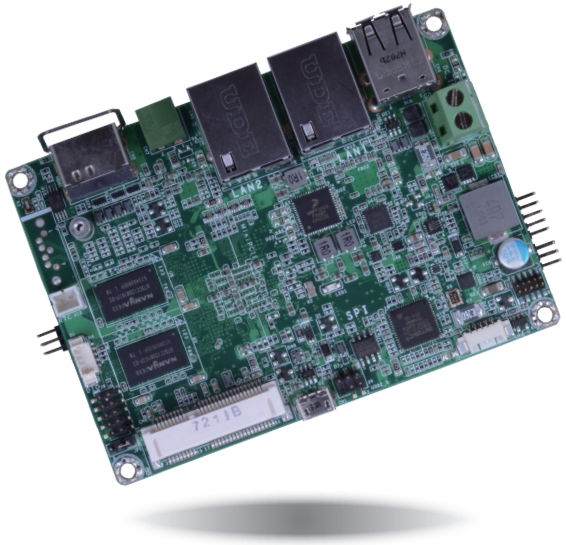
DFI



FS053

Embedded SBC 2.5”

User’s Manual

A-459-M-2019

Copyright

Trademarks

FCC and DOC Statement on Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

Notice:

1. The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Shielded interface cables must be used in order to comply with the emission limits.

Table of Contents

Warranty

1. Warranty does not cover damages or failures that arised from misuse of the product, inability to use the product, unauthorized replacement or alteration of components and product specifications.

2. The warranty is void if the product has been subjected to physical abuse, improper installation, modification, accidents or unauthorized repair of the product.

3. Unless otherwise instructed in this user's manual, the user may not, under any circumstances, attempt to perform service, adjustments or repairs on the product, whether in or out of warranty. It must be returned to the purchase point, factory or authorized service agency for all such work.

4. We will not be liable for any indirect, special, incidental or consequential damages to the product that has been modified or altered.

Static Electricity Precautions

It is quite easy to inadvertently damage your PC, system board, components or devices even before installing them in your system unit. Static electrical discharge can damage computer components without causing any signs of physical damage. You must take extra care in handling them to ensure against electrostatic build-up.

1. To prevent electrostatic build-up, leave the system board in its anti-static bag until you are ready to install it.

2. Wear an antistatic wrist strap.

3. Do all preparation work on a static-free surface.

4. Hold the device only by its edges. Be careful not to touch any of the components, contacts or connections.

5. Avoid touching the pins or contacts on all modules and connectors. Hold modules or connectors by their ends.

Important:
Electrostatic discharge (ESD) can damage your processor, disk drive and other components. Perform the upgrade instruction procedures described at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

Safety Measures

To avoid damage to the system:
- Use the correct AC input voltage range.

To reduce the risk of electric shock:
- Unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging the power cord.

About the Package

The package contains the following items. If any of these items are missing or damaged, please contact your dealer or sales representative for assistance.

- One FS053 board
- One terminal block for RS485
- One heat spreader (Height: 11mm)

Optional Items

- USB 2.0 port cable (Length: 200mm, 1 x USB port)
- COM cable (Length: 250mm, 1 x COM port)
- Power cable for SATA and LCD backlight (Length: 155mm)
- Heat sink (Height: 16.8mm)

The board and accessories in the package may not come similar to the information listed above. This may differ in accordance to the sales region or models in which it was sold. For more information about the standard package in your region, please contact your dealer or sales representative.

Before Using the System Board

Before using the system board, prepare basic system components.
If you are installing the system board in a new system, you will need at least the following internal components.

- Storage devices such as a SD card and hard disk drives, etc.

You will also need external system peripherals you intend to use which will normally include at least a keyboard, a mouse and a video display monitor.

Chapter 1 - Introduction

Specifications

SYSTEM	Processor	NXP i.MX6 Cortex-A9 Dual Lite, 1.0 GHz NXP i.MX6 Cortex-A9 Quad, 1.0 GHz
	Memory	1GB/2GB SDRAM Memory Down Single Channel DDR3L 1600MHz
	Flash	4MB NOR Flash
GRAPHICS	Display	1 x HDMI 1 x LVDS HDMI: resolution up to 1920x1080 @ 60Hz LVDS: single channel, resolution up to 1366x768 @ 60Hz
	Single/Dual Displays	Yocto: HDMI or LVDS (default) Android: HDMI + LVDS (available upon request)
EXPANSION	Interface	1 x Full-size Mini PCIe (PCIe/USB)
ETHERNET	Controller	1 x ATHEROS AR8033 Ethernet (10/100/1000Mbps) 1 x LAN7500 Ethernet (10/100/1000Mbps)
REAR I/O	Ethernet	2 x GbE (RJ-45)
	Serial	1 x RS-485 (2-wire)
	USB	2 x USB 2.0
	Display	1 x HDMI
Front I/O	USB	1 x USB 2.0 OTG Port
INTERNAL I/O	Serial	1 x RS-232/422/485 (8-wire)
	USB	1 x USB 2.0
	Display	1 x LVDS LCD Panel Connector
	SATA	1 x SATA 2.0 (up to 3Gb/s) (Quad processor only)
	eMMC	Supports 8GB, 16GB and 32GB eMMC onboard
	SD	1 x Micro SD Slot
	DIO	1 x 8-bit DIO
WATCHDOG TIMER	Output & Interval	System Reset, Programmable via Software from 1 to 255 Seconds

POWER	Type	9~36V DC
	Connector	Terminal block (2-pin)
	Consumption	Typical: 12V @ 0.355A (4.26Watt) Max.: 12V @ 0.631A (7.58Watt)
OS SUPPORT		Yocto (1.8, default preloaded on eMMC) Android (5.1.1)
ENVIRONMENT	Temperature	Operating: 0 to 60°C / -20 to 70°C Storage: -40 to 85°C
	Humidity	Operating: 5 to 95% RH Storage: 5 to 95% RH
MECHANICAL	Dimensions	2.5" Pico-ITX Form Factor 100mm (3.94") x 72mm (2.83")
	Height	PCB: 1.6mm Top Side: 16.15mm, Bottom Side: 4mm
CERTIFICATIONS		CE, FCC, RoHS

Features

• DDR3L

DDR3L requires less voltage (1.35V) than DDR3 (1.5V). DDR3L SDRAM modules support 1600MHz for DDR modules.

• Storage

The board features microSD card and eMMC memory for storing system firmware. And with the i.MX6 Quad processor, an additional Serial ATA 2.0 port is provided for storing system and user data.

• Gigabit LAN

The Ethernet LANs are built around the Atheros AR8033 Ethernet controller (10/100/1000Mbps) and LAN7500 Ethernet controller (10/100/1000Mbps).

• Power Failure Recovery

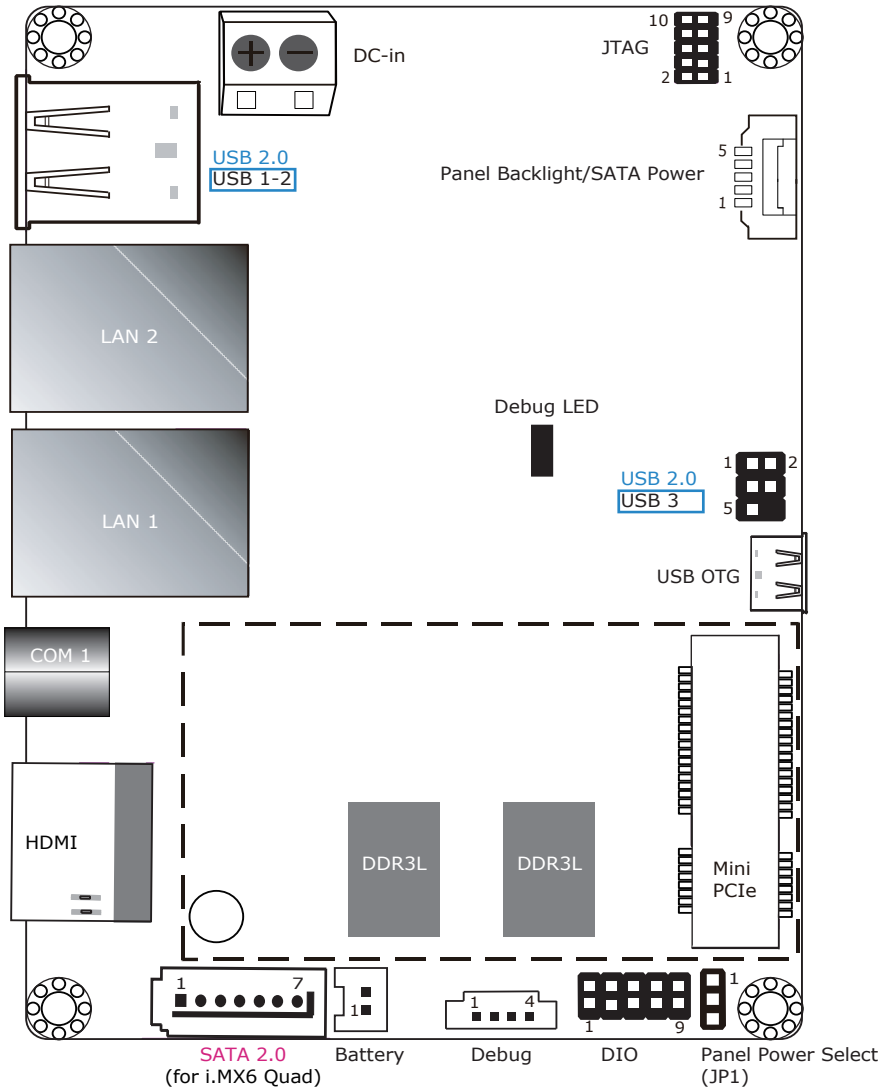
When power returns after an AC power failure, the system will power on automatically.

• USB

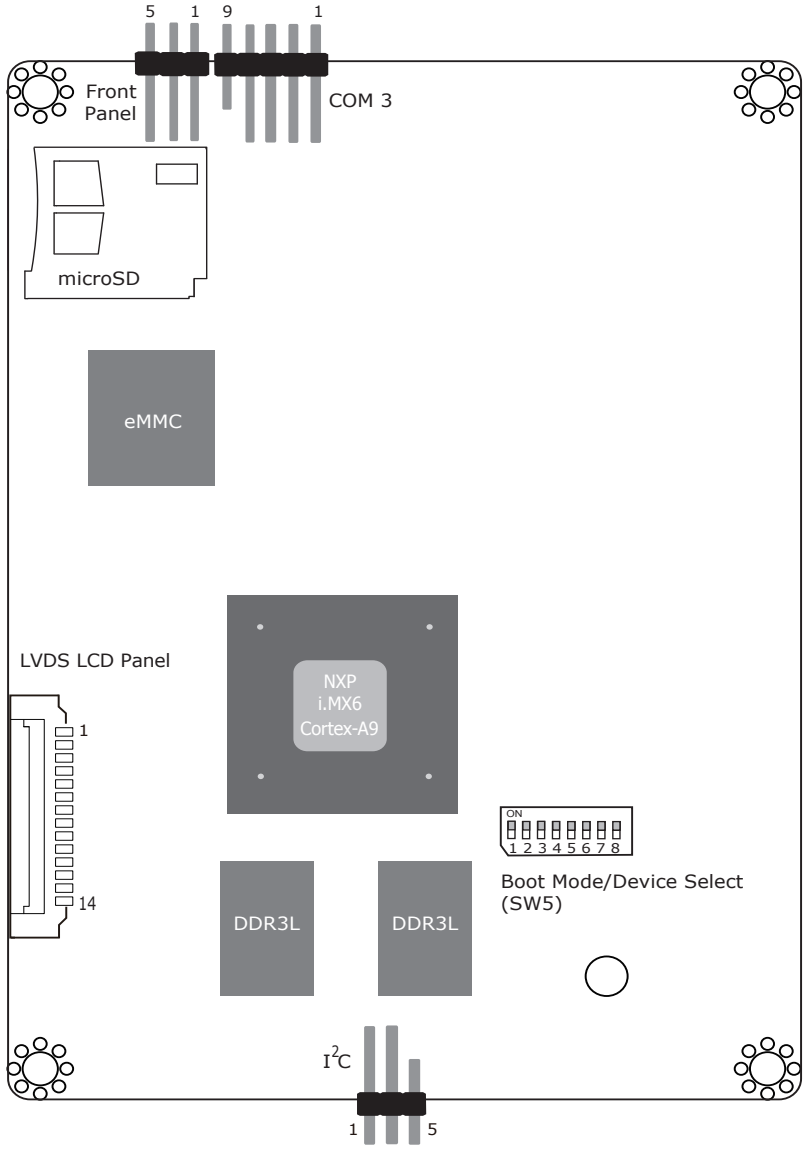
The system board supports the USB 2.0 to provide two USB host Type-A ports, one USB OTG port and one internal pin header for one additional USB port.

Chapter 2 - Hardware Installation

Board Layout

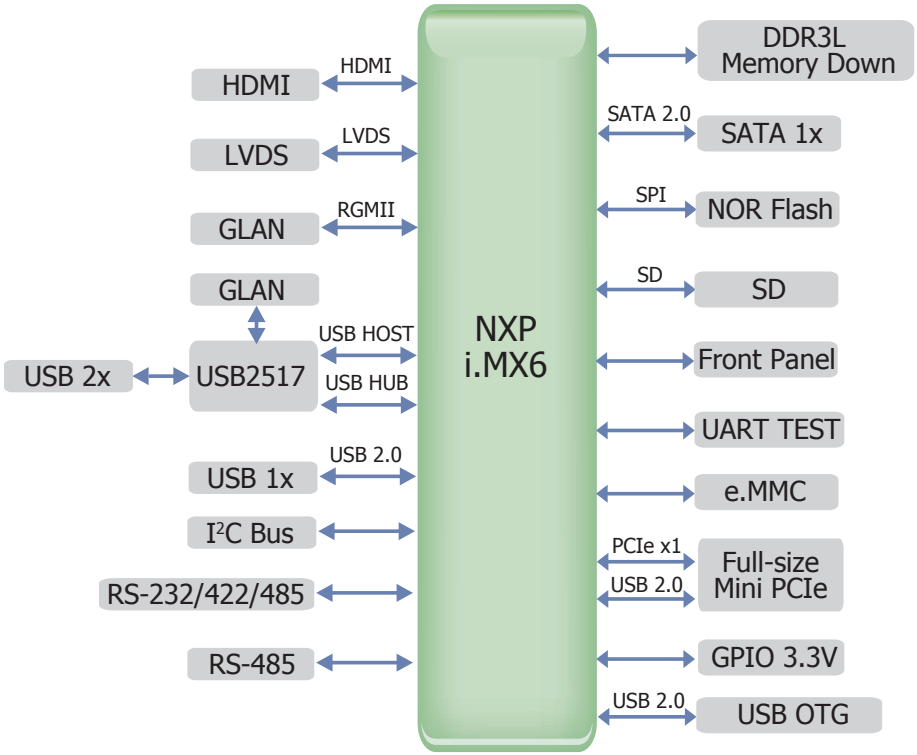


Top View

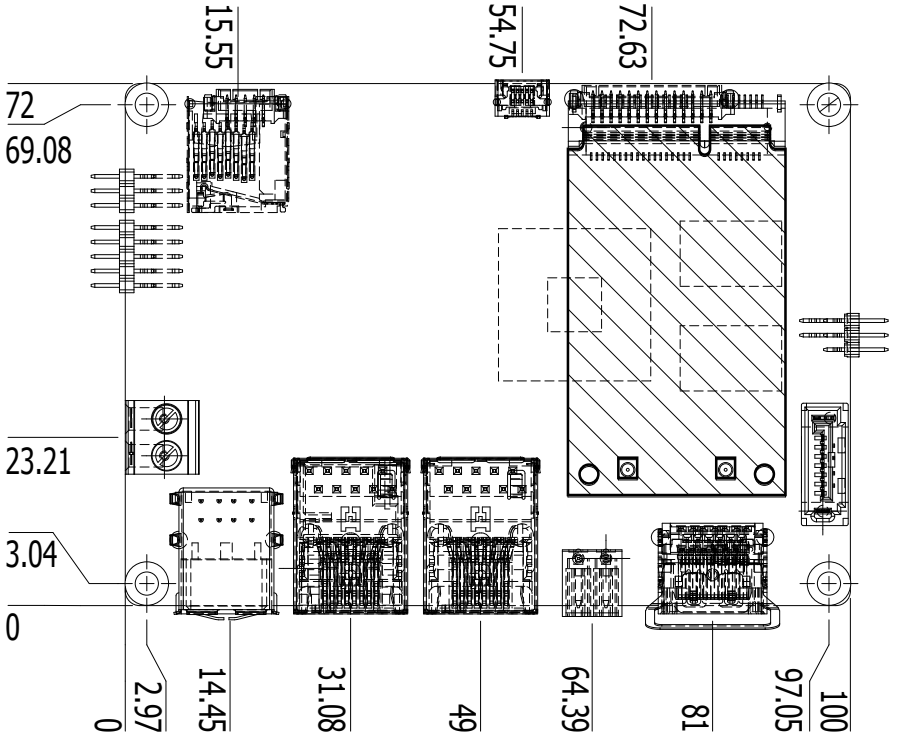


Bottom View

Block Diagram



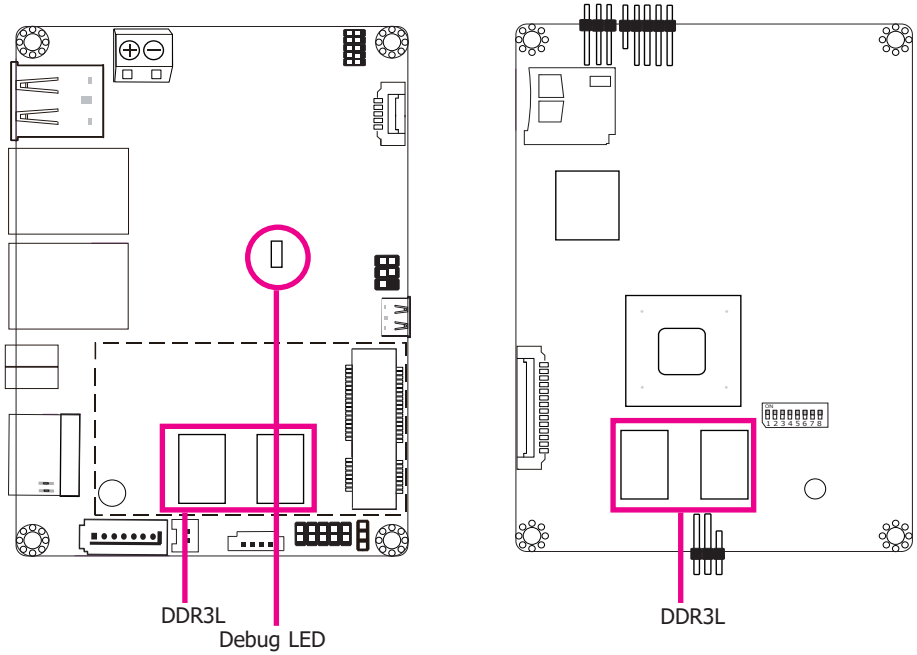
Mechanical Drawing



Important:
Electrostatic discharge (ESD) can damage your board, processor, disk drives, add-in boards, and other components. Perform installation procedures at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

System Memory

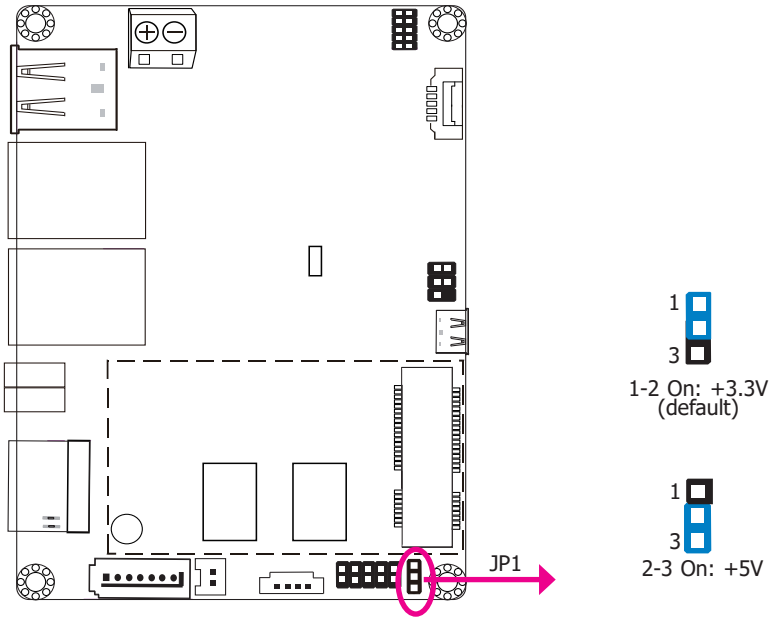
Important:
The Debug LED lights red until the operating system is being accessed. Power-off the PC then unplug the power cord prior to installing any devices. Failure to do so will cause severe damage to the motherboard and components.



Features

- 1GB/2GB SDRAM Memory Down
- Single Channel DDR3L 1600MHz

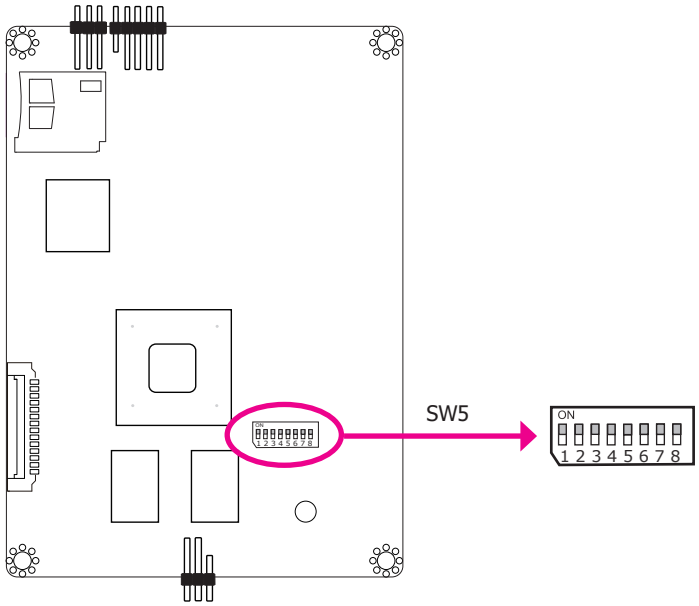
Jumper Settings
Panel Power Select



JP1 is used to select the power supplied with the LCD panel.

Important:
Before powering-on the system, make sure that the power settings of JP1 match the LCD panel's specification. Selecting the incorrect voltage will seriously damage the LCD panel.

Boot Mode/Device Select



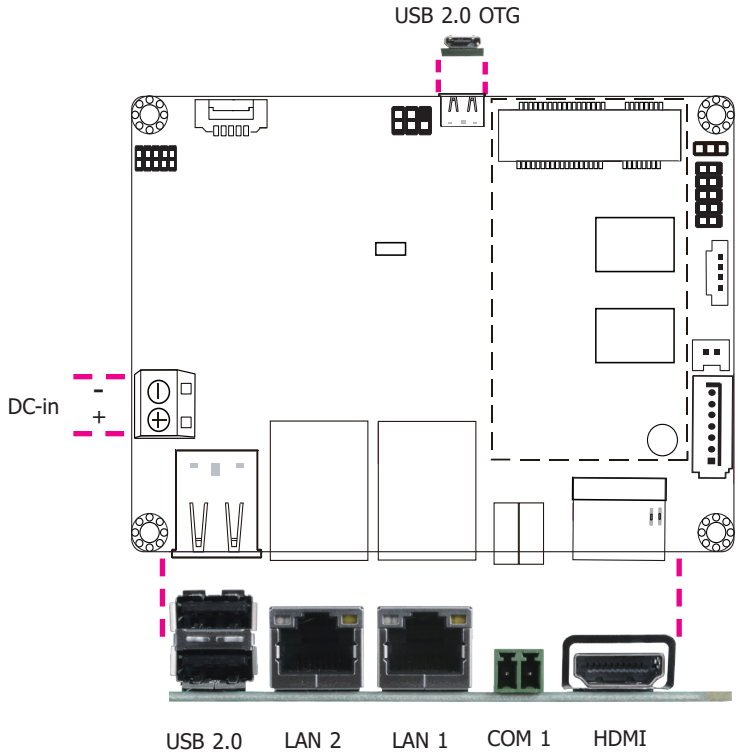
Note:
Based on different board versions, i.e. Rev. A and Rev. B, the boot device may be pre-configured differently. Please refer to Appendix A for a thorough comparison.

To select the boot mode and boot device, please use finger switch SW5.

Boot Mode Select	**SW5**
Boot from the fuses	7 Off, 8 Off
Serial downloader	7 On, 8 Off
Boot from the board settings (default)	7 Off, 8 On
Reserved	7 On, 8 On

Boot Device Select	SW5							
	1	2	3	4	5	6	7	8
eMMC Note	On	On	Off	Off	On	On	Off	On
SPI Note	xx	xx	xx	On	On	Off	Off	On
SD	On	Off	On	Off	Off	On	Off	On

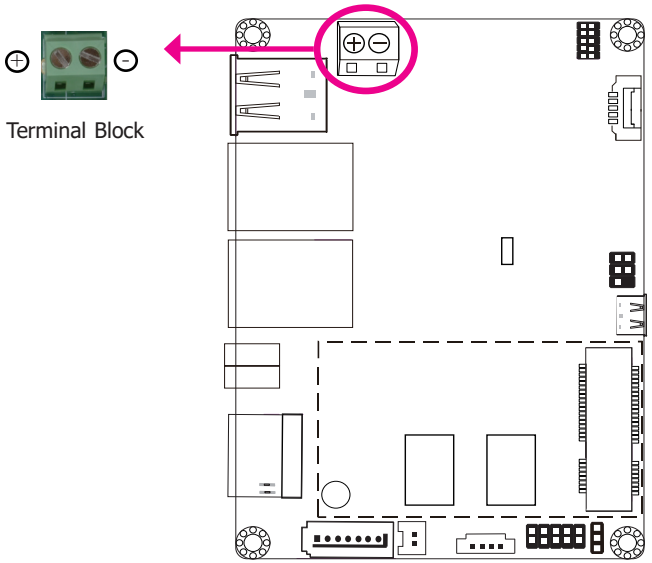
Rear Panel I/O Ports



The rear I/O ports consist of the following:

- 1 9~36V DC-in 2-pin terminal block
- 2 USB 2.0 ports
- 2 LAN ports
- 1 serial (RS-485) port
- 1 HDMI port
- 1 USB 2.0 OTG port

9~36V DC-in

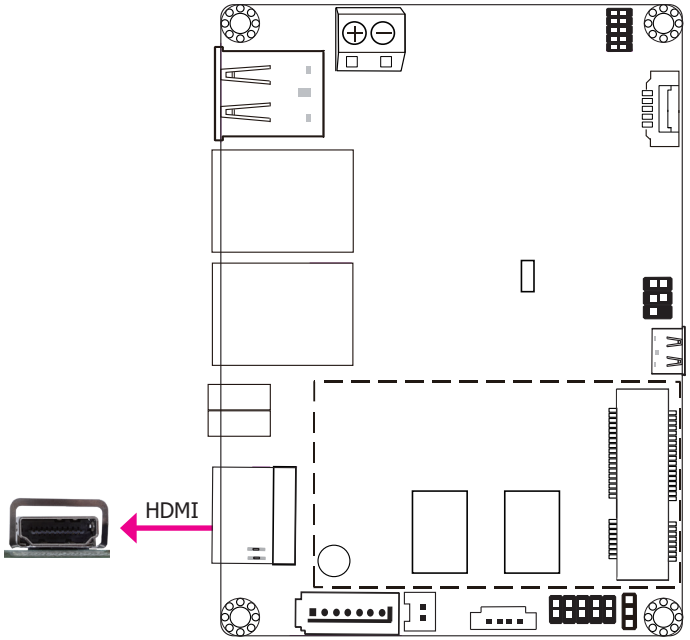


This 2-pin terminal block is considered a low power solution. Connect a DC power cord to this terminal block. Using a voltage more than the recommended range may fail to boot the system or cause damage to the system board.

Graphics Interface

The display port consists of the following:

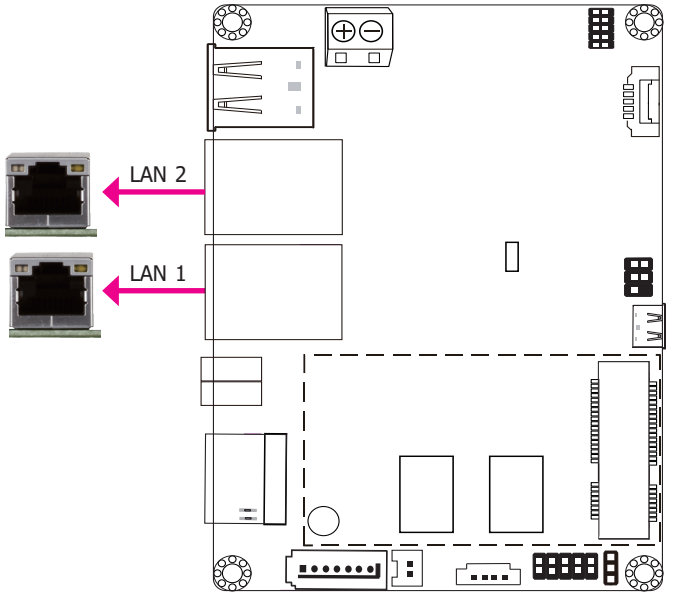
- 1 HDMI port



HDMI Port

The HDMI port carries video signals and is used to connect a LCD monitor or a digital TV that has a HDMI port.

RJ45 LAN Ports

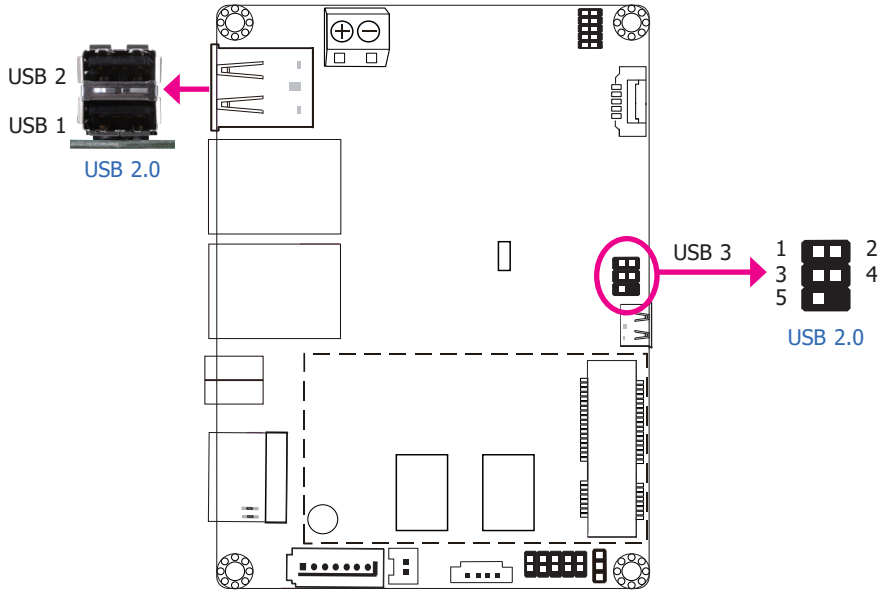


Features

- 1 Atheros AR8033 Ethernet controller (10/100/1000Mbps)
- 1 LAN7500 Ethernet controller (10/100/1000Mbps)

The LAN ports enable the system board to connect to a local area network with a network hub.

USB Ports

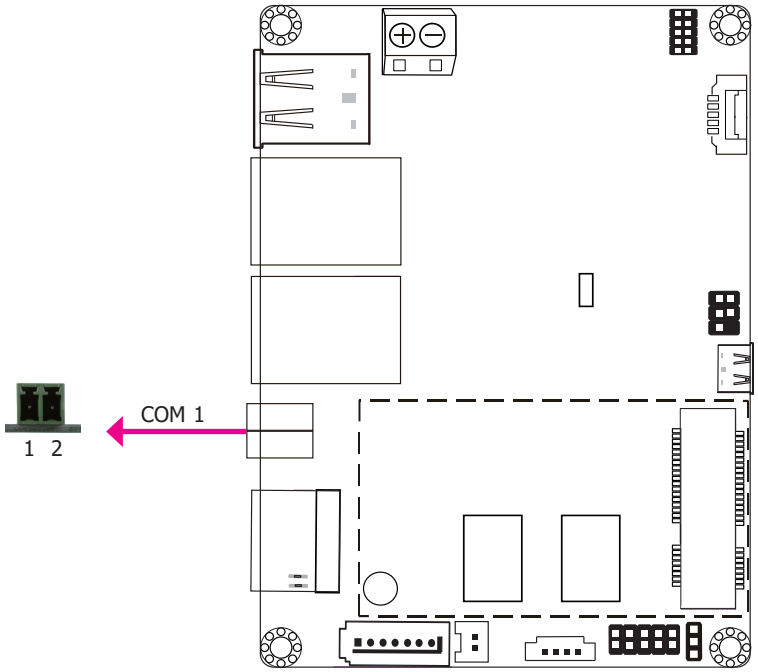


The USB device allows data exchange between your computer and a wide range of simultaneously accessible external Plug and Play peripherals.

The system board is equipped with 2 onboard USB 2.0 ports (USB 1-2). The 6-pin connector allows you to connect 1 additional USB 2.0 port (USB 3). The additional USB port may be mounted on a card-edge bracket. Install the card-edge bracket to an available slot at the rear of the system chassis and then insert the USB port cables to a connector.

Pin	Pin Name
1	5V
2	Data-
3	Data+
4	GND
5	NC

Serial Port

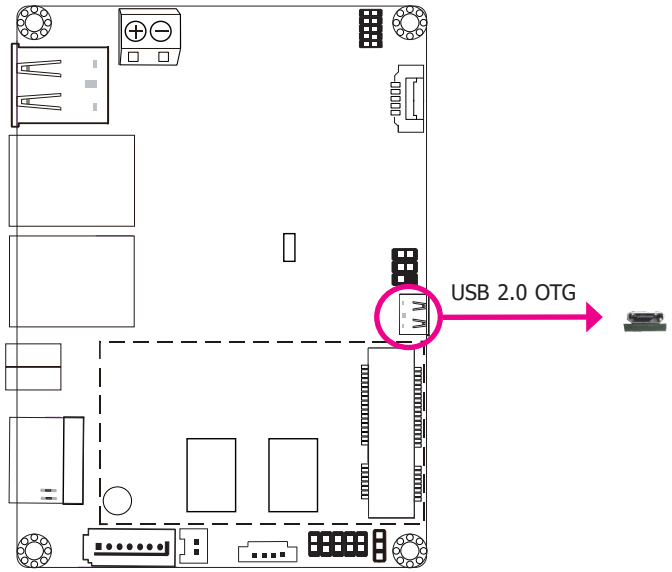


The serial port provides 2-wire RS485 communication with support of auto flow control.

Pin	Pin Name	Pin	Pin Name
1	RS485-	2	RS485+

Front Panel I/O Connectors

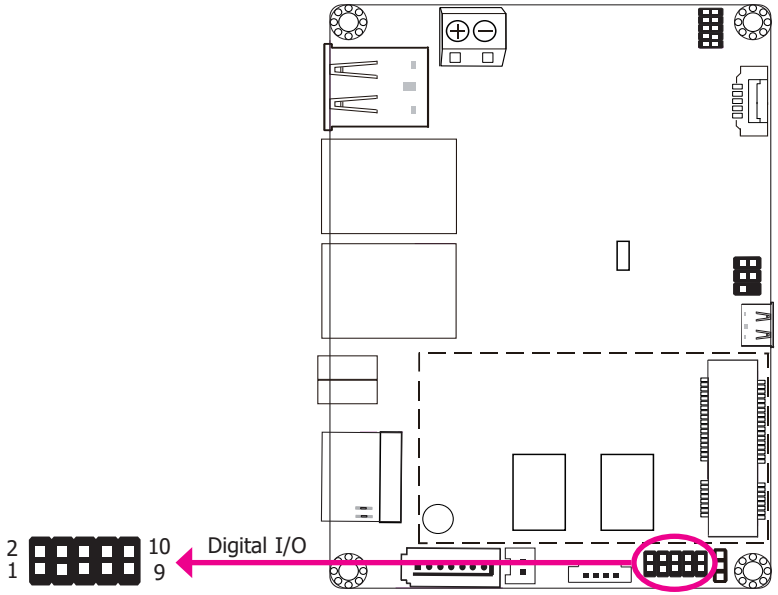
USB 2.0 OTG Port



The USB 2.0 OTG port is used for USB communication.

Internal I/O Connectors

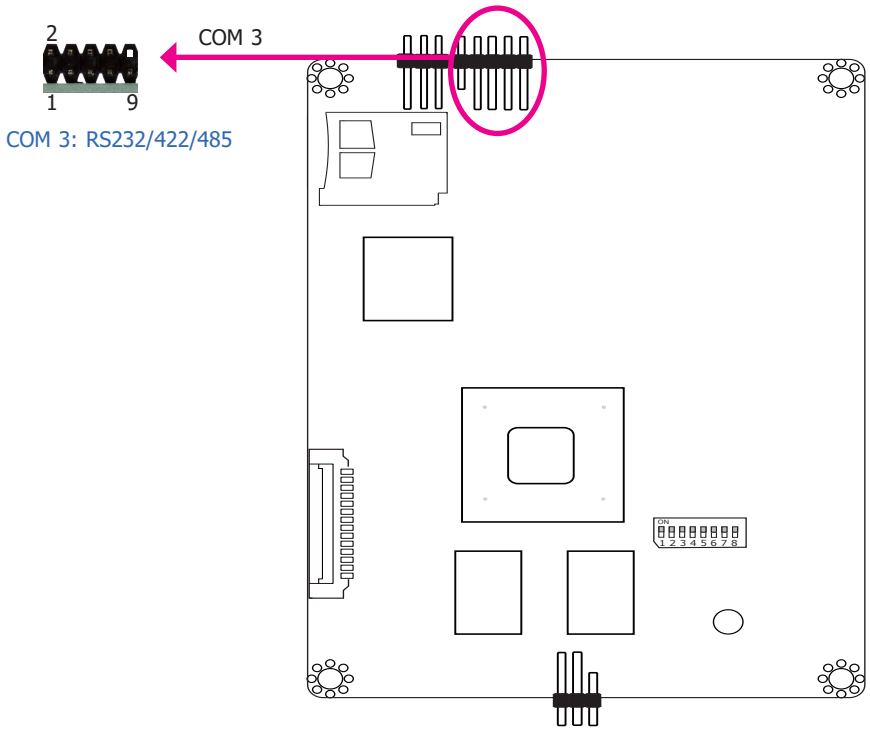
Digital I/O Connector



The Digital I/O connector supports 8-bit digital input/output signals to provide powering-on function of the connected devices.

Pin	Pin Name
1	GPIO7
2	GPIO6
3	GPIO5
4	GPIO4
5	GPIO3
6	GPIO2
7	GPIO1
8	GPIO0
9	3.3V
10	GND

COM (Serial) Port

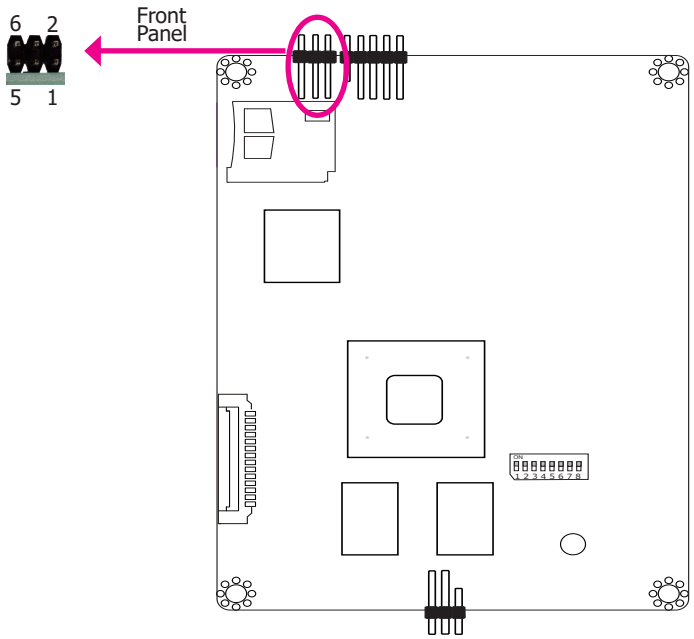


Pin	RS-232	RS-422	RS-485
1	DCD	TX-	DATA-
2	DSR	NC	NC
3	SIN	TX+	DATA+
4	RTS	NC	NC
5	SO	RX+	NC
6	CTS	NC	NC
7	DTR	RX-	NC
8	RI	NC	NC
9	GND	GND	GND

COM 3 can be selected among RS232, RS422 and RS485. RS485 communication supports auto flow control.

The serial port is asynchronous communication ports with 16C550A-compatible UARTs that can be used with modems, serial printers, remote display terminals, and other serial devices.

Front Panel Connector



Reset Button

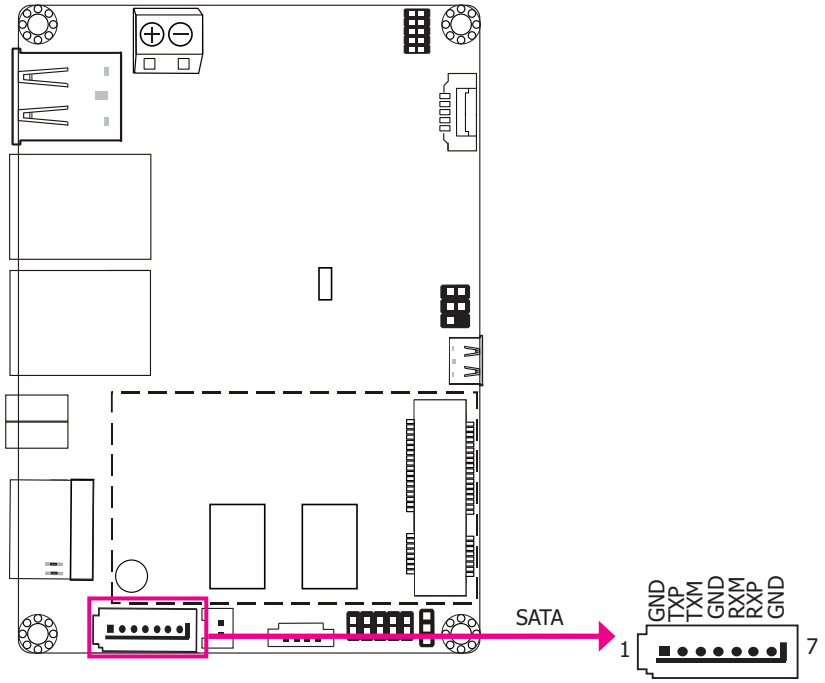
This switch allows you to reboot without having to power off the system.

Power_LED

This LED indiates power status.

Pin	Pin Name	Pin	Pin Name
1	Power Button	2	Power LED
3	GND	4	Standby LED
5	Reset Button	6	Lid Button

SATA (Serial ATA) Connector (for i.MX6 Quad only)

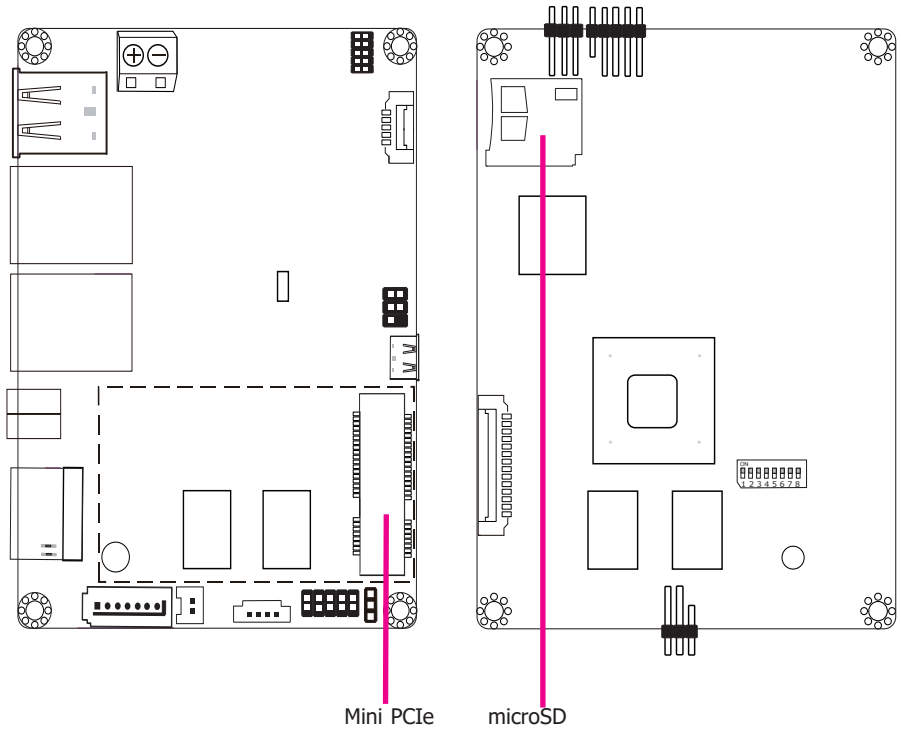


Features

- 1 Serial ATA 2.0 port with data transfer rate up to 3Gb/s

The Serial ATA connector is used to connect the Serial ATA device. Connect one end of the Serial ATA data cable to a SATA connector and the other end to your Serial ATA device.

Expansion Slots



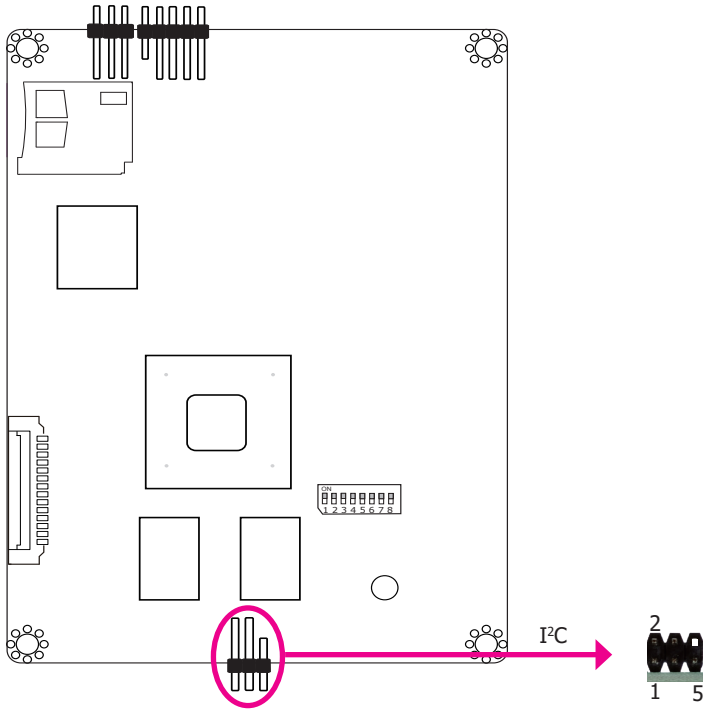
Mini PCI Express Slot

The full-size Mini PCIe socket supports PCIe x1 and USB 2.0 signals and is used to install a Mini PCIe card.

microSD Socket

The microSD socket allows you to install a microSD card for the expansion of available storage.

I²C Connector

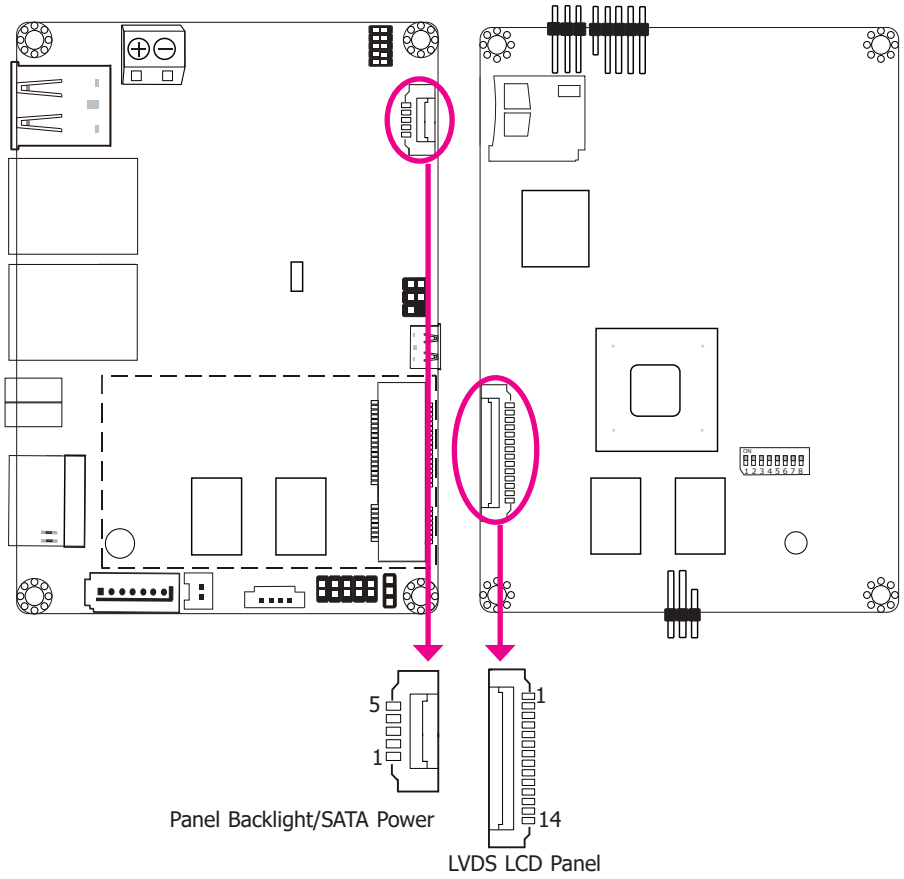


The I²C connector is used to monitor or communicate with system components.

Pin	Pin Name
1	3.3V
2	GND
3	I2C_Clock
4	NC
5	I2C_DATA

LVDS LCD Panel Connector

Panel Backlight/SATA Power Connector



The system board allows you to connect a LCD Display Panel by means of the LVDS LCD panel connector and the Panel Backlight/SATA power connector. These connectors transmit video signals and power from the system board to the LCD Display Panel. Panel Backlight/SATA power connector also supplies power to the SATA drive. Connect one end of the provided power cable to the SATA power connector and the other end to your storage device.

Refer to the right side for the pin functions of these connectors.

LVDS LCD Panel Connector

Pin	Pin Name	Pin	Pin Name
1	GND	2	GND
3	LVDS_CLK-	4	LVDS_CLK+
5	LVDS_Out3-	6	LVDS_Out3+
7	LVDS_Out2-	8	LVDS_Out2+
9	LVDS_Out1-	10	LVDS_Out1+
11	LVDS_Out0-	12	LVDS_Out0+
13	Panel Power	14	Panel Power

Panel Backlight/SATA Power Connector

Pin	Pin Name
1	Panel Backlight/SATA Power (+5V)
2	GND
3	Panel Backlight On/Off Control
4	Dimming Control
5	Panel Backlight/SATA Power (+5V)

Note:
1. DFI board's LVDS connector:

Manufacturer: E-call
Part No.: 0110-3221140
Description: Wafer connector, 14 pin, 1.25mm (pitch), White, 3.45mm (height), SMT type, 90 degree

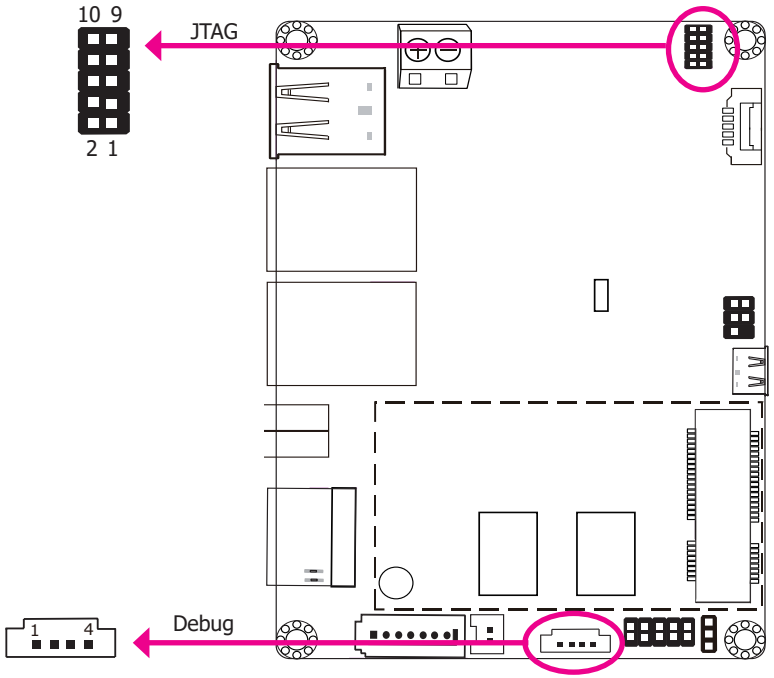
2. DFI board's Panel Backlight/SATA power connector:

Manufacturer: E-call
Part No.: 0110-3221050
Description: Wafer connector, 5 pin, 1.25mm (pitch), 3.45mm (height), SMT type, 90 degree, White

3. DFI board's LVDS cable:

Manufacturer: Molex
Part No.: 51021-1400
Description: 1.25mm (pitch)

Debug Connectors



The JTAG and debug connectors are used for debugging purposes.

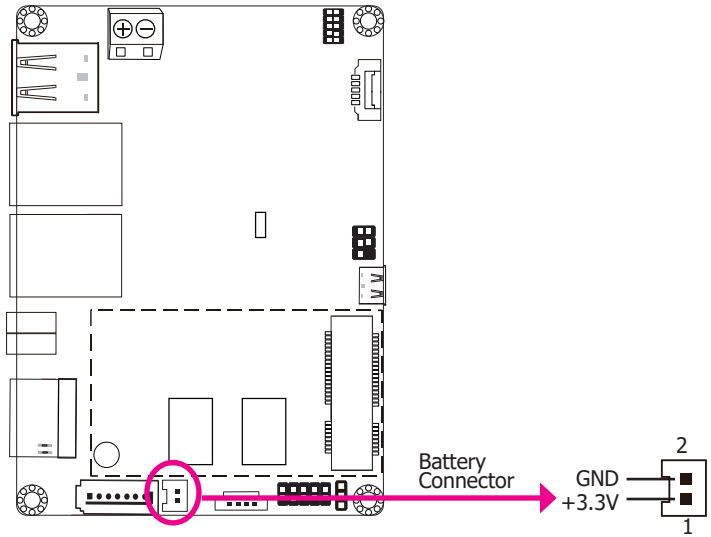
Debug Connector

Pin	Pin Name
1	3.3V
2	UART5_RX
3	UART5_TX
4	GND

JTAG Connector

Pin	Pin Name	Pin	Pin Name
1	3.3V	2	JTAG _TMS
3	GND	4	JTAG_TCK
5	GND	6	JTAG_TDO
7	JTAG_MOD	8	JTAG_TDI
9	JTAG_nTRST	10	JTAG_nRESET

Battery



The lithium ion battery powers the real-time clock. It is an auxiliary source of power when the main power is shut off.

Safety Measures

- Danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent type recommended by the manufacturer.
- Dispose of used batteries according to local ordinance.

Chapter 3 - Software User Guide

► Introduction

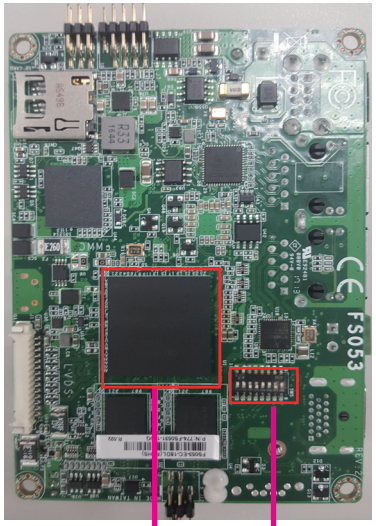
FS053 platform is an embedded system with Yocto 1.8 preloaded on eMMC. Demo images are supported under Yocto 1.8 and Android 5.1.1 environment.

► Revision Control

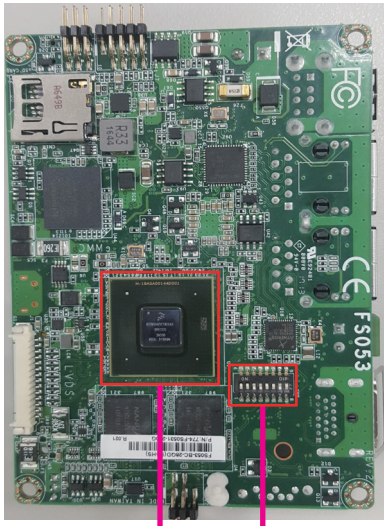
The system board of a specific revision — Rev. A or Rev. B — is only compatible with the software images that correspond to its revision. It is strongly recommended against that a Rev. A system be loaded with Rev. B images or vice versa. Failure in loading a compatible image onto the system may result in malfunction and unexpected errors.

► Check Board Type

The CPU core type of the system board dictates which images and only which images can be loaded. Identify which of the two core types the board is before proceeding — i.MX6 DualLite CPU or i.MX6 Quad CPU.



FS053 DualLite SW5



FS053 Quad SW5

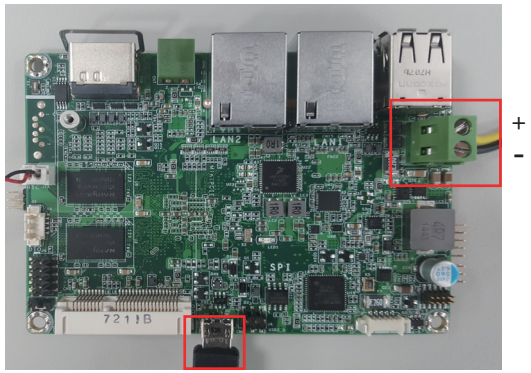
► Loading Images

Download Images to eMMC with MFGTool

1. Set the finger switch SW5 to "Serial Downloader Mode": pins 7 on and 8 off.

2. Plug in the Micro USB cable to your PC and power-on the FS053.

Important:
The adapter output voltage is 9~36V for FS053.



Micro USB Cable

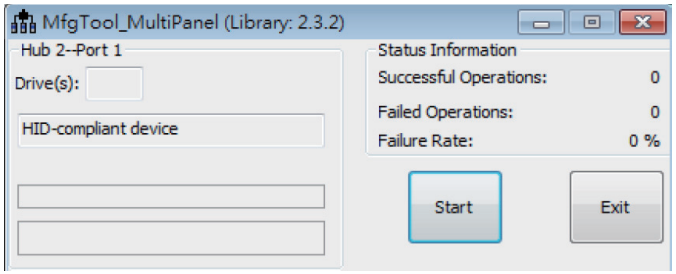
3. Unzip Image package on your PC.

4. Yocto image: execute "\\[core type]\yocto-emmc-fs053-[core type]-all.vbs".
   For example, for DualLite CPU, execute "\\DualLite_core\yocto-emmc-fs053-DualLite-all.vbs".

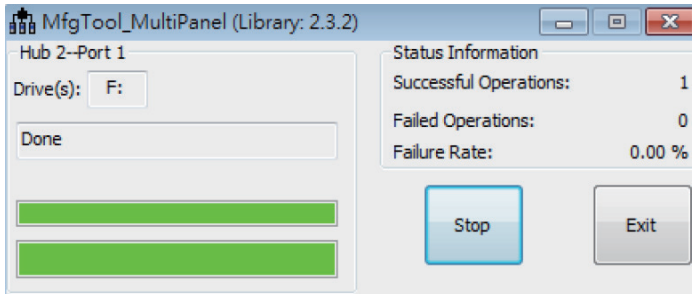
   Android image: execute "\\[core type]\android-emmc-fs053-[core type]-all.vbs".
   For example, for DualLite CPU, execute
   "\\DualLite_core\android-emmc-fs053-DualLite-all.vbs".

5. You will see the device connected as "HID-compliant device."

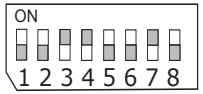
6. After all preparation is done, click "Start" to burn the file. Wait until the process ends.



7. After the burning is done, click "Stop" and turn the power off.



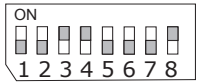
8. Set the finger switch SW5 to the "eMMC Start Mode": pins 1, 2, 5, 6, 8 on and 3, 4, 7 off.



9. Power-on the device again to reboot it into the system.

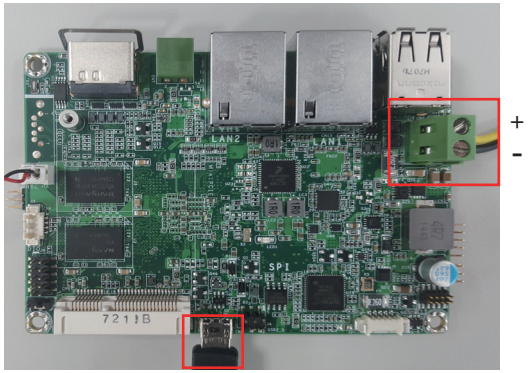
Download Uboot Images to SPI with MFGTool

1. First complete above "Download Images to eMMC with MFGTool" steps.
2. Set the finger switch SW5 to "Serial Downloader Mode": pins 7 on and 8 off.



3. Plug in the Micro USB cable to your PC and power-on the FS053.

Important:
The adapter output voltage is 9~36V for FS053.



Micro USB Cable

4. Unzip Image package on your PC.

5-1. For Rev. A only

Yocto image: execute "\\[core type]\yocto-spi-fs053_[core type]-u-boot.vbs".
For example, for DualLite CPU, execute "\\DualLite_core\yocto-spi-fs053_DualLite-u-boot.vbs".

Android image: execute "\\[core type]\android-spi-fs053_[core type]-u-boot.vbs".
For example, for DualLite CPU, execute
"\\DualLite_core\android-spi-fs051_DualLite-u-boot.vbs".

5-2. For Rev. B only

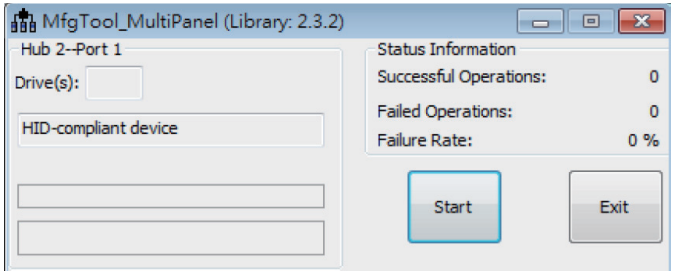
Yocto image: execute "\\[core type]\yocto-spi-fs053_[core type]-all.vbs".
For example, for Quad CPU, execute "\\Quad\yocto-spi-fs053_Quad-all.vbs".

Android image: execute "\\[core type]\android-spi-fs053_[core type]-all.vbs".
For example, for Quad CPU, execute "\\Quad\android-spi-fs053_Quad-all.vbs".

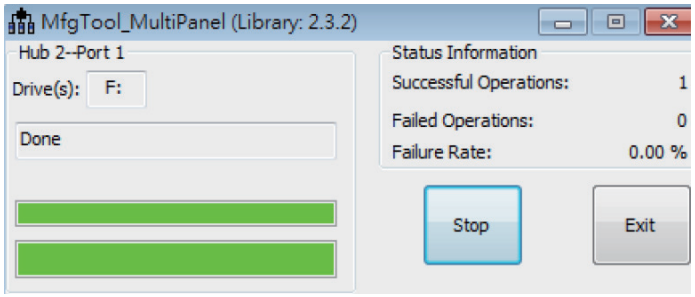
Important:
Failure in loading a compatible image (i.e. Rev. A or Rev. B) onto the system may result in malfunction and unexpected errors.

6. You will see the device connected as "HID-compliant device."

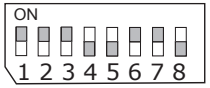
7. After all preparation is done, click "Start" to burn the file. Wait until the process ends.



8. After the burning is done, click "Stop" and turn the power off.



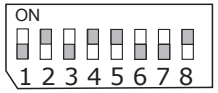
9. Set the finger switch SW5 to the "SPI Start Mode": pins 4, 5, 8 on and 6,7 off.



10. Power-on the device again to reboot it into the system

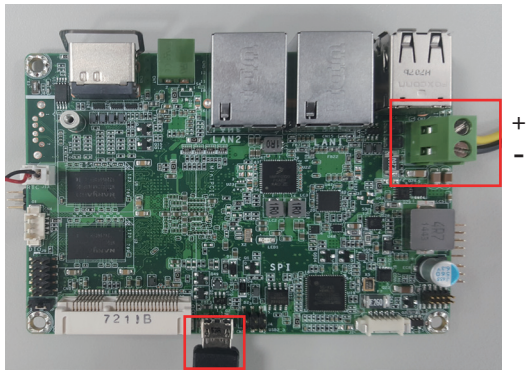
Download Images to SD Card with MFGTool

1. Set the finger switch SW5 to "SD Card Download Mode": pins 1, 3, 6, 7 on and 2, 4, 5, 8 off.



2. Plug in the Micro USB cable to your PC and power-on the FS053.

Important:
1. The adapter output voltage is 9~36V for FS053.
2. Do not insert SD card before turning on the device power.



Micro USB Cable

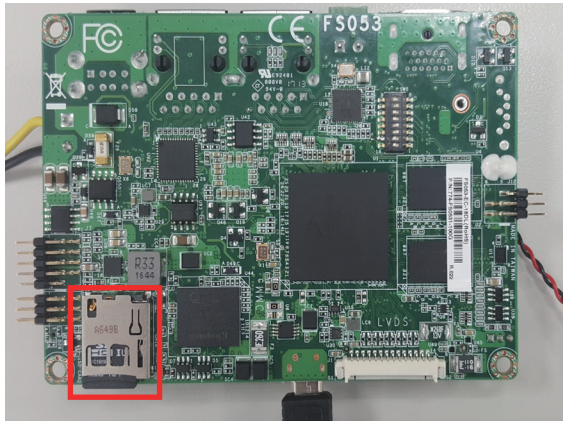
3. Unzip Image package on your PC.

4. Yocto image: execute "\\[core type]\SDBoot\yocto-sdcard-fs053-[core type]-all.vbs".
   For example, for Quad CPU, execute "\\Quad_core\SDBoot\yocto-sdcard-fs053-Quad-all.vbs".

   Android image: execute "\\[core type]\SDBoot\android-sdcard-fs053-[core type]-all.vbs".
   For example, for Quad CPU, execute
   "\\Quad_core\SDBoot\android-sdcard-fs053-Quad-all.vbs".

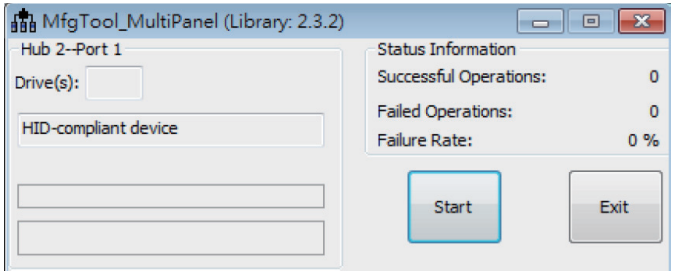
5. You will see the device connected as "HID-compliant device."

6. Insert SD card.

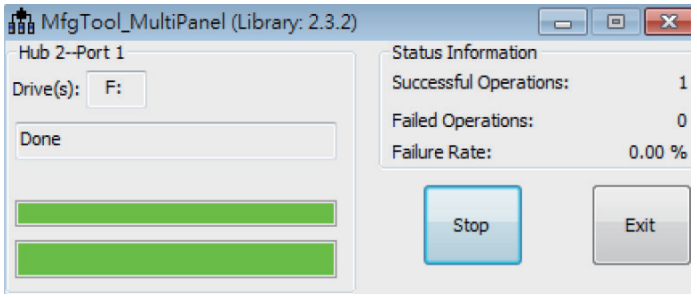


SD Card

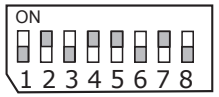
7. After all preparation is done, click "Start" to burn the file. Wait until the process ends.



8. After the burning is done, click "Stop" and turn the power off.



9. Set the finger switch SW5 to the "SD Card Start Mode": pins 1, 3, 6, 8 on and 2, 4, 5, 7 off.



10. Power-on the device again to reboot it into the system.

Software Features

General Support

(*) is depended on the NXP support.

Component	Name	Base-Line Feature
General	OS Support	Yocto 1.8 - Kernel 3.14.52 (default preloaded on eMMC) Android 5.1.1 - Kernel 3.14.52
Misc	Firmware Upgrade (*)	MFGTool firmware update tool
	Utilities (*)	Hardware diagnostic utilities

Linux AP/API Support

(*) is depended on the NXP support.

Component	Description	Detail
Linux	Yocto 1.8 - Kernel 3.14.52	It is an open-source project that delivers a set of tools which create operating system images for embedded Linux systems. Support X-11 Demo Image Only (*)
Linux AP/API	NXP i.MX6 Yocto 1.8 BSP Support X11 Window Support BitBake build tool	All library and utility should support (*). Source code package (support by request)
	Support I^2C, Watchdog, GPIO, LVDS brightness control	Provide support console for i.MX6 platform
Android	Android 5.1.1 - Kernel 3.14.52	Support Demo Image
Android AP/API	NXP i.MX6 Android 5.1.1 NXP BSP Support Android AOSP launcher Support Android ADB shell Support Android APK install	All library, utility and Android apk should support (*). Source code package (support by request)
	Support I^2C, Watchdog, GPIO, LVDS brightness control	Provide support console for i.MX6 platform.

Yocto Support
(*) is depended on the NXP support.

Component	Support Status
Yocto Version	1.8
Kernel Version	3.14.52
Window System	X11 without QT5 build
eMMC	Support eMMC boot, eMMC v5.1, Linux ext3 file system
Ethernet LAN1	Support "ping", "ifconfig" console commands verify, static IP/DHCP Dynamic IP, fixed MAC address.
Ethernet LAN2	Support "ping", "ifconfig" console commands verify, static IP/DHCP Dynamic IP, fixed MAC address. Due to LAN7500 is PCIe over USB2.0 Ethernet card, data transfer throughput limit is below 480Mbps (USB2.0 SPEC limitation).
USB 2.0	1. Support USB HID Keyboard and Mouse Device 2. Support USB Mass Storage by "mount" console command, EXT3/EXT4/ FAT filesystem
USB OTG	1. Support USB HID Keyboard and Mouse Device 2. Support USB Mass Storage by "mount" console command, EXT3/EXT4/ FAT filesystem 3. Support connect to PC to update image by i.MX6 MFGTool
LVDS Panel	1. Single display function - resolution 800x480, RGB666 (Rev. B default, verified panel: AM-800480R3TMQW-T31H) - resolution 1024x600, RGB24 (Rev. A default, verified panel: OT070UADDBT-00) 2. Multi-panel selection function for backward compatibility (Rev. B Image only; activation required, please refer to Appendix A).
LVDS Backlight	Support control by Linux device node, level value 0~7
Touch	Support single touch function (Rev. B Image only)
HDMI Video Output	Support single display function, need to plug in HDMI cable before power on, resolution 1920x1080@60
DIO	Support read input voltage, set outpout voltage high/low status, control by Linux device node, 8 pins
Micro SD Card (SD Slot)	Support SD card boot, support SD storage by "mount" console command, FAT filesystem. (Support Kingston, micro SDHC 4GB class 4, 4GB/16GB) For standard product, we do not port any SDIO module.
Mini PCIe	Support "lspci" console command for check PCIe card status. For standard product, we only port ENLi AP12356 WiFi/BT module.
SATA (Quad Only)	Support SATA storage only (by "mount" console command, EXT3/ EXT4/FAT filesystem). For standard product, we do not port any SATA module.
UART1 - RS232	Support Loopback & flow control test, BR 115200 (need DFI Linux user space utility)
UART1 - RS485	Support Loopback test, BR 115200 (need DFI Linux user space utility)
UART1 - RS422	Support Loopback test, BR 115200 (need DFI Linux user space utility)
UART2 - RS485	Support Loopback test, BR 115200 (need DFI Linux user space utility)
SPI2 Nor-Flash	Support SPI2 Nor-Flash boot (Uboot image only)
RTC	Support Linux "date -s" and "hwclock -w" console commands to set system time
Thermal Sensor	Support read device temperature (degrees C) by Linux device node
Debug Serial Port	Suport read Linux kernel debug log by serial port, use PC serial terminal tool (ex. PuTTY), BR 115200
Play Video	Support play MPEG4 file (need DFI Linux user space utility).
Watchdog	Support NXP utility "wdt_driver_test.out"(*) to test Watchdog reboot function
VNC Server	Support PC control via VNC, disabled by default (Rev. B Image only)
Wifi/BT	1. Support AP12356 Wifi/BT module 2. AP12356 WiFi: Support Wifi STA Mode (connect Wifi AP), Soft AP Mode (enable DHCP/IPv4 routing); support commands — ifconfig, wpa_supplicant, wpa_cli, udhcpc, hostapd, iptables console, and ping console (for verification). 3. AP12356 BT: Support files transfer protocol only (BT OBEX protocol); support commands — obexd, obexctl, and obexpushd console.
Image Size	1. u-boot.imx : around ~420 KB 2. zImage: around ~6MB 3. rootfs.tar.bz2: around ~245MB (compressed), or around ~830MB (uncompressed)
Free Storage Size	Around ~5.3G free space (/dev/root)

Android Support
(*) is depended on the NXP support.

Component	Support Status
Android Version	5.1.1
Kernel Version	3.14.52
eMMC	Support eMMC boot, eMMC v5.1, Linux ext4 file system
Ethernet LAN1	1. Support "ping", "ifconfig" console commands, and NXP Ethernet APP (*) 2. Support static IP/DHCP Dynamic IP, fixed MAC address 3. If both LAN1 Ethernet port and LAN2 Ethernet port are plugged-in with Ethernet cables, only the first Ethernet port plugged-in with Ethernet cable will connect to network. If the first Ethernet port plugged-in with Ethernet cable is unplugged, the second Ethernet port will connect to network automatically.
Ethernet LAN2	1. Support "ping", "ifconfig" console commands, and NXP Ethernet APP (*) 2. Support static IP/DHCP Dynamic IP, fixed MAC address 3. If both LAN1 Ethernet port and LAN2 Ethernet port are plugged-in with Ethernet cables, only the first Ethernet port plugged-in with Ethernet cable will connect to network. If the first Ethernet port plugged-in with Ethernet cable is unplugged, the second Ethernet port will connect to network automatically.
USB 2.0	1. Support USB HID Keyboard and Mouse Device 2. Support Android auto mount USB Mass Storage function (only one USB storage is available at a time. If second USB is plugged-in the USB cable, second USB is not available. If first USB is unplugged, second USB needs to be unplugged and re-plugged back to be available.) FAT32 filesystem only without multi-partition
USB OTG	1. Support USB HID Keyboard and Mouse Device 2. Support Android auto mount USB Mass Storage function (only one USB storage is available at a time. If second USB is plugged-in the USB cable, second USB is not available. If first USB is unplugged, second USB needs to be unplugged and re-plugged back to be available.) FAT32 filesystem only without multi-partition 3. Support connect to PC to update image by i.MX6 MFGTool
LVDS Panel	1. Support LVDS+HDMI dual display — LVDS as main output — resolution 800x480, RGB666 (Rev. B default, verified panel: AM-800480R3TMQW-T31H) 2. For Android standard product, dual display is by default enabled. 3. Multi-panel selection function for backward compatibility (activation required, please refer to Appendix A).
LVDS Backlight	1. Support Android->Settings->Display->Brightness level control without adaptive brightness function. 2. For standard product, we do not port any light sensor module.
Touch	Support single touch function
HDMI Video Output	1. Default support LVDS+HDMI dual display function. HDMI is slave output, resolution 1024x600 (based on LVDS resolution). 2. If users want to change HDMI resolution (i.e. 1920x1080), users need to modify kernel parameter to change LVDS resolution to 1920x1080 too. 3. For Android standard product, we enable dual display function by default.
DIO	1. Support read input voltage, set outpout voltage high/low status, control by Linux device node, 8 pins 2. Support DFI Android GPIO demo APP (support by request)
Micro SD Card (SD Slot)	1. Support SD card boot, support SD storage by "mount" console command, FAT32 filesystem. (Support Kingston, micro SDHC 4GB class 4, 4GB/16GB) 2. Support Android auto mount SD card function (FAT32 filesystem only, without multi-partition) 3. For standard product, we do not port any SDIO module.
Mini PCIe	1. Support "busybox lspci" console command for check PCIe card status. 2. For standard product, we only port ENLi AP12356 WiFi/BT module.
SATA (Quad Only)	1. Support SATA hard disk storage only 2. Support Android auto mount SATA function (FAT32 filesystem only, without multi-partition) 3. For standard product, we do not port any SATA module.
UART1 - RS232	Support Loopback & flow control test, BR 115200 by DFI Android UART demo APP (supoprt by request)
UART1 - RS485	Support Loopback test, BR 115200 by DFI Android UART demo APP (supoprt by request)
UART1 - RS422	Support Loopback test, BR 115200 by DFI Android UART demo APP (supoprt by request)
UART2 - RS485	Support Loopback test, BR 115200 by DFI Android UART demo APP (supoprt by request)
SPI2 Nor-Flash	Support SPI2 Nor-Flash boot (Uboot image only)
RTC	Support Android->Settings->Date to set system time function.
Thermal Sensor	Support read device temperature (degrees C) by Android CPU-Z APP installed by user
Debug Serial Port	Suport read Linux kernel debug log by serial port, use PC serial terminal tool (ex. PuTTY), BR 115200

Play Video	Support play MPEG4 file by Android AOSP Gallery APP.
Watchdog	Support adb shell command "am hang --allow-restart" to test Watchdog reboot function
WiFi/BT	1. Support AP12356 WiFi/BT module 2. AP12356 WiFi: (1) Support WiFi STA Mode (connect WiFi AP) by Android UI to enable/disable it. (2) Support Soft AP Mode (enable DHCP/IPv4 routing) by Android UI to enable/disable it. (3) Support Android UI to set up Soft AP information (4) Support Android Airplane mode to disable WiFi function (5) Not support STA mode and Soft AP mode enable at the same time (6) Not support other WiFi modes, i.e. Wi-Fi Direct, Miracast, Wi-Fi TimeSYnc, etc. (7) STA mode limitation: when plug-in wired LAN, STA mode will disconnect automatically by Android network framework limitation 3. AP12356 BT: (1) Support BT connected and enable/disable by Android UI (2) Support BT files transfer by OPP profile using "Bluetooth File Transfer" tool. (3) Support OPP, FTP, OBEX, SDAP profile only (4) Not support other BT profiles which are not listed above (5) Suppot Android Airplane mode to disable BT function
Android Build Type	ENG Build without SELinux
Android ADB	Support
Android Factory Reset	Support
Android Fastboot	Not support
Android OTA	Not support
Android CTS	Not support
Android GMS/ GTS	Not support
Android Suspend	Not support suspend, set never to suspend by default.

Preload Android APPs	1. AOSP Browser: Web Browser 2. AOSP Calculator: Calculator APP 3. AOSP Calendar: Calendar APP 4. AOSP Clock: Clock APP, support alarm wake-up 5. AOSP Contacts: function not ready, preload for 3G module test in the future 6. AOSP Dev Tools: develop test tool 7. AOSP Downloads: show downloads APP 8. AOSP Email: E-Mail APP 9. AOSP Gallery: Gallery APP (JPEG) 10. AOSP Messaging: Short Message Service (SMS) APP. Function not ready, preload for 3G module test in the future. 11. AOSP Music: Play music APP (MP3) 12. AOSP Phone: function not ready, preload for 3G module test in the future. 13. AOSP Settings: Android Settings APP 14. AOSP Sound Recorder: Sound Recorder APP. Function not ready, preload for AOSP Audio module test in the future 15. NXP Audio Route (*): function not ready, preload for Audio module test in the future. 16. NXP Ethernet (*): Ethernet settings APP. 17. Open-source Simple Explorer: File Explorer APP

Appendix A - Compatibility

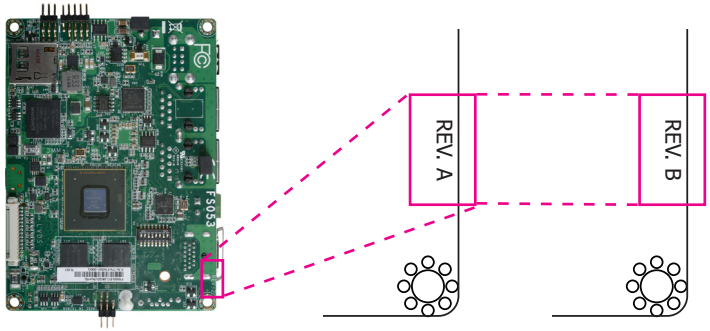
► Introduction

The hardware update from revision A (Rev. A) to B (Rev. B) results in some changes of settings, and is followed by software updates required by downward compatibility. Changes are detailed, listed, and compared in this Chapter.

► Examine Procured Revision

The revision of the system is printed on the bottom side of the board. The location is illustrated in the diagram below. Currently there have been two versions already officially released, which are Rev. A and Rev. B.

››› Bottom View (Rear I/O on the Right)



► Boot Device Select

Default settings of the Boot Device Select are different between CPU versions and board versions. Boot Device can be configured via the 8-pin switch (i.e. SW5) as instructed in Chapter 2. For initial setup, it is strongly suggested that the system is booted from the default boot device as listed below.

Board Revision	CPU version	Default Boot Device
Rev. A	Quad	eMMC
	DualLite	eMMC
Rev. B	Quad	SPI
	DualLite	eMMC

► Panel Backward Compatibility

Along with the Rev. B update, the software parameters were also modified and optimized specifically for Rev. B design and for a verified panel — AM-800480R3TMQW-T31H. For the previous Rev. A version, the software parameters were optimized specifically for Rev. A design and for a verified panel — OT070UADDBT-00. The Rev. B software parameters, in addition, can be manually re-configured to support the panel — OT070UADDBT-00 — for panel backward compatibility. Please follow the multi-panel switching instructions below to switch between the configurations preset for the two said panels on a Rev. B system. The default parameters of Rev. B are for the panel — AM-800480R3TMQW-T31H.

Board Revision	Verified Panel Model
Rev. A	OT070UADDBT-00
Rev. B	AM-800480R3TMQW-T31H, OT070UADDBT-00 (software switched)

► Multi-panel Switching Guide

To switch between the two verified panel models on Rev. B systems, two methods are provided and instructed below:

Method 1: U-Boot command via UART console

1. Connect the board to a UART serial console via the debug UART port.
2. Power on the system, and press ENTER when the line "Hit any key to stop autoboot:" appears as shown below.

```
U-Boot 2015.04-gfc2e889-dirty (Mar 27 2018 - 14:04:25)

CPU:   Freescale i.MX6DL rev1.3 at 792 MHz
CPU:   Temperature 46 C
Reset cause: POR
Board: MX6-SabreSD
I2C:   ready
DRAM:  1 GiB
PMIC:  PFUZE100 ID=0x10
MMC:   FSL_SDHC: 0, FSL_SDHC: 1
BOOT: Select MMC/eMMC boot
BOOT_CFG2[4] and BOOT_CFG2[3]  = 3
BOOT select dev_no set to 1
BOOT: Select MMC/eMMC boot
BOOT_CFG2[4] and BOOT_CFG2[3]  = 3
BOOT select dev_no set to 1
BOOT: Select MMC/eMMC boot
BOOT_CFG2[4] and BOOT_CFG2[3]  = 3
BOOT select dev_no set to 1
*** Warning - bad CRC, using default environment

BOOT: Select MMC/eMMC boot
BOOT_CFG2[4] and BOOT_CFG2[3]  = 3
BOOT select dev_no set to 1
Display: AM-800480R3TMQW-T31H (800x480)
In:    serial
Out:   serial
Err:   serial
BOOT: Select MMC/eMMC boot
BOOT_CFG2[4] and BOOT_CFG2[3]  = 3
BOOT select dev_no set to 1
switch to partitions #0, OK
mmc1(part 0) is current device
Net:   FEC [PRIME]
Error: FEC address not set.

Normal Boot
Hit any key to stop autoboot:  0
=>
```

3. Enter the command below, and substitute the argument <panel_name> with either of the verified panels — AM-800480R3TMQW-T31H, or OT070UADDBT-00 — as shown in the example below.

   => setenv panel <panel_name>

4. Enter the command below to save the changes.

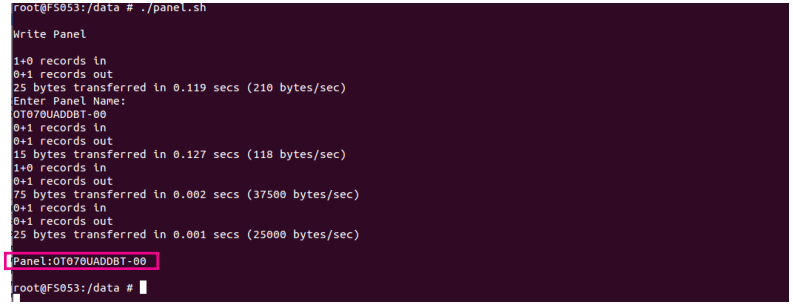
   => saveenv

5. Restart the system, and the new settings will be applied. The software parameters will then support the panel model inserted previously in step 3.

Method 2: shell script command after booting into OS

1. Power on the system and finish booting into the OS.

2. Execute the file panel.sh — please contact your sales representative or DFI FAE personnel for the executable file. When the prompt below shows up, insert either of the verified panels — AM-800480R3TMQW-T31H, or OT070UADDBT-00.



3. Restart the system, and the new settings will be applied. The software parameters will then support the panel model inserted previously in step 2.