UM12359

FRDM-MCXW23 Board User Manual

Rev. 1.0 — 10 July 2025 User manual

Document information

Information	Content
Keywords	UM12359, FRDM-MCXW23, MCX W, MCXW236B, Arduino, mikroBUS, MCU-Link, PMOD, MCXW23x, MCX W23, FRDM MCXW23, FRDMMCXW23, FRDM MCX W23, user manual, NHS5204, Ultra-low power, small footprint, Bluetooth Low Energy, Integrated flash, Security, IoT, Coin battery, Small body-worn device
Abstract	The FRDM-MCXW23 board is a design and evaluation platform based on the NXP MCX W23 Bluetooth Low Energy MCU.

1 Board overview

The FRDM-MCXW23 board is a design and evaluation platform based on the NXP MCX W23 Bluetooth Low Energy microcontroller (MCU). The MCX W23 features a 32 MHz Arm Cortex-M33 core coupled with a Bluetooth Low Energy. Because of the integrated ultra-low power radio and flash, the MCX W23 provides extended battery lifetime.

The MCX W23 provides a cost-effective solution within a small solution area required for body-worn sensors and actuators applications.

The board is compatible with the Arduino UNO R3 and Mikroe click boards. It can be used with a wide range of development tools, including NXP MCUXpresso IDE, IAR Embedded Workbench, and Arm Keil MDK. The board is lead-free and RoHS-compliant.

For debugging the MCX W23 MCU, the FRDM-MCXW23 board uses an onboard (OB) debug probe, MCU-Link OB, which is based on another NXP MCU: LPC55S69. For simplicity, the MCX W23 MCU and the LPC55S69 MCU are respectively referred to as "target MCU" and "debug MCU" at some places in this document.

This document provides details about the FRDM-MCXW23 board interfaces, accelerometer, temperature power supplies, clocks, connectors, jumpers, push buttons, LEDs, and MCU-Link OB.

1.1 Radio Equipment Directive 2014/53/EU

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

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

Part number	RF technology	Frequency range (EU)	Maximum RF power transmitted
FRDM-MCXW23	Bluetooth Low Energy	2.400 GHz to 2.480 GHz	+6 dBm

European Declaration of Conformity (Simplified DoC, Article 10.9 of the Radio Equipment Directive 2014/53/EU). This apparatus, namely FRDM-MCXW23 Freedom Development Platform, conforms to the Radio Equipment Directive 2014/53/EU. The full EU Declaration of Conformity for this apparatus can be found at this location: MCX W23

1.2 Block diagram

Figure 1 shows the FRDM-MCXW23 board block diagram.

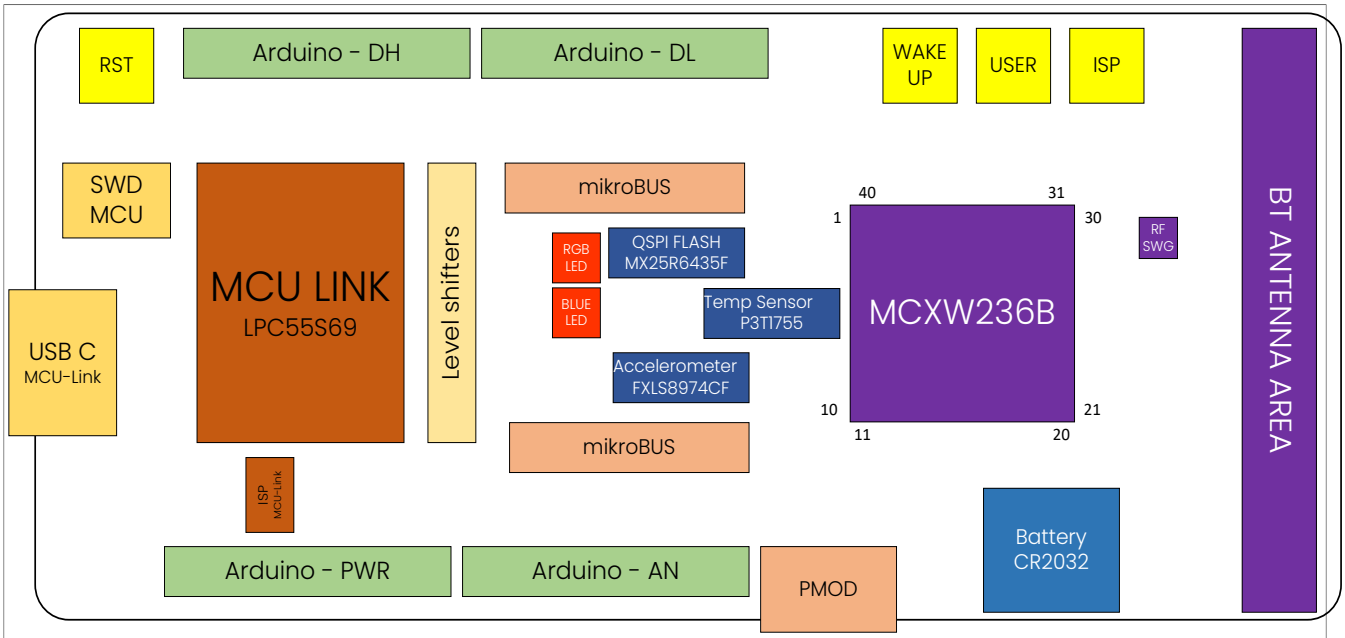

Figure 1. FRDM-MCXW23 board block diagram

1.3 Board features

Table 1 lists the features of the FRDM-MCXW23 board.

Table 1. FRDM-MCXW23 features

Board feature	Target MCU features used	Description
MCU (target MCU)		NXP MCXW23IHNAR wireless MCU based on an Arm Cortex- M33 core, running at speeds of up to 33 MHz. ***Note:*** *For details on the MCX W23, see MCX W23 Reference Manual and MCX W23 Product Family Data Sheet.*
UART interface	UART0 module	• Supports an external UART connection through Arduino socket connector J1 • Supports an external UART connection through mikroBUS socket connector J5 • Supports a USB-to-UART bridge connection using MCU-Link (enabled by default)
	UART2 module	• Supports a USB-to-UART bridge connection using MCU-Link (disabled by default) • Supports an external UART connection through Arduino socket connector J1 • Supports an external UART connection through Arduino socket connector J4
SPI interface	SPI module	• Supports an external SPI connection through Arduino socket connector J2 • Supports an external SPI connection through mikroBUS socket connector J6 • Supports an external SPI connection through Pmod connector J22 (DNP) • Supports an SPI connection with onboard QSPI flash memory

Table 1. FRDM-MCXW23 features*...continued*

Board feature	Target MCU features used	Description
I2C interface	I2C module	• Provides an I^2C bus to an accelerometer, temperature sensor, Arduino socket connector J2 and J4, mikroBUS socket connector J5, and Pmod connector J22 (DNP) • Supports a USB-to-I^2C bridge connection using MCU-Link (disabled by default)
RF interface	2.4 GHz radio	Supports RF operations through a PCB-integrated monopole antenna (default option) or SWG connector J21 (alternative option)
Accelerometer (I^2C sensor)	I2C module	Provides a 12-bit, 3-axis, low-power digital accelerometer (FXLS8974CFR3)
Temperature sensor	I2C module	A ±0.5 °C accurate temperature-to-digital converter with a -40 °C to +125 °C range (P3T1755)
Arduino socket	UART0, UART2, SPI, and I2C	Arduino socket with four connectors J1, J2, J3, and J4
mikroBUS socket	UART0, SPI, and I2C	mikroBUS socket with a pair of connectors J5 and J6
Pmod connector	SPI and I2C modules	Pmod connector J22 (DNP)
Debug interface	UART0 and UART2 modules	Onboard MCU-Link debug probe with USB Type-C connector J10 for debugging the MCX W23 MCU
Power supply		The following options are available to power up the board: • External 5 V power through USB Type-C connector J10 • 5-9 V power from Arduino socket connector J3, pin 8
Battery power		Possibility to power the MCX W23 by a 3 V battery (type CR2032)
Clocks		• 32 MHz and 32.768 kHz clocks for the MCX W23 MCU • 16 MHz clock for the LPC55S69 MCU
Orderable part number		FRDM-MCXW23

1.4 Kit contents

Table 2 lists the items included in the FRDM-MCXW23 board hardware kit.

Table 2. Kit contents

Item	Quantity
FRDM-MCXW23 board hardware assembly	1
USB 2.0 Type-A to Type-C cable, 1 meter	1
FRDM-MCXW23 Quick Start Guide	1

1.5 Board pictures

Figure 2 shows the top-side view of the FRDM-MCXW23 board with the MCX W23 MCU (target MCU), monopole antenna, QSPI flash, accelerometer (I^2C sensor), and temperature sensor highlighted.

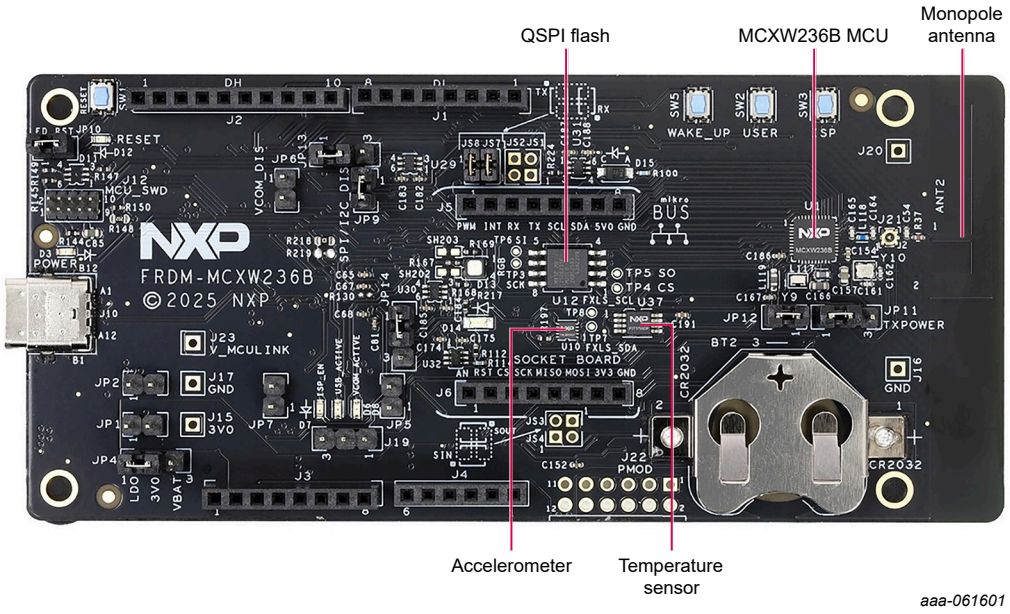

Figure 2. Top-side view of the FRDM-MCXW23 board

Figure 3 shows the bottom-side view of the FRDM-MCXW23 board with the LPC55S69 MCU (debug MCU) highlighted.

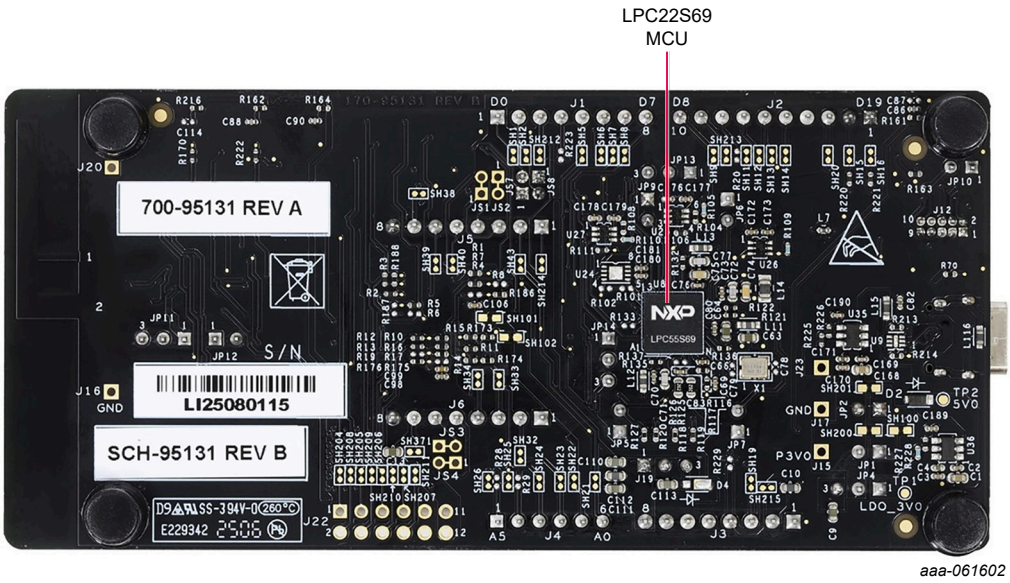

Figure 3. Bottom-side view of the FRDM-MCXW23 board

1.6 Connectors

Figure 4 shows the FRDM-MCXW23 board connectors.

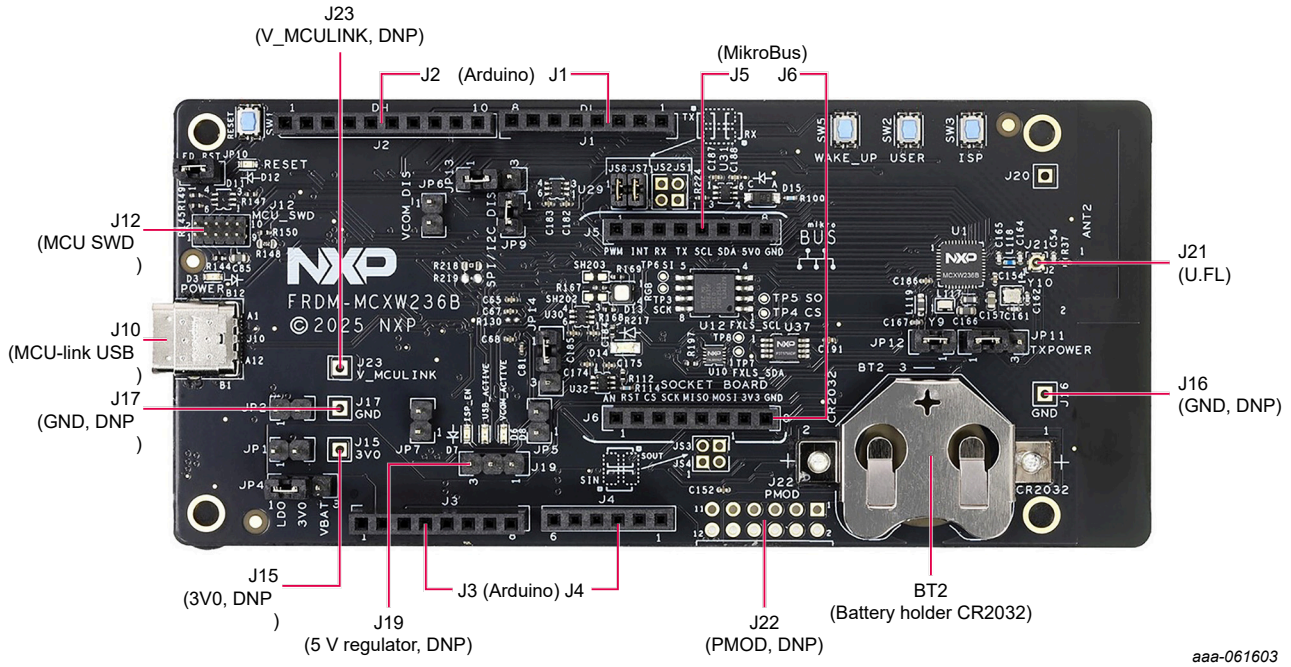

Figure 4. FRDM-MCXW23 board connectors

Table 3 describes the connectors available on the FRDM-MCXW23 board.

Table 3. FRDM-MCXW23 connectors

Part identifier	PCB label	Connector type	Description	Reference section
J1	DL	1x8-position receptacle	Arduino socket connectors	Section 2.10
J2	DH	1x10-position receptacle		
J3		1x8-position receptacle		
J4		1x6-position receptacle		
J5		1x8-position receptacle	mikroBUS socket connectors	Section 2.11
J6		1x8-position receptacle		
J9		U.FL connector	U.FL RF connector – type SWG	Section 2.8
J10		USB Type-C connector	MCU-Link USB connector	Section 3.6
J19 (DNP)		1x3-pin/position connector	5 V DC voltage regulator connector	Section 2.1
J12	MCU SWD	2x5-pin connector	Target MCU (MCX W23) external debugger connector	Section 3.2
J22 (DNP)	PMOD	2x6-pin/position connector	Pmod connector	Section 2.12
J15 (DNP)	3V3	1-pin/position connector	Power supply test points	For more information on these connectors, see FRDM-MCXW23 board schematics.
J23 (DNP)	V_MCULINK	1-pin/position connector		
J16 (DNP)	GND	1-pin/position connector	GND test points	
J17 (DNP)	GND	1-pin/position connector		
BT2	CR2032	Battery holder	Coin cell battery holder CR2032	

Table 3. FRDM-MCXW23 connectors...*continued*

Part identifier	PCB label	Connector type	Description	Reference section
J20 (DNP)	VREF_OUT	1-pin/position connector		

1.7 Jumpers

Figure 5 shows the FRDM-MCXW23 board jumpers.

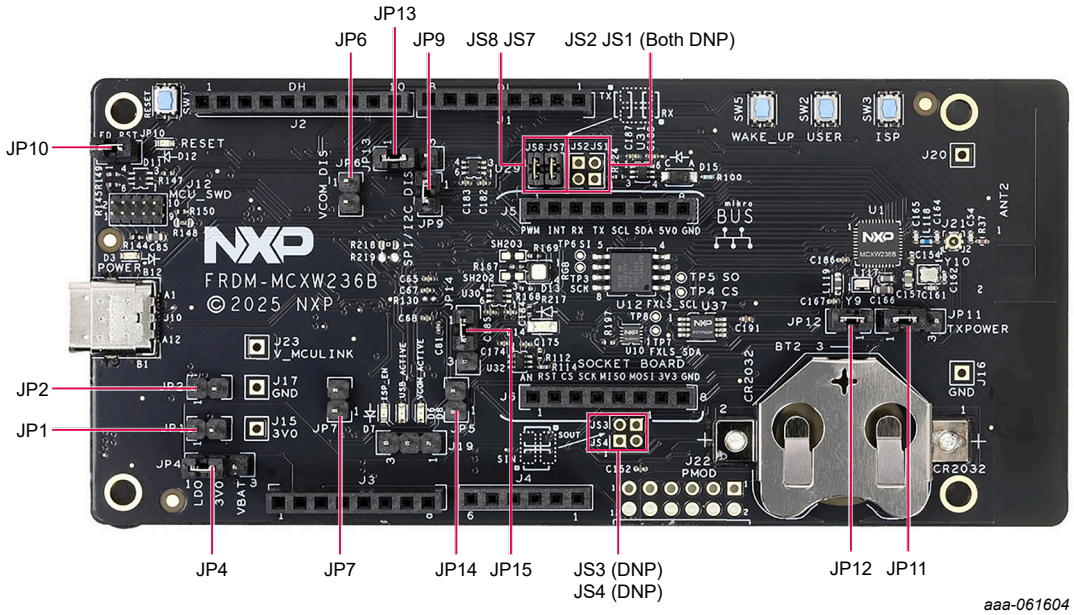

Figure 5. FRDM-MCXW23 board jumpers

Table 4 describes the FRDM-MCXW23 board jumpers.

Table 4. FRDM-MCXW23 jumpers

Part identifier	Jumper type	Description	Reference section
JP1	1x2-pin header	Board power (VBOARD) measurement jumper. JP1 is not closed by default. It can be used to measure the current for the VBOARD supply. When measuring, ensure to cut the PCB trace on the bottom side between the pads of the shunt resistor SH200. When open, JP1 can be used to measure the current for the VBOARD supply. When shorted, JP1 produces the VBOARD supply.	Section 2.1
JP2	1x2-pin header	Target MCU (MCX W23) power (P3V0_DUT) measurement jumper. JP2 is not closed by default. It can be used to measure the current for the P3V0_ DUT supply. When measuring, ensure to cut the PCB trace on the bottom side between the pads of the shunt resistor SH201. When open, JP2 can be used to measure the current for the target MCU power including some digital buffers (P3 V3_DUT), JP2 produces the P3V0_ DUT supply.	
JP4	1x3-pin header	P3V3 supply power source selection jumper: • 1-2 shorted (default setting): The P3V3 supply is produced from the LDO_3V3 supply.	

Table 4. FRDM-MCXW23 jumpers*...continued*

Part identifier	Jumper type	Description	Reference section
		• 2-3 shorted: The P3V3 supply is produced from the Battery supply.	
JP5	1x2-pin header	MCU-Link (LPC55S69) ISP mode enable jumper: • Open (default setting): MCU-Link (LPC55S69) follows the normal boot sequence (MCU-Link boots from its internal flash if a boot image is found). With the internal flash erased, the MCU-Link normal boot sequence falls through to In-System Programming (ISP) boot mode. • Shorted: MCU-Link is forced to ISP mode (USB1). 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 internal flash is preprogrammed with a version of the CMSIS-DAP firmware.*	Section 3.4
JP6	1x2-pin header	MCU-Link VCOM port disable jumper: • Open (default setting): The MCU-Link virtual communication (VCOM) port (USB-to-UART bridge) is enabled. • Shorted: The MCU-Link VCOM port (USB-to-UART bridge) is disabled.	Section 3.7
JP7	1x2-pin header	MCU-Link SWD disable jumper: • Open (default setting): The MCU-Link serial wire debug (SWD) feature is enabled. MCU-Link can be used to drive the SWD of the target MCU. • Shorted: The MCU-Link SWD feature is disabled. This jumper setting can be used for debugging the target MCU, using an external debugger connected through connector J12.	Section 3.2
JP9	1x2-pin header	USB-to-I^2C bridge disable jumper: • Open: MCU-Link acts as a USB-to-I^2C bridge between the host computer and the target MCU. • Shorted (default setting): The USB-to-I^2C bridge is disabled (DNP).	For more information on these jumpers, see FRDM-MCXW23 board schematics.
JP10	1x2-pin header	Reset LED enable jumper: • Open: The reset LED is disabled. • Shorted (default setting): The reset LED is enabled, and it turns ON when the reset button (SW1) is pressed.	Section 1.7
JP11	1x3-pin header	BLE Tx transmit power selection jumper: • 1-2 shorted (default setting): VDD_RF is connected to VBAT_HV. The RF transmitter level is configured in TX Mode 2 (TXM2). The maximum RF output power equals +6 dBm. • 2-3 shorted: VDD_RF is connected to VBAT_LV. The RF transmitter level is configured in TX Mode 1 (TXM1). The maximum RF output power equals +2 dBm. For more information, see *MCX W23 Data Sheet*.	
JP12	1x2-pin header	Current SNS Jumper:	

Table 4. FRDM-MCXW23 jumpers*...continued*

Part identifier	Jumper type	Description	Reference section
		• 1-2 shorted (default setting): works as a buck mode	
JS1[1] (DNP)	1x2-pin header	mikroBUS socket UART transmit signal control jumper. JS1 is not populated by default, but JS1 pads are shorted via a physical (trace) connection on the secondary (bottom) side of the PCB. Therefore, a UART signal can be transmitted from mikroBUS socket connector J5 to the MCX W23 UART0 module. To populate JS1 (if needed to control the mikroBUS socket UART transmit signal), cut the PCB trace between the JS1 pads.	Section 2.4
JS2[1] (DNP)	1x2-pin header	mikroBUS socket UART receive signal control jumper. JS2 is not populated by default, but JS2 pads are shorted via a trace connection on the bottom side of the PCB. Therefore, a UART signal can be received at mikroBUS socket connector J5 from the MCX W23 UART0 module. To populate JS2 (if needed to control the mikroBUS socket UART receive signal), cut the PCB trace between the JS2 pads.	
JS3[1] (DNP)	1x2-pin header	mikroBUS socket SPI input signal control jumper. JS3 is not populated by default, but JS3 pads are shorted via a trace connection on the bottom side of the PCB. Therefore, an SPI signal can be received at mikroBUS socket connector J6 from the MCX W23 SPI module. To populate JS3 (if needed to control the mikroBUS socket SPI input signal), cut the PCB trace between the JS3 pads.	Section 2.5
JS4[1] (DNP)	1x2-pin header	mikroBUS socket SPI output signal control jumper. JS4 is not populated by default, but JS4 pads are shorted via a trace connection on the bottom side of the PCB. Therefore, an SPI signal can be transmitted from mikro BUS socket connector J6 to the MCX W23 SPI module. To populate JS4 (if needed to control the mikroBUS socket SPI output signal), cut the PCB trace between the JS4 pads.	
JS7[1]	1x2-pin header	Arduino shield UART receive signal control jumper. • Populated (default setting): MCX W23 is the controller of the UART port. An Arduino shield can be attached to the FRDM-MCXW23 board. A UART signal can be received from Arduino shield connector J1 to the MCX W23 UART0 module. • POKA-YOKE setting: An Arduino Uno board is the controller of the UART port. The FRDM-MCXW236 acts as an Arduino shield.	
JS8[1]	1x2-pin header	Arduino shield UART transmit signal control jumper. • Populated (default setting): MCX W23 is the controller of the UART port. An Arduino shield can be attached to the FRDM-MCXW23 board. An UART signal can be transmitted to Arduino shield connector J1 from the MCX W23 UART0 module.	

Table 4. FRDM-MCXW23 jumpers...*continued*

Part identifier	Jumper type	Description	Reference section
		• POKA-YOKE setting: A Arduino Uno board is the controller of the UART port. The FRDM-MCXW23 acts as an Arduino shield.	

[1] The 1pitch of jumper is 2.00 mm.

1.8 Push buttons

Figure 6 shows the FRDM-MCXW23 board push buttons.

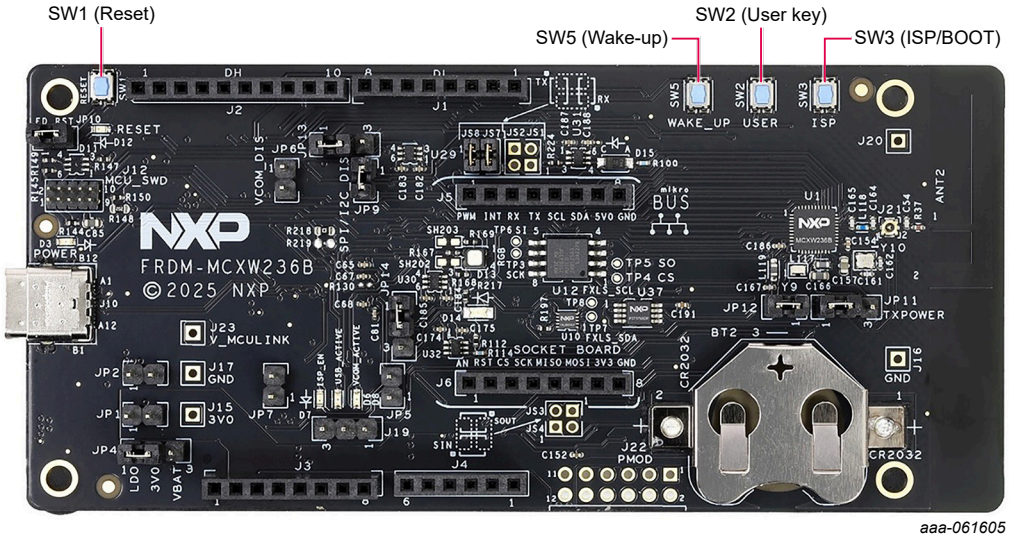

Figure 6. Push buttons

Table 5 describes the FRDM-MCXW23 board push buttons.

Table 5. FRDM-MCXW23 push buttons

Part identifier	PCB label	Name/function	Description
SW1	RESET	Reset button	Pressing SW1 asserts the MCX W23 MCU pin (RST_ TGTMCU_B), which wakes up the MCU from any mode. When SW1 is pressed with jumper JP10 shorted, the reset LED D12 turns ON.
SW5	SW_WAKE_UP	Power (wake-up) button	Pressing SW5 asserts the MCX W23 MCU pin SWITCH_ WAKEUP_B (PIO0_21). This switch can trigger a wake-up from low-power modes.
SW3	ISP	ISP/boot configuration button	Pressing SW3 asserts the MCX W23 MCU pin PIO0_20 (BOOT_ CONFIG), which forces the MCU ROM bootloader to run in In-System Programming (ISP) mode. To boot the MCU in ISP mode, hold down SW3 while pressing SW1 (reset button) or while supplying power to the board. For more information on the MCX W23 MCU ISP mode, see *MCX W23 Reference Manual*.
SW2	PB WU	User wake-up button	User-application-specific push buttons (PIO0_18)

1.9 LEDs

The FRDM-MCXW23 board provides light-emitting diodes (LEDs) for monitoring system status. The information collected from the LEDs can be used for debugging purposes.

Figure 7 shows the FRDM-MCXW23 board LEDs.

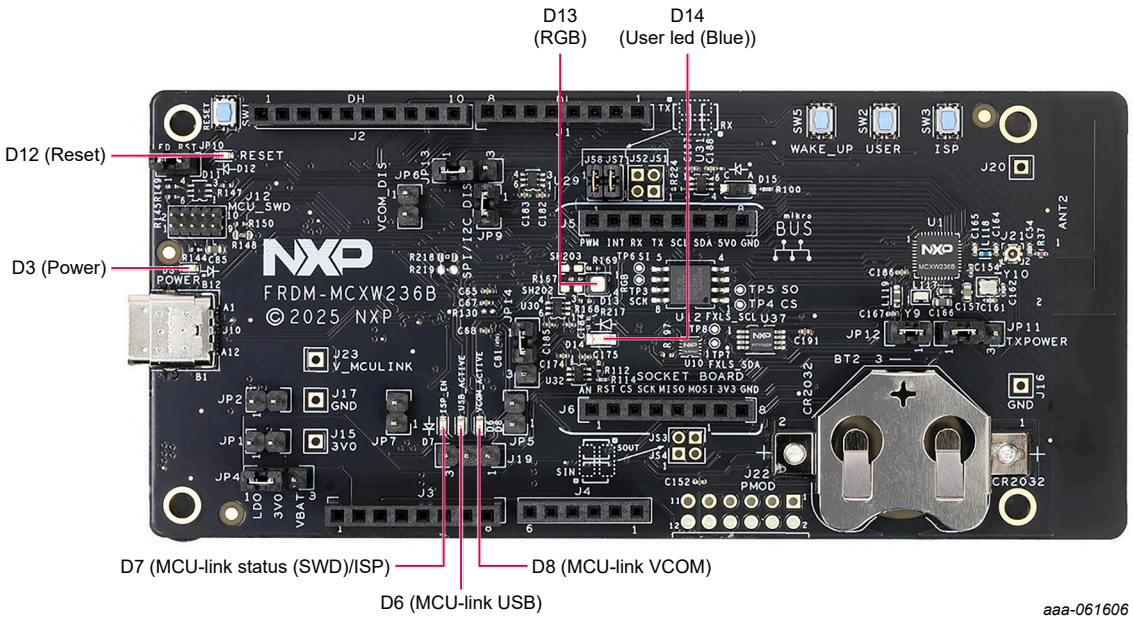

Figure 7. LEDs

Table 6 describes the FRDM-MCXW23 board LEDs except for MCU-Link-specific LEDs, which are described in Section 3.9.

Table 6. FRDM-MCXW23 LEDs

Part identifier	PCB label	LED color	LED name/function	Description (when LED is ON)
D3	POWER	Green	Power-on indicator LED	Indicates system power-on status. When the board is powered up, D3 turns ON.
D12	RESET	Red	Reset LED	Indicates system reset activity. When board reset is initiated, for example, by pressing the reset button (SW1), D12 turns ON.
D13	RGB	Red/green/blue	RGB LED	User-defined LEDs, which can be controlled through a user application.
D14	User LED	Blue	General-purpose LED	

Note: *MCU-Link-specific LEDs D6, D7, and D8 are described in Section 3.9.*

2 Functional description

This section contains the following subsections:

2.1 Power supplies

2.1.1 External power supply

The FRDM-MCXW23 board is powered up using one of the following primary external power supply options:

- External 5 V power through USB Type-C connector J10.
- 5-9 V power from Arduino socket connector J3, pin 8.

The primary power supply is used to produce secondary power supplies on the board. The secondary power supplies provide power to board components, including the MCX W23 MCU, MCU-Link, QSPI flash memory, accelerometer, temperature sensor, LED's, Arduino socket, mikroBUS socket, and Pmod connector.

2.1.2 Power supplies

describes the FRDM-MCXW23 board power supplies.

Table 7

Table 7. FRDM-MCXW23 power supplies

Power source	Manufacturer and part number	Power supply	Description
External supply through MCU-Link USB Type-C connector J10		P5V_MCU_ LINK_USB (5 V)	• One of the two power source options (default option) for the SYS_5V supply • Provides the USB1_VBUS power to the LPC55 S69 MCU (MCU-Link)
External supply through Arduino socket power connector J3, pin 8		P5-9V_VIN (5-9 V)	Supplies power to 5 V DC voltage regulator connector J19
DC voltage regulator attached to connector J19 (DNP)		P5V_HDR_IN (5 V)	Second power source option for the SYS_5V supply
From the P5V_MCU_LINK_ USB/P5V_HDR_IN supply ***Note:*** *By default, the option to produce the SYS_5V*		SYS_5V (5 V)	Produces the P5V0 supply

Table 7. FRDM-MCXW23 power supplies*...continued*

Power source	Manufacturer and part number	Power supply	Description
supply from the P5V_HDR_IN supply is disabled.			
From the SYS_5V supply		P5V0 (5 V)	Supplies power to LDO voltage regulator U36, Arduino socket power connector J3, and mikroBUS
LDO voltage regulator U36	Torex Semiconductor RT9065GE	LDO_3V0 (3.0 V)	One of the two power source options (default option) for the P3V0 supply through jumper JP4
CR2032 battery		CR2032 3V0	Battery holder for a 3V Lithium battery, type CR2032 Second power source option for the P3V3 supply through jumper JP4 ***Note:*** *By default, the battery is not installed.*
From the P3V0 supply, through shunt resistor SH200 or jumper JP1 (DNP)		VBOARD	• Produces the VDD_MEM supply through shunt resistor SH101 • Produces the VDD_SENSOR supply through shunt resistor SH102 • Produces the P_LED supply through shunt resistor SH100 • Provides the VIO power to the CAN transceiver U13 • Supplies power to MCU-Link/produces other secondary supplies (MCU_LINK_3V3 and VREF_MCULINK) for MCU-Link • Supplies power to: – Arduino socket power connector J3 (pins 2 and 4) – mikroBUS socket connector J6 – Pmod connector J22 (DNP) – External debugger connector J12 – ISP/boot configuration switch SW3 – MCU-Link LEDs D6, D7, and D8 – Ambient light sensor Q2 • Enables reset signal from reset switch SW1 • Enables wake-up signal from power switch SW5 • Enables non-maskable interrupt (NMI) signal from user-defined NMI switch SW4 • Enables MCU-Link status/SWD/ISP signal, which can be disabled by shorting jumper JP5 ***Note:*** • *The VBOARD supply can also be used to enable wake-up signal from user-defined wake-up switch SW2, by populating resistor R162.* • *The VBOARD supply can also be used to enable I^2C signals from/to MCU-Link, by populating resistors R157 and R158.* • *The VBOARD supply can also be used to enable UART signals from/to Arduino socket analog connector J4, by populating resistors R28 and R29.*

Table 7. FRDM-MCXW23 power supplies*...continued*

Power source	Manufacturer and part number	Power supply	Description
From the P3V3 supply, through shunt resistor SH201 or jumper JP2 (DNP)		P3V3_DUT (3.3 V)	• One of the two power source options (default option) for the VDD_REG and VDD_DCDC supplies • Produces the VDD_SWITCH supply
From the VBOARD supply, through shunt resistor SH101		VDD_MEM	Supplies power to QSPI flash memory U12
From the VBOARD supply, through shunt resistor SH102		VDD_ SENSOR	Supplies power to accelerometer U10
From the VBOARD supply, through shunt resistor SH100		P_LED	Supplies power to power-on indicator LED D3, reset LED D12, RGB LED D13, and user LED D14
From the P3V3_DUT supply or the VOUT_SWITCH power of the MCX W23 MCU (through shunt resistor SH105)		VDD_REG	Produces the VDD_IO_ABC and VDD_ANA supplies
From the P3V3_DUT supply or the VOUT_SWITCH power of the MCX W23 MCU (through shunt resistors SH105 and SH107)		VDD_DCDC	• Alternative option to produce the VDD_SYS supply • Provides the VDD_IO_D/VDD_DCDC power to the MCX W23 MCU
From the P3V3_DUT supply (through shunt resistor SH104)		VDD_ SWITCH	Provides the VDD_SWITCH power to the MCX W23 MCU
From the VDD_REG supply (through shunt resistor SH108)		VDD_IO_ ABC	Provides the VDD_IO_ABC power to the MCX W23 MCU
From the VDD_REG supply (through shunt resistor SH109)		VDD_ANA	Provides the VDD_ANA power to the MCX W23 MCU
Internally within the MCX W23 MCU or from the VDD_ DCDC supply		VDD_SYS (1.71 V – 2.75 V)	Provides the VDD_SYS power to the MCX W23 MCU
From the DCDC_LX power of the MCX W23 MCU		1V8_DCDC (1.8 V)	Produces the VDD_LDO_CORE and VDD_RF supplies
From the 1V8_DCDC supply (through shunt resistor SH110)		VDD_LDO_ CORE	Provides the VDD_LDO_CORE power to the MCX W23 MCU
From the 1V8_DCDC supply (through shunt resistor SH111)		VDD_RF	Provides the VDD_RF power to the MCX W23 MCU
From the VPA_2P4GHZ power of the MCX W23 MCU		VDD_PA_2 G4	Supplies power to the RF (antenna) circuit
From the VREFO power of the MCX W23 MCU		VREF_OUT	Provides reference voltage to the plugged-in Arduino board through Arduino socket connector J2, pin 3

2.1.3 Current measurement

The FRDM-MCXW23 board supports current measurement using an ampere meter (ammeter) on the power supplies shown in Table 8.

Table 8. Power supplies with current measurement support

Power supply	Description	Shunt resistor	Jumper (2-pin)
VBOARD	Board power	SH200	JP1 (DNP)
P3V3_DUT	Target MCU (MCX W23) total power	SH201	JP2 (DNP)
VDD_HV	Target MCU VDD_HV power	-	JP11
VDD_RF	Target MCU VDD_RF power	-	JP12

2.2 Clocks

Table 9 describes the clocks available on the FRDM-MCXW23 board.

Table 9. FRDM-MCXW23 Clocks

Clock generator	Manufacturer and part number	Clock	Frequency	Destination
Crystal Y10	ECS Inc. ECS-320-8-37B-CKY-TR	XI_32M, XO_32M	32 MHz	MCX W23 MCU (RF section)
Crystal Y9	MICRO CRYSTAL CM9V-T1A-32.768KHZ-7PF-20PPM-TA-QC	XI_32K, XO_32K	32.768 kHz	MCX W23 MCU (RTC section)
Crystal X1	Würth Elektronik 830064296	MCU_LINK_[P, N]_16 MHz	16 MHz	LPC55S69 MCU

2.3 UART interface

The MCX W23 MCU can be configured as an SPI, UART, or I^2C interface. The FRDM-MCXW23 board supports communication with two UART modules: UART0 and UART2.

Figure 8 shows the FRDM-MCXW23 UARTdiagram.

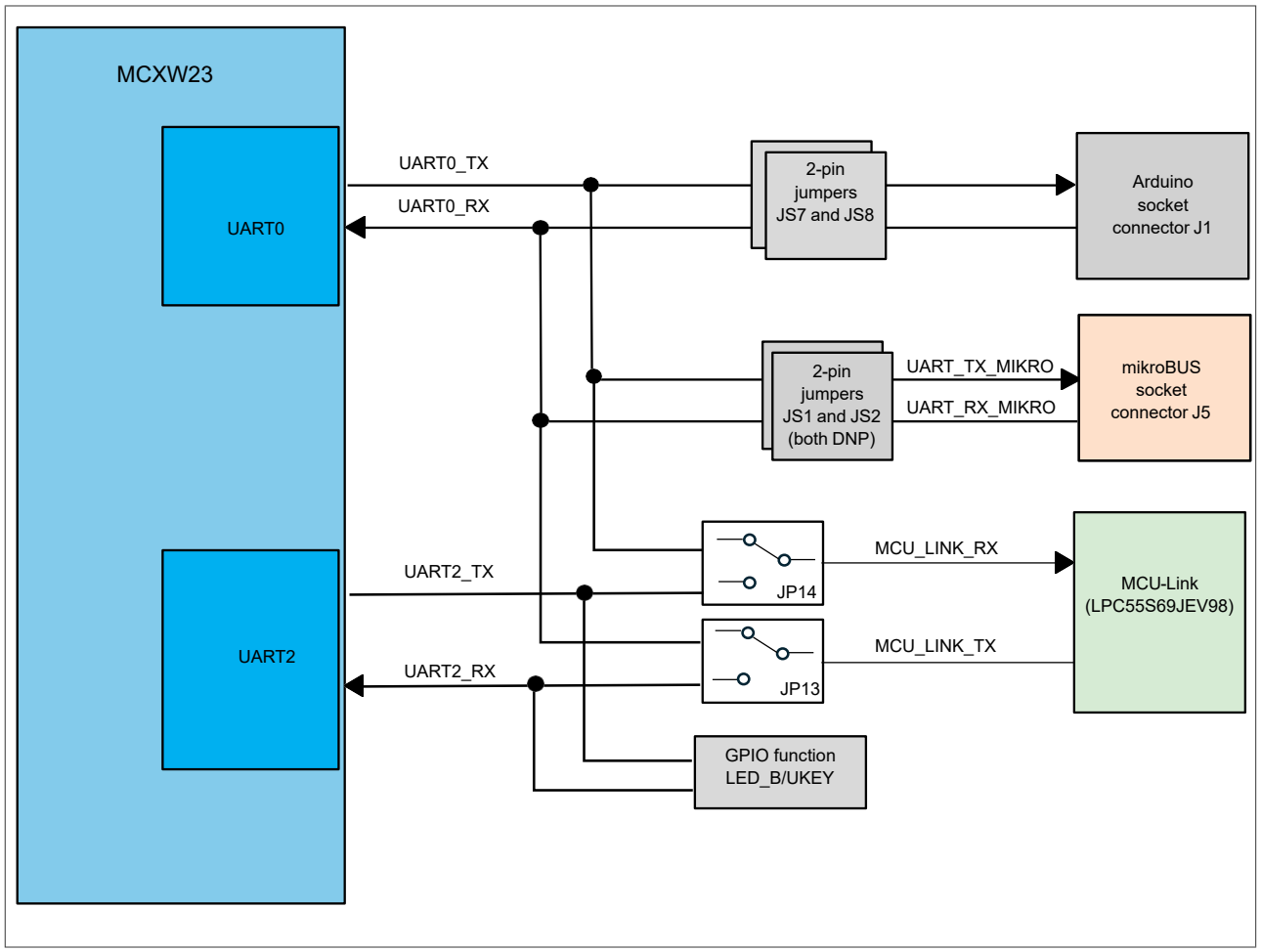

Figure 8. UART diagram

Table 11 describes the FRDM-MCXW23 UART connections.

Table 10. UART connections

UART module	Peripheral devices		
	Part identifier	**Manufacturer and part number**	**Description**
UART0	J1		1x8-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX W23 MCU through a UART connection.
	J5		1x8-position mikroBUS socket connector that allows the plugged-in mikroBUS click board to communicate with the MCX W23 MCU through a UART connection. The UART transmit (TX) and receive (RX) signals between the MCX W23 MCU and J5 connector pass through a pair of 2-pin jumpers JS1 (DNP) and JS2 (DNP). The JS1 and JS2 pads are shorted on the bottom side of the PCB. It implies that the TX and RX connections are active by default. To control the TX and RX signals, actual jumpers can be populated at the JS1 and JS2 footprints after cutting the traces on the PCB bottom side. The TX and RX signals can be cross-connected by:

Table 10. UART connections...*continued*

UART module	Peripheral devices		
			• Shorting pin 1 of JS1 with pin 2 of JS2 • Shorting pin 2 of JS1 with pin 1 of JS2
UART0	U8	NXP LPC55S69JEV98	MCU-Link, which is a 32-bit MCU based on the Arm Cortex-M33 core running at speeds of up to 150 MHz. MCU-Link can act as a USB-to-UART bridge between the host computer and the target MCU (MCX W23) for debugging the target MCU. For more details, see Section 3.7.

In the FRDM-MCXW23 board, MCU-Link is connected to the UART0 module of the target MCU, by default. However, the board also allows connecting MCU-Link to the UART2 module of the target MCU, instead of the UART0 module.

Connecting to the UART2 module requires:

- Place JP13 and JP14 [2-3] pin

2.4 SPI interface

The MCX W23 MCU has a Low-Power Serial Peripheral Interface (SPI) module. The MCX W23 SPI module supports up to two peripheral chip selects (PCSs):

- CS0
- CS1

The FRDM-MCXW23 board only supports communication with the SPI module.

Table 12 shows PCS mapping for the FRDM-MCXW23 SPI interface, with master-slave arrangement indicated.

Table 11. SPI PCS mapping

SPI module	Peripheral chip selects	Connected device
SPI (master/slave)	CS0 (default option) and CS1 (alternative option)	QSPI flash memory (slave)
	CS1 (default option) and CS0 (alternative option)	Arduino socket connector J2 (slave)
	CS1	mikroBUS socket connector J6 (slave)
	CS1	Pmod connector J22 (DNP) (slave)

Figure 9 shows the FRDM-MCXW23 SPI diagram.

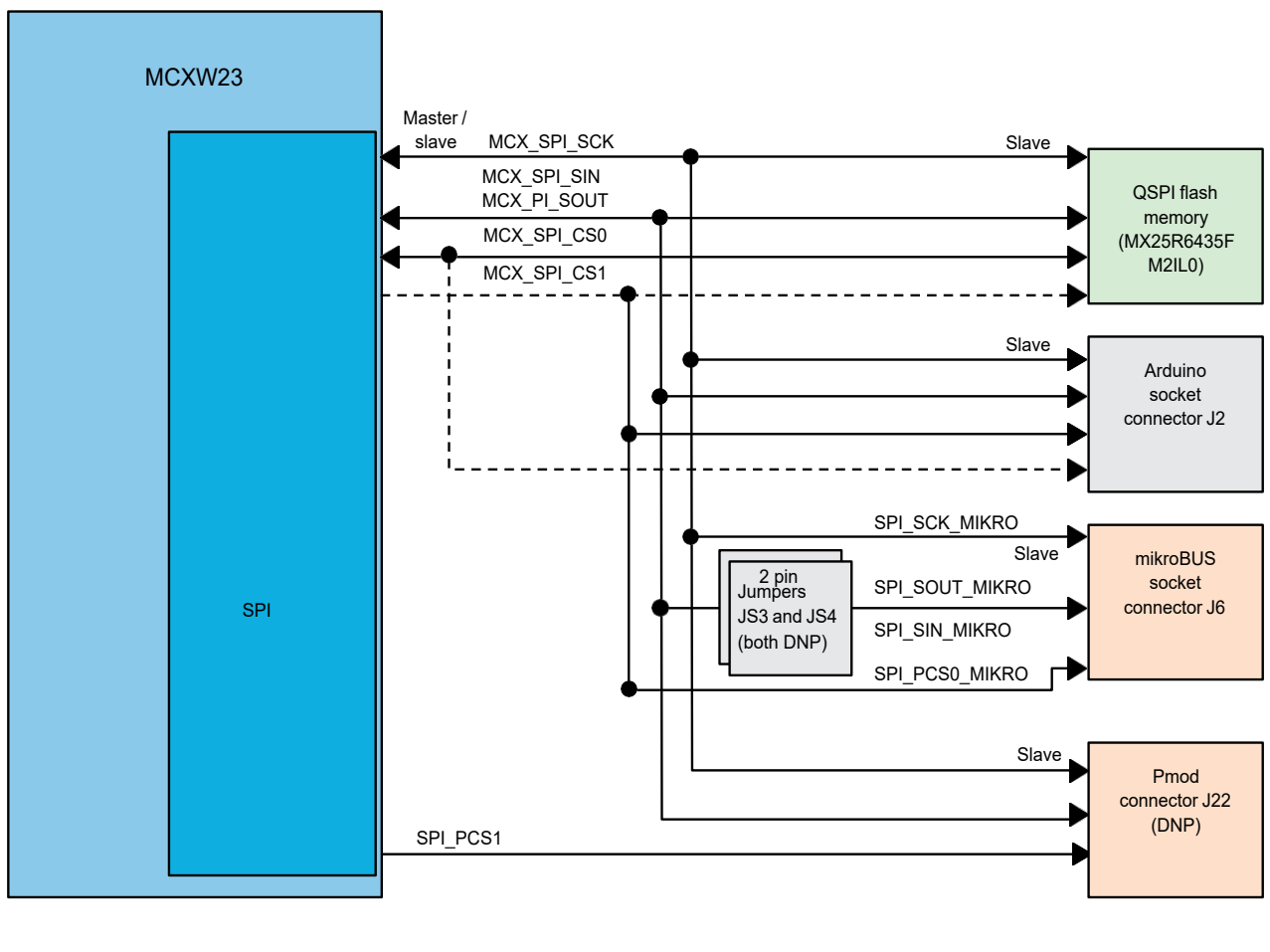

Figure 9. SPI diagram

Table 13 describes the FRDM-MCXW23 SPI connections.

Table 12. SPI connections

SPI module	Peripheral devices		
	Part identifier	**Manufacturer and part number**	**Description**
SPI	U12	Macronix MX25R6435 FM2IL0	64 Mbit (8 MB) QSPI flash memory with clock frequencies of up to 80 MHz
	J2		1x10-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCXW23 MCU through an SPI connection.
	J6		1x8-position mikroBUS socket connector that allows the plugged-in mikroBUS click board to communicate with the MCX W23 MCU through an SPI connection. The SPI data input (SIN) and SPI data output (SOUT) signals between the MCX W23 MCU and J6 connector pass through a pair of 2-pin jumpers JS3 (DNP) and JS4 (DNP). The JS3 and JS4 pads are shorted on the bottom side of the PCB. It implies that the SIN and SOUT connections are active by default.

Table 12. SPI connections*...continued*

SPI module	Peripheral devices		
			To control the SIN and SOUT signals, actual jumpers can be populated at the JS3 and JS4 footprints after cutting the traces on the PCB bottom side. The SIN and SOUT signals can be cross-connected by: • Shorting pin 1 of JS3 with pin 2 of JS4 • Shorting pin 2 of JS3 with pin 1 of JS4
	J22 (DNP)	Sullins Connector Solutions PPPC062 LJBN-RC	Pmod connector

2.5 I2C interface

The MCX W23 MCU has A Low-Power Inter-Integrated Circuit (I2C) module. The I2C module supports serial I^2C communication through a pair of control and data signals, and can act as a controller or target.

The FRDM-MCXW23 board only supports communication with the I2C module.

Figure shows the FRDM- MCXW23 I2C diagram.

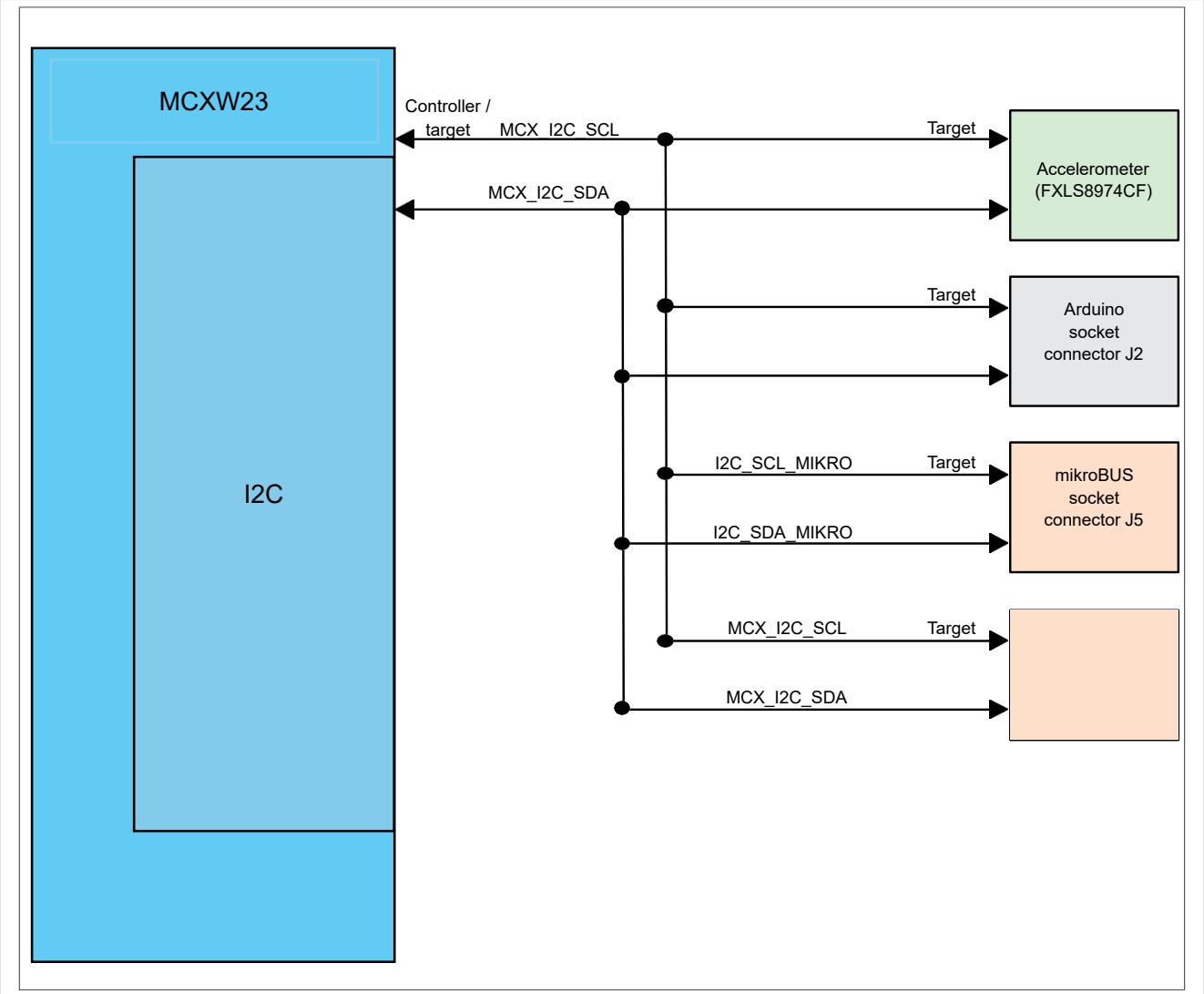

Figure 10. I2C diagram

Table 14 shows the FRDM-MCXW23 I^2C bus device map.

Table 13. I^2C bus device map

I2C bus	7-bit I2C address[1]	Device	Description
(All)		NXP MCXW236CMFTA (U1)	Target MCU. It acts as the I^2C controller for all I^2C connections on the board except for I^2C connection with MCU-Link.
I2C	0x19	NXP FXLS8964AF (U10)	Accelerometer (I^2C sensor)
	I^2C address depends on the plugged-in Arduino board.	Arduino board	Board/module attached to the Arduino socket comprising connectors J1, J2, J3, and J4. The I^2C signals connect through pins 1 and 2 of the J2 connector.
	I2C address depends on the	mikroBUS click board	Board/module attached to the mikroBUS socket comprising connectors J5 and J6. The I^2C signals connect through pins 5 and 6 of the J5 connector.

Table 13. I²C bus device map...*continued*

I2C bus	7-bit I2C address[1]	Device	Description
	plugged-in mikro BUS click board.		
	I²C address depends on the plugged-in Pmod board.	Pmod board	Board/module attached to the Pmod connector J22 (not populated by default). The I²C signals connect through J22 pins 6 and 8.
		NXP LPC55S69JEV98 (U8)	MCU-Link, which is a 32-bit MCU based on the Arm Cortex-M33 core running at speeds of up to 150 MHz. MCU-Link can act as a USB-to-I²C bridge between the host computer and the target MCU (MCX W23) for debugging the target MCU. By default, the I2C connection between MCU-Link and the target MCU is disabled (DNP).

[1] A 7-bit address does not include the read/write (R/W) bit.

2.6 RF interface

The MCX W23 MCU is compatible with Bluetooth Low Energy 5.3.

The FRDM-MCXW23 board supports communication with the 2.4 GHz radio through a monopole antenna or a U.FL connector. The various components of the radio frequency (RF) circuit are connected through a 50 Ω controlled impedance line.

Figure 11 shows the FRDM-MCXW23 RF diagram.

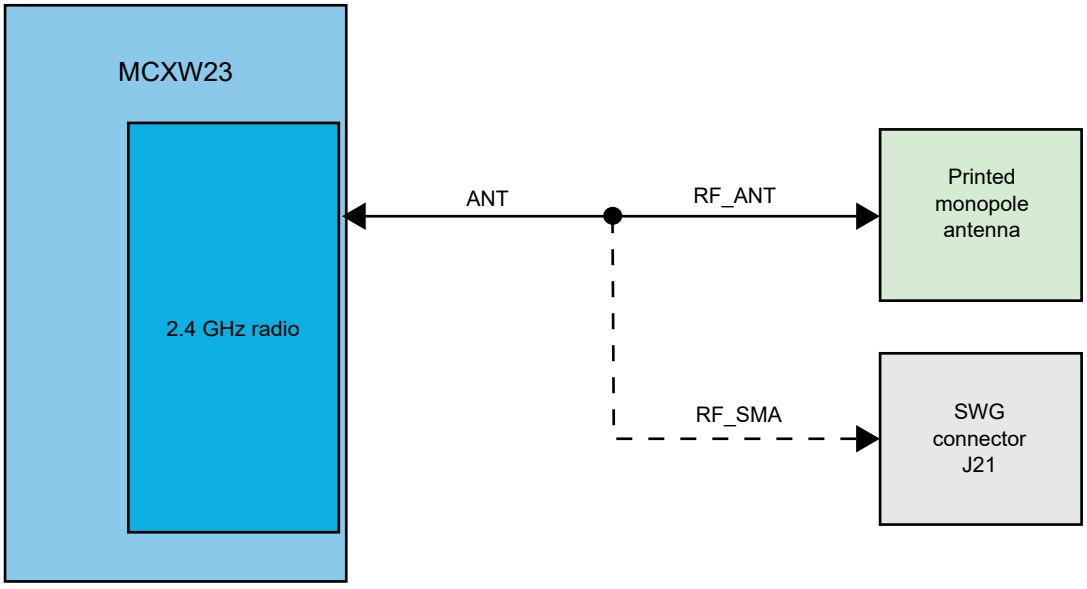

Figure 11. RF diagram

Table 16 describes the FRDM-MCXW23 RF connections.

Table 14. RF connections

RF module	Peripheral devices	
	Part identifier	**Description**
2.4 GHz radio	ANT2	Monopole antenna (copper wire) printed on the PCB. It provides the default RF connection to communicate with the 2.4 GHz radio of the MCX W23 MCU.
	J21	U.FL connector, which provides an alternative RF connection to communicate with the 2.4 GHz radio of the MCX W23 MCU. By default, the RF connection is disabled.

2.7 Accelerometer

The FRDM-MCXW23 board has a 3-axis, compact digital accelerometer U10 (NXP FXLS8974CFR3) designed for use in a wide range of industrial and medical IOT applications that require ultra-low-power wake-up on motion.

The accelerometer supports:

- ±2/4/8/16 g user-selectable, full-scale measurement ranges
- 12-bit acceleration data
- 8-bit temperature sensor data
- I^2C interface frequencies of up to 1 MHz
- 3- or 4-wire SPI interface with clock frequencies of up to 4 MHz The I^2C addresses of the accelerometer are defined as follows:
- Write address: 0x32
- Read address: 0x33

For more information on FXLS8974CFR3, visit nxp.com.

2.8 Temperature sensor

The FRDM-MCXW23 board has a P3T1755 (U37) is a temperature-to-digital converter from -40 °C to +125 °C range. The P3T1755 can be configured for different operation conditions. It can be set in normal mode to periodically monitor the ambient temperature, or in shut-down mode to minimize power consumption. The temperature register always stores a 12-bit two's complement data, giving a temperature resolution of 0.0625 °C

The temperature sensor supports:

- I3C (up to 12.5 MHz) and I2C (up to 3.4 MHz) interface – 32 I2C target addresses – 32 I3C Provisional-ID
- Supply range: 1.4 V to 3.6 V
- Programmable overtemperature alerts
- Resolution: 12 bits (0.0625 °C)
- Accuracy: – 1.4 V < VCC < 3.6 V – ±0.5 °C (maximum) from –20 °C to +85 °C – ±1 °C (maximum) from -40 °C to +125 °C
- Low quiescent current: 4.1 µA supply current (typical)
- ESD protection exceeds 2000 V HBM per JS-001-2017 and 1000 V CDM per JS-002-2018

For more information on P3T1755, visit nxp.com

2.9 Arduino socket

The FRDM-MCXW23 board has an Arduino socket with four connectors, as listed in Table 17.

Table 15. Arduino socket connectors

Part identifier	Connector type	Description
J1	1x8-position receptacle	Destination address (low 32 bits) (DL)
J2	1x10-position receptacle	Destination address (high 32 bits) (DH)
J3	1x8-position receptacle	Power (PWR)
J4	1x6-position receptacle	Analog (AN)

The two 8-position receptacles are placed diagonally opposite to each other. The socket is pin-compatible with an Arduino Uno revision 3 (R3) board.

Figure 12 shows the pinouts of the Arduino socket connectors.

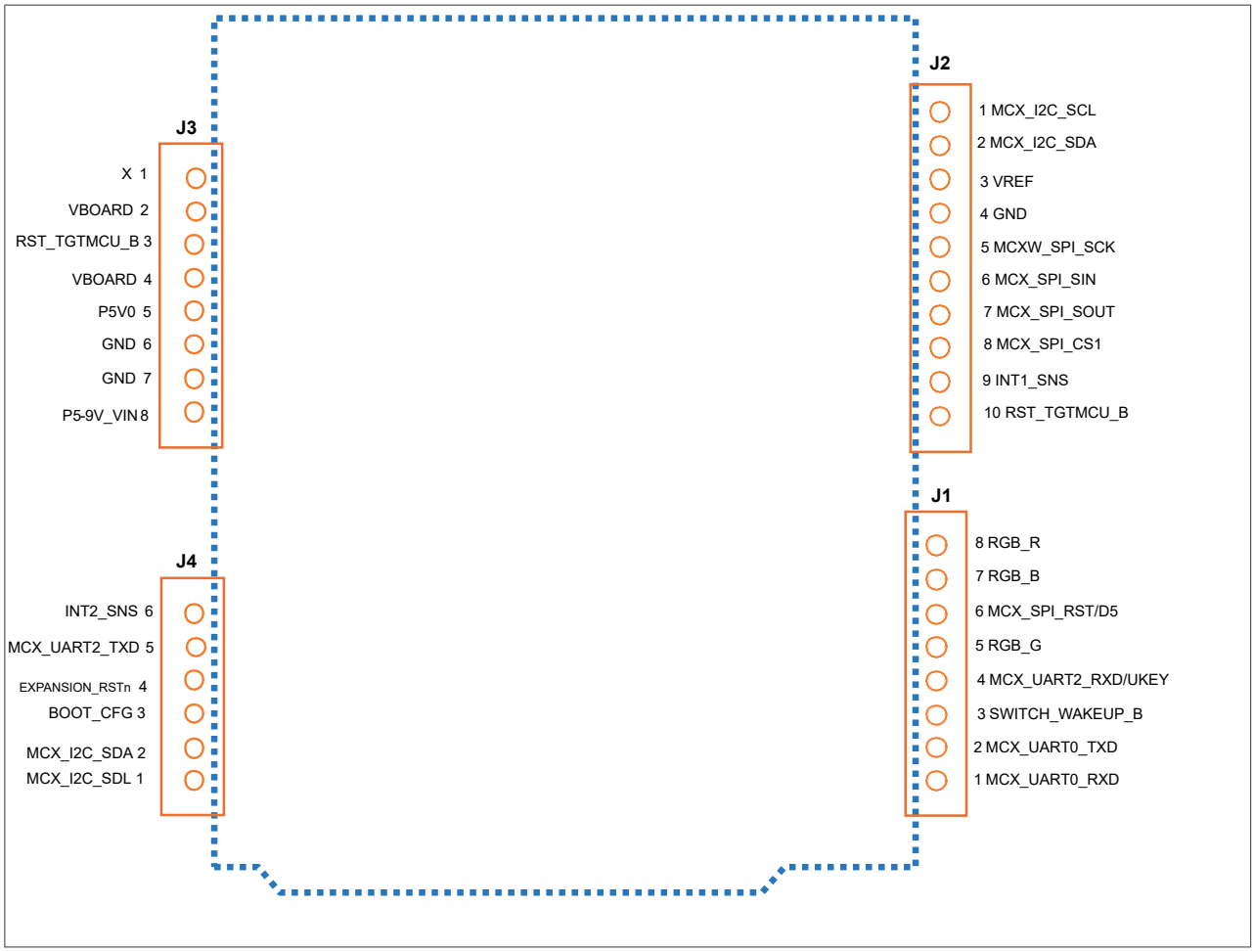

Figure 12. Arduino socket connector pinouts

The Arduino socket allows communication with the following modules of the MCX W23 MCU:

- Low-Power Universal Asynchronous Receiver/Transmitter 0 (UART0) and 1 (UART2)
- Low-Power Serial Peripheral Interface (SPI)
- Low-Power Inter-Integrated Circuit (I2C)

2.10 mikroBUS socket

A mikroBUS socket is a pair of 1x8-position receptacles (connectors) with a proprietary pin configuration and silkscreen markings. It provides many hardware expansion options with few pins.

The FRDM-MCXW23 board has a mikroBUS socket with a pair of 1x8-position receptacles, J5 and J6.

Figure 13 shows the pinouts of the mikroBUS socket connectors.

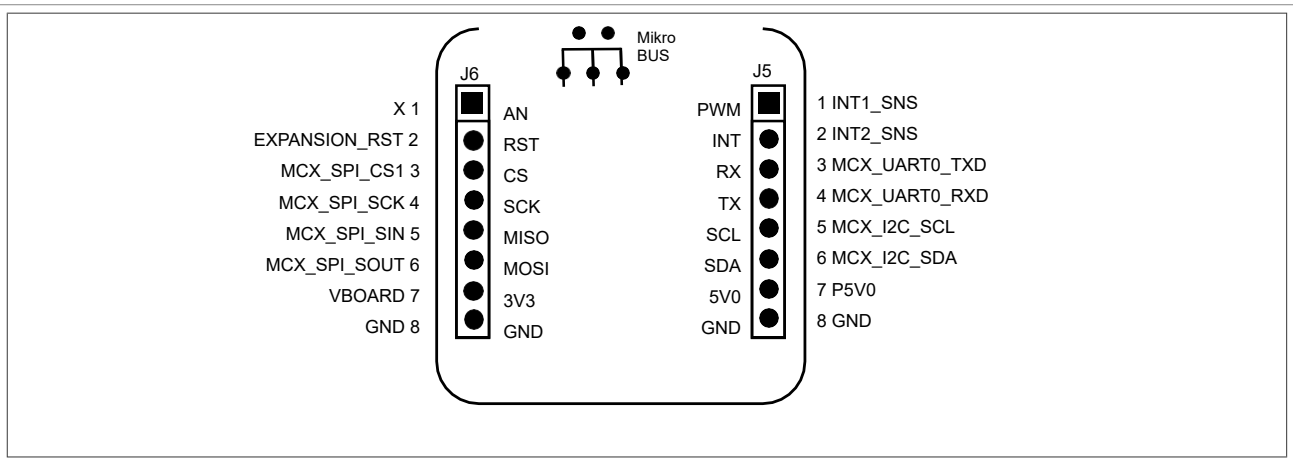

Figure 13. mikroBUS socket connector pinouts

The mikroBUS socket allows communication with the following modules of the MCX W23 MCU:

- Low-Power Universal Asynchronous Receiver/Transmitter 0 (UART0)
- Low-Power Serial Peripheral Interface (SPI)
- Low-Power Inter-Integrated Circuit (I2C)

An add-on board, called *click board*, can be installed on a mikroBUS socket. A click board provides a plug-and-play solution for adding new functionality to a board design. A click board has a pair of 1x8-pin headers that connects to the pair of receptacles on a mikroBUS socket. MikroElektronika (MIKROE) is one of the manufacturers of click boards. To find some example click boards for the FRDM-MCXW23 mikroBUS socket, visit MIKROE website.

2.11 Pmod connector

Digilent Pmod (peripheral module) devices are small input/output interface boards that can be easily integrated with embedded control boards for expanding their capabilities.

The FRDM-MCXW23 board supports a Pmod connector J22 (Digilent PPPC062LJBN-RC) for expanding the capabilities of the board. J22 is not populated on the board. If populated, it can be used to work with a remote host, or as an interface to a Pmod expansion board.

Table 18 shows the pinout of the Pmod connector J22.

Table 16. Pmod connector pinout

Pin number	Signal name	Description
1	MCX_SPI_PCS1	
3	MCX_SPI_SOUT	
5	MCX_SPI_SIN	
7	MCX_SPI_SCK	

Table 16. Pmod connector pinout*...continued*

Pin number	Signal name	Description
2	INT1_SNS	Interrupt signal
4	EXPANSION_RSTn	Reset signal
6	MCX_I2C_SCL	I^2C signals
8	MCX_I2C_SDA	
9, 10	GND	Ground
11, 12	VBOARD	Power supply

The Pmod connector allows communication with the following modules of the MCX W23 MCU:

- Low-Power Serial Peripheral Interface (SPI)
- Low-Power Inter-Integrated Circuit (I2C)

3 MCU-Link OB debug probe

MCU-Link is a debug probe architecture jointly developed by NXP and Embedded Artists. The MCU-Link architecture is based on the NXP LPC55S69 MCU, which is based on an Arm Cortex-M33 core. It can be configured to support different debug feature options.

The MCU-Link architecture is used in:

- Standalone debug probes, such as MCU-Link Pro.
- Onboard debug probes implemented on NXP evaluation boards, such as FRDM-MCXW23. The onboard implementation of MCU-Link is referred to as *MCU-Link OB*.

The FRDM-MCXW23 board implements a subset of the MCU-Link architecture features, as mentioned in Section 3.1. For more details on the MCU-Link architecture, visit the MCU-Link Debug Probe Architecture page.

The MCU-Link OB on the FRDM-MCXW23 board is factory-programmed with the firmware based on the NXP CMSIS-DAP protocol. The firmware also supports all other features supported in the hardware. A custom version of the J-Link firmware to make MCU-Link OB compatible with J-Link LITE is also available. However, this firmware version only supports limited features, including debug/SWO and VCOM. For information on how to update the firmware, see Section 3.4.

3.1 Supported MCU-Link features

MCU-Link includes several mandatory and optional features. Table 19 summarizes the MCU-Link features supported on the FRDM-MCXW23 board.

Table 17. Supported MCU-Link features

Feature	Description
Serial wire debug (SWD)/serial wire debug trace output (SWO)	MCU-Link allows SWD-based debugging with SWO for profiling and/or low overhead debug standard I/O communication.
Virtual communication (VCOM) serial port	MCU-Link adds a serial COM port on the host computer and connects it to the target MCU, while acting as a USB-to-UART bridge.
USB serial input/output (USBSIO[1]) port	MCU-Link adds a USB serial I/O port on the host computer and connects it to the target MCU, while acting as a USB-to-I^2C bridge.
External debug probe support	The MCU-Link interface supports debugging the target MCU (MCX W23) using an external debug probe, instead of MCU-Link. Support for an external debug probe is enabled by disabling the SWD feature.

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

3.2 Supported debug scenarios

Table 20 describes the debug scenarios supported on the FRDM-MCXW23 board.

Table 18. Supported debug scenarios

Debug scenario	Feature support	Required jumper/connector settings
Use MCU-Link for debugging the MCX W23 MCU	SWD: Enabled	MCU-Link SWD disable jumper JP7 is open.
		Target MCU external debugger connector J12 is not used for external connection.

Table 18. Supported debug scenarios*...continued*

Debug scenario	Feature support	Required jumper/connector settings
	VCOM: Enabled	MCU-Link VCOM port disable jumper JP6 is open.
Use an external debugger for debugging the MCX W23 MCU	SWD: Not supported	Short JP7.
		Connect the external debugger to J12.
	VCOM: Supported	JP6 is open.

3.3 MCU-Link firmware update utility installation

The MCU-Link debug probe is supported on a host computer running a Windows 10/11, MacOS X, or Ubuntu Linux operating system (OS). The debug probe works with standard OS drivers. For Windows, the MCU-Link firmware installation program also includes information files to provide user-friendly device names.

Support for MCU-Link can be enabled using the LinkServer utility, which is an NXP GDB server and flash utility that supports many NXP debug probes. For more details on this utility, visit the https://nxp.com/linkserver page.

Running the LinkServer installer also installs a firmware update utility and the drivers (information files) required for MCU-Link. NXP recommends you to use the LinkServer installer for installing the MCU-Link firmware update utility.

Note: *If the MCU-Link firmware version is 3.122 or later, an automatic firmware update can be done using LinkServer installer version 1.4.85 or later. For more details on automatic firmware update, refer to the Readme mark-down file in the LinkServer installation package. However, if the current firmware version is earlier than 3.122, you require to run manually the MCU-Link firmware update utility, which is included in the LinkServer installation package. To update the MCU-Link firmware using the firmware update utility, see Section 3.4*

To work with MCU-Link, NXP recommends using the latest MCU-Link firmware. The steps to update the MCU-Link firmware manually are provided in Section 3.4. Before updating the MCU-Link firmware, check the versions of the MCUXpresso IDE and LIBUSBIO (if you are using these tools) installed on your host computer. Then, check the compatibility of these tools with the MCU-Link firmware by referring to Table 21. If you are using the MCUXpresso for Visual Studio Code extension or a third-party IDE from IAR or Keil, NXP recommends using the latest MCU-Link firmware version.

Table 19. Compatibility check between MCUXpresso IDE and MCU-Link firmware

MCUXpresso IDE version	Supported MCU-Link firmware version	USB driver type	CMSIS-SWO support	FreeMASTER support via	
				SWD/JTAG	USB bridge
MCUXpresso 11.3 or later	V1.xxx and V2.xxx	HID	No	Yes	Yes
MCUXpresso 11.7.0 or later	V3.xxx (up to and including V3.108)	WinUSB	No	Yes	FreeMASTER V3.2.2 or later
MCUXpresso 11.7.1 or later	V3.117 and later	WinUSB	Yes	Yes	FreeMASTER V3.2.2 or later

3.4 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 JP5, and reconnect the board. The red MCU-Link status LED D7 lights up and stays on. For more details on MCU-Link LEDs, see Section 3.9.
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" or later.
3. Navigate to the `MCU-LINK_installer_Vx_xxx` directory, where `Vx_xxx` indicates the version number, for example, `V3.117`.
4. Follow the instructions in the `Readme.txt` to find and run the firmware update utility for CMSIS-DAP or J-Link firmware version.
5. Disconnect the board from the host computer, open jumper JP5, and reconnect the board. The board is enumerated on the host computer as a WinUSB or HID device (depending on the firmware version, see Table 21).

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.*

3.5 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
- Arm Keil MDK

3.5.1 Using MCU-Link with MCUXpresso IDE

The MCUXpresso IDE recognizes any type of MCU-Link probe that uses either the 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 3.4.

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 installed on your host computer. To check the compatibility of the MCU-Link firmware you want to use with your MCUXpresso IDE, see Table 21.

3.5.2 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 3.3. For more details on MCUXpresso for Visual Studio Code, visit the MCUXpresso for Visual Studio Code page.

3.5.3 Using MCU-Link with third-party IDEs

The MCU-Link debug probe can be used with third-party IDEs, such as IAR Embedded Workbench and Arm Keil MDK. For more details, refer to the third-party tool documentation, covering the use of generic CMSIS-DAP probes or J-Link probes (depending on the firmware image you are using).

3.6 MCU-Link USB connector

The FRDM-MCXW23 board has a USB Type-C connector J10, which allows you to connect MCU-Link with your host computer. It can also be used to supply 5 V power to the board.

3.7 VCOM port (USB to target UART bridge)

MCU-Link supports a feature, known as *virtual communication (VCOM) serial port*. This feature allows MCU-Link to add a serial COM port on the host computer and connect it to the target MCU. In this setup, MCU-Link acts as a USB-to-UART bridge.

In the FRDM-MCXW23 board, MCU-Link is connected to the UART0 module of the target MCU, by default. However, the board also allows connecting MCU-Link to the UART2 module of the target MCU, instead of the UART0 module. Connecting to the UART2 module requires:

- Place JP13 and JP14 [2-3]pin

To use MCU-Link as a USB-to-UART bridge, follow these steps:

1. Ensure that the jumper JP5 is open (MCU-Link boots normally).
2. Ensure that the jumper JP6 is open (MCU-Link VCOM port is enabled).
3. Connect the MCU-Link USB connector J10 to the USB port of the host computer.

When you boot the FRDM-MCXW23 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.

The VCOM function can be disabled by shorting jumper JP6, before powering up the board. Changing the JP6 setting (open/short) after powering up the board has no impact on the MCU-Link VCOM function.

3.8 MCU-Link status LEDs

The FRDM-MCXW23 board has three status indicator LEDs for MCU-Link. Table 22 lists these LEDs and describes how each LED behaves in different MCU-Link modes.

Table 20. MCU-Link LEDs

Part identifier	PCB label	LED color	LED function		
			Normal operation (with CMSIS-DAP)	**Normal operation (with J-Link)**	**ISP (firmware update) mode**
D6	USB_ACT	Green	Indicates USB communication. The LED lights up after successful USB enumeration at startup, and then stays ON.	The LED remains OFF.	The LED remains OFF.
D7	ISP_EN	Red	Indicates MCU-Link status/ SWD activity. It acts as a heartbeat LED (fades in/ out repeatedly), with SWD activity overlaid. If an error occurs at startup, the D7 LED blinks rapidly.	The LED remains OFF.	The LED lights up when MCU-Link (LPC55S69) boots in ISP mode.
D8	VCOM_ ACT	Green	Indicates if the VCOM port is receiving/sending data. The LED lights up when MCU-Link boots, and then	Indicates if the VCOM port is receiving/sending data. The LED lights up when MCU-Link boots, and then	The LED remains OFF.

Table 20. MCU-Link LEDs*...continued*

Part identifier	PCB label	LED color	LED function		
			blinks when debug activity happens.	blinks when debug activity happens.	

4 Board errata

Not applicable for the current board revision.

5 Related documentation

Table 23 lists some additional documents and resources that you can refer to for more information on the FRDM-MCXW23 board. Some of these documents may be available only under a nondisclosure agreement (NDA). To access such a document, contact your local NXP field applications engineer (FAE) or sales representative.

Table 21. Related documentation

Document	Description	Link/how to obtain
MCX W23 Reference Manual	Provides a detailed description about the MCX W23 MCU and its features, including memory maps, power supplies, and clocks.	Contact an NXP FAE or sales representative
MCX W23 Product Family Data Sheet	Provides information about the MCX W23 electrical characteristics, hardware design considerations, and ordering information.	
FRDM-MCXW23 board schematics	Provides a circuit representation showing the functionality and connectivity of the FRDM-MCXW23 board components.	

6 Acronyms

Table 24 lists the acronyms used in this document.

Table 22. Acronyms

Acronym	Description
ADC	Analog-to-Digital Converter
CAN	Controller area network
DNP	Do not populate / do not place
DUT	Device under test
FlexCAN	Flexible Controller Area Network
FSK	Frequency shift keying
GFSK	Gaussian frequency shift keying
GMSK	Gaussian minimum shift keying
HID	Human interface device
I^2C	Inter-Integrated Circuit
IoT	Internet of Things
ISP	In-System Programming
LCD	Liquid-crystal display
LDO	Low-dropout regulator
LE	Low Energy
LED	Light-emitting diode
I2C	Low-Power Inter-Integrated Circuit
SPI	Low-Power Serial Peripheral Interface
UART	Low-Power Universal Asynchronous Receiver/Transmitter
MCU	Microcontroller unit
MSK	Minimum shift keying
NMI	Non-maskable interrupt
OB	Onboard
OS	Operating system
PCS	Peripheral chip select
PDA	Personal digital assistant
PWM	Pulse Width Modulator
RF	Radio frequency
RTC	Real-time clock
RX	Receive
SPI	Serial Peripheral Interface
SWD	Serial wire debug
SWO	Serial wire debug trace output

Table 24. Acronyms*...continued*

Acronym	Description
TFT	Thin-film transistor
TPM	Timer/PWM Module
TX	Transmit
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
USBSIO	USB serial input/output
VCOM	Virtual communication

7 Revision history

Table 23 summarizes the revisions done to this document.

Table 23. Revision history

Document ID	Release date	Description
UM12359 v.1.0	10 July 2025	Initial public release

Legal information

Definitions

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