

MODEL NAME: OSD0220CE1AB	PAGE: 1 OF 26	DOC. NO.: T9-OSD0220CE-1AB0	VERSION: A.0
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# **2.2” 262K TFT LCD PANEL SPECIFICATION**

**MODEL NAME: OSD0220CE1AB**

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MODEL NAME:	PAGE: 3 OF 26	DOC. NO.:	VERSION: A.0
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## Table of Contents

1	GENERAL DESCRIPTION	4
2	ABSOLUTE MAXIMUM RATINGS	6
3	AC CHARACTERISTICS	7
4	DC CHARACTERISTICS	9
5	OPTICAL CHARACTERISTICS	11
6	OUTLINE DIMENSION	14
7	INTERFACE PIN CONNECTION	15
8	BLOCK DIAGRAM	16
9	FPC	17
10	PACKING FORM	20
11	DESIGNATION OF LOT MARK	21
12	RELIABILITY	23
13	PRECAUTIONS	24

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MODEL NAME:	PAGE: 4 OF 26	DOC. NO.:	VERSION: A.0
-------------	------------------	-----------	-----------------

# 1 GENERAL DESCRIPTION

## 1.1 Description

OSD0220CE1AB is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that used amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit, and a back-light unit. The resolution of 2.2” contains 240 x 320 pixels and can display up to 262K colors.

## 1.2 Features

LCD Type	:	Transmissive color active matrix LCD panel TN (Twisted Nematic) mode
Drive IC	:	ILITEK ILI9320 or Compatible IC
Built-in Drive Power	:	Low power consumption
System Interface	:	80 System interface 8-bit bus
Internal RAM Capacity	:	172,800 Bytes
Color Mode	:	262,144 colors
Outline Dimensions	:	40.3 (W) × 57.3 (H) × 2.45 (D) mm
Effective Viewing Area	:	33.48 (W) × 44.64 (H) mm
Pixel Size	:	0.1395 (W) × 0.1395 (H) mm
Viewing Direction	:	12 O’ Clock
Weight	:	9.0 g Max.

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MODEL NAME:	PAGE: 5 OF 26	DOC. NO.:	VERSION: A.0
-------------	------------------	-----------	-----------------

### 1.3 Environmental impact substances controlled for containing in products

The environmental impact substances we control are classified into 2 types as described below.

a. Prohibited substances:

LOI, in principle, does not produce any products containing or contaminated by substances of this type.

- ◆ Cadmium (Cd) < 100 ppm
- ◆ Mercury (Hg) < 1000 ppm
- ◆ Hexavalent-Chromium (Cr <sup>+6</sup>) < 1000 ppm
- ◆ Polybrominated biphenylethers (PBDE) < 1000 ppm
- ◆ Polybrominated biphenyls (PBB) < 1000 ppm

b. Prohibited substances:

Desired not to be contained in or contaminate our products as far as possible and abolished by a targeted date. LOI moderately produces products containing substances of this type.

- ◆ Lead (Pb) < 1000 ppm
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MODEL NAME:	PAGE: 6 OF 26	DOC. NO.:	VERSION: A.0
-------------	------------------	-----------	-----------------

## 2 ABSOLUTE MAXIMUM RATINGS

### 2.1 Electrical absolute maximum ratings

Item	Symbol	Value	Unit	Note
Power Supply Voltage (1)	Vcc, IOVcc	-0.3 to +4.6	V	(1),(2)
Power Supply Voltage (1)	Vci - AGND	-0.3 to +4.6	V	(1),(4)
Power Supply Voltage (1)	DDVDH-AGND	-0.3 to +6.0	V	(1),(4)
Power Supply Voltage (1)	AGND - VCL	-0.3 to +4.6	V	(1)
Power Supply Voltage (1)	DDVDH - VCL	-0.3 to +9.0	V	(1),(5)
Power Supply Voltage (1)	VGH - AGND	-0.3 to +18.5	V	(1),(5)
Power Supply Voltage (1)	AGND - VGL	0.0 to -16.5	V	(1),(6)
Input Voltage	Vt	-0.3 ~ Vcc+0.3	V	(1)

Note:

- (1) VCC,DGND must be maintained
- (2) (High) (VCC = VCC) ≥ DGND (Low), (High) IOVCC ≥ DGND (Low).
- (3) Make sure (High) VCI ≥ DGND (Low).
- (4) Make sure (High) DDVDH ≥ ASSD (Low).
- (5) Make sure (High) DDVDH ≥ VCL (Low).
- (6) Make sure (High) VGH ≥ ASSD (Low).
- (7) Make sure (High) ASSD ≥ VGL (Low).

### 2.2 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	unit	Note
Storage Temperature	T <sub>STG</sub>	(-30)	(80)	°C	(1)
Operating Temperature (Ambient Temperature)	T <sub>OPR</sub>	(-20)	(70)	°C	(1),(2)

Note:

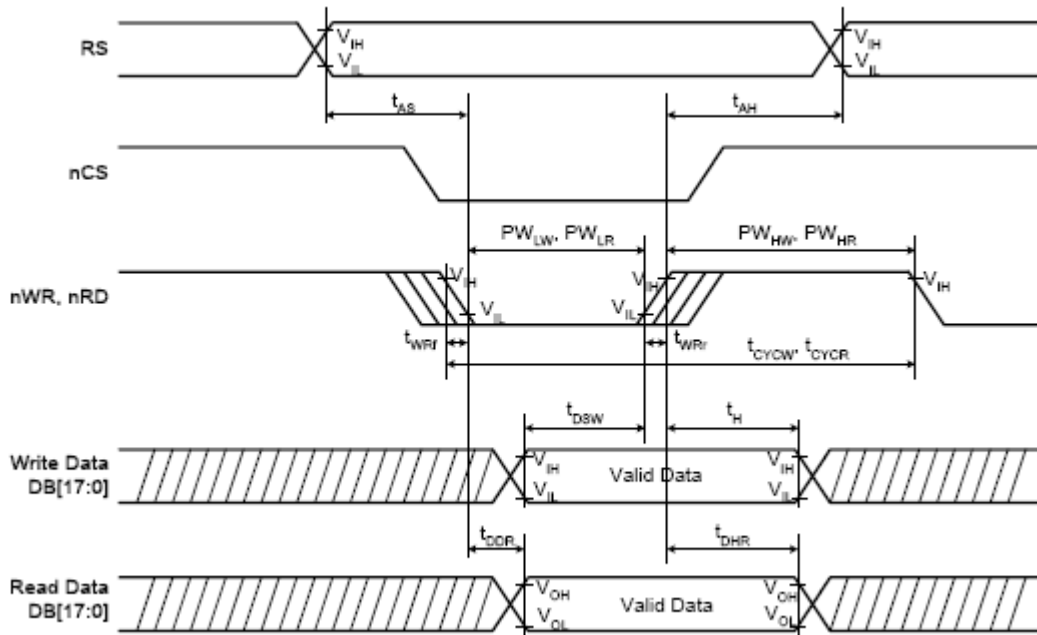
- (1) 95 % RH Max. ( 40 °C ≥ Ta )
- (2) In Case of below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

MODEL NAME:	PAGE: 7 OF 26	DOC. NO.:	VERSION: A.0
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### 3 AC CHARACTERISTICS

#### 3.1 80-system bus interface timing characteristics

Normal write mode



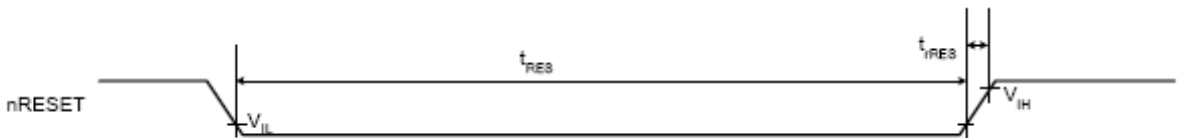
(IOVcc=1.65~3.3V, Vcc=2.4~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	t <sub>CYCW</sub>	ns	100	-	-
	Read	t <sub>CYCR</sub>	ns	300	-	-
Write low-level pulse width		PW <sub>LW</sub>	ns	50	-	500
Read low-level pulse width		PW <sub>LR</sub>	ns	150	-	-
Write high-level pulse width		PW <sub>HW</sub>	ns	50	-	-
Read high-level pulse width		PW <sub>HR</sub>	ns	150	-	-
Write / Read rise / fall time		t <sub>WRr</sub> , t <sub>WRf</sub>	ns	-	-	25
Setup time	Write (RS to NCS, E_NWR)	t <sub>AS</sub>	ns	10	-	-
	Read (RS to NCS, RW_NWR)		ns	5	-	-

MODEL NAME:	PAGE: 8 OF 26	DOC. NO.:	VERSION: A.0
-------------	------------------	-----------	-----------------

Item	Symbol	Unit	Min.	Typ.	Max.
Address hold time	$t_{AH}$	ns	5	-	-
Write data set up time	$t_{DSW}$	ns	10	-	-
Write data hold time	$t_H$	ns	15	-	-
Read data delay time	$t_{DDR}$	ns	-	-	100
Read data hold time	$t_{DHR}$	ns	5	-	-

### 3.2 Reset timing characteristics



( $V_{CC}=1.8\sim 3.3V$ ,  $IOV_{CC}=1.65\sim 3.3V$ )

Item	Symbol	Unit	Min.	Typ.	Max.
Reset low level width	$t_{RES}$	ms	1	-	-
Reset rise time	$t_{RES}$	$\mu s$	-	-	10

MODEL NAME:	PAGE: 9 OF 26	DOC. NO.:	VERSION: A.0
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## 4 DC CHARACTERISTICS

### 4.1 DC characteristics

(IOVcc=1.65~3.3V, Vcc=2.4~3.3V, Ta=-40~85°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Input high voltage	V <sub>IH</sub>	IOVcc=1.8~3.3V	0.8xIOVcc	-	IOVcc	V
Input low voltage	V <sub>IL</sub>	IOVcc=1.8~3.3V	-0.3	-	0.2xIOVcc	V
Output high voltage (1) (DB0~17 Pins)	V <sub>OH1</sub>	I <sub>OH</sub> = -0.1 mA	0.8xIOVcc	-	-	V
Output low voltage (DB0~17 Pins)	V <sub>OL1</sub>	IOVcc=1.65~3.3V I <sub>OL</sub> = 0.1 mA	-	-	0.2xIOVCC	V
I/O leakage current	I <sub>Li</sub>	V <sub>in</sub> = 0~Vcc	-0.1	-	0.1	μ A
Current consumption during standby mode (Vcc-DGND)	I <sub>ST(Vcc)</sub>	Vcc=Vci=2.8V Ta=25°C	-	5	10	μ A
Output voltage deviation	-	-	-	5	-	mV
Dispersion of the Average Output Voltage	V	-	-10	-	10	mV

MODEL NAME:	PAGE: 10 OF 26	DOC. NO.:	VERSION: A.0
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#### 4.2 DC characteristics of the LED back-light

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
LED current	$I_L$		-	15	20	mA	(1)
Forward voltage	$V_f$		9.0	10.2	11.4	V	(2)
Power consumption	P		135	153	171	mW	

Note: (1) Four LEDs are in serial type.

(2) The reference value obtained by calculation ( $V_f \times I_L$ ),  $I_L=15\text{mA}$

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MODEL NAME:	PAGE: 11 OF 26	DOC. NO.:	VERSION: A.0
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## 5 OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: BM-5A, BM-7

(Ta = 25 +/- 2°C, Vcc = Vci = 2.8V)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center Point)		C/R	Note (1) Θ= 0 φ= 0 Normal Viewing Angle B/L On	(150)	(200)		-	(1)(2) BM-5A
Brightness		B		(160)	(190)	-	cd/m <sup>2</sup>	(1)(3) BM-5A
Luminance Uniformity		U <sub>L</sub>		(70)	(80)	-	%	(1) BM-5A
Response Time	Rising	Tr		(25)	(35)	(50)	msec	(1)(4) BM-7
	Falling	Tf						
Color Chromaticity (CIE 1931)	White	Wx		(0.257)	(0.307)	(0.357)	-	(1)(5) BM-5A
		Wy		(0.250)	(0.300)	(0.350)		
	Red	Rx	(0.554)	(0.604)	(0.654)			
		Ry	(0.303)	(0.353)	(0.403)			
	Green	Gx	(0.271)	(0.321)	(0.371)			
		Gy	(0.487)	(0.537)	(0.587)			
Blue	Bx	(0.093)	(0.143)	(0.193)				
	By	(0.037)	(0.087)	(0.137)				
Viewing Angle	Hor.	ΘR	C/R ≥ 10	-	(45)	-	Degree	(1)(6) BM-5A
		ΘL		-	(45)	-		
	Ver.	ΦH	B/L On	-	(35)	-		
		ΦL		-	(15)	-		

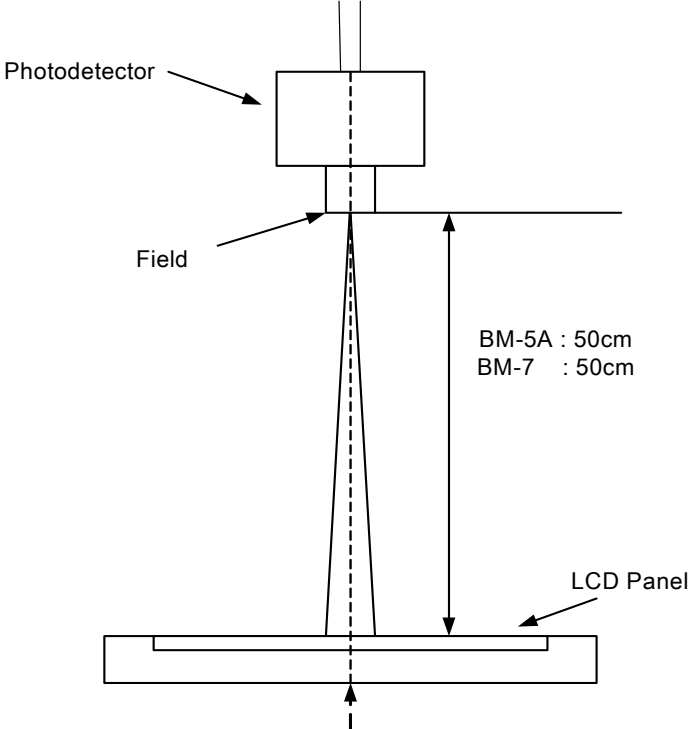
Note:

(1) Test Equipment Setup

After stabilizing and leaving the module alone at a given temperature for 30 min, the measurement should be executed. Measurement should be executed in a stable,

MODEL NAME:	PAGE: 12 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

windless, and dark room.30 min after lighting the back-light. This should be measured in the center of screen with a viewing cone of 1° by photodetector.



(2) Definition of Contrast Ratio (C/R)

Ratio of gray max (Gmax) & gray min (Gmin) at the center point:

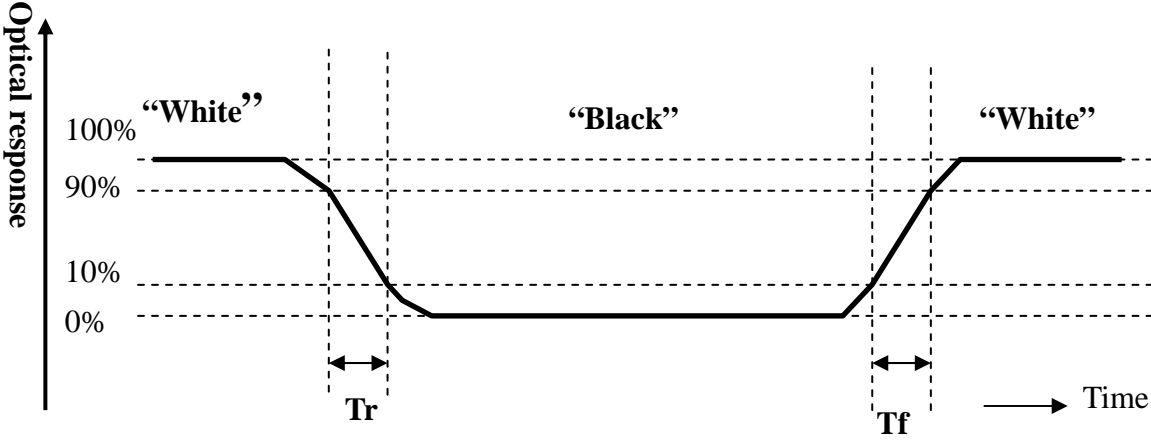
$$CR = \frac{G_{max}}{G_{min}}$$

\* Gmax: Luminance with all pixels white

Gmin: Luminance with all pixels black

(3) Definite of Brightness of White: Brightness of white at the center point

(4) Definition of Response time: Sum of Tr, Tf

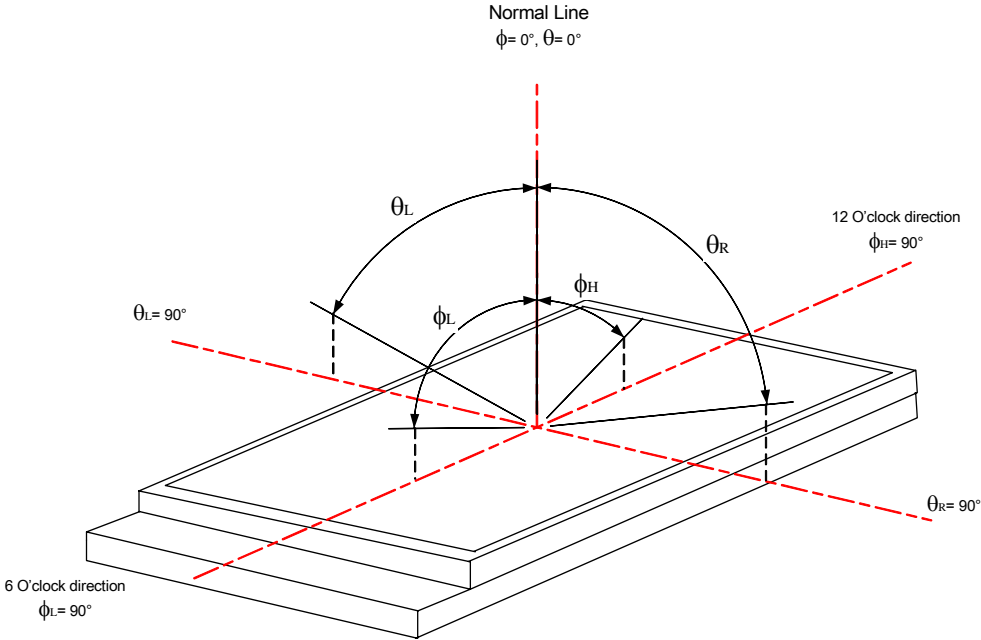


MODEL NAME:	PAGE: 13 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

**(5) Definition of Chromaticity Coordinate**

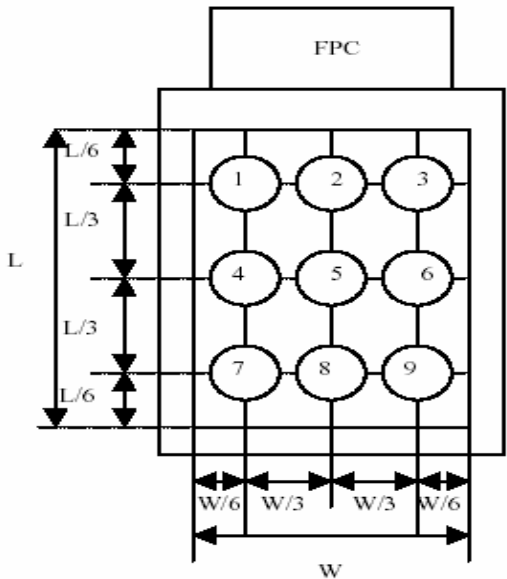
Color coordinate of white & red, green, blue at center point.

**(6) Definition of Viewing Angle: Viewing angle range ( CR ≥ 10)**



**(7) Definition of luminance uniformity**

To test for uniformity, the tested area is divide 3 rows and 3 columns. The measurement spot is placed at the center of each box.



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

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

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



MODEL NAME:	PAGE: 15 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

## 7 INTERFACE PIN CONNECTION

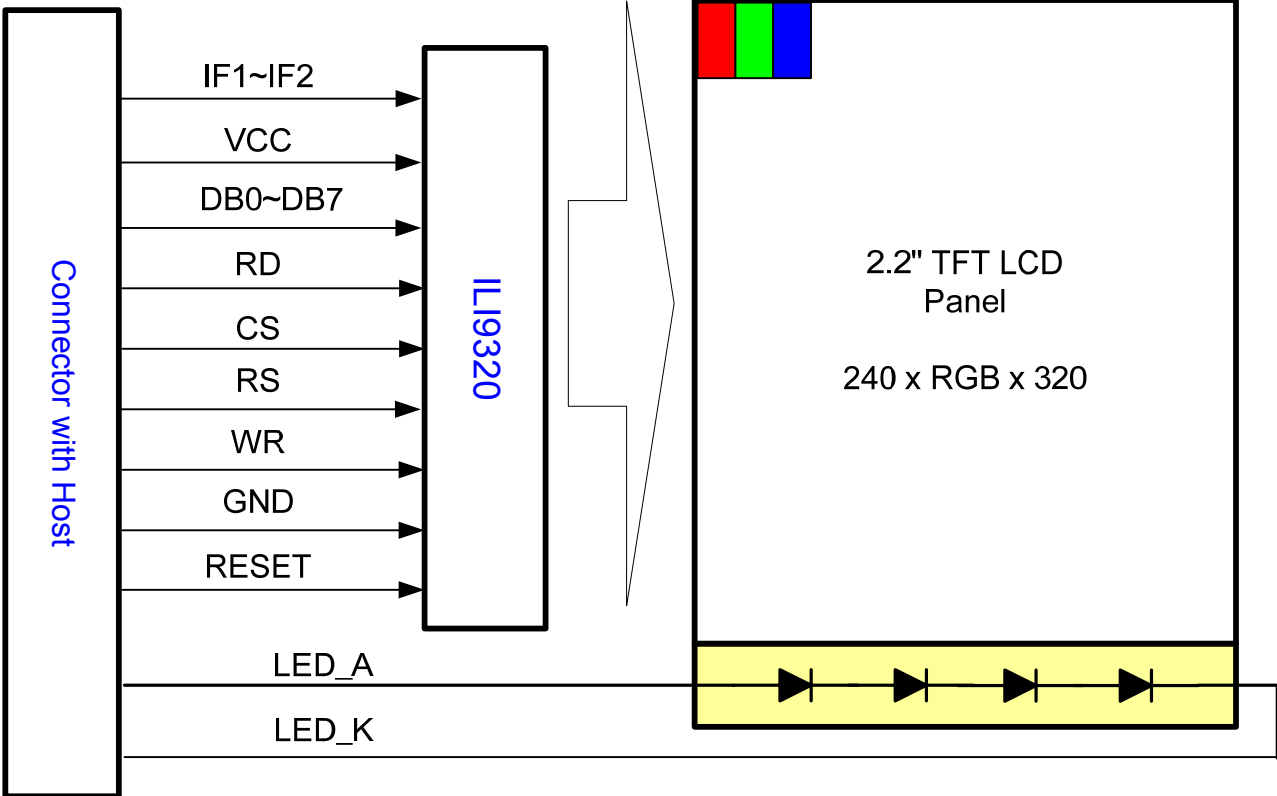
Pin No.	Symbol	Description
1	GND	Power Ground
2	IF1	RMA DATA Format*1
3	IF2	RMA DATA Format*1
4	RESET	Reset
5~12	DB7~DB0	Data Bus
13	RD	Read
14	WR	Write
15	RS	Command / Data
16	CS	Chip Select
17	IOVCC	Logic-Circuit Power Supply
18	VCI	DC / DC Converter Power
19	VCC	Logic-Circuit Power Supply
20	GND	Power Ground
21	LED_K	LED backlight supply: cathode
22	LED_K	LED backlight supply: cathode
23	LED_A	LED backlight supply : anode
24	LED_A	LED backlight supply : anode

\* 1 RMA DATA Format as listed below:

IF1	IF2	Command	RMA DATA
0	1	8-bit × 2	6-bit × 3
1	1	8-bit × 2	8-bit + 8-bit + 2-bit
1	0	8-bit × 2	8-bit × 2

MODEL NAME:	PAGE: 16 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

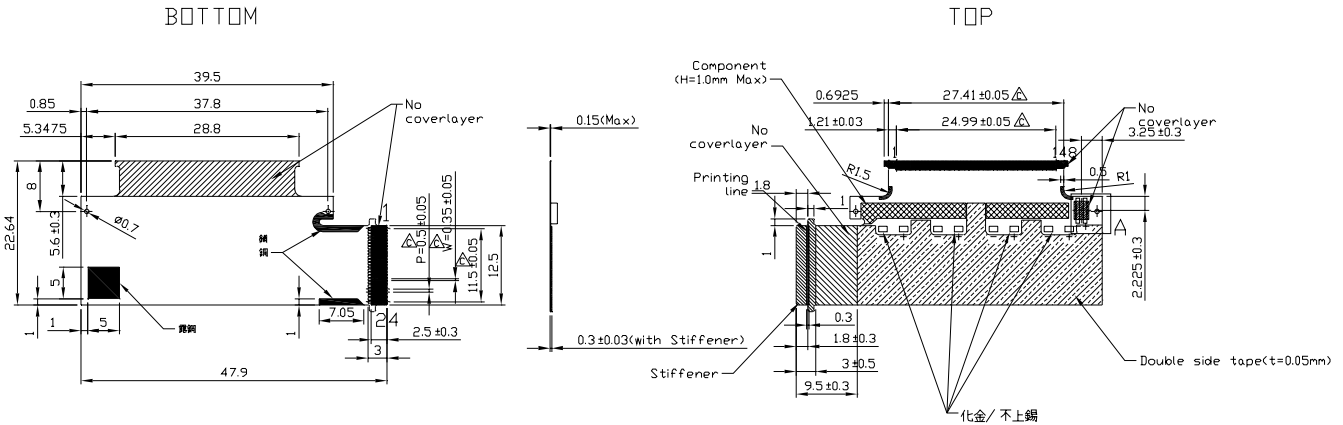
### 8 BLOCK DIAGRAM



MODEL NAME:	PAGE: 17 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

## 9 FPC

### 9.1 FPC drawing

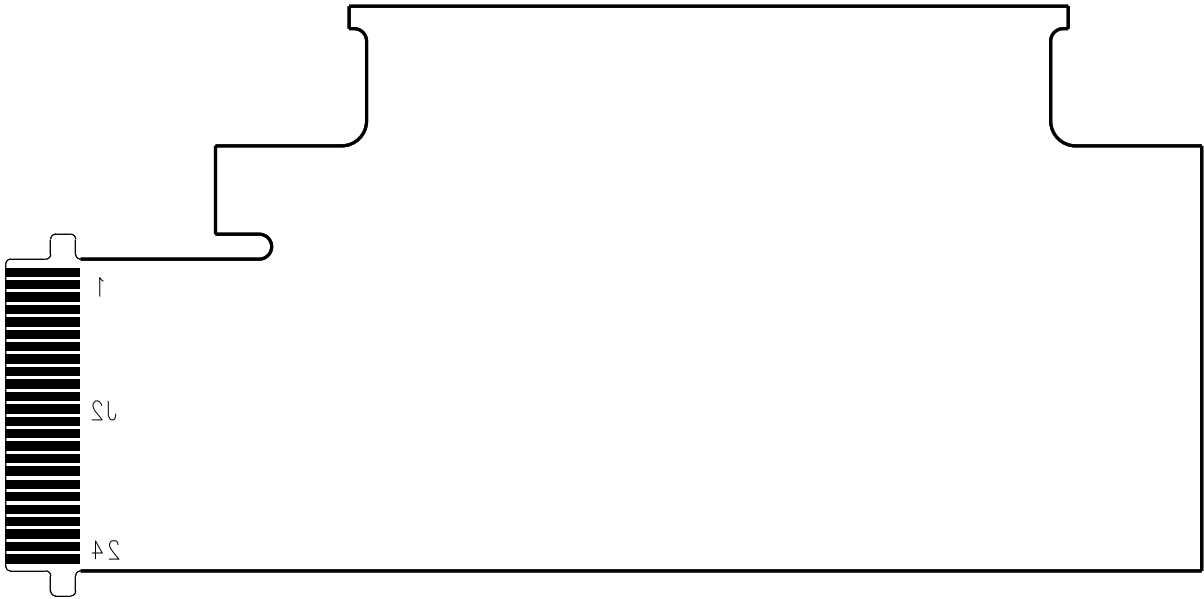
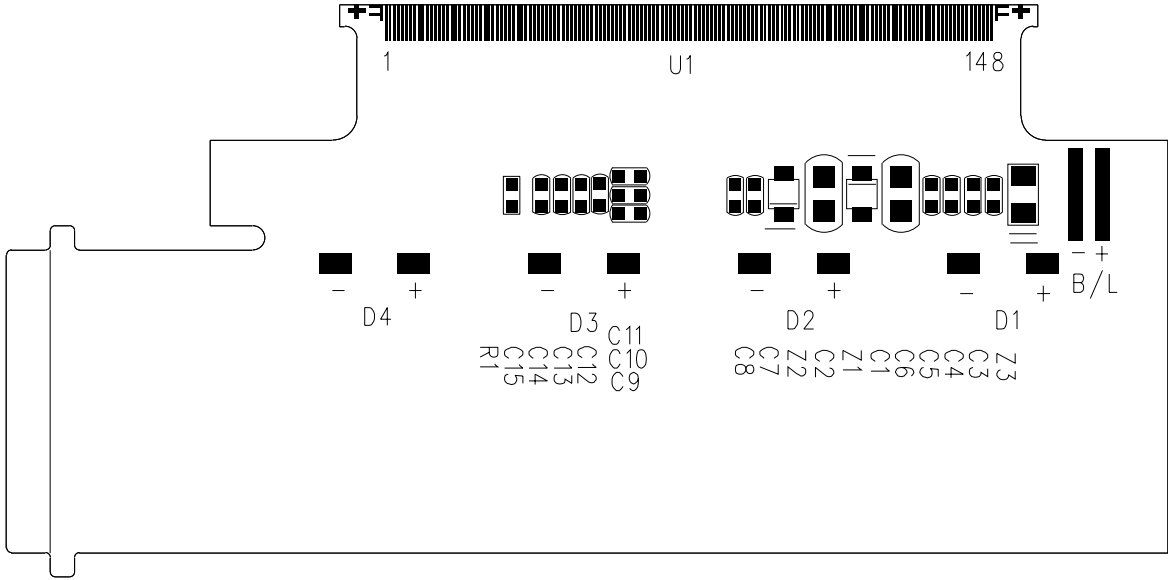


### 9.2 FPC part list

No	Spec.	Place	Unit
1	Diode Schottky RB520S-30, 2pin SMT	Z2	1
2	MLR 100Kohm(104) +/-5% 1/16w 0402	R1	1
3	MLC 1uf(105) +80/-20% 10V 0402	C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18	16
4	MLC 1uf(105) +80/-20% 25V 0603	C1, C2	2

MODEL NAME:	PAGE: 18 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

9.3 FPC Placement





<b>MODEL NAME:</b>	<b>PAGE:</b> 20 OF 26	<b>DOC. NO.:</b>	<b>VERSION:</b> A.0
--------------------	--------------------------	------------------	------------------------

# 10 PACKING FORM

SYM	ECN NO.	Rev.	DATE
▽		VA.1	2005.10.05
▽		VA.2	2006.03.11

**Paper Cover**  
White EPE 30P  
585L\*345W\*5H  
料號: (C3-583400-0001)

**Anti-static Bag PE (165\*54mm)**  
料號: D-165054-A001

1 package (10g) Desiccant per Buffer  
料號: CS-SICC10-1001

**Buffer EPP 45D**  
(Capacity: 72pcs/Buffer)  
(590Lx348Wx67H)  
料號: D4-593406-0002

**Lot number Tape (4x6cm)**  
料號: C2-LTM018-7001

**Plastic Bag**  
595Lx355Wx650H  
料號: D3-593565-0001

**Capacity : 3 Buffers/Carton Box**  
**216 pcs/Carton Box**  
**Carton Box Dimension :**  
箱內裝法: 592Lx350Wx208H  
外箱裝法: 608Lx366Wx240H  
(81/分層裝)(C1-593520-0001)

**Product information Tape 10\*11cm**  
(C2-LTM018-7002)

UNIT	mm	Free	SCALE	Free	WEIGHT	ORIGINAL MODEL
TITLE A-1 Type 216pcs Packing Method (for 1.79", 2.0", 2.2" Long FPC)						
DRAWING NO.(PART NO.)						
APPROVED	Jefferson	2006.03.11	CHECK POINT	2006.03.11	SIZE	A4
CHECKED	Eddie	2006.03.11		2006.03.11	SHT	1-1
DESIGNED	YMLo	2006.03.11			REV	0.2

**General tolerance ±**

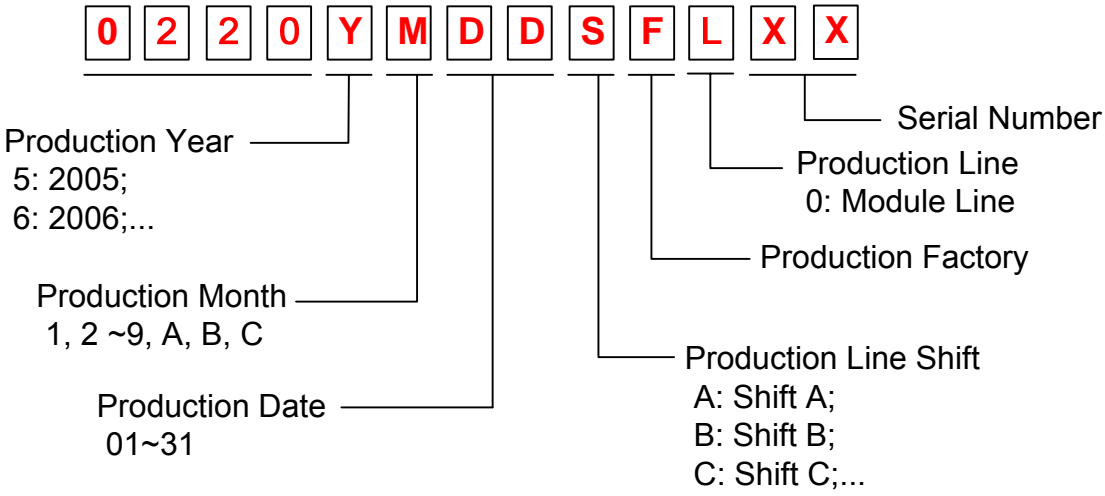
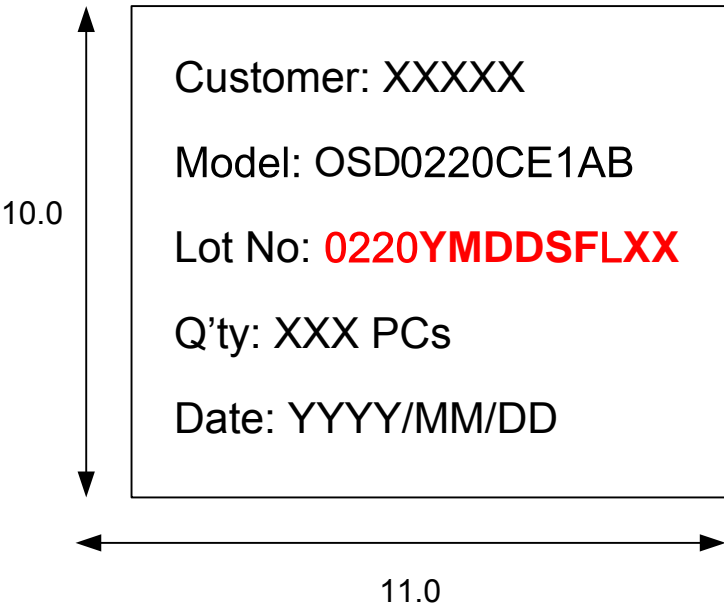
DIM.	LEVEL	1	2	3	4	5	6	SELECT LEVEL
0 ~ 4	0.05	0.1	0.1	0.1	0.1	0.2	0.5	0.5
4 ~ 14	0.05	0.1	0.1	0.2	0.3	0.3	0.8	0.8
14 ~ 63	0.05	0.1	0.2	0.3	0.5	0.5	1.2	1.2
63 ~ 250	0.1	0.2	0.3	0.5	0.8	1.2	1.8	1.8
250 ~ 600	0.3	0.5	0.8	1.2	1.8	3.0	3.0	3.0
600 ~ 4000	0.8	1.2	1.8	3.0	5.0	5.0	5.0	5.0

MODEL NAME:	PAGE: 21 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

# 11 DESIGNATION OF LOT MARK

## 11.1 Lot Mark on Packing Label

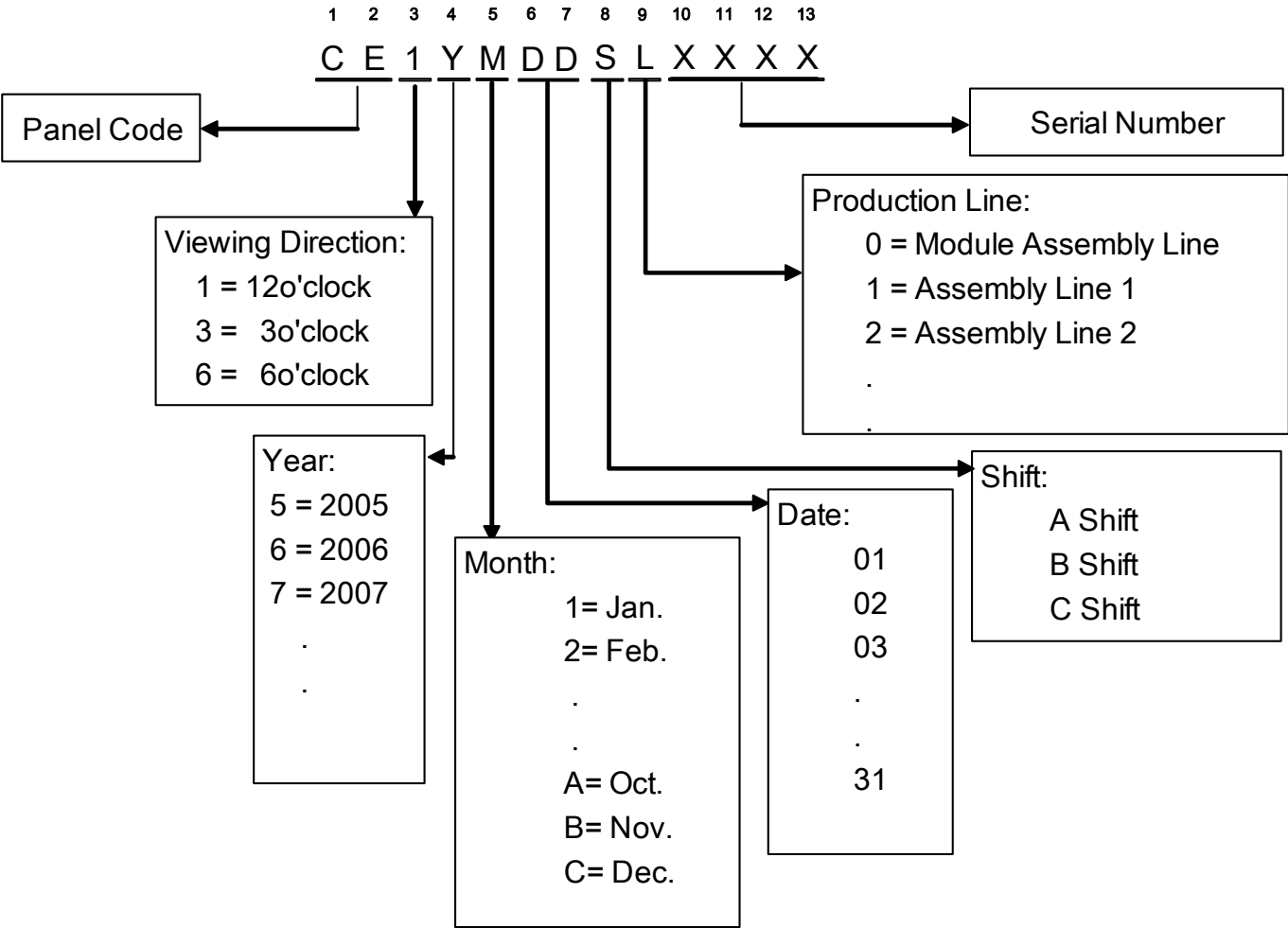
Lot Number on Outer  
Carton Box



MODEL NAME:	PAGE: 22 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

### 11.2 Production Lot Mark of LCD Panel

The production lot of module is specified on the back of panel. The lot mark is consisted of 13-digit number.



MODEL NAME:	PAGE: 23 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

## 12 RELIABILITY

No.	Test Items	Test Conditions
1	High Temperature Storage Test	Ta=80°C, 120 Hrs
2	Low Temperature Storage Test	Ta=-30°C, 120Hrs
3	High Temperature and High Humidity Operating Test	Ta=60°C, 90%RH, 120Hrs (No condensation of dew)
4	High Temperature Operating Test	Ta=70°C, 120Hrs
5	Low Temperature Operating Test	Ta=-20°C, 120Hrs
6	Heat Shock Test	Ta=-30°C (0.5H) ~ 80°C (0.5H) / 32 cycles
7	Electro Static Discharge Test	+200V, 200pF (0Ω), 1 time for each terminal

Note: (1) Evaluation should be tested after storage at room temperature for one hour.

(2) There should be no change that might affect the practical display function when the display quality test is conducted under normal operating conditions.

(3) Judgment:

- a. In the standard condition, there shall be no practical problems that may affect the display function.
- b. No serious image quality degradation.



MODEL NAME:	PAGE: 24 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

## 13 PRECAUTIONS

### 13.1 Handling

- (1) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
  - (2) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
  - (3) Note that the polarizer is very fragile and could be easily damaged. Do not press or scratch the surface harder than a B pencil lead.
  - (4) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
  - (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
  - (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Don't use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
  - (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
  - (8) Protect the module from static; it may cause damage to the CMOS Gate Array IC.
  - (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
  - (10) Do not disassemble the module.
-

MODEL NAME:	PAGE: 25 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.

### 13.2 Storage

- (1) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35oC and relative humidity of less than 70%.
- (2) Do not store the TFT-LCD module in direct sunlight.
- (3) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

### 13.3 Operation

- (1) Do not connect; disconnect the module in the “Power on” condition.
- (2) Power supply should always be turned on/off by the chapter 8 TFT-LCD Driver IC Operation Algorithms.

### 13.4 Others

- (1) The Liquid crystal is deteriorated by ultra violet, do not leave it in direct sunlight and strong ultraviolet ray for many hours.
  - (2) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
  - (3) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation in part contents and environmental temperature and so on). Otherwise the panel may be damaged.
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MODEL NAME:	PAGE: 26 OF 26	DOC. NO.:	VERSION: A.0
-------------	-------------------	-----------	-----------------

- (4) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.
  - (5) His panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.
-