MS1820

Multi-Functions Video Processor

DATA SHEET

General Description

The MS1820 is a multi-functions video processor chip. It consists of 10-bit triple-ADC module, TV encoder module, 10-bit triple-DAC module and embedded OSD function. It can receive interlaced or progressive video input and graphic input. It is capable of advanced de-interlacing, video enhancement, 3D noise reduction, Y/C cross talk suppression and frame rate conversion.

Features

Analog Input

- 10-bit triple-ADC
- Maximum analog sampling rate up to 165MSPS
- Supports analog input range: 0.45V ~ 1.1V (P-P)
- Up to three analog input channels
- 3 to 1 input mux
- Supports RGBHV/RGBS/YCbCr/YPbPr input
- Auto offset/phase adjustment
- Supports Sync-on-Green(SOG) and Composite-sync
- Supports input resolution up to 1080P
- Supports macrovision input

Flexible Digital Video Input

- Supports 24-bit RGB/YUV digital input
- Supports 16-bit YUV 4:2:2 input
- Supports 8-bit BT656, 601 input
- Supports 8-bit BT1120 input
- Supports interlace and progressive SD input
- Supports 720P, 1080I, 1080P HD input
- Supports VGA input up to UXGA

Auto-mode Detection

Auto Position (Blank) Detection

Frame Rate Conversion

- Independent horizontal and vertical scaling
- Frame rate conversion

External Memory Controller

- Supports 2/8MByte memory size
- 16/32-bit data access
- Memory bus speed up to 162MHz

De-interlacing

- Supports HD1080I to1080P conversion
- Supports SD NTSC/PAL to 480P/576P conversion
- Edge correction De-interlacing
- 4-field motion adaptive de-interlacing for SD and 3-field for HD
- Global noise reduction
- 3:2/2:2 pull-down detection

Video Enhancement

- Black/white level expansion
- Color transition improvement
- Dynamic peaking
- Dynamic range expansion
- Brightness, saturation, contrast and hue adjustable
- 2 sets primary color enhancement
- Blue stretch

Embedded OSD

- Supports 1/2/4-bit DRCS character mode
- Shadowing, transparency and blinking
- Block double width and height
- Zoom out
- One OSD window with alpha-blending

Output Formatter

- 10-bit triple-DAC for component video output
- Analog VGA or YPbPr output
- Video encoder
- 50~75Hz scan rate conversion
- 15~75KHz horizontal frequency
- 16-bit YUV 4:2:2 digital output with sync
- 24-bit YUV/RGB 4:4:4 digital output with LCD panel compatible sync
- VGA output resolution up to UXGA
- Video outputs: 480I, 480P, 576I, 576P, 720P, 1080I, 1080P

2-wire I2C Slave Interface

Package

- LQFP-176 plastic (20mm×20mm)
- PB-free and RoHS compliant

Applications

- LCD Controller
- Video Converter/ Set-Top-Box
- Car Infotainment Device
- Portable/ Desktop Visualizer
- Industrial Camera

Table of Contents

Function Block Diagram

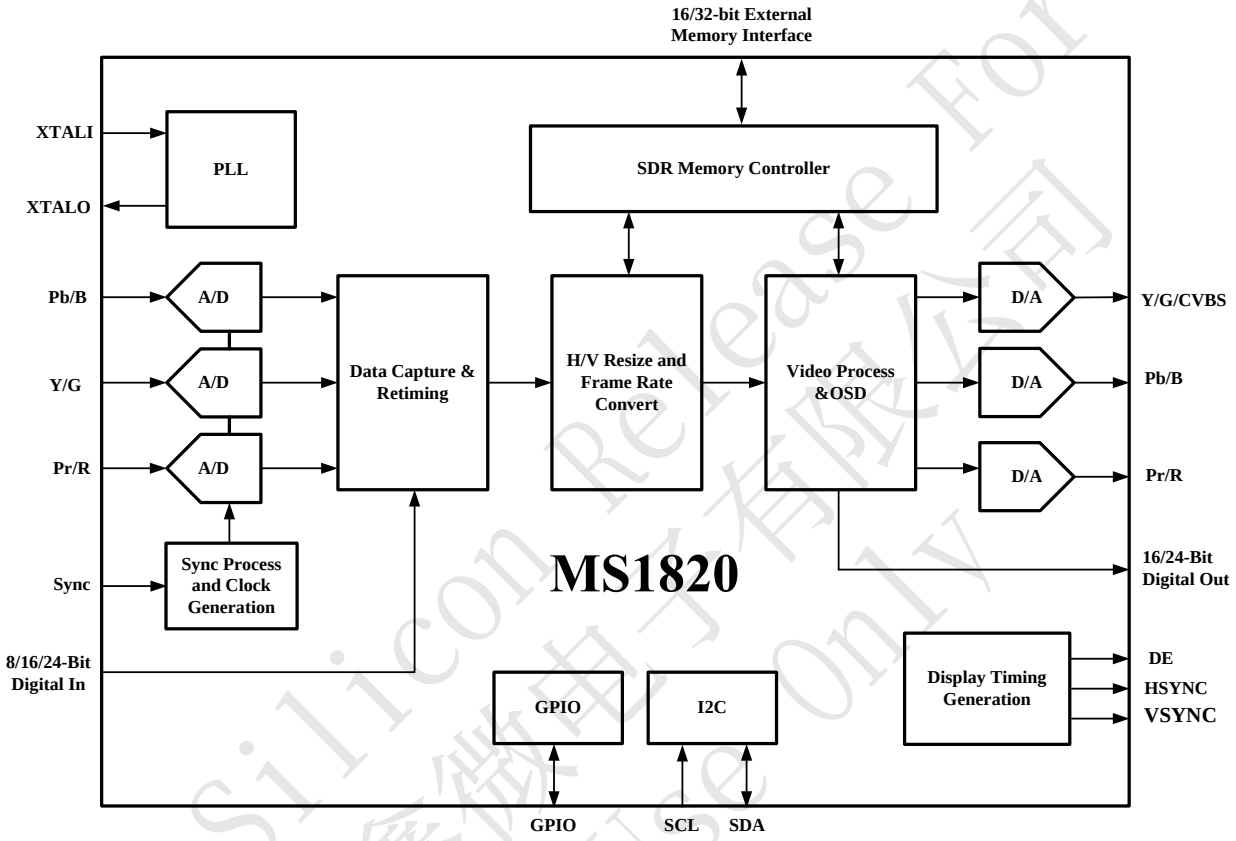

Figure 1. Function Block

Function Description

Host Interface

MS1820 registers are accessed by a 2-wire serial bus interface. It operates as a slave device and follows I2C standard. The data transfer rate up to 400Kbit/s.

Table 1. I2C Slave Address

I2C Slave Addresses		
Pin SCLSA Value	Read	Write
SCLSA = 0	0xB3	0xB2
SCLSA =1	0xBB	0xBA

Motion Adaptive De-interlacing

The MS1820 integrates a motion adaptive de-interlacing module. This module can automatically identify the content type of input video such as film, static interlaced or moving interlaced video. Different algorithms are applied for each content type. The module also produces a progressive scan video output. Noise can be removed during the processing. It also uses an edge detection algorithm which enables the smoothing of jagged edges that could occur in the de-interlacing process, and different detection angles can be programmed.

Horizontal/Vertical Scaling and Frame Rate Conversion

MS1820 Horizontal/Vertical scaling engine can change the video resolution, which scaling ratio from (1/4)x to 4x both for Horizontal and Vertical. The scan rate conversion engine can change the video frame rate such as 50Hz to 60Hz.

OSD Engine

The embedded character-based OSD Engine supports 1/2/4-bit DRCS character mode, character blinking, shadowing, transparency, block double width and height and Zoom out. It also supports 256 levels of alpha blending to overlay OSD image on background video. The detailed description of the build-in OSD function, please refer to the application, rather than the embedded OSD.

Memory Controller

The integrated memory controller takes care of addressing and controlling of the external SDRAM. The types of SDRAM used with MS1820 should be organized as:
1M×16×2BANK、1M×16×4BANK、512K×32×4BANK、1M×16×4BANK
The typical configuration is 512K×32×4BANK or two 1M×16×4BANK SDRAM. The detailed description of connecting with the external SDRAM refer to the application, rather than SDRAM connection.

PIN Map

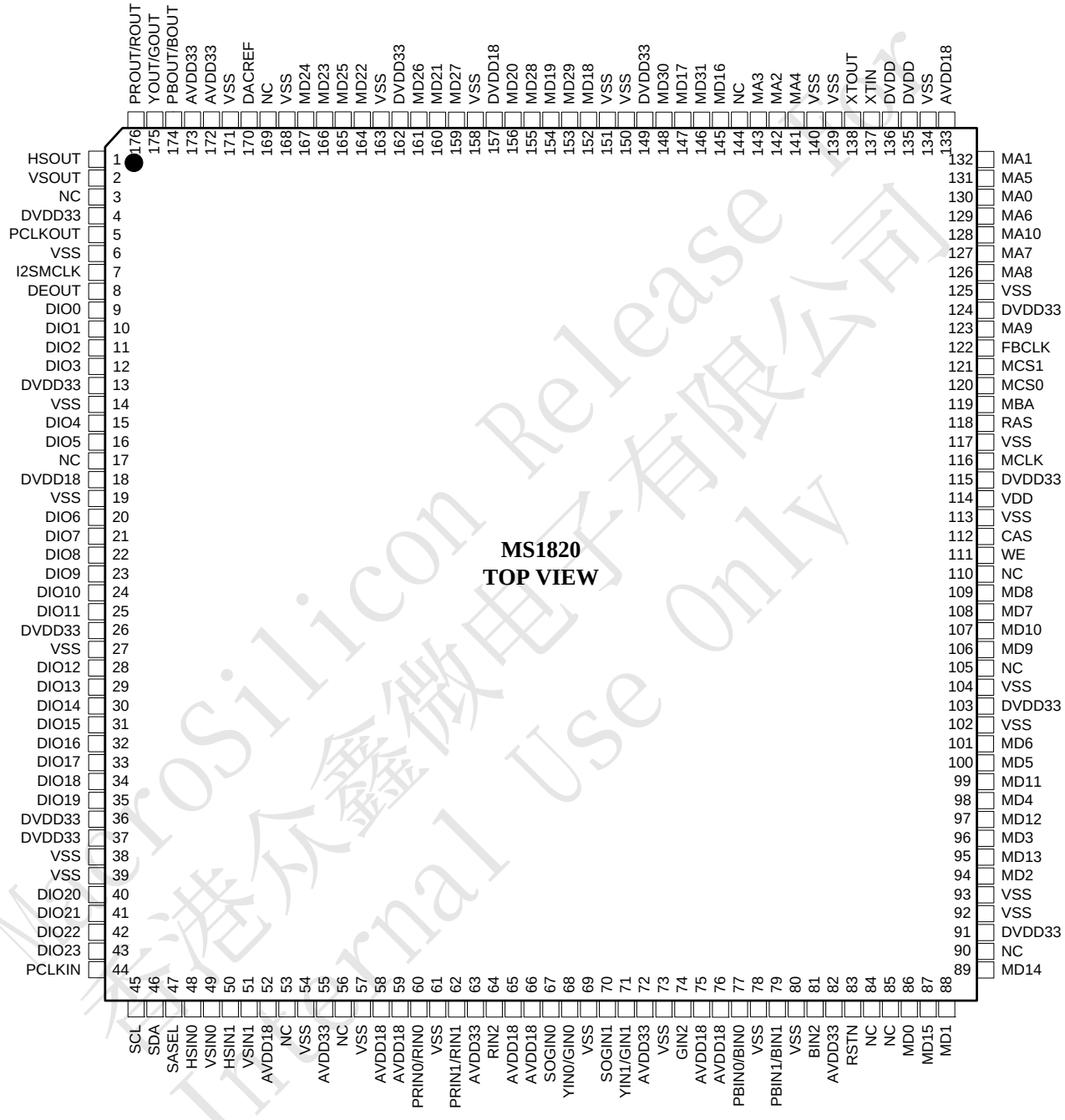

Figure 2. PIN MAP

PIN Description

Table 2. PIN Description

Pin Name	Pin #	Type	Description
System			
RSTN	83	DI	External reset in, active low
XTIN	137	AI	External crystal input
XTOUT	138	AO	External crystal output
SCL	45	DI	Serial bus clock
SDA	46	DIO	Serial bus data
SASEL	47	DIO	Serial address selection
Digital Video Interface			
HSOUT	1	DO	Horizontal sync output
VSOUT	2	DO	Vertical sync output
PCLKOUT	5	DO	Video pixel clock output
I2SMCLK	7	DO	12.288MHz audio clock output
DEOUT	8	DO	Video display enable output
DIO[0:7]	9-12, 15,16,20,21	DIO	Digital video input/output Byte0
DIO[8:15]	22-25, 28,29,30,31	DIO	Digital video input/output Byte1
DIO[16:23]	32-35,40-43	DIO	Digital video input/output Byte2
PCLKIN	44	DI	Input video pixel clock
HSIN0	48	DI	1st set video horizontal SYNC input
VSIN0	49	DI	1st set video vertical SYNC input
HSIN1	50	DI	2nd set video horizontal SYNC input
VSIN1	51	DI	2nd set video vertical SYNC input
Analog Video Input			
PRIN0/RIN0	60	AI	1st set analog video R/Cr component in
YIN0/GIN0	68	AI	1st set analog video G/Y component in
PBIN0/BIN0	77	AI	1st set analog video B/Cb component in
PRIN1/RIN1	62	AI	2nd set analog video R/Cr component in
YIN1/GIN1	71	AI	2nd set analog video G/Y component in
PBIN1/BIN1	79	AI	2nd set analog video B/Cb component in
RIN2	64	AI	3rd set analog video R/Cr component in
GIN2	74	AI	3rd set analog video G/Y component in
BIN2	81	AI	3rd set analog video B/Cb component in
SOGIN0	67	AI	1st set analog video composite SYNC in
SOGIN1	70	AI	2nd set analog video composite SYNC in
External SDRAM Interface			

Pin Name	Pin #	Type	Description
MCLK	116	DO	Memory clock to external SDRAM
FBCLK	122	DI	Feedback clock from external SDRAM
WE	111	DO	Write enable for external SDRAM
RAS	118	DO	Row address strobe
CAS	112	DO	Column address strobe
MBA	119	DO	External SDRAM bank selection
MCS0	120	DO	External SDRAM chip 0 selection
MCS1	121	DO	External SDRAM chip 1 selection
MA[0:10]	130,132,142,143, 141,131,129,127, 126,132,128	DO	External SDRAM address
MD[0:15]	86,88,94,96, 98,100,101,108, 109,106,107,99, 97,95,89,87	DIO	External SDRAM data low 16-bit
MD[16:31]	145,147,152,154, 156,160,164,166, 167,165,161,159, 155,153,148,146	DIO	External SDRAM data high 16-bit
Analog Video Output			
PBOUT/BOUT	174	AO	Analog component video B/Cb output
YOUT/GOUT	175	AO	Analog component video G/Y output
PROUT/ROUT	176	AO	Analog component video R/Cr output
DACREF	170	AI	Full-scale adjust reference resistor
Power and Ground			
DVDD18	18,114,157	P	Digital Power 1.8V
AVDD18	52,58,59,65, 66,75,76,133	P	Analog Power 1.8V
DVDD33	4,13,26,36, 37,91,103,115, 124,135,136,149, 162	P	Digital Power 3.3V
AVDD33	55,63,72, 82, 172,173	P	Analog Power 3.3V
VSS	6,14,19,27, 38,39,54,57, 61,69,73,78, 80,92,93,102, 104,113,117,125, 134,139,140,150, 151,158,163,168, 171	G	Ground

Table 3. Abbreviation of Pin Description

Abbreviation	Description
AI	Analog input
AO	Analog output
AIO	Analog bi-direction
DI	Digital input
DO	Digital output
DIO	Digital bi-direction
P	Power
G	Ground
NC	No connect

Electrical Characteristics

Absolute Maximum Ratings

Table 4. Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Ambient Operating Temperature	TA	0 to 70	℃
Storage Temperature	Tsto	-40 to 150	℃
ESD Ratings	Vsed		
Human Body Model		2000	V
Machine Model		200	V

Note1：Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and does not imply functional operation of the device. Exposure to Absolute Maximum Ratings for extended periods may affect device reliability.

ESD CAUTION: Electrostatic charges accumulate on the human body and test equipment and can discharge without detection. Although this product features has dedicated ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

DC Characteristics

Table 5. DC Characteristics

Parameter	Symbol	MIN	TYP	MAX	Unit
Analog Module 3.3V Power	AVDD33	2.97	3.3	3.63	V
Analog Module 1.8V Power	AVDD18	1.62	1.8	1.98	V
Digital IO Power	DVDD33	2.97	3.3	3.63	V

Parameter	Symbol	MIN	TYP	MAX	Unit
Digital Core Power	DVDD18	1.62	1.8	1.98	V

Video DAC Characteristics

Table 6. Video DAC Characteristics

Analog Output	MIN	TYP	MAX	Unit
Full-scale Output Current R/G/B/S		26.7		mA
LSB Current R/G/B/S		26		uA
Output Compliance	0	--	1.8	V
Voltage Reference				
Reference Voltage Output		1.22		V
Reference Input Current		2.2		mA
Static Performance				
DAC Resolution		10		Bit
DNL (Differential Non-Linearity)		+/-0.5		LSB
INL (Integral Non-Linearity)		+/-0.7		LSB
Dynamic Performance				
Clock Rate	13.5	--	162	MHz
Power Supply				
Supply Voltage	2.97	3.3	3.63	V

Video ADC Characteristics

Table 7. Video ADC Characteristics

Symbol	MIN	TYP	MAX	UNIT
Voltage Reference				
Reference Voltage Output		1.22		V
Static Performance				
ADC Resolution		10		Bit
DNL (Differential Non-Linearity)		+/-0.5		LSB
INL (Integral Non-Linearity)		+/-1		LSB
Dynamic Performance				
Sample Rate	13.5	--	162	MHz
SNDR		56		dB
SFDR		70		dB
Power Supply				
Supply Voltage for AVDD33	2.97	3.3	3.63	V
Supply Voltage for AVDD18	1.62	1.8	1.98	V

External Memory Interface

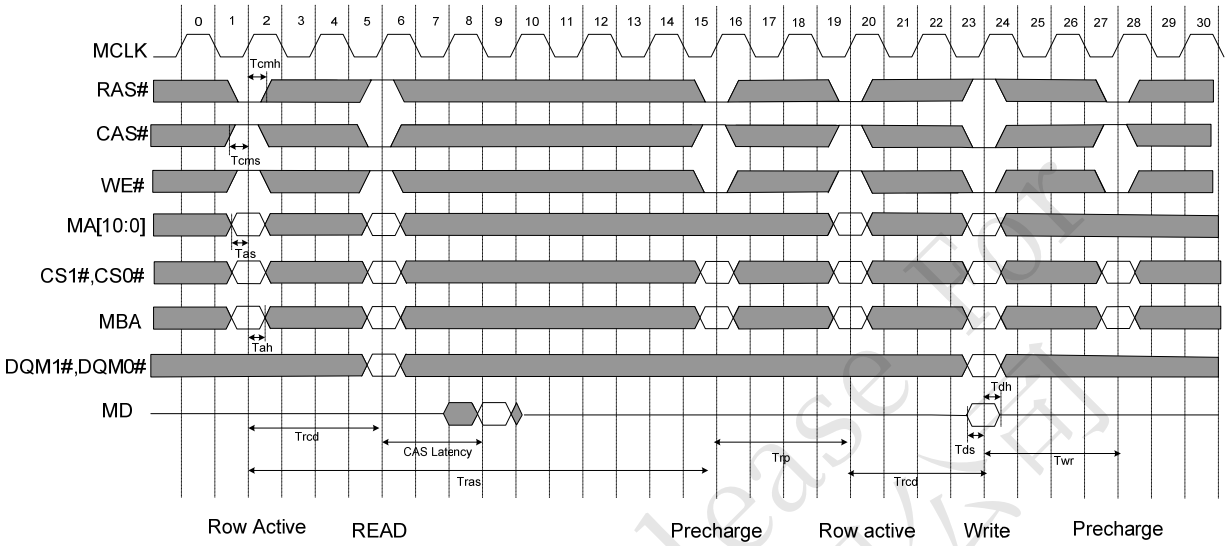

Figure 3. External Memory Interface

Table 8. Parameter of External Memory Interface

Parameter	Symbol	Value		Unit
		Min	Max	
Active to Pre-charge command period	Tras	42	120,000	ns
Pre-charge to Active command period	Trp	18		ns
Active to read/write command delay	Trcd	18		ns
Write recovery time	Twrt	12		ns
CS#, RAS#, CAS#, WE#, DQM hold time	Tcmh	2		ns
CS#, RAS#, CAS#, WE#, DQM setup time	Tcms	1.5		ns
Data-out hold time	Tdh	2		ns
Data-out setup time	Tds	1.5		ns
Address hold time	Tah	2		ns
Address setup time	Tas	1.5		ns

Package Outline

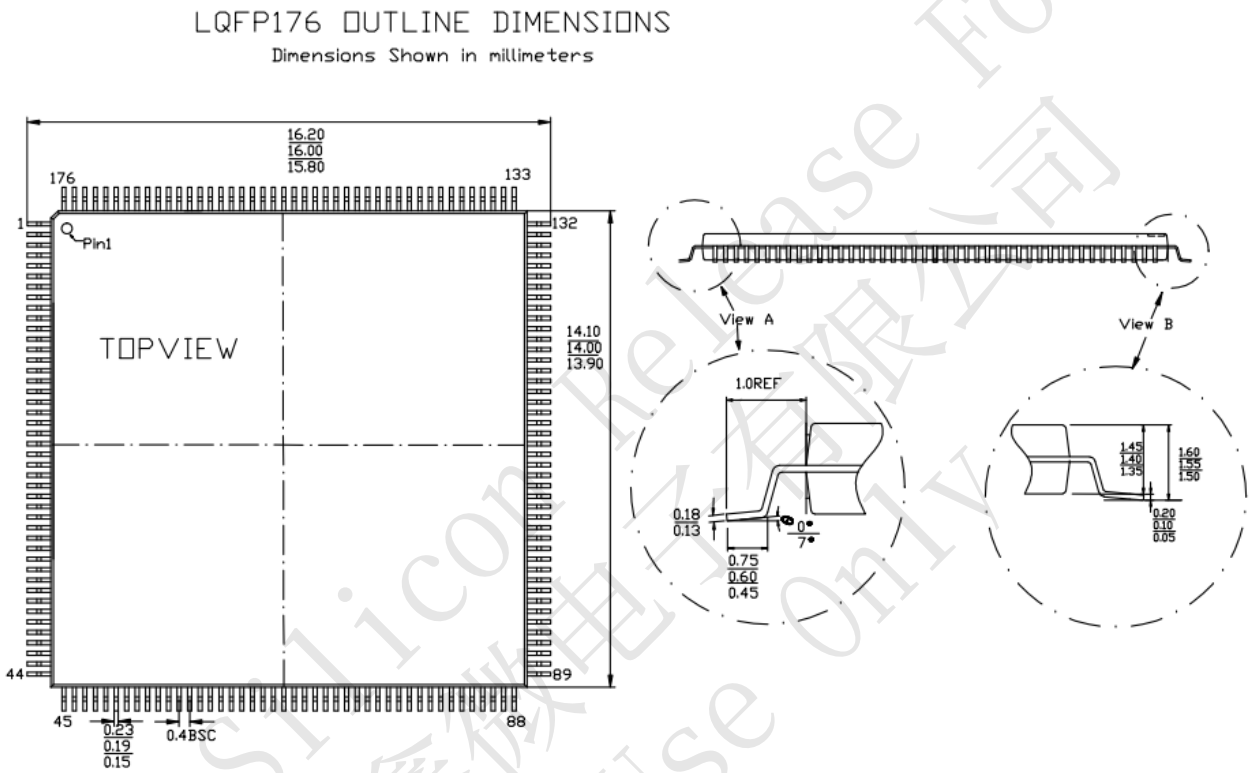

Figure 4. LQFP176 Package Diagram

Top Mark

Figure 5. Top Mark Diagram

Revision History

Date	Version	Author	Comments
2012-9-27	V1.0	John Liu	Initial Version
2016-4-18	V1.1	Feng Gu	Add Absolute Maximum Ratings