B3 EV213QXM-N10 Product Specification Rev.P0

BUYER	
SUPPLIER	HEFEI BOE Optoelectronics Technology CO., LTD
FG-Code	EV213QXM-N10-3DK0

ITEM	BUYER SIGNATURE	DATE

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	张晓磊	
Reviewed	王贺陶 王盛	
Approved	布占场 李乘揆	

REVISION HISTORY

(√)preliminary specification

( )Final specification

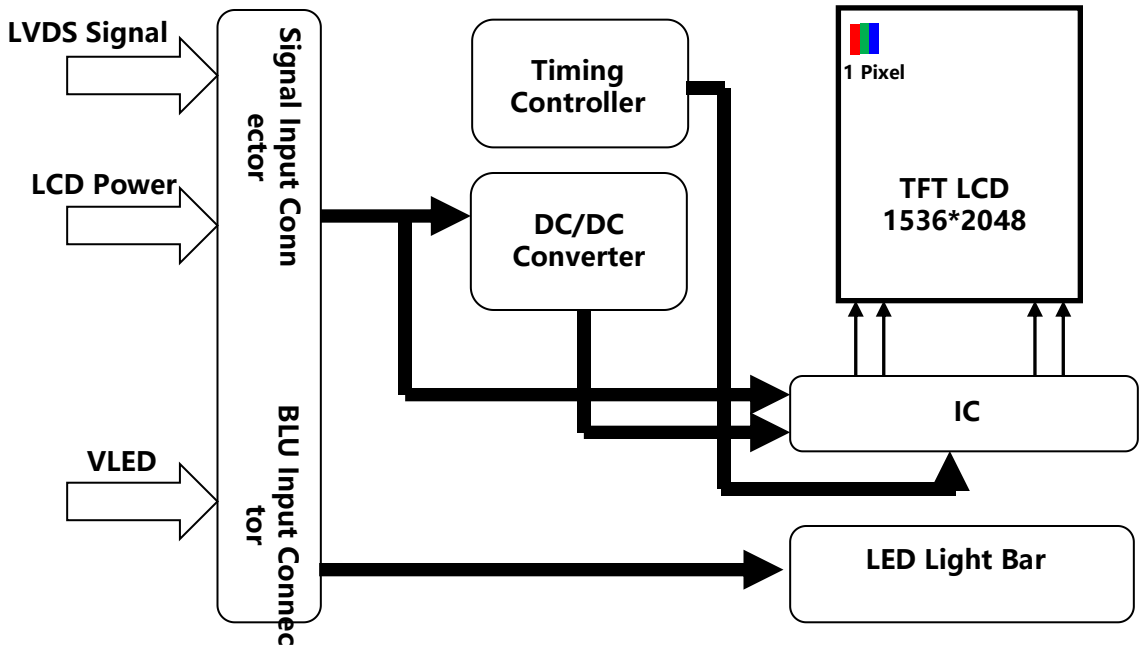
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		Initial Release	2022-11-20	张晓磊

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

EV213QXM-N10 is a color active matrix TFT LCD module using amorphous silicon TFT ‘s (Thin Film Transistors) as an active switching devices. This module has a 21. 3 inch diagonally measured active area with QXGA resolutions (1536 horizontal b y 2048 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots whic h are arranged in vertical stripe and this module can display 1.07B colors.



1.2 Features

- 0.4T Glass (Single)
- 10Bit color depth, display 1.07Bcolors
- LVDS Interface with 2 pixel / clock
- DE (Data Enable) only
- Reverse Type
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS compliant

1.3 Application

- Diagnostic

1.4 General Specification

The followings are general specifications at the EV213QXM-N10

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
Active Area	324.862(H)*433.152(V)	mm	
Number Of Pixels	1536(H) ×2048(V)	pixels	
Pixel Pitch	70.5(H) ×211.5(V)	um	
Pixel Arrangement	1 pixel = R + G + B dots		
Display Mode	HADS		
Display Colors	1.07B	colors	10bit
Surface Treatment	Anti Glare，Haze 42%		
Contrast Ratio	Typ. 2000:1, Min. 1800:1		
Viewing Angle(CR>10)	Typ. 89/89/89/89, Min. 85/85/85/85	deg.	U/D/L/R
Response Time	Typ. 35ms, Max.40ms	ms	Ton+Toff
Color Gamut	Typ. 95%, Min. 90%	NTSC	
Brightness	Typ. 900	cd/m2	
Brightness Uniformity	Typ.85%，Min.80%		
Power Consumption	49.1W(Tpy.)	watt	
Outline Dimension	336*453*10.3（B）	mm	
Weight	1700（typ.）	gram	
Back-light	ELED, Two LED Light bars		

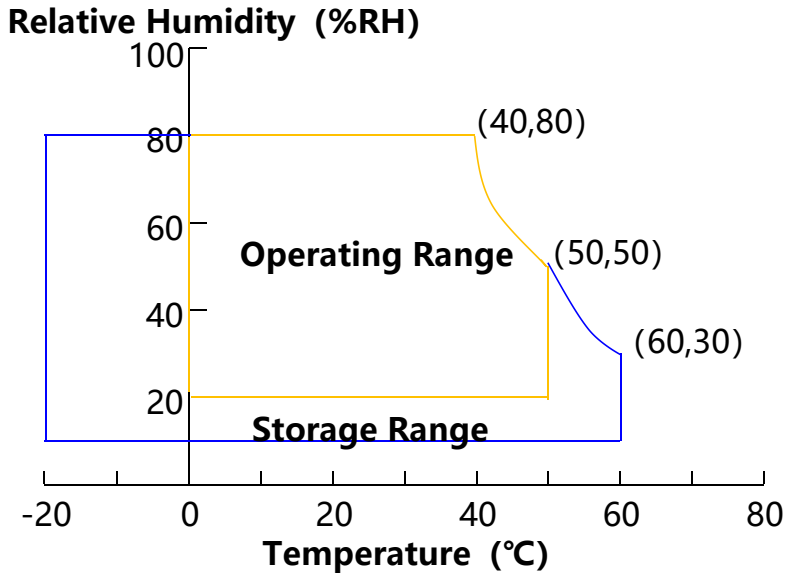
2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.2	V	Ta = 25 ℃
	VBLU	VSS-0.3	26.4	V	Ta = 25 ℃
Operating Temperature	T_{OP}	0	+50	℃	Note 1
	T_{SUR}	-	+60	℃	
Storage Temperature	T_{ST}	-20	+60	℃	
Operating Ambient Humidity	Hop	10	80	%RH	
Storage Humidity	Hst	10	80	%RH	

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.
T_{SUR} : Panel surface Temperature is measured at 50℃ Dry Condition



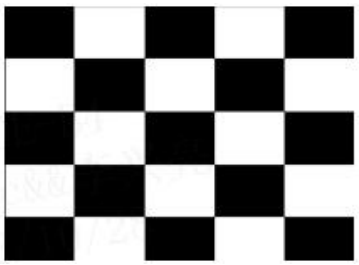
3.0 ELECTRICAL SPECIFICATIONS

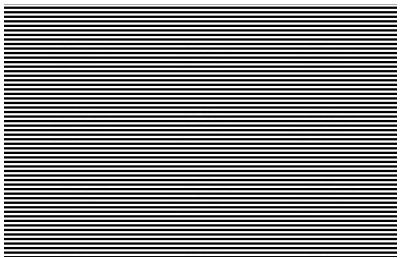
3.1 TFT LCD Module

< Table 3. LCD Module Electrical specifications > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	VDD	10.8	12	13.2	V	Note 1
Power Supply Ripple Voltage	VRP	-	-	600	mV	
Power Supply Current	IDD	-	462	788	mA	
Rush current	IRUSH	-	-	3	A	Note 2
BLU Supply Voltage	V_{LED}	-	24			
BLU Supply Current	I_{LED}	-	1.81	-	A	
Power Consumption	P_D	-	5.54	9.45	W	Note 1
	P_{LED}	-	43.5	-	W	
	P_{total}	-	49.1	53	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VBAT=12V, Frame rate f_V=60Hz and Clock frequency = 60.7MHz. Test Pattern of power supply current
a) Typ : Mosaic 5 x 5 Pattern(L0/L255) b) Max : H 1 line





2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

3.2 Back-Light Unit

Table 4. LED Bar Electrical Specifications >

[Ta =25±2 ℃]

Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max.		
LED Supply Voltage		V_{LED}	-	45	48	V	
LED Supply Current		I_{LED}	-	680	-	mA	Note 1
Power Consumption		P_{LED}	-	30.6	32.7	W	
LED Quantity		QLED	-	120	-	EA	
LED Life Time		TLED	50000	-	-	Hrs	Note 2/3
PWM Control Level	PWM High Level	-	2.7	3.3	5	V	
	PWM Low Level	-	0	-	0.7	V	
LEDEN Control Level	LEDEN High Level	-	2.7	3.3	5	V	
	LEDEN Low Level	-	0	-	0.7	V	
PWM Control Frequency		F_{PWM}	200	-	10000	Hz	
Duty Ratio		-	1	-	100	%	

Notes: 1. LED Bar:4Parallel*15String ，ILED=85mA*4*2=680mA（There are two light bar）
PLED = VLED ×ILED(Without LED converter transfer efficiency)

2. The life time of LED, 50,000Hrs, is determined as the time at which luminance of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25 ± 2°C.

3. Only under the above operating conditions could the life time of LED be guaranteed.

4.0 INTERFACE CONNECTION

4.1 Interface Input Signal & Power :

Connector : CI4412M1HR0-NH （瀚荃）or equivalent

Connector : IS050-C41B-C39-S （UJU/巨铖）or equivalent

Connector : IS050-C51B-C39-S（UJU/巨铖） or equivalent

< Table5. Pin Assignment for LCD Module Connector >

Pin No.	Symbol	Description	I/O
1	GND	Ground	-
2	GND	Ground	-
3	GND	Ground	-
4	GND	Ground	-
5	GND	Ground	-
6	GND	Ground	-
7	VDD	Power supply	
8	VDD	Power supply	
9	VDD	Power supply	
10	VDD	Power supply	
11	VDD	Power supply	
12	VDD	Power supply	

Pin No.	Symbol	Description	I/O
1	GND	Ground	-
2	GND	Ground	-
3	GND	Ground	-
4	RxC0-	LVDS receiver negative signal channel C0	I
5	RxC0+	LVDS receiver positive signal channel C0	I
6	GND	Ground	-
7	RxC1-	LVDS receiver negative signal channel C1	I
8	RxC1+	LVDS receiver positive signal channel C1	I

Notes : 1. Input Level of LVDS signal is based on the EIA-644 Standard.

Rear view of LCM

CI4412M1HR0-NH/ IS050-C41B-C39-S/ IS050-C51B-C39-S

BIST Pattern

PT1:Black (2sec)	PT2:White (2sec)	PT3:Red (2sec)	PT4:Green(2sec)	PT5:Blue (2sec)	PT5:Color bar (2sec)

Pin No.	Symbol	Description	I/O
9	GND	Ground	-
10	RxC2-	LVDS receiver negative signal channel C2	I
11	RxC2+	LVDS receiver positive signal channel C2	I
12	GND	Ground	-
13	CLKC-	LVDS receiver negative signal clock	I
14	CLKC+	LVDS receiver positive signal clock	I
15	GND	Ground	-
16	RxC3-	LVDS receiver negative signal channel C3	I
17	RxC3+	LVDS receiver positive signal channel C3	I
18	GND	Ground	-
19	RxC4-	LVDS receiver negative signal channel C4	I
20	RxC4+	LVDS receiver positive signal channel C4	I
21	GND	Ground	-
22	RxD0-	LVDS receiver negative signal channel D0	I
23	RxD0+	LVDS receiver positive signal channel D0	I
24	GND	Ground	-
25	RxD1-	LVDS receiver negative signal channel D1	I
26	RxD1+	LVDS receiver positive signal channel D1	I
27	GND	Ground	-
28	RxD2-	LVDS receiver negative signal channel D2	I
29	RxD2+	LVDS receiver positive signal channel D2	I
30	GND	Ground	-
31	CLKD-	LVDS receiver negative signal channel CLOCK	I
32	CLKD+	LVDS receiver positive signal channel CLOCK	I
33	GND	Ground	-
34	RxD3-	LVDS receiver negative signal channel D3	I
35	RxD3+	LVDS receiver positive signal channel D3	I
36	GND	Ground	-
37	RxD4-	LVDS receiver negative signal channel D4	I
38	RxD4+	LVDS receiver positive signal channel D4	I
39	GND	Ground	-
40	GND	Ground	-
41	GND	Ground	-

Pin No.	Symbol	Description	I/O
1	GND	Ground	-
2	GND	Ground	-
3	GND	Ground	-
4	RxA0-	LVDS receiver negative signal channel A0	I
5	RxA0+	LVDS receiver positive signal channel A0	I
6	GND	Ground	-
7	RxA1-	LVDS receiver negative signal channel A1	I
8	RxA1+	LVDS receiver positive signal channel A1	I
9	GND	Ground	-
10	RxA2-	LVDS receiver negative signal channel A2	I
11	RxA2+	LVDS receiver positive signal channel A2	I
12	GND	Ground	-
13	CLKA-	LVDS receiver negative signal clock	I
14	CLKA+	LVDS receiver positive signal clock	I
15	GND	Ground	-
16	RxA3-	LVDS receiver negative signal channel A3	I
17	RxA3+	LVDS receiver positive signal channel A3	I
18	GND	Ground	-
19	RxA4-	LVDS receiver negative signal channel A4	I
20	RxA4+	LVDS receiver positive signal channel A4	I
21	GND	Ground	-
22	RxB0-	LVDS receiver negative signal channel B0	I
23	RxB0+	LVDS receiver positive signal channel B0	I
24	GND	Ground	-
25	RxB1-	LVDS receiver negative signal channel B1	I
26	RxB1+	LVDS receiver positive signal channel B1	I
27	GND	Ground	-
28	RxB2-	LVDS receiver negative signal channel B2	I
29	RxB2+	LVDS receiver positive signal channel B2	I
30	GND	Ground	-
31	CLKB-	LVDS receiver negative signal channel CLOCK	I
32	CLKB+	LVDS receiver positive signal channel CLOCK	I
33	GND	Ground	-
34	RxB3-	LVDS receiver negative signal channel B3	I
35	RxB3+	LVDS receiver positive signal channel B3	I
36	GND	Ground	-
37	RxB4-	LVDS receiver negative signal channel B4	I
38	RxB4+	LVDS receiver positive signal channel B4	I

Pin No.	Symbol	Description	I/O
39	GND	Ground	-
40	GND	Ground	-
41	SDA_P	SDA_P for PMIC	I
42	SCL_P	SDA_P for PMIC	I
43	BIST	BIST for TCON	I
44	SECTION	section	I
45	GND	Ground	-
46	GND	Ground	-
47	GND	Ground	-
48	NC	For internal use	-
49	NC	For internal use	-
50	NC	For internal use	-
51	GND	Ground	-

4.2 Pin assignment for LED Bar

Connector **CI4412M1HR0-NH（瀚荃）** or equivalent

< Table6. Pin assignment for LED Bar >

Pin No	Symbol	Description	Remarks
1	VLED	Power supply 24v	
2	VLED	Power supply 24v	
3	VLED	Power supply 24v	
4	VLED	Power supply 24v	
5	VLED	Power supply 24v	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	NC	NC	
12	BL ON	BLU Control pin	High：2.7~5V,Low：0~0.8V
13	NC	NC	
14	PWM	BLU PWM	High：2.7~5V,Low：0~0.8V

4.4 LVDS Interface

- LVDS Receiver : Timing Controller (LVDS Rx merged) / LVDS Data : Pixel Data

< Table 7. LVDS Input Data Mapping >

Channel No.	Data No.	10-bit LVDS Type
		JEIDA
0	Bit-0	R4
	Bit-1	R5
	Bit-2	R6
	Bit-3	R7
	Bit-4	R8
	Bit-5	R9
	Bit-6	G4
1	Bit-0	G5
	Bit-1	G6
	Bit-2	G7
	Bit-3	G8
	Bit-4	G9
	Bit-5	B4
	Bit-6	B5
2	Bit-0	B6
	Bit-1	B7
	Bit-2	B8
	Bit-3	B9
	Bit-4	HS
	Bit-5	VS
	Bit-6	DE
3	Bit-0	R2
	Bit-1	R3
	Bit-2	G2
	Bit-3	G3
	Bit-4	B2
	Bit-5	B3
	Bit-6	

4.4 LVDS Interface

- LVDS Receiver : Timing Controller (LVDS Rx merged) / LVDS Data : Pixel Data

< Table 7. LVDS Input Data Mapping >

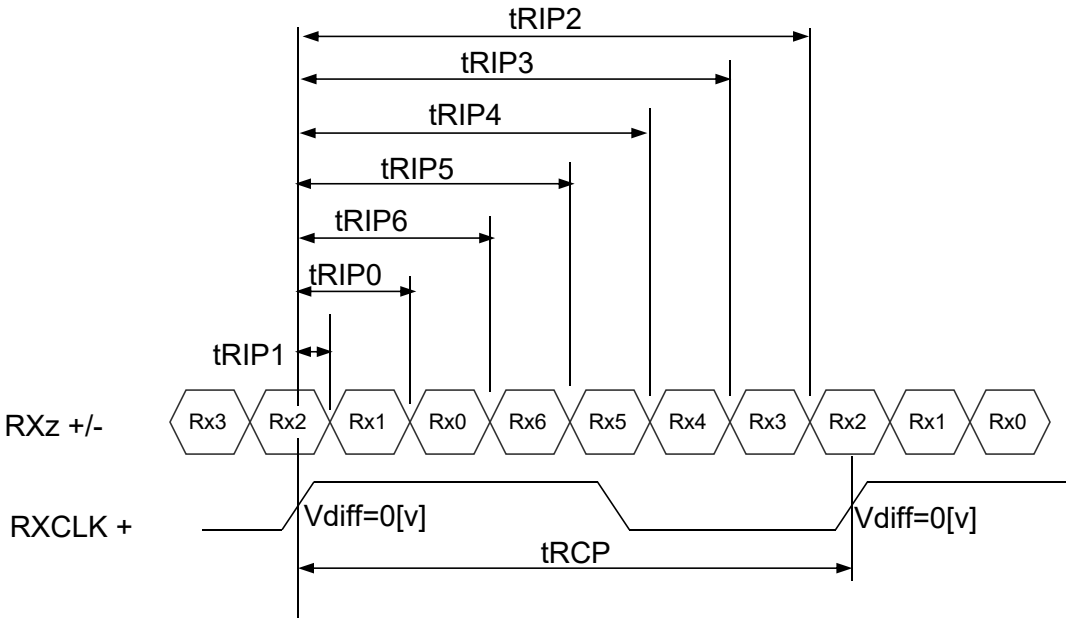
Channel No.	Data No.	10-bit LVDS Type
		JEIDA
4	Bit-0	R0
	Bit-1	R1
	Bit-2	G0
	Bit-3	G1
	Bit-4	B0
	Bit-5	B1
	Bit-6	-

4.5 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 8.

<Table 8. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCP	11.76	T	50	nsec	
Receiver Data Input Margin	tRMG	-0.39	-	+0.39	nsec	fCLKIN=85MHz
		-0.44	-	+0.44	nsec	fCLKIN=75MHz
Input Data 0	tRIP1	- | tRMG |	0.0	| tRMG |	Clock	
Input Data 1	tRIP0	T/7- | tRMG |	T/7	T/7+ | tRMG |	Clock	
Input Data 2	tRIP6	2 T/7- | tRMG |	2T/7	2T/7+ | tRMG |	Clock	
Input Data 3	tRIP5	3T/7- | tRMG |	3T/7	3T/7+ | tRMG |	Clock	
Input Data 4	tRIP4	4T/7- | tRMG |	4T/7	4T/7+ | tRMG |	Clock	
Input Data 5	tRIP3	5T/7- | tRMG |	5T/7	5T/7+ | tRMG |	Clock	
Input Data 6	tRIP2	6T/7- | tRMG |	6T/7	6T/7+ | tRMG |	Clock	



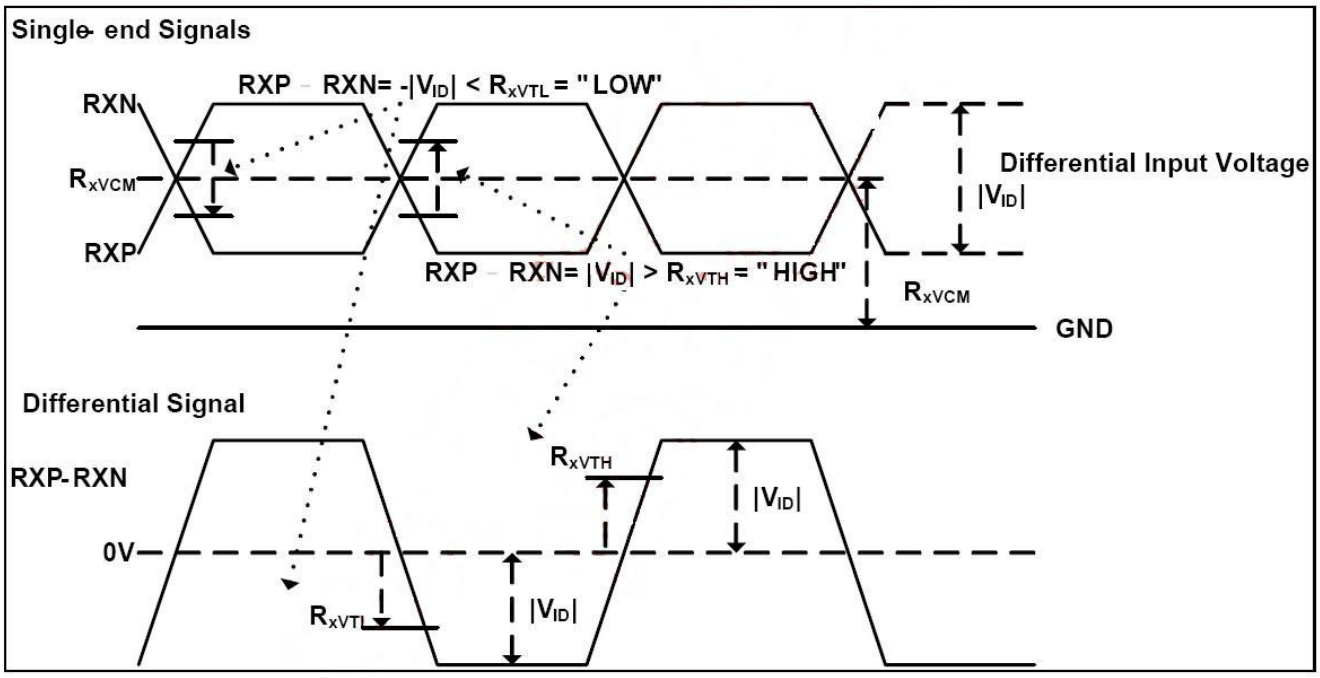
* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

4.6 DC Specification

- LVDS Receiver Differential Input (DC Characteristics)

< Table 9-1. LVDS Rx DC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Differential Input High Threshold Voltage	VTH	-	-	+100	mV	VCM=1.25V
Differential Input Low Threshold Voltage	VTL	-100	-	-	mV	
Differential Input Common Mode Voltage	VCM	1.125	1.25	1.375	V	
Differential Input Voltage	| VID |	100	-	300	mV	

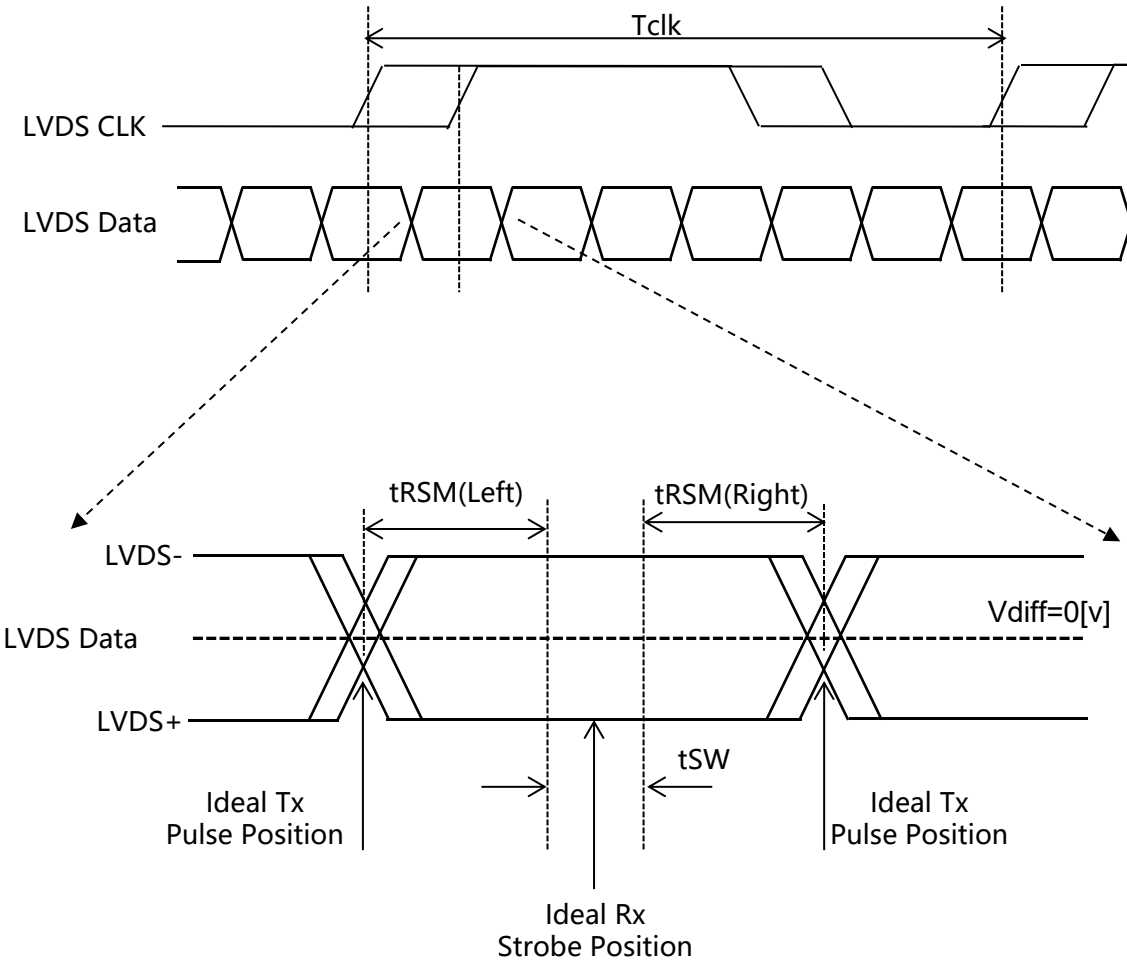


4.7 AC Specification

- LVDS Receiver Differential Input (AC Characteristics)

< Table 9-2. LVDS Rx AC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Strobe Width	t_{SW}	-	-	-	ps	Vcm=1.25V VID = 200mV @75MHz
LVDS Receiver Skew Margin	t_{RSM}	440	-	-	ps	



Note:
RSM: Receiver Skew Margin
SW: Strobe Width (Setup and Hold time; TCON Internal data sampling window)

5.0 SIGNAL TIMING SPECIFICATION

5.1 Timing Parameters (DE only mode)

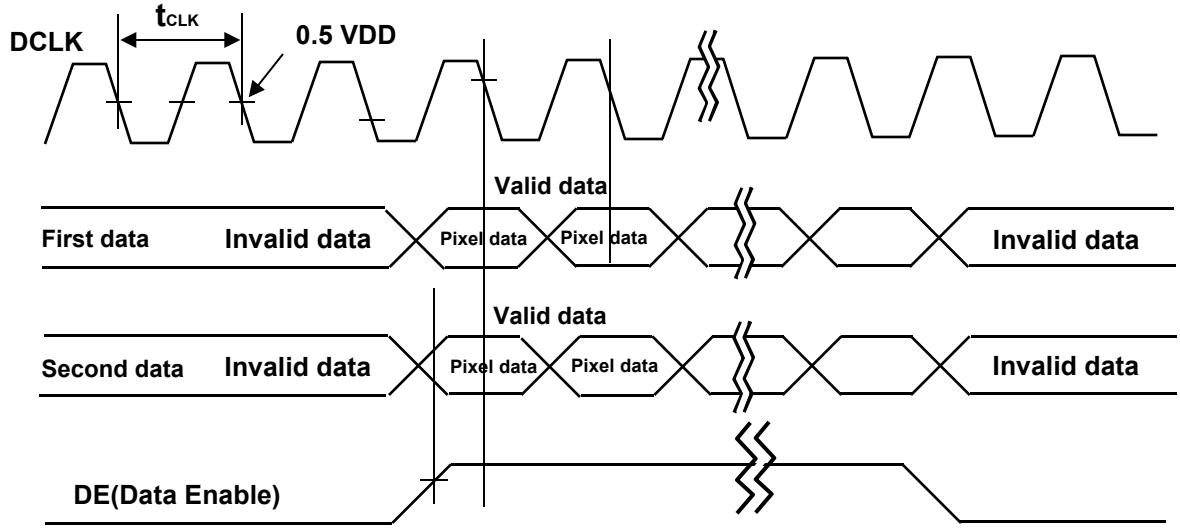
< Table10. Timing Parameter >

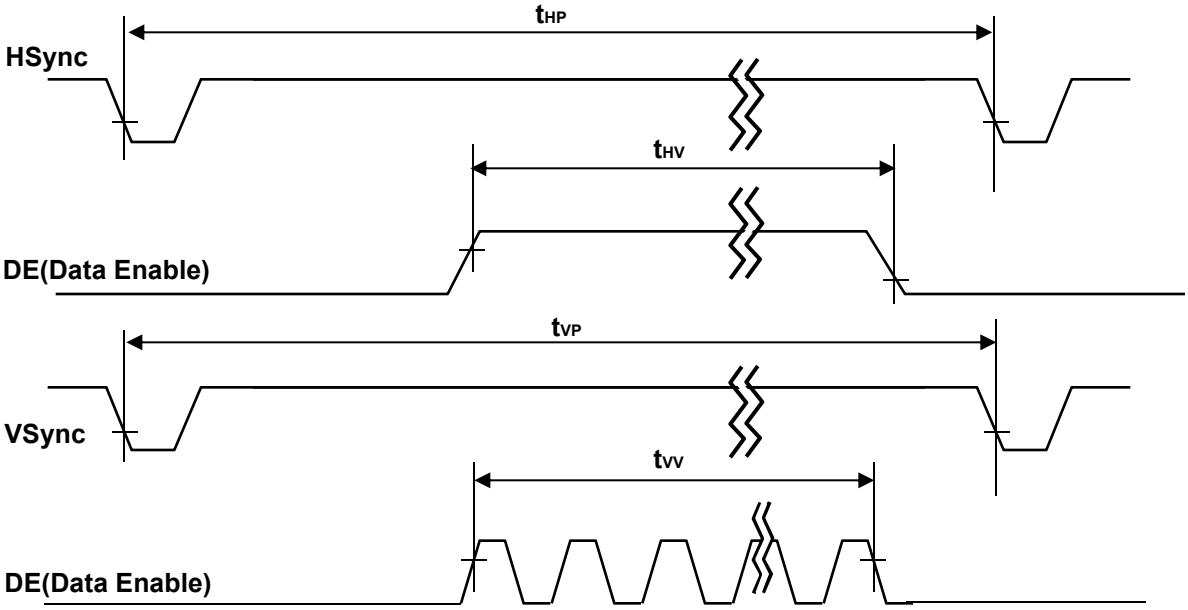
Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	-	16.47	-	ns	-
	Frequency	-	58.9	60.7	62.1	MHz	-
Horizontal	Horizontal Period (Total)	tHP	469	**484**	494	tCLK	-
	Horizontal Valid	tHV		384		tCLK	-
	Horizontal Blank	tHB	85	100	110		-
	Frequency	fH	124.2	125.4	126	KHz	-
Vertical	Vertical Period (Total)	tVP	2070	2090	2100	tHP	-
	Vertical Valid	tVV		2048		tHP	-
	Vertical Blank	tVB	22	42	62	tHP	-
	Frequency	fV	58	60	62	Hz	-

Note

1. DE Only Mode, While operation, DE signal should be have the same cycle. The input of HSYNC & VSYNC signal does not have an effect on normal operation.
2. Best operation clock frequency is 60.7Mhz.
3. Frequency] = [H Total] * [V Total] * [vertical Frame rate]
   H Total, V Total and Frame rate]should operate within the range between Frequency_Min and Frequency_Max
4. Except Best operation clock frequency, FOS(Flicker & Brightness & Crosstalk, Etc.) are not guaranteed.
5. Main frequency Max is 60.7Mhz MHz without spread spectrum

5.2 Signal Timing Waveform





Note: While operation, DE signal should be have the same cycle and continuous;

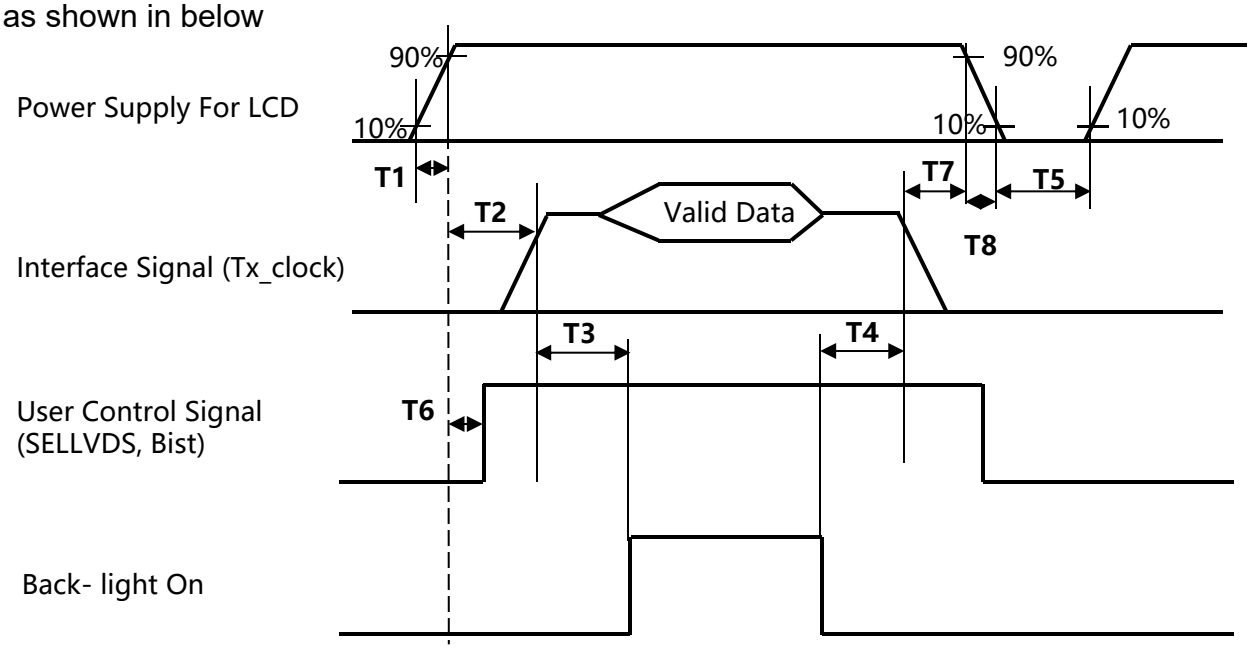
5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 12. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																													
		RED Data										Green Data										Blue Data									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	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	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale of Red	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	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	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	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Gray Scale of Blue	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	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
Gray Scale of White	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	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	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	1	1	1	1	1	1

5.4 Power Sequence

To prevent a latch-up or DC operation of the Open Cell, the power on/off sequence shall b e as shown in below



< Table 13. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0.1	-	T7	ms
T3	400	-	-	ms
T4	200	-	-	ms
T5	1	-	-	s
T6	0.1	-	T2	ms
T7	0.1	-	-	ms
T8	0.5	-	10	Ms

Note 1: Even though T1 is over the specified value, there is no problem if the rush current is within Spec.

Note 2: When the power supply VDD is 0V, keep the level of input signals on the low or high impedance;

※ Please avoid floating state of interface signal at invalid period.

※ When the power supply for LCD (VDD) is off, be sure to pull down the valid and invalid data to 0V.

Note 3: The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

Note 4: T5 should be measured after the Module has been fully discharged between power off and on period

Note 5: If the on time of signals (Interface signal and user control signals) precedes the on time of Power (VLCD),it w ill be happened abnormal display. When T6 is NC status, T6 doesn' t need to be measured

Note 6: T8: Voltage of VDD must decay smoothly after power-off , there should be none re-bounding voltage. (custo mer system decide this value)

6.0 OPTICAL SPECIFICATIONS

6.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Gonio meter system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ =0 (=θ3) as the 3 o′ clock direction (the "right"), θØ=90 (= θ12) as the 12 O′ clock direction ("upward"), θØ=180 (= θ9) as the 9 O′ clock direction ("left") and θØ=270(= θ6) as the 6 O′ clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed.

6.2 Optical Specifications

< Table15. Optical Table >

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Brightness（MDL出货）	Lv	θ=0°	800	900	--	cd/m2	Note 1
Brightness Uniformity	▵Bp		80	85	--	%	Note 2
Viewing Angle	θL	Cr≥10	85	89	--	deg	Note 3
	θ_R		85	89	--		
	ψ_T		85	89	--		
	ψ_B		85	89	--		
Contrast Ratio	Cr	θ=0° FF=0°	1800	2000		-	Note 4
Response Time	Tr+Tf		-	35	40	ms	Note 5
Color Coordinate of CIE1931	Rx	θ=0°	0.645	0.675	0.705	-	Note 6
	Ry		0.293	0.323	0.353		
	Gx		0.231	0.261	0.291		
	Gy		0.661	0.691	0.721		
	Bx		0.119	0.149	0.179		
	By		0.032	0.062	0.092		
	Wx		0.283	0.313	0.343		
	Wy		0.299	0.329	0.359		
NTSC Ratio	NTSC	CIE1931	90	95	--	%	Note 7
Gamma Scale			2.0	2.2	2.4		

Note1:Luminance measurement

The test condition is at ILED=640mA and measured on the surface of LCD module at 25℃.

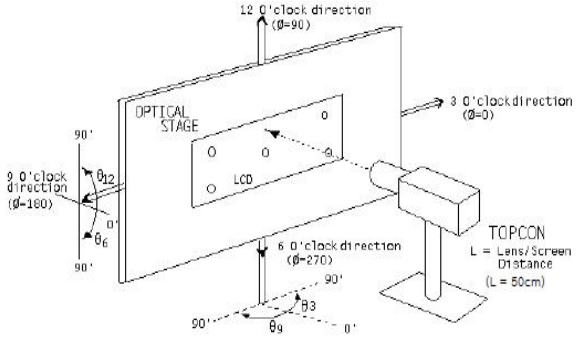
●The data are measured after LEDs are lighted on for more than 5 minutes and LCM displays are fully white. The brightness is the center of the LCD. Measurement equipment CS2000 or similar equipments (Field of view:1deg,Distance:50cm)

●Measuring surroundings: Dark room.

●Measuring temperature: Ta=25℃.

●Adjust operating voltage to get optimum contrast at the center of the display.

●Measured value at the center point of LCD panel must be after more than 5 minutes while backlight turning on.



Note2:Uniformity

●The test condition is at ILED=640mA and measured on the surface of LCD module at 25℃.

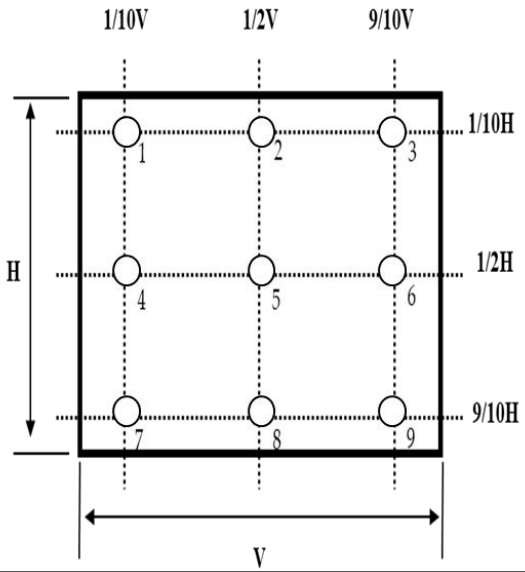
●Measurement equipment:CS2000 or similar equipments

●The luminance uniformity is calculated by using following formula:

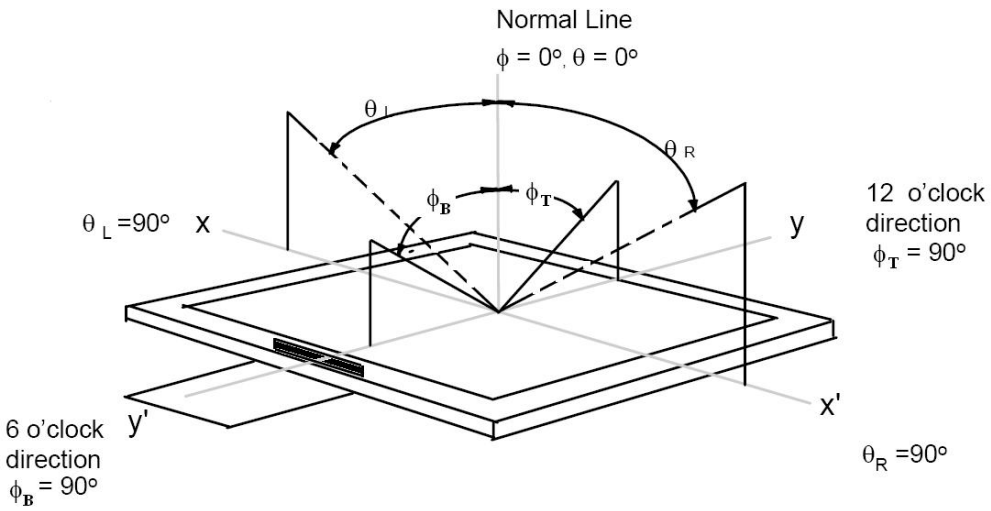
●▵Bp = Bp (Min.) / Bp (Max.)×100 (%)

●Bp (Max.) = Maximum brightness in 9 measured spots

●Bp (Min.) = Minimum brightness in 9 measured spots.



Note 3:**The definition of Viewing Angle**
Refer to the graph below marked by θ and Φ.

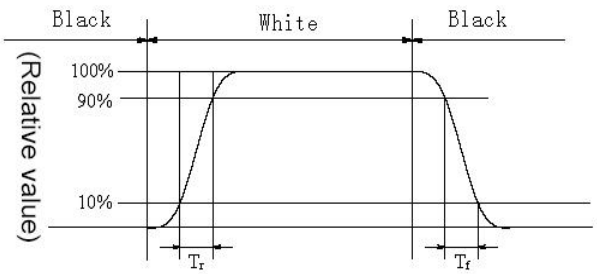


Note4:**ThedefinitionofContrastRatio** (Test LCM using CS2000 or similar equipments):

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

(Contrast Ratio is measured in optimum common electrode voltage)

Note5:**Definitionof Response time.**(Test LCD using DMS501 or similar equipments):
The output sign also photo detector are measured when the input sign also are changed from “black” to “white” (Voltage falling time)and from “white” to “black” (Voltage rising time), respectively .Th e response time is defined as the time interval between the 10% and 90% of amplitudes . Refer to figu res below.

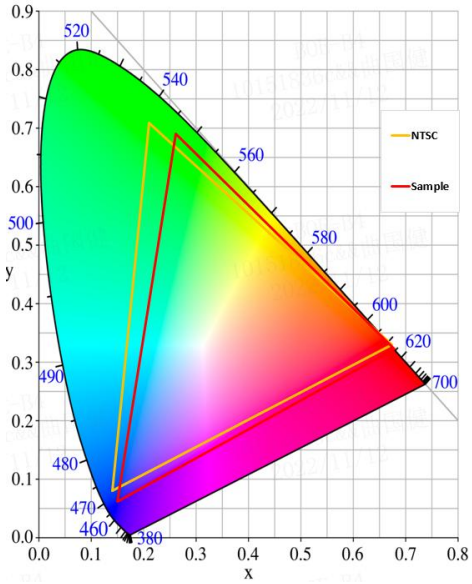


Response time of gray to gray:
Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize. Each time in below table is defined as Figure 2 and shall be measured by switching the signals for “any level of gray（bright）”and any levelof gray（dark）
5. Theoutputsignalsofphotodetectoraremeasuredwhentheinputsignalsarechanged from “Lx” to “Ly”, x, y= [0, 7]. The response time is defined as the time interval between the 10% and 90% of amplitudes. The result of the test can be noted as below:

Note 6: Color Coordinates of CIE 1931
The test condition is at ILED=640mA and measured on the surface of LCD module at 25℃.
Measurement equipment: CS2000 or similar equipments
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

Note 7: Definition of Color of CIE Coordinate and NTSC Ratio.

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV366FBM-N10 . Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	336(H)*453(V)*10.3(B)	mm
Weight	1700 (typ.)	gram
Active area	324.862(H)*433.152(V)	mm
Pixel pitch	70.5(H) ×211.5(V)	um
Number of pixels	1536(H) ×2048(V)(1 pixel = R + G + B dots)	pixels
Back-light	ELED 2-LED Light bar	

7.2 Mounting

See FIGURE 5. (shown in Appendix)

7.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

8.0 RELIABLITY TEST

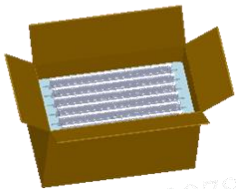
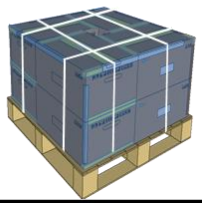
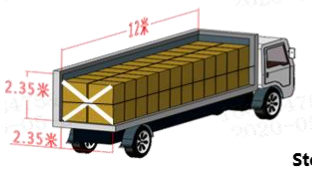
The Reliability test items and its conditions are shown in below.

<Table 12. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature & high humidity (storage test)	60℃，90%RH，240hr
2	High temperature storage test	60℃，240hr
3	Low temperature storage test	-20℃，240hr
4	High temperature & high humidity (operation test)	50℃，80%RH，240hr
5	Low temperature operation test	0℃，240hr
6	High temperature operation test	50℃，240hr
7	Thermal Shock Test	-20℃~60℃，1hr/cycle，100cycle
8	Image Sticking	Chess 4*4，25℃ Aging 3hrs，check@Gray 50%（L512），the residual image need disappear within 10 seconds.
9	ESD	150pF，330Ω，±8kV(Contact)，±15kV（Air），Class B：accidental screen failure or abnormal function that can be recovered automatically is allowed.
10	Packing VIB	1.47G，1-200hz，X，Y，±Z，30min/Axis

9.0 PACKING INFORMATION(产品形态： LCM)

Packing procedure:

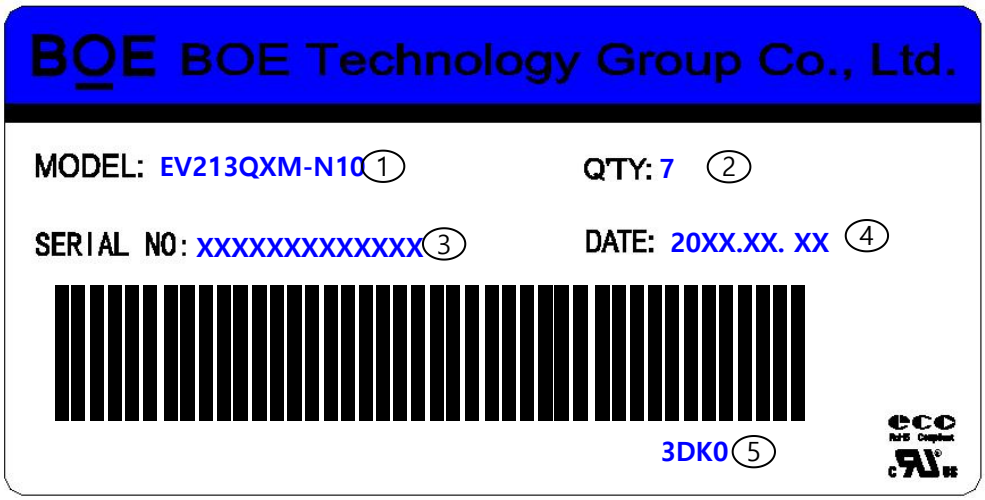
将 EPE Bottom 放入纸箱内	将LCM装入PE袋中，并沿产品边缘折叠，再将7pcs套有PE袋的LCM（背光面向操作人员，PCB朝右）依次放入Bottom对应的卡槽内 容量：7 LCM/Box， 7 PE Bag/Box	将 EPE Cover 盖在 Bottom 上，使用胶带工字型封箱 容量：7 LCM/Box
 Step 1	 Step 2	 Step 3
将封装好的纸箱放到木托上，回字形排布，堆叠2层，共8箱 容量：56 LCM/8 Box/Pallet	放置8ea纸护角，用缠绕裹包（≥3层）再用打包带“井”字形固定	厢车装载方式：两横摆放，双层码放 厢车装载量_12m：2464 pcs（44托）
 Step 4	 Step 5	 Step 6

9.1 Packing Note(产品形态：LCM)

- Box Dimension: 537mm(W) x 424mm(D) x 430mm(H)
- Package Quantity in one Box: 7pcs

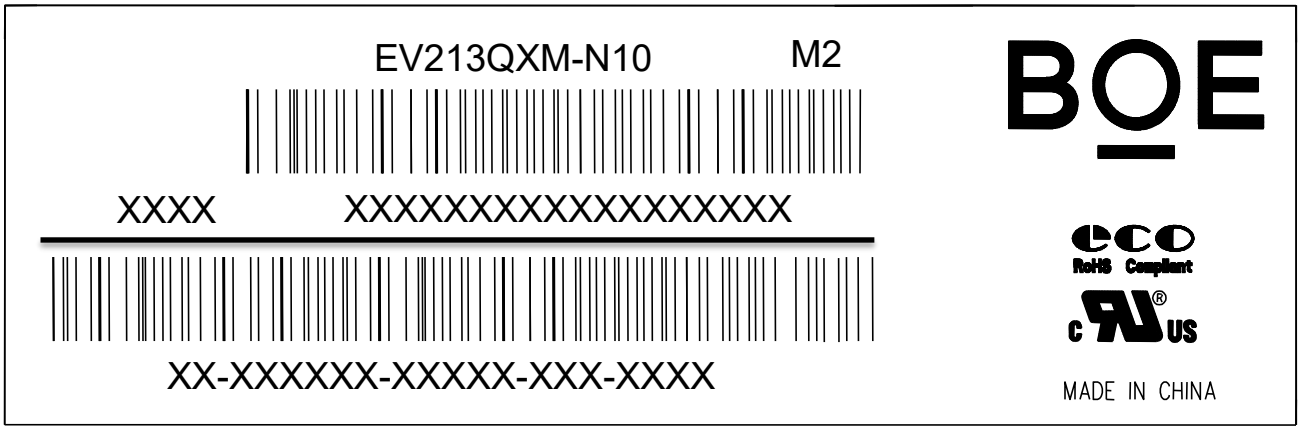
9.2 Box label (产品形态：LCM)

- Label Size :110mm*55mm
- Contents
  Model : LCM
  Q`ty : 7pcs/Box
  Serial No. : Box Serial No. as shown below.
  Date : Packing Date
  FG Code : FG Code of Product



No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	X	X	S	3	1	8	B	0	0	0	1	H	D
	GBN		Grade	B3	Year		Month	Rev	Serial number				

9.3 Product Label



BOE MDL ID rule

1	2	3	4	5	6	7
X X	X	X	X X	X	X X X X	X X X X X X

1. Control Number
2. Rank / Grade
3. Line Classification
4. Year (2001 : 01, 2002 : 02, …)
5. Month (1,2,3, … , 9, X, Y, Z)
6. Internal Use
7. Serial Number

10.0 Handling & Cautions

Please pay attention to the followings when you use this TFT LCD Module.

10.1 Mounting Precautions

- Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- You must mount a module using specified mounting holes (Details refer to the drawings).
- You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Do not apply mechanical stress or static pressure on module , and avoid impact, vibration and falling.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Protection film for polarizer on the module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module surface.
- You should adopt radiation structure to satisfy the temperature specification.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.

  Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)

- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- This module has its circuitry PCB' s on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire.
- Do not disassemble the module.

10.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Module at the "Power On" Condition.
- When the module is operating, do not lose CLK, ENAB signals. If any one of these si gnals is lost, the module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Do not allow to adjust the adjustable resistance or switch.
- The electrochemical reaction caused by DC voltage will lead to LCD module degrad ation, so DC drive should be avoided.
- The LCD modules use C-MOS LSI drivers, so customers are recommended that any u nused input terminal would be connected to Vdd or Vss, do not input any signals be fore power is turn on, and ground you body, work/assembly area, assembly equipme nt to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input v oltage variation, variation in part contents and environmental temperature, and so o n) Otherwise the Module may be damaged.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic int erference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- Long side LED Bar design is recommended when using E-LED type Back Light.

- For long-term lighting products, it is recommended to shut down periodically.
- If the product is used for a long time under the condition of 7*24 hr, it is strongly recommended to contact BOE for filed application engineering advice.
- Long time and large angle forward use or unconventional use , It is strongly recommended to contact BOE for filed application engineering advice.
- Products exposed to low temperature environment for a long time, need to carry out necessary protection , low temperature environment is usually refrigerators , vending machine Etc…

10.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothin g or other conductivity-treated fibers.
- Since a module is composed of electronic circuits, it is not strong to electrostatic dis charge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

10.4 Precautions for Strong Light Exposure

- Do not leave the module operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

10.5 Precautions for Storage

A. Atmosphere Requirement

ITEM	UNIT	MIN	TYP	MAX
Storage Temperature	(℃)	5	25	40
Storage Humidity	(%rH)	40	50	75
Storage Life	6 months			
Storage Condition	• The storage room should be equipped with a dark and good ventilation facility. • Prevent products from being exposed to the direct sunlight, moisture and water. • The product need to keep away from organic solvent and corrosive gas. • Be careful for condensation at sudden temperature change. • Storage condition is guaranteed under packing conditions.			

B. Package Requirement

- The product should be placed in a sealed polythene bag.
- Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

10.6 Precautions for protection film

- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- People who peeled off the protection film should wear anti-static strap and grounded well.

10.7 Appropriate Condition for Commercial Display

-Generally large-sized LCD modules are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module's lifetime and function, several operating usages are required.

1. Normal operating condition
   - Temperature: 20±15℃
   - Operating Ambient Humidity : 55±20%
   - Display pattern: dynamic pattern (Real display)
   - Well-ventilated place is recommended to set up Commercial Display system
2. Special operating condition

   a. Ambient condition

   - Well-ventilated place is recommended to set up Commercial Display system.

   b. Power and screen save

   - Periodical power-off or screen save is needed after long-term display.

   c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD module may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD module will return to normal display.

   d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot ）,the LCD module may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD module ‘s surface which may affect the operation of the polarizer and LCD module .

   e. Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

   f. Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, highlight, special display images, running time, long time operation, outdoor operation, etc. It is strongly recommended to contact BOE for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

3. Operating usages to protect against image sticking due to long-term static display.
   a. Suitable operating time: under 20 hours a day.
   b. Static information display recommended to use with moving image.
   - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
   c. Background and character (image) color change
   - Use different colors for background and character, respectively.
   - Change colors themselves periodically.
   d. Avoid combination of background and character with large different luminance.
   1) Abnormal condition just means conditions except normal condition.
   2) Black image or moving image is strongly recommended as a screen save
4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.
5. Module should be turned clockwise based on front view when used in portrait mode.

10.8 Other Precautions

A. LC Leak

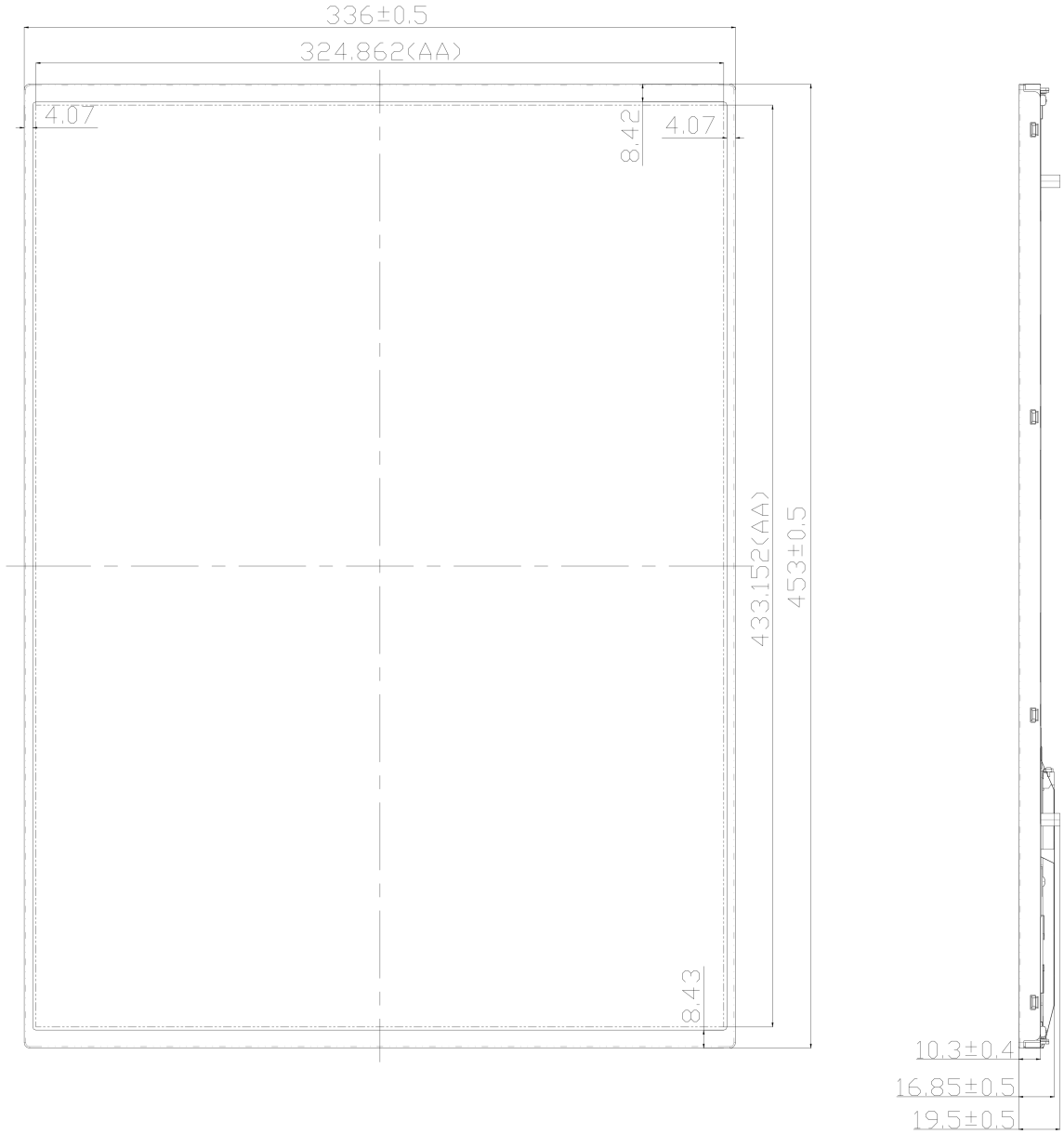
- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- If the liquid crystal material leaks from the panel, it should be kept away from the ey es or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

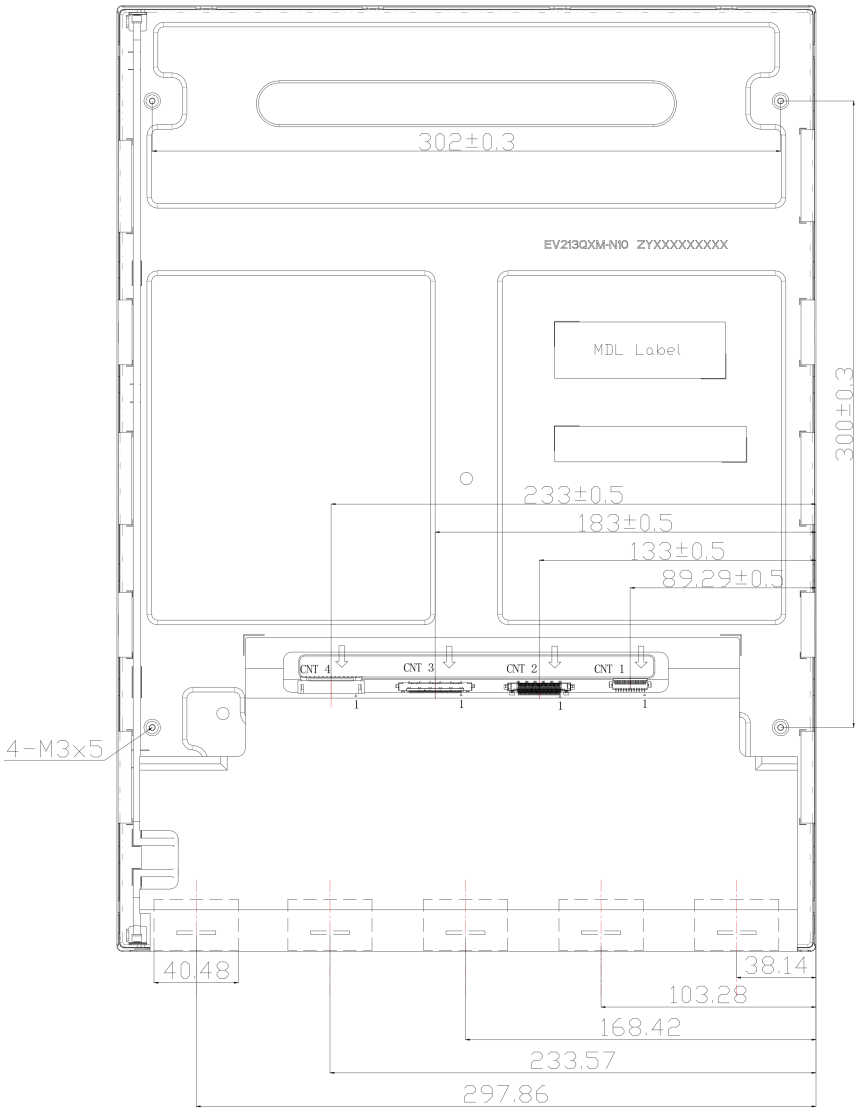
- When returning the module for repair or etc., Please pack the module not to be bro ken. We recommend to use the original shipping packages.

11.0 APPENDIX

Mechanical Drawing



Mechanical Drawing



NOTE:
1. Torque of userhole: 3.0~4.0kgf-cm.
2. Unspecified tolerances to be ±0.5mm.
3.CNT
CNT1: CI4412M1HR0-NH (12 Pin)
CNT2: IS050-C41B-C39 (41 Pin)
CNT3: IS050-C51B-C39 (51 Pin)
CNT4: CI0114M-HR0 (14 Pin)
4.The COF area is weak&sensive,so please do not press the COF area.