19-5534; Rev 0; 9/10

MAX7060评估板

评估板：MAX7060

概述

MAX7060评估板(EV kit)提供经过验证的设计，用于评估MAX7060频率可编程ASK/FSK发送器，器件采用带有裸焊盘的24引脚TQFN封装。评估板使用Windows XP®、Windows Vista®和Windows® 7兼容软件，提供简捷的图形用户界面(GUI)，以简化评估。该评估板能够测试IC的RF性能，无需额外电路。RF输出采用50Ω匹配网络，并带有SMA连接器，便于连接测试设备。评估板PCB预装了MAX7060ATG+。

Windows、WIndows XP和Windows Vista是Microsoft Corp.的注册商标。

特性

- ♦ Windows XP、Windows Vista和Windows 7兼容软件
- ♦ USB供电
- ♦ 经过验证的PCB布局
- ♦ 经过验证的元件列表
- ♦ 可调节频率
- ♦ 仿真模式能够对硬件电路进行仿真
- ♦ 完全安装并经过测试

定购信息

PART	TYPE
MAX7060EVKIT+	EV Kit

+表示无铅(Pb)并符合RoHS标准。

元件列表

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
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

元件列表(续)

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)

元件列表(续)

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
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+

*表示匹配元件。
**EP = 裸焊盘。

元件供应商

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

注：在联系这些元件供应商时，请说明您使用的是MAX7060。

MAX7060评估文件

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评估板

快速入门

所需设备

- MAX7060评估板
- 具有空闲USB口的Windows XP、Windows Vista或Windows 7 PC
- 频谱分析仪
- (可选)功率计

注： 以下章节中，与软件相关的条目用粗体字标识。**粗体**字表示直接由评估软件提供的条目，**粗体字加下划线**表示与Windows操作系统相关的条目。

步骤

评估板已完全安装并经过测试，按照以下步骤验证评估板的工作情况：

1) 从**china.maxim-ic.com/evkitsoftware**下载最新版本的评估软件7060Rxx.ZIP。将评估软件保存至一个临时文件夹，然后解压缩ZIP文件。
2) 运行临时文件夹中的INSTALL.EXE程序，在计算机上安装评估软件和USB驱动。程序文件将被拷贝至PC，并在Windows的Start | Programs菜单中创建图标。软件安装期间，有些Windows版本可能会显示一条警告消息，提示软件来自于未知发行商。这不是错误，可继续安全安装。在Windows中安装USB设备驱动需要管理员权限。
3) 确认全部跳线位于其默认位置，如表1、表2和表3所示。
4) 用USB电缆连接PC和评估板。首次将评估板连接至PC时，显示一条Windows消息。根据Windows版本的不同，消息会稍有不同。如果看到Windows消息提示ready to use，即可进入下一步。否则，打开Windows的Start | Programs菜单中的USB_Driver_Help_200.PDF文件，检查USB驱动是否安装正确。
5) 点击Start | Programs菜单中的图标，启动评估软件。图1所示为评估软件主窗口，GUI界面在左下角状态栏中显示是否已连接USB硬件。
6) VDUT电源应设为3.3V，可选择用DMM在TP127上进行测量。可通过电阻R100调节VDUT电源。
7) 将RF SMA连接器连接至频谱分析仪，查看功率水平和调制频谱。将频谱分析仪的中心频率设置为315MHz，频率宽度为2MHz。
8) IC默认工作于ASK模式。通过在**Center Frequency**编辑框中输入以MHz为单位的频率，将IC的载波频率设置为315MHz。然后按回车键。
9) 通过在**PA Setting**下拉列表中选择相应的值，将PA输出功率设置为**0x1E**。
10) 点击**ENABLE (0x10)**选择框，确认数值改为**1**。确认**lockdet**灯指示为绿色。
11) 点击**DATAIN (0x11)**选择框。
12) 频谱分析仪应显示315MHz的未调制载波。功率水平取决于在第9步中输入的值。当采用3.3V供电电压时，最大设置0x1E应产生大约+15dBm (30mW至35mW)的发送功率。
13) 为了测试FSK，取消选中**DATAIN (0x11)**和**ENABLE (0x10)**选择框。
14) 点击**mode**选择框，并确认**Conf0 (0x01)**组合框中显示**FSK**。在**FSK**组合框中，中心频率应设为315MHz。在**Frequency Deviation**编辑框中，输入**50**，然后按回车键。这样产生的峰峰值将被四舍五入至合成器的频率分辨率。**FSK**组合框中，在**fhi**和**flo**标签旁边显示高频和低频。
15) 点击**ENABLE (0x10)**选择框。确认未选中**DATAIN (0x11)**选择框。频谱分析仪应显示逻辑0 (空号)频率的未调制载波，大约等于**flo**值。根据晶体频率容差的不同，频率可能会偏移最多几十kHz。
16) 选中**DATAIN (0x11)**选择框，并在频谱分析仪上观察频率偏移。逻辑1 (传号)频率应接近**fhi**值。

其它评估

17) 如需测量效率，关闭GUI，断开USB电缆。

18) 移除跳线JU111引脚1-2上的短路器，串联一个安培计。

19) 重新连接USB电缆，并重新启动GUI。

20) 将功率计连接至RF SMA连接器，测量输出功率和供电电流。

21) 按下式计算效率：

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

表1. 控制侧跳线表(J100、JU100至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.

*默认位置。

表2. JU111跳线表

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是Motorola, Inc.的商标。

表2. JU111跳线表(续)

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.

*默认位置。

表3. DUT侧跳线表

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.

*默认位置。

MAX7060评估板

布局问题

对于任何RF/微波电路来说，设计合理的PCB都至关重要。使高频输入和输出线路尽量短，以将损耗和辐射降至最小。高频时，大约λ/10或更长的走线相当于天线。

寄生电感和电容都会影响电路布局，使用较短的走线长度能很好地避免该问题。通常情况下，接地区域上方0.0625in处的10mil宽PCB走线，在采用FR4电介质时产生大约19nH/in的电感和大约1pF/in的电容。匹配网络中，电感大约为22nH，电容大约为10pF，IC附近的电路对元件有效值的影响非常大。

为了降低寄生电感，在信号走线下方采用稳固的接地或电源区域。在全部GND引脚上，采用低电感通路连接至地，并在所有靠近VDD连接的位置安装去耦电容。不要在去耦电容上共用GND过孔，每个电容使用独立的过孔。

软件详细说明

MAX7060评估软件的主窗口如图1所示。

评估板采用Windows XP、Windows Vista和Windows 7兼容软件提供简单的GUI，演示MAX7060的功能。利用评估板GUI Main Control标签页，可以方便地设置IC，无需关注寄存器的编程。可在Registers标签页中查看寄存器的值。这样就能够利用GUI采用不同的设置进行方便的原型设计。

主控制标签页

Main Control标签页着重于设置发送器和GPO配置。发送器频率范围可通过GUI来指定。发送频率范围为301.5MHz至450.5MHz，采用16MHz晶体。可通过Registers标签页将频率设置为任意值，但仅限于Main Control标签页中的允许值。发送频率为ASK组合框中的Center Frequency。对于FSK，中心频率规定了空号频率(flo)和传号频率(fhi)的中点。低频和高频由Center Frequency附近的频率偏移规定。最大PA功率设置可选。对于ASK数字整形，还提供定时和功率步长设置。

DATAIN和ENABLE功能可通过软件(选择框)或硬件(按钮)设置。位电平和硬件逻辑在内部进行“或”操作。

GPO配置

IOConf1 (0x05)组合框显示GPO1和GPO2的不同信号输出选项。

IOConf0 (0x04)组合框给出了不同内部信号的状态，如表4所示。改变TestMUX的值时，这些状态反映在Status寄存器中。

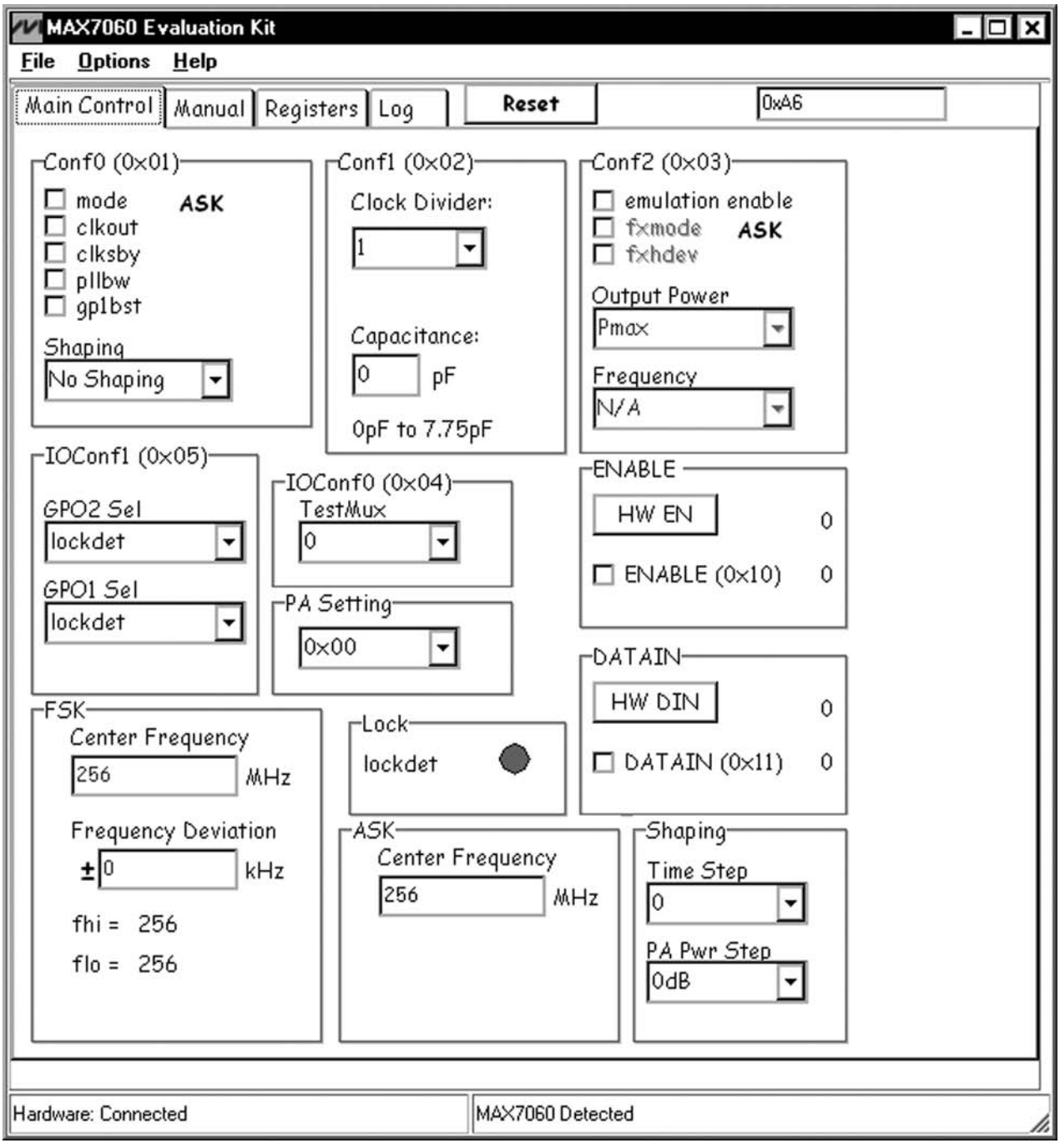

图1. MAX7060评估软件主窗口(主控制标签页)

表4. 状态总线信号

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

— 保留信号

nock 无时钟标识，若晶振被禁用则为(1)，若观察到IC时钟活动则为(0)

ckd4 4分频后的晶振时钟信号

ckd16 16分频后的晶振时钟信号

ckout 时钟输出信号，对应于编程分频器(ckdiv[2:0])

enable 内部使能信号(ENABLE引脚和使能位的“或”函数)

cap[4:0] SPI模式电容设置

frac_fxdb N分数模式(1)或ASK N定值模式(0)

capfxd[4:0] 仿真模式可变电容设置

notover ASK数字整形标识，当PA功率值不为0时为(1)

integ[3:0] N分数4位整数值

frac[11:0] N分数12位小数值

xmit_en 发送器PA使能标识

lockdet PLL锁定检测标识

仿真模式

利用仿真模式，可通过SPI寄存器Conf2实现手动模式下相同的设置。这样就能够通过写单个寄存器实现对IC的完整配置。

手动标签页

IC可工作于固定的纯硬件模式，无需SPI控制器。利用Manual标签页(图2)可通过软件控制硬件设置。板载微控制器根据该标签页中的选项设置电平，而不是通过跳线设置高和低逻辑电平。固定硬件模式亦可通过JU1和JU2手动控制。需要安装JU1和JU2，并且移除JU111 (引脚3至30)上的短路器。跳线位置可切换，以实现不同的输出设置。

寄存器标签页

Registers标签页(图3)显示每个寄存器的每个位的逻辑电平状态。粗体数据位表示逻辑高，非粗体数据位表示逻辑低。点击单个数据位切换该位状态，并执行写和读命令。新值显示在最右侧的编辑框中。亦可通过在编辑框中键入十六进制数值然后按键盘上的回车键，向寄存器中写入完整的寄存器值。

记录标签页

Log标签页可用于确认命令是否执行。Log Page表旁边有一个编辑框，显示上次写入至Log Page的值。不必切换至Log Page确认命令是否发送。

使用提示

评估板包含一个简单的GUI用于演示IC特性。有些动作在后台执行多次写入和读取操作。为确保软件正常工作，请遵循以下提示:

- 确保跳线处于默认位置。
- 程序启动时，确认左下角状态栏上显示Hardware: Connected，右下角状态栏上显示MAX7060 Detected。
- 拔下USB电缆，再次插入前等待大约5s。这使供电电压下降至低于复位门限。
- 将USB电缆从PC插入至评估板后，等待大约5s，然后再运行评估软件。软件运行之前，需要一些时间检测USB驱动。

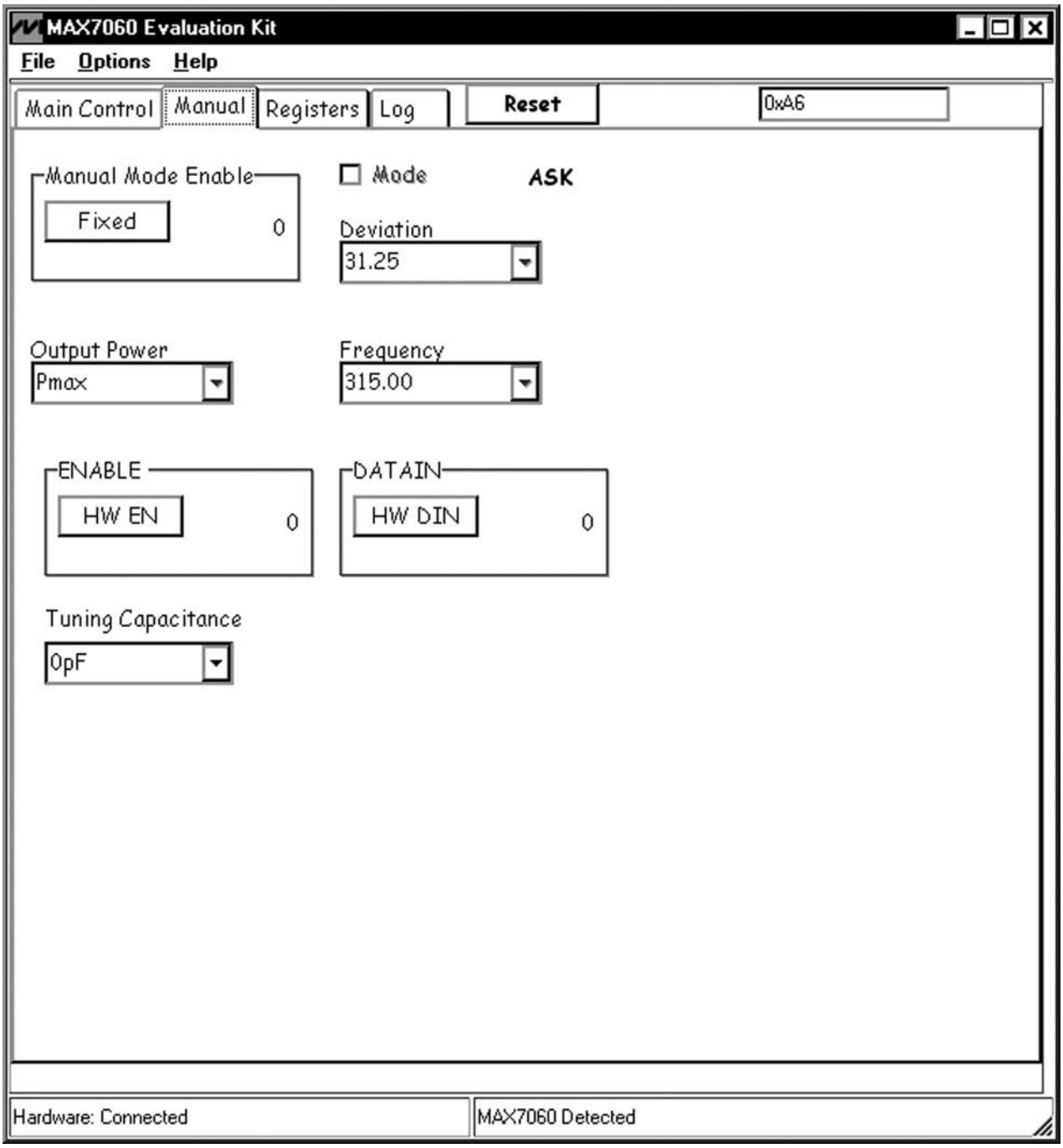

图2. MAX7060评估软件(手动标签页)

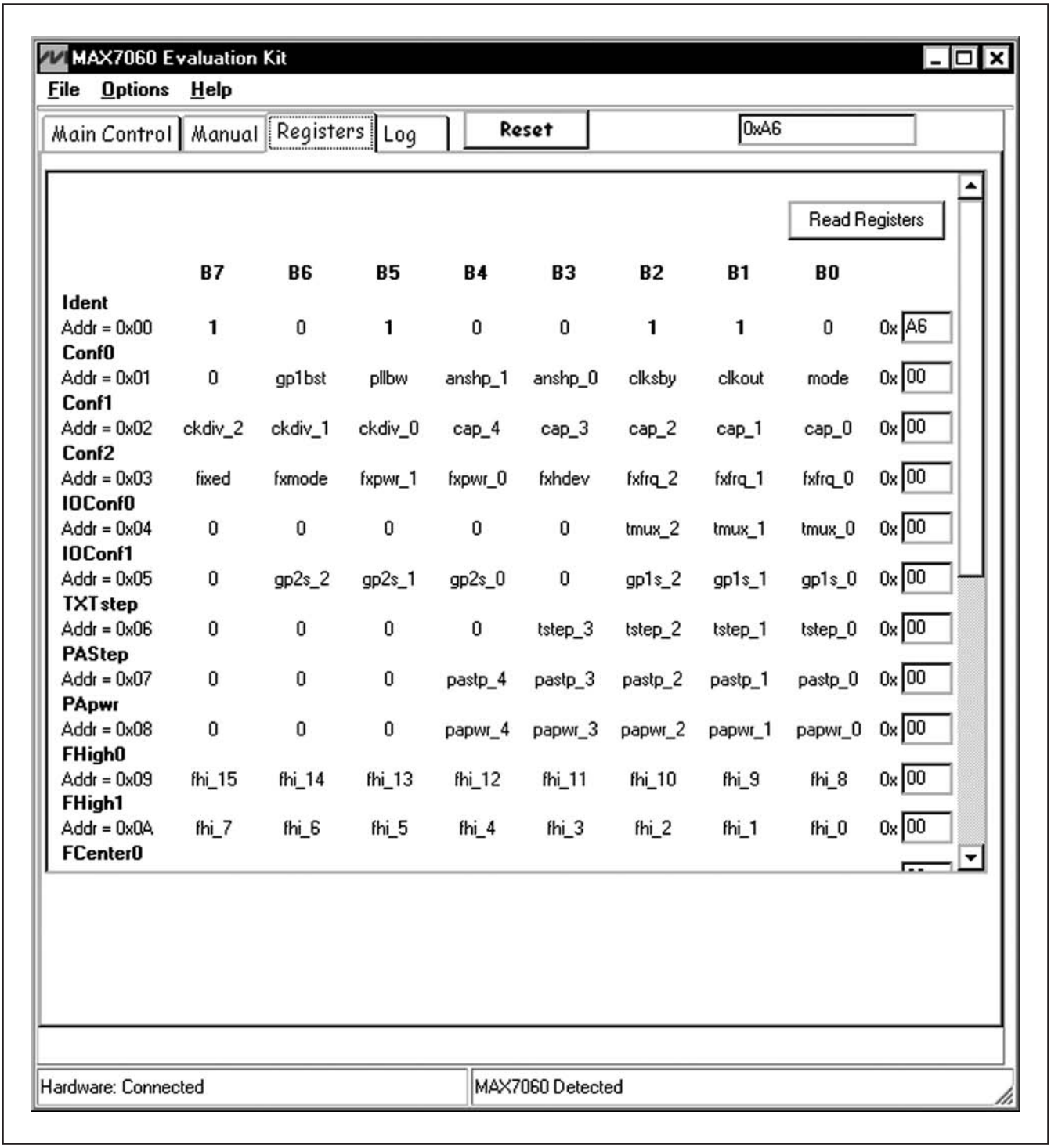

图3. MAX7060评估软件(寄存器标签页)

硬件详细说明

MAX7060评估板为MAX7060提供了经过验证的布局。IC可在5V或3V电源电压下工作。对于纯硬件模式，安装跳线JU1和JU2，以实现手动模式设置。评估板上包含了监测不同信号的测试点(表5)。

功率放大器匹配网络

评估板上的匹配网络是专门针对低端工作频率范围而优化设计的宽带网络。在300MHz至330MHz范围内可实现功率和效率的最佳组合。在频带的高端(430MHz至450MHz)，功率比频带低端处低2dB至3dB。功率下降是由于谐波滤波器(C55-L2-C56)截止频率被设置为抑制较低频率的二次谐波造成的。可采用其它匹配网络元件参数移动最优频率范围。

手动模式操作

手动模式设置请参见表6、表7和表8。

电源

IC可采用2.1V至3.6V或4.5V至5.5V电源工作。评估板有几个选项，在两种设置下均可由USB供电。用户亦可使用外部电源为控制侧电路供电。J100上的1-2位置允许VDUT从电池供电，需要电池支架(未安装)。

从USB获得3V电源

为了从USB电源获得2.1V至3.6V的供电电压，将控制侧J100上的短路器移至7-8位置。短路器默认处于7-8位置。该位置使VDUT等于VADJ。用户可利用伏特计监测VADJ，并通过改变电位计电阻(R100)在2.1V至3.6V范围内调节电压。在DUT侧，需将JU8闭合。

从USB获得5V电源

如需使用5V USB电源供电，将控制侧J100上的短路器移至3-4位置。该位置使VDUT等于5V。这种情况下，需将JU8开路。HVIN输入为5V时，AVDD引脚变为LDO输出，并为其它电源产生V3V供电电压。

表5. DUT侧信号测试点

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.

表6. JU1和JU2跳线表，用于手动模式

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

表7. 手动模式功率设置

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

表8. 手动模式频率

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

外部供电

如需由外部供电，将J100上的短路器移至5-6位置。然后在VEXT和GND-_测试点之间加外部电压。JU8上的跳线设置取决于输入供电电压。如果输入供电电压为2.1V至3.6V，则应安装跳线。如果输入供电电压为4.5V至5.5V，则应将跳线开路。

独立供电的电流测量

IC具有不同的电源输入，均可独立监测。这些电源位于DUT侧，由来自于控制侧的V3V和V5V供电。全部电源默认连接在一起。如需测量特定电源的供电电流，修改与该电源相对应的跳线，并通过一个安培计将V3V或V5V连接至相应的测试点。

施加外部信号

如需在使能(ENABLE)和Tx数据(DIN)测试点施加外部信号，必须首先移除JU111上的相应跳线，然后将信号施加至测试点。如果已安装JU1，也应该将那里的相应跳线取下。例如，如需将外部信号加至DIN，首先取消选中**DATAIN (0x11)**选择框。然后从JU111的引脚31-32上移除跳线，将DIN信号加至DIN测试点。采用这种配置方式的发送器，可发送复杂的模式。使能的处理方式与之类似。施加信号之前，确保外部信号的电压范围限制至DVDD。

外部SPI

移除SPI跳线上的短路器，施加信号至SPI测试点。SPI跳线位于JU111上(表2)，请参考表9的说明。外部SPI信号需限制至DVDD供电电压。J101可用于观察控制侧的SPI信号(表10)。

外部频率输入

对于希望用外部频率取代晶体频率的应用，可以通过XTAL SMA连接器施加外部频率。取下晶体，并安装电阻R12（采用0Ω)。IC GUI默认的晶体频率为16MHz。

表9. SPI跳线和测试点(JU111)

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

表10. SPI接头(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

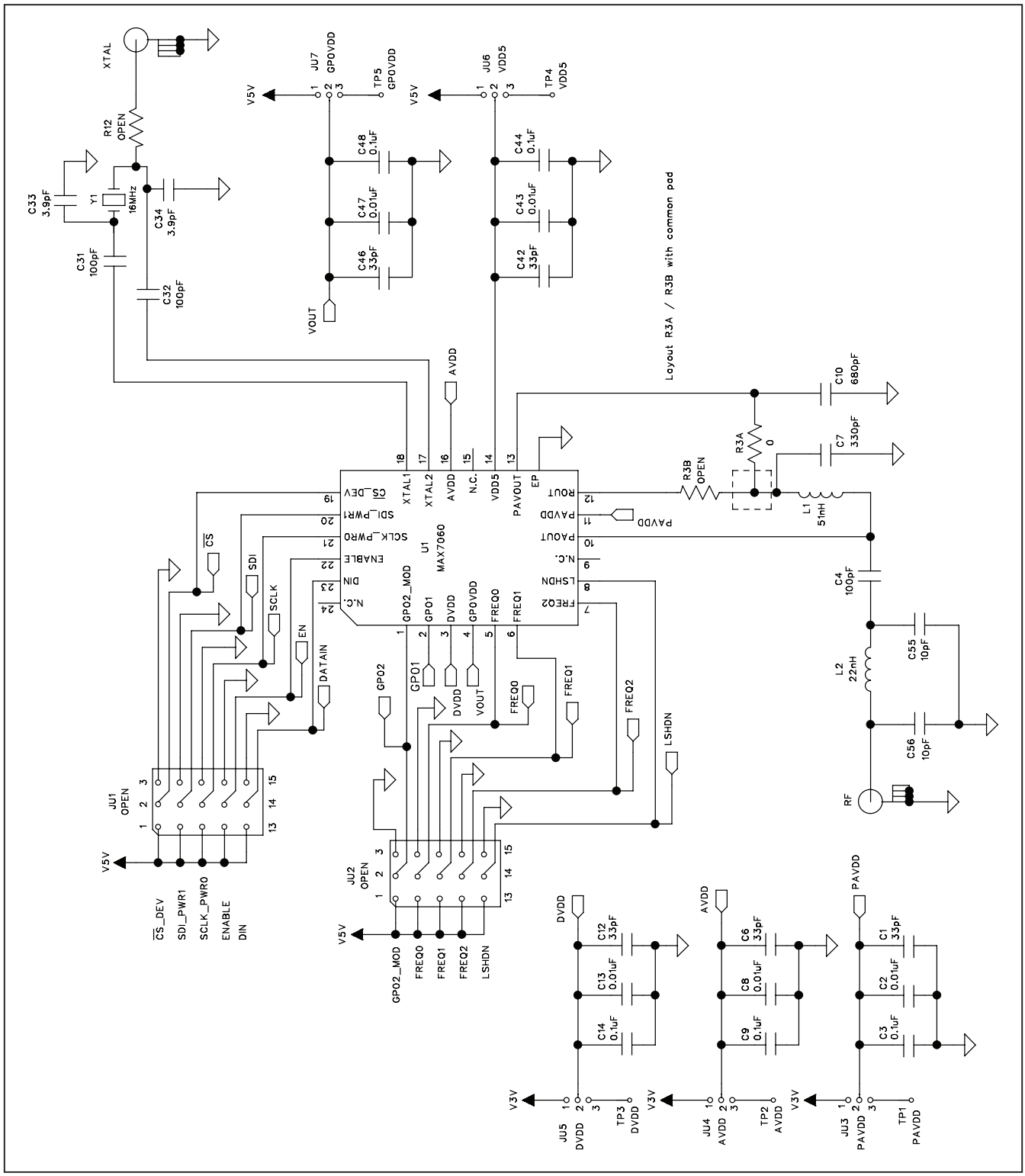

图4a. MAX7060评估板原理图(1/5)

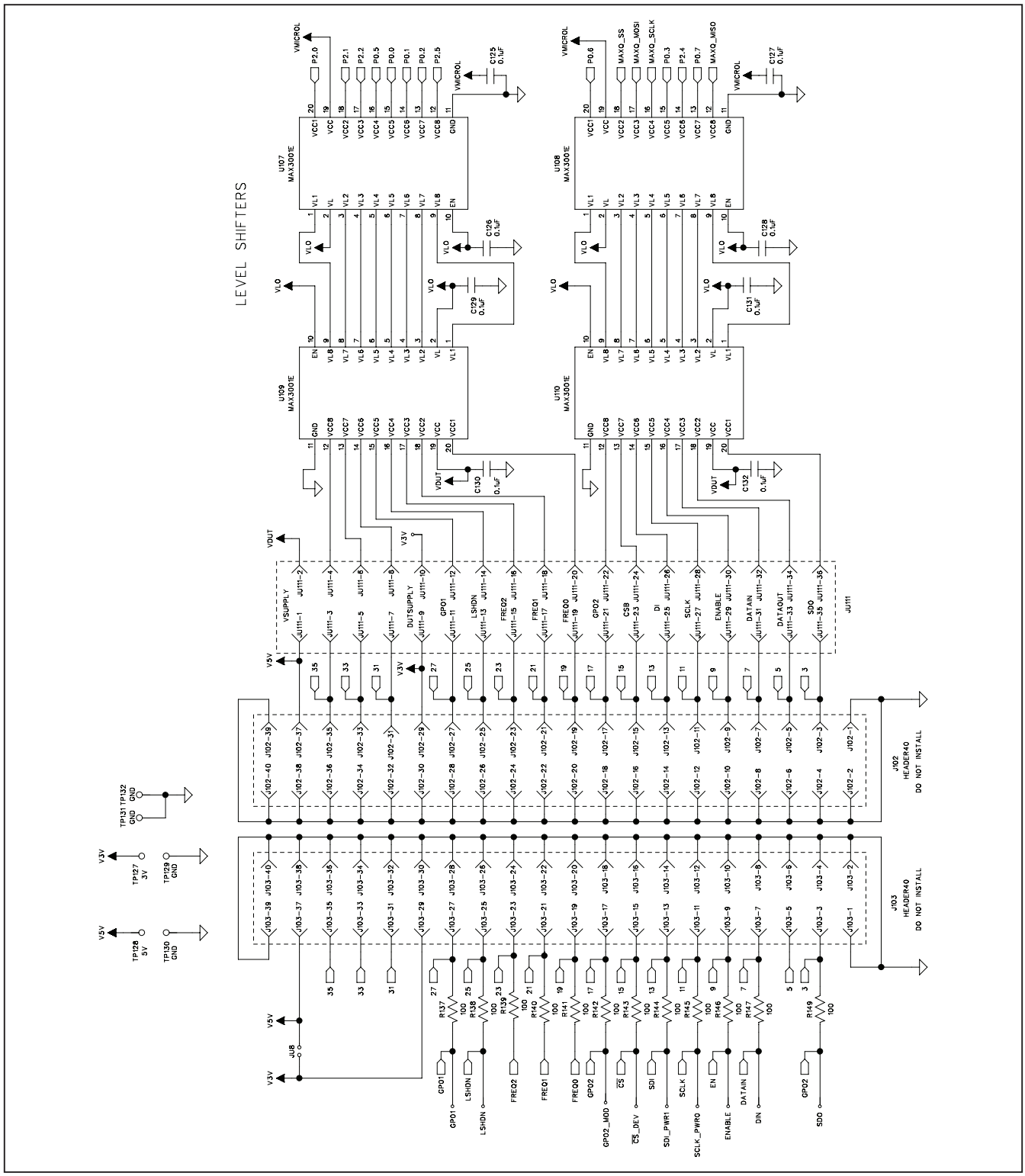

图4b. MAX7060评估板原理图(2/5)

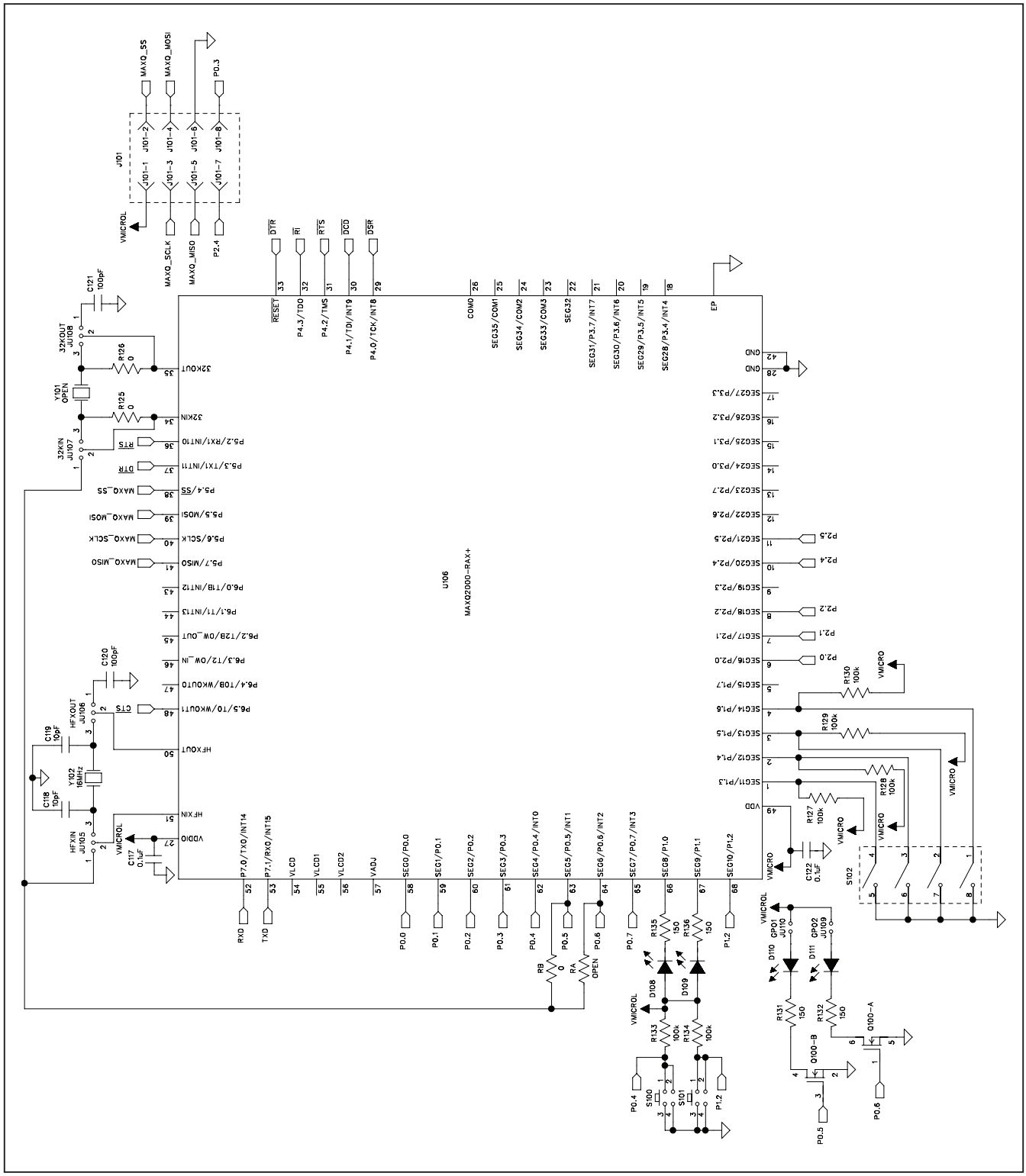

图4c. MAX7060评估板原理图(3/5)

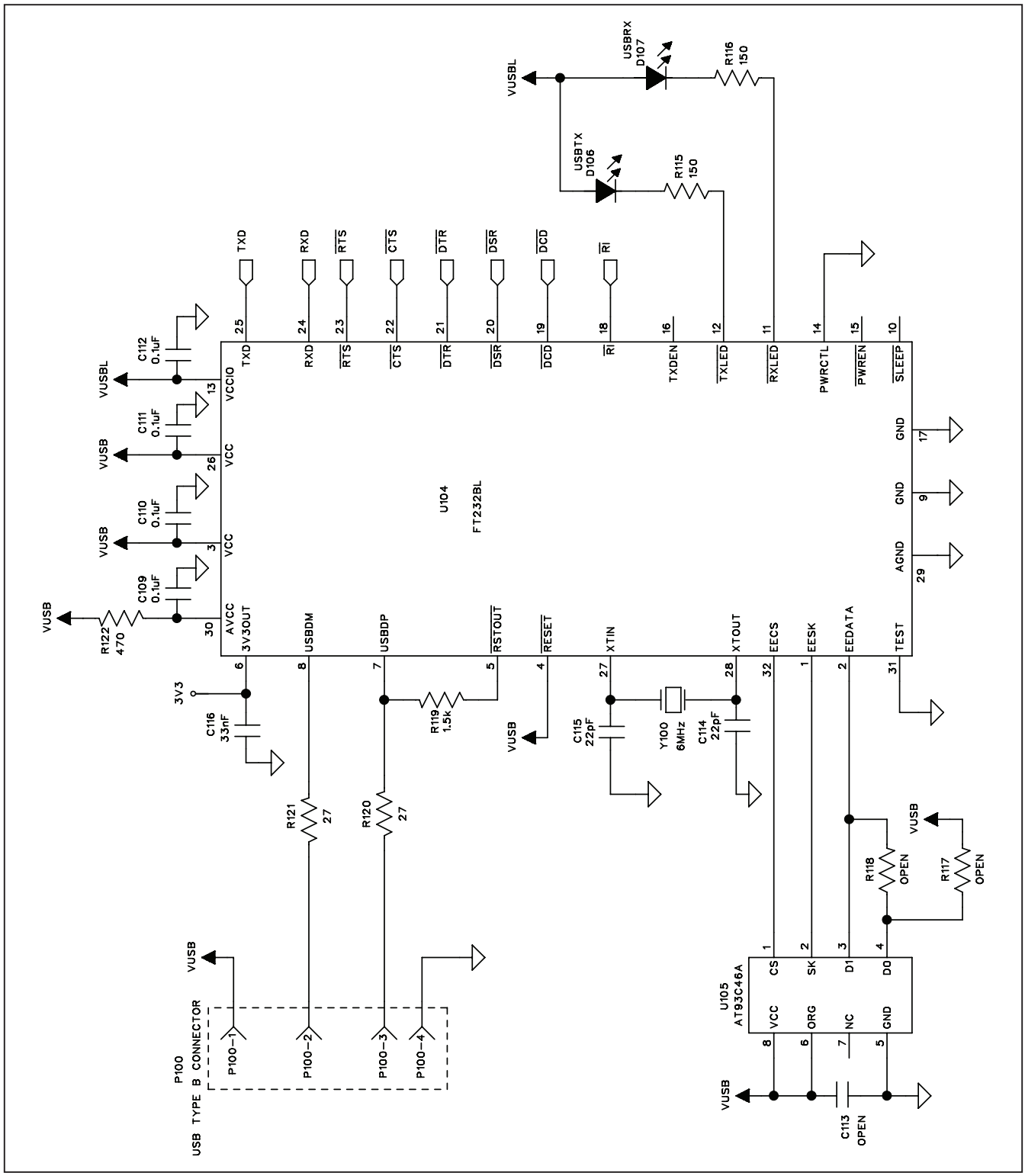

图4d. MAX7060评估板原理图(4/5)

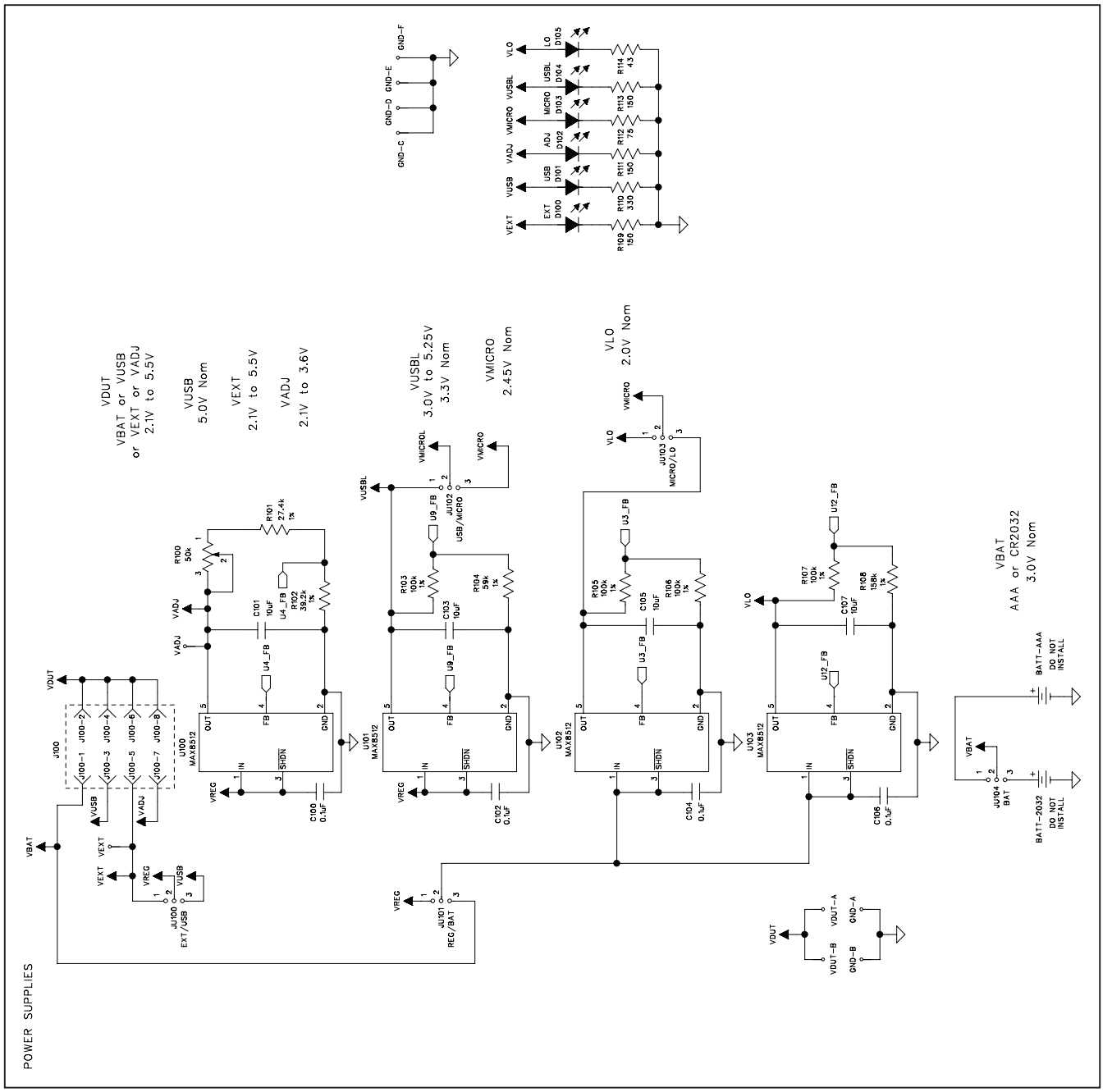

图4e. MAX7060评估板原理图(5/5)

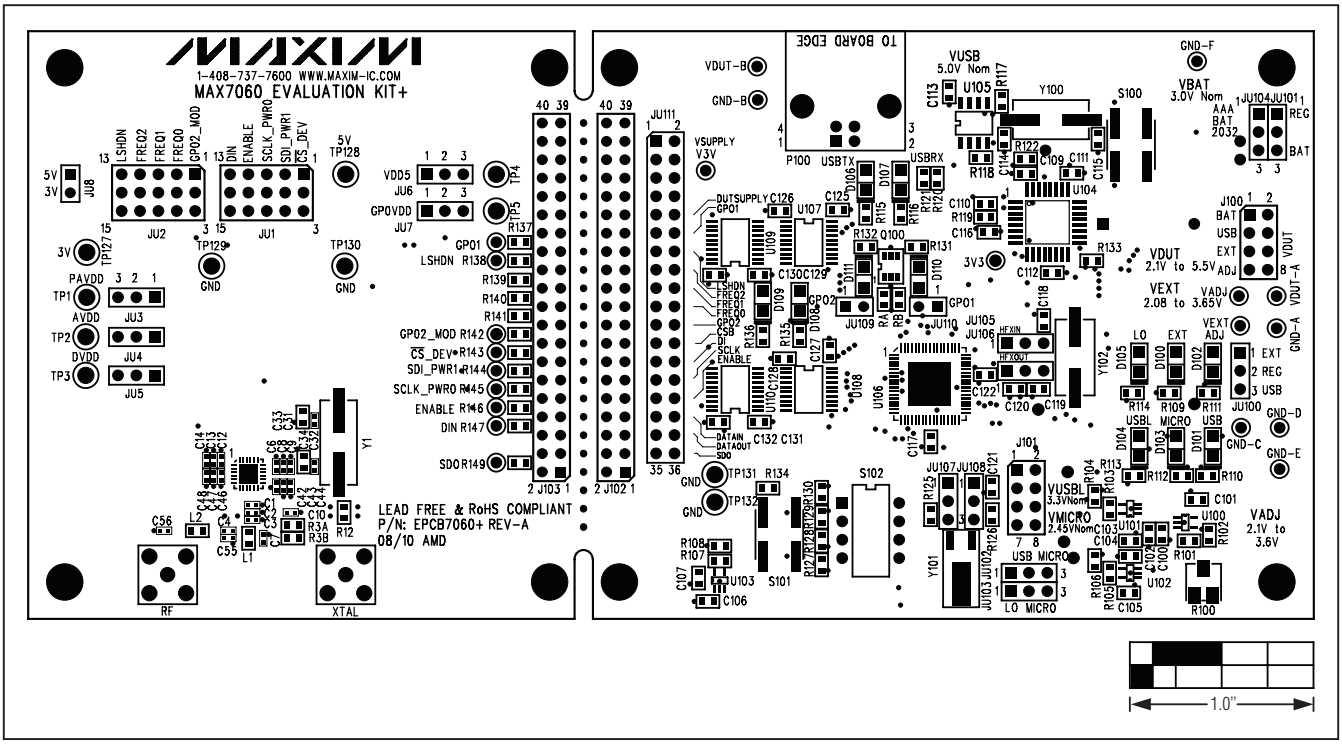

图5. MAX7060评估板元件布局—元件层

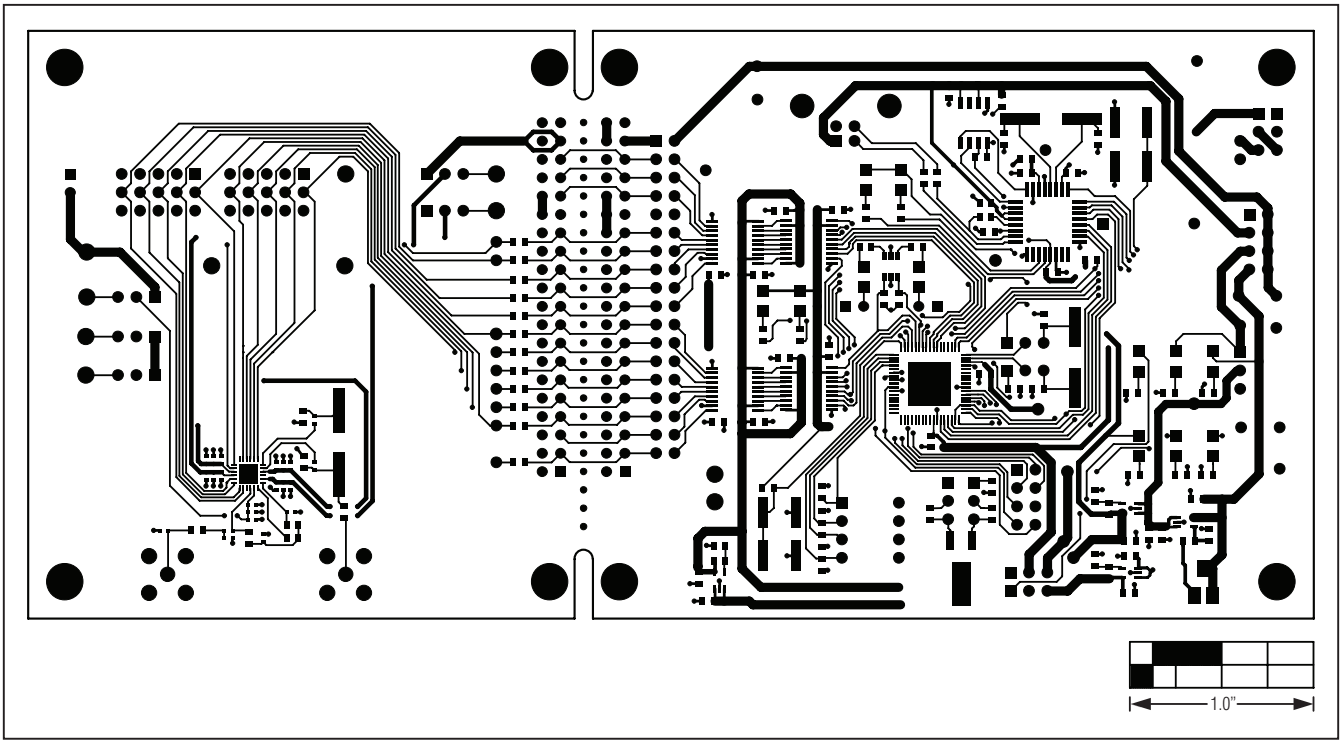

图6. MAX7060评估板PCB布局—元件层

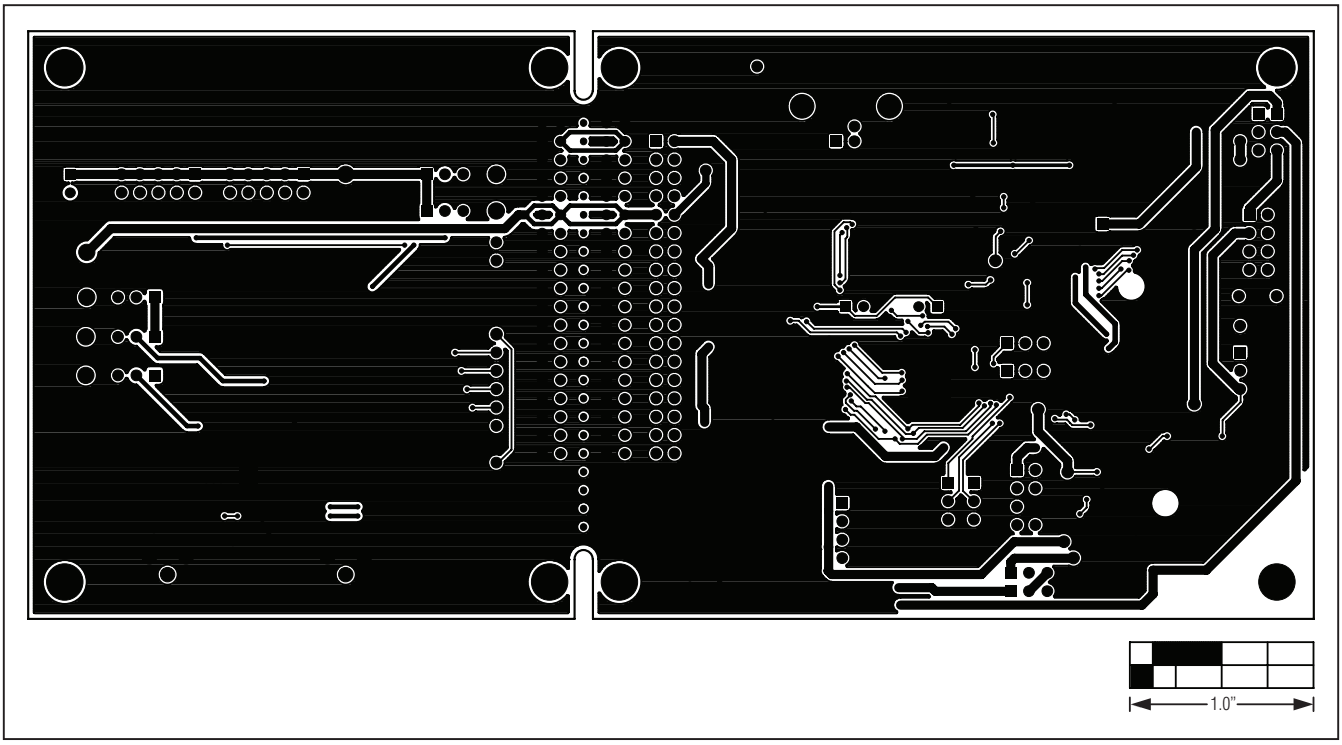

图7. MAX7060评估板PCB布局—焊接层

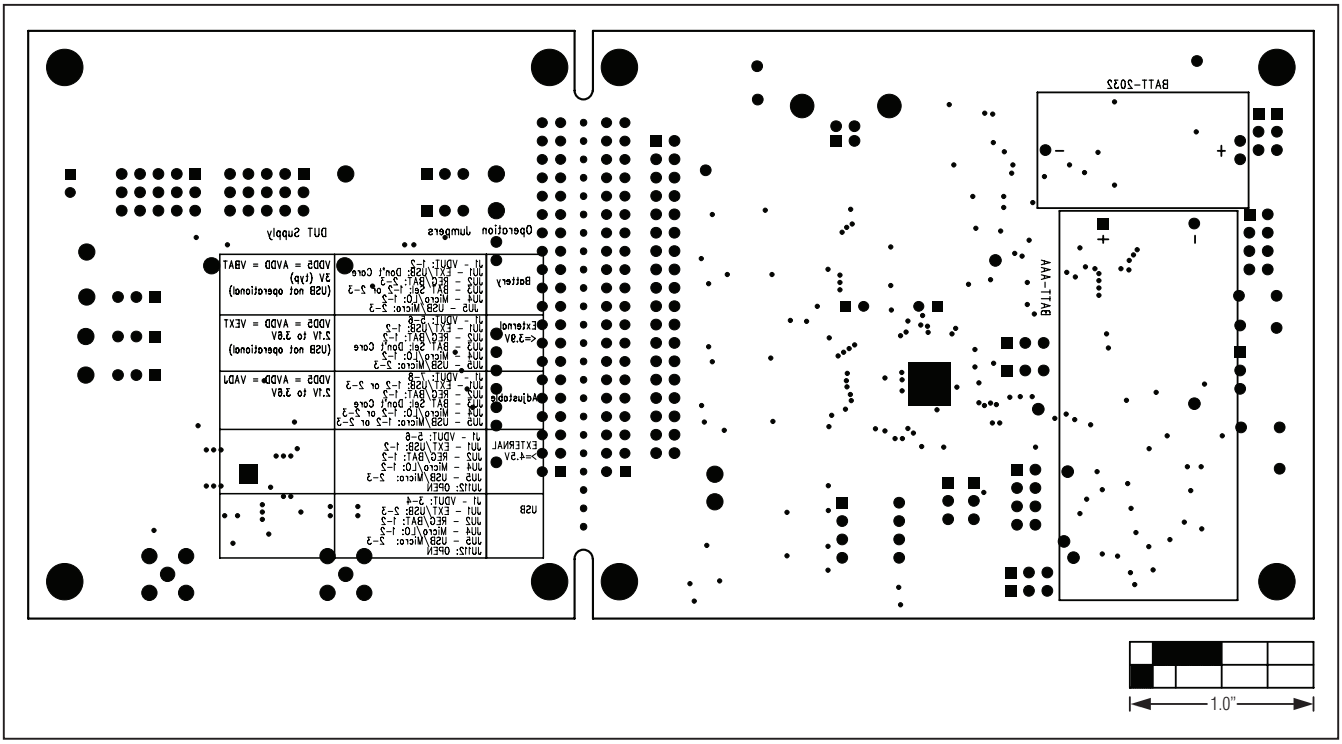

图8. MAX7060评估板元件布局—焊接层

修订历史

修订号	修订日期	说明	修改页
0	9/10	最初版本。	—

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