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LCD MODULE SPECIFICATION

Customer:**Model Name:****ET080WS01-Z1****Date:****2020/3/15****Version:****01**☐ Preliminary Specification☒ Final Specification**For Customer's Acceptance**

Approved by	Comment

Approved by	Reviewed by	Prepared by

Record of Revision

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1. General Specifications

No.	Item	Specification	Remark
1	LCD size	8.0 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	1024x3(RGB)x600	
4	Display mode	Normally White	
5	Dot pitch	0.1725(W)x0.1656(H)	
6	Active area	176.64(W)x99.36(H)mm	
7	Module size	192.80(W)x116.90(H)x6.40(D)mm	Note 1
8	Surface treatment	Plain	
9	Color arrangement	RGB-stripe	
10	View Direction(Gray Inversion)	6:00 O' Clock	
11	Interface	LVDS	
12	Backlight power consumption	3.744W (Typ.)	
13	Panel power consumption	TBD W(Typ)	
14	Weight	TBD g(Typ)	

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

2.1. TFT LCD Panel Driving Section

FPC Connector is used for the module electronics interface. The recommended model is FH12A-40S-0.5SH manufactured by Hirose.

Pin No.	Symbol	I/O	Function	Remark
1	VCOM	P	Common Voltage	
2	VDD	P	Power Voltage for digital circuit	
3	VDD	P	Power Voltage for digital circuit	
4	NC	---	No connection	
5	Reset	I	Global reset pin	
6	STBYB	I	Standby mode, Normally pulled high STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z	
7	GND	P	Ground	
8	RXIN0-	I	- LVDS differential data input	
9	RXIN0+	I	+ LVDS differential data input	
10	GND	P	Ground	
11	RXIN1-	I	- LVDS differential data input	
12	RXIN1+	I	+ LVDS differential data input	
13	GND	P	Ground	
14	RXIN2-	I	- LVDS differential data input	
15	RXIN2+	I	+ LVDS differential data input	
16	GND	P	Ground	
17	RXCLKIN-	I	- LVDS differential clock input	
18	RXCLKIN+	I	+ LVDS differential clock input	
19	GND	P	Ground	
20	RXIN3-	I	- LVDS differential data input	
21	RXIN3+	I	+ LVDS differential data input	
22	GND	P	Ground	
23	NC	---	No connection	

24	NC	---	No connection	
25	GND	P	Ground	
26	NC	---	No connection	
27	DIMO	O	Backlight CABC controller signal output	
28	SELB	I	6bit/8bit mode select	Note1
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31	LED-	P	LED Cathode	
32	LED-	P	LED Cathode	
33	L/R	I	Horizontal inversion	Note3
34	U/D	I	Vertical inversion	Note3
35	VGL	P	Gate OFF Voltage	
36	CABCEN1	I	CABC H/W enable	Note2
37	CABCEN0	I	CABC H/W enable	Note2
38	VGH	P	Gate ON Voltage	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

I: input, O: output, P: Power

Note1: If LVDS input data is 6 bits ,SELB must be set to High;

If LVDS input data is 8 bits ,SELB must be set to

Low. Note2: When CABC_EN="00", CABC OFF.

When CABC_EN="01", user interface
image. When CABC_EN="10", still picture.

When CABC_EN="11", moving image.

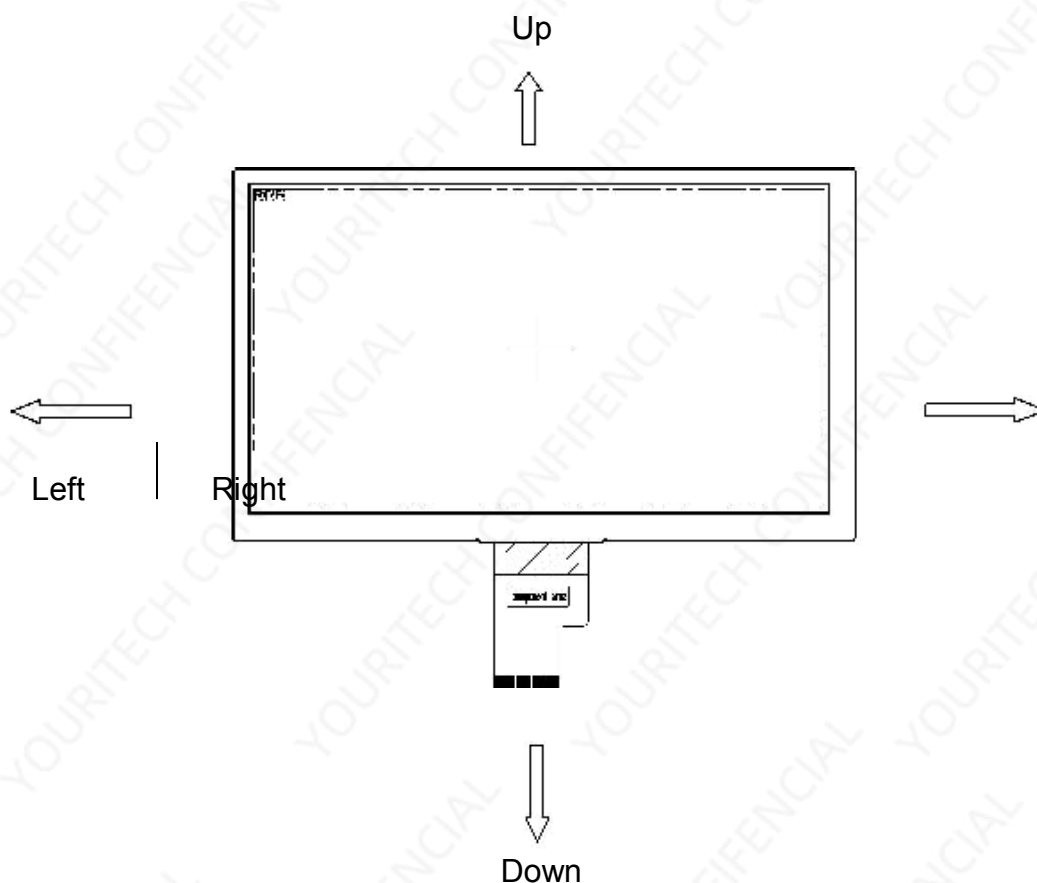
When CABC off, don't connect DIMO, else connect it to
backlight. Note3: When L/R="0", set right to left scan direction.

When L/R="1", set left to right scan direction.

When U/D="0", set top to bottom scan direction.

When U/D="1", set bottom to top scan direction.

Note: Definition of scanning direction.
Refer to the figure as below:



3. Operation Specifications

3.1. Absolute Maximum Rating

(GND=AV_{SS}=0V, Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	V _{DD}	-0.5	3.96	V	
	AV _{DD}	-0.5	14.85	V	
	V _{GH}	-0.3	42	V	
	V _{GL}	-20.0	0.3	V	
	V _{GH} -V _{GL}	-	40.0	V	
Operation Temperature Storage Temperature	T _{OP}	-30	80	°C	
	T _{ST}	-30	85	°C	
LED Reverse Voltage	V _R	-	5	V	
LED Forward Current	I _F	-	60	mA	

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

3.1.1. Typical Operation Conditions

(GND=AVSS=0V, Note 1)

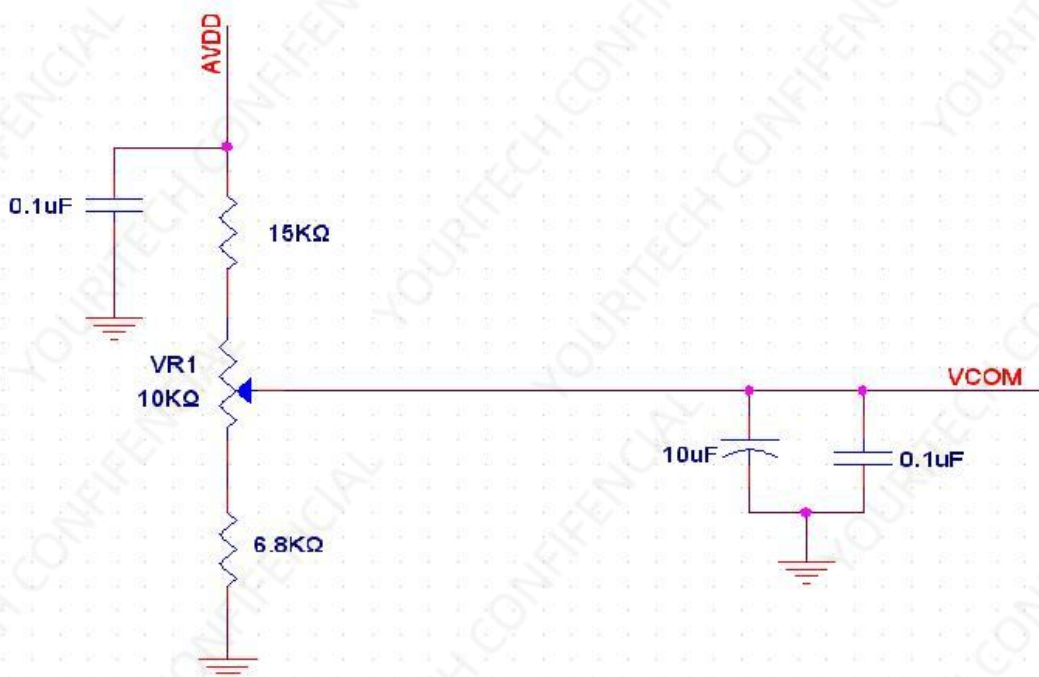
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	V _{DD}	2.3	---	3.6	V	Note 2
	AV _{DD}	6.5	---	13.5	V	
	V _{GH}	16	20	24	V	
	V _{GL}	-9.8	-6.8	-3.8	V	
Input signal voltage	V _{COM}	3.4	(3.7)	4.0	V	Note 3
Input logic high voltage	V _{IH}	0.7V _{CC}	-	V _{CC}	V	Note 4
Input logic low voltage	V _{IL}	0	-	0.3V _{CC}	V	

Note 1: Be sure to apply V_{CC} and V_{GL} to the LCD first, and then apply V_{GH}.

Note 2: V_{CC} setting should match the signals output voltage (refer to Note 3) of customer's system board .

Note 3: Typical V_{com} is only a reference value, it must be optimized according to each LCM. Please use VR and base on below application circuit.

Note 4: RESET, STBYB, SELB, L/R, U/D, CABCE0, CABCE1.



3.1.2. Current Consumption

(GND=AV_{SS}=0V)

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Drive	I _{GH}	-	0.25	1.0	mA	V _{GH} =20V
	I _{GL}	-	0.25	1.0	mA	V _{GL} =-6.8V

3.1.3. Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	V _L	-	9.6	-	V	Note 1
Current for LED backlight	I _L	-	520	-	mA	
LED life time	-	-	50,000	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25°C and I_L = 520mA.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and I_L =520mA. The LED lifetime could be decreased if operating I_L is larger than 520mA.

3.2. Power Sequence

To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

Power on: VDD, GND → AVDD, AGND → V1 to V14

Power off: V1 to V14 → AVDD, AGND → VDD, GND

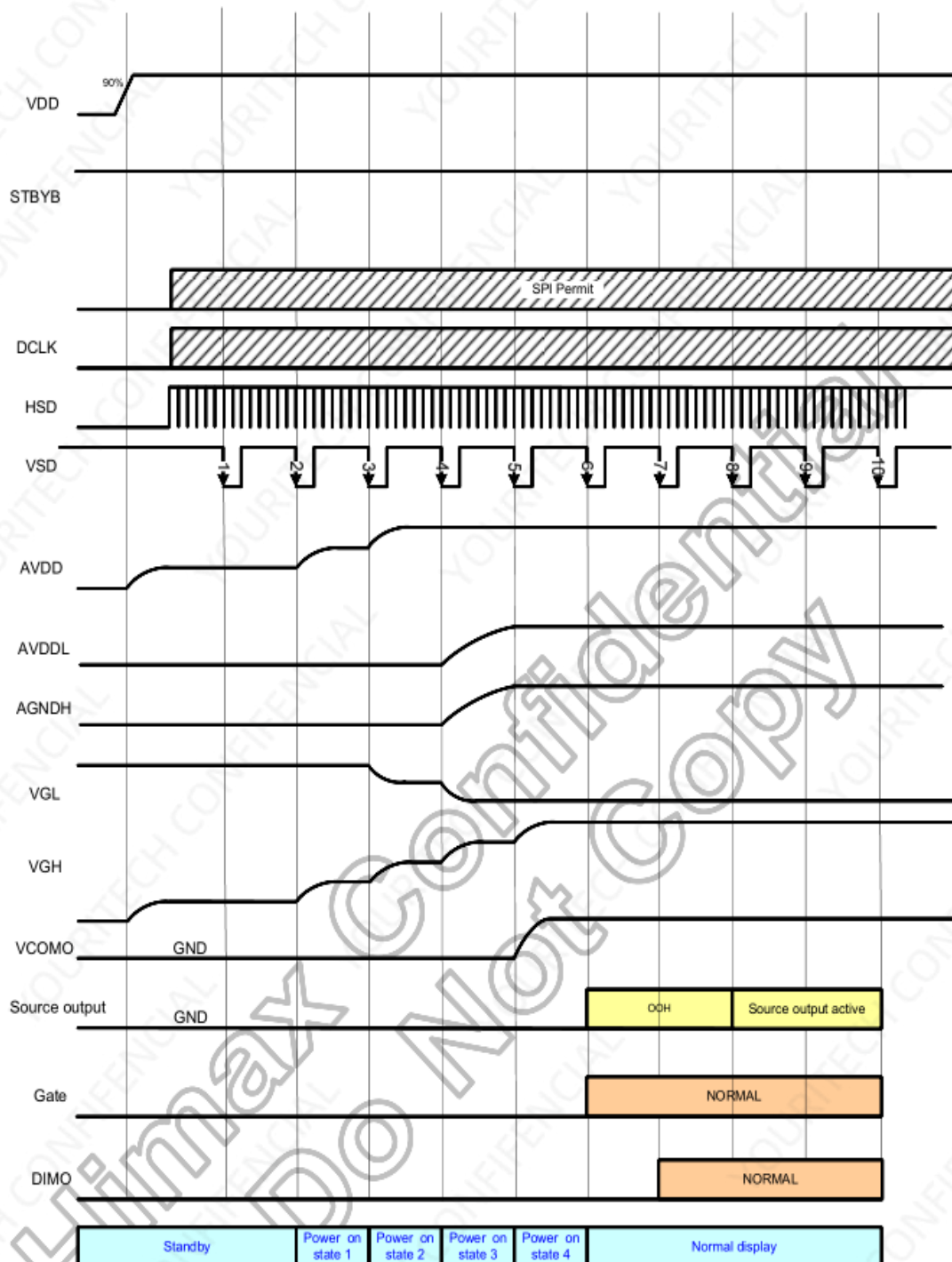


Figure 8.1: Power on timing sequence

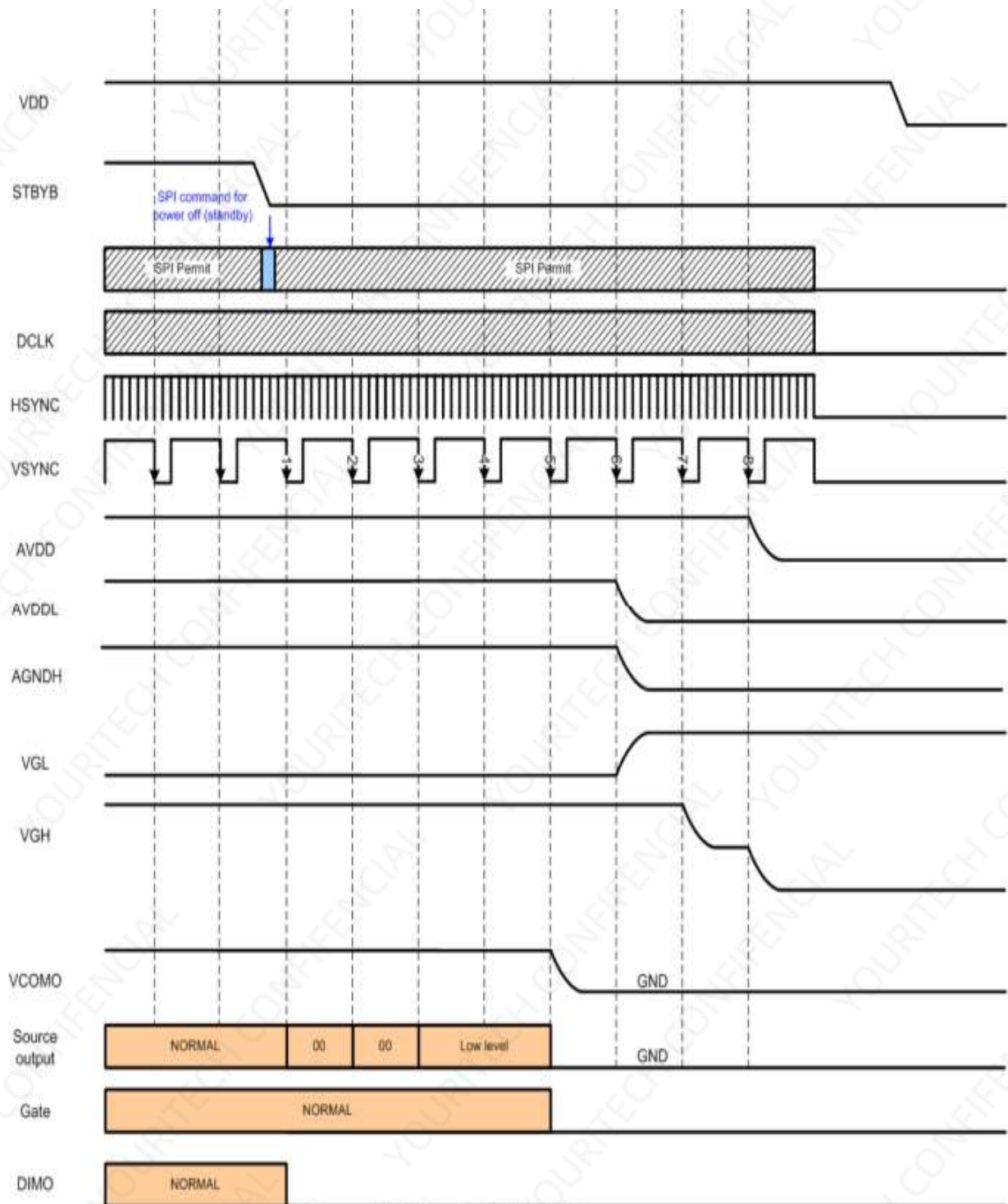


Figure 8.2: Power off timing sequence

Note: Low level=3FH, when NBW=L (Normally white)
Low level=00H, when NBW=H (Normally black)

3.3. Timing Characteristics

3.3.1. AC Electrical Characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R_{XFCLK}	20	-	71	MHz	-
Input data skew margin	T_{RSKM}	500	-	-	pS	$ V_{ID} =400mV$ $R_{XVCM}=1.2V$ $R_{XFCLK}=71MHz$
Clock high time	T_{LVCH}	-	$4/(7 \cdot R_{XFCLK})$	-	ns	-
Clock low time	T_{LVCL}	-	$3/(7 \cdot R_{XFCLK})$	-	ns	-
PLL wake-up time	T_{emPLL}	-	-	150	μs	-

3.3.2. Input Clock and Data Timing Diagram

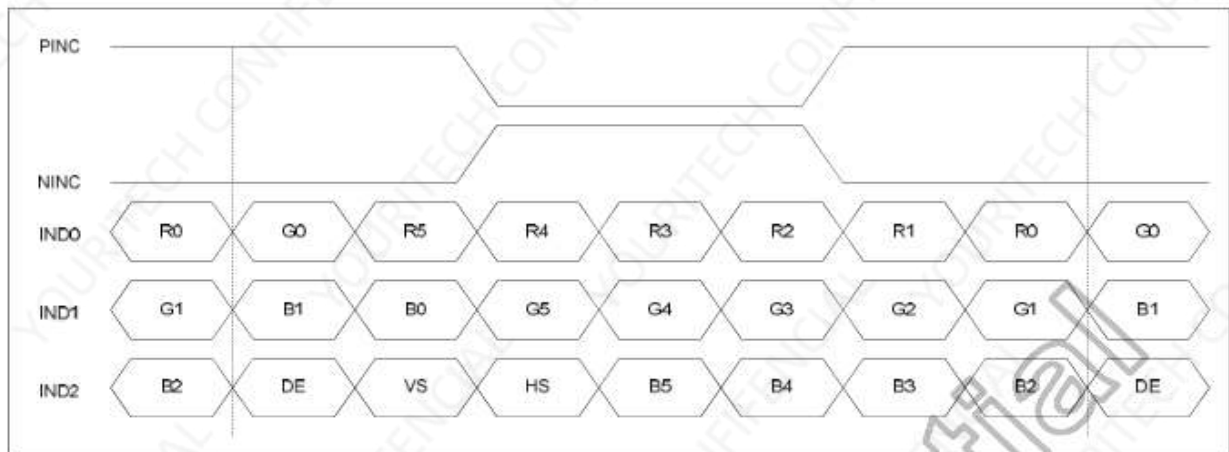


Figure 10.4: 6-bit LVDS input

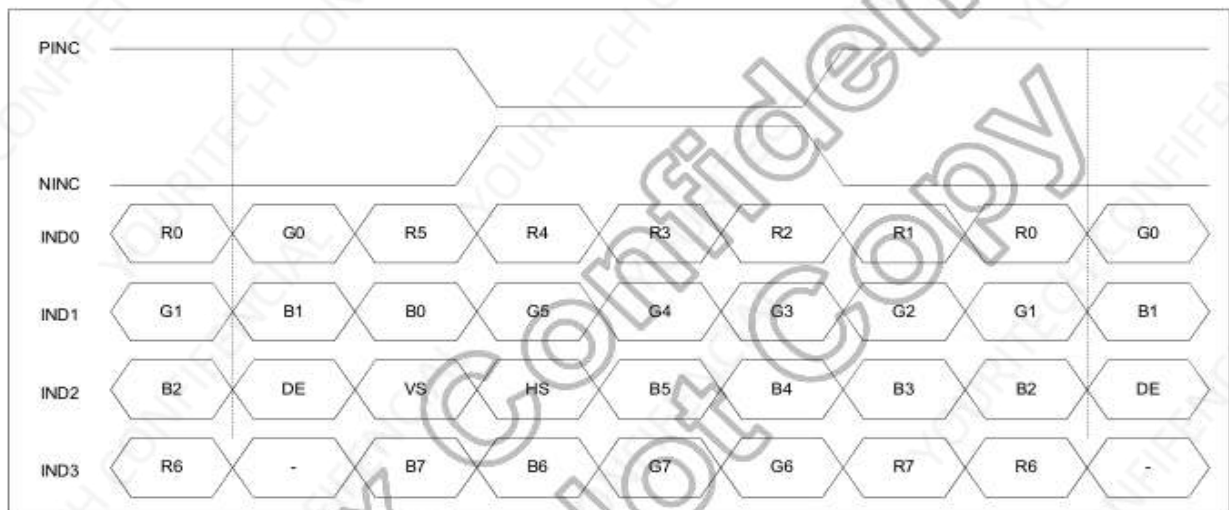


Figure 10.5: 8-bit LVDS Input

3.3.3. DC Electrical Characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Differential input high Threshold voltage	R_{XVTH}	-	-	+0.1	V	$R_{XVCM}=1.2V$
Differential input low threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{XVIN}	0	-	$VDD-1.2+ V_{ID} /2$	V	-
Differential input common Mode voltage	R_{XVCM}	$ V_{ID} /2$	-	$VDD-1.2$	V	-
Differential input voltage	$ V_{ID} $	0.2	-	0.6	V	-
Differential input leakage Current	RV_{Xlilz}	-10	-	+10	μA	-
LVDS Digital Operating Current	I_{ddlvds}	-	15	30	mA	Fclk=65MHz, VDD=3.3V
LVDS Digital Stand-by Current	I_{stlvds}	-	10	50	μA	Clock & all Functions are stopped

Table 9.3: LVDS mode DC electrical characteristics

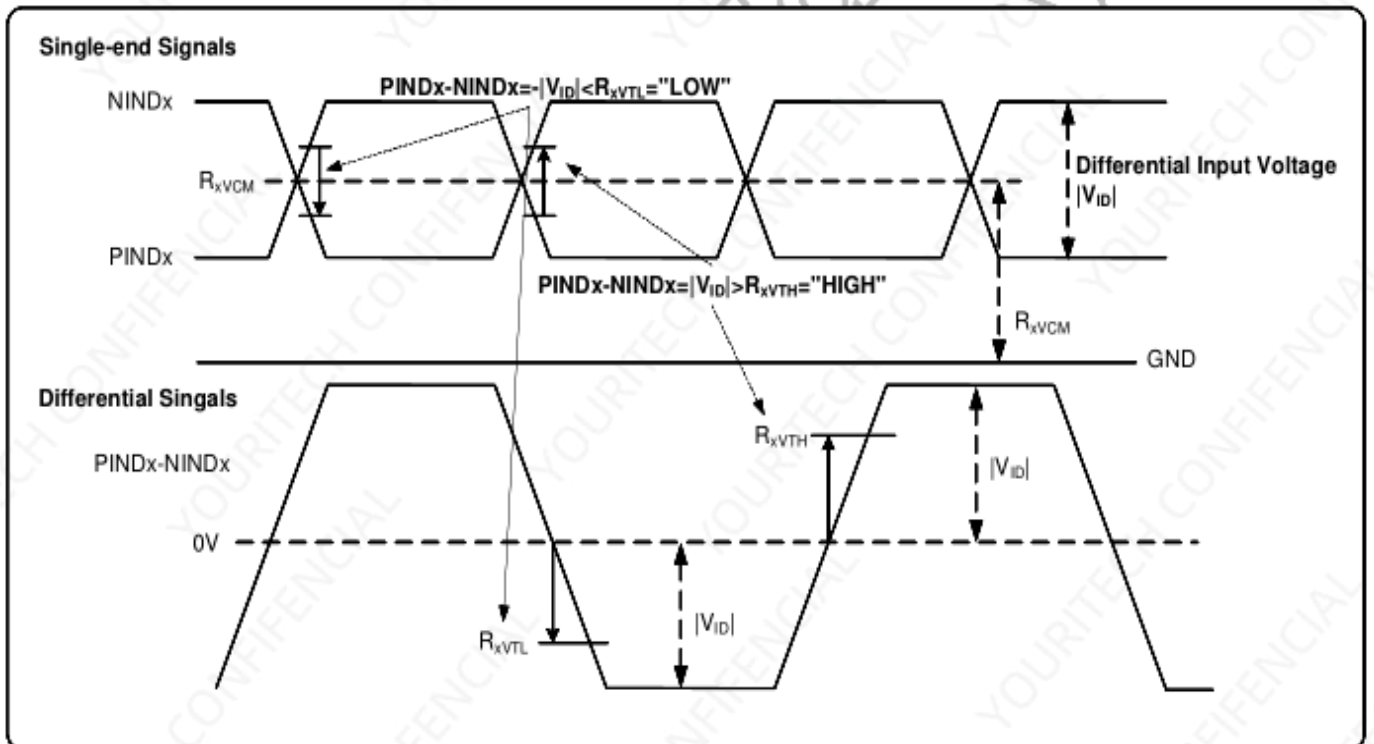


Figure 9.1: Single-end signals

3.3.4. Timing

● DE mode

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd	600			T _H
VSD Period	tv	610	635	800	T _H
VSD Blanking	tvbp+ tvfp	10	35	200	T _H

Table 10.4: DE mode (1024x600)

● HV mode

Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp	160			DCLK
HSD Front Porch	thfp	16	160	216	DCLK

Table 10.5: HV mode horizontal timing (1024x600)

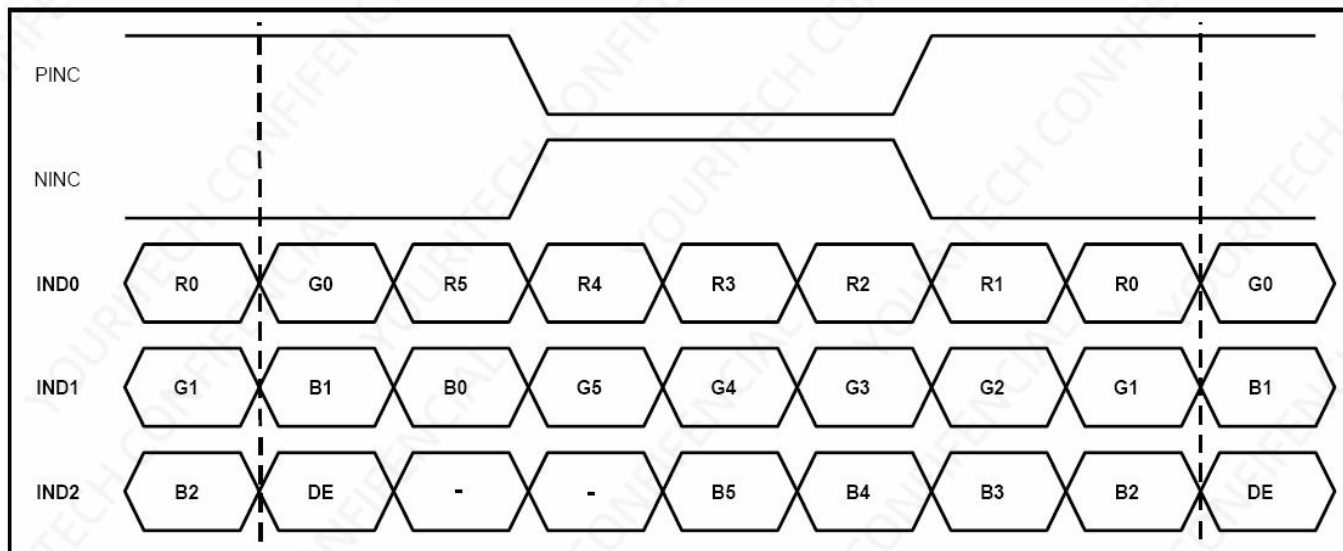
Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd	600			T _H
VSD Period	tv	624	635	750	T _H
VSD Pulse Width	tvpw	1	-	20	T _H
VSD Back Porch	tvbp	23			T _H
VSD Front Porch	tvfp	1	12	127	T _H

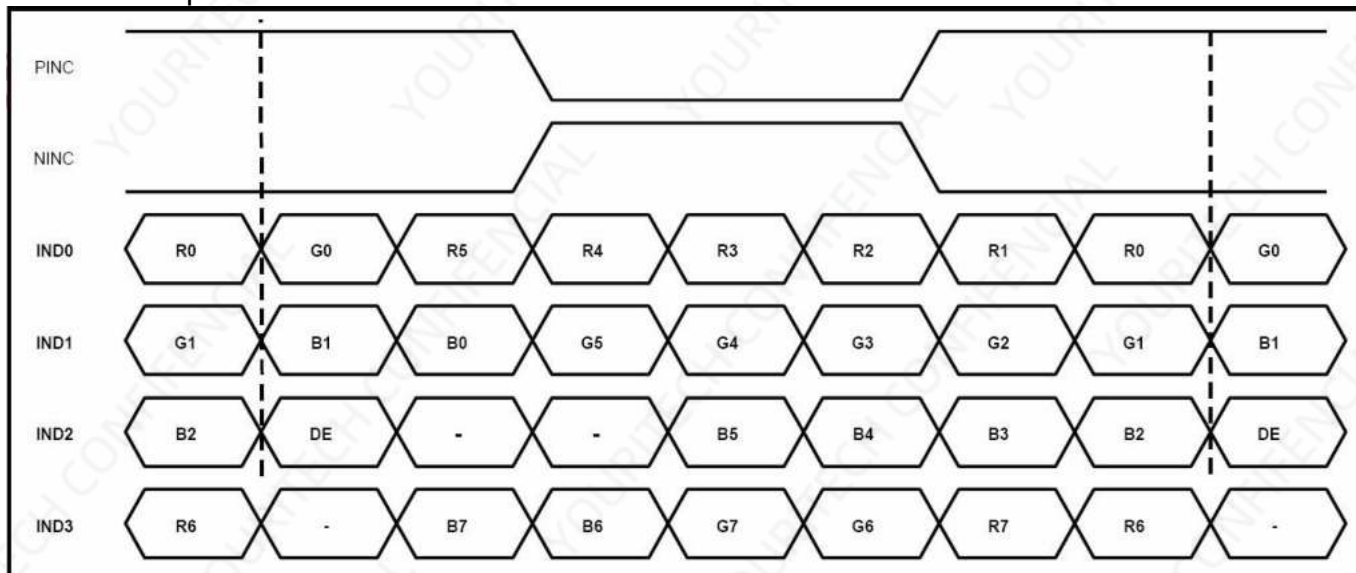
Table 10.6: HV Mode Vertical Timing (1024x600)

3.3.5. Data Input Format

6bit LVDS input



8bit LVDS input



Note: Support DE timing mode only, SYNC mode not supported.

3.3.6. Output timing table

Parallel 24-bit RGB mode

Parameter	Symbol	Spec.			Unit	Conditions
		Min.	Typ.	Max.		
CLKIN Frequency	Fclk	-	65	71	MHz	VDD=3.0V~3.6V
CLKIN Cycle Time	Tclk	14.1	15.4	-	ns	-
CLKIN Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso	64			CLKIN	-
Time from HSD to LD	Thld	64			CLKIN	-
Time from HSD to STV	Thstv	2			CLKIN	-
Time from HSD to CKV	Thckv	20			CLKIN	-
Time from HSD to OEV	Thoev	4			CLKIN	-
LD Pulse Width	Twld	10			CLKIN	-
CKV Pulse Width	Twckv	66			CLKIN	-
OEV Pulse Width	Twoev	74			CLKIN	-

Table 11.1: Parallel 24-bit RGB mode

4. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	65	75	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	65	75	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	60	70	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	65	75	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	20	30	msec	Note 3
Contrast ratio	CR		500	700	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2
	W_Y		0.28	0.33	0.38	-	Note 5 Note 6
Luminance	L		1000	1500	-	cd/m2	Note 6
Luminance uniformity	Y_U		70	80	-	%	Note 7

Test Conditions:

1. $V_{CC}=3.3V$, $I_L=520mA$ (Backlight current), the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

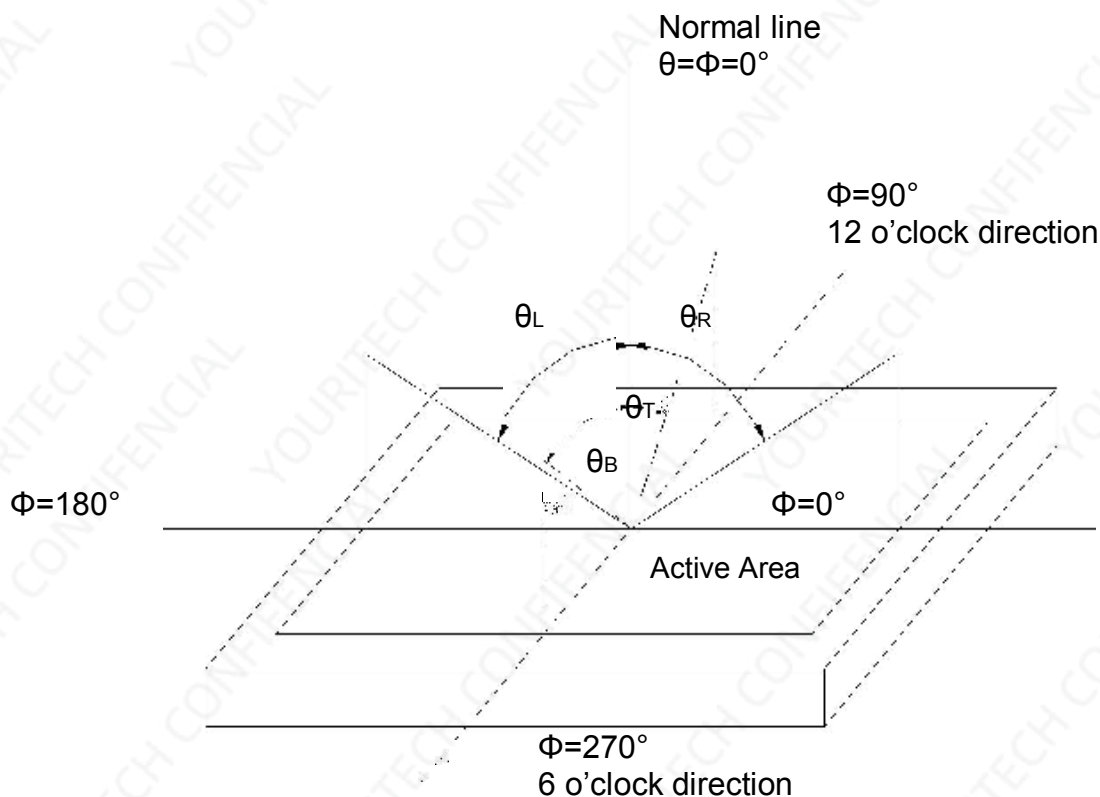


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

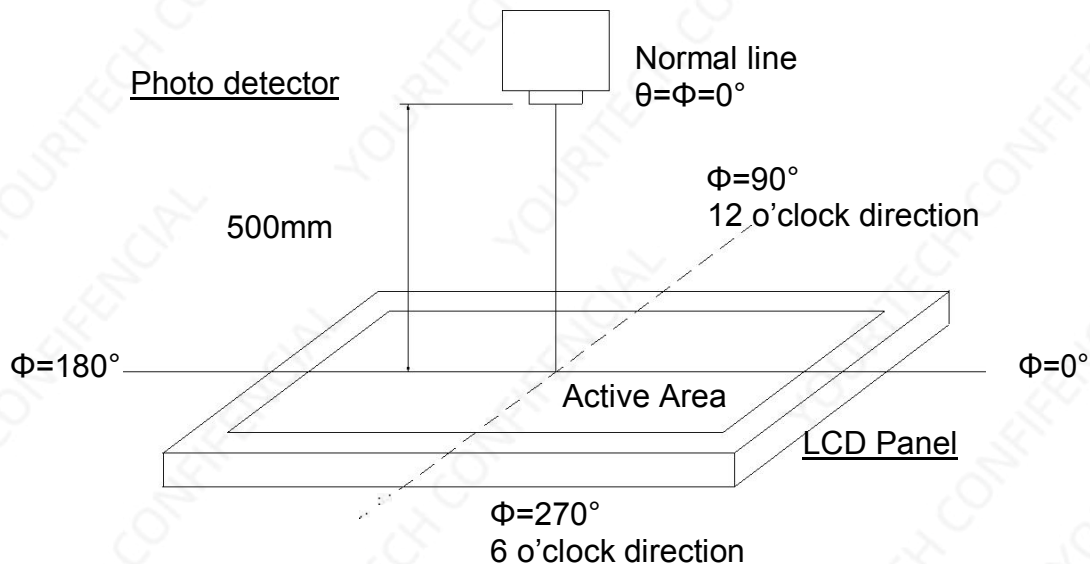


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

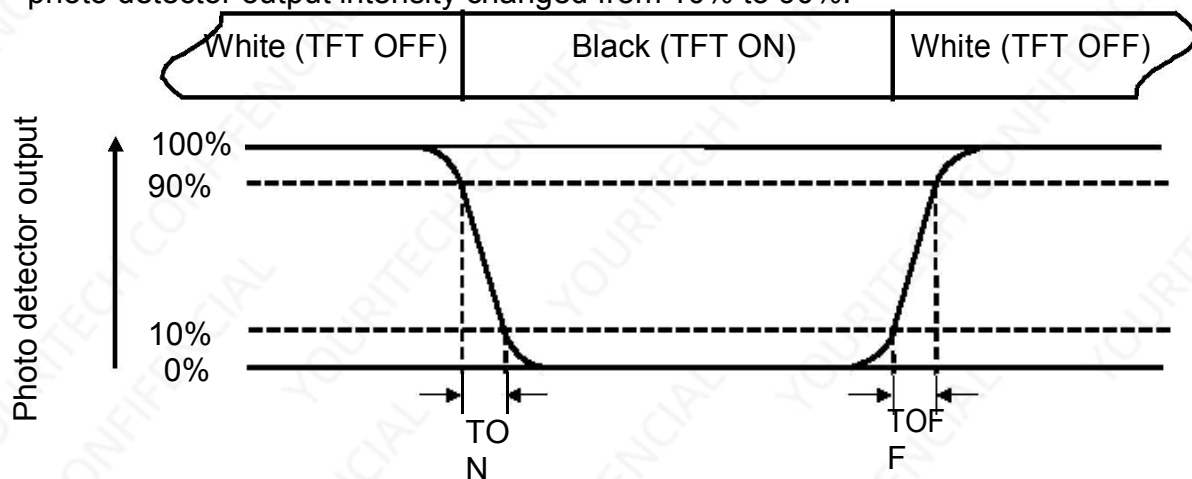


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of luminance:

Measured at the center area of the panel when LCD panel is driven at "white" state. The LED driving condition is $I_L=520\text{mA}$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{\min}}{B_{\max}}$$

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

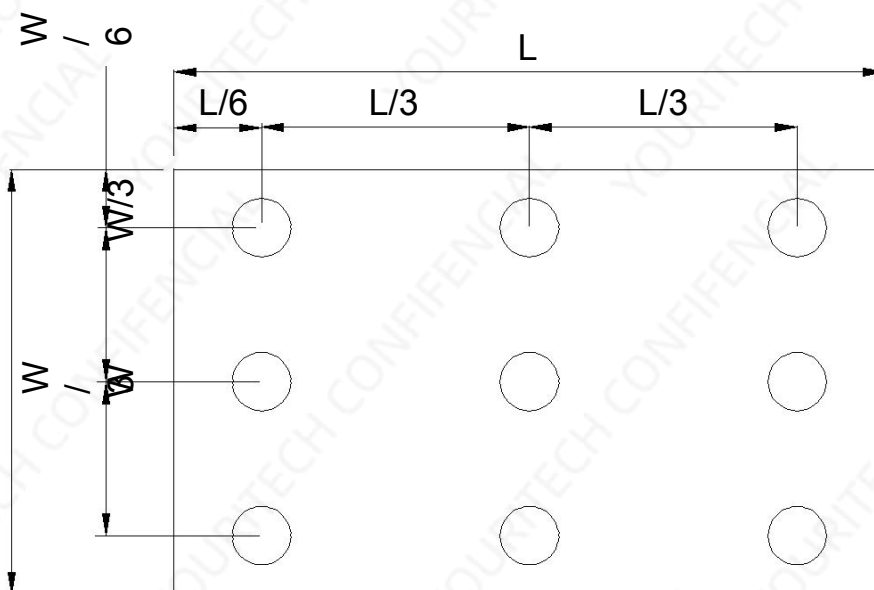


Fig. 4-4 Definition of measuring points

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

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

5. Reliability Test Items

(Note3)

Item	Test Conditions	Remark
High Temperature Storage	Ta = 85°C 240hrs	Note 1, Note 4
Low Temperature Storage	Ta = -30°C 240hrs	Note 1, Note 4
High Temperature Operation	Ts = 80°C 240hrs	Note 2, Note 4
Low Temperature Operation	Ta = -30°C 240hrs	Note 1, Note 4
Operate at High Temperature and Humidity	+60°C, 90%RH 240hrs	Note 4
Thermal Shock	-20°C/30 min ~ +60°C/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Note 4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-100HZ, -6dB/Octave from 100-200HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

6. General Precautions

6.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

6.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

6.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

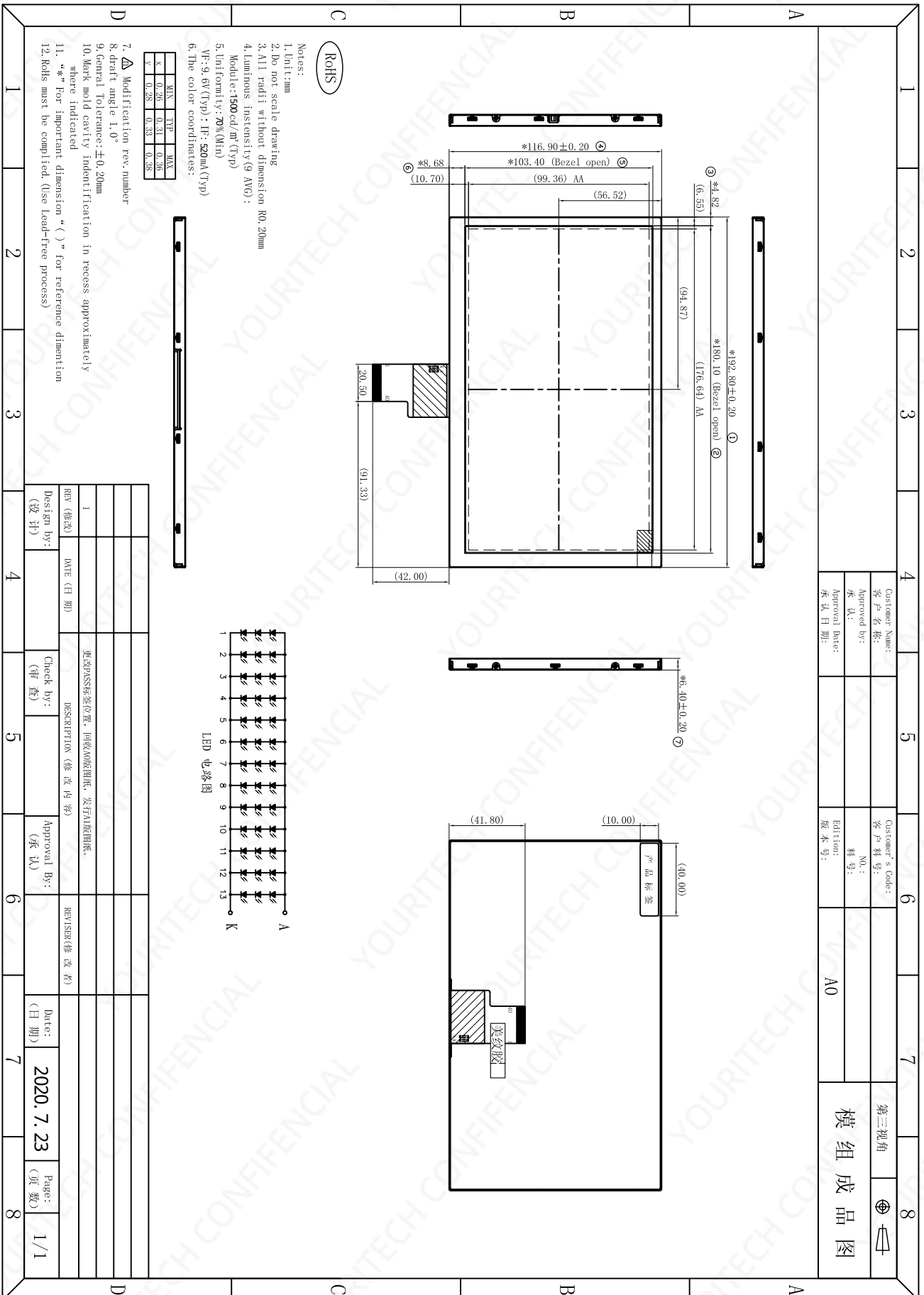
6.4. Storage

1. Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

6.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

7. Mechanical Drawing



8. Package Drawing

TBD