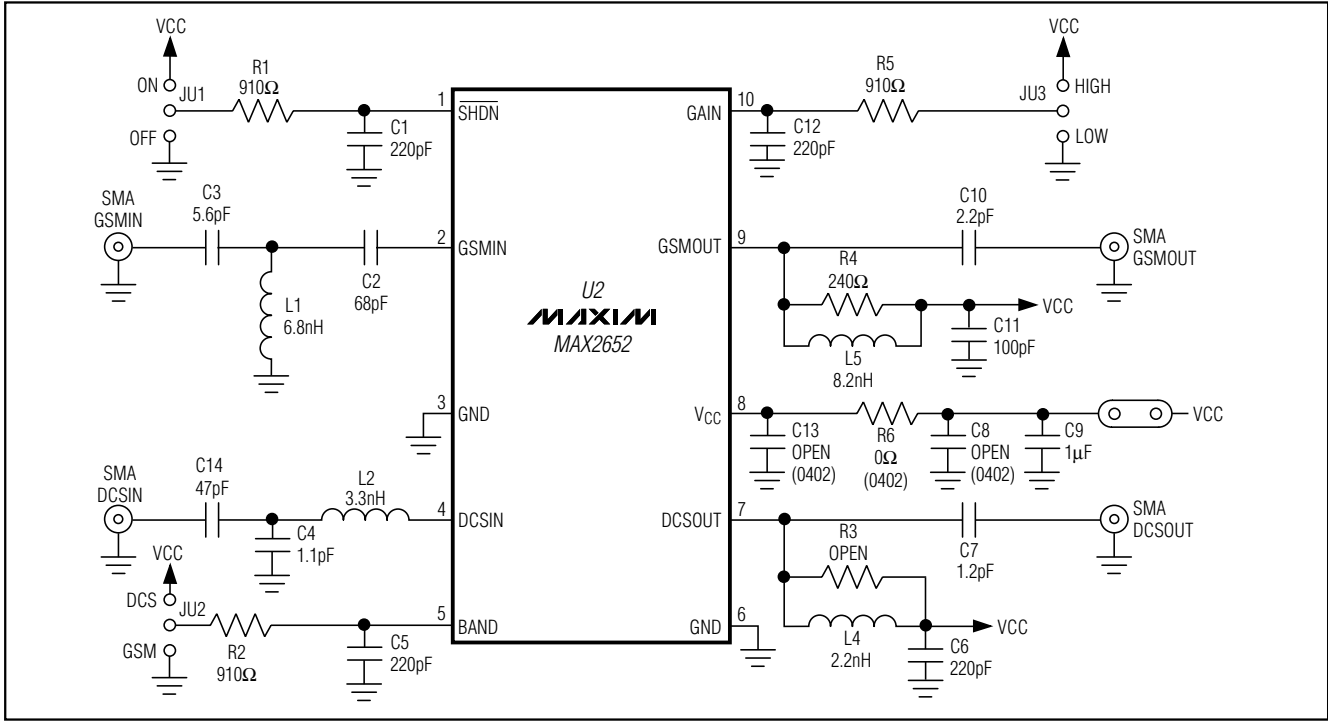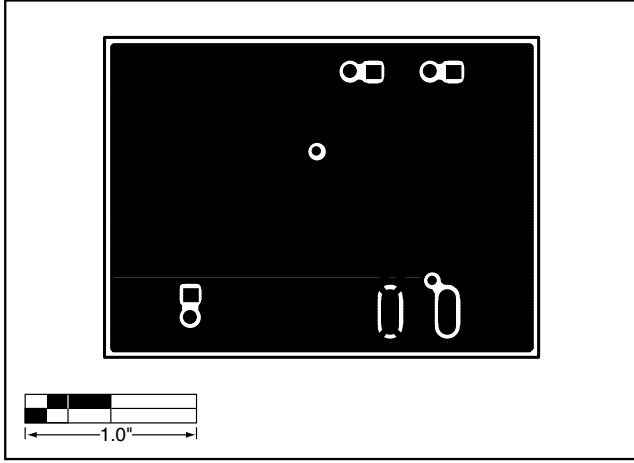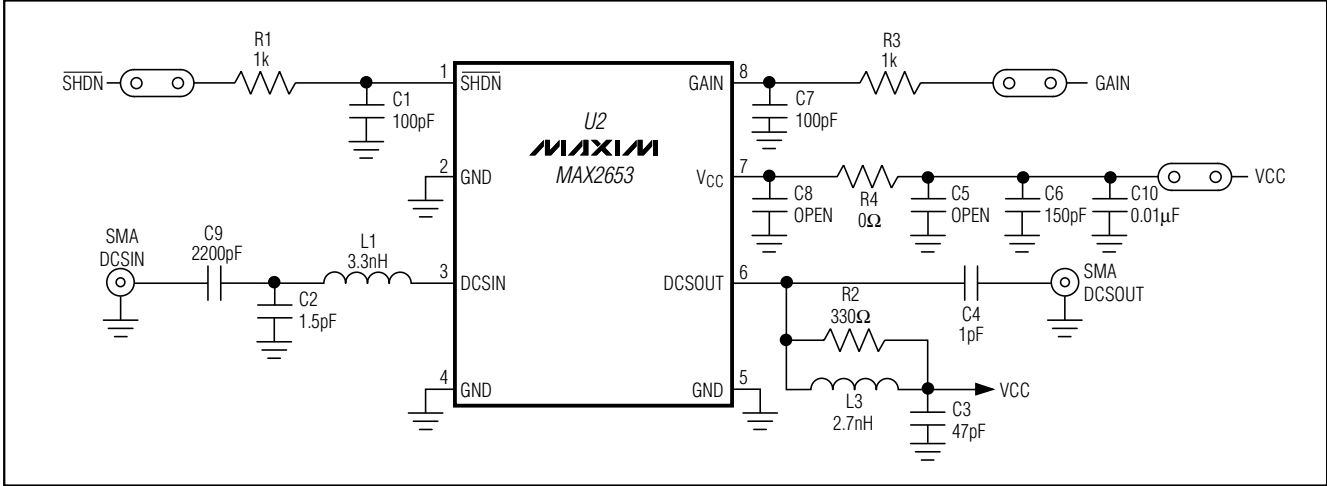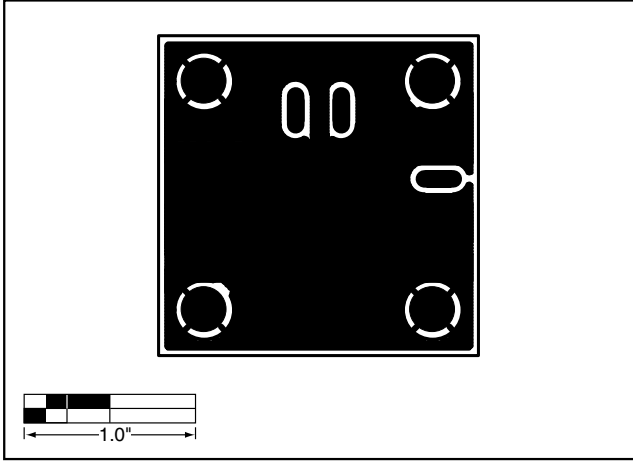

Figure 5. MAX2651 EV Kit PC Board Layout—Ground Plane 2

Figure 6. MAX2651 EV Kit PC Board Layout—Solder Side

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Figure 7. MAX2652 EV Kit Schematic
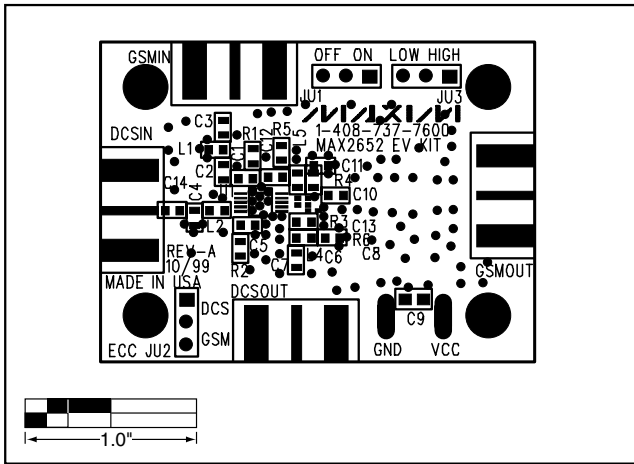
Figure 8. MAX2652 EV Kit Component Placement Guide
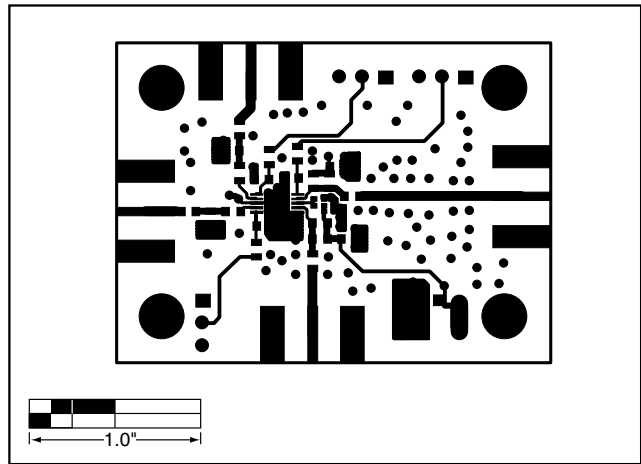
Figure 9. MAX2652 EV Kit PC Board Layout—Component Side

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Figure 10. MAX2652 EV Kit PC Board Layout—Ground Plane 1
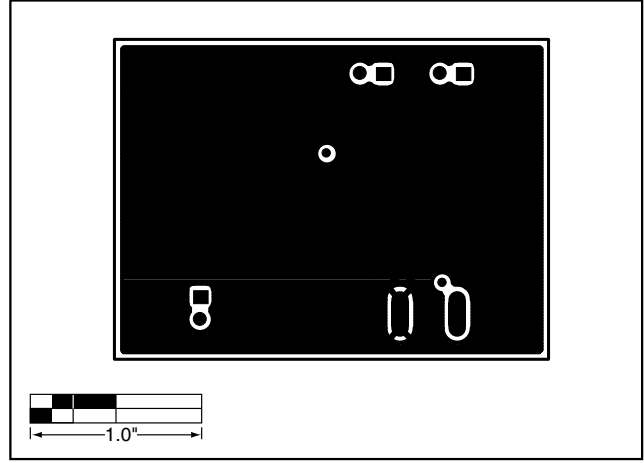
Figure 11. MAX2652 EV Kit PC Board Layout—Ground Plane 2
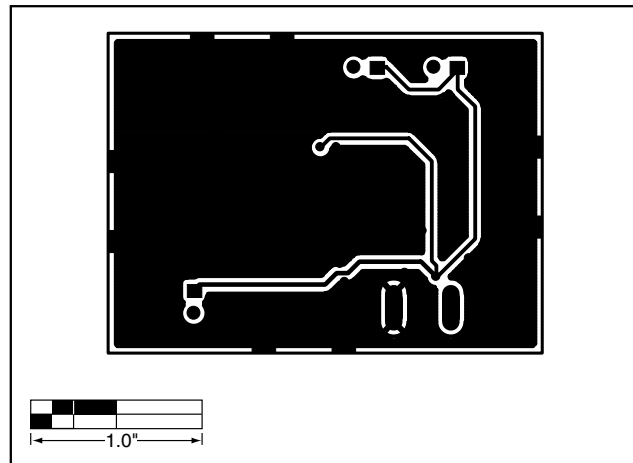
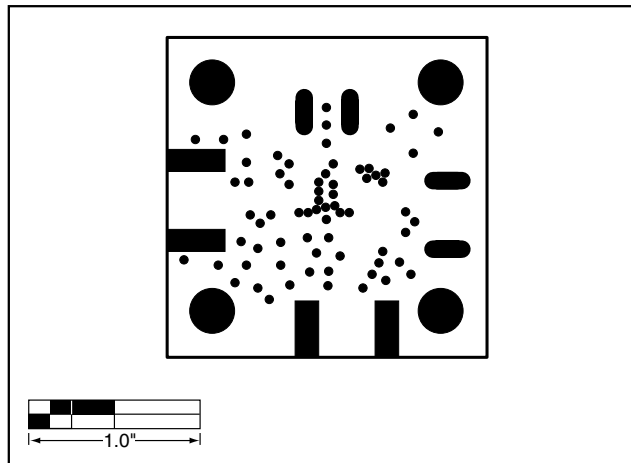Figure 12. MAX2652 EV Kit PC Board Layout—Solder Side

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Figure 13. MAX2653 EV Kit Schematic
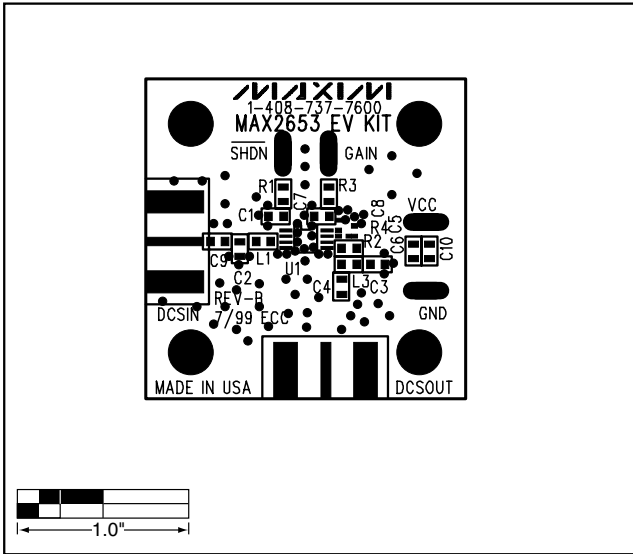
Figure 14. MAX2653 EV Kit Component Placement Guide
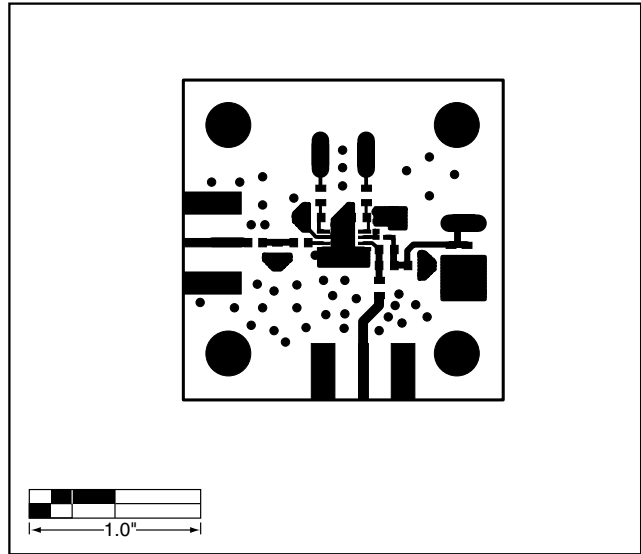
Figure 15 MAX2653 EV Kit PC Board Layout—Component Side

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Figure 16. MAX2653 EV Kit PC Board Layout—Ground Plane 1
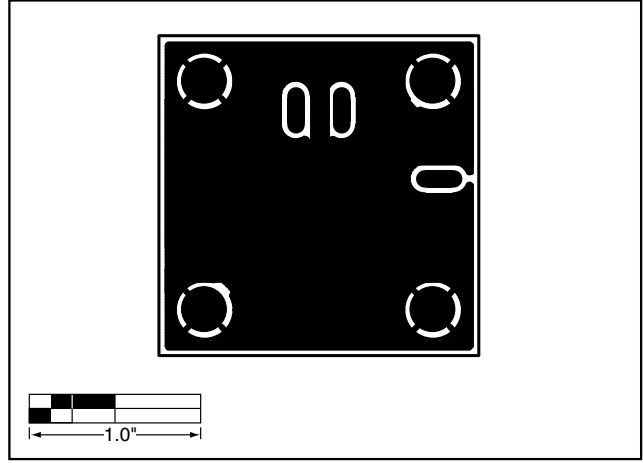
Figure 17. MAX2653EV Kit PC Board Layout—Ground Plane 2

Figure 18. MAX2653 EV Kit PC Board Layout—Solder Side

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Evaluate: MAX2651/MAX2652/MAX2653

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