

# MIMXRT1024 EVK Board Hardware User's Guide



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# Chapter 1

## Introduction

This Hardware User's Guide for the MIMXRT1024 Evaluation Kit (EVK) is based on the NXP Semiconductor i.MX RT1024 Processor. This board is fully supported by NXP Semiconductor. The guide includes system setup and debugging, and provides detailed information on overall design and usage of the EVK board from a hardware systems perspective.

### 1.1 Board overview

This EVK board is a platform designed to showcase the most commonly used features of the i.MX RT1024 Processor in a small, low cost package. The MIMXRT1024 EVK board is an entry-level development board, which gives the developer the option of becoming familiar with the processor before investing a large amount of resources in more specific designs.

[Table 1](#) lists features of the MIMXRT1024 EVK board.

Table 1. Board features

<b>Processor</b>	NXP Processor	MIMXRT1024
<b>DRAM Memory</b>	SDRAM 256 Mb, 166 MHz	IS42S16160J-6TLI
<b>DCDC</b>	MPS	MP2144GJ
<b>LDO</b>	UNION	UM1750S-00
<b>Mass Storage</b>	TF Card Slot	
	On-Chip 32 Mbit Quad SPI Flash	
<b>Ethernet</b>	10/100 Mbit/s Ethernet Connector. PHY Chip: KSZ8081RNB	
<b>USB</b>	USB 2.0 OTG Connector	
<b>Audio Connector</b>	3.5 mm Audio Stereo Headphone Jack	
	Board-Mounted Microphone	
<b>Power Connector</b>	5 V DC-Jack	
<b>Debug Connector</b>	JTAG 10-pin Connector (SWD by default)	
	OpenSDA with DAP-Link	
<b>Sensor</b>	FXOS8700CQ: 6-Axis Ecompass (3-Axis Mag, 3-Axis Accel)	
<b>CAN</b>	CAN Bus Connector	
<b>User Interface Button</b>	ON/OFF, POR Reset, POWER Reset, USER Button	
<b>Led Indicator</b>	Power Status, Reset, OpenSDA, USER LED	
<b>Expansion Port</b>	Arduino Interface and Motor Control Interface	
<b>PCB</b>	3.543-inch × 5.711-inch (9cm × 14.5cm), 2-layer board	

## 1.2 MIMXRT1024 EVK contents

The MIMXRT1024 EVK contains the following items:

- MIMXRT1024 EVK board
- USB Cable (Micro B)

## 1.3 MIMXRT1024 EVK board revision history

- Rev A: Polit.
- Rev B: Mass production.

# Chapter 2 Specifications

This chapter provides detailed information about the electrical design and practical considerations of the EVK Board, and is organized to discuss each block of the EVK board, as shown in [Figure 1](#).

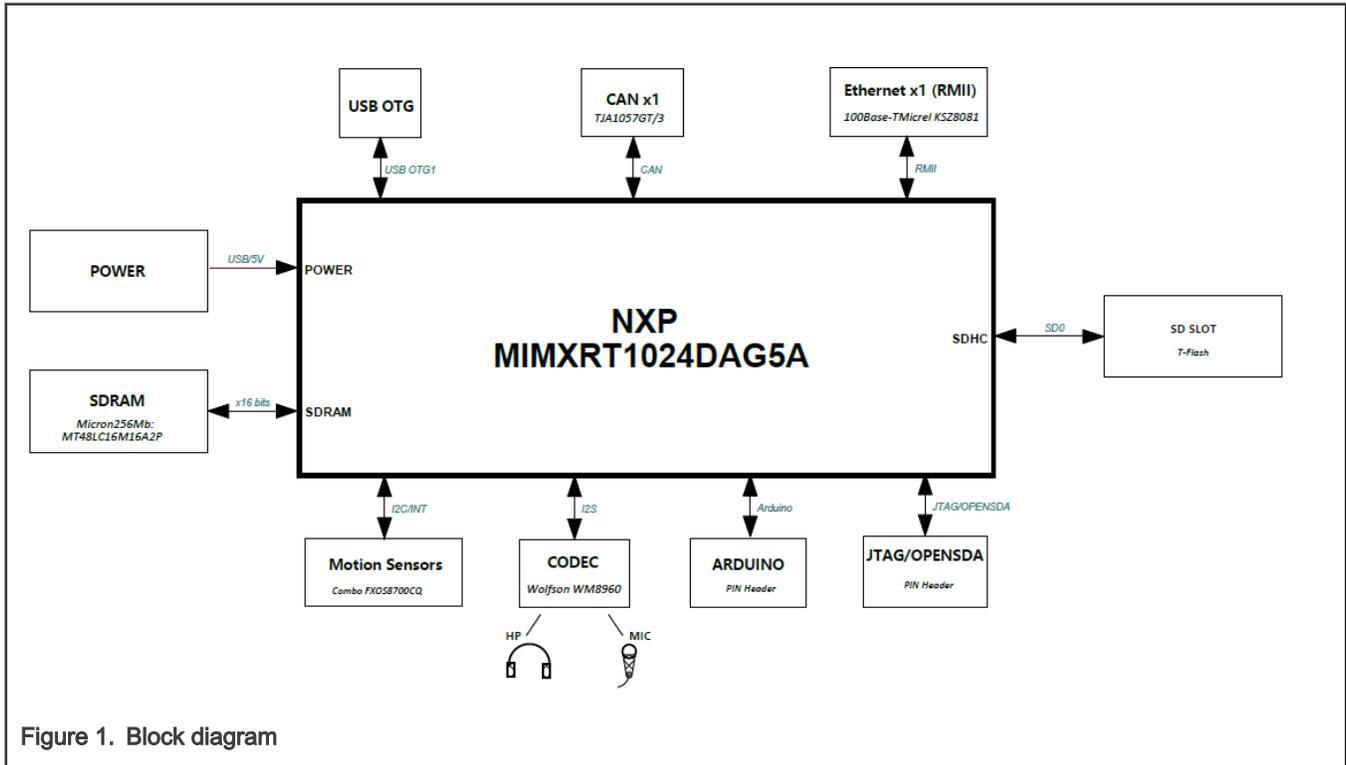


Figure 1. Block diagram

[Figure 2](#) and [Figure 3](#) show the overview of the MIMXRT1024 EVK board.

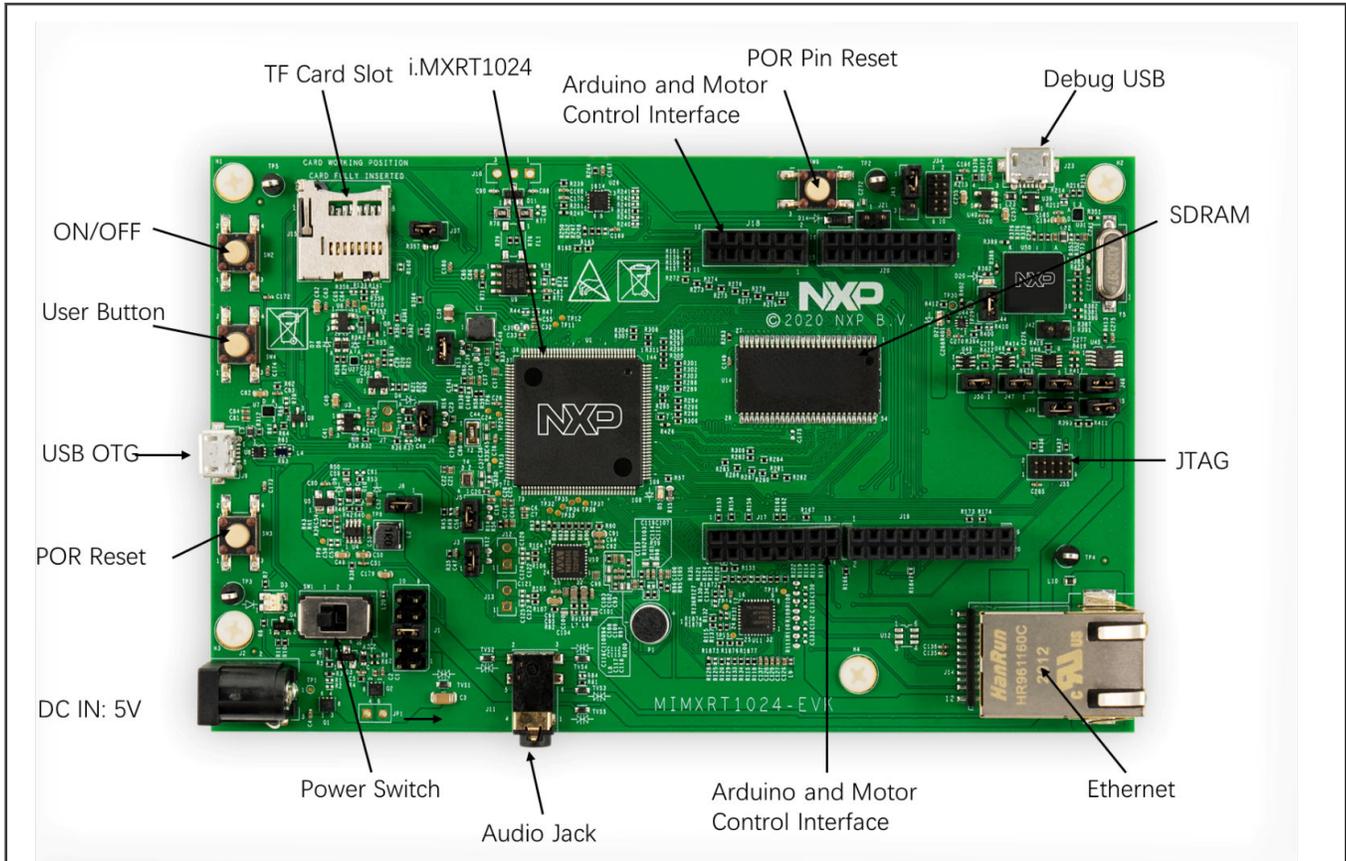


Figure 2. Overview of the MIMXRT1024 EVK board (Front side)

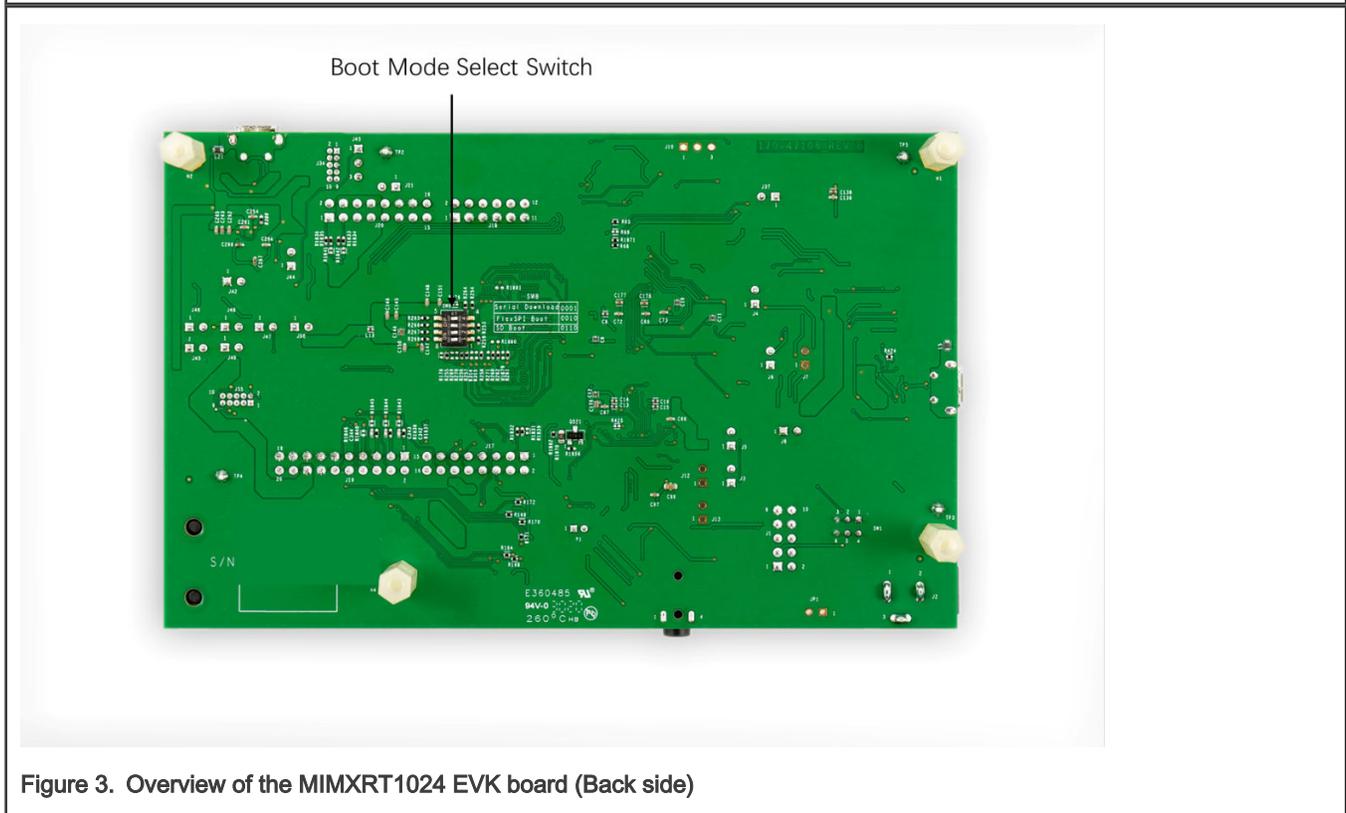


Figure 3. Overview of the MIMXRT1024 EVK board (Back side)

## 2.1 i.MX RT1024 processor

The i.MX RT1024 is a new processor family featuring NXP's advanced implementation of the Arm<sup>®</sup> Cortex<sup>®</sup>-M7 core. It provides high CPU performance and best real-time response. The i.MX RT1024 provides a 4 MB On-Chip flash. It provides various memory interfaces, including SDRAM, Raw NAND FLASH, NOR FLASH, SD/eMMC, Quad SPI, and a wide range of other interfaces for connecting peripherals, such as WLAN, Bluetooth<sup>™</sup>, GPS. i.MX RT1024 also has rich audio features, including SPDIF and I<sup>2</sup>S audio interface.

The i.MX RT1024 applications processor can be used in areas such as industrial HMI, IoT, motor control and home appliances. The architecture's flexibility enables it to be used in a wide variety of other general embedded applications too.

For more detailed information about i.MX RT1024, see the i.MX RT1024 Datasheet and Reference Manual.

## 2.2 Boot mode configurations

The device has four boot modes (one is reserved for NXP's use). The boot mode is selected based on the binary value stored in the internal `BOOT_MODE` register. Switch, **SW8-3** & **SW8-4**, is used to select the boot mode on the MIMXRT1024 EVK board.

Table 2. Boot mode pin settings

BOOT_MODE[1:0] (SW8-3 SW8-4)	BOOT type
00	Boot From Fuses
01	Serial Downloader
10	Internal Boot
11	Reserved

Typically, the internal boot is selected for normal boot, which is configured by external `BOOT_CFG` GPIOs. Table 3 shows the typical boot mode and boot device settings.

Table 3. Typical boot mode and boot device settings

SW8-1	SW8-2	SW8-3	SW8-4	Boot device
OFF	OFF	ON	OFF	On-Chip QSPI Flash
OFF	ON	ON	OFF	SD Card

### NOTE

For more details about boot mode configuration, see the **System Boot** chapter in MIMXRT1024 Reference Manual.

For more details about MIMXRT1024 EVK boot device selection and configurations, see the main board schematic.

## 2.3 Power tree

A DC 5 V external power supply is used to supply the MIMXRT1024 EVK board at J2. A slide switch, **SW1**, is used to turn the power ON/OFF. J23 and J9 can also be used to supply the EVK board. Different power supplies need to configure different Jumper settings of J1. Table 4 shows the details.

Table 4. Jumper settings of power supply

Power supply	J1 settings
J2	1-2

*Table continues on the next page...*

Table 4. Jumper settings of power supply (continued)

Power supply	J1 settings
J9	3-4
J23	5-6

**NOTE**

Some USB of PC cannot support 500ma before establishing communication. In this case, it is recommended to replace the computer or use the power adapter, J2, to power the EVK Board.

Figure 4 shows the power tree.

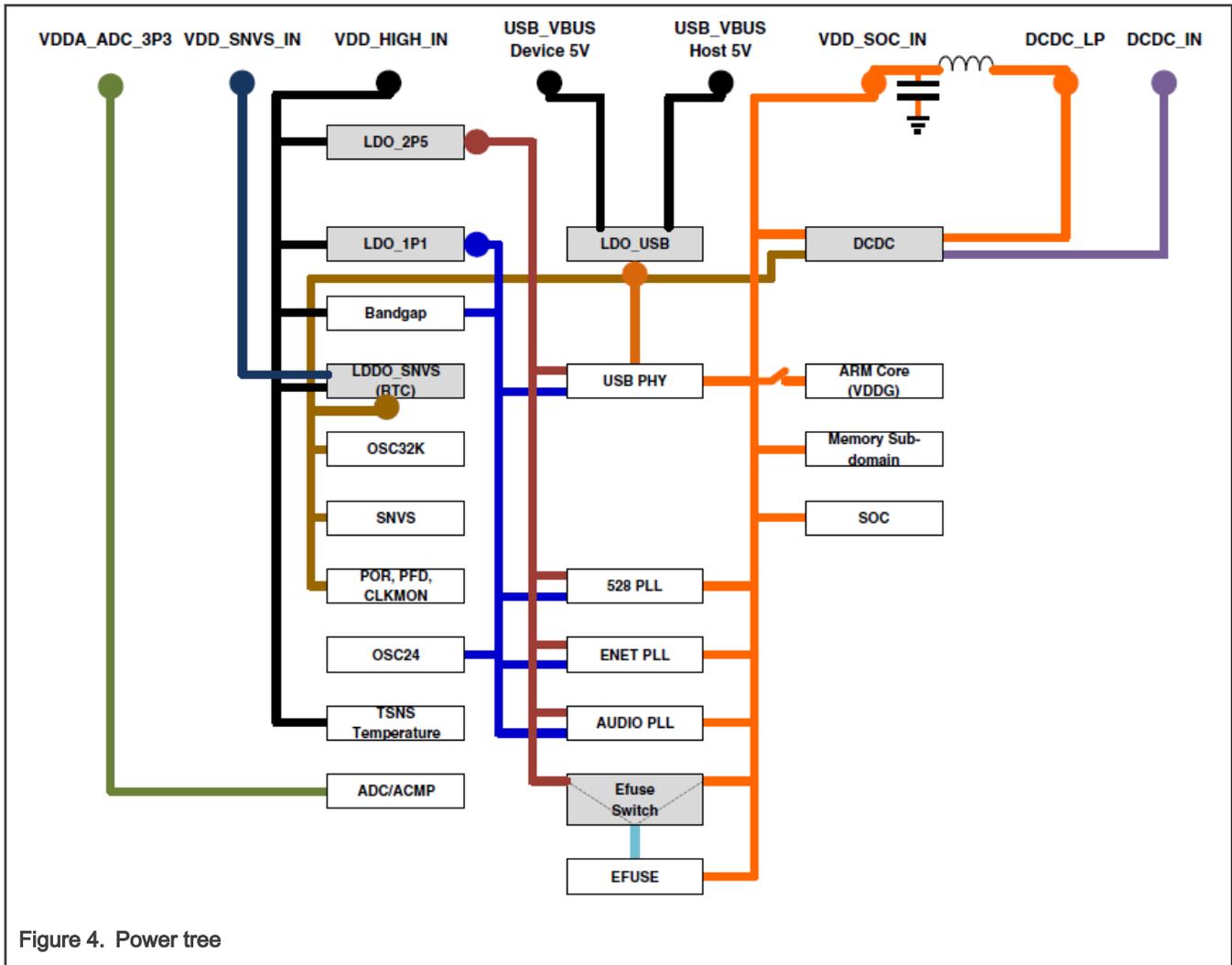


Figure 4. Power tree

Figure 5 shows the power control logic of the MIMXRT1024 EVK board.

- It will power up SNVS, then `PMIC_REQ_ON` will be switched on to enable external DC/DC to power up other power domains.
- ON/OFF button is used to switch ON/OFF and `PMIC_REQ_ON` will enable the external DCDC.
- The **RESET** button and WDOG output are used to reset the system power.

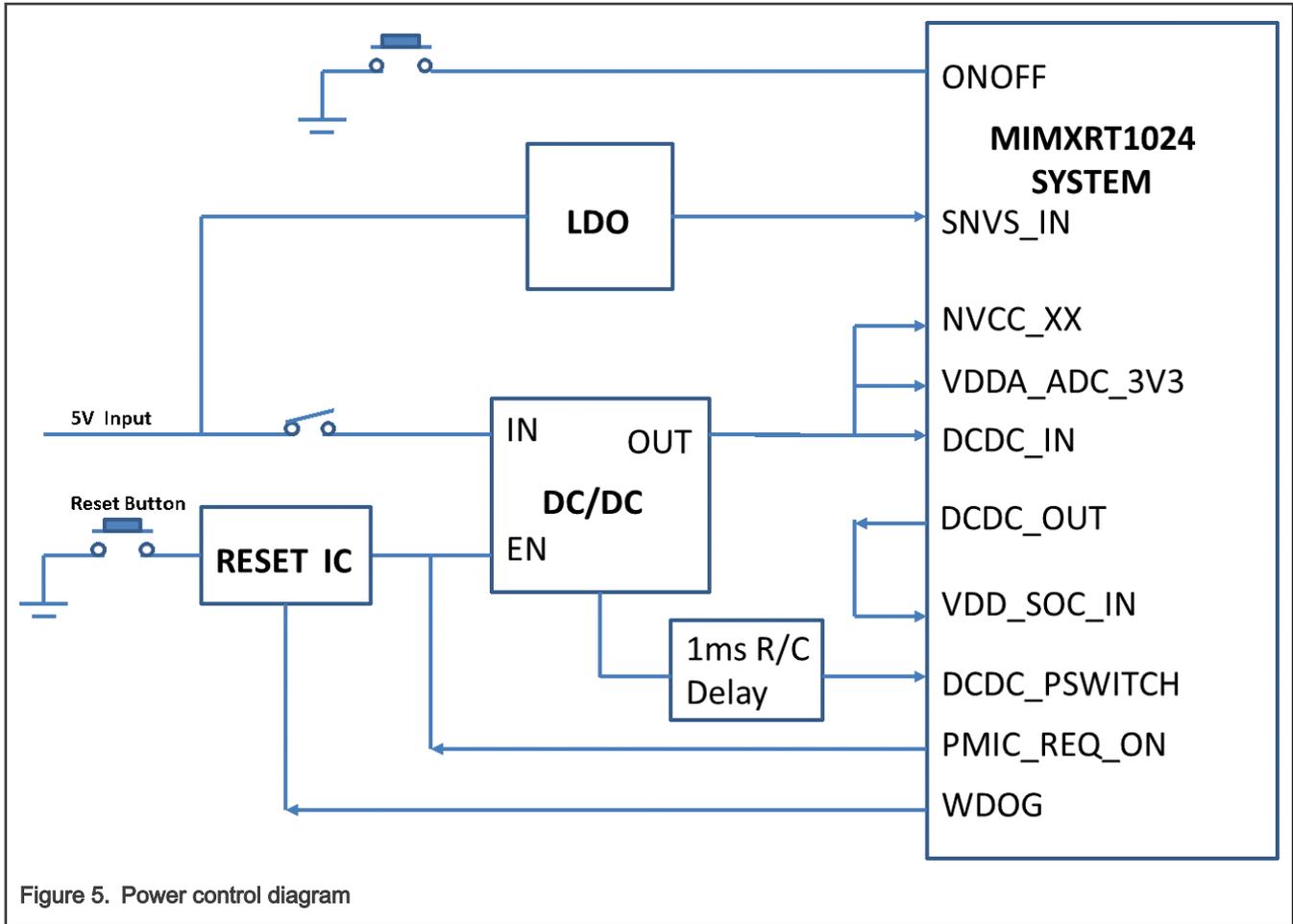


Figure 5. Power control diagram

Table 5 describes the power rails on the board.

Table 5. Power rails

Power rail	Min. (V)	Typ. (V)	Max. (V)	Description
VDD_SOC_IN	0.925	—	1.3	Core supply input voltage
VDD_HIGH_IN	3	3.3	3.6	VDD_HIGH_IN supply voltage
DCDC_IN	3	3.3	3.6	Power for DCDC
VDD_SNVIS_IN	2.4	3	3.6	Power for SNVS and RTC
USB_OTG1_VBUS	4.4	5	5.5	Power for USB VBUS
VDDA_ADC	3	3.3	3.6	Power for 12-bit ADC
NVCC_SD0	3	3.3	3.6	Power for GPIO in SDIO1 bank (3.3 V mode)
	1.65	1.8	1.95	Power for GPIO in SDIO1 bank (1.8 V mode)
NVCC_GPIO	3	3.3	3.6	IO power for GPIO

## 2.4 SDRAM memory

A 256 Mb, 166 MHz SDRAM (IS42S16160J-6TLI) is used on the EVK board.

## 2.5 SD card slot

There is a SD card slot, **J15**, on the MIMXRT1024 EVK board. J15 is a Micro SD slot for USDHC1 interface. If developer wants to boot from the SD Card, the boot device switch, **SW8**, settings should be: OFF, ON, ON, OFF, as shown in [Table 3](#).

## 2.6 QSPI Flash

There is an On-Chip 32 Mbit QSPI Flash is used on the MIMXRT1024. If the developer wants to boot from the QSPI Flash, the boot device switch, **SW8**, settings should be: OFF, OFF, ON, OFF, as shown in [Table 3](#).

## 2.7 Ethernet connector

There is one Ethernet controller in the MIMXRT1024 processor. The Ethernet subsystem of the MIMXRT1024 EVK board is provided by the KSZ8081RNB 10/100M Ethernet transceiver, **U11**, and a RJ45, **J14**, with integrated magnetic.



Figure 6. Ethernet connector RJ45

## 2.8 USB PHY connector

The MIMXRT1024 contains an integrated USB 2.0 PHYs capable of connecting to USB host/device systems at the USB Low-Speed (LS) rate of 1.5 Mbits/s, Full-Speed (FS) rate of 12 Mbits/s or at the USB 2.0 High-Speed (HS) rate of 480 Mbits/s.

## 2.9 Audio input/output connector

There is an Audio CODEC on the MIMXRT1024 EVK board: Wolfson's Low Power, high quality Stereo Codec, WM8960. The MIMXRT1024 EVK board includes:

- One headphone interface, **J11**
- One on-board MIC, **P1**
- Two speaker interfaces, **J12** and **J13**

**J11** is a 3.5 mm audio stereo headphone jack, which supports jack detect.

## 2.10 OpenSDA circuit (DAP-Link)

The OpenSDA circuit (CMSIS-DAP) is an open-standard serial and debug adapter. It bridges serial and debug communications between a USB host and an embedded target processor.

CMSIS-DAP features a Mass Storage Device (MSD) bootloader, which provides a quick and easy mechanism for loading different CMSIS-DAP Applications such as flash programmers, run-control debug interfaces, serial-to-USB converters, and more. Two or more CMSIS-DAP applications can run simultaneously. For example, run-control debug application and serial-to-USB converter runs in parallel to provide a virtual COM communication interface while allowing code debugging via CMSIS-DAP with just single USB connection.

For the MIMXRT1024 EVK bBoard, **J23** is the connector between the USB host and the RT1024. If developer wants to switch to the bootloader mode, pressing SW9 then connect J23 by an USB cable. There will appear a **MAINTENANCE DISK**. The developer can drag/drop a new application firmware to the OpenSDA.

OpenSDA also supports the drag/drop feature for U-Disk.

1. Use the seral downloader mode and drag/drop the image file to U-Disk.
2. Select QSPI Flash as boot device and reset the board.

Now, the image will run.

### 2.11 JTAG connector

**J55** is a standard connector for JTAG. **Figure 7** shows the pin definitions. For RT1024, **SWD** is the default debug interface.

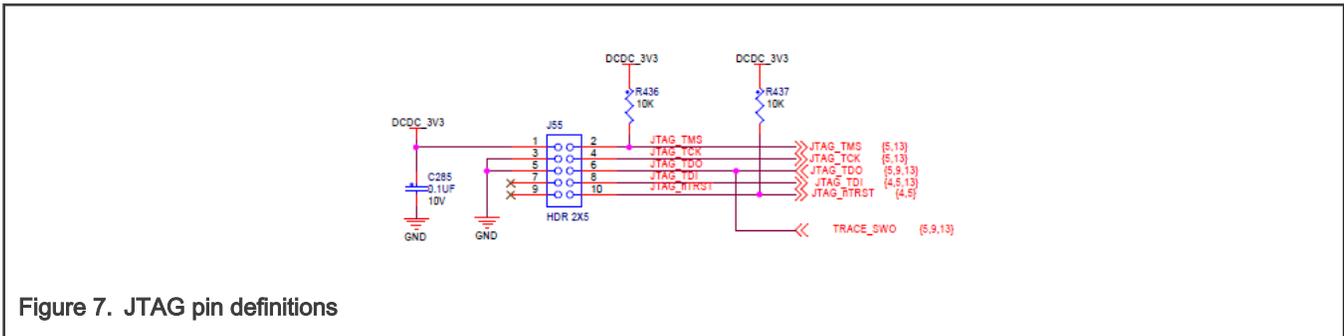


Figure 7. JTAG pin definitions

### 2.12 Arduino expansion port

**J17** to **J20** are Arduino interfaces and motor control interfaces.

Table 6. Arduino and Motor Control Interface pin definitions - J17

J17: Arduino interface	J17: Motor control
UART_RX/D0/UART_RX	NC
UART_TX/D1/UART_TX	ENC_I
D2/INT0	NC
D3/INT1/PWM/OC2B	NC
D4/T0/XCK	NC
D5/TI/PWM	NC
D6/AIN0/PWM/OC0A	NC
D7/AIN1/PWM	NC

**Table 7. Arduino and Motor Control Interface pin definitions - J18**

J18: Motor control	J18: Arduino interface
NC	A5/ADC5/SCL
NC	A4/ADC4/SDA
NC	A3/ADC3
NC	A2/ADC2
NC	A1/ADC1
NC	A0/ADC0

**Table 8. Arduino and Motor Control Interface pin definitions - J19**

J19: Arduino interface	J19: Motor control
D8/CLKO/ICP1	CUR_A
D9/OC1A/PWM	CUR_B
D10/SPI_CS	CUR_C
D11/OC2A/PWM/SPI_MOSI	VOLT_DCB
D12/SPI_MISO	CUR_DCB
D13/SPI_CLK	NC
GND	NC
AREF	NC
D14/I2C_SDA	NC
D15/I2C_SCL	NC

**Table 9. Arduino and Motor Control Interface pin definitions - J20**

J20: Motor control	J20: Arduino interface
PWM_AT	VIN
PWM_AB	GND
PWM_BT	GND
PWM_BB	5 V
PWM_CT	3V3
PWM_CB	RESET_b

*Table continues on the next page...*

Table 9. Arduino and Motor Control Interface pin definitions - J20 (continued)

J20: Motor control	J20: Arduino interface
ENC_A	IOREF
ENC_B	NC
PWM_AT	VIN
PWM_AB	GND

### 2.12.1 Power switch

**SW1** is a slide switch to control the power of the MIMXRT1024 EVK when the power supply is from **J2**.

### 2.12.2 ON/OFF button

**SW2** is the ON/OFF button for MIMXRT1024 EVK board. A short pressing in the OFF mode causes the internal power management state machine to change state to **ON**. In the ON mode, a short pressing generates an interrupt, intended to be a software-controllable (power-down). An approximate five seconds or longer pressing time causes a forced OFF which will power down all the power domain except SNVS domain.

### 2.12.3 Reset button

There are two Reset buttons on the EVK board.

- **SW3**: Pressing the **SW3** in the ON state will force to reset the system power except SNVS domain. The processor will be immediately turned off and reinitiate a boot cycle from the OFF state.
- **SW9**: It is a POR pin reset button.

### 2.12.4 USER button

**SW4** is the user button, GPIO5-00, for developers to use. Pressing can produce changes in high and low levels.

## 2.13 User interface LED indicator

There are four LED status indicators located on the EVK Board. The functions of these LEDs include:

- Main power supply: **D3**
  - Green: DC 5 V main supply is normal.
  - Red: **J2** input voltage is over 5.6 V.
  - OFF: The board is not powered.
- Reset RED LED: **D21**
- OpenSDA LED: **D20**
- User LED: **D5**

## Chapter 3

# PCB information

The MIMXRT1024 EVK board uses the standard 2-layer technology. The material used is FR-4. [Table 10](#) describes the PCB stack-up information.

**Table 10. Board stack-up information**

Layer	Description	Copper(Oz)	Dielectric thickness(mil)
Top	Signal, Power, GND	1	1.4
Dielectric	FR4	—	56
Bottom	Signal, Power, GND	1	1.4

# Chapter 4

## EVK design files

The schematics, layout files, and gerber files (including Silkscreen) can be downloaded from MIMXRT1024-EVK.

# Chapter 5

## Contents of Evaluation kit

Table 11. EVK contents

Item	Description
EVK board	EVK board with processor, memory, interfaces, etc.
USB cable	USB cable (Micro-B to Standard-A)

**NOTE**

Power adaptor, Micro SD card are not standard parts of the Evaluation kit.

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