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**2.0" 176x220 + 1.1" 128x128  
DUAL TFT LCD MODULE  
SPECIFICATION**

**MODEL NAME: OSD0200CE381**

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### Record of Revision

Ver.	Revise Date	Page	Content	Modified By
A.0	2006/02/20	-	New specification was first issued.	SF Chen
A.1	2006/03/14	4	Updated General Description	SF Chen
		5	Updated Absolute Maximum Ratings	
		7	Updated AC Characteristics	
		11	Updated DC Characteristics	
		18	Updated Outline Dimension	
		21	Updated Block Diagram	



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# 1 GENERAL DESCRIPTION

## 1.1 Description

OSD0200CE381 is a camera LCD module which composed of a 2.0” transmissive TFT LCD panel, 1.1” transmissive TFT sub-display and a camera module interface. The resolution of main LCD contains 176 x 220 pixels and can display up to 262K colors. The resolution of sub display contains 128 x 128 pixels and can display up to 65K colors. The camera LCD module is designed and manufactured specifically for use in camera phone.

## 1.2 Features

Module Size		38.5 (W) × 60.8 (H) × 4.0 (D) mm
		: The protrusions (PCB, parts) are included.
Display Type		: a-Si TFT LCD, Transmissive type
Drive IC	Main	: Himax HX8309A
	Sub	: Tomato TL1771
Active Area	Main	: 31.68 (W) × 39.6 (H) mm
	Sub	: 19.58 (W) × 19.58 (H) mm
Number of Dots	Main	: 176 (W) × 3 [R.G.B] × 220 (H) dots
	Sub	: 128 (W) × 3 [R.G.B] × 128 (H) dots
Color	Main	: 262,144
	Sub	: 65,536
Pixel Size	Main	: 0.180 (W) × 0.180 (H) mm
	Sub	: 0.153 (W) × 0.153 (H) mm
Viewing Direction		: 3 O’ Clock / 12 O’clock
MPU Interface		: 80-Systems 16 bit bus
Back-light		: 3 x LED Back-light / White
Weight		: T.B.D.

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## 2 ABSOLUTE MAXIMUM RATINGS

### 2.1 Electrical absolute maximum ratings-Main

Item	Symbol	Value	Unit	Note
Power Supply Voltage (1)	Vcc, IOVcc	-0.3 to +4.6	V	(1),(2)
Power Supply Voltage (2)	Vci-VSSA	-0.3 to +4.6	V	(1),(2)
Power Supply Voltage (3)	VLCD-VSSA	-0.3 to +6.0	V	(1),(3)
Input Voltage	Vt	-0.3 ~ Vcc+0.3	V	

Note:

- (1) Vcc, VSSD must be maintained.
- (2) To make sure  $IOVCC \geq VSSD$
- (3) To make sure  $Vci \geq VSSD$
- (4) If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

### 2.2 Electrical absolute maximum ratings-Sub

Item	Symbol	Value	Unit	Note
Power Supply Voltage (1)	VCC	-0.3 to +3.6	V	(1),(2)
Power Supply Voltage (2)	IOVCC	-0.3 to +3.6	V	(1),(2)
Input Voltage Range	Vin	-0.5 ~ VCC+0.5	V	(1)

Note:

- (1) If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.
- (2) Indicate the voltage from VSS=0V



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### 2.3 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	unit	Note
Storage Temperature	Tstg	(-30)	(80)	°C	(1)
Operating Temperature (Ambient Temperature)	Topr	(-20)	(70)	°C	(1),(2)

Note:

(1) 95 % RH Max. (  $40^{\circ}\text{C} \geq T_a$  )

(2) In Case of below  $0^{\circ}\text{C}$ , the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

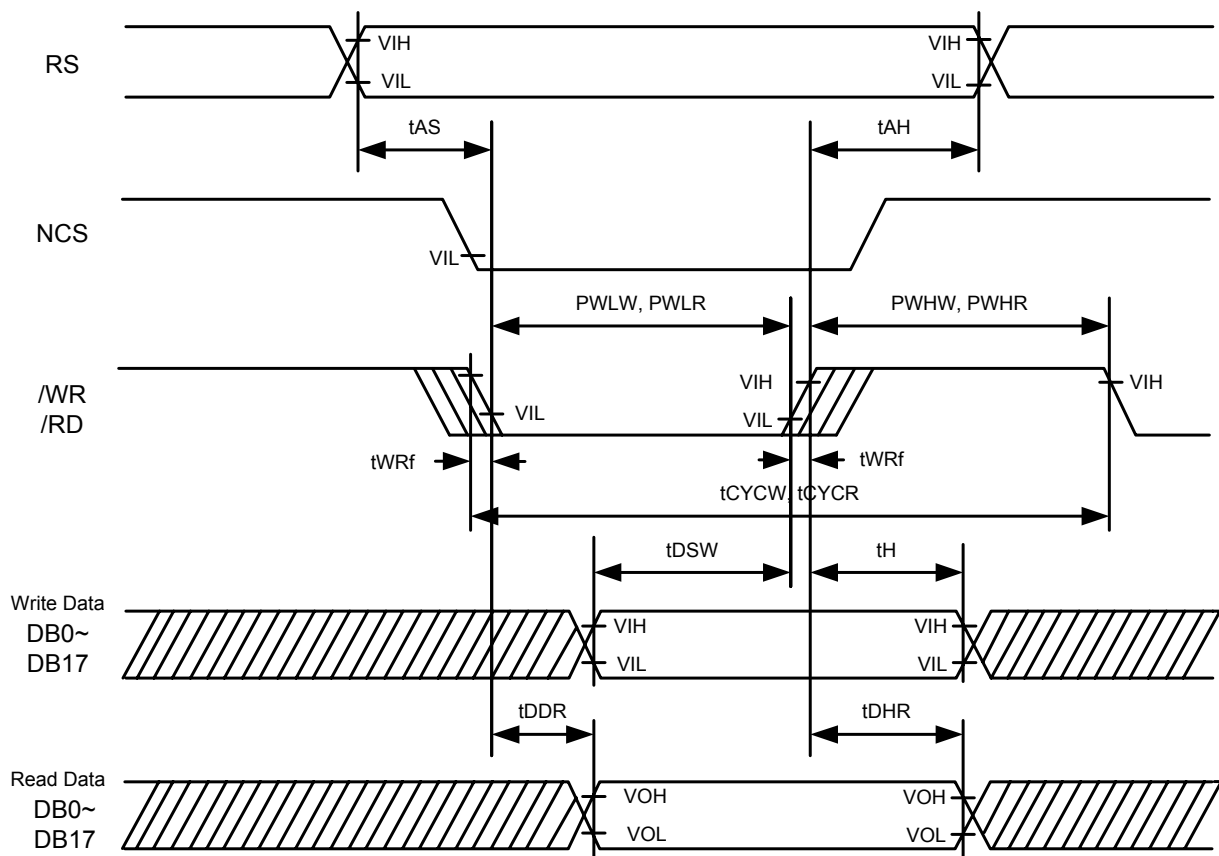
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### 3 AC CHARACTERISTICS

#### 3.1 Bus interface timing characteristics-Main

Normal write mode (HWM=0)



(IOV<sub>cc</sub>=1.65~2.4V, V<sub>cc</sub>=2.4~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	
Bus cycle time	Write	$t_{CYCW}$	ns	350	-	-
	Read	$t_{CYCR}$	ns	500	-	-
Write low-level pulse width	$PW_{LW}$	ns	40	-	-	
Read low-level pulse width	$PW_{LR}$	ns	250	-	-	
Write high-level pulse width	$PW_{HW}$	ns	30	-	-	



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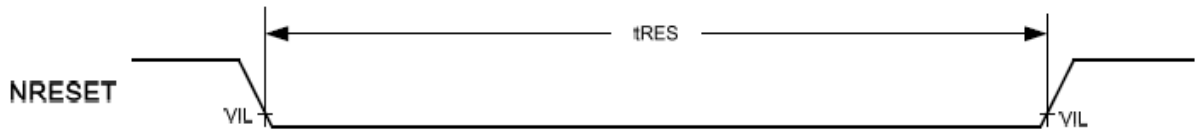
Item		Symbol	Unit	Min.	Typ.	Max.
Read high-level pulse width		$PW_{HR}$	ns	200	-	-
Write / Read rise / fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Setup time	Write (RS to NCS, E_NWR)	$t_{AS}$	ns	5	-	-
	Read (RS to NCS, RW_NWR)		ns	5	-	-
Address hold time		$t_{AH}$	ns	5	-	-
Write data set up time		$t_{DSW}$	ns	15	-	-
Write data hold time		$t_H$	ns	20	-	-
Read data delay time		$t_{DDR}$	ns	-	-	120
Read data hold time		$t_{DHR}$	ns	5	-	-

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

Item		Symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	$t_{CYCW}$	ns	300	-	-
	Read	$t_{CYCR}$	ns	500	-	-
Write low-level pulse width		$PW_{LW}$	ns	40	-	-
Read low-level pulse width		$PW_{LR}$	ns	250	-	-
Write high-level pulse width		$PW_{HW}$	ns	30	-	-
Read high-level pulse width		$PW_{HR}$	ns	200	-	-
Write / Read rise / fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Setup time	Write (RS to NCS, E_NWR)	$t_{AS}$	ns	5	-	-
	Read (RS to NCS, RW_NWR)		ns	5	-	-
Address hold time		$t_{AH}$	ns	5	-	-
Write data set up time		$t_{DSW}$	ns	15	-	-
Write data hold time		$t_H$	ns	20	-	-
Read data delay time		$t_{DDR}$	ns	-	-	120
Read data hold time		$t_{DHR}$	ns	5	-	-

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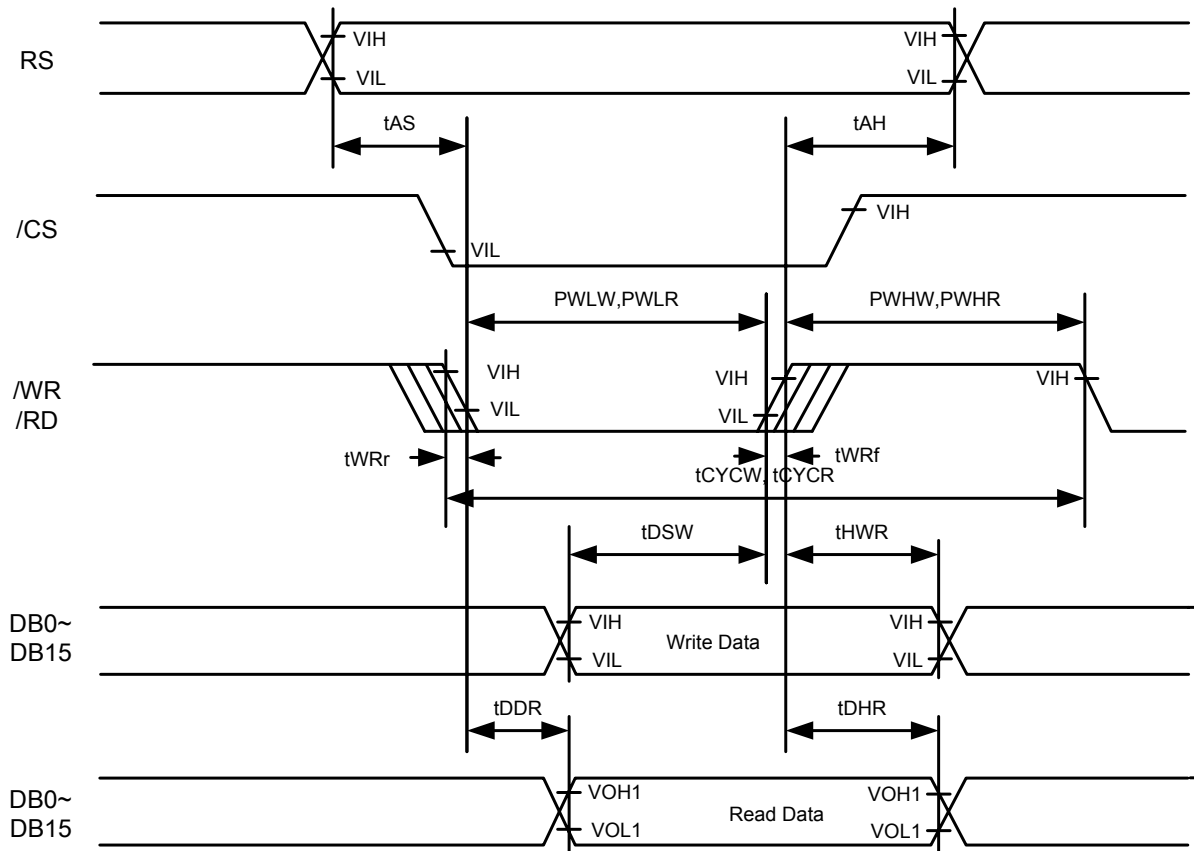
### 3.2 Reset timing characteristics-Main



(Vcc=1.8~3.3V, IOVcc=1.65~3.3V)

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

### 3.3 System bus interface timing characteristics-Sub

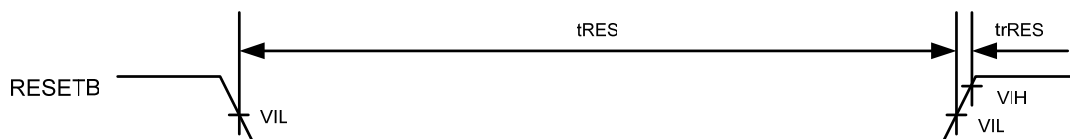


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(IOVCC=1.7~3.3V, VCC=2.4~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	$t_{CYCW}$	ns	100	-	-
	Read	$t_{CYCR}$	ns	250	-	-
Write low-level pulse width		$PW_{LW}$	ns	40	-	-
Read low-level pulse width		$PW_{LR}$	ns	150	-	-
Write high-level pulse width		$PW_{HW}$	ns	40	-	-
Read high-level pulse width		$PW_{HR}$	ns	100	-	-
Write / Read rise / fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Set up time	Write (RS to CSB, WRB)	$t_{AS}$	ns	0	-	-
	Read (RS to CSB, RDB)		ns	10	-	-
Address hold time		$t_{AH}$	ns	2	-	-
Write data set up time		$t_{DSW}$	ns	25	-	-
Write data hold time		$t_H$	ns	5	-	-
Read data delay time		$t_{DDR}$	ns	-	-	100
Read data hold time		$t_{DHR}$	ns	5	-	-

### 3.4 Reset timing characteristics-Sub



(IOVCC=1.7~3.3V, VCC=2.4~3.3V)

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

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## 4 DC CHARACTERISTICS

### 4.1 DC characteristics-Main

(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=1.65~3.3V	0.8xIOVcc	-	IOVcc	V
Input low voltage	V <sub>IL</sub>	IOVcc=1.65~3.3V	-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=1.65~2.4V I <sub>OL</sub> = 0.1 mA	-	-	0.2xIOVCC	V
I/O leakage current	I <sub>Li</sub>	V <sub>in</sub> = 0~Vcc	-1	-	1	μ A
Current consumption during standby mode (Vcc-VSSD)+(IOVcc-VSSD)	V <sub>ST(VCC)</sub>	Vcc=2.8V, Ta=25°C	-	1	10	μ A
Current consumption during standby mode (Vci-VSSD)	V <sub>ST(VCi)</sub>		-	0.5	1	μ A
Output voltage deviation		-	-	5	-	mV
Dispersion of the Average Output Voltage	Δ V	-	-	-	35	mV



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## 4.2 DC characteristics-Sub

(IOVCC=1.7~3.3V, VCC=2.4~3.3V, Ta=25°C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Operation voltage		IOVCC		1.7	-	3.3	V	(1)
		VCC		2.4	-	3.3	V	(1)
		VCI		2.5	-	3.3	V	(1)
Logic input voltage	High	V <sub>IH</sub>		0.8xIOVCC	-	IOVCC	V	(2)
	Low	V <sub>IL</sub>		-0.2	-	0.2xIOVCC	V	(2)
Logic output voltage	High	V <sub>OH</sub>	I <sub>OH</sub> = -0.1 mA	0.8xIOVCC	-	IOVCC	V	(3)
	Low	V <sub>OL</sub>	I <sub>OL</sub> = 0.1 mA	-0.2	-	0.2xIOVCC	V	(3)
Input leakage current		I <sub>Li</sub>	V <sub>in</sub> =VSS or IOVcc	-1.0	-	1.0	μA	
Output leakage current		I <sub>oi</sub>	V <sub>in</sub> =VSS or IOVcc	-3.0	-	3.0	μA	(4)
Operating frequency		F <sub>osC</sub>	Frame freq.=60Hz Display line=160 Rf=82kΩ, VCC=2.8V	176	196	216	KHz	

Note:

(1) VSS=0V

(2) Applied pins: IM2-0, CSB, RS, E\_WRB, RW\_RDB, DB0-15, VLD, RESETB.

(3) Applied pins: DB0-15.

(4) Target frame frequency=60Hz, Display line=160, Back porch=3, Front port=3, Internal RTN [3:0] register = "0000", Internal DIV [1:0] register="00".



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#### 4.3 DC characteristics of the LED back-light

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
LED Forward voltage	Vf	If=15x3mA	(3.0)	(3.4)	(3.8)	V	
LED Forward current	If		-	15	-	mA/LED	

Note: (1) Three LEDs are in parallel type.

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## 5 OPTICAL CHARACTERISTICS

### 5.1 Optical characteristics -Main

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
Viewing Angle	Hor.	ΘR	C/R ≥ 10	-	(35)	-	Degree	(1)(6) BM-5A
		ΘL		-	(15)	-		
	Ver.	ΦH	B/L On	-	(45)	-		
		ΦL		-	(45)	-		
Contrast Ratio (Center Point)		C/R		(150)	(200)	-	-	(1)(2) BM-5A
Brightness		Bm		T.B.D.	(110)	-	Cd/m <sup>2</sup>	(1)(3) BM-5A
Response Time	Rising: Tr	Tr+f	Note (1) Θ = 0 Φ = 0 Normal	(25)	(35)	(50)	msec	(1)(4) BM-7
	Falling: Tf							
Chromaticity Coordinate	White	Wx	Viewing Angle B/L On	(0.26)	(0.31)	(0.36)	-	(1)(5) BM-5A
		Wy		(0.27)	(0.32)	(0.37)		
	Red	Rx		(0.53)	(0.58)	(0.63)		
		Ry		(0.31)	(0.36)	(0.41)		
	Green	Gx		(0.29)	(0.34)	(0.39)		
		Gy		(0.53)	(0.58)	(0.63)		
	Blue	Bx		(0.10)	(0.15)	(0.20)		
		By		(0.07)	(0.12)	(0.17)		

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## 5.2 Optical characteristics –Sub

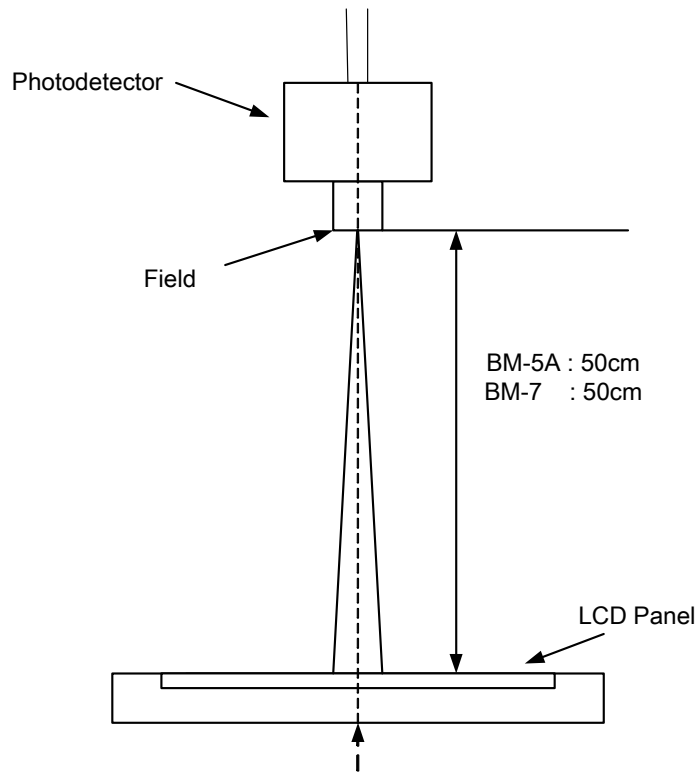
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Hor.	ΘR	C/R ≥ 10	-	(35)	-	Degree	(1)(6) BM-5A
		ΘL		-	(15)	-		
	Ver.	ΦH	B/L On	-	(45)	-		
		ΦL		-	(45)	-		
Contrast Ratio (Center Point)		C/R	Note (1) Θ = 0 Φ = 0 Normal Viewing Angle B/L On	(150)	(200)	-	-	(1)(2) BM-5A
Brightness		Bm		T.B.D.	(80)	-	Cd/m <sup>2</sup>	(1)(3) BM-5A
Response Time	Rising: Tr	Tr+f		(25)	(35)	(50)	msec	(1)(4) BM-7
	Falling: Tf							
Chromaticity Coordinate	White	Wx	Viewing Angle B/L On	(0.26)	(0.31)	(0.36)	-	(1)(5) BM-5A
		Wy		(0.27)	(0.32)	(0.37)		
	Red	Rx		(0.52)	(0.57)	(0.62)		
		Ry		(0.31)	(0.36)	(0.41)		
	Green	Gx		(0.28)	(0.33)	(0.38)		
		Gy		(0.49)	(0.54)	(0.59)		
	Blue	Bx		(0.10)	(0.15)	(0.20)		
		By		(0.07)	(0.12)	(0.17)		

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, 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.

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

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

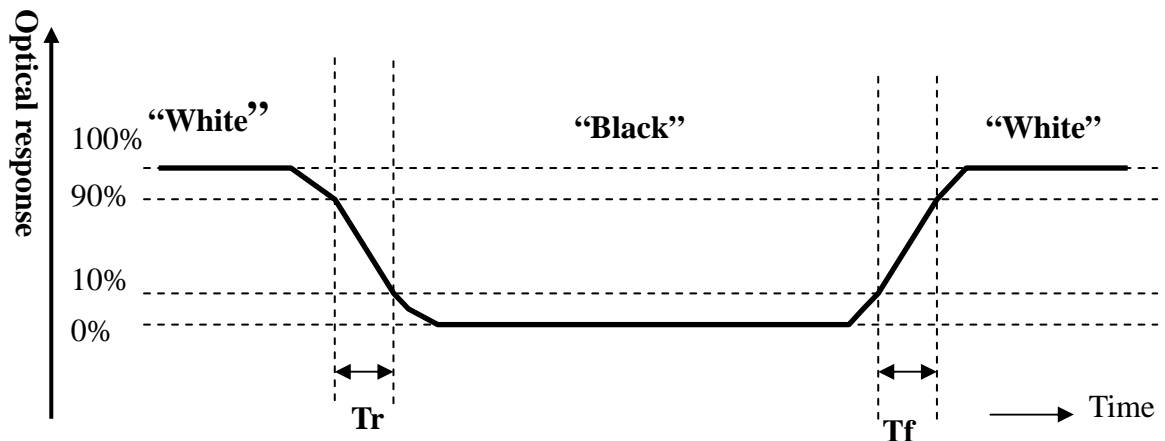
$$CR = \frac{G_{max}}{G_{min}}$$

\* 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

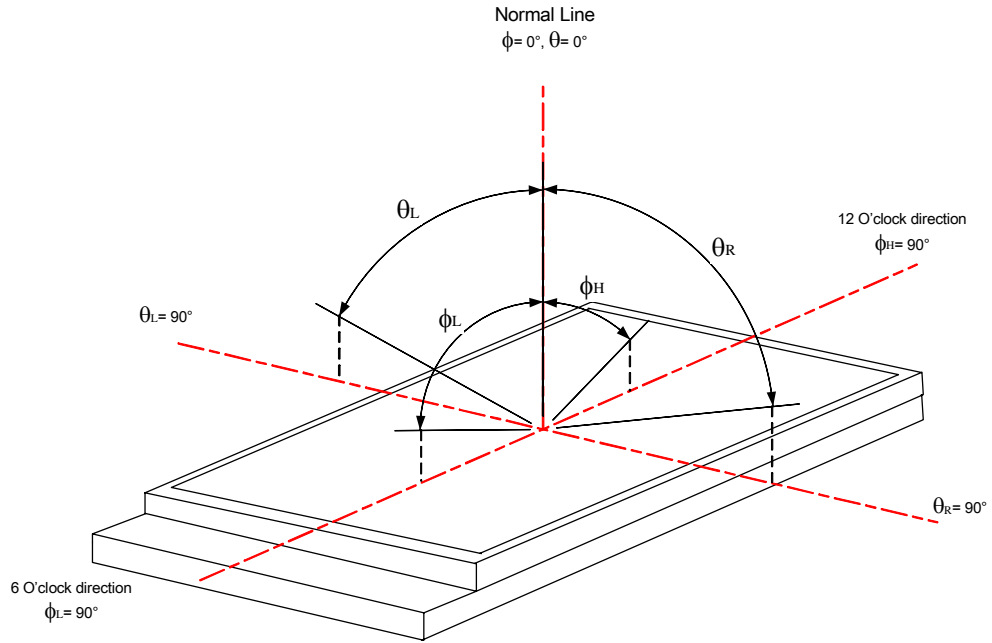


(5) Definition of Chromaticity Coordinate

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

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(6) Definition of Viewing Angle: Viewing angle range (  $CR \geq 10$  )





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## 7 INTERFACE PIN CONNECTION

### 7.1 Module Pin Assignment CN1

Pin No.	Symbol	Pin No.	Symbol
1~2	VBAT	43	SEN_SDA
3	/LCD_MAIN_CS	44	SEN_HREF
4	/LCD_RD	45	SEN_VSYNC
5	/LCD_WR	46	SEN_VCLK
6	LCD_RS	47	SEN_MCLK
7~22	LCD_D0~D15	48	SEN_RESET
23	/LCD_RESET	49	SEN_VDD
24	SEN_PWDN	50	SEN_AVDD
25	/LCD_SUB_CS	51	VIBTATOR
26	REC-	52	LCD_VDD
27	REC+	53	LED3-
28	SPK-	54	LED2-
29	SPK+	55	LED1-
30~39	SEN_D0~D9	56~57	VOUT_BL
40	VFLASH	58	MCATCH1.8V
41	FLASH_DIM	59~60	GND
42	SEN_SCK		

### 7.2 Sensor Module Pin Assignment CN2

Pin No.	Symbol	Pin No.	Symbol
1	DVDD	13	D1
2	VSYNC	14	D0
3	HREF	15	PWRDN
4	VCLK	16	AVDD



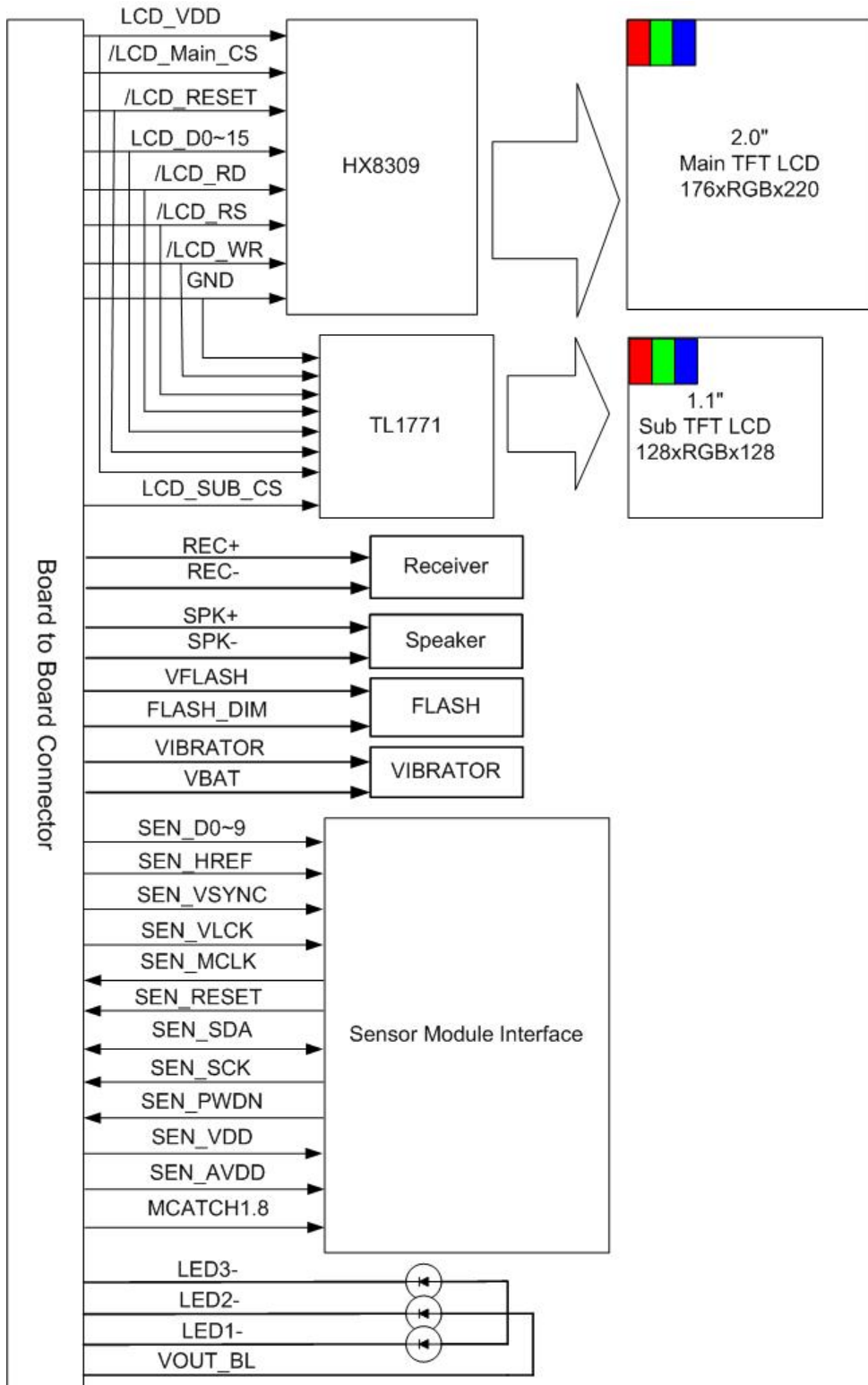
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Pin No.	Symbol	Pin No.	Symbol
5	NC/VDD18	17	AGND
6	MCLK	18	SDA
7	RESET	19	SCK
8	DGND	20	D2
9	D9	21	D3
10	D8	22	D4
11	D7	23	D5
12	D6	24	GND

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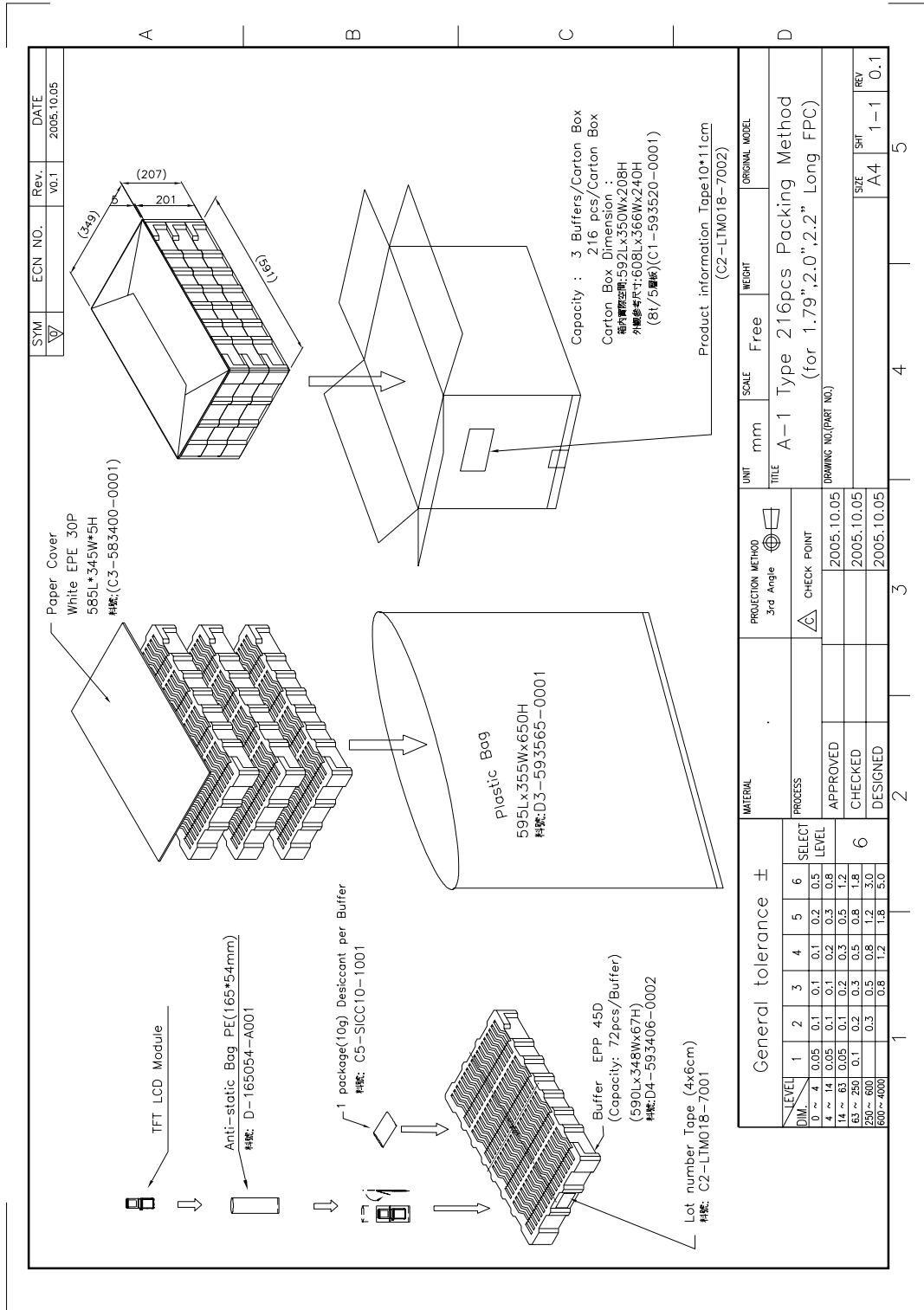
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## 8 BLOCK DIAGRAM



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# 9 PACKING FORM



UNIT		mm	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.)									
PROJECTION METHOD		3rd Angle	CHECK POINT						
APPROVED		2005.10.05	2005.10.05						
CHECKED		2005.10.05	2005.10.05						
DESIGNED		2005.10.05	2005.10.05						
MATERIAL		PROCESS							
General tolerance ±		LEVEL	1	2	3	4	5	6	SELECT LEVEL
DIM.		0 ~ 4	0.05	0.1	0.1	0.1	0.2	0.5	0.8
		4 ~ 14	0.05	0.1	0.1	0.2	0.3	0.5	0.8
		14 ~ 63	0.05	0.1	0.2	0.3	0.5	1.2	1.8
		63 ~ 250	0.1	0.2	0.3	0.5	0.8	1.8	3.0
		250 ~ 600	0.3	0.5	0.8	1.2	3.0	5.0	6
		600 ~ 6000	0.8	1.2	1.8	3.0	5.0		
SIZE		A4	SHEET		1-1		REV		0.1

Capacity : 3 Buffers/Carton Box  
216 pcs/Carton Box  
Carton Box Dimension :  
箱内實際空間:592Lx350Wx208H  
箱外參考尺寸:608Lx366Wx240H  
(81/5層紙)(C1-593520-0001)

Product information Tape10\*11cm  
(C2-LTM018-7002)

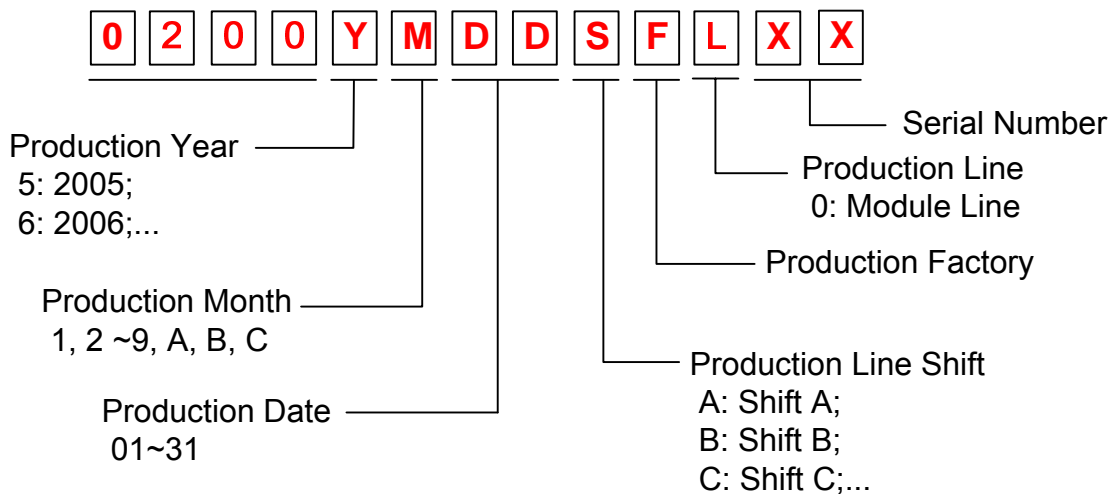
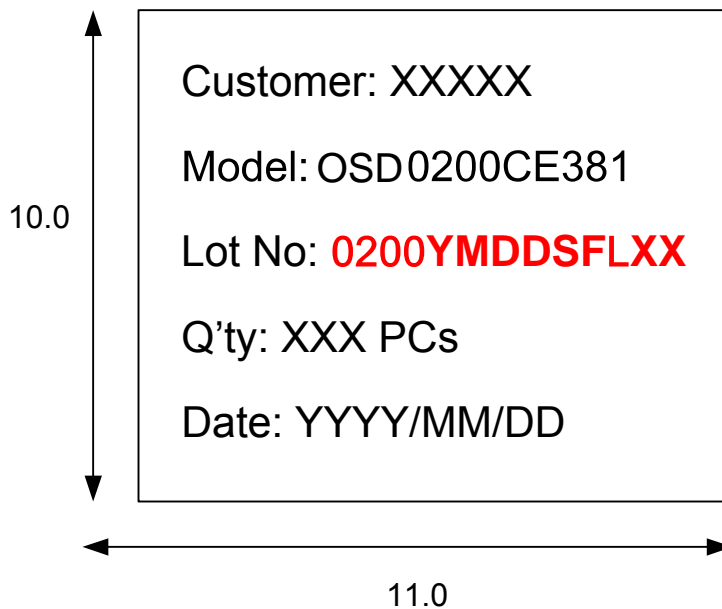


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## 10 DESIGNATION OF LOT MARK

### 10.1 Lot Mark on Packing Label

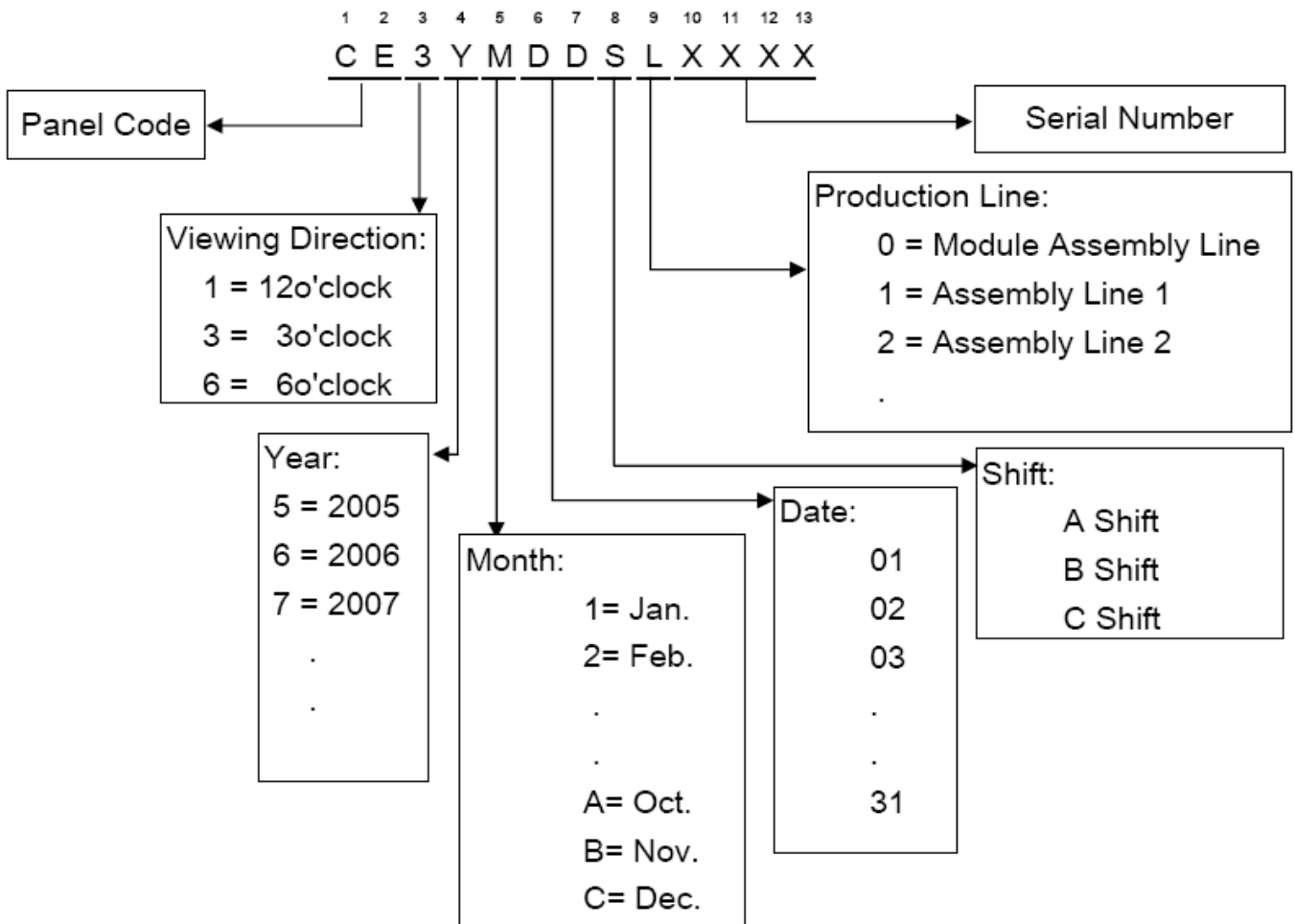
Lot Number on Outer  
Carton Box



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### 10.2 Production Lot Mark of LCD Module

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





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## 11 RELIABILITY DATA

No.	Test Items	Test Conditions
1	High Temperature Storage Test	Ta=80°C, 240 Hrs
2	Low Temperature Storage Test	Ta=-30°C, 240Hrs
3	High Temperature and High Humidity Operating Test	Ta=40°C, 90%RH, 240Hrs (No condensation of dew)
4	High Temperature Operating Test	Ta=70°C, 240Hrs
5	Low Temperature Operating Test	Ta=-20°C, 240Hrs
6	Heat Shock Test	Ta=-30°C (0.5H) ~ 80°C (0.5H) / 50 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.





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## 12 PRECAUTIONS

### 12.1 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.
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- (10) Do not disassemble the module.
- (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.

## 12.2 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.

## 12.3 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.

## 12.4 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)..
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Otherwise the panel may be damaged.

- (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.

