



## Product Specification

<b>Model Name</b>	LM035CQ08NS-DC01
<b>Description</b>	Standard LCD Module 3.5" QVGA 320x(RGB)x240 Dots
<b>Date</b>	2018/08/26
<b>Version</b>	1.0

- Preliminary Specification
- Final Product Specification

Prepared by	Checked by	Approved by
SXY 2018/08/26	SXY 2018/08/26	LX 2018/08/26

### For Customer Approval

Approved By	Comment



# 深圳市美显实业有限公司 LCD Mall Limited

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## 2. General Specifications

	Feature	Spec
Characteristics	Size	3.5 inch
	Resolution	320(horizontal)*240(Vertical)
	Interface	24 BIT RGB+SPI
	Pixel pitch (mm)	0.219*0.219
	Pixel Configuration	R.G.B.-Stripe
	LCD Driver IC	HX8238D
	CTP Driver IC	FT5446DQS
	Viewing Direction	12 O'clock
Mechanical	LCM (W x H x D) (mm)	76.90*63.90*5.10
	Active Area(mm)	70.08*52.56
	With /Without TSP	With CTP
	Weight (g)	TBD
	LED Numbers	6 LEDs

Note 1: Requirements on Environmental Protection: RoHs

Note 2: LCM weight tolerance: +/- 5%



### 3. Input/Output Terminals

#### LCD PIN-MAP

No.	Symbol	Description
1	LED_K	Cathode of LED back light
2	LED_K	Cathode of LED back light
3	LED_A	Anode of LED back light
4	LED_A	Anode of LED back light
5~7	NC	No connect
8	IMO~IM3	Note
9	RESET	Reset pin.
10	SPENA	Chip select of serial interface
11	SPDAT	Data input pin of serial interface
12~19	B0~B7	Blue data bus
20~27	G0~G7	Green data bus
28~35	R0~R7	Red data bus
36	HSYNC	Horizontal sync signal; negative polarity
37	VSYNC	Vertical sync signal; negative polarity
38	DCLK	Clock signal; latching data at the falling edge
39~40	NC	No connect
41~42	VDD	Power supply
43~47	NC	No connect
48	SEL2	Interface mode select(note)
49	SEL1	
50	SEL0	
51	NC	No connect
52	DEN	Display enable pin form controller
53~54	GND	Power ground

#### CTP PIN-MAP

No.	Symbol	Description
1	VSS	Ground electrode
2	VDD	Power supply for analog voltage.
3	SCL	I2C clock input
4	NC	No connect
5	SDA	I2C data input and output
6	NC	No connect
7	RST	External Reset, Low is active
8	NC	No connect



9	INT	Interrupt request to the host, or Wakeup request from the host
10	VSS	Ground electrode.

#### 4. Absolute Maximum Rating

Item	Symbol	MIN	MAX	Unit
Supply voltage for analog	VDD	-0.3	4.5	V
Supply voltage for logic	VDD	-0.3	4.5	V
Supply current (One LED)	I <sub>LED</sub>		30	mA
Operating temperature	T <sub>OP</sub>	-20	+70	°C
Storage temperature	T <sub>ST</sub>	-30	+80	°C

Note: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed

#### 5. Electrical Characteristics

##### 5.1 Input Power

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply Voltage for Analog	VDD	3.0	3.3	3.6	V	
Supply Voltage for Logic	VDD	3.0	3.3	3.6	V	
Input Voltage	V <sub>IL</sub>	GND	-	0.3IOVCC	V	
	V <sub>IH</sub>	0.7IOVCC	-	IOVCC		
Input leakage Current	I <sub>LKG</sub>	-1		1	uA	

### 5.2 CTP Electrical Characteristics

FPC Design	Item	Description	Remark
<b>COF</b>	IC solution on TP Model	FT5446DQS	
	Touch Count Max	10 Point	
	Display Resolution	320*240	
	Interface Type	I2C	
	I2C Slave Address	0x70	
	Origin of Coordinate	Top left corner	

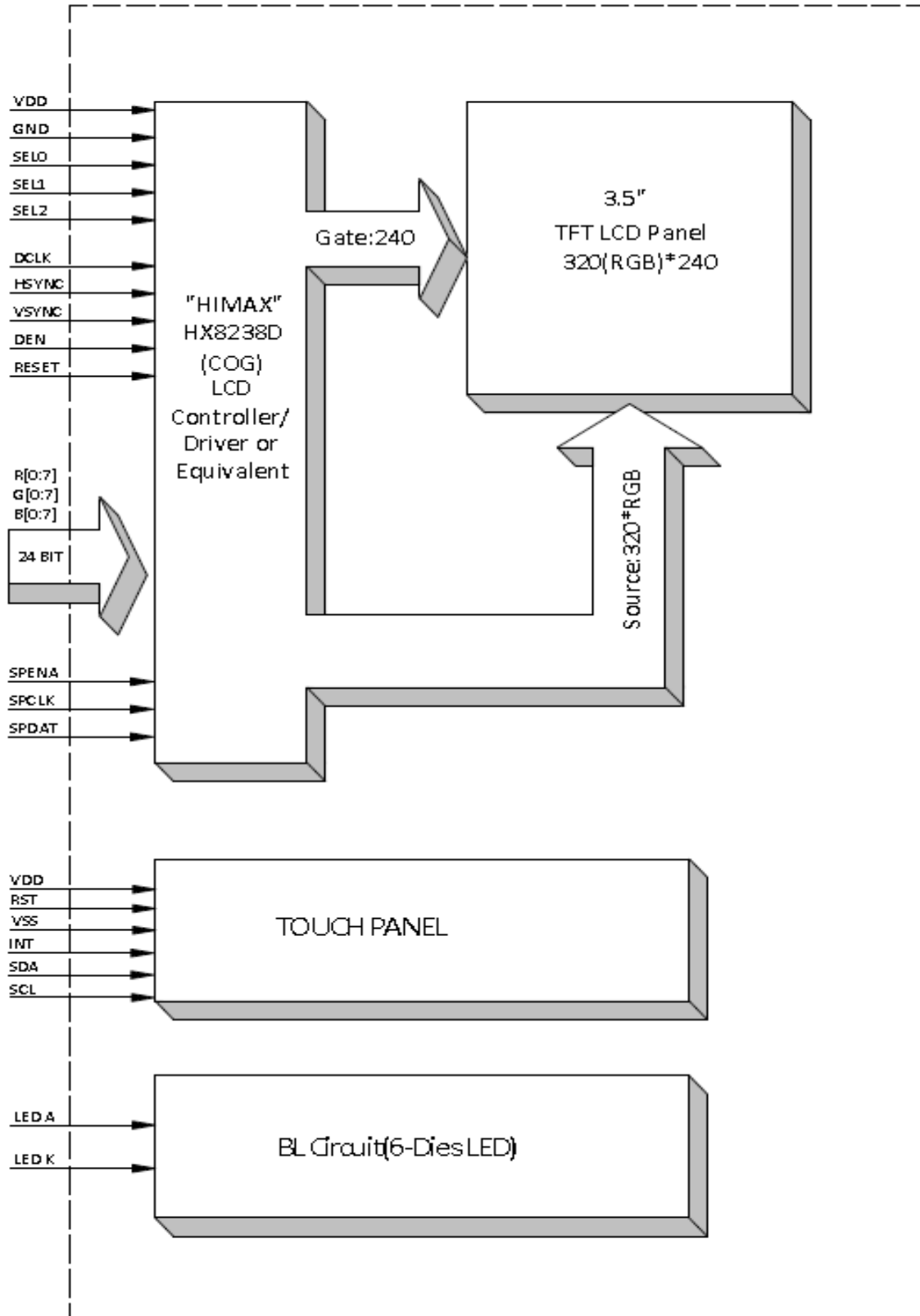
Parameter	Symbol	Min	Typ	Max	Unit
Interface Signal for Analog	VDD	2.8	3.3	3.6	V
Supply Voltage for Logic	IOVCC	1.71	3.3	3.6	V

### 5.3 Backlight Driving Conditions

Item	Symbol	Value			Unit	Remark
		Min	Typ	Max		
Voltage for LED Backlight	$V_F$	16.8	19.2		V	$I_L=20mA$
Current for LED Backlight	$I_L$		20	30	mA	
Power Consumption	P		0.64		W	
LED Life Time		30,000	50,000		Hr	Note

Note: Brightness to be decreased to 50% of the initial value at ambient temperature  $T_A=25^{\circ}C$

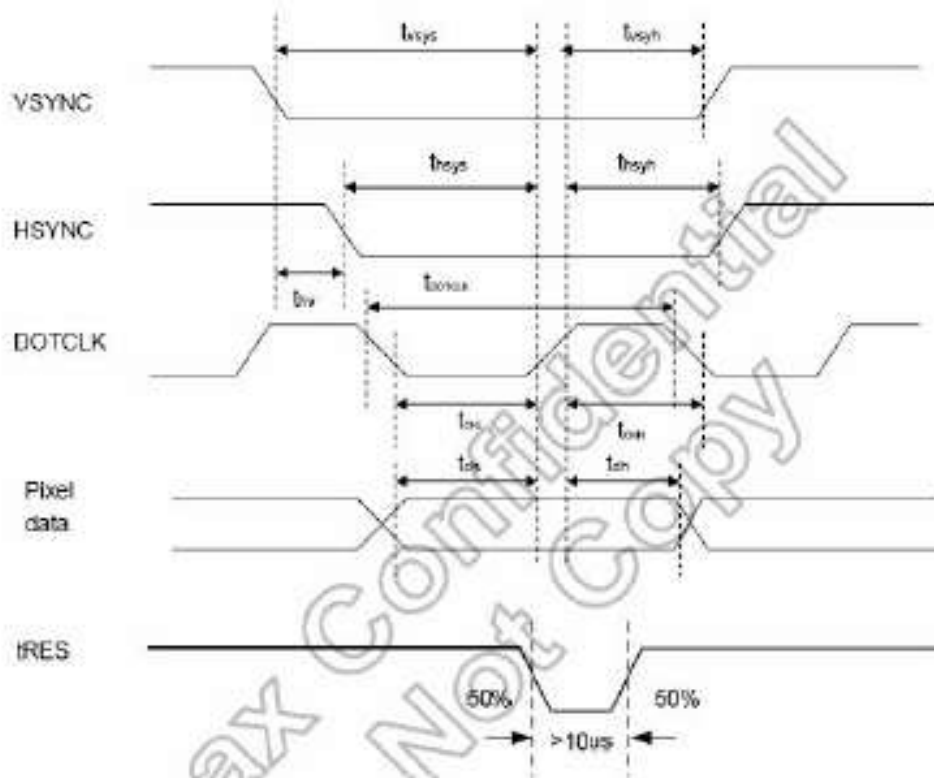
### 5.3 Block Diagram





## 6. Interface Timing

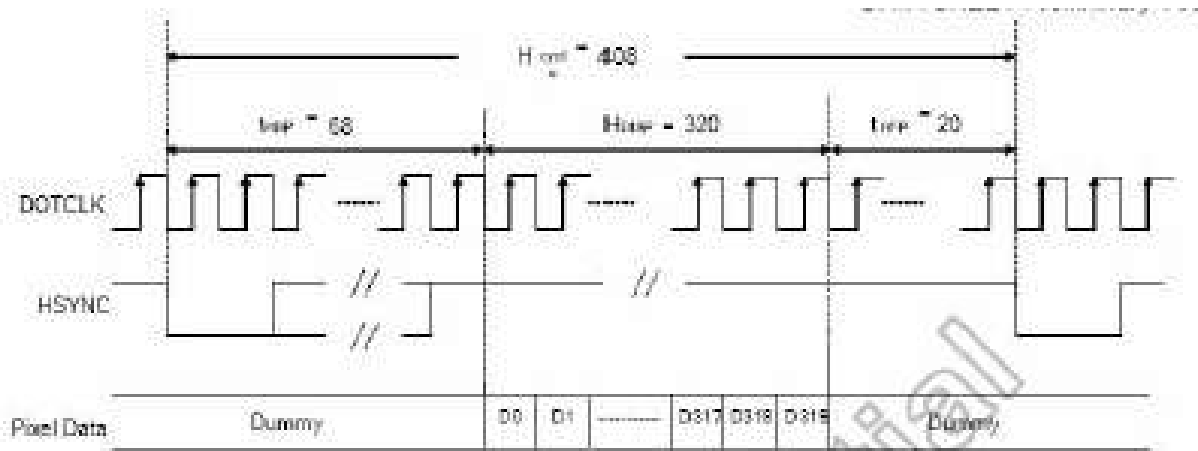
### 6.1 Pixel Timing Diagram.



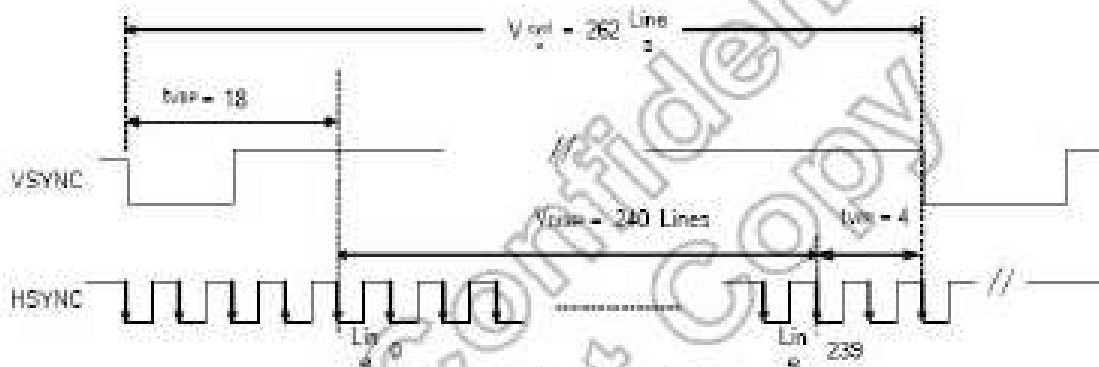
Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	$t_{sys}$	20	10	-	-	-	-	ns
Vertical Sync Hold Time	$t_{sh}$	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	$t_{sv}$	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	$t_{shv}$	20	10	-	-	-	-	ns
Phase difference of Sync signal Falling Edge	$t_{hw}$	1		-		240		tDOTCLK
DOTCLK Low Period	$t_{ckl}$	60	15	-	-	-	-	ns
DOTCLK High Period	$t_{ckh}$	60	15	-	-	-	-	ns
Data Setup Time	$t_{ds}$	12	10	-	-	-	-	ns
Data hold Time	$t_{dh}$	12	10	-	-	-	-	ns
Reset pulse width	$t_{RES}$	10		-		-		µs

**Note:** External clock source must be provided to DOTCLK pin of HX8238-D. The driver will not operate if absent of the clocking signal.

6.2 SYNC mode Timing Diagram.



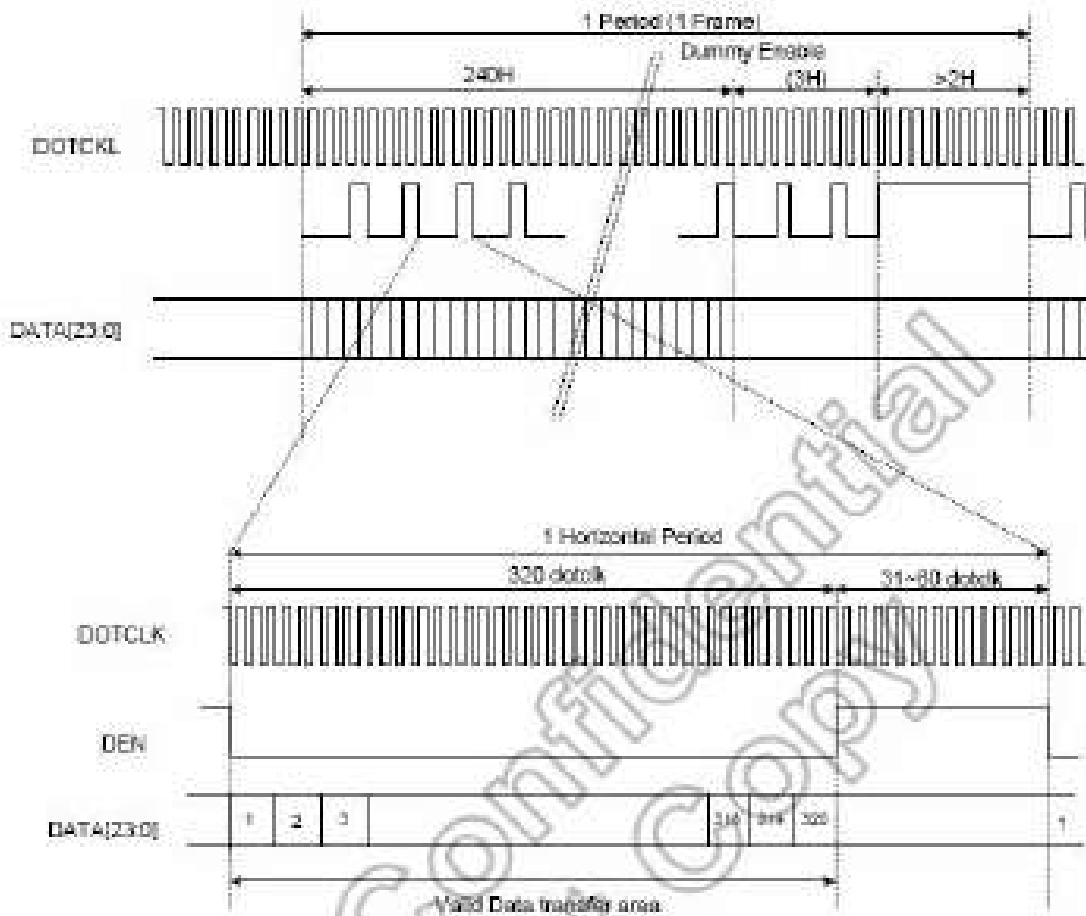
(a) Horizontal Data Transaction Timing



(b) Vertical Data Transaction Timing

Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	8.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)	fH	-	-	14.9	-	22.35	-	KHz
Vertical Frequency (Refresh)	fV	-	-	60	-	90	-	Hz
Horizontal Back Porch	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch	tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period	tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area	HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle	Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch	tVBP	-	-	18	-	-	-	Lines
Vertical Front Porch	tVFP	-	-	4	-	-	-	Lines
Vertical Data Start Point	tVBP	-	-	18	-	-	-	Lines
Vertical Blanking Period	tVBP + tVFP	-	-	22	-	-	-	Lines
Vertical Display Area	NTSC	VDISP		240		-		Lines
	PAL			280(PALM=0)				
	PAL			268(PALM=1)				
Vertical Cycle	NTSC	Vcycle		262		350		Lines
	PAL			313				

### 6.3 DE mode Timing Diagram.



Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24-bit	8-bit	24-bit	8-bit	24-bit	8-bit	
DOTCLK Frequency	f <sub>DOTCLK</sub>	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	t <sub>DOTCLK</sub>	100	33.3	154	51.3	-	-	ns
Horizontal Blanking Period	t <sub>HBP</sub> + t <sub>HFP</sub>	52	146	86	264	180	960	t <sub>DOTCLK</sub>
Horizontal Display Area	t <sub>HDISP</sub>	-	-	320	960	-	-	t <sub>DOTCLK</sub>
Horizontal Cycle	t <sub>Hcycle</sub>	372	1106	408	1224	500	1920	t <sub>DOTCLK</sub>
Vertical Blanking Period	t <sub>VBP</sub> + t <sub>VFP</sub>	2	-	-	-	47	-	Lines
Vertical Display Area	t <sub>VDISP</sub>	-	-	240	-	-	-	Lines
Vertical Cycle	t <sub>Vcycle</sub>	242	-	-	-	287	-	Lines

Note: The above parallel RGB interface timing sequence is for reference only. For the other interface timing sequence, please refer to the driver IC(HX8238D) data sheet.

## 7. Optical Characteristics

ITEM	SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
			MIN	TYP	MAX		
Luminance	L	IL=20mA	200	250	300	Cd/m <sup>2</sup>	
Contrast Ratio	CR	$\theta=0^\circ$	200	300			
Response Time	T <sub>ON</sub>	25°C		15	30	ms	
	T <sub>OFF</sub>			35	50		
CIE Color Coordinate	Red	X <sub>R</sub>	Viewing normal angle	0.588	0.608	0.628	
		Y <sub>R</sub>		0.342	0.362	0.382	
	Green	X <sub>G</sub>		0.311	0.331	0.351	
		Y <sub>G</sub>		0.574	0.594	0.614	
	Blue	X <sub>B</sub>		0.120	0.140	0.160	
		Y <sub>B</sub>		0.068	0.088	0.108	
	White	X <sub>W</sub>		0.258	0.278	0.298	
		Y <sub>W</sub>		0.287	0.307	0.327	
Viewing Angle	Hor	$\theta_{x+}$	CR ≥ 10		60	Degree	Gray Scale inversion
		$\theta_{x-}$			60		
	Ver	$\theta_{y+}$			50		
		$\theta_{y-}$			60		
Uniformity	Un		80			%	

### Note1. Definition of contrast ratio

Contrast ratio(Cr) is defined mathematically by the following formula. For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

For contrast ratio, Surface Luminance, Luminance uniformity and CIE,the testing data is base on TOPCON's BM-5 or BM-7 photo detector or compatible.

### Note2. Definition of surface luminance.

Surface luminance is the luminance with all pixels displaying white. For more information see FIG.2.

L<sub>v</sub> = Average Surface Luminance with all white pixels(P1,P2,P3, .....,Pn)

### Note3. Definition of luminance uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance.For more information see FIG.2.

$$YU = \frac{\text{Minimum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}{\text{Maximum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}$$

**Note4. Definition of response time**

The response time is defined as the LCD optical switching time interval between “White” state and “Black”state. Rise time ( $T_r$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_f$ ) is the time between photo detector output intensity changed from 10% to 90%.

For additional information see FIG1.

**Note5. Definition of color chromaticity (CIE1931)**

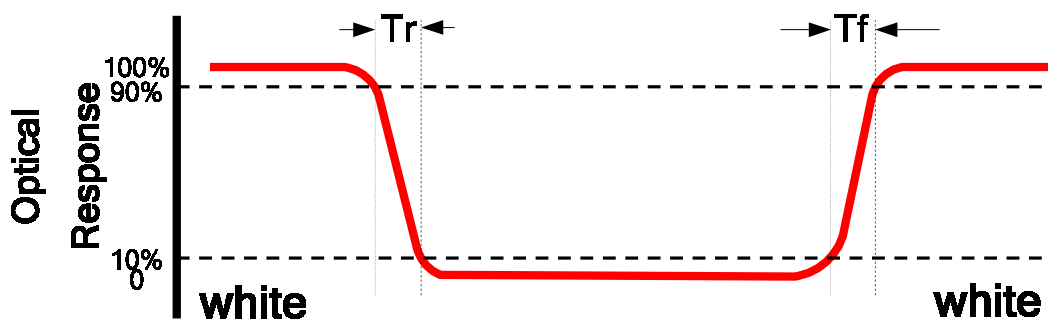
CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

**Note6. Definition of viewing angle**

Viewing angle is the angle at which the contrast ratio is greater than 10. Angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers’s ConoScope or DMS series Instruments or compatible.

**FIG.1. The definition of response Time**



**FIG.2. Measuring method for contrast ratio, surface luminance,**

**luminance uniformity, CIE (x,y) chromaticity**

Size :  $S \leq 5''$  (see Figure a) A : 5 mm B : 5 mm

H, V : Active area

Light spot size  $\phi = 5\text{mm}$  (BM-5) or  $\phi = 7.7\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure a.

measurement instrument : TOPCON’s luminance meter BM-5 or BM-7 or compatible (see Figure c).

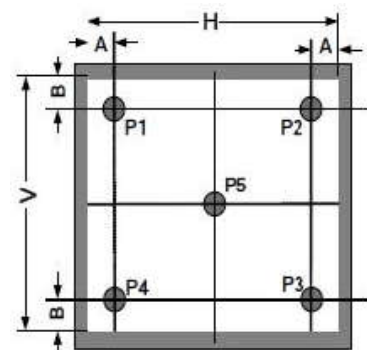


Figure a

Size : 5" < S ≤ 12.3" (see Figure b) H,V : Active area

Light spot size  $\phi=5\text{mm}$  (BM-5) or  $\phi=7.7\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure b.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

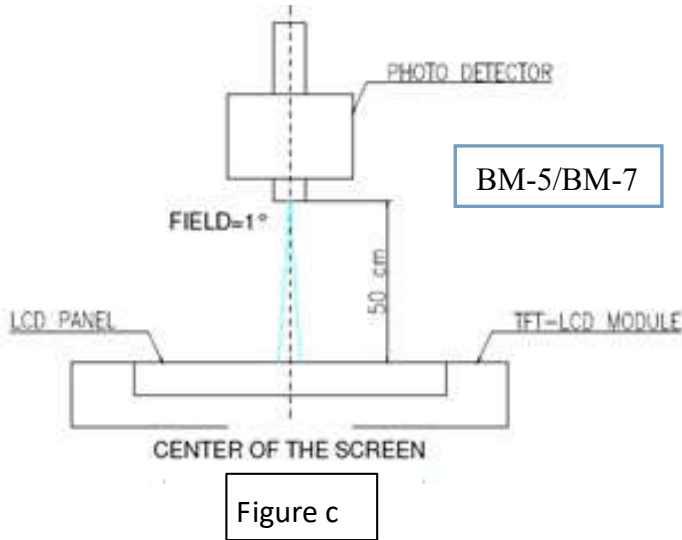
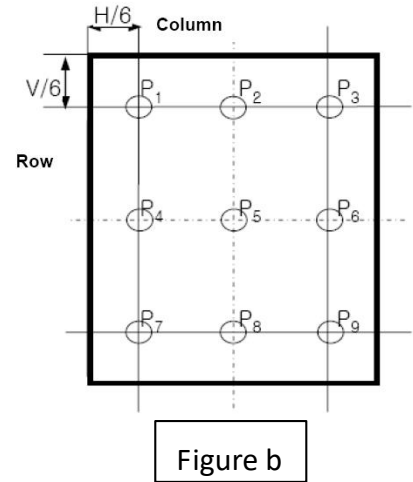
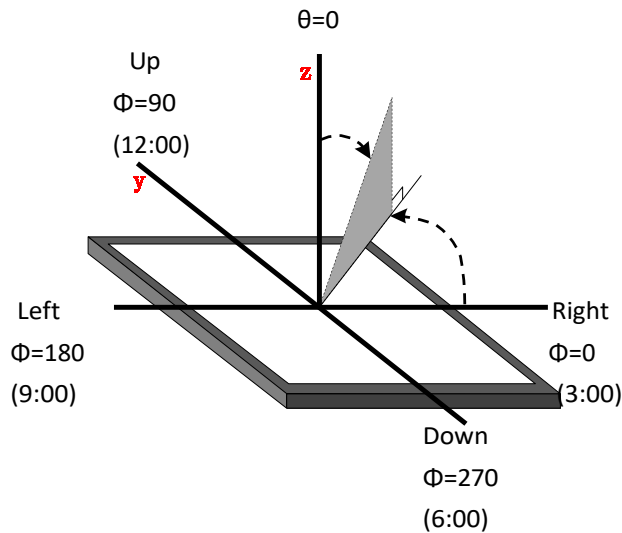


FIG.3.The definition of viewing angle

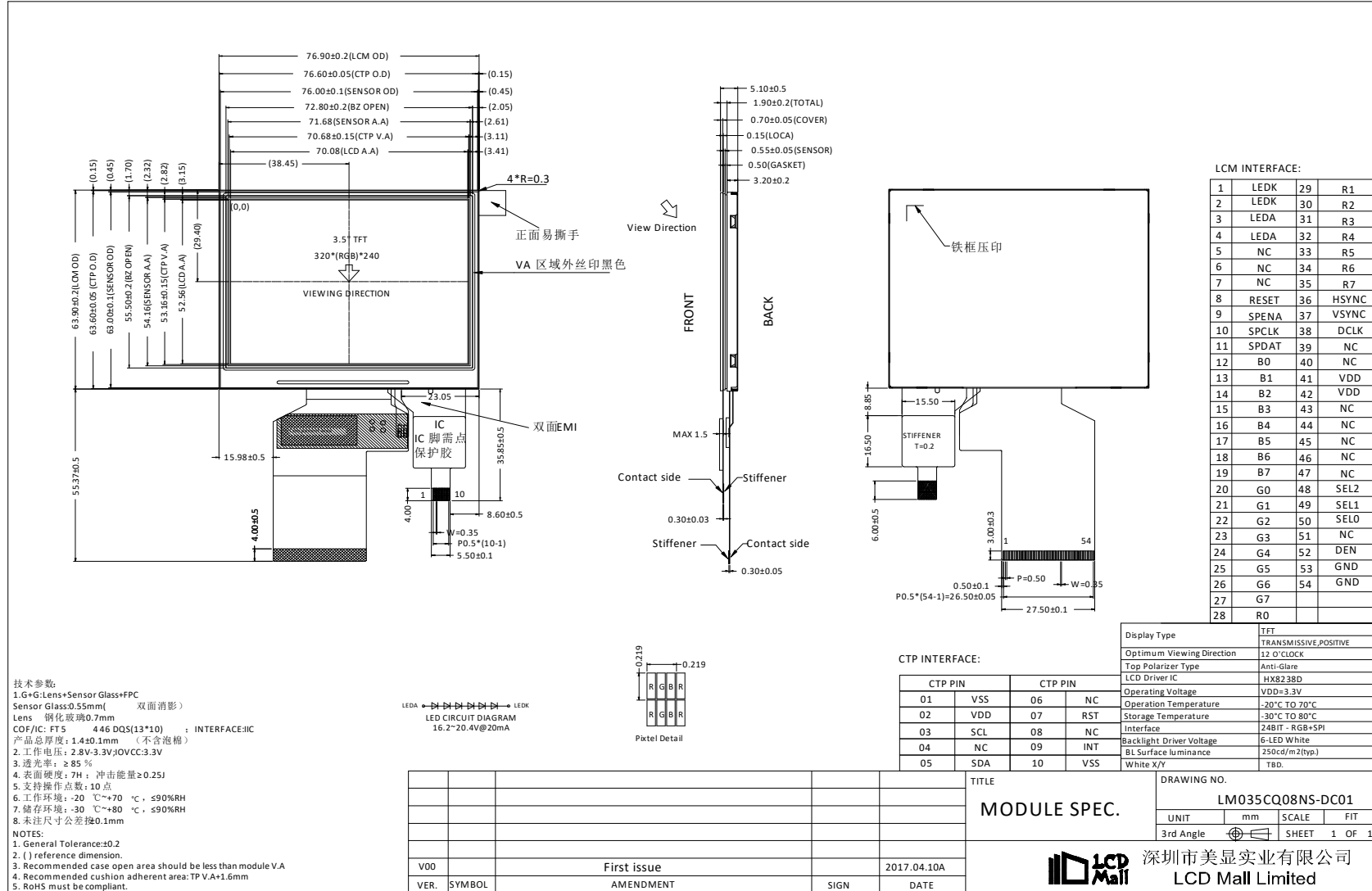


## 8. Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts= +70°C, 96hrs	Note 1 IEC60068-2-2, GB2423.2-89
2	Low Temperature Operation	Ta= -20°C, 96hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	Ta= +80°C, 120hrs	IEC60068-2-2 GB2423.2-89
4	Low Temperature Storage	Ta= -30°C, 120hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature & Humidity Storage	Ta= +60°C, 90% RH max, 120 hours	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-20°C 30 min ~ +60°C 30 min Change time: 5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Electro Static Discharge (Operation)	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15°C ~ 35°C, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2 GB/T17626.2-1998
8	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (package condition)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ±Y, ± Z 3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

- Note: 1. Ts is the temperature of panel's surface.  
2. Ta is the ambient temperature of sample.  
3. The size of sample is 5pcs.

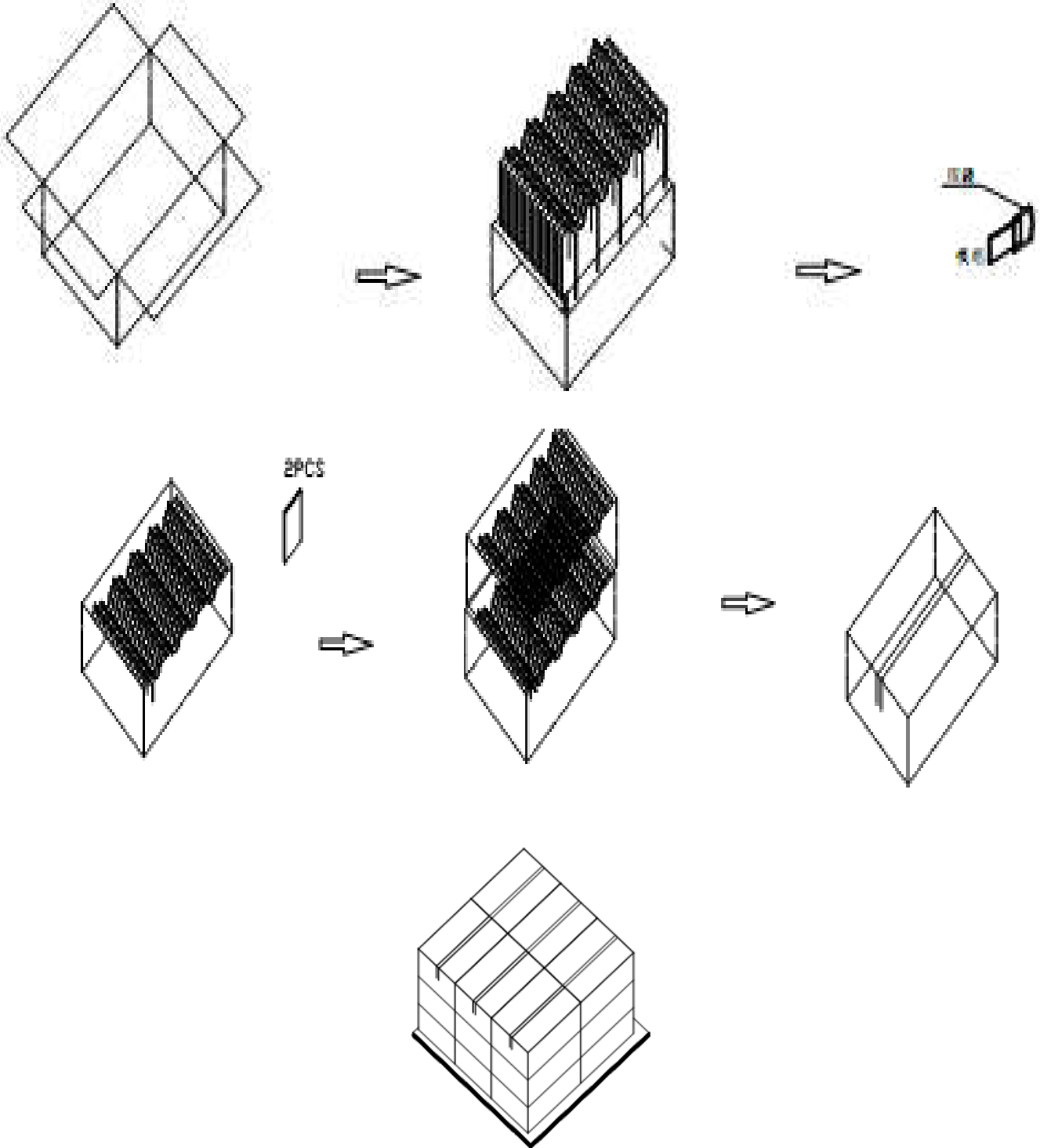
## 9. Mechanical Drawing





### 10. Packing

#### Packing Method



## 11. TFT-LCD Module Inspection Criteria

### 11.1 Scope

The incoming inspection standards shall be applied to TFT –LCD Modules (hereinafter Called "Modules") that supplied by LCD Mall Limited.

### 11.2 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the inspection period) at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to The seller, If the results of the inspecting from buyer does not send to the seller within twenty Calendar days of the delivery date. The modules shall be regards as acceptance.

Should the customer fail to notify the seller within the inspection period, the buyers Right to reject the modules shall be lapsed and the modules shall be deemed to have Been accepted by the buyer

### 11.3 Inspection Sampling

- 3.1. Lot size: Quantity per shipment lot per model
  - 3.2. Sampling type: Normal inspection, Single sampling
  - 3.3. Inspection level: II
  - 3.4. Sampling table: MIL-STD-105E
  - 3.5. Acceptable quality level (AQL )
- Major defect: AQL=0.65 Minor defect: AQL=1.00

### 11.4 Inspection Conditions

#### 4.1 Ambient conditions:

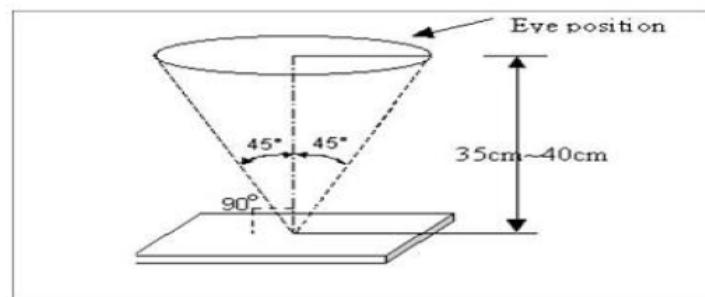
- a. Temperature: Room temperature  $25\pm 5^{\circ}\text{C}$
- b. Humidity:  $(60\pm 10)\% \text{RH}$
- c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)

#### 4.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be at least  $35\pm 5 \text{ cm}$ .

#### 4.3 Viewing Angle

U/D:  $45^{\circ}/45^{\circ}$ , L/R:



$45^{\circ}/45^{\circ}$

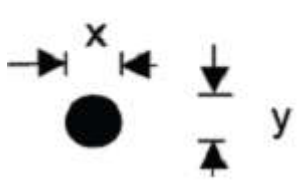
### 11.5 Inspection Criteria

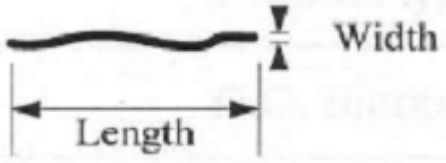

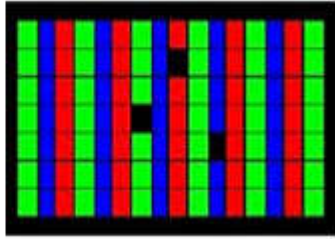
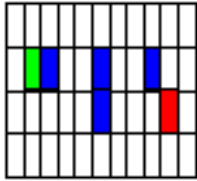
Defects are classified as major defects and minor defects according to the degree of Defectiveness defined herein.

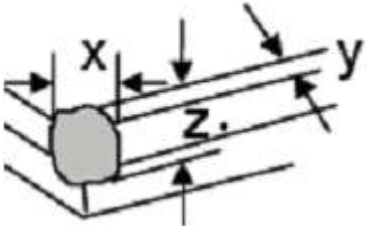
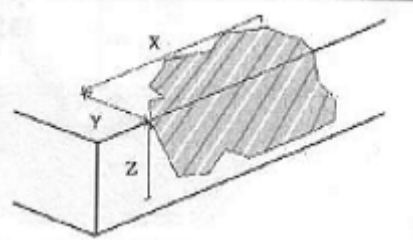
#### 11.5.1 Major defect

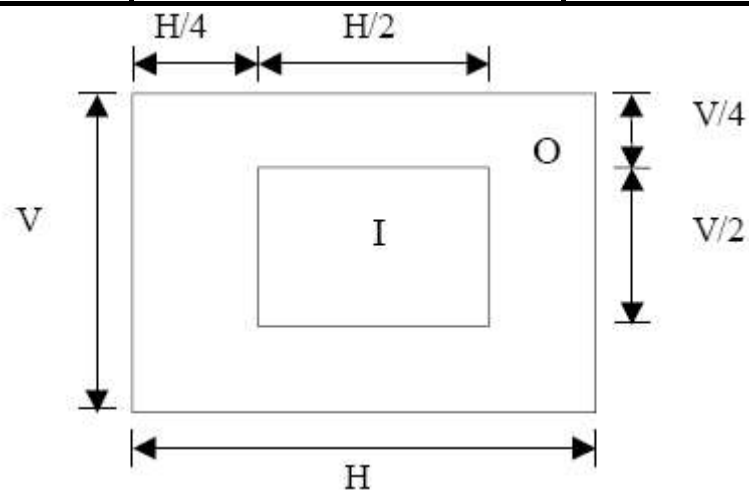
Item No	Items to be inspected	Inspection Standard
5.1.1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
5.1.2	Missing	Missing function component
5.1.3	Crack	Glass Crack

#### 11.5.2 Minor defect

Item No	Items to be inspected	Inspection standard	
5.2.1	Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt	For dark/white spot is defined $\phi = (x+y) / 2$ 	
		Size $\phi$ (mm)	Acceptable Quantity
		$\phi \leq 0.2$	Ignore
		$0.2 < \phi \leq 0.5$	3
		$0.5 < \phi$	Not allowed

5.2.2	Line Defect Including Black line White line Scratch	Define: 		
		Width(mm) Length(mm)		Acceptable Quantity
		W≤0.05		Ignore
		0.05 < W≤0.1 L≤2.5		3
		0.1 < W, or L>2.5		Not allowed
5.2.3	Polarizer Dent/Bubble	Sizeφ(mm)		Acceptable Quantity
		φ≤0.2		Ignore
		0.2 < φ≤0.3		2
		0.3 < φ≤0.5		1
		0.5 < φ		Not allowed
		Total QTY		3
5.2.4	Electrical Dot Defect	Bright and Black dot define:  and 		
				
		Two Adjacent Dot		
		Inspection pattern: Full white、Full black、Red、green and blue screens		
		Item		Acceptable Quantity
		I	O	Note
Black dot defect		2		

		Bright dot defect	1	(5mm≤Distance)
		Two Adjacent Dot	1	
		There or more Adjacent Dot	Not allowed	
		Total Dot	2	
5.2.5	Glass defect	 <p>1. Corner Fragment:</p>		
		Size(mm)	Acceptable Quantity	
		X≤3mm Y≤1mm Z≤T	Ignore T: Glass thickness X: Length Y: Width Z: thickness	
		 <p>2. Side Fragment:</p>		
		Size(mm)	Acceptable Quantity	
X≤5.0mm Y ≤1mm Z≤T	T: Glass thickness X: Length Y: Width Z: thickness			





## I area & O area

- Note:
- 1). Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
  - 2). The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.
  - 3). The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
  - 4). Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

### 11.6 Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification  
For more details



## 12. Precautions for Use of LCD modules

### 12.1 Handling Precautions

12.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

12.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

12.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

12.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

12.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

Isopropyl alcohol & Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following: Water & Ketene & Aromatic solvents

12.1.6. Do not attempt to disassemble the LCD Module.

12.1.7. If the logic circuit power is off, do not apply the input signals.

12.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

12.1.8.1. Be sure to ground the body when handling the LCD Modules.

12.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.

12.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

12.1.8.4. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 12.2 Storage Precautions

12.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

12.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

12.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 12.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.