KIT_XMC7200_DC_V1 motor drive card guide

About this document

Scope and purpose

This document describes the kit operation, out-of-the-box example, operation, and the hardware details of the KIT_XMC7200_DC_V1 motor drive card.

Intended audience

This evaluation board is intended for all technical specialists who are familiar with connectivity and is intended for use in laboratory conditions.

Reference Board/Kit

Product(s) embedded on a PCB with a focus on specific applications and defined use cases that may include software. PCB and auxiliary circuits are optimized for the requirements of the target application.

Note: Boards do not necessarily meet safety, EMI, quality standards (for example UL, CE) requirements.

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Safety precautions

Note: Please note the following warnings regarding the hazards associated with development systems.

Table 1 Safety precautions

	**Caution:** *The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.*
	**Caution:** *The evaluation or reference board is shipped with packing materials that need to be removed prior to installation. Failure to remove all packing materials that are unnecessary for system installation may result in overheating or abnormal operating conditions.*

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1 Introduction

The XMC7200_DC motor drive card enables you to evaluate and develop the motor control applications using the XMC7200D microcontroller (XMC7200D).

XMC7200D is designed for industrial applications. XMC7200D is a true programmable embedded system-on-chip, integrating up to two 350-MHz Arm® Cortex®-M7 as the primary application processors, a 100-MHz Arm® Cortex®-M0+ that supports low-power operations, up to 8-MB flash and 1-MB SRAM, Gigabit Ethernet, Controller Area Network Flexible Data-Rate (CAN FD), Secure Digital Host Controller (SDHC) supporting SD/SDIO/eMMC interfaces, programmable analog and digital peripherals that allow faster time-to-market.

The motor drive card features two potentiometers, a push button, and two user LEDs for easy interaction and visual feedback. It includes a USB Type-C connector for convenient USB device connectivity. The onboard debugger based on J-Link simplifies programming and debugging tasks. Additionally, it offers a Tracebox and ETM header. With four hall sensor headers, four encoder headers, a mikroBUS header, and a high-density connector, it provides the flexibility and expandability for sensor integration and connectivity options. The board supports operating voltages from 3.3 V to 5.0 V for XMC7200D.

The ModusToolbox™ software is used to develop and debug the XMC7200D projects. ModusToolbox™ software is a set of tools that enables you to integrate these devices into your existing development methodology.

For more details on XMC7200D, see AN234334 - Getting started with XMC7000 MCU on ModusToolbox™ software application note that aids you in creating a customized design using the Eclipse IDE for ModusToolbox™ software.

1.1 Getting started

The guide has the following sections:

- The Kit details chapter provides the kit package and board details.
- The Kit operation chapter describes the major features of the XMC7200 motor drive card and its functionalities such as programming, debugging, the USB-UART, and USB-I2C bridges.
- The Hardware chapter provides a detailed hardware description, kit schematics, and the bill of materials (BOM).
- ModusToolbox™ software supports the application development using the XMC7200 motor drive card kit. The ModusToolbox™ software is a free development eco-system that includes the Eclipse IDE for ModusToolbox™ software and the XMC7000 SDK with XMC7200D. ModusToolbox™ enables and configures the device resource, middleware libraries; write *C/* assembly source code; and program and debug the device. The software can be downloaded from the ModusToolbox™ Software webpage. For more details, see the ModusToolbox™ software installation guide.
- There are a wide range of code examples to evaluate the XMC7200 board. These examples help to familiarize with XMC7200D and help to create a customized design. These examples can be accessed through ModusToolbox™ Project Creator tool. To access the code examples, visit Infineon's Code examples for ModusToolbox™ software GitHub page.

1.2 Additional learning resources

Infineon provides a wealth of data in the 32-bit XMC™ Industrial Microcontroller Arm® Cortex®-M webpage, to select the right XMC™ MCU for the design and to quickly and effectively integrate the device into the design.

1.3 Technical support

For further assistance, go to www.infineon.com/support. Visit community.infineon.com to ask questions in the Infineon developer community.

1.4 Documentation conventions

Table 2 Document conventions for guides

Convention	Usage
`Courier New`	Displays user-entered text and source code
Italics	Displays file names. Read about the *sourcefile.hex* file in the PSoC™ Creator user guide.
File > **Open**	Represents menu paths: File > Open > New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: 2 + 2 = 4
Text in gray boxes	Describes cautions or unique functionality of the product.

2 Kit details

2.1 Kit contents

- XMC7200 motor drive card
- Interface card

Figure 1 Kit contents

For information on missing parts, go to www.infineon.com/support.

2.2 Board details

The XMC7200 motor drive card has the following features:

- XMC7200D – XMC7200D-E272K8384. See the XMC7000 microcontroller datasheet.
- Selectable input supply voltages of 3.3 V and 5.0 V for the XMC7200D
- Two potentiometers, two user LEDs, one user button, and a reset button for the XMC7200D
- USB Type-C connector for USB device interface
- Onboard debugger based on J-Link
- Four Hall and Encoder headers
- Tracebox and ETM header
- mikroBUS header

Kit details

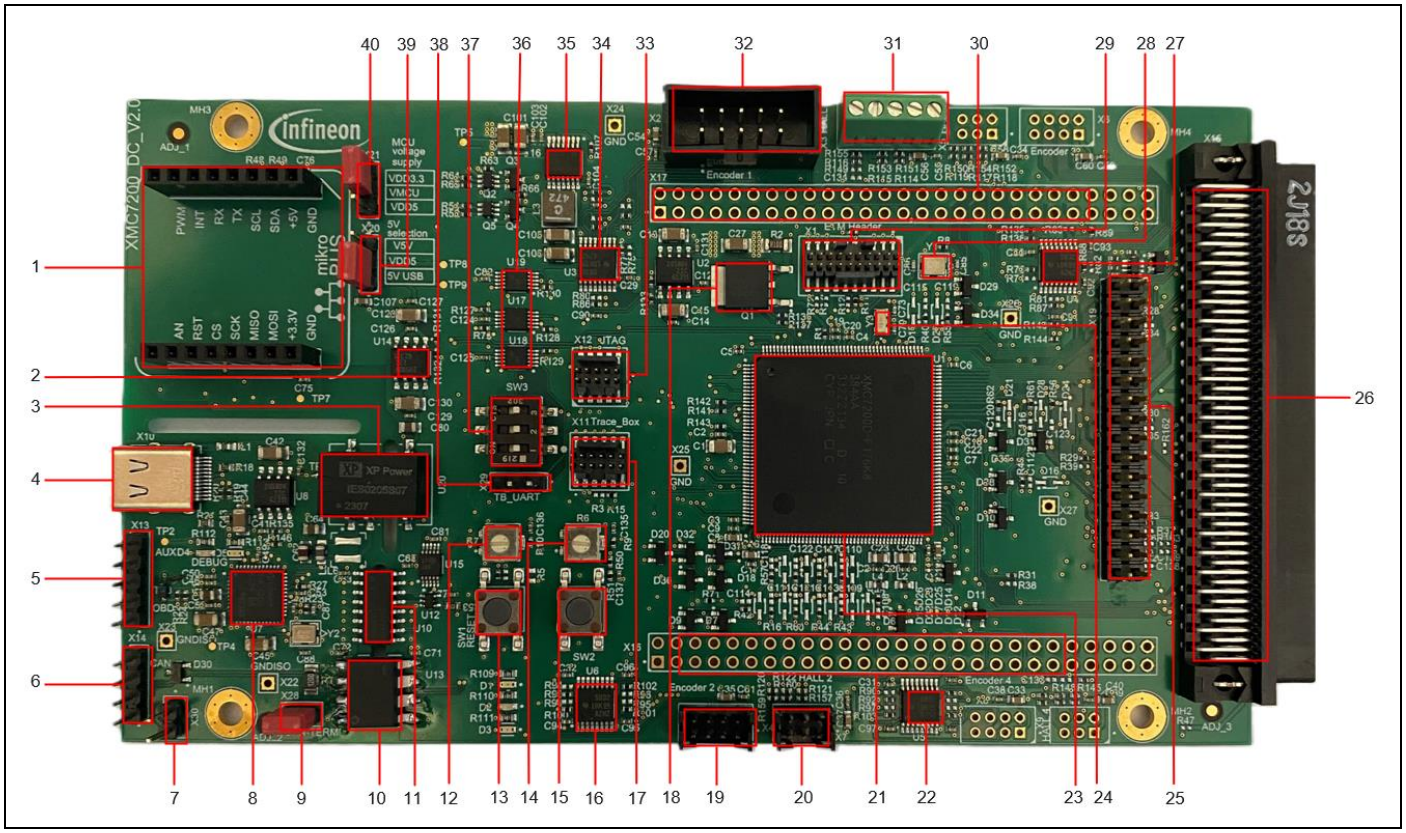


Figure 2 XMC7200 motor drive card – top view

The XMC7200 motor drive card has the following interfaces, as shown in Figure 2.

Table 3 Interfaces

Sl. No.	Interfaces
1	mikroBUS header (X18)
2	Low dropout voltage regulator (TLS205B0EJV, U14)
3	Isolated DC-DC Converter (IES0205S07, U20)
4	USB-C connection (X10)
5	XMC42 Program/Debug connector (X13)
6	CAN FD interface connector (X14)
7	Power jumper (X30)
8	XMC4200 on-board debugger (U7)
9	CAN termination register jumper (X28)
10	Isolated CAN transceiver (U13)
11	Digital isolator (U10)
12	Potentiometer (POT2)
13	XMC7200D reset button (SW1)
14	Potentiometer (POT1)
15	User button (SW2)
16	Quadruple Differential Line Receiver (U6)

Kit details

Sl. No.	Interfaces
17	Infineon Tracebox debugger connector (X11)
18	Pass transistor (ZXT849KTC, Q1)
19	Encoder 2 connector (X4)
20	Hall 2 connector (X7)
21	GPIO Header 1 (X16)*
22	Quadruple Differential Line Receiver (U5)
23	XMC7200D microcontroller (XMC7200D-F176K8384 – U1)
24	RTC Crystal Clock 32.77kHz (Y3)
25	Power Board connector (X19)
26	HD connector (X15)
27	Quadruple Differential Line Receiver (U4)
28	External Crystal Oscillator Clock 16MHz (Y1)
29	ETM Header for debugging (X1)
30	GPIO Header 2 (X17)*
31	Hall 1 connector (X3)
32	Encoder 1 connector (X2)
33	JTAG debugger connector (X12)
34	Quadruple Differential Line Receiver (U3)
35	DC-DC Converter (TLS4125D0EPV50, U16)
36	Analog switch (TS5A23157DGSR, U17, U18, U19)
37	DIP switch (SW3)
38	Non-isolated UART interface (X29)
39	VDD5 selection jumper (X20)
40	VCMU selection jumper (X21)

* Footprint only, not populated on the board.

Table 4 lists PCB components of the XMC7200 motor drive card.

Table 4 XMC7200 motor drive card PCB component details

Sl. No.	Component	Description
1.	Power LED (D3)	Power supply ON/OFF LED status indicator.
2.	VDD5 selection jumper (X20)	X20 is a 3-pin voltage selection header to select between 5 V coming from isolated domain or power domain.
3.	VMCU selection jumper (X21)	X21 is a 3-pin voltage selection header to select VDD3.3 (3.3 V) or VDD5 (5 V) for VMCU.
4.	Tracebox RX/TX header (X29)	Communication and data acquisition interface
5.	XMC7200D 20-pin debug and trace header X1)	Connect to an Embedded Trace Macrocell (ETM)-compatible programmer/debugger.
6.	XMC7200D 10-pin SWD/JTAG program and debug header (X12)	This 10-pin header allows you to program and debug the XMC7200D using an external programmer.

Kit details

Sl. No.	Component	Description
7.	XMC7200D 12-pin Tracebox header (X11)	This 12-pin header allows you to connect via a Tracebox tool to the XMC7200D.
8.	XMC7200D extended I/O headers (X16, X17)	These headers provide connectivity to XMC7200D GPIOs. Few of these pins are multiplexed with on-board peripherals. By default, these connectors are not populated.
9.	Power board connector (X19)	This header provides connectivity to XMC7200D. You can attach one power board connector via this connector.
10.	High-Density connector (X15)	This header provides connectivity to XMC7200D. You can attach one adapter to attach multiple power board.
11.	mikroBUS connector (X18)	Bring out pins from XMC7200D to interface with shields compatible with mikroBUS. Some of these pins are multiplexed with on-board peripherals and are not connected to XMC7200D by default.
12.	Tracebox/JTAG input switch (SW3)	Switch to select input to on-board debugger between Tracebox or SWD/JTAG connector.
13.	XMC7200D reset button (SW1)	Resets XMC7200D. It connects the XMC7200D reset (XRES) pin to ground.
14.	XMC7200D user buttons (SW2)	Provide an input to XMC7200D. Note that by default the button connects the XMC7200D pin to ground when pressed, so you need to configure the XMC7200D pin as a digital input with resistive pull-up for detecting the button press.
15.	Potentiometers (R6, R7)	Two 10 kΩ potentiometers connected to XMC7200D pin P12[7] and P19[4]. It can be used to simulate a sensor output to XMC7200D.
16.	XMC7200D user LEDs (D1, D2)	The user LEDs can operate at the entire operating voltage range of the XMC7200D. The LEDs are active HIGH, so the pins must be driven to ground to turn ON the LEDs.
17.	XMC4200 status LEDs (D4, D5)	AUX_LED and DEBUG_LED used as status LED by the onboard debugger (XMC4200).
18.	XMC7200D Microcontroller (XMC7200D-E272K8384 – U1)	XMC™ MCU device used on the kit.
19.	XMC4200 Microcontroller (XMC4200-K256 – U7)	Onboard debugger used on the kit.
20.	CAN FD resistor termination jumper (X28)	Install a jumper to enable the termination resistor for another CAN FD transceiver in place of U13.
21.	CAN FD interface connector (X14)	Connector to connect kit to the CAN / CAN FD network.
22.	CAN FD transceiver (ISO1050DUB- U13)	CAN FD transceiver
23.	10pin encoder connector (X2)	One 10-pin connector to connect optical encoder
24.	8pin encoder connector (X4, X6, X8)	Three 8-pin connectors to connect optical encoder. Some of them are not populated by default.

Kit details

Sl. No.	Component	Description
26.	5pin Hall connector (X3)	One 5-pin connector to connect hall sensor
27.	6pin Hall connector (X5, X7, X9)	Three 6-pin connectors to connect hall sensor. Some of them are not populated by default.
28.	USB-C connector (X10)	USB-C connector to attach the kit to power source or to the PC.

XMC7200 motor drive card headers are shown in Figure 3.

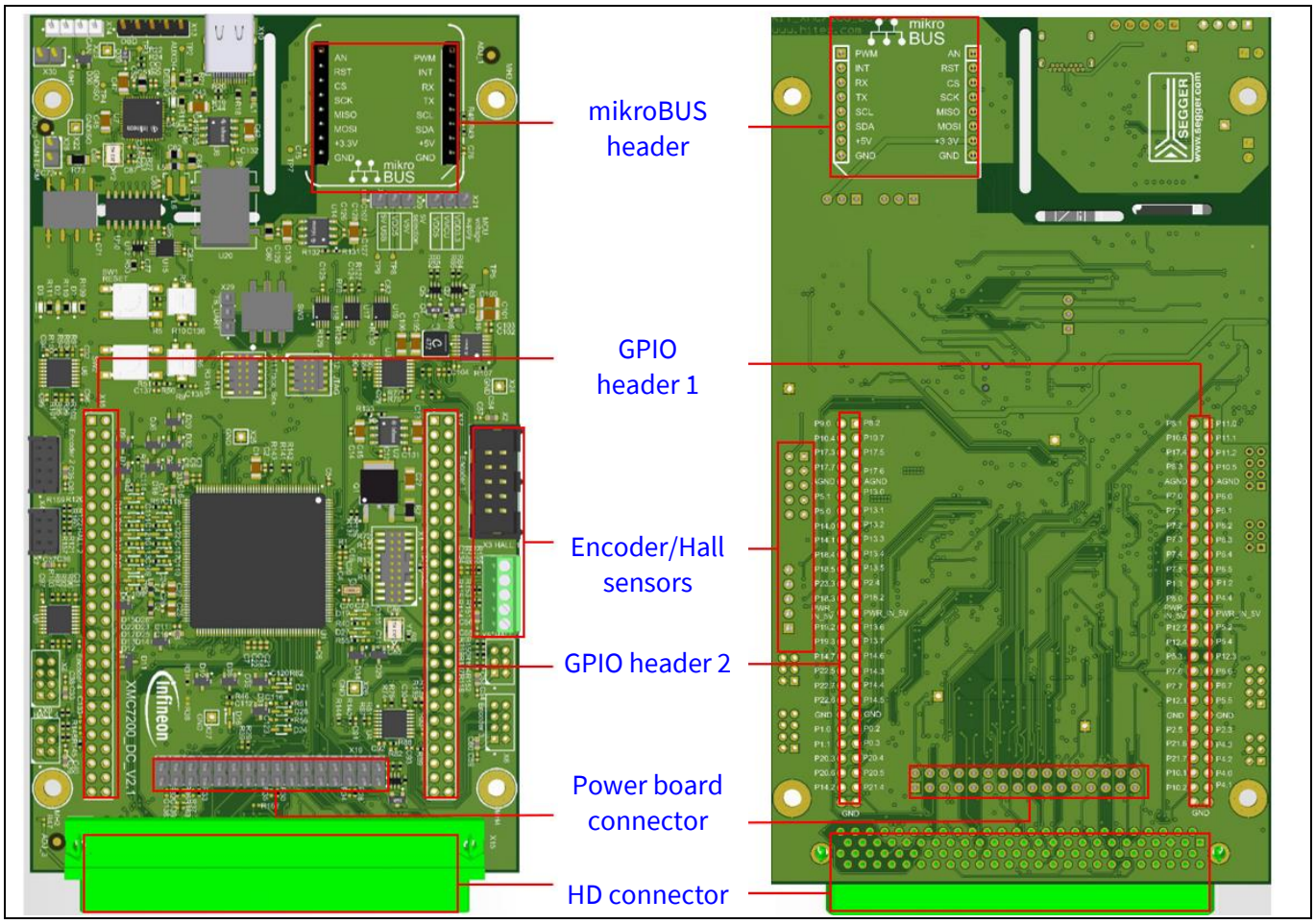


Figure 3 XMC7200 motor drive card headers

3 Kit operation

3.1 Theory of operation

The XMC7200 drive kit is built around XMC7200D. XMC7200D incorporates Infineon's low-power flash memory, multiple high-performance analog and digital peripherals, and enables the creation of a secure computing platform.

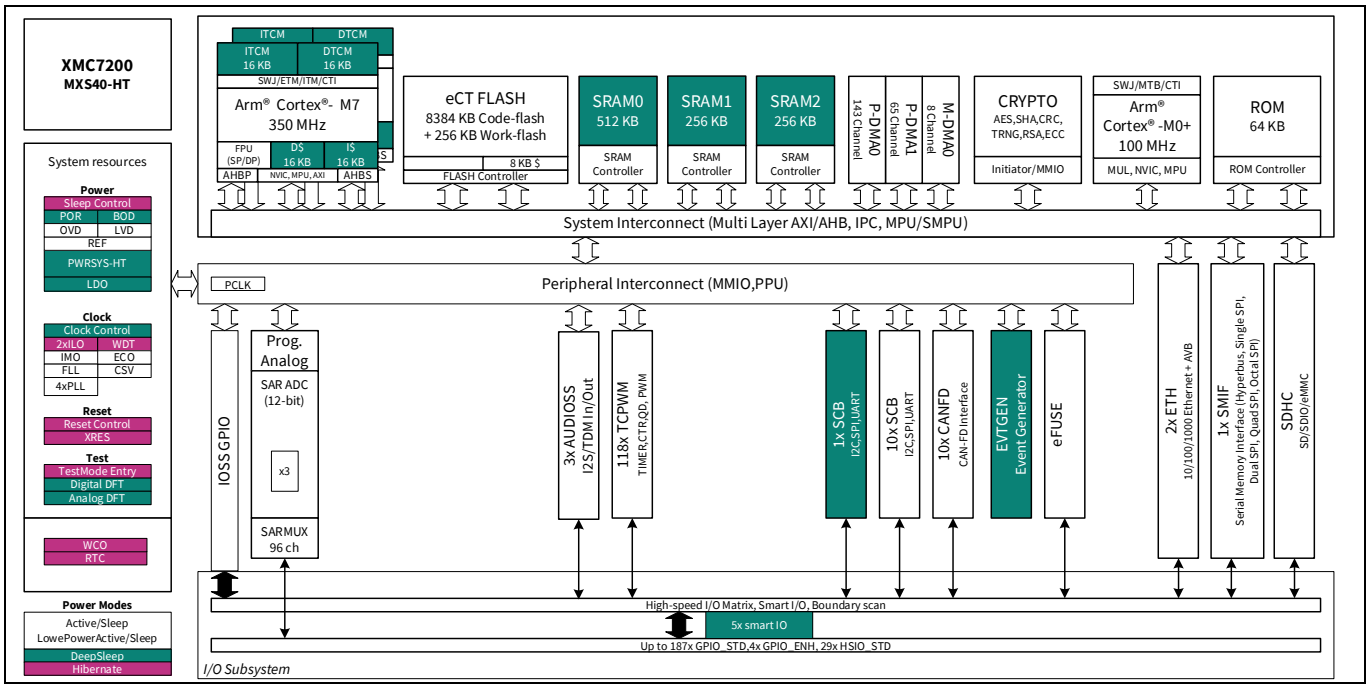


Figure 4 XMC7200D block diagram

Features

- CPU subsystem
  - One or two 350-MHz 32-bit Arm® Cortex®-M7 CPUs
  - 100-MHz 32-bit Arm® Cortex® M0+ CPU
  - Interprocessor communication in hardware
  - Three DMA controllers
- Integrated memories
  - 8384 KB of code-flash with an additional 256 KB of work-flash
  - 1024 KB of SRAM with selectable retention granularity
- Cryptography engine
  - Supports Enhanced Secure Hardware Extension (eSHE) and Hardware Security Module (HSM)
  - Secure boot and authentication
- Safety for application
  - Memory protection unit (MPU), shared memory protection unit (SMPU), peripheral protection unit (PPU), watchdog timer (WDT), multi-counter watchdog timer (MCWDT), low-voltage detector (LVD), brown-out detection (BOD), overvoltage detection (OVD), clock supervisor (CSV), hardware error correction (SECDED ECC) on all safety-critical memories (SRAM, flash, TCM)

Kit operation

- Low-power 2.7 V to 5.5-V operation
  - Low-power Active, Sleep, Low-power Sleep, Deep Sleep, and Hibernate modes for fine-grained power
- Clocks
  - Internal Main Oscillator (IMO), Internal Low-Speed Oscillator (ILO), External Crystal Oscillator (ECO), Watch Crystal Oscillator (WCO), Phase-Locked Loop (PLL), Frequency-Locked Loop (FLL)
- Communication interfaces
  - Up to 10 CAN FD channels
  - Up to 11 runtime-reconfigurable SCB (serial communication block) channels, each configurable as I2C, SPI, or UART
  - Up to two 10/100/1000 Mbps Ethernet MAC interfaces conforming to IEEE-802.3az.
- External memory interface
- SDHC interface
- Audio interface
- Timers
  - Up to 102 16-bit and 16 32-bit Timer/Counter Pulse-Width Modulator (TCPWM) blocks
    - Up to 15 16-bit counters for motor control
    - Up to 87 16-bit counters and 16 32-bit counters for regular operations
    - Supports timer, capture, quadrature decoding, pulse-width modulation (PWM), PWM with dead time (PWM_DT), pseudorandom PWM (PWM_PR), and shift-register (SR) modes
  - Up to 16 Event Generation (EVTGEN) timers supporting cyclic wake up from Deep Sleep
- Real-time clock (RTC)
- I/O
  - Up to 220 Programmable I/Os
  - Three I/O types
- Regulators
- Programmable analog
  - Three SAR A/D converters with up to 99 external channels (96 I/Os + 3 I/Os for motor control)
  - Each ADC supports 12-bit resolution and sampling rates of up to 1 Msps.
  - Each ADC also supports six internal analog inputs like
  - Each ADC supports addressing of external multiplexers.
  - Each ADC has a sequencer supporting autonomous scanning of configured channels.
  - Synchronized sampling of all ADCs for motor-sense applications
- Smart I/O
  - Up to five Smart I/O blocks, which can perform Boolean operations on signals going to and from I/Os
  - Up to 36 I/Os (GPIO_STD) supported
- Debug interface
  - JTAG controller and interface compliant to IEEE-1149.1-2001.
  - Arm® SWD (Serial Wire Debug) port
  - Supports Arm® Embedded Trace Macrocell (ETM) Trace

- Industry advanced development tools
  - Infineon IDE ModusToolbox™ software for code development and debugging
- Packages
  - 176-TEQFP, 24 × 24 × 1.7 mm (max), 0.5-mm lead pitch.
  - 272-BGA, 16 × 16 × 1.7 mm (max), 0.8-mm ball pitch

For more detailed information on device features, see the device datasheet.

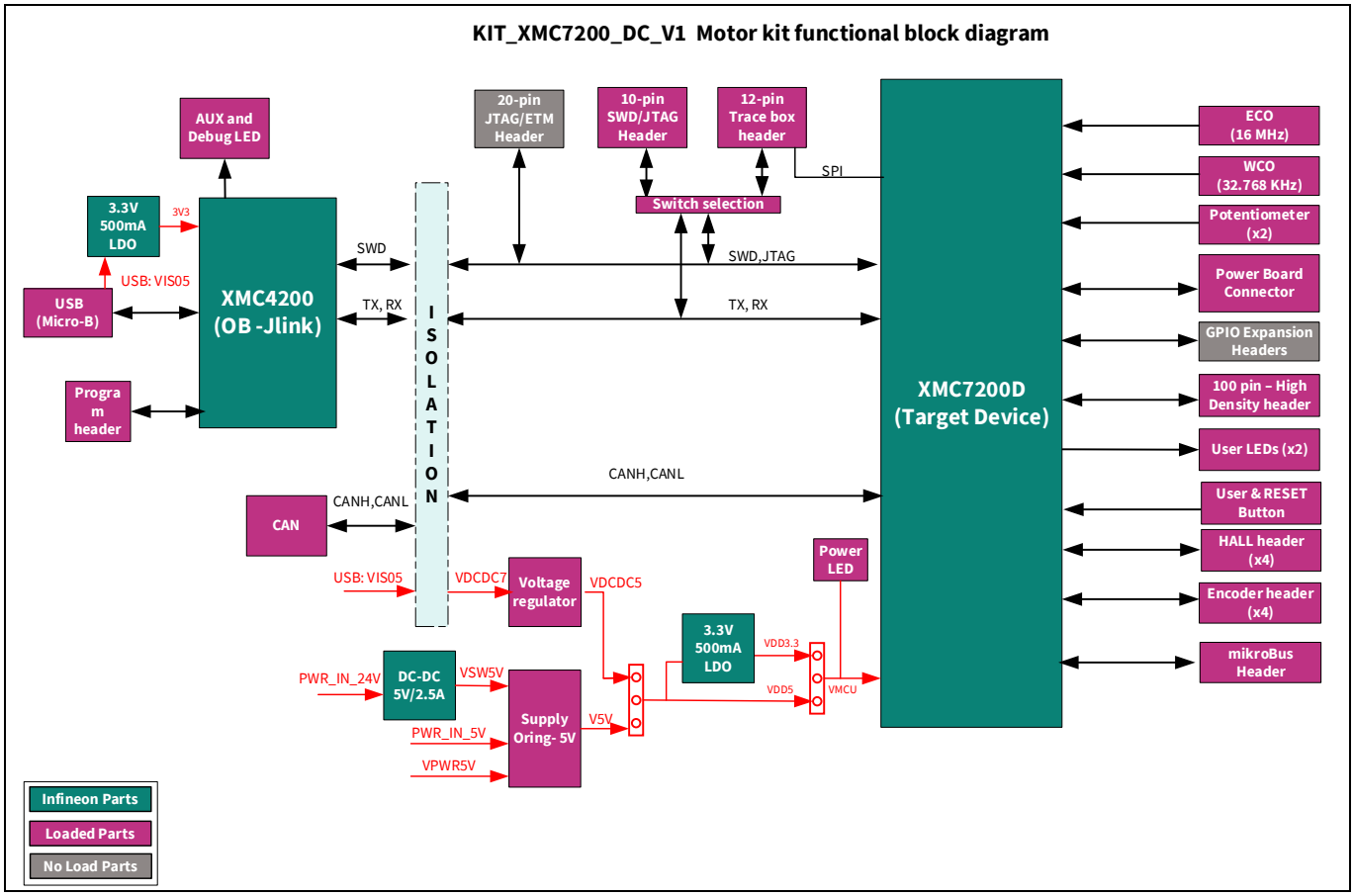


Figure 5 Block diagram of XMC7200 motor drive card

Figure 5 shows the high-level block diagram of the XMC7200 motor drive card. High-level blocks include the target device XMC7200D with various header connectors and an isolated onboard debugger via XMC4200. By default, the JTAG debug interface is enabled on the XMC7200 motor drive card. For powering the drive card, use an external 24 V DC supply (such as 5 V with DC-DC converter), or a USB connection (5 V).

Kit operation

Figure 6 shows the top view of the XMC7200 motor drive card. In the top view, you can see the default configuration of the drive card. Additionally, you can see all components, headers, and connectors that are populated by default.

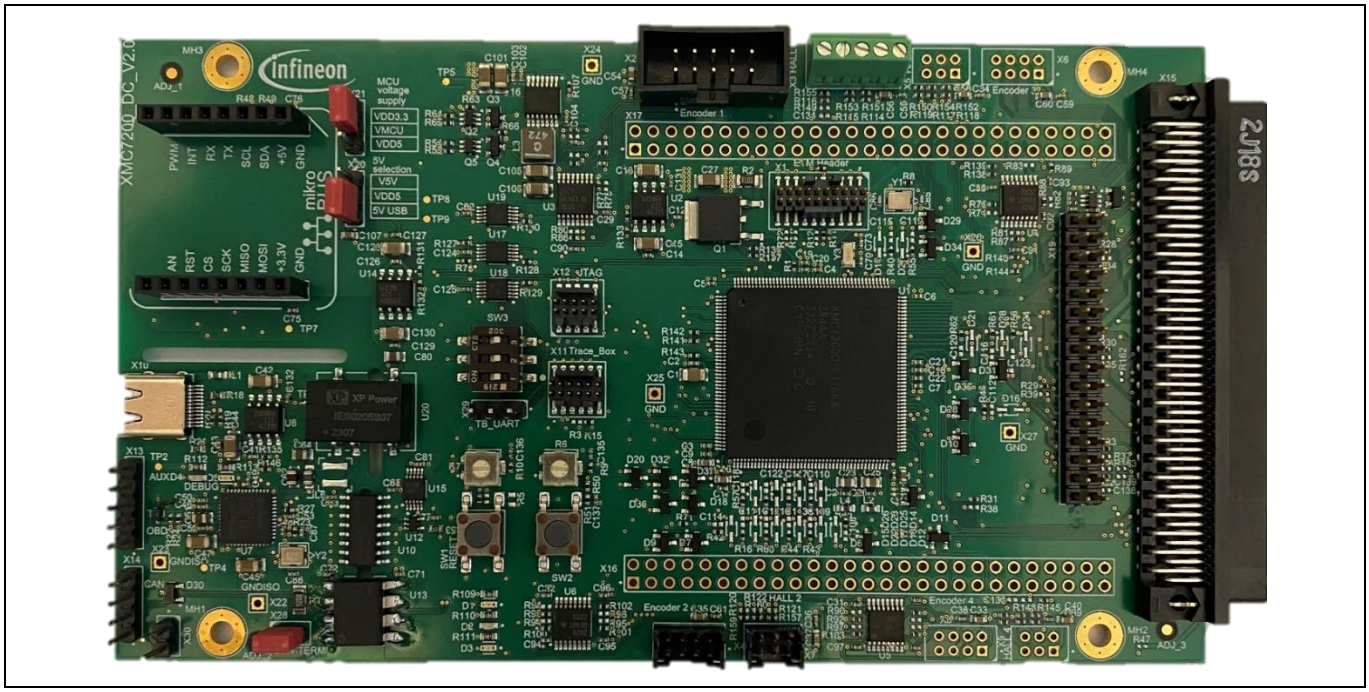


Figure 6 XMC7200 motor drive card - top view

Figure 7 shows the bottom view of the XMC7200 motor drive card. You can see the MikroBUS interface signal names together with GPIO header signal names. By default, the GPIO header is not populated for the XMC7200 motor drive card.

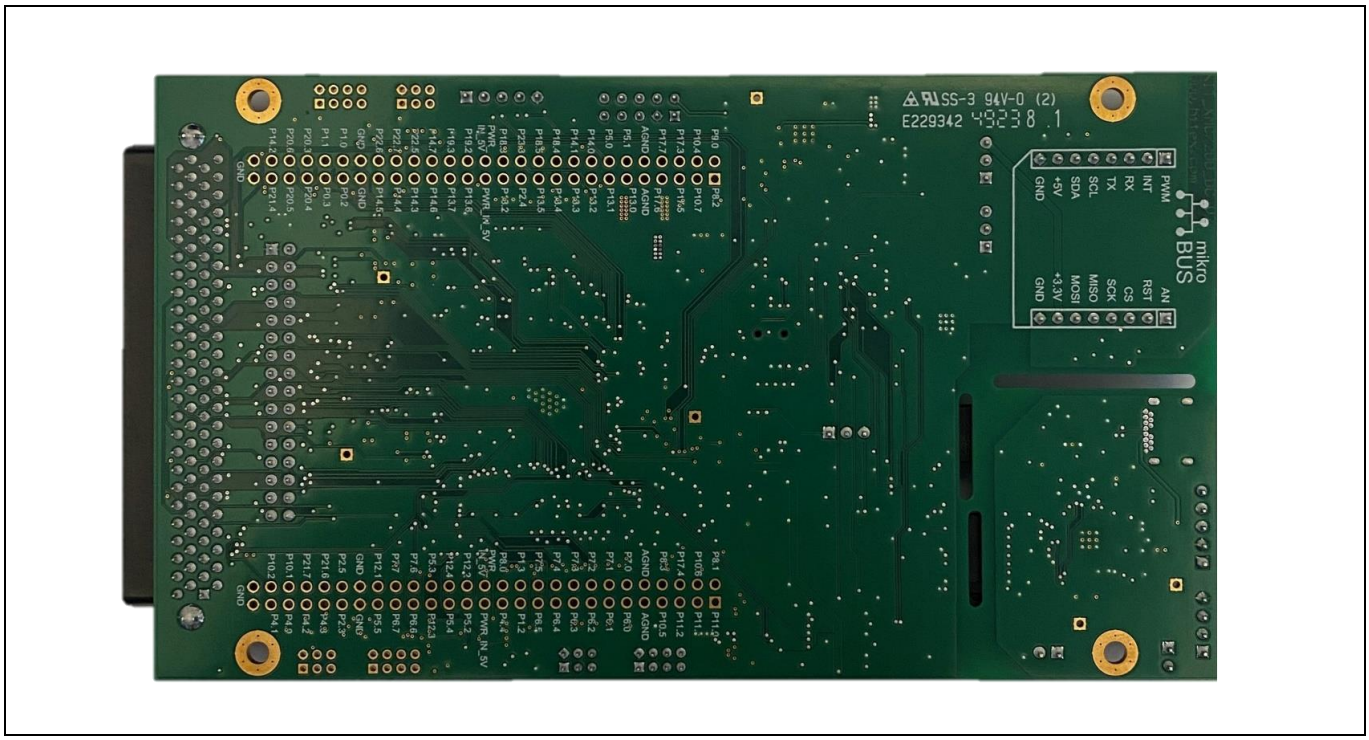


Figure 7 XMC7200 motor drive card – bottom view

3.2 Default configurations

By default, the XMC7200 motor drive card has the following configurations:

- Power jumpers (X20, X21)
  - MCU voltage supply: 3.3V VDD
  - 5V selection: 5V via USB
- CAN Interface (X28): Terminated
- DIP Switch (SW3): All three switched to right side, JTAG enabled.

3.3 Board support package (BSP) selection

The XMC7200 drive kit includes a KIT_XMC7200_DC_V1 board support package to build and run code examples on the kit by following the instructions mentioned in the **Board Support Packages** section of the ModusToolbox™ user guide.

3.4 J-link: onboard programmer/debugger

The XMC7200 drive kit is programmed and debugged using the onboard J-Link, which is implemented via the XMC4200 device. The J-Link interface supports protocols such as JTAG, SWD, and SWO, while also offering a virtual COM port over a USB for direct communication. The tool is designed to work with several common development environments.

3.4.1 Programming and debugging using ModusToolbox™ software

1. To program or debug the XMC7200 drive kit, connect it to the PC using a USB Type-C cable. Attach the cable to the J-Link USB connector as shown in Figure 8. Upon first connection, the PC recognizes the device as a USB composite device.
2. The onboard J-Link, utilizing the XMC4200 device for its functionality, supports standard programming and debugging protocols. When active, a status LED provides a visual confirmation of the operational mode.

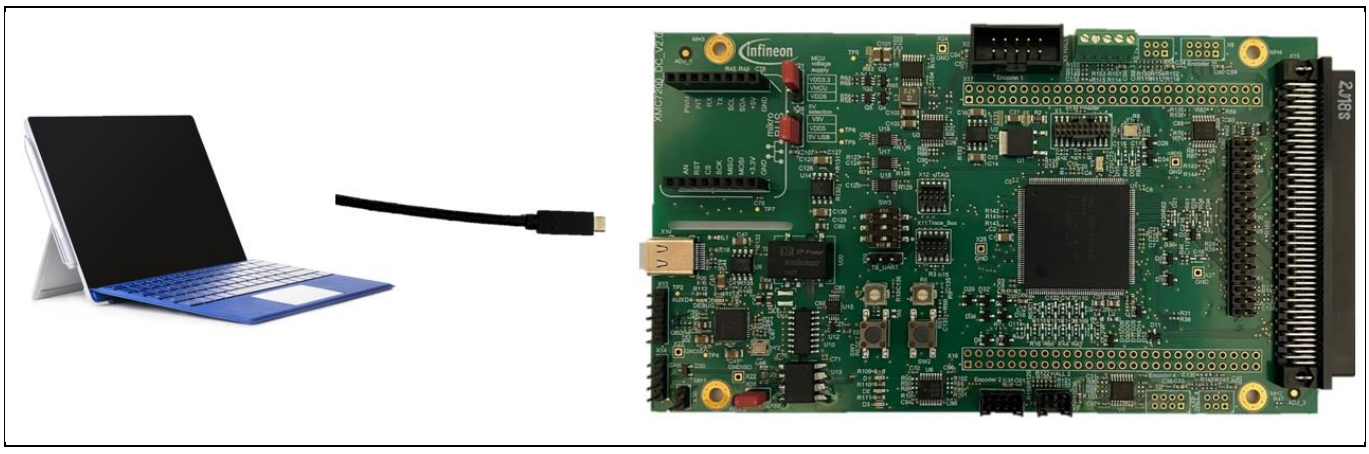


Figure 8 Connect USB cable to the USB connector on the board

3. In the Eclipse IDE for ModusToolbox™ software, import the desired code example (application) into a new workspace.

   a) Click on **New Application** from the **Quick Panel**.

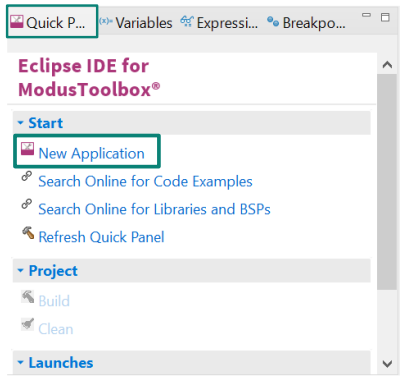


Figure 9 Create a new application

   b) Select the BSP in the “Choose Board Support Package” window and click **Next**.

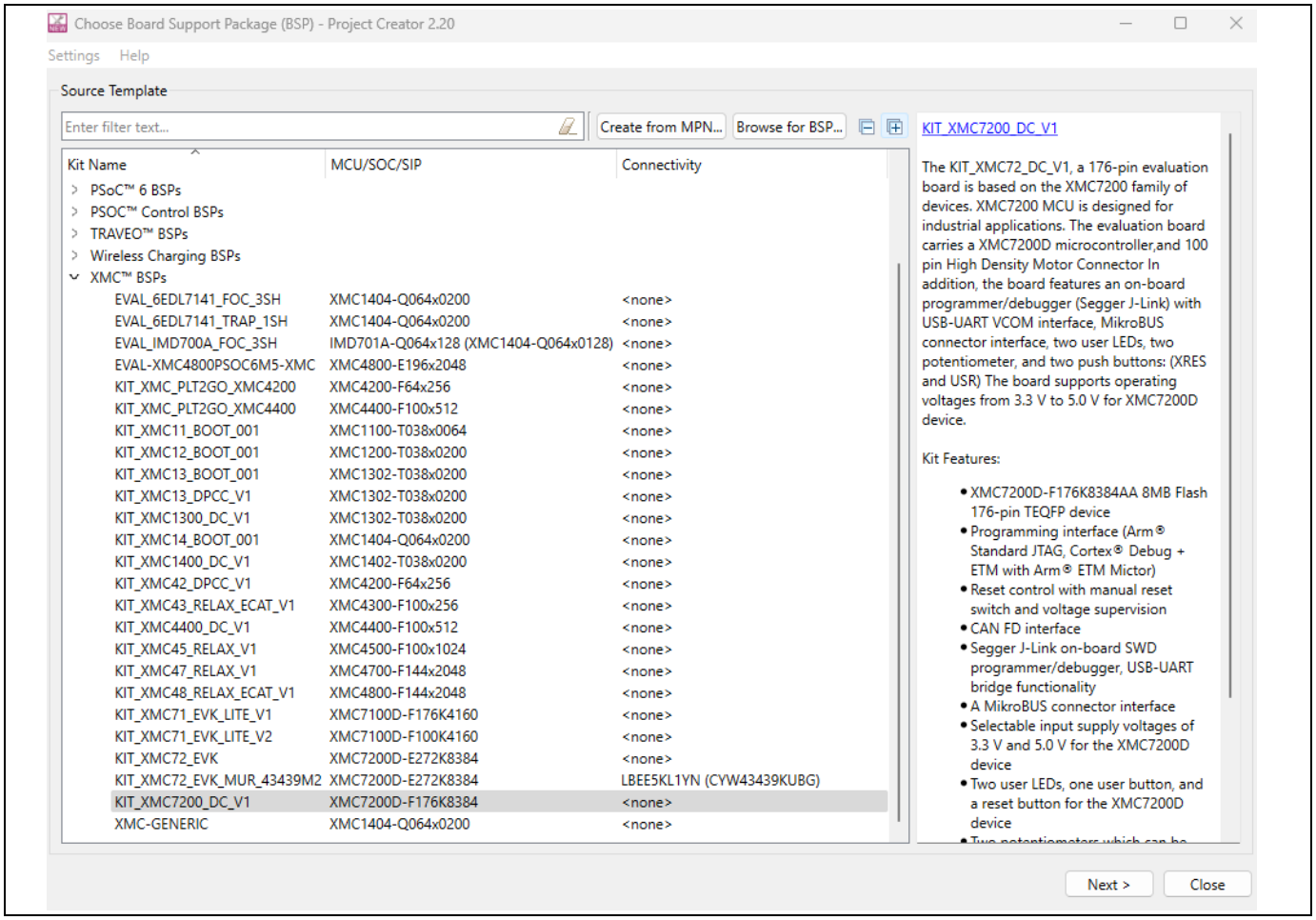


Figure 10 Board support package in the new application window

c) Select the application in the “Select Application” window and click **Create**.

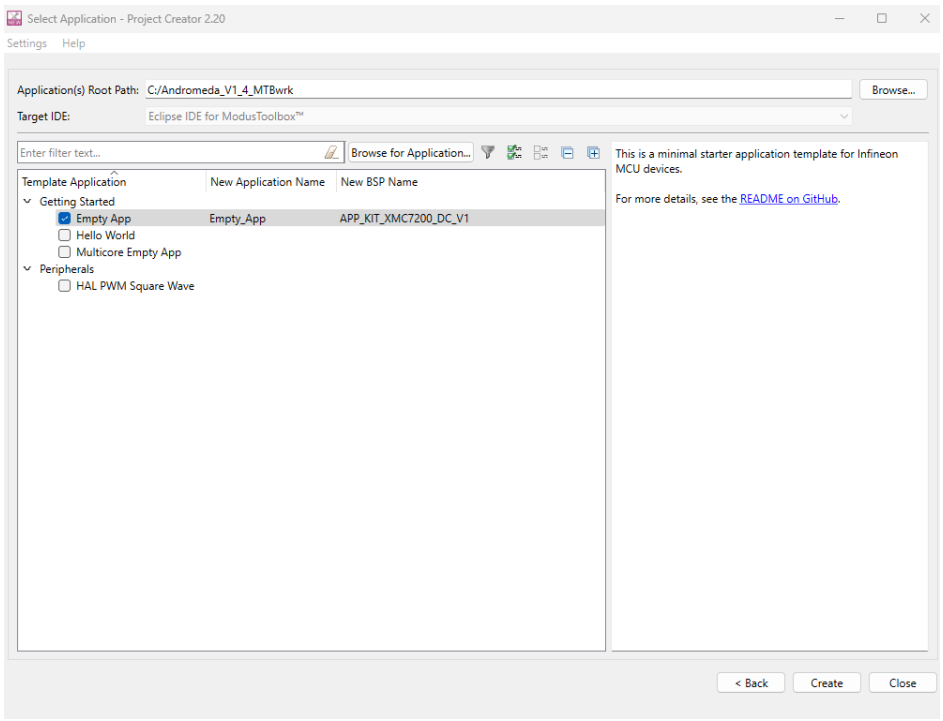


Figure 11 Select application window

4. To build and program a XMC7200D application, in the Project Explorer, select **<App_Name>** project. In the Quick Panel, scroll to the Launches section and click the **<App_Name> Program (JLink)** configuration, as shown in Figure 12.

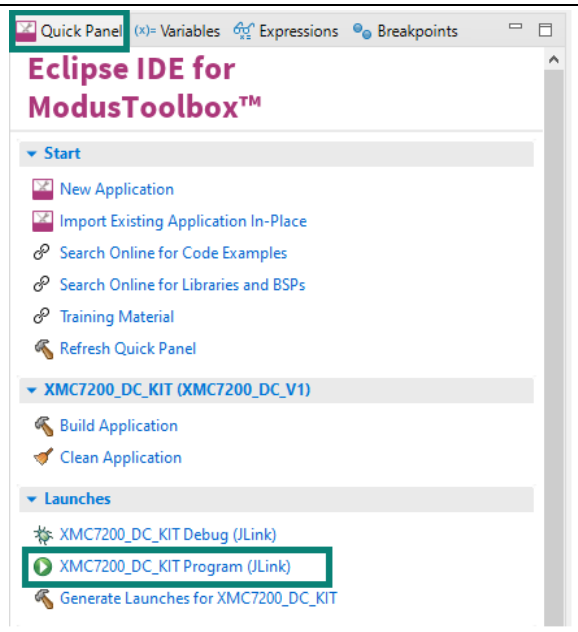


Figure 12 Programming in the ModusToolbox™ software

5. The ModusToolbox™ software has an integrated debugger. To debug a XMC7200D application, in the Project Explorer, select **<App_Name>** project. In the Quick Panel, scroll to the **Launches** section and click the **<App_Name> Debug (JLink)** configuration as shown in Figure 13. For more details, see the “Program and debug” section in the Eclipse IDE for ModusToolbox™ user guide.

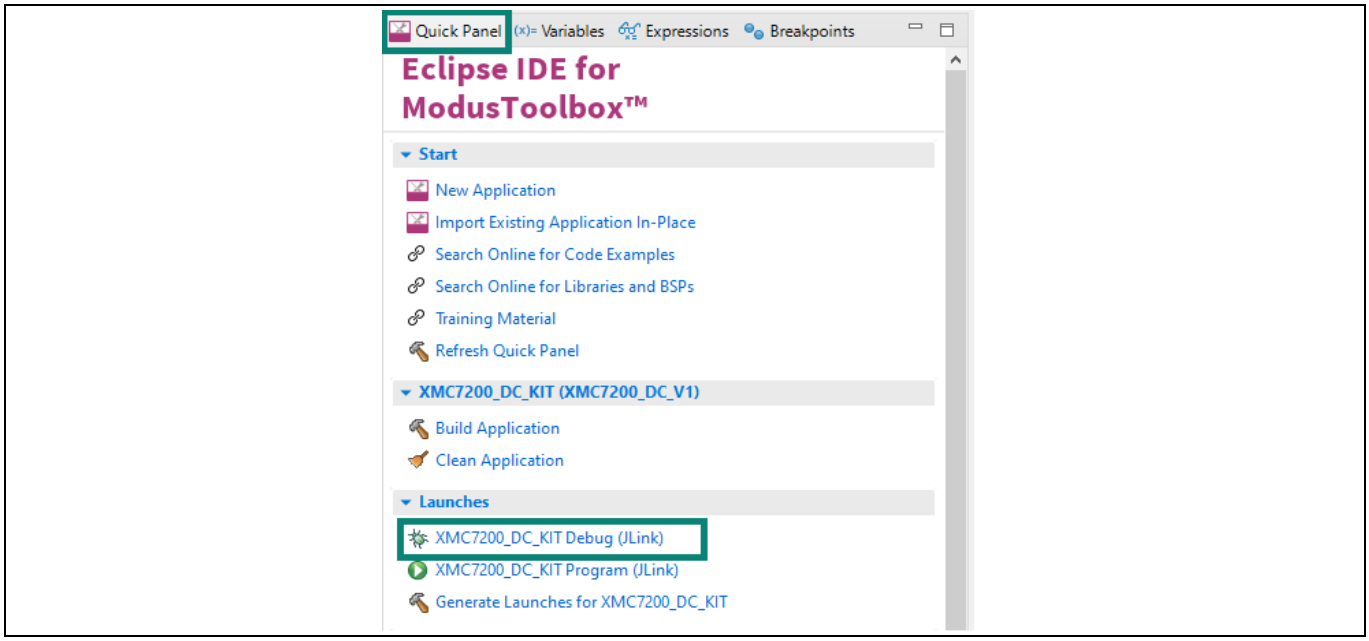


Figure 13 Debugging in the ModusToolbox™ software

3.4.2 Virtual COM port (UART-to-USB bridge)

The onboard debugger (XMC4200 MCU) supports the communication between a PC/laptop and target XMC™ device via a Virtual COM Port (UART-to-USB Bridge). Therefore, UART pins of the target XMC™ device needs to be connected to TX/RX pins of the debug connector (see Table 3).

Note: Take care of the UART cross connection. TX pin of the debugger needs to be connected to the RX pin of the XMC device. The RX pin of the debugger needs to be connected to the TX pin of the XMC device.

Table 5 Onboard debugger connection details

Pin function	Input/output	XMC72 pin
Transmit pin for UART communication (PC_RX)	O	Receive pin for UART communication (PC_TX)
Receive pin for UART communication (PC_TX)	I	P17.1 (SCB3.RX)

4 Hardware

4.1 Schematics

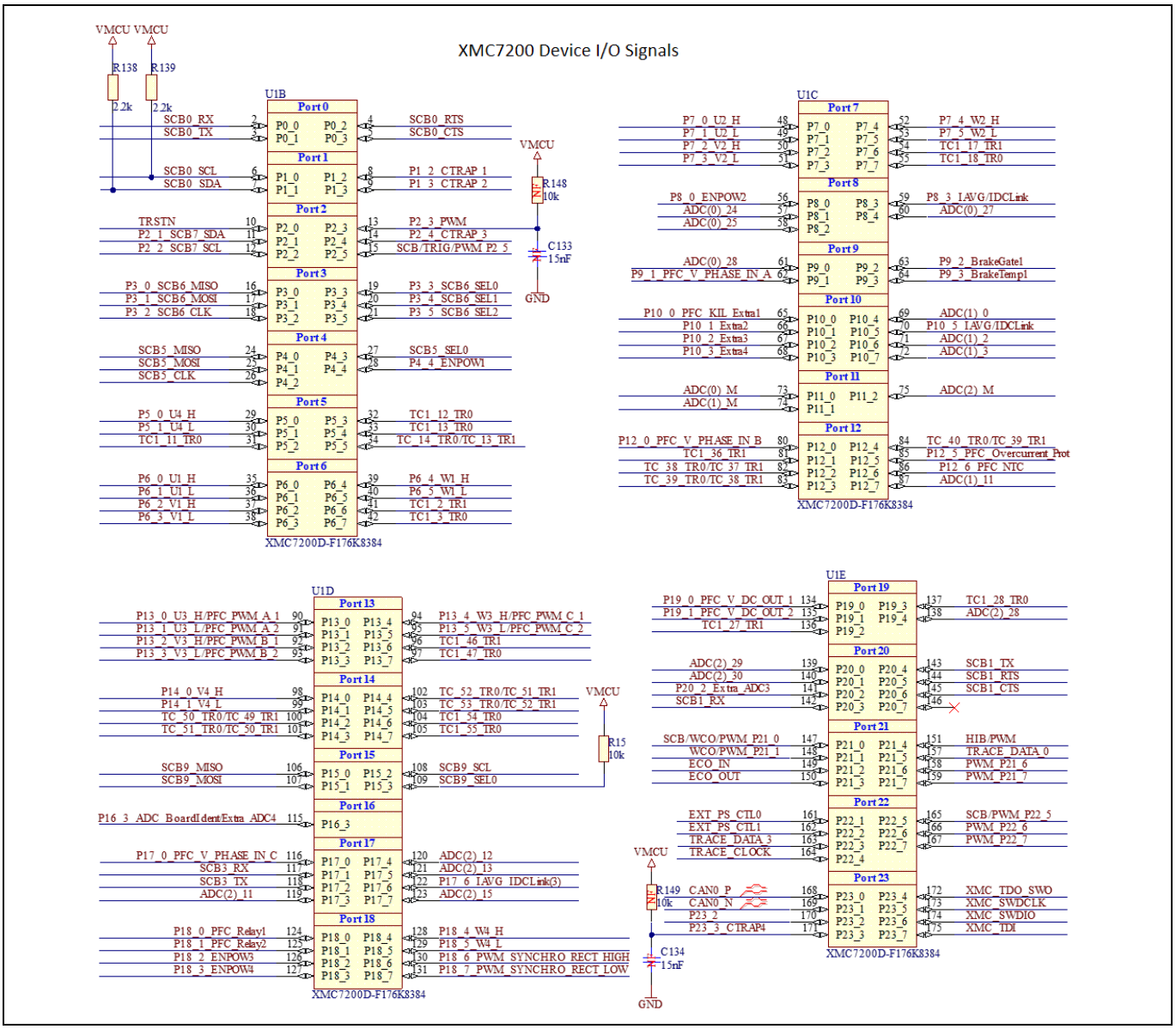
See the schematic files available in the kit webpage.

4.2 Hardware functional description

4.2.1 XMC7200D

XMC7200 is a family of XMC7000 MCUs with industrial applications. XMC7200 has two Arm® Cortex®-M7 CPUs for primary processing, and an Arm® Cortex®-M0+ CPU for peripheral and security processing. These devices contain embedded peripherals supporting CAN FD and Gigabit Ethernet. XMC7200 devices are manufactured on an advanced 40-nm process. XMC7200 incorporates Infineon's low-power flash memory, multiple high-performances analog and digital peripherals, and enables the creation of a secured computing platform.

For more information, see the XMC7200D datasheet.



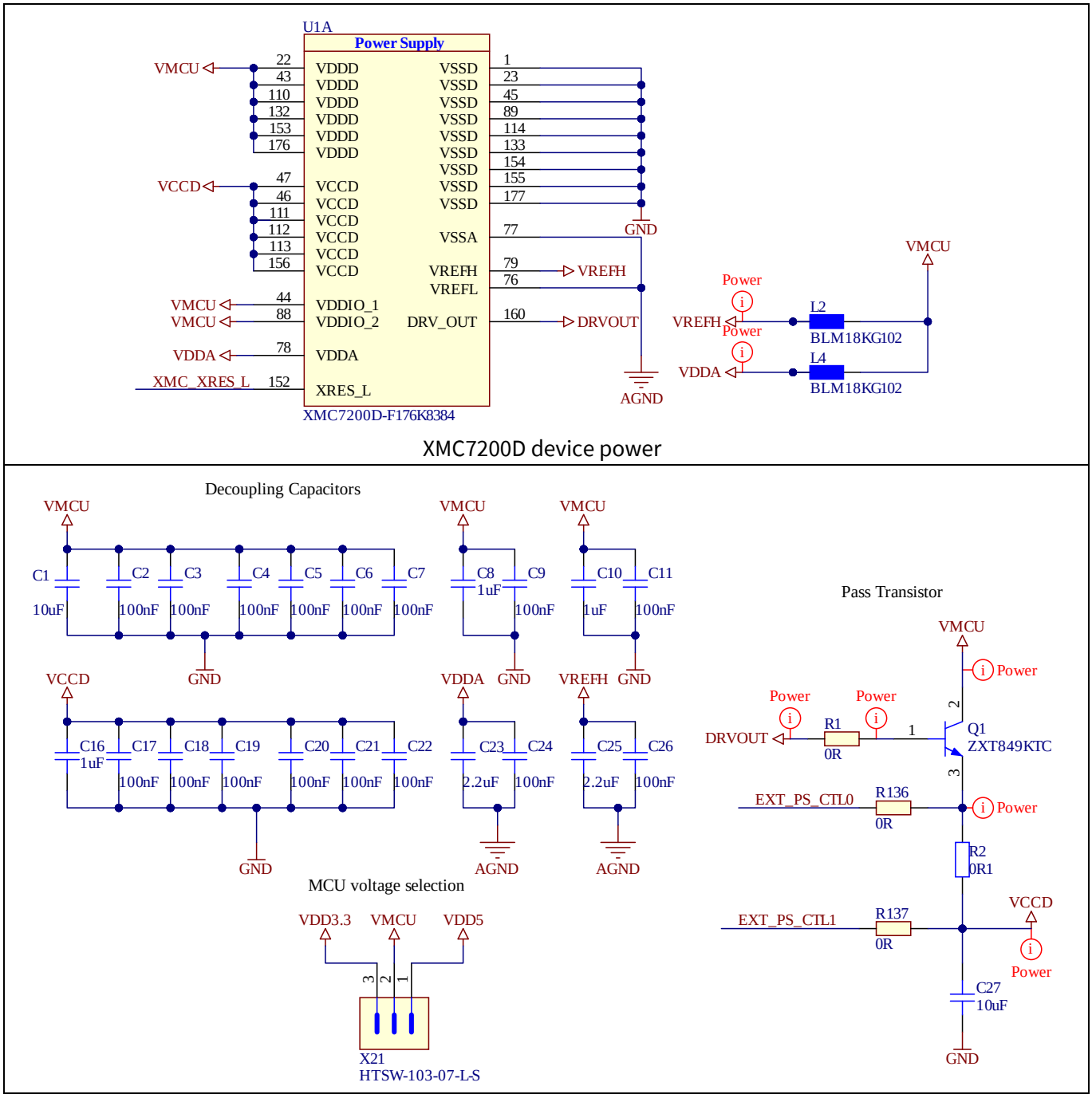


Figure 14 XMC7200D device I/O signals

4.2.2 Debug interface

The KIT_XMC7200_DC_V1 kit is designed to use “Serial Wire Debug” (SWD) or JTAG as debug interface. It supports debugging via different channels that are all galvanically isolated from the power GND supply domain:

- On-board USB Debugger
- 10-pin Cortex® Debug Connector (JTAG or SWD)
- TraceBox and ETM Connector

4.2.2.1 Onboard USB debugger

An XMC4200 (XMC4200-F64K256 BA) is utilized as an on-board debug probe, providing support for Serial Wire Debug (SWD) and UART communication. Both require the installation of Segger’s J-Link Driver which is part of the ModusToolbox™ installation. ModusToolbox™ is used to develop and debug the XMC7200D projects. The ModusToolbox™ software is a set of tools that enables you to integrate these devices into existing development methodology.

For more details on XMC7200D, see the application note AN234334 - Getting started with XMC7000 MCU on ModusToolbox™ software that aids in creating a customized design using the Eclipse IDE. Download the software from the ModusToolbox™ software webpage. Download the latest Segger J-Link Driver from the J-Link / J-Trace Downloads webpage. Table 6 shows the pin assignment of the XMC7200 used for debugging and UART communication.

Table 6 Onboard debugger connection details

Pin function	Input/output	XMC72 pin
Data pin for Debugging via SWD	I/O	P23.6 (XMC_SWDIO)
Clock pin for Debugging via SWD	O	P23.5 (XMC_SWDCLK)
Transmit pin for UART communication (PC_RX)	O	P17.2 (SCB3.TX)
Receive pin for UART communication (PC_TX)	I	P17.1 (SCB3.RX)

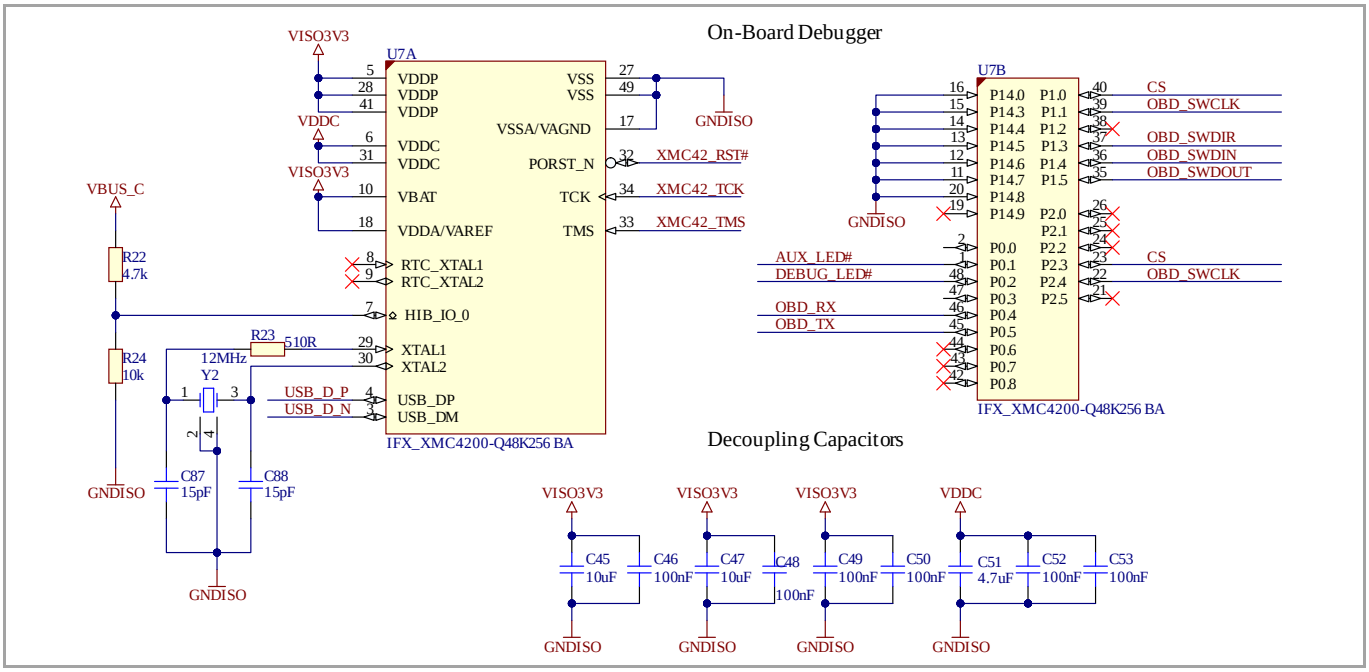


Figure 15 Onboard debugger

4.2.2.2 Cortex® debug connector (10-pin)

The 10-pin SWD/JTAG header provides a versatile debug and programming interface for supported microcontrollers. This header supports both Serial Wire Debug (SWD) and JTAG protocols, allowing for flexible debugging and programming options.

The pin assignment for the 10-pin SWD/JTAG header is shown in Table 7.

Table 7 JTAG header peripheral detail

Pin number	Signal name	Description
1	VCC	+3.3 V
2	CON_XMC_SWDIO	Serial Wire Data I/O , JTAG-TMS
3	GND	Ground
4	CON_XMC_SWDCLK	Serial Wire Clock, JTAG-TCK
5	GND	Ground
6	XMC_TDO_SWO	Serial Wire Output , JTAG-TDO
7	N.C.	Not connected
8	XMC_TDI	JTAG-TDI
9	ISO_DISABLE	Disable On-Board Debugger
10	CON_RESET#	Reset (active low)

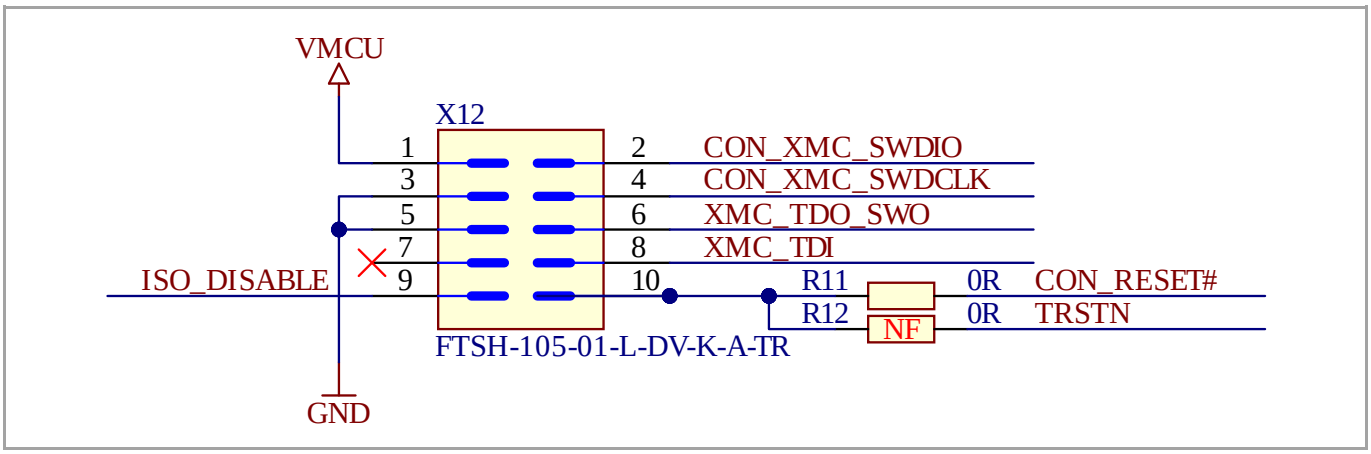


Figure 16 10-pin SWD/JTAG header

4.2.2.3 Interconnection between XMC4200 and XMC7200D

The KIT_XMC7200_DC_V1 motor control kit incorporates isolation between the onboard debugger (XMC4200) and the XMC7200 microcontroller to ensure the reliable communication and protection. This allows efficient programming, debugging, and control of motor applications.

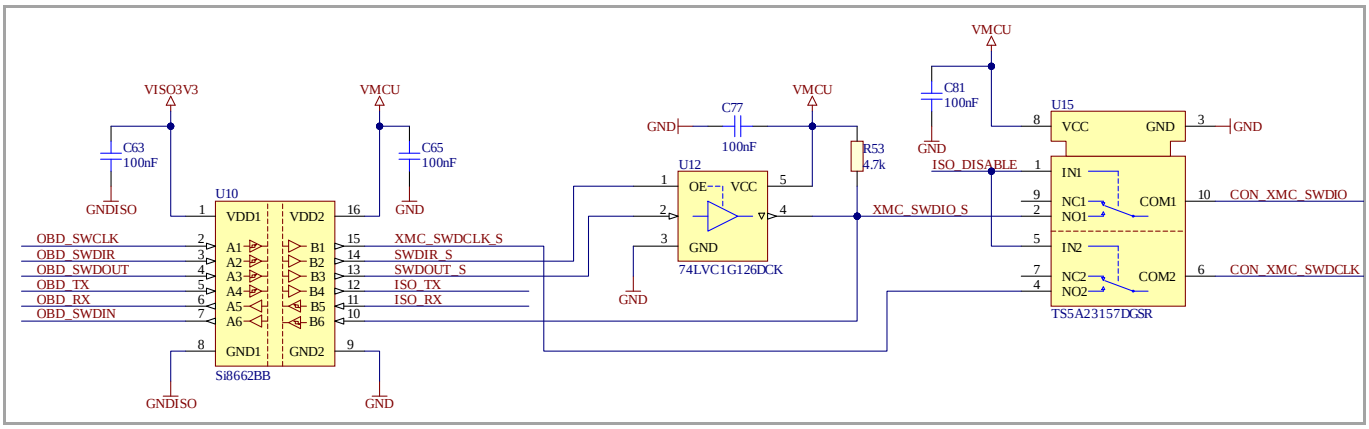


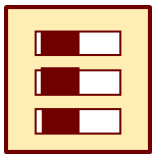
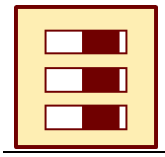
Figure 17 Interconnection between power plane and debugger plane

4.2.2.4 Debugging programing selection switch

The kit features a convenient DIP switch that provides a simple and efficient way to switch between two options for debugging and programming the XMC7200D chip: the Tracebox header and the JTAG header. This DIP switch allows you to select the desired debugging interface based on specific requirements.

Table 8 lists the pin configuration and resulting functionality of the Debugging and Programming selection DIP switch:

Table 8 Peripheral details

Position	Function	Input signal name	Output signal name	XMC7 pin
1	Tracebox Header Selected			
All left side switch 		TB_SWDIO_TMS	XMC_SWDIO	P23_6
		TB_SWCLK_TCLK	XMC_SWDCLK	P23_5
		TB_RX	SCB3_TX	P17_2
		TB_TX	SCB3_RX	P17_1
		TB_RESET#	XMC_XRES_L	XRES_L
2	JTAG Header Selected			
Default switch (all right side) 		CON_XMC_SWDIO	XMC_SWDIO	P23_6
		CON_XMC_SWDCLK	XMC_SWDCLK	P23_5
		ISO_RX	SCB3_TX	P17_2
		ISO_TX	SCB3_RX	P17_1
		CON_RESET#	XMC_XRES_L	XRES_L

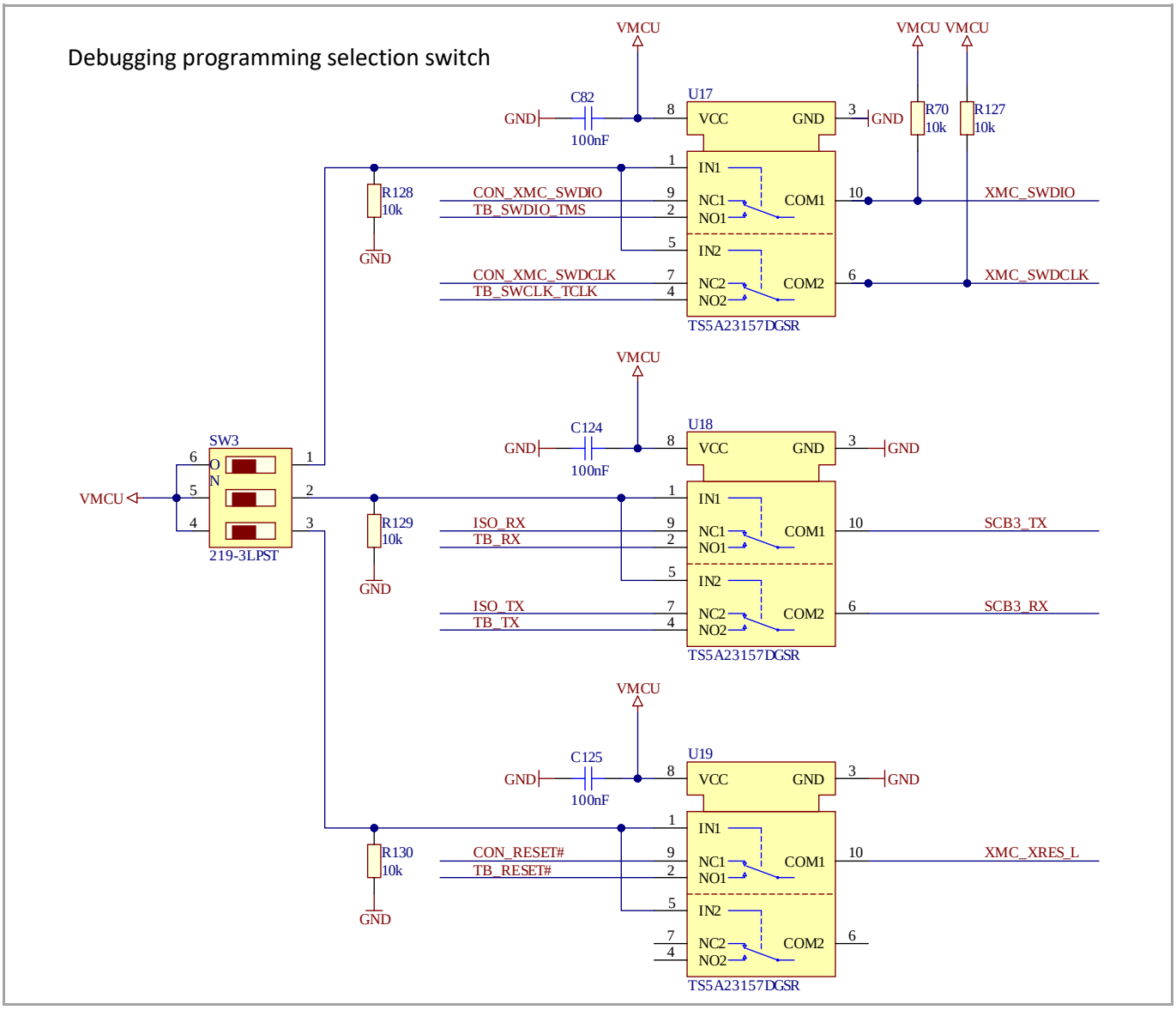


Figure 18 Debugger selection switch

To choose the desired debugging interface, simply position the DIP switch to either Position1 or Position2 according to the switch figures in Table 8. When set to Position1, the Tracebox header is selected, enabling debugging and programming via the Tracebox interface. Conversely, when set to Position2, the JTAG header is selected, allowing debugging and programming through the JTAG interface. The default switch (SW3) setting is adjusted to Position2 on the drive card. By default, you can use the onboard debugger with the switch at Position2.

Ensure that the DIP switch is securely positioned in the desired setting before starting the debugging or programming process. See the XMC7200D chip documentation and the provided user guide for detailed instructions on utilizing the selected debugging interface.

4.2.2.5 ETM headers

The kit includes an ETM header that facilitates advanced debugging and trace capabilities for the XMC7200D chip. The ETM header supports the Serial Wire Viewer (SWV) functionality, enabling real-time tracing and debugging of the XMC7200D chip. It provides convenient access to trace the data, allowing developers to gain insights into the system behavior, optimize the code, and identify issues. Solder the resistors R12, R17, and R72 to enable the ETM connection.

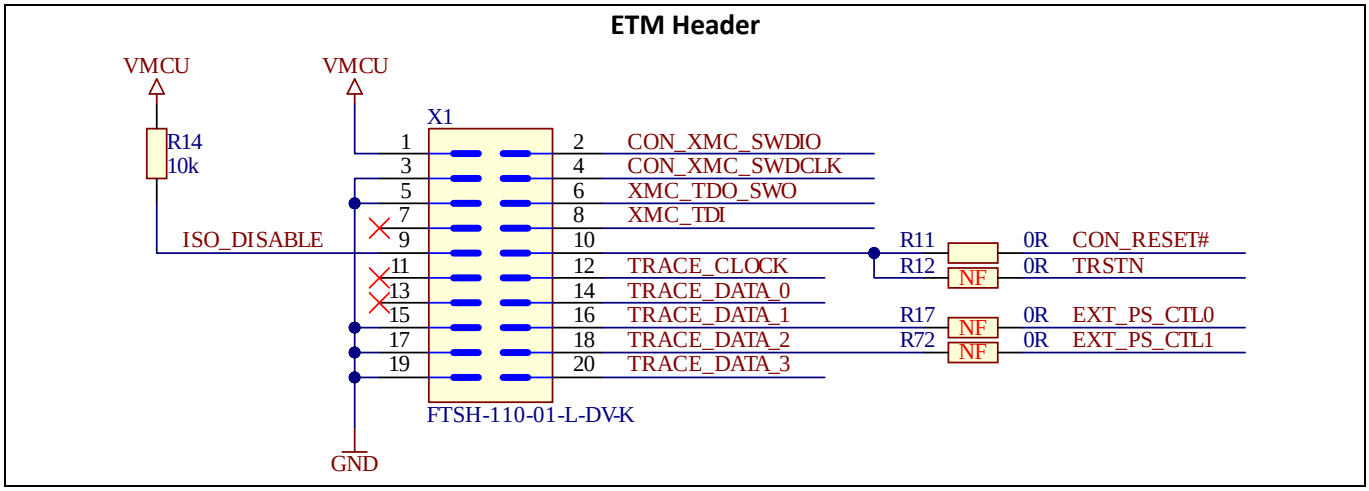


Figure 19 ETM header

Table 9 ETM header peripheral details

Pin number	Signal name	Intermediate signal	XMC7 pin
1	VMCU		
3 – 5 – 15 – 17 – 19	GND		
7 – 11 – 13	N.C.		
2	CON_XMC_SWDIO	XMC_SWDIO	P23_6
4	CON_XMC_SWDCLK	XMC_SWDCLK	P23_5
6	XMC_TDO_SWO		P23_4
8	XMC_TDI		P23_7
9	ISO_DISABLE		
10	CON_RESET#	XMC_XRES_L	XRES_L
	(N.C.) TRSTN	TRSTN	P2_0
12	TRACE_CLOCK		P22_4
14	TRACE_DATA_0	P21_5	
16	TRACE_DATA_1	EXT_PS_CTL0 (R17 to be populated)	P22_1
18	TRACE_DATA_2	EXT_PS_CTL1 (R72 to be populated)	P22_2
20	TRACE_DATA_3		P22_3

4.2.2.6 Infineon Tracebox headers

The kit includes an Infineon Tracebox header that facilitates a connection to an external data acquisition and communication tool for the development and validation of motor control software that can be used with real target hardware. It also supports data streaming via SPI/UART, flashing and debugging via SWD. Solder the resistor R3 to enable the Tracebox connection.

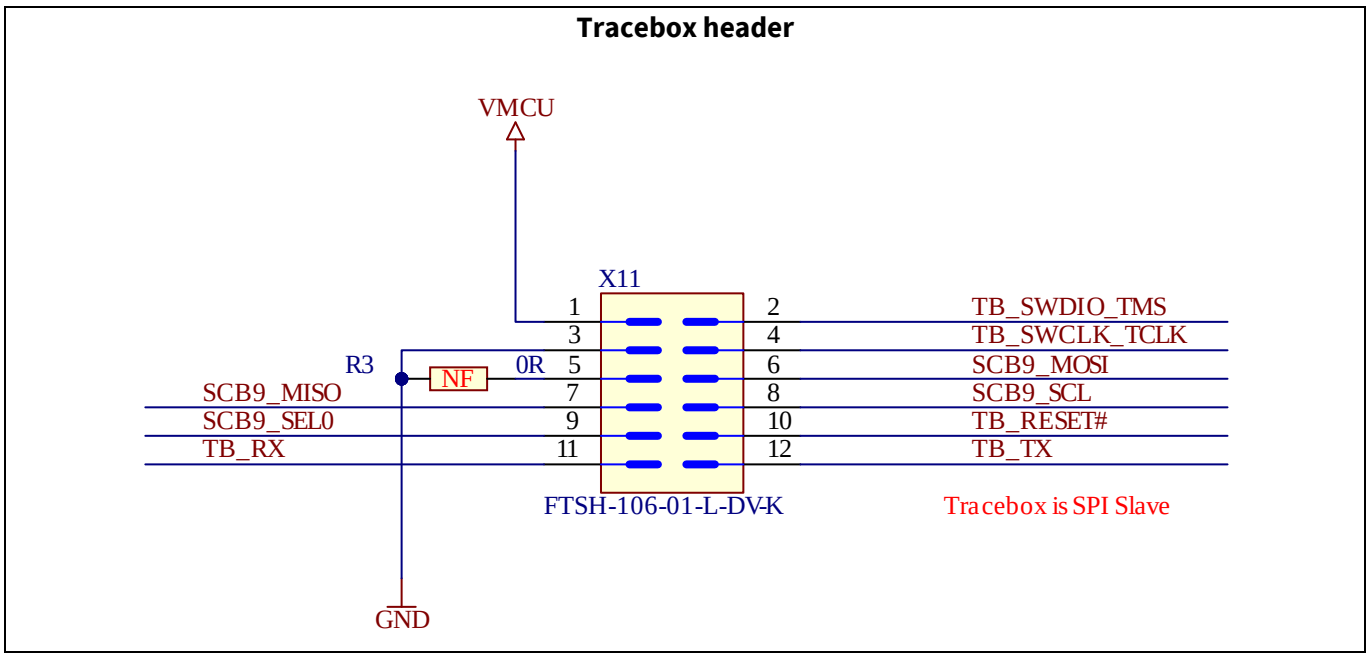


Figure 20 Tracebox header

Table 10 Tracebox header peripheral details

Pin number	Signal name	Intermediate signal	XMC7 pin
1	VMCU		
3 – 5	GND		
2	TB_SWDIO_TMS	XMC_SWDIO	P23_6
4	TB_SWDIO_TCLK	XMC_SWDCLK	P23_5
6	SCB9_MOSI		P15_1
7	SCB9_MISO		P15_0
8	SCB9_SCL		P15_2
9	SCB9_SEL0		P15_3
10	TB_RESET#	XMC_XRES_L	XRES_L
11	TB_RX	SCB3_TX	P17_2
12	TB_TX	SCB3_RX	P17_1

4.2.3 CAN interface and interconnection to XMC7200D

The KIT_XMC7200_DC_V1 board provides an isolated CAN interface with 120 Ω termination (see Figure 21 for details).

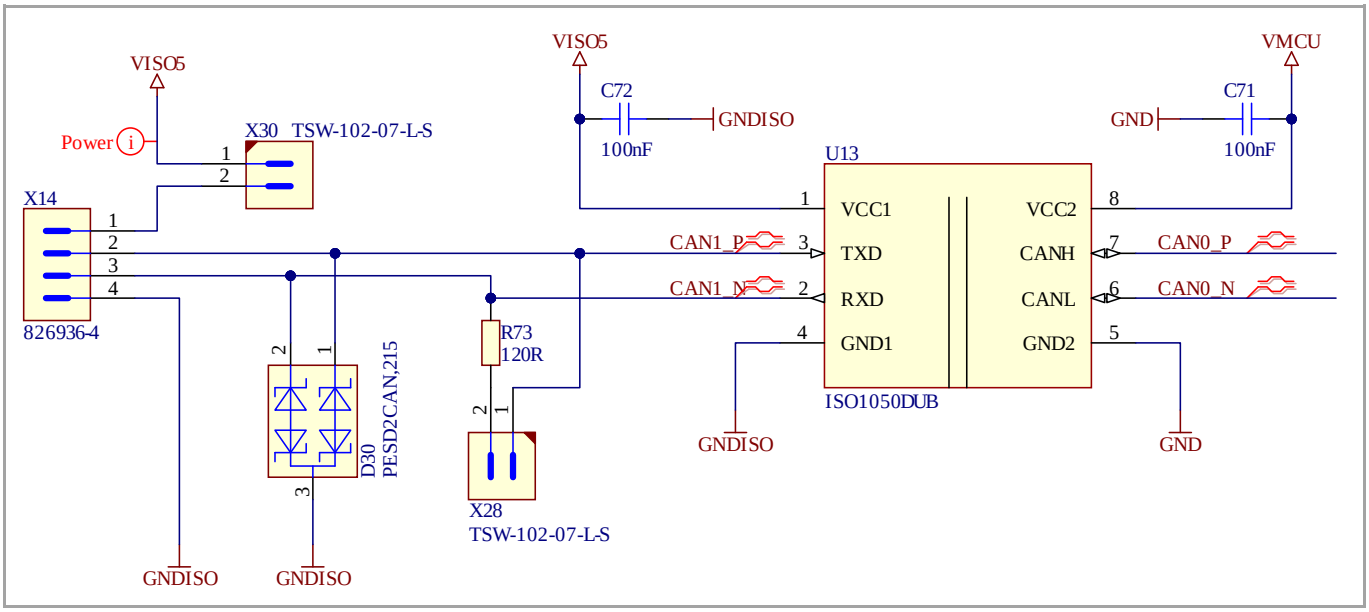


Figure 21 CAN interface and isolation

The isolated CAN transceiver (U13) is connected to CAN node 1 of XMC7200 via port pins P23.0 (CANH) and P23.1 (CANL).

Table 11 CAN header peripheral details

Pin number	Signal name	Intermediate signal	XMC7 pin
1	VISO5		
2	CAN1_P	CAN0_P (CANH)	P23_0
3	CAN1_N	CAN0_N (CANL)	P23_1
4	GNDISO		

4.2.4 Power supply system

The KIT_XMC7200_DC_V1 board is designed with two galvanically isolated supply domains. On the left side, there is the debug domain that contains an XMC4200 MCU as onboard debug controller (OBD). The debug domain can be powered via a USB-C plug (5 V) or a CAN connector or the Infineon debug connector. From the middle to the right side there is the power GND supply domain that provides the power supply for the MCU and the peripheral components. This power supply domain is usually powered from the power board connector.

For the power GND supply domain, a power indicating LED is available.

To indicate the power status of the power GND domain on the KIT_XMC7200_DC_V1 board, one LED is provided (see Figure 30). The LED will be “ON” when the power rail is powered.

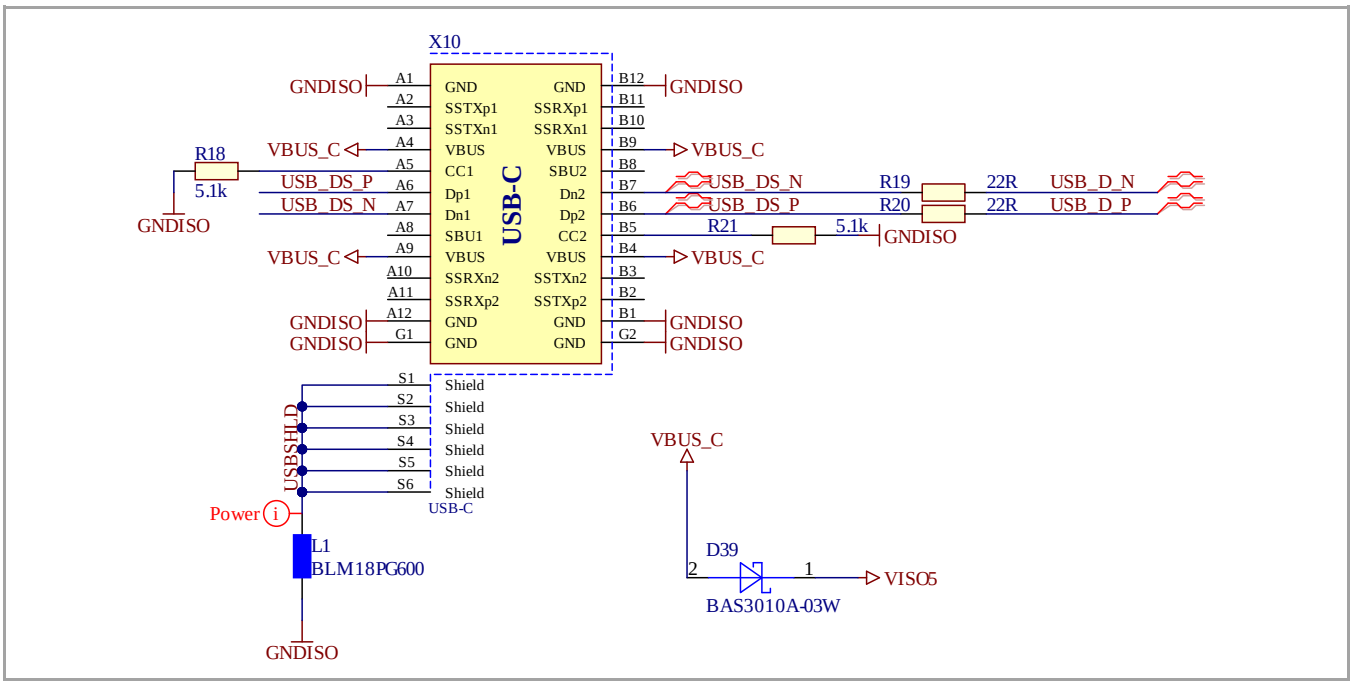


Figure 22 USB-C connector

4.2.4.1 Power interconnection

The isolator U20 on the board transfers the 5 V power supply from the isolation domain to the power GND supply domain, ensuring the secure and efficient power distribution between the two domains. This isolator enables reliable power transfer while maintaining galvanic isolation, enhancing the performance of the board.

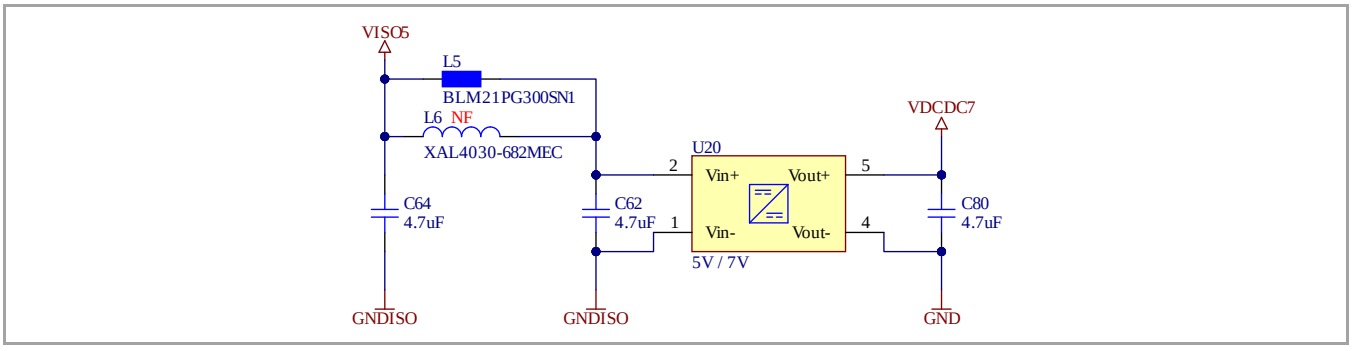


Figure 23 Power interconnection

4.2.4.2 Voltage regulators

The board is equipped with the following four voltage regulators:

- The U8 regulator powers the onboard debugger within the isolation plane.
- The U14 regulator converts the 7 V from the DC-DC converter to a regulated 5 V output on the power GND supply domain.
- The U16 regulator transforms the 24 V input from the power board to a regulated 5 V output.
- The U2 regulator converts 5 V to 3.3 V to power the XMC7200 device. These voltage regulators ensure stable and reliable power supply for different components, enabling optimal performance of the board.

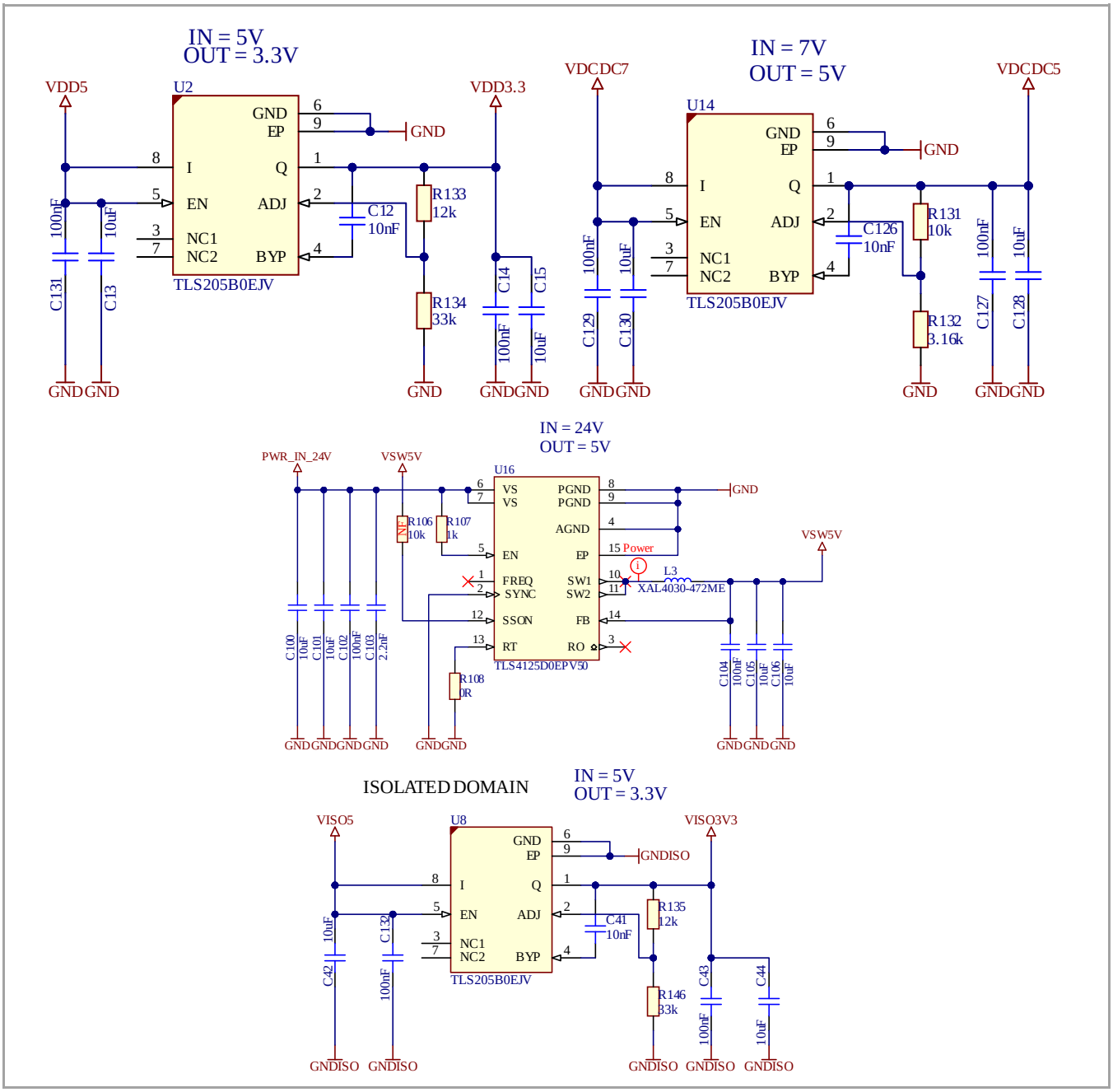


Figure 24 Voltage regulators

4.2.4.3 Voltage selection

The KIT_XMC7200_DC_V1 board features the following two voltage selection headers:

- The X20 header enables voltage selection between the high-density connector (5 V) or from 5 V coming from the isolated plane as the power source for VDD5.
- The X21 header allows you to choose between VDD3_3 (3.3 V) and VDD5 (5 V) as the power source for VMCU.

These headers provide flexibility in configuring the power supply for different components on the board, ensuring optimal performance for your specific requirements.

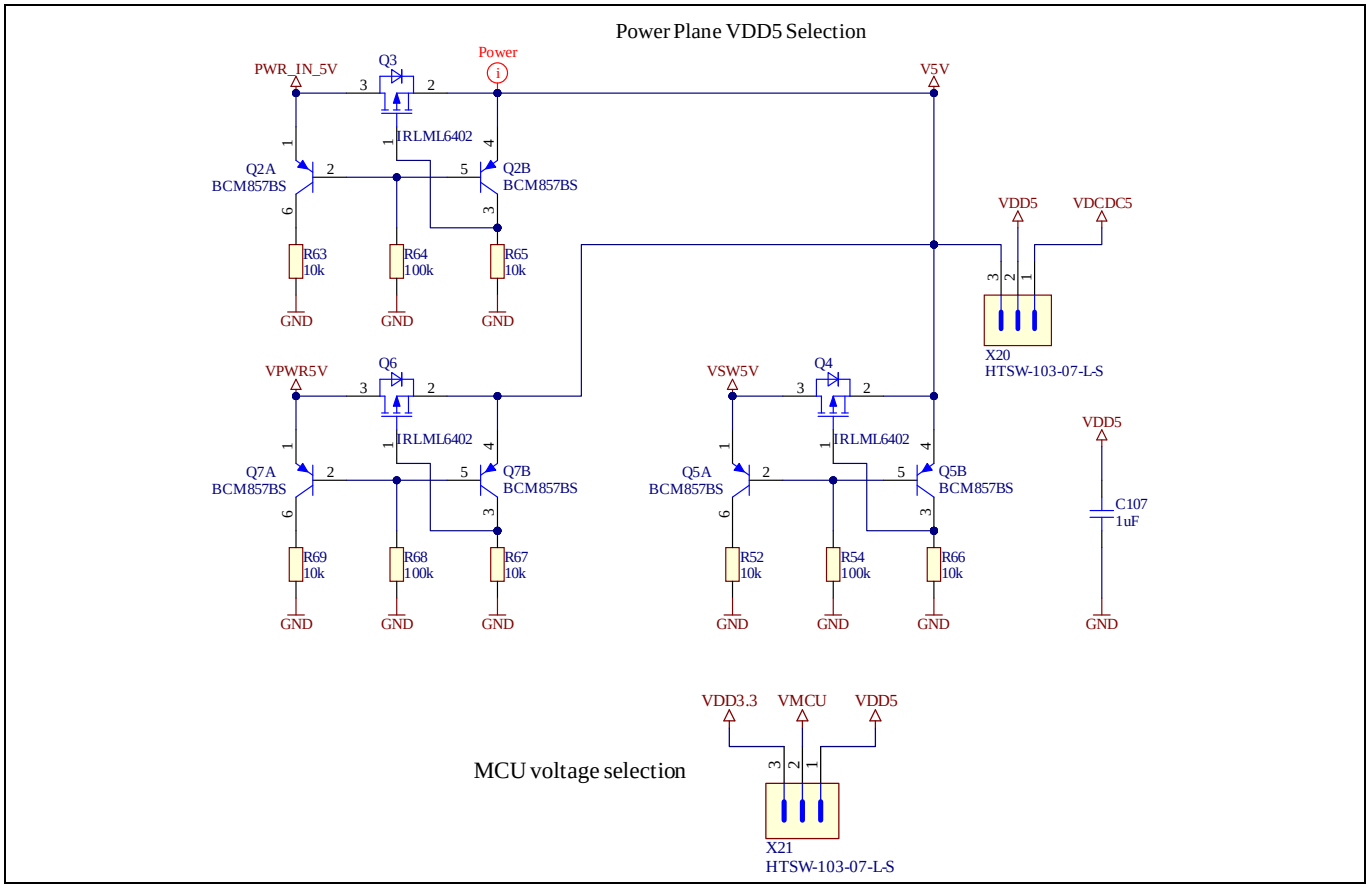


Figure 25 Voltage selection headers

Table 12 Peripheral details

Pin number	Signal name	Selection	
X20 header			
1	VDCDC5	1-2	VDD5 = 5V (isolated 5V coming from USB supply)
2	VDD5		
3	VCC3_5V OR PWR_IN_5V	2-3	VDD5 = 5V (from external supply source)
X21 header			
1	VDD5	1-2	VMCU is connected to 5V
2	VMCU		
3	VDD3.3	2-3	VMCU is connected to 3.3V

4.2.5 I/O headers

4.2.5.1 mikroBUS header

The mikroBUS header provides a standardized interface for connecting compatible MIKROE Click boards, expanding the functionality of the kit with sensors, actuators, communication modules, and so on. Figure 26 shows the available signals at these pin headers. The pin table is also printed onto the top and bottom sides of the PCB in each view.

Table 13 Peripheral details

Pin number	Signal name	Connected to signal	XMC7 pin
1	AN	ADC(2)_29	P20_0
2	RST	SCB1_RTS	P20_5
3	CS	SCB5_SEL0	P4_3
4	SCK	SCB5_CLK	P4_2
5	MISO	SCB5_MISO	P4_0
6	MOSI	SCB5_MOSI	P4_1
7	+3.3V	VDD3.3V	3.3V
8	GND	GND	GND
9	GND	GND	GND
10	+5V	VDD5	5V
11	SDA	P10_1_Extra2	P10_1
12	SCL	P10_2_Extra3	P10_2
13	TX	SCB0_RX	P0_0
14	RX	SCB0_TX	P0_1
15	INT	SCB/TRIG/PWM_P2_5	P2_5
16	PWM	P2_3_PWM	P2_3

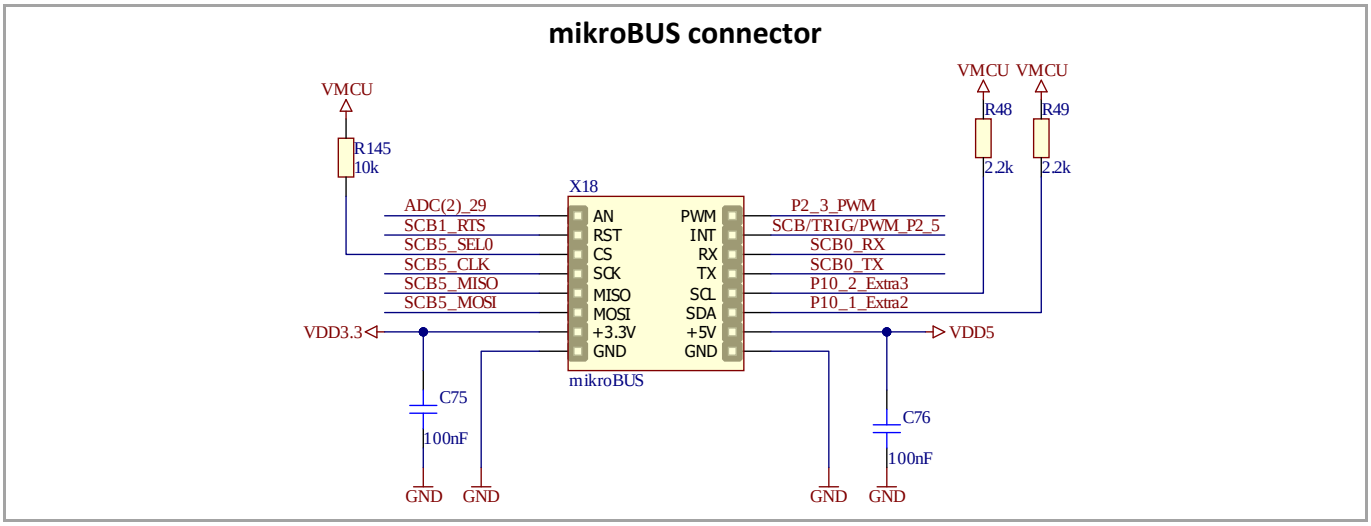


Figure 26 mikroBUS connector

4.2.5.2 XMC7200D I/O headers

The board has two headers: X16, X17. These headers provide a simpler connectivity to XMC7200D GPIOs other than the HD or power board connector. By default, these connectors are not populated.

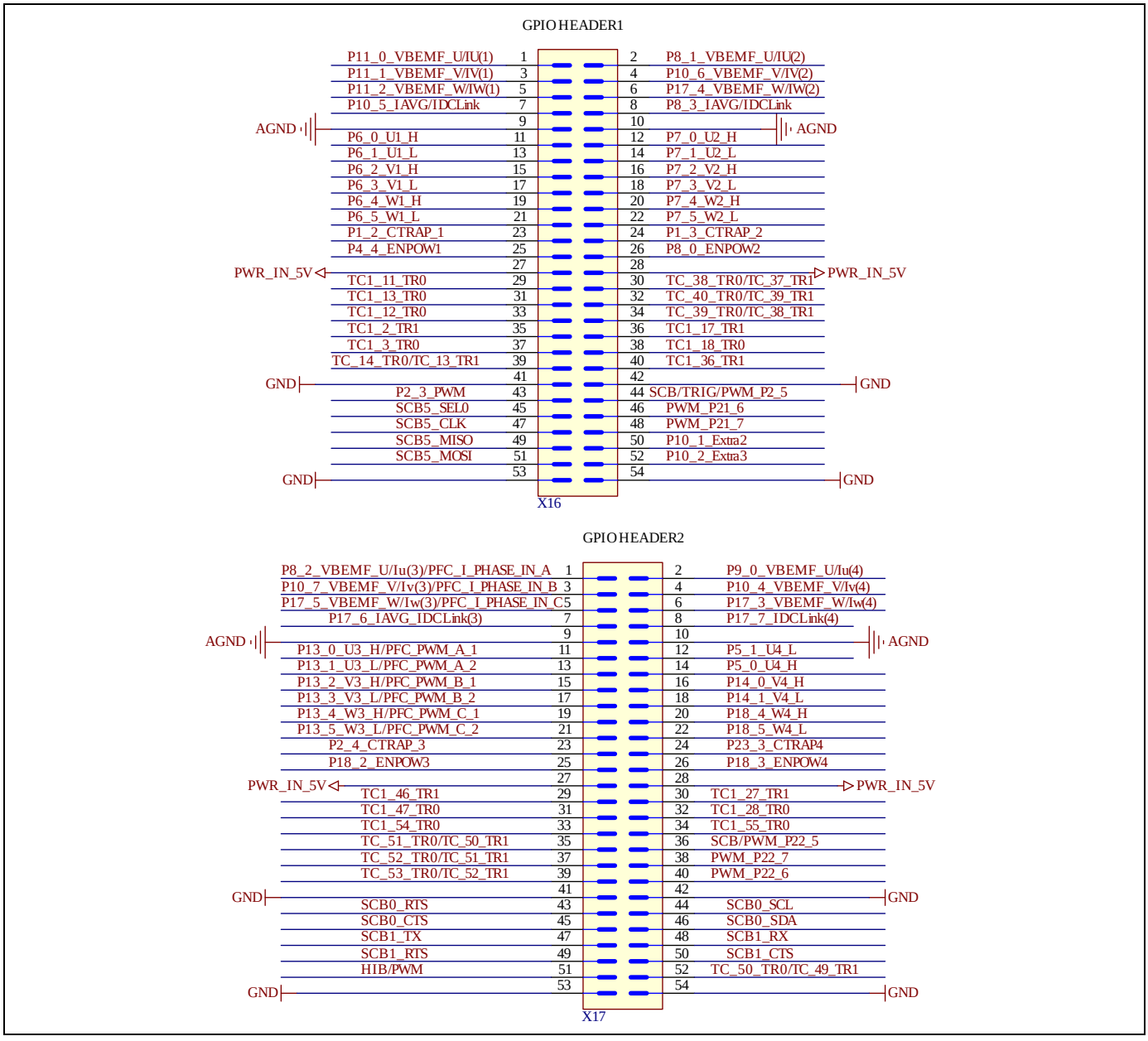


Figure 27 XMC7200D I/O headers

4.2.5.3 Power board connector

The KIT_XMC7200_DC_V1 board provides a power board connector with all the signals required to control the power inverter. Next to the PWM output signals of TCPWM and the ADC signals, there are power supply pins for the power GND supply domain.

Figure 28 shows a picture of the power board connector. The pin and peripheral assignment can be found in Table 14. In addition, different use cases for three phase inverters can be found in Table 16.

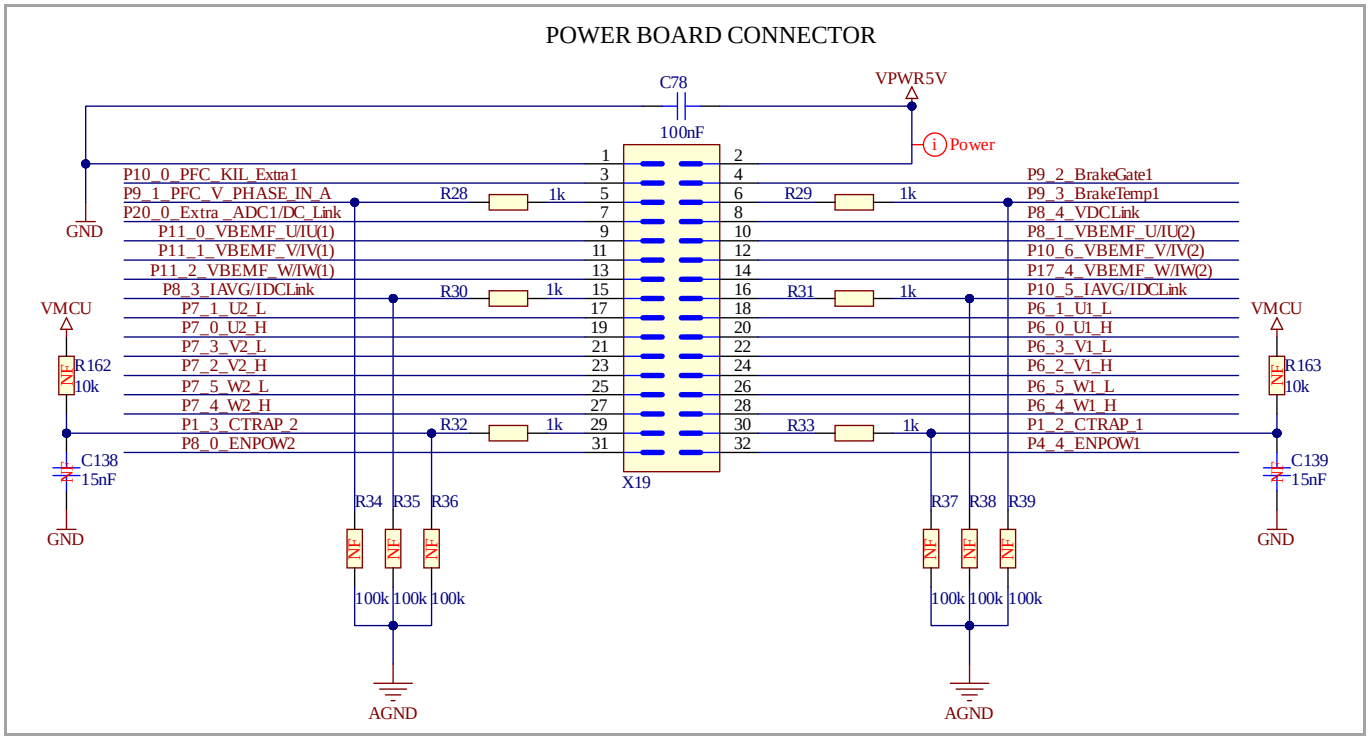


Figure 28 Power board connector

Table 14 X19 peripheral detail

Pin number	Signal name	XMC7 pin	Description
1	GND	VSSD	Ground
2	VDD5	VDD5 (VMCU)	Power signal
3	P10_0_PFC_KIL_Extra1	P10_0	
4	P9_2_BrakeGate1(Motor 1)	P9_2	
5	P9_1_PFC_V_PHASE_IN_A	P9_1	
6	P9_3_BrakeTemp1(Motor 1)	P9_3	Analog signal
7	P20_0_Extra _ADC1/DC_Link	P20_0	Analog signal
8	P8_4_VDCLink1(Motor 1)	P8_4	Analog signal
9	P11_0_VBEMF_U/IU (Motor 1)	P11_0	Analog signal
10	P8_1_VBEMF_U/IU (Motor 2)	P8_1	Analog signal
11	P11_1_VBEMF_V/IV (Motor 1)	P11_1	Analog signal
12	P10_6_VBEMF_V/IV (Motor 2)	P10_6	Analog signal
13	P11_2_VBEMF_W/IW(Motor 1)	P11_2	Analog signal
14	P17_4_VBEMF_W/IW (Motor 2)	P17_4	Analog signal
15	P8_3_IAVG/IDCLink (Motor 1)	P8_3	Analog signal
16	P10_5_IAVG/IDCLink (Motor 2)	P10_5	Analog signal
17	P7_1_U2_L (Motor 2)	P7_1	Digital signal
18	P6_1_U1_L (Motor 1)	P6_1	Digital signal
19	P7_0_U2_H (Motor 2)	P7_0	Digital signal
20	P6_0_U1_H (Motor 1)	P6_0	Digital signal
21	P7_3_V2_L (Motor 2)	P7_3	Digital signal
22	P6_3_V1_L (Motor 1)	P6_3	Digital signal
23	P7_2_V2_H (Motor 2)	P7_2	Digital signal
24	P6_2_V1_H (Motor 1)	P6_2	Digital signal
25	P7_5_W2_L (Motor 2)	P7_5	Digital signal
26	P6_5_W1_L (Motor 1)	P6_5	Digital signal
27	P7_4_W2_H (Motor 2)	P7_4	Digital signal
28	P6_4_W1_H (Motor 1)	P6_4	Digital signal
29	P1_3_CTRAP_2 (Motor 2)	P1_3	Digital signal
30	P1_2_CTRAP_1 (Motor 1)	P1_2	Digital signal
31	P8_0_ENPOW2 (Motor 2)	P8_0	Digital signal
32	P4_4_ENPOW1 (Motor 1)	P4_4	Digital signal

4.2.5.4 High-density connector

The KIT_XMC7200_DC_V1 provides a high-density 100 pin connector in a compact design, this connector enables easy connectivity for power, control, and communication signals. By attaching a Drive adapter card to the connector, you can expand the capabilities of the kit and establish connections with external devices such as motors and sensors. It plays a significant role in enhancing the functionality of the kit and extending its capabilities for a wide range of motor control applications.

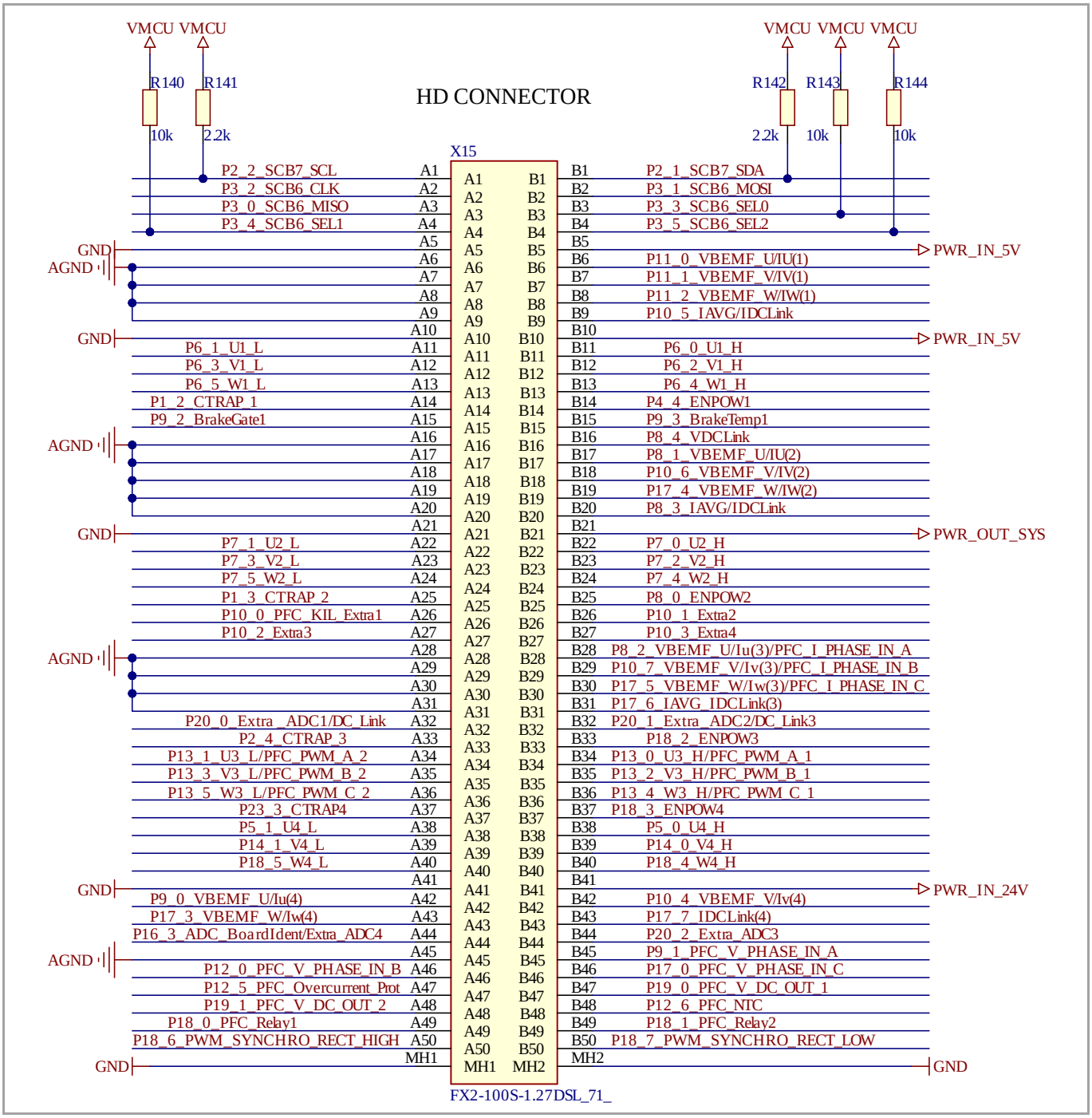


Figure 29 High-density connector

Table 15 X15 peripheral details

X15 HD-C	Signal name	XMC7 Pin	Peripherals
A1	P2_2_SCB7_SCL	P2_2	I2C Clock
A2	P3_2_SCB6_CLK	P3_2	SPI Clock
A3	P3_0_SCB6_MISO	P3_0	SPI Master Input Slave Output
A4	P3_4_SCB6_SEL1	P3_4	SPI Chip Select
A5	GND	VSSD	
A6	AGND	VSSA	
A7	AGND	VSSA	
A8	AGND	VSSA	
A9	AGND	VSSA	
A10	GND	VSSD	
A11	P6_1_U1_L	P6_1	PWM output
A12	P6_3_V1_L	P6_3	PWM output
A13	P6_5_W1_L	P6_5	PWM output
A14	P1_2_CTRAP_1	P1_2	Digital input
A15	P9_2_BrakeGate1	P9_2	GPIO
A16	AGND	VSSA	
A17	AGND	VSSA	
A18	AGND	VSSA	
A19	AGND	VSSA	
A20	AGND	VSSA	
A21	GND	VSSD	
A22	P7_1_U2_L	P7_1	PWM output
A23	P7_3_V2_L	P7_3	PWM output
A24	P7_5_W2_L	P7_5	PWM output
A25	P1_3_CTRAP_2	P1_3	Digital input
A26	P10_0_PFC_KIL_Extra1	P10_0	Digital input
A27	P10_2_Extra3	P10_2	GPIO
A28	AGND	VSSA	
A29	AGND	VSSA	
A30	AGND	VSSA	
A31	AGND	VSSA	
A32	P20_0_Extra _ADC1/DC_Link	P20_0	Analog input
A33	P2_4_CTRAP_3	P2_4	Digital input
A34	P13_1_U3_L/PFC_PWM_A_2	P13_1	PWM output
A35	P13_3_V3_L/PFC_PWM_B_2	P13_3	PWM output
A36	P13_5_W3_L/PFC_PWM_C_2	P13_5	PWM output
A37	P23_3_CTRAP4	P23_3	Digital input

X15 HD-C	Signal name	XMC7 Pin	Peripherals
A38	P5_1_U4_L	P5_1	PWM output
A39	P14_1_V4_L	P14_1	PWM output
A40	P18_5_W4_L	P18_5	PWM output
A41	GND	VSSD	
A42	P9_0_VBEMF_U/Iu(4)	P9_0	Analog input
A43	P17_3_VBEMF_W/Iw(4)	P17_3	Analog input
A44	P16_3_ADC_BoardIdent/Extra_ADC4	P16_3	Analog input
A45	AGND	VSSA	
A46	P12_0_PFC_V_PHASE_IN_B	P12_0	Analog input
A47	P12_5_PFC_Overcurrent_Prot	P12_5	Analog input
A48	P19_1_PFC_V_DC_OUT_2	P19_1	Analog input
A49	P18_0_PFC_Relay1	P18_0	GPIO
A50	P18_6_PWM_SYNCHRO_RECT_HIGH	P18_6	PWM output
B1	P2_1_SCB7_SDA	P2_1	I2C Serial Data
B2	P3_1_SCB6_MOSI	P3_1	SPI Master Output Slave Input
B3	P3_3_SCB6_SEL0	P3_3	SPI Chip Select
B4	P3_5_SCB6_SEL2	P3_5	SPI Chip Select
B5	PWR_IN_5V		Power supply 5V input
B6	P11_0_VBEMF_U/IU(1)	P11_0	Analog input
B7	P11_1_VBEMF_V/IV(1)	P11_1	Analog input
B8	P11_2_VBEMF_W/IW(1)	P11_2	Analog input
B9	P10_5_IAVG/IDCLink(1)	P10_5	Analog input
B10	PWR_IN_5V		Power 5V input
B11	P6_0_U1_H	P6_0	PWM output
B12	P6_2_V1_H	P6_2	PWM output
B13	P6_4_W1_H	P6_4	PWM output
B14	P4_4_ENPOW1	P4_4	GPIO
B15	P9_3_BrakeTemp1	P9_3	Analog input
B16	P8_4_VDCLink	P8_4	Analog input
B17	P8_1_VBEMF_U/IU(2)	P8_1	Analog input
B18	P10_6_VBEMF_V/IV(2)	P10_6	Analog input
B19	P17_4_VBEMF_W/IW(2)	P17_4	Analog input
B20	P8_3_IAVG_IDCLink	P8_3	Analog input
B21	PWR_OUT_SYS		Power 3.3V output
B22	P7_0_U2_H	P7_0	PWM output
B23	P7_2_V2_H	P7_2	PWM output
B24	P7_4_W2_H	P7_4	PWM output
B25	P8_0_ENPOW2	P8_0	Analog input

X15 HD-C	Signal name	XMC7 Pin	Peripherals
B26	P10_1_Extra2	P10_1	GPIO
B27	P10_3_Extra4	P10_3	GPIO
B28	P8_2_VBEMF_U/Iu(3)/PFC_I_PHASE_IN_A	P8_2	Analog input
B29	P10_7_VBEMF_V/Iv(3)/PFC_I_PHASE_IN_B	P10_7	Analog input
B30	P17_5_VBEMF_W/Iw(3)/PFC_I_PHASE_IN_C	P17_5	Analog input
B31	P17_6_IAVG_IDCLink(3)	P17_6	Analog input
B32	P20_1_Extra_ADC2/DC_Link3	P20_1	Analog input
B33	P18_2_ENPOW3	P18_2	GPIO
B34	P13_0_U3_H/PFC_PWM_A_1	P13_0	PWM output
B35	P13_2_V3_H/PFC_PWM_B_1	P13_2	PWM output
B36	P13_4_W3_H/PFC_PWM_C_1	P13_4	PWM output
B37	P18_3_ENPOW4	P18_3	GPIO
B38	P5_0_U4_H	P5_0	PWM output
B39	P14_0_V4_H	P14_0	PWM output
B40	P18_4_W4_H	P18_4	PWM output
B41	PWR_IN_24V		Power 10-36V input
B42	P10_4_VBEMF_V/Iv(4)	P10_4	Analog input
B43	P17_7_IDCLink(4)	P17_7	Analog input
B44	P20_2_Extra_ADC3	P20_2	Analog input
B45	P9_1_PFC_V_PHASE_IN_A	P9_1	Analog input
B46	P17_0_PFC_V_PHASE_IN_C	P17_0	Analog input
B47	P19_0_PFC_V_DC_OUT_1	P19_0	Analog input
B48	P12_6_PFC_NTC	P12_6	Analog input
B49	P18_1_PFC_Relay2	P18_1	GPIO
B50	P18_7_PWM_SYNCHRO_RECT_LOW	P18_7	PWM output
MH1	GND	VSSD	
MH2	GND	VSSD	

Table 16 Use Cases of PWM Signals

X15 HD-C	Signal name	XMC7 Pin	Peripheral
2-level inverter with TCPWM			
B11	P6_0_U1_H	P6_0	PWM1_M_0 (TCPWM1_Group1_Counter0)
A11	P6_1_U1_L	P6_1	PWM1_M_0_N (TCPWM1_Group1_Counter0)
B12	P6_2_V1_H	P6_2	PWM1_M_1 (TCPWM1_Group1_Counter1)
A12	P6_3_V1_L	P6_3	PWM1_M_1_N (TCPWM1_Group1_Counter1)
B13	P6_4_W1_H	P6_4	PWM1_M_2 (TCPWM1_Group1_Counter2)
A13	P6_5_W1_L	P6_5	PWM1_M_2_N (TCPWM1_Group1_Counter2)
A14	P1_2_CTRAP_1	P1_2	GPIO (TCPWM1_Group1_Counter0/1/2 Kill input)
B14	P4_4_ENPOW1	P4_4	GPIO
2-level inverter with TCPWM			
B22	P7_0_U2_H	P7_0	PWM1_M_4 (TCPWM1_Group1_Counter4)
A22	P7_1_U2_L	P7_1	PWM1_M_4_N (TCPWM1_Group1_Counter4)
B23	P7_2_V2_H	P7_2	PWM1_M_5 (TCPWM1_Group1_Counter5)
A23	P7_3_V2_L	P7_3	PWM1_M_5_N (TCPWM1_Group1_Counter5)
B24	P7_4_W2_H	P7_4	PWM1_M_6 (TCPWM1_Group1_Counter6)
A24	P7_5_W2_L	P7_5	PWM1_M_6_N (TCPWM1_Group1_Counter6)
A25	P1_3_CTRAP_2	P1_3	GPIO (TCPWM1_Group1_Counter4/5/6 Kill input)
B25	P8_0_ENPOW2	P8_0	GPIO
2-level inverter with TCPWM			
B34	P13_0_U3_H/PFC_PWM_A_1	P13_0	PWM1_M_8 (TCPWM1_Group1_Counter8)
A34	P13_1_U3_L/PFC_PWM_A_2	P13_1	PWM1_M_8_N (TCPWM1_Group1_Counter8)
B35	P13_2_V3_H/PFC_PWM_B_1	P13_2	PWM1_M_9 (TCPWM1_Group1_Counter9)
A35	P13_3_V3_L/PFC_PWM_B_2	P13_3	PWM1_M_9_N (TCPWM1_Group1_Counter9)
B36	P13_4_W3_H/PFC_PWM_C_1	P13_4	PWM1_M_10 (TCPWM1_Group1_Counter10)
A36	P13_5_W3_L/PFC_PWM_C_2	P13_5	PWM1_M_10_N (TCPWM1_Group1_Counter10)
A33	P2_4_CTRAP_3	P2_4	GPIO (TCPWM1_Group1_Counter8/9/10 Kill input)
B33	P18_2_ENPOW3	P18_2	GPIO
2-level inverter with TCPWM			
B38	P5_0_U4_H	P5_0	PWM0_M_0 (TCPWM0_Group1_Counter0)
A38	P5_1_U4_L	P5_1	PWM0_M_0_N (TCPWM0_Group1_Counter0)
B39	P14_0_V4_H	P14_0	PWM0_M_1 (TCPWM0_Group1_Counter1)
A39	P14_1_V4_L	P14_1	PWM0_M_1_N (TCPWM0_Group1_Counter1)
B40	P18_4_W4_H	P18_4	PWM0_M_2 (TCPWM0_Group1_Counter2)
A40	P18_5_W4_L	P18_5	PWM0_M_2_N (TCPWM0_Group1_Counter2)
A37	P23_3_CTRAP4	P23_3	GPIO (TCPWM0_Group1_Counter0/1/2 Kill input)
B37	P18_3_ENPOW4	P18_3	GPIO

4.2.6 LEDs

The KIT_XMC7200_DC_V1 board has the following five LEDs:

- Two of them are user-controllable LEDs (D1 yellow and D2 red) connected to XMC7200D pins for user applications.
- D3 (green) power LED indicates the status of power supplied to the board.
- D4 (red) indicates the status of onboard debugger.
- D5 (green) provides visual feedback and status information related to the debugging process.

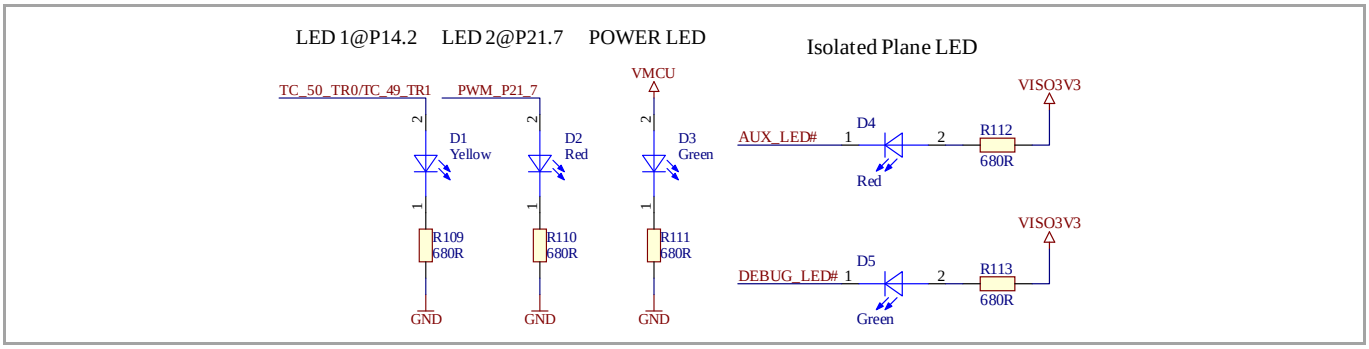


Figure 30 User LEDs

Table 17 Peripheral details

User LEDs	Connected to port pin
D1	P14_2
D2	P21_7

4.2.7 User buttons

The board has a reset button and one user-controllable button. The reset button (SW2) is connected to the XMC_XRES_L pin of the XMC7200D device and is used to reset the device. The button SW2 is connected to pin P23_2 of the XMC7200D device. All buttons are ACTIVE LOW configuration and short to GND when pressed.

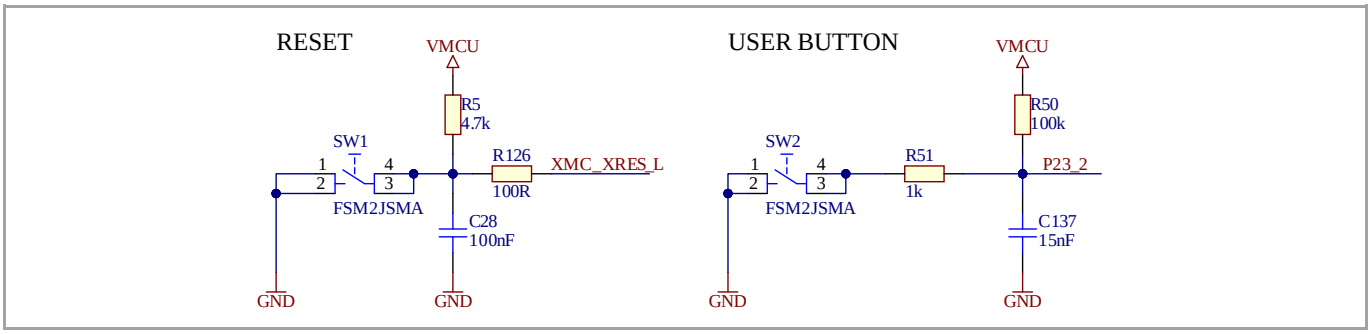


Figure 31 User buttons

Table 18 Peripheral details

User button	Connected to port pin
SW1	XMC_XRES_L
SW2	P23_2

4.2.8 Crystal and oscillators

The board has the following three crystals/oscillators:

- A 32.768-kHz crystal connected to P21[0] and P21[1] as a watch crystal oscillator (Y3)
- A 16-MHz crystal connected to P21[2] and P21[3] of the XMC7200D as the external crystal oscillator (Y1)
- A 12-MHz crystal connected to the onboard debugger as the external crystal oscillator (Y2)

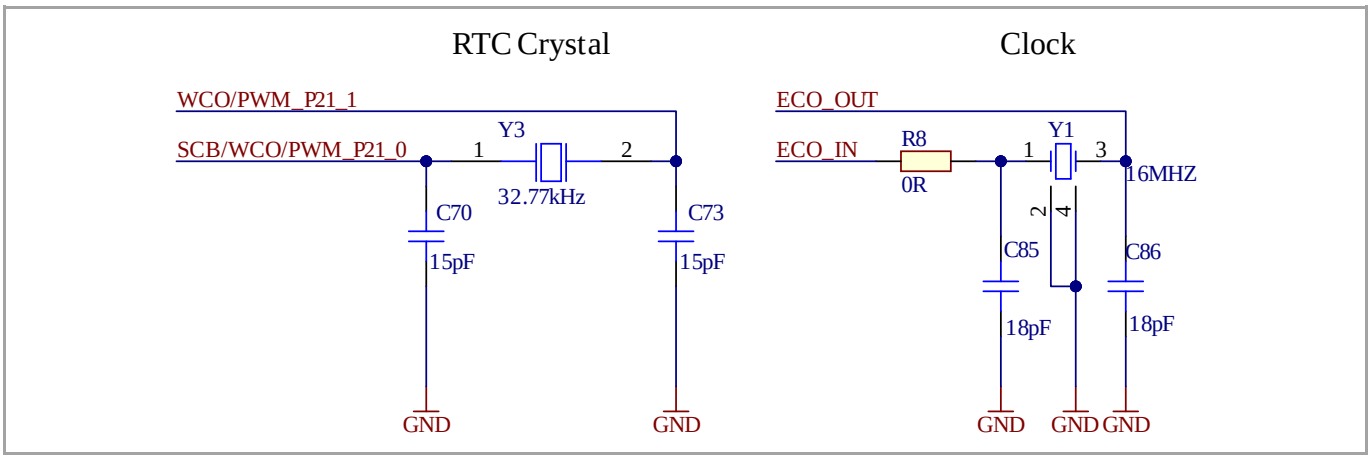


Figure 32 Crystal and oscillators

4.2.9 Potentiometer

The board has two 10k potentiometers, POT1 and POT2, connected to P12_7 and P19_4, respectively. The fixed ends are connected to VMCU and GND, potentially causing leakage current on the XMC_VDD supply.

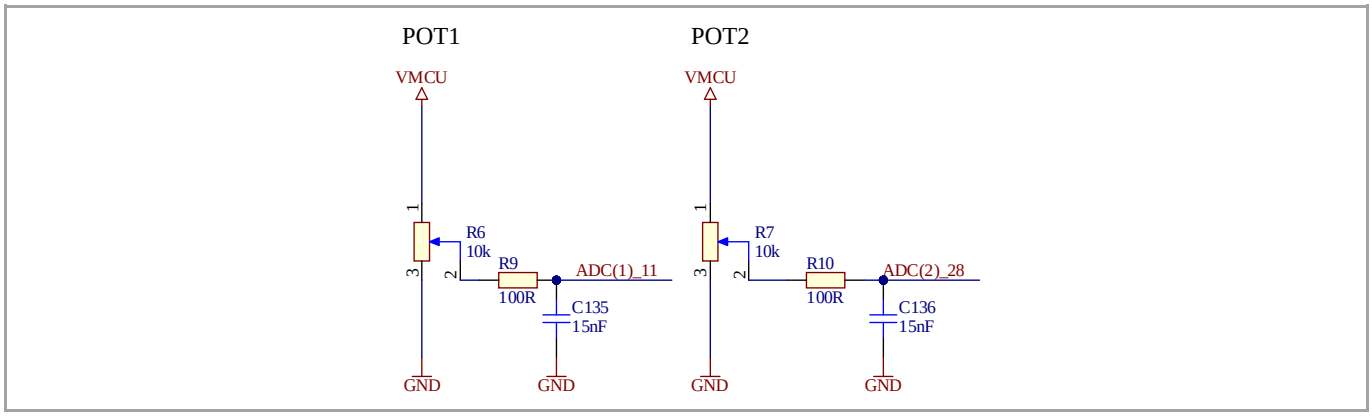


Figure 33 Potentiometers

Table 19 Peripheral details

Potentiometer	Connected to port pin	ADC group
POT1	ADC(1)_11 (P12_7)	ADC group 1, channel 11
POT2	ADC(2)_28 (P19_4)	ADC group 2, channel 28

4.2.10 Motor control

4.2.10.1 Encoder line driver

The KIT_XMC7200_DC_V1 provides four pairs of HALL and incremental encoder connectors. The encoder interface connector provides a differential input, which is transformed into single-ended signals by an interface IC. The HALL sensor interface provides a pull-up resistor for each HALL sensor signal and a power supply for the HALL sensors.

You can use the encoder and HALL sensor interfaces simultaneously, enabling combined functionality and expanded sensing capabilities. You have the flexibility to select the desired interface through software control. See Table 20 for details on pin and peripheral assignment.

Table 20 Peripheral details

Connector number	Signals	MCU interface	MCU pin no.
HALL sensor interface – X3			
1	VDD5	5 V	
2	HALL1	TC1_11_TR0	P5_2
3	HALL2	TC1_13_TR0	P5_4
4	HALL3	TC1_12_TR0	P5_3
5	GND	GND	
Encoder Interface - X2			
1	N.C.		
2	VDD5	5 V	
3	GND	GND	
4	N.C.		
5	ENC1_A_N	TC1_2_TR1	P6_6
6	ENC1_A_P		
7	ENC1_B_N	TC1_3_TR0	P6_7
8	ENC1_B_P		
9	ENC1_Z_N	TC_14_TR0/TC_13_TR1	P5_5
10	ENC1_Z_P		
HALL Sensor Interface – X7			
1	VDD5	5 V	
2	HALL1	GND	
3	HALL2	TC_38_TR0/TC_37_TR1	P12_2
4	HALL3	TC_39_TR0/TC_38_TR1	P12_3
5	GND	TC_40_TR0/TC_39_TR1	P12_4
6	N.C.		
Encoder Interface – X4			
1	VDD5	Encoder power supply	
2	GND		

Connector number	Signals	MCU interface	MCU pin no.
3	ENC2_A_P	TC1_17_TR1	P7_6
4	ENC2_A_N		
5	ENC2_B_P	TC1_18_TR0	P7_7
6	ENC2_B_N		
7	ENC2_Z_P	TC1_36_TR1	P12_1
8	ENC2_Z_N		
HALL Sensor Interface – X5			
1	VDD5	5 V	
2	HALL1	GND	
3	HALL2	TC_51_TR0/TC_50_TR1	P14_3
4	HALL3	TC_52_TR0/TC_51_TR1	P14_4
5	GND	TC_53_TR0/TC_52_TR1	P14_5
6	N.C.		
Encoder Interface – X6			
1	VDD5	Encoder power supply	
2	GND		
3	ENC3_A_P	TC1_46_TR1	P13_6
4	ENC3_A_N		
5	ENC3_B_P	TC1_47_TR0	P13_7
6	ENC3_B_N		
7	ENC3_Z_P	TC1_54_TR0	P14_6
8	ENC3_Z_N		
HALL Sensor Interface – X9			
1	VDD5	5 V	
2	HALL1	GND	
3	HALL2	SCB/PWM_P22_5	P22_5
4	HALL3	PWM_P22_6	P22_6
5	GND	PWM_P22_7	P22_7
6	N.C.		
Encoder Interface – X8			
1	VDD5	Encoder power supply	
2	GND		
3	ENC4_A_P	TC1_27_TR1	P19_2
4	ENC4_A_N		
5	ENC4_B_P	TC1_28_TR0	P19_3
6	ENC4_B_N		
7	ENC4_Z_P	TC1_55_TR0	P14_7
8	ENC4_Z_N		

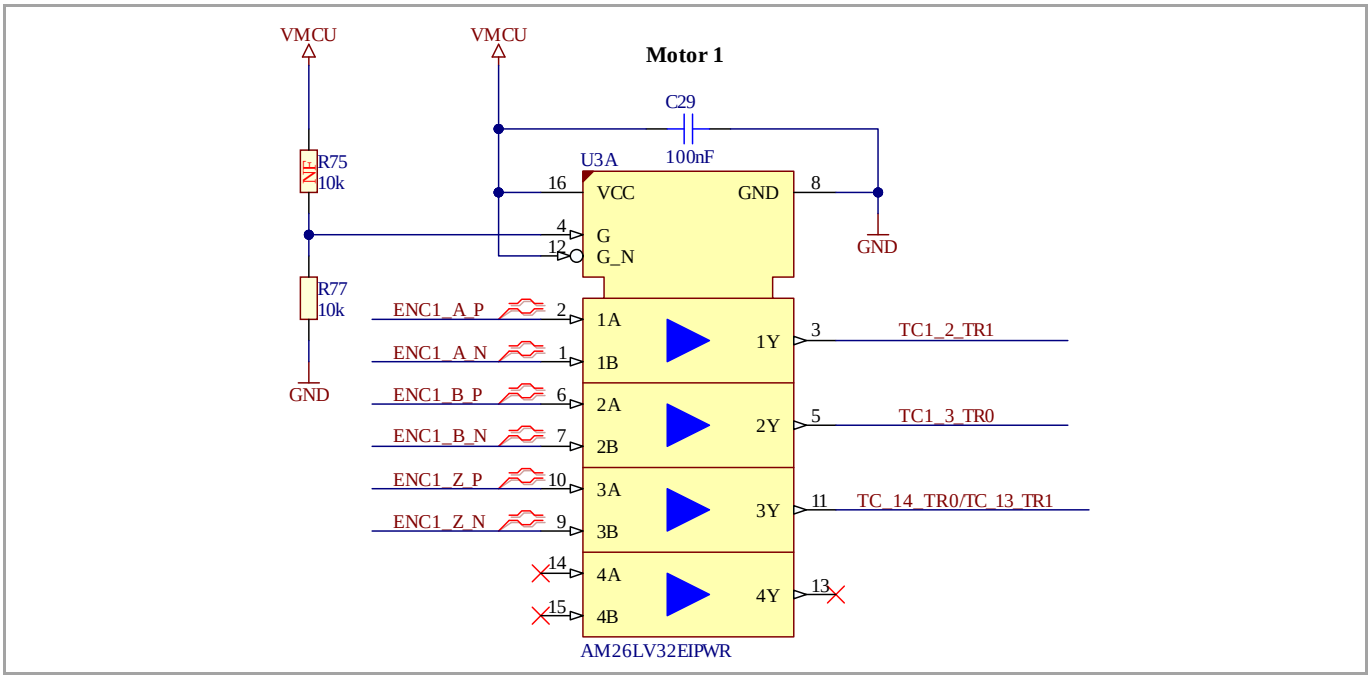


Figure 34 Motor encoder driver

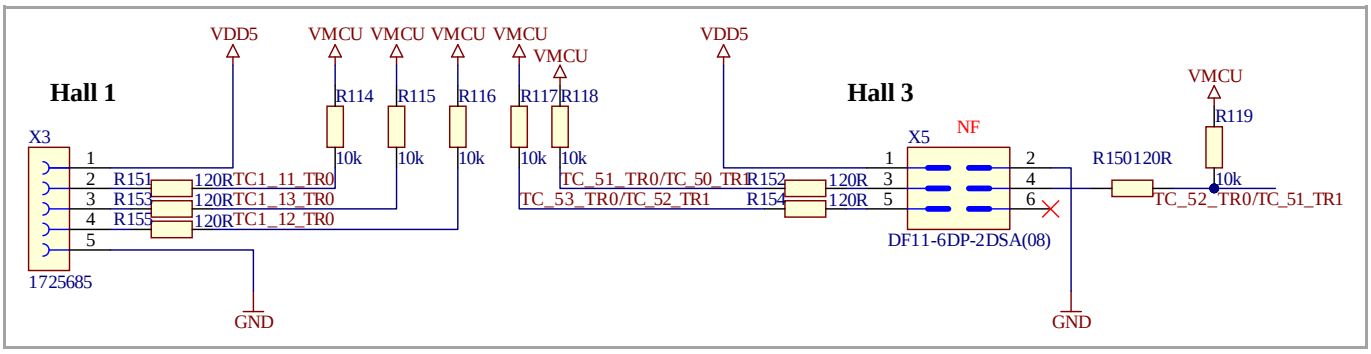


Figure 35 Hall headers

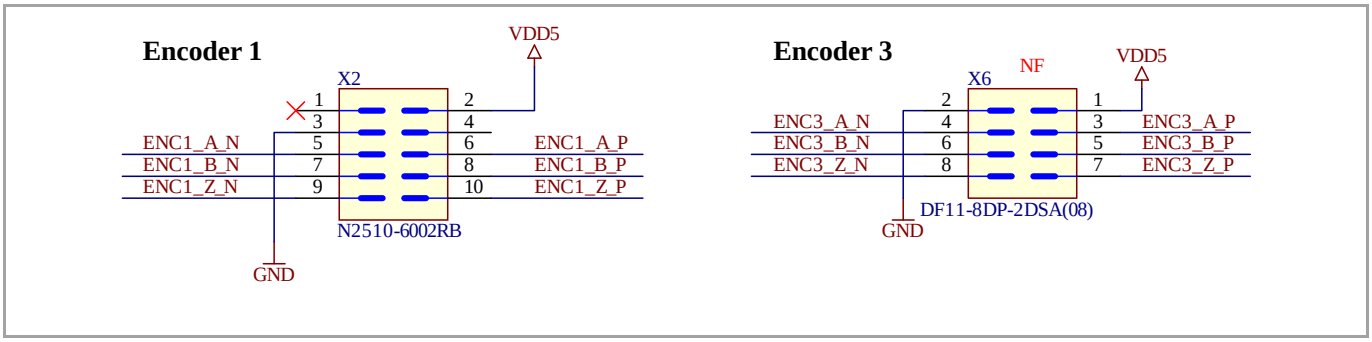


Figure 36 Encoder headers

4.2.10.2 Encoder interconnection

The KIT_XMC7200_DC_V1 board provides the encoder interface with 120R termination that serves as a termination resistor. (See Figure 37 for details). This termination resistor helps to prevent signal distortions and improve the overall performance and reliability of the encoder's communication interface.

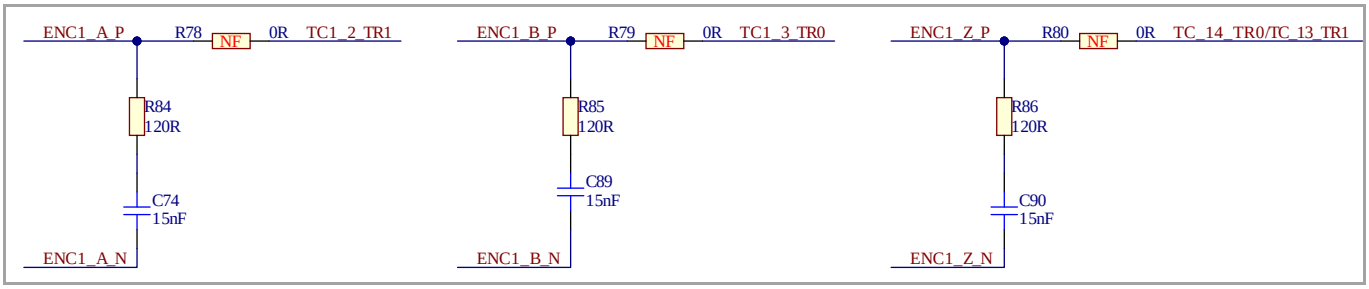


Figure 37 Encoder interconnection

4.2.10.3 Analog signal converter

The kit includes an Analog Signal Converter featuring a resistor and diode configuration to clamp voltages exceeding 5.6 V. By placing the resistor in series with the input signal and the diode in parallel with the output, the circuit ensures that any voltage beyond the threshold is limited to approximately 0.7 V, protecting the XMC.

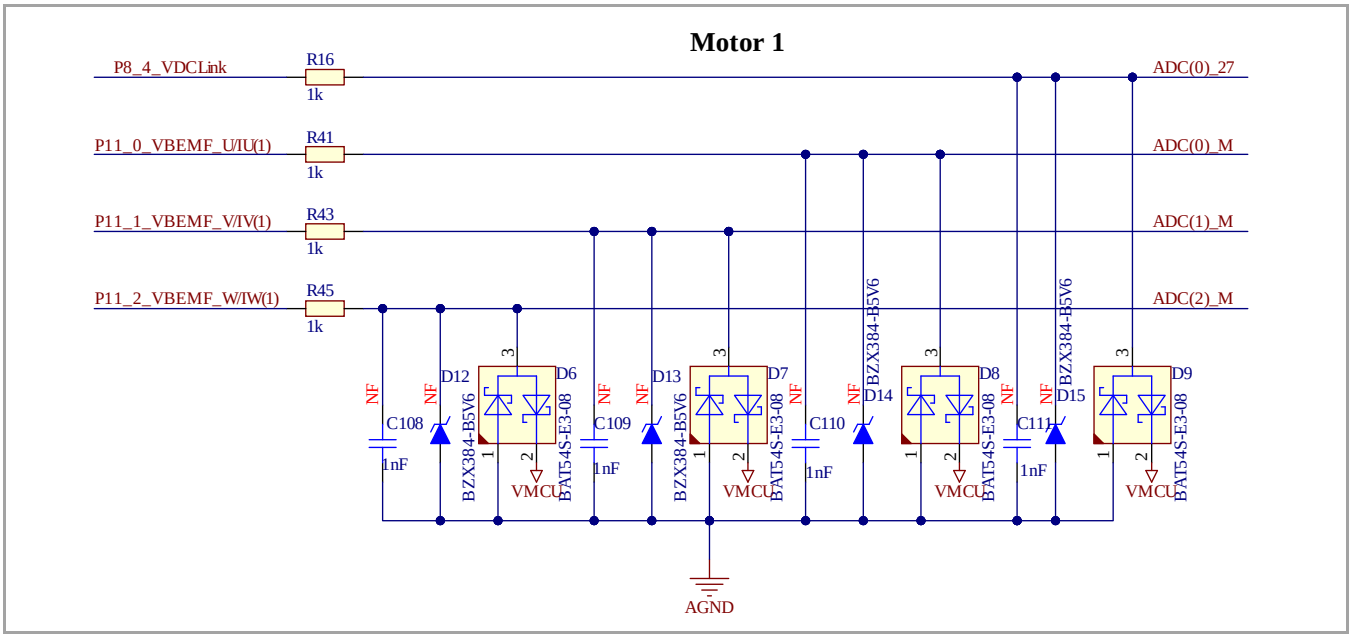


Figure 38 Analog to digital converter

4.3 Kit rework

4.3.1 VDDIO2 supply voltage selection

By default, VDDIO2 is connected to the XMC_VDD (VTARG) interface. Voltage selection depends on the VTARG selection between 3.3 V and 5 V. To select separate voltage domains for VDDIO2, use the resistor rework option provisioned on the board. Populate resistor R89 for 3.3 V and R90 for 5 V. Ensure that you remove jumper J12 whenever using the resistor configuration for VDDIO2.

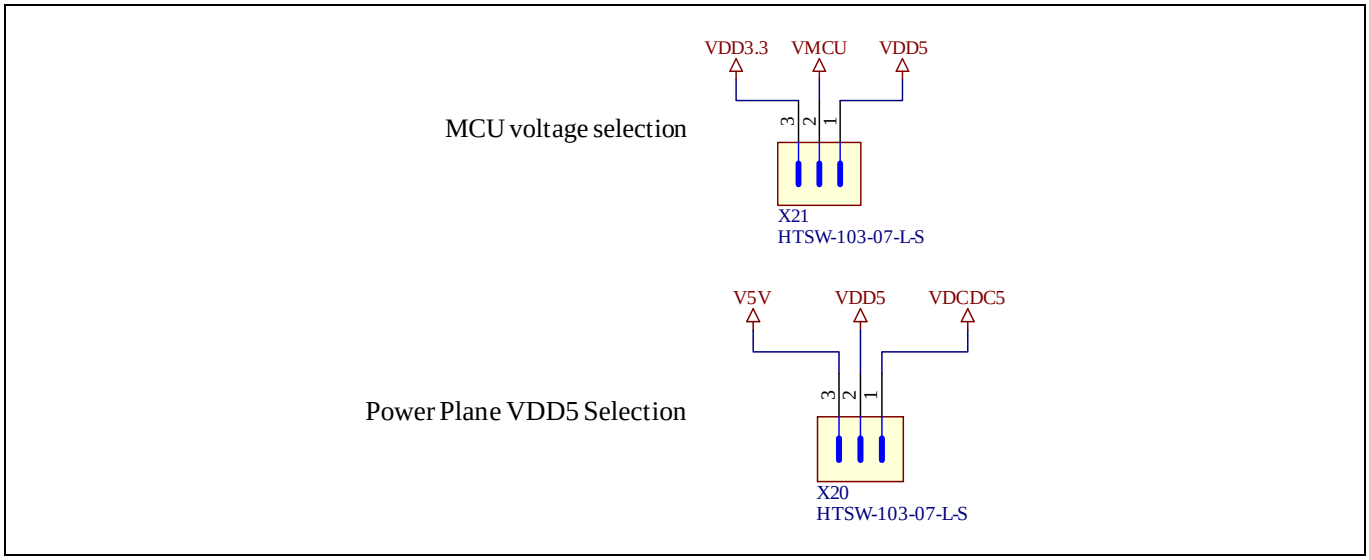


Figure 39 XMC7200 VDDIO2 voltage selection

4.3.2 Hall and encoder header

By default, only two hall and encoder headers are populated. If required, populate X5 and X9 for the hall header (DF11-6DP-2DSA) and X6 and X8 for the encoder header (DF11-8DP-2DSA).

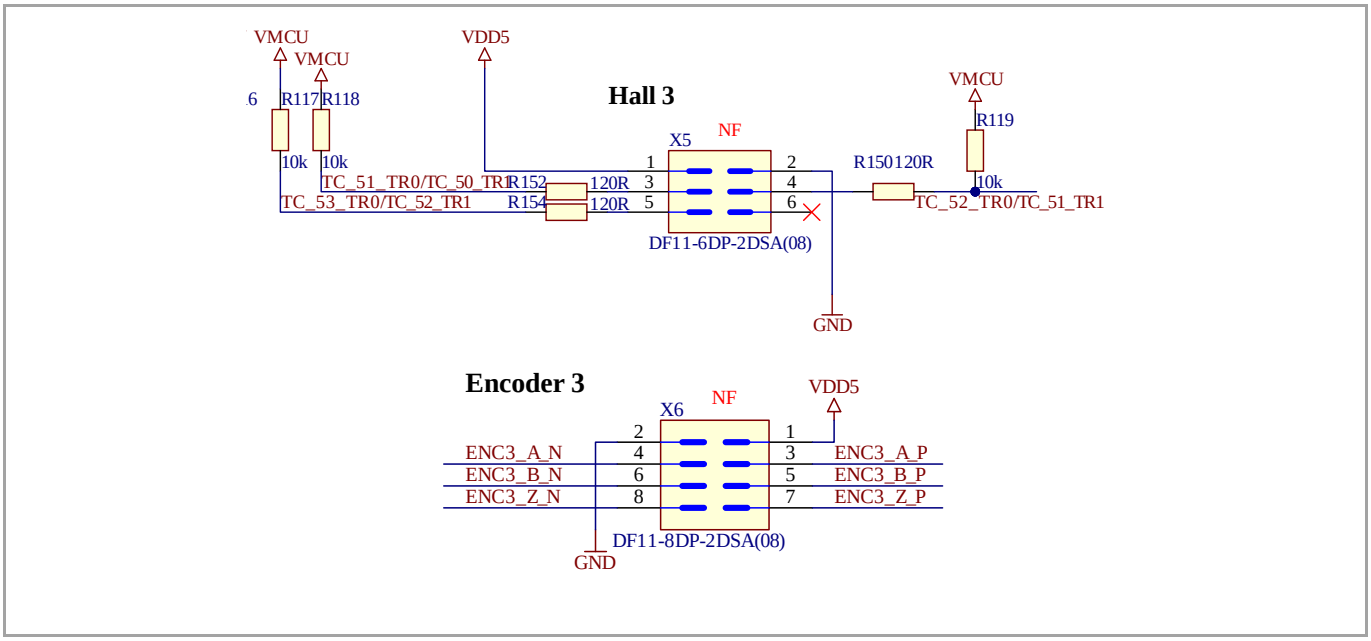


Figure 40 N.C. hall and encoder headers

4.4 Bill of materials

See the BOM file available on the KIT_XMC7200_DC_V1 kit webpage.

4.5 Kit component placement diagram

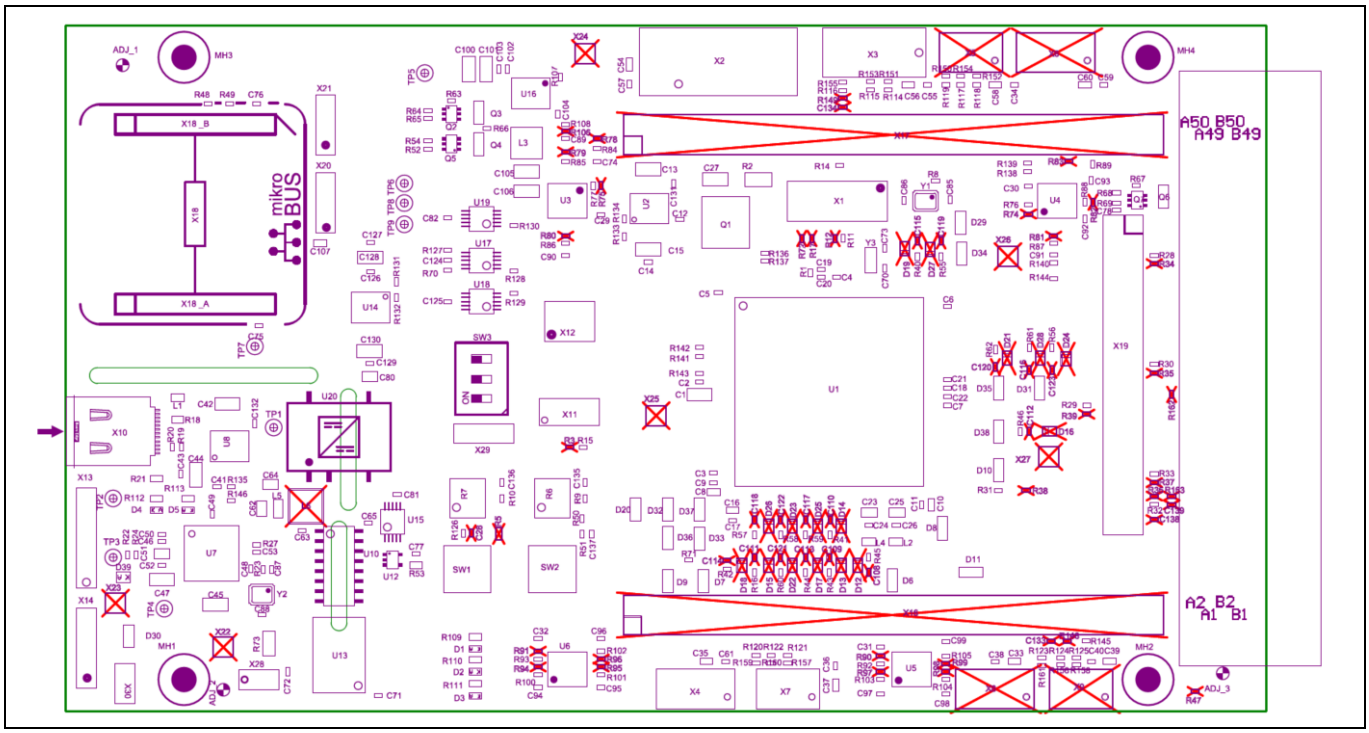


Figure 41 Component placement diagram

References

This user guide should be read in conjunction with the following documents:

[1] AN234334 - Getting started with XMC7000 MCU on ModusToolbox™ software

[2] 002-33522: XMC7200, XMC7000 microcontroller 32-bit Arm® Cortex®-M7 Datasheet

[3] 002-33896: XMC7100, XMC7000 microcontroller 32-bit Arm® Cortex®-M7 Datasheet

[4] 002-33812: XMC7200 MCU registers reference manual

Glossary

ADC
analog-to-digital converter

BOM
bill of materials

CAN
controller area network

CPU
Central Processing Unit

DC
direct current

ECO
external crystal oscillator

ESD
electrostatic discharge

ETM
Embedded Trace Macrocell

FPC
Flexible Printed Circuit

GPIO
general purpose input/output

IC
Integrated Circuit

IDE
integrated development environment

IoT
Internet of Things

Glossary

I2C
Inter-Integrated Circuit

I2S
inter-IC sound

JTAG
Joint Test Action Group

LED
light-emitting diode

LPO
low-power oscillator

MAC
medium access control

PC
personal computer

PDL
Peripheral Driver Library

POT
Potentiometer

QSPI
Quad Serial Peripheral Interface

RGMII
Reduced Gigabit Media Independent Interface

SDHC
Secure Digital Host Controller

SDIO
secure digital input output

SDK
software development kit

Glossary

SMIF
Serial Memory Interface

SPI
Serial Peripheral Interface

SRAM
static random-access memory

SWD
Serial Wire Debug

UART
Universal Asynchronous Receiver Transmitter

USB
Universal Serial Bus

WCO
watch crystal oscillator

Revision history

Document revision	Date	Description of changes
**	2024-07-24	Initial release.

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