19-1807; Rev 1; 4/03

MAXIM

MAX2338 Evaluation Kit

Evaluates: MAX2338

General Description

The MAX2338 evaluation kit (EV kit) simplifies evaluation of the MAX2338 dual-band, triple-mode LNA and mixers. This kit allows evaluation of the device's low noise amplifiers (LNA), downconverters and buffers. Figure 1 shows the MAX2338 EV kit schematic. The EV kit provides 50Ω SMA connectors for all RF and IF input and output signals.

Component Suppliers

SUPPLIER	PHONE	FAX	WEB
AVX	803-946-0690	803-626-3123	avx-corp.com
EFJohnson	402-474-4800	402-474-4858	efjohnson.com
Kamaya	219-489-1533	219-489-2261	kamaya.com
Murata	949-852-2001	949-852-2002	murata.com
Toko	708-297-0070	708-699-1194	toko.com

Note: *When contacting these suppliers, please specify that you are using the MAX2338.*

Features

- **Easy Evaluation of the MAX2338**
- **+2.7V to +3.3V Single Supply Operation**
- **All Critical Matching Components Included**
- **Cellular-Band RF Ports Matched to 880MHz**
- **PCS-Band RF Ports Matched to 1960MHz**
- **SMA Connectors for all RF and IF Signal Ports**
- **Easy Configuration of Operating Modes**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX2338EVKIT	-40°C to +85°C	28 QFN

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C4, **C9**	3	0.1µF ±10% ceramic capacitors (0402) Murata GRM39X7R103K016A
C2, C3, C24, C27	6	100pF ±5% ceramic capacitors (0402) Murata GRM36COG101J050A
C5, C14, C16	3	6800pF ±10% ceramic capacitors (0402) Murata GRM36X7R682025A
C6, C13, C15, C17, C21	3	**Not Installed**
C7	1	2.7pF ±0.1pF ceramic capacitor (0402) Murata GRM36COG2R7B050A
C8	1	0.75pF ±0.1pF ceramic capacitor (0402) Murata GRM36COGR75B050A
C10	1	7pF ±0.1pF ceramic capacitor (0402) Murata GRM36COG070B050A
C11, **C18**, **C19**, C20, **C26**, C28, **C33**	7	1000pF ±10% ceramic capacitors (0402) Murata GRM36X7R102050A
C12	1	0Ω resistor (0402)
C22	1	22pF ±5% ceramic capacitor (0402) Murata GRM36COG220J050A
C23, C25	2	4.0pF ±0.1pF ceramic capacitors (0402) Murata GRM36COG040B050A
C29	1	22µF, 10V min tantalum capacitor AVX TAJC226K010
C30	1	15pF ±5% ceramic capacitor (0603) Murata GRM39COG150J050A
C31	1	4.7pF ±0.1pF ceramic capacitors (0402) Murata GRM36COG4R7B050
R1, **R4**, **R5**, **R6**, **R8**	5	1kΩ ±5% resistors (0402)
R2, R3	2	24.3Ω ±1% resistors (0402)
R7	1	3.3kΩ ±1% resistor (0402)
R9, R10	2	0Ω resistors (0402)
R11	1	8.25kΩ ±5% resistor (0402)
R12, R13	2	Not installed
R14	1	20Ω ±1% resistor (0402)
L1	1	8.2nH inductor Toko LL1608-FS8N2J

Note: *Components in bold text are on the backside of the PC board.*

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

MAX2338 Evaluation Kit

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
L2, **L12**	2	2.7nH inductors Toko LL1608-FS2N7S
L3	1	0Ω resistor (0603)
L4	1	2.2nH inductor Toko LL1608-FS2N2S
L5	1	3.9nH inductor Toko LL1608-FS2N9J
L6	1	15nH inductor Toko LL1608-FS15J
L7, L8, **L11**	3	120nH inductors Toko LL1608-FS15J
L10	1	Not installed
T1	1	Balun transformer Toko B5F 458Db-1011
U1	1	MAX2338EGI 44-pin QFN **NOTE: U1 HAS AN EXPOSED PADDLE WHICH IS SOLDERED TO THE CIRCUIT BOARD GROUND PLANE.**

DESIGNATION	QTY	DESCRIPTION
JU2	1	20Ω ±1% resistor (0603)
JU6, JU8, JU10	3	1 × 2 headers (0.1 inch centers)
JU1, JU3, JU4, JU5, JU7	5	1 × 3 headers (0.1 inch centers)
JU1, JU3, JU4, JU5, JU6, JU7, JU8, JU10	8	Shunts
PMIXIN, CMIXIN, CLOOUT	3	SMA connectors (PC mount) Johnson 142-0701-201
CLNAOUT, IFOUT, PLNAOUT, PLNAIN, CLNAIN, LOIN, PLOOUT, FMOUT	8	SMA connectors (edge mount) Johnson 142-0701-801
VCC, GND	2	Test points
None	1	MAX2338 data sheet
None	1	MAX2338 EV kit data sheet
None	1	MAX2338 Rev A EV kit circuit board

Recommended Test Equipment

Power Supply	Capable of providing at least 100mA at +2.7V to +3.3V.
RF Signal Generators (2)	HP 8648C or equivalent, capable of delivering -50dBm to -10dBm of output power from 800MHz to 2500MHz.
Network Analyzer	HP8753 or equivalent, covering the MAX2338 operating frequency range.
Spectrum Analyzer	HP8561E or equivalent, covering MAX2338 operating frequency range.
Cables (50Ω)	Three 50Ω cables with SMA connectors.
Ammeter (optional)	For measuring supply current.
Noise Figure Meter (optional)	HP8970B or equivalent, for measuring the noise figure of the LNA and downconverters.

Quick Start

The MAX2338 EV kit is fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section for proper device evaluation.

Connections and Setup

This section provides a step-by-step guide to setting up the MAX2338 EV kit and testing the LNA and downconverters. **Do not turn on the DC power or RF signal generators until all connections are made.**

Low-Noise Amplifier, High-Gain High-Linearity Mode

1) Set the GAIN jumper (JU4) on the EV kit to V_{CC} (HIGH). This enables the LNA to operate in high gain mode.
2) Set the $\overline{BAND}$ jumper (JU1) on the EV kit to V_{CC} (HIGH) to test cellular band [JU1 to GND for PCS].
3) Set the LIN jumper (JU3) on the EV kit to V_{CC} (HIGH) to test the amplifiers in high linearity mode.
4) Connect a DC supply preset to +3V (through an ammeter, if desired) to the EV kit's V_{CC} and GND terminals. Do not turn on the supply.
5) Perform a full two-port calibration on a network analyzer at a power level of -30dBm over frequency range of 800MHz to 900MHz for cellular band [1900MHz to 2000MHz for PCS band].
6) Connect port 1 and port 2 of the network analyzer to CLNAIN [PLNAIN for PCS] and CLNAOUT [PLNAOUT for PCS] respectively to measure the cellular [PCS] band gain.
7) Turn on the DC supply. If an ammeter is connected, the supply current should read approximately 28mA for cellular band [25mA for PCS].
8) The network analyzer display should indicate a typical gain of 15.7dB for cellular band and 15.3dB for PCS band after accounting for board losses. The input and output board losses are 0.12dB for the cellular band. The input and output board losses for PCS band are 0.17dB and 0.3dB, respectively. These losses are to be added to the measurements to obtain the performance of the LNAs.

Downconverter

1) Turn off the DC supply.
2) Remove the network analyzer from the LNA input and output connections. The DC supply connections needed for testing the downconverter mixer are the same as in the LNA section.
3) Set the LO/2 jumper (JU5) to V_{CC} (ON) to enable the LO divider circuit for cellular band. When testing PCS band, this jumper setting has no effect.
4) Set the $\overline{BAND}$ jumper (JU1) on the EV kit to V_{CC} (HIGH) to test cellular band [JU1 to GND for PCS].
5) Set the LIN jumper (JU3) on the EV kit to V_{CC} (HIGH) to test cellular and PCS downconverters in high-linearity mode.
6) Connect an RF signal generator (with output disabled) to the LOIN connector. Set the frequency to 2126MHz for cellular band [2143MHz for PCS] and the output power to -3dBm.
7) Connect another RF signal generator (with output disabled) to the CMIXIN SMA connector. Set the frequency to 880MHz for cellular band [1960MHz for PCS band] and the output power to -25dBm.
8) Connect the spectrum analyzer to the IFOUT SMA connector. Set the spectrum analyzer center frequency to 183MHz.
9) Turn on the DC supply. Enable the LO signal generator and RF input signal generator outputs.
10) Measure the peak of the 183MHz IF signal on the spectrum analyzer. Compensate the IF signal conversion gain for the balun and board losses. Balun loss is 0.3dB and the input and output board losses are 0.1dB each.
11) The conversion gain for cellular and PCS band are typically +13.3dB and +14.5dB respectively, after corrections from step 10 are applied.

Checking Noise Figure

Noise figure measurements are sensitive to board and lab setup losses and parasitics. There are many techniques and precautions for measuring a low-noise figure. 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 operating manual, as well as to Hewlett Packard application note #57-2, *Noise Figure Measurement Accuracy*.

PC Board Layout Considerations

The MAX2338 EV kit can serve as a board layout guide. Keep PC board trace lengths as short as possible to minimize parasitics. Keep decoupling capacitors close to the device, with a low inductance connection to the ground plane.

MAX2338 Evaluation Kit

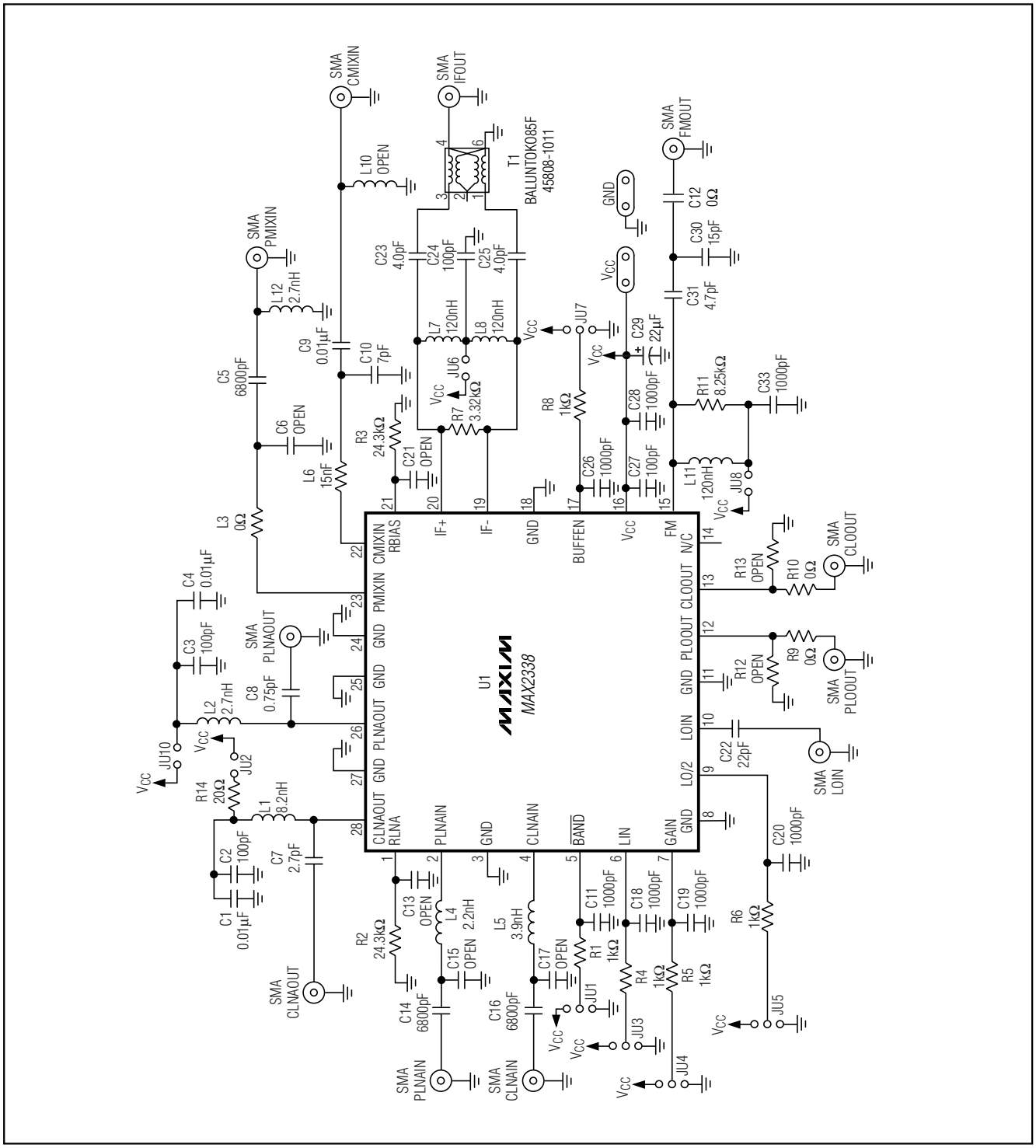


Figure 1. MAX2338 EV Kit Schematic

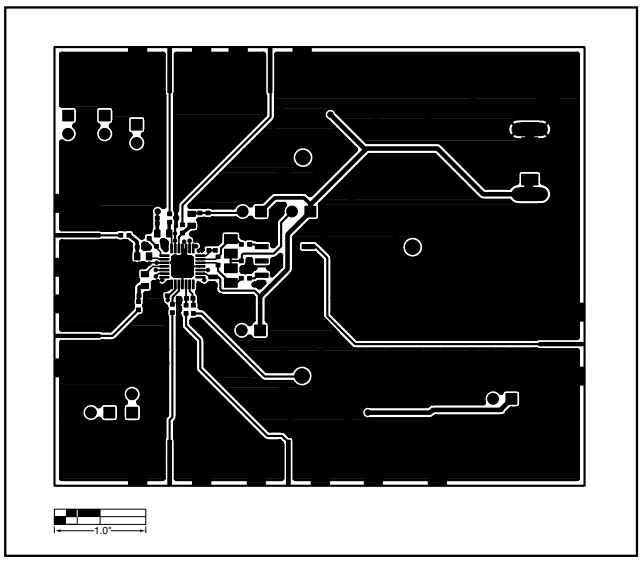


Figure 2. MAX2338 EV Kit PC Board Layout—Front Side

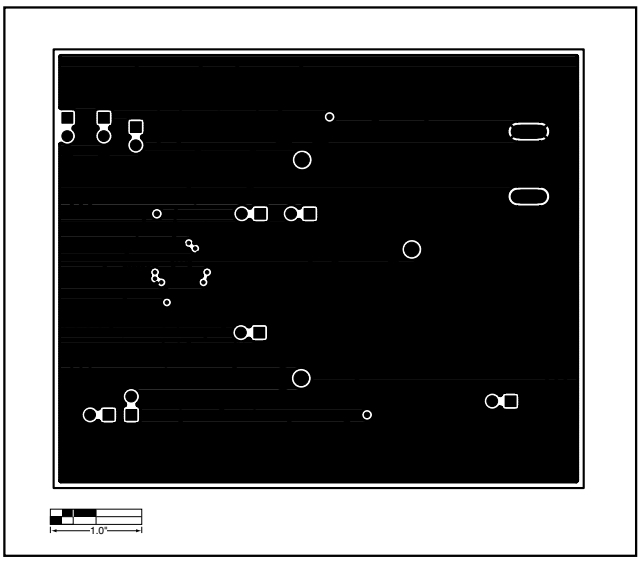


Figure 3. MAX2338 EV Kit PC Board Layout—Ground Layer 2

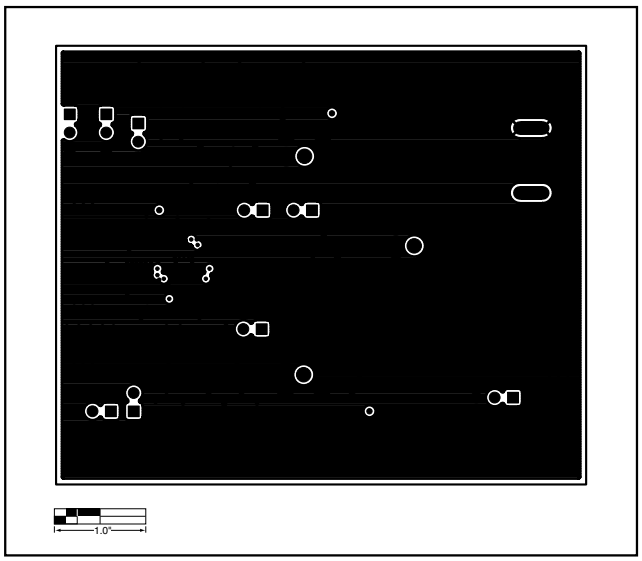


Figure 4. MAX2338 EV Kit PC Board Layout—Ground Layer 3

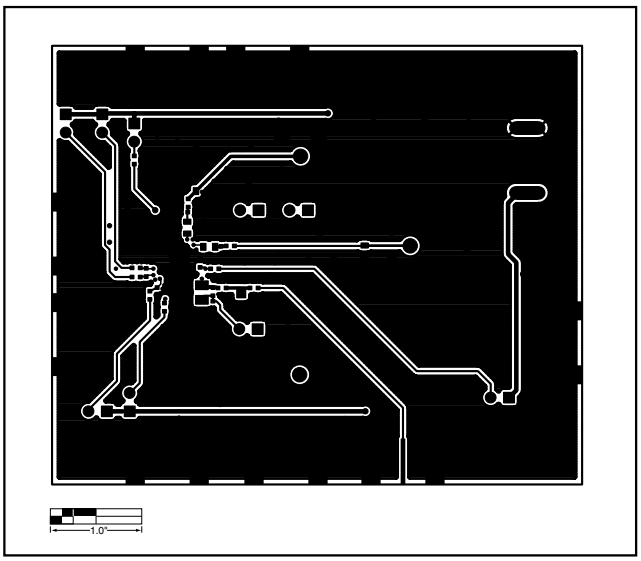


Figure 5. MAX2338 EV Kit PC Board Layout—Back Side

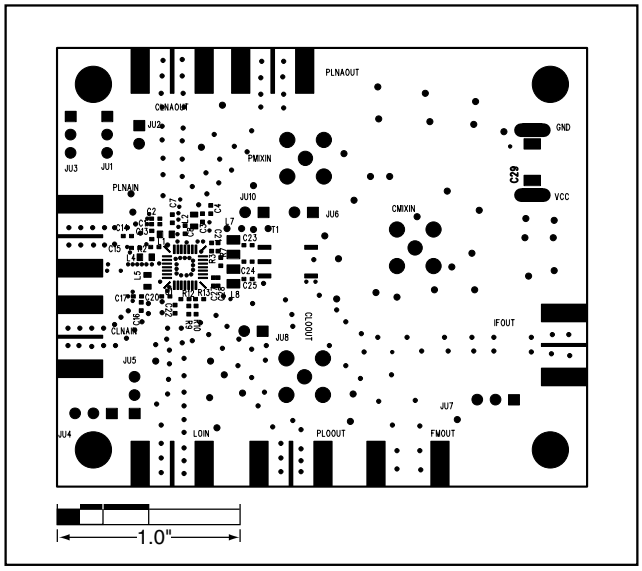


Figure 6. MAX2338 EV Kit Component Placement Guide—Front Side

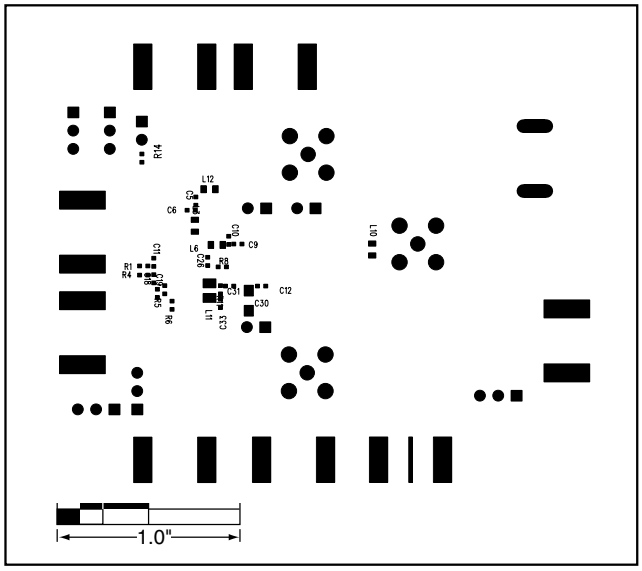


Figure 7. MAX2338 EV Kit Component Placement Guide—Back Side

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