LinkIt 2523 HDK User's Guide

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Document Revision History

Revision	Date	Description
1.0	2 September 2016	Initial release. This document is for LinkIt 2523 HDK v11.
1.1	4 November 2016	• Updated introduction to include top and bottom views of the LinkIt 2523 HDK v11. • Updated the section for Bluetooth and Bluetooth Low Energy. • Updated the schematic and the BOM list.
1.2	13 January 2017	• Updated the PinMux description. • Updated the MSDC power rail setup to activate eMMC. • Updated the keypad settings.

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1. Introduction

Airoha IoT 2523 hardware development kit (HDK) by SAC is a fully functional development platform for RTOS for IoT and Wearable applications powered by MT2523G, an ARM Cortex-M4 core-based microcontroller unit (MCU). The HDK has rich connectivity features and interfaces such as SPI, I2S, PCM, UART, ADC, PWM, JTAG and clock out generators.

The LinkIt 2523 HDK enables application development, prototyping and evaluation using sensors, Bluetooth, Bluetooth low energy, GNSS, audio (speech, headset and speaker), MIPI, serial, camera serial interface, keypad, battery management, micro SD and eMMC portable storage support and high speed USB 2.0. The LinkIt 2523 HDK also has built-in antenna that is able to receive Bluetooth (compatibility with up to 4.0 and higher versions), and GNSS (GPS, GLONASS and BeiDou) signals. In addition, the USB to serial wire debug (SWD) converter and JTAG feature provides convenient development and debugging.

The LinkIt 2523 HDK supports OpenSDA to provide more streamlined development to debug and flash the binary code.

This user's guide covers MT2523G and MT2523D integrated chipsets. The functions and pin assignments from both chipsets are identical, except the MT2523D doesn't support GNSS communication.

The user manual guides you through the following.

- Describing the hardware features of the LinkIt 2523 HDK.
- Configuring the LinkIt 2523 HDK with specific pin and jumper assignments.
- Providing the hardware schematics for more detailed configuration and reference design.
- Listing bill of materials (BOM) for the LinkIt 2523 HDK.

Front and back views of the LinkIt 2523 HDK version 11 are presented in Figure 1 and Figure 2, respectively.

Figure 1. Top view of the LinkIt 2523 HDK v11

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Figure 2. Bottom view of the LinkIt 2523 HDK v11

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2. Get Started with the HDK

This section provides details on how to configure the HDK and install the required peripheral drivers for the full operation of the development platform.

Before commencing the application development, set the jumpers for the camera daughterboard, as shown in Figure 3.

Figure 3. USB connectors on the LinkIt 2523 development board

The **2523 USB** can be used for powering up the board and downloading the binary with 2523 Flash Tool. The **MK20 USB** can be used for debugging with GDB and downloading the binary using Keil IDE. To learn more about **2523 USB** COM port driver, see section 2.3, "Installing the USB driver" of MT2523 Flash Tool Users Guide.

2.1. Installing the LinkIt 2523 HDK drivers on Microsoft Windows

Install mbed serial port driver to use the USB serial port on Windows OS for debugging:

1) Download and install the Windows serial port driver from here.
2) Connect the board to the computer through **2523 USB** and the **MK20 USB**.
3) Open Windows **Control Panel**, click **System** and:
   - On Windows 7 and 8, click **Device Manager**.
   - On Windows XP, click the **Hardware** tab and then **Device Manager**.
4) In **Device Manager**, navigate to **Ports (COM & LPT)** (see Figure 4).

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A new COM device should appear under **Ports (COM & LPT)**, as shown in Figure 4. Note the COMx port number of the **mbed Serial Port**. Use this port to send and receive data to and from the LinkIt 2523 HDK.

Figure 4. Device COM port for debugging on your PC

To install a USB to UART driver, such as prolific USB to UART converter:

1) Connect a USB to UART cable to PC, such as USB to Serial/UART Bridge Controller (Integrated crystal/OTP). A new unknown device will be detected on Microsoft Windows system, if the device driver wasn't setup before.

2) Download and install the USB to UART cable driver from Prolific. After the driver is installed, unknown device will be changed to **Prolific USB-to-Serial Comm Port**.

3) Open Windows **Control Panel**, click **System**.

   - On Windows 7 and 8, click **Device Manager**.
   - On Windows XP, click the **Hardware** tab and then **Device Manager**.

4) In **Device Manager**, navigate to **Ports (COM & LPT)** (see Figure 5). A new COM device should appear. Note the COMx port number of the **Prolific USB-to-Serial Comm Port**. The COM port can now be used to receive system logs through the UART interface on the LinkIt 2523 HDK.

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Figure 5. Device COM port for logging on your PC

A typical USB to UART converter is shown in Figure 6. The USB connector should be connected to the PC. The jump wires (count of four) should be connected to the UART interface on the LinkIt 2523 HDK. Connect the black wire to the GND, the white wire to the RX and the green wire to the TX and no need to connect the red wire. Once the converter is connected, the system logs will display on the serial monitor tool, such as Tera Terminal. Figure 20 shows the UART port connector location.

Figure 6. A typical USB to UART converter

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2.2. Downloading the project image using the LinkIt 2523 HDK as a removable storage

To update the FreeRTOS image only (example project image: `iot_sdk_demo.bin`) use the LinkIt 2523 HDK as a removable disk drive according to the following steps:

1) Connect the LinkIt 2523 HDK to your PC with a micro-USB cable to the **MK20 USB** connector.

2) Navigate to **Computer** on your PC to check if a new mass storage named **MT2523** is available under **Devices with Removable Storage**, as shown in Figure 7.

Figure 7. LinkIt 2523 HDK connected as removable disk storage

3) Open the **MT2523** removable storage, then drag and drop the project image, such as `iot_sdk_demo.bin`, from the original image folder to update the image on the HDK's flash.

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3. Hardware Description

LinkIt 2523 HDK provides connections between the system on chip (SOC) and the peripherals, such as micro SD card, eMMC, MIPI LCM, serial LCM, touch panel, serial camera, sensor daughterboard, GNSS, Bluetooth, audio speech and high speed USB 2.0.

The top and bottom layout views (Figure 8 and Figure 9, respectively) show the positions of the peripherals on the development board. Some of the peripheral interfaces are mutually exclusive. The eMMC and the micro SD, for example, cannot be used at the same time, as the corresponding pins can only be assigned to one function at a time.

The LinkIt 2523 HDK provides the following features for application development.

- ARM Cortex-M4 core-based MT2523G microcontroller.
- Internal 160kB SRAM and 4MB PSRAM.
- Internal 4MB serial flash.
- Three I2C interfaces.
- Three SPI master and one SPI slave interfaces ready to use.
- One I2S master and one I2S slave interfaces ready to use.
- One PCM interface that supports master.
- Three sets of UARTs. The first set of UART is directly configured through pin headers, the other two sets are software configurable.
- Six PWMs by alternative voltage level.
- One SDMMC.
- JTAG debugging support.
- Five sets of clock outputs.
- Peripherals.
- One serial camera interface supporting up to 3-bit mode image capture.
- Two display modes supporting serial interface and MIPI with the resolution of up to 320*320 pixels.
- Keypad supported to simulate buttons, such as volume up or down, backward and enter.
- Onboard speaker, onboard analog microphone and audio jack appliance.
- User-friendly customization.
- Supports Bluetooth (2.4GHz) and GNSS onboard antenna connectivity and an SMA connector for dedicated antenna connectivity.
- Supports 2-wire SWD interface for debugging purposes.
- Headers for convenient and accurate current measurement.

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Figure 8. LinkIt 2523 HDK's top view

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Figure 9. LinkIt 2523 HDK's bottom view

For more details on the HDK schematics see chapter 5, "Schematics".

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4. Hardware Configuration

4.1. Microcontroller unit

The LinkIt 2523 HDK is powered by MT2523G SOC designed for IoT applications and equipped with flexible pin assignments for custom applications.

MT2523G SOC is an ARM Cortex-M4 core-based architecture with built-in Bluetooth and Bluetooth Low Energy connectivity support, GNSS, audio interface, internal PSRAM and flash storage. The LinkIt 2523 HDK provides peripheral support for the I2C, SPI, UART, ADC, PWM, clock generator, audio and SDMMC interfaces.

LinkIt 2523 platform featured applications include but are not limited to industrial applications and automation, medical signal processing applications, such as sports physiological signal recording, long term medical data recording, home automation applications, tracking and safety applications using GNSS.

4.2. Power

This section describes the power source options for the LinkIt 2523 HDK. The HDK can operate powered by USB or a battery. To charge the battery, the USB cable has to be connected. The board can enter to sleep mode using the PSRAM memory. The sleep mode can be enabled or disabled by the software.

The LinkIt 2523 HDK also enables GPIO voltage setting configuration based on the supported components. It also can supply power to the storage, such as micro SD or eMMC. The HDK supports an active GNSS antenna that requires a power input, see section 4.2.4, “Powering on an active GPS antenna”.

4.2.1. Powering up with the USB

Connect a micro USB cable directly to **2523 USB** or **MK20 USB** (see Figure 3) to supply power to the HDK. Set the jumper J2001 (**system power**) to pin 1 and pin 2, to charge the battery using a USB connector. To boot up the system without a battery, apply the jumper settings, as shown in Table 1. The jumper J2001 (**system power**) location is marked in Figure 3, it’s assigned for the power rail source. The main power traces through jumper J2001 to the system.
For the battery criteria of LinkIt 2523 HDK, the capacity between 30mAh to 500mAh is recommended; charging voltage from USB connector with tolerance between 4.15V to 7V is acceptable. The LinkIt 2523 HDK also supports powering on the battery with power key, where the system power jumper setting is the same as to charge the battery.

Table 1. Power input jumpers

Power path switch	Set the jumper J2001 pins to assign the power source from **2523 USB** connector or **MK20 USB** connector, as shown below. Set the jumper J2001 pins to get the power source from battery connector CON2101 (see Figure 19), as shown below.

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4.2.2. Power source for digital I/O

LinkIt 2523 HDK supplies power to devices with different voltage support. GPIO voltage level customization is shown in Table 2. Jumper and resistor positions are specified in Figure 10 and Figure 11.

Table 2. GPIO voltage level customization with jumper and pin (illustrated) settings

Power rail DVDD_VIO_A voltage	Set the jumper J1106 pins with 0Ω resistor to assign the power rail DVDD_VIO_A to VIO28, as shown below.
	Set the jumper J1106 pins with 0Ω resistor to assign the power rail DVDD_VIO_A to VIO18, as shown below.
Power rail DVDD_VIO_C voltage	Set the jumper J1108 pins with 0Ω resistor to assign the power rail DVDD_VIO_C to VIO28, as shown below.
	Set the jumper J1108 pins with 0Ω resistor to assign the power rail DVDD_VIO_C to VIO18, as shown below.
Power rail DVDD_GPO voltage	Set the jumper J1109 pins with 0Ω resistor to assign the power rail DVDD_GPO to VIO28, as shown below.
	Set the jumper J1109 pins with 0Ω resistor to assign the power rail DVDD_GPO to VIO18, as shown below.
Power rail DVDD18_VIO18 voltage selection	Set the jumper J1110 pins with 0Ω resistor to assign the power rail DVDD18_VIO18 to VIO28, as shown below.
	Set the jumper J1110 pins with 0Ω resistor to assign the power rail DVDD18_VIO18 to VIO18, as shown below.
	Set the jumper J1111 pins with 0Ω resistor to assign the power rail DVDD_VMC to VIO28, as shown below.

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Power rail DVDD_VMC voltage	 Set the jumper J1111 pins with 0Ω resistor to assign the power rail DVDD_VMC to VIO18, as shown below. Remove the jumper J1111 with 0Ω resistor to select the power rail DVDD_VMC connected with VMC while the 0Ω resistor R1113 is mounted. Mount the 0Ω resistors R1113 and R4101, to use micro SD storage.

Figure 10. The positions of jumpers J1105, J1110 to J1112. J1114, resistors R4101, R1113, GPDAC test point TP1101 and micro SD cardholder

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4.2.3. Powering on the eMMC or micro SD

The LinkIt 2523 HDK supports eMMC and micro SD card for storage. The HDK operates with either eMMC or micro SD card (see Figure 10) enabled but not both at the same time.

4.2.4. Powering on an active GPS antenna

The active GPS antenna on LinkIt 2523 HDK can be either software controlled or hardware activated. Table 3 provides details on how to determine if the antenna is activated by direct power supply or by software control. Adjust the jumpers J5201 and J5202 to change the settings. The jumper locations are shown in Figure 10 and Figure 11.

Table 3. Enabling the active GPS antenna on HDK with jumper pin settings (illustrated)

Low noise amplifier activation control (should be synchronized with J5202)	Set the jumper J5201 pins with 0Ω resistor to enable the active GPS antenna using the power rail, as shown below.
	Set the jumper J5201 pins with 0Ω resistor to enable the active GPS antenna controlled by software settings, as shown below.
Active antenna power supply (should be synchronized with J5201)	Set the jumper J5202 pins with 0Ω resistor to supply power and enable the active GPS antenna using the power rail, as shown below.
	Set the jumper J5202 pins with 0Ω resistor to supply power and enable the active GPS antenna controlled by software settings, as shown below.

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Figure 11. The jumper positions for J5201 and J5202, J1106, J1108, J1109

4.2.5. The LCM backlight power source ISINK

The current sink for LCM backlight is the pin named ISINK. The current and voltage settings are configurable.

If the current sink is active, LED9209 is powered on to indicate the backlight is enabled. More details can be found in Table 8, Figure 12 and Figure 13.

4.2.6. PSRAM power source

The PSRAM power source can be set to either always powered on or could be controlled by user-defined settings. Table 4 provides the jumper settings for each of the methods. The jumpers J1105 (see Figure 10) and J1113 (see Figure 27) can be adjusted for PSRAM power source.

Table 4. PSRAM power source selection jumpers

PSRAM power supply J1105 (Should be synchronized with J1113)	Connect the jumper J1105 pins with 0Ω resistor to set the power source from VSWXM, as shown below.

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	Connect the jumper J1105 pins with 0Ω resistor to set the power source from VIO18, as shown below.
PSRAM power supply J1113 (Should be synchronized with J1105)	Connect the jumper J1113 pins to set the power source from VIO18, as shown below.
	Connect the jumper J1113 pins to set the power source from VSWXM, as shown below.

4.2.7. Serial flash I/O power source

Table 5 provides two different settings to power up the serial flash.

Table 5. Serial flash I/O power source selection jumper

Serial flash I/O power supply J1112	Connect the jumper J1112 (see Figure 10) pins with 0Ω resistor to set the power source from VIO18, as shown below.
	Connect the jumper J1112 (see Figure 10) pins with 0Ω resistor to set the power source from VSF, as shown below.

4.2.8. Analog I/O power selection

Table 6 provides two different settings to power up the analog I/O.

Table 6. Analog I/O power source selection jumper

Analog I/O power supply J1114	Connect the jumper J1114 (see Figure 10) pins with 0Ω resistor to set the power source from VA28, as shown below.
	Connect the jumper J1114 pins with 0Ω resistor to set the power source from VIO28, as shown below.

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4.3. Jumpers

The HDK offers flexible jumper settings for customization. Table 7 summarizes the functions associated with different jumpers.

Table 7. LinkIt 2523 HDK jumper index

Jumpers	Purpose	Features	Type
J1001 **J1002** **J1003** **J1004** **J1005** **J1006**	Storage options	• eMMC • Micro SD	GPIO selection, see section 4.10, "MSDC".
J1007 **J1008** **J1009** **J1010** **J1011** **J1012** **J1015**	Daughterboard options of camera or sensor	• Sensor daughterboard • Camera daughterboard	GPIO selection, see section 4.11, "Camera".
J1101	Selection of external buck LDO by ROM control or system boot	• Enable by VIO28 • Enable by EXT_PWREN	Power selection, see section 4.14, "Bluetooth and Bluetooth Low Energy".
J1102	MT2523 D-die eFuse options	• Enable by VIO28 • Disable by GND	GPIO selection, see section 4.6.1, "MT2523 digital die eFuse".
J1103	32.768kHz XTAL support (Should be synchronized with J1104)	• Mount the 32.768kHz XTAL for power saving operations • Unmount the 32.768kHz XTAL for cost reduction	GPIO selection, see section 4.6.2, "RTC source ".
J1104	32.768kHz XTAL support (Should be synchronized with J1103)	• Mount the 32.768kHz XTAL needed by VIO18 • Unmount the 32.768kHz XTAL by VA18	GPIO selection, see section 4.6.2, "RTC source ".
J1105	Power path for PSRAM power source (SMT type)	• VIO18 for PSRAM power source • VSWXM for PSRAM power source	Power selection, see section 4.2.6, "PSRAM power source".
J1106	Power path selection for DVDD_VIO_A cluster power source	• VIO18 for DVDD_VIO_A cluster I/O voltage 1.8V • VIO28 for DVDD_VIO_A cluster I/O voltage 2.8V	Power selection, see section 4.2.2, "Power source for digital I/O".
J1108	Power path selection for DVDD_VIO_C cluster power source	• VIO18 for DVDD_VIO_**C** cluster I/O voltage 1.8V • VIO28 for DVDD_VIO_**C** cluster I/O voltage 2.8V	Power selection, see section 4.2.2, "Power source for digital I/O".

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J1109	Power path selection for DVDD_GPO cluster power source	• VIO18 for DVDD_GPO cluster I/O voltage 1.8V • VIO28 for DVDD_GPO cluster I/O voltage 2.8V	Power selection, see section 4.2.2, "Power source for digital I/O".
J1110	Power path selection for DVDD18_VIO18 cluster power source	• VIO18 for DVDD18_VIO18 cluster I/O voltage 1.8V • VIO28 for DVDD18_VIO18 cluster I/O voltage 2.8V	Power selection, see section 4.2.2, "Power source for digital I/O".
J1111	Power path selection for DVDD_VMC cluster power source	• VIO18 for DVDD_VMC cluster IO voltage 1.8V • VIO28 for DVDD_VMC cluster IO voltage 2.8V	Power selection, see section 4.2.2, "Power source for digital I/O".
J1112	Power path selection for serial flash power source	• VSF for internal serial flash power source • VIO18 for internal serial flash power source	Power selection, see section 4.2.7, "Serial flash I/O power source".
J1113	Power path for PSRAM power source (Jumper type)	• VIO18 for PSRAM power source • VSWXM for PSRAM power source	Power selection, see section 4.2.6, "PSRAM power source selection jumpers".
J1114	Power path for analog I/O power source	• VIO28 for analog IO power source • VA28 for analog IO power source	Power selection, see section 4.2.8, "Analog I/O power selection".
J2001	Power path selection	• VBAT for buck power supply to system directly • VBAT_CONN for battery power supply to system, also including battery charging	GPIO selection, see section 4.2.1, "Powering up with the USB".
J5001	External clock 26MHz signal input support	• Enable using VIO28 • Disable using GND	GPIO selection, see section 4.14, "Bluetooth and Bluetooth Low Energy".
J5002	Bluetooth mode or BLE mode selection	• VBT for Bluetooth mode and BLE modes • VIO18 for BLE mode only.	Power selection, see section 4.14, "Bluetooth and Bluetooth Low Energy".
J5003	RF signal path selection by onboard antenna or SMA connector	• Select onboard antenna by connecting pin 1 and pin 2. • Select SMA connector antenna by connecting pin 2 and pin 3.	GPIO selection, see section 4.14, "Bluetooth and Bluetooth Low Energy".
J5004	Bluetooth mode selection or external buck cost reduction	• VBT for both of Bluetooth mode and BLE mode • VIO18 for external buck LDO cost reduction	Power selection, see section 4.14, "Bluetooth and Bluetooth Low Energy".

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J5201	Active GPS antenna control	• Controlled by power rail GPS_VTCXO_SW • Software control by net TX2	Power selection, see section 4.2.4, "Powering on an active GPS antenna".
J5202	Active GPS antenna power source	• Controlled by power rail GPS_VTCXO_SW • Software control by external buck LDO	Power selection, see section 4.2.4, "Powering on an active GPS antenna".
J6101 **J6102** **J6103** **J6104** **J6105** **J6106**	Display output by serial jumpers or high speed connector	• Select serial pin header by connecting pin 2 and pin 3. • Select MIPI display LCM connecting pin 1 and pin 2.	GPIO selection, see section 4.7, "LCM".
R9001 **R9002** **R9007** **R9008** **Disable JTAG interface when R9002 and R9008 are mounted**	Switch of JTAG interface enable/disable on keypad and camera clusters	• Select JTAG interface enable on keypad cluster if R9002 and R9007 are mounted. • Select JTAG interface on camera cluster is enabled if R9001 and R9007 are mounted.	Strap pin selection, see section 4.15, "Debugging".

4.4. LEDs

The LED indicators (see Figure 12 and Figure 13) on the HDK are listed in Table 8.

Table 8. The LED indicators

USB power source indicator	LED2001 indicates if the power is supplied to both LinkIt 2523 HDK and CMSIS-DAP using USB connectors.
Buck power indicator	LED2003 indicates if the power source is from the USB cable and the buck is enabled.
CMSIS-DAP power indicator	LED6601 indicates if the CMSIS-DAP power is on. This LED is not mounted on the HDK v1.1. It can be soldered, if necessary.
eMMC/micro SD power indicator	LED9201 indicates if the micro SD or eMMC power rail is enabled.
Core power indicator	LED9206 indicates if the main power rail for LinkIt 2523 HDK core operates successfully.
Display current sink indicator	The only amber indicator LED9209 indicates if the backlight of the display panel is on.

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Figure 12. LED positions for LED2001, LED2003 and LED6601

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Figure 13. LED positions for LED9201, LED9206 and LED9209

4.5. Buttons

The LinkIt 2523 HDK has four buttons that could support keypad functionality. To improve the pin usage on the development board, the buttons could be designed with double key feature, as shown in Table 9.

By default, the HDK supports JTAG connectivity with corresponding pin assignment. The JTAG debug feature is assigned to the same set of pins as the buttons on the HDK. The pins are SW6502, SW6503, SW6504 and SW6505. The pin locations are shown in Figure 14.

Note that keypad and JTAG functionality are always mutually exclusive. Once JTAG is enabled, GPIO 18, 19, 21, 22 and 23 pins are configured as output, see section 4.15, "Debugging" and Table 19.

To enable buttons on keypad on the HDK:

- Remove 10kΩ resistor from R9001.
- Mount 10kΩ resistor to R9002. Resistor R9008 is mounted by default.
- Set GPIO 18, GPIO 20 and GPIO 22 to keypad function using the Easy PinMux Tool (EPT).

Table 9. Buttons and corresponding keypad functionality

System reset	Push **Reset** to reset the HDK.
Power on	Push **PWR key** to power on the HDK with a battery. There is no need to press this button, if the system is powered on with a USB cable as it will automatically turn on.

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Volume up	SW6502 button is assigned to control the volume up function.
Volume down	SW6503 button is assigned to control the volume down function.
Enter	SW6504 button is assigned to simulate **ENTER** key similar to the keypad.
Back	SW6505 button is assigned to simulate **BACK** key similar to the keypad.

Figure 14. The positions of buttons, strap pin resistors, jumpers J1102 to J1104

4.6. GPIO

LinkIt 2523 GPIOs provide the following internal states: digital high and digital low, input and output. The pin configuration is stored under `project\mt2523_hdk\template\ept_config` folder and the Easy PinMux Tool is in resources at MediaTek Labs. To learn more about the software registers and GPIO functionality, refer to the 2523 API Reference Manual.

MT2523 digital die eFuse, MT2523 real-time clock (RTC) source selection and pins assigned for user applications are GPIO features that could be customized in user-defined applications.

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4.6.1. MT2523 digital die eFuse

The MT2523 digital die eFuse function can be enabled to protect the binary image stored on the HDK, as shown in Table 10 and Figure 14.

Table 10. LinkIt 2523 board's eFuse jumper pin settings (illustrated)

Enable or disable eFuse	Set the jumper J1102 with 0Ω resistor to GND to disable the eFuse setting on the HDK, as shown below. Set the jumper J1102 with 0Ω resistor to power rail VIO28 to enable the eFuse setting on the HDK, as shown below.

4.6.2. RTC source

The RTC source can be provided using either an internal or an external clock. Connect the jumper J1103 pin 2 and pin 3 to provide 32.786kHz internal clock signal for BOM cost saving setting. Connect jumper J1103 pin 1 and pin 2 to select the clock source generated by external XTAL or built-in oscillator. Jumper J1104 should be synchronized with the jumper J1103.

Set the jumper J1104 pins 1 and pin 2 to apply power saving mode, if 32.768kHz XTAL is mounted. Connect jumper J1104 pins 2 and pin 3 for XTAL cost reduction. Table 11 provides details on how to configure the RTC jumper settings for the HDK. The pin, jumper and resistor locations can be found in Figure 14.

Table 11. LinkIt 2523 board's RTC jumper pin settings

Enable or disable 32.768kHz XTAL	Set the jumpers J1103 and J1104 with 0Ω resistors to supply 32.768kHz clock by XTAL, as shown below. Set the jumpers J1103 and J1104 with 0Ω resistors to supply 32.768kHz internal clock, as shown below.

4.6.3. Pins reserved for user-defined applications

The camera and sensor daughterboard pin headers can be configured in user-defined applications. In addition, LinkIt 2523 HDK provides two sets of two-pin header jumpers for I2C, UART, EINT and GPIO that are software configurable using the EPT (see Figure 20). Pin assignment tables to implement multi-mode selections can be found in sections 4.16.1, "UART " and 4.16.2, "I2C ".

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4.7. LCM

The LinkIt 2523 HDK supports two types of display topology: MIPI DSI and serial. The MIPI interface provides a maximum resolution of display of up to 320*320 pixels and it's a hyper RGB 1.63 inch AMOLED display. The serial interface is a 240*240 pixel graphical RGB 1.6 inch thin film transistor LCD. The connector CON6102 on the HDK is reserved for the serial display LCM.
The HDK supports only one display LCM at a time. The capacitive touch screen is enabled on both displays.

The onboard MIPI LCM or CON6102 supports touch panel connected to the I2C interface. The pin definition of the connectors can be found in Table 13 and Table 14, with the path selection resistor locations shown in Figure 14. Resistors J6101 to J6106 are designed for onboard LCM and serial pin header switching.

For MIPI LCM display, users should connect the connectors CON501 and CON502 (located behind CON501 on the back of the board) for touch and display functions; for serial display, the set of CON401 and CON402 should be used.

Jumpers J401 and J402 enable the current sink, and jumpers J201, J202, J203 are reserved for external current sink IC to power up the serial display backlight. Only one type of backlight source is needed at a time. All descriptions of backlight source jumpers and path selections are shown in Table 12. Table 15 presents jumper settings for different use case scenarios.

Figure 15. LCM display module and backlight jumper locations

Table 12. LCM backlight source selection settings (illustrated)

	Set the jumpers J201, J202 and J203 to activate the external current sink IC for backlight. Remove the jumpers J401 and J402.

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LCM backlight boost source	
	Remove the jumpers J201, J202 and J203 to deactivate current IC and set jumpers J401 and J402 for backlight source through the current sink path.
LCM current sink source	Set the jumpers J401, J402 to activate the current sink and remove jumpers J201, J202 and J203 to disable the external current sink IC.
	Remove the jumpers J401, J402 to deactivate the current sink and set jumpers J201, J202 and J203 to activate the external current sink IC.

Table 13. Pin definition of Truly touch IC GT9137 connector CON402

PIN number	Description
1	VIO28
2	I2C_SCL
3	I2C_SDA
4	Touch panel EINT
5	Touch panel reset pin
6	GND
7	GND
8	NC
9	GND
10	GND

Table 14. Pin definition of touch IC ITE7258 connector CON502

Pin number	Description
1	GND
2	I2C_SCL
3	I2C_SDA
4	GND
5	Touch panel EINT
6	VIO28
7	Touch panel EINT
8	NC

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Pin number	Description
9	Touch panel reset pin
10	GND

Table 15. LinkIt 2523 HDK display peripheral jumper pin settings (illustrated)

LCM display reset	Set the jumper J6101 with 0Ω resistor to connect the LCM reset signal to onboard LCM, as shown below.
	Set the jumper J6101 with 0Ω resistor to connect the LCM reset signal to serial pin header, as shown below.
LCM display chip select	Set the jumper J6102 with 0Ω resistor to connect the LCM SCE signal to onboard LCM, as shown below.
	Set the jumper J6102 with 0Ω resistor to connect the LCM SCE signal to serial pin header, as shown below.
LCM display clock	Set the jumper J6103 with 0Ω resistor to connect the LCM SCK signal to onboard LCM, as shown below.
	Set the jumper J6103 with 0Ω resistor to connect the LCM SCK signal to serial pin header, as shown below.
LCM display tearing	Set the jumper J6104 with 0Ω resistor to connect the LCM PTE signal to onboard LCM, as shown below.
	Set the jumper J6104 with 0Ω resistor to connect the LCM PTE signal to serial pin header, as shown below.
LCM display data	Set the jumper J6105 with 0Ω resistor to connect the LCM SDA signal to onboard LCM, as shown below.

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	Set the jumper J6105 with 0Ω resistor to connect the LCM SDA signal to serial pin header, as shown below.
LCM display address	Set the jumper J6106 with 0Ω resistor to connect the LCM SA0 signal to onboard LCM, as shown below.
	Set the jumper J6106 with 0Ω resistor to connect the LCM SA0 signal to serial pin header, as shown below.

4.8. Audio

The LinkIt 2523 HDK is equipped with a loud speaker to enable audio playback. To enable the speaker, configure the GPIO45 as an output using the Easy PinMux Tool. The LinkIt 2523 HDK also supports full duplex to develop audio receive and speak at the same time for real-time development. The HDK is using the I2S interface with master and slave with a sampling rate of 48Hz and bit width of up to 16 bits for stereo.

4.9. Speech

There is one analog microphone on the LinkIt 2523 HDK for audio recording. The audio jack also supports the OMTP standard for recording. The locations of the microphone and audio jack are shown in Figure 8.

4.10. MSDC

The LinkIt 2523 HDK supports any micro SD card of FAT32 format to read and write data. The micro-SD card plug-in is detected at GPIO10 with various voltage levels. To power on the eMMC, the power rail should be connected to the power rail VMC, which means DVDD33_VMC should be connected to VMC using R1113 and the resistor J1111 should be removed (see Figure 10).

Mount the resistors R4005 (Figure 9) and R4009 to enable the eMMC. The eMMC and micro-SD operation are mutually exclusive. Remove the resistors R4005 and R4009 and mount R4010 to enable the micro-SD card.

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Figure 16. Power rail resistors R4009 and R4010

The eMMC feature is shared with micro SD card by configuring the pin jumper settings, see Table 16 and Figure 17.

Table 16. Jumper settings (illustrated) for storage options

Storage data line 0	Set the jumper J1001 pins to assign the storage data line 0 to micro SD, as shown below.
	Set the jumper J1001 pins to assign the storage data line 0 to eMMC, as shown below.
Storage data line 1	Set the jumper J1002 pins to assign the storage data line 1 to micro SD, as shown below.
	Set the jumper J1002 pins to assign the storage data line 1 to eMMC, as shown below.

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Storage data line 2	Set the jumper J1003 pins to assign the storage data line 2 to micro SD, as shown below.
	Set the jumper J1003 pins to assign the storage data line 2 to eMMC, as shown below.
Storage data line 3	Set the jumper J1004 pins to assign the storage data line 3 to micro SD, as shown below.
	Set the jumper J1004 pins to assign the storage data line 3 to eMMC, as shown below.
Storage clock line	Set the jumper J1005 pins to assign the storage clock line to micro SD, as shown below.
	Set the jumper J1005 pins to assign the storage clock line to eMMC, as shown below.
Storage command line	Set the jumper J1006 pins to assign the storage command line to micro SD, as shown below.
	Set the jumper J1006 pins to assign the storage command line to eMMC, as shown below.
MSDC power rail resistor selections	Mount the resistor R4009 on the left side of overlap footprint to enable the eMMC, as shown below.

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Mount the resistor R4010 on the right side of overlap footprint to enable the micro SD card slot, as shown below.

Figure 17. Jumpers J1001 to J1006 for storage options

4.11. Camera

Connect the camera daughterboard (see Figure 24) to the camera connector to enable the camera. The sensor daughterboard features are shared with camera using a jumper (see Table 17 and Figure 18). The LinkIt 2523 HDK supports serial interface cameras.

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Figure 18. Jumper pin locations of J1007 to J1012, J1015

Table 17. Jumper pin settings (illustrated) for camera and sensor daughterboards

Camera power down or sensor daughterboard chip select	Set the jumper J1007 to connect the sensor daughterboard using SPI chip select, as shown below.
	Set the jumper J1007 to connect camera daughterboard using camera power down, as shown below.
Camera reset or sensor board power down	Set the jumper J1008 to connect the sensor daughterboard using the GPIO, as shown below.
	Set the jumper J1008 to connect the camera daughterboard using the camera reset, as shown below.
Camera data line 1 or sensor daughterboard data output	Set the jumper J1009 to connect the sensor daughterboard using the SPI data output, as shown below.

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	Set the jumper J1009 to connect the camera daughterboard using data line 1, as shown below.
Camera data line 0 or sensor daughterboard clock	Set the jumper J1010 to connect the sensor daughterboard using the SPI clock, as shown below.
	Set the jumper J1010 to connect the camera daughterboard using data line 0, as shown below.
Camera pixel clock input or sensor daughterboard data input	Set the jumper J1011 to connect the sensor daughterboard using the SPI data input, as shown below.
	Set the jumper J1011 to the camera daughterboard using pixel clock input, as shown below.
Camera pixel clock output or sensor daughterboard reset	Set the jumper J1012 to connect the sensor daughterboard connection using the GPIO, as shown below.
	Set the jumper J1012 to connect the camera daughterboard using the camera pixel clock output or data line 0, as shown below.
Camera pixel clock output / camera data line 2	Set the jumper J1015 to connect the camera daughterboard using the camera pixel clock output, as shown below.
	Set the jumper J1015 to connect the camera daughterboard using the camera data line 2, as shown below.

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4.12. USB

LinkIt 2523 HDK has two USB connectors, **2523 USB** see section 4.16.10, "USB 2.0 high speed connector" and **MK20 USB** see section 4.16.11, "CMSIS-DAP USB 1.1 full speed connector ", as shown in Figure 3. The **2523 USB** connector is used to flash the board with the 2523 Flash Tool.

The **MK20 USB** is for CMSIS-DAP USB and serial port communication and setting up the board as a mass storage device. The CMSIS-DAP is the debugging user interface for embedded devices. The mass storage is for flashing the LinkIt 2523 using the SWD interface. The user can drag and drop the LinkIt 2523 binary file and the FreeRTOS binary file to the HDK operating as a mass storage device to flash the image directly. The serial port also supports UART2 connectivity on the LinkIt 2523 HDK.

The maximum charging current is 1.5A at 5V DC for the LinkIt 2523 HDK's internal charger. The USB power source is passing through the jumper J2001 on the HDK.

4.13. GNSS (LinkIt 2523G only)

The LinkIt 2523G HDK is equipped with multi-GNSS chip with a built-in multiband onboard antenna with an operating range of 1.5GHz-2.4GHz. Set the jumper J5003 to receive Bluetooth, Bluetooth Low Energy and GNSS signal by an onboard antenna or SMA connector. It's convenient to use the onboard antenna for direct line of sight signals, where the environment conditions are clear for satellite visibility and location estimation. It's recommended to use the passive onboard antenna for the satellite signals with signal-noise-ratio (SNR) greater than 40dB. If users would like to validate the satellite performance, please connect external antenna to the GNSS/BT SMA header shown in Figure 8.

The HDK supports GPS, GLONASS, BeiDou, Galileo, QZSS and SBAS standards with optimized power consumption and extended battery life. Onboard antenna and SMA connector path settings are described in section 4.14, "Bluetooth and Bluetooth Low Energy".

4.14. Bluetooth and Bluetooth Low Energy

The LinkIt 2523 HDK supports Bluetooth 4.2 for Bluetooth core specification updates to provide an improved speed and reliable data transfer. The transfer speed is up to 2.5 times faster and the protocol stack size is smaller. Bluetooth 4.2 also consumes less power. It's backward compatible with Bluetooth 4.0 and 4.1 and has adopted Bluetooth core versions starting from 1.1 with Bluetooth BR/EDR.

There are three options to power up the HDK with Bluetooth, Bluetooth LE and external buck power supply. The data transfer is through an onboard antenna or an external antenna with an SMA connector. The SMA connector SMA5002 could be connected with an external antenna cable for Bluetooth and Bluetooth LE signal strength validation.
Some of the jumpers are designed to switch between the RF signal and Bluetooth mode. Details on switching between the modes are presented in Table 18 with the jumpers shown in Figure 19.

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Figure 19. Positions of J1101 and Bluetooth antenna path selection from J5001 to J5004, U1101, CON2101 and resistor R5005

Table 18. Jumper pin settings (illustrated) for Bluetooth

Bluetooth external buck activated	Connect the jumper J1101 pin 1 and pin 2 to set the external buck U1101 enabled by power rail VIO28, as shown below.
	Connect the jumper J1101 pin 1 and pin 2 to set the external buck U1101 enabled by ROM, as shown below.
	Connect the jumper J5001 pins with 0Ω resistor to set the Bluetooth clock to the clock signal generated by 26MHz XTAL, as shown below.

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Bluetooth external clock source	
	Connect the jumper J5001 pins with 0Ω resistor to set the Bluetooth clock to an external clock source, as shown below.
Bluetooth power input	Connect the jumper J5002 pins with 0Ω resistor to set the Bluetooth main power source to VBT, as shown below.
	Connect the jumper J5002 pins with 0Ω resistor to set the Bluetooth main power source to VIO18, as shown below.
Bluetooth antenna path	Connect the jumper J5003 pins with 0Ω resistor to select the antenna signal uplink and downlink paths on an onboard antenna, as shown below.
	Connect the jumper J5003 pins with 0Ω resistor to select the antenna signal uplink and downlink path using SMA connector, as shown below.
Bluetooth I/O power input	Connect the jumper J5004 pins with 0Ω resistor to set the Bluetooth I/O power source to VBT, as shown below.
	Connect the jumper J5004 pins with 0Ω resistor to set the Bluetooth I/O power source to VIO18, as shown below.
	Mount the 0Ω resistor R5005 and disconnect the jumper J5004 with 0Ω resistor to set the Bluetooth main power source to external buck LDO for low power consumption.

4.15. Debugging

To enable debugging on the LinkIt 2523 HDK, activate the JTAG interface using Easy PinMux Tool. Switch from the camera operation mode to debugging mode using JTAG interface by replacing the output pins in a range from GPIO 24 to GPIO 28 in Easy PinMux Tool from camera function to JTAG interface. The debugging log can be captured

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through the same jumpers, if the JTAG interface is activated. To capture logs by JTAG formal pin assignment connector, mount 0Ω resistors on footprint R9016, R9017, R9018, R9019, R9020, R9021 and R9023, then the connector CON9002 will be ready for JTAG signal transmission.

Resistors from R9001, R9002, R9007 and R9008 are the strap pins to adjust the feature settings, such as JTAG debug interface output cluster, as shown in Table 19. LinkIt 2523 HDK also provides the I2C and UART pin headers to receive system log or connect to external components directly, as shown in Figure 20. Both Figure 14 and Figure 20 provide the detailed locations of the pins.

Table 19. Resistor selections for JTAG function

JTAG function activated	Mount 10kΩ resistors R9002 and R9008 to deactivate the JTAG signals.
	Mount 10kΩ resistors R9001 and R9007 to activate the JTAG signals through the GPIO pins in a range from GPIO 24 to GPIO 28 to interface the camera pin headers.
	Mount 10kΩ resistors R9001 and R9008 to activate the JTAG signals through the GPIO of keypad cluster. Apply this setting to activate the MK20 JTAG connector.

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Figure 20. The positions of UART and I2C pin header for debugging facilitation

4.16. Connectors

The LinkIt 2523 HDK supports connectors to capture a signal, plug-in an external component, update an image and more. This section provides details and pin definitions for the connectors.

4.16.1. UART pin header

The **UART** pin header is reserved for user applications that can be configured for different modes, such as UART, GPIO and EINT (see Figure 20).

4.16.2. I2C pin header

The **I2C** pin header is reserved for user applications that can be configured for different modes, such as GPIO and I2C (see Figure 20).

Note, the pull-up resistors are needed for the I2C interface to provide sufficient driving power to the I2C clock and data lines. The two pull-up resistors R1003 and R1002 are already installed for the I2C interface, as shown in Figure 22.

4.16.3. Battery connector CON2102

The pin configuration of the battery connector CON2101 is shown in Table 20.

Table 20. Battery connector CON2101 (see Figure 19)

Pin number	Description	Pin number	Description
1	VBAT	2	VBAT
3	NC	4	NTC
5	GND	6	NC

4.16.4. Push-Push micro SD tray CON4101

The push-push micro SD tray is able to read micro SD card directly to conveniently provide data from the storage. Connector details are shown in Table 21. The connector location is shown in Figure 10 and the schematic view is in Figure 21.

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Figure 21. Micro-SD card holder CON4101

Table 21. Micro-SD tray

Pin number	Description	Pin number	Description
1	Data 2	2	Data 3
3	CMD	4	VDD
5	CLK	6	GND
7	Data 0	8	Data 1
9	GND	10	GND
11	GND	12	GND
13	GND	14	GND
15	Card detect		

4.16.5. RTC battery connector BAT5201

The coin battery connector is located at the bottom of the LinkIt 2523 HDK. The RTC saves the satellite information even when the system is powered off, see Figure 9.

4.16.6. OMTP standard audio connector CON6001

Audio jack pin assignment follows the OMTP standard and supports audio playback and microphone features. It enables to record speech and playback using the **Audio Jack** (see Figure 8), as described in Table 22.

Table 22. OMTP Audio jack connector

Pin number	Description	Pin number	Description
1	GND	2	MIC
3	Headset left	4	Headset right
5	Headset plug-in detection	6	NC

4.16.7. Serial display connector CON6102

CON6102 connector is mounted for external serial interface LCM daughterboard, as shown in Figure 22 and described in Table 23. You can only operate one LCM display at a time, make sure to change the signal path by resistors J6101 to J6106.

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Figure 22. Serial LCM daughterboard's connector and I2C pull-up resistors (R1002, R1003)

Table 23. LCM serial display daughterboard connector

Pin number	Description	Pin number	Description
1	LCM backlight current sink	2	VIO18
3	LCM backlight PWM	4	VIO28
5	LPTE	6	VIO28
7	LSDA	8	I2C_SCL
9	LSA0	10	I2C_SDA
11	LSCK	12	GND
13	LSCE_B	14	Touch panel EINT
15	LSRSTB	16	Touch panel reset pin
17	VBAT	18	GND
19	VBAT	20	GND

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4.16.8. Camera daughterboard connector CON6201

Connect the camera daughterboard to connector CON6201 (see Figure 23 and Figure 24) to capture images. The direction of camera module is to the left, which means the camera module on daughterboard should be toward USB connectors. The pin assignments can be customized for user-defined applications (see Table 24), if no camera daughterboard is available.

Mode 7 of the board configuration is for internal use only and it's not included in Table 24.

Figure 23. Serial camera daughterboard CON6201

Figure 24. The position of the camera daughterboard pin headers

Table 24. Serial camera daughterboard connector CON6201

PIN number	GPIO #	Power domain	Mode 0	Mode1	Mode2	Mode3	Mode4	Mode5	Mode6	Mode8	Mode9
1		VBAT	VBAT								
2	24	DVDD_VIO_A	GPIO24	CMRST	LSRSTB	CLKO1	EINT19	GPCOUNTER_0	JTDI	MC1_B_DA3	
3		VCAMA	VCAMA								
4	25	DVDD_VIO_A	GPIO25	CMPDN	LSCK1	DAICLK	MA_SPI2_A_CS	MA_SPI3_A_CS	JTMS	MC1_B_DA2	SLV_SPI0_CS

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PIN number	GPIO #	Power domain	Mode 0	Mode1	Mode2	Mode3	Mode4	Mode5	Mode6	Mode8	Mode9
5			GND								
6	29	DVDD_VIO_A	GPIO29	CMCSK	LPTE		CMCSD2	EINT10			
7	37	DVDD_VIO_A	GPIO37	SDA0	SDA1						
8	28	DVDD_VIO_A	GPIO28	CMMCLK	LSA0DA1	DAISYNC	MA_SPI2_A_MISO	MA_SPI3_A_MISO	JTDO	MC1_B_DA0	SLV_SPI0_MISO
9	36	DVDD_VIO_A	GPIO36	SCL0	SCL1						
10	29	DVDD_VIO_A	GPIO29	CMCSK	LPTE		CMCSD2	EINT10			
11			GND								
12	27	DVDD_VIO_A	GPIO27	CMCSD1	LSDA1	DAIPCMOUT	MA_SPI2_A_MOSI	MA_SPI3_A_MOSI	JTRSTB	MC1_B_CK	SLV_SPI0_MOSI
13			GND								
14	26	DVDD_VIO_A	GPIO26	CMCSD0	LSCE_B1	DAIPCMIN	MA_SPI2_A_SCK	MA_SPI3_A_SCK	JTCK	MC1_B_CM0	SLV_SPI0_SCK

4.16.9. Sensor daughterboard connector CON6301

Connect the sensor daughterboard to CON6301. The pin assignments can be customized in user-defined applications, if sensor daughterboard is unplugged, as described in Table 25 and Figure 27.

Table 25. Sensor daughterboard connector CON6301

Pin number	GPIO #	Power domain	Mode 0	Mode 1	Mode2	Mode3	Mode4	Mode 5	Mode6	Mode7	Mode8	Mode9
1		VBAT										
2		VA28										
3		VIO28										
4		VIO18										
5		GND										
6		GND										
7	37	DVDD_VIO_A	GPIO36	SDA0	SDA1							
8	28	DVDD_VIO_A	GPIO28	CMMCLK	LSA0DA1	DAISYNC	MA_SPI2_A_MISO	MA_SPI3_A_MISO	JTDO		MC1_B_DA0	SLV_SPI0_MISO
9	36	DVDD_VIO_A	GPIO36	SCL0	SCL1							
10	27	DVDD_VIO_A	GPIO27	CMCSD1	LSDA1	DAIPCMOUT	MA_SPI2_A_MOSI	MA_SPI3_A_MOSI	JTRSTB		MC1_B_CK	SLV_SPI0_MOSI
11		GND										
12	26	DVDD_VIO_A	GPIO26	CMCSD0	LSCE_B1	DAIPCMIN	MA_SPI2_A_SCK	MA_SPI3_A_SCK	JTCK		MC1_B_CM0	SLV_SPI0_SCK
13	48	DVDD_GPO	GPO48	MA_SPI3_CS1								

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Pin number	GPIO #	Power domain	Mode 0	Mode 1	Mode2	Mode3	Mode4	Mode 5	Mode6	Mode7	Mode8	Mode9
14	25	DVDD_VIO_A	GPIO25	CMPDN	LSCK1	DAICLK	MA_SPI2_A_CS	MA_SPI3_A_CS	JTMS		MC1_B_DA2	SLV_SPI0_CS
15	4	DVDD_VIO_A	GPIO4	EINT3	MC1_A_CK	SLA_EDIDO			URXD1	MA_SPI0_B_CS		
16		GND										
17	5	DVDD_VIO_A	GPIO5	EINT4	MC1_A_CM0	SLA_EDIDI			UTXD1	MA_SPI0_B_SCK		
18	7	DVDD_VIO_A	GPIO7	EINT6	MC_A_DA1	SLA_EDICK	UTXD2			MA_SPI0_B_MISO		
19	6	DVDD_VIO_A	GPIO6	EINT5	MC_A_DA0	SLA_EDIWS	URXD2			MA_SPI0_B_MOSI		
20	29	DVDD_VIO_A	GPIO29	CMCSK	LPTE		CMCSD2	EINT10				
21	13	DVDD_VIO_C	GPIO13	EINT11	CLKO3	MA_EDIWS	MA_SPI1_B_MOSI	PWM2	SLA_EDIWS			
22	24	DVDD_VIO_A	GPIO24	CMRST	LSRSTB	CLKO1	EINT19	GPCOUNTER_0	JTDI			
23		GND										
24		GND										

4.16.10. USB 2.0 high speed connector

The **2523 USB** connector (see Figure 3 and Figure 25) follows USB 2.0 high-speed standard to communicate with other compatible devices. It's used for charging and system power supply. The 5V power rail is also connected with **MK20 USB**. The connector pins are described in Table 26.

Figure 25. High-speed USB2.0 connector

Table 26.The HDK's high speed USB 2.0 connector

Pin number	Description	Pin number	Description
1	VUSB_BB	2	D-
3	D+	4	NC
5	GND	-	-

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4.16.11. CMSIS-DAP USB 1.1 full speed connector

Apply the **MK20 USB** connector (see Figure 26 and Figure 27) to update the binary on the HDK using CMSIS-DAP without other tools. The HDK operates as a removable mass storage, if the **MK20 USB** is used for connecting the device to the PC.

Figure 26. CMSIS-DAP USB 1.1 full speed connector

The connector pin details are described in Table 27.

Table 27. CMSIS-DAP USB full speed connector

Pin number	Description	Pin number	Description
1	VUSB_DAP	2	D-
3	D+	4	NC
5	GND	-	-

4.16.12. MK20 JTAG connector

MK20 JTAG connector is used to provide a factory update of the MK20 bootloader (see Figure 27 and Table 28). No further modification can be applied.

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Figure 27. MK20 JTAG connector, sensor daughterboard connector and PSRAM power switch J1113

The connector pin details are described in Table 28Table 28.

Table 28. MK20 JTAG connector pin definition

Pin number	Description	Pin number	Description
1	VIO28	2	VIO28
3	SDA_JTAG_TRST	4	GND
5	SDA_JTAG_TDI	6	GND
7	SDA_JTAG_TMS	8	GND
9	SDA_JTAG_TCLK	10	GND
11	-	12	GND
13	SDA_JTAG_TDO	14	GND
15	-	16	GND
17	-	18	GND
19	-	20	GND

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4.16.13. eMMC / micro SD holder jumpers

There are six jumpers (J1001 to J1006) (see Figure 17) dedicated for eMMC or micro SD card, as shown in Table 29. If the assigned jumpers are idle, they can be customized for other applications. Use only the middle pin of those jumpers. The pins are sorted from up to down starting from 1 to 6.

Table 29. eMMC/micro SD jumpers

Pin order from upside	GPIO #	Mode 0	Mode1	Mode2	Mode3	Mode4	Mode5	Mode6	Mode7	Mode8	Mode9
1	32	GPIO 32	SLV_SPI 0_CS	EINT13	PWM2	DAISY NC	MC0_D A0				MA_SP I3_CS
2	33	GPIO 33	SLV_SPI 0_SCK	EINT14	PWM3	DAIPC MIN	MC0_D A1	BT_RG PIO3			MA_SP I3_SCK
3	34	GPIO 34	SLV_SPI 0_MOSI	EINT15	PWM4	DAICLK	MC0_D A2	BT_RG PIO4			MA_SP I3_MO SI
4	35	GPIO 35	SLV_SPI 0_MISO	EINT3	PWM5	DAIPC MOUT	MC0_D A3	CLKO2	BT_RG PIO5		MA_SP I3_MIS O
5	30	GPIO 30	SCL0	EINT11	PWM0	URXD1	MC0_C K	BT_RG PIO0			SCL2
6	31	GPIO 31	SDA0	EINT12	PWM1	UTXD1	MC0_C M0			BT_RG PIO1	SDA2

4.16.14. JTAG connector CON9002

The connector CON9002 provides the standard JTAG connection. CON9002 could be enabled using the resistors R9011 to R9021 and R9023 (see Figure 9 and Figure 8).

Table 30. JTAG connector CON9002

Pin number	Description	Pin number	Description
1	DVDD_VIO_A	2	DVDD_VIO_A
3	JTRST	4	GND
5	JTDI	6	GND
7	JTMS	8	GND
9	JTCK	10	GND
11	NC	12	GND
13	JTDO	14	GND
15	SYSRSTB_IN	16	GND
17	NC	18	GND
19	NC	20	GND

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Figure 28. JTAG connector CON9002 pin definition

4.16.15. SMA connectors

There are two SMA headers to connect to the external antennas. The GNSS/BT SMA is used to connect to GNSS/Bluetooth antenna. The BT SMA could be connected to a Bluetooth antenna. The connectors are shown in Figure 8. To activate the BT SMA connector, move 0Ω resistor from R5010 to R5011.

4.16.16. External component connectivity support

This section provides the detailed pin layout for sensor and daughterboard connectors and GPIO pins, see Figure 29 and Table 31.

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Ref	Left	Right
1	GND	GND
2	GPIO24	GPIO14
3	GPIO29	GPIO6
4	GPIO7	GPIO5
5	GND	GPIO4
6	GPIO25	GPO48
7	GPIO26	GND
8	GPIO27	GPIO36
9	GPIO28	GPIO37
10	GND	GND
11	VIO18	VIO28
12	VA28	VBAT

Ref	GPIO #
J1001	GPIO32
J1002	GPIO33
J1003	GPIO34
J1004	GPIO35
J1005	GPIO30
J1006	GPIO31

Ref	GPIO #	GPIO #	Ref
1	ISINK	VIO18	2
3	LCM_B LPWM	VIO28	4
5	GPIO43	VIO28	6
7	GPIO41	GPIO36	8
9	GPIO42	GPIO37	10
11	GPIO40	GND	12
13	GPIO39	GPIO15	14
15	GPIO38	GPO47	16
17	VBAT	GND	18
19	VBAT	GND	20

Ref	GPIO #
J1010	GPIO26
J1008	GPIO24
J1007	GPIO25
J1011	GPIO28
J1015	X
J1012	GPIO29
J1009	GPIO27

Figure 29. LinkIt 2523 HDK extension connectors

Table 31. GPIO pin functionalities

Pin alias	Name	Direction	Description
GPIO4	MC[1]_CK	O	MSDC clock, output
	GPIO[4]	I/O	General purpose input, output
	SLA_EDIDO	O	Slave I2S data output
	EINT[3]	I	External interrupt
	URXD[1]	I	UART receive port, input

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	MA_SPI[0]_CS	O	SPI master chip select
GPIO5	MC[1]_CM0	O	MSDC command, output
	GPIO[5]	I/O	General purpose input, output
	SLA_EDIDI	I	Slave I2S data input
	EINT[4]	I	External interrupt
	UTXD[1]	O	UART transmit port, output
	MA_SPI[0]_SCK	O	SPI master clock output
GPIO6	MC[1]_DA0	I/O	MSDC data input, output
	GPIO[6]	I/O	General purpose input, output
	SLA_EDIWS	I	Slave I2S frame clock input
	EINT[5]	I	External interrupt
	URXD[2]	I	UART receive port, input
	MA_SPI[0]_MOSI	O	SPI master MOSI
GPIO7	MC[1]_DA1	I/O	MSDC data input, output
	GPIO[7]	I/O	General purpose input, output
	SLA_EDICK	I	Slave I2S bit clock input
	EINT[6]	I	External interrupt
	UTXD[2]	O	UART transmit port, output
	MA_SPI[0]_MISO	I	SPI master MISO
	BT_BUCK_EN_HW	O	External buck enable pin, output
GPIO14	EINT[12]	I	External interrupt
	CLKO[4]	O	Clock output
	MA_EDICK	O	Master I2S bit clock output
	GPIO[14]	I/O	General purpose input, output
	PWM[3]	O	Pulse width modulation in 3.3V
	MA_SPI[1]_MISO	I	SPI master MISO
	SLA_EDICK	I	Slave I2S bit clock output
GPIO15	EINT[13]	I	External interrupt
	PWM[4]	O	Pulse width modulation in 3.3V
	GPIO[15]	I/O	General purpose input, output
GPIO24	CMRST	O	Serial camera reset, output
	LSRSTB	O	Serial display reset, output
	CLKO[1]	O	Clock output
	GPIO[24]	I/O	General purpose input, output
	EINT[9]	I	External interrupt
	GPCOUNTER_0	I	General interrupt counter, input
	JTDI	I	JTAG data input
	MC[1]_DA3	I/O	MSDC data input, output
GPIO25	CMPDN	O	Serial camera power down, output
	LSCK1	O	Serial display clock, output

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	DAICLK	O	Digital audio interface clock, output
	GPIO[26]	I/O	General purpose input, output
	MA_SPI[2]_CS	O	SPI master chip select
	MA_SPI[3]_CS	O	SPI master chip select
	JTMS	O	JTAG mode selection, input
	MC[1]_DA2	I/O	MSDC data input, output
	SLV_SPI[0]_CS	I	SPI slave chip select
GPIO26	CMCSD0	I	Camera sensor data 0, input
	LSCE_B1	O	Serial display chip select, output
	DAIPCMIN	I	Digital audio interface data input
	GPIO[26]	I/O	General purpose input, output
	MA_SPI[2]_SCK	O	SPI master clock output
	MA_SPI[3]_SCK	O	SPI master clock output
	JTCK	O	JTAG clock output
	MC[1]_CM0	O	MSDC command, output
	SLV_SPI[0]_SCK	I	SPI slave clock input
GPIO27	CMCSD1	I	Camera sensor data 1, input
	LSDA1	O	Serial display data, output
	DAIPCMOUT	O	Digital audio interface data output
	GPIO[27]	I/O	General purpose input, output
	MA_SPI[2]_MOSI	O	SPI master data output
	MA_SPI[3]_MOSI	O	SPI master data output
	JTRSTB	O	JTAG clock reset, output
	MC[1]_CK	O	MSDC clock output
	SLV_SPI[0]_MOSI	I	SPI slave data input
GPIO28	CMMCLK	O	Camera main clock, output
	LSA0DA1	O	Serial display address, output
	DAISYNC	O	DAI frame synchronization output
	GPIO[28]	I/O	General purpose input, output
	MA_SPI[2]_MISO	I	SPI master data input
	MA_SPI[3]_MISO	I	SPI master data input
	JTDO	O	JTAG data output
	MC[1]_DA0	I/O	MSDC data input, output
	SLV_SPI[0]_MISO	O	SPI slave data output
GPIO29	CMCSK	I	Camera sensor clock, input
	LPTE	O	Serial display tearing signal, output
	CMCSD2	I	Camera sensor data 2, input
	GPIO[29]	I/O	General purpose input, output
	EINT[10]	I	External interrupt

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	MC[1]_DA1	I/O	MSDC data input, output
GPIO30	SCL[0]	O	I2C clock output
	EINT[11]	I	External interrupt
	URXD[1]	I	UART receive port, input
	MC[0]_CK	O	MSDC clock, output
	GPIO[30]	I/O	General purpose input, output
	SCL[2]	O	I2C clock output
	PWM[0]	O	Pulse width modulation
GPIO31	SDA[0]	I/O	I2C data input, output
	EINT[12]	I	External interrupt
	UTXD[1]	O	UART transmit port, output
	MC[0]_CM0	O	MSDC command, output
	GPIO[31]	I/O	General purpose input, output
	SDA[2]	I/O	I2C data input, output
	PWM[1]	O	Pulse width modulation
GPIO32	SLV_SPI[0]_CS	I	SPI slave chip select
	EINT[13]	I	External interrupt
	GPIO[32]	I/O	General purpose input, output
	PWM[2]	O	Pulse width modulation
	DAISYNC	O	DAI frame synchronization output
	MC[0]_DA0	I/O	MSDC data input, output
	MA_SPI[3]_CS	O	SPI master chip select
GPIO33	SLV_SPI0_SCK	I	SPI slave clock input
	EINT[14]	I	External interrupt
	GPIO[33]	I/O	General purpose input, output
	PWM[3]	O	Pulse width modulation
	DAIPCMIN	I	Digital audio interface data input
	MC[0]_DA1	I/O	MSDC data input, output
	MA_SPI[3]_SCK	O	SPI master clock output
GPIO34	SLV_SPI0_MOSI	I	SPI slave data input
	EINT[15]	I	External interrupt
	GPIO[34]	I/O	General purpose input, output
	PWM[4]	O	Pulse-width-modulated output
	DAICLK	O	Digital audio interface clock, output
	MC[0]_DA2	I/O	MSDC data input, output
	MA_SPI[3]_MOSI	O	SPI master data output
GPIO35	SLV_SPI0_MISO	O	SPI slave data output
	EINT[3]	I	External interrupt
	GPIO[35]	I/O	General purpose input, output
	PWM[5]	O	Pulse-width-modulated output

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	DAIPCMOUT	O	Digital audio interface data output
	MC[0]_DA3	I/O	MSDC data input, output
	MA_SPI[3]_MISO	I	SPI master data input
	CLKO[2]	O	Clock output
GPIO36	SCL[0]	O	I2C clock output
	GPIO[36]	I/O	General purpose input, output
	SCL[1]	O	I2C clock output
GPIO37	SDA[0]	I/O	I2C data input, output
	GPIO[37]	I/O	General purpose input, output
	SDA[1]	I/O	I2C data input, output
GPIO38	LSRSTB	O	Serial display reset, output
	CMRST	O	Serial camera reset, output
	GPIO[38]	I/O	General purpose input, output
	CLKO[3]	O	Clock output
	SFSWP	O	Serial Flash write protect
	SCL[1]	O	I2C clock output
GPIO39	LSCE_B0	O	Serial display chip select, output
	CMCSD0	I	Camera sensor data 0, input
	GPIO[39]	I/O	General purpose input, output
	CLKO[4]	O	Clock output
	SFSCS0	O	Serial Flash chip select 0
	SCL[1]	O	I2C clock output
	MA_SPI[2]_CS	O	SPI master chip select
	EINT[4]	I	External interrupt
GPIO40	LSCK0	O	Serial display clock, output
	CMPDN	O	Serial camera power down, output
	GPIO[40]	I/O	General purpose input, output
	SFSHOLD	O	Serial Flash data hold
	MA_SPI[2]_SCK	O	SPI master clock output
GPIO41	LSDA0	O	Serial display data, output
	CMCSD1	I	Camera sensor data 1, input
	GPIO[41]	I/O	General purpose input, output
	SFSCK	O	Serial Flash clock
	SDA[1]	I/O	I2C data input, output
	MA_SPI[2]_MOSI	O	SPI master data output
	EINT[4]	I	External interrupt
GPIO42	LSA0DA0	O	Serial display interface address, output
	LSCE1_B0	O	Serial display chip select, output
	GPIO[42]	I/O	General purpose input, output

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	CMMCLK	O	Camera main clock, output
	SFSOUT	I	Serial Flash data output
	CLKO[5]	O	Clock output
	MA_SPI[2]_MISO	I	SPI master data input
GPIO43	LPTE	O	Serial display tearing signal, output
	CMCSK	I	Camera sensor clock, input
	GPIO[43]	I/O	General purpose input, output
	CMCSD2	I	Camera sensor data 2, input
	SFSIN	I	Serial Flash data input
	SDA[1]	I/O	I2C data input, output
	EINT[6]	I	External interrupt
GPO47	GPO[47]	O	General purpose output
	MA_SPI[1]_CS1	O	SPI master chip select
GPO48	GPO[48]	O	General purpose output
	MA_SPI[3]_CS1	O	SPI master chip select

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5. Schematics (V11)

Figure 30. Block diagram

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I2C	Function	I2C Spec.	Budgeted Timing	I2C Slave Address (7-bit mode)
I2C0	Rear Camera	400 Kbps	Yes.	Rear camera (GC0310) I2C address: 0X21 (Write:0x42, Read:0x43)
	Touch IC	400 Kbps	Yes.	TP (GT9137) I2C address: 0X24 (Write:0x28, Read:0x29)

Figure 31. I2C ID

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		Vout(V)	I_max(mA)
Buck	Vcore	0.6~1.3	200
Digital LDO	Vcore	0.6~1.3	20
Analog LDO	VBT	2.8/1.8	100
	VA28	2.8	150
	VCAMA	2.8	150
	VA18	1.8	2.5
Digital LDO	VSF	1.86/3.0/3.3	100
	VIO28	2.8	150
	VIO18	1.8	200
	VUSB	3.3	80
	VMC	1.8/2.8/3/3.3	230
	VIBR	1.3/1.5/1.8/2/ 2.5/2.8/3/3.3	100
	VDIG18	1.8	5
Driver	ISINK		1X(96mA;48mA/0.25V)

Figure 32. PMU_SPEC

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Schematic design notice of "10_BB_MT2523G_BB" page.

Note 10-1:	Jumper selection for microSD or eMMC; also flexible pin mux feature for user appliance.
Note 10-2:	R1004 should be closed to Larkspur ball out position
Note 10-3:	Jumper selection for Camera or sensor DTB; also flexible pin mux feature for user appliance.
Note 10-4:	Dedicate pins for GPS function are fixed; please don't change this design to other appliance.
Note 10-5:	Optional schematic for external flash

Figure 33. BB MT2523G BB

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Schematic design notice of "11_BB_MT2523G_ABB" page.

Note 11-1:	Those capacitors must be closed Larkspur ball out placement Total capacitor value at VBAT must larger than 28.4uF for DL without battery.
Note 11-2:	Selection of 32.768 KHz crystal mounted: GND: 32.768 KHz crystal is existed VRTC: 32.768 KHz crystal is not existed
Note 11-3:	This jumper could be switched for efuse function workable. Burning eFUSE case is needed: Pin FSOURCE_D connected to VEFUSE No burning eFUSE case: Pin FSOURCE_D is tied to GND .
Note 11-4:	This jumper could be switched for 32.768KHz crystal mounted VA18: 32.768KHz crystal less VIO18: 32.768KHz crystal existed
Note 11-5:	This jumper could be switched for PSRAM power saving VSWXM: Switch off power supply in suspend mode VIO18: Default setting
Note 11-6:	Users are able to adjust IO cluster power source by design; Active eMMC should unmount R1113 and mount J1111.
Note 11-7:	AVSS28_ABB ball L5 and K5 connected first, then connected to C1109 GND side by point directly which without any branch.
Note 11-8:	This test point is used for DCXO calibration C1107/C1108 mounted when 32K co-clock with GNSS function
Note 11-9:	DVDD_VIO_B should be connected to 2.8V power only

Figure 34. BB_MT2523G_ABB

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Schematic design notice of "20_POWER_COMMON_LDO" page.	
Note 20-1:	Users must connect CON6401 for total system power supply
Note 20-2:	External LDO are option components Remove R1118, R1119, C1114 change to 10uF when applying external LDO

FD and Hole

DC 5V supply

Title	20_POWER_COMMON_LDO
Size C	MediaTek HDK MT2523G
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Figure 35. POWER_COMMON_LDO

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Schematic design notice of "21_Power_Charging" page.	
Note 21-1:	1. Close to Battery Connector. (Rsense (R2103) <10mm) 2. Main path should be 40mil. (VBUS -> U2101's E, -> U2101's C -> R2103 -> VBAT) 3. Star connection from R2103 to BAT Connector
Note 21-2:	Capacitor rating depends on Phone OVP spec.
Note 21-3:	Before you select BJT , please take power dissipation into consideration. Refer to MT6385 design notice.
Note 21-4:	60mils from battery connector to MT2523 chip
Note 21-5:	L style pin header for battery sub board plug in
Note 21-6:	Based on your system level design , if better ESD performance is needed on your system, please refer to ESD performance enhance proposal. Please place ESD2101 closed by R1137.
Note 21-7:	Thermal protection : battery with NTC (1) if battery NTC is 10kohm; R2106=16.9K (+/-1%) (2) if battery NTC is 47kohm; R2106=61.9K (+/-1%)

Figure 36. POWER_Charging

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Schematic design notice of "40_MEMORY_eMMC" page.	
Note 40-1:	For eMMC 5.0, connect eMMC's A6 & J5 pin to GND. For eMMC 4.5, check eMMC's A6 & J5 is no connection (NC).
Note 40-2:	Please refer eMMC datasheet for the recommendation of VCC/VCCQ/VDDI bypass capacitors values.
Note 40-3:	C4003 need to be placed near by eMMC
Note 40-4:	R4005 and R4009 must be removed when micro SD feature active R4009 and R4010 co-layout for path selection only on one time
Note 40-5:	eMMC is an optional component

MEDIATEK labs	
Title	40_Memory_eMMC
Size C	MediaTek HDK MT2523G
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Figure 37. MEMORY_eMMC

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Schematic design notice of "41_MEMORY_SD Card" page.	
Note 41-1:	These ESD diodes are optional for better ESD and RF de-sense performance. (The C load of Diodes on trace should be less than 15pF)
Note 41-2:	R4101 must be removed when eMMC feature active

Figure 38. MEMORY_SD Card

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Schematic design notice of "50_CONNECTIVITY_BT_MT2523G" page.	
Note 50-1:	These capacitors should be placed near by ball out position
Note 50-2:	26MHz crystal must be placed near by Larkspur ball out position
Note 50-3:	R5002, C5003 and C5004 are reserved for BT antenna matching tuning J5006 is set for single Bluetooth performance measurement.
Note 50-4:	J5001 should keep low for clock is generated by crystal; Pull high if clock signal is injected from net XTAL1.
Note 50-5:	The impedence of traces about diplexer should be 50 ohm
Note 50-6:	J5002 connected to VBT for dual mode of Bluetooth and BLE modes J5002 connected to VIO18 for BLE mode J5004 connected to VBT for dual mode of Bluetooth and BLE modes J5004 connected to VIO18 for external buck LDO cost reduction J5005 connected to AVDD_BTRF_ext for power saving
Note 50-7:	SMA 5001 SMA5002 are optional components

Figure 39. CONNECTIVITY_BT_MT2523G

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Schematic design notice of "52_CONNECTIVITY_GPS_MT2523G" page.

Note 52-1:	Both of pin AVDD43_VBAT and AVDD43_DCV voltage should be keeped between 3.1V to 4.3V (VGPS_MAIN)
Note 52-2:	C5214 is close to G1 ball (AVDD28_TLDO)
Note 52-3:	AVSS43_DCV should be connected to C5218 GND net first, then connect to reference GND.
Note 52-4:	Buck Mode : L5202 = 1uH, R5205 = 0 ohm , R5206 = NC LDO Mode : L5202 = 0 ohm , R5205 = NC , R5206 = 0 ohm
Note 52-5:	Recommend to select 3V coin battery for leakage consideration. Pin GPS_VRTC_4V3 should be provided between 2.0V to 4.3V. GNSS_VBAT for pin GPS_VRTC_4V3 should be provided between 2.0V to 4.3V.
Note 52-6:	U5204/C5221/C5222 could be removed, R5210 = 0 ohm, GPS_VRTC_4V3 should be kept (always alive voltage source). Or change C5220 to 0 ohm and feed 1.1V (always alive voltage source) into GPS_VRTC_1V1.
Note 52-7:	VTCXO voltage selection 2.8V TCXO: TLDO 2.8V : R5209 = NC 1.8V TCXO: SMPS 1.8V : R5209 = 10K
Note 52-8:	RF clock selection 16.368MHZ TCXO : R5207 = NC , R5208 = NC 26MHZ TCXO : R5207 = NC , R5208 = 10K
Note 52-9:	IO Voltage Selection 2.8V IO : R5201= 0 , R5202 = NC (IO voltage is GPS_VTLDO) 1.8V IO : R5201 = NC , R5202 = 0 (IO voltage is GPS_DCV_1V8)
Note 52-10:	Host interface selection UART : R5203 = NC , R5204 = NC (I/F : TX0 , RX0) SPI : R5203 = NC , R5204 = 10K I2C : R5203 = 10K , R5204 = 10K
Note 52-11:	C5201 is close to U5201 VCC
Note 52-12:	In order to keep good GPS clock stability, TCXO layout please refer to MTK TCXO layout rule. MT2523 support 16.368MHz&26MHz TCXO, please refer the QVL to select TCXO component
Note 52-13:	C5203, C5206 and L5201 are reserved for LNA matching
Note 52-14:	Main Input Voltage Requirement and External LDOs Selection [1] Please choose one voltage source without built-in output high-speed discharge function and confirm the voltage drop-down curve to keep long output voltage drop-down period. [2] Please choose external LDOs without output high-speed discharge function, such as Torex XC6210/XC6215/XC6221 series to keep long output voltage drop-down period (>1ms from 2.7V to 0.5V). The voltage drop must can't be lower than 3.1V.
Note 52-15:	matching value depends on LNA selected
Note 52-16:	GPS_VTCXO_SW Note for external active antenna, GPS_VTCXO_SW is 1.8V or 2.8V base on TCXO selection. Please ensure external active antenna is operating at this range. Otherwise, please using external power supply.
Note 52-17:	Please refer the QVL to select LNA component
Note 52-18:	GPS HOT re-start feature No support: BAT5201=NC, R5211=NC, R5243=NC, R5234=0ohm X5204=NC, C5222=NC, C5221=NC, R5210=120K, R5220=91K Support: BAT5201=NC, R5211=NC, R5243=0ohm, R5234=NC X5204=NC, C5222=NC, C5221=NC, R5210=120K, R5220=91K Support and Power optimization BAT5201=ML621S, R5211=1K, R5243=NC, R5234=0 ohm X5204=FC-135, C5222=22pF, C5221=22pF, R5210=NC, R5220=NC

Title	52_CONNECTIVITY_GPS_MT3333
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Figure 40. CONNECTIVITY_GPS_MT2523G

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Schematic design notice of "60_PERI_Audio_IO" page.	
Note 60-1:	The GND of headset microphone and Headset earphone should be connected together first, then connected to main GND.
Note 60-2:	The gain of class-D amplifier is set to 12dB (4V/V);
Note 60-3:	ESD diodes are for ehnhacement proposal; also could be cost reduction.
Note 60-4:	Speaker is an optional component

Headset microphone

AMIC

Headset earphone

Title	60_PERI_Audio_IO
Size C	MediaTek HDK MT2523G
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Figure 41. PERI_Audio_IO

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Figure 42. PERI_LCD_Capacitive touch panel

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Title	62_PERI_CAMERA
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Figure 43. PERI_CAMERA

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Figure 44. PERI_SENSOR_DTB_IO

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Schematic design notice of "64_PERI_USB" page.

Note 64-1:	This ESD components are optional for better ESD performance. The C load of these diodes must smaller than 3pf and close to USB jack.

USB

Figure 45. PERI_USB

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Schematic design notice of "65_PERI_KEY" page.

Note 65-1: This ESD diode D6501 must be closed by power button SW6301

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Size C	MediaTek HDK MT2523G
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Figure 46. PERI_KEY

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Schematic design notice of "66_PERI_SWD" page.

Note 66-1: Replace to bead 330ohm@100MHz 1.5A if power noise impact existed

Figure 47. PERI_SWD

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Schematic design notice of "90_Debug_IO" page.	
Note 90-1:	One of JTAG trap pin, selection combination with note 90-2 The sequence is (GPS_HRST_B, LCM_BLPWM) (Low, Low): no JTAG; (Low, High): JTAG at keypad; (High, High): JTAG at CAM
Note 90-2:	Net KCOL0 is the trap pin of USB download. Keep low for image download, keep high for normal boot.
Note 90-3:	This trap pin is used to adjust serial flash voltage. Low: 1.86V, High: 3V
Note 90-4:	This trap pin is used to adjust system into system level test or not. Low: Normal mode, High: Test mode

Figure 48. DEBUG_IO

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Power Indicator

Figure 49. POWER INDICATOR

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Figure 50. LCM

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6. Layout (V11)

Figure 51. LinkIt 2523 HDK layout (Layer 1)

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Figure 52. LinkIt 2523 HDK layout (Layer 2)

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Figure 53. LinkIt 2523 HDK layout (Layer 3)

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Figure 54. LinkIt 2523 HDK layout (Layer 4)

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7. LinkIt 2523 HDK's BOM (V11)

Table 32 shows the bill of material details of the HDK. Users can refer this table to understand the components used on the HDK as well as to customize and change parts as needed.

Table 32. LinkIt 2523 HDK bill of materials

Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
1	2	ANT5001,ANT5002	ANT sprint	PAD/SMD/2.3X1.0	
2	1	BAT5201	ML621S	C0.22F3.3V/SMD/EN-RL	Panasonic
3	1	BEAD6001	L / BLM15AG100SN1 / 0402	BEAD0402	Murata
4	1	CON2101	HEAD_6P	DIP6/P2.54	PIN CHIH
5	1	CON401	CON / 24 / OK-03F024-04	CON12X4/SMD/F/OK-03F024-04/WS3287	OCN
6	1	CON402	CON / 10 / OK-20F010-04	CON5X2/SMD/P0.4/F/OK-20F010-04/WS3287	OCN
7	1	CON4101	CON / 12 / TA-M017-012-07-811	MICROSD/8P/SMD/TA-M017-012-07-811	Smart-conn
7	1	CON501	CON / 24 / AXE520127	CON10X2/SMD/P0.4/F/AXE520127/WS3287	Panasonic
8	1	CON502	AXE510124	CON5X2/SMD/P0.4/F/AXE510124/WS3287	Panasonic
9	1	CON6001	JACK_CON/5P/EJ-3699M-GP	AUDIOJACK/5P/SMD/EJ-3699M-GP	Dian Jin
10	1	CON6101	QTH-060-01-FDA (120 pin)	QTH-060-01-F-D-A	SAMTEC
11	1	CON6102	JUMPER 10x2 DIP/P2.54	DIP10X2/P2.54	PIN CHIH
12	1	CON6201	HE7X2 MALE_TOP	DIP7X2/P2.54	PIN CHIH
13	1	CON6301	JUMPER 12x2 DIP/P2.54	DIP12X2/P2.54	PIN CHIH
14	2	CON6401,CON6601	Proconn_8791-N005-M1A0	MICROUSB/5P/SMD/P0.65/R/8791-N005-M1A0	Proconn
15	2	CON6602,CON9002	HE10X2 RA HOUSING	JP10X2/P2.54/R	PIN CHIH
16	1	CON9001	CON / 40 / AXT640124 / NC		Panasonic
17	1	C201	C / 470 / nF / 0402	C0402	
18	35	C501,C502,C503,C1102,	C / 1 / µF / 0402	C0402	

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Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
		C1103,C1106,C1112,C1113, C1118,C1121,C1122,C1123, C1124,C1125,C1126,C1131, C1132,C1137,C1138,C2002, C4101,C5201,C5210,C5211, C5214,C5215,C5216,C5217, C5220,C5226,C5231,C6016, C6017,C6604,C6607			
19	2	C1105,C1117	C / 2.2 / µF / 0402 / NC	C0402	
20	2	C1107,C1108	C / 10 / pF / 0402	C0402	
21	10	C402,C1109,C1119,C1120, C1139,1140,C2003,C4001, C5212,C5223	C / 2.2 / µF / 0402	C0402	
22	6	C204,C1110,C1115,C1128, C1130,C2004	C / 10 / µF / 0603	C0603	
23	9	C1114,C1127,C5218,C5219, C5224,C5225,C5237,C5238, C6005	C / 4.7 / µF / 0603	C0603	
24	4	C505,C506,C507,C1116	C / 10 / µF / 0402	C0402	
25	3	C1129,C2006,C5227	C / 22 / pF / 0402	C0402	
26	2	C1133,C6608	C / 100 / nF / 0402 / NC	C0402	
27	16	C401,C403,C504,C1134, C1135,C4003,C4004,C4006, C5002,C6001,C6002,C6012, C6018,C6020,C6021,C9001	C / 100 / nF / 0402	C0402	
28	1	C1136	C / 2.2 / nF / 0402 / X5R	C0402	
29	3	C2001,C2101,C6606	C / 1 / µF / 0603 / 50V	C0603	
30	2	C2005,C2102	C / 22 / µF / 0603	C0603	
31	2	C4002,C4005	C / 4.7 / µF / 0402	C0402	
32	1	C5001	C / 2.2 / pF / 0402	C0402	
33	4	C5003,C5004,C5007,C5008	C / NC / 0402	C0402	
34	6	C5005,C5006,C5229,C5236, C6601,C6602	C / 18 / pF / 0402	C0402	
35	1	C5009	C / 3.6 / pF / 0402 / GJM1555C1H3R6WB01D	C0402	Murata
36	45	TP1001,TP1101,TP1102, TP1103,TP1104,TP1105, TP1106,TP5001,L5001, TP5002,L5002,TP5003, TP5201,TP5202,TP5203, C5203,TP5204,TP5205, TP5206,TP5207,TP5208, TP5209,TP5210,TP5211, TP5212,TP5213,TP5214, TP5215,TP5216,TP6001, TP6003,TP6004,TP6601,	NC	TP30MIL	

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Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
		TP6602,TP6603,TP6604, TP6605,TP6606,TP6607, TP6608,TP6609,TP6610, TP6611,TP6612,TP9001			
37	1	C5206	C / 1 / pF / 0402	C0402	
38	1	C5207	C / 1 / nF / 0402	C0402	
39	3	C5208,C5209,C5213	C / 4.7 / nF / 0402	C0402	
40	2	C5221,C5222	C / 22 / pF / 0402	C0402	
41	1	C5228	C / 220 / nF / 0402	C0402	
42	5	C5230,C5232,C5233,C5234, C5235	C / 0402 / NC	C0402	
43	6	C6003,C6004,C6008,C6009, C6010,C6011	C / 33 / pF / 0402 / NC	C0402	
44	1	C6006	C / 100 / pF / 0402 / NC	C0402	
45	2	C6007,C6025	C / 22 / µF / 0402	C0402	
46	2	C6013,C6023	C / 100 / pF / 0402	C0402	
47	4	C6014,C6015,C6022,C6024	C / 33 / pF / 0402	C0402	
48	1	C6019	C / 4.7 / µF / 0402 / X5R	C0402	
49	1	C6605	C / 2.2 / µF / 0603	C0603	
50	1	DIPX5001	DP1608-V1524CA	DIPLEXER/6P/SMD/DP1608	Advanced Ceramic
51	3	ESD2101,ESD6402,ESD6601	ESD / AZ5825-01F	VR0402	Amazing Microelectronic
52	1	ESD2102	ESD / AZ5725-01F	VR0402	Amazing Microelectronic
53	12	ESD4101,ESD4102,ESD4103 , ESD4104,ESD4105,ESD4106 , ESD4107,ESD4108,ESD4109 , ESD6001,ESD6002,ESD6501	ESD5451NKM / NC	SOD923/SMD/AK	TY Semiconductor
54	4	ESD6003,ESD6004,ESD6005 , ESD6006	ESD5Z5.0T1G	SOD523/ESD5Z2.5T1	ON Semiconductor
55	2	ESD6401,ESD6602	ESD / AZ5315-02F	ESD/SMD/AZ5315-02F	Amazing Microelectronic
56	2	ESD6502,ESD6503	ESD / ESD5311NKM /NC	VR0402	TY Semiconductor
57	2	ESD6504,ESD6505	ESD / AZ5325-01F /NC	VR0402	Amazing Microelectronic
58	1	F2001	2A FUSE	FUSE/DIP/SMD	PAN HAO
59	5	H2001,H2002,H2003,H2004 , H2005	STAND	HOLE/PTH/R6D3.5	
60	15	J1001,J1002,J1003,J1004, J1005,J1006,J1007,J1008, J1009,J1010,J1011,J1012, J1015,J1101,J2001	JMP_3P(2-3)	DIP3/P2.54	

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Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
61	7	J201,J202,J203,J1013, J1014,J1018,J6501	HEADER 2X1(W/O JMP)	DIP2/P2.54	
62	2	J401,J402	HEADER 2X1(W JMP)	DIP2/P2.54	
63	23	R404,R405,J1016,J1102, J1103,J1104,J1106,J1108, J1109,J1110,J1111,J1112, J1114,J5001,J5002,J5003, J5004,J5201,J5202,J6101, J6102,J6103,J6104,J6105, J6106	R / 0 / ohm / 0402-3P(1-2)	R0402/(1-2)	
64	1	J1105	R / 0 / ohm / 0402-3P(1-2) / NC	R0402/(1-2)	
65	1	J1113	CON3/SMD/P2.54/C111400/B/ACMELUX	CON3/SMD/P2.54/C111400/B/ACMELUX	ACMELUX
66	4	LED2001,LED2003,LED9201, LED9206	LED / CL190YG	LED190	CITIZEN ELECTRONIC
67	1	LED6601	LED / CL190YG / NC	LED190	CITIZEN ELECTRONIC
68	1	LED9209	LED / LAL296-P1R2-Z	LED190	OSRAM
69	3	L201,L501,L502	PL / 10 / uH / L-NR3012	L-NR3012	Taiyo Yuden
70	1	L1101	PL / MBKK1608T1R0M / SMD1608	L/IND/SMD/MBKK1608	Taiyo Yuden
71	1	L1102	PL / MAKK2016T2R2M	L/IND/SMD/MAKK2016	Taiyo Yuden
72	1	L2001	PL / MEKK2520T1R0M	L/IND/SMD/2520	Taiyo Yuden
73	1	L5003	L / 6.8 / nH / LQG15HS6N8H02D	L0402	Murata
74	1	L5201	L / 1.2 / nH / 0402	L0402	
75	1	L5202	L / 1 / uH / 0806	L/IND/SMD/0402	
	1	L5203	L / 22 / nH / 0402 / NC	L/IND/SMD/LQM2MPN1R0NG0	
76	1	L5204	L / 5.6 / nH / 0402	L0402	
77	1	MIC6001	MIC / SPU0410HR5H-PB	L0402	Knowles
78	1	Q2101	Q / PNMT6N1-LB	FILTER/SMD/SPU0410HR5H-PB	Prisemi
79	3	Q6602,Q6603,Q9206	Q / SSM3K15AMFV	DFN6/SMD/P0.65/PNMT6N1-LB	Toshiba
80	1	Q9201	Q / SSM3K37MFV	2-1L1B/SMD/SSM3K35MFV	Toshiba
81	1	R204	R / 3.3 / ohm / 0402	R0402	
81	2	R1002,R1003	R / 4.7 / K / 0402	2-1L1B/SMD/SSM3K35MFV	
82	1	R1004	R / 5.1 / K / 0402 / 1%	R0402	

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Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
83	32	R1006,R1105,R1113,R1136,R4005,R4009,R5005,R5009,R5011,R5012,R5013,R5206,R5217,R5218,R5243,R6002,R6003,R6017,R6018,R6101,R6616,R9011,R9012,R9013,R9014,R9015,R9017,R9018,R9019,R9020,R9021,R9023	R / 0 / ohm / 0402 / NC	R0402	
84	1	R1010	R / 1.8 / K / 0402 / 1%	R0402	
85	2	R1101,R2004,R5211	R / 1 / K / 0402 / NC	R0402	
86	77	R501,R502,R1102,R1103,R1104,R1106,R1112,R1114,R1115,R1117,R1118,R1119,R1120,R1121,R1122,R1123,R1124,R1125,R1126,R1135,R1139,R2002,R2108,R2109,R4007,R4008,R4010,R4101,R5002,R5003,R5006,R5007,R5010,R5201,R5205,R5216,R5219,R5225,R5226,R5227,R5228,R5230,R5232,R5233,R5234,R5235,R5236,R5237,R5238,R5239,R5240,R5241,R5242,R6014,R6015,R6016,R6019,R6020,R6021,R6022,R6023,R6024,R6025,R6102,R6103,R6301,R6302,R6303,R6304,R6605,R6614,R6618,R6619,R6620,R6621,R6622,R6623	R / 0 / ohm / 0402	R0402	
87	1	R1116	R / 1 / ohm / 0402	R0402	
88	1	R1131	R / 100 / K / 0402	R0402	
89	1	R1133	R / 430 / K / 0402	R0402	
90	1	R1134	R / 360 / K / 0402	R0402	
91	4	R1137,R5224,R6625,R9211	R / 0 / ohm / 0603	R0603	
92	1	R2001	R / 2.2 / K / 0402	R0402	
93	1	R2003	R / 1 / K / 0402	R0402	
94	2	R2005,R6615	R / 510 / K / 0402	R0402	
95	1	R2006	R / 91 / K / 0402	R0402	
96	3	R2018,R9201,R9206	R / 1.58 / K / 0402	R0402	
97	1	R2019	R / 1 / K / 0603	R0603	
98	3	R2101,R5211,R6004,R6502	R / 1 / K / 0402	R0402	
99	1	R2102	R / 39 / K / 0402 / 1%	R0402	
100	1	R2103	R / 0.056 / ohm / 0805 / 1%	R0805	
101	1	R2104	R / 330 / K / 0402 / 1%	R0402	
102	2	R2105,R6001	R / 1.5 / K / 0402	R0402	

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Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
103	1	R2106	R / 16.9 / K / 0402 / 1%	R0402	
104	1	R2107	NTC / NTCG103JF103FT / 0402	R0402	TDK
105	21	R4001,R4002,R4003,R4004, R4006,R4102,R4103,R4104, R5203,R5204,R5207,R5209, R6624,R9002,R9003,R9004, R9005,R9006,R9007,R9009, R9010	R / 10 / K / 0402 / NC	R0402	
106	1	R5210	R / 120 / K / 0402 / NC	R0402	
107	1	R5220	R / 91 / K / 0402 / NC	R0402	
108	2	R6005,R6006	R / 100 / ohm / 0402	R0402	
109	1	R6007	R / 470 / K / 0402	R0402	
110	2	R6008,R6009	R / 470 / ohm /0402	R0402	
111	1	R6010	R / 47 / K / 0402	R0402	
112	2	R6011,R6012	R / 75 / K / 0402	R0402	
113	1	R6013	R / 300 / K / 0402 / NC	R0402	
114	2	R6501,R6503	R / 20 / K / 0402	R0402	
115	2	R6602,R6603	R / 33 / ohm / 0402	R0402	
116	7	R5208,R6604,R6609,R6610, R6611,R9001,R9008	R / 10 / K / 0402	R0402	
117	3	R6606,R9016,R9022	R / 5.1 / K / 0402 / NC	R0402	
118	1	R6607	R / 6.6 / K / 0402 / NC	R0402	
119	1	R6608	R / 470 / ohm / 0402 / NC	R0402	
120	1	R6617	R / 5.1 / K / 0402	R0402	
115	1	R9209	R / 180 / ohm / 0402	R0402	
116	1	SHORT6001	SHORT / NC-MMD-L6-4MIL	NC-4MIL	
117	2	SMA5001,SMA5002	SMA-1.66MM	SMA1	PIN CHIH
118	1	SPK1	SPK / 2403-260-00071-190-EN	SPEAKER/SMD/2403-260-00071/WS3330	EDOM
119	6	SW6501,SW6502,SW6503, SW6504,SW6505,SW6601	KSW (DJT-1109S-2)	SW/4P/SMD/SHOWMAN	DJ TECH
120	1	TCXO5201	TCXO / 26 / MHz / 7L26002009	TCXO/SMD/2.5X2.0/IT2205BE	TXC
121	1	U201	U / KTD2898 / TDFN22-6	TDFN22/6P/SMD/P0.65/KTD2898	Kinetic
122	1	U501	U / TPS65631W	SON10/SMD/P0.5/TPS65631W	Texas Instruments
123	1	U1000	MT2523G	MT2523G/TFBGA246/P0.4/B0.25/9.2X6.0	Airoha

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Item	Quantity	Reference	Part	PCB Footprint	Manufacturer
124	1	U1101	U / TPS62560	SON6/SMD/P0.65/TPS62560	Texas Instruments
125	2	U2001,U2002	U / SS2003M	SOT-363/6P/SMD/P0.65/SS2003M	ON Semiconductor
126	1	U2003	U / TPD1S514-1	DSBGA12/P0.4/B0.225/TPD1S514	Texas Instruments
127	1	U2004	U / TPS62065	WSON8/SMD/P0.5/TPS62060	Texas Instruments
128	1	U4001	U / 153 eMMC / THGBMBG5D1KBAIL	FBGA153/P0.5/B0.27/11.5X13/SKHYNIX	Toshiba
129	2	U5203,U5205	U / XC6210A332MR	SOT23-5	Torex Semiconductor
130	2	U5206,U5208	U / EPOCOS_B8313	SAW/SMD/1.05X1.35	TDK
131	1	U5207	U / BGA725L6	TSLP6/SMD/P0.4/BGA725L6/S	Infineon Technologies
132	1	U6001	U / TPA2010D1	WCSP9/SMD/P0.5/B0.27/TPA2010D1	Texas Instruments
133	1	U6601	U / MK20DX128VFM5	QFN32/SMD/P0.5/98ARE10566D	Freescale
134	1	U6604	U / NXP 74LVC125A	DHVQFN14/SMD/P0.5/74LVC125A	NXP
135	1	U6605	U / ATMEL AT45DB161E-SHD2B-T / NC	SOIC8/SMD	ATMEL
136	1	U6606	TCXO / SiT1533AI-H4-D14-32768 / NC	SIT1533AI-SMD-32768	Si-Time
137	1	X1101	X / 32 / KHz / SC-20S / 7pF	CRYSTAL/SMD/CM8V-T1A	Seiko Instruments
138	1	X5001	X / 26 / MHz / 8Q26000008	CRYS/SMD/D1.6X1.2/8Q26000008	TXC
139	1	X5204	X / FC-135 32.768KHZ 12.5pF	RTC/SMD/2P/3.2X1.5	EPSON
140	1	X6601	X / 8 / MHz / ABM3B-8.000MHZ-18-B2-T	CRYS/SMD/5X3.2/ABM3B-8.000MHZ-22-B2-T	ABRACON

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8. Appendix A: Acronyms and Abbreviations

The acronyms and abbreviations used in this user manual are listed in Table 33.

Table 33. Acronyms and abbreviations

Acronym	Description	Acronym	Description
ADC	Analog-to-Digital Converter	BT	Bluetooth
BLE	Bluetooth Low Energy	CLKO	Clock out
CMSIS-DAP	Cortex® Microcontroller Software Interface Standard Debug Access Port	CTP	Capacitive Touch Panel
eFuse	Electronic Fuses	EINT	External interrupt
GPIO	General Purpose I/O	GPS	Global Positioning System
HDK	Hardware Development Kit	I2C	Inter-Integrated Circuit
I2S	Integrated Interchip Sound	ISINK	LCM backlight current sink source
JTAG	Joint Test Action Group	MIPI	Mobile Industry Processor Interface
MSDC	Mass Storage Device Class	NC	Not connected
NTC	Negative Temperature Coefficient	OMTP	Open Mobile Terminal Platform
PCM	Pulse-code modulation	PSRAM	Pseudo Static Random Access Memory
RTC	Real Time Counter	SDMMC	Secure Digital Multimedia Card
SPI	Serial Peripheral Interface Bus	SWD	Serial Wire Debug
TFT	Thin-Film Transistor	USB	Universal Serial Bus
VIO18	The power rail of digital LDO output 1.8V	VIO28	The power rail of digital LDO output 2.8V.
VSF	The power rail of digital LDO output for the serial flash	VA28	The power rail of analog LDO output 2.8V.
VA18	The power rail of analog LDO output 1.8V.	VBT	The power rail of analog LDO output for Bluetooth.
VCAMA	The power rail of analog LDO output for camera.	VUSB33	The power rail of digital LDO output for USB.
VMC	The power rail of digital LDO output for eMMC.	VBAT	The main power rail for battery charging and system operating power source.

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