B4 10.1 WU TDDI Amazon Product Specification Rev.O

BUYER	Amazon
SUPPLIER	BEIJING BOE Display TECHNOLOGY CO., LTD
FG-Code	TV101WUM-LML

ITEM	BUYER SIGNATURE	DATE

ITEM	SUPPLIER SIGNATURE	DATE
Prepared		
Reviewed		
Approved		

REVISION HISTORY

REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	/	Initial Release	2023-04-10	Hejun
O	202307008	Update HQ code	2023-09-07	Liyehui

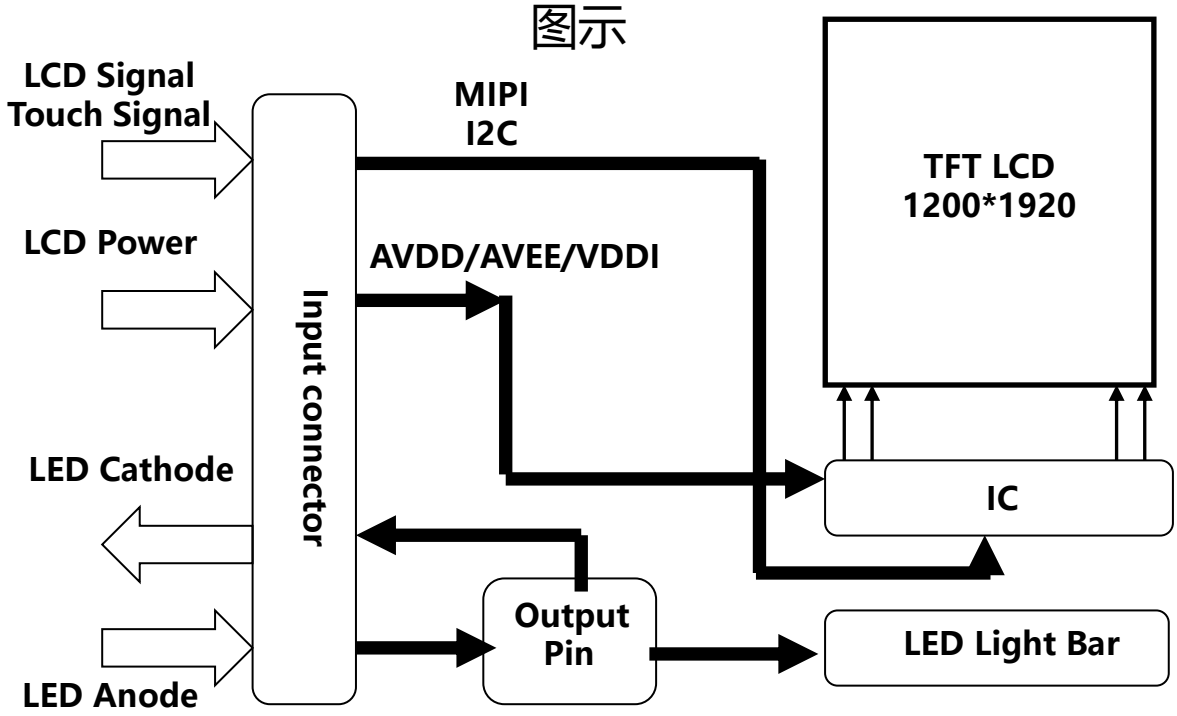
Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

TV101WUM-LML 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 10.1 inch diagonally measured active area with WUXGA resolutions (1200 horizontal by 1920 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.

图示



1.2 Features

- 4 Lane MIPI Interface;
- 8-bit color depth, display 16.7M colors
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS compliant

1.3 Application

- Tablet PC

1.4 General Specification

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
Active Area	135.36(W) × 216.58(H)	mm	
Number Of Pixels	1200(H)×1920(V)	pixels	
Pixel Pitch	0.1128(H)×RGB×0.1128(V)	mm	
Pixel Arrangement	Pixels RGB stripe arrangement		
Display Colors	16.7M(8bits)	colors	
Display Mode	Normally Black		
Surface Treatment	Glare		
Contrast Ratio	1400:1(typ.)		
Viewing Angle(CR>10)	85/85/85/85(typ.)	deg.	
Response Time	35 Max	ms	
Color Gamut	70%		
Brightness	360(min)/440(typ)	cd/m2	
Brightness Uniformity	13 point: min 70% (Before RA)		
Power Consumption	TLCM: 0.45W(Max.)(Include touch) BLU: 1.92W(Max.)(w/o Driver)	watt	@White Pattern
Outline Dimension	142.5(H)*227.93(V)*1.95 (typ)(LCM) 158.36(H)*239.58(V)*3.0(max)(TLCM)	mm	
Weight	175(max.) @TDM	gram	

<Table 2. Touch Panel Specifications>

Parameter		Specification				Remarks
TP Structure		TDDI				
Sensing Method		Self-Capacitance				
Number Of Touch		10				
Performance	Sensitivity(mm)	Φ5				
	Report Rate	> 90Hz				
	Finger Separation	< 14mm				
	Response Time	≤35ms				
	Accuracy(mm)	Center	≦1.0	Edge	≦1.5	@Φ7mm
	Precision(mm)		≦0.3		≦0.5	
	Linearity(mm)		≦1.0		≦1.5	
	Jitter(mm)		≦0.3		≦0.5	
SNR(dB)		≧30				
Pen Type & Pen Size		NA				
Glove Touch		NA				
Hover		NA				
Palm & Face Rejection(Φ30mm)		Yes				
Anti Water		Yes				
Gesture Support		Yes				
Power Consumption(Typ.) Active/Idle/Sleep		100mW/80mW/25mW				

2.0 ABSOLUTE MAXIMUM RATINGS

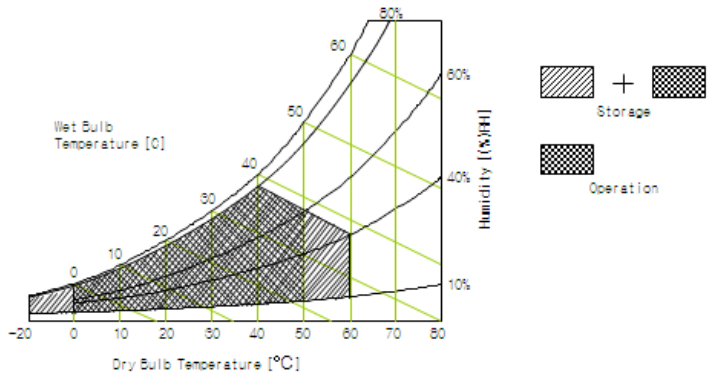
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

< Table 3. Absolute Maximum Ratings>

Parameter		Symbol	Min.	Max.	Unit	Remarks
Power Supply	LCD Module	AVDD	VSS-0.3	6.5	V	Ta = 25 ℃ Note 1
		AVEE	-6.5	VSS-0.3	V	
		VDDI	VSS-0.3	1.95	V	
	BLU	VLED	21.6	24	V	
		ILED	-	80	mA	
Operating Temperature		T_{OP}	-10	+60	℃	Note 2
Storage Temperature		TST	-30	+70	℃	
Operating Ambient Humidity		Hop	10	90	%RH	
Storage Humidity		Hst	10	90	%RH	

Note:

1. BOE is not responsible for product problems beyond the use conditions.
2. Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39 ℃ max. and no condensation of water.



3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Module

< Table 4. LCD Module Electrical specifications > [Ta =25±2 ℃]

Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max.		
Power Supply Voltage		AVDD	5.9	6.0	6.1	V	Include Touch Power
		AVEE	-6.1	-6.0	-5.9	V	
		VDDI	1.7	1.8	1.9	V	
Power Supply Current		IAVDD	-	-	30	mA	Note 1
		IAVEE	-	-	25	mA	
		IVDDI	-	-	65	mA	
Power Consumption		PTLCM	-	0.40	0.45	W	
Rush current		IRUSH	-	-	1.0	A	Note 2
CMOS Interface	Input Voltage	VIH	0.7VDDI		VDDI	V	
		VIL	VSS		0.3VDDI	V	
	Output Voltage	VOH	0.8VDDI		VDDI	V	
		VOL	VSS		0.2VDDI	V	
TFT Gate On Voltage		VGH	18	19	20	V	VGH-VGL≤ 30V
TFT Gate Off Voltage		VGL	-12	-11	-10	V	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption(Include touch active mode power) specified is for Frame rate f_V=60Hz
and Clock frequency = 159.9MHz. Test Pattern :White

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

3.2 Back-Light Unit

Table 5. LED Driver Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
LED Supply Voltage	VLED	21.6	-	24	V	Note 1
LED Forward Current	ILED	-	-	80	mA	
Power Consumption	PLED	-	-	1.92	W	
LED Quantity	QLED	-	32	-	EA	
LED Life Time	TLED	30000	-	-	Hrs	Note 2

Notes: 1. PLED = VLED ×ILED (Without LED converter transfer efficiency)

2. The life time of LED 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.

3.4 INPUT TERMINAL PIN ASSIGNMENT

This TLCM employs three interface connections, a 51 pin ZIF connector is used for the TLCM module electronics interface, a 9 pin ZIF connector is used for the internal backlight system.

3.4.1 Pin assignment for LCD module

Connector : 20982-051E (I-PEX)

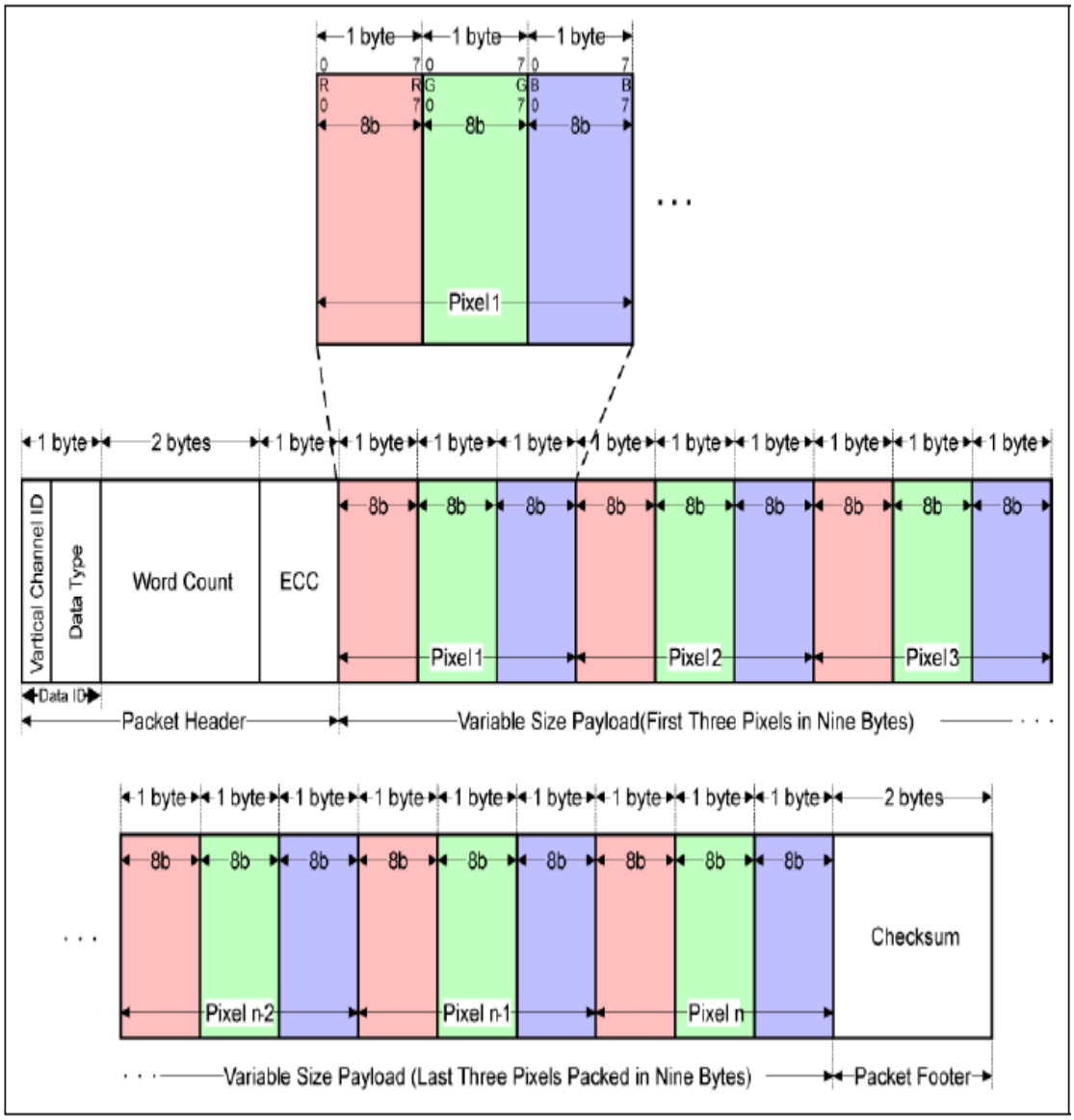
< Table7. Pin Assignment for LCD Module Connector >

Pin No.	Symbol	Description	I/O
1	GND	Ground	P
2	TP_INT	Interrupt pin for TP	I
3	TP_RST	Reset pin for TP	I
4	TP_SCL	I2C Clock for TP	I
5	TP_SDA	I2C Data for TP	I
6	GND	Ground	P
7	IOVCC_1.8V	Power Supply for Driver IC IO	I
8	IOVCC_1.8V	Power Supply for Driver IC IO	I
9	IOVCC_1.8V	Power Supply for Driver IC IO	I
10	NC	NC	-
11	AVDD	Analog Power for Driver IC	I
12	AVDD	Analog Power for Driver IC	I
13	NC	NC	-
14	AVEE	Analog Power for Driver IC	I
15	AVEE	Analog Power for Driver IC	I
16	NC	NC	-
17	GND	Ground	P
18	D0+	MIPI Differential Data Input	I
19	GND	Ground	P
20	D0-	MIPI Differential Data Input	I
21	GND	Ground	P
22	D1+	MIPI Differential Data Input	I
23	GND	Ground	P
24	D1-	MIPI Differential Data Input	I
25	GND	Ground	P

Pin No.	Symbol	Description	I/O
26	CLK+	MIPI Differential Clock Input	I
27	GND	Ground	P
28	CLK-	MIPI Differential Clock Input	I
29	GND	Ground	P
30	D2+	MIPI Differential Data Input	I
31	GND	Ground	P
32	D2-	MIPI Differential Data Input	I
33	GND	Ground	P
34	D3+	MIPI Differential Data Input	I
35	GND	Ground	P
36	D3-	MIPI Differential Data Input	I
37	GND	Ground	P
38	RST(GRB)	LCM Reset signal from system	I
39	ID0	10K to GND	-
40	ID1	10K to IOVCC_1.8V	-
41	ID2	10K to GND	-
42	PWMO	PWM control for LED	O
43	TP_SYNC	Connect to LCM driver "TP_sync" pin for ESD recovery	O
44	NC	NC	-
45	LED1-	Cathode for light bar	O
46	LED2-	Cathode for light bar	O
47	LED3-	Cathode for light bar	O
48	LED4-	Cathode for light bar	O
49	NC	NC	-
50	LED+	anode for light bar	I
51	LED+	anode for light bar	I

3.5 MIPI Interface Characteristic

3.5.1 Data Format

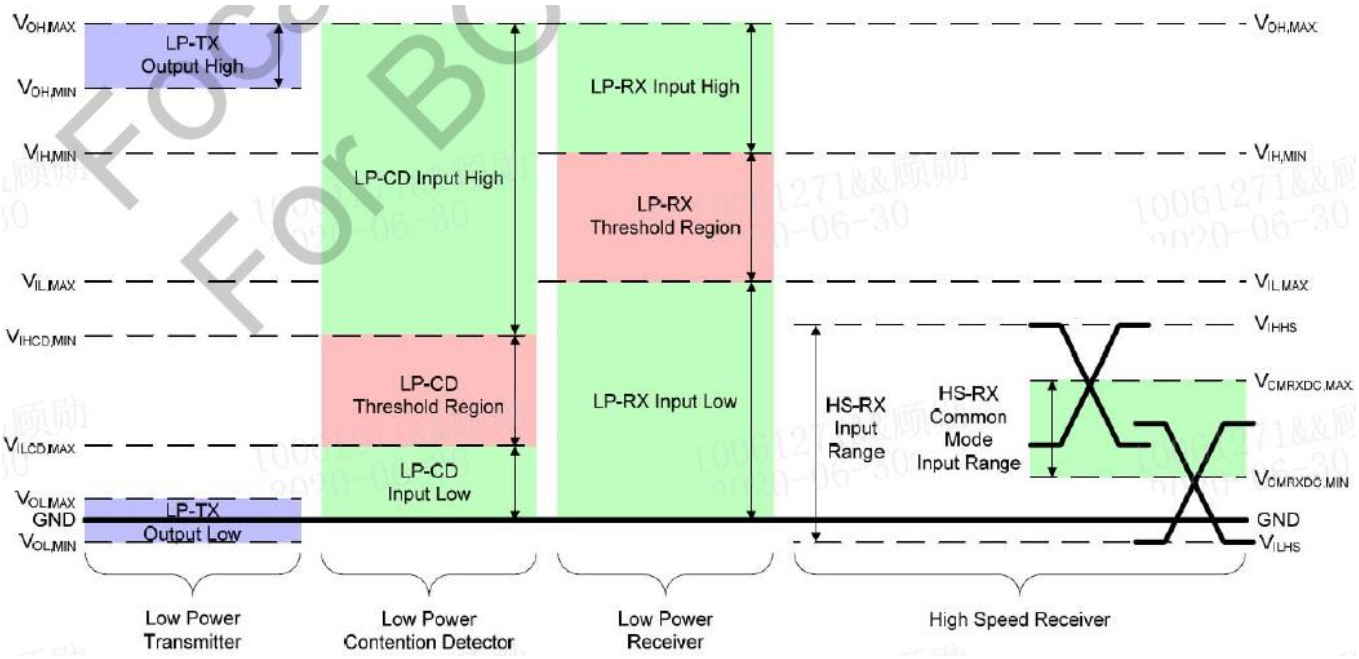


< MIPI Tx Data Configuration >

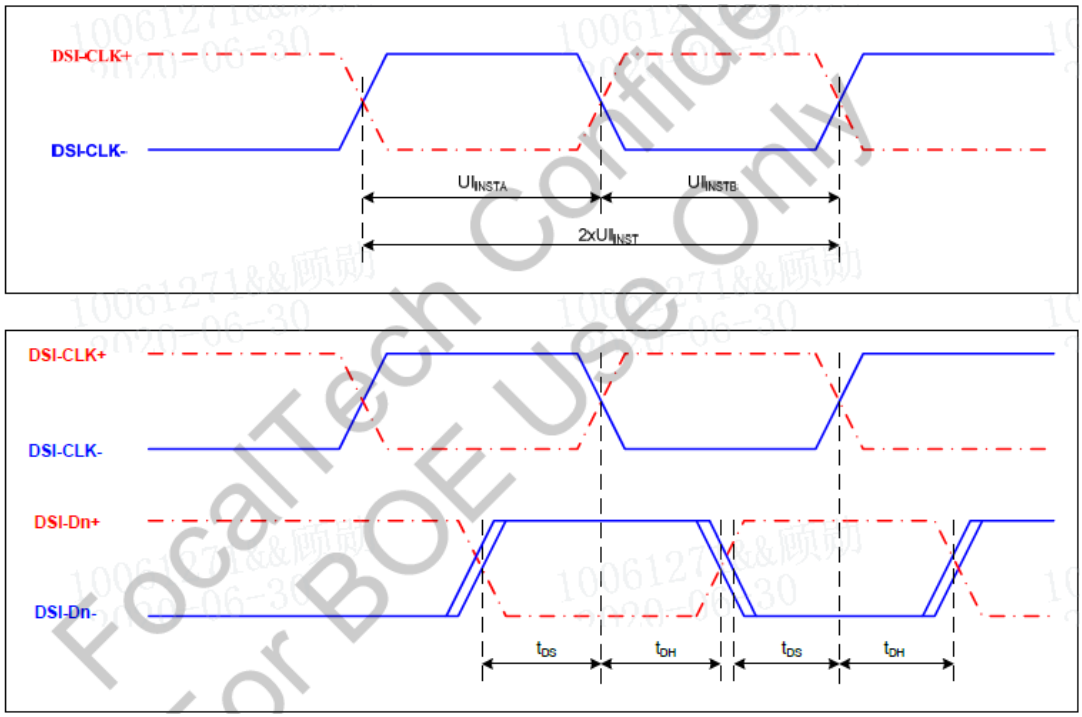
3.5.2 DC Specification

< Table11. DC Specification >

Parameter	Symbol	Min	Typ	Max	Unit	Condition
MIPI Characteristics for High Speed Receiver						
Single-ended input low voltage	V_{ILHS}	-40	-	-	mV	
Single-ended input high voltage	V_{IHHS}	-	-	460	mV	
Common-mode voltage	V_{CMRXDC}	70	-	330	mV	
Differential input impedance	Z_{ID}	80	100	125	Ω	
HS transmit differential voltage($V_{OD}=V_{DP}-V_{DN}$)	$\|V_{OD}\|$	140	200	250	mV	
MIPI Characteristics for Low Power Receiver						
Pad signal voltage range	V_I	-50	-	1350	mV	
Ground shift	V_{GNDSH}	-50	-	50	mV	
Output low level	V_{OL}	-50	-	50	mV	
Output high level	V_{OH}	1.1	1.2	1.3	V	



3.5.3 AC Specification



$1UI_{INST}$ = 1 ns @ 1Gpbs (MIPI input data rate : 1 Gbps => Clock frequency : 500MHz => $1UI_{INST}$: 1 ns

< Timing Diagram of MIPI Transmitter>

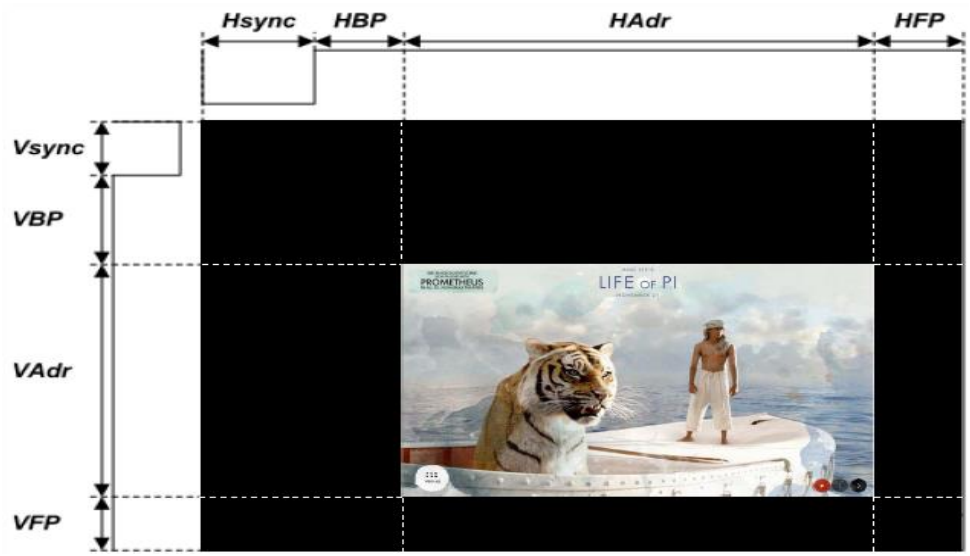
< Table12. AC Specification >

Description	Symbol	Condition	Min	Typ	Max	Unit
Data to Clock Setup Time	T_{SETUP}	-	0.15	-	-	UI_{INST}
Clock to Data Hold Time	T_{HOLD}	-	0.15	-	-	UI_{INST}

3.6 Interface timing Parameter

< Table13. Timing Parameter >

Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	-	60	-	Hz
	Pixels Rate		-	-	156	-	MHz
Timing	DCLK	Frequency	fCLK	-	472	-	MHz
		Period	Tclk	-	2.1	-	ns
	Horizontal	Horizontal total time	tHP	-	1287	-	t_{CLK}
		Horizontal Active time	tHadr		1200		t_{CLK}
		Horizontal Pulse Width	tHsync	-	7	-	t_{CLK}
		Horizontal Back Porch	tHBP	-	40	-	t_{CLK}
		Horizontal Front Porch	tHFP	-	40	-	t_{CLK}
	Vertical	Vertical total time	tvp	-	2020	-	t_H
		Vertical Active time	tVadr		1920		t_H
		Vertical Pulse Width	tVsync	-	2	-	t_H
		Vertical Back Porch	tVBP	-	44	-	t_H
		Vertical Front Porch	tVFP	-	54	-	t_H
Bit Rate			TX SPD (Mbps)	-	944	-	Mbps
Lane				-	4	-	Lane



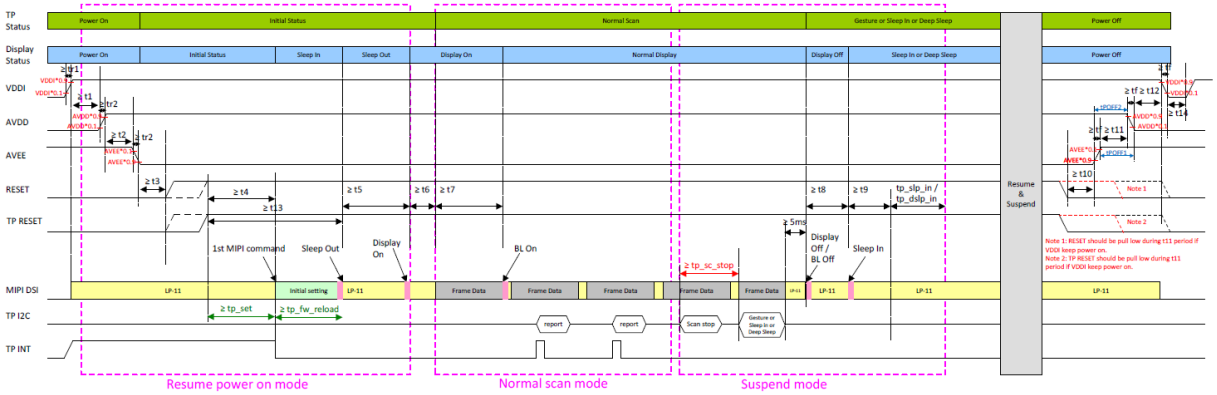
3.7 Input Color Data Mapping

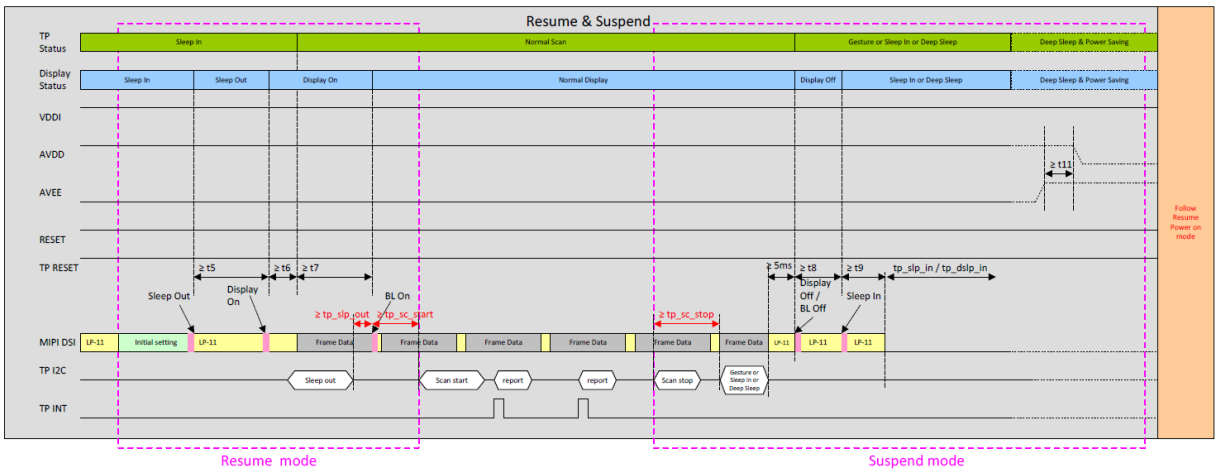
< Table14. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		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 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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	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
	Red	1	1	1	1	1	1	1	1	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	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
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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▵	↑								↑								↑							
	▿	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▿	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	1	1	1	1	1	1	1	1	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	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	▵	↑								↑								↑							
	▿	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▿	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	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	1
	Darker	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	1	1	1	1	1	1	0	1
	▿	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	▵	↑								↑								↑							
	▿	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▿	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	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

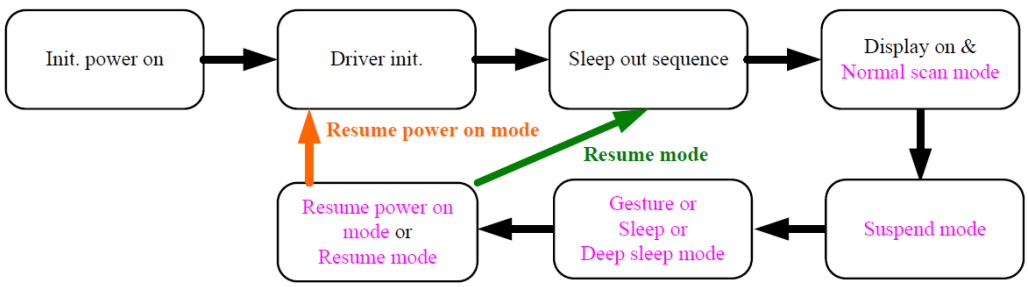
3.8 Power Sequence

The power sequence of normal mode





The flow chart of normal mode



The external power status of normal mode

External Power Status	VDDI	AVDD	AVEE	Note
Gesture Mode	On	On	On	VDDI/AVDD/AVEE must be kept power in gesture mode.
Sleep In Mode	On	On/Off	On/Off	VDDI must be kept power in sleep in mode.
Deep Sleep Mode	On/Off	On/Off	On/Off	All external power can turn off for power saving.

The TP I/O power status of normal mode

Power	TP RESET	TP SDA	TP SCL	TP INT	Note
0	0	X	X	X	Power down
1	0	High	High	High	TP sleep in
1	1	I2C function	I2C function	Input NP	Normal operating

* NP : no pull(disable pull up/pull down)

Normal Mode	Min.	Typ.	Max.	Note
tr1 (ms)	0.05	-	20	VDDI rising time
tr2 (ms)	0.1	-	20	AVDD, AVEE rising time
tf (ms)	0.05	-	20	External power falling time
t1 (ms)	1	-	-	
t2 (ms)	1	-	-	
t3 (ms)	1	-	-	
t4 (ms)	10	-	-	DDI OTP reload. RESET to first command in display sleep in mode time.
t5 (ms)	60	-	-	Sleep Out Sequence
t6 (ms)	0	-	-	
t7 (ms)	50	-	-	
t8 (ms)	16.67	-	-	Depend on frame rate.
T9 (ms)	80	-	-	Sleep In Sequence *The min. time of sleep in should be longer than panel power off request

t10 (ms)	1	-	-	
t11 (ms)	0	-	-	AVDD≧|AVEE| *No limitation for t11
tPOFF2 (ms)	0.05	-	-	AVEE 90% to AVDD 90%
tPOFF1 (ms)	0.05	-	-	AVEE 10% to AVDD 10%
t12 (ms)	0	-	-	
t13 (ms)	47	-	-	TP RESET to 1st TP CMD delay time
t14(ms)	10	-	-	Delay time between VDDI power off to power on
tp_set (ms)	10	-	-	TP OTP reload
tp_fw_reload (ms)	200	-	-	Flash reload
tp_slp_out (ms)	0	-	-	Resume timing
tp_sc_start (ms)	10	-	-	
tp_sc_stop (ms)	10	-	-	
tp_slp_in (ms)	60	-	-	Entry Sleep mode wait time
tp_dslp_in (ms)	60	-	-	Entry Deep Sleep mode wait time

*Resume Power On mode : If resume AVDD & AVEE power off, please follow Resume power on mode.

* Before VDDI power on, please make sure VDDI, VDD, VDD_TP are under 100mV for 10ms.

* When sleep in mode, RESET & TP RESET can keep low after AVDD & AVEE power off.

* Exit Deep Sleep mode : Entry deep sleep mode and AVDD & AVEE power off, please follow Resume power on mode.

4.0 OPTICAL SPECIFICATIONS

4.1 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.

4.2 Optical Specifications

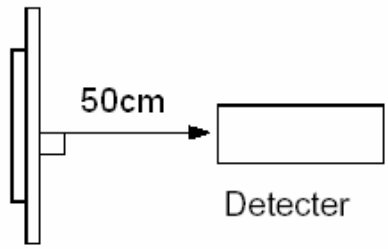
< Table16. Optical Table >

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
luminance	Bp	θ=0°	360	440	--	cd/m2	Note 1
Brightness Uniformity	▵Bp		70	80	--	%	Note 2
Color Uniformity	Δu'v'		--	--	0.02		Note12 Sign the limit sample shall prevail.
Viewing Angle	θL	Cr≥10	80	85	--	deg	Note 3
	θ_R		80	85	--		
	ψ_T		80	85	--		
	ψ_B		80	85	--		
Contrast Ratio	Cr	θ=0° FF=0°	1000	1400		-	Note 4
Response Time	Tr+Tf		→	25	35	ms	Note 5
	Tgray			45	55	ms	
Color Coordinate of CIE1931	Rx	θ=0°	Typ -0.03	0.64	Typ +0.03	-	Note 6
	Ry			0.33			
	Gx			0.30			
	Gy			0.60			
	Bx			0.15			
	By			0.06			
	Wx		Typ -0.025	0.3127	Typ +0.025		
	Wy			0.329			
NTSC Ratio	NTSC	CIE1931	65	70	--	%	Note 7
Flicker	amount		-	-	-30	dB	
Gamma	-		1.9	2.2	2.5		
Crosstalk	▵CT	-	-	-	2%		Note 10
Afterimage					3	Minute	Note 11

Note1:Luminance measurement

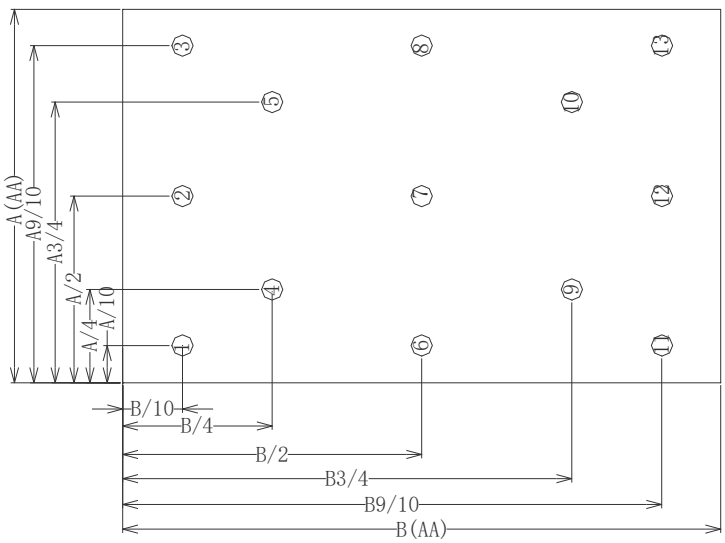
The test condition is at ILED=20mA and measured on the surface of LCD module at 25℃.

- The data are measured after LEDs are lighted on for more than 5 minutes and LCM displays are fully white. The brightness refers to the brightness of the center point. 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

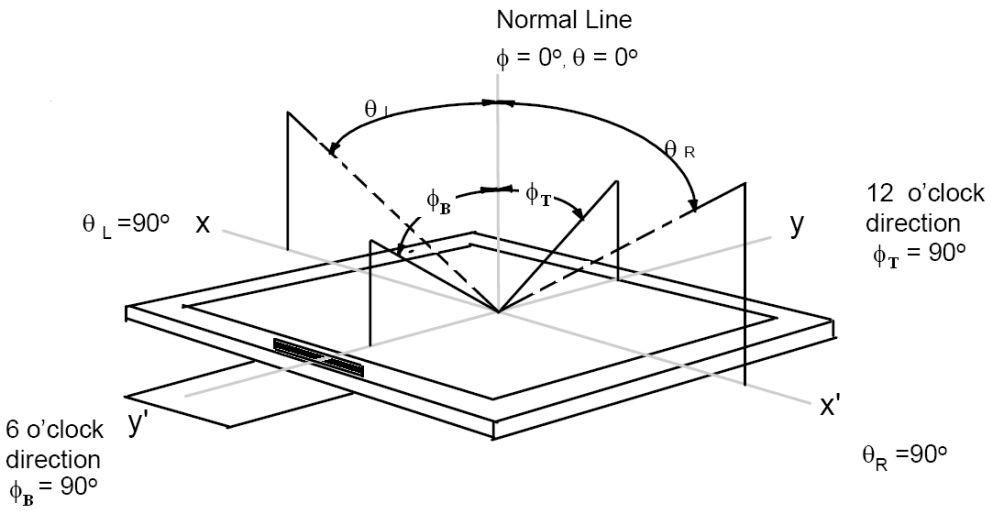


Note2:Uniformity

- The test condition is at ILED=20mA 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 13 measured spots
- Bp (Min.) = Minimum brightness in 13 measured spots.



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

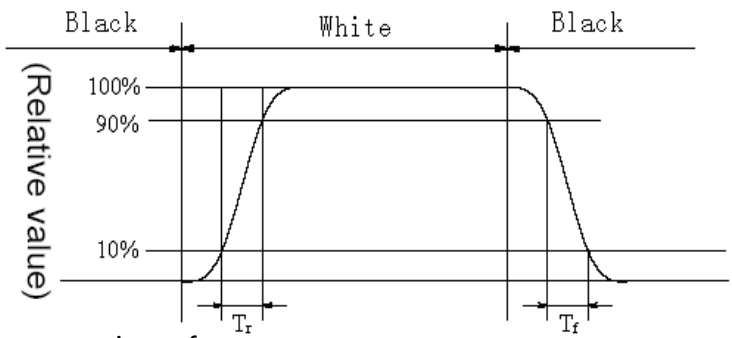


Note4:**ThedefinitionofContrastRatio** (Test LCM using CS2000 or similar equipments):

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

(Contrast Ratio is measured in optimum common electrode voltage)

Note5:**DefinitionofResponse 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 . The response time is defined as the time interval between the 10% and 90% of amplitudes . Refer to fi gures below.



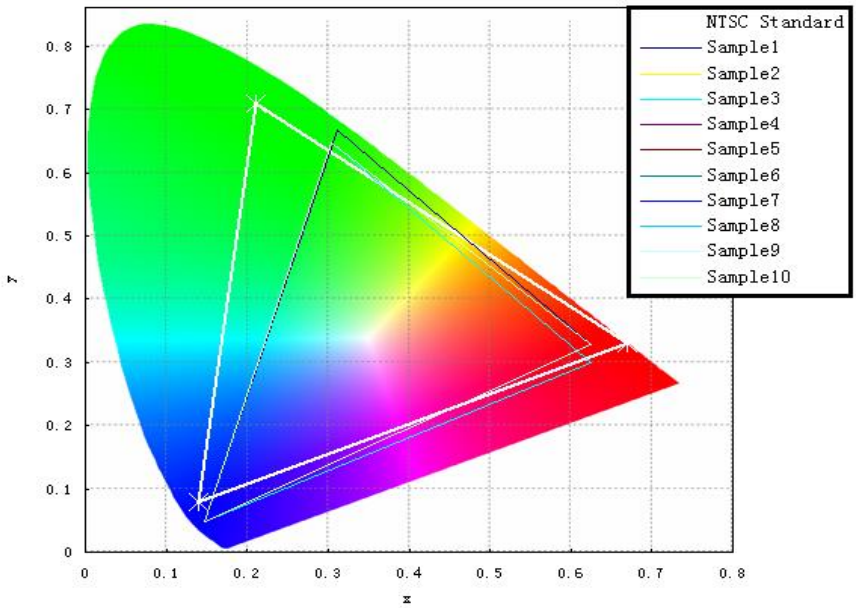
	L0	L1	L2	L3	L4	L5	L6	L7
L0	■							
L1		■						
L2			■					
L3				■				
L4					■			
L5						■		
L6							■	
L7								■

Response time of gray to gray:
Measurement equipment: DMS501 or similar equipments.
Test method: we define 8 grays L0-L7,the grays of L0-L7 were defined as:0,36,73, 109, 146, 182, 219, 25 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:

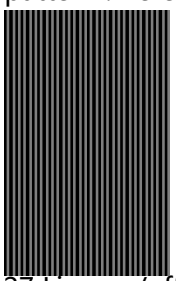
Note 6: Color Coordinates of CIE 1931
The test condition is at ILED=20mA and measured on the surface of LCD module at 25℃.
Measurement equipment:CS2000 or similar equipments
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

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

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



Note 8: **Flicker**
- Measurement equipment :CA-210 or similar equipments
- Measuring temperature: Ta=25℃.
- Test method: JEITA method
- Test pattern : Refer to below(Test Pattern should be full-fill of display screen)



L0/L127 Line on/off pixel
The point should be marked is, for line and frame inversion, the background of Flicker Test Pattern
- "gray " are defined as middle gray scale .For example, RGB 24bit "gray" defined as below:

R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

●Frame Frequency Requirement before test： The LCD must be tuned to more than 60Hz before measu rement.

●Measurement Point: the center of display active area

●Conversion of Flicker ratio:

Flicker [dB] = 10 x log[Px/P0]

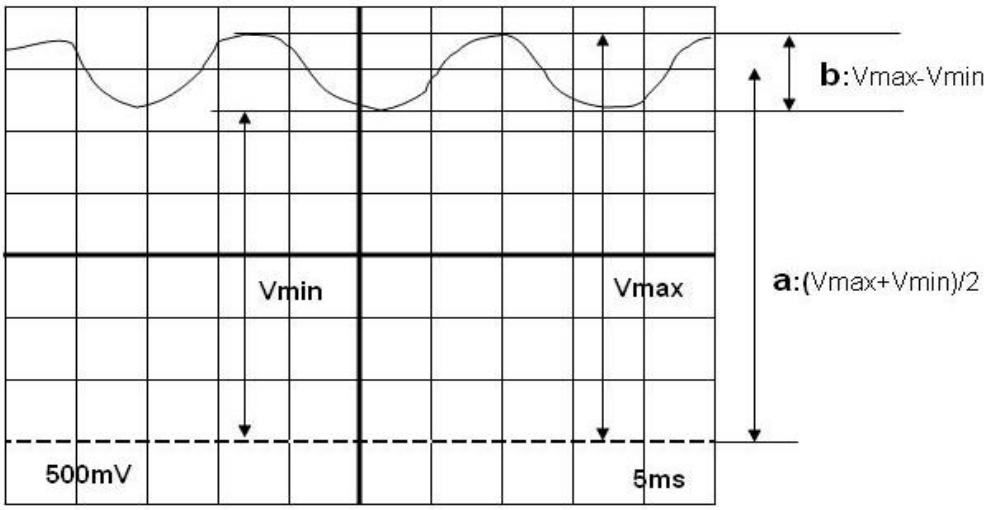
Where

Px: Maximum power spectrum of AC component after passing through integrator

P0: Power spectrum of DC component after passing through integrator

AC component=b (Refer to below diagram)

DC component=a (Refer to below diagram)



Note 9: gamma curve control

●The whole curve’ s tolerance must control within +/-0.3, the test gray scale below： 0, 8, 16, 25, 3 3, 41, 49, 58, 66, 74, 82, 90, 99, 107, 115, 123, 132, 140, 148, 156, 165, 173, 181, 189, 197,206, 214, 22 2, 230, 239, 247, 255

Note 10:Crosstalk

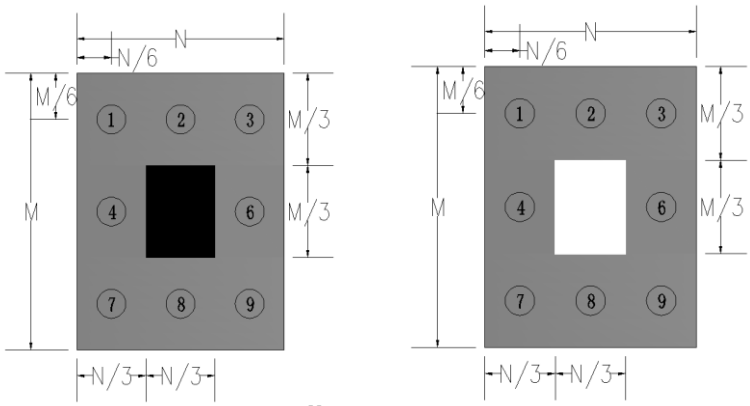
●There should be no visible cross-talk in normal direction of the display when the two ” Cross-talk Test Patterns ” below are loaded.

●Measurement equipment:CS2000 or similar equipments

●The point should be marked is, the background of Cross-talk Test Pattern- “gray ” are defined as middle gray scale . For example, RGB 24bit “gray” defined as below:

R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

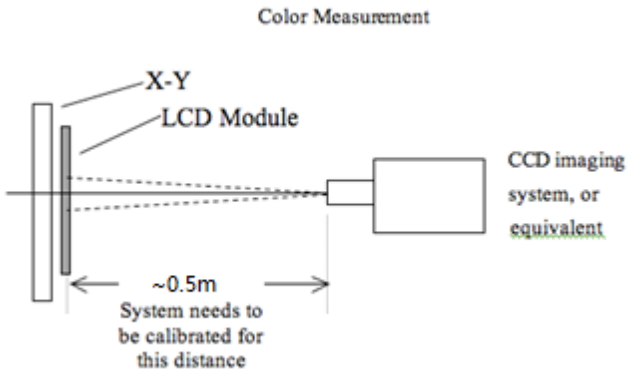
●△CT = (L127-L(Bar))/L127
Which n means the dot No. In the Test Pattern ;
L127means the brightness of the No.n spots in L127 Test Pattern;
L(Bar) means the brightness of the No.n spots in Crosstalk Test Pattern;
●△CT must be less than 2%



Cross-talk Test Pattern

Note 11: **After image judgment**
Power on the LCD 1 hour at tessellated picture(8*8), then switch to 128 gray picture or Flicker picture, if the afterimage can' t be seen within 3 minutes, the LCD is OK.

Note 12: Color uniformity
●Measurement Conditions
Recommended measuring equipment for color is ICPMI16 Colorimeter or similar CCD type equipment.
The optical characteristics are determined after the unit has been 'ON' and stable at the following con ditions:
Maximum brightness
Dark environment
Ambient temperature at 25°C ± 2°C
●Optical measurement system



5.0 Application_CG

- **Cover Glass**

5.1 General specification

<Table 1. CG Specifications>

No.	Item	Material SPEC	Unit	Equipment	Mark
1	CG OD/thickness	158.36*239.58*0.55±0.05	mm	2D Measuring	
2	CG VA	136.36*217.58±0.15	mm	2D Measuring	
3	VA toCG outline（X&Y)	X/Y=11±0.15	mm	2D Measuring	
4	CG flatness	0.5mm max	mm	Plug gauge	

<Table 2. CG Strength related specifications>

No.	Item	Material SPEC	Unit	Equipment	Mark
1	CS	≥750MPa	cd/m2	FM6000	
2	DOL	≥35μm	cd/m2	FM6000	
3	4PB/3PB	B10≥580MPa	%	4PB machine	
4	Ball drop	110g/40cm，3T	J	-	

<Table 3. CG Printing related specifications>

No.	Item	Material SPEC	Mark
1	BM Color	L* = 25.13, a* = 0.08, b* = -0.31，E<0.70	
2	VA Transmittance	≥90% @550nm	
3	CameraTransmittance	≥90% @550nm	
4	ALSTransmittance	TR: @550nm 15±5%TR: @850nm 30±10%	
5	Ink adhesion	≥4B	
6	Ink surface energy	E≥34 Dyne	
7	BM OD	≥5	
8	BM thickness	≤16μm	

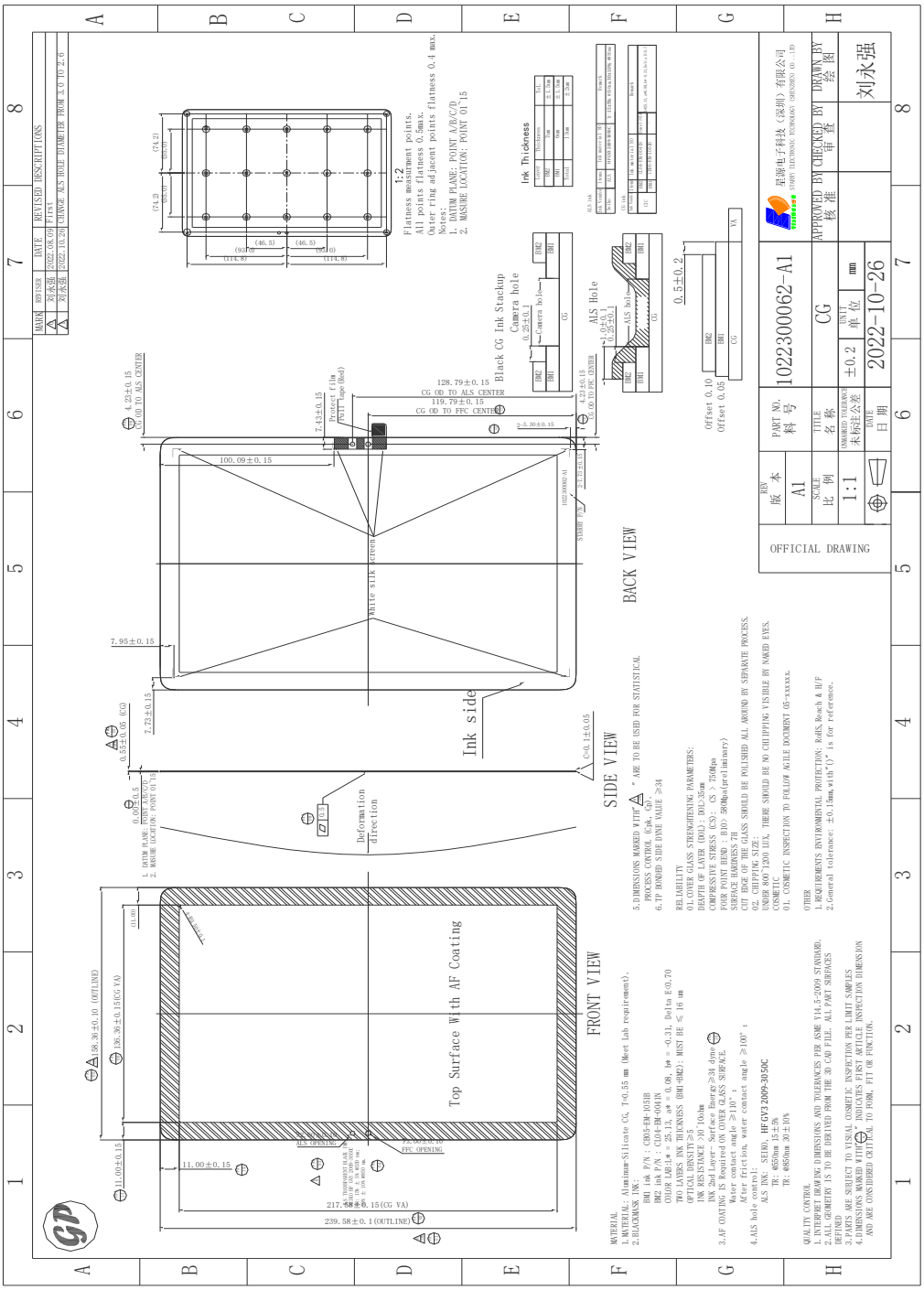
<Table 4. CG Other specifications>

No.	Item	Material SPEC	Unit	Equipment	Mark
1	Glass	Cai Hong	-	-	
2	Surface Hardness	> 7H	-	-	
3	Contact angle	AF，Reference drawing	-	-	
4	ROHS	Meet regulatory requirements			

<Table 5. CG Reliability testing>

No.	Item	LNV	Remark
1	Ball drop	110g/40cm/3次	
2	Surface Hardness	> 7H；	
3	Ink surface energy	Dyne > 34	
4	4PB	0.55mm； B10>580MPA	
5	Contact angle	The initial dripping angle is 115 ° ± 5 ° , and the dripping angle i s less than 100 ° after applying 1 kg force with 99.5% anhydrous a lcohol and rubbing with arubber (Sanford 75215)/0000 Grade Ste el Wool/sanford 75215 rubber band	

<Table 6. Mechanical Drawing>



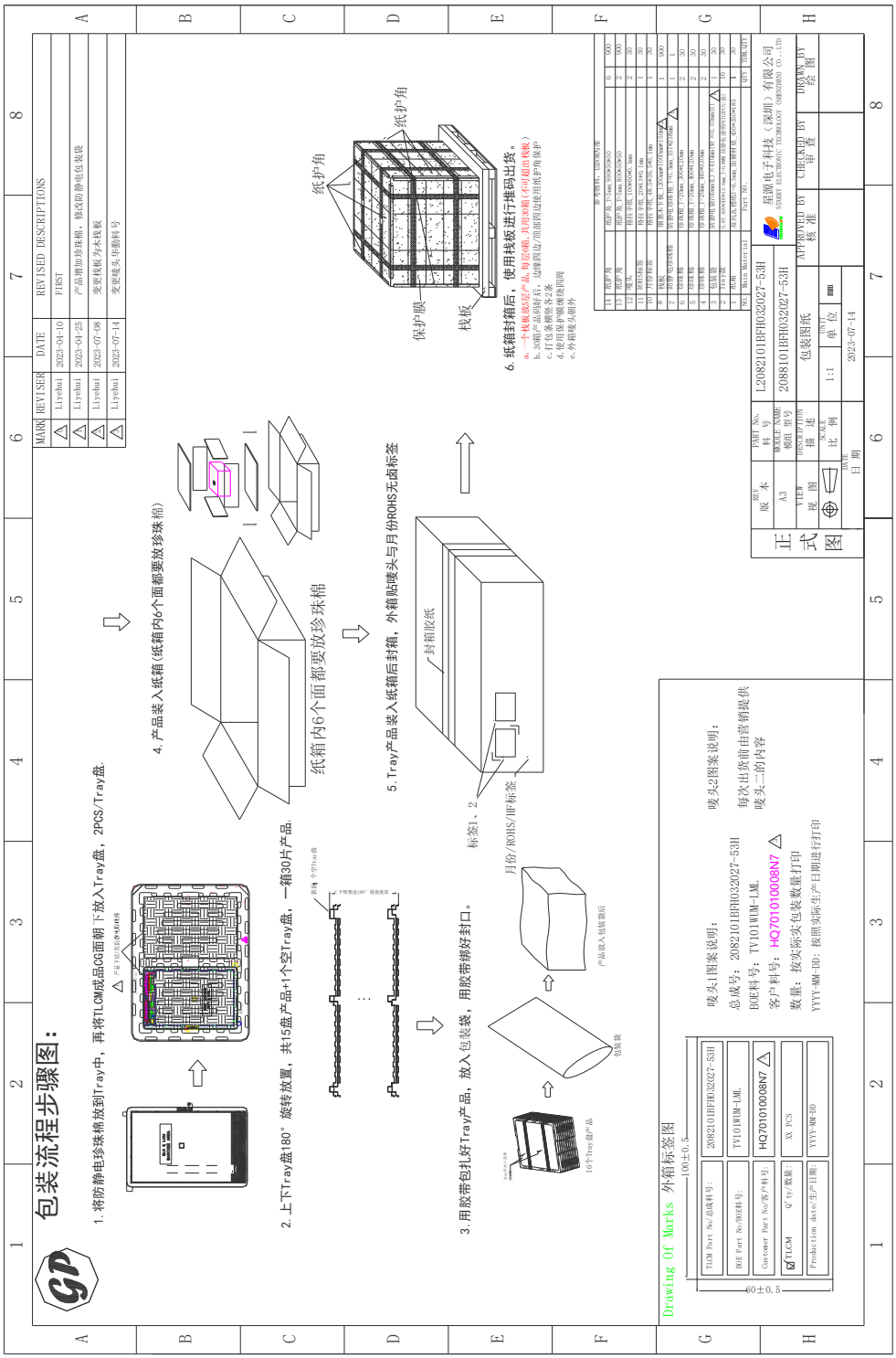
6.0 RELIABLITY TEST

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

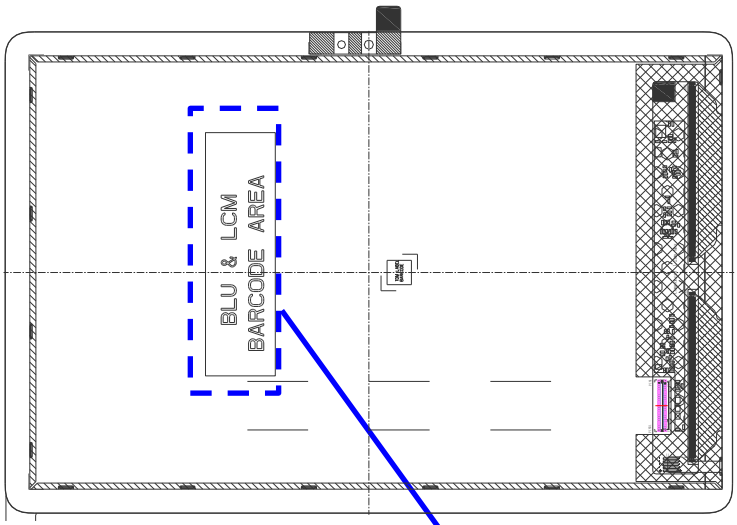
<Table 17. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature storage test	Ta=70℃; 240hrs
2	Low temperature storage test	Ta=-30℃; 240hrs
3	High temperature & high humidity (operation test)	Ta=60℃&90%RH(5h) to -20℃(5h), 2 hours ramps, 14 cycles
4	High temperature operation test	Ta=60℃，240Hrs
5	Low temperature operation test	Ta=-10℃; 240hrs
6	Thermal Shock Test	-40℃(23min) ~ 60℃(23min) , 60min/cycle, total 100 cycles

7.0 PACKING INFORMATION



8.0 Product Label



喷码至背板侧边，信息分为4部分

1. **客户要求喷码信息，编码规则如下:**
2. **BOE MDL ID 条纹码**
3. **产品FG-CODE**
4. **BOE MDL ID**

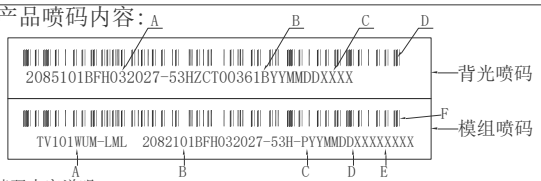
1 2 3

XXXX-XXX-XX **TV101WUM-LML**

XXXXXXX-XXXXX **XXXXXXXXXXXXXXXXX**

4

产品喷码内容:



背光喷码内容说明:

A:2085101BFH032027-53H--->1-20码：星源背光料号;

B:ZCT00361B---------->21-29码：背光供应商型号

C:YYMMDD---------->30-35码：生产日期;

D:XXXX---------->36-39码：流水码,0001~ZZZZ

模组喷码内容说明:

A:TV101WUM-LML---------->1-12码:BOE FG CODE;

B:2082101BFH032027-53H-P-->13-34码:2082101BFH032027-53H-P星源料号,"-P"指PVT/MP

C:YYMMDD---------->35-40码：生产日期;

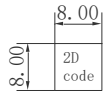
D:XXXX---------->41-44码：生产线体

E:XXXX---------->45-48码：流水码,0001~ZZZZ

F:条形码---------->扫码内容说明见下表注:

序号	1-10	11-12	13-14	15-16	17-18	19-22	备注
内容描述	模组后9位+阶段代码	年	月	日	线体	流水码（共四位）10进制	年：2021—21；2022—22;... 月：1-12 日：1-31
示例	BFH032027P	21	01	31	A1	0001	

QR二维码条码内容:



二维码内容：模组厂商+IC供应商+年份+月份+日期+流水号+版本号+型号(共26码)

XXXXXXXXXXXXXXXXXXXXXXXXXX

第14-26位:星源料号后13位数，即BFH032027-53H,固定码

第12-13位:版本号（用01~99表示，PVT/MP版本用“10”固定码）

扫码显示和明码保持一致（注：无明码）

第8-11位:流水号（用0001~FFFF表示,采用16进制）

第6-7位:日期（用01~31表示）

第5位:月份（1~9月用“1-9”10~12月用“A~C”）

第4位:年份，取年份最后一位（2022年用“2”）

第3位:表示IC供应商,使用ILI IC,用“I”表示,固定码

（注：ILI用“I”；FOCAL用“F”;NOVA用“N”;FITI用“T”）

第1-2位:表示模组厂商（星源用“XY”，固定码）

备注:二维码等级按C级管控

9.0 Handling & Cautions

9.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizers which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.

9.2 Caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration,and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizers or it leads the polarizers to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent （recommended below) to clean the LCD ‘s surface with wipe lightly.
  -IPA(Isopropyl Alcohol), Ethyl Alcohol, Trichlorotriflorothane
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers and others. Do not use the following solvent.
  -Water, Ketone, Aromatics
- It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC,Soldering flux,Chlorine,Sulfur,saliva or fingerprint. To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

9.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- 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.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

9.4 Caution For operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

9.5 Packaging

- Modules use LCD element, and must be treated as such.
  -Avoid intense shock and falls from a height.
  -To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

9.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCD’ s surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizers.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
  -Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
  -Store in a dark place where neither exposure to direct sunlight nor light is.
  -Keep temperature in the specified storage temperature range.
  -Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation LCD when it was delivered.

9.7 Safety

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water an soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

10.0 APPENDIX

Mechanical Drawing