19-4221; Rev 0; 7/08

MAX2838 Evaluation Kit

Evaluates: MAX2838

General Description

The MAX2838 evaluation kit (EV kit) simplifies testing of the MAX2838 receive and transmit performance in WiMAX™ applications operating in the 3.3GHz to 3.9GHz ISM band. The EV kit provides 50Ω SMA connectors for all RF and baseband inputs and outputs. Differential to single-ended and single-ended to differential line drivers are provided to convert the differential I/Q baseband inputs and outputs to single ended.

Features

- **On-Board Line Driver and Voltage Reference**
- **50Ω SMA Connectors on All RF and Baseband Ports**
- **PC Control Software Available at www.maxim-ic.com/evkitsoftware**

Ordering Information

PART	TYPE
MAX2838EVKIT+	EV Kit

+Denotes lead-free and RoHS compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C3, C8, C24, C28, C30, C33, C38, C41–C44, C47, C75, C77	0	Not installed, capacitors
C4–C7, C10, C13, C17, C18, C40, C45, C46, C59, C60, C67	14	0.1µF ±10% ceramic capacitors (0402) Murata GRM155R61A104K
C9, C16, C31, C70, C74, C86, C89	7	0.033µF ±10% ceramic capacitors (0402) Murata GRM155R71A333K
C11, C23, C26, C32	4	0.01µF ±10% ceramic capacitors (0402) Murata GRM155R71E103K
C12, C53, C55, C66	4	10µF ±10% tantalum capacitors—R-case AVX TAJR106K006R
C14	1	2200pF ±10% ceramic capacitor (0402) Murata GRM155R71H222K
C19, C88	2	0.15µF ±10% ceramic capacitors (0402) Murata GRM155R61A154K
C20, C29, C35	3	1.0µF ±10% ceramic capacitors (0805) Murata GRM155R60J105K
C25	1	1000pF ±5% ceramic capacitor (0402) Murata GRM1555C1H102J
C27	1	2.2µF ±10% tantalum capacitor—R-case AVX TAJR225K006R
C37, C39	2	2.2µF ±10% ceramic capacitors (0603) Murata GRM188R61A225K
C48, C49	2	3.3pF ±0.1pF ceramic capacitors (0402) Murata GRM1555C1H3R3B
C68, C69	2	4.7pF ±0.1pF ceramic capacitors (0402) Murata GRM1555C1H4R7B
C79	1	120pF ±5% ceramic capacitor (0402) Murata GRM1555C1H121J
C81, C83	2	2.4pF ±0.1pF ceramic capacitors (0402) Murata GRM1555C1H2R4B
J17	0	Not installed, 2 x 13-pin header
J18	1	DB25 horizontal male PCB connector AMP 5747238-4
L1	1	2.2nH ±0.1nH inductor (0402) Murata LQP15MN2N2B02
L2, L4, L5	0	Not installed, inductors
L7	1	4.7nH ±0.1nH inductor (0402) Murata LQP15MN4R7B02
R1, R7	2	200Ω ±1% resistors (0402)
R2, R5, R6, R38	4	205Ω ±1% resistors (0402)
R3, R10	2	226Ω ±1% resistors (0402)
R4, R26	2	49.9Ω ±1% resistors (0402)

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R8, R11, R15, R19, R23, R24, R25, R27, R28, R30, R35, R39, R41, R43, R45–R50, R52–R64, R66	0	Not installed, resistors
R12, R31, R40, R42, R65, R67	0	Not installed, resistors
R20, R51	2	750Ω ±5% resistors (0402)
R21, R22	2	61.9Ω ±1% resistors (0402)
R33, R36	2	1kΩ trimmer potentiometers Bourns 3296W-1-102LF
R34	1	620Ω ±5% resistor (0402)
R37	1	301Ω ±1% resistor (0402)
R44	1	10Ω ±5% resistor (0402)
R68	1	0Ω ±5% resistor (0402)
T1, T2	2	3.6GHz RF baluns Murata LDB213G6010C-001
T3	1	4.5GHz RF balun Murata LDB184G5010C-110
U1, U3	2	Low-noise differential ADC drivers ADI AD8139ARDZ
U2, U6	2	Maxim MAX4444ESE+ (16 narrow SO)
U4	1	Maxim MAX2838ETM+ (48 Thin QFN-EP, 6mm x 6mm x 0.8mm)
U7	1	Low-dropout linear regulator Maxim MAX8887EZK29+ (5 SOT23)
U8, U9	2	SN74LVTH244ADB Texas Instruments SN74LVTH244ADBR
U10	1	Low-dropout voltage reference Maxim MAX6062AEUR+ (3 SOT23)
U11	1	40MHz TCXO Kyocera KT3225N40000ECV28ZAA
U13	1	Ultra-low-noise LDO Maxim MAX8510EXK29+ (5 SC70)
U14	0	Not installed, ultra-low-noise LDO

DESIGNATION	QTY	DESCRIPTION
B1–B7, CSB, DIN, DOUT, ENABLE, PABIAS, RXHP, RXTX, SCLK, TPCLKOUT, TPSPIDOUT, TXENOUT/RSSI, VCM	19	Test points, PCB mini-red Keystone 5000
CLKCOUT, RXBBI, RXBBQ, RXRF, TXBBI, TXBBQ, TXRF, VCOIO	8	SMA edge-mount connectors, round Johnson 142-0701-801
FREF	0	Not installed, SMA edge-mount connector
GND1, GND2	2	Test points, PCB black Keystone 5011
JPB1–JPB7, JPSHDNB, RXBBBUF	9	1 x 3-pin headers Sullins PEC36SAAN
JP2CSB, JPENABLE, JPRXHP, JPRXTX, JPSHDNB, JPSPICLK, JPSPIDIN	0	Not installed, 1 x 3-pin headers
VCCCP, VCCDB, VCCDIG, VCCLNA, VCCLO, VCCPAD, VCCREF, VCCRXFL, VCCRXMX, VCCRXVGA, VCCTCXO, VCCTXMX, VCCVCO, JPRXBBI+, JPRXBBI-, JPRXBBQ+, JPRXBBQ-, JPTXBBI+, JPTXBBI-, JPTXBBQ+, JPTXBBQ-, TUNE	0	Not installed, 1 x 2-pin headers
+5V, -5V, VBAT, VCCAUX	4	Test points, PCB red Keystone 5010
—	8	Shunts (JPB1–JPB7, RXBBBUF) Sullins SSC02SYAN
—	1	MAX2838 EV Kit+ PCB

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Analog Device	800-262-5643	www.analog.com
Digi-Key Corp.	800-344-4539	www.digikey.com
Keystone Electronics Corp.	800-221-5510	www.keyelco.com
Murata Mfg. Co., Ltd.	770-436-1300	www.murata-northamerica.com

Note: *Indicate that you are using the MAX2838 when contacting these component suppliers.*

Quick Start

Recommended Test Equipment

This section lists the recommended test equipment to verify the operation of the MAX2838. It is intended as a guide only and substitutions may be possible:

- 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 3.9GHz
- Two HP or equivalent arbitrary waveform generators
- One HP 8561E or equivalent RF spectrum analyzer with a minimum 100kHz to 3GHz frequency range
- One TDS3012 or equivalent oscilloscope with 200MHz bandwidth
- One HP 437B power meter and power head
- A user-supplied Windows® 95/98/2000/XP (or later) PC with an available parallel port
- One female-to-male 25-pin parallel straight-through cable

Connections and Setup

The MAX2838 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 MAX2838 control software. Select MAX2838 for MAXIM IC type under Options.
2) To control the EV kit through the 4-wire interface, connect the female-to-male 25-pin parallel straight-through cable between the PC and the EV kit.
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.
8) Adjust the Tx common-mode potentiometer (R36) until measuring 0.9V common-mode voltage at the VCM test point.
9) In the Registers 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 3600MHz.

Receive Mode

1) Use the power meter to calibrate the RF signal generator to deliver -98dBm at 3601MHz. After calibration, turn the RF signal generator off, disconnect it from the power meter, and connect it to the RXRF port of the MAX2838 EV kit.
2) Connect either the I or the Q baseband output to a spectrum analyzer. Set the center frequency to be 1MHz and the span to be 1MHz.
3) In the Registers panel of the software, enter the recommended register setting shown in Figure 1 for operating the MAX2838 in steady-state receive mode bench measurement. This setup fixes the VGA highpass corner at 1kHz.

Windows is a registered trademark of Microsoft Corp.

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4) Press the SEND ALL button.
5) In the Registers panel of the software, set ENABLE and RXTX to be 1 to activate the receive path.
6) 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.
7) Turn on the RF signal source. The output CW tone at 1MHz should be approximately 0dBm.

Transmit Mode

1) Connect the spectrum analyzer to the TXRF port. Set the center frequency to be 3600MHz and the span to be 5MHz.
2) Connect a 1MHz I/Q signal to pins TXBBI and TXBBQ, respectively. Set the input amplitude of each channel to 90mV$_{RMS}$ with 90 degrees phase shift.
3) In the Registers panel of the software, set ENABLE to be 1 and RXTX to be 0 to activate the transmit path.
4) In the Registers panel of the software, enter the recommended register setting shown in Figure 2.
5) Press the Send All button.
6) Enable the output of the baseband signal sources. The desired tone, LO leakage, and the sideband appear at 3601MHz, 3600MHz, and 3599MHz,

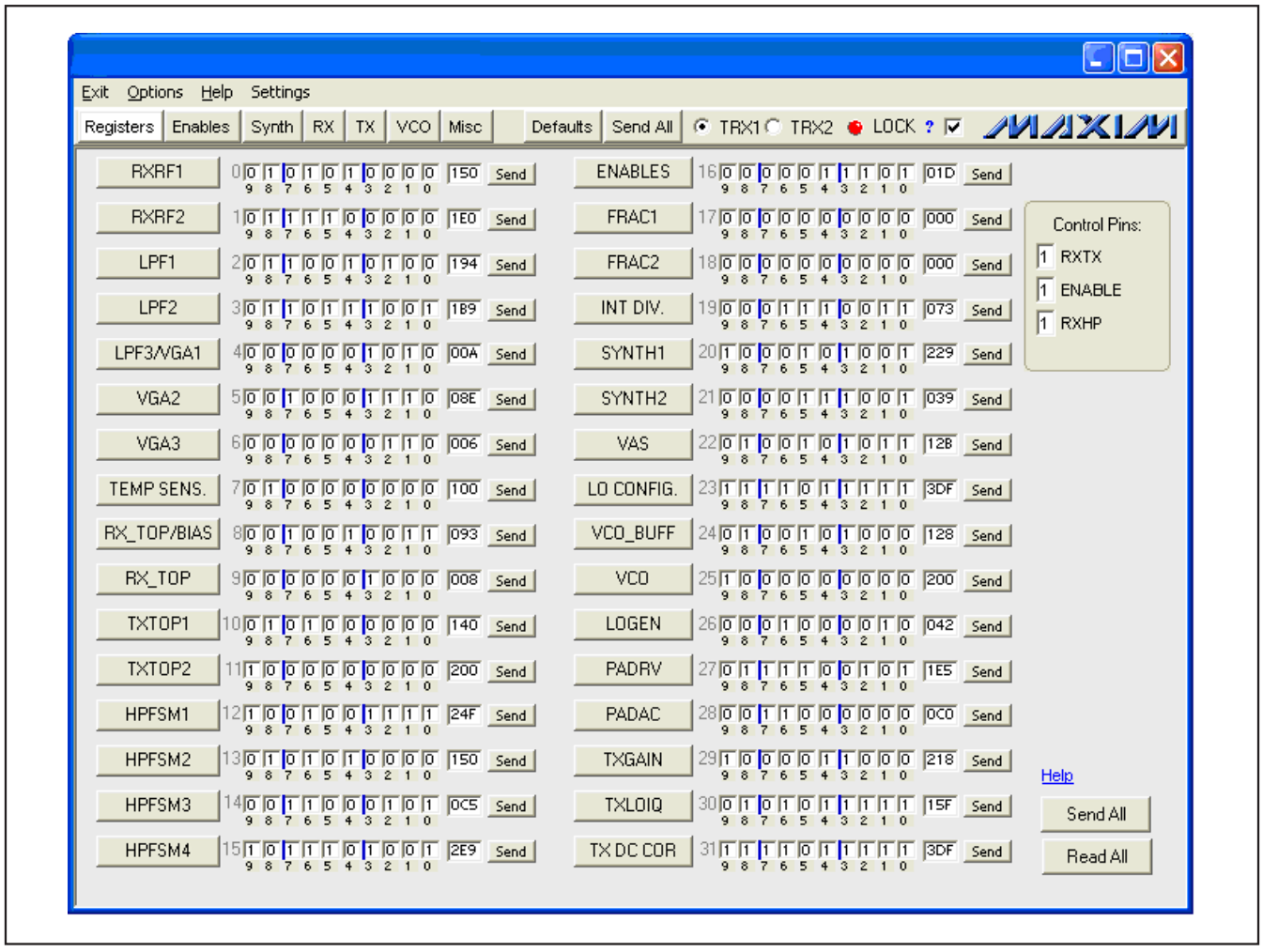

Figure 1. Receive Mode Register Setting

respectively. In the TX panel of the software, toggle TXVGA to be SPI. Set the Tx VGA gain to be 3dB back from the max gain. The power level of the desired tone is approximately -1.5dBm in the spectrum analyzer marker reading, assuming that the balun on board contributes a 1dB loss.

Layout Considerations

The MAX2838 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_{CC} node. The V_{CC} traces branch out from this node, each going to a separate V_{CC} node in the circuit. Place a bypass capacitor as close to each supply pin as possible. This arrangement provides local decoupling at each V_{CC} 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.

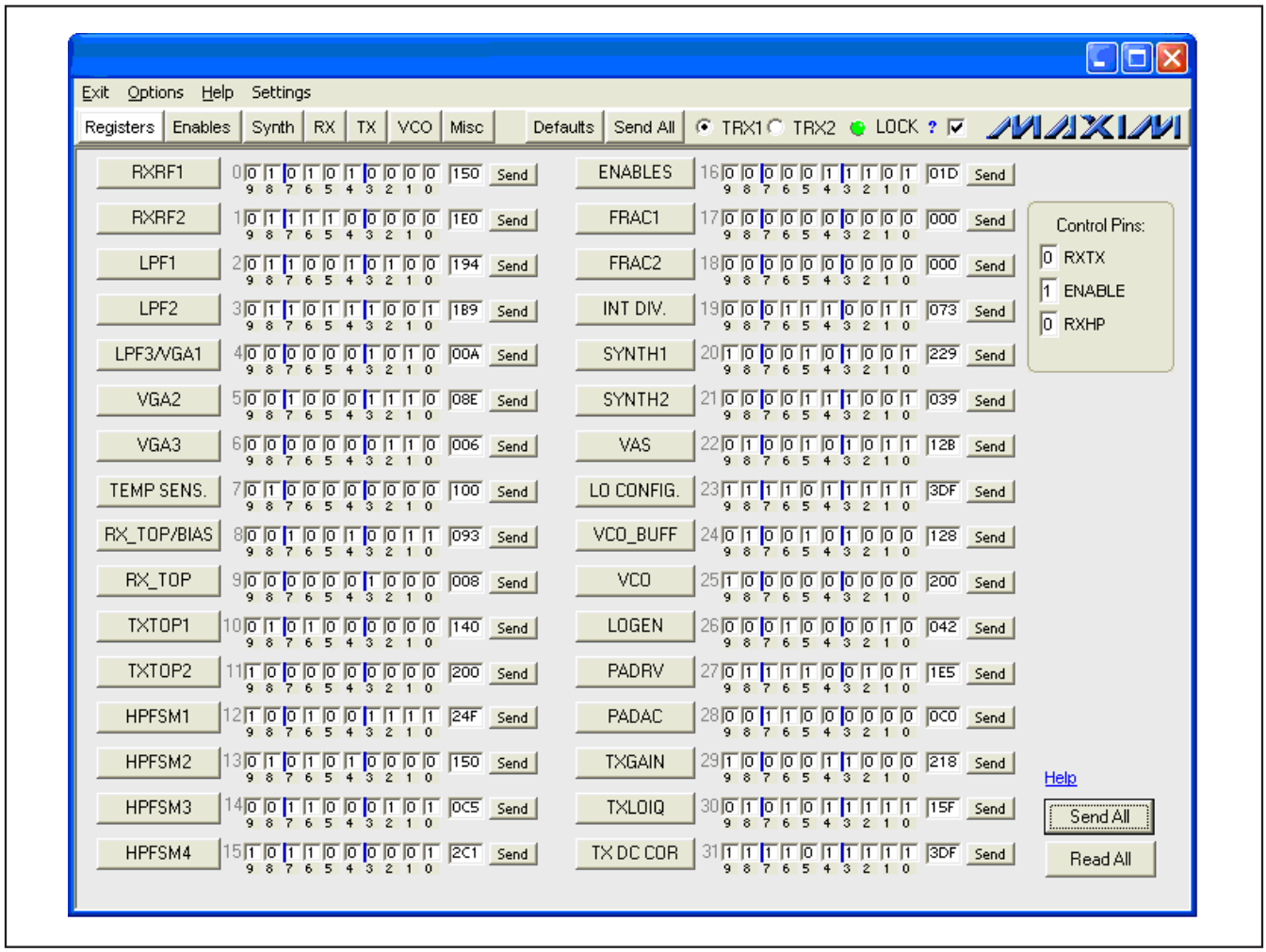

Figure 2. Transmit Mode Register Setting

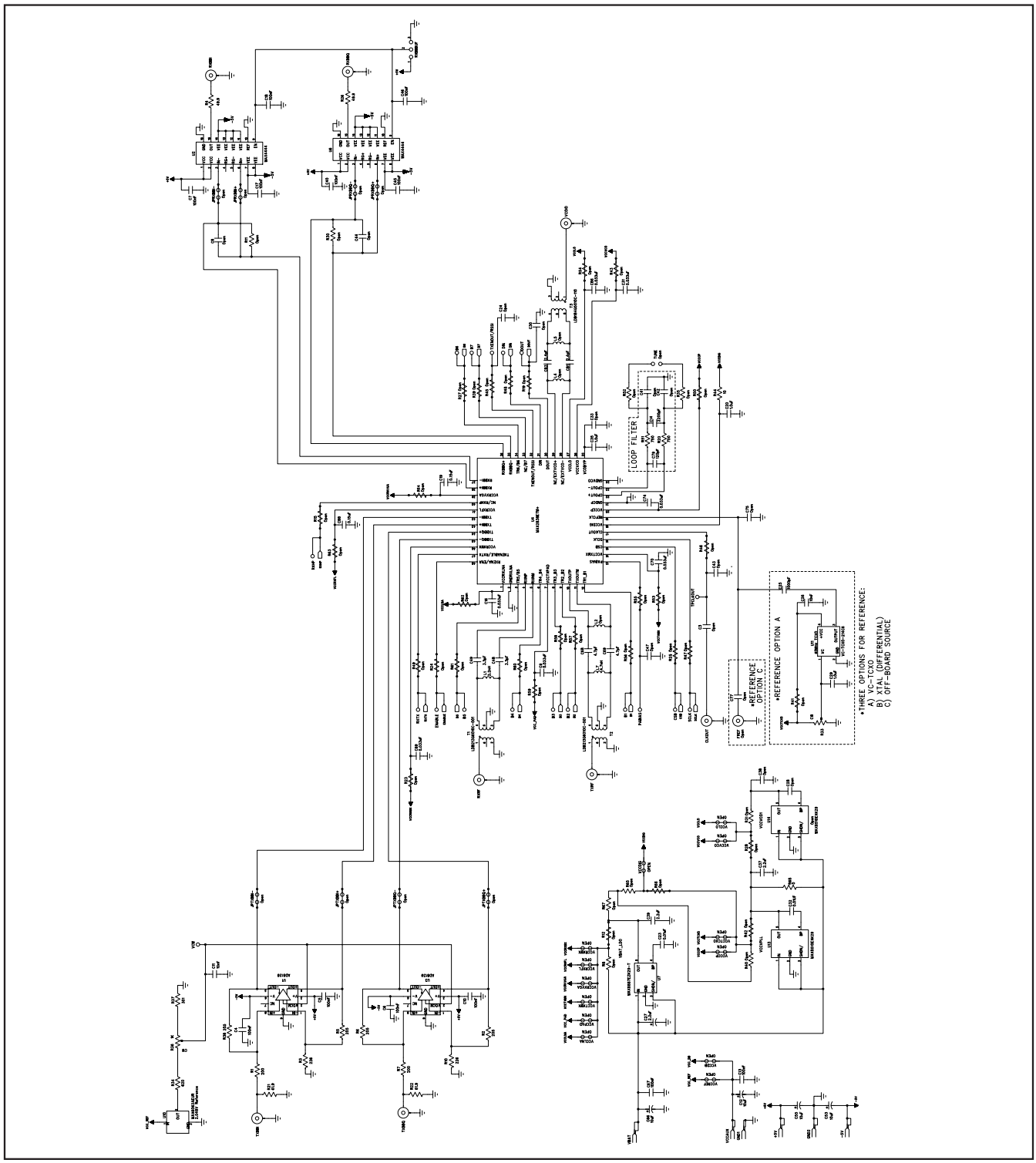

Figure 3a. MAX2838 EV Kit Schematic (Sheet 1 of 2)

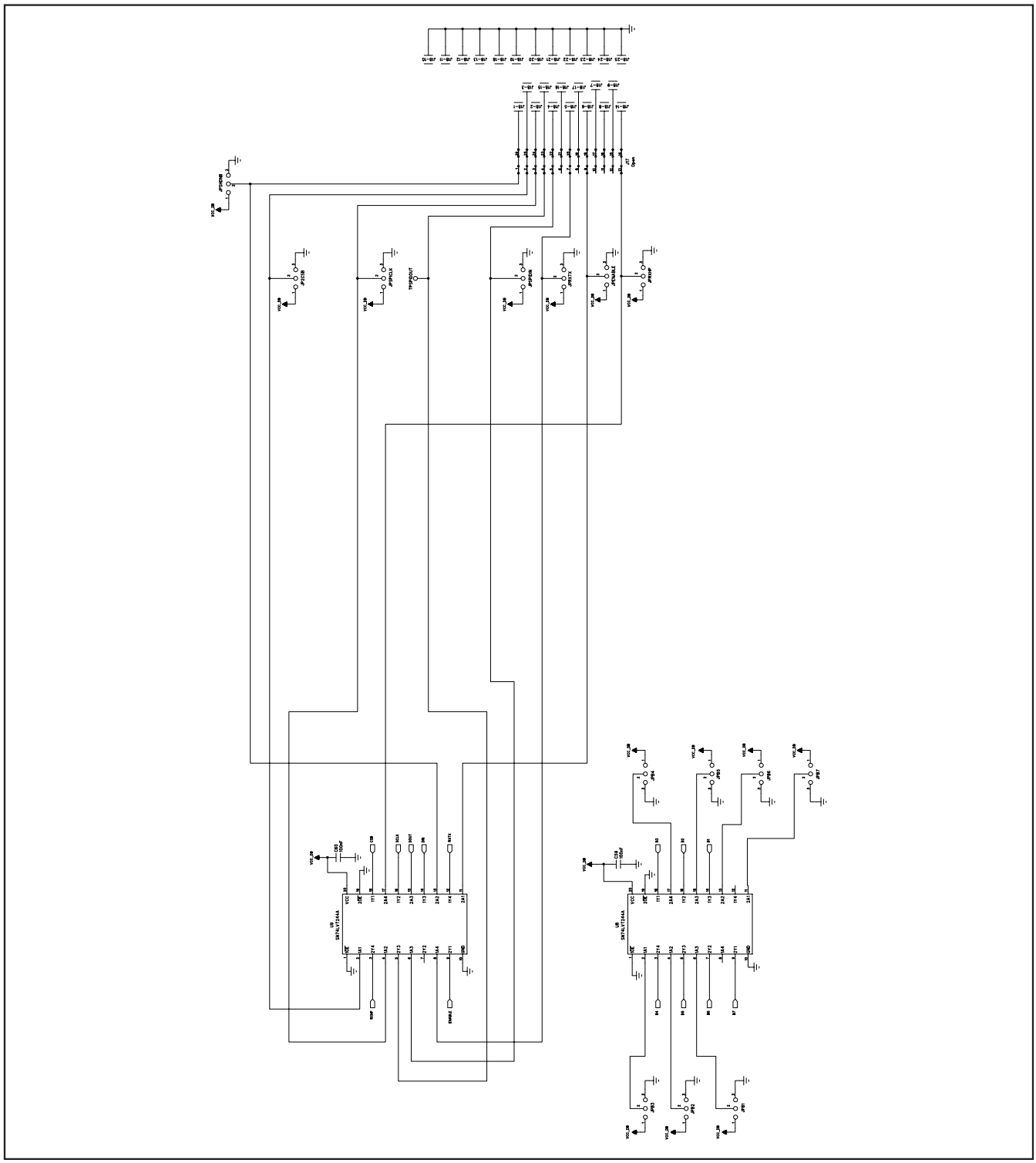

Figure 3b. MAX2838 EV Kit Schematic (Sheet 2 of 2)

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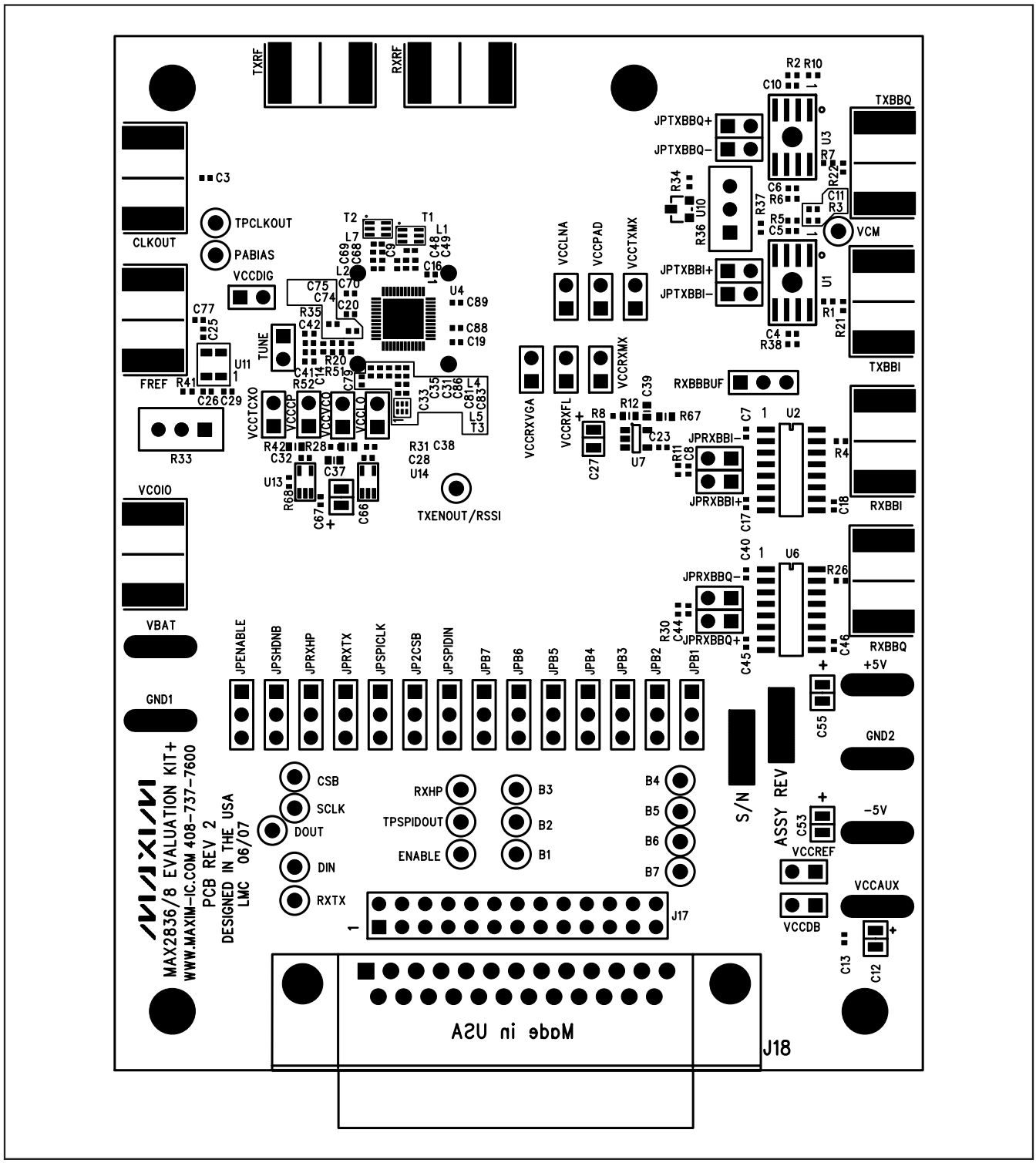

Figure 4. MAX2838 EV Kit PCB Layout—Top Silkscreen

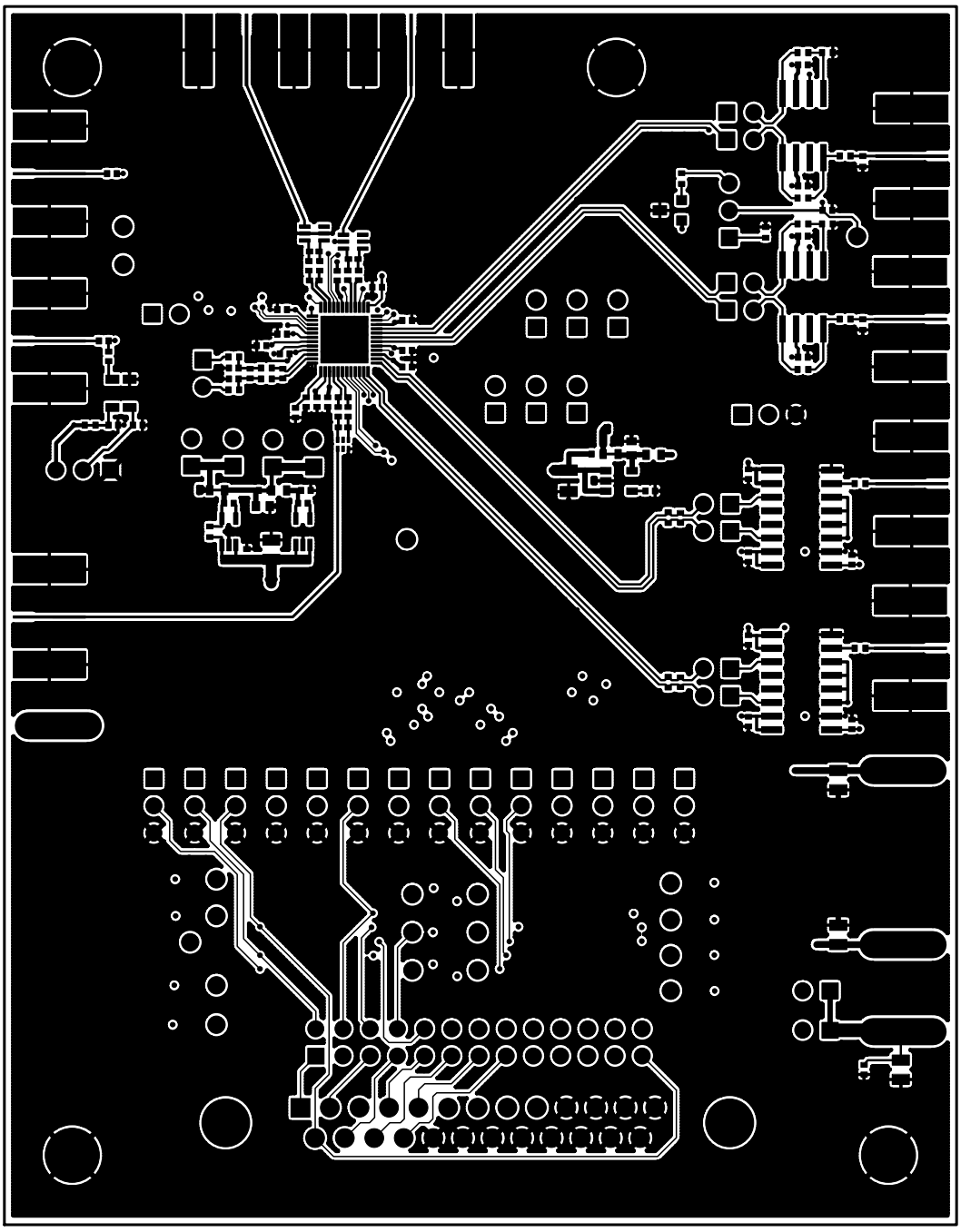

Figure 5. MAX2838 EV Kit PCB Layout—Component Side

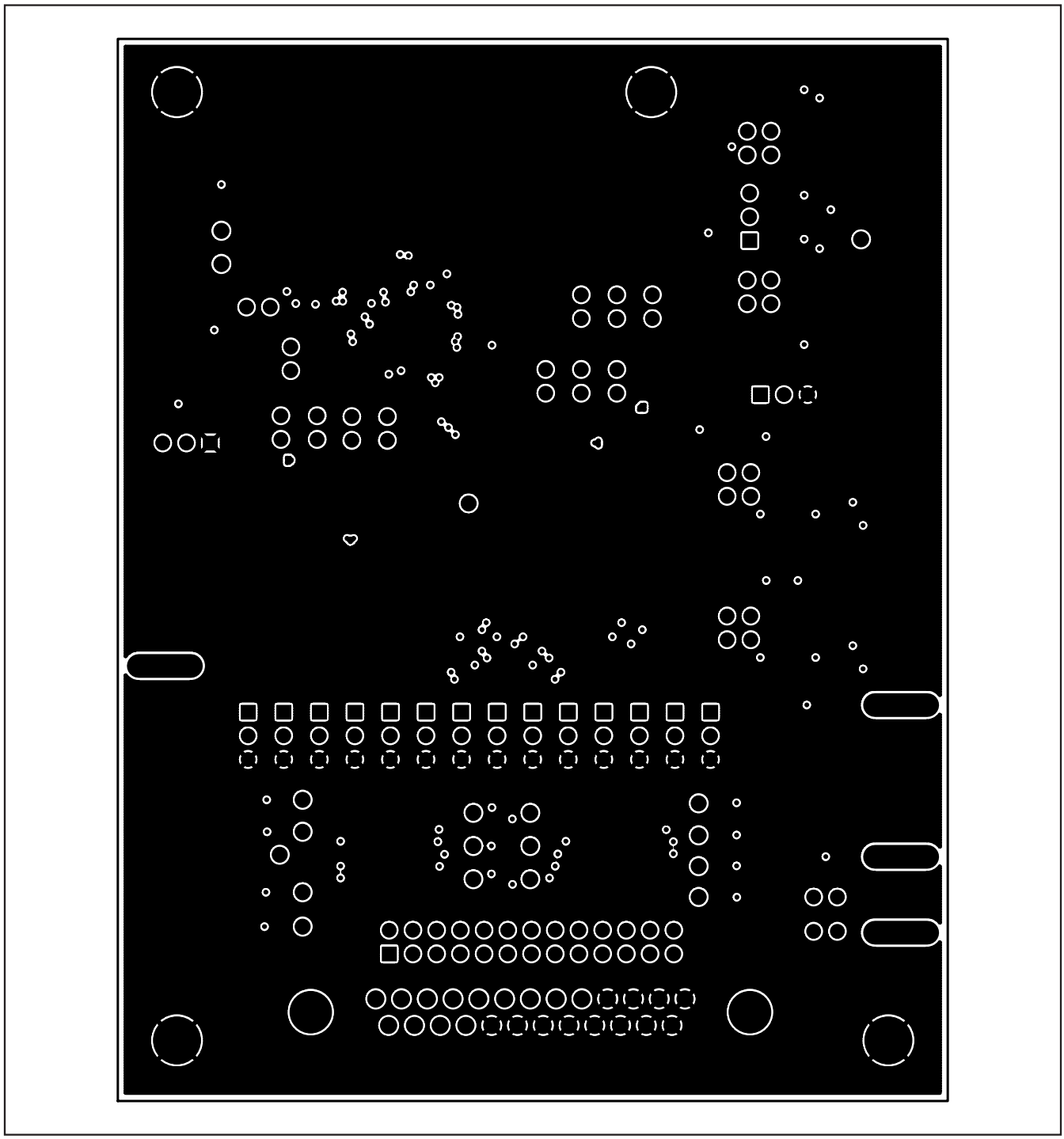

Figure 6. MAX2838 EV Kit PCB Layout—Inner Layer 2, Ground Layer

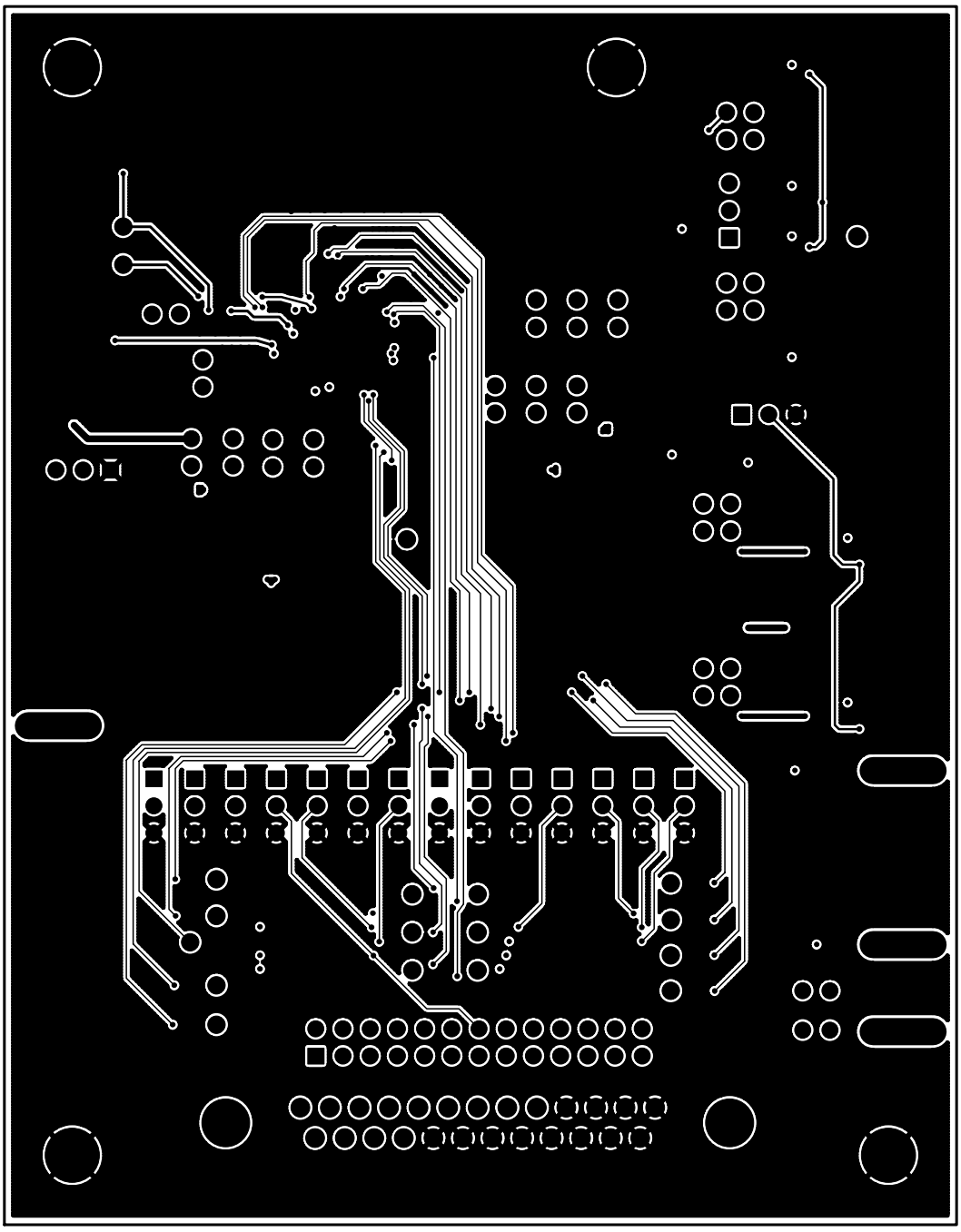

Figure 7. MAX2838 EV Kit PCB Layout—Inner Layer 3, Routes

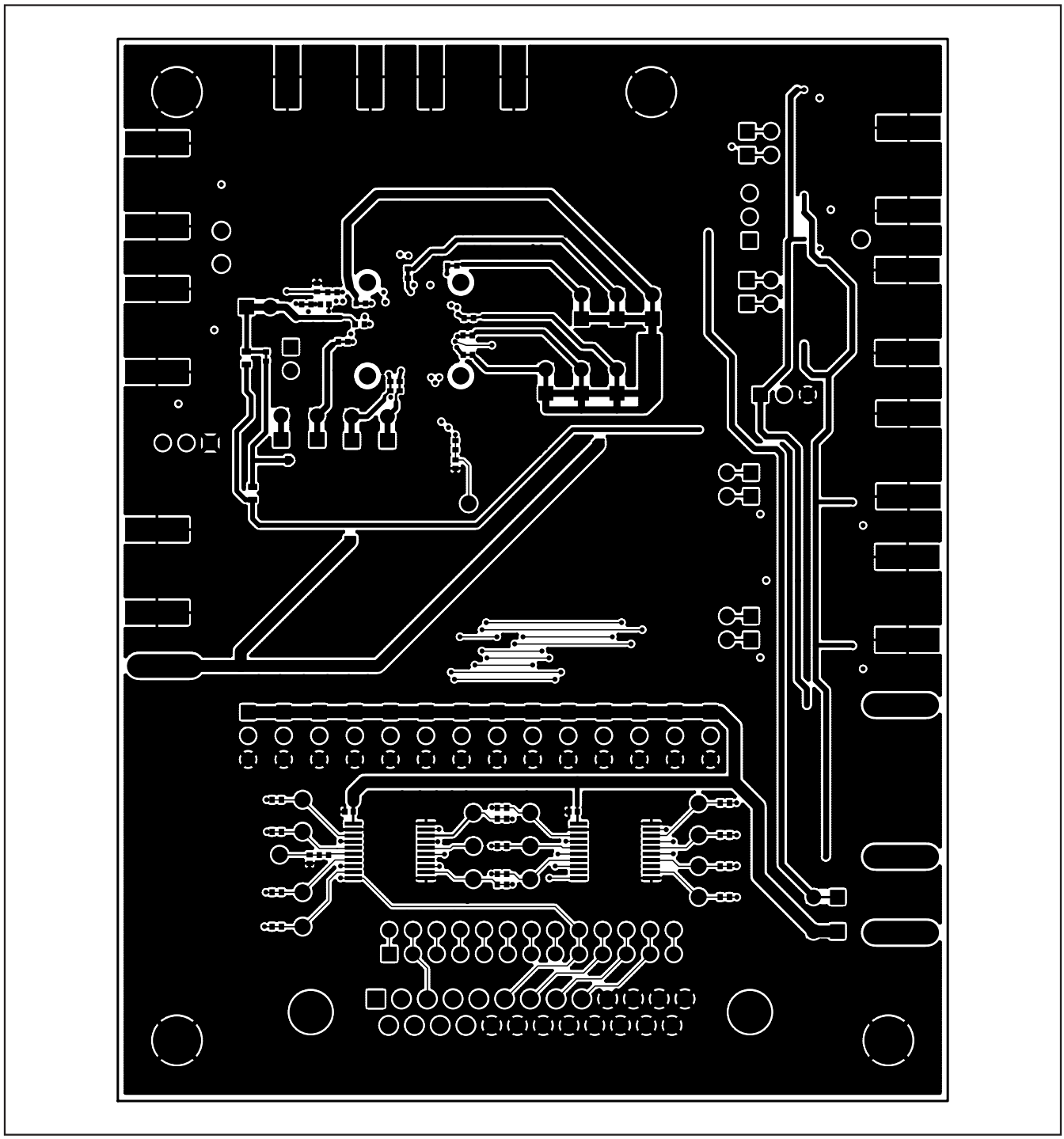

Figure 8. MAX2838 EV Kit PCB Layout—Solder Side

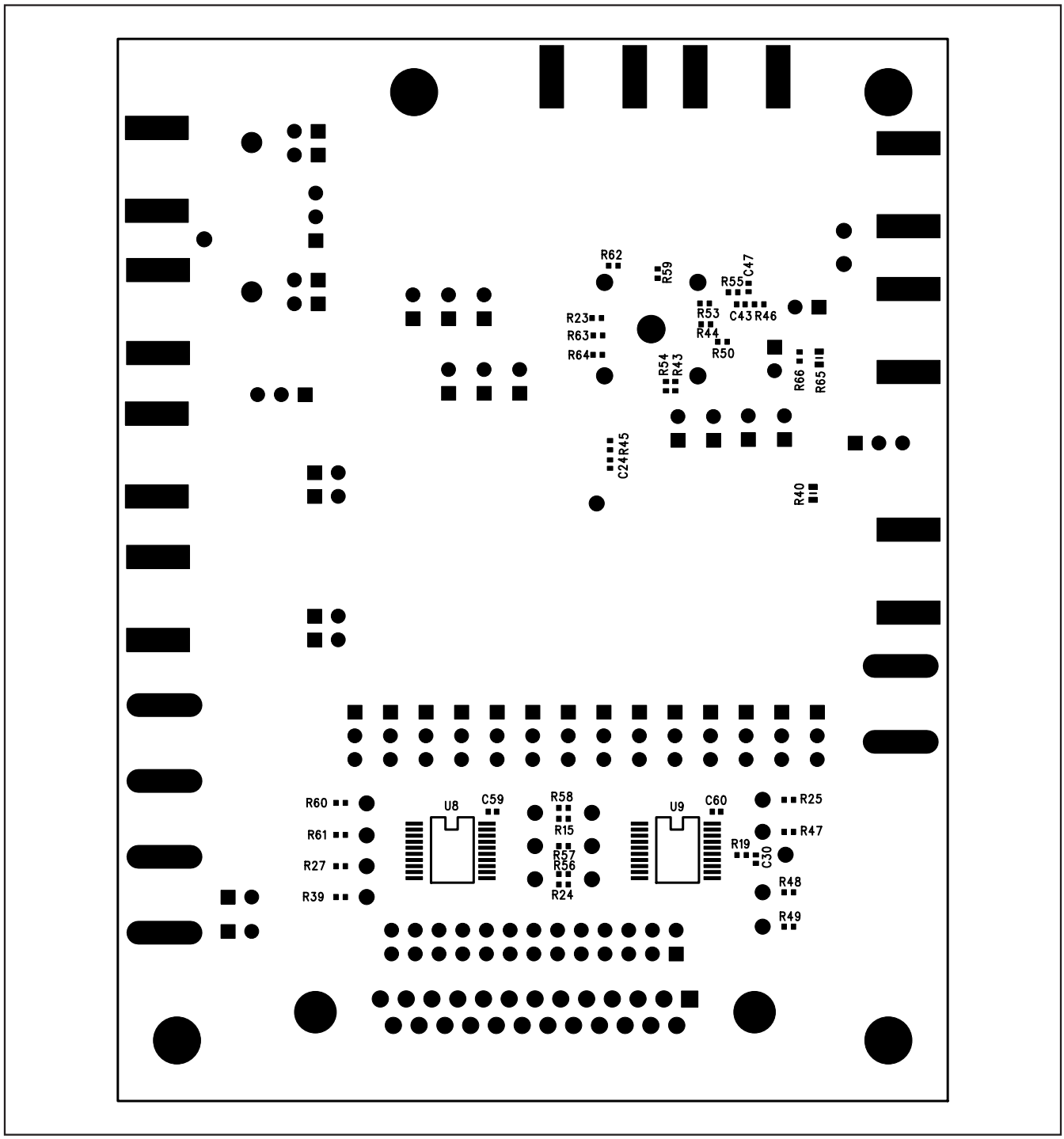

Figure 9. MAX2838 EV Kit PCB Layout—Bottom Silkscreen