

深圳市优智景科技有限公司

ROUND TFT LCD MODULE

1.28 inch 240RGB*240DOTS

MODULE NUMBER: **UN128R-IF10-TP**

REVISION: **A**

Customer:
Approved by

From: Shenzhen unvision Technology Inc.
Approved by

Notes:

1. Please contact Shenzhen unvision Technology Inc. before assigning your product based on this module specification
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by unVISION Technology Inc. for any intellectual property claims or other problems that may result from application based on the module described herein.

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Revised History

Part Number	Revision	Revision Content	Revised on
LH128R-IF10-TP	A	New	2021-06-18

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Revision History

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1. General Description

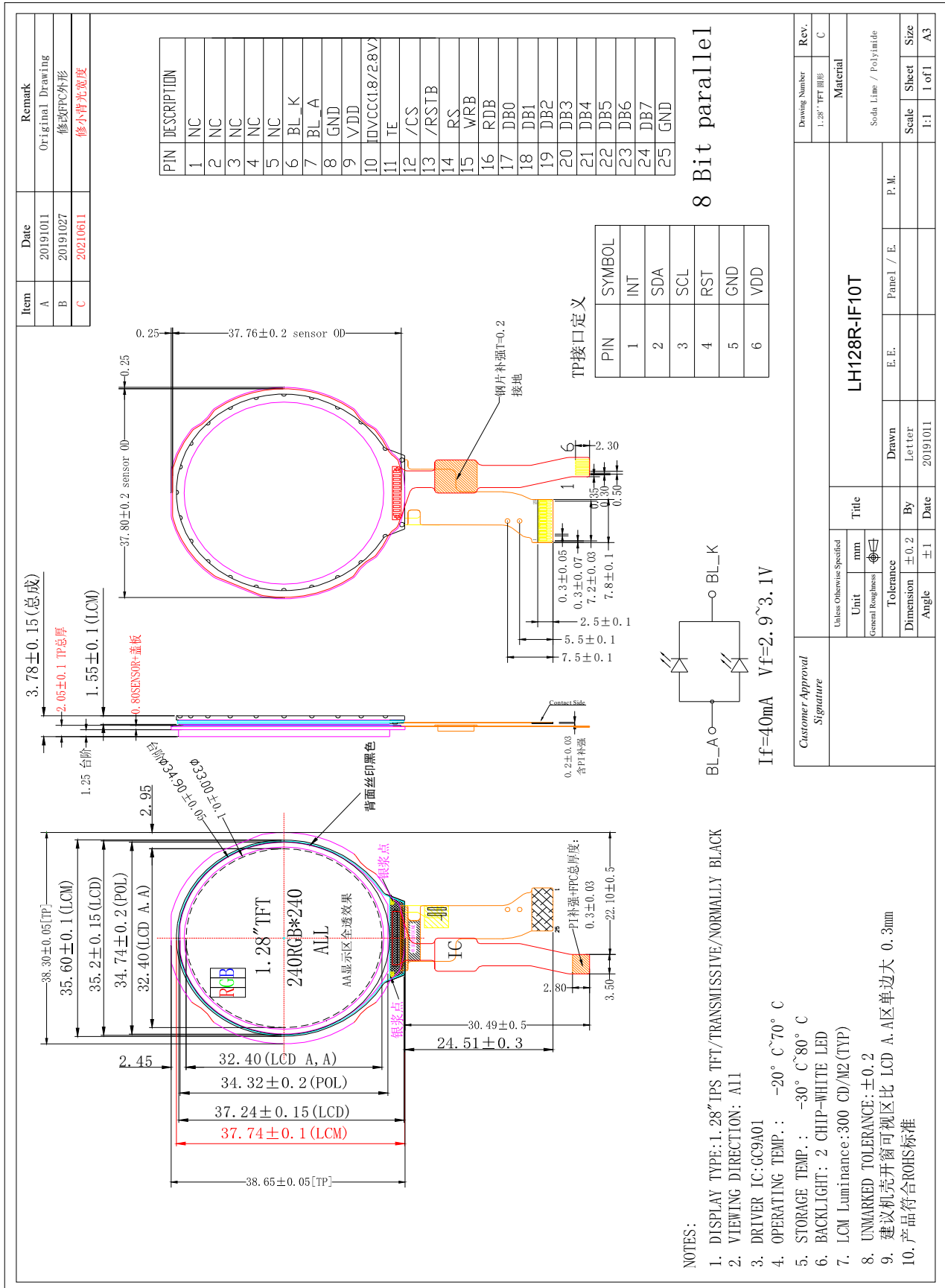
1.1 Description

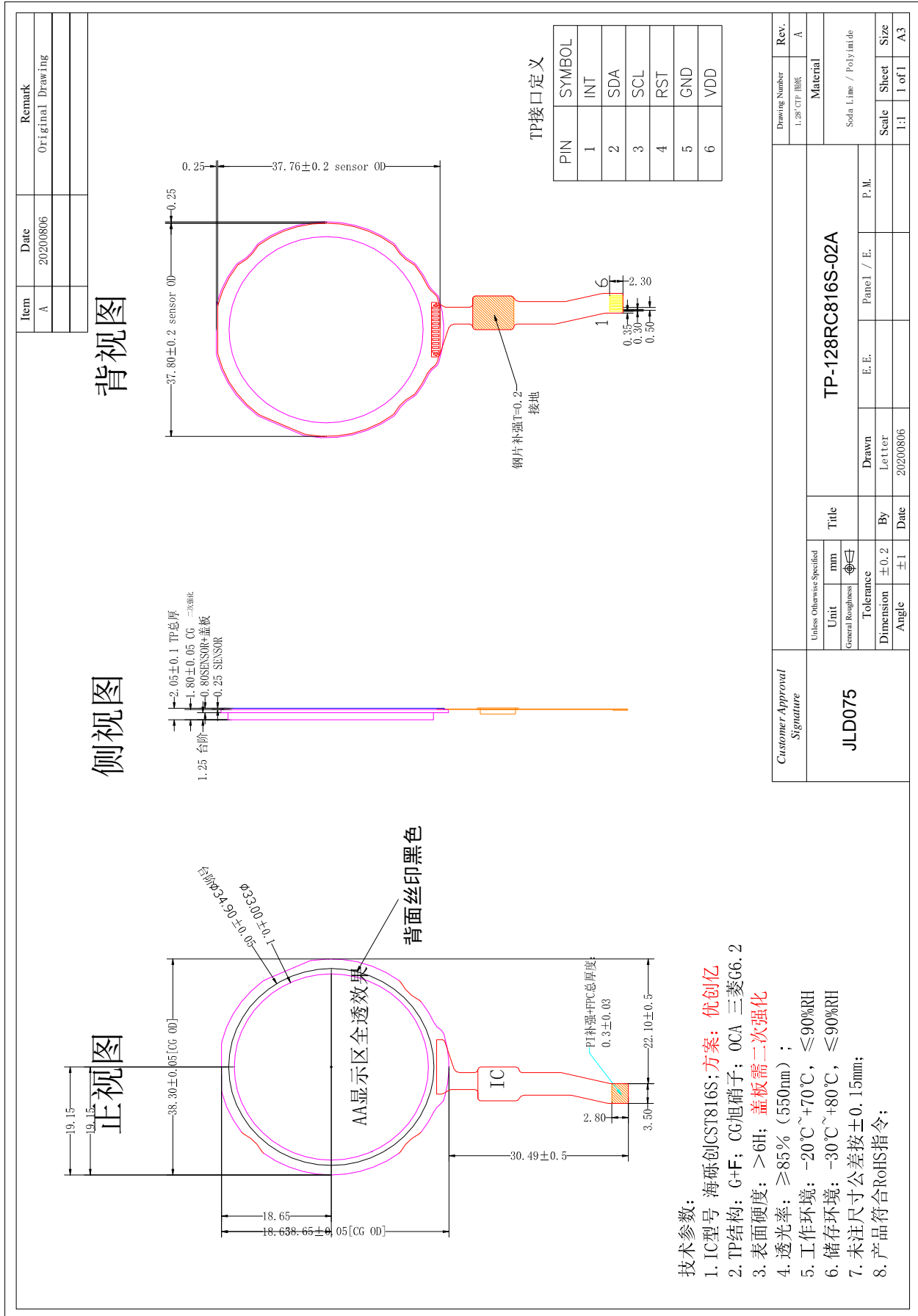
LH128R-IF10-TP is a 240RGBX240 dot-matrix TFT LCD module. This module is composed of a TFT LCD Panel, driver ICs, FPC , a Backlight and a CTP unit.

1.2 Features

NO.	Item	Contents	Unit
1	LCM Size	1.28	inch
2	CTP Type	G+F	
3	Display Mode	Normally black	-
4	Resolution	240(H)RGB x240(V)	pixels
5	Pixel pitch	0.135(H) x 0.135(V)	mm
6	Active area	Ø32.4	mm
7	Module size	38.3(H) x 38.65(V) x3.78 (D)	mm
8	Pixel arrangement	RGB Vertical stripe	-
9	LCM Interface	8 Bit 8080 MCU	-
10	CTP Interface	I2C	
11	Display Colors	262K	colors
12	LCM Drive IC	GC9A01	-
13	CTP Drive IC	CST816S	-
14	CTP Light transmissivity	≥85%	
15	Luminance(cd/m2)	300 (TYP)	Cd/m2
16	Viewing Direction	All View	Best image
17	Backlight	2 White LED Parallel	-
18	Surface Hardness	≥6H	-
19	Operating Temp.	-10°C~ + 60°C	°C
20	Storage Temp.	-20°C~+ 70°C	°C
21	Weight	TBD	g

2. Mechanical Drawing





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3. Pin Definition

LCM FPC Connector is used for the module electronics interface.

NO.	Symbol	Description
1	NC	No Connect
2	NC	No Connect
3	NC	No Connect
4	NC	No Connect
5	NC	No Connect
6	BL_K	LED Cathode
7	BL_A	LED Anode
8	GND	Power Ground.
9	VDD	Power Supply for Analog .VDD=2.5V-3.3V
10	IOVCC	Power Supply for I/O system .IOVCC=1.65V-3.3V
11	TE	Tearing effect signal is used to synchronize MCU to frame memory writing.
12	/CS	Chip selection pin ,Low enable ,High disable.
13	/RESET	This signal will reset the device ,Signal is active low.
14	RS	Display data/command selection pin .
15	WRB	Write enable in MCU parallel interface.
16	RDB	Read MCU parallel interface
17	DB0	MCU parallel interface data
18	DB1	MCU parallel interface data
19	DB2	MCU parallel interface data
20	DB3	MCU parallel interface data
21	DB4	MCU parallel interface data
22	DB5	MCU parallel interface data
23	DB6	MCU parallel interface data
24	DB7	MCU parallel interface data
25	GND	Power Ground.

CTP FPC Connector is used for the module electronics interface.

NO.	Symbol	Description
1	TP_INT	External interrupt to the host
2	TP_SDA	I2C data input and output
3	TP_SCL	I2C clock input
4	TP_RST	This signal will reset the TP, Signal is active low.
5	GND	Power Ground.
6	TP_VDD	Analog Power Supply for TP

Note:

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	MAX	Unit	Notes
Supply Voltage (I/O)	VDD	-0.3	4.6	V	
Analog Supply Voltage	VDDIO	-0.3	4.6	V	
Logic Input Voltage	VIN	-0.3	VDDIO+0.3	V	
Operation Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	

4.2 Operating Conditions

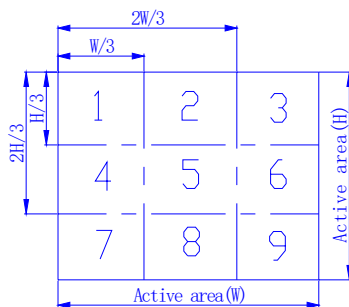
Parameter	Symbol	Min	TYP	MAX	Unit	Notes
System Voltage	VDD	2.5	2.8	3.3	V	
Interface Operation Voltage	VDDIO	1.65	1.8	3.3	V	
Gate Driver High Voltage	VGH	12	-	13	V	
Gate Driver Low Voltage	VGL	-11	-	-8	V	
Operating Current for V _{DD}	I _{DD}	-	8.5	10.5	mA	
Sleep_In Mode VDD	I _{dd}	-	15	30	uA	
Sleep_In Mode VDDIO	I _{ddio}	-	5	10	uA	

4.3 Backlight Unit

Parameter	Symbol	Min	TYP	MAX	Unit	Notes
Voltage for LED backlight	VLED	2.9	3.0	3.1	V	
Current for LED backlight	ILED	-	40	60	mA	2 LED
Power Consumption	Pbl	-	120	186	mW	1
Brightness	L _{br}	250	300	-	cd/m ²	2
LED Life time	-	20000	-	-	hr	3

Note:

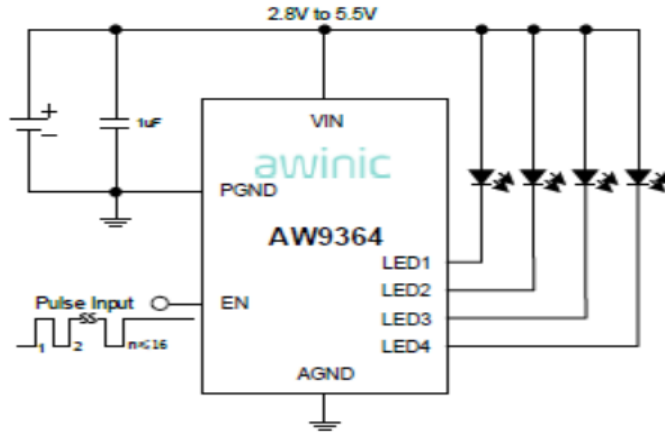
1. Where ILED = 40mA , VLED = 3.0V , Pbl = ILED x VLED
2. Uniform measure condition:
 - a: Measure 9 point , Measure location is show below:
 - b: Uniform = (Min brightness / Max brightness) x 100%
 - c: Best Contrast.



3. The environmental conducted under ambient air flow , at Ta = 25±2°C, 60%RH±5%

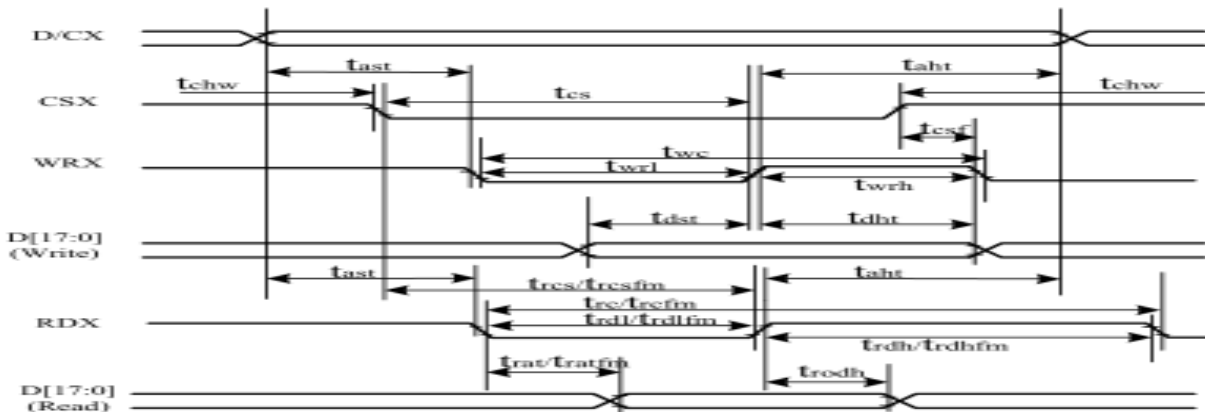
4.4 Backlight Recommended Circuit

Motherboard driver backlight is need constant current circuit , if threated voltage screen after light brightness difference . Current and power consumption of the machine are inconsistent , so recommend a backlight driving circuit is best rated current . It is recommended to use IC (AW9364) . The reference circuit is as follows:



4.5 AC Timing Characteristic of The LCD

8080 Series MCU Parallel interface Characteristics:

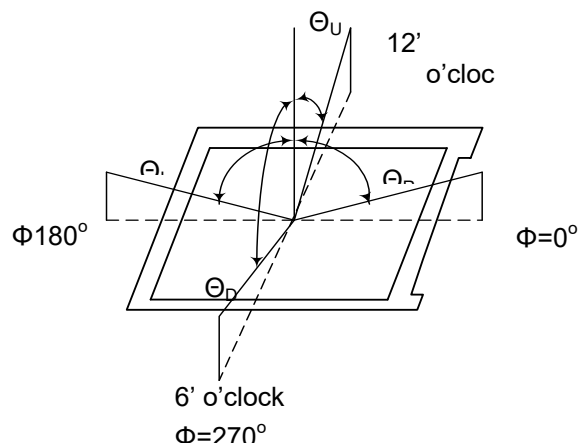


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time(Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time(Write)	15	-	ns	
	trcs	Chip Select setup time(Read ID)	45	-	ns	
	trcsfm	Chip Select setup time(Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write Cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX(FM)	trcfm	Read Cycle (FM)	380	-	ns	
	trdhfm	Read Control H duration(FM)	180	-	ns	
	trdlfm	Read Control L duration(FM)	200	-	ns	
RDX(ID)	trc	Read Cycle (ID)	160	-	ns	
	trdh	Read Control H pulse duration	90	-	ns	
	trdl	Read Control L pulse duration	70	-	ns	
D[17:0], D[15:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF
	tdht	Write data hold time	10	-	ns	

5. OPTICAL CHARACTERISTICS

Item	Symbol	Measuring Conditions		Min.	Typ.	Max.	Unit	Remark
Viewing Angle	θ	$\phi = 0^\circ$	25 °C	80	85	-	Deg	Note1
		$\phi = 180^\circ$	25 °C	80	85	-		
	θ	$\phi = 90^\circ$	25 °C	80	85	-		
		$\phi = 270^\circ$	25 °C	80	85	-		
Brightness	L_{br}	--	-	250	300	-	Cd/m2	
Luminance Uniformity	ΔL	--	-	70	75	-		
Contrast Ratio	CR	--	25 °C	900	1100	-	--	Note2
Response Time	T_r+T_f	$\theta = 0^\circ$ $\phi = 0^\circ$	25 °C	-	30	35	ms	Note3
Color of CIE Coordinate	White	X	25 °C	-0.03	0.291	+0.03	--	BM-7A
		Y	25 °C		0.308			
	Red	X	25 °C		0.614			
		Y	25 °C		0.348			
	Green	X	25 °C		0.350			
		Y	25 °C		0.598			
	Blue	X	25 °C		0.152			
		Y	25 °C		0.073			
Transmittance (with polarizer)	--	--	--	4.4	4.9	-	%	--

Note 1 Definition of Viewing Angle:

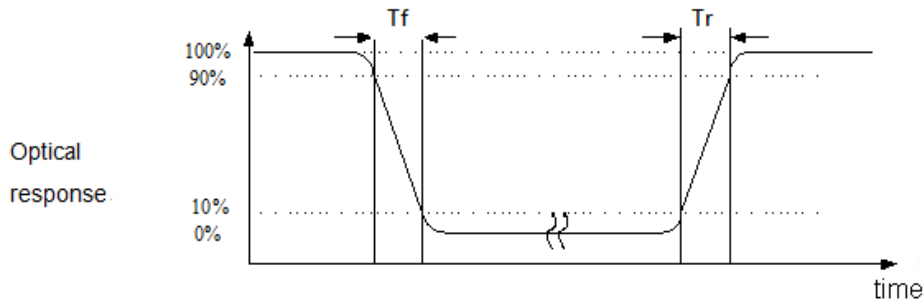


Note 2: Definition of Contrast Ratio (CR) :
measured at the center point of panel

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

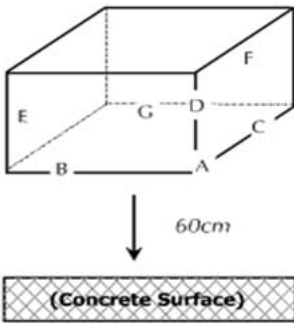
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Note 3: Definition of Response Time : Sum of Tr and Tf :



6. Reliability

Contents of Reliability Tests

No.	Item	Conditions	Note
1	High Temperature Operation	60°C±2°C, 96 hrs	
2	Low Temperature Operation	-10°C±2°C, 96 hrs	
3	High Temperature Storage	70°C±2°C, 96 hrs	
4	Low Temperature Storage	-20°C±2°C, 96 hrs	
5	High Temperature /Humidity Operation	60°C±2°C, 85% RH, 96 hrs	
6	Temperature Cycling	-10°C→25°C→60°C→25°C→-10°C 30min 5min 30min 5min 30min 10 cycle.	
7	Vibration Test	Total fixed amplitude:1.5mm. Vibration Frequency:10~55Hz One cycle 60 seconds to 3 direction of X,Y,Z each 15 minutes.	
8	ESD Test	Air Discharge:Apple ±4KV with 5 times. Contact Discharge:Apple ±2KV with 5 times.	
9	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  <i>Dropping method corner dropping:</i> <i>A corner: Once edge dropping.</i> <i>B, C, D edge: Once face dropping.</i> <i>E, F, G face: Once.</i>	

Note:

No charge on display and in operation under the following test condition.

Please note that the reliability test project requires the use of virgin samples

Condition : Unless otherwise specified ,tests will be conducted under the following condition.

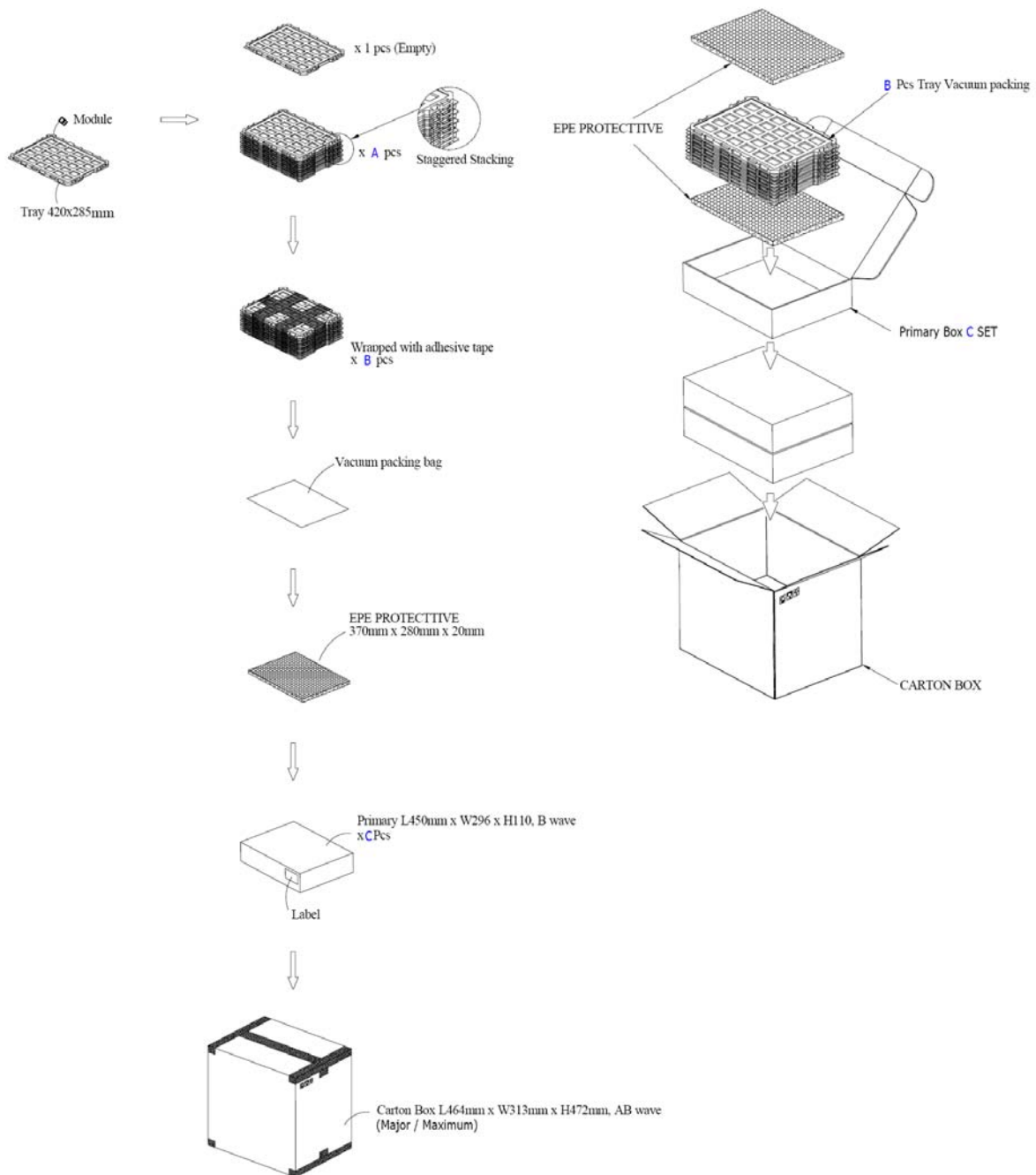
Temperature:20°C±5°C.

Humidity:65±5%RH.

Tests will be not conducted under functioning state.

7. Package Specifications

Item		Quantity	
Module		TBD	per Primary Box
Holding Trays	(A)	15	per Primary Box
Total Trays	(B)	16	per Primary Box (Including 1 Empty Tray)
Primary Box	(C)	1~4	per Carton (4 as Major / Maximum)

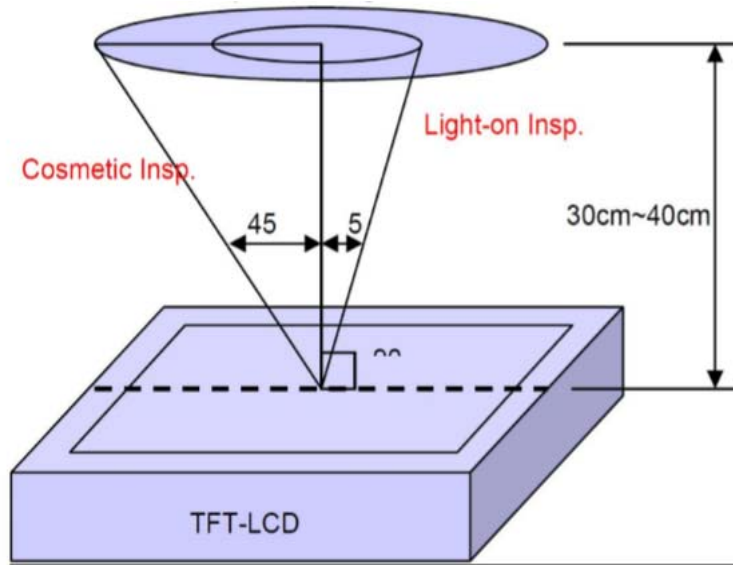


8. Incoming Inspection Standards

8.1. Inspection and Environment Conditions

8.1.1. Inspection Conditions:

- (1) Inspection Distance :35 cm±5cm
- (2) View Angle : Light-on Inspection Angle: ±5°
Cosmetic Inspection Angle: ±45°



(perpendicular to LCD panel surface)

8.1.2 Environment Conditions:

Ambient Temperature		23°C±5°C
Ambient Humidity		55±10%RH
Ambient Illumination	Cosmetic Inspection	More than 600 Lux
	Functional Inspection	300~500 Lux

8.1.3 Sampling Conditions:

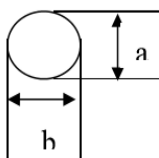
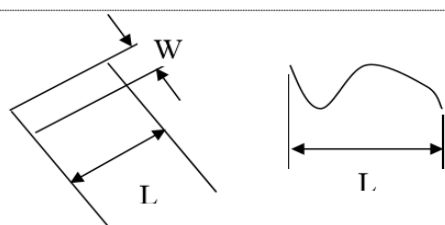
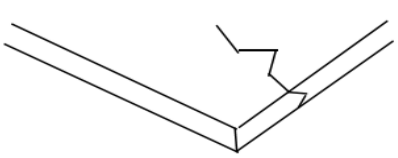
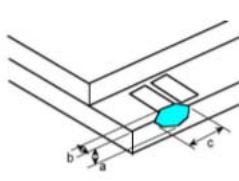
- (1) Lot Size:Quantity of shipment lot per model
- (2) Sampling Method:

Sampling Plan		MIL-STD-105E
		Normal Inspection, Single Sampling
		Level II
AQL	Major Defect	0.65%
	Minor Defect	1.5%

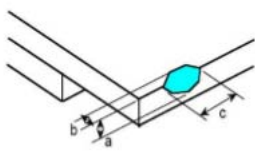
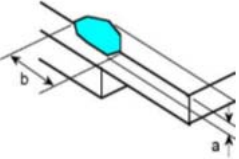
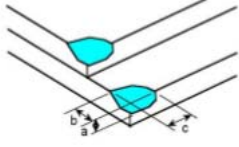
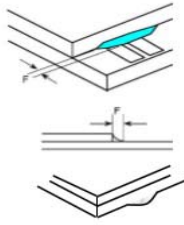
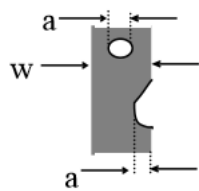
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8.1.4 Inspection Criteria


8.1.4.1 Cosmetic Inspection(Panel):

Check Item	Classification	Criteria(Unit: mm)																		
Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell.	Minor	 $\varphi = (a + b) / 2$ <table border="1" data-bbox="981 380 1380 716"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$\varphi \leq 0.10$</td> <td></td> <td>Ignore</td> </tr> <tr> <td>$0.10 < \varphi \leq 0.15$</td> <td></td> <td>2</td> </tr> <tr> <td>$0.15 < \varphi \leq 0.20$</td> <td></td> <td>1</td> </tr> <tr> <td>$0.20 < \varphi$</td> <td></td> <td>0</td> </tr> <tr> <td>Total</td> <td></td> <td>2 no include $\varphi \leq 0.10$</td> </tr> </tbody> </table> <p>Distance between 2 defects should more than 5mm apart.</p>	Size	Area	Acc. Qty	$\varphi \leq 0.10$		Ignore	$0.10 < \varphi \leq 0.15$		2	$0.15 < \varphi \leq 0.20$		1	$0.20 < \varphi$		0	Total		2 no include $\varphi \leq 0.10$
Size	Area	Acc. Qty																		
$\varphi \leq 0.10$		Ignore																		
$0.10 < \varphi \leq 0.15$		2																		
$0.15 < \varphi \leq 0.20$		1																		
$0.20 < \varphi$		0																		
Total		2 no include $\varphi \leq 0.10$																		
Black and White line Scratch Foreign material (Line type)	Minor	 <table border="1" data-bbox="798 1030 1316 1254"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td>$W \leq 0.03$</td> <td>Ignore</td> </tr> <tr> <td>$L \leq 2$</td> <td>$0.03 < W \leq 0.05$</td> <td>1</td> </tr> <tr> <td>/</td> <td>$0.05 < W$</td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>1</td> </tr> </tbody> </table> <p>Distance between 2 defects should more than 5mm apart. Scratches not viewable through the back of the display are acceptable.</p>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2$	$0.03 < W \leq 0.05$	1	/	$0.05 < W$	0	Total		1			
Length	Width	Acc. Qty																		
/	$W \leq 0.03$	Ignore																		
$L \leq 2$	$0.03 < W \leq 0.05$	1																		
/	$0.05 < W$	0																		
Total		1																		
Glass Crack	Minor	 <p>LCD with extensible crack line is unacceptable(When press the cracked LCD Area, the line will expand,we define it is extensible crack line)</p>																		
Glass Chipping Pad Area	Minor	 <table border="1" data-bbox="805 1814 1276 1926"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$c < 5.0, b < 0.4$</td> <td>Ignore</td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c < 5.0, b < 0.4$	Ignore														
Length and Width	Acc. Qty																			
$c < 5.0, b < 0.4$	Ignore																			

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Check Item	Classification	Criteria(Unit: mm)										
<p>Glass Chipping Rear Of Pad Area</p> 	Minor	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Length and Width</th> <th style="text-align: center;">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$c > 3.0, b < 1.0$</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$c < 3.0, b < 1.0$</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">$c < 3.0, b < 0.5$</td> <td style="text-align: center;">4</td> </tr> <tr> <td colspan="2" style="text-align: center;">$a < \text{Glass Thickness}$</td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>Glass Chipping Except Pad Area</p> 	Minor	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Length and Width</th> <th style="text-align: center;">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$c \leq 0.6, b < 5.0$</td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td colspan="2" style="text-align: center;">$a < \text{Glass Thickness}$</td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c \leq 0.6, b < 5.0$	Ignore	$a < \text{Glass Thickness}$					
Length and Width	Acc. Qty											
$c \leq 0.6, b < 5.0$	Ignore											
$a < \text{Glass Thickness}$												
<p>Glass Corner Chipping</p> 	Minor	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Length and Width</th> <th style="text-align: center;">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$c < 2.0, b < 1.5$</td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$c < 1.5, b < 2$</td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td colspan="2" style="text-align: center;">$a < \text{Glass Thickness}$</td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c < 2.0, b < 1.5$	Ignore	$c < 1.5, b < 2$	Ignore	$a < \text{Glass Thickness}$			
Length and Width	Acc. Qty											
$c < 2.0, b < 1.5$	Ignore											
$c < 1.5, b < 2$	Ignore											
$a < \text{Glass Thickness}$												
<p>Glass Burr</p> 	Minor	<p>Glass burr don't affect assemble and module dimension.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Length</th> <th style="text-align: center;">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$F < 0.5$</td> <td style="text-align: center;">Ignore</td> </tr> </tbody> </table>	Length	Acc. Qty	$F < 0.5$	Ignore						
Length	Acc. Qty											
$F < 0.5$	Ignore											
<p>FPC Defect</p> 	Minor	<ol style="list-style-type: none"> 1.Dent , pinhole width $a < W/2$. (W:circuitry width) 2.Open circuit is unacceptable. 3.No oxidation, contamination and distortion. 										
<p>Bubble on Polarizer</p>	Minor	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Diameter</th> <th style="text-align: center;">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\varphi \leq 0.15$</td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.15 < \varphi \leq 0.20$</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">$0.20 < \varphi \leq 0.30$</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$0.3 < \varphi$</td> <td style="text-align: center;">None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.15$	Ignore	$0.15 < \varphi \leq 0.20$	2	$0.20 < \varphi \leq 0.30$	1	$0.3 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.15$	Ignore											
$0.15 < \varphi \leq 0.20$	2											
$0.20 < \varphi \leq 0.30$	1											
$0.3 < \varphi$	None											

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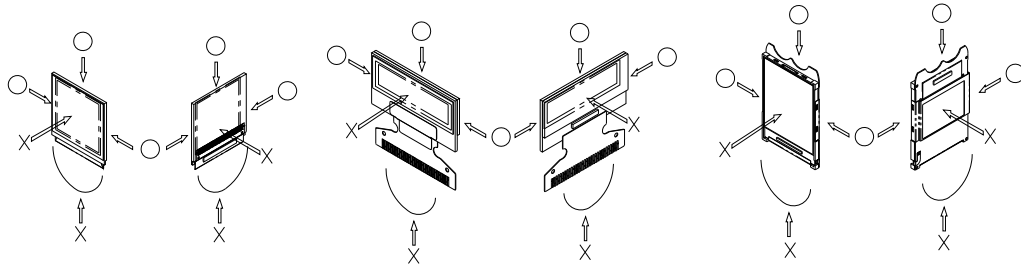
Check Item	Classification	Criteria(Unit: mm)										
Dent on Polarizer	Minor	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="804 297 1086 349">Diameter</th> <th data-bbox="1086 297 1275 349">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="804 349 1086 400">$\varphi \leq 0.15$</td> <td data-bbox="1086 349 1275 400">Ignore</td> </tr> <tr> <td data-bbox="804 400 1086 452">$0.15 < \varphi \leq 0.20$</td> <td data-bbox="1086 400 1275 452">2</td> </tr> <tr> <td data-bbox="804 452 1086 504">$0.20 < \varphi \leq 0.30$</td> <td data-bbox="1086 452 1275 504">1</td> </tr> <tr> <td data-bbox="804 504 1086 555">$0.3 < \varphi$</td> <td data-bbox="1086 504 1275 555">None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.15$	Ignore	$0.15 < \varphi \leq 0.20$	2	$0.20 < \varphi \leq 0.30$	1	$0.3 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.15$	Ignore											
$0.15 < \varphi \leq 0.20$	2											
$0.20 < \varphi \leq 0.30$	1											
$0.3 < \varphi$	None											
Screen deformation 	/	Test for insertion of plug gauge at highest warping point: $H \leq 0.25\text{mm}$ The client has special requirements, according to drawing.										
Bezel	/	1.No rust, distortion on the Bezel. 2.No visible fingerprints, stains or other contamination.										
Touch Panel	/	D:Diameter W: width L: length 1.Spot: $D \leq 0.2$ is acceptable $0.2 < D \leq 0.3$, acceptable Inspection and Environment Conditions 2dots are acceptable and the distance between defects Should more than 5mm. $D > 0.3$ is unacceptable 2.Dent: $D > 0.3$ is unacceptable. 3.Scratch: $W \leq 0.03, L \leq 10$ is acceptable, $0.03 < W \leq 0.1, L \leq 10$, acceptable Inspection and Environment Conditions Distance between 2 defects should more than 5 mm. $W > 0.1$ is unacceptable.										
PCB	/	1.No distortion or contamination on PCB terminals. 2.All components on PCB must same as documented on the BOM/component layout. 3.Follow IPC-A-600F.										
Soldering	/	Follow IPC-A-610C standard.										
Leak	/	Yellow light, OK。 White light, According to the limit sample										

Check Item	Classification	Criteria(Unit: mm)
Electrical Defect	Major	The below defects must be rejected. 1. Missing vertical / horizontal segment. 2. Abnormal Display. 3. No function or no display. 4. Current exceeds product specifications. 5. LCD viewing angle defect. 6. No Backlight. 7. Dark Backlight. 8. Touch Panel no function. 9. Dark Dot –one Allowed. 10. Bright Dot- one Allowed.

9. Precautions When Using These TFT Display Modules

9.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
- 2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- 3) If pressure is applied to the display surface or its neighborhood of the TFT display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- 4) The polarizer covering the surface of the TFT display module is soft and easily scratched. Please be careful when handling the TFT display module.
- 5) When the surface of the polarizer of the TFT display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
 - * Scotch Mending Tape No. 810 or an equivalent
 Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
 Also, pay attention that the following liquid and solvent may spoil the polarizer:
 - * Water
 - * Ketone
 - * Aromatic Solvents
- 6) Hold TFT display module very carefully when placing TFT display module into the system housing. Do not apply excessive stress or pressure to TFT display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



- 7) Do not apply stress to the driver IC and the surrounding molded sections.
- 8) Do not disassemble nor modify the TFT display module.
- 9) Do not apply input signals while the logic power is off.

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- 10) Pay sufficient attention to the working environments when handing TFT display modules to prevent occurrence of element breakage accidents by static electricity.
 - * Be sure to make human body grounding when handling TFT display modules.
 - * Be sure to ground tools to use or assembly such as soldering irons.
 - * To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
 - * Protective film is being applied to the surface of the display panel of the TFT display module. Be careful since static electricity may be generated when exfoliating the protective film.
- 11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the TFT display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
- 12) If electric current is applied when the TFT display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

9.2 Storage Precautions

- 1) When storing TFT display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Limito technology Inc.)
At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
- 2) If electric current is applied when water drops are adhering to the surface of the TFT display module, when the TFT display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

9.3 Designing Precautions

- 1) The absolute maximum ratings are the ratings which cannot be exceeded for TFT display module, and if these values are exceeded, panel damage may be happen.
- 2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the V_{IL} and V_{IH} specifications and, at the same time, to make the signal line cable as short as possible.
- 3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (V_{DD}). (Recommend value: 0.5A)
- 4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- 5) As for EMI, take necessary measures on the equipment side basically.
- 6) When fastening the TFT display module, fasten the external plastic housing section.
- 7) If power supply to the TFT display module is forcibly shut down by such errors as taking out the main battery while the TFT display panel is in operation, we cannot guarantee the quality of this OEL display module.
- 8) The electric potential to be connected to the rear face of the IC chip should be as follows:
 - * Connection (contact) to any other potential than the above may lead to rupture of the IC.

9.4 Precautions when disposing of the TFT display modules

- 1) Request the qualified companies to handle industrial wastes when disposing of the TFT display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

9.5 Other Precautions

- 1) When an TFT display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur. Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
- 2) To protect TFT display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the TFT display modules.
 - * Pins and electrodes
 - * Pattern layouts such as the FPC

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- 3) With this TFT display module, the TFT driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this TFT driver is exposed to light, malfunctioning may occur.
 - * Design the product and installation method so that the TFT driver may be shielded from light in actual usage.
 - * Design the product and installation method so that the TFT driver may be shielded from light during the inspection processes.
- 4) Although this TFT display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- 5) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

10. Warranty:

The warranty period shall last twelve (12) months from the date of delivery. Buyer shall be completed to assemble all the processes within the effective twelve (12) months. Limito technology Inc. shall be liable for replacing any products which contain defective material or process which do not conform to the product specification, applicable drawings and specifications during the warranty period. All products must be preserved, handled and appearance to permit efficient handling during warranty period. The warranty coverage would be exclusive while the returned goods are out of the terms above.

11. Notice:

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