



SiI9022A/SiI9024A HDMI Transmitter

Data Brief

Document # SiI-DB-1076-D01

January 2011

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General Description

The SiI9022A/SiI9024A HDMI transmitter supports the High Definition Multimedia Interface (HDMI[®]) Specification on a wide range of mobile products. High definition camcorders, digital still cameras, and personal mobile devices connect directly to a large installed base of HDMI TVs and DVI PC monitors by using the flexible audio and video interfaces provided by this ultra-low-power solution. S/PDIF or I²S inputs enable a pure digital audio connection to virtually any system audio processor or codec. This transmitter is the next generation of its family and is an enhanced replacement for the SiI9022/SiI9024 device, with lower power and enhanced features.

The SiI9024A transmitter is pre-programmed with HDCP keys and has completely self-sequencing HDCP detection and authentication, including SHA-1 for repeaters. The device supports High-bandwidth Digital Content Protection (HDCP) for devices that require secure content delivery.

Video Input

- xvYCC metadata support
- BTA-T1004 video input format
- Integrated color space converter allows direct connection to all major MPEG decoders, including those that provide only an ITU-R.656 output
- Internal DE generator supports non-embedded sync formats

HDMI Output

- HDMI, HDCP, and DVI compatible
- TMDS[™] core runs at 165 MHz
- Video resolutions up to 1080p and UXGA (72-pin QFN package supports 165-MHz dual-edge mode)
- 3D-capable at 720p/60, 1080i/60, and 1080p/24 frame-pack, side-by-side, L + D, and Top-and-Bottom modes
- HDMI Type A, Type-C, and micro-D connector support

Control Capability

- Consumer Electronics Control (CEC) interface incorporates an HDMI-compliant CEC I/O with hardware protocol and arbitration logic, and requires no external calibration
- Monitor detection is supported through both Hot Plug and Receiver Sense circuits
- Single slave I²C from host, passing through to master I²C interface for DDC connection, simplifies board layout and lowers cost
- Defaults to SiI9020 transmitter register-compatible mode for operation with existing legacy software

Digital Audio Interface:

- Four I²S inputs for Dolby Digital, DTS, or MPEG2 audio with programmable channel mapping (49-ball package supports one I²S input)
- DVD-Audio input (2 or up to 8 channels)
- MCLK is not required for I²S and S/PDIF
- S/PDIF input supports 2-channel PCM or compressed Dolby Digital and DTS digital
- 2:1 and 4:1 down-sampling to handle 96-kHz and 192-kHz audio streams

Power Management

- Flexible power management with hot-plug wakeup
- Ultra low power requirement: less than 90 mW active, 150 μ W standby

Packaging

- 81-ball VFBGA (4.0 x 4.0 mm) package
- 72-pin QFN (10 x 10 mm) package
- 49-ball VFBGA (4.0 x 4.0 mm) package
- Standard part covers extended (-20 to +85 °C) temperature range.

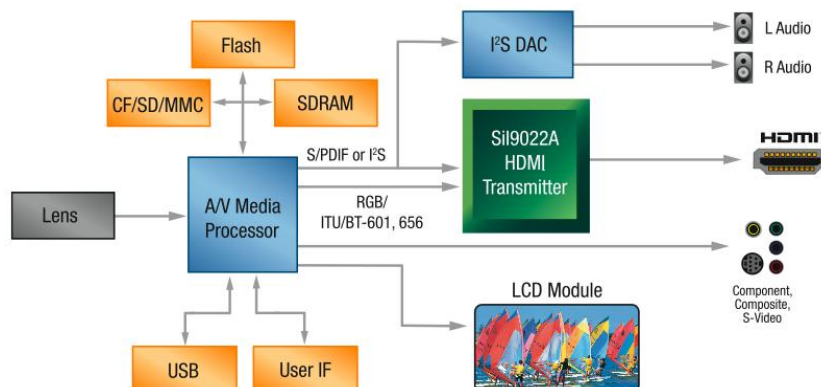


Figure 1. Typical Application (SiI9022A HDMI Transmitter Shown)

Comparison of the SiI9022A/SiI9024A Device With Other HDMI Transmitters

Table 1 summarizes the differences among the previous Silicon Image HDMI transmitters and the SiI9022A/SiI9024A HDMI transmitters.

Table 1. Summary of Features

HDMI Transmitter	SiI9030	SiI9020	SiI9022	SiI9022-6	SiI9024	SiI9024-6	SiI9022A	SiI9024A	SiI9022A	SiI9024A
							VFBGA	QFN		
Video Input										
Clock duty cycle	60/40	60/40	70/30	70/30	70/30	70/30	70/30	70/30	70/30	70/30
Max frequency	150 MHz	84 MHz	82.5 MHz	165 MHz	82.5 MHz	165 MHz	165 MHz	165 MHz	165 MHz ³	165 MHz ³
Input signal level ²	3.3 V	3.3 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V
Audio Input										
Max S/PDIF frequency	96 kHz	96 kHz	192 kHz	192 kHz	192 kHz	192 kHz	192 kHz	192 kHz	192 kHz	192 kHz
I ² S MCLK required?	Yes	Yes	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
S/PDIF MCLK required?	Yes	Yes	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
DDC I²C Bus										
Voltage Tolerance ¹	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V
HDCP										
Encryption engine	Yes	No	No	No	Yes	Yes	No	Yes	No	Yes
Auto authentication	No	No	No	No	Yes	Yes	No	Yes	No	Yes
Other										
Core power supply	1.8 V	1.8 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
I/O power supply ²	3.3 V	3.3 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8 V	3.3 V or 1.8V	3.3 V or 1.8 V	3.3 V or 1.8V ⁴	3.3 V or 1.8 V ⁴
Package	80-pin TQFP	84-ball TFBGA	84-ball TFBGA or 81-ball VFBGA	84-ball TFBGA	84-ball TFBGA or 81-ball VFBGA	84-ball TFBGA	81-ball VFBGA or 49-ball VFBGA	81-ball VFBGA or 49-ball VFBGA	72-pin QFN	72-pin QFN

Notes:

1. The DDC pads of the SiI9022A/SiI9024A device are 5 V compliant with or without IOVCC power supply. For other devices listed above, the DDC pads are 5-V tolerant only when chip IOVCC is applied.
2. The SiI9022A/SiI9024A 81-ball and 72-pin package supports both 1.8-V and 3.3-V threshold-compliant operation. The 49-ball package only supports 1.8-V compliant I/O. Both devices have 3.3-V tolerant I/O when IOVCC is 1.8 V.
3. Supports up to 165 MHz dual-edge and single-edge modes.
4. For dual-edge mode above 82.5 MHz, only 3.3 V ± 10% can be used for IOVCC.

Ball and Pin Diagrams

81-ball VFBGA Package

Figure 2 shows the ball diagram for the SiI9022A/SiI9024A transmitter in the 81-ball package. Balls are shaded using the grouping shown in Figure 4 on page 5.

	1	2	3	4	5	6	7	8	9
A	HCTRL_IO	RSVD	GND	HDATA_O	HDATA_O	HDATA_O	HDATA_O	GND	EXT_SWING
B	CCTRL_IO	VDD	HDATA_O	HDATA_O	HDATA_O	HDATA_O	CCTRL_IO	CCTRL_I	RSVD
C	CCTRL_IO	CCTRL_IO	CCTRL_I	CVCC12	GND	AVCC12	AVCC12	HCTRL_IO	HCTRL_IO
D	GND	GND	VCC12	GND	VCC	GND	VCC12	HCTRL_O	CCTRL_O
E	VDATA_1	VDATA_1	VDATA_1	VDATA_1	VCC	ADATA_1	VCC12	VCC	VCC
F	VDATA_1	VDATA_1	VDATA_1	VDATA_1	VCC12	ADATA_1	ACTRL_1	ACTRL_1	ADATA_1
G	VDATA_1	VDATA_1	VDATA_1	VDATA_1	GND	VCC12	ADATA_1	ACTRL_1	ADATA_1
H	VDATA_1	VDATA_1	VCTRL_1	VDATA_1	GND	VDATA_1	VDATA_1	VDATA_1	VCTRL_I
J	VDATA_1	VDATA_1	VDATA_1	VDATA_1	GND	VDATA_1	VDATA_1	VCTRL_I	VCTRL_I

Ball Name	Purpose
VDATA_I	Video data Input
VCTRL_I	Video control Input
ADATA_I	Audio data Input (S/PDIF, I ² S)
ACTRL_I	Audio control Input (WS, MCLK, SCK)
CCTRL_x	Chip control Input, Output, or Input/Output (INT, RESET, CSCL, CSDA, etc.)
HDATA_O	HDMI data Output (TMDS-level signals)
HCTRL_x	HDMI control Input, Output, or Input/Output

Figure 2. 81-ball Ball Diagram (Top View)

49-ball VFBGA Package

Figure 3 shows the ball diagram for the SiI9022A/SiI9024A transmitter in the 49-ball package. Balls are shaded using the grouping shown in Figure 4 on the next page.

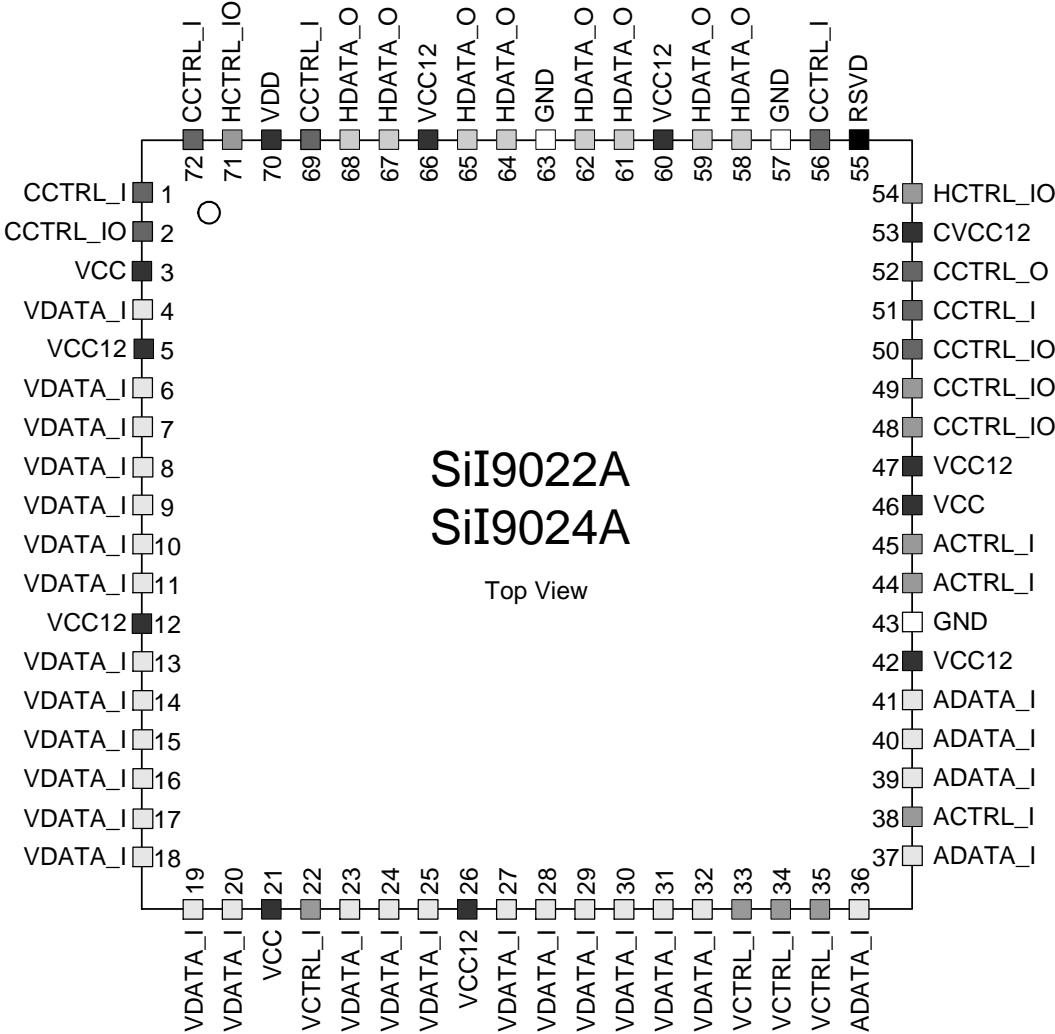
	1	2	3	4	5	6	7
A	HDATA_O	HDATA_O	HDATA_O	HDATA_O	HDATA_O	HDATA_O	HDATA_O
B	HCTRL_IO	HDATA_O	GND	VCC12	CCTRL_IO	RSVDL	CCTRL_I
C	CCTRL_IO	CCTRL_IO	VDD	VCC12	CCTRL_I	CCTRL_O	CCTRL_IO
D	VDATA_I	VDATA_I	GND	GND	HCTRL_I	ACTRL_I	ADATA_I
E	VDATA_I	VDATA_I	VCC	VDATA_I	ACTRL_I	VDATA_I	ACTRL_I
F	VDATA_I	VDATA_I	VCTRL_I	VDATA_I	VDATA_I	VDATA_I	VCTRL_I
G	VDATA_I	VDATA_I	VDATA_I	VDATA_I	VDATA_I	VCTRL_I/ ADATA_I	VCTRL_I

Ball Name	Purpose
VDATA_I	Video data Input
VCTRL_I	Video control Input
ADATA_I	Audio data Input (S/PDIF, I ² D)
ACTRL_I	Audio control Input (WS, MCLK, SCK)
CCTRL_x	Chip control Input, Output, or Input/Output (INT, RESET, CSCL, CSDA, etc.)
HDATA_O	HDMI data Output (TMDS-level signals)
HCTRL_x	HDMI control Input, Output, or Input/Output

Figure 3. 49-ball Ball Diagram (Top View)

72-pin QFN Package

Figure 4 shows the pin diagram for the SiI9022A/SiI9024A transmitter in the 72-pin package.



VDATA_I	Video data Input	CCTRL_x	Chip control Input, Output, or Input/Output (INT, RESET, CSCL, CSDA, etc.)
VCTRL_I	Video control Input	HDATA_O	HDMI data Output (TMDS-level signals)
ADATA_I	Audio data Input (S/PDIF, I ² S)	HCTRL_x	HDMI control Input, Output, or Input/Output
ACTRL_I	Audio control Input (WS, MCLK, SCK)		

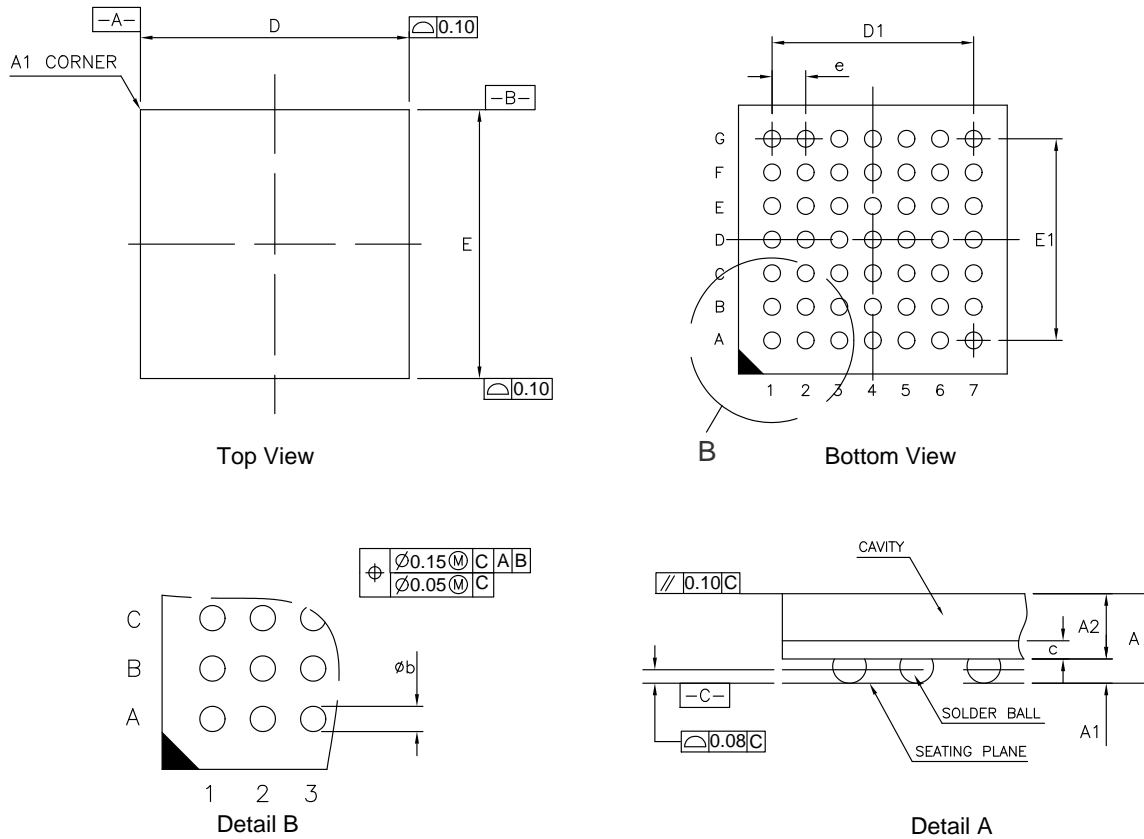
- Ground
- Audio and video data input
- TMDS output
- Audio, video, and HDMI control I/O
- Chip configuration and control
- Power
- Reserved and not connected

Figure 4. 72-pin QFN Pin Diagram (Top View)

Packaging

49-ball Package Dimensions

These drawings are not to scale.



JEDEC Package Code MO-225

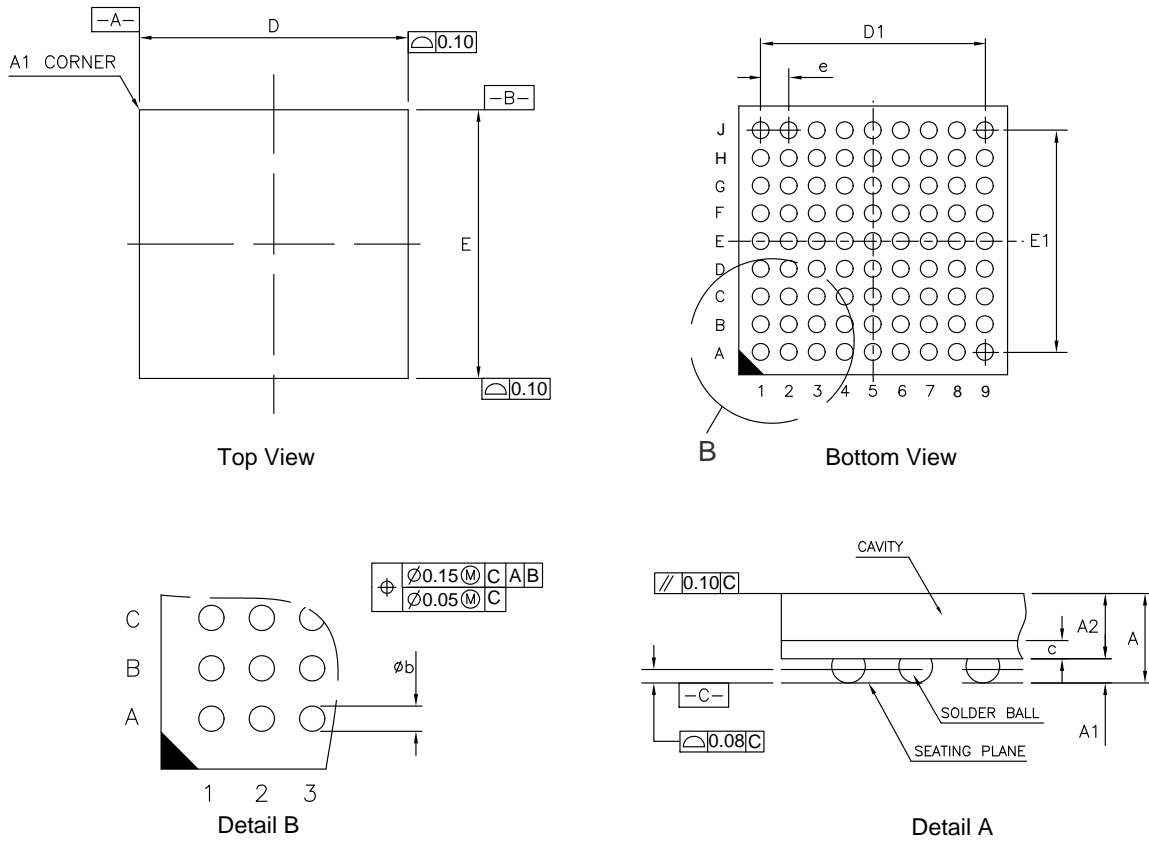
Item	Description	Min	Typ	Max
A	Thickness	—	—	0.80
A1	Stand-off	0.13	0.18	0.23
A2	Substrate thickness + Mold thickness	0.446	0.508	0.560
D	Body size	3.90	4.00	4.10
E	Body size	3.90	4.00	4.10
D1	Footprint	—	3.00	—
E1	Footprint	—	3.00	—
b	Ball width	0.20	0.25	0.30
e	Ball pitch	—	0.50	—

All dimensions are in millimeters.

Figure 5. 49-ball VFBGA Package Diagram (SiI902nAYBT)

81-ball Package Dimensions

These drawings are not to scale.



JEDEC Package Code MO-225

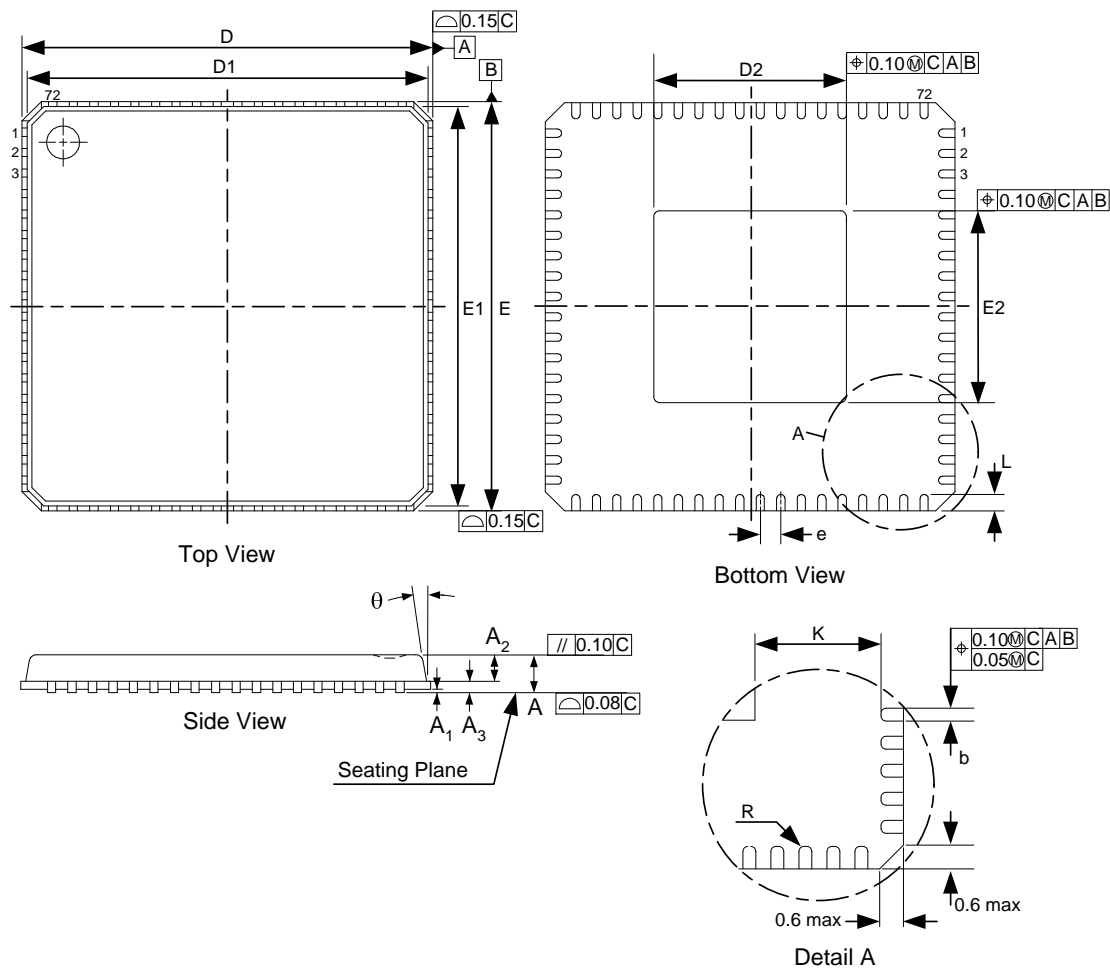
Item	Description	Min	Typ	Max
A	Thickness	—	—	0.80
A1	Stand-off	0.13	0.18	0.23
A2	Substrate thickness + Mold thickness	0.446	0.508	0.560
D	Body size	3.90	4.00	4.10
E	Body size	3.90	4.00	4.10
D1	Footprint	—	3.20	—
E1	Footprint	—	3.20	—
b	Ball width	0.20	0.25	0.30
e	Ball pitch	—	0.40	—

All dimensions are in millimeters.

Figure 6. 81-ball VFBGA Package Diagram (SiI902nARBT)

72-pin Package Dimensions

These drawings are not to scale.



JEDEC Package Code MO-220

Item	Description	Min	Typ	Max
A	Thickness	0.80	0.85	0.90
A ₁	Stand-off	0.00	0.02	0.05
A ₂	Body thickness	0.60	0.65	0.70
A ₃		0.20 REF		
D	Footprint	10.00 BSC		
E	Footprint	10.00 BSC		
D ₁	Body size	9.75 BSC		
E ₁	Body size	9.75 BSC		

Item	Description	Min	Typ	Max
D ₂	ePad size	4.55	4.70	4.85
E ₂	ePad size	4.55	4.70	4.85
b	Plated lead width	0.18	0.23	0.28
e	Lead pitch	0.50 BSC		
K	ePad-to-pin clearance	0.20	—	—
L	Lead foot length	0.30	0.40	0.50
R	Lead radius	0.09	—	—
θ	Lead foot angle	0°	—	14°

All dimensions are in millimeters.

Figure 7. 72-pin QFN Package Diagram (SiI902nACNU)

Marking Specification

Marking drawings are not to scale.

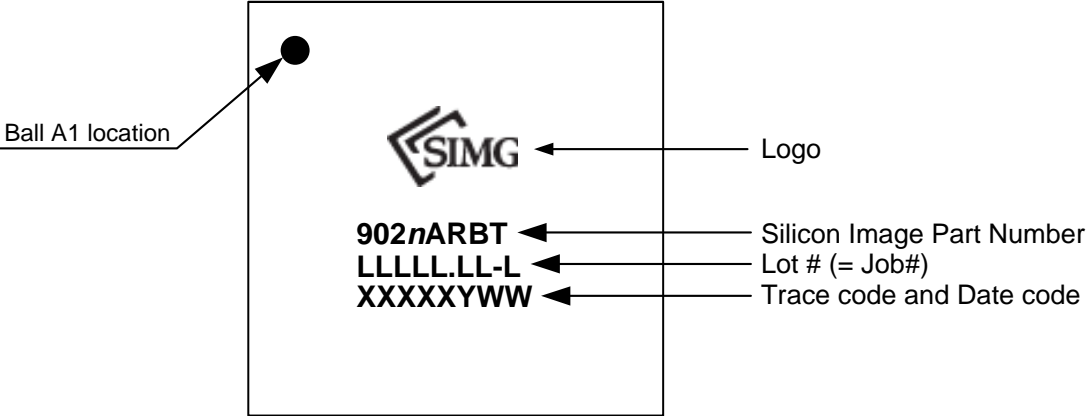


Figure 8. Marking Diagram (SiI902nARBT)

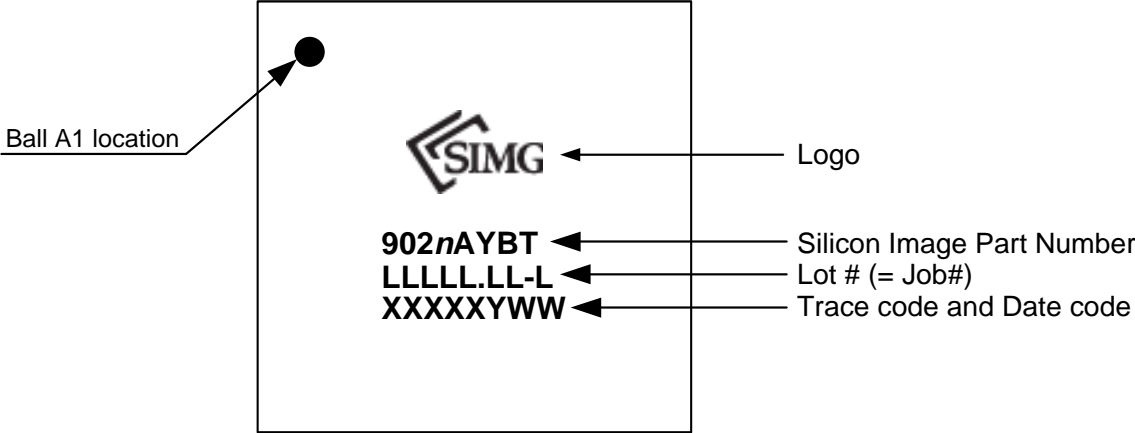


Figure 9. Marking Diagram (SiI902nAYBT)

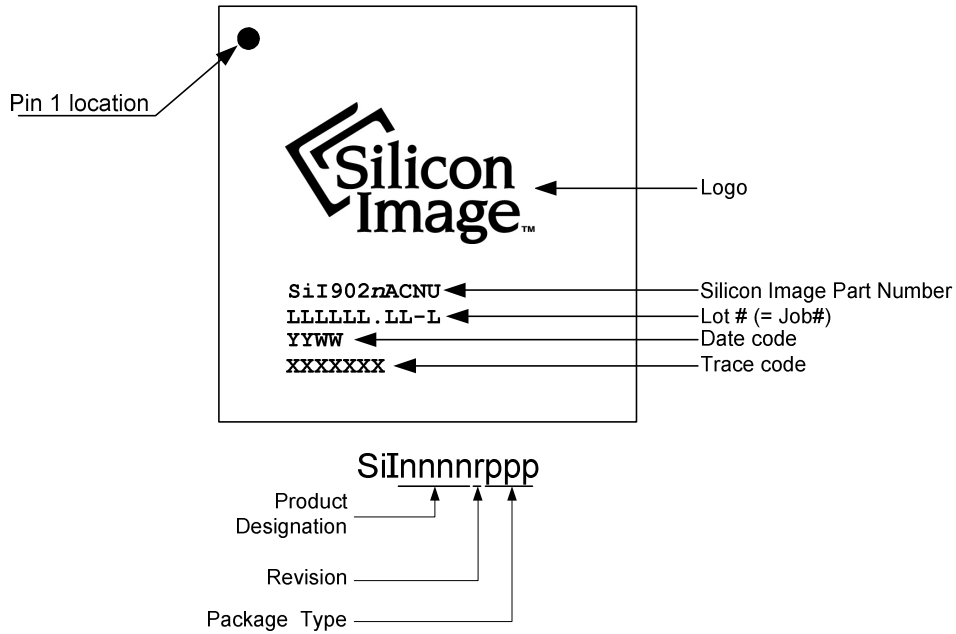


Figure 10. Marking Diagram (SiI902nACNU)

Ordering Information

Part Numbers	Package Type	Pixel Clock Range	Security	Temperature Grade
SiI9022ARBT	81-ball 4 x 4 mm VFBGA	25–165 MHz	—	Extended (–20 to +85 °C)
SiI9022AYBT	49-ball 4 x 4 mm VFBGA	25–165 MHz	—	Extended (–20 to +85 °C)
SiI9022ACNU	72-pin 10 x 10 mm QFN	25–165 MHz	—	Extended (–20 to +85 °C)
SiI9024ARBT	81-ball 4 x 4 mm VFBGA	25–165 MHz	HDCP	Extended (–20 to +85 °C)
SiI9024AYBT	49-ball 4 x 4 mm VFBGA	25–165 MHz	HDCP	Extended (–20 to +85 °C)
SiI9024ACNU	72-pin 10 x 10 mm QFN	25–165 MHz	HDCP	Extended (–20 to +85 °C)

The universal package can be used in both lead-free and ordinary process lines.

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