



GSV2202D

DisplayPort 1.4 to HDMI 2.0 Converter with
Embedded MCU

May, 2023

Preliminary Product Specification

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Glossary

DDC	Display Data Channel
EDID	Extended Display Identification Data
ESD	Electrostatic Discharge
HDCP	High-bandwidth Digital Content Protection
HDMI	High-Definition Multimedia Interface
HPD	Hot Plug Detect
I ² C	Inter-Integrated Circuit
MCU	Microcontroller Unit
MISO	Master In Slave Out
MOSI	Master Out Slave In
OTP	One Time Programmable
PCM	Pulse Code Modulation
S/PDIF	Sony/Philips Digital Interface Format
SPI	Serial Peripheral Interface
TMD5	Transition Minimized Differential Signaling
SCDC	Status and Control Data Channel
CEC	Consumer Electronics Control
AUX	AUX_CH, DisplayPort Auxiliary Channel
DPCD	DisplayPort Configuration Data
Main-Link	Unidirectional channel stream from DPTX to DPRX
SDP	Secondary-data Packet
DDC/CI	VESA Display Data Channel/Command Interface
MCCS	Monitor Control Command Set (VESA)
DP	DisplayPort (VESA)
DPRX	DisplayPort Receiver
DPTX	DisplayPort Transmitter
DSC	Display Stream Compression
FEC	Forward Error Correction
HBR	DisplayPort High Bit Rate, HDMI High Bit-Rate Audio
MST	DisplayPort Multi-Stream Transport
SSC	Spread-Spectrum Clock

1. General Description

1.1 General Information

Gschoolink GSV2202D is a high-performance, low-power, USB Type-C Alternate Mode DisplayPort 1.4 to HDMI 2.0 converter. By integrating enhanced microcontroller and flash, GSV2202D has created a cost-effective solution that provides time-to-market advantages. The DisplayPort Receiver supports up to 32.4Gbps (HBR3, 4-lane) and HDMI Transmitter supports up to 18Gbps (TMDS, 6G3Lane). Integrated Power Delivery 3.0 controller handles Type-C CC interface for USB power management and DisplayPort mode entry. The superior architecture of GSV2202D provides economical smaller footprint solutions using QFN48, targeting application of Type-C Hub.

GSV2202D supports all DisplayPort SDP packets pass-through to HDMI output. HDCP 1.4 and HDCP2.2/2.3 are implemented in GSV2202D for both DisplayPort Rx and HDMI Tx. Color Space Conversion, 444/422-420 Converter are supported at HDMI Tx in TMDS mode.

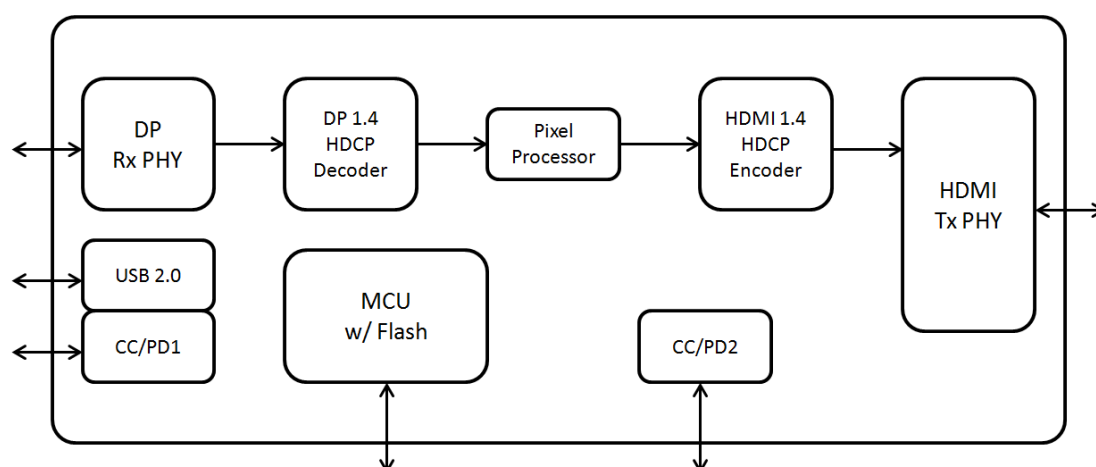


Figure 1. Top Diagram

The supported audio formats are listed in Table 1

Table 1. Supported Audio Format

Packet ID	Packet Type	Sampling Frequency (KHz)		
		32/44.1/48/88.2/ 96/176.4/192	256/352.8/384/ 512/705.6/768	64/128
0x02	Audio Sample Packet (LPCM and Compressed Audio)	Y		Y

0x07	One Bit Audio Sample Packet	Y		
0x08	DST Audio Packet	Y		
0x09	High Bit-rate Audio Stream Packet	Y	Y	

1.2 Features

1.2.1 DisplayPort Receiver

- Compliant with VESA DisplayPort 1.4
- Compliant with HDCP 2.2/2.3 and HDCP 1.4
- Support HBR3, HBR2, HBR and RBR (8.1/5.4/2.7/1.62 Gbps)
- Flexible 1/2/4 lane Main-Link configuration
- Programmable Adaptive Equalization
- Support Full-Link Training and No-Link Training
- Support High Dynamic Range (HDR) and Dynamic/Static Metadata
- Support Horizontal Blanking Expansion up to 4K@60Hz format
- Support Forward Error Correction (FEC)
- Embedded arbitrary EDID and MCCS
- Support Spread Spectrum Clock (SSC)
- 3D format support of frame sequential, stacked frame, side-by-side, top-to-bottom

1.2.2 HDMI Transmitter

- Compliant with HDMI 2.0b, HDMI 1.4b
- Compliant with HDCP 2.2/2.3 and HDCP 1.4
- Data rate up to 18Gbps (TMDS 6Gbps/3 Lane)
- Programmable Voltage Swing, Slew-Rate and Pre-emphasis
- Support AC-coupling on TMDS
- Support Color Space Converter
- Support HDR (HDR10/HDR10+/Dolby Vision/HLG)
- 5V tolerance on DDC/HPD pins
- 3D format support of frame packing, side-by-side, top-and-bottom

1.2.3 USB Type-C Interface

- Dual USB Power Delivery 3.0 Compliant controller
- 2 Configuration Channels (CC) with on-chip Rp/Rd resistors
- Dual Role Power Port (DRP)
- Fast Role Swap
- USB 2.0 Billboard Enumeration

1.2.4 System Features

- Embedded internal MCU and Flash
- External 25MHz Crystal required
- Available Pins for UART/Timer/GPIO

1.3 Chip Application Modes

1.3.1 DP to HDMI Conversion in Type-C Hub Application

Based on the DisplayPort input and output requirement, GSV2202D can dynamically switch between HDMI 1.4 and HDMI 2.0 mode for the best compatibility in 4K/2K timings.

After CC/PD controller tunes Type-C UFP into Alternative DP mode, GSV2202D handles Type-C UFP's TX/RX/SBU for DisplayPort to HDMI conversion. GSV2202D's internal USB 2.0 controller can enumerate Billboard for source identification.

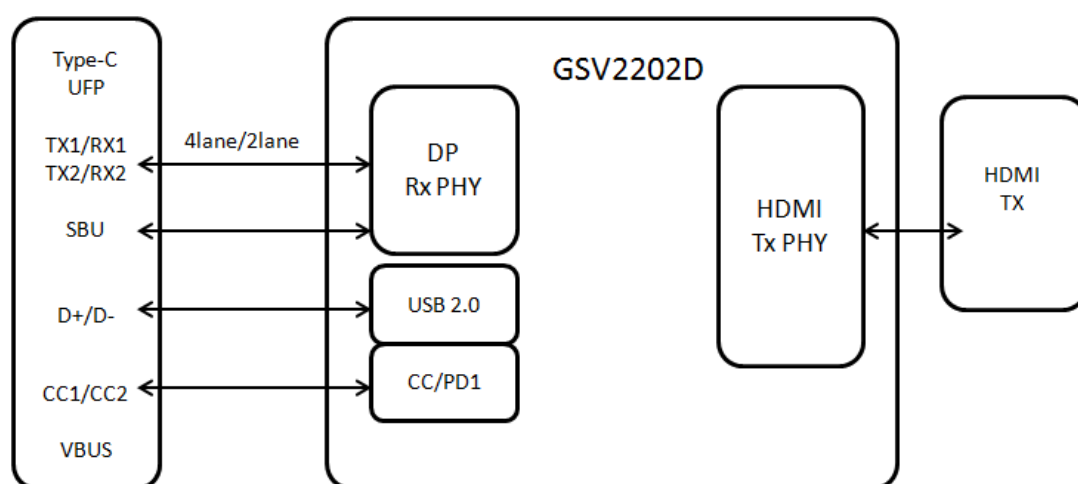


Figure 2. DisplayPort to HDMI TMDS mode Conversion in Hub Application

2. Pin Description

2.1 Pin Diagram

QFN48 Pin definition is defined as below.

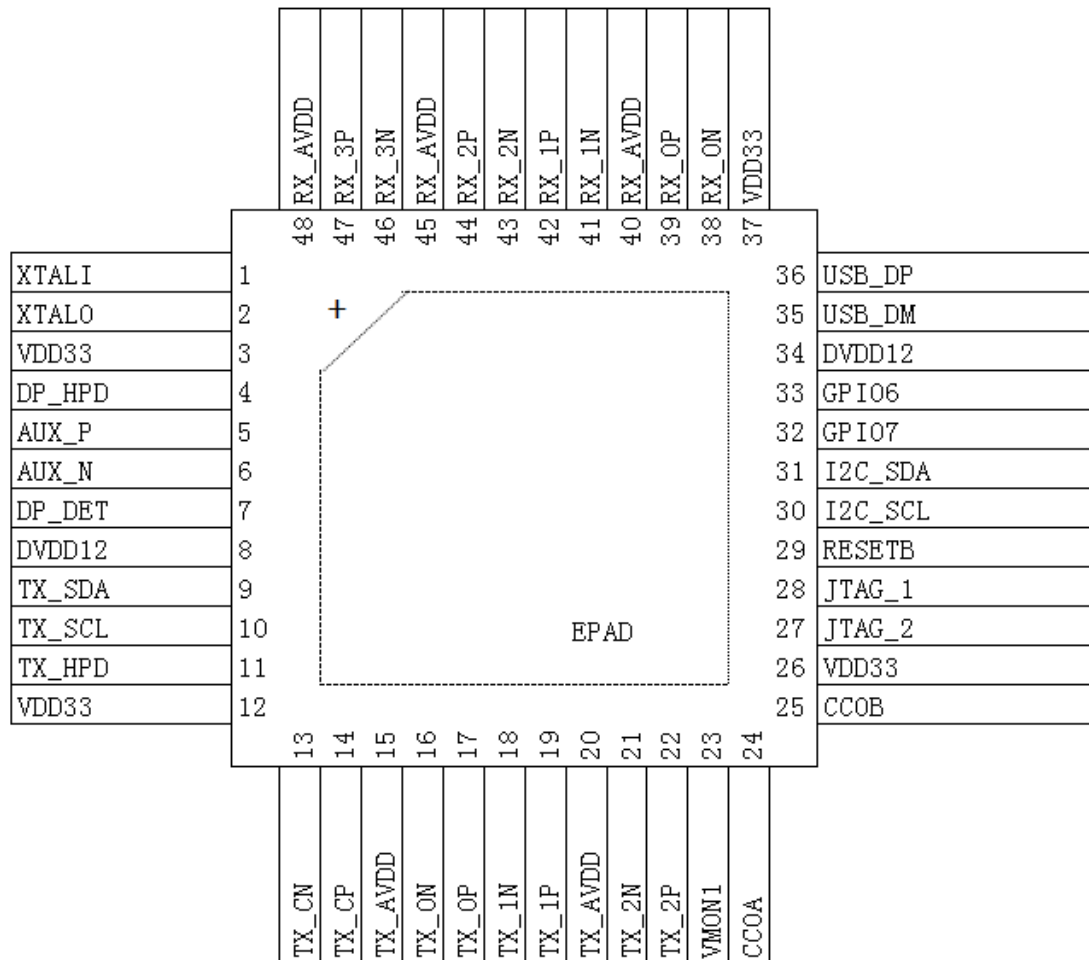


Figure 3. GSV2202D QFN48 Pin Diagram

2.2 Pin Description

Table 2. QFN48 Pin Description

Pin Name	Direction	Pin No.	Description
DisplayPort Rx Pins			
DP_DET	I	7	RX DP Detection PAD Alternate 1: GPIO16

DP_HPD	O	4	RX HPD PAD Alternate 1: GPIO15
AUX_P	I/O	5	RX AUX_P PAD, Type-C SBU_P
AUX_N	I/O	6	RX AUX_N PAD, Type-C SBU_N
RX_0N	I	38	RX Negative Main-Link differential data input [0]
RX_0P	I	39	RX Positive Main-Link differential data input [0]
RX_1N	I	41	RX Negative Main-Link differential data input [1]
RX_1P	I	42	RX Positive Main-Link differential data input [1]
RX_2N	I	43	RX Negative Main-Link differential data input [2]
RX_2P	I	44	RX Positive Main-Link differential data input [2]
RX_3N	I	46	RX Negative Main-Link differential data input [3]
RX_3P	I	47	RX Positive Main-Link differential data input [3]
USB Type-C Pins			
USB_DP	I/O	36	USB 2.0 D+ Pin
USB_DM	I/O	35	USB 2.0 D- Pin
VMON1	I/O	23	VBus Monitor Pin 1
CC0A	I/O	24	Type-C CC Group0 PinA Alternate 1: DisplayPort Rx 3D Left/Right Indication Pin
CC0B	I/O	25	Type-C CC Group0 PinB
Power/Ground Pins			
DVDD12	Power	8,34	Digital 1.1V voltage power supply
VDD33	Power	3,12,26, 37,	Digital 3.3V voltage power supply
RX_AVDD	Power	40,45,48	Analog 1.1V voltage power supply for RX Port
TX_AVDD	Power	15,20	Analog 1.1V voltage power supply for TX Port
HDMI Tx Pins			
TX_SDA	I/O	9	TXA DDC SDA Pin
TX_SCL	O	10	TXA DDC SCL Pin
TX_HPD	I	11	TXA HPD PAD
TX_CN	O	13	TXA Negative TMDS clock output/ differential data output [3]
TX_CP	O	14	TXA Positive TMDS clock output/ differential data output [3]
TX_0N	O	16	TXA Negative TMDS differential data output [0]
TX_0P	O	17	TXA Positive TMDS differential data output [0]

TX_1N	O	18	TXA Negative TMDS differential data output [1]
TX_1P	O	19	TXA Positive TMDS differential data output [1]
TX_2N	O	21	TXA Negative TMDS differential data output [2]
TX_2P	O	22	TXA Positive TMDS differential data output [2]
Digital pins			
I2C_SDA	I/O	31	Digital IO for I2C Data Alternate 1: GPIO8
I2C_SCL	I/O	30	Digital IO for I2C Clock Alternate 1: GPIO9
RESETB	I	29	Reset Pin. Low for reset state, High for functional state.
XTALI	I/O	1	25M Crystal Input
XTALO	I/O	2	25M Crystal output
JTAG_1	I/O	28	TCK, Internal MCU programming pin
JTAG_2	I	27	TMS, Internal MCU programming pin

3. Electrical Specifications

3.1 Timing Information

3.1.1 Power Up and Reset Timing Diagrams

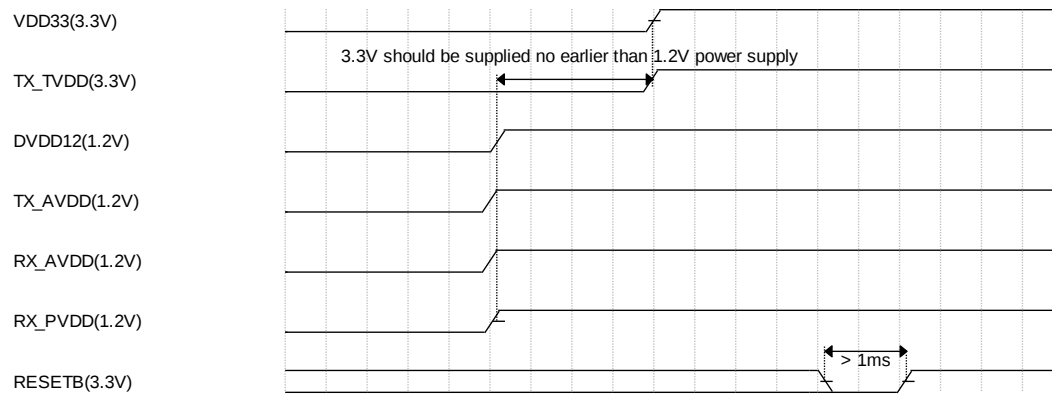


Figure 4. Power Up Sequence

3.1.2 I2C Timing Diagrams

The I2C bus uses 8-bit page address and 16-bit register address. ACK should be provided per 8-bit transaction. For every register, 8-bit data will be accessed. The device address is 0xB0 in 8-bit.

The I2C write timing is shown below.

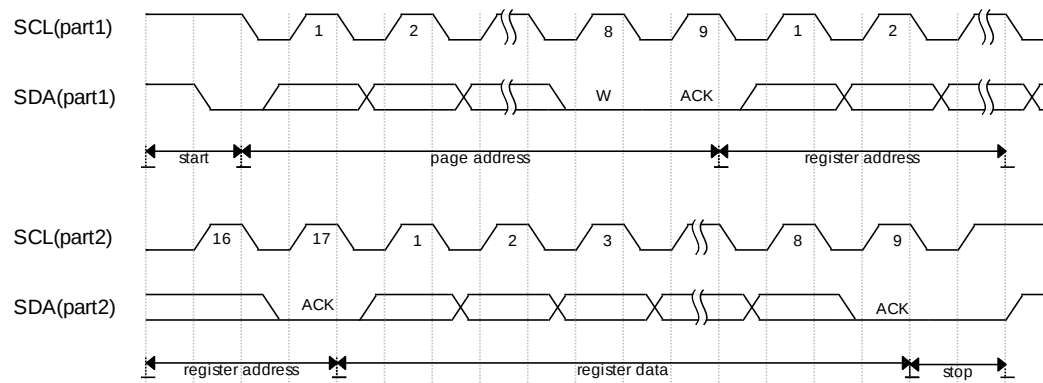


Figure 5. I2C Timing Diagram(Write)

The I2C read timing is shown below.

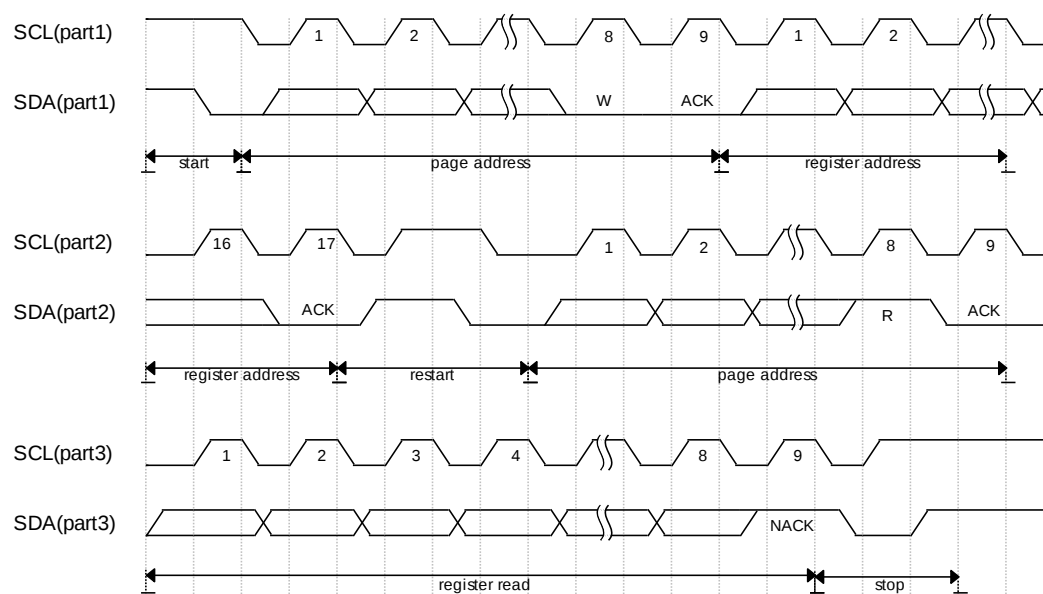


Figure 6. I2C Timing Diagram(Read)

3.2 Operating Conditions

3.2.1 Temperature Conditions

GSV2202D's operation temperature range is -20 °C to 85 °C. GSV2202D embeds internal temperature sensor for junction temperature read back.

3.2.2 Electrical Conditions

Table 3. Absolute Maximum Ratings

Power Domain	Minimum	Typical	Maximum
VDD33	-0.5V	3.3V	5.0V
TX_TVDD	-0.5V	3.3V	5.0V
DVDD12	-0.5V	1.1V	1.8V
RX_AVDD	-0.5V	1.1V	1.8V
TX_AVDD	-0.5V	1.1V	1.8V
HBM(ESD)			+/-2KV
CDM(ESD)			+/-1KV
MM(ESD)			+/-200V

Table 4. Functional Operation Conditions

Power Domain	Minimum	Typical	Maximum
VDD33	3.0V	3.3V	3.6V
TX_TVDD	3.0V	3.3V	3.6V
DVDD12	1.04V	1.1V	1.16V
RX_AVDD	1.04V	1.1V	1.16V
TX_AVDD	1.04V	1.1V	1.16V

Table 5. Low Power Conditions

Power Domain	Voltage	Current	Power
VDD33	3.3V	9mA	30mW
TX_TVDD			
DVDD12	1.2V	39mA	43mW
RX_AVDD			
TX_AVDD			

3.2.3 Audio Pin Conditions

GSV2202D's Audio TTL pins can tolerate 2.8V~3.6V as logic HIGH.

3.2.4 I2C Conditions

GSV2202D's I2C maximum SCL frequency is 400KHz.

3.2.5 Crystal Oscillator Conditions

GSV2201D's crystal oscillator input should be <300 ppm, EF<0.7, CL=18pF,ESR=50.

3.3 HDMI Transmitter

Table 6. TMDS DC and AC Characteristics

Item	Value
Single-Ended High Level Voltage Range: Data Channels 0,1,2	TVDD - 400mV ~ TVDD + 10mV
Single-Ended Low Level Voltage Range: Data Channels 0,1,2	TVDD - 1000mV ~ TVDD - 400mV
Single-Ended High Level Range: Clock Channel	TVDD - 400mV ~ TVDD + 10mV
Single-Ended Low Level Voltage Range: Clock Channel	TVDD - 1000mV ~ TVDD - 400mV
Single-Ended Swing Voltage: Data Channels 0,1,2	400mV~600mV
Single-Ended Swing Voltage: Clock Channel	200mV~600mV

4. Package Information

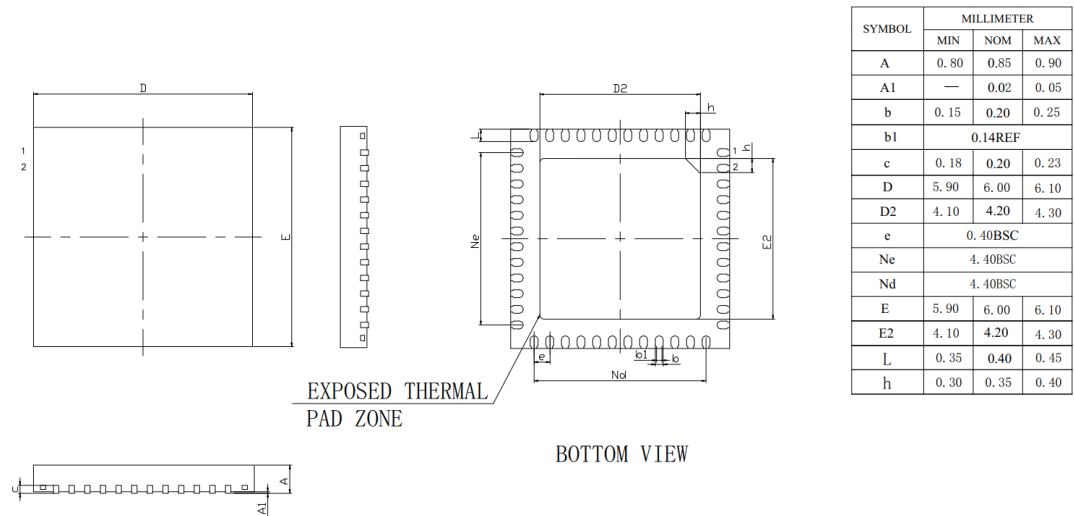


Figure 7. Package Dimensions (QFN48)

5. Ordering Guide

Table 7. Ordering Information

Part Number.	Temperature Range	Package Description	Packing Type
GSV2202D	-20°C to +85°C	QFN48	Tray

6. Revision History

Table 8. Revision history

Revision No.	Description	Date
V0.1	Draft Initial Version for internal review.	Aug 17, 2022
V0.2	Adjust Temperature Description	Nov 7, 2023
V0.3	Fix typo for HDCP capability	Nov 16, 2023
V0.4	Change 1.2V power domain to 1.1V for power reduction	Jan 2, 2024
V0.5	Remove CEC support	Jun 4, 2024
V0.6	Correct Typo, Add Crystal and Low Power Status	Oct 9, 2024
V0.7	Update temperature range to -20 degree.	Mar 8, 2025
V0.8	Add DisplayPort Rx 3D Left/Right Indication Pin	Jul 14, 2025
V0.9	Update package information	Aug 30, 2025

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