UM12286

FRDM-MCXE247 Board User Manual

Rev. 3.0 — 5 August 2025 User manual

Document information

Information	Content
Keywords	UM12286, FRDM-MCXE247, MCX E247, Arduino, mikroBUS, MCU-Link
Abstract	The FRDM-MCXE247 board is a design and evaluation platform based on the NXP MCX E247 MCU.

1 Board overview

The FRDM-MCXE247 board is a design and evaluation platform based on the NXP MCX E247 microcontroller (MCU). The MCX E247 MCU is based on an Arm Cortex-M4F core, running at speeds of up to 112 MHz with a 2.70 V–5.5 V supply.

The FRDM-MCXE247 board consists of one MCX E247 device with a 64 Mbit external serial flash (provided by Winbond). The board also features FXLS8974CFR3 I2C accelerometer sensor, one NMH1000 I2C magnetic switch, three TJA1057BTK CAN PHY, Ethernet PHY, RGB LED, push buttons, and MCU-Link debug probe circuit. The board is compatible with the Arduino shield modules, Pmod boards, and mikroBUS.

For debugging the MCX E247 MCU, the FRDM-MCXE247 board uses an onboard (OB) debug probe, MCU-Link OB, which is based on another NXP MCU: LPC55S16. For simplicity, the MCX E247 MCU and the LPC55S16 MCU are respectively referred to as "target MCU" and "debug MCU" at some places in this document.

This document provides details about the FRDM-MCXE247 board interfaces, accelerometer, power supplies, clocks, connectors, jumpers, push buttons, LEDs, and MCU-Link OB debug probe.

1.1 Block diagram

Figure 1 shows the FRDM-MCXE247 board block diagram.

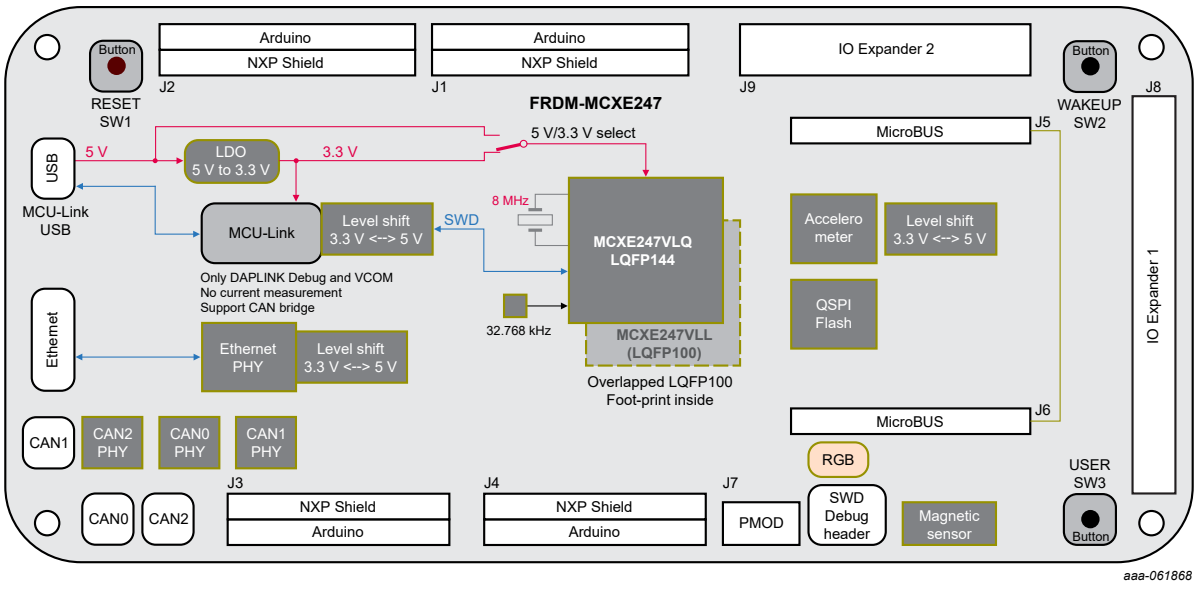

Figure 1. FRDM-MCXE247 block diagram

1.2 Board features

Table 1 lists the features of the FRDM-MCXE247 board.

Table 1. FRDM-MCXE247 features

Board feature	Target MCU features used	Description
MCU (target MCU)		NXP MCX E247 MCU is a 32-bit general-purpose microcontroller based on the Arm Cortex-M4F core. This product series provides up to 112 MHz CPU performance with DSP and FPU support, up to 2 MB Flash, and up to 256 kB SRAM.

Table 1. FRDM-MCXE247 features...*continued*

Board feature	Target MCU features used	Description
		Note: *For details on the MCX E247 MCU, see MCX E24x Reference Manual and MCX E24x Data Sheet mentioned in Section 5.*
Power supply		P5V0 (5 V) input power supply using one of the following power sources: • MCU-Link USB2.0 Type-C connector • Arduino shield compatible header • One LDO for 3.3 V power supply • Jumpers and resistors configuration for different power supplies
Clock		• Crystal oscillators for: – 8 MHz system reference clock – 50 MHz Ethernet PHY clock input – 16 MHz clock input for MCU-Link • Active crystal oscillator for: – 32.768 kHz real-time clock (RTC)
Flash memory	QuadSPI	Winbond W25Q64JVSSIQ - 64 Mbit QSPI flash memory (populated)
Ethernet	Ethernet controller (ENET0)	10 / 100 Mbit/s (RMII) LAN8741 Ethernet PHY and RJ45
I/O headers		Headers compatible with: • Arduino shields (outer rows) and FRDM header (inner rows) • Mikroe click board • Peripheral module (Pmod)
FlexCAN interface	CAN0/CAN1/CAN2 module	Provides three high-speed CAN transceivers accessible through 2x2-pin header J17/J18/J19
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, or USB-to-I2C bridge. • 10-pin Arm JTAG/SWD connector for connecting an external debug probe.
PCB		118 mm x 55 mm
Orderable part number		FRDM-MCXE247

1.3 Kit contents

Table 2 lists the items included in the FRDM-MCXE247 board hardware kit.

Table 2. Kit contents

Item	Quantity
FRDM-MCXE247 board hardware assembly	1
USB 2.0 Type-A to Type-C cable, 1 meter	1
FRDM-MCXE247 Quick Start Guide	1

1.4 Board pictures

Figure 2 shows the top-side view of the FRDM-MCXE247 board with the MCX E247 MCU (target MCU), QSPI flash, accelerometer (I2C sensor), and magnetic sensor highlighted.

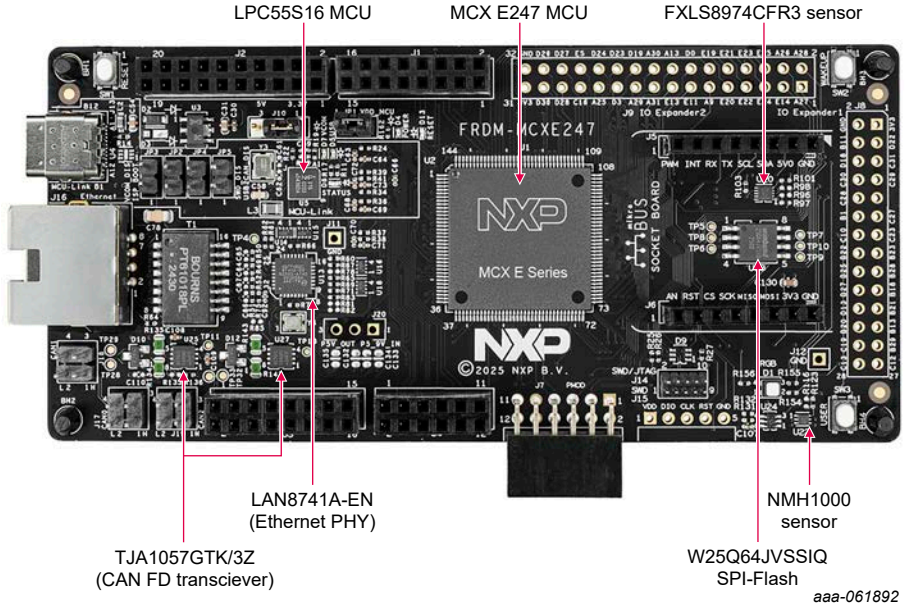

Figure 2. FRDM-MCXE247 board top-side view

Figure 3 shows the bottom-side view of the FRDM-MCXE247 board.

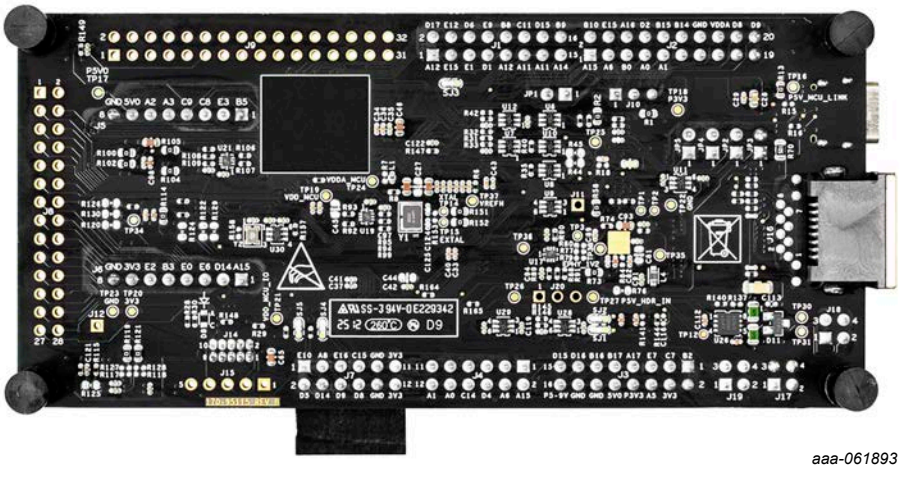

Figure 3. FRDM-MCXE247 board bottom-side view

1.5 Connectors

Figure 4 shows the FRDM-MCXE247 board connectors.

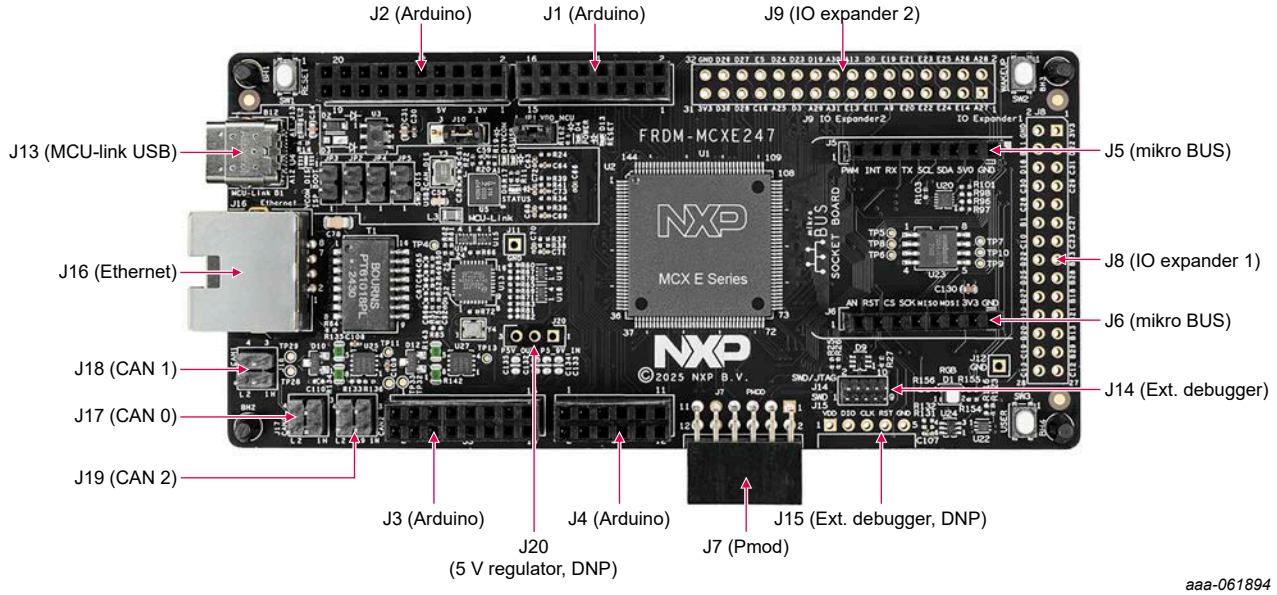

Figure 4. FRDM-MCXE247 board connectors

Table 3 describes the connectors available on the FRDM-MCXE247 board.

Table 3. FRDM-MCXE247 connectors

Part identifier	PCB label	Connector type	Description	Reference section
J1		2 x 8-pin header	Arduino compatible I/O header (outer rows) and FRDM header (inner rows)	Section 2.9
J2		2 x 10-pin header		
J3		2 x 8-pin header		
J4		2 x 6-pin header		
J5		1x 8-pin header	mikroBUS socket connectors	Section 2.10
J6		1 x 8-pin header		
J7	PMOD	2 x 6-pin header	Pmod connector	Section 2.11
J8	IO Expander 1	2 x 14 pins header (DNP)	IO expander 1	Section 2.12
J9	IO Expander 2	2 x 16-pin header (DNP)	IO expander 2	Section 2.12
J13	MCU-Link	USB Type-C connector	MCU-Link USB connector	Section 3.6
J14	SWD/JTAG	2 x 5 pins header	Debug (JTAG / SWD) connector to connect an external debug probe	Section 3.2
J15	SWD	1 x 5-pin header	Debug SWD connector to connect an external debug probe	See board schematic for detail
J16	Ethernet	RJ45 connector	Shielded RJ45 connector jack	Section 2.4
J17	CAN0	2 x 2-pin header	Connects to the CAN0 bus and allows external connection with the bus	Section 2.5
J18	CAN1	2 x 2-pin header	Connects to the CAN1 bus and allows external connection with the bus	Section 2.5

Table 3. FRDM-MCXE247 connectors...*continued*

Part identifier	PCB label	Connector type	Description	Reference section
J19	CAN2	2 x 2-pin header	Connects to the CAN2 bus and allows external connection with the bus	Section 2.5

1.6 Jumpers

Figure 5 shows the FRDM-MCXE247 board jumpers.

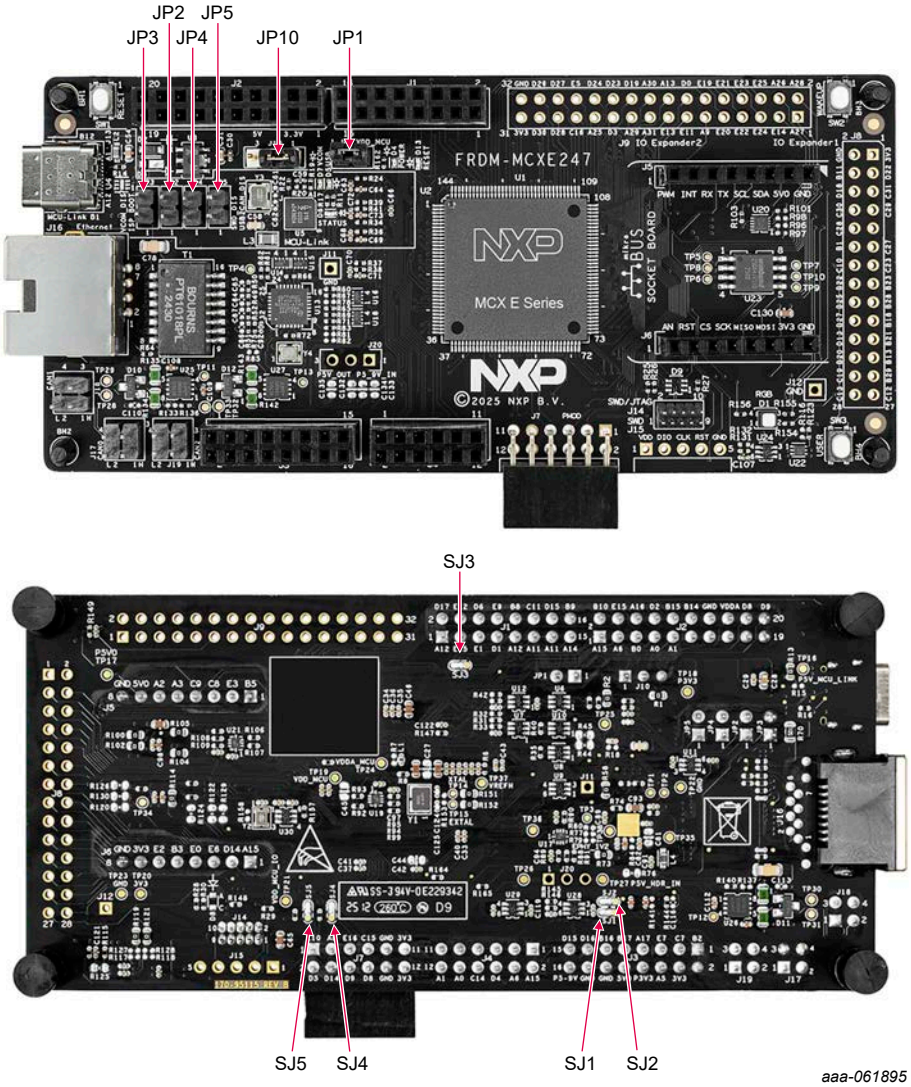

Figure 5. FRDM-MCXE247 board jumpers

Table 4 describes the FRDM-MCXE247 board jumpers.

Table 4. FRDM-MCXE247 jumpers

Part identifier	Jumper type	Description	Reference section
J10	1x3-pin header	MCU power selection	Section 2.1

Table 4. FRDM-MCXE247 jumpers*...continued*

Part identifier	Jumper type	Description	Reference section
		• Pin 1-2 shorted (**default setting**): MCU is sourced from the P3V3 power supply. • Pin 2-3 shorted: MCU is sourced from the 5 V power supply.	
JP1	1x2-pin header	MCU power selection • Pin 1-2 shorted (**default setting**): VDD_MCU is sourced from the P3V3 power supply. • Pin 1-2 open: VDD_MCU power down.	
JP2	1x2-pin header	MCU-Link (LPC55S16) ISP mode enable jumper: • Open (default setting): MCU-Link (LPC55S16) 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. ***Note:*** *By default, the MCU-Link internal flash is preprogrammed with a version of the CMSIS-DAP firmware.*	Section 3.4
JP3	1x2-pin header	MCU-Link VCOM port disable jumper: • 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 3.2
JP4	1x2-pin header	MCU-Link SWD disable jumper: • Open (**default setting):** Enables the MCU-Link SWD feature • Shorted: Sends a low signal on LPC_HW_VER_7 to disable the onboard MCU-Link SWD feature. ***Note:*** *This configuration is required to enable target MCU debug through an external debug probe.*	Section 3.2
JP5	1x2-pin header	USB-to-CAN bridge disable jumper: • Open (**default setting**): MCU-Link acts as a USB-to-CAN bridge between the host computer and the target MCU. • Shorted (default setting): USB-to-CAN bridge is disabled.	See board schematic for detail
SJ1	1x3-pin solder bridge	Signal function switch • Pin 1-2 shorted (**default setting**): connect PTB13/ CAN2_TX to CAN PHY U27 pin 1 • Pin 2-3 shorted:connect U29 pin 4 to CAN PHY U27 pin 1	See board schematic for detail
SJ2	1x3-pin solder bridge	Signal function switch • Pin 1-2 shorted (**default setting**): connect PTB12/ CAN2_RX to CAN PHY U27 pin 4 • Pin 2-3 shorted:connect U28 pin 4 to CAN PHY U27 pin 4	See board schematic for detail

Table 4. FRDM-MCXE247 jumpers...*continued*

Part identifier	Jumper type	Description	Reference section
SJ3	1x3-pin solder bridge	Signal function switch • Pin 1-2 shorted (**default setting**): connect PTE15 to header J1 pin 3 • Pin 2-3 shorted: connect PTA11 to header J1 pin 3	See board schematic for detail
SJ4	1x3-pin solder bridge	Signal function switch • Pin 1-2 shorted (**default setting**): connect PTD8/LPI2C1_SDA-PMOD to header J7 pin 8 • Pin 2-3 shorted: connect PTA15/LPSPI_PCS3-PMOD to header J7 pin 8	See board schematic for detail
SJ5	1x3-pin solder bridge	Signal function switch • Pin 1-2 shorted (**default setting**): connect PTD9/LPI2C1_SCL-PMOD to header J7 pin 6 • Pin 2-3 shorted: connect PTE13/LPSPI_PCS2-PMOD to header J7 pin 6	See board schematic for detail

1.7 Push buttons

Figure 6 shows the FRDM-MCXE247 board push buttons.

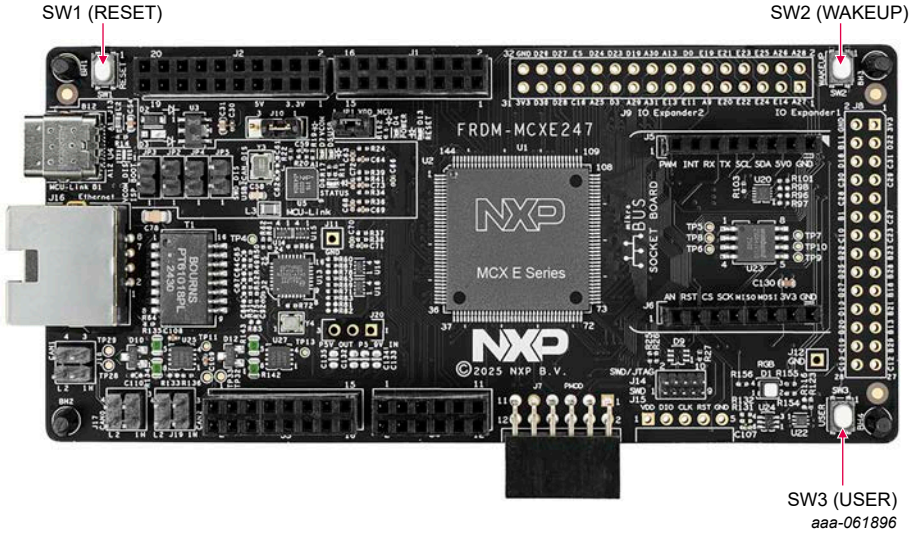

Figure 6. FRDM-MCXE247 board push buttons

Table 5 describes the FRDM-MCXE247 board push buttons.

Table 5. FRDM-MCXE247 push buttons

Part identifier	PCB label	Name / function	Description
SW1	RESET	Reset button	Pressing SW1 asserts the MCX E247 MCU pin PTA5 (RESET_b), which wakes up the MCU from any mode. When SW1 is pressed, the reset LED D13 turns ON.
SW2	WAKEUP	Power (wake-up) button	SW2 is a general-purpose input and a low-power wake-up unit pin. Pressing SW2 gives a low level on PTA9/WAKEUP_SW2, otherwise, it is a high level on PTA9/WAKEUP_SW2.

Table 5. FRDM-MCXE247 push buttons...*continued*

Part identifier	PCB label	Name / function	Description
SW3	USER	User button	Pressing SW3 gives a low level on the MCX E247 MCU pin PTC10.

1.8 LEDs

The FRDM-MCXE247 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-MCXE247 board LEDs.

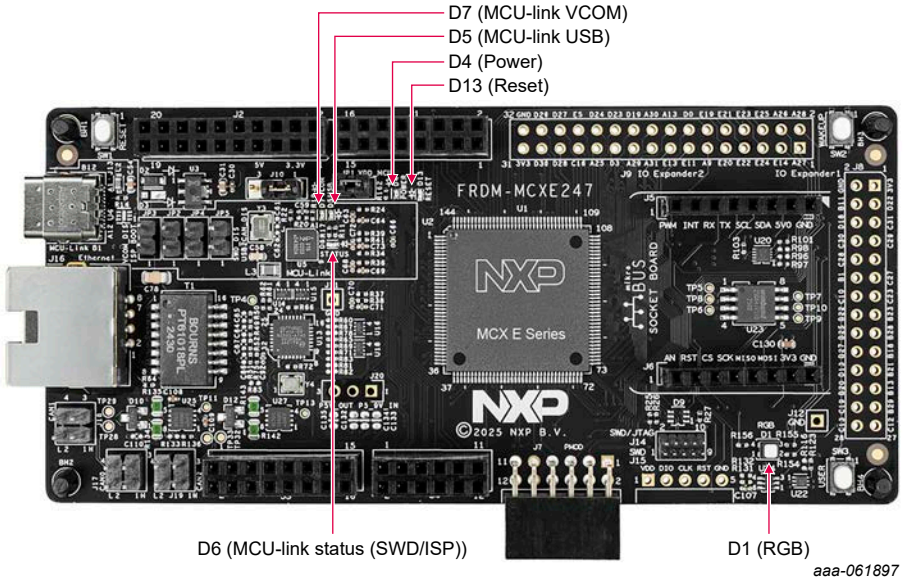

Figure 7. FRDM-MCXE247 board LEDs

Table 6 describes the FRDM-MCXE247 board LEDs except for MCU-Link-specific LEDs, which are described in Section 3.9.

Table 6. FRDM-MCXE247 LEDs

Part identifier	PCB label	LED color	LED name/function	Description (when LED is ON)
D4	POWER	Green	MCU power-on indicator LED	Indicates MCU power-on status. When the MCU is powered up, D4 turns ON.
D13	RESET	Red	Reset LED	Indicates system reset activity. When board reset is initiated, for example, by pressing the reset button (SW1), D13 turns ON.
D1	RGB	Red/green/blue	RGB LED	This LED is controlled via three GPIO pins of the MCX E247 MCU. Each color channel (Red, Green, Blue) is connected to a specific GPIO as follows: • Red LED → PTC13 • Green LED → PTB11 • Blue LED → PTC12 Driving a low level on any of these pins turns on the corresponding LED color, as the

Table 6. FRDM-MCXE247 LEDs*...continued*

Part identifier	PCB label	LED color	LED name/function	Description (when LED is ON)
				LEDs are typically connected in an active-low configuration.

Note: *MCU-Link-specific LEDs D5, D6, and D7 are described in Section 3.9.*

2 Functional description

This section explains the functions and usage of various interfaces on the the FRDM-MCXE247 board.

Note: *For details on the MCX E247 MCU, see MCX E24x Reference Manual and MCX E24x Data Sheet mentioned in Section 5.*

2.1 Power supplies

The FRDM-MCXE247 board is powered up using one of the following primary power supply options:

- P5V_MCU_LINK supply from MCU-Link USB2.0 Type-C connector (J13)
- P5V_HDR_IN supply from 5 V regulator populated at 3-pin jumper (J20) (Not populated by default)
- P5V0 supply from Arduino Shield compatible header, J3 (pin 10)

The power supplies provide power to board components, including the MCX E247 MCU, MCU-Link, QSPI flash memory, CAN transceiver, accelerometer, Arduino socket, mikroBUS socket, and Pmod connector.

The MCX E247 MCU can be powered by a supply voltage ranging from 2.7 V to 5.5 V. The J10 jumper on the board is provided to power the MCU with either 3.3 V or 5 V. However, the MCU-Link debugger MCU LPC55S16JEV59 is always 3.3 V powered.

Note: *When powered by 5 V, the onboard Ethernet PHY, Sensors (FXLS8974CFR3 and NMH1000), and MCU-Link can all communicate normally with the MCX E247 MCU through a 3.3 V <-> 5 V level conversion circuit. However, the flash W25Q64JVSSIQ only works normally when the MCX E247 MCU is powered by 3.3V.*

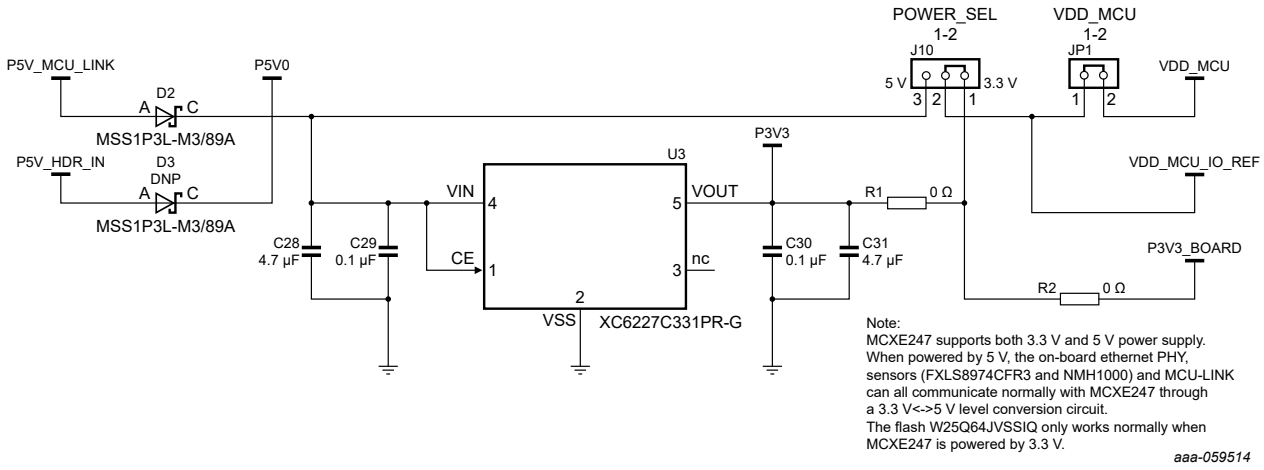

Figure 8. Power supply schematic

5 V power sources and selection

Table 7 describes the 5 V input power sources and their output power supplies.

Table 7. 5 V power sources and selection

Part identifier	Device / power source	Output power supply	Description
J13	MCU-Link USB2.0 Type-C connector	P5V_MCU_LINK	• One of the sources of P5V0 (5 V) supply (default option) • USB regulator input power supply for MCU-Link microcontroller LPC55S16
J20 (DNP)	DC voltage regulator attached to connector	P5V_HDR_IN	One of the sources for P5V0 (5 V) supply
J3 (pin 10)	Arduino shield compatible header	P5V0	Power supply for: • XC6227C331PR-G LDO voltage regulator (U3) • TJA1057 CAN PHY (U25/U26/U27) and CAN 2x2-pin header (J17/J18/J19) • mikroBUS connector (J5)

3.3 V power sources and selection

Table 8 describes the 3.3 V input power sources and their output power supplies.

Table 8. 3.3 V power sources and selection

Part identifier	Device / power source	Output power supply	Description
U3	XC6227C331PR-G	P3V3	One of the sources for P3V3 supply (default selection)
J3 (pin 8)	Arduino shield compatible header	P3V3	• Power supply for: – FXLS8974CFR3 I2C sensor – QSPI flash memory (W25Q64JVSSIQ) – Crystal oscillator (Y4/Y2) – mikroBUS connector (J6) – Pmod connector (J7) – I/O Expander1 connector (J9) – I/O Expander1 connector (J8) – MCU-Link LPC55S16 (U5) • Power source for the VDD_MCU supply through the JP1 • Power source for EPHY_VDDIO and EPHY_VDDA supplies for Ethernet transceiver LAN8741 (U13)

2.1.1 Power supply configuration

Once the main power configurations are set, the target MCU power configurations must be made. These jumpers provide access to insert ammeters in all the supplies connecting to the MCX E247 device. They also provide a means of connecting external supplies to any of the MCX E247 MCU power pins.

Table 9 describes the power supply configurations for MCU analog, USB, and other operations.

Table 9. MCU power supplies

Power source	Zero-ohm resistor or Jumper used	Power supply rail	Description
P3V3	• R1 resistor (installed) • J10 jumper (1-2 short) • JP1 jumper (1-2 short)	VDD_MCU	Power supply for the MCU

Table 9. MCU power supplies*...continued*

Power source	Zero-ohm resistor or Jumper used	Power supply rail	Description
	• R1 resistor (installed) • J10 jumper (1-2 short)	VDD_MCU_IO_REF	Power supply for the level shifters, IO pullup
	• R1 resistor (installed) • R2 resistor (installed)	P3V3_BOARD	• Power supply for: – FXLS8974CFR3 I2C sensor – Magnetic switch – Level shifters – QSPI flash memory (W25Q64JVSSIQ) – Crystal oscillator (Y4/Y2) – CAN transceiver TJA1057 (U25/U26/U27) – RGB LED (D1) – mikroBUS connector (J6) – Pmod connector (J7) – IO Expander1 connector (J9) – IO Expander1 connector (J8) – MCU-Link LPC55S16 (U5) • Power source for the VDD_MCU supply through the JP1 • Power source for EPHY_VDDIO and EPHY_VDDA supplies for Ethernet transceiver LAN8741 (U13)

2.2 Clocks

Table 10 describes the clocks available on the FRDM-MCXE247 board.

Table 10. FRDM-MCXE247 clocks

Clock generator	Clock frequency	Destination	Destination
Crystal oscillator, Y1(CX3225 GA08000 D0PPVTT, KYOCERA)	8 MHz	• PTB7/8M_EXTAL of target MCU MCX E247 • PTB6/8M_XTAL of target MCU MCX E247	For high-frequency accurate timebase
Crystal oscillator, Y2(KC2016K32 K7680C12A00, KYOCERA)	32.768 kHz	PTA7/RTC_CLKIN of target MCU MCX E247	MCX E247 MCU (RTC section)
Crystal oscillator, Y3(CX3225 SB16000 D0GLLCC, KYOCERA)	16 MHz	XTAL32M_N/P pins of LPC55S16 MCU-Link	Option for external clock input
Crystal oscillator, Y4(KC2520Z50. 0000C1GX00, KYOCERA)	50 MHz	RMII 10/100 Mbit/s Ethernet transceiver LAN8741A-EN	Provides clock at XTAL1/CLKIN pin of Ethernet PHY depending upon the R76 resistor setting (DNP by default). Also, it provides a provision to feed the clock back into the target MCU (MCX E247) through (ENET_TXCLK) ***Note:*** *R76 is DNP by default, and populating it disables the oscillator.*

2.3 MCU overlapped footprint

The FRDM-MCXE247 can support MCUs in two different package types: LQFP144 (MCXE247VLQ) and LQFP100 (MCXE247VLL). The LQFP100 footprint is covered within the LQFP144 footprint.

By default, the board comes with the LQFP144-packaged chip (MCXE247VLQ) soldered. To evaluate the LQFP100-packaged chip (MCXE247VLL), remove the default LQFP144 chip and replace it with the LQFP100-packaged chip (MCXE247VLL).

2.4 Ethernet interface

The target MCU (MCX E247) features one Ethernet controller (ENET) module.

On the FRDM-MCXE247 board, the Ethernet controller connects to an RJ45 connector through an Ethernet PHY transceiver. The FRDM-MCXE247 only supports RMII configuration. For this reason, the TXD3 and TXD2 pins of the Ethernet PHY (LAN8741A-EN) have been grounded through resistors R61 and R62, respectively.

Table 11 describes the onboard devices supporting the Ethernet interface.

Table 11. Ethernet interface devices

Part identifier	Part name and Manufacturer	Description
J16	Heling MJ88B-B011-RVL11-P	Shielded RJ45 connector jack with magnetic built-in to connect to an Ethernet cable
U13	Microchip Technology LAN8741 A-EN	Single-chip 10 /100 Mbit/s RMII Ethernet PHY compliant with IEEE802.3/802.3u (Fast Ethernet), ISO 802-3/IEEE 802.3 (10 BASE-T), and energy-efficient Ethernet IEEE 802.3az
T1	Bourns Inc. PT61018PEL	Dual-channel 16-pin Ethernet transformer for LAN 10/100 Base-Tx

Input to the XTAL1/CLKIN pin of the Ethernet PHY is a 50 MHz clock from an external 50 MHz crystal oscillator (Y4). The oscillator is enabled by default. The clock circuit also provides a provision to feed the clock back into the target MCU (MCX E247) through ENET_TXCLK.

Note: *The 50 MHz oscillator can be disabled by populating the R76 resistor.*

2.5 FlexCAN interface

The MCX E247 MCU has three flexible controller area network (FlexCAN) modules: CAN0, CAN1 and CAN2. The FRDM-MCXE247 board supports communication with the CAN0/CAN1/CAN2 module.

Table 12 describes the FRDM-MCXE247 FlexCAN connections.

Table 12. FlexCAN connections

FlexCAN module	Peripheral devices		
	Part identifier	Manufacturer and part number	Description
CAN0/ CAN1/ CAN2	U25/ U26/U27	NXP TJA1057BTK	A high-speed CAN transceiver, which drives CAN signals between the CAN module of the MCX E247 MCU and a physical two-wire CAN bus. It performs the following functions: • Receives digital data from the MCU, converts it into analog data, and sends it to CAN bus lines. • Receives analog data from the CAN bus lines, converts it into digital data, and sends it to the MCU.

Table 12. FlexCAN connections*...continued*

FlexCAN module	Peripheral devices		
	Part identifier	Manufacturer and part number	Description
	J17/ J18/J19		A 2x2-pin header that allows external CAN connection with the CAN bus. It has the following pinout: • Pin 1: High-level CAN bus line connection • Pin 2: Low-level CAN bus line connection • Pin 3: Power connection (P5V0) • Pin 4: GND

Figure 9 shows the FlexCAN0 interface schematic diagram.

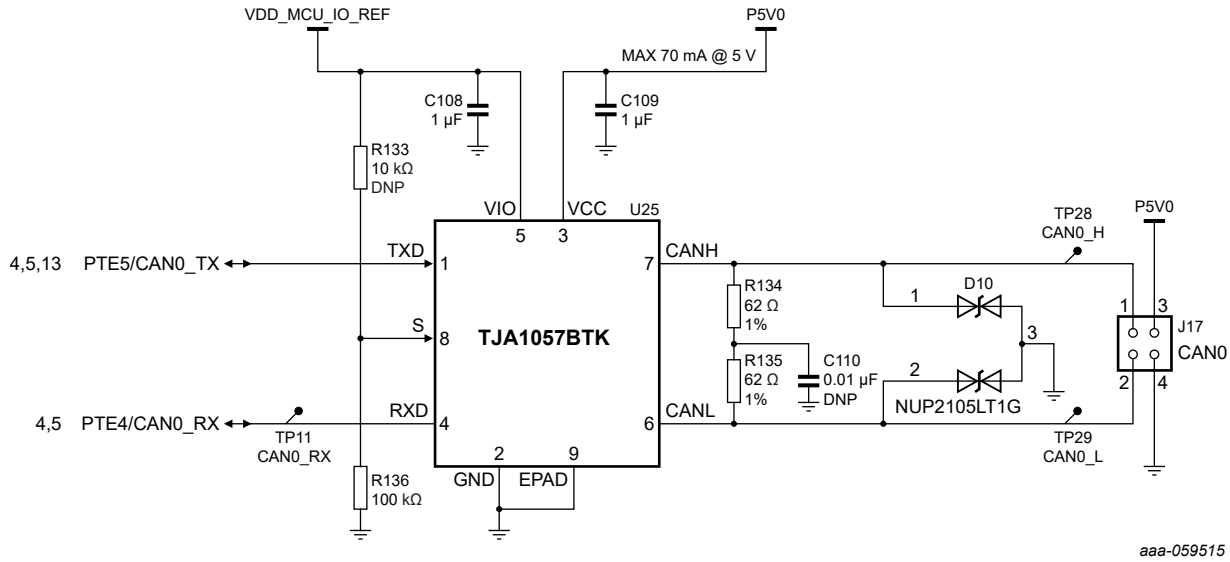

Figure 9. FlexCAN0 interface schematic

2.6 Accelerometer sensor

The FRDM-MCXE247 board has a 3-axis, compact digital accelerometer U20 (NXP FXLS8974CFR3), which is designed for use in automotive remote keyless entry (key fob) 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
- I2C interface frequencies of up to 1 MHz
- 3- or 4-wire SPI interface with clock frequencies of up to 4 MHz The I2C addresses of the accelerometer are defined as follows:
  - Write address: 0x30
  - Read address: 0x31

Figure 10 shows the Accelerometer sensor schematic diagram.

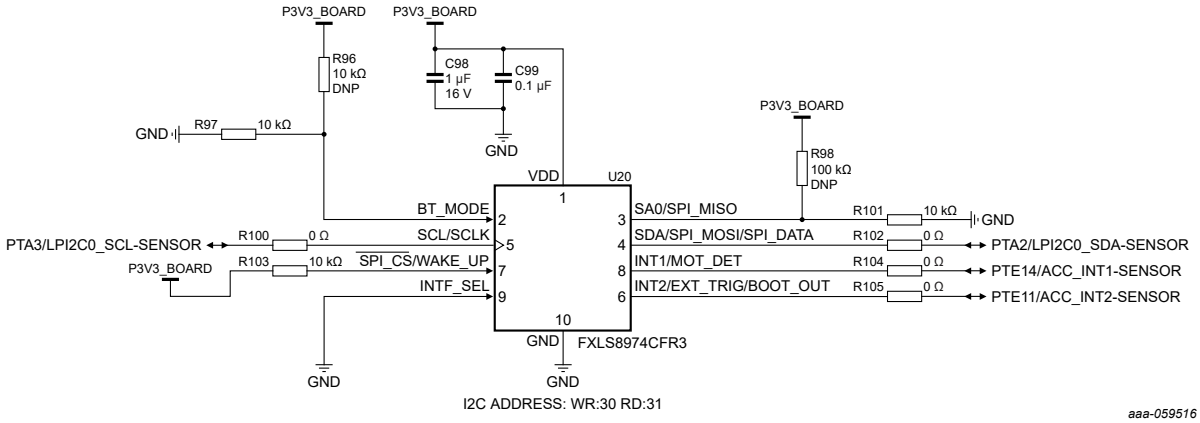

Figure 10. Accelerometer sensor schematic

For more information on FXLS8974CFR3, visit nxp.com.

2.7 Magnetic switch

The FRDM-MCXE247 board has a Hall effect magnetic field switch U22 (NXP NMH1000), which is most sensitive to a vertical field passing through the top-to-bottom surfaces, orthogonal to the plane of the application PCB. The switch operates at low voltage, low current, low output data rate, and is a small physical size.

The magnetic switch supports:

- Threshold selection 3-state hardware pin.
- Threshold selection data bit(s) in an I2C accessible register.
- Sample rate selection 3-state hardware pin.
- Sample rate selection data bit(s) in an I2C accessible register.
- Mode selection hardware pin to select between standalone or I2C serial interface.
- Mode selection data bit(s) in an I2C accessible register.
- Two types of output indicate the absence of a magnetic field as compared to an internally set threshold:
  - Binary state hardware pin.
  - Binary state data bit(s), configurable as assert-high or assert-low, in an I2C accessible register.

Figure 11 shows the magnetic switch schematic diagram.

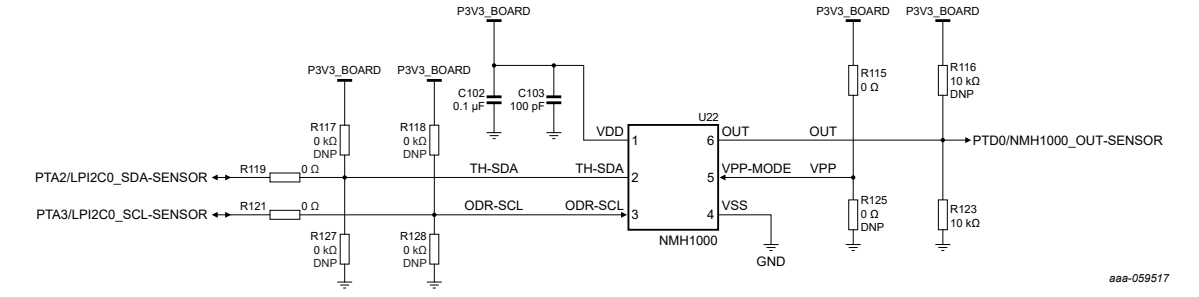

Figure 11. Magnetic switch schematic

For more information on NMH1000, visit nxp.com.

2.8 Flash memory interface

The target MCU (MCX E247) features one quad serial peripheral interface (QuadSPI) controller, which can support an external memory.

On the FRDM-MCXE247 board, the MCU MCX E247 QuadSPI controller can connect to an onboard QSPI flash memory (U23). The flash memory VCC is supplied by the P3V3 rail.

Note: *When the MCX E247 MCU is powered by 5 V, the flash W25Q64JVSSIQ cannot be connected.*

Table 13 provides the details of the flash memory used on the board.

Table 13. Flash memory

Part identifier	Manufacturer and part name	Description
U23	Winbond W25Q64JVSSIQ	It is a 3 V 64 Mbit (8 MB) 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 device data sheet.

Figure 12 shows the flash memory schematic diagram.

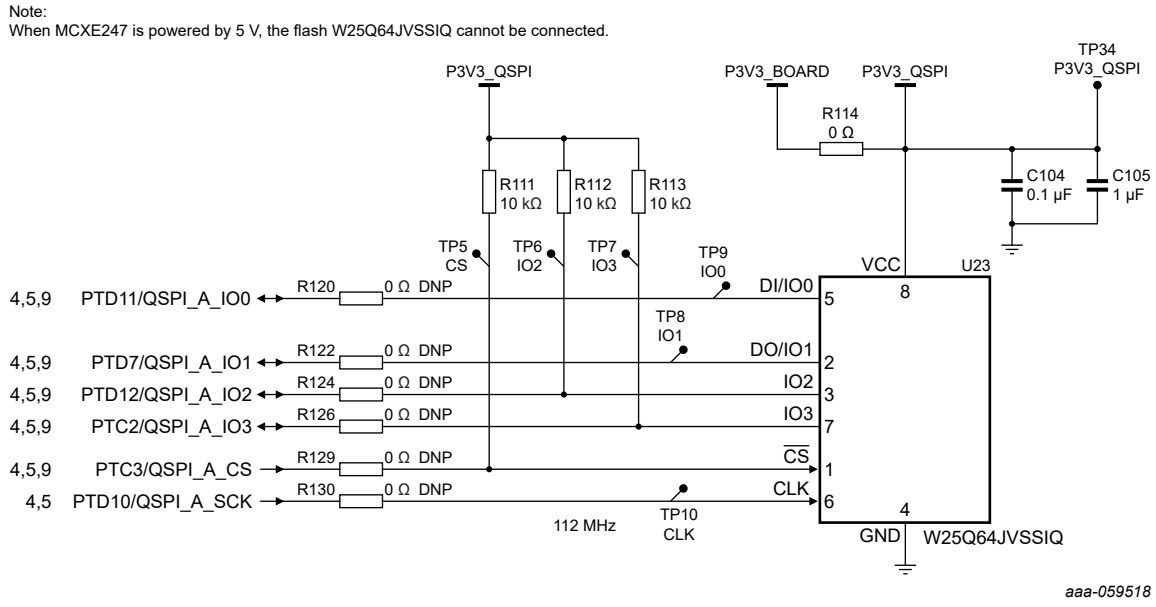

Figure 12. Flash memory schematic

2.9 Arduino compatible I/O headers

The FRDM-MCXE247 board provides Arduino Uno compatible headers to support the Arduino and FRDM ecosystem shield modules. These headers are dual-row headers with the outer rows supporting the Arduino compatible shields and the inner rows supporting the various FRDM shields. These headers are designed to support the following shields:

- Sensor: FRDM-STBC-AGM01, FRDM-STBC-AGM04, FRDM-FXS-MULT2-B
- NFC: OM5577, OM5578
- USB Type C: OM13790 (Host)
- Motor control: FRDM-MC-LVBLDC, FRDM-MC-LVPMSM

Table 14 describes the connectors of the Arduino socket.

Table 14. Arduino socket connectors

Part identifier	Connector type
J1	2x8 position receptacle
J2	2x10 position receptacle
J3	2x8 position receptacle
J4	2x6 position receptacle

Figure 13 shows the pinout of the Arduino socket connectors.

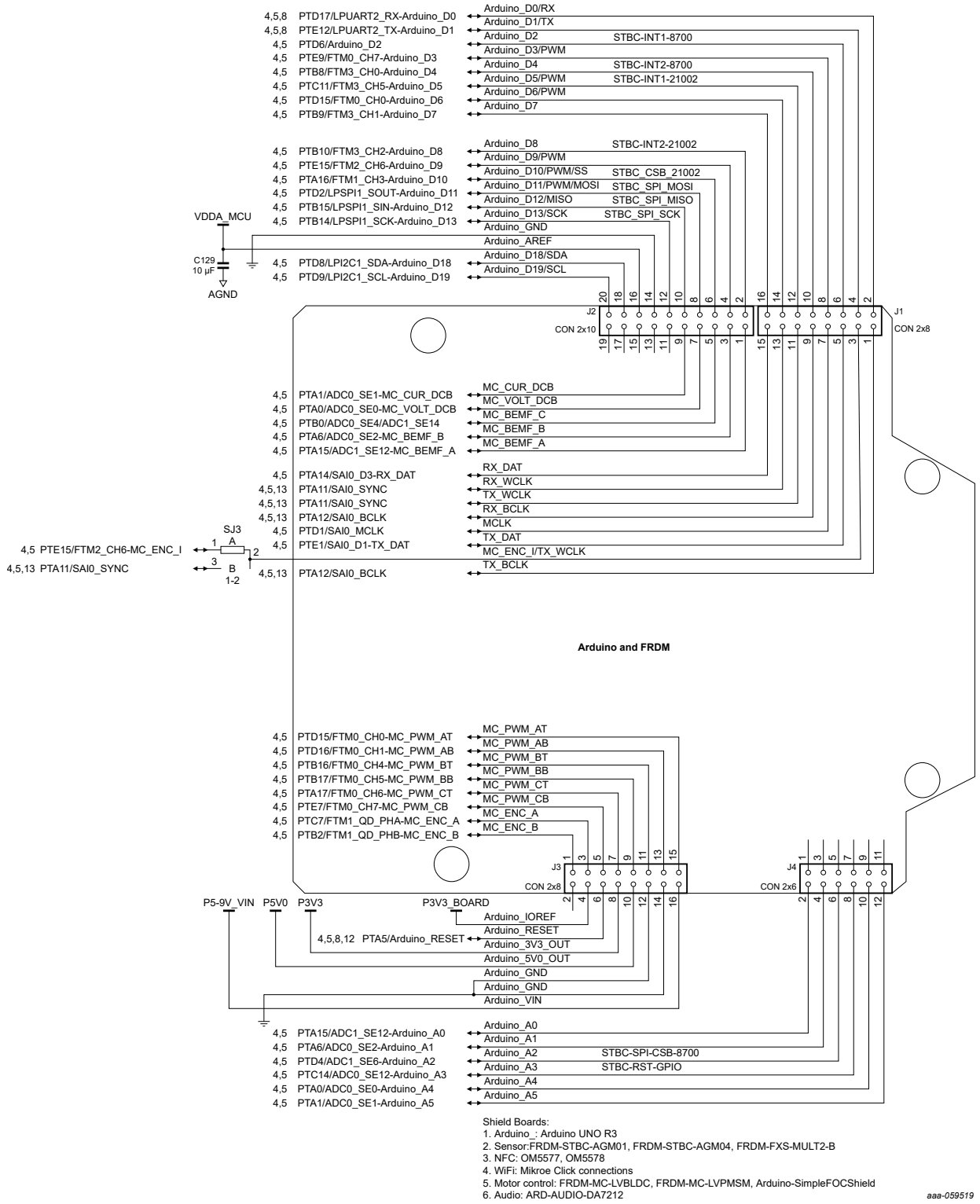

Figure 13. Arduino socket diagram

2.10 mikroBUS header

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-MCXE247 board has a mikroBUS socket with a pair of 1x8-position receptacles, J5 and J6. Table 15 and Table 16 describe the pinout of the mikroBUS headers (J5 and J6).

Table 15. J5 header pinout

Pin number	Net name	GPIO	Function / Signal name
1	PWM	PTB5	FTM0_CH5-MIKROE
2	INT	PTE3	MIKROE_INT
3	RX	PTC8	LPUART1_RX-MIKROE
4	TX	PTC9	LPUART1_TX-MIKROE
5	SCL	PTA3	LPI2C0_SCL-MIKROE
6	SDA	PTA2	LPI2C0_SDA-MIKROE
7	5V0	P5V0	5 V power line
8	GND	GND	Ground

Table 16. J6 header pinout

Pin number	Net name	GPIO	Function / signal name
1	AN	PTA15	ADC1_SE12-MIKROE
2	RST	PTD14	MIKROE_RESET
3	CS	PTE6	LPSPI0_PCS2-MIKROE
4	SCK	PTE0	LPSPI0_SCK-MIKROE
5	MISO	PTB3	LPSPI0_SIN-MIKROE
6	MOSI	PTE2	LPSPI0_SOUT-MIKROE
7	3V3	P3V3	3.3 V power line
8	GND	GND	Ground

An add-on board called a *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. Microelectronic (MIKROE) is one of the manufacturers of click boards. To find some click boards for the FRDM-MCXE247 mikroBUS socket, visit MIKROE website.

2.11 Pmod header

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-MCXE247 board supports a Pmod connector J7 (Digilent PPPC062LJBN-RC) for expanding the capabilities of the board. It can be used to work with a remote host, or as an interface to a Pmod expansion board.

Table 17 describes the pinout of the Pmod header.

Table 17. Pmod header pinout

Pin number	GPIO	Function / signal name	Resistor setting
1	PTE10	LPSPI2_PCS1-PMOD	-
2	PTD5	PMOD_INT	-
3	PTA8	LPSPI2_SOUT-PMOD	-
4	PTD14	PMOD_RESET	-
5	PTE16	LPSPI2_SIN-PMOD	-
6	PTD9	LPI2C1_SCL-PMOD	SJ5 Pin 1-2 selection (default setting)
	PTE13	LPSPI_PCS2-PMOD	SJ5 Pin 2-3 selection
7	PTC15	LPSPI2_SCK-PMOD	-
8	PTD8	LPI2C1_SDA-PMOD	SJ4 Pin 1-2 selection (default setting)
	PTA15	LPSPI_PCS3-PMOD	SJ4 Pin 2-3 selection
9	-	GND	-
10	-	GND	-
11	-	P3V3	-
12	-	P3V3	-

2.12 IO expander headers

The IO expanders J8 and J9 bring out pin signals that are present in the 144-pin package but not in the 100-pin package. Also, these expanders expose some trace signals from the board, such as button and LED signals, and sensor interrupt output signals.

These two headers are not populated on the board by default. To use these headers, solder the sockets.

Figure 14 shows the pinout of the IO expander (J8) header.

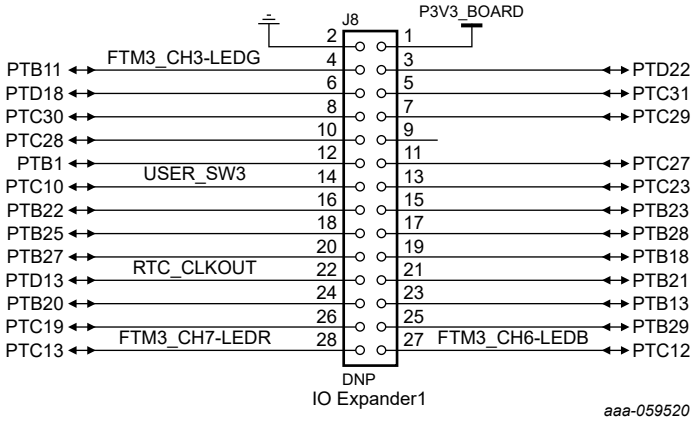

Figure 14. J8 header pinout

Figure 15 shows the pinout of the IO expander (J9) header.

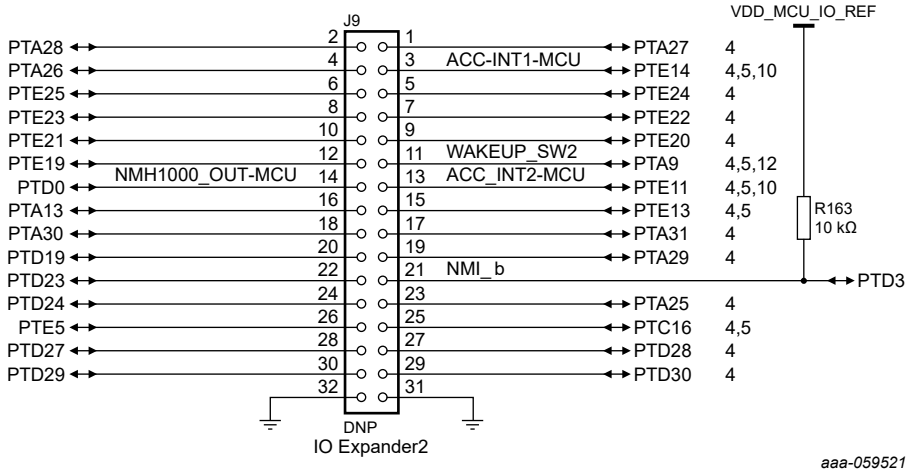

Figure 15. J9 header pinout

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 LPC55S16 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-MCXE247. The onboard implementation of MCU-Link is referred to as MCU-Link OB.

The FRDM-MCXE247 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-MCXE247 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 18 summarizes the MCU-Link features supported on the FRDM-MCXE247 board.

Table 18. 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-I2C bridge.

Table 18. Supported MCU-Link features*...continued*

Feature	Description
External debug probe support	The MCU-Link interface supports debugging the target MCU (MCX E247) 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 19 describes the debug scenarios supported on the FRDM-MCXE247 board.

Table 19. Supported debug scenarios

Debug scenario	Feature support	Required jumper / connector settings
Use MCU-Link for debugging the MCX E247 MCU	SWD: Enabled	MCU-Link SWD enabled if jumper JP4 is open.
		Target MCU external debugger connector J14 is not used for external connection.
	VCOM: Enabled	MCU-Link VCOM port enable if jumper JP3 is open.
Use an external debugger for debugging the MCX E247 MCU	SWD: Not supported	Short JP4.
		Connect the external debugger to J14.
	VCOM: Enabled	MCU-Link VCOM port enable if jumper JP3 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 3.155 or later, an automatic firmware update can be done using LinkServer installer version 24.12.15 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 3.155, 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 is 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 20. 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 20. 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
MCUXpresso 24.12.100 or later	V3.155 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 JP2, and reconnect the board. The red MCU-Link status LED D6 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 24.12.15 installer for Windows".
3. Navigate to the MCU-LINK_installer_Vx_xxx directory, where Vx_xxx indicates the version number, for example, V3.155.
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 JP2, and reconnect the board. The board is enumerated on the host computer as a WinUSB or HID device (depending on the firmware version, see Compatibility check between MCUXpresso IDE and MCU-Link firmware).

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.*

Note: *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 20.

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-MCXE247 board has a USB Type-C connector J13, 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.

On the FRDM-MCXE247 board, MCU-Link is connected to the LPUART2 module of the target MCU.

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

1. Ensure that the jumper JP2 is open (MCU-Link boots normally).
2. Ensure that the jumper JP3 is open (MCU-Link VCOM port is enabled).
3. Connect the MCU-Link USB connector J13 to the USB port of the host computer.

When you boot the FRDM-MCXE247 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 JP3, before powering up the board. Changing the JP3 setting (open/short) after powering up the board has no impact on the MCU-Link VCOM function.

3.8 USBSIO port (USB to target I2C bridge)

MCU-Link supports a feature known as *USB serial input/output (USBSIO) port*. This feature allows MCU-Link to add a USB serial I/O port on the host computer and connect it to the target MCU. In this setup, MCU-Link acts as a 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.

The FRDM-MCXE247 board supports connecting MCU-Link to the LPI2C0 module of the target MCU. By default, this I2C connection is disabled. It can be enabled by populating the following resistors:

- 0 Ω resistors R44 and R45

To use MCU-Link as a USB-to-I2C bridge, the board must be connected to the host computer by connecting a USB cable from its J13 connector. A USB-to-I2C bridge can be used to emulate the host system / board peripherals.

By default, the USBSIO feature is disabled for I2C on the FRDM-MCXE247 board, allowing the target MCU I2C port to be used for other purposes. Disabling the USBSIO feature instructs the firmware not to enumerate the USB endpoint for USBSIO (which is called “MCU-Link LPCSIO” for backward compatibility reasons). Disabling the USBSIO feature also frees more USB bandwidth for the SWO profiling feature and energy measurement feature (not supported on this board) of MCU-Link.

3.9 MCU-Link status LEDs

The FRDM-MCXE247 board has three status indicator LEDs for MCU-Link. Table 21 lists these LEDs and describes how each LED behaves in different MCU-Link modes.

Table 21. 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
D5	USB	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.
D6	STATUS	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 (LPC55S16) boots in ISP mode.
D7	VCOM_ACT	Green	Indicates if the VCOM port is receiving/sending data. The LED lights up when MCU-Link boots, and then blinks when debug activity happens.	Indicates if the VCOM port is receiving/sending data. The LED lights up when MCU-Link boots, and then blinks when debug activity happens.	The LED remains OFF.

4 Board errata

Not applicable for the current board revision.

5 Related documentation

Table 22 lists some additional documents and resources that you can refer to for more information on the FRDM-MCXE247 board. Some of these documents may be available only under a non-disclosure agreement (NDA). To access such a document, contact a local NXP field applications engineer (FAE) or sales representative.

Table 22. Related documentation

Document	Description	Link / how to obtain
MCX E24x Series Reference Manual	Provides a detailed description about the MCX E247 MCU and its features, including memory maps, power supplies, and clocks.	MCXE24XRM
MCX E24x Data Sheet	Provides information about the MCX E24x electrical characteristics, hardware design considerations, and ordering information.	MCXEP144M112F70
FRDM-MCXE247 board schematics	Provides a circuit representation showing the functionality and connectivity of the FRDM-MCXE247 board components.	FRDM-MCXE247-DESIGN-FILES
LPC55S1x User Manual	Intended for system software and hardware developers and application programmers who want to develop products with LPC55 S1x MCU	UM11295

6 Acronyms

Table 23 lists the acronyms used in this document.

Table 23. Acronyms

Acronym	Description
ADC	Analog-to-digital converter
CAN	Controller area network
DAP	Debug authentication protocol
DNP	Do not populate / do not place
DSP	Digital signal processor
DUT	Device under test
FlexCAN	Flexible controller area Network
FPU	Floating point unit
HID	Human interface device
I^2C	Inter-Integrated Circuit
IoT	Internet of Things
ISP	In-system programming
JTAG	Joint test action group
LDO	Low-dropout regulator
LE	Low energy
LED	Light-emitting diode
LPI2C	Low-power Inter-Integrated Circuit
LPSPI	Low-power serial peripheral interface
LPUART	Low-power universal asynchronous receiver/transmitter
MCU	Microcontroller unit
OB	Onboard

Table 23. Acronyms...*continued*

Acronym	Description
OS	Operating system
PCS	Peripheral chip select
PDA	Personal digital assistant
PWM	Pulse width modulator
RTC	Real-time clock
RX	Receive
SPI	Serial peripheral interface
SRAM	Static-random access memory
SWD	Serial wire debug
SWO	Serial wire debug trace output
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 24 summarizes the revisions to this document.

Table 24. Revision history

Document ID	Release date	Description
UM12286 v.3.0	5 August 2025	• Updated Section 1.6 • Updated LED D1 description and Figure 7 in Section 1.8 • Updated figures in following sections: Section 1.5, Section 1.1, Section 1.4, and Section 1.7 • Updated I2C address of accelerometer sensor in Section 2.6 • Added a note in Table 10 • Updated Section 5
UM12286 v.2.0	8 July 2025	Initial public release

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