S1D13705 Embedded Memory LCD Controller

Windows® CE 2.x Display Drivers

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WINDOWS® CE 2.x DISPLAY DRIVERS

The Windows CE display driver is designed to support the S1D13705 Embedded Memory LCD Controller running under the Microsoft Windows CE 2.x operating system. The driver is capable of: 4 and 8 bit-per-pixel landscape modes (no rotation), and 4 and 8 bit-per-pixel SwivelView™ 270 degree mode.

This document and the source code for the Windows CE drivers are updated as appropriate. Before beginning any development, please check the Epson Electronics America Website at www.eea.epson.com or the Epson Research and Development Website at www.erd.epson.com for the latest revisions.

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Example Driver Builds

The following sections describe how to build the Windows CE display driver for:

1. Windows CE 2.0 using a command-line interface.
2. Windows CE Platform Builder 2.1x using a command-line interface.

In all examples “x:” refers to the drive letter where Platform Builder is installed.

Build for CEPC (X86) on Windows CE 2.0 using a Command-Line Interface

To build a Windows CE v2.0 display driver for the CEPC (X86) platform using a S5U13705B00C evaluation board, follow the instructions below:

1. Install Microsoft Windows NT v4.0 or 2000.
2. Install Microsoft Visual C/C++ version 5.0 or 6.0.
3. Install the Microsoft Windows CE Embedded Toolkit (ETK) by running SETUP.EXE from the ETK compact disc #1.
4. Create a new project by following the procedure documented in “Creating a New Project Directory” from the Windows CE ETK v2.0. Alternately, use the current “DEMO7” project included with the ETK v2.0. Follow the steps below to create a “X86 DEMO7” shortcut on the Windows NT v4.0 desktop which uses the current “DEMO7” project:
   a. Right click on the “Start” menu on the taskbar.
   b. Click on the item “Open All Users” and the “Start Menu” window will come up.
   c. Click on the icon “Programs”.
   d. Click on the icon “Windows CE Embedded Development Kit”.
   e. Drag the icon “X86 DEMO1” onto the desktop using the right mouse button.
   f. Click on “Copy Here”.
   g. Rename the icon “X86 DEMO1” on the desktop to “X86 DEMO7” by right clicking on the icon and choosing “rename”.
   h. Right click on the icon “X86 DEMO7” and click on “Properties” to bring up the “X86 DEMO7 Properties” window.
   i. Click on “Shortcut” and replace the string “DEMO1” under the entry “Target” with “DEMO7”.
   j. Click on “OK” to finish.
5. Create a sub-directory named S1D13705 under x:\wince\platform\cepc\drivers\display.
6. Copy the source code to the S1D13705 subdirectory.

7. Edit the file x:\wince\platform\cepc\drivers\display\dirs and add S1D13705 into the list of directories.

8. Edit the file PLATFORM.BIB (located in x:\wince\platform\cepc\files) to set the default display driver to the file EPSON.DLL (EPSON.DLL will be created during the build in step 13).

   Replace or comment out the following lines in PLATFORM.BIB:

```
IF CEPC_DDI_VGA2BPP
        ddi.dll     $(_FLATRELEASEDIR)\ddi_vga2.dll     NK SH
ENDIF
IF CEPC_DDI_VGA8BPP
        ddi.dll     $(_FLATRELEASEDIR)\ddi_vga8.dll     NK SH
ENDIF
IF CEPC_DDI_VGA2BPP !
IF CEPC_DDI_VGA8BPP !
        ddi.dll     $(_FLATRELEASEDIR)\ddi_s364.dll     NK SH
ENDIF
ENDIF
```

   with this line:

```
        ddi.dll     $(_FLATRELEASEDIR)\EPSON.dll        NK SH
```

9. The file MODE0.H (located in x:\wince\platform\cepc\drivers\display\S1D13705) contains the register values required to set the screen resolution, color depth (bpp), display type, active display (LCD/CRT/TV), display rotation, etc.

   Before building the display driver, refer to the descriptions in the file MODE0.H for the default settings of the driver. If the default does not match the configuration you are building for then MODE0.H will have to be regenerated with the correct information.

   Use the program 13705CFG to generate the header file. For information on how to use 13705CFG, refer to the *13705CFG Configuration Program User Manual*, document number X27A-B-001-xx, available at www.erd.epson.com

   After selecting the desired configuration, export the file as a “C Header File for S1D13705 WinCE Drivers”. Save the new configuration as MODE0.H in x:\wince\platform\cepc\drivers\display\S1D13705, replacing the original configuration file.

10. Edit the file PLATFORM.REG to match the screen resolution, color depth (bpp), active display (LCD/CRT/TV) and rotation information in MODE.H. PLATFORM.REG is
    located in x:\wince\platform\cepc\files.

For example, the display driver section of PLATFORM.REG should be as follows when using a 320x240 LCD panel with a color depth of 8 bpp in SwivelView 0° (landscape) mode:

```
; Default for EPSON Display Driver
; 320x240 at 8 bits/pixel, LCD display, no rotation
; Useful Hex Values
; 1024=0x400, 768=0x300 640=0x280 480=0x1E0 320=140 240=0xF0
[HKEY_LOCAL_MACHINE\Drivers\Display\S1D13705]
"Width"=dword:140
"Height"=dword:F0
"Bpp"=dword:8
“ActiveDisp”=dword:1
“Rotation”=dword:0
```

11. Delete all the files in the x:\wince\release directory, and delete x:\wince\platform\cepc*.bif
12. Generate the proper building environment by double-clicking on the sample project icon (i.e. X86 DEMO7).
13. Type BLDDEMO <ENTER> at the command prompt of the X86 DEMO7 window to generate a Windows CE image file (NK.BIN).

Build for CEPC (X86) on Windows CE Platform Builder 2.1x using a Command-Line Interface

Throughout this section 2.1x refers to either 2.11 or 2.12 as appropriate.

1. Install Microsoft Windows NT v4.0 or 2000.
2. Install Microsoft Visual C/C++ version 5.0 or 6.0.
3. Install Platform Builder 2.1x by running SETUP.EXE from compact disk #1.
4. Follow the steps below to create a “Build Epson for x86” shortcut which uses the current “Minshell” project icon/shortcut on the Windows desktop.
   a. Right click on the “Start” menu on the taskbar.
   b. Click on the item “Explore”, and “Exploring -- Start Menu” window will come up.
   c. Under “x:\winnt\profiles\all users\start menu\programs\microsoft windows ce platform builder\x86 tools”, find the icon “Build Minshell for x86”.
   d. Drag the icon “Build Minshell for x86” onto the desktop using the right mouse button.

e. Choose “Copy Here”.

f. Rename the icon “Build Minshell for x86” to “Build Epson for x86” by right clicking on the icon and choosing “rename”.

g. Right click on the icon “Build Epson for x86” and click on “Properties” to bring up the “Build Epson for x86 Properties” window.

h. Click on “Shortcut” and replace the string “Minshell” under the entry “Target” with “Epson”.

i. Click on “OK” to finish.

5. Create an EPSON project.

   a. Make an Epson directory under x:\wince\public.

   b. Copy MAXALL and its sub-directories (x:\wince\public\maxall) to the Epson directory.

      xcopy /s /e x:**\wince\public\maxall*.* \wince\public\epson**

   c. Rename x:\wince\public\epson\maxall.bat to epson.bat.

   d. Edit EPSON.BAT to add the following lines to the end of the file:

      @echo on

      set CEPC_DDI_S1D13705=1

      @echo off

6. Make an S1D13705 directory under x:\wince\platform\cepc\drivers\display, and copy the S1D13705 driver source code into x:\wince\platform\cepc\drivers\display\S1D13705.

7. Edit the file x:\wince\platform\cepc\drivers\display\dirs and add S1D13705 into the list of directories.

8. Edit the file x:\wince\platform\cepc\files\platform.bib and make the following two changes:

   a. Insert the following text after the line “IF ODO_NODISPLAY !”:

      IF CEPC_DDI_S1D13705

      ddi.dll $(_FLATRELEASEDIR)\epson.dll NK SH

      ENDIF

   b. Find the section shown below, and insert the lines as marked:

      IF CEPC_DDI_S1D13705 ! *Insert this line*

      IF CEPC_DDI_S3VIRGE !

      IF CEPC_DDI_CT655X !

      IF CEPC_DDI_VGA8BPP !

```
        ddi.dll     $(_FLATRELEASEDIR)\ddi_s364.dll     NK  SH
    ENDIF
    ENDIF
    ENDIF
    ENDIF                                   Insert this line
```

9. The file MODE0.H (located in x:\wince\platform\cepc\drivers\display\S1D13705) contains the register values required to set the screen resolution, color depth (bpp), display type, active display (LCD/CRT/TV), display rotation, etc.

   Before building the display driver, refer to the descriptions in the file MODE0.H for the default settings of the driver. If the default does not match the configuration you are building for then MODE0.H will have to be regenerated with the correct information.

   Use the program 13705CFG to generate the header file. For information on how to use 13705CFG, refer to the *13705CFG Configuration Program User Manual*, document number X27A-B-001-xx, available at www.erd.epson.com

   After selecting the desired configuration, export the file as a “C Header File for S1D13705 WinCE Drivers”. Save the new configuration as MODE0.H in x:\wince\platform\cepc\drivers\display\S1D13705, replacing the original configuration file.

10. Edit the file PLATFORM.REG to match the screen resolution, color depth (bpp), active display (LCD/CRT/TV) and rotation information in MODE.H. PLATFORM.REG is located in x:\wince\platform\cepc\files.

    For example, the display driver section of PLATFORM.REG should be as follows when using a 320x240 LCD panel with a color depth of 8 bpp in SwivelView 0° (landscape) mode:

```
; Default for EPSON Display Driver
; 320x240 at 8 bits/pixel, LCD display, no rotation
; Useful Hex Values
; 1024=0x400, 768=0x300 640=0x280 480=0x1E0 320=140 240=0xF0
[HKEY_LOCAL_MACHINE\Drivers\Display\S1D13705]
"Width"=dword:140
"Height"=dword:F0
"Bpp"=dword:8
“ActiveDisp”=dword:1
“Rotation”=dword:0
```

11. Delete all the files in \wince\release directory and delete x:\wince\platform\cepc*.bif

12. Generate the proper building environment by double-clicking on the Epson project icon --”Build Epson for x86”.

13. Type BLDDEMO <ENTER> at the command prompt of the “Build Epson for x86” window to generate a Windows CE image file (NK.BIN).

Installation for CEPC Environment

Once the NK.BIN file is built, the CEPC environment can be started by booting either from a floppy or hard drive configured with a Windows 9x operating system. The two methods are described below.

1. To start CEPC after booting from a floppy drive:
   a. Create a bootable floppy disk.
   b. Edit CONFIG.SYS on the floppy disk to contain only the following line:

      ```
      device=a:\himem.sys
      ```

   c. Edit AUTOEXEC.BAT on the floppy disk to contain the following lines:

      ```
      mode com1:9600,n,8,1
      loadcepc /B:9600 /C:1 c:\nk.bin
      ```

   d. Copy LOADCEPC.EXE and HIMEM.SYS to the bootable floppy disk. Search for the loadCEPC utility in your Windows CE directories.
   e. Copy NK.BIN to c:\.
   f. Boot the system from the bootable floppy disk.
2. To start CEPC after booting from a hard drive:
   a. Copy LOADCEPC.EXE to C:\. Search for the loadCEPC utility in your Windows CE directories.
   b. Edit CONFIG.SYS on the hard drive to contain only the following line:

      ```
      device=c:\himem.sys
      ```

   c. Edit AUTOEXEC.BAT on the hard drive to contain the following lines:

      ```
      mode com1:9600,n,8,1
      loadcepc /B:9600 /C:1 c:\nk.bin
      ```

   d. Copy NK.BIN and HIMEM.SYS to c:\.
   e. Boot the system.

Configuration

There are several issues to consider when configuring the display driver. The issues cover debugging support, register initialization values and memory allocation. Each of these issues is discussed in the following sections.

Compile Switches

There are several switches, specific to the S1D13705 display driver, which affect the display driver.

The switches are added or removed from the compile options in the file SOURCES.

WINCEVER

This option is automatically set to the numerical version of WinCE for version 2.12 or later. If the environment variable, _WINCEOSVER is not defined, then WINCEVER will default 2.11. The display driver may test against this option to support different WinCE version-specific features.

DEBUG_MONITOR

This option enables the use of the debug monitor. The debug monitor can be invoked when the display driver is first loaded and can be used to view registers, and perform a few debugging tasks. The debug monitor is still under development and is untested.

This option should remain disabled unless you are performing specific debugging tasks that require the debug monitor.

TEST_BITMAP

This option allows the debug monitor to display a test bitmap. This bitmap is big and will make the display driver considerably larger. The flag DEBUG_MONITOR must also be enabled for this option to work.

This option should be disabled unless the image is required for debugging.

Mode File

A second variable which will affect the finished display driver is the register configurations contained in the mode file.

The MODE tables (contained in files MODE0.H, MODE1.H, MODE2.H . . .) contain register information to control the desired display mode. The MODE tables must be generated by the configuration program 13705CFG.EXE. The display driver comes with example MODE tables.

By default, only MODE0.H is used by the display driver. New mode tables can be created using the 13705CFG program. Edit the #include section of MODE.H to add the new mode table.

If you only support a single display mode, you do not need to add any information to the WinCE registry. If, however, you support more that one display mode, you should create registry values (see below) that will establish the initial display mode. If your display driver contains multiple mode tables, and if you do not add any registry values, the display driver will default to the **first** mode table in your list.

To select which display mode the display driver should use upon boot, add the following lines to your PLATFORM.REG file:

[HKEY_LOCAL_MACHINE\Drivers\Display\S1D13705]

“Width”=dword:140
“Height”=dword:F0
“Bpp”=dword:8
“Rotation”=dword:0
“RefreshRate”=dword:3C
“Flags”=dword:1

Note that all dword values are in hexadecimal, therefore 140h = 320, F0h = 240, and 3Ch = 60. The value for “Flags” should be 1 (LCD). When the display driver starts, it will read these values in the registry and attempt to match a mode table against them. All values must be present and valid for a match to occur, otherwise the display driver will default to the FIRST mode table in your list.

A WinCE desktop application (or control panel applet) can change these registry values, and the display driver will select a different mode upon warmboot. This allows the display driver to support different display configurations and/or orientations. An example application that controls these registry values will be made available upon the next release of the display driver; preliminary alpha code is available by special request.

Comments

- The display driver is CPU independent, allowing use of the driver for several Windows CE Platform Builder supported platforms.
- When using 13705CFG.EXE to produce multiple MODE tables, make sure you change the Mode Number in the WinCE tab for each mode table you generate. The display driver supports multiple mode tables, but only if each mode table has a unique mode number.
- At this time, the drivers have been tested on the x86 CPUs and have been run with version 2.0 of the ETK, Platform Builder v2.1x.

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