

## General Description

The MAX3521 evaluation kit (EV kit) simplifies the testing and evaluation of the MAX3521 DOCSIS 3.0 upstream amplifier. 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 list of components for the EV kit, and artwork for each layer of the PCB.

## Features

- Easy Evaluation of the MAX3521
- 50Ω SMA Connectors
- All Critical Peripheral Components Included
- Proven PCB Layout
- Fully Assembled and Tested
- PC Control Software  
(Available at [www.maximintegrated.com](http://www.maximintegrated.com))

*Ordering Information appears at end of data sheet.*

## Component List

DESIGNATION	QTY	DESCRIPTION
B1, B2	2	Ferrite beads (0805) Murata BLM21AG601SN1
B3	1	Ferrite bead 1206, Murata BLM31PG121SN1
C1–C4, C8	5	0.01μF ±10% ceramic capacitors (0603) Murata GRM188R71H103K
C5, C9	2	5.6pF ±0.1pF ceramic capacitors (0603) Murata GRM1885C1H5R6B
C6	1	10μF ±10% ceramic capacitor (0805) Murata GRM21BR61A106K
C7	1	0.1μF ±10% ceramic capacitor (0402) Murata GRM155R71A104K
C10, C11	2	10pF ±5% ceramic capacitors (0603) Murata GRM1885C1H100J
JP2	1	20-pin (2 x 10) dual inline header Sullins PEC36DAAN

DESIGNATION	QTY	DESCRIPTION
JP3 (+5V)	1	PC mini red test point Keystone 5000
JP4 (GND)	1	PC mini black test point Keystone 5001
R1	1	100kΩ ±5% resistor (0603)
R2, R6	2	100Ω ±1% resistors (0603)
R3	1	43.2Ω ±1% resistor (1206)
R4	1	86.6Ω ±1% resistor (1206)
R5, R7	2	37.4Ω ±1% resistors (0603)
RFIN, RFOUT	2	SMA end-launch jack receptacles Emerson (Johnson) 142-0701-801
T1	1	1:4 transformer TOKO 617PT-1664
T2	1	1:2 transformer TOKO 617PT-2270
U1	1	DOCSIS 3.0 upstream amplifier (20 TQFN-EP*) Maxim MAX3521ETP+
—	1	PCB: MAX3521 EVALUATION KIT#

\*EP = Exposed pad.

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Emerson Network Power	507-833-8822	www.emersonnetworkpower.com
Keystone Electronics Corp.	800-221-5510	www.keyelco.com
Murata Americas	800-241-6574	www.murataamericas.com
Sullins Electronics Corp.	760-545-6700	www.sullinselectronics.com
TOKO America, Inc.	847-297-0070	www.tokoam.com

**Note:** Indicate that you are using the MAX3521 when contacting these component suppliers.

## Quick Start

### Test Equipment Required

- Power supply capable of supplying at least 750mA at +5V
- Power supply capable of supplying at least 5mA at +3.3V (sets logic level on INTF3000+ interface board)
- RF signal generator capable of delivering at least -10dBm of output power at 40MHz frequency (e.g., HP8482A or equivalent)
- RF spectrum analyzer capable of covering the operating frequency range of the device
- Windows® PC with a spare USB port
- USB cables
- 50Ω SMA cables
- (Optional) Multichannel digital oscilloscope
- (Optional) Network analyzer to measure return loss
- (Optional) Ammeter to measure supply current

### Connections and Setup

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

- 1) Verify that the shunt across jumper JU1 on the INTF3000+ interface board has been removed.
- 2) Connect 20-pin header J1 on the INTF3000+ interface board to 20-pin header JP2 on the EV kit using the supplied ribbon cable. **Note:** Pin 1 of the interface cable corresponds to the red wire. Pin 1 is designated in the silkscreen on each of the PCBs.
- 3) With its output disabled, set the DC power supply to +5V. Connect the power supply to the +5V (through an ammeter if desired) and GND terminals on the EV kit. If available, set the current limit to 650mA.
- 4) With its output disabled, set the other DC power-supply voltage to +3.3V. Connect the power supply to the VPULL and GND terminals on the INTF3000+ interface board.
- 5) With its output disabled, set the RF signal generator to a 40MHz frequency and a -20dBm power level. Connect the output of the RF signal generator to the SMA connector labeled RFIN on the evaluation board.
- 6) Install and run the MAX3521 EV kit software, available for download [HERE](#).
- 7) Turn on the +3.3V power supply, followed by the +5V power supply. The supply current from the +5V supply should read approximately 5mA. Be sure to adjust the power supply to account for any voltage drop across the ammeter.
- 8) Load the default register settings from the control software by clicking on the **Defaults** button.
- 9) Connect the SMA connector labeled RFOUT on the evaluation board to a spectrum analyzer or to an oscilloscope. Set TXEN = 1. The supply current from the +5V supply should read approximately 475mA.
- 10) Enable the RF signal generator's output. Check the output level on the spectrum analyzer or oscilloscope. Expected power level is about +12.3dBm under default setting
- 11) Set the gain code using the control software. Check the output level on the spectrum analyzer or oscilloscope.

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## Detailed Description

### Gain Calculations

The 1:4 impedance ratio transformer (T1) on the EV kit converts the unbalanced 50Ω impedance of the signal generator to a balanced 200Ω, matching the input of the device. T1 is included to assist in evaluation of the device using standard 50Ω lab equipment. It is not required for most applications.

A 1:4 impedance ratio corresponds to a 1:2 voltage ratio, or 6dB voltage gain. The power loss of T1, which must be included, is approximately 0.3dB across the operating frequency range of the device, giving a total voltage gain due to T1 of 5.7dB.

A minimum loss pad (MLP) on the output of T2 transforms the 75Ω output impedance of the device to 50Ω test-equipment impedance, with a voltage loss of 7.4dB. Because the 1:2 impedance ratio output transformer (T2) is required in the application, we do not include the loss in this transformer in the voltage-gain calculation.

To calculate the voltage gain of the device from 50Ω power measurements at RFIN and RFOUT on the EV kit:

$$\begin{aligned} A_V &= P_{OUT}(\text{dBm}) + 7.4\text{dB (MLP)} - [P_{IN}(\text{dBm}) + 5.7\text{dB (T1)}] \\ &= P_{OUT}(\text{dBm}) - P_{IN}(\text{dBm}) + 1.7\text{dB} \end{aligned}$$

### Layout Considerations

The EV kit can serve as a guide for PCB layout. Keep RF signal lines as short as possible to minimize losses and radiation. To minimize second-order distortion, traces in the balanced input and output circuitry should be as symmetric as possible. 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 device, 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 device. Each  $V_{CC}$  pin must have a bypass capacitor with low impedance to ground at the frequency of interest. Do not share ground vias among multiple connections to the PCB ground plane.

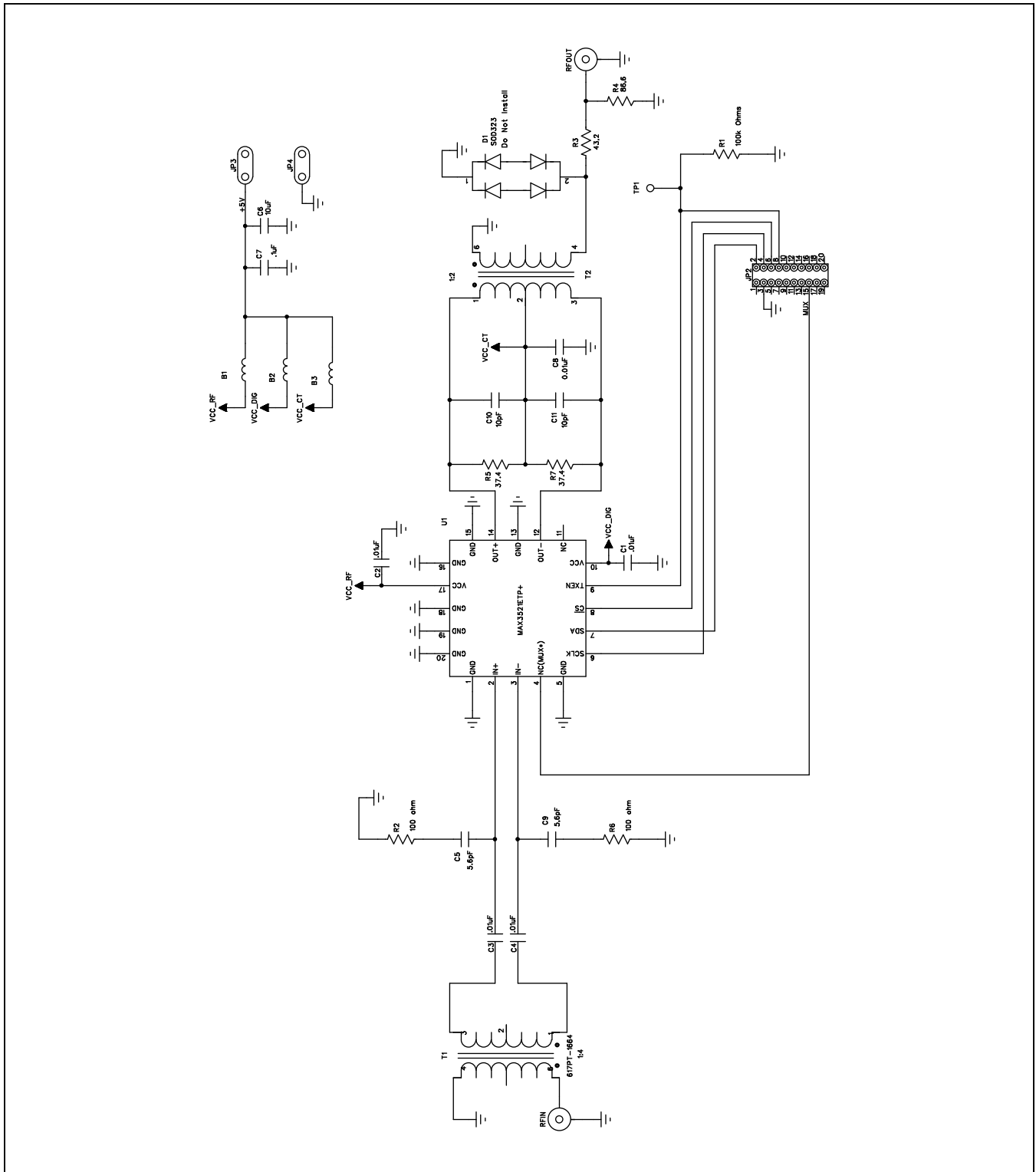


Figure 1. MAX3521 EV Kit Schematic

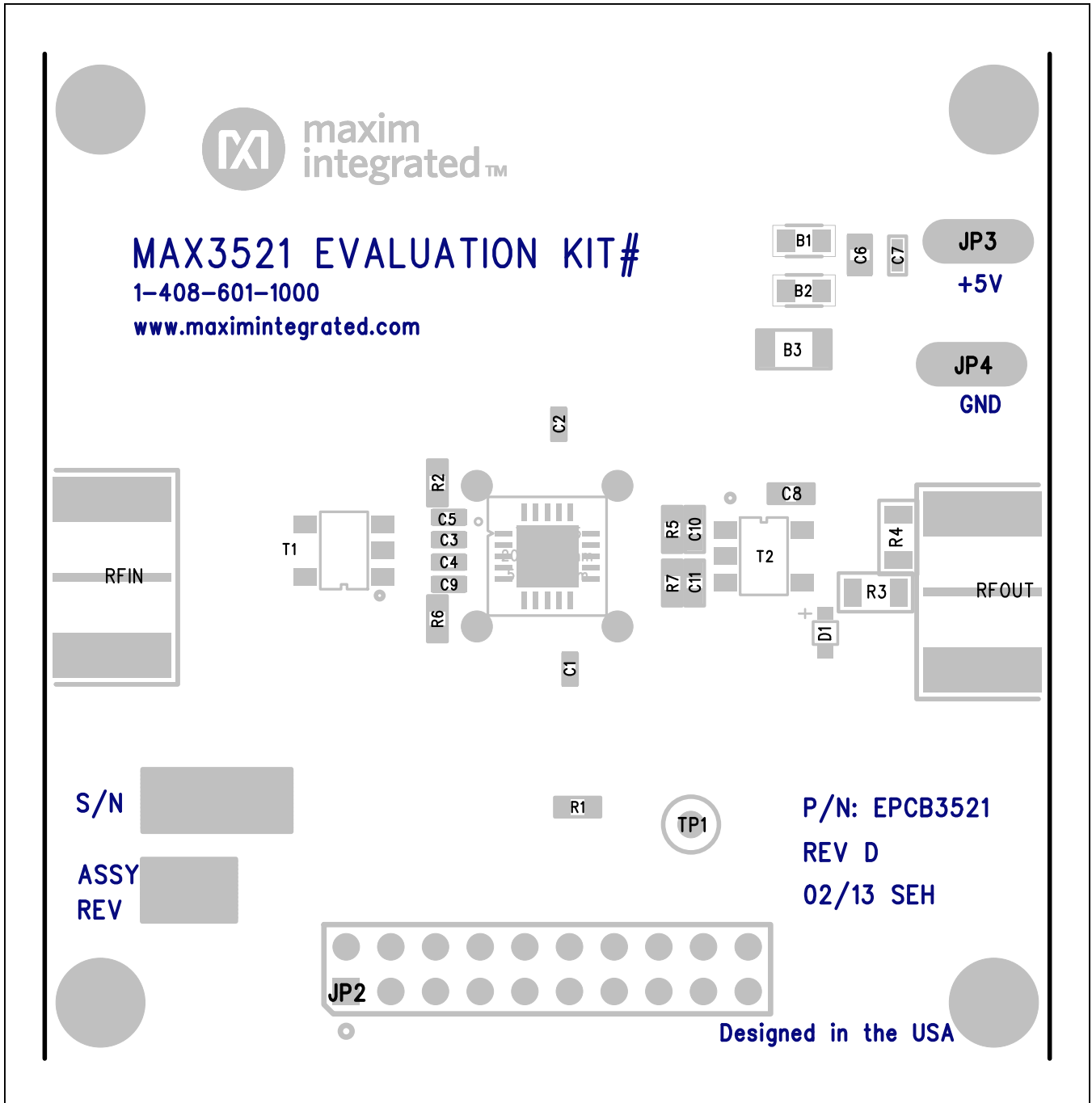


Figure 2. MAX3521 EV Kit Component Placement Guide

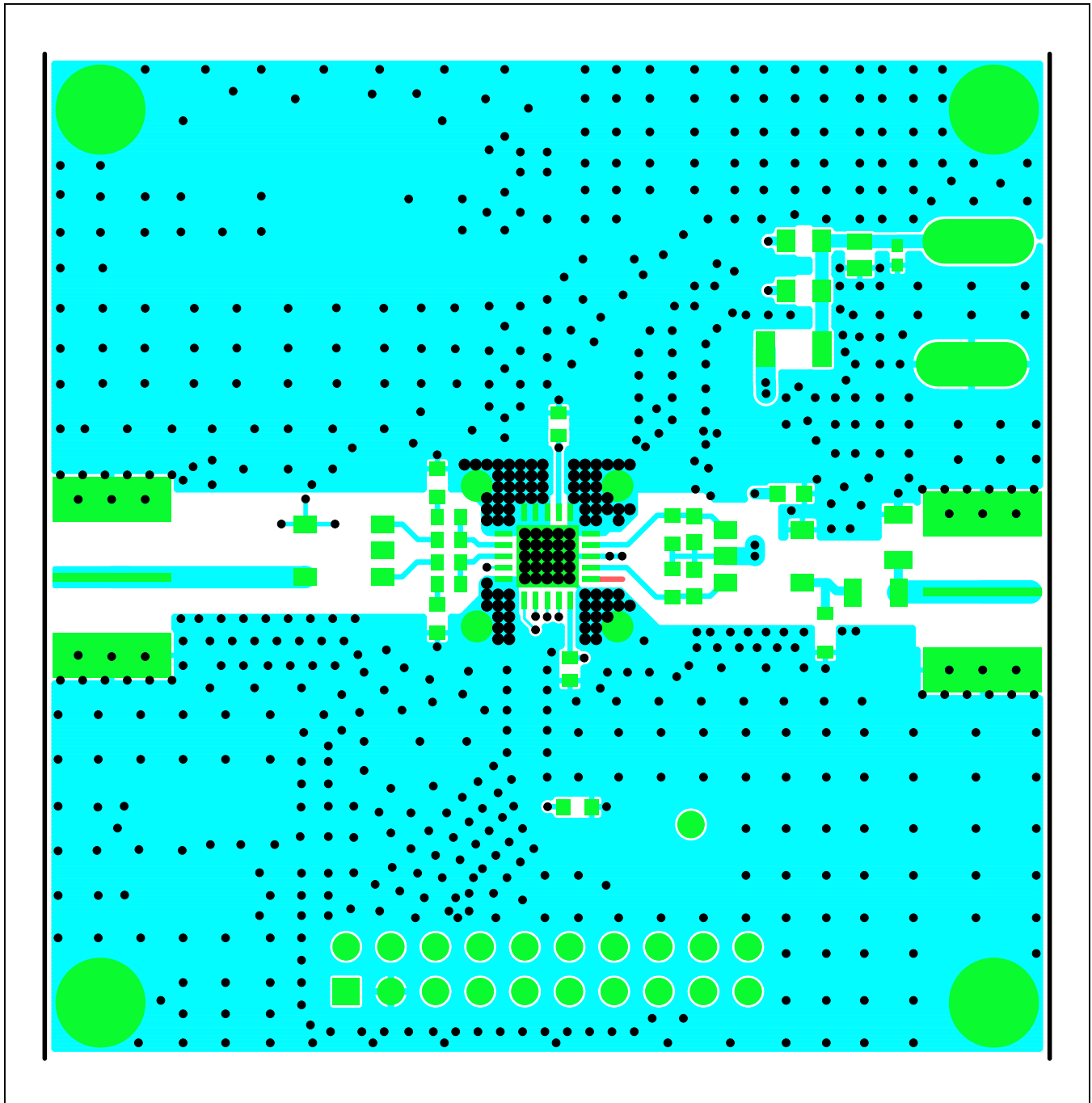


Figure 3. MAX3521 EV Kit PCB Layout—Primary Component Side

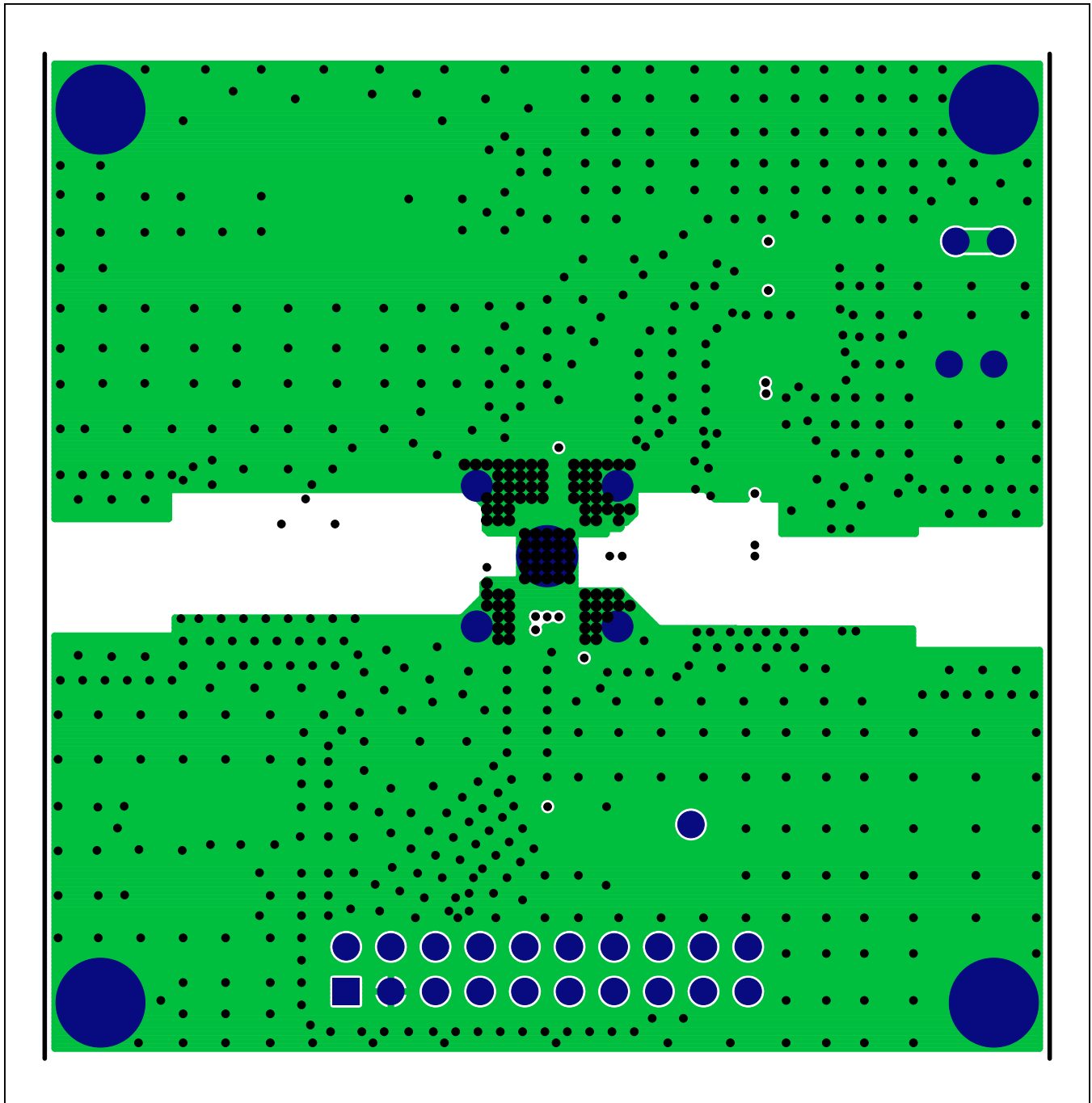


Figure 4. MAX3521 EV Kit PCB Layout—Inner Layer 2

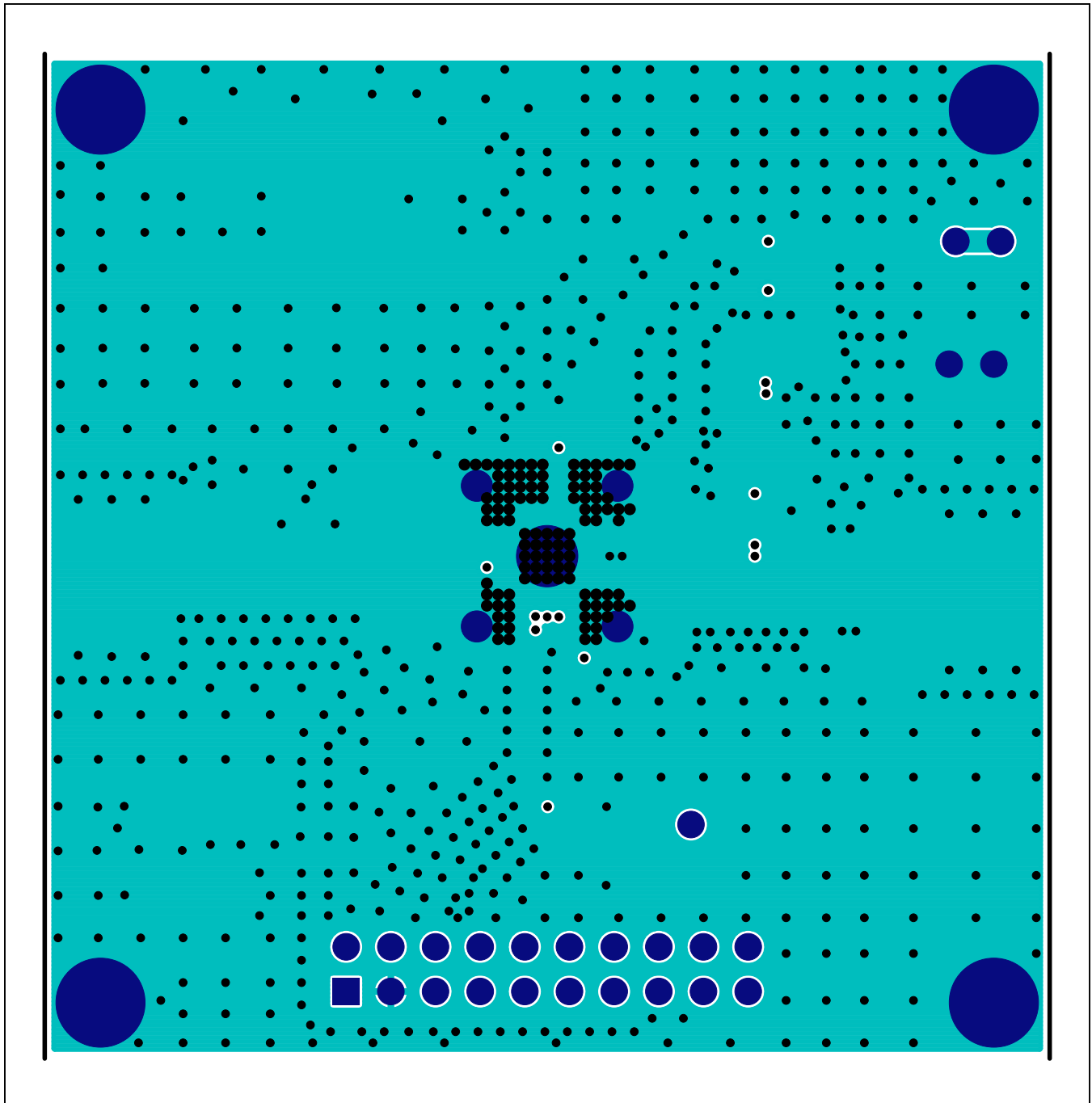


Figure 5. MAX3521 EV Kit PCB Layout—Inner Layer 3



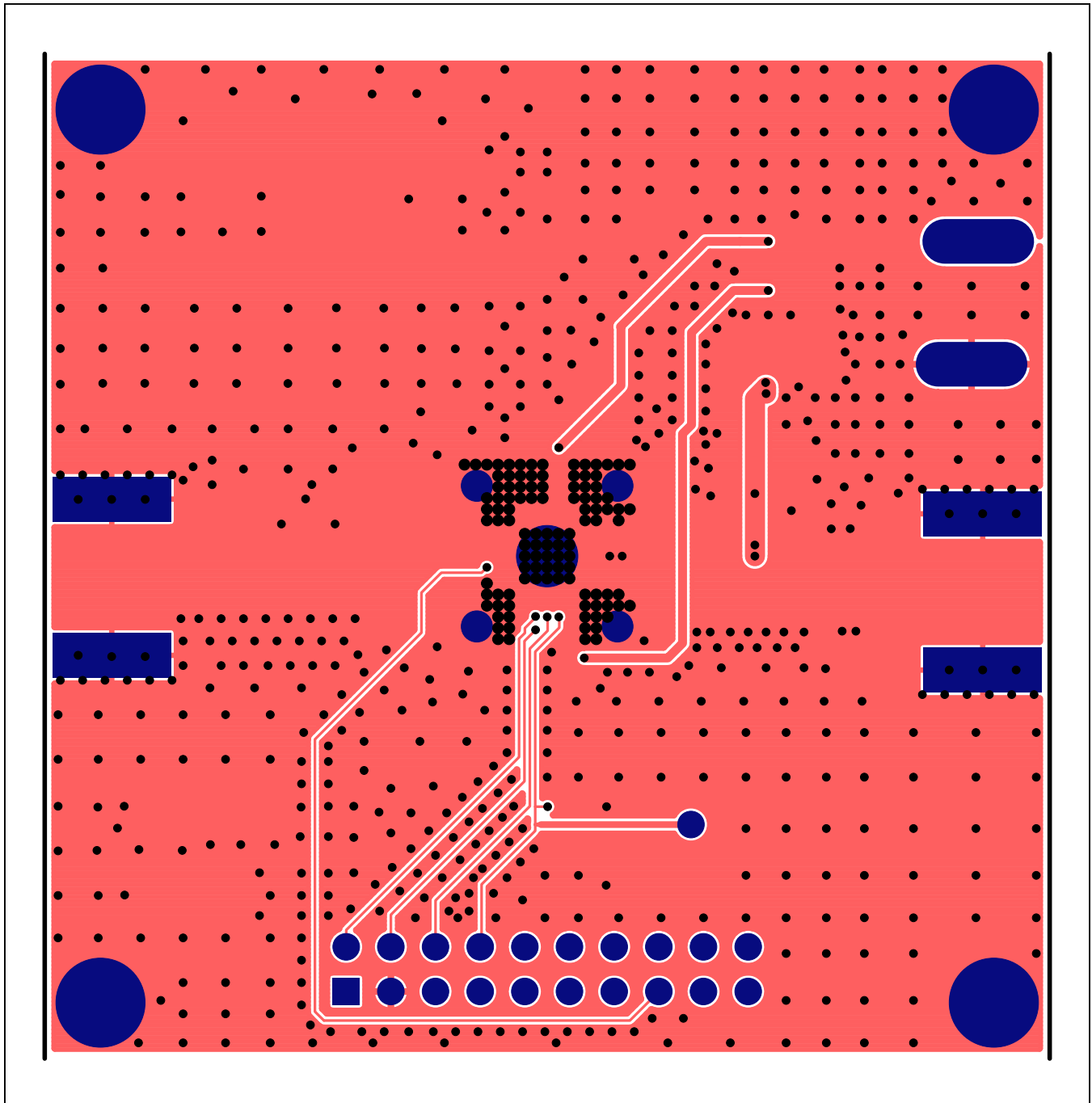


Figure 6. MAX3521 EV Kit PCB Layout—Secondary Component Side

### Ordering Information

PART	TYPE
MAX3521EVKIT#	EV Kit

#Denotes RoHS compliant.

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/13	Initial release	—
1	6/16	Data sheet improvements	2, 3

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