























[Note]

- \*1) Data is latched during DCLK falling period.
- \*2) HD、VD is negative.
- \*3) DENA (DATA ENABLE) usually is positive.
- \*4) During the whole blank period, DCLK should keep input.  
During the vertical blank period, HD should keep input.

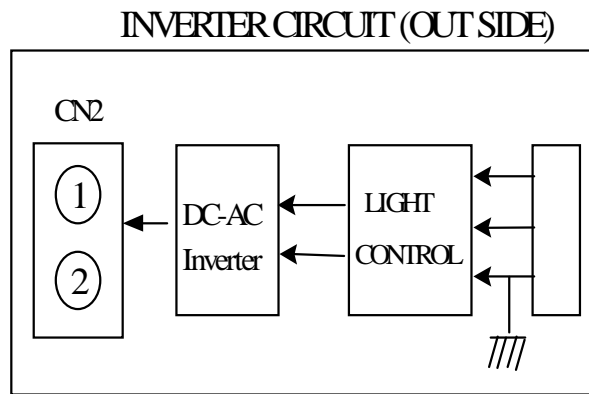
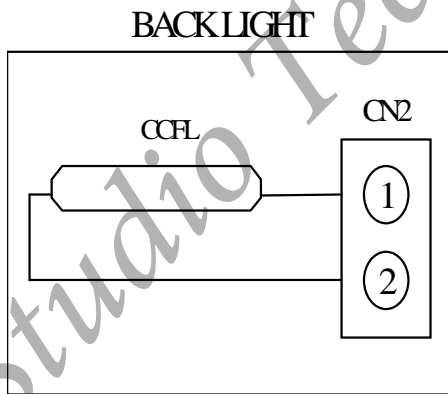
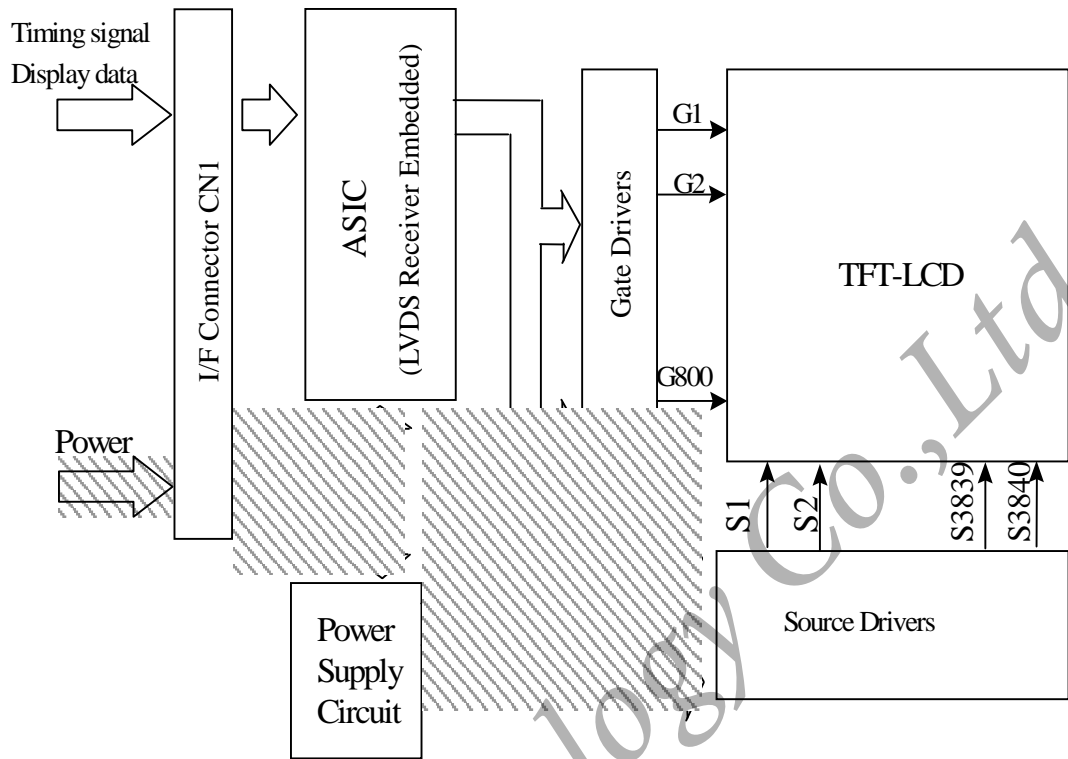
(2) DATA mapping

Color	Input Data	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MS B					LS B	MS B					LS B	MS B					LS B
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

- 1) Gray level:  
Color(n) : n is level order; higher n means brighter level.
- 2) DATA:  
1: high、0: low

6. BLOCK DIAGRAM

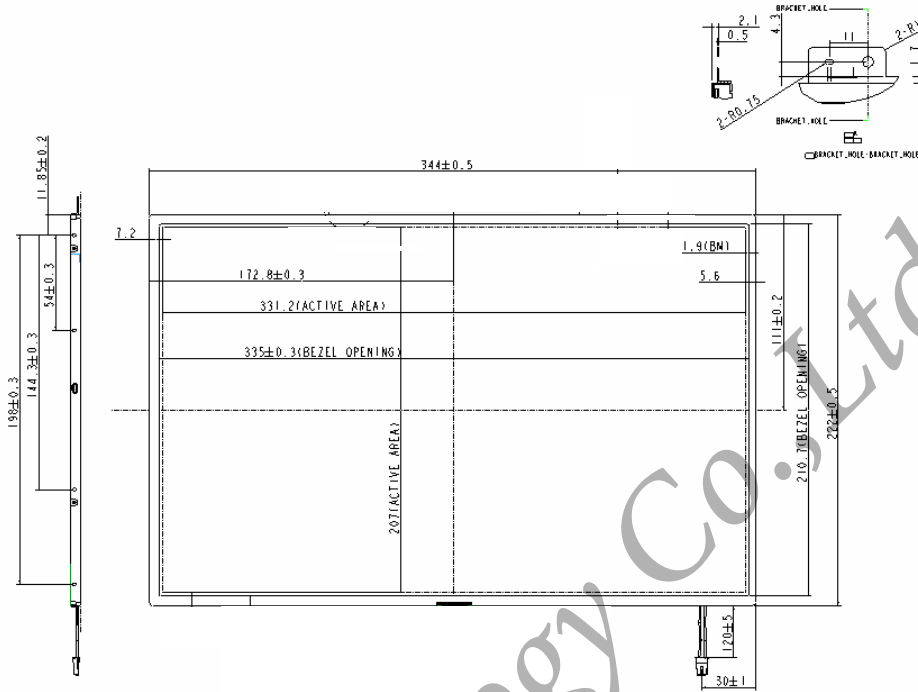


### 7. MECHANICAL SPECIFICATION

#### (1) Front side

The tolerance, not show in the figure, is  $\pm 0.5\text{mm}$ .

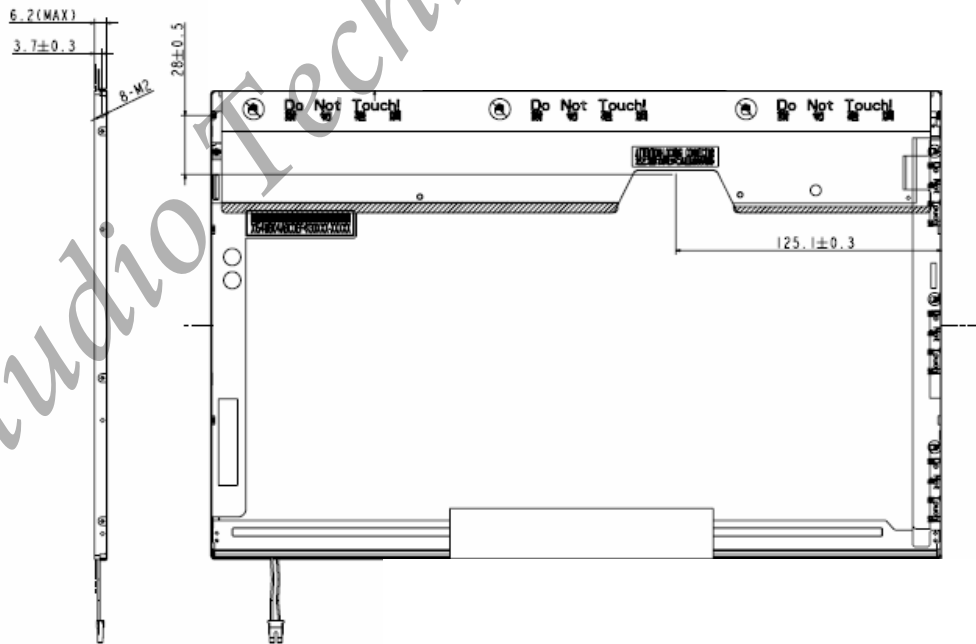
[Unit : mm]



#### (2) Rear side

The tolerance, not show in the figure, is  $\pm 0.5\text{mm}$ .

[Unit : mm]



8. OPTICAL CHARACTERISTICS

Ta=25°C , VDD=3.3V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK	
Contrast Ratio	CR	$\theta = \psi = 0^\circ$	300	500	--	--	*1)	
Luminance (5P)	L	$\theta = \psi = 0^\circ$	170	200	--	cd/m <sup>2</sup>	*2)	
Uniformity(5P)	$\Delta L$	$\theta = \psi = 0^\circ$	--	80	--	%	*2)	
Response Time	Tr	$\theta = \psi = 0^\circ$	--	6	9	ms	*4)	
	Tf	$\theta = \psi = 0^\circ$	--	10	16	ms	*4)	
Cross talk	CT	$\theta = \phi = 0^{*3}$	--	--	1	%	*5)	
View angle	Horizontal	$\psi$	CR $\geq 10$	40/-40	45/-45	--	°	*3)
	Vertical	$\theta$		10/-30	15/-35	--	°	*3)
Color Temperature Coordinate	W	X	$\theta = \psi = 0^\circ$	0.283	0.313	0.343	--	*2)
		Y		0.299	0.329	0.359		
	R	X		0.584	0.614	0.644		
		Y		0.306	0.336	0.366		
	G	X		0.281	0.311	0.341		
		Y		0.534	0.564	0.594		
	B	X		0.123	0.153	0.183		
		Y		0.100	0.130	0.160		

These items are measured using BM-5A (TOPCON) under the dark room condition (no ambient light).  
 Measurement Condition: IL=6.0×6mA

Inverter : SUMIDA / IV12139/T

Definition of these measurement items is as follows:

**\*1) Definition of Contrast Ratio**

CR=ON (White) Luminance/OFF (Black) Luminance

**\*2) Definition of Luminance and Luminance uniformity**

Central luminance: The white luminance is measured at the center position “5” on the screen, see Fig.1 below.

5P Luminance (AVG): The white luminance is measured at measuring points 5、10、11、12、13, see Fig.1 below.

5P Uniformity:  $\Delta L = (Lmin / Lmax) \times 100\%$

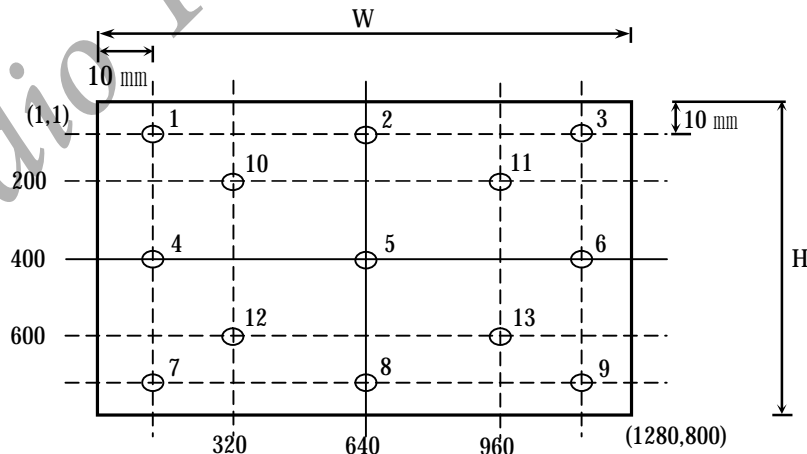
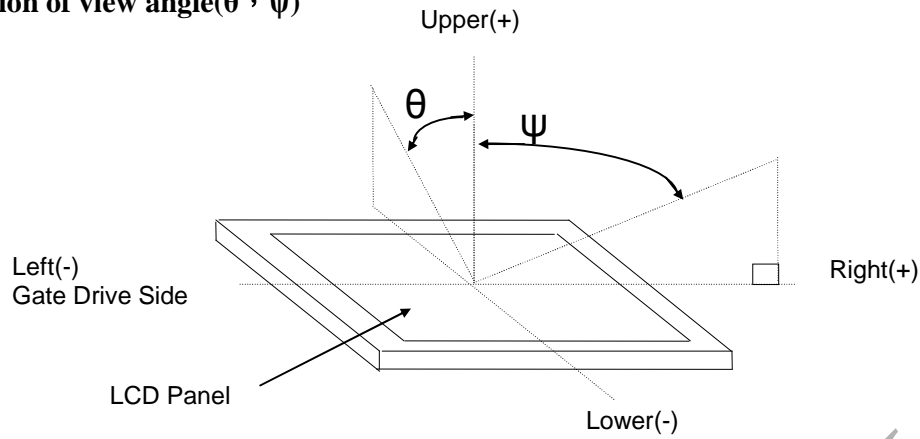
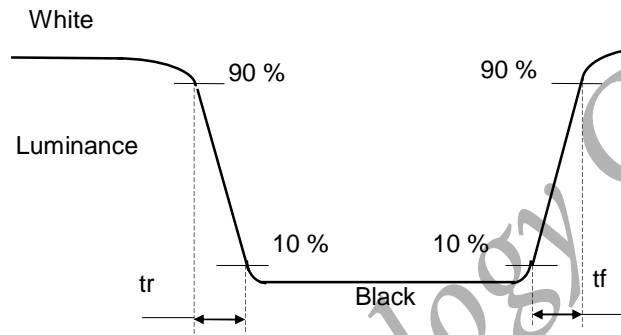


Fig.1 Measure

**\*3) Definition of view angle( $\theta$  ,  $\psi$ )**



**\*4) Definition of response time**



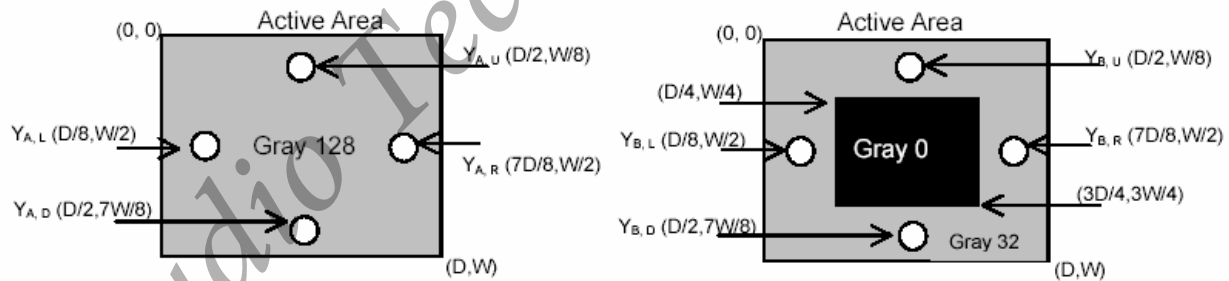
**\*5) Crosstalk Modulation Ratio:**

$$CT = \frac{|Y_B - Y_A|}{Y_A} \times 100\%$$

$Y_A$  、  $Y_B$  measure position and definition

$Y_A$  means luminance at gray level 32(exclude gray level 0 pattern)

$Y_B$  means luminance at gray level 32(include gray level 0 pattern)



## 9.RELIABILITY TEST CONDITIONS

### (1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature Operation	50° C ; 240HR Follow page 5 diagram
High Temperature Storage	60° C ; 240HR Follow page 5 diagram
High Temperature High Humidity Operation	240HR(No condensation) Follow page5 diagram
High Temperature High Humidity Storage	48HR(No condensation) Follow page5 diagram
Low Temperature Operation	0° C ; 240HR Follow page5 diagram
Low Temperature Storage	-20° C ; 240HR Follow page5 diagram
Thermal Shock	-20° C (0.5 hr) ~ 60° C (0.5 hr) , Ramp < 20° C , 100 CYCLE
Temperature & Pressure Storage	25° C ; 260hPa(about 10000m) , 24 Hrs

### (2) Shock & Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level : 1960m/s <sup>2</sup> (200G), Waveform : half sinusoidal wave, 2ms, 6 axis (± X, ± Y, ± Z) per cycle
Vibration (Non-Operation)	Vibration level : 9.8m/s <sup>2</sup> (1.0G), sinusoidal wave (each x,y,z axis : 1hr, total 3hrs) Frequency range : 5 ~ 500 Hz Sweep speed : 0.5 Octave/min.

### (3) ESD

	Surface discharge(Panel display area , Frame , PWB , Panel back side)		Electrics capacity of Connector
	Contact	Air	Contact
Capacity	150 pF	150 pF	200 pF
Resistance	330 Ω	330 Ω	0 Ω
Voltage	±8kV	±8kV/±15kV	±250 V
Interval	1 sec	1 sec	1 sec
Times(single point)	25	25	1

Acceptance Criteria	Air Discharge	Air Discharge
	+/-8 kV	+/-15 kV
A	Permitted	Permitted
B	Permitted	Permitted
C	Not Permitted	Permitted
D	Not Permitted	Not Permitted

Acceptance Definitions	
A	Normal operation. No degradation. No failures.
B	Some performance degradation allowed. No data lost. Self-recoverable.
C	Temporary performance degradation. Recovery by operator is acceptable.
D	Degradation or loss of function, which is not recoverable due to damage of equipment (components)

**(4) Judgment standard**

The judgment of the above test should be made as follow:

Pass : Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts should be ignored.

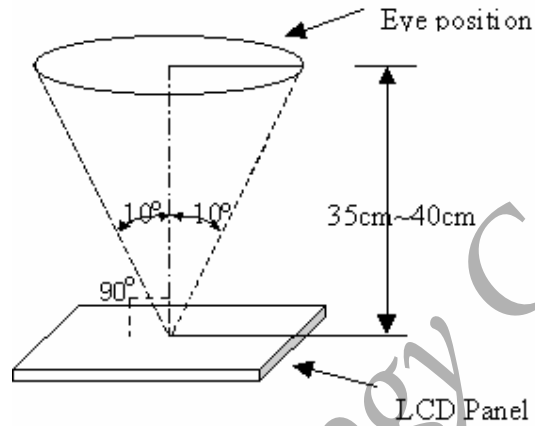
Fail : No display image, obvious non-uniformity, or line defects.

Studio Technology Co., Ltd

## 10. VISUAL INSPECTION SPECIFICATION

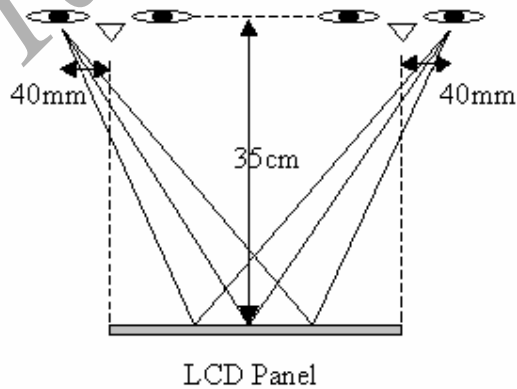
### 10.1 Inspection condition

- (1) Viewing distance is approximately 35 ~ 40 cm.
- (2) Viewing angle is normal to the LCD panel as figure below(10°).
- (3) Ambient temperature is approximately  $25 \pm 5^{\circ}\text{C}$ .
- (4) Ambient humidity is  $60 \pm 5\%$  RH.
- (5) Ambient illumination is from 300 ~ 500 lux.
- (6) Input signal timing should be typical value.



### 10.2 Special condition

- (1) Viewing distance is close for inspection of adjacent dots and distance between defect dots.
- (2) Viewing condition of “ Shot block non-uniformity from oblique angle” is as figure below.
- (3) Exceptional case: View angle  $\pm 40^{\circ}$  while inspected image-sticking.

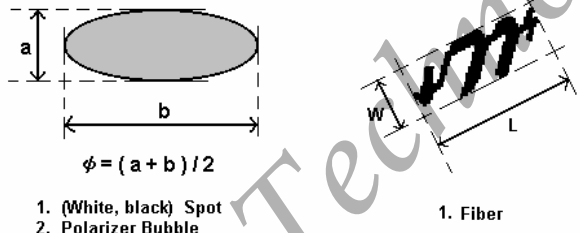


10.3 Inspection Criteria

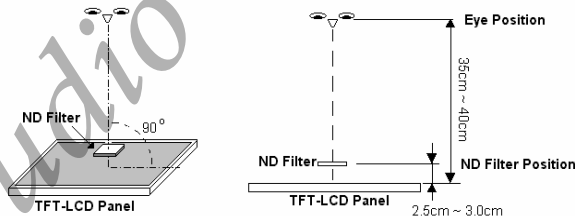
DEFECT TYPE		LIMIT		Note
VISUAL DEFECT	SCRATCH		$0.01\text{mm} \leq W \leq 0.05\text{mm}$ $L \leq 10\text{mm}$	$N \leq 4$ --
	INTERNAL	SPOT	$0.15\text{mm} \leq \phi \leq 0.5\text{mm}$	$N \leq 4$ *1)
		FIBER	$W \leq 0.1\text{mm}, L \leq 3.0\text{mm}$	$N \leq 4$ *1)
		POLARIZER BUBBLE	$0.15\text{mm} \leq \phi \leq 0.5\text{mm}$	$N \leq 4$ *1)
		TOTAL	$N \leq 4$ --	
ELECTRICAL DEFECT	BRIGHT DOT		$N \leq 4$ *2)	
	DARK DOT		$N \leq 5$ --	
	TOTAL DOT		$N \leq 6$ *2)	
	TWO ADJACENT DOT		$\leq 1$ PAIRS *3)	
	THREE OR MORE ADJACENT DOT		NOT ALLOWED --	
	DISTANCE BETWEEN DEFECT DOT		Bright dot and dark dot	$\geq 15\text{mm}$ *4)
			Two dark dots	$\geq 15\text{mm}$ *4)
	LINE DEFECT		NOT ALLOWED --	
	MURA		$\leq 5\%$ ND --	

One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)

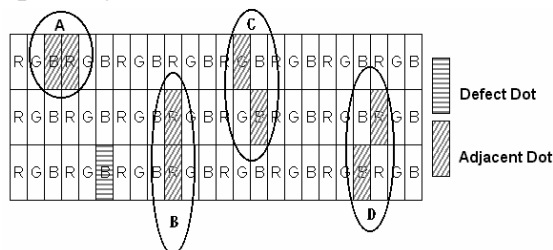
[Note1] W : Width[mm], L : Length[mm], N : Number,  $\phi$  : Average Diameter



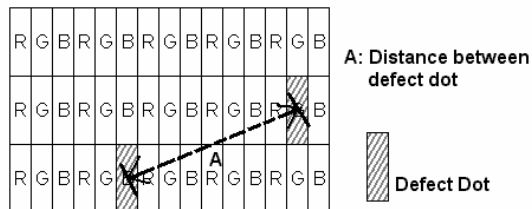
[Note2] Bright dot is defined through 5% transmission ND Filter as following.



[Note3] Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) adjacent defect dots, including bright and dark adjacent dot. And they will be counted 2 defect dots in total quantity.



[Note4] Definition of distance between defect dot as following.



#### 10.4 Handling precaution

- (1) Don't disassemble and reassemble the module by self. (禁止自行拆解。)
- (2) Acid, alkali, alcohol or touched directly by hand will damage the display.  
(酸性、鹼性、酒精或手的直接接觸將會損傷顯示面。)
- (3) Static electricity will damage the module. Please configure grounding device.  
(靜電會損傷模組。請裝配接地設備。)
- (4) The strong vibration, shock, twist or bend will cause material damage, even module broken.  
(強烈的衝擊、震動、扭轉或彎曲將會造成原材損傷，甚至面板破裂)
- (5) It is easy to cause image sticking while displaying the same pattern for very long time.  
(長期顯示同一畫面亦造成影像殘留。)
- (6) The response time, brightness and performance will vary from different temperature.  
(反應時間、亮度與均勻性會因溫度而有所變化)

## 11. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling- TFT-LCD products;

### 11.1 ASSEMBLY PRECAUTION

- (1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
- (2) Please design display housing in accordance with the following guidelines.
  - Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
  - Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
  - When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
  - Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.
  - Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.
- (3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
- (4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
- (5) Please wipe out LCD panel surface with absorbent cotton or soft clothe in case of it being soiled.
- (6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- (7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- (8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
- (9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

### 11.2 OPERATING PRECAUTIONS

- (1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- (2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.
- (3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
- (4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
- (5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.
- (6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

### 11.3 PRECAUTIONS WITH ELECTROSTATICS

- (1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.
- (2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

#### 11.4 STORAGE PRECAUTIONS

- (1) When you store LCDs for a long time, it is recommended to keep the temperature between 0 °C ~40°C without the exposure of sunlight and to keep the humidity less than 90% RH.
- (2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60 °C 90% RH.
- (3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

#### 11.5 SAFETY PRECAUTIONS

- (1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- (2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

#### 11.6 OTHERS

- (1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays.
- (2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- (3) For the packaging box, please pay attention to the followings:
  - Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
  - Please do not pile them up more than 3 boxes. (They are not designed so.) And please do not turn over.
  - Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
  - Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)