Osptek Display

AMOLED SPECIFICATION

Model No:

AM119Q390390FLS2

CONTENT

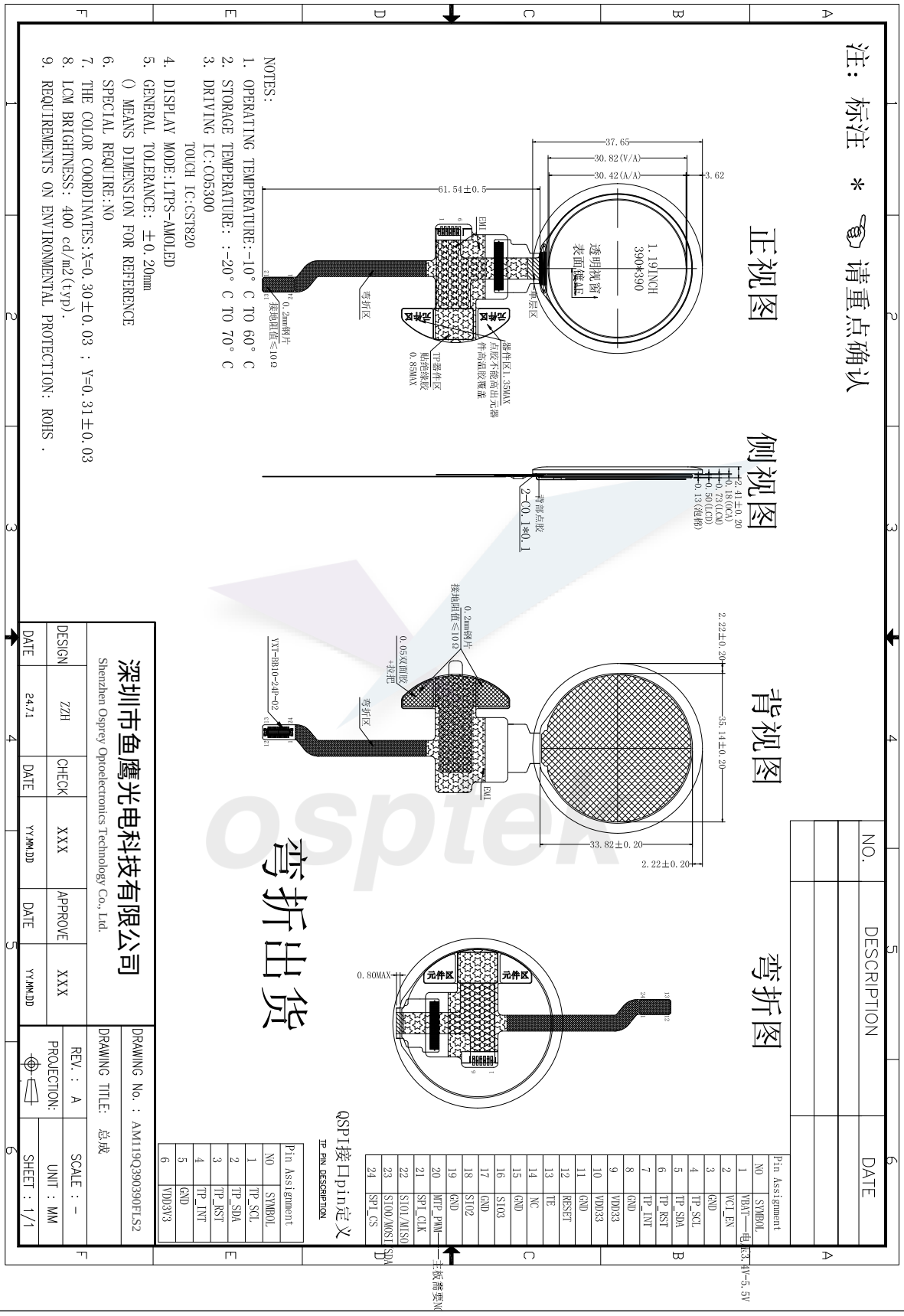
REVISION RECORD

Version	Revision Items	Page	Name	Date
1.0	First release			20240701

1.General Spec

Item	Standard values	Unit 单位
Diagonal Inch	1.19	inch
Dot arrangement	390(W) x RGB x 390(H)	dots
Pixel pitch	-	μm
Display mode	AMOLED	/
Driver IC	CO5300	/
Module size	37.65(V) x 37.65(W) x 2.41(T)	mm
Active area	Φ30.42	mm
Interface	QSPI	-
Operating temperature	-10~60	℃
Storage temperature	-20~70	℃

2.Mechanical drawing



3. Interface description

Pin No.	Symbol	Description
1	VBAT	Analog Power Input for POWER IC Input Voltage Range: 3.4V to 5.5V
2	VCI-EN	Enable for POWER IC
3	GND	Ground.
4	TPSCL	Touch Panel Clock
5	TPSDA	Touch Panel Data
6	TPRST	Touch Panel Reset
7	TPINT	Touch Panel interrupt
8	GND	Ground.
9	VDD	Power Supply for Analog Circuits VCI < 0.05V (When power is turned off
10	VDD	Power Supply for Analog Circuits VCI < 0.05V (When power is turned off
11	GND	Ground.
12	RESET	Device reset signal (0 : Enable ; 1: Disable)
13	TE	Tearing effect output pin to synchronize MCU to frame
14	NC	NC
15	GND	Ground.
16	SD3	Serial Data Input in Quad-SPI
17	GND	Ground.
18	SD2	Serial Data Input in Quad-SPI
19	GND	Ground.
20	MTP	External Voltage Input for OTP Data Program
21	SCL	Synchronous Clock Signal in MIPI DBI Type-B(MPU) and Type-C(SPI)
22	SD1	Serial Data Input in Quad-SPI
23	SD0	Serial Data Input in Quad-SPI
24	CS	Chip Select Signal in MIPI DBI Type-B(MPU) and Type-C(SPI)

4. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Supply voltage (Display)	VDD	-0.3	3.6	V
	IOVCC	-0.3	3.6	V
	VBAT	3.4	5.5	V
	VCI_EN	3.3		V
Operating temperature range	Top	-10	+60	℃
Storage temperature range	Tst	-20	+70	℃
Storage humidity	HD	-	90	%RH

5. DC Characteristics

DC Characteristics List

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit	Notes
Power generation & Operation Voltage							
AVDD booster voltage	AVDD	Operating Voltage	4.5	-	6.5	V	
VCL booster voltage	VCL	Operating Voltage	-5.0	-	-3.5	V	
Analog Operating voltage	VREFP	Operating Voltage	0.5	-	5.0	V	
Analog Operating voltage	VREFN	Operating Voltage	-5.0	-	-0.5	V	
Analog Operating voltage	I_ELVDD	Operating Voltage	2.0	-	5.0	V	
Analog Operating voltage	I_ELVSS	Operating Voltage	-5.4	-	-0.5	V	
Gamma reference voltage	VGMP	Operating Voltage	2	-	6.3	V	
Gamma reference voltage	VGSP	Operating Voltage	0	-	4.5	V	
VGH booster voltage	VGH	Operating Voltage	3		10.6	V	
VGL booster voltage	VGL	Operating Voltage	-15		-2	V	
Voltage difference between VGH and VGL	VGH-VGL	|VGH-VGL| ≦30			30	V	
I/O operating voltage	VDDI	I/O supply voltage	1.65	-	3.3	V	
LOGIC INPUT/ OUTPUT							
Logic High level input voltage	V_{IH}		0.8× VDDI	-	VDDI	V	1
Logic Low level input voltage	V_{IL}	-	VSS	-	0.2× VDDI	V	1
Logic High level output voltage	V_{OH}	I_{OH} = -0.1mA	0.8× VDDI	-	VDDI	V	2
Logic Low level output voltage	V_{OL}	IOL = +0.1mA	VSS	-	0.2× VDDI	V	2
Logic High level leakage	I_{LIH1}	Vin = 0 to *VDDI*	-	-	1	μA	1,2
Logic Low level leakage	I_{LIL1}	Vin = 0 to *VDDI*	-1	-	-	μA	1,2
Source OP Output							
Output deviation voltage	V_{dev}	Sout ≧ 4.2V Sout ≦ 0.8V			TBD	mV	4
Output deviation voltage	V_{dev}	4.2V>Sout>0.8V			TBD	mV	
Output offset voltage	V_{OFSET}				TBD	mv	
Stand-by Current							
Sleep In mode	I_{stlp1}	DSI LP mode VDDI Current		TBD		μA	
		DSI LP mode VCI Current		TBD		μA	1
	I_{stul1}	DSI Ultra Low power VDDI Current		TBD		μA	
		DSI Ultra Low power VCI Current		TBD		μA	1
Oscillator Output							
Oscillator tolerance	ΔOSC	All Temperature	-2%	-	2%	%	3

6.Electron-optical Characteristics

5.1 Electrical Characteristics

5.1.1 Power Characteristic:

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
AMOLED Power positive	ELVDD	-	-	-	V	-
AMOLED power Negative	ELVSS	-	-	-	V	Ref
Digital Power supply	VDDIO	1.7	1.8	1.95	V	Ref
Analog Power supply	VCI	3.25	3.3	3.35	V	Ref

1) Normal Mode

Power Supply: IOVCC=1.8V VCI=3.3V

Frame Frequency: F_{frame} =60HZ @ 25degC, Brightness 450 nits, Command Mode,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 450nits	IELVDD /ELVSS	-	-	-	mA	Ref
	IVCI	-	6	7.2	mA	Ref
	IVDDIO	-	3	3.6	mA	Ref

2) Idle Mode

Power Supply: IOVCC=1.8V VCI=2.8V

Frame Frequency: F_{frame} =15HZ @ 25degC, Brightness:100nits, OPR:10%,Command Mode(driver ic fc power)

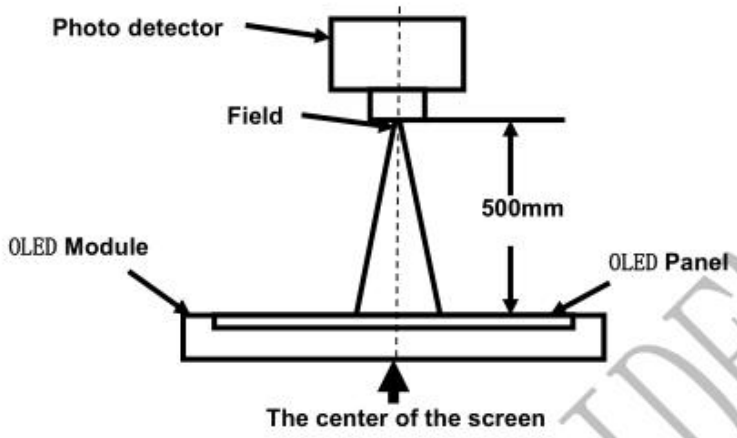
Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
10% Pixel On 100 nits	IELVDD /ELVSS	-	-	-	mA	Supplied by Driver IC
	IVCI	-	5	6	mA	Ref
	IVDDIO	-	1.2	1.5	mA	Ref

3) Deep Standby Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
Deep Standby(Vci Off)	Power Consumption	-	-	<50	uW	Ref

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Luminance (with Lens)	Normal mode Bp	Φ=0°,θ=0°	315	350	NA	cd/m^2	Note1 Note2
Contrast Ratio	CR	Φ=0°,θ=0°	10000		-	-	Note3
Uniformity	ΔBp	Normal mode@W255 Φ=0°,θ=0°	70	-	-	%	Note4
Color Gamut	NTSC	CIE 1931	70		-	%	Note5
Response Time	T_{on} Or T_{off}	GL0-255	-	-	1	ms	Note6

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the OLED screen. All input terminals OLED panel must be ground when measuring the center area of the panel.

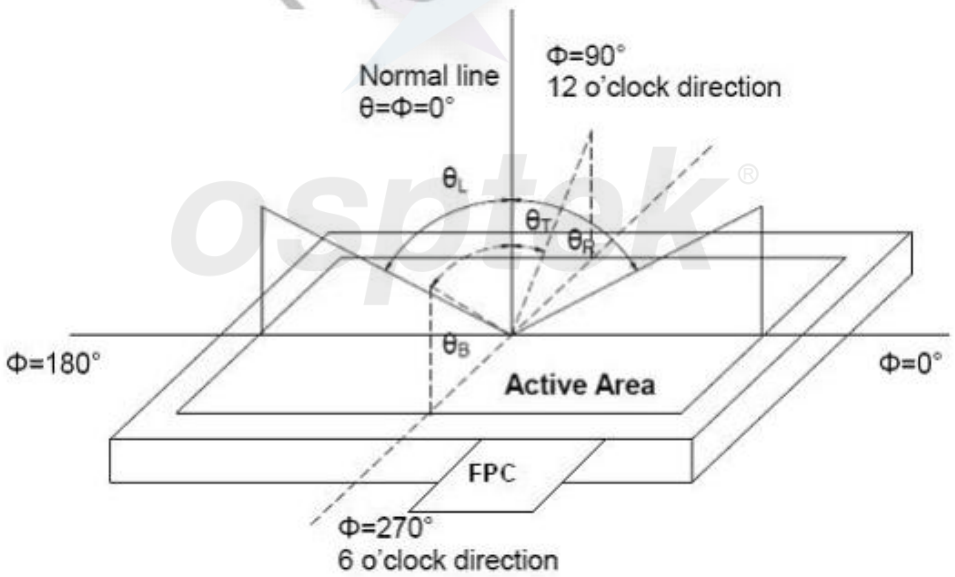


Item	Photo detector
Contrast Ratio	PR730
Luminance	
Chromaticity	
Lum Uniformity	
Response Time	DMS803

Fig. 1 Optical measurement system

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the OLED by PR730.



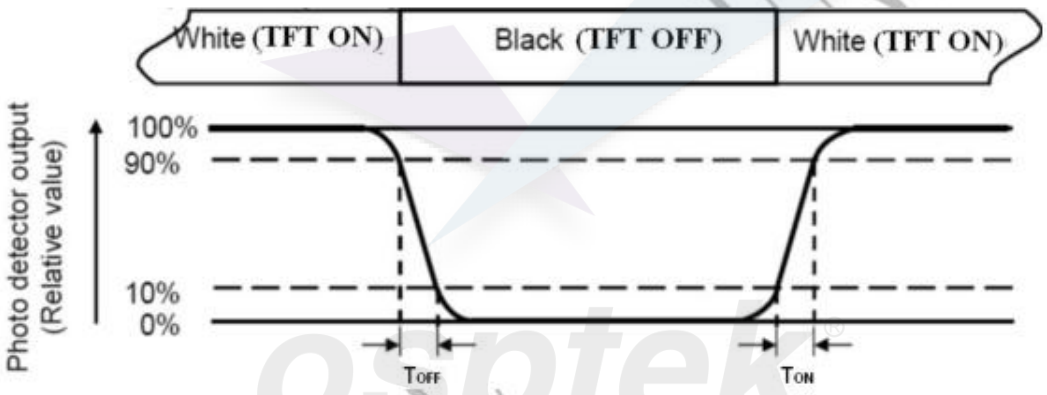
$$\text{Contrast ratio(CR)} = \frac{\text{Luminnace measured when OLED is on the "White" state}}{\text{Luminnace measured when OLED is on the "Black" state}}$$

"White state ":The state is that the OLED should be driven by Vwhite.

"Black state": The state is that the OLED should be driven by Vblack.

Note 4: Definition of Response time

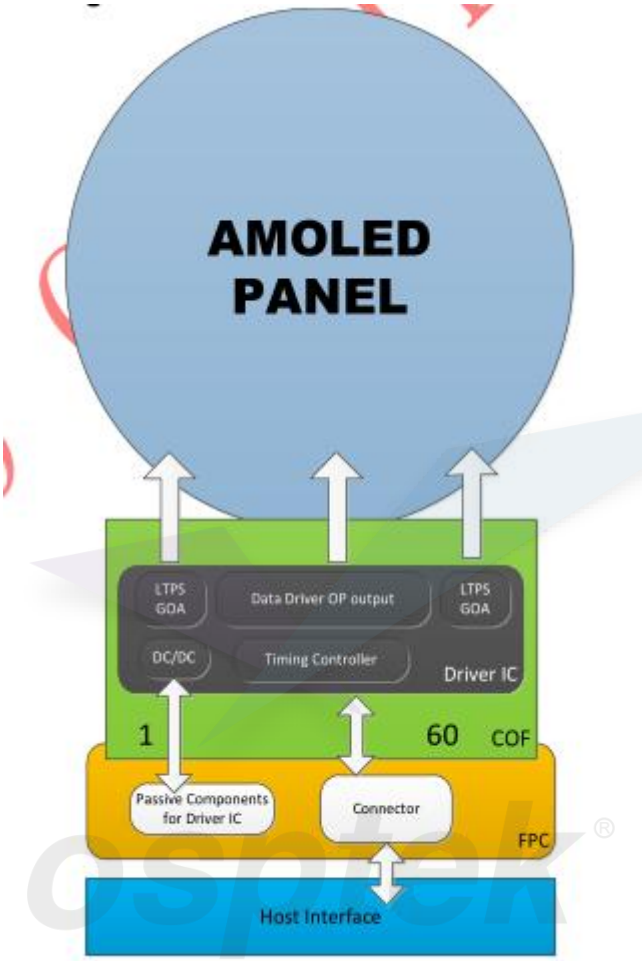
The response time is defined as the OLED optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of OLED.

7. System Block Diagram



8. AC characteristic

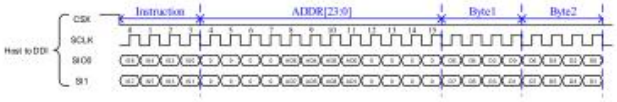
QSPI write protocol

- QSPI Command/pixel write:支持888/666/565/332/111/GRAY256 data format

1 wire write

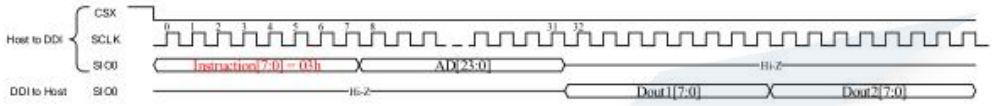
666/565/332格式支持补位方式：
补MSB/补0/补1

2 wire write



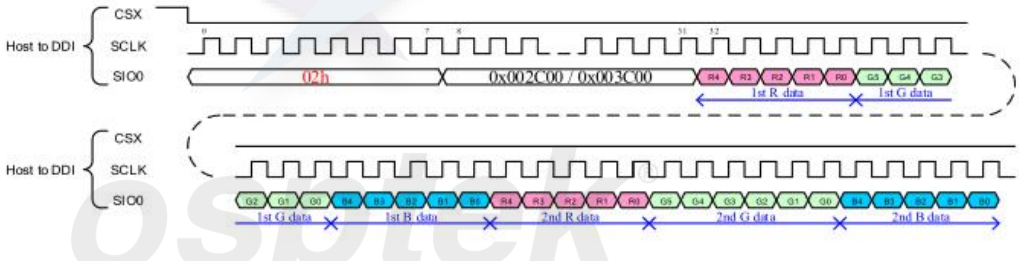
4 wire write

- QSPI Command/pixel read

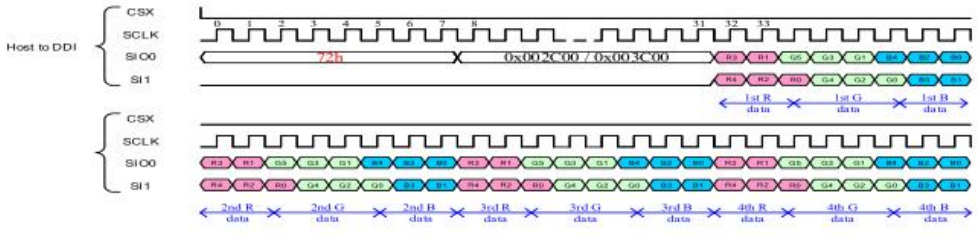


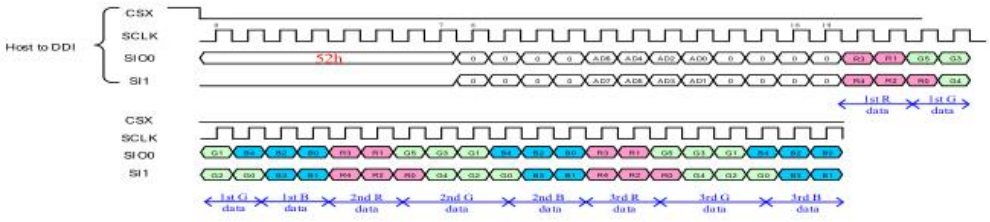
QSPI Data format for RGB565

1 wire



2 wire





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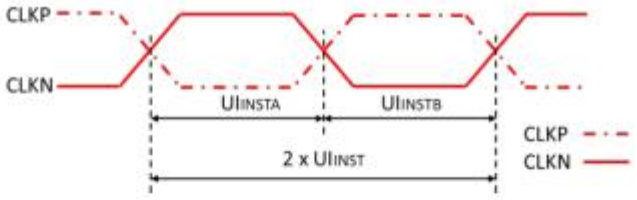
MIPI AC Characteristics

6.5.1 High Speed Mode - Clock Timings



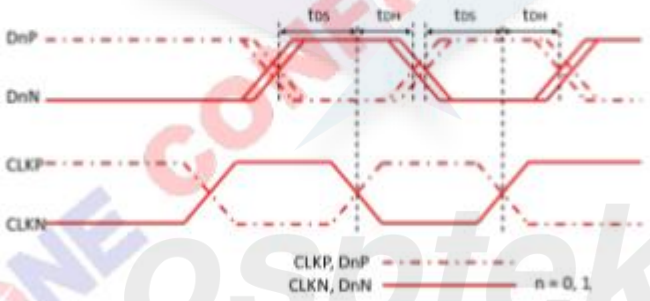
Clock Timing

High Speed Mode - Clock Timing

Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
CLK P/N	2xUIINST	Double UI instantaneous	2		25	nS	
CLK P/N	UIINSTA, UIINSTB	UI instantaneous Half	4		12.5	nS	1

Note 1: *UI = UIINSTA = UIINSTB.*

6.5.2 High Speed Mode - Clock / Data Timings



DSI Clock / Data Timings

High Speed Mode - Clock / Data Timing

Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
Dn P/N	tDS	Data to Clock Setup time	0.15*UI			UI	
(n=0, and1)	tDH	Clock to Data Hold time	0.15*UI			UI	

High Speed Mode - Rising and Falling Timings

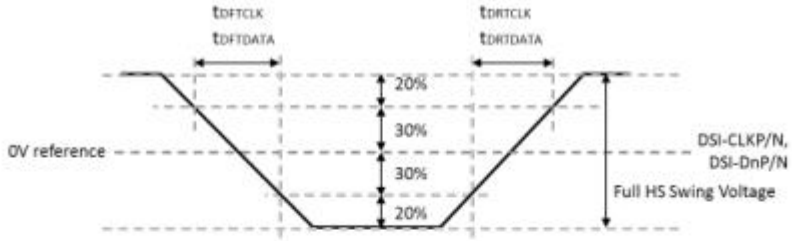


Figure 6-2 Rising and Falling Timings

High Speed Mode - Rising and Falling Timing

Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Differential Rise Time for Clock	t_{DRTCLK}	CLKP/N	150pS		0.3*UI		2,3
Differential Rise Time for Data	$t_{DRTDATA}$	DnP/N	150pS		0.3*UI		1,2,3
Differential Fall Time for Clock	t_{DFTCLK}	CLKP/N	150pS		0.3*UI		2,3
Differential Fall Time for Data	$t_{DFTDATA}$	DnP/N	150pS		0.3*UI		1,2,3

Note 1: *DnP/N, n =0, and 1.*

Note 2: *The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-PHY standard.*

Note 3: *DSI-CLK+ = CLKP.*
DSI-CLK- =CLKN.
DSI-D0+ =D0P.
DSI-D0- =D0N.

10.Reliability test conditions and methods

No	Test Item	Test condition	Criterion
1	High Temperature Storage	70℃±3℃ 48H Power off	Inspection after 4 hours storage at room temperature,the sample shall be free from defects: 1. Air bubble in the LCD; 2.Seal leak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value. 7.The surface shall be free from damage. 8.The electric characteristic requirements shall be satisfied
2	Low Temperature Storage	-20℃±3℃ 48H Power off	
3	High Temperature Operation	60℃±3℃ 48H Power on	
4	Low Temperature Operation	-10℃±3℃ 48H Power on	
5	High Temperature & Humidity Operation	60℃±3℃ 90%RH 48H Power off	
6	Temperature Cycle	-10℃←→25℃←→60℃ 30min 5min 30min 5 cycle Power off	

Remark:

1.The test samples should be applied to only one test item.
2.Sample size for each test item is 3~5pcs.
3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.
4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5.EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen
by natural chemical reaction with humidity and Fluorescence EL has.
6.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.