Specification for Approval

Customer:_____

Model Name:_____

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
Peter	*Peng Jun*		

Revision Record

REV NO.	REV DATE	CONTENTS	Note
A	2012-07-10	NEW ISSUE	
B	2013-07-04	Change Interface 48 PIN to NC	
C	2019-05-16	Modify Backlight and FPC	
D	2024-03-12	Modify Backlight	

Table of Contents

1. Scope

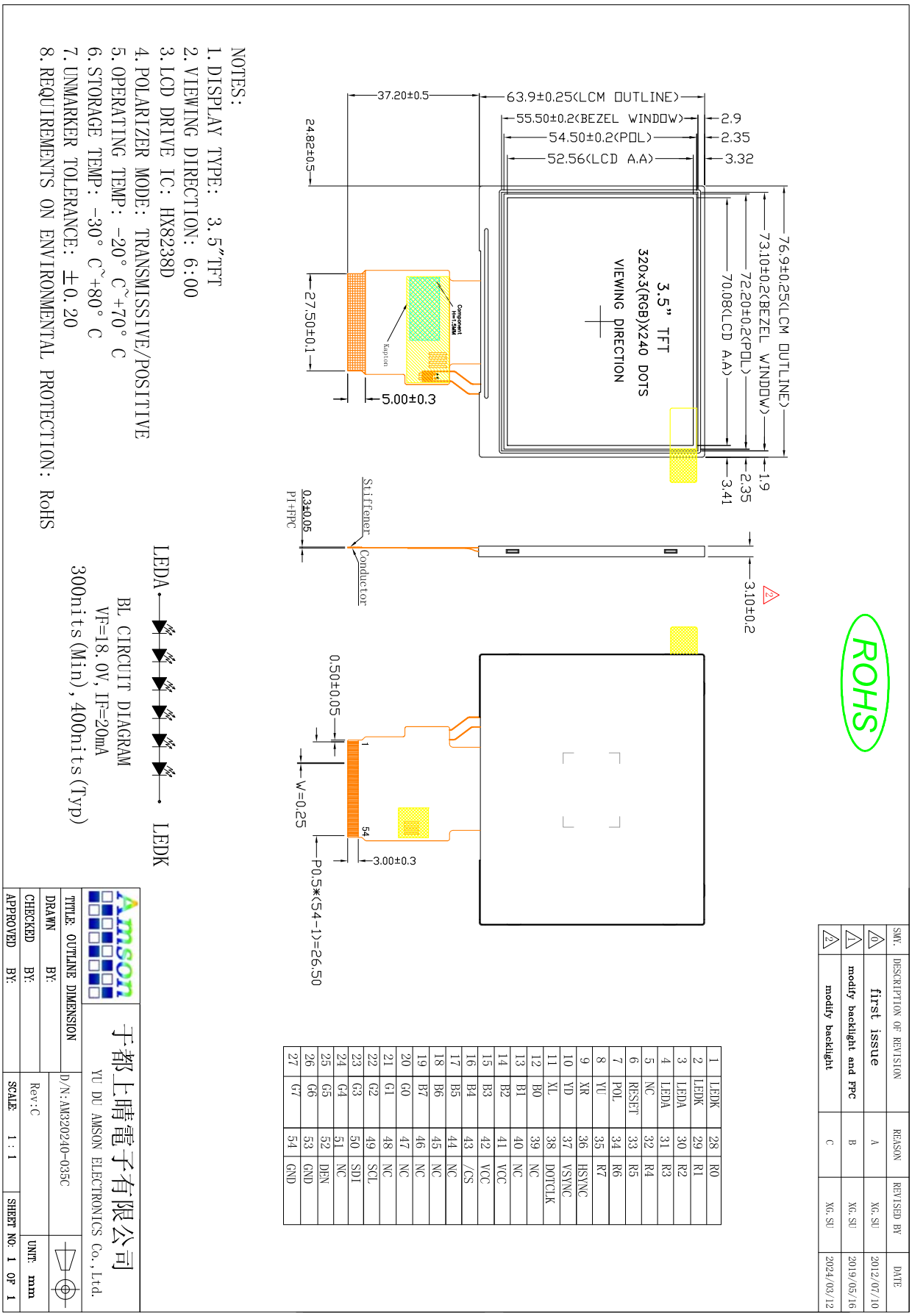
This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

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

2. General Information

ITEM	STANDARD VALUES	UNITS
LCD type	3.5”TFT	--
Dot arrangement	320(RGB)×240	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmission / Normally White	--
Gray Scale Inversion Direction	6 O’clock	--
Eyes Viewing Direction	12 O’clock	--
Driver IC	HX8238-D	--
Module size	76.90(W)×63.90(H)×3.10(T)	mm
Active area	70.08(W)×52.56(H)	mm
Dot pitch	0.219(W)×0.219(H)	mm
Interface	24-bit RGB interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	6 White LED	--

3. External Dimensions



4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1~2	LEDK	LED backlight cathode
3~4	LEDA	LED backlight anode
5	NC	No connection
6	RESET	Reset signal input terminal, active at ‘L’
7	POL	Write signal input terminal, Active at ‘L‘. Synchronizing clock signal in SPI mode.
8	YU	connection /TP Up
9	XR	connection /TP Right
10	YD	connection /TP Bottom.
11	XL	connection /TP Left
12~19	B0	Data bus
20~27	G0	Data bus
28~35	R0	Data bus
36	HSYNC	Line synchronizing signal for RGB interface operation.
37	VSYNC	Frame synchronizing signal for RGB interface operation.
38	DOTCLK	Dot clock signal for RGB interface operation.
39~40	NC	No connection
41~42	VCC	Power Voltage
43	/CS	Chip select signal input terminal, Active at ‘L’
44~48	NC	No connection
49	SCL	Write signal input terminal, Active at ‘L‘. Synchronizing clock signal in SPI mode.
50	SDI	SPI interface input pin.
51	NC	No connection
52	DE	Data ENEABLE signal for RGB interface operation.
53	GND	Power ground
54	GND	Power ground

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power Voltage	VCC	-0.3	4.6	V
Input Voltage	Vin	-0.3	VCC +0.3	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Voltage	VDD	2.5	2.8	3.6	V	-
Input High Voltage	V_{IH}	0.7VCC	-	VCC	V	-
Input Low Voltage	V_{IL}	GND	-	0.3 VCC	V	-
Output High Voltage	V_{OH}	0.8 VCC	-	VCC	V	-
Output Low Voltage	V_{OL}	GND	-	0.2 VCC	V	-
I/O Leak Current	ILI	-1	-	1	uA	-

7. Timing Characteristics

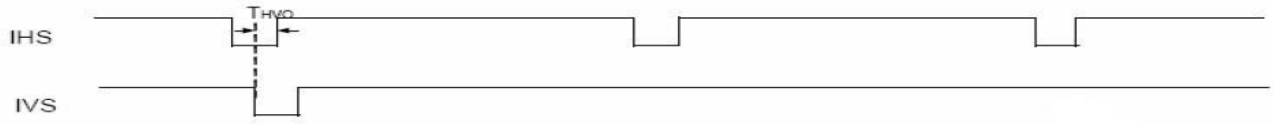
7.1.1 Parallel RGB Interface Timing Characteristics

Hsync and Vsync timing

CCIR601 timing waveform VS_POL=H, HS_POL=L in Register R2)

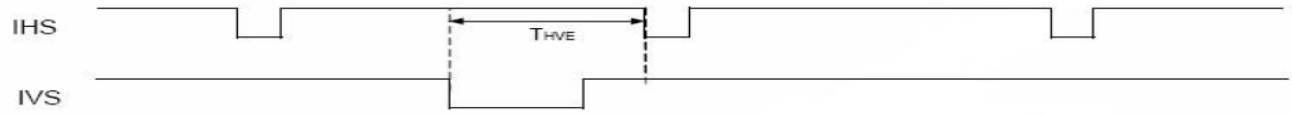
IHS and IVS timing

- Odd field



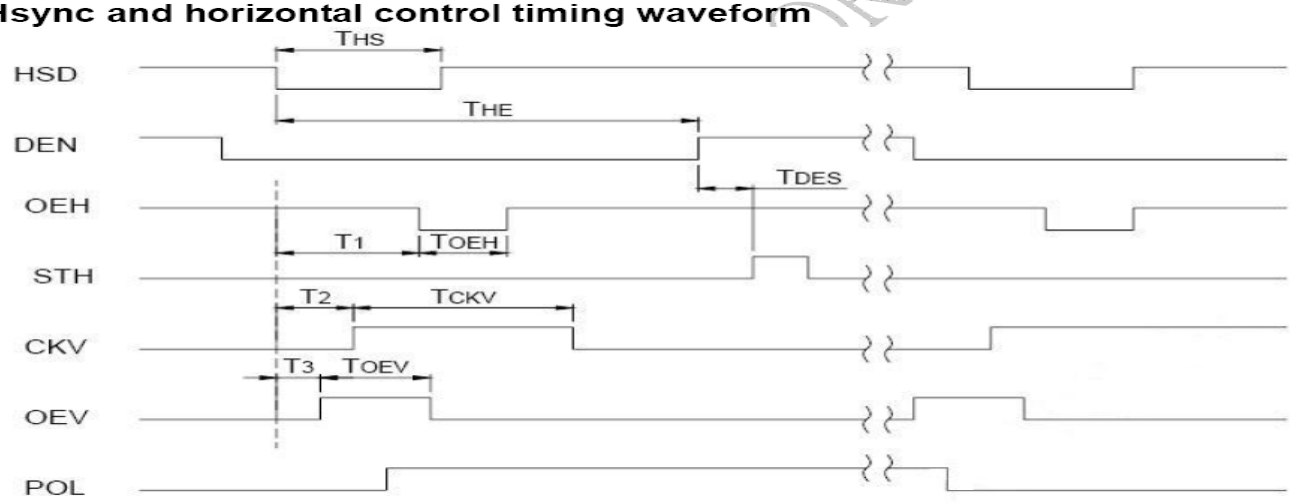
IHS and IVS waveforms in odd field

- Even field

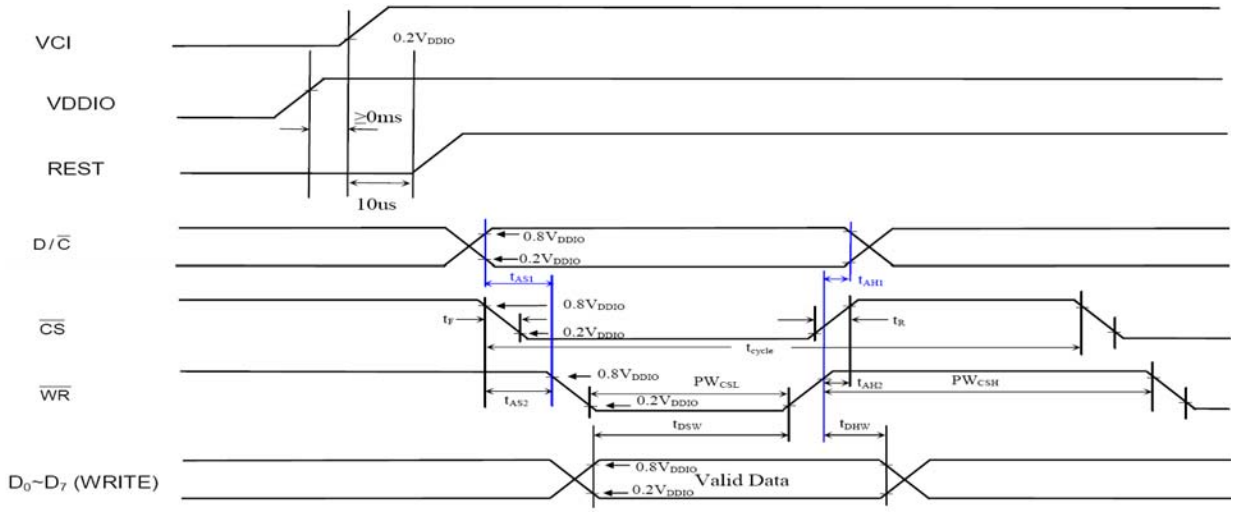


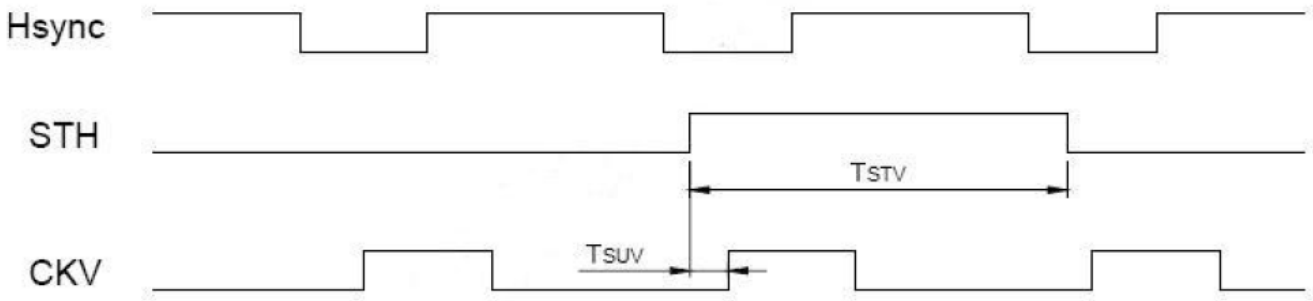
IHS and IVS waveforms in even field

Hsync and horizontal control timing waveform

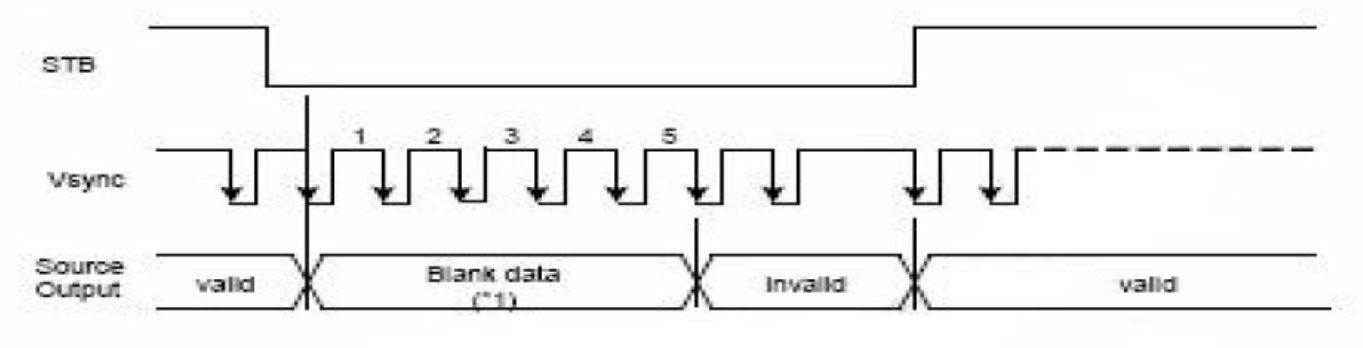


Hsync and vertical shift clock timing waveform





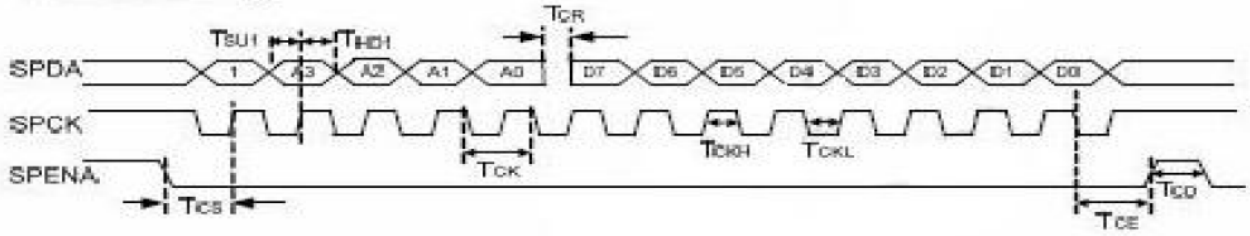
7.1.2 Power Up Sequence for RGB mode



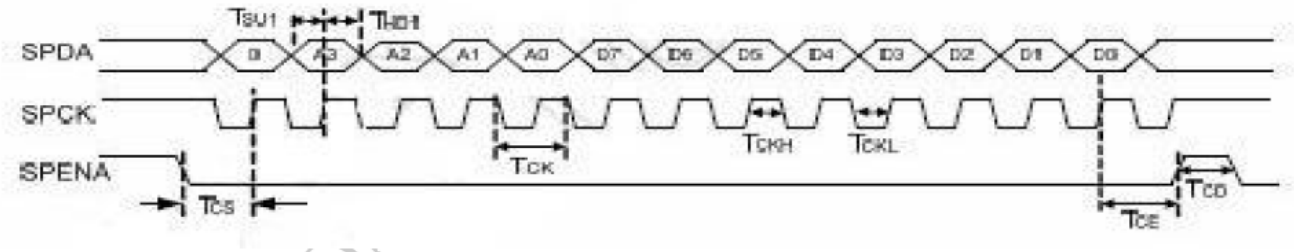
7.1.3 SPI Timing Characteristics

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
SPCK period	T_{CK}	60	-	-	ns
SPCK high width	T_{CKH}	30	-	-	ns
SPCK low width	T_{CKL}	30	-	-	ns
Data setup time	T_{SU1}	12	-	-	ns
Data hold time	T_{HD1}	12	-	-	ns
SPENA to SPCK setup time	T_{CS}	20	-	-	ns
SPENA to SPDA hold time	T_{CE}	20	-	-	ns
SPENA high pulse width	T_{CD}	50	-	-	ns
SPDA output latency	T_{CR}	-	1/2	-	T_{CK}

- **SPI read timing**

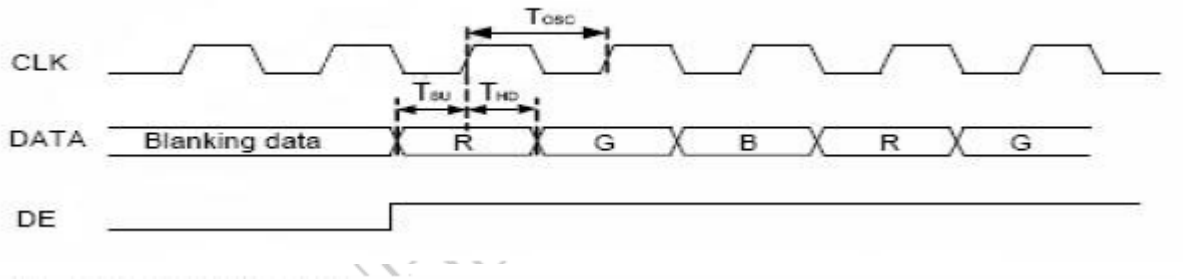


- **SPI write timing**

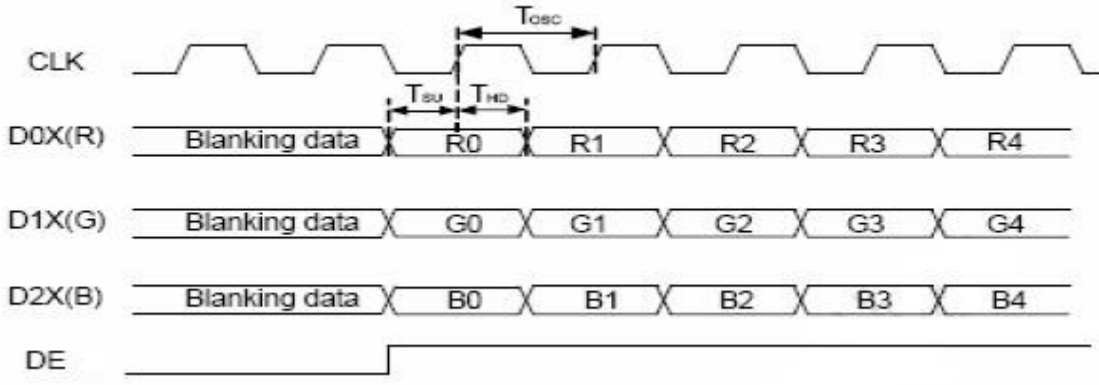


7.1.4 RGB Timing Characteristics

- **Digital Serial RGB**

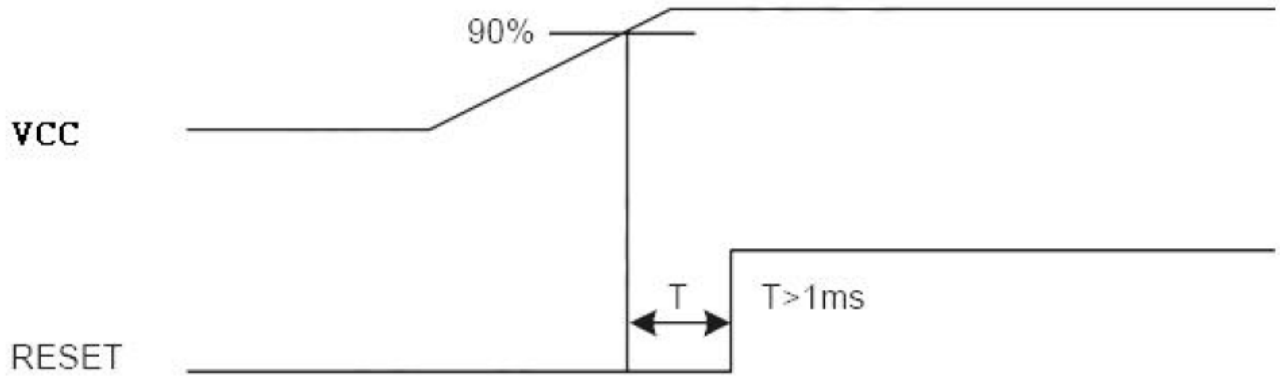


- **Digital Parallel RGB**



7.2 Reset Timing Characteristics

The RESET input must be held at least 1ms after power is stable



Reset timing

8. Backlight Characteristics

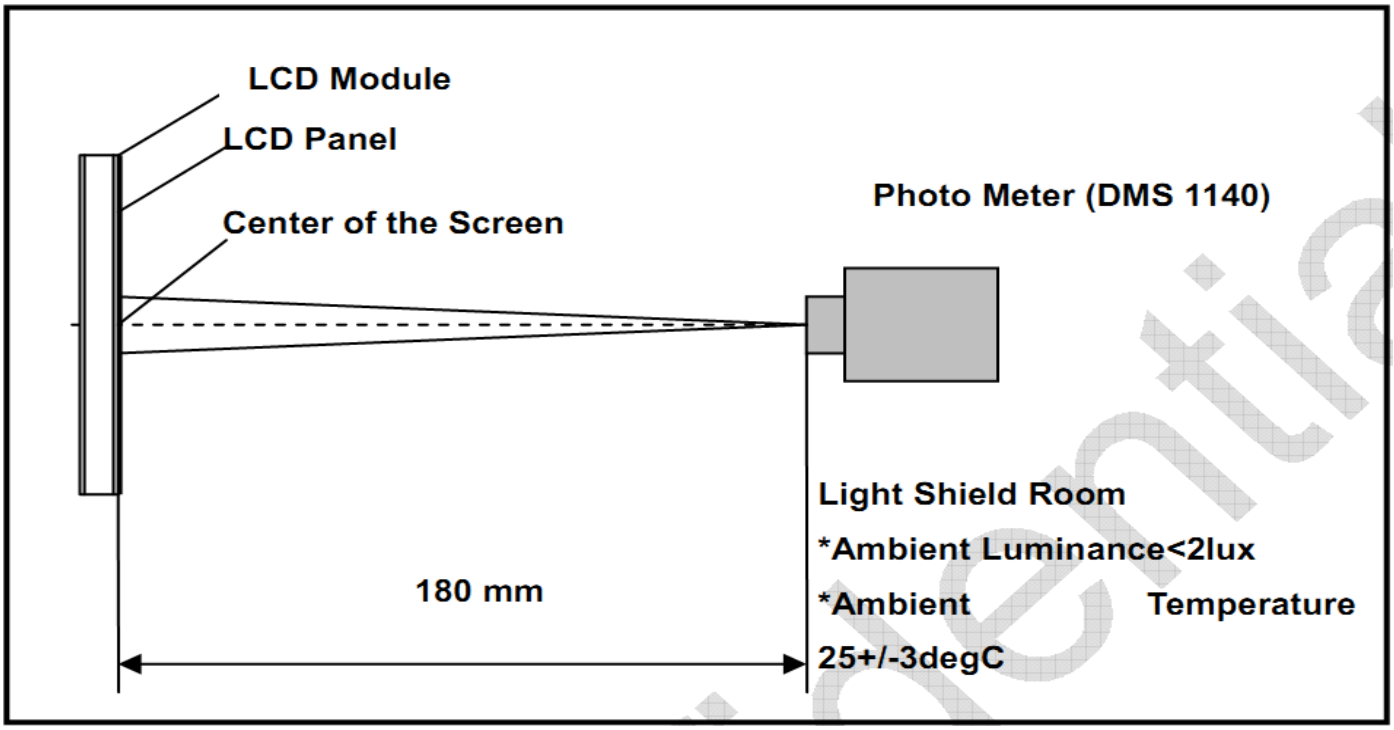
BL Circuit Diagram:

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	16.8	18	21	V	If=20mA
Supply Current	If	-	20	-	mA	-
Luminous Intensity for LCM	-	300	400	-	Cd/m^2	If=20mA
Uniformity for LCM	-	80	-	-	%	If=20mA
Life Time(25℃)	-	50000	-	-	Hr	If=20mA
Backlight Color	White					

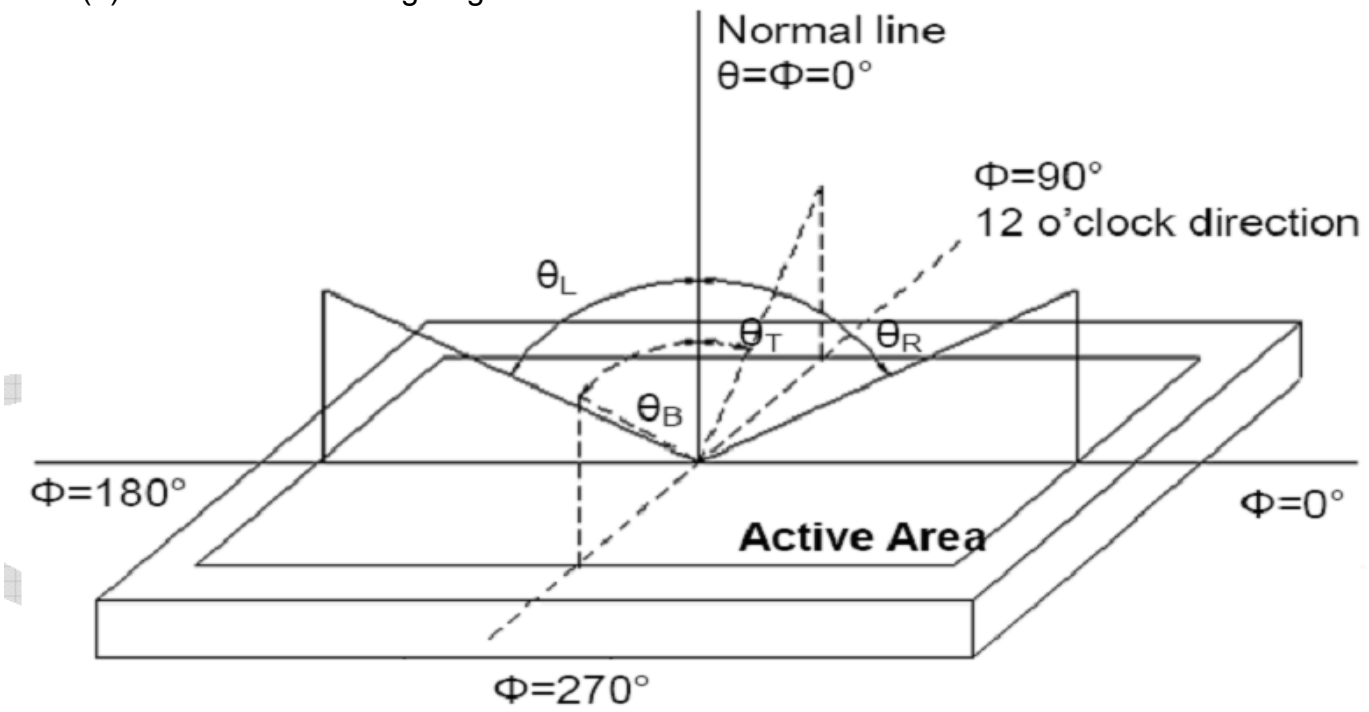
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	-	(15)	-	degree	(1),(2),(6)
		θ_R	-	(35)	-		
	Vertical	θ_T	-	(45)	-		
		θ_B	-	(45)	-		
Contrast Ratio	Center		200	300	-	-	(1),(3),(6)
Response Time	Rising		-	15	30	ms	(1),(4),(6)
	Falling		-	35	50		
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			0.2774		-	
	White y			0.2876		-	
Transmittance	-		-	5.0	-	%	(1),(5),(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

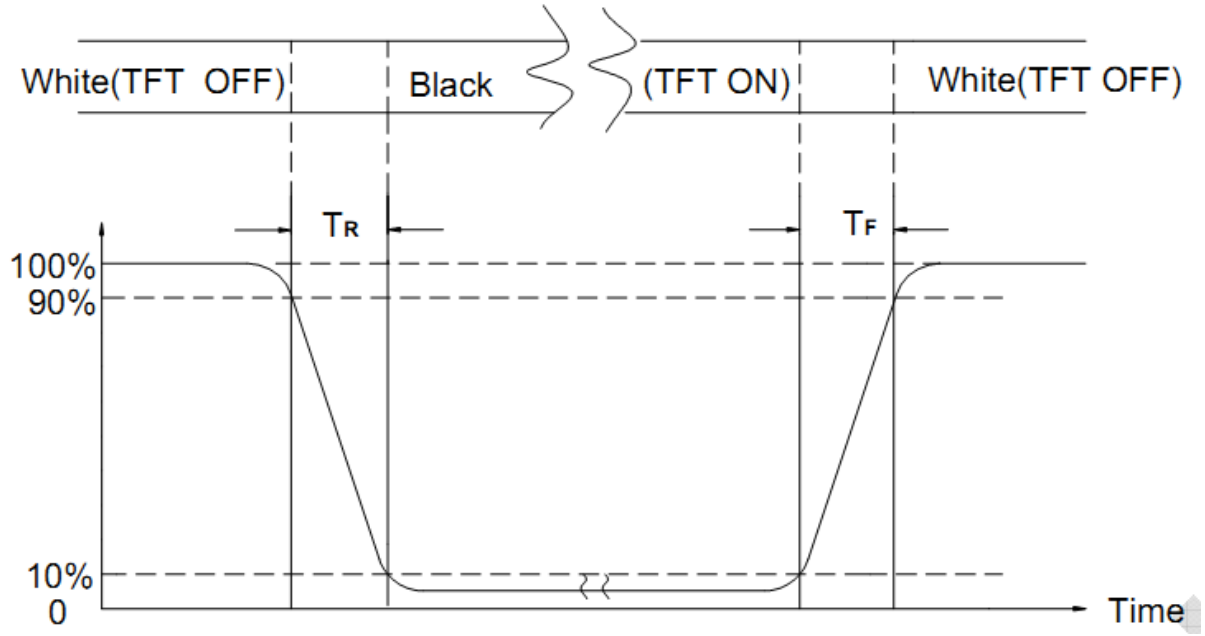


Note (3) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression
Contrast Ratio (CR) = L63 / L0

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)

Transmittance = Center Luminance of LCD / Center Luminance of Back Light x 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. 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.

11.1.2. 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 SINGLE PLAN.

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

11.1.3. 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

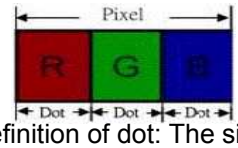
11.2.1.CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

11.2.2.CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

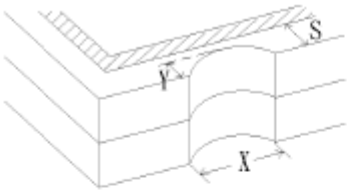
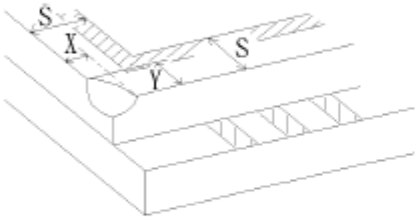
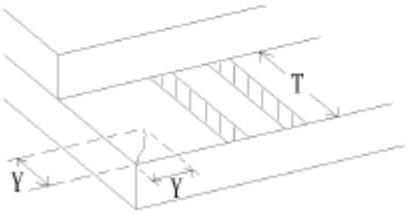
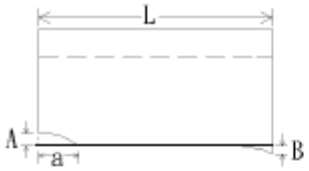
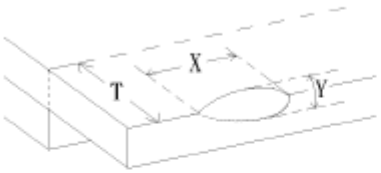
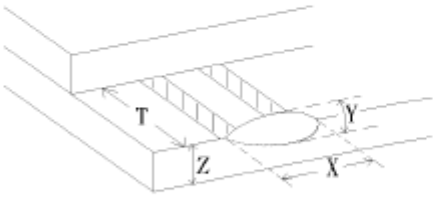
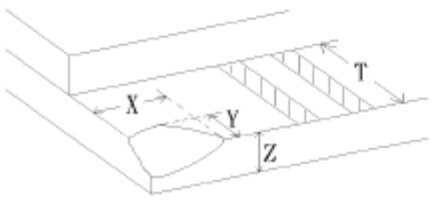
11.3. INSPECTION PLAN :

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

11.4 STANDARD OF VISUAL INSPECTION

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGEMENT</th></tr>
<tr><td>11.4.1</td><td>MINOR</td><td>BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH</td><td>(A) ROUND TYPE: unit: mm
<table>
<tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>∅≤0.1</td><td>Disregard</td></tr>
<tr><td>0.2 < ∅ ≤ 0.3</td><td>2 (Distance ≥ 5mm)</td></tr>
<tr><td>0.3 < ∅</td><td>0</td></tr>
</table>
NOTE: ∅=(LENGTH*WIDTH)/2
(S) LINE TYPE: unit: mm
<table>
<tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE QTY</th></tr>
<tr><td>……</td><td>W≤ 0.03</td><td>Disregard</td></tr>
<tr><td>L ≤5.0</td><td>0.03 < W ≤ 0.07</td><td>3 (Distanced ≥ 5mm</td></tr>
<tr><td>……</td><td>0.07 < W</td><td>FOLLOW ROUND TYPE</td></tr>
</table>
NOTE: ∅=(LENGTH*WIDTH)/2</td></tr>
<tr><td>11.4.2</td><td>MINOR</td><td>BUBBLE IN POLARIZER
DENT ON POLARIZER</td><td>unit: mm.
<table>
<tr><th>DIAMETER</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>∅<0.15</td><td>Disregard</td></tr>
<tr><td>0.2<∅≤ 0.3</td><td>2(Distance≥ 5mm)</td></tr>
<tr><td>0.3<∅</td><td>0</td></tr>
</table></td></tr>
<tr><td>11.4.3</td><td>MINOR</td><td>Dot Defect</td><td>
<table>
<tr><th>Items</th><th>ACC. Q'TY</th></tr>
<tr><td>Bright dot</td><td>N ≤1(Distance ≥ 5mm)</td></tr>
<tr><td>Dark dot</td><td>N ≤2(Distance ≥ 5mm)</td></tr>
</table>
Pixel Define :
Note 

1: The definition of dot: The size of a defective dot over 1 of whole dot is regarded as one defective dot. Definition:<1/2 dot and visible by 5% ND filter
2: Bright dot: Dots appear bright and unchanged in size m which LCD panel is displaying under black pattern.
3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red. green 、 blue pattern.</td></tr>
<tr><td>11.4.3.1</td><td>MINOR</td><td>Mura</td><td>Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary</td></tr>
</table>

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

12. Handling Precautions

12.1 Mounting method

The LCD panel of AMSON TFT module consists of two thin glass plates with polarizes which easily be damaged. And since the module in 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 sili8con coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen 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 use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to VDDIO or GND, 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 then the limit cause 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 then the operating temperature range and on the other hand at higher temperature LCD's how 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