#### **General Description**

The MAX2839 evaluation kit (EV kit) simplifies testing of the MAX2839 receive and transmit performance in WiMAX<sup>TM</sup> applications operating in the 2.3GHz to 2.7GHz band. The EV kit provides 50 $\Omega$  SMA connectors for all RF and baseband inputs and outputs. Differential to singleended and single-ended to differential line drivers are provided to convert the differential I/Q baseband inputs and outputs to single ended.

#### **Component List**

DESIGNATION	QTY	DESCRIPTION
+5V, -5V, VBAT, VCCAUX	4	Test points, PCB red Keystone 5010
B0–B7, CSB, DIN, DOUT, ENABLE, LOAD, PABIAS, RSSI, RXBBIA+, RXBBIA-, RXBBIB+, RXBBIB-, RXBBQA+, RXBBQA-, RXBBQB+, RXBBQB-, RXHP, SCLK, TPCLKOUT, TUNEM, TUNEP, TXBBI+, TXBBI-, TXBBQ+, TXBBQ-, TXRX, VCM	34	Test points, PCB mini-red Keystone 5000
CLKOUT, FREF, RXBBIA, RXBBIB, RXBBQA, RXBBQB, RXINA, RXINB, TXBBI, TXBBQ, TXRF	11	SMA edge-mount connectors, round Johnson 142-0701-801
C1, C3, C8, C21, C22, C24, C30, C36, C38, C41, C42, C44, C49, C76	0	Open, ±10%, 0402 capacitors Murata Leave site open
C2, C15, C54, C56, C68, C69	6	3.9pF ±0.1pF, 0402 capacitors Murata GRM1555C1H3R9B
C4–C7, C10, C13, C17, C18, C35, C40, C43, C45–C48, C50, C51, C52, C59, C60, C67	21	0.1µF ±10%, 0402 capacitors Murata GRM155R61C104K

#### Features

- On-Board Line Drivers and Voltage References
- $50\Omega$  SMA Connectors on All RF and Baseband Ports

### **Ordering Information**

PART	TYPE
MAX2839EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

DESIGNATION	QTY	DESCRIPTION			
C9, C16, C19, C70, C89	5	22pF ±5%, 0402 capacitors Murata GRM1555C1H220J			
C11, C23, C26, C32, C74, C75, C87, C88	8	0.01µF ±10%, 0402 capacitors Murata GRM155R71C103K			
C12, C53, C55, C66	4	10μF ±10%, 0805 capacitors Murata GRM21BR61A106K			
C14	1	2200pF ±10%, 0402 capacitor Murata GRM155R71H222K			
C25, C77	2	1000pF ±10%, 0402 capacitors Murata GRM155R71H102K			
C27	1	2.2µF ±10%, 0805 capacitor Murata GRM21BR71A225K			
C29, C86	2	1.0μF ±10%, 0402 capacitors Murata GRM155R60J105K			
C33	1	100pF ±5%, 0402 capacitor Murata GRM155C1H101J			
C37, C39	2	2.2µF ±10%, 0603 capacitors Murata GRM188R61A225K			
C79	1	120pF ±5%, 0402 capacitor Murata GRM1555C1H121J			
GND1, GND2	2	Test points, PCB black Keystone 5011			
J17	0	Not installed, 2 x 13-pin header			
J18	1	DB25 horizontal male PCB connector AMP 5747238-4			



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# **Component List (continued)**

DESIGNATION	QTY	DESCRIPTION
JPB0–JPB7, JPENABLE, JPLOAD, JPRXHP, JPTXRX, RXBBBUF1, RXBBBUF2, VBAT_LDO, SYNTH_LDO	16	1 x 3-pin headers Sullins PEC36SAAN
JPCSB, JPDIN, JPDOUT, JPSCLK	0	Not installed, 1 x 3-pin headers
L1, L6, L13–L16	0	Do not install, ±0%, 0402 inductors Murata LQP15MN2N7B02
L2, L4, L5, L7, L9, L10	0	Not installed, inductors
L3, L8	2	3.0nH ±0.1nH, 0402 inductors Murata LQP15MN3N0B02
R1, R7	2	200Ω ±1%, 0402 resistors*
R2, R5, R6, R38	4	$205\Omega \pm 1\%$ , 0402 resistors*
R3, R10	2	226Ω ±1%, 0402 resistors*
R4, R26, R40, R57	4	49.9Ω ±1%, 0402 resistors*
R8, R11, R12, R14–R19, R24, R25, R28, R30, R31, R35, R42, R45, R47, R48, R50, R52–R54, R58–R60	0	Not installed, ±1%, 0402 resistors (leave open)
R9, R13, R23, R27, R29, R32, R39, R41, R55, R56	10	0Ω ±0%, 0402 resistors*
R20, R51	2	750Ω ±1%, 0402 resistors*
R21, R22	2	61.9Ω ±1%, 0402 resistors*
R33, R36	2	$1k\Omega \pm 0\%$ , trimmer potentiometers Bourns 3296W-1-102LF
R34	1	576Ω ±1%, 0402 resistor*
R37	1	332Ω ±1%, 0402 resistor*
SYNTH_LDO	1	1 x 3-pin header Sullins PEC36SAAN
SYNTH_LDO	1	Shorting jumper Sullins SSC02SYAN
T1, T2, T4	3	3.6GHz RF baluns Murata LDB182G5010G-120

DESIGNATION	QTY	DESCRIPTION
U1, U3	2	Low-noise-differential ADC drivers ADI AD8139ARDZ
U2, U5, U6, U15	4	Line receivers (16 SO) Maxim MAX4444ESE+
U4	1	RF transceiver (56 TQFN) Maxim MAX2839
U7	1	Low-dropout linear regulator (5 SOT23) Maxim MAX8887EZK29+
U8, U9	2	SN74LVTH244ADB TI N74LVTH244ADBR
U10	1	Low-dropout voltage reference (3 SOT23) Maxim MAX6062AEUR+
U11	1	40MHz TCXO Kyocera KT3225N40000ECV28ZAA
U13	1	Ultra-low-noise LDO Maxim MAX8510EXK29+ (5 SC70)
VCCCP, VCCLNA_A, VCCLNA_B, VCCRXBB1, VCCRXBB2, VCCRXMX, VCCTCXO, VCCTXMX, VCCVCO, VCCTXAL, VCC_DB, VCC_PAD, VCC_REF	0	Not installed, 1 x 2-pin headers
Y1	0	Not installed, quartz crystal
_	1	PCB: MAX2839 EVALUATION KIT+

\*Use lead-free parts only.

### **Component Suppliers**

SUPPLIER	WEBSITE
Analog Device	www.analog.com
Digi-Key Corp.	www.digikey.com
Keystone Electronics	www.keyelco.com
Murata Americas	www.murataamericas.com

Note: Indicate that you are using the MAX2839 when contacting these component suppliers.

#### **Quick Start**

The MAX2839 EV kit is fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section to test the devices.

#### **Recommended Test Equipment**

This section lists the recommended test equipment to verify the operation of the MAX2839. It is intended as a guide only and substitutions may be possible.

- MAX2839 EV kit
- MAX2839 DC supply capable of delivering +5V and 250mA of continuous current
- DC supply capable of delivering -5V and 250mA of continuous current
- DC supply capable of delivering +3.3V and 250mA of continuous current
- One HP 8648 or equivalent signal source capable of generating 0dBm up to 2.7GHz
- Two HP or equivalent arbitrary waveform generators
- One HP 8561E or equivalent RF spectrum analyzer with a minimum 100kHz to 3GHz frequency range
- One HP 437B power meter and power head
- PC laptop or tablet with Microsoft Windows XP<sup>®</sup>, Windows<sup>®</sup> 7, 8 OS and a spare USB port
- USB-A male to USB-B male cable
- US keyboard

#### **Connections and Setup**

The EV kit is fully assembled and factory tested. Follow the instructions below to test the devices. This section provides step-by-step instructions for getting the EV kit up and running in all modes:

1) Install and run the MAX2839 control software. Select MAX2839 Ev.Kt for "select IC" under Options.

Windows and Windows XP are registered trademarks and registered service marks of Microsoft Corporation.

- Connect the PC to the INTF3000 interface board using the USB-A male to USB-B male cable. On INTF3000, place a jumper between pins 1-2 of JU1 (VBUS Pos). Connect the 25-pin connector of the INTF3000 (J4) directly to the 25-pin connector on the EV kit (J18).
- 3) With the power supply turned off, connect the +3.3V power supply to VBAT and VCCAUX. Connect the power-supply ground to the header labeled GND.
- 4) With the power supply turned off, connect the +5V power supply to the +5V pin and the -5V power supply to the -5V pin. Connect the power-supply ground to the header labeled GND. Connect all the power-supply grounds together.
- 5) Set the RXBBBUF jumper across pins 1-2 to enable the Rx baseband buffers.
- 6) Turn on the +3.3V power supply, and the +5V and -5V power supplies.
- 7) In the enables panel of the software, check the EN\_SPI box to enable the 3-wire interface.
- Adjust the Tx common-mode potentiometer (R36) until measuring 0.9V common-mode voltage at the VCM test point.
- In the register panel of the software, set ENABLE to 0 and RXTX to 1 to put the IC into standby mode.
- 10) In the synth panel of the software, set the LO frequency to 2500MHz.

#### **Receive Mode**

- Use the power meter to calibrate the RF signal generator to deliver -98dBm at 2501MHz. After calibration, turn the RF signal generator off, disconnect it from the power meter, and connect it to the RXINA port of the EV kit.
- Connect either the I or the Q baseband output of receiver A to a spectrum analyzer. Set the center frequency to 1MHz and the span to 1MHz.

- 3) In the register panel of the software, enter the recommended register setting shown in Figure 1 for operating the MAX2839 in steady state receive mode bench measurement. This setup fixes the VGA highpass corner at 1kHz.
- 4) Press the SEND ALL button.
- 5) In the register panel of the software, set ENABLE and RXTX to be 1 to activate the receive path.
- In the Rx panel of the software, toggle the LNA gain enable and the baseband VGA enable both to be SPI. Set both of the gain controls to be max.
- Turn on the RF signal source. The output CW tone at 1MHz should be approximately 0dBm.

#### **Transmit Mode**

- Connect the spectrum analyzer to the TXRF port. Set the center frequency to 2500MHz and the span to 5MHz.
- Connect a 1MHz I/Q signal to pins TXBBI and TXBBQ, respectively. Set the input amplitude of each channel to 90mV<sub>RMS</sub> with 90° phase shift.
- In the register panel of the software, set ENABLE to 1 and RXTX to 0 to activate the transmit path.
- 4) In the register panel of the software, enter the recommended register setting shown in Figure 2.
- 5) Press the SEND ALL button.

Exit Options Help	Settings				
Registers Enables	Synth RX TX Misc	Defaults	Send All	🖶 LOCK 🕇 🗖	
RXENABLE	00000000000000 9876543210	000 Send	Block SPI En.	160000011101 01 Send	
BXRF1	10000001100 9876543210	0 00C Send	FRAC1	1701010101101155 Send Control Pin 9 8 7 6 5 4 3 2 1 0	<u>s:</u>
RXRF2	2001000001	081 Send	FRAC2	180101010101011155 Send RX TXRX	
RXRF & LPF	30110111001 9876543210	1B9 Send	INT DIV.	1901010100111 153 Send 0 LOAD	
LPF	41111100110	) 3E6 Send	SYNTH1	2011 0 0 11 0 0 1 0 0 1 249 Send	
RX1 LPF & VGA	501000000000 9876543210		SYNTH2	21 0 0 0 0 1 0 1 1 0 1 0 2 Send Pulse "LOA 9 8 7 6 5 4 3 2 1 0	.D''
RX2 LPF & VGA	60000000000000 9 8 7 6 5 4 3 2 1 0		VAS	220111010101011A9 Send	
RSSI & VGA	71000001000	) 208 Send	LO CONFIG.	231001001111124F Send 9876543210	
RXTOP & BIAS	81000100010 9876543210	) 222 Send	XTAL	24011100000000 180 Send	
RX_TOP	90000101000 9876543210	028 Send	VCO	25000000000000000000	
TX_TOP		0 00C Send	LOGEN	2611111000000 3C0 Send	
Temp. Sens.	1100101100100 9876543210	) OB4 Send	TXLO I/Q	27 1 0 1 0 0 0 0 0 0 280 Send	
HPFSM1	1210010011111 9 8 7 6 5 4 3 2 1 0	24F Send	PADAC	280011000000 Send	
HPFSM2	13010101010000 9876543210	) 150 Send	TX Gain	29 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
HPFSM3	1401111000101 9876543210	1C5 Send	TX DC Cor. I	30]1 [1 0 0 0 0 0 0 0 0 300 Send Send All	
HPFSM4	151000111001 9876543210	239 Send	TX DC Cor. Q	311 0 1 1 0 0 0 0 0 0 20 Send Read All	

Figure 1. Receive Mode Register Setting

6) Enable the output of the baseband signal sources. The desired tone, LO leakage, and the sideband appear at 2501MHz, 2500MHz, and 2499MHz, respectively. Set the Tx VGA gain to be 3dB below the max gain. The power level of the desired tone is approximately -1dBm in the spectrum analyzer marker reading, assuming that the balun on board contributes 1dB of loss.

#### Layout Considerations

The EV kit can serve as a guide for board layout. Keep PCB trace lengths as short as possible to minimize parasitic inductance. Also, keep decoupling capacitors as close to the IC as possible with a direct connection to the ground plane.

#### **Power-Supply Layout**

To minimize coupling between different sections of the IC, use a "star" power-supply routing configuration with a large decoupling capacitor at a central V<sub>CC</sub> node. The V<sub>CC</sub> traces branch out from this node, each going to a separate V<sub>CC</sub> node in the circuit. Place a bypass capacitor as close as possible to each supply pin. This arrangement provides local decoupling at each V<sub>CC</sub> pin. Use at least one via per bypass capacitor for a low-inductance ground connection. Do not share the capacitor ground vias with any other branch.

<u>E</u> xit <u>O</u> ptions <u>H</u> elp	Settings					
Registers Enables	Synth F	RX TX	Misc	Defaults	Send All	🔮 LOCK ? 🥅
RXENABLE	0000 987	000		000 Send	Block SPI En.	16000001110101 Send
BXRF1	1000	0000 654	1100 3210	00C Send	FRAC1	170101010101155 Send Control Pins: 9 8 7 6 5 4 3 2 1 0
RXRF2	2001	0000 654	0001	081 Send	FRAC2	180 101 010101011155 Send TX TXRX
RXRF & LPF				1B9 Send	INT DIV.	1901010100111153 Send 0 LOAD
LPF		110 654		3E6 Send	SYNTH1	201 0 0 1 0 0 1 0 0 1 249 Send 0 RXHP
RX1 LPF & VGA		0000		100 Send	SYNTH2	21 0 0 0 0 1 0 1 1 0 1 02 Send Pulse "LOAD"
RX2 LPF & VGA	6000 987		0000 3210	000 Send	VAS	22011010101011001 1A9 Send
RSSI & VGA	7100			208 Send	LO CONFIG.	2310010011111124F Send
RXTOP & BIAS	8100 987		0010	222 Send	XTAL	24011100000000 180 Send
RX_TOP	9000	010 654	1000 3210	028 Send	VCO	25000000000000000000000000000000000000
TX_TOP	10000	0000 654	1100 3210	OOC Send	LOGEN	2611111000000 3C0 Send
Temp. Sens.	11001	011		OB4 Send	TXLO I/Q	2710100000000 9876543210
HPFSM1	12100	100 654		24F Send	PADAC	280011000000000000000000000000000000000
HPFSM2	13010 987	101		150 Send	TX Gain	29 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
HPFSM3	14011	100 654	0101	1C5 Send	TX DC Cor. I	30111000000000000000000000000000000000
HPFSM4	15 <mark>100</mark> 987	0000 654	0001	201 Send	TX DC Cor. Q	311 0 1 1 0 0 0 0 0 0 20 Send Read All

Figure 2. Transmit Mode Register Setting

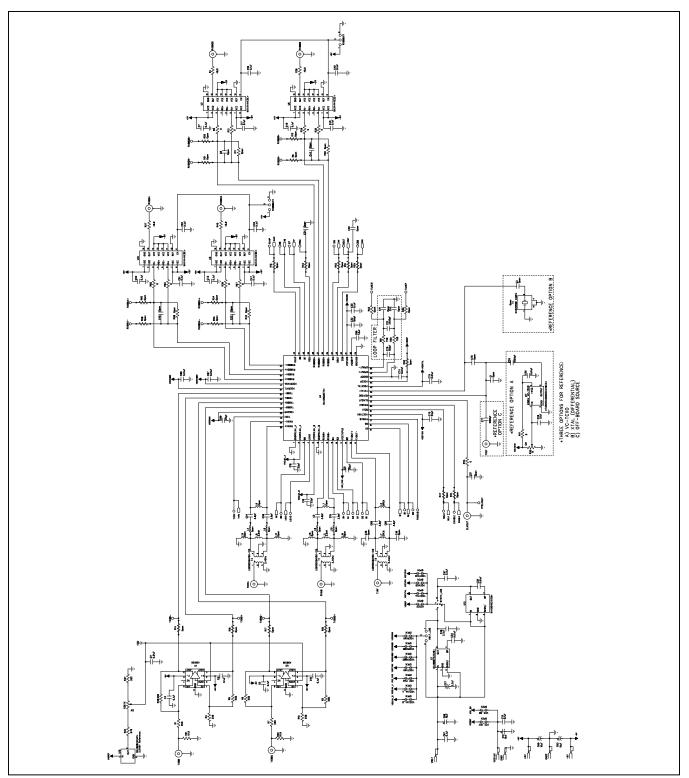


Figure 3a. MAX2839 EV Kit Schematic (Sheet 1 of 2)

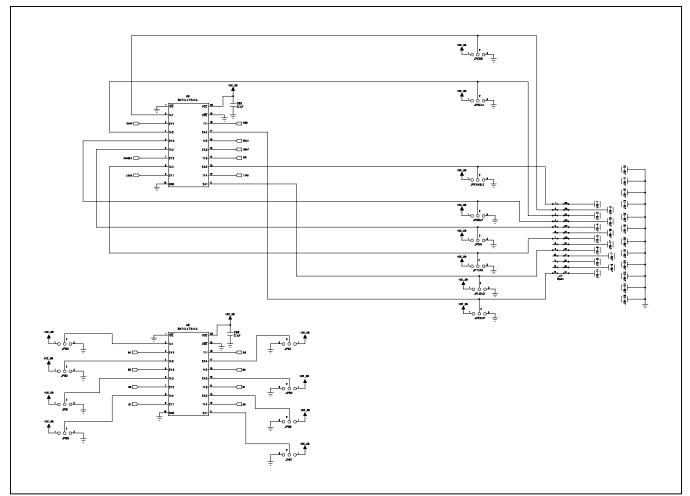


Figure 3b. MAX2839 EV Kit Schematic (Sheet 2 of 2)

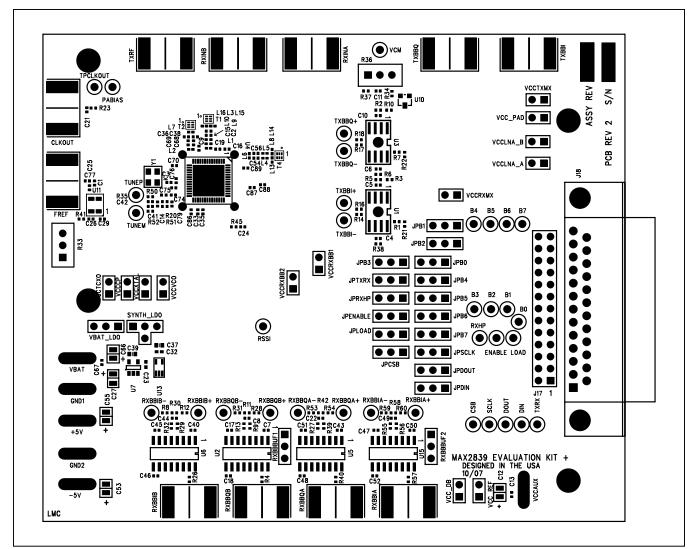


Figure 4. MAX2839 EV Kit PCB Layout—Top Silkscreen

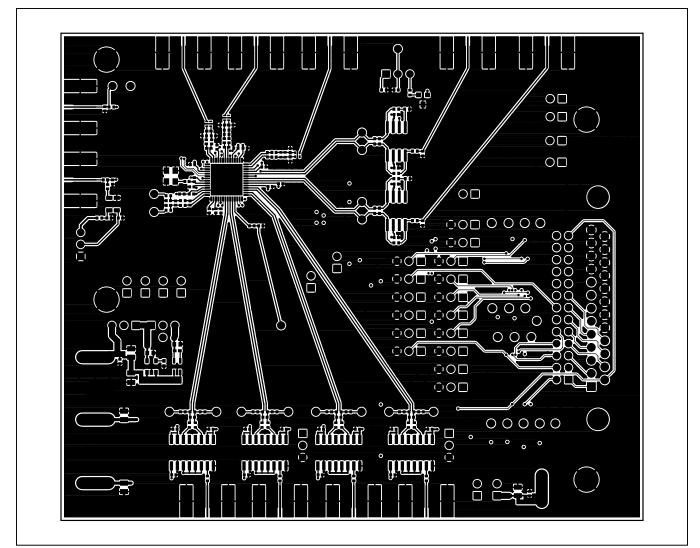


Figure 5. MAX2839 EV Kit PCB Layout—Component Side

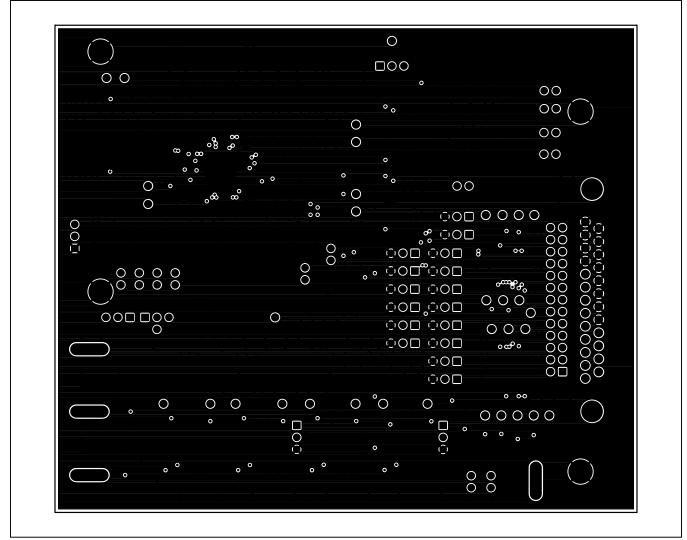


Figure 6. MAX2839 EV Kit PCB Layout—Inner Layer 2, Ground Layer

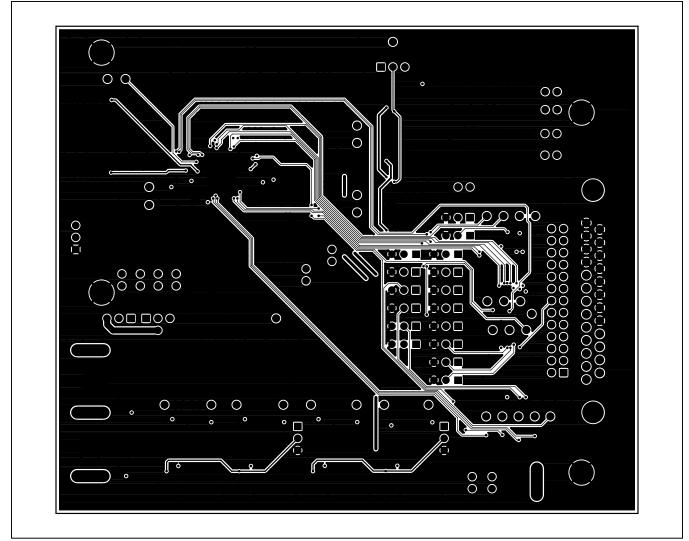


Figure 7. MAX2839 EV Kit PCB Layout—Inner Layer 3, Routes

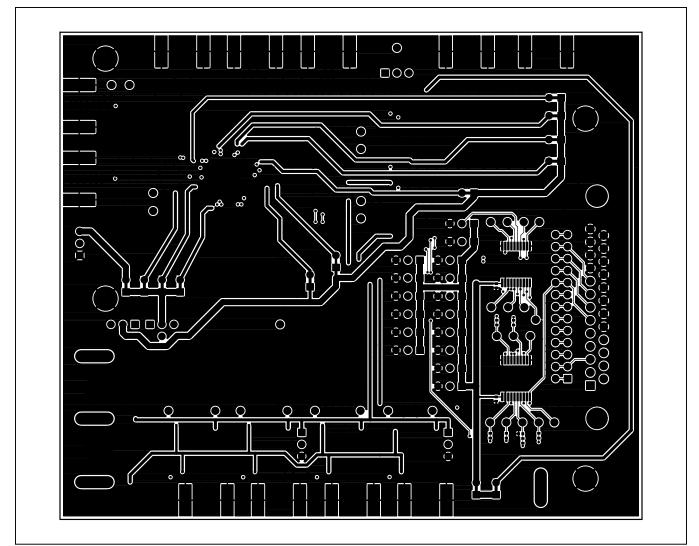


Figure 8. MAX2839 EV Kit PCB Layout—Solder Side

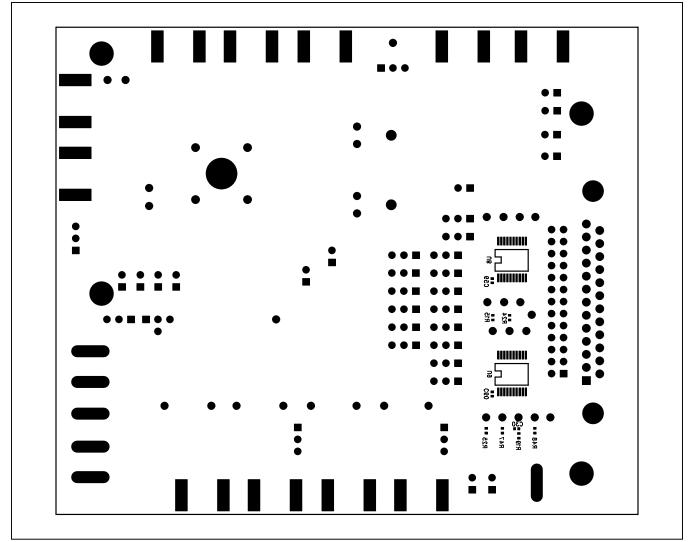


Figure 9. MAX2839 EV Kit PCB Layout—Bottom Silkscreen

### Evaluates: MAX2839

### **Revision History**

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/08	Initial release	—
1	11/14	Updated Quick Start section	3

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