### **Evaluates: MAX6956**

### **General Description**

The MAX6956 evaluation kit (EV kit) is a fully assembled and tested surface-mount PCB that contains a MAX6956 IC. The MAX6956 is a 28-port LED driver and I/O expander. The EV kit also includes Windows<sup>®</sup> 2000/XPand Windows Vista<sup>®</sup>-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX6956.

Windows and Windows Vista are registered trademarks of Microsoft Corp.

\*\* For Windows 10, follow step 6 in the Quick Start section.

### **Component List**

DESIGNATION	QTY	DESCRIPTION
C1, C5–C9, C12, C17, C18, C37	10	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C2	0	Not installed, ceramic capacitor (0603)
C3, C11, C38, C40	4	10μF ±20%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106M
C4	1	0.033µF ±10%, 16V X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA
C10, C39	2	1µF 10%, ±16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C15, C16	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C30, C31	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
H1–H4	4	10-pin headers
J1	1	USB type-B, right-angle PC-mount receptacle
J3	0	Not installed

\*EP = Exposed pad.

#### **Features**

- Windows 2000/XP-, Windows Vista (32-Bit)- and Windows 10\*\* Compatible Software
- USB-PC Connection (Cable Included)
- USB Powered
- Lead-Free and RoHS Compliant
- Proven PCB Layout
- Surface-Mount Components
- Fully Assembled and Tested

### **Ordering Information**

PART	TYPE	
MAX6956EVKIT+	EV Kit	

+Denotes lead-free and RoHS compliant.

DESIGNATION	QTY	DESCRIPTION	
JU1, JU3	2	Dual-row (2 x 4) vertical headers	
JU2, JU4, JU7, JU8	4	3-pin headers	
JU5, JU6, JU9–JU13	0	Not installed, 2-pin headers	
JU14	1	2-pin header	
L1	1	Ferrite bead TDK MMZ1608R301A (0603)	
LED1, LED3–LED14	13	Red LEDs (0805)	
LED2	1	Dual-digit 0.56in, 7-segment display	
Q1, Q2	0	Not installed, 2N7002 (SOT23)	
R1, R2	2	27Ω ±5% resistors (0603)	
R3	1	1.5kΩ ±5% resistor (0603)	
R4	1	470Ω ±5% resistor (0603)	
R5	1	2.2kΩ ±5% resistor (0603)	
R6	1	10kΩ ±5% resistor (0603)	
R7, R8	2	4.7kΩ ±5% resistors (0603)	
R11	1	100kΩ ±5% resistor (0603)	
R12, R14	0	Not installed, $10k\Omega \pm 5\%$ resistors (0603)	
R13	1	150kΩ ±5% resistor (0603)	
R15, R16, R18, R24–R48	28	0Ω resistors (0603)	



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DESIGNATION	QTY	DESCRIPTION
R17	1	330Ω ±5% resistor (0603)
R19–R23	0	Not installed, resistors (0402)
SW1	1	Momentary 6mm pushbutton switch
U1	1	28-port LED driver and I/O expander (40 TQFN-EP*) Maxim MAX6956ATL+
U2	1	2.5V LDO regulator (5 SC70) Maxim MAX8511EXK25+ (Top Mark: ADV)
U3	1	3.3V LDO regulator (5 SC70) Maxim MAX8511EXK33+ (Top Mark: AEI)
U4	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+

### **Component List (continued)**

DESIGNATION	QTY	DESCRIPTION
U5	1	USB-to-UART converter (32 TQFP) FTDI FT232BL
U6	1	93C46 type 3-wire EEPROM (8 SO) Atmel AT93C46A-10SU-2.7
Y2	1	16Hz crystal (HCM49) Hong Kong X'tals SSM1600000E18FAF
Y3	0	Not installed, crystal
Y4	1	6MHz crystal (HCM49) Hong Kong X'tals SSL6000000E18FAF
—	7	Shunts
_	1	USB high-speed A-to-B cables, 6ft
_	1	PCB: MAX6956 Evaluation Kit+

\*EP = Exposed pad.

### **Component Suppliers**

SUPPLIER	PHONE	WEBSITE
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: Indicate that you are using the MAX6956 when contacting these component suppliers.

### MAX6956 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs EV kit files on your computer
MAX6956.EXE	Application program
FTD2XX.INF	USB device driver file
USB_Driver_Help.PDF	USB driver installation help file

### **Quick Start**

#### **Recommended Equipment**

Before beginning, the following equipment is needed:

- MAX6956 EV kit (USB cable included)
- A user-supplied Windows 2000/XP-, Windows Vista or Windows 10-compatible PC with a spare USB port

**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 MAX6956 EV kit is fully assembled and tested. Follow the steps below to verify board operation.

# Caution: Do not turn on the power supply until all connections are completed.

 Visit <u>www.maximintegrated.com/evkitsoftware</u> to download the latest version of the EV kit software, 6956Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.

- Install the EV kit software on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied and icons are created in the Windows <u>Start | Programs</u> menu.
- 3) Verify jumper settings (see Table 1).
- 4) Connect the USB cable from the PC to the EV kit board. A <u>Building Driver Database</u> window pops up in addition to a <u>New Hardware Found</u> message when installing the USB driver for the first time. If you do not see a window that is similar to the one described above after 30 seconds, remove the USB cable from the board and reconnect it. Administrator privileges are required to install the USB device driver on Windows 2000/XP and Windows Vista.
- 5) Follow the directions of the <u>Add New Hardware</u> <u>Wizard</u> to install the USB device driver. Choose the <u>Search for the best driver for your device</u> option. Specify the location of the device driver to be C:\ Program Files\MAX6956 (default installation directory) using the <u>Browse</u> button. During device driver

installation, Windows may show a warning message indicating that the device driver Maxim uses does not contain a digital signature. This is not an error condition and it is safe to proceed with installation. Refer to the USB\_Driver\_Help.PDF document included with the software for additional information.

- 6) For Windows 10 system, download the driver file <u>Maxim\_VID\_FTDI\_x64\_CDM\_2.06.00.zip</u>, extract the file and run the application file, then allow the Installation Wizard by pressing the Next button. Next, the Device Driver Installation Wizard page pops up, click the Finish button, and now drivers are ready to use. Connect the USB cable from the PC to the EV kit.
- Start the MAX6956 EV kit software by opening its icon in the <u>Start | Programs</u> menu. The EV kit software main window appears, as shown in Figure 1.
- Press function key F1 to configure all of the ports for LED output and enter display test mode. Verify that all of the LEDs light up. Click <u>OK</u> to end display test mode.

### **Jumper Selection**

#### Table 1. Jumper Selection (JU1–JU14)

JUMPER	FUNCTION	SHUNT POSITION	DESCRIPTION		
		1-2*			
JU1	AD0	3-4	I <sup>2</sup> C address selection (see Table 2)		
JU1	ADU	5-6			
		7-8			
JU2	V+	1-2*	U1 V+ powered by VDDIO 3.3V		
302	VT	2-3	U1 V+ from external power EXT_V+		
		1-2*			
11.12		3-4	1 <sup>2</sup> C address colorition (can Table 2)		
103	JU3 AD1	5-6	I <sup>2</sup> C address selection (see Table 2)		
		7-8			
JU4	VLED	1-2*	VLED powered by VDDIO 3.3V		
JU4 VLED		2-3	VLED from external power EXT_VLED		
JU5	Level Not installed*		SDA connects directly to MAXQ2000		
105	translator	PCB trace cut open	See the Operation with External 2.5V to 5.5V Supply section		
JU6	Level	Not installed*	SCL connects directly to MAXQ2000		
JU6	translator	PCB trace cut open	See the Operation with External 2.5V to 5.5V Supply section		
11.17	D24	1-2*	U1 P31 port connected to LED2 right decimal point		
JU7	P31	2-3	U1 P31 port connected to interrupt input and LED15		
JU8	8 P30 1-2*		U1 P30 port connected to LED2 left decimal point; pushbutton switch is not used		
		2-3	U1 P30 port connected to switch SW1		

\*Default position.

JUMPER	FUNCTION	SHUNT POSITION	DESCRIPTION
JU9	INT	Not installed*	INT connected to MAXQ2000
109		PCB trace cut open	MAXQ2000 INT not connected
JU10	SDA	Not installed*	SDA connected to on-board I <sup>2</sup> C bus
3010	SDA	PCB trace cut open	SDA must be connected to an external I <sup>2</sup> C bus
JU11	SCL	Not installed*	SCL connected to on-board I <sup>2</sup> C bus
JUII SOL	PCB trace cut open	SCL must be connected to an external I <sup>2</sup> C bus	
JU12	SDA	Not installed*	SDA pullup resistor R7 connected
JU12	SDA	PCB trace cut open	SDA pullup must be user-supplied
JU13	SCL	Not installed*	SCL pullup resistor R8 connected
3013	SCL	PCB trace cut open	SCL pullup must be user-supplied
JU14	P30/SW1	1-2*	R11 pulls up P30 pushbutton switch
3014	pullup	Open	R11 not connected; SW1 pulls down only

### Table 1. Jumper Selection (JU1–JU14) (continued)

\*Default position.

### I<sup>2</sup>C Device Address Table 2. U1 MAX6956 I<sup>2</sup>C Device Address

JU3	AD1	JU1	AD0	I <sup>2</sup> C ADDRESS
1-2 *	GND	1-2*	GND	1000 000 r/w
1-2	GND	5-6	V+	1000 001 r/w
1-2	GND	7-8	SDA	1000 010 r/w
1-2	GND	3-4	SCL	1000 011 r/w
5-6	V+	1-2	GND	1000 100 r/w
5-6	V+	5-6	V+	1000 101 r/w
5-6	V+	7-8	SDA	1000 110 r/w
5-6	V+	3-4	SCL	1000 111 r/w
7-8	SDA	1-2	GND	1001 000 r/w
7-8	SDA	5-6	V+	1001 001 r/w
7-8	SDA	7-8	SDA	1001 010 r/w
7-8	SDA	3-4	SCL	1001 011 r/w
3-4	SCL	1-2	GND	1001 100 r/w
3-4	SCL	5-6	V+	1001 101 r/w
3-4	SCL	7-8	SDA	1001 110 r/w
3-4	SCL	3-4	SCL	1001 111 r/w

\*Default position.

### **Detailed Description of Software**

The MAX6956 EV kit software provides a graphical user interface (GUI) to configure the EV kit hardware. See Figures 1-4.

The **Interrupt pin status** group box indicates MAX6956 INT output pin status.

#### **Interface History Tab**

The **Interface History** tab sheet provides a list of the  $I^2C$  and other commands generated by the MINIQUSB.

#### Advanced User Interface

The menu item **Options | Interface (Advanced User)** brings up the **Advanced User Interface** window shown in Figure 5. This window allows sending arbitrary commands on the  $I^2C$  bus.

#### **Transition Detection**

Follow the steps below to verify transition-detection operation:

- 1) Set EV kit jumpers JU7 = 2-3, JU8 = 2-3, and JU14 = 1-2.
- 2) Select the Port Configuration tab (Figure 2). In the 0x09 .. 0x0F Port Configuration group box, set P30 = 10 GPIO Input (no pullup), set P31 = 01 GPIO Output (push-pull), and press the Write button.
- Select the Main Configuration tab (Figure 1). In the 0x06 Transition Detect group box, check P30 mask and press the Write button.
- 4) In the **0x04 Configuration** group box, set **1 transition detection enabled** and press the **Write** button.

- 5) On the EV kit, press and release momentary pushbutton switch SW1. The MAX6956 detects the transition on pin P30 and drives pin P31 high. The MAX6956 EV kit software **Interrupt pin status** group box indicates **INT pin: 1 active**.
- 6) Select the Main Configuration tab. In the 0x06 Transition Detect group box, press the Read button. Verify that INT = 1 appears. After the read operation, the MAX6956 drives P31 low. The MAX6956 EV kit software Interrupt pin status group box indicates INT pin: 0 inactive.
- 7) To detect another transition, repeat steps 4, 5, and 6.

Z MAX6956 Evaluation Kit
Main Configuration Port Configuration Single Ports Multiple Ports Interface History
Global configuration registers
Read       1 - transition detection enabled       I - global current control       I - operate       Write         Affects P31 output port       Affects P31 output port
0x06 Transition Detect
Read         INT = 1         IV         P29 mask         P28 mask         P27 mask         P26 mask         P25 mask         P24 mask         Write
Checked = enable transition detection for selected bit; Not checked = ignore transitions
Transition detection is a one-shot event. When INT has been cleared after responding to a transition event, transition detection is automatically disabled, even though the M bit in the configuration register remains set (unless cleared by the user). Reenable transition detection by writing the configuration register with the M bit set, to take a new snapshot of the seven ports P24 to P30.
Ox07 Display Test         Read       Enable display test mode         Write       Configure P4-P31 as LED outputs, and enable display test mode         (display test supersedes shutdown mode)       Outputs, and enable display test mode
Ox02 Global Current Control (enabled by register 0x04)       Read     1/16       Write
I2C Device Address Interrupt pin status Ux80  INT pin: 0 inactive
Device Address 0x80

Figure 1. MAX6956 EV Kit Software Main Window (Main Configuration Tab)

Z MAX6956 Evaluation Kit
File Options Help
Main Configuration Port Configuration Single Ports Multiple Ports Interface History
Port Configuration
P7 🛛 O0 LED Drive (open-drain) 💌 P6 🖾 O0 LED Drive (open-drain) 💌 P5 🖾 O0 LED Drive (open-drain) 💌 P4 🖾 O0 LED Drive (open-drain) 💌
P11 00 LED Drive (open-drain) 💌 P10 00 LED Drive (open-drain) 💌 P9 00 LED Drive (open-drain) 💌 P8 00 LED Drive (open-drain) 💌
P15 00 LED Drive (open-drain) 💌 P14 00 LED Drive (open-drain) 💌 P13 00 LED Drive (open-drain) 💌 P12 00 LED Drive (open-drain) 💌
P19 00 LED Drive (open-drain) 💌 P18 00 LED Drive (open-drain) 💌 P17 00 LED Drive (open-drain) 💌 P16 00 LED Drive (open-drain) 💌
P23 00 LED Drive (open-drain) 💌 P22 00 LED Drive (open-drain) 💌 P21 00 LED Drive (open-drain) 💌 P20 00 LED Drive (open-drain) 💌
P27 00 LED Drive (open-drain) 💌 P26 00 LED Drive (open-drain) 💌 P25 00 LED Drive (open-drain) 💌 P24 00 LED Drive (open-drain) 💌
P31 00 LED Drive (open-drain) 💌 P30 00 LED Drive (open-drain) 💌 P29 00 LED Drive (open-drain) 💌 P28 00 LED Drive (open-drain) 💌
Read       All ports 00 LED Drive       All ports 01 GPI0 Output (push-pull)       All ports 10 GPI0 Input       All ports 11 GPI0 Input (internal pullup)       Write
⊡0x12 0x1F Individual Port Current (enabled by register 0x04)
P7 1/16 • P6 1/16 • P5 1/16 • P4 1/16 •
P11 1/16 • P10 1/16 • P9 1/16 • P8 1/16 •
P15 1/16 • P14 1/16 • P13 1/16 • P12 1/16 •
P19 9/16 💌 P18 9/16 💌 P17 9/16 💌 P16 9/16 💌
P23 9/16 V P22 9/16 V P21 9/16 V P20 9/16 V
P27 9/16 • P26 9/16 • P25 9/16 • P24 9/16 •
P31 9/16 💌 P30 9/16 💌 P29 9/16 💌 P28 9/16 💌
Read         All Ports 1/16         All Ports 4/16         All Ports 8/16         All Ports 12/16         All Ports 16/16         Write
12C Device Address Interrupt pin status
0x80 _ INT pin: 1 active
Device Address 0x80

Figure 2. MAX6956 EV Kit Software Main Window (Port Configuration Tab)

WAX6956 Evaluation Kit						
File Options Help						
Main Configuration Port Configuration S	ingle Ports   Multiple Ports   Interface Histo	y				
Access individual port pins P4 - P31						
0x27 Port 7 port status	0x26 Port 6 port status	0x25 Port 5 port status	0x24 Port 4 port status			
Read P7 Write	Read F P6 Write	Read F <sup>P5</sup> Write	Read P4 Write			
0x2B Port 4 port status	0x2A Port 10 port status	Ox29 Port 9 port status	0x28 Port 8 port status			
Read   T P11 Write	Read ViteWrite	Read F9 Write	ReadP8Write			
0x2F Port 4 port status	Ox2E Port 4 port status	0x2D Port 4 port status	0x2C Port 4 port status			
Read P15 Write	Read ViteWrite	Read F P13 Write	Read P12 Write			
Ox33 Port 19 port status	0x32 Port 18 port status	Ox31 Port 17 port status	0x30 Port 16 port status			
Read F19 Write	Read   F P18Write	Read F17 Write	Read 🔽 P16Write			
Ox37 Port 16 port status	Ox36 Port 16 port status	0x35 Port 16 port status	0x34 Port 16 port status			
Read 🔽 P23 Write	Read 🔽 P22 Write	Read F P21 Write	Read P20 Write			
Ox3B Port 16 port status	Ox3A Port 16 port status	0x39 Port 16 port status	0x38 Port 16 port status			
Read 🔽 P27 Write	Read 🔽 P26 Write	Read 🔽 P25 Write	Read   T P24Write			
Ox3F Port 31 port status	⊂0x3E Port 30 port status	Ox3D Port 16 port status	0x3C Port 16 port status			
Read 🔽 P31 Write	Read   F P30Write	Read 🔽 P29 Write	Read 🔽 P28Write			
LED3=P4			2 R.A=P23			
Head All LED4=P6 LED5=P8	LED10=P7 LED2.L.F=P17 LED11=P9 LED2.	LED2.L.B=P21 LED2.R.F=P28 L.G=P16 LED	LED2.R.B=P24 Write All			
LEDG=P10	LED12=P11 LED2.L.E=P18	LED2.L.C=P20 LED2.R.E=P27	LED2.R.C=P25			
LED7=P12 LED8=P14	LED13=P13 LED2 LED14=P15	L.D=P19 LED LED2.L.DP=P30	2.R.D=P26 LED2.R.DP=P31			
12C Device Address Interrupt pin sta	118					
Dx80 INT pin: 1 active						
Device Address (	)x80		1			

Figure 3. MAX6956 EV Kit Software Main Window (Single Ports Tab)

ZZ MAX6956 Evaluation Kit						
File Options Help						
Main Configuration Port Configuration Single Ports Multiple Ports Interface History						
Access port pins in consecutive groups of eight						
Move the trackbar to select the consecutive group of 8 ports to control						
Port Status						
v P20 Read 8 Ports						
F P21						
✓ P22 Write 8 Ports						
₩ P23						
✓ P24 ✓ P25						
<b>₩</b> P26						
₽27						
120 Davies Address - John Statistics						
I2C Device Address     Interrupt pin status       0x80     INT pin: 1 active						
Device Address 0x80	1.					

Figure 4. MAX6956 EV Kit Software Main Window (Multiple Ports Tab)

Advanced User Interface
Connection 2-wire interface Logging
Device Address Target Device Address: 0x80  1000000r/w Hunt for active listeners
General commands SMBus register watch Low Level commands
Command (SMBus Protocols, Raw Block Read/Write, EEPROM Read/Write)
4 - SMBusReadByte(addr,cmd) -> data8
Command byte: 0x06 💌 Data Out:
Byte count: 1 Data In: 0x00
Hunting for active listeners on SCL/SDA
One Device was found at 0x80
Executing protocol Q - SMBusQuick(addr) -> device present? SMBusQuick(0x80)> Success: Device is Present
Executing protocol 4 - SMBusReadByte(addr.cmd) -> data8 CmodSMBusReadByte(0x80,0x06)> 0x00
Maxim MINIQUSB V01.05.39 > USB:0 @ 460800 baud CmodSMBusReadByte(0x80,0x06)> 0x4

Figure 5. Advanced User Interface Window (2-Wire Interface Tab)

### **Detailed Description of Hardware**

The MAX6956 EV kit is a fully assembled and tested surface-mount PCB that contains a MAX6956 IC. The MAX6956 is a 28-port LED driver and I/O expander.

The microcontroller circuitry (U2–U6) is equivalent to Maxim's MAXQ2000-based MINIQUSB board.

#### User-Supplied I<sup>2</sup>C Interface

To use the MAX6956 EV kit with a user-supplied I<sup>2</sup>C interface, first cut the JU5 and JU6 default traces, disconnecting SDA and SCL from the on-board microcontroller. If the user-supplied I<sup>2</sup>C bus provides its own SCL/SDA pullup resistors, disable on-board pullup resistors R7 and R8 by cutting the JU12 and JU13 default traces. Next, apply your own 2.5V to 5.5V power supply between the EXT V+ and GND pads. Lastly, connect your SCL and SDA signals to the corresponding SDA and SCL test points on header H4 on the MAX6956 EV kit board.

# Operation with External 2.5V to 5.5V Supply

As shipped from the factory, the V+ supply voltage is connected to the on-board 3.3V regulator by jumper JU2.

Configuring the EV kit to accept user-supplied power between 2.5V and 5.5V requires cutting traces and mounting additional components, as listed below. The Absolute Maximum Rating of the MAXQ2000 microcontroller is 3.6V. **Warning: If SCL or SDA ever exceed**  **3.6V, the microcontroller will be damaged**. To protect the MAXQ2000 against high voltage, a leveltranslation circuit can be mounted on the board.

- 1) Obtain the following parts (Maxim does not supply these components)
- 2) Cut the PCB trace that shorts across JU5 and JU6.

DESIGNATION	QTY	DESCRIPTION
Q1, Q2	2	2N7002 (SOT23) Central Semiconductor 2N7002FC Diodes, Inc. 2N7002-7-F Fairchild 2N7002_NL Vishay/General Semiconductor 2N7002-E3
R12, R14	2	10kΩ ±5% resistors (0603)

- 3) Mount components Q1, Q2, R12, and R14.
- 4) Connect external power supply between the EXT V+ oval pad and the GND oval pad.
- 5) Move JU2 shunt to 2-3 position.

To restore the EV kit, remove Q1 and Q2. Then install shunts at JU5 and JU6. If Q1 and Q2 are not removed, the 2N7002's body diode will be forward-biased, which may prevent the SCL and SDA signals from meeting minimum logic-high threshold  $V_{IH(min)}$ .

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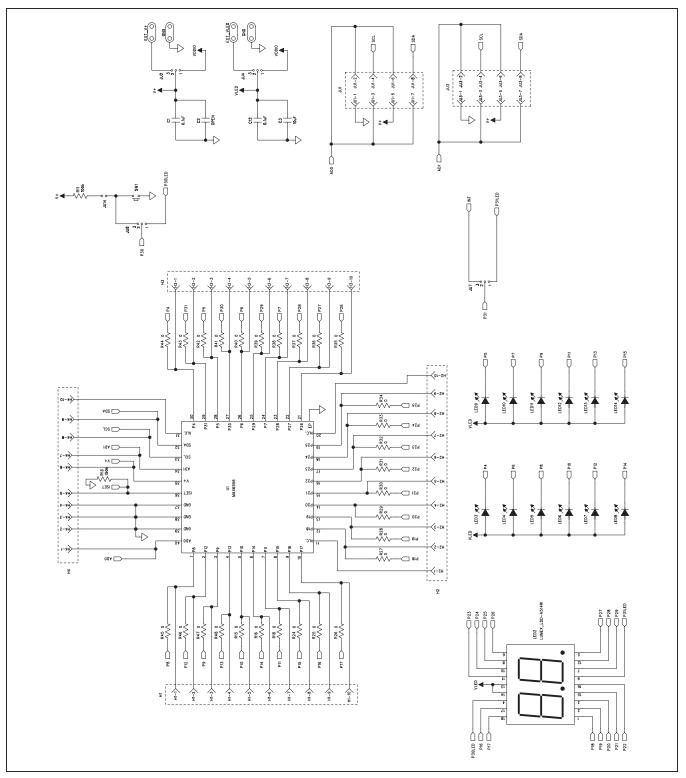


Figure 6a. MAX6956 EV Kit Schematic (Sheet 1 of 2)

# Evaluates: MAX6956

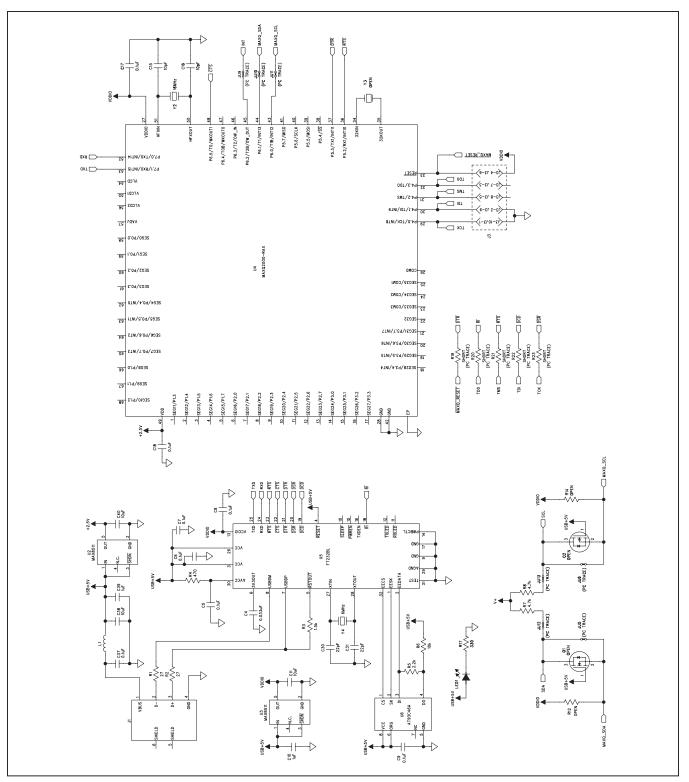


Figure 6b. MAX6956 EV Kit Schematic (Sheet 2 of 2)

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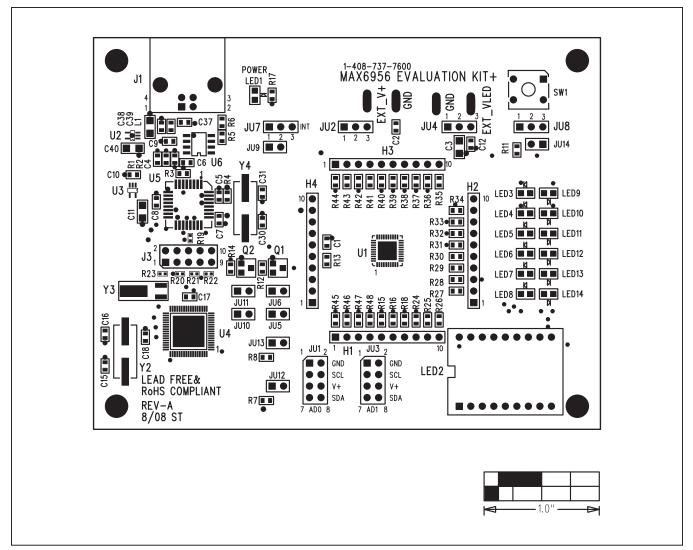


Figure 7. MAX6956 EV Kit Component Placement Guide—Component Side

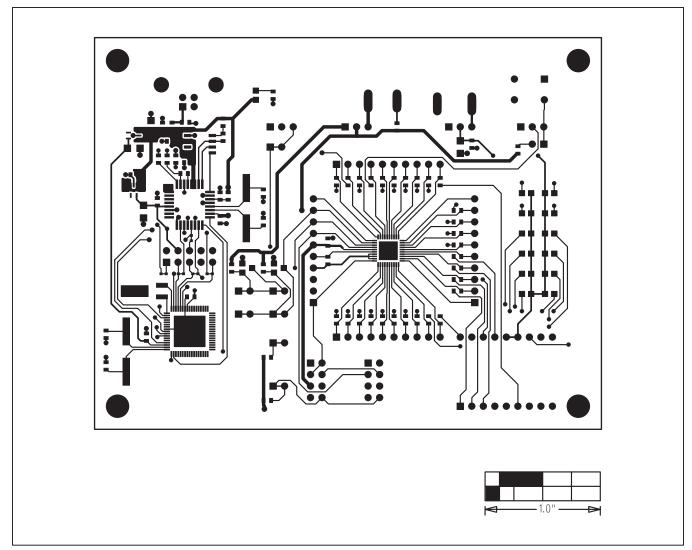


Figure 8. MAX6956 EV Kit PCB Layout—Component Side

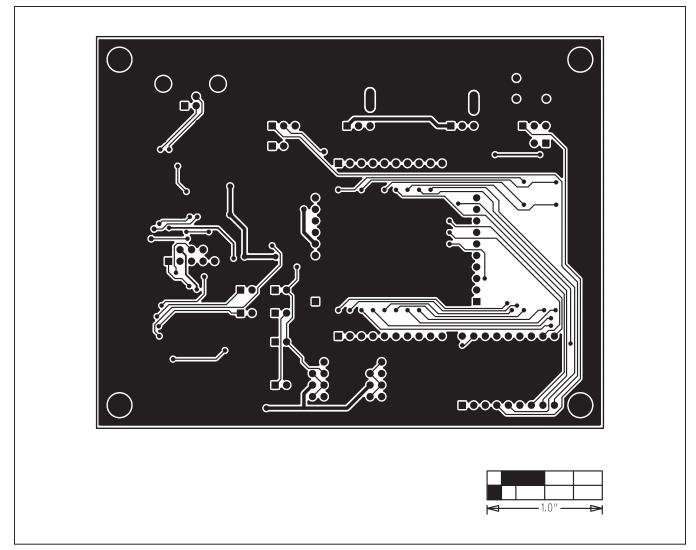


Figure 9. MAX6956 EV Kit PCB Layout—Solder Side

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### **Revision History**

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/08	Initial release	—
1	7/21	Updated Features and Quick Start sections	1–3

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront/storefront.html.

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