



MacroSilicon Release For
深圳市九黎科技有限公司
Internal Use Only
2021年5月24日

MS9331

HDMI Retimers

Data Sheet

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1. Basic Introduction

The MS9331 is an HDMI signal retiming chip with a maximum signal rate of 3Gbps and supports both I2S and SPDIF outputs. At 3Gbps, the MS9331 supports HDMI input signals at 4K x 2K @ 30Hz and 4K x 2K (YCbCr420) @ 60Hz resolution. The HDMI input clock and data recovery function can adapt to different cable lengths with different quality, so that the TMDS signal transmitted at high speed always has the best performance. RAM.

2. Functional Features

- ◆ Compliant with HDMI 1.4b standard
- ◆ Support 1 DVI/HDMI input, 1 DVI/HDMI output
- ◆ Supports HDMI1.4b 4K×2K@30Hz format and HDMI2.0 YCbCr420 4K×2K@60Hz format
- ◆ Supports I2S and SPDIF outputs
- ◆ Support audio output frequency 32KHz ---192KHz
- ◆ Support for all compressed and uncompressed audio formats
- ◆ HDMI input with adaptive EQ
- ◆ HDMI output with pre-emphasis function
- ◆ Supports 10/12/16-bit color depth input/output
- ◆ Automatic monitoring of HDMI input signals
- ◆ Automatic monitoring of HDMI output device status
- ◆ DDC channel with 5V TTL level support
- ◆ Integrated HDCP KEY RAM
- ◆ Integrated 512 bytes of EDID RAM
- ◆ No external crystal required
- ◆ QFN48 Package
- ◆ RoHS compliant

3. Application Scenarios

HDMI Retimers

4. Catalog

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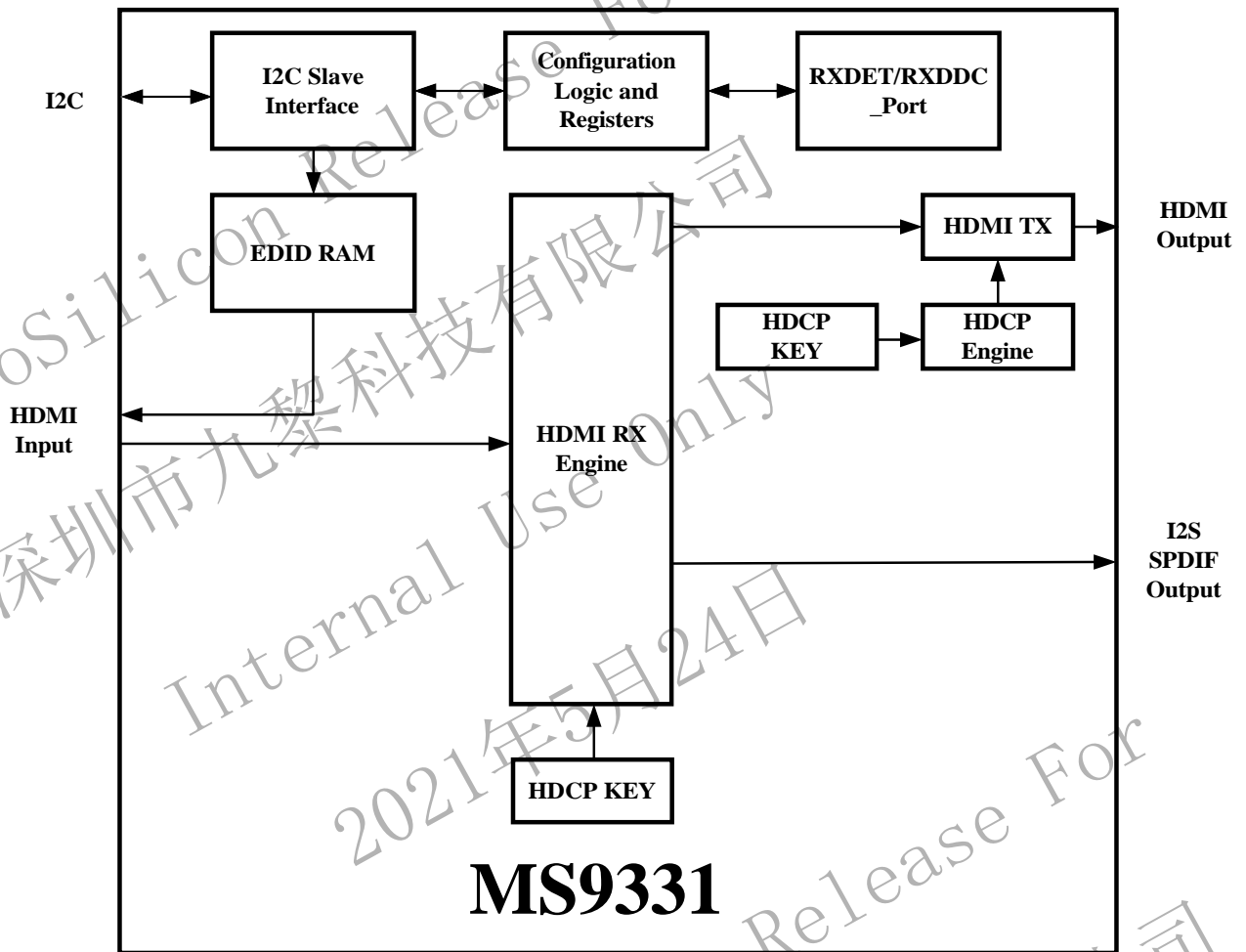


Figure 1. Functional block diagram

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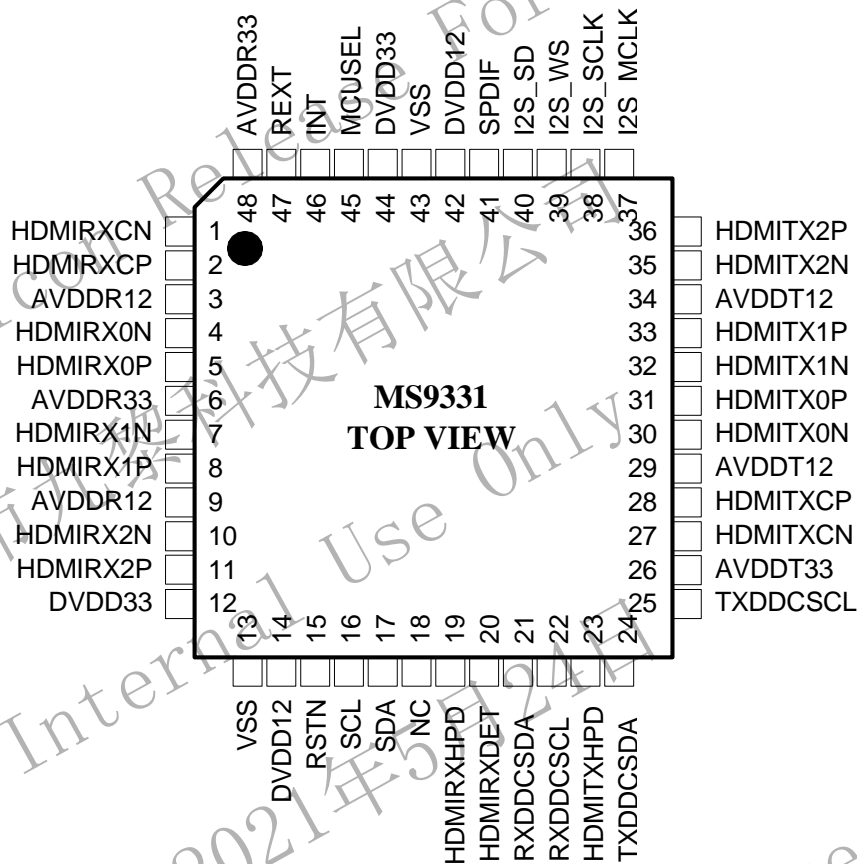


Figure 2. Pinout diagram

7. Pin Description

Table 7.1. Pin Descriptions

Pin Name	Pin number	Type	Description
System			
RSTN	15	Input	Chip reset pin, active low
SCL	16	Input	Serial Clock Bus
SDA	17	Input and Output	Serial Data Bus
INT	46	Output	Interrupt output
REXT	47	Input	External reference resistor, a 10 kOhm resistor must be connected to the ground
MCUSEL	45	Input	Internal and external MCU selection. MCUSEL=0 to select external MCU MCUSEL=1 or dangling to select internal MCU
NC	18	None	No connection
HDMI signal input			
HDMIRXC�	1	Input	Differential clock input on HDMI receiver side
HDMIRXCP	2	Input	Differential clock input on HDMI receiver side
HDMIRX0N	4	Input	HDMI receiver differential channel 0 data input
HDMIRX0P	5	Input	HDMI receiver differential channel 0 data input
HDMIRX1N	7	Input	HDMI receiver differential channel 1 data input
HDMIRX1P	8	Input	HDMI receiver differential channel 1 data input
HDMIRX2N	10	Input	HDMI receiver differential channel 2 data input
HDMIRX2P	11	Input	HDMI receiver differential channel 2 data input
HDMIRXHPD	19	Output	HDMI receiver hot-swappable signal output
HDMIRXDET	20	Input	HDMI receiver 5V input detection
RXDDCSDA	21	Input and Output	HDMI receiver display data channel serial data bus
RXDDCSCL	22	Input	HDMI receiver display data channel serial

Pin Name	Pin number	Type	Description
Audio Output			
I2S_MCLK	37	Output	I2S signal master clock output
I2S_SCLK	38	Output	I2S signal serial clock output
I2S_WS	39	Output	I2S signal frame clock output
I2S_SD	40	Output	I2S signal serial data output
SPDIF	41	Output	Digital audio signal output
Power and Ground			
AVDDR33	6,48	Power supply	Analog 3.3V power supply for HDMI receiver
AVDDT33	26	Power supply	HDMI transmitter analog 3.3V power supply
DVDD33	12,44	Power supply	Digital 3.3V power supply
AVDDR12	3,9	Power supply	HDMI receiver analog 1.2V power supply
AVDDT12	29,34	Power supply	HDMI transmitter analog 1.2V power supply
DVDD12	14,42	Power supply	Digital 1.2V power supply
VSS	13,43,49	ground	ground

8. Electrical Characteristics

8.1 Limit parameters

Table 8.1. Limiting electrical parameters

Parameters	Symbols	Numeric al value	Unit
Ultimate operating voltage	VDD33	3.63	V
Ultimate operating voltage	VDD12	1.32	V
Ambient working temperature	TA	0 to +70	°C
Storage temperature	Tsto	-55 to +125	°C

Note: If the operating conditions of the device exceed the above "limit parameters", it will cause permanent damage to the device. Functionality is guaranteed only when the device operates within the limits specified in the specification. Devices operating under the conditions listed in the limit parameters will affect the reliability of the device's operation.

Table 8.2. Limit antistatic parameters

Parameters	Symbols	Numeric al value	Unit
Human Body Model (HBM)	VESD(HBM)	±4000	V
Machine Model (MM)	VESD(MM)	±200	V
Charged Model (CDM)	VESD(CDM)	±2000	V

Static Protection Precautions: Static charges accumulate on the human body and test equipment and can discharge without being detected. Although this product has a dedicated electrostatic protection circuit, permanent damage may occur on equipment with high energy electrostatic discharge. Therefore, appropriate electrostatic

precautions are recommended.

8.2 DC Parameters

Table 8.3. DC parameters (test condition: input resolution 4K×2K@30Hz)

Parameters	Symbols	Minimum value	Typical values	Maximum value	Unit
HDMI receiver analog 3.3V voltage	AVDDR33	2.97	3.3	3.63	V
HDMI transmitter analog 3.3V voltage	AVDDT33	2.97	3.3	3.63	V
Digital 3.3V Voltage	DVDD33	2.97	3.3	3.63	V
HDMI receiver analog 1.2V voltage	AVDDR12	1.08	1.2	1.32	V
HDMI transmitter analog 1.2V voltage	AVDDT12	1.08	1.2	1.32	V
Digital 1.2V Voltage	DVDD12	1.08	1.2	1.32	V
HDMI receiver analog 3.3V current	IAVDDR33		110		mA

Parameter	Symbols	Minimum value	Typical value	Maximum value	Unit
HDMI transmitter analog 3.3V current	IAVDDT33		9		mA
Digital 3.3V Current	IDVDD33		5		mA
HDMI receiver analog 1.2V current	IAVDDR12		85		mA
HDMI transmitter analog 1.2V current	IAVDDT12		61		mA
Digital 1.2V Current	IDVDD12		128		mA

Table 8.4. HDMI Electrical Characteristics

Parameter	Symbols	Minimum value	Typical value	Maximum value	Unit
TMDS Differential Input Signal Amplitude		150		1200	mV
TMDS Output Terminal Voltage		3.135	3.3	3.465	V
TMDS output high level amplitude		3.3-0.2		3.3+0.01	V
TMDS output low level amplitude		3.3-0.7		3.3-0.4	V
TMDS Output Single-Ended Voltage Amplitude		400	500	600	mV

9. Package Information

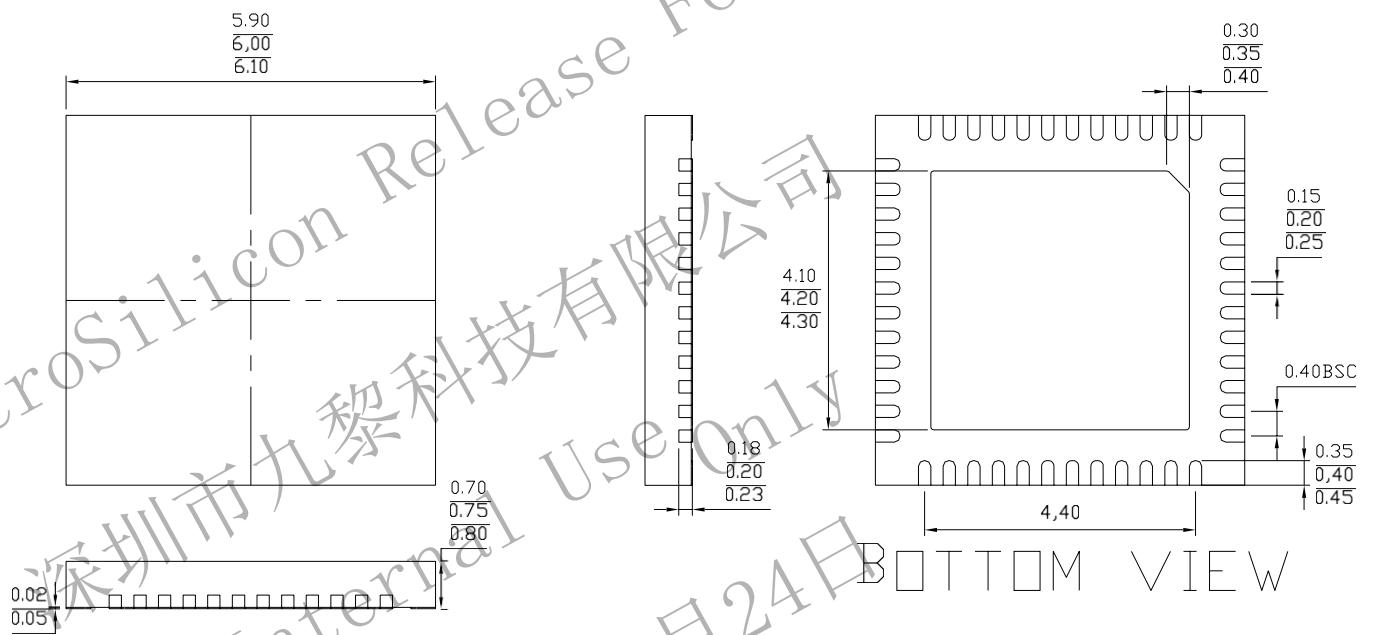


Figure 3. Package Outline Diagram

10. Chip

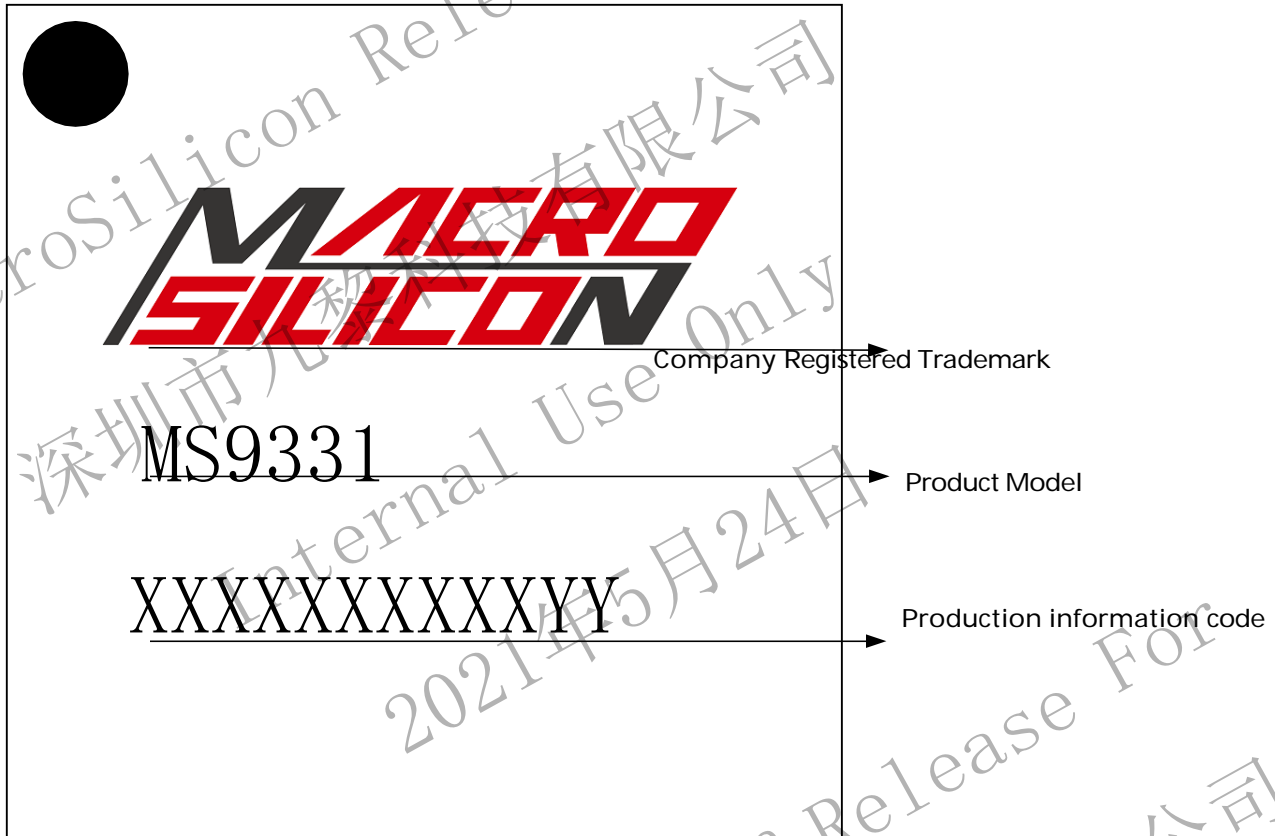


Figure 4. Chip identification

11.

Date	Versions	Author	Remarks
2020-5-7	V1.0	Ctang	Initial Version