19-2509; Rev 0; 7/02

MAXIM

MAX2116/MAX2118 Evaluation Kits

Evaluate: MAX2116/MAX2118

General Description

The MAX2116/MAX2118 evaluation kits (EV kits) simplify evaluation of the MAX2116/MAX2118 complete DBS direct-conversion tuner ICs. They enable testing of the devices' performance and require no additional support circuitry. The EV kits' signal inputs and outputs use SMA and F-type connectors to facilitate the connection of RF/cable test equipment.

Features

- ♦ **Easy Evaluation of the MAX2116/MAX2118**
- ♦ **4.75V to 5.25V Single-Supply Operation**
- ♦ **Jumpers for Digital Power Control**
- ♦ **All Critical Peripheral Components Included**
- ♦ **PC Control Software (Available at www.maxim-ic.com)**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX2116EVKIT	0°C to +85°C	40 QFN
MAX2118EVKIT	0°C to +85°C	40 QFN

Component List

DESIGNATION	QTY	DESCRIPTION
C4, C6	2	22pF ±5% capacitors Murata GRP1555C1H220J
C7, C26, C27	3	Open
C8	1	1000pF capacitor Murata GRP155R71H102K
C9, C10	2	0.1µF ±10% capacitors Murata GRP155R61A104K
C11, C12, C14, C15, C21, C28, C30	7	1000pF ±10% capacitors Murata GRM188R71H102K
C13, C18	2	0.01µF ±10% capacitors Murata GRM188R71H103K
C16	1	100µF ±5% capacitor Panasonic EEVHA0J101WR
C17, C22	2	0.22µF ±10% capacitors Murata GRM188R71A224K
C19	1	0.1µF ±10% capacitor Murata GRM188R71C104K
C20	1	3300pF ±10% capacitor Murata GRM188R71H332K
C23, C25	2	330pF ±5% capacitors Murata GRM188R71H331K
C24	1	39pF ±5% capacitor Murata GRM1885C1H390J
C29	1	10µF ±10% capacitor AVX TAJC106K016

DESIGNATION	QTY	DESCRIPTION
C32, C33	2	100pF ±5% capacitors Murata GRM1885C1H101J
J1, J3	2	SMA connectors, edge mount, round contact EFJohnson 142-0701-801
J2, J4, J8	3	Open
J5	1	RF connector Mouser ME161-5371
J6, J7	2	Test points Digi-Key 5000K-ND
J10	1	DB25 connector, right angle, male AMP 747238-4 Digi-Key A2098
JP1	1	2-pin header Digi-Key S9000-ND
R1, R3, R20, R23	4	1kΩ ±1% resistors
R2, R4	2	1kΩ ±1% resistors (MAX2118), open (MAX2116)
R5	1	If J5 is 50Ω SMA connector, use 86.6Ω ±1% resistor; if J5 is 75Ω F-connector, leave open
R6	1	If J5 is 50Ω SMA connector, use 43.2Ω ±1% resistor; if J5 is 75Ω F-connector, use 0Ω ±1% resistor

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.

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R7, R13, R21	3	2.21kΩ ±1% resistors
R8, R14	2	150Ω ±1% resistors
R9, R12	2	10kΩ ±1% resistors
R10	1	0Ω ±1% resistor
R11, R16, R22	3	Open
R15	1	75Ω ±1% resistor
R17	1	1kΩ ±1% resistor
R18	1	20kΩ ±1% resistor
R19	1	4.7Ω ±5% resistor
TP1, TP2	2	Open
TP3, TP4, TP5, TP7–TP10	7	Test points Digi-Key 5000K-ND
U1	1	MAX2116UGL
U2	1	TI SN74LV07ADR, Digi-Key 296-3764-1-ND
Y1	1	4MHz Crystal Citizen America HCM49-4.000MABJT, Digi-Key 300-6103-1-ND, Pletronics SM42306-4M
None	1	MAX2116/MAX2118 EV kit circuit board, rev 2
None	1	MAX2116/MAX2118 EV kit data sheet
None	1	MAX2116/MAX2118 data sheet

Quick Start

The MAX2116/MAX2118 EV kits are fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section for proper device evaluation.

Test Equipment Required

This section lists the recommended test equipment needed to verify operation of the MAX2116/MAX2118. It is intended as a guide, and substitutions are possible:

- One RF signal generator capable of delivering 5dBm of output power at the operating frequency (HPE4433B or equivalent)
- One RF power sensor capable of handling 20dBm of output power at the operating frequency (HP 8482A or equivalent)
- One RF power meter capable of measuring 20dBm of output power at the operating frequency (HP 437B or equivalent)
- An RF spectrum analyzer that covers the MAX2116/MAX2118 operating frequency range, as well as a few harmonics (FSEB20, for example)
- Two power supplies capable of 500mA at 5V
- SMA cables
- One SMA 20dB pad
- (Optional) An ammeter for measuring the supply current
- (Optional) A network analyzer (HP 8753D, for example) to measure small-signal return loss and gain
- (Optional) A digital oscilliscope (TDS 3014, for example)
- An F-connector to SMA adapter and matching PAD
- A PC loaded with control software

Component Suppliers

SUPPLIERS	PHONE	FAX	WEBSITE
AVX	843-448-9411	843-448-7139	www.avxcorp.com
Digi-Key	800-344-4539	218-681-3380	www.digikey.com
Murata Electronics	770-436-1300	770-436-3030	www.murata.com
Panasonic	800-833-9626	—	www.panasonic.com
Texas Instruments	800-336-5236	—	www.ti.com

Measurement Corrections

Corrections on both the input and the output are necessary for accurate measurements. On the MAX2116/MAX2118 EV kit boards, F-connectors (75Ω impedance) are mounted at the RFIN port. To use 50Ω test equipment, an adapter is needed. Thus, the input power must be adjusted to compensate for the adapter loss (typically 5.7dB for a "min-loss" pad).

At the baseband output ports, there are 1kΩ resistors in series with the output pins, which lead to 26.4dB loss if 50Ω test equipment is used. Therefore, for the MAX2116 EV kit, full-scale output (800mV$_{P-P}$) corresponds to -24.4dBm. For the MAX2118 EV kit, when DL = 1, full-scale output (1V$_{P-P}$, differential) corresponds to -28.4dBm on each output port, while for DL = 0, full-scale output (590mV$_{P-P}$, differential) corresponds to -33dBm on each output port. When connecting to 50Ω test equipment, always ensure that DC blocking is used so that I/Q output bias networks are not disrupted.

Note on MAX2118:

All power levels specified in this EV kit description refer to single-ended measurements.

Connections and Setup

This section provides a step-by-step guide to operating the EV kit and testing the device's function. Do not turn on the DC power or RF signal generators until all connections are made:

1) Verify that all jumpers are in place.
2) Connect the PC to the EV kit using the parallel cable.
3) Connect a DC power supply set to +5V (through an ammeter, if desired) to the VCC and GND terminals on the EV kit. Set the current limit to 300mA. Do not turn on the supply.
4) Connect the second DC power supply set to 0.75V (max RF gain) to GC1 (TP7). Set the current limit to 10mA. Do not turn on the supply.
5) Connect an RF signal generator to the RFIN connector. Use a 75Ω to 50Ω adapter if necessary. Do not turn on the generator's output.
6) Connect the I or Q output to a spectrum analyzer or a digital oscilloscope. If using a spectrum analyzer or an oscilloscope in 50Ω mode, insert a DC block to protect the analyzer from damage.
7) Turn on the DC supplies. The 5V supply should read approximately 190mA. The 0.75V supply should be less than 1mA.
8) Open the MAX2116/MAX2118 software. The software opens in either the MAX2116 or MAX2118 mode. You can change to the appropriate part under the Option Menu: "Select EVkit type: MAX2116 or MAX2118".
9) Click on the Synthesizer tab and configure the following:
   a) Ref = 4
   b) R Divider = 4 (This sets the comparison frequency to 1MHz when using the on-board 4MHz crystal)
   c) Calibrate VCOs by clicking the "VCO Cal" button.
   d) Check "Auto Div Select" and "Auto Band Select" (This allows the software to pick the appropriate divider (div by 2 or div by 4) and to select the appropriate VCO for the entered LO frequency.)
   e) Enter the desired LO frequency
10) Select the Base tab and set the following:
   a) Gain Control 2 = 0 (max baseband gain)
   b) M Divide = 2 and FDAC = 127 (max baseband filter bandwidth)
   c) If using the MAX2118, select the desired baseband peak-to-peak output under the "Drive Level" box (1V$_{P-P}$ or 590mV$_{P-P}$).
11) Set the RF generator's output power to approximately -65dBm. Activate the RF generator's output and select the desired CW input frequency so that the generator's frequency is 5MHz higher than the frequency set in Step 9d. This creates a single 5MHz tone at the baseband output ports.
12) Set the spectrum analyzer: CF = 5MHz, Span = 200kHz, RBW = 1kHz, and VBW = 1kHz. Or, using an oscilloscope, observe a tone at 5MHz. Adjust the RF power to obtain the proper output levels as specified in the "Measurement Corrections" section of this procedure.

Analog Gain Control (GC1) Test:

1) Adjust the power supply connected to TP7 (GC1) to 0.75V (max RF gain).
2) Ensure that the baseband gain setting is set for decimal 0 (max baseband gain).
3) Set the RF signal generator's frequency to 5MHz higher than the desired LO frequency and its input power to -65dBm. (The signal generator power might need to be adjusted to produce a full-scale baseband output level.)

4) Put a delta marker on the desired tone and increase the GC1 voltage.
5) The gain delta is greater than 60dB.

Digital Gain Control (GC2) Test:

1) Adjust the power supply connected to TP7 to 0.75V (max RF gain).
2) Set the baseband gain control to 0 (max baseband gain).
3) Set the RF signal generator's frequency to 5MHz higher than the desired LO frequency and its input power to -65dBm. (The signal generator power might need to be adjusted to produce a full-scale baseband output level.)
4) Put a delta marker on the desired tone and increase the baseband gain control to 31.
5) The gain delta is larger than 20dB.

Lowpass Filters Test:

1) Adjust the power supply connected to TP7 to 0.75V and GC2 to decimal 0 (max baseband gain).
2) Set the RF generator to -65dBm and 10MHz higher than the desired LO frequency.
3) Set the spectrum analyzer to measure from 0 to 50MHz and put a delta marker on the desired tone. (Adjust GC1 level for a full-scale baseband output level.)
4) While monitoring the 10MHz tone on the spectrum analyzer, decrease FDAC.
5) Note the decrease in filter-noise-floor bandwidth. When the computed 3dB BW equals 10MHz, the desired tone is attenuated by more than 1dB.

Layout Issues

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 MAX2116/MAX2118. Keep traces carrying RF signals as short as possible to minimize radiation and insertion loss. Use impedance control on all RF signal traces. The VCC node on the PC board should have decoupling capacitors to the closest ground. Refer to the *Layout* section of the MAX2116/MAX2118 data sheet for more information.

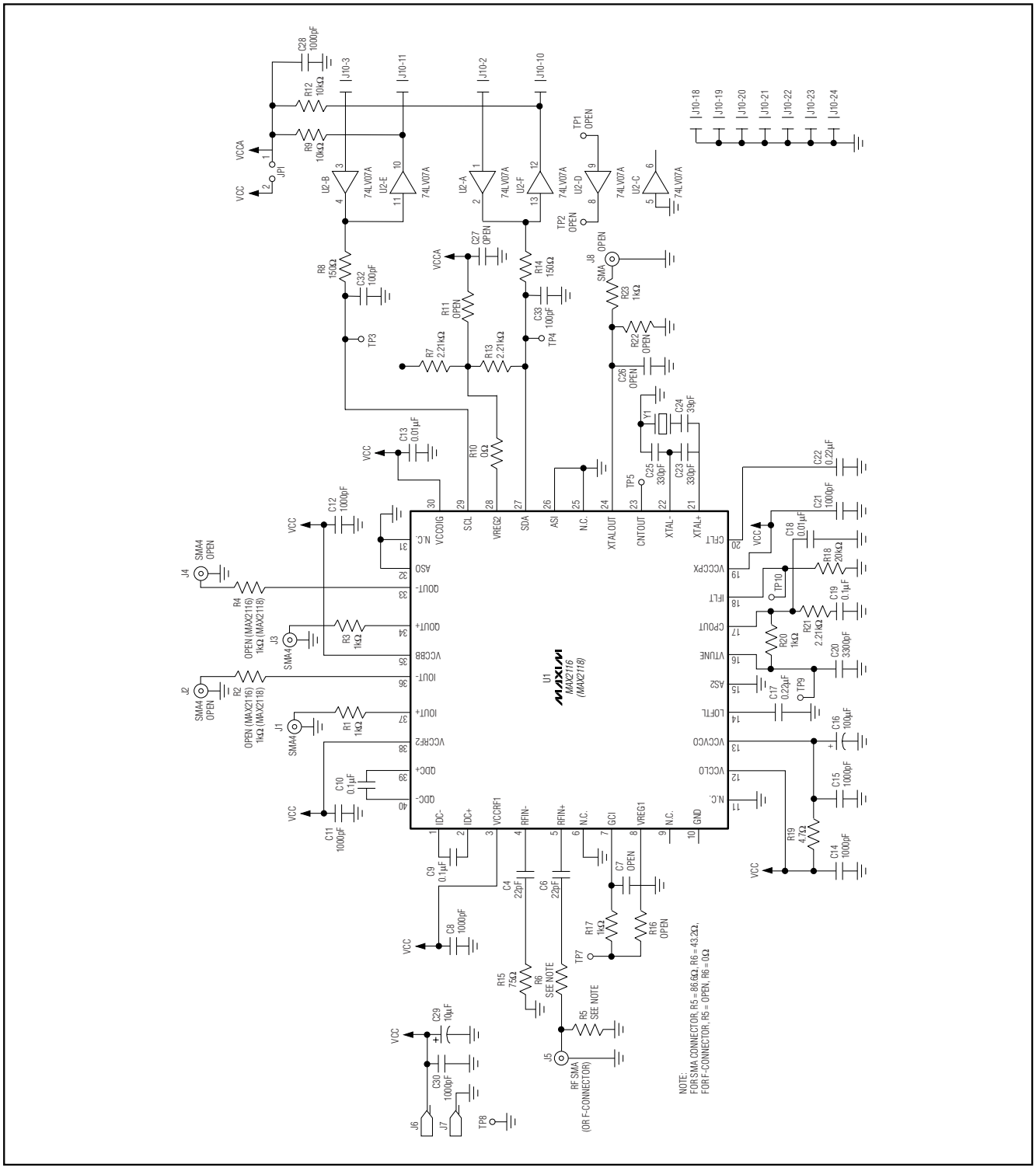


Figure 1. MAX2116/MAX2118 EV Kit Schematic

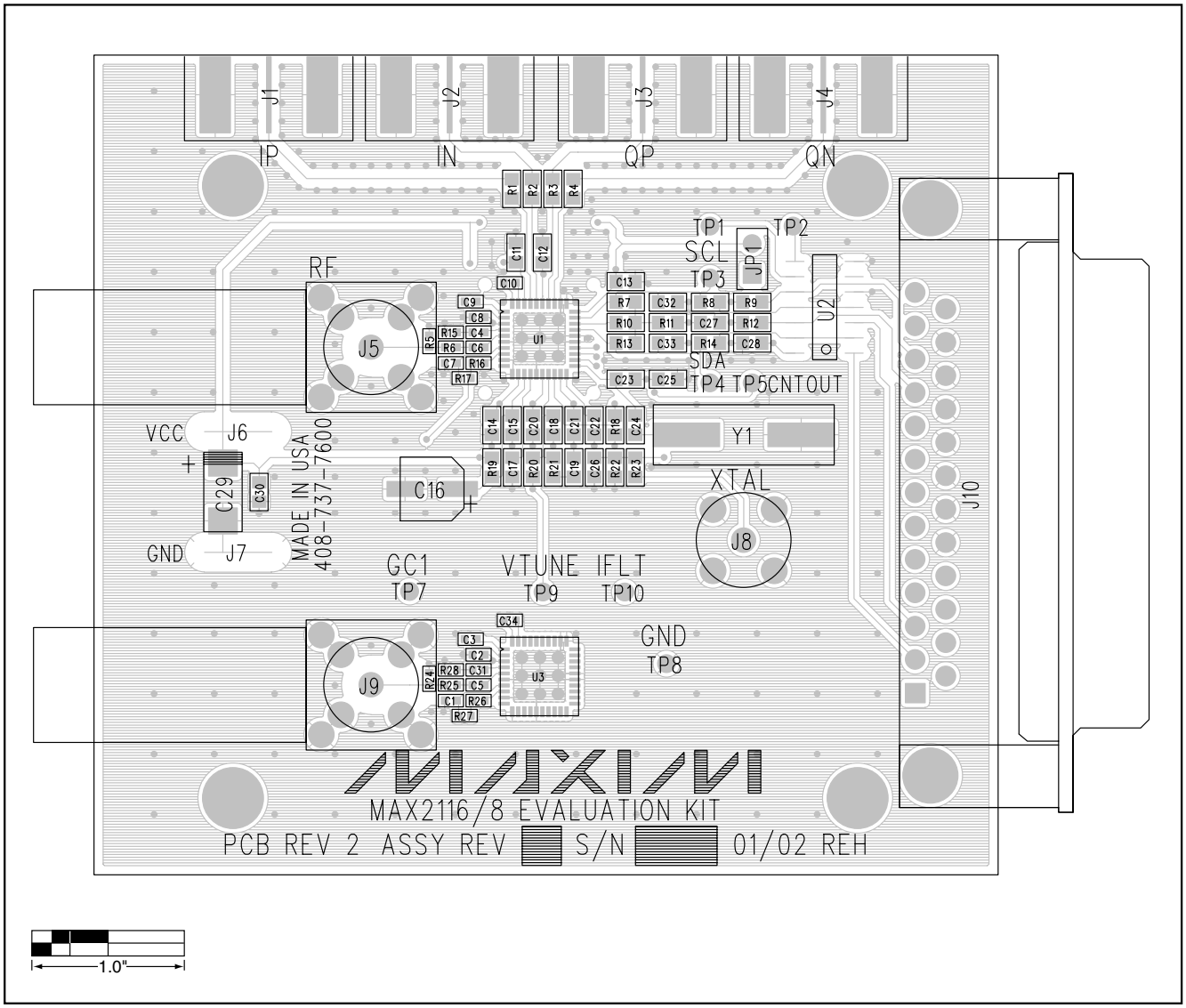


Figure 2. MAX2116/MAX2118 EV Kit Component Placement Guide

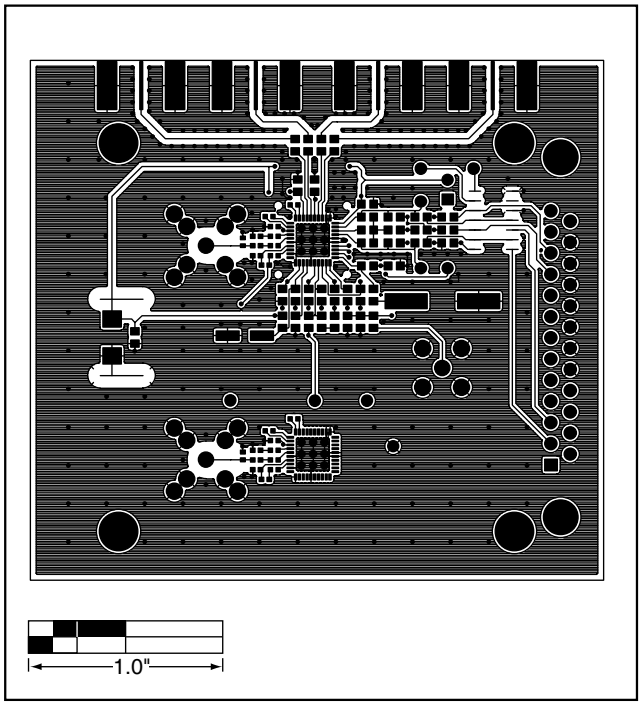


Figure 3. MAX2116/MAX2118 EV Kit Component Placement Guide—Component Side

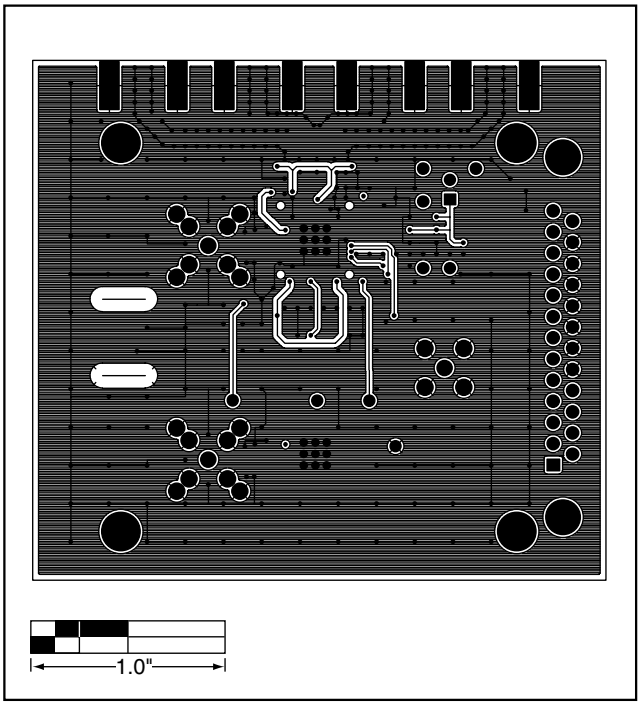


Figure 4. MAX2116/MAX2118 EV Kit Component Placement Guide—Solder Side

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