

# Specification for Approval

Customer: \_\_\_\_\_

Model Name: \_\_\_\_\_

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
<i>Peter</i>	<i>Peng Jun</i>		

## Revision Record

REV NO.	REV DATE	CONTENTS	Note
A	2019-10-31	NEW ISSUE	

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## 1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

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

## 2. General Information

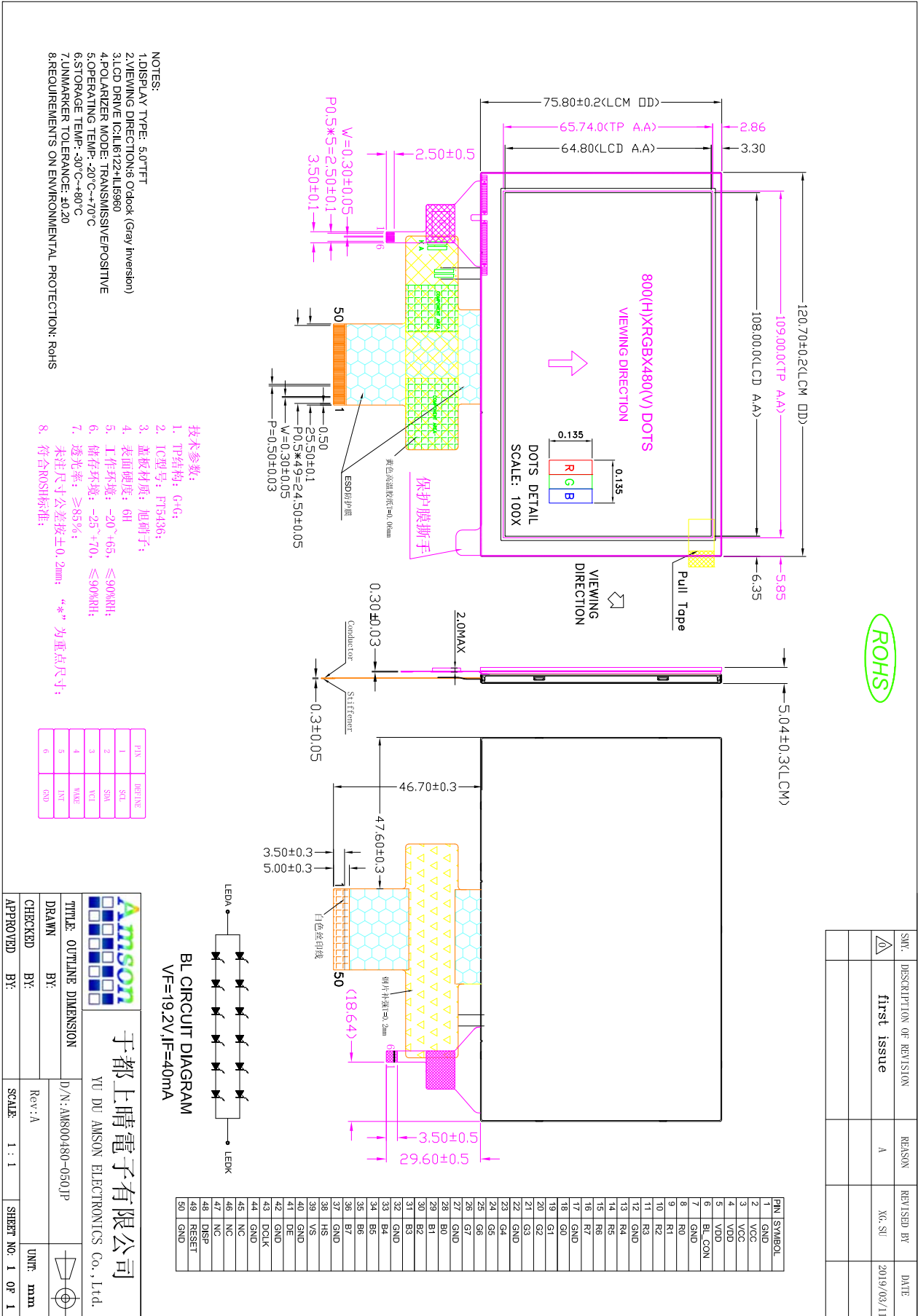
### LCM

ITEM	STANDARD VALUES	UNITS
LCD type	5.0" TFT	--
Dot arrangement	800 (RGB) × 480	dots
Color filter array	RGB vertical stripe	--
Display mode	Normally white TN	-
Gray Scale Inversion Direction	6 O'clock	--
Eyes Viewing Direction	12 O'clock	--
Driver IC	ILI6122+ILI5960	--
Module size	120.7(W) × 75.8(H) × 5.04(T)	mm
Active area	108(W) × 64.80(H)	mm
Dot pitch	0.135(W) × 0.135(H)	mm
Interface	24-bit Parallel RGB Interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	12 White LED	--

### CTP

ITEM	STANDARD VALUES	UNITS
CTP type	Cover Lens + sensor + FPC	--
CTP Driver IC	FT5436	--
Surface Treatment	6H	--
Transmittance	≥85%	--
The cover hardness	6H	--
CTP size	120.70(W) × 75.80(H) × 1.95(T)	mm
CTP Active area	109.0(W) × 65.74(H)	mm
CTP Interface	I2C	
response time	10	ms

## 3. External Dimensions



## 4. Interface Description

### TFT

PIN	PIN NAME	DESCRIPTION
1	GND	Power ground.
2, 3	VCC	Supply Voltage
4, 5	VDD	BL VIN Voltage
6	BL_CON	Common Voltage.
7	GND	Power ground.
8~11	R0~R3	Red Data Input
12	GND	Power ground.
13~16	R4~R7	Red Data Input.
17	GND	Power ground.
18~21	G0	Green Data Input
22	GND	Power ground.
23~26	G4	Green Data Input.
27	GND	Power ground.
28~31	B0	Blue Data Input
32	GND	Power ground.
33~36	B4	Blue Data Input.
37	GND	Power ground.
38	HS	Horizontal sync input. Negative polarity.
39	VS	Vertical sync input. Negative polarity.
40	GND	Power ground.
41	DE	Data Enable signal.
42	GND	Power ground.
43	DCLK	Clock input.
44	GND	Power ground.
45~47	NC.	Not connect.
48	DISP	STANDBY MODE. NORMALLY PULLED HIGH. DISP=H,NORMAL OPERATION.(DEFAULT) DISP=L, TIMING ,CONTORLLER , SOURCE DRIVER WILL TURN OFF,ALL OUTPUT ARE HIGH-Z
49	RESET	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high.(R=10KΩ, C=1μF)
50	GND	Power ground.

## CTP

Pin	Symbol	Description.
1	SCL	CTP I <sup>2</sup> C_clock.
2	SDA	CTP I <sup>2</sup> C_data
3	VCI	CTP Power Voltage .
4	WAKE	CTP reset pin. Active low to enter reset state.
5	INT	CTP interruption signal.
6	GND	CTP Power ground

## 5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power Supply Voltage	VCC	-0.3	3.6	V
	VDD	-0.3	18	V
CTP Power Voltage	VCI	-0.3	3.6	V
Operating Temperature	T <sub>OP</sub>	-20	70	°C
Storage Temperature	T <sub>ST</sub>	-30	80	°C
Storage Humidity	HD	-	90	%RH

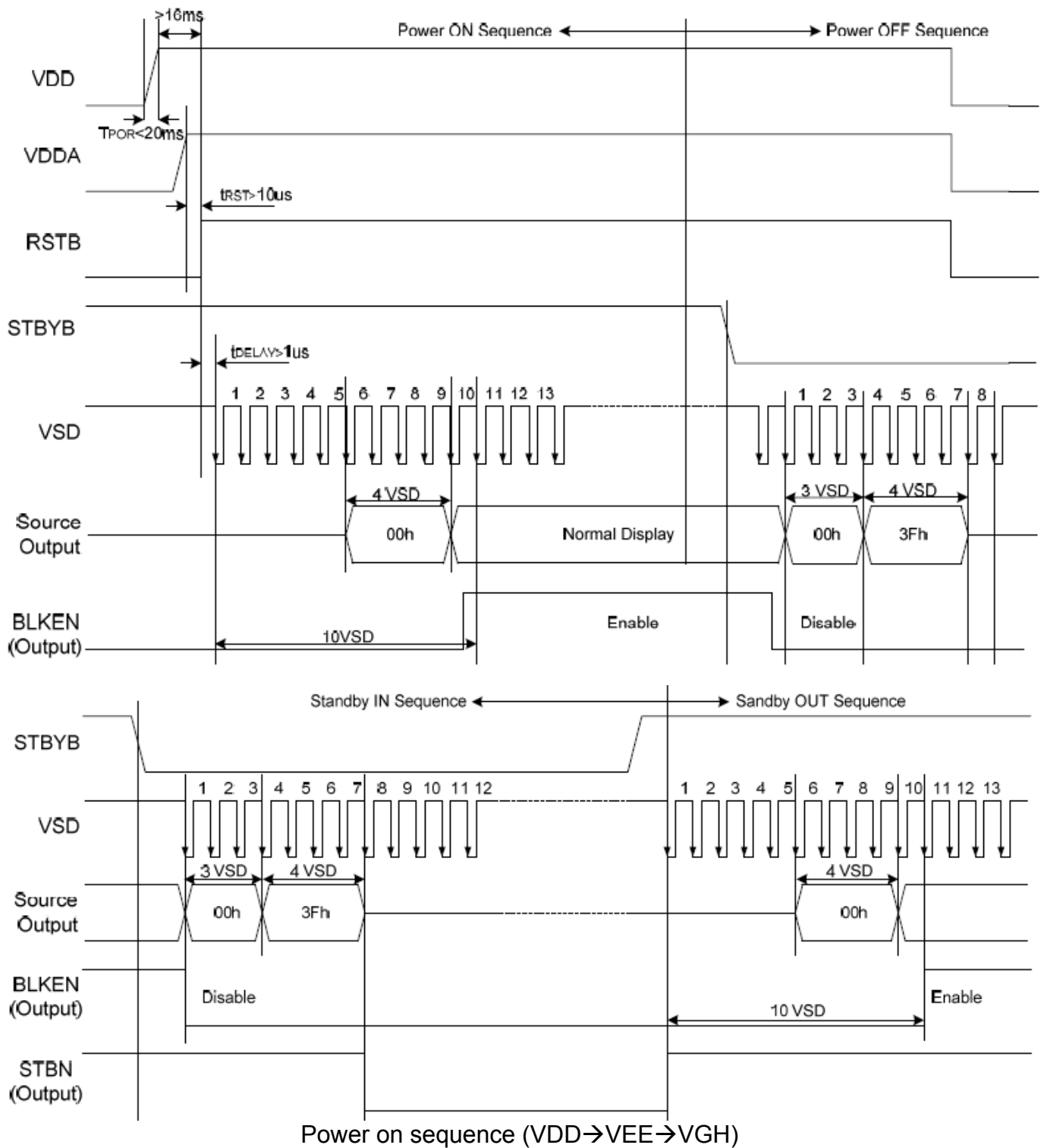
## 6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Supply Voltage	VCC	3.0	3.3	3.6	V	-
	VDD	3.0	5.0	15.0	V	-
CTP Power Voltage	VCI	2.8	3.3	3.6	V	-
Input High Voltage	V <sub>IH</sub>	0.7VCC	-	VCC	V	-
Input Low Voltage	V <sub>IL</sub>	GND	-	0.3 VCC	V	-
Output High Voltage	V <sub>OH</sub>	0.8 VCC	-	VCC	V	-
Output Low Voltage	V <sub>OL</sub>	GND	-	0.2 VCC	V	-
Logic Voltage	BL_PWM		3.3V		V	-
PWM Frequency	F <sub>pwm</sub>	5		100	KHz	-

Note: Maximum current from RGB full-display

## 7. Timing Characteristics

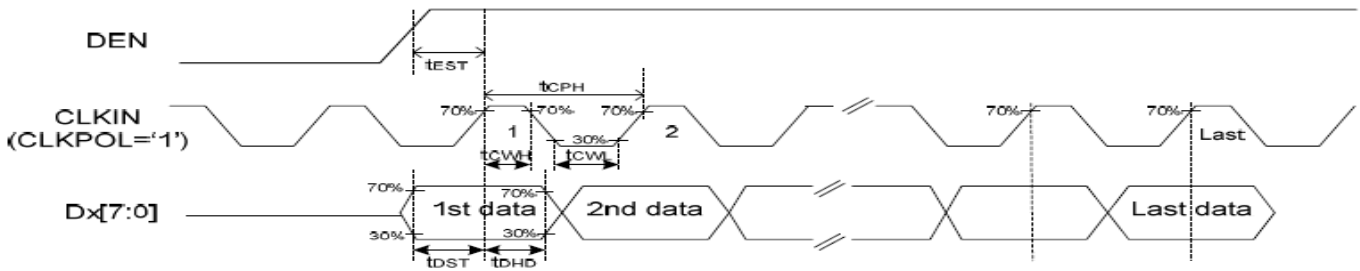
### 7.1 Power Sequence



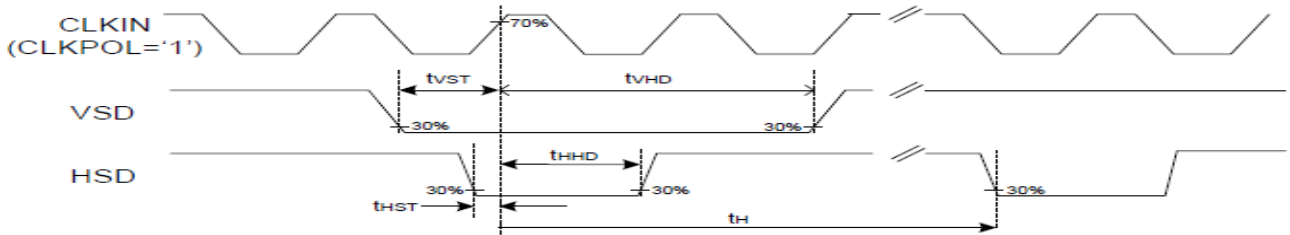


## 7.2 AC Timing characteristics

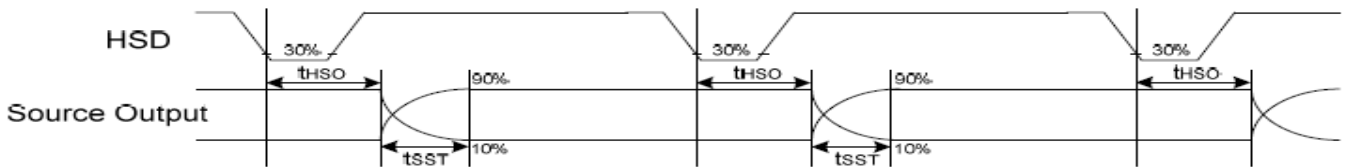
### DE Mode (MODE='1')



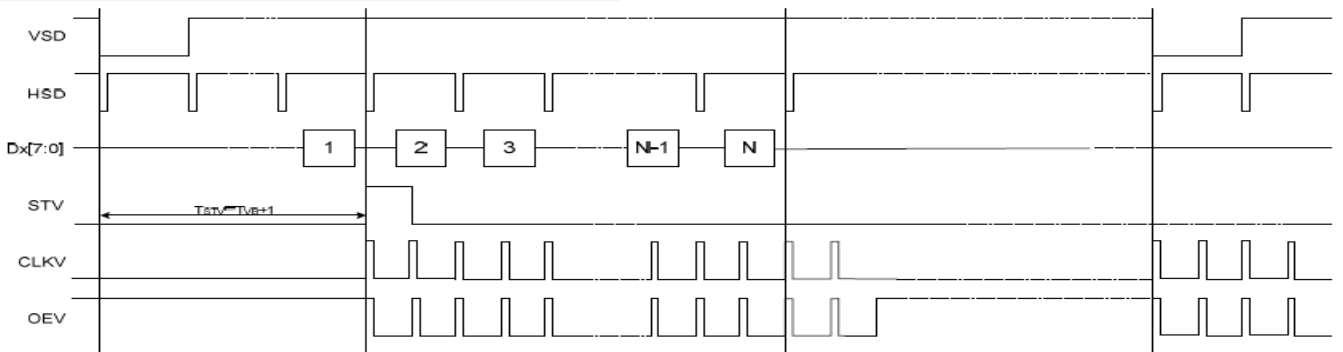
### SYNC Mode (MODE='0')



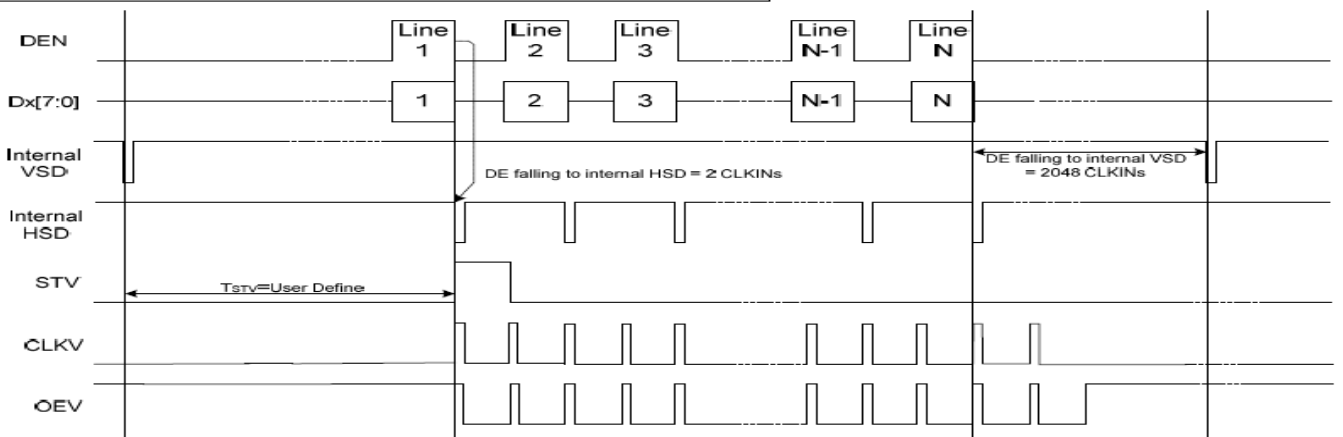
### Source Output timing Diagram (Cascade)



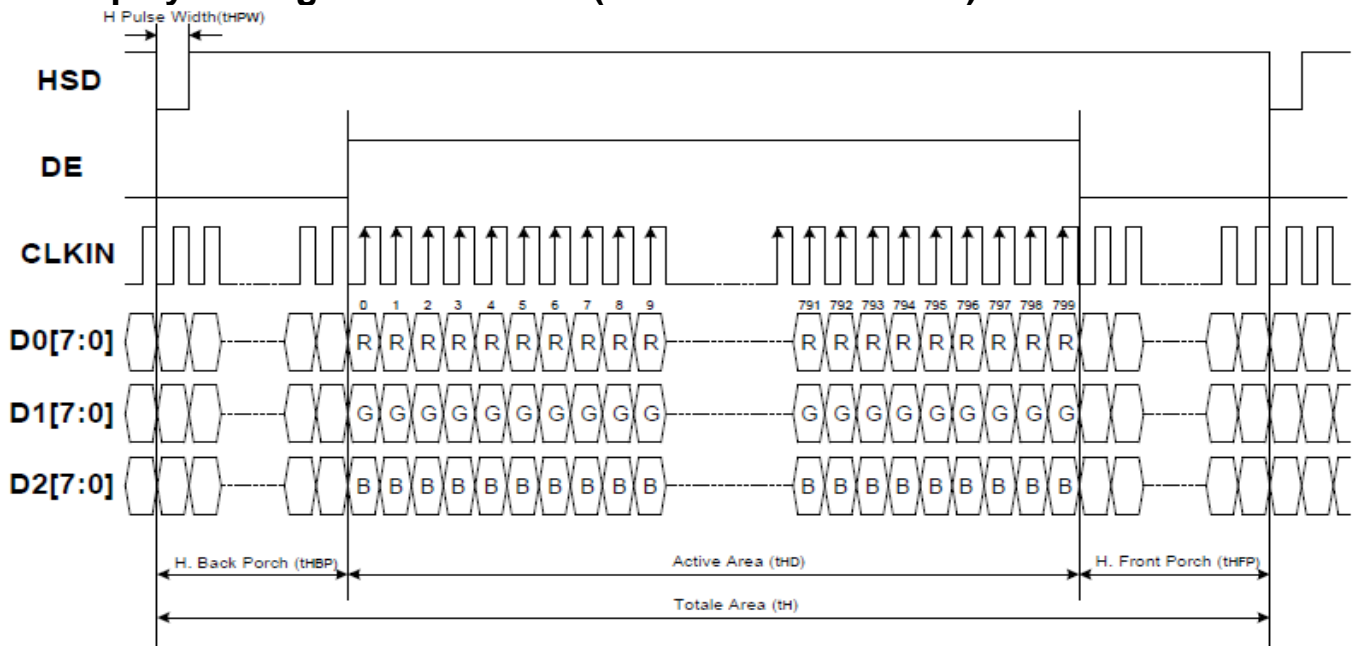
### Vertical Timing Diagram of SYNC Mode (Dual Gate)



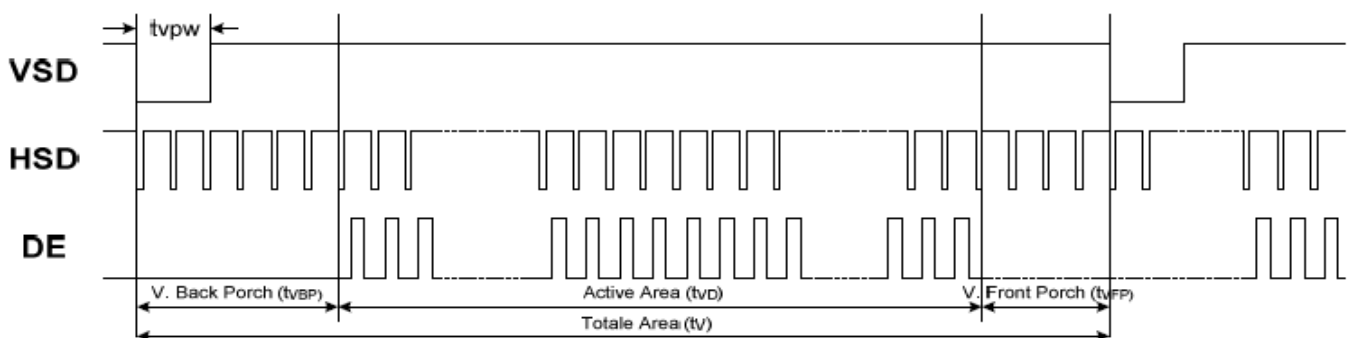
### Vertical Timing Diagram of DE Mode (Dual Gate)



## 7.3 Display Timing characteristics (Resolution: 800x480)



Horizontal Input Timing						
Parameter	Symbol	Value			Unit	
		Min.	Typ.	Max.		
Horizontal display area	$t_{HD}$	--	800	--	CLKIN	
CLKIN frequency	$f_{CLK}$	--	33.3	50	MHz	
1 Horizontal line period	$t_H$	862	1056	1200	CLKIN	
HSD pulse width	$t_{HPW}$	Min.	--	1	CLKIN	
		Typ.	--	--	CLKIN	
		Max.	--	40	CLKIN	
HSD back porch	SYNC	$t_{HBP}$	46	46	46	CLKIN
HSD front porch	SYNC	$t_{HFP}$	16	210	354	CLKIN

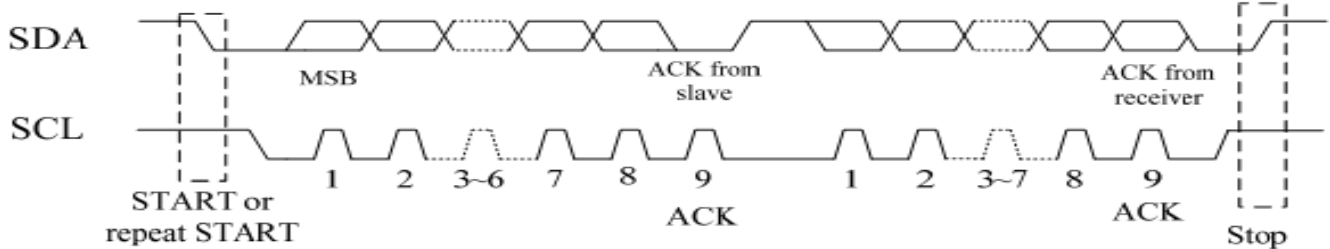


Vertical Input Timing					
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	$t_{VD}$	--	480	--	HSD
VSD period time	$t_V$	510	525	650	HSD
VSD pulse width	$t_{VPW}$	1	--	20	HSD
VSD back porch	$t_{VBP}$	23	23	23	HSD
VSD front porch	$t_{VFP}$	7	22	147	HSD

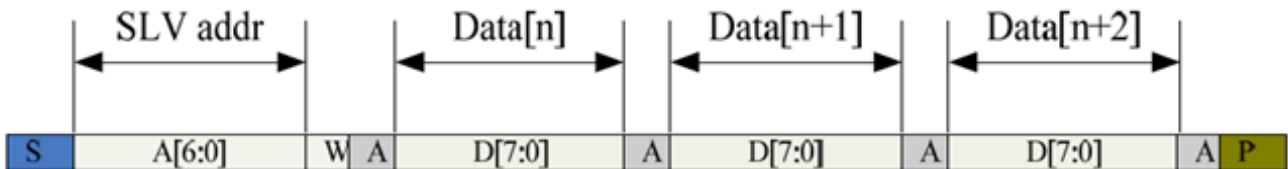
## 7.4CTP Timing characteristics

### 7.4.1 Serial Interface

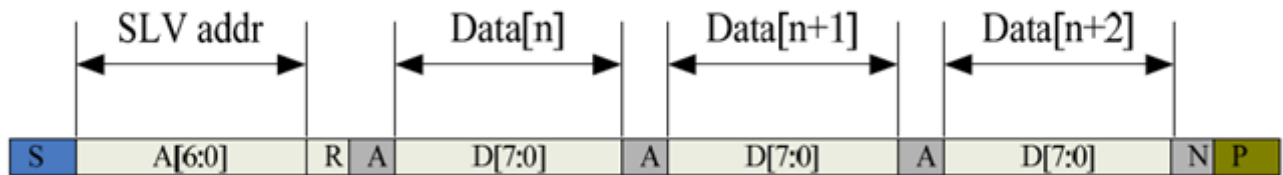
#### I<sup>2</sup>C



#### I<sup>2</sup>C Serial Data Transfer Format



#### I<sup>2</sup>C master write, slave read



#### I<sup>2</sup>C master read, slave write

### Mnemonics Description

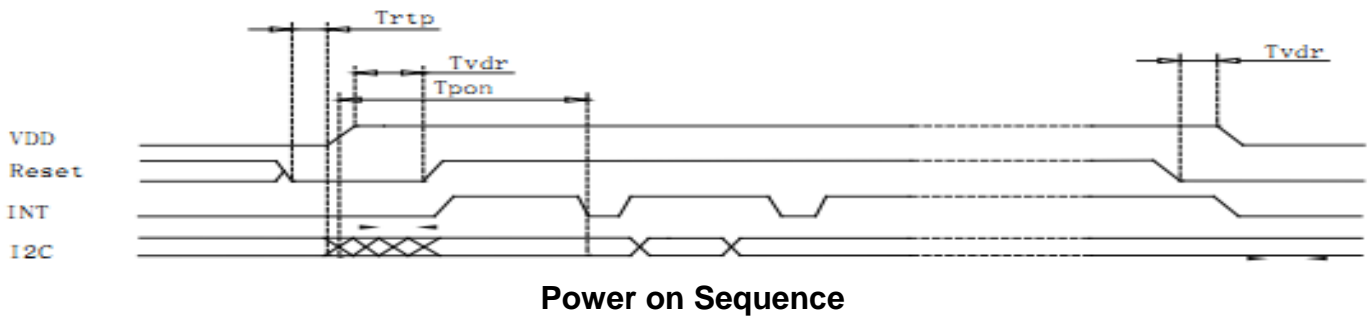
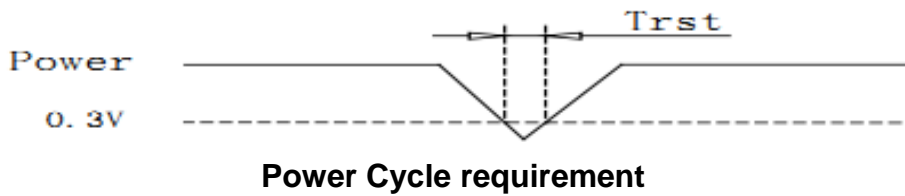
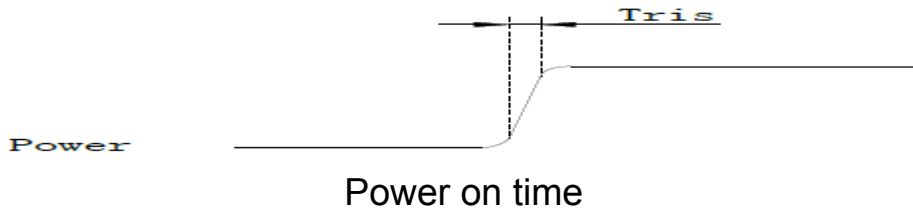
Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address A[6:0]: address bits are identical to those of I2CADDR [7:1] register.
R/ W	'1' for read, '0' for write
A(N)	ACK(NACK)
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

### Timing Characteristics

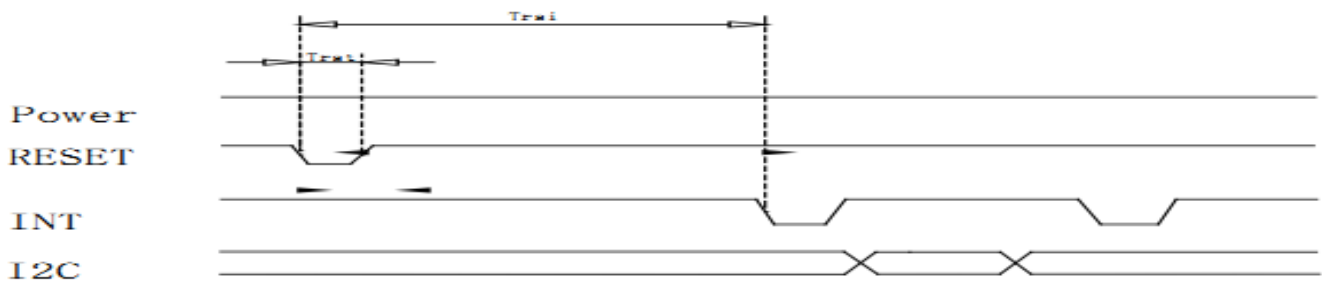
Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address
R/ W	READ/WRITE bit, '1' for read, '0' for write
A(N)	ACK(NACK) bit
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

## 7.4.2 POWER NO /Reset/Wake Sequence

Reset should be pulled down to be low before powering on and powering down. I2C shouldn't be used by other devices during Reset time after VDD powering on ( $T_{rtp}$ ). INT signal will be sent to the host after initializing all parameters and then start to report points to the host. If Power is down, the voltage of supply must be below 0.3V and  $T_{rst}$  is more than 1ms.



Reset time must be enough to guarantee reliable reset, the time of starting to report point after resetting approach to the time of starting to report point after powering on.

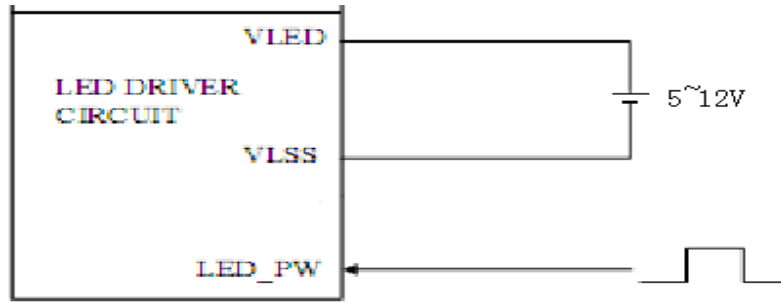


Reset Sequence

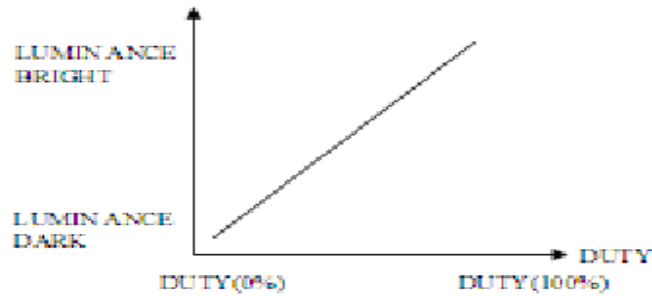
### Power on/Reset Sequence Parameters

Parameter	Description	Min	Max	Units
$T_{ris}$	Rise time from 0.1VDD to 0.9VDD	--	5	ms
$T_{rtp}$	Time of resetting to be low before powering on	100	--	$\mu s$
$T_{pon}$	Time of starting to report point after powering on	200	--	ms
$T_{vdr}$	Reset time after VDD powering on	1	--	ms
$T_{rsi}$	Time of starting to report point after resetting	200	--	ms
$T_{rst}$	Reset time	1	--	ms

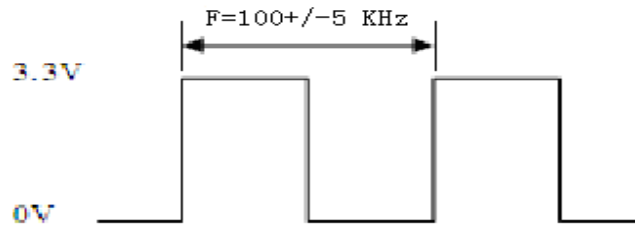
## 8. Backlight Characteristic



NOTE ( 1 ) : ADJUST THE PWM SIGNAL IN ORDER TO CONTROL LED BACKLIGHTS BRIGHTNESS. THE HIGHER THE DUTY CYCLE, THE HIGHER THE BRIGHTNESS LUMINANCE



NOTE ( 2 ) : PWM SIGNAL=0-3.3V • OPERATION FREQUENCY : 100+/-5 KHz

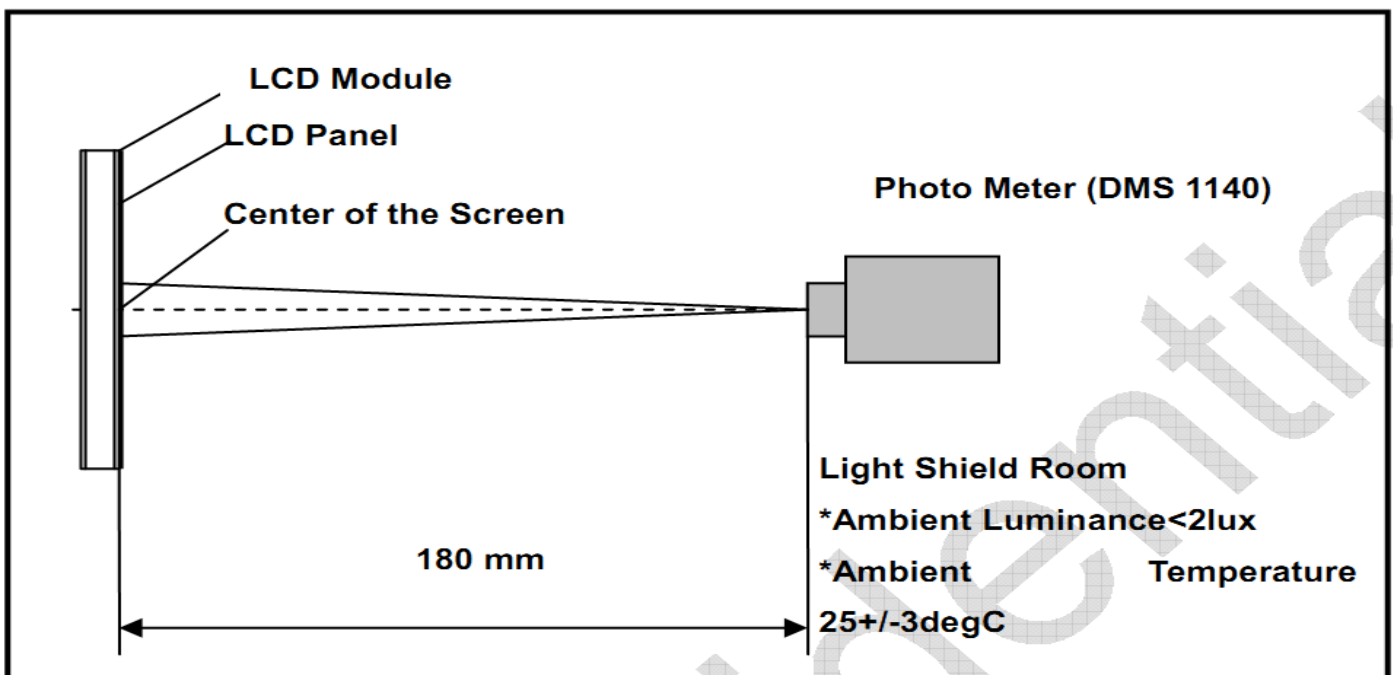


Item	Symbol	MIN	TYP	MAX	UNIT	NOTE
Backlight Power	LED_VCC	3	5	15	V	Ta = 25°C
Backlight Power	ILED_VCC	-	(0.15)	(0.2)	A	LED_VCC=5V
		-	(0.07)	(0.1)	A	LED_VCC=12V
EN Signal Voltage	VIH	1.2			V	
	VIL	GND		0.4	V	
PWM Frequency	LED_PWM	5		100	KHz	
Lifetime		50000	-	-	Hr	
Color	White					
Average Brightness	-	400	450	-	Cd/cm2	
Luminance uniformity	-	--	80	-	%	

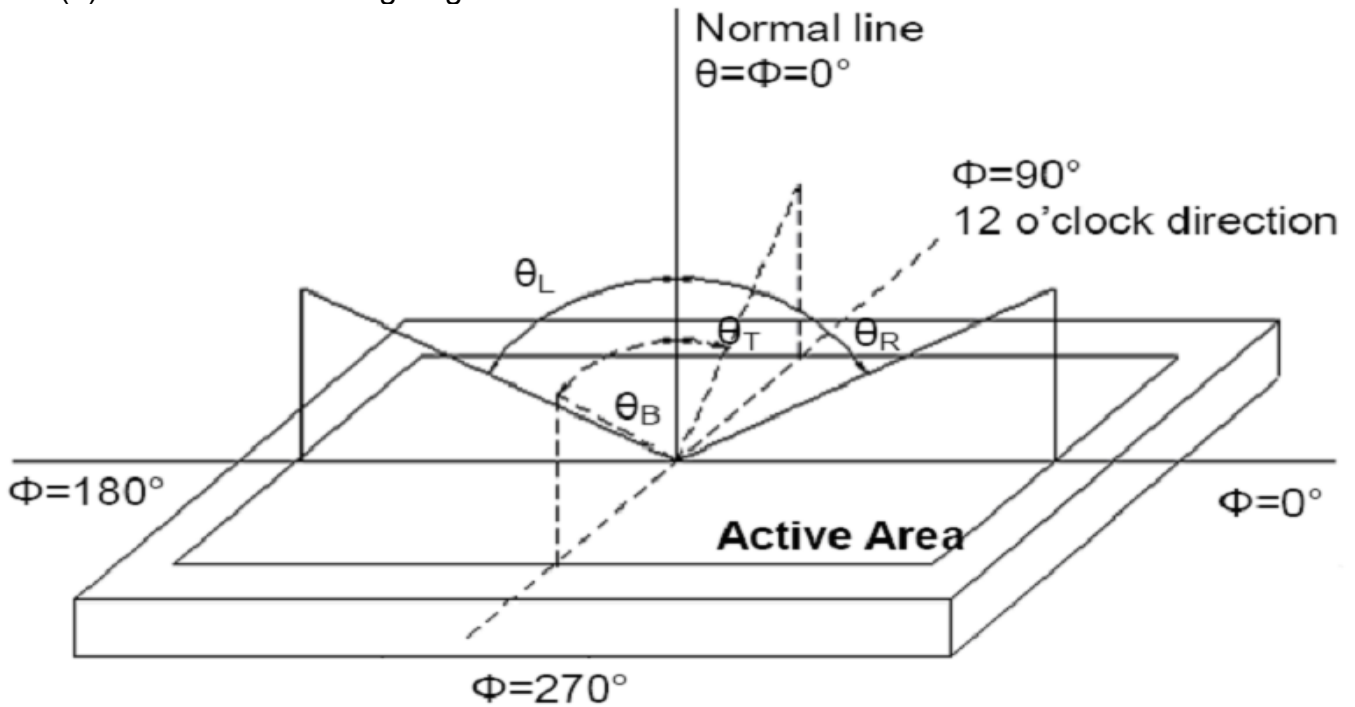
## 9. Optical Characteristics

Item	Conditions	Min.	Typ.	Max.	Unit	Note	
Viewing Angle (CR>10)	Horizontal	$\theta_L$	-	70	-	degree	(1),(2),(6)
		$\theta_R$	-	70	-		
	Vertical	$\theta_T$	-	50	-		
		$\theta_B$	-	70	-		
Contrast Ratio	Center	400	500	-	-	(1),(3),(6)	
Response Time	Rising	-	10	20	ms	(1),(4),(6)	
	Falling	-	15	30			
CF Color Chromaticity (CIE1931)	Red x	Typ. -0.05	TBD	Typ. +0.05	-	(1), (6)	
	Red y		TBD		-		
	Green x		TBD		-		
	Green y		TBD		-		
	Blue x		TBD		-		
	Blue y		TBD		-		
	White x		TBD		-		
	White y		TBD		-		
NTSC		-	61.	-	%	(1),(6)	

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



Note (2) Definition of Viewing Angle



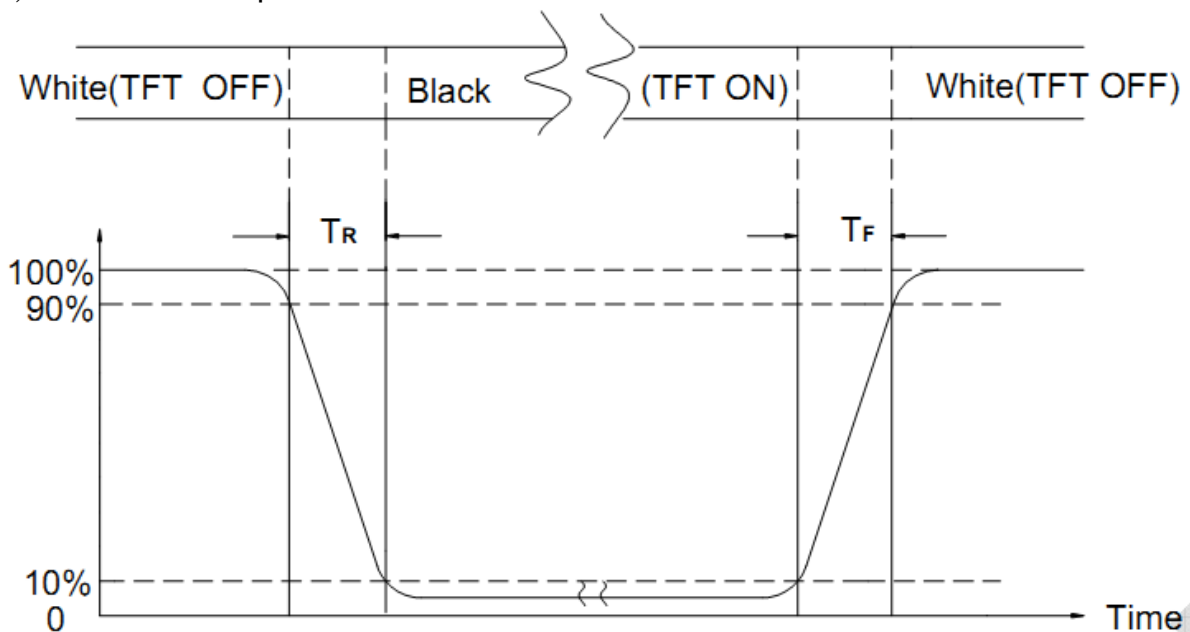
Note (3) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

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

Note (4) Definition of response time



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

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

Note (6) Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

## 10. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
□	High Temperature Storage	80°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, 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.
□	Low Temperature Storage	-30°C±2°C×96Hours	
□	High Temperature Operating	70°C±2°C×96Hours	
□	Low Temperature Operating	-20°C±2°C×96Hours	
□	Temperature Cycle(Storage)	-20°C ↔ 25°C ↔ 70°C (30min)    (5min)    (30min) ←—————→ 1cycle Total 10cycle	
□	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
□	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5MM X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
□	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
□	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 accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- 6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.



## 11. Inspection Standard

### 11.1. QUALITY :

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

#### 11.1.1. INSPECTION TOOLS AND INSTRUMENTS

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

#### 11.1.2. THE METHOD OF PRESERVING GOODS

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

#### 11.1.3. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

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

(B) THE STANDARD OF QUALITY

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

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

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

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

#### 11.1.4. WARRANTY POLICY

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

## 11.2. CHECKING CONDITION

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

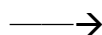
11.2.2.CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE

11.2.3.Ambient Illumination:

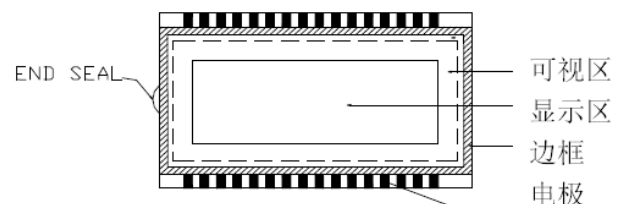
0 ~30 Lux for functional inspection

500 ~ 1200 Lux for external appearance inspection.

11.2.4. TEST AREA:



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



**11.2.6.** The inspector may make a visual inspection or a comparative examination with a film ruler and a magnifying eyepiece. Individual defects shall be determined according to the limited samples.

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

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

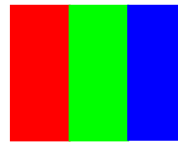
### **11.2.9. the principle of judgment**

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

11.3.2 Poor definition

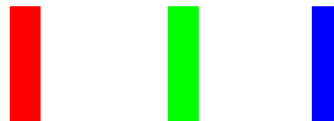
Pixel:

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



**Dot:**

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



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

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

### **Highlights:**

Usually considered to be shown on a black screen.

### **Dark spots:**

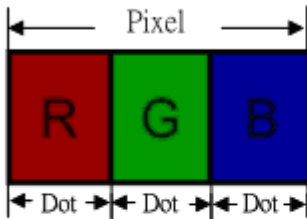
They are generally considered to be shown on R, G, B solid colors or white images.

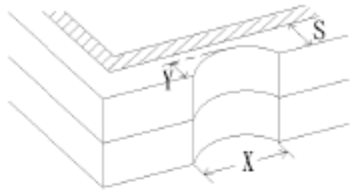
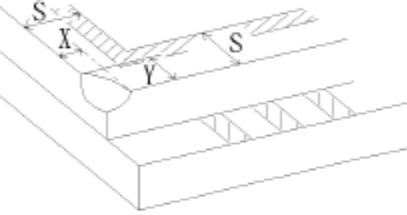
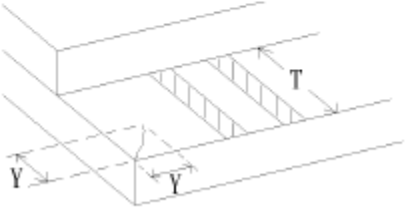
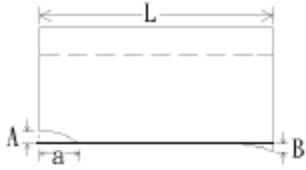
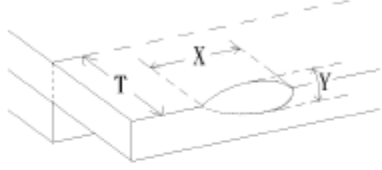
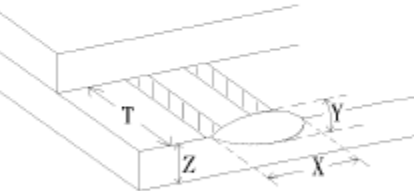
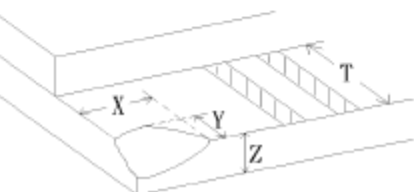
### **Neighborhood:**

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

## 11.3. INSPECTION PLAN :

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

NO.	CLASS	ITEM	JUDGEMENT																				
11.4.1	MINOR	BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH	<p>(A) ROUND TYPE: <span style="float: right;">unit : mm.</span></p> <table border="1"> <thead> <tr> <th>DIAMETER (mm.)</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td>Distance<math>\geq</math>1mm</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.4</math></td> <td>3 (Distance<math>&gt;</math>15mm)</td> </tr> <tr> <td><math>0.4 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>NOTE: <math>\Phi=(\text{LENGTH}+\text{WIDTH})/2</math></p> <p>(B) LINEAR TYPE: <span style="float: right;">unit : mm.</span></p> <table border="1"> <thead> <tr> <th>LENGTH</th> <th>WIDTH</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>-----</td> <td><math>W \leq 0.03</math></td> <td>Distance<math>\geq</math>1mm</td> </tr> <tr> <td><math>L \leq 4.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3 (Distance<math>&gt;</math>15mm)</td> </tr> <tr> <td>-----</td> <td><math>0.05 &lt; W</math></td> <td>FOLLOW ROUND TYPE</td> </tr> </tbody> </table>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\Phi \leq 0.15$	Distance $\geq$ 1mm	$0.15 < \Phi \leq 0.4$	3 (Distance $>$ 15mm)	$0.4 < \Phi$	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	$W \leq 0.03$	Distance $\geq$ 1mm	$L \leq 4.0$	$0.03 < W \leq 0.05$	3 (Distance $>$ 15mm)	-----	$0.05 < W$	FOLLOW ROUND TYPE
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11.4.4	MINOR	Mura	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary																				

NO.	CLASS	ITEM	JUDGEMENT
11.4.4	MINOR	LCD GLASS CHIPPING	 <p><math>Y &gt; S</math></p> <p>Reject</p>
11.4.5	MINOR	LCD GLASS CHIPPING	 <p><math>X \text{ or } Y &gt; S</math></p> <p>Reject</p>
11.4.6	MAJOR	LCD GLASS GLASS CRACK	 <p><math>Y &gt; (1/2) T</math></p> <p>Reject</p>
11.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	 <p>1. <math>a &gt; L/3</math>, <math>A &gt; 1.5\text{mm}</math>. Reject</p> <p>2. B : ACCORDING TO DIMENSION</p>
11.4.8	MINOR	LCD GLASS CHIPPING ( ON THE TERMINAL AREA )	 <p><math>\Phi = (x+y)/2 &gt; 2.5 \text{ mm}</math></p> <p>Reject</p>
11.4.9	MINOR	LCD GLASS CHIPPING ( ON THE TERMINAL SURFACE )	 <p><math>Y &gt; (1/3) T</math></p> <p>Reject</p>
11.4.10	MINOR	LCD GLASS CHIPPING	 <p><math>Y &gt; T</math></p> <p>Reject</p>

## 12. Handling Precautions

### 12.1 Mounting method

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

Extreme care should be needed when handling the LCD modules.

### 12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent

[Recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

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

Do not use the following solvent:

- Water
- Aromatics

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

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

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

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

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

### 12.3 Caution against static charge

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

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

### 12.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed 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.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

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

## 12.6 storing

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

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.  
[It is recommended to store them as they have been contained in the inner container at the time of delivery from us.]

## 12.7 Safety

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

## 13. Precaution for Use

### 13.1

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

### 13.2

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

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

## 14. Packing Method

TBD