19-1759; Rev 0; 7/00

MAX2645 Evaluation Kit

Evaluates: MAX2645

General Description

The MAX2645 evaluation kit (EV kit) simplifies evaluation of the MAX2645 3.4GHz to 3.8GHz low-noise amplifier/PA predriver. The EV kit is fully assembled and tested, allowing simple evaluation of all device functions. All RF signal ports use SMA connectors, providing a convenient interface to RF test equipment.

The MAX2645 is a versatile, high-performance, low-noise amplifier with adjustable IP3. These features allow the MAX2645 to be used in a variety of applications, from a low-noise amplifier to a PA predriver. As assembled, the MAX2645 EV kit is configured for lowest noise figure performance (NF = 2.3dB, IIP3 = +4dBm). A few minor component changes configure the device as a low-noise amplifier with higher linearity and slightly degraded noise figure performance (NF = 2.6dB, IIP3 = +10dBm) or as a PA predriver with high output P1dB performance (output P1dB = +12dBm). Refer to the MAX2645 data sheet for application-specific performance data.

Features

- ♦ **Easy Evaluation of the MAX2645**
- ♦ **All Critical Peripheral Components Included**
- ♦ **SMA Input and Output Connectors**
- ♦ **RF Ports Matched to 50Ω at 3.55GHz**
- ♦ **Fully Assembled and Tested**

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX2645EVKIT	-40°C to +85°C	10 µMAX-EP*

*Exposed paddle

Component Suppliers

SUPPLIER	PHONE	FAX	WEB
AVX	843-448-9411	843-448-1943	Avxcorp.com
EFJohnson	402-474-4800	402-474-4858	Efjohnson.com
Kamaya	219-489-1533	219-489-2261	Kamaya.com
Murata	800-831-9172	814-238-0490	Murata.com
Taiyo Yuden	800-348-2496	847-925-0899	T-Yuden.com
Toko	800-PIK-TOKO	708-699-1194	Tokoam.com

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	1.5pF ±0.1pF ceramic capacitor (0402) Murata GRM36COG1R5B050
C2	1	220pF ±10% ceramic capacitor (0402) Murata GRM36X7R221K050
C3	1	47pF ±5% ceramic capacitor (0402) Murata GRM36COG470J050
C4	1	0.75pF ±0.1pF ceramic capacitor (0402) Murata GRM36COGR75B050
C5, C6, C8	3	0.1µF ±10% ceramic capacitors (0603) Murata GRM39X7R104K016
C7	1	10µF, 16V tantalum capacitor AVX TAJC106K016
C9	1	1000pF ±10% ceramic capacitor (0402) Murata GRM36X7R102K050
Z1	1	1.8nH inductor Toko LL1005-FH1N8S

DESIGNATION	QTY	DESCRIPTION
R1	1	20kΩ ±1% resistor (0603)
R2, R3	2	1kΩ ±5% resistors (0603)
JU1, JU2	2	3-pin headers
None	2	Shunts (JU1, JU2)
J1, J2	2	Test points (VCC, GND)
J3, J4	2	SMA connectors (edge mount) EFJohnson 142-0701-801
U1	1	MAX2645EUB
None	1	MAX2645 PC board (GETek)
None	1	MAX2645 data sheet
None	1	MAX2645 EV kit data sheet

Test Equipment Required

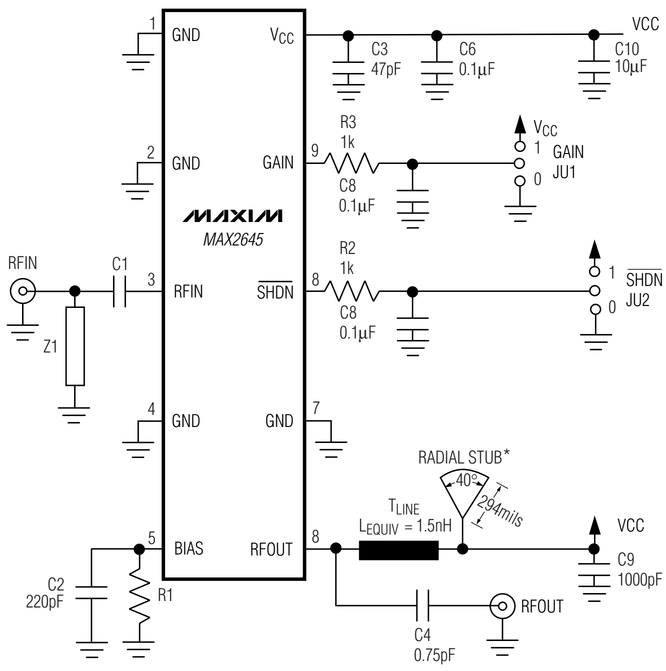
This section lists the test equipment required for evaluating the MAX2645:

- One DC power supply capable of supplying 20mA of supply current over the supply voltage range +3.0V to +5.5V
- One RF-signal generator or equivalent (50Ω) sine-wave source capable of delivering at least -10dBm of output power up to 3.8GHz (HP 8648, for example)
- One RF-spectrum analyzer or equivalent with a frequency range of at least 4GHz (HP 8561E, for example)
- Two 50Ω SMA cables (RG-58A/U or equivalent)
- Optional: Digital multimeters (DMMs) to monitor DC supply voltage and supply current
- Optional: Power meter for calibrating system measurements (HP 438A for example)

Connections and Setup

This section provides step-by-step instructions for setting up the EV kit and ensuring proper operation:

1) **DC Power Supply:** Set the DC power supply voltage to +3.3V. Turn the power supply off and connect it to the VCC and GND connections on the EV kit. If desired, place an ammeter in series with the power supply to measure supply current and a voltmeter in parallel with the VCC and GND connections to measure supply voltage at the device.
2) **RF Signal Generator:** Connect one of the 50Ω SMA cables to the RF output of the signal generator. Set the RF frequency of the signal generator to 3.55GHz at an output power level of -20dBm. To improve measurement accuracy, use a power



APPLICATION CIRCUIT	C1	Z1	R_{BIAS} (kΩ)	V_{CC} (V)
LNA, LOW NF	1.5pF	1.8nH	20	3.3
LNA, HIGH INPUT IP3	1000pF	0.75pF	20	3.3
PA PREDRIVER	0.01µF	0.75pF	15	5.0

*BOARD MATERIAL = GETek, COPPER THICKNESS = 1 oz
BOARD THICKNESS = 0.012in, DIELECTRIC CONSTANT = 3.8

Figure 1. MAX2645 EV Kit Schematic

meter to measure the actual power at the end of the SMA connector. Turn the output of the signal generator off once the output power has been set. Connect the other end of the SMA cable to the RFIN port of the MAX2645 EV kit.

3) **Spectrum Analyzer:** Connect the spectrum analyzer to the RFOUT port of the MAX2645 EV kit using a 50Ω SMA cable. Set the center frequency of the spectrum analyzer to 3.55GHz, the frequency span to 1MHz, and the reference level to 0dBm. To improve measurement accuracy, calibrate out any cable losses and spectrum analyzer offsets.

4) **Jumper Connections:** To enable the MAX2645, connect the $\overline{SHDN}$ jumper (JU2) on the EV kit to the "1" position ($\overline{SHDN}$ = V_{CC}). To place the MAX2645 in high-gain mode, connect the GAIN jumper (JU1) on the EV kit to the "1" position (GAIN = V_{CC}).

Analysis

Turn on the power supply, then the RF signal generator. The ammeter should read approximately 9.2mA, and the spectrum analyzer should show an output power of approximately -6dBm in high-gain mode. Be sure to take into account cable and board losses when calculating power gain. Typical board losses are 0.5dB at 3.5GHz.

To evaluate the MAX2645 in low-gain mode, connect the GAIN jumper (JU1) on the EV kit to the "0" position (GAIN = GND). The ammeter should read approximately 3mA, and the spectrum analyzer should show an output power of approximately -31dBm in low-gain mode.

To evaluate the MAX2645 low-power shutdown mode, connect the $\overline{SHDN}$ jumper (JU2) on the EV kit to the "0" position ($\overline{SHDN}$ = GND). The ammeter should read approximately 0.1µA.

To evaluate the MAX2645 as a low-noise amplifier with higher linearity performance or as a PA predriver, replace capacitor C1, Z1, and resistor R1 with the components recommended in the EV kit schematic (Figure 1). Refer to the MAX2645 data sheet for application-specific performance data.

Layout and Bypassing

The MAX2645 RFOUT output port requires an equivalent 1.5nH of high-impedance transmission line to V_{CC} for proper biasing and matching. This transmission line is terminated at the VCC node with a radial stub for high-frequency bypassing. This arrangement provides a high-Q, low-loss bias network used to optimize performance. The radial stub can be replaced with an appropriate microwave capacitor.

Good PC board layout is an essential aspect of RF circuit design. The MAX2645 EV board can serve as a guide for layout of your board. Keep PC board trace lengths as short as possible to minimize parasitics and losses. Keep bypass capacitors as close to the device as possible with low-inductance connections to the ground plane. Refer to the MAX2645 data sheet for more information regarding bypassing.

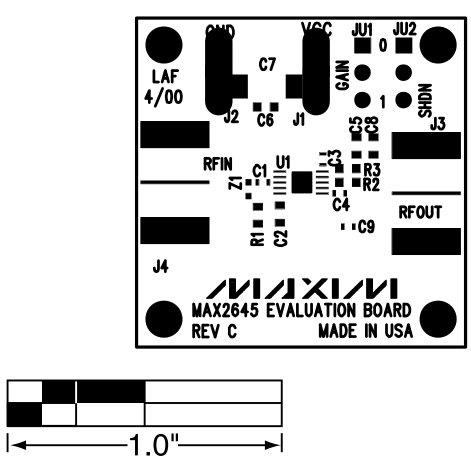


Figure 2. MAX2645 EV Kit PC Board Layout—Component Placement Guide

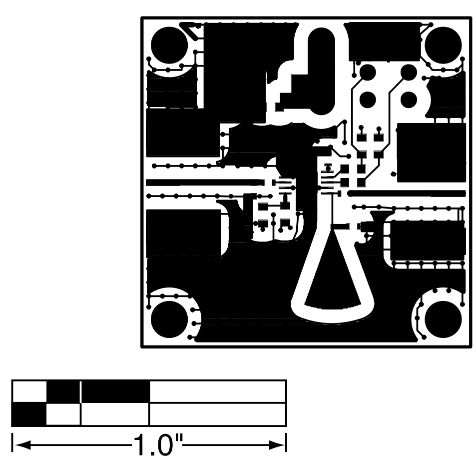


Figure 3. MAX2645 EV Kit PC Board Layout—Component Side

MAX2645 Evaluation Kit

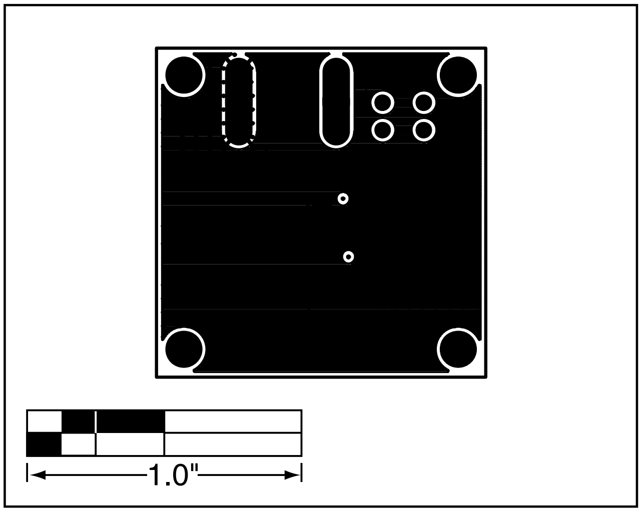


Figure 4. MAX2645 EV Kit PC Board Layout—Ground Plane

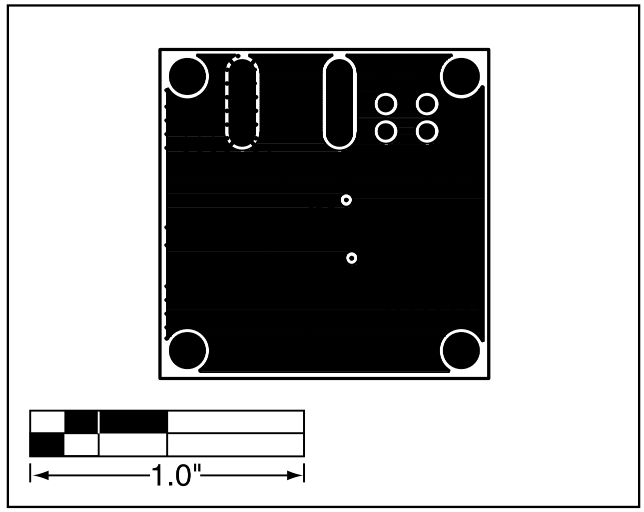


Figure 5. MAX2645 EV Kit PC Board Layout—Power Plane

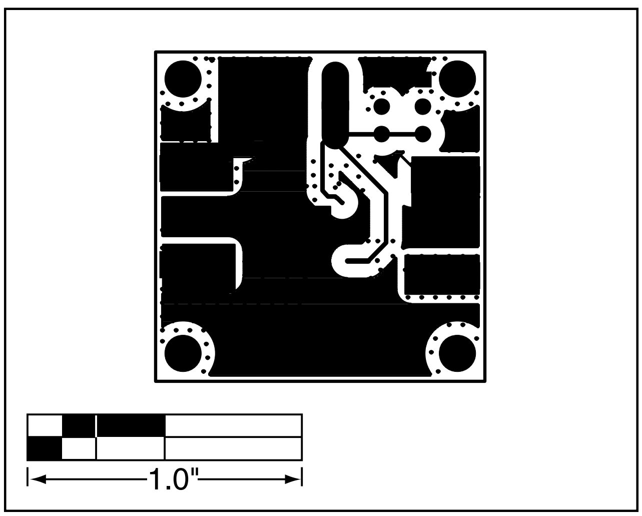


Figure 6. MAX2645 EV Kit PC Board Layout—Solder Side