UM12160

FRDM-RW612 Board User Manual

Rev. 1.0 — 20 September 2024 User manual

Document information

Information	Content
Keywords	FRDM-RW612, UM12160, RW612
Abstract	The NXP FRDM-RW612 board is a low-cost design and evaluation board based on RW612 MCU. This document describes the hardware of the FRDM-RW612 board.

1 FRDM-RW612 overview

The NXP FRDM-RW612 board is a low-cost design and evaluation board based on the RW612 device.

The RW612 system integrates a dual Arm Cortex microcontroller and Wi-Fi 6 + Bluetooth Low Energy (LE) 5.4 / 802.15.4 tri-radio wireless MCU designed for a broad array of applications. NXP supports the RW612 device with tools and software, including hardware evaluation boards, software development IDE, example applications, and drivers.

The FRDM-RW612 board consists of one RW612 device with 512 Mbit external serial flash (provided by Winbond). The board also features a 64 Mbit PSRAM (provided by Apmemory), Ethernet PHY, a P3T1755 I3C temperature sensor, RGB LED, push buttons, high-speed USB circuit, and MCU-Link debug probe circuit. The board is also compatible with the Arduino shield modules, mikroBUS, and Pmod header for an NXP low-cost LCD module PAR-LCD-S035.

The onboard MCU-Link debug probe is based on the LPC55S69 MCU. Before using the MCU-Link functionality, ensure that it is programmed with the required firmware. For details, see Section 3.5.

1.1 Block diagram

Figure 1 shows the FRDM-RW612 board block diagram.

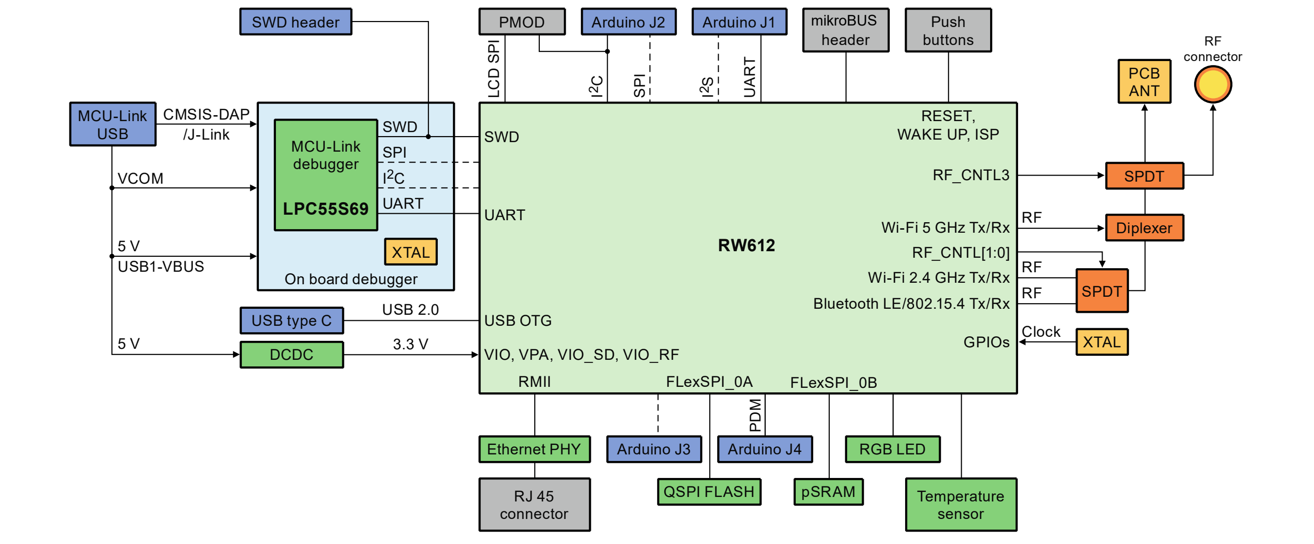

Figure 1. FRDM-RW612 Block Diagram

1.2 Board features

Table 1 describes the features of the FRDM-RW612 board.

Table 1. FRDM-RW612 features

Board feature	Target MCU features used	Description
RW612 MCU (Target MCU)		The RW612 is a highly integrated, low-power tri-radio Wireless MCU with an integrated MCU and Wi-Fi 6 + Bluetooth Low Energy (LE) / 802.15.4 radios. The RW612 MCU subsystem includes a 260 MHz Arm Cortex-M33 core with TrustZone-M, 1.2 MB on-chip SRAM and a high-bandwidth Quad SPI interface with an on-the-fly decryption engine for securely accessing off-chip XIP flash. The RW612 includes a full-featured 1x1 dual-band (2.4 GHz / 5 GHz)

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Table 1. FRDM-RW612 features*...continued*

Board feature	Target MCU features used	Description
		20 MHz Wi-Fi 6 (802.11ax) subsystem bringing higher throughput, better network efficiency, lower latency, and improved range over previous generation Wi-Fi standards. The Bluetooth LE radio supports 2 Mbit/s high-speed data rate, long range, and extended advertising. The on-chip 802.15.4 radio supports the Thread and Zigbee networking protocols. The RW612 is an ideal device for Matter applications running over Wi-Fi, Ethernet, and Thread. The RW612 can operate as a Matter controller and Thread Border Router. For details, see the *RW612 Data Sheet*.
Power supply		• 5 V input power supply using one of the following power sources: – MCU-Link USB2.0 Type-C connector – Arduino Shield-compatible header – 5 V regulator populated at 3-pin jumper • One DCDC converter for 3.3 V power supply • Jumpers and resistors configuration for different power supplies
Clock		• 40 MHz crystal for system reference clock • 32.768 kHz crystal for real-time clock (RTC) • 50 MHz Ethernet PHY clock from MAC • 16 MHz crystal for MCU-Link onboard debugger
USB	High-speed (HS) USB module	One USB Type-C connector interfaced with a high-speed USB controller and PHY module
Memory	FlexSPI controller	Supports both: • Winbond W25Q512JVFIQ – 512 Mbit QSPI flash memory • APmemory APS6404L-3SQN-SN – 64 Mbit QSPI PSRAM
Temperature sensor	Inter-integrated circuit (I2C)	Supports NXP P3T1755 temperature sensor
Ethernet	Ethernet controller (ENET0)	10 / 100 Mbit/s (RMII) KSZ8081RNB Ethernet PHY and RJ45 connector
I/O headers		Headers compatible with: • Arduino shields (outer rows) and FRDM header (inner rows) • Mikroe click boards • LCD on peripheral module (Pmod)
Debug		• Onboard MCU-Link debug probe with CMSIS-DAP and SEGGER J-Link protocol options. It can connect to the target MCU through a USB-to-UART, USB-to-SPI, or USB-to-I2C bridge. • 10-pin Arm JTAG/SWD connector for connecting an external debug probe
RF front-end	Wi-Fi 6 / Bluetooth LE 5.4 / 802.15.4	Single-antenna configuration through either of the following: • One PCB antenna • A coaxial connector (U.FL-R-SMT-1) for RF cable connection
PCB		130 mm x 55 mm

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Table 1. FRDM-RW612 features*...continued*

Board feature	Target MCU features used	Description
Orderable part number		FRDM-RW612

1.3 Board kit contents

The FRDM-RW612 board kit contains the following items:

- FRDM-RW612 board hardware assembly
- A 3 ft micro USB Type A to USB Type C cable

1.4 Board pictures

Figure 2 shows the FRDM-RW612 top view.

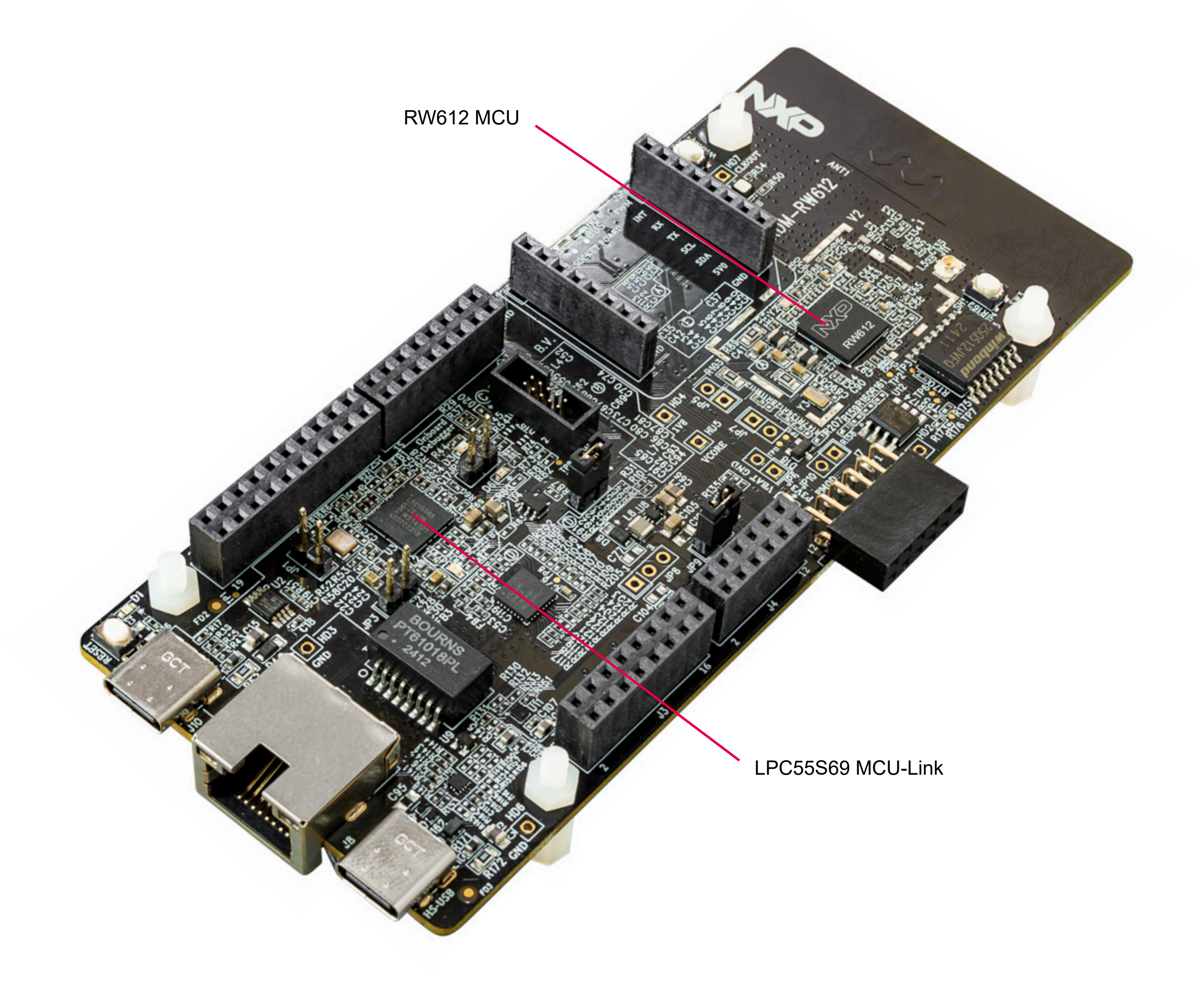

Figure 2. FRDM-RW612 top view

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Figure 3 shows the top-side view of the FRDM-RW612 board, with connectors, push buttons, and LEDs highlighted.

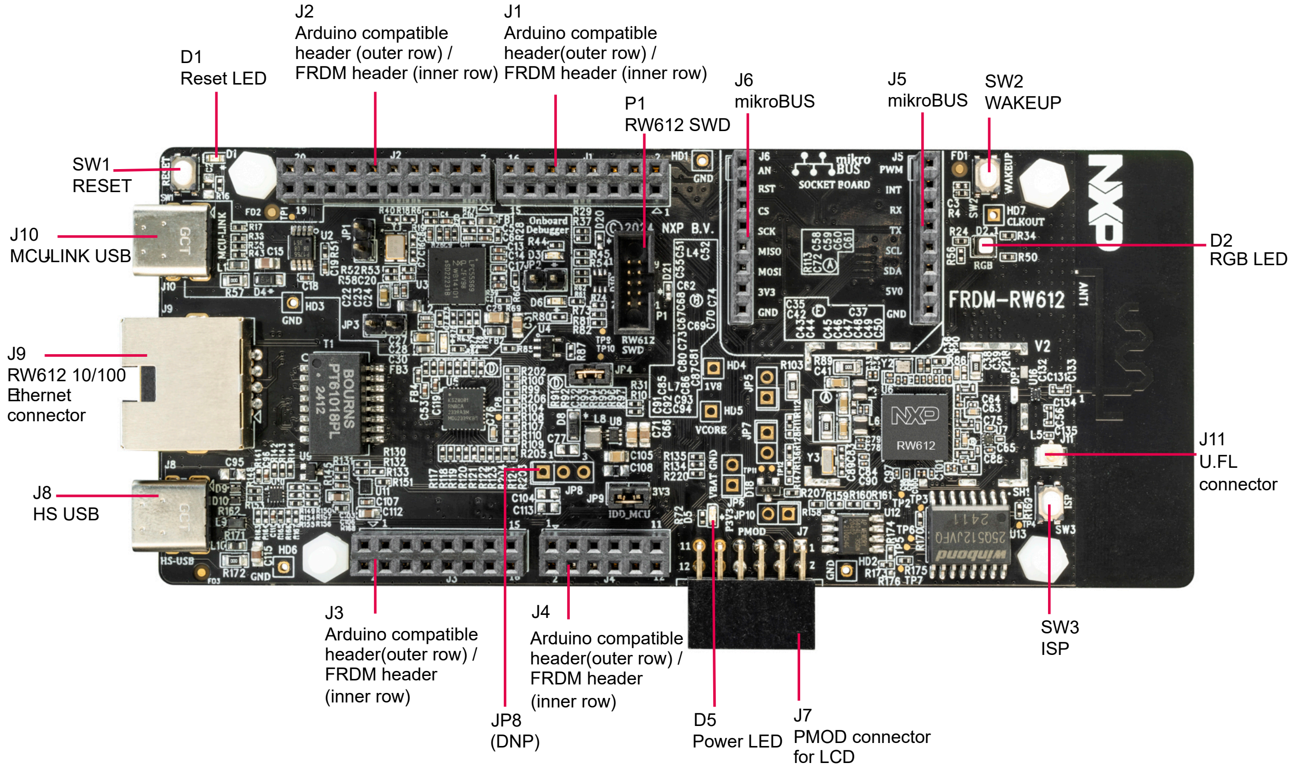

Figure 3. FRDM-RW612 connectors, push buttons, and LEDs

Figure 4 shows the jumpers on the FRDM-RW612 board.

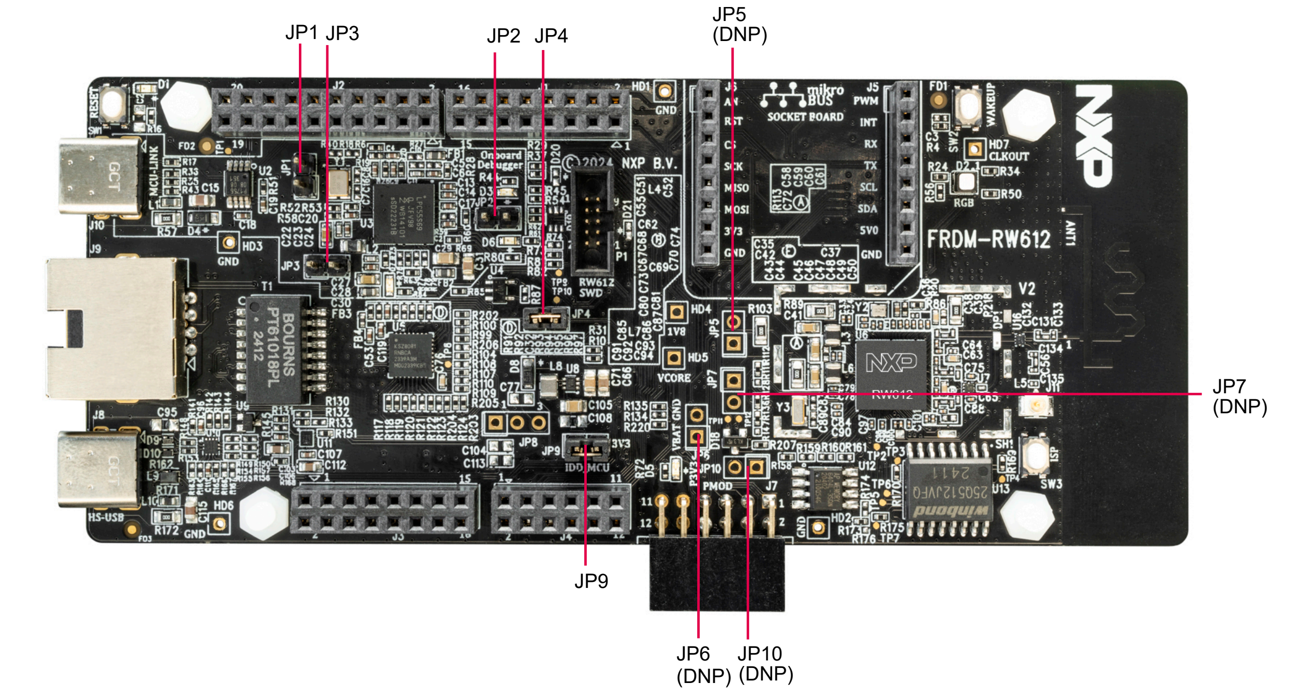

Figure 4. FRDM-RW612 jumpers

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Figure 5 shows the FRDM-RW612 bottom view, with soldered jumpers highlighted.

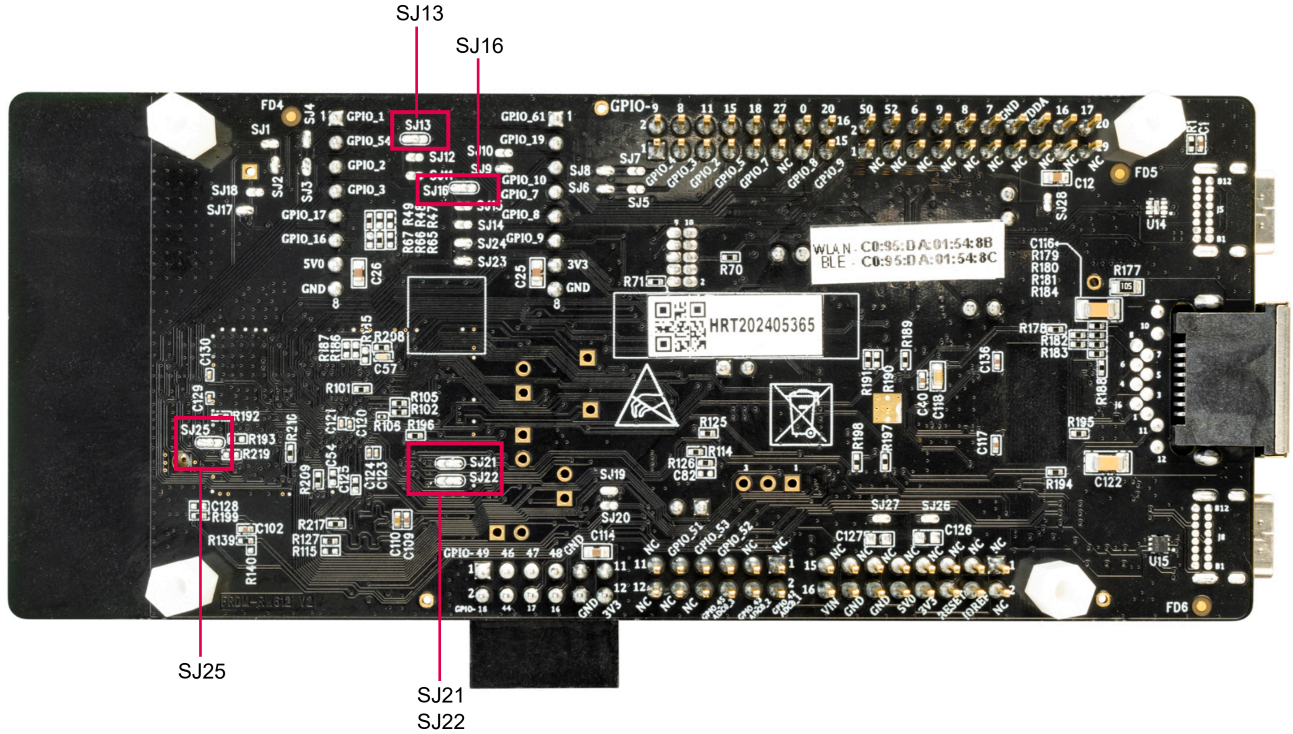

Figure 5. FRDM-RW612 bottom view

1.5 Connectors

Table 2 describes the FRDM-RW612 connectors. Figure 3 shows the connectors position on the board.

Table 2. FRDM-RW612 connectors

Part identifier	Connector type	Description	Reference section
J1	2 x 8 pin header	Arduino compatible I/O header (outer rows) and FRDM header (inner rows)	Section 2.7
J2	2 x 10 pin header		
J3	2 x 8 pin header		
J4	2 x 6 pin header		
J5	1 x 8 position receptacles	mikroBUS socket connector	Section 2.8
J6	1 x 8 position receptacles	mikroBUS socket connector	Section 2.8
J7	2 x 6 position receptacles	Pmod connector	Section 2.9
J8	USB Type-C connector	USB-OTG High-speed connector	Section 2.3
J9	RJ45 connector	Shielded RJ45 connector jack	Section 2.4
J10	USB Type-C connector	MCU-Link USB connector	Section 3.7
J11	U.FL connector	Micro Coaxial U. FL connector for RF connection	Section 2.10
P1	2 x 5 pin header	RW612 SWD connector	Section 2.11
JP8	1 x 3 pin header	5 V DC voltage regulator	Section 2.1

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1.6 Jumpers

Table 3 describes the FRDM-RW612 jumpers. Figure 4 and Figure 5 show the jumpers position on the board.

Table 3. FRDM-RW612 jumpers

Part identifier	Jumper type	Description	Reference section
JP1	1x2 jumper	• Open (**default setting**): Enables the MCU-Link SWD feature • Shorted: Sends a low signal on HW_VER_7 to disable the onboard MCU-Link SWD feature ***Note:*** *This configuration is required to enable the target MCU to debug through an external debug probe.*	Section 3.2
JP10 (DNP)	1x2 pin jumper	RW612 VIO power supply • Open **(default setting)**: VIO_3_AON_PIN A5 is powered through the R207 zero-ohm shunt resistor • Shorted: VIO_3_AON_PIN A5 is powered through the JP10 jumper	Section 2.1.1
JP2	1x2 jumper	MCU-Link (LPC55S69) force ISP mode jumper: • Open **(default setting)**: MCU-Link follows the normal boot sequence (MCU-Link boots from internal flash if a boot image is found). With the internal flash erased, the MCU-Link normal boot sequence falls through to ISP boot mode. • Shorted: MCU-Link is forced to ISP mode (USB). Use this setting to reprogram the MCU-Link internal flash with a new image or use the MCUXpresso IDE with the CMSIS-DAP protocol. ***Note:*** *By default, the MCU-Link flash is preprogrammed with a version of J-Link firmware.*	Section 3.5
JP3	1x2 pin header	• Open **(default setting)**: MCU-Link VCOM port is enabled. • Shorted: Sends a low signal on LPC_HW_VER_6 to disable MCU-Link VCOM port	Section 3.8
JP4	1x2 pin jumper	MCU-Link SWD clock enable jumper: • Open: MCU-Link SWD clock is disabled. • Shorted **(default setting)**: MCU-Link SWD clock is enabled.	For more information on this jumper, see the FRDM-RW612 schematic
JP5 (DNP)	1x2 pin jumper	RW612 VBAT power supply • Open **(default setting)**: RW612 internal buck regulator input VBAT is powered from the +3.3V_DUT supply through the R103 zero-ohm shunt resistor • Shorted: RW612 internal buck regulator input VBAT is powered by +3.3V_DUT through the jumper	Section 2.1.1
JP6 (DNP)	1x2 pin jumper	External Battery supply for VIO_3_AON_PINA5 Open (**default setting**): VIO_3_AON_PINA5 is powered from the +3.3V_DUT ***Note:*** *External battery can be connected to this jumper for always-on (AON) supply to target MCU RW612 AON supply domain VIO_3*	For more information on this jumper, see the FRDM-RW612 schematic
JP7 (DNP)	1x2 pin jumper	RW612 VIO power supply • Open **(default setting)**: VIO_DUT is powered from the +3.3V_DUT supply through the R128 zero-ohm shunt resistor	Section 2.1.1

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Table 3. FRDM-RW612 jumpers...*continued*

Part identifier	Jumper type	Description	Reference section
		• Shorted: VIO_DUT is powered by +3.3V_DUT through the jumper	
JP9	1x2 pin jumper	Pin 1-2 shorted **(default setting)**: +3.3V_DUT supply to the target MCU RW612 sourced from the 3.3 V power supply	Section 2.1
SJ13	Soldered 3-pin Jumper	• Pin 1-2 selection (**default setting**): Arduino connector J1 Pin 4 connects to GPIO[8] (FC1_UART_TXD) • Pin 2-3 selection: Arduino connector J1 Pin 4 connects to GPIO[9] (FC1_UART_RXD)	For more information on this jumper, see the FRDM-RW612 schematic
SJ16	Soldered 3-pin jumper	• Pin 1-2 selection (**default setting**): Arduino connector J1 Pin 2 connects to GPIO[9] (FC1_UART_RXD) • Pin 2-3 selection: Arduino connector J1 Pin 2 connects to GPIO[8] (FC1_UART_TXD)	For more information on this jumper, see the FRDM-RW612 schematic
SJ21	Soldered 3-pin jumper	• Pin 1-2 selection (**default setting**): GPIO[22] connects to Ethernet PHY Pin RXD0/DUPLEX through GPIO_22_ ENET_RX_DATA0 signal • Pin 2-3 selection: Provides a provision to connect the 32.768 kHz crystal to the target MCU through GPIO[22] (AON_XTAL32K_IN)	Section 2.2
SJ22	Soldered 3-pin jumper	• Pin 1-2 selection (**default setting**): GPIO[23] connects to Ethernet PHY Pin RXD1/PHYAD2 through GPIO_23_ ENET_RX_DATA1 signal • Pin 2-3 selection: Provides a provision to connect the 32.768 kHz crystal to the target MCU through GPIO[23] (AON_XTAL32K_OUT)	Section 2.4
SJ25	Soldered 3-pin jumper	• Pin 1-2 selection (**default setting**): RF front-end switch RTC7608U (U16) direct power supply from 3.3V_BRD • Pin 2-3 selection: Provides RF_CNTL_2 as a second control line provision	Section 2.10

1.7 Push buttons

Tactile buttons are populated on the FRDM-RW612 board. Each of the SW [1:3] buttons have a provision for a 0.1 μF bypass capacitor for debouncing and pads for external pull-up resistors.

Table 4 describes the FRDM-RW612 push buttons. Figure 3 shows the push buttons available on the board.

Table 4. FRDM-RW612 push buttons

Part identifier	Switch name	Description
SW1	Reset button (RW612 RST)	Pressing SW1 resets the target MCU that causes board peripherals to reset to their default states and execute the boot code. When SW1 is pressed, the reset LED D1 (Red) turns ON.
SW2	Wakeup button	SW2 is a general-purpose input and has provision to connect to low-power wake-up pin. Pressing SW2 gives a low level on MCU_ AONWAKEUP, otherwise, it is a high level on MCU_AONWAKEUP.
SW3	In-system programming (ISP) mode switch	SW3 is an ISP mode switch. Pressing SW3 gives a low level on ISP_ MODEn, otherwise, it is a high level on ISP_MODEn.

Figure 6 shows the circuit diagrams of the FRDM-RW612 push buttons.

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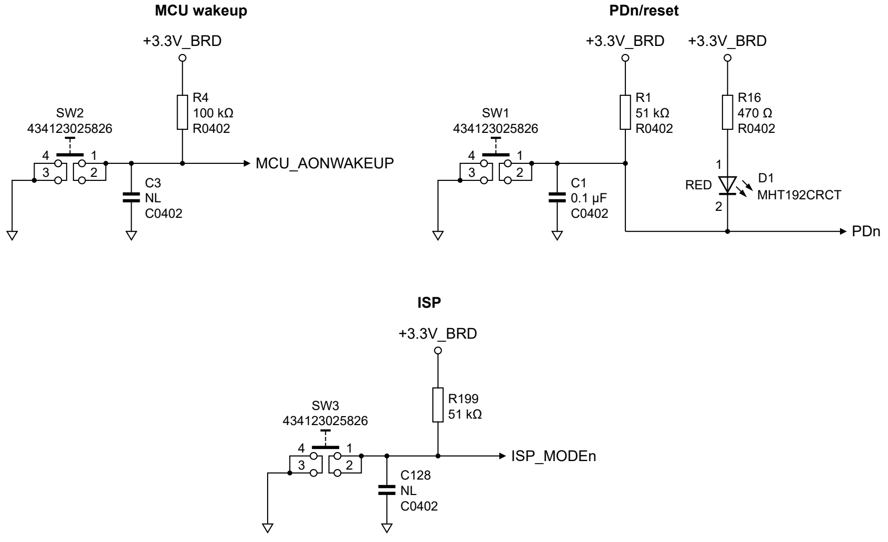

Figure 6. FRDM-RW612 push buttons

1.8 LEDs

Table 5 describes the FRDM-RW612 light-emitting diodes (LEDs) that correspond to the target MCU. The board also has some MCU-Link-specific LEDs, which are described in Section 3.10. The LEDs are shown in Figure 3.

Table 5. FRDM-RW612 LEDs

Part identifier	LED color	LED name / function	Description
D1	Red	Reset LED	Indicates system reset activity. When board reset is initiated, for example, by pressing the SW1 reset button, the D1 LED turns ON.
D2	Red / Green / Blue	RGB LED	User application LEDs. Each of these LEDs can be controlled through a user application. • Red LED connects to target MCU pin GPIO_1 • Green LED connects to target MCU pin GPIO_12 • Blue LED connects to target MCU pin GPIO_0
D5	Green	Power LED	Indicates 3.3V power-on status. When 3.3 V is available on board, D5 turns ON.

Figure 7 shows the circuit diagram of the RGB LEDs described in Table 5.

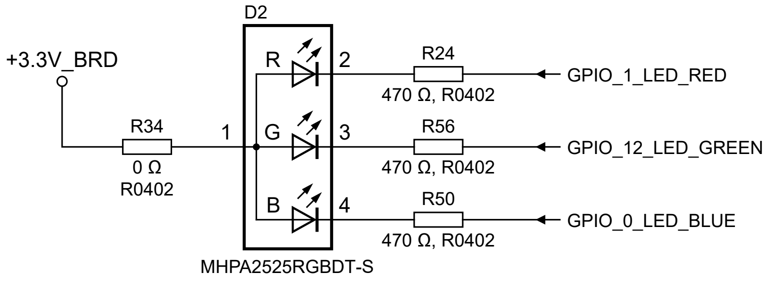

Figure 7. FRDM-RW612 LEDs

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2 FRDM-RW612 functional description

This section describes the features and functions of the FRDM-RW612 board. You can use the functionality described in this section as a reference while designing your own target board.

Note: *For more details on the RW612 MCU, see the RW612 Data Sheet and RW61X User Manual.*

2.1 Power supplies

The FRDM-RW612 board is powered with a SYS_5V (5 V) power supply using one of the following source options:

- 5V_MCU_LINK_USB supply from MCU-Link USB2.0 Type-C connector (J10) [Default selection]
- SYS_5V supply from Arduino Shield compatible header, J3 (pin 10)
- 5V_HDR_IN supply from 5 V regulator populated at 3-pin jumper (JP8) [Not populated by default]

The SYS_5V supply is an input power supply on the board and is a source for secondary power supplies.

Other power supplies in the FRDM-RW612 board are through voltage regulators or are connected through jumpers, which can be used to enable/disable a power supply.

Figure 8 shows the system power circuit on the FRDM-RW612 board.

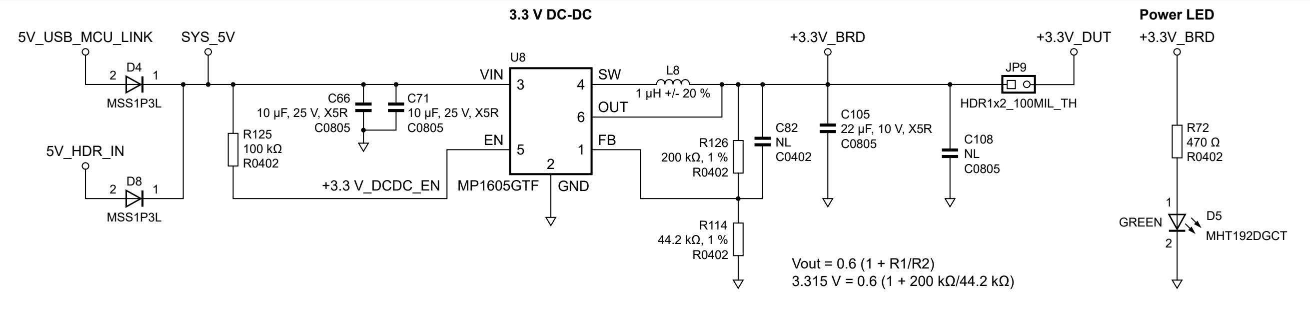

Figure 8. FRDM-RW612 power circuit

5 V power sources and selection

Table 6 describes the 5 V input power sources and their output power supplies.

Table 6. 5 V power sources

Part identifier	Device / power source	Output power supply	Description
J10	MCU-Link USB2.0 Type-C connector	5V_USB_MCU_LINK	• One of the sources of SYS_5V (5 V) supply (default option) • USB regulator input power supply for MCU-Link microcontroller LPC55S69
JP8	5 V power regulator populated at JP8	5V_HDR_IN	One of the sources for SYS_5V (5 V) supply
-	5V_USB_MCU_LINK/ 5 V_HDR_IN / J3 (pin 10) [1]	SYS_5V	• mikroBUS connector (J5) • HS USB connector power switch NX5P3090UK (U11)

[1] Pin 10 on connector J3 is a versatile pin that can be used either to output 5 V power from the EVK or to input 5 V power from an external source, depending on the requirements.

3.3 V power sources and selection

Table 7 describes the 3.3 V input power sources and their output power supplies.

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Table 7. 3.3 V power sources

Part identifier	Device/power source	Output power supply	• Description
U8	MP1605GTF	+3.3V_BRD	• One of the sources for +3.3V_DUT supply to target MCU RW612 through the JP9 jumper **(default selection).** For details, see Section 1.6 • Power supply for: – PTN5150A USB Type-C CC logic (U10) – RGB LED (D2) – P3T1755 I2C sensor (U2) – Pmod connector (J7) – mikroBUS connector (J6) – MCU-Link LPC55S69 (U3) – Arduino shield compatible header pin16 (J2) – Single-buffer/inverter gate IC 74LVC1G07 GV,125 (U4) used for bootstrap configuration – RW612 SWD connector (P1) • +3.3V power source for VCC_Flash supplies for IC_W25Q512JVFIQ QSPI flash (U13) through R139 zero-ohm resistor **(default selection)** • +3.3V power source for VCC_PSRAM APS6404 L-3SQN-SN PSRAM (U12) through R173 zero-ohm resistor **(default selection)** • Power supply for RTC7608U (U16) through SJ25 **(default selection)** • Power source for ENET_3V3 supplies for Ethernet transceiver KSZ8081RNB (U5)

2.1.1 Power supply configuration

Once the main power configurations are set, the target MCU power configurations must be made. The MCU power is configured by a network of jumpers or by a combination of resistors, capacitors, and diodes as shown in Figure 9.

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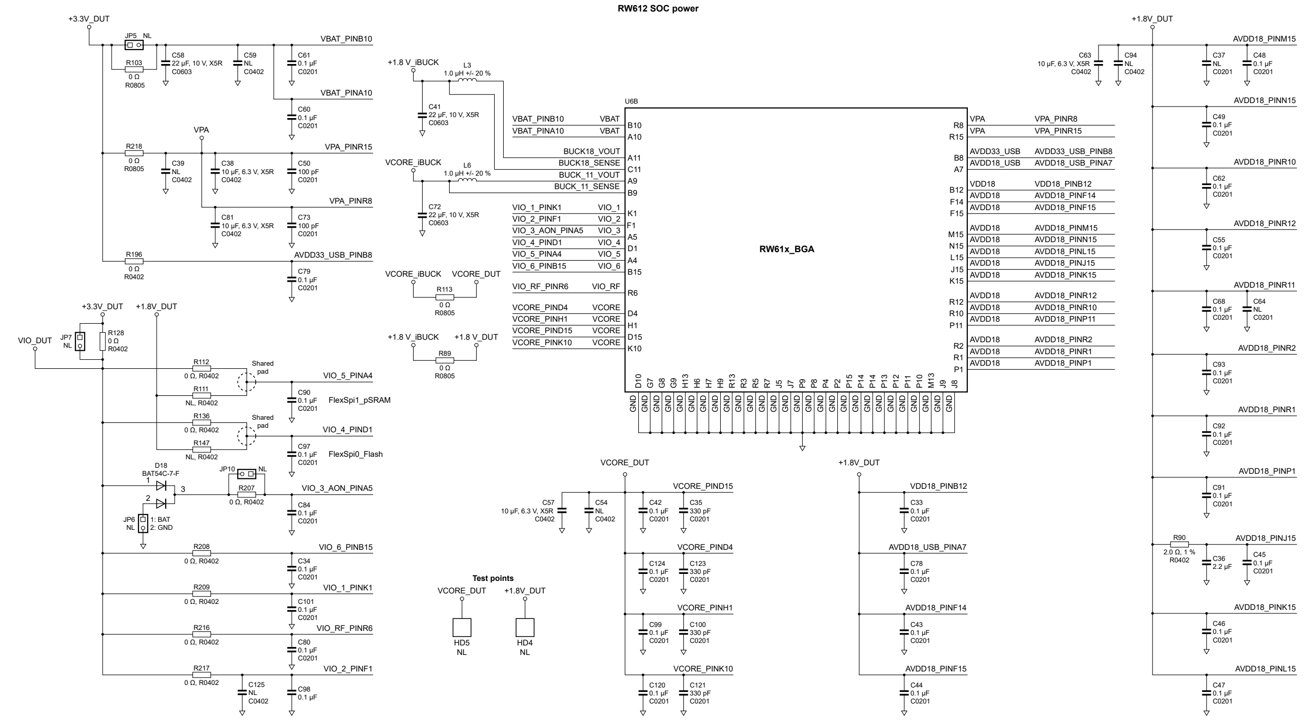

Figure 9. Power configuration

These jumpers provide access to insert ammeters in all the supplies connecting to the RW612 device. They also provide a means of connecting external supplies to any of the RW612 power pins.

Table 8 describes the power supply configurations for MCU analog, USB, and other operations.

Table 8. MCU power supplies

Power source	Zero-ohm resistor or Jumper used	Power supply rail	Description
+3.3V_DUT	• R103 resistor (installed) • JP5 jumper (DNP)	• VBAT_PINA10 • VBAT_PINB10	Power source for MCU (RW612) VBAT
	• R218 resistor (installed)	VPA • VPA_PINR15 • VPA_PINR8	Power source for MCU (RW612) VPA
	• R196 resistor (installed)	AVDD33_USB_PINB8	Power source for MCU (RW612) 3.3 V analog power AVDD33_USB pin
	• R128 resistor (installed) • JP7 jumper (DNP) • R112 resistor (installed) • R111 resistor (DNP) • R136 resistor (installed) • R147 resistor (DNP) • R207 resistor (installed) • JP10 jumper (DNP) • R208 resistor (installed) • R209 resistor (installed) • R217 resistor (installed) • R216 resistor (installed)	VIO_DUT • VIO_5_PINA4 • VIO_4_PIND1 • VIO_3_AON_PINA5 • VIO_6_PINB15 • VIO_1_PINK1 • VIO_2_PINF1 VIO_RF • VIO_RF_PINR6	• Power source for MCU (RW612) 3.3 V VIO digital power VIO_5, VIO_4, VIO_3, VIO_6, VIO_1, and VIO_2 • Power source for MCU (RW612) VIO_RF

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Table 8. MCU power supplies...*continued*

Power source	Zero-ohm resistor or Jumper used	Power supply rail	Description
VCORE iBuck	R113 resistor (installed)	VCORE_DUT • VCORE_PIND15 • VCORE_PIND4 • VCORE_PINH1 • VCORE_PINK10	• Power source for MCU (RW612) VCORE
+1.8V_iBUCK	• R89 resistor (installed) • R90 resistor (installed) • R111 resistor • R147 resistor	+1.8V_DUT • VDD18_PINB12 • AVDD18_PINF14 • AVDD18_PINF15 • AVDD18_PINM15 • AVDD18_PINN15 • AVDD18_PINR10 • AVDD18_PINR12 • AVDD18_PINR11 • AVDD18_PINR2 • AVDD18_PINR1 • AVDD18_PINP1 • AVDD18_PINJ15 • AVDD18_PINK15 • AVDD18_PINL15 • AVDD18_USB_PINA7 VIO • VIO_5_PINA4 • VIO_4_PIND1	• Power source for MCU (RW612) 1.8 V analog power AVDD18 pins • Power source for MCU (RW612) 1.8 V analog power AVDD18_USB • Power supply for MCU (RW612) 1.8 V VIO digital power VIO_5, VIO_4

2.1.2 RW612 iBuck

The FRDM-RW612 board uses internal Buck regulators through two DC-DC inductors L3, and L6 for VCORE and AVDD18 power supply. Figure 9 shows the iBUCK circuit diagram of the FRDM-RW612 board.

Choosing the right DC-DC inductor for your target board is important. When selecting a DC-DC inductor, refer to the specifications mentioned in the *RW612 Data Sheet*.

2.2 Clocks

The FRDM-RW612 board provides crystal oscillators to provide accurate time bases for the device and different components on the board.

Table 9 describes the clock sources available on the FRDM-RW612 board.

Table 9. FRDM-RW612 clocks

Clock generator	Clock frequency	Destination	Description
Crystal oscillator, Y1 (8300064629, Würth Elektronik)	16 MHz	XTAL32M_N/P pins of LPC55S69 MCU-Link	Option for external clock input

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Table 9. FRDM-RW612 clocks...*continued*

Clock generator	Clock frequency	Destination	Description
Crystal oscillator, Y2 (8Q40070007, TXC Corporation)	40 MHz	XTAL_IN/OUT of target MCU RW612	• Drive a PLL to achieve higher clock rates for both high-gain mode and low-power mode • A larger voltage swing is used at the crystal pin in high-gain mode
Crystal oscillator, Y3 (830009678, Würth Elektronik)	32.768 kHz	GPIO[22] / GPIO[23] of target MCU RW612	Provides sleep clock option for RW612 through GPIO[22] (AON_XTAL32K_IN) and GPIO[23] (AON_XTAL32K_OUT)

2.3 USB interface

The target MCU (RW612) features two USB modules (FS USB and HS USB), each with device and host capabilities and a built-in transceiver.

On the FRDM-RW612 board, only the HS USB controller and PHY interface are used, and are connected to the USB Type-C connector J8.

Figure 10 shows the HS USB circuit diagram.

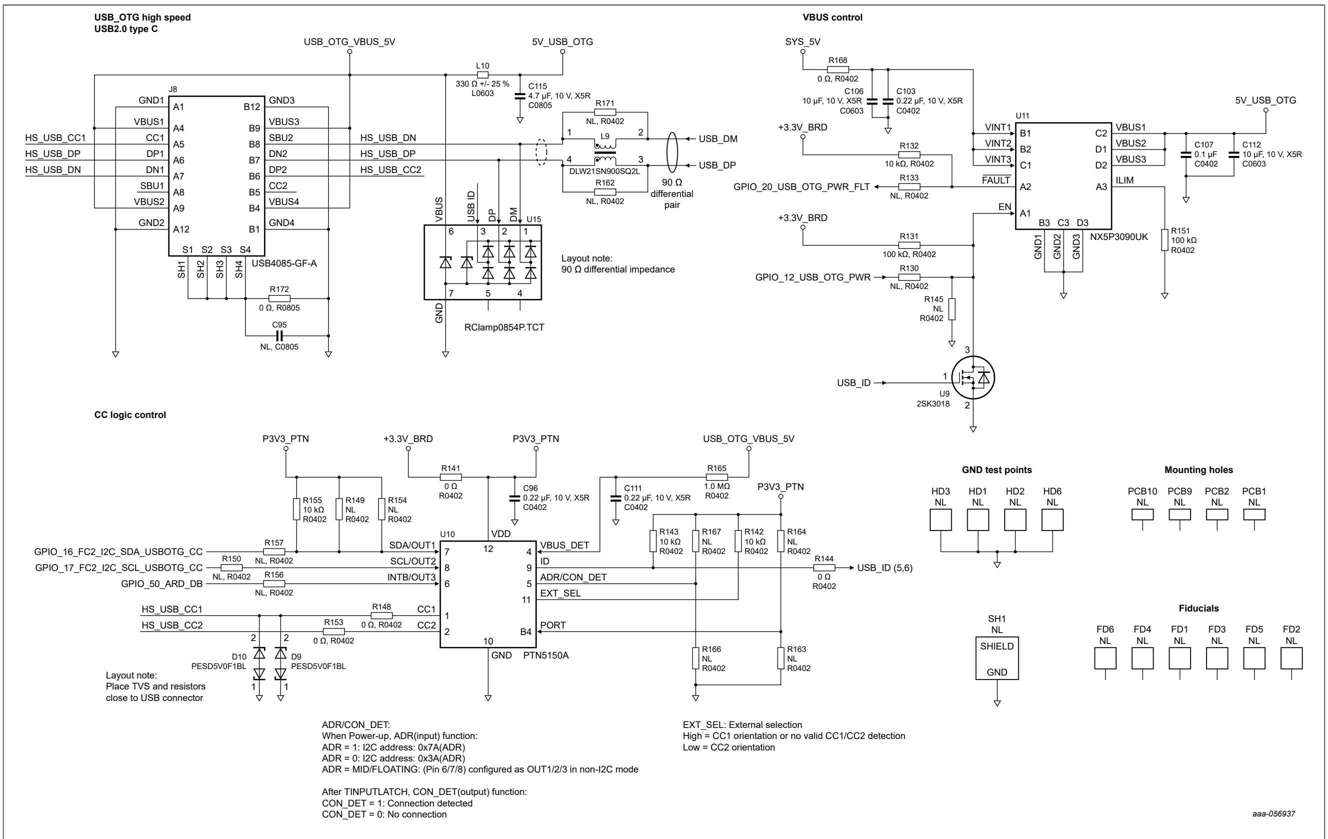

Figure 10. High-speed USB circuit diagram

Table 10 describes the devices used for connection between HS USB controller and USB Type-C connector.

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Table 10. USB ports

Part identifier	Connector type	Description
J8	USB2.0 Type-C connector	Port can connect in both Host and Device mode. In Device mode, this port provides the 5 V power supply (5V_USB_HS) source to the board.
U11	NX5P3090UK	USB Power Delivery (PD) and type C current-limited power switch
U10	PTN5150A	CC Logic chip supporting the USB Type-C connector application with Configuration Channel (CC) control logic detection and indication functions • ADR/CON_DET pin configuration: – When pull up to P3V3_PTN with 10 kΩ resistor (R167), ADR (input) function: ADR=1: I2C Address: 0x7A (ADR) – When pull down to GND with 10 kΩ resistor (R166), ADR (input) function: ADR=0: I2C Address: 0x3A (ADR) – ADR=Mid/Floating **(default setting)**, this pin automatically switches from input to CON_DET output in non-I2C mode. Pin 6/7/8 is configured as OUT1/2/3 in non-I2C mode – After TINPUTLATCH, CON_DET (output) function: – CON_DET=1: Connection detected – CON_DET=0: No connection • PORT pin configuration: – When pull up to P3V3_PTN with 10 kΩ resistor (R164), PORT=1: DFP mode – When pull down to GND with 10 kΩ resistor (R163), PORT=0: UFP mode – When Floating (default setting): DRP mode

On the FRDM-RW612 board, the USB_DM and USB_DP signals from the target MCU connect to the onboard USB connector (J8) directly through a common mode choke (L9). The common mode choke is included for noise suppression on the DM / DP signals.

2.4 Ethernet interface

The target MCU (RW612) features one Ethernet controller (ENET0) module.

On the FRDM-RW612 board, the Ethernet controller connects to an RJ45 connector through an Ethernet PHY transceiver. The transmit, receive, and other Ethernet signals are on the GPIO pins. The FRDM- RW612 only supports RMII configuration, therefore, the Ethernet PHY (KSZ8081RNB) has been chosen.

Table 11 describes the onboard devices supporting the Ethernet interface.

Table 11. Ethernet interface devices

Part identifier	Part name and Manufacturer	Description
J9	Heling MJ88B-B011-RVL11-P	Shielded RJ45 connector jack with magnetic built-in to connect to an Ethernet cable
U5	Microchip Technology KSZ8081 RNB	Single-chip 10 /100 Mbit/s RMII Ethernet PHY compliant with IEEE802.3.
T1	BOURNS PT61018PEL	Dual-channel 16-pin Ethernet transformer for LAN 10/100 Base-Tx

The Ethernet PHY (KSZ8081RNB) receives the 50 MHz RMII reference clock at XI (Pin 9) from the MCU Ethernet controller through GPIO[25]. The Pin 19 (REF_CLK) of the PHY is a no connect.

2.5 I2C sensor interface

The FRDM-RW612 board includes one P3T1755 digital temperature sensor that communicates with the target MCU through FlexComm I2C interface (FC2 I2C). The P3T1755 is a temperature-to-digital converter from -40

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°C to +125 °C range. This sensor device allows for 32 I2C target addresses and an alert function that becomes active when the temperature exceeds the programmed limits.

The 8-bit I2C address of the sensor device is 0x1001000 (0x90).

Figure 11 shows the I2C sensor schematic diagram.

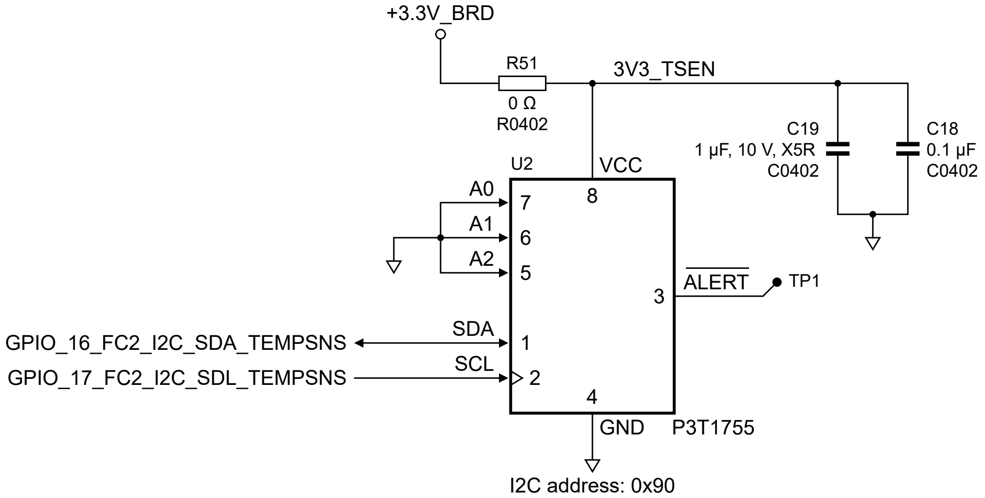

Figure 11. Temperature sensor schematic diagram

The sensor device is connected to the I2C controller of the device through the GPIO[16:17] pin.

2.6 Flash memory interface

The target MCU (RW612) features one Flexible Serial Peripheral Interface (FlexSPI) controller, which can support external memory. On the FRDM-RW612 board, the MCU RW612 FlexSPI controller can connect to an onboard QSPI flash memory (U13) and a PSRAM flash memory (U12).

The flash memory VCC_Flash and VCC_PSRAM can be supplied by the +3.3V_BRD rail (by default) or by 1.8V_DUT through zero-ohm resistors (DNP).

Table 12 provides the details of the flash memory used on the board.

Table 12. Flash memory

Part identifier	Manufacturer and part name	Description
U13	Winbond W25Q512JVFIQ	It is a 3 V 512 Mbit serial flash memory with dual and quad SPI, which is intended for demonstrating FlexSPI boot applications, and general FlexSPI operation. For main features, refer to the datasheet.
U12	AP Memory APS6404L-3SQN-SN	64 Mbit, 2.7 V – 3.6 V, Octal I/O type PSRAM Flash memory

Figure 12 shows the flash memory circuit diagram.

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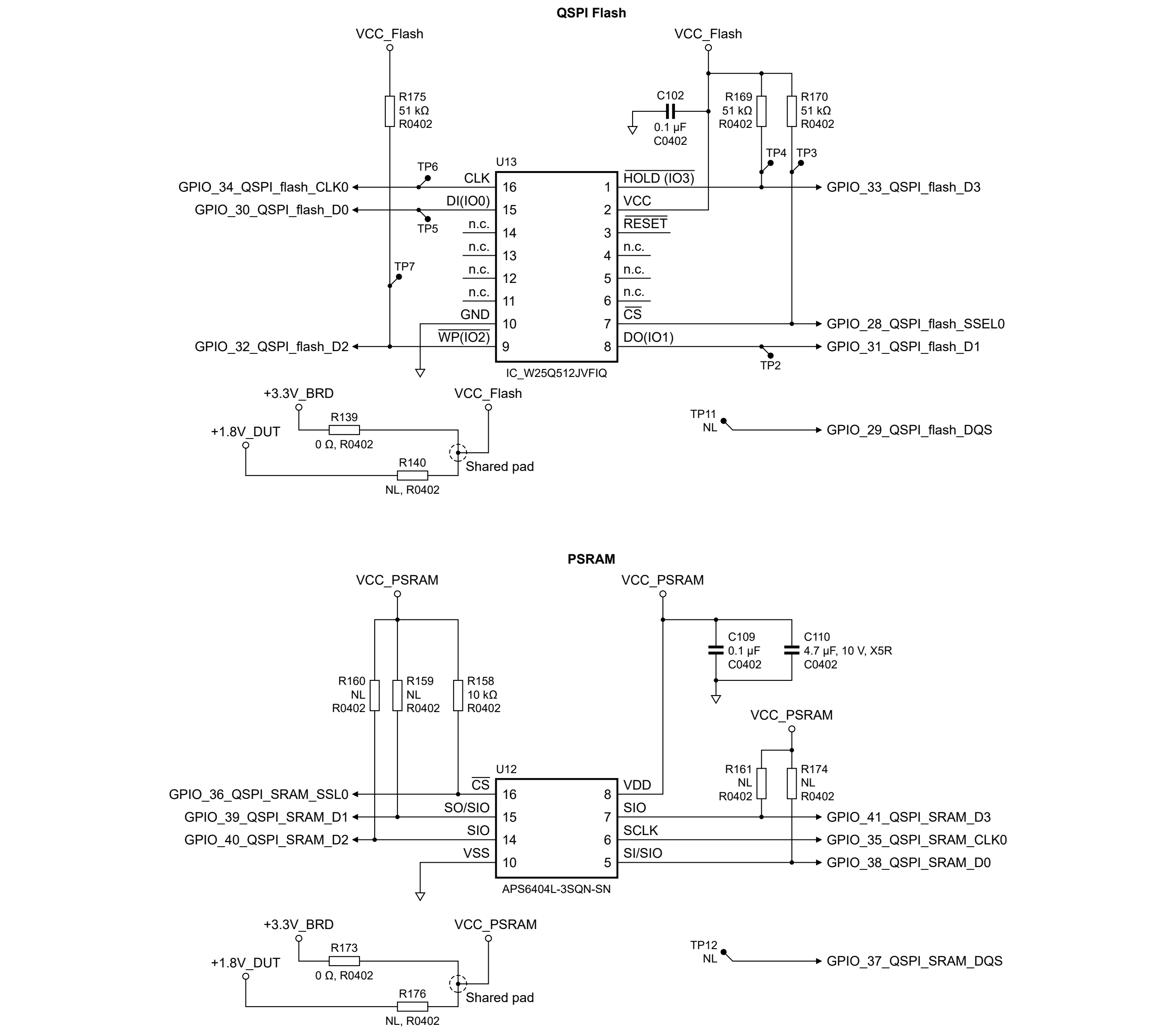

Figure 12. Flash memory circuit diagram

The FlexSPI data and clock signals for the Flash memory interface are available on GPIO[30:33] and GPIO[34] pins, for the PSRAM memory interface are available on GPIO[38:41] and GPIO[35] pins.

2.7 Arduino compatible I/O headers

The FRDM-RW612 board provides Arduino Uno-compatible headers to support the Arduino and FRDM ecosystem shield modules. To get a list of shield modules that are compatible with these headers, see NXP Expansion Board Hub.

Table 13 describes the connectors of the Arduino socket.

Table 13. Arduino socket connectors

Part identifier	Connector type
J1	2x8 position receptacle

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Table 13. Arduino socket connectors*...continued*

Part identifier	Connector type
J2	2x10 position receptacle
J3	2x8 position receptacle
J4	2x6 position receptacle

Figure 13 shows the pinout of the Arduino socket connectors.

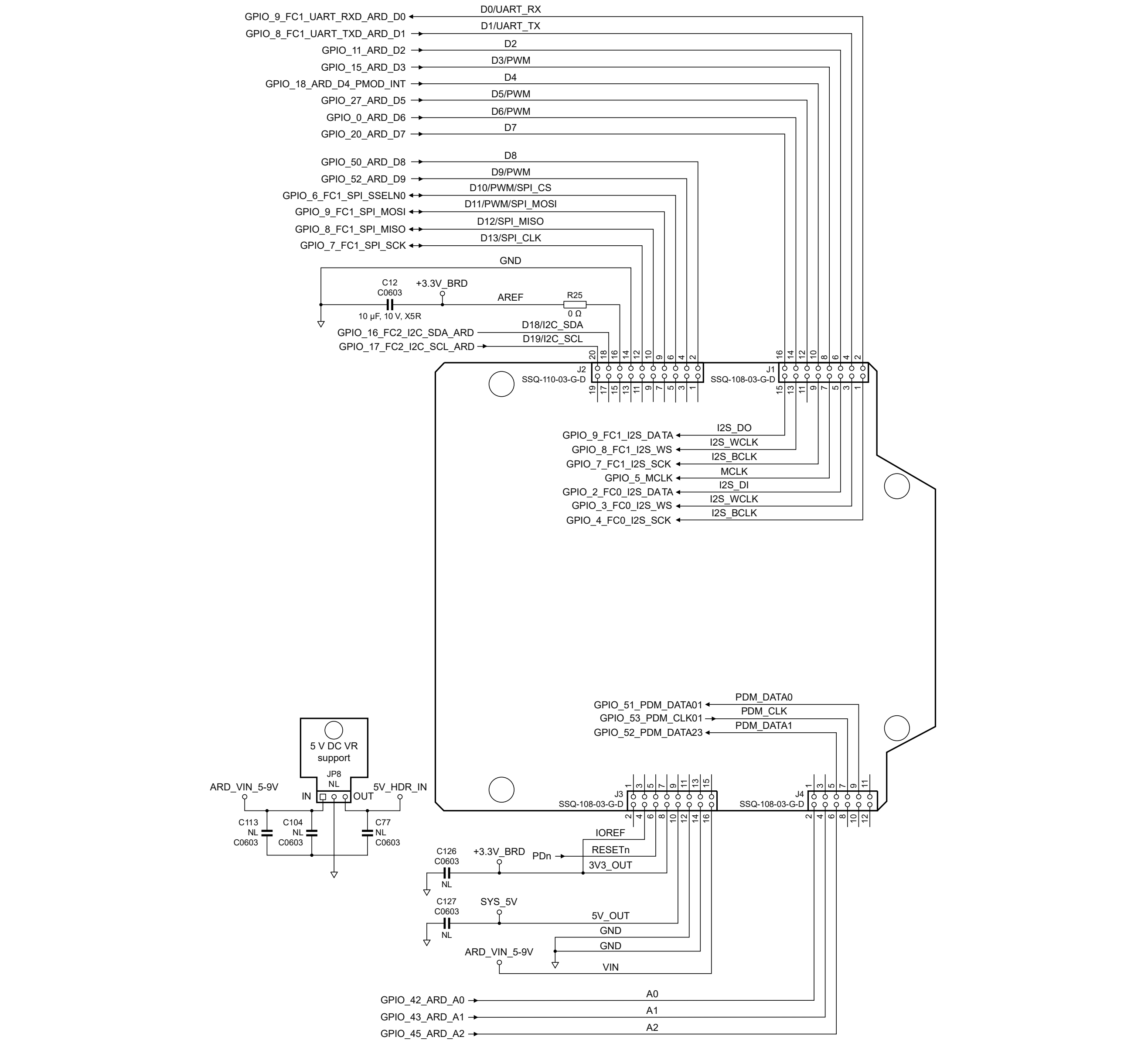

Figure 13. Arduino headers

To allow for flexibility in the design, some of the signals on the I/O headers can be swapped for other connections using zero-ohm resistors or jumpers. Table 14 to Table 17 describe such signals.

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Table 14. Arduino compatible header J1 pinout

Pin number	Device pin / GPIO	Function / Signal name	Jumper setting	Potential conflict
1	GPIO[4]	FC0_I2S_SCK	-	-
2	GPIO[9]	FC1_UART_RXD_ARD_D0	SJ16 Pin 1-2 selection (Default setting)	• Arduino header J1 pin 15 (GPIO_9_ FC1_I2S_DATA) • Arduino header J2 pin 8 / mikroBUS J6 pin 6 / MCU_LINK_USB_Bridge (GPIO_9_FC1_SPI_MOSI)
3	GPIO[3]	FC0_I2S_WS	SJ7 Pin 1-2 selection	mikroBUS header J5 pin 4 (GPIO_3_ FC0_UART_TXD_ME)
4	GPIO[8]	FC1_UART_TXD_ARD_D1	SJ13 Pin 1-2 selection (Default setting)	• Arduino header J1 pin 13 (GPIO_8_ FC1_I2S_WS) • Arduino header J2 pin 10 / mikroBUS J6 pin 5 / MCU_LINK_USB_Bridge (GPIO_8_FC1_SPI_MISO)
5	GPIO[2]	FC0_I2S_DATA	SJ5 Pin 1-2 selection	mikroBUS header J5 pin 3 (GPIO_2_ FC0_UART_RXD_ME)
6	GPIO[11]	ARD_D2	-	-
7	GPIO[5]	MCLK	-	-
8	GPIO[15]	ARD_D3	-	-
9	GPIO[7]	FC1_I2S_SCK	SJ10 Pin 1-2 selection	Arduino header J1 pin 12 / mikroBUS header J6 pin 4 / MCU_LINK_USB_ Bridge (GPIO_7_FC1_SPI_SCK)
10	GPIO[18]	ARD_D4_PMOD_INT	-	Pmod J7 pin 2 (GPIO_18_ARD_D4_ PMOD_INT)
11	-	-	-	-
12	GPIO[27]	ARD_D5	-	-
13	GPIO[8]	FC1_I2S_WS	SJ12 Pin 1-2 selection	• Arduino header J1 pin 4 (GPIO_8_ UART_TXD_ARD_D1) • Arduino header J2 pin 10 / mikroBUS J6 pin 5 / MCU_LINK_USB_Bridge (GPIO_8_FC1_SPI_MISO)
14	GPIO[0]	ARD_D6	SJ2 Pin 1-2 selection (Default setting)	RGB LED D2 pin 4 (GPIO_0_LED_BLUE)
15	GPIO[9]	FC1_I2S_DATA	SJ15 Pin 1-2 selection	• Arduino header J1 pin 2 (GPIO_9_ FC1_UART_RXD_ARD_D0) • Arduino header J2 pin 8/mikroBUS J6 pin 6/MCU_LINK_USB_Bridge (GPIO_ 9_FC1_SPI_MOSI)
16	GPIO[20]	ARD_D7	SJ19 Pin 1-2 selection (Default setting)	USB power control (GPIO_20_USB_ OTG_PWR_FLT through zero-ohm resistor R133 (DNP by default))

Table 15. Arduino compatible header J2 pinout

Pin number	Device pin / GPIO	Function / Signal name	Jumper setting	Potential conflict
1	-	-	-	-
2	GPIO[50]	ARD_D8	-	-
3	-	-	-	-

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Table 15. Arduino compatible header J2 pinout*...continued*

Pin number	Device pin / GPIO	Function / Signal name	Jumper setting	Potential conflict
4	GPIO[52]	ARD_D9	SJ24 Pin 1-2 selection (default setting)	Arduino header J4 pin 5 (GPIO_52_ PDM_DATA23)
5	-	-	-	-
6	GPIO[6]	FC1_SPI_SSELN0	-	-
7	-	-	-	-
8	GPIO[9]	FC1_SPI_MOSI	SJ14 Pin 1-2 selection	• Arduino header J1 pin 2 (GPIO_9_ FC1_UART_RXD_ARD_D0) • Arduino header J1 pin 15 (GPIO_9_ FC1_I2S_DATA)
9	-	-	-	-
10	GPIO[8]	FC1_SPI_MISO	SJ11 Pin 1-2 selection	• Arduino header J1 pin 13 (GPIO_8_ FC1_I2S_WS) • Arduino header J1 pin 4 (GPIO_8_ UART_TXD_ARD_D1)
11	-	-	-	-
12	GPIO[7]	FC1_SPI_SCK	SJ9 Pin 1-2 selection (default setting)	• Arduino header J1 pin 9 (GPIO_7_ FC1_I2S_SCK)
13	-	-	-	-
14	-	GND	-	-
15	-	-	-	-
16	-	+3.3V_BRD	-	-
17	-	-	-	-
18	GPIO[16]	FC2_I2C_SDA_ARD	-	• Pmod connector J7 pin 8 (GPIO_16_ FC2_I2C_SDA_PMOD) • mikroBUS header J5 pin 6 (GPIO_16_ FC2_I2C_SDA_ME) • I2C sensor device (GPIO_16_FC2_I2 C_SDA_TEMPSNS) • MCU-Link USB-to-I2C bridge (GPIO_ 16_FC2_I2C_SDA_MLINK)
19	-	-	-	-
20	GPIO[17]	FC2_I2C_SCL_ARD	-	• Pmod connector J7 pin 6 (GPIO_17_ FC2_I2C_SCL_PMOD) • mikroBUS header J5 pin 5 (GPIO_17_ FC2_I2C_SCL_ME) • I2C sensor device (GPIO_17_FC2_I2 C_SCL_TEMPSNS) • MCU-Link USB-to-I2C bridge (GPIO_ 17_FC2_I2C_SCL_MLINK)

Table 16. Arduino compatible header J3 pinout

Pin number	Device pin / GPIO	Function / Signal name	Jumper setting	Potential conflict
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-

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Table 16. Arduino compatible header J3 pinout...*continued*

Pin number	Device pin / GPIO	Function / Signal name	Jumper setting	Potential conflict
4	-	+3.3V_BRD	-	-
5	-	-	-	-
6	PDn	-	-	-
7	-	-	-	-
8	-	+3.3V_BRD	-	-
9	-	-	-	-
10	-	SYS_5V	-	-
11	-	-	-	-
12	GND	-	-	-
13	-	-	-	-
14	GND	-	-	-
15	-	-	-	-
16	-	ARD_VIN_5-9V	-	-

Table 17. Arduino compatible header J4 pinout

Pin number	Device pin / GPIO	Function / Signal name	Jumper setting	Potential conflict
1	-	-	-	-
2	GPIO[42]	ARD_A0	-	-
3	-	-	-	-
4	GPIO[43]	ARD_A1	-	-
5	GPIO[52]	PDM_DATA23	SJ23 Pin 1-2 selection (default setting)	Arduino J2 pin 4 (GPIO_52_ARD_D9)
6	GPIO[45]	ARD_A2	-	-
7	GPIO[53]	PDM_CLK01	-	-
8	-	-	-	-
9	GPIO[51]	PDM_DATA01	-	-
10	-	-	-	-
11	-	-	-	-
12	-	-	-	-

2.8 mikroBUS headers

Table 18 and Table 19 describe the pinout of the mikroBUS headers (J6 and J5).

Table 18. J6 header pinout

Pin number	Net name	GPIO	Function / Signal name	Jumper setting	Potential conflict
1	AN	GPIO[61]	ADC1_ME_AN	-	-
2	RST	GPIO[19]	ME_RST	-	-
3	CS	GPIO[10]	FC1_SPI_SSELN1	-	-

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Table 18. J6 header pinout...*continued*

Pin number	Net name	GPIO	Function / Signal name	Jumper setting	Potential conflict
4	SCK	GPIO[7]	FC1_SPI_SCK	SJ9 Pin 1-2 selection (default setting)	Arduino connector (J1) pin 9 (GPIO_7_FC1_I2S_SCK)
5	MISO	GPIO[8]	FC1_SPI_MISO	SJ11 Pin 1-2 selection	• Arduino connector (J1) pin 13 (GPIO_8_FC1_I2S_WS) • Arduino connector (J1) pin 4 (FC1_UART_TXD_ARD_D1)
6	MOSI	GPIO[9]	FC1_SPI_MOSI	SJ14 Pin1-2 selection	• Arduino connector (J1) pin 15 (GPIO_9_FC1_I2S_DATA) • Arduino connector (J1) pin 2 (FC1_UART_RXD_ARD_D1)
7	VDD_TGT	+3.3V_BRD	3.3 V power line	-	-
8	GND	GND	Ground	-	-

Table 19. J5 header pinout

Pin number	Net name	GPIO	Function / Signal name	Jumper setting	Potential conflict
1	PWM	GPIO[1]	ME_PWM	SJ4 Pin1-2 selection	RGB LED (GPIO_1_LED_RED)
2	INT	GPIO[54]	ME_INT	-	-
3	RX	GPIO[2]	FC0_UART_RXD_ME	SJ6 Pin1-2 selection	Arduino connector J1 pin 5 (GPIO_2_FC0_I2S_DATA)
4	TX	GPIO[3]	FC0_UART_TXD_ME	SJ8 Pin1-2 selection	Arduino connector J1 pin 3 (GPIO_3_FC0_I2S_WS)
5	SCL	GPIO[17]	FC2_I2C_SCL_ME	-	• Arduino connector (J2) pin 20 (GPIO_17_FC2_I2C_SCL_ARD) • Pmod connector J7 pin 6 (GPIO_17_FC2_I2C_SCL_PMOD) • I2C sensor device (GPIO_17_FC2_I2C_SCL_TEMPSNS) • MCU-Link USB-to-I2C bridge (GPIO_17_FC2_I2C_SCL_MLINK)
6	SDA	GPIO[16]	FC2_I2C_SDA_ME	-	• Arduino connector (J2) pin 18 (GPIO_16_FC2_I2C_SDA_ARD) • Pmod connector J7 pin 8 (GPIO_16_FC2_I2C_SDA_PMOD) • I2C sensor device (GPIO_16_FC2_I2C_SDA_TEMPSNS) MCU-Link USB-to-I2C bridge (GPIO_16_FC2_I2C_SDA_MLINK)

2.9 Pmod header

The FRDM-RW612 board supports a Pmod header J7 (Sullins PPPC062LJBN-RC) for connecting peripheral modules. Table 20 describes the pinout of the Pmod header.

Table 20. Pmod header pinout

Pin number	GPIO	Function name / Signal name	Resistor setting	Potential conflict
1	GPIO[49]	LCD_SPI_SS	-	-
2	GPIO[18]	ARD_D4_PMOD_INT	-	-

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Table 20. Pmod header pinout...*continued*

Pin number	GPIO	Function name / Signal name	Resistor setting	Potential conflict
3	GPIO[46]	LCD_SPI_SDIO	-	-
4	GPIO[44]	LCD_SPI_RESETn	-	-
5	GPIO[47]	LCD_SPI_DC	-	-
6	GPIO[17]	FC2_I2C_SCL_PMOD	-	• Arduino connector (J2) pin 20 (GPIO_17_FC2_I2C_SCL_ARD) • mikroBUS header J5 pin 5 (GPIO_17_FC2_I2C_SCL_ME)
				• I2C sensor device (GPIO_17_FC2_I2C_SCL_TEMPSNS) • MCU-Link USB-to-I2C bridge (GPIO_17_FC2_I2C_SCL_MLINK)
7	GPIO[48]	LCD_SPI_SCK	-	-
8	GPIO[16]	FC2_I2C_SDA_PMOD	-	• Arduino connector (J2) pin 18 (GPIO_16_FC2_I2C_SDA_ARD) • mikroBUS header J5 pin 6 (GPIO_16_FC2_I2C_SDA_ME) • I2C sensor device (GPIO_16_FC2_I2C_SDA_TEMPSNS) • MCU-Link USB-to-I2C bridge (GPIO_16_FC2_I2C_SDA_MLINK)
9	-	GND	-	-
10	-	GND	-	-
11	-	+3.3V_BRD	-	-
12	-	+3.3V_BRD	-	-

2.10 RF front-end interface

The RW612 MCU includes a full-featured 1x1 dual-band (2.4 GHz / 5 GHz) 20 MHz Wi-Fi 6 (802.11ax) and Bluetooth LE 5.4/802.15.4 subsystem.

By default, the FRDM-RW612 is designed as a single antenna configuration. On the FRDM-RW612 board, the RF signals from the target MCU connect either to a PCB antenna (ANT1) or to an antenna connected to the U.FL connector (J11). The default configuration is to use PCB Antenna. The RF front-end control signals RF_CNTL_[0:3] from the target MCU are used for the RF front-end SPDT switch controls.

Figure 14 shows the FRDM-RW612 RF front-end design.

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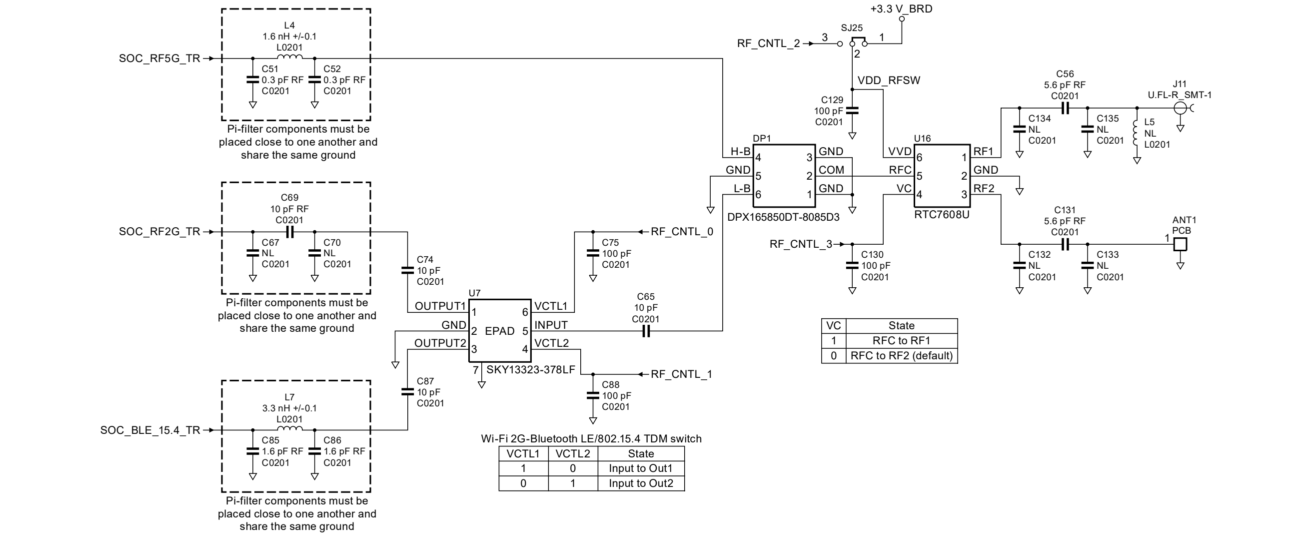

Figure 14. RF front-end interface

Table 21 describes the devices and connectors used for the RF interface on the board.

Table 21. RF interface device configuration

Part identifier	Manufacturer name and part name	Description	Configuration	RF signals and control signals
U7	SKYWORKS SKY13323-378LF	Wi-Fi 2G - Bluetooth LE / 802.15.4 TDM SPDT switch is used to transmit/receive by connecting the RF common port (INPUT, pin 5) to either the OUTPUT1 or OUTPUT2 port	• VCTL1: 1, VCTL2: 0 ➔ Transmit and receive is for Wi-Fi 2G signals • VCTL1: 0, VCTL2: 1 ➔ Transmit and receive is for Bluetooth LE / 802.15.4 signals	• RF signals: – SOC_RF2G_TR – SOC_BLE_15.4_TR • Control signals: – RF_CNTL_0 – RF_CNTL_1
DP1	TDK Corporation DPX165850DT-8085 D3	Diplexer to allow both Wi-Fi 5G and either of Wi-Fi 2G or Bluetooth LE/802.15.4 signals to transmit and receive simultaneously		• RF signals: – SOC_RF5G_TR – SOC_RF2G_TR – SOC_BLE_15.4_TR
U16	RichWave Technology Corp RTC7608U	RF SPDT switch for switching the RF signal between PCB antenna and u.FL connector	• VC: 1 ➔ RFC to RF1 ➔Transmission/Receiver channel is available for U.FL connector • VC: 0 (Default setting) ➔ RFC to RF2 ➔Transmission/ Receiver channel is available for PCB antenna	• RF signals: – SOC_RF5G_TR – SOC_RF2G_TR – SOC_BLE_15.4_TR • Control signals: – RF_CNTL_3
J11	Hirose U.FL-R-SMT-1	U.FL RF connectors / Coaxial connectors	-	-
ANT1	-	PCB antenna connected by default	-	-

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2.11 SWD header

The FRDM-RW612 board supports the Arm serial wire debug (SWD) and JTAG interface. SWD is the default function for pins GPIO[13] (SWCLK) and GPIO[14] (SWDIO) after a reset. For details, see *FRDM-RW612 schematic*.

2.12 Board operating conditions

The operating temperature range for the FRDM-RW612 board is -40 °C to +85 °C. For further details on device operating conditions, see *RW612 Data Sheet*.

3 MCU-Link OB debug probe

This section describes the MCU-Link onboard (OB) debug probe, its features, how to install software and how to update its firmware.

3.1 MCU-Link overview

MCU-Link is a debug probe architecture jointly developed by NXP and Embedded Artists. The MCU-Link architecture is based on the LPC55S69 MCU, which is based on the Arm Cortex-M33 core.

The MCU-Link architecture is configurable to support different debug feature options, and to support both standalone probes (such as MCU-Link Pro) and for use on-board evaluation boards such as FRDM-RW612. These on-board implementations are referred to as MCU-Link OB.

The FRDM-RW612 board implements a subset of the MCU-Link architecture features, as described in Section 3.2. For more information on MCU-Link visit MCU-Link Debug Probe Architecture.

The MCU-Link OB on the FRDM-RW612 board is factory programmed with the J-Link firmware. NXP CMSIS-DAP is also available to add extra debug features. For information on how to update the MCU-Link firmware, see Section 3.5.

3.2 Supported MCU-Link features

MCU-Link includes several mandatory and optional features. Table 22 summarizes the MCU-Link features supported on the FRDM-RW612 board.

Table 22. Supported MCU-Link features

Feature	Description
Serial wire debug (SWD) / serial wire debug trace output (SWO)	Allows SWD-based debugging with SWO for profiling and/or low overhead debug standard I/O communication
Virtual communication (VCOM) serial port	Adds a serial COM port on the host computer, and connects it to the target MCU by using MCU-Link as a USB-to-UART bridge
USB serial input/output (USBSIO)[1]	Adds a USB serial I/O port on the host computer, and connects it to the target MCU by using MCU-Link as a USB-to-SPI bridge or USB-to-I2C bridge
External debug probe support	Allows debugging the target MCU (RW612) using an external debug probe, instead of MCU-Link. Support for an external debug probe is enabled by disabling the SWD feature. While using an external debug probe, the VCOM and USBSIO features can be used.

[1] J-Link firmware does not support this feature.

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3.3 Supported debug scenarios

In the FRDM-RW612 board, the MCU-Link debug probe target is RW612 MCU. The board also allows the external debugger to debug the RW612 MCU in place of the MCU-Link debug probe.

Table 23 describes the debug scenarios supported on the FRDM-RW612 board.

Table 23. Supported debug scenarios

Debug scenario	Feature support	Jumper / Resistor settings
Use MCU-Link as a debugger for the target MCU (RW612)	• SWD is enabled • VCOM is enabled • USBSIO is enabled	• JP3 must be open • JP1 must be open • R78 must be unpopulated
Use an external debugger to debug the target MCU (RW612)	• SWD is disabled • VCOM is enabled • USBSIO is enabled	• JP1 must be shorted • JP3 must be open • R78 must be unpopulated • Connect an external debugger to the target MCU SWD connector P1

3.4 MCU-Link host driver and utility installation

The MCU debug probe is supported on Windows 10/11, MacOS X, and Ubuntu Linux platforms. The probe uses standard OS drivers. For Windows, the installation program also includes information files to provide user-friendly device names.

MCU-Link is supported by the LinkServer utility. Running the LinkServer installer also installs all the drivers and a firmware update utility required for MCU-Link. The LinkServer utility is a GDB server and flash utility from NXP with support for many NXP debug probes. You are recommended to use the LinkServer installer unless you are using MCUXpresso IDE version 11.6.1 or earlier. For details on this utility, refer https://nxp.com/linkserver.

Note: *If the firmware version of the onboard MCU-Link probe is 3.122 or later, LinkServer version 1.4.85 or later provides the support of automatic firmware update. For further details on automatic firmware update, refer to the readme markdown file in the LinkServer package. However, If the current firmware version is earlier than 3.122, you can update the firmware (see Section 3.5) for the MCU-Link probe using the MCU-Link firmware update utility, which is included in the LinkServer installation package.*

Note: *In case you are using MCUXpresso IDE version 11.6.1 or earlier, you must install the firmware update utility version 2.263, which is not included in the LinkServer installation.*

You are recommended to update the MCU-Link firmware on the board to the latest firmware version to get the latest functionality. However, before updating the firmware, check compatibility with the MCUXpresso IDE and LIBUSBIO versions in Table 24 (if you are using these tools). *If you are using the MCUXpresso for Visual Studio Code extension or third-party IDEs from IAR or Keil, the latest firmware version is recommended.*

Table 24. Compatibility between MCU-Link firmware and MCUXpresso IDE

MCU-Link firmware version	USB driver type	CMSIS-SWO support	FreeMASTER support via		Supported MCUXpresso IDE versions
			SWD / JTAG	USB bridge	
V1.xxx and V2.xxx	HID	No	Yes	Yes	MCUXpresso 11.3 or later
V3.xxx (up to and including V3.108)	WinUSB	No	Yes	FreeMASTER V3.2.2 or later	MCUXpresso 11.7.0 or later

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Table 24. Compatibility between MCU-Link firmware and MCUXpresso IDE*...continued*

MCU-Link firmware version	USB driver type	CMSIS-SWO support	FreeMASTER support via		Supported MCUXpresso IDE versions
			SWD / JTAG	USB bridge	
V3.117 and later	WinUSB	Yes	Yes	FreeMASTER V3.2.2 or later	MCUXpresso 11.7.1 or later

3.5 Updating MCU-Link firmware using firmware update utility

To update the MCU-Link firmware using the firmware update utility included in the LinkServer installation package, the MCU-Link must be powered up in ISP mode. Follow these steps to configure MCU-Link in ISP mode and update MCU-Link firmware:

1. Disconnect the board from the host computer, short jumper JP2, and reconnect the board. The red MCU-Link status D6 LED lights up and stays on. For more details on MCU-Link LEDs, see Section 3.10.
2. Download the LinkServer installation package from https://nxp.com/linkserver and install the LinkServer utility. For example, download and install "Linkserver 1.4.85 installer for Windows".
3. Navigate to the `MCU-LINK_installer_Vx_xxx` directory, where `Vx_xxx` indicates the version number. For example, MCU-LINK_installer_3.119.
4. Follow the instructions in the `readme.txt` to find and run the firmware update utilities for CMSIS-DAP or J-Link versions.
5. Disconnect the board from the host computer, open jumper JP2, and reconnect the board. The board enumerates on the host computer as a WinUSB or HID device (depending on the firmware version).

Note:

- *Starting version V3.xxx, the MCU-Link firmware uses WinUSB instead of HID for higher performance; however, it is not compatible with MCUXpresso IDE versions earlier than 11.7.0.*
- *To enable SWO-related features in non-NXP IDEs, CMSIS-SWO support was introduced in firmware version V3.117.*

3.6 Using MCU-Link with development tools

The MCU-Link debug probe can be used with IDEs supported within the MCUXpresso ecosystem, such as MCUXpresso IDE, MCUXpresso for Visual Studio Code, IAR Embedded Workbench, and Arm Keil MDK.

3.6.1 Using MCU-Link with MCUXpresso IDE

The MCUXpresso IDE recognizes any type of MCU-Link probe that uses either CMSIS-DAP or J-Link firmware. When you start a new debug session, the IDE checks for all the available debug probes. For all the probes it finds, the IDE displays the probe types and unique identifiers in the **Probes discovered** dialog box.

If a debug probe requires a firmware update, the probe is displayed with a warning in the **Probes discovered** dialog box. For each such probe, the latest firmware version is indicated and a link to download the latest firmware package is provided. To update the firmware for the MCU-Link debug probe, see the instructions provided in Section 3.5.

You are advised to use the latest MCU-Link firmware to take the benefit of the latest functionality. However, the MCU-Link firmware version you can use depends on the MCUXpresso IDE version you are using. Table 24 shows the compatibility between the MCU-Link firmware and the MCUXpresso IDE.

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3.6.2 Using MCU-Link with MCUXpresso for Visual Studio Code

The MCU-Link debug probe can be used with the MCUXpresso for Visual Studio Code extension from NXP. This extension uses the Linkserver debug server. To work with MCUXpresso for Visual Studio Code, install the Linkserver utility using the MCUXpresso Installer tool or as described in Section 3.4. For more details on MCUXpresso for Visual Studio Code, visit the MCUXpresso for Visual Studio Code page.

3.6.3 Using MCU-Link with third-party IDEs

The MCU-Link debug probe can be used with IAR Embedded Workbench and Arm Keil MDK, and may also work with other third-party tools. Refer to the documentation for these products, covering the use of generic CMSIS-DAP probes or J-Link probes (depending on the firmware image you are using.)

3.7 MCU-Link USB connector

The FRDM-RW612 board has a universal serial bus (USB) 2.0 Type-C connector (J10). This USB connector is used to create an MCU-Link high-speed USB connection with the host computer. The MCU-Link receives power when the USB connector (J10) is plugged into a USB host.

3.8 Connecting to a target through a USB-to-UART bridge

The MCU-Link supports the VCOM serial port feature, which adds a serial COM port on the host computer, and connects it to the target MCU using MCU-Link as a USB-to-UART bridge.

On the FRDM-RW612 board, the MCU-Link LPC55S69 is connected to the GPIO[26] and GPIO[24] pins of the target MCU through the R77 and R69 resistors, respectively.

Note: *The GPIO[26] and GPIO[24] pins are also the UART ISP pins to allow for ISP connection through the MCU-Link VCOM.*

To use MCU-Link as a USB-to-UART bridge, ensure that the JP3 jumper is open and connect the J10 connector on the board to the USB port of the host computer.

When you boot the FRDM-RW612 board, a VCOM port with the name MCU-Link Vcom Port (COMxx) is enumerated on the host computer, where “xx” may vary from one computer to another. Each MCU-Link based board has a unique VCOM number associated with it.

3.9 Connecting to a target through a USB-to-SPI or USB-to-I2C bridge

MCU-Link supports the USB serial input/output (USBSIO) port feature, which adds a USB serial I/O port on the host computer, and connects it to the target MCU by using MCU-Link as a USB-to-SPI bridge or USB-to-I2C bridge. Support for the USBSIO feature can be enabled on the host computer using the libusbsio library, which is a free host library from NXP for Windows/Linux/MacOS systems. For more details on the libusbsio library, see https://www.nxp.com/libusbsio.

In the FRDM-RW612 board, the MCU-Link connects to the GPIO[6:9] pins of the target MCU using the FC1 SPI interface connection, through zero-ohm resistors (DNP by default). Populating these resistors enables the communication between MCU-Link and the target MCU through the USB-to-SPI bridge.

The SPI interface connections for this functionality are shared with the SPI connections on the Arduino compatible connectors and Mikroe connector connections. To prevent contention with these connectors, zero-ohm resistors are used to isolate the connections from the MCU-Link circuit by default.

A USB-to-SPI bridge can be used to emulate the host system. To use MCU-Link as a USB-to-SPI bridge, the board must be connected to the host computer through a USB cable from its J10 connector. Also, ensure the following resistor configuration on the board to enable the USBSIO bridge feature for SPI:

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- Resistors R40, R76, R80, and R18 are populated
- Resistor R78 is DNP (default setting)

On the FRDM-RW612 board, the MCU-Link is also connected to the GPIO[17:16] pins of the target MCU using the FC2 I2C interface connection through zero-ohm resistors (DNP by default). Populating these resistors enables the communication between MCU-Link and the target MCU through the USB-to-I2C bridge.

A USB-to-I2C bridge can be used to emulate the host system/board peripherals. To use MCU-Link as a USB-to-I2C bridge, the board must be connected to the host computer through a USB cable from its J10 connector. Also, ensure the following resistor configuration on the board to enable the USBSIO bridge feature for I2C:

- Zero-ohm resistors R65 and R47 are populated
- Resistor R78 is DNP (default setting)
- 2.2 kΩ resistors R48 and R67 should be populated

3.10 MCU-Link status LEDs

The FRDM-RW612 board has three status indicator LEDs for MCU-Link. Table 25 lists these LEDs and describes how each LED behaves in different MCU-Link modes. These LEDs are shown in Figure 3.

Table 25. MCU-Link LEDs

Part identifier	LED name / color	MCU-Link mode		
		Normal mode (with CMSIS-DAP firmware)	**Normal mode (with J-Link firmware)**	**Firmware update (ISP) mode**
D7	USB COMM / green	Lights up after successful USB enumeration at startup. Afterward, the LED stays ON.	Remains OFF	Remains OFF
D6	Status / red	Indicates heartbeat (fades in/out repeatedly), with SWD activity overlaid. The LED blinks rapidly at startup, if an error occurs.	Remains OFF	Lights up when MCU-Link target (LPC55S69) boots in ISP mode
D3	VCOM ACT / green	Indicates if the VCOM port is transmitting/receiving data	Lights up when MCU-Link boots, and blinks when debug activity happens	Remains OFF

4 European declaration of conformity

The following information is provided per Article 10.8 of the Radio Equipment Directive 2014/53/EU:

- Frequency band in which the equipment operates
- The maximum RF power transmitted

Table 26. FRDM-RW612 RF certificated

Part number	RF technology	Frequency band (EU)	Max RF transmitted power
FRDM-RW612	Bluetooth LE	2400 MHz - 2483.5 MHz	2 dBm
	802.15.4	2400 MHz - 2483.5 MHz	6 dBm
	Wi-Fi (IEEE 802.11)	2400 MHz - 2483.5 MHz	16 dBm
		5150 MHz - 5350 MHz	16 dBm
		5470 MHz - 5725 MHz	15 dBm

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Table 26. FRDM-RW612 RF certificated*...continued*

Part number	RF technology	Frequency band (EU)	Max RF transmitted power
		5725 MHz - 5850 MHz	12 dBm
		5850 MHz - 5850 MHz	9 dBm

EUROPEAN DECLARATION OF CONFORMITY (Simplified DoC per Article 10.9 of the Radio Equipment Directive 2014/53/EU)

This apparatus, namely FRDM-RW612 conforms to the Radio Equipment Directive 2014/53/EU. The full EU Declaration of Conformity for this apparatus is available at European Union Declaration of Conformity for FRDM-RW612 board Kit.

5 Related documentation

Table 27 lists and explains the additional documents and resources that you can refer to for more information on the FRDM-RW612 board. Some of the documents listed below may be available only under a non-disclosure agreement (NDA). To request access to these documents, contact your local field applications engineer (FAE) or sales representative.

Table 27. Related documentation

Document	Description	Link / how to access
RW612 Data Sheet - RW612-Wireless MCU with Integrated Tri-radio Wi-Fi 6 + Bluetooth Low Energy 5.4 / 802.15.4	It provides information about electrical characteristics, hardware design considerations, and ordering information	RW612
RW61X User Manual	It is intended for the board-level product designers and product software developers who want to develop products with RW61X MCU	UM11865
FRDM-RW612 design files	A zip file including *.DSN, ASY, Layout, schematic files, and so on	FRDM-RW612 design files
LPC55S6x/LPC55S2x/LPC552x User manual (UM11126)	Intended for system software and hardware developers and application programmers who want to develop products with LPC55S6x/ LPC55S2x/ LPC552x MCU	UM11126.pdf

6 Acronyms

Table 28 lists and defines the acronyms used in this document.

Table 28. Acronyms

Term	Description
ADC	Analog-to-digital converter
DNP	Do not populate
ESR	Equivalent series resistor
GPIO	General-purpose input/output
I2C	Inter-integrated circuit

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Table 28. Acronyms*...continued*

Term	Description
I3C	Improved inter-integrated circuit
ISP	In-system programming
PCB	Printed-circuit board
PHY	Physical interface of the OSI model
PMIC	Power management integrated circuit
POR	Power-on reset
PSRAM	Pseudo-Static Random Access Memory
PWM	Pulse width modulation
QSPI	Quadruple serial peripheral interface
RGMII	Reduced gigabit media independent interface
RTC	Real-time clock
SDHC	Secured digital host controller
SPI	Serial peripheral interface
SWD	Serial wire debug
SWO	Serial wire debug trace output
UART	Universal asynchronous receiver/transmitter
USB	Universal serial bus
USBSIO	USB serial input/output
VCOM	Virtual communication
WUU	Wake-up unit

7 Revision history

Table 29 summarizes the revisions to this document.

Table 29. Revision history

Document ID	Release date	Description
UM12160 v.1.0	20 September 2024	Initial public release

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