

LI-OS05A20-MIPI-145H SPECIFICATION

**Rev 1.0
Leopard Imaging Inc.**

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Version History

Version	Description	Release Date
1.0	First Release	16. Sep. 2018



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Key Information

Module Part#		LI-OS05A20-MIPI-145H
Module Size		39.75 mm (L) x 22.0 mm (W) x 17.7 mm(H)
Sensor Type		OS05A20 Color sensor
Array Size		2688 x 1944
Power Supply	core	1.2V (nominal)
	analog	2.8V (nominal)
	I/O	1.8V (nominal)
Lens		1/2.7"
F/No		2.0
Focal Length		1.98 mm
View Angle		145 °(H)
TV Distortion		< -50%
Object distance		20cm - Infinity
Sensitivity		13,000 e-/Lux-sec
Pixel size		2 um x 2 um
IR Cutter Filter		Yes
Temperature Range	Operating	-30 °C to +85 °C
	Stable	0 °C to +60 °C
Output Formats		RGB Raw output
Maximum Image Transfer Rate		2688 x 1944 @ 60fps
Dynamic Range		74 dB @16 x gain
Lens Chief Ray Angle		11 °linear
Input Clock Frequency		6 ~ 27 MHz
Power Requirement	Active	210 mW
	Standby	2 mA
	XSHUTDOWN	2 uA
Fixed Pattern Noise		TBD
Shutter		Rolling shutter
Max S/N ratio		39 dB
Image Area		5434.56 um x 3948.05 um
Package Dimensions		6638.8 um x 5935 um



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Pin Assignment

No.	Name	Pin type	Description
1	SDA	I/O	SCCB data
2	SCL	Input	SCCB input clock
3	DOVDD1.8V	Power	Power for I/O circuit
4	MCP	Output	MIPI clock positive output
5	MCN	Output	MIPI clock negative output
6	DGND	Ground	
7	MDP0	Output	MIPI data positive output
8	MDN0	Output	MIPI data negative output
9	DGND	Ground	
10	MDP1	Output	MIPI data positive output
11	MDN1	Output	MIPI data negative output
12	DGND	Ground	
13	PWDN	Input	Power down (active low)
14	ATEST	reference	Analog test
15	AGND	Ground	
16	NC		
17	SID	Input	Chip ID selection
18	DVDD1.2V	Power	Power for digital circuit
19	XCLK	Input	System input clock
20	STROBE	I/O	Strobe output
21	XSHUTDOWN	Input	Reset and power down (active low)
22	AVDD2.8	Power	Analog power
23	NC		
24	DGND	Ground	



Electrical Characteristics

1. Absolute Maximum Ratings

parameter	absolute maximum rating ^a
ambient storage temperature	-40°C to +125°C
supply voltage (with respect to ground)	V _{DD-A} 4.5V
	V _{DD-D} 3V
	V _{DD-IO} 4.5V
electro-static discharge (ESD)	human body model 2000V
all input/output voltages (with respect to ground)	-0.3V to V _{DD-IO} + 1V
I/O current on any input or output pin	± 200 mA
peak solder temperature (10 second dwell time)	245°C

- a. exceeding the absolute maximum ratings shown above invalidates all AC and DC electrical specifications and may result in permanent damage to the device. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

2. Functional temperature

parameter	range
operating temperature (for applications up to 90 fps) ^a	-30°C to +85°C junction temperature
stable image temperature ^b	0°C to +60°C junction temperature

- a. sensor functions but image quality may be noticeably different at temperatures outside of stable image range
- b. image quality remains stable throughout this temperature range



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3. DC Characteristics (-30° C < TJ < 85° C)

symbol	parameter	min	typ	max ^a	unit
supply					
V _{DD-A}	supply voltage (analog)	2.7	2.8	2.9	V
V _{DD-D}	supply voltage (digital core)	1.14	1.2	1.26	V
V _{DD-IO}	supply voltage (digital I/O)	1.7	1.8	1.9	V
I _{DD-A}	active (operating) current		35	42	mA
I _{DD-IO}			1.1	1.5	mA
I _{DD-D}			90	120	mA
I _{DDS-SCCB}			2	9	mA
I _{DDS-PWDNB}	standby current ^b		2	9	mA
I _{DDS-XSHUTDOWN}			2	10	μA
digital inputs (typical conditions: AVDD = 2.8V, DVDD = 1.2V, DOVDD = 1.8V)					
V _{IL}	input voltage LOW			0.54	V
V _{IH}	input voltage HIGH	1.26			V
C _{IN}	input capacitor			10	pF
digital outputs (standard loading 25 pF)					
V _{OH}	output voltage HIGH	1.62			V
V _{OL}	output voltage LOW			0.18	V
serial interface inputs					
V _{IL}	SCL and SDA	-0.5	0	0.54	V
V _{IH}	SCL and SDA	1.28	1.8	3.0	V

a. maximum active current is measured under typical supply voltage

b. standby current is measured at room temperature with external clock off

4. Timing Characteristics

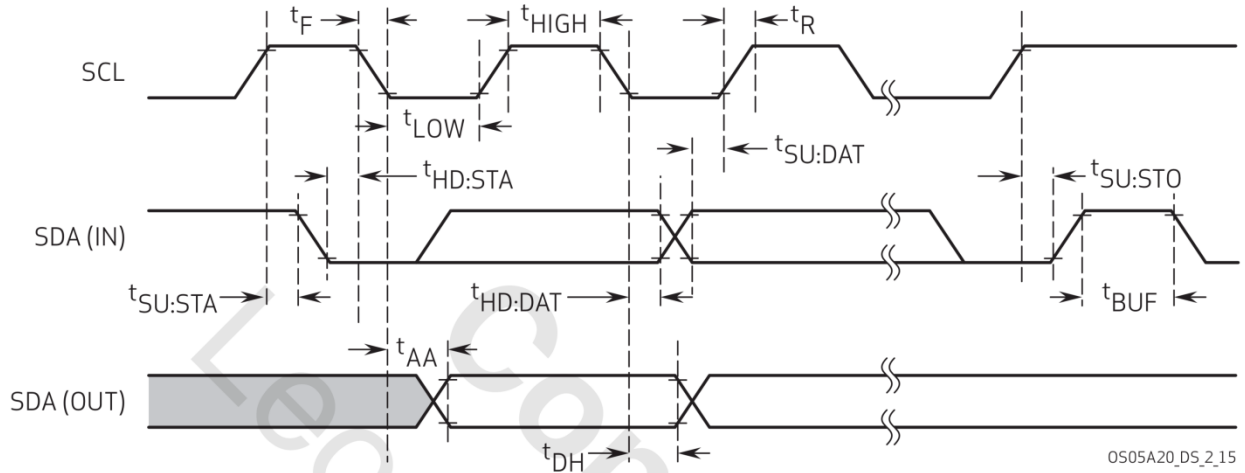
symbol	parameter	min	typ	max	unit
oscillator and clock input					
f _{XVCLK}	frequency (XVCLK) ^a	6	24	64	MHz
T _{PERIOD}	period (XVCLK)	15.6	41.7	166.7	ns
T _{LOW}	low level width (XVCLK)	0.35×T _{PERIOD}		0.65×T _{PERIOD}	ns
T _{HIGH}	high level width (XVCLK)	0.35×T _{PERIOD}		0.65×T _{PERIOD}	ns

a. for input clock range 6~64MHz, the OS05A20 can tolerate input clock period jitter up to 600ps peak-to-peak



5. SCCB timing

a. SCCB interface timing



SCCB interface timing specifications^a

symbol	parameter	min	typ	max	unit
f_{SCL}	clock frequency			400	kHz
t_{LOW}	clock low period	1.3			μs
t_{HIGH}	clock high period	0.6			μs
t_{AA}	SCL low to data out valid	0.1		0.9	μs
t_{BUF}	bus free time before new start	1.3			μs
$t_{HD:STA}$	start condition hold time	0.6			μs
$t_{SU:STA}$	start condition setup time	0.6			μs
$t_{HD:DAT}$	data in hold time	0			μs
$t_{SU:DAT}$	data in setup time	0.1			μs
$t_{SU:STO}$	stop condition setup time	0.6			μs
t_R, t_F	SCCB rise/fall times			0.3	μs
t_{DH}	data out hold time	0.05			μs

- SCCB timing is based on 400kHz mode
- timing measurement shown at beginning of rising edge and/or end of falling edge signifies 30%,
timing measurement shown in middle of rising/falling edge signifies 50%,
timing measurement shown at end of rising edge and/or beginning of falling edge signifies 70%

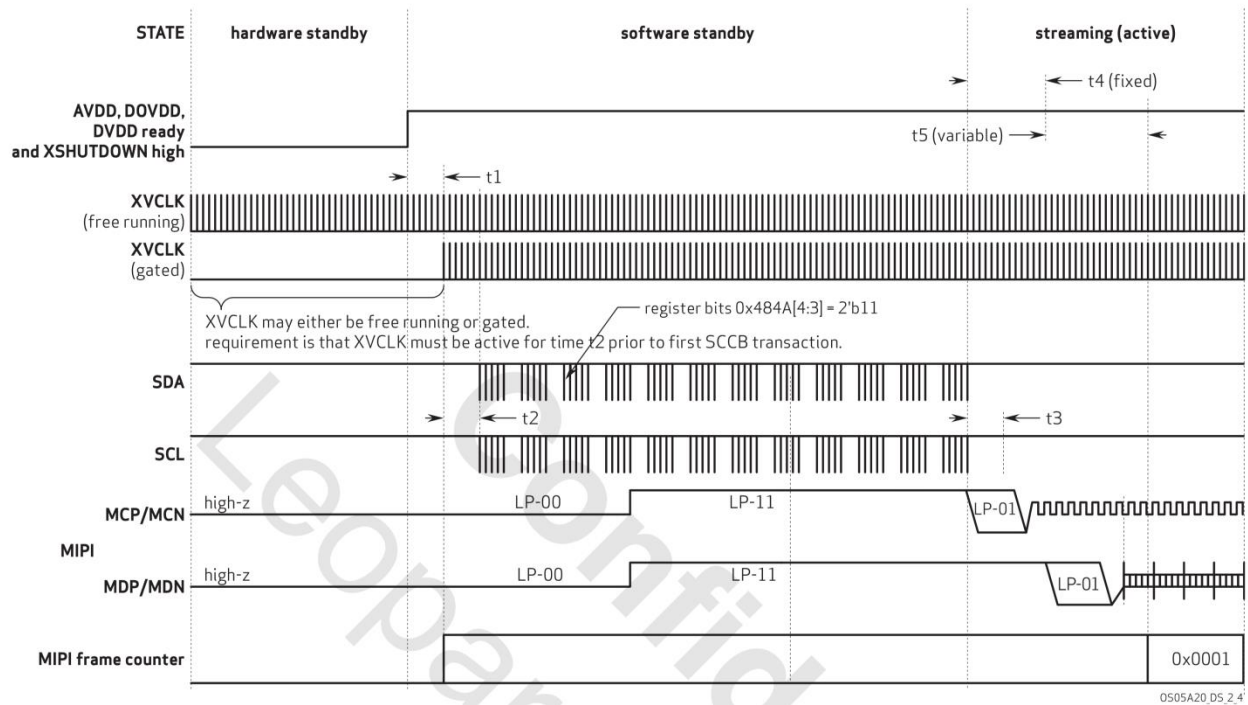


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6. Power Up Sequence

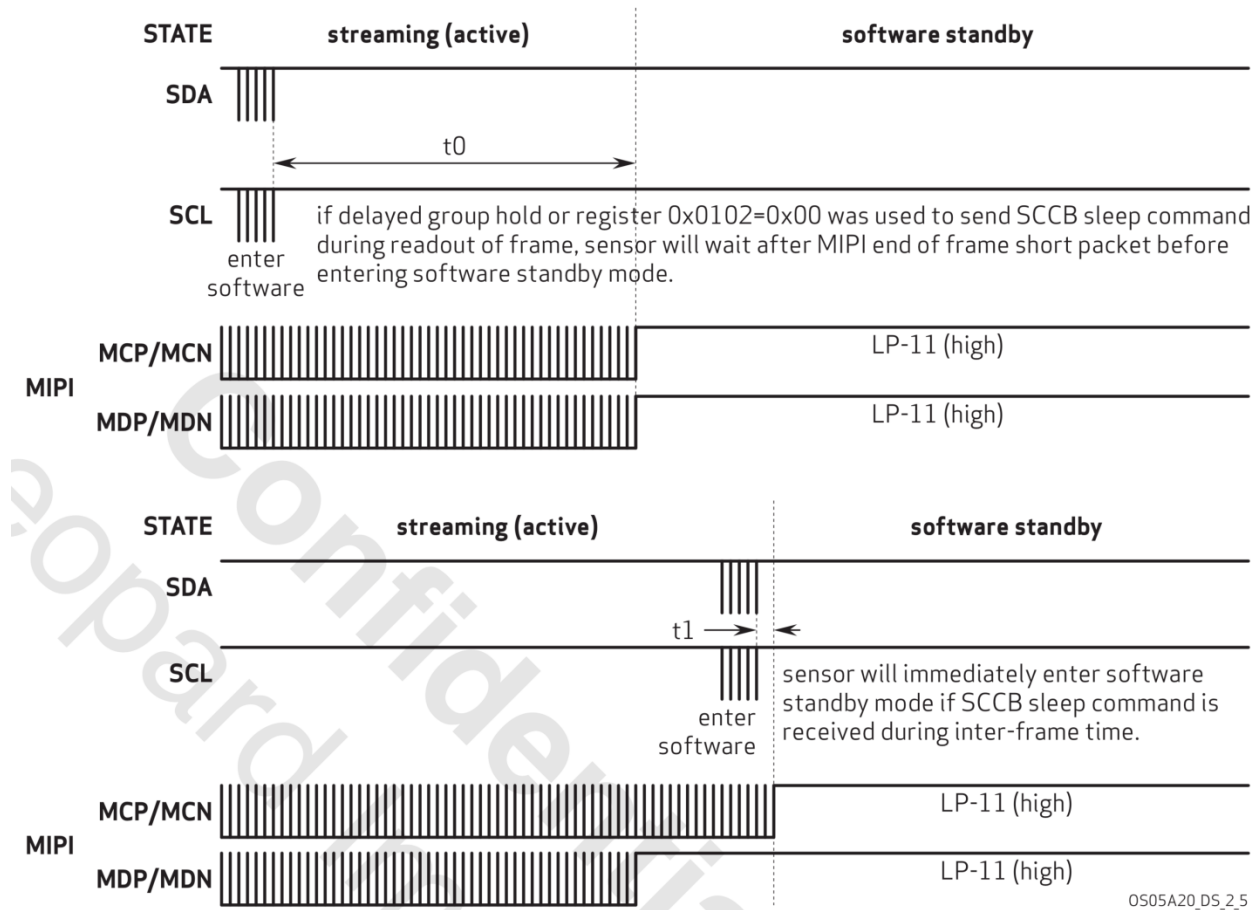
constraint	label	min	max	unit
XSHUTDOWN rising – system ready	t1	5		ms
minimum number of XVCLK cycles prior to first SCCB transaction	t2	8192		XVCLK cycles
PLL start up/lock time	t3		0.2	ms
entering streaming mode – first frame start sequence (fixed part)	t4		10	ms
entering streaming mode – first frame start sequence (variable part)	t5	delay is the exposure time value		lines

a. if not used, tie both PWDNB and XSHUTDOWN2 pins to DOVDD



7. Power Down Sequence

constraint	label	min	max	unit
enter software standby SCCB command device in software standby mode	t0	If user decides to enter standby immediately during frame readout, sensor will insert an MIPI EOF short packet, making last frame output a bad frame. If user decides otherwise, sensor will wait for blanking period to enter software standby mode.		
minimum of XVCLK cycles after last SCCB transaction or MIPI frame end	t1	512		XVCLK cycles
last SCCB transaction or MIPI frame end, XSHUTDOWN falling	t2	512		XVCLK cycles
XSHUTDOWN falling – AVDD falling or DOVDD falling whichever is first	t3	0.0		ns



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