MAXIM

MAX1246/MAX1247 Evaluation Systems

Evaluate: MAX1246/MAX1247

_____General Description

The MAX1247 evaluation kit (EV kit) is an assembled and tested surface-mount PC board that demonstrates the 3V, 12-bit, 4-channel MAX1247 analog-to-digital converter.

The MAX1247 evaluation system (EV system) is a complete, low-cost, 4-channel data-acquisition system consisting of a MAX1247 EV kit and a Maxim 3V microcontroller (µC) module. IBM PC-compatible software provides a handy user interface to exercise the MAX1247′s features. Source code is provided.

The MAX1246 EV kit and EV system are identical to the MAX1247 EV kit and EV system except that the MAX1247 is replaced by the MAX1246, which has an internal 2.5V reference.

Order the EV system for comprehensive evaluation of the MAX1247 or MAX1246 using a personal computer. Order the EV kit if you have already purchased the 3V µC module with a previous Maxim EV system, or for custom use in other µC-based systems.

_____Features

♦ **Proven PC Board Layout**

♦ **Complete Evaluation System**

♦ **Convenient On-Board Test Points**

♦ **Data-Logging Software**

♦ **Source Code Provided**

♦ **Fully Assembled and Tested**

_____Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX1246EVKIT-QSOP	0°C to +70°C	Surface Mount
MAX1246EVL11-QSOP	0°C to +70°C	Surface Mount
MAX1247EVKIT-QSOP	0°C to +70°C	Surface Mount
MAX1247EVL11-QSOP	0°C to +70°C	Surface Mount

MAX1246/MAX1247 EV Kits _____ Component List

DESIGNATION	QTY	DESCRIPTION
C1, C7–C10	5	0.01µF ceramic surface-mount capacitors
C2, C4, C6, C11	4	0.1µF ceramic surface-mount capacitors
C13	1	0.1µF ceramic surface-mount capacitor (MAX1247 EV kit only)
C3	1	4.7µF surface-mount tantalum capacitor
C5	1	10µF surface-mount tantalum capacitor
C12	1	0.047µF ceramic surface-mount capacitor (MAX1247 EV kit only)
H1	1	10-pin header
J1	1	2 x 20 header
JU1, JU2, JU5, JU6	4	2-pin headers
R1–R4	4	1kΩ, 5% surface-mount resistors
R5	1	100Ω, 5% surface-mount resistor
R6, R7	2	1MΩ, 5% surface-mount resistors
U1	1	MAX1247BCEE or MAX1246BCEE
U2	1	MAX872CSA (MAX1247 EV kit only)
U3	1	MAX393CSE
U4	1	MAX495CSA
None	1	Printed circuit board

MAX1246EVL11 _____Component List

QTY	DESCRIPTION
1	MAX1246EVKIT-QSOP
1	68L11D µC MODULE (68L11D MODULE)

MAX1247EVL11 _____Component List

QTY	DESCRIPTION
1	MAX1247EVKIT-QSOP
1	68L11D µC MODULE (68L11D MODULE)

_____Stand-Alone EV Kits

The MAX1246/MAX1247 EV kit provides a proven PC board layout to facilitate evaluation of the MAX1246 or MAX1247. It must be interfaced to appropriate timing signals for proper operation. Refer to the MAX1246/MAX1247 data sheet for timing requirements.

Systems that have 5V as well as 3V logic must provide level translation for the MAX1246/MAX1247 DOUT and SSTRB outputs. No level translation is necessary on the digital interface inputs.

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_____ EV Systems Quick Start

A single program, "MAX1247", is used for both the MAX1246 and the MAX1247 EV systems.

1) Copy the files from the distribution disk to your hard disk or to blank floppy disks. The EV kit software should be in its own directory. The necessary files are in the distribution disk's root directory, and the source code is in the SOURCE subdirectory. The SOURCE subdirectory is not required to operate the EV kit.

2) Make sure that the jumpers are configured according to Table 1. Table 2 lists the functions associated with each jumper.

3) Carefully connect the boards by aligning the EV kit's 40-pin header with the µC module's 40-pin connector. Gently press them together. The two boards should be flush against each other.

4) Connect a 5V DC power source (16V max) to the µC module at the terminal block located next to the on/off switch, in the upper-right corner of the µC module. Observe the polarity marked on the board.

5) Connect a cable from the computer's serial port to the µC module. If using a 9-pin serial port, use a straight-through, 9-pin, female-to-male cable. If the only available serial port uses a 25-pin connector, a standard 25-pin to 9-pin adapter is required. The EV kit software checks the modem status lines (CTS, DSR, DCD) to confirm that the correct port has been selected.

6) Start the software on the IBM PC by setting the current directory to match the directory that contains the Maxim programs, and then type the program name "MAX1247" (for the MAX1246, type **"MAX1247 FASTPD"**). Do not turn off or disconnect the µC module while the program is running; if you do, you will have to restart the program.

Table 1. Default Jumper Settings

JUMPER	MAX1246 JUMPER STATE	MAX1247 JUMPER STATE	FUNCTION
JU1	Closed	Closed	Drive $\overline{SHDN}$ pin
JU2	Open	Closed	See Table 2
JU3	Closed (trace)	Closed (trace)	Bypass supply-current measurement
JU4	Closed (trace)	Closed (trace)	Drive COM pin
JU5	Open	Closed	See Table 2
JU6	Open	Open	VREF not connected to V_{DD}

7) The program will ask which port the µC module is connected to. Press the space bar until the correct PC serial port is highlighted, then press ENTER. The program will be in terminal-emulation mode.

8) Turn on the power for the µC module. The µC module will display its logon banner and test its RAM.

9) Download and run the RAM resident program on the µC module by pressing ALT+L (i.e., hold down the ALT key as you strike the L key). The program will prompt you for the file name. Press the ENTER key to download and run the file.

10) Press ALT+C to switch to the Control Panel screen after the RAM resident program has been successfully downloaded.

11) Apply input signals to CH0–CH3 on the EV board. Observe the readout on the screen. Table 3 lists the commands that are available from the control panel screen.

12) Before turning off power to the EV kit, exit the program by pressing ALT+X.

Table 2. Jumper Settings

JUMPER	STATE	FUNCTION
JU1	Closed	Drive $\overline{SHDN}$ pin with pin 34 of the μC module.
	Open	Force $\overline{SHDN}$ to float.
JU2	Closed	REFADJ = V_{DD}. Disable the internal reference buffer (see JU5 and JU6 settings).
	Open	REFADJ = Open. Enable the internal reference buffer. Refer to the MAX1246/MAX1247 data sheet for additional information.
JU3	Closed	Current-sense jumper (in series with V_{DD})
	Open	Do not operate the kit with JU3 open. Supply current may be measured by cutting JU3 open and connecting a current meter across JU3.
JU4	Closed	Drive the COM pin with buffer U4.
	Open	COM disconnected from U4; COM must be driven directly by the user.
JU5*	Closed	VREF = MAX872 reference (MAX872 not supplied with MAX1246 EV kit).
	Open	MAX872 disconnected from the MAX1247's VREF input.
JU6*	Closed	VREF = V_{DD}
	Open	V_{DD} disconnected from the VREF input.

Note: Jumpers JU5 and JU6 should not both be closed.

Detailed Description of Hardware

The MAX872 is a micropower 2.5V reference supplied with the MAX1247 EV kit.

The MAX495 is a low-voltage Rail-to-Rail® op amp with a 500kHz gain-bandwidth product. The MAX495 buffers the external COM input source.

The MAX393 analog switch allows the EV kit software to route the MAX1246/MAX1247 COM pin to ground or to the external COM input. In addition, the external COM input can be routed to input channel 0. Typical systems connect COM directly to analog ground or the analog common voltage.

Changing the Reference Voltage

To supply a different external reference, open JU2 and apply the reference voltage between VREF and GND or J10 (REFADJ) and GND. Refer to the MAX1246/MAX1247 data sheet for additional information.

Input Filtering

The EV kit has an RC filter on each input with a time constant (τ) of 10μs. The MAX1246/MAX1247's acquisition time with a 1MHz clock is 3μs.

The RC filter's settling time may increase the acquisition time required for full accuracy when switching input channels.

Detailed Description of Software

The software allows all features of the MAX1246/MAX1247 to be exercised. Refer to Tables 3 and 4 for a complete listing of available features.

The EV kit default software program ("KIT1247.L11") that is loaded into the 68L11D module operates at a throughput rate of 6.41ksps. For faster throughput, download the program "FAST1247.L11" at step 9 of the *Quick Start* section. This program has a throughput rate of approximately 13ksps.

Listing 1 shows an example of interfacing the MAX1246/MAX1247 to the 68HC11 processor.

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Table 3. Command Reference

KEY	FUNCTION
0, 1, 2, 3	Enables or disables the corresponding input channel 0, 1, 2, or 3. The EV kit software scans all enabled channels.
C	Displays the conversion results in decimal form.
D	Delay between samples. Delays longer than one second are handled by the IBM PC; otherwise, the μC module handles the delay. Timing is approximate and should be verified with an oscilloscope.
L	Enables or disables data logging. If the -L command-line option was not specified, the L command prompts for a log-file name.
O	Oscilloscope demo. Samples are collected and discarded as fast as possible. Observe waveforms and timing with an oscilloscope.
P	Power-up delay. Timing is approximate and should be verified with an oscilloscope. When using an external reference, power-up delay is not necessary and should be set to zero. Power-up delay is used regardless of which power-cycling mode is selected.
S	Samples one of the four inputs at high speed. The sampling rate is controlled by the P and D delays. Due to program overhead, the O and S commands operate at different rates. Timing should be verified with an oscilloscope.
V	Displays the conversion results in volts.
F1	Selects input scale (unipolar, bipolar, unipolar differential, bipolar differential) for all enabled channels. Disabled channels are unaffected.
F3	Writes a marker into the data-log file.
F4	Measures the value of a user-applied COM voltage.
F5	Changes the assumed value of VREF.
F6	Changes the assumed voltage at COM. Selecting G connects the COM pin to ground; selecting E connects the COM pin to the EXTCOM input pad.
F7	Internal clock mode
F8	External clock mode
⇑, ⇓	Selects power-down mode.
ALT+T	Switches back to terminal mode.
ALT+X	Exits to DOS.

Table 4. Command-Line Options when Starting Software

COMMAND	FUNCTION
FASTPD	Enables the fast power-down mode for the MAX1246.
1	Defaults to COM1 PC serial port.
2	Defaults to COM2 PC serial port.
MONO	For use with monochrome or LCD display.
-L*filename*	Opens file *filename* for data logging and enables the data-logging commands.
VREF *vvv*	Specifies the actual measured voltage at the VREF pin (nominally 2.5V).
COM *vvv*	Specifies the voltage at the COM pin.
?	Lists command-line options.

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ControlWord:    fcb $97  ; memory location containing outgoing control word
temp_value:     ds 2     ; temporary storage for 2 bytes of raw received data

SSTRBpin        EQU J1PIN30            ; sstrb input
SSTRBout        EQU J1PIN30_OUTPUT     ; Pactl mask for J1 pin 30
CSpin           EQU J1PIN31            ; active low chip select
SHDNpin         EQU J1PIN34            ; shutdown / reference select
SHDNout         EQU J1PIN34_OUTPUT     ; Pactl mask for J1 pin 34

Init:   LDX   #base
        BCLR low Pactl,X,SSTRBout           ; make sure SSTRB is an input
; (make SHDN an input or an output as appropriate for user application)
        BSET low PortA,X,CSpin              ; initial CS pin state = 1
        BSET low PortA,X,SHDNpin            ; initial SHDN pin state = 1
        BCLR low PortD,X,PINSCK+PINMOSI     ; SCLK and DOUT pins normally low
        BSET low DDRD,X,PINSCK+PINMOSI      ; SPI output pins
        BCLR low DDRD,X,PINSS+PINMISO       ; SPI input pins

ReadADC:
        pshx                                ; save index register X
        ldaa #%01010000                     ; No interrupt, Enable SPI, Master
        staa Spcr                           ; CPOL=0, CPHA=0, SPR=00=1 MHz
        LDX  #base                          ; register base address
; make sure that the ADC is powered up
        BRCLR low Pactl,X,SHDNout,ReadShdnPinOk      ; is SHDN driven?
        BRSET low PortA,X,SHDNpin,ReadShdnPinOk      ; is SHDN driven low?
        BSET low PortA,X,SHDNpin            ; make SHDN high
        BSET low Pactl,X,SHDNout            ; make sure SHDN is an output
ReadShdnPinOk:
ReadWasAwake:                               ; SHDN is not low
        BCLR low PortA,X,CSpin              ; drive -CS low
        ldaa ControlWord                    ; send the control word
        staa Spdr                           ; begin SPI transfer
Wait2:  BRCLR low Spsr,X,Spsr_SPIF,Wait2    ; wait until SPI finished flag = 1
Wait2a: BRCLR low PortA,X,SSTRBpin,Wait2a   ; wait until SSTRB goes high
        clra                                ; keep DOUT = 0 for next 8 bits
        staa Spdr                           ; continue SPI transfer
Wait4:  BRCLR low Spsr,X,Spsr_SPIF,Wait4    ; wait until SPI finished flag = 1
        ldaa Spdr                           ; get first 8 bits
        staa temp_value                     ; save high byte
        clra                                ; keep DOUT = 0 for next 8 bits
        staa Spdr                           ; continue SPI transfer
Wait3:  BRCLR low Spsr,X,Spsr_SPIF,Wait3    ; wait until SPI finished flag = 1
        ldaa Spdr                           ; get next 8 bits
        staa temp_value+1                   ; save low byte
        BSET low PortA,X,CSpin              ; drive -CS high
        LDD  temp_value                     ; get result from receive ram
        rolb                                ; shift A:B left one bit
        rola                                ; (discard the start bit)
        andb #$F0                           ; mask off the unused sub-LSB bits
        pulx                                ; restore index register X
        RTS                                 ; end of subroutine
```

Listing 1. Reading the MAX1246/MAX1247 with the 68HC11/68L11 SPI Interface
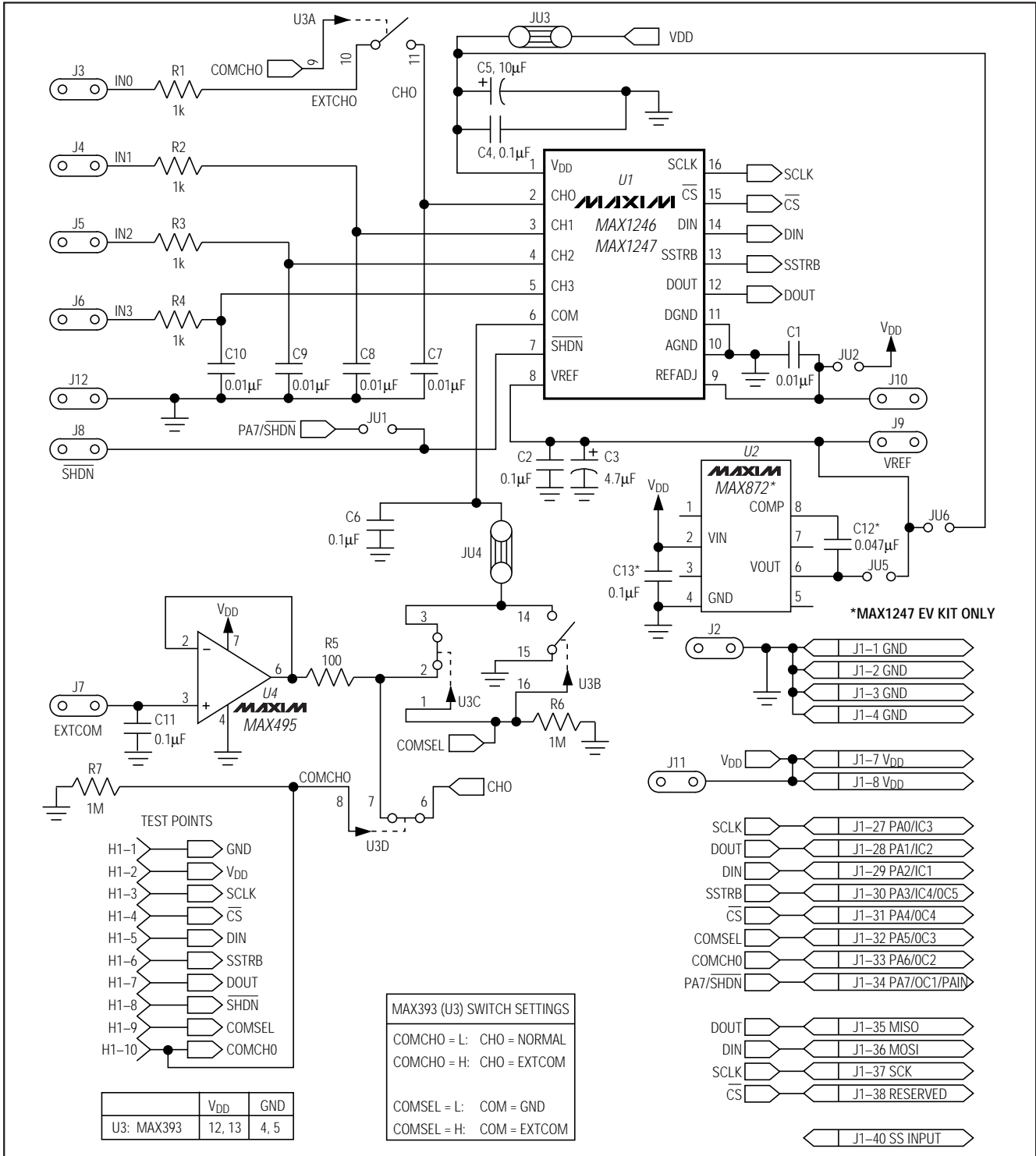
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Figure 1. MAX1246/MAX1247 EV Kit Schematic

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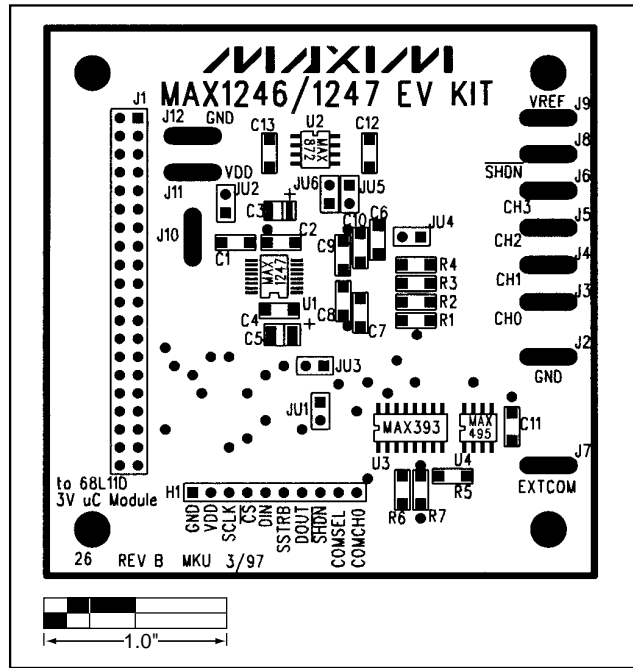
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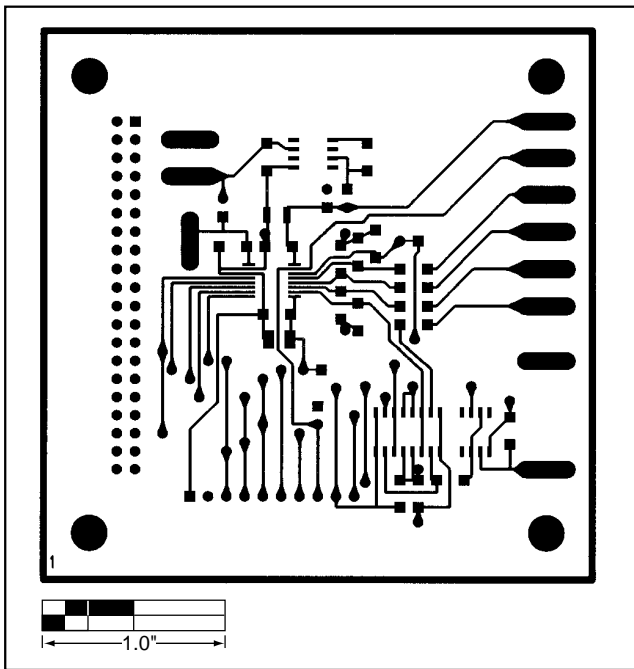
Figure 2. MAX1246/MAX1247 EV Kit Component Placement Guide

Figure 3. MAX1246/MAX1247 EV Kit PC Board Layout—
Component Side

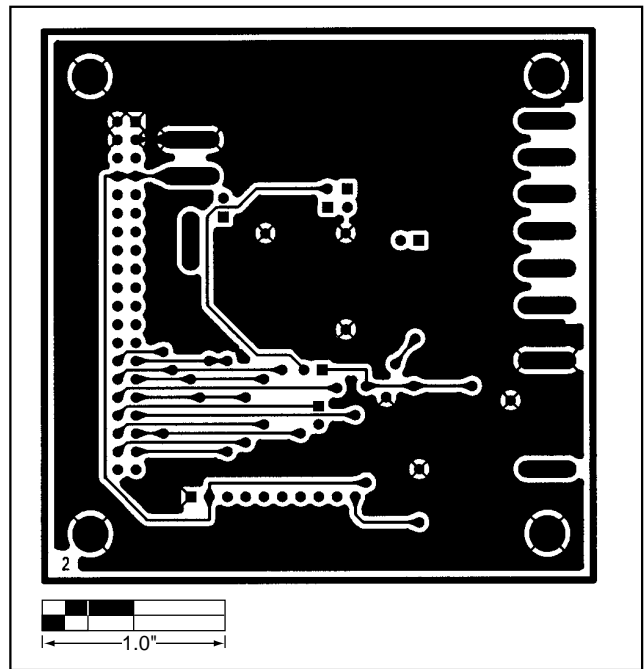Figure 4. MAX1246/MAX1247 EV Kit PC Board Layout—
Solder Side

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NOTES

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Authorized Distributor

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