



SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HG MODEL : **HG060HD012T01-P**

☐ Preliminary Specification

☒ Final Specification

Customer Confirmation column :

Approved by : _____ Dept. : _____ Data : _____

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document.If it is not returned,we will assume that you agree to the entire contents of this specification document.

Designed by	Checked by	Approved by



Revision History

Version NO.	DATE	Description	Remak
V1.0	2024.09.25	FIRST ISSUE	



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1. GENERAL INFORMATION

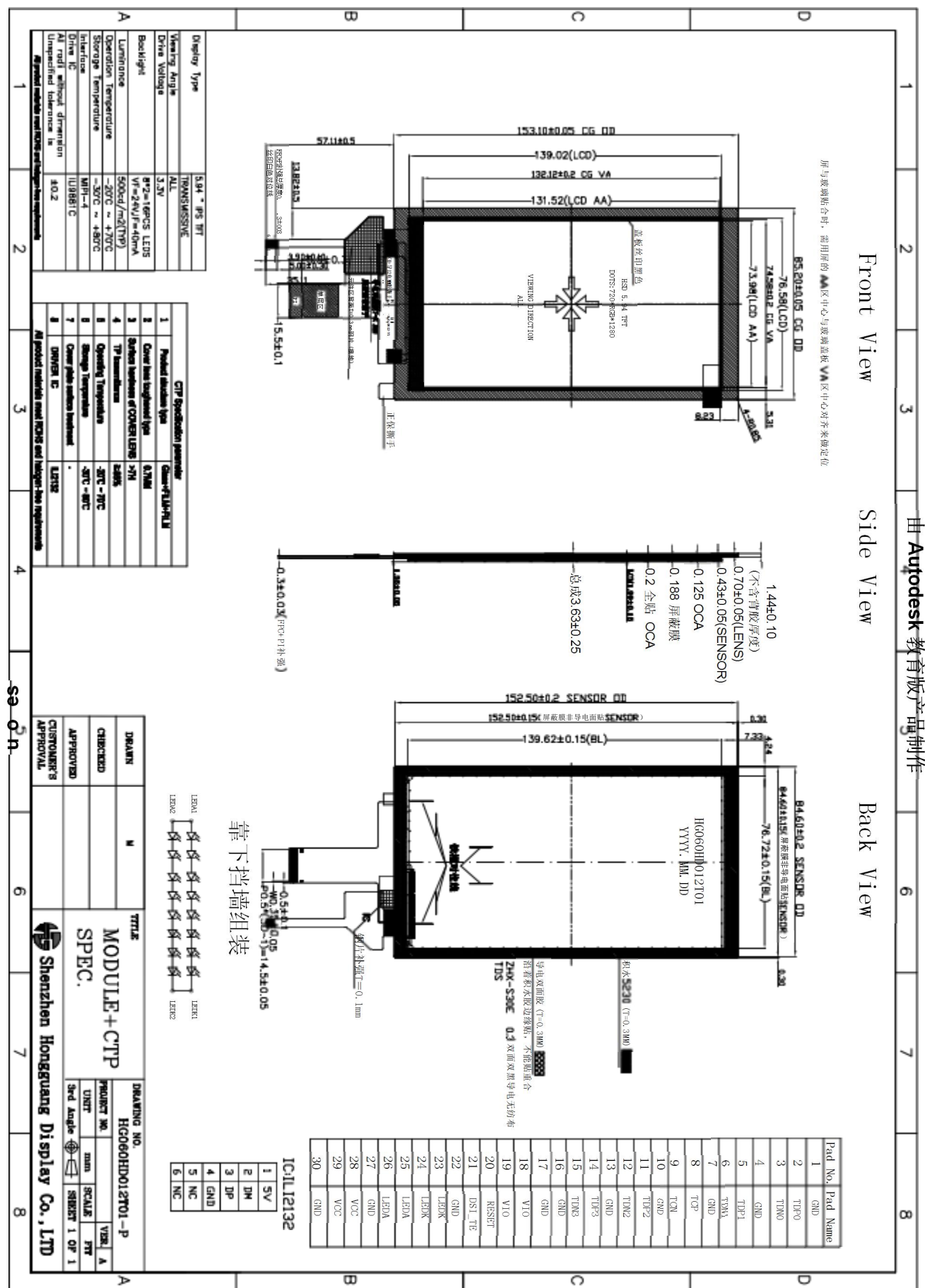
1.1 features

- 1) Structure: TFT PANNEL+IC+FPC+BL+CTP+PB
- 2) IPS Type LCD 720 dot-segment and 1280 dot-common outputs
- 3) 16.7M Color can be selected by software
- 4) White LED back light
- 5) MIPI-4 interface
- 6) Operation Temperature : -20~70°C
- 7) Storage Temperature : -30~80°C
- 8) CTP cover lens : -20~70°C
- 9) CTP structure : -30~80°C

1.2 General specification

Item of	Contents	Unit
Panel Size	5.94	inch
LCD Type	a-si/TRANSMISSIVE	/
Display mode	Normally Black	/
Pixel arrangement	720*3(RGB)*1280	Dots
Pixel pitch (W*H)	0.10275(H)*0.10275(V)	um
Active Area	73.98(H)*131.52(V)	Mm
Module area (W*H*T)	85.2(H)*153.1(V)*3.63(T)	Mm
Recommended Viewing Direction	ALL	O' clock
LCM IC	ILI9881C	/
TP IC	ILI2132	
Interface	MIPI-4	/
Luminance for LCM+TP	500	cd/m2
NTSC	70	%
Weight	TBD	g

2.DIAGRAM FOR LCM





3. I/O CONNECTION & BLOCK DIAGRAM

3.1 I/O connection

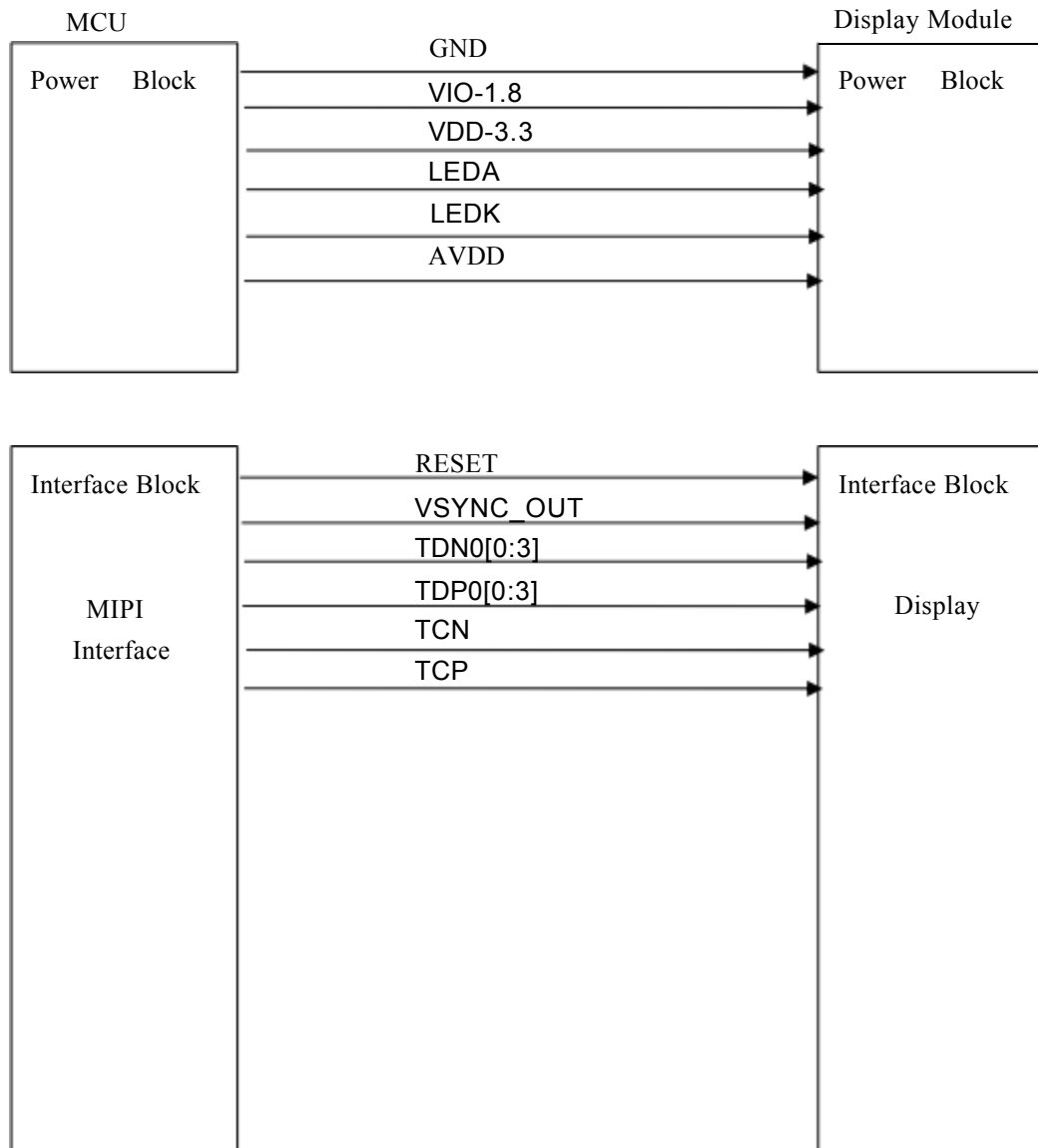
LCM Pin NO.	Symbol	I/O	Description
1	GND	P	Power Ground
2	TDP0	I	DSI-D0+ differential data signals for MIPI interface
3	TDN0	I	DSI-D0- differential data signals for MIPI interface
4	GND	P	Power Ground
5	TDP1	I	DSI-D1+ differential data signals for MIPI interface
6	TDN1	I	DSI-D1- differential data signals for MIPI interface
7	GND	P	Power Ground
8	TCP	I	DSI-LCK+ differential data signals for MIPI interface
9	TCN	I	DSI-LCK- differential data signals for MIPI interface
10	GND	P	Power Ground
11	TDP2	I	DSI-D3+ differential data signals for MIPI interface
12	TDN2	I	DSI-D3- differential data signals for MIPI interface
13	GND	P	Power Ground
14	TDP3	I	DSI-D3+ differential data signals for MIPI interface
15	TDN3	I	DSI-D3- differential data signals for MIPI interface
16	GND	P	Power Ground
17	GND	P	Power Ground
18	IOVCC(1.8V)	P	A power supply for the logic power and I/O circuit(1.8V)
19	IOVCC(1.8V)	P	A power supply for the logic power and I/O circuit(1.8V)
20	RST	I	The signal will reset the LCM, Signal is active low.
21	TE	I	TE
22	GND	P	Power Ground
23	LED_K	P	Power supply for LED cathode
24	LED_K	P	Power supply for LED cathode
25	LED_A	P	Power supply for LED anode
26	LED_A	P	Power supply for LED anode
27	GND	P	Power Ground
28	VCC(3.3V)	P	A power supply for the logic power and I/O circuit(3.3V)
29	VCC(3.3V)	P	A power supply for the logic power and I/O circuit(3.3V)
30	GND	P	Power Ground

I : Input ; O : Output ; P : Power



3.2 block diagram

MCU and Display Module Interface Configuration





4. ABSOLUTE MAXIMUM RATINGS

(GND=AGND=0V)

Item	Symbol	Values			Unit	Remarks
		Min.	Typ.	Max.		
Power Voltage Supply1	VDD-2.8	2.5	3.3	6.6	V	
Power Voltage Supply2	VIO-1.8	1.65	1.8	3.6	V	
Luminance(LCM)	L _v	-	500	-	cd/m ²	
Backlight Forward Voltage	V _f	-	24	25.6	V	
LED Forward Current	I _f	-	40	-	MA	Note

5. ELECTRICAL CHARACTERISTICS

5.1 LED backlight specification :

项目	符号	额定值	单位
工作电流	I _{BL}	20*2	mA
工作电压	V _{BL}	3*8	V
功耗	P _{BL}	960	mW
亮度	Lum	TBD	CD/M ² (*)
X 色坐标	0.26	0.29	0.32
Y 色坐标	0.27	0.30	0.33

Note:The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=20Ma(for each led). The LED life time could be decreased if operating I_L is larger than 20mA

Note: 1 6 chips (8 series 2 parallel) connection, LED luminous color: WHITE.



5.2 DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Power & Operation Voltage							
Analog operating voltage	VCI	-	2.5	2.8	6.6	V	
Analog operating voltage	VCIREF		2.5	2.8	6.6	V	
Digital operating voltage	VDDI	-	1.65	2.8	3.6	V	
Digital operating voltage	VCC1		1.65	2.8	6.6	V	
Digital operating voltage	VCC2		1.65	2.8	6.6	V	
DSI operating voltage	VDDAM	-	1.65	1.8	3.6	V	
OTP Supply voltage	MTP_PWR	-	8.4	8.5	8.6	V	
Analog operating voltage	VSP	-	4.5		6.6	V	
Analog operating voltage	VSN	-	-6.6		-4.5	V	
Logic High level input voltage	VIH	-	0.7*VDDI		VDDI	V	Note1
Logic Low level input voltage	VIL	-	-0.3		0.3*VDDI	V	Note1
Logic High level output voltage TE , LEDPWM	VOH	IOH = -1.0mA	0.8*VDDI		VDDI	V	Note1
Logic Low level output voltage TE , LEDPWM	VOL	IOL = +1.0mA	0		0.2*VDDI	V	Note1
Gate Driver High Voltage	VGH	-	8.0	-	18	V	
Gate Driver Low Voltage	VGL	-	-18.0	-	-7.0	V	
Driver Supply Voltage	-	[VGH-VGL]	15	-	32	V	
VCOM Operation							
DC VCOM Amplitude Voltage	VCOM	-	-4.0	-	0	V	Note3
Source Driver							
Source Output Range	VSOUT(+)	-	0.3	-	VREG1OUT-0.1	V	Note4
	VSOUT(-)	-	VREG2OUT +0.1	-	-0.3	V	Note4
Positive Gamma Reference Voltage	VREG1OUT	-	3.5	-	VSP-0.5 (VSP<=6.1)	V	
					5.6 (VSP>6.1)		
Negative Gamma Reference Voltage	VREG2OUT	-	VSN+0.5 (VSN>=-6.1)	-	-3.5	V	
			-5.6 (VSN<-6.1)				
Source Output Setting Time	Tr	Below with 99% precision	-	10	-	uS	Note3.4
Output Deviation Voltage (Source Output channel)	Vdev	Sout>=4.2V	-	-	20	mV	Note3
		Sout<=0.8V	-	-	15	mV	
Output Offset Voltage	VOFFSET	-	-	-	35	mV	Note3
Standby mode current consumption							
Sleep In mode	I(VDDI SLP IN)	Ta = 25 °C VCI=2.8V VDDI=1.8V	-	35	-	uA	
	I(VCI SLP IN)		-	25	-	uA	

Notes:

1. Ta = -30 to 70 °C (to 85 °C no damage) , VCI = 2.5V to 6.6V, VDDI = 1.65V to 3.6V
2. Supply digital VDDI voltage equal or less than analog VCI voltage.
3. Source channel loading = 9KΩ, 70pF/channel
4. The maximum value is between with Note 3 and Gamma setting value



5.3 AC Characteristics

5.31 High Speed Mode – Data Clock Channel Timing

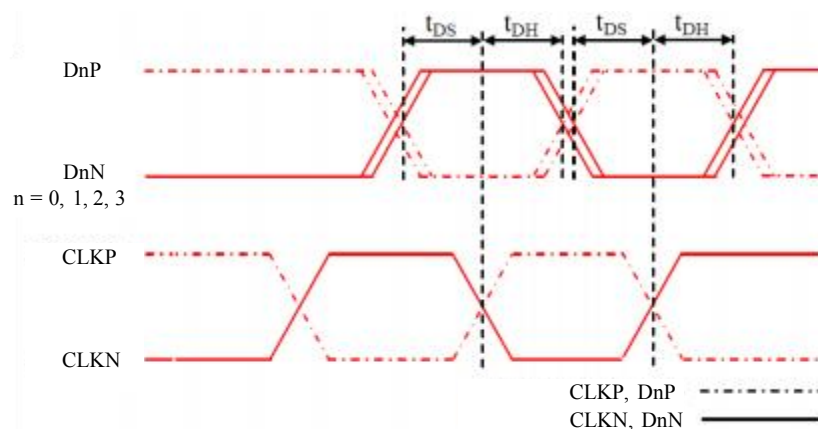


Figure 106: DSI Data to Clock Channel Timings

Table 40: DSI Data to Clock Channel Timings

Signal	Symbol	Parameter	Min	Max
DnP/N , n=0 and 1	t_{DS}	Data to Clock Setup time	0.15xUI	-
	t_{DH}	Clock to Data Hold Time	0.15xUI	-

5.32 High Speed Mode – Rising and Falling Timings

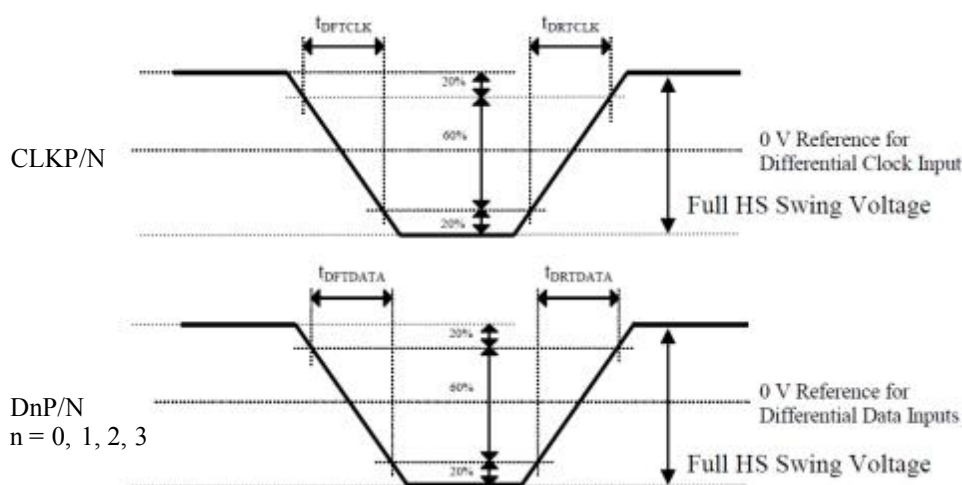


Figure 107: Rising and Falling Timings on Clock and Data Channels

Table 41: Rise and Fall Timings on Clock and Data Channels

Parameter	Symbol	Condition	Specification		
			Min	Typ	Max
Differential Rise Time for Clock	t_{DRTCLK}	CLKP/N	150 ps	-	0.3UI (Note)
Differential Rise Time for Data	$t_{DRTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)
Differential Fall Time for Clock	t_{DFTCLK}	CLKP/N	150 ps	-	0.3UI (Note)
Differential Fall Time for Data	$t_{DFTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)

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



5.33 Reset Timing

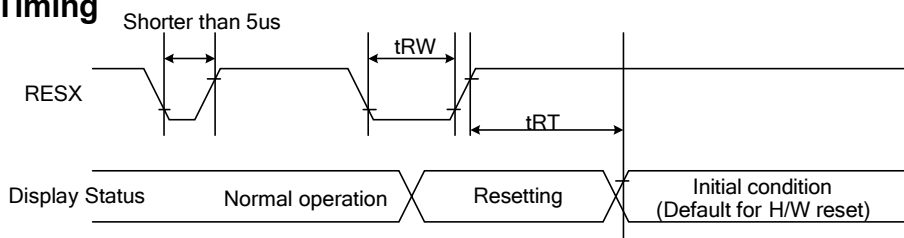


Figure 113: Reset Timing

5.34 Power Structure

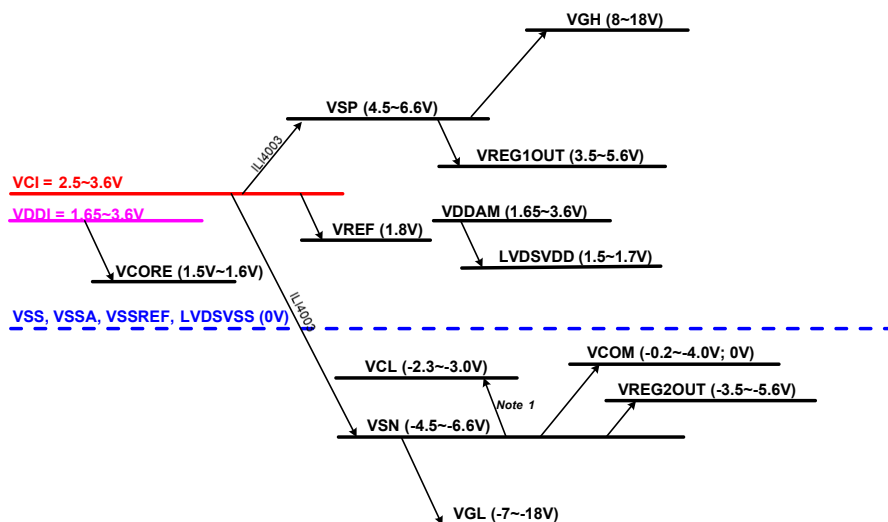
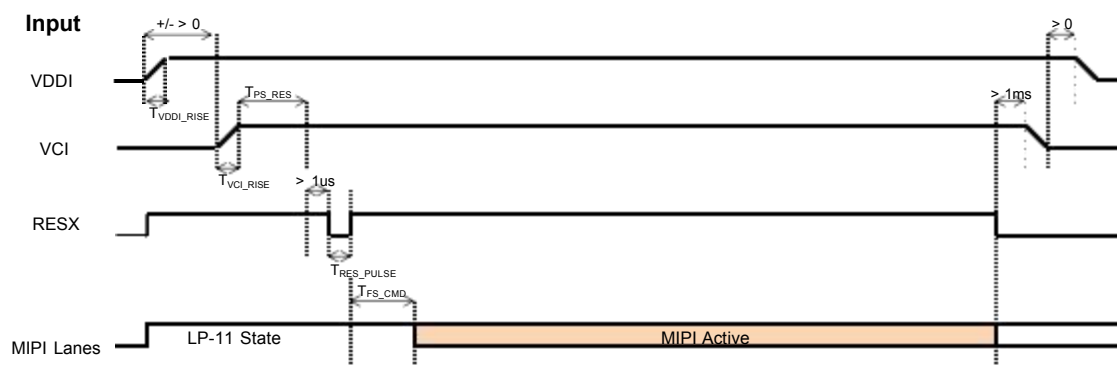


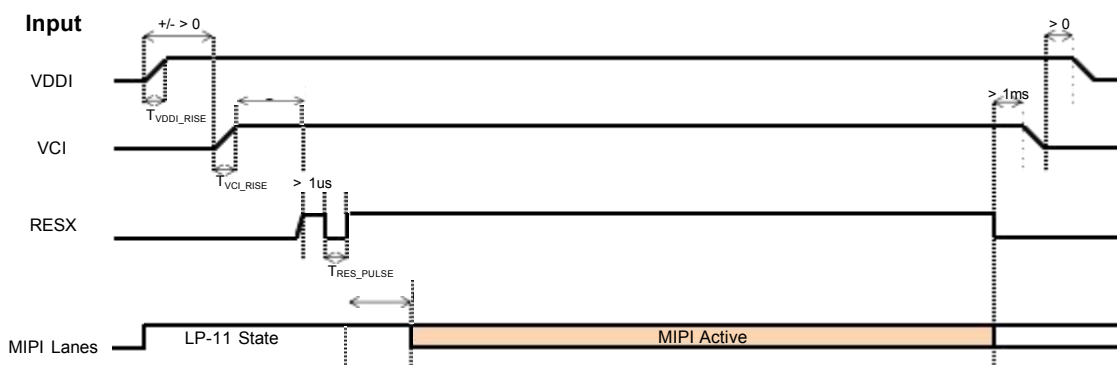
Figure 117: Power Structure of Power Mode 3

5.4 Power Mode

Case A:



Case B:





6. ELECTRO-OPTICAL CHARACTERISTICS

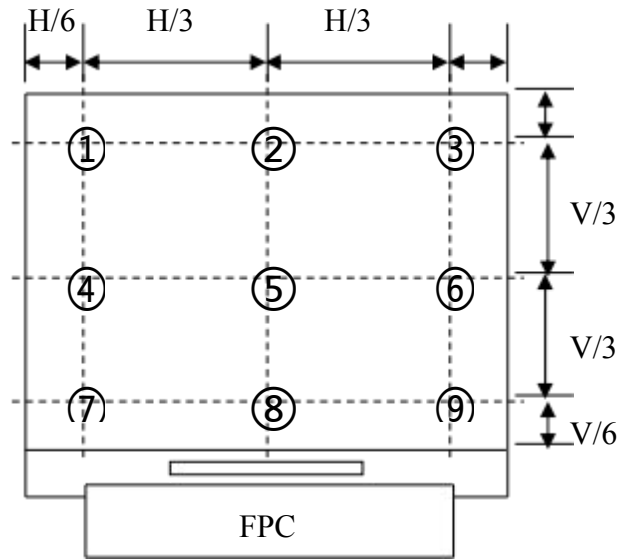
Item	Symbol		Condi tion	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		$\Phi_{1=0^{\circ}}$ $\Phi_{2=0^{\circ}}$	-	500	-	Cd/m ²	1
Uniformity	Δ Bp			80%				1,2
Viewing Angle	$\Phi_{1(\text{up down})}$		Cr≥10	80typ			Deg	3
	$\Phi_{2(\text{left right})}$			80typ				
Contrast Ratio	Cr		$\Theta=0$ Normal Viewing angle	-	800	-	-	4
Response Time	Tr			-	16	21	ms	5
	Tf				19	24		
Color of CIE Coordinate	W	x	$\Phi_{1=0^{\circ}}$ $\Phi_{2=0^{\circ}}$	-	0.304	-	-	1,6
		y		-	0.324	-	-	
	R	x		-	0.647	-	-	
		y		-	0.317	-	-	
	G	x		-	0.258	-	-	
		y		-	0.566	-	-	
	B	x		-	0.140	-	-	
		y		-	0.088	-	-	
Transmittance	Trans			3.64%				



Note1 Definition of Contrast Ratio (CR):

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note2: Definition of Luminance Uniformity: Active area is divided into 9 measuring areas (Shown in below), every measuring point is placed at the center of each measuring area.



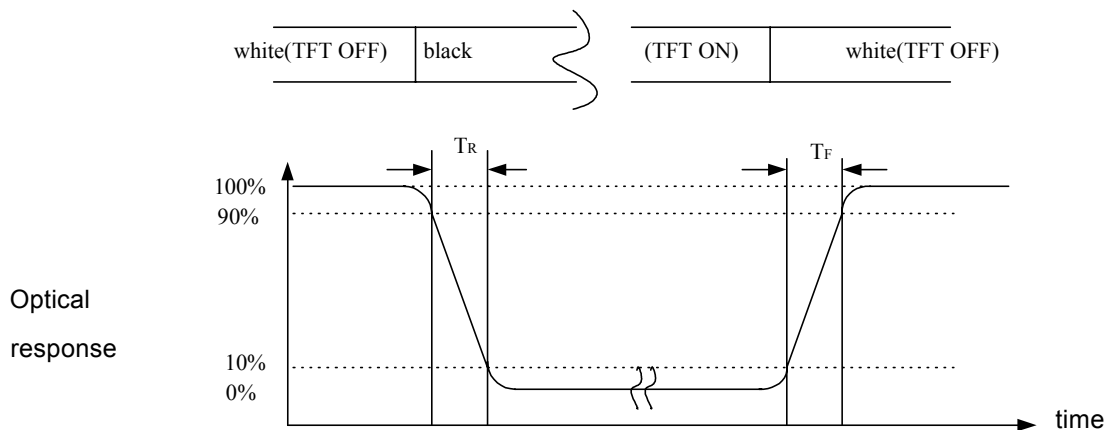
The spot locations for luminance measurement

$$\text{Luminance Uniformity} = \frac{H/6 B_{\min}}{V/6 B_{\max}} \times 100\%$$

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

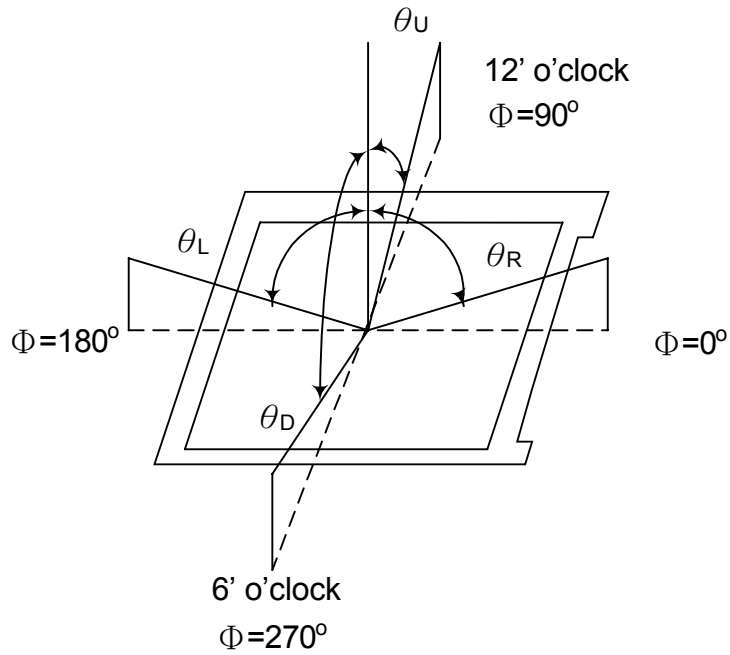
$B_{\min}$: The measured minimum luminance of all measurement position.

Note 3: Definition of Response time: Sum of T_r and T_f





Note4. Definition of Viewing Angle: The viewing angle range that the $CR \geq 10$



Note 5: Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.



7. RELIABILITY TEST CONDITIONS

No	Test Item	Test Condition	STANDARD
1	High Temperature Storage	+80°C / 96Hours	1. Functional test is OK. Missing Segment, short, unclear segment, on-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temperature Storage	-30°C / 96Hours	
3	High Temperature Operating	+70°C / 96Hours	
4	Low Temperature Operating	-20°C / 96Hours	
5	Thermal and cold shock	0°C $\leftrightarrow$ +50°C x 10cycles (30min) (5min) (30min)	
6	Operate at High Temperature and Humidity	60°C x 90%RH / 24H	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude:1.5mm, 2 hours for each direction of X, Y, Z	
8	Dropping test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	
9	ESD test	Contact: $\pm$ 6KV Air: $\pm$ 10KV 150PF/330 Ω , 5Points/panel, 5times	The test results shall be subject to the whole machine test.

NOTE :

1. The reliability items will be fully performed in new sample qualification,
2. The reliability status will be tested as monitor during mass production. Individual reliability test shall be performed by lot, Moreover, the individual reliability item shall be decided according to reliability plan.
3. All samples are inspected after keeping in the room with normal temperature and humidity for 2 hours or above.
4. Vibration test: It is not necessary to test for those products without assembly frame, backlight, PCB and so on.
5. Dropping test: It is necessary for affirming new package.
6. For the high temperature and high humidity test, pure water of over 10 M Ω .cm should be used.
7. Each test item applies for test LCM only once. Then tested LCM cannot be used again in any other test item.
8. The quantity of LCM examination for each test item is 5pcs to 10pcs.



8. INSPECTION STANDARDS

8.1 AQL Sampling inspection standard

Use GB/T 2828-2003 general level II, with single sampling for normal inspection; specific sampling methods shall follow the "Finished Product Inspection Management Procedure" and the "Sampling Management Standards."

Defect Classification	AQL Acceptable level
Serious defects	Zero collection and one return
Severe shortage	0.4
Minor deficiency	1.0

8.2 Inspect the condition

8.2.1 Under the illumination of a 20-40W fluorescent lamp, the sample should be examined approximately 30cm away from the examiner's eyes. The inspection direction is 45° forward, backward, left and right along the vertical line (at 3 o'clock, 6 o'clock, 9 o'clock and 12 o'clock on the clock).

8.2.2 The vision of the examinee must reach above 1.0 of the standard vision.

8.2.3 The examiner must wear an anti-static wristband and eight finger cots on both hands.

8.2.4 The visual inspector shall conduct visual inspection or comparison with a film comparison card.

8.2.5 Electrical testing uses an electrical test stand, motherboard, power cord and single-chip microcomputer.

8.2.6 In case of any discrepancy between the standards and the specification sheet, the special inspection specifications and engineering changes in the specification sheet issued for the product shall prevail

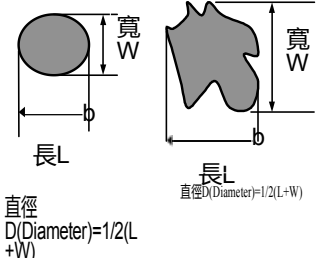
8.2.7 For chroma testing, please refer to the sample. The testing method shall be in accordance with the chroma inspection standards.

8.2.8 Electrical inspection environment: Illuminance below 200LUX; Visual inspection environment: Illuminance 600LUX-1000 Lux; inspection time: 1 second -3 seconds.

8.2.9 Inspection tools: Electrical test stand, main board, power cord and single-chip microcomputer, film comparison card, vernier caliper, magnifying glass, physical microscope (if necessary), etc.

8.3 Judgment criterion

Criteria for small-sized points and lines: (within 6.2 inches)

1	Point-like defect "Abrasion Foreign object, needle Holes, dents Lack of film and gas Soak, white spots Colorful dots, dirty Click		Judgment (A /B/C Area)	D≤0.10 , Negligible, but intensive is not allowed	MI	OK	
	0.1 < D≤0.15 , ds≥10			N≤2			
	0.15 < D≤0.2 , ds≥10			N≤1			
	LCD High : 0.15 < D			N≤1			
	D > 0.2			NG			
			Judgment (D Area)	The impurity determination standard for the screen printing ink area on the same back			
			Note : 1) The point defects in Area D should not be affected The CTP function, customer assembly and the appearance of the entire machineIn this case, it is determined to be OK			MI	

2	Linear defect (Abrasion, no feeling of scratching Injury, hair Shavings, fibers Etc.		Judgment (A /B/C Area)	W≤0.03mm , L≤3mm , ds ≥ 10	MI	N≤2
	0.03mm < W≤0.05mm , L ≤3mm , ds≥10			N≤1		
	W > 0.05mm 或 L > 3mm			NG		

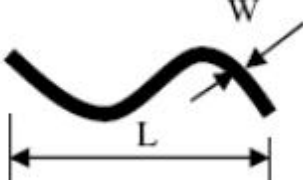


Criteria for determining medium-sized points and lines: (Within 6.2 to 8 inches)

1	Point-like defect "Abrasion" Foreign object, needle Holes, dents Lack of film and gas Soak, white spots Colorful dots, dirty Click	 直径D(Diameter)=1/2(L+W)	Judgment (A /B/C Area)	$D \leq 0.10$, Negligible, but intensive is not allowed $0.15 < D \leq 0.25$, $ds \geq 10$ $0.25 < D \leq 3$, $ds \geq 10$ LCD 亮点 : $0.2 < D$ $D > 0.3$	MI	OK N≤2 N≤1 N≤1 NG
	Judgment (D Area)	The impurity determination standard for the screen printing ink area on the same back				
	Note: 1) The point defects in Area D should not affect The CTP function, customer assembly and the appearance of the entire machine In this case, it is determined to be OK		MI			
2	Linear defect (Abrasion, no feeling of scratching Injury, hair Shavings, fibers Etc.		Judgment (A /B/C Area)	$W \leq 0.03\text{mm}$, $L \leq 3\text{mm}$, $ds \geq 10$ $0.03\text{mm} < W \leq 0.05\text{mm}$, $L \leq 3\text{mm}$, $ds \geq 10$ $W > 0.05\text{mm}$ 或 $L > 3\text{mm}$	MI	N≤2 N≤1 NG

Criteria for determining large-sized points and lines: (within 8.1 to 13.3 inches)

1	Point defects (scratches, foreign objects, pinholes, dents, missing films, bubbles, white spots, colored spots, dirty spots)		Judgment (A /B/C Area)	$D \leq 0.1$, Negligible, but intensive is not allowed	MI	OK	
			$0.15 < D \leq 0.3$, $ds \geq 10$	$N \leq 2$			
			$0.3 < D \leq 0.35$, $ds \geq 10$	$N \leq 1$			
			LCD Highlights : $0.25 < D$	$N \leq 1$			
			$D > 0.35$	NG			
			Judgme nt (D Area)	The impurity determination standard for the screen printing ink area on the same back			
			Note : 1) The point defects in Area D should not be affected			MI	
			The CTP function, customer assembly and the appearance of the entire machine				
			In this case, it is determined to be OK				

2	Linear defects (abrasive s, non-perceptible scratches, lint, fibers, etc.		Judgment (A /B/C Area)	$W \leq 0.05\text{mm}$, $L \leq 5\text{mm}$, $ds \geq 10$	MI	$N \leq 2$
				$0.05\text{mm} < W \leq 0.07\text{mm}$, $L \leq 5\text{mm}$, $ds \geq 10$		$N \leq 1$
				$W > 0.07\text{mm}$ 或 $L > 5\text{mm}$		NG



9. PACKAGE DRAWING

