

SPECIFICATION

FOR LCD MODULE

MODEL NO:	TM070RDZG01
CUSTOMER:	
CUSTOMER P/N.	
VERSION	V0.2
CUSTOMER APPROVED	

- ☒ Preliminary specification
☐ Final specification

PREPARED BY	CHECKED BY	VERIFIED BY QA DEPT.	APPROVED BY

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REVISION RECORD

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V0.1		First release	Liu Guohua	2012.10.31
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1. General Specifications

Feature		Spec
Display Spec.	Size	7.0 inch(AA diagonal 6.95 inch)
	Resolution	800(RGB) x 480
	Interface	RGB 24 bits with T-con
	Color Depth	16.7M
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1926x0.1790
	Pixel Configuration	R.G.B. Stripe
	Display Mode	Transmissive with Normally White
	Surface Treatment(Up Polarizer)	Anti-Glare
	Gray Scale Inversion Direction	6 o'clock
	LCM (W x H x D) (mm)	164.9x100.0x6.0
Mechanical Characteristics	Active Area(mm)	154.08X85.92
	With /Without TSP	Without TSP
	Weight (g)	tbd
	LED Numbers	12 LEDs

Note 1: Requirements on Environmental Protection: RoHS

Note 2: The height dimension does not include the length of FPC

Note 3: LCM weight tolerance: $\pm 5\%$

2. Input/Output Terminals

2.1 CN1 pin assignment

Connector type: FH28-60S-0.5SH

No	Symbol	I/O	Description	Comment
1	DGND	P	Ground for digital circuit	Note1
2	V10	I	Gamma Voltage 10	
3	V9	I	Gamma Voltage 9	
4	V8	I	Gamma Voltage 8	
5	V7	I	Gamma Voltage 7	
6	V6	I	Gamma Voltage 6	
7	V5	I	Gamma Voltage 5	
8	V4	I	Gamma Voltage 4	
9	V3	I	Gamma Voltage 3	
10	V2	I	Gamma Voltage 2	
11	V1	I	Gamma Voltage 1	
12	VCOM	I	Common polarity signal	Note3
13	DGND	I	Ground for digital circuit	
14	RSTB	I	Global Reset Pin. Active low to enter Reset State. Fix to VCC level if no used. Suggest to connecting with an RC reset circuit for stability. (Suggest R=10K Ω , C=0.1uF)	
15	STBYB	I	Standby Mode Select H: normal; L: standby.Pull high if no used.	
16	UPDN	I	Gate Up or Down Scan	Note2
17	SHLR	I	Source Right or Left Sequence Control	Note2
18	DITH	I	Dithering Setting H:6bit Resolution,Disable internal dithering function.(Default) L:8bit Resolution,Enable internal dithering function.	
19	MODE	I	DE/SYNC Mode Select. H:DE; L:SYNC mode	Note4
20	R0	I	Red Data, fix to DGND in 18bit RGB interface.	
21	R1	I	Red Data, fix to DGND in 18bit RGB interface.	
22	R2	I	Red Data	
23	R3	I	Red Data	
24	R4	I	Red Data	
25	R5	I	Red Data	
26	R6	I	Red Data	
27	R7	I	Red Data(MSB)	
28	DGND	P	Ground for digital circuit	
29	G0	I	Green Data, fix to DGND in 18bit RGB interface.	
30	G1	I	Green Data, fix to DGND in 18bit RGB interface.	
31	G2	I	Green Data	
32	G3	I	Green Data	
33	G4	I	Green Data	
34	G5	I	Green Data	
35	G6	I	Green Data	
36	G7	I	Green Data(MSB)	
37	DGND	P	Ground for digital circuit	
38	B0	I	Blue Data, fix to DGND in 18bit RGB interface.	

39	B1	I	Blue Data, fix to DGND in 18bit RGB interface.	
40	B2	I	Blue Data	
41	B3	I	Blue Data	
42	B4	I	Blue Data	
43	B5	I	Blue Data	
44	B6	I	Blue Data	
45	B7	I	Blue Data (MSB)	
46	DGND	P	Ground for digital circuit	
47	DCLK	I	Data clock	
48	DGND	P	Ground for digital circuit	
49	DE	I	Data enable signal, Active high to enable data	
50	HSD	I	Horizontal signal	
51	DGND	P	Ground for digital circuit	
52	VSD	I	Vertical signal	
53	DGND	P	Ground for digital circuit	
54	VCC	P	Power supply for internal logic circuit	
55	AGND	P	Ground for logic circuit	
56	AVDD	P	Digital Power supply	
57	VGH	P	Positive Power for TFT	
58	VCC	P	Power supply for internal logic circuit	
59	VGL	P	Negative Power for TFT	
60	GND	P	Ground for digital circuit	

Note1: I/O definition.

I---Input, O---Output, P--- Power/Ground, N--- No connection

Note2:

Scan Control Input		Scanning Direction
UPDN	SHLR	
DGND	VCC	Up to down, Left to right
VCC	DGND	Down to up, Right to left
DGND	DGND	Up to down, Right to left
VCC	VCC	Down to up, Left to right

Note3: VCOM is DC value, don't inverse.

Note4: Select the DE mode, HS and VS pull high. Select the SYNC mode, DE pull low.

Note5: The recommended resistance of pull high/low resistor in U/D or R/L pin is 4.7K ohm.

2.2 CN2 pin assignment (Backlight interface)

No	Symbol	I/O	Description	Comment
1	VLC1	P	VLC1 Cathode	
2	VLC1	P	VLC1 Cathode	
3	VLC2	P	VLC2 Cathode	
4	VLC2	P	VLC2 Cathode	
5	NC	N	NC	
6	NC	N	NC	
7	VLA	P	VLA Anode	
8	VLA	P	VLA Anode	
9	VLA	P	VLA Anode	
10	VLA	P	VLA Anode	

3. Absolute Maximum Ratings

DGND=AGND=0V, Ta = 25℃

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VCC	-0.50	5.0	V	
	AVDD	-0.50	14.85	V	
	VGH	-0.30	40.00	V	
	VGL	-20.00	0.30	V	
	VGH-VGL	-0.30	40.00	V	
Backlight forward current	I_LED	-	85	mA	Note1
Operating Temperature	Topr	-30	85	℃	Note2
Storage Temperature	Tstg	-40	90	℃	

Table 3.1 absolute maximum rating

Note1 : The current limitation is for each LED.

Note2 : The high temperature operating limitation is defined as panel surface.

4. Electrical Characteristics

4.1 Driving TFT LCD Panel

DGND =AGND=0V, Ta = 25℃

Item		Symbol	Min	Typ	Max	Unit	Remark
Power Supply Voltage		VCC	3.0	3.30	3.60	V	
Analog Supply Voltage		AVDD	6.50	tbd	13.50	V	
Gate On Voltage		VGH	14.40	tbd	24.00	V	
Gate Off Voltage		VGL	-9	tbd	-5	V	
Common Electrode Driving Signal		VCOM	3.5	tbd	5.0	V	VCOM is just for reference.
Input Level Of Gamma Voltage		V1~V5	0.4x AVDD	-	AVDD -0.1	V	
		V6~V10	0.1	-	0.6x AVDD	V	
Input Signal Voltage	Low Level	VIL	0	-	0.2x VCC	V	R0~R7,G0~G7, B0~B7,DE,DCLK,HSD,VSD,MODE, RSTB,STBYB,SHLR,UPDN,DITH
	High Level	VIH	0.8x VCC	-	VCC	V	
Output Signal Voltage	Low Level	VOL	GND	-	GND+0.4	V	
	High Level	VOH	VCC-0.4	-	VCC	V	

Table 4.1 LCD module electrical characteristics

Note: For different LCM, the value may have a bit of difference. The typical values are for reference.

4.2 Driving Backlight

Item		Symbol	Tem	Min	Typ	Max	Unit	Remark
Forward Voltage		VBL	25° C		18	20.4	V	I _F =20mA Note 1
Forward Current		I _F	-	-	80	85	mA	Note 1
Backlight Power Consumption		WBL	-	-	2.88	3.468	W	
Life Time		-	-	10,000	-	-	Hrs	Note 2

Table 4.2 LED backlight characteristics

Note 1: I_F is defined for one channel LED. There are total 2 LED channels in backlight unit. Under LCM operating, the stable forward current should be inputted.

Note 2: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

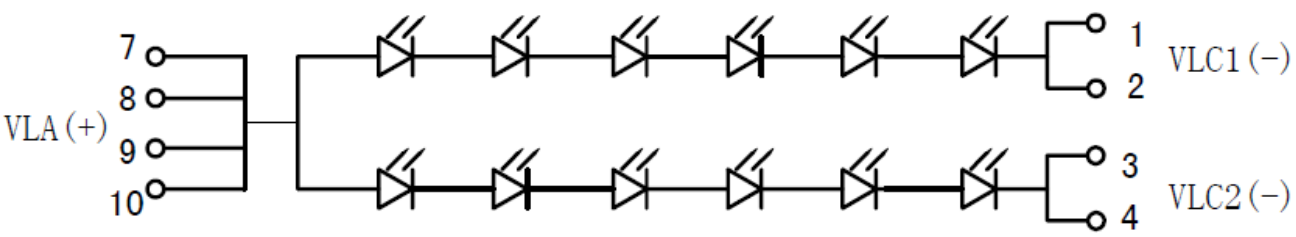


Figure 4.1 LED connection of backlight

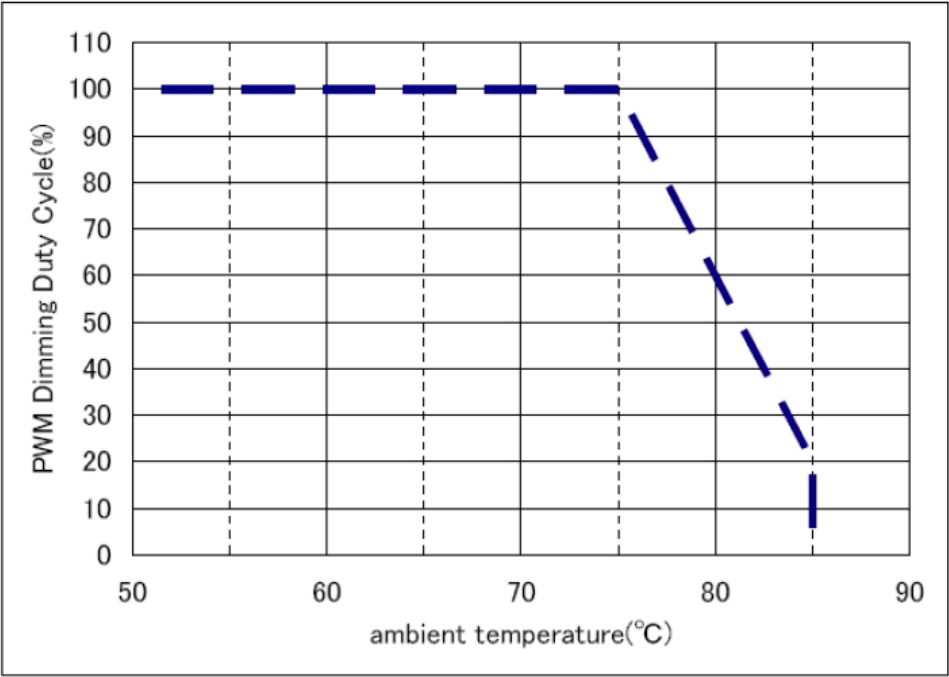


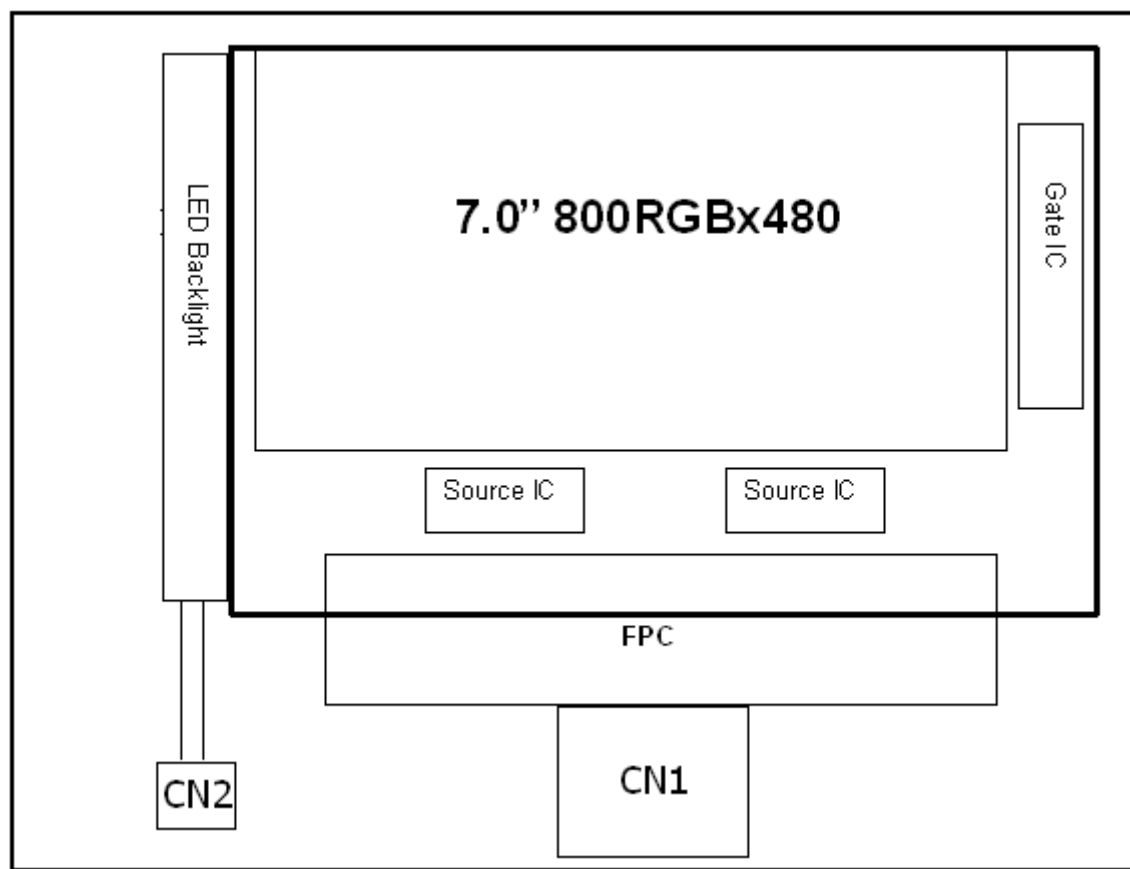
Figure 4.2 PWM Dimming Duty vs Ambient Temperature

4.3 Power Consumption

DGND =AGND=0V, Ta = 25℃

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Digital Supply Current	I_{VCC}	VCC=3.3V	-	Tbd	14.00	mA	
Analog Supply Current	I_{AVDD}	AVDD=13.5V max	-	Tbd	40.00	mA	
Gate On Current	I_{VGH}	VGH=24V max	-	Tbd	0.60	mA	
Gate Off Current	I_{VGL}	VGL= -7.00V min	-	Tbd	0.60	mA	
Power Consumption	Panel		-	tbd	0.6	W	
	Backlight		-			W	
	Total		-	tbd	2.532	W	

4.4 Block Diagram

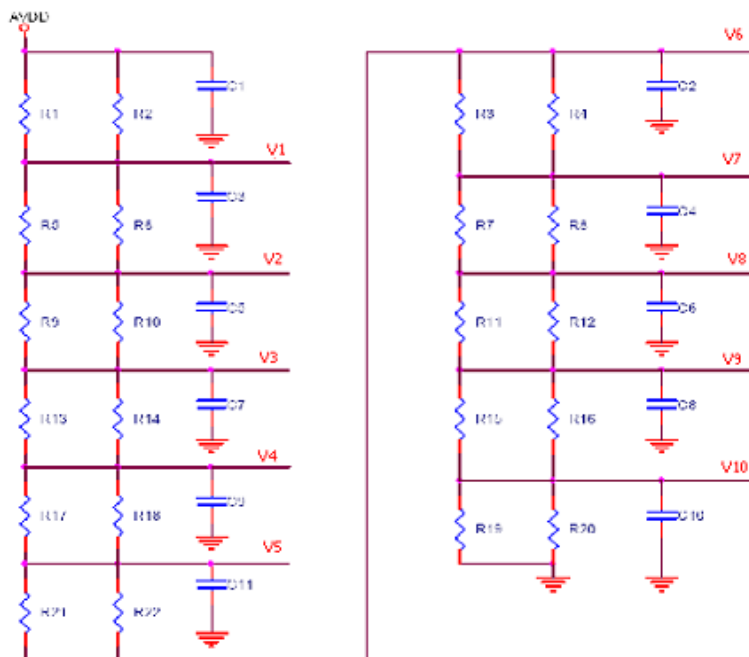


4.5 Gamma Correction Reference Voltage Setting

Parameter	Symbol	MIN	TYP	MAX	Unit	Remark
Gamma correction reference voltage V1~V10	V1	-	10.14	AVDD-0.1	V	
	V2	-	8.25	-	V	
	V3	-	7.66	-	V	
	V4	-	7.19	-	V	
	V5	-	5.50	-	V	
	V6	-	5.10	-	V	
	V7	-	3.41	-	V	
	V8	-	2.94	-	V	
	V9	-	2.35	-	V	
	V10	AGND+0.1	0.46	-	V	

Note: The value is for design stage only, and will be adjusted based on actual sample.
AVDD-0.1V>V1>V2>V3>V4>V5>V6>V7>V8>V9>V10>AGND+0.1V

4.6 Gamma Correction Resistance Setting



4.7 Gamma Correction Resistance Value

Symbol	Unit	Resistance	Symbol	Unit	Resistance
R1// R2	Ω	47//NC	R3// R4	Ω	240//620
R5// R6	Ω	240//1000	R7// R8	Ω	62//220
R9// R10	Ω	91//180	R11// R12	Ω	91//180
R13// R14	Ω	62//220	R15// R16	Ω	240//1000
R17// R18	Ω	240//620	R19// R20	Ω	47//NC
R21// R22	Ω	47//300	C1~C10	uF	1.0 (16V)

Note: This resistor table is for design stage only and will be adjusted based on actual sample.

5. Timing Chart

5.1 Recommended Timing Setting of TCON

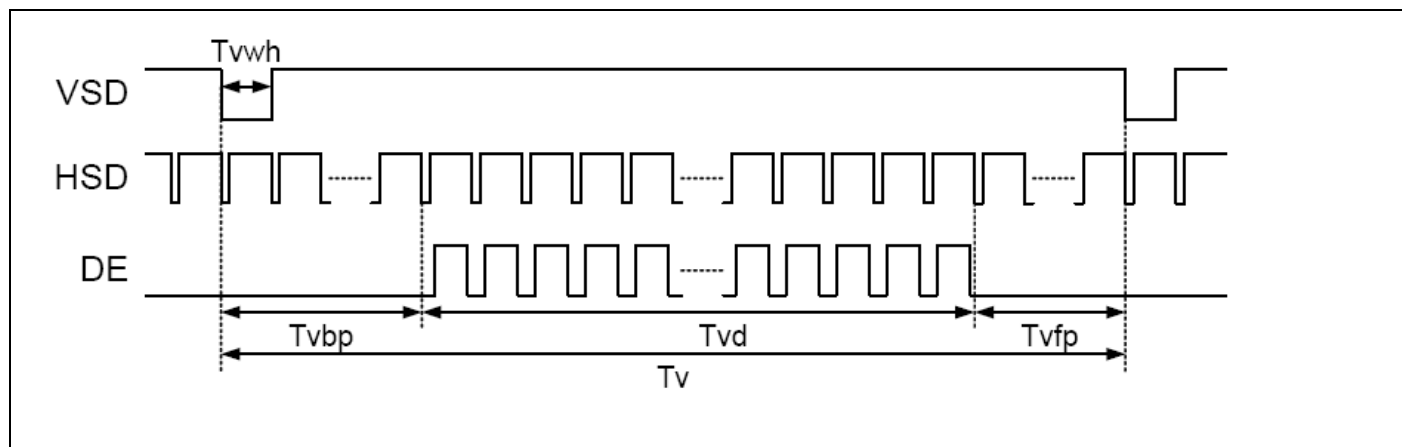
(VCC=3.3V, AGND =DGND=0V, Ta=25℃)

SYNC mode input signal characteristic, 800x480						
parameter	symbol	min	typ	max	unit	remark
CLK	Fclk	25	33.26	40	MHz	
	Tclk	25	30	40	ns	
HSYNC	TH	890	1056	1600	DCLK	
	THD	800			DCLK	This value is fixed
	THPW	4	48	81	DCLK	
	THB	88			DCLK	This value is fixed
	THFP	2	168	712	DCLK	
VSYNC	TV	514	525	960	TH	
	TVD	480			TH	This value is fixed
	TVPW	1	3	5	TH	
	TVB	32			TH	This value is fixed
	TVFP	4	13	446	TH	

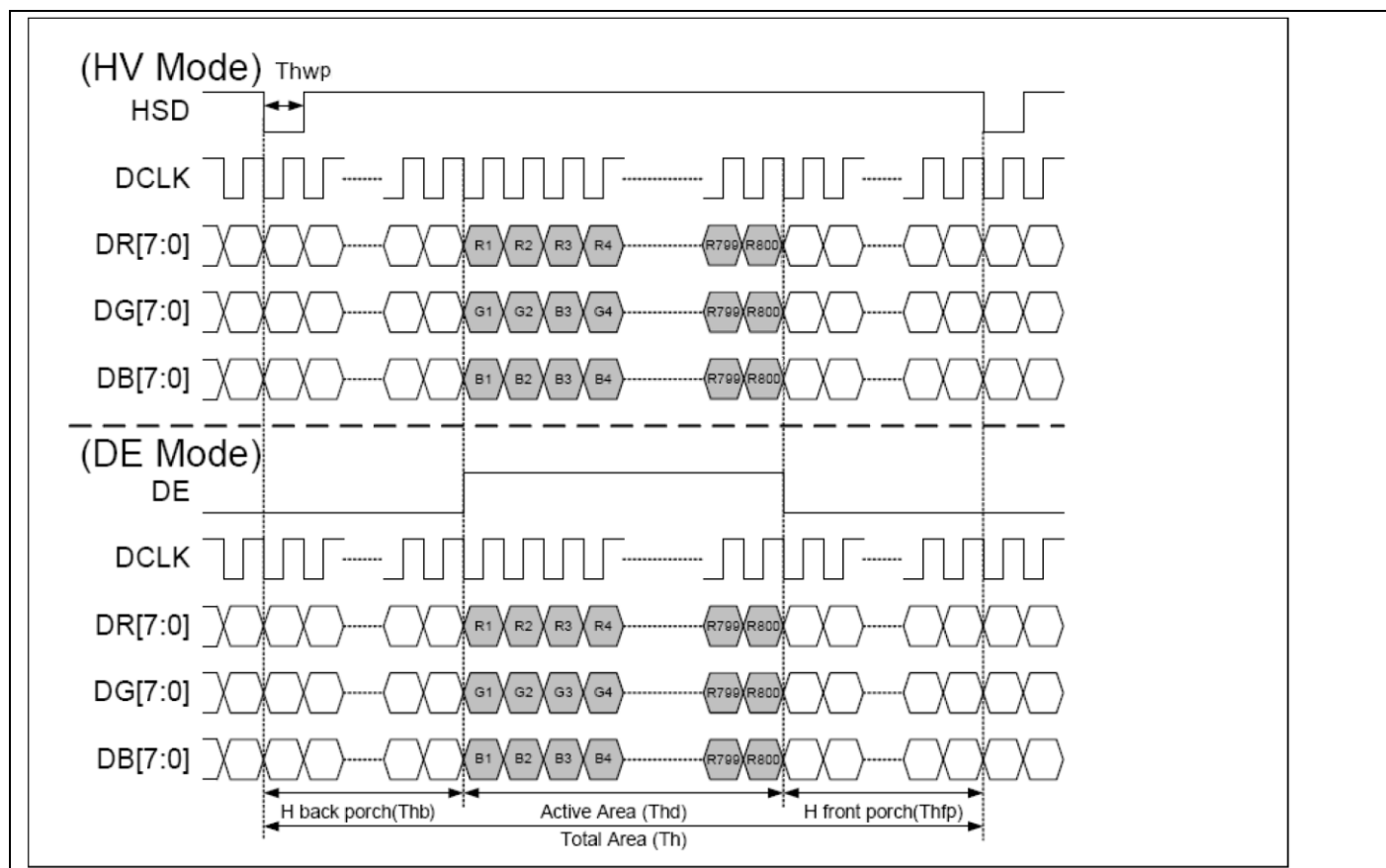
DE mode input signal characteristic, 800x480						
parameter	symbol	min	typ	max	unit	remark
CLK	Fclk	25	33.26	40	MHz	
	Tclk	25	30	40	ns	
DE	TH	820	1056	1600	DCLK	
	THD	800			DCLK	This value is fixed
	TV	485	525	960	TH	
	TVD	480			TH	This value is fixed

5.2 Timing Diagram

5.2.1 Vertical Input Timing



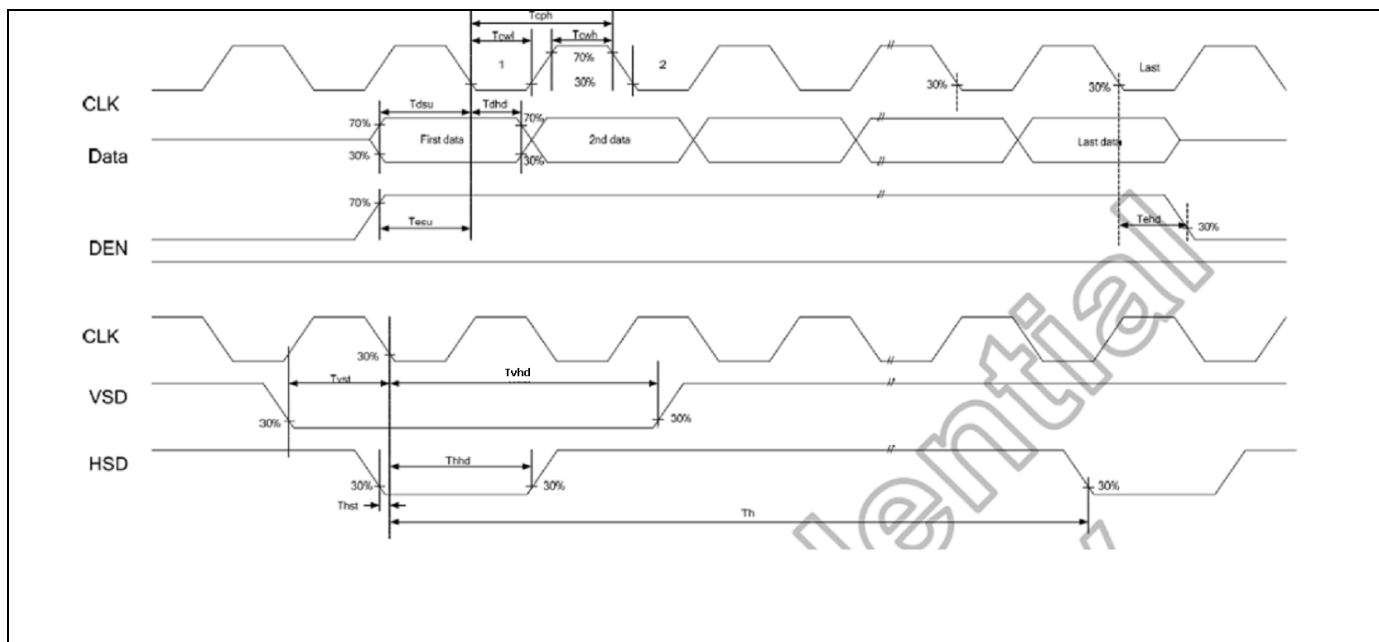
5.2.2 Horizontal Input Timing



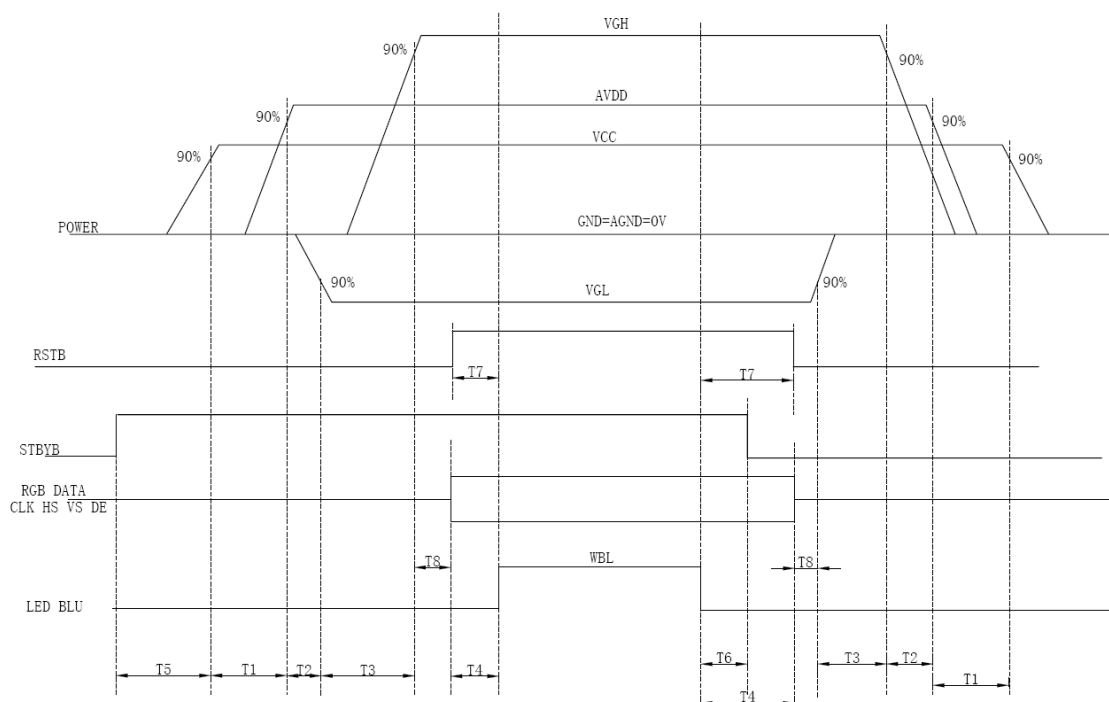
5.3 TFT LCD Input Timing

(VCC=3.3V, AGND =DGND=0V, Ta=25℃)

Parameter	Symbol	Min	Typ	Max	Unit	Remark
CLK Frequency	Fclk	-	33.26	40	MHz	
CLKIN Cycle Time	Tcph	25	30	-	ns	
CLK Pulse Width	Tcwh	40%	50%	60%	Tclk	
Data Set-up Time	Tsu	8	-	-	ns	
Data Hold Time	Thd	8	-	-	ns	
DE Set-up Time	Tesu	8			ns	
DE Hold Time	Tehd	8			ns	
HS Set-up Time	Thst	8			ns	
HS Hold Time	Thhd	8			ns	
VS Set-up Time	Tvst	8			ns	
VS Hold Time	Thhd	8			ns	
RSTB Pulse Width	TRst	10	-	-	us	
Output Stable Time	Tsst	-	-	6	us	



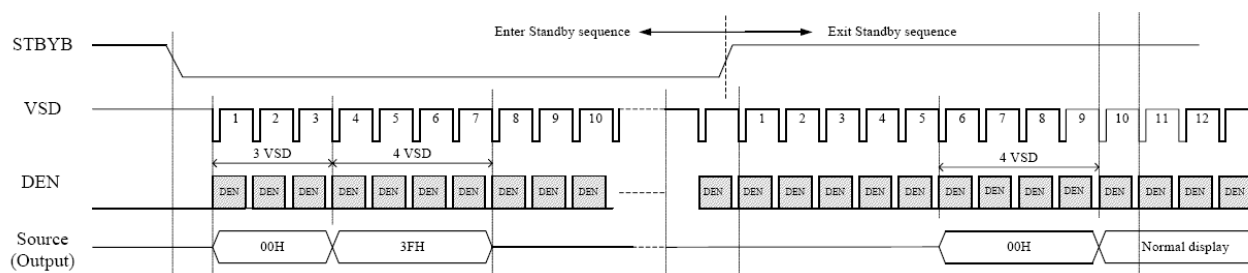
5.4 Recommended Power ON/OFF Sequence



Note1: $T1 \geq 20\text{ms}$, $T2 \geq 20\text{ms}$, $T3 \geq 5\text{ms}$, $T4 \geq 200\text{ms}$, $T5 \geq 5\text{ms}$, $T6 \geq 5\text{ms}$, $T7 \geq 200\text{ms}$, $T8 \leq 20\text{ms}$

Note2: The timing of V1 to V10, VCOM are same as AVDD.

5.5 Enter and exit standby mode sequence



6. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark		
View Angles		θU	CR≧10	50	60	-	Degree	Note 2		
		θD		60	70	-				
		θL		60	70	-				
		θR		60	70	-				
Contrast Ratio		CR	θ=0°	400	500	-		Note1 Note3		
Response Time		T _{ON}	25℃	-	15	30	ms	Note1 Note4		
		T _{OFF}		-	20	30				
				T _{ON}	-20℃	-	80	150	ms	Note1 Note4
				T _{OFF}		-	150	350		
Chromaticity	White	x	Backlight is on	X-0.05	X	X+0.05		Note5 Note1		
		y		Y-0.05	Y	Y+0.05				
	Red	x		X-0.05	X	X+0.05				
		y		Y-0.05	Y	Y+0.05				
	Green	x		X-0.05	X	X+0.05				
		y		Y-0.05	Y	Y+0.05				
	Blue	x		X-0.05	X	X+0.05				
		y		Y-0.05	Y	Y+0.05				
Uniformity		U		75	80	--	%	Note1 Note6		
NTSC				--	50	--	%	Note5		
Luminance		L		400	500	--	cd/m ²	Note1 Note7		

Test Conditions:

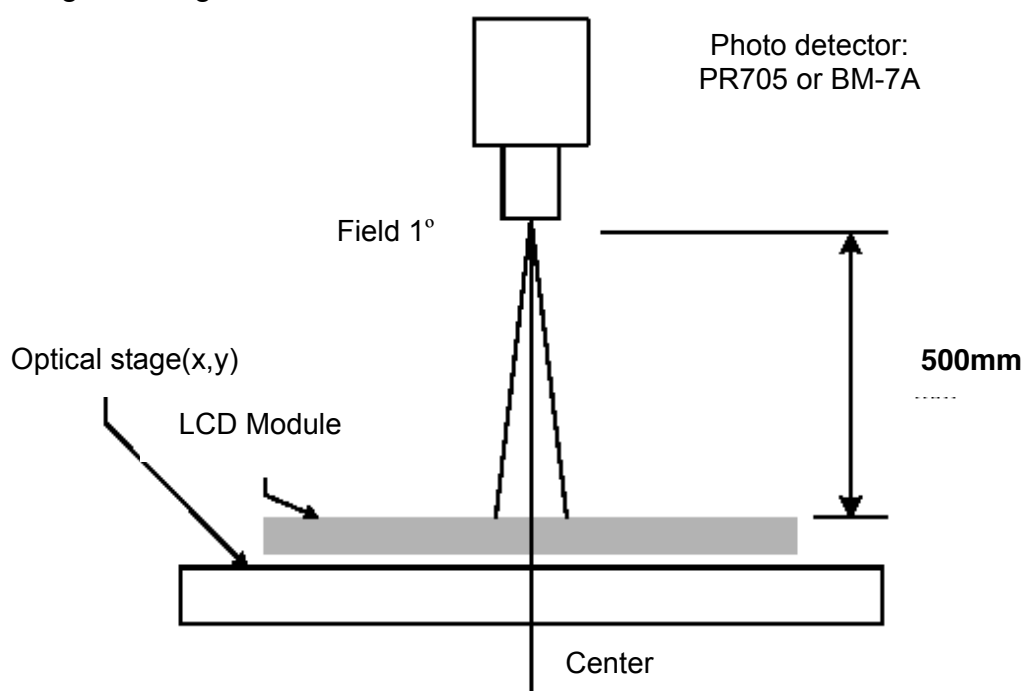
1. $I_F = 80\text{mA}$ (one channel), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system

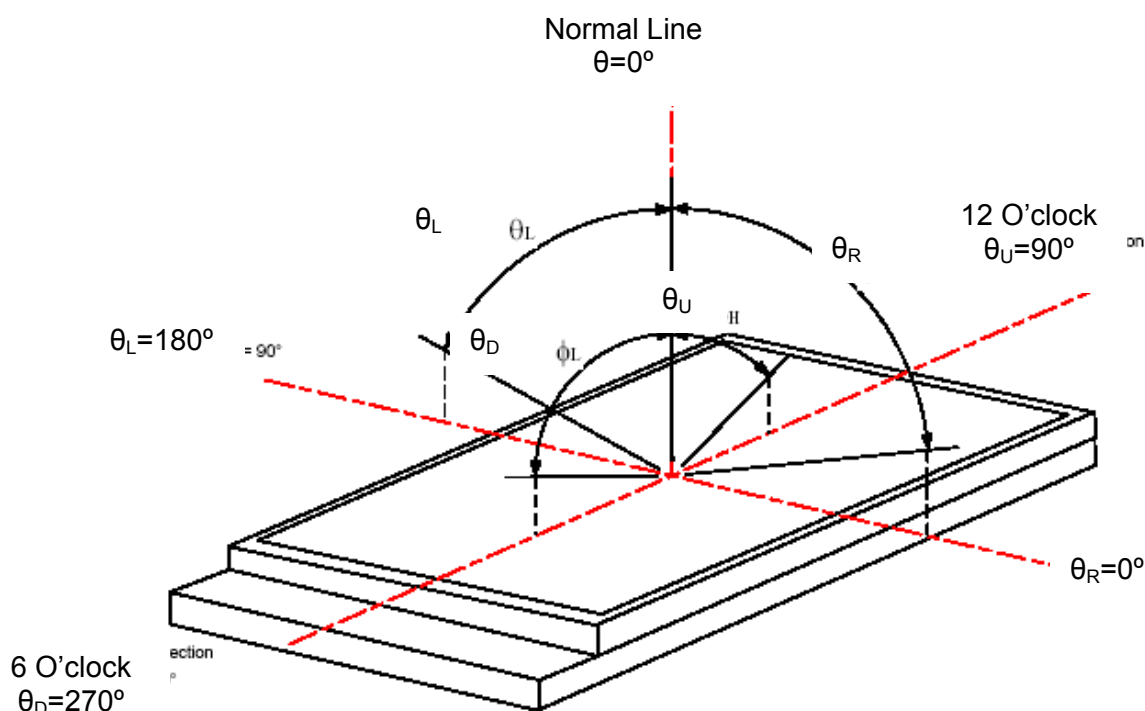
Measured on the center area of the panel by PR705 or BM-7A.

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a = +25^{\circ}\text{C}$.
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel after more than 10 minutes while backlight turning on.



Note 2 Definition of viewing angle range and measurement system



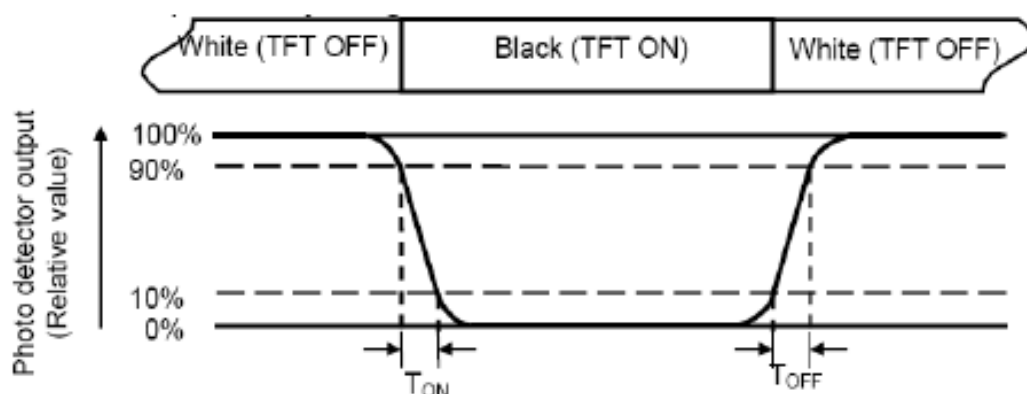
Note 3 Definition of the contrast ratio

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is White}}{\text{Luminance When LCD is Black}}$$

Contrast Ratio is measured in optimum common electrode voltage

Note 4 Definition fo Response time(for normally white LCD ,Test LCD using DMS501 or LCD-5200)

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(T_{OFF}) and from “white” to “black”(T_{ON}), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 5 Definition of color chromaticity(CIE1931)

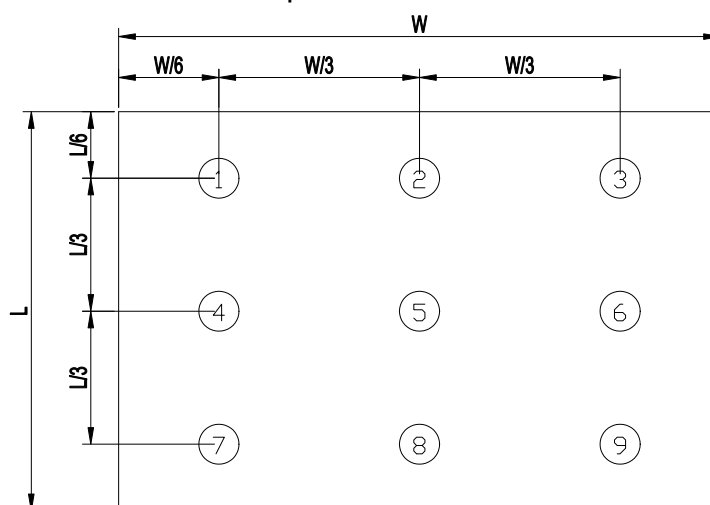
Color coordinates measured at center point of LCD.

Note 6 Definition of Luminance Uniformity

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (Lu)} = \frac{\text{Minimum luminance from ① to ⑨}}{\text{Maximum luminance from ① to ⑨}}$$

The luminance is measured near the 9 points in Active Area shown below.

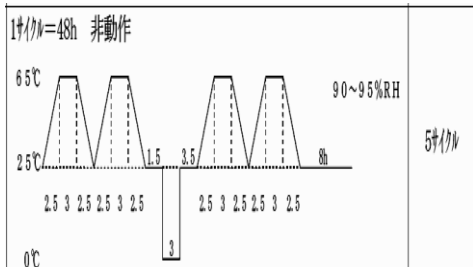


Note 7 Definition of Luminance

Measure the luminance of white state at the center point.

7. Reliability Test

7.1 Content of Reliability Test

No	Test Item	Test condition	Criterion
1	High Temperature Storage	90°C±2°C 240H RH≤45% Restore 2H at 25°C Power off	luminance change <±30%, CR change <50%, Color coordinate tolerance <0.05
2	Low Temperature Storage	-40°C±3°C 240H Restore 2H at 25°C Power off	luminance change <±30%, CR change <50%, Color coordinate tolerance <0.05
3	High Temperature Operation	85°C±2°C (panel surface) 240H RH≤45% Restore 2H at 25°C Power on	Turn on B/L Turn on LCD, luminance change <±30%, CR change <50%, Color coordinate tolerance <0.05
4	Low Temperature Operation	-30°C±2°C 240H Restore 4H at 25°C Power on	Turn on B/L Turn on LCD, luminance change <±30%, CR change <50%, Color coordinate tolerance <0.05
5	High Temperature & Humidity Storage	60°C±2°C 90±2%RH 240H	luminance change <+30%, CR change <50%, Color coordinate tolerance <0.05
7	Temperature Cycle	-30°C→ change→+80°C 30min 5min 30min 100cycle Power off	luminance change <±50%, CR change <50%, Color coordinate tolerance <0.05
8	Temperature & Humidity Cycle	 <p>The graph shows a temperature cycle between 65°C and 25°C with a dwell time of 1.5h at 25°C. The humidity is maintained at 90~95%RH. The cycle is repeated 5 times. The total test time is 48h. The test is performed with the device in a non-operating state (非動作).</p>	luminance change <±30%, Response time change <±50%, Power current <+100%, CR change <50%, Color coordinate tolerance <0.05

9	Shock Test	Half Sine Wave 100G 6ms, ±X, ±Y, ±Z 3 times for each direction, Power off	After this test has been done, the specimen should function normally without any fatal defect (no picture, line defect, out of synchronization)
10	ESD	C=150pF±10%, R=330Ω±10% 5 point/panel surface Contact discharge: ±4kV, 5 times Air discharge: ±8kV, 5 times C=200pF, R=0Ω, ±200V FPC terminal 3 times, non-operation. (Environment: 15°C~35°C, 30%~60% RH, 86Kpa~106Kpa)	In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
11	Drop Test (package state)	800mm, concrete floor, 1 corner, 3 edges, 6 sides each time	1. After testing, cosmetic and electrical defects should not happen. 2. the product should remain at initial place 3. Product uncover or package broken is not permitted.
12	Vibration Test	Frequency: 10Hz-150Hz-10Hz, Amplitude: 1.5mm, Sweep Time: 11min, Gravity 34.3m/s ² (3.5G) Test Period: 3.5 hours for each direction of X, Y, Z Power off	After this test, the specimen should function normally without any fatal defect (no picture, line defect, out of synchronization)
13	Static load	Press the centre of panel with panometer. contact diameter φ=15mm, Pressure: 5×9.8N (=5kgf), 1 time, non-operation	Show no unusual features.
14	Low atmospheric pressure Test	50,000 Pa, 2 hours, non-operation	After test, display normally, operation normally
15	FPC peeling test	Peeling the FPC terminal with 500g force from angle +/−90°, non-operation	After test, display normally, operation normally

Notes:

1 The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample shall be free from defects:

- 1) Air bubble in the LCD;
- 2) Sealleak
- 3) Non-display

4) Missing segments

5) Glass crack

2. Each test item applies for a test sample only once, the test sample cannot be used again in any other test item.

3. The test sample is inspected after 2 hours or more storing at room temperature and room humidity after each test item is finished.

4. For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

5. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part. Using ionizer (an antistatic blower) is recommended at working area in order to reduce electro-static voltage. When removing protection film from LCM panel, peel off the tag slowly (recommended more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

6. Temperature range based on Daxon automotive polarizer.

7. Polarizer test criteria

a. when testing avoid samples take out then return, It can cause water coagulation in Polarizer. Increase the distance of samples , And put samples before the wind.

b. When the samples are put into the test, put them upright so that the glasses keep spaces between them each other. (Fig.7)

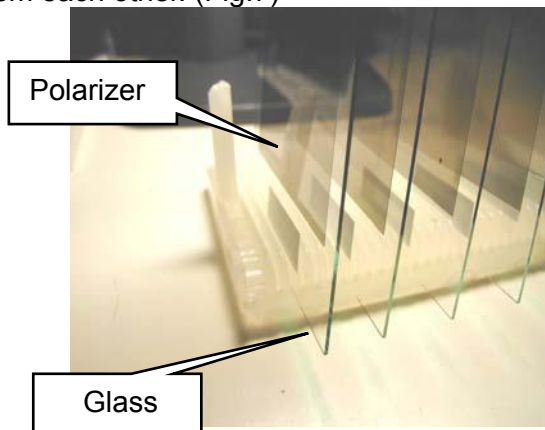


Fig.7

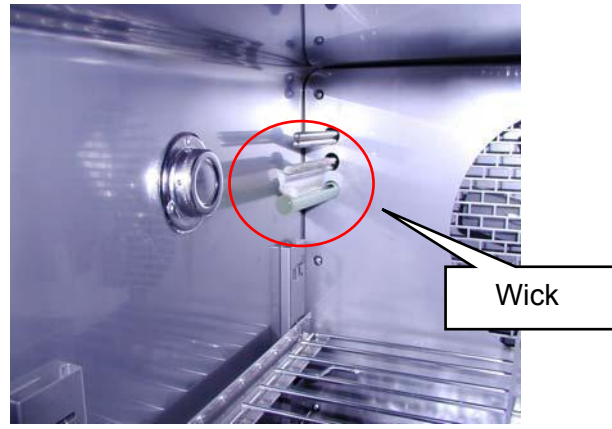


Fig.8

c. Put samples into testing machine as small as possible so that it is drafty.

d. Do not put samples under wick because water will fall.(Fig.8)

e. Do not open testing machine except for taking them out in order to prevent moisture condensation.

Pin	Symbol	Pin	Symbol
1	VDD	1	VDD
2	VDD	2	VDD
3	VDD	3	VDD
4	VDD	4	VDD
5	VDD	5	VDD
6	VDD	6	VDD
7	VDD	7	VDD
8	VDD	8	VDD
9	VDD	9	VDD
10	VDD	10	VDD
11	VDD	11	VDD
12	VDD	12	VDD
13	VDD	13	VDD
14	VDD	14	VDD
15	VDD	15	VDD
16	VDD	16	VDD
17	VDD	17	VDD
18	VDD	18	VDD
19	VDD	19	VDD
20	VDD	20	VDD
21	VDD	21	VDD
22	VDD	22	VDD
23	VDD	23	VDD
24	VDD	24	VDD
25	VDD	25	VDD
26	VDD	26	VDD
27	VDD	27	VDD
28	VDD	28	VDD
29	VDD	29	VDD
30	VDD	30	VDD
31	VDD	31	VDD
32	VDD	32	VDD
33	VDD	33	VDD
34	VDD	34	VDD
35	VDD	35	VDD
36	VDD	36	VDD
37	VDD	37	VDD
38	VDD	38	VDD
39	VDD	39	VDD
40	VDD	40	VDD
41	VDD	41	VDD
42	VDD	42	VDD
43	VDD	43	VDD
44	VDD	44	VDD
45	VDD	45	VDD
46	VDD	46	VDD
47	VDD	47	VDD
48	VDD	48	VDD
49	VDD	49	VDD
50	VDD	50	VDD
51	VDD	51	VDD
52	VDD	52	VDD
53	VDD	53	VDD
54	VDD	54	VDD
55	VDD	55	VDD
56	VDD	56	VDD
57	VDD	57	VDD
58	VDD	58	VDD
59	VDD	59	VDD
60	VDD	60	VDD

9. Product Inspection Criteria

9.1 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the inspection period) at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller, If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regards as acceptance.

Should the customer fail to notify the seller within the inspection period, the buyers right to reject the modules. Shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

9.2 Inspection Sampling Method

- 10.2.1. Lot size: Quantity per shipment lot per model
- 10.2.2. Sampling type: Normal inspection, Single sampling
- 10.2.3. Inspection level: II
- 10.2.4. Sampling table: MIL-STD-105D
- 10.2.5. Acceptable quality level (AQL)
 - Major defect: AQL=0.65
 - Minor defect: AQL=1.00

9.3 Inspection Conditions

9.3.1 Ambient conditions:

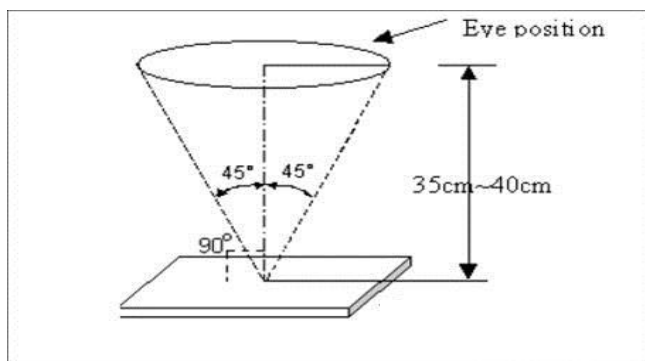
- a. Temperature: Room temperature $25\pm 5^{\circ}\text{C}$
- b. Humidity: $(60\pm 10)\ \% \text{RH}$
- c. Illumination: Under 300 LUX
- d. $I_{\text{BL}}=80*2=160\text{mA}$

9.3.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be at least 35~40 cm.

9.3.3 Viewing Angle

U/D: $45^{\circ}/45^{\circ}$, L/R: $45^{\circ}/45^{\circ}$



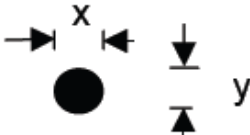
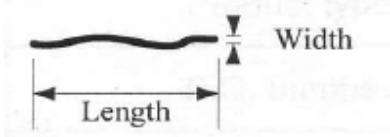
9.4 Inspection Criteria


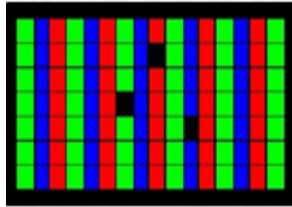
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

9.4.1 Major defect

Item No	Items to be inspected	Inspection Standard
1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
2	missing	Missing function component
3	Crack	Glass Crack

9.4.2 Minor defect

Item No	Items to be inspected	Inspection standard	
1	Spot Defect Including Black spot White spot Pin hole Foreign particle Polarizer dirt	For dark/white spot is defined $\varphi = (x + y) / 2$ 	
		Size φ (mm)	Acceptable Quantity
		$\varphi \leq 0.15$	Ignore
		$0.15 < \varphi \leq 0.30$	3
		$0.30 < \varphi \leq 0.40$	2
		$0.40 < \varphi$	Not allowed
2	Line Defect Including Black line White line Scratch	Define: 	
		Width(mm) Length(mm)	Acceptable Quantity
		$W \leq 0.02$	Ignore
		$0.02 < W \leq 0.05$ and $L \leq 5.0$	4
		$0.05 < W$	Not allowed

3	Polarizer Dent/Bubble	Size ϕ (mm)	Acceptable Quantity
		$\phi \leq 0.20$	Ignore
		$0.20 < \phi \leq 0.5$	3
		$0.5 < \phi$	0
4	Electrical Dot Defect	Bright and Black dot define:  	
		Inspection pattern: Full white, Full black, Red, green and blue screens	
		Item	Acceptable Quantity
		Black dot defect	5
		Bright dot defect	3
		Total Dot	5
5	Display non-uniformity	There should be no distinct non-uniformity visible through 2% ND filter.	
6	Residual image	Image shall disappear within 10 seconds after the same pattern is displayed for 5 seconds. (It should be checked with every 1,000pcs.)	

Note: 1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.

2. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

3. If any problems or doubts arise with the LCD, the customer and supplier will cooperate and make efforts to solve it with mutual confidence and respect.
Issues which is not defined in this criteria shall be discussed with both parties, customer and supplier, for the better solution.
4. The distance between black dot defects should be more than 5mm.

10. Precautions for Use of LCD Modules

10.1 Handling Precautions

- 10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
 - Water
 - Ketone
 - Aromatic solvents
- 10.1.6 Do not attempt to disassemble the LCD Module.
- 10.1.7 If the logic circuit power is off, do not apply the input signals.
- 10.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - 10.1.8.1 Be sure to ground the body when handling the LCD Modules.
 - 10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
 - 10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - 10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

- 10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 10.2.2 The LCD modules should be stored under the storage temperature range. the recommend condition is: Temperature : 0℃ ~ 40℃, Relatively humidity: ≤80%, and no more than 1 year.
- 10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

- 10.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

11. Packing Instruction (For reference)

