MIMXRT1170EVKBHUG

MIMXRT1170 EVKB Board Hardware User Guide

Rev. 4 — 11 June 2024 **User guide**

Document information

Information	Content
Keywords	MIMXRT1170EVKBHUG, User guide, MIMXRT1170 EVKB
Abstract	This document is a hardware user guide for the MIMXRT1170 Evaluation Kit (EVKB) based on the NXP Semiconductor i.MX RT1170 processor.

1 Introduction

This document is a hardware user guide for the MIMXRT1170 Evaluation Kit (EVKB) based on the NXP Semiconductor i.MX RT1170 processor. NXP Semiconductor fully supports this board. The user guide includes system setup and debugging. It provides detailed information on the overall design and usage of the EVKB board from a hardware system perspective.

1.1 Board overview

This EVKB board is a platform designed to showcase the most commonly used features of the i.MX RT1170 Processor in a small, low-cost package. The MIMXRT1170 EVKB board is an entry level development board. It gives developers an option to be familiar with the processor before investing a large amount of resources in more specific designs. For the Board Kit contents, refer to Section 5.

Table 1 lists the features of the MIMXRT1170 EVKB board.

Table 1. Board features

Processor	NXP Processor	MIMXRT1176DVMAA
DRAM Memory	512 Mb SDRAM, 200 MHz	W9825G6KH-5I * 2
DC-DC	MPS	MP2143DJ
	NXP	MPF5020CMMACES
LDO	UNION，AMS	UM1750S-00, UM1550S-28, AMS1117-1.8
Mass Storage	TF Card Slot	
	512 Mb Quad SPI Flash	
	512 Mb Oct Flash	
	4 Mb LPSPI Flash	
	2 Gb Parallel NAND Flash	
Display Interface	MIPI DSI LCD Connector	
	RPI LCD Connector	
Ethernet	10/100 Mb/s Ethernet Connector. PHY Chip: RTL8201FI-VC-CG	
	10/100/1000 Mb/s Ethernet Connector. PHY Chip: RTL8211FDI-CG	
USB	USB 2.0 OTG Connector * 2	
Audio Connector	3.5 mm Audio Stereo Headphone Jack	
	Board-Mounted Microphone	
	Left and Right Speaker Out Connectors	
	S/PDIF Interface (DNP)	
	Audio Extension Port	
	DMIC Extension Port	
Power Connector	5 V DC-Jack	
Debug Connector	JTAG 20-pin Connector (SWD by default)	
	MCU LINK	
Sensor	FXLS8974CFR3 3-axis MEMS accelerometer	

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Table 1. Board features...*continued*

Camera	MIPI CSI Interface
CAN	CAN Bus Connector
User Interface Button	ON/OFF, POR Reset, Reset, User Button
LED Indicator	Power Status, Reset, OpenSDA, User LED
Expansion Port	Arduino Interface, M.2 interface
MFI connector	2 * 4-pin MFI connector
PCB	6.302 inch x 5.197 inch (16 cm x 13.2 cm), 6-layer board

1.2 MIMXRT1170 EVKB contents

The MIMXRT1170 EVKB contains the following items:

- MIMXRT1170 EVKB board
- 5 V power adapter
- OV5640 MIPI camera module
- USB cable (Micro B)

1.3 MIMXRT1170 EVKB board revision history

- EVK REVA: Internal use
- EVK REVB: Internal use and Alpha program
- EVK REVC: Internal use and Alpha program
- EVK REVC1: Internal use, Alpha program, and product launch

2 Specifications

This chapter provides detailed information about the electrical design and practical considerations of the EVKB board. Figure 1 shows the block diagram of the EVKB board.

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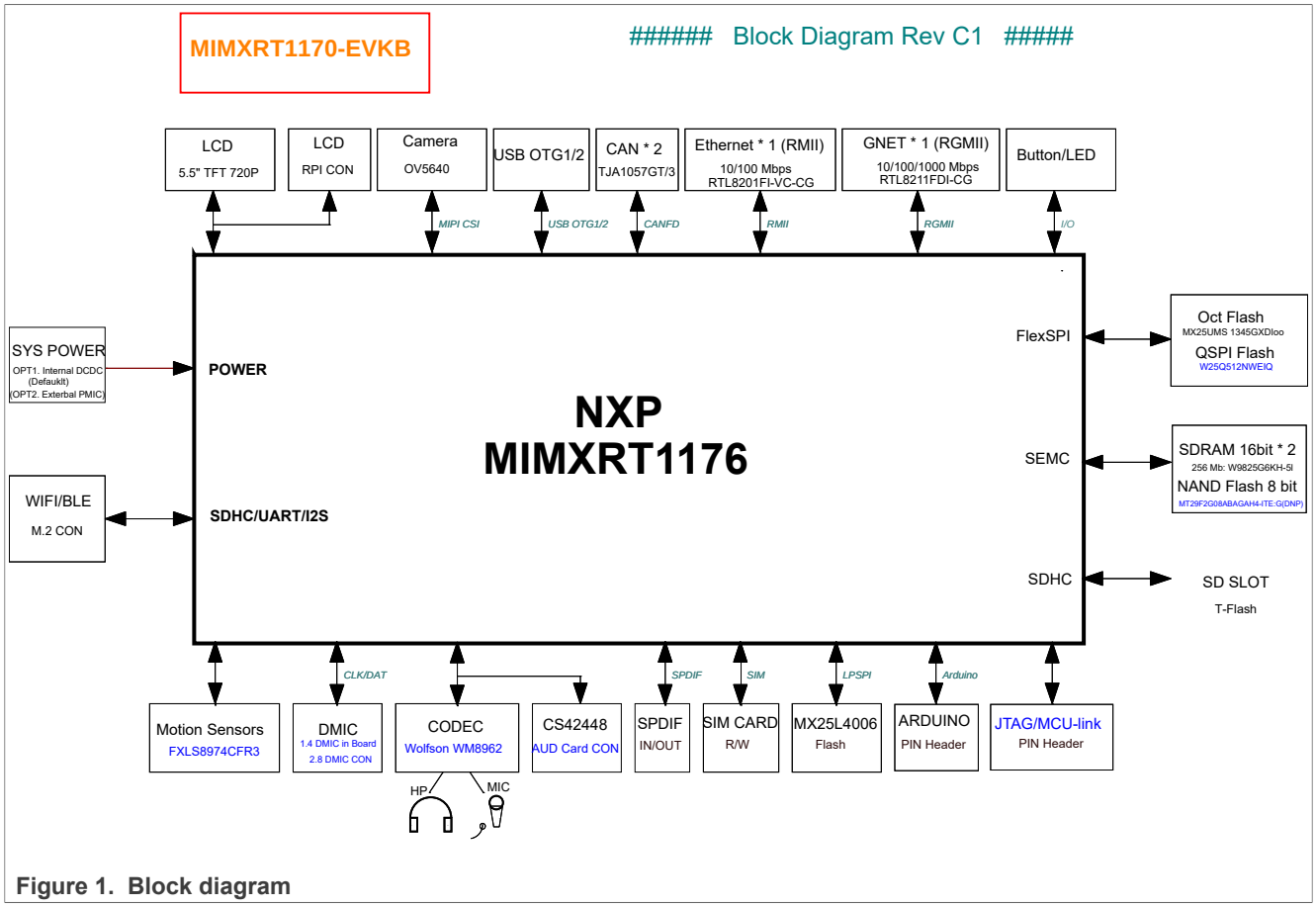

Figure 1. Block diagram

Figure 2 and Figure 3 show the overview of the MIMXRT1170 EVKB board.

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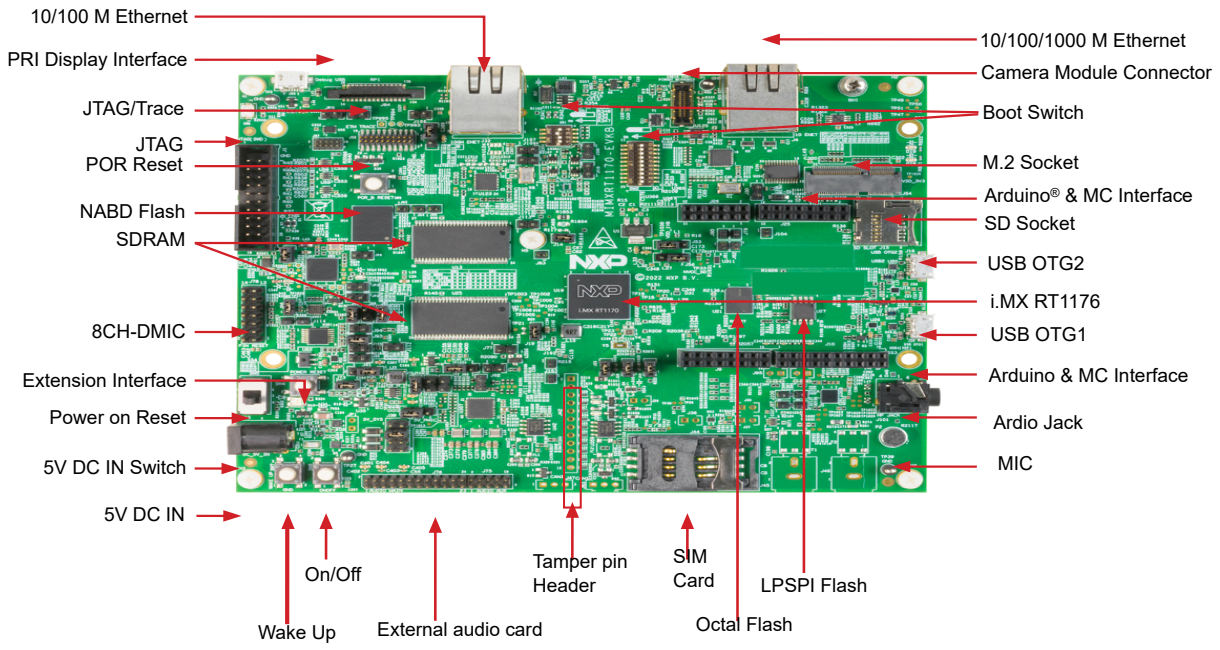

Figure 2. Overview of the MIMXRT1170 EVKB board (Front side)

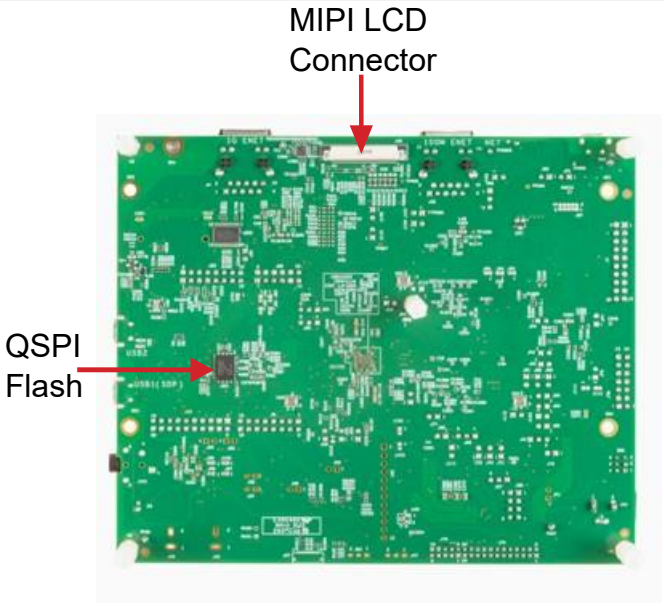

Figure 3. Overview of the MIMXRT1170 EVKB board (Back side)

2.1 i.MX RT1170 processor

The i.MX RT1170 is a new processor family featuring NXP advanced implementation of the high-performance Arm Cortex M7 Core and power efficient Arm Cortex M4 Core. It provides high CPU performance and best real-time response.

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The i.MX RT1170 has 2 MB on-chip RAM in total, including a 512 kB RAM, which can be flexibly configured as TCM or general-purpose on-chip RAM. The i.MX RT1170 integrates an advanced power management module with DC-DC and LDO that reduces the complexity of external power supply and simplifies power sequencing.

It provides memory interfaces, including SDRAM, Raw NAND FLASH, NOR flash, SD/eMMC, Quad SPI, and Hyper RAM/Flash. It also provides a wide range of other interfaces for connecting peripherals, such as WLAN, BluetoothR, GPS, displays, and camera sensors. Like other i.MX processors, the i.MX RT1170 has rich audio and video features, including MIPI CSI/DSI, LCD display, graphics accelerator, camera interface, S/PDIF, and I^2S audio interface.

The i.MX RT1170 applications processor can be used in areas, such as industrial HMI, IoT, high-end audio appliance, low-end instrument cluster, Point-of-Sale (PoS), motor control, and home appliances.

2.2 Boot mode configurations

The device has four boot modes, with one reserved for NXP use. The boot mode is selected based on the binary value stored in the internal `BOOT_MODE` register. Switch (SW1-3 and SW1-4) is used to select the boot mode on the MIMXRT1170 EVKB board.

Table 2. Boot mode pin settings

BOOT_MODE[1:0] (SW1-3 SW1-4)	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 setting

SW1-3	SW1-4	SW2-3	SW2-6	SW2-7	Boot device
0[1]	1	0	0	0	SDP mode
1	0	0	0	0	QSPI Flash
1	0	1	0	0	OCT Flash
1	0	0	1	0	NAND Flash
1	0	0	0	1	SD card

[1] The switch value is not described if the option remains **0** for a different boot device.

Note:

*For more information about boot mode configuration, see the **System Boot** chapter in the i.MX RT1170 Processor Reference Manual (document IMXRT1170RM).*

For more information about MIMXRT1170 EVKB boot device selection and configuration, see Board schematic.

2.3 Power tree

A DC 5 V external power supply is used to supply the MIMXRT1170 EVKB board at J43, and a slide switch **SW5** is used to turn the power ON/OFF. J20 and J11 can also be used to supply the EVKB board. Different power supplies must configure different Jumper settings of J38. Table 4 lists the details.

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Table 4. Jumper settings of power supply

Power supply	J38 settings
J43	1 - 2
J20	3 - 4
J11	5 - 6

Note: *For some use cases, the power consumption is larger than 500 mA @5V. Suggest using the DC adapter instead, which can support up to 3A.*

Figure 4 shows the power tree.

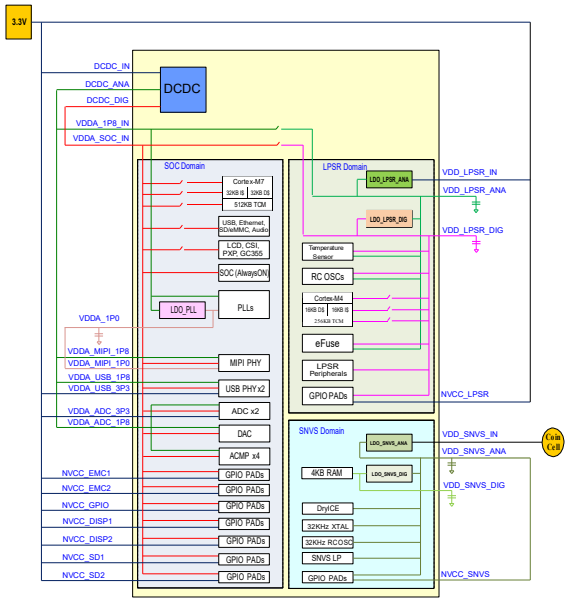

Figure 4. Power tree

- Power on sequence requirements:
  - `VDD_SNVS_IN` supply must be turned on before any other power supply, or be connected (shorted) with `VDD_LPSR_IN` and `DCDC_IN` supply.
  - If a coincell is used to power `VDD_SNVS_IN`, ensure that it is connected before any other supply is switched on.
  - When internal DC-DC is enabled, an external delay circuit is required to delay the `DCDC_PSWITCH` signal 1 ms after `DCDC_IN` is stable.
  - The `POR_B` input, if used, must be immediately asserted at power on and remain asserted until after the last power rail reaches its working voltage. In the absence of an external reset feeding the `POR_B` input, the internal POR module takes control.
- Power off sequence requirements:
  - `VDD_SNVS_IN` supply must be turned off after any other power supply, or be connected (shorted) with `VDD_LPSR_IN` and `DCDC_IN` supply.
  - If a coincell is used to power `VDD_SNVS_IN`, ensure that it is removed after any other supply is switched off.

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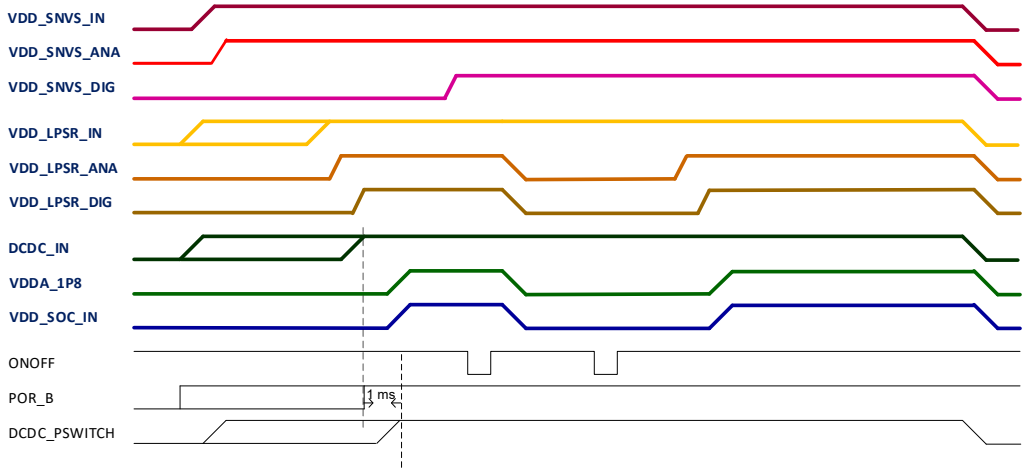

Figure 5. Power on and power off sequence

Figure 6 shows the power control logic of the MIMXRT1170 EVKB board.

- It powers up SNVS first, then `PMIC_ON_REQ` is switched on to enable external DC-DC to power up other power domains.
- The **ON**/**OFF** button is used to switch on/off the `PMIC_ON_REQ` to control power modes.
- The RESET button and WDOG output are used to reset the system power.

Note: *The on-chip DC-DC regulator of the processor is suitable for consumer and industrial applications up to 105 °C. For automotive applications, contact your NXP representative.*

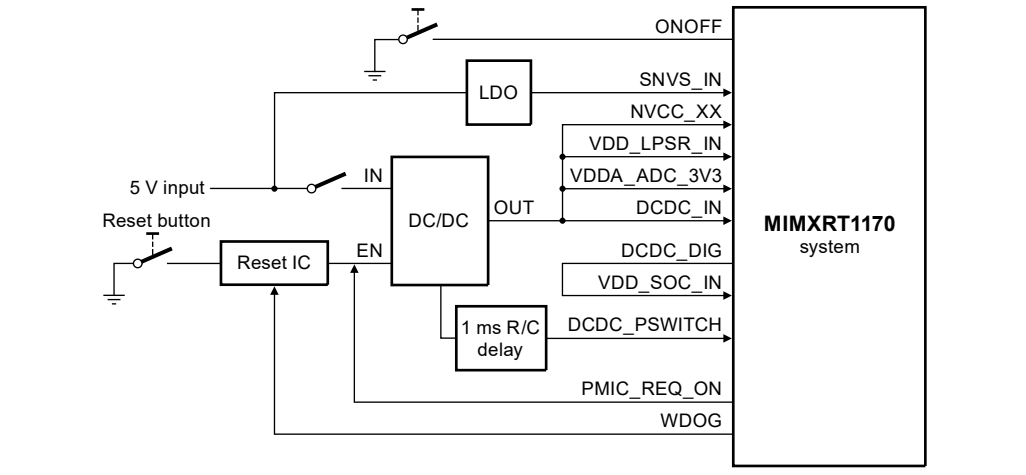

Figure 6. Power control diagram

Table 5 describes the power rails on the board.

Table 5. Power rails

Power rail	Min. (V)	Type (V)	Max. (V)	Description
DCDC_IN	3	3.3	3.6	Power for DC-DC
VDDA_1P8_IN	1.71	1.8	1.89	Power for PLL, OSC, and LDOs
VDD_SOC_IN	0.7	1.0	1.155	Power for digital logics
VDD_LPSR_IN	3	3.3	3.6	Power for LPSR domain
VDD_SNVS_IN	2.4	3	3.6	Power for SNVS and RTC

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Table 5. Power rails*...continued*

Power rail	Min. (V)	Type (V)	Max. (V)	Description
VDD_USB_1P8	1.65	1.8	1.95	Power for USB OTG PHYs
VDD_USB_3P3	3	3.3	3.6	
VDD_ADC_1P8	1.65	1.8	1.95	Power for ADC, Power for DAC and ACMP, ADC_VREFH<VDDA_ADC_1P8
VDD_ADC_3P3	3	3.3	3.6	
VDD_MIPI_1P8	1.65	1.8	1.95	Power for MIPI CSI/DSI PHY
VDD_MIPI_1P0	0.9	1.0	1.1	Power for MIIPI CSI/DSI PHY
NVCC_SD1	3	3.3	3.6	IO power for GPIO in SDIO1 bank (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in SDIO1 bank (1.8 V mode)
NVCC_SD2	3	3.3	3.6	IO power for GPIO in SDIO2 bank (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in SDIO2 bank (1.8 V mode)
NVCC_EMC1	3	3.3	3.6	IO power for GPIO in EMC bank1 (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in EMC bank1 (1.8 V mode)
NVCC_EMC2	3	3.3	3.6	IO power for GPIO in EMC bank2 (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in EMC bank2 (1.8 V mode)
NVCC_GPIO	3	3.3	3.6	IO power for GPIO in GPIO AD bank (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in GPIO AD bank (1.8 V mode)
NVCC_DISP1	3	3.3	3.6	IO power for GPIO in DISP1 bank (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in DISP1 bank (1.8 V mode)
NVCC_DISP2	3	3.3	3.6	IO power for GPIO in DISP2 bank (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in DISP2 bank (1.8 V mode)
NVCC_LPSR	3	3.3	3.6	IO power for GPIO in LPSR bank (3.3 V mode)
	1.65	1.8	1.95	IO power for GPIO in LPSR bank (1.8 V mode)
NVCC_SNVS	1.65	1.8	1.95	IO power for GPIO in SNVS bank (1.8 V mode)

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2.4 SDRAM memory

Two 256 Mb, 200 MHz SDRAM (W9825G6KH-5I) is used on the EVKB board.

2.5 SD card slot

There is an SD card slot (J15) on the MIMXRT1170 EVKB board. J15 is the micro SD slot for USDHC1 interface. If the developer wants to boot from the SD card, the boot device switch settings must be set correctly as shown in Table 3.

2.6 Octal flash

On the MIMXRT1170 EVKB board, there is one 512 Mb Octal flash device. If the developer wants to boot from the Octal flash, the boot device switch settings must be set correctly as shown in Table 3.

By default, the Octal flash is not used. To enable the onboard OCT flash, update the settings as below:

1. Remove resistors: R380/R399/R386/R390/R392/R385.
2. Weld 0 Ω resistors: R381/R378/R382/R389/R402/R377/R388/R391.

2.7 QSPI flash

A 512 Mb QSPI flash is used on the MIMXRT1170 EVKB board. If the developer wants to boot from the QSPI flash, the boot device switch settings must be set correctly as shown in Table 3.

By default, this QSPI Flash is enabled on the EVKB.

2.8 ENET PHY connector

There are two Ethernet Mac controllers in the MIMXRT1170 processor.

The 10/100 M Ethernet subsystems of the MIMXRT1170 EVKB board are provided by the RTL8201FI-VC-CG 10/100 M Ethernet transceiver (U123) and an RJ45 (J32) with integrated magnetic.

The 10/100/1000 M Ethernet subsystems of the MIMXRT1170 EVKB board are provided by the RTL8211FDI-CG 10/100/1000 M Ethernet transceiver (U10) and an RJ45 (J4) with integrated magnetic.

2.9 USB PHY connector

The MIMXRT1170 contains two integrated USB 2.0 PHYs capable of connecting to USB host/device systems at the USB low-speed (LS) rate of 1.5 Mb/s, full-speed (FS) rate of 12 Mb/s, or at the USB 2.0 high-speed (HS) rate of 480 Mb/s.

2.10 Audio input/output connector

The audio CODEC used on the MIMXRT1170 EVKB board is Wolfson low-power, high-quality Stereo Codec, WM8962. The MIMXRT1170 EVKB board includes:

1. One headphone interface (J101) which is a 3.5 mm audio stereo headphone jack, which supports jack detect.
2. One onboard MIC (P2).
3. Two speaker interfaces (J95, J96).

The EVKB also provides the SPDIF interface (J45 and J46, DNP) and DMIC interface input through U40/U41/U44/U45.

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2.11 On-board debugger

Jointly developed by NXP and Embedded Artists, MCU-Link is a powerful and cost-effective debug probe that can be used seamlessly with the MCUXpresso IDE, and is also compatible with the third-party IDEs that support the CMSIS-DAP protocol. MCU-Link also includes a USB to UART bridge feature (VCOM) that can be used to provide a serial connection between the target MCU and a host computer. MCU-Link is based on the LPC55S69 microcontroller, and features a high-speed USB interface for high-performance debug.

To update the firmware, install the MCU LINK installer from the NXP website and follow the steps below.

1. Install jumper JP3.
2. Connect MCU-Link to your host computer via USB.
3. Go to the scripts directory in the software package installation and run the `program.cmd` (Windows) or program (Linux/MacOS) script by double-clicking it. Follow the onscreen instructions
4. To exit the script, press **Ctrl-C**.
5. Disconnect MCU-Link from the host computer, remove JP3, and then reconnect to the computer
6. Review the *Readme.txt* for other OS-specific setup.

2.12 JTAG connector

J1 is a standard 20-pin/2.54 mm box header connector for JTAG. Figure 7 shows the pin definitions. SWD is supported by default.

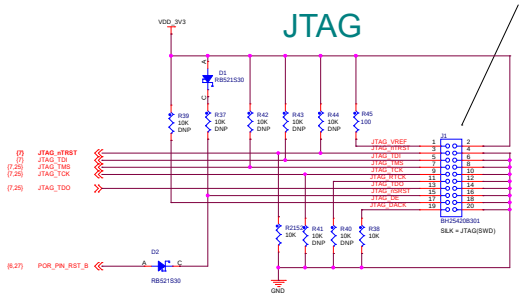

Figure 7. JTAG pin definitions

Note: *By default, the RT1170 silicon can use both SWD and JTAG modes using the Arm stitching sequence. For the RT1170EVKB board, SWD debug is used by default without any board modification. To use JTAG debug, solder out R187, R208, and R195, because some JTAG signals are multiplexed with other functions.*

2.13 Arduino expansion port

J22 to J25 are defined as Arduino interfaces. Table 6 lists the pin definitions of Arduino interfaces.

Table 6. Arduino Interface pin definitions

J9	J26	J10	J25
UART_RX/D0	A0/ADC0	D8/CLKO/ICP1	NC
UART_TX/D1	A1/ADC1	D9/OC1A/PWM	IOREF
D2/INT0	A2/ADC2	D10/SPI_CS	RESET
D3/INT1/PWM/OC2B	A3/ADC3	D11/OC2A/PWM/SPI_MOSI	3.3 V
D4/T0/XCK	A4/ADC4/SDA	D12/SPI_MISO	5 V
D5/TI/PWM	A5/ADC5/SCL	D13/SPI_CLK	GND
D6/AIN0/PWM/OC0A	—	GND	GND

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Table 6. Arduino Interface pin definitions*...continued*

J9	J26	J10	J25
D7/AIN1/PWM	—	AREF	VIN
—	—	D14/I2C_SDA	—
—	—	D15/I2C_SCL	—

The EVKB board uses the two-line connector which reserve the function to interface the motor control board.

2.14 Camera module connector

The i.MX RT1170 supports one MIPI CSI. There is a Camera Module Connector (J2) on the MIMXRT1170 EVKB board. The MT9M114 based on OV5640 can be used directly.

2.15 User interface switch/button

There are four user interface switches/buttons on the MIMXRT1170 EVKB board. Their functionalities are as below.

1. Power switch
   SW5 is a slide switch to control the power of the MIMXRT1170 EVKB board when the power supply is from J43. The functions of this switch are listed as below:
   - Sliding the switch to the ON position connects the 5 V power supply to the evaluation board main power system.
   - Sliding the switch to the OFF position immediately removes all power from the board.
2. ON/OFF button
   SW6 is the ON/OFF button for the MIMXRT1170 EVKB 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). Pressing for about five seconds or longer causes a forced OFF. Both boot mode inputs can be disconnected.
3. Reset button
   There are three reset buttons on the EVKB board.
   - **SW4** is the power-on reset button. Pressing the **SW4** in the ON state forces to reset the system power except SNVS domain. The processor is immediately turned off and reinitiates a boot cycle from the OFF state.
   - **SW3** is the reset button of the POR pin.
   - **SW8** is the reset button of the MCU LINK.
4. User button
   SW7 is the user button connected to the WAKEUP pin for developers to use.

2.16 Sensor

U115 on the EVK board is a 3-axis MEMS accelerometer. Sensor FXLS8974CFR3.

2.17 User interface LED indicator

There are four LED status indicators on the EVKB board. The functions of these LEDs include:

- Main power supply (D16)
  - Green: DC 5 V main supply is normal.
  - Red: J2 input voltage is over 5.6 V.
  - Off: the board is not powered.

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- MCULINK
- SWD activity (D39)
- MCU link heartbeat (D30)
- USB Communication (D45)
- USER LEDs (D6, D34)

2.18 LCD interface

The Mobile Industry Processor Interface (MIPI) Display Serial Interface (DSI) controller is a flexible digital core, with high-performance and easy to use. It implements all protocol functions defined in the MIPI DSI specification. The MIPI DSI controller provides an interface that allows communication with MIPI DSI-compliant peripherals.

If developers want to use LCD, NXP provides an optional LCD module RK055HDMIPI4M equipped with a 5.5” 720*1280 TFT LCD display with touch sensitive overlay. This module contains one FPC cable that connects to RT1170EVKB. The LCD interface can be connected to J48. LCD modules can be purchased from the NXP website.

RT1170 EVKB also supports the Raspberry Pi Touch Display. This Display can be connected to J84.

2.19 Cortex debug + ETM

J58 is a Cortex Debug+ETM connector. This interface can access the Embedded Trace Macrocell (ETM) TRACECLK and TRACEDATA(n) signals. To enable TRACE function on the EVKB board, Weld Trace-related resistors, TRACE_CLK(R1885), TRACE_D0(R1881), TRACE_D1(R1882), TRACE_D2(R1883), and TRACE_D3(R1884).

For ETM trace implementation on i.MX RT1170 EVKB, as the `DMIC_DATA1` pin is sharing with `JTAG_nTRST`, and drives it to be low by default, it would lead to ETM trace failure.

The workaround is to switch `JTAG_nTRST pinmux` to be GPIO.

The patch for J-Trace:

```
void AfterTargetReset (void)
{
    … …
    Target.WriteU32(0x40c08028, 0xa);
}
```

The patch for µTrace:

```
Data.Set AD:0x40c08028 %Long 0x0000000a
  ;IOMUXC_SetPinMux(IOMUXC_GPIO_LPSR_10_GPIO12_IO10,0U);
```


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3 PCB information

The MIMXRT1170 EVKB board uses the standard 6-layer technology. The material used is FR-4. Table 7 describes the PCB stack-up information.

Table 7. Board stack-up information

Layer	Description	Copper (Oz)	Dielectric thickness (mil)
1	Signal	1/2	—
	Dielectric	—	3.5
2	GND	1	
	Dielectric		5
3	Signal	1	—
	Dielectric	—	37
4	Power	1	—
	Dielectric		5
5	GND	1	—
	Dielectric	—	3.5
6	Signal	1/2	—

4 EVKB design files

The schematics, layout files, and gerber files (including Silkscreen) can be downloaded from MIMXRT1170-EVKB.

5 Contents of evaluation kit

Table 8. EVKB contents

Item	Description
EVKB board	EVKB board with processor, memory, interfaces, and so on
Power adapter	5V/3A power adapter
Camera module	OV5640 MIPI camera module
USB cable	USB cable, Micro-B to Standard-A

Note: *Micro SD card and LCD module are not standard parts of the evaluation kit.*

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6 Key differences between EVK and EVKB

Table 9 describes the key differences between i.MX RT1170 EVK board and i.MX RT1170 EVKB board.

Table 9. Key difference between EVK and EVKB

	RT1170 EVK	RT1170 EVKB
PMIC	×	✓
Audio extension port	×	✓
DMIC extension port	×	✓
RPI LCD connector	×	✓
CAN interface	1	2
On-board debugger	Free Link	MCU Link
QSPI flash	S25WP128-JBLE	W25Q512NWEIQ
Audio Codec	WM8960	WM8962

7 Note about the source code in the document

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8 Revision history

Table 10 summarizes the revisions to this document.

Table 10. Revision history

Document ID	Release date	Description
MIMXRT1170 EVKBHUG v.4	11 June 2024	Updated Section 2.12
MIMXRT1170 EVKBHUG v.3	16 November 2023	Updated Table 9
MIMXRT1170 EVKBHUG v.2	20 September 2023	Added Section 2.19
MIMXRT1170 EVKBHUG v.1	23 August 2023	Initial public release

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