



## KIT6410 Overview



The **Kit6410** Evaluation Board is developed based on Samsung ARM11 S3C6410X ARM1176JZF-S core 16/32-bit RISC microprocessor, which is designed to provide a cost-effective, low-power capabilities, high performance Application Processor solution for mobile phones ,notebook ,industrial navigation system and general applications. To provide optimized H/W performance for the 2.5G & 3G communication services, the ARM chip S3C6410X adopts 64/32-bit internal bus architecture. The 64/32-bit internal bus architecture is composed of AXI, AHB and APB buses. The chip also includes many powerful hardware accelerators for tasks such as motion video processing, audio processing, 2D/3D graphics, display manipulation and scaling. An integrated Multi Format Codec (MFC) supports encoding and decoding of MPEG4/H.263/H.264 and decoding of VC1.. To reduce total system cost and enhance overall functionality, the S3C6410X includes many hardware peripherals such as a Camera Interface, TFT 24-bit true color LCD controller, System Manager (power management & etc.),and so on.

Boardcon **Kit6410** Evaluation Board takes full features of the processor By providing a complete set of common system peripherals, minimizing overall system costs and eliminating the need to configure additional componentsand. It supports 128MByte DDR SDRAM and 256MByte NAND Flash as well as high-speed USB2.0 OTG function. The board has exposed many other hardware interfaces including RS232 serial port, LCD/TSP, TVOUT, S-Video, Ethernet, SD/MMC, GPIO, camera, SPI, and JTAG. The board has two methods to boot the system from either SD card or NAND flash. It is able to support WinCE and Linux OS as well as coming with WinCE6.0 BSP and Linux2.6.24 BSP. Boardcon also provides OS of Google Android OS and Ubuntu.

The **kit includes** the CPU Board and Carrier Board, LCD, Windows Embedded CE 6.0 or Linux OS BSP, complete electronic documentation, schematics, demo applications, and third party Cross compilers (Arm-none-linux-gnueabi, 3.3.2 , 3.4.1 , 4.2.2-eabi) and embedded development environments (DNW, MoviNAND\_Fusing\_Tool.exe, activesync,sdboot, TCPMP, USB Interface Driver and so on) for evaluation.

## 1. Hardware Specification

- Processor: Samsung S3C6410XH-66, ARM1176JZF-S core, up-to 833MHz.
- Two pcs 128M Bytes Mobile DDR, 266MHz, 32bit, Samsung K4X51163PC
- 256M Bytes SLC Nand Flash, Samsung K9F2G08
- 2M Bytes NOR FLASH, AMD AM29LV160DB
- One 100Mbps Ethernet interface, RJ45 interface. DM9000AE network chip
- One USB2.0 Host interface 12Mbps, USB A type interface
- One USB OTG 480Mbps, mini-USB AB type interface
- AC97 audio interface, WM9714 chip, Green interface for audio output, Blue interface for MIC input, white interface for LINE IN input
- One high speed SD card interface
- SD/MMC interface (supports 3.3V and 1.8V logic voltage)
- Four serial ports (Two are five-wire RS-232 DB9 interface, another two are

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three-wire TTL serial port led out from a 20-pin expansion connector)

- Two kinds of LCD/Touch Screen interface. Supporting 3.5 inch TFT LCD, 4.3 inch TFT LCD and 7 inch TFT LCD
- One S-Video display interface
- One RTC for the time and calendar are working normally if power off
- One TV OUT interface, 2-Pin 2.0 Pin pitch socket (White), standard RCA port
- One VGA interface
- Two Camera interfaces, (support ITU-R BT 601/656 8 Bit, one 10x2 Pin connector, another one is 30-pin FPC connector)
- One 10-pin A/D interface
- Two 20-pin high speed SPI interfaces, for expanding the Wi-Fi, CMMB, and other Module with SPI interface.
- One I<sup>2</sup>C bus interface, 10x2 Pin connector.
- One 50-pin GPIO interface
- One 50-pin Data and address BUS connector
- Four Blue LED user indicator
- One red LED power indicator
- Six Keys to realize UP, DOWN, LEFT, RIGHT, BACK and ENTER
- One 8x8 matrix keyboard interface, 25x2 Pin connector
- One Reset key, MAX811T Reset chip to control the system reset operation
- One 20-pin 2.54mm pitch JTAG interface
- One 10-pin CPLD JTAG interface
- Switch of SW1 is for setting boot-up mode, Switch of SW2 and SW3 are for setting output format of serial interface
- Back-up power supply interface for other power module inputting, the most input voltage is 40V.
- One Power Switch
- One 12V power interface

## 2. More introduction on some points of Specification

- **Processor**
  - Samsung S3C6410
  - ARM1176JZF-S core with Java acceleration engine and 16KB/16KB I/D Cache and 16KB/16KB I/D TCM.
  - Clock Rates up to 667Mhz
  - 266Mhz 64/32-bit system bus architecture is composed of AXI, AHB and APB buses.
  - Multi Format Codec (co-processor) provides encoding and decoding of MPEG-4/H.263/H.264 up to 30fps@SD/D1 and decoding of VC1 video up to 30fps@SD/D1.

- Manufactured using the 65nm process (Compared to earlier S3C6400 which is 90nm process)
  - 2D graphics acceleration with BitBlit and rotation
  - 3D graphics hardware accelerator which can accelerate OpenGL ES 1.1 & 2.0 rendering
  - Vector Floating-Point (VFP) coprocessor support allowing efficient implementation of various encryption schemes as well as high quality 3D graphics applications
- **Power Supply**
    - +12V or 5V DC power input
    - Real-time clock battery powered
- **Ethernet**
    - Chipset: Davicom DM9000
    - Compliance with IEEE 802.3u 100Base-TX and 802.3 10Base-T
    - Full-duplex/half -duplex capability
    - Supports IEEE 802.3x full duplex flow control
    - Supports AUTO-MDIX
- **SD Card Host Interface**
    - Chipset: CPU internal
    - SD Memory Card Protocol version 2.0 compatible
    - SDIO CARD Protocol version 1.0 compatible
    - 128 word FIFO for Tx/Rx
    - DMA based or Interrupt based operation
    - 3 channel SD/MMC Host Controller
    - Support CE-ATA Interface
- **Video Post Processor**
    - Chipset: CPU internal
    - Video input format conversion
    - Video/Graphic scaling up/down or zooming in/out
    - Color space conversion from YCbCr to RGB and from RGB to YCbCr
    - Dedicated scaler for TV Encoder
- **TV Out**
    - Chipset: CPU internal
    - Support NTSC-M,J / PAL-B,D,G,H,I,M,Nc compliant video format

- Built in the MIE(Mobile Image Enhancer) Engine
  
- **Multi Format Codec (MFC)**
  - Chipset: CPU internal MFC co-processor
  - MPEG-4 part-II simple profile encoding/decoding 30fps@SD/D1
  - H.264/AVC baseline encoding/decoding 30fps@SD/D1
  - H.263 profile3 encoding/decoding 30fps@SD/D1
  - VC1 decoding 30fps@SD/D1
  - Encoding tools
    - [-16,+16] 1/2 and 1/4 pel accuracy motion estimation using the full-search algorithm
    - Variable block sizes: 16x16, 16x8, 8x16 and 8x8
    - Unrestricted motion vector
    - MPEG-4 AC/DC prediction
    - H.264/AVC intra-prediction (hardwired mode decision)
    - In-loop deblocking filter for both H.264 and H.263 P3
    - Error resilience tools
    - MPEG-4 resync. Marker and data-partitioning with RVLC
    - MPEG-4/AVC FMO
    - Bit-rate control (CBR and VBR)
  - Decoding tools
    - Support all features of the standards
  
- **JPEG Codec**
  - Chipset: CPU JPEG Codec co-processor
  - Compression/decompression up to UXGA size
  - Encoding format: YCbCr 4:2:2 / RGB565
  - Decoding format: YCbCr 4:4:4/4:2:2/4:2:0 or gray
  
- **2D Graphic Accelerator**
  - Chipset: CPU internal
  - Line/Point drawing, BitBLT and Color Expansion /Text Drawing
  
- **3D Graphic Accelerator**
  - Chipset: CPU internal
  - 4M triangles/s @133MHz (Transform Only)
  - 75.8M pixels/s fill-rates @133MHz (shaded pixels)
  - Programmable Shader Model 3.0 support
  - 128-bit (32-bit x 4) Floating-point Vertex Shader
  - Geometry-texture cache support

- 128-bit (32-bit x 4) Floating-point two Fragment Shaders
- Max. 4K x 4K frame-buffer (16/32-bpp)
- 32-bit depth buffer (8-bit stencil/24-bit Z)
- Texture format: 1/2/4/8/16/32-bpp RGB, YUV 422, S3TC Compressed
- Support max. 8 surfaces (max. 8 user-defined textures)
- API Support: OpenGL ES 1.1 & 2.0, D3D Mobile
- Intelligent Host Interface
  - 15 input data-types, Vertex Buffer & Vertex Cache
- H/W Clipping (Near & Far)
- 8-stage five-threaded Shader architecture
- Primitive assembly & hard-wired triangle setup engine
- One pixels/cycle hard-wired rasterizer
- One texturing engine (one bilinear-filtered texel/cycle each)
- Nearest/bilinear/trilinear filtering
- 8-layered multi-texturing support
- Fragment processing: Alpha/Stencil/Z/Dither/Mask/ROP
- Memory bandwidth optimization through hierarchical caching
  - L1/L2 Texture-caches, Z/Color caches
- **Security Sub-System**
  - Chipset: CPU internal
  - AES accelerator: ECB, CBC, CTR mode support
  - DES/3DES accelerator: ECB, CBC mode support
  - SHA-1 Hash engine
  - H/W HMAC support
  - Random Number Generator : PRNG 320-bit generation per 160 cycles
  - FIFO-Rx/Tx: (two 32-word) for input and output streaming.
  - DMA I/F to SDMA1(Security DMA 1)
- **Camera Interface**
  - ITU-R 601/ITU-R 656 format input support. 8-bit input is supported
  - Both progressive and interlaced input are supported
  - Camera input resolution up to 4096x4096 in YCbCr 4:2:2 format
    - 4096x4096 input resolution assumes the hardware down-scaling units will be bypass
    - Up to 2048x2048 input resolution can optionally be input to the hardware down-scaling unit
  - Resolution down-scaling hardware support for input resolutions up to 2048x2048
  - Codec/Preview output image generation (RGB 16/18/24-bit format and YCbCr 4:2:0/4:2:2 format)
  - Image windowing and digital zoom-in function

- Image mirror and rotation supports Y-mirror, X-mirror, 90°, 180° and 270° rotation
- H/W Color Space Conversion
- LCD controller direct path supported
- Image effect supported.
  
- **Watchdog Timer (WDT)**
  - Chipset: CPU internal
  - 16-bit Watchdog Timer
  - Interrupt Request or System Reset at Timeout
  
- **System Bus Interface**
  - Chipset: CPU CARD BUS
  - 16-bit or 8-bit support
  
- **IIC interface**
  - Chipset: CPU internal
  - 1-ch Multi-Master IIC-Bus
  - Serial, 8-bit oriented and bi-directional data transfers can be made at up to 100 Kbit/s in Standard mode or up to 400 Kbit/s in Fast mode
  
- **SPI interface**
  - Chipset: CPU internal
  - Compatible with 2-ch Serial Peripheral Interface Protocol version 2.11
  - 2x8 bits Shift register for Tx/Rx
  - DMA-based or interrupt-based operation
  
- **Pulse Width Modulation (PWM)**
  - Chipset: CPU internal
  - 2-ch 16-bit Timer with PWM / 1-ch 16-bit internal timer with DMA-based or interrupt-based operation
  - Programmable duty cycle, frequency, and polarity



### 3. Software features

KIT6410 Support 4 operating system: WinCE6.0, Linux2.6.28. Android-1.5, Ubuntu-9.04.  
We provide bootloader and kernel source code.

## WINCE

### (1) Operating system version

- Windows CE 6.0

### (2) Drivers support

- 128M Mobile DDR driver
- 256M NAND FLASH driver
- LCD driver ( Support 3.5" 320x240, 4.3" 480x272, 7" 800x480, 10.2" and 10.4" LVDS 800x600)
- Audio driver ( Support external earphone, record, Line in)
- USB HOST driver ( Support USB Keyboard, Mouse, USB disk and other USB interface device)
- USB DEVICE driver ( Through the synchronous software to synchronize the data with PC)
- USB OTG driver
- DM9000AE Ethernet driver (10/100M self-adapt network interface with working status indicator)
- Four serial interfaces driver (One debug serial interface, three user interface. Two are five-wire RS-232 DB9 interface, another two are three-wire TTL serial port led out from pin header )
- I<sup>2</sup>C bus driver
- SPI driver
- CF\_ATA
- Touch screen driver
- SD/MMC driver ( Maximum support 32G capacity)
- High Speed SD Card
- Powerbutton, Powercontrol, UA0
- DMA, CMM, DrvLib
- UA0
- JPEG hardware decode driver
- MFC multimedia decode driver
- TV OUT driver ( Display output to TV)
- S-Video driver



- RTC driver (Real time clock reserve, ensure the system running proper when power off)
- Keyboard driver (UP, DOWN, LEFT, RIGHT, ENTER, RETURN)
- Camera driver ( Support OV9650, 130M Pixel camera, providing the source code of driver and schematic drawing for OV9650)
- WIFI driver (SDIO WIFI module, support USI, Murata and other brand)
- USB 3G Modem
- Bluetooth Module

### **(3) Other functions**

- Provide Eboot to Support SD card boot. Burning image from SD card instead of burning from JTAG method.
- Save register change
- ROM File system support
- Support USB and SD card update the Eboot and system NK.
- Video hardware code/decode supporting MPEG-4/H263/H264/VC-1
- Supporting TCPMP player complete hardware decoding, Video/Audio decode of MPEG-4/H264/VC-1 is up-to 35fps under resolution D1
- Supporting MediaPlayer + Directshow Video Hardware decoding
- Supporting Camera play-back, H264/MPEG-4 Video decoding
- Supporting JPEG graphics hardware decoding
- Supporting record and store the record into Nand Flash
- Supporting display boot progress bar, boot logo
- Supporting many Messenger tools like Skype, MSN, QQ
- Supporting OFFICE, PDF reader
- Supporting Adobe Flash Lit, IE Browse plays video
- Providing with abundant test program in source code
- Media Player: Support various video format decode
- TCPMP player: Support H264/H263/MPEG4/WMV9 video hardware decode

### **(4) Development Environment**

- Microsoft Visual Studio 2005
- Windows Embedded CE 6.0

### **(5) Debugging tools**

- DNW (provided in the CD-ROM)
- IROM\_Fusing\_Tool (Provided in the CD-ROM)
- Activesync (provided in the CD-ROM)

## LINUX

### (1) Kernel Version

- Linux-2.6.28

### (2) Bootloader version

- U-boot-1.1.6

### (3) Drivers support

- 128M Bytes mDDR driver
- 256M NAND FLASH driver
- LCD driver ( Support 3.5" 320x240, 4.3" 480x272, 7" 800x480, 10.2" and 10.4" LVDS 800x600)
- TOUCH driver: 4-line resistor type touch screen driver
- USB HOST Driver
- SPI
- IIC
- DMA
- JPEG
- WAVEDEV, Audio, AC97
- MFC multimedia decode driver
- TV OUT
- Ethernet interface: 10M/100M self-adapt network interface driver
- SD/MMC driver: Support high speed SD/MMC card, maximum support 8G
- UART driver: One debug serial interface, three user interfaces
- CAMERA driver: Support OV9650 camera module, providing the source code of driver and schematic drawing for OV9650
- 2D/3D hardware graphics accelerator OpenGL ES1.1 & 2.0, D3DM

### (4) File system

- Yaffs or NFS file system
- Provided Lib (ALSA-lib, tslib, glibc), udev support

### (5) Network Protocol & Application

- TCP/IP
- H.264 display Hardware decoding test program
- MPEG-4 Hardware decoding test program
- H.263 Hardware decoding test program
- VC-1 Hardware decoding test program
- 4-windows display
- Camera preview & MFC encoding
- MFC decoding & Camera preview
- Camera input and JPEG encoding

- JPEG decoding and display
- MFC decoding & Camera preview through TV
- H.264 decoding through TVOUT
- Telnet server, telnet remote login
- File transfer, FTP Client/Server
- Web Server

## **(6) Graphic user interface**

- Qtopia 2.2.0, which supports below functions:
  1. Image browser
  2. MediaPlayer
  3. Calendar, time, counter
  4. Browser
  5. File manager
  6. Terminal
  7. Many games
  8. Touch Screen calibration program
  9. Plug-in Manager
  10. And so on

## **(7) Other functions**

- Provide u-boot to Support SD card boot and NAND Flash. Burning image from SD card instead of burning from JTAG method.
- Support use USB or SD Card updated kernel and file system

## **(8) Compiler**

- Cross-3.3.2 (provided in the CD-ROM)
- Cross-3.4.1 (provided in the CD-ROM)
- Corss-4.2.2-eabi (provided in the CD-ROM)

## **(9) Debugging tools**

- DNW (provided in the CD-ROM)
- MoviNAND\_Fusing\_Tool.exe (provided in the CD-ROM)

## **Android-1.5**

### **(1) Bootloader Version**

- U-boot-1.1.6

### **(2) Kernel Version**

- Linux-2.6-27-android

### **(3) Drivers support**

- 128 DDR driver
- 256 NAND FLASH driver
- LCD drivers (4.3Inch-480\*272, 7Inch-800\*480)
- TOUCH driver
- DM9000 Ethernet
- IIC
- SPI
- WAVEDEV, AC97 and IIS
- DMA
- RTC
- USB Device
- JPEG
- MFC
- TV OUT
- ROTATOR
- 2D/3D Hardware graphics accelerator OpenGLES1.1 & 2.0, D3DM
- SD/MMC driver
- Keyboard driver

### **(4) File system**

- Yaffs2 (Androidfs-sdk-m5-rc15)

### **(5) Graphic user interface**

- Android-1.5

### **(6) Other functions**

- Provide u-boot to Support SD card boot. Burning image from SD card instead of burning from JTAG method
- Support USB update the kernel and file system.

### **(7) Compiler**

- Arm-none-linux-gnueabi (provided in the CD-ROM)

### **(8) Debugging tools**

- DNW (provided in the CD-ROM)
- MoviNAND\_Fusing\_Tool.exe (provided in the CD-ROM)

## **Ubuntu**

### **(1) Bootloader Version**

- U-boot-1.1.6

## **(2) Kernel Version**

- Linux-2.6-29.1

## **(3) Drivers support**

- 128 DDR driver
- 256 NAND FLASH driver
- LCD driver (4.3Inch-480\*272)
- TOUCH driver
- SD/MMC driver
- Four UARTs driver
- RTC
- Keyboard driver

## **(4) File system**

- EXT3 rootfs

## **(5) Graphic user interface**

- Lxde-ubuntu, supporting file browser, Mediaplayer

## **(6) Other functions**

- Provide u-boot to Support SD card boot and NAND Flash. Burning image from SD card instead of burning from JTAG method
- Support USB and SD Card to update the kernel and file system.

## **(7) Compiler**

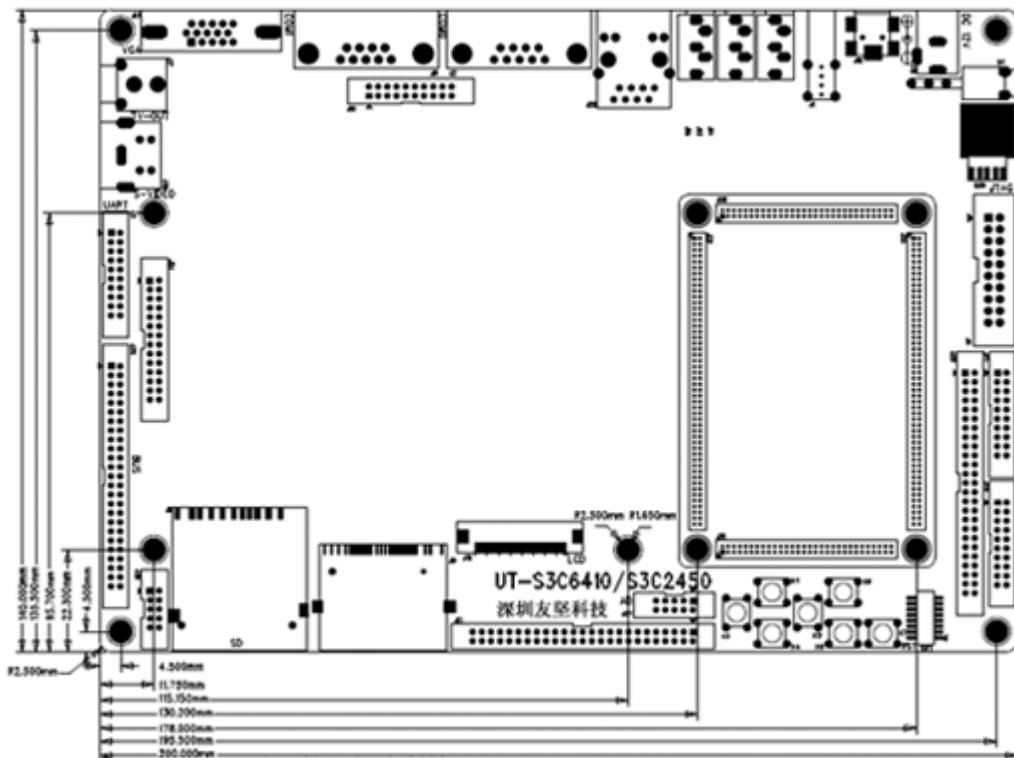
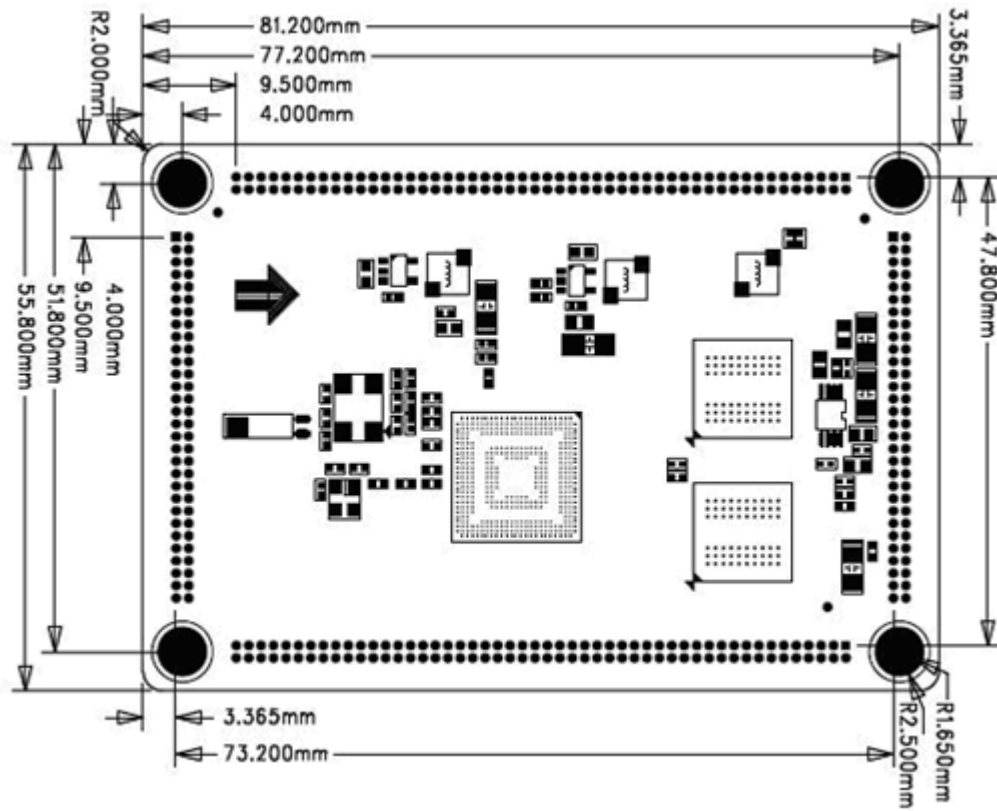
- Arm-none-linux-gnueabi (provided in the CD-ROM)

## **(8) Debugging tools**

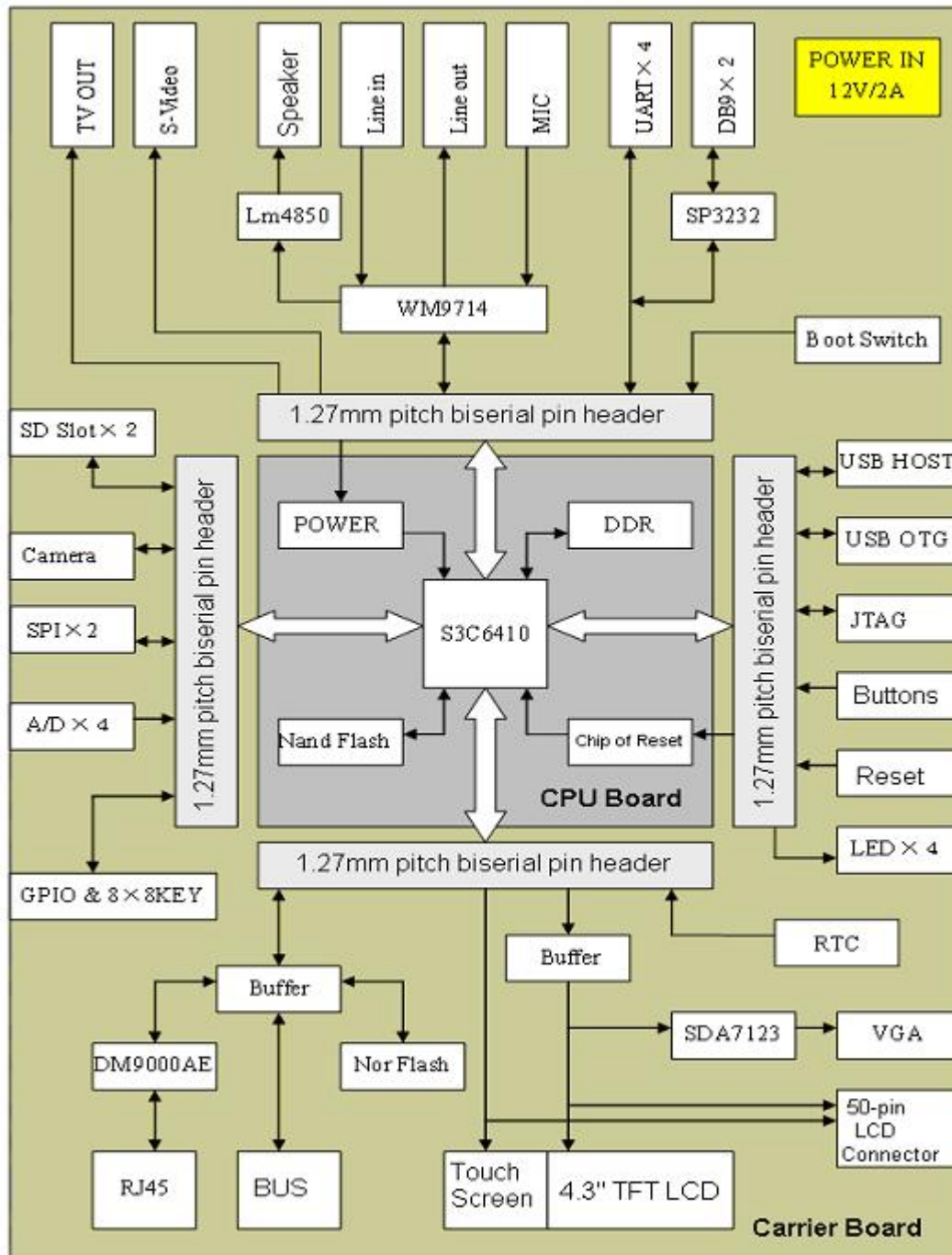
- DNW (provided in the CD-ROM)
- MoviNAND\_Fusing\_Tool.exe (provided in the CD-ROM)



## 4. KIT6410 PCB Diagram



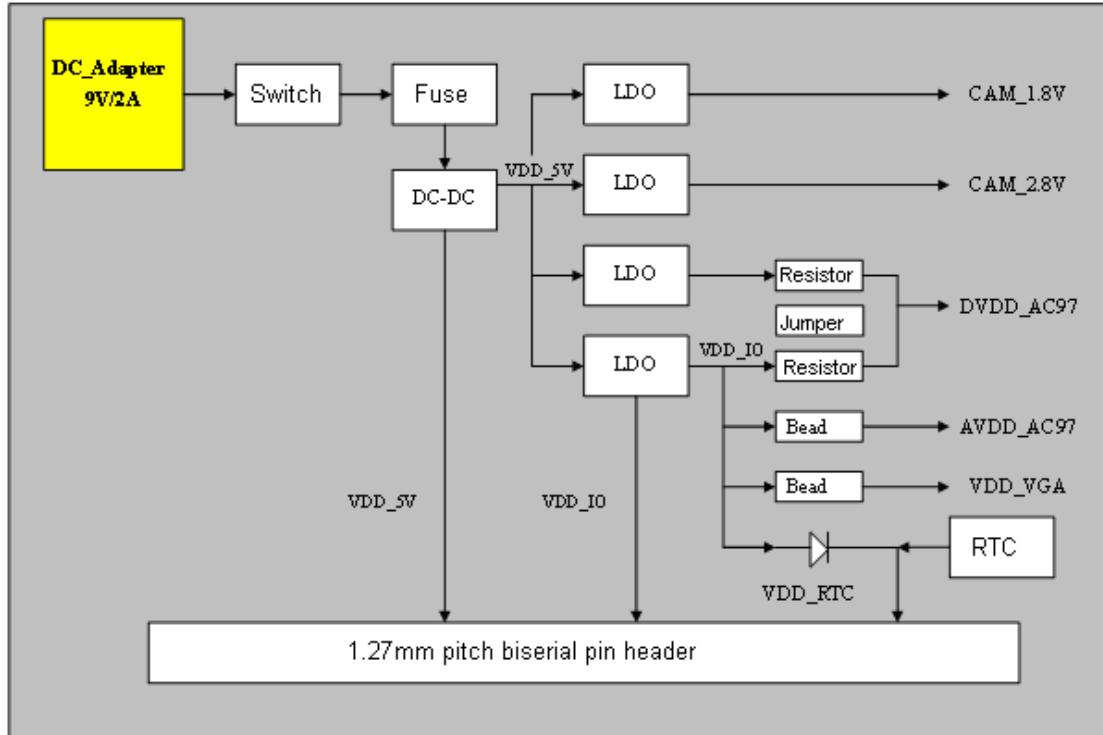
## 5. KIT6410 Block Diagram



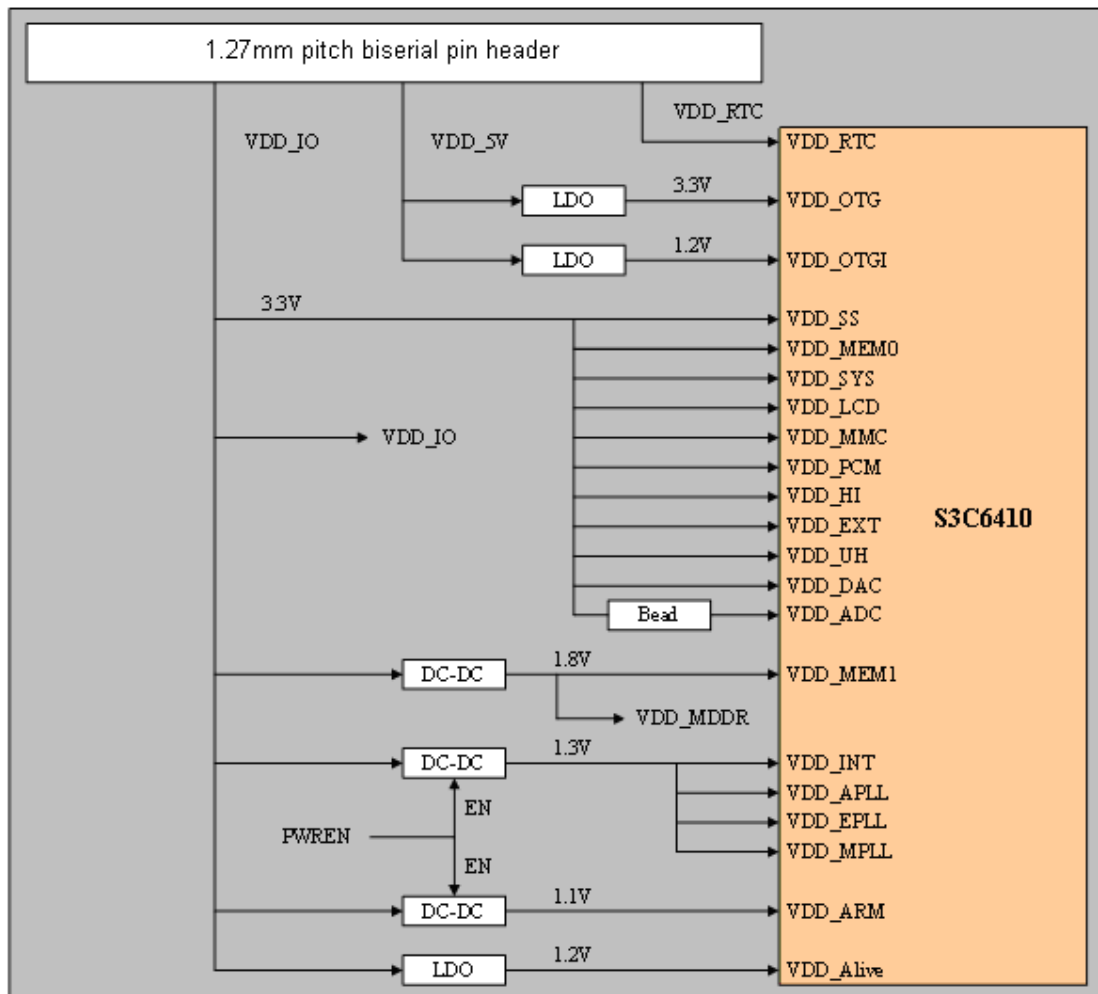


## 6. KIT6410 Power Supply Block Diagram

- For Carrier Board



- For CPU Board



## 7. KIT6410 Application fields

- Mobile Internet Devices
- Notebook
- 3G Handheld or Smartphones
- High-Speed Video Encode/Decode
- Portable Navigation Device
- Gaming
- Web Tablet
- Digital TV
- Point-of-Sale Devices
- Portable Data Collection
- Advanced Portable consumer Electronics

## 8. Standard contents

- One ARM11 KIT6410 Development Board
- One CD-ROM (WinCE 6.0 BSP, Linux BSP, Documents, tools, Schematic Drawing, datasheets)
- One Serial cable (IDC10-to-DB9)
- One [12V@2A](#) Power adapter
- One Touch Pen
- One USB cable
- One Cross Ethernet cable

## 9. External expansion modules

- 4.3" TFT LCD
- 7" TFT LCD (optional)
- 10.4" LVDS LCD (optional)
- WI-FI module (optional, providing schematic drawing and source code driver for the Module )
- Camera module (optional, providing schematic drawing and source code driver for the Module )
- GPS module (optional, providing schematic drawing ,source code driver and Chinese Map for the Module)
- USB HUB+ 4x4 (optional, providing schematic drawing and source code driver for the Module)
- USB 3G Modem
- USB Bluetooth
- LVDS Conversion Module



## 10. More pictures about KIT6410



KIT6410 is running GPS



GPS Module



USB HUB

3G Module



LVDS Module



Bluetooth Module





[www.armdesigner.com](http://www.armdesigner.com)

## Product Contact:



### Boardcon Information and Technology Co., Limited

**Add:** Room 604,A YunXiXiAn Building, XueFu Road North, NanShan District, Shenzhen, China.518056

**Tel:** +86-755-86064716

**Fax:** +86-755-86064756

**MSN:** [Boardcon@hotmail.com](mailto:Boardcon@hotmail.com)

**General Email:** [market@armdesigner.com](mailto:market@armdesigner.com)

**Technical Support Inquiries:** [support@armdesigner.com](mailto:support@armdesigner.com)

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1.0	2009-04-16	Initial Release Version
1.1	2009-12-04	The second Release version