CapStone

CS5261 Datasheet

USB Type-C to HDMI1.4b 4k@30Hz Converter

Rev 1.1

January,2021

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1 Introduction

The Capstone CS5261 is a high-performance Type-C/DP1.4 to HDMI1.4b converter, designed to connect a USB Type-C source or a DP1.4 source to an HDMI1.4b sink. The CS5261 integrates a DP1.4 compliant receiver, an HDMI1.4b compliant transmitter. Also, two CC controllers are included for CC communication to implement DP Alt Mode and power delivery (5V Slow charging) function, one for upstream Type-C port and another for downstream port.

The DP interface comprises 2 main lanes, AUX channel, and HPD signal. The receiver supports maximum 5.4Gbps (HBR2) data rate per lane. The DP receiver incorporates HDCP1.4 content protection scheme with embedded key for secure transmission of digital audio-video content.

The HDMI interface includes 4 TMDS clock/data pairs, DDC, and HPD signal. The HDMI transmitter is capable of supporting up to 3Gpbs data rate, quite adequate for handling video resolutions up to FHD 1080p 120Hz and UHD 4k 30Hz formats. The HDMI transmitter incorporates HDCP engines which support HDCP1.4. With the inclusion of HDCP, the CS5261 allows secure transmission of protected content. Embedded key is available that provides the highest level of HDCP key security.

The CS5261 is a highly integrated single chip suitable for multiple market segments and display applications, such as the dongle, docking station etc.

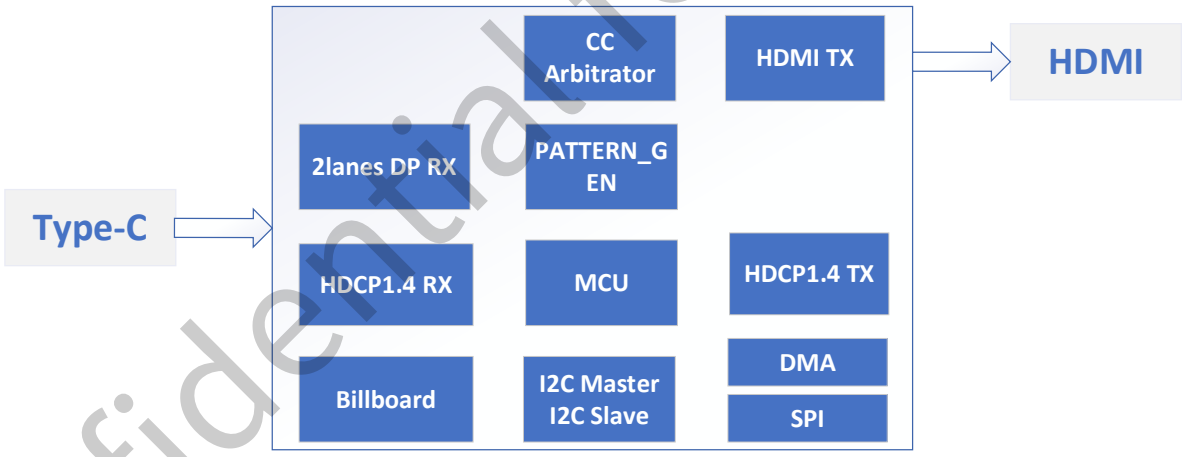

Figure 1-1 CS5261 Block Diagram

2 Features

General

- USB Type-C Specification 1.2
- VESA DisplayPort™ (DP) v1.4 compliant receiver
- HDMI specification v1.4b compliant transmitter,Max data rate up to 3-Gbps.
- Support all USB Type-C Channel Configuration (CC)
- Embedded oscillator and there's no need for the external crystal
- Embedded MCU and SPI flash
- Embedded EDID (CS5261 will response EDID if terminal device doesn't have it)
- Support HDCP 1.4 with on-chip keys to support HDCP Transmitter/Receiver.
- Support RGB 4:4:4 8/10bit bpc and YCbCr 4:4:4, 4:2:2, 4:2:0 8/10-bit bpc
- Max audio sample rate of 192KHz x8 channels
- LPCM and Compressed Audio encoding formats
- AUX channel, I2C host interface for chip control

USB Type-C DisplayPort (DP) Alt Mode Input (receiver)

- USB Type-C Specification 1.2 and backward compatible with Type-C Specification 1.0
- VESA DisplayPort™ v1.4 compliant. Support 2-lane.
- Built-in CC controller for plug and orientation detection
- Up to HBR2(5.4-Gbps) input. Built-in high-performance adaptive equalizer. Support 1-MHz AUX channel
- USB Type-C Channel Configuration (CC) function
- Support Hot Plug Detect (HPD)

HDMI Digital Output

- HDMI 1.4b compliant
- Max data rate up to 3-Gbps
- Support up to 3840 x 2160@30Hz or 4096x2160@30Hz
- Audio stream handling
- LPCM and Compressed Audio encoding formats
- Max audio sample rate of 192k Hz x8 channels

MISC

- Support I2C Master and Slave up to 400-kHz.
- HBM 6KV for connector pins
- 6*6mm 48-pin QFN package with e-Pad

Power & Technology

- 5V/1.0V system voltage, integrated 3.3V LDO and 1.8V LDO.

3 Pin Definition

3.1 Pin Assignments

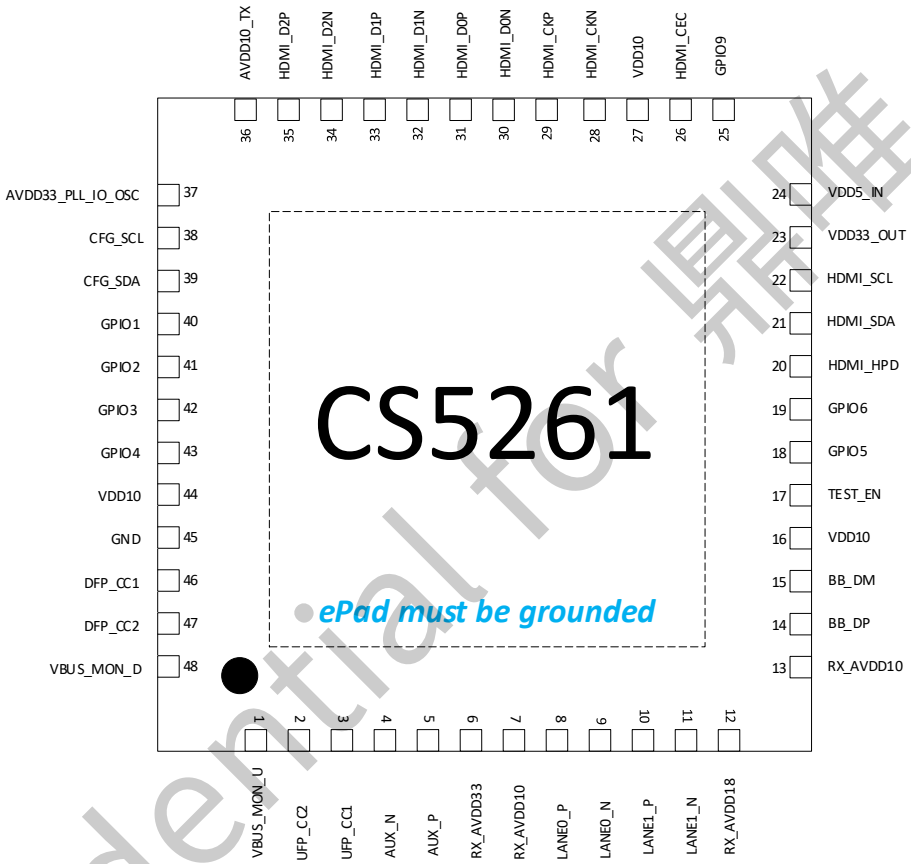

Figure 3-1 CS5261 Pin Layout

3.2 Pin Description

Table 3-1 CS5261 Pin Definitions

Pin #	Description	Type	PU/PD	Note
1	VBUS_MON_U	AI		VBUS voltage monitor for UFP
2	UFP_CC2	AIO		USB Type-C configuration channel for UFP

Pin #	Description	Type	PU/PD	Note
3	UFP_CC1	AIO		USB Type-C configuration channel for UFP
4	AUX_N	AIO		DisplayPort AUX channel negative
5	AUX_P	AIO		DisplayPort AUX channel positive
6	RX_AVDD33	P	-	3.3V power input
7	RX_AVDD10	P	-	1.0V power input
8	LANE0_P	AI		DisplayPort Rx lane0 positive
9	LANE0_N	AI		DisplayPort Rx lane0 negative
10	LANE1_P	AI		DisplayPort Rx lane1 positive
11	LANE1_N	AI		DisplayPort Rx lane1 negative
12	RX_AVDD18	P	-	1.8V LDO output, connect a 4.7uF capacitor on it.
13	RX_AVDD10	P	-	1.0V power input
14	BB_DP	AIO		USB Type-C D+ signal for billboard device
15	BB_DM	AIO		USB Type-C D- signal for billboard device
16	VDD10	P	-	1.0V power input
17	TEST_EN	I	PD	1: Test mode. 0: Normal mode.
18	GPIO5	I/O		General input output
19	GPIO6	I/O		General input output
20	HDMI_HPD	I/O	PD	HDMI Hot Plug detect input (GPIO7)
21	HDMI_SDA	I/O	PU	HDMI DDC data (GPIO13)
22	HDMI_SCL	I/O	PU	HDMI DDC clock (GPIO12)
23	VDD33_OUT	P	-	3.3V power output
24	VDD5_IN	P	-	5V power input
25	GPIO9	I/O		General input output
26	HDMI_CEC	I/O		HDMI CEC Pin (GPIO8)
27	VDD10	P		1.0V power input
28	HDMI_CKN	I	-	HDMI clock differential pair N output
29	HDMI_CKP	I	-	HDMI clock differential pair P output
30	HDMI_D0N	I	-	HDMI data channel 0 different pair N output
31	HDMI_D0P	I	-	HDMI data channel 0 different pair P output
32	HDMI_D1N	I	-	HDMI data channel 1 different pair N output
33	HDMI_D1P	I	-	HDMI data channel 1 different pair P output
34	HDMI_D2N	I	-	HDMI data channel 2 different pair N output
35	HDMI_D2P	I	-	HDMI data channel 2 different pair P output
36	AVDD10_TX	P	-	1.0V power input
37	AVDD33_PLL_OSC_IO	P	-	3.3V power input
38	CFG_SCL	I/O	-	I2C slave CLOCK pin for debug

Pin #	Description	Type	PU/PD	Note
39	CFG_SDA	I/O	-	I2C slave DATA pin for debug
40	GPIO1	I/O		General input output
41	GPIO2	I/O		General input output
42	GPIO3	I/O		General input output
43	GPIO4	I/O		General input output
44	VDD10	P	-	1.0V power input
45	GND	P		GND
46	DFP_CC1	AIO		USB Type-C configuration channel for DFP
47	DFP_CC2	AIO		USB Type-C configuration channel for DFP
48	VBUS_MON_D	AI		VBUS voltage monitor for DFP

4 Electrical Specifications

4.1 Absolute Maximum Conditions

Permanent damage may occur if absolute maximum conditions are violated. Refer to Section 4.2 for functional operating limits.

Table 4-1 Absolute Maximum Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDD5_IN	5V Power Input	-0.3	—	6	V
VDD33	3.3V power input	-0.3	—	3.96	V
VDD10	1.0V power input	-0.3	—	1.2	V
T_A	Junction temperature	-40	—	125	°C
Q_{JA}	Storage temperature1	-65	—	150	°C
ESD_{HBM}	ESD protection (Human body model)	—	—	±4	KV
ESD_{CDM}	ESD protection (Charge Device model)	—	—	700	V

1. Max 260°C can be guaranteed with max 8 sec soldering time.

4.2 Operating Conditions

Table 4-2 Normal Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDD33_OUT	3.3V LDO output	3.0	3.3	3.6	V
VDD5_IN	5V Power Input	4.75	5	5.25	V
VDD33	3.3V power input	3.0	3.3	3.6	V
VDD10	1.0V power input	0.95	1.0	1.1	V
T_A	Ambient temperature	0		70	°C
Q_{JA}	Package thermal resistance, no air flow	—	39.3	—	°C/W

4.3 Electrical Specification

Table 4-3 DC Electrical Specification

Symbol	Parameter	For 3.3V I/O		
		Min	Typ	Max
V_{il} (V)	Input low voltage	—	—	0.8
V_{ih} (V)	Input high Voltage	2.0	—	—
V_{ol} (V)	Output low voltage	0	—	0.4
V_{oh} (V)	Output high voltage	2.4	—	—

Symbol	Parameter	For 3.3V I/O		
		Min	Typ	Max
I_{in} (uA)	Input leakage current	-10	—	+10
I_{hiz} (uA)	Output tri-state leakage current	-10	—	+10

5 Package Specification

Figure 5-1 CS5261 Package Outline (QFN48 Leads 6x6mm2)

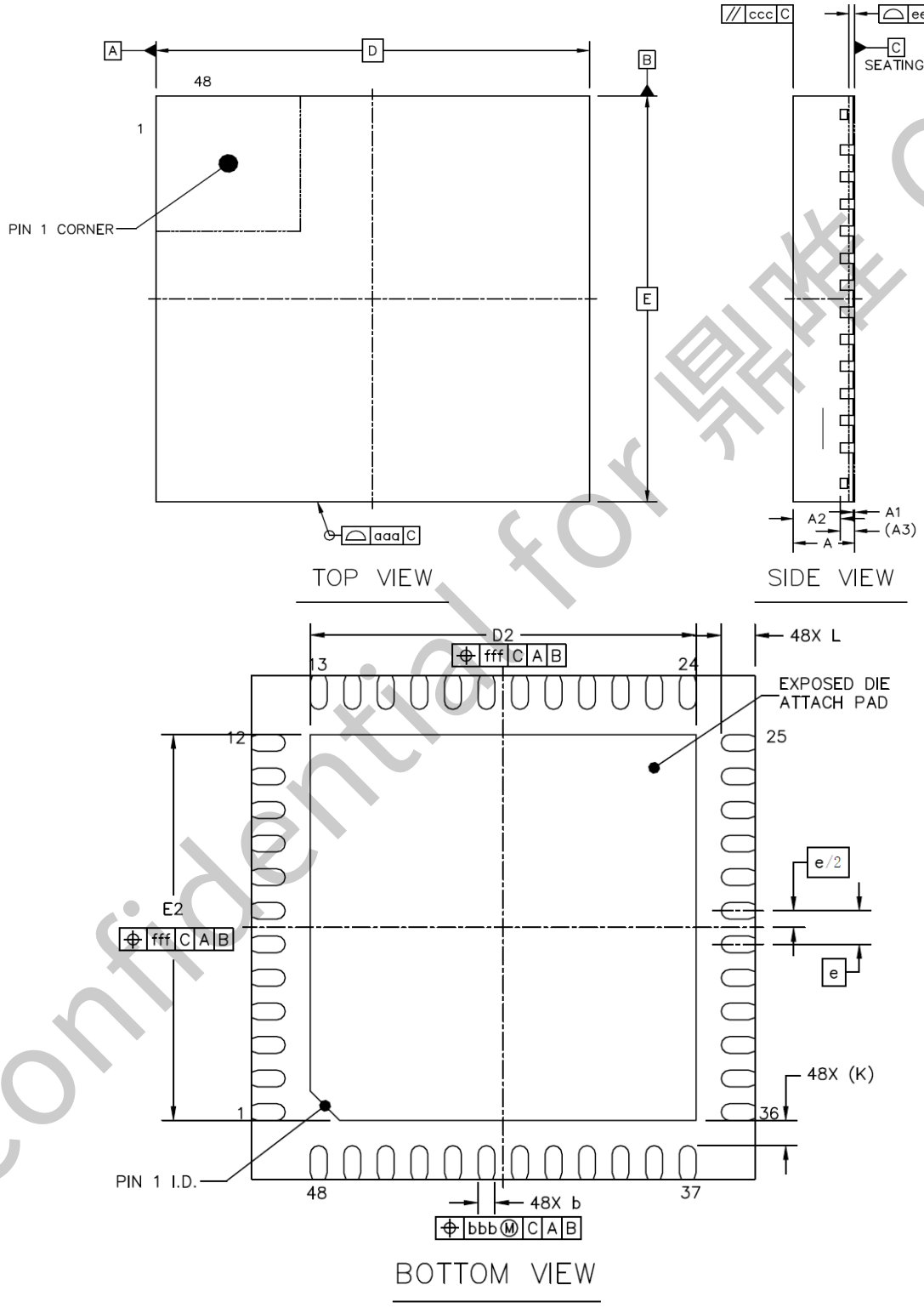

Table 5-1 Package Dimension

		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.8	0.85	0.9
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.65	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		6 BSC	
	Y	E		6 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	D2	4.5	4.6	4.7
	Y	E2	4.5	4.6	4.7
LEAD LENGTH		L	0.3	0.4	0.5
LEAD TIP TO EXPOSED PAD EDGE		K		0.3 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.07	
EXPOSED PAD OFFSET		fff		0.1	

6 Ordering Information

The CS5261 can be ordered using the part numbers in Table 6-1. Please consult sales for further details.

Table 6-1 CS5261 Ordering Information

Part No.	Description	Temperature Range	Packing Type
CS5261	48 Pin (QFN) Lead-free package	Commercial: 0 to 70 degree C	Sample

Table 6-2 CS5261 Marking Information

Line No.	Description	Temperature Range
Line1	CS5261	Product Name
Line2	XXXXXX	Lot #
Line3	YYWW	YYWW: Date code;
Line4	PIN1 indicator	

Figure 6-1 CS5261 Marking

7 Revision History

Table 7-1 Document Revision History

Revision	Date	Changes
V1.0	Dec.2021	initial version.
V1.1	Jan.2022	Update content