

## **General Description**

The MAX7456 evaluation kit (EV kit) is a fully assembled and tested printed-circuit board (PCB) that evaluates the MAX7456 single-channel monochrome on-screen display (OSD) with integrated video driver. The EV kit includes a stand-alone NTSC/PAL demo mode (no PC required) that demonstrates the OSD capabilities of the MAX7456. The Windows<sup>®</sup>-based MAX7456 EV kit software can be used to create display memory files and character memory files, and uploads their contents into the MAX7456's memory. The EV kit software also allows easy manipulation of all the MAX7456's functions.

## **\_Features**

- Proven PCB Layout
- Windows 98/2000/XP-Compatible Evaluation Software with Character Editor
- Supports NTSC and PAL
- Stand-Alone Demonstration (Demo) Mode (No PC Required)
- BNC Connectors for CVBSIN and CVBSOUT

### **\_Ordering Information**

PART	TYPE
MAX7456EVKIT	EV Kit
MAX7456EVKIT+	EV Kit

+Denotes lead-free and RoHS-compliant.

QTY

2

3

1

1

1

1

1

1

1

1

1

1

1

1

1

4

1

DESIGNATION

R1, R2

R3, R4, R5

R6

R7

S1

S2

TP1

U1

U2

U3

U4

U5

Y1

Y2

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\_\_\_\_

### Component List

DESCRIPTION

 $75\Omega \pm 1\%$  resistors (0603)

 $1k\Omega \pm 5\%$  resistors (0402)

 $100k\Omega \pm 5\%$  resistor (0402)

470Ω ±5% resistor (0603)

SPST switch

E-Switch EG1218 Momentary switch

Omron B3F-1000 Not installed (test point)

10mm x 10mm) Level translator

RS-232 transceiver

27MHz crvstal

20MHz crystal

Shunts

Bumps

Single-channel OSD

MAX7456EUI+ (28-pin TSSOP EP) Low-power microcontroller (µC)

MAXQ2000-RAX+ (68-pin QFN-EP

MAX3002EUP+ (20-pin TSSOP) 2.5V LDO linear regulator

MAX8881EUT25+ (6-pin SOT23)

MAX3311EUB+ (10-pin µMAX<sup>®</sup>)

Citizen HC49US27.000MABJU

Citizen HC49US20.000MABJU DB9 I/O extension cable

PCB: MAX7456 Evaluation Kit+

DESIGNATION	QTY	DESCRIPTION	
C1	1	100µF ±20%, 6.3V X5R capacitor (1210) TDK C3225X5R0J107M	
C2	1	22µF ±10%, 6.3V X5R capacitor (0805) TDK C2012X5R0J226K	
C3, C4, C5	3	10μF ±20%, 10V X5R capacitors (1206) TDK C3216X5R1A106M	
C6	1	4.7μF ±10%, 6.3V X5R capacitor (0603) TDK C1608X5R0J475K	
C7–C18	12	0.1µF ±10%, 10V X5R capacitors (0402) TDK C1005X5R1A104K	
C19, C20	2	10pF ±5%, 50V C0G capacitors (0402) TDK C1005C0G1H100J	
D1	1	Green LED	
J1	0	Not installed (2 x 5-pin header)	
J2	0	Not installed (2 x 4-pin header)	
JU1, JU2	2	3-pin headers	
JU3	1	4-pin header	
CVBSIN, CVBSOUT	2	Female R/A BNCs A/D Electronics 591-071-00	
P1	1	Female DB9	

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

### Component Suppliers

SUPPLIER	PHONE	WEBSITE	
Citizen America Corporation	949-428-3700	www.citizencrystal.com	
TDK	847-803-6100	www.component.tdk.com	

**Note:** Indicate you are using the MAX7456 when contacting these component suppliers

## Quick Start (Stand-Alone Demo)

This section provides instructions for running the MAX7456 EV kit in demo mode (no PC required).

#### **Recommended Equipment**

- MAX7456 EV kit
- 5V power supply at 250mA for DVDD (DVDD supplies AVDD and PVDD)
- NTSC or PAL signal source
- NTSC or PAL video monitor
- Video cables (not included)

#### Procedure

## Do not enable the power supply until all connections are made.

- 1) Place a shunt on JU1 to 2-3 (selects DVDD as PVDD source).
- 2) Place a shunt on JU2 to 2-3 (selects DVDD as AVDD source).
- 3) Set S1 to the OFF position (disable demo mode).
- 4) Connect the NTSC or PAL signal source to the CVBSIN BNC connector.
- 5) Connect the NTSC or PAL video monitor to the CVBSOUT BNC connector.
- Connect the 5V power supply between the DVDD and DGND pads.
- 7) Enable the 5V power supply (LED D1 lights up).
- 8) Set S1 to the **ON** position (enable demo mode).
- 9) Press S2 to view the next demo mode screen.

### Quick Start (Software)

### **Recommended Equipment**

Before beginning, the following equipment is needed:

- MAX7456 EV kit (includes DB9 I/O extension cable)
- Windows 98SE/2000/XP-compatible PC with a spare RS-232 COM port

- 5V power supply at 250mA for DVDD (DVDD supplies AVDD and PVDD)
- NTSC or PAL signal source
- NTSC or PAL video monitor
- Video cables (not included)

**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 98SE/2000/XP operating system.

#### Procedure

## Do not turn on the power until all connections are made.

- Visit www.maxim-ic.com/evkitsoftware to download the latest version of the EV kit software, 7456Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
- Install the EV kit software on your computer by launching the INSTALL.EXE program inside the ZIP file. The program files are copied and icons are created in the Windows <u>Start I Programs</u> menu.
- 3) Connect the DB9 I/O extension cable from the computer's serial port to the MAX7456 EV kit.
- 4) Place a shunt on jumper JU1 to 2-3 (selects DVDD as PVDD source).
- 5) Place a shunt on jumper JU2 to 2-3 (selects DVDD as AVDD source).
- 6) Set S1 to the **OFF** position (disable demo mode).
- 7) Connect the NTSC or PAL signal source to the CVBSIN BNC connector.
- 8) Connect the NTSC or PAL video monitor to the CVBSOUT BNC connector.
- Connect the 5V power supply between the DVDD and DGND pads.
- 10) Enable the 5V power supply (LED D1 lights up).
- Start the EV kit software by clicking its icon in the Windows <u>Start</u> menu.
- 12) The software automatically searches for the MAX7456. Check the Enable OSD Display checkbox in the Global Video Options group box (Figure 6) to make the on-screen display video visible. Type the filename SHOW\_ALL\_CHARACTERS.MDM into the Upload Display Memory to the MAX7456 edit box, then click the Upload button.

## \_Detailed Description of Hardware

The MAX7456 evaluation kit (EV kit) is a fully assembled and tested PCB that evaluates the MAX7456 singlechannel OSD generator with integrated video driver. When DVDD is applied to the system, LED D1 lights up. Factory-default settings power AVDD and PVDD from DVDD. In order to use separate power supplies, see Tables 3 and 4.

The MAX7456 communicates using an SPI<sup>TM</sup> interface. On the EV kit, the MAXQ2000 (U2)  $\mu$ C is used as the SPI master. Because the MAX7456 and the MAXQ2000 have different supply voltages, the MAX3002 (U3) is used as a level translator for the SPI interface.

Note that the MAX7456 EV kit software does not communicate directly with the MAX7456. The EV kit software transfers data to the MAXQ2000  $\mu$ C on the EV kit board using the PC's serial port. The MAXQ2000 then transfers the corresponding data to the MAX7456 using the SPI interface, as described in the MAX7456 IC data sheet.

Header JU3 allows access to the LOS,  $\overline{VSYNC}$ , and  $\overline{HSYNC}$  pins on the MAX7456. The connector J1 is the JTAG interface for the MAXQ2000 on the EV kit board. When shipped, firmware has already been loaded into the  $\mu$ C; therefore, J1 is typically not needed.

When the EV kits are assembled, the character memory in the MAX7456 is loaded with the contents of the demo.mcm file included with the EV kit software (see Figure 4). Note that this character memory is different than the character memory shipped with the MAX7456. The factory-default character set is contained in the defaultcm.mcm file and can be uploaded if desired. Refer to the MAX7456 IC data sheet for factory-set character memory.

### **Changing the Master SPI Interface**

On the EV kit, the MAXQ2000  $\mu$ C supplies the master SPI interface to the MAX7456. To use a different master SPI interface, cut the traces connecting adjacent pins on J2 and apply the new master SPI interface as detailed in Table 1.

Table 1.	Master	SPI	Interface	Lines
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INTERFACE	PIN
MISO	J2-2
SCLK	J2-4
MOSI	J2-6
CS	J2-8



Figure 1. CVBSOUT with the First OSD Display in Demo Mode (NTSC)



Figure 2. CVBSOUT with the Second OSD Display in Demo Mode (NTSC)



Figure 3. CVBSOUT in Demo Mode During LOS (NTSC)



#### **Changing the Slave SPI Interface**

To use the EV kit board as the master SPI interface for a different MAX7456 than the one supplied on the EV kit, cut the traces connecting adjacent pins on J2 and connect the slave SPI interface of the new MAX7456, as detailed in Table 2.

### Table 2. Slave SPI Interface Lines

INTERFACE	PIN
SDOUT	J2-1
SCLK	J2-3
SDIN	J2-5
CS	J2-7

#### Demo Mode

Demo mode can be used to evaluate the MAX7456 EV kit without a PC. To enable demo mode, set S1 to the **ON** position. When the EV kit enters demo mode, the MAXQ2000  $\mu$ C reads the MAX7456's status register to determine if the EV kit is receiving a video signal (NTSC or PAL). The output is automatically set to work in the format detected. If no video signal is present, demo mode automatically begins in NTSC mode. To force PAL mode when no signal is present, hold the S2 button while setting the S1 switch to the **ON** position.

If the MAX7456 detects NTSC or PAL on its input (CVBSIN) when entering demo mode, the first OSD display, shown in Figure 1, appears on the video output (CVBSOUT). A second OSD display, shown in Figure 2, appears after pressing the S2 momentary switch.

When LOS is detected, the MAX7456 enters internal sync mode and displays the OSD shown in Figure 3 on CVBSOUT.

When shipped, the character memory on the EV kit's MAX7456 has been loaded with the characters shown in Figure 4. These characters are stored in the file demo.mcm (included with the MAX7456 EV kit software). Use the **Character Memory File Builder** tab in the MAX7456 EV kit software to access these characters. If the character memory in the MAX7456 is changed, demo mode may not appear as expected (see Figures 1, 2, and 3). Upload demo.mcm to the MAX7456 using the EV kit software to view the original demo mode.

### Jumper Selection Tables

### Table 3. PVDD Select

JUMPER	SHUNT POSITION	DESCRIPTION
	1-2	Supply PVDD from the PVDD pad
JUT	2-3*	Supply PVDD from the DVDD pad

\*Default configuration

### Table 4. AVDD Select

JUMPER	SHUNT POSITION	DESCRIPTION
	1-2	Supply AVDD from the AVDD pad
JU2	2-3*	Supply AVDD from the DVDD pad

\*Default configuration

## Detailed Description \_\_\_\_\_\_of Software

Make sure the demo switch S1 is in the **OFF** position. To start the MAX7456 EV kit software, double-click the MAX7456 EV kit icon created during installation.

#### **Connecting to the MAX7456 EV Kit**

When the MAX7456 EV kit software begins, the window shown in Figure 5 appears. If the MAX7456 EV kit is present and connected to one of the PC's serial ports, select **Connect to EVKit on port** and click **OK**. The COM port should be autodetected, but the user may have to enter the name of the port manually (i.e., COM10) if it cannot be found.

To use the MAX7456 EV kit software without the EV kit board, select **Standalone Mode** and click **OK**. Standalone mode is useful for using the **Display Memory File Builder** and the **Character Memory File Builder**, which do not require the EV kit board.

#### **Controls Tab**

The **Controls** tab shown in Figure 6 allows access to most of the registers on the MAX7456. Refer to the MAX7456 IC data sheet for a description of the controls.

#### MAX7456 Status

If the **OptionsIPoll Status Register** menu item is checked, the MAX7456 status register is queried every second. The values in the register are shown in the **MAX7456 Status** group box.





Figure 4. Character Memory Stored in the MAX7456 on the EV Kit

**Uploading Display Memory to the MAX7456** The **Upload Display Memory to the MAX7456** group box contains all the controls necessary to write to the MAX7456's display memory on the EV kit. The ellipses (...) button selects the display memory file (.mdm) and the **Upload** button sends the display memory to the MAX7456.

Uploading Character Memory to the MAX7456 The Upload Character Memory to the MAX7456 group box contains all the controls necessary to write to the MAX7456's character memory on the EV kit. The ellipses (...) button selects the character memory file (.mcm) and the **Upload** button sends the character memory to the MAX7456. In order for the video monitor display to match the EV kit software display, the associated character memory file (\*.mcm) must have been uploaded prior to uploading the display memory file (\*.mdm).

#### **Display Memory File Builder Tab**

The **Display Memory File Builder** tab (Figure 7) creates display memory files (.mdm) that can be uploaded to the MAX7456 using the EV kit software.

M/XI/M

valuates: MAX7456

 Maxim MAX7456 Evaluation Kit

 Select Maxim MAX7456 Evaluation Kit Software Mode

 Connect to EVKit on port:

 On onot connect to EVKit (Standalone Mode)

 OK

Figure 5. Select EV Kit Software Mode Window

To help visualize the display memory, a character memory file can be selected at the bottom of the tab. When the user clicks on a character in the **Display Memory** group box, the address and attributes for the selected character are posted in the corresponding group boxes to the right. When the user double-clicks, a character selection window appears and a character can be selected to replace the previous character.

#### Display Memory File Builder Tools

The **Display\_Memory\_Tools** menu contains global commands for the **Display Memory File Builder**. The user should also select the video format (NTSC or PAL) for the display memory file in this menu.

**Character Memory File Builder Tab** The **Character Memory File Builder** tab (Figure 8) creates character memory files (.mcm) that can be uploaded to the MAX7456 using the EV kit software. To edit a character, click its location in the **Character List** group box. A zoomed-in version of the character appears in the **Edit Character** group box where clicking the individual pixels changes the color of that pixel (transparent, black, or white).

**Character Memory File Builder Tools** The **Character\_Memory\_Tools** menu contains commands to help the user edit individual characters. Note that the **Copy Character** and **Paste Character** menu items can be used to copy characters to a different location in a **Character Memory File Builder** or even to a different character memory file.

' <b>V</b> Maxim MAX7456 Evaluation Kit - COM1 <u>F</u> ile <u>O</u> ptions <u>D</u> isplay_Memory_Tools <u>C</u> haracter_Mem	nory_Tools <u>H</u> elp
Controls Display Memory File Builder Character Memory Fil	le Builder
Global Video Options Video Standard: NTSC Sync Select Mode: Auto Display New OSD Immediately Background Mode: Transparent	Row Brightness Row Number: 0 Black Level: 0% White Level: 100% OSD Position Offset
Background Mode Brightness:       28%         Blink Time:       4 Fields         Blink Duty Cycle:       3:1         Enable OSD Display       Video Buffer Enable         Clear Display Memory       Software Reset	Horizontal 0 pixels + • Vertical 0 pixels + • OSD Sharpness Rise and Fall Time: 60ns • Mux Switch Time: 75ns •
MAX7456 Status       Upload Display M         Device Status:       Ready         NV Memory Status:       Ready         Loss of Sync:       No         Input Format:       NTSC	Iemory to the MAX7456 Upload r Memory to the MAX7456 Upload

Figure 6. MAX7456 EV Kit Software—Controls Tab

**Evaluates: MAX7456** 

W Maxim MAX7456 Evaluation Kit - COM1 - 🗆 🗙 File Options Display\_Memory\_Tools Character\_Memory\_Tools Help Display Memory File Builder Character Memory File Builder Controls Display Memory File: C:\MAX7456\maxim.mdm Display Memory: NTSC -> (Double-Click to change character) = Zoom In 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 ٥ 1 2 3 4 5 6 7 8 MAXIM Display 273 Address 9 integrated products 10 Address: 0x0B 11 Display 273 Attributes 12 Background: Transparent • Blink: Yes • Use Fonts from the following Character Memory file: Invert: defaultCM.mcm ... No. Ŧ

Figure 7. MAX7456 EV Kit Software—Display Memory File Builder Tab

Evaluates: MAX7456



Figure 8. MAX7456 EV Kit Software—Character Memory File Builder Tab

**Evaluates: MAX7456** 



Figure 9a. MAX7456 EV Kit Schematic (Sheet 1 of 2)



Figure 9b. MAX7456 EV Kit Schematic (Sheet 2 of 2)

## \_\_\_\_\_

11





Figure 10. MAX7456 EV Kit Component Placement Guide—Component Side



Figure 11. MAX7456 EV Kit PCB Layout—Component Side



Figure 12. MAX7456 EV Kit PCB Layout—Solder Side

## **Revision History**

REVISION NUMBER	<b>REVISION DATE</b>	REVISION DESCRIPTION	PAGES CHANGED
0	8/07	Initial release	
1	11/07	Added MAX7456EVKIT to ordering info and changed component U3 from MAX3007 to MAX3002.	1, 3, 10

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