GSV2001

1 In to 2 Out HDMI2.0 Repeater with Audio Extraction/Insertion

September, 2019

PRODUCT SPECIFICATION

1 General Information

1.1 General Information

The GSV2001 is HDMI1.4/2.0 compatible, HDCP 1.4/2.2 supported, configurable 1-in-2-out repeater device. All 2 outputs are identical on transmitter capability.

The HDMI input and output maximum processing pixel clock frequency is 600MHz which means the video resolution can support up to 4kx2k@60Hz 4:4:4 8-bit. The maximum processing audio sample frequency is 192K Hz for non-compression timing. GSV2001 supports HDR10 and Dolby Vision HDR as input and output.

For audio insertion and extraction, the versatile TTL pin bus of GSV2001 can be configured as either input mode or output mode regarding platform requirement. GSV2001 can support up to 8-channel I2S or 2-channel S/PDIF, 3D and multi-stream audio. In TDM mode, each audio pin supports up to 8 channels.

Internal Scaler and Color Space Converter enables the input and output to be timing format independent and capable of long distance transmission.

With powerful HDMI Rx equalizer and Tx pre-emphasis capability, GSV2001 can cascade itself (or GSV2000 series chips) with at least 7 stages for all HDMI 1.3/1.4/2.0 timings.

An internal Clock Generator can be used to generate 4 independent output clocks, which will greatly remove complexity of using dedicated clock device.

1.2 Features

1.2.1 HDMI Video Input and Output

- Compliant with HDMI2.0b, HDMI1.4b
- Compliant with HDCP2.2/2.3 and HDCP1.4
- Data rate up to 18Gbps
- Programmable HDMI Tx output swing, slew-rate, pre-emphasis
- Adaptive receiver equalization
- AC-coupling capable
- Color Space Converter supports any conversion between different color spaces
- HDR supported (HDR10/HDR12/Dolby Vision/HLG)
- 5V tolerance on DDC/HPD/CEC
- Arbitrary video stream matrix between HDMI Rx and HDMI Tx

1.2.2 Audio Input/Output

- SPDIF/I2S/HBR/DSD/TDM Audio Extraction
- SPDIF/I2S/HBR/DSD/TDM Audio Insertion
- Configurable direction for each Audio bus
- Arbitrary audio stream matrix between HDMI Rx/HDMI Tx/Audio bus

1.2.3 Internal Downscaler

Scaler is only used to downscale 4k UHD timings to 2k FHD timings. The horizontal resolution and vertical resolution are both cut in half while frame rate remains the same.

1.2.4 Color Space Converter

Color Space Converter can convert RGB and YCbCr by the following table. It should be noted that YCbCr 422 shares the same color space with YCbCr 444 in internal routing. So any conversion that YCbCr 444 supports, YCbCr 422 also supports it.

Table 1. Color Space Converter Support Table

From	To	To
RGB	YCbCr 444	YCbCr 420
YCbCr 444	YCbCr 420	RGB
YCbCr420	YCbCr444	RGB

1.2.5 Clock Generator

Internal Clock Generator has 4 independent clock outputs ranging 25MHz~600MHz. Clock Generator generates output clocks based on divider/multiplier ratio of GSV2001's 27MHz oscillator. The no-compensation PLL circuit architecture minimizes output clock jitter. With fast PLL acquisition time, clock generator output clock frequency matches its ratio register settings in nano-seconds.

1.2.6 CEC

There is an internal CEC engine for handling CEC low level transactions. Customer design only needs to manipulate I2C registers for reading and writing CEC commands.

1.3 Chip Application Modes

1.3.1 Audio Extraction and Video Distribution

GSV2001 has 1 HDMI input port and 2 HDMI output ports. All of the ports are HDCP 1.4 and HDCP 2.2 capable.

One important purpose of extracting HDMI encrypted stream is to extract audio, process it in audio signal processing chip (DSP/FPGA e.g.). As shown below, TTL audio pins can be configured as output to implement this feature. It should be noted that extracted audio stream is routed from the selected HDMI input to distribute to HDMI outputs.

Limited by the only audio TTL bus, when audio extraction is implemented, audio insertion can not be implemented. So when using audio extraction, both Txs' audio can only be streamed from HDMI Rx rather than from external audio input.

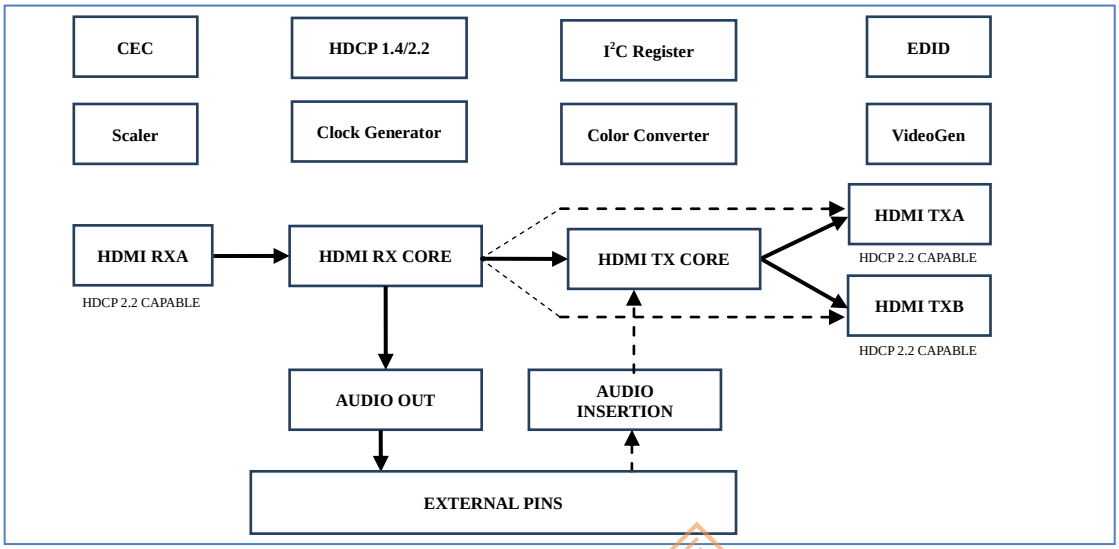


Figure 1. GSV2001 audio extraction diagram

1.3.2 Audio Insertion and Video Distribution

Inserted audio can be routed to any individual Tx or both Tx streams while HDMI video is still routed from HDMI Rx.

Limited by the only audio bus, when audio insertion is implemented, audio extraction can not be implemented. In this mode, both Txs' audio can be streamed either from HDMI Rx or external audio input.

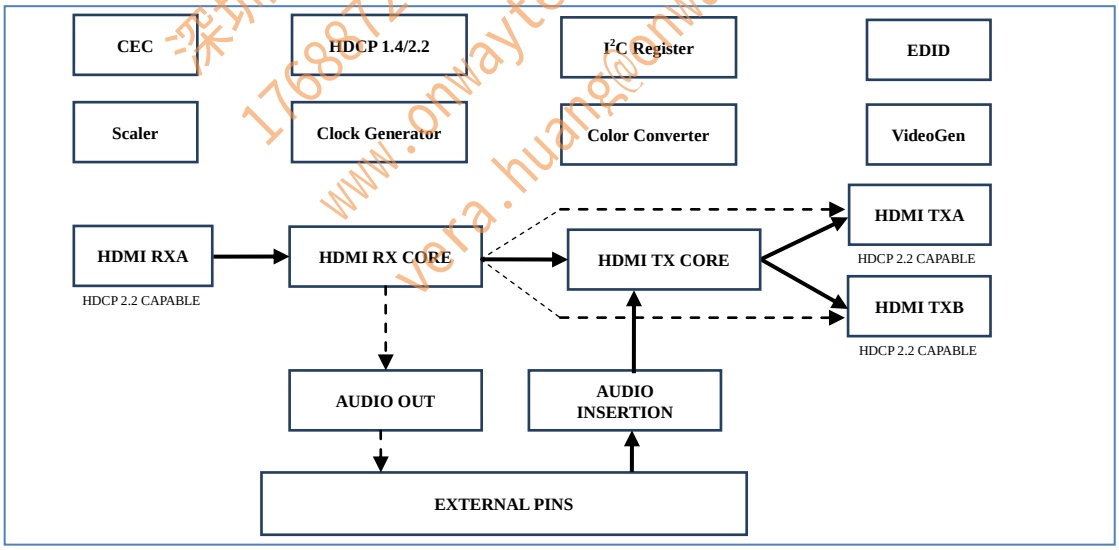


Figure 2. GSV2001 audio insertion diagram

1.3.3 HDMI 2.0 to HDMI 1.4 downscaler

GSV2001 has a built-in scaler and color converter. These blocks enable the chip to do internal video processing for matching HDMI source and sink's capability with a wider range and better performance. Flexible connection between IPs creates versatile

usage modes.

Here is an example of 4K YCbCr 420 (300MHz pixel clock) input, 4K YCbCr 420 (300MHz pixel clock) output and 1080p YCbCr 422 (150MHz pixel clock) output. It should be noted that Tx Core can still do color space conversion (except for YCbCr420) without Color Conversion block. This makes HDMI output flexible in color space.

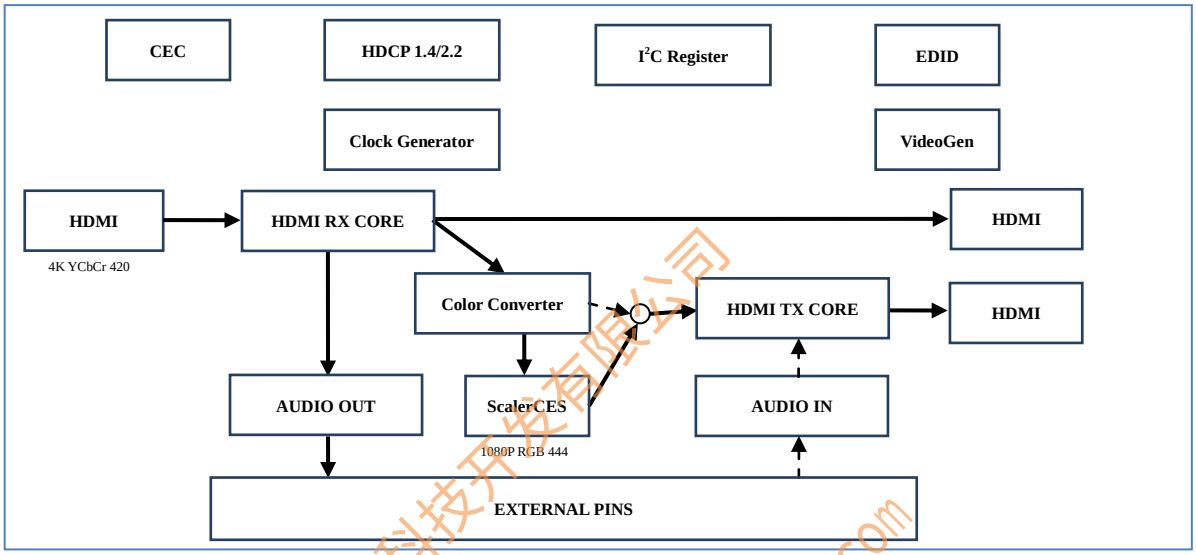


Figure 3. GSV2001 4K 420-to-1080p 422 diagram

1.3.4 HDMI 2.0 YCbCr 420 color space conversion

Here is an example of 4K RGB 444 (600MHz pixel clock) input, 4K YCbCr 422 (600MHz pixel clock) output and 4K YCbCr 420 (300MHz pixel clock) output. It should be noted that Tx Core can still do color space conversion (except for YCbCr420) without Color Conversion block. This makes HDMI output flexible in color space.

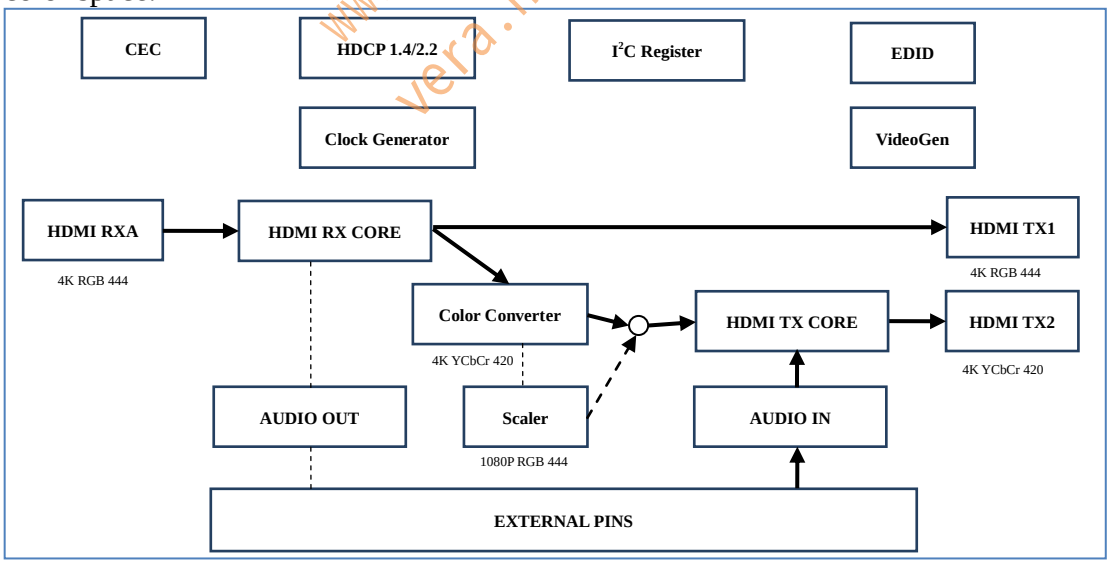


Figure 4. GSV2001 4K 444-to-4K 420 diagram

2 Pin Description

2.1 Pin Diagram

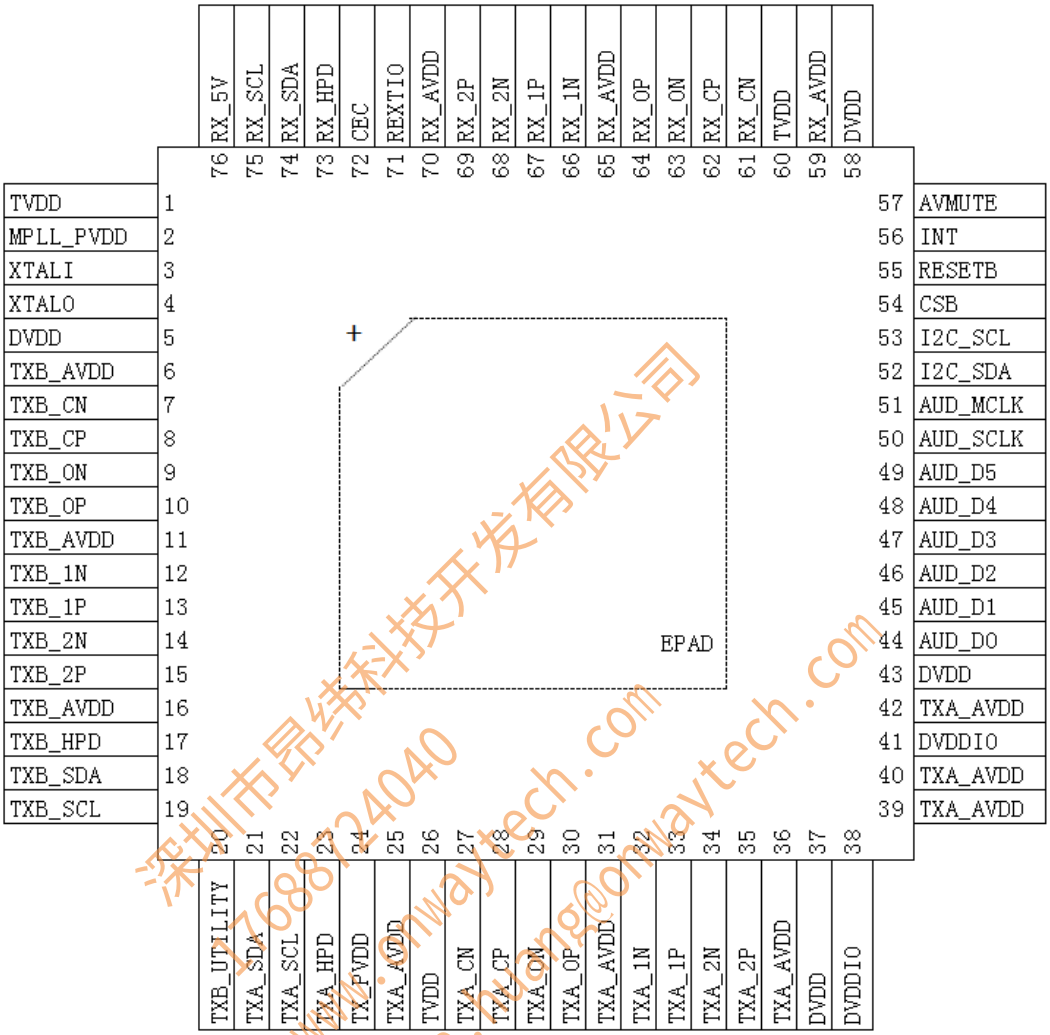


Figure 6. Pin Mapping

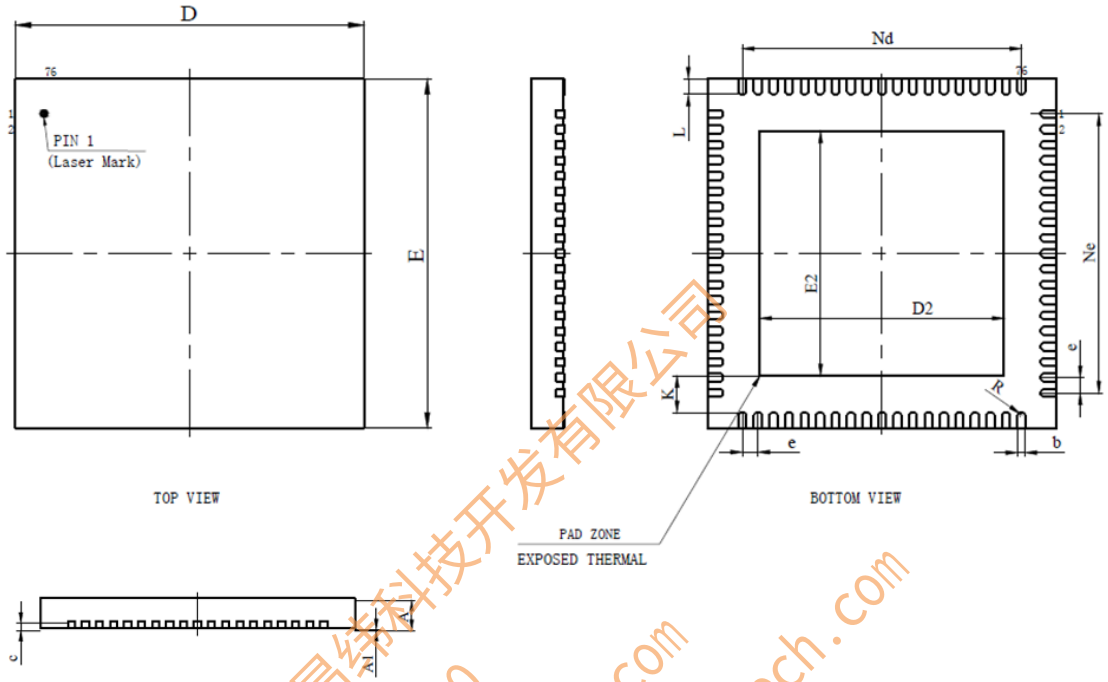
2.2 Pin Description

Table 7. Pin Description

Pin No.	Pin Name	Direction	Description
1	TVDD	Power	Analog 3.3V voltage power supply
2	MPLL_PVDD	Power	1.2V voltage power supply for MPLL When PCB combined with DVDD, MPLL_PVDD can also be increased to 1.28V~1.32V(typical 1.30V) for compensation of complex system level integrity margin loss
3	XTALI	I/O	27M Crystal Input
4	XTALO	I/O	27M Crystal output
5	DVDD	Power	Digital 1.2V voltage power supply In complex system design, due to the possible impact of Power Integrity and Signal Integrity, it is required to increase DVDD to 1.28V~1.32V(typical 1.30V). The increased DVDD compensates for system level integrity margin loss.

4 Package Information

The GSV2001 device is packaged in a 76-pin, 9mmx9mm QFN76L package. There is an ePad as the electrical ground of the device. It is critical to solder the entire ePad firmly onto the PCB. A weak connection of the ePad could result in poor performance on higher frequency HDMI video timing.



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
b	0.15	0.20	0.25
c		0.203REF	
D	8.90	9.00	9.10
D2	6.20	6.30	6.40
e		0.40BSC	
Nd		7.20BSC	
E	8.90	9.00	9.10
E2	6.20	6.30	6.40
Ne		7.20BSC	
L	0.35	0.40	0.45
K	0.85	0.95	1.05
R	0.075	--	--

Figure 10. GSV2001 package dimensions

5 Ordering Guide

Table 12. Ordering Infomation

Part Number.	Temperature Range	Package Description	Packing Type
GSV2001	−20 ℃ to +85 ℃	QFN76L, 0.4 mm ball pitch, 9 mm x 9 mm outline	Tray