UM12348

FRDM-MCXA346 Board User Manual

Rev. 1.1 — 14 August 2025 User manual

Document information

Information	Content
Keywords	UM12348, FRDM-MCXA346, MCX A346, MCX A, Arduino, mikroBUS, Pmod, MCU-Link
Abstract	The FRDM-MCXA346 board is a design and evaluation platform based on the NXP MCX A346 MCU.

1 Board overview

The FRDM-MCXA346 board is a design and evaluation platform based on the NXP MCX A346 microcontroller (MCU). The MCX A346 MCU is a low-power microcontroller for industrial and consumer Internet of Things (IoT) applications. It has one Arm Cortex-M33 core that runs at speeds of up to 180 MHz. It supports industrial communication protocol, brushless direct current (BLDC) motor / permanent magnet synchronous motor (PMSM) control, and integrated sensor interfaces (MIPI-I3C, I^2C, and SPI).

The board is compatible with Arduino boards (Arduino UNO R3 and Arduino A4/A5), motor control boards (FRDM-MC-LVBLDC and FRDM-MC-LVPMSM), Mikroe click boards, and Pmod 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 A346 MCU, the FRDM-MCXA346 board uses an onboard (OB) debug probe, MCU-Link OB, which is based on another NXP MCU: LPC55S16. For simplicity, the MCX A346 MCU and the LPC55S16 MCU are respectively referred to as "target MCU" and "debugger MCU" at some places in this document.

This document provides details about the FRDM-MCXA346 board interfaces, power supplies, clocks, connectors, jumpers, push buttons, LEDs, and MCU-Link OB.

1.1 Block diagram

Figure 1 shows the FRDM-MCXA346 board block diagram.

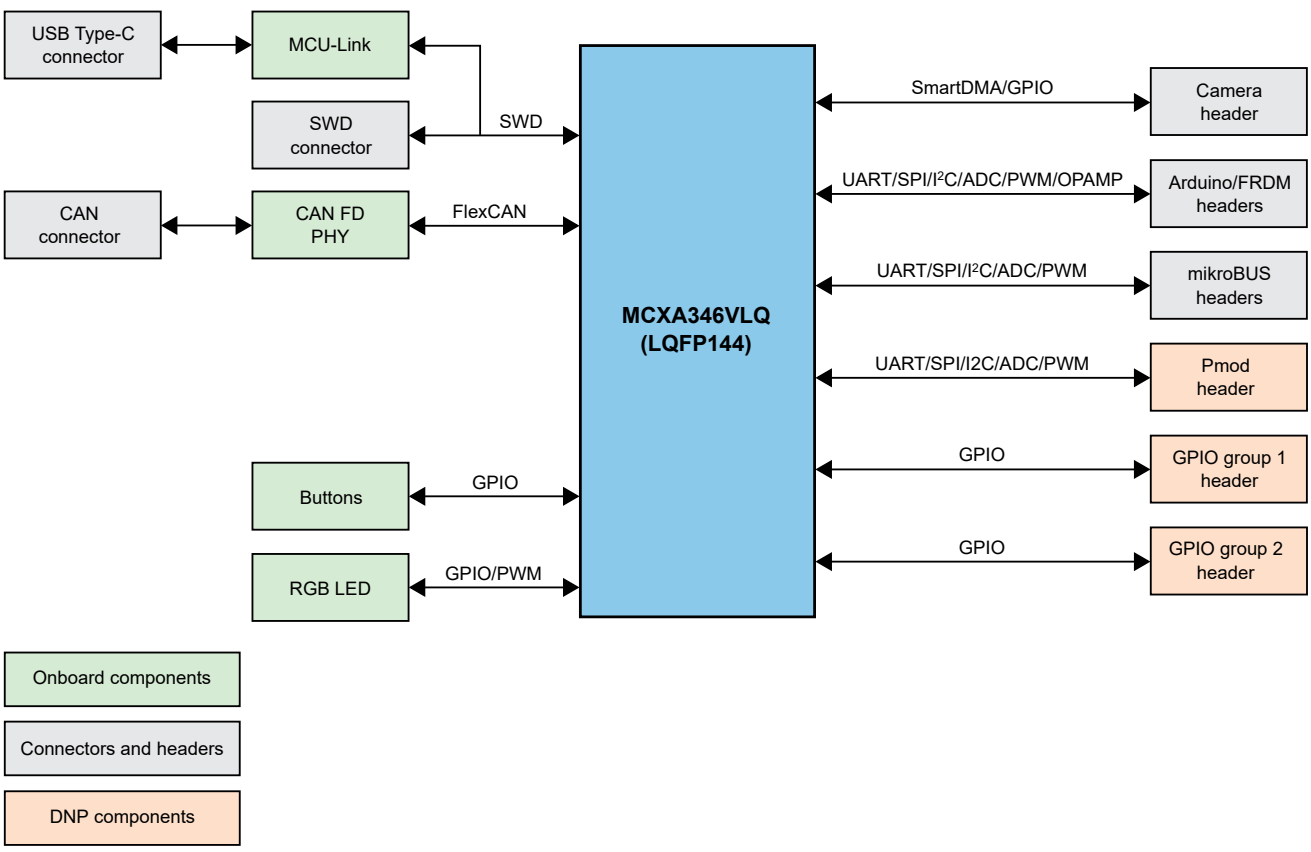

Figure 1. FRDM-MCXA346 block diagram

1.2 Board features

Table 1 lists the features of the FRDM-MCXA346 board.

Table 1. FRDM-MCXA346 features

Board feature	Target MCU features used	Description
MCU (target MCU)		NXP MCX A346 MCU (part number: MCXA346VLQ) based on an Arm Cortex-M33 core, running at speeds of up to 180 MHz. ***Note:*** *For details on the MCX A346 MCU, see MCX A345 and A346 Reference Manual and MCXA345/346 Data Sheet.*
FlexCAN interface	CAN0 module	Provides a high-speed CAN FD transceiver accessible through a 2x2-pin header J16
LPUART interface	LPUART2 module	• Supports a USB-to-UART bridge connection using MCU-Link • Supports an external UART connection through the Arduino socket connector J1
	LPUART3 module	Supports an external UART connection through the mikroBUS socket connector J5
LPSPI interface	LPSPI0 module	Supports an external SPI connection through the mikroBUS socket connector J6 or the Pmod connector J7 (DNP)
	LPSPI1 module	Supports an external SPI connection through the Arduino socket connector J2
LPI2C interface	LPI2C0 module	Provides an I^2C connection to the GPIO group 2 connector J19 (DNP)
	LPI2C1 module	Provides an I^2C connection to the Arduino socket connector J4
	LPI2C2 module	• Provides an I^2C connection to the Arduino socket connector J2 and the camera connector J9 • Supports a USB-to-I^2C bridge connection using MCU-Link
	LPI2C3 module	Provides an I^2C connection to the mikroBUS socket connector J5 and the Pmod connector J7 (DNP)
Camera interface	SmartDMA module	Supports a SmartDMA connection through the camera connector J9
ADC interface	ADC0 module	Accepts ADC inputs through the Arduino socket connectors J2 and J4, the mikroBUS socket connector J6, and the GPIO group 2 connector J19 (DNP)
	ADC1 module	Accepts ADC inputs through the Arduino socket connectors J2, J3, and J4 and the GPIO group 1 connector J8 (DNP)
	ADC2 module	Accepts ADC inputs through the GPIO group 1 connector J8 (DNP) and the GPIO group 2 connector J19 (DNP)
	ADC3 module	Accepts ADC inputs through the GPIO group 1 connector J8 (DNP)
Op-amp interface	OPAMP0 module	Connects to the test points TP15 (INP), TP18 (INN), and TP16 (OUT)
	OPAMP1, OPAMP2, and OPAMP3 modules	Connect to the Arduino socket connector J4
Arduino socket	LPUART2, LPSPI1, LPI2C1, LPI2C2, ADC0, ADC1, OPAMP1, OPAMP2, OPAMP3, PWM0, and PWM1 modules	Arduino socket with four connectors J1, J2, J3, and J4

Table 1. FRDM-MCXA346 features*...continued*

Board feature	Target MCU features used	Description
mikroBUS socket	LPUART3, LPSPI0, LPI2C3, ADC0, and CTIMER1 modules	mikroBUS socket with a pair of connectors J5 and J6
Pmod connector	LPSPI0 and LPI2C3 modules	Pmod connector J7 (DNP)
Debug interface	LPUART2 module	Onboard MCU-Link debug probe with the USB Type-C connector J15 for debugging the MCX A346 MCU
Power supply		The following are the primary power supply options available for the board: • External 5 V power through the USB Type-C connector J15 • External 5 V power through the CAN0 connector J16, pin 3 (default option) • External 5–9 V power from: – Arduino socket connector J3, pin 16 – CAN0 connector J16, pin 3 (requires changing the SJ2 setting from 1-2 shorted to 2-3 shorted)
Clocks		• 8 MHz clock for the MCX A346 MCU • 16 MHz clock for the LPC55S16 MCU
Orderable part number		FRDM-MCXA346

1.3 Kit contents

The FRDM-MCXA346 board hardware kit contains items listed in Table 2.

Table 2. Kit contents

Item	Quantity
FRDM-MCXA346 board hardware assembly	1
FRDM-MCXA346 Quick Start Guide	1

1.4 Board pictures

Figure 2 shows the top-side view of the FRDM-MCXA346 board with the MCX A346 MCU (target MCU), the LPC55S16 MCU (debugger MCU), and the CAN FD transceiver highlighted.

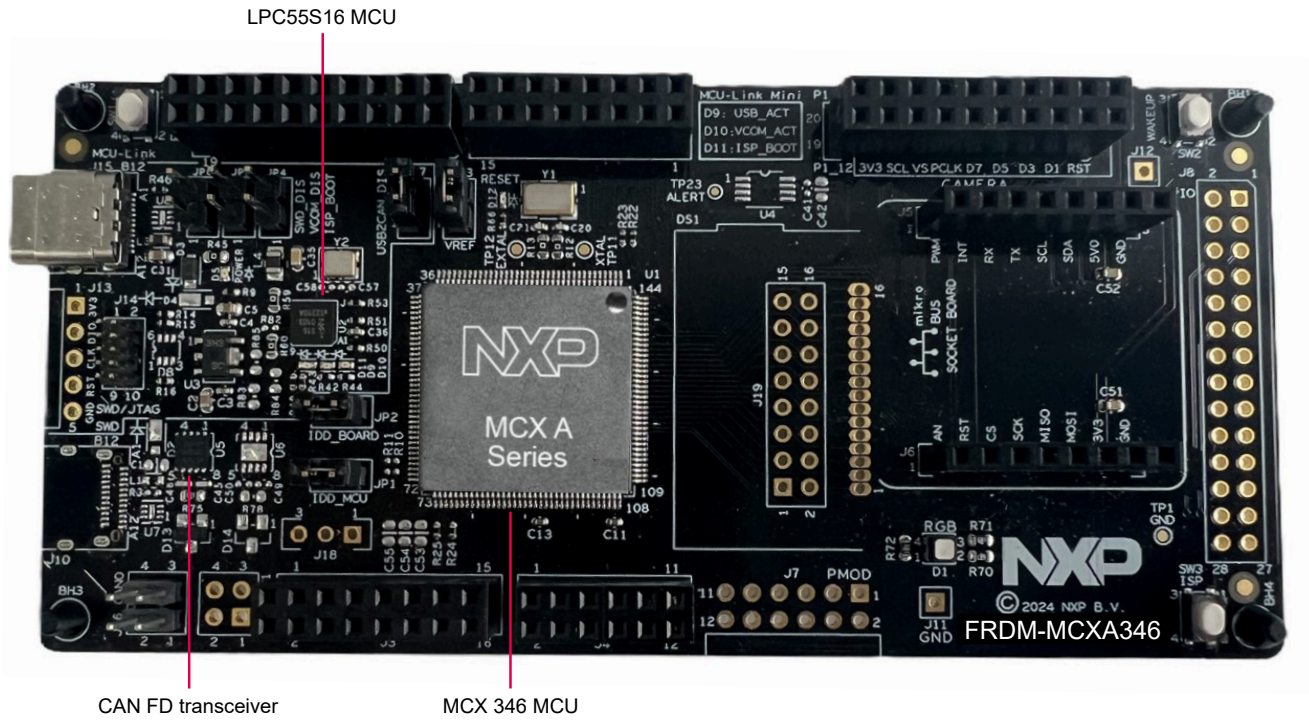

Figure 2. Board top-side view

Figure 3 shows the bottom-side view of the FRDM-MCXA346 board.

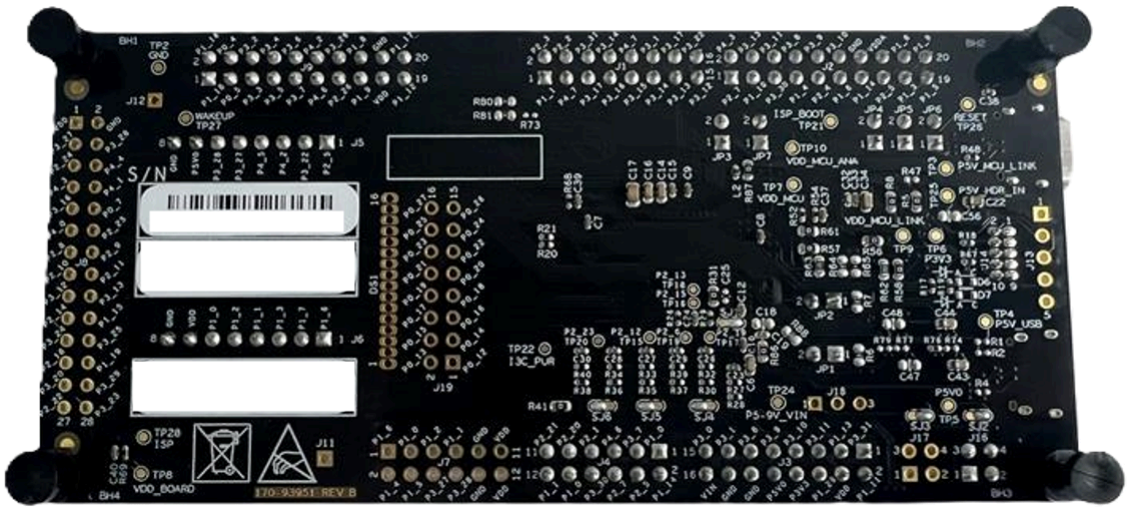

Figure 3. Board bottom-side view

1.5 Connectors

Figure 4 shows the FRDM-MCXA346 board connectors.

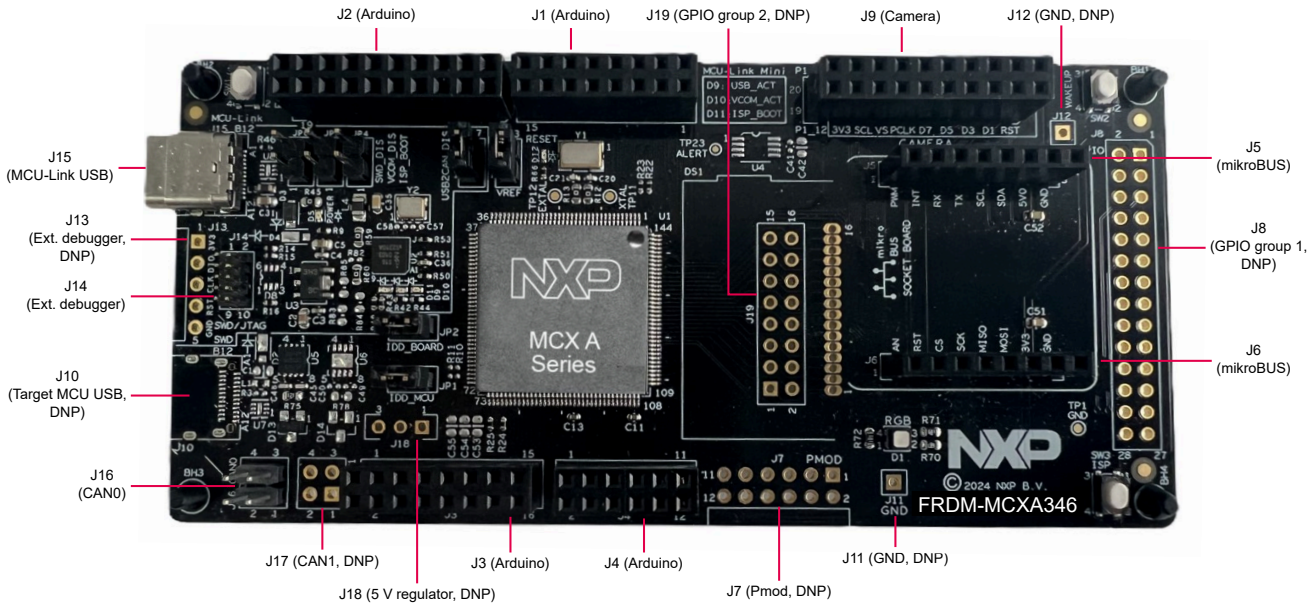

Figure 4. Connectors

Table 3 describes the connectors available on the FRDM-MCXA346 board.

Table 3. FRDM-MCXA346 connectors

Part identifier	Connector type	Description	Reference section
J1	2x8-position receptacle	Arduino socket connectors	Section 2.14
J2	2x10-position receptacle		
J3	2x8-position receptacle		
J4	2x6-position receptacle		
J5	1x8-position receptacle	mikroBUS socket connectors	Section 2.15
J6	1x8-position receptacle		
J7 (DNP)	2x6-position receptacle	Pmod connector	Section 2.16
J8 (DNP)	2x14-position receptacle	GPIO group 1 connector	Section 2.10
J19 (DNP)	2x8-position receptacle	GPIO group 2 connector	Section 2.11
J9	2x10-position receptacle	Camera connector	Section 2.7
J10 (DNP)	USB Type-C connector	USB connector (not populated as MCX A346 does not have a USB module)	For more information on these connectors, see FRDM-MCXA346 board schematics
J11 (DNP)	1-pin/position connector	GND test point	
J12 (DNP)	1-pin/position connector	GND test point	
J13 (DNP)	1x5-pin header	5-pin, 2.54 mm target MCU (MCX A346) external debugger connector	Section 3.2
J14	2x5-pin header	10-pin, 1.27 mm target MCU (MCX A346) external debugger connector	
J15	USB Type-C connector	MCU-Link USB connector	Section 3.9
J16	2x2-pin header	CAN0 header	Section 2.3

Table 3. FRDM-MCXA346 connectors...*continued*

Part identifier	Connector type	Description	Reference section
J17 (DNP)	2x2-pin header	CAN1 header (not populated as MCX A346 has only one CAN module: CAN0)	
J18 (DNP)	1x3-pin/position connector	5 V DC voltage regulator connector	Section 2.1

1.6 Jumpers

Figure 5 shows the FRDM-MCXA346 board jumpers.

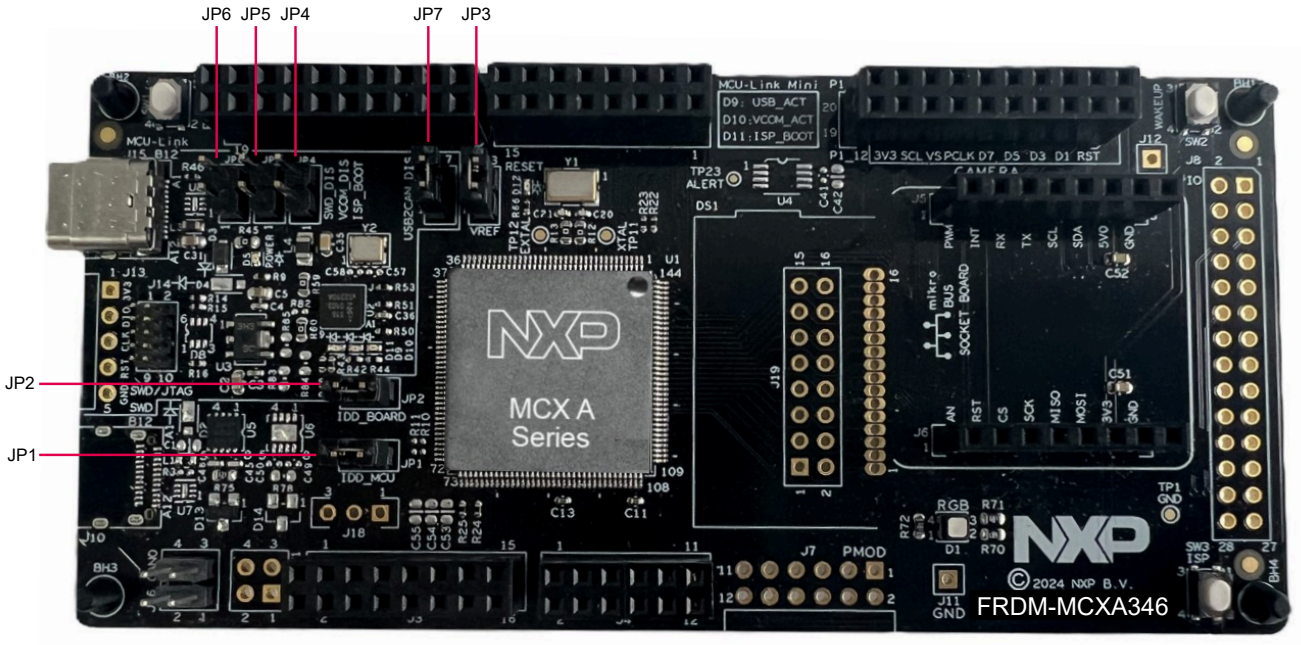

Figure 5. Jumpers

Table 4 describes the FRDM-MCXA346 board jumpers.

Table 4. FRDM-MCXA346 jumpers

Part identifier	PCB label	Jumper type	Description	Reference section
JP1	IDD_MCU	1x2-pin header	Target MCU (MCX A346) digital power (VDD_MCU) measurement jumper: • Open: The VDD_MCU supply is OFF initially. JP1 can be used to measure the current consumption of the MCX A346 digital IPs (see Section 2.1.1 for more details). • Shorted (default setting): JP1 produces the VDD_MCU supply.	Section 2.1
JP2	IDD_BOARD	1x2-pin header	Board power (VDD_BOARD) measurement jumper: • Open: The VDD_BOARD supply is OFF initially. JP2 can be used to measure the current for the VDD_BOARD supply (see Section 2.1.1 for more details). • Shorted (default setting): JP2 produces the VDD_BOARD supply.	

Table 4. FRDM-MCXA346 jumpers*...continued*

Part identifier	PCB label	Jumper type	Description	Reference section
JP3	VREF	1x2-pin header	Target MCU (MCX A346) analog reference power (VREFH) measurement jumper: • Open: The VREFH power source for the target MCU is OFF initially. JP3 can be used to measure the current consumption of the MCX A346 analog reference power (VREFH) (see Section 2.1.1 for more details). • Shorted (default setting): JP3 sources the MCX A346 analog reference power (VREFH).	
JP4	ISP_BOOT	1x2-pin header	MCU-Link (LPC55S16) ISP mode enable jumper: • Open (default setting): MCU-Link 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 jumper setting to reprogram the MCU-Link internal flash with a new image by using 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
JP5	VCOM_DIS	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 3.10
JP6	SWD_DIS	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 the connector J14 or J13 (DNP).	Section 3.2
JP7	USB2CAN_DIS	1x2-pin header	MCU-Link USB2CAN port disable jumper: • Open: The MCU-Link USB-to-CAN bridge[1] is enabled. • Shorted (default setting): The MCU-Link USB-to-CAN bridge is disabled.	Section 3.2

[1] The USB-to-CAN feature is not currently supported by MCU-Link. It is planned for the future.

1.7 Push buttons

Figure 6 shows the FRDM-MCXA346 board push buttons.

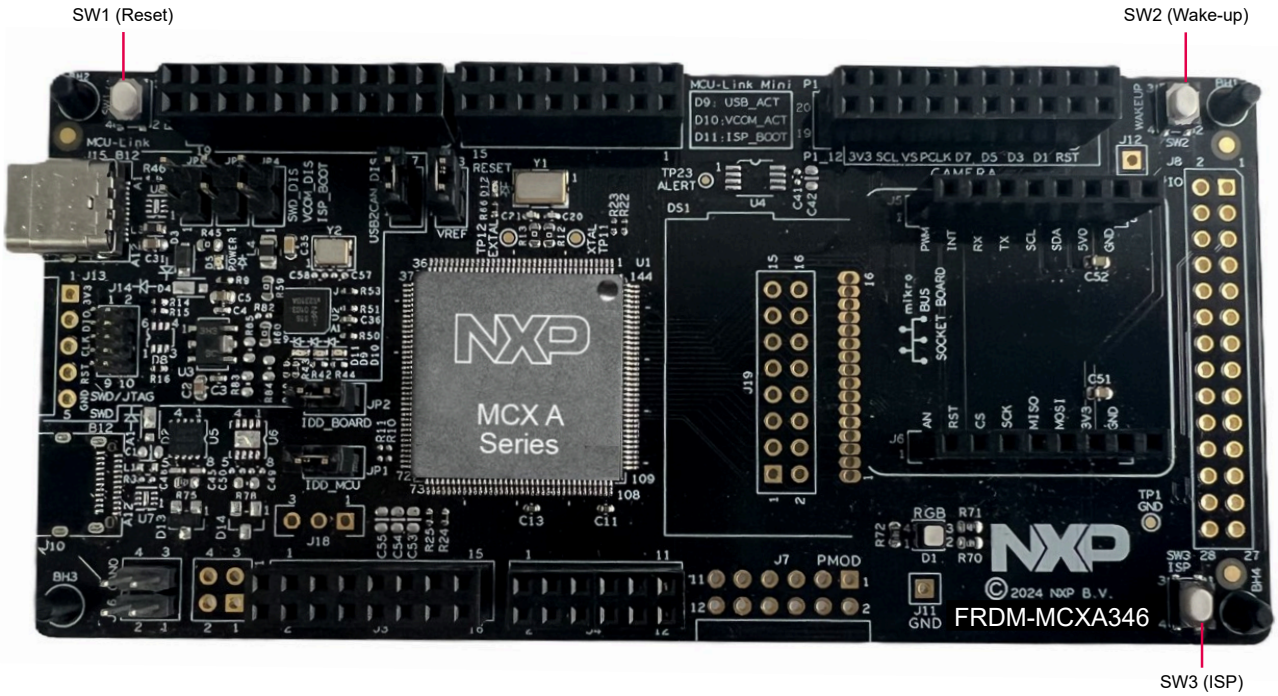

Figure 6. Push buttons

Table 5 describes the FRDM-MCXA346 board push buttons.

Table 5. FRDM-MCXA346 push buttons

Part identifier	PCB label	Name/function	Description
SW1	RESET	Reset button	Pressing SW1 asserts the MCX A346 MCU pin P1_29 (RESET_B), which wakes up the MCU from any mode. When you press SW1, the reset LED D12 turns ON.
SW2	WAKE UP	Wake-up button	Pressing SW2 asserts the MCX A346 MCU pin P1_7. You can configure this pin through software to wake up the MCU from low-power modes.
SW3	ISP	ISP button	Pressing SW3 asserts the MCX A346 MCU pin P0_6 (ISPMODE_N), which forces the MCU extended 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 details on the MCX A346 MCU ISP mode, refer to *MCX A345 and A346 Reference Manual*.

1.8 LEDs

The FRDM-MCXA346 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-MCXA346 board LEDs.

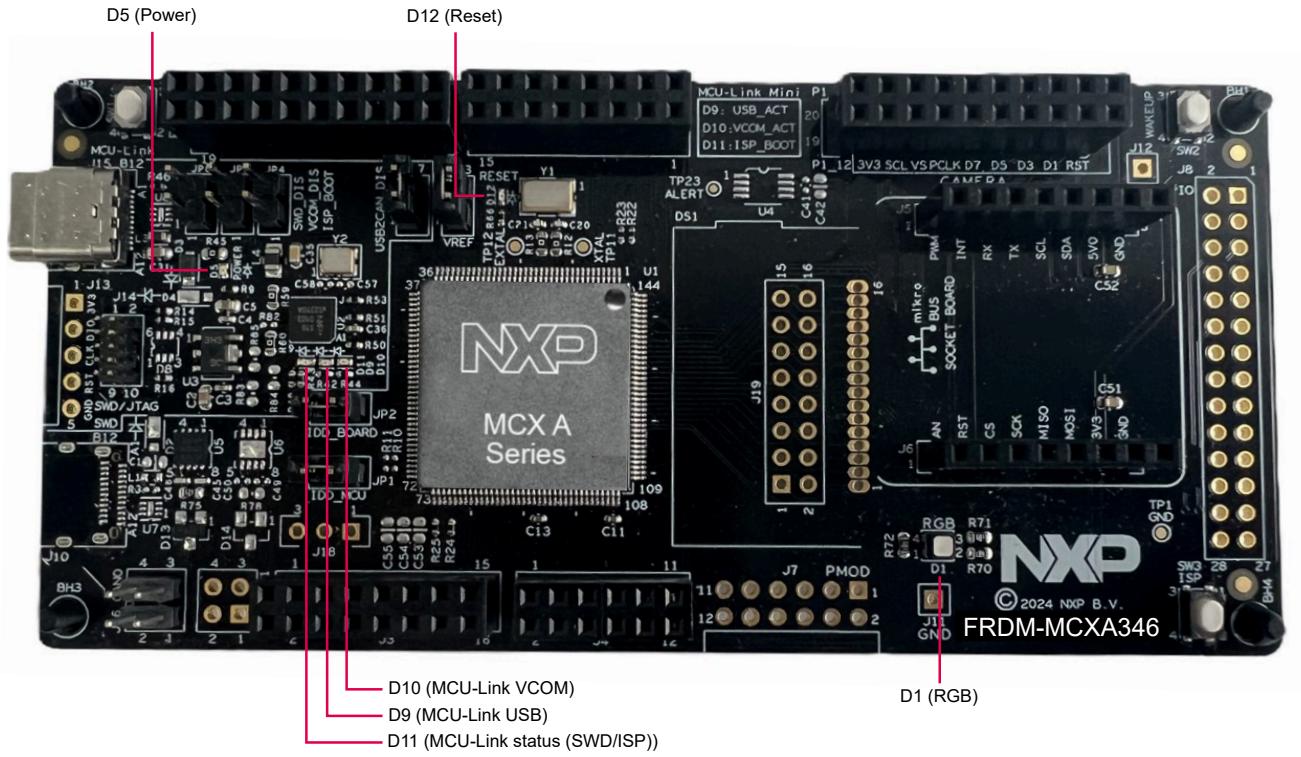

Figure 7. LEDs

Table 6 describes the FRDM-MCXA346 board LEDs except for MCU-Link-specific LEDs, which are described in Section 3.12.

Table 6. FRDM-MCXA346 LEDs

Part identifier	PCB label	LED color	Description (when LED is on)
D5	POWER	Green	Indicates that the LDO 3.3 V (P3V3) supply is available.
D12	RESET	Red	Indicates system reset activity. When board reset is initiated, for example, by pressing the reset button (SW1), D12 turns ON.
D1	RGB	Red / green / blue	It is a user-defined LED (it can be controlled through a user application).

Note: *MCU-Link-specific LEDs D9, D10, and D11 are described in Section 3.12.*

2 Functional description

This section contains the following subsections:

2.1 Power supplies

The following are the primary power supply options available for the FRDM-MCXA346 board:

- External 5 V power through the USB Type-C connector J15
- External 5 V power through the CAN0 connector J16, pin 3 (default option)
- External 5–9 V power from:
  - Arduino socket connector J3, pin 16
  - CAN0 connector J16, pin 3 (requires changing the SJ2 setting from 1-2 shorted to 2-3 shorted)

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 A346 MCU, MCU-Link, CAN FD transceiver, CAN connector, Arduino socket, mikroBUS socket, Pmod connector, camera connector, and external debugger connector.

Table 7 describes the FRDM-MCXA346 board power supplies.

Table 7. FRDM-MCXA346 power supplies

Power source	Manufacture and part number	Power supply	Description
External supply through the USB Type-C connector J15		P5V_MCU_LINK (5 V)	• One of the four power source options for the system 5 V power supply (P5V0) • Provides the USB1_VBUS power to the LPC55S16 MCU (MCU-Link) • Supplies power to the power test point TP3
External supply through the USB Type-C connector J10 (DNP) ***Note:*** *Connector J10 is not populated as the*		P5V_USB (5 V)	• Another power source option (disabled by default) for the system 5 V power supply (P5V0) • Supplies power to the power test point TP4

Table 7. FRDM-MCXA346 power supplies*...continued*

Power source	Manufacture and part number	Power supply	Description
MCX A346 MCU does not have a USB module.			
Arduino socket connector J3 (pin 16) or CAN0 connector J16 (pin 3) ***Note:*** *Getting the P5-9V_VIN supply at pin 3 of CAN0 connector J16 requires changing the SJ2 setting from 1-2 shorted to 2-3 shorted.*		P5-9V_VIN (5–9 V)	• An alternative power supply for the CAN connectors J16 (pin 3) and J17 (pin 3) (DNP) • Supplies power to 5 V DC voltage regulator connector J18 (not populated)
DC voltage regulator attached to the connector J18 (DNP)		P5V_HDR_IN (5 V)	A third power source option (disabled by default) for the system 5 V power supply (P5V0)
From the P5V_MCU_LINK / P5V_USB / P5 V_HDR_IN supply or external supply through the CAN0 connector J16 (pin 3) ***Note:*** *By default, the options to produce the P5V0 supply from the P5V_USB and P5V_HDR_IN supplies are disabled.* ***Note:*** *Getting the P5V0 supply at pin 3 of CAN0 connector J16 requires SJ2 configured in default setting 1-2 shorted.*		P5V0 (5 V)	• Provides the VCC power to the CAN FD transceivers U5 and U6 (DNP) • The default power supply for the CAN connectors J16 (pin 3) and J17 (pin 3) (DNP) • Supplies power to the LDO voltage regulator U3, the Arduino socket connector J3 (pin 10), the mikroBUS socket connector J5 (pin 7), and the power test point TP5
LDO voltage regulator U3	Torex Semiconductor XC6227C331 PR-G	P3V3 (3.3 V)	• Produces the VDD_MCU (3.3 V) supply through either the jumper JP1 or the 0 Ω resistor R6 (not populated) • Produces the VDD_BOARD (3.3 V) supply through either the jumper JP2 or the 0 Ω resistor R7 (not populated) • Produces the VDD_MCU_LINK (3.3 V) supply through the 0 Ω resistor R8 • Supplies power to the Arduino socket connector J3 (pin 8), the power LED D5, and the power test point TP6
From the P3V3 supply through the jumper JP1 or the resistor R6 (DNP)		VDD_MCU (3.3 V)	• Produces the VDD_MCU_ANA supply through the 0 Ω resistor R87 • Provides the VDD power to the MCX A346 MCU • Supplies power to the SWD connector J13 (DNP) and the power test point TP7
From the VDD_MCU supply through the resistor R87		VDD_MCU_ANA (3.3 V)	• Provides the VDD_ANA power to the MCX A346 MCU • Provides the VREFH power to the MCX A346 MCU through the jumper JP3. Alternatively, you can open JP3 and connect to its pin 2 an external VREF source for the MCX A346 MCU.

Table 7. FRDM-MCXA346 power supplies*...continued*

Power source	Manufacture and part number	Power supply	Description
			• Supplies power to the Arduino socket connector J2 (pin 16)
From the P3V3 supply through the jumper JP2 or the resistor R7 (DNP)		VDD_BOARD (3.3 V)	• Provides the VIO power to CAN FD transceivers U5 and U6 (not populated) • Supplies power to: – Arduino socket connector J3 (pin 4) – mikroBUS socket connector J6 – Pmod connector J7 (not populated) – GPIO group 1 connector J8 (not populated) – Camera connector J9 – External debugger connector J14 – Push buttons SW1, SW2, and SW3 – Reset LED D11 and RGB LED D1 – Power test point TP8 – Temperature sensor U4 (not populated)
From the VDD_BOARD supply		VDD_MCU_ LINK (3.3 V)	• Provides the VDD, VDDA, and USB1_3V3 powers to the LPC55S16 MCU (MCU-Link) • Supplies power to MCU-Link LEDs D9, D10, and D11

2.1.1 Current measurement

The FRDM-MCXA346 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

Source power supply	Power supply to be measured	Jumper (2-pin)	Resistor	Current measurement steps
P3V3	VDD_MCU: Target MCU total power (analog + digital)	JP1	R6 (DNP)	1. Open the jumper (JP1). 2. Connect an ammeter to the jumper pins 1 and 2.
P3V3	VDD_BOARD: Board power	JP2	R7 (DNP)	1. Open the jumper (JP2). 2. Connect an ammeter to the jumper pins 1 and 2.
VDD_MCU	Target MCU (MCX A346) digital power		R86	1. Remove the resistor R86. 2. Connect an ammeter to the resistor R86 pins 1 and 2.
VDD_MCU	VDD_MCU_ANA: Target MCU analog power		R87	1. Remove the resistor R87. 2. Connect an ammeter to the resistor R87 pins 1 and 2.
VDD_MCU_ ANA	Target MCU analog reference power	JP3		1. Open the jumper (JP3). 2. Connect an ammeter to the jumper pins 1 and 2.

2.2 Clocks

Table 9 provides details about inputs clocks on the FRDM-MCXA346 board.

Table 9. FRDM-MCXA346 clocks

Clock generator	Manufacturer and part number	Clock	Frequency	Destination
Crystal Y1	Würth Elektronik 830055663	XTAL48M, EXTAL48M	8 MHz	MCX A346 MCU
Crystal Y2	Würth Elektronik 830064296	XTAL32M_[P, N]	16 MHz	LPC55S16 MCU

The MCX A346 MCU also provides a clock output CLKOUT, which can be accessed through the camera connector J9 (pin 12) and the mikroBUS connector J5 (pin 3).

2.3 FlexCAN interface

The MCX A346 MCU has one Flexible Data Rate Controller Area Network (FlexCAN) module: CAN0. The FRDM-MCXA346 board supports communication with the CAN0 module. Figure 8 shows the FRDM-MCXA346 FlexCAN diagram.

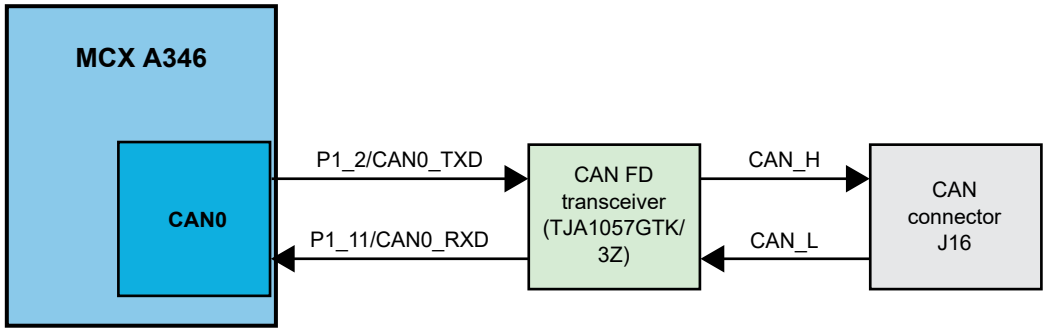

Figure 8. FlexCAN diagram

Table 10 describes the FRDM-MCXA346 FlexCAN connections.

Table 10. FlexCAN connections

FlexCAN module	Peripheral devices		
	Part identifier	Manufacturer and part number	Description
CAN0	U5	NXP TJA1057GTK/3Z	A high-speed CAN flexible data rate (FD) transceiver, which drives CAN signals between the CAN0 module of the MCX A346 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.
	J16		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 (default) / P5-9V_VIN (alternative)) • Pin 4: Ground
CAN1	U6 (DNP)	NXP TJA1057GTK/3Z	Not populated as MCX A346 has only one CAN module: CAN0
	J17 (DNP)		Not populated as MCX A346 has only one CAN module: CAN0

2.4 LPUART interface

The MCX A346 MCU has six Low-Power Universal Asynchronous Receiver/Transmitter (LPUART) modules: LPUART0, LPUART1, LPUART2, LPUART3, LPUART4, and LPUART5. The FRDM-MCXA346 board supports communication with the LPUART0, LPUART2, LPUART3, LPUART4, and LPUART5 modules.

Figure 9 shows the FRDM-MCXA346 LPUART diagram.

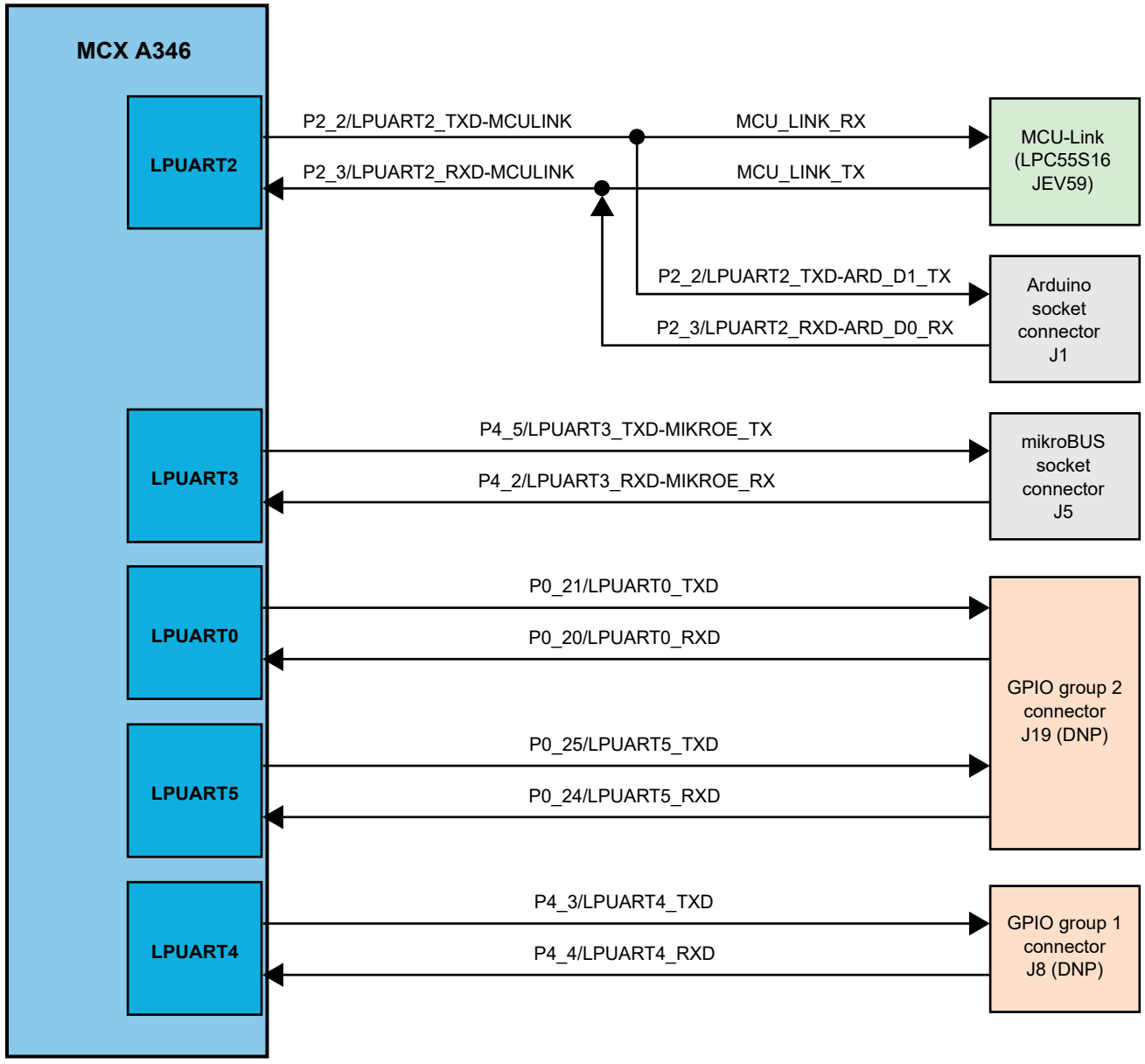

Figure 9. LPUART diagram

Table 11 describes the FRDM-MCXA346 LPUART connections.

Table 11. LPUART connections

LPUART modules	Peripheral devices		
	Part identifier	Manufacturer and part number	Description
LPUART2	U2	NXP LPC55S16JEV59	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 be used as a USB-to-UART bridge to debug the target MCU (MCX A346) through a virtual communication (VCOM) port.
	J1		2x8-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through a UART connection.
LPUART3	J5		1x8-position mikroBUS socket connector that allows the plugged-in mikroBUS click board to communicate with the MCX A346 MCU through a UART connection
LPUART0 and LPUART5	J19 (DNP)		2x8-position GPIO group 2 socket connector that allows the plugged-in module board to communicate with the MCX A346 MCU through a UART connection. J19 pins 9 and 10 are connected to LPUART0. J19 pins 13 and 14 are connected to LPUART5.
LPUART4	J8 (DNP)		2x14-position GPIO group 1 socket connector that allows the plugged-in module board to communicate with the MCX A346 MCU through a UART connection. J8 pins 6 and 7 are connected to LPUART4.

2.5 LPSPI interface

The MCX A346 MCU has two Low-Power Serial Peripheral Interface (LPSPI) modules: LPSPI0 and LPSPI1.

Each LPSPI module supports two modes:

- Controller mode, with support for up to four peripheral chip selects (PCSs)
- Peripheral mode

The FRDM-MCXA346 board supports communication with both LPSPI modules of the MCX A346 MCU. Figure 10 shows the FRDM-MCXA346 LPSPI diagram.

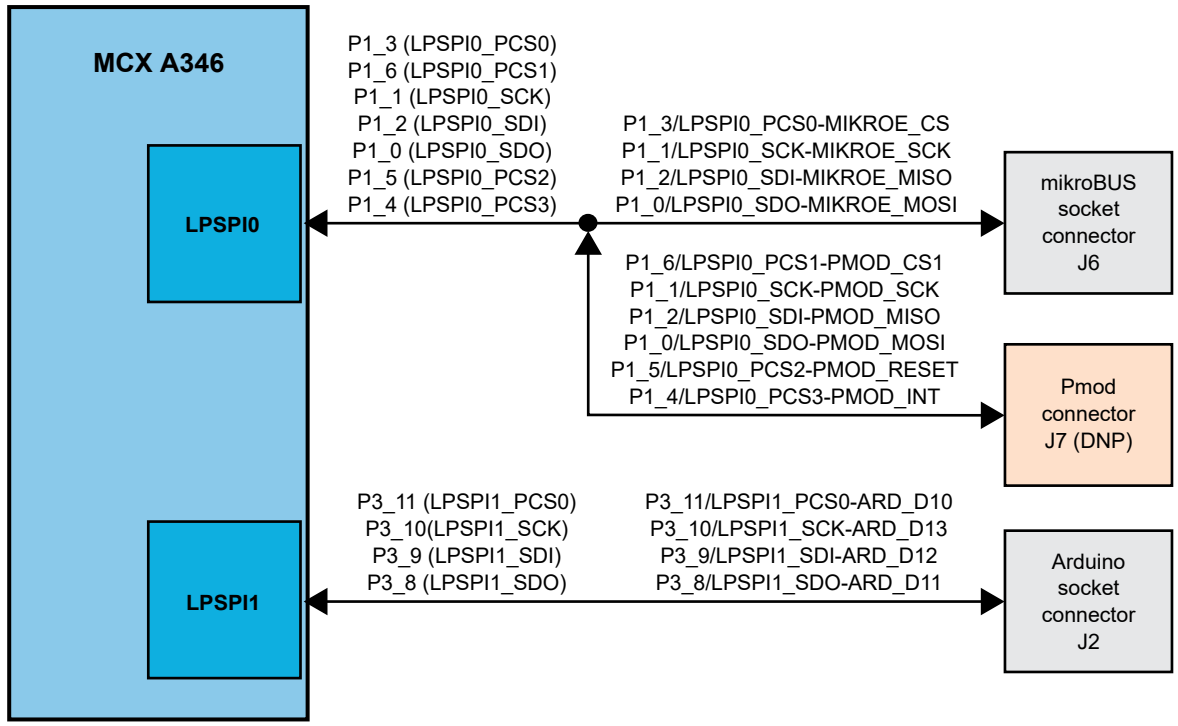

Figure 10. LPSPI diagram

Table 12 describes the FRDM-MCXA346 LPSPI connections.

Table 12. LPSPI connections

LPSPI module	Peripheral chip select	Peripheral devices	
		Part identifier	Description
LPSPI0	PCS0	J6	1x8-position mikroBUS socket connector that allows the plugged-in mikroBUS click board to communicate with the MCX A346 MCU through an SPI connection
	PCS1	J7 (DNP)	2x6-pin/position Pmod connector that allows the plugged-in Pmod board to communicate with the MCX A346 MCU through an SPI connection. J7 also supports LPSPI0 while configured in Quad SPI mode. By default, J7 is not populated on the board.
LPSPI1	PCS1	J2	2x10-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an SPI connection.

2.6 LPI2C interface

The MCX A346 MCU has four Low-Power Inter-Integrated Circuit (LPI2C) modules: LPI2C0, LPI2C1, LPI2C2, and LPI2C3. Each LPI2C module supports serial I^2C communication through a pair of control and data signals and can act as a controller or target.

The FRDM-MCXA346 board supports communication with all the LPI2C modules. Figure 11 shows the FRDM-MCXA346 LPI2C diagram.

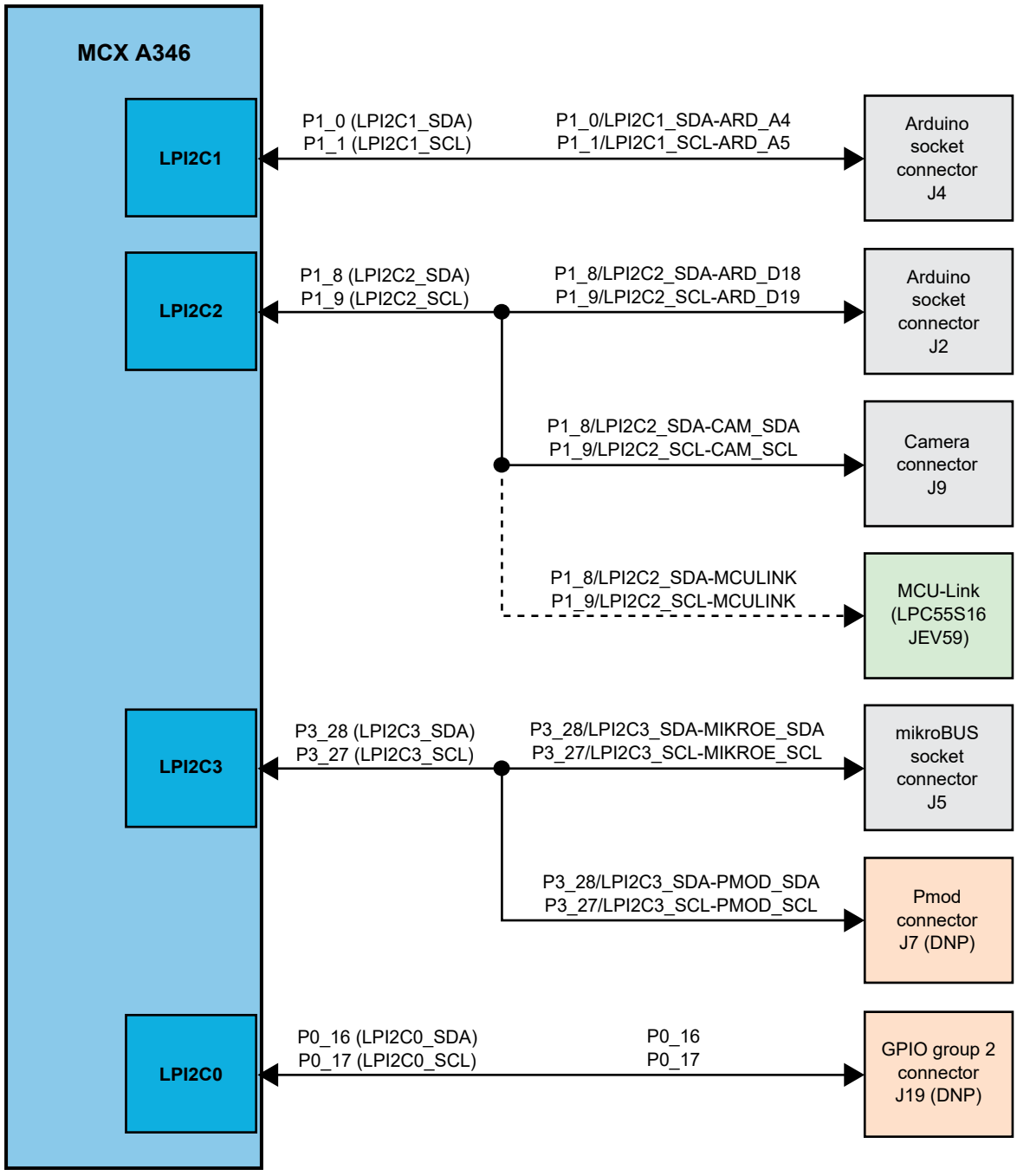

Figure 11. LPI2C diagram

Table 13 describes the FRDM-MCXA346 LPI2C devices. The I^2C address of each device (except MCU-Link, which acts as an I^2C controller) depends on the plugged-in board/module.

Table 13. LPI2C devices

LPSPI module	Peripheral devices		
	Part identifier	Manufacturer and part number	Description
LPI2C1	J4		2x6-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an I^2C connection. ***Note:*** *This I^2C connection is shared with SPI functions (SCK and MOSI) of the mikroBUS socket connector J6 and the Pmod connector J7 (DNP).*
LPI2C2	J2		2x10-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an I^2C connection
	J9		2x10-position camera connector that allows the plugged-in module board to communicate with the MCX A346 MCU through an I^2C connection. Pins 15 and 16 of J9 are connected to the SCL and SDA signals, respectively, of LPI2C2.
	U2	NXP LPC55S16JEV59	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 be used as a USB-to-I^2C bridge to debug the target MCU (MCX A346) through a USB port.
LPI2C3	J5		1x8-position mikroBUS socket connector that allows the plugged-in mikroBUS click board to communicate with the MCX A346 MCU through an I^2C connection
	J7 (DNP)		2x6-pin/position Pmod connector that allows the plugged-in Pmod board to communicate with the MCX A346 MCU through an I^2C connection. By default, J7 is not populated on the board.
LPI2C0	J19 (DNP)		2x8-position GPIO group 2 socket connector that allows the plugged-in module board to communicate with the MCX A346 MCU through an I^2C connection

2.7 Camera interface

The MCX A346 MCU has one SmartDMA module, which is a coprocessor for applications, such as parallel camera interface and keypad scanning. The SmartDMA module can also be used to emulate interfaces, such as UART, SPI, and I^2C.

The FRDM-MCXA346 board supports communication with the SmartDMA module through the camera connector J9, which is a 2x10-position camera connector. The connector supports a camera module based on the OmniVision OV7670 image sensor.

Figure 12 shows the FRDM-MCXA346 camera (SmartDMA) diagram.

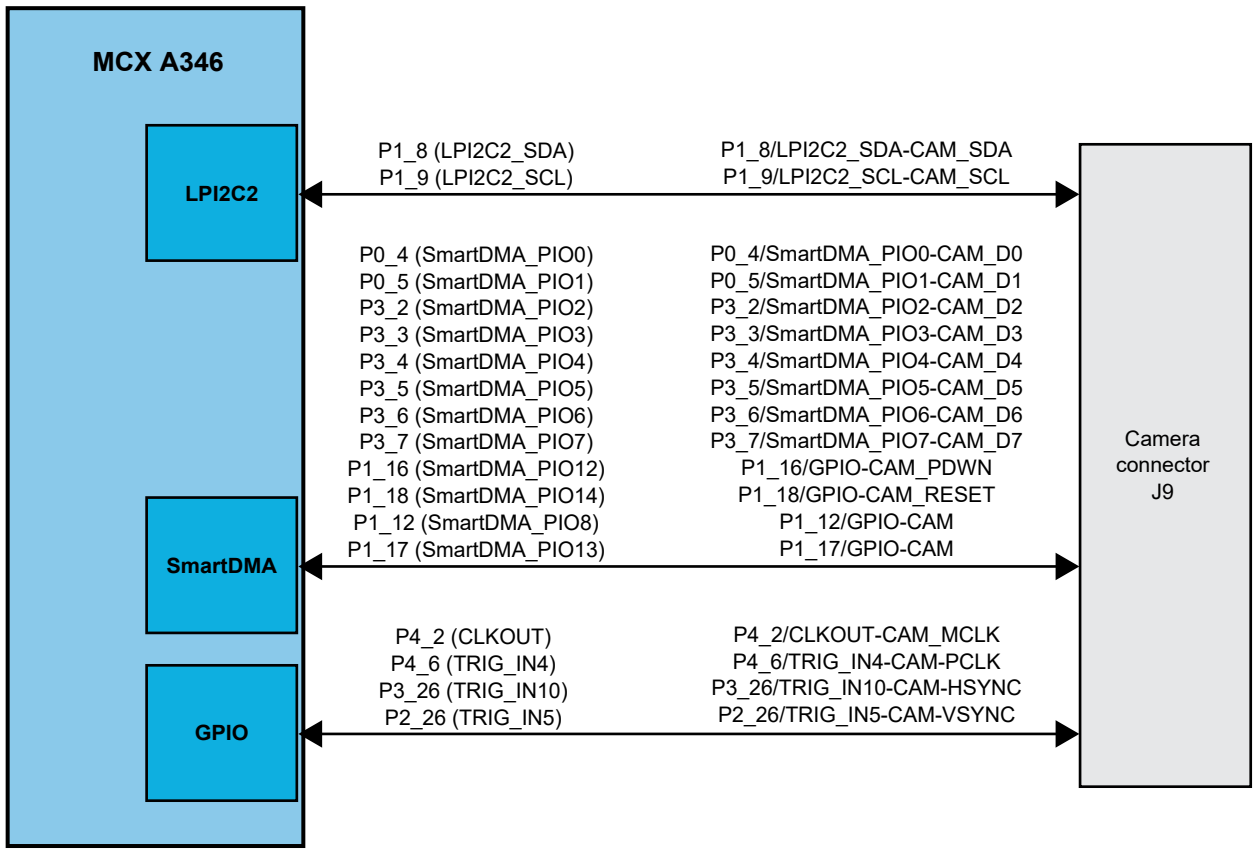

Figure 12. Camera (SmartDMA) diagram

Table 14 shows the pinout of the SmartDMA camera connector J9.

Table 14. Camera connector pinout

Pin number	Signal name	Description
1	P1_18/GPIO-CAM_RESET	Camera reset signal
2	P1_16/GPIO-CAM_PDWN	Camera power-down signal
3	P0_5/SmartDMA_PIO1-CAM_D1	Camera data signals
4	P0_4/SmartDMA_PIO0-CAM_D0	
5	P3_3/SmartDMA_PIO3-CAM_D3	
6	P3_2/SmartDMA_PIO2-CAM_D2	
7	P3_5/SmartDMA_PIO5-CAM_D5	
8	P3_4/SmartDMA_PIO4-CAM_D4	
9	P3_7/SmartDMA_PIO7-CAM_D7	
10	P3_6/SmartDMA_PIO6-CAM_D6	
11	P4_6/TRIG_IN4-CAM_PCLK	Camera pixel clock signal
12	P4_2/CLKOUT-CAM_MCLK	Camera input clock signal
13	P2_26/TRIG_IN5-CAM_VSYNC	Camera vertical sync signal
14	P3_26/TRIG_IN10-CAM_HSYNC	Camera horizontal reference signal

Table 14. Camera connector pinout*...continued*

Pin number	Signal name	Description
15	P1_9/LPI2C2_SCL-CAM_SCL	I^2C signals
16	P1_8/LPI2C2_SDA-CAM_SDA	
17	VDD	Power supply
18	GND	Ground
19	P1_12/GPIO-CAM	Reserved GPIO
20	P1_17/GPIO-CAM	Reserved GPIO

2.8 ADC interface

The MCX A346 MCU has four 16-bit Analog-to-Digital Converter (ADC) modules: ADC0, ADC1, ADC2, and ADC3. The FRDM-MCXA346 board supports communication with all the ADC modules of the MCX A346 MCU.

Table 15 describes the FRDM-MCXA346 ADC connections.

Table 15. ADC connections

ADC modules	ADC input connections		Peripheral devices	
	MCX A346 I/O number	ADC function	Part identifier	Description
ADC0 and ADC1	P2_4	ADC0_A1	J2	2x10-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an ADC connection
	P2_7	ADC0_A7		
	P1_3	ADC0_A19		
	P1_4	ADC0_A20		
	P1_5	ADC0_A21		
	P1_6	ADC0_A22		
	P2_5	ADC1_A1		
	P1_10	ADC1_A8		
	P1_14	ADC1_A12		
ADC1	P1_11	ADC1_A9	J3	2x8-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an ADC connection
ADC0 and ADC1	P2_8	ADC0_A7	J4	2x6-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an ADC connection
	P1_0	ADC0_A16		
	P1_1	ADC0_A17		
	P2_5	ADC1_A1		
	P1_14	ADC1_A12		
	P3_30	ADC1_A21		
ADC0	P1_6	ADC0_A22	J6	1x8-position mikroBUS socket connector that allows the plugged-in mikroBUS click board to communicate with the MCX A346 MCU through an ADC connection

Table 15. ADC connections*...continued*

ADC modules	ADC input connections		Peripheral devices	
	MCX A346 I/O number	ADC function	Part identifier	Description
ADC1, ADC2, and ADC3	P0_7	ADC2_A11	J8 (DNP)	2x14-position GPIO group 1 connector that allows the plugged-in module board to communicate with the MCX A346 MCU through an ADC connection
	P1_15	ADC1_A13		
	P1_19	ADC1_A17		
	P2_10	ADC2_A1		
	P2_11	ADC3_A1		
	P2_24	ADC2_A3		
	P2_25	ADC3_A3		
	P3_20	ADC3_A18		
	P3_23	ADC3_A21		
	P3_24	ADC3_A22		
	P3_25	ADC3_A23		
	P3_29	ADC1_A22		
	P4_0	ADC2_A16		
	P4_1	ADC2_A17		
	P4_3	ADC2_A19		
	P4_4	ADC2_A20		
ADC0 and ADC2	P0_12	ADC2_A12	J19 (DNP)	2x8-position GPIO group 2 connector that allows the plugged-in module board to communicate with the MCX A346 MCU through an ADC connection
	P0_13	ADC2_A13		
	P0_14	ADC2_A14		
	P0_15	ADC2_A15		
	P0_18	ADC0_A8		
	P0_19	ADC0_A9		
	P0_20	ADC0_A10		
	P0_21	ADC0_A11		
	P0_22	ADC0_A12		
	P0_23	ADC0_A13		

2.9 Op-amp interface

The MCX A346 MCU has four operational amplifier (op-amp) modules (without PGA): OPAMP0, OPAMP1, OPAMP2, and OPAMP3. The FRDM-MCXA346 board supports communication with all the op-amp modules of the MCX A346 MCU.

Table 16 describes the FRDM-MCXA346 op-amp connections.

Table 16. Op-amp connections

Op-amp module	MCU pin	Op-amp I/O function	Peripheral devices		Required connection settings
			Part identifier	Description	
OPAMP0	P2_12	OPAMP0_INP		OPAMP0 does not connect to any connectors. It is only connected to the test points TP15 (INP), TP18 (INN), and TP16 (OUT), which are on the bottom side of the PCB.	
	P2_13	OPAMP0_INN			
	P2_25	OPAMP0_OUT			
OPAMP1	P2_16	OPAMP1_INP	J4	2x6-position Arduino socket connector that allows the plugged-in Arduino board to communicate with the MCX A346 MCU through an op-amp connection	This connection requires changing the SJ4 and SJ5 settings from 1-2 shorted to 2-3 shorted.
	P2_17	OPAMP1_INN			
	P2_19	OPAMP1_OUT			
OPAMP2	P2_0	OPAMP2_INP			This connection requires changing the SJ6 setting from 1-2 shorted to 2-3 shorted.
	P2_1	OPAMP2_INN			
	P2_6	OPAMP2_OUT			
OPAMP3	P2_20	OPAMP3_INP			
	P2_21	OPAMP3_INN			
	P2_23	OPAMP3_OUT			

2.10 GPIO group 1 interface

The MCX A346 MCU does not have a Flexible Input/Output (FlexIO) module. Therefore, the connector J8 meant for FlexIO is not populated on the FRDM-MCXA346 board. However, the MCX A346 GPIO signals connected to J8 (DNP) can still be used as alternative GPIO functions.

The GPIO group 1 connector J8 (DNP) is a 2x14-position connector. Table 17 shows the pinout of the connector J8 (DNP).

Table 17. GPIO group 1 connector pinout

Pin number	Signal name	Supported functions
1	VDD_BOARD	Power supply
2	GND	Ground
3	P3_27	P3_27/TRIG_OUT7/LPI2C3_SCL/LPUART4_TXD/CT_INP13/CT3_MAT1/PWM1_A3/SmartDMA_PIO27/WUU0_IN30
4	P3_28	P3_28/TRIG_IN11/LPI2C3_SDA/LPUART4_RXD/CT_INP12/CT3_MAT2/PWM1_B3/SmartDMA_PIO28/WUU0_IN26
5	P2_24	P2_24/ADC2_A3/TRIG_OUT6/CT_INP8

Table 17. GPIO group 1 connector pinout*...continued*

Pin number	Signal name	Supported functions
6	P4_4	P4_4/ADC2_A20/LPI2C2_SDA/LPUART4_RXD/CT4_MAT2/PWM0_A1/SmartDMA_PIO24/WUU0_IN17
7	P4_3	P4_3/ADC2_A19/LPI2C2_SCL/LPUART4_TXD/CT4_MAT1/PWM0_B2/SmartDMA_PIO23
8	P4_1	P4_1/ADC2_A17/PWM0_B3/SmartDMA_PIO21
9	P3_16	P3_16/LPUART4_RTS_B/CT_INP8/PWM1_A0/SmartDMA_PIO16
10	P0_7	P0_7/ADC2_A11/CMP2_IN1/CT_INP3/SmartDMA_PIO3/WUU0_IN1
11	P4_0	P4_0/ADC2_A16/TRIG_IN5/PWM0_A3/SmartDMA_PIO20
12	P2_25	P2_25/ADC3_A3/TRIG_OUT7/CT_INP9
13	P2_8	P2_8/TRIG_OUT3/CT3_MAT0
14	P2_9	P2_9/TRIG_IN4/CT3_MAT1
15	P2_10	P2_10/ADC2_A1/TRIG_OUT5/LPUART2_TXD/CT3_MAT2/SmartDMA_PIO14
16	P2_11	P2_11/ADC3_A1/TRIG_IN4/LPUART2_RXD/CT3_MAT3/SmartDMA_PIO15
17	P3_12	P3_12/ADC3_A14/LPUART2_RTS_B/LPUART3_TXD/CT1_MAT2/PWM0_X0/PWM1_A2/SmartDMA_PIO12
18	P3_13	P3_13/ADC3_A15/LPUART2_CTS_B/LPUART3_RXD/CT1_MAT3/PWM0_X1/PWM1_B2/SmartDMA_PIO13
19	P2_14	P2_14/CT4_MAT2
20	P1_15	P1_15/ADC1_A13/LPI2C1_SDAS/LPUART2_CTS_B/CT3_MAT1/SmartDMA_PIO11/WUU0_IN13
21	P3_24	P3_24/ADC3_A22/TRIG_IN11/CT_INP16/SmartDMA_PIO24
22	P3_25	P3_25/ADC3_A23/TRIG_OUT6/CT_INP15/SmartDMA_PIO25
23	P2_18	P2_18/CT3_MAT2
24	P1_19	P1_19/ADC1_A17/FREQME_CLK_IN1/CT3_MAT1/SmartDMA_PIO15/LPUART5_CTS_B/CAN0_RXD/WUU0_IN15
25	P3_20	P3_20/ADC3_A18/TRIG_OUT0/LPI2C3_SDA/LPUART1_RXD/CT2_MAT2/PWM0_X2/PWM1_A3/SmartDMA_PIO20
26	P3_29	P3_29/ADC1_A22/ISPMODE_N/LPI2C3_HREQ/CT_INP3/CT3_MAT3/SmartDMA_PIO29/WUU0_IN27
27	P2_22	P2_22/CT2_MAT2
28	P3_23	P3_23/ADC3_A21/LPUART1_CTS_B/CT_INP11/PWM1_X3/SmartDMA_PIO23

2.11 GPIO group 2 interface

The MCX A346 MCU does not have a segment Liquid-Crystal Display (LCD) module. Therefore, the connector J19 meant for segment LCD and the associated component DS1 are not populated on the FRDM-MCXA346 board. However, the MCX A346 GPIO signals connected to J19 (DNP) can still be used as alternative GPIO functions.

The GPIO group 2 connector J19 (DNP) is a 2x8-position connector. Table 18 shows the pinout of the connector J19 (DNP).

Table 18. GPIO group 2 connector pinout

Pin number	Signal name	Supported functions
1	P0_12	P0_12/ADC2_A12/CT0_MAT2
2	P0_13	P0_13/ADC2_A13/CT0_MAT3
3	P0_14	P0_14/ADC2_A14/CT_INP2/UTICK_CAP0/SmartDMA_PIO4
4	P0_15	P0_15/ADC2_A15/CT_INP3/UTICK_CAP1/SmartDMA_PIO5
5	P0_16	P0_16/LPI2C0_SDA/LPSPI0_PCS2/CT0_MAT0/UTICK_CAP2/SmartDMA_PIO6/WUU0_IN2
6	P0_17	P0_17/LPI2C0_SCL/LPSPI0_PCS3/CT0_MAT1/UTICK_CAP3/SmartDMA_PIO7
7	P0_18	P0_18/ADC0_A8/LPI2C0_SCLS/CT0_MAT2/SmartDMA_PIO8/CMP0_OUT
8	P0_19	P0_19/ADC0_A9/LPI2C0_SDAS/CT0_MAT3/SmartDMA_PIO9/CMP1_OUT/WUU0_IN3
9	P0_20	P0_20/ADC0_A10/LPUART0_RXD/CT_INP0/SmartDMA_PIO10/CMP2_OUT/WUU0_IN4
10	P0_21	P0_21/ADC0_A11/LPUART0_TXD/CT_INP1/SmartDMA_PIO11
11	P0_22	P0_22/ADC0_A12/LPUART0_RTS_B/CT_INP2/CT0_MAT0/SmartDMA_PIO12
12	P0_23	P0_23/ADC0_A13/CMP2_IN2/LPUART0_CTS_B/CT_INP3/CT0_MAT1/SmartDMA_PIO13/WUU0_IN5
13	P0_24	P0_24/CT0_MAT0/LPUART5_RXD
14	P0_25	P0_25/CT0_MAT1/LPUART5_TXD
15	P0_26	P0_26/CT0_MAT2/LPUART5_RTS_B
16	P0_27	P0_27/CT0_MAT3/LPUART5_CTS_B

2.12 USB interface

The MCX A346 MCU does not have a Universal Serial Bus (USB) module. Therefore, the connector J10 meant for the target MCU USB port is not populated on the FRDM-MCXA346 board.

2.13 I3C interface

The MCX A346 MCU does not have an Improved Inter-Integrated Circuit (I3C) module. Therefore, the I3C temperature sensor U4 (NXP P3T1755DPZ) and the associated components R73, R80, R81, C41, and C42 are not populated on the FRDM-MCXA346 board.

2.14 Arduino socket

The FRDM-MCXA346 board has an Arduino socket with the following four connectors:

- J1: 2x8-position receptacle
- J2: 2x10-position receptacle
- J3: 2x8-position receptacle
- J4: 2x6-position receptacle

The two 2x8-position receptacles are placed diagonally opposite to each other. Figure 13 shows the pinouts of the Arduino socket connectors.

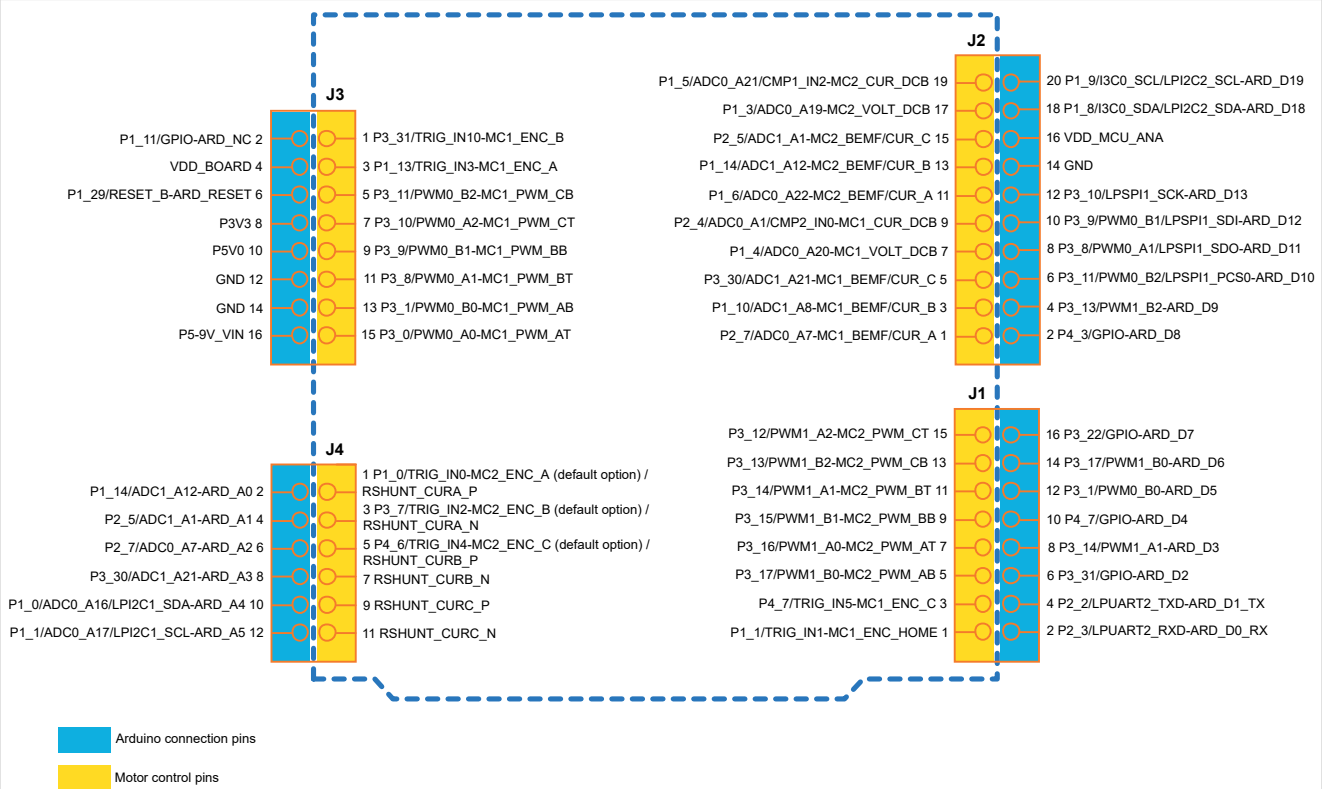

Figure 13. Arduino socket connector pinouts

The Arduino socket allows communication with the following modules of the MCX A346 MCU:

- Low-Power Universal Asynchronous Receiver/Transmitter 2 (LPUART2)
- Low-Power Serial Peripheral Interface 1 (LPSPI1)
- Low-Power Inter-Integrated Circuit 1 (LPI2C1)
- Low-Power Inter-Integrated Circuit 2 (LPI2C2)
- Analog-to-Digital Converter 0 (ADC0)
- Analog-to-Digital Converter 1 (ADC1)
- Operational Amplifier 1 (OPAMP1) (optional)
- Operational Amplifier 2 (OPAMP2) (optional)
- Operational Amplifier 3 (OPAMP3)
- Pulse Width Modulator 0 (PWM0)
- Pulse Width Modulator 1 (PWM1)

The Arduino socket is pin-compatible with the following boards:

- Arduino boards:
  - Arduino Uno revision 3 (R3)
  - Arduino A4/A5
- Motor control boards:
  - FRDM-MC-LVBLDC
  - FRDM-MC-LVPMSM

2.15 mikroBUS socket

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

The FRDM-MCXA346 board has a mikroBUS socket with a pair of 1x8-position receptacles, J5 and J6. Figure 14 shows the pinouts of the mikroBUS socket connectors.

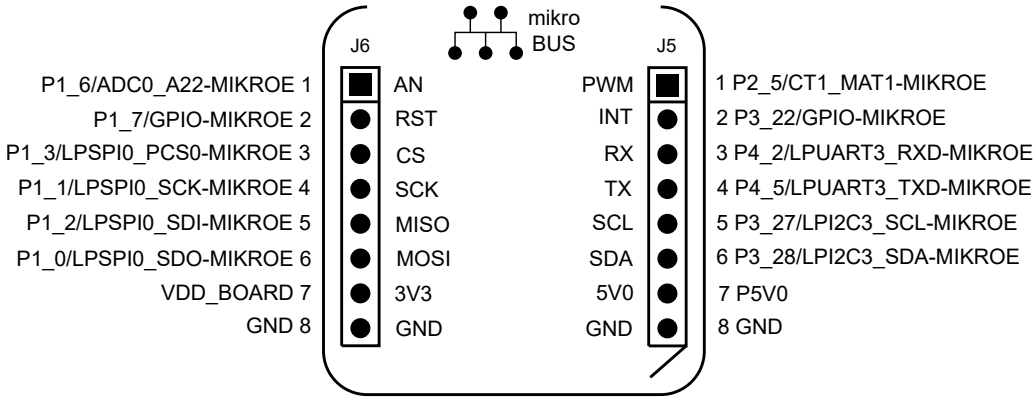

Figure 14. mikroBUS socket connector pinouts

The mikroBUS socket allows communication with the following modules of the MCX A346 MCU:

- Low-Power Universal Asynchronous Receiver/Transmitter 3 (LPUART3)
- Low-Power Serial Peripheral Interface 0 (LPSPI0)
- Low-Power Inter-Integrated Circuit 3 (LPI2C3)
- Analog-to-Digital Converter 0 (ADC0)
- Standard asynchronous counter/timer 1 (CTIMER1)

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 examples click boards for the FRDM-MCXA346 mikroBUS socket, visit MIKROE website.

2.16 Pmod connector

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

The FRDM-MCXA346 board supports a Pmod connector J7 (Digilent PPPC062LJBN-RC) for expanding the capabilities of the board. J7 is not populated on the board by default. If populated, it can be used to work with a remote host, or as an interface to a Pmod expansion board.

Table 19 shows the pinout of the Pmod connector J7.

Table 19. Pmod connector pinout

Pin number	Signal name	Description
1	P1_6/LPSPI0_PCS1-PMOD_CS1	SPI signals
3	P1_0/LPSPI0_SDO-PMOD_MOSI	
5	P1_2/LPSPI0_SDI-PMOD_MISO	

Table 19. Pmod connector pinout*...continued*

Pin number	Signal name	Description
7	P1_1/LPSPI0_SCK-PMOD_SCK	
2	P1_4/LPSPI0_PCS3-PMOD_INT	GPIO signals
4	P1_5/LPSPI0_PCS2-PMOD_RESET	
6	P3_27/LPI2C3_SCL-PMOD_SCL	I^2C signals
8	P3_28/LPI2C3_SDA-PMOD_SDA	
11, 12	VDD_BOARD	Power supply
9, 10	GND	Ground

The Pmod connector allows communication with the following modules of the MCX A346 MCU:

- Low-Power Serial Peripheral Interface 0 (LPSPI0)
- Low-Power Inter-Integrated Circuit 3 (LPI2C3)

Note: *In Quad SPI mode, the MCX A346 pins P1_0, P1_1, P1_2, P1_4, P1_5, and P1_6 can act as LPSPI0. For details, refer to the LPSPI chapter of MCX A345 and A346 Reference manual.*

3 MCU-Link OB debug probe

MCU-Link is a debug probe architecture jointly developed by NXP and Embedded Artists. 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-MCXA346. The onboard implementation of MCU-Link is referred to as MCU-Link OB.

In the FRDM-MCXA346 board, the MCU-Link architecture is based on the NXP LPC55S16 MCU, which is based on an Arm Cortex-M33 core. The 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-MCXA346 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 is also available to make the MCU-Link OB compatible with J-Link LITE. 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 20 summarizes the MCU-Link features supported on the FRDM-MCXA346 board.

Table 20. 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 or USB-to-CAN[2] bridge.
External debug probe support	The MCU-Link interface supports debugging the target MCU (MCX A346) using an external debug probe, instead of MCU-Link. To enable support for an external debug probe, disable the SWD feature by shorting the jumper JP6.

[1] J-Link firmware does not support this feature.
[2] The USB-to-CAN feature is not currently supported by MCU-Link. It is planned for the future.

3.2 Supported debug scenarios

Table 21 describes the debug scenarios supported on the FRDM-MCXA346 board.

Table 21. Supported debug scenarios

Debug scenario	MCU-Link feature	Description
Use MCU-Link for debugging the MCX A346 MCU	SWD	• MCU-Link SWD feature is enabled if the jumper JP6 is open. • Target MCU external debugger connector J14 or J13 (DNP) is not used for an external connection.
	VCOM	MCU-Link VCOM port is enabled if the jumper JP5 is open.

Table 21. Supported debug scenarios*...continued*

Debug scenario	MCU-Link feature	Description
	USB-to-CAN	MCU-Link USB-to-CAN port is enabled if the jumper JP7 is open. The USB-to-CAN feature is not currently supported, and therefore, JP7 is shorted by default.
Use an external debugger for debugging the MCX A346 MCU	SWD	Not supported
	VCOM	Not supported
	USB-to-CAN	Not supported

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 the MCU-Link firmware update utility manually. The utility 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 22. If you are using the MCUXpresso for Visual Studio Code extension or a third-party IDE from IAR or Keil, get the latest MCU-Link firmware version.

Table 22. 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. To configure MCU-Link in ISP mode and update MCU-Link firmware, follow these steps:

1. Disconnect the board from the host computer, short the jumper JP4, and reconnect the board. The red MCU-Link status LED D11 lights up and stays on. For more details on MCU-Link LEDs, see Section 3.12.
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 file 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 the jumper JP4, 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 22).

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

3.6 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 MCU-Link functionality. However, the MCU-Link firmware version that 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 22.

3.7 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.

3.8 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 that covers the use of generic CMSIS-DAP probes or J-Link probes (depending on the firmware image you are using).

3.9 MCU-Link USB connector

The FRDM-MCXA346 board has a USB Type-C connector J15, which allows you to connect MCU-Link with your host computer. It can also be used to supply 5 V power to the board.

3.10 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-MCXA346 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 JP4 is open (MCU-Link boots normally).
2. Ensure that the jumper JP5 is open (MCU-Link VCOM port is enabled).
3. Connect the MCU-Link USB connector J15 to the USB port of the host computer.

When you boot the FRDM-MCXA346 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.

To disable the VCOM function, short the jumper JP5 before powering up the board. Changing the JP5 setting (open/short) after powering up the board does not modify the enable/disable setting of the MCU-Link VCOM function.

3.11 USBSIO port (USB to target I^2C 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-I^2C 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 http://www.nxp.com/libusbsio.

The FRDM-MCXA346 board supports connecting MCU-Link to the LPI2C2 module of the target MCU. By default, this I^2C connection is disabled. It can be enabled by populating the 0 Ω resistors R64 and R65.

To use MCU-Link as a USB-to-I^2C bridge, the board must be connected to the host computer through a USB cable from its J15 connector. A USB-to-I^2C bridge can be used to emulate the host system / board peripherals.

By default, the USBSIO feature is disabled for I^2C on the FRDM-MCXA346 board, allowing the target MCU I^2C 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.

3.12 MCU-Link status LEDs

The FRDM-MCXA346 board has three status indicator LEDs for MCU-Link. Table 23 lists these LEDs and describes how each LED behaves in different MCU-Link modes.

Table 23. MCU-Link LEDs

Part identifier	Label on board schematics	LED color	LED function		
			Normal operation (with CMSIS-DAP)	Normal operation (with J- Link)	ISP (firmware update) mode
D9	USB_ ACTIVE	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.
D10	VCOM_ ACTIVE	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.
D11	ISP_BOOT	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 LED D11 blinks rapidly.	The LED remains OFF.	The LED lights up when MCU-Link (LPC55S16) boots in ISP mode.

4 Board errata

Not applicable for the current board revision.

5 Related documentation

Table 24 lists some additional documents and resources that you can refer to for more information on the FRDM-MCXA346 board. Some of these documents may only be available under a non-disclosure agreement (NDA). To access such a document, contact a local NXP field applications engineer (FAE) or sales representative.

Table 24. Related documentation

Document	Description	Link / how to obtain
MCX A345 and A346 Reference Manual	Provides a detailed description about the MCX A345/346 MCU and its features, including memory maps, power supplies, and clocks.	MCXAP144M240F60RM.pdf
MCXA345/346 Data Sheet	Describes the features, electrical characteristics, packaging information, and ordering details about the MCX A345/346 MCU.	MCXAP144M240F60.pdf
FRDM-MCXA346 board schematics	Provides a circuit representation showing the functionality and connectivity of the FRDM-MCXA346 board components.	FRDM-MCXA346 Design Files
MCX A345/346 Chip Errata	Lists the details of all known silicon errata for the MCX A345/346 device.	Contact an NXP FAE / sales representative
LPC55S1x/LPC551x User Manual (UM11295)	Provides a detailed description about the LPC55S1x/LPC551x MCU and its features, including memory maps, power supplies, and clocks.	UM11295.pdf

6 Acronyms

Table 25 lists the acronyms used in this document.

Table 25. Acronyms

Acronym	Description
ADC	Analog-to-Digital Converter
BLDC	Brushless direct current
CAN	Controller area network
DNP	Do not populate / do not place
FlexCAN	Flexible Controller Area Network
FlexIO	Flexible Input/Output
GPIO	General-purpose input/output
HID	Human interface device
I^2C	Inter-Integrated Circuit
I3C	Improved Inter-Integrated Circuit
IoT	Internet of Things
ISP	In-System Programming
LCD	Liquid-Crystal Display
LDO	Low-dropout regulator
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
MIPI	Mobile Industry Processor Interface
OB	Onboard
Op-amp	Operational amplifier
OS	Operating system
PCS	Peripheral chip select
PMSM	Permanent magnet synchronous motor
PWM	Pulse Width Modulator
SPI	Serial Peripheral Interface
SWD	Serial wire debug
SWO	Serial wire debug trace output
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
USBSIO	USB serial input/output
VCOM	Virtual communication

7 Revision history

Table 26 summarizes the revisions to this document.

Table 26. Revision history

Document ID	Release date	Description
UM12348 v.1.1	14 August 2025	Corrected default setting for jumper JP7 in Table 4
UM12348 v.1.0	18 July 2025	Initial public release

Legal information

Definitions

Draft — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at https://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Suitability for use in non-automotive qualified products — Unless this document expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

HTML publications — An HTML version, if available, of this document is provided as a courtesy. Definitive information is contained in the applicable document in PDF format. If there is a discrepancy between the HTML document and the PDF document, the PDF document has priority.

Translations — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Security — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately.

Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

NXP B.V. — NXP B.V. is not an operating company and it does not distribute or sell products.

Trademarks

Notice: All referenced brands, product names, service names, and trademarks are the property of their respective owners.

NXP — wordmark and logo are trademarks of NXP B.V.

Contents