



# MAX2120 Evaluation Kit

## General Description

The MAX2120 evaluation kit (EV kit) simplifies the testing and evaluation of the IC's direct-conversion tuner. The evaluation kit is fully assembled and tested at the factory. Standard 50Ω SMA and BNC 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 for the kit, and artwork for each layer of the printed-circuit board (PCB).

## Features

- ◆ Easy Evaluation of the MAX2120
- ◆ 50Ω RF Input SMA Connector
- ◆ 50Ω Baseband Output BNC Connector
- ◆ Single 3.3V ±5% Supply
- ◆ I<sup>2</sup>C 2-Wire Serial Interface
- ◆ All Critical Peripheral Components Included
- ◆ Fully Assembled and Tested
- ◆ PC Control Software  
(available at [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware))

## Ordering Information

| PART          | TYPE   |
|---------------|--------|
| MAX2120EVKIT+ | EV Kit |

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

## Component List

| DESIGNATION   | QTY | DESCRIPTION   |
|---|-----|---|
| ADDR  | 0   | Not installed, 3-pin (1 x 3) inline header, 0.01in centers<br>Sullins PEC36SAAN |
| BB_I_O/P,<br>BB_Q_O/P   | 2   | 50Ω BNC PC mounts<br>Amphenol 31-5329-52RFX                                     |
| BB_IN, BB_IP,<br>BB_QN, BB_QP,<br>CP_OUT, J12,<br>J13, J17,<br>REF_O/P, VGC | 10  | PC mini red test points<br>Keystone 5000  |
| C1–C6, C9, C14  | 8   | 1000pF ±10% ceramic capacitors<br>(0603)<br>Murata GRM188R71H102K               |
| C7, C13, C19,<br>C20, C75   | 5   | 0.1μF ±10% ceramic capacitors<br>(0603)<br>Murata GRM188R71C104K                |
| C8, C12,<br>C25–C29   | 0   | Not installed, capacitors   |

| DESIGNATION                | QTY | DESCRIPTION  |
|----------------------------|-----|--|
| C10, C11                   | 2   | 0.047μF ±10% ceramic capacitors<br>(0603)<br>Murata GRM188R71C473K |
| C15                        | 1   | 0.033μF ±10% ceramic capacitor<br>(0603)<br>Murata GRM188R61A334K  |
| C16                        | 1   | 0.022μF ±10% ceramic capacitor<br>(0603)<br>Murata GRM188R71H223K  |
| C17, C18                   | 2   | 10μF ±10% tantalum capacitors<br>(C Case)<br>AVX TAJC016K016       |
| C22                        | 1   | 43.2Ω ±1% resistor (0603);<br>use lead-free parts only             |
| C23, C24, C71,<br>C72, C73 | 5   | 330pF ±5% ceramic capacitors<br>(0603)<br>Murata GRM1885C1H331J    |
| J6                         | 1   | DB25 right-angle male connector<br>AMP 5747238-4                   |

# MAX2120 Evaluation Kit

## Component List (continued)

| DESIGNATION  | QTY | DESCRIPTION  |
|--|-----|--|
| JP_VCC,<br>VCC_BB,<br>VCC_DIG,<br>VCC_LO,<br>VCC_RF1,<br>VCC_RF2,<br>VCC_SYN,<br>VCC_VCO | 0   | Not installed, 2-pin (1 x 2) inline headers, 0.01in centers<br>Sullins PEC36SAAN |
| L1   | 1   | 33pF $\pm 5\%$ capacitor (0603)<br>Murata GRM1885C1H330J                         |
| R2, R12, R18,<br>R19, R20, R22,<br>R25, R27–R33  | 0   | Not installed, resistors   |
| R3, R7, R15,<br>R16, R17, R21  | 6   | 0 $\Omega$ $\pm 5\%$ resistors (0603);<br>use lead-free parts only               |
| R4, R5, R13,<br>R24  | 4   | 1k $\Omega$ $\pm 5\%$ resistors (0603);<br>use lead-free parts only              |
| R6   | 1   | 820 $\Omega$ $\pm 5\%$ resistor (0603);<br>use lead-free parts only              |
| R8   | 1   | 86.6 $\Omega$ $\pm 1\%$ resistor (0603);<br>use lead-free parts only             |
| R9, R10, R11,<br>R41, R42  | 5   | 100 $\Omega$ $\pm 1\%$ resistors (0603);<br>use lead-free parts only             |
| R14, R43   | 2   | 5.1k $\Omega$ $\pm 5\%$ resistors (0603);<br>use lead-free parts only            |
| R23, R26   | 2   | 0.1 $\mu$ F $\pm 10\%$ ceramic capacitors<br>(0603)<br>Murata GRM188R71C104K     |

| DESIGNATION | QTY | DESCRIPTION   |
|-------------|-----|---|
| R46, R47    | 2   | 2.7k $\Omega$ $\pm 5\%$ resistors (0603);<br>use lead-free parts only   |
| REF_INPUT   | 0   | Not installed, SMA edge-mount<br>connector, round contact<br>Emerson 142-0701-801   |
| RF_INPUT    | 1   | SMA edge-mount connector,<br>round contact<br>Emerson 142-0701-801  |
| U1          | 1   | Maxim DVBS tuner<br>MAX2120CTI+ (28-pin thin QFN-EP)  |
| U2, U4      | 0   | Not installed, Maxim single-supply<br>op amps with R2R outputs<br>Maxim MAX4453ESA  |
| U3          | 1   | 74LV07A hex buffer/driver OC<br>TI SN74LV07ADR  |
| U5          | 0   | Not installed, Maxim open I/O<br>comparator<br>MAX985   |
| Y1          | 1   | 4MHz crystal<br>Citizen America 300-8526-1-ND<br>Digi-Key HCM49-4.000MABJ-UT  |
| —           | 0   | Not installed, shunts (JP_VCC,<br>VCC_BB, VCC_DIG, VCC_LO,<br>VCC_RF1, VCC_RF2, VCC_SYN,<br>VCC_VCO)<br>Shorting jumpers, 2 position<br>Sullins SSC02SYAN |
| —           | 1   | PCB: MAX2112/20<br>EVALUATION KIT   |

# MAX2120 Evaluation Kit

Evaluates: MAX2120

## Component Suppliers

| SUPPLIER                        | PHONE        | FAX          | WEBSITE                     |
|---------------------------------|--------------|--------------|-----------------------------|
| AMP/Tyco Electronics            | 800-522-6752 | —            | www.tycoelectronics.com     |
| Amphenol RF                     | 800-627-7100 | —            | www.amphenolrf.com          |
| AVX Corp.                       | 843-448-9411 | 843-448-7139 | www.avxcorp.com             |
| Digi-Key Corp.                  | 800-344-4539 | 218-681-3380 | www.digikey.com             |
| Emerson Network Power           | 507-833-8822 | —            | www.emersonnetworkpower.com |
| Keystone Electronics Corp.      | 209-796-2032 | —            | www.keyelco.com             |
| Maxim Integrated Products, Inc. | 888-629-4642 | 800-992-1884 | www.maxim-ic.com            |
| Murata Mfg. Co., Ltd.           | 770-436-1300 | 770-436-3030 | www.murata.com              |
| Sullins Electronics Corp.       | 760-744-0125 | 760-744-6081 | www.sullinselectronics.com  |
| Texas instruments               | 800-336-5236 | —            | www.ti.com                  |

**Note:** Indicate that you are using the MAX2120 when contacting these component suppliers.

## Quick Start

### Test Equipment Required

- One dual-output power supply capable of supplying up to 3.3V at > 160mA for V<sub>CC</sub> and 3V at > 50 $\mu$ A for V<sub>G</sub>C gain control voltage
- One RF signal generator capable of delivering at least 0dBm of output power at frequencies up to 2.175GHz
- 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, Windows 4.0/XP®, or later operating system, 64MB of memory, and an available parallel port
- One 25-pin parallel cable
- One multichannel digital oscilloscope (optional)
- One network analyzer to measure return loss (optional)
- One ammeter to measure supply current (optional)

### Procedure

The EV kit is fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section for proper device evaluation.

### Measurement Considerations

The EV kit includes on-board matching circuitry at the MAX2120 RF input to convert the 50 $\Omega$  source to a 75 $\Omega$

input. Note that the input power to the device must be adjusted to account for the -6dB power loss of the matching resistor network.

### 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 all jumpers are in place.
- 2) With its output disabled, connect the DC power supply to V<sub>G</sub>C set to 0.5V (maximum gain).
- 3) With its output disabled, set the DC power supply to 3.3V. Connect the power supply to the V<sub>CC</sub> (through an ammeter if desired) and GND terminals on the EV kit. If available, set the current limit to 200mA.
- 4) With its output disabled, set the RF signal generator to a 955MHz frequency at -69dBm to account for the 6dB resistive pad loss. When measuring noise figure, this 6dB must also be accounted for by subtracting 6dB from the measured noise figure, unless the pad has been removed.
- 5) Connect the output of the RF signal generator to the SMA connector labeled RF\_INPUT on the evaluation board.
- 6) Connect a 25-pin parallel cable between the PC's parallel port and the EV kit board.

Windows and Windows XP are registered trademarks of Microsoft Corp.

## **MAX2120 Evaluation Kit**

- 7) Turn on the 3.3V V<sub>CC</sub> power supply, followed by the 3V gain-control power supply. The supply current from the 3.3V V<sub>CC</sub> supply should read approximately 100mA, and the supply current from the 3V V<sub>GC</sub> should read approximately 50μA. Be sure to adjust the power supply to account for any voltage drop across the ammeter.
- 8) Install and run the IC's control software. Software is available for download on the Maxim website at [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware).
- 9) Load the default register settings from the control software by clicking **Edit: Load Defaults**. Set ICP = 1 and BBG[3:0] = 1011.
- 10) Connect the output to a spectrum analyzer or an oscilloscope.
- 11) Enable the RF signal generator's output.
- 12) Activate and set the power level of the RF generator to achieve 1V<sub>P-P</sub> at the baseband BNC connector outputs.
- 13) Check the I/Q outputs.
- 14) Observe the baseband output at 5MHz with 1V<sub>P-P</sub>.

### **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. Use controlled impedance on all high-frequency traces. The exposed paddle must be soldered evenly to the board's ground plane for proper operation. Use abundant vias beneath the exposed paddle 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<sub>CC</sub> node. The V<sub>CC</sub> traces branch out from this node, with each trace going to separate V<sub>CC</sub> pins of the IC. Each V<sub>CC</sub> 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.

# MAX2120 Evaluation Kit

Evaluates: MAX2120

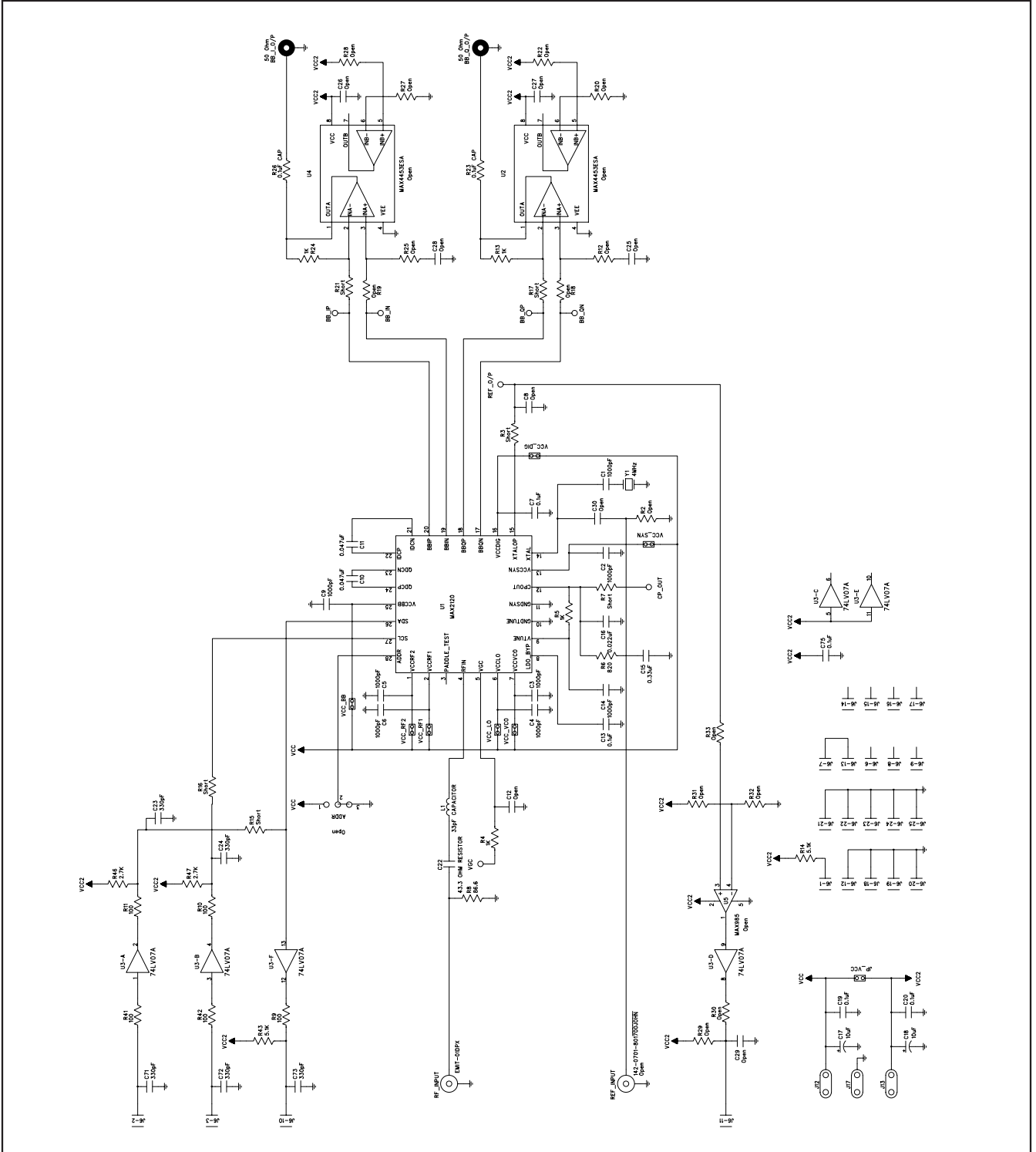


Figure 1. MAX2120 EV Kit Schematic

# MAX2120 Evaluation Kit

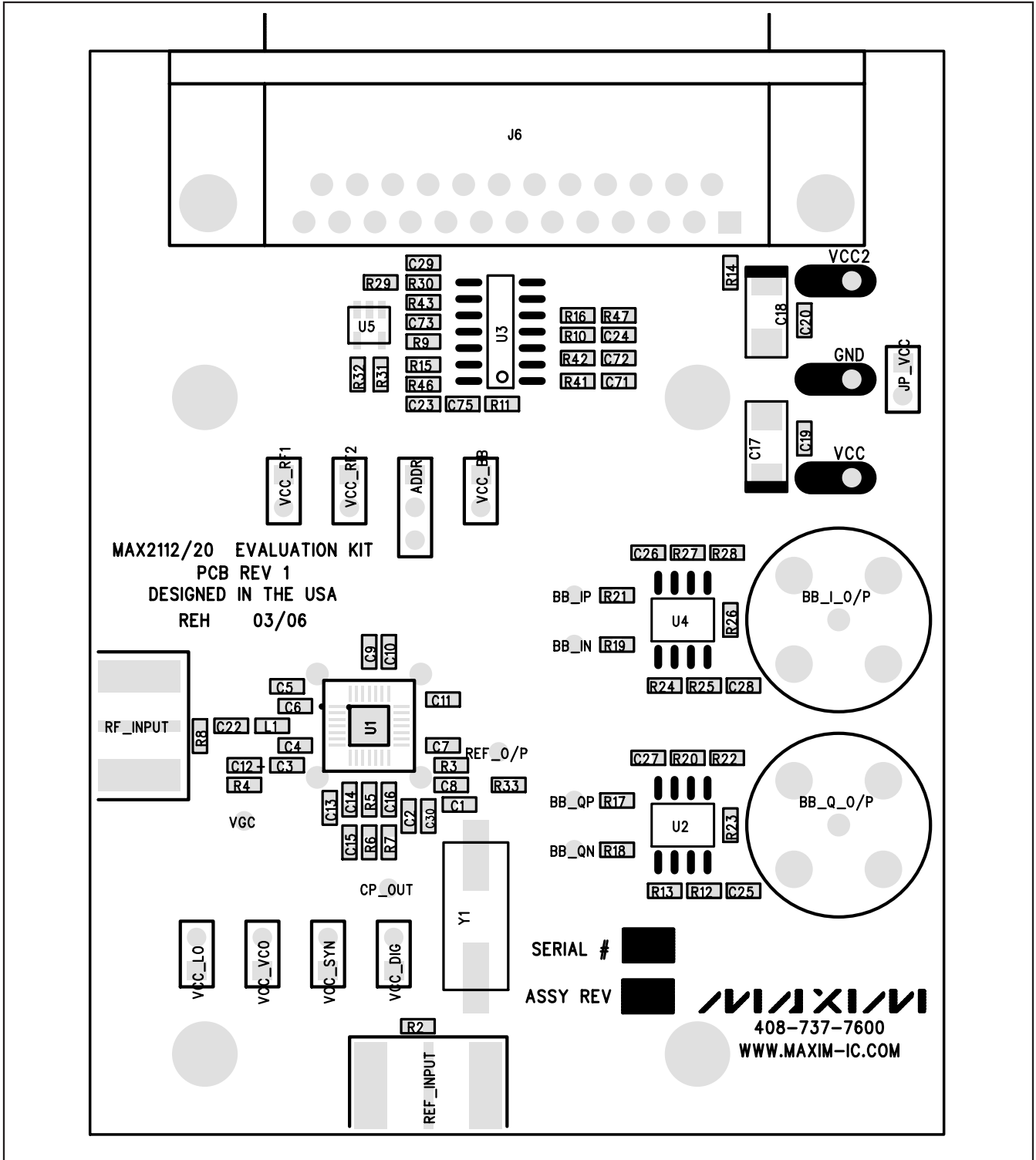


Figure 2. MAX2120 EV Kit PCB Layout—Component Placement Guide

# MAX2120 Evaluation Kit

Evaluates: MAX2120

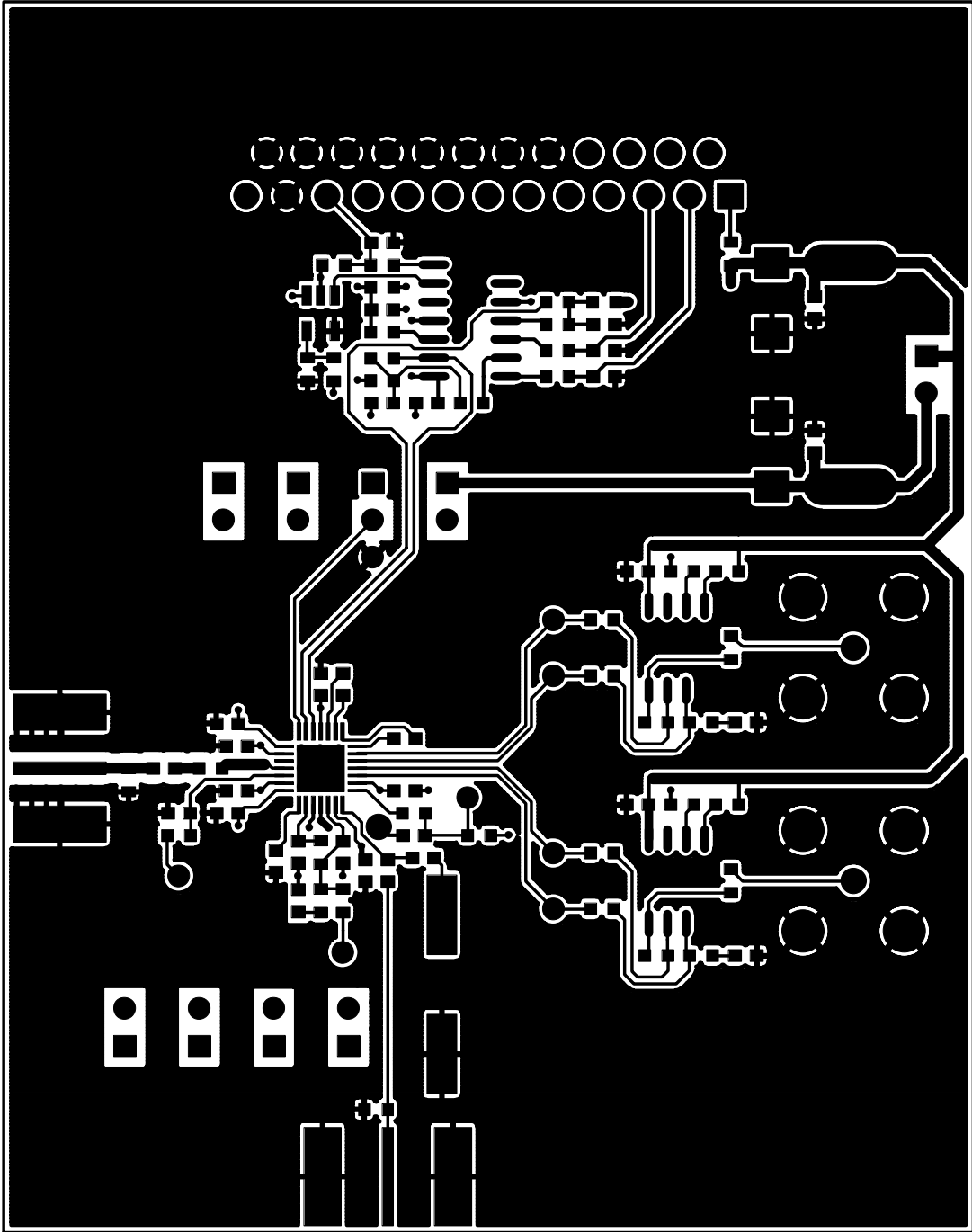


Figure 3. MAX2120 EV Kit PCB Layout—Top

# MAX2120 Evaluation Kit

Evaluates: MAX2120

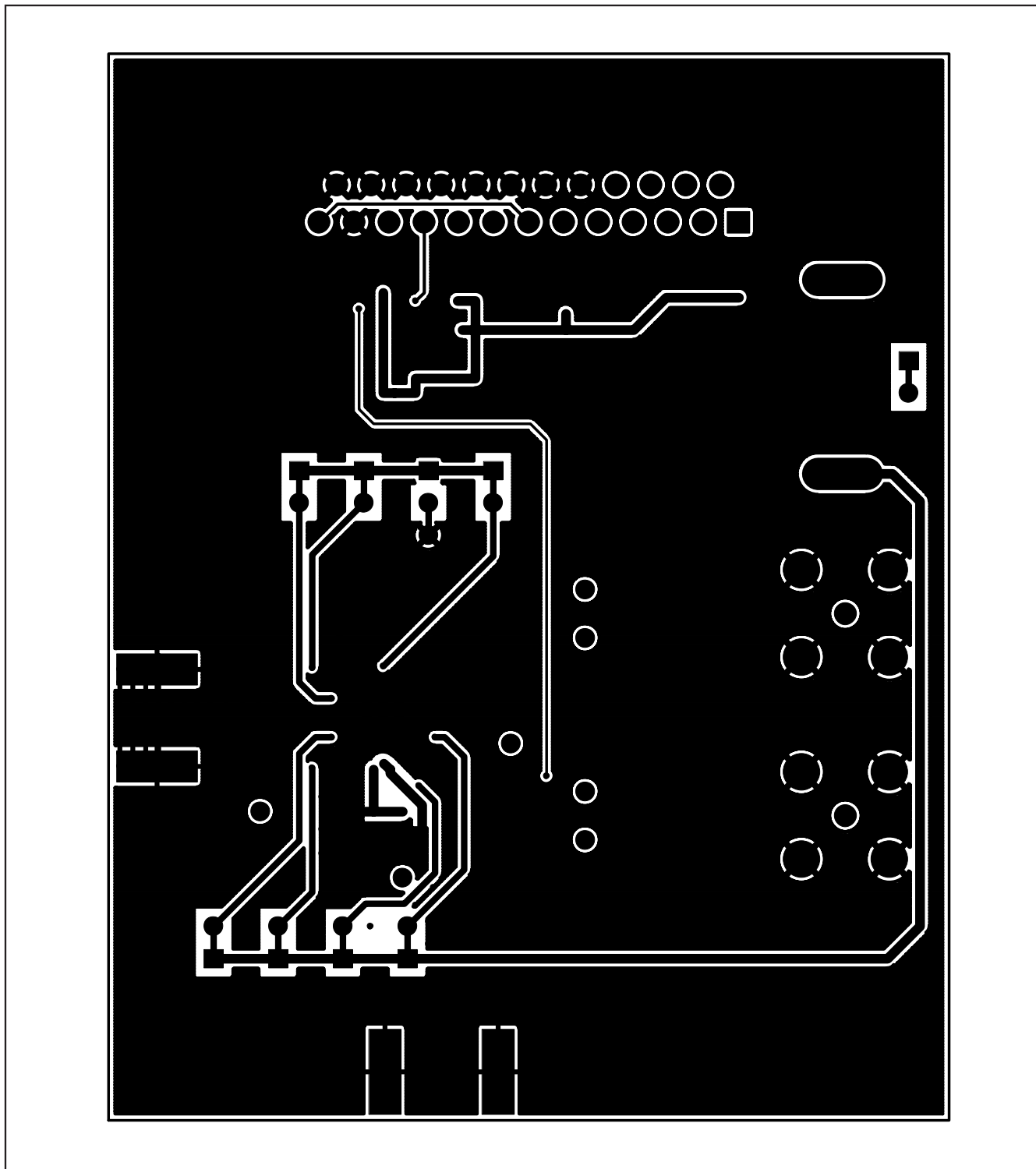


Figure 4. MAX2120 EV Kit PCB Layout—Bottom



# MAX2120 Evaluation Kit

Evaluates: MAX2120

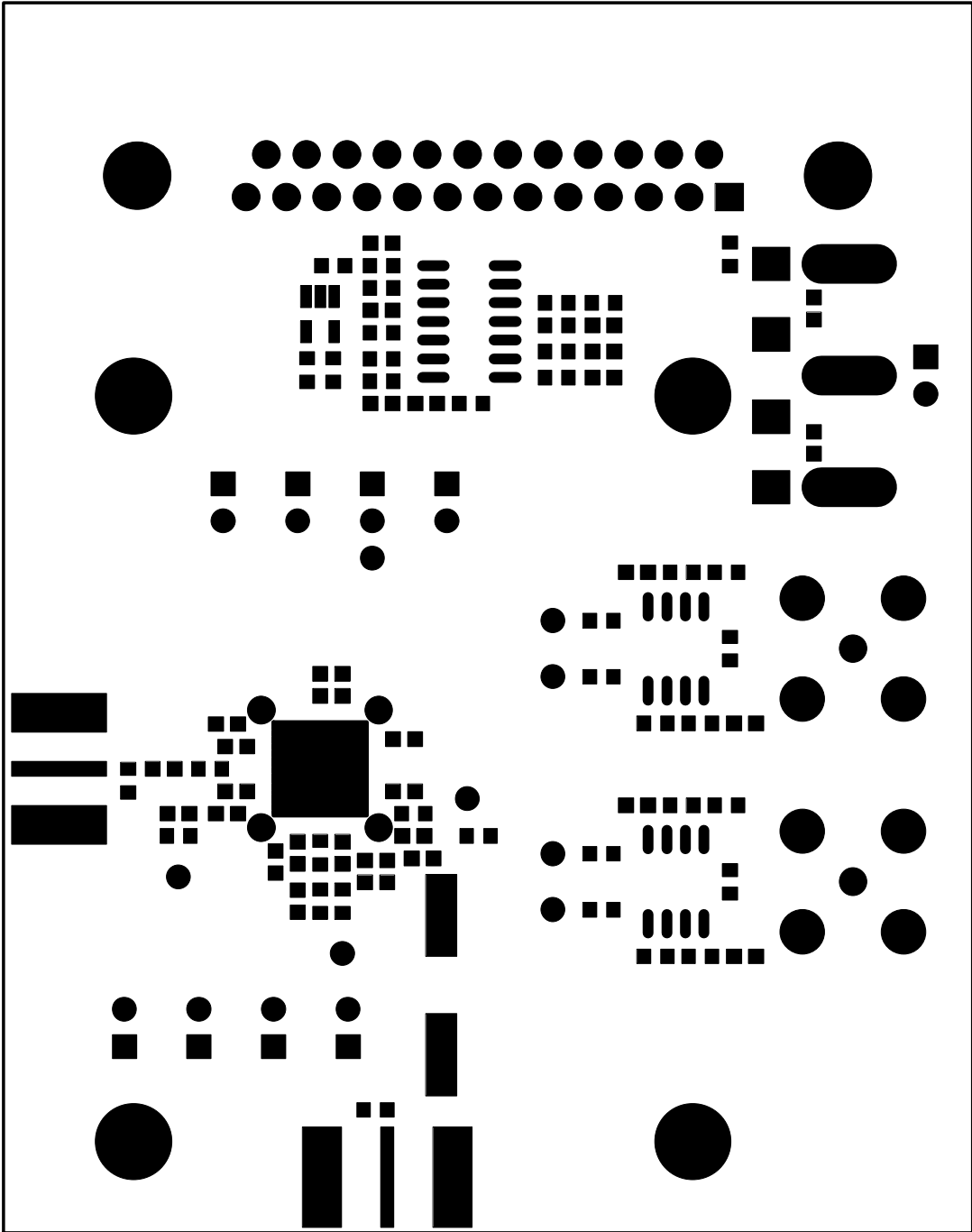


Figure 5. MAX2120 EV Kit PCB Layout—Top Soldermask

# MAX2120 Evaluation Kit

Evaluates: MAX2120

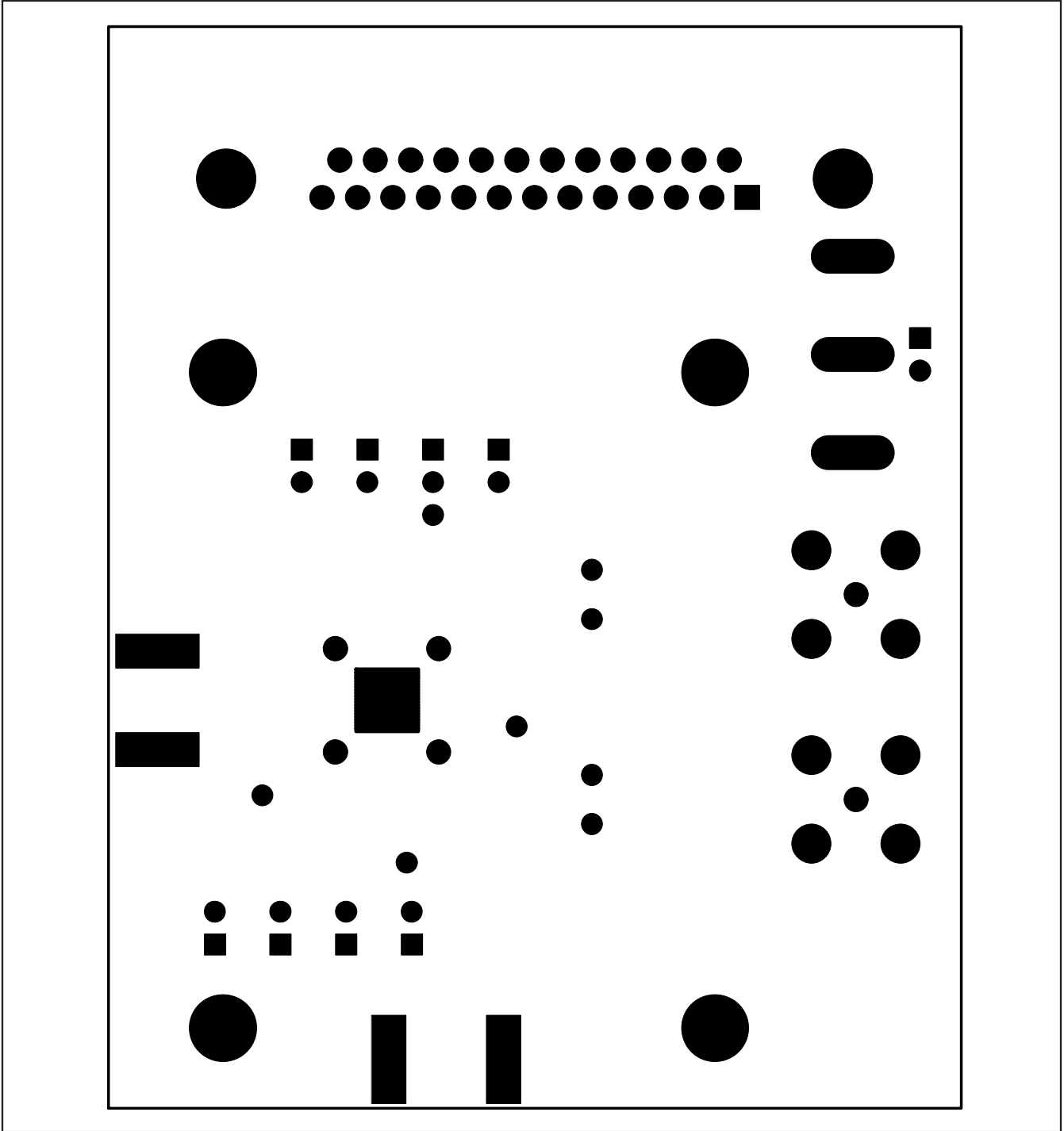


Figure 6. MAX2120 EV Kit PCB Layout—Bottom Soldermask

# MAX2120 Evaluation Kit

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION  | PAGES CHANGED |
|-----------------|---------------|--|---------------|
| 0               | 11/07         | Initial release                                      | —             |
| 1               | 5/10          | Updated L1 in the <i>Component List</i> and Figure 1 | 2, 5          |

Evaluates: MAX2120

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

11 \_\_\_\_\_ **Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600**