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General Purpose Multimedia Interface Specification 1.0 Part 5: Alternate Mode over Type-C

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Issued by Shenzhen 8K UHD Video Industry Cooperation Alliance

Contents

Foreword

This document was drafted in accordance with GB/T 1.1-2020 *Directives for Standardization - Part 1: Rules for the Structure and Drafting of Standardizing Documents*.

This document is Part 5 of T/SUCA 001 *General Purpose Multimedia Interface Specification*. T/SUCA 001 includes the following parts proposed to be published:

- Part 1: Architecture, specifying a general purpose multimedia interface (GPMI) architecture that supports information transmission between consumer electronic devices.
- Part 2: Protocols, specifying the protocols of the electrical layer, logical layer, transport layer, and adaptation layer of the GPMI.
- Part 3: Connectors and Cables, specifying the technical requirements for connectors and cables using GPMI Type-B.
- Part 4: Power Supply, describing the architecture of the power supply for GPMIs, and specifying the electrical characteristics and timing requirements, physical layer, protocol layer, application layer, and power input and output requirements.
- Part 5: Alternate Mode over Type-C, specifying the method of using GPMI signals via USB Type-C ports.

This Standard was proposed by and is under the centralized management of Shenzhen 8K UHD Video Industry Cooperation Alliance.

This standard is drafted by: Huawei Technologies Co., Ltd., HiSilicon Technologies Co., Ltd., China Electronics Standardization Institute, Shenzhen Skyworth-RGB Electronics Co., Ltd., Shenzhen Skyworth Digital Technology Co., Ltd., China Mobile (Hangzhou) Information Technology Co., Ltd., National Engineering Laboratory for Digital TV (Beijing), Guilin University of Electronic Science and Technology, Shenzhen CESI Information Technology Co., Ltd., Sinolink Technologies (Beijing) Co., Ltd., Hisense Visual Technology Co.,Ltd., Konka Group Co., Ltd., Hangzhou Hikvision Digital Technology Co., Ltd., Shenzhen National Engineering Laboratory of Digital Television Co., Ltd., Guangdong National UHD Video Innovation Center, Shenzhen Bajiuling Optoelectronics Technology Co., Ltd., Shenzhen Wanliyan Technology Co., Ltd., Ceyear Technologies Co., Ltd., Jiangsu Anlan-WK Electronics Co., Ltd., Malanshan Audio&Video Laboratory, Guangdong Wire & Cable Association, and Shenzhen 8K UHD Video Industry Cooperation Alliance.

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General Purpose Multimedia Interface Specification Part 5: Alternate Mode over Type-C

1 Scope

This document specifies the method of using general purpose multimedia interface signals via Type-C ports.

This document is applicable to the design and development of general purpose multimedia interfaces using Type-C configurations. It may be used as a reference for devices using general purpose multimedia interfaces.

In this document, Type-C refers specifically to USB Type-C.

2 Normative References

The following documents constitute, through normative references in the text, indispensable provisions of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

T/SUCA 001.1-2024 General Purpose Multimedia Interface Specification Part 1: Architecture

T/SUCA 001.2-2024 General Purpose Multimedia Interface Specification Part 2: Protocols

T/SUCA 001.3-2024 General Purpose Multimedia Interface Specification Part 3: Connectors and Cables

T/SUCA 001.4-2024 General Purpose Multimedia Interface Specification Part 4: Power Supply

USB-C 2.3-2023.10 Universal Serial Bus Type-C Cable and Connector Specification 2.0-October 2023

USB PD 3.1-2022.7 Universal Serial Bus Power Delivery Specification Revision 3.1, Version 1.5-July 2022

USB3.2-2017.9 Universal Serial Bus 3.2 Specification-September 22, 2017

3 Term, Definition, and Abbreviation

3.1 Terms and Definitions

The terms and definitions defined in T/SUCA 001.1-2024 and the following apply to this document.

3.1.1 configuration channel

An entity consisting of a line for transmitting signals and its sending and receiving circuits as specified in the USB PD 3.1-2022.7 specification.

3.1.2 downstream facing port

The port in a USB topology that is usually connected to the USB Host root port or the downstream port of the Hub as defined in the USB3.2-2017.9 protocol.

3.1.3 upstream facing port

The port on a device or router connected to the host or router's downstream port, generally indicating the data flow direction in a USB connection.

3.1.4 standard or vendor ID

Identification SID or VID, which represents standard or vendor identification in USB PD structured VDM.

Note: The GPMI_SVID value is 0xFF10.

3.1.5 vendor defined message

The data message format specified in the USB PD 3.1-2022.7 protocol for vendors and other standards.

Note: In this document, VDM is equivalent to Structured VDM unless otherwise specified.

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

CC: configuration channel

DFP: downstream facing port

GPMI: general purpose multimedia interface

ML: main link

SID: standard ID

SL: sideband link

SVID: SID or VID

UFP: upstream facing port

VBUS: voltage bus

VID: vendor ID

VDM: vendor defined message

4 Overview

USB-C 2.3-2023.10 "E Alternate Modes" defines alternate modes that allow third-party specifications to use the Type-C port by redefining some pins in the Type-C connector.

Section 6.4.4.4 of USB PD 3.1-2022.7 defines the discovery and handling process of alternate modes, including discovering SVIDs supported by the device, supported modes, and entry and exit modes.

T/SUCA 001.1 and T/SUCA 001.2 indicate the main and sideband links of the GPMI. When the main link uses a Type-C connector, it supports up to 4 differential channels, numbered ML0, ML1, ML2, and ML3. Each main link differential channel supports nine speeds: 2 Gbps, 4 Gbps, 6 Gbps, 8 Gbps, 10 Gbps, 12 Gbps, 16 Gbps, 20 Gbps, and 24 Gbps. The auxiliary link has 12.5 Mbps

full-duplex communication capability and consists of two single-ended channels in different directions, numbered SL1 and SL2.

When the GPMI uses a Type-C connector, it works in one of the following modes:

(a) Standard USB mode. If the device supports the full-function USB standard, it works in standard USB mode by default.

(b) GPMI mode. The device enters GPMI mode through the alternate mode process of USB PD 3.1-2022.7. After entering GPMI mode, the device works in either of the two following modes according to its needs for USB data communication:

  (1) GPMI full-function mode. Both the main link and the sideband link follow the GPMI protocol and therefore can use all GPMI capabilities.

  (2) GPMI compatibility mode. If the device supports standard USB function, then in compatibility mode, some pins can be switched back to USB function so that the device can support both GPMI video streaming and USB data streaming. See section 5.3.2 for the relevant pin configurations and section 6.2 for the detailed configuration process.

Note: If the GPMI device does not integrate a separate USB function, it shall enter GPMI mode during the device discovery process.

USB-C 2.3-2023.10 Table 3-1 USB Type-C Standard Cable Assemblies specifies the Type-C standard cable types. The following table lists the Type-C cables supported by the GPMI and the maximum channel speed recommended in GPMI mode.

Table 1 Type-C cable types and working speeds supported by GPMI

Type-C Cable Type		**Maximum Working Speed Recommended**
USB3.2 Gen 1 (5 Gbps)	Passive	6 Gbps
USB3.2 Gen 2 (10 Gbps) USB4 Gen 2 (10 Gbps)	Passive	12 Gbps
USB4 Gen 3 (20 Gbps)	Passive	24 Gbps
	Active	Not supported
USB4 Gen 4 (40 Gbps) and above	Passive	24 Gbps
	Active	Not supported

5 Pin Assignment

5.1 Overview

This section describes the pin assignment of GPMI signals on the Type-C female connector, including the pin assignment scheme when the Type-C cable is inserted in the normal orientation (forward orientation) and the flip orientation (reverse orientation).

The GPMI controller and the Type-C female connector are fixedly connected. Channel configuration is used to achieve the adaptation of Type-C cables in normal or reverse orientation. GPMI devices with Type-C female connector shall have appropriate channel configuration capabilities to match the channel configuration when the male connector of the cable is inserted to

the female connector in normal or flip orientation.

Section 2 of USB-C 2.3-2023.10 defines the pins of Type-C connectors.

5.2 Type-C Pin Assignment

Section E.2.1 of USB-C 2.3-2023.10 specifies the reconfigurable pins of the Type-C connector to support other modes. After the Type-C connector works in GPMI mode, its pin assignment is shown in Table 2.

Table 2 Pin assignment of GPMI mode on Type-C connector

Pin	USB Pin Definition	Pin Definition in GPMI Mode
A1	GND	(USB-C)
A2	TX1+	ML2+
A3	TX1-	ML2-
A4	VBUS	(USB-C)
A5	CC1	(USB-C)
A6	D+	(USB-C)
A7	D-	(USB-C)
A8	SBU1	SL1
A9	VBUS	(USB-C)
A10	RX2-	ML1-
A11	RX2+	ML1+
A12	GND	(USB-C)
B1	GND	(USB-C)
B2	TX2+	ML0+
B3	TX2-	ML0-
B4	VBUS	(USB-C)
B5	CC2	(USB-C)
B6	D+	(USB-C)
B7	D-	(USB-C)
B8	SBU2	SL2
B9	VBUS	(USB-C)
B10	RX1-	ML3-
B11	RX1+	ML3+
B12	GND	(USB-C)
Note 1: (USB-C) indicates that the alternate mode specified in this document does not		

reconfigure the pin.

Note 2: SL1 and SL2 indicate the single-ended channel pins of the sideband link, and ML0+/ML0-, ML1+/ML1-, ML2+/ML2-, and ML3+/ML3- indicate the differential channel pins of each main link respectively. For example, ML0+/ML0- indicates the pin corresponding to the ML0 differential channel.

5.3 Main Link Channel Configuration

5.3.1 Overview

Before initiating the process of entering GPMI mode, the interface is in USB mode with USB configurations according to the USB-C 2.3-2023.10 specification.

When the GPMI device enters the GPMI mode, there are two working modes: full-function mode and compatibility mode, corresponding to different pin configurations.

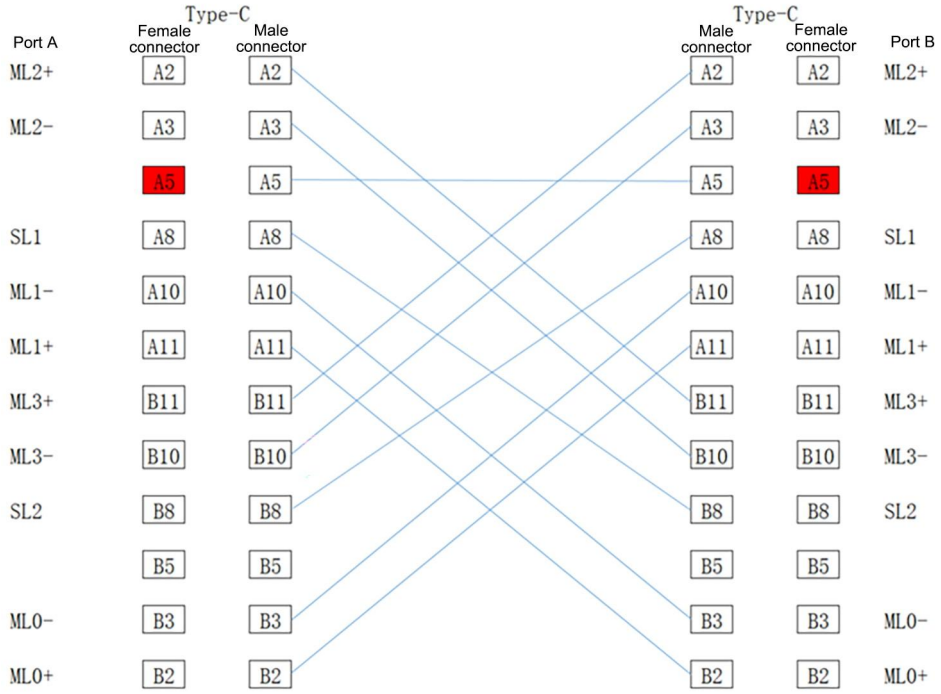
According to the USB-C 2.3-2023.10 specification, the Type-C port detects the insertion orientation through the CC1 and CC2 pins. When the DFP or UFP detects the connection with a peer device from CC1, it is identified as a forward insertion. When the DFP or UFP detects the connection with a peer device from CC2, it is identified as a reverse insertion. The Type-C ports on both sides of the device support four cable insertion orientations: forward/forward, forward/reverse, reverse/forward, and reverse/reverse. The ports at both ends of the GPMI link shall decide the pin configuration based on these orientations.

5.3.2 GPMI Full-Function Mode Pin Configuration

This section describes the pin configuration when GPMI is in full-function mode.

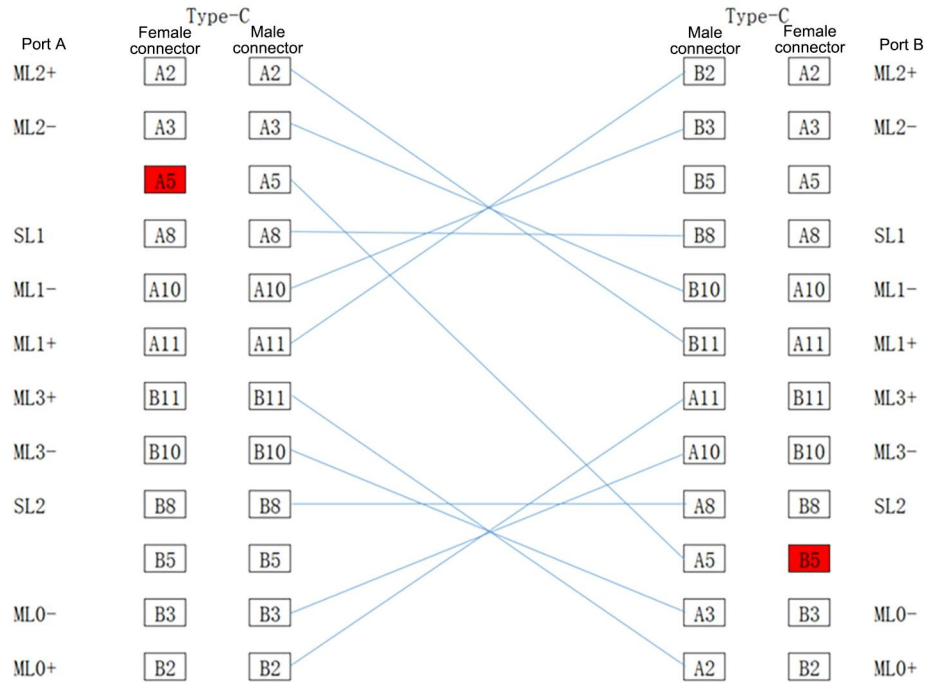
Figures 1 to 4 list the connection relationship between the main link and sideband link pins of GPMI port A and port B in four Type-C cable insertion orientations.

Figure 1 Pin configuration of GPMI port A and port B when the cable is inserted to the Type-C ports on both sides of the device in forward/forward orientation



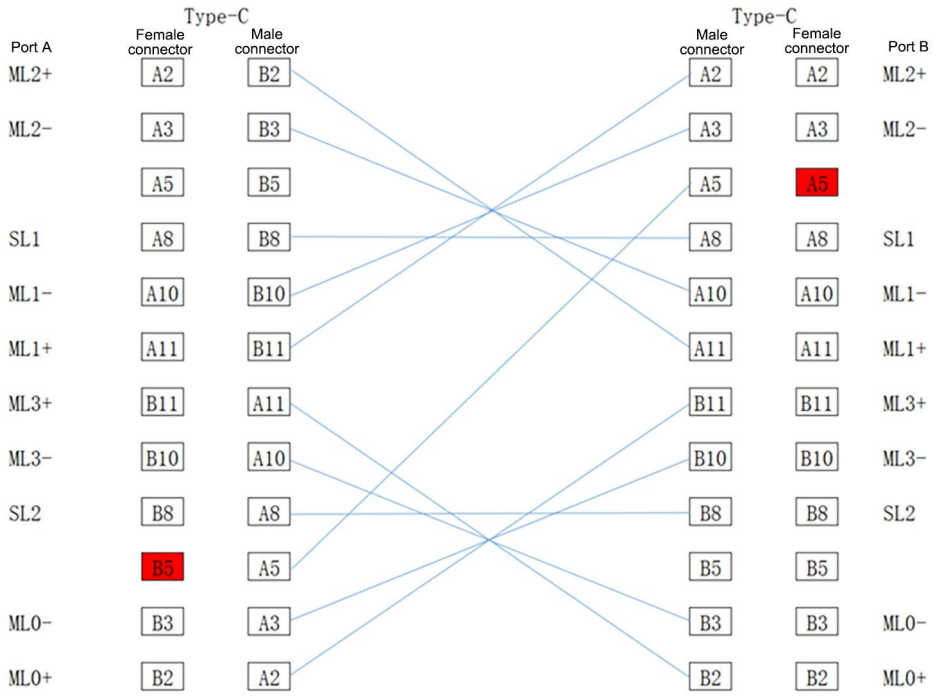
Note: The forward/forward insertion orientation in Figure 1 indicates that the Type-C port is inserted to both port A and port B in forward orientation.

Figure 2 Pin configuration of GPMI port A and port B when the cable is inserted to the Type-C ports on both sides of the device in forward/reverse orientation



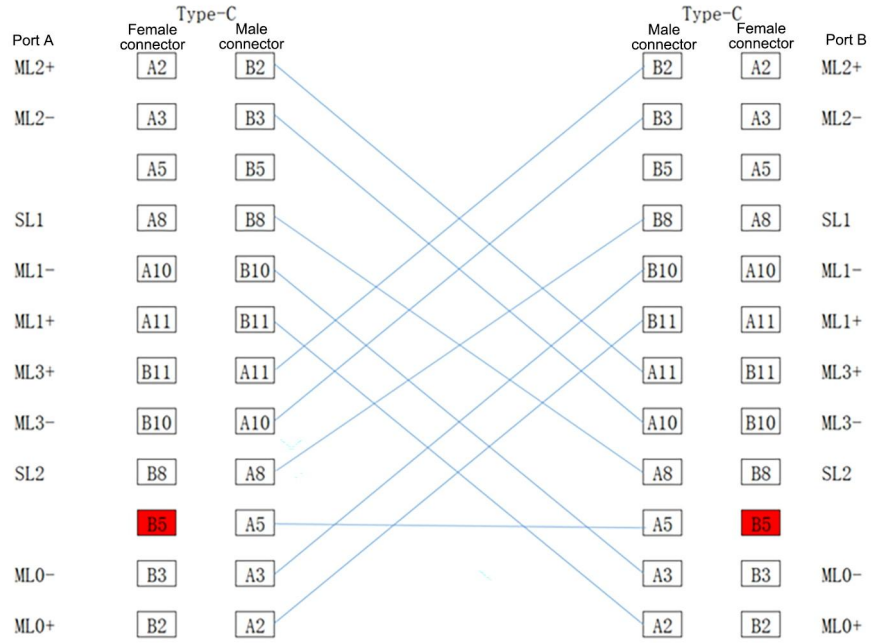
Note: The forward/reverse insertion orientation in Figure 2 indicates that the Type-C port is inserted to port A in forward orientation and port B in reverse orientation.

Figure 3 Pin configuration of GPMI port A and port B when the cable is inserted to the Type-C ports on both sides of the device in reverse/forward orientation



Note: The reverse/forward insertion orientation in Figure 3 indicates that the Type-C port is inserted to port A in reverse orientation and port B in forward orientation.

Figure 4 Pin configuration of GPMI port A and port B when the cable is inserted to the Type-C ports on both sides of the device in reverse/reverse orientation



Note: The reverse/reverse insertion orientation in Figure 4 indicates that the Type-C port is inserted to both port A and port B in reverse orientation.

According to Figures 1 to 4, when the Type-C port cable is inserted in forward/forward and reverse/reverse orientations, the connection relationship between GPMI port A and port B is the same. When the Type-C port cable is inserted in forward/reverse and reverse/forward orientations, the connection relationship between GPMI port A and port B is the same. The connection relationship is specified in Tables 3 and 4.

Table 3 GPMI channel configuration when the cable is inserted to Type-C ports on both sides of the device in forward/forward and reverse/reverse orientations

Port A Pin	Port B Pin
ML0	ML1
ML1	ML0
ML2	ML3
ML3	ML2

Table 4 GPMI channel configuration when the cable is inserted to Type-C ports on both sides of the device in forward/reverse and reverse/forward orientations

Port A Pin	Port B Pin
ML2	ML1
ML3	ML0
ML1	ML2
ML0	ML3

5.3.3 GPMI Compatibility Mode Pin Configuration

This section describes the pin configuration method of GPMI devices working in GPMI compatibility mode. In compatibility mode, the USB module overspeed pin SSTX is connected to the female connector A2/A3, and SSRX is connected to the female connector B11/B10. The GPMI module retains ML0's connection to B2/B3 and ML1's connection to A11/A10.

The GPMI compatibility mode also detects the insertion orientation. Figures 5 to 8 list the connection relationship between the pins of port A and port B in four Type-C port cable insertion orientations.

Figure 5 Pin configuration of port A and port B when the cable is inserted in forward/forward orientation in GPMI compatibility mode

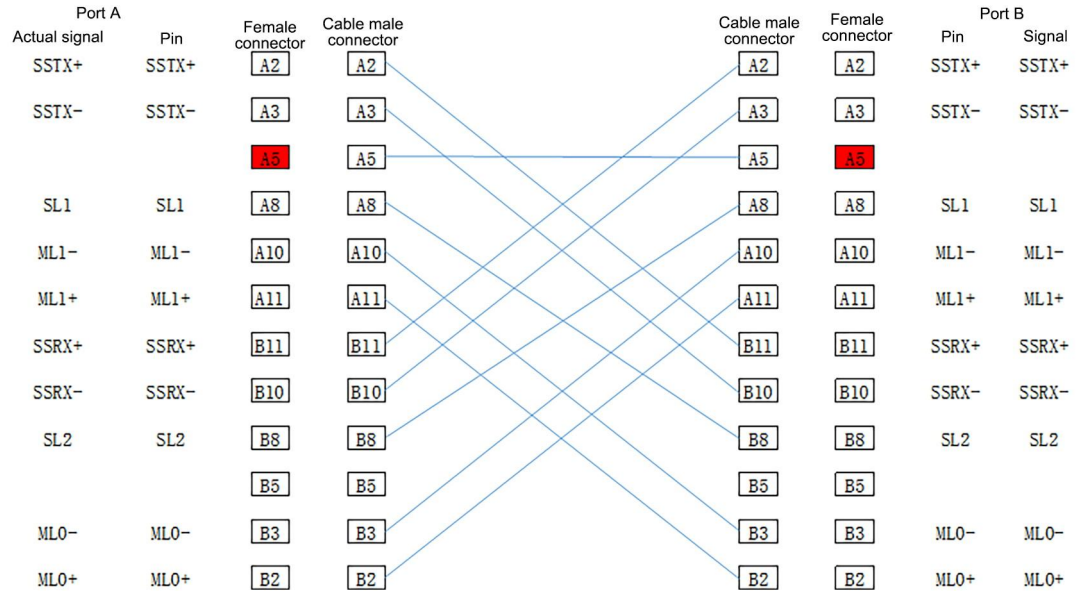


Figure 6 Pin configuration of port A and port B when the cable is inserted in forward/reverse orientation in GPMI compatibility mode

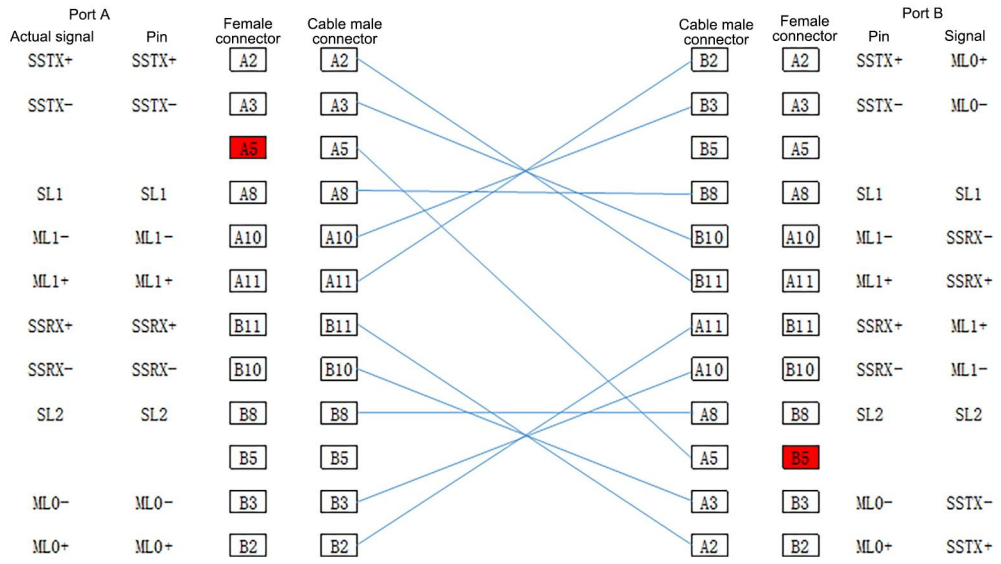


Figure 7 Pin configuration of port A and port B when the cable is inserted in reverse/forward orientation in GPMI compatibility mode

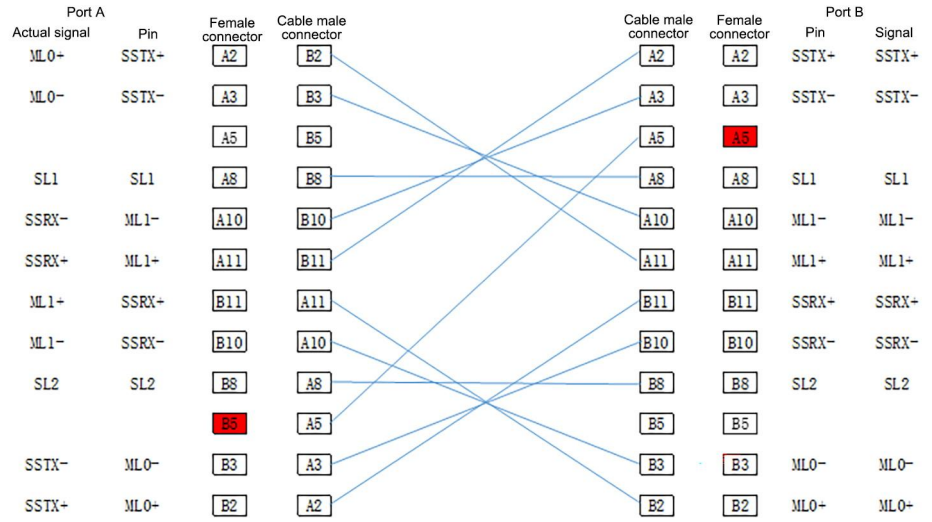


Figure 8 Pin configuration of port A and port B when the cable is inserted in reverse/reverse orientation in GPMI compatibility mode

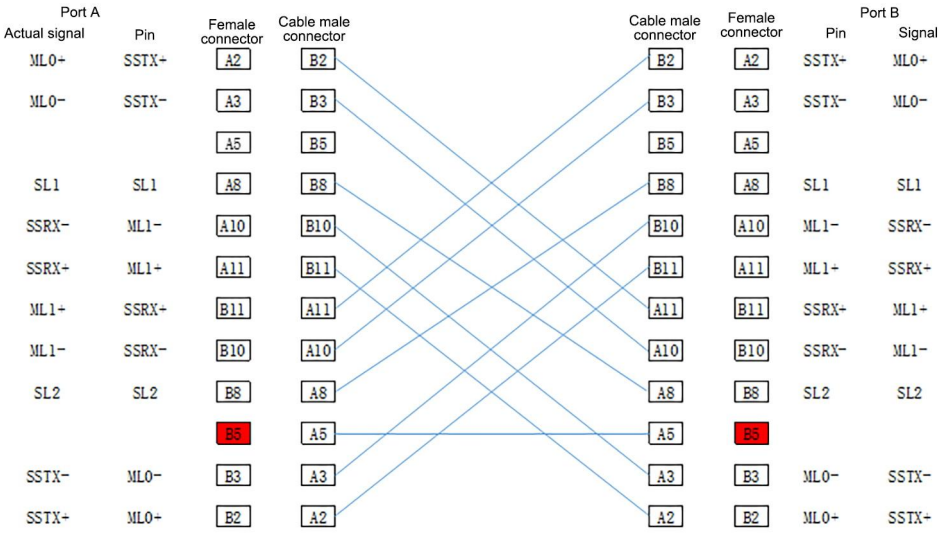


Table 5 GPMI channel configuration when the cable is inserted to the Type-C ports on both sides of the device in forward/forward and reverse/reverse orientations in GPMI compatibility mode

Port A Pin	**Port B Pin**
ML0	ML1
ML1	ML0
SSTX	SSRX
SSRX	SSTX
Note: The chip on the side in reverse insertion orientation performs the switching of GPMI and	

USB signals.

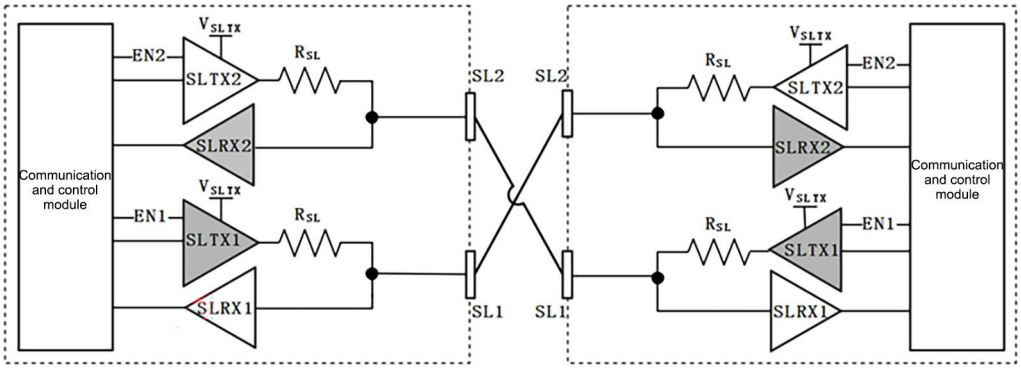
Table 6 GPMI channel configuration when the cable is inserted to the Type-C ports on both sides of the device in forward/reverse and reverse/forward orientations in GPMI compatibility mode

Port A Pin	Port B Pin
SSTX	ML1
SSRX	ML0
ML1	SSTX
ML0	SSRX
Note: The chip on the side in reverse insertion orientation performs the switching of GPMI and USB signals.	

5.4 Sideband Link Channel Configuration

The circuit structure of the GPMI sideband link is shown in Figure 9. Both SL1 and SL2 of the ports at both ends of the sideband link have sending and receiving capabilities.

Figure 9 Schematic diagram of GPMI sideband link circuit structure



According to Figures 1 to 8, the GPMI sideband link adopts a fixed pin configuration scheme, that is, SL1 is fixedly connected to the A8 pin of the Type-C female connector, and SL2 is fixedly connected to the B8 pin of the Type-C female connector. The GPMI port decides whether to use SL1 or SL2 for transmission based on the forward or reverse insertion orientation of the Type-C port on this side.

The sideband link enables SL1 or SL2 for transmission based on the forward or reverse insertion orientation at this side. For details, see the following table.

Table 7 Sideband link channel configuration when the cable is inserted to the Type-C port in forward and reverse orientations

Type-C Port Interface Orientation	GPMI SL1	GPMI SL2	Description

Type-C Port Interface Orientation	GPMI SL1	GPMI SL2	Description
Forward insertion	Transmission	Receiving	EN1 increasing and EN2 decreasing
Reverse insertion	Receiving	Transmission	EN2 increasing and EN1 decreasing

6 Device Discovery and Communication

6.1 Overview

Sections 6.4.4.4.1 and 6.4.4.4.2 of USB PD 3.1-2022.7 specify the method for entering and exiting the alternate mode, which is followed in this document to enter the GPMI mode.

Refer to Figure 6-27 of USB PD 3.1-2022.7. The USB PD specification performs the GPMI mode discovery and entry process after completing the power supply negotiation.

In this section, the **GPMI_SVID** value is **0xFF10**.

6.2 Data Structures Involved in the GPMI Model

6.2.1 Structured VDM

Table 6-29 of USB PD 3.1-2022.7 defines structured VDM for negotiating operating modes. A message includes standard Discover Identity, Discover SVIDs, Discover Modes, Enter Mode, Exit Mode, and Attention messages, and reserves 16–31 (B4...B0 in the VDM message), a total of 16 command codes for VDM.

The GPMI **Status Update** command, numbered 16, and the GPMI **Status Configure** command, numbered 17, were added to the GPMI mode. The key fields related to GPMI in Table 6-29 of USB PD 3.1-2022.7 are shown in Table 8.

Table 8 Key fields related to the GPMI in VDM Header

Bits	Field	Description
B31...16	Standard or Vendor ID (SVID)	GPMI_SVID
…	…	…
B4...B0	Command	0 = Reserved, Shall Not be used 1 = Discover Identity 2 = Discover SVIDs 3 = Discover Modes 4 = Enter Mode 5 = Exit Mode 6 = Attention

Bits	Field	Description
		16 = GPMI Status Update (GPMI custom) 17 = GPMI status configure (GPMI custom)

6.2.2 Discovery SVIDs

The **SVID** field value of the VDM Header in the **Discover SVIDs** command is **PD SID** (**0xFF00**).

The DFP learns which SVIDs the message responder UFP contains through the **Discover SVIDs** command. If the responder returns an ACK, it needs to attach a list of supported SVIDs in the VDO. The SVID list usually has **0x0000** as the last one or two SVIDs. See Figure 6-17 and Figure 6-18 in USB PD 3.1-2022.7 for details.

After receiving the Discover SVIDs message, the UFP supporting GPMI mode needs to respond with the Discover SVIDs response message. The structure is shown in the following table.

Table 9 Discover SVID response message format (including GMI_SVID)

Message Header							
Rsvd	Number of Objects	Message ID	Port Data Role		Spec Revision	Rsvd	Message Type
0	2	000b…111b	0 = UFP		10b or 01b	0	01111b
VDM Header							
SVID	VDM Type	VDM Version	Rsvd	Object Position	Command Type	Rsvd	Command
0xFF00	1	01b	00b	000b	01b	0	00010b
VDO1							
Bit(s)		Value				Parameter	
B31…16		GPMI_SVID				SVID 0	
B15…0		0x0000				SVID 1	

6.2.3 Discover Modes

The **SVID** of the VDM Header in the **Discover Modes** command shall be defined as **GPMI_SVID**.

The message initiator learns which modes the responder has for a specified SVID through the **Discover Modes** command. If the responder returns an ACK, it needs to include one or more modes in the return message.

The GPMI modes supported in this document include GPMI mode (Type-C to Type-C).

After receiving the Discover Modes message with SVID **GPMI_SVID**, the UFP supporting GPMI mode needs to respond with the Discover Modes response message. The specific structure is shown in the following table.

Table 10 Discover Modes command response message format (including GPMI mode)

Message Header							
Rsvd	Number of Objects	Message ID	Port Data Role		Spec Revision	Rsvd	Message Type
0	2	000b…111b	0 = UFP		10b or 01b	0	01111b
VDM Header							
SVID	VDM Type	VDM Version	Rsvd	Object Position	Command Type	Rsvd	Command
GPMI_SVID	1	01b	00	000b	01b	0	00011b
GPMI VDO1							
Bit(s)		Value				Parameter	
B31…B4		Shall be set to 0				Reserved	
B3…B0		0000 Reserved 0001 GPMI mode (Type-C to Type-C) 0010–1111 Reserved				Device Type	

6.2.4 Enter Mode Command

The SVID of the VDM Header in the **Enter Mode** command shall be defined as **GPMI_SVID**.

The **Enter Mode** command is used by DFP to notify UFP to enter the discovered mode. Only DFP can initiate the **Enter Mode** command. DFP needs to specify the Mode number to be entered in the Object Position of the VDM Header. For a successful **Enter Mode** command process, see Figure 6-21 of USB PD 3.1-2022.7.

The **Enter Mode** command supports 0–1 VDO, and the VDO of the **Enter Mode** command is not used in GPMI mode currently. Table 11 defines the **Enter Mode** command to enter the GPMI alternate mode, where the value **001b** of **Object Position** indicates entering the mode specified by the first VDO in the Discovery Modes response message.

Table 11 Enter Mode command message format (entering the GPMI mode)

Message Header							
Rsvd	Number of Objects	Message ID	Port Data Role		Spec Revision	Rsvd	Message Type
0	1	000b…111b	1 = DFP		10b or 01b	0	01111b
VDM Header							
SVID	VDM Type	VDM Version	Rsvd	Object Position	Command Type	Rsvd	Command
GPMI_SVID	1	01b	0	001b	00b	0	00100b

6.2.5 Exit Mode Command

The SVID of the VDM Header in the **Exit Mode** command shall be defined as **GPMI_SVID**.

The **Exit Mode** command is used by the DFP to instruct the UFP to exit the GPMI alternate mode and return to normal USB mode. Only the DFP can send an **Exit Mode** command. The **Exit Mode** command has no VDOs, and the exit mode is instructed by Object Position. The value **1** represents the first mode corresponding to the VDM Header.

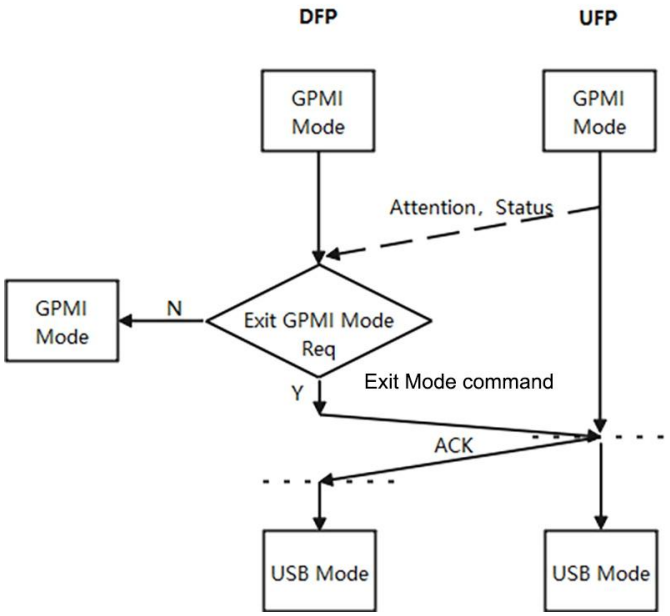
If the UFP receives an **Exit Mode** command in GPMI mode and the UFP supports USB configuration, the UFP shall switch to USB configuration and respond with the ACK. Otherwise, it responds with the NAK. After receiving the ACK, the DFP side exits the GPMI mode. For details about the exiting process, see Figure 6-24 of USB PD 3.1-2022.7.

6.2.6 Attention Command

The **Attention** command is the only VDM command that can be initiated by the UFP. It is mainly used to interrupt the DFP query status reminder in the USB PD 3.1-2022.7 specification. Note that the Objection Position must still correspond to Enter Mode. The UFP proposes a command to switch between GPMI full-function mode, GPMI compatibility mode, or GPMI **Exit Mode** in the GPMI mode, which needs to be completed through the **Attention** command. In the GPMI mode, the **Attention** command is accompanied by one VDO, and its content can be found in Table 12 GPMI VDO.

The reference flow of the **Attention** command is shown in the figure below.

Figure 10 Example flow of exiting the GPMI mode by the UFP initiating Attention



6.2.7 GPMI Status Update Command

The SVID of the VDM Header in the GPMI **Status Update** command shall be defined as **GPMI_SVID**.

The GPMI mode adds a GPMI **Status Update** command to synchronize the GPMI mode status between the DFP and UFP. The current GPMI **Status Update** command can be used to apply to the peer end for switching configurations or exiting the GPMI mode.

The message format of the GPMI **Status Update** command is as follows.

Table 12 Request message format of the GPMI Status Update command

Message Header							
Rsvd	Number of Objects	Message ID	Port Data Role		Spec Revision	Rsvd	Message Type
0	2	0…7	1 = DFP		10b or 01b	0	01111b
VDM Header							
SVID	VDM Type	VDM Version	Rsvd	Object Position	Command Type	Rsvd	Command
GPMI_SVID	1	01b	0	001b	00b	0	10000b
GPMI VDO1							
Bit(s)		Value				Parameter	
B31…7		0				Reserved	
B6		0 = Maintain the current mode 1 = Request to exit the GPMI mode (currently in GPMI mode)				Maintain or exit the GPMI mode	
B5		0 = Request to switch to the GPMI configuration (if currently in the USB mode) 1 = Request to switch to the USB configuration (if currently in the GPMI configuration)				Request to switch configurations	
B4		0 = Request the GPMI full-function mode 1 = Request the GPMI compatibility mode				Request to enter the GPMI full-function mode or compatibility mode	
B3…0		0				Reserved	

The DFP can send a **Status Update** command at any time. Usually after the Enter Mode process ends, the DFP needs to send a **Status Update** command to the UFP. After receiving the GPMI **Status Update** command, the UFP needs to add the local GPMI **Status** in the returned **ACK** command to the **VDO** command. The format of ACK message is shown in the following table.

Note: B4/B5/B6 are currently only used for the UFP sending the status update. Keep all these values at **0** when the DFP sends commands. After receiving the corresponding request, the DFP needs to switch to the corresponding mode or configuration by issuing a command according to the UFP request.

Table 13 Request message format of the GPMI Status Update command

Message Header						
Rsvd	Number of Objects	Message ID	Port Data Role	Spec Revision	Rsvd	Message Type

0	2	0…7	0 = UFP		10b or 01b	0	01111b
VDM Header							
SVID	VDM Type	VDM Version	Rsvd	Object Position	Command Type	Rsvd	Command
GPMI_SVID	1	01b	0	001b	01b	0	10000b
GPMI VDO1							
Bit(s)		Value				Parameter	
B31…7		0				Reserved	
B6		0 = Maintain the current mode 1 = Request to exit the GPMI mode (currently in GPMI mode)				Maintain or exit the GPMI mode	
B5		0 = Request to switch to the GPMI configuration (if currently in the USB mode) 1 = Request to switch to the USB configuration (if currently in the GPMI configuration)				Request to switch configurations	
B4		0 = Request the GPMI full-function mode 1 = Request the GPMI compatibility mode				Request to enter the GPMI full-function mode or compatibility mode	
B3…0		0				Reserved	

Table 14 Configurations available in the GPMI mode

USB-C Pin Configuration	Function
USB 3.2 x 1	Default USB configuration
GPMI x 4	GPMI full-function mode, which can realize all functions of the GPMI
GPMI x2 + USB 3.2 x1	GPMI compatibility mode, which can transmit USB3 data while transmitting GPMI data

6.2.8 GPMI Status Configure Command

In the GPMI mode, the DFP can send a **Status Configure** command at any time to switch between different configurations, and the UFP needs to switch configurations according to the command. After the switch is completed, an **ACK** command is sent to inform the DFP. After receiving the ACK from the UFP, the DFP performs configuration switch.

When switching configurations, first refer to **B0** to determine whether it is a USB configuration or a GPMI configuration, and then refer to **B11...8** to determine whether to enter the full-function or compatibility mode.

Table 15 Request message format of the GPMI Status Update command

Message Header							
Rsvd	Number of Objects	Message ID	Port Data Role		Spec Revision	Rsvd	Message Type
0	2	0…7	1 = DFP		10b or 01b	0	01111b
VDM Header							
SVID	VDM Type	VDM Version	Rsvd	Object Position	Command Type	Rsvd	Command
GPMI_SVID	1	01b	0	001b	00b	0	10001b
GPMI VDO1							
Bit(s)		Value				Parameter	
B31…12		0				Reserved	
B11…8		0h = Pin configuration not selected 4h = GPMI full-function mode configuration 8h = GPMI compatibility mode configuration				Configuration switch in the GPMI mode	
B7…1		0				Reserved	
B0		0 = Set to USB configuration 1 = Set to GPMI configuration				Selecting USB configuration or GPMI configuration	

Note: The USB configuration in Table 15 is a single-lane USB configuration.

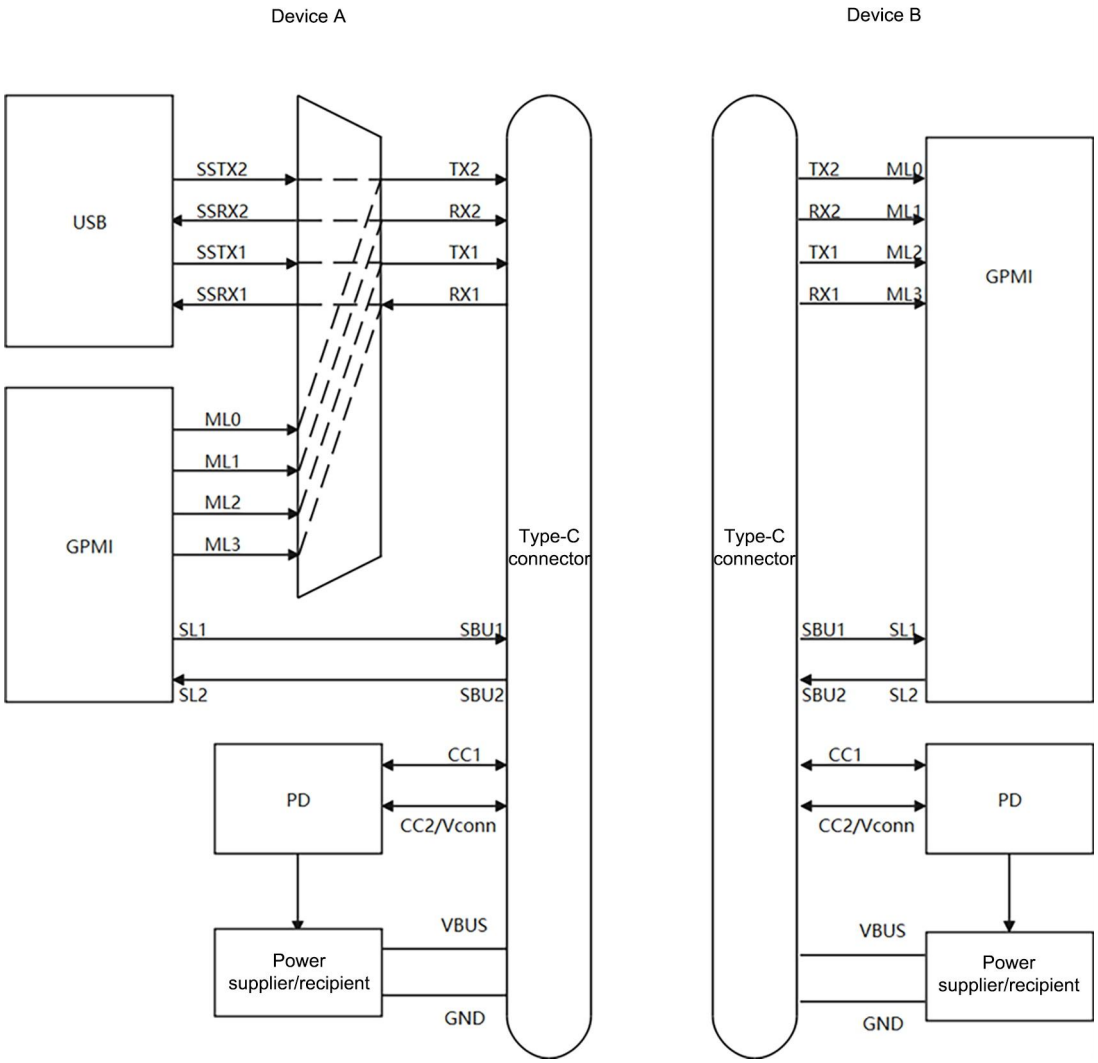
7 Example of Alternate Mode

7.1 GPMI Full-Function Mode Example

This example describes how a GPMI device can support the full-function configuration in the GPMI mode using Type-C connectors through custom VDM messages. In the example, device A supports two modes: GPMI and USB. Device B is a standard GPMI device. When a Type-C connector is used, it only supports the GPMI function and does not support switching between the USB mode and GPMI mode according to the type of peer device.

The logic diagram in the GPMI device mode is shown in the figure below.

Figure 11 Logic diagram of the GPMI full-function mode



When the USB PD controller detects that the device is inserted through CC, it feeds back the insertion status and orientation to the GPMI controller.

The USB PD controller confirms the power supplier and power recipient based on the USB PD 3.1-2022.7 specification, and supplies power on VBUS/Vconn. After completing the power supply and data role allocation, it detects the standard/mode supported by the peer device through Discover SVID/Discover Mode in the VDM message, enters the USB working mode or GPMI mode according to the standard and mode supported by the peer device, and controls the selection multiplexer to switch between USB and GPMI modes.

When the USB PD of device A detects that the peer device is a USB device, the USB PD controller configures the selection multiplexer to USB mode.

When the USB PD of device B detects that the peer device is a GPMI device, the USB PD controller configures the selection multiplexer to GPMI mode. When entering the GPMI mode, the GPMI device refreshes its own status according to the insertion orientation, configures the channels of the main link and sideband link, and configures the sending and receiving of sideband links SL1 and SL2. For details, see Section 5.

If the sideband link communication is normal, the GPMI performs the control-related functions

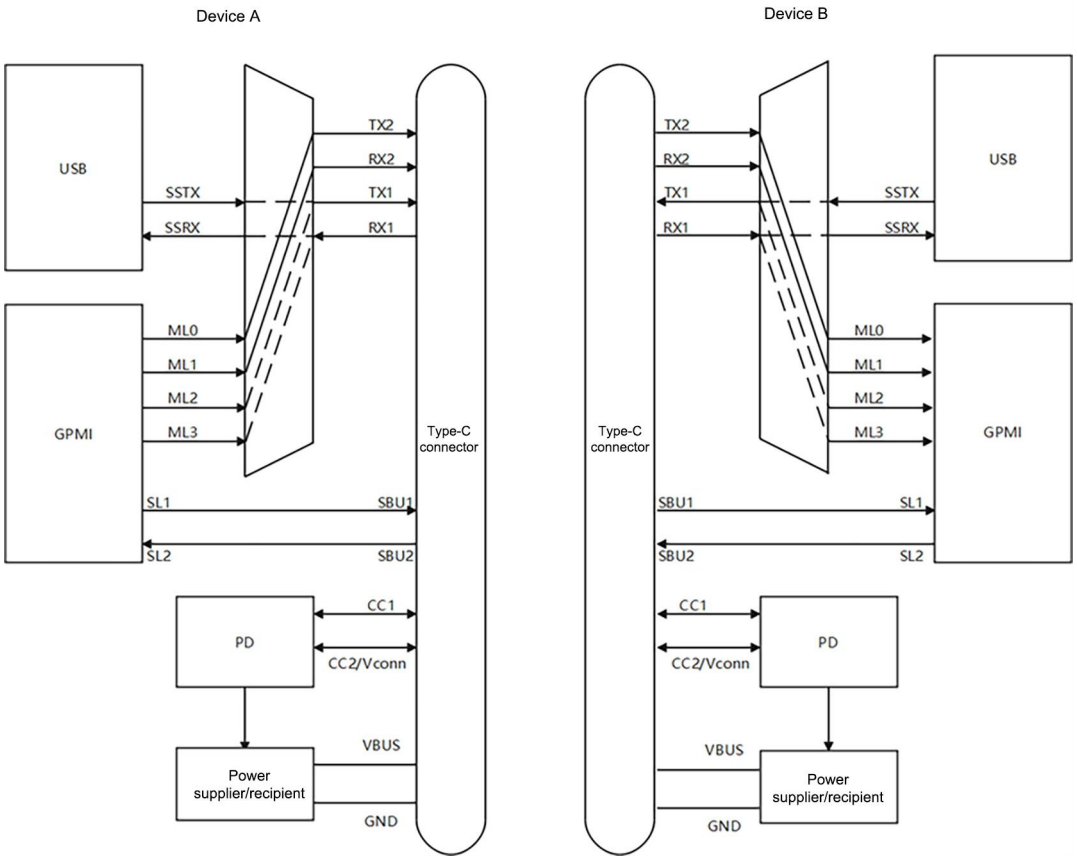
through the management adapter, officially enters the GPMI working mode, and transmits GPMI high-speed signals through the Type-C port.

7.2 GPMI Compatibility Mode Example

This example describes how a GPMI device configures the GPMI compatibility mode using a Type-C connector via a USB PD vendor custom VDM message. Both the source device and sink device support the GPMI compatibility mode.

When the USB PD controller detects that the device is inserted through CC, it feeds back the insertion status and orientation to the GPMI controller. The GPMI device refreshes its own status based on the insertion orientation, and configures the main link, CC1/CC2, and sideband links SL1 and SL2 for sending and receiving data. For configurations, see Section 5.3.3.

Figure 12 Logic diagram of the GPMI compatibility mode



The USB PD controller confirms the power supplier and power recipient based on the USB PD 3.1-2022.7 specification, and supplies power on VBUS/Vconn. After completing the power supply and data role allocation, the USB PD controller detects the standard and mode supported by the peer device through the Structure VDM message Discover SVID/Discover Mode, and enters the USB working mode or GPMI mode according to the standard and mode supported by the peer device. In this example, both device A and device B support GPMI compatibility mode. Device A sends an **Enter Mode** command to enter the GPMI mode.

After receiving the **Enter Mode** command, the UFP switches to the GPMI mode and returns an ACK. After the DFP receives the ACK, it switches to the GPMI mode. After entering the GPMI mode, the USB configuration is applied by default. The DFP understands the configuration intention of both devices by sending a **Status Update** command, and switches configurations

through the **Status Configure** command. The GPMI channel starts subsequent operations through SL, and the USB channel starts the insertion detection and enumeration process according to the USB protocol.