



## ASI-T-2001EA1EN/AU

ITEM	STANDARD VALUES
LCD type	2.0" TFT
Dot arrangement	320RGB * 240
Color filter array	RGB vertical stripe
Display mode	AIFF / Transflective / Normally Black
Viewing direction	ALL
Driver IC	ILI9342C
Module size	46.10(W) * 40.96(H) * 2.53(T)
Active area	40.8(H) * 30.6 (V)
Dot pitch	0.0425(W) * 0.1275(H)
Interface	18bit RGB and 3/4 wire SPI
Operating temperature	-20 ~ +70
Storage temperature	-30 ~ +80
Weight	TBD



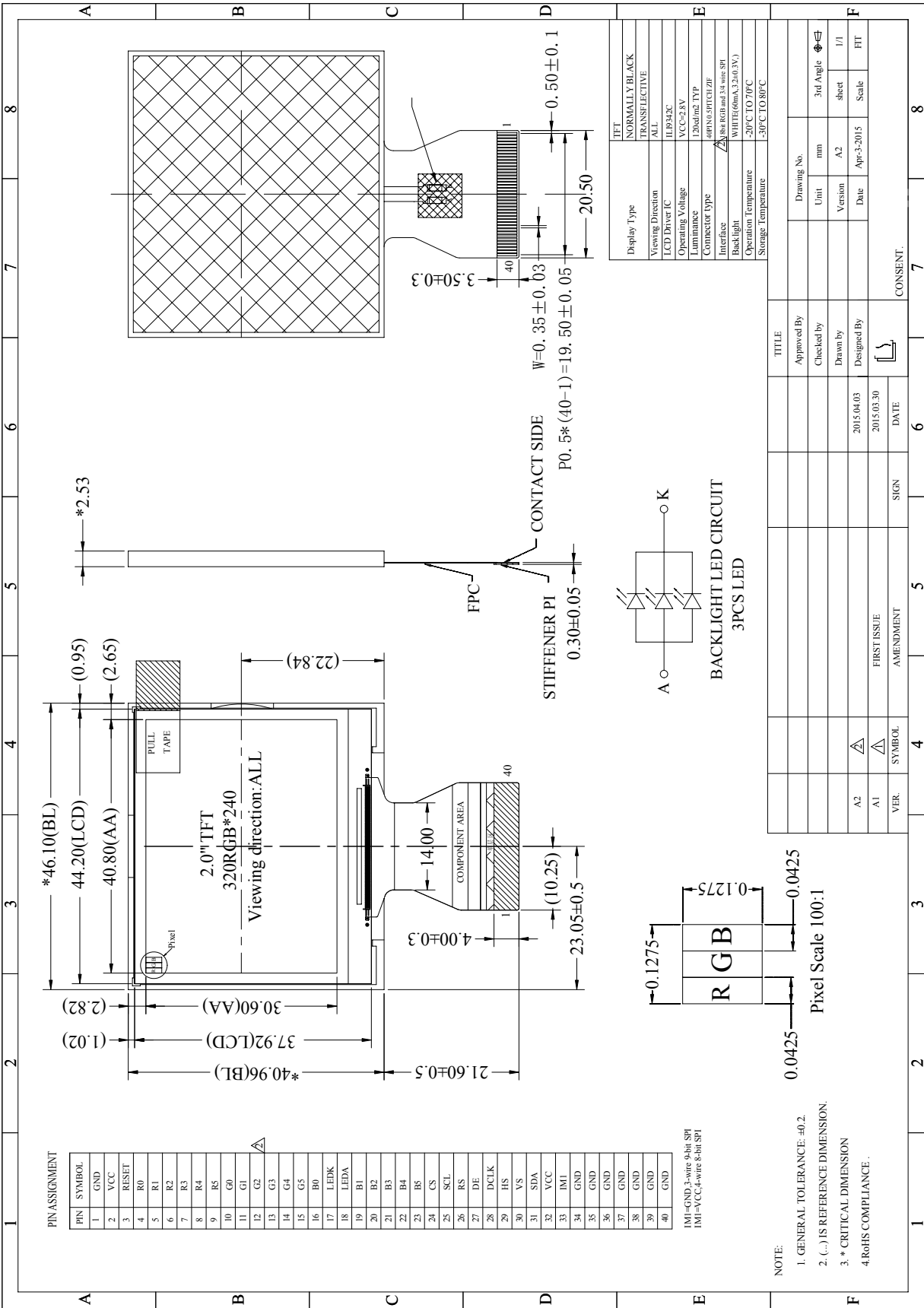
### Revision History

Version	Date	Page (New)	Section	Description
A1	2015-03-30	All	All	Preliminary

**1. General Spec.**

<b>ITEM</b>	<b>STANDARD VALUES</b>	<b>UNITS</b>
LCD type	<b>2.0" TFT</b>	--
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Color filter array	<b>RGB vertical stripe</b>	--
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Interface	<b>18bit RGB and 3/4 wire SPI</b>	--
Operating temperature	<b>-20 ~ +70</b>	°C
Storage temperature	<b>-30 ~ +80</b>	°C
Weight	<b>TBD</b>	g

2. Mechanical drawing



### 3. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1	GND	Power ground .
2	VCC	Power supply .
3	RESET	Reset control signal of device.
4	R0	Data bus.
5	R1	
6	R2	
7	R3	
8	R4	
9	R5	
10	G0	
11	G1	
12	G2	
13	G3	
14	G4	
15	G5	
16	B0	
17	LED-	Power supply for backlight cathode input terminals.
18	LED+	Power supply for backlight anode input terminals.
19	B1	Data bus.
20	B2	
21	B3	
22	B4	
23	B5	
24	CS	Chip select input pin .
25	SCL	Serial interface clock.
26	RS	4 wire SPI:Serves as command or parameter select.
27	DE	Data enable signal for RGB interface operation.
28	DCLK	Dot clock signal for RGB interface operation.
29	HSYNC	Line synchronizing signal for RGB interface operation.
30	VSYNC	Line synchronizing signal for RGB interface operation.
31	SDA	Serial interface data.
32	VCC	Power supply .
33	IM1	3 or 4 wire SPI select pin.
34	GND	Ground .
35	GND	
36	GND	
37	GND	
38	GND	
39	GND	
40	GND	

IM1=GND,3-wire 9-bit SPI.

IM1=VCC,4-wire 8-bit SPI.

**4. Absolute Maximum Ratings**

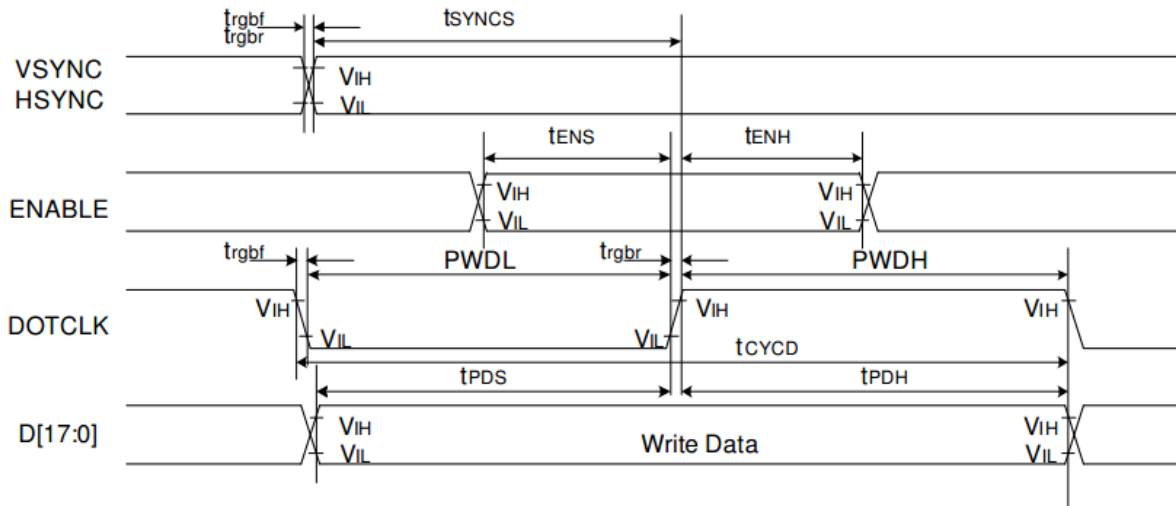
Item	Symbol	Min.	Max.	Unit
Supply Voltage	VCC	-0.3	4.6	V
Operating Temperature	T <sub>OP</sub>	-20	70	°C
Storage Temperature	T <sub>ST</sub>	-30	80	°C
Storage Humidity	HD	20	90	%RH

**5. DC Characteristics**

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage	VCC	2.6	2.8	3.3	V	-
Input High Voltage	V <sub>IH</sub>	0.7VCC	-	VCC	V	-
Input Low Voltage	V <sub>IL</sub>	GND	-	0.3VCC	V	-
Output High Voltage	V <sub>OH</sub>	0.8VCC	-	VCC	V	I <sub>OH</sub> =-1.0mA
Output Low Voltage	V <sub>OL</sub>	GND	-	0.2VCC	V	I <sub>OH</sub> =1.0mA
I/O Leak Current	ILI	-	-	1	uA	-

## 6. Timing Characteristics

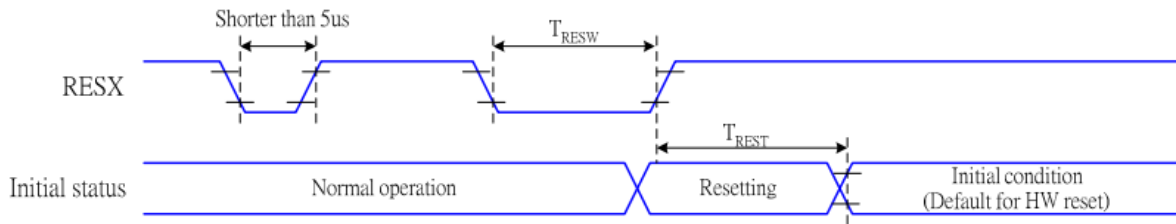
### 6.1 Vertical input timing



Signal	Symbol	Parameter	min	max	Unit	Description	
VSYNC / HSYNC	$t_{SYNCS}$	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode	
	$t_{SYNCH}$	VSYNC/HSYNC hold time	15	-	ns		
DE	$t_{ENS}$	DE setup time	15	-	ns		
	$t_{ENH}$	DE hold time	15	-	ns		
D[17:0]	$t_{POS}$	Data setup time	15	-	ns		
	$t_{PDH}$	Data hold time	15	-	ns		
DOTCLK	PWDH	DOTCLK high-level period	33	-	ns		
	PWDL	DOTCLK low-level period	33	-	ns		
	$t_{CYCD}$	DOTCLK cycle time(18 bit)	100	-	ns		
	$t_{rgbbr}, t_{rgbfr}$	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		
VSYNC / HSYNC	$t_{SYNCS}$	VSYNC/HSYNC setup time	15	-	ns		6-bit bus RGB interface mode
	$t_{SYNCH}$	VSYNC/HSYNC hold time	15	-	ns		
DE	$t_{ENS}$	DE setup time	15	-	ns		
	$t_{ENH}$	DE hold time	15	-	ns		
D[17:0]	$t_{POS}$	Data setup time	15	-	ns		
	$t_{PDH}$	Data hold time	15	-	ns		
DOTCLK	PWDH	DOTCLK high-level pulse period	25	-	ns		
	PWDL	DOTCLK low-level pulse period	25	-	ns		
	$t_{CYCD}$	DOTCLK cycle time	50	-	ns		
	$t_{rgbbr}, t_{rgbfr}$	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		

Note:  $T_a = -30$  to  $70$  °C,  $I_{OVCC}=1.65V$  to  $3.3V$ ,  $V_{CI}=2.6V$  to  $3.3V$ ,  $AGND=GND=0V$

6.2 Reset timing



Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	tRESW	Reset pulse duration	10	-	us
	tREST	Reset cancel	-	5	ms
				120	ms

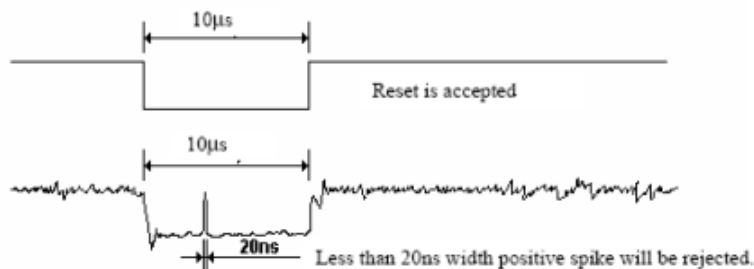
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from EEPROM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out -mode. The display remains the blank state in Sleep In -mode.) and then return to Default condition for Hardware Reset.

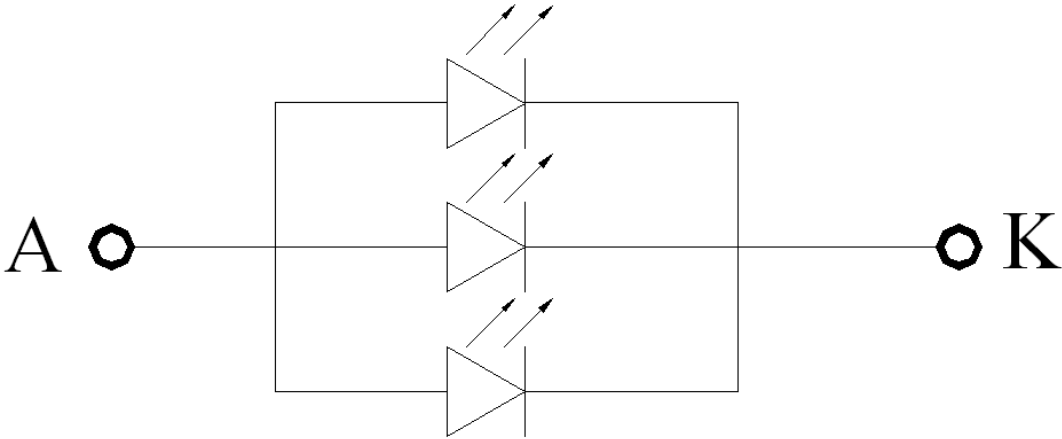
4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.



7. Backlight Characteristics



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	2.9	3.2	3.5	V	If=60mA
Supply Current	If	-	60	-	mA	-
Backlight Color	White					If=60mA

**8. Electro-optical characteristics**

**8.1 Transmissive Mode**

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Contrast ratio*	Cr ( $\Theta=0^\circ$ )	-	300	-		*[1]Here the data are design value. [2]Chromaticity measuring machine: CA310
Response time (25°C)*	T <sub>r</sub> +T <sub>f</sub>	-	30	50	ms	
Viewing angle (Cr≥ 10)*	Θ21	-	80	-	deg	
	Θ22	-	80	-		
	Θ12	-	80	-		
	Θ11	-	80	-		
Chromaticity of LCM	Red	x	TBD	TBD	TBD	
		y	TBD	TBD	TBD	
	Green	x	TBD	TBD	TBD	
		y	TBD	TBD	TBD	
	Blue	x	TBD	TBD	TBD	
		y	TBD	TBD	TBD	
	White	x	TBD	TBD	TBD	
		y	TBD	TBD	TBD	
Color gamut of CF (NTSC%)	S		58		%	
Luminous Intensity for LCM	-	-	120	-	Cd/m2	
Uniformity for LCM	-	80	-	-	%	

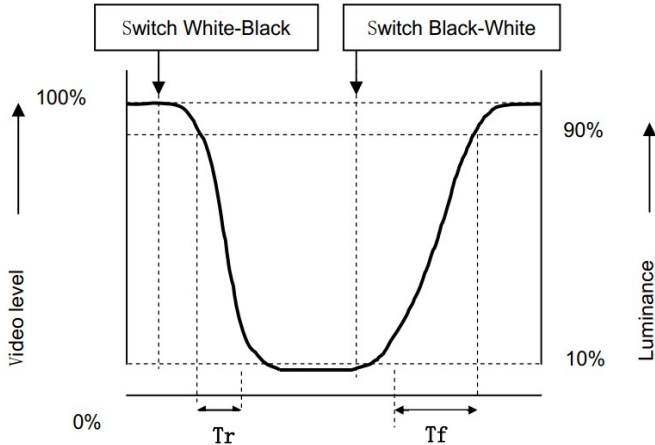
**8.2 Reflective Mode**

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Reflection Ratio*	Cr ( $\theta = \phi = 0^\circ$ )	-	7	-	%	Here the data are design value.
Reflective Contrast ratio*	Cr ( $\Theta=0^\circ$ )	-	15	-		
Viewing angle (Cr≥ 10)*	Θ21	-	45	-	deg	
	Θ22	-	45	-		
	Θ12	-	45	-		
	Θ11	-	45	-		

8.3 Definitions and measuring methods

[1] Response Time(Tr、 Tf)

The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.

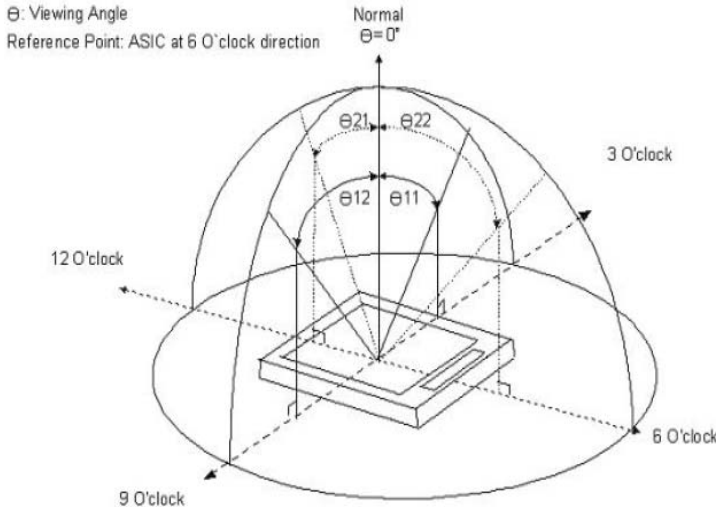


[2] Contrast ratio (Cr)

The contrast ratio (Cr), measured on a module, is the ratio between the luminance (L\_w) in a full white area (R=G=B=1) and the luminance (L\_d) in a dark area (R=G=B=0):

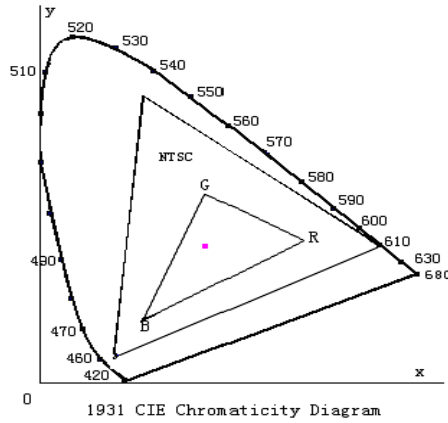
$$Cr = \frac{L_w}{L_d}$$

[3] Viewing angle diagram



**[4] Definition of color gamut**

Measuring machine:CFT-01. NTSC'S Primaries: R(x,y,Y)、G(x,y,Y)、 B(x,y,Y).



**Fig. 1931 CIE chromaticity diagram**

$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$

**[5] Definition of luminance uniformity**

Active area is divided into 9 measuring areas, every measuring points is placed at the center of each measuring area.

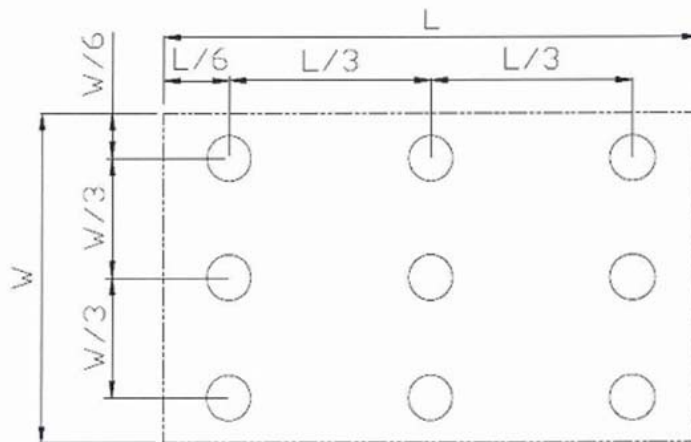
luminance uniformity=Lmin/Lmax.

L:Active area length .

W:Active area width.

Lmax:The measured maximum luminance of all measurement position.

Lmin :The measured minimum luminance of all measurement position.



**[6] Definition of luminance**

Measure the luminance of white state at center point.

**9. Reliability Test Conditions And Methods**

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80°C×48Hours	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×48Hours	
③	High Temperature Operating	70°C×48Hours	
④	Low Temperature Operating	-20°C×48Hours	
⑤	Damp Proof Test (Storage)	60°C×90%RH×48Hours	

**REMARK:**

- 1,The Test samples should be applied to only one test item.
- 2,Sample for each test item is 5pcs.
- 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.

## 10. Quality standards

### 10.1 Dot defects(operation)

Item	Size((mm))	Acceptable number	Remark
Bright dots (red / green / blue)	$D \leq 0.1$	Neglected	MI
	$0.1 < D \leq 0.2$	max, 2	MI
	$0.2 < D$	0	MI
Black dots	-	max, 2	Not adjoining black dots
	-	0	adjacent black dots

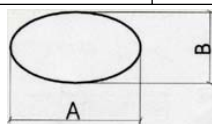
### 10.2 Major defects

Item	Acceptable number	Remark
Function defect	not allowed	
Abnormal operation including distinct RGB line defects and white line defect	not allowed	
RGB timing	not allowed	
Wrong color	not allowed	
Less brightness	not allowed	
No backlight	not allowed	
Broken glass	not allowed	

### 10.3 Minor defects (visual)

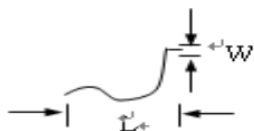
Item	Size(mm)	Acceptable number	Remark
Black spots or white spots	$D < 0.1$ ,	Neglected	(Note1)
	$0.1 < D \leq 0.2$	max, 2	
	$0.2 < D$ ,	max, 0	
Black lines,white lines	$W \leq 0.03$	Neglected	(Note2)
	$0.03 < W \leq 0.05$ $L \leq 2$ ,	max, 2	
	$0.05 < W$	max, 0	

Note1



$$D = (A+B) / 2$$

Note2



L: 长度↕

W: 宽度↕

## 11. Handling Precautions

### 11.1 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.

### 11.2 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.

### 11.3 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.

### 11.4 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

### 11.5 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.

### 11.6 Storage

In the case of storing for a long period of time for instance, for years for the purpose of 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

## 11.7 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

## 12. Precaution For Use

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.

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.