Video Electronics Standards Association

Mini DisplayPort™ Connector Standard

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VESA Mini DisplayPort Connector Standard

Version 1
October 26, 2009

Purpose

The purpose of this document is to define a small size connector capable of transporting video, audio and other data in the DisplayPort format.

Summary

The Mini DisplayPort Connector is a small size connector supporting the full range of signaling and protocol capabilities defined in the DisplayPort Standard Version 1, Revision 1a. It can be used as an alternative to the connector defined in the DisplayPort Standard Version 1, Revision 1a.

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Preface

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Acknowledgements

This document would not have been possible without the efforts of VESA's DisplayPort Task Group. In particular, the following individuals and their companies contributed significant time and knowledge to this version of the standard.

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Revision History

October 26, 2009 – Intitial release of the standard

1 Introduction

DisplayPort is an industry standard created to accommodate the growing broad adoption of digital display technology within the PC and CE industries. It consolidates internal and external connection methods to reduce device complexity, supports necessary features for key cross industry applications, and provides performance scalability to enable the next generation of displays featuring higher color depths, refresh rates, and display resolutions.

The DisplayPort Standard defines an external connector interface, referred to herein as the full-size DisplayPort plug and receptacle. The need has been identified for a smaller form factor connector for some devices, particularly Source devices, for example thin portable computers and add-in cards with multiple display interfaces. The Mini DisplayPort (mDP) connector aims to meet this need.

This Standard defines the mechanical dimensions of the mDP connector and the cable assemblies and adaptors supported. Devices using the mDP connector must meet all the electrical and protocol specifications required by the current published DisplayPort Standard (currently DisplayPort 1.1a). Cable assemblies incorporating a mDP connector at either or both ends must meet the cable assembly electrical specifications required by current published DisplayPort Standard

It is anticipated that DisplayPort 1.2 will revise the cable assembly electrical specifications. **It is strongly recommended that, prior to the publication of DisplayPort 1.2, cable assemblies also meet the requirements in the most recently available draft of DisplayPort 1.2.**

Resizing adaptors and extension cables are not covered by the DisplayPort 1.1a standard. It is anticipated that the electrical specification for these will be incorporated into the DisplayPort 1.2 standard. **It is strongly recommended that, prior to the publication of DisplayPort 1.2, resizing adaptors and extension cables meet the requirements in the most recently available draft of DisplayPort 1.2.**

1.1 Acronyms

Table 1-1: List of Acronyms

Acronym	Stands For:
DP	DisplayPort (VESA)
HBR	High Bit Rate (2.7 Gbps per lane)
HBR2	High Bit Rate 2 (5.4 Gbps per lane)
HPD	Hot Plug Detect
mDP	Mini DisplayPort
RBR	Reduced Bit Rate
VESA	Video Electronics Standard Association

1.2 Glossary

Table 1-2: Glossary of Terms

Terminology	Definition
AUX CH	Half-duplex, bi-directional channel between DisplayPort transmitter and DisplayPort receiver. Consists of 1 differential pair transporting self-clocked data. The DisplayPort AUX CH supports a bandwidth of 1Mbps over DisplayPort link. DisplayPort Source Device is the master (also referred to as AUX CH requester) that initiates an AUX CH transaction. DisplayPort Sink Device is the slave (also referred to as AUX CH replier) that replies to the AUX CH transaction initiated by the requester.
Box-to-box connection	DisplayPort link between two boxes that is detachable by an end user. A DisplayPort cable-connector assembly for the box-to-box connection shall have four Main Link lanes.
Captive cable	DisplayPort cable that is attached to Sink Device and cannot be detached by an end user. Captive DisplayPort cable may have one, two, or four Main Link lanes, while end-user-detachable cable is required to have four Main Link lanes.
Main link	Uni-directional channel for isochronous stream transport from DisplayPort Source Device to DisplayPort Sink Device. Consists of 1, 2, or 4 lanes, or differential pairs. Supports 2 bit rates: 2.7Gbps per lane (referred to as “high bit rate”) and 1.62Gbps per lane (referred to as “low bit rate” or “reduced bit rate”).
Sink Device	Contains one sink function and at least one rendering function, and is a Leaf Device in a DisplayPort tree topology.
Source Device	Contains one or more source functions and is a root in a DisplayPort tree topology.

1.3 References

Table 1-3: Reference Documents

Document	Version / Revision	Date
ANSI/EIA-364-09C, Durability Test Procedure for Electrical Connectors and Contacts - see global.ihs.com		June 1999
ANSI/EIA-364-13B, Mating and Unmating Forces Test Procedure for Electrical Connectors - see global.ihs.com		December 1998
ANSI/EIA-364-17B, Temperature Life with or without Electrical Load Test Procedure for Electrical Connectors and Sockets - see global.ihs.com		June 1999
ANSI/EIA-364-20C, Withstanding Voltage Test Procedure for Electrical Connectors, Sockets, and Coaxial Contacts - see global.ihs.com		June 2004
ANSI/EIA-364-21C, Insulation Resistance Test Procedure for Electrical Connectors, Sockets, and Coaxial Contacts - see global.ihs.com		May 2000
ANSI/EIA-364-23B, Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets - see global.ihs.com		December 2000
ANSI/EIA-364-27B, Mechanical Shock (Specified Pulse) Test Procedure for Electrical Connectors - see global.ihs.com		May 1996
ANSI/EIA-364-28D, Vibration Test Procedure for Electrical Connectors and Sockets - see global.ihs.com		July 1999
ANSI/EIA-364-31B, Humidity Test Procedure for Electrical Connectors - see global.ihs.com		May 2000
ANSI/EIA-364-32C, Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets - see global.ihs.com		May 2000
ANSI/EIA-364-41C, Cable Flexing Test Procedure for Electrical Connectors - see global.ihs.com		June 1999
ANSI/EIA-364-70, Temperature Rise Versus Current Test Procedure for Electrical Connector and Sockets - see global.ihs.com		May 1998
ANSI/EIA-364-98, Housing Locking Mechanism Strength Test Procedure for Electrical Connectors - see global.ihs.com		June 1997
IEC 61000-4-2, Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test– see webstore.iec.ch	2.0	December 2008
JEDEC JESD22-A114FElectrostatic Discharge (ESD) Sensitivity Testing Human Body Model (HBM) – see www.jedec.org/download/default.cfm		December 2008
VESA Glossary of Terms – see www.vesa.org	Current	Current
VESA Intellectual Property Rights (IPR) policy 200 – see www.vesa.org/Policies/ipp.htm	B	February 2005
VESA DisplayPort Standard	1.1a	January 2008

2 Mechanical

This section describes the mechanical specifications of a DisplayPort link incorporating the Mini DisplayPort connector. Cable assembly specification for external connection and connector specification are covered in this section[1]. Applications requiring a larger or longer "box to box" application space than supported by a passive cable assembly as defined in this section may be supported by the use of an active, Hybrid Device or any other such device as provided for under Section The interfaces of these devices must meet the interface requirements of a source and sink respectively.

2.1 Cable-Connector Assembly Specifications (for box-to-box)

The cable assembly specification is divided into two categories reflecting the high bit rates (2.7 Gbps per lane) and the low bit rate (1.62 Gbps per lane), respectively. A cable assembly incorporating the Mini DisplayPort connector must meet the appropriate DisplayPort electrical specifications for the intended category.

It is anticipated that DisplayPort 1.2 will revise the cable assembly electrical specifications. **It is strongly recommended that, prior to the publication of DisplayPort 1.2, cable assemblies also meet the requirements in the most recently available draft of DisplayPort 1.2.**

Resizing adaptors and extension cables are not covered by the DisplayPort 1.1a standard. It is anticipated that the electrical specification for these will be incorporated into the DisplayPort 1.2 standard. **It is strongly recommended that, prior to the publication of DisplayPort 1.2, resizing adaptors and extension cables meet the requirements in the most recently available draft of DisplayPort 1.2.**

2.1.1 Cable-Connector Assembly Definition

A DisplayPort Cable Assembly is comprised of two plug type connectors terminating both ends of a bulk cable.

The plug on either end may be a full-size DisplayPort plug or a Mini DisplayPort plug.

The following Cable Assembly types are supported:

Type C1

Cable Assembly with a full size DisplayPort plug on each end. The Type C1 Cable Assembly is depicted in Figure 2-1.

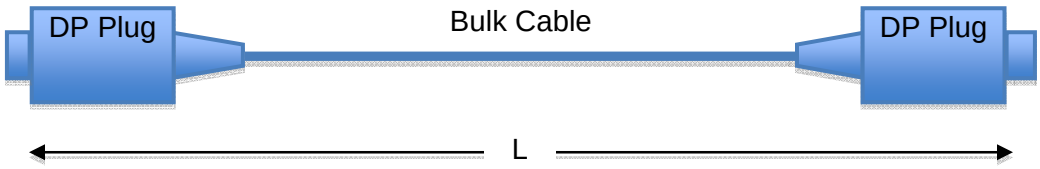


Figure 2-1: Type C1 Cable Assembly

Type C2

Cable Assembly with a Mini DisplayPort plug on one end and a full sized DisplayPort plug on the other end. The Type C2 Cable Assembly is depicted in Figure 2-2.

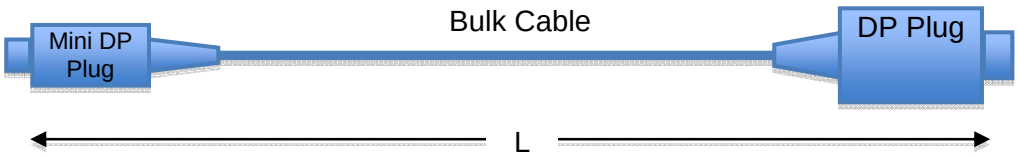


Figure 2-2: Type C2 Cable Assembly

Type C3

Cable Assembly with a Mini DisplayPort plug on each end.. The Type C3 Cable Assembly is depicted in Figure 2-3.

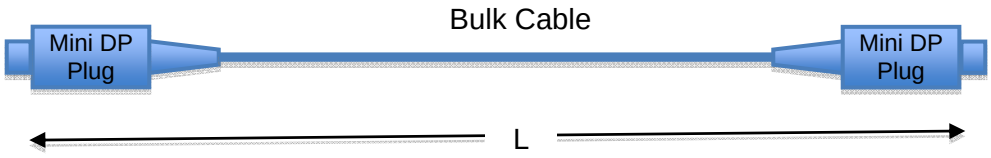


Figure 2-3: Type C3 Cable Assembly

A DisplayPort Connector Resizing Adaptor is comprised of a plug type connector terminating one end of a bulk cable and a receptacle type connector terminating the other end of the same cable. The following Resizing Adaptor types are supported:

Type A1

Resizing Adaptor with a Mini DisplayPort plug on one end and a full size DisplayPort receptacle on the other end. The Type A1 Resizing Adaptor is depicted in Figure 2-4.

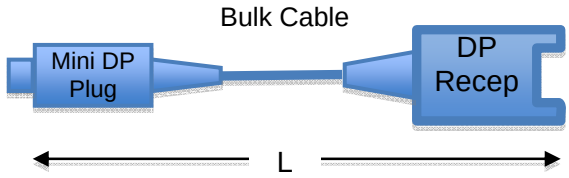
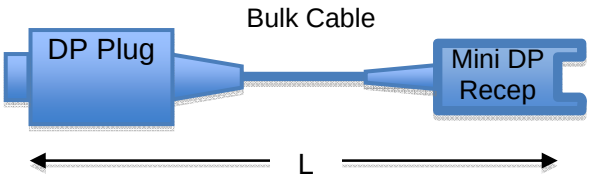


Figure 2-4: Type A1 Resizing Adaptor

Type A2

Resizing Adaptor with a full size DisplayPort plug on one end and a Mini DisplayPort receptacle on the other end. The Type A2 Resizing Adaptor is depicted in Figure 2-5.

Figure 2-5: Type A2 Resizing Adaptor



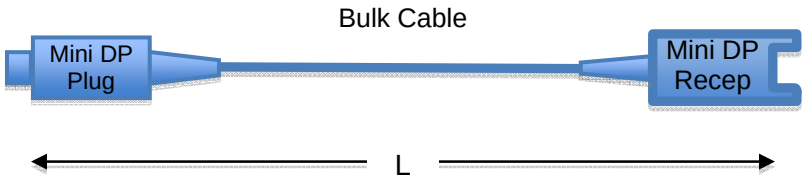
In addition, a sink may have a permanently attached cable with a full size DisplayPort plug or a permanently attached cable with a Mini DisplayPort plug.

A DisplayPort Extension Cable is designed specifically to be used in conjunction with displays (or adaptors) with a permanently attached cable with a Mini DisplayPort plug. The following type of Extension Cable is supported:

Type E1

Cable Assembly with a Mini DisplayPort plug on one end and a Mini DisplayPort receptacle on the other end. The Type E1 Extension Cable is depicted in Figure 2-6.

Figure 2-6: Type E1 Extension Cable



The following configurations of Cable Assemblies and Resizing Adaptors are supported:

Source (TP2) -> Cable Assembly type C1 -> sink (TP3)

Source (TP2) -> Cable Assembly type C2 -> sink (TP3)

Source (TP2) -> Cable Assembly type C3 -> sink (TP3)

Source (TP2) -> full size DisplayPort plug permanently attached to sink

Source (TP2) -> Mini DisplayPort plug permanently attached to sink

Source (TP2) -> Resizing Adaptor type A1 -> full size DisplayPort plug permanently attached to sink

Source (TP2) -> Resizing Adaptor type A2 -> Mini DisplayPort plug permanently attached to sink

Source (TP2) -> Extension Cable type E1 -> Mini DisplayPort plug permanently attached to sink

The following configurations of Cable Assemblies and Resizing Adaptors are supported for RBR and HBR only:

Source (TP2) -> Resizing Adaptor type A1 -> Cable Assembly type C1 -> sink (TP3)

Source (TP2) -> Resizing Adaptor type A2 -> Cable Assembly type C3 -> sink (TP3)

2.1.1.1 Cable Construction Guideline for EMI Reduction (Informative)

The following recommendations for the construction of DisplayPort cable assemblies should be followed to prevent EMI issues:

- The intra-pair skew for differential pairs in the cable assembly should be made as small as possible and should meet the defined limits defined by the cable assembly electrical specification.
- The termination of the cable shielding to the connector shield should cover a full 360^{o} around the cable and be of low impedance.
- The shielding between the device chassis, DisplayPort receptacle shield, DisplayPort plug shield, and cable shielding should form a unified low impedance link in order to maximize the efficiency of the shielding and minimize EMI. To facilitate this, the use of multiple grounding points and contact points between shield parts is recommended.

- As a general rule, unnecessary apertures in the shields may cause leakage. It is strongly recommended that the gaps between shielding components be eliminated. It is also strongly recommended that the shell cover as much of the connector as possible to yield the maximum EMI protection of the signal pins.
- As a recommendation, the shielding construction of the bulk cable should follow general high speed practices of including both a foil and braid shielding materials in its construction. A further recommendation is that the foil layer be a Al / Mylar wrap (spiral or longitudinal) with a minimum 20% overlap, and that the conductive braid should have a minimum 75% coverage over the inner foil layer to ensure effective EMI shielding.

2.1.2 Type of Bulk Cable

The bulk cable must be chosen to meet or exceed all of the electrical and mechanical requirements described below. A reference construction is depicted in Figure 2-7 below.

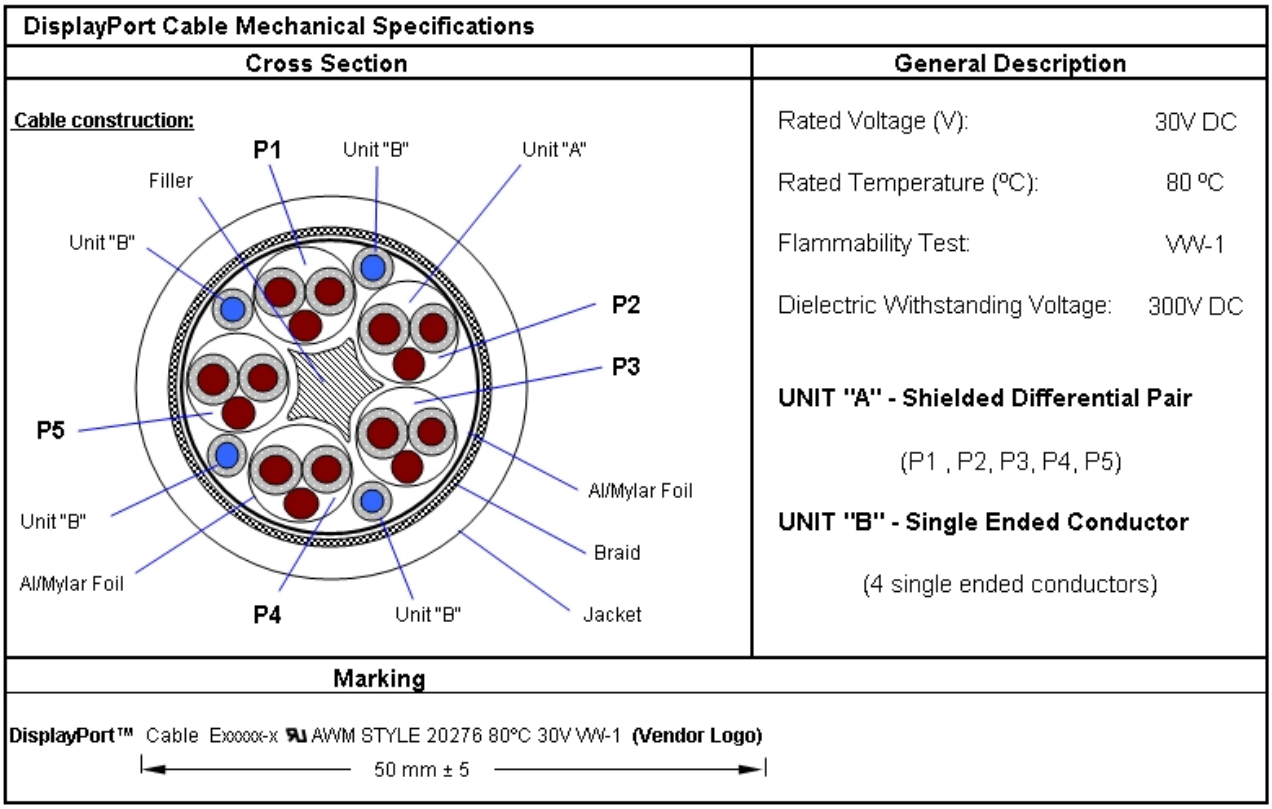


Figure 2-7: Bulk Cable Construction (Informative - for reference only)

The following is the description of the reference bulk cable construction. This description is for reference only.

- Overall shielded (braid) structure coated with jacket above;
- Unit “A”: P1-P5 ‘STP’ or ‘Twinax’ # 30 AWG insulated stranded conductors, with # 30 AWG drain conductor for use in Cable Assembly Type C1 and displays with permanently attached cables with full size DisplayPort connectors, and # 36 or #38 AWG insulated stranded conductors, with # 36 or #38 AWG drain conductor for use in all other Cable Assemblies, Resizing Adaptors and Extension Cables (for use for Main Link and AUX connections);
- Unit “B”: Unshielded, # 30 AWG single insulated stranded conductor (for GND). # 30 - # 38 AWG single insulated stranded conductor (for use for CONFIG1, CONFIG2 and HPD connections).

Examples of differences:

1) Wire gauge selection is implementation specific provided all the appropriate electrical cable specifications are met.
2) A cable that is permanently attached to a DisplayPort device may have less than four Main Link Lanes.
3) Sinks with permanently attached cables may have an extra #24 - #28 AWG single insulated stranded conductor for power.

4) Resizing Adaptors must have a #30 - #36 AWG single insulated stranded conductor for power.

5) Extension Cables must carry all four lanes and include a #24 AWG single insulated stranded conductor for power.

2.1.3 Mini DisplayPort External Connector

The Mini DisplayPort Connector is intended for use as an external connector on source devices where a small form factor connector is advantageous.

2.1.3.1 Mini DisplayPort Connector Pin Assignment

Table 2-1 shows the Source side pin assignments of the Mini DisplayPort connector.

Table 2-1: Source-Side Mini DisplayPort Connector Pin Assignment

Top Row				Bottom Row		
Pin Number	**Signal Type**	**Pin Name**		**Pin Number**	**Signal Type**	**Pin Name**
1	GND	**GND**		**2**	In	**Hot Plug Detect**
3	Out	**ML_Lane 0 (p)**		**4**	CONFIG (see note 1)	**CONFIG1**
5	Out	**ML_Lane 0 (n)**		**6**	CONFIG (see note 1)	**CONFIG2**
7	GND	**GND**		**8**	GND	**GND**
9	Out	**ML_Lane 1 (p)**		**10**	Out	**ML_Lane 3 (p)**
11	Out	**ML_Lane 1 (n)**		**12**	Out	**ML_Lane 3 (n)**
13	GND	**GND**		**14**	GND	**GND**
15	Out	**ML_Lane 2 (p)**		**16**	I/O	**AUX_CH (p)**
17	Out	**ML_Lane 2 (n)**		**18**	I/O	**AUX_CH (n)**
19	GND	**GND**		**20**	PWR Out (see note 2)	**DP_PWR**

Notes:

1) Pins 4 and 6 must be connected to ground through a pull-down device. External devices and cable assemblies must be designed to not rely on a low impedance ground path from these pins.

2) Pin 20, PWR Out, must provide +3.3V+/-10% with a maximum current of 500 mA and a minimum power capability of 1.5 watts.

It is recommended that sink devices should use the full size DisplayPort connector. However, if a sink device implements the Mini DisplayPort connector, then it must use the pinout specified in Table 2-2.

Table 2-2: Sink-Side Mini DisplayPort Connector Pin Assignment

Top Row				Bottom Row		
Pin Number	**Signal Type**	**Pin Name**		**Pin Number**	**Signal Type**	**Pin Name**
1	GND	**GND**		**2**	Out	**Hot Plug Detect**
3	In	**ML_Lane 3 (n)**		**4**	CONFIG (see note 1)	**CONFIG1**
5	In	**ML_Lane 3 (p)**		**6**	CONFIG (see note 1)	**CONFIG2**
7	GND	**GND**		**8**	GND	**GND**
9	In	**ML_Lane 2 (n)**		**10**	In	**ML_Lane 0 (n)**
11	In	**ML_Lane 2 (p)**		**12**	In	**ML_Lane 0 (p)**
13	GND	**GND**		**14**	GND	**GND**
15	In	**ML_Lane 1 (n)**		**16**	I/O	**AUX_CH (p)**
17	In	**ML_Lane 1 (p)**		**18**	I/O	**AUX_CH (n)**
19	GND	**GND**		**20**	PWR Out (see note 2)	**DP_PWR**

Notes:

1) Pins 4 and 6 must be connected to ground through a pull-down device. External devices and cable assemblies must be designed to not rely on a low impedance ground path from these pins.

2) Pin 20, PWR Out, must provide +3.3 volts ± 10% with a maximum current of 500 mA and a minimum power capability of 1.5 watts.

A cable assembly may be constructed with a Mini DisplayPort plug at both ends, or a Mini DisplayPort plug at one end and a full size DisplayPort plug at the other end, or a full size DisplayPort plug at both ends. The standard external cable connector assembly must not have a wire on pin 20, DP_PWR.

Figure 2-8 shows the wiring of an external cable connector assembly when a Mini DisplayPort plug is used at both ends.

Mini DP Source connector			Mini DP to Mini DP Cable assembly			Mini DP Sink connector		
Signal Type	**Pin Name**	**Pin**	**Plug Pin**		**Plug Pin**	**Pin**	**Pin Name**	**Signal Type**
GND	**GND**	**1**	**1**	⟷	**8**	**8**	**GND**	GND
Out	**ML_Lane 0 (p)**	**3**	**3**	⟷	**12**	**12**	**ML_Lane 0 (p)**	In
Out	**ML_Lane 0 (n)**	**5**	**5**	⟷	**10**	**10**	**ML_Lane 0 (n)**	In
GND	**GND**	**7**	**7**	⟷	**13**	**13**	**GND**	GND
Out	**ML_Lane 1 (p)**	**9**	**9**	⟷	**17**	**17**	**ML_Lane 1 (p)**	In
Out	**ML_Lane 1 (n)**	**11**	**11**	⟷	**15**	**15**	**ML_Lane 1 (n)**	In
GND	**GND**	**13**	**13**	⟷	**7**	**7**	**GND**	GND
Out	**ML_Lane 2 (p)**	**15**	**15**	⟷	**11**	**11**	**ML_Lane 2 (p)**	In
Out	**ML_Lane 2 (n)**	**17**	**17**	⟷	**9**	**9**	**ML_Lane 2 (n)**	In
GND	**GND**	**19**	**19**	⟷	**19**	**19**	**GND**	GND
In	**Hot Plug Detect**	**2**	**2**	⟷	**2**	**2**	**Hot Plug Detect**	Out
CFG	**CONFIG1**	**4**	**4**	⟷	**4**	**4**	**CONFIG1**	CFG
CFG	**CONFIG2**	**6**	**6**	⟷	**6**	**6**	**CONFIG2**	CFG
GND	**GND**	**8**	**8**	⟷	**1**	**1**	**GND**	GND
Out	**ML_Lane 3 (p)**	**10**	**10**	⟷	**5**	**5**	**ML_Lane 3 (p)**	In
Out	**ML_Lane 3 (n)**	**12**	**12**	⟷	**3**	**3**	**ML_Lane 3 (n)**	In
GND	**GND**	**14**	**14**	⟷	**14**	**14**	**GND**	GND
I/O	**AUX_CH (p)**	**16**	**16**	⟷	**16**	**16**	**AUX_CH (p)**	I/O
I/O	**AUX_CH (n)**	**18**	**18**	⟷	**18**	**18**	**AUX_CH (n)**	I/O
PWR Out	**DP_PWR**	**20**	**20**	(no connection)	**20**	**20**	**DP_PWR**	PWR Out

Figure 2-8: Mini DisplayPort Cable Connector Assembly Wiring

Figure 2-9 and Figure 2-10 show the wiring of an external cable connector assembly when a Mini DisplayPort plug is used at one end and a full size DisplayPort plug is used at the other end.

Mini DP Source Connector			Mini DP to DisplayPort Cable Assembly			DisplayPort Sink Connector		
Signal Type	**Pin Name**	**Pin**	**Plug Pin**		**Plug Pin**	**Pin**	**Pin Name**	**Signal Type**
GND	**GND**	**1**	**1**	⟷	**11**	**11**	**GND**	GND
Out	**ML_Lane 0 (p)**	**3**	**3**	⟷	**12**	**12**	**ML_Lane 0 (p)**	In
Out	**ML_Lane 0 (n)**	**5**	**5**	⟷	**10**	**10**	**ML_Lane 0 (n)**	In
GND	**GND**	**7**	**7**	⟷	**8**	**8**	**GND**	GND
Out	**ML_Lane 1 (p)**	**9**	**9**	⟷	**9**	**9**	**ML_Lane 1 (p)**	In
Out	**ML_Lane 1 (n)**	**11**	**11**	⟷	**7**	**7**	**ML_Lane 1 (n)**	In
GND	**GND**	**13**	**13**	⟷	**5**	**5**	**GND**	GND
Out	**ML_Lane 2 (p)**	**15**	**15**	⟷	**6**	**6**	**ML_Lane 2 (p)**	In
Out	**ML_Lane 2 (n)**	**17**	**17**	⟷	**4**	**4**	**ML_Lane 2 (n)**	In
GND	**GND**	**19**	**19**	⟷	**19**	**19**	**GND**	GND
In	**Hot Plug Detect**	**2**	**2**	⟷	**18**	**18**	**Hot Plug Detect**	Out
CFG	**CONFIG1**	**4**	**4**	⟷	**13**	**13**	**CONFIG1**	CFG
CFG	**CONFIG2**	**6**	**6**	⟷	**14**	**14**	**CONFIG2**	CFG
GND	**GND**	**8**	**8**	⟷	**2**	**2**	**GND**	GND
Out	**ML_Lane 3 (p)**	**10**	**10**	⟷	**3**	**3**	**ML_Lane 3 (p)**	In
Out	**ML_Lane 3 (n)**	**12**	**12**	⟷	**1**	**1**	**ML_Lane 3 (n)**	In
GND	**GND**	**14**	**14**	⟷	**16**	**16**	**GND**	GND
I/O	**AUX_CH (p)**	**16**	**16**	⟷	**15**	**15**	**AUX_CH (p)**	I/O
I/O	**AUX_CH (n)**	**18**	**18**	⟷	**17**	**17**	**AUX_CH (n)**	I/O
PWR Out	**DP_PWR**	**20**	**20**	(no connection)	**20**	**20**	**DP_PWR**	PWR Out

Figure 2-9: Mini DisplayPort to DisplayPort Cable Connector Assembly Wiring

DisplayPort Source Connector				DisplayPort to Mini DP Cable Assembly				Mini DP Sink Connector		
Signal Type	**Pin Name**	**Pin**		**Plug Pin**		**Plug Pin**		**Pin**	**Pin Name**	**Signal Type**
GND	**GND**	**2**		**2**	⟷	**8**		**8**	**GND**	GND
Out	**ML_Lane 0 (p)**	**1**		**1**	⟷	**12**		**12**	**ML_Lane 0 (p)**	In
Out	**ML_Lane 0 (n)**	**3**		**3**	⟷	**10**		**10**	**ML_Lane 0 (n)**	In
GND	**GND**	**5**		**5**	⟷	**13**		**13**	**GND**	GND
Out	**ML_Lane 1 (p)**	**4**		**4**	⟷	**17**		**17**	**ML_Lane 1 (p)**	In
Out	**ML_Lane 1 (n)**	**6**		**6**	⟷	**15**		**15**	**ML_Lane 1 (n)**	In
GND	**GND**	**8**		**8**	⟷	**7**		**7**	**GND**	GND
Out	**ML_Lane 2 (p)**	**7**		**7**	⟷	**11**		**11**	**ML_Lane 2 (p)**	In
Out	**ML_Lane 2 (n)**	**9**		**9**	⟷	**9**		**9**	**ML_Lane 2 (n)**	In
GND	**GND**	**19**		**19**	⟷	**19**		**19**	**GND**	GND
In	**Hot Plug Detect**	**18**		**18**	⟷	**2**		**2**	**Hot Plug Detect**	Out
CFG	**CONFIG1**	**13**		**13**	⟷	**4**		**4**	**CONFIG1**	CFG
CFG	**CONFIG2**	**14**		**14**	⟷	**6**		**6**	**CONFIG2**	CFG
GND	**GND**	**11**		**11**	⟷	**1**		**1**	**GND**	GND
Out	**ML_Lane 3 (p)**	**10**		**10**	⟷	**5**		**5**	**ML_Lane 3 (p)**	In
Out	**ML_Lane 3 (n)**	**12**		**12**	⟷	**3**		**3**	**ML_Lane 3 (n)**	In
GND	**GND**	**16**		**16**	⟷	**14**		**14**	**GND**	GND
I/O	**AUX_CH (p)**	**15**		**15**	⟷	**16**		**16**	**AUX_CH (p)**	I/O
I/O	**AUX_CH (n)**	**17**		**17**	⟷	**18**		**18**	**AUX_CH (n)**	I/O
PWR Out	**DP_PWR**	**20**		**20**	(no connection)	**20**		**20**	**DP_PWR**	PWR Out

Figure 2-10: DisplayPort to Mini DisplayPort Cable Connector Assembly Wiring

A Resizing Adaptor may be constructed with a Mini DisplayPort plug at one end and a DisplayPort connector at the other end. Such an adaptor must carry all 20 signals (including DP_PWR) and must make the signal connections so that the mini DisplayPort plug adapts to a full size DisplayPort connector. Figure 2-11 shows the wiring of a passive adaptor with a Mini DisplayPort plug at one end and a DisplayPort connector at the other end.

Mini DP Source Connector			Mini DP to DisplayPort Adaptor			DisplayPort Cable Plug		
Signal Type	**Pin Name**	**Pin**	**Plug Pin**		**Conn -ector Pin**	**Pin**	**Pin Name**	**Signal Type**
GND	**GND**	**1**	**1**	⟷	**2**	**2**	**GND**	GND
Out	**ML_Lane 0 (p)**	**3**	**3**	⟷	**1**	**1**	**ML_Lane 0 (p)**	In
Out	**ML_Lane 0 (n)**	**5**	**5**	⟷	**3**	**3**	**ML_Lane 0 (n)**	In
GND	**GND**	**7**	**7**	⟷	**5**	**5**	**GND**	GND
Out	**ML_Lane 1 (p)**	**9**	**9**	⟷	**4**	**4**	**ML_Lane 1 (p)**	In
Out	**ML_Lane 1 (n)**	**11**	**11**	⟷	**6**	**6**	**ML_Lane 1 (n)**	In
GND	**GND**	**13**	**13**	⟷	**8**	**8**	**GND**	GND
Out	**ML_Lane 2 (p)**	**15**	**15**	⟷	**7**	**7**	**ML_Lane 2 (p)**	In
Out	**ML_Lane 2 (n)**	**17**	**17**	⟷	**9**	**9**	**ML_Lane 2 (n)**	In
GND	**GND**	**19**	**19**	⟷	**19**	**19**	**GND**	GND
In	**Hot Plug Detect**	**2**	**2**	⟷	**18**	**18**	**Hot Plug Detect**	Out
CFG	**CONFIG1**	**4**	**4**	⟷	**13**	**13**	**CONFIG1**	CFG
CFG	**CONFIG2**	**6**	**6**	⟷	**14**	**14**	**CONFIG2**	CFG
GND	**GND**	**8**	**8**	⟷	**11**	**11**	**GND**	GND
Out	**ML_Lane 3 (p)**	**10**	**10**	⟷	**10**	**10**	**ML_Lane 3 (p)**	In
Out	**ML_Lane 3 (n)**	**12**	**12**	⟷	**12**	**12**	**ML_Lane 3 (n)**	In
GND	**GND**	**14**	**14**	⟷	**16**	**16**	**GND**	GND
I/O	**AUX_CH (p)**	**16**	**16**	⟷	**15**	**15**	**AUX_CH (p)**	I/O
I/O	**AUX_CH (n)**	**18**	**18**	⟷	**17**	**17**	**AUX_CH (n)**	I/O
PWR Out	**DP_PWR**	**20**	**20**	⟷	**20**	**20**	**DP_PWR**	PWR Out

Figure 2-11: Mini DisplayPort to DisplayPort Adaptor Wiring

A Resizing Adaptor may be constructed with a DisplayPort plug at one end and a Mini DisplayPort connector at the other end. Such an adaptor must carry all 20 signals (including DP_PWR) and must make the signal connections so that the full size DisplayPort plug adapts to a mini DisplayPort connector. Figure 2-12 shows the wiring of a passive adaptor with a DisplayPort plug at one end and a Mini DisplayPort connector at the other end.

DisplayPort Source Connector			DisplayPort to Mini DP Cable Adaptor			Mini DP Cable Plug		
Signal Type	Pin Name	Pin	Plug Pin		Conn-ector Pin	Pin	Pin Name	Signal Type
GND	GND	2	2	⟷	1	1	GND	GND
Out	ML_Lane 0 (p)	1	1	⟷	3	3	ML_Lane 0 (p)	In
Out	ML_Lane 0 (n)	3	3	⟷	5	5	ML_Lane 0 (n)	In
GND	GND	5	5	⟷	7	7	GND	GND
Out	ML_Lane 1 (p)	4	4	⟷	9	9	ML_Lane 1 (p)	In
Out	ML_Lane 1 (n)	6	6	⟷	11	11	ML_Lane 1 (n)	In
GND	GND	8	8	⟷	13	13	GND	GND
Out	ML_Lane 2 (p)	7	7	⟷	15	15	ML_Lane 2 (p)	In
Out	ML_Lane 2 (n)	9	9	⟷	17	17	ML_Lane 2 (n)	In
GND	GND	19	19	⟷	19	19	GND	GND
In	Hot Plug Detect	18	18	⟷	2	2	Hot Plug Detect	Out
CFG	CONFIG1	13	13	⟷	4	4	CONFIG1	CFG
CFG	CONFIG2	14	14	⟷	6	6	CONFIG2	CFG
GND	GND	11	11	⟷	8	8	GND	GND
Out	ML_Lane 3 (p)	10	10	⟷	10	10	ML_Lane 3 (p)	In
Out	ML_Lane 3 (n)	12	12	⟷	12	12	ML_Lane 3 (n)	In
GND	GND	16	16	⟷	14	14	GND	GND
I/O	AUX_CH (p)	15	15	⟷	16	16	AUX_CH (p)	I/O
I/O	AUX_CH (n)	17	17	⟷	18	18	AUX_CH (n)	I/O
PWR Out	DP_PWR	20	20	⟷	20	20	DP_PWR	PWR Out

Figure 2-12: DisplayPort to Mini DisplayPort Adaptor Wiring

An Extender may be constructed with a Mini DisplayPort plug at one end and a Mini DisplayPort connector at the other end. Such an adaptor must carry 20 signals and must make the signal connections so that the mini DisplayPort plug connects to a mini DisplayPort connectorFigure 2-13 shows the wiring of a passive extender with a Mini DisplayPort plug at one end and a Mini DisplayPort connector at the other end.

Mini DP Source Connector			Mini DP Plug to Mini DP Connector Cable Assembly			Mini DP Cable Plug		
Signal Type	**Pin Name**	**Pin**	**Plug Pin**		**Conn-ector Pin**	**Pin**	**Pin Name**	**Signal Type**
GND	**GND**	**1**	**1**	⟷	**1**	**1**	**GND**	GND
Out	**ML_Lane 0 (p)**	**3**	**3**	⟷	**3**	**3**	**ML_Lane 0 (p)**	In
Out	**ML_Lane 0 (n)**	**5**	**5**	⟷	**5**	**5**	**ML_Lane 0 (n)**	In
GND	**GND**	**7**	**7**	⟷	**7**	**7**	**GND**	GND
Out	**ML_Lane 1 (p)**	**9**	**9**	⟷	**9**	**9**	**ML_Lane 1 (p)**	In
Out	**ML_Lane 1 (n)**	**11**	**11**	⟷	**11**	**11**	**ML_Lane 1 (n)**	In
GND	**GND**	**13**	**13**	⟷	**13**	**13**	**GND**	GND
Out	**ML_Lane 2 (p)**	**15**	**15**	⟷	**15**	**15**	**ML_Lane 2 (p)**	In
Out	**ML_Lane 2 (n)**	**17**	**17**	⟷	**17**	**17**	**ML_Lane 2 (n)**	In
GND	**GND**	**19**	**19**	⟷	**19**	**19**	**GND**	GND
In	**Hot Plug Detect**	**2**	**2**	⟷	**2**	**2**	**Hot Plug Detect**	Out
CFG	**CONFIG1**	**4**	**4**	⟷	**4**	**4**	**CONFIG1**	CFG
CFG	**CONFIG2**	**6**	**6**	⟷	**6**	**6**	**CONFIG2**	CFG
GND	**GND**	**8**	**8**	⟷	**8**	**8**	**GND**	GND
Out	**ML_Lane 3 (p)**	**10**	**10**	⟷	**10**	**10**	**ML_Lane 3 (p)**	In
Out	**ML_Lane 3 (n)**	**12**	**12**	⟷	**12**	**12**	**ML_Lane 3 (n)**	In
GND	**GND**	**14**	**14**	⟷	**14**	**14**	**GND**	GND
I/O	**AUX_CH (p)**	**16**	**16**	⟷	**16**	**16**	**AUX_CH (p)**	I/O
I/O	**AUX_CH (n)**	**18**	**18**	⟷	**18**	**18**	**AUX_CH (n)**	I/O
PWR Out	**DP_PWR**	**20**	**20**		**20**	**20**	**DP_PWR**	PWR Out

Figure 2-13: Mini DisplayPort Cable Extender Wiring

2.1.3.2 Mini DisplayPort Connector Mechanical Performance Requirements

Table 2-3 below shows the mechanical performance requirements for a Mini DisplayPort connector.

Table 2-3: Mini DisplayPort Connector Mechanical Performance Requirements

Item	Test Condition	Requirement	
Vibration	Amplitude: 1.52 mm P-P or 147 m/s^2 {15G} Sweep time: 50-2000-50Hz in 20 minutes. Duration: 12 times in each of X, Y, Z axes (Total of 36 times) Electrical load: DC 100 mA current must be conducted during the test. (ANSI/EIA-364-28 Condition III Method 5A)	Appearance	No Damage
		Contact Resistance	Contact: Change from initial value: 30 mΩ maximum. Shell Part: Change from initial value: 50 mΩ maximum.
		Discontinuity	1 µs maximum.
Durability	Measure contact and shell resistance after the following. Automatic cycling : 10,000 cycles at 100 ± 50 cycles per hour (ANSI/EIA-364-09)	Contact Resistance	Contact: Change from initial value: 30 mΩ maximum. Shell Part: Change from initial value: 50 mΩ maximum.
Insertion / Withdrawal Force	Insertion and withdrawal speed: 25 mm / minute. (ANSI/EIA-364-13)	Withdrawal force	9.8 N {1.0kgf} minimum 39.2 N {4.0kgf} maximum
		Insertion force	44.1 N {4.5kgf} maximum
Cable Flex	100 cycles in each of 2 planes. Dimension: X = 3.7 x Cable Diameter. (ANSI/EIA-364-41, Condition I)	Discontinuity	1 µs maximum.
		Dielectric Withstanding Voltage and Insulation Resistance.	Conform to item of dielectric withstanding voltage and insulation resistance

2.1.3.3 Mini DisplayPort Connector Electrical Performance Requirements

Table 2-4 below shows the electrical performance requirements for a Mini DisplayPort connector.

Table 2-4: Mini DisplayPort Connector Electrical Performance Requirements

Item	Test Condition	Requirement
Low Level Contact Resistance	Mated connectors, Contact: measured by dry circuit, 20 mVolts maximum, and 10mA. Shell: measured by open circuit, 5 Volts maximum, 100mA. (ANSI/EIA-364-23)	Contact: Change from initial value = 30 mΩ maximum Shell: Change from initial value = 50 mΩ maximum
Dielectric Strength	Unmated connectors, apply 500 Volts RMS between adjacent terminal and ground. (ANSI/EIA 364-20,Method 301) Mated connector, apply 300 Volts RMS between adjacent terminal and ground.	No Breakdown
Insulation Resistance	Unmated connectors, apply 500 Volts DC between adjacent terminal and ground. (ANSI/EIA 364-21,Method 302)	Unmated: 100 MΩ minimum
	Mated connectors, apply 150 Volts DC between adjacent terminal and ground.	Mated: 10 MΩ minimum
Contact Current Rating	55 °C, maximum ambient 85 °C, maximum temperature change (ANSI/EIA-364-70,TP-70)	0.5 A minimum
Applied Voltage Rating	40 Volts RMS continuous maximum, on any signal pin with respect to the shield.	No Breakdown
Electrostatic Discharge	Test unmated connectors from 1 kVolt to 8 kVolts in 1 kVolt steps using 8mm ball probe. (IEC61000-4-2)	No evidence of discharge to contacts at 8kVolts

2.1.3.4 Mini DisplayPort Connector Environmental Performance requirements

Table 2-5 below shows the environmental performance requirements for a Mini DisplayPort connector.

Table 2-5: Mini DisplayPort Connector Environment Performance Requirements

Item	Test Condition	Requirement	
Thermal Shock	10 cycles of: a) -55°Cfor 30 minutes b) +85°C for 30 minutes (ANSI/EIA-364-32, Condition I)	Appearance	No Damage
		Contact Resistance	Contact: Change from initial value: 30 mΩ maximum. Shell Part: Change from initial value: 50 mΩ maximum.
Humidity	A) Mate connectors together and perform the test as follows: Temperature : +25 to +85°C Relative Humidity : 80 to 95% Duration : Four cycles (96 hours) Upon completion of the test, specimens must be conditioned at ambient room conditions for 24 hours, after which the specified measurements must be performed. (ANSI/EIA-364-31)	Appearance	No Damage
		Contact Resistance	Contact: Change from initial value: 30 mΩ maximum. Shell Part: Change from initial value: 50 mΩ maximum.
	B) Unmate connectors and perform the test as follows: Temperature : +25 to +85°C Relative Humidity : 80 to 95% Duration : Four cycles (96 hours) Upon completion of the test, specimens must be conditioned at ambient room conditions for 24 hours, after which the specified measurements must be performed. (ANSI/EIA-364-31)	Appearance	No Damage
		Dielectric Withstanding Voltage and Insulation Resistance	Conform to item of Dielectric Withstanding Voltage and Insulation Resistance
Thermal Aging	Mate connectors and expose to (+105 ± 2)°C for 250 hours. Upon completion of the exposure period, the test specimens must be conditioned at ambient room conditions for one to two hours after which the specified measurements must be performed. (ANSI/EIA-364-17, Condition 4, Method A)	Appearance	No Damage
		Contact Resistance	Contact: Change from initial value: 30 mΩ maximum. Shell Part: Change from initial value: 50 mΩ maximum.

2.1.3.5 Connector Performance Test Sequence

To evaluate the connector performance, the test sequence must follow the test groups 1, 2, 3 and 7 in the ANSI/EIA Standard (EIA-364-1000.01).

2.1.3.6 Mini DisplayPort Cable-Connector (Plug) Dimensions

Figure 2-14 and Figure 2-15 show the Mini DisplayPort plug dimensions, including the maximum external dimensions for the overmold. The external shape of the overmold cross-section is shown for illustration only and is not part of this specification. A plug must meet all dimensions and tolerances shown.

All dimensions are in mm. Except where otherwise specified, tolerances are x.x ±0.2, x.xx ±0.10, x.xxx ±0.050, angles ±0.5° .

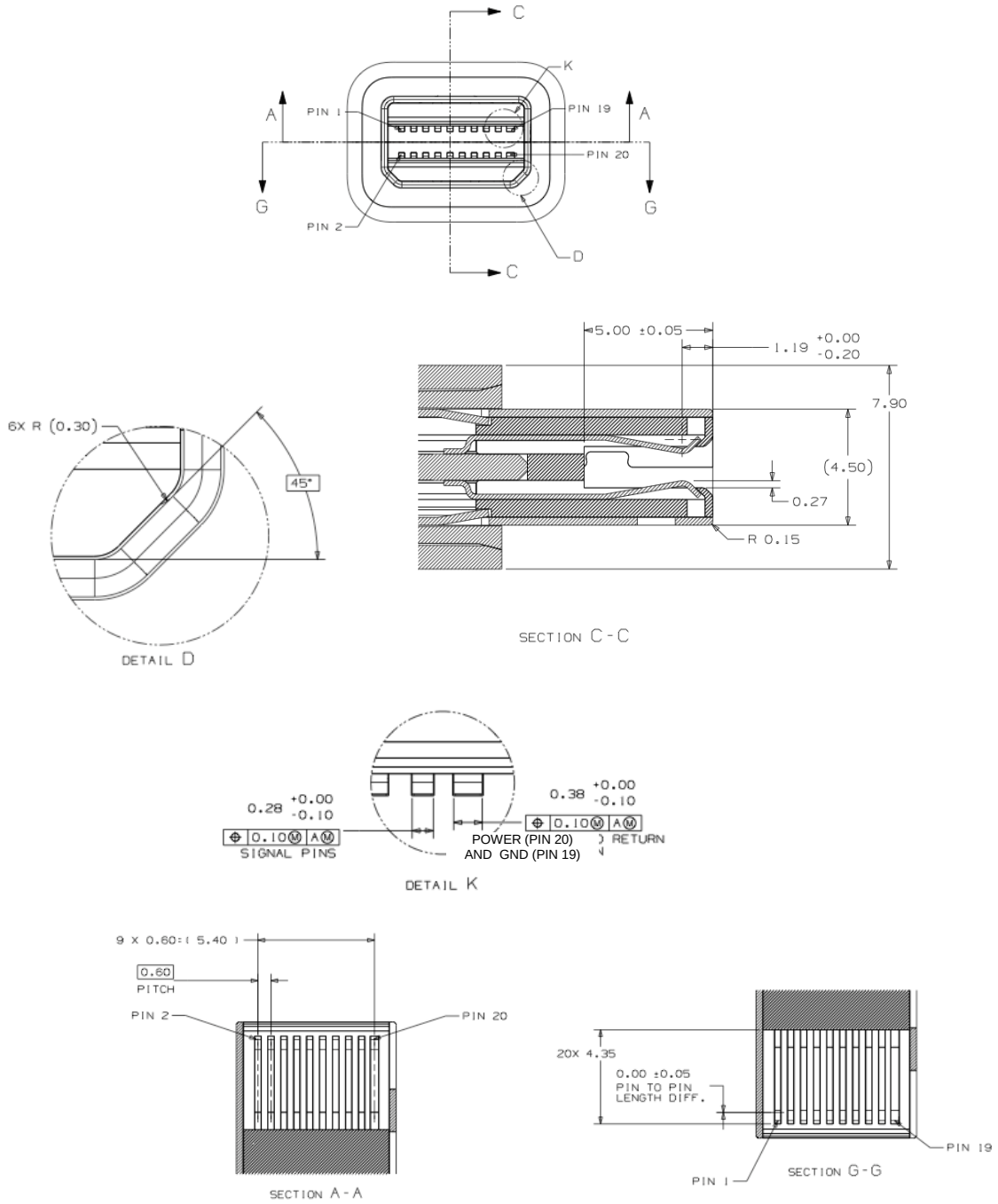


Figure 2-14: Mini DisplayPort Cable-Connector Dimensions – 1

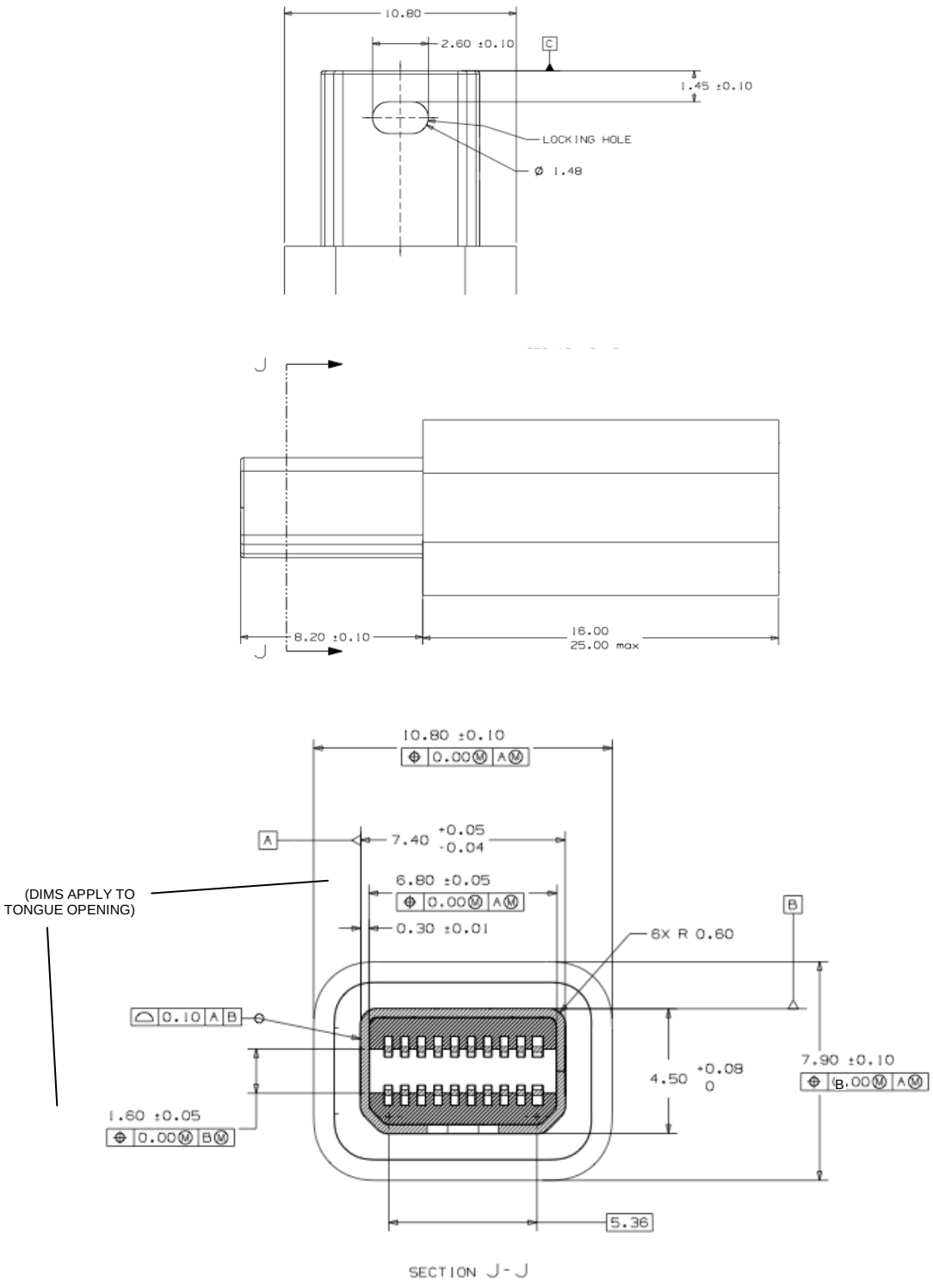


Figure 2-15: Mini DisplayPort Cable-Connector Dimensions – 2

2.1.3.7 Mini DisplayPort Connector (Receptacle) Dimensions

Figure 2-16 and Figure 2-17 below show the Mini DisplayPort Connector dimensions. A connector must meet all dimensions and tolerances shown.

All dimensions are in mm. Except where otherwise specified, tolerances are x.x ±0.2, x.xx ±0.10, x.xxx ±0.050, angles ±0.5°.

See also 2.1.3.8 below for the required mating sequence. See also 2.1.3.9 below for the required panel allowance. See also 2.1.3.10 below for an appropriate PCB layout.

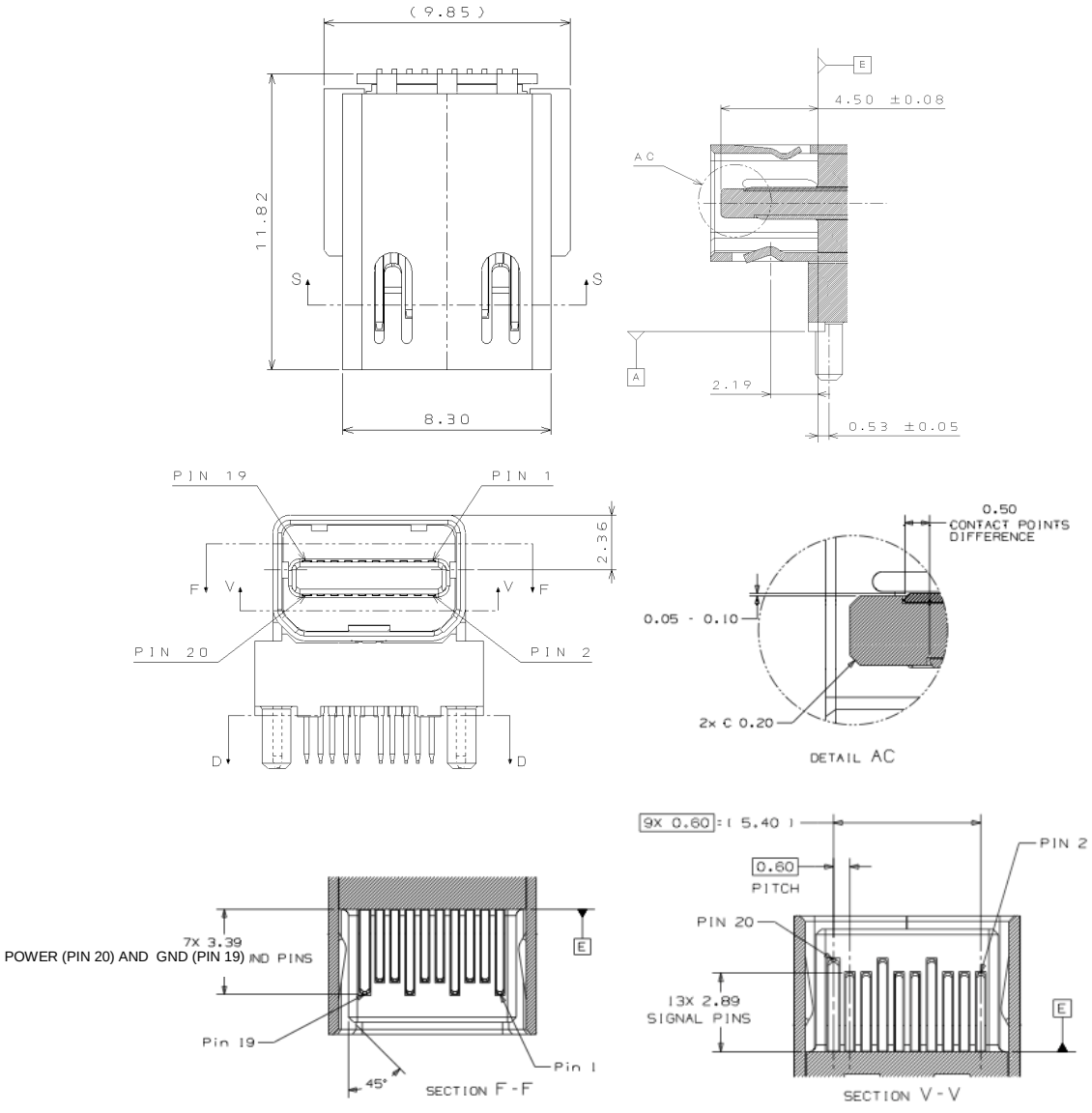


Figure 2-16: Mini DisplayPort Connector Dimensions - 1

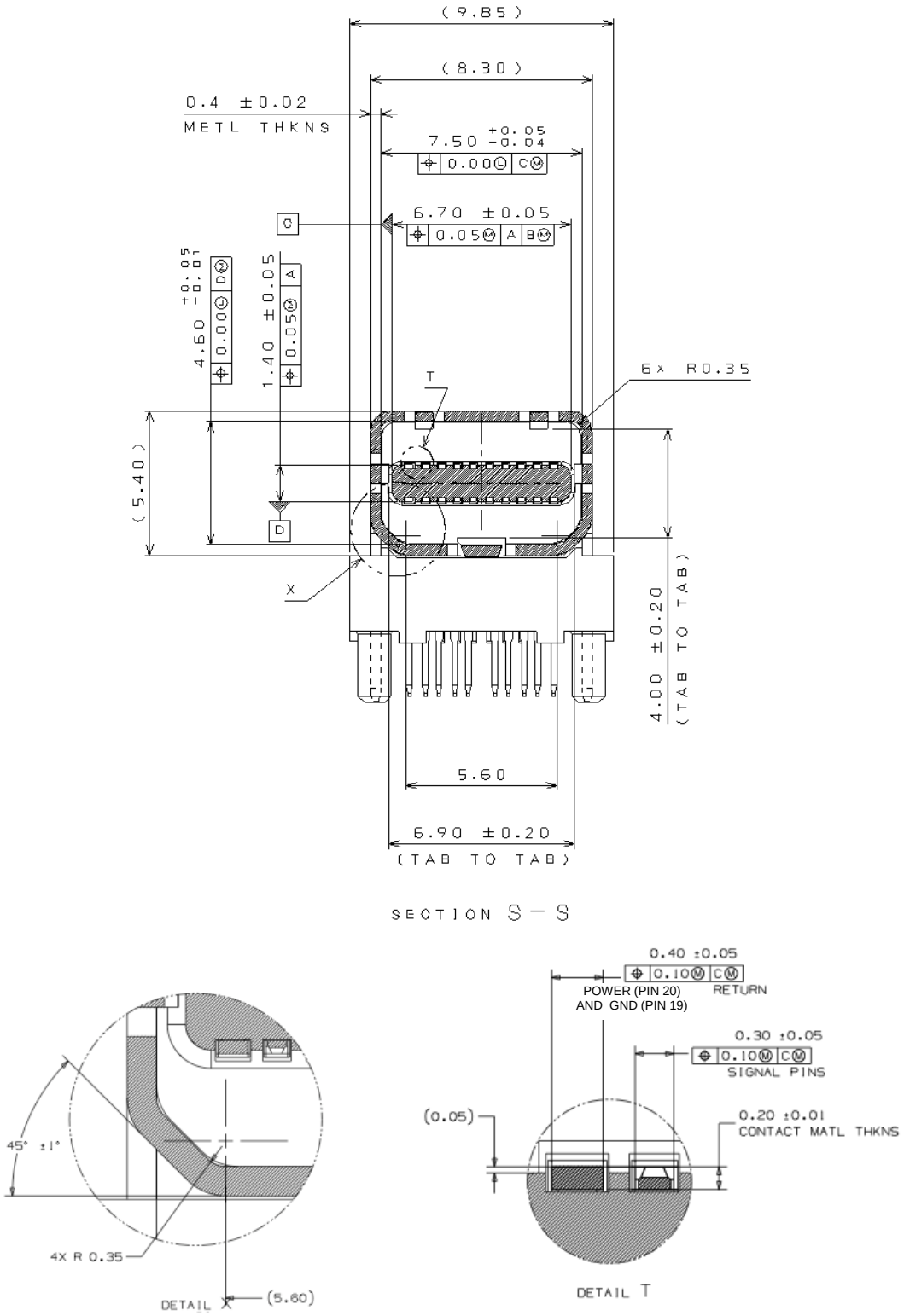


Figure 2-17: Mini DisplayPort Connector Dimensions – 2

2.1.3.8 Mini DisplayPort Contact Sequence

A Mini DisplayPort receptacle must be designed to ensure the correct mating sequence. Table 2-6 shows the legend for signal name / type mating level.

Table 2-6: Mating Sequence Level

Signal Type		Level
Connector Shell		First Mate[1]
DP_PWR	GND	Second Mate
Auxiliary (+) / (-) ML_Lane (i) (+) / (-)	Hot Plug Detect, CONFIG1, CONFIG2	Third Mate

Note 1: the EMC fingers on the shell may mate after all contacts have mated.

Figure 2-18 shows the mating levels of the fully mated Mini DisplayPort receptacle and plug. All dimensions are in mm. Except where otherwise specified, tolerances are x.x ±0.2, x.xx ±0.10, x.xxx ±0.050, angles ±0.5°.

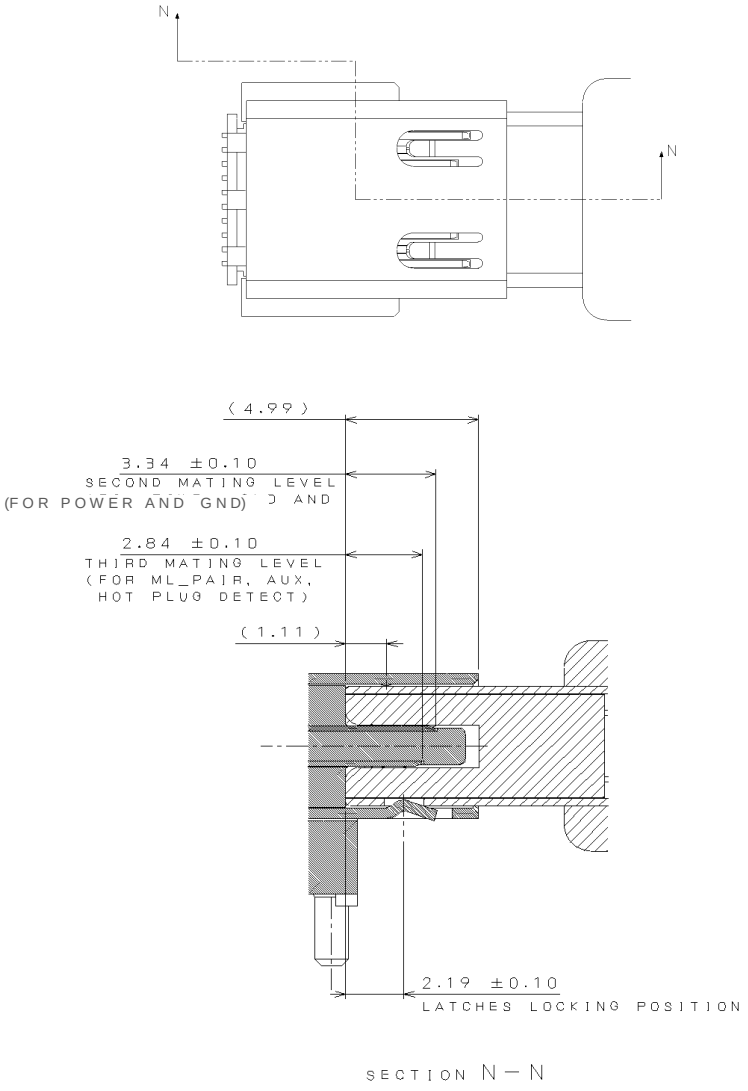


Figure 2-18: Fully Mated Mini DisplayPort Connector Showing Mating Levels

2.1.3.9 Mini DisplayPort Panel Allowances

The figure in the previous section shows the plug protrusion in the fully mated condition of the plug and the board receptacles. The system design incorporating a Mini DisplayPort receptacle must be designed so that a Mini DisplayPort plug fully mates with the Mini DisplayPort receptacle with appropriate margin, but with sufficient control to prevent an incorrect contact sequence due to angled insertion. The receptacle design must provide an appropriate allowance for a panel, bezel or similar (when used) so that this requirement is met. To meet these requirements, the distance from datum E in the receptacle to the externally accessible mating interface on the device shall be at least 5.7mm and shall not exceed 8.0mm.

2.1.3.10 Recommended PCB Mounting

The recommended mounting for the Mini DisplayPort Connector to a PCB uses surface-mount contacts for the mating interface top row of pins and thru-hole contacts for the mating interface bottom row of pins. Figure 2-19 below shows the Mini DisplayPort Connector's PCB interface, i.e. the sizes and positions of the surface mount contacts, the thru-hole contacts and the locating lugs. The actual landing pad design to receive these contacts will be system dependent.

All dimensions are in mm (except where otherwise specified). Tolerances are x.x ±0.2, x.xx ±0.10, x.xxx ±0.050, angles ±0.5°.

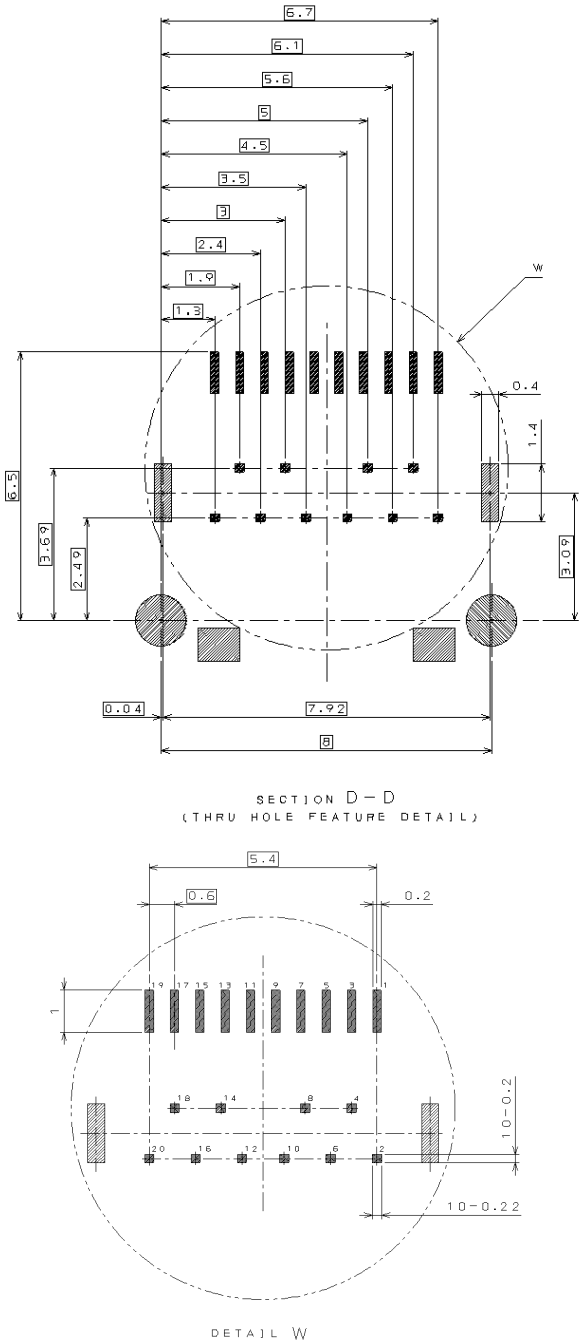


Figure 2-19: Recommended Mini DisplayPort Connector PCB Contacts and Mounting

2.1.3.11 Reference Design for Four Mini DisplayPort Connectors on a Reduced Height PCI Card

Figure 2-20 and Figure 2-21 show a reference application design for four Mini DisplayPort connectors on a low profile PCI/PCIe card.

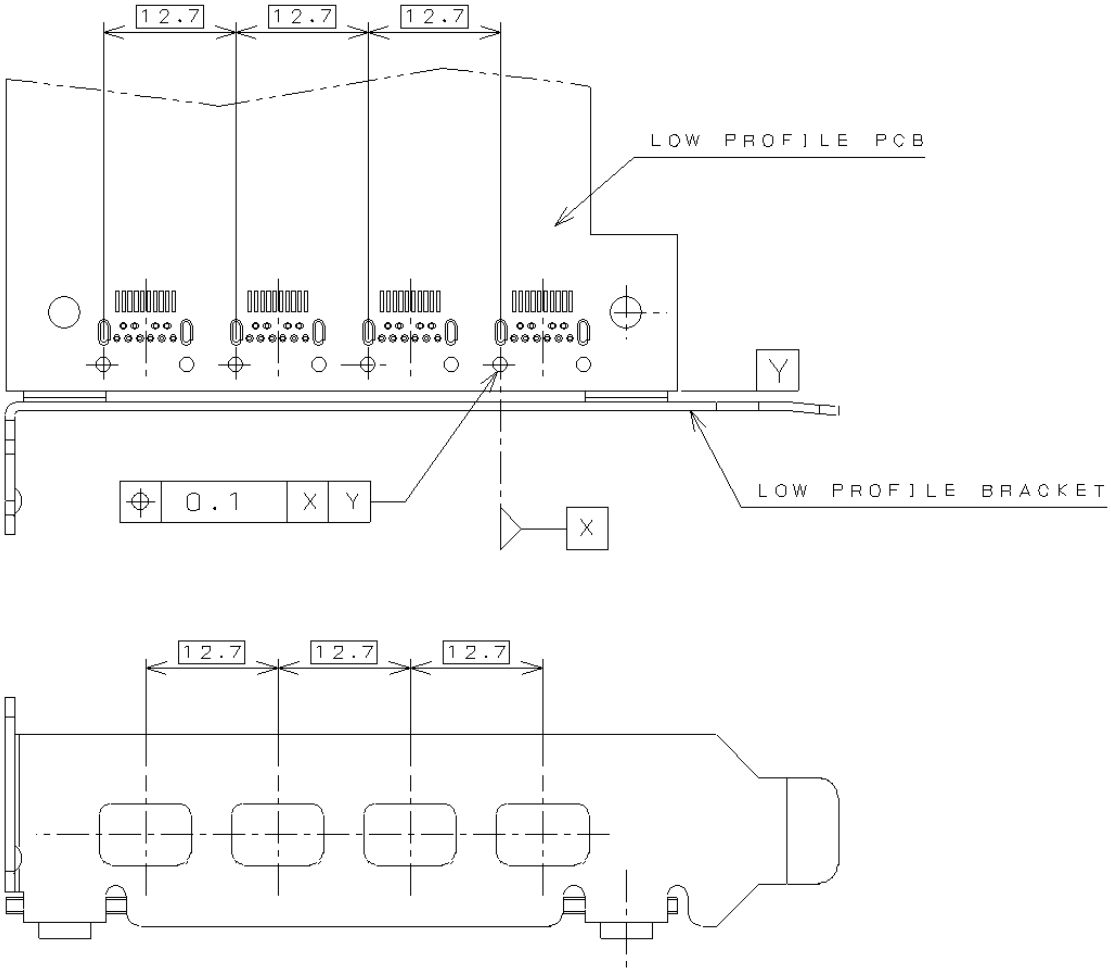


Figure 2-20: Reference Design for Four Mini DP Connectors on a Reduced Height PCI Card – 1

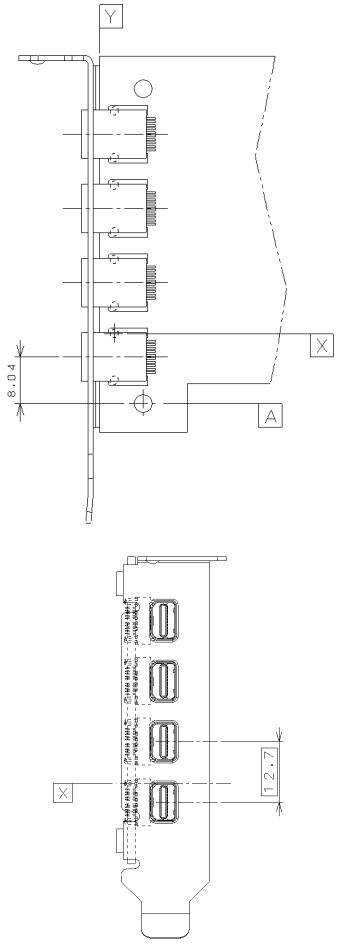


Figure 2-21: Reference Design for Four Mini DP Connectors on a Reduced Height PCI Card - 2