Specification for Approval

Customer:_____

Model Name:_____

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
SAM	Peng Jun	Shuiming	

Revision Record

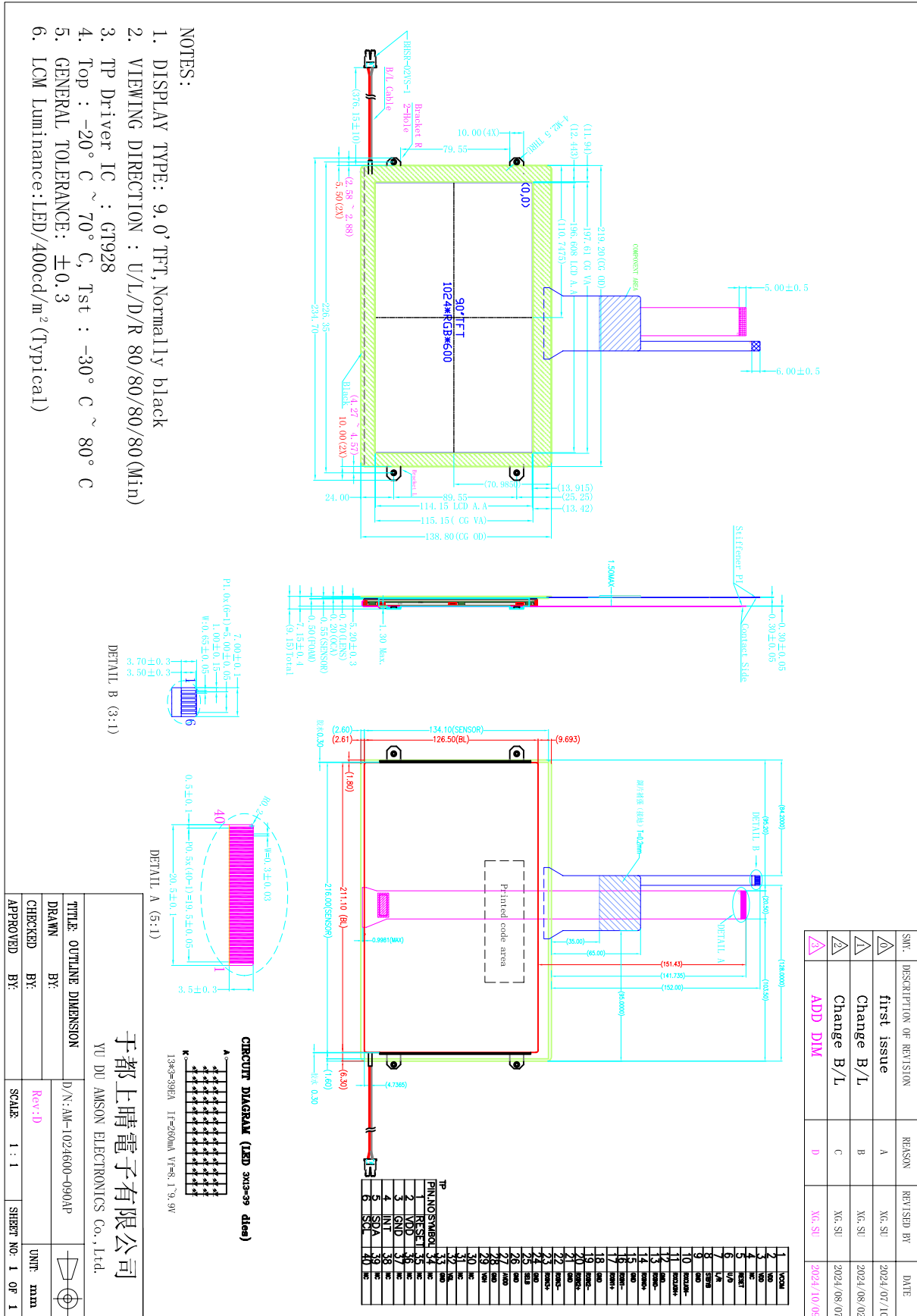| REV NO.	REV DATE	CONTENTS	Note
A	2024/09/27	NEW ISSUE	
B	2024/10/9	Add CF Color Chromaticity(Page14)	

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	9.0"TFT	--
Dot arrangement	1024(RGB)×600	dots
Color filter array	RGB vertical stripe	--
Display mode	Normally Black	--
Viewing Direction	ALL	--
Module size	219.20(H) x138.80(V)x 9.15(T)	mm
Active area	196.608(H) x114.15(V)	mm
Pixel pitch	0.192(H) x 0.19025(V)	mm
Interface	LVDS	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
ModuleWeight (without bracket)	315	g

3. External Dimensions

NOTES:
1. DISPLAY TYPE: 9.0" TFT, Normally black
2. VIEWING DIRECTION: U/L/D/R 80/80/80/80(Min)
3. TP Driver IC: GT928
4. Top: -20°C ~ 70°C, Tst: -30°C ~ 80°C
5. GENERAL TOLERANCE: ±0.3
6. LCM Luminance:LED/400cd/m² (Typical)

4. Interface Description

No.	Symbol	Function
1	VCOM	Power supply for Common voltage.
2	VDD	Power Supply For LCD.
3	VDD	Power Supply For LCD.
4	NC	No Connection.
5	RESET	Reset Signal input pin.
6	U/D	Gate Up or Down scan control.Normally pull low.
7	L/R	Source Right or Left sequence control.Normally pull high.
8	STBYB	Standby mode, Normally pulled high. STBYB = "1" ,normal operation STBYB = "0" , timing controller, source driver will turn off.
9	GND	Ground.
10	RXCLKIN-	Negative LVDS differential clock inputs
11	RXCLKIN+	Positive LVDS differential clock inputs
12	GND	Ground.
13	RXIN0-	Negative LVDS differential data0 inputs
14	RXIN0+	Positive LVDS differential data0 inputs
15	GND	Ground.
16	RXIN1-	Negative LVDS differential data1 inputs
17	RXIN1+	Positive LVDS differential data1 inputs
18	GND	Ground.
19	RXIN2-	Negative LVDS differential data2 inputs
20	RXIN2+	Positive LVDS differential data2 inputs
21	GND	Ground.
22	RXIN3-	Negative LVDS differential data3 inputs
23	RXIN3+	Positive LVDS differential data3 inputs
24	GND	Ground.

25	SELB	Horizontal Sync input for TTL mode. Negative polarity. (In LVDS interface connected SELB to FPC for pin setting SELB ="L":8 bit SELB ="H":6 bit)
26	GND	Ground.
27	AVDD	Analog Supply Voltage
28	GND	Ground.
29	VGH	Power supply for Positive Power for TFT
30	NC	No Connection.
31	NC	No Connection.
32	VGL	Power supply for Positive Power for TFT
33	GND	Ground.
34-40	NC	No Connection.

5. Absolute Maximum Ratings

Condition:Ta=25°C

Parameter	Min.	Max.	Unit
Supply Voltage (Analog)VDD	-0.5	+5.0	V
Analog Supply Voltage, AVDD, V1~V14	-0.5	+15.0	V
OperatingTemperature	-20	70	°C
StorageTemperature	-30	80	°C

Note: If one of the above items is exceeded its maximum limitation momentarily, the quality of the product may be degraded. Absolute maximum

limitation, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the

recommend range.

6. DC Characteristics

Operating Conditions

| Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	-
TFT Gate on voltage	VGH	22	23	24	V	-
TFT Gate off voltage	VGL	-9	-10	-11	V	-
TFT Common electrode voltage	VCOM	5.6	5.8	6	V	-
Input signalvoltage	VIH	0.7VDD	-	VDD	V	-
	VIL	0	-	0.3VDD	V	

7. Timing Characteristics
7.1 Power ON/OFF Sequence

In order to prevent IC from power on reset fail, the rising time (TPOR) of the digital power supplyVDD should be maintained within the given specifications. Refer to "AC Characteristics" for moredetail on timing.Power on/off control
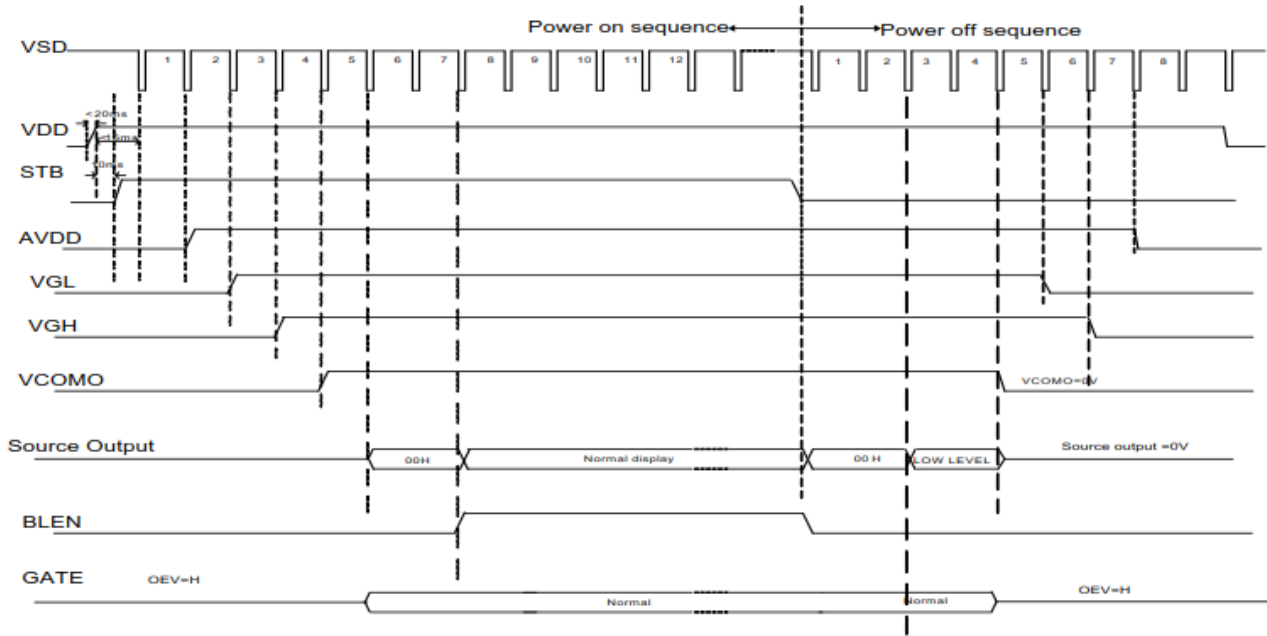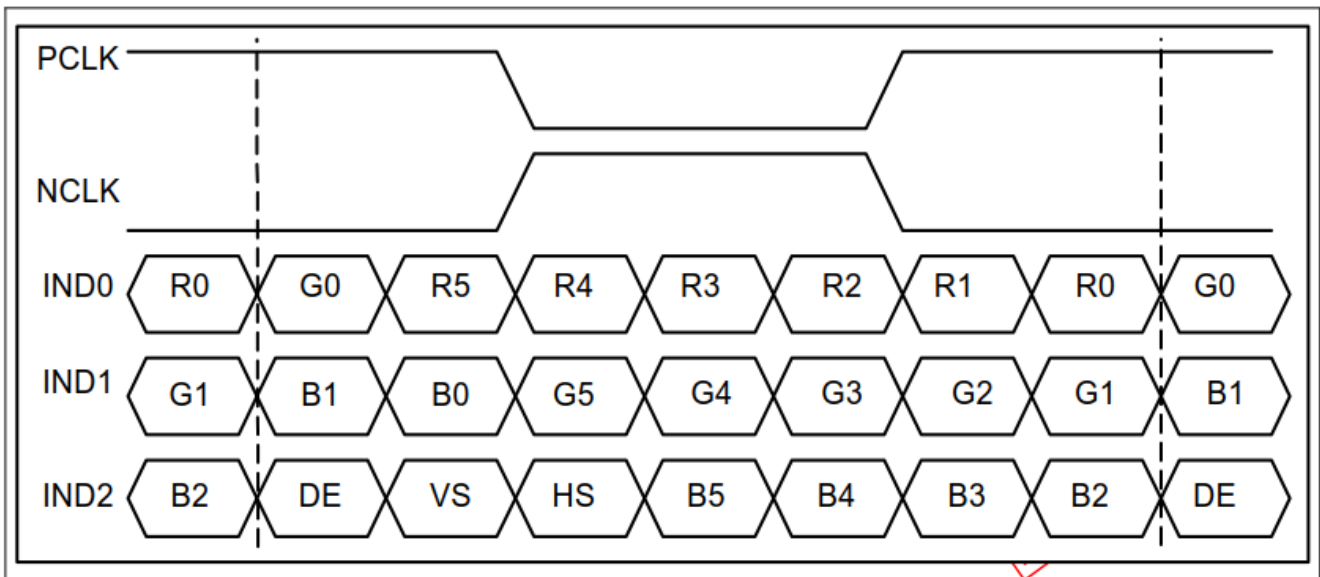
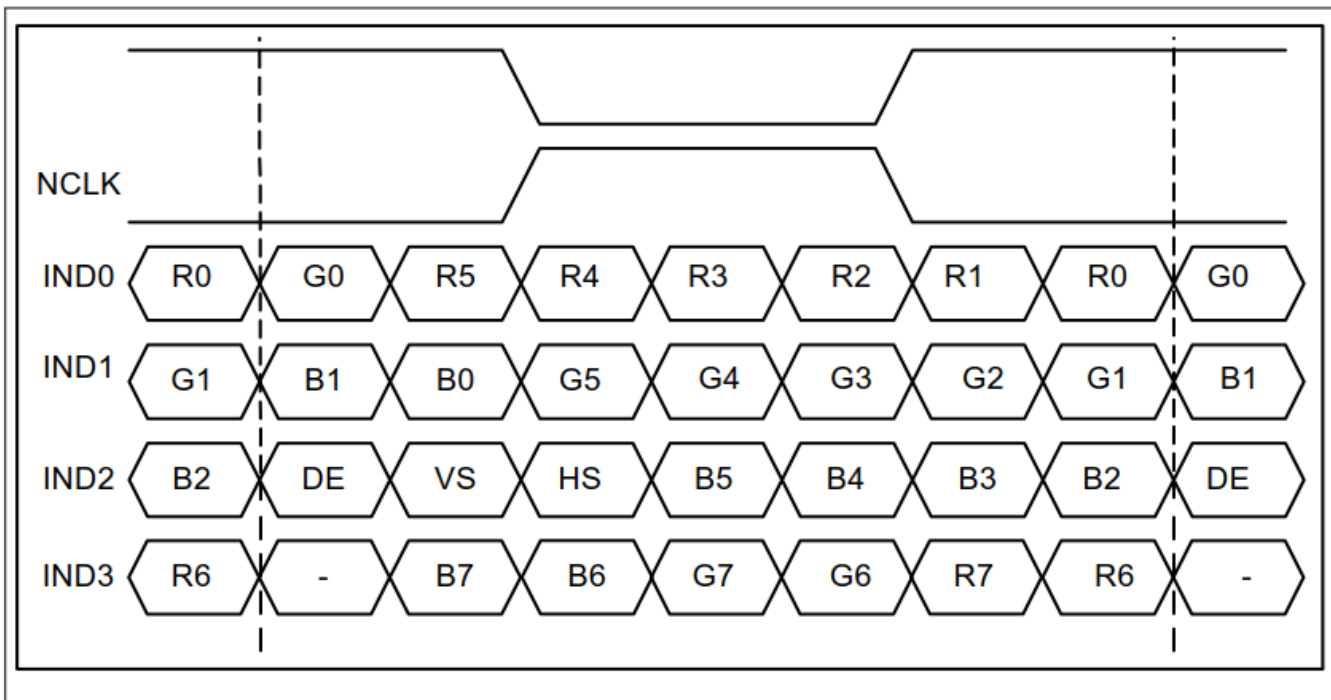Power On/Off   timing chart
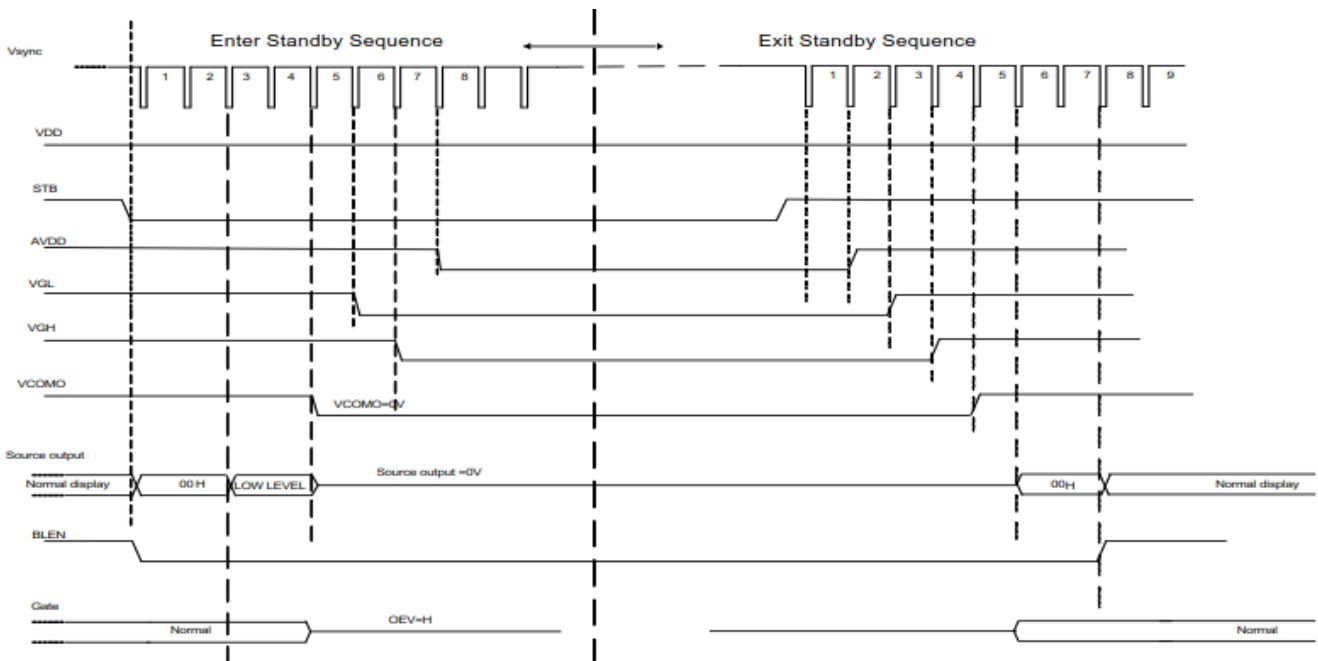
Enter and Exit Standby Mode timing chart

Note: Low level=3Fh,when NBW=L(Normally white)
   Low level=00h,when NBW=H(Normally black)

## 7.2 Data Input Format for LVDS

6-bit LVDS input(SELB =" H")

PCLK / NCLK

IND0 R0	G0	R5	R4	R3	R2	R1	R0	G0
IND1 G1	B1	B0	G5	G4	G3	G2	G1	B1
IND2 B2	DE	VS	HS	B5	B4	B3	B2	DE

8 -bit LVDS input (SELB =" L")

NCLK

IND0 R0	G0	R5	R4	R3	R2	R1	R0	G0
IND1 G1	B1	B0	G5	G4	G3	G2	G1	B1
IND2 B2	DE	VS	HS	B5	B4	B3	B2	DE
IND3 R6	-	B7	B6	G7	G6	R7	R6	-

7.3 LVDS mode(Receiver Differential :PINDO-PIND3,NINDO~NIND3,PINC,NINC)
LVDS DC characteristic

LVDS DC characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential input high threshold voltage	R_{XVTH}			+0.1V	V	R_{XVCM}=1.2V
Differential input low threshold voltage	R_{XVTL}	-0.1			V	
Input voltage range(single-end)	R_{XVIN}	0		2.4	V	
Differential input common mode voltage	R_{XVCM}	$|V_{ID}|/2$		2.4 -$|V_{ID}|/2$	V	
Differential input voltage	$|V_{ID}|$	0.2		0.6	V	
Differential input leakage current	R_{XVTH}	-10		+10	V	
LVDS Digital Operating Current	Iddlvsd	-	40(TBD)	50	mA	Fclk=65Mhz, VDD=3.3V
LVDS Digital Standby Current	Istlvds	-	10(TBD)	50	uA	Clock & all functions are stop
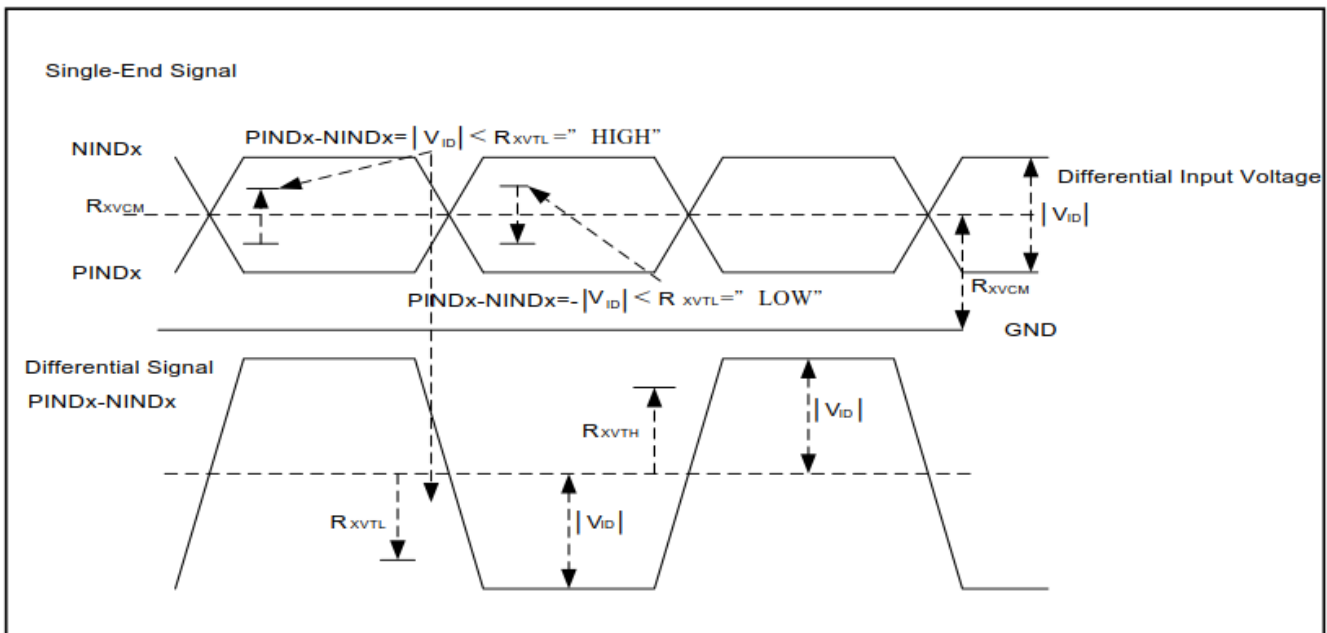
LVDS DC Characteristic

7.4 AC Electrical Characteristics

LVDS mode

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Clock Frequency	R_{xFCLK}		20	-	71	MHz
Input data skew margin	T_{RSKM}	$\|V_{ID}\|=400mV$ $R_{xVCM}=1.2V$ $R_{xFCLK}=71MHz$	500			ps
Clock High Time	T_{LVCH}			$4/(7 * R_{xFCLK})$		ns
						ns
Clock Low Time	T_{LVCL}			$3/(7 * R_{xFCLK})$		ns
PLL wake-up-time	T_{enPLL}				150	us

8. Backlight Characteristic
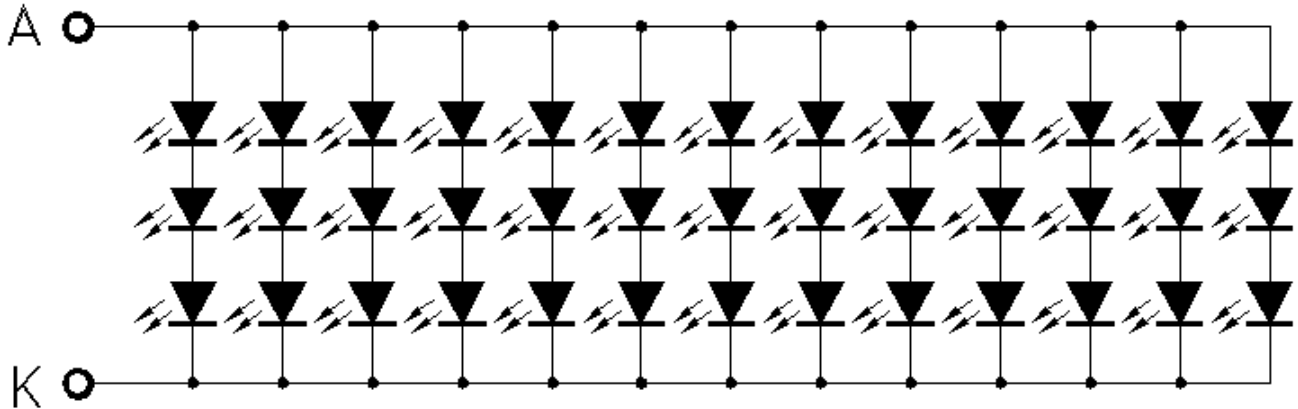
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	8.1	9.0	9.9	V	If=260mA
Supply Current	If	-	260	-	mA	If=260mA
Luminous Intensity for LCM	-	-	400	-	cd/m^2	If=260mA
Uniformity for LCM	-	70	80	-	％	If=260mA
Life Time	-	-	30000	-	Hr	If=260mA

Note: LEDlifetimeisdefinedasthetimewhenBrightnessbecomes50%oftheoriginalvalueatTa=25°C

9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θL	80	85	-	degree	(1),(2),(6)
		θR	80	85	-		
	Vertical	θT	80	85	-		
		θB	80	85	-		
Contrast Ratio	Center		640	800	-	-	(1),(3),(6)
Response Time	Rising + Falling		-	30	40	ms	(1),(4),(6)
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.05	0.61	Typ. +0.05	-	(1), (6)
	Red y			0.33		-	
	Green x			0.28		-	
	Green y			0.53		-	
	Blue x			0.15		-	
	Blue y			0.14		-	
	White x			0.30		-	
	White y			0.31		-	

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.
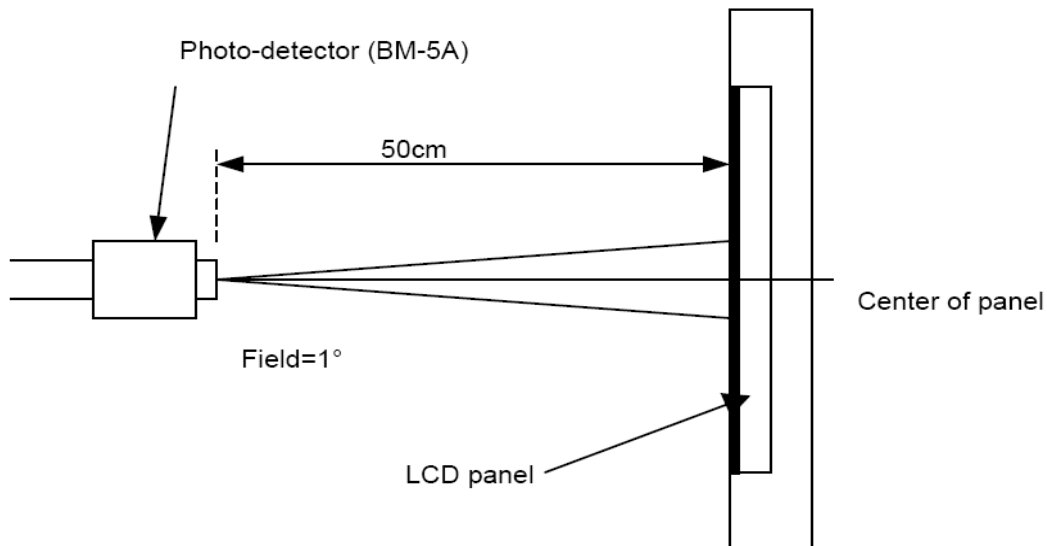
Note (2) Definition of Viewing Angle
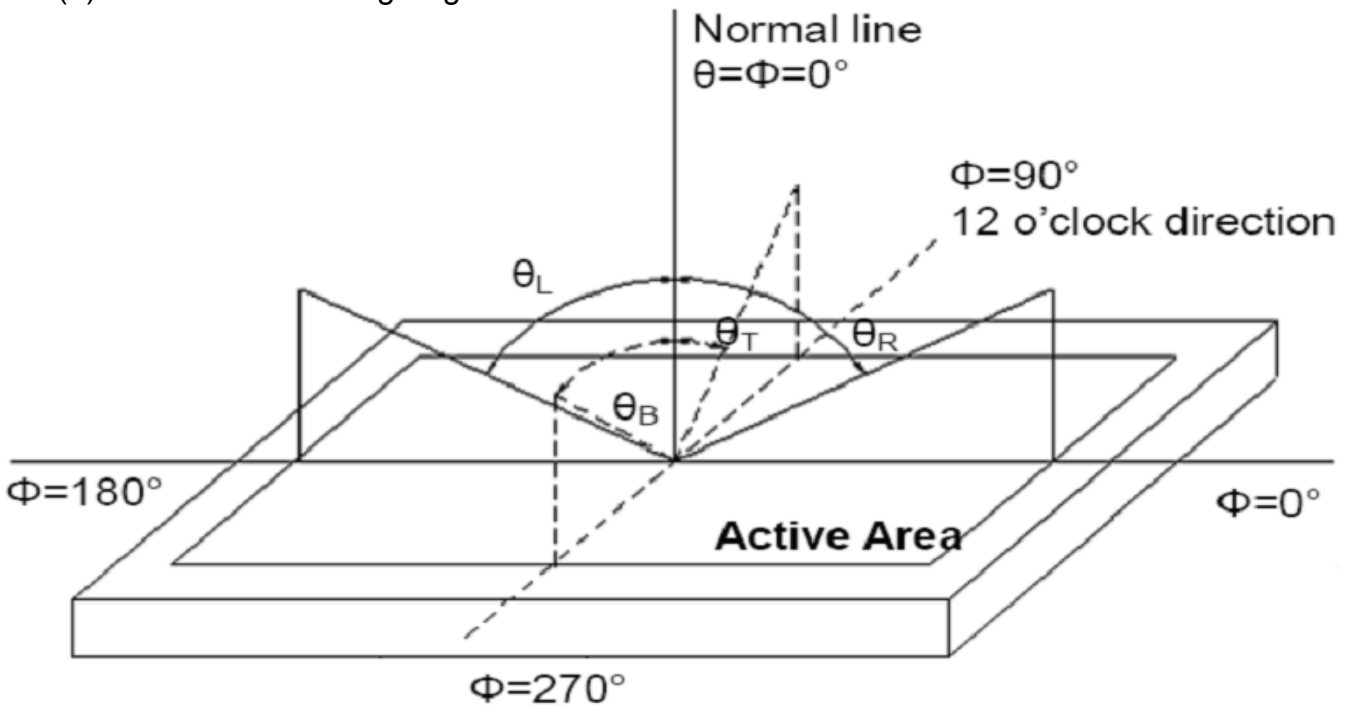
Note (3) Definition of Contrast Ratio (CR)

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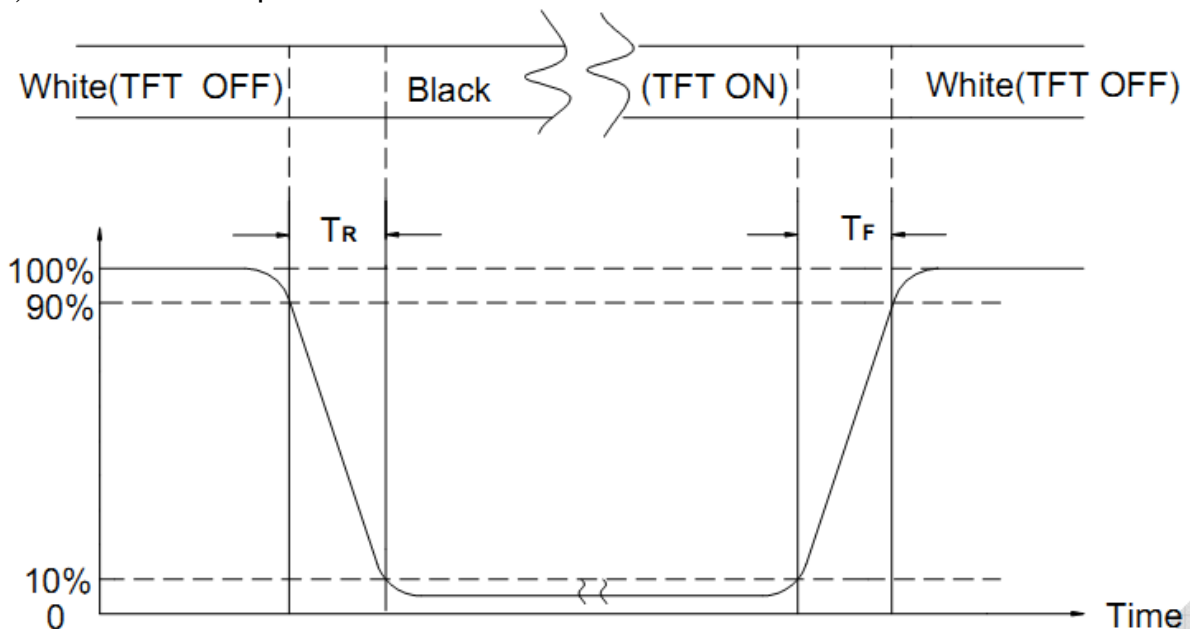
Note (5) Definition of Transmittance (Module is without signal input)

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

Test Item	Test Condition	Remark
High Temperature Storage	Ta=80℃; 240hrs	IEC60068-2-1：2007 GB2423.2-2008
Low Temperature Storage	Ta=-30℃; 240hrs	IEC60068-2-1：2007 GB2423.1-2008
High Temperature Operation	Ta=70℃，240Hrs	IEC60068-2-1：2007 GB2423.2-2008
Low Temperature Operation	Ta=-20℃; 240hrs	IEC60068-2-1：2007 GB2423.1-2008
High Temperature High Humidity Operation	Ta=60℃，90%RH，240Hrs(no condensation)	IEC60068-2-78：2001 GB/T2423.3-2006
Thermal Shock	-30℃(0.5h) ~ 80℃(0.5h) / 100cycles	Start with cold temperature，End with high temperature，IEC60068-2-14:1984,GB2423.22-2002
Image Sticking	25℃ ; 4hrs	Note1

Note1:Condition of image sticking test :25℃±2℃

Operation with test pattern sustained for 4hrs,then change to gray pattern immediately.after5 mins,themura must be disappeared completely
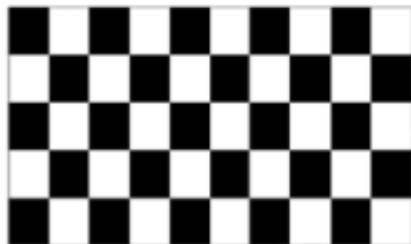
(a) Test Pattern (chess board Pattern)　　　(b) Gray Pattern

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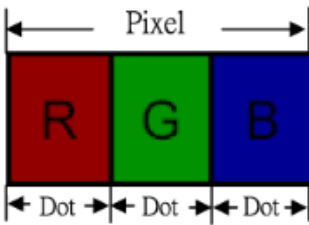
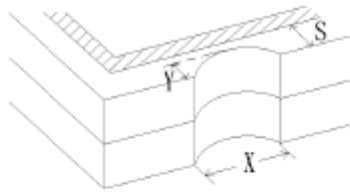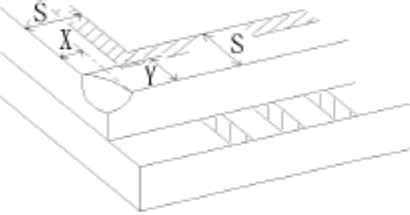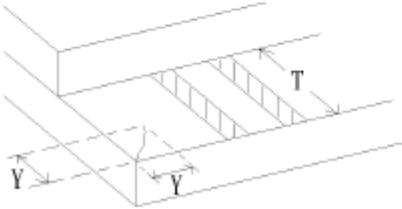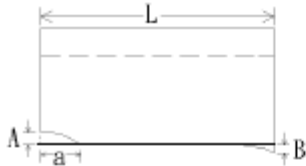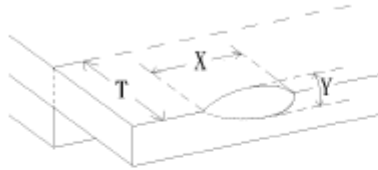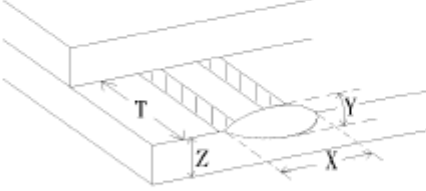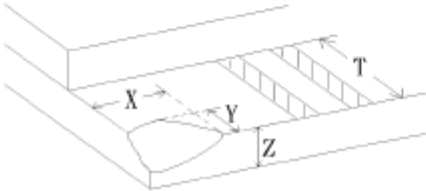11.2.1. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

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

NO.	CLASS	ITEM	JUDGEMENT
11.4.1	MINOR	BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH	(A) ROUND TYPE: unit : mm.
11.4.2	MINOR	BUBBLE IN POLARIZER DENT ON POLARIZER	
11.4.3	MINOR	Dot Defect	

(A) ROUND TYPE: unit : mm.

DIAMETER (mm.)	ACCEPTABLE Q'TY
Φ ≤ 0.1	DISREGARD
0.1 < Φ ≤ 0.25	3 (Distance>5mm)
0.25 < Φ	0

NOTE: Φ=(LENGTH+WIDTH)/2

(B) LINEAR TYPE: unit : mm.

LENGTH	WIDTH	ACCEPTABLE Q'TY
------	W ≤ 0.03	DISREGARD
L ≤ 5.0	0.03 < W ≤ 0.07	3 (Distance>5mm)
------	0.07 < W	FOLLOW ROUND TYPE

unit : mm.

DIAMETER	ACCEPTABLE Q'TY
Φ ≤ 0.2	DISREGARD
0.2 < Φ ≤ 0.5	2 (Distance>5mm)
0.5 < Φ	0

Items	ACC. Q'TY
Bright dot	N ≤ 4
Dark dot	N ≤ 4

Pixel Define :

Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.

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)		$\Phi = (x+y)/2 > 2.5$ 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 (CI) , 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 happen by miss-handling or using some materials such as Chlorine (CI), 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 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 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 which is not specified in this specifications

● 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