



GSV6165

HDMI 2.1 to Type-C DisplayPort 1.4
Converter with Embedded MCU

Oct, 2022

Preliminary Product Specification

1. General Description

1.1 General Information

Gscoolink GSV6165 is a high-performance, low-power HDMI 2.1 to Type-C DisplayPort 1.4 converter. By integrating enhanced microcontroller, GSV6165 has created a cost-effective solution that provides time-to-market advantages. The DisplayPort Transmitter supports up to 32.4Gbps (HBR3, 4-lane), HDMI Receiver supports up to 40Gbps (FRL, 10G/4Lane). With embedded Channel Configuration (CC), Power Delivery (PD) controller and Billboard USB 2.0 controller, GSV6165 can support Type-C Alternate DisplayPort for Type-C application. The superior architecture of GSV6165 provides economical smaller footprint solutions using QFN64, targeting for low power embedded applications.

HDCP 1.4 and HDCP 2.2/2.3 are implemented in GSV6165 for its DisplayPort and HDMI port. Color Space Conversion, 420-444/422 Conversion, De-Interlacer and Downscaler are supported for flexible video processing. Audio Extraction of HDMI Rx is supported in GSV6165 for audio processing.

Within 8kV HBM tolerance, GSV6165's operation temperature range is -40 °C to 85 °C using automotive qualified process.

An internal Video Generator can be used to generate any uncompressed video timing defined in DisplayPort HBR3 bandwidth, such as 4K@60Hz, 4K@30Hz, 480i@60Hz.

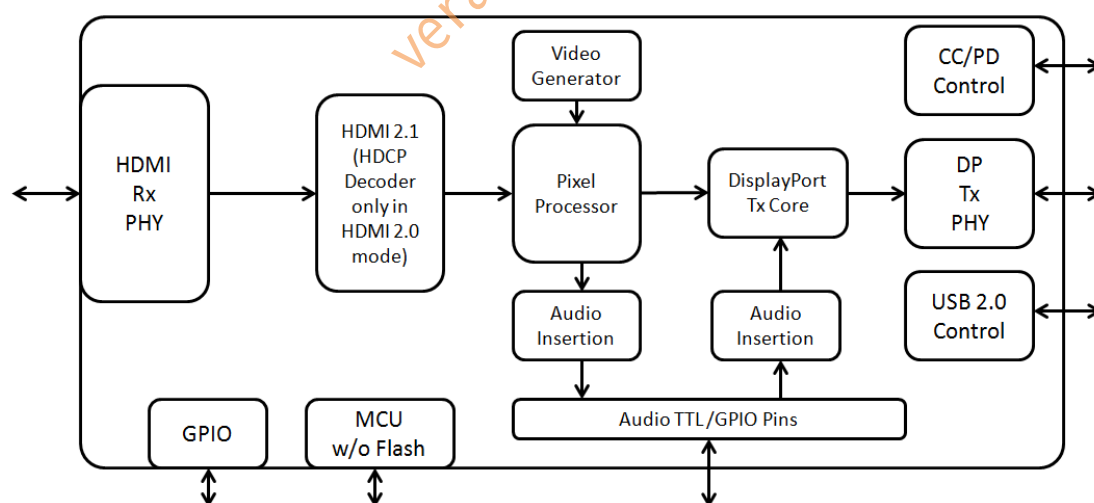


Figure 1. Top Diagram

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 Transmitter

- Compliant with VESA DisplayPort 1.4a
- Compliant with HDCP 2.2/2.3 and HDCP 1.4
- Compliant with both DisplayPort and USB Type-C Alternative Mode
- 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 High Dynamic Range (HDR) and Dynamic/Static Metadata
- Support Audio Insertion
- Support Horizontal Blanking Reduction up to 4K@60Hz format
- Support Spread Spectrum Clock (SSC)
- 3D format support of stacked frame, side-by-side, top-to-bottom

1.2.2 HDMI Receiver

- Compliant with HDMI 2.1b, HDMI 2.0b, HDMI 1.4b
- Compliant with HDCP 2.2/2.3 and HDCP 1.4 in repeater/receiver mode in HDMI 2.0 mode
- No HDCP Support in HDMI 2.1 mode
- Data rate up to 40Gbps (FRL 10Gbps/4 Lane)
- Programmable Adaptive Equalization
- Support High Dynamic Range (HDR) and Dynamic/Static Metadata
- Embedded arbitrary EDID (up to 512 bytes)

- 5V tolerance on DDC/HPD pins
- 3D format support of frame packing, side-by-side, top-and-bottom

1.2.3 USB Type-C DisplayPort Alternative Mode Transmitter

- Compliant with USB Type-C 1.1/1.0 Specification
- Compliant with USB Power Delivery 3.0 Specification
- Programmable USB Type-C Channel Configuration function
- Support Billboard in USB 2.0

1.2.4 Pixel Processor

- Color Space conversion
- YCbCr 444-420 timing conversion
- Downscaler with fixed horizontal and vertical 2 ratio for 4K to 2K conversion
- Deinterlacer for interlaced timing

1.2.5 Audio Input/Output

- I2S and SPDIF Audio Extraction from HDMI Rx
- SPDIF/I2S/HBR/DSD/TDM Format Supported for Audio Extraction and Insertion
- SPDIF to I2S Conversion using single Bi-directional TTL bus

1.2.6 System Features

- Optional External MCU (via I2C)/ Internal MCU mode
- Embedded MCU using External Flash
- External 25MHz Crystal required
- Available Pins for UART/Timer/GPIO control from embedded MCU
- Mailbox feature for external MCU access on chip function status
- Temperature Sensor Monitoring Circuit

1.3 Chip Application Modes

1.3.1 HDMI 2.1 to DisplayPort Conversion

HDMI Rx is directly converted to DisplayPort Tx. With internal Color Space Converter, De-Interlacer, HDMI 2.1 input timing can be converted to DisplayPort compatible output timing.

With Downscaler in Pixel Processor, output can be downscaled automatically when video stream bandwidth exceeds downstream capability.

Meanwhile, Audio extraction can be applicable if required.

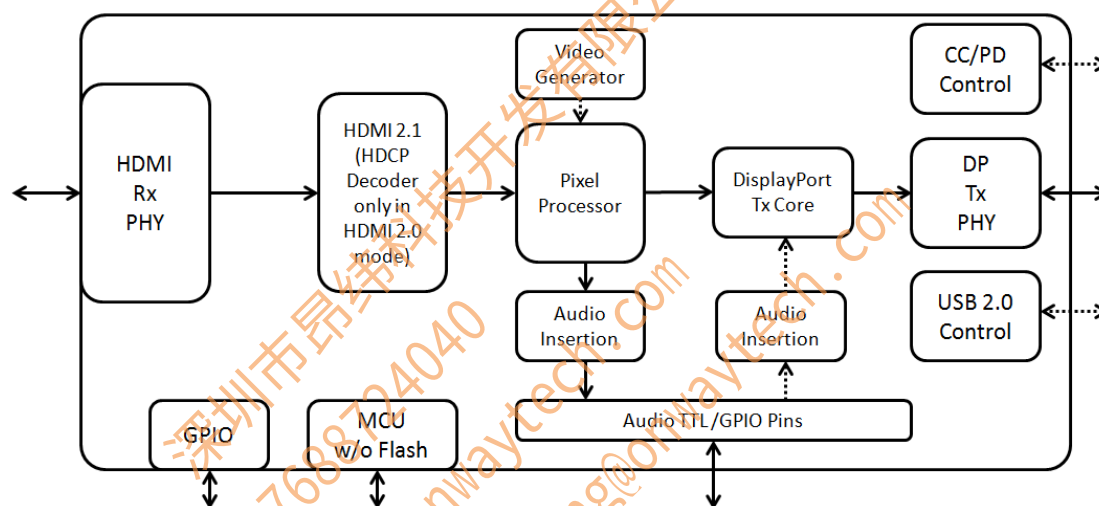


Figure 2. HDMI 2.1 to DisplayPort Application

1.3.2 HDMI 2.1 to Type-C Alternative DisplayPort Conversion

HDMI Rx is directly converted to DisplayPort Tx. With internal Color Space Converter, De-Interlacer, HDMI 2.1 input timing can be converted to DisplayPort compatible output timing.

Altogether with internal Type-C CC/PD controller and USB 2.0 controller, DisplayPort Output in Type-C Alternative Mode is applicable when UFP is Alternative DisplayPort mode is supported.

With Downscaler in Pixel Processor, output can be downscaled automatically when video stream bandwidth exceeds downstream capability.

Meanwhile, Audio insertion can be applicable if required.

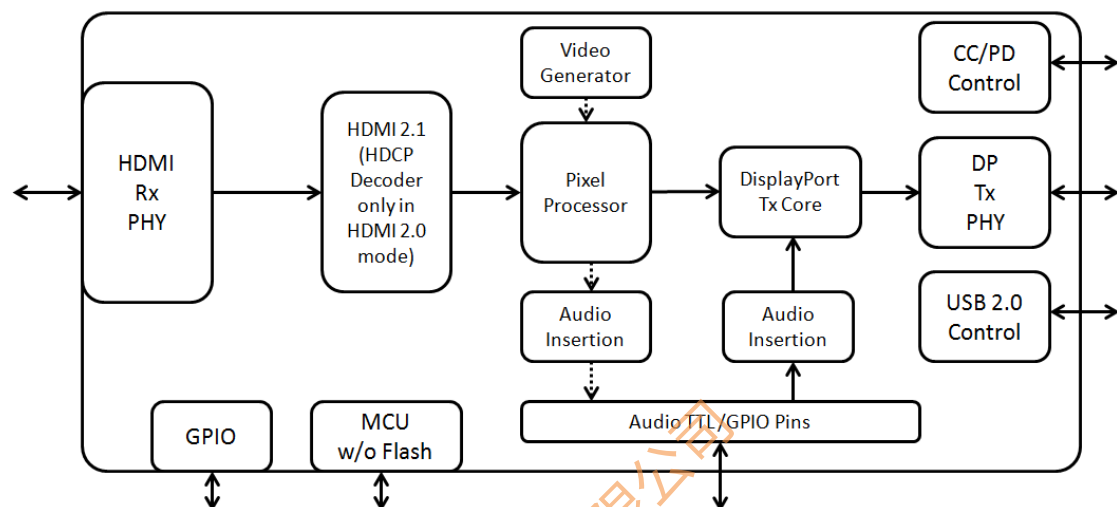


Figure 3. HDMI 2.1 to Type-C Alt-DP Application

1.4 Audio Bus Output Configuration

When one group of audio bus is configured as output, I2S and SPDIF are output at the same time. General configuration of pin settings is shown below.

Table 2. I2S Audio Extraction

Pin Name	Alias	Direction	Description
AUD_D0	SDATA[0]	Output	I2S Data, default stereo channels
AUD_D5	LRCLK/WS	Output	Fs (0 = Left, 1 = Right)
SCLK	BCLK	Output	Fixed to 64Fs
MCLK	Sys Clock	Output	Selected from 128Fs/256Fs/384Fs/512Fs

SPDIF is also capable of sending out with by configuring to AUD_D0 pins. So in GSV6165 application, AUD1 group bus can be used to extract I2S while AUD2_D0 can be used to extract SPDIF.

Table 3. SPDIF Audio Extraction

Pin Name	Alias	Direction	Description
AUD_D0	SPDIF[0]	Output	SPDIF Data[0], 1/2 channels

1.5 Audio Bus Input Configuration

2. Pin Description

2.1 Pin Diagram

QFN64 Pin definition is defined as below.

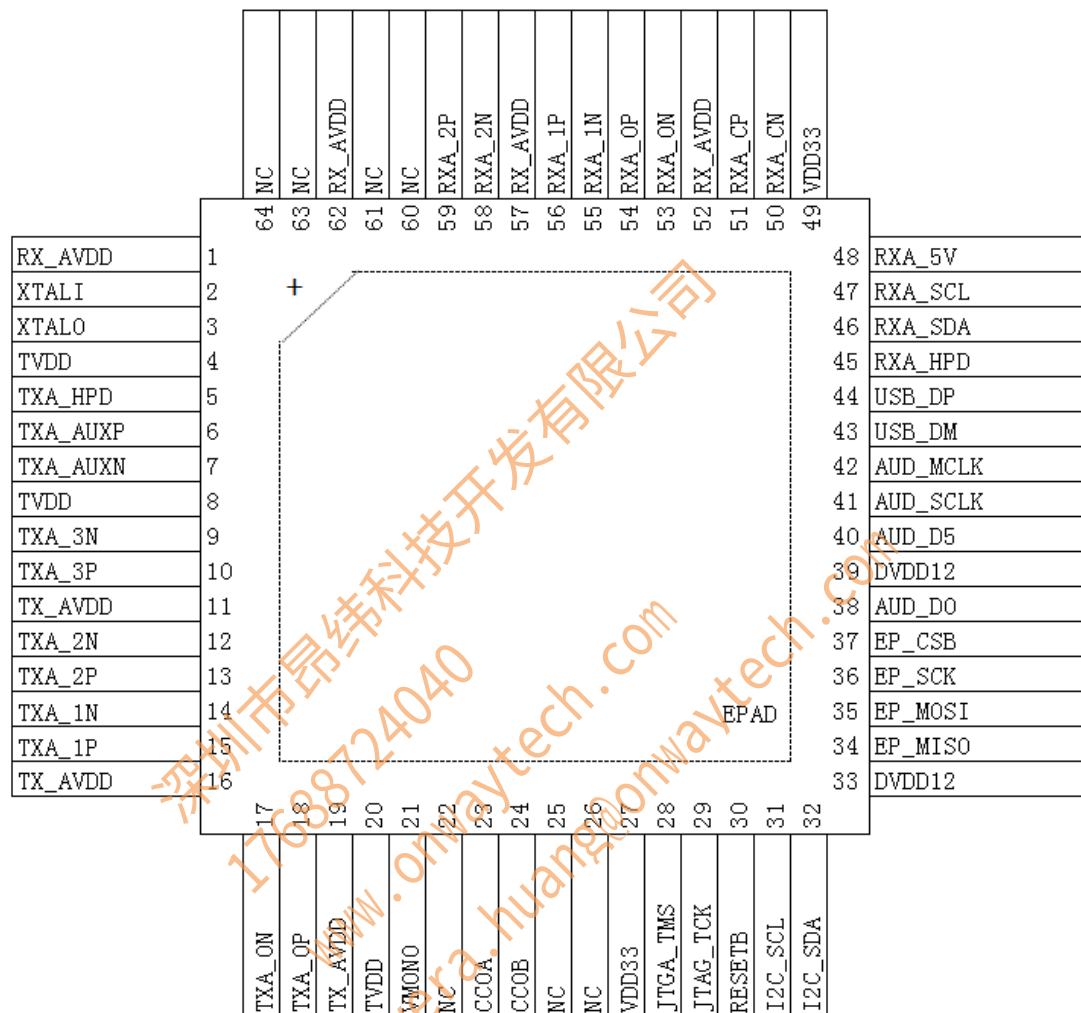


Figure 4. GSV6165 QFN64 Pin Diagram

2.2 QFN64 Pin Description

Table 6. QFN64 Pin Description

Pin Name	Direction	Pin No.	Description
HDMI RX Pins			
RXA_5V	I	48	HDMI: RX 5V Detection PAD
RXA_HPD	O	45	HDMI: RX HPD PAD
RXA_SDA	I/O	46	HDMI: RX DDC SDA PAD
RXA_SCL	I/O	47	HDMI: RX DDC SCL PAD

4. Package Information

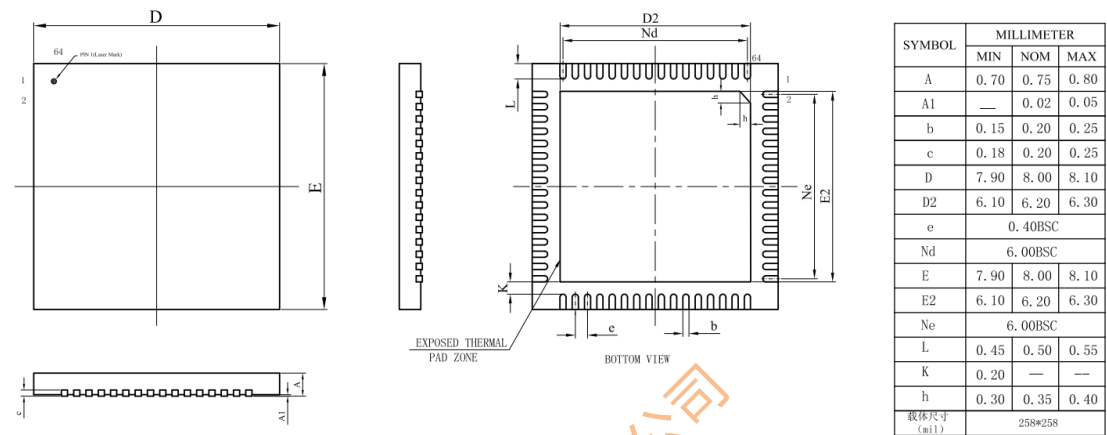


Figure 8. Package Dimensions (QFN64)

5. Ordering Guide

Table 15. Ordering Information

Part Number.	Temperature Range	Package Description	Packing Type
GSV6165	−40°C to +85°C	QFN64	Tray

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