19-2205; Rev 0; 10/01

MAX2385/MAX2386 Evaluation Kits

General Description

The MAX2385/MAX2386 evaluation kits (EV kits) simplify evaluation of the MAX2385/MAX2386. The EV kits allow the evaluation of the CDMA and GPS low-noise amplifiers (LNA), as well as the CDMA and GPS down-converter mixers, without the use of any additional support circuitry. The signal inputs and outputs use SMA connectors to simplify the connection of RF test equipment.

The MAX2385/MAX2386 EV kits are assembled with an associated IC and incorporate input and output matching components optimized for RF frequencies from 832MHz to 870MHz and an IF frequency of 110MHz.

Features

- ♦ **+2.7V to +3.6V 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
MAX2385EVKIT	-40°C to +85°C	5 × 4 UCSP™
MAX2386EVKIT	-40°C to +85°C	5 × 4 UCSP™

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C42	2	1000pF ±10% ceramic capacitors (0402) Murata GRM36X7R102K050A
C3, C4, C39, C40	4	7.0pF ±0.1pF ceramic capacitors (0402) Murata GRM36COG070B050A
C5, C6, C13, C37, C38	5	0.5pF ±0.1pF ceramic capacitors (0402) Murata GRM36COG0R5B050A
C7, C8, C22, C24, C30, C34, C35	7	100pF ±5% ceramic capacitors (0402) Murata GRM36COG101J050A
C9, C26	2	0.01µF 10% ceramic capacitors (0402) Murata GRM36X7R103K016A
C12	1	3.0pF ±0.1pF ceramic capacitor (0402) Murata GRM36COG030B050A
C16, C23, C29, C33	4	6.8nF ±10% ceramic capacitors Murata GRM36COG682B050A
C19	1	2.2pF ±0.1pF ceramic capacitor (0402) Murata GRM36COG2R2B050A
C25, C32	2	2.0pF ±0.1pF ceramic capacitors Murata GRM36COG020B050A
C27	1	22µF ±10% tantalum capacitor, C case AVX TAJC226K016
C28	1	1.8pF ±0.1pF ceramic capacitor (0402) Murata GRM36COG1R8B050A
J1, J2, J3, J5, J9, J11, J12	7	SMA edge mounts EFJohnson 142-0701-801
J4, J7, J10	3	SMA PC mounts EFJohnson 142-0701-201
JU1, JU2, JU3, JU8	4	1 × 2 headers (0.1in centers) Digi-Key S1012-36-ND
JU4–JU7	4	1 × 3 headers (0.1in centers) Digi-Key S1012-36-ND
JU1–JU9	9	Shunts Digi-Key S9000-ND
L2, L3, L10, L11	4	180nH 5% inductors Toko 1608-FSR18J
L4	1	2.7nH ±0.3nH inductor Toko 1608-FS2N7S
L5, L6	2	5.6nH ±0.3nH inductors Toko 1608-FS5N6S
L7	1	22nH ±2% inductor Murata LQW1608A22NG00
L8	1	3.9nH ±0.3nH inductor Toko 1608 FS3N9S

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
L9	1	10nH ±2% inductor Murata LQW1608A10NG00
R2, R3, R4, R10	4	0Ω ±1% resistors (0402)
R5	1	47.5kΩ ±1% resistor (0402)
R6, R7	2	69.8Ω ±1% resistors (0402)
R8	1	20kΩ ±1% resistor (0402)
T1, T2	2	Transformers Macom ETC1-1T
U1	1	MAX2385EBP/MAX2386EBP 5 × 4 UCSP
VCC, GND, TP1	3	Test points Digi-Key 5000K-ND

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	843-448-9411	843-448-1943
Murata	770-436-1300	770-436-3030
Toko	408-432-8281	408-943-9790

Quick Start

The MAX2385/MAX2386 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 required test equipment to verify MAX2385/MAX2386 operation. It is intended as a guide only, and some substitutions are possible.

Table 1. Required Test Equipment

EQUIPMENT	DESCRIPTION
RF Signal Generators	Capable of delivering at least 0dBm of output power up to 1.6GHz (HP 8648C or equivalent)
RF Spectrum Analyzer	Capable of covering the operating frequencies of the device, as well as a few harmonics (HP 8561E or equivalent)
Power Supply	Capable of up to 40mA at +2.7V to +3.6V
Power Meter	Capable of measuring up to 20dBm
Ammeter	To measure supply current (optional)
Network Analyzer	To measure small-signal return loss and gain (optional, HP 8753D or equivalent)

Connections and Setup

This section provides a step-by-step guide to operating the EV kits and testing the devices' functions. Ensure that the shunts across jumpers ICLNA (JU1), IGLNA (JU2), ICMIX (JU8), and IGMIX (JU3) are installed. Do not turn on DC power or RF signal generators until all connections are made.

Testing the Supply Current

1) Connect a DC supply set to +2.75V (through an ammeter, if desired) to the V_{CC} and GND terminals on the EV kit. If available, set the current limit to 40mA. Do not turn on the supply.
2) Set the shunt across BUFF (JU7) to OFF. See Table 2 for positions of the shunts across G1, G2, and MODE for the different modes of operation.
3) Turn on the DC supply; the supply current should read approximately 0mA (shutdown mode), 9.6mA (GPS mode, MAX2385), 16.9mA (GPS mode, MAX2386), 3.7mA (ULG mode), 6.5mA (LG mode), 10.3mA (MG mode), 12.5mA (HGLL mode), and 17.4mA (HGHL mode).
4) Set the shunt across BUFF (JU7) to ON. This should increase the current consumption in each mode by 5.2mA.

Testing the CDMA LNA

1) Connect a DC supply set to +2.75V (through an ammeter if desired) to the V_{CC} and GND terminals on the EV kit. If available, set the current limit to 40mA. Do not turn on the supply.
2) See Table 2 for positions of the shunts across G1, G2, and MODE for the different CDMA LNA modes.
3) Connect one RF signal generator to the CLNAIN SMA connector. Do not turn on the generator's output. Set the generator to an output frequency of 851MHz and set the generator power level to -30dBm.
4) Connect the spectrum analyzer to the CLNAOUT SMA connector. Set the spectrum analyzer to a center frequency of 851MHz and a total span of 10MHz.
5) Turn on the DC supply, then activate the RF generator's output. An 851MHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -15dBm (HGHL mode), -16dBm (HGLL mode), -29dBm (MG mode), and -35dBm (LG mode). 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.
6) (Optional) Another method for determining gain is by using a network analyzer. This has the advantage of

Table 2. Mode Selection Truth Table

MODES	CONTROL PINS			FUNCTION									
				LNA					MIXER				
	G1	G2	MODE	HGHL	HGLL	MG	LGHL	GPS	HG	MG	LG	ULG	GPS
High Gain, High Linearity (HGHL)	0	0	1	•	—	—	—	—	•	—	—	—	—
High Gain, Low Linearity (HGLL)	1	1	0	—	•	—	—	—	•	—	—	—	—
Midgain (MG)	1	0	1	—	—	•	—	—	—	•	—	—	
Low Gain (LG)	1	1	1	—	—		•	—	—	—	•	—	—
Ultra-Low Gain (ULG)	1	0	0	—	—	—	•	—	—	—	—	•	—
GPS	0	1	1	—	—	—	—	•	—	—	—	—	•
Shutdown (SHDN)	0	X	—	—	—	—	—	—	—	—	—	—	—

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 GPS LNA

1) Connect a DC supply set to +2.75V (through an ammeter, if desired) to the V_{CC} and GND terminals on the EV kit. If available, set the current limit to 40mA. Do not turn on the supply.
2) Set the shunt across MODE to HI, across G1 to LO, and across G2 to HI. This places the device in GPS mode (see Table 2).
3) Connect one RF signal generator to the GLNAIN SMA connector. Do not turn on the generator's output. Set the generator to an output frequency of 1575.42MHz and set the generator power level to -30dBm.
4) Connect the spectrum analyzer to the GLNAOUT SMA connector. Set the spectrum analyzer to a center frequency of 1575.42MHz and a total span of 10MHz.
5) Turn on the DC supply and activate the RF generator's output. A 1575.42MHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -12dBm (MAX2385) or -10dBm (MAX2386). 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.
6) (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 CDMA Mixer

1) Connect a DC supply set to +2.75V (through an ammeter if desired) to the V_{CC} and GND terminals on the EV kit. If available, set the current limit to 40mA. Do not turn on the supply.
2) See Table 2 for positions of the shunts across G1, G2, and MODE for the different CDMA mixer modes.
3) Connect one RF signal generator to the LO_IN SMA connector. Do not turn on the generator output. Set the frequency to 1482MHz, and output power to -10dBm. This is the LO signal.
4) Connect another RF signal generator to the CMIXIN SMA connector. Do not turn on the generator output. Set the signal generator to 851MHz and output power level to -30dBm.
5) Connect the spectrum analyzer to the CIF SMA connector. Set the spectrum analyzer to a center frequency of 110MHz and a total span of 10MHz.
6) Turn on the DC supply and the signal generator outputs.
7) A 110MHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -19dBm (HGHL/HGLL mode), -19dBm (MG mode), -20dBm (LG mode), or -27dBm (ULG mode). 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.

Testing the GPS Mixer

1) Connect a DC supply set to +2.75V (through an ammeter, if desired) to the V_{CC} and GND terminals on the EV kit. If available, set the current limit to 40mA. Do not turn on the supply.
2) Set the shunt across MODE to HI, across G1 to LO, and across G2 to HI. This places the device in GPS mode (see Table 2).
3) Connect one RF signal generator to the LO_IN SMA connector. Do not turn on the generator output. Set the frequency to 1465.42MHz, and output power to -10dBm. This is the LO signal.
4) Connect another RF signal generator to the GMIXIN SMA connector. Do not turn on the generator output. Set the signal generator to 1575.42MHz and output power level to -30dBm.
5) Connect the spectrum analyzer to the GIF SMA connector. Set the spectrum analyzer to a center frequency of 110MHz and a total span of 10MHz.
6) Turn on the DC supply and the signal generator outputs.
7) A 110MHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -18dBm (MAX2385) or -17dBm (MAX2386). 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.

Testing the LO Output Buffer

1) Connect a DC supply set to +2.75V (through an ammeter, if desired) to the V_{CC} and GND terminals on the EV kit. If available, set the current limit to 40mA. Do not turn on the supply.
2) Set the shunt across jumper BUFF (JU7) to ON.
3) Connect one RF signal generator to the LO_IN SMA connector. Do not turn on the generator output. Set the frequency to 1482MHz, and output power to -10dBm.
4) Connect the spectrum analyzer to the LO_OUT SMA connector. Set the spectrum analyzer to a center frequency of 741MHz and a total span of 10MHz.
5) Turn on the DC supply and the signal generator outputs.
6) A 741MHz signal shown on the spectrum analyzer display should indicate a magnitude of approximately -14dBm. Be sure to account for cable losses (between 0.5dB and 2dB), the 7.4dB 100Ω to 50Ω matching pad, and circuit board losses (approximately 0.5dB) when computing gain and noise figure.

Layout

The EV kit's PC board can serve as a guide for laying out a circuit board using the MAX2385/MAX2386.

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.

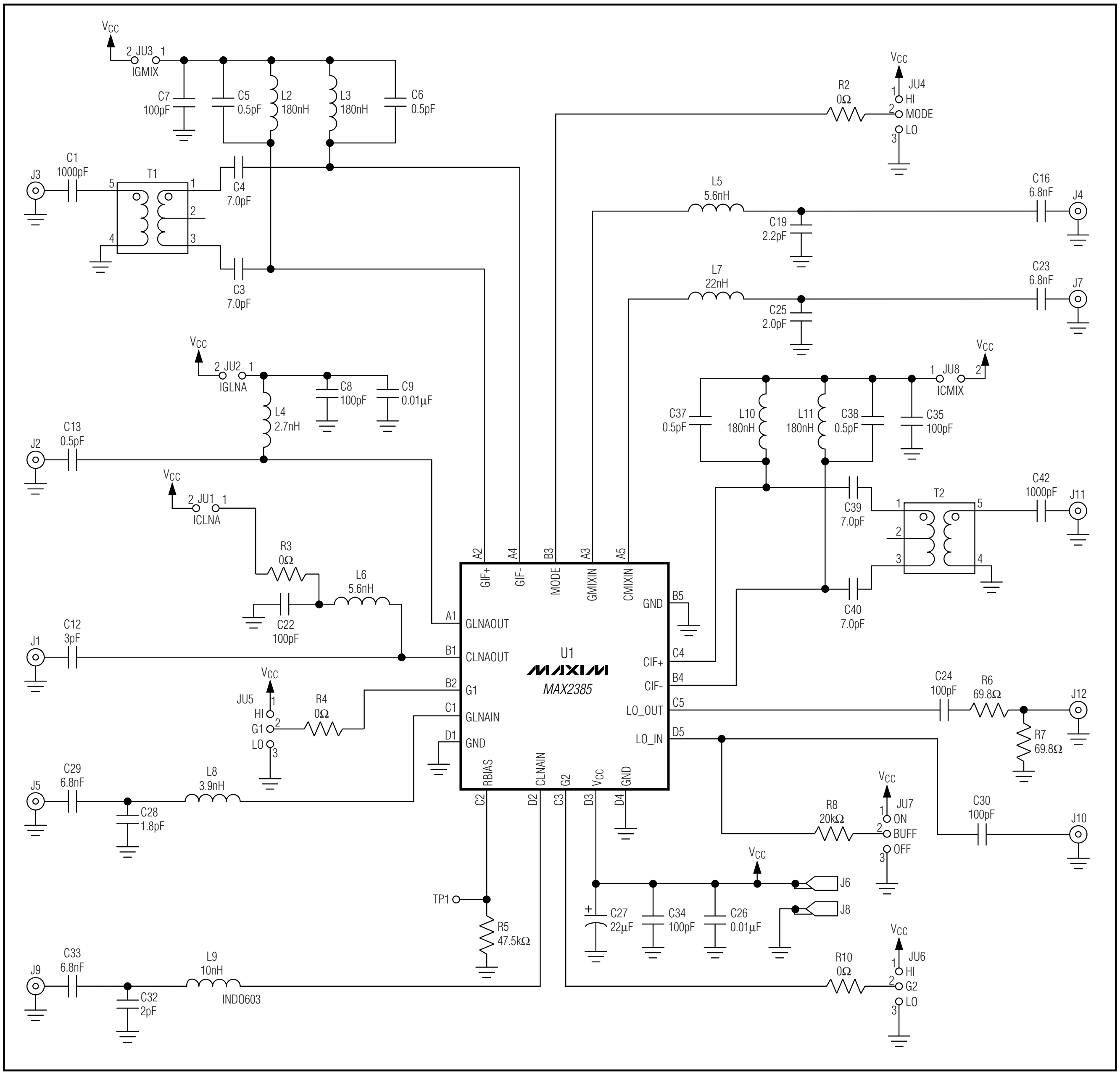

Figure 1. MAX2385/2386 EV Kit Schematic

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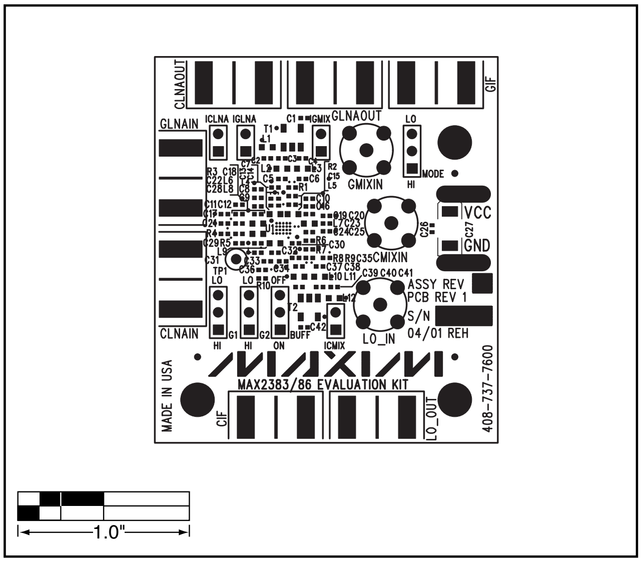

Figure 2. MAX2385/MAX2386 EV Kit Component Placement Guide—Component Side

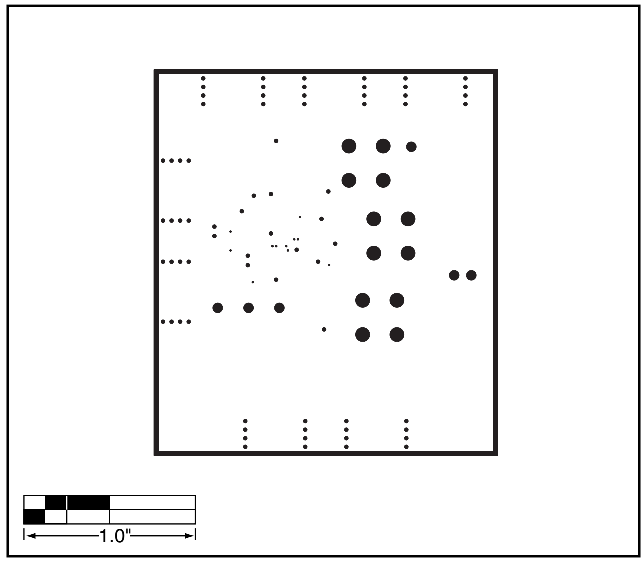

Figure 4. MAX2385/MAX2386 EV Kit PC Board Layout—Ground Plane 1

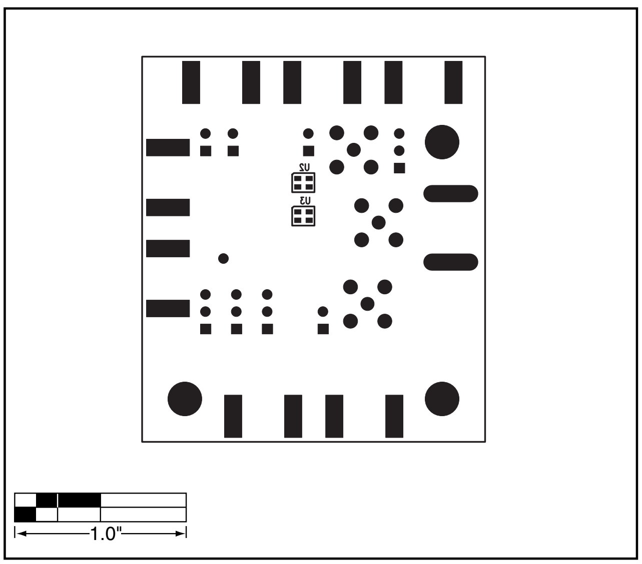

Figure 3. MAX2385/MAX2386 EV Kit Component Placement Guide—Solder Side

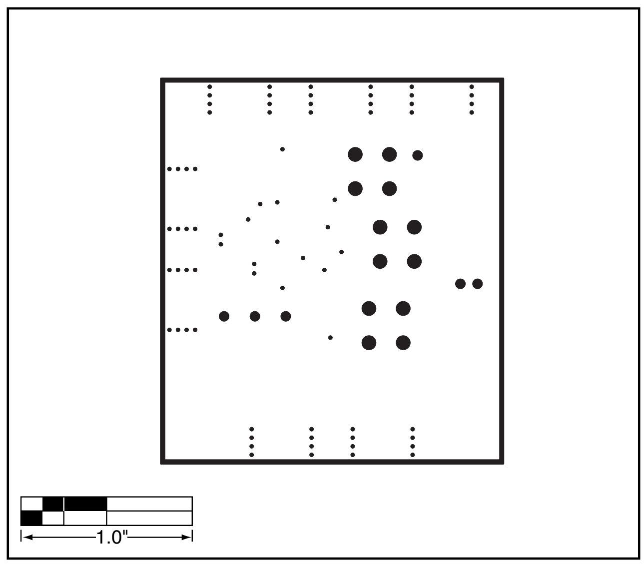

Figure 5. MAX2385/MAX2386 EV Kit PC Board Layout—Component Side

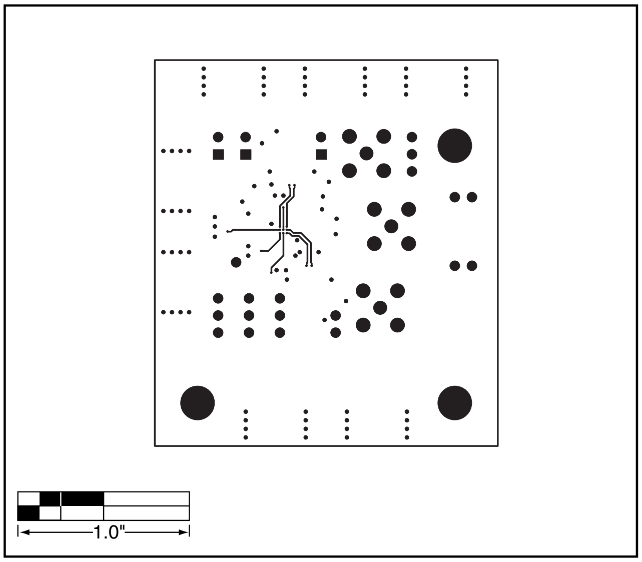

Figure 6. MAX2385/MAX2386 EV Kit PC Board Layout

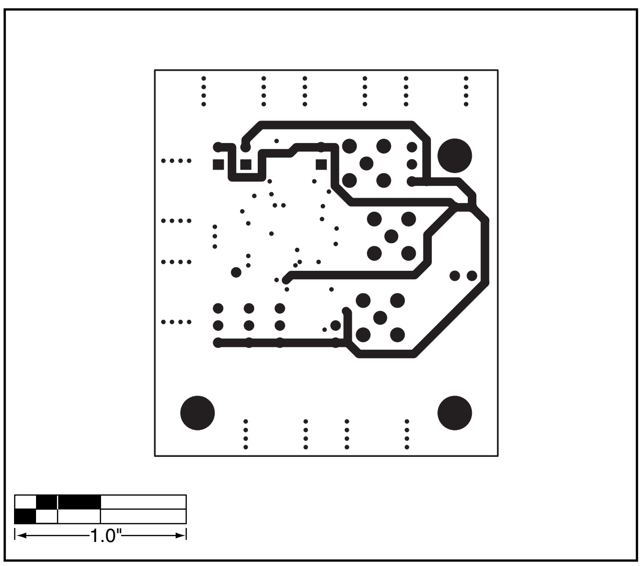

Figure 7. MAX2385/MAX2386 EV Kit PC Board Layout

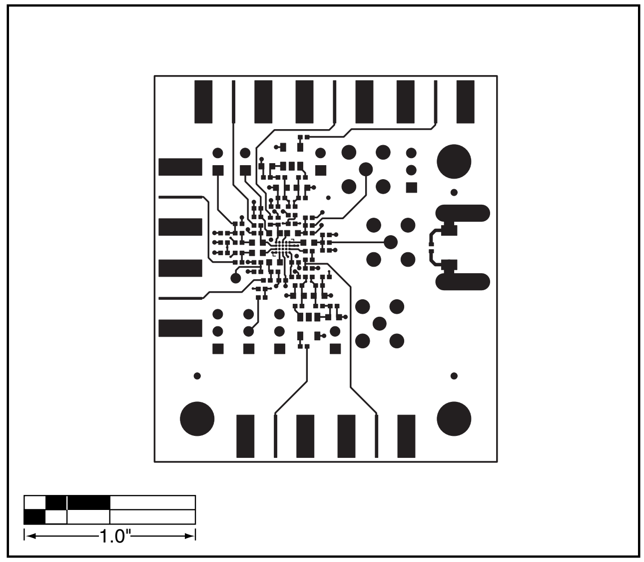

Figure 8. MAX2385/MAX2386 EV Kit PC Board Layout—Component Side

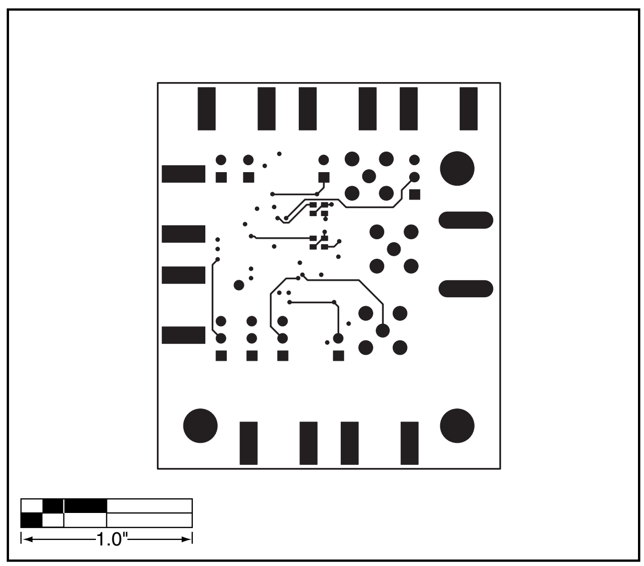

Figure 9. MAX2385/MAX2386 EV Kit PC Board Layout—Solder Side