

Mx-5A01-LTS

Network Multimedia Information Platform

DS16060201

V0.01

Date: March 1, 2017

Product Data Sheet

Overview

Mx-5A01-LTS motherboard is featured with NXP (Freescale) industrial grade i.MX 6 series high-performance application processor as the main control unit. The chip has the characteristics such as high reliability, high performance, long supply cycle and so on, which is capable of meeting the demand of conventional industrial applications. The onboard peripherals include DDR3 SDRAM, eMMC, USB, Ethernet, LVDS interface, audio CODEC, high-performance RTC, etc., which is ideal for the occasions requiring the strong multimedia processing performance and the strict reliability at the same time, such as elevator multimedia, car-mounted multimedia, rail transportation industry and so on. The motherboard supports Linux and Android operating systems.

Product Features

- ◆ Support LVDS high-definition video interfaces;
- ◆ High-performance ARM processor, single-core 1GHz;
- ◆ Support video output up to 1080p@60Hz;
- ◆ Support Micro-SD card up to 64GB;
- ◆ 16V~26V wide voltage working range;
- ◆ 2*1W audio amplifier output interface;
- ◆ Support 3 channels of USB2.0 host and PCIE2.0 host;
- ◆ Motherboard is featured with ultra-thin design;
- ◆ Support wired Ethernet and WIFI wireless LAN;
- ◆ Industrial reliability design;
- ◆ Provide up to 10 years of supply period;

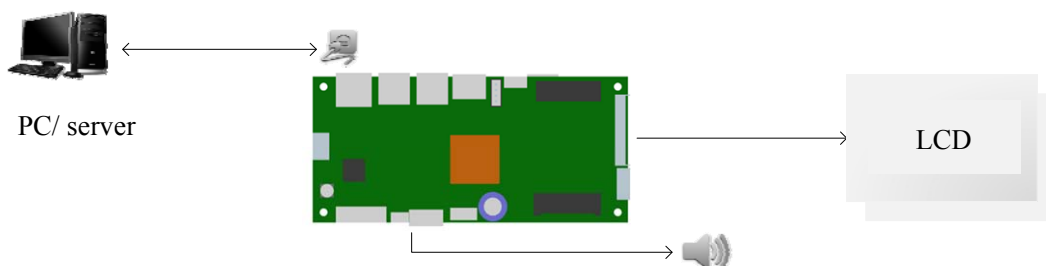
Product Application

It can be applied to the occasions such as multimedia display in the elevator system, the touch floor selector, the elevator group control elevator appointing system and so on.

Ordering Information

Refer to the model selection guide.

Typical Application



Revision History

Version	Date	Reason
V0.00	Nov. 1, 2016	Create Document
V0.01	Mar. 1, 2017	Modify the Model Selection Guide
V0.02	Jan.23.2019	Add Operating System and Software Development Document

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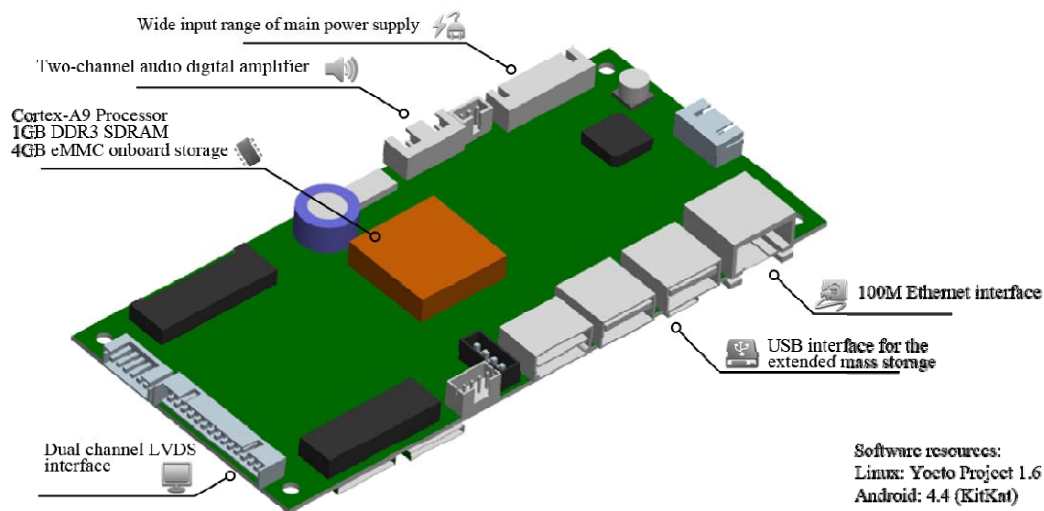
1. Brief Introduction of the Function

1.1 Product Features

Mx-5A01-LTS motherboard is featured with NXP (Freescale) industrial grade i.MX 6 series high-performance application processor as the main control unit. The chip has the characteristics such as high reliability, high performance, long supply cycle and so on, which is capable of meeting the demand of conventional industrial applications. The onboard peripherals include DDR3 SDRAM, eMMC, USB, Ethernet, LVDS interface, audio CODEC, high-performance RTC, etc., which is ideal for the occasions requiring the strong multimedia processing performance and the strict reliability at the same time, such as elevator multimedia, car-mounted multimedia, rail transportation industry and so on. The motherboard supports Linux and Android operating systems.

1.2 System Block Diagram

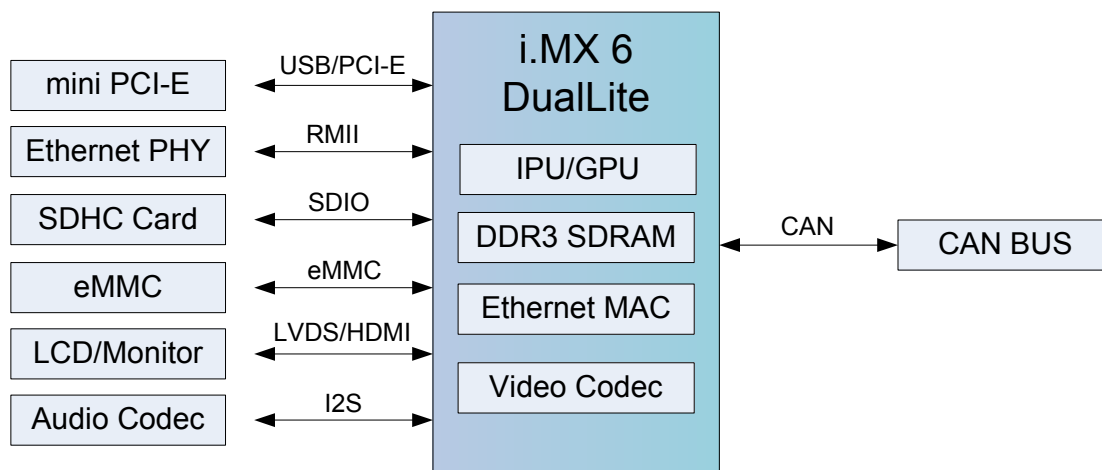
The block diagram of the main onboard resources is as follows:



2. Hardware Specifications

2.1 Hardware Framework

Mx-5A01 master control platform uses the high-performance i.MX 6 Cortex-A9 processor, and the main hardware framework is as follows:



2.2 Onboard Storage

2.2.1 DDR3 SDRAM

SDRAM is configured as 1G Byte, and the specific parameters are:

Bandwidth: 32bit@800Mbps

Capacity: 1GByte

2.2.2 eMMC

EMMC is functioned as the main program and data storage system, and its standard configuration is 4GByte.

2.2.3 SDHC

Support the SD Card/MMC specifications with higher version, maximum of 104MB/s transmission speed, and the capacity support of 64GB.

2.3 Audio and video interfaces

2.3.1 Video output interface

Support dual-channel LVDS signal, and the specific parameters are:

Interface	Resolution specification	Other Information
LVDS	800x600 @60Hz 1024x768 @60Hz 1366x768 @60Hz 1280x800@60Hz 1920x1080@60Hz (Dual Channel)	IO voltage can be configured as 3.3V, 5V and 12V The backlight voltage can be configured as 12V and 24V Support 10 level backlight energy saving control

Note: Other display resolutions can also be supported by modifying the software.

2.3.2 Video Input Interface

Through the onboard MIPI video input channel (CSI), the digital camera up to 5 megapixel is supported, and the external interface adapter IC can also support the signal input such as HDMI, CVBS and so on. i.MX video encoders can encode streams.

2.3.3 Audio Interface

The onboard audio codec is equipped with microphone, headphone and 1W power amplifier output interfaces, which can directly drive the speaker to output the two-channel sound, or capture audio signals after accessed to the microphone. If there are demands that the onboard power amplifier cannot meet, the headphone jack can also be used to connect to the external active speakers. If the system is equipped with PCI-E 3G/4G communication modules, it can support the function of PCM voice call.

2.4 Extended User Interface

2.4.1 Mini PCI-Express interface

As a high-speed interface, Mini PCI-Express enables the users to easily expand a variety of functions, which generally include:

- 3G/4G wireless communication module
- WIFI/Bluetooth wireless communication module
- SSD high-speed mass storage
- USB3.0 expansion card

The main technical specifications are:

PCI-Express 2.0 5Gb/s

USB 2.0 480Mb/s

2.4.2 USB Host Interface

The high-performance USB hub supports 3-way USB output, including 2 ways of direct external interfaces (USB standard HOST interface) and 1 way of board-to-board interface. Each interface contains a separate 8KV ESD and 500mA overcurrent protection.

2.4.3 General IO Expansion

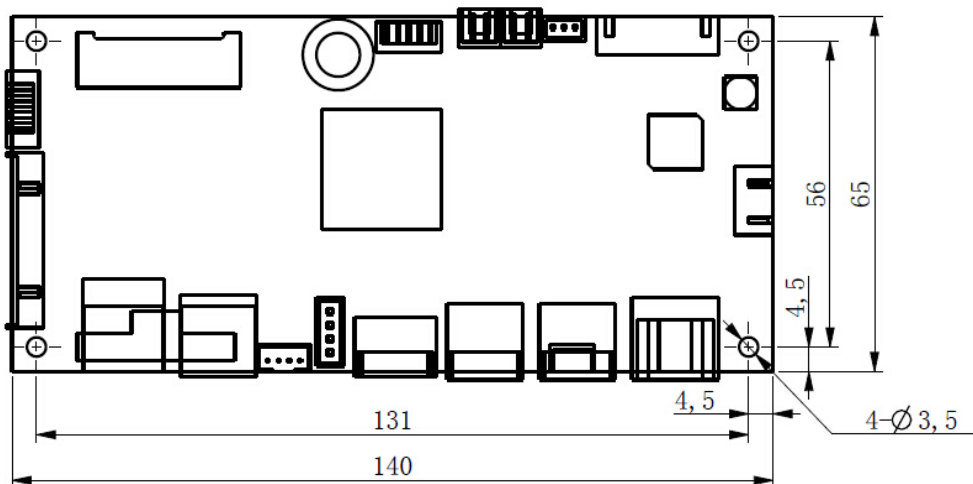
It includes 3 ways of UART and 1 way of I2C expansion interface.

2.5 Product Specification

Product Specifications	Parameters	Value
Electrical characteristics	Standard input voltage	24V/DC
	Input voltage range	16~26V/DC
	Characteristic working current	90mA (24V input)

	Characteristic power consumption	2.16W
	Instantaneous burst interference	2kV, work normally; 4kV, the device is not damaged
	Electrostatic discharge	Contact discharge 6kV, air discharge 8KV, work normally Contact discharge 8KV, air discharge 15KV, the device is not damaged
Environmental characteristics	Storage temperature	-40°C~80 °C
	Working Temperature	-20°C~60 °C
	Humidity	≤ 95%, no condensation
	Service life	30,000 h
Technical Specifications	CPU specifications	Dual-core 1GHz Cortex-A9
	RAM	1G Byte
	FLASH	4G Byte
	External Memory Card	Support Micro-SD card up to 64GB
	Communication Interface	RS232
	LCD interface	LVDS
	LCD resolution	Maximum of 1920x1080 pixels
Mechanical characteristics	Dimension	TBD
	Weight	TBD

2.6 Product Dimension



Tolerance: 0.5 Unit: mm

2.7 Port Definition

Port label	Function	Definition
P8	Power supply and	1: 24V+ 2: 24V- 3: CANH 4: CANL

	CAN Interface	
J11	LVDS video signal output	
J10	Backlight power control interface	J10.1; J10.2: VCC; J10.3: Backlight Enable; J10.4: Backlight Brightness Adjustment (PWM); J10.5; J10.6: GND
P2	Network Interface	RJ45 network interface
USB-A1, USB-A2	USB interface	Type-A USB interface (female port)
JP3	External Communication Interface	JP3.1: UART 1RXD; JP3.3: UART 1TXD; JP3.7: UART 2RXD; JP3.9: UART 2TXD; JP3.2: UART 3RXD; JP3.4: UART 3TXD; JP3.8: I2C_SCL; JP3.10: I2C_SDA; JP3.6: VCC_5V; JP3.5: GND;
J7	Mini PCI-E	Standard Mini PCI-E interface
JP8	Power supply and RS232 interface	JP8.1, JP8.2: VCC_24 external input; JP8.3, JP8.4: GND; JP8.5: RS232_TXD; JP8.6: RS232_RXD;
J1	RS232 debug interface	J1.1:VCC_5V; J1.2:TXD; J1.3:RXD; J1.4:GND
J2, J3	Audio output interface	J2.1: SPK_LN; J2.2: SPK_LP; J3.1: SPK_RN; J3.2: SPK_RP
P1	Video Input Interface	MIPI video input
S3	3G communication card interface	USIM deck
TF1	Micro SD card interface	Micro SD card deck

3. Commonly used operations for operating system

3.1 System introduction

Mx-5A01 uses Yocto Project 1.6 to compile the file system, and the main software version is as follows:

Linux kernel version: 3.14.28

Display interface back end: weston 1.6.0

Qt Version: Qt 5.2.1

Multimedia library version: gstreamer-0.10

3.2 Display parameter adjustment

The configuration file of display resolution is located at the path of

```
/media/0/Mux/mx6_sys_config.ini
```

The file can be modified to change the display signal source, resolution, color order of bits, boot logo display rotation angle. For example, usually only the LVDS interface output signal source is used, and only the content in [Monitor_1] needs to be modified:

```
[Monitor_1]
Id=1;
Switch=1;
Interface=ldb;
Resolution=LDB-SVGA;
ResModes=LDB-SVGA|LDB-XGA|LDB-WXGA|LDB-WXSGAP|LDB-FHD;
Bpp=32;
PixFmt=RGB24;
LdbRes=0;
LdbDepth=24;
Rotation=0;
MaxRot=4;
```

Where the items including Id, Switch, Interface, ResModes, Bpp and MaxRot cannot be modified

The resolution value can be modified to change the logo resolution displayed in the u-boot stage, and the optional values include LDB-SVGA LDB-XGA LDB-WXGA LDB-WXSGAP LDB-FHD, and the corresponding LCD resolutions are 800*600, 1024*768, 1280*800, 1366*768 and 1920*1080 respectively.

PixFmt value corresponds to the LVDS color bit order when the logo is displayed in the u-boot stage; RGB24 stands for 24-bit color LVDS signal of the driver, and RGB666 means the 18-bit color LVDS signal of the driver.

LdbRes value is the display resolution index value after the Linux system is started, and the optional value is from 0 to 13, and the corresponding LCD resolutions are as follows respectively:

0: 800x600;

1:1024x768

2:1280x800

3:1360x768

4:1920x1080
 5:1680x1050
 6:720x1280
 7:800x480
 8:1440x900
 9:1360x384
 10:800x1280
 11:1920x540
 12:1280x1024
 13:1600x1200

The LdbDepth value is the color order of the LVDS signal after the Linux system is started. The optional value is 24 or 18; 24 means the 24-bit color, and 18 means the 18-bit color

The rotation value is the logo display rotation angle of u-boot and Linux kernel stage, and the optional value is from 0 to 3, and the corresponding rotation angles are 0 degree, 90 degrees, 180 degrees and 270 degrees respectively. Note: changing the value here will only change the rotation angle of the logo stage. The following commands should be used to modify the progress bar and the rotation angle of Wayland after the system is started:

```
/etc/muxconfig/scripts/config-rotation 1
```

The optional parameter value of the command is from 0 to 3, and the corresponding rotation angles are 0 degree, 90 degrees, 180 degrees and 270 degrees respectively.

Another configuration item for this file - ldb, means to use the single channel lvds or dual channel lvds signal:

Single-mode means the single-channel mode, and split-mode means the dual-channel mode.

3.3 Screen brightness setting

Directly write values from 0 to 10 to the brightness profile to set the screen brightness, where 0 is the backlight off and 10 is the maximum brightness.

```
echo 1 > /sys/class/backlight/backlight.26/brightness
```

3.4 Touch screen driver

Most touch screens with USB interface do not need to manually load the driver, so that the plug and play function can be enabled. For the touch screens with I2C interface, the driver needs to be manually loaded when the system is started. Currently, only the GT9 series touch control IC is supported, and the corresponding touch screen interface driver can be loaded through the following methods:

```
modprobe gt9xx
```

After the driver is loaded, the corresponding input devices can be seen under the directory of /dev/input/; the weston-simple-touch tool can be used for touch screen test, and the software supports multi-touch function.

3.5 Network Configuration

The system uses DHCP to assign IP addresses by default. If it is used as a standalone or other application that does not require dynamic IP, the commands can be used to quickly disable DHCP function:

```
/etc/muxconfig/scripts/dhcp disable
```

When DHCP is disabled, the system uses static IP whose configuration file is located at:

```
/etc/default/staticip
```

Similarly, use the following commands to enable DHCP function:

```
/etc/muxconfig/scripts/dhcp enable
```

The onboard contains WiFi AP mode configuration, which can be started quickly by command:

```
/etc/muxconfig/scripts/ap SSID PASSWORD // to set AP SSID and password
/etc/muxconfig/scripts/ap enable // to turn on AP
```

3.6 Cross Compiling of Application

The downloaded SDK two versions of x86 and x64, which are corresponding to 32-bit and 64-bit Linux hosts respectively; the file names are:

```
poky-eglibc-i686-meta-toolchain-qt5-cortexa9hf-vfp-neon-toolchain-1.6.1.sh // For 32-bit
systems
poky-eglibc-x86_64-meta-toolchain-qt5-cortexa9hf-vfp-neon-toolchain-1.6.2.sh // For 64-bit
systems
```

Download and install the SDK, then the cross-compilation environment is ready to develop applications for Mx-5A01. Take the default installation path of /opt/poky/1.6.2 as an example, the following command can import the variables of cross-compilation environment:

```
source /opt/poky/1.6.2/environment-setup-cortexa9hf-vfp-neon-poky-linux-gnueabi
```

Before editing the application, first ensure that the cross-compilation environment has been properly imported. If the cross-compilation environments for other BSPs have already been imported before this, the terminal should be exited and logged in again. If the terminal is exited after importing the environment variable, it needs to be re-imported again. Use the following commands to see if the environment variables are imported correctly:

```
qmake -v
```

The correct echo is as follows:

```
QMake version 3.0
Using Qt version 5.2.1 in /opt/poky/1.6.2/sysroots/cortexa9hf-vfp-neon-poky-linux-gnueabi/usr/lib
```

Copy the application Qt project from other Windows or Linux hosts to the compilation host and go to the project's home directory and execute the following commands to produce the Makefile for compilation:

```
cd ~/testproject
qmake
```

After the Makefile is generated, use the make command to compile the application for Mx-5A01:

```
make
```

Generally, the compiled binary results are in the current directory, and they can be executed after copying to Mx-5A01 system through the network or flash disk.

3.7 Startup script of user software

After debugging the application, it can be added to the startup script to achieve the start-up at the boot. The path to the startup script is

```
/home/root/.muxusrboot
```

Edit the file and write the application startup item into it.

4. Application Software Development Guide

It is recommended to use Qt development environment for the application development, and the host Qt version shall not be below 5.2.1.

Federal Communication Commission Statement (FCC, U.S.)

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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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 of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and 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.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTES

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End product labeling:

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ASTY-MX5A01".

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Antenna Specification:

Type: FPCB Antenna

Gain: 3.7dBi