Interfacing Display Peripherals to the i.MX Processors

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Session Objectives

► Display technology for multimedia applications
► Overview of display support on i.MX
► Guidelines on display interfacing with i.MX Processor
Display Technology for Multimedia Applications
The i.MX constellation of display devices
Display Devices: Monochrome and Low Resolution LCD

- Monochrome and low resolution LCD display is suitable for basic and low cost media player applications where richness of display is not a requirement.

- These displays usually connect through serial (I2C or SPI) interface as their display data rate is very low.

- Use of one or two LEDs is enough for backlight generation. White LED is not a requirement (since multi color support is not needed) and this keeps the cost low.
Display Devices : COLOR TFT Dumb LCD

- Color TFT LCD with rich (16/18/24-bit) color.

- Different physical sizes and display resolution available.

- Backlighting based on white LEDs in series/parallel or series-parallel combinations.

- Interface to the processor is through the parallel display bus.

- LCD has no on-board controller to perform screen refresh. So, the host processor must continuously drive the display bus to keep the display active.
Display Devices: COLOR OLED Display

- OLED (Organic LED) displays are gaining fast acceptance in mobile consumer devices.

- Different physical sizes and display resolution available. Extremely thin (less than a mm).

- No backlighting required as each pixel (OLED) generates its own light. Better in power efficiency compared to TFT-LCD needing external backlighting.

- Interface to the processor is through the parallel or serial bus (depending on the display selection).
Display Devices : E-Ink Display

- E-Ink display is a completely new class of display, needing no backlighting.

- Ideal for devices needing very low screen update rates, such as e-books.

- Currently, commercial availability is limited to gray-scale display only. Color E-Ink displays for commercial use is expected by 2010/11.

- Interface to the processor is through the parallel display bus.

- Due to its unique display principle, the device does not need frequent refresh, making very-very low power operation possible.
Display Devices: LVDS TFT LCD Display

- LVDS interface based TFT-LCDs support a wide range of display resolution and color depth.

- The display itself require minimal lines for interface with the host-processor / display-controller.

- Backlighting is based on either white LED or CCFL.

- This class of display is ideal for netbook or portable DVD player applications.
Display Devices: DVI/HDMI/Analog-VGA Display

- HDTV and (modern) PC monitors support DVI/HDMI and analog-VGA interface.

- This class of display is ideal when larger physical size of the display screen and higher display resolution are both required.

- Depending on the use case, even mobile products need to support DVI/HDMI/Analog-VGA connectivity.
Display Devices: Analog (NTSC/PAL) TV with Composite/S-Video

► This class of display has already started vanishing as the industry is embracing the digital TV standard. However, they are expected to exist for a few more years as legacy displays.

► Ideal for legacy display support, needing NTSC/PAL/SECAM interface.

► Interface requires component-video, composite-video or the S-Video interface.
Overview of display support on i.MX
What is needed to support the display constellation?

- Serial data interface (SPI/I2C/UART)
- Parallel display interface bus with sync/async interface support
- LVDS transmitter
- DVI transmitter
- VGA transmitter
- CVBS/S-Video transmitter
Serial dot-matrix display devices come with various types of interface options as shown above. All i.MX products can support this type of display directly.
i.MX has direct support for parallel LCD display. A wide varieties of interface timing is supported by programming the IPU control registers.

Use of SPI and I2C control bus is required for certain display models only.

Use of auxiliary GPIOs is mainly for sequencing and power control.

Use of level shifter may be required if the display I/O levels are not compatible. I/O level on I.MX side can be appropriately selected to avoid use of level shifter.
Physical Interface: DVI

Note: MIPI displays can be interfaced in a similar manner using a MIPI bridge connecting to the i.MX display port.
Physical Interface : PC-VGA

- i.MX
  - Disp_Data[D23..D0]
  - D_RDY/CLK
  - Opt. GPIO_RST

- Video DAC
  - To VGA CONN.

- PC VGA CONN.

- VGA Monitor

Reference Implementation
• Only legacy i.MX parts need external TV encoder.
• Newer parts (i.MX37, MX51) can drive a TV monitor directly.
Display Interface Auxiliary Support  Peripherals
Freescale’s Power Management IC (MC13892) comes with integrated resistive touch screen controller.

Suggested implementation is shown in this picture.
The backlight for LCD draws a major fraction of the total system power (30 to 40% in a typical system). Hence regulating the backlight intensity can provide longer battery life, per charging.

An example of ambient light sensor interface has been shown in this circuit.
Summary

► The i.MX processor family can support a large variety of display devices directly.

► In a case where direct support is not available, the respective display interface chip can directly connect to i.MX processor’s display interface bus.

► MIPI display can also be interface using a suitable MIPI bridge.

► Future i.MX parts will be integrating a number of display transmitter ICs (like LVDS, DVI and MIPI) to keep the BOM cost low.
Thank you for attending this presentation. We’ll now take a few moments for the audience’s questions and then we’ll begin the question and answer session.