Specification for Approval

Customer:_____

Model Name:_____

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

Revision Record

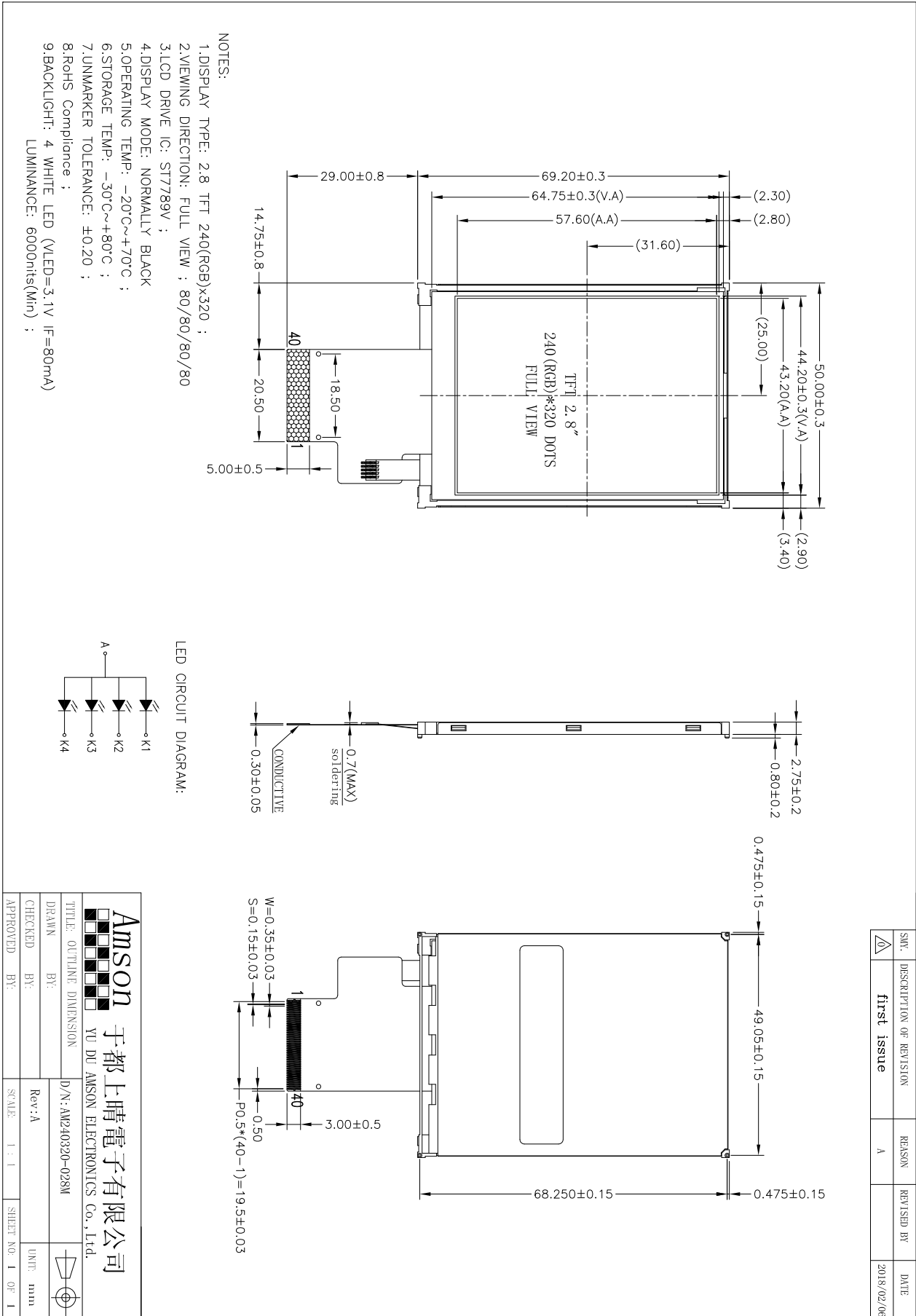| REV NO.	REV DATE	CONTENTS	Note
A	2018-02-06	NEW ISSUE	

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	2.8"TFT	--
Dot arrangement	240(RGB)×320	dots
Color filter array	RGB vertical stripe	--
Display mode	Transmission / Normally Black	--
Viewing Direction	Full view	--
Driver IC	ST7789V	--
Module size	50(W)×69.2(H)×2.75(T)	mm
Active area	43.2(W)×57.6(H)	mm
Dot pitch	0.18(W)×0.18(H)	mm
Interface	8-/ 9-/16-/18-bit 8080-series system interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	4 White LED	--
Weight	TBD	g

3. External Dimensions

NOTES:
1.DISPLAY TYPE: 2.8 TFT 240(RGB)x320 ;
2.VIEWING DIRECTION: FULL VIEW ; 80/80/80/80
3.LCD DRIVE IC: ST7789V ;
4.DISPLAY MODE: NORMALLY BLACK
5.OPERATING TEMP: -20°C~+70°C ;
6.STORAGE TEMP: -30°C~+80°C ;
7.UNMARKER TOLERANCE: ±0.20 ;
8.RoHS Compliance ;
9.BACKLIGHT: 4 WHITE LED (VLED=3.1V IF=80mA)
    LUMINANCE: 6000nits(Min) ;

TFT 2.8"
240(RGB)*320 DOTS
FULL VIEW

LED CIRCUIT DIAGRAM:

first issue

SMY.	DESCRIPTION OF REVISION	REASON	REVISED BY	DATE
	first issue	A		2018/02/06

TITLE: OUTLINE DIMENSION		
DRAWN	BY:	D/N:AM240320-028M
CHECKED	BY:	Rev:A
APPROVED	BY:	

Amson
于都上晴電子有限公司
YU DU AMSON ELECTRONICS Co.,Ltd.

SCALE: 1:1   SHEET NO. 1 OF 1   UNIT: mm

4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION			
1	IM0	elect the MPU system interface mode			
2	IM1	IM1	IM0	MPU- Interface mode	DB Pin in use
		0	0	80 MCU 16bit interface II	DB[17: 10],DB[8: 1]
		0	1	80 MCU 8bit interface II	DB[17:10]
		1	0	80 MCU 18bit interface II	DB[17:0]
		1	1	80 MCU 9bit interface II	DB[17:9]
3	K4	The cathode of LED power			
4	K3				
5	K2				
6	K1				
7	A	The Anode of LED power			
8	RESX	Reset pin setting either pin low initializes the LSI Must be reset after power supplied			
9~12	GND	Power supply for ground			
13~30	DB17~DB0	18-bit bi-directional data bus The unused pins let to open			
31	NC	No connection			
32	GND	Power supply for ground			
33	RDX	Read enable pin I80 parallel bus system interface			
34	WRX	Write enable pin I80 parallel bus system interface			
35	D/CX	Command/parameter or display data selection pin			
36	CSX	Chip select signal Low: chip can be accessed High: chip cannot be accessed			
37	VDD	Analog power supply			
38~39	GND	Power supply for ground			
40	VDDIO	Logic power supply			

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	VDDIO	-0.3	4.6	V
Analog Supply Voltage	VDD	-0.3	4.6	V
Input Voltage	Vin	-0.3	VDDIO +0.5	V
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	VDDIO	1.65	1.8	3.3	V	-
Analog Supply Voltage	VDD	2.4	2.75	3.3	V	-
Input High Voltage	V_{IH}	0.7 VDDIO	-	VDDIO	V	Digital input pins
Input Low Voltage	V_{IL}	GND	-	0.3 VDDIO	V	Digital input pins
Output High Voltage	V_{OH}	0.8 VDDIO	-	VDDIO	V	Digital output pins
Output Low Voltage	V_{OL}	GND	-	0.2 VDDIO	V	Digital output pins
I/O Leak Current	I_{LI}	-1	-	-	uA	-

7. Timing Characteristics

7.1 i80-System Interface Timing Characteristics
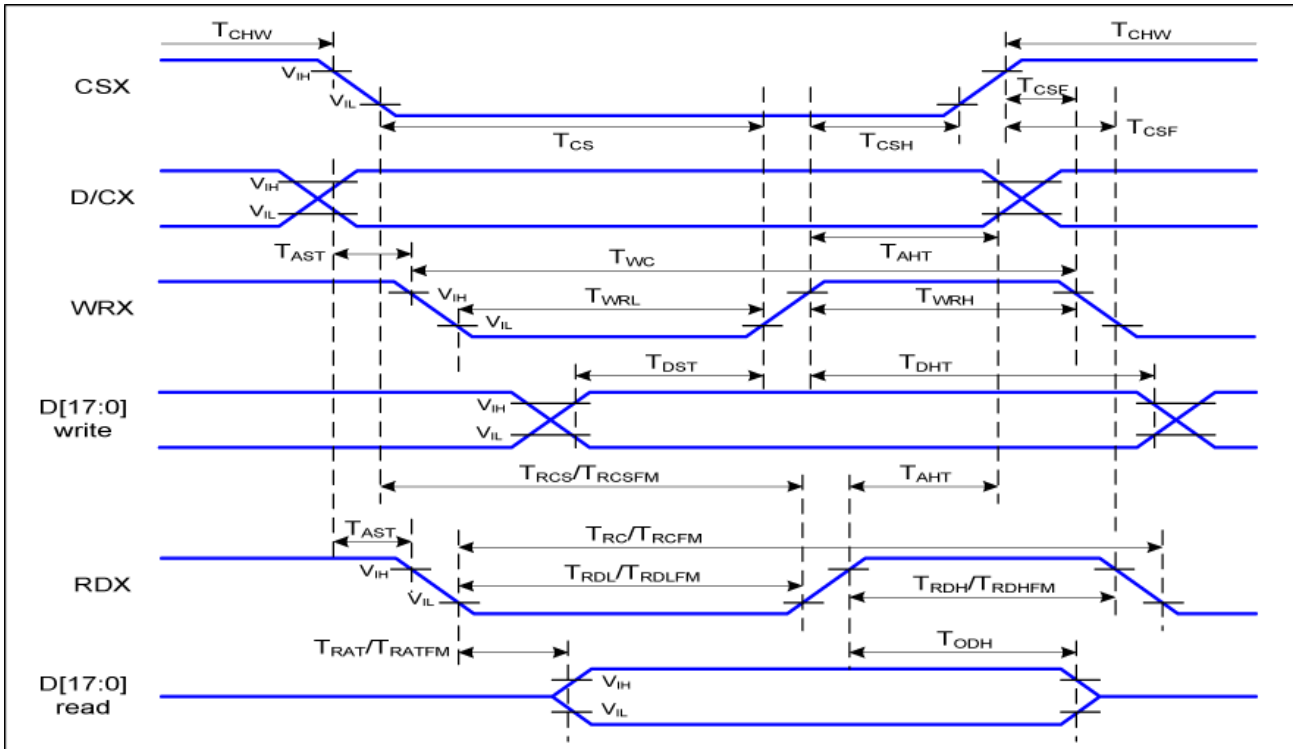
Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF

7.2 Reset Timing Characteristics
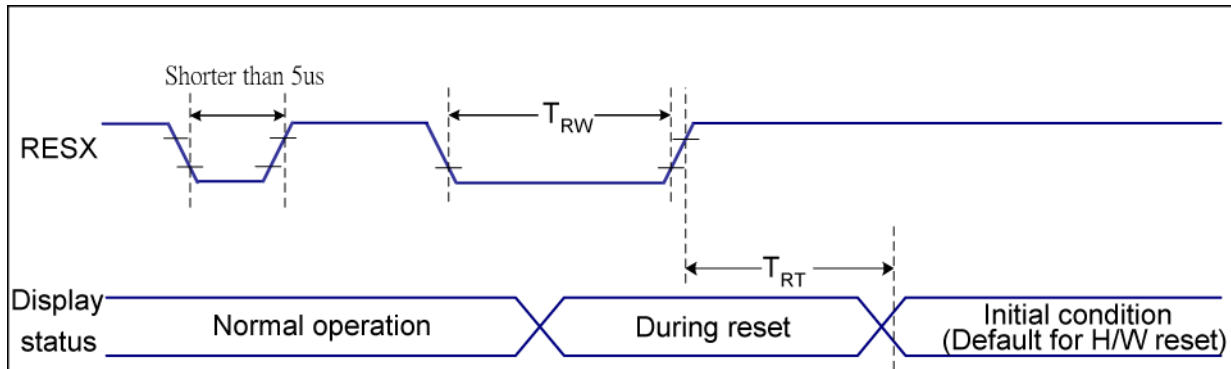
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

8. Backlight Characteristic
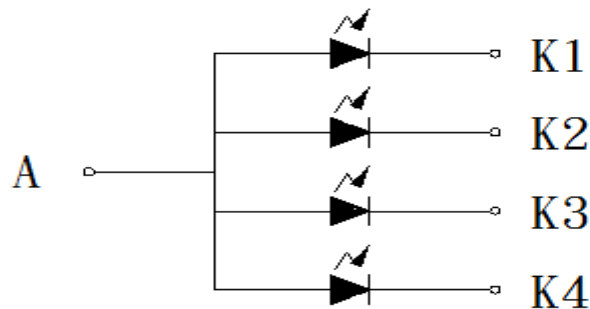
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	-	3.1	-	V	If=80mA
Supply Current	If	-	80	-	mA	-
Luminous Intensity for LCM	-	170	220	-	cd/m^2	If=80mA
Uniformity for LCM	-	75	80	-	％	If=80mA
Life Time	-	-	20000	-	Hr	If=80mA
Backlight Color	White					

9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θL	70	80	-	degree	(1),(2),(6)
		θR	70	80	-		
	Vertical	θT	70	80	-		
		θB	70	80	-		
Contrast Ratio	Center		640	800	-	-	(1),(3),(6)
LCM Luminance	Center point		170	220	-	Cd/m^2	
Response Time	Rising + Falling		-	30	40	ms	(1),(4),(6)
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		-	
Transmittance	-		-	3.9	-	%	(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.
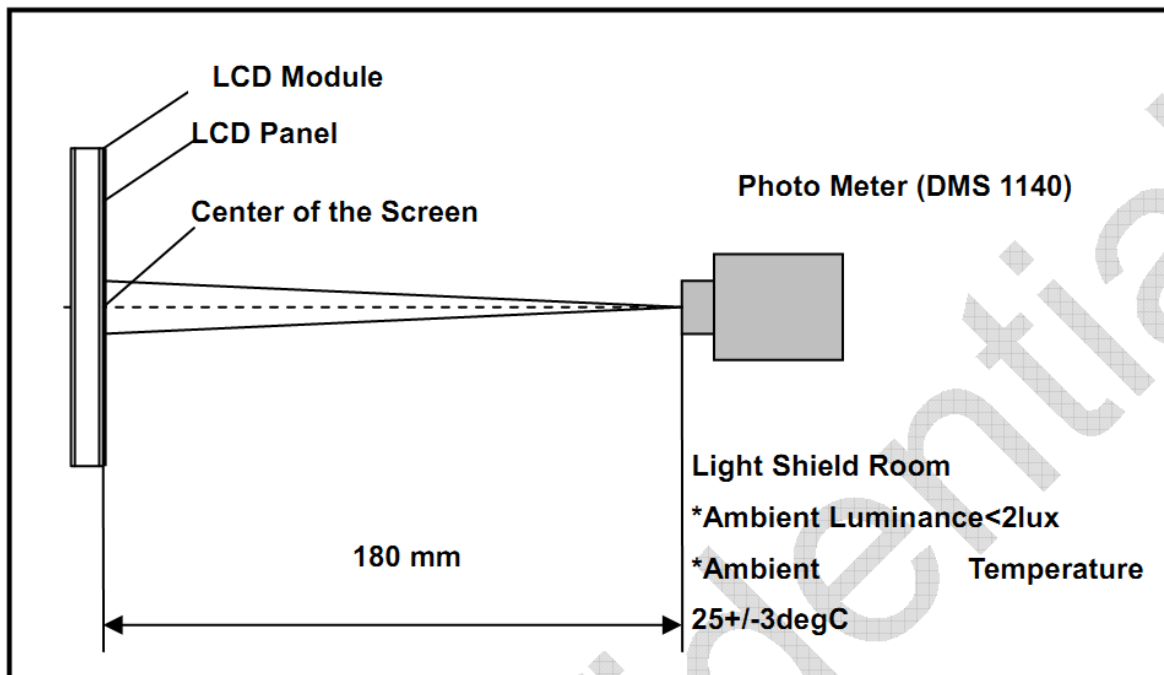
Note (2) Definition of Viewing Angle
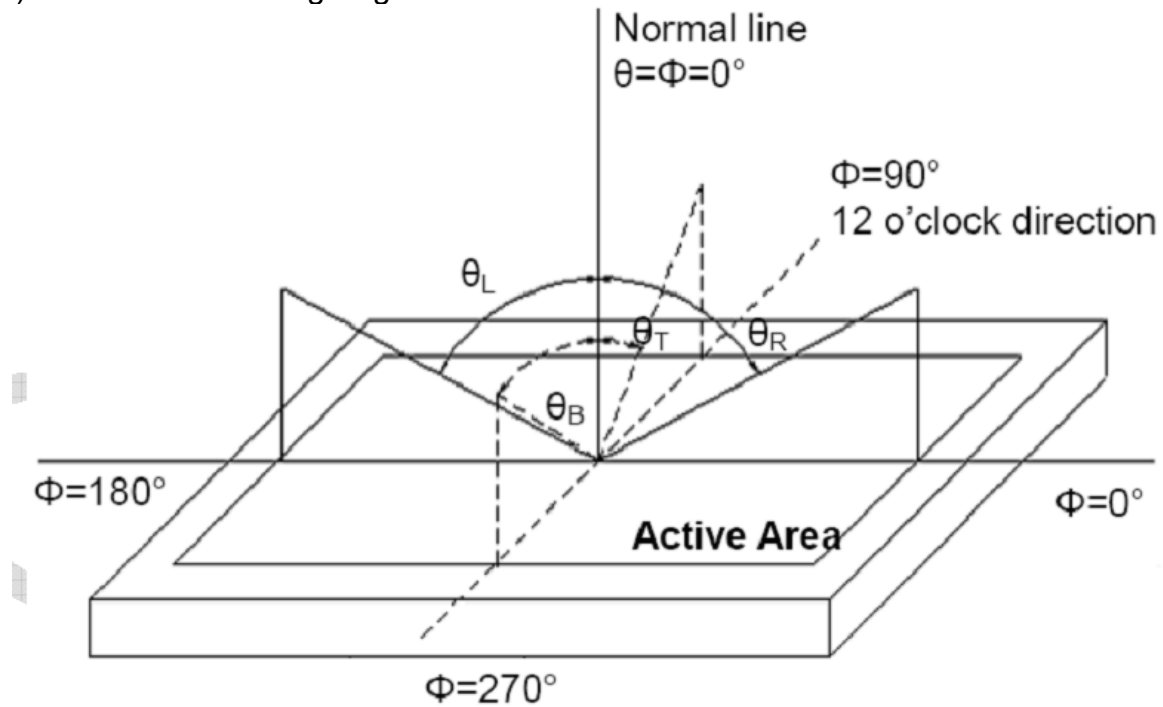
Note (3) Definition of Contrast Ratio (CR)

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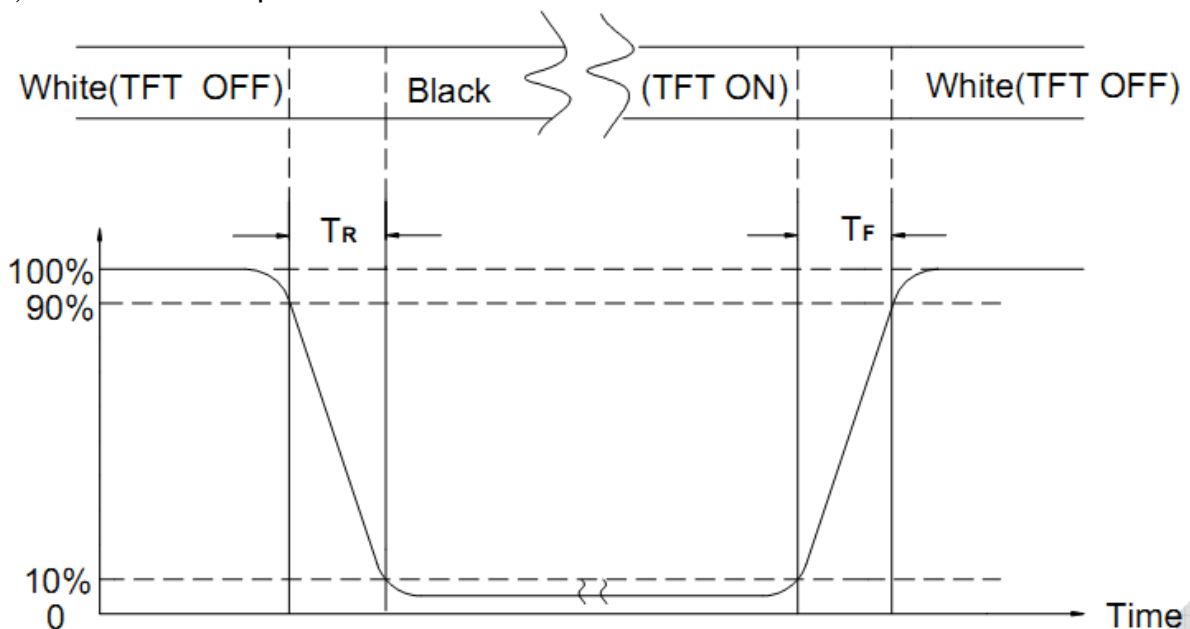
Note (5) Definition of Transmittance (Module is without signal input)

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×200Hours	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×200Hours	
	High Temperature Operating	70°C±2°C×120Hours	
	Low Temperature Operating	-20°C±2°C×120Hours	
	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×120Hours	
	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M 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
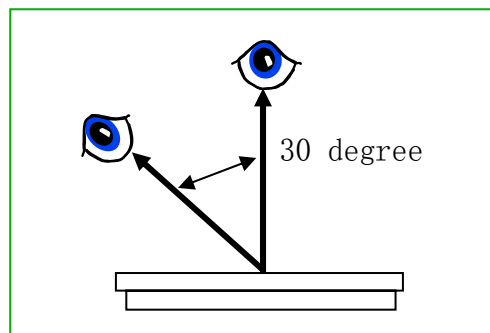
This standard apply to C-STN/TFT module

1. **Spot check plan：**

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

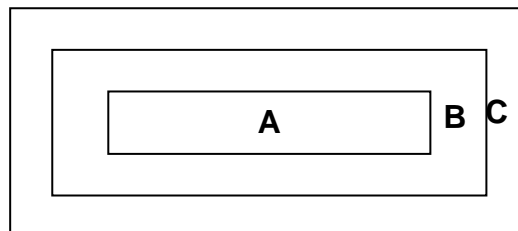   3A 级、2A 级：major non-conformance：AQL 0.25 minor non-conformance：AQL 0.4

   A 级：major non-conformance： AQL 0.65　　 minor non-conformance：AQL 1.

2. **Inspection condition：**

   30 degree

   Under daylight lamp 20～40W，product distance inspector 'eye 30cm,incline degree 30°。

3. **LCD area define：**

   A　　B　C

   Area A：display area

   Area B：VA area

   Area C：out of VA area, not in sight after assembly
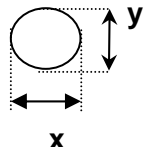
   Remark: non-conformance at area C, but is OK that isn't influence reliability of product & assembly by customer.
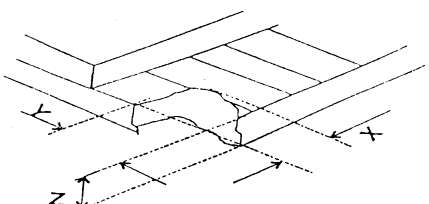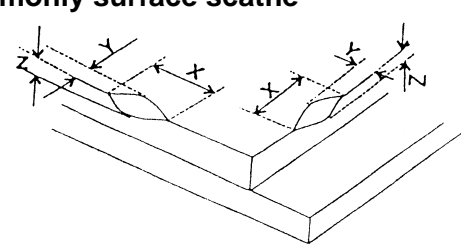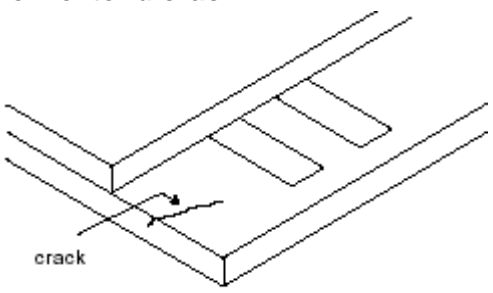
4. Inspection standard
4.1 Major non-conformance

NO.	Item	Inspection standard	Rate
4.1.1	**Function non-conformance**	1) No display, display abnormally 2) Miss line, short 3) B/L no function or function abnormally 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 $\Phi = \dfrac{(x+y)}{2}$ **A grade** (see table below) **Most approve 4 damages, dot to dot ≥10mm**	**Minor**

A grade:

Area Size (mm)	Most approve q'ty		
	A	B	C
$\Phi \leq 0.10$	ignore		
$0.10 < \Phi \leq 0.15$	4		ignore
$0.15 < \Phi \leq 0.20$	2		
$0.20 < \Phi \leq 0.25$	1		
$0.25 < \Phi$	0		

4.2.2	**Black or white line（power on）**	**A grade**					**Minor**

A grade

Size(mm)		Most approve q'ty		
L(length)	**W(width)**	**A**	**B**	**C**
ignore	W≤0.03	ignore		ignore
L≤5.0	0.03＜W≤0.05	3		
L≤3.0	0.05＜W≤0.07	1		
	0.07＜W	Treat with dot non-conformance		

Most approve 3 damages, line to line ≥10mm

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**	...	**Minor**

(i) crash at side（remark: S=ITO length）

X	Y	Z
≤3.0	≤S	ignore

Crash disallow extend to ITO or seal.

(ii) commonly surface scathe

X	Y	Z
≤2.0	<frame edge	ignore

		(iii) crack **Disallow extend crack** 	
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 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 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 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