

## CUSTOMER' S APPROVAL SPECIFICATIONS

**MODEL: CH070DLDL-CT5**

**(Complied with RoHS)**



**ISSUE:AUG.07.2015**

**Spec Condition: preliminary**

No.	ITEM	PAGE
1	COVER	--
2	RECORD OF REVISION	0-1
3	MECHANICAL SPECIFICATIONS	1
4	OUTLINE DIMENSIONS	2
5	INTERFACE PIN CONNECTION	3
6	BLOCK DIAGRAM	4
7	ABSOLUTE MAXIMUM RATINGS	4
8	ELECTRICAL CHARACTERISTICS	5
9	OPTICAL CHARACTERISTICS	6~8
10	TIMING SPECIFICATIONS	9~11
12	RELIABILITY TEST	12
13	PRECAUTZONS FOR USE	13
14	INCOMING INSPECTION SPECIFICATION	14~15

CUSTOMER	CHEFREE		
APPROVAL	APPROVAL	CHECKER	PREPARE
	<i>ch lee</i>	<i>ch lee</i>	<i>cloud</i>

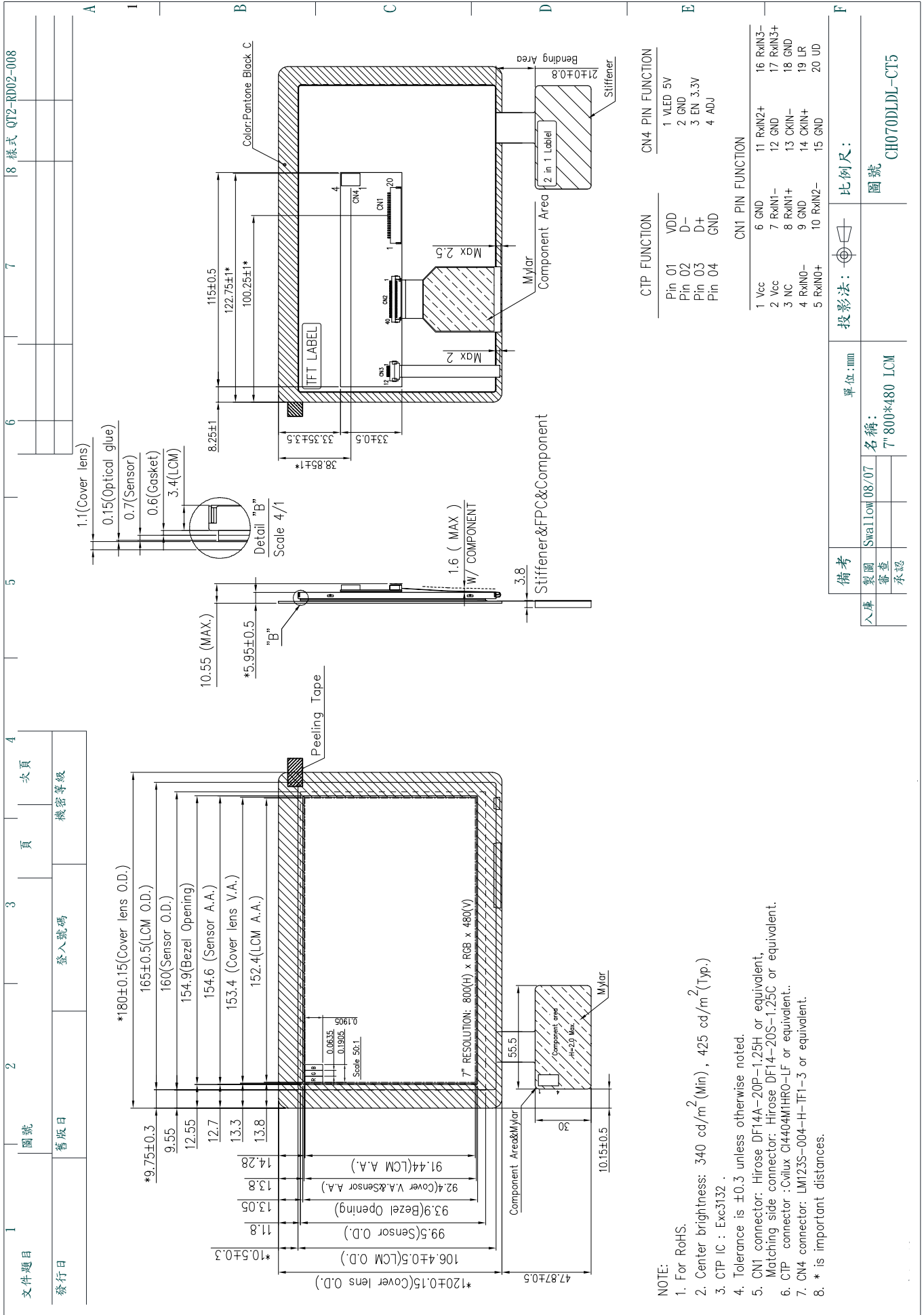
2.RECORD OF REVISION

Rev	DATE	PAGE	SUMMARY
0.1	2015.08.07	ALL	Preliminary specification was first issued.

### 3.MECHANICAL SPECIFICATIONS

(1)	Number Of Dots (Dots)	800(R.G.B) X 480
(2)	Module Size(mm)	180.00(W) X 120.00(H) X 10.55(D)mm
(3)	Active Area(mm)	152.4(H) X 91.44(V)
(4)	Pixel Pitch(mm)	0.0635(H) X 0.1905(V)
(5)	LCD Model	TFT , Transmissive, Normally/White
(6)	Polarizer Model	Anti-glare
(7)	LED Backlight Color	White
(8)	Viewing Direction	All Direction
(9)	Color Configuration	R.G.B Stripe
(10)	Module Weight(g)	TBD
(11)	PCAP Cover Glass	1.1mm, clear surface
(12)	PCAP Touch Controller	EXC3132
(13)	PCAP Interface	USB interface
(14)	PCAP Touch Fingers	5 fingers multi-touch

# 4. OUTLINE DIMENSIONS



- NOTE:**
- For RoHS.
  - Center brightness: 340 cd/m<sup>2</sup> (Min), 425 cd/m<sup>2</sup> (Typ.)
  - CTP IC : Exc3132 .
  - Tolerance is ±0.3 unless otherwise noted.
  - CN1 connector: Hirose DF14A-20P-1.25H or equivalent, Matching side connector: Hirose DF14-20S-1.25C or equivalent.
  - CTP connector : Cvilux C4404M1HR0-LF or equivalent..
  - CN4 connector: LMI23S-004-H-TF1-3 or equivalent.
  - \* is important distances.

## 5. INTERFACE PIN CONNECTION

### 5.1 LCM PANEL DRIVING SECTION (CN1: DF14A-20P-1.25H or Equivalent)

PIN NO.	SIGNAL	FUNCTION
1	VCC	Power Supply For Digital Circuit
2	VCC	Power Supply For Digital Circuit
3	NC	No Connection
4	RxIN0-	Differential Data Input, CH0(Negative)
5	RxIN0+	Differential Data Input, CH0(Positive)
6	GND	Ground
7	RxIN1-	Differential Data Input, CH1(Negative)
8	RxIN1+	Differential Data Input, CH1(Positive)
9	GND	Ground
10	RxIN2-	Differential Data Input, CH2(Negative)
11	RxIN2+	Differential Data Input, CH2(Positive)
12	GND	Ground
13	CKIN-	Differential Clock Input(Negative)
14	CKIN+	Differential Clock Input(Positive)
15	GND	Ground
16	RxIN3-	Differential Data Input, CH3(Negative)
17	RxIN3+	Differential Data Input, CH3(Positive)
18	GND	Ground
19	LR	LR=H SO1--> ... ..SO1200(internal pull high) LR=H SO1--> ... ..SO1
20	UD	When UD=H, reverse scan When UD=L, normal scan(internal pull low)

Note : LR&UD setting

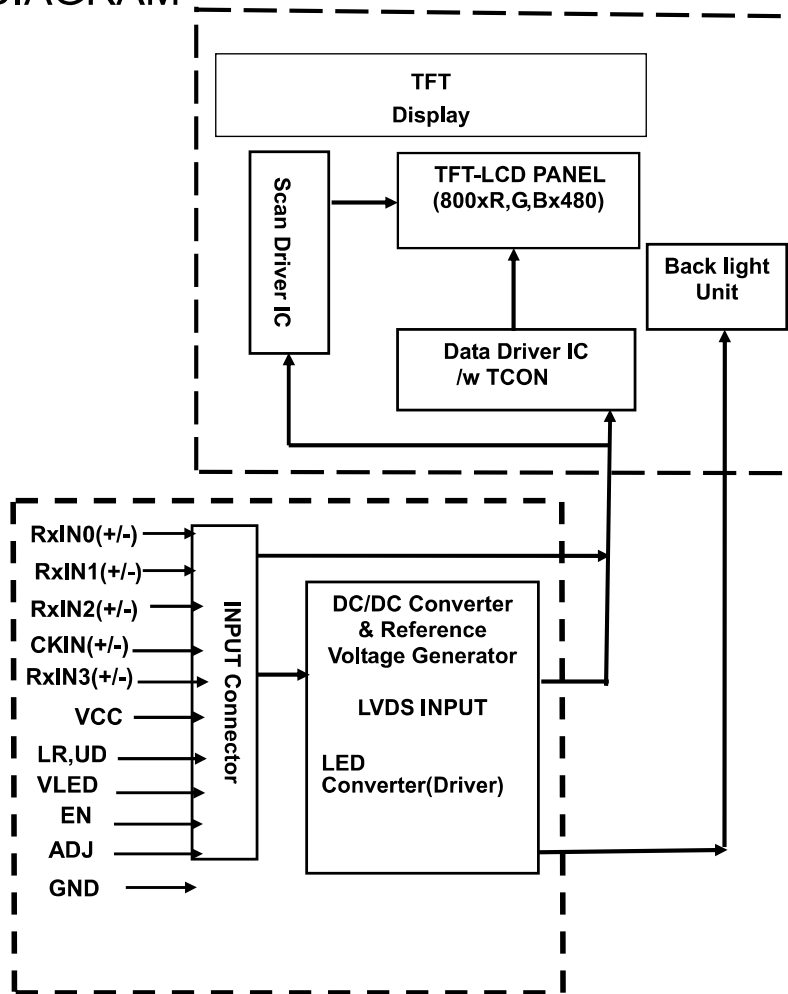
LR	UD	Function
1	0	Normally display
0	0	Left and Right opposite
1	1	Up and Down opposite
0	1	Left and Right opposite, Up and Down opposite

### 5.2 BACKLIGHT SECTION

CN2:LM123S-004-H-TF1-3 or equivalent

PIN NO	SYMBOL	FUNCTION	REMARK
1	VLED	Power for LED Driver IC, 5V	
2	GND	Ground	
3	EN	LED Driver IC enable control, High="ON" , Low="OFF"	
4	ADJ	LED Driver IC PWM control	

## 6. BLOCK DIAGRAM



## 7. ABSOLUTE MAXIMUM RATINGS

GND=0V

Parameter	Symbol	MIN.	MAX.	Unit	Remark
Power supply voltage	VCC	-0.3	6	V	Ta=25°C
Logic input voltage	VI	-0.3	V <sub>CC</sub> +0.3	V	
Operating temperature	Top	-20	70	°C	Module surface*
Storage temperature	Tst	-30	80	°C	
Humidity	Operation	20%~90% relative humidity			Ta<=60°C
	Non Operation	5%~90% relative humidity			Ta<=60°C

GND=0V

Symbol	Description	Min	Typ.	Max	Unit	Notes
VDD	Supply voltage	-0.3	-	4	V	

Note 1: for Capacitive Touch.

## 8. ELECTRICAL CHARACTERISTICS

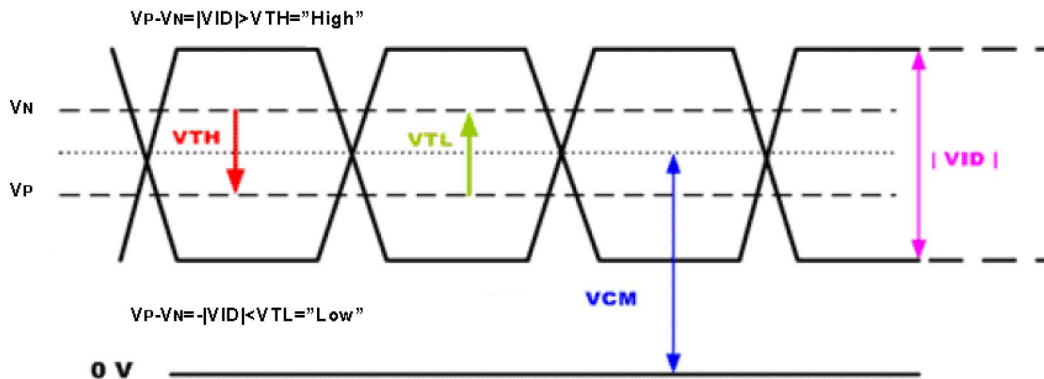
### 8.1 ELECTRICAL CHARACTERISTICS OF LCD

fH=31.5KHz, fV=60Hz, fCLK=33.26MHz, Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply voltage for LCD	V <sub>CC</sub>	+3.0	+3.3	+3.6	V	
Power Supply Current for LCD	I <sub>CC</sub>		180	240	mA	V <sub>CC</sub> =3.3V
Power Supply voltage for LED	V <sub>LED</sub>	4.5	5	5.5	V	
Power Supply Current for LED	I <sub>MLED</sub>		600	850	mA	V <sub>LED</sub> =5.0V
Ripple voltage	V <sub>RF</sub>	-	-	100	mV <sub>P-P</sub>	
Logic input voltage	V <sub>IH</sub>	0.8*V <sub>CC</sub>	-	V <sub>CC</sub>	V	UD, LR
	V <sub>IL</sub>	0	-	0.2*V <sub>CC</sub>	V	
ADJ frequency		18K	20K	22K	Hz	
ADJ input voltage	V <sub>IH</sub>	3.0	-	3.6	V	
	V <sub>IL</sub>	0	-	0.3	V	
EN input voltage	V <sub>IH</sub>	3.0	-	3.6	V	
	V <sub>IL</sub>	0	-	0.3	V	
Differential Input High Threshold	V <sub>TH</sub>	-	-	100	[mV]	V <sub>CM</sub> =1.2V Note 1
Differential input Low Threshold	V <sub>TL</sub>	-100	-	-	[mV]	
LED dice life time			30,000		Hr	Note 2

Note 1: LVDS Signal Waveform.

#### Differential Signal



Note 2: The "LED dice life time" is defined as the brightness decrease to 50% original brightness that the ambient temperature is 18°C ~28°C and LED dice current=25mA.

### 8.2 ELECTRICAL CHARACTERISTICS OF Capacitive Touch

GND=0V

Symbol	Description	Min	Typ.	Max	Unit	Notes
VDD	Supply voltage	4.75	5	5.25	V	
IDD	Supply current		35	100	mA	VDD=3.3V
V <sub>IH</sub>	Input high voltage	VDD-0.8	-	-	V	
V <sub>IL</sub>	Input low voltage	-	-	0.8	V	
V <sub>OH</sub>	Output high voltage	VDD-0.4	-	-	V	
V <sub>OL</sub>	Output low voltage	-	-	0.4	V	

## 9. OPTICAL CHARACTERISTICS

Ta=25°C

ITEM	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast Ratio	CR	Viewing	300	400	-	-	Note (1)
Response Time	TR	Normal	-	5	10	ms	Note (2)
	TF	Angle	-	15	20	ms	
Chromaticity	White	x	0.29	0.30	0.31	-	Note (4)
		y	0.29	0.30	0.31	-	
Viewing Angle	Hor.	$\Theta_{x+}$	70	80	-	Deg.	Note (3)
		$\Theta_{x-}$	70	80	-		
	Ver.	$\Theta_{y+}$	70	80	-		
		$\Theta_{y-}$	70	80	-		
Luminance	L		340	425	-	cd/m <sup>2</sup>	
Luminance uniformity	YU	PWM=100%	70	80	-	%	Note(5)

\*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

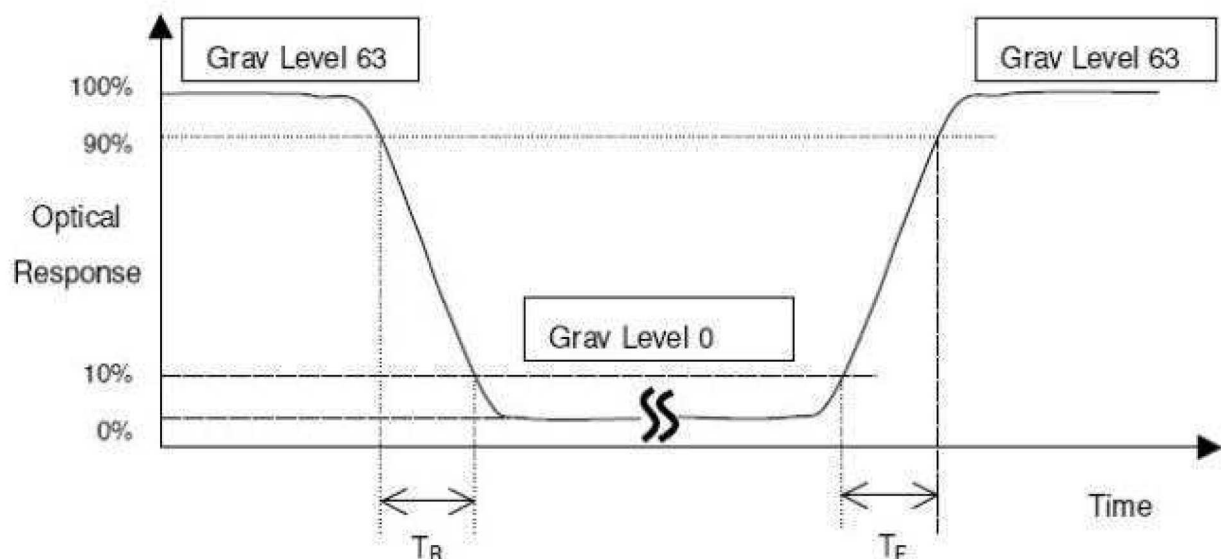
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$CR = CR (5)$$

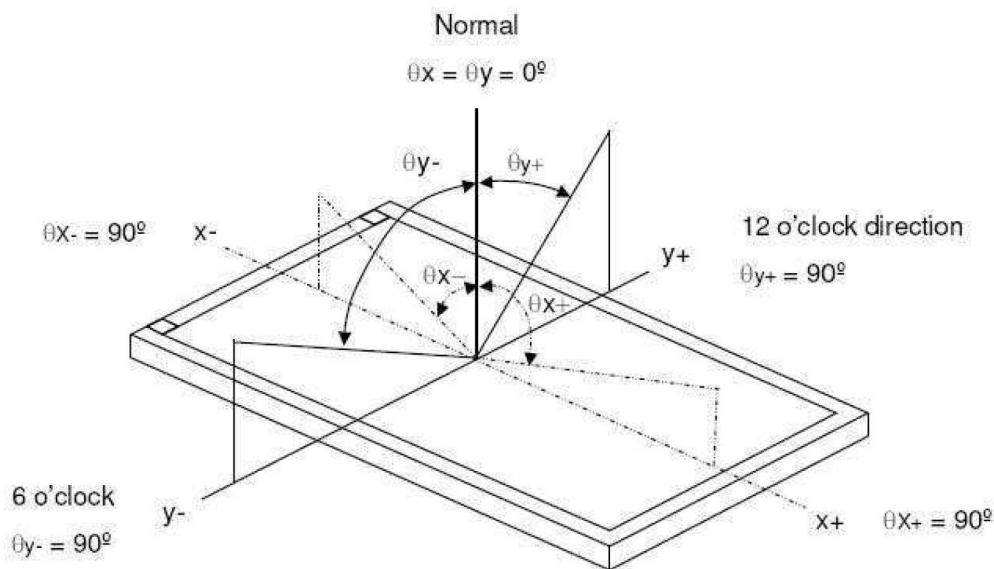
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

\*Note (2) Definition of Response Time ( $T_R$ ,  $T_F$ ):



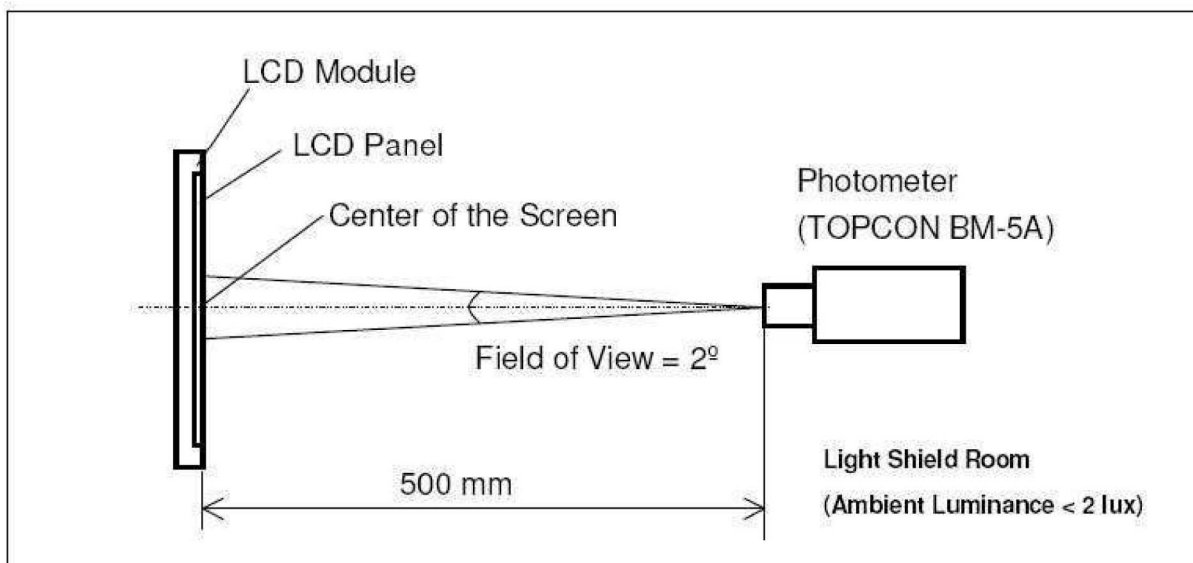


\*Note(3) Definition of Viewing Angle

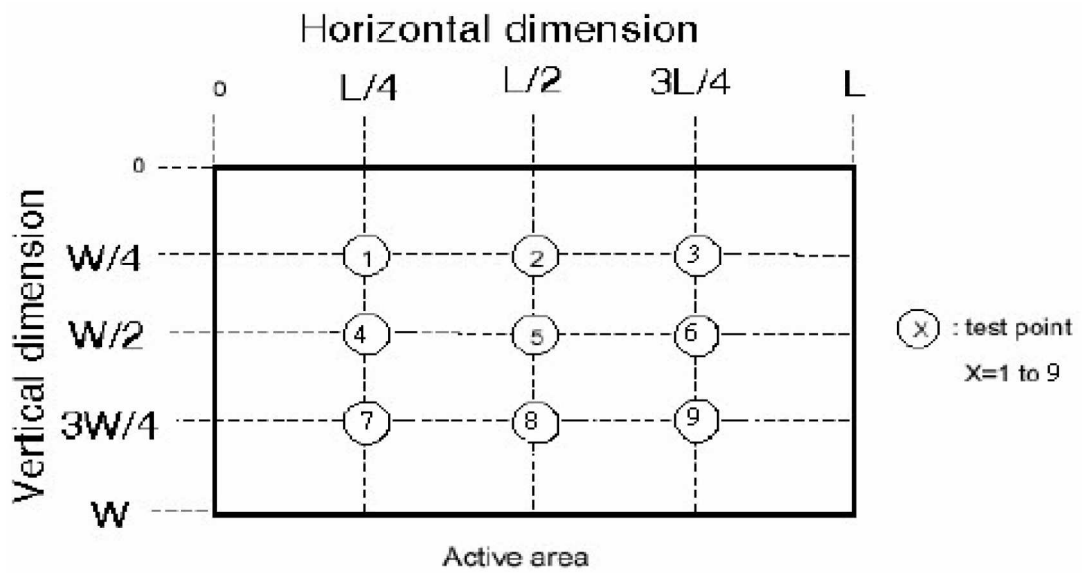


\*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



\*Note (5)

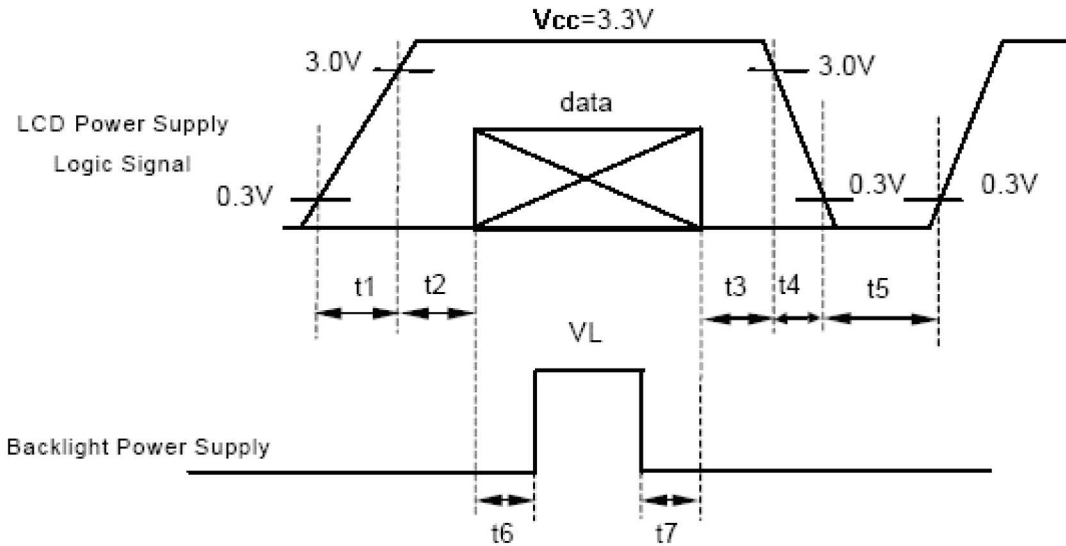


$$\left( 1 - \frac{\text{MAX Luminance} - \text{Average Luminance}}{\text{Average Luminance}} \right) \times 100\% > 70\%$$

# 10. TIMING SPECIFICATIONS

## 10.1 POWER SINGAL SEQUENCE

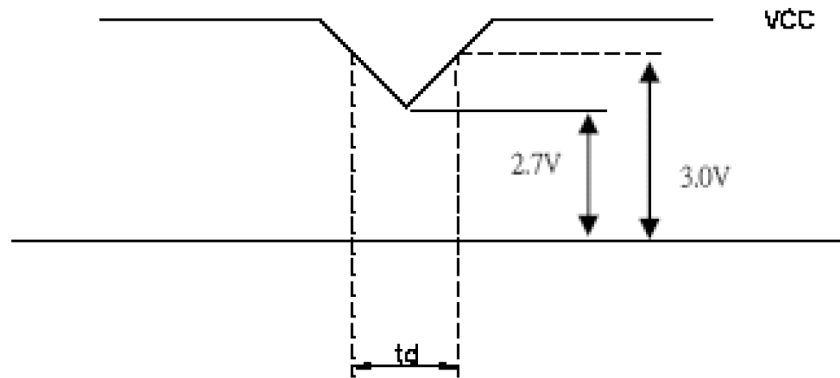
$t1 \leq 10\text{ms}$  ;  $1 \text{ sec} \leq t5$   
 $50\text{ms} \leq t2$  ;  $200\text{ms} \leq t6$   
 $0 < t3 \leq 50\text{ms}$  ;  $200\text{ms} \leq t7$   
 $0 < t4 \leq 10\text{ms}$



Data : RxIN0+/-, RxIN1+/-, RxIN2+/-, RxIN3+/-, CKIN+/-

VCC-dip condition:

- (1)  $2.7 \text{ V} \leq VCC < 3.0\text{V}$ ,  $t_d \leq 10 \text{ ms}$
- (2)  $VCC > 3.0\text{V}$ , VCC-dip condition should be the same with VCC-turn-on condition.



## 10.2 TIMING CHARACTERISTICS OF INPUT SIGNALS

### 10.2.1 AC Electrical Characteristics

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Data setup time	$T_{dsu}$	6	-	-	ns
Data hold time	$T_{dhd}$	6	-	-	ns
DE setup time	$T_{esu}$	6	-	-	ns

### 10.2.2 Resolution : 800x480

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	$F_{CPH}$	25	33.26	40	MHz
CLK period	$T_{CPH}$	25	30.06	40	ns
CLK pulse duty	$T_{CWH}$	40	50	60	%
DE period	$T_{DEH}+T_{DEL}$	1000	1056	1200	$T_{CPH}$
DE pulse width	$T_{DEH}$	800	800	800	$T_{CPH}$
DE frame blanking	$T_{DEB}$	10	45	110	$T_{DEH}+T_{DEL}$
DE frame width	$T_{DE}$	480	480	480	$T_{DEH}+T_{DEL}$

### 10.2.3 Timing Controller Timing Chart

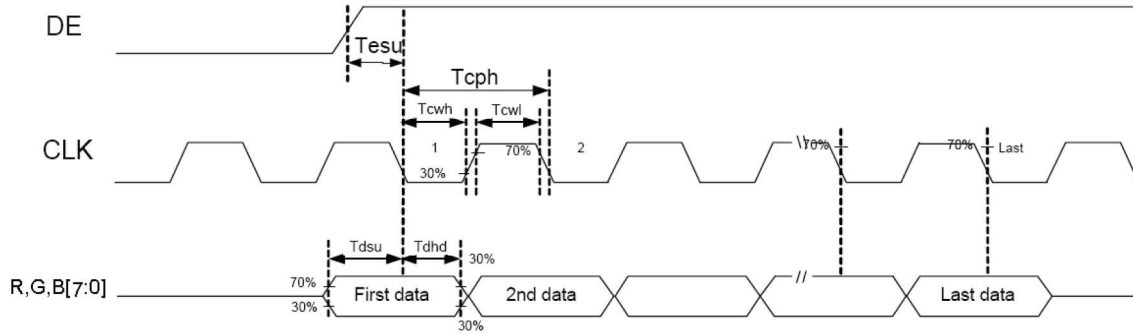
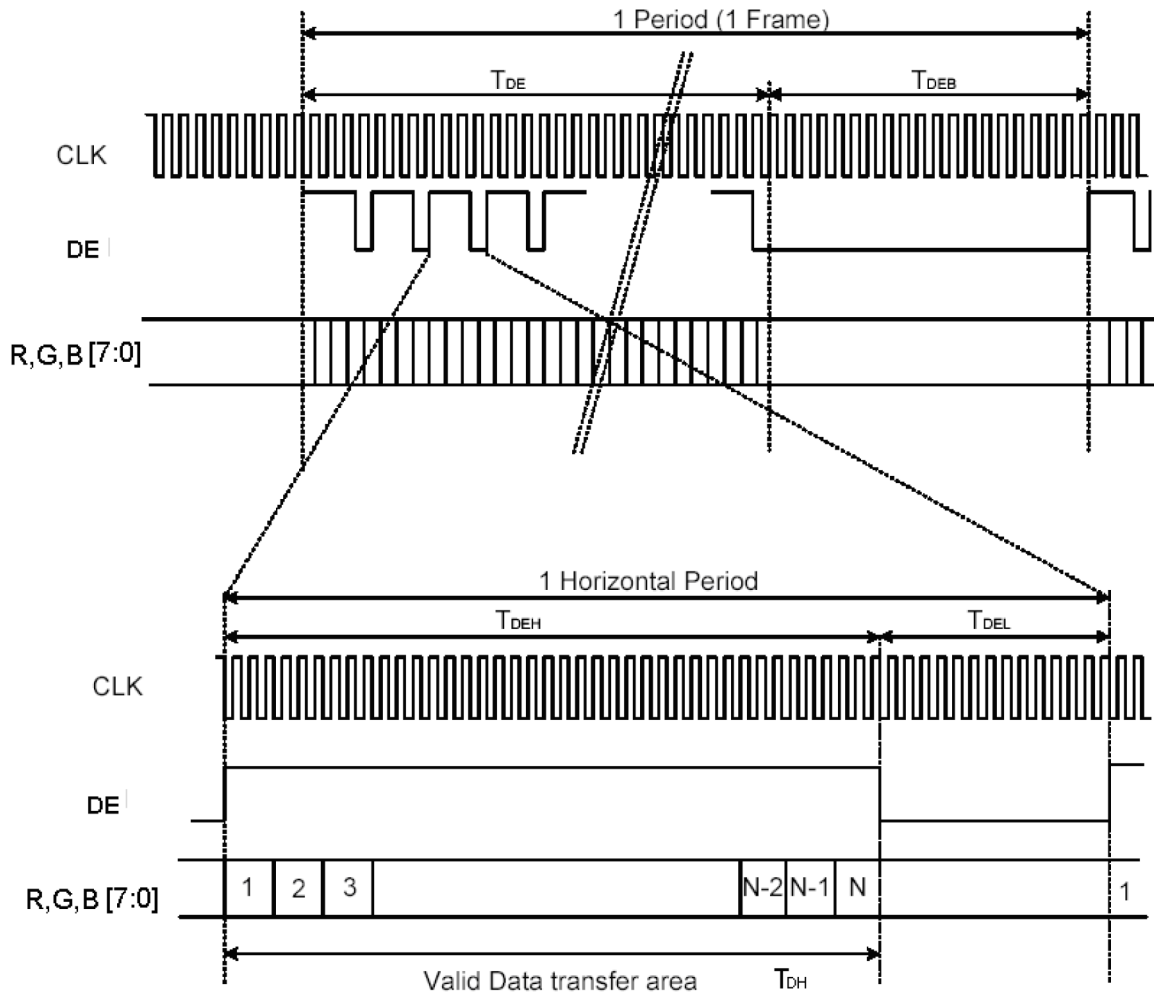
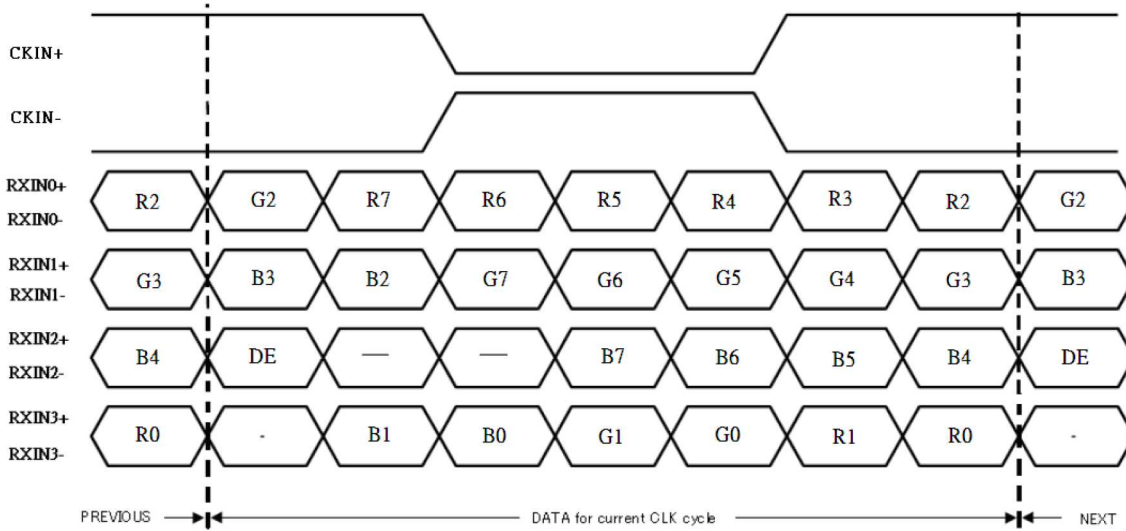


Figure 1 Clock and Data input waveforms.



## 10.2.4 LVDS Input Data Format



## 10.2.5 Color Data Input Assignment

COLOR	DISPLAY	DATA SIGNAL																												GRAY SCALE LEVEL
		RED								GREEN								BLUE												
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7					
BASIC COLOR	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	-
	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	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	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	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	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	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	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	-
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	R0	
	DARK ↑	1	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	R1	
		0	1	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	R2	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3-R252	
		↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	LIGHT	1	0	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	R253	
		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	0	0	R254	
	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	0	0	0	R255	
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	G0	
	DARK ↑	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	G1	
		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	G2	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3-G252	
		↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	G253	
		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	G254	
	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	0	0	0	G255	
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	B0		
	DARK ↑	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	B1	
		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	B2	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3-B252	
		↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	B253	
		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	B254	
	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	1	1	1	B255	

Note) Definition of Gray :

R<sub>n</sub> : Red Gray, G<sub>n</sub> : Green Gray, B<sub>n</sub> : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

# 11. RELIABILITY TEST

Temperature : 25 ± 5°C  
 Humidity : 65 ± 5%

Reliability Test Item & Level		Test Level	Remark
No.	Test Item		
1	High Temperature Storage Test	T=80°C,240hrs	IEC68-2-2
2	Low Temperature Storage Test	T=-30°C,240hrs	IEC68-2-1
3	High Temperature Operation Test	T=70°C,240hrs	IEC68-2-2
4	Low Temperature Operation Test	T=-20°C,240hrs	IEC68-2-1
5	High Temperature and High Humidity Operation Test	T=60°C,90%RH,240hrs	IEC68-2-3
6	Thermal Cycling Test (No operation)	-30°C → +25°C → +80°C, 100 Cycles 30 min 5 min 30 min	IEC68-2-14
7	Vibration Test (No operation)	Frequency :10 ~ 55 Hz Amplitude :1.5 mm Sweep time : 11 mins Test Period: 6 Cycles for each direction of X, Y, Z	IEC68-2-6
8	ESD Test	State: operating Location: LCM/TP surface Condition:150pf 330Ω Contact +/- 4kV Air +/-8kV Criteria: Class C	Note2 (IEC61000-4-2)

## 12.PRECAUTIONS FOR USE

### 12.1 SAFETY

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

### 12.2 HANDLING

- a. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- b. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
- c. To avoid contamination on the display surface, do not touch the module surface with bare hands.
- d. Keep a space so that the LCD panels do not touch other components.
- e. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
- f. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
- g. Do not leave module in direct sunlight to avoid malfunction of the ICs.

### 12.3 STATIC ELECTRICITY

- a. Be sure to ground module before turning on power or operating module.
- b. Do not apply voltage which exceeds the absolute maximum rating value.

### 12.4 STORAGE

- a. Store the module in a dark room where must keep at  $25\pm 10^{\circ}\text{C}$  and 65%RH or less.
- b. Do not store the module in surroundings containing organic solvent or corrosive gas.
- c. Store the module in an anti-electrostatic container or bag.

### 12.5 CLEANING

- a. Do not wipe the polarizer with dry cloth. It might cause scratch.
- b. Only use a soft cloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer

## 13. INCOMING INSPECTION SPECIFICATION

### 13.1 Inspection condition

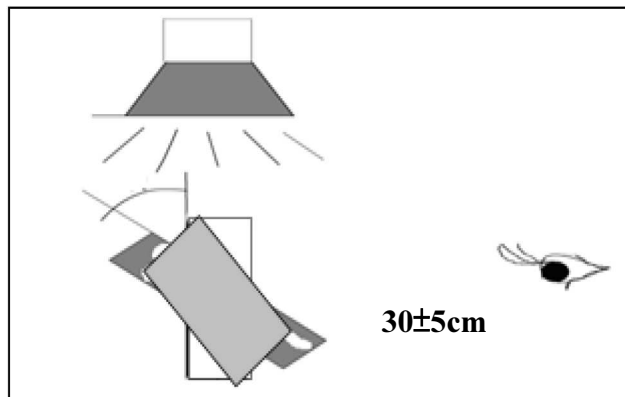
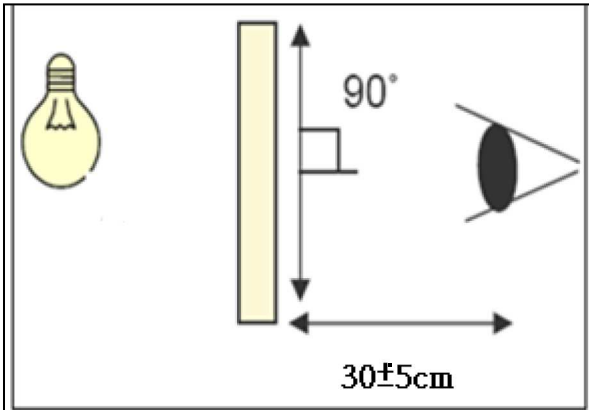
#### 13.1.1 Inspection conditions

13.1.1.1 Inspection Distance :  $30 \pm 5$  cm

13.1.1.2 View Angle :

(1) Inspection that light pervious to the product:  $90 \pm 15^\circ$

(2) Inspection that light reflects on the product:  $90 \pm 15^\circ$

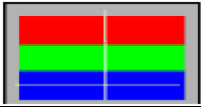


#### 13.1.2 Environment conditions


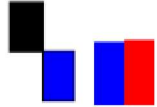
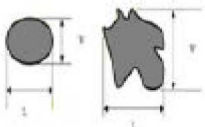
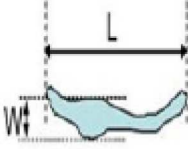
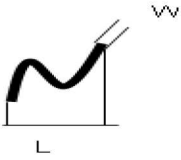
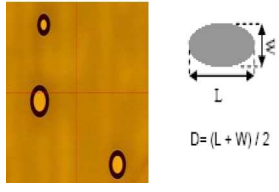

Ambient Temperature :	$25 \pm 5^\circ\text{C}$
Ambient Humidity :	30~75%RH
Ambient Illumination	600~800 lux

### 13.2 Inspection Parameters

Appearance inspection standard (D: diameter, L: length; W: width, Z: height, T: glass thickness)

Inspection item	Inspection standard	Description
No image	Prohibited	
Image abnormal	Prohibited	
Bright line	Prohibited	
Thin line	It is acceptable that the defect can not be seen with 10% ND filter.	
Mura	It is acceptable that the defect can not be seen with 5% ND filter.	



Dot	Item	Acceptable	Total	<p>One Dot </p> <p>Two adjacent dot </p>
		Visible area		
	Bright dot	3	6	
	Dark dot	5		
	Bright adjacent dots	1	1	
	Dark adjacent dots	2	2	
Adjacent dots with a bright dot and a dark dot	2	2		
Foreign material in dot shape	SPEC (unit: mm)		Acceptable	 <p><math>D = (L + W) / 2</math></p>
	$D \leq 0.5$		Ignored	
	$0.5 < D \leq 0.8$ , distance $> 5$		$n \leq 5$	
	$D > 0.8$		0	
Foreign material in line shape	SPEC		Acceptable	 <p>L : Long W : Width</p>
	$W \leq 0.05$ and $L \leq 10$		Ignored	
	$0.05 < W \leq 0.1$ , $L \leq 10$ , distance $> 5$		$n \leq 5$	
	$W > 0.1$ or $L > 10$		0	
Contamination	It is acceptable if the dirt can be wiped.			
Scratch	SPEC		Acceptable	
	$W \leq 0.05$ and $L \leq 10$		Ignored	
	$0.05 < W \leq 0.08$ , $L \leq 10$ , distance $> 5$		$n \leq 5$	
	$0.08 < W \leq 0.1$ , $L \leq 10$ , distance $> 5$		$n \leq 3$	
	$W > 0.1$ or $L > 10$		0	
Bubble	SPEC (unit: mm)		Acceptable	 <p><math>D = (L + W) / 2</math></p>
	$D \leq 0.3$		Ignored	
	Non visible area		Ignored	
	$0.3 < D \leq 0.5$ , distance $> 5$		$n \leq 5$	
	$D > 0.5$		0	
Cover & Sensor Crack	Prohibited			

Cover angle missing	SPEC (unit: mm)	Acceptable	
	Side/Bottom	Ignored	
	It is prohibited if the defect appears on the front.	0	
Cover edge break	SPEC (unit: mm)	Acceptable	
	$X \leq 3.0, Y \leq 3.0, Z \leq T$	Ignored	
	$X > 3.0, Y > 3.0, Z > T$	0	
Inspection item	SPEC		Description
Ink	SPEC (unit: mm)	Acceptable	
	word unclear, inverted, mistake, break line	0	
Bubble under protection film	SPEC (unit: mm)	Acceptable	
	NA		
Function	Prohibited		

### 13.3 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

Sampling table: MIL-STD-105E

Inspection level: Level II

Class of defects	Definition		
	<b>Major</b>	AQL 0.65	It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	<b>Minor</b>	AQL 1.5	It is a defect that will not result in functioning problem with deviation classified.

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