LCD MODULE SPECIFICATION

Doc. Number:
■ Preliminary Specification
☐ Approval Specification

Customer: _____

Model Name: MD103TL01-50IR-27A-AM

Date: 2020-02-24

Version: 03

For Customer's Acceptance

Approved by	Comment

Approved By	Checked By	Prepared By
Lee	CoCo	WG

Record of Revision

Version	Revise Date	Page	Content
00	2018/12/21	ALL	First Release
01	2019/05/08	5-6	Update Pin definition
02	2019/06/18	21	Update PCB outline to the module drawing
03	2020/02/24	4	Update POL surface treatment

Contents

1. General Specifications

No.	Item	Specification	Remark
1	LCD size	10.25 inch	
2	Driver element	a-Si TFT active matrix	
3	Resolution	1920RGB(W) x 720(H)	
4	Display mode	Normally Black, Transmissive	
5	Dot pitch	0.1269 (w)x 0.1269(H)	
6	Active area	243.65(W) x 91.37(H)	
7	Module size	261(W) ×110.5(H) ×7.65(D) mm	Note 1
8	View direction	Free	O'clock
9	Surface treatment	HC	
10	Color arrangement	RGB-stripe	
11	Interface	LVDS	
12	Lcm power consumption	(10.5W)	
13	Driver IC	HX8290,HX8695	
14	Weight	(380g)	

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

PCB Connector is used for the module electronics interface. The recommended model is F31L-1A7H1-11050 manufactured by AORORA.

Pin No.	Symbol	I/O	Function	Remark
1	GND	P	Ground	
2	NC	---	No connect	
3	VDD	P	Main Power Supply	
4	VDD	P	Main Power Supply	
5	GND	P	Ground	
6	GND	P	Ground	
7	NC	---	No connect	
8	NC	---	No connect	
9	GND	P	Ground	
10	ORXIN0-	I	Odd pixel negative LVDS differential data input(O0-)	
11	ORXIN0+	I	Odd pixel positive LVDS differential data input(O0+)	
12	ORXIN1-	I	Odd pixel negative LVDS differential data input(O1-)	
13	ORXIN1+	I	Odd pixel positive LVDS differential data input(O1+)	
14	ORXIN2-	I	Odd pixel negative LVDS differential data input(O2-)	
15	ORXIN2+	I	Odd pixel positive LVDS differential data input(O2+)	
16	ORXCLKIN-	I	Odd pixel negative LVDS differential CLK input(OCLK-)	
17	ORXCLKIN+	I	Odd pixel positive LVDS differential CLK input(OCLK+)	
18	ORXIN3-	I	Odd pixel negative LVDS differential data input(O3-)	
19	ORXIN3+	I	Odd pixel positive LVDS differential data input(O3+)	
20	ERXIN0-	I	Even pixel negative LVDS differential data input(E0-)	
21	ERXIN0+	I	Even pixel positive LVDS differential data input(E0+)	
22	ERXIN1-	I	Even pixel negative LVDS differential data input(E1-)	
23	ERXIN1+	I	Even pixel positive LVDS differential data input(E1+)	

24	ERXIN2-	I	Even pixel negative LVDS differential data input(E2-)	
25	ERXIN2+	I	Even pixel positive LVDS differential data input(E2+)	
26	ERXCLKIN-	I	Even pixel negative LVDS differential CLK input(ECLK-)	
27	ERXCLKIN+	I	Even pixel positive LVDS differential CLK input(ECLK+)	
28	ERXIN3-	I	Even pixel negative LVDS differential data input(E3-)	
29	ERXIN3+	I	Even pixel positive LVDS differential data input(E3+)	
30	GND	P	Ground	
31	NC	---	No connect	
32	RESETB	I	Global reset pin, active low.	NOTE 1
33	STBYB	I	Standby mode setting pin, active low.	
34	CA3	O	Fail detection signal outputs(Leave this pin open)	
35	SCL(NC)	I	Keep this pin floating when not programming OTP	
36	SDA(NC)	I	Keep this pin floating when not programming OTP	
37	OTP(NC)	P	Keep this pin floating when not programming OTP	
38	GND	P	Ground	
39	GND	P	Ground	
40	NC	---	No connect	
41	NC	---	No connect	
42	NC	---	No connect	
43	NC	---	No connect	
44	NC	---	No connect	
45	NC	---	No connect	
46	NC	---	No connect	
47	NC	---	No connect	
48	NC	---	No connect	
49	NC	---	No connect	
50	NC	---	No connect	

I: input; O: output; P: Power or Ground(0V).

Note 1: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.

BL-FPC Connector is used for the module electronics interface. The recommended model is F31L-1A7H1-11010 manufactured by AORORA.

BL PIN	1	2	3	4	5	6	7	8	9	10
	LED+ (A)	LED+ (A)	LED+ (A)	NC	NTC1	NTC2	NC	LED- K3	LED- K2	LED- K1

3. Operation Specifications

3.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	VDD	0.3	3.6	V	TA=25℃
Operation Temperature	T_{OP}	-30	85	℃	
Storage Temperature	T_{ST}	-40	90	℃	

Note1 : 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.

3.2. Typical Operation Conditions

Test condition: GND=0V, T_A=25 °C

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Digital Operating voltage	VDD	2.3	3.3	3.6	V	
High Level Input Voltage	V_{IH}	0.7 V_{DD}	-	V_{DD}	V	
Low Level Input Voltage	V_{IL}	0		0.3 V_{DD}	V	

3.3. Current Consumption

3.3.1 Current for LCD Driver

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
	Ivdd	-	250	-	mA	VDD=3.3V
Total Power Consumption	PC	-	825	-	mW	

3.3.2 Current for LED Drive

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	V_L	22.5	27	32.5	V	Note 1
Crrent for LED Backlight	I_L	-	360	-	mA	
BL Power Consumption	PC	-	9.72	-	W	
LED life time	-	30,000	-	-	Hrs	Note 2

Note1: V_L=27V, I_L=360mA (Backlight circuit: 9series connection, 3 parallel connection), the ambient temperature is 25℃.

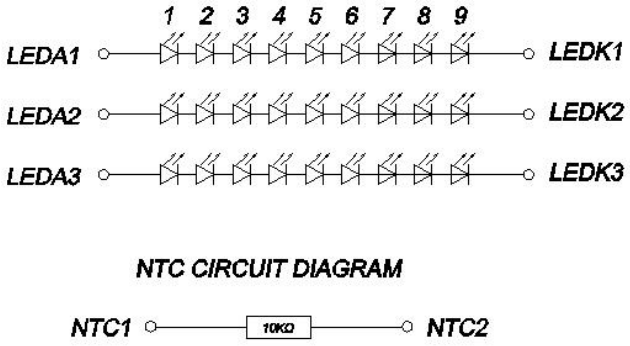


Fig. 3-1 LED test circuit diagram

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and 1/2 rated current. The LED lifetime could be decreased if operating I_L is larger than 360 mA.

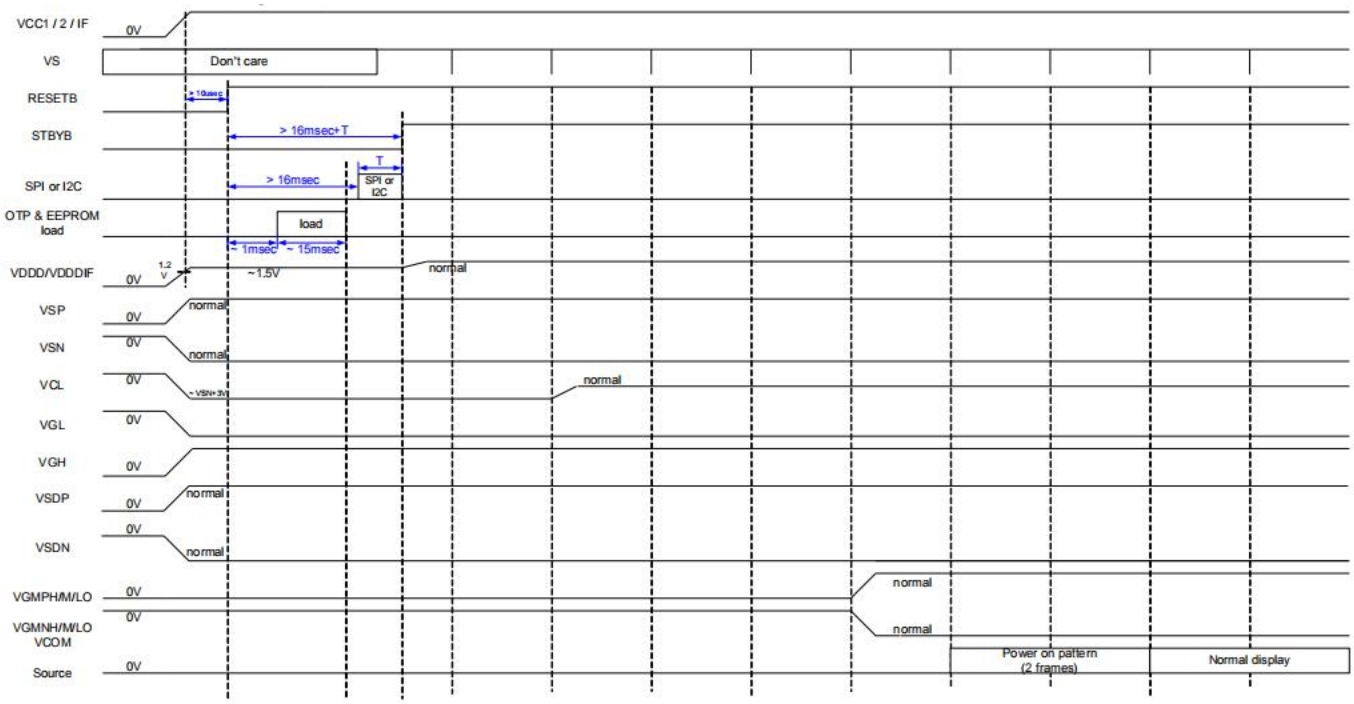
3.3.3 Backlight NTC Resistor

To limit the heat dissipation under high ambient temperature (Ta). The LED string has a NTC(Negative Temperature Coefficient) to detect the ambient temperature of LED string. This NTC was located in the middle of FPC mounted with LED that acts as an indicator to show if the module is operated under safe operation region without overheating and damage. The detail application for this NTC, please refer to data sheet of Murata P/N : NCP15XH103F03RC About Murata NCP15XH103F03RC application. Please follow component data sheet.

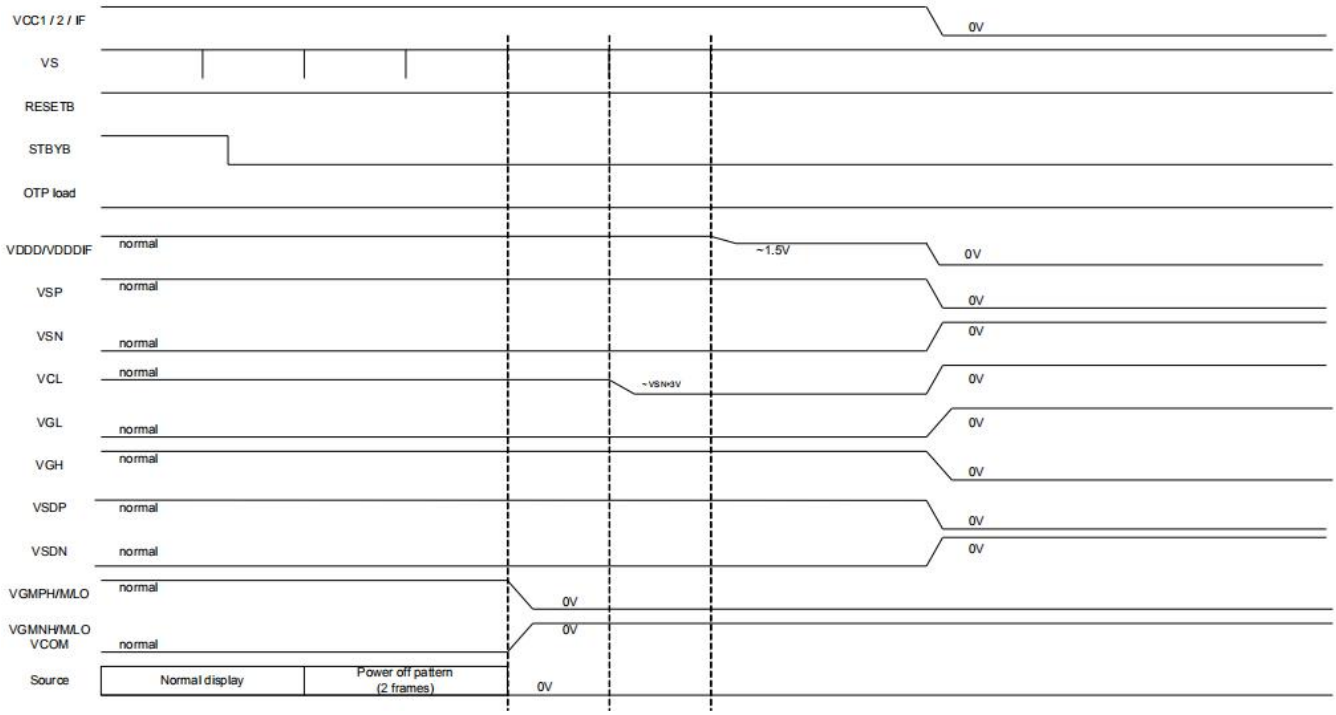
Murata NTC Specification NCP15XH103F03RC			
R25 10k ohm +/- 1%			
B(25/50) 3380K +/-1%			
TEMP.	R-low	R-center	R-high
(deg.C)	(k ohm)	(k ohm)	(k ohm)
-40	188.0202	195.652	203.5731
-35	142.7877	148.171	153.7418
-30	109.5221	113.3471	117.294
-25	84.8227	87.5588	90.3741
-20	66.2694	68.2367	70.2554
-15	52.2283	53.6496	55.104
-10	41.4765	42.5062	43.557
-5	33.1462	33.8922	34.6515
0	26.678	27.2186	27.7675
5	21.6294	22.0211	22.4175
10	17.643	17.9255	18.2107
15	14.4712	14.6735	14.8772
20	11.9371	12.0805	12.2244
25	9.9	10	10.1
30	8.2162	8.3145	8.4132
35	6.8534	6.9479	7.043
40	5.7443	5.8336	5.9238
45	4.8333	4.9169	5.0015
50	4.0833	4.1609	4.2395
55	3.4634	3.535	3.6076
60	2.9486	3.0143	3.0812
65	2.5259	2.5861	2.6476
70	2.1724	2.2275	2.2839
75	1.8741	1.9245	1.9761
80	1.6225	1.6685	1.7157
85	1.4101	1.4521	1.4952
90	1.2296	1.268	1.3074
95	1.0746	1.1096	1.1456
100	0.9419	0.9738	1.0067
105	0.8288	0.858	0.8881
110	0.7313	0.758	0.7856
115	0.6471	0.6715	0.6968
120	0.574	0.5964	0.6196
125	0.5106	0.5311	0.5524

3.4. Power Sequence

a. Power on:



b. Power off



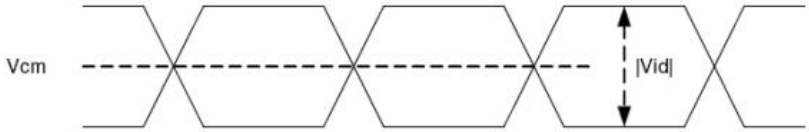
3.5. LVDS Signal Timing Characteristics

3.5.1. AC Electrical Characteristics

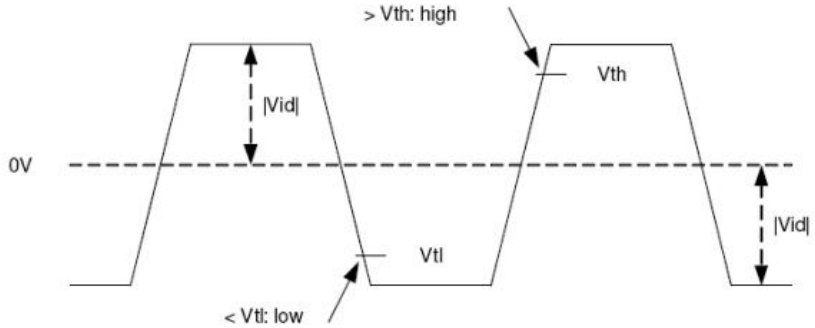
LVDS mode DC electrical characteristics

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Differential input high Threshold voltage	Vth	Vcm=1.2V	+0.15	-	-	V
Differential input low threshold voltage	Vtl		-	-	-0.15	V
Differential input common Mode voltage	V_{CM}	-	1	1.2	1.7-|V_{id}|/2	V
LVDS input voltage	V_{INLV}		0.7		1.7	V
Differential input voltage	|Vid|	-	0.15	-	0.6	V
Differential input leakage Current	Ilvleak	-	-10	-	+10	μA

Single-ended:
LVCLKP(R),
LVCLKN(R),
LVD[3:0]P(R),
LVD[3:0]N(R)

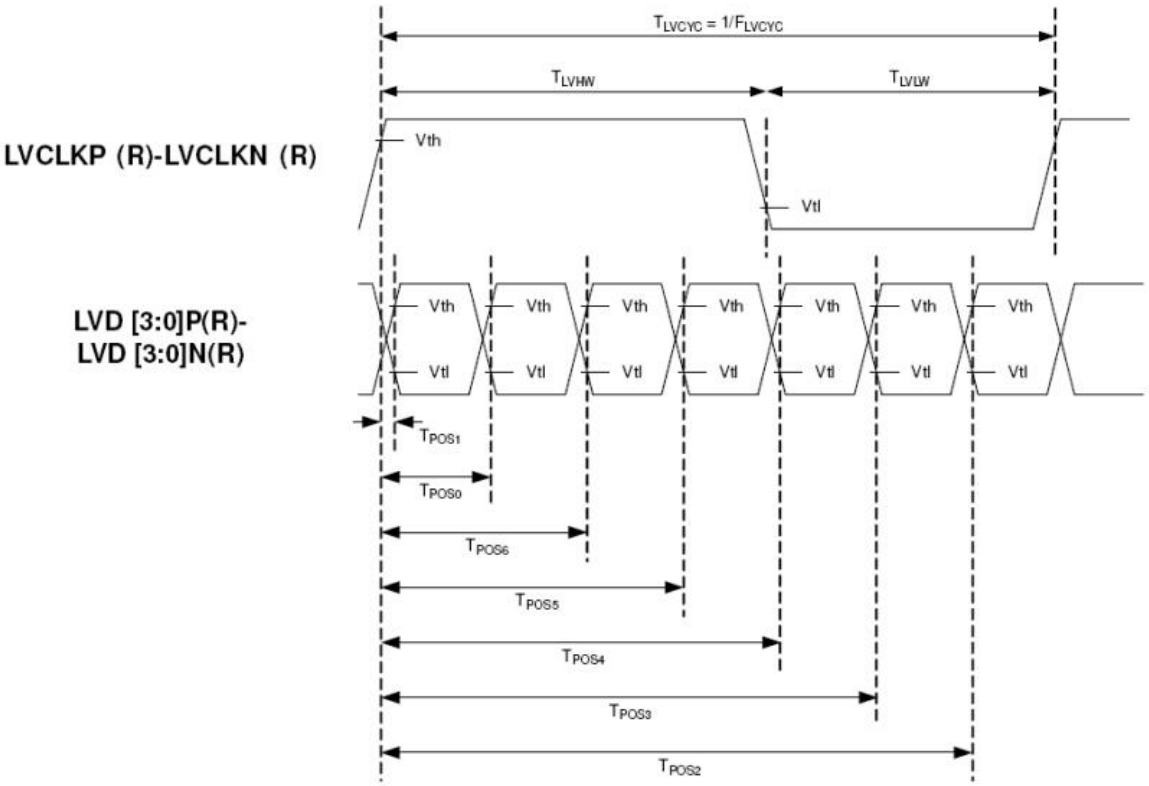


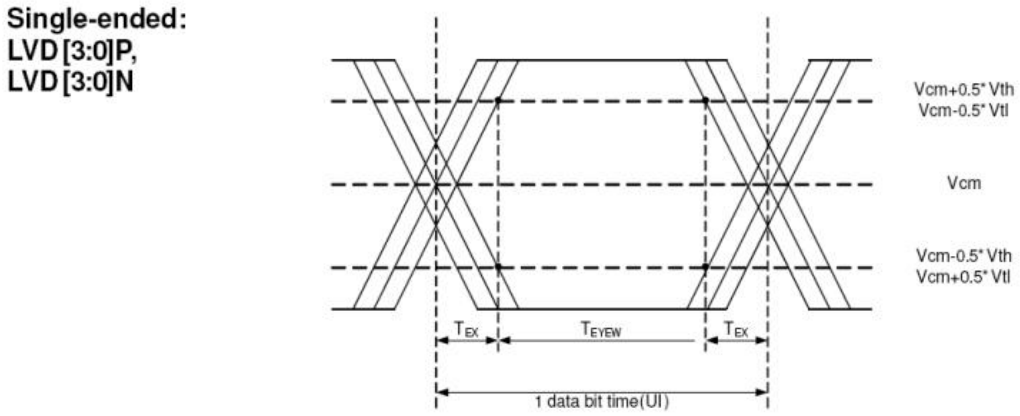
Differential:
LVCLKP(R)-LVCLKN(R),
LVD[3:0]P(R)-
LVD[3:0]N(R)

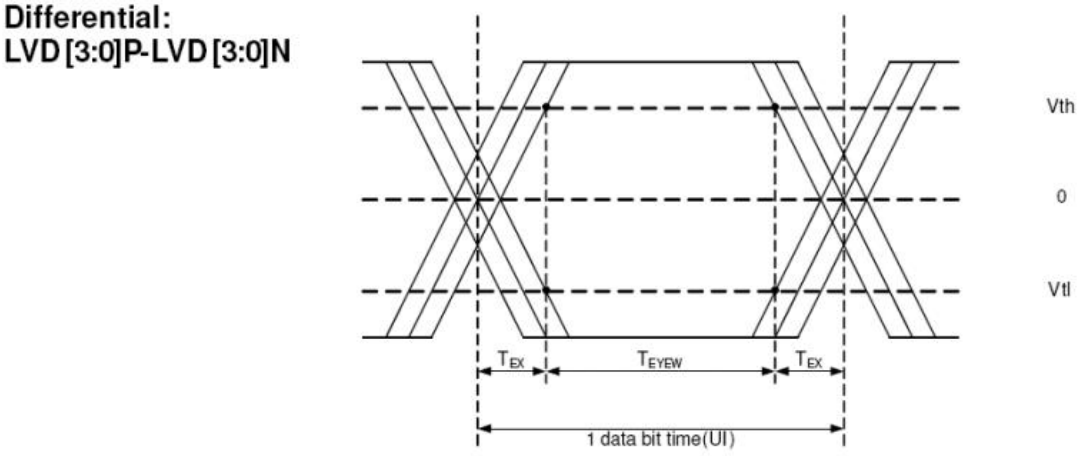


LVDS mode AC electrical characteristics

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock frequency	F_{LVCYC}	20		85	MHz
Clock period	T_{LVCYC}	11.76			ns
1 data bit time	UI		1/7		T_{LVCYC}
Clock high time	T_{LVCH}		4		UI
Clock low time	T_{LVCL}		3		UI
Position 1	T_{POS1}	-0.2	0	0.2	UI
Position 0	T_{POS0}	0.8	1	1.2	UI
Position 6	T_{POS6}	1.8	2	2.2	UI
Position 5	T_{POS5}	2.8	3	3.2	UI
Position 4	T_{POS4}	3.8	4	4.2	UI
Position 3	T_{POS3}	4.8	5	5.2	UI
Position 2	T_{POS2}	5.8	6	6.2	UI
Input eye width	T_{EYEW}	0.6	-	-	UI
Input eye border	T_{EX}	-	-	0.2	UI
LVDS wake up time	T_{ENLVDS}	-	-	150	ms

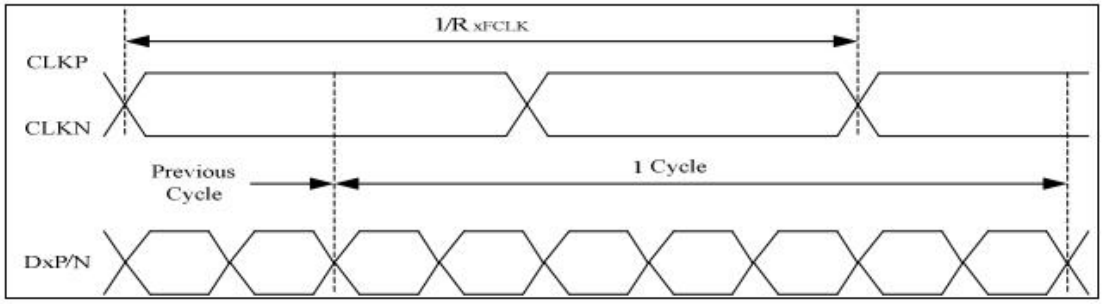


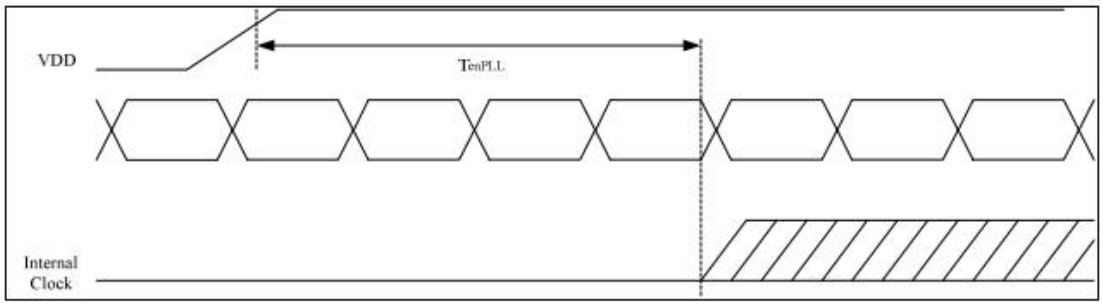


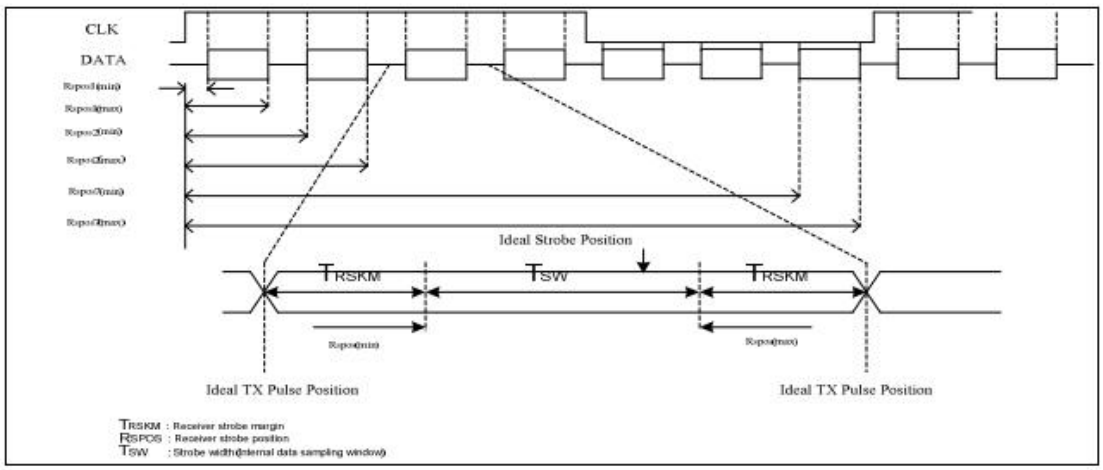


3.5.2. DC Electrical Characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R_{xFCLK}	30	-	TBD	MHz	Refer to input timing table for each display resolution
Input data skew margin	T_{RSKM}	500	-	-	ps	|VID| = 200mV RxVCM = 1.2V RxFCLK = 81MHz
Clock high time	T_{LVCH}	-	4/(7* R_{xFCLK})	-	ns	
Clock low time	T_{LVCL}	-	3/(7* R_{xFCLK})	-	ns	
PLL wake-up time	T_{enPLL}	-	-	150	us	





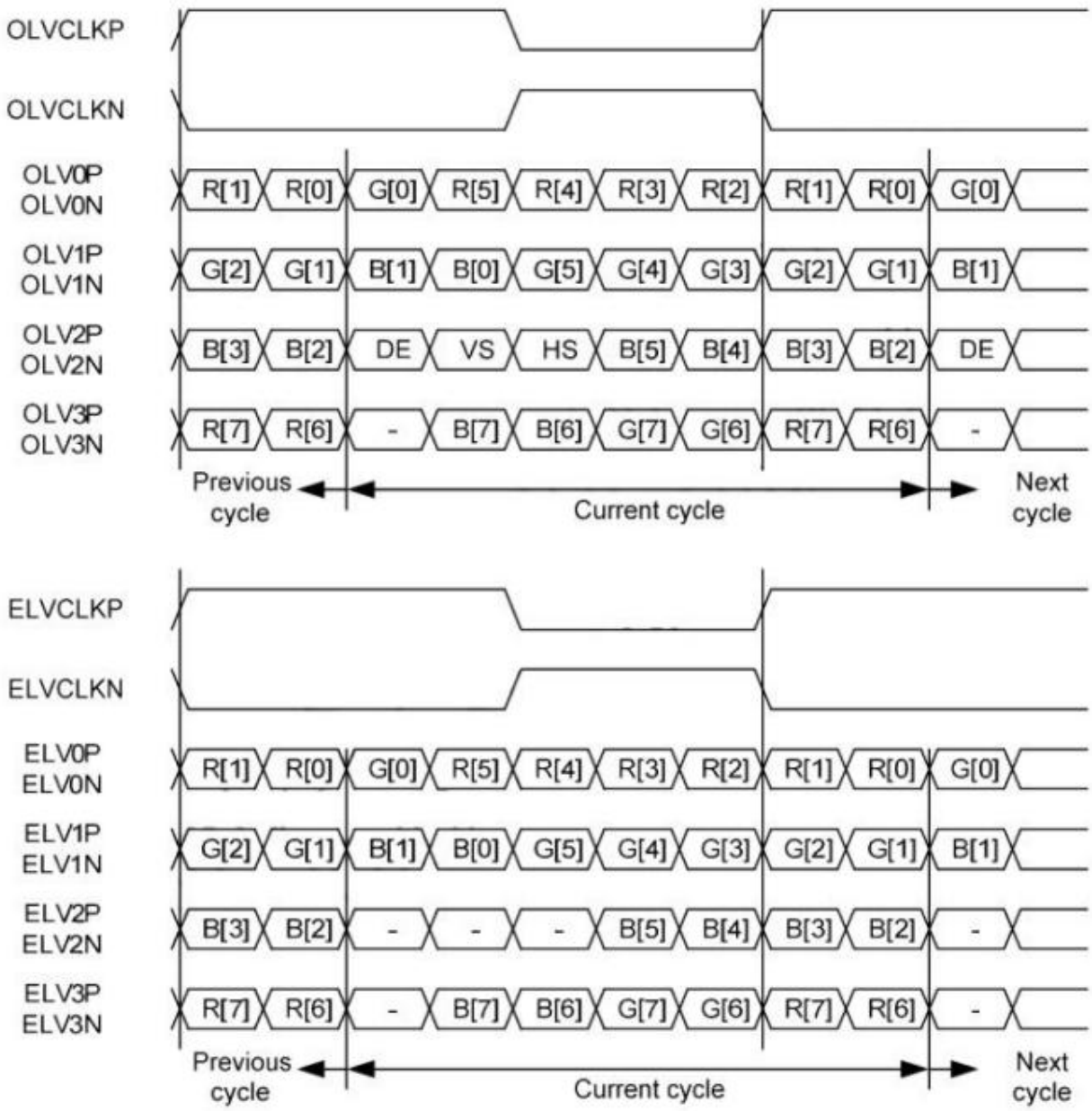


3.5.3. Timing Controller

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
DCLK frequency	fclk	43.1	44	70.1	MHz	Frame rate =60Hz
Horizontal valid data	thd		1920		DCLK	
Hsync pulse Width	thpw	10	12	255	DCLK	
Hsync back porch	thbp	5	12	255	DCLK	
Hsync front porch	thfp	24	26	260	DCLK	
Vertical valid data	tvd		720		H	
Vsync pulse width	tvpw	1	3	20	H	
Vsync back porch	tvbp	2	5	255	H	
Vsync front porch	tvfp	3	8	260	H	

3.5.4. LVDS Data Input Format

2-port LVDS signals, VESA format, 8-bit mode



Data Mapping for VESA Format

4. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	Φ=180° (9 o'clock)	80	-	-	degree	Note 1
	θ_R	Φ=0°(3 o'clock)	80	-	-		
	θ_T	Φ=90° (12 o'clock)	80	-	-		
	θ_B	Φ=270° (6 o'clock)	80	-	-		
Response time	T_{ON+} T_{OFF}	Normal θ=Φ=0°	-	20	30	msec	Note 3
Contrast ratio	CR		800	1000	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2 Note 5 Note 6
	W_Y		0.28	0.33	0.38	-	
NTSC (CIE 1931)			-	76	-	%	Note 2 Note 5
Luminance	L		650	850	-	cd/m²	Note 6
Luminance uniformity	Y_U		75	-	-	%	Note 7

The test systems refer to Note 2.

Note 1: Definition of viewing angle range

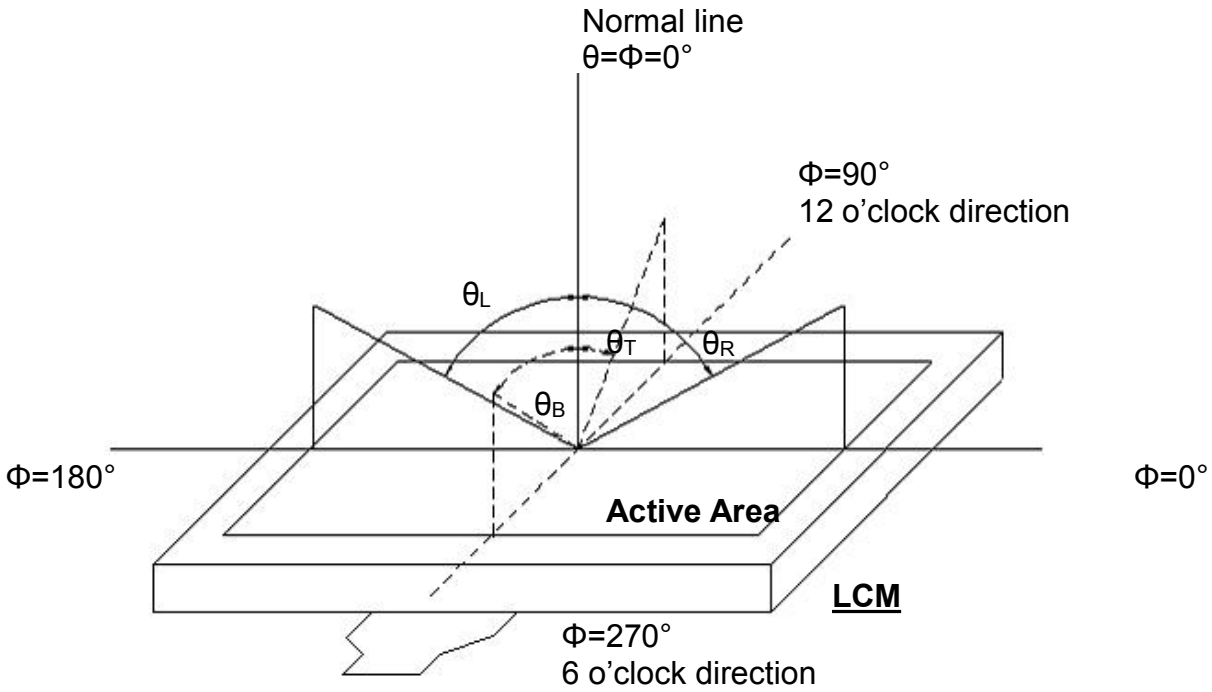


Fig. 4-2 Definition of viewing angle

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. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm, Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.) or CA-210.

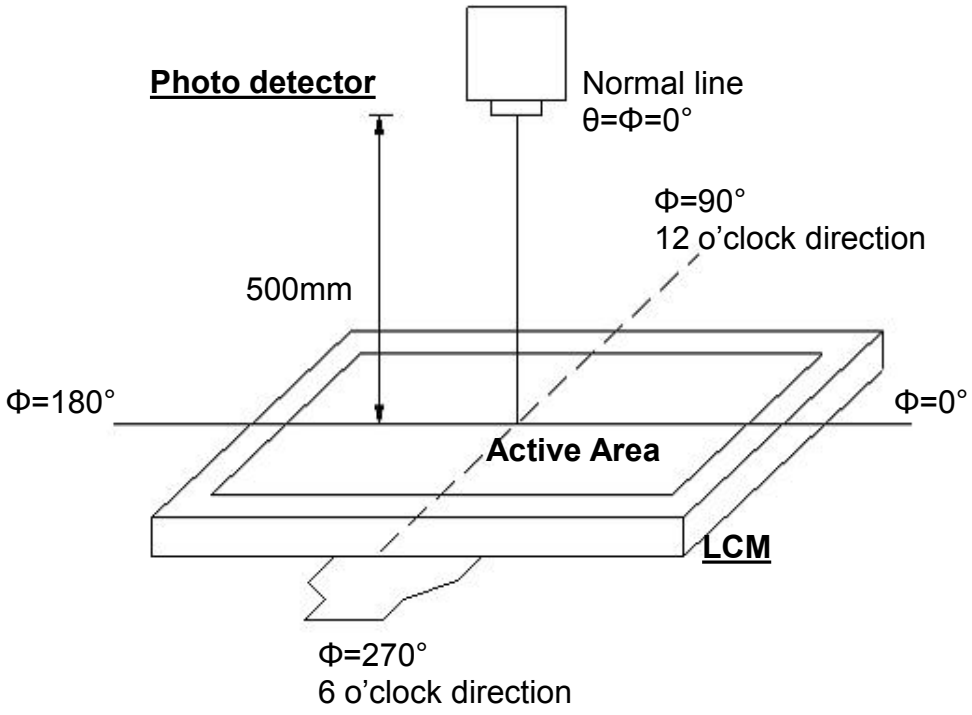


Fig. 4-3 Optical measurement system setup

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%.

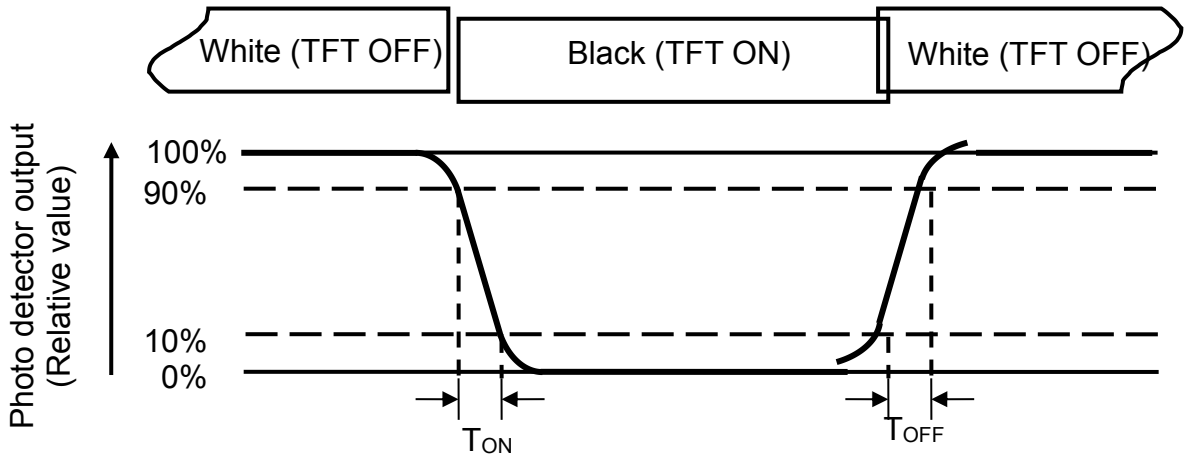


Fig. 4- 4 Definition of response time

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: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is I_L=360mA .

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.

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

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

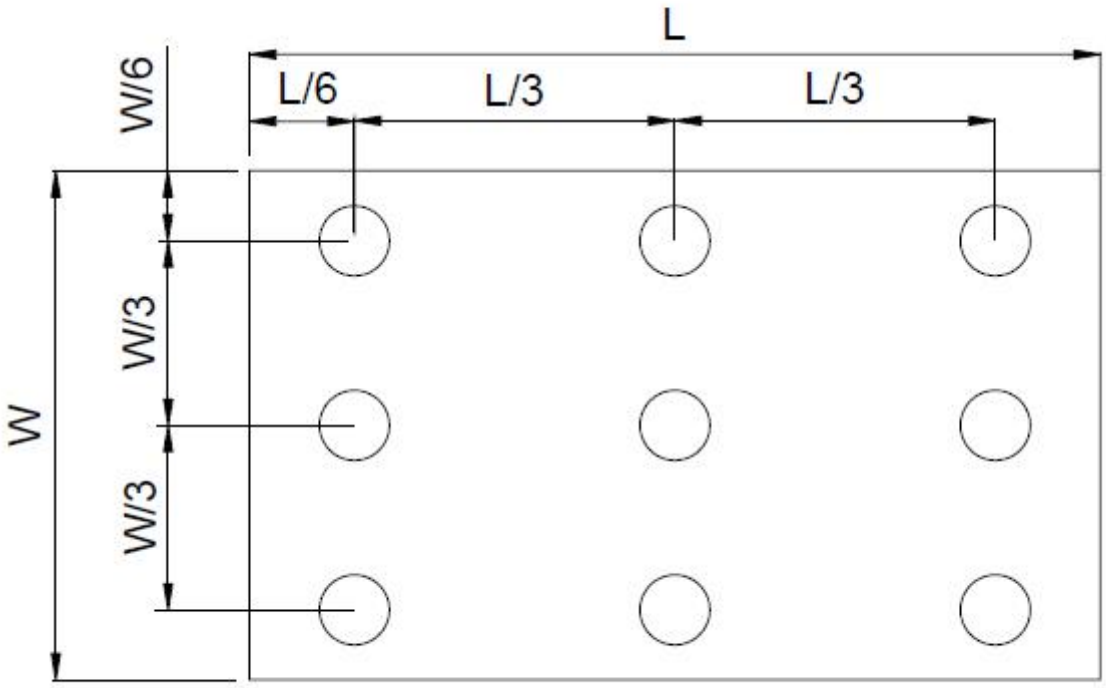


Fig. 4-4 Definition of measuring points

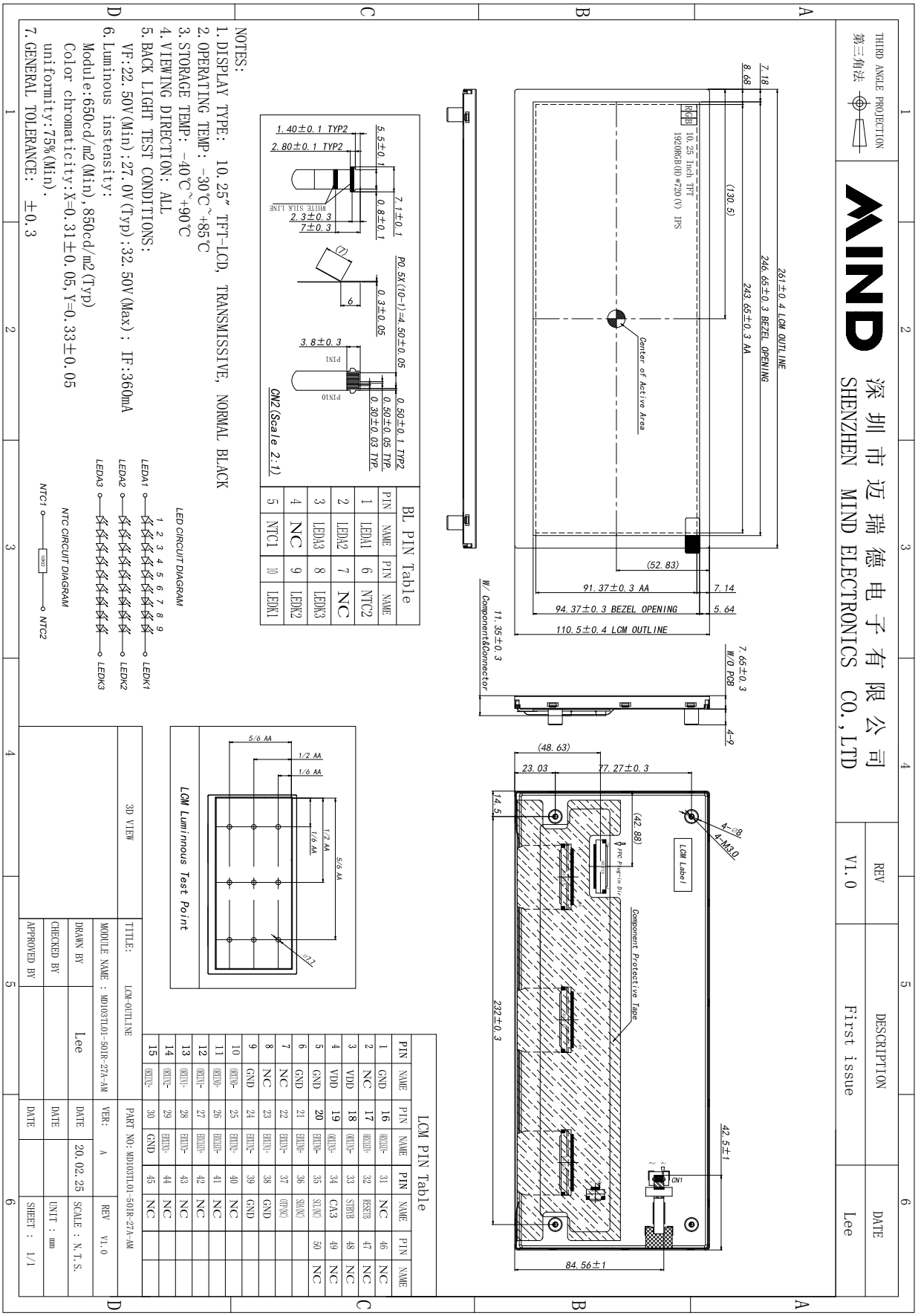
B_{MAX}: The measured maximum luminance of all measurement position.
B_{MIN}: The measured minimum luminance of all measurement position.

5. Reliability Test Items

Item	Test Conditions	Criterion
High Temperature Storage	Ta = 90℃ 240hrs	A,B,C,D,E
Low Temperature Storage	Ta = -40℃ 240hrs	A,B,C,D,E
High Temperature Operation	Ts = 85℃ 240hrs	A,B,C,D,E
Low Temperature Operation	Ta =-30℃ 240hrs	A,B,C,D,E
Operate at High Temperature and Humidity	+60℃, 90%RH 240hrs	A,B,C,D,E
Thermal Shock （non operation）	-20℃/30 min ~ +85℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	A,B,C,D,E
Vibration Test	Sweep:10Hz~55Hz~10Hz 2G 2 hours for each direction of X. Y. Z. (6 hours for total)	A,B,C,D,E
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	A,B,C,D,E
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	A,B,C,D,E
Electro Static Discharge	Contact=+/-8KV, Air=+/-15KV,(R=330R,C=150pF), 1 sec,9point,10times/point;	A,B,C,D,E

※Criterion:
A.LCM each function is OK,.
B.LCM appearance inspection without abnormalities (Including scratch, damage, corrosion and serious deformation)
C.LCM brightness above the Min. value of Spec.
D. Luminance uniformity above the Min. value of Spec.
E. Color chromaticity within tolerance range

6. Mechanical Drawing



7. Package Drawing

7.1.Packaging Material Table

TBD

7.2.Packaging Quantity

Total LCM quantity in Carton: No. of Partition TBD

7.3.Packaging Drawing

TBD

8. General Precautions

8.1. 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.

8.2. 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.

8.3. 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.

8.4. Storage

1. Store the module in a dark room where must keep at 25±10℃ 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.

8.5. 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.