General Description

The MAX7060 evaluation kit (EV kit) provides a proven design to evaluate the MAX7060 frequency-programmable ASK/FSK transmitter in a 24-pin TQFN package with an exposed pad. The EV kit uses Windows XP®-, Windows Vista®-, and Windows® 7-compatible software to provide a simple graphical user interface (GUI) to simplify evaluation. The EV kit enables testing of the IC'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 PCB comes with a MAX7060ATG+ installed.

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Features

♦ **Windows XP-, Windows Vista-, and Windows 7-Compatible Software**
♦ **USB Powered**
♦ **Proven PCB Layout**
♦ **Proven Components List**
♦ **Adjustable Programmable Frequency**
♦ **Emulation Mode Simulates Hardware-Only Options**
♦ **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX7060EVKIT+	EV Kit

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

Component List

DESIGNATION	QTY	DESCRIPTION
BATT-2032	0	Not installed, battery holder and contact solution
BATT-AAA	0	Not installed, plastic battery holder
C1, C6, C12, C42, C46	5	33pF ±5%, 50V C0G ceramic capacitors (0402) Murata GRM1535C1H330J
C2, C8, C13, C43, C47	5	0.01µF ±10%, 25V X7R ceramic capacitors (0402) Murata GRM155R71E103J
C3, C9, C14, C44, C48	5	0.1µF ±10%, 16V X7R ceramic capacitors (0402) Murata GRM155R71C104K
C4*, C31, C32	3	100pF ±5%, 50V C0G ceramic capacitors (0402) Murata GRM1555C1H101J
C55*, C56*	2	10pF ±5%, 50V C0G ceramic capacitors (0402) Murata GRM1555C1H100J
C7	1	330pF ±5%, 50V C0G ceramic capacitor (0402) Murata GRM1555C1H331J

DESIGNATION	QTY	DESCRIPTION
C10	1	680pF ±5%, 50V C0G ceramic capacitor (0402) Murata GRM1555C1H681J
C33, C34	2	3.9pF ±0.25pF, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H3R9C
C100, C102, C104, C106, C109–C112, C117, C122, C125–C132	18	0.1µF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C104K
C101, C103, C105, C107	4	10µF ±10%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R60J106M
C113	0	Not installed, ceramic capacitor (0603)
C114, C115	2	22pF ± 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maximintegrated.com.

19-5534; Rev 0; 9/10

MAX7060 Evaluation Kit

Evaluates: MAX7060

DESIGNATION	QTY	DESCRIPTION
C116	1	33nF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C333K
C118, C119	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C120, C121	2	100pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H101J
$\overline{CS}$_DEV, DIN, ENABLE, GPO1, GPO2_MOD, LSHDN, SCLK_PWR0, SDI_PWR1, SDO	9	Red miniature test points
D100–D105	6	Yellow LEDs (1206)
D106–D111	6	Green LEDs (1206)
GND-A–GND-F, VADJ, VDUT-A, VDUT-B, VEXT, 3V3, V3V	12	1-pin headers
J100, J101	2	8-pin (2 x 4) headers
J102, J103	0	Not installed, 40-pin (2 x 20) headers
JU1, JU2	0	Not installed, 15-pin (3 x 5) headers
JU3–JU7, JU100–JU108	14	3-pin headers
JU8, JU109, JU110	3	2-pin headers
JU111	1	36-pin (2 x 18) header
L1*	1	51nH ±2% inductor (0603) Murata LQW18AN51NG00
L2*	1	22nH ±2% inductor (0603) Murata LQW18AN22NG00
P100	1	USB type-B right-angle female receptacle
Q100	1	Dual n-channel FET (6 SuperSot) Fairchild FDC6301N

DESIGNATION	QTY	DESCRIPTION
RA, R12, R3B, R117, R118	0	Not installed, resistors (0603)
RB, R3A, R125, R126	4	0Ω ±5% resistors (0603)
R100	1	50kΩ ±10% potentiometer
R101	1	27.4kΩ ±1% resistor (0603)
R102	1	39.2kΩ ±1% resistor (0603)
R103, R105, R106, R107	4	100kΩ ±1% resistors (0603)
R104	1	59kΩ ±1% resistor (0603)
R108	1	158kΩ ±1% resistor (0603)
R109, R111, R113, R115, R116, R131, R132, R135, R136	9	150Ω ±5% resistors (0603)
R110	1	330Ω ±5% resistor (0603)
R112	1	75Ω ±5% resistor (0603)
R114	1	43Ω ±5% resistor (0603)
R119	1	1.5kΩ ±5% resistor (0603)
R120, R121	2	27Ω ±5% resistors (0603)
R122	1	470Ω ±5% resistor (0603)
R127–R130, R133, R134	6	100kΩ ±5% resistors (0603)
R137–R147, R149	12	100Ω ±5% resistors (0603)
RF	1	SMA female vertical connector
S100, S101	2	Momentary pushbutton switches
S102	1	Quad SPST NO dip switch
TP1–TP5, TP127, TP128	7	Red multipurpose test points
TP129–TP132	4	Black multipurpose test points
U1	1	280MHz to 450MHz frequency-programmable ASK/FSK transmitter (24 TQFN-EP**) Maxim MAX7060ATG+
U100–U103	4	Low-noise LDO linear regulators (5 SC70) Maxim MAX8512EXK+
U104	1	UART-to-USB converter (32 TQFP)

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
U105	1	Not installed, 93C46 3-wire EEPROM (8 SO)
U106	1	32-bit microcontroller (68 QFN-EP**) Maxim MAXQ2000-RAX+
U107–U110	4	8-channel level translators (20 TSSOP) Maxim MAX3001EEUP+
XTAL	0	Not installed, SMA female vertical connector
Y1	1	16MHz crystal

DESIGNATION	QTY	DESCRIPTION
Y100	1	6MHz crystal (HCM49) Hong Kong X'tals SSL600000018FAF
Y101	0	Not installed, 32.768kHz crystal
Y102	1	16MHz crystal Hong Kong X'tals SSM1600000E18FAF
—	36	Shunts
—	1	USB high-speed A-to-B cables, 6ft
—	1	PCB: MAX7060 EVALUATION KIT+

*Indicates matching component.
**EP = Exposed pad.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
Murata Electronics North America	770-436-1300	www.murata-northamerica.com

Note: Indicate that you are using the MAX7060 when contacting these component suppliers.

MAX7060 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX7060.EXE	Application program
CDM20600.EXE	Installs the USB device driver
UNINSTALL.EXE	Uninstalls the EV kit software
USB_Driver_Help_200.PDF	USB driver installation help file

MAX7060 Evaluation Kit

Evaluates: MAX7060

Quick Start

Required Equipment

- MAX7060 EV kit
- Windows XP, Windows Vista, or Windows 7 PC with a spare USB port
- Spectrum analyzer
- (Optional) Power meter

Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

Procedure

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

1. Visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, 7060Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.

2. Install the EV kit software and the USB driver on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied to your PC and icons are created in the Windows **Start | Programs** menu. During software installation, some versions of Windows may show a warning message indicating that this software is from an unknown publisher. This is not an error condition and it is safe to proceed with installation. Administrator privileges are required to install the USB device driver on Windows.

3. Verify that all jumpers are in their default positions, as shown in Tables 1, 2, and 3.

4. Connect the USB cable from the PC to the EV kit board. A Windows message appears when connecting the EV kit board to the PC for the first time. Each version of Windows has a slightly different message. If you see a Windows message stating **ready to use**, then proceed to the next step. Otherwise, open the USB_Driver_Help_200. PDF document in the Windows **Start | Programs** menu to verify that the USB driver was installed successfully.

5. Start the EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1. The GUI indicates if the USB hardware is connected in the lower left status bar.

6. The VDUT supply should be set to 3.3V and can optionally be measured with a DMM on TP127. Adjustment to the VDUT supply can be made through resistor R100.

7. Connect the RF SMA connector to a spectrum analyzer to see the power level and modulation spectrum. Set the analyzer to a center frequency of 315MHz and the frequency span to 2MHz.

8. The IC operates in ASK mode by default. Set the IC's carrier frequency to 315MHz by typing the frequency in MHz in the **Center Frequency** edit box. Then press Enter.

9. Set the PA output power level to **0x1E** by selecting the value in the **PA Setting** drop-down list.

10. Click on the **ENABLE (0x10)** checkbox and verify that the value changes to **1**. Verify that the **lockdet** light is also green.

11. Click on the **DATAIN (0x11)** checkbox.

12. The spectrum analyzer should display an unmodulated carrier at 315MHz. The power level depends on the value entered in Step 9. The maximum setting of 0x1E should produce a transmitted power level of approximately +15dBm (30mW to 35mW), with a 3.3V supply voltage.

13. To test FSK, uncheck the **DATAIN (0x11)** and **ENABLE (0x10)** checkboxes.

14. Click on the **mode** checkbox and verify that **FSK** is shown in the **Conf0 (0x01)** group box. In the **FSK** group box, the center frequency should be set to 315MHz. In the **Frequency Deviation** edit box, type in **50** and press enter. That produces a peak-to-peak value that rounds to the frequency resolution of the synthesizer. Inside the **FSK** group box, the high and low frequencies are shown next to the **fhi** and **flo** labels.

15. Click on the **ENABLE (0x10)** checkbox. Verify that the **DATAIN (0x11)** checkbox is not checked. The spectrum analyzer should display an unmodulated carrier at the logic 0 (Space) frequency, which is approximately equal to the **flo** value. This frequency may be off by up to a few tens of kilohertz depending on the crystal frequency tolerance.

16. Toggle the **DATAIN (0x11)** checkbox and observe the frequency shift on the spectrum analyzer. The logic 1 (Mark) frequency should be near the **fhi** value.

Additional Evaluation

17) For efficiency measurements, close the GUI and disconnect the USB cable.

18) Take the shunt off pins 1-2 of jumper JU111 and connect an ammeter in series.

19) Reconnect the USB cable and restart the GUI.

20) Connect a power meter to the RF SMA connector. Measure the output power and supply current.

21) The efficiency is calculated by the following equation:

$$\text{Efficiency} = \frac{10 \wedge (P_{OUT}/10)}{I \cdot V}$$

Table 1. Control-Side Jumper Table (J100, JU100–JU111)

JUMPER	SHUNT POSITION	DESCRIPTION
J100	1-2	VDUT (IC) powered by the battery.
	3-4	VDUT powered by the USB (+5V).
	5-6	VDUT powered by an external supply. Apply the external voltage between the VEXT and GND-_ test points.
	7-8*	VDUT powered by an adjustable on-board regulator. Change the resistance of potentiometer R100 to the required DUT supply. The supply voltage range is between 2.1V and 3.6V.
JU100	1-2	Connects the external supply to the REG supply.
	2-3*	Connects the USB supply to the REG supply.
JU101	1-2*	Microcontroller supply comes from the REG supply.
	2-3	Microcontroller supply comes from the battery. Installation of the battery holders is required.
JU102	1-2*	Logic microcontroller supply (VMICROL) is set to 3.3V.
	2-3	Logic microcontroller supply (VMICROL) is set to VMICRO.
JU103	1-2	Core microcontroller supply (VMICRO) is set to 2.0V.
	2-3*	Core microcontroller supply (VMICRO) is set to 2.5V.
JU104	1-2*	Selects the AAA battery holder for the VBAT supply. Installation of the battery holder is required.
	2-3	Selects the 2032 battery holder for the VBAT supply. Installation of the battery holder is required.
JU105	1-2	Must supply the microcontroller oscillation frequency externally.
	2-3*	Connects the microcontroller oscillator to the on-board crystal.
JU106	1-2	Must supply the microcontroller oscillation frequency externally.
	2-3*	Connects the microcontroller oscillator to the on-board crystal.
JU107	1-2	Must supply the RTC oscillation frequency externally.
	2-3*	Connects the RTC oscillator to the on-board crystal (not installed).
JU108	1-2	Must supply the RTC oscillation frequency externally.
	2-3*	Connects the RTC oscillator to the on-board crystal (not installed).
JU109	Closed*	GPO2 connects to the DUT through level translators.
	Open	GPO2 does not connect to the DUT.
JU110	Closed*	GPO1 connects to the DUT through level translators.
	Open	GPO1 does not connect to the DUT.
JU111	Closed*	See Table 2.

*Default position.

Table 2. JU111 Jumper Table

SHUNT POSITION		DESCRIPTION
1-2	Closed*	IC supply powered by the VDUT supply on the control side.
	Open	Connection point for an ammeter if supply current measurements are required.
3-4	Closed*	Don't care.
5-6	Closed*	Don't care.
7-8	Closed*	Don't care.
9-10	Closed*	Connects the IC AVDD voltage to test point V3V.
	Open	The V3V test point is unconnected.
11-12	Closed*	Connects the GPO1 signal from the IC to the on-board microcontroller. The GPO1 signal can be monitored on the GPO1 test point.
	Open	GPO1 signal is not connected to the on-board microcontroller. The GPO1 signal can be monitored by an external microcontroller on the GPO1 test point without interference loading from the on-board microcontroller.
13-14	Closed*	Connects the low-power shutdown (LSHDN) signal from the on-board microcontroller to the IC. The LSHDN signal can be monitored on the LSHDN test point.
	Open	The LSHDN signal is not connected to the on-board microcontroller. When using an external LSHDN signal, remove the jumper and apply the signal on the LSHDN test point. Alternatively, LSHDN can be driven high or low through JU2. LSHDN must be driven low for normal operation.
15-16	Closed*	FREQ2 signal to the IC.
	Open	FREQ2 can be driven high or low through JU2.
17-18	Closed*	FREQ1 signal to the IC.
	Open	FREQ1 can be driven high or low through JU2.
19-20	Closed*	FREQ0 signal to the IC.
	Open	FREQ0 can be driven high or low through JU2.
21-22	Closed*	Connects the GPO2_MOD signal from the IC to the on-board microcontroller. The GPO2_MOD signal can be monitored on the GPO2_MOD test point.
	Open	GPO2_MOD signal is not connected to the on-board microcontroller. The GPO2_MOD signal can be monitored by an external microcontroller on the GPO2_MOD test point without interference loading from the on-board microcontroller. GPO2_MOD can be driven high or low through JU2.
23-24	Closed*	Connects the on-board $\overline{CS}$_DEV signal to the IC. $\overline{CS}$ _DEV can be monitored on the $\overline{CS}$ _DEV test point.
	Open	Does not connect the on-board $\overline{CS}$ _DEV to the IC. When using external SPI™, remove this jumper and apply the $\overline{CS}$ signal to the $\overline{CS}$ _DEV test point. For manual mode, $\overline{CS}$ _DEV can be driven high or low through JU1.
25-26	Closed*	Connects the on-board SDI_PWR1 signal to the IC. SDI_PWR1 can be monitored on the SDI_PWR1 test point.
	Open	Does not connect the on-board SDI_PWR1 to the IC. When using external SPI, remove this jumper and apply the SDI signal to the SDI_PWR1 test point. For manual mode, SDI_PWR1 can be driven high or low through JU1.
27-28	Closed*	Connects the on-board SCLK_PWR0 to the IC. SCLK_PWR0 can be monitored on the SCLK_PWR0 test point.
	Open	Does not connect the on-board SCLK_PWR0 to the IC. When using external SPI, remove this jumper and apply the SCLK signal to the SCLK_PWR0 test point. For manual mode, SCLK_PWR0 can be driven high or low through JU1.

SPI is a trademark of Motorola, Inc.

Table 2. JU111 Jumper Table (continued)

SHUNT POSITION		DESCRIPTION
29-30	Closed*	Connects the on-board enable signal (ENABLE) to the IC. ENABLE can be monitored on the ENABLE test point.
	Open	Does not connect the on-board enable signal to the IC. When using an external signal for enable, remove this jumper and apply the ENABLE signal to the ENABLE test point. For manual mode, ENABLE can be driven high or low through JU1.
31-32	Closed*	Connects the on-board transmitter data signal (DIN) to the IC. DIN can be monitored on the DIN test point.
	Open	Does not connect the on-board transmitter data signal to the IC. When using an external signal for transmitter data, remove this jumper and apply the DIN signal to the DIN test point.
33-34	Closed*	Don't care.
35-36	Closed*	Connects the microcontroller to the on-board SDO from the IC. SDO can be monitored on the SDO test point.
	Open	Does not connect the microcontroller to the SDO signal from the IC. When using external SPI, remove this jumper and apply the MISO input to the SDO test point.

*Default position.

Table 3. DUT-Side Jumper Table

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	—	See Table 6.
JU2	—	See Table 6.
JU3	1-2*	Connects PAVDD to the on-board 3V supply.
	2-3	External PAVDD. Must apply an external voltage on TP1 to power PAVDD.
JU4	1-2*	Connects AVDD to the on-board 3V supply.
	2-3	External AVDD. Must apply an external voltage on TP2 to power AVDD.
JU5	1-2*	Connects DVDD to the on-board 3V supply.
	2-3	External DVDD. Must apply an external voltage on TP3 to power DVDD.
JU6	1-2*	Connects the 5V net to the on-board 5V supply.
	2-3	External 5V supply. Must apply an external voltage on TP4 to power V5V.
JU7	1-2*	Connects GPOVDD to the on-board 5V supply.
	2-3	External GPOVDD supply. Must apply an external voltage on TP5 to power GPOVDD.
JU8	Closed*	Connects the V5V net to the V3V for 3V operation.
	Open	For 5V operation, the V3V net is sourced by the IC's AVDD pin.

*Default position.

MAX7060 Evaluation Kit

Evaluates: MAX7060

Layout Issues

A properly designed PCB is essential for any RF/microwave 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 λ/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 approximately 19nH/in of inductance and approximately 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 IC 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. Do not share GND vias on decoupling capacitors; give each capacitor its own via.

Detailed Description of Software

The main window of the MAX7060 EV kit is shown in Figure 1.

The EV kit uses Windows XP-, Windows Vista-, and Windows 7-compatible software to provide a simple GUI to demonstrate the MAX7060. The EV kit GUI **Main Control** tab allows the IC to be set up easily without having to focus on programming the registers. The register values can be viewed in the **Registers** tab. This allows easy prototyping with the GUI with different configuration settings.

Main Control Tab

The **Main Control** tab highlights the features for setting the transmitter and GPO configuration. The transmitter frequency has a specified range through the GUI. The transmit frequency range is 301.5MHz to 450.5MHz, with a 16MHz crystal. The frequency can be changed to any value through the **Registers** tab, but only to the allowable values through the **Main Control** tab. The transmit frequency is the **Center Frequency** in the **ASK** group box. For FSK, the center frequency defines the midpoint between the Space frequency (**flo**) and the Mark frequency (**fhi**). The low and high frequencies are defined by the frequency deviation around the **Center Frequency**. The maximum PA power setting is selectable. Timing and power steps are also available for ASK digital shaping.

The **DATAIN** and **ENABLE** functions can be set through software (checkbox) or hardware (button). The bit level and hardware logic are internally ORed.

GPO Configuration

The **IOConf1 (0x05)** group box shows the different signal output options that GPO1 and GPO2 have.

The **IOConf0 (0x04)** group box gives the status of different internal signals, as shown in Table 4. These show up in the **Status** register as you change the value of **TestMUX**.
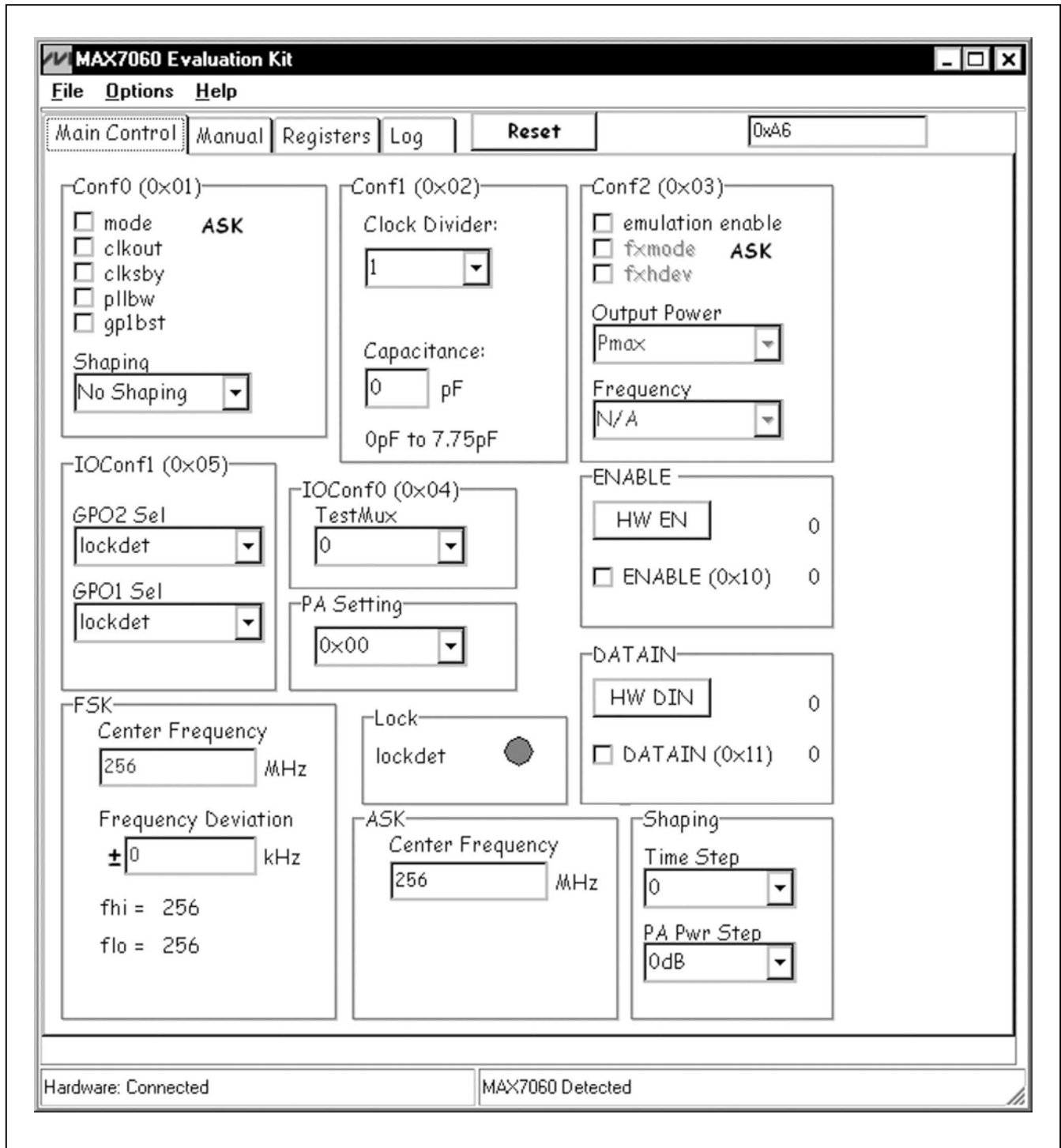
Figure 1. MAX7060 EV Kit Software Main Window (Main Control Tab)

Table 4. Status Bus Signals

tmux[2:0]	status[7]	status[6]	status[5]	status[4]	status[3]	status[2]	status[1]	status[0]
0	—	—	—	—	ckout	ckd16	ckd4	nock
1	—	—	—	—	—	—	—	—
2	—	—	—	—	enable	—	—	—
3	—	frac_fxdb	—	cap[4]	cap[3]	cap[2]	cap[1]	cap[0]
4	—	—	notover	capfxd[4]	capfxd[3]	capfxd[2]	capfxd[1]	capfxd[0]
5	integ[3]	integ[2]	integ[1]	integ[0]	frac[11]	frac[10]	frac[9]	frac[8]
6	frac[7]	frac[6]	frac[5]	frac[4]	frac[3]	frac[2]	frac[1]	frac[0]
7	—	—	—	—	—	—	lockdet	xmit_en

—   Reserved signals

nock   No-clock flag (1) if crystal oscillator is disabled, and (0) IC clock activity is observed

ckd4   Crystal clock signal divided by 4

ckd16   Crystal clock signal divided by 16

ckout   Clock output signal, according to programmed dividers (ckdiv[2:0])

enable   Internal enable signal (OR function of the ENABLE pin and enable bit)

cap[4:0]   SPI mode capacitor setting

frac_fxdb   Fractional-N mode (1) or ASK fixed-N mode (0)

capfxd[4:0]   Emulation mode variable capacitor setting

notover   ASK digital shaping flag (1) when PA power value is different than 0

integ[3:0]   Fractional-N 4-bit integer value

frac[11:0]   Fractional-N 12-bit fractional value

xmit_en   Transmitter PA enable flag

lockdet   PLL lock-detect flag

Emulation Mode

The emulation mode allows the same settings available in manual mode through the SPI register, **Conf2**. This allows complete configuration of the IC by writing to a single register.

Manual Tab

The IC can operate in a fixed hardware-only mode that requires no SPI controller. The **Manual** tab (Figure 2) allows the hardware settings to be controlled through software. Instead of jumpers to set the high and low logic levels, the on-board microcontroller sets the levels dependent on the settings chosen within this tab. The fixed hardware mode can also be manually controlled through JU1 and JU2. JU1 and JU2 need to be installed and shunts on JU111 (pins 3–30) need to be removed. Jumper positions can be toggled for different output settings.

Registers Tab

The **Registers** tab (Figure 3) displays each register's individual bit logic-level status. A data bit in bold indicates a logic-high, while a data bit not bolded indicates a logic-low. Clicking on the individual data bit toggles the bit and performs a write and read command. The new value is shown in the edit boxes at the far right. Full register values can be written to the registers alternatively by typing a hex value in the edit box and pressing the Enter key on the keyboard.

Log Tab

The **Log** tab can be used to verify that a command was executed. Next to the **Log Page** table is an edit box that shows what was last written to the **Log Page**. It is not necessary to switch to the **Log Page** to verify if a command was sent.

Useful Tips

The EV kit contains a simple GUI for demonstrating the IC. Some actions do multiple writes and reads in the background. To ensure that the software works correctly, follow these tips:

- Make sure jumpers are installed in the default configuration.

- When the program is started, verify that **Hardware: Connected** is displayed in the lower left status bar and **MAX7060 Detected** is displayed in the lower right status bar.

- When unplugging the USB cable, wait approximately 5s before plugging it back in. This lets the supply voltage drop below the reset threshold.

- After plugging the USB cable from the PC to the EV kit, wait approximately 5s before running the EV kit

Figure 2. MAX7060 EV Kit Software (Manual Tab)
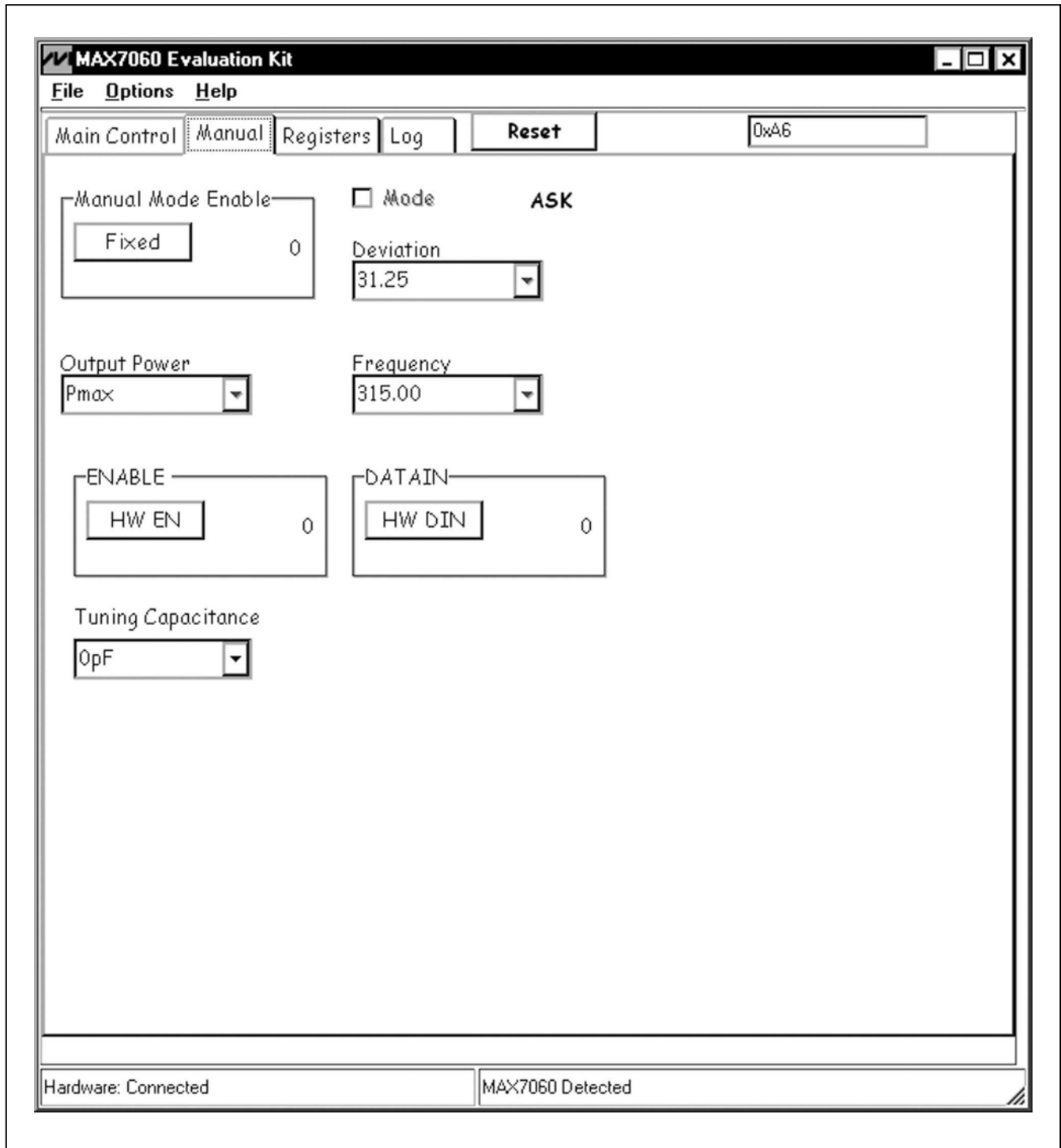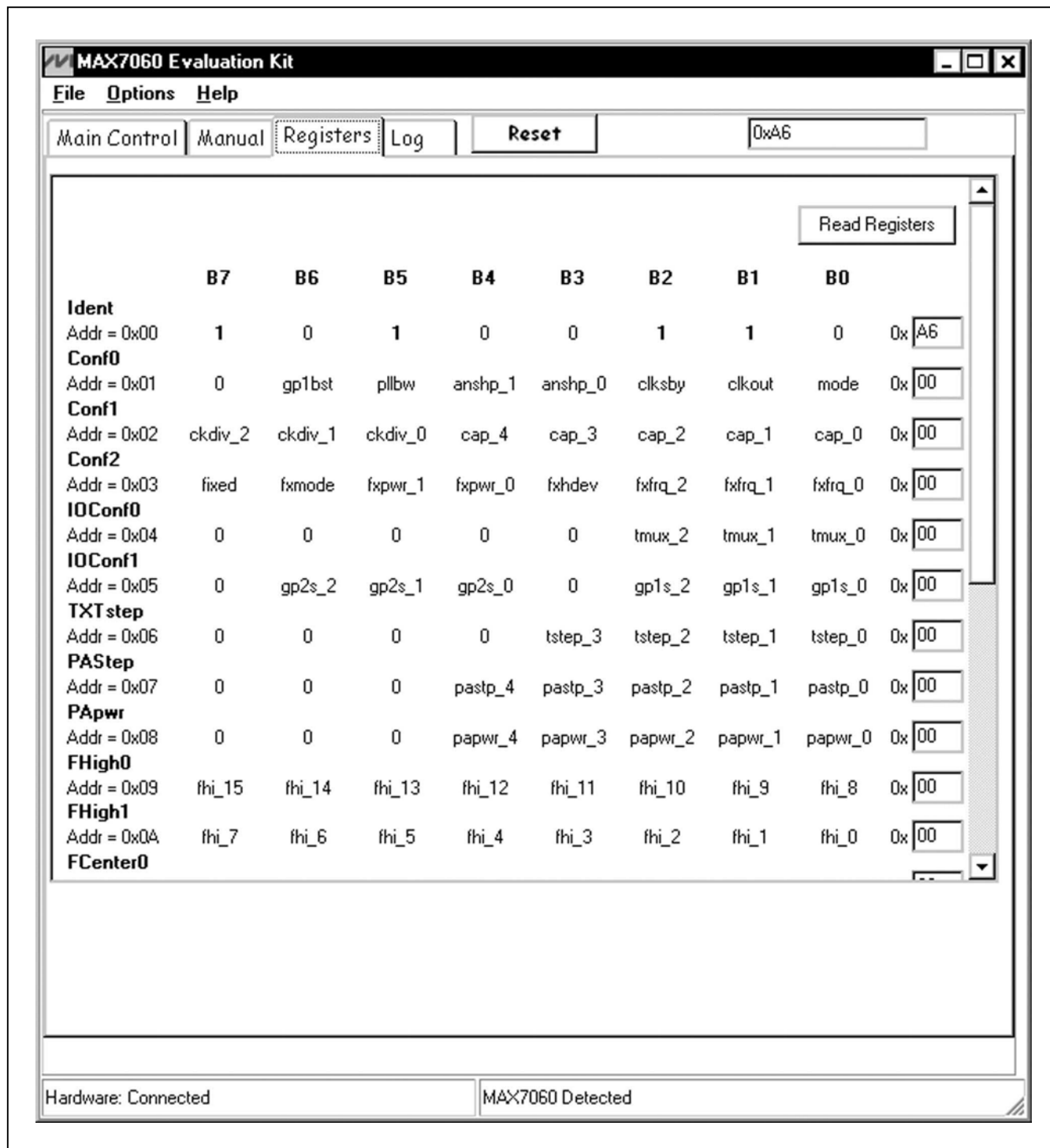
Figure 3. MAX7060 EV Kit Software (Registers Tab)

software. The USB driver needs some time to be detected before the software can be run.

_Detailed Description of Hardware

The MAX7060 EV kit provides a proven layout for the MAX7060. The IC can be operated with a 5V supply or a 3V supply. For hardware-only mode, populate jumpers JU1 and JU2 for the manual-mode settings. On-board test points are included to monitor various signals (Table 5).

Power Amplifier Matching Network

The matching network in the EV kit is a broadband network optimized for the low end of the operating frequency range. The best combination of power and efficiency is found between 300MHz and 330MHz. At the high end of the band (430MHz to 450MHz), the power is 2dB to 3dB lower compared to the low end of the band. This drop in power is the result of the harmonic-filter (C55-L2-C56) cutoff frequency being set to reject the second harmonic of the lower frequencies. Other matching-network component values can be used to move the optimum frequency range.

Manual-Mode Operation

See Tables 6, 7, and 8 for manual-mode settings.

Power Supply

The IC can operate from a 2.1V to 3.6V or 4.5V to 5.5V supply. The EV kit has several options to power from the USB for both settings. The user can also externally supply a voltage to the control side. The 1-2 position on J100 allows the VDUT to be powered from a battery. Battery holders (not populated) are required.

3V Supply from USB

To power from the USB supply with a 2.1V to 3.6V range, change the shunt on J100 to the 7-8 position on the control side. The shunt is in the 7-8 position by default. That position makes VDUT equal to VADJ. The user can monitor VADJ with a voltmeter and change the potentiometer resistance (R100) to adjust the voltage between 2.1V and 3.6V. On the DUT side, JU8 needs to be closed.

5V Supply from USB

To power from the 5V USB supply, change the shunt on J100 to the 3-4 position on the control side. That position makes VDUT equal to 5V. JU8 needs to be open to operate in this state. The AVDD pin becomes an LDO output with a 5V input at HVIN, and generates the V3V supply net for the other supplies.

Table 5. DUT-Side Signal Test Points

NAME	DESCRIPTION
GPO1	General-Purpose Output 1. In SPI mode, this test point can monitor internal status signals. In manual mode, this test point monitors the synthesizer lock-detect (lockdet) signal.
LSHDN	Low-Power Shutdown Current-Select Digital Input. Disables SPI when high. Must be driven low for normal operation in 3V mode. Functional only in 3V mode. Connect to GND in 5V mode.
GPO2_MOD	(SPI Mode/Manual Mode) Digital Signal. Acts as an SPI data output (SDO) when $\overline{CS}$_DEV is low. ASK (0)/ FSK (1) modulation select input in manual mode.
$\overline{CS}$_DEV	(SPI Mode/Manual Mode) Serial Peripheral Interface (SPI) Active-Low Chip-Select Signal.
SDI_PWR1	(SPI Mode/Manual Mode) SPI Data Signal in SPI Mode. Power-control MSB input in manual mode.
SCLK_PWR0	(SPI Mode/Manual Mode) SPI Clock Signal in SPI Mode. Power-control LSB input in manual mode.
ENABLE	Enable signal. All internal circuits (except the PA in ASK mode) are enabled on the rising edge of ENABLE.
DIN	Transmit Data Digital Signal.
SDO	See the GPO2_MOD description.

Table 6. JU1 and JU2 Jumper Table for Manual Mode

JUMPER	SIGNAL NAME	SHUNT POSITION	DESCRIPTION
JU1	$\overline{CS}$_DEV	1-2	$\overline{CS}$_DEV = low, 31.25kHz deviation
		2-3	$\overline{CS}$ _DEV = high, 101.56kHz deviation
	SDI_PWR1	4-5	SDI_PWR1 = low (see Table 7)
		5-6	SDI_PWR1 = high (see Table 7)
	SCLK_PWR0	7-8	SCLK_PWR0 = low (see Table 7)
		8-9	SCLK_PWR0 = high (see Table 7)
	ENABLE	10-11	ENABLE = low, transmitter off
		11-12	ENABLE = high, transmitter on
	DIN	13-14	DIN = low, data = 0
		14-15	DIN = high, data = 1
JU2	GPO2_MOD	1-2	GPO2_MOD = low, ASK mode
		2-3	GPO2_MOD = high, FSK mode
	FREQ0	4-5	FREQ0 = low (see Table 8)
		5-6	FREQ0 = high (see Table 8)
	FREQ1	7-8	FREQ1 = low (see Table 8)
		8-9	FREQ1 = high (see Table 8)
	FREQ2	10-11	FREQ2 = low (see Table 8)
		11-12	FREQ2 = high (see Table 8)
	LSHDN	13-14	LSHDN = low, normal operation
		14-15	LSHDN = high, shutdown

Table 7. Manual-Mode Power Settings

SDI_PWR1	SCLK_PWR0	dB BELOW P_{MAX}
0	0	0
0	1	3
1	0	6
1	1	10

Table 8. Manual-Mode Frequency

FREQ2	FREQ1	FREQ0	FREQUENCY (MHz)	DIVIDE RATIO
0	0	0	SPI	N/A
0	0	1	315.00	19.68750
0	1	0	433.62	27.10125
0	1	1	390.00	24.37500
1	0	0	418.00	26.12500
1	0	1	372.00	23.25000
1	1	0	345.00	21.56250
1	1	1	433.92	27.12000

External Supply

To power from an external supply, change the shunt on J100 to the 5-6 position. Then apply the external voltage between the VEXT and GND-_ test points. The jumper setting on JU8 is dependent on the input-supply voltage. If the input-supply voltage is between 2.1V and 3.6V, the jumper should be installed. If the input supply is between 4.5V and 5.5V, the jumper should be left open.

Current Measurements for Individual Supplies

The IC has various supply inputs that can all be monitored independently. These supplies are on the DUT side and powered by the V3V and V5V supply nets coming from the control side. All supplies are connected together by default. For supply current measurements for a specific supply, change the jumper associated with the supply and connect V3V or V5V through an ammeter to the corresponding test point.

Applying External Signals

To apply an external signal to the enable (ENABLE) and Tx data (DIN) test points, the respective jumper on JU111 must first be removed and the signal applied to the signal test point. If JU1 is installed, the respective jumpers need to be removed there, too. For example, to apply an external signal to DIN, first uncheck the **DATAIN (0x11)** checkbox. Then remove the jumper from pins 31-32 of JU111 and apply the DIN signal to the DIN test point. A complex pattern can be sent using the transmitter in this fashion. The enable works similarly. Make sure the voltage range of the external signals is limited to DVDD before applying the signals.

External SPI

Remove the shunts from the SPI jumpers and apply the signals to the SPI test points. The SPI jumpers are located on JU111 (Table 2). See Table 9 for descriptions. The external SPI signals need to be limited to the DVDD supply voltage. J101 can be used for observing SPI signals on the control side (Table 10).

External Frequency Input

For applications where an external frequency is desired over the crystal frequency, it is possible to apply an external frequency through the XTAL SMA connector. Remove the crystal and install resistor R12 (use 0Ω). The IC GUI default crystal frequency is 16MHz.

Table 9. SPI Jumpers and Test Points (JU111)

PINS	NAME
23-24	$\overline{CS}$_DEV
25-26	SDI_PWR1
27-28	SCLK_PWR0
35-36	SDO (GPO2_MOD)

Table 10. SPI Header (J101)

JUMPER POSITION	NAME	DESCRIPTION
1	VMICROL	SPI I/O logic voltage
2	MAXQ_SS	SPI chip select
3	MAXQ_SCLK	SPI clock
4	MAXQ_MOSI	SPI data out (goes to SDI)
5	MAXQ_MISO	SPI data in (goes to SDO)
6	GND	GND
7	P2.4	Tx data
8	P0.3	Enable signal

MAX7060 Evaluation Kit
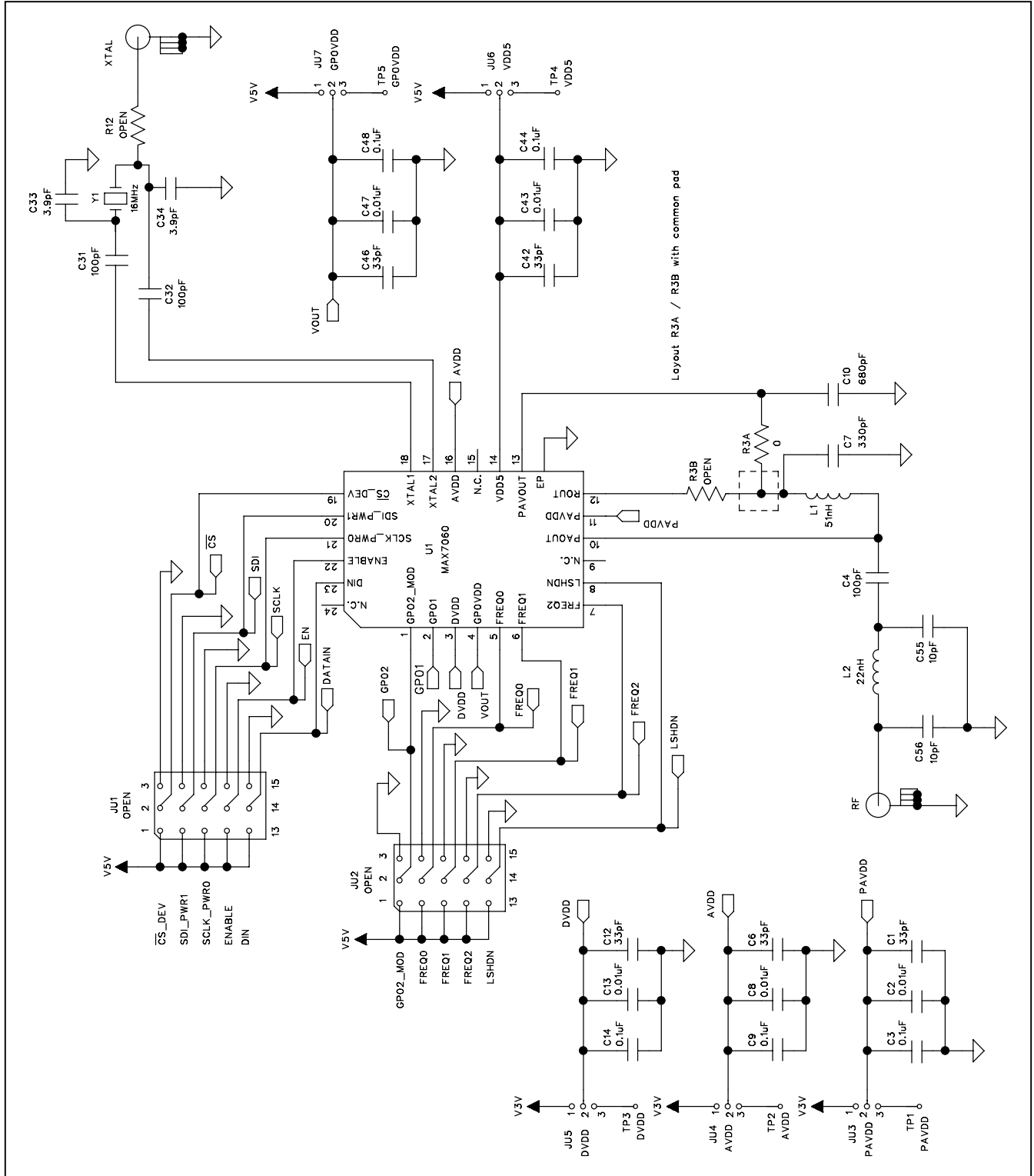
Evaluates: MAX7060

Figure 4a. MAX7060 EV Kit Schematic (Sheet 1 of 5)

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Figure 4b. MAX7060 EV Kit Schematic (Sheet 2 of 5)

Figure 4c. MAX7060 EV Kit Schematic (Sheet 3 of 5)
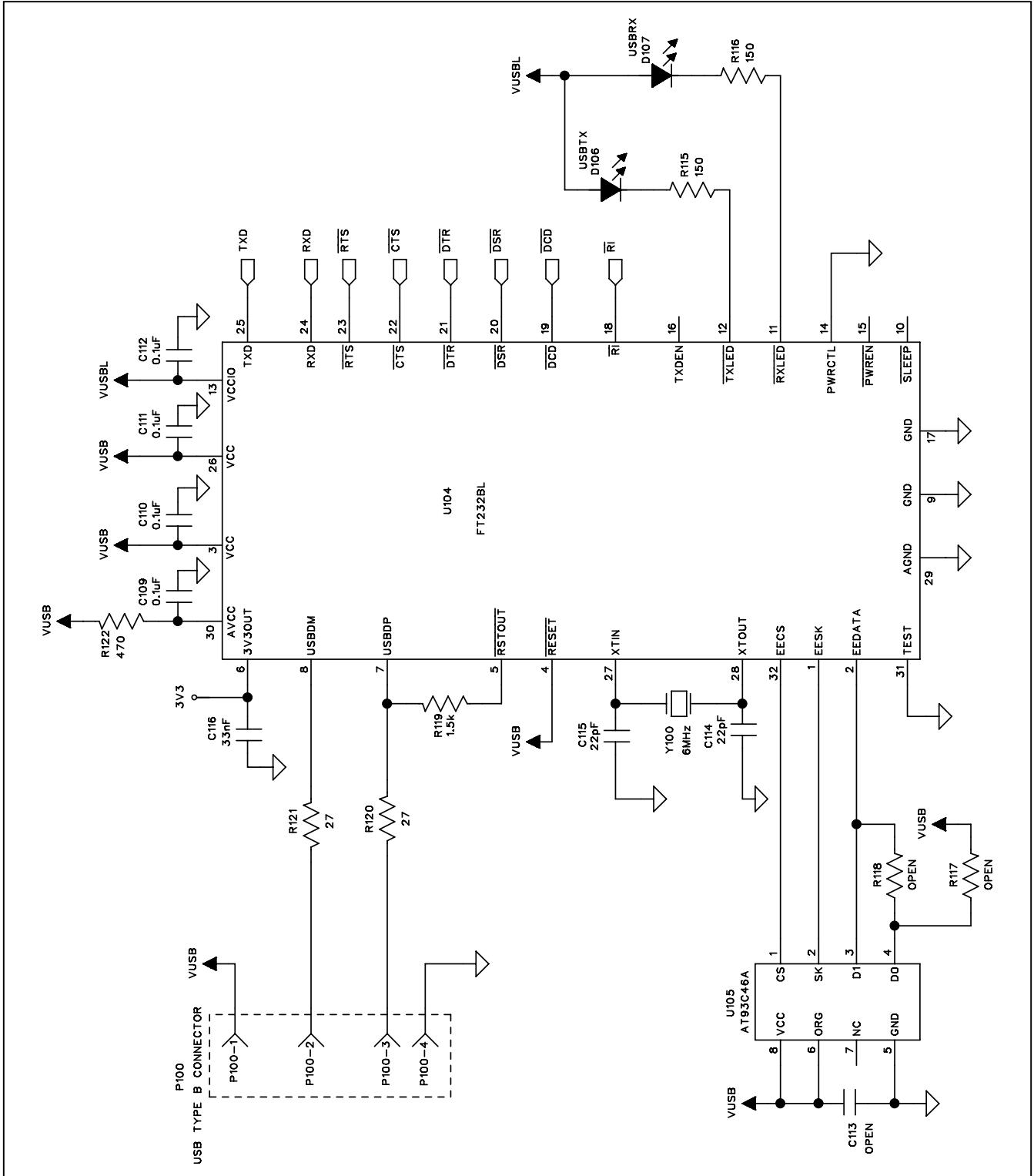
Figure 4d. MAX7060 EV Kit Schematic (Sheet 4 of 5)

Figure 4e. MAX7060 EV Kit Schematic (Sheet 5 of 5)

Figure 5. MAX7060 EV Kit Component Placement Guide—Component Side

Figure 6. MAX7060 EV Kit PCB Layout—Component Side

Figure 7. MAX7060 EV Kit PCB Layout—Solder Side

Figure 8. MAX7060 EV Kit Component Placement Guide—Solder Side

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/10	Initial release	—

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