

MAX2121 Evaluation Kit

Evaluates: MAX2121

General Description

The MAX2121 evaluation kit (EV kit) simplifies the testing and evaluation of the IC 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 PCB.

Features

- ◆ Easy Evaluation of the MAX2121
- ◆ 50Ω RF Input SMA Connector
- ◆ 50Ω Baseband Output BNC Connector
- ◆ Single 3.3V ±5% Supply
- ◆ I²C 2-Wire Serial Interface
- ◆ All Critical Peripheral Components Included
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested
- ◆ PC Control Software
(Available at www.maximintegrated.com/evkitsoftware)

Ordering Information appears at end of data sheet.

Component List

| DESIGNATION | QTY | DESCRIPTION |
|---|-----|---|
| ADDR | 0 | Not installed, 3-pin (1 x 3) inline header, 0.01in centers Sullins PEC36SAAN |
| CP_OUT, J13, REF_O/P, VGC | 4 | PC mini red test points Keystone 5000 |
| C1–C6, C9 | 7 | 1000pF ±10% ceramic capacitors (0603) Murata GRM188R71H102K |
| C7, C13, C20, C21, C25, C26, C27, C75 | 8 | 0.1μF ±10% ceramic capacitors (0603) Murata GRM188R71C104K |
| C8, C12, C30 | 0 | Not installed, capacitors |
| C10, C11 | 2 | 0.047μF ±10% ceramic capacitors (0603) Murata GRM188R71C473K |
| C14 | 1 | 100pF ±5% ceramic capacitor (0603) Murata GRM1885C1H101J |
| C15 | 1 | 0.033μF ±10% ceramic capacitor (0603) Murata GRM188R71E333K |
| C16 | 1 | 2200pF ±5% ceramic capacitor (0603) Murata GRM188R71H222J |

| DESIGNATION | QTY | DESCRIPTION |
|--|-----|--|
| C18 | 1 | 10μF ±10% tantalum capacitor (C Case) AVX TAJC016K016 |
| C23, C24, C71, C72, C73 | 5 | 330pF ±5% ceramic capacitors (0603) Murata GRM1885C1H331J |
| C28, C31 | 2 | 5pF ±0.25pF ceramic capacitors (0603) Murata GRM1885C1H5R0C |
| C32 | 1 | 33pF ±5% capacitor (0603) Murata GRM1885C1H330J |
| IN, IP, QN, QP | 4 | SMA PC top-mount connectors Emerson 142-0701-201 |
| J6 | 1 | DB25 right-angle male connector AMP 5747238-4 |
| J17 | 1 | PC mini black test point Keystone 5001 |
| JP1, JP2, VCC_BB, VCC_DIG, VCC_LO, VCC_RF1, VCC_RF2, VCC_SYN, VCC_VCO | 0 | Not installed, 2-pin (1 x 2) inline headers, 0.01in centers Sullins PEC36SAAN |

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Component List (continued)

| DESIGNATION | QTY | DESCRIPTION |
|------------------------|-----|---|
| R1, R12, R13, R17 | 4 | 49.9Ω ±1% resistors (0603); use lead-free parts only |
| R2 | 0 | Not installed, resistor |
| R3, R7, R15, R16 | 4 | 0Ω ±5% resistors—short (0603); use lead-free parts only |
| R4 | 1 | 1kΩ ±5% resistor (0603); use lead-free parts only |
| R5 | 1 | 820Ω ±5% resistor (0603); use lead-free parts only |
| R6 | 1 | 390Ω ±5% resistor (0603); use lead-free parts only |
| R8 | 1 | 86.6Ω ±1% resistor (0603); use lead-free parts only |
| R9, R10, R11, R41, R42 | 5 | 100Ω ±1% resistors (0603); use lead-free parts only |
| R14, R43 | 2 | 5.1kΩ ±5% resistors (0603); use lead-free parts only |
| R18 | 1 | 43.2Ω ±1% resistor (0603); use lead-free parts only |
| R46, R47 | 2 | 2.7kΩ ±5% resistors (0603); use lead-free parts only |

| DESIGNATION | QTY | DESCRIPTION |
|-------------|-----|--|
| REF_INPUT | 0 | Not installed, SMA edge-mount connector, round contact Emerson 142-0701-801 |
| RF_INPUT | 1 | SMA edge-mount connector, round contact Emerson 142-0701-801 |
| U1 | 1 | DVBS tuner (28 TQFN-EP) Maxim MAX2121ETI+ |
| U3 | 1 | 74LV07A hex buffer/driver OC TI SN74LV07ADR |
| Y1 | 1 | 27MHz crystal Citizen America HCM49-27.000MABJ-UT Digi-Key 300-8571-1-ND |
| — | 0 | Not installed, shunts (JP1, JP2, VCC_BB, VCC_DIG, VCC_LO, VCC_RF1, VCC_RF2, VCC_SYN, VCC_VCO) Shorting jumpers, 2 position Sullins SSC02SYAN |
| — | 1 | PCB: MAX2121 EVALUATION KIT# |

Component Suppliers

| SUPPLIER | PHONE | WEBSITE |
|--|--------------|-----------------------------|
| AMP/Tyco Electronics | 800-522-6752 | www.tycoelectronics.com |
| AVX Corporation | 843-946-0238 | www.avx.com |
| Citizen America Corp. | 310-781-1460 | www.citizencrystal.com |
| Digi-Key Corp. | 800-344-4539 | www.digikey.com |
| Emerson Network Power | 507-833-8822 | www.emersonnetworkpower.com |
| Keystone Electronics Corp. | 209-796-2032 | www.keyelco.com |
| Murata Electronics North America, Inc. | 770-436-1300 | www.murata-northamerica.com |
| Sullins Electronics Corp. | 760-744-0125 | www.sullinselectronics.com |

Note: Indicate that you are using the MAX2121 when contacting these component suppliers.

Quick Start

Test Equipment Required

- MAX2121 EV kit
- Dual-output power supply capable of supplying up to 3.3V at > 160mA for V_{CC} and 3V at > 50μA for V_{GC} gain-control voltage
- RF signal generator capable of delivering at least 0dBm of output power at frequencies up to 2.175GHz

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- RF spectrum analyzer capable of covering the operating frequency range of the device
- PC, laptop, or tablet with Windows XP®, Windows® 7 or 8 operating system, and a USB port
- USB A male to USB B male cable
- US keyboard
- Multichannel digital oscilloscope (optional)
- Network analyzer to measure return loss (optional)
- Ammeter to measure supply current (optional)

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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 MAX2121 RF input to convert the 50Ω source to a 75Ω 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 VGC 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 VCC (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 the PC to the INTF3000 Interface Board using a USB A male to USB B male cable. On INTF3000, place a jumper between pins 1-2 of JU1 (VBUS Pos). Connect a 25-pin connector of the INTF3000 (J4) directly to the 25-pin connector of the EV kit (J6).
- 7) Turn on the 3.3V V_{CC} power supply, followed by the 3V gain-control power supply. The supply current from the 3.3V V_{CC} supply should read approximately 150mA, and the supply current from the 3V VGC should read approximately 50 μ A. Be sure to adjust the power supply to account for any voltage drop across the ammeter.
- 8) Install and run the IC control software. Software is available for download at www.maximintegrated.com/evkitsoftware.
- 9) Load the default register settings from the control software by clicking **Edit: Load Defaults**.
- 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_{p-p} differential across IP/IN or QP/QN. Note that the intended 200 Ω differential load is dependent on each baseband output being properly terminated into 50 Ω . For example, terminate IP into a 50 Ω spectrum analyzer and terminate IN into 50 Ω . The summation of these two 50 Ω terminations and the two series 50 Ω resistors on the EV kit equates to the desired 200 Ω differential load. In this configuration, the 1V_{p-p} differential voltage across IP/IN is reduced to 250mV_{p-p} (-8dBm) at the spectrum-analyzer input.
- 13) Check the I/Q outputs.
- 14) Observe the baseband output at 5MHz with differential 1V_{p-p}.

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 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 IC. 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.

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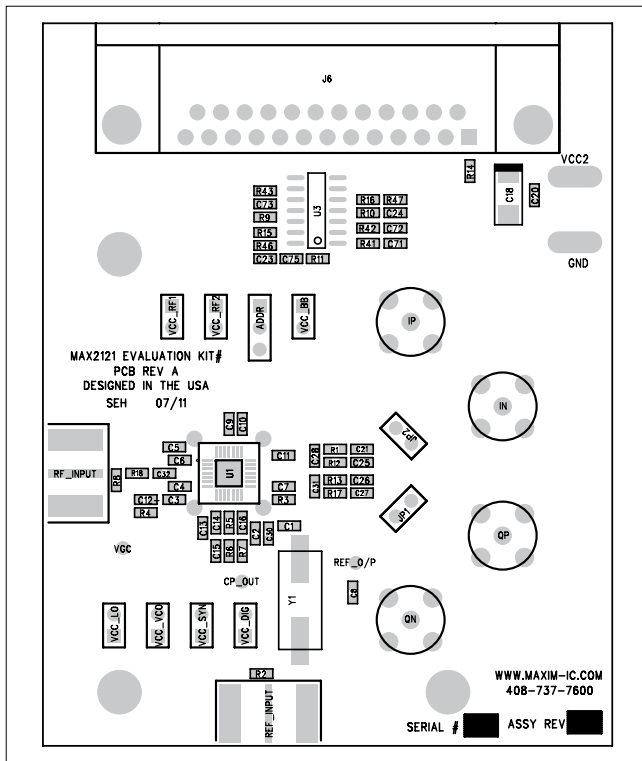


Figure 2. MAX2121 EV Kit Component Placement Guide—Component Side

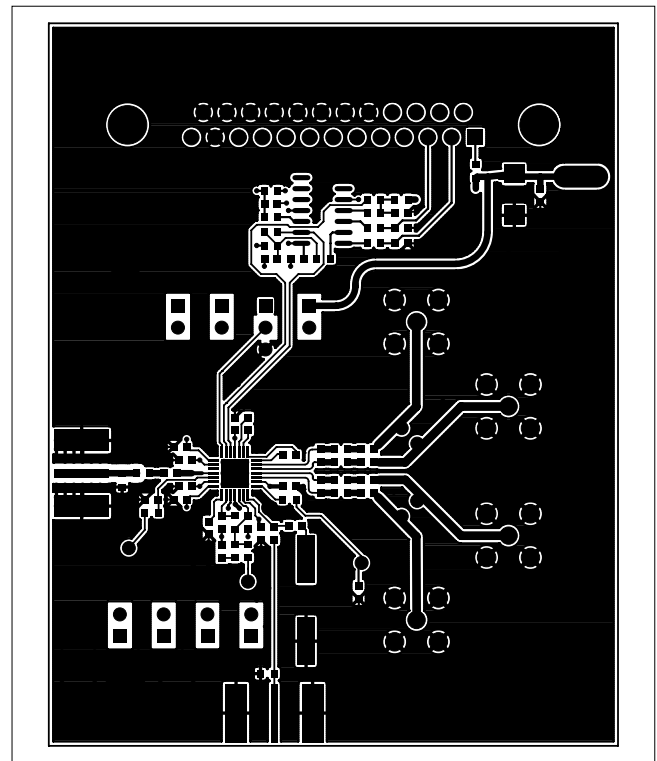


Figure 3. MAX2121 EV Kit PCB Layout—Top

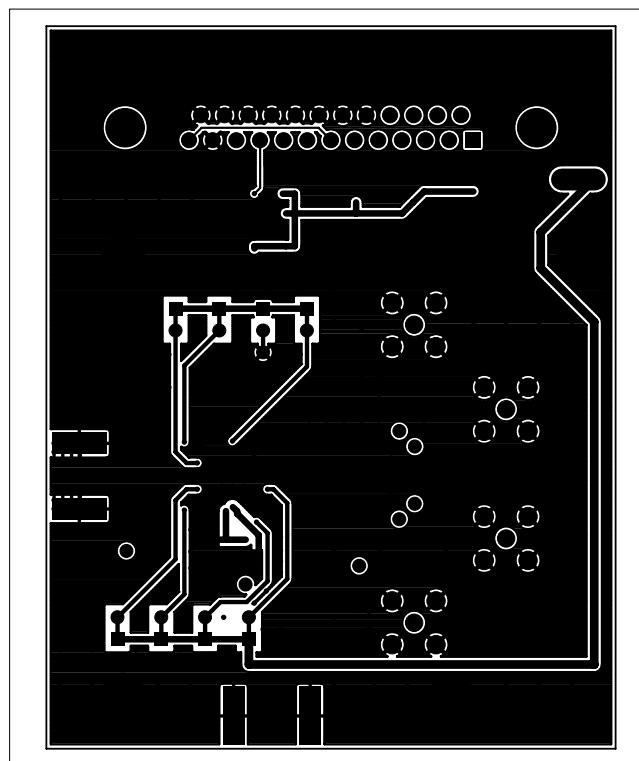


Figure 4. MAX2121 EV Kit PCB Layout—Bottom

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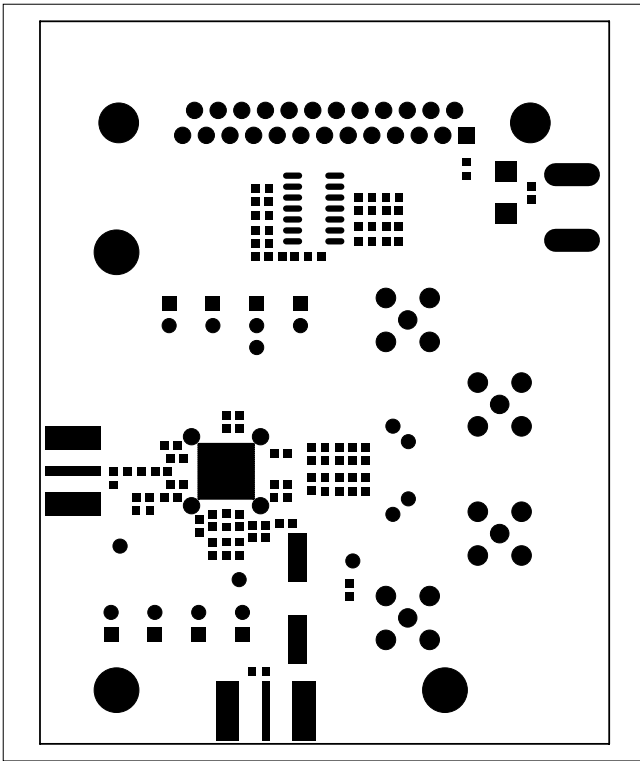


Figure 5. MAX2121 EV Kit PCB Layout—Top Soldermask

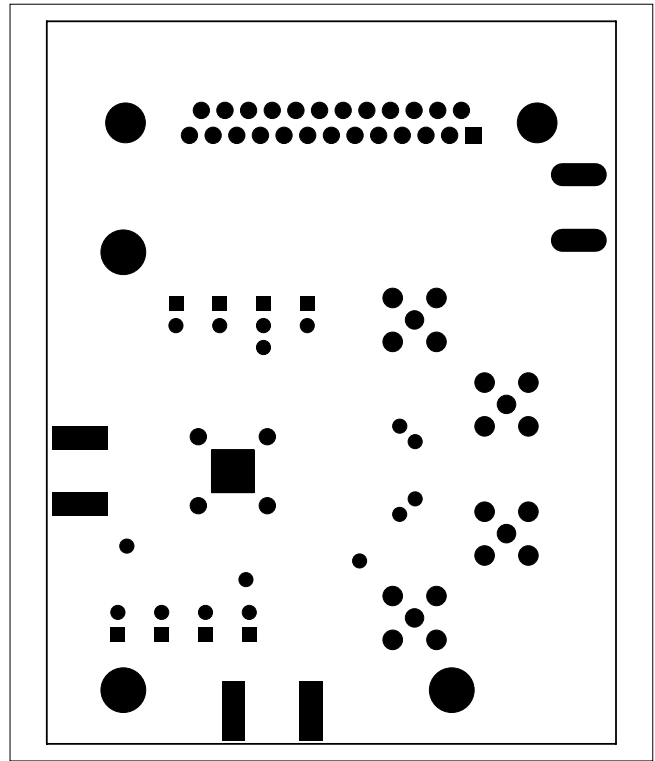


Figure 6. MAX2121 EV Kit PCB Layout—Bottom Soldermask

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Ordering Information

| PART | TYPE |
|---------------|-------------|
| MAX2121EVKIT# | EV Kit |

#Denotes RoHS compliant.

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Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|-----------------|---------------|--|---------------|
| 0 | 11/11 | Initial release | — |
| 1 | 5/15 | Updated the <i>Test Equipment Required</i> and the <i>Connections and Setup</i> sections | 2, 3 |



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