





# SPECIFICATION

**Product Model: PV03509LZR54J**

DESIGNED	CHECKED	Approved
		

## Approval by Customer:

Ok

NG, Problem survey

Approved By \_\_\_\_\_



## Revision Record

REV NO.	REV DATE	CONTENTS	Note
V0	2018.12.13	NEW ISSUE	



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## 1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by Kingtech Group Co.,Ltd.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

## 2. General Information

ITEM	STANDARD VALUES	UNITS
LCD type	3.5" TFT	--
Dot arrangement	320(RGB)×240	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmission / Normally White	--
Gray Scale Inversion Direction	6 O'clock	--
Eyes Viewing Direction	12 O'clock	--
Driver IC	HX8238-D	--
Module size	76.70(W)×63.70(H)×3.26(T)	mm
Active area	70.08(W)×52.56(H)	mm
Dot pitch	0.219(W)×0.219(H)	mm
Interface	24-bit RGB interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	12 White LED	--
Weight	TBD	g



## 3. External Dimensions

1	2	3	4	5	6
All Pages Of This Edition Approved		<b>ROHS</b>		REV. V0	DESCRIPTION NEW
Signature: _____		Date: _____		REVISED RONG	DATE 20180102

1	LEDK	28	R0
2	LEDK	29	R1
3	LEDA	30	R2
4	LEDA	31	R3
5	YU	32	R4
6	XR	33	R5
7	NC	34	R6
8	RESET	35	R7
9	CS	36	HSYNC
10	CLK	37	VSYNC
11	SDA	38	DCLK
12	B0	39	NC
13	B1	40	NC
14	B2	41	VCC
15	B3	42	VCC
16	B4	43	YD
17	B5	44	XL
18	B6	45	NC
19	B7	46	NC
20	G0	47	NC
21	G1	48	IF2
22	G2	49	IF1
23	G3	50	IF0
24	G4	51	NC
25	G5	52	DE
26	G6	53	GND
27	G7	54	GND

**Kingtech Group Co., Ltd.**

MODEL NUMBER: PV03509LZR54J

DATE: 20180102

DESIGN BY: RONG

CHECKED BY:

APPROVED BY:

UNSPECIFIED TOLERANCE: ±0.20

UNITS: mm

PROJECTION

SHEET: 1 OF 1

DRAWING DESCRIPTION: MODEL

**NOTES:**

- DISPLAY TYPE: 3.5" TFT
- VIEWING DIRECTION: 6:00
- LCD DRIVE IC: HX8238D
- POLARIZER MODE: TRANSMISSIVE/POSITIVE
- OPERATING TEMP: -20° C ~ +70° C
- STORAGE TEMP: -30° C ~ +80° C
- UNMARKER TOLERANCE: ±0.20
- REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

**LEDK**

LEDK BL CIRCUIT DIAGRAM  
Vf=19.8V, If=40mA  
900nits (Min), 1000nits (Typ)



## 4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1~2	LEDK	LED backlight cathode
3~4	LEDA	LED backlight anode
5	YU	RTP (No connection)
6	XR	RTP (No connection)
7	NC	No connection
8	RESET	Reset signal input terminal, active at 'L'
9	CS	Chip select signal input terminal, Active at 'L'
10	SCK	Write signal input terminal, Active at 'L'. Synchronizing clock signal in SPI mode.
11	SDA	SPI interface input pin.
12~19	B0~B7	Data bus
20~27	G0~G7	Data bus
28~35	R0~R7	Data bus
36	HSYNC	Line synchronizing signal for RGB interface operation.
37	VSYNC	Frame synchronizing signal for RGB interface operation.
38	DCLK	Dot clock signal for RGB interface operation.
39,40	NC	No connection
41,42	VCC	System power supply.
43	YD	RTP (No connection)
44	XL	RTP (No connection)
45~47	NC	No connection
48	SEL2	Define the input interface(Note1)
49	SEL1	Define the input interface(Note1)
50	SEL0	Define the input interface(Note1)
51	NC	No connection
52	DE	Data ENEABLE signal for RGB interface operation.
53,54	GND	Power ground

Note1:

SEL2	SEL1	SEL0	Format	Operating Frequency
0	0	0	Parallel-RGB data format (only support stripe type color filter)	6.5MHz
0	0	1	Serial-RGB data format	19.5MHz
0	1	0	CCIR 656 data format (640RGB)	24.54MHz
0	1	1	CCIR 656 data format (720RGB)	27MHz
1	0	0	YUV mode A data format (Cr-Y-Cb-Y)	24.54MHz
1	0	1	YUV mode A data format (Cr-Y-Cb-Y)	27MHz
1	1	0	YUV mode B data format (Cb-Y-Cr-Y)	27MHz
1	1	1	YUV mode B data format (Cb-Y-Cr-Y)	24.54MHz



## 5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCC	-0.3	4.0	V
Input Voltage	Vin	GND-0.3	5.0	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	-	90	%RH

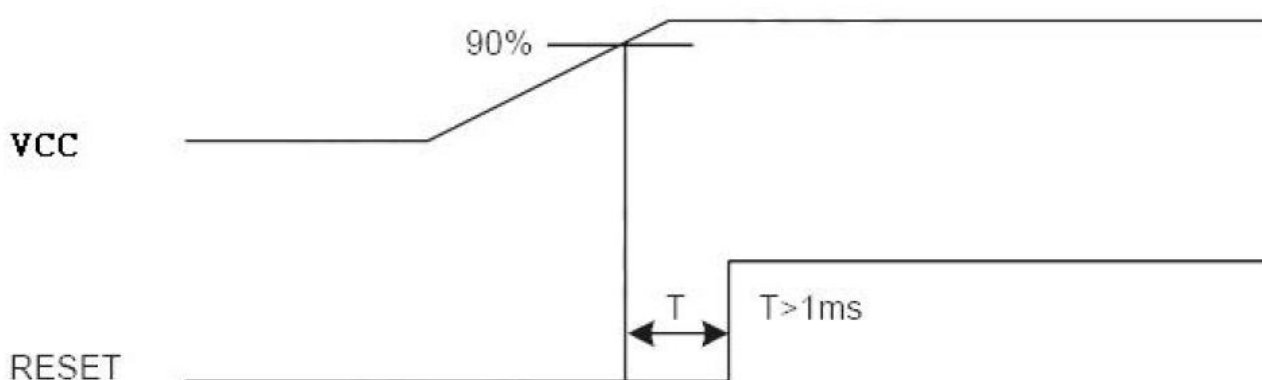
## 6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Supply Voltage	VCC	2.5	-	3.6	V	-
Input High Voltage	V <sub>IH</sub>	0.8	-	-	V	-
Input Low Voltage	V <sub>IL</sub>	0	-	0.2	V	-
Output High Voltage	V <sub>OH</sub>	0.9	-	-	V	-
Output Low Voltage	V <sub>OL</sub>	0	-	0.1	V	-
Logic Input Current	I <sub>IL</sub> /I <sub>IH</sub>	-1	-	1	uA	-

## 7. Timing Characteristics

### 7.1 Reset Timing Characteristics

The RESET input must be held at least 1ms after power is stable



Reset timing



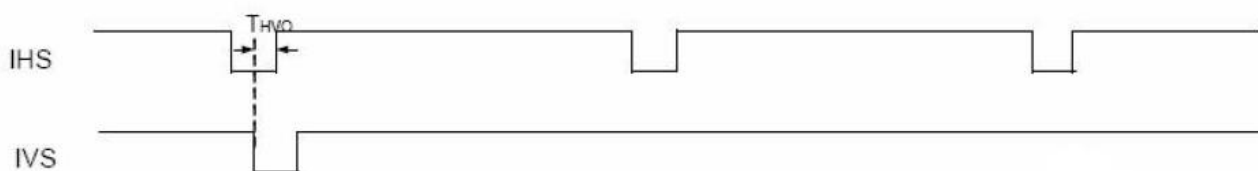
## 7.2 Parallel RGB Interface Timing Characteristics

Hsync and Vsync timing

CCIR601 timing waveform VS\_POL=H, HS\_POL=L in Register R2)

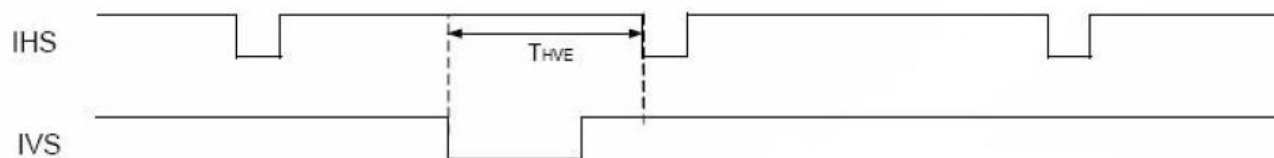
### IHS and IVS timing

- Odd field



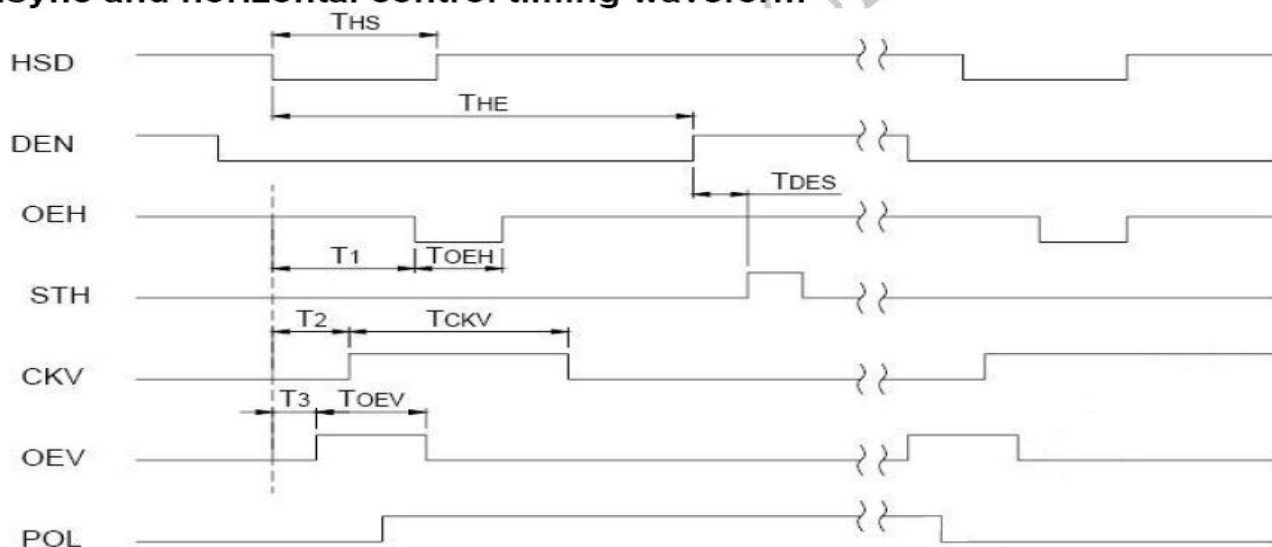
IHS and IVS waveforms in odd field

- Even field



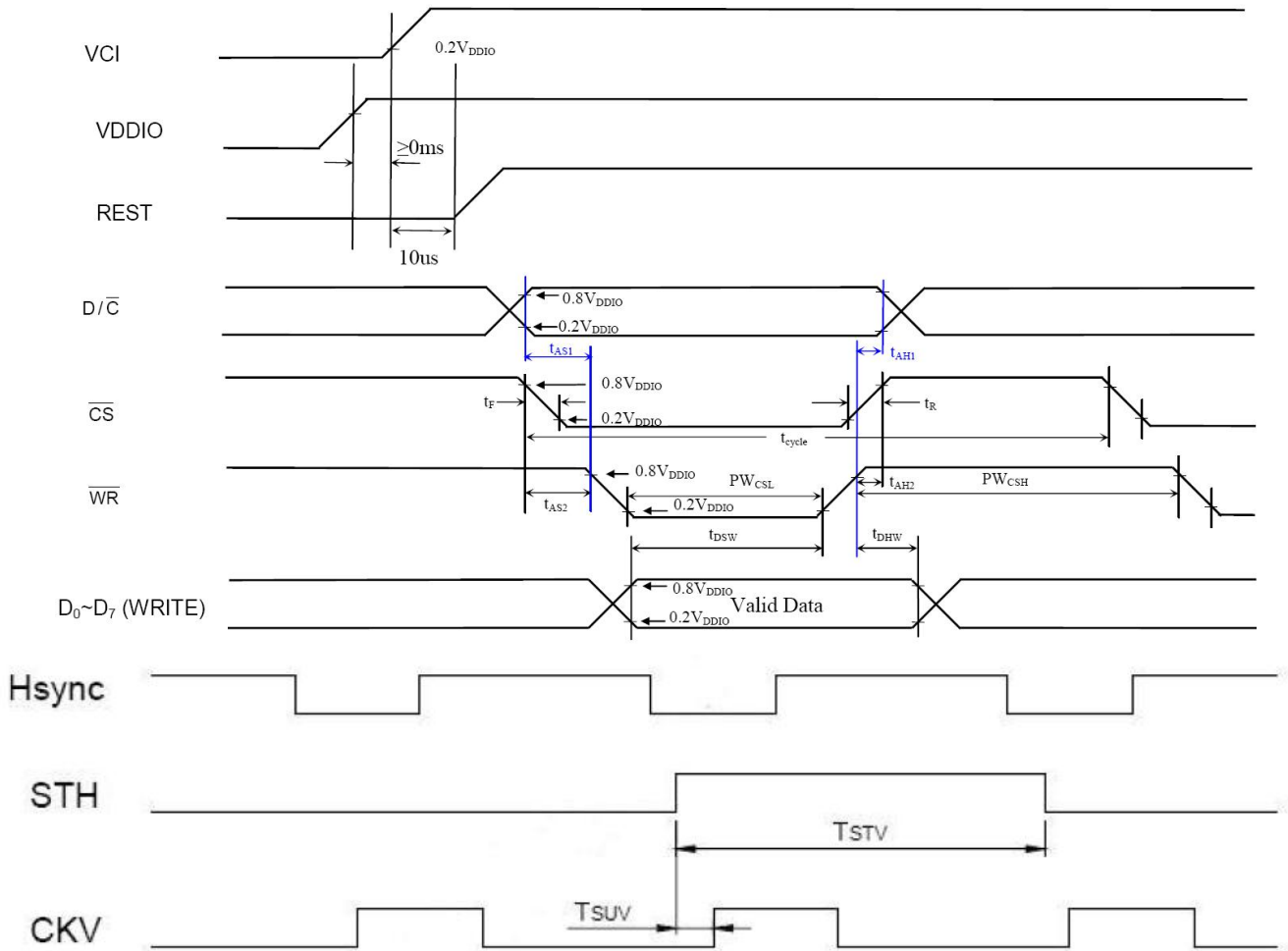
IHS and IVS waveforms in even field

### Hsync and horizontal control timing waveform



### Hsync and vertical shift clock timing waveform

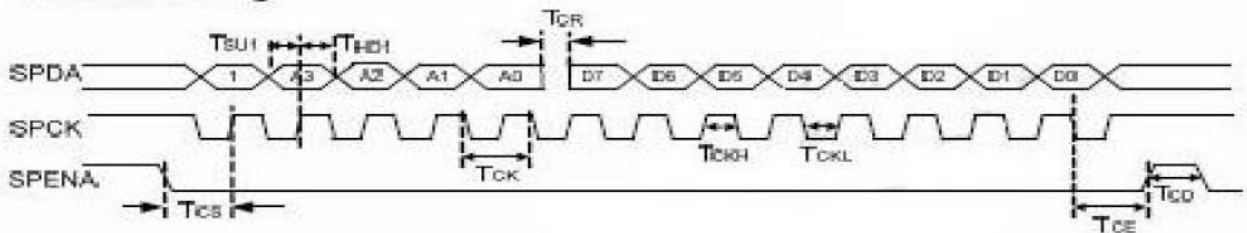




### 7.3 SPI Timing Characteristics

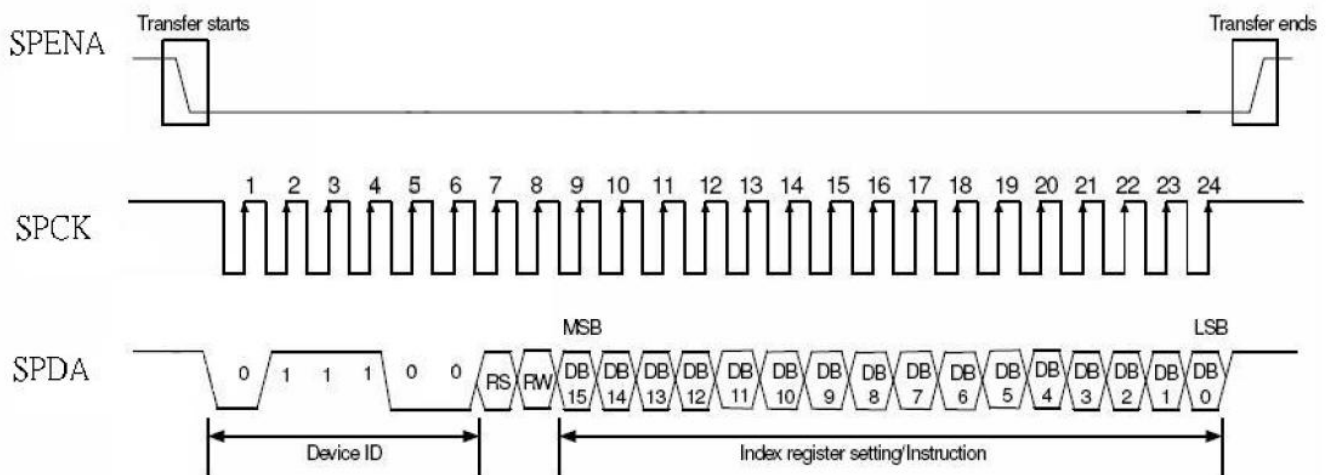
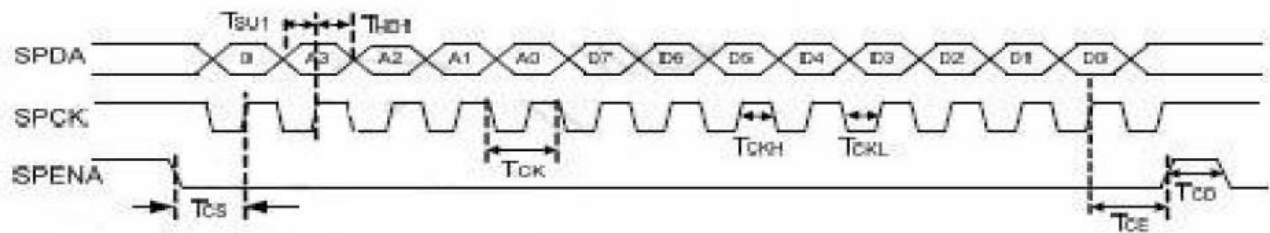
PARAMETER	Symbol	Min.	Typ.	Max.	Unit
SPCK period	$T_{CK}$	60	-	-	ns
SPCK high width	$T_{CKH}$	30	-	-	ns
SPCK low width	$T_{CKL}$	30	-	-	ns
Data setup time	$T_{SU1}$	12	-	-	ns
Data hold time	$T_{HD1}$	12	-	-	ns
SPENA to SPCK setup time	$T_{CS}$	20	-	-	ns
SPENA to SPDA hold time	$T_{CE}$	20	-	-	ns
SPENA high pulse width	$T_{CO}$	50	-	-	ns
SPDA output latency	$T_{CS}$	-	1/2	-	$T_{CK}$

#### ● SPI read timing



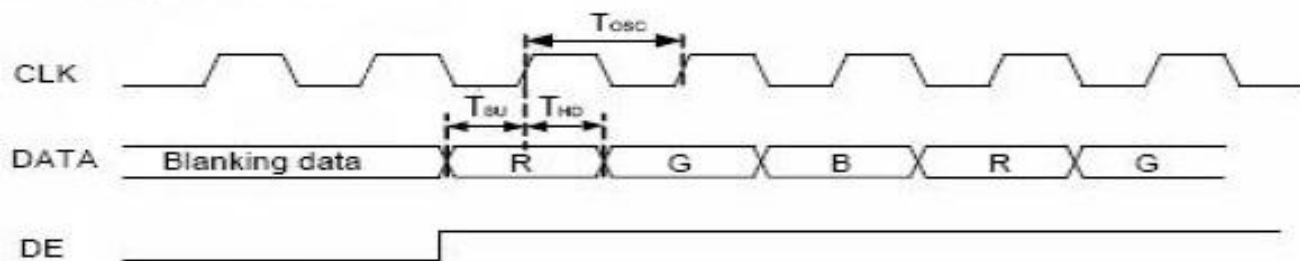


● **SPI write timing**



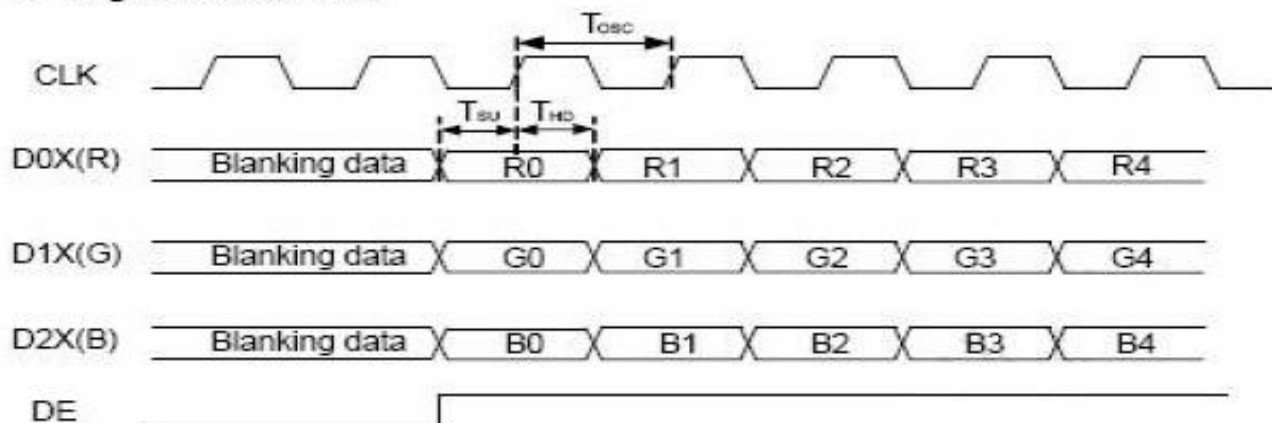
**7.4 RGB Timing Characteristics**

● **Digital Serial RGB**

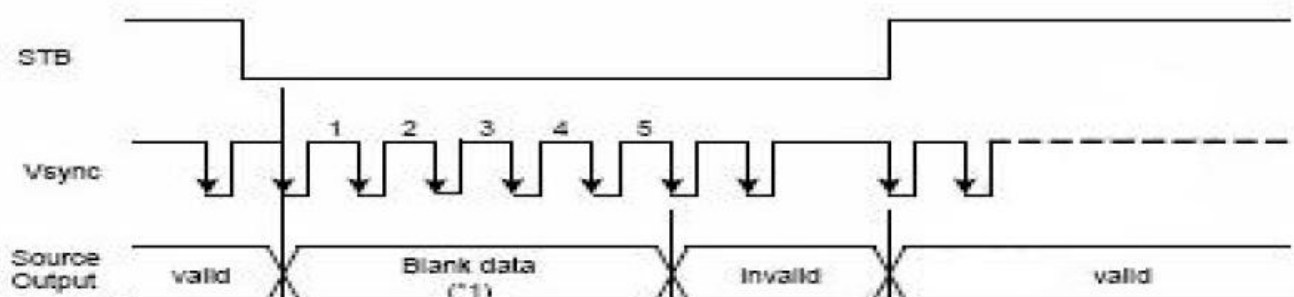




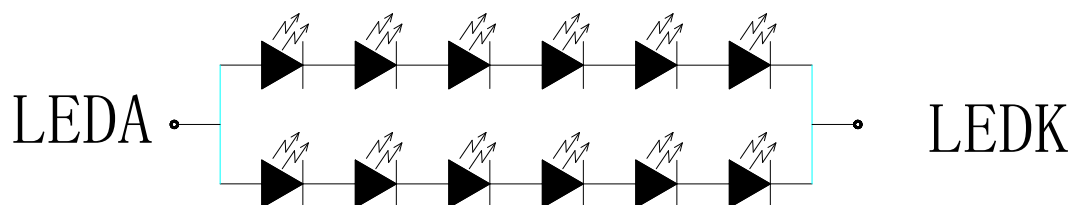
## ● Digital Parallel RGB



## 7.5 Power Up Sequence for RGB mode



## 8. Backlight Characteristic



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	16.8	18	21	V	If=40mA
Supply Current	If	-	40	-	mA	-
Luminous Intensity for LCM	-	900	1000	-	Cd/m <sup>2</sup>	If=40mA
Uniformity for LCM	-	80	-	-	%	If=40mA
Life Time	-	50000	-	-	Hr	If=40mA
Backlight Color	White					

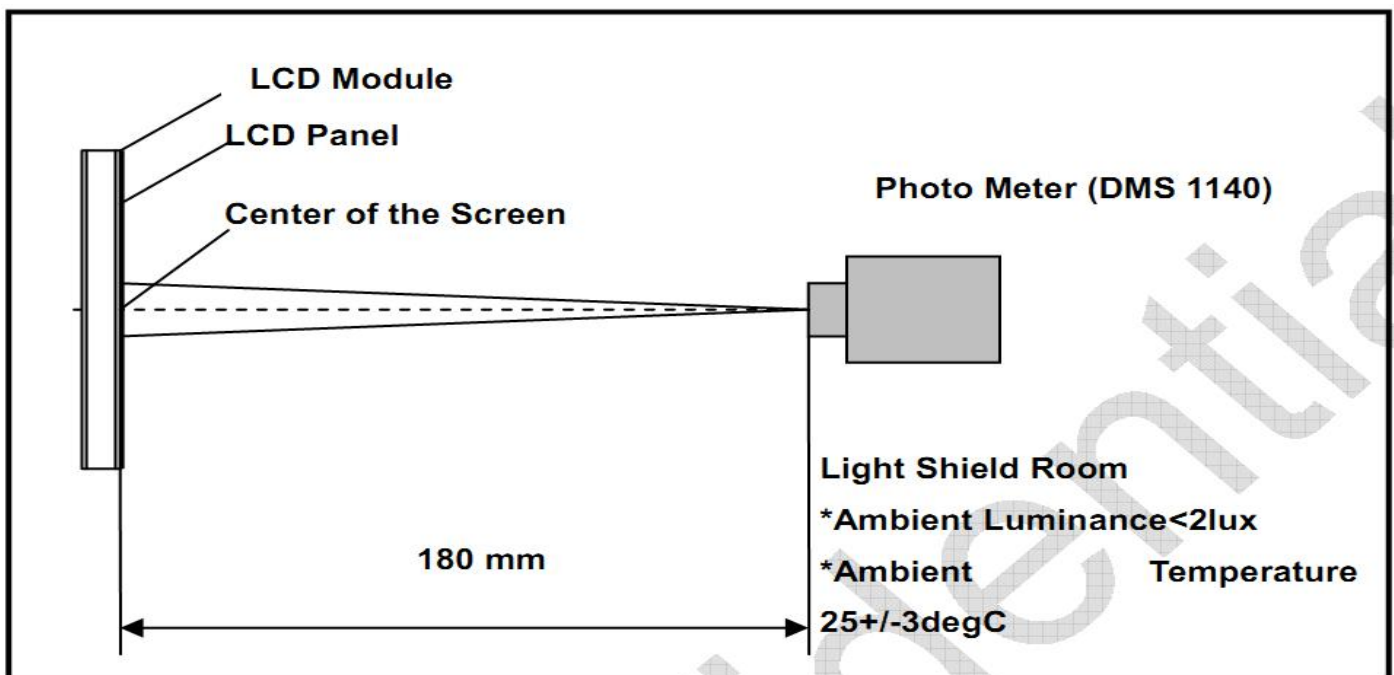


## 9. Optical Characteristics

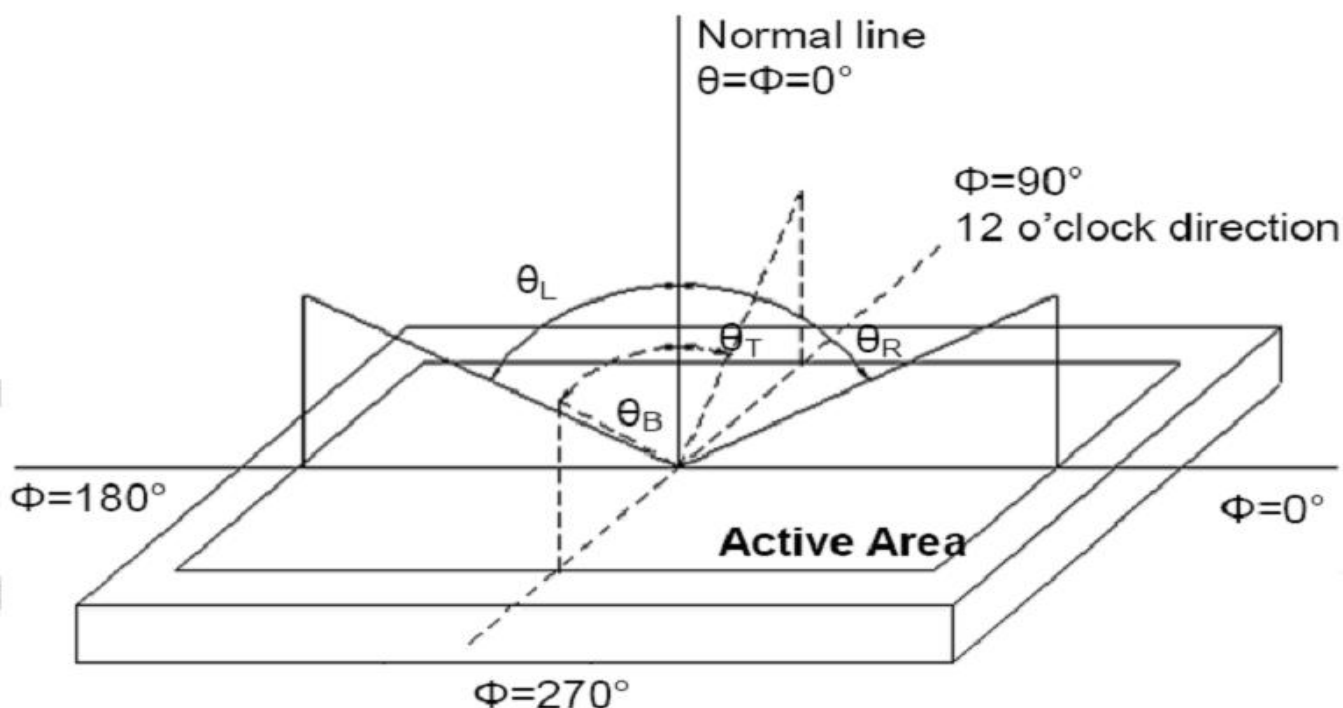
(Note1 · Note2) (Using Normal Polarizer + Backlight, reference only)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK		
Contrast Ratio	CR	$\theta = \varphi = 0^\circ$	300	400	--	--	Note1,Note3		
Response Time	Tr+ Tf	$\theta = \varphi = 0^\circ$	--	50	70	ms	Note1,Note4		
Viewing Angle	Upper	$\theta$	$CR \geq 10$	--	(45)	--	--	Note 5	
	Down			--	(45)	--	--		
	Right			$\varphi$	--	(35)	--		--
	Left				--	(15)	--		--
Color Filter Chromaticity	White	X y	$\theta = \varphi = 0^\circ$	Typ. -0.05	0.294	Typ. +0.05	--	Note 6	
					0.334		--		
	Red	X y	$\theta = \varphi = 0^\circ$		0.633		--		
					0.326		--		
	Green	X y	$\theta = \varphi = 0^\circ$		0.297		--		
					0.577		--		
	Blue	X y	$\theta = \varphi = 0^\circ$		0.133		--		
					0.129		--		

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.



Note (2) Definition of Viewing Angle



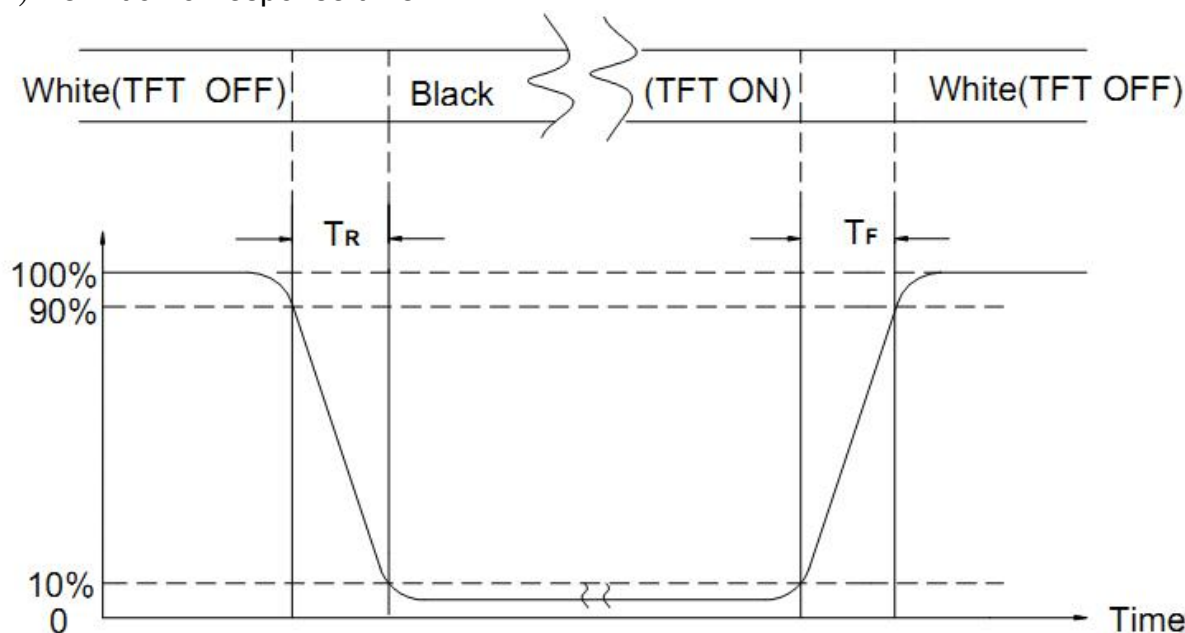
**Note (3) Definition of Contrast Ratio (CR)**

The contrast ratio can be calculated by the following expression

$$\text{Contrast Ratio (CR)} = L63 / L0$$

L63: Luminance of gray level 63, L0: Luminance of gray level 0

**Note (4) Definition of response time**



**Note (5) Definition of Transmittance (Module is without signal input)**

$$\text{Transmittance} = \text{Center Luminance of LCD} / \text{Center Luminance of Back Light} \times 100\%$$

**Note (6) Definition of color chromaticity (CIE1931)**

Color coordinates measured at the center point of LCD



## 10. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80°C±2°C×200Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1, Air bubble in the LCD. 2, Seal leak. 3, Non-display. 4, Missing segments. 5, Glass crack. 6, Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8, The electric characteristic requirements shall be satisfied.
②	Low Temperature Storage	-30°C±2°C×200Hours	
③	High Temperature Operating	70°C±2°C×120Hours	
④	Low Temperature Operating	-20°C±2°C×120Hours	
⑤	Temperature Cycle(Storage)	-20°C ↔ 25°C ↔ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test (Storage)	50°C±5°C×90%RH×120Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
⑨	ESD Test	Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times	

### REMARK:

- The Test samples should be applied to only one test item.
- Sample side for each test item is 5~10pcs.
- For Damp Proof Test, Pure water(Resistance > 10MΩ)should be used.
- In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.



## 11. Inspection Standard

### 11.1. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

#### 11.1.1. INSPECTION TOOLS AND INSTRUMENTS

Vernier calipers, film scales, multimeter, magnifying eyepiece, ND5%, luminance meter and so on.

#### 11.1.2. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM KINGTECH TO PURCHASER. PURCHASER SHALL CONTROL THE LCM AT -10 TO 40 ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

#### 11.1.3. INCOMING INSPECTION

##### (A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

##### (B) THE STANDARD OF QUALITY

ISO-2859-1 (SAME AS MIL-STD-105E ) ,LEVEL:II

CLASS	AQL(%)
CRITICAL	0.4 %
MAJOR	0.65 %
MINOR	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

##### (C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

#### 11.1.4. WARRANTY POLICY

KINGTECH WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. KINGTECH WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF KINGTECH.

## 11.2. CHECKING CONDITION

11.2.1. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

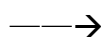
11.2.2. CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE

11.2.3. Ambient Illumination:

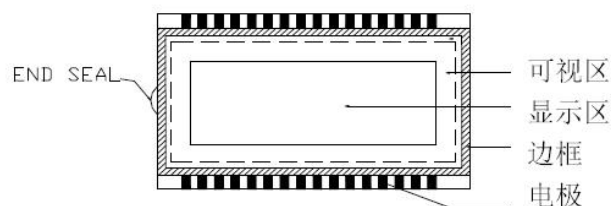
0 ~30 Lux for functional inspection

500 ~ 1200 Lux for external appearance inspection.

11.2.4. TEST AREA:



11.2.5. Inspection should be carried out with rope electrostatic ring and static finger cover (both hands except small fingers must be worn)



11.2.6. The inspector may make a visual inspection or a comparative examination with a film



ruler and a magnifying eyepiece. Individual defects shall be determined according to the limited samples.

**11.2.7.** Functional testing uses electrical testing fixtures or test fixtures required by customers.

**11.2.8.** the ion fan should be used when testing.

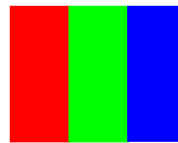
### **11.2.9. the principle of judgment**

11.3.1 If the defect outside the visual area does not affect the assembly and display, it will be judged as a good product.

11.3.2 Poor definition

Pixel:

A combination of three sub-pixels  
(Red + Green + Blue).



**Dot:**

Any of the sub-pixels  
(Red or Green or Blue).



#### **Bright and dark dots:**

A point pixel (sub-pixel: R, G, B pixels) is lit or turned off during the display function test.

#### **Highlights:**

Usually considered to be shown on a black screen.

#### **Dark spots:**

They are generally considered to be shown on R, G, B solid colors or white images.

#### **Neighborhood:**

Two or three adjacent point pixels (dot: sub-pixel) connected together (R, G or G, B or B, R or RGB).





### 11.3. INSPECTION PLAN :

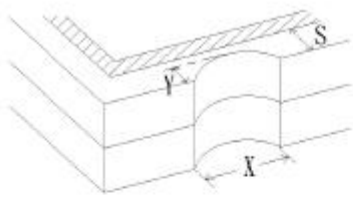
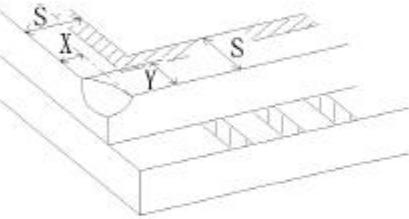
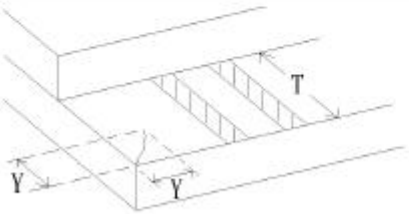
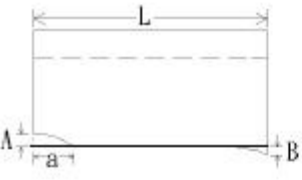
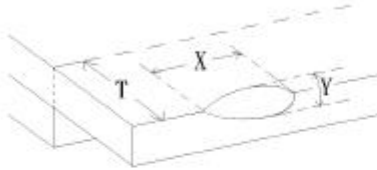
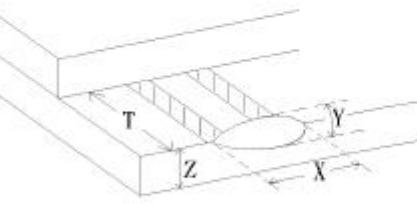
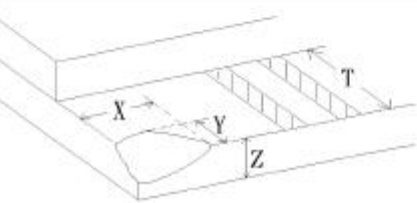
CLASS	ITEM	JUDGEMENT	CLASS
PACKING & INDICATE	1. OUTSIDE AND INSIDE PACKAGE	"MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE.	Minor
	2. MODEL MIXED AND QUANTITY	OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED	Critical
	3. PRODUCT INDICATION	"MODEL NO." SHOULD INDICATE ON THE PRODUCT	Major
ASSEMBLY	4. DIMENSION, LCD GLASS SCRATCH AND SCRIBE DEFECT.	ACCORDING TO SPECIFICATION OR DRAWING.	Major
APPEARANCE	5. VIEWING AREA	POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREA .....REJECTED	Minor
	6. BLEMISH · BLACK SPOT · WHITE SPOT IN THE LCD AND LCD GLASS CRACKS	ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA)	Minor
	7. BLEMISH · BLACK SPOT WHITE SPOT AND SCRATCH ON THE POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA)	Minor
	8. BUBBLE IN POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA)	Minor
	9. LCD'S RAINBOW COLOR	STRONG DEVIATION COLOR ( OR NEWTON RING) OF LCD.....REJECTED. OR ACCORDING TO LIMITED SAMPLE ( IF NEEDED, AND INSIDE VIEWING AREA )	Minor
ELECTRICAL	10. ELECTRICAL AND OPTICAL CHARACTERISTICS ( CONTRAST· VOP· CHROMATICITY ... ETC )	ACCORDING TO SPECIFICATION OR DRAWING . ( INSIDE VIEWING AREA )	Critical
	11.MISSING LINE	MISSING DOT· LINE · CHARACTER .....REJECTED	Critical
	12.SHORT CIRCUIT· WRONG PATTERN DISPLAY	NO DISPLAY · WRONG PATTERN DISPLAY · CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Critical
	13. DOT DEFECT (FOR COLOR AND TFT)	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor



### 11.4. STANDARD OF VISUAL INSPECTION

NO.	CLASS	ITEM	JUDGEMENT																				
11.4.1	MINOR	BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH	<p>(A) ROUND TYPE: <span style="float:right">unit : mm.</span></p> <table border="1"> <thead> <tr> <th>DIAMETER (mm.)</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td>Distance&gt;1mm</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.4</math></td> <td>3 (Distance&gt;15mm)</td> </tr> <tr> <td><math>0.4 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>NOTE: <math>\Phi=(\text{LENGTH}+\text{WIDTH})/2</math></p> <p>(B) LINEAR TYPE: <span style="float:right">unit : mm.</span></p> <table border="1"> <thead> <tr> <th>LENGTH</th> <th>WIDTH</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>-----</td> <td><math>W \leq 0.03</math></td> <td>Distance&gt;1mm</td> </tr> <tr> <td><math>L \leq 4.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3 (Distance&gt;15mm)</td> </tr> <tr> <td>-----</td> <td><math>0.05 &lt; W</math></td> <td>FOLLOW ROUND TYPE</td> </tr> </tbody> </table>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\Phi \leq 0.15$	Distance>1mm	$0.15 < \Phi \leq 0.4$	3 (Distance>15mm)	$0.4 < \Phi$	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	$W \leq 0.03$	Distance>1mm	$L \leq 4.0$	$0.03 < W \leq 0.05$	3 (Distance>15mm)	-----	$0.05 < W$	FOLLOW ROUND TYPE
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11.4.3	MINOR	Dot Defect	<table border="1"> <thead> <tr> <th>Items</th> <th>ACC. Q'TY</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td><math>N \leq 2</math> (Distance&gt;15mm)</td> </tr> <tr> <td>Dark dot</td> <td><math>N \leq 3</math> (Distance&gt;15mm)</td> </tr> </tbody> </table> <p>Pixel Define :</p> <p>Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Definition:&lt;1/2dot and visible by 5% ND filter <math>N \leq 5</math></p> <p>Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.</p>	Items	ACC. Q'TY	Bright dot	$N \leq 2$ (Distance>15mm)	Dark dot	$N \leq 3$ (Distance>15mm)														
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11.4.4	MINOR	Mura	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary																				



NO.	CLASS	ITEM	JUDGEMENT
11.4.4	MINOR	LCD GLASS CHIPPING	 $Y > S$ Reject
11.4.5	MINOR	LCD GLASS CHIPPING	 $X \text{ or } Y > S$ Reject
11.4.6	MAJOR	LCD GLASS GLASS CRACK	 $Y > (1/2) T$ Reject
11.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	 <ol style="list-style-type: none"> <li><math>a &gt; L/3</math>, <math>A &gt; 1.5\text{mm}</math>. Reject</li> <li>B: ACCORDING TO DIMENSION</li> </ol>
11.4.8	MINOR	LCD GLASS CHIPPING ( ON THE TERMINAL AREA )	 $\Phi = (x+y)/2 > 2.5 \text{ mm}$ Reject
11.4.9	MINOR	LCD GLASS CHIPPING ( ON THE TERMINAL SURFACE )	 $Y > (1/3) T$ Reject
11.4.10	MINOR	LCD GLASS CHIPPING	 $Y > T$ Reject



## 12. Handling Precautions

### 12.1 Mounting method

The LCD panel of KINGTECH TFT module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

### 12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [Recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

### 12.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to power or ground, do not input any signals before power is turned on, and ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

### 12.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity

### 12.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.



Usage under the maximum operating temperature, 50%Rh or less is required.

## 12.6 storing

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.

[It is recommended to store them as they have been contained in the inner container at the time of delivery from us

## 12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

## 13. Precaution for Use

### 13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

### 13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to KINGTECHTFT , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

## 14. Packing Method

TBD