

# MAX7058 Evaluation Kit

## Evaluates: MAX7058

### General Description

The MAX7058 evaluation kit (EV kit) provides a proven design to evaluate the MAX7058 dual-frequency ASK transmitter in a 24-pin TQFN package with an exposed pad. The EV kit enables testing of the device's RF performance and requires no additional support circuitry. The RF output uses a 50Ω matching network and an SMA connector for convenient connection to test equipment. The EV kit comes with a MAX7058ATG+ installed on the EV board.

### Features

- ◆ Proven PCB Layout
- ◆ Proven Components List
- ◆ Adjustable Programmable Frequency (315MHz and 390MHz)
- ◆ Fully Assembled and Tested

### Ordering Information

PART	TYPE
MAX7058EVKIT+	EV Kit

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

### Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3	3	0.01μF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H103K
C4, C5	2	0.1μF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C104K
C6	1	680pF ±5%, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H681J
C7, C8	2	220pF ±10%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H221K
C9, C10	2	100pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H101J
C11	1	8.2pF ±0.25pF, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H8R2C
C12, C13	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C14, C15	0	Not installed, ceramic capacitors (0603)

DESIGNATION	QTY	DESCRIPTION
J1	1	5-pin header
JU1–JU12	12	3-pin headers
L1	1	18nH ±5% inductor (0603) Murata LQW18AN18NJ00
L2	1	22nH ±5% inductor (0603) Murata LQW18AN22NJ00
R1	1	0Ω ±5% resistor
REFIN	0	Not installed, SMA female vertical mount
RFOUT	1	SMA female vertical mount
TP1, TP3–TP12	11	Black miniature test points
TP2	0	Not installed, miniature test point
U1	1	315MHz/390MHz dual-frequency ASK transmitter (24 TQFN-EP*) Maxim MAX7058ATG+
Y1	1	15MHz crystal Crystek O17480
—	12	Shunts
—	1	PCB: MAX7058 EVALUATION KIT+

\*EP = Exposed pad.

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### Component Suppliers

SUPPLIER	PHONE	WEBSITE
Crystek Corporation	800-237-3061	www.crystek.com
Murata Electronics North America	770-436-1300	www.murata-northamerica.com

**Note:** Indicate that you are using the MAX7058 when contacting these component suppliers.

### Quick Start

#### Required Equipment

- MAX7058 EV kit
- Spectrum analyzer
- 2.7V, 25mA power supply

#### Procedure

The MAX7058 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Verify that all jumpers (JU1–JU12) are in their default positions, as shown in Table 1.
- 2) Connect the positive terminal of the 2.7V power supply to the VDD pad and the GND terminal to the GND pad. **Do not turn on the power supply.**
- 3) By default, the MAX7058 is set to the carrier frequency of 315MHz (TOGGLE = 0, FSEL = 1).
- 4) Connect the RFOUT SMA connector to the spectrum analyzer. Set the analyzer to a center frequency of 315MHz and a span of 1MHz.
- 5) Add a shunt on jumper JU2 to the 1-2 position. This forces DIN to go high.
- 6) Turn on the power supply and observe the spectrum analyzer. The spectrum analyzer should display a peak of approximately +10dBm at 315MHz. Set DIN to 0 by moving the shunt on jumper JU2 to the 2-3 position. The spectrum analyzer peak at 315MHz is gone and only the noise floor displays. Set DIN to 1 by changing the shunt on JU2 to the 1-2 position. The center frequency is again at 315MHz.

- 7) To test at a carrier frequency of 390MHz, change the shunt on jumper JU12 to the 2-3 position (FSEL = 0).
- 8) Set the spectrum analyzer to a center frequency of 390MHz and a span of 1MHz.
- 9) With the shunt on jumper JU2 in the 1-2 position, the spectrum analyzer should display a peak of approximately +10dBm at 390MHz. Set DIN to 0 by moving the shunt on JU2 to the 2-3 position. The spectrum analyzer peak at 390MHz is gone and only the noise floor displays. Set DIN to 1 by changing the shunt on JU2 to the 1-2 position. The center frequency is again at 390MHz.

#### Additional Evaluation

For efficiency measurements, apply power to the VDD pad with an ammeter in series. Apply 2.7V to VDD.

Connect a power meter to RFOUT. Measure the output power and supply current.

The efficiency is calculated by the following equation:

$$\text{Efficiency} = \frac{10^{(P_{\text{OUT}}/10)}}{I \times V} \quad \text{eq. 1}$$

where I is in milliamps, V is in volts, and P<sub>OUT</sub> is in decibels relative to 1mW.

For example, if P<sub>OUT</sub> is equal to +10dBm, supply current is 10mA, supply voltage is 2.7V, and the efficiency is approximately 37%.

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**Table 1. MAX7058 EV Kit Jumper Description (JU1–JU12)**

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Connects DVDD to VDD.
	2-3	Connects DVDD to TP1. Must apply an external voltage on TP1 to power DVDD.
JU2	1-2	Connects DIN to VDD.
	2-3	Connects DIN to GND.
	Open*	To apply external data to DIN, take the shunt off and apply a pattern on TP3. Data rate can be as high as 100kbps NRZ.
JU3	1-2*	Connects ENABLE to VDD (normal operation).
	2-3	Connects ENABLE to GND (standby).
JU4	1-2	Connects TOGGLE to VDD (RF output data is toggled between the two carrier frequencies (see Table 2)).
	2-3*	Connects TOGGLE to GND (single-carrier frequency).
JU5	1-2*	Connects AVDD to VDD.
	2-3	Connects AVDD to TP6. Must apply an external voltage on TP6 to power AVDD.
JU6	1-2*	Connects PAVDD to VDD.
	2-3	Connects PAVDD to TP7. Must apply an external voltage on TP7 to power PAVDD.
JU7	1-2*	Connects PAOUT to ROUT for ASK amplitude shaping in.
	2-3	Connects PAOUT to PAVDD for ASK amplitude shaping out.
JU8	1-2	Connects CAP4 to VDD to add 4pF shunt capacitance to PAOUT only at 315MHz.
	2-3*	Connects CAP4 to GND.
JU9	1-2*	Connects CAP3 to VDD to add 2pF shunt capacitance to PAOUT only at 315MHz.
	2-3	Connects CAP3 to GND.
JU10	1-2	Connects CAP2 to VDD to add 1pF shunt capacitance to PAOUT only at 315MHz.
	2-3*	Connects CAP2 to GND.
JU11	1-2	Connects CAP1 to VDD to add 0.5pF shunt capacitance to PAOUT only at 315MHz.
	2-3*	Connects CAP1 to GND.
JU12	1-2*	Connects FSEL to VDD (see Table 2).
	2-3	Connects FSEL to GND (see Table 2).

\*Default position.

**Table 2. Toggle Pin Operation**

TOGGLE PIN	FSEL PIN	OPERATING STATE
0	0	Continuous fixed-frequency operation at 390MHz.
0	1	Continuous fixed-frequency operation at 315MHz.
1	0	Five packets toggle operation between 315MHz and 390MHz.
1	1	100 packets toggle operation between 315MHz and 390MHz.

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### Layout Issues

A properly designed PCB is essential for any RF/micro-wave circuit. Keep high-frequency input and output lines as short as possible to minimize losses and radiation. At high frequencies, trace lengths that are on the order of  $\lambda/10$  or longer can act as antennas.

Both parasitic inductance and capacitance are influential on circuit layouts and are best avoided by using short trace lengths. Generally, a 10-mil wide PCB trace, 0.0625in above a ground plane, with FR4 dielectric has about 19nH/in of inductance and about 1pF/in of capacitance. In the matching network, where the inductor is on the order of 22nH and a capacitor is on the order of 10pF, the proximity of the circuit to the MAX7058 has a strong influence on the effective component values.

To reduce the parasitic inductance, use a solid ground or power plane below the signal traces. Also, use low-inductance connections to ground on all GND pins, and place decoupling capacitors close to all VDD connections.

### Detailed Description of Hardware

The MAX7058 EV kit provides a proven layout for the MAX7058. On-board test points are included to monitor various signals and to provide power (Table 3).

**Table 3. Test Points**

TP	DESCRIPTION
1	External DVDD supply
2	No connection (not populated)
3	DIN input
4	ENABLE input
5	TOGGLE input
6	External AVDD supply
7	External PAVDD supply
8	CAP4 input
9	CAP3 input
10	CAP2 input
11	CAP1 input
12	FSEL input

### Power Supply

The MAX7058 operates from a 2.1V to 3.6V supply. Apply an external voltage up to 3.6V between the VDD and GND pads. VDD by default powers DVDD, AVDD, and PAVDD.

### DVDD, AVDD, and PAVDD

DVDD, AVDD, and PAVDD are powered by VDD by default. To apply an external voltage to DVDD, change the shunt on jumper JU1 to the 2-3 position and apply an external voltage on TP1. To apply an external voltage to AVDD, change the shunt on jumper JU5 to the 2-3 position and apply an external voltage on TP6. To apply an external voltage to PAVDD, change the shunt on jumper JU6 to the 2-3 position and apply an external voltage on TP7.

### External Frequency Input

For applications where an external frequency is desired over the crystal frequency, it is possible to apply an external frequency through REFIN. Capacitors C14 and C15 are necessary (use a 100pF capacitor and remove the Y1 crystal). The MAX7058 operates by multiplying the crystal frequency to the necessary RF carrier frequency. When FSEL is low, the crystal frequency is multiplied by 26 (390MHz) and when FSEL is high, the multiplication is 21 (315MHz). Changing the frequency to a different value would result in different carrier frequencies and components not matching the required impedance characteristics.

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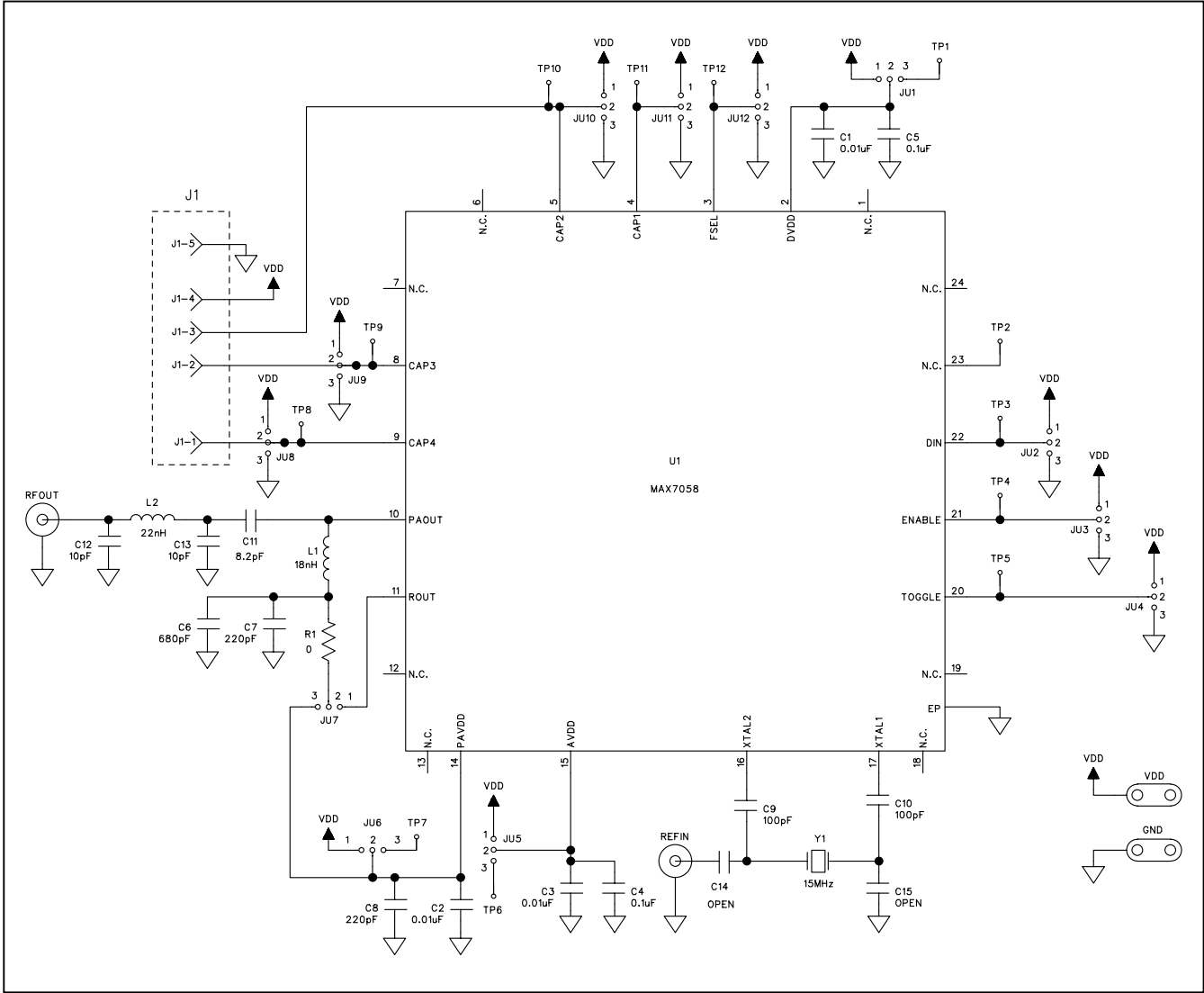


Figure 1. MAX7058 EV Kit Schematic

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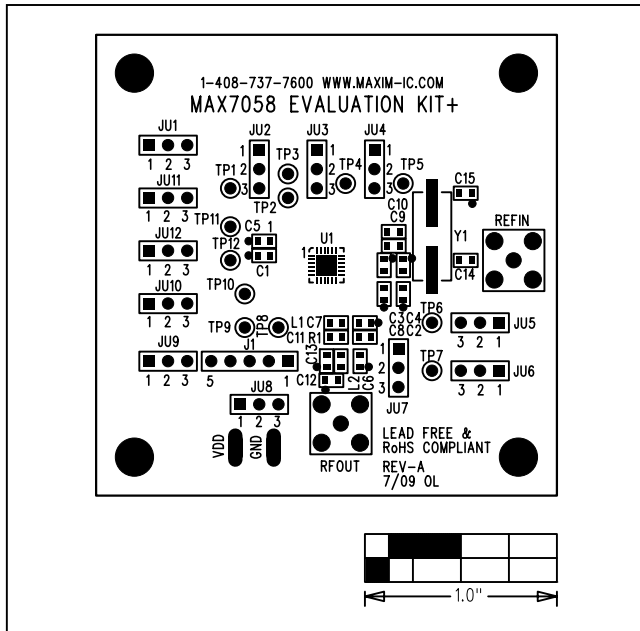


Figure 2. MAX7058 EV Kit Component Placement Guide—Component Side

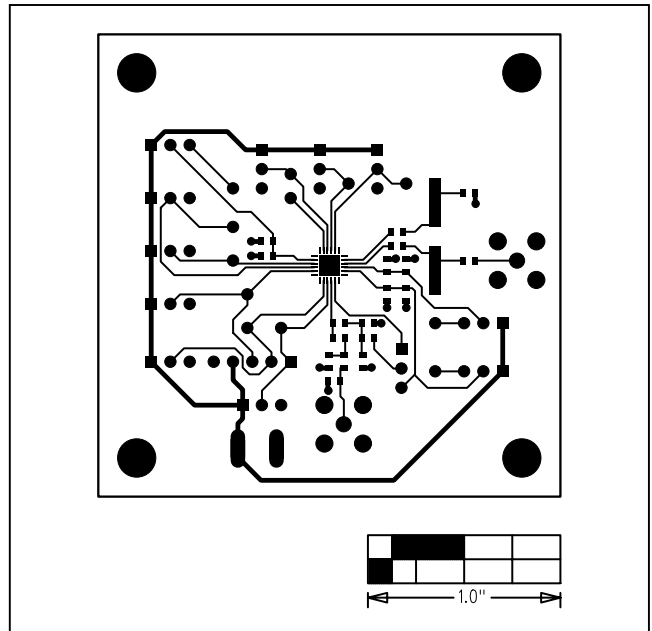


Figure 3. MAX7058 EV Kit PCB Layout—Component Side

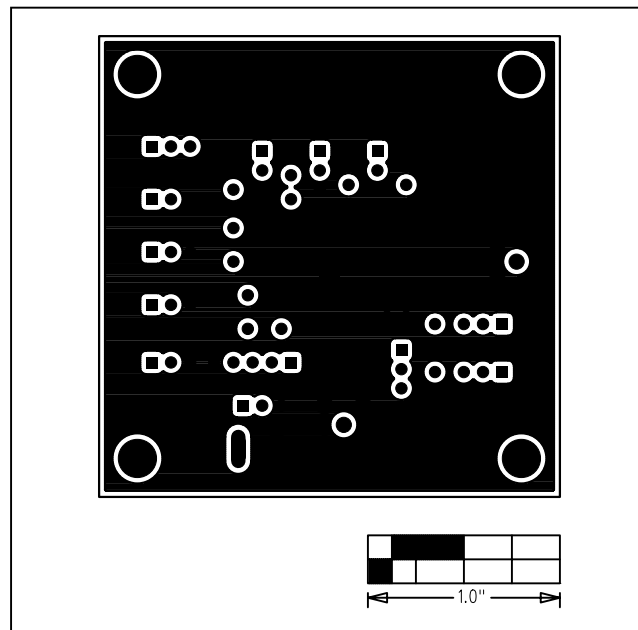


Figure 4. MAX7058 EV Kit PCB Layout—Solder Side

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