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APPLICATION NOTE 980

Experimenting with the MAX6952 and MAX6953 SPI and I²C LED Display Drivers from a PC

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Abstract: This application note describes a PC program, downloadable free, to assist design, evaluation, font design with MAX6952 and MAX6953 5x7 matrix LED display drivers.

The MAX6952 and MAX6953 are 4-digit common-row 5x7 matrix LED display drivers that are controlled through a high speed SPI[™] (MAX6952) or I²C (MAX6953) serial interface. This application note describes a utility program which allows a MAX6952 or MAX6953 driver to be controlled from a PC. The utility can be used standalone simply to help an engineer familiarize himself or herself with the registers and functions of the drivers. More usefully, it can be used to "prove" a display board prototype by directly controlling the MAX6952 or MAX6953 registers before the equipment's software is designed.

Requirements

A PC running Windows® 95, 98, 98SE, ME, NT, or 2000 with a parallel printer port configured for either LPT1 or LPT2.

Description

The utility is a Visual Basic 5 program called MAX6952.EXE which requires the standard Visual Basic run time library MSVBVM50.DLL in order to run at all. The program uses the DriverLINX[™] freeware parallel port driver DLPortIO.DLL which provides the Win32 DLL hardware I/O functions not available as standard in Visual Basic. Windows NT and 2000 users also require the DLPortIO.SYS kernel mode driver. Both of these drivers are copyright Scientific Software Tools, Inc. (http://www.driverlinx.com).

Installation

To install to a Windows 95, 98, 98SE, ME platform, download the MAX6952-95.EXE file. This is a WinZIP self-extracting archive that contains ReadMe.txt, ReadMeSST.txt, MAX6952.EXE, DLPortIO.DLL, and MSVBVM50.DLL. The default download directory is C:MAX6952. MSVBVM50.DLL may be deleted if the library is already registered on the computer.

To install to a Windows NT or 2000 platform, download the MAX6952-NT.EXE file. This is a WinZIP selfextracting archive that contains ReadMe.txt, ReadMeSST.txt, MAX6952.EXE, PORT95NT.EXE, and MSVBVM50.DLL. The default download directory is C:MAX6952. PORT95NT.EXE is the install program for the DriverLINX drivers which installs and registers the DLPortIO.DLL library and DLPortIO.SYS driver. PORT95NT.EXE can be deleted after installation. Windows 95, 98, 98SE, ME users can also use this installation procedure if they wish.

Source Code

The source code for this application note is available http://www.maximintegrated.com/products/display/software/. Connecting a MAX6952 or MAX6953 to the Parallel Port

This utility uses 3 of the 8 parallel port printer output lines to simulate SPI serial interface activity, and another 2 output lines to simulate I²C serial interface activity. A parallel port control input line is additionally used to read back blink status. You may operate multiple (up to 16, daisy-chained) MAX6952s and/or multiple (up to 16, configured with different I²C addresses) MAX6953s at once. You

may select either LPT1 or LPT2 port from the software. The port can be a standard, ECP, or EPP type. The port connections are shown in **Figure 1**.



Figure 1. MAX6952 or MAX6953 connections to the parallel port.

The program display on start up is shown in **Figure 2** below. The register defaults mirror the register power-up conditions of the MAX6952 and MAX6953. The "Driver type" radio buttons select whether the software will transmit to MAX6952 (using the SPI connection) or the MAX6953 (using the I²C connection).

MAX6952 (SP) and	MAX6953 (I°C)	5x7	Matrix LED Driv	vers T	est	Bench		×
REGISTER	HEX	BINARY			ADI	DRS	3		ADDRS
Digit 0	00	00000000	1	Write Digit Q Play	ne O	20	Write D	Digit D Plane	1 40
Digit 1	00	00000000	1	Write Digit <u>1</u> Plan	ne O	21	Write D	Digit 1 Plane	1 41
Digit 2	00	00000000		Write Digit 2 Plas	ne O	22	Write D	Digit 2 Plane	1 42
Digit 3	00	00000000	1	Write Digit 3 Plan	ne O	23	Write D	Digit 3 Plane	1 43
Intensity10	00	0 <u>4)</u> 1 <u>4)</u>		Write Intensity	10	01	−Port/ €⊔	Address — PT1 - 378h	
Intensity32	00	2 ·		Write Intensity	32	02	O L	PT2-278h	
Scan Limit	01			Write Scan Lin	nit	03	Hig	h - Pha	se O
Test Mode	00	🗖 TestMode		Write Test Mod	de	07			
Configuration	00	00000000	1	Write Configurat	tian -	04	Aboy	ø	Exit
Configuration Register flags									
- Global Clear-	F	Reset Blink-	-6	Blink Enable — 📊	- Blink	Rate		- Shutdown	
C R bit set	1	T bit set	0	E bit set	0.88	ait se	et 🛛	C S bit se	±t .
C Ribit clear	1	T bit clear	6	E bit clear	€В₿	bit al	eor	🖲 Skitd	ear
Port Connections and Help Blink is Blink Rate is Shi disabled slow r					Shutdo mod	e			
- Cascaded SPI Driver Configuration									
Current Driver is 1 🕐 🕑 Encole global criver write 🖉 MAX5952									
Number of Drivers is 1 💽 💽 Encle autoincrement C MAX8953									
Design User Fonts Send Fonts to Current Driver Send Fonts to All Drivers									

Figure 2. Program display on startup.

In SPI mode, the software controls up to 16 MAX6952 drivers. The drivers are presumed to be cascaded, i.e. the DOUT pin of the first MAX6952 connects to the DIN pin of the second MAX6952, whose DOUT pin connects to the DIN pin of the third MAX6952 (and so on). The total number of MAX6952 devices is set by the "Number of Drivers" slider. When this is set to more than 1, the "Enable global driver write" and "Enable auto-increment" check boxes are available. When "Enable global driver write" is clear, only the MAX6952 driver selected by the "Current Driver" slider is written to when a write command is selected, the others receive the no-op instruction. When "Enable global driver write" is checked, all the MAX6952 drivers are written to with the same data. When "Enable auto-increment" is checked, the current driver number is automatically incremented after each write action. This allows the user to quickly send the same data to a series of MAX6952 drivers.

The SPI interface connection to the parallel port can be tested with the "Test Stream" facility which can be found under "Port Connections and Help..." when the program is running. The "Test Stream" facility transmits the no-op instruction continuously to the MAX6952(s) (as set by the "Number of Drivers" slider) allowing the interface connections to be verified without affecting register contents.

In I²C mode, the software controls up to 16 MAX6953 drivers. The first driver is presumed to be set to address 1010000x, with the addresses of subsequent devices increasing to 1011111x for the last device. To access, for example, a single MAX6953 driver at address 1011111x, simply set the "Number of Drivers" slider to 16 and then the "Current Driver" slider to 16, address 1011111x. The main form in I²C mode is shown in **Figure 3**.

MAX6952 (SP) and	MAX6953 (PC)	5x7 Matrix LED Dri	vers Test	Bench	×	
REGISTER	HEX	BINARY		ADDR	9	ADDRS	
Digit 0	00	00000000	Write Digit Q Pla	лө () 20	Write Di	igit 0 Plane 1 40	
Digit 1	00	00000000	Write Digit 1 Pla	ne 0 21	Write Di	igit 1 Plane 1 41	
Digit 2	00	00000000	Write Digit 2 Pla	ne 0 22	Write Di	igit 2 Plane 1 42	
Digit 3	00	00000000	Write Digit 3 Pla	ле () 23	Write Di	igit 3 Plane 1 43	
Intensity10	00	0 <u>4</u>) 1 <u>4</u>)	Write Intensity	10 01	- Port A	ddress 711 - 378h	
Intensity32	00	2 4 5	Write Intensity	32 02	O LP	Phase	
Scan Limit	01		Write Scan Lir	nit 03	High	1 - Phase O	
Test Mode	00	🗖 TestMode	Write <u>T</u> est Mo	de 07			
Configuration	00	00000000	Write <u>C</u> onfigure	nion 04	About	t Egit	
Configuration Register flags							
- Global Clear-		Reset Blink	-Blink Enable	- Blink Rate	в —	-Shutdown	
C R bit set		C T bit set	C E bit set	OBbits	et	C Sbitset	
R bitclear		🖲 T bit clear	E bit clear	B bitclear		Skitclear	
Port Connections and Help Blink is Blink Rate is Shutdown mode					Shutdown mode		
-Multiple PC Driver Configuration with base address 1010000x							
Current Addrs 1010000x 🕐 🕨 🗖 Encode global crivervinte 🛛 C MAX6952							
Number of Drivers is 1							
Design User Fonts Send Fonts to Current Driver Send Fonts to All Drivers							

Figure 3. I²C program display.

The I²C interface connection to the parallel port can be tested with the "Test Stream" facility which can be found under "Port Connections and Help..." when the program is running. The "Test Stream" facility transmits the no-op instruction continuously to all MAX6953(s) (as set by the "Number of Drivers" slider) allowing the interface connections to be verified without affecting register contents.

The "Design User Fonts..." button brings up a form to allow the user to load from disk, create, and save to disk the 24 user-definable fonts that the MAX6952 and MAX6953 can store. The form is shown in **Figure 4**. The software comes with some pre-defined fonts in the file MAX6952-3_fonts.txt. These fonts are shown in Figure 4. The fonts can be changed by clicking pixels with the mouse. Clicking a pixel toggles it's condition. The user-definable fonts are stored in memory, and are not automatically sent to the MAX6952 and MAX6952 and MAX6953 drivers. The fonts can be transmitted to any or all drivers from the main menu. It is possible to send different user-definable fonts to each driver, if desired.

User Definable Fonts designer						
Soft Font 00	Soft Font 02	Soft Font03	Soft Fork04	Soft Fort/05	SoftFont05	Soft Font 07
Sch Font 08 Sch Font 0	9 Soft Font 10	Soft Font 11	Soft Fork 12	Soft Fore 13	SottFort14	SoftFork15
-Set Ford 18 - Set Ford 1	7 - Soft Font 18	Soft Font 19	Soft Fork20	Soft Fort 21	SoftFort 22	Soft Fant 22
Beed forit data from the MAX8952-3_lonis bit Instructions Write forit data to the MAX8952-3_fonis bit Egit						

Figure 4. Designing user definable fonts.

The format of the data in the file MAX6952-3_fonts.txt is shown in **Figure 5**. The software searches for a line starting "Font xx" where xx is a one or two digit decimal number ranging from 0 to 23 identifying the font. Up to seven lines starting "Data" are parsed for an 8 bit binary word, MSB to LSB, which describe the font character. The file can contain the data for as few or as many font characters are desired. When the file is read, the on screen patterns for characters omitted from the file are not cleared or overwritten.

The program saves the data in order Font 0 to Font 23, and it is therefore in the same order as required to write sequentially to a MAX6952 or MAX6952. Therefore the MAX6952-3_fonts.txt file data can be taken with minimum edits for inclusion in a user's application code.

Font 0 Data 00011100 Data 00011100 Data 00011100 Data 00011100 Data 00011100 Font 1 Data 01111111 Data 01111111 Data 00111110 Data 00011100 Data 00001000 Font 2 Data 00000000 Data 00000000 Data 01111111 Data 00000000 Data 00000000 ...

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Related Parts		
MAX6952	4-Wire Interfaced, 2.7V to 5.5V, 4-Digit 5 x 7 Matrix LED Display Driver	Free Samples
MAX6953	2-Wire Interfaced, 2.7V to 5.5V, 4-Digit 5 x 7 Matrix LED Display Driver	Free Samples

More Information

For Technical Support: http://www.maximintegrated.com/support For Samples: http://www.maximintegrated.com/samples Other Questions and Comments: http://www.maximintegrated.com/contact

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