

# ON TAT INDUSTRIAL COMPANY

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## SPECIFICATION

Product Model: YX350HV15-CT (Rev.B)

Designed by	R&D Checked by	Quality Department by	Approved by

### Approval by Customer

<p>OK</p> <p>NG, Problem survey:</p> <p style="text-align: right;">Approved By _____</p>
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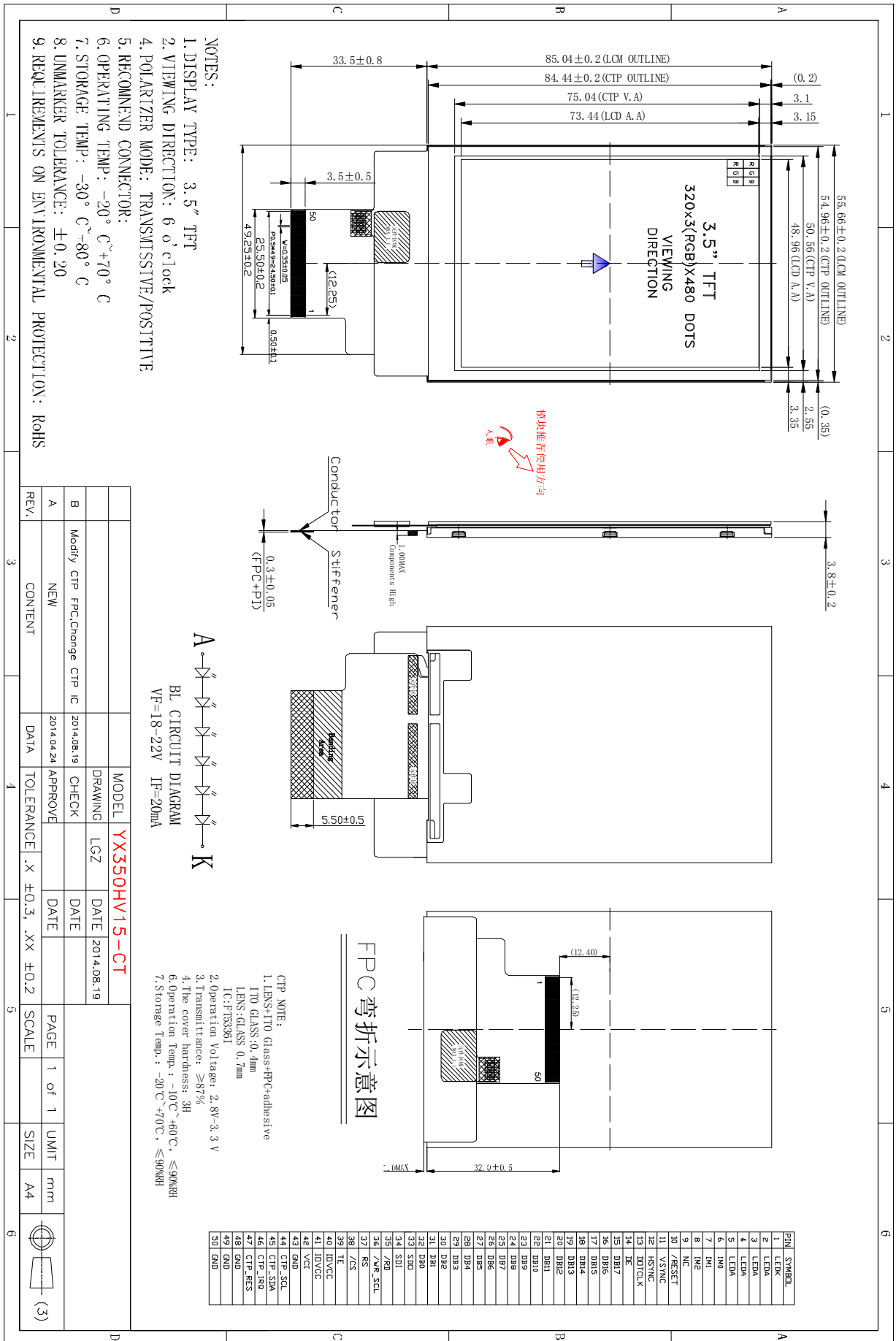
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## 1. Numbering System

## 2. TFT General Information

ITEM	STANDARD VALUES	UNITS
LCD type	3.5" TFT With CTP	--
Dot arrangement	320(RGB)×480	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmission / Normally White	--
Viewing Direction	6 o'clock	--
TFT Driver IC	HX8357D	--
CTP type	G+G	--
Surface Treatment	3H	--
CTP Driver IC	FT5336I	--
Module size	55.66(W)×85.04(H)×3.8(T)	mm
TFT Active area	48.96(W)×73.44(H)	mm
CTP Active area	48.96(W)×73.44(H)	mm
Dot pitch	0.153(W)×0.153(H)	mm
Interface	4-lines_8bit / 3-lines_9bit SPI 8-/ 9-/16-/18-bit 8080-series system interface 16-/18-bit RGB interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	6 White LED in serial	--
Weight	TBD	g

### 3. External Dimensions



## 4. Interface Description

Pin	Symbol	Description.																																			
1	LEDK	LED backlight (Cathode).																																			
2	LEDA	LED backlight (Anode).																																			
3	LEDA	LED backlight (Anode).																																			
4	LEDA	LED backlight (Anode).																																			
5	LEDA	LED backlight (Anode).																																			
6	IM0	System interface Mode																																			
		<table border="1"> <thead> <tr> <th>IM2</th> <th>IM1</th> <th>IM0</th> <th>Interface mode</th> <th>DB Pin</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>i80-system 18-bit interface</td> <td>DB[17:0]</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>i80-system 9-bit interface</td> <td>DB[8:0]</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>i80-system 16-bit interface</td> <td>DB[15:0]</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>i80-system 8-bit interface</td> <td>DB[7:0]</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>3-wires_9-bit SPI</td> <td>/CS,SDI,SDO,SCL</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>4-wires_8-bit SPI</td> <td>/CS,RS,SDI,SDO,SCL</td> </tr> </tbody> </table>	IM2	IM1	IM0	Interface mode	DB Pin	0	0	0	i80-system 18-bit interface	DB[17:0]	0	0	1	i80-system 9-bit interface	DB[8:0]	0	1	0	i80-system 16-bit interface	DB[15:0]	0	1	1	i80-system 8-bit interface	DB[7:0]	1	0	1	3-wires_9-bit SPI	/CS,SDI,SDO,SCL	1	1	1	4-wires_8-bit SPI	/CS,RS,SDI,SDO,SCL
IM2	IM1	IM0	Interface mode	DB Pin																																	
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7	IM1																																				
8	IM2																																				
9	NC	NC																																			
10	/RESET	Reset input pin, Active “L”.																																			
11	VSYNC	Vertical sync signal in RGB I/F.																																			
12	HSYNC	Horizontal sync signal in RGB I/F.																																			
13	DOTCLK	Pixel clock signal in RGB I/F.																																			
14	DE	Data enable signal in RGB I/F mode																																			
15	DB17	<p>18-bit parallel bi-directional data bus for MPU system:              8-bit I/F: DB[7:0] is used.              9-bit I/F: DB[8:0] is used.              16-bit I/F: DB[15:0] is used.              24-bit I/F: DB[17:0] is used.</p> <p>18-bit input data bus for RGB I/F.              16-bit/pixel: DB[17:13]=R[4:0], DB[11:6]=G[5:0] and DB[5:1]=B[4:0];              18-bit/pixel: DB[17:12]=R[5:0], DB[11:6]=G[5:0] and DB[5:0]=B[5:0];              Connect unused pins to GND.</p>																																			
16	DB16																																				
17	DB15																																				
18	DB14																																				
19	DB13																																				
20	DB12																																				
21	DB11																																				
22	DB10																																				
23	DB9																																				
24	DB8																																				
25	DB7																																				
26	DB6																																				
27	DB5																																				
28	DB4																																				
29	DB3																																				
30	DB2																																				
31	DB1																																				
32	DB0																																				

33	SDO	Serial output signal in SPI I/F.
34	SDI	Serial input signal in SPI I/F.
35	/RD	Reads strobe signal to write data when /RD is “Low” in MPU interface.
36	/WR_SCL	MCU: Serves as a write signal and writes data at the rising edge. SPI: SCL pin as Serial Clock when operates in the serial interface.
37	RS	Display data / command selection in 80-series MPU I/F. RS = “0” : Command      RS = “1” : Display data.
38	/CS	Chip select input pin (“Low” enable) in MPU I/F and SPI I/F.
39	TE	Tearing effect output pin to synchronize MPU to frame writing.
40	IOVCC	I/O power supply.
41	IOVCC	I/O power supply.
42	VCI	System power supply.
43	GND	Power ground
44	CTP_SCL	I2C clock line
45	CTP_SDA	I2C data line
46	CTP_IRQ	Interrupt
47	CTP_RES	CTP reset line
48	GND	Power ground
49	GND	Power ground
50	GND	Power ground

## 5. Absolute Maximum Ratings

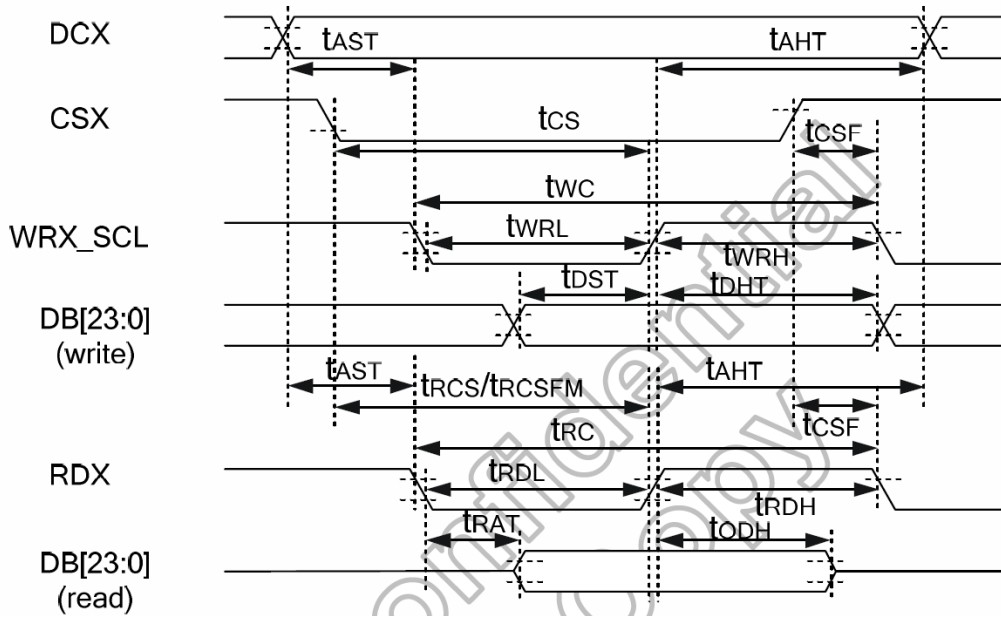
Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	IOVCC	-0.3	4.6	V
Analog Supply Voltage	VCC	-0.3	4.6	V
Input Voltage	V <sub>in</sub>	-0.3	IOVCC+0.5	V
Operating Temperature	T <sub>OP</sub>	-20	70	°C
Storage Temperature	T <sub>ST</sub>	-30	80	°C
Storage Humidity	HD	20	90	%RH

## 6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	-
Analog Supply Voltage	VCC	2.5	2.8	3.3	V	-
Input High Voltage	V <sub>IH</sub>	0.7IOVCC	-	IOVCC	V	Digital input pins
Input Low Voltage	V <sub>IL</sub>	GND	-	0.3IOVCC	V	Digital input pins
Output High Voltage	V <sub>OH</sub>	0.8IOVCC	-	IOVCC	V	Digital output pins
Output Low Voltage	V <sub>OL</sub>	GND	-	0.2IOVCC	V	Digital output pins
I/O Leak Current	I <sub>LI</sub>	-1.0	-	1.0	uA	-

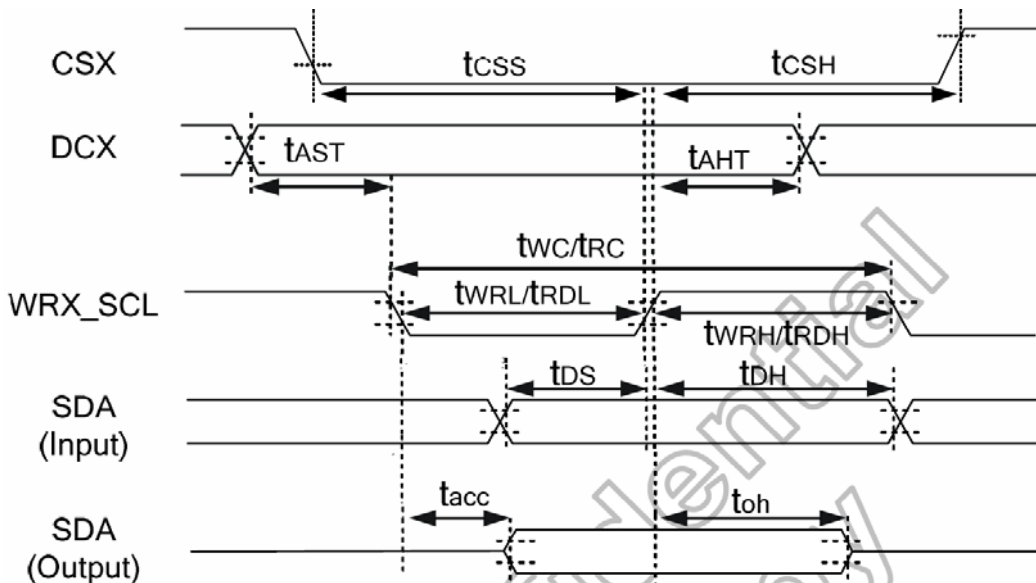
## 7. Timing Characteristics

### 7.1 i80-System Interface Timing Characteristics



Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DCX	$t_{AST}$	Address setup time	0	-		
	$t_{AHT}$	Address hold time (Write/Read)	10	-	ns	-
CSX	$t_{CS}$	Chip select setup time (Write)	10	-		
	$t_{RCS}$	Chip select setup time (Read register)	45	-	ns	-
	$t_{RCSFM}$	Chip select setup time (GRAM)	355	-		
	$t_{CSTF}$	Chip select wait time (Write/Read)	10	-		
WRX_SCL	$t_{WC}$	Write cycle (write register)	50	-		
	$t_{WC}$	Write cycle (write GRAM@SLPOUT)	47	-		
	$t_{WC}$	Write cycle (write GRAM@SLPIN)	100	-	ns	-
	$t_{WRH}$	Control pulse "H" duration	15	-		
	$t_{WRL}$	Control pulse "L" duration	15	-		
RDX	$t_{RC}$	Read cycle (read register)	160	-		
	$t_{RC}$	Read cycle (GRAM)	450	-		
	$t_{RDH}$	Control pulse "H" duration	90	-	ns	-
	$t_{RDL}$	Control pulse "L" duration (read register)	35	-		
	$t_{RDL}$	Control pulse "L" duration (GRAM)	345	-		
DB[23:0]	$t_{DST}$	Data setup time	10	-		
	$t_{DHT}$	Data hold time	10	-		
	$t_{RAT}$	Read access time (read register)	-	40	ns	For maximum $C_L=30pF$
	$t_{RAT}$	Read access time (GRAM)	-	340		For minimum $C_L=8pF$
	$t_{ODH}$	Output disable time	20	80		

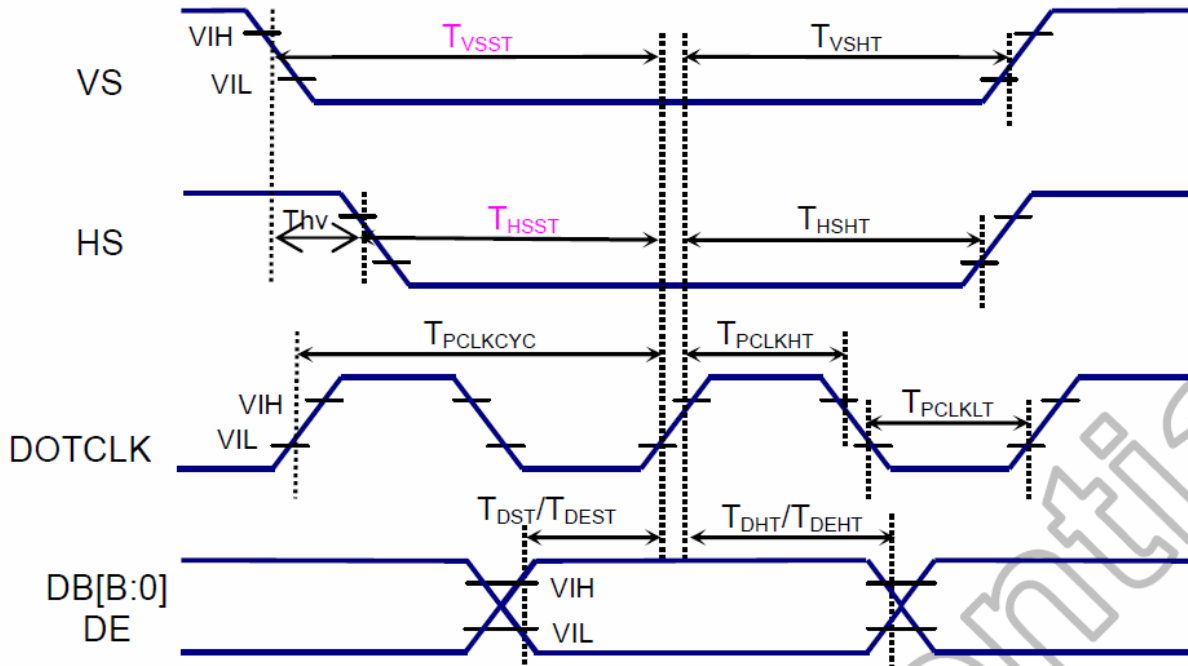
### 7.2 Display Serial Interface Timing Characteristics (SPI system)





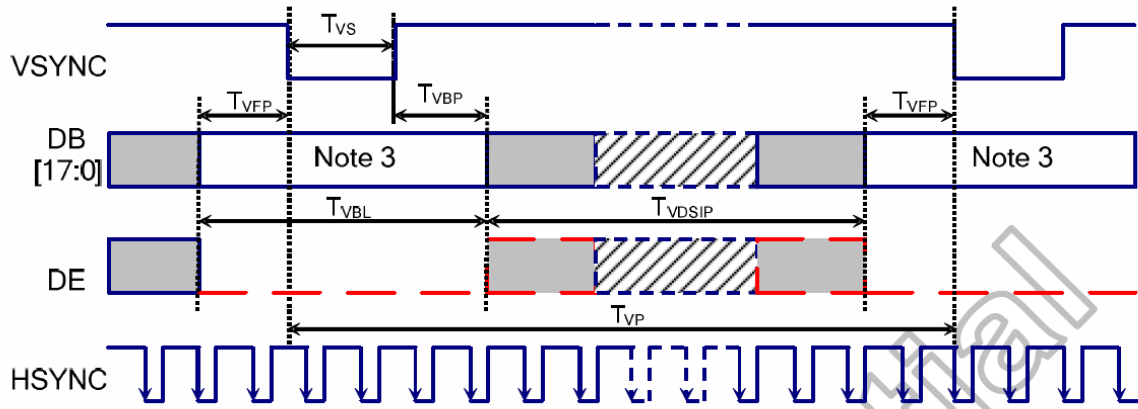
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	tcss	Chip select setup time (Write)	15	-	ns	-
	tcss	Chip select setup time (Read)	60	-		
	tcssh	Chip select hold time (Write)	15	-		
	tcssh	Chip select hold time (Read)	65	-		
DCX	tast	Address setup time	0	-	ns	-
	taht	Address hold time (Write/Read)	10	-		
WRX_SCL (Write)	twc	Write cycle	66	-	ns	-
	twrh	Control pulse "H" duration	15	-		
	twrl	Control pulse "L" duration	15	-		
WRX_SCL (Read)	trc	Read cycle	150	-	ns	-
	trdh	Control pulse "H" duration	60	-		
	trdl	Control pulse "L" duration	60	-		
SDA (Input)	tbs	Data setup time	10	-	ns	For maximum $C_L=30pF$ For minimum $C_L=8pF$
	tah	Data hold time	10	-		
SDA (Output)	tacc	Read access time	10	50	ns	
	tch	Output disable time	15	50		

### 7.3 RGB Interface Timing Characteristics

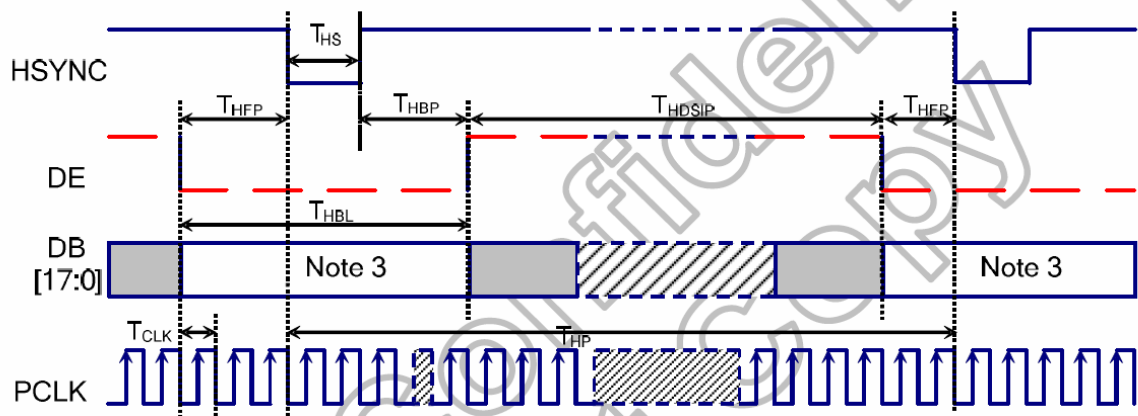


Item	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Pixel low pulse width	$T_{CLKLT}$		15	-	-	ns
Pixel high pulse width	$T_{CLKHT}$		15	-	-	ns
Vertical Sync. set-up time	$T_{VSST}$		15	-	-	ns
Vertical Sync. hold time	$T_{VSHT}$		15	-	-	ns
Horizontal Sync. set-up time	$T_{HSST}$		15	-	-	ns
Horizontal Sync. hold time	$T_{HSHT}$		15	-	-	ns
Data Enable set-up time	$T_{DEST}$		15	-	-	ns
Data Enable hold time	$T_{DEHT}$		15	-	-	ns
Data set-up time	$T_{DST}$		15	-	-	ns
Data hold time	$T_{DHT}$		15	-	-	ns
Phase difference of sync signal falling edge	$Thv$		0	-	320	Dotclk

### Vertical Timing for RGB I/F

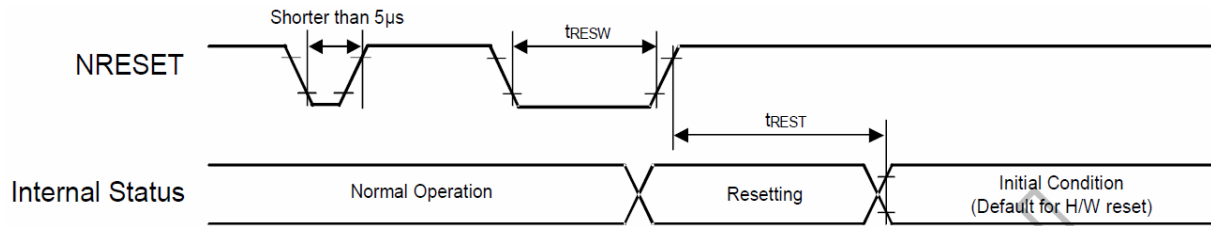


### Horizontal Timing for RGB I/F



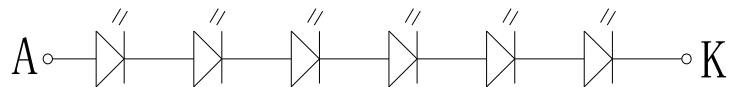
Item	Symbol	Condition	Specification			Unit
			Min.	Typ.	Max.	
<b>Vertical Timing</b>						
Vertical cycle period	$T_{VP}$	-	486	-	-	HS
Vertical low pulse width	$T_{VS}$	-	2	-	-	HS
Vertical front porch	$T_{VFP}$	-	2	-	-	HS
Vertical back porch	$T_{VBP}$	-	2	-	-	HS
Vertical blanking period	$T_{VBL}$	$T_{VBP} + T_{VFP}$	6	-	-	HS
Vertical active area	$T_{VDSIP}$	-	-	480	-	HS
			-		-	HS
			-		-	HS
Vertical refresh rate	$T_{VRR}$	Frame rate	50	60	70	Hz
<b>Horizontal Timing</b>						
Horizontal cycle period	$T_{HP}$	-	326	-	-	DOTCLK
Horizontal low pulse width	$T_{HS}$	-	2	-	-	DOTCLK
Horizontal front porch	$T_{HFP}$	-	2	-	-	DOTCLK
Horizontal back porch	$T_{HBP}$	-	2	-	-	DOTCLK
Horizontal blanking period	$T_{HBL}$	$T_{HBP} + T_{HFP}$	6	-	-	DOTCLK
Horizontal active area	$T_{HDISP}$	-	-	320	-	DOTCLK
Pixel clock cycle TVRR=60Hz	$f_{CLKCYC}$	-	9	-	-	MHz

## 7.4 Reset Timing Characteristics



Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width <sup>(1)</sup>	NRESET	10	-	-	-	µs
tREST	Reset complete time <sup>(2)</sup>	-	5	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

## 8. Backlight Characteristics



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	18.0	19.8	21.0	V	If=20mA
Supply Current	If	-	20	30	mA	-
Luminous Intensity for LCM	-	300	350	-	Cd/m <sup>2</sup>	If=20mA
Uniformity for LCM	-	80	-	-	%	If=20mA
Life Time	-	20000	-	-	Hr	If=20mA
Backlight Color	White					

## 9. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)	T (%)	—	—	(14.74)	—	—	
Contrast Ratio	CR	$\Theta=0$	400	500	—	—	(1)(2)
Response time	Rising	$T_R$	Normal viewing angle — —	(4)	(8)	msec	(1)(3)
	Falling	$T_F$		(12)	(24)		
Color gamut	S(%)			(60)		%	
Color chromaticity (CIE1931)	White	$W_x$		(0.283)	(0.303)	(0.323)	(1)(4) CF glass
		$W_y$		(0.305)	(0.325)	(0.345)	
	Red	$R_x$		(0.606)	(0.626)	(0.646)	
		$R_y$		(0.314)	(0.334)	(0.354)	
	Green	$G_x$		(0.257)	(0.277)	(0.297)	
		$G_y$		(0.529)	(0.549)	(0.569)	
	Blue	$B_x$		(0.122)	(0.142)	(0.162)	
$B_y$			(0.102)	(0.122)	(0.142)		
Viewing angle	Hor.	$\Theta_L$	CR>10	60	70	—	Viewing Angle base on using EWV Polarizer , Reference Only
		$\Theta_R$		60	70	—	
	Ver.	$\Theta_U$		60	70	—	
		$\Theta_D$		40	60	—	
Optima View Direction	12 O'clock						(5)

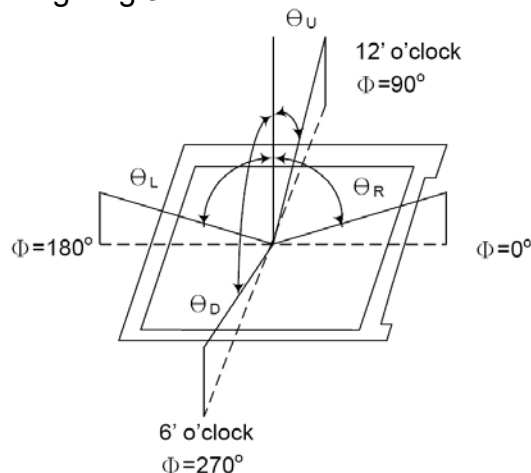
### Measuring Condition:

Dark room,  $25\pm 2^\circ\text{C}$ , 15min. warm-up time.

### Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle :

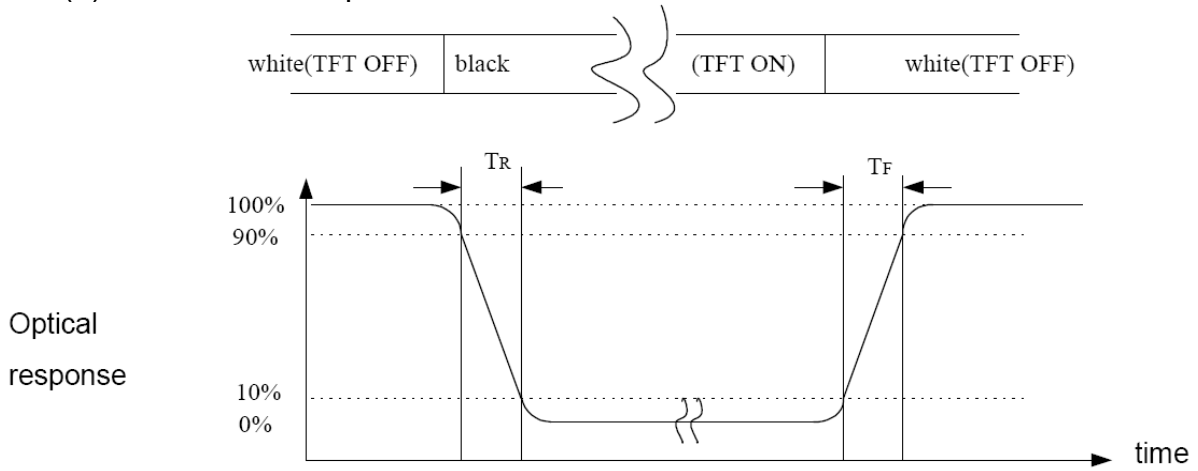


Note (2) Definition of Contrast Ratio(CR) :

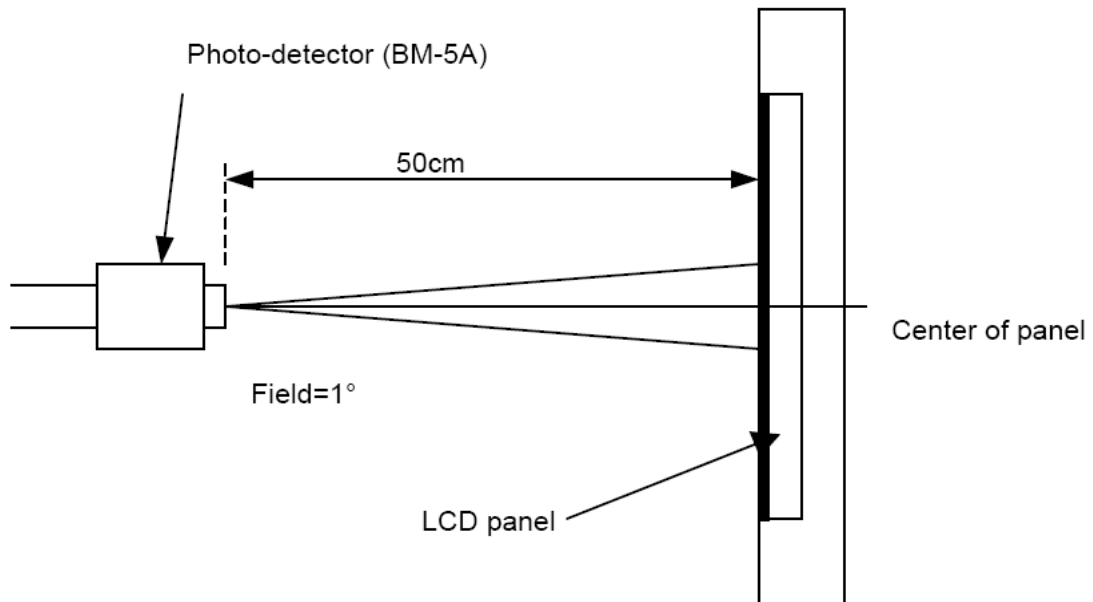
Measured at the center point of panel

$CR = \text{Luminance with all pixels white} / \text{Luminance with all pixels black}$

Note (3) Definition of Response Time : Sum of TR and TF



Note (4) Definition of optical measurement setup



## 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,Sealleak. 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 charateristic 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)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
⑨	ESD Test	Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times	

### REMARK:

- 1,The Test samples should be applied to only one test item.
- 2,Sample side for each test item is 5~10pcs.
- 3,For Damp Proof Test,Pure water(Resistance > 10MΩ)should be used.
- 4,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.
- 5,EL evaluation should be excepted 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.
- 6,Failure Judgment Criterion:Basic Specification Electrical Characteristic,Mechanical Characteristic,Optical Characteristic.

## 11. Inspection Standard

This standard apply to C-STN/TFT module

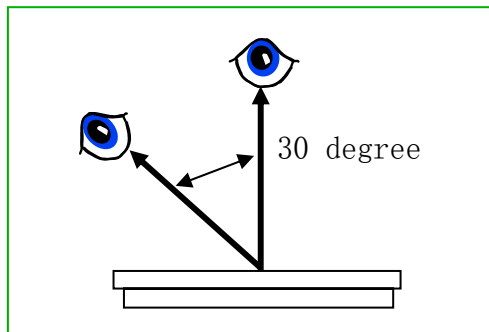
### 1. Spot check plan:

According to spot check level II ,MIL-STD-105D Level II ,the rank of accept or reject is below:

3A 级、2A 级 : major non-conformance : AQL 0.25 minor non-conformance : AQL 0.4

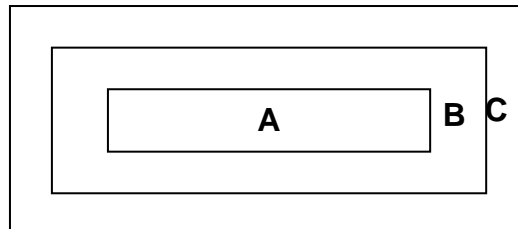
A 级 : major non-conformance : AQL 0.65 minor non-conformance : AQL 1.

### 2. Inspection condition:



Under daylight lamp 20~40W, product distance inspector'eye 30cm,incline degree 30°.

### 3. LCD area define:



Area A: display area

Area B: VA area

Area C: out of VA area,not in sight after assembly

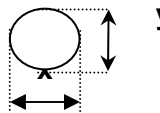
Remark :non-conformance at area C,but is OK that isn't influence raliability of product & assembly by customer.

#### 4. Inspection standard

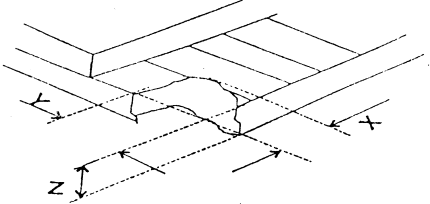
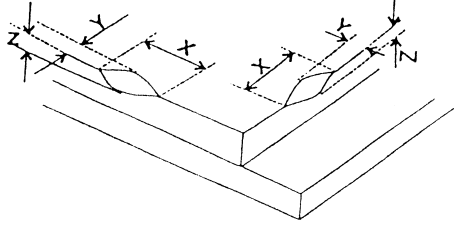
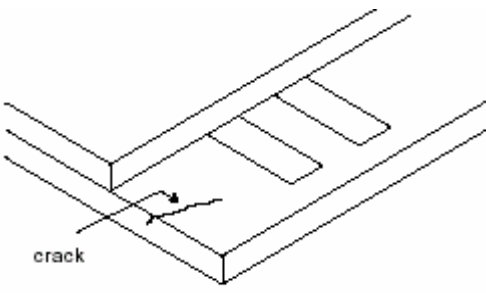
##### 4.1 Major non-conformance

NO.	Item	Inspection standard	Rate
4.1.1	Function non-conformance	1) No display, display abnormaly 2) Miss line, short 3) B/L no function or function abnormaly 4) TP no function	major
4.1.2	miss	No matter miss what component	
4.1.3	Out of size	Module dimension out of spec	

##### 4.2 Appearance non-conformance

NO.	Item	Inspection standard	Rate																														
4.2.1	Black or white spot (power on)	<b>dot non-conformance define <math>\Phi</math></b> $\Phi = \frac{(x+y)}{2}$ 	Minor																														
		<b>A grade</b> <table border="1"> <thead> <tr> <th rowspan="2">area size (mm)</th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td colspan="3">ignore</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.15</math></td> <td colspan="3">3</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.20</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td colspan="3">1</td> </tr> <tr> <td><math>0.25 &lt; \Phi</math></td> <td colspan="3">0</td> </tr> </tbody> </table> <p>Most approve 4 damages, dot to dot <math>\geq 10\text{mm}</math></p>		area size (mm)	Most approve q'ty			A	B	C	$\Phi \leq 0.10$	ignore			$0.10 < \Phi \leq 0.15$	3			$0.15 < \Phi \leq 0.20$	2			$0.20 < \Phi \leq 0.25$	1			$0.25 < \Phi$	0					
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4.2.2	Black or white line (power on)	<b>A grade</b> <table border="1"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>L(length)</th> <th>W(width)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>ignore</td> <td><math>W \leq 0.03</math></td> <td colspan="3">ignore</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.05 &lt; W \leq 0.07</math></td> <td colspan="3">1</td> </tr> <tr> <td></td> <td><math>0.07 &lt; W</math></td> <td colspan="3">Treat with dot non-conformance</td> </tr> </tbody> </table> <p>Most approve 3 damages, line to line <math>\geq 10\text{mm}</math></p>	Size(mm)		Most approve q'ty			L(length)	W(width)	A	B	C	ignore	$W \leq 0.03$	ignore			$L \leq 5.0$	$0.03 < W \leq 0.05$	2			$L \leq 3.0$	$0.05 < W \leq 0.07$	1				$0.07 < W$	Treat with dot non-conformance			Minor
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4.2.3	<b>Polarizer position</b>	1) polarizer attach meet drawing, disallow out of LCD. 2) polarizer must cover display area (special require unless)	<b>Minor</b>													
4.2.4	<b>LCD non-conformance</b>	<p>(i) crash at side (remark: S=ITO length)</p>  <table border="1" data-bbox="557 546 1192 642"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0</td> <td>≤S</td> <td>ignore</td> </tr> </tbody> </table> <p>Crash disallow extend to ITO or seal.</p> <p>(ii) commonly surface scathe</p>  <table border="1" data-bbox="534 981 1214 1077"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤2.0</td> <td>&lt;frame edge</td> <td>ignore</td> </tr> </tbody> </table> <p>(iii) crack Disallow extend crack</p> 	X	Y	Z	≤3.0	≤S	ignore	X	Y	Z	≤2.0	<frame edge	ignore	<b>Minor</b>	
X	Y	Z														
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4.2.5	<b>Contrast voltage warp</b>	VOP/Vlcd voltage of confirmed sample ±0.15V	<b>Minor</b>													
4.2.6	<b>color</b>	Color & luminance of module scope reference spec	<b>Minor</b>													
4.2.7	<b>Cross talk</b>	Reference confirmed limit sample	<b>Minor</b>													

## 12. Handling Precautions

### 12.1 Mounting method

The LCD panel of SC LCD 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 Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, 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 direct 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.
- A 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 storage

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 GT LCD , 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

