



# MAX2406 Evaluation Kit

Evaluates: MAX2406

## General Description

The MAX2406 evaluation kit (EV kit) simplifies testing of the MAX2406. This EV kit allows the evaluation of the low-noise amplifier (LNA) as well as the receive down-converter mixer.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	47pF ceramic capacitors
C3, C7, C8, C13	4	220pF ceramic capacitors
C4, C5, C11, C12	4	1000pF ceramic capacitors
C6, C15	2	1pF ceramic capacitors
C9	1	10μF tantalum capacitor AVX TAJC106K016
C10, C14	2	0.1μF ceramic capacitors
IF, LNAIN, LO, LNAOUT, RXMXIN	5	SMA connectors (PC edge mount)
JU1	1	3-pin header
L1, L2, L6, L7	4	27nH inductors Coilcraft 1008CS-270XMBC
L3	1	4:1 balun Toko 617DB-1010 type B4F
L4	0	Not installed
L5	1	4.7nH inductor Toko LL2012-F4N7S
R1	1	1kΩ resistor
R2, R3	2	0Ω resistors
R4	0	Not installed
U1	1	MAX2406EEP (20 QSOP)

## Component Suppliers

SUPPLIER	PHONE/ FAX	INTERNET
Coilcraft	(847) 639-6400/ (847) 639-1469	<a href="http://www.coilcraft.com">http://www.coilcraft.com</a>
AVX	(803) 946-0690/ (803) 626-3123	<a href="http://www.avxcorp.com">http://www.avxcorp.com</a>

## Features

- ◆ **+2.7V to +5.5V Single-Supply Operation**
- ◆ **50Ω SMA Inputs and Outputs on RF, IF, and LO Ports**
- ◆ **Allows Testing of Shutdown Mode**
- ◆ **Fully Assembled and Tested**

## Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX2406EVKIT	-40°C to +85°C	20 QSOP

## Quick Start

The MAX2406 is fully assembled and factory tested. Follow these instructions for initial evaluation of the MAX2406.

### Test Equipment Required

This section lists the test equipment recommended for verifying operation of the MAX2406. It is intended as a guide only; some substitutions may be possible.

- Two RF signal generators capable of delivering at least 0dBm of output power at frequencies up to 2GHz (HP8648C or equivalent). One generator is required for the local oscillator (LO) source; the other is required for the mixer input. Only one generator is required to operate the LNA.
- An RF spectrum analyzer that covers the MAX2406's operating frequency range (HP8561E, for example).
- A power supply that can provide up to 100mA at 2.7V to 5.5V.
- An ammeter for measuring the supply current (optional).
- Several 50Ω SMA cables.

### Connections and Setup

This section provides a step-by-step guide to getting the EV kit operational and testing both the LNA and the receive mixer. **Do not turn on the DC power or RF signal generators until all connections have been made.**



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## **Low-Noise Amplifier**

- 1) Set the RXEN jumper (JU1) on the EV kit to the "logic 1" position. This enables the MAX2406.
- 2) Connect a DC supply set to 3V (through an ammeter, if desired) to the VCC and GND terminals on the EV kit. Do not turn on the supply.
- 3) Connect one RF signal generator to the LNAIN SMA connector. Do not turn on the generator's output. Set the generator for an output frequency of 1.9GHz and a power level of -40dBm.
- 4) Connect a spectrum analyzer to the LNAOUT SMA connector on the EV kit. Set the spectrum analyzer to a center frequency of 1.9GHz, a total span of 200MHz, and a reference level of 0dBm.
- 5) Turn on the DC supply; the supply current should read approximately 20mA (if using an ammeter).
- 6) Activate the RF generator's output. A 1.9GHz signal shown on the spectrum analyzer's display should indicate a typical gain of 16dB after accounting for cable losses.
- 7) If desired, the shutdown feature can be tested by moving the RXEN jumper (JU1) into the "logic 0" position. This disables the part and reduces the supply current to typically 0.1 $\mu$ A.

## **Receive Downconverter Mixer**

- 1) Remove the RF signal generator and spectrum analyzer from the LNAIN and LNAOUT connections, if necessary. The DC supply connections needed for testing the downconverter mixer are the same as in the LNA section.
- 2) Connect one RF signal generator (with the output disabled) to the LO SMA connector. Set the frequency to 1.5GHz and the output power to -10dBm. This is the LO signal.
- 3) Connect the other RF signal generator (with the output disabled) to the RXMXIN SMA connector. Set the frequency to 1.9GHz and the amplitude to -30dBm.
- 4) Connect the spectrum analyzer to the IF SMA connector. Set the spectrum analyzer to a 400MHz center frequency, a 200MHz total span, and a 0dBm reference level.
- 5) Turn on the LO signal generator and the RF signal generator.
- 6) The downconverted output signal at 400MHz is visible on the spectrum analyzer, indicating a mixer conversion gain of 8.4dB after accounting for cable and balun losses. The balun loss is typically 1dB at 400MHz.

## **Detailed Description**

This section describes the MAX2406 EV kit circuitry. For more detailed information about the operation of the device itself, please consult the MAX2406 data sheet.

### **Low-Noise Amplifier**

The LNA circuitry consists of two DC-blocking capacitors: one at the input (C13) and one at the output (C8). A shunt capacitor (C15) provides a simple matching network to improve the input return loss.

### **Local Oscillator**

The MAX2406 EV kit's LO input requires only a DC blocking capacitor (C3). No other circuitry is needed. For more information on the LO port, including the optional use of a differential LO source, consult the MAX2406 data sheet.

### **Mixer Input**

The receiver mixer's input (RXMXIN) requires a simple matching network. Capacitor C6 and inductor L5 are used to match the input pin to 50 $\Omega$ , while C7 provides DC blocking.

### **IF Output**

The MAX2406 has a differential IF output port (IF and  $\overline{\text{IF}}$ ) that can be used either in a differential or single-ended configuration. The EV kit uses a differential configuration. The balun (L3) converts the MAX2406's differential output signal into a single-ended signal compatible with 50 $\Omega$  test equipment. The balun is not required in a typical application. Inductors L1, L2, L6, and L7 provide DC bias and an impedance-matching network. Please note that the matching network is frequency selective and must be changed for operation at other IF frequencies. Consult the MAX2406 data sheet for a plot of IF output impedance versus frequency. Capacitors C4 and C5 provide DC blocking. The balun (L3) provides the differential to single-ended conversion with about 1dB of loss at 400MHz. The IF output signal is then connected to the IF SMA connector. Resistors R2 and R3 (0 $\Omega$ ) and inductor L4 (not installed) are provided as pads on the EV kit's PC board layout for experimentation, if desired.

## **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 MAX2406.

Each VCC node on the PC board has its own decoupling capacitor. This minimizes supply coupling from one section of the MAX2406 to another. A star topology for the supply layout, in which each VCC node on the MAX2406 circuit has a separate connection to a central VCC node, can further minimize coupling between the LNA and mixer sections of the MAX2406.

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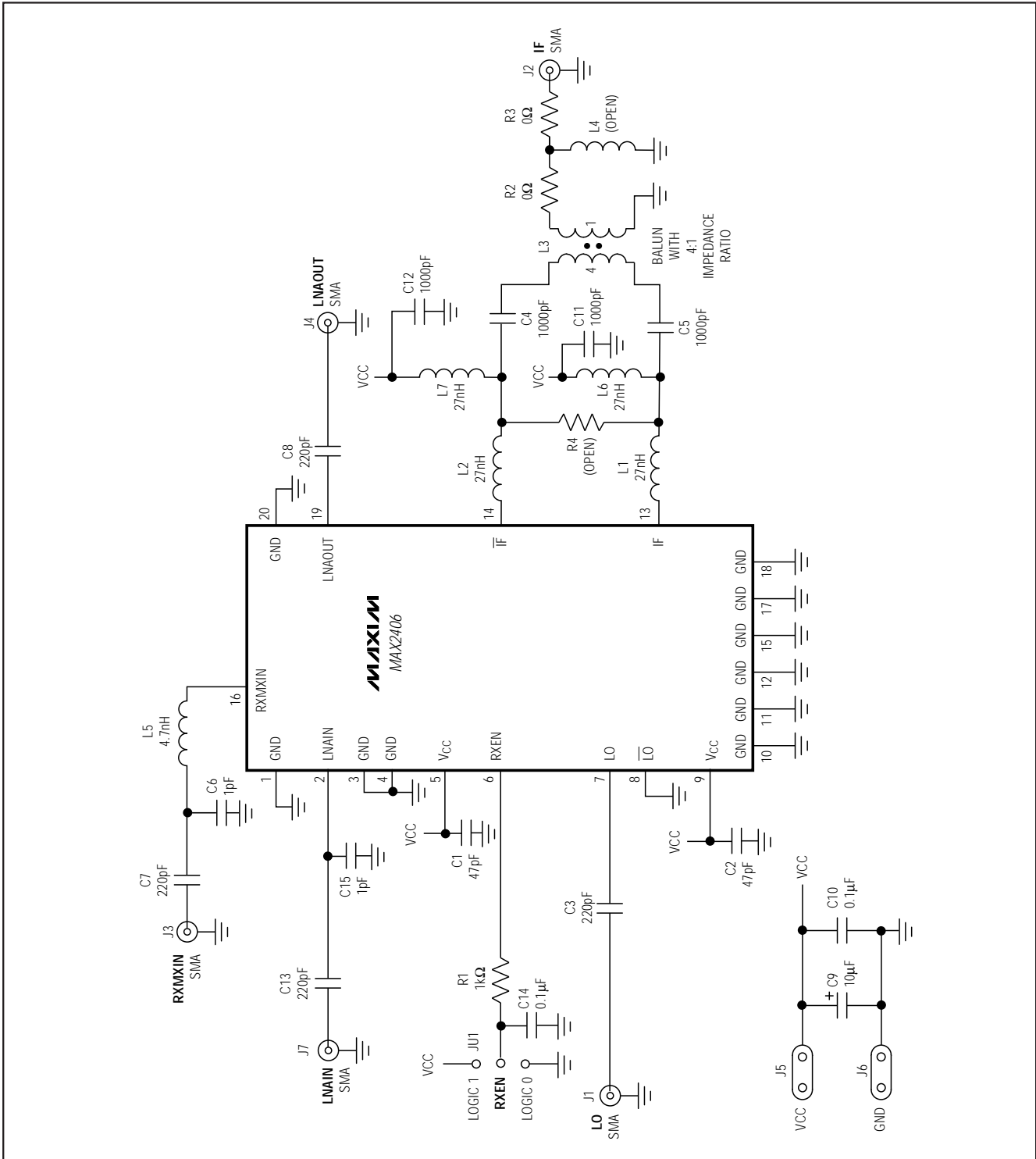


Figure 1. MAX2406 EV Kit Schematic

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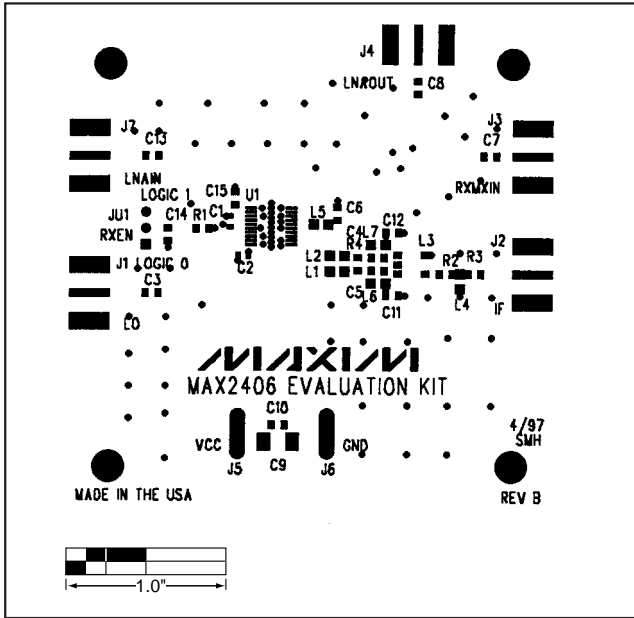


Figure 2. MAX2406 EV Kit Layout—Top Silk Screen and Pad Placement

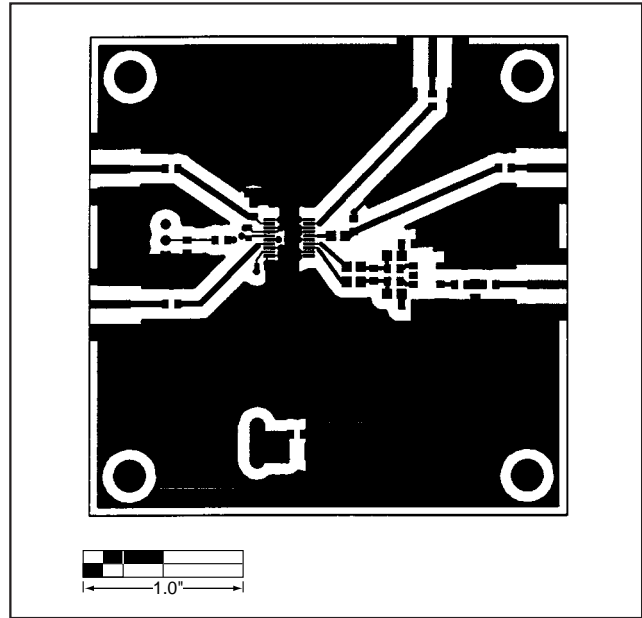


Figure 3. MAX2406 EV Kit Layout—Component Side

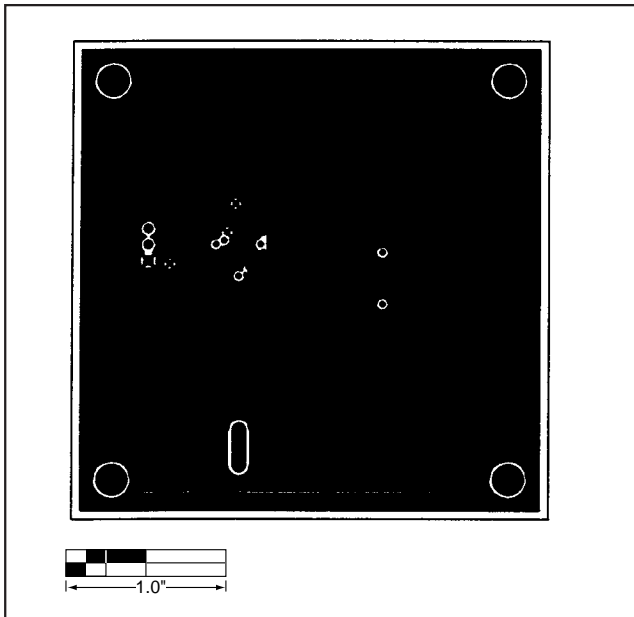


Figure 4. MAX2406 EV Kit Layout—Ground Plane (layer 2)

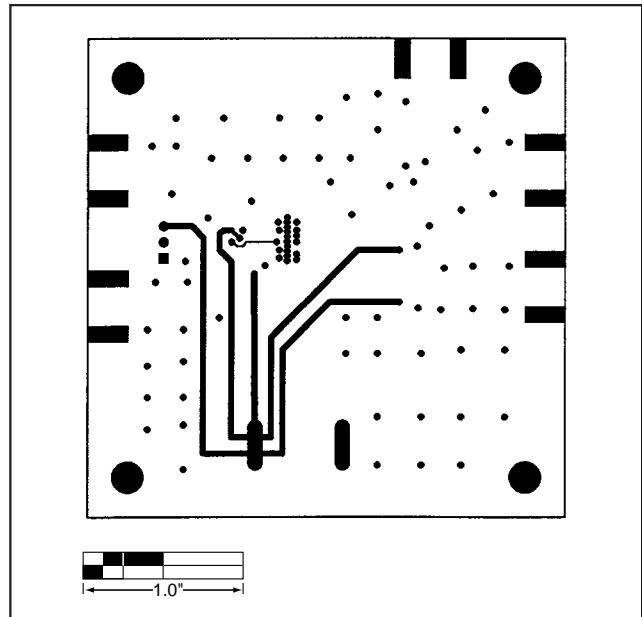


Figure 5. MAX2406 EV Kit Layout—Bottom Side (solder side) (layer 4)

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