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T/SUCA 001.3-2024

General Purpose Multimedia Interface Specification 1.0
Part 3: Connectors and Cables

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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 3 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.

Drafting organizations of this standard: Huawei Technologies Co., Ltd., China Electronics Standardization Institute, Jiangsu Anlan-WK Electronics Co., Ltd., HiSilicon Technologies Co. Ltd., Shenzhen Chuangwei-RGB Electronics Co., Ltd., Shenzhen Skyworth Digital Technology Co., Ltd., Guilin University of Electronic Technology, Shenzhen CESI Information Technology Co., Ltd., Hynetek Semiconductor Co., Ltd., Hangzhou Hikvision Digital Technology Co., Ltd., Shenzhen Bajiuling Optoelectronics Technology Co., Ltd., Shenzhen Afalight Co., Ltd., Shenzhen DNS Industries Co., Ltd., Ceyear Technologies Co., Ltd., Guangdong Wire & Cable Association, and Shenzhen 8K UHD Video Industry Cooperation Alliance.

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General Purpose Multimedia Interface Specification Part 3: Connectors and Cables

1 Scope

This document specifies the technical requirements for connectors and cables using Type-B general purpose multimedia interface, including dimensions, mechanical characteristics, electrical characteristics, and environmental adaptability.

This document is applicable to the design and development of Type-B general purpose multimedia interfaces and cables of such interfaces. This document may be referenced for consumer electronic devices and other electronic devices adopting the general-purpose multimedia interface.

This document only specifies technical requirements for passive cable components.

This document does not apply to Type-C general purpose multimedia interfaces.

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.

GB/T 16935.1-2023 Insulation Coordination for Equipment Within Low-Voltage Supply Systems—Part 1: Principles, Requirements and Tests

GB/T 17626.2-2006 Electromagnetic Compatibility—Testing and Measurement Techniques—Electrostatic Discharge Immunity Test

GB/T 18015.1-2017 Multicore and Symmetrical Pair/Quad Cables for Digital Communications—Part 1: Generic Specification

GB/T 26572-2011 Requirements of Concentration Limits for Certain Restricted Substances in Electrical and Electronic Products

GB/T 4210-2015 Electrotechnical Terminology—Electromechanical Components for Electronic Equipment

SJ/T 11364-2014 Marking for Restriction of Hazardous Substances in Electrical and Electronic Products

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 001.4-2024 General Purpose Multimedia Interface Specification—Part 4: Power Supply

IEC 62153-4-9-2018 Metallic Communication Cable Test Methods - Part 4-9: Electromagnetic Compatibility (EMC) - Coupling Attenuation of Screened Balanced Cables, Triaxial Method

3 Term, Definition, and Abbreviation

3.1 Terms and Definitions

The terms and definitions defined in T/SUCA 001.1-2024 and T/SUCA 001.4-2024 and the following apply to this document.

3.1.1 connector

Components that are combined and separated with corresponding plug-in components.

[Source: GB/T 4210-2015, 2.6]

3.1.2 pin

Terminals used to make electrical connections.

3.1.3 mated connector

The male and female connectors that can be plugged into each other.

Note: The male connector is also known as the plug or male header, and the female connector is also known as the socket or female header.

3.1.4 near-end crosstalk

The magnitude of the signal power that is coupled from a near-end disturbing wire (pair) to a near-end disturbed wire (pair).

[Source: GB/T 18015.1-2017, 3.14, modified]

Note: It is also known by the abbreviation NEXT.

3.1.5 far-end crosstalk

The magnitude of the signal power that is coupled from a near-end disturbing wire (pair) to a far-end disturbed wire (pair).

[Source: GB/T 18015.1-2017, 3.15, modified]

Note: It is also known by the abbreviation FEXT.

3.2 Abbreviations

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

CL: cable information link

DBUS: digital bus

DGND: digital ground (digital GND)

EMC: electromagnetic compatibility

EMI: electromagnetic interference

ESD: electrostatic discharge

ML: main link

PBUS: power bus

PCB: printed circuit board

PGND: power ground (power GND)

RSV: reserved pins

SDC: differential to common conversion

SMA: sub-miniature A connector

SL: sideband link

TP: test point

4 Type-B Connector

4.1 Basic Requirements

4.1.1 Working Environment

Unless otherwise specified, Type-B connectors shall work in the following environments:

——Temperature: –15°C to 70°C;

——Relative humidity: 0% to 90%;

——Atmospheric pressure: 86 kPa to 106 kPa.

4.1.2 Electrostatic Discharge Protection

Type-B connectors should meet the requirements of GB/T 31841-2015.

4.1.3 Restriction and Prohibition

Type-B connectors shall comply with the provisions of GB/T 26572-2011 and SJ/T 11364-2014.

4.1.4 Pin Description and Structure

4.1.4.1 Pin Description

The male and female Type-B connectors shall adopt a central symmetrical design and support forward and reverse plug-in (commonly referred to as "reversible plug-in"). The male connector has 42 pins and the female connector has 44 pins, as shown in Figure 1. The pins of the Type-B connector include the following:

—16 main link (ML) pins, ML0+ to ML7+ and ML0- to ML7-

—2 cable information link (CL) pins, CL1 and CL2

—2 sideband link (SL) pins, SL1 and SL2

—USB 2.0 D+/D- pins, the female connector including two pairs and the male connector including one pair

—4 reserved (RSV) pins, RSV1, RSV2, RSV3, and RSV4

—8 digital ground (DGND) pins, also known as isolated ground pins

—4 power bus (PBUS) pins

—4 power ground (PGND) pins

Note 1: The power bus is referred to as PBUS, and the power ground is also known as PGND.

Note 2: DGND is used in connectors for reference ground and noise isolation of high-speed digital signals to ensure signal integrity, so it is also known as isolated ground.

ML pins are high-speed signal pins and shall be used in pairs to transmit signals at a rate greater than 1 Gbps. CL pins, SL pins, USB 2.0 D+/D- pins, and RSV pins are low-speed signal pins used to transmit signals at a rate less than 1 Gbps.

Figure 1 Distribution of Type-B connector pins

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22
PGND	ML6+	ML6−	DGND	ML2+	ML2−	DGND	RSV1	PBUS	CL1	D+	D−	RSV4	PBUS	SL1	DGND	ML1−	ML1+	DGND	ML5−	ML5+	PGND
PGND	ML7+	ML7−	DGND	ML3+	ML3−	DGND	SL2	PBUS	RSV3	D−	D+	CL2	PBUS	RSV2	DGND	ML0−	ML0+	DGND	ML4−	ML4+	PGND
B22	B21	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

(a) Type-B female connector

A22	A21	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
PGND	ML5+	ML5−	DGND	ML1+	ML1−	DGND	SL1	PBUS	RSV4	D−	D+	CL1	PBUS	RSV1	DGND	ML2−	ML2+	DGND	ML6−	ML6+	PGND
PGND	ML4+	ML4−	DGND	ML0+	ML0−	DGND	RSV2	PBUS	CL2			RSV3	PBUS	SL2	DGND	ML3−	ML3+	DGND	ML7−	ML7+	PGND
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22

(b) Type-B male connector

The Type-B female connector includes upper and lower pin groups, referred to as the first pin group and the second pin group. Each group includes 22 pins. The pin signal sequence distribution of the first pin group is opposite to that of the second pin group, and the contact segments of multiple pins in the two pin groups are centrally symmetric (also known as oblique symmetry) to support reversible plug-in. This means that pins corresponding to A1–A22 and B1–B22 sequentially transmit the same type of signals. The signal sequence of the two pin groups is as follows:

— The signal sequence of the first pin group (A1–A22) is as follows: PGND pin, ML pin pair (ML6+, ML6-), DGND pin, ML pin pair (ML2+, ML2-), DGND pin, RSV pin (RSV1), PBUS pin (PBUS), CL pin (CL1), USB 2.0 pin pair (D+, D-), RSV pin (RSV4), PBUS pin, SL pin (SL1), DGND pin, ML pin pair (ML1-, ML1+), DGND pin, ML pin pair (ML5-, ML5+), and PGND pin.

— The signal sequence of the second pin group (B1–B22) is as follows: PGND pin, ML pin pair (ML7+, ML7-), DGND pin, ML pin pair (ML3+, ML3-), DGND pin, SL pin (SL2), PBUS pin, RSV pin (RSV3), USB 2.0 pin pair (D-, D+), CL pin (CL2), PBUS pin, RSV pin (RSV2), DGND pin, ML pin pair (ML0-, ML0+), DGND pin, ML pin pair (ML4-, ML4+), and PGND pin.

Note: The pins corresponding to A1–A22 and B1–B22 sequentially transmit the same type of signals—A1 and B1, A2 and B2, ... , A22 and B22 transmit the same type of signals.

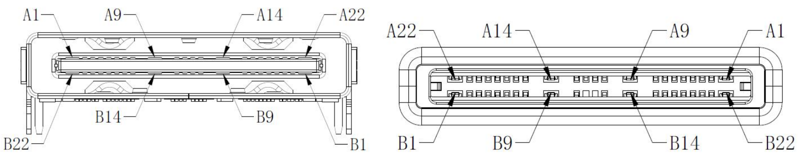
The Type-B male connector includes upper and lower pin groups, referred to as the third pin group and the fourth pin group. The third pin group includes 22 pins, and the fourth pin group includes 20 pins. The pin signal sequence distribution of the third pin group is opposite to that of the fourth pin group, and the mating segments of multiple pins in the two pin groups are centrally symmetric (also known as oblique symmetry). This means that except for A11 and B11, and A12 and B12, pins corresponding to A1–A22 and B1–B22 sequentially transmit the same type of signals. The signal sequence of the two pin groups is as follows:

— The signal sequence of the third pin group (A22–A1) is as follows: PGND pin, ML pin pair (ML5+, ML5-), DGND pin, ML pin pair (ML1+, ML1-), DGND pin, SL pin (SL1), PBUS pin, RSV pin (RSV4), USB 2.0 pin pair (D-, D+), CL pin (CL1), PBUS pin, RSV pin (RSV1), DGND pin, ML pin pair (ML2-, ML2+), DGND pin, ML pin pair (ML6-, ML6+), and PGND pin.
— The signal sequence of the fourth pin group (B1–B22) is as follows: PGND pin, ML pin pair (ML4+, ML4-), DGND pin, ML pin pair (ML0+, ML0-), DGND pin, RSV pin (RSV2), PBUS pin (PBUS), CL pin (CL2), RSV pin (RSV3), PBUS pin, SL pin (SL2), DGND pin, ML pin pair (ML3-, ML3+), DGND pin, ML pin pair (ML7-, ML7+), and PGND pin.

Each pin group of the Type-B female and male connectors includes 4 ML pin pairs and 2 PBUS pin pairs, and each ML pin pair includes 2 adjacent ML pins, such as A2 (ML6+) and A3 (ML6-) in the first pin group. As shown in Figure 2, each PBUS pin pair includes 1 PBUS pin and 1 PGND pin. PBUS pin pairs of female and male connectors:

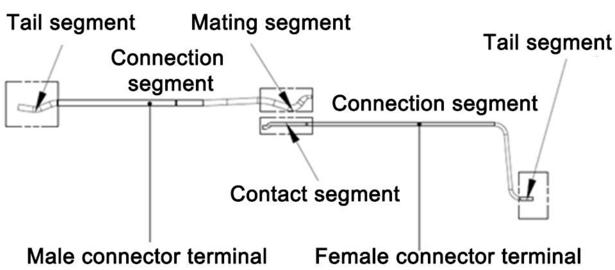
— The first pin group includes 2 PBUS pin pairs: A9 and A1, and A14 and A22;
— The second pin group includes 2 PBUS pin pairs: B14 and B22, and B9 and B1;
— The third pin group includes 2 PBUS pin pairs: A14 and A22, and A9 and A1;
— The fourth pin group includes 2 PBUS pin pairs: B9 and B1, and B14 and B22.

Figure 2 Front view of female and male Type-B connectors



Each pin of the Type-B female connector includes a contact segment, a connection segment, and a tail segment, and each pin of the Type-B male connector includes a mating segment, a connection segment, and a tail segment. The mating segment of the male connector pin contacts the contact segment of the female connector pin to establish electrical connection between the male and female connectors.

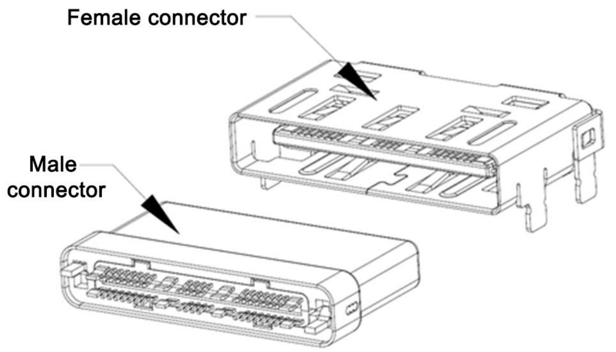
Figure 3 Connection of male and female connector pins



4.1.4.2 Connector Structure

Type-B male and female connectors are shown in Figure 4.

Figure 4 Type-B male and female connectors



The dimensions of the Type-B female connector are shown in Figures 5 and 6. The dimensions of the Type-B male connector are shown in Figures 7 and 8. The upper and lower pin groups of male and female connectors are stacked and spaced apart from each other. The matching length and width requirements of the Type-B female and male connectors are as follows:

— The matching length and width of the female connector: 19.70 mm × 3.49 mm; matching depth: 6.25 mm.

— The matching length and width of the male connector: 19.58 mm × 3.17 mm; matching depth: 6.25 mm.

Figure 5 Type-B female connector 2D dimension (a)

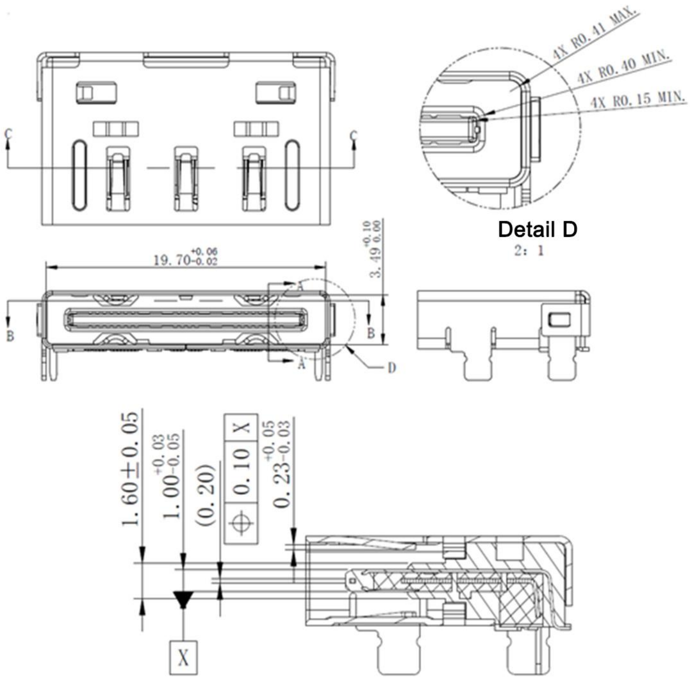


Figure 6 Type-B female connector 2D dimension (b)

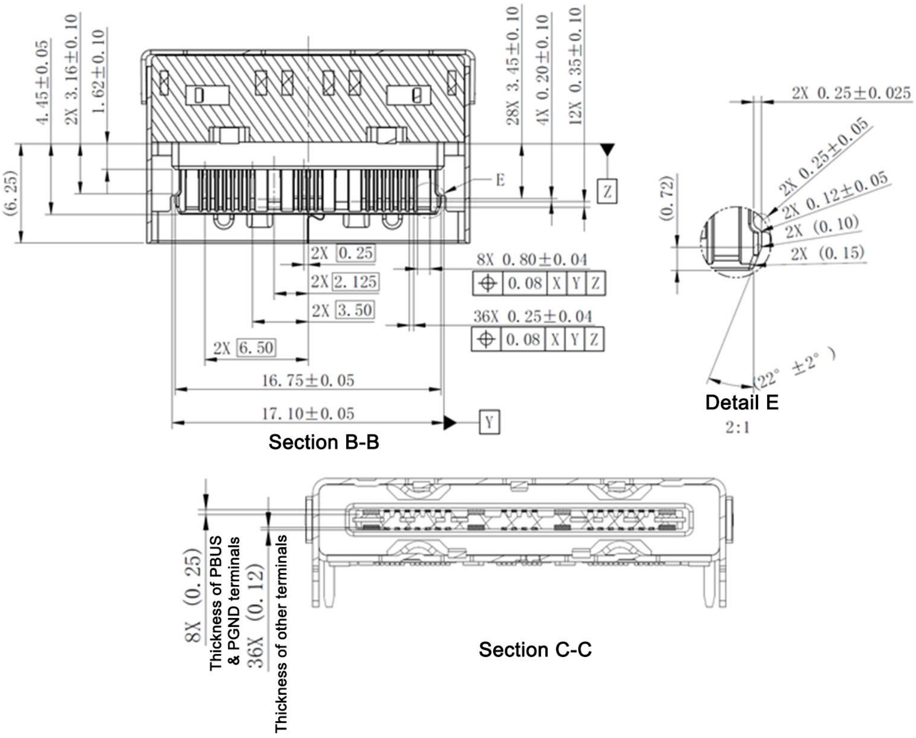


Figure 7 Type-B male connector 2D dimension (a)

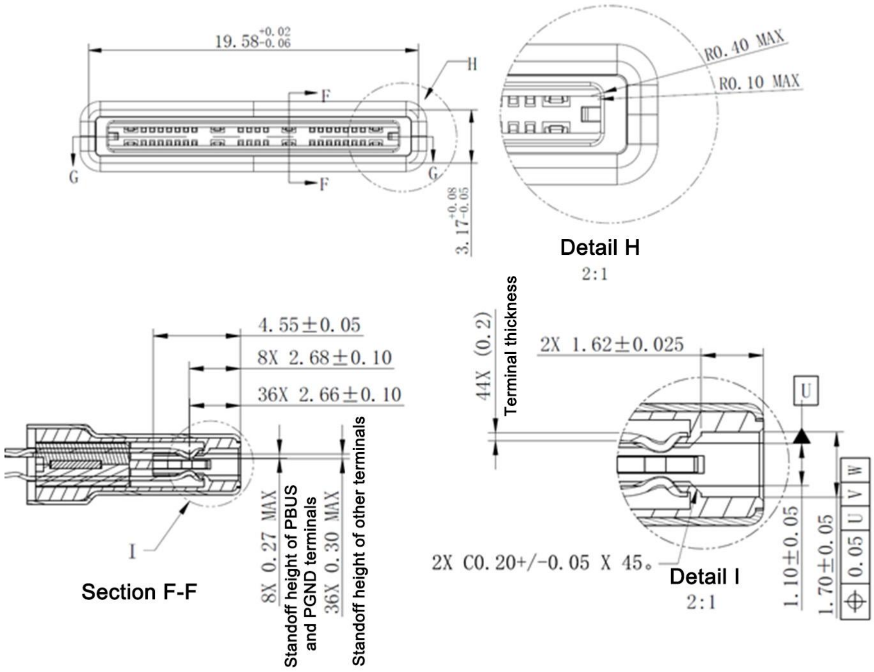
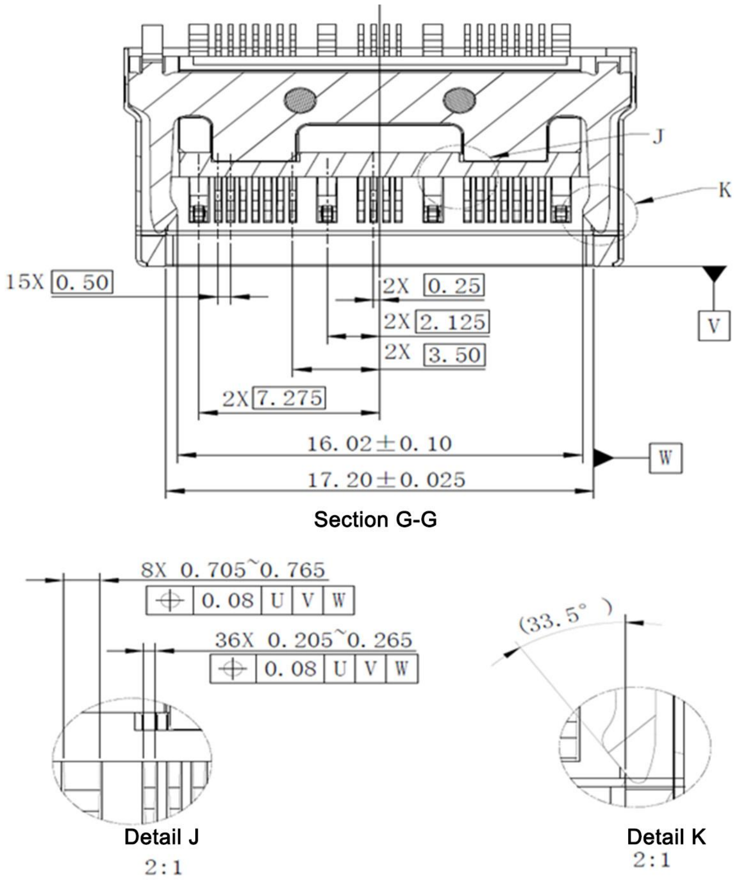


Figure 8 Type-B male connector 2D dimension (b)



As shown in Figure 9, for contact segments, the cross-sectional area of the female connector PBUS pin and PGND pin shall be larger than that of other pins (such as ML pins). For connection segments, the cross-sectional area of the female connector PBUS pin and PGND pin shall be larger than that of other pins. For tail segments, the cross-sectional area of the female connector PBUS pin and PGND pin shall be larger than that of other pins.

As shown in Figure 10, for mating segments, the cross-sectional area of the male connector PBUS pin and PGND pin shall be larger than that of other pins (such as ML pins). For connection segments, the cross-sectional area of the male connector PBUS pin and PGND pin shall be larger than that of other pins. For tail segments, the cross-sectional area of the male connector PBUS pin and PGND pin shall be larger than that of other pins.

Figure 9 Type-B female connector PBUS pin and PGND pin width

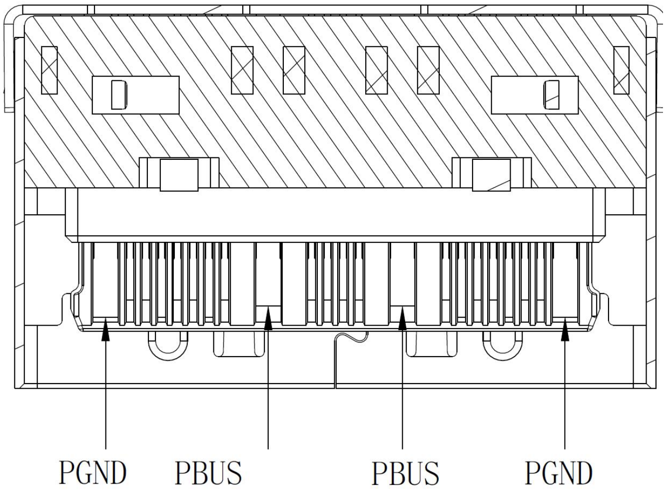
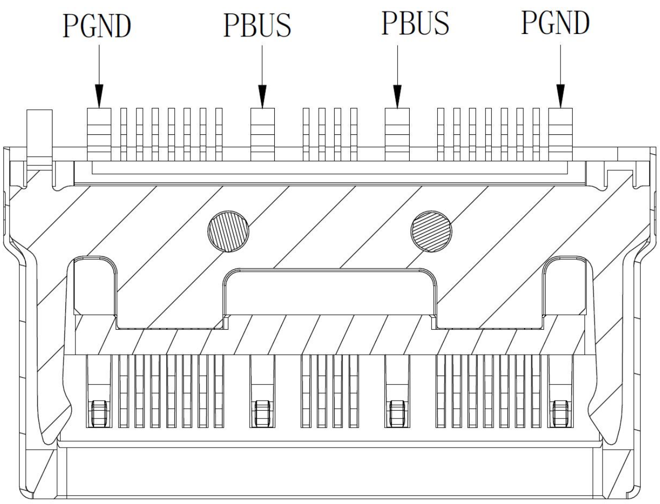


Figure 10 Type-B male connector PBUS pin and PGND pin width

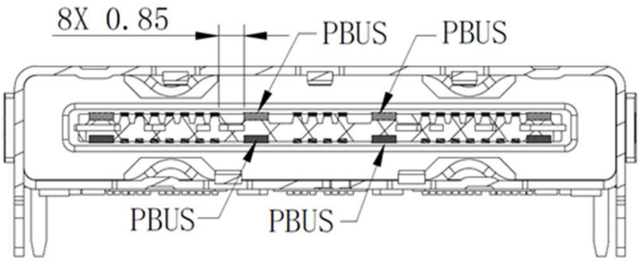


Type-B male and female connector PBUS pins support 48 V working voltage, which shall comply with the provisions of Table F.5 in GB/T 16935.1-2023. The minimum spacing between PBUS pins and adjacent pins shall be 0.85 mm. The materials shall meet the use environment requirements of pollution degree 2 specified in Section 4.5.2 of GB/T 16935.1-2023. Plastics should meet the requirements of material group II or material group I of pollution degree 2 specified in Table F.5 of GB/T 16935.1-2023.

As shown in Figure 11, the spacing between Type-B female connector PBUS pins and adjacent pins shall be greater than the spacing between Type-B female connector ML pins and adjacent pins, and the spacing between Type-B male connector PBUS pins and adjacent pins shall be greater than the spacing between Type-B male connector ML pins and adjacent pins.

Note: The spacing between 2 adjacent pins of Type-B male connector refers to the spacing between mating segments of 2 adjacent pins, and the spacing between 2 adjacent pins of Type-B female connector refers to the spacing between contact segments of 2 adjacent pins.

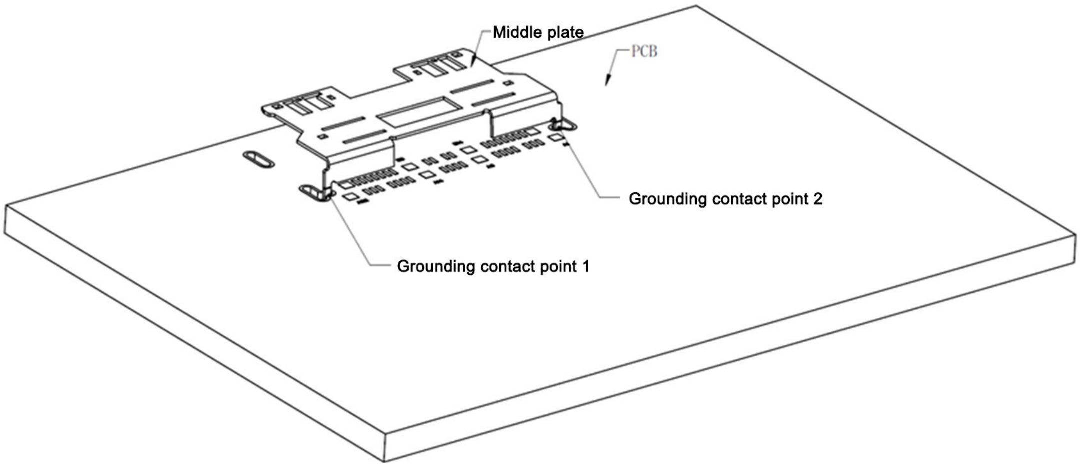
Figure 11 Spacing between Type-B female connector PBUS pins and adjacent pins



Section C-C

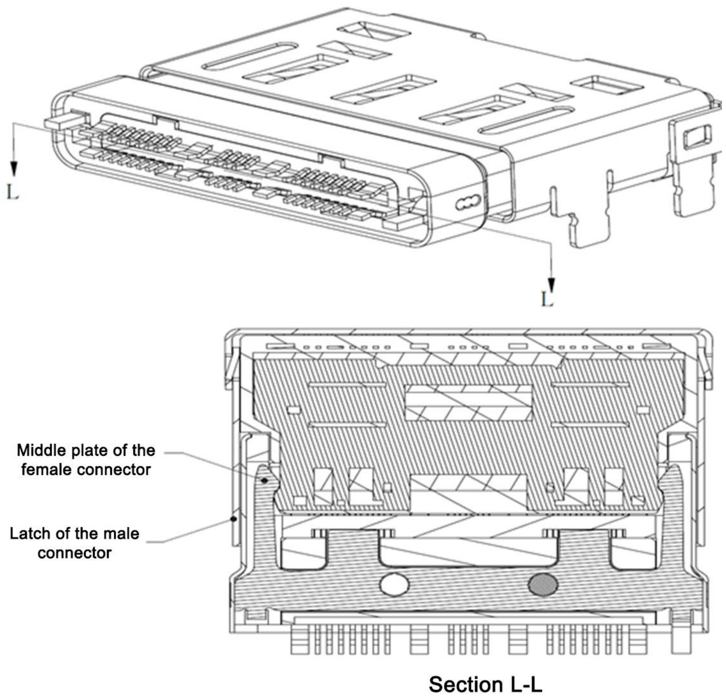
As shown in Figure 12, the metal material of the middle plate shall prevent interference between the upper and lower rows of signals, and there shall be at least two grounding contact points between the middle plate and the PCB.

Figure 12 Implementation of a middle plate



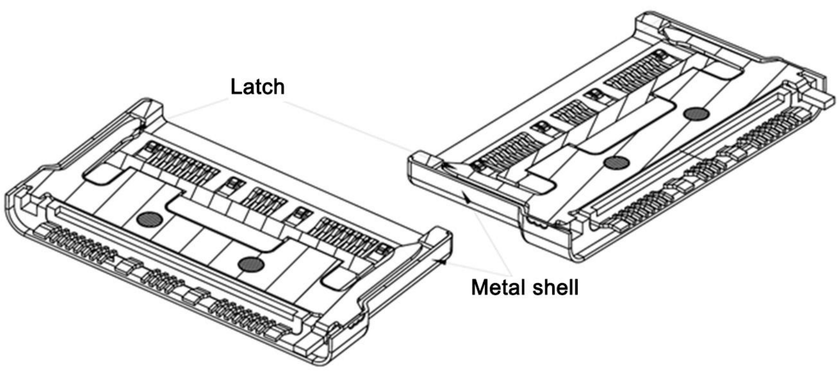
The male and female connectors feature a side latch mechanism, where the male connector's latch engages with the middle plate of the female connector's tongue, as shown in Figure 13.

Figure 13 Male connector's latch engaging with the middle plate of the female connector's tongue



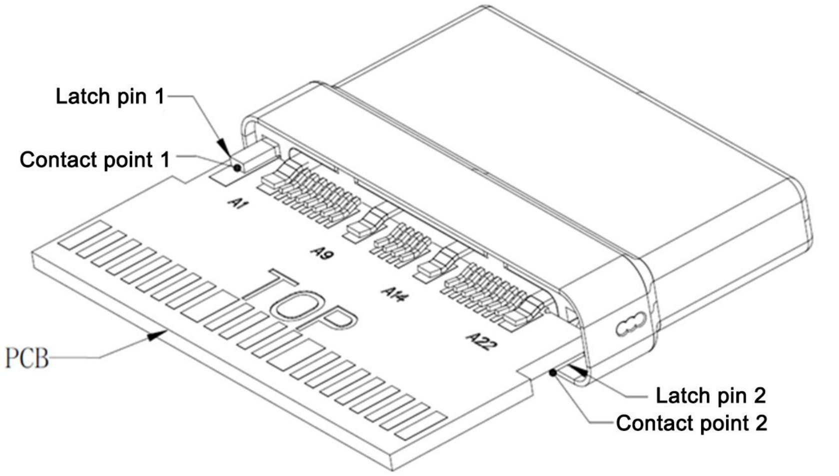
As shown in Figure 14, the male connector's latch should be securely fastened to both sides of its shell.

Figure 14 Male connector's latch and metal shell



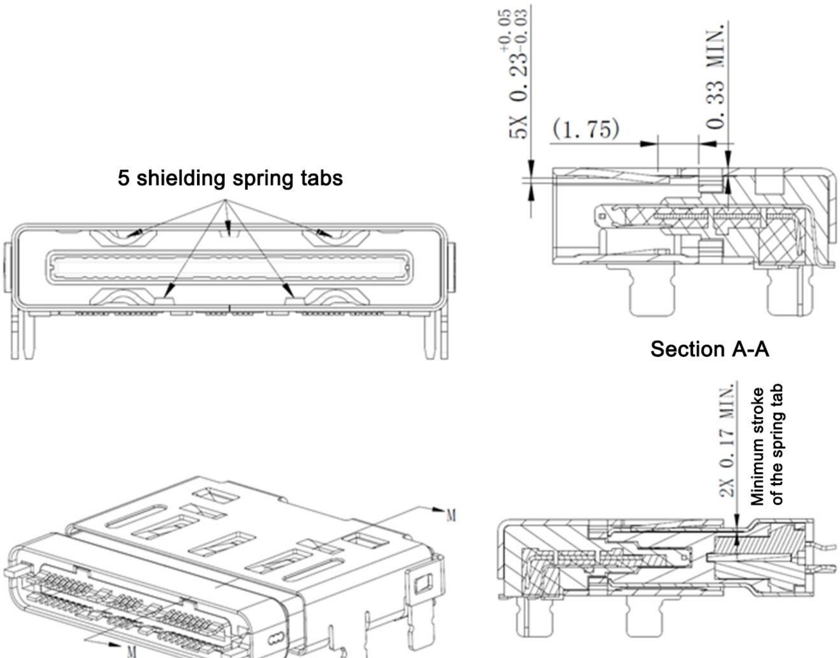
As shown in Figure 15, there should be two grounding contact points between the male connector's latch and its corresponding PCB to form a grounding circuit.

Figure 15 Male connector's latch and PCB circuit contact points



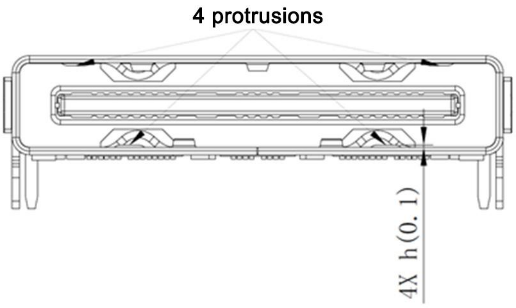
As shown in Figure 16, the female connector's inner frame should have five shielding spring tabs, which shall connect to the male connector's shell during mating.

Figure 16 Design of female connector's shielding spring tabs



As shown in Figure 17, the female connector's inner frame should be designed with four protrusions to ensure stable mating.

Figure 17 Type-B female connector protrusions



Signal pins and PBUS pins must not be short-circuited to the shell. The length of the Type-B female connector shell should be 6.25 mm.

4.1.4.3 Mating Sequence

The side view of the mating sequence of Type-B connectors is shown in Figure 18, and the top view of the insertion and mating sequence is shown in Figure 19. During the mating process of male and female connectors, the contact sequence of functional pins and spring tabs is as follows: EMI spring tabs, GND (including PGND and DGND) pins, PBUS pins, and other pins. Each pin establishes electrical connection between the male and female connectors after mating through its contact segment.

Note: The term "other pins" in this section refers to pins other than GND pins and PBUS pins.

Figure 18 Side view of the mating sequence of Type-B connectors

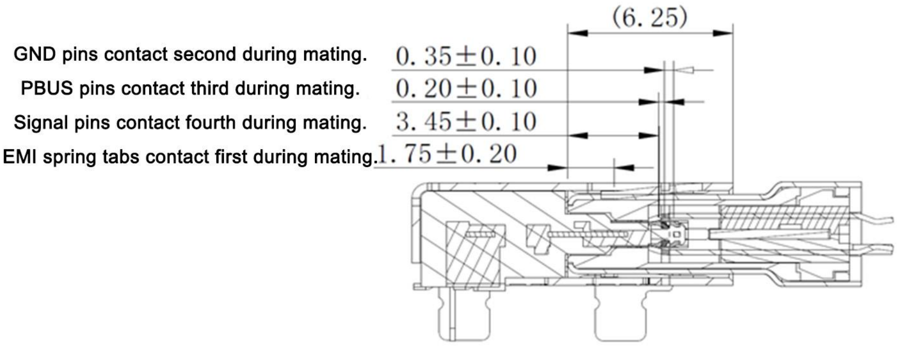
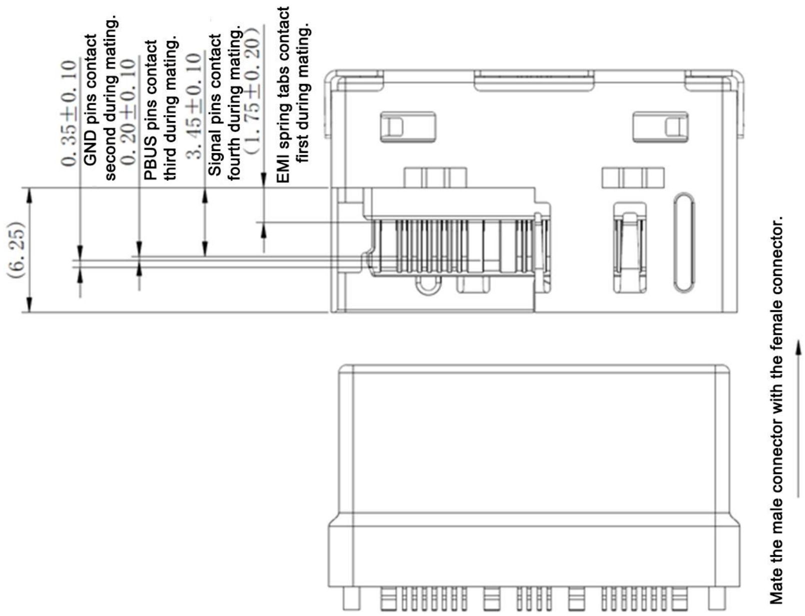


Figure 19 Top view of the mating sequence of Type-B connectors



4.2 Functional Requirements

4.2.1 RSV Pin

The RSV pins of the Type-B connector are used for protocol upgrades or expansions. Pin function extensions shall comply with the following requirements:

— RSV1 and RSV2 pins are allowed to transmit low-speed signals (rates less than 1 Gbps).

— RSV3 and RSV4 pins are allowed to transmit low-speed signals (rate less than 1 Gbps) or supply power. For power use, the voltage per pin should not exceed 5.5 V, and the current should not exceed 0.65 A. RSV3 and RSV4 may support higher current or voltage, but shall comply with the specifications in product documentation.

— Due to the reversible plug-in feature of the connector, RSV pins shall be used in pairs, that is, RSV1/RSV2 and RSV3/RSV4 shall be used in pairs.

4.2.2 Power Supply Capacity

PBUS pins support a current-carrying capacity of 10 A and a voltage of 48 V. PBUS pins may support higher currents or voltages, but such usage shall comply with the specifications in product documentation.

Each CL pin supports a current-carrying capacity of 0.65 A and a voltage not exceeding 5.5 V.

The power supply capacity of RSV pins shall comply with the requirements in 4.2.1.

4.3 Performance Requirements

4.3.1 Mechanical Indicator

The mechanical indicators of the connector shall comply with the requirements in Table 1.

Table 1 Mechanical indicators of Type-B connectors

No.	Mechanical Indicator	Technical Requirements
1	Mating force	The force range for the first or subsequent mating shall be 5 N to 20 N.
2	Unmating force	The unmating force range shall be 15 N to 35 N. After 5,000 mating and unmating cycles, the unmating force shall be 10 N to 35 N.
3	Durability	After 5,000 mating and unmating cycles, the connector and cable show no physical damage, and the electrical performance meets all specified criteria.
4	Torque (optional)	(a) When a torque of 0–1.125 N·m is applied in upward, downward, left, or right directions, the male connector shall not disengage from the test fixture or exhibit mechanical failure. (b) When a torque of 2.0 N·m is applied in upward/downward directions and 3.5 N·m in left/right directions, the male connector shall disengage from the female connector or exhibit mechanical failure.
5	Random vibration	(a) The connector shall exhibit no functional failure, terminal deformation, or physical damage such as cracks or breaks in plastic. (b) Momentary disconnection during testing shall not exceed 1 μs. (c) After testing, low-level contact resistance, insulation resistance, dielectric withstand voltage, mating force, and unmating force meet the requirements.

4.3.2 Environmental Indicator

The environmental indicators of connectors shall comply with the requirements in Table 2.

Table 2 Environmental technical requirements for connectors

No.	Environment	Technical Requirements
1	Damp-heat cycle	Temperature: 25°C to 85°C; humidity: 80% RH to 95% RH; 10 cycles (24 hours per cycle). After testing, leave at room temperature for 24 hours: (a) The connector shall exhibit no functional failure, terminal deformation, or physical damage such as cracks or breaks in plastic. (b) Mating state: Contact resistance, insulation resistance, and withstand voltage meet the test requirements. Unmating state: Insulation resistance and withstand voltage meet the test requirements.
2	Temperature shock	Temperature: –55°C to 85°C; 25 alternating cycles (1 hour per cycle). After testing: (a) The connector shall exhibit no functional failure, terminal deformation, or physical damage such as cracks or breaks in

No.	Environment	Technical Requirements
		plastic. (b) Contact resistance, insulation resistance, and withstand voltage meet the test requirements.
3	High temperature/humidity	Temperature: 85°C; humidity: 95% RH; testing duration: 120 hours. After testing, leave at room temperature for 24 hours: (a) The connector shall exhibit no functional failure, terminal deformation, or physical damage such as cracks or breaks in plastic. (b) Contact resistance, insulation resistance, and withstand voltage meet the test requirements.
4	Salt spray	Temperature: 35±2°C; humidity: 95% RH to 98% RH; NaCl concentration: 5%; continuous spray for 48 hours. After testing, rinse and leave at room temperature for 2 hours: (a) When observed under 40x magnifier, the plating on contact areas shows no peeling, cracking, wrinkling, or separation. The area of corrosion products on the surface is less than 5%, and the maximum diameter of corrosion spots is less than 0.05 mm. (b) Contact resistance, insulation resistance, withstand voltage, mating force, and unmating force meet the test requirements[a].
[a] The assessment area includes all visually metallic areas of the tongue and metal shell, and all exposed metallic areas of the middle plate. The metal shell meets the 24-hour salt spray requirement. Exposed metallic areas of the shell, middle plate, and terminals show no corrosion products. Contact resistance and insulation resistance meet requirements.		

4.3.3 DC Electrical

The DC electrical indicators of the connector shall comply with the requirements of Table 3.

Table 3 DC electrical indicators of Type-B connectors

No.	Electrical Indicator	Function	Technical Requirements
1	Low-level contact resistance	Ensure that the change in pin contact resistance remains within controlled limits, both initially and after medium- and long-term use.	The resistance of PBUS and PGND pins is not higher than 10 mΩ. After mating and unmating testing and environmental testing, the change shall be less than 10 mΩ. The resistance of RSV3 and RSV4 pins is not higher than 45 mΩ. After mating and unmating testing and environmental testing, the change shall be less than 10 mΩ. The resistance of other pins is not higher than 60 mΩ. After mating and unmating testing and environmental testing, the change shall be less than 10 mΩ.
2	Insulation resistance	Ensure a high enough resistance between the two circuits of the	The initial resistance shall be greater than 1000 mΩ. After environmental testing, the

No.	Electrical Indicator	Function	Technical Requirements
		connector to prevent weak currents that could affect signal transmission.	resistance shall be greater than 100 mΩ.
3	Dielectric withstand voltage	Ensure connector safety under overvoltage conditions, preventing short circuits and potential hazards like fire.	No breakdown shall occur between any adjacent conductors. The leakage current shall not exceed 0.5 mA.
4	Temperature rise	—	The maximum temperature rise on the connector surface shall not exceed 30°C.

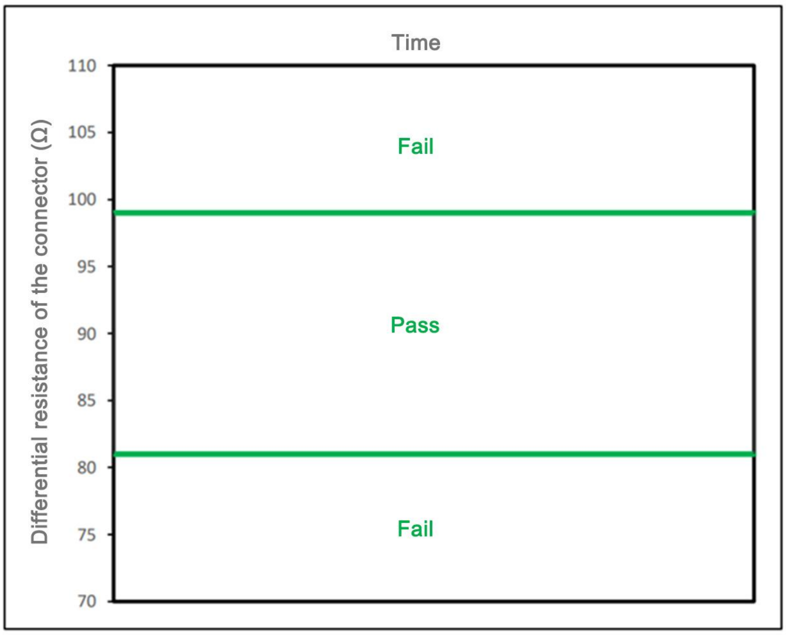
4.3.4 Signal Integrity

4.3.4.1 High-Speed Signal

4.3.4.1.1 Differential Resistance

The differential resistance of the mating connector should be 90 Ω±10%. The differential resistance of the connector lane should not be out of the upper and lower limits in Figure 20.

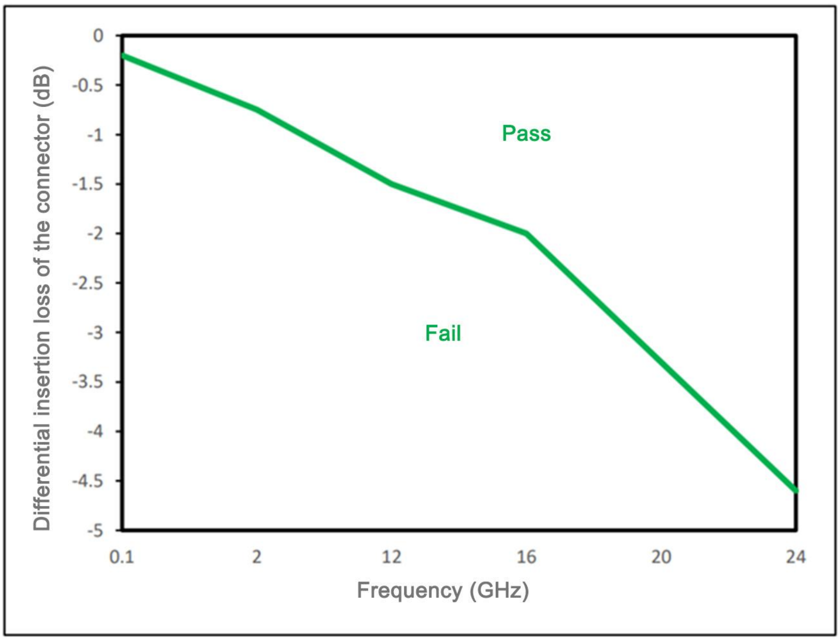
Figure 20 Requirements for Type-B mating connector lane differential resistance



4.3.4.1.2 Differential Insertion Loss

Figure 21 is generated based on the following frequencies and corresponding differential insertion loss values: (0.1 GHz, –0.2 dB), (2 GHz, –0.75 dB), (12 GHz, –1.5 dB), (16 GHz, –2 dB), (20 GHz, –3.3 dB), (24 GHz, –4.6 dB). The differential insertion loss of mating connectors should be higher than the benchmark values at each frequency point indicated by the polyline in the figure.

Figure 21 Requirements for Type-B mating connector insertion loss



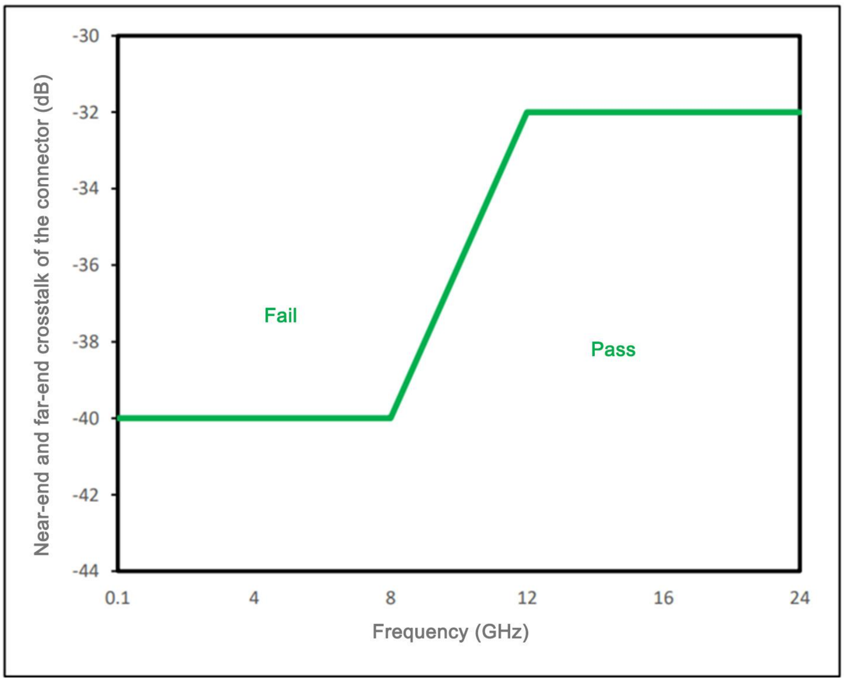
4.3.4.1.3 Differential Near-End and Far-End Crosstalk

Figure 22 is generated based on the following frequencies and corresponding differential near-end crosstalk values: (0.1 GHz, –40 dB), (4 GHz, –40 dB), (8 GHz, –40 dB), (16 GHz, –32 dB), (20 GHz, –32 dB), (24 GHz, –32 dB).

The requirements for far-end crosstalk and near-end crosstalk are consistent.

The near-end crosstalk of mating connectors should be lower than the benchmark values at each frequency point indicated by the polyline in the figure.

Figure 22 Differential near-end and far-end crosstalk of Type-B connector



5 Type-B Cable

5.1 Basic Requirements

5.1.1 Working Environment

Unless otherwise specified, the normal working environment of Type-B cable shall comply with the provisions in 4.1.1.

5.1.2 Electrostatic Discharge Protection

The Electrostatic discharge (ESD) protection of Type-B cables should comply with the requirements in 4.1.2.

5.1.3 Restriction and Prohibition

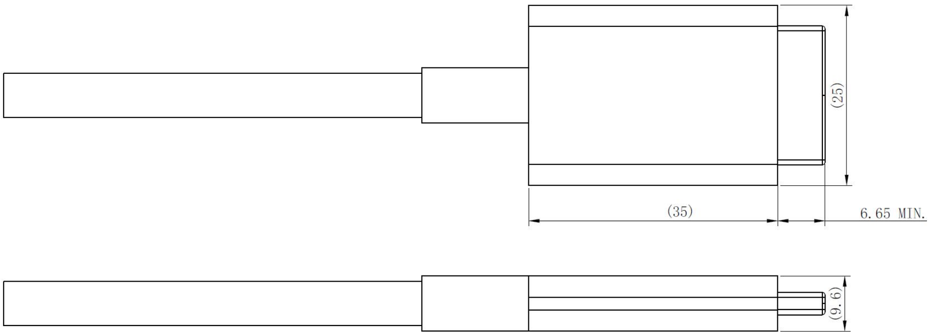
Restricted and prohibited substances for Type-B connectors shall comply with the requirements in 4.1.3.

5.1.4 Cable Structure and Wiring Arrangement

5.1.4.1 Cable Structure

The mating distance of cable components shall not be less than 6.65 mm, and the appearance dimensions should meet the requirements of Figure 23. Other dimensions are for reference only, and specific requirements shall be stipulated in the product specifications.

Figure 23 Appearance dimensions of a cable component male connector

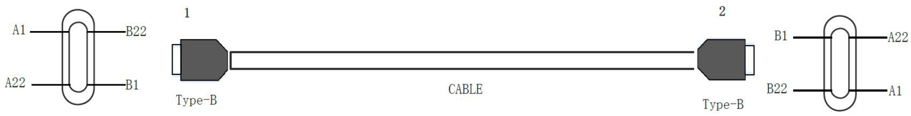


A Type-B cable design is shown in Appendix C.

5.1.4.2 Cable Wiring Arrangement

Type-B cable components include two configurations: full specification and simplified specification. The wiring arrangement is shown in Figure 25.

Figure 24 Type-B cable component wiring



The full-specification cable component wiring arrangement shall comply with the requirements of Table 4.

Table 4 Type-B full-specification cable components (eight pairs of high-speed cables)

Type-B Male Connector 1		**Cable**		**Type-B Male Connector 2**	
Pin	**Signal Name**	**Cable No.**	**Signal Name**	**Pin**	**Signal Name**
A1, B1, A22, B22	PGND	1	GND_PWRrt	A1, B1, A22, B22	PGND
A9, B9, A14, B14	PBUS	2	PWR_Pbus	A9, B9, A14, B14	PBUS
A2	ML6+	3	HSp1	B21	ML7+
A3	ML6-	4	HSn1	B20	ML7-
B21	ML7+	5	HSp2	A2	ML6+
B20	ML7-	6	HSn2	A3	ML6-
A4, A7, A16, A19 B4, B7, B16, B19	DGND	7	Data Shield	A4, A7, A16, A19 B4, B7, B16, B19	DGND
A5	ML2+	8	HSp3	B18	ML3+

Type-B Male Connector 1		Cable		Type-B Male Connector 2	
Pin	**Signal Name**	**Cable No.**	**Signal Name**	**Pin**	**Signal Name**
A6	ML2-	9	HSn3	B17	ML3-
B18	ML3+	10	HSp4	A5	ML2+
B17	ML3-	11	HSn4	A6	ML2-
A8	RSV1	12	RSV_A	B8	RSV2
B8	RSV2	13	RSV_B	A8	RSV1
A10	CL1	14	CL_A	B10	CL2
B10	CL2	/	/	A10	CL1
A11	D+	15	Dp	A11	D+
A12	D-	16	Dn	A12	D-
A13,	RSV4	17	RSV_D	B13	RSV3
B13	RSV3	18	RSV_C	A13	RSV4
A15	SL1	19	SL_A	B15	SL2
B15	SL2	20	SL_B	A15	SL1
A17	ML1-	21	HSp5	B6	ML0-
A18	ML1+	22	HSn5	B5	ML0+
B6	ML0-	23	HSp6	A17	ML1-
B5	ML0+	24	HSn6	A18	ML1+
A20	ML5-	25	HSp7	B3	ML4-
A21	ML5+	26	HSn7	B2	ML4+
B3	ML4-	27	HSp8	A20	ML5-
B2	ML4+	28	HSn8	A21	ML5+

The simplified-specification cable component wiring arrangement shall comply with the requirements of Table 5.

Table 5 Type-B simplified-specification cable components (four pairs of high-speed cables)

Type-B Male Connector 1		Cable		Type-B Male Connector 2	
Pin	**Signal Name**	**Cable No.**	**Signal Name**	**Pin**	**Signal Name**
A1, B1, A22, B22	PGND	1	GND_PWRrt	A1, B1, A22, B22	PGND
A9, B9, A14, B14	PBUS	2	PWR_Pbus	A9, B9, A14, B14	PBUS

Type-B Male Connector 1		Cable		Type-B Male Connector 2	
Pin	Signal Name	Cable No.	Signal Name	Pin	Signal Name
A4, A7, A16, A19 B4, B7, B16, B19	DGND	7	Data Shield	A4, A7, A16, A19 B4, B7, B16, B19	DGND
A5	ML2+	8	HSp3	B18	ML3+
A6	ML2-	9	HSn3	B17	ML3-
B18	ML3+	10	HSp4	A5	ML2+
B17	ML3-	11	HSn4	A6	ML2-
A10	CL1	14	CL_A	B10	CL2
B10	CL2	/	/	A10	CL1
A11	D+	15	Dp	A11	D+
A12	D-	16	Dn	A12	D-
A13	RSV4	17	RSV_D	B13	RSV3
B13	RSV3	18	RSV_C	RSV4	RSV4
A15	SL1	19	SL_A	B15	SL2
B15	SL2	20	SL_B	A15	SL1
A17	ML1-	21	HSp5	B6	ML0-
A18	ML1+	22	HSn5	B5	ML0+
B6	ML0-	23	HSp6	A17	ML1-
B5	ML0+	24	HSn6	A18	ML1+

5.2 Functional Requirements

5.2.1 Signal Description

For cable signal description, see Table 6.

Table 6 Cable signal description

Signal Classification	Signal Name	Description
Main link	ML0+, ML0-; ML1+, ML1-; ML2+, ML2-; ML3+, ML3-; ML4+, ML4-; ML5+, ML5-; ML6+, ML6-; ML7+, ML7-	The ML contains eight high-speed lanes for transmitting high-speed signals. For details, see Sections 4.1, 4.2.1, and 5.2 of T/SUCA 001.2-2024.
USB 2.0	D+, D-	USB 2.0 D+/D- pins are supported for transmitting USB 2.0 data.

Signal Classification	Signal Name	Description
Cable information link	CL1 and CL2 in connectors; CL signal cables (CL_A in Table 4 and Table 5)	The CL signal cable supports board insertion detection and power supply negotiation. When not connected to the CL signal cables, the CL1 or CL2 pin can be used to supply power to the cable e-marker (Cable Marker chip).
Sideband link	SL1, SL2	Transmit control information. For details, see Sections 5.1, 5.2.2, and 6.3 of T/SUCA 001.2-2024.
Power bus link	PBUS	Power bus, which can meet the power supply of high-power devices.
	PGND	Power ground.
	DBUS	Digital bus, which can meet the power supply requirements of low-power devices. For details, see Class A power rules in the power rules section of T/SUCA 001.4-2024. The DBUS pin should be connected to the RSV3 and RSV4 pins.
	DGND	Digital ground
	VCL	Supply power to the cable e-marker.
Note 1: During high-power supply, if the current exceeds a certain value (such as 6 A), excessive voltage drop on the ground wire may affect chip communication. This issue can be resolved through dual-lane power supply, that is, using DBUS/DGND to supply power to low-power devices such as System on Chip (SoC), and using PBUS/PGND to supply power to high-power devices such as TV backlight boards. Note 2: Whether the device employs single-lane or dual-lane power supply is specified in Section 9.2 of T/SUCA 001.4-2024.		

5.2.2 Cable Information Link

5.2.2.1 Mating and Unmating Detection and Forward/Reverse Insertion Identification

For the connection mode, see Figure 3 in Section 4.2 of T/SUCA 001.4-2024.

For mating and unmating detection and power supply sequence procedure, see Section 6.2 of T/SUCA 001.4-2024.

The provider device and the consumer device are connected through the CL signal cable. The identification of forward and reverse insertion status is detailed in Table 7.

Table 7 Forward and reverse insertion status

Provider Device CL Pin Number	Consumer Device CL Pin Number	Qualification Requirements
CL1	CL2	Forward insertion
CL2	CL1	Forward insertion
CL1	CL1	Reverse insertion
CL2	CL2	Reverse insertion
Note: The device pin number is the pin number of the CL signal cable connected to the Type-B female connector.		

5.2.2.2 CL Electrical Requirements

See Section 5.1.2 of T/SUCA 001.4-2024.

5.2.2.3 Cable E-Marker

For the content of CableInfo saved in the cable e-marker, see Section 7.2.4.6 of T/SUCA 001.4-2024.

5.2.3 Power Bus Link

5.2.3.1 Power Supply

The power supply for mating and unmating detection and cable e-marker shall comply with the requirements of Table 1 in 5.2.2 of T/SUCA 001.4-2024.

The power of PBUS/DBUS shall comply with the requirements of 9.3 and 9.4 in T/SUCA 001.4-2024.

5.2.3.2 Voltage Drop

The PGND/DGND voltage drop shall comply with the requirements of 5.5 in T/SUCA 001.4-2024.

5.3 Performance Requirements

5.3.1 Mechanical Indicator

The mechanical indicators of Type-B cable components shall comply with the provisions in Table 8.

Table 8 Mechanical indicators of Type-B cable components

No.	Environmental and Mechanical Indicator	Technical Requirements
1	Mating force	Comply with the provisions in Table 1.
2	Unmating force	Comply with the provisions in Table 1.
3	Durability	Comply with the provisions in Table 1.
4	Cable flexing	After 200 bending cycles, the cable shows no physical

No.	Environmental and Mechanical Indicator	Technical Requirements
		damage, and the electrical performance meets all specified criteria.
5	Cable pull-off resistance	After the plug is fixed and a tensile force of 50 N is applied to the cable at a point 10 cm from the SR tail for 1 minute, the cable shows no physical damage, and the electrical performance meets all specified criteria.
6	Tensile durability	After a tensile force of 50 N is applied to the cable for 1 minute, the cable shows no physical damage, and the electrical performance meets all specified criteria.
7	Torque (optional)	Comply with the provisions in Table 1.

5.3.2 Environmental Indicator

The environmental indicators of Type-B cable components shall comply with the provisions in Table 9.

Table 9 Environmental indicators of Type-B cable components

No.	Environmental and Mechanical Indicator	Technical Requirements
1	Temperature shock	Temperature: –55°C to 85°C; 25 alternating cycles (1 hour per cycle). After testing: The appearance and electrical function are normal.
2	High temperature/humidity	Temperature: 85°C; humidity: 95% RH; testing duration: 120 hours. After testing, leave at room temperature for 24 hours: The appearance and electrical function are normal.
3	Damp-heat cycle	Temperature: 25°C to 85°C; humidity: 80% RH to 95% RH; 10 cycles (24 hours per cycle). After testing, leave at room temperature for 24 hours: After the testing, the appearance and electrical performance are normal.
4	Salt spray	Temperature: 35°C±2°C; humidity: 95% RH to 98% RH; NaCl concentration: 5%; continuous spray: After 24-hour testing, the appearance of the sample metal shell and connector shows no obvious changes, such as rust, discoloration, or coating peeling. After 48-hour testing, when observed under 40x magnifier, the sample PIN shows no obvious changes, such as rust, discoloration, or coating peeling.

5.3.3 EMI/EMC Indicator

The EMI/EMC indicators of Type-B cable components shall comply with the provisions in Table 10.

Table 10 EMI/EMC indicators of Type-B cable components

Indicator	Technical Requirements
EMI/EMC	Common mode noise shielding performance: ≤ 29 dB(30 MHz to 230 MHz) ≤ 30 dB(230 MHz to 1 GHz) ≤ 25 dB (1 GHz to 6 GHz) (According to the testing method of IEC62153-4-9)
Note: More stringent specifications apply at frequency transitions.	

5.3.4 DC Electrical

The DC electrical indicators of Type-B cable components shall comply with the provisions in Table 11.

Table 11 DC electrical indicators of Type-B cable components

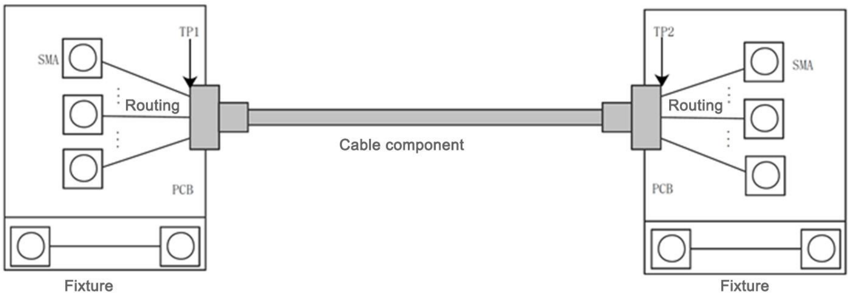
No.	Electrical Indicator	Effect	Technical Requirements
1	Low-level contact resistance	—	Comply with the provisions in Table 3.
2	Insulation resistance	Ensure a high enough resistance between the two circuits to prevent weak currents that could affect signal transmission.	The insulation resistance shall not be less than 100 mΩ. During mating testing, the insulation resistance shall not be less than 10 mΩ.
3	Dielectric withstand voltage	Ensure the safety of connectors and cables under overvoltage conditions, preventing short circuits and potential hazards like fire.	No breakdown shall occur between any adjacent pins or between any pin and the shell. Functions are normal. The leakage current shall be less than 0.5 mA.
4	Temperature rise	—	The temperature rise at any point on the surface of the cable component (including the male connector) shall not exceed 30°C.
5	Voltage drop of the cable component	—	Comply with the requirements in Section 5.4 of T/SUCA 001.4.

5.3.5 Signal Integrity

5.3.5.1 Basic Requirements

The Type-B cable component should be tested using the method shown in Figure 25, with testing points from TP1 to TP2. The testing results shall be de-embedded. De-embedding refers to removing the effects of the PCB routing from the SMA connector to TP1 and from TP2 to the SMA connector from the testing results.

Figure 25 Type-B cable component testing connection



5.3.5.2 High-Speed Signal

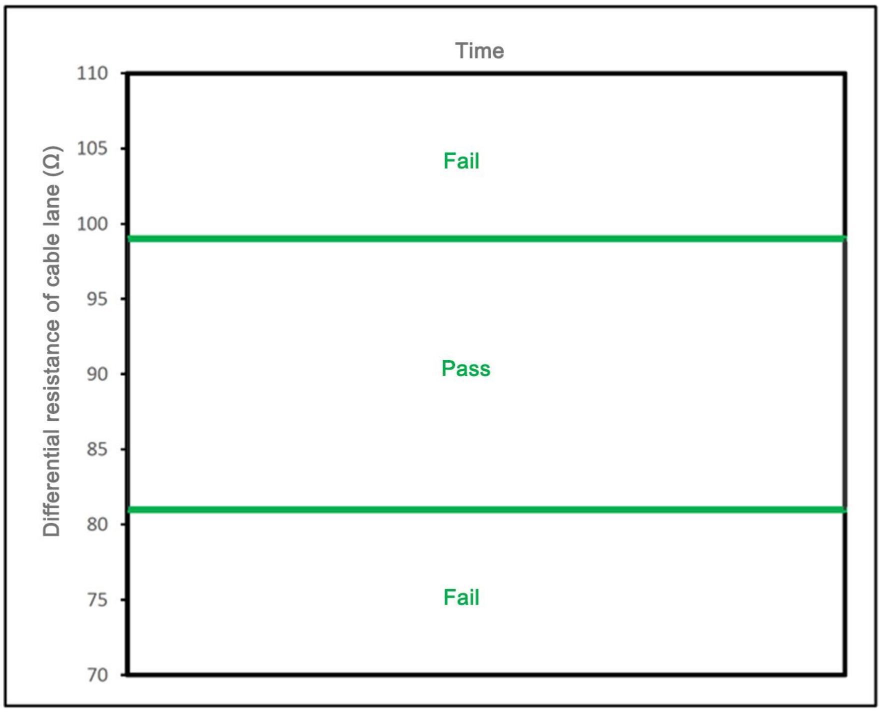
5.3.5.2.1 Differential Resistance

The high-speed signal cable differential resistance of the cable component shall be 90 Ω±10%. The differential resistance of the cable lane shall not be out of the upper and lower limits in Figure 26.

The rising time of differential mode signal of HS2 cable should be 100 ps (10%−90%).

The rising time of differential mode signal of HS3 and HS4 cables should be 40 ps (10%−90%).

Figure 26 Requirements for Type-B cable component lane differential resistance



5.3.5.2.2 Differential Insertion Loss

Figure 27 is generated based on the following frequencies and corresponding differential insertion loss values: (0.1 GHz, –5 dB), (1 GHz, –10 dB), (2 GHz, –15 dB), (4 GHz, –19.5 dB), (8 GHz, –43 dB). The differential insertion loss of the HS2 Type-B to Type-B cable component shall be higher than the benchmark values at each frequency point indicated by the polyline in Figure 27.

Figure 27 HS2 Type-B to Type-B cable component differential insertion loss

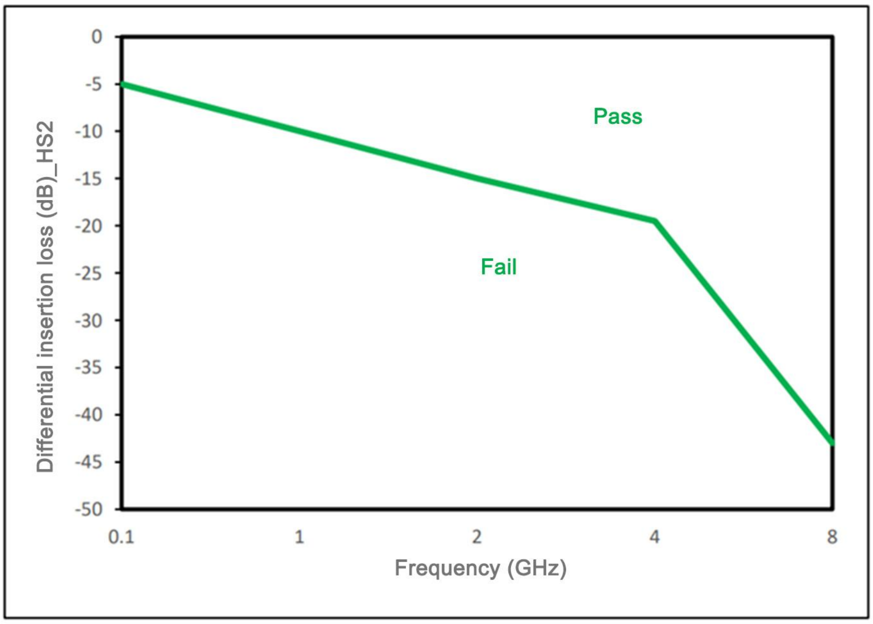


Figure 28 is generated based on the following frequencies and corresponding differential insertion loss values: (0.1 GHz, –4 dB), (2 GHz, –7 dB), (4 GHz, –9 dB), (6 GHz, –11 dB), (8 GHz, –13 dB), (12 GHz, –23 dB), (16 GHz, –33 dB). The differential insertion loss of the HS3 Type-B to Type-B cable component shall be higher than the benchmark values at each frequency point indicated by the polyline in the figure.

Figure 28 HS3 Type-B to Type-B cable component differential insertion loss

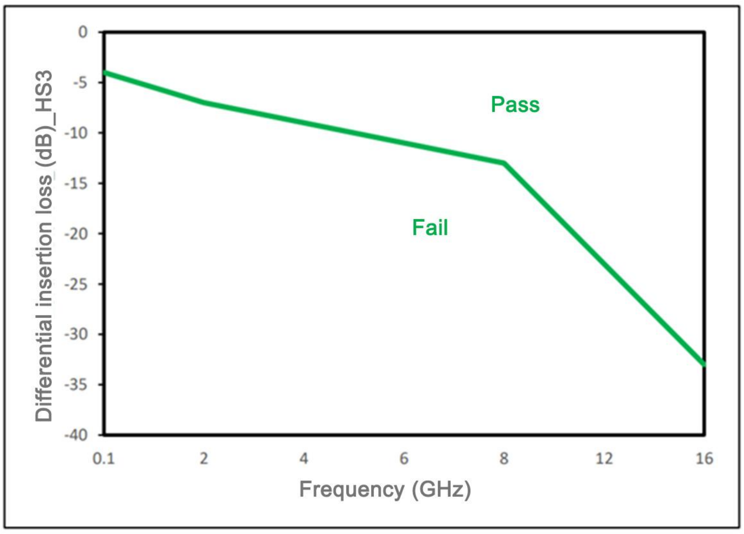
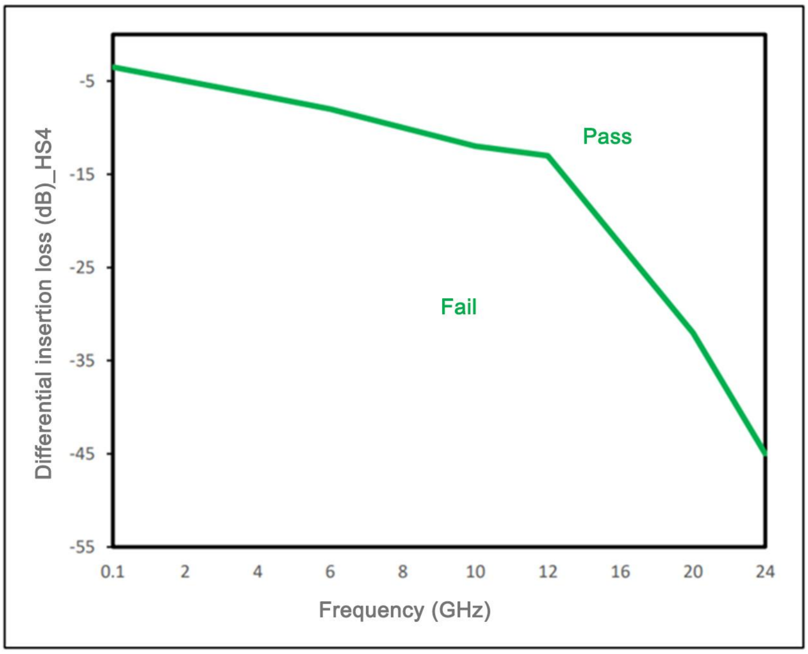


Figure 29 is generated based on the following frequencies and corresponding differential insertion loss values: (0.1 GHz, –3.5 dB), (2 GHz, –5 dB), (4 GHz, –6.5 dB), (6 GHz, –8 dB), (8 GHz, –10 dB), (10 GHz, –12 dB), (12 GHz, –13 dB), (16 GHz, –22.5 dB), (20 GHz, –32 dB), (24 GHz, –45 dB). The differential insertion loss of the HS4 Type-B to Type-B cable component shall be higher than the benchmark values at each frequency point indicated by the polyline in the figure.

Figure 29 HS4 Type-B to Type-B cable component differential insertion loss



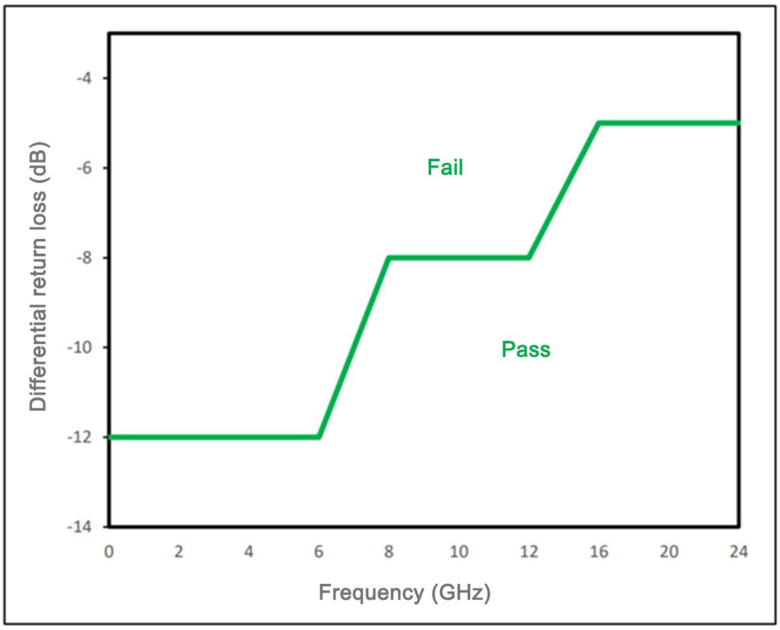
5.3.5.2.3 Differential Return Loss

Figure 30 is generated based on the following frequencies and corresponding return loss values: (0, –12 dB), (2 GHz, –12 dB), (4 GHz, –12 dB), (6 GHz, –12 dB), (8 GHz, –8 dB), (10 GHz, –8 dB), (12 GHz, –8 dB), (16 GHz, –5 dB), (20 GHz, –5 dB), (24 GHz, –5 dB).

The test frequency is 0 GHz to 12 GHz for HS2 cable, and 0 GHz to 24GHz for HS3/HS4 cable.

The differential return loss of the Type-B to Type-B cable component shall be lower than the benchmark values at each frequency point indicated by the polyline in the figure.

Figure 30 Type-B to Type-B cable component return loss curve

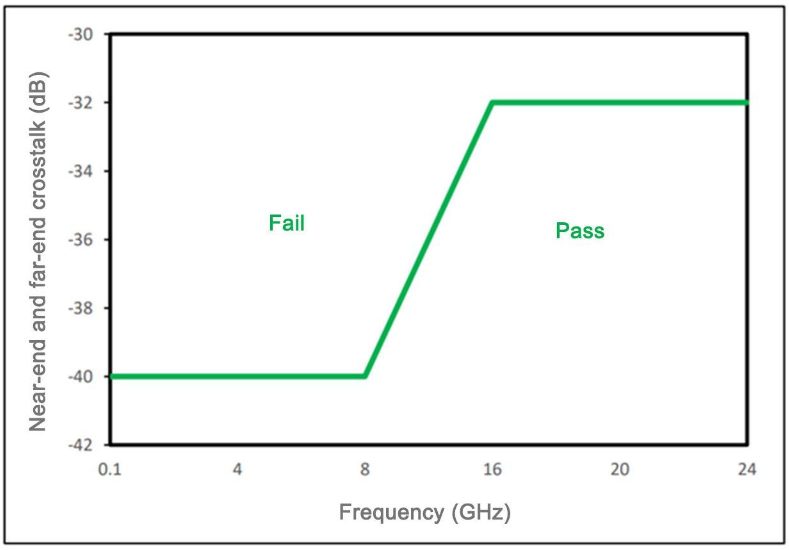


5.3.5.2.4 Differential Near-End and Far-End Crosstalk

Figure 31 is generated based on the following frequencies and corresponding differential near-end crosstalk values: (0.1 GHz, –40 dB), (4 GHz, –40 dB), (8 GHz, –40 dB), (16 GHz, –32 dB), (20 GHz, –32 dB), (24 GHz, –32 dB). The requirements for far-end crosstalk and near-end crosstalk are consistent.

The differential near-end crosstalk of Type-B to Type-B cable component shall be lower than the benchmark values at each frequency point indicated by the polyline in the figure.

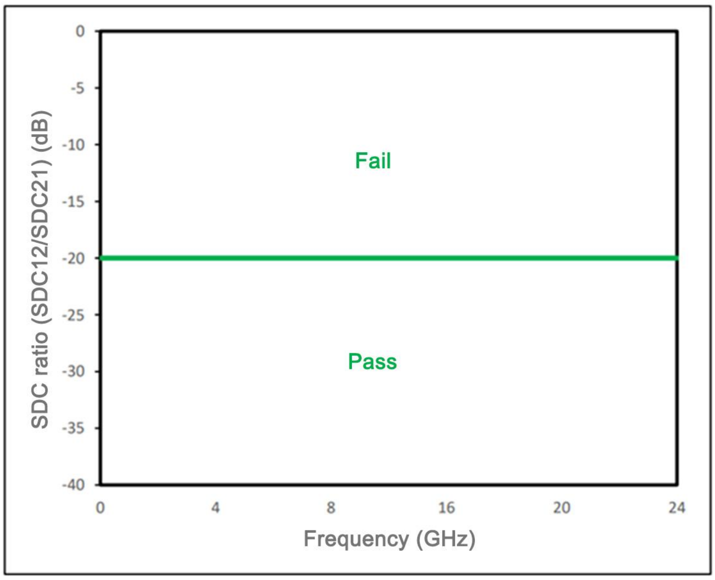
Figure 31 Differential near-end and far-end crosstalk of Type-B cable component



5.3.5.2.5 SDC Ratio

As shown in Figure 32, SDC12/SDC21 shall be less than or equal to –20 dB below 24 GHz.

Figure 32 SDC ratio of Type-B cable component



5.3.5.2.6 Differential Intra-pair Skew

Record the time when the positive and negative signals within a differential pair reach 50% of the voltage level. The absolute value of the time difference is the intra-pair skew.

(a) Intra-pair skew of the HS2 cable component: ≤ 40 ps (0.32 UI).

(b) Intra-pair skew of the HS3 cable component: ≤ 20 ps (0.32 UI).

(c) Intra-pair skew of the HS4 cable component: ≤ 13 ps (0.32 UI).

5.3.5.2.7 Differential Inter-pair Skew

Record the time when the positive and negative signals within a differential pair reach 50% of the voltage level. The absolute value of the difference between the fastest and slowest times is the inter-pair skew.

(a) Inter-pair skew of the HS2 cable component: ≤ 250 ps (2 UI).

(b) Inter-pair skew of the HS3 cable component: ≤ 125 ps (2 UI).

(c) Inter-pair skew of the HS4 cable component: ≤ 81 ps (2 UI).

5.3.5.3 Near-End and Far-End Crosstalk Between High-Speed Signals and USB 2.0 D+/D- Signals

For the requirements for near-end and far-end crosstalk between high-speed differential signals and USB 2.0 D+/D- differential signals, refer to third-party interface protocols (such as the relevant provisions in Table 3-28 of USB Type-C 2.0-2019.8).

5.3.5.4 Requirements for USB 2.0 D+/D- Signals

For the requirements for USB 2.0 D+/D- signals, refer to third-party interface protocols (such as the relevant provisions in Table 3-27 of USB Type-C 2.0-2019.8).

5.3.5.5 Low-Speed Signal

5.3.5.5.1 Basic Requirements

The electrical characteristics of the SL cable and RSV cable shall comply with the provisions in Table 12, and the electrical characteristics of the CL cable shall comply with the provisions in Table 13.

Table 12 Electrical characteristics of SL cable

Indicator Name	Description	Minimum Value	Maximum Value
zCbl_SL	Characteristic resistance of SL cable	32 Ω	90 Ω
rCbl_SL	DC resistance of SL cable	-	5 Ω
tCbl_SL[a]	Delay of SL cable	-	80 ns
IL_SL	Insertion loss of SL cable	-	(0.5 MHz, –2 dB) (1 MHz, –4 dB) (10 MHz, –10 dB) (25 MHz, –17 dB) (50 MHz, –27 dB) (100 MHz, –33 dB)

Indicator Name	Description	Minimum Value	Maximum Value
[a] The delay of SL cables is related to the cable length. The maximum delay of SL cables is 80 ns for a 15-meter cable, and 26 ns for a 5-meter cable.			

Table 13 Electrical characteristics of CL cable

Indicator Name	Description	Minimum Value	Maximum Value
zCbl_CL	Characteristic resistance of CL cable	32 Ω	90 Ω
rCbl_CL	DC resistance of CL cable	-	15 Ω
tCbl_CLa	Delay of CL cable	-	80 ns
cCblPlug_CC	Plug capacitance of CL cable	-	25 pF
[a] The delay of CL cables is related to the cable length. The maximum delay of CL cables is 80 ns for a 15-meter cable, and 26 ns for a 5-meter cable.			

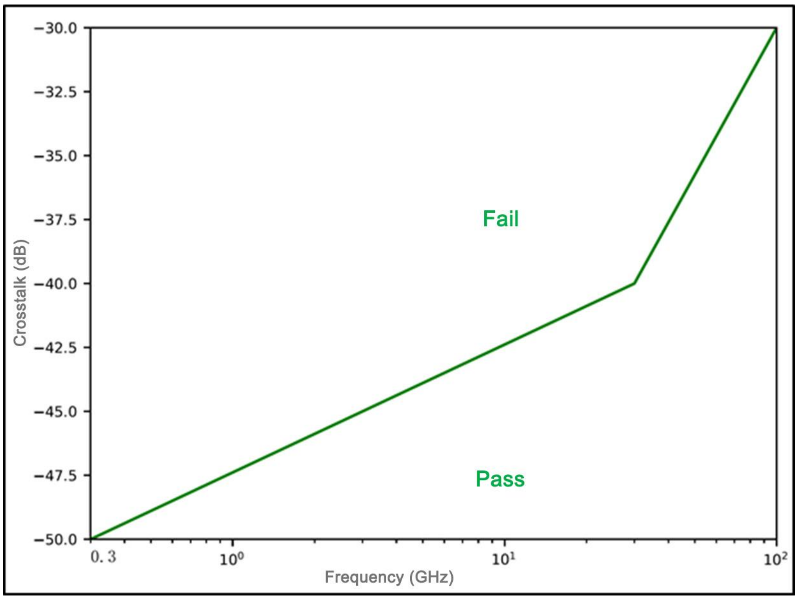
Low-speed signals shall control crosstalk, including near-end crosstalk and far-end crosstalk. The requirements for near-end crosstalk and far-end crosstalk are consistent.

Note: Crosstalk is also known as coupling degree.

5.3.5.5.2 Crosstalk Between USB 2.0 D+/D- Signals and CL Signals

Figure 33 is generated based on the following frequencies and corresponding crosstalk values: (0.3 MHz, –50 dB), (30 MHz, –40 dB), (100 MHz, –30 dB). The crosstalk between USB 2.0 D+/D- and CL in the cable component shall be lower than the benchmark values at each frequency point indicated by the polyline in the figure.

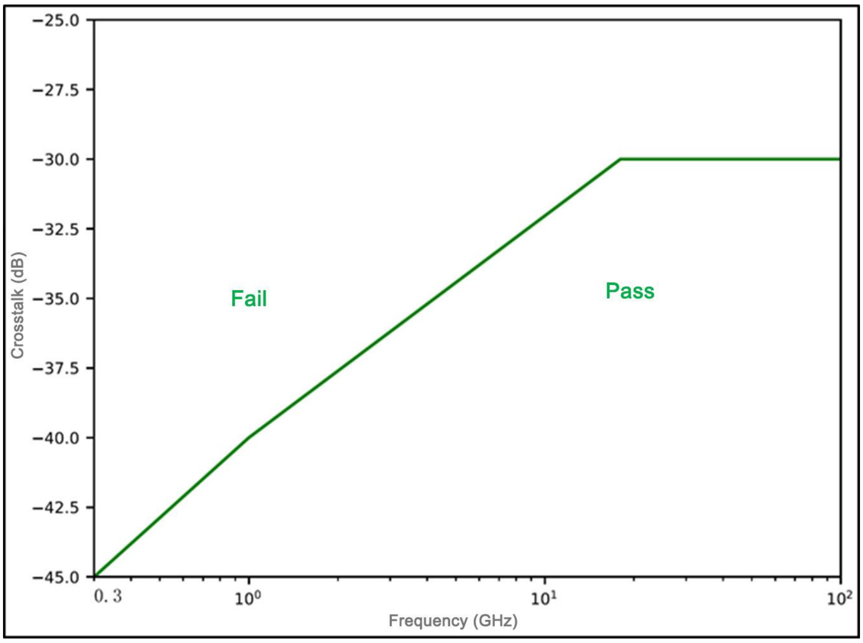
Figure 33 Crosstalk between USB 2.0 D+/D- signals and CL signals



5.3.5.5.3 Crosstalk Between SL and SL/CL Signals

The crosstalk between SL and SL/CL signals in the Type-B to Type-B cable component includes the crosstalk between SL1 and SL2, SL1 and CL, and SL2 and CL. Figure 34 is generated based on the following frequencies and corresponding crosstalk values: (0.3 MHz, –45 dB), (1 MHz, –40 dB), (18 MHz, –30 dB), (100 MHz, –30 dB). The crosstalk between SL and SL signal/CL signal shall be lower than the benchmark values at each frequency point indicated by the polyline in the figure.

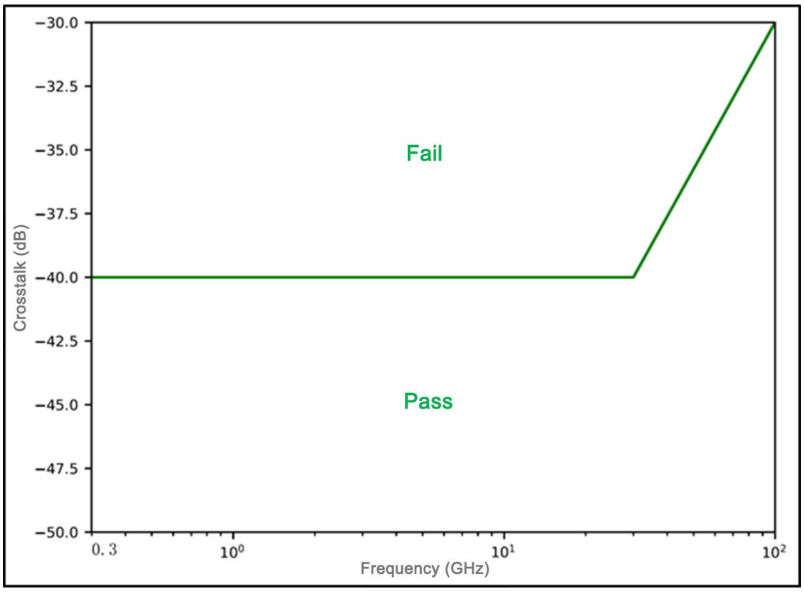
Figure 34 Crosstalk between SL and SL/CL signals



5.3.5.5.4 Crosstalk Between PBUS and SL/CL Signals

The crosstalk between PBUS and SL signals/CL signals in the Type-B to Type-B cable component includes the crosstalk between PBUS and SL1, PBUS and SL2, and PBUS and CL. Figure 35 is generated based on the following frequencies and corresponding crosstalk values: (0.3 MHz, –40 dB), (1 MHz, –40 dB), (30 MHz, –40 dB), (100 MHz, –30 dB). The crosstalk between PBUS and SL signal/CL signal in the cable component shall be lower than the benchmark values at each frequency point indicated by the polyline in the figure.

Figure 35 Crosstalk between PBUS and SL/CL signals



5.3.5.5.5 Crosstalk Between SL Signal and RSV Signal

For crosstalk between SL signal and RSV signal, refer to Section 5.3.5.5.3.

5.3.5.5.6 Crosstalk Between PBUS Signal and RSV Signal

For crosstalk between PBUS signal and RSV signal, refer to Section 5.3.5.5.4.

Appendix A
(Normative)
Type-B Connector PCB Design

The Type-B male and female connectors should be designed with double-sided multilayer PCBs, and the shell of the female connector shall be connected to the grounding layer of the PCB. The PCB layout of the male connector is shown in Figure A.1, and the PCB layout of the female connector is shown in Figure A.2. On PCBs of male and female connectors:

—All PBUS pins shall be connected together;

—All DBUS pins (including RSV pins serving as DBUS pins) shall be connected together;

—All DGND pins shall be connected together;

—All PGND pins shall be connected together.

Figure A.1 Example of PCB layout of Type-B male connector

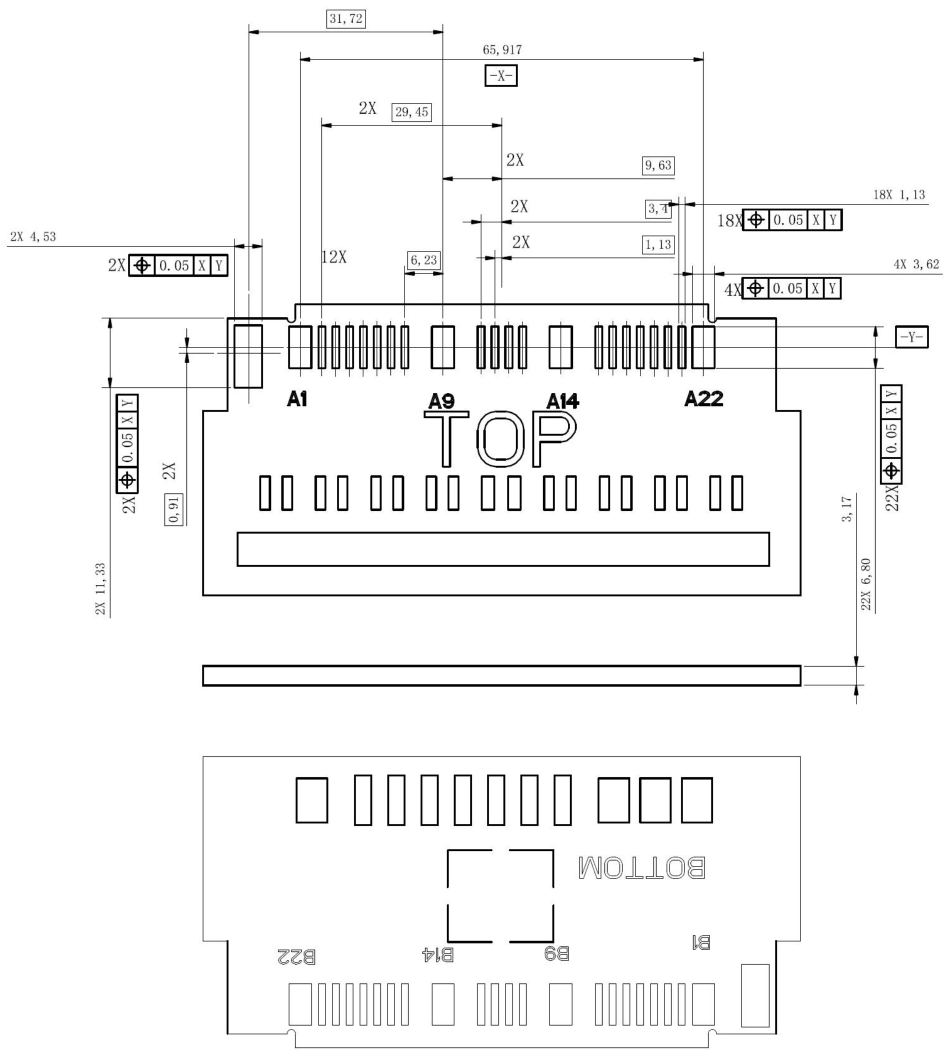
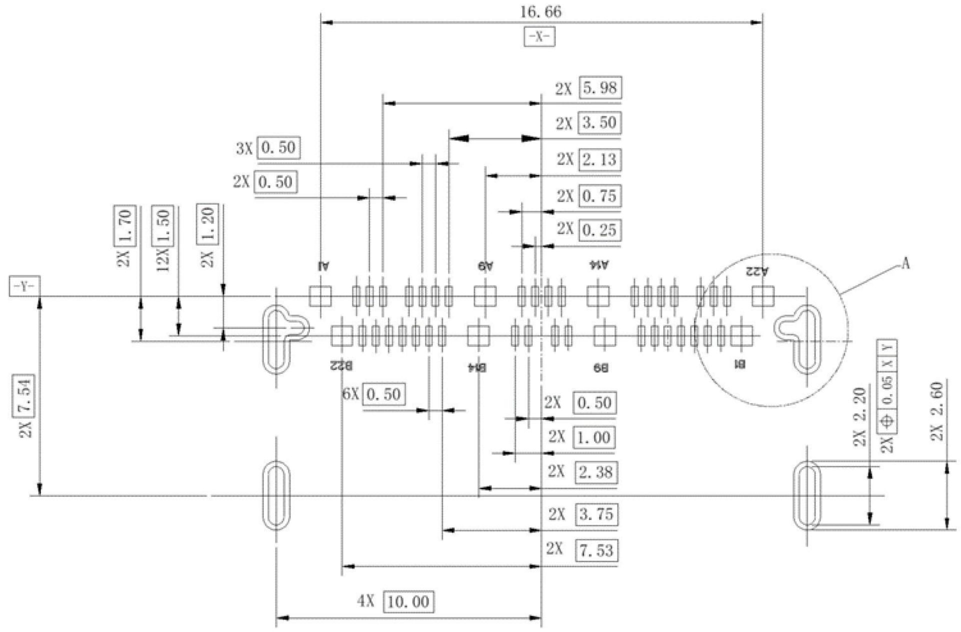
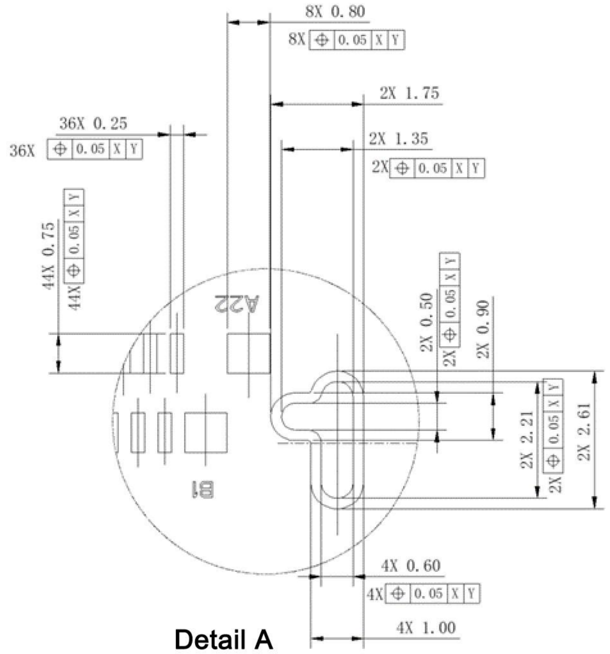


Figure A.2 Example of PCB layout of Type-B female connector





Detail A
2:1

Appendix B
(Informative)
Type-B Connector Reference Design

This section provides Type-B connector design recommendations:

(a) Pin design for reference: Pins can be classified into signal pins, signal power supply pins, and PBUS and PGND pins.

   (1) The creepage distance between the PBUS pin and the adjacent pin shall not be shorter than 0.85 mm to meet the 48 V voltage boost requirement.

   (2) The ML pins of the female connector shall be routed on the surface of the PCB. The rear row of pins shall reserve space on the PCB for the routing of the front row pins.

(b) Male connector latch design for reference: The latch provides mating and unmating forces for the male and female connectors, ensuring stable and reliable mechanical and electrical performance during connector operation.

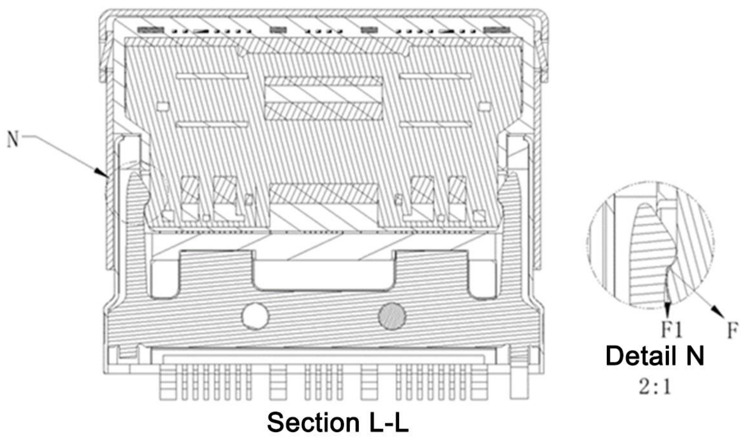
   (1) The latch shall have two grounding contact points with the male connector PCB to form a grounding loop and reduce interference, as shown in Figure 15.

   (2) The latch shall have at least two grounding contact points with the male connector shell to form a grounding loop and reduce crosstalk, as shown in Figure 15.

   (3) After the latch is inserted, it should maintain a minimum positive force (F) of 0.5 N against the middle plate of the female connector tongue to form a stable EMI connection and reduce interference. The solution is shown in Figure B.1.

   (4) After the latch is inserted, it should maintain a component force (F1) in the insertion direction against the middle plate of the female connector tongue to enhance the stability and reliability of mechanical mating and electrical performance. The solution is shown in Figure B.1.

Figure B.1 Forces applied on the latch



(c) The distance between the upper and lower pins of the latch shall be consistent to reduce changes in characteristic resistance.

(d) The shell of the female connector shall be connected to the grounding layer of the PCB.

(e) The role of the middle plate: first, to provide a locking position for the mechanical mating of the latch; second, to offer guidance and friction paths for mating; third, to shield the upper and lower rows of pin signals to prevent interference; fourth, to increase the strength of the product. The design suggestions are as follows:

(1) For the locking position and the guidance area on the middle plate, refer to the dimensions of the Type-B female connector shown in Figure 5 to ensure mating compatibility.

(2) The distance from the middle plate to the upper and lower rows of pins should be consistent to reduce changes in characteristic resistance.

(3) The middle plate should have two grounding contact points with the female connector PCB to form a grounding loop and reduce crosstalk.

(4) The thickness of the middle plate should be designed with reference to the dimension of 0.20 mm provided in Figure 5.

(f) Stable connection of EMI spring tabs can reduce interference in connectors. Reference design for EMI spring tabs in male/female connectors:

(1) A design where tabs are directly formed by cutting and bending holes in the shell.

(2) A design where metal spring tabs are soldered to the inner frame of the shell.

Appendix C
(Informative)
Type-B Cable Reference Design

C.1 Type-B Cable

C.1.1 Cable Type

The cable component types that the general purpose multimedia interface should support are shown in Table C.1.

Table C.1 Type-B cable component type

Model	Male Connector 1	Male Connector 2	Number of Lanes	Maximum Supply Current	Recommended Length	Cable E-Marker
BB-HS4-8L-48V/10A[a]	Type-B	Type-B	8	48 V/10 A	0.2–0.8 m	2 ends[b]
BB-HS3-8L-48V/10A	Type-B	Type-B	8	48 V/10 A	1–1.5 m	2 ends
BB-HS2-4L-48V/5A	Type-B	Type-B	4	48 V/5 A	1–3 m	1 end

[a] In "BB-HS4-8L-48V/10A", "BB" indicates that the male connector types on both ends of the cable are Type-B. "HS4" denotes the speed grade/classification. "8L" stands for eight lanes. "48V/10A" indicates that the cable supports a maximum power supply voltage of 48 V and a current of 10 A.

[b] "2 ends" means that one Cable E-Marker chip is installed on each end of the cable. The Cable E-Marker chip should implement a temperature detection function.

C.1.2 Cable Structure

The full-specification cable is shown in Figure C.1, which includes the USB data cable (USB 2.0 D+/D-), PBUS cable, reserved electronic cable (RSV3/RSV4), PGND cable, CL signal cable, reserved electronic cable (RSV1/RSV2), SL signal cable (SL1/SL2), wrapping layer, high-speed coaxial cable, shielding layer, and protective layer. In the cable, the reserved electronic cable (RSV3/RSV4) serves as the DBUS cable, and the shielding layer and coaxial cable braiding serve as the DGND.

The functions of different cables are as follows:

— The USB data cable is used to transmit USB 2.0 low-speed signals.

— The PBUS cable and the PGND cable are used to transmit the power required by high-power devices, complying with the power delivery specifications for Class A and/or Class B as defined in T/SUCA 001.4-2024.

— The DBUS cable and coaxial cable braiding/shielding layer (DGND cable) are used for transmitting power required by low-power devices, meeting the Class A power transmission rules specified in Section 9.3 of T/SUCA 001.4-2024.

— The SL signal cable is used to transmit the SL low-speed signal. The signal rate is shown in Section 6.3 of T/SUCA 001.2-2024.

— The CL signal cable is used to transmit the low-speed signal for power supply negotiation.

The signal rate is shown in Section 6.5.6 of T/SUCA 001.4-2024.

— The coaxial cable is used to transmit high-speed digital signals. Every two coaxial cables form an ML lane. The rate supported by each ML lane is shown in Table 3 of T/SUCA 001.1-2024. The cable supports up to eight ML lanes and can meet the maximum transmission bandwidth of 192 Gbps.

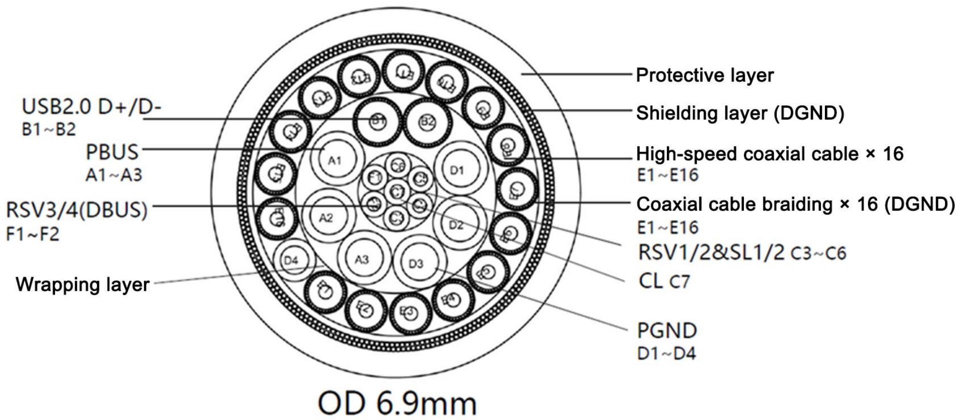
The cable structure consists of three layers: a wrapping layer, a shielding layer, and a protective layer. Their functions are as follows:

— The wrapping layer wraps the USB data cable, PBUS cable, DBUS cable, PGND cable, reserved electronic cable, CL signal cable, and SL signal cable.

— The shielding layer is located between the protective layer and wrapping layer, and is arranged around the wrapping layer to shield the cable from external signal interference.

— The protective layer wraps the coaxial cable and the wrapping layer through the shielding layer. Multiple coaxial cables are situated outside the wrapping layer but inside the shielding layer, arranged around the wrapping layer to form a ring.

Figure C.1 Example of full-specification cable



The design suggestions are as follows:

— The protective layer is made of thermoplastic polyurethane (TPU) or thermoplastic elastomer (TPE), providing high strength and great bendability.

— The wrapping layer is made of tissue paper, PET, PTFE, or wave-absorbing materials.

— Fluorinated Ethylene Propylene (FEP) sheathed cables should be used for the PBUS cable and PGND cable. Each FEP sheathed cable includes an inner power conductor and an FEP insulation layer encasing the conductor. The conductor diameter depends on the current-carrying capacity.

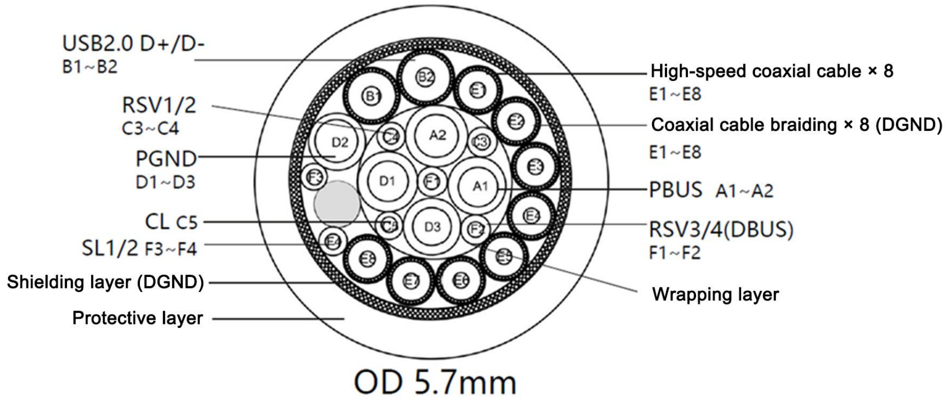
— There are 16 high-speed coaxial cables with a conductor diameter of 32 AWG. The specifications of the coaxial cable can be adjusted according to cable length and attenuation requirements.

— USB 2.0 D+/D- signal cables consist of one pair of unshielded twisted pair cables. For cables longer than 5 meters, support for USB 2.0 D+/D- signal cables is optional.

— The outer diameter of the cable should be less than 6.9 mm.

The simplified-specification cable is shown in A.2, which includes the USB data cable (USB 2.0 D+/D-), reserved electronic cable (RSV1/RSV2 cable), PGND cable, CL signal cable (CL cable), SL signal cable (SL1/SL2 cable), shielding layer, protective layer, wrapping layer, reserved electronic cable (RSV3/RSV4 cable), and PBUS cable. In the cable, the reserved electronic cable (RSV3/RSV4 cable) serves as the DBUS cable, and the shielding layer and coaxial cable braiding serve as the DGND.

Figure C.2 Example of simplified-specification cable



For an introduction to the functions of different cables, refer to the descriptions for the full-specification cable. The key design differences compared to the full-specification cable are as follows:

— There are eight high-speed coaxial cables with a conductor diameter of 32 AWG. The coaxial cable specifications can be adjusted according to cable length and attenuation requirements.

— The outer diameter of the cable should be less than 5.7 mm.

C.2 Wire Gauge

The wire gauges for cables are shown in Table C.2.

Table C.2 Wire gauges for cables

Cable No.	Signal Name	Wire Gauge (AWG)	Cable No.	Signal Name	Wire Gauge (AWG)
1	GND_PWRrt [a]	20–28	15	Dp	28–32
2	PWR_Pbus	20–28	16	Dn	28–32
3	HSp1	28–34	17	RSV_D	28–32
4	HSn1	28–34	18	RSV_C	28–32
5	HSp2	28–34	19	SL_A	28–32
6	HSn2	28–34	20	SL_B	28–32
7	Data Shield	28–34	21	HSp5	28–34
8	HSp3	28–34	22	HSn5	28–34
9	HSn3	28–34	23	HSp6	28–34
10	HSp4	28–34	24	HSn6	28–34

Cable No.	Signal Name	Wire Gauge (AWG)	Cable No.	Signal Name	Wire Gauge (AWG)
11	HSn4	28–34	25	HSp7	28–34
12	RSV_A	28–32	26	HSn7	28–34
13	RSV_B	28–32	27	HSp8	28–34
14	CL_A	28–32	28	HSn8	28–34
[a] GND_PWRrt represents PGND					

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[1] USB Type-C 2.0-2019.8 Universal Serial Bus Type-C Cable and Connector Specification Release 2.0 - August 2019

[2] USB 2.0-2000.4 Universal Serial Bus Specification Revision 2.0 - April 2000

[3] ANSI/EIA-364-09C Durability Test Procedure for Electrical Connectors and Contacts

[4] ANSI/EIA-364-13D Mating and Unmating Force Test Procedure for Electrical Connectors and Sockets

[5] ANSI/EIA-364-20D Withstanding Voltage Test Procedure for Electrical Connectors, Sockets and Coaxial Contacts

[6] ANSI/EIA-364-21C Insulation Resistance Test Procedure for Electrical Connectors, Sockets, and Coaxial Contacts

[7] ANSI/EIA-364-23C Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets

[8] ANSI/EIA-364-32C Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets

[9] ANSI/EIA-364-38B Cable Pull-Out Test Procedure for Electrical Connectors

[10] ANSI/EIA-364-41C Cable Flexing Test Procedure for Electrical Connectors

[11] ANSI/EIA-364-70B Temperature Rise Versus Current Test Procedure for Electrical Connectors and Sockets

[12] GB/T 31841-2015 Mechanical Structures of Electrical and Electronic Equipment—Guidelines for Design of Electromagnetic Shielding and Electrostatic Discharge Protection

[13] ROHS (2011/65 & 2015/863) Restriction of Hazardous Substances in Electrical and Electronic Equipment (https://environment.ec.europa.eu/topics/waste-and-recycling/rohs-directive_en)

[14] China ROHS2 (2016) Administrative Measure on the Control of Pollution Caused by Electronic Information Products (https://www.miit.gov.cn/jgsj/zfs/gzdt/art/2020/art_26714a290ac8407fb6df9eb816c2596f.html)