IMXABHUG

i.MX Audio Board Hardware User Guide

Rev. 2 — 1 June 2023 **User guide**

Document Information

Information	Content
Keywords	i.MX 8M, i.MX 8M Plus, i.MX 8M Mini, i.MX 8M Nano, Audio, Audio Board, Audio Processor, Dolby, DTS
Abstract	This document provides an overview of the i.MX audio board system based on the NXP i.MX 8M series application processors.

1 Introduction

This document provides an overview of the i.MX Audio Board system based on the NXP i.MX 8M series application processors.

NXP Semiconductors fully supports the i.MX Audio Board system.

Additionally, this document provides detail on board features, assembly, and settings plus system setup, configurations, and steps to update the required software.

1.1 Board overview

The i.MX audio board system demonstrates the commonly used audio features of the i.MX 8M series applications processors. The i.MX audio board system helps developers become familiar with the audio features and processor before investing resources in custom designs.

Table 1 lists the features of the i.MX audio board system.

Table 1. Board features

Processor	NXP Applications Processor	i.MX 8M Series SOM (required but not included)
DAC	3×8-CHDAC Line Out using I^2S, MSB justified, LSB justified, DSD, or TDM. Supports sample rates up to 768 kHz and bit depth up to 32 bits.	
ADC	1×2-CH ADC Line In using I^2S, MSB justified, DSD or, TDM.Supports sample rates up to 768 kHz and bit depth up to 32 bits.	
S/PDIF I/O	S/PDIF I/O with RCA and TOSLINK connectors. TOSLINK support for sample rates up to 192 kHz.	
Ethernet	Up to 1000 Mbps with RJ45 connector.	
Trigger	DC 12.0 V 100 mA output.	
MIPI-DSI	DSI interface with mini-SAS connector.	
USB	Type-C connector for USB 3.0 or USB2.0 based on the SOM type.	
Debug connector	Micro USB for UART debug.	
Micro-SD	Supports TF card slot with detect pin.	
FPGA/CPLD	LCMXO3LF-9400C-6BG484I, 484 balls with 383 I/O, 9400 LUTs, two PPLs. This CPLD is routes SAI signals to support multiple audio configurations.	
I^2C connector	8-pin dual-row Pin Header for I^2C expansion.	
Onboard buttons	ON/OFF, RESET buttons on the Audio Board.	
LED indicators	Power status, UART on the Audio Board.	
Interposer board	Support i.MX 8M Nano and i.MX 8M Mini SOM.	
HDMI card	The default card uses an Explore Microelectronics EP92A7E. It implements an HDMI 2.0 3-in 1-out repeater with audio I/O, eARC/ARC, and HDCP 1.4/2.3.	
Button board	It is a dedicated board for the front panel. It supports six user buttons, one ON/OFF button, and one status LED.	
8MIC-RPI-MX8 board	Eight digital microphones board (optional)	

1.2 Board contents

The i.MX audio board system contains the following:

- i.MX audio board with metal enclosure
- Interposer board
- EP HDMI card
- Button board
- 12 V, 5 A power brick
- SCREW-TY PE3 M3X5-5-S × 1
- BT/Wi-Fi antenna × 3
- Quick start guide

2 Boards

The i.MX audio board system is a highly configurable audio processing platform.

The i.MX audio board system consists of:

- **Audio board (or MCIMX8M-AUD)** — A base board used to carry the various sub-boards, audio devices, and other integrated circuit devices. For more information, see Section 2.1.
- **Interposer board** — An adapter for connecting the i.MX 8M series SOM and the audio board. For more information, see Section 2.2.
- **EP HDMI card** — An HDMI signal switch to distribute HDMI audio and video signal from 3-RX port to 1-TX port. For more information, see Section 2.3.
- **Button board** — Integrates six push buttons for customized use and one red LED for status indicator. For more information, see Section 2.4.
  For more information on the system, see Figure 1.

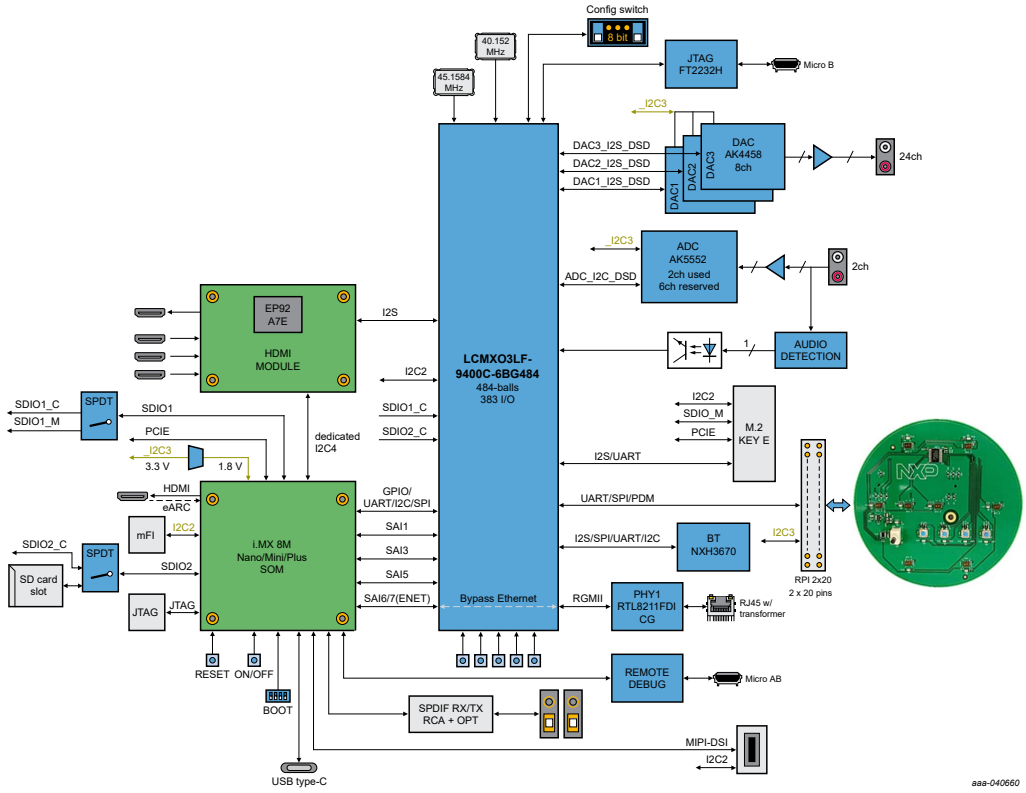

Figure 1. System block diagram

2.1 Audio board

Audio board is a mixed signal base board with rich onboard functions and extensive interfaces. To build different scenarios, you can freely configure the DAC and ADC channels through application software. Subboards HDMI card, digital microphone board, and M.2 card can be plugged in or out from the audio board base on the hardware resource allocation.

Note: *There is an M.2 KEY-E connector on the audio board that supports PCIe bus when using i.MX 8M Mini SOM. The connector supports PCIe and SDIO bus when using i.MX 8M Plus. However, the connector is not suitable for i.MX 8M Nano SOM. NXP has only verified the Wi-Fi/Bluetooth module with PCIe or SDIO bus supporting this connector.*

There are three DACs on the audio board. Each DAC has eight channels line out, the whole system has 24 channels line out with RCA connectors. Immersive decoders, such as Dolby ATMOS, DTS:X, and MPEG-H, support channel configurations from 2-CH to 24-CH including 9.1.6, 7.1.4, 5.1.2. The onboard DAC chips support digital audio data protocols including I^2S, MSB justified, LSB justified, DSD, and TDM. Its maximum sample up to 768 kHz, The maximum bit depth up to 32 bits. User can distribute the line-out signals freely base on the real application.

There is an ADC which supports two channels line in with RCA connectors. The ADC is a Δ-Σ A/D converter, it supports I^2S, MSB justified, DSD, and TDM digital audio data protocols, the maximum sample rate up to 768 kHz and the maximum bit depth up to 32 bits.

An audio detection circuit is constructed by separating components for ADC input. If a valid audio signal which greater than -41.5 dBV appears on the red RCA connector, the detection circuit responds to it. The analog audio signal is amplified and transmitted to the controller via optocoupler. Optocoupler outputs low logic when a valid audio signal appears. If this signal is not used, system can ignore it directly.

Except for DAC and ADC codecs, this system also supports S/PDIF I/O, HDMI audio extraction, and ARC/eARC, eight DMICs, and other audio related things. S/PDIF I/O with RCA connectors for coaxial communication and TOSLINK connectors for optical communication. HDMI with type A connectors can realize audio extraction and ARC/eARC. DMIC with general 40 pins connector for voice cases.

For more information on audio board, see Section 2. For more information on the real board, see Section 2.1.

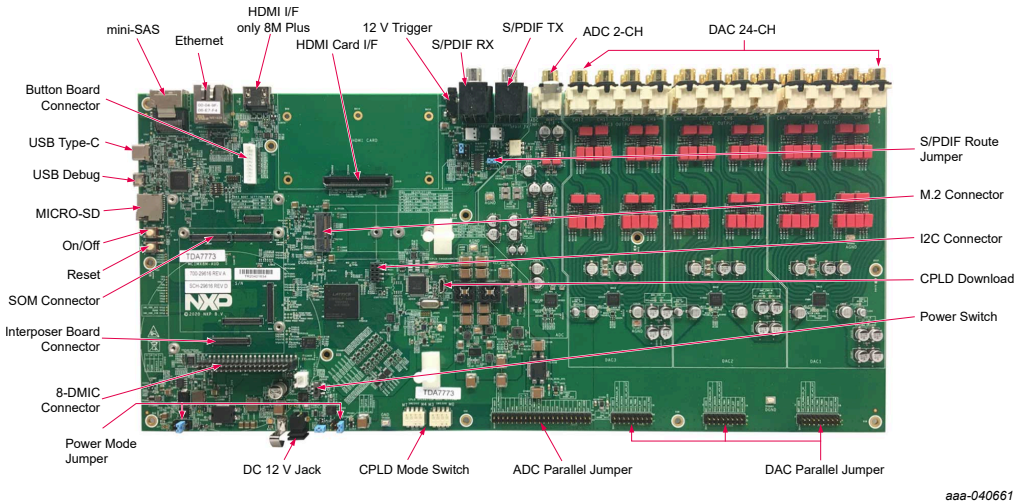

Figure 2. Audio board

2.2 Interposer board

Interposer board is an adapter for connecting i.MX 8M SOM and audio board. This board perfectly connects i.MX 8M Nano or i.MX 8M Mini SOM and audio board. The Interposer board makes audio board extensible and compatible. For more information on the principle block diagram and the real board, see Figure 3. The i.MX 8M Nano does not contain purple signals, such as MIPI-DSI, PCIe, USB2, and SAI1. For i.MX 8M Plus, SOM is plugged on the audio board directly and does not need an interposer board.

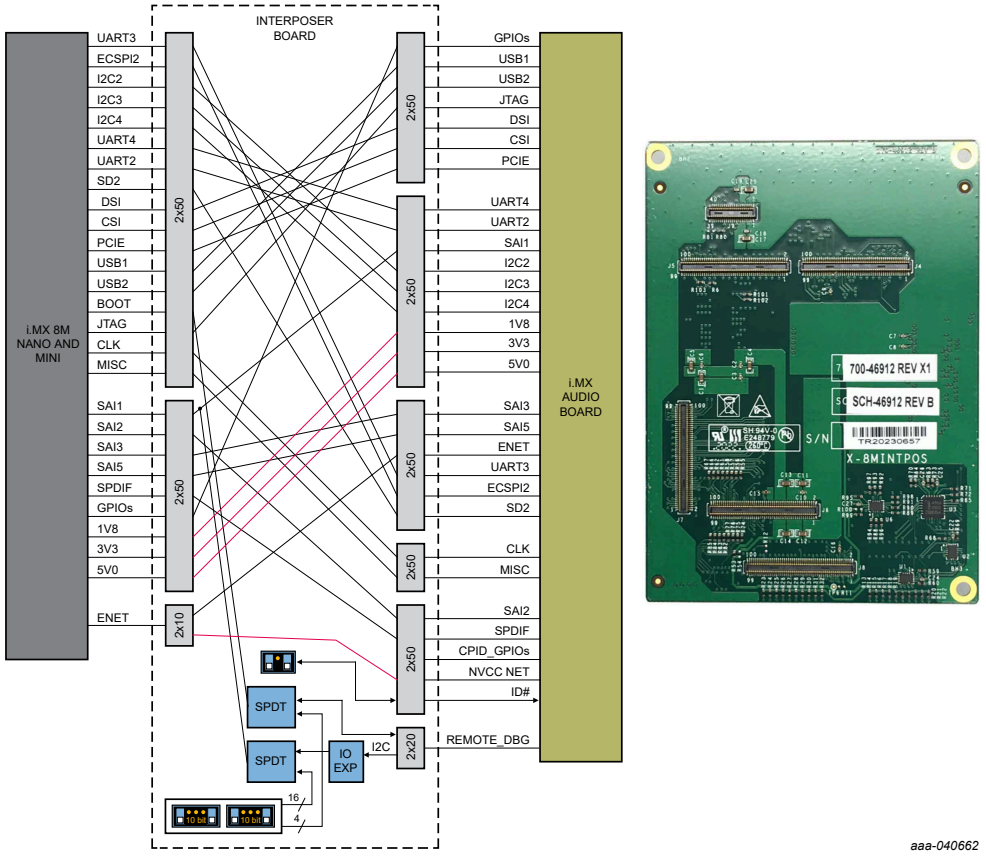

Figure 3. Interposer board block diagram and real board

2.3 HDMI card

HDMI board is an ecological design. Any company or individual can join this ecosystem and design an HDMI card based on the NXP standard documentation. The HDMI card provided by NXP has 3-CH receivers and 1-CH transmitter. The card supports HDMI input and HDMI ARC/eARC. This HDMI card supports SAI, SPDIF, and other misc signals. These signals are connected to CPLD except I2C. CPLD distributes these signals to the i.MX 8M MPU base on different CPLD mode setting.

For more information on the principle block diagram and the real board, see Figure 4.

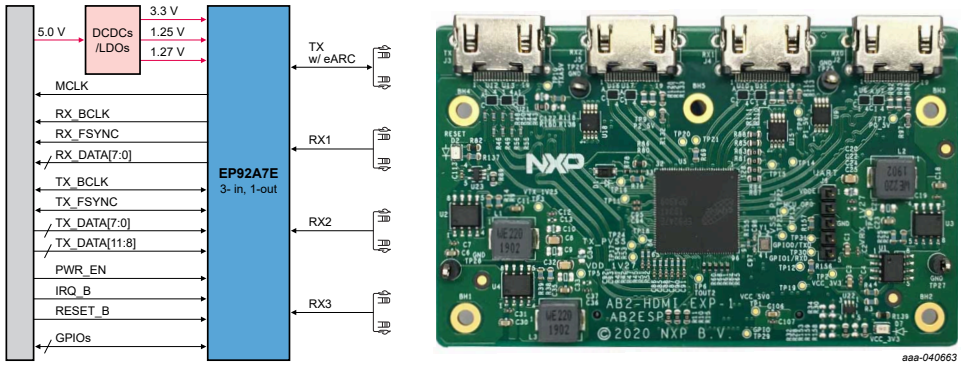

Figure 4. HDMI card block diagram and real board

2.4 Button board

The Button board is assembled on the front panel of the metal enclosure. It has six push buttons. The functions of the five buttons can be customized freely. NXP does not strictly define the functions of these five buttons. One button is for the ON/OFF function. The function is fixed and cannot change because it comes from the ON/OFF pin of the chip. All button signals are active low. A 10-pin cable creates the connection between the button board and the audio board. The button board is shown in Figure 5.

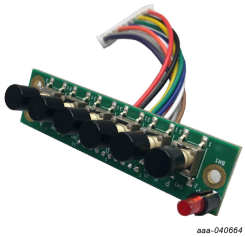

Figure 5. Button board

2.5 8MIC-RPI-MX8 board (Not included in the AB2 kit)

8MIC-RPI-MX8 is a digital mic phone board. There are eight microphones on the board. This module can be used for voice development, and so on, like Amazon Alexa Voice AI.The 8MIC-RPI-MX8 board is not available in the Audio Board system kit by default. However, you can purchase the product from the NXP website 8MIC-RPI-MX8 and plug directly into the 40-pin expansion connector J1003 on the audio board.

For a reference picture of the 8MIC-RPI-MX8 board, see Figure 6.

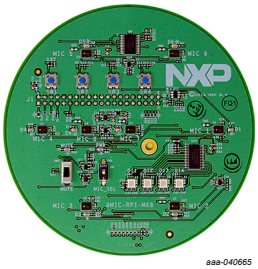

Figure 6. 8MIC-RPI-MX8 board

2.6 IMX-MIPI-HDMI board (Not included in the AB2 Kit)

IMX-MIPI-HDMI is a MIPI Display Serial Interface (MIPI-DSI) to the HDMI board. Use the IMX-MIPI-HDMI board for MIPI-DSI to HDMI transformation. It is possible to tie the HDMI monitor to this interface for video display or other HMI cases.

The Audio Board System Kit is not available in the Audio Board System kit by default. However, you can purchase the product from the NXP website IMX-MIPI-HDMI.

For a reference picture of the IMX-MIPI-HDMI board, see Figure 7.

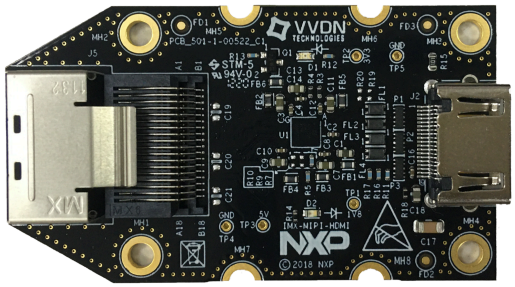

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Figure 7. IMX-MIPI_HDMI board

3 Assembly

The audio board system has a number of circuit boards and a metal enclosure. When developing and debugging, the assembly of circuit board and the enclosure should follow the correct sequence of steps.

CAUTION: *Failing to follow the sequence may result in irreversible damage the hardware.*

3.1 Enclosure assembly

The enclosure consists of three parts:

- L-shaped bottom shell
- U-shaped top shell
- I-shaped rear panel

The only need to tear down the top shell is for printed board assembly, electrical measurement, and testing during development stage. A cross screwdriver is required to remove the top shell. The upper casing is removed after removing 28 screws distributed on the top and both sides of the top shell.

3.2 Board assembly

Audio board is a base board for other assemblable subboards, such as, HDMI Card, SOM board, 8MIC-RPI-MX8 board, and so on. All installation and uninstallation should pay attention to electrical connectivity. Bad connectivity leads to poor signal quality, communication failure, and even system downtime. Do not install and uninstall these subboards frequently, because each connector has a limited plug-time.

3.2.1 Assembly of Interposer board

It is the difficult to install and uninstall Interposer board because there are three B2B connectors on the top of the board for connection between SOM and Interposer board. Additionally, there are six B2B connectors on the bottom of the board for connection between audio board and Interposer board.

The operation steps for the Interposer board are:

1. Check all connectors on audio board.
2. Install Interposer board into the base board.
3. Install the SOM board.Figure 8 shows the overview of steps for the board operation.

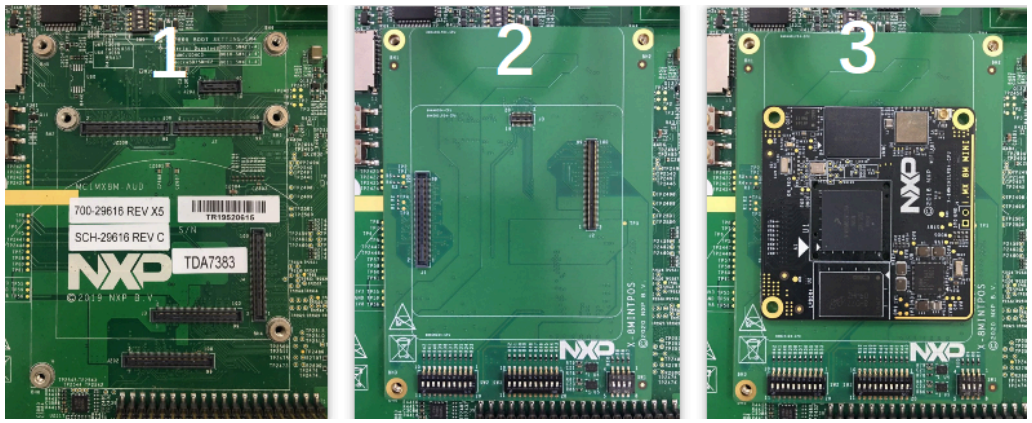

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Figure 8. Interposer board installation

There is also a wizard to uninstall the Interposer board. For uninstallation of the interposer board and SOM, use of elbow tweezers, as shown in Figure 9 is recommended to tear them down.

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Figure 9. Elbow tweezers

When using tweezers to pry the Interposer board or the SOM board, make sure to use protective objects to avoid any damage to traces and components on the audio board. Pay attention to the placement of the fulcrum and contact point of the tweezers. Ensure that even force is applied to remove the subboard smoothly. For details, see Figure 10.

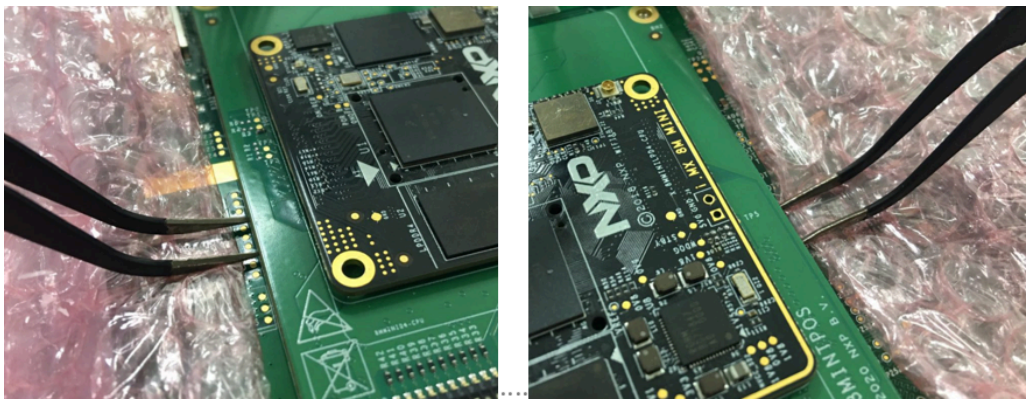

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Figure 10. Interposer board uninstallation

3.2.2 Assembly of 8MIC-RPI-MX8

A 40 pins expansion connecter with **riser** is for connection of 8MIC-RPI-MX8. If a heat sink is used, the riser increases the distance and avoids interference with SOM board. Bracket and screws are provided for mechanical stability. There are no holes on the top shell of enclosure for mic phones and no sound insulation rubber ring. Therefore, when enabling this function, it is recommended to remove the top shell.

4 Board setting

One of the features of the audio board system is its flexible configuration for different applications.

4.1 Power setting

Audio Board System supports four kinds of power settings. For details, see Table 2.

Table 2. Power settings

Mode	J2521[1]	J2522[1]	Description
GPIO mode	3-4	7-8	This mode can enable or disable power supplies dynamically through SOM GPIOs for better consumption control. This mode is supported in the software.
3V3 mode	5-6	3-4	The SOM board generates 3V3. The system can be supplied automatically after SOM boots. This is a hardware configuration.
Self-mode	1-2	1-2	Independent of the control when no SOM board is installed. The respective input power supply enables the system power.
CPLD mode	—	5-6	For downloading CPLD code when CPLD development

[1] Pin number-pin number, such as 3-4, it means short pin 3 and pin 4 with a jumper socket.

4.2 Board ID settings

The board ID is the SOM board I and distinguishes the SOM board. The Audio Board System supports i.MX 8M Nano, i.MX 8M Mini, and i.MX 8M Plus. Each SOM has different logic level. Therefore, the board ID must be set correctly. For example, the voltage level of SAI1 on i.MX 8M Nano and i.MX 8M Mini is 3.3 V. However, the voltage level of SAI1 on i.MX 8M Plus is 1.8 V.

CAUTION: *Incorrect settings may cause hardware damage.*

Table 3 shows an ID distribution table for ID setting. The IDs are changed through SW1 4-bit dual in-line package (DIP) switch on the Interposer board. The SW1 4-bit DIP switch reversed the logic. For example, ON is Low (0) logic and OFF is High (1) logic. In Table 3, **0** means that the DIP switch is ON.

Table 3. Board ID settings

SW1[4:1]	SOM	Description
0000[1]	Reserved	Reserved
0001	i.MX 8M Nano DDR4	Set on the Interposer board
0010	i.MX 8M Nano LPDDR4	Set on the interposer board
0011	i.MX 8M Mini DDR4	Set on the interposer board
0100	i.MX 8M Mini LPDDR4	Set on the interposer board

Table 3. Board ID settings...*continued*

SW1[4:1]	SOM	Description
…	Reserved	Reserved
1111	i.MX 8M Plus DDR4 and LPDDR4	The Interposer board is not required and is removed by default.

[1] 0 is ON, 1 is OFF, and x means no action.

4.3 Boot settings

SW2 and SW3 on the Interposer board determine the different boot settings for i.MX 8M Nano and i.MX 8M Mini. SW4 on the audio base board determines the different boot settings for i.MX 8M Plus.

The boot switches for i.MX 8M Nano are available on the Interposer board. However, only SW2[4:1] are active. Two DIP switches are equipped and are compatible with more SOMs. The detailed boot list is shown in Table 4.

Table 4. i.MX 8M Nano boot settings

SW2 [0, 9:1]	SW3 [0, 9:1]	Boot device
xxxxx_x0000[1]	xxxxx_xxxxx	Boot from internal fuses
xxxxx_x0001	xxxxx_xxxxx	USB serial download
xxxxx_x0010	xxxxx_xxxxx	USDHC3 (eMMC boot only, SD3 8-bit)
xxxxx_x0011	xxxxx_xxxxx	USDHC2 (SD boot only, SD2)
xxxxx_x0100	xxxxx_xxxxx	NAND 8-bit single device 256 page
xxxxx_x0101	xxxxx_xxxxx	NAND 8-bit single device 512 page
xxxxx_x0110	xxxxx_xxxxx	QSPI 3 B read
xxxxx_x0111	xxxxx_xxxxx	QSPI HyperFlash 3.3 V
xxxxx_x1000	xxxxx_xxxxx	ECSPI boot
xxxxx_x1001	xxxxx_xxxxx	Reserved
xxxxx_x1010	xxxxx_xxxxx	Reserved
xxxxx_x1011	xxxxx_xxxxx	Reserved
xxxxx_x1100	xxxxx_xxxxx	Reserved
xxxxx_x1101	xxxxx_xxxxx	Reserved
xxxxx_x1110	xxxxx_xxxxx	Infinite loop mode
xxxxx_x1111	xxxxx_xxxxx	Reserved

[1] 0 is ON, 1 is OFF, and x means no action.

Table 5 shows some boot examples of i.MX 8M Mini.

SW2 and SW3 set the i.MX 8M Mini boot. However, `SW2[3]` and `SW2[4]` are inactive for it. The 2 bits must be set to **SW2[4:3]=01**. For more information, see the *i.MX 8M Mini Reference Manual* (document IMX8MMRM) and the EVK schematics.

Table 5. i.MX 8M Mini boot settings

SW2 [0, 9:1]	SW3 [0, 9:1]	Boot device
xxxxx_x0100[1]	0xxxx_xxxxx	Boot from internal fuses
xxxxx_x0101	0xxxx_xxxxx	USB serial download

Table 5. i.MX 8M Mini boot settings*...continued*

SW2 [0, 9:1]	SW3 [0, 9:1]	Boot device
10001_10110	00101_01000	USDHC3 (eMMC boot only, SD3 8-bit)
01001_10110	00010_11000	USDHC2 (SD boot only, SD2)
00000_00110	00110_00001	NAND 8-bit single device 128 page
00000_00110	00111_10001	NAND 8-bit single device 256 page
00000_00110	01000_00000	QSPI 3 B read
00000_00110	01000_01100	QSPI HyperFlash 3.3 V
00000_00110	01100_00000	ECSPI boot
…	…	…

[1] 0 is ON, 1 is OFF, and x means no action.

The SOM board is installed to the base board directly. Therefore, the Interposer board is required for i.MX 8M Plus SOM. The SW4 on the audio board, sets the boot settings. For more information, see Table 6.

Table 6. i.MX 8M Plus boot settings

SW4 [4:1]	Boot device
0000[1]	Boot from internal fuses
0001	USB serial download
0010	USDHC3 (eMMC boot only, SD3 8-bit)
0011	USDHC2 (SD boot only, SD2)
0100	NAND 8-bit single device 256 page
0101	NAND 8-bit single device 512 page
0110	QSPI 3 B read
0111	QSPI HyperFlash 3.3 V
1000	ECSPI boot
1001	Reserved
1010	Reserved
1011	Reserved
1100	Reserved
1101	Reserved
1110	Reserved
1111	Reserved

[1] 0 is ON, 1 is OFF, and x means no action.

4.4 CPLD mode setting

Audio Board System is flexible because it has multiple interfaces and supports CPLD mode configuration. There is an onboard JTAG for CPLD development. It is possible for developers to code a mode base on a real application or use the NXP code snippets that cover most of the use cases. Dual 4-bit DIP switches, SW2300 and SW2302, set the use cases or CPLD modes on the audio board.

4.4.1 CPLD mode settings for i.MX 8M Nano

The board ID must be set before setting CPLD mode, see Section 4.2 for detailed board ID settings.

Regarding CPLD mode setting of i.MX 8M Nano, there are eight modes. Each mode has different output channels and communication format. It supports up to 16-CH line out. The modes are as shown in Table 7.

Table 7. CPLD mode settings for i.MX 8M Nano

SW2302[4:1]	SW2300[4:1]	Description	Diagram
0000[1]	0000	4-ch output, I^2S bus, serial configuration for DAC codecs	Figure 11
0000	0001	8-ch output, TDM4, serial configuration for DAC codecs	Figure 12
0000	0010	8-ch output, TDM8, serial configuration for DAC codecs	Figure 13
0000	0011	16-ch output, TDM8, serial configuration for DAC codecs	Figure 14
0000	0100	6-ch output, I^2S bus, serial configuration for DAC codecs	Figure 15
0000	0101	12-ch output, TDM4, serial configuration for DAC codecs	Figure 16
0000	0110	8-ch output, I^2S bus, serial configuration for DAC codecs	Figure 17
0000	0111	16-ch output, TDM4, serial configuration for DAC codecs	Figure 18

[1] 0 is ON, 1 is OFF, and x means no care.

See Figure 11 to Figure 18 for output connections. Unused signals from DAC are connected to GND by default according to DAC data sheet.

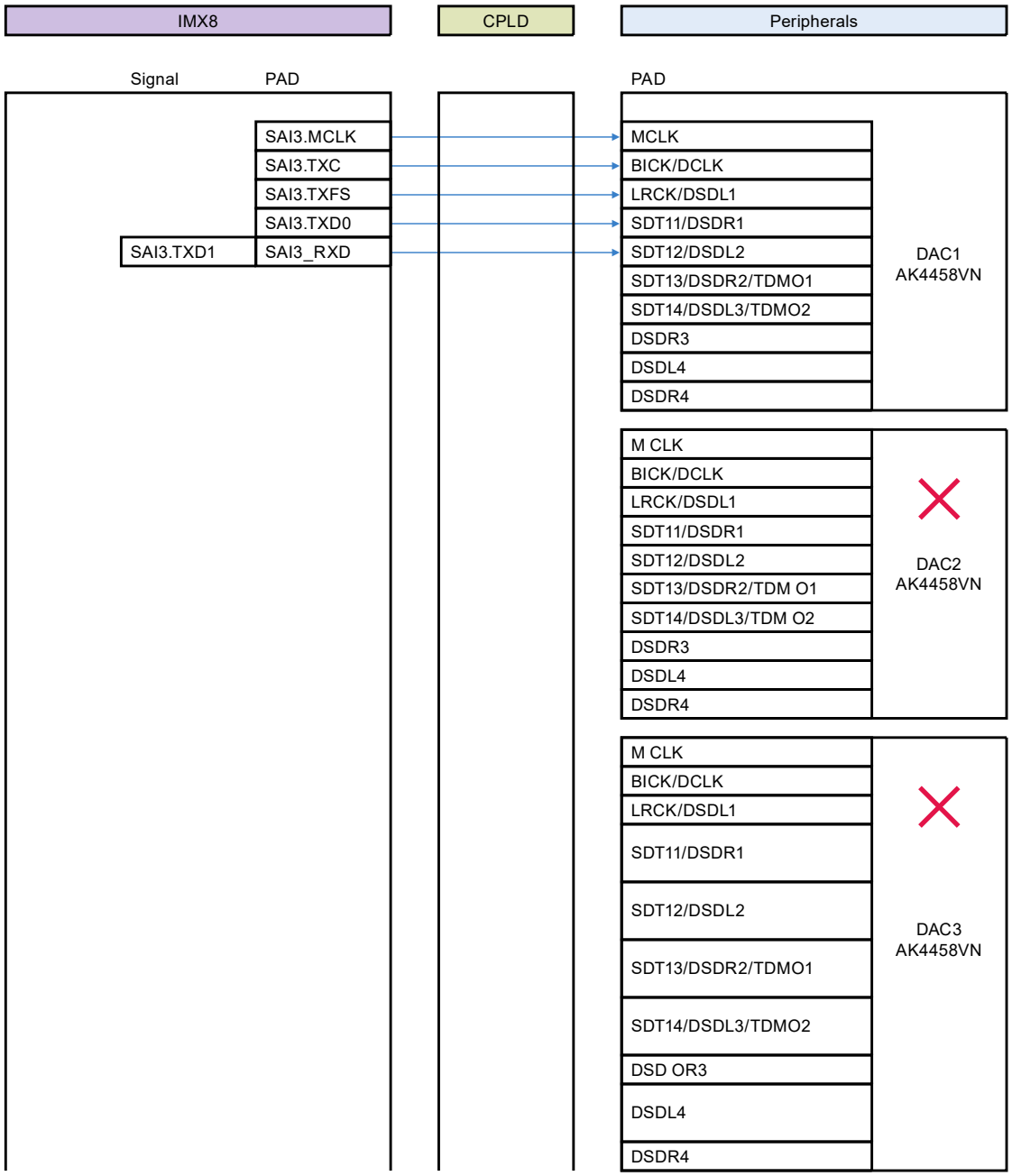


Figure 11. Mode 0 for i.MX 8M Nano

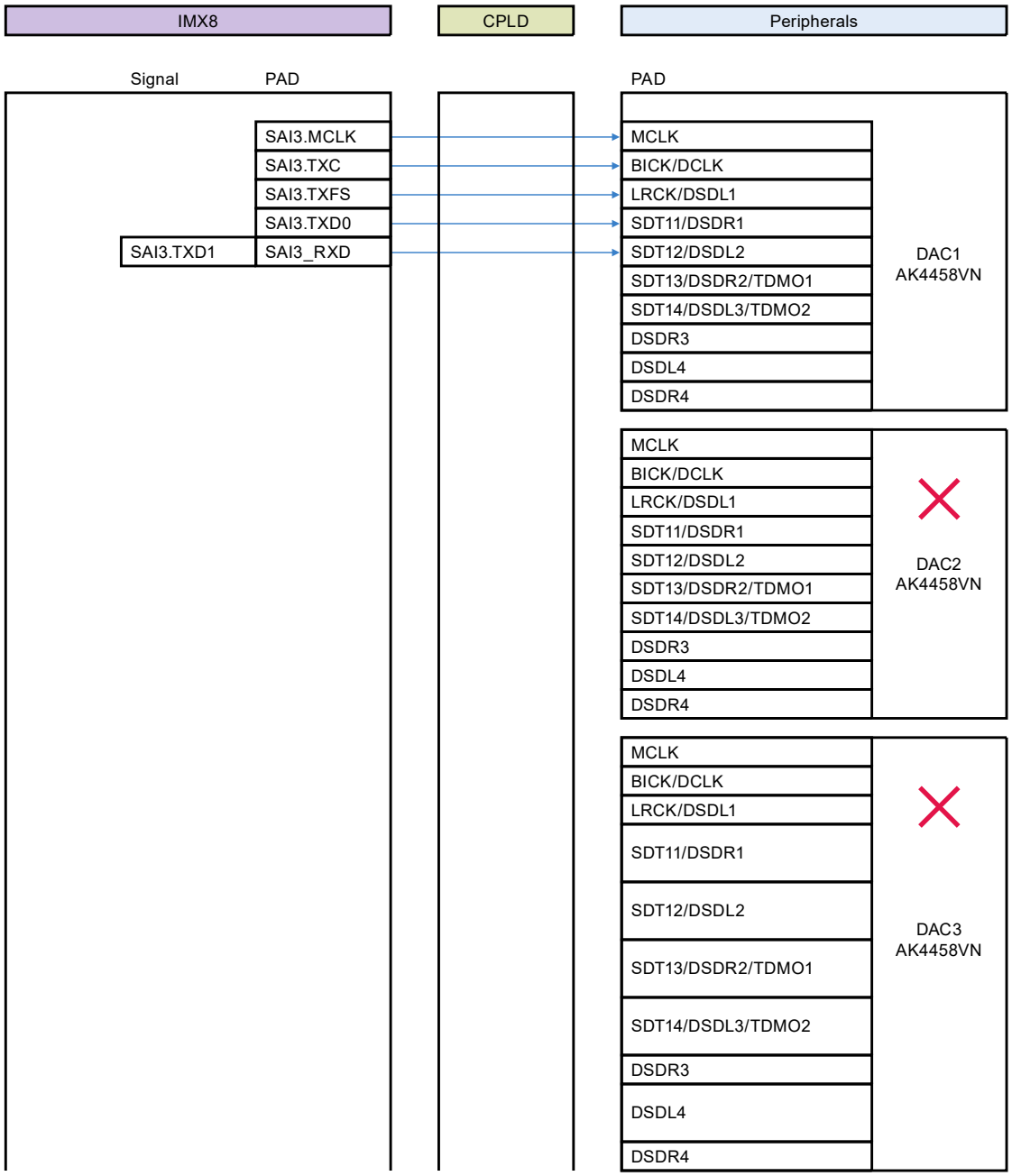


Figure 12. Mode 1 for i.MX 8M Nano

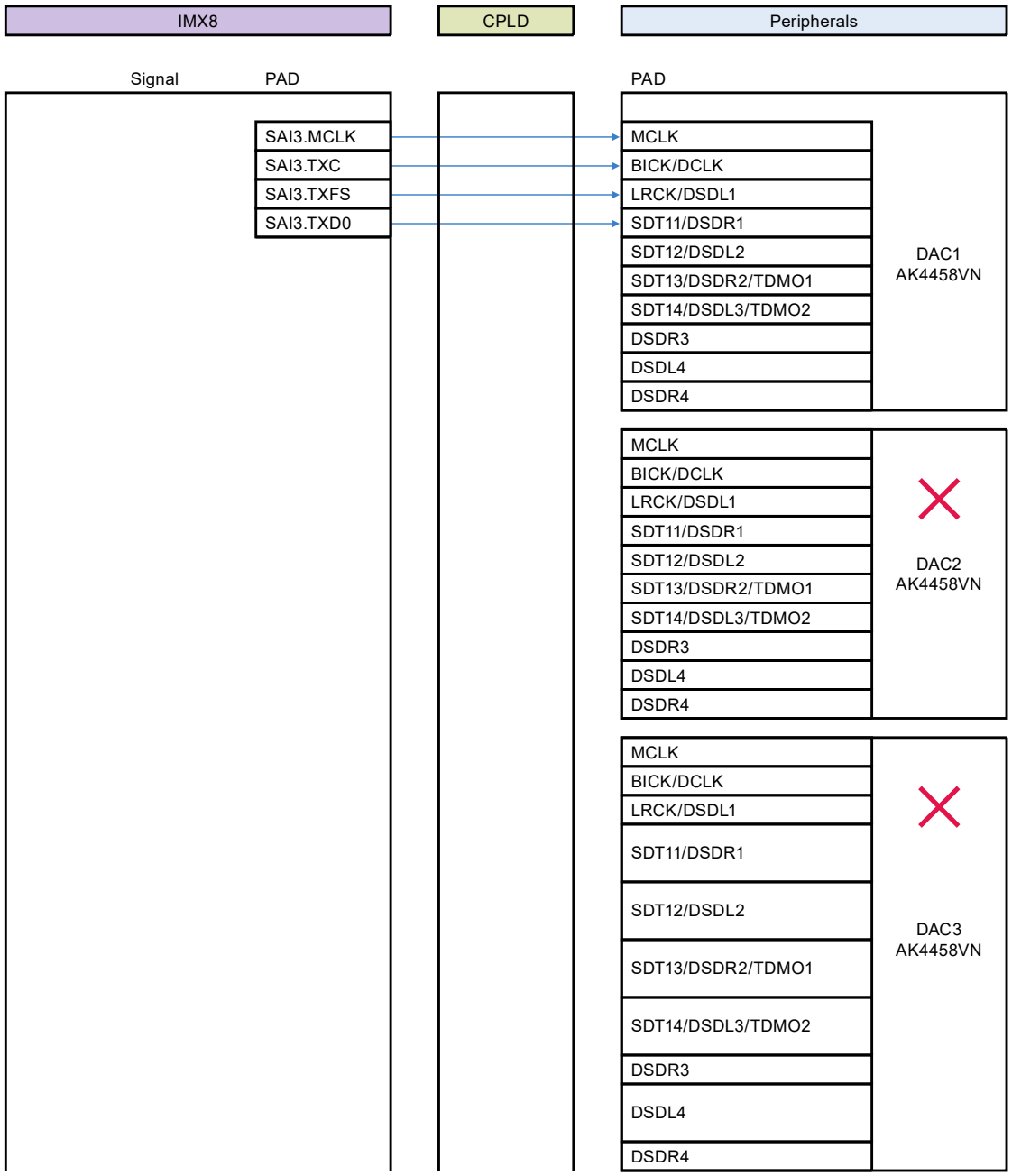


Figure 13. Mode 2 for i.MX 8M Nano

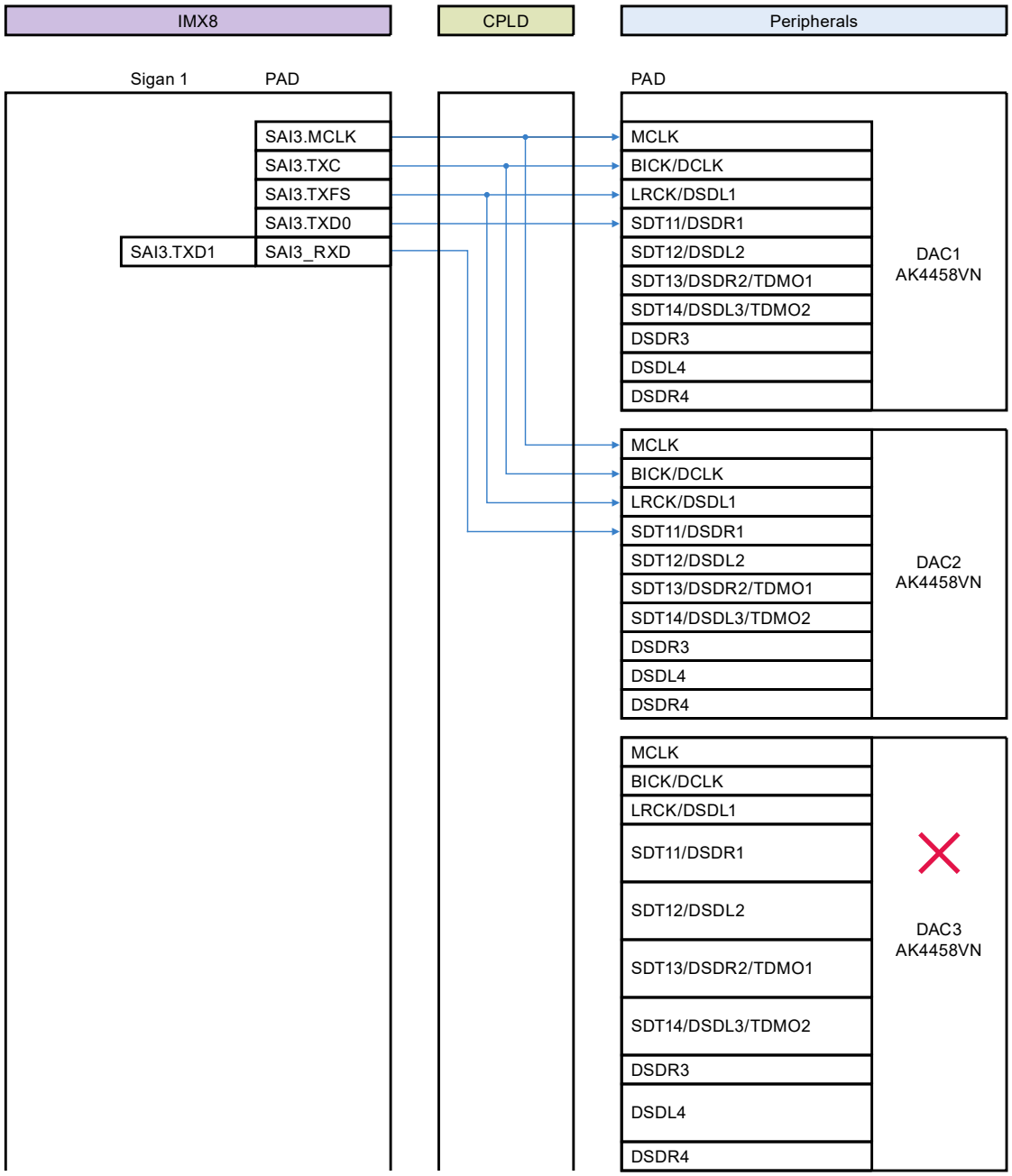


Figure 14. Mode 3 for i.MX 8M Nano

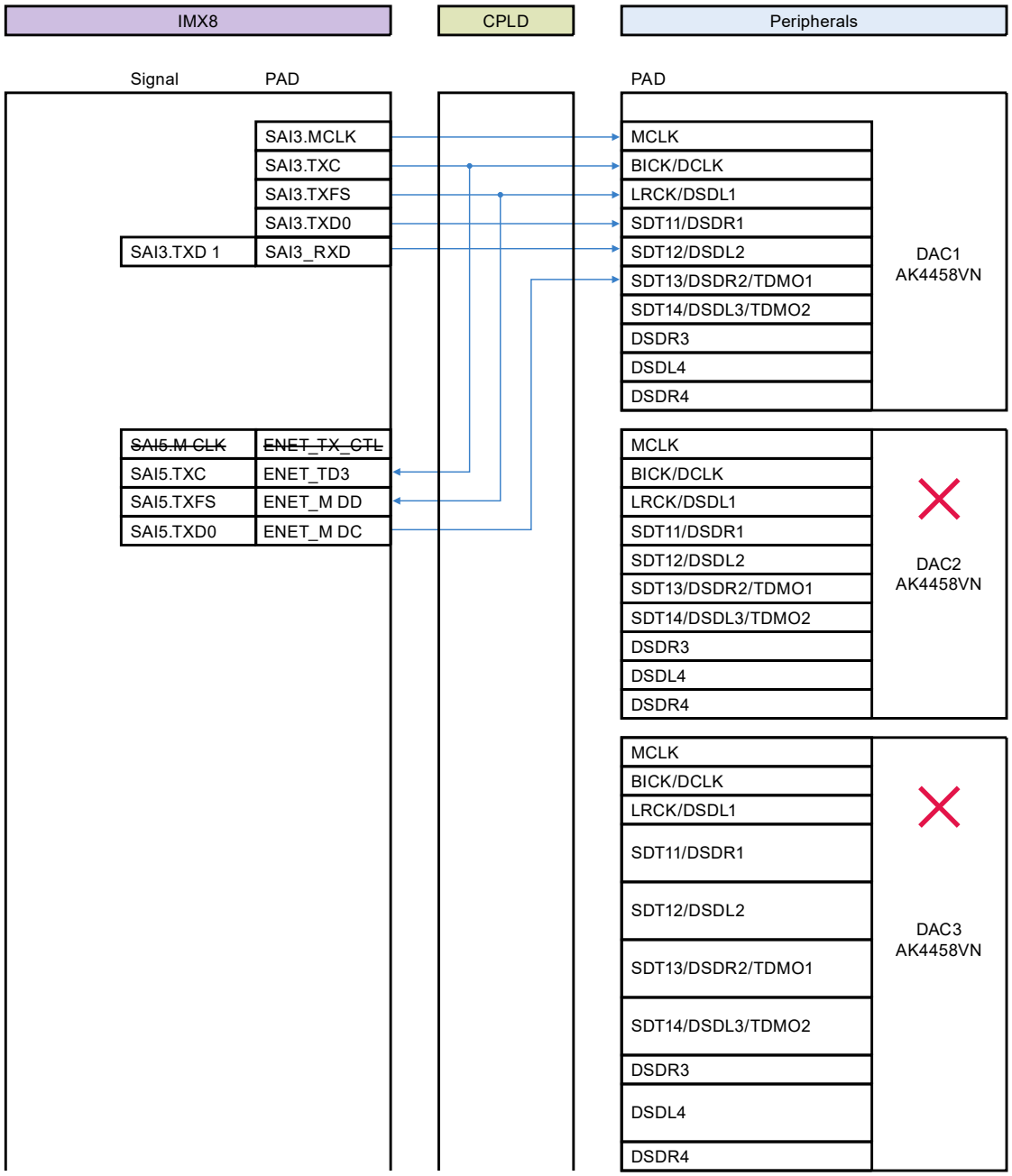


Figure 15. Mode 4 for i.MX 8M Nano

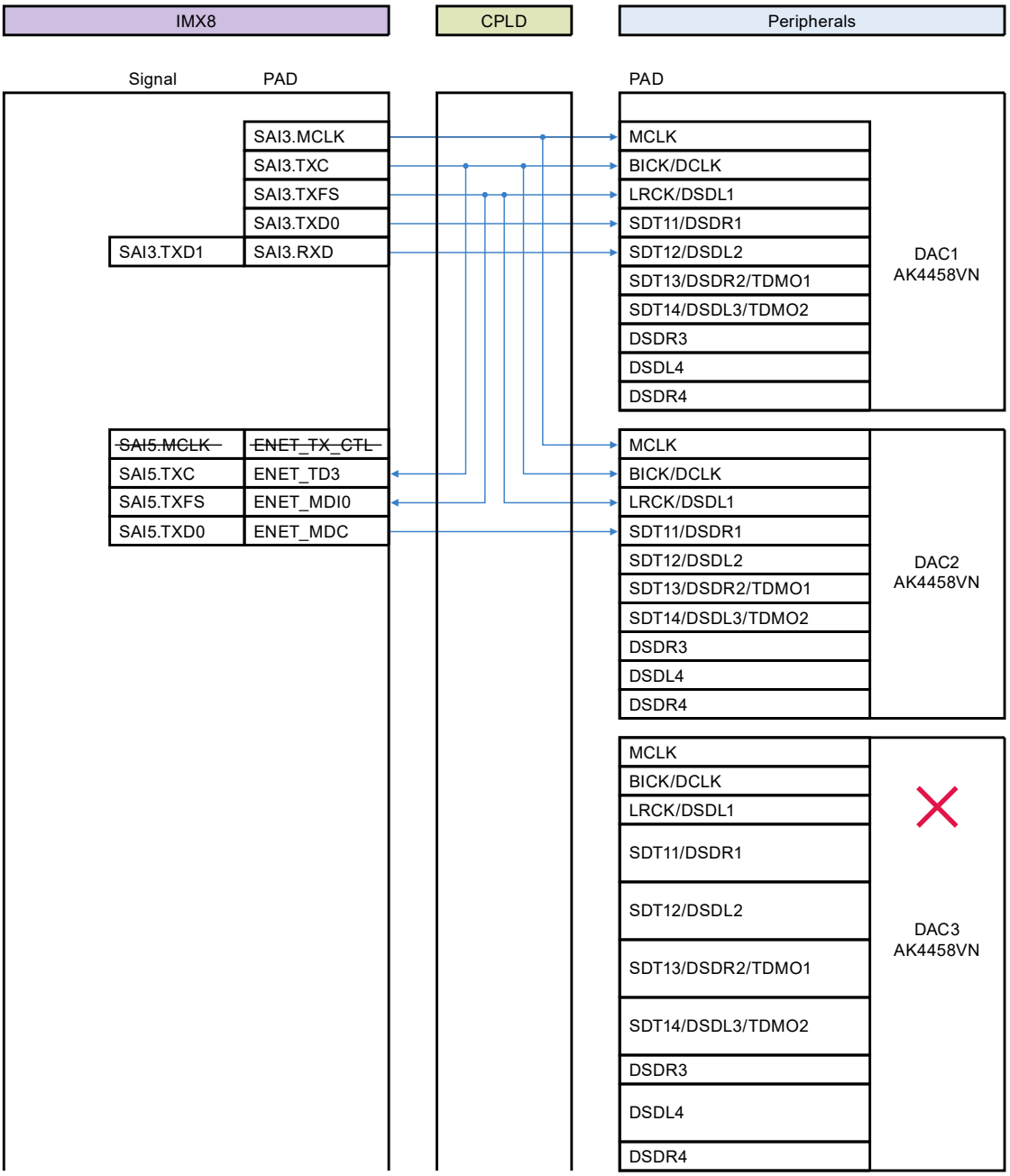


Figure 16. Mode 5 for i.MX 8M Nano

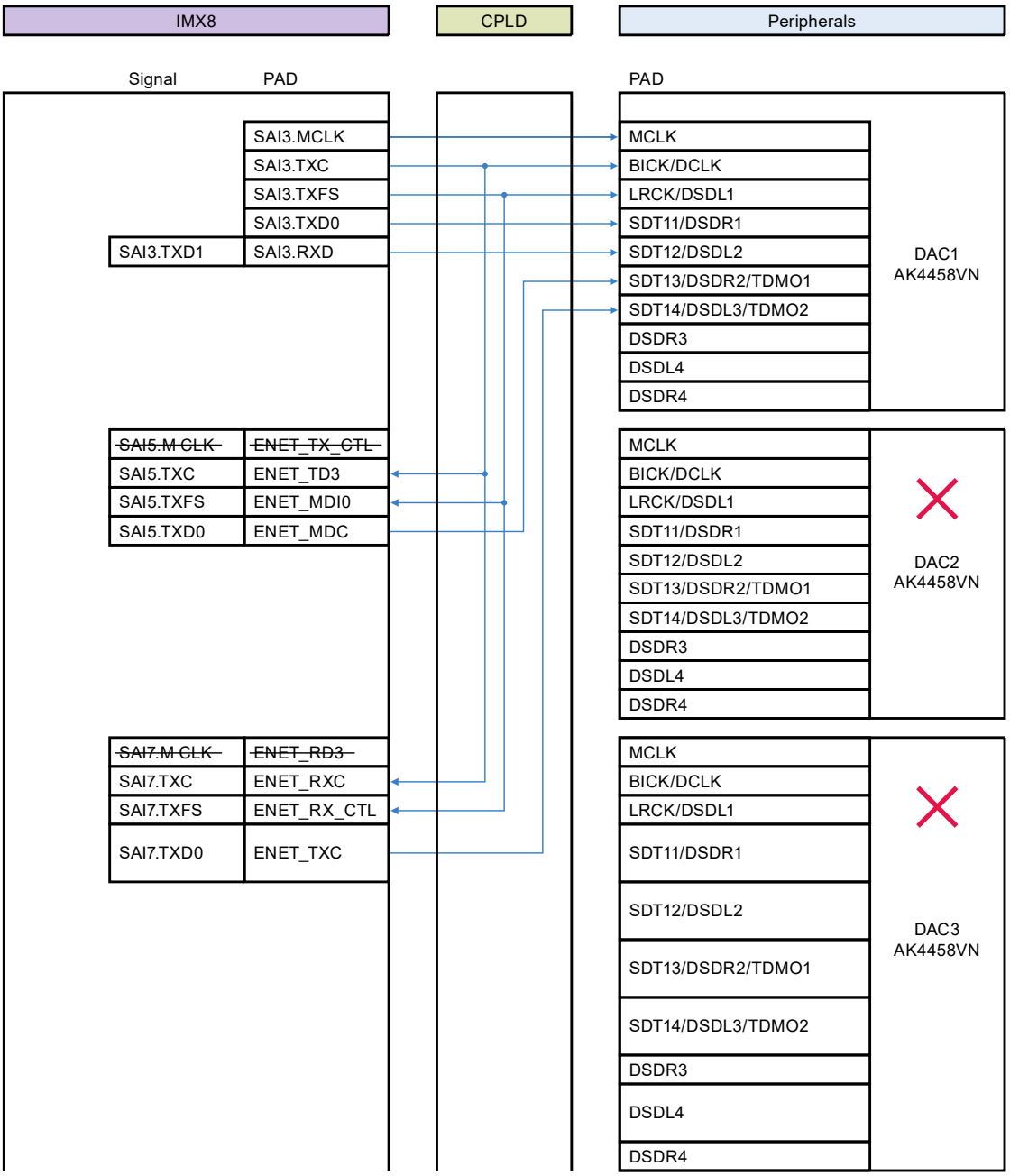


Figure 17. Mode 6 for i.MX 8M Nano

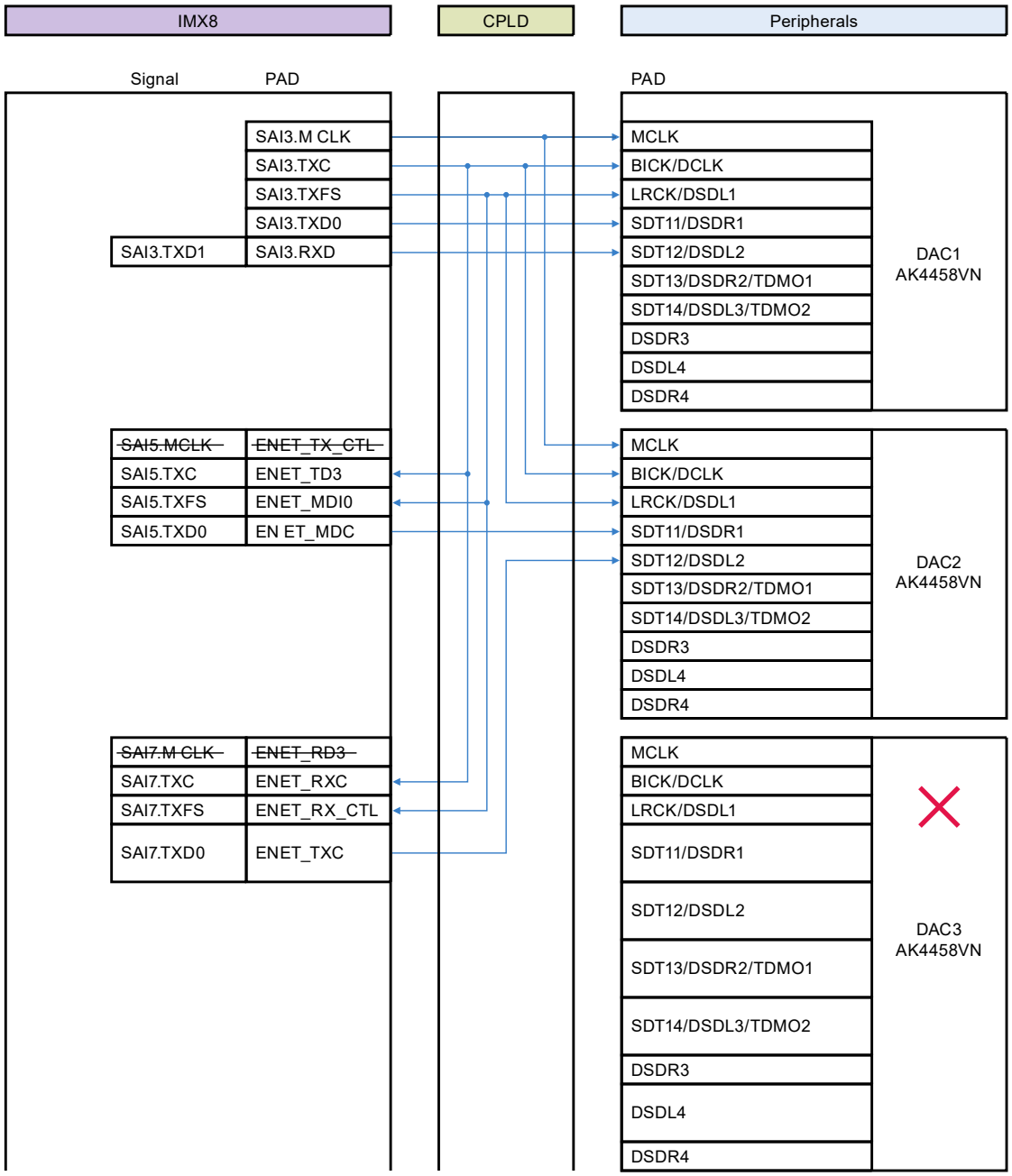


Figure 18. Mode 7 for i.MX 8M Nano

4.4.2 CPLD mode settings for i.MX 8M Mini

The board ID must be set before setting CPLD mode, see Section 4.2 for board ID setting. For CPLD mode setting, there are nine modes in i.MX 8M Mini application. Up to 24-CH line out is supported. See Table 8 for details.

Table 8. CPLD mode settings for i.MX 8M Mini

SW2302[4:1]	SW2300[4:1]	Description	Diagram
0000[1]	0000	16-ch output, I2S-bus, serial configuration for DAC codecs	Figure 19

Table 8. CPLD mode settings for i.MX 8M Mini*...continued*

SW2302[4:1]	SW2300[4:1]	Description	Diagram
0000	0001	16-ch output, I^2S HDMI_MCLK, serial configuration for DAC codecs	Figure 20
0000	0010	16-ch I^2S dual-zone mode, serial configuration for DAC codecs	Figure 21
0000	0011	16-ch I^2S three-zone mode, serial configuration for DAC codecs	Figure 22
0000	0100	24-ch output, TDM4, serial configuration for DAC codecs	Figure 23
0000	0101	16-ch output, TDM multi-zone, TDM4, serial configuration for DAC codecs	Figure 24
0000	0110	16-ch output, I2S-bus with 8 dmic, serial configuration for DAC codecs	Figure 25
0000	0111	1+PDM, serial configuration for DAC codecs	Figure 26
0001	0000	16-ch output, sync-sai, serial configuration for DAC codecs	Figure 27
0001	0001	Ext-MCLK, DSD, 3-DAC, serial configuration for DAC codecs	Figure 28
0001	0010	Ext-MCLK, DSD, 4-DAC, serial configuration for DAC codecs	Figure 29

[1] 0 is ON, 1 is OFF, and x means no care.

See Figure 19 to Figure 29 for output connections. Unused signals from DAC are connected to GND by default according to DAC data sheet.

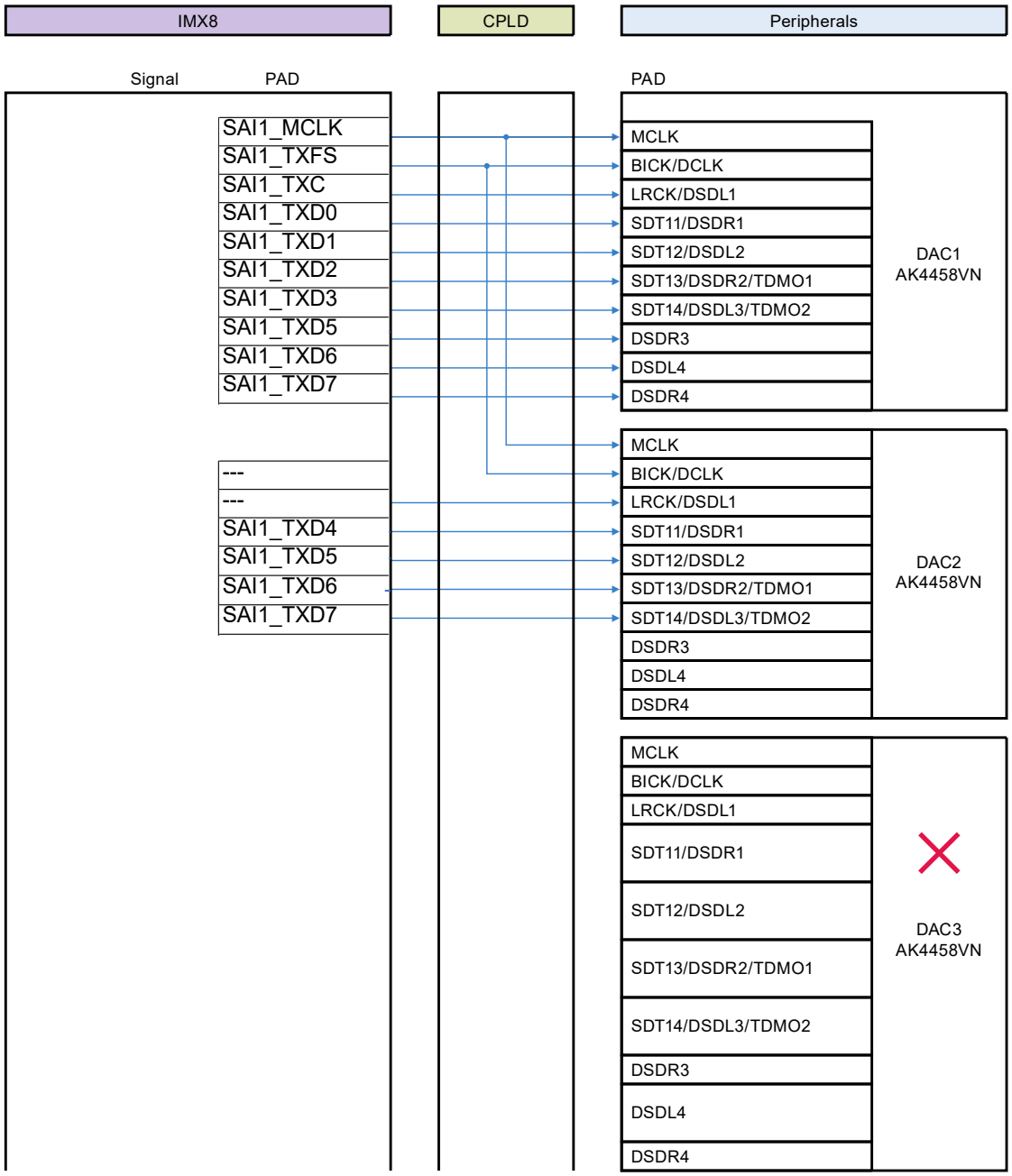


Figure 19. Mode 0 for i.MX 8M Mini

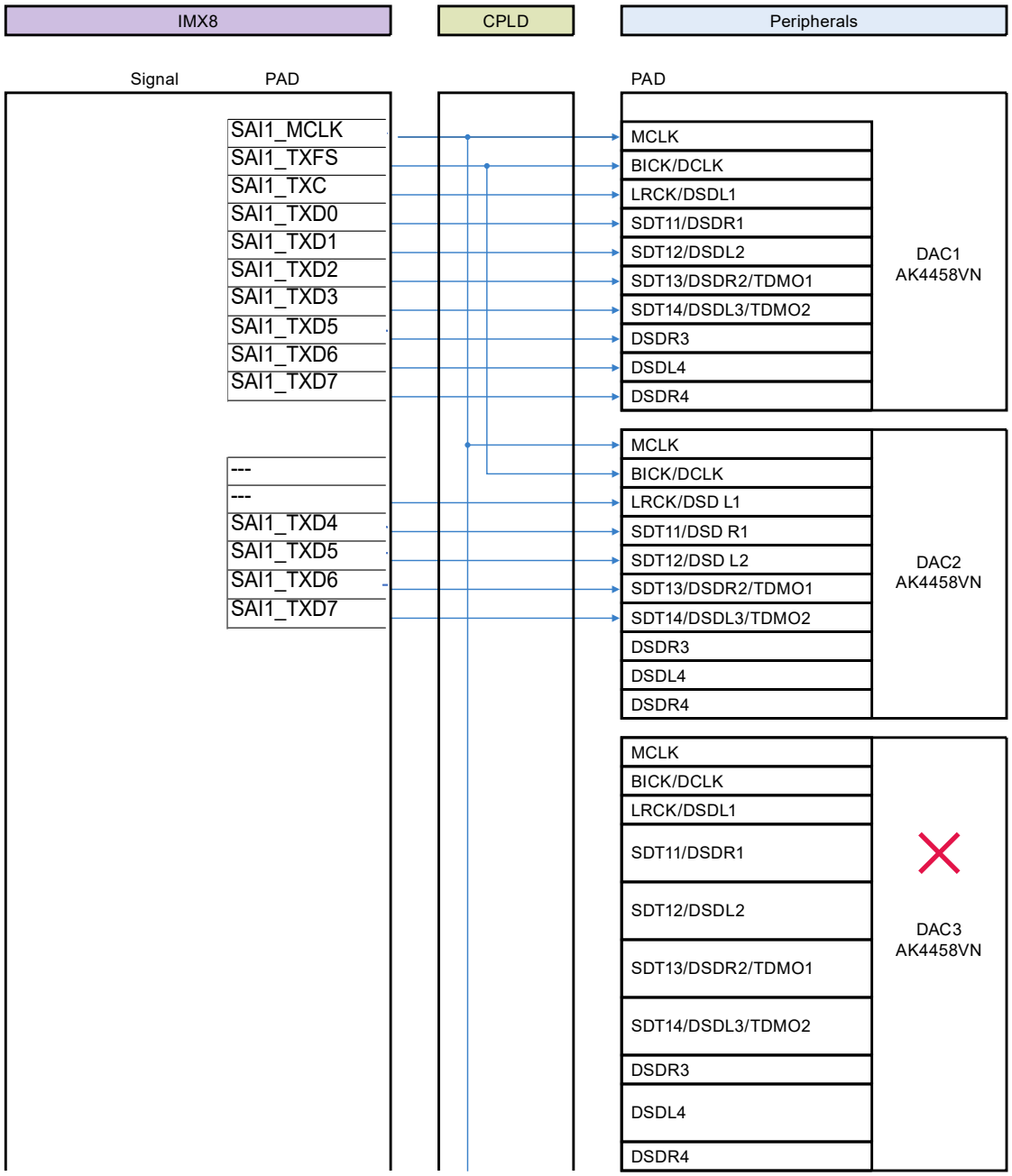


Figure 20. Mode 1 for i.MX 8M Mini

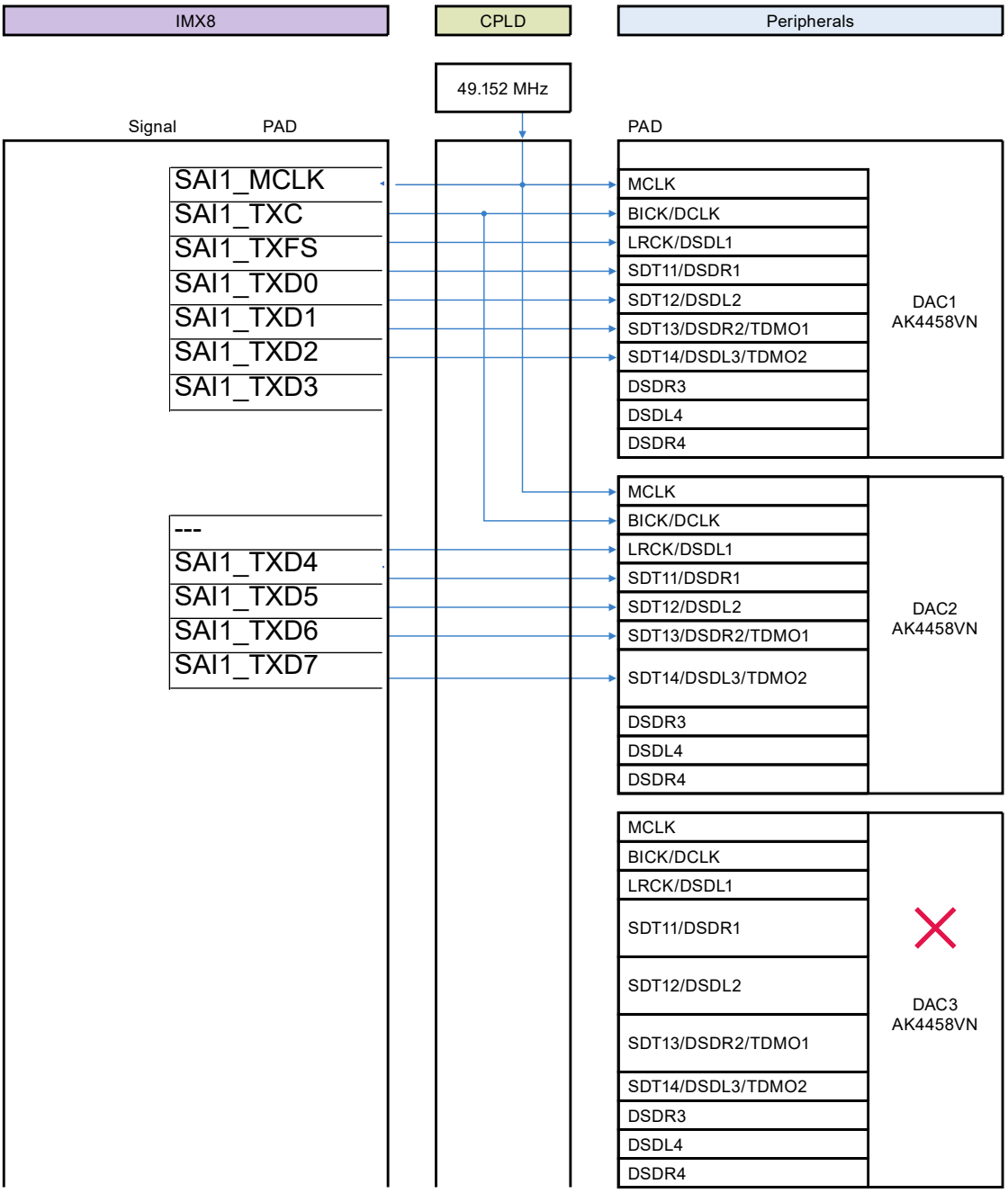


Figure 21. Mode 2 for i.MX 8M Mini

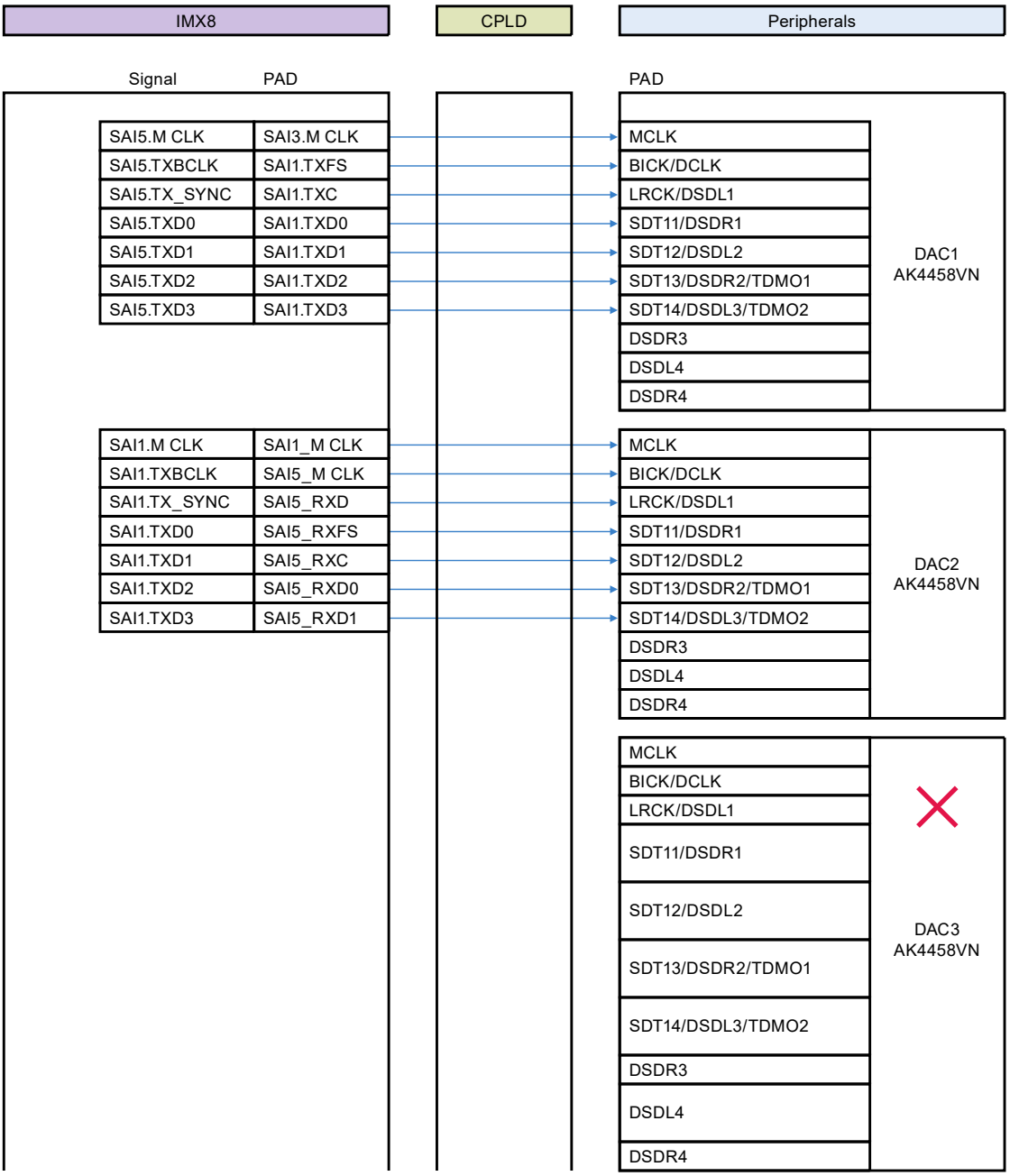


Figure 22. Mode 3 for i.MX 8M Mini

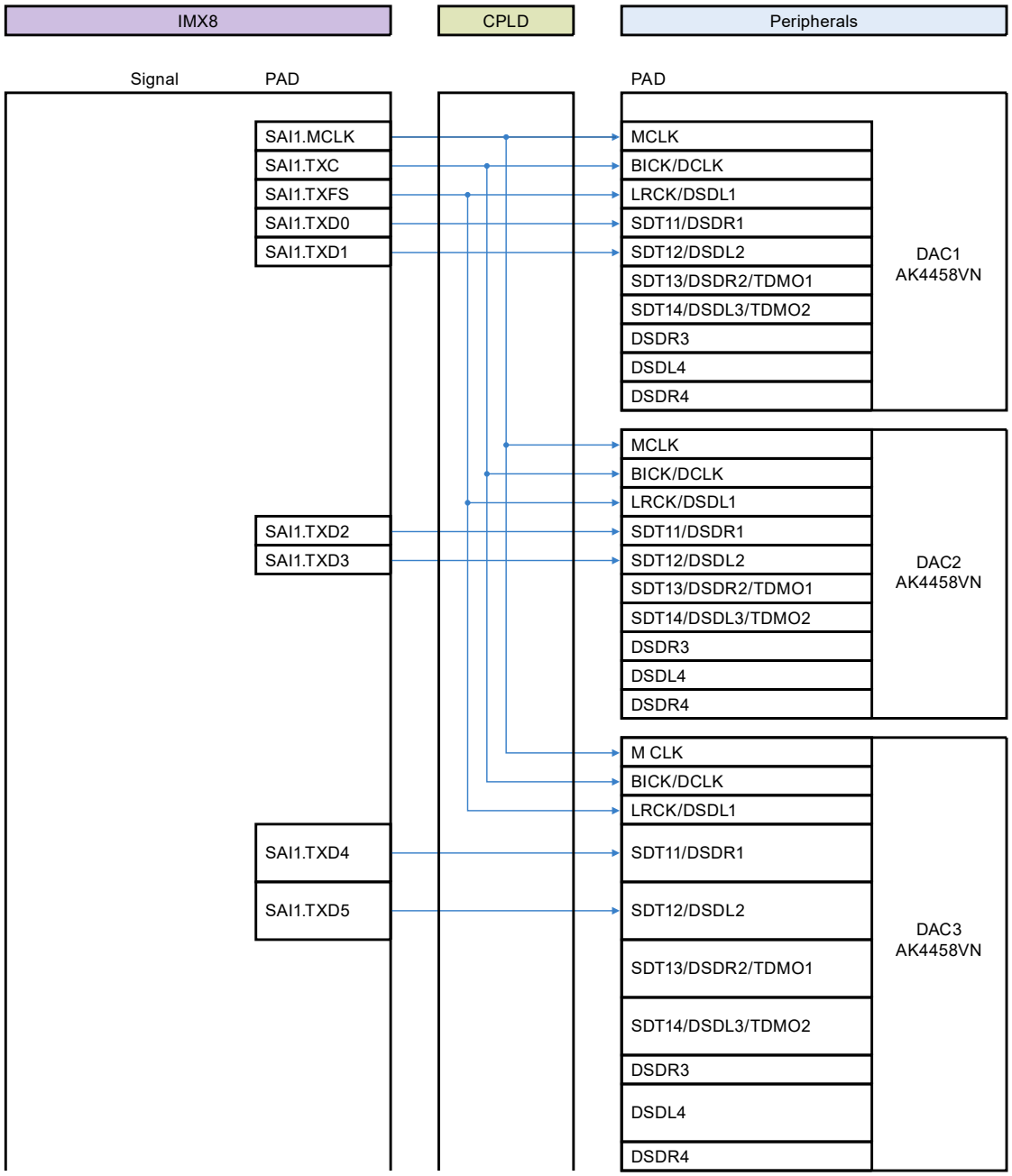


Figure 23. Mode 4 for i.MX 8M Mini

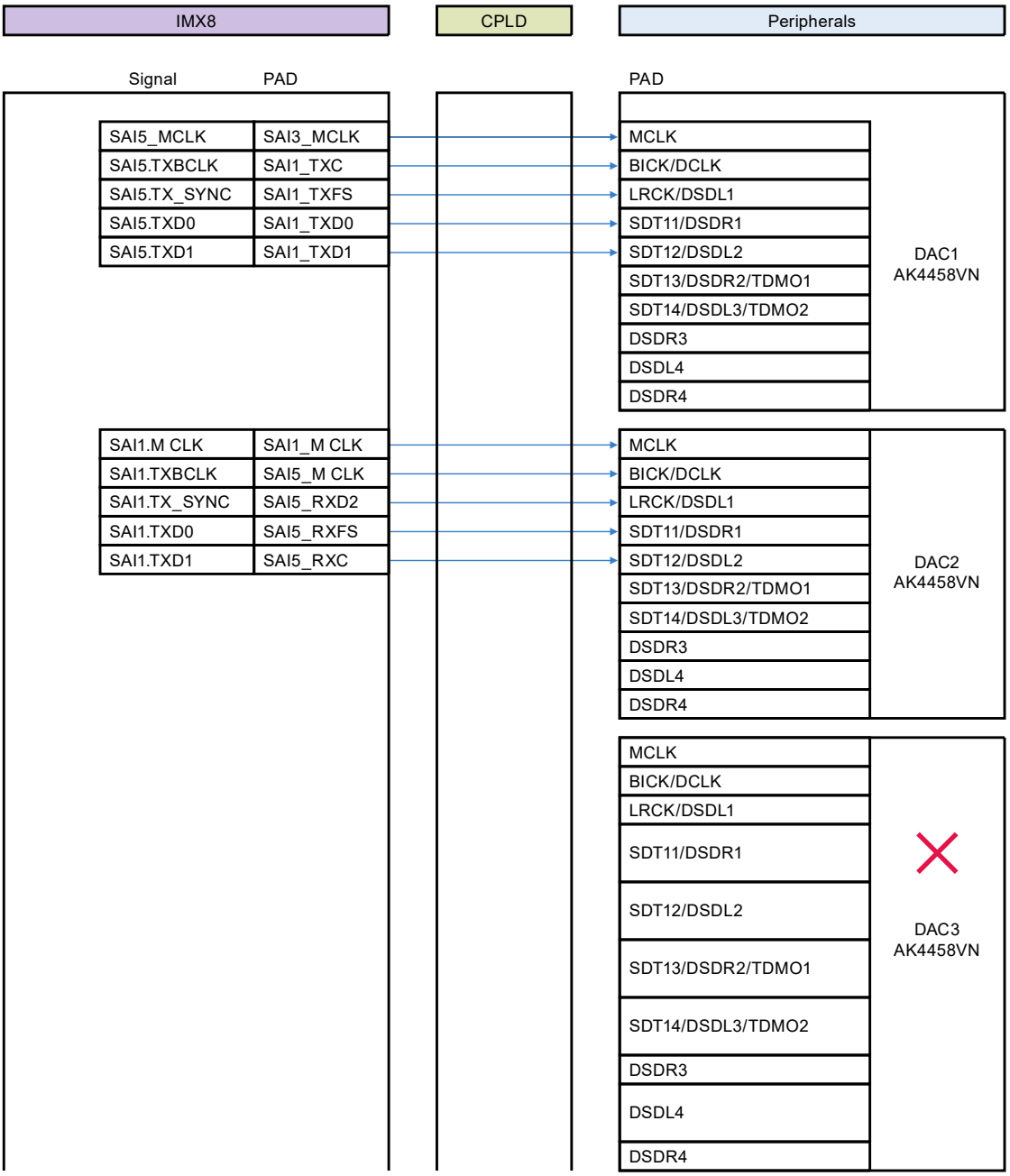


Figure 24. Mode 5 for i.MX 8M Mini

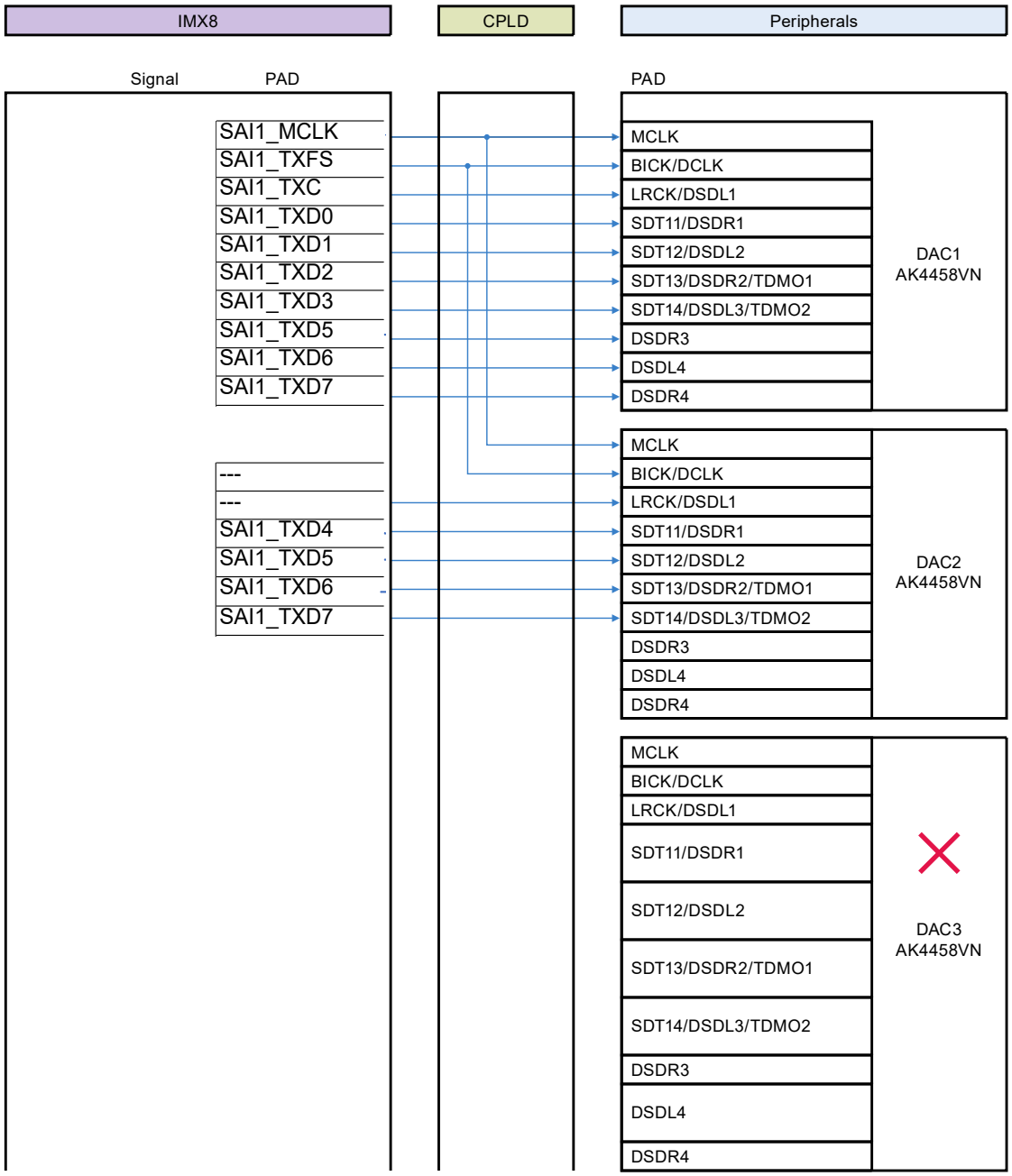


Figure 25. Mode 6 for i.MX 8M Mini

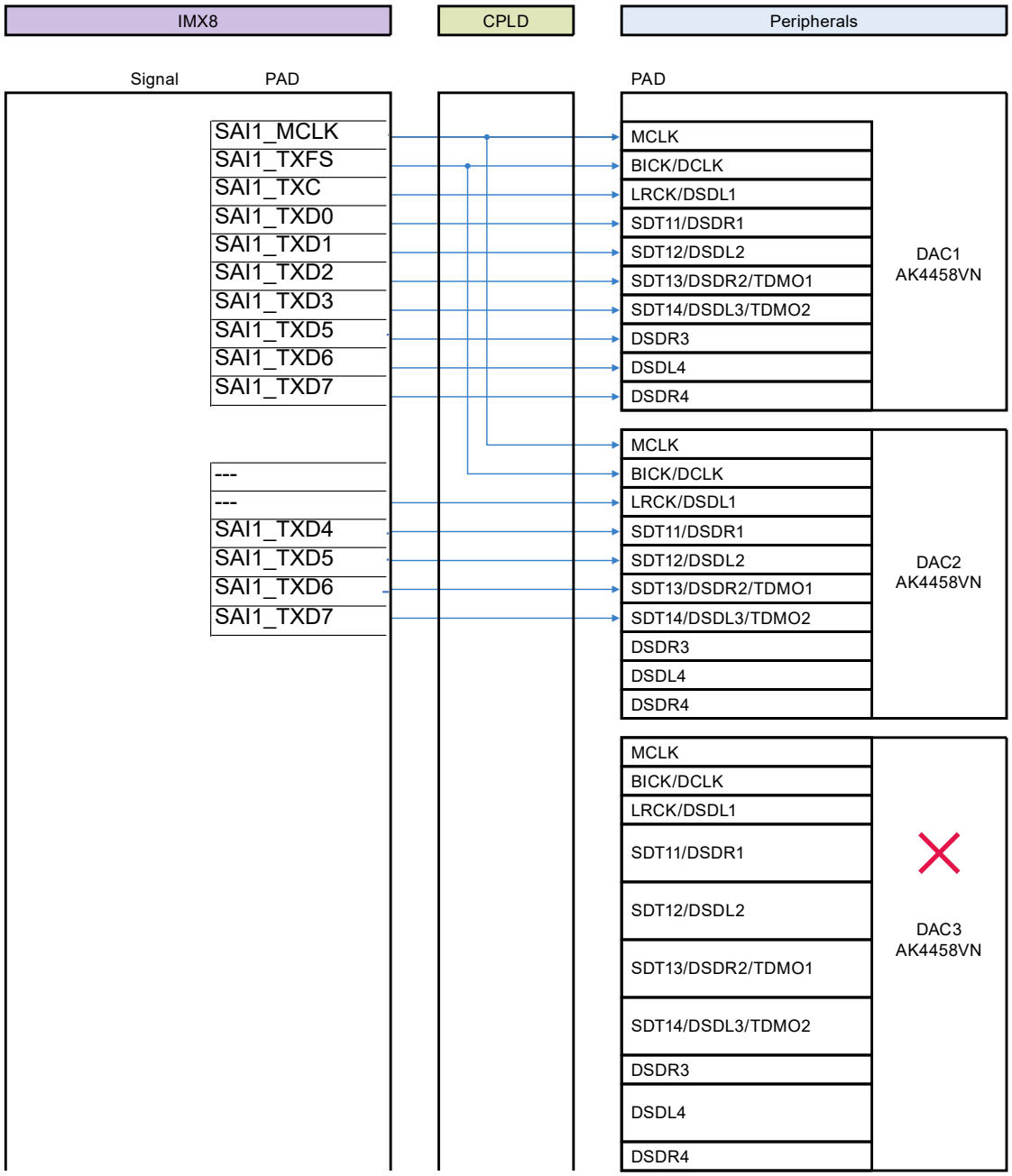


Figure 26. Mode 7 for i.MX 8M Mini

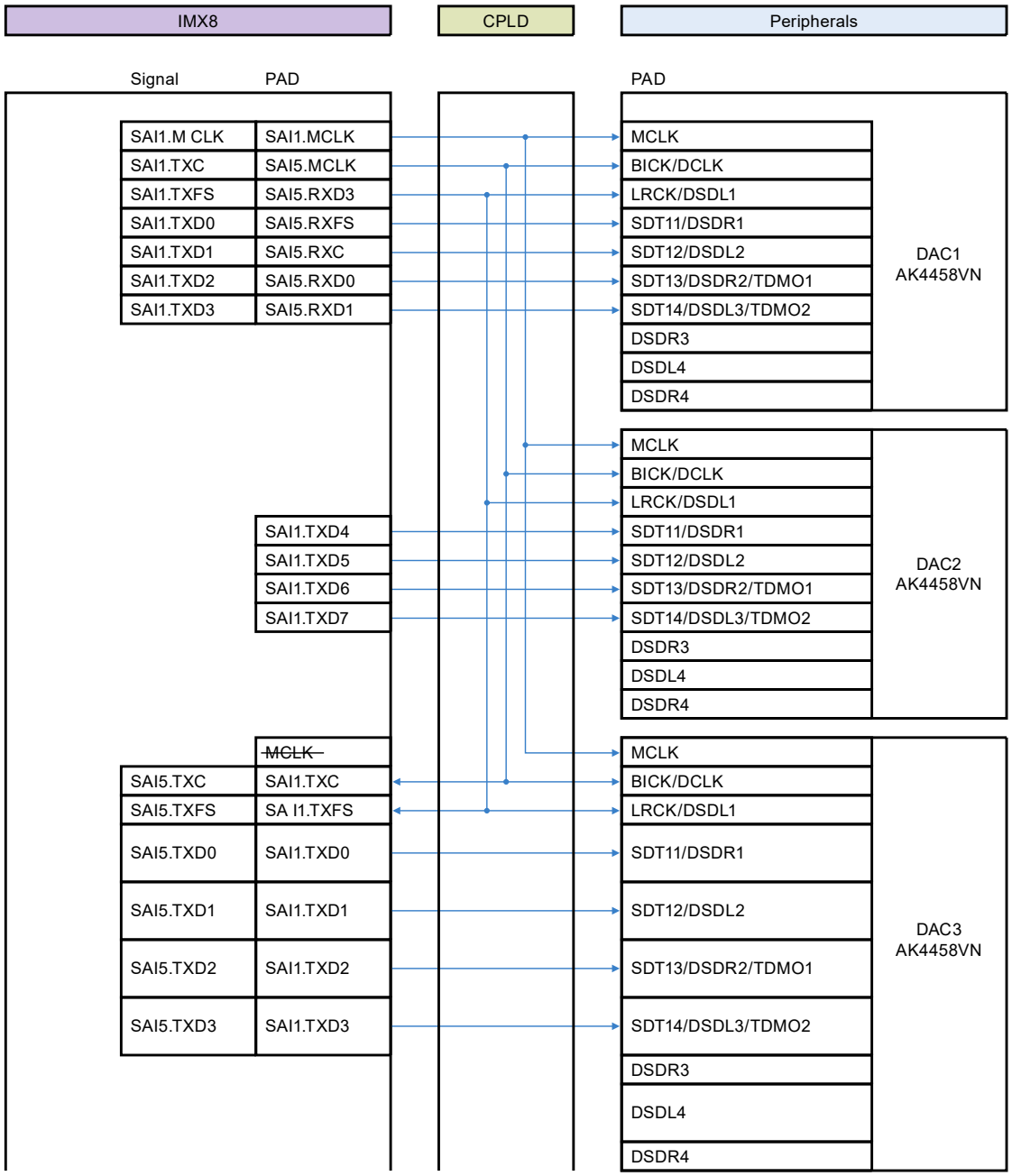


Figure 27. Mode 8 for i.MX 8M Mini

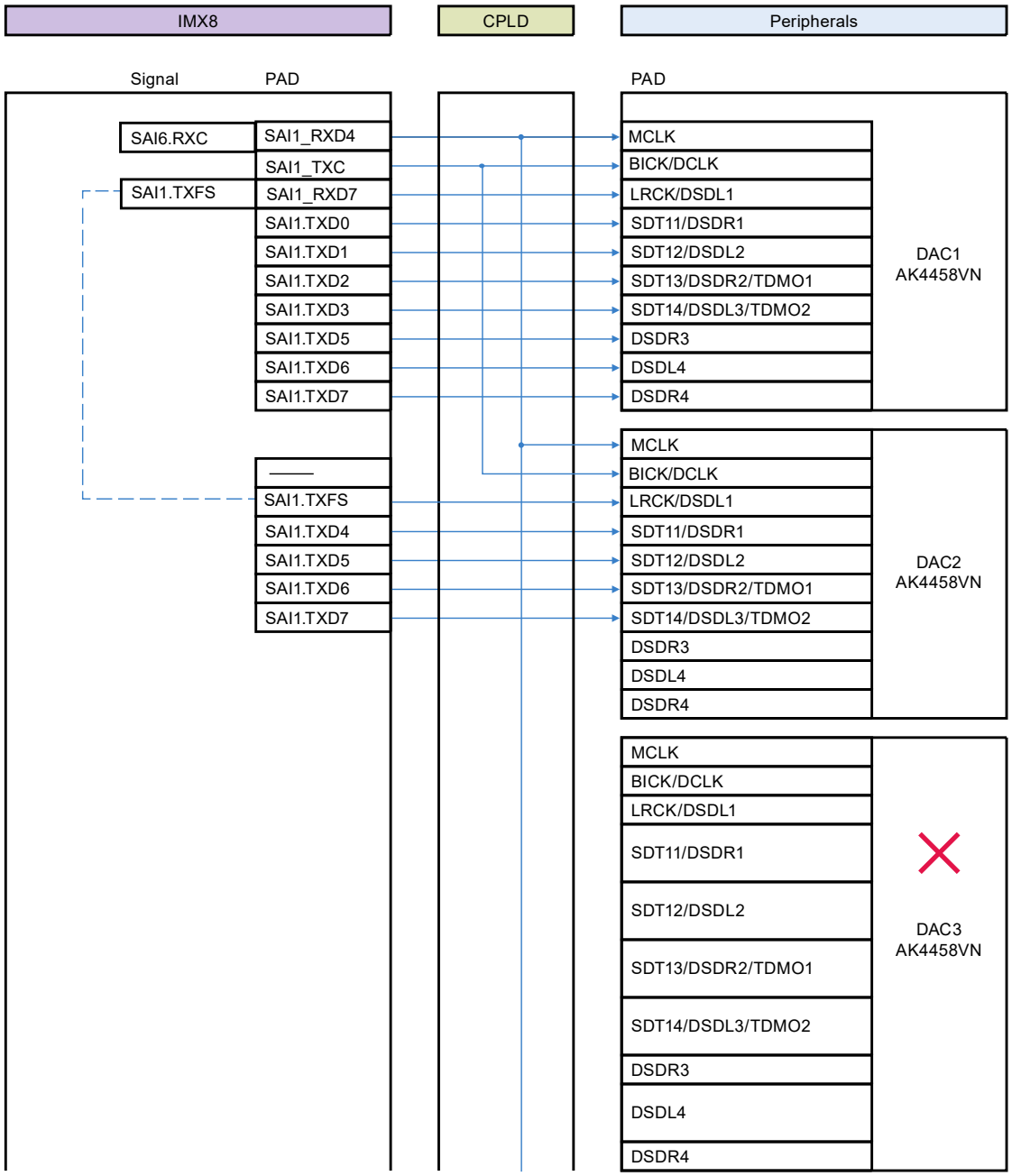


Figure 28. Mode 9 for i.MX 8M Mini

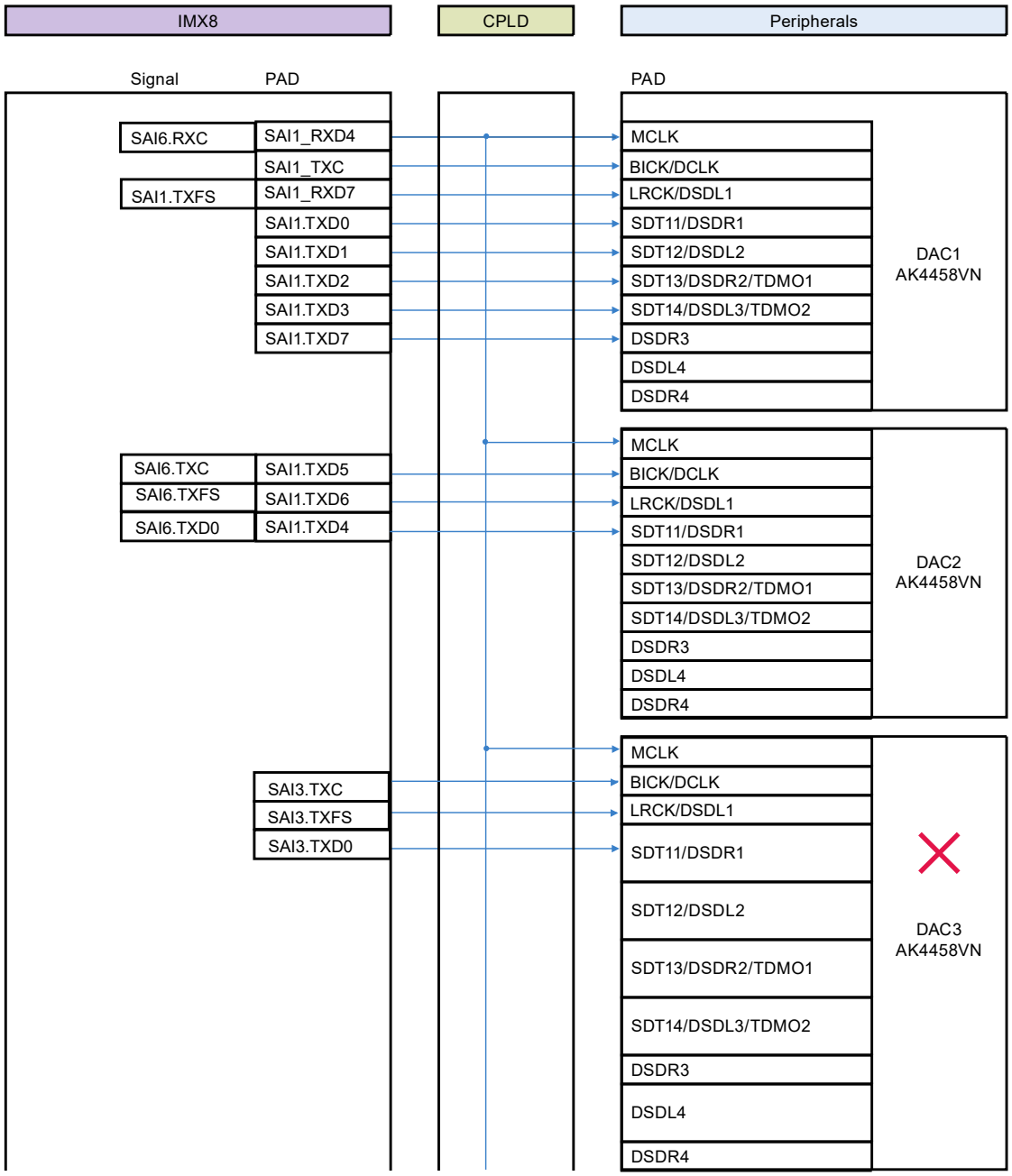


Figure 29. Mode 10 for i.MX 8M Mini

4.4.3 CPLD mode settings for i.MX 8M Plus

The board ID must be set before setting CPLD mode, see Section 4.2 for board ID setting. For CPLD mode setting, there are six modes in i.MX 8M Plus application. Up to 24-CH is supported. All modes are as shown in Table 9.

Table 9. CPLD mode settings for i.MX 8M Plus

SW2302[4:1]	SW2300[4:1]	Description	Diagram
0000[1]	0000	24-ch output, I^2S bus, serial configuration for DAC codecs	Figure 30

Table 9. CPLD mode settings for i.MX 8M Plus*...continued*

SW2302[4:1]	SW2300[4:1]	Description	Diagram
0000	0001	16-ch output, I^2S bus, serial configuration for DAC codecs	Figure 31
0000	0010	8-ch output, DSD bus, serial configuration for DAC codecs	Figure 32
0000	0011	24-ch output, TDM4/128 mode, serial configuration for DAC codecs	Figure 33
0000	0100	24-ch output, TDM8/256 mode, serial configuration for DAC codecs	Figure 34
0000	0101	24-ch output, TDM16/512 with daisy chain mode, serial configuration for DAC codecs	Figure 35
0000	0110	Reserved	—
0000	0111	Reserved	—

[1] 0 is ON, 1 is OFF, and x means no care.

See Figure 30 to Figure 35 for output connections. Unused signals from DAC are connected to GND by default according to DAC data sheet.

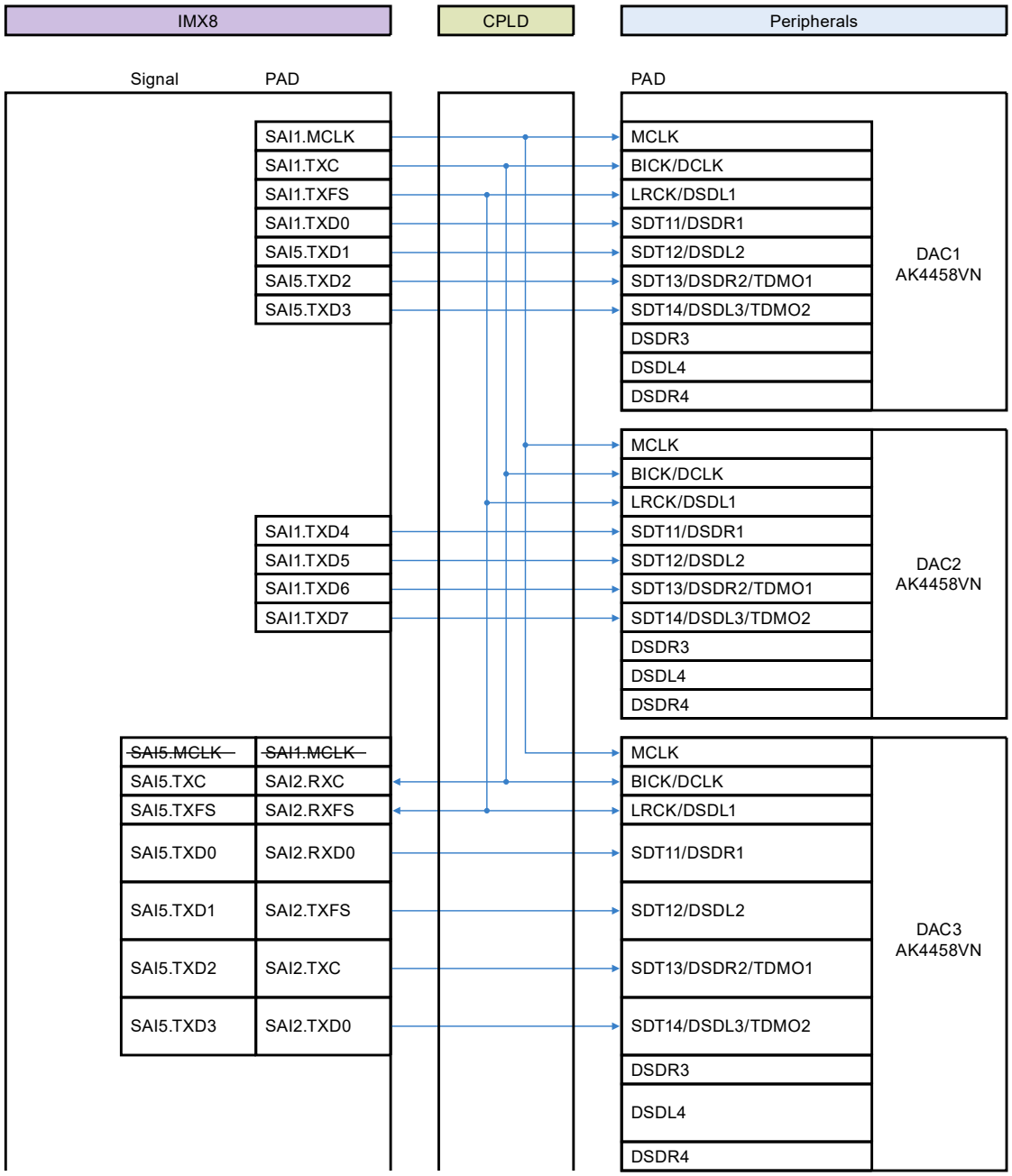


Figure 30. Mode 0 for i.MX 8M Plus

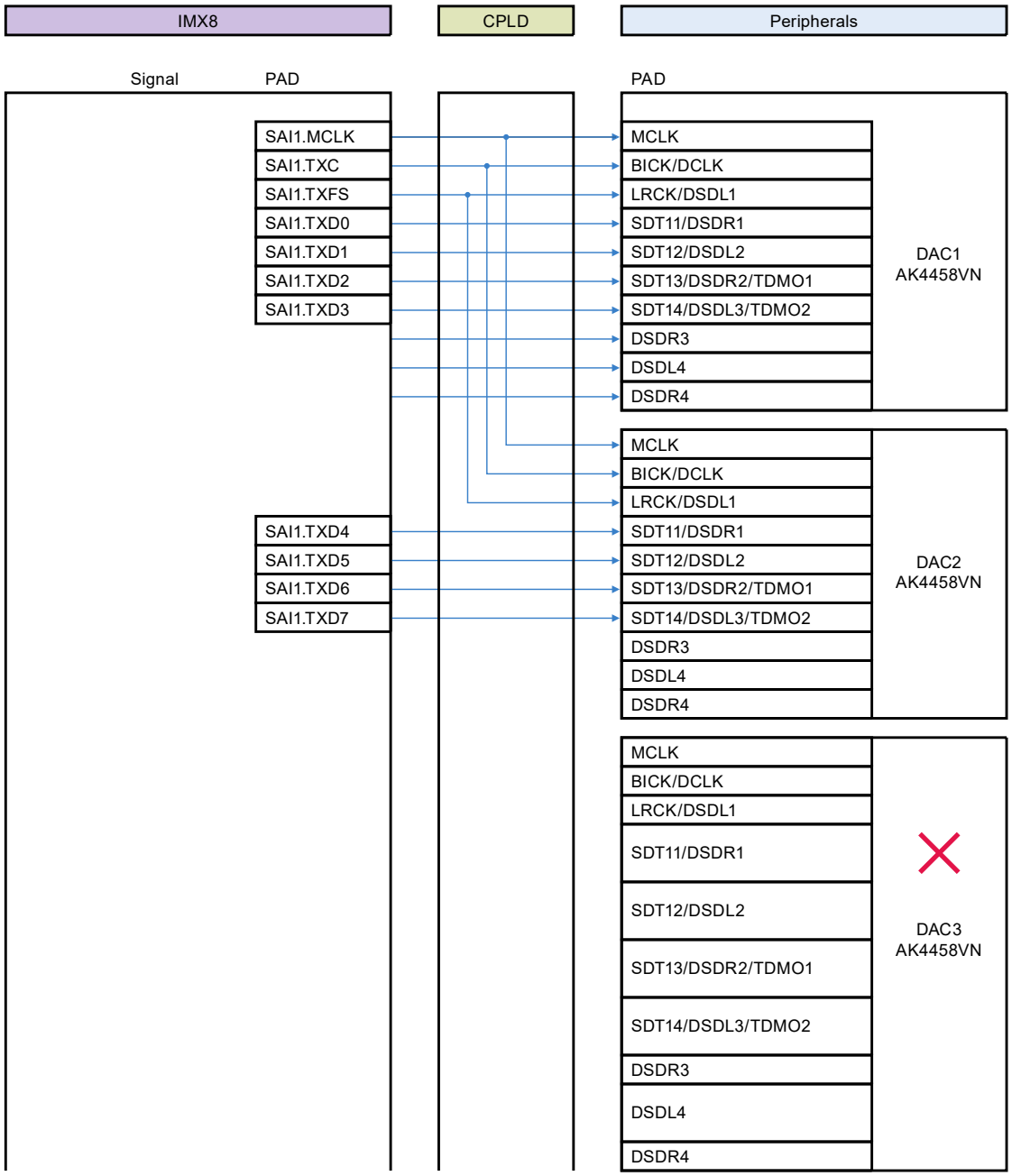


Figure 31. Mode 1 for i.MX 8M Plus

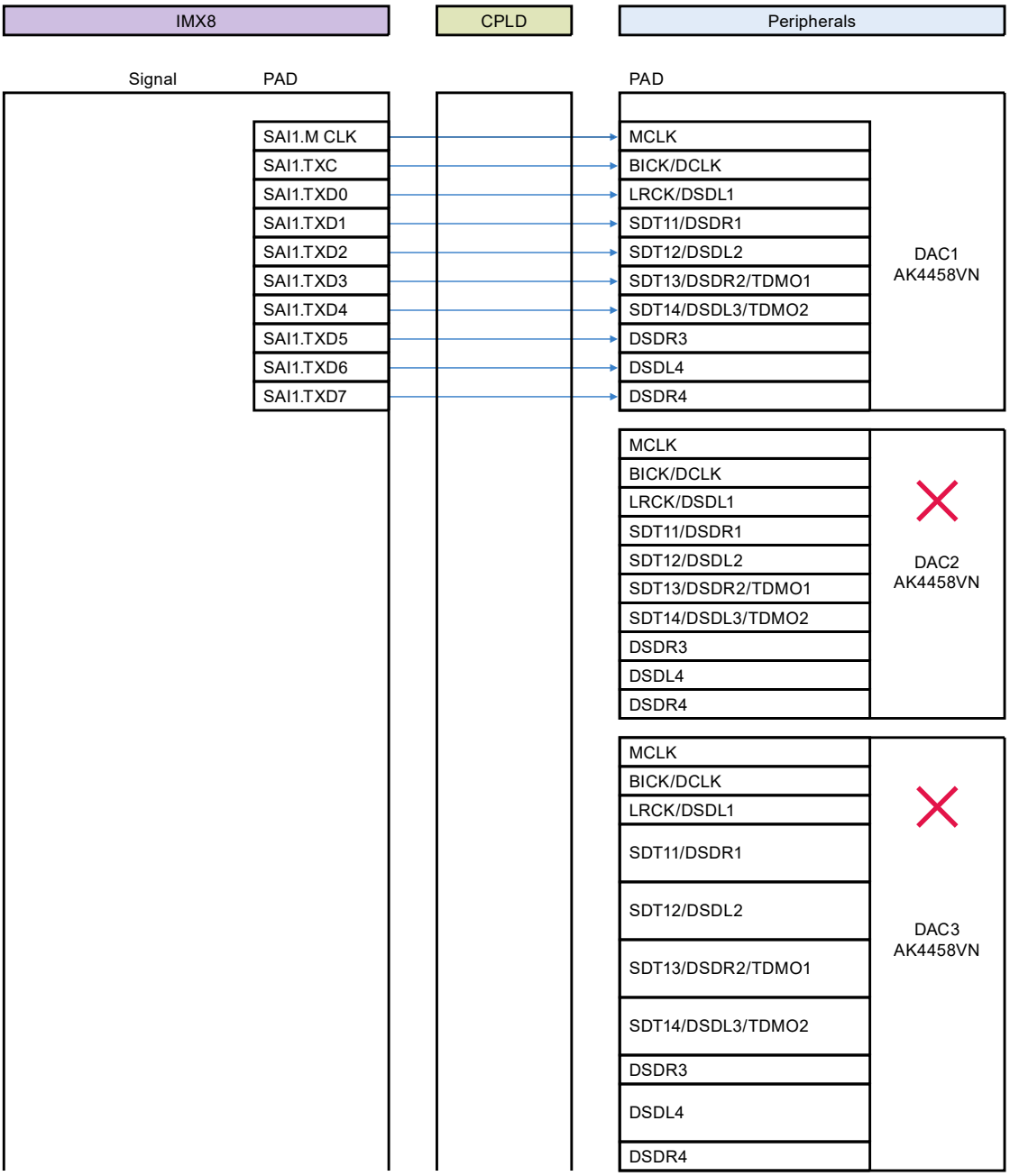


Figure 32. Mode 2 for i.MX 8M Plus

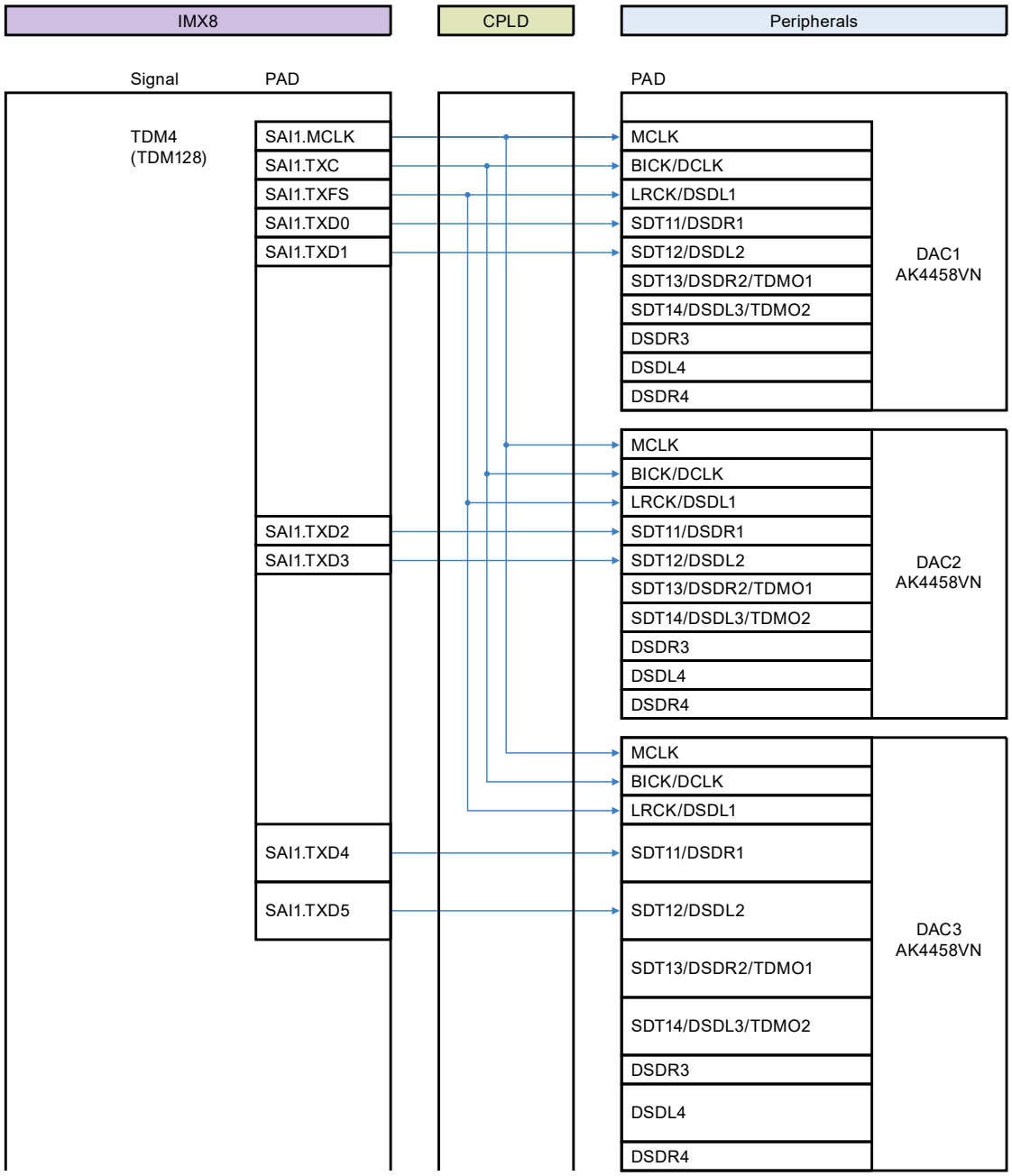


Figure 33. Mode 3 for i.MX 8M Plus

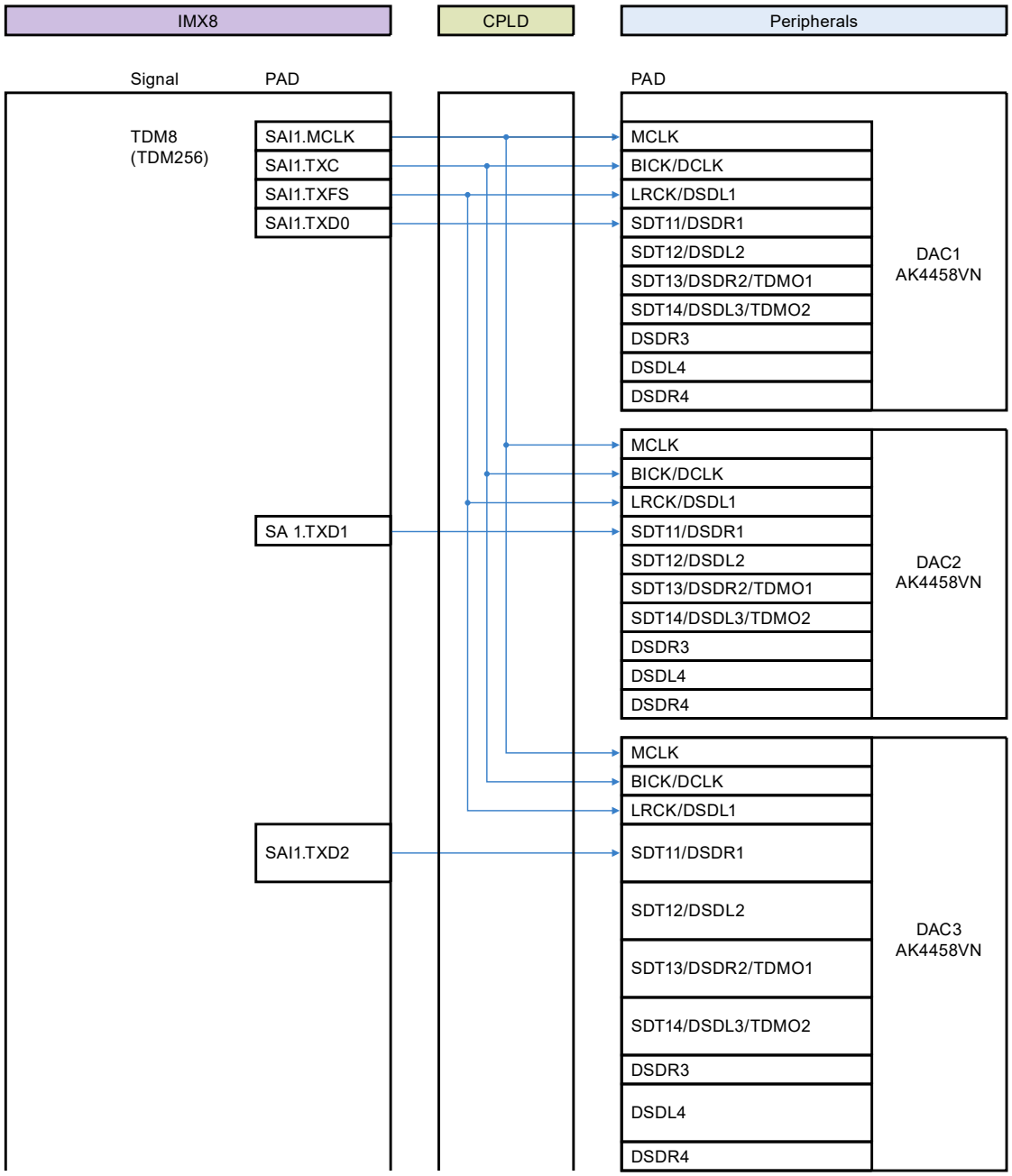


Figure 34. Mode 4 for i.MX 8M Plus

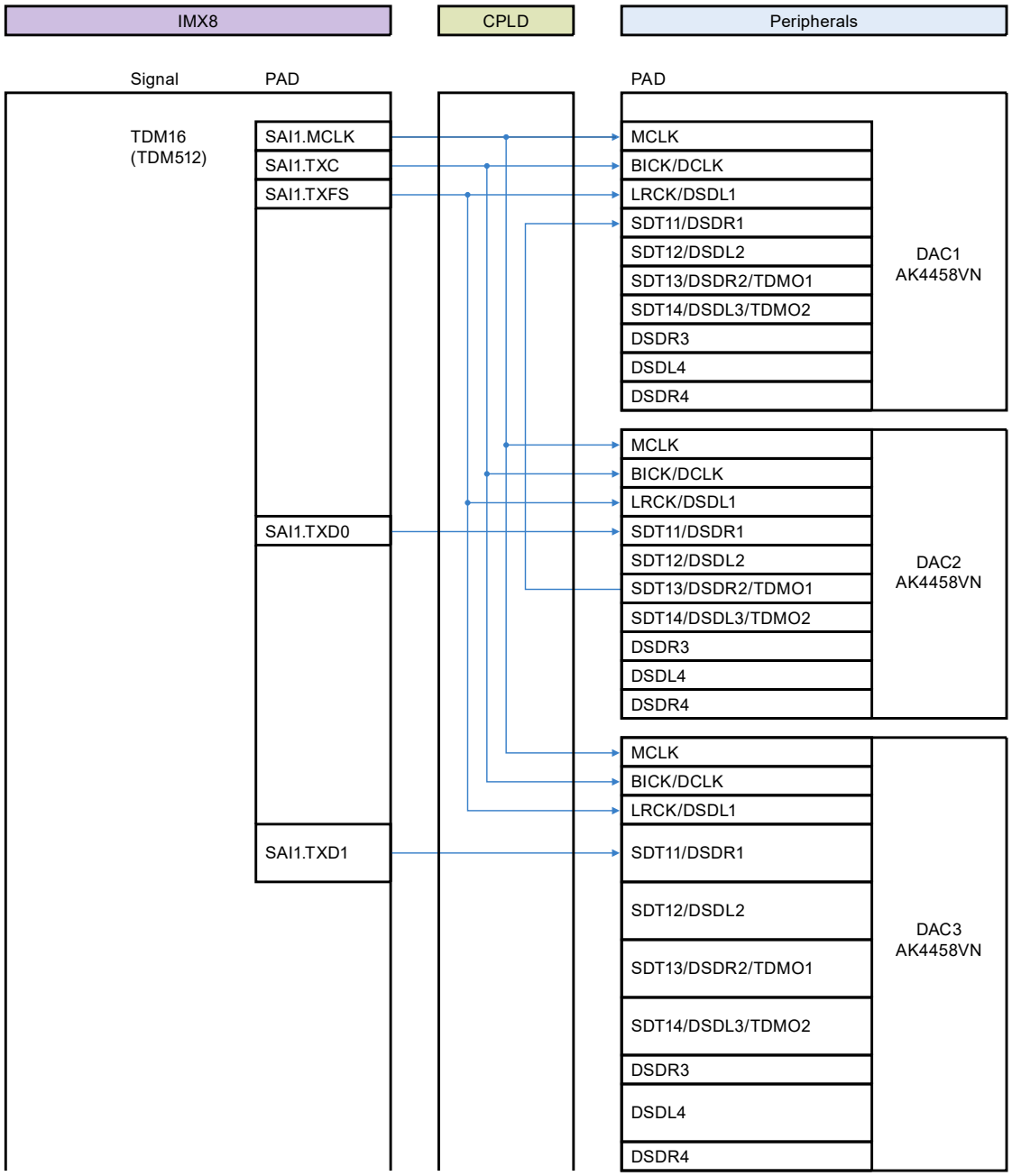


Figure 35. Mode 5 for i.MX 8M Plus

4.5 S/PDIF settings

The Audio Board system is compatible and configurable. Table 10 lists configurations for S/PDIF output and Table 11 lists configurations for S/PDIF input.

Table 10. S/PDIF output settings

J2511	Description
1-2	i.MX 8M Plus to S/PDIF connector

Table 10. S/PDIF output settings*...continued*

J2511	Description
3-4	HDMI card to CPLD to S/PDIF connector[1]
5-6	i.MX 8M Nano or i.MX 8M Mini to S/PDIF connector
1-3	i.MX 8M Plus to CPLD to HDMI card
3-5	i.MX 8M Nano or i.MX 8M Mini to CPLD to HDMI card

[1] CPLD must be remapped (swap HDMI Card S/PDIF in and out).

Table 11. S/PDIF input settings

J1500	Description
1-2	Coaxial connector to i.MX 8M Plus
4-5	Optical connector to i.MX 8M Plus
7-8	HDMI card to CPLD to i.MX 8M Plus
2-3	Coaxial connector to i.MX 8M Nano or i.MX 8M Mini
5-6	Optical connector to i.MX 8M Nano or i.MX 8M Mini
8-9	HDMI card to CPLD to i.MX 8M Nano or i.MX 8M Mini
5-8	Optical connector to CPLD to HDMI card[1]
2-8	Coaxial connector to CPLD to HDMI card[2].

[1] CPLD must be remapped (swap HDMI Card S/PDIF in and out).
[2] CPLD must be remapped (swap HDMI Card S/PDIF in and out)

5 Software update

To enable corresponding features base on an application, software update is a must.

5.1 SOM software

Download the related software for each SOM board from the NXP website. For details on how to download the software and start development, see the corresponding EVK.

5.2 CPLD software

FT2232H IC on the audio board handles the programming of CPLD. The FT2232H IC connects the audio board and accesses the JTAG port of CPLD.

Note: *Before programming the Lattice Diamond design software, ensure that the Diamond Programmer is installed on the PC.*

To program the Lattice Diamond design software, perform the following steps.

1. Download the software from LATTICE.
2. Install the downloaded software.
3. Run **Install and Uninstall Cable Drivers**.
4. Select **All Drivers**, as shown in Figure 36.

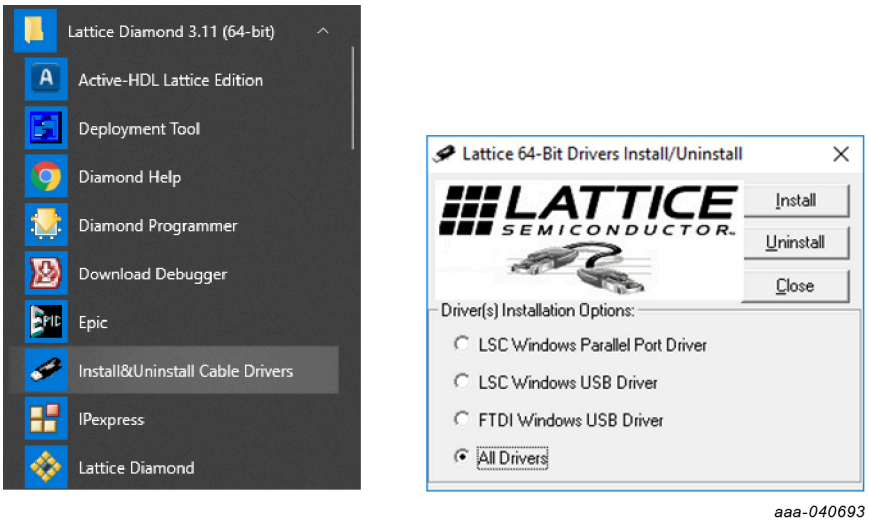


Figure 36. Install driver

To set the hardware environment, perform the following steps.

1. Make sure that the power switch SW2000 on the audio board and the rocker switch on the rear panel is OFF.
2. Plug in 12 V power brick and turn on SW2000 or rocker switch.
3. Connect the USB cable between the PC and the J2400 of the audio board.
4. Run **Diamond Programmer**.

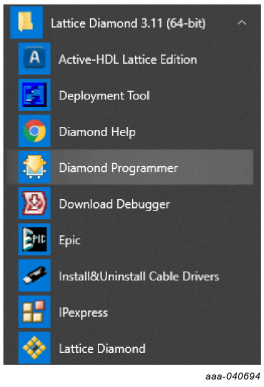
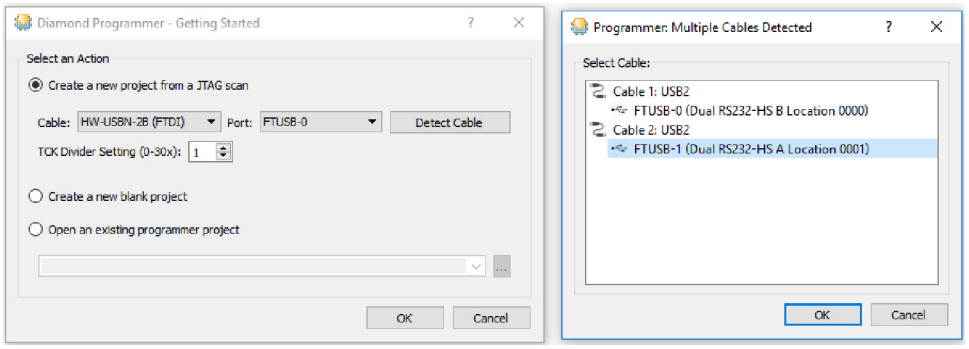


Figure 37. Diamond Programmer

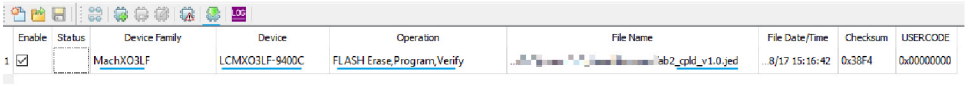
5. Select the right communication port.
6. Select the **Create a new project from a JTAG scan** option.
7. Click **Detect Cable**.
8. Select a suitable port in the new dialog box. In most cases, it is A. If the communication fails, use another port. For details, see Figure 38.



aaa-040695

Figure 38. Selecting the port

9. The selected options are:
   - Device Family is **MachXO3LF**
   - Device is **LCMXO3LF-9400C**
   - Operation is FLASH Erase, Program, Verify.
10. Select the latest *xxxxx.jed* file.
11. Click  button to transfer the code into CPLD. For details, see Figure 39.



aaa-040696

Figure 39. Device configurations

12. Figure 40 shows the progress.

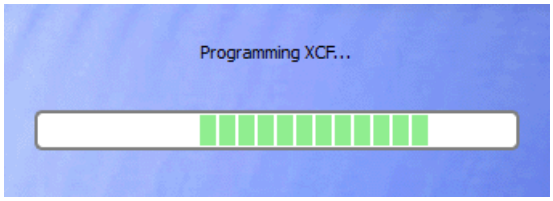
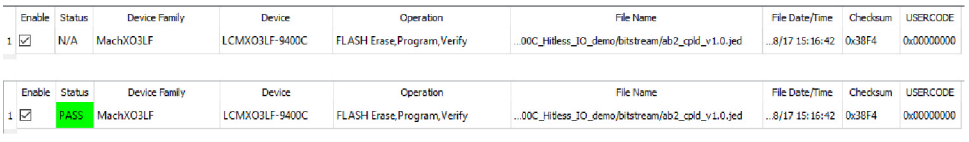


Figure 40. Programming XCF

During programming, the status is N/A. When the software is successfully written the status changes to PASS. For details, see Figure 41.



aaa-040698

Figure 41. Program results

The reference log is shown as following.

```
Lattice VM Drivers detected (HW-DLN-3C (Parallel), HW-USBN-2B (FTDI))
           Programmer device database loaded
           INFO - Scanning USB2 Port FTUSB-1...
           INFO - Scan completed successfully.
           INFO - Check configuration setup: Start.
           INFO - JTAG Chain Verification. No Errors.
           INFO - Check configuration setup: Successful.
           INFO - Device1 LCMXO3LF-9400C: FLASH Erase,Program,Verify
```

```
INFO - Operation Done. No errors.
INFO - Elapsed time: 00 min : 41 sec
INFO - Operation: successful.
```

5.3 HDMI card software

HDMI board is an ecological design. Any company or individual can join this ecosystem and design their own HDMI card based on the NXP standard documentation. The HDMI card that NXP provides has 3-CH receivers and 1-CH transmitter and supports both HDMI input and HDMI eARC. This HDMI card supports SAI, SPDIF, and other miscellaneous signals. These signals are connected to CPLD except I2C. CPLD distributes these signals to the i.MX 8M MPU base on different CPLD mode setting.

To transfer the HDMI Card software, perform the following steps.

1. Short pin 1 and pin2 of J6 on HDMI card to enable ICP mode.
2. Connect EP HDMI card and computer through USB to UART module. The UART is 3.3 V logic level.
3. Power on the HDMI card to ensure that 5.0 V works well.
4. Run EPConsole_3.9.9.exe .
5. Select baud rate as 57600.
6. Select the correct serial port.
7. Select the correct firmware.
8. Click  to download the firmware.
   The progress is shown at the bottom of window.
9. Remove the shunt of J6 to exit ICP mode and enter the normal work mode.
   The configuration and result appears as shown in Figure 42.

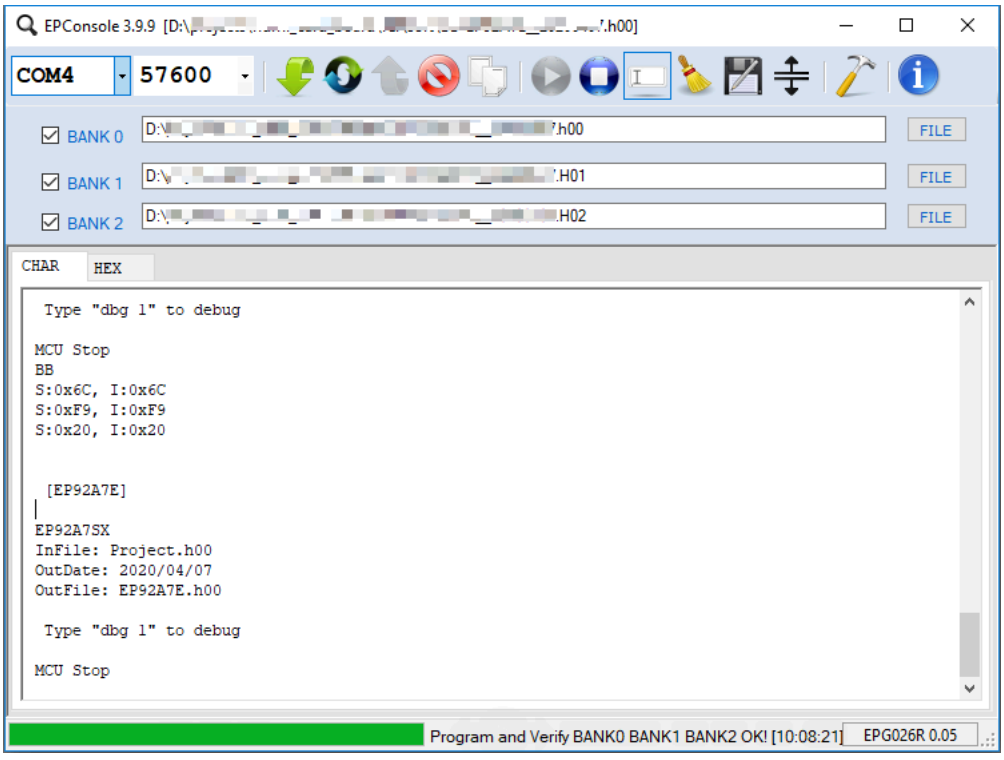


Figure 42. HDMI program

Note: *A software license agreement may be signed for customized firmware with Explore Microelectronics Inc. Contact the NXP marketing representative or Explore Microelectronics for detailed information.*

6 Revision history

This table summarizes revisions to this document.

Table 12. Revision history

Revision number	Date	Substantive changes
2	01 June 2023	Updated Section 4.4.2
1	11 June 2021	Updated for editorial and technical changes
0	02 March 2021	Initial Release

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