



PRODUCT SPECIFICATION

MODEL: ZTM686BOEM1215

<◇>PRELIMINARY SPECIFICATION

<◆>APPROVAL SPECIFICATION

CUSTOMER
APPROVED BY
DATE:

DESIGNED	CHECKED	APPROVED

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REVISION STATUS

Version	Revise Date	Page	Content	Modified by
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TABLE OF CONTENTS

No.	CONTENTS	PAGE
	REVISION STATUS.....	1
	TABLE OF CONTENTS.....	3
1.	GENERAL DESCRIPTION.....	4
2.	MECHANICAL SPECIFICATION.....	5
3.	PIN DESCRIPTION.....	6
4.	ELECTRICAL CHARACTERISTICS.....	7
5.	INPUT SIGNAL TIMING.....	10
6.	OPTICAL CHARACTERISTICS.....	13
7.	RELIABILITY TEST ITEMS.....	15
8.	GENERAL PRECAUTION.....	16
9.	PACKAGE DRAWING.....	17



1. GENERAL DESCRIPTION

1.1 DESCRIPTION

This LCM is a color active matrix thin film transistor (TFT) IPS liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, Driver IC, FPC and Backlight, This TFT LCD has a 6.86-inch diagonally measured active display area with (480 horizontal by 1280 vertical pixel) resolution.

1.2 FEATURES:

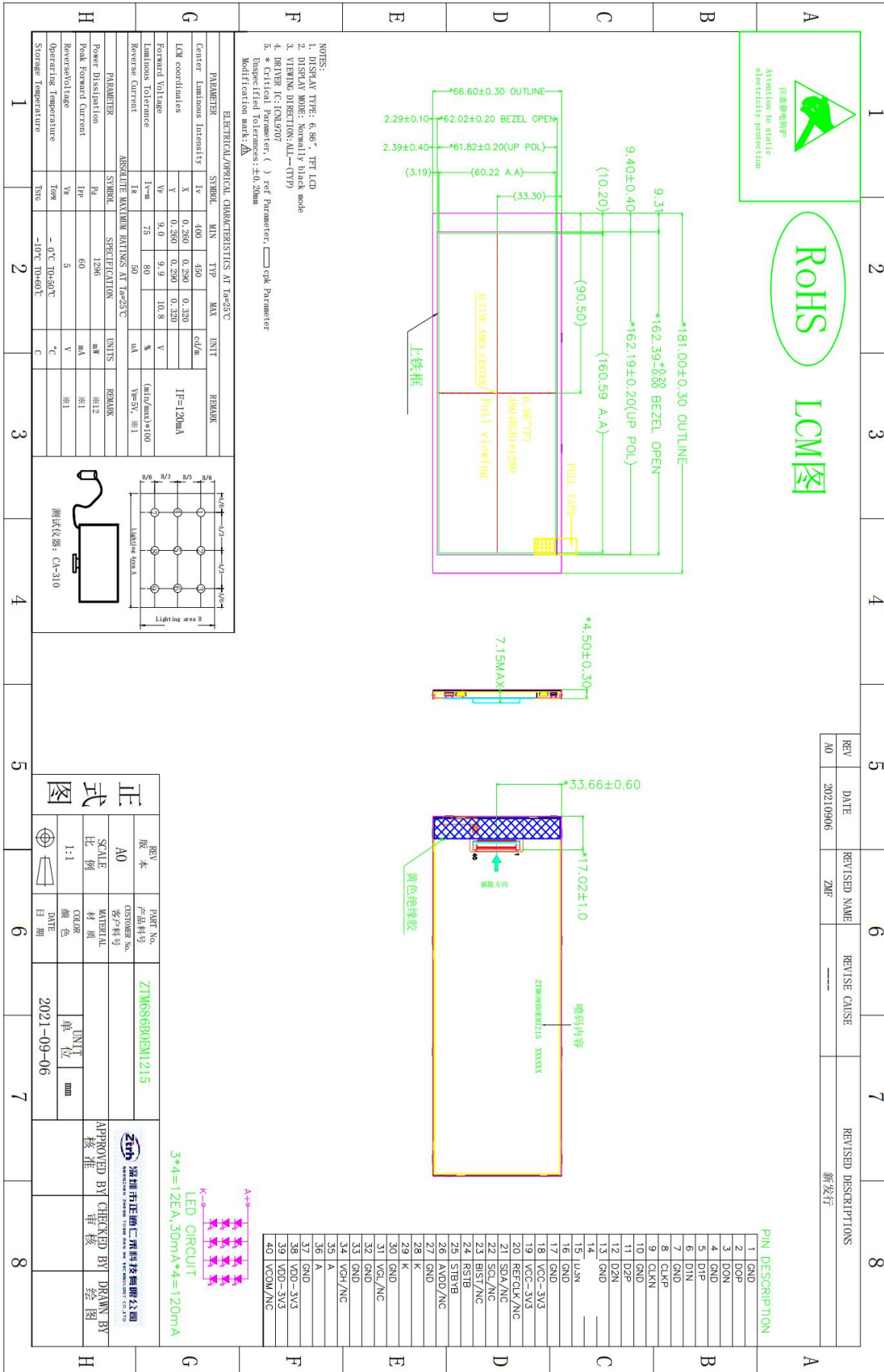
No.	Item	Specification	Unit
1	Panel Size	6.86"	inch
2	Number of Pixels	480×RGB (3)×1280	pixels
3	Active Area	60.22(H)× 160.59(V)	mm
4	Pixel Pitch	41.82(H)×125.46(V)	um
5	Outline Dimension	66.6(W)×181.0(H)×4.5 (D)	mm
6	Number of Colors	16.7M	-
7	Display Mode	Transmission mode, Normally black	-
8	Viewing Direction	Full viewing	-
9	Display Format	RGB vertical stripe	-
10	Surface Treatment	Anti-Glare	-
11	Interface	MIPI	-
12	Backlight	White LED	-
13	Operation Temperature	-20~70	°C
14	Storage Temperature	-30~80	°C
15	Driver IC	ICN9707	-
16	Weight	-	g



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2. MECHANICAL SPECIFICATION





3. PIN DESCRIPTION

FPC Connector is used for the module electronics interface.

No.	Symbol	Function	Remark
1	GND	Ground	
2	MIPI-D0P	Positive MIPI differential data lane0 input	
3	MIPI-D0N	Negative MIPI differential data lane0 input	
4	GND	Ground	
5	MIPI-D1P	Positive MIPI differential data lane1 input	
6	MIPI-D1N	Negative MIPI differential data lane1 input	
7	GND	Ground	
8	MIPI-CLKP	Positive MIPI differential clock input	
9	MIPI-CLKN	Negative MIPI differential clock input	
10	GND	Ground	
11	MIPI-2P	Positive MIPI differential data lane2 input	
12	MIPI-2N	Negative MIPI differential data lane2 input	
13	GND	Ground	
14	MIPI-3P	Positive MIPI differential data lane3 input	
15	MIPI-3N	Negative MIPI differential data lane3 input	
16	GND	Ground	
17	GND		
18	IOVCC(3.3V)	A power supply for the logic power and I/O circuit.	
19	IOVCC(3.3V)		
20	NC	No connection	
21	NC	No connection	
22	NC	No connection	
23	NC	No connection	
24	RESET(3.3V)	Reset pin.	
25	NC	No connection	
26	NC	No connection	
27	GND	Ground	
28	K	LED Cathode	
29	K		
30	GND	Ground	
31	NC	No connection	
32	GND	Ground	
33	GND	Ground	
34	NC	No connection	
35	A	LED Anode	
36	A		
37	GND	Ground	
38	VDD	A power supply for the analog power.	
39	VDD		
40	NC	No connection	



4. ELECTRICAL CHARACTERISTICS

4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Digital Supply Voltage	VCI	-0.3	6.6	V	
Digital Supply Voltage	IOVCC	-0.3	3.6	V	
Supply Voltage	VSP	-0.3	6.6	V	
Supply Voltage	VSN	-6.6	0	V	

4.2 TFT LCD MODULE

4.2.1 Operating Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Digital Supply Voltage	VDD	2.6	3.3	3.6	V	
Digital Supply Voltage	IOVCC	1.8	3.3	3.6	V	
Logic Input Voltage	VIH	0.7VDD	-	VDD	V	
	VIL	GND	-	0.3VDD	V	

Note1: Please adjust VCOM to make the flicker level be minimum

Note2: TYP VCOM is only reference value. It must be optimized according to each LCM. Be sure to use VR and OP buffer on VCOM output. Please adjust VCOM to make the flicker level be minimum for getting excellent image.

4.2.2 Current Consumption

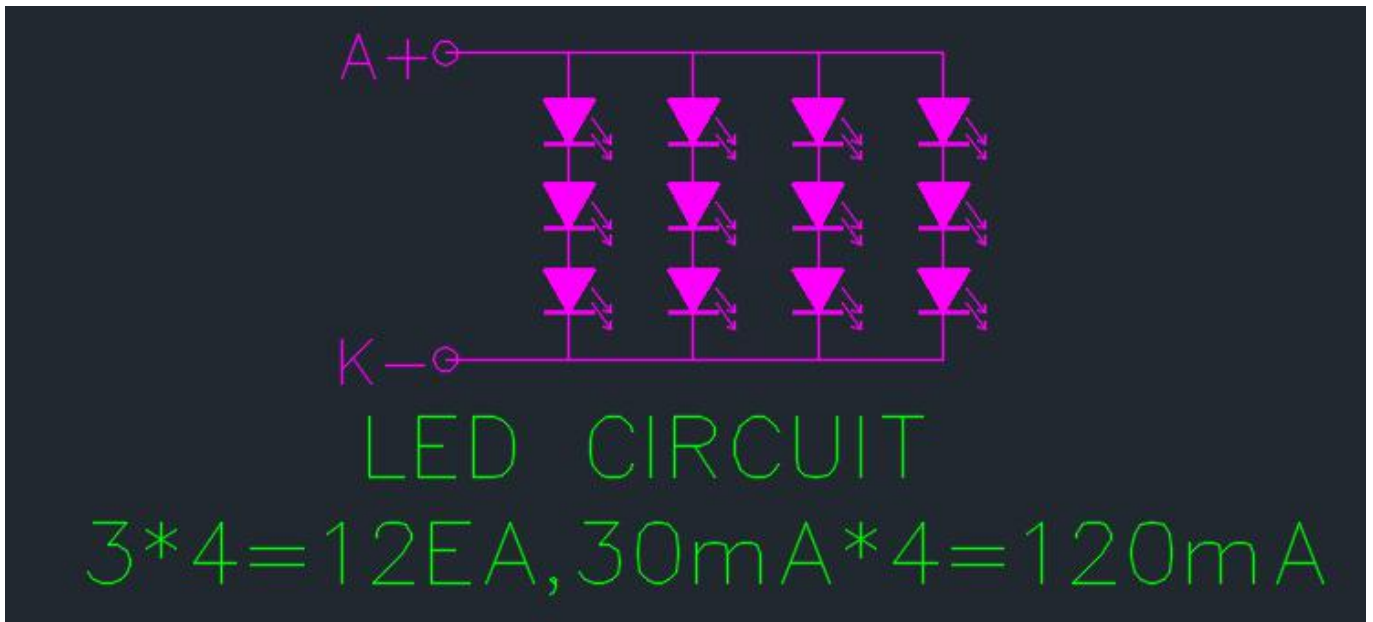
Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Digital Current	IVCI	VDD= 3.3V	-	-	-	mA	Note1
Digital Current	IIOVCC	IOVCC=3.3V	-	-	-	mA	

Note1: Typ. specification : Gray-level test Pattern



4.3 BACKLIGHT UNIT

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED Current	Iled	-	120	-	mA	Total LED
Forward voltage	VF	9.0	9.6	10.8	V	IF=120mA
Reverse current	IR	-	-	50	μA	VR=5V, 1LED
Power dissipation	Pd	1152			mW	Total LED
Peak forward current	IFP	100			mA	1LED
Reverse Voltage	VR	5			V	1LED





4.4 POWER ON/OFF SEQUENCE

Application Power: IOVCC, VSP, VSN, VGH, VGL

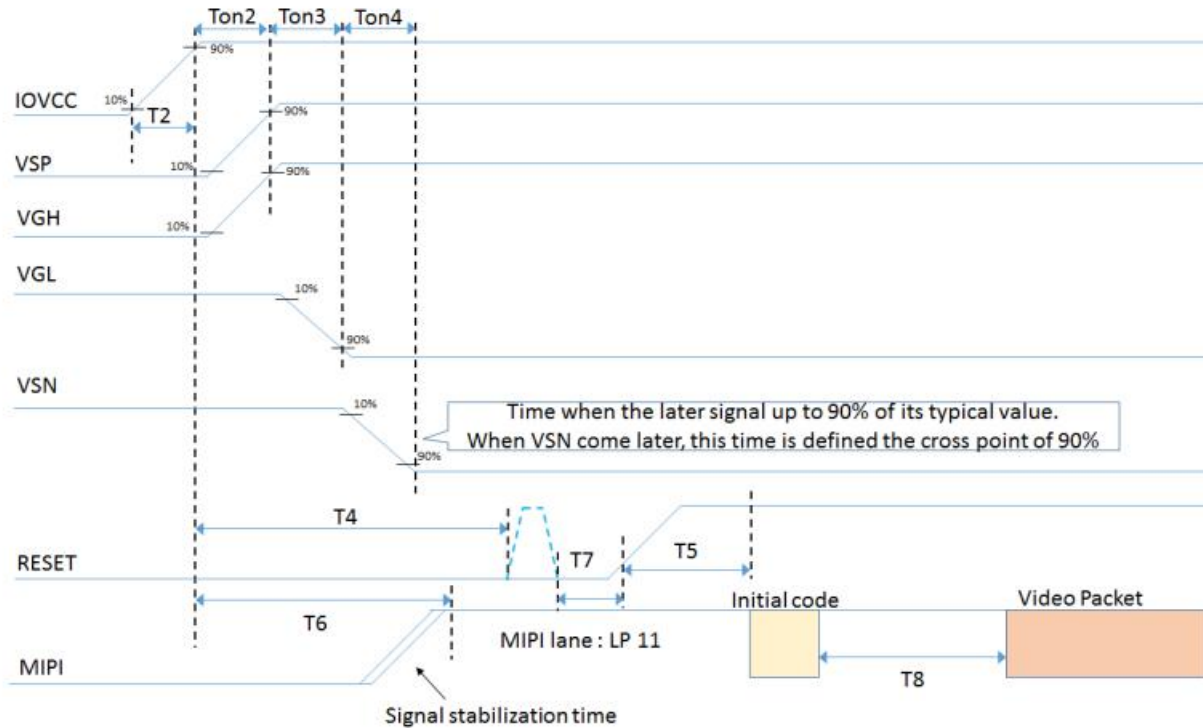


Figure 7.1.1-1: Power On-PPCS[1:0]= L,L mode sequence

Note1: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

Note2: This power-on sequence is based on adding schottky diode on VGL pin to ground.

Note3: Keep VGH is equal to or larger than VSP during power on sequence.



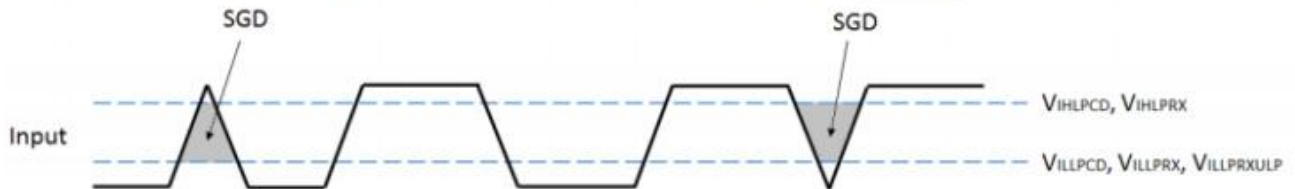
5. INPUT SIGNAL TIMING

5.1 MODE DC ELECTRICAL CHARACTERISTICS

Condition : Ta =25°C ,IOVCC =1.6V~3.6V, VCI =2.6V~6.5V.

Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Logic high level input voltage	V _{IHLPCD}	LP-CD	450		1350	mV	
Logic Low level input voltage	V _{ILLPCD}	LP-CD	0		200	mV	
Logic high level input voltage	V _{IHLPRX}	LP-RX (CLK,D0)	880		1350	mV	
Logic Low level input voltage	V _{ILLPRX}	LP-RX (CLK,D0)	0		550	mV	
Logic Low level input voltage	V _{ILLPRXULP}	LP-RX(CLK ULP mode)	0		300	mV	
Logic high level input voltage	V _{OHLPTX}	LP-TX(D0)	1.1		1.3	V	
Logic Low level input voltage	V _{OLLPTX}	LP-TX(D0)	-50		50	mV	
Logic high level input voltage	I _{IH}	LP-RX, Vin =0~1.3V			10	uA	
Logic Low level input voltage	I _{IL}	LP-RX, Vin =0~1.3V	-10			uA	
Input pulse rejection	SGD	DSI-CLK+/-, DSI Dn+/-			300	Vps	1

Note 1: Peak interference amplitude max. 200mV and interfere frequency min. 450MHz





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Condition : Ta =25°C ,IOVCC =1.6V~3.6V, VCI =2.6V~6.5V.

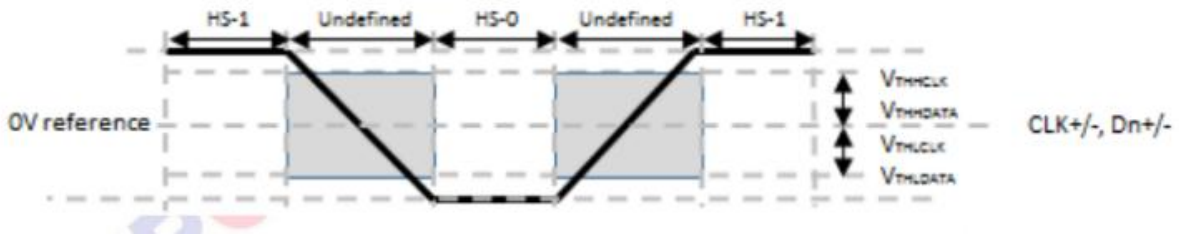
Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Input voltage common mode range	V _{CMCLK} V _{CMDATA}	CLK+/-, Dn+/-	70		330	mV	1,2
Input voltage common mode variation(≤450MHz)	V _{CMRCLKL} V _{CMRDATAL}	CLK+/-, Dn+/-	-50		50	mV	3
Input voltage common mode variation(≥450MHz)	V _{CMRCLKM} V _{CMRDATAM}	CLK+/-, Dn+/-			100	mV	
Low-level differential input voltage threshold	V _{THLCLK} V _{THLDATA}	CLK+/-, Dn+/-	-70			mV	
High-level differential input voltage threshold	V _{THHCLK} V _{THHDATA}	CLK+/-, Dn+/-			70	mV	
Single-ended input low voltage	V _{ILHS}	CLK+/-, Dn+/-	-40			mV	2
Single-ended input high voltage	V _{IHHS}	CLK+/-, Dn+/-			460	mV	2
Differential input termination resistor	R _{TERM}	CLK+/-, Dn+/-	80	100	125	Ω	
Single-ended threshold voltage for termination enable	V _{TERM_EN}	CLK+/-, Dn+/-			450	mV	
Termination capacitor	C _{TERM}	CLK+/-, Dn+/-			14	pF	

Note 1: Includes 50mV (-50mV to 50mV) ground difference

Note 2: Without V_{CMRCLKM} / V_{CMRDATAM}

Note3: Without 50mV (-50mV to 50mV) ground difference

Note4: Dn =D0,D1,D2 and D3





Horizontal Timings for DSI video mode

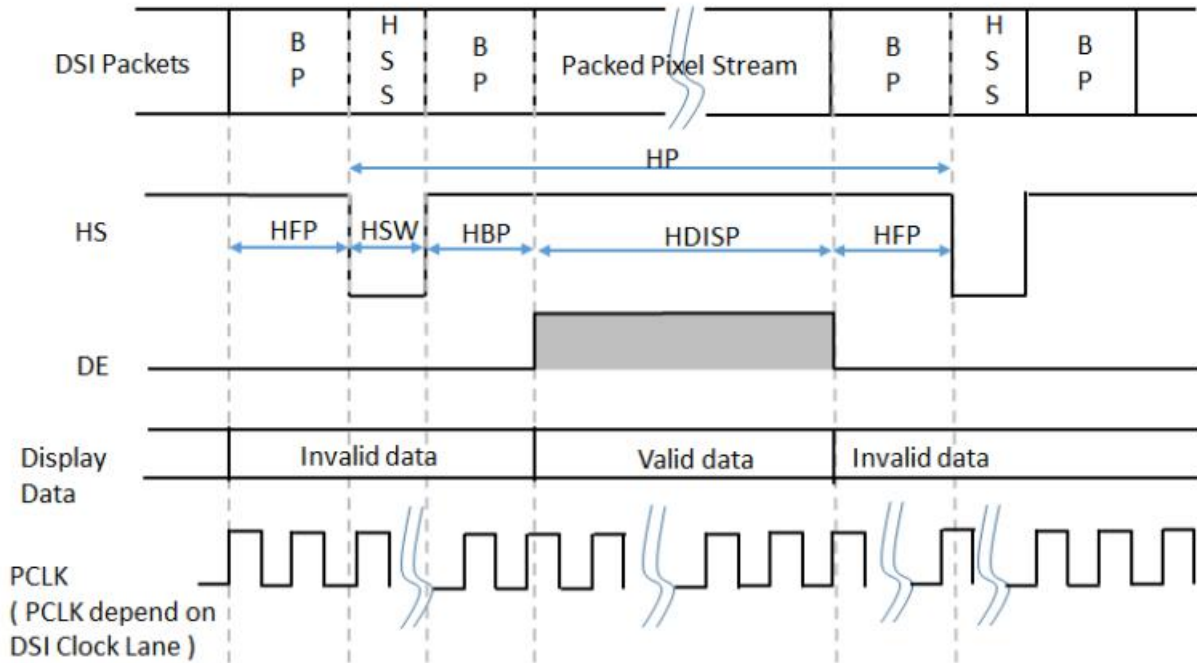


Figure 4.4.2-1: Horizontal timings for DSI video mode

Condition : Ta =25°C, Resolution = 800(RGB)* 1280

Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
HS low pulse width	HSW		0.2			uS	
Horizontal back porch	HBP		1.0			uS	
Horizontal front porch	HFP		1.0			uS	
Horizontal data start point		HSW+HBP	1.2			uS	
Horizontal blanking period	HBLK	HSW+HBP+HFP	2.2			uS	
Horizontal active area	HDISP			800		DC K	

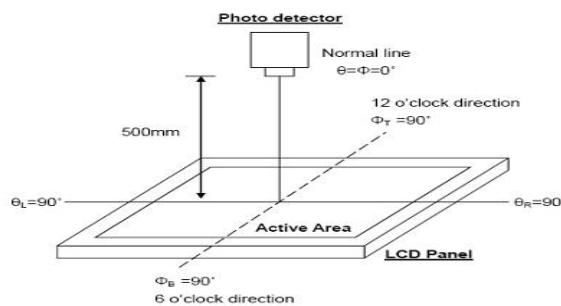


6.OPTICAL CHARACTERISTICS

Ta=25±2℃

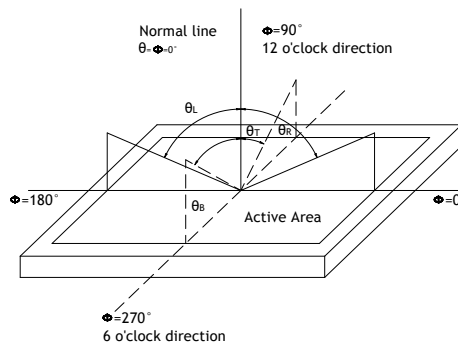
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio	CR	-	1000	-		Note1 Note3	
Luminance(center)	L	400	450	-	cd/m ²	Note1 Note5 Note7	
Luminous tolerance	LU	75	80		%	Note7	
Response Time	Rising + Falling	-	25	35	ms	Note1 Note4	
Viewing Angle K=Contrast Ratio>10	Horizontal	θx^+	80	85	-	degr ee	Note2
		θx^-	80	85	-		
	Vertical	θy^+	80	85	-		
		θy^-	80	85	-		
Color Chromaticity (CIE1931)	Red	x	Typ- 0.03	0.636	Typ+ 0.03	Note1 Note5 Note7	
		y		0.340			
	Green	x		0.294			
		y		0.600			
	Blue	x		0.134			
		y		0.066			
	White	x		0.266			
		y		0.278			
Color gamut (NTSC ratio)		-	70		%		

Note1: Definition of optical measurement system (BM-7)



Note2: Definition of viewing angle range and measurement system

Viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).



Note3: Definition of Response time



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The response time is defined as the LCD 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%.

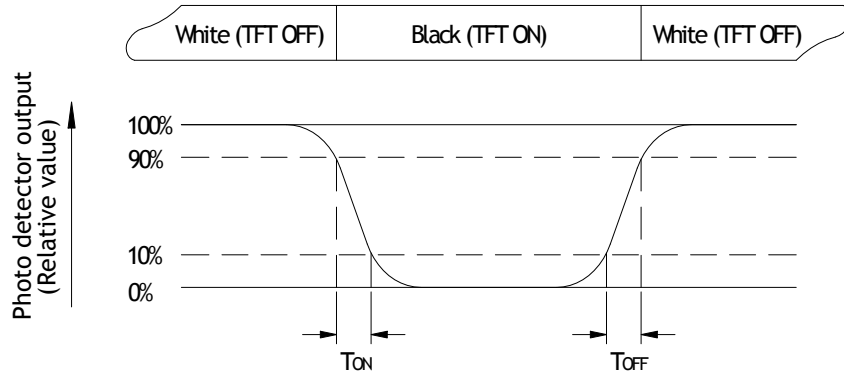


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio

$$\text{Contrast ratio(CR)} = \frac{\text{Luminance measured when LCD on the Whitestate}}{\text{Luminance measured when LCD on the Blackstate}}$$

“White state “: The state is that the LCD should drive by V_{white} .

“Black state”: The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

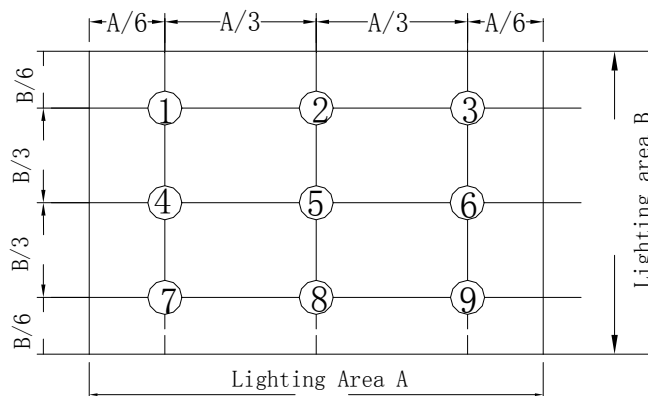
Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L=120\text{mA}$

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{min} / L_{max}$$

L----Active area length, W---- Active area width



B_{max} : The measured maximum luminance of all measurement position.

B_{min} : The measured minimum luminance of all measurement position.



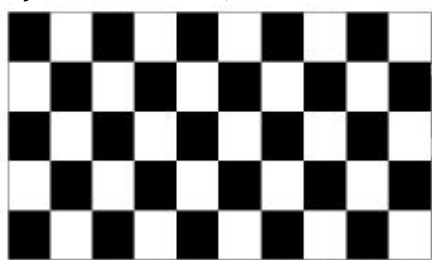
7. RELIABILITY TEST ITEMS

7.1 TEMPERATURE AND HUMIDITY

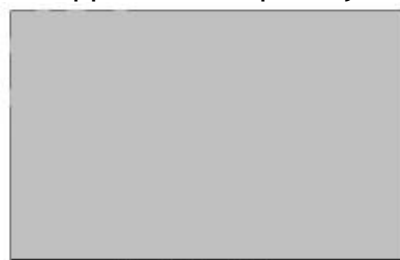
Test Item	Test Condition	Remark
High Temperature Storage	Ta=80°C; 240hrs	IEC60068-2-1 : 2007 GB2423.2-2008
Low Temperature Storage	Ta=-30°C;240hrs	IEC60068-2-1 : 2007 GB2423.1-2008
High Temperature Operation	Ta=70°C , 240Hrs	IEC60068-2-1 : 2007 GB2423.2-2008
Low Temperature Operation	Ta=-20°C; 240hrs	IEC60068-2-1 : 2007 GB2423.1-2008
High Temperature High Humidity Operation	Ta=60°C , 90%RH , 96Hrs(no condensation)	IEC60068-2-78 : 2001 GB/T2423.3-2006
Thermal Shock	-30°C(0.5h) ~ 80°C(0.5h) / 100 cycles	Start with cold temperature , End with high temperature , IEC60068-2-14:1984,GB2423.22-2002
Image Sticking	25°C ; 1hrs	Note1

Note1:Condition of image sticking test :25°C±2°C

Operation with test pattern sustained for 1 hrs,then change to gray pattern immediately.after 5 mins,the mura must be disappeared completely



(a) Test Pattern (chess board Pattern)



(b) Gray Pattern

7.2 VIBRATION&SHOCK

Test item	Conditions	Remark
Packing Shock (non-operation)	980m/s ² ,6ms, ±x,y,z 3times for direction	IEC60068-2-27 : 1987 GB/T2423.5-1995
Packing Vibration (non-operation)	Frequency range:10 HZ~50HZ Stroke:1.0mm,sweep:10 HZ ~50HZ x,y,z 2 hours for each direction	IEC60068-2-32 : 1990 GB/T2423.8-1995

7.3 ESD

Test item	Conditions	Remark	
Electro Static Discharge Test (non-operation)	150pF , 330Ω , Contact:±2KV,Air:±4KV	1	Class C
	200pF , 0Ω , ±200V contact test	2	

Note: Measure point :

1. LCD glass and metal bezel
2. IF connector pins
- 3.ESD class B:some performance degradation allowed. Self-recoverable
No data lost,no hardware failures.



8. GENERAL PRECAUTION

8.1 SAFETY

1. Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
2. If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
3. If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

8.2 STORAGE CONDITIONS

1. Store the panel or module in a dark place where the temperature is $23 \pm 5^{\circ}$ C and The humidity is below $50 \pm 20\%$ RH.

2. Store in anti-static electricity container.
3. Store in clean environment, free from dust, active gas, and solvent.
4. Do not place the module near organics solvents or corrosive gases.
5. Do not crush, shake, or jolt the module.

8.3 HANDLING PRECAUTIONS

1. Avoid static electricity which can damage the CMOS LSI.
2. The polarizing plate of the display is very fragile. So, please handle it very carefully.
3. Do not give external shock.
4. Do not apply excessive force on the surface.
5. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the Surface of plate.
6. Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
7. Do not operate it above the absolute maximum rating.
8. Do not remove the panel or frame from the module.
9. When the module is assembled, it should be attached to the system firmly, Be careful not to twist and bend the module.
10. Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
11. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth in case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

8.4 WARRANTY

1. The period is within twelve months since the date of shipping out under normal using and storage conditions.
2. Do not repaired or modified the LCM. It may cause function to lose efficacy, Starry does not warrant the LCM.
3. All process and material comply ROHS.