19-4164; Rev 0; 6/08

MAX3540 Evaluation Kit

Evaluates: MAX3540

General Description

The MAX3540 evaluation kit (EV kit) simplifies the testing and evaluation of the MAX3540 NTSC, ATSC, and hybrid tuner. The EV kit is fully assembled and tested at the factory. Standard 50Ω SMA connectors are included on the EV kit for the inputs and outputs to allow quick-and-easy evaluation on the test bench.

This document provides a list of equipment required to evaluate the device, a straightforward test procedure to verify functionality, a description of the EV kit circuit, the circuit schematic, a component list of materials for the kit, and artwork for each layer of the PCB.

Features

- **Easy Evaluation of the MAX3540**
- **50Ω SMA Connectors**
- **All Critical Peripheral Components Included**
- **Fully Assembled and Tested**
- **PC Control Software Available at www.maxim-ic.com**

Ordering Information

PART	TYPE
MAX3540EVKIT	EV Kit

Component List

DESIGNATION	QTY	DESCRIPTION
+3.3V, +5V, IF_AGC, MUX, TP1	5	Red test points, PC mini red Keystone 5000
C1, C6, C26, C27, C37, C70–C74	10	100pF ±5% ceramic capacitors (0603) Murata GRM1885C1H101J
C2, C4, C5, C19, C20, C53, C54, C56, C59, C62, C63, C64, C66, C86	14	1000pF ±5% ceramic capacitors (0402) Murata GRM1555C1H102J
C3	1	0.033µF ±5% ceramic capacitor (0805) Murata GRM21A7U1H333J
C7	1	2.0pF ±0.1pF ceramic capacitor (0402) Murata GRM1555C1H3R9B
C8, C23, C78	3	1000pF ±10% ceramic capacitors (0603) Murata GRM188R71H102K
C9, C12, C13, C15, C16, C45	6	22pF ±5% ceramic capacitors (0402) Murata GRM1555C1H220J
C10, C30, C87	3	0.1µF ±10% ceramic capacitors (0402) Murata GRM155R71C104K
C11, C96	2	5.6pF ±0.25pF ceramic capacitors (0402) Murata GRM1555C1H5R6C
C14	1	1.2pF ±0.1pF ceramic capacitor (0402) Murata GRM1555C1H1R2B
C17	1	22nF ±10% ceramic capacitor (0603) Murata GRM188R71H223K
C18	1	4.7pF ±0.25pF ceramic capacitor (0402) Murata GRM1555C1H4R7C
C21, C25	2	22pF ±5% ceramic capacitors (0603) Murata GRM1885C1H220J
C22	1	330pF ±10% ceramic capacitor (0402) Murata GRM155R71H331K
C24, C75, C77	3	0.1µF ±10% ceramic capacitors (0603) Murata GRM188R71C104K
C28	1	120pF ±5% ceramic capacitor (0603) Murata GRM1885C1H121J
C29, C31	2	30pF ±5% ceramic capacitors (0603) Murata GRM1885C1H300J
C35	1	47pF ±5% ceramic capacitor (0603) Murata GRM1885C1H470J

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C36	1	0.01µF ±10% ceramic capacitor (0402) Murata GRM155R71C103K
C38, C39	0	Not installed, capacitors
C52	1	1500pF ±10% ceramic capacitor (0402) Murata GRM155R71H152K
C55	1	10µF ±10% ceramic capacitor (0805) Murata GRM21BR61A106K
C60, C61	2	120pF ±5% ceramic capacitors (0402) Murata GRM1555C1H121J
C65	1	0.47µF ±10% ceramic capacitor (0805) Murata GRM21BR71C474K
C76	1	10µF ±10% tantalum capacitor (R case) AVX TAJR106K006
C82	1	4700pF ±10% ceramic capacitor (0603) Murata GRM188R71H472K
C85	1	470pF ±10% ceramic capacitor (0402) Murata GRM155R71H471K
D1	1	DA221 dual switching diode ROHM DA221TL
FL2	1	X6941 bandpass filter EPCOS B39440-X6941-D100
GND1, GND2, GND4	3	Black test points, PC mini black Keystone 5001
J1, J4	0	Not installed, SMA end-launch jacks
J3, J19	2	Connector SMA end-launch jack receptacles, 0.062in Johnson 142-0701-801
J13	1	DB25 right-angle female connector AMP 5745783-4
JP1, JP2, JP6	3	1 x 2-pin headers Sullins PEC36SAAN
JP3, JP4, JP5	0	Not installed
JP11, JP12	2	1 x 3-pin headers Sullins PEC36SAAN
JP2, JP11, JP12	3	Shunt shorting jumpers Sullins SSC02SYAN
L1	1	22nH ±5% inductor (0603) Murata LQG18HN22NJ00
L2, L15	2	270nH ±5% inductors (0603) TOKO LL1608-FSLR27J
L3, L16	2	3.3µH ±10% inductors (0805) Murata LQM21NN3R3K10
L4	1	Not installed, inductor (0805) TOKO LL2012-FHLR68J
L5	1	15nH ±3% inductor (0402) Murata LQW15AN15NH00
L6	1	1.8µH ±5% inductor (1008) Coilcraft 1008CS-182XJLC
L7, L8	2	150nH ±5% inductors (0603) Murata LQW18ANR15J00
L9	1	82nH ±5% inductor (0603) Murata LQW18AN82NJ00
L11	1	220nH ±5% inductor (0603) Murata LQW18ANR22J00
L12, L13	2	0Ω resistors (0603)
L14	1	47nH ±5% inductor (0603) Murata LQG18HN47NJ00
L18	0	Not installed, inductor
Q1	1	UPA801T npn silicon high-frequency transistor NEC UPA801T
R1, R2, R17, R18, R34, R56	0	Not installed, resistors
R3, R8, R48	3	100Ω ±5% resistors (0402)
R4, R15, R16, R55	4	0Ω resistors (0603)
R5	1	75Ω ±5% resistor (0402)
R6, R13, R40, R41, R42	5	100Ω ±5% resistors (0603)
R7, R9	2	10kΩ ±5% resistors (0402)
R10	1	86.6Ω ±1% resistor (0603)
R11	1	43.2Ω ±1% resistor (0603)
R12, R28	2	1.0kΩ ±5% resistors (0603)
R14	1	300Ω ±5% resistor (0603)
R19	1	0Ω resistor (0402)
R20, R21	2	1.0kΩ ±5% resistors (0402)
R22, R23	2	1.1kΩ ±5% resistors (0402)
R24	1	2.4kΩ ±5% resistor (0402)
R25	1	2.2kΩ ±5% resistor (0402)
R26, R27	2	120Ω ±5% resistors (0402)
R29, R31	2	51Ω ±5% resistors (0402)
R30	0	Not installed, resistor
R33	1	33Ω ±5% resistor (0402)
R38	1	1.3kΩ ±5% resistor (0402)
R39	1	270Ω ±5% resistor (0402)
R43, R44, R58	3	5.1kΩ ±5% resistors (0603)
R45, R46, R47	3	2.7kΩ ±5% resistors (0603)
R49	1	2.7kΩ ±5% resistor (0402)

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
T1	0	Not installed
T8	1	4:1 transformer TOKO #617PT-1664
U3	1	SN74LV07ADR hex buffer/driver Texas Instruments SN74LV07ADR
U4	1	Complete single-conversion television tuner (48 fcLGA-EP*) Maxim MAX3540ULM+

DESIGNATION	QTY	DESCRIPTION
Y2	1	4MHz crystal Citizen Am HCM49-4.000MABJ-UT
VCC2	0	Not installed, PC mini red
—	8	Shunts (JPB1–JPB7, RXBBBUF) Sullins SSC02SYAN
—	1	PCB: MAX3540 Evaluation Kit

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
AVX Corporation	843-946-0238	www.avxcorp.com
Citizen America Corp.	310-781-1460	www.citizencrystal.com
Coilcraft, Inc.	847-639-6400	www.coilcraft.com
EPCOS AG	732-906-4300	www.epcos.com
Johnson Components	507-833-8822	www.johnsoncomponents.com
Keystone Electronics Corp.	209-796-2032	www.keyelco.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
NEC Corp.	408-588-6000	www.nec.com
ROHM Co., Ltd.	858-625-3630	www.rohm.com
Sullins Electronics Corp.	760-744-0125	www.sullinselectronics.com
Texas Instruments Inc.	972-644-5580	www.ti.com
TOKO America, Inc.	847-297-0070	www.tokoam.com

Note: *Indicate that you are using the MAX3540 when contacting these component suppliers.*

Quick Start

Test Equipment Required

This section lists the recommended test equipment to verify operation of the MAX3540. It is intended as a guide only, and some substitutions are possible:

- One power supply capable of supplying at least 500mA at +3.3V
- One power supply capable of supplying at least 100mA at +5V for external IF LNA
- One dual-output power supply capable of supplying at least 5mA up to 3V (to apply gain control voltages)
- One RF signal generator capable of delivering at least 0dBm of output power at frequency (HP 8482A or equivalent)
- One RF spectrum analyzer capable of covering the operating frequency range of the device
- One PC (486DX33 or better) with Windows® 95/98, 2000, NT 4.0, XP or later operating system, 64MB of memory, and an available parallel port
- One 25-pin parallel cable
- 50Ω SMA cables
- (Optional) One multichannel digital oscilloscope
- (Optional) One network analyzer to measure return loss
- (Optional) One ammeter to measure supply current

Windows is a registered trademark of Microsoft Corp.

Connections and Setup

This section provides a step-by-step guide to testing the basic functionality of the EV kit in UHF mode. **Caution: Do not turn on DC power or RF signal generators until all connections are completed:**

1) Verify that the JP1 and JP6 shunts are removed, the JP2 shunt is installed, and JP11 and JP12 have shunts across pins 1-2.
2) With its output disabled, set the DC power supply to +3.3V. Connect the power supply to the +3.3V (through an ammeter if desired) and GND1 terminals on the EV kit. If available, set the current limit to 500mA.
3) With its output disabled, set the second DC power supply to +5V. Connect the power supply to the +5V (through an ammeter if desired) and GND1 terminals on the EV kit. If available, set the current limit to 100mA.
4) With its output disabled, set both outputs of the dual-output DC power-supply voltages to +3V. Connect one of the outputs to the TP1 terminal and connect the other output to the IF_AGC terminal.
5) With its output disabled, set the RF signal generator to a 55.25MHz frequency and a -80dBm power level. Connect the output of the RF signal generator to the SMA connector labeled RFIN on the evaluation board.
6) Connect a 25-pin parallel cable between the PC's parallel port and the MAX3540 evaluation board.
7) Turn on the +3.3V V_{CC} power supply, +5V V_{CC} power supply, and the +3V dual-output gain-control power supply. The supply current from the +3.3V V_{CC} supply should read approximately 200mA. The supply current from the +5V V_{CC} supply should read approximately 20mA. Be sure to adjust the power supply to account for any voltage drop across the ammeter.
8) Install and run the MAX3540 control software. Software is available for download on the Maxim website at www.maxim-ic.com/evkitsoftware.
9) Load the default register settings from the control software by clicking Edit: Load Defaults.
10) Connect the SMA connector labeled IF_OUT on the evaluation board to a spectrum analyzer or to an oscilloscope.
11) Enable the RF signal generator's output.
12) Set the center frequency of the RF spectrum analyzer to the IF frequency set on the control software. Check the output.

Gain Adjustment Calculations

Add an additional 6dB to the voltage gain to account for the 2:1 transformer on the output. Add another 3.96dB to the voltage gain to account for the minimum loss pad (R11 and R10) on the input. When measuring noise figure, account for 5.7dB power loss of the minimum loss pad.

An anti-aliasing filter is provided on the IF output (C21, C25–C29, C31, C35, L9, L11). The passband of this filter is 6MHz centered at the IF frequency of 44MHz, and is designed for a 200Ω termination. Anti-aliasing filter requirements vary depending on application; the filter architecture and component values are provided as general guidelines only.

Layout Considerations

The MAX3540 EV kit serves as a guide for PCB layout. Keep RF signal lines as short as possible to minimize losses and radiation. Use controlled impedance on all high-frequency traces. The exposed pad must be soldered evenly to the board's ground plane for proper operation. Use abundant vias beneath the exposed pad for maximum heat dissipation. Use abundant ground vias between RF traces to minimize undesired coupling.

To minimize coupling between different sections of the IC, the ideal power-supply layout is a star configuration, which has a large decoupling capacitor at the central V_{CC} node. The V_{CC} traces branch out from this node, with each trace going to separate V_{CC} pins of the MAX3540. Each V_{CC} pin must have a bypass capacitor with a low impedance to ground at the frequency of interest. Do not share ground vias among multiple connections to the PCB ground plane.

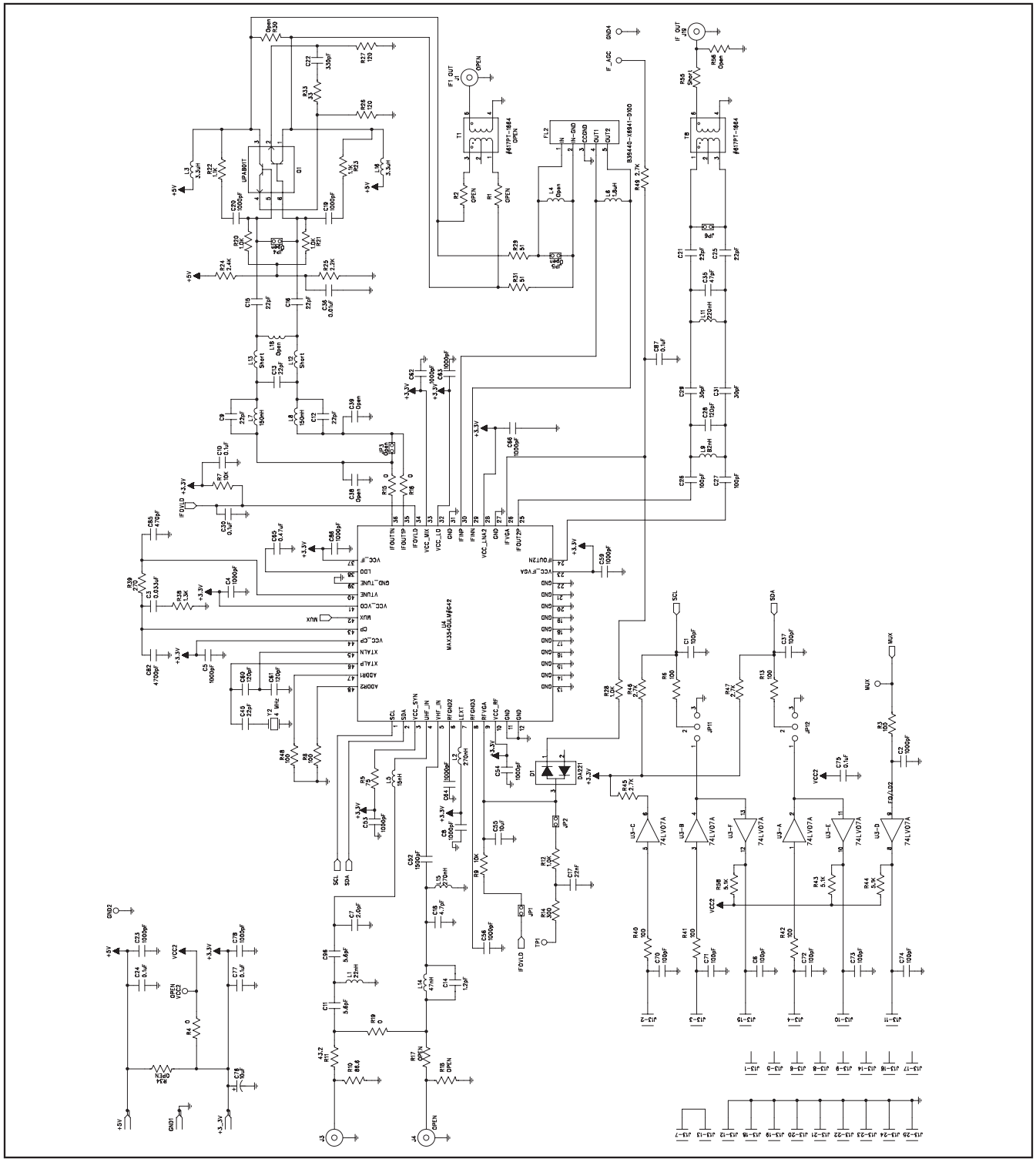

Figure 1. EV Kit Schematic

MAX3540 Evaluation Kit

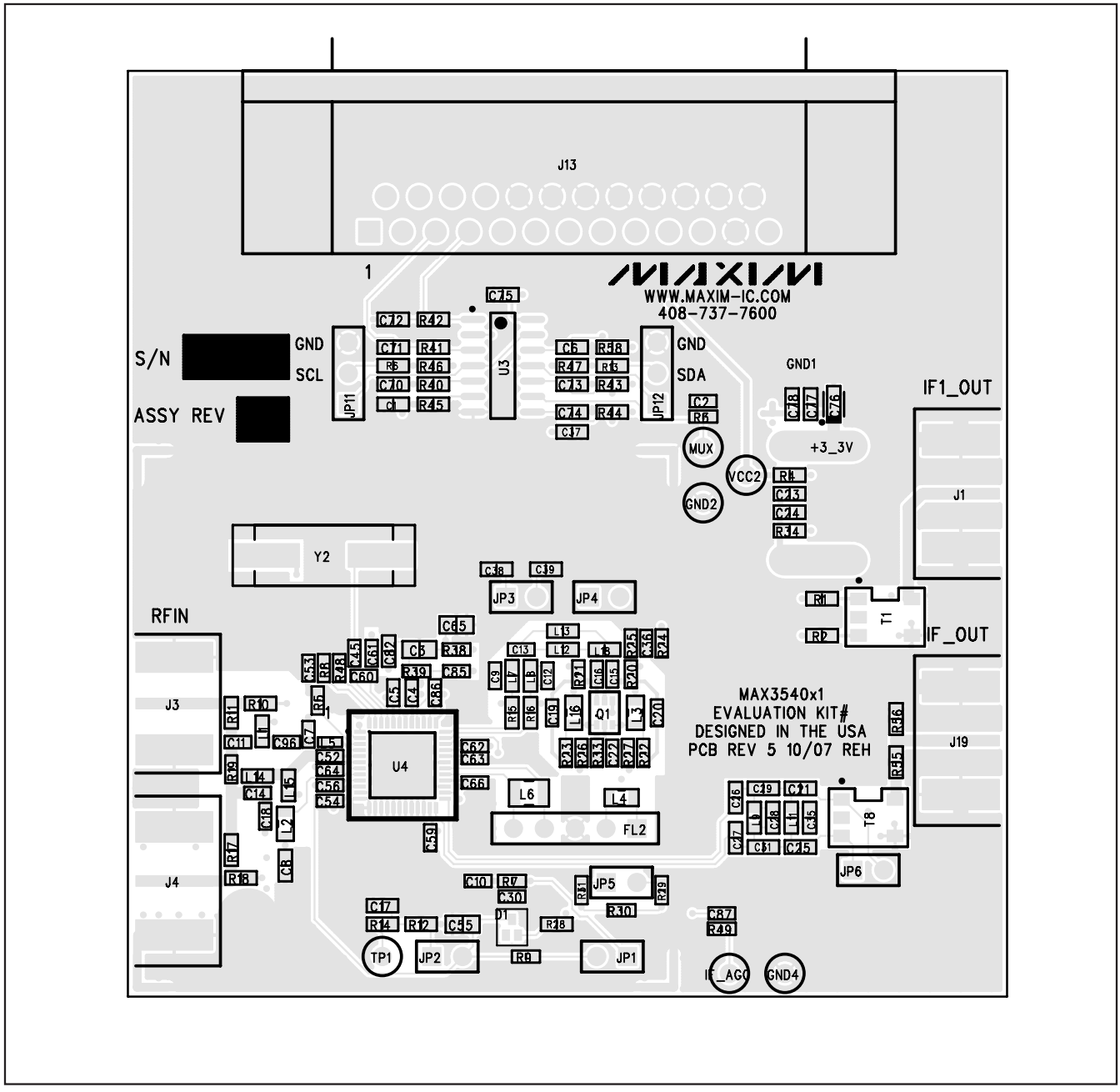

Figure 2. MAX3540 EV Kit PCB Layout—Component Placement Guide

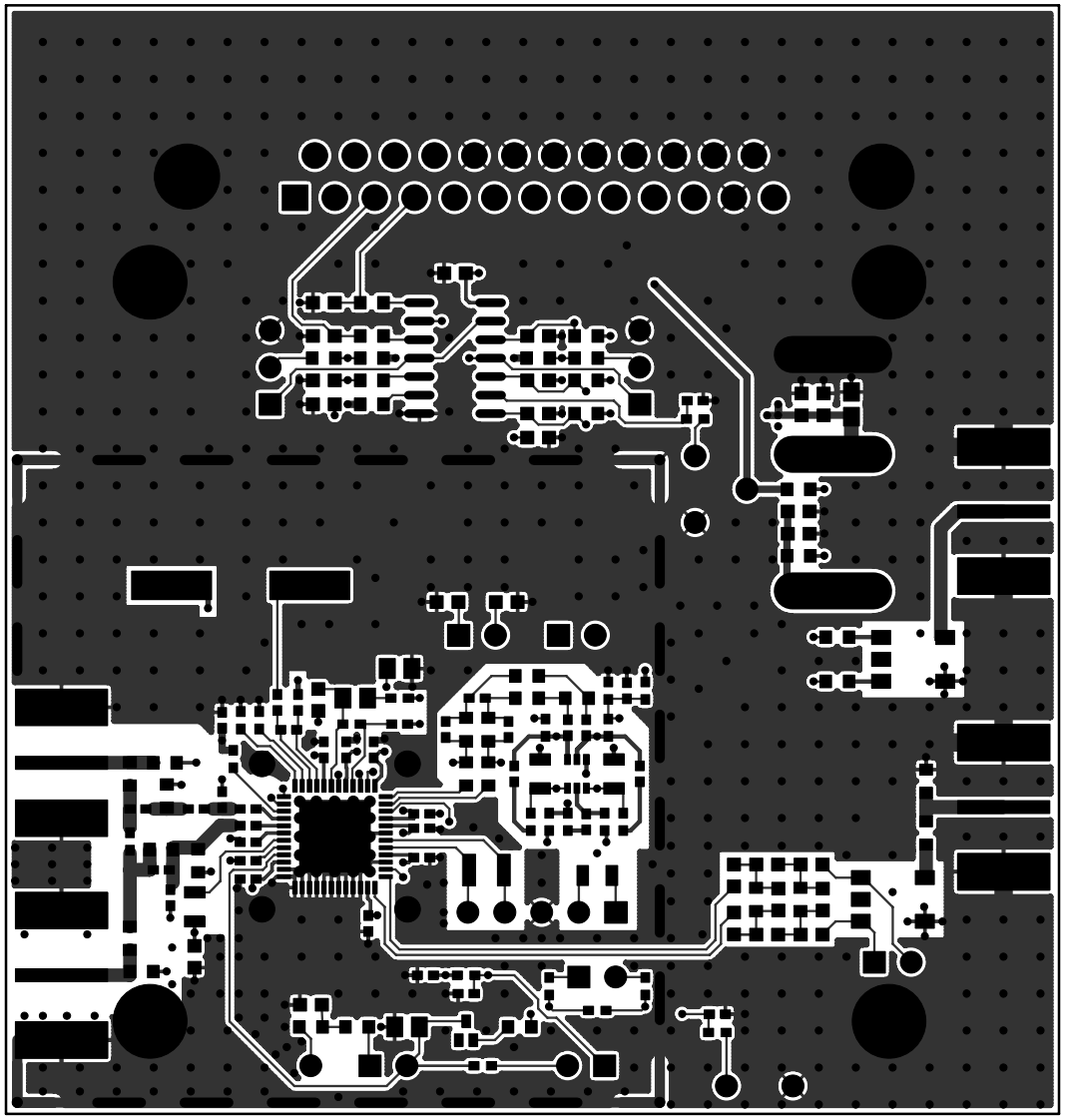

Figure 3. MAX3540 EV Kit PCB Layout—Primary Component Side

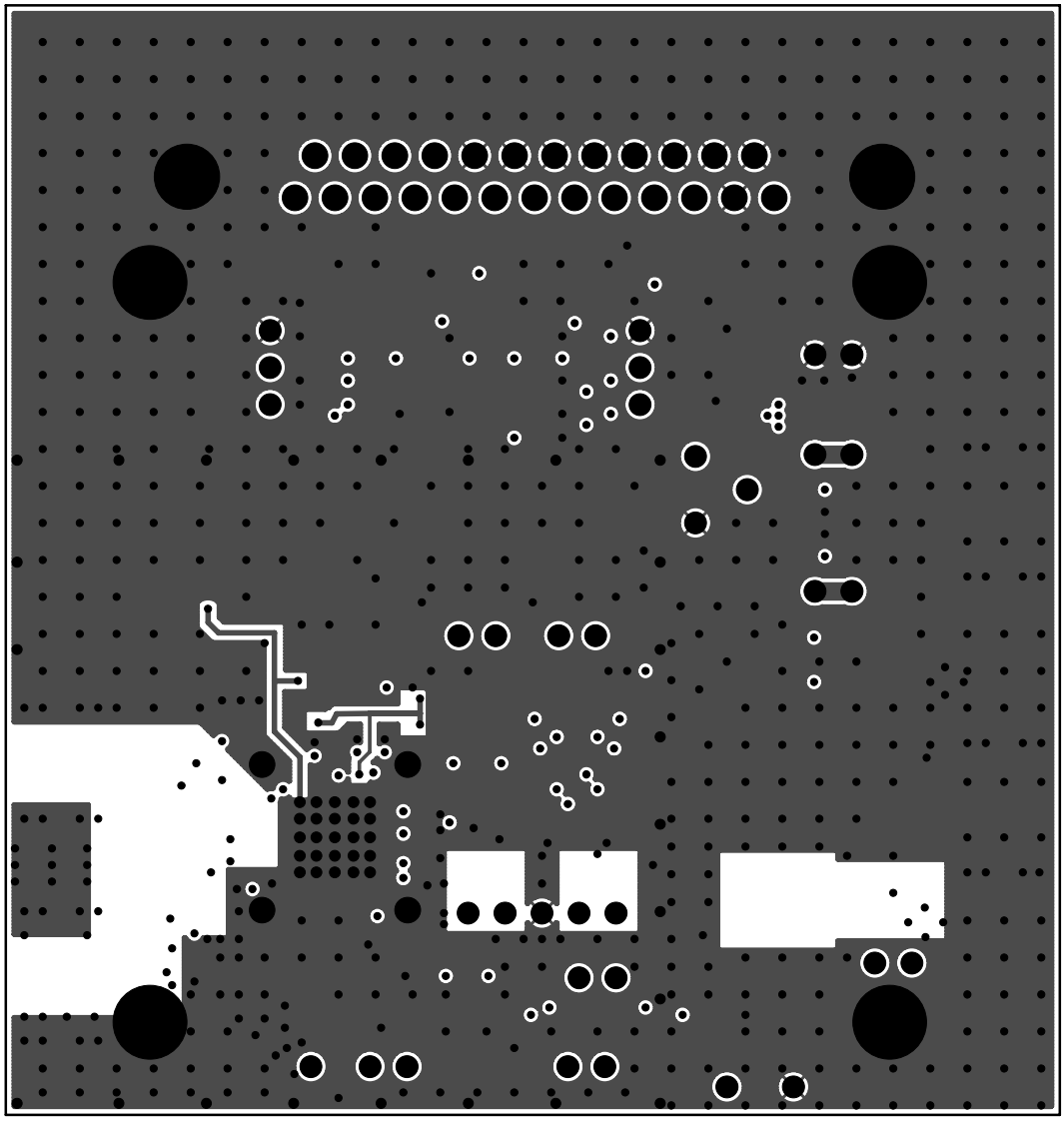

Figure 4. MAX3540 EV Kit PCB Layout—Inner Layer 2

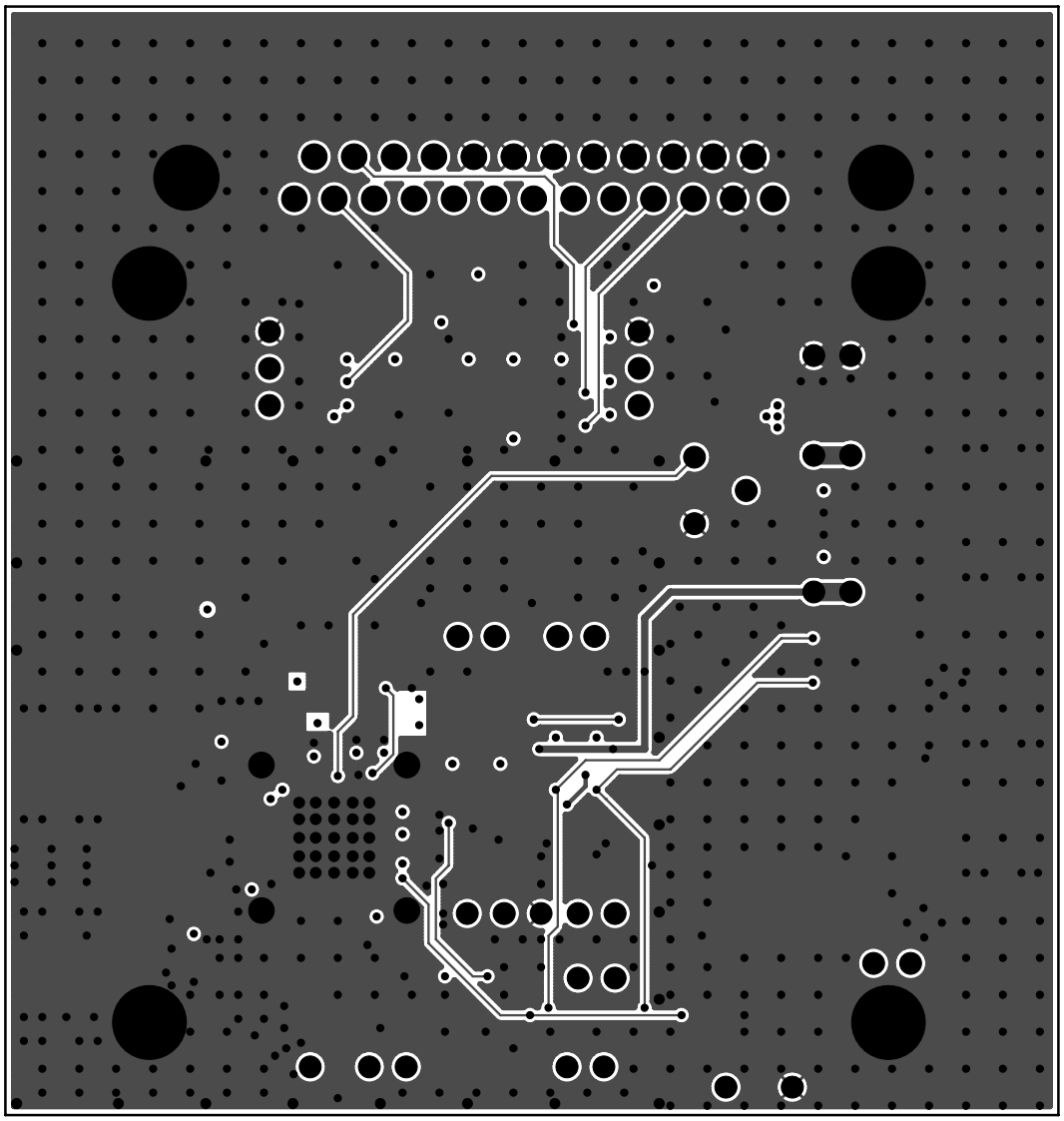

Figure 5. MAX3540 EV Kit PCB Layout—Inner Layer 3

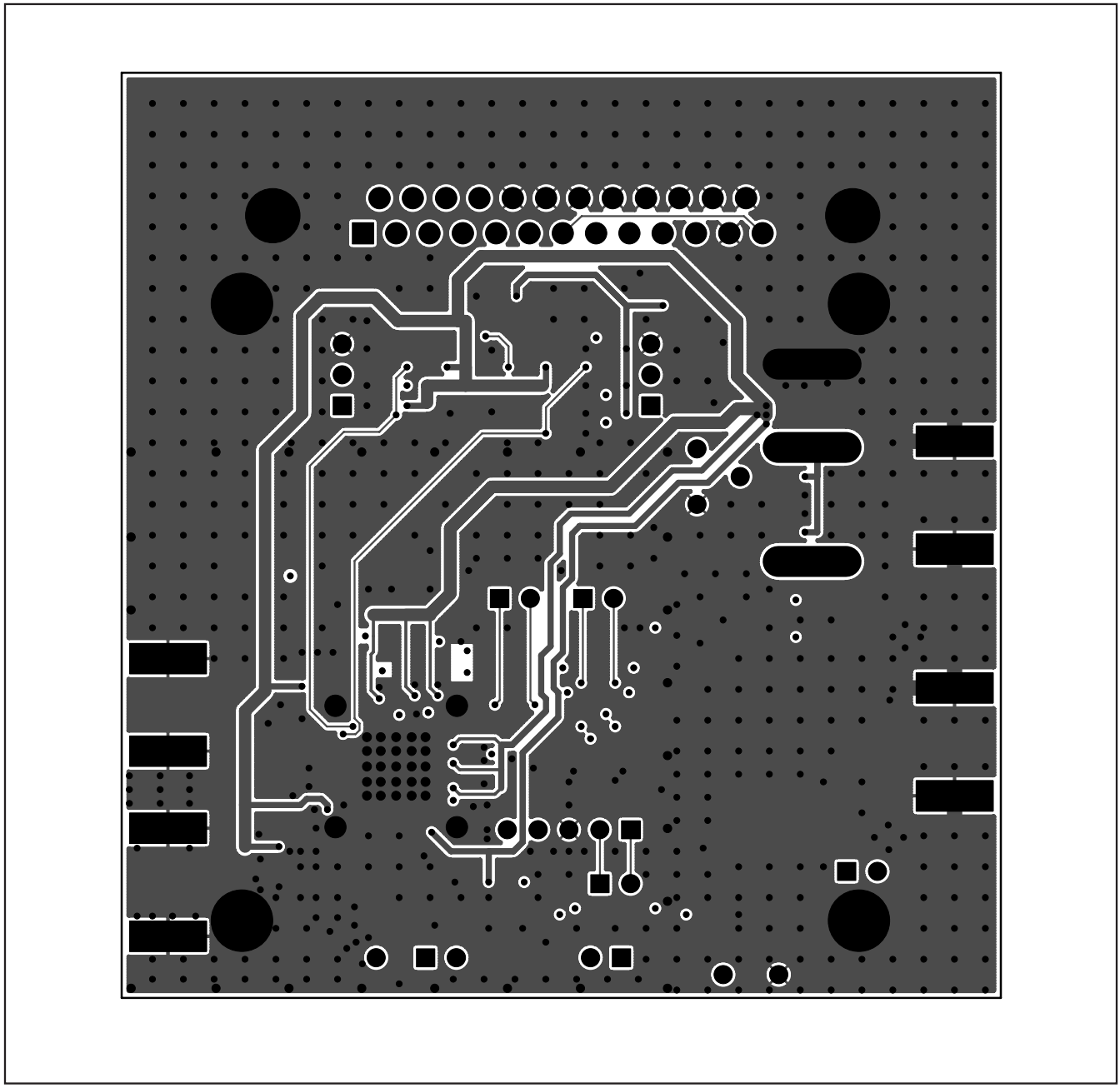

Figure 6. MAX3540 EV Kit PCB Layout—Secondary Component Side