General Description

The MAX2181 evaluation kit (EV kit) simplifies evaluation of the MAX2181 FM low-noise amplifier. The EV kit enables testing of the device's features and performance and does not require additional support circuitry or software. The signal input and output use SMA connectors to facilitate connection of RF test equipment.

The EV kit is fully assembled with the device on board and incorporates input matching components for the U.S. FM broadcast band.

Features

- Easy Evaluation of the MAX2181
- +6V to +24V Single-Supply Operation
- RF Input and Output Matched to 50Ω
- Proven PCB Layout
- Fully Assembled and Tested

***Ordering Information** appears at end of data sheet.*

Quick Start

Required Test Equipment

- RF signal generator (or generators) capable of delivering a signal in the 76MHz to 162.5MHz (FM) range at a power level of -34dBm.(A higher power source is required to measure distortion performance. See the *Measurements* section for more details)
- RF spectrum analyzer that covers the operating frequency range
- DC power supply capable of supplying +6V to +24V
- 50Ω cables with SMA connectors
- Ammeter to measure supply current (optional)
- Noise-figure meter to measure NF (optional)
- Network analyzer to measure gain and return loss (optional)

Connections and Setup

Checking Gain

The EV kit is fully assembled and factory tested. Follow the steps below for proper device evaluation in the default configuration.

1) Connect a DC supply with its output disabled (preset to +10V) to the VBATT and GND terminals (through an ammeter, if desired) on the EV kit.
2) Set the RF generator to the desired frequency at a power level of -37dBm. Disable the generator's output and connect it to the FMIN SMA connector on the EV kit.
3) Connect an SMA cable from the FMOUT SMA connector to the input of the spectrum analyzer.
4) Turn on the DC supply. The supply current should read approximately 56mA.
5) Activate the RF generator's output. The signal on the spectrum analyzer's display should indicate a typical

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gain, as shown on the MAX2181 IC data sheet after accounting for cable and board losses.

6) Optional: Another method of determining gain is by using a network analyzer. This has the advantage of displaying gain versus a swept frequency band, in addition to displaying input and output return loss. Refer to the user manual of the network analyzer for setup information. **Note:** Depending on the settings of the device's maximum gain and power detector, the AGC loop can become active for input power levels as low as -24dBm. To ensure consistent results are obtained, the stimulus level of the network analyzer should be no greater than -34dBm, ensuring that the gain is unaffected by the AGC loop.

Detailed Description of Hardware

Test Points

The MAX2181 signal path includes a power detector and AGC loop, which can be adjusted for maximum gain and AGC threshold. In addition, the AGC loop can be overridden by applying an external voltage to the FMAGC pin. Table 1 describes how to control the performance of the device using the test points on the EV kit.

Measurements

Noise

Noise figure can be measured using a NF meter. Because of the large number of FM broadcast signals that might be present, this measurement should take place with the EV kit in a screen box or other type of RF shield.

Distortion

Two-tone distortion of the amplifier can be measured using a power combiner to couple the signals from two generators into FMIN on the EV kit. During closed-loop operation, as the signal levels increase, the device's input impedance is reduced. At the upper end of the input signal level range, where each tone can be greater than 120dBµV, this reduced impedance could create distortion within the signal generators. For accurate distortion measurement, the input of the EV kit should be isolated from the signal generators and power combiner. This can be accomplished using a ferrite isolator.

Layout Considerations

Electrical

At high-signal-level conditions, the RF currents flowing in the device can induce voltages in the PCB ground plane, known as "ground bounce." To avoid unwanted spurious products due to ground bounce, proper grounding techniques must be followed.

Thermal

The device is designed to meet data sheet specifications at supply voltages up to +15V and to function at supply voltages up to +24V. Under these conditions, a significant amount of power must be dissipated by the device. This requires the application PCB to provide a low thermal impedance path to a thermal ground.

The EV kit PCB design accounts for this by providing an array of thermal vias in the ground plane and a wide top metal trace connecting the package pad to a nearby screw. Adjacent pins 5-7 and 14-16 are all grounded, which allows the wide trace.

Table 1. Control Performance with Test Points

TEST POINT	FUNCTION	DESCRIPTION
ANTSENSE	Antenna sense	Disables the device and sets the supply current to 20mA (typ) if the antenna fault is detected. Refer to the MAX2181 IC data sheet.
FMAGC	FM AGC loop control voltage	Applying a DC control voltage to FMAGC allows the user to override the AGC loop. 0V gives maximum gain; 5V gives minimum gain.
FMDET	FM AGC threshold	Sets the FM AGC threshold. Refer to the MAX2181 IC data sheet. Default value on the EV kit is 99dBµV (typ) referred to the FMOUT SMA connector (R4 = 43kΩ).
FMGAIN	FM gain control	Sets the maximum value of FM gain (FMAGC = 0V). Default setting on the EV kit is 6dB (typ) referred to the FMOUT SMA connector (R2 = 10kΩ).
LDO	Regulated voltage	Allows measurement of internal regulator voltage.

Component List

DESIGNATION	QTY	DESCRIPTION
ANTSENSE, FMAGC, FMDET, FMGAIN, LDO, VBATT (x2)	7	Test points
C3, C9	2	0.1µF ±10% ceramic capacitors (0603) Murata GRM188R71E104K
C4	1	2700pF ±10% ceramic capacitor (0603) Murata GRM1885C1H272K
C5	1	0.47µF ±10% ceramic capacitors(0603) Murata GRM188R71C474K
C6	1	100pF ±5% ceramic capacitor (0603) Murata GRM1885C1H101J
C7	1	33pF ±5% ceramic capacitor (0603) Murata GRM1885C1H3300J
C10	1	10µF ±10% tantalum capacitor (C case) AVX TAJC106K035R
C11	1	10µF ±10% tantalum capacitor (A case) AVX TAJA106K010R
FMIN, FMOUT	2	Connectors
GND	2	Test points
L1	1	470nH ±5% inductor (0603) Murata LQW18ANR47J00
L2	0	Not installed, ±5% midi spring air-cored inductor Coilcraft 1812SMS-R10JL
L3	1	82nH ±5% inductor (1008) Murata LQW2UAS82NJ00
L4	1	27nH ±5% inductor (0603) Murata LQW18AN27NJ00
R1	1	43kΩ resistor
R2	1	61.9Ω resistor
R3	1	105Ω resistor
R4	1	20kΩ resistor
R6	1	0Ω resistor
R7	1	100kΩ resistor
R8	1	10kΩ resistor
U1	1	FM automotive low-noise amplifier (16 TQFN-EP*) Maxim MAX2181
—	1	Metal heat sink
—	10	Screws
—	5	Standoffs
—	1	Brown box, 9 3/16in x 7in x 7/8in
—	1	ESD bag, 4in x 6in with ESD logo
—	1	Pink foam, 12in x 12in x 5mm
—	1	Web instructions
—	1	PCB: MAX2181 EVALUATION KIT#

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
AVX North America	864-967-2150	www.avx.com
Keystone Electronics Corp.	800-221-5510	www.keyelco.com
Murata Americas	800-241-6514	www.murataamericas.com

Note: *Indicate that you are using the MAX2181 when contacting these component suppliers.*

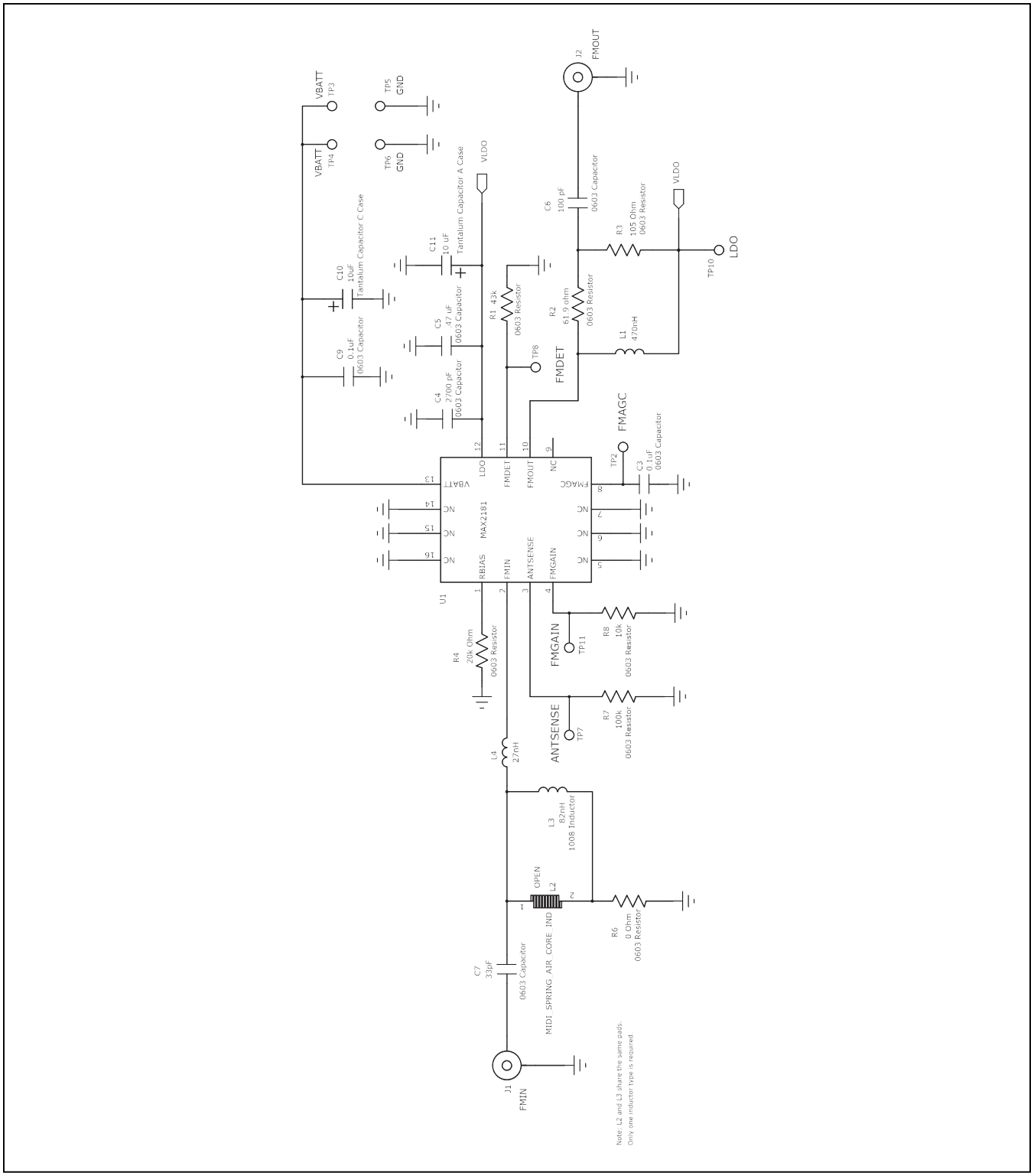

Figure 1. MAX2181 EV Kit Schematic

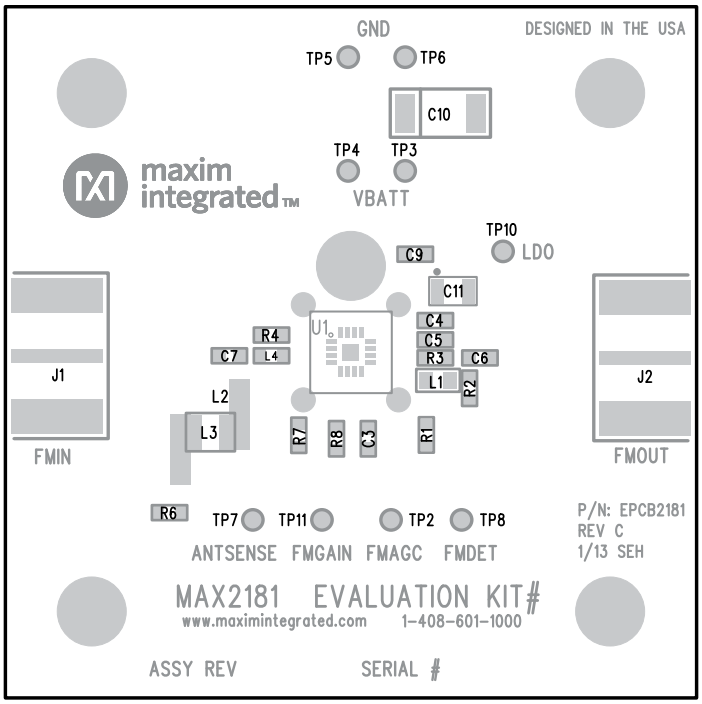

Figure 2. MAX2181 EV Kit Component Placement Guide—Top Silkscreen

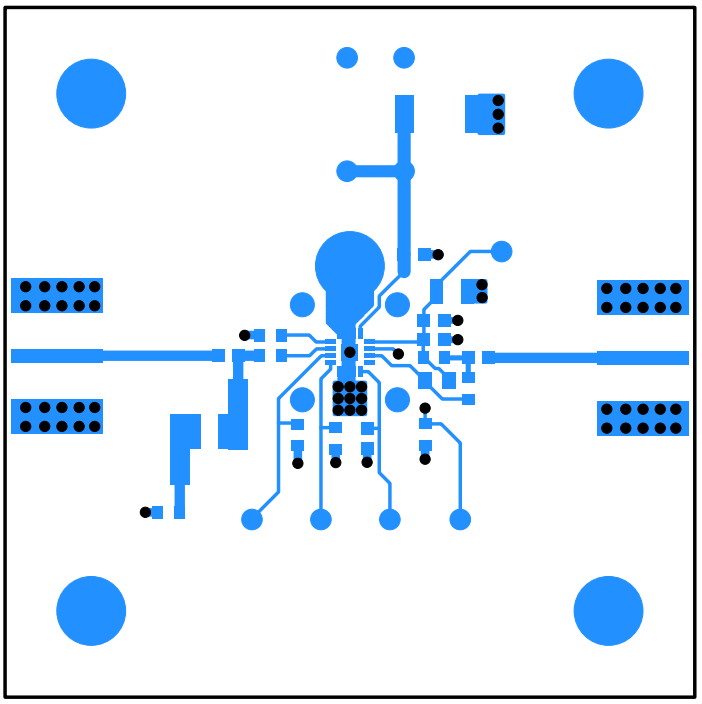

Figure 3. MAX2181 EV Kit PCB Layout—Top Copper

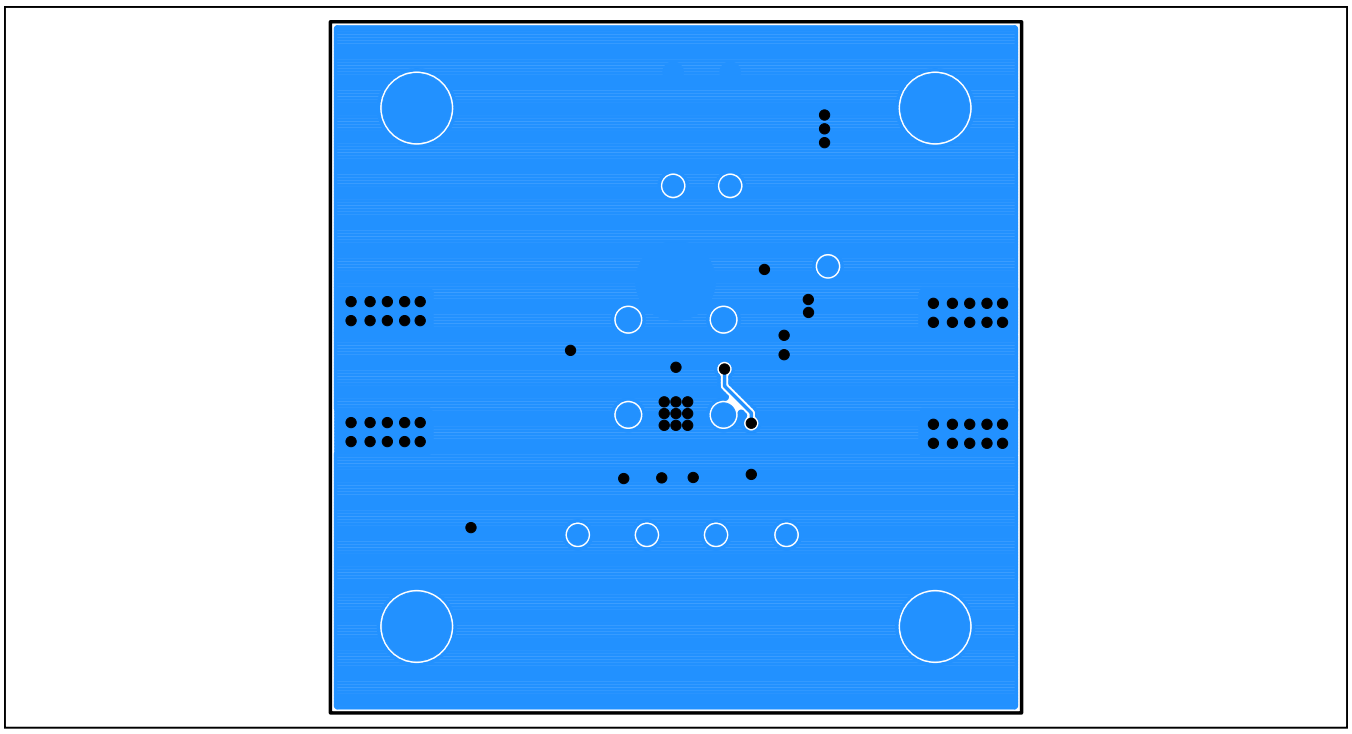

Figure 4. MAX2181 EV Kit PCB Layout—Bottom Copper

Ordering Information

PART	TYPE
MAX2181EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/13	Initial release	—

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