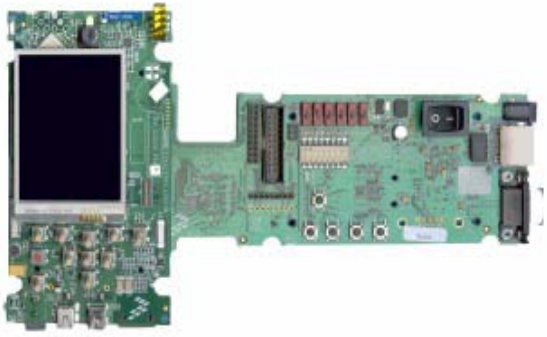
i.MX31 3-Stack Development Kit

Quick Start Guide for Linux



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About the Boards

This chapter provides detailed information about the three boards (CPU, Debug, Personality) and identifies the locations of the connectors and switches.

Table 1.1 Chapter Summary

Board	See
3-Stack Platform	"About the 3-Stack Platform System" on page 3
CPU	"CPU Board" on page 6
Debug	"Debug Board" on page 7
Personality	"Personality Board" on page 10

About the 3-Stack Platform System

Freescale introduces the 3-Stack Platform System, which you use to develop multimedia and connectivity applications using the i.M31 Applications Processor and the MC13783 Audio and Power Management device.

The 3-Stack Platform System decreases the time between first development and final product release by providing you (as the system designer) with a near-to-final product design, which you can use as a development platform for software and hardware.

There are two Board Support Packages (BSP) for the 3-Stack Platform System, with one BSP for WinCE and one BSP for Linux operating systems. These BSPs contain drivers optimized for multimedia operations using the i.MX31 and MC13783 devices.

Freescale's 3-Stack Platform System consists of three small boards: CPU, Debug, and Personality.

- A CPU board contains the i.MX31 CPU, memories and the MC13783 Power Management IC (PMIC).
- A Debug board provides the debug interfaces (like JTAG), and also has a CPLD that implements an external Ethernet and serial controller for debug purposes.
- The Personality board implements the functionality of the 3-Stack board system, and contains hardware for WiFi connectivity, FM receiver, and so on. The Personality board can be modified to meet your specific requirements without the need to modify the other two boards (CPU, Debug). The Personality board was designed to support common multimedia applications, and has a 2.8-inch VGA display, image sensor

camera, WiFi 802.11g/b, FM receiver, SD Card connector, USB OTG, USB Host, 2.4 QVGA smart display panel connector, ATA connector and TV-Out connector. As the 3-Stack Platform continues to evolve, more Personality boards will be created to meet new multimedia requirements.

Table 1.2 describes the 3-Stack Platform features in detail.

Table 1.2 3-Stack Platform Features

Item	Description
All boards	• Near to final product form-factor demonstration modules and working platforms. • Solid reference schematics that closely resemble final products to aid customers' designs.
CPU board	• i.MX31 ARM-11 Applications Processor • MC13783 Atlas power management chip • 256 MB of NAND Flash Memory • 128 MB of 32 bit DDR SDRAM memory • 37.914 mm x 67.517 mm
Personality board	• Peripheral components • Interface connectors • 71.428 mm x 129.462 mm
Debug board	• Two RS-232 interfaces • 10/100 Base-T Ethernet connector • Current measure connectors • 71.400 mm x 174.900 mm
Expansion Headers	• Utilizing reliable high density connector to interface between boards, 3 board assembly for software development and 2-board assembly (without debug board) for demonstration
Battery Support	• +4.2 V 2400mAh Battery power supply and Battery Charging Function
LCD Display	• 2.8 inch TFTLCD display panel with touch panel and LED backlight
Smart LCD Connector	• 2.4 inch QVGA smart display panel connector
Camera Interface	• Image sensor camera connector
Selectable Clock Sources	• Two selectable system clock sources: 32.768 KHz and 26 Mhz
Debug Port	• RealView-ICE debug support

Table 1.2 3-Stack Platform Features

Item	Description
Video and Audio Stereo	• Stereo microphone jack, headphone and video jack, stereo and mono (ear piece) speaker terminals
GPS Connector	• One connector to outboard GPS module
FM Receiver	
TV Out	• TV decoder that supports 8-bit color, NTSC and PAL formats
PC Card Expansion	• SD card connectors, with card sense
Keypad	• Onboard keypad and keypad connector
Network Support	• WiFi 802.11g/b and BT2.0 + EDR Combo Module onboard • One Ethernet jack connector (for application/debug)
USB	• One USB OTG high-speed transceiver with mini-USB connector • One USB high-speed host transceiver, with standard USB host connector
ATA Support	ATA5 controller with • One 44-position dual row 2 mm header for small form-factor disk drivers • One 40-pin ZIF connector for Toshiba HDD
Accelerometer	• Onboard accelerometer with sensitivity in three separate axes (X, Y, Z)
Serial Port	Two RS-232 interfaces with DB-9 connectors • One RS-232 interface is driven by a UART channel internal to the MX31, and it supports DCE with optional full modem controls • The other RS-232 interface is DTE with optional full modem controls
Cables	• 5.0V/2.4A universal power supply kit • RS-232 standard serial cable • High Speed USB cables with mini-AB connectors for OTG • High speed cable with standard A-to-mini-B connectors • Mini-USB adaptor • Ethernet cables (2) with RJ45-8 connectors

Table 1.2 3-Stack Platform Features

Item	Description
Software	• Sample Windows® embedded CE binary image from Freescale • Windows embedded CE BSP available from Freescale
Application Development Tools	• ATK software • Platform Builder 5.0/6.0 • Visual Studio 2005

CPU Board

CPU Board

J1 Board-to-Board Connector

Figure 1.1 CPU Board

You use the J1 board-to-board connector (500 pins) to connect the CPU board to either of the other two boards:

- Connect the CPU board to a Personality board, for running demos (no Debug board is needed).
- Connect the CPU board to a Debug board, (and connect the Personality board to the Debug board) for developing software. The Personality board plugs into the other side of the Debug board.

Debug Board

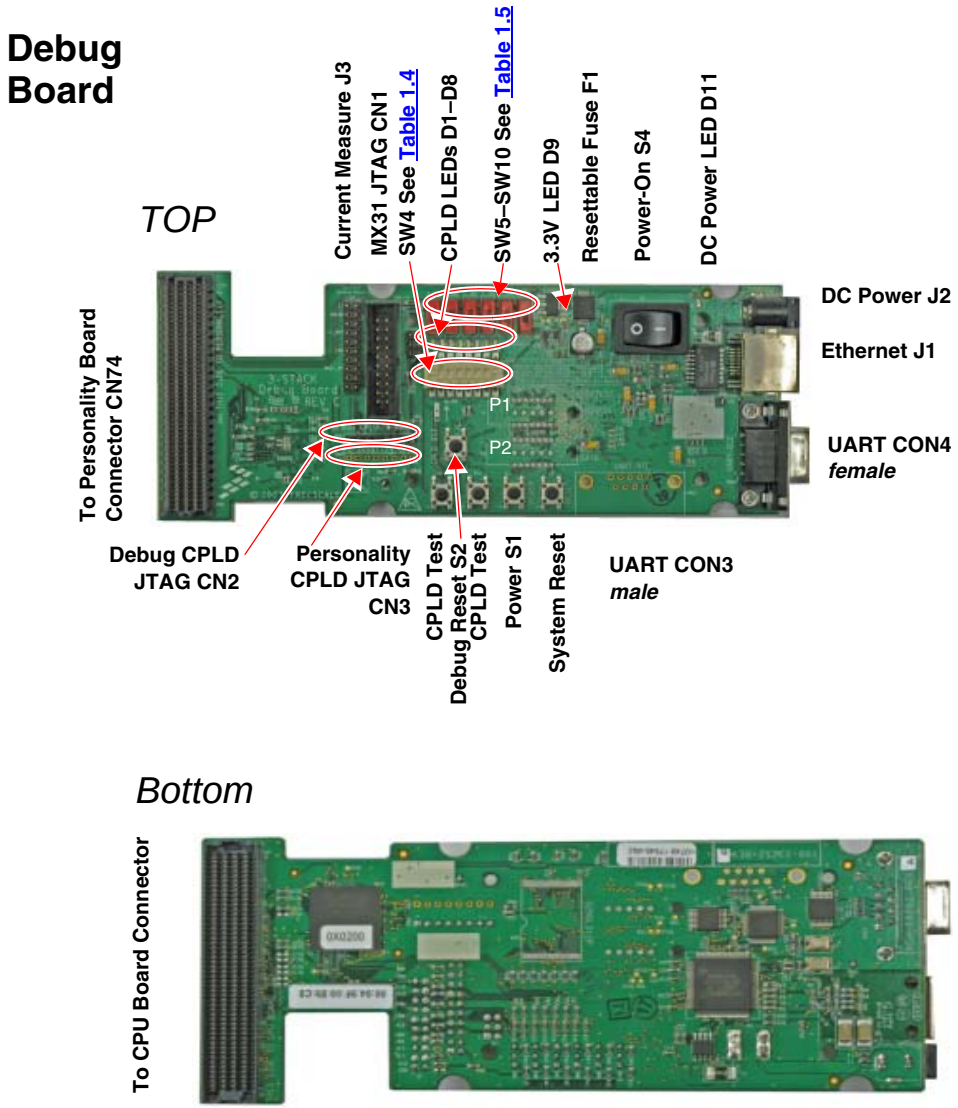


Figure 1.2 Debug Board

Table 1.3 Debug Board Physical Features

Type	Physical Feature
Switches	• S1: Power button • S2: Debug board reset button • S3: System reset switch • S4: Power-on switch • SW4: Enable switch
Connectors	• J1:10/100 Base-T Ethernet RJ45 connector • J2: 5.0V DC power connector • J3: Current measure connector • J4: 500-pin connector to CPU board • P1: WEIM Address measure connector • P2: WEIM Data measure connector • CN1: i.MX31 JTAG connector • CN2: Debug board CPLD JTAG connector • CN3: Personality board CPLD JTAG connector (Reserved) • CN74: 500-pin connector to Personality board • CON4: UART (DCE) DB9 female connector
LEDs	• D1–D8: LEDs for CPLD debug • D9: LED for debug board 3.3V power • D11:LED for DC power supply
Buttons	• BT1, BT2: Test buttons for CPLD
Fuse	• F1: Resettable Fuse

Table 1.4 Debug Board SW4 Switch

Switch	Setting	Effect
SW4-1 UART Port Select	ON	Selects serial port UART (DCE) CON4
SW4-8 Power Enable	ON	Power is supplied to all three boards.
	OFF	Power is only supplied to the Debug board.

Table 1.5 Boot Mode Setting (SW5–SW10)

Boot Mode Device	SW5	Boot4 SW6	Boot3 SW7	SW8	SW9	SW10
UART/USB bootloader	X	0	0	0	0	0
8-bit NAND Flash (2KB page) Ext	X	1	0	0	0	0

Personality Board

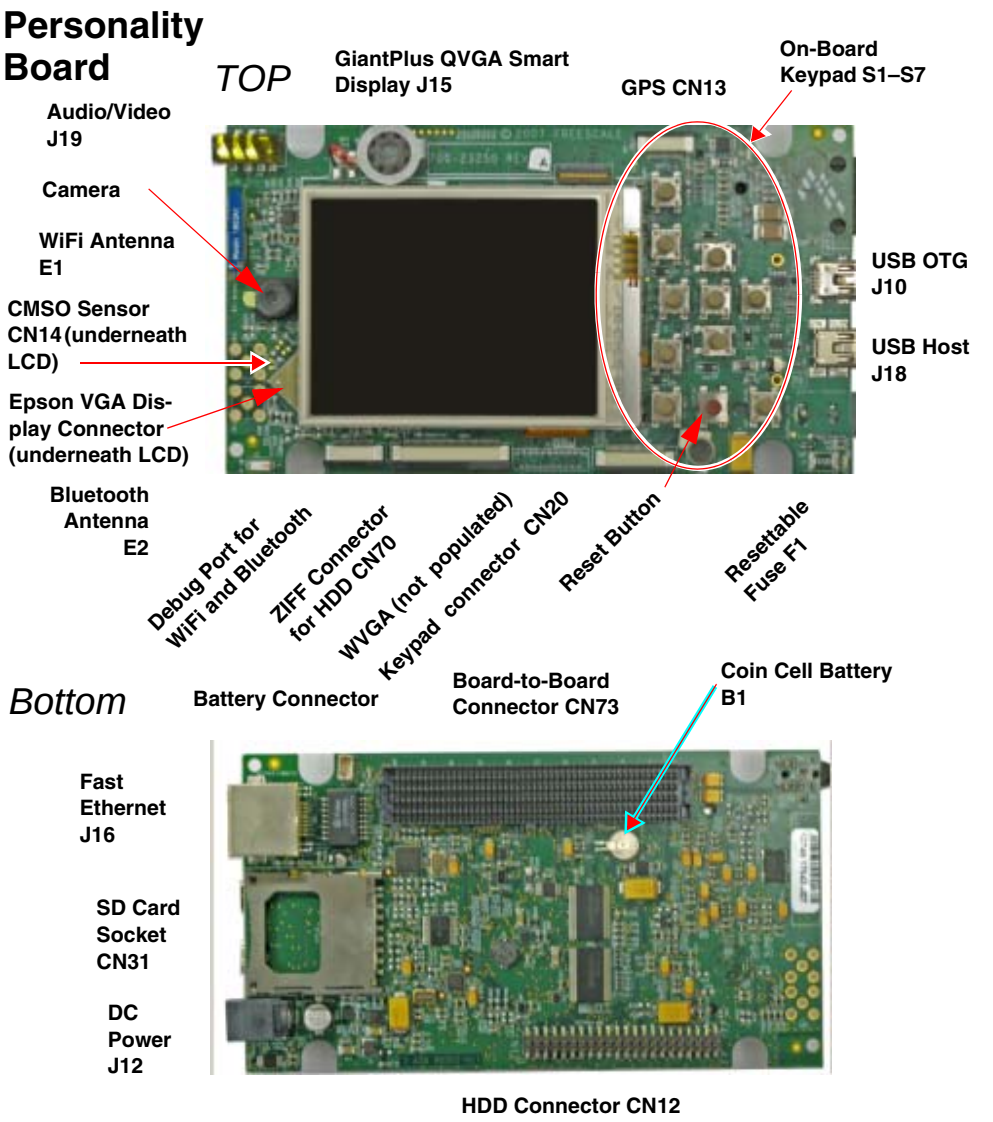


Figure 1.3 Personality Board

Table 1.6 Personality Board Physical Features

Type	Physical Feature
Connectors	• CN12: 44-position dual row, 2 mm header for HDD • CN13: GPS module connector • CN14: 2.0 M pixel CMOS sensor connector • CN16: Debug port for WiFi and Bluetooth module • CN31: SD card socket • CN70: 40-pin ZIF connector for HDD • CN73: 500-pin connector to CPU Engine board (in demo configuration) or Debug board (in development configuration) • J10: Mini-USBOTG high speed connector • J12: 5.0 VDC power connector • J14: Epson VGA display connector • J15: GiantPlus QVGA smart display connector • J16: 10/100 BT Fast Ethernet Connector • J18: Standard USB host high speed connector • J19: Audio and video connector
Battery	• B1: Coin cell battery
Buttons	• S7–S17: Onboard keypad
Fuse	• F1: Resetable fuse
Antennas	• E1: WiFi Antenna • E2: Bluetooth antenna

2

Getting Started

Unpack the Kit

The 3-Stack Platform System is shipped with the items listed in Table 2.1.

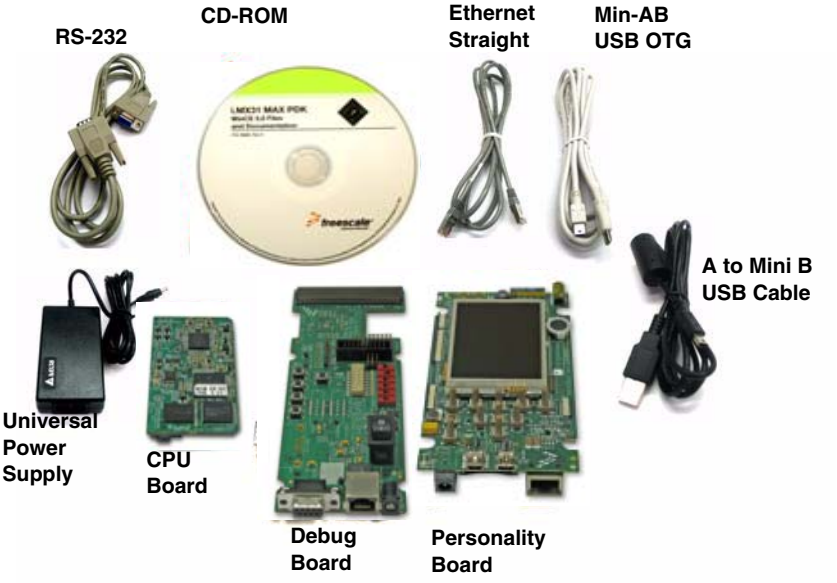
Table 2.1 3-Stack Development Kit Contents

Type	Items
Boards	• CPU board • Debug board • Personality board
Cables	• RS-232 serial cable • Ethernet straight cable • High-speed USB cables with mini AB connectors for OTG • High-speed cable with standard A to mini B connectors • Mini-USB adaptor
Power Supply	• 5.0V/2.4A universal power supply kit
Paperwork	• CD-ROMs: Content CD • End-User License Agreement • Quick Start Guide (this document) • Warranty card • Freescale Support card

Verify that all the items are contained in the package. See Figure 2.1.

Take out the three boards from their anti-static bags and check the boards for any visible damage.

Figure 2.1 PDK Kit Contents



CD-ROM Contents

Table 2.2.identifies the items on the CD-ROM set.

Table 2.2 Development PC Requirements

Type	Requirement
Product Documentation	• 3-Stack Platform Product Brief • Bill of Materials, Schematics, and Gerber files for CPU Board, Personality Board, and Debug Board • 3-Stack Platform Hardware User's Guide • i.MX31 MAX PDK Readme, Linux 2.6.19 • i.MX31 MAX PDK Quick Start Guide, Linux 2.6.19 • i.MX31 MAX PDK Release Notes, Linux 2.6.19 • i.MX31 MAX PDK User's Guide, Linux 2.6.19 • i.MX31 MAX PDK Reference Manual, Linux 2.6.19 • i.MX31 MAX PDK Hello World Application Note, Linux 2.6.19 • Data sheets for the 3-Stack Platform's non-Freescale components • Advanced ToolKit (ATK) User's Guide
Software Development Tools	• Linux Toolchain (included in LTIB distribution) • Linux SDK installation file • Advanced ToolKit (ATK) software

Provide a Development PC

To develop applications using the 3-Stack development kit, you need a PC with the requirements shown in Table 2.3.

Table 2.3 Development PC Requirements

Type	Requirement
Operating System	Linux OS- the following are platforms on which LTIB was tested. • Redhat: 7.3, 8.0, 9.0 • Fedora Core: 1, 2, 3 • Debian: 3.1r0 (stable), unstable • SuSE: 8.2, 9.2, 10.0
Network	• Internet access
PC HW	• 933 MHz Pentium II or later processor; 2 GHz processor recommended • 512 MB of RAM; 1 GB recommended • 1 GB of available space required on system drive • 10 GB of available hard-disk space • DVD ROM drive • 1024x768 or higher resolution display with 256 colors

3

Build the Platform

This chapter explains how to connect the three types of 3-Stack boards (Debug, Personality, CPU) together, to make either a development platform (Personality board + CPU board + Debug board), or a demonstration platform (Personality board + CPU board), and how to connect the 3-Stack platform to your PC. See Figure 3.1.

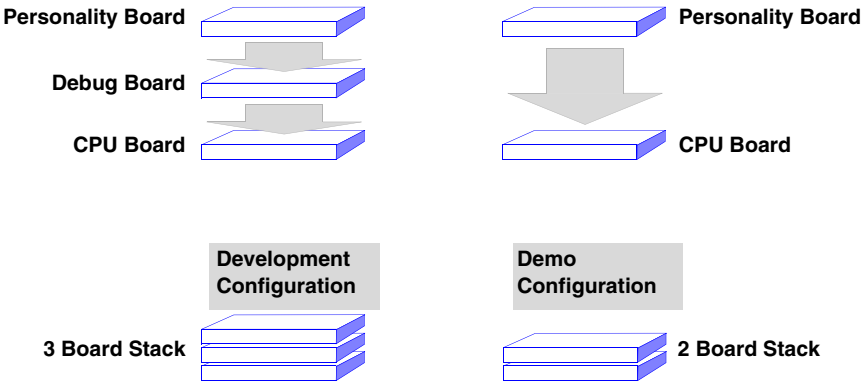


Figure 3.1 3-Stack Platform Configurations

The three 3-Stack boards in your development kit may already be assembled. If the three boards are already assembled, review the procedures in the following sections, and be sure to configure the debug board appropriately.

- To build a development platform, follow the procedures in "Build a Development Platform: Assemble 3 Boards" on page 17.
- To build a demonstration platform, follow the procedures in "Build a Demo Platform: Assemble 2 Boards" on page 21.

Build a Development Platform: Assemble 3 Boards

This section explains how to connect the Personality, Debug, and CPU boards.

Connect Personality Board to Debug Board

The Personality board connects to the Debug board using a 500-pin connector. The connector is keyed to avoid misconnection, so there is only one way to connect these boards. Connect the Personality board to the Debug board. See Figure 3.2.

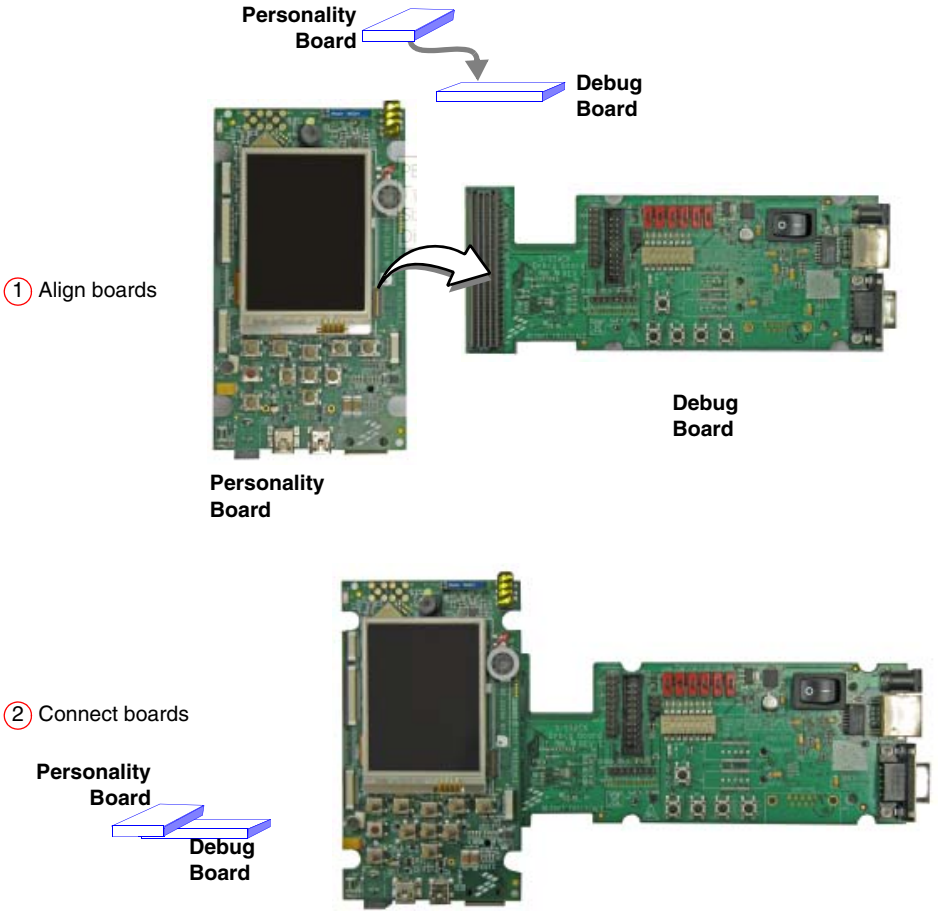


Figure 3.2 Install Personality Board onto Debug Board

Connect CPU Board to Debug Board

After connecting the Personality board to the Debug board, connect the CPU board to the underside of the Debug board.

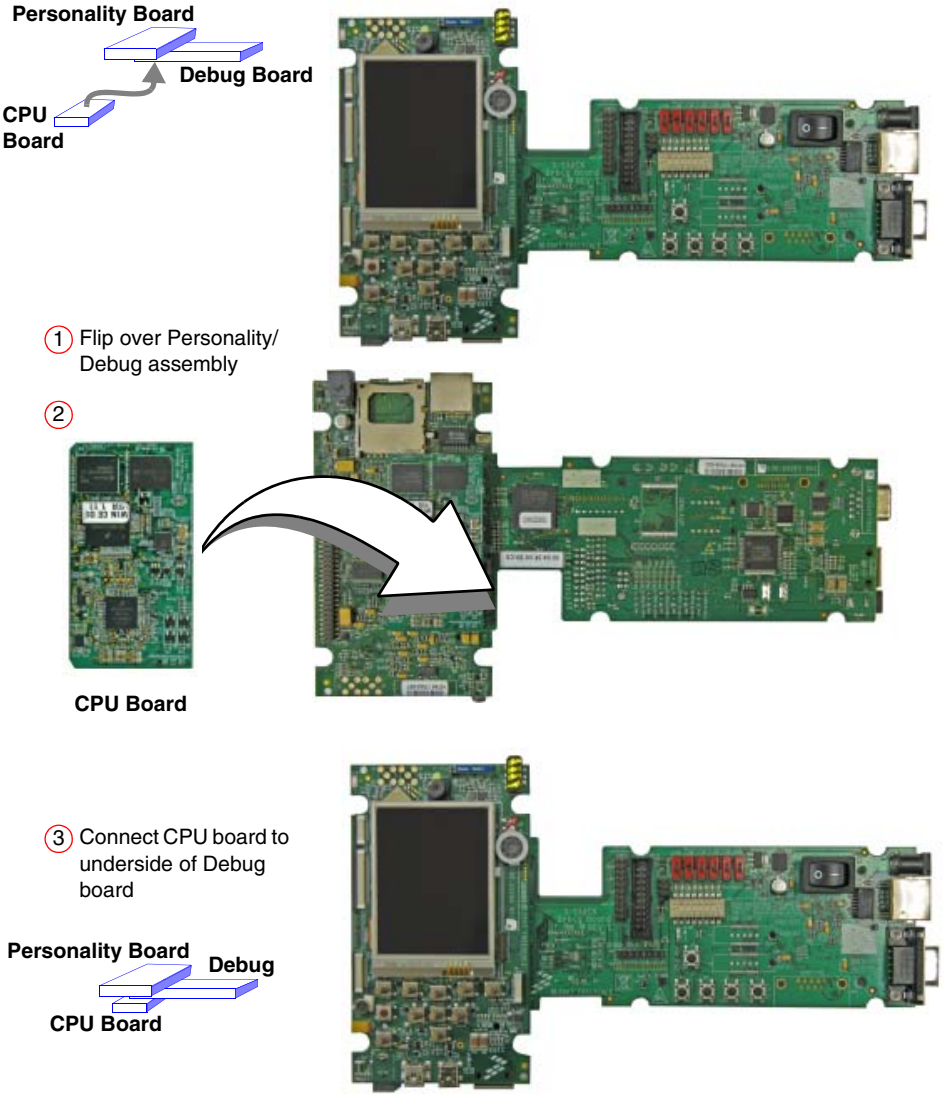


Figure 3.3 Align CPU Board and Debug/Personality Board

Connect Development Platform to PC; Run Preloaded Image

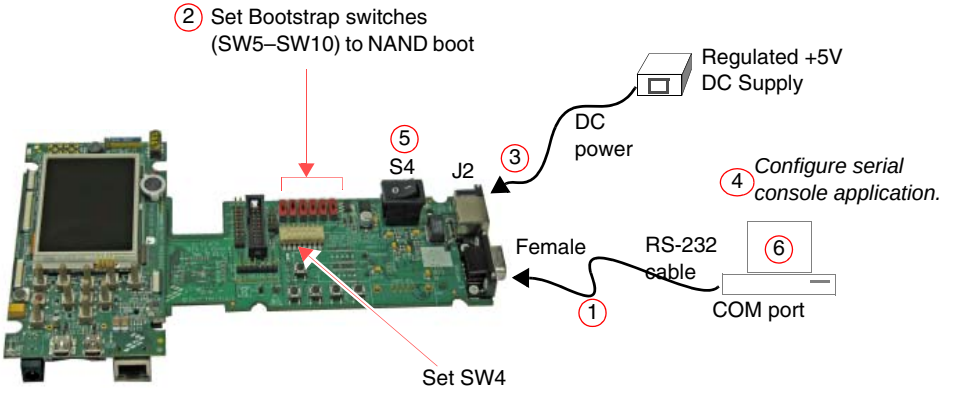


Figure 3.4 Connecting the Platform to your PC

To connect the 3-Stack platform to your host PC:

1. Connect one end of an RS-232 serial cable (included in the kit) to a serial port connector (CON4) on the Debug board and connect the other end to a COM port on the host PC.
    - Configure SW4-1 to ON.
    - Make sure that SW4-8 is ON, to supply power to all three boards.
    - Configure SW4-2 to OFF.
2. Confirm that the Bootstrap switches (SW5–SW10) are set for NAND boot. See Table 3.1.

Table 3.1 Boot Mode Setting (SW5–SW10)

Boot Mode Device	SW5	SW6 (Boot4)	SW7 (Boot3)	SW8	SW9	SW10
UART/USB bootloader	X	0	0	0	0	0
8-bit NAND Flash (2KB page) Ext	X	1	0	0	0	0

3. Connect the regulated 5V power supply to the appropriate power adapter. Plug the power adapter into an electrical outlet and the 5V line connector into the J2 (5V POWER JACK) connector on the Debug board. See Figure 3-5.
4. Start a serial console application on your host PC with the following configuration:

Table 3.2 Serial Console Configuration

Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

5. On the Debug board, switch the power switch (S4) to 1.
6. The OS image pre-loaded in the 3-Stack board will boot and the debug messages from the bootloader should now appear on the serial console application on your PC.

Build a Demo Platform: Assemble 2 Boards

This section explains how to make a demonstration platform using the Personality and CPU boards.

To make a demonstration platform, the CPU board is directly connected to the Personality board using the 500-pin connector; the Debug board is not used.

NOTE If your system is already configured as a development platform (using all three boards), disconnect all boards from one another.

Connect CPU Board to Personality Board

Connect the CPU board to the Personality board. The connector is keyed to avoid misconnections, so there is only one way to connect the CPU board to the Personality board.

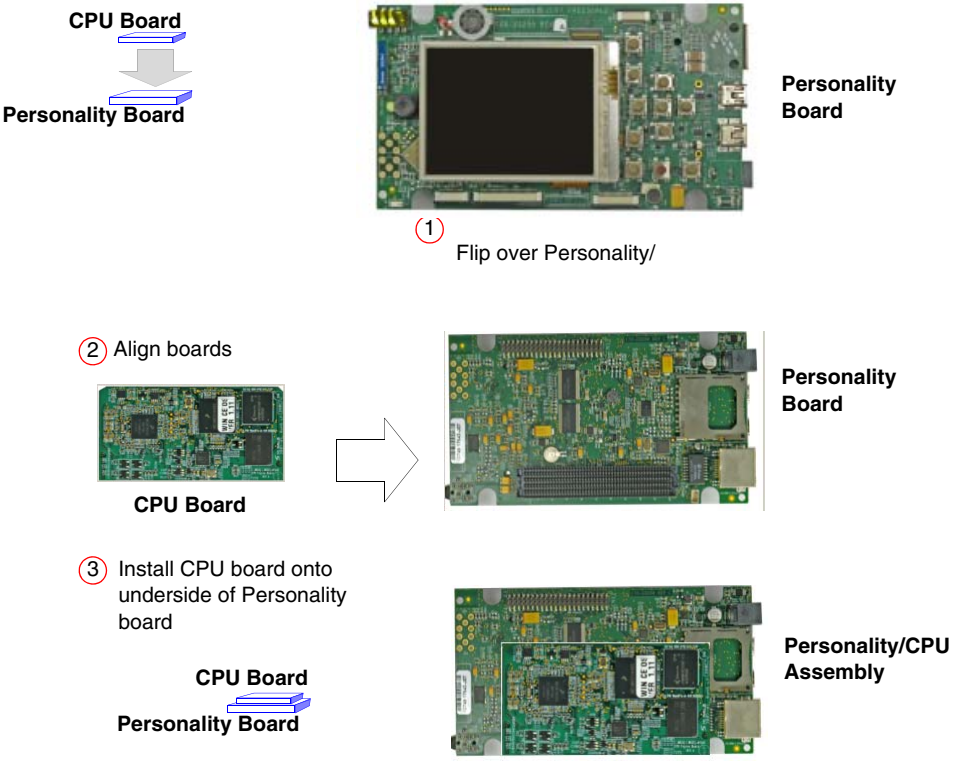


Figure 3.5 Install CPU Board onto Personality Board

Connect Power Supply; Run Preloaded Demo

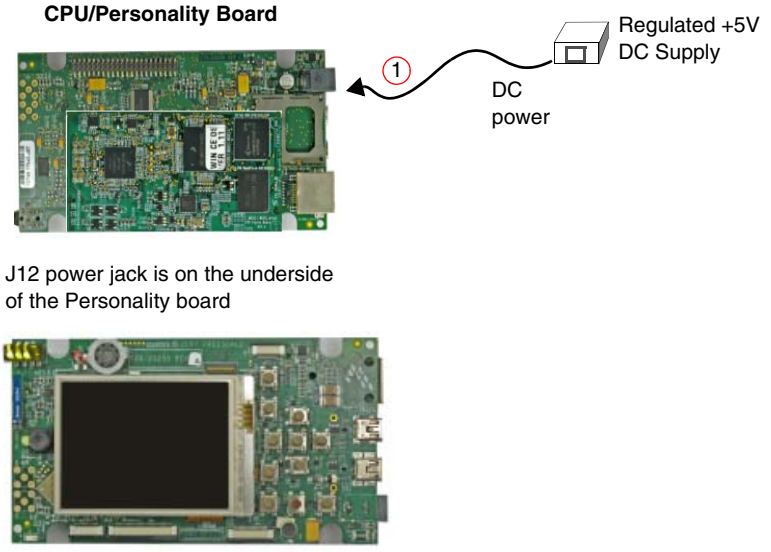


Figure 3.6 Connect Personality Board to Power Supply

1. Connect the regulated 5V power supply to the appropriate power adapter. Plug the 5V line into the J12 (5V POWER JACK) connector on the Personality board. See Figure 3.6. Turn the 5V power supply ON.
2. The OS image pre-loaded in the 3-Stack should boot and the Linux operating system should appear at the Personality board's LCD display.

4

Using the Linux Demo Image

After you have assembled the 3-Stack board and powered it up, the Linux image that was loaded to the board will boot up. The first image you will see is the menu for Multimedia Applications.

Linux Menus

There are three important menus for our use: Multimedia Applications, Connectivity, and Settings.

Multimedia Applications Menu

The Multimedia applications menu contains the following options:

- Audio Player
- Video Player
- Picture Viewer
- Camera Application
- FM Radio Application

Connectivity Menu

The Connectivity menu contains the following options:

- USB OTG Port

Settings Menu

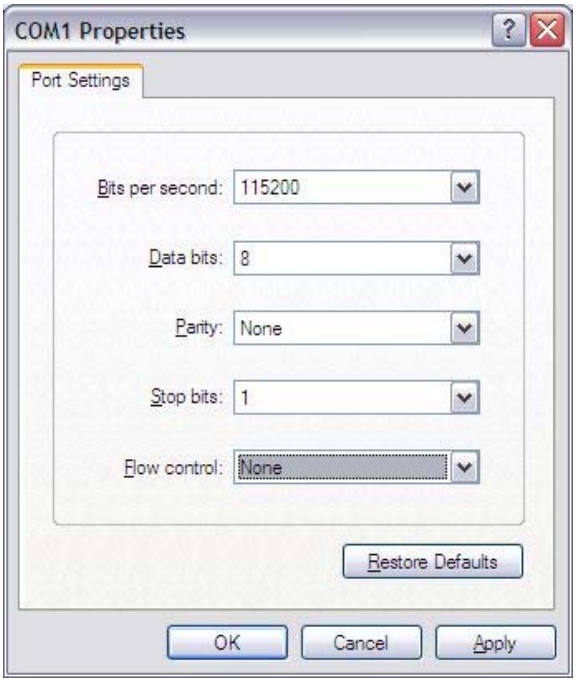
The Settings menu provides options for changing the appearance, language settings, and volume and display settings, as well as other tools.

Downloading Multimedia to the 3-Stack Board

Downloading the multimedia content to the 3-Stack board requires the following items:

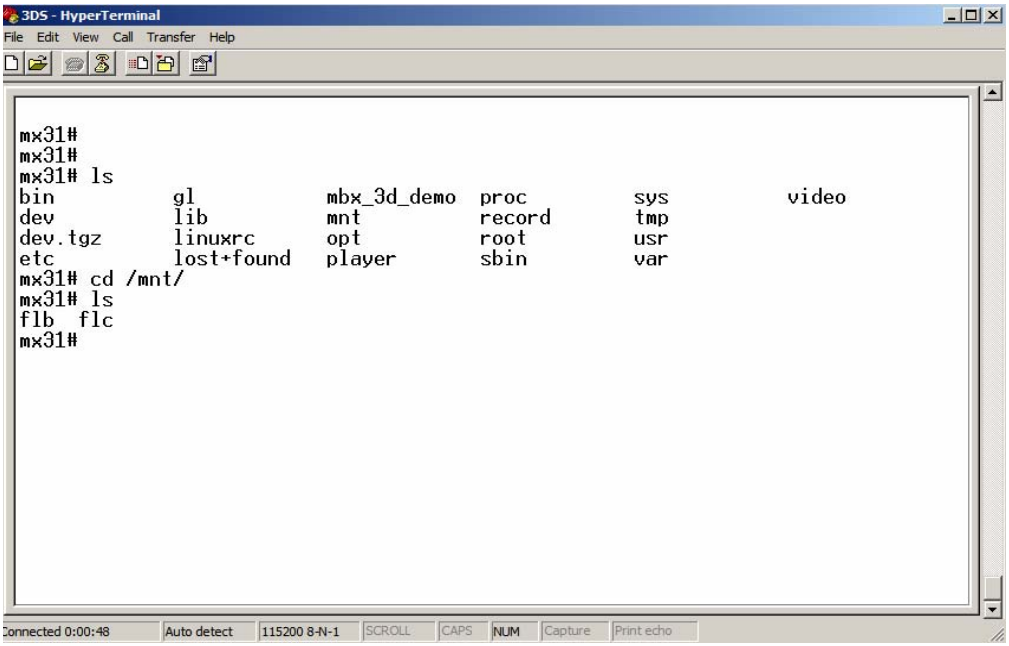
- An SD card -After the SD card is plugged in, you may load the multimedia files from a PC if the USB Mass Storage Application is launched.
- (Optional) the USBS Mass Storage Application
- A serial connection between the board and the PC (HyperTerminal software can be used). Figure 4-1 shows the configuration for HyperTerminal software. After communication is established, you can view the Linux directories using standard Linux commands. Figure 4-2 illustrates the resulting display on the HyperTerminal.

Figure 4.1 Configuration for HyperTerminal



Select "Yes" and click Next

Figure 4.2 HyperTerminal Display



Using an SD Card

If you have an SD Card with pictures or other multimedia content, you may use the 3-Stack Board to view its content.

To use the SD Card, follow these steps:

1. Insert the SD Card in the SD Card slot, which is located in the lower part of the personality board, just below the USB connectors.

   The system displays an SD card image in the left side of the display, and mounts the card in the /mnt/mmcblk0p1 folder. If the mmcblk0p1 folder is not there, then the card may not have the correct format. If so, then enter the following command:

   mx31#fsdisk /dev/mmcblk

   - For **partition**, use the **n** command.
   - For **type** (extended or primary), use **p** for primary.
   - Accept the default options provided by the prompt.
   - To save the changes, apply **w**.

   The SD card will now be mounted in /mnt.

2. Notice the multimedia file locations. By default, the multimedia files are stored in the /mnt/flc/directory. There are three folders: one for pictures, one for music and one for video.

   - mx31#cp /mnt/<sd_card/picture_file> /mnt/flc/Pictures
   - mx31#cp /mnt/<sd_card/audio_file> /mnt/flc/Music
   - mx31#cp /mnt/<sd_card/video_file> /mnt/flc/Video

3. Copy the content on the SD card to those folders, storing the picture files to the Pictures folder, audio files to the Music folder, and video files to the Video folder.

   The files are now visible to the multimedia applications.

Using a USB Mass Storage Application

If the SD card is plugged and detected by the system, then you can run the USB Mass Storage application, which allows the system to be seen by a PC as an external hard disk driver that contains the content stored on the SD card.

This allows you to transfer information from the PC to the system and from the system to the PC.

The information transferred from the PC to the system is stored on the SD card. You can send multimedia files from the PC to the system, store them in the SD card, and then copy them to the /mnt/flc directories

To use a USB mass storage application, follow these steps:

1. Make sure the SD card is plugged in and detected.
2. Connect a B-type to mini-AB cable from the USB mini-AB port (which is the OTG port in the Personality board), to a USB port in the PC.
3. Select the Mass Storage mode.
4. Click on the **Launch** button.

   The application is launched, and the PC will detect an external mass storage device. Typically, the drive is seen as Drive F. Now the system can load information to this drive as if it were a regular mass storage device.

   After the files are stored in the SD card, repeat the steps in the previous section, Using an SD Card, to make the files visible to the Multimedia applications.

Running the Applications

Now that the system contains the multimedia files, you can run the applications. First, see "Supported Codecs" for a description of the software packages supported by the system.

Running the Video Application

The Video application enables you to view video files.

To use the Video application, follow these steps:

1. In the Multimedia Menu, select the VideoPlayer application.
2. Click on the arrow that is located in the top of the display in the right corner (near the cross button).

   A menu displays video options such as **Open File**, **Playlist**, and **About.**
3. Select **Open File**.

   The /mnt/flc/Video folder is displayed, listing the files previously saved.

4. Select one file and click **Select**.

   The file and reproduction open, providing options to stop, seek, forward, pause, increase the volume or even play the file in full screen.

Running the Audio Application

The Audio application enables you to listen to music and manage the music files.

To use the Audio application, follow these steps:

1. In the Multimedia Menu, select the Audio Player application.
2. Click on the arrow that is located in the top of the display in the right corner (near the cross button).

   A menu displays video options such as **Open File**, **Playlist**, and **About.**
3. Select **Open File**.

   The /mnt/flc/Music folder is displayed, listing the files previously saved.
4. Select one file and click **Select**.

   The file and reproduction open, providing options to stop, seek, forward, pause, or increase the volume.

Running the Picture Viewer Application

The Picture Viewer application enables you to view and modify the view of images.

To use the Picture Viewer application, follow these steps:

1. In the Multimedia Menu, select the Picture Viewer application.
2. Select the Picture Viewer Application

   The /mnt/flc/Pictures folder is displayed, showing the files previously saved. Click on a picture to view it.
3. When a picture is selected, options are displayed to manage the image, such as zoom in or zoom out, change picture (to the previous or next image), rotate the picture, and view it full screen.

   The next time the system is turned on, the files in the /mnt/flc directories will remain, and you will not need to use the Debug board unless you want to add files.

Running the Camera Application

The Camera application reflects in the display panel the image to which the camera on the board is pointing.

Running the FM Radio Application

The FM Radio application enables you to search and listen to FM radio stations. Search functions include an automatic mode for seeking selected stations and a manual mode for searching for all available stations.

To use the FM Radio application, follow these steps:

1. In the Multimedia Menu, select the FM Radio application.
2. Use the selection control to select a station and the volume control to set the volume.
3. Connect headphones to the board and put on the headphones to listen.

Supported Codecs

Table 4-1 describes the supported video and audio codecs.

Table 4.1 Supported Codecs

Plugin	Description	Features
mfw_mp3decoder	MPEG Layer 3 decoder	Play, Pause, Stop, Seek, metadata query
mfw_wmadecoder	WMA7, WMA8, WMA9 decoder Does not support wma pro and lossless decoders	Play, Pause, Stop, Seek, metadata query
mfw_aacdecoder	AAC LC decoder Does not support standalone seek in aac files with the adif format.	Play, Pause, Stop, Seek, metadata query
mfw_h264decoder	H264 baseline decoder	Play, Pause, Stop, Seek, metadata query
mfw_mpeg4decoder	MPEG-4/H263 simple profile decoder	Play, Pause, Stop, metadata query
mfw_avidemuxer	.avi Parser (H264 + MP3, MPEG-4 + MP3, DIVX + MP3)	Play, Pause, Stop, Seek, metadata query
mfw_asfdemuxer	.asf Parser (wma + wmv)	Play, Pause, Stop, Seek, metadata query
mfw_mp4demuxer	.mp4 parser (H264 + AAC, H264 + MP3, MPEG-4 + MP3)	Play, Pause, Stop, Seek, metadata query
mfw_v4lsink	video YUV420 rendering plugin	CSC, rotate, resize
mfw_mpeg4encoder	MPEG-4/H263 encoder	encode only
mp3enc	MPEG Layer 3 encoder	encode only
V4lsrc	Video capture plugin	

Ready to Begin Your Development?

If you are ready to develop new applications using the i.MX31 MAX PDK, use the following documents to locate the information required for your development:

- *i.MX31 3-Stack Platform Hardware User's Guide* - provides all of the hardware information for the 3-Stack board, including the connectors, switches, options, and pins.
- *i.MX31 3-Stack SDK1.2 Release Notes for Linux* - provides the tools needed to use the SDK, including the SDK driver availability, and known errors.
- *SDK1.2 User's Guide for Linux* - explains how to build and modify a Linux image and deploy the image to the 3-Stack board.
- *SDK1.2 Reference Manual for Linux* - provides detailed information about the Linux BSP drivers, including functional information, dependencies, and building options for each driver.
- *i.MX31 3-Stack SDK1.2 Application Note* - explains how to create a simple Hello World application using the LTIB environment from the Linux Package.

For additional information, please use the support information enclosed in your package.

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