



ASI-T-350ZA3SRN/AC

ITEM	STANDARD VALUES	UNITS
LCD type	3.5" TFT	--
Dot arrangement	320(RGB)×480	dots
Color filter array	RGB vertical stripe	--
Display mode	IPS / Transmissive / Normally Black	--
Viewing Direction	80/80/80/80 deg(U/D/L/R @ C/R>10)	--
Driver IC	ST7796S	--
Module size	53.76(W)×84.18(H)×2.15(T)	mm
Active area	48.96(W)×73.44(H)	mm
Dot pitch	0.153(W)×0.153(H)	mm
Interface	SPI + 18-bit RGB interface	--
Operating temperature	-10 ~ +60	°C
Storage temperature	-20 ~ +70	°C
Back Light	6 White LED in parallel	--
Weight	TBD	g



Revision Record

REV NO.	REV DATE	CONTENTS	Note
V01	2017.12.19	NEW ISSUE	

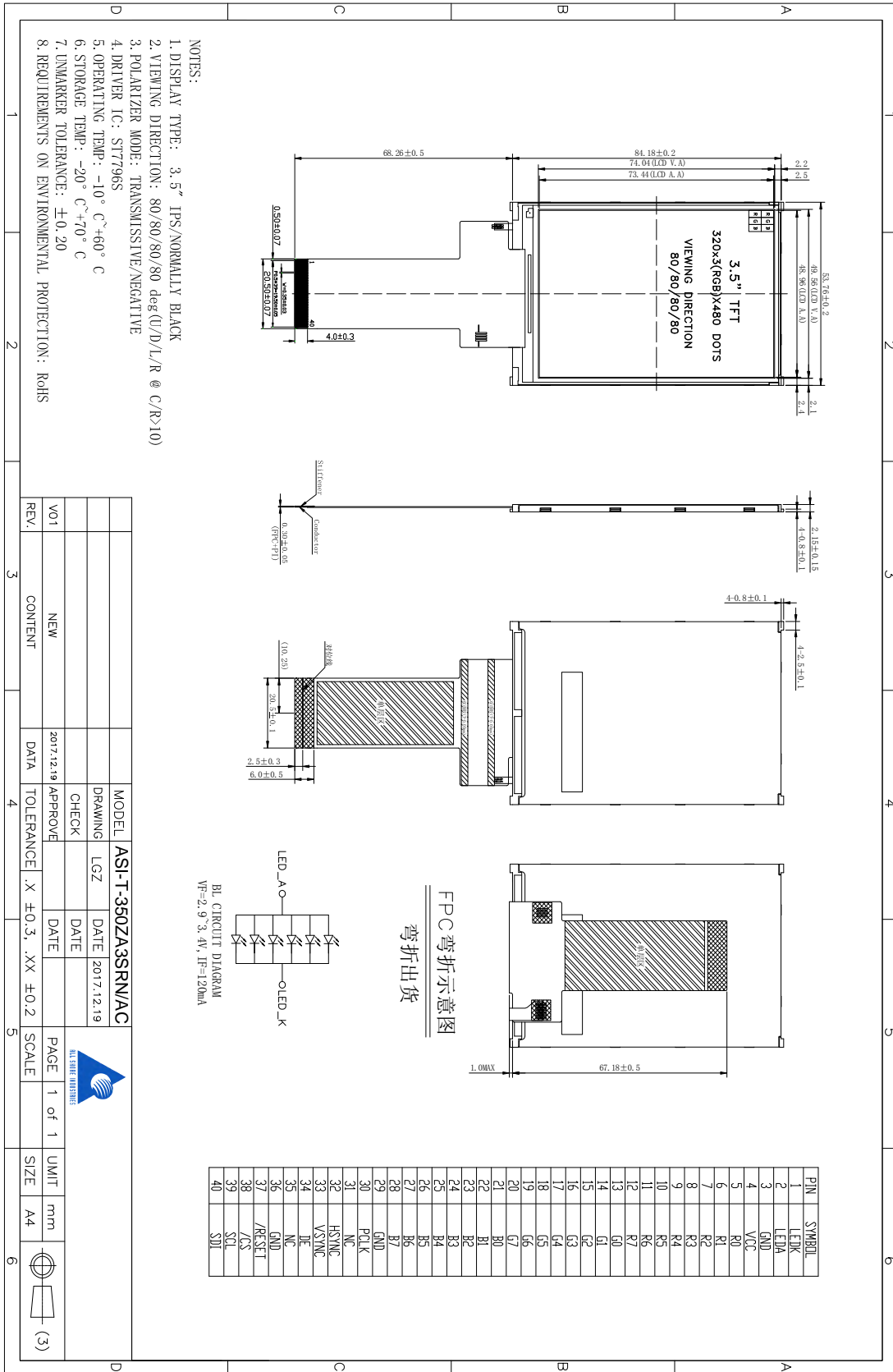
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2. General Information

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3. External Dimensions



4. Interface Description

Pin	Symbol	Description.
1	VLED-	LED backlight (Cathode).
2	VLED+	LED backlight (Anode).
3	GND	Ground.
4	VDD	Power supply.
5~12	R0~R7	Red Data.
13~20	G0~G7	Green Data.
21~28	B0~B7	Blue Data.
29	GND	Ground.
30	PCLK	Dot clock signal input. Latching input data at its rising edge.
31	NC	NC.
32	HSYNC	Horizontal sync input. Negative polarity.
33	VSYNC	Vertical sync input. Negative polarity.
34	DE	Data enable input. Active high to enable the input data bus.
35	NC	NC.
36	GND	Ground.
37	/RESET	Reset input pin, Active "L".
38	/CS	Chip select input pin ("Low" enable) in MPU I/F and SPI I/F.
39	SCL	Serial Clock when operates in the serial interface
40	SDI	Serial input signal in SPI I/F.

5. Absolute Maximum Ratings

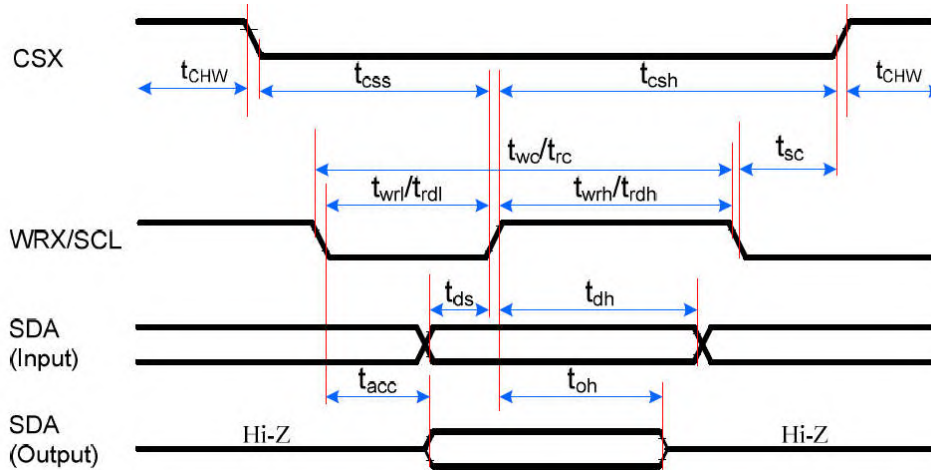
Item	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCC	-0.3	3.3	V
Input Voltage	Vin	-0.3	VCC+0.3	V
Operating Temperature	T _{OP}	-10	60	°C
Storage Temperature	T _{ST}	-20	70	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Supply Voltage	VCC	2.65	2.8	3.3	V	-
Input High Voltage	V _{IH}	0.7VCC	-	VCC	V	Digital input pins
Input Low Voltage	V _{IL}	GND	-	0.3VCC	V	Digital input pins
Output High Voltage	V _{OH}	0.8VCC	-	VCC	V	Digital output pins
Output Low Voltage	V _{OL}	GND	-	0.2VCC	V	Digital output pins
I/O Leak Current	I _{LI}	-1.0	-	1.0	uA	-

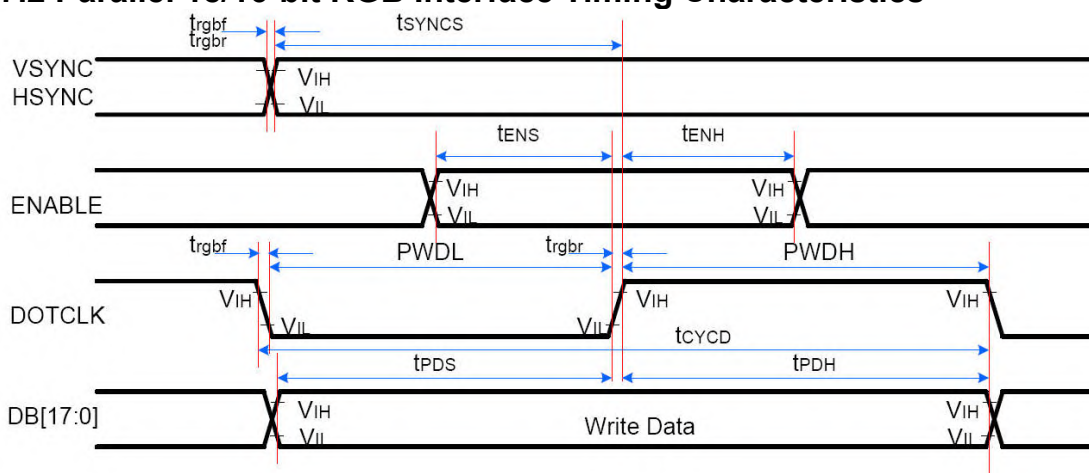
7. Timing Characteristics

7.1 Display Serial Interface Timing Characteristics (3-line SPI system)



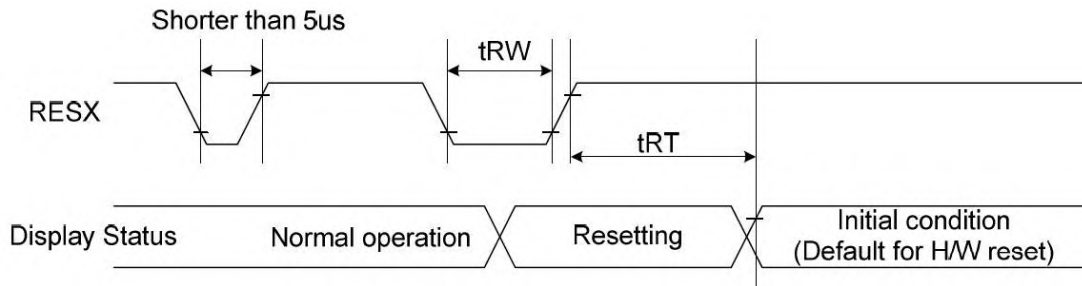
Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tsc	SCL-CSX	15	-	ns	
	tchw	CSX H Pulse Width	40	-	ns	
	tcss	Chip select time (Write)	60	-	ns	
	tcsh	Chip select hold time (Read)	65	-	ns	
SCL	twc	Serial Clock Cycle (Write)	66	-	ns	
	twrh	SCL H Pulse Width (Write)	15	-	ns	
	twrl	SCL L Pulse Width (Write)	15	-	ns	
	trc	Serial Clock Cycle (Read)	150	-	ns	
	trdh	SCL H Pulse Width (Read)	60	-	ns	
	trdl	SCL L Pulse Width (Read)	60	-	ns	
SDA/SDI (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	tacc	Access time (Read)	10	50	ns	For maximum CL=30pF
	toh	Output disable time (Read)	15	50	ns	For minimum CL=8pF

7.2 Parallel 18/16-bit RGB Interface Timing Characteristics



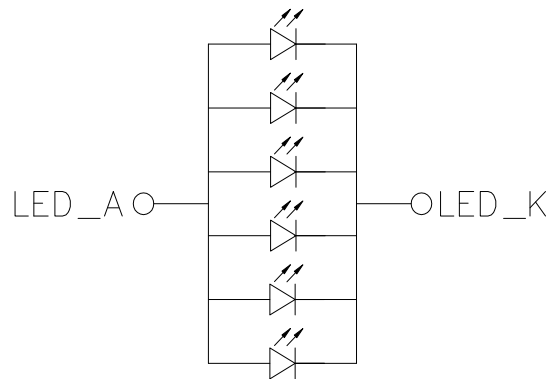
Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/HSYNC	t _{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	16-/18-/24-bit bus RGB interface mode
	t _{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t _{ENS}	ENABLE setup time	15	-	ns	
	t _{ENH}	ENABLE hold time	15	-	ns	
DB [23:0]	t _{POS}	Data setup time	15	-	ns	
	t _{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	20	-	ns	
	PWDL	DOTCLK low-level period	20	-	ns	
	t _{CYCD}	DOTCLK cycle time	50	-	ns	
	t _{qtr} , t _{qbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

7.3 Reset Timing Characteristics



Signal	Symbol	Parameter	Min	Max	Unit
RESX	t _{RW}	Reset pulse duration	10		uS
	t _{RT}	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

8. Backlight Characteristics



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	V _f	2.9	3.2	3.4	V	I _f =120mA
Supply Current	I _f	-	120	150	mA	-
Luminous Intensity for LCM	-	260	300	-	Cd/m ²	I _f =120mA
Life Time	-	20000	-	-	Hr	I _f =120mA
Backlight Color	White					

9. Optical Characteristics

Item	Symbol	Conditions	Specifications (typ)	Unit	Note
Transmittance	T%	Viewing normal angle $q_x = q_y = 0^\circ$	4.3	%	All left side data are based on INX's following condition – 1.CG : NTSC 69% 2.AR : 67.5% 3.Light Source : INX LED BLU 4.Machine : DMS 803 5. Vwhite > 5.0 V, Vdark < 0.3V 6. Polarizer : NPF-TEGQ1465DUHC
Contrast Ratio	CR		700	--	
Response Time	Ton+ Toff		30	ms	
Viewing Angle	Hor.	q_{x+}	80	deg.	
		q_{x-}	80		
	Ver.	q_{y+}	80		
		q_{y-}	80		
CF only Chromaticity	Red	X_R	0.660	--	Under C light Simulation
		Y_R	0.325	--	
	Green	X_G	0.277	--	
		Y_G	0.568	--	
	Blue	X_B	0.145	--	
		Y_B	0.072	--	
	White	X_W	0.309	--	
		Y_W	0.332	--	

*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

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

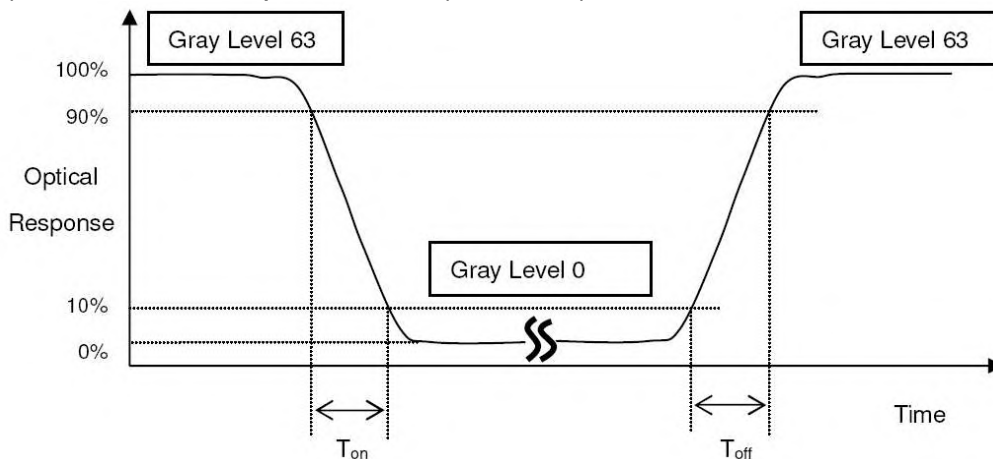
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

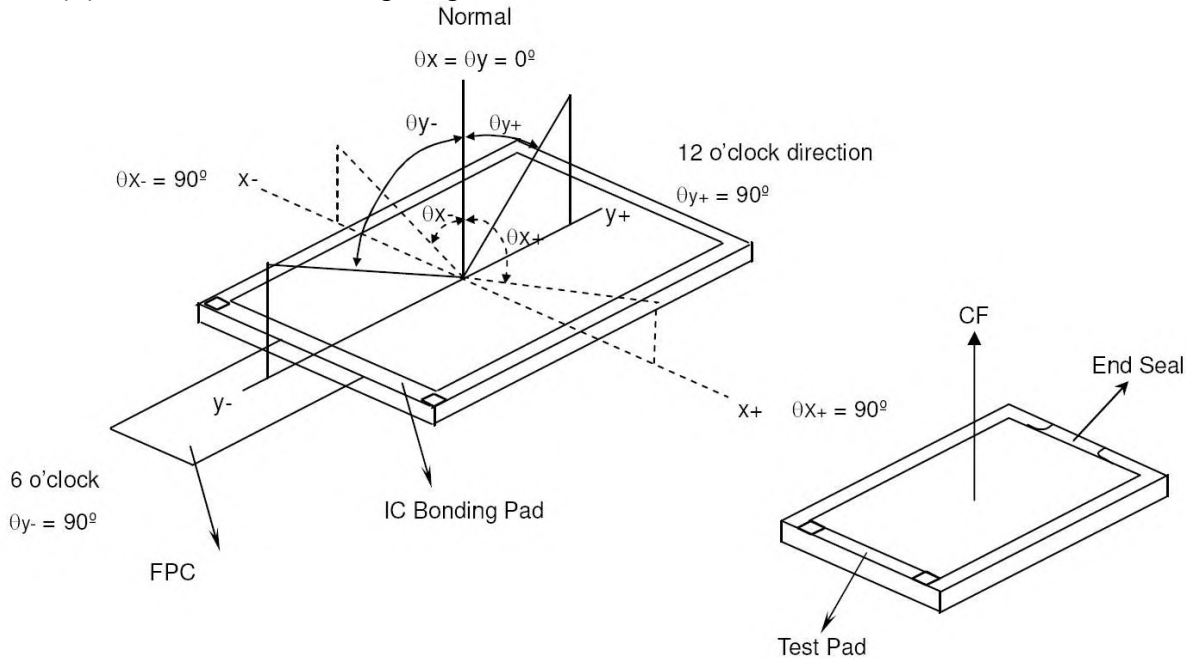
$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

*Note (2) Definition of Response Time (Ton, Toff):

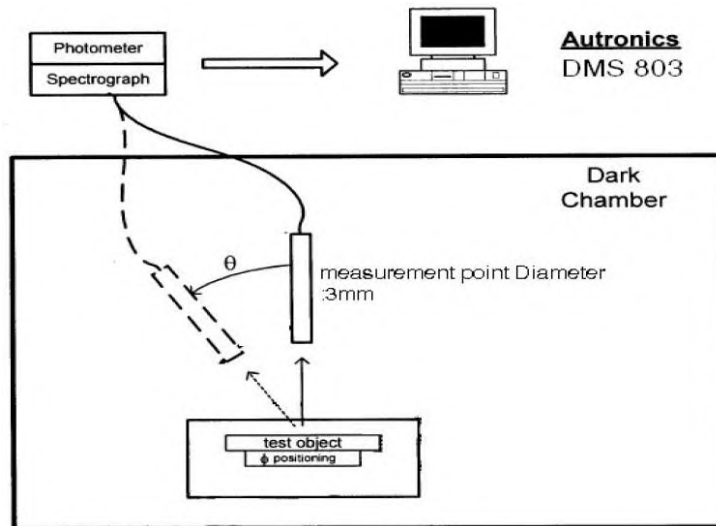


***Note(3) Definition of Viewing Angle**



***Note (4) Measurement Set-Up:**

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



10. Reliability Test Conditions And Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	70°C±2°C×96Hours	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	-20°C±2°C×96Hours	
③	High Temperature Operating	60°C±2°C×96Hours	
④	Low Temperature Operating	-10°C±2°C×96Hours	
⑤	Temperature Cycle(Storage)	$ \begin{array}{c} -10^{\circ}\text{C} \begin{array}{c} \longleftrightarrow \\ (30\text{min}) \end{array} 25^{\circ}\text{C} \begin{array}{c} \longleftrightarrow \\ (5\text{min}) \end{array} 60^{\circ}\text{C} \\ \begin{array}{c} \longleftarrow \\ (30\text{min}) \end{array} \quad \begin{array}{c} \longrightarrow \\ (30\text{min}) \end{array} \\ \text{1cycle} \\ \text{Total 10cycle} \end{array} $	
⑥	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
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 TFT module

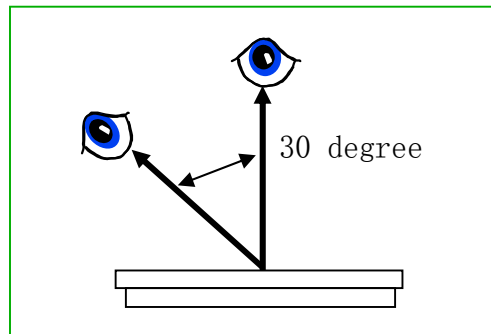
1. Spot check plan:

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

3A & 2A Levels: major non-conformance: AQL 0.25;
 minor non-conformance: AQL 4.0

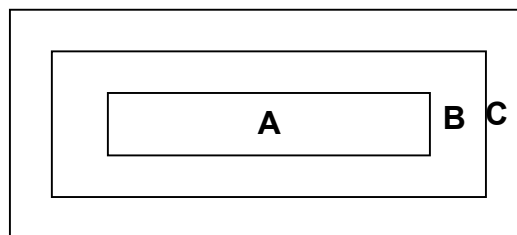
A Level: major non-conformance : AQL0.65; minor non-conformance : AQL 1.

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

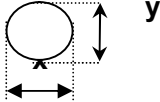
Remark :non-conformance at area C,but is OK that isn't influence raliability of product & assembly by customer.

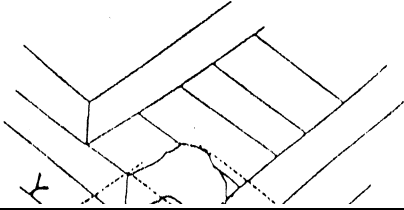
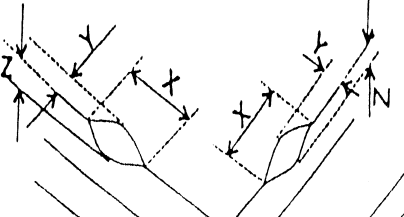
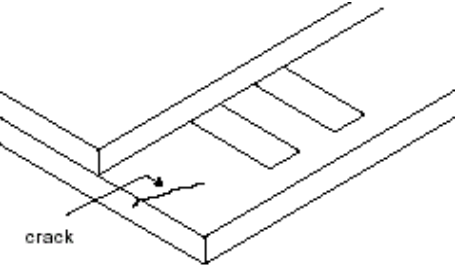
4. Inspection standard

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)	dot non-conformance define Φ $\Phi = \frac{(x+y)}{2}$ 	Minor																														
		A grade <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>$\Phi \leq 0.10$</td> <td colspan="3">ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td>3</td> <td colspan="2" rowspan="3">ignore</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td>2</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> <td colspan="2"></td> </tr> </tbody> </table> <p>Most approve 4 damages, dot to dot $\geq 10\text{mm}$</p>		area size (mm)	Most approve q'ty			A	B	C	$\Phi \leq 0.10$	ignore			$0.10 < \Phi \leq 0.15$	3	ignore		$0.15 < \Phi \leq 0.20$	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)	A grade <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>$W \leq 0.03$</td> <td colspan="3">ignore</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="3">2</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.05 < W \leq 0.07$</td> <td colspan="3">1</td> </tr> <tr> <td></td> <td>$0.07 < W$</td> <td colspan="3">Treat with dot non-conformance</td> </tr> </tbody> </table> <p>Most approve 3 damages, line to line $\geq 10\text{mm}$</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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	$0.07 < W$	Treat with dot non-conformance																															

4.2.3	Polarizer position	1) polarizer attach meet drawing, disallow out of LCD. 2) polarizer must cover display area (special require unless)	Minor													
4.2.4	LCD non-conformance	<p>(i) crash at side (remark: S=ITO length)</p>  <table border="1" data-bbox="534 645 1137 734"> <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="513 1057 1158 1146"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤2.0</td> <td><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	Minor	
X	Y	Z														
≤3.0	≤S	ignore														
X	Y	Z														
≤2.0	<frame edge	ignore														
4.2.5	Contrast voltage warp	VOP/Vlcd voltage of confirmed sample ±0.15V	Minor													
4.2.6	color	Color & luminance of module scope reference spec	Minor													
4.2.7	Cross talk	Reference confirmed limit sample	Minor													



12. Handling Precautions

12.1 Mounting method

The 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 V_{dd} or V_{ss}, 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, 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

