19-1834; Rev 1; 5/01

MAXIM

MAX2387/MAX2388/MAX2389 Evaluation Kits

Evaluate: MAX2387/MAX2388/MAX2389

General Description

The MAX2387/MAX2388/MAX2389 evaluation kits (EV kits) simplify evaluation of the MAX2387/MAX2388/MAX2389. The EV kits allow the evaluation of the low-noise amplifier (LNA) as well as the downconverter mixer without the use of any additional support circuitry. The board comes in a single-ended IF load and single-ended VCO configuration. The signal inputs and outputs use SMA connectors to simplify the connection of RF test equipment.

The MAX2387/MAX2388/MAX2389 are assembled with an associated IC and incorporate input- and output-matching components optimized for RF frequencies from 2.11GHz to 2.17GHz and an IF frequency of 190MHz.

Features

- **+2.7V to +3.3V Single-Supply Operation**
- **50Ω SMA Inputs and Outputs on RF, IF, and LO Ports for Easy Testing**
- **All Matching Components Included**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX2387EVKIT	-40°C to +85°C	12 QFN
MAX2388EVKIT	-40°C to +85°C	12 QFN
MAX2389EVKIT	-40°C to +85°C	12 QFN

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C18, C19, C22	4	6800pF ±10%, 10V ceramic capacitors (0402) Murata GRM36X7R682K025
C2, C27	2	0.8pF ±0.1pF, 50V ceramic capacitors (0402) Murata GRM36COG0R8B050
C3, C5	2	82pF ±5%, 10V ceramic capacitors (0402) Murata GRM36COG820J050
C4	1	0.068µF ±10%, 10V ceramic capacitor (0402) Murata GRM36X5R683K010
C6, C7, C8, C17	0	Not installed
C11	1	0.5pF ±0.1pF, 50V ceramic capacitor (0402) Murata GRM36COG0R5B050
C12, C13, C24, C25, C26	5	0.01µF ±10%, 16V ceramic capacitors (0402) Murata GRM36X7R103K016 or Taiyo Yuden EMK105B103KW
C14, C15	2	39pF ±5%, 50V ceramic capacitors (0402) Murata GRM36COG390J050
C16, C23	2	22pF ±5%, 050 ceramic capacitors (0402) Murata GRM36COG220J050 or Taiyo Yuden UMK105CH220JW
C20	1	0.01µF ±10%, 16V ceramic capacitor (0603) Murata GRM39X7R103K016
C21	1	10µF ±20%, 10V tantalum capacitor (B case) AVX TAJB106M010R
L1, L4	2	2.2nH ±10% inductors (0402) Coilcraft 0402CS-2N2XKBG
L2, L3	2	27nH ±5% inductors (0603) Coilcraft 0603CS-27NXJBC
C9, L5, L6	3	0Ω resistors (0402)
L7	1	5.6nH ±5% inductor (0402) Coilcraft 0402CS-5N6XJBG
R1	1	20Ω ±5% resistor (0402)
R2, R3	2	10kΩ ±5% resistors (0402)
R4	1	10kΩ ±1% resistor (0402)
R5	1	24kΩ ±1% resistor (0402)
T1	1	Balun transformer (B4F type) Toko 617DB-1018
T2	1	Balun transformer Murata LDB15C201A2400
LNA_IN, LNA_OUT, LO, MIX_IN, IF	5	SMA connectors (PC-edge mount) EFJohnson 142-0701-801 or Digi-Key J502-ND
JU1, JU2	2	3-pin headers Digi-Key S1012-36-ND or equivalent
None	2	Shunts for JU1–JU12 Digi-Key S9000-ND or equivalent
VCC, GND	2	Test points Mouser 151-203 or equivalent

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	847-946-0690	803-626-3123
Coilcraft	847-639-6400	847-639-1469
Murata	770-436-1300	770-436-3030
Toko	708-297-0070	708-699-1194

Note: *Please indicate that you are using the MAX2387/MAX2388/MAX2389 when contacting these component suppliers.*

Quick Start

The MAX2387/MAX2388/MAX2389 EV kits are fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section for proper device evaluation.

Test Equipment Required

Table 1 lists the test equipment required to verify MAX2387/MAX2388/MAX2389 operation. It is intended as a guide only, and some substitutions are possible.

Connections and Setup

This section provides a step-by-step guide to operating the EV kits and testing the devices' functions. **Do not turn on DC power or RF signal generators until all connections are made.**

Testing the LNA

1) Set the $\overline{SHDN}$ jumper (JU2) on the EV kit to VCC. This enables the device.
2) Set the GAIN jumper (JU1) on the EV kit to VCC (high-gain mode) or to GND (low-gain mode).
3) Connect a DC supply set to +2.7V (through an ammeter if desired) to the VCC and GND terminals on the EV kit. If available, set the current limit to 20mA. Do not turn on the supply.
4) Connect one RF signal generator to the LNA_IN SMA connector. Do not turn on the generator's output. Set the generator to an output frequency of 2.14GHz and set the generator power level to -30dBm.
5) Connect the spectrum analyzer to the LNA_OUT SMA connector. Set the spectrum analyzer to a center frequency of 2.14GHz and a total span of 10MHz.
6) Turn on the DC supply; the supply current should read approximately 6.5mA (low-gain mode) or 9.5mA (high-gain mode), depending on the part version.

Table 1. Test Equipment

EQUIPMENT	DESCRIPTION
RF Signal Generators	Capable of delivering at least 0dBm of output power up to 2.5GHz (HP 8648C or equivalent)
RF Spectrum Analyzer	Capable of covering the operating frequency range of the devices as well as a few harmonics (HP 8561E or equivalent)
Power Supply	Capable of up to 40mA at +2.7V to +3.3V
Ammeter	To measure supply current (optional)
Network Analyzer	To measure small-signal return loss and gain (optional, HP 8753D or equivalent)

7) Activate the RF generator's output. A 2.14GHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -15dBm in high-gain mode. In low-gain mode the magnitude should read approximately -46.5dBm for the MAX2387 and -33dBm for the MAX2388/MAX2389. Be sure to account for cable losses (between 0.5dB and 2dB) and circuit board losses (approximately 0.5dB) when computing gain and noise figure.
8) (Optional) Another method for determining gain is by using 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.

Testing the Mixer

1) Connect a DC supply set to +2.7V (through an ammeter if desired) to the VCC and GND terminals on the EV kit. If available, set the current limit to 20mA. Do not turn on the supply.
2) Connect one RF signal generator to the LO SMA connector. Do not turn on the generator output. Set the frequency to 2.33GHz, and output power to -10dBm (MAX2387/MAX2388) or -4dBm (MAX2389). This is the LO signal.
3) Connect another RF signal generator to the MIX_IN SMA connector. Do not turn on the generator output. Set the signal generator to 2.14GHz and output power level to -30dBm.
4) Connect the spectrum analyzer to the IF SMA connector. Set the spectrum analyzer to a center frequency of 190MHz and a total span of 10MHz.

5) Turn on the DC supply and the signal generator outputs.

6) A 190MHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -20dBm, indicating a conversion gain of 10dB. Be sure to account for cable losses (between 0.5dB and 2dB) and circuit board losses including the balun (approximately 1.0dB) when computing gain and noise figure.

Layout

A good PC board layout is an essential part of an RF circuit design. The EV kit's PC board can serve as a guide for laying out a board using the MAX2387/MAX2388/MAX2389.

Keep RF signal lines as short as possible to minimize losses and radiation. Always use controlled impedance lines on all high-frequency inputs and outputs and use low-inductance connections to ground on all GND pins. At the mixer outputs, keep the differential lines together and of the same length to ensure signal balance.

MAX2387/MAX2388/MAX2389 Evaluation Kits

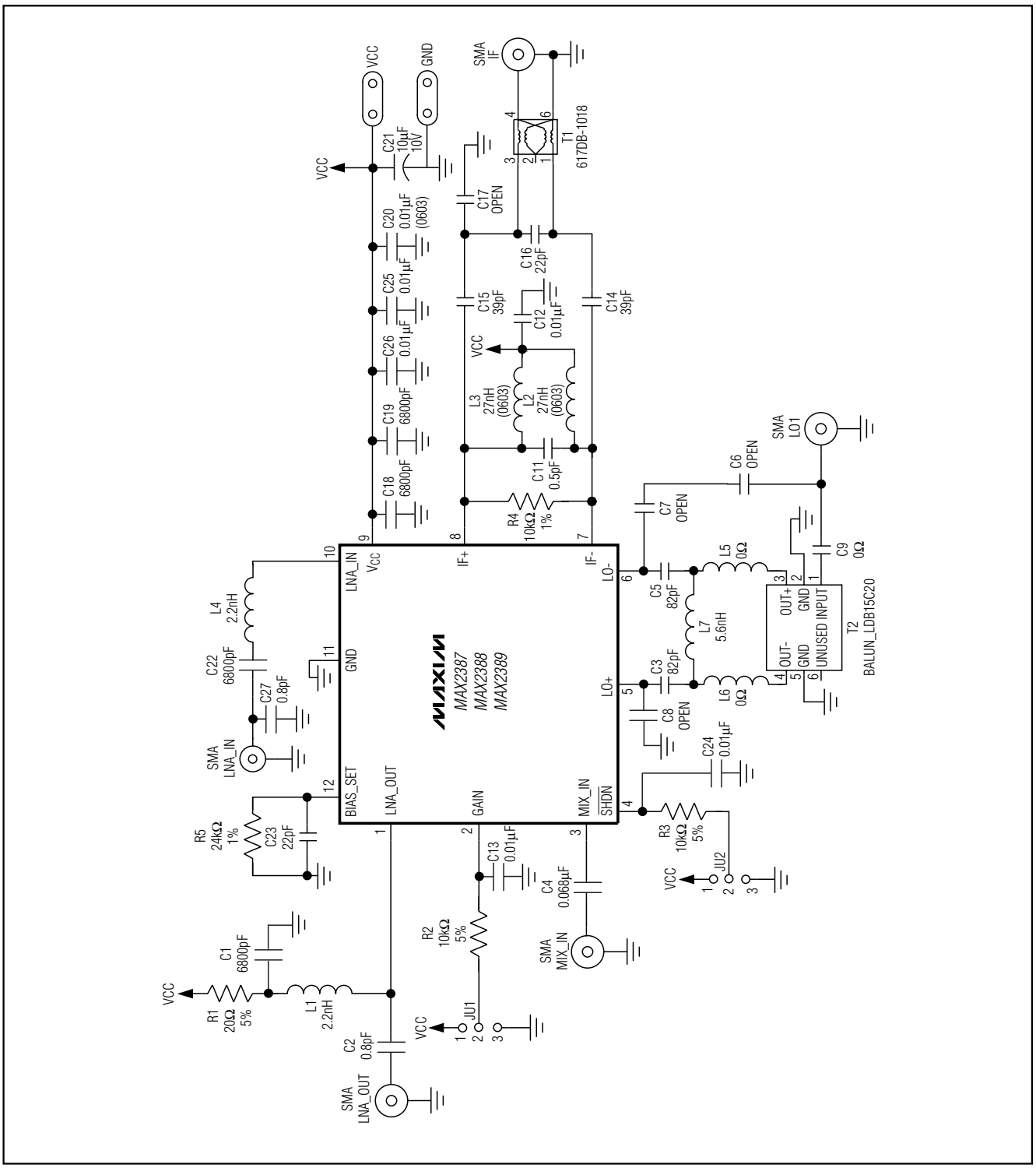

Figure 1. MAX2387/MAX2388/MAX2389 EV Kit Schematic

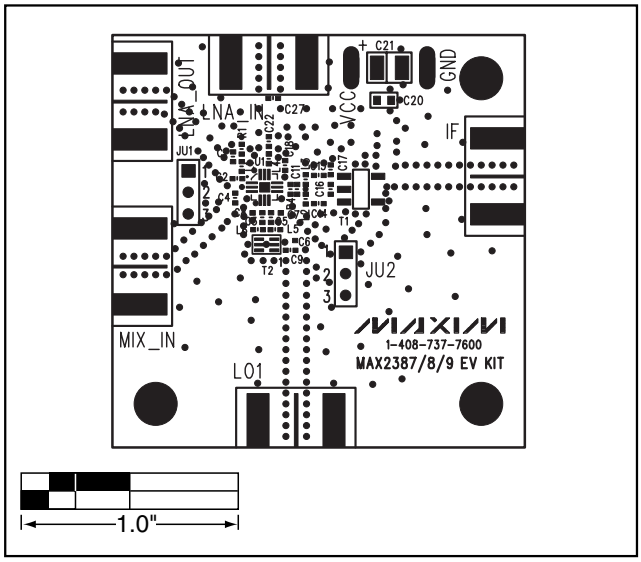

Figure 2. MAX2387/MAX2388/MAX2389 EV Kit Component Placement Guide—Component Side

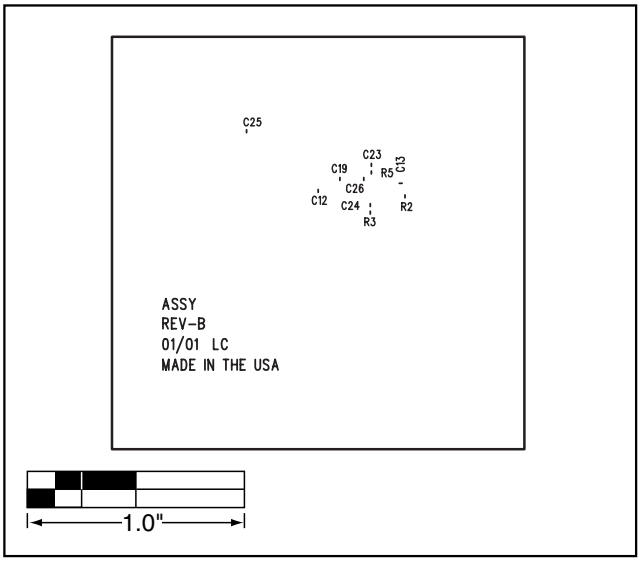

Figure 3. MAX2387/MAX2388/MAX2389 EV Kit Component Placement Guide—Solder Side

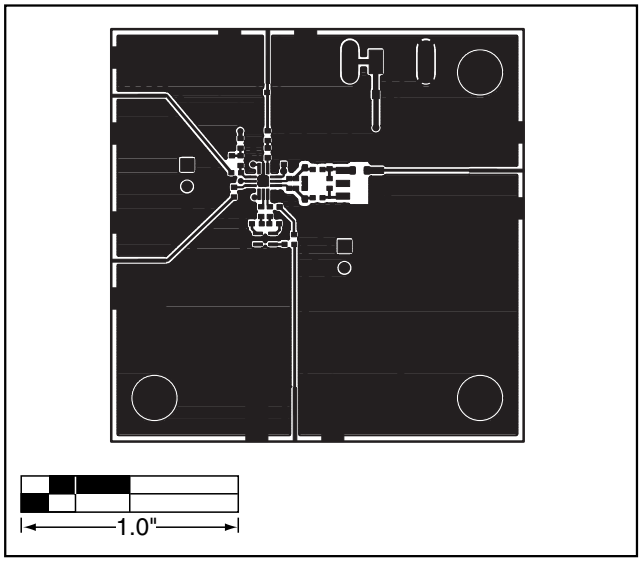

Figure 4. MAX2387/MAX2388/MAX2389 EV Kit PC Board Layout—Component Side

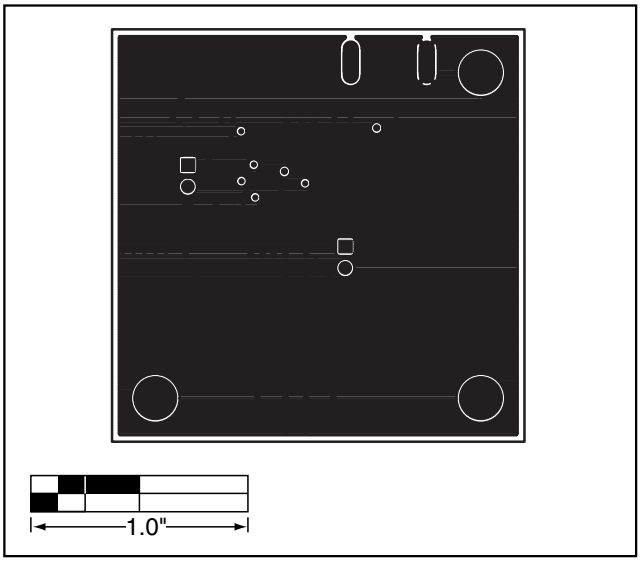

Figure 5. MAX2387/MAX2388/MAX2389 EV Kit PC Board Layout—Ground Layer 2

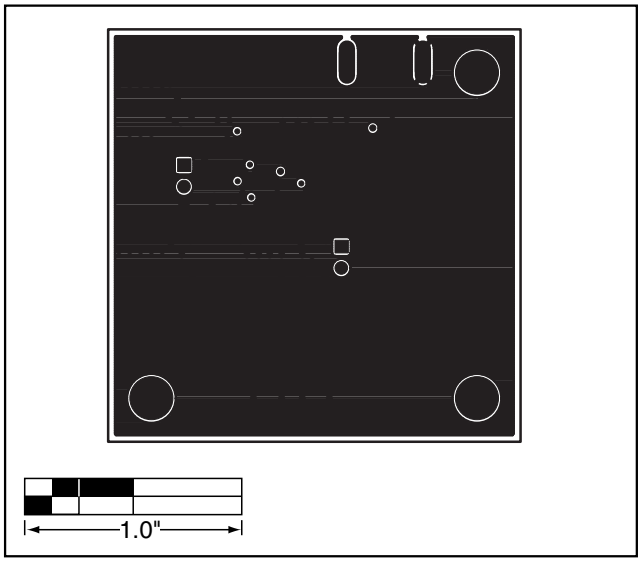

Figure 6. MAX2387/MAX2388/MAX2389 EV Kit PC Board Layout—Ground Layer 3

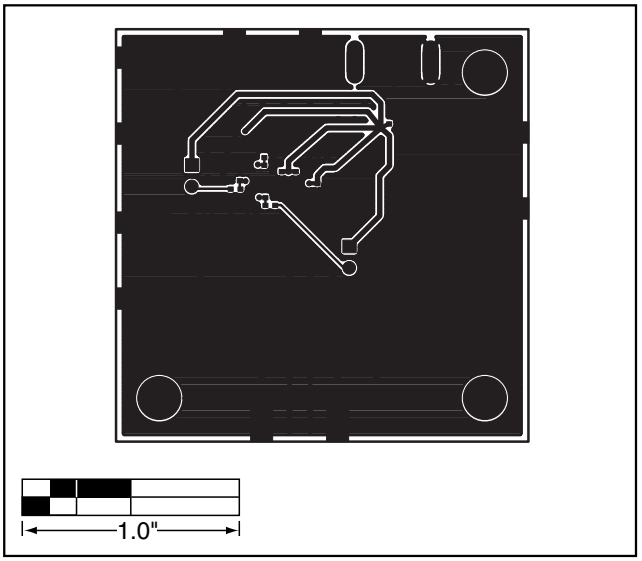

Figure 7. MAX2387/MAX2388/MAX2389 EV Kit PC Board Layout—Solder Side