

To :

Date :

Product Specification **(Preliminary)**

Revision : 1.0

Model Name : LHH1025TPFA-2A

Product Type : TFT LCD Module

APPROVED SIGNATURE☐ Approved Product Specification only☒ Approved Product Specification and Samples

<u>Prepared By</u>	<u>Checked By</u>	<u>Approved By</u>

* This cover page is for your comments and signatures back

Rev.	Date	Description of change	Name
1.0	Nov, 12, 2021	Preliminary Product Specification was first released.	Ichi

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1.0 GENERAL DESCRIPTION

1.1 Introduction

This is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses low temperature poly-silicon TFT as a switching device with normal-black technology. It is composed of a TFT LCD panel, driver IC and back-light. The TFT LCD has a 10.25 inch with 1920 x 720 resolution and RoHS directive.

1.2 Features

- 10.25 (8:3 diagonal) inch configuration
- Landscape type
- Fail detect function
- Horizontal and vertical shift control function
- 16.7M LVDS (two port w/ VESA format)

1.3 Applications

- TFT LCD Monitor
- Industrial Application
- Amusement
- Vehicle

1.4 General information

Item	Specification	Unit
Diagonal Size	10.25	Inch
Resolution	1920 (H) x 720 (V)	pixels
Active area	243.65 (H) x 91.37 (V)	mm
Pixel pitch	0.1269 (H) x 0.1269 (V)	mm
Pixel Configuration	RGB Vertical Stripe	
Display mode	Normally Black	
Technology Type	LTPS w/ in cell	
NTSC	85 (Typ.) / 80 (Min.)	%
Timing Control Mode	DE mode	
Surface treatment	Glare w/ Hard-Coating (3H)	
Border (U/D/L/R)	3.5 / 11.13 / 3.5 / 3.5	mm
Back-light	White LED	
Outline Dimension	250.65 (H) x 106 (V) x 6.4 (D) (Typ.)	mm
Weight	202 +/- 5%	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Environment Absolute Rating

Item	Symbol	Min.	Max.	Time	Note
Operating Temperature	T _{opa}	-40°C	85°C	500 hrs	
Storage Temperature	T _{stg}	-40°C	90°C	500 hrs	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

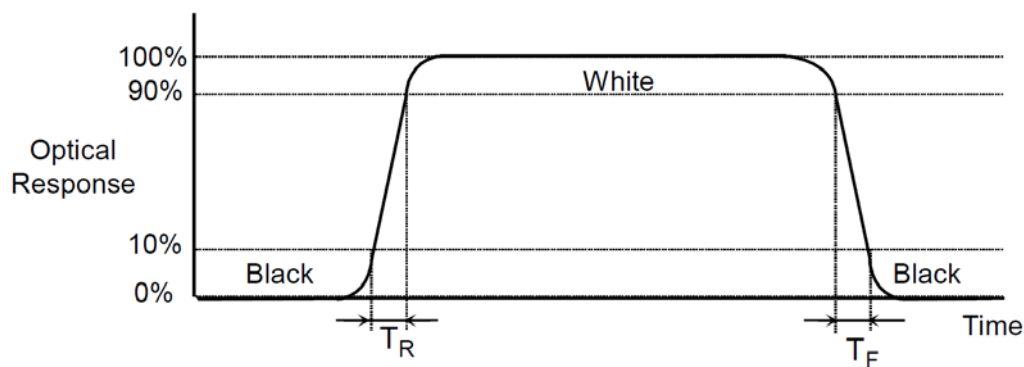
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	Center	1200	1500	-		1 3
Response time	25℃	T _R +T _F	Θ=0 Normal viewing angle	-	-	25	msec	4
	-20℃	T _R +T _F		-	-	200		
	-30℃	T _R +T _F		-	-	300		
Color chromaticity (CIE1931)	White	W _x		+/- 0.03	0.307 0.335 0.670 0.306 0.277 0.658 0.152 0.060	+/- 0.03		5 6 8
		W _y						
	Red	R _x						
		R _y						
	Green	G _x						
		G _y						
	Blue	B _x						
		B _y						
Viewing angle	Hor.	Θ _L	CR≥ 10	85	88	-		
		Θ _R		85	88	-		
	Ver.	Θ _U		40	-	-		
		Θ _D		40	-	-		
White Luminance		YL	25℃	800	1000	-	cd/m ²	2 / 9
Transmittance Uniformity		White	25℃	80	85	-	%	9
		Black	9 points	50	-	-		
Reflectivity		SCI	25℃	-	-	5.5	%	
Gamma		VESA	25℃	2.0	2.2	2.4	%	7

Note :

1. Contrast Ratio (CR) is defined mathematically as :
Measured area is defined as below.

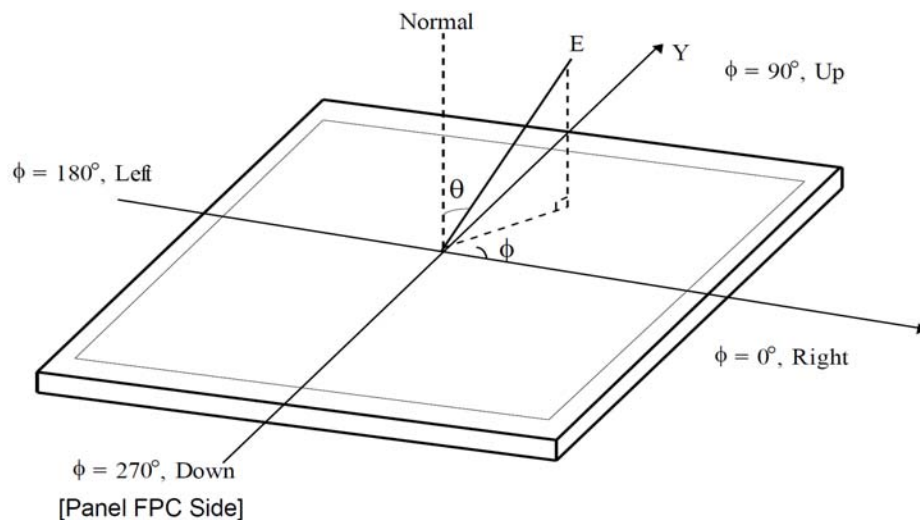
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Panel Transmittance is determined after the unit has been turned on and more than 15minutes after lighting the backlight in a dark environment at $25 \pm 2^\circ\text{C}$.
Panel Transmittance is the transmittance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white.
3. Response time is obtained by measuring the transition time of photo detector output, when input signals are applied to make center point "black" and "white".
4. Low temperature response time measure method :
The LCD panel has remained at low temperature(-20°C or -30°C) for 30 minutes and then kept turning on for 30 minutes before measured.
This is a part of design warranty.
No additional management will be fulfilled for this in mass production.

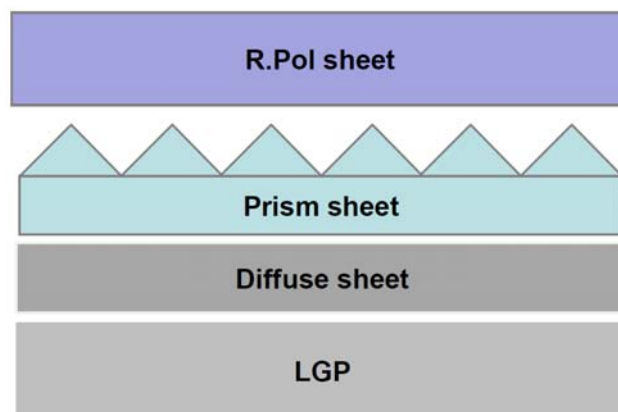


5. All of Electro-optical characteristics are measured by illuminant "C" as defined by the International Commission on illumination.

6. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface.

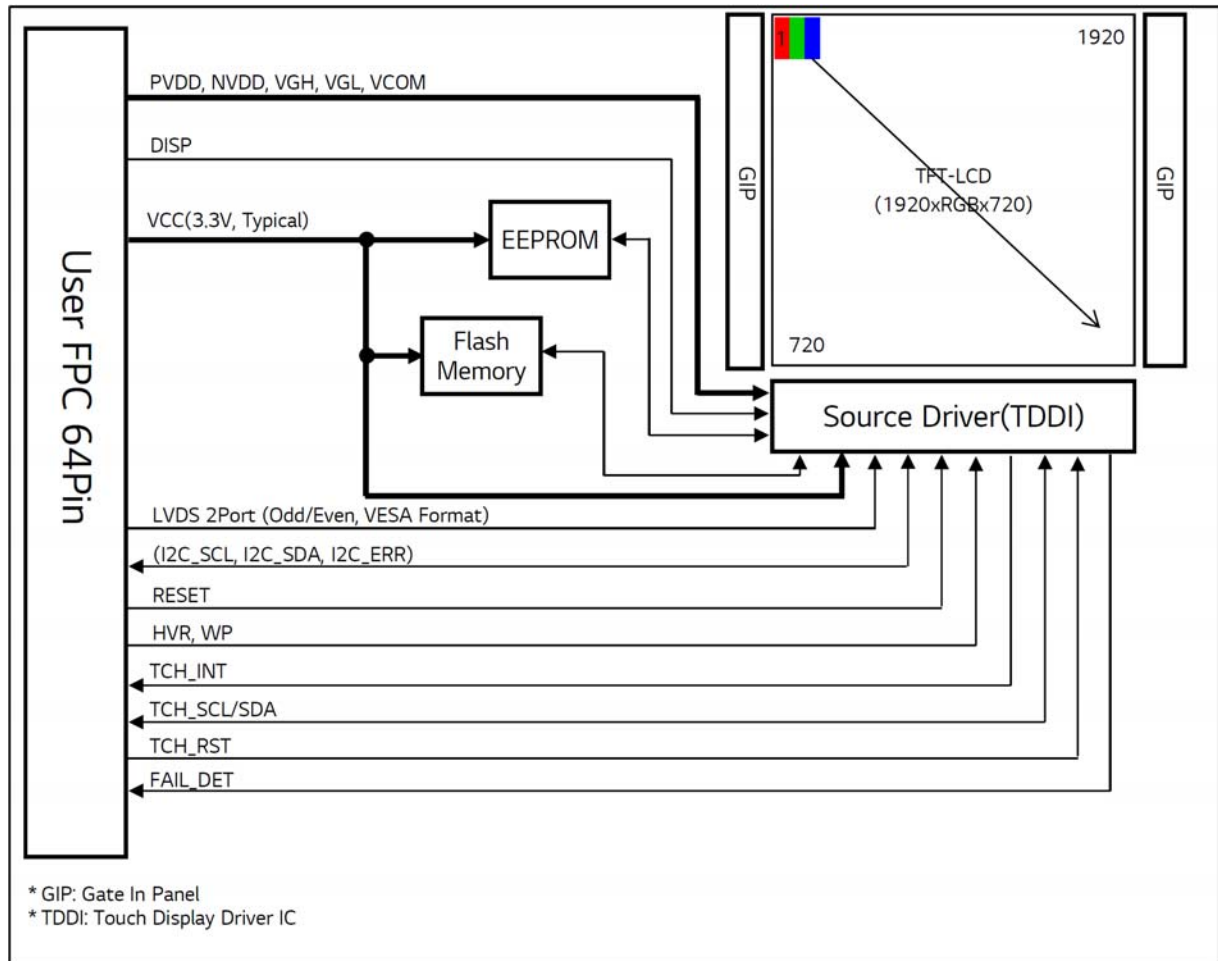


7. Gamma is measured and evaluated according to " information display measurements standard " version 1.03
(Society for Information Display, 2012-06-01)
- Measurements: Log-Log fitting method 9point
255Gray, 223Gray, 191Gray, 159Gray, 127Gray, 95Gray, 63Gray, 31Gray, 0Gray
8. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface.
9. This measurement items are measured with BLU using internal stack-up below.



4.0 BLOCK DIAGRAM

4.1 TFT LCD Module:



5.0 INTERFACE PIN CONNECTION

5.1 FPC Pin Assignment:

The electronics interface connector is a model F31L-1B7H manufactured by AORORA or equivalent.

NO.	Symbol	I/O	Description
1	NC	-	No connection
2	VCOM	I	Common Voltage (-0.02V, Typical)
3	NC	-	No connection
4	VGL	I	Gate Low Voltage (-8V, Typical)
5	NC	-	No connection
6	VGH	I	Gate High Voltage (11V, Typical)
7	NC	-	No connection
8	VCC	I	LCD Power Supply Voltage (+3.3V, Typical)
9	VCC	I	LCD Power Supply Voltage (+3.3V, Typical)
10	NC	-	No connection
11	PVDD	I	Positive Analog Voltage (6V, Typical)
12	PVDD	I	Positive Analog Voltage (6V, Typical)
13	NC	-	No connection
14	NVDD	I	Negative Analog Voltage (-6V, Typical)
15	NVDD	I	Negative Analog Voltage (-6V, Typical)
16	NC	-	No connection
17	GND	-	Ground
18	TCH_INT	O	Interrupt Signal for Touch
19	TCH_SCL	I	I2C Clock for Touch
20	TCH_SDA	I	I2C Data for Touch
21	TCH_RST	I	Reset Signal for Touch
22	GND	-	Ground
23	WP	I	Write Protection of internal EEPROM (H : Protection, L : Write)
24	FAIL_DET	O	Failure Detect Pin
25	HVR	I	Horizontal and Vertical Reverse
26	RESET	I	Reset Signal for LCD
27	NC	-	No Connection (LGD Internal Test Pin : BIST, Active High)
28	GND	-	Ground
29	DISP	I	Display Control Signal
30	NC	-	No Connection (LGD Internal Test Pin, I2C Checksum Error signal)
31	NC	-	No connection
32	NC	-	No connection

NO.	Symbol	I/O	Description
33	GND	-	Ground
34	RDP_O	I	Positive LVDS differential data Input for odd pixel (D+)
35	RDM_O	I	Negative LVDS differential data Input for odd pixel (D-)
36	GND	-	Ground
37	RCLKP_O	I	Positive LVDS differential clock input for odd pixel (+)
38	RCLKM_O	I	Negative LVDS differential clock input for odd pixel (-)
39	GND	-	Ground
40	RCP_O	I	Positive LVDS differential data Input for odd pixel (C+)
41	RCM_O	I	Negative LVDS differential data Input for odd pixel (C-)
42	GND	-	Ground
43	RBP_O	I	Positive LVDS differential data Input for odd pixel (B+)
44	RBM_O	I	Negative LVDS differential data Input for odd pixel (B-)
45	GND	-	Ground
46	RAP_O	I	Positive LVDS differential data Input for odd pixel (A+)
47	RAM_O	I	Negative LVDS differential data Input for odd pixel (A-)
48	GND	-	Ground
49	RDP_E	I	Positive LVDS differential data Input for even pixel (D+)
50	RDM_E	I	Negative LVDS differential data Input for even pixel (D-)
51	GND	-	Ground
52	RCLKP_E	I	Positive LVDS differential clock input for even pixel (+)
53	RCLKM_E	I	Negative LVDS differential clock input for even pixel (-)
54	GND	-	Ground
55	RCP_E	I	Positive LVDS differential data Input for even pixel (C+)
56	RCM_E	I	Negative LVDS differential data Input for even pixel (C-)
57	GND	-	Ground
58	RBP_E	I	Positive LVDS differential data Input for even pixel (B+)
59	RBM_E	I	Negative LVDS differential data Input for even pixel (B-)
60	GND	-	Ground
61	RAP_E	I	Positive LVDS differential data Input for even pixel (A+)
62	RAM_E	I	Negative LVDS differential data Input for even pixel (A-)
63	GND	-	Ground
64	NC	-	No connection

Note :

1. All GND pins should be connected together.
2. FAIL_DET means LCD module status. Please refer below table.

Status	FAIL_DET
Normal	L
Failure	H

3. Display Direction as following pictures.

HVR	Display Image
Low (Regular Display)	
Hi (Horizontal and Vertical Inverted Display)	

4. Make sure that NC pins should be floated.
5. All VCC pins should be connected together.
6. WP pin is used for Write Protection. Internally WP should be pulled-up.
7. Please see the Appendix-I for more information about Equivalent Circuits.

6.0 ELECTRICAL CHARACTERISTICS

6.1 Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or damage to the LCD panel.

Parameter	Symbol	Value		Unit	Note
		Min.	Max.		
Digital Supply Voltage	VCC	-0.3	4.5	V	1
Analog Supply Voltage	PVDD	-0.3	7.0	V	
	NVDD	-7.0	0.3	V	
Gate Analog Voltage	VGH	-0.3	11.5	V	
	VGL	-8.5	-0.3	V	
Input Signal Voltage	V _{LVDS}	-0.3	2.5	V	2
	V _{CTRL}	-0.3	3.6	V	
Storage Temperature	T _{ST}	-40	90	°C	3
Operating Temperature	T _{OP}	-40	85	°C	3,4,5

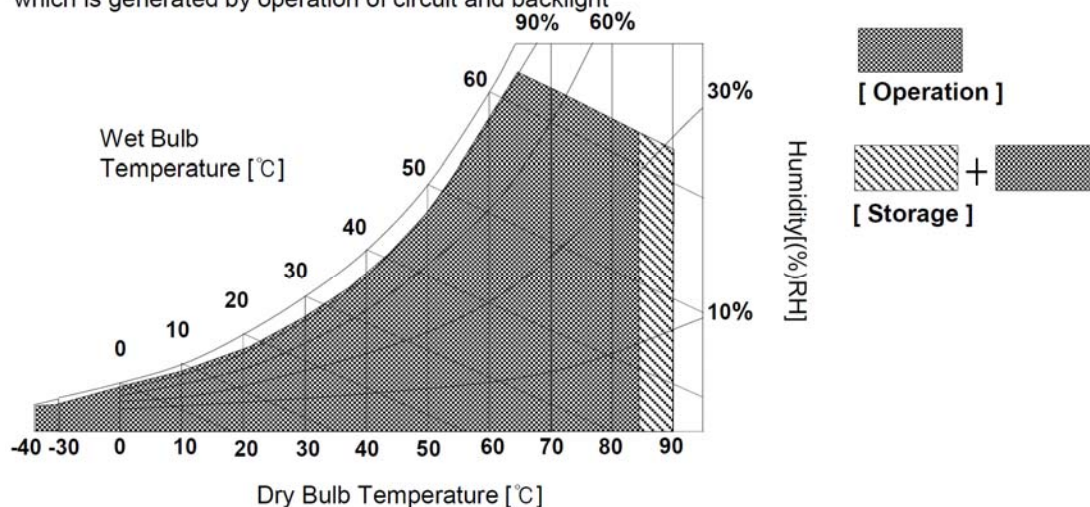
Note 1. The system should supply enough current for TFT LCD's stable operation at -40 ~ +85°C.

2. V_{LVDS}: LVDS input signal(RAxN/P_O/E, RBxN/P_O/E, RCxN/P_O/E, RCLKxN/P_O/E, RDxN/P_O/E)
V_{CTRL}: TCH_INT/SCL/SDA/RST, WP, HVR, RESET, I2C_ERR/SCL/SDA.

3. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be Max. 62°C. Condensation of dew must be avoided, because it may cause electrical current leakage, and deterioration of performance and quality.

4. The operating temperature is the temperature under which the LCD panel circuits operate normally.
All the contents of chapter 7 Electro-optical specifications are provided on the condition of the room temperature.

5. This temperatures here in are reference values for the ambient temperature with the heat which is generated by operation of circuit and backlight

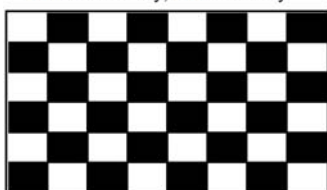


6.2 Electrical Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Source Driver	Digital Supply Voltage	VCC	3.0	3.3	3.6	V	
	Analog Supply Voltage(+)	PVDD	5.9	6.0	6.1	V	
	Analog Supply Voltage(-)	NVDD	-6.1	-6.0	-5.9	V	
Gate	Hi	VGH	10.9	11.0	11.1	V	
	Low	VGL	-8.1	-8.0	-7.9	V	
Common Voltage		VCOM	-0.32	-0.02	0.28	V	6
Digital Supply Voltage Current	Mosaic	I_{VCC}	-	95.0	123.0	mA	1
	White			94.0	122.0		
Source Driver Analog Voltage Current(+)		I_{PVDD}	-	32.0	41.0	mA	1
Source Driver Analog Voltage Current(-)		I_{NVDD}	-	32.0	41.0	mA	1
Gate High Voltage Current		I_{VGH}	-	5.0	6.5	mA	1
Gate Low Voltage Current		I_{VGL}	-	4.0	5.2	mA	1
Common Voltage Current		I_{VCOM}	-	0.1	0.2	mA	1
Power Consumption		PVCC	-	0.3	0.4	W	1, 2
Rush Current		IRUSH	-	-	0.2	A	3
Permissive input ripple					200	mVpp	
Input/Output Signal Voltage		V_H	$0.8 \cdot VCC$	-	VCC	V	4,5
		V_L	0	-	$0.2 \cdot VCC$	V	

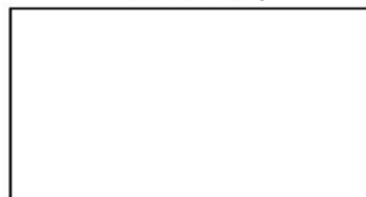
Note 1. The specified current and power consumption are under the VCC = 3.3V, Ta=25±2°C, fV = 60Hz condition where Mosaic Pattern(8x6) and white Pattern are displayed.

White: 255Gray, Black: 0Gray



Mosaic Pattern(8 X 6)

White : 255 Gray



White Pattern

2. $PVCC(Typ.) = IVCC(Typ.) \cdot VCC(Typ.)$, $PVCC(Max) = IVCC(Max) \cdot VCC(Typ.)$ where Mosaic Pattern.

3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min).
($VCC = 3.3V$, $T_a = 25 \pm 2^\circ C$, $f_v = 60Hz$)

4. TCH_INT, TCH_SCL, TCH_SDA, TCH_RST, WP, FAIL_DET, HVR, RESET.
HVR pins should be pulled-down to low internally.

5. The values indicate the ranges in which the device can operate normally.
Operation beyond the limit of the range is not assured, even though other operating conditions are within the limit of the maximum ratings.

6. VCOM adjustment method.

* Pattern : Flicker pattern (H1V1 Dot)

* VCOM adjustment temperature : $25^\circ C$

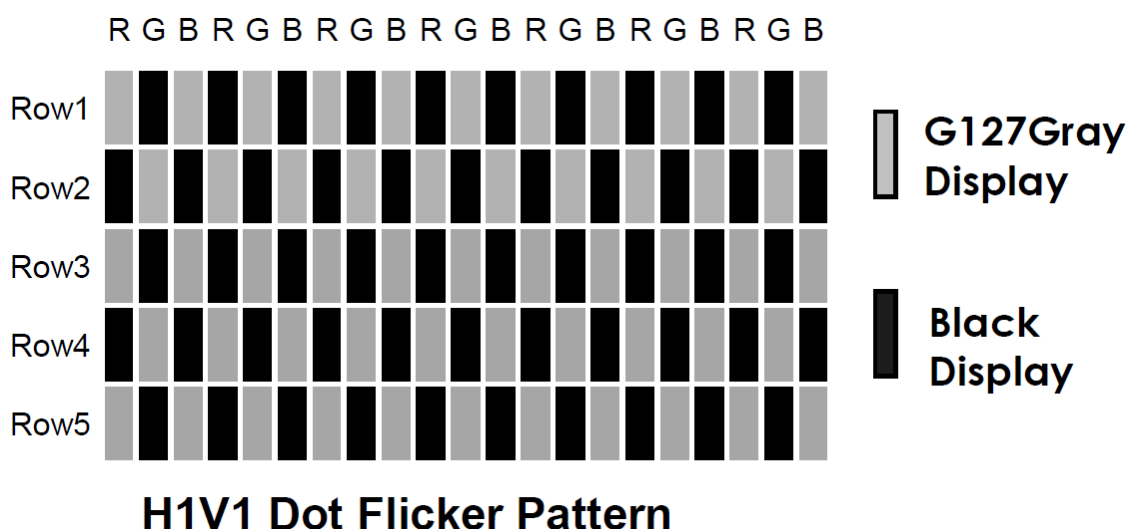
* Method

- Adjust the VCOM Voltage to the minimum flicker phenomenon.

- adjustment must be finished within 30 sec

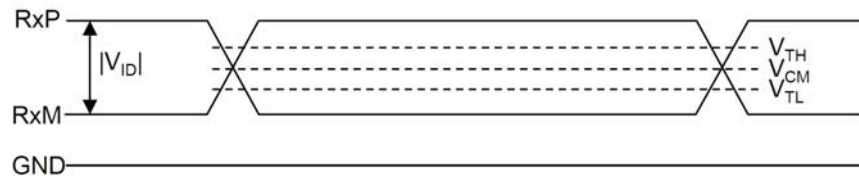
- Precaution : 1hr waiting after failed adjustment VCOM.

For remove remained panel DC charge



6.3 DC Characteristics

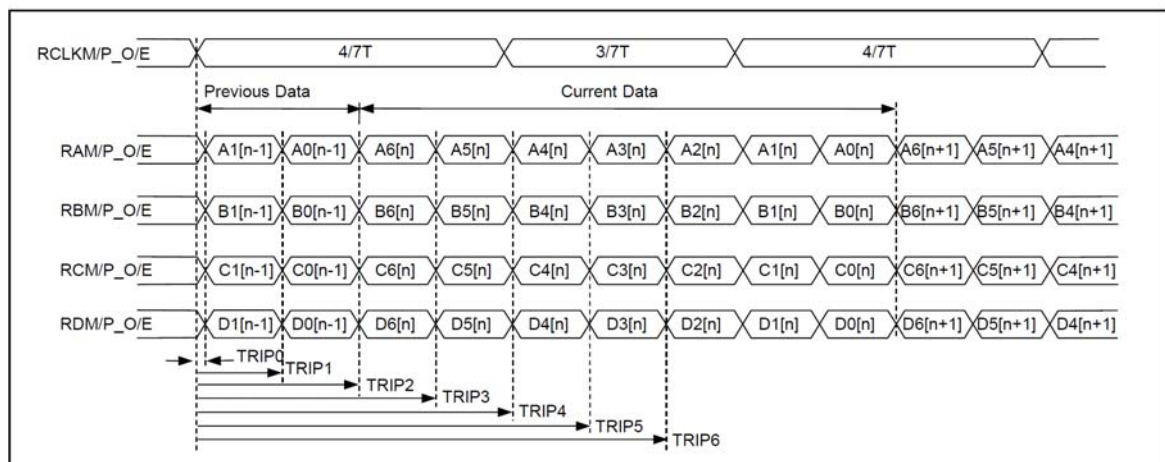
Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Differential Voltage	$ V_{ID} $	200	350	500	mV	1
LVDS Input Common Mode Voltage	V_{CM}	1.0	1.2	1.4	V	
Positive-going Input Threshold Voltage	V_{TH}	-	-	100	mV	
Negative-going Input Threshold Voltage	V_{TL}	-100	-	-	mV	



Note 1. All LVDS Rx termination resistor(100Ω) is integrated on the FPC.

6.4 AC Characteristics

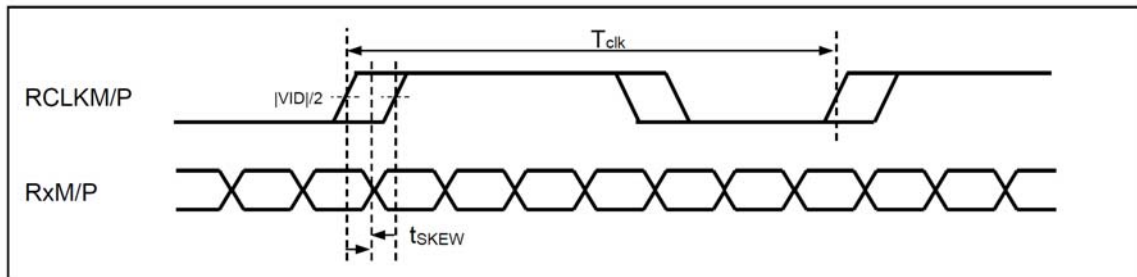
Parameter	Symbol	Min	Typ	Max	Unit
Input Data Position for Bit0	T_{RIP0}	-	0	-	ns
Input Data Position for Bit1	T_{RIP1}	-	$T/7$	-	ns
Input Data Position for Bit2	T_{RIP2}	-	$2T/7$	-	ns
Input Data Position for Bit3	T_{RIP3}	-	$3T/7$	-	ns
Input Data Position for Bit4	T_{RIP4}	-	$4T/7$	-	ns
Input Data Position for Bit5	T_{RIP5}	-	$5T/7$	-	ns
Input Data Position for Bit6	T_{RIP6}	-	$6T/7$	-	ns



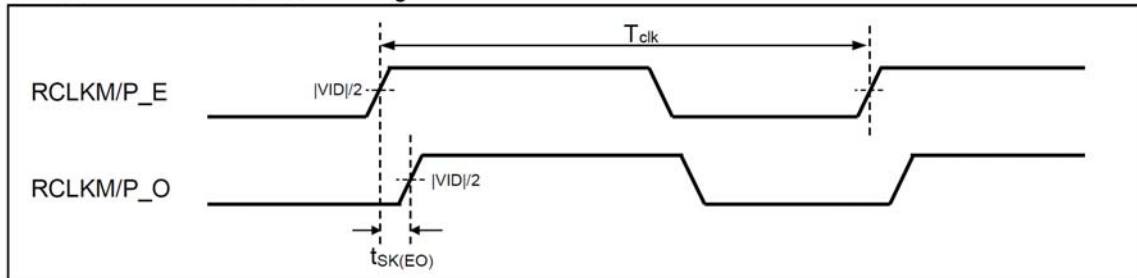
Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}	-300	-	+300	ps	1
Skew Even to Odd port	$t_{SK(E0)}$	-1/7	-	1/7	Tclk	2
Maximum deviation of input clock frequency during SSC	F_{DEV}	-	-	± 2.5	%	3
Maximum modulation frequency of input clock during SSC	F_{MOD}		-	150	KHz	

Note:

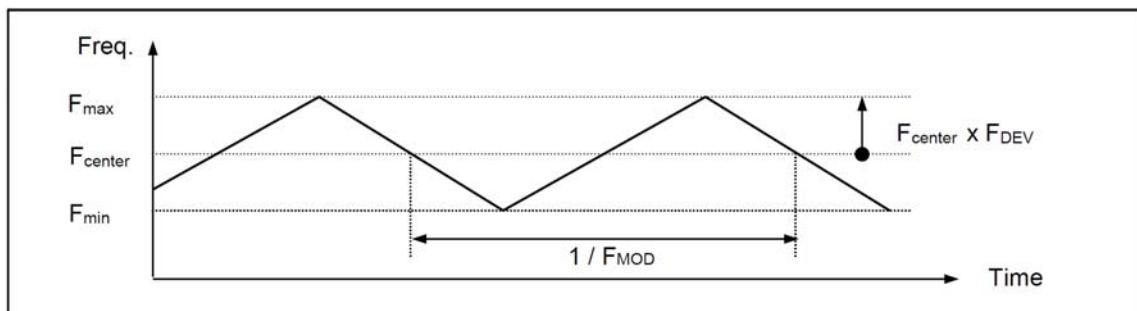
1. LVDS Clock to Data Skew Margin.



2. LVDS Clock Even to Odd Skew Margin.

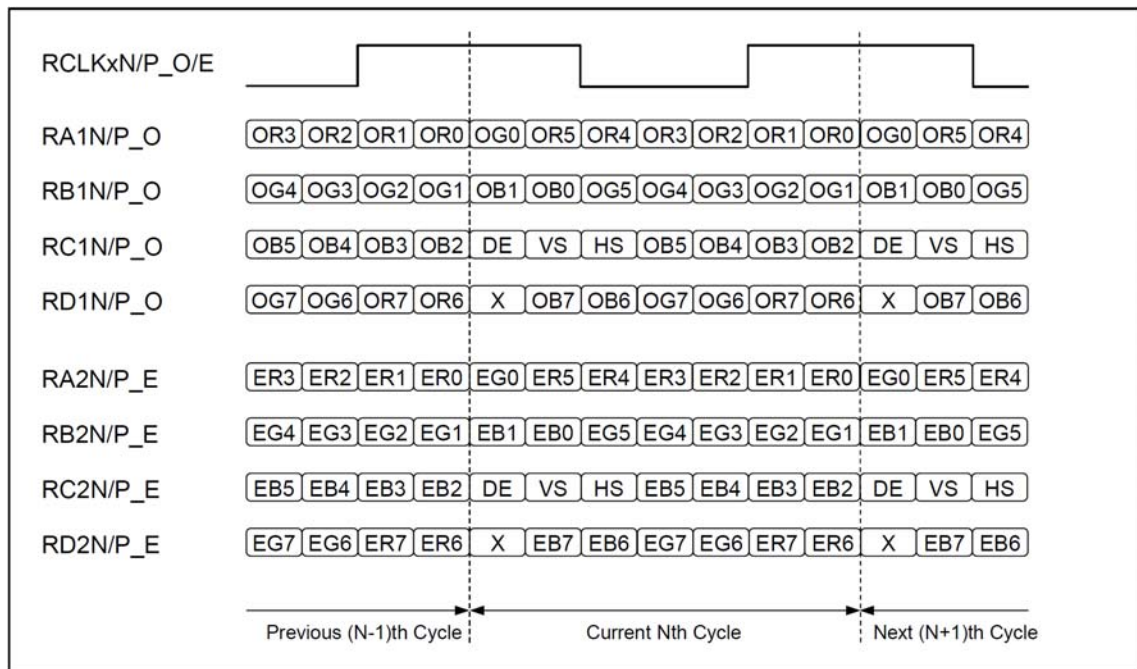


3. Spread spectrum



6.5 LVDS Bit assignment

LVDS 2Port 8Bit (VESA Format)



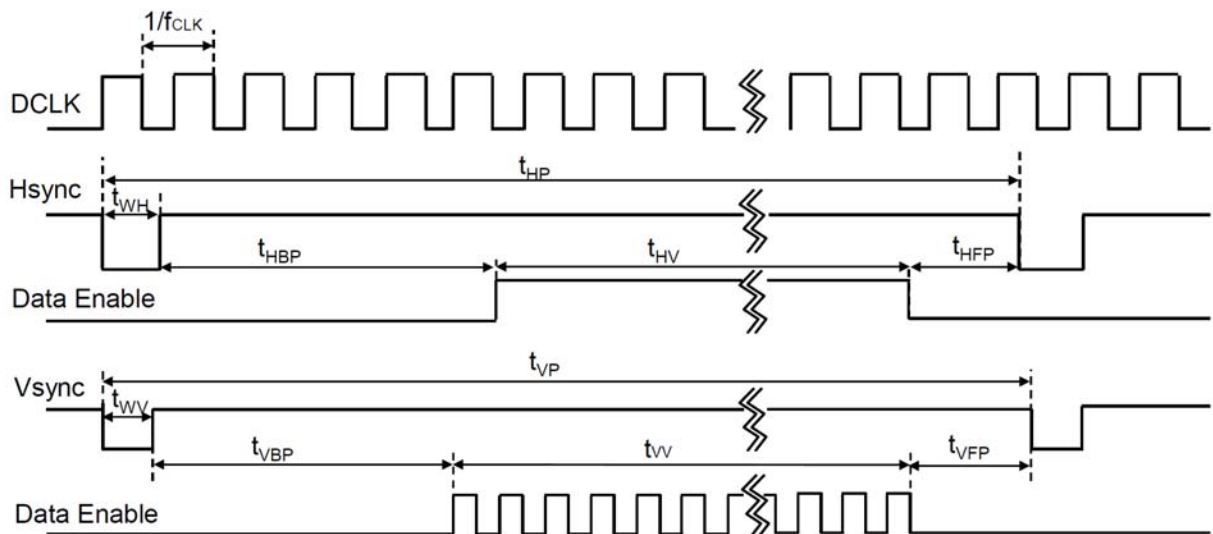
6.6 Signal Timing Specifications

Table shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Parameter		Symbol	Min	Typ	Max	Unit	Note
DCLK	Frequency	f _{CLK}	89.0 (44.5)	89.6 (44.8)	90.2 (45.1)	MHz	() 2port
	Period	t _{CLK}	11.09 (22.17)	11.16 (22.32)	11.24 (22.47)	ns	() 2port
HSYNC	Period	t _{HP}	2040 (1020)	2048 (1024)	2056 (1028)	t _{CLK}	() 2port, 2
	Width	t _{WH}	40 (20)	40 (20)	40 (20)		
	Horizontal Valid	t _{HV}	1920 (960)				() 2port
	Horizontal Back Porch	t _{HBP}	40 (20)	40 (20)	48 (24)		
	Horizontal Front Porch	t _{HFP}	40 (20)	48 (24)	48 (24)		
VSYNC	Period	t _{VP}	727	729	732	t _{HP}	
	Width	t _{WV}	2	2	2		
	Vertical Valid	t _{VV}	720				
	Vertical Back Porch	t _{VBP}	2	2	2		
	Vertical Front Porch	t _{VFP}	3	5	8		

Note 1. The electro-optical performance may be influenced by variance of the vertical refresh rates.

2. It should be set to an even number for 2port.



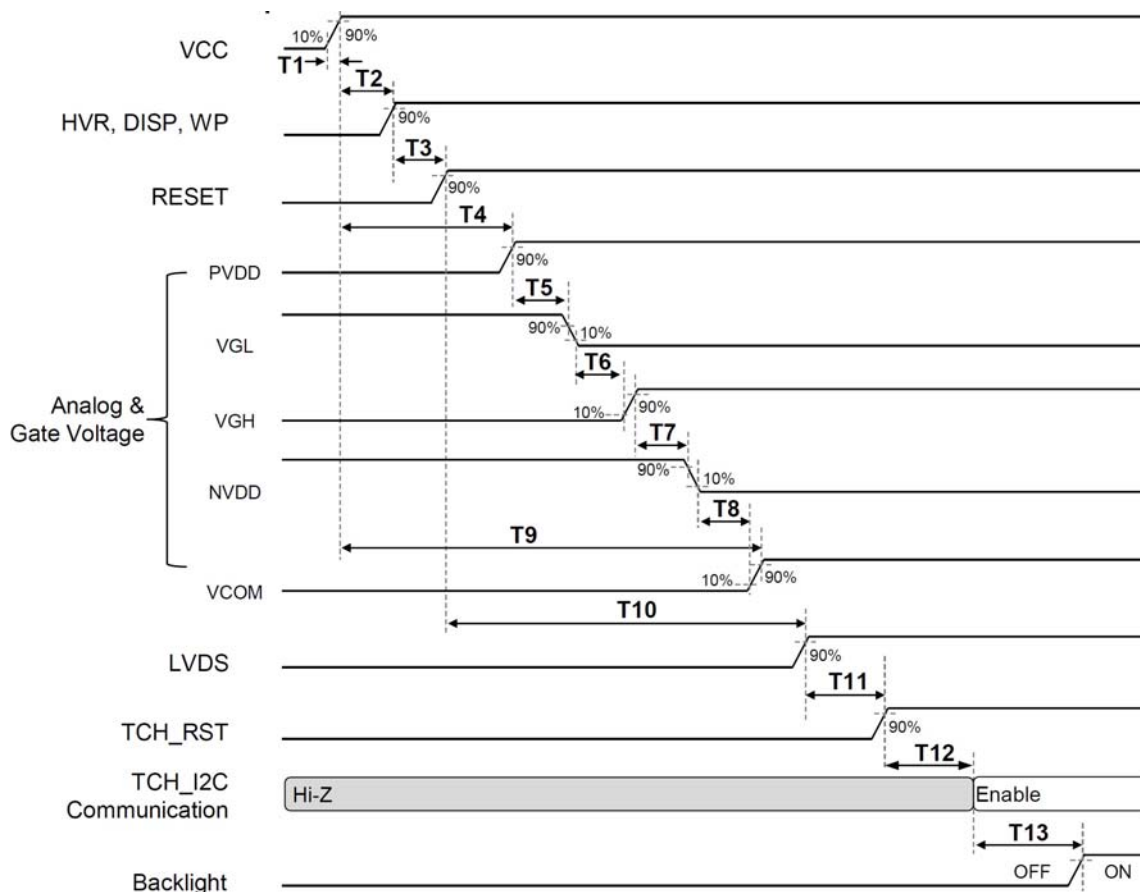
6.7 Color Data Reference

The brightness of each primary color (red, green, blue) is based on the 8bit gray scale data input for the color.

The higher binary input, the brighter the color. Table provides a reference for color versus data input as below.

Color		Input Color Data																							
		RED								GREEN								BLUE							
		MSB				LSB				MSB				LSB				MSB				LSB			
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...	...								...								...							
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN	GREEN (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN (01)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
...		...								...								...							
GREEN (254)		0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		0	0	0	0	0	0	0	0
GREEN (255)		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		0	0	0	0	0	0	0	0
BLUE		BLUE (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	...	...								...								...							
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6.8 Power On Sequence



Parameter	Value			Unit	Note
	Min	Typ	Max		
T1	0	-	5	ms	
T2	0	-	10	ms	
T3	1	-	10	ms	
T4	1	-	-	ms	
T5	1	-	-	ms	
T6	1	-	-	ms	
T7	1	-	-	ms	
T8	1	-	-	ms	
T9	10	-	100	ms	
T10	120	-	-	ms	
T11	17	-	-	ms	
T12	120	-	-	ms	
T13	700	-	-	ms	5

Note 1. Please avoid floating state of all input signals.

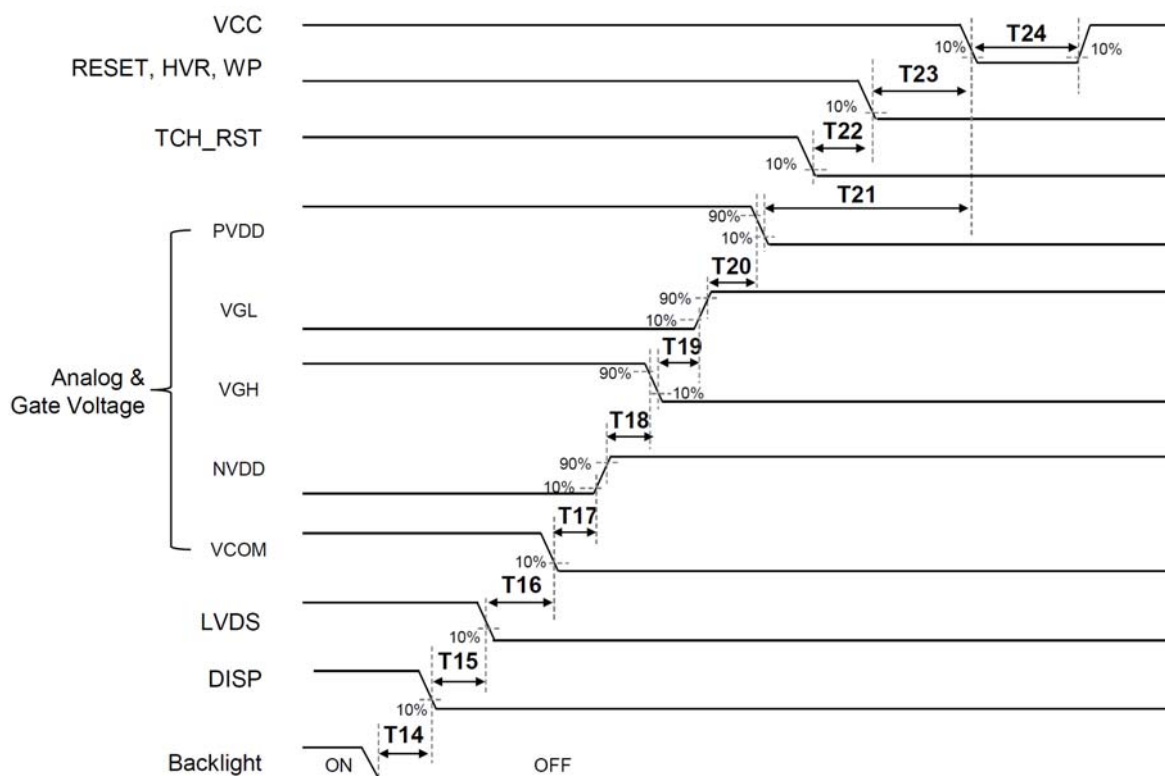
2. When the interface signal is invalid, be sure to pull down the power supply for VCC to 0V.

3. When Power On Sequence or during operation, interface signal is not allowed momentary off or abnormal waveform.

4. The On Sequence should meet PVDD → VGL → VGH → NVDD → VCOM.

5. Backlight must be turn on after power supply for LCD and interface signal are valid.

6.9 Power Off Sequence



Parameter	Value			Unit	Note
	Min	Typ	Max		
T14	5	-	-	ms	2
T15	0	-	-	ms	
T16	34	-	200	ms	
T17	1	-	1000	ms	
T18	1	-	1000	ms	
T19	1	-	1000	ms	
T20	1	-	1000	ms	
T21	10	-	1000	ms	
T22	0	-	1000	ms	
T23	10	-	1000	ms	
T24	1000	-	-	ms	1

Note 1. Power on Sequence must be observed to restart LCM after all power and signal off.

- Input Signal must be turn off after Backlight turn off to avoid the abnormal display.
- The Off Sequence should meet VCOM → NVDD → VGH → VGL → PVDD.
- If it is difficult to perform as our recommendation, customers are asked to confirm the Power sequence with LG Display prior to their use..

6.10 Touch Specifications

Item		Spec.	Note.
General Specification	Touch Panel Technology	Projected Capacitive Touch	
	Sensor Type	In-Cell	AIT
	Touch IC	SW17700A(TDDI)	Siliconworks
	Multi Touch Points	5 points	
	Active Touch Area [mm]	243.648 x 91.368	[mm]
	Finger Size (min.~max.)	9Φ (6~25Φ)	
	Interface	I2C	
	Touch Block	48ch by 18ch	
	F/W Version	V0.01	

General Specifications

Item			Unit	Spec.			Notes
				Min.	Typ.	Max.	
Touch Performance	Point Accuracy	Center	mm	-	-	1.0	8Φ Finger (w/o Glove)
		Edge	mm	-	-	2.0	
	Linearity	Center	mm	-	-	1.0	6Φ Finger (w/o Glove)
		Edge	mm	-	-	2.0	
	Finger Separation		mm	12	-	-	(6Φ center to center)

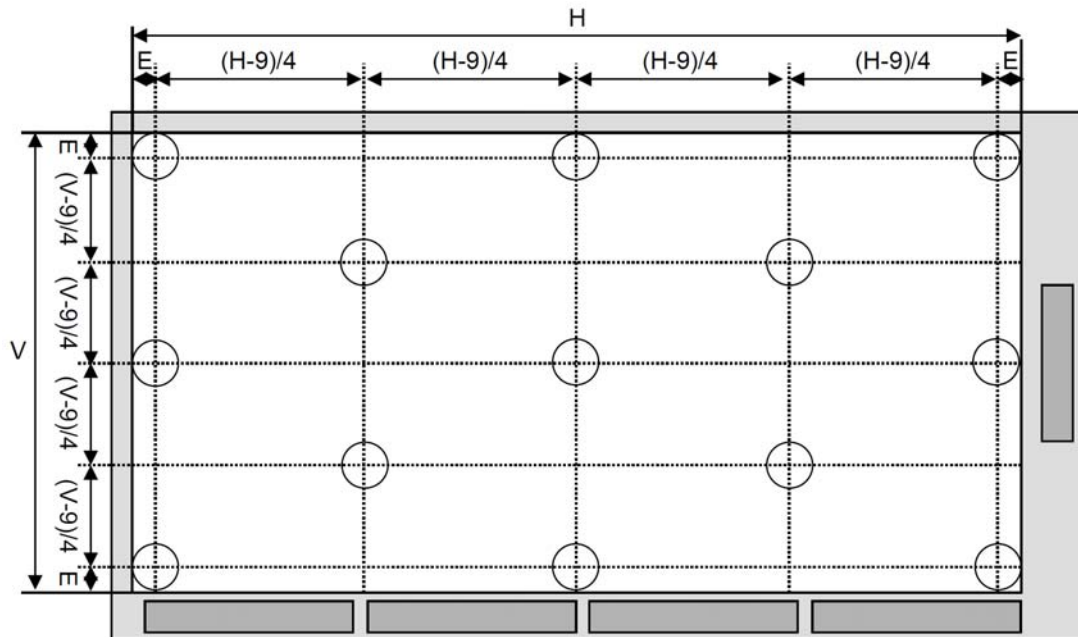
Touch Performance

Note 1. All kind of specifications and functions are optimized with the below Test condition.

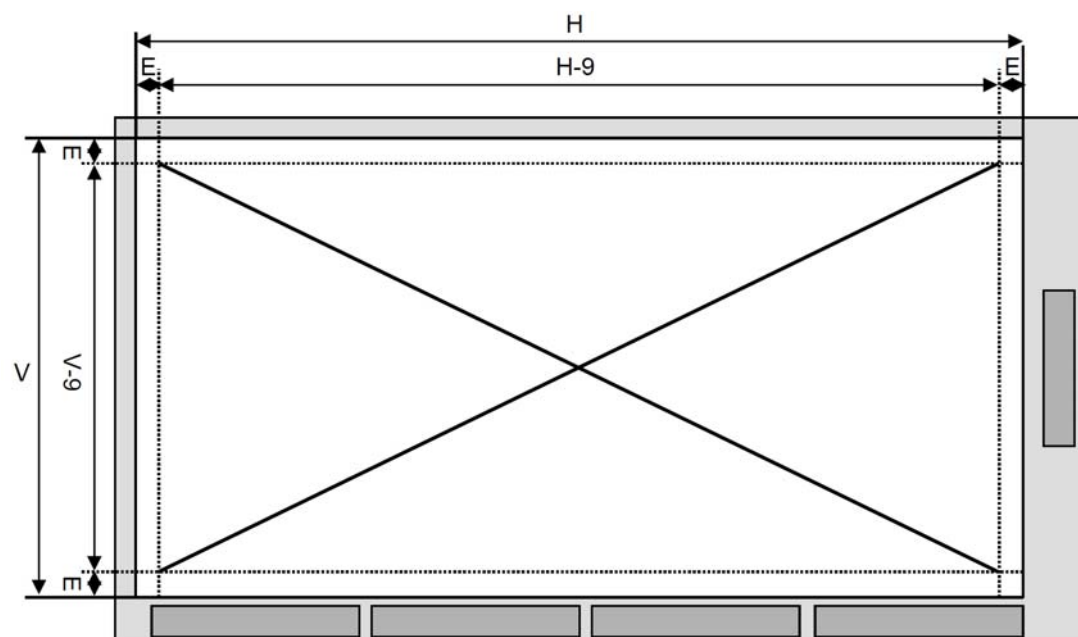
-. Report rate 60Hz@1-finger

Note 2. Touch Performance measurement

- Test Machine : MIK K9830RP
- Test Tip : 7Φ Slug
- E : 3.5mm(Test Tip Size/2)



Accuracy Test



Linearity Test

6.11 DC Characteristics Backlight Driving

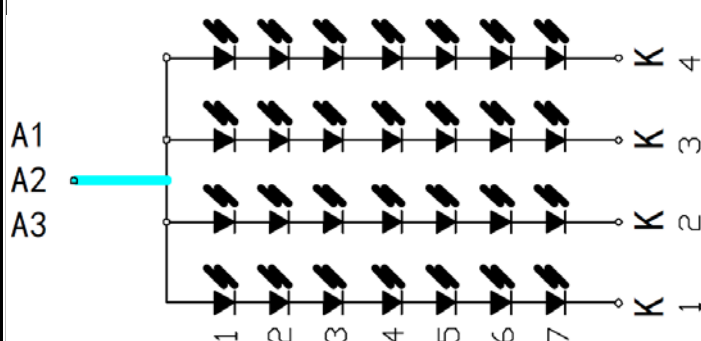
Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Current	I_F	-	300	-	mA	$T_a=25^{\circ}\text{C}$
LED Voltage	V_F	18.9	21	23.1	Volt	$T_a=25^{\circ}\text{C}$
LED Life-Time	N/A	20,000	--	--	Hour	$T_a=25^{\circ}\text{C}$ $I_F=75\text{mA}$

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm 3^{\circ}\text{C}$, typical I_L value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=300\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 300 mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit 7S4P =28 pcs LED

Note (4) LED temperature current curve, the temperature at 70 degree before the output Duty 100%, 70 degree C to 85 degree C when the linear drop to Duty 30%.



LED 电路图

村田: NCU15XH103F6SRC



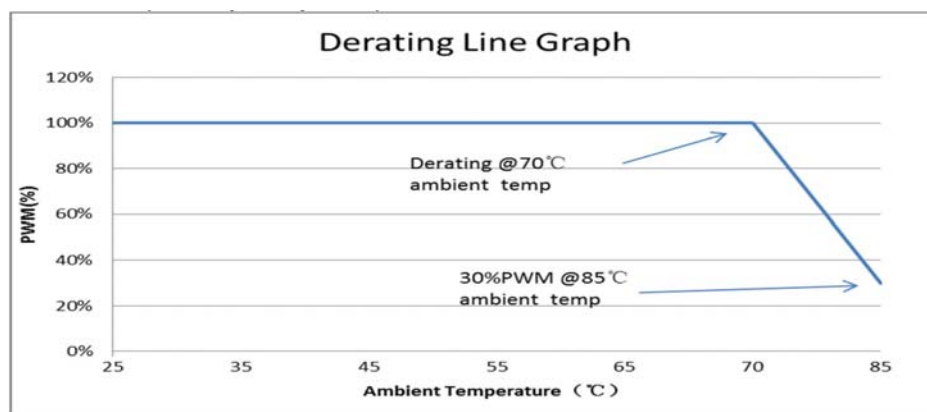
NTC 电路图

Pin assignment for Back light :

NO.	Symbol	Description
1	A1	Power LED anode power supply (+)
2	A2	Power LED anode power supply (+)
3	A3	Power LED anode power supply (+)
4	NC	No connection
5	NTC 1	Heat sensor (+)
6	NTC 2	Heat sensor (-)
7	K1	Power LED cathode power supply (-)
8	K2	Power LED cathode power supply (-)
9	K3	Power LED cathode power supply (-)
10	K4	Power LED cathode power supply (-)

NTC information :

Item	Value	Remark
Part number	NCU15XH103F6SRC	Murata
Resistance / Tolerance	10kΩ+/- 1%	Ta = 25°C
Permissive Operating Current (Max.)	0.31 mA	



Thermistor Description

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TEMP. (deg.C)	R-center (k ohm)	TEMP. (deg.C)	R-center (k ohm)	TEMP. (deg.C)	R-center (k ohm)	TEMP. (deg.C)	R-center (k ohm)	TEMP. (deg.C)	R-center (k ohm)
-40	195.652	-2	29.689	36	6.707	74	1.981	112	0.722
-39	184.917	-1	28.423	37	6.475	75	1.925	113	0.705
-38	174.845	0	27.219	38	6.253	76	1.870	114	0.688
-37	165.391	1	26.076	39	6.039	77	1.817	115	0.672
-36	156.513	2	24.988	40	5.834	78	1.766	116	0.656
-35	148.171	3	23.951	41	5.636	79	1.716	117	0.640
-34	140.330	4	22.963	42	5.445	80	1.669	118	0.625
-33	132.958	5	22.021	43	5.262	81	1.622	119	0.611
-32	126.022	6	21.123	44	5.086	82	1.578	120	0.596
-31	119.494	7	20.267	45	4.917	83	1.535	121	0.583
-30	113.347	8	19.450	46	4.754	84	1.493	122	0.569
-29	107.565	9	18.670	47	4.597	85	1.452	123	0.556
-28	102.116	10	17.926	48	4.446	86	1.413	124	0.544
-27	96.978	11	17.214	49	4.301	87	1.375	125	0.531
-26	92.132	12	16.534	50	4.161	88	1.338	126	0.519
-25	87.559	13	15.886	51	4.026	89	1.303	127	0.507
-24	83.242	14	15.266	52	3.896	90	1.268	128	0.496
-23	79.166	15	14.674	53	3.771	91	1.234	129	0.485
-22	75.316	16	14.108	54	3.651	92	1.202	130	0.474
-21	71.677	17	13.566	55	3.535	93	1.170	131	0.464
-20	68.237	18	13.049	56	3.423	94	1.139	132	0.454
-19	64.991	19	12.554	57	3.315	95	1.110	133	0.444
-18	61.919	20	12.081	58	3.211	96	1.081	134	0.434
-17	59.011	21	11.628	59	3.111	97	1.053	135	0.424
-16	56.258	22	11.195	60	3.014	98	1.026	136	0.415
-15	53.650	23	10.780	61	2.922	99	0.999	137	0.406
-14	51.178	24	10.382	62	2.834	100	0.974	138	0.397
-13	48.835	25	10.000	63	2.748	101	0.949	139	0.389
-12	46.613	26	9.634	64	2.666	102	0.925	140	0.381
-11	44.506	27	9.284	65	2.586	103	0.902	141	0.373
-10	42.506	28	8.947	66	2.509	104	0.880	142	0.365
-9	40.600	29	8.624	67	2.435	105	0.858	143	0.357
-8	38.791	30	8.315	68	2.364	106	0.837	144	0.350
-7	37.073	31	8.018	69	2.294	107	0.816	145	0.342
-6	35.442	32	7.734	70	2.228	108	0.796	146	0.335
-5	33.892	33	7.461	71	2.163	109	0.777	147	0.328
-4	32.420	34	7.199	72	2.100	110	0.758	148	0.322
-3	31.020	35	6.948	73	2.040	111	0.740	149	0.315

7.0 RELIABILITY TEST ITEMS

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta = +90°C, 500hrs	
2	Low Temperature Storage	Ta = -40°C, 500hrs	
3	High Temperature Operation	Ta = +85°C, 500hrs	
4	Low Temperature Operation	Ta = -40°C, 500hrs	
5	High Temperature and High Humidity (operation)	Ta = +60°C, 90%RH, 500hrs	
6	Thermal Cycling Test (Non operation)	-40°C(30min) → +85°C(30min), 100 cycles	
7	Static load	50N, 5S	
8	Shock Test (Non operation)	Half-Sine, 50G, 6ms, XYZ directions, 1/2 sin wave, Each directions to 10 times	
9	Electrostatic Discharge (operation)	R=330Ω,C=150pF, 5 points/panel Contact = ± 8 kV, class B; Air = ± 15 kV, class B; 1 time for each point.	
10	Image Sticking	Viewing distance : 35 cm Ambient illumination : 100 lux Ambient temperature : +65°C Light source condition : Full luminance Viewing angle : 0 degree Zone : Active area Pattern : 8x6 chess pattern(black & white) Burn in : 1 hours Judgment : after 3 min @ mid gray pattern Criteria : level 2	
11	Package drop test	Drop 1m	

Note 1 : There is no display function NG issue occurred,
all the cosmetic specification is judged before the reliability stress.

Note 2 : Use sample for only one reliability test.

Note 3 : In case of an abnormal display caused by discharge,
if it can recover to normal state after reset, it is considered "PASS".
The use of an ionizer (antistatic blower) is recommended during this test.
When removing the protection film from LCM,
do it at a slow speed (prefer more than one second)
and blow with ionizer toward the peeling face to minimize ESD
which may damage the electrical circuit

Note 4 : For duration test in the chamber :

- a. Keep a small distance between each sample
and don't place the samples close to the wall or the wick.
- b. During the test avoid moisture condensation on the polarizer.
- c. After taking the samples out of the chamber and returning to room temperature and humidity, wait at least two hours before inspecting and measuring data.
- d. Perform de-rating during high temperature, operation test.

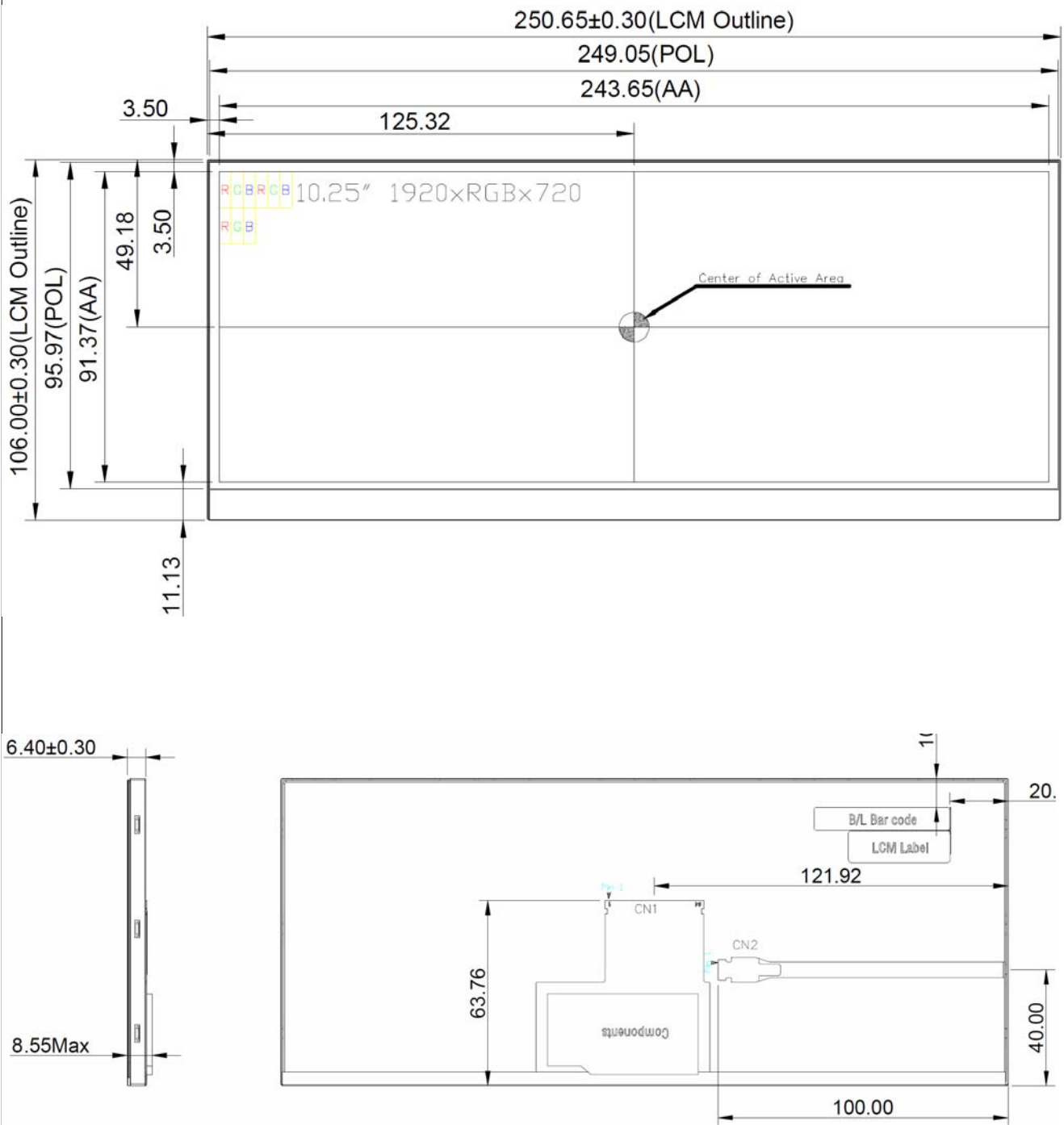
Note 5 : Level Definition :

Level	Description	Remark
L0	Completely invisible	For all distance and viewing angle
L1	Invisible from perpendicular viewing direction	For all distance
L2	Visible by a closer look	Invisible by 60cm distance and viewing angle
L3	Slightly Visible	60cm distance and viewing angle
L4	Prominent	60cm distance and viewing angle

Note 6 : LED forward current should follow the De-rating curve.

8.0 OUTLINE DIMENSION

General tolerance: $\pm 0.3\text{mm}$



9.0 Product Inspection Criteria

序号	缺陷名称	产品类别	缺陷大小判定		缺陷等级
			部品质量判定标准		
1	显示缺划、多划、乱码	A/B/C 类	不允许		C
2	显示模糊、重影、阴影	A/B/C 类	不允许		C
3	显示黑屏、花屏、白屏、绿屏、蓝屏、红屏	A/B/C 类	不允许		C
4	屏闪、灯闪	A/B/C 类	不允许		C
5	显示歪斜	A/B/C 类	不允许		C
6	LCD 屏显示亮点	A/B/C 类	D > 0.2		B
			① D≤0.10, 忽略不计, 点间距 10; ② 0.10<D≤0.2, N≤2, 间距≥10		C
7	LCD 屏显示黑点, 暗点	A/B/C 类	D > 0.3		B
			① D≤0.10, 忽略不计, 点间距 10; ② 0.10<D≤0.3, N≤2, 间距≥10		C
8	镜尘	A/B/C 类	D > 0.2 或 S > 0.03		B
			① D≤0.10, 忽略不计, 点间距 10; ② 0.10<D≤0.2,或 S≤0.03,N≤2, 间距≥10		C
9	显示屏/Lens 表面划伤、撞伤	A/B/C 类	不允许		C
	显示屏/Lens 表面划痕、刮花	A/B/C 类	L×W > 10×0.075		B
L×W≤10×0.075,N≤2,间距>15				C	
10	LCD 油墨区色差	A/B/C 类	不透光		C
11	边缘崩边, 缺角	A/B/C 类	W≤0.5 L≤0.4 仅限触摸屏		C

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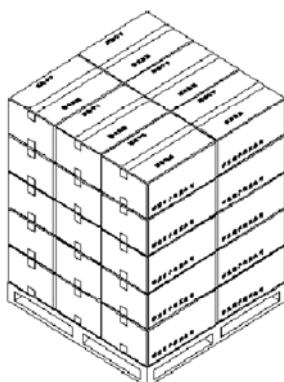
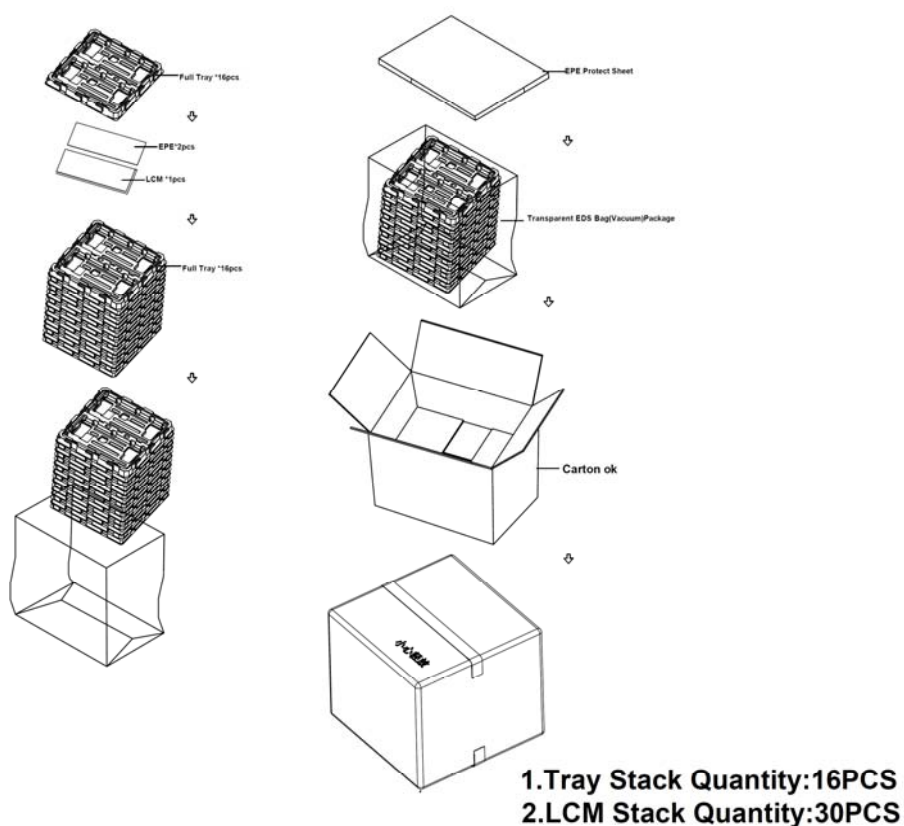
12	TFT 屏显示亮点 (像素点)	A/B/C 类	不允许		C
13	TFT 屏显示暗点 (像素点)	A/B/C 类	$N \leq 2$, 点间距 ≥ 50		C
14	600P(含)以下或 8 寸 (含) 以下: TFT 屏点状缺陷 (异物亮点、暗点, 背光异物、玻璃缺陷)	A/B/C 类	$D > 0.3$		B
			$D < 0.15$ 不计 (不可密集), 点间距 ≥ 10		C
			$0.15 \leq D \leq 0.3$, $N \leq 2$, 点间距 ≥ 50		C
15	600P(含)以下或 8 寸 (含) 以下: TFT 屏线状缺陷 (异物线、伤, 背光异物、玻璃缺陷、毛丝)	A/B/C 类	$L > 1.0$, $W > 0.05$		B
			$L \leq 0.5$, $W \leq 0.05$, $N \leq 2$, 点间距 ≥ 50		C
			$0.5 < L \leq 1.0$, $W \leq 0.05$, $N \leq 1$		C
16	720P (含) 以上且 8 寸 (含) 以上: 点状缺陷 (异物亮点、暗点, 背光异物、玻璃缺陷)	A/B/C 类	$D > 0.3$		B
			$D < 0.15$ 不计 (不可密集), 点间距 ≥ 10		C
			$0.15 \leq D \leq 0.3$, $N \leq 3$, 点间距 ≥ 50		C
17	720P (含) 以上且 8 寸 (含) 以上: 线状缺陷 (异物线、划伤, 背光异物、玻璃缺陷、毛丝)	A/B/C 类	$W > 0.05$		B
			$W \leq 0.01$, 不计 (不可密集), 点间距 ≥ 10		C
			$L \leq 3$, $0.01 \leq W \leq 0.05$, $N \leq 3$, 点间距 ≥ 50		C
18	保护膜气泡	A/B/C 类	$D > 5$, $N > 5$, 保护膜超出 TP/TFT 屏任何一边, 且保护膜贴于 TP/TFT 屏四边不均匀, 保护膜与 TP/TFT 屏单边 > 1		B
			$D \leq 5$, $N \leq 5$, 点间距 ≥ 10 , 保护膜不能超出 TP/TFT 屏任何一边, 且保护膜贴于 TFT 屏四边均匀, 保护膜与 TP/TFT 屏单边 ≤ 1		C
19	保护膜划痕/划伤	A/B/C 类	保护膜划伤(触摸到有手感), 折痕		B
			线状划痕未发白, 非片状		C

10.0 PACKAGE SPECIFICATION

10.1 Packing form

LCM Model	Qty. in the Box	Inner Box Size(mm)	Note
LHH1025TPFA-2A	30 pcs/Box	Ref. 370 x 365 x 280	--

10.2 Packing assembly drawings



Notes:
1.Pallet:30pcs Cartons
2.Carton:30pcs LCM
3.Pallet:900pcs LCM

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11.0 Precautions for Use of LCD Module

11.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.

11.1.2 If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.

11.1.3 Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.

11.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents :

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer.

Specifically, do not use the following :

- Water
- Ketone
- Aromatic solvents

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuitry is powered off, do not apply the input signals.

11.1.8 To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.

11.2 Storage precautions

11.2.1 When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2 The LCD modules should be stored within the rated storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is :

Temperature : 15~35 degree C (or at least Temp. 10~40 degree C / Humidity 25%~75%), for National Std. recommendation.

11.2.3 The LCD modules should be stored in a room without acid, alkali or other harmful gases.

11.3 Transportation Precautions

11.3.1 The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.