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# **i.MX51 EVK Hardware**

## User's Guide

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## About This Book

This manual explains how to connect and operate the i.MX51 EVK System.

### Audience

This document is intended for software, hardware, and system engineers who are planning to use the product and want to understand more about the product

### Revision History

2009.08 Ver1.0  
2009.09 Ver1.6  
2009.10 Ver1.7

### Reference Documents

1. MCIMX51EVKJ Product Preview (Rev. 0) , Freescale Semiconductor, 2009.01
2. Atlas AP Lite MC13892 Reference Manual (Rev 2.0), Freescale Semiconductor, 2008.11
3. MC34713 Datasheet(Rev 4.0), Freescale Semiconductor, 2007.05
4. SGTL5000 Datasheet, SigmaTel, 2007.04
5. EDE1116AEBG, 1Gb DDR2 SDRAM Specification, Elpida, 2008.01
6. SD Memory Card Specifications, SD Group, 2001.04.

### Acronyms and Abbreviations

The following acronyms and abbreviations are used in this manual. This list does not include signal, register, and software mnemonics.

ATA	Hard drive interface spec
CD	Compact Disk
CMOS	Complementary Metal Oxide Semiconductor
CPLD	Custom Programmed Logic Devices

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CPU	Central Processing Unit
CSI	Camera Sensor Imaging
CSPI	Serial Peripheral Interface
DCE	Data Communications Equipment
DDR	Double Data Rate
DIP	Dual In-line Package
DMA	Direct Memory Access
DTE	Data Terminal Equipment
DUART	Dual Universal Asynchronous Receiver/Transmitter
EEPROM	Electrically Erasable Programmable Read Only Memory
EPROM	Erasable Programmable Read Only Memory
FIR	Infra Red
GPIO	General Purpose Input/Output
GPO	General Purpose Output
I2C	Inter-Integrated Circuit
ICE	In-Circuit Emulator
I/O	Input/Output
IrDA	Infrared Data Association
ISA	Instrumentation, System, and Automation Society
JTAG	Joint Test Access Group
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MB	Megabyte
MCU	Microcontroller Unit
MMC	Multi-media Card

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MCP	Multi-chip product
MS	Memory Stick
NVRAM	Non-volatile Random Access Memory
OTG	On the Go
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PCB	Printed Circuit Board
PHY	Physical interface
POR	Power on Reset
PSRAM	Pseudo Random Access Memory
PWM	Pulse Width Modulation
QVGA	Graphics Adapter
RAM	Random Access Memory
SD	SanDisk (Smart Media)
SDRAM	Synchronous Dynamic Random Access Memory
SI	System International (international system of units and measures)
SIMM	Single In-Line Memory Module
SPST	Single Pole Single Throw
SSI2	Synchronous Serial Interface
TFT	Thin Film Transistor
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

# 1. General Information

The i.MX51 EVK architecture is different from 3DS. It is only one board including CPU and other peripheral blocks. Also it can connect many peripheral cards for expansion functions.

Figure 1-1 and Figure 1-2 show the top view and bottom view of i.MX51 EVK board.

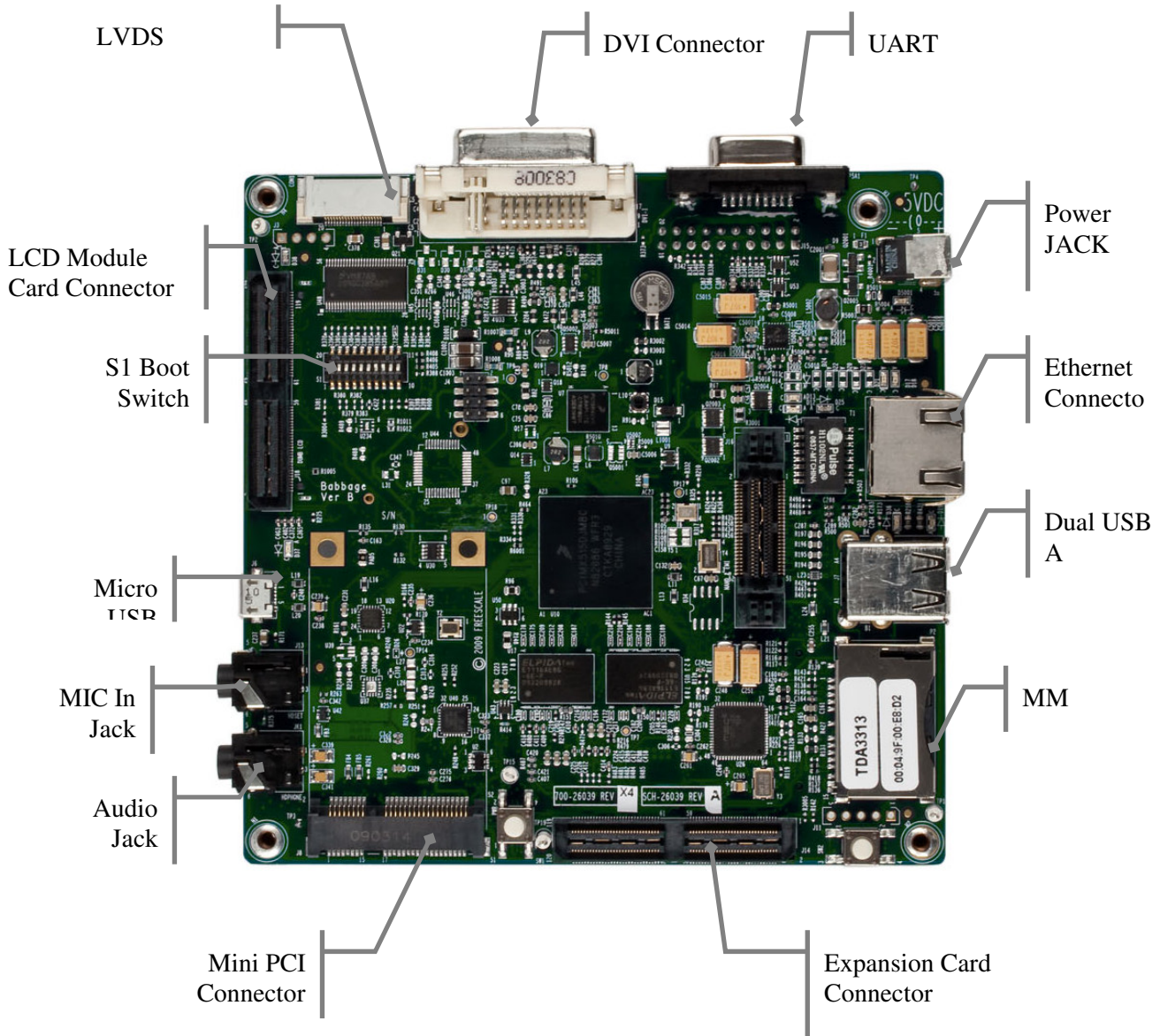
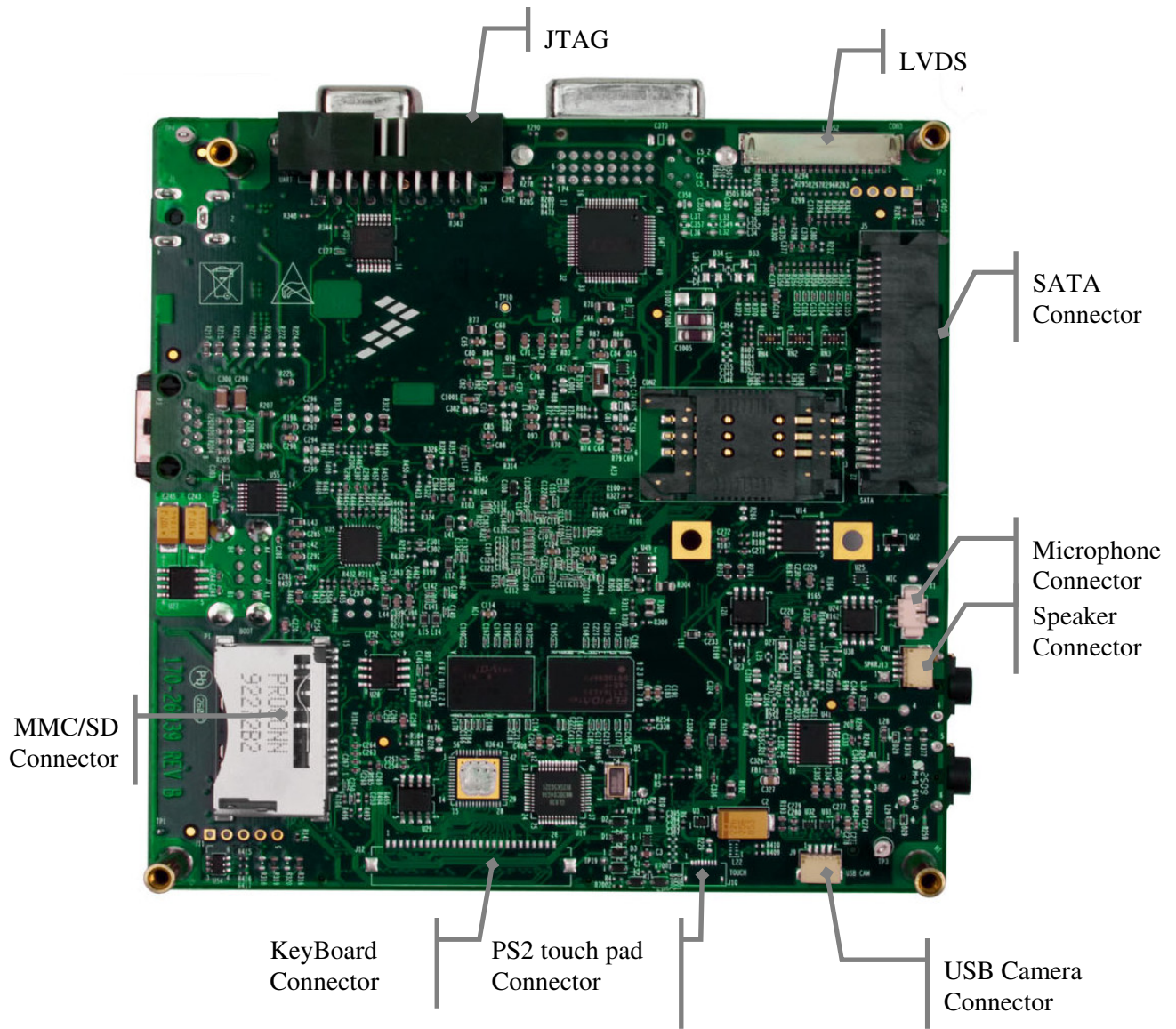


Figure 1-1: Top view of i.MX51 EVK





**Figure 1-2: Bottom view of i.MX51 EVK**

Figure 1-3 shows Block diagram of i.MX51 EVK board.

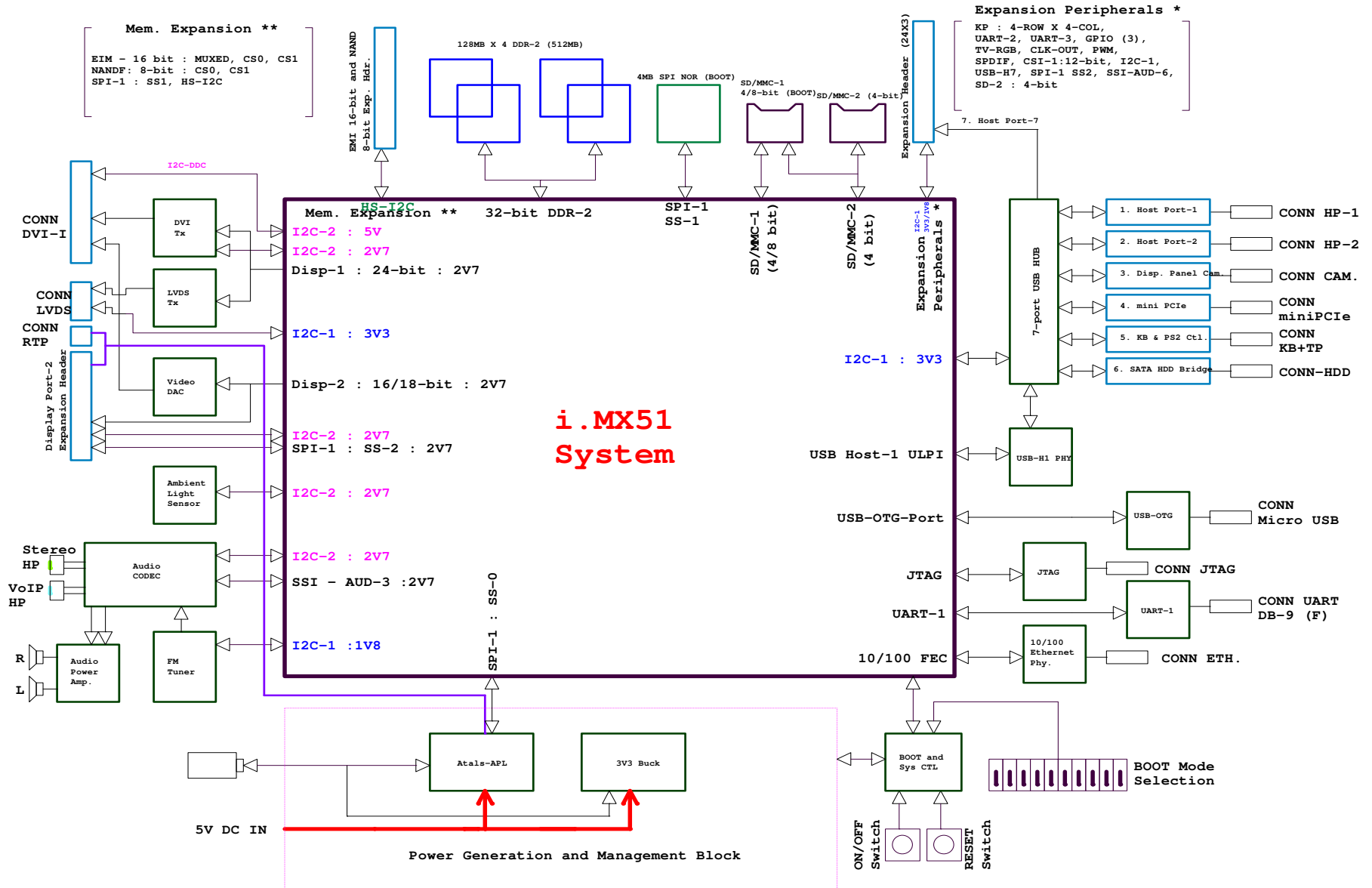


Figure1-3: Block Diagram of i.MX51 EVK board

Characteristic	Specifications
Clock	Selectable 32.768KHz or 24 MHz
Temperature:	
Operating	-10 °C to + 50 °C
Storage	-40 °C to +85 °C
Relative Humidity	0 to 90% (noncondensing)
Power Requirements	5.0 V DC @3.8 A
Dimension	4.724 inch × 4.724 inch

**Table 1-1: Specifications**

**CAUTION**

Never supply more than +5.0V power to the i.MX51 EVK.

Doing so can damage board components.

## 2. i.MX51 Processor

The i.MX51 multimedia applications processor represents Freescale Semiconductor's latest addition to a growing family of multimedia-focused products offering high performance processing optimized for lowest power consumption.

The i.MX51 EVK platform is intended to support the followings:

- Multi-standard Audio playback
- Multi-standard Video Playback of 30fps at D1 (720x576) resolution
- Open OS support (Linux, WinCE, Other auto RTOS)

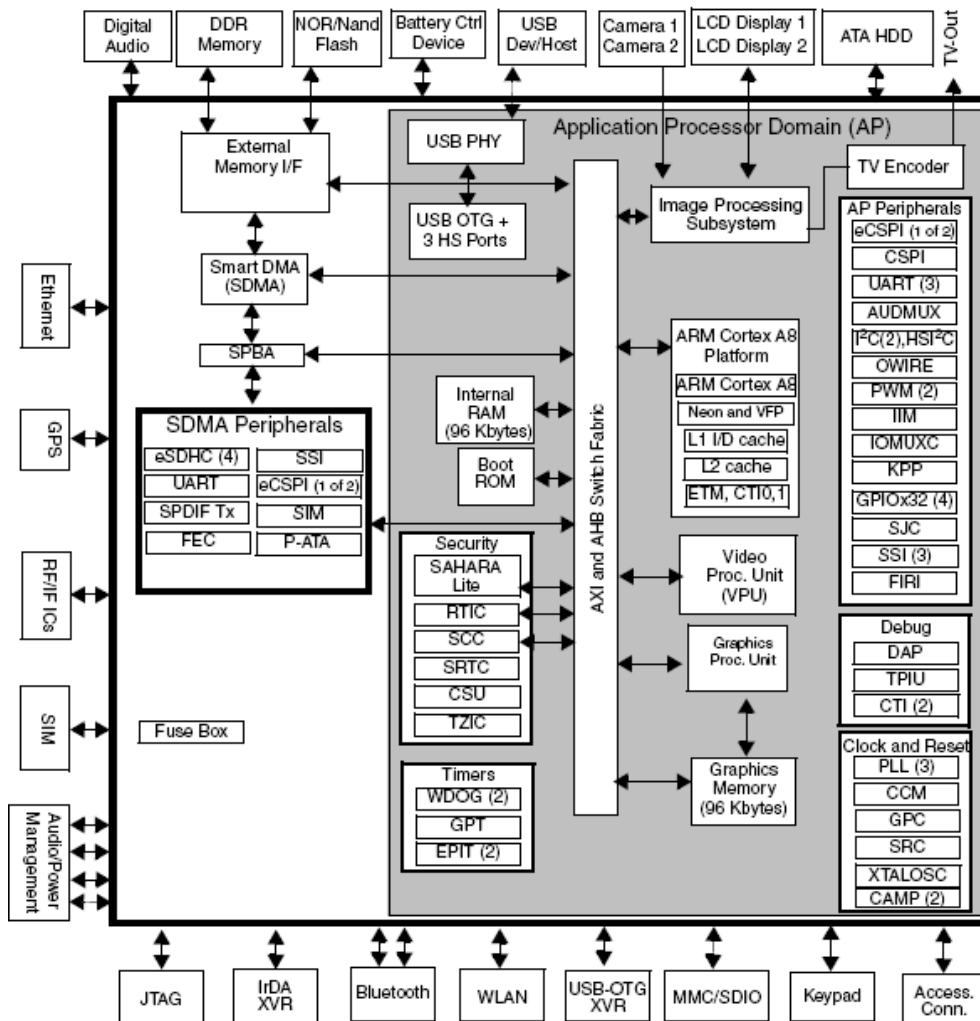


Figure 2-1: i.MX51 Block Diagram

### 3. DDR II SDRAM

There are total 4x128MB DDR II SDRAM, the part number EDE1116AEBG-6E-F from Elpida, each is organized as 8M words × 16 bits × 8 banks. The key feature is:

Speed	CAS latency	tRFC(min)	tRP(min)	tRCD(min)	tRC(min)
DDR2-667 5-5-5	5(tCK)	127.5(ns)	15(ns)	15(ns)	60(ns)

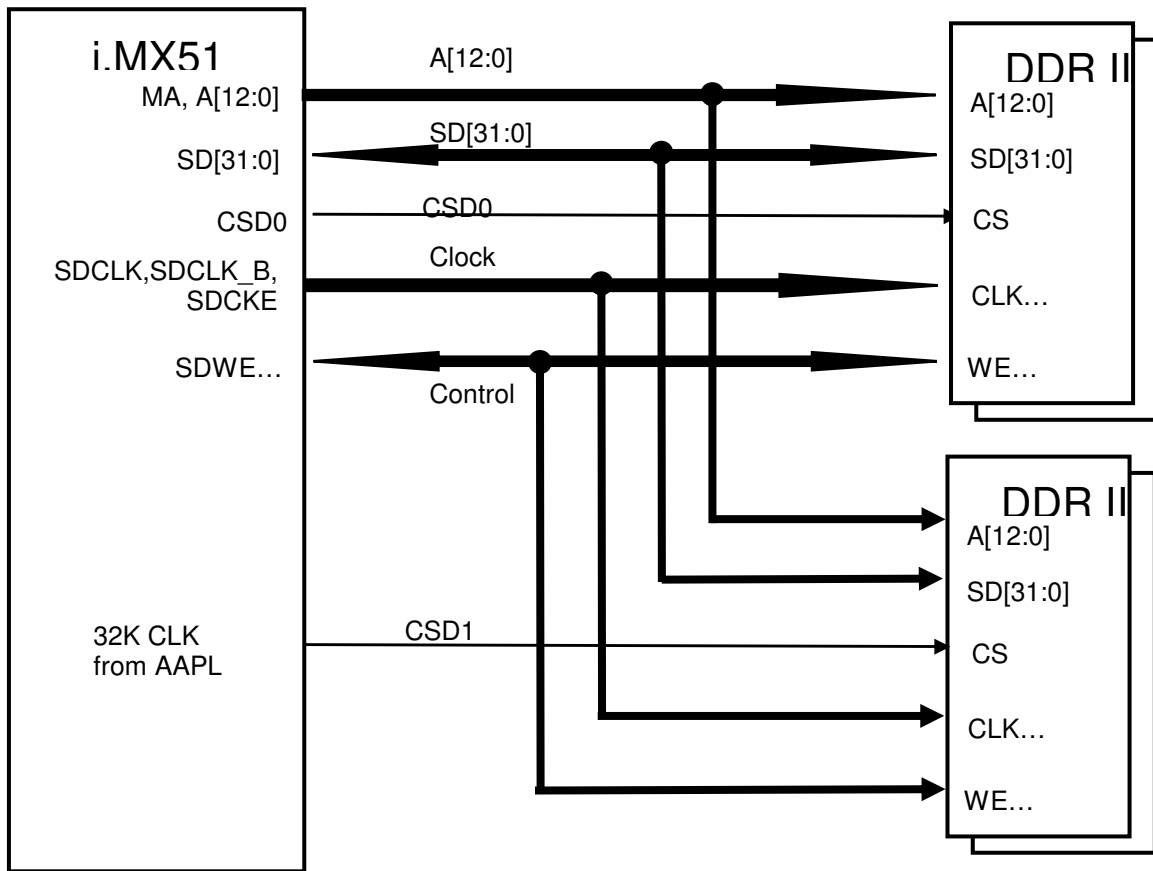


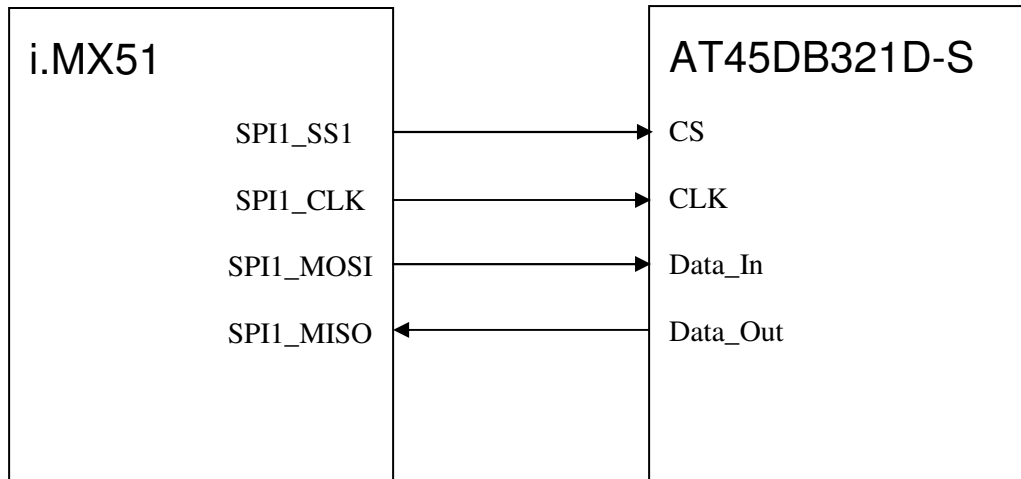
Figure 3-1: Connection between i.MX51 and DDR II

- The bus width is 32bit.
- The clock is 200MHz.
- The DDR II works at 1.8V.
- The ODT (on-die-termination) is disabled in default.

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## 4. SPI NOR Flash

i.MX51 has the SPI boot mode. A 4MB SPI NOR Flash is integrated on i.MX51 EVK. Customer can flash the boot code into the SPI NOR Flash and choose SPI boot mode by configuring the SW1 setting on board.

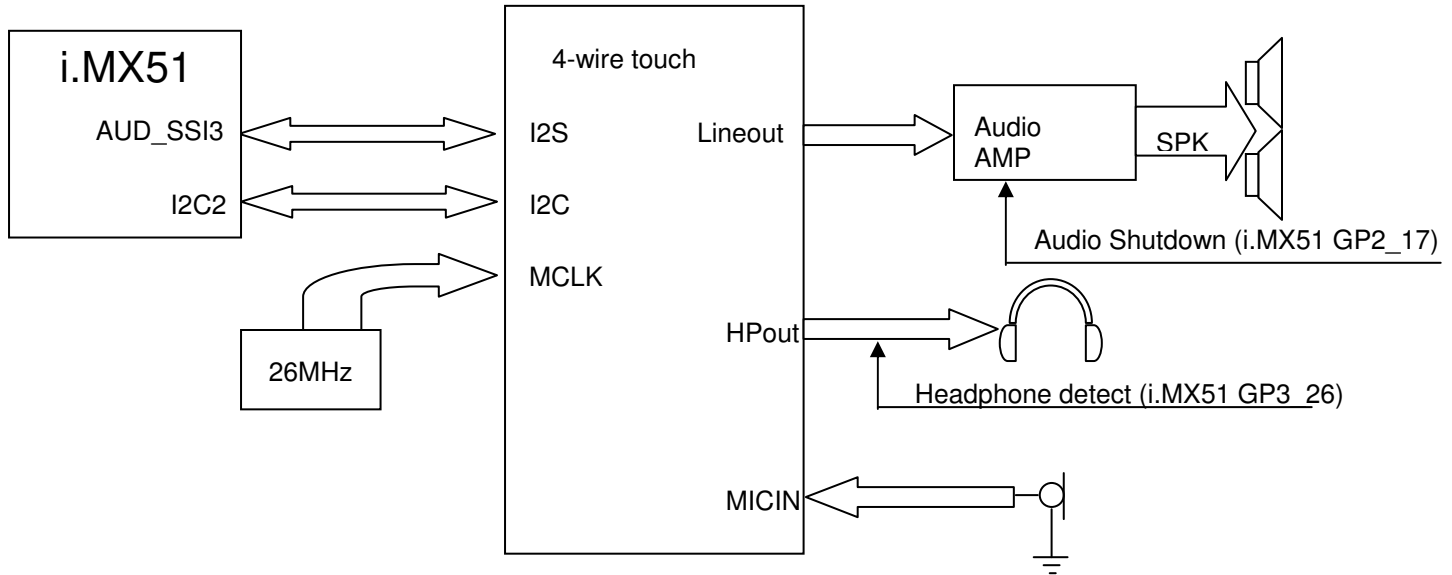


**Figure 4-1: Connection between i.MX51 and SPI NOR FLASH**

1. SPI NOR Flash works at 2.775V.
2. SPI NOR Flash connect to SPI1, it is able to be used as boot device.

## 5. Stereo Audio Codec & Audio extension Connector

A stereo automotive qualified audio codec is integrated on i.MX51 EVK; the part number is SGTL5000 from SigmaTel. The SGTL5000 uses 26MHz clock which can come from external oscillator (Y2) on board as its MCLK. It is connected to I2S interface to i.MX51 as audio stream path and configured by i.MX51 through I2C2.



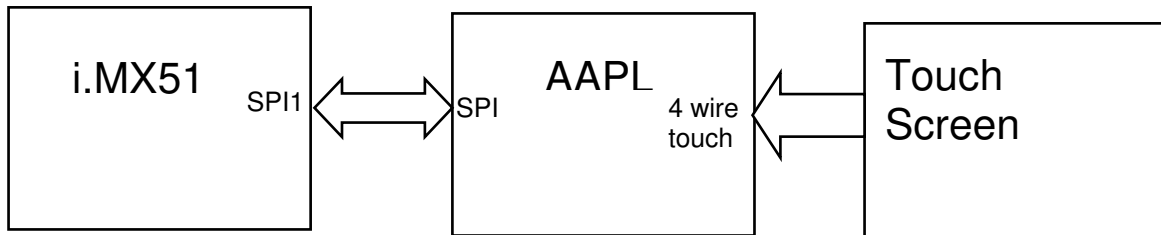
**Figure 5-1: Connection of i.MX51 and SGTL5000**

The SGTL5000 is a low power stereo codec with integrated headphone amplifier. It is designed to provide a complete audio solution for portable products needing line-in, mic-in (mic bias only available in 32QFN version), line-out, headphone-out, and digital I/O.

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## 6. Touch screen controller

i.MX51 EVK supports 4-wire touch screen controller which is controlled by ATLAS AP LITE.



**Figure 6-1: Touch screen control**

There is no LCD panel by default. The 4 wire touch control signals are connected to LCD Module card connector (J18). It can support touch screen function for kinds of LCD panels on display card for i.MX51 EVK.



## 7. USB OTG and Host

i.MX51 has on-chip USB PHY for USB2.0 high speed which can support USB OTG. Customer can just add an USB OTG connector on board to realize the USB2.0 OTG function.

Also i.MX51 has USB parallel interface which is connected to USB transceiver to support USB host function. On i.MX51 EVK board, a USB Hub chip is connected to the USB host interface to expand 7 ports for many applications, such as USB mouse, keypad, HDD and etc. The diagram is shown as below:

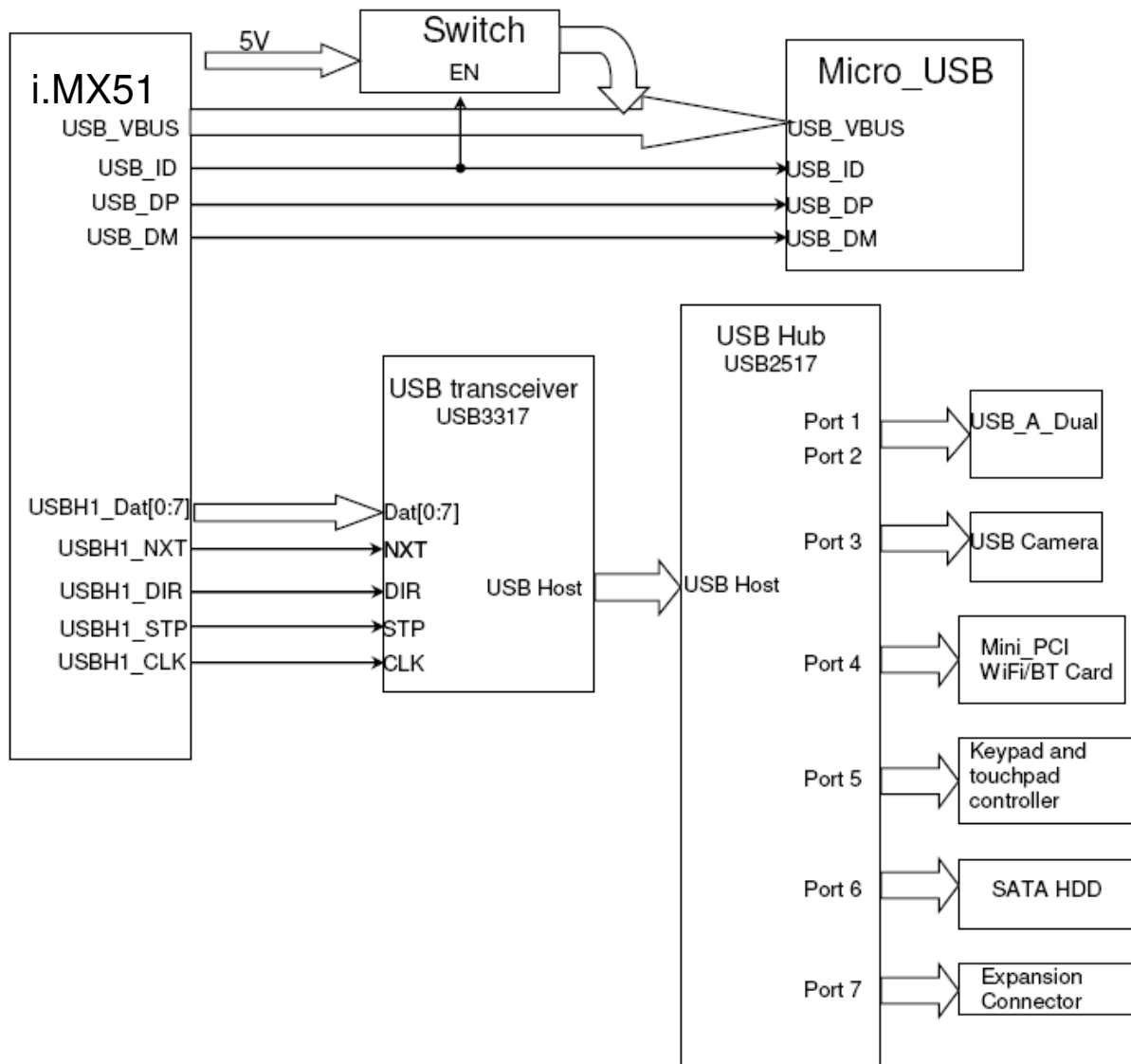


Figure 7-1: USB connection

## 8. CMOS Sensor

IPUv3EX in i.MX51 enables connectivity to displays and image sensors, relevant processing and synchronization. It supports two display ports and two camera ports. As the cost and functional agility consideration, there is no Camera sensor on i.MX51 EVK board by default. Customers can test Camera sensors in their future design through the expansion connector (J14) on board.

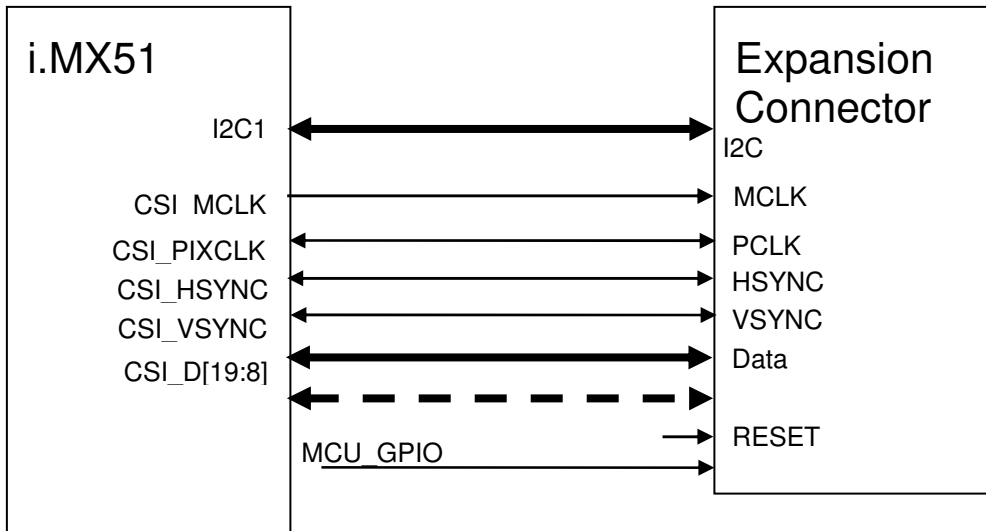


Figure 8-1: CMOS to CSI connection

## 9. VGA and DVI out

There are rich of video interfaces on i.MX51 EVK for different purposes. DVI and VGA output are important features of i.MX51 EVK. The ADV7123 is the VGA DAC and the TFP410PA is the DVI DAC.

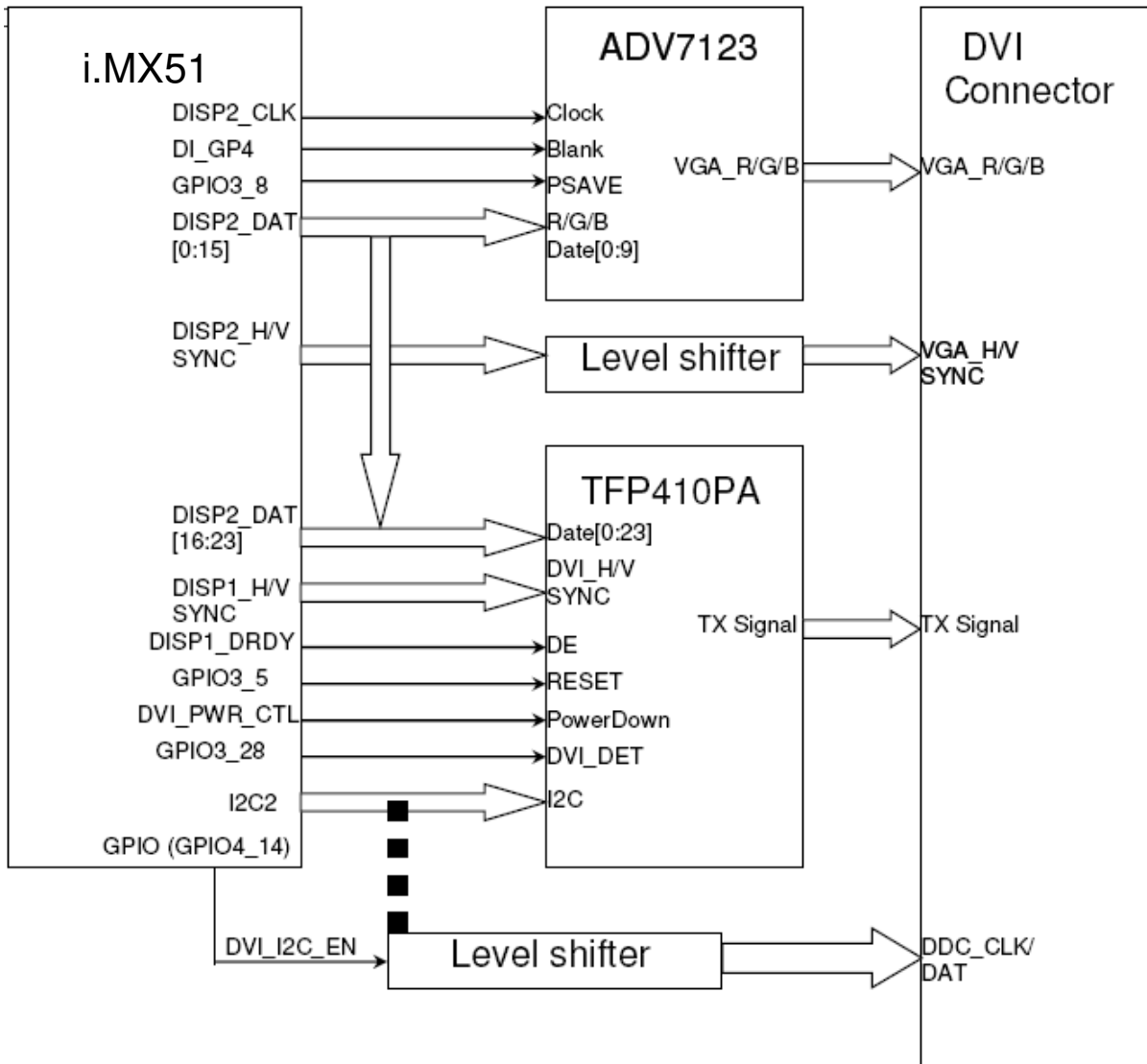


Figure 9-1: VGA and DVI connection

## 10. LCD Connectors

i.MX51 EVK has a lot of LCD interfaces for different customer design. It supports LVDS (Low Voltage Differential Signaling) panel and parallel data LCD panels.

There is a LVDS DAC (DS90C385) connected to display1 interface of i.MX51 on board. It supports (VGA, SVGA, XGA, SXGA (dual pixel), SXGA+ (dual pixel), and UXGA (dual pixel)). Two connectors CON1 and CON3 are the connectors for different LVDS panels.

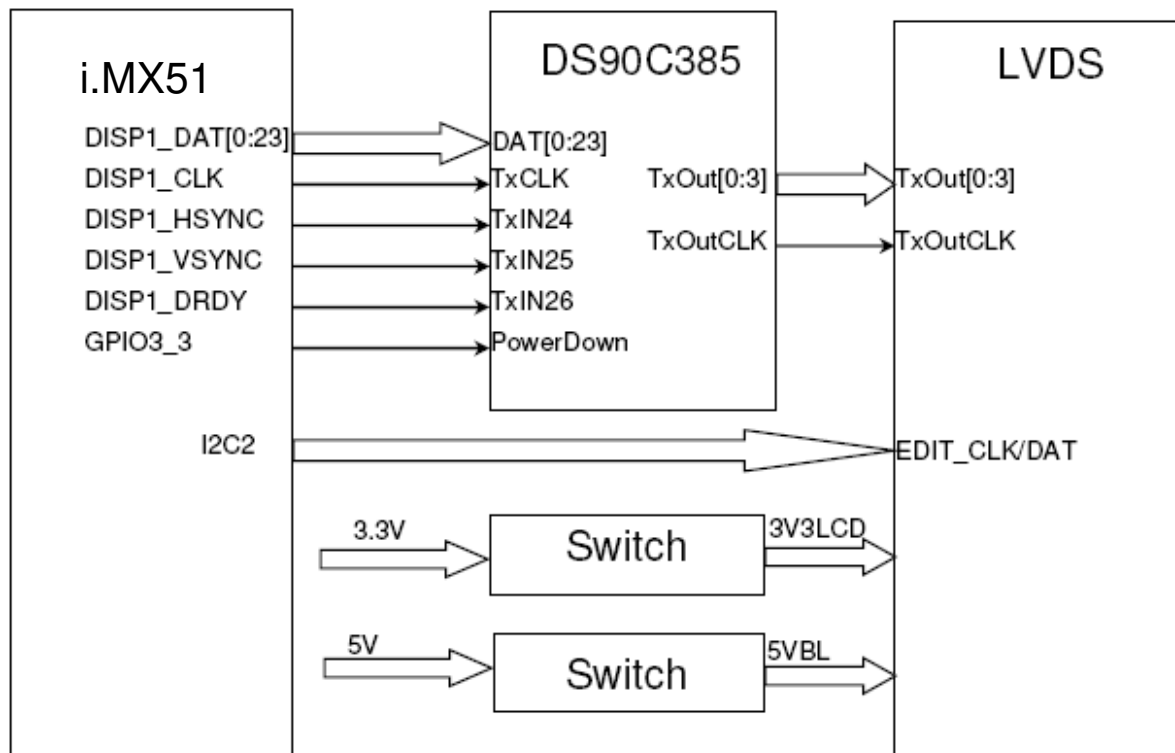
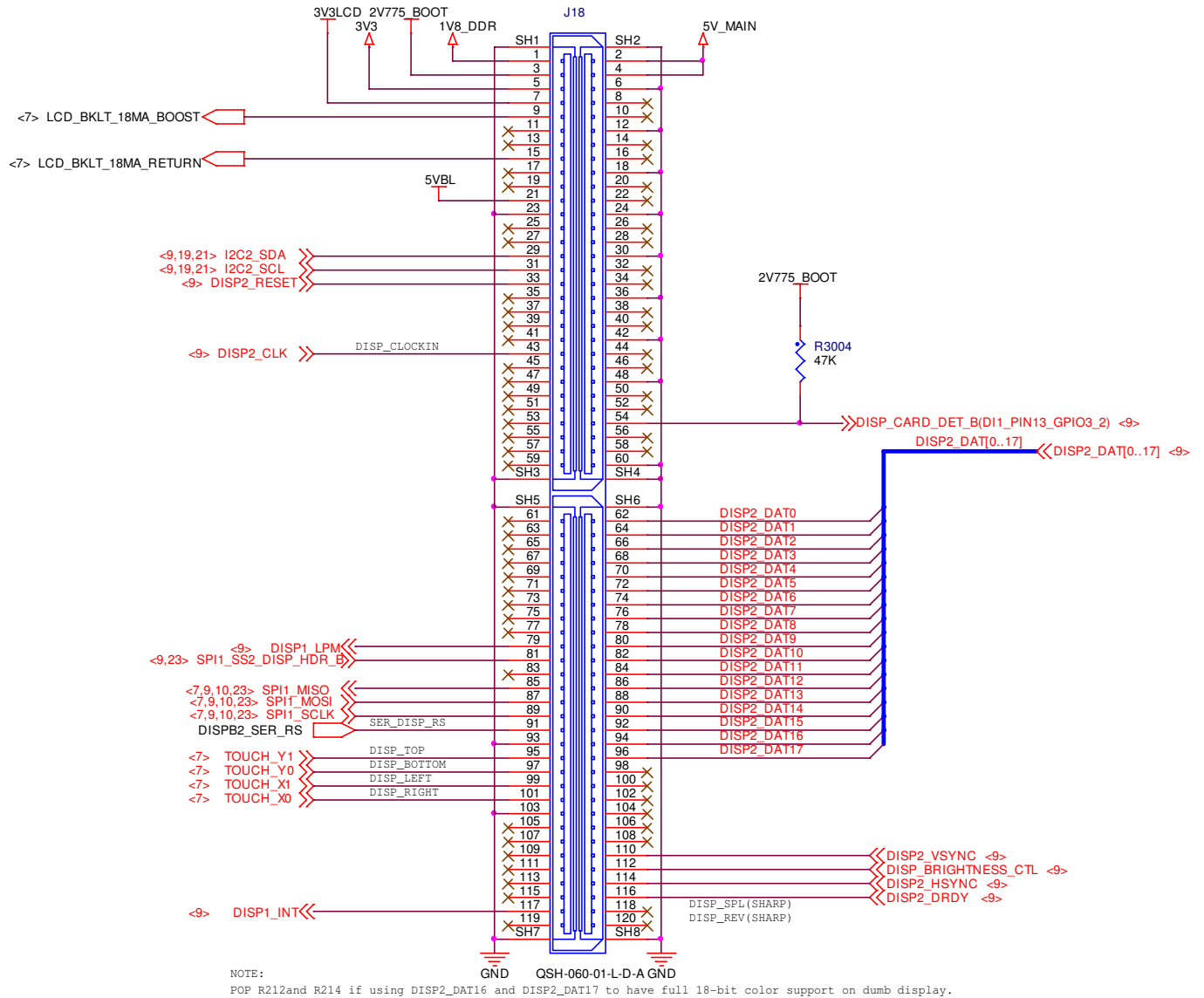


Figure 10-1: Diagram for LCD connection

There is no parallel LCD panel on i.MX51 EVK by default. Customer can test different panels through J18, the connector for other LCD Module card.



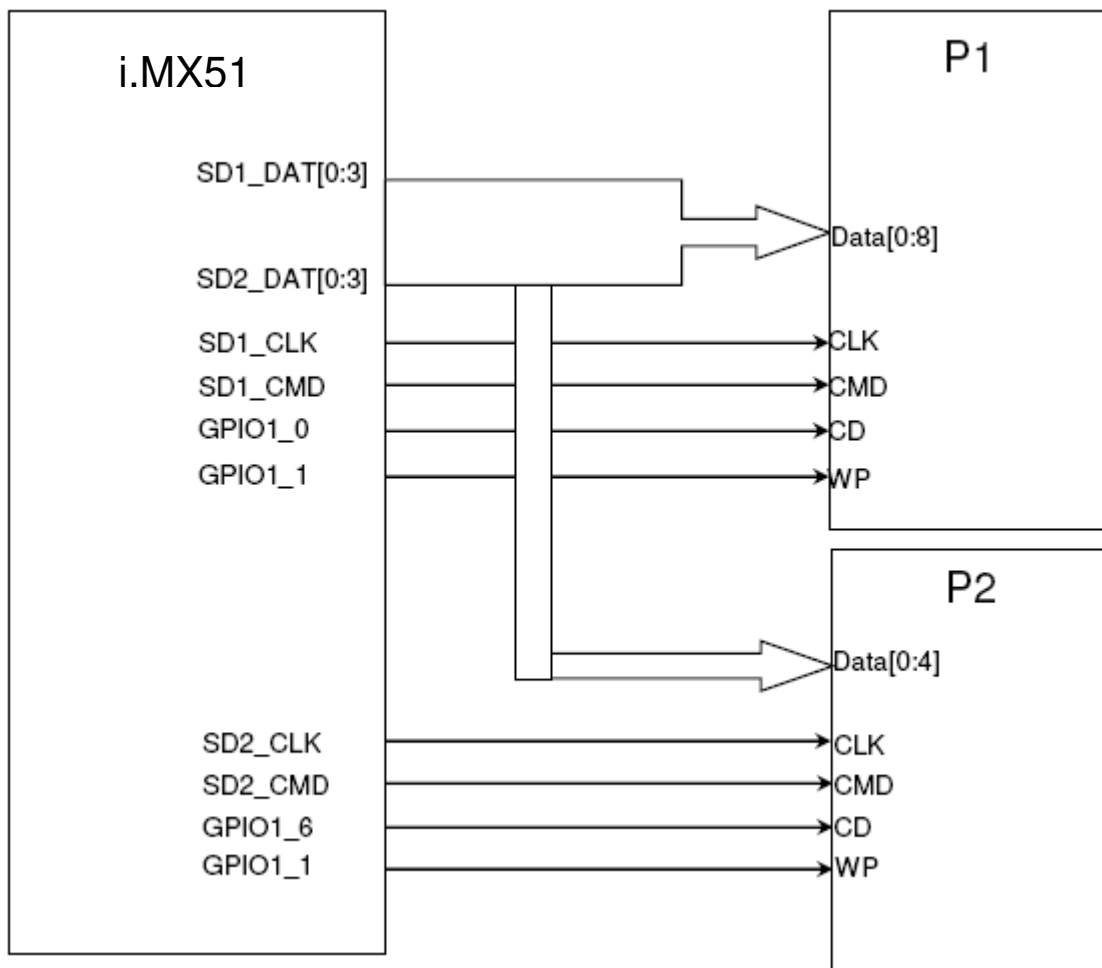
**Figure 10-2: Interface definition of UI extension connector**

Signal name	Specifications
5V_MAIN/1V8_DDR/2V775_BOOT/3V3/3V3LCD/ 5VBL/ LCD_BKLT_18MA_BOOST/RETURN	Power for LCD Module card
DISP2_DAT[0..17]	LCD data bus
DISP2_HSYNC/VSYNC/CLK/DRDY/RESET DISP1_LPM/INT DISP_BRIGHTNESS_CTL	Control signals to LCD
I2C2_SDA/SCL	I2C bus to LCD
SPI1_SS2_DISP_HDR_B/ SPI1_MISO/MOSI/CLK	SPI bus to LCD
TOUCH_X0/X1/Y0/Y1	Touch 4 wire signals to LCD touch screen
DISP_CARD_DET_B(DI1_PIN13_GPIO3_2)	LCD Module card detect signal

**Table 10-1: DISP connector signal description**

## 11. MMC/SD Interface

There are 2 MMC/SD connectors (P1 and P2) on board. P1 can support 8 bit MMC card. P2 supports 4 bit SD.



**Figure 11-1: Connection of SD/MMC Connector**

1. The SD/MMC interface is connected to SD1 and SD2 of i.MX51.
2. The SD interface support both standard SD memory card and SDIO card (such as Wi-Fi SDIO card).
3. The two slots P1 and P2 on i.MX51 EVK board are for different purpose. P1 is for SD booting function. Customer can select SD boot by configuring the SW1 setting on board. P2 is for SD/MMC storage or SDIO card such BT / Wi-Fi and etc.

## 12. Fast Ethernet Connect

The FEC (Fast Ethernet Controller) is designed to support both 10 and 100 Mbps Ethernet /IEEE 802.3 networks. An external transceiver (LAN8700) interface and transceiver function are required to complete the interface to the media. The FEC supports the 10/100 Mbps MII (18 pins in total) and the 10 Mbps-only 7-wire interface, which uses 7 of the MII pins, for connection to an external Ethernet transceiver.

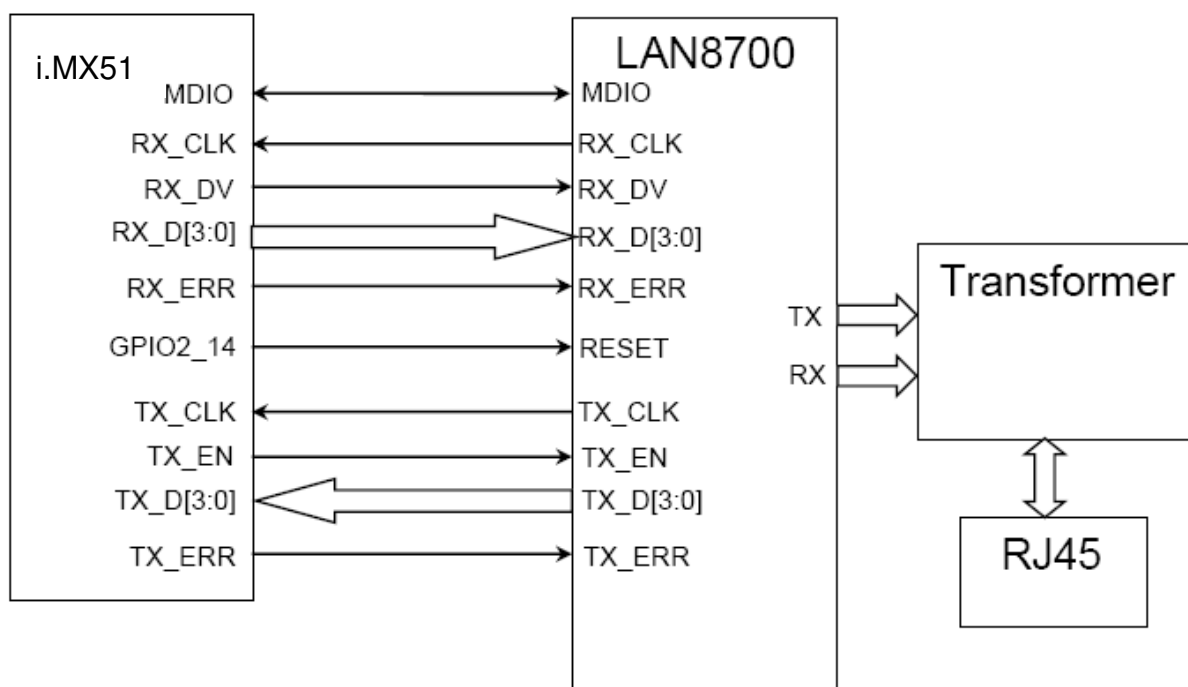


Figure 12-1: Connection of FEC



## 13. FM

FM is also a feature in i.MX51 EVK reference design. The FM receiver chip is Si4702. It integrates the complete tuner function from antenna input to stereo audio output for FM broadcast radio reception. It is controlled by I2C1 interface of i.MX51 and GPIO2\_4 as its reset signal. Its 32K clock comes from PMIC. Its antenna input comes from the headphone jack (JK1).

Note: There is no FM module soldered on board by default.

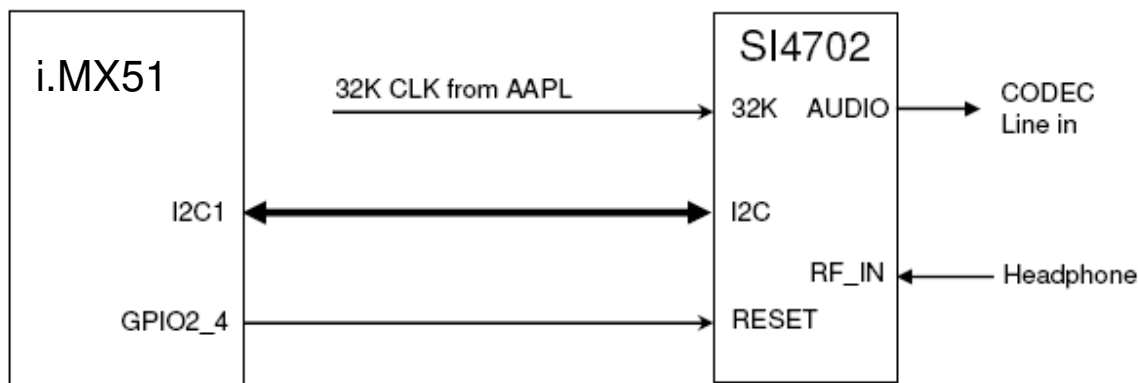


Figure 13-1: Block diagram of FM

## 14. Power Supply

### 14.1 Power of i.MX51 IO bank

Power supply Group	Voltage level	Related Module
VDDGP1~12	1.0V	ARM Core supply voltage
VCC1~19	1.2V	Peripheral supply voltage
NVCC_DRAM1~9	1.8V	DDR and Fuse Read supply
NVCC_NANDF	1.8V	NAND Flash I/O supply
NVCC_I2C	1.8V	I2C and HS-I2C I/O Supply
NVCC_EMI1~6	1.8V	EMI supply
NVCC_IPU	2.775V	IPU supply
NVCC_PER3/11/14	1.8V	GPIO supply
NVCC_PER5/8~13	2.775V	GPIO supply
NVCC_PER15/17	3.3V	GPIO supply
AHVDDRGB1~2	2.775V	TV to DAC level shifter supply
NVCC_TV_BACK	2.775V	TV to DAC level shifter supply
TVDAC_DHVDD	2.775V	TV to DAC level shifter supply
NVCC_USBPHY	2.6V	USB_PHY analog supply
VDD_ANA_PLL	1.8V	PLL analog supply
VDD_DIG_PLL	1.2V	PLL digital supply
NVCC_OSC	2.6V	Oscillator supply
NVCC_SRTC_POW	1.2V	SRTC core and I/O(VLIO) supply
VDDA1~6	1.2V	Memory arrays supply
VDDA33	3.3V	USB_PHY I/O analog supply
NVCC_HS4_1	1.8V	HS_GPIO additional digital supply
NVCC_HS4_2	1.2V	HS_GPIO additional digital supply

Power supply Group	Voltage level	Related Module
NVCC_HS6/10	2.775V	HS_GPIO additional digital supply
VDD_FUSE	3.15V	Fusebox program supply

**Table 14-1: i.MX51 IO Bank Power list**

## 14.2 Power block diagram

The power for whole board comes from the wall adapter (3.8A @5V). There are two PMIC chips on i.MX51 EVK board. One is Atlas AP Lite 2.0A and the other one is MC34713EP. The MC34713EP converts 5V to 3.3V for peripheral devices power. The Atlas AP Lite 2.0A supplies the other power for whole board, such as VDD\_GP, VDD\_LP for i.MX51 core, 1.8V for DDR2, 2.775V for i.MX51 I/O and etc. The detail diagram is shown as below:

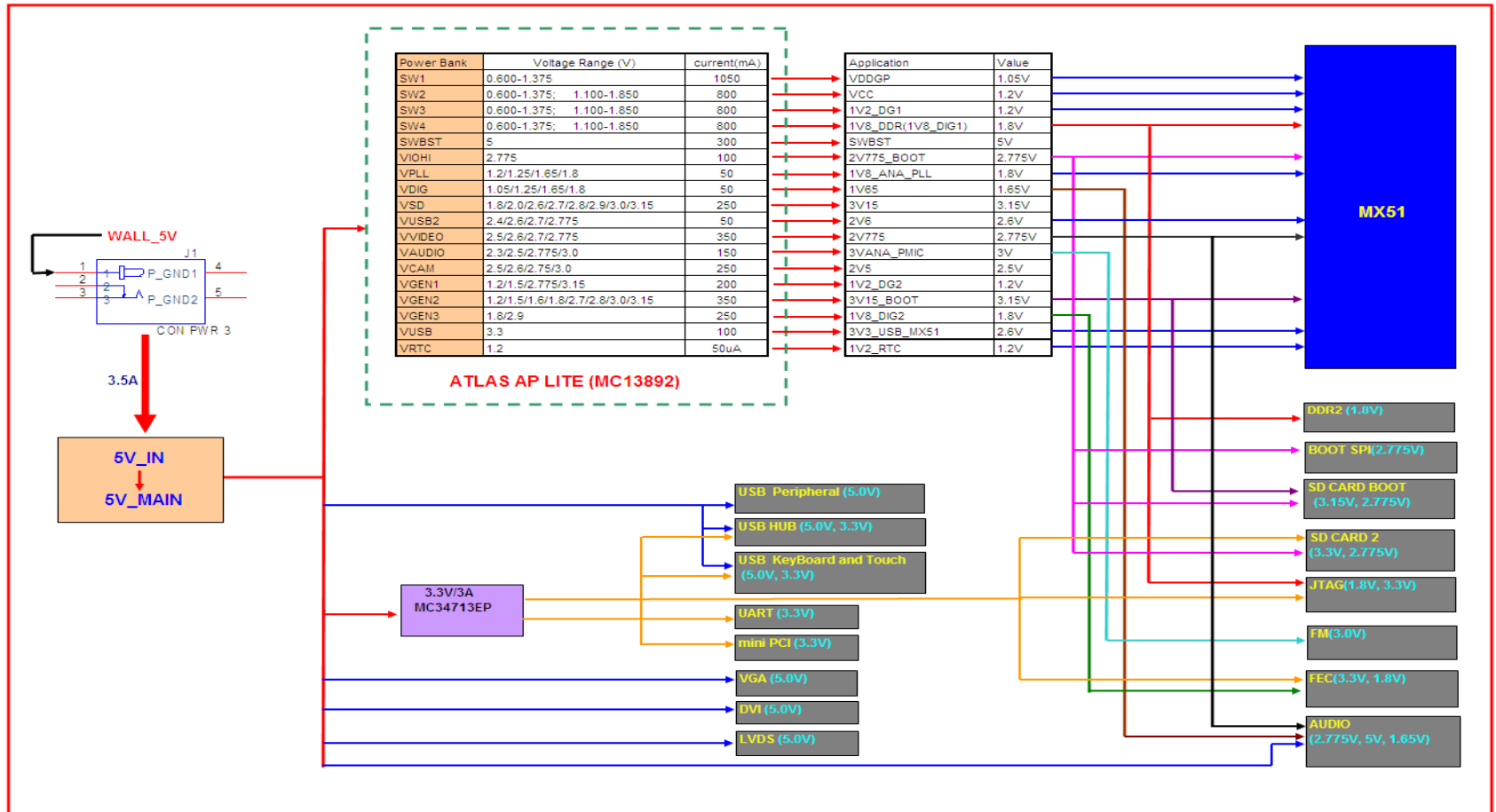


Figure 14-1: Power Block Diagram

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## 14.3 Power Measurement Point

Power Supply Group	Voltage Level	Mode
VDDGP(SW1)	1.0V	Sense resistor ---R70
VCC(SW2)	1.2V	Sense resistor ---R74
1V2_DIG1	1.2V	Sense resistor----R77
1V8_DIG1	1.8V	Sense resistor ---R78

**Table 14-2: Power measurement point on i.MX51 EVK.**

All the sense resistors are 20mohm 1% precision resistor. Costumers can measure the voltage on both sides of these resistors and divide the 20mohm, and then they can get the current value on the circuit path. So the power consuming can be got.

## 15. Accessory boards for i.MX51 EVK

There are a lot of connectors on the i.MX51 EVK board for expansion functions, such as Nand flash, LCD display, Camera and etc.

### 15.1 Expansion Card

There are five function blocks for accessory card: CMOS Camera, TV out, Keypad, EEPROM and UART. It is connected to J14 of the i.MX51 EVK board.

Note: This board is not included in the i.MX51 EVK kit

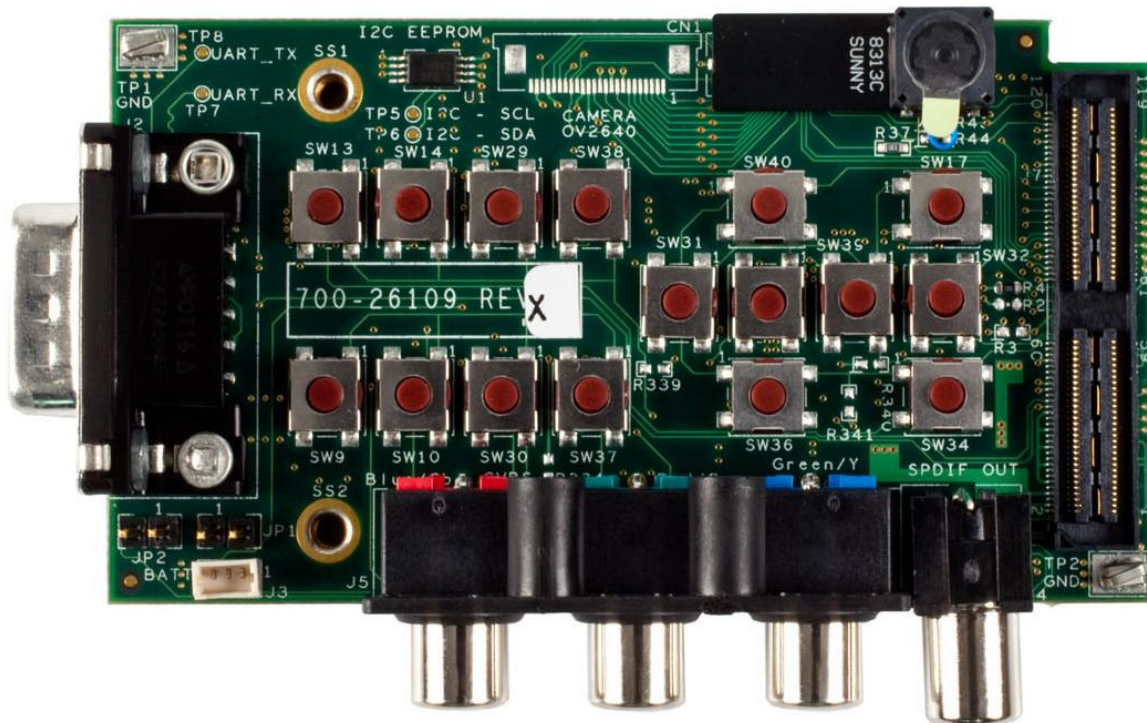


Figure 15-1: Expansion card

## 15.2 LCD Module Card

The WVGA board will support the following display interfaces: CPT 7" WVGA with resistive touch screen, CPT 5.7" VGA with resistive touch screen, Seiko 4.3" WVGA with resistive or capacitive touch screen and 18-Bit LVDS interface without touch screen.

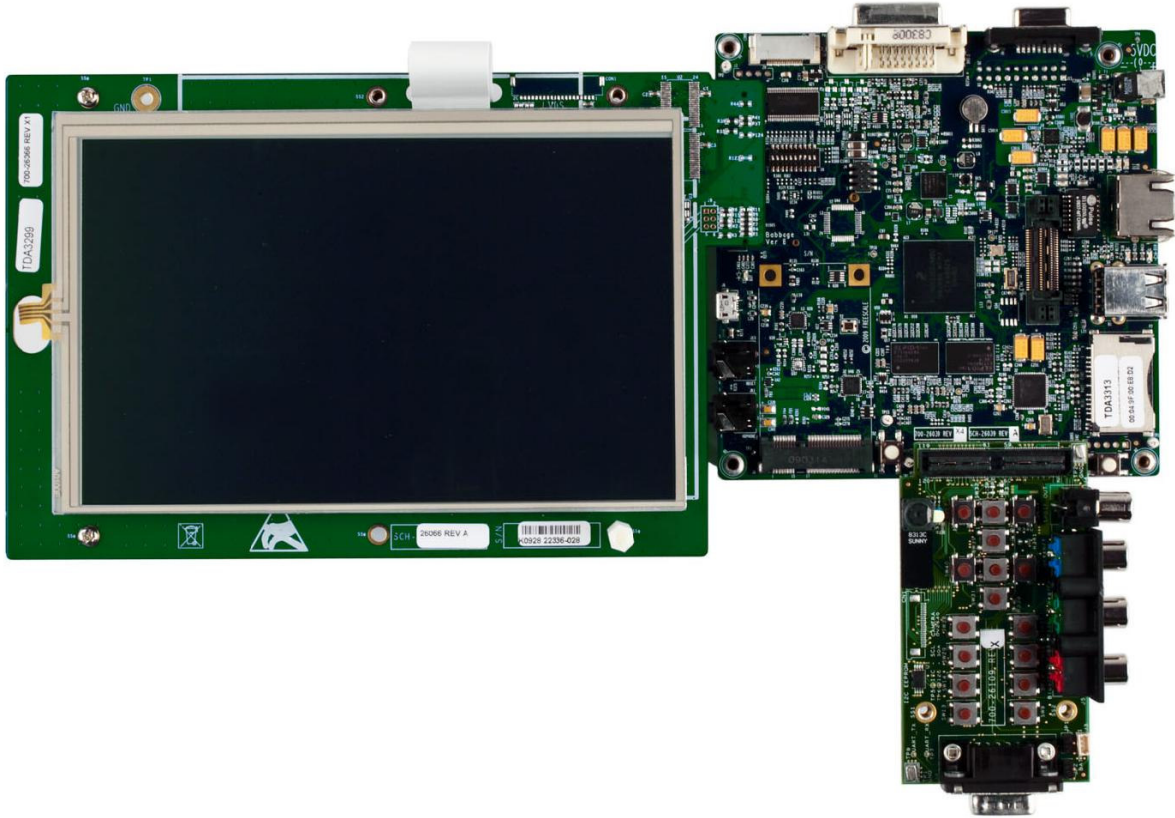
The LCD Module board will interface to each development system using a common interface connector. The Default LCD is CPT 7" WVGA CLAA070VC01.

Note: This board is not included in the i.MX51 EVK kit



Figure 15-2: LCD Module card

The figure 15-3 shows that the board architecture of i.MX51 EVK connecting Accessory boards.



**Figure15-3: Board Architecture**



## 15. Boot mode setting for i.MX51 EVK

There are several booting modes for i.MX51, such as SPI boot, USB boot, SD/MMC boot and etc. On i.MX51 EVK board, we can set the different booting modes through the switch S1.

	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10
	BOOT_MODE [1:0]		BT_BUS_WIDTH	BT_MEM_TYPE[1:0]		BT_SRC [0]	BT_MEM_CTL[1:0]		LID_CLOSE_B	PWR_BYP
SPI-NOR	0	0	1	1	1	0	1	1	x	x
MMC-1	0	0	0	0	0	0	1	1	x	x
MMC-2	0	0	0	0	0	1	1	1	x	x
UART-1	1	1	0	0	0	0	1	1	x	x
USB-OTG	1	1	0	0	0	0	1	1	x	x

**Table 15-1: Boot mode setting on i.MX51 EVK**

DIP Switch (S1) is 10-position. 0 = off, 1 = on. See schematic sheet 25 for additional functions allowed by 0-ohm resistors.

Position 9 is for simulation of net-book lid open and close.

Position 10, when it is turned on, forces the system to power up as soon as power is applied. For normal operation, it must be off.

The i.MX51 EVK board has the following Push-Buttons:

SW1. - Power On Switch

SW2. - Reset Switch

---

## 16. Know Issues

The table 16-1 lists some important know issues and workarround for them.

Features	Description	Workarround
Audio/DVI	Some DVI monitor/cable configurations can cause the audio to not be able to load due to I2C conflict.	Remove R287 and R284 to avoid I2C signal interference

**Table 16-1: i.MX51 EVK Board Know Issues**