

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>		

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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

ITEM	STANDARD VALUES	UNITS
LCD type	3.5" TFT	--
Dot arrangement	320(RGB)×480	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmission / Normally Black	--
Viewing Direction	12 o'clock(Gray scale inversion)	--
Driver IC	ILI9488	--
Module size	55.66(W)×85.04(H)×3.6 (T)	mm
Active area	48.96(W)×73.44(H)	mm
Dot pitch	0.153(W)×0.153(H)	mm
Interface	8-/16--bit 8080-series system interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	6 White LED in serial	--
Weight	TBD	g

4. Interface Description

Pin	Symbol	Description.
1	XL	Touch panel pin.
2	XR	
3	YD	
4	YU	
5	GND	Power ground.
6	VCC	A supply voltage to the analog circuit.
7	GND	Power ground.
8	IOVCC	A supply voltage to the logic circuit.
9	GND	Power ground.
10	TE	Tearing effect output pin to synchronize MCU to frame writing.
11	CSX	Chip select input pin ("Low" enable) in MPU I/F and SPI I/F.
12	D/CX	Display data / command selection in 80-series MPU I/F. D/CX = "0" : Command D/CX = "1" : Display data.
13	WRX	Writes strobe signal to write data when WRX is "Low" in MPU I/F.
14	GND	Power ground.
15	RDX	Reads strobe signal to write data when RDX is "Low" in MPU interface.
16	GND	Power ground.
17	DB0	16-bit parallel bi-directional data bus for MPU system: 8-bit I/F: DB [7:0] is used. 16-bit I/F: DB [15:0] is used.
18	DB1	
19	DB2	
20	DB3	
21	DB4	
22	GND	Power ground
23	DB5	16-bit parallel bi-directional data bus for MPU system: 8-bit I/F: DB [7:0] is used. 16-bit I/F: DB [15:0] is used.
24	DB6	
25	DB7	
26	DB8	
27	DB9	
28	DB10	
29	GND	Power ground.
30	DB11	16-bit parallel bi-directional data bus for MPU system: 8-bit I/F: DB [7:0] is used. 16-bit I/F: DB [15:0] is used.
31	DB12	
32	DB13	
33	DB14	
34	DB15	
35	GND	Power ground.
36	RESX	Reset input pin, Active "L".
37	NC	No Connection.
38	GND	Power ground.
39	LEDA	LED backlight (Anode).

40	LEDK	LED backlight (Cathode).
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5. Absolute Maximum Ratings

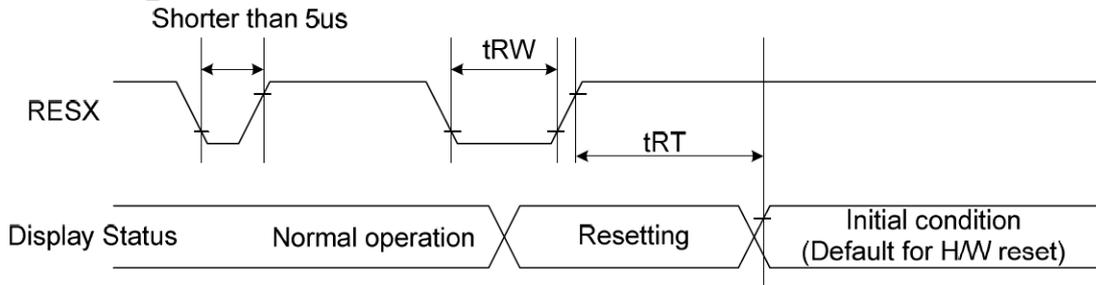
Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	IOVCC	-0.3	3.3	V
Analog Supply Voltage	VCI	-0.3	3.3	V
Input Voltage	Vin	-0.3	IOVCC+0.3	V
Operating Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	-
Analog Supply Voltage	VCI	2.5	2.8	3.3	V	-
Input High Voltage	V _{IH}	0.7IOVCC	-	IOVCC	V	Digital input pins
Input Low Voltage	V _{IL}	GND	-	0.3IOVCC	V	Digital input pins
Output High Voltage	V _{OH}	0.8IOVCC	-	IOVCC	V	Digital output pins
Output Low Voltage	V _{OL}	GND	-	0.2IOVCC	V	Digital output pins
I/O Leak Current	I _{LI}	-1.0	-	1.0	μA	-

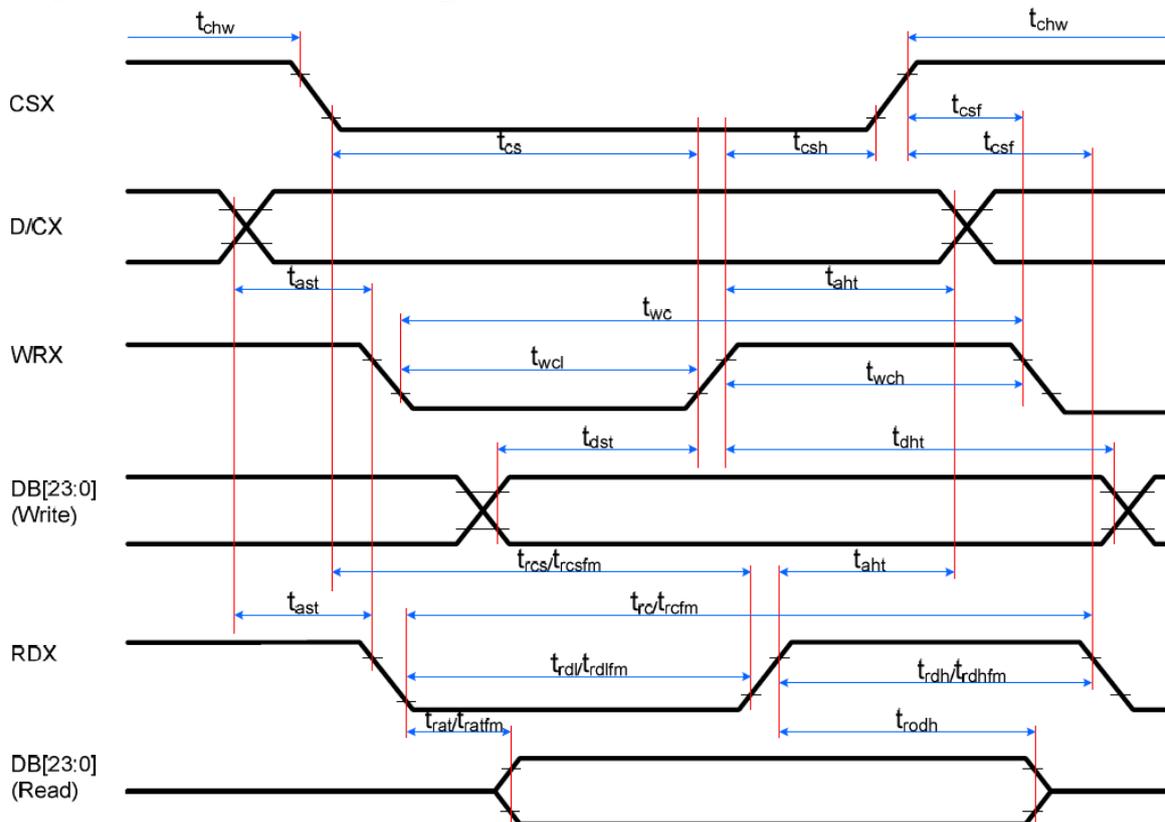
7. Timing Characteristics

7.1 Reset Timing Characteristics



Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

7.2 i80-System Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	that	Address hold time (Write/Read)	0	-	ns	-
CSX	tchwh	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	15	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	0	-	ns	-
	twc	Write cycle	30	-	ns	-
WRX	twrh	Write Control pulse H duration	15	-	ns	-
	twrl	Write Control pulse L duration	15	-	ns	-
	trcfm	Read Cycle (FM)	450	-	ns	When read from Frame Memory
trdhfm	Read Control H duration (FM)	90	-	ns		
trdlfm	Read Control L duration (FM)	355	-	ns		
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [7:0]	tdst	Write data setup time	10	-	ns	For maximum, CL=30pF For minimum, CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

8. Backlight Characteristics

BL Circuit Diagram:



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	16.8	--	19	V	If=20mA
Supply Current	If	--	20		mA	--
Luminous Intensity for LCM	--	270	320	--	Cd/m ²	If=20mA
Uniformity for LCM	--	80	--	--	%	If=20mA
Life Time	--	20000	--	--	Hr	If=20mA
Backlight Color	White					

9. Touch Panel Characteristics

9.1 General Standard Specification

Item	Specification
Input Method	Finger or Stylus pen
ITO Glass	T=0.7mm
ITO Film	T=0.188mm
Operating Temperature Range	-20°C ~+70°C 90%RH ↓(Except for dew gathering)
Storage Temperature Range	-30°C ~+80°C 90%RH ↓ (Except for dew gathering)
Surface Hardness	3H(Pencil)
Hitting Durability	1,000,000 times
Pen Sliding Durability	100,000 times
Light Transparency	77% min.
Activation Force	≤100g

9.2 Electrical Characteristic Specification

Item	Specification
Operating Voltage	DC5V 1mA
Circuit Resistance	Film : 400Ω
	Glass : 300Ω~500Ω
Insulation Resistance	>20 MΩ
Chatting	≤10ms
Linearity	≤1.5%

10. Optical Characteristics

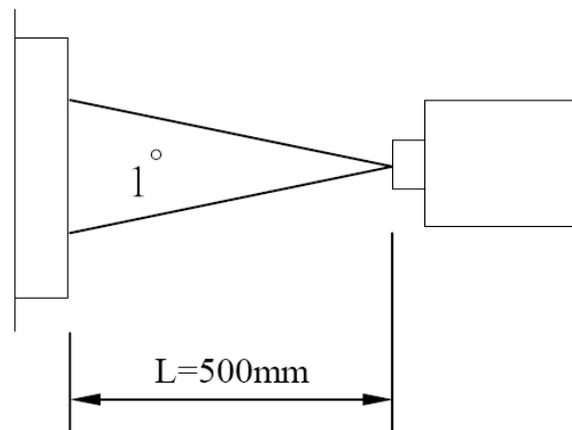
(Note1 · Note2) (Using Normal Polarizer + Backlight, reference only)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Brightness		BL	$\theta = \varphi = 0^\circ$	270	320	--	cd/m ²	Note2
Contrast Ratio		CR	$\theta = \varphi = 0^\circ$	400	500	--	--	Note1,Note3
Response Time		Tr	$\theta = \varphi = 0^\circ$		(4)	(8)		
		Tf	$\theta = \varphi = 0^\circ$	--	(12)	(24)	ms	Note1,Note4
Viewing Angle	Upper	θ	$CR \geq 10$	60	70	--	--	Note 5
	Down			40	60	--	--	
	Right	φ		60	70	--	--	
	Left			60	70	--	--	
Color Filter Chromaticity	White	X y	$\theta = \varphi = 0^\circ$	--	TBD	--	--	Note 6
				--	TBD	--	--	
	Red	X y	$\theta = \varphi = 0^\circ$	--	TBD	--	--	
				--	TBD	--	--	
	Green	X y	$\theta = \varphi = 0^\circ$	--	TBD	--	--	
				--	TBD	--	--	
Blue	X y	$\theta = \varphi = 0^\circ$	--	TBD	--	--		
			--	TBD	--	--		

Note1.Ambient condition: 25°C±2°C, 60±10%RH, under 10 Lux in the darkroom。

Note2.Measure device:

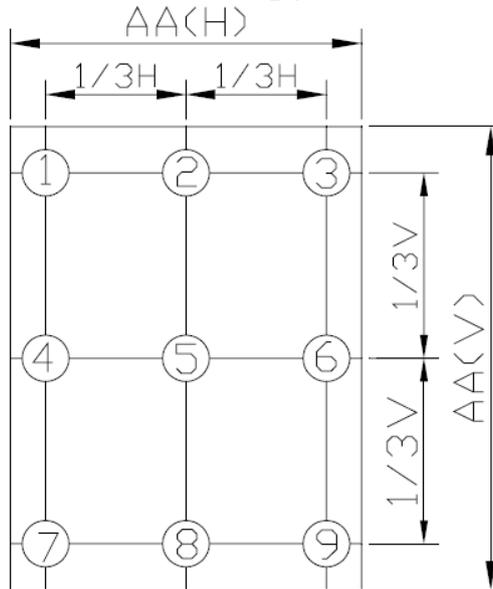
BM-7 (TOPCON),
viewing cone=1°,
If=20mA or If=20mA。



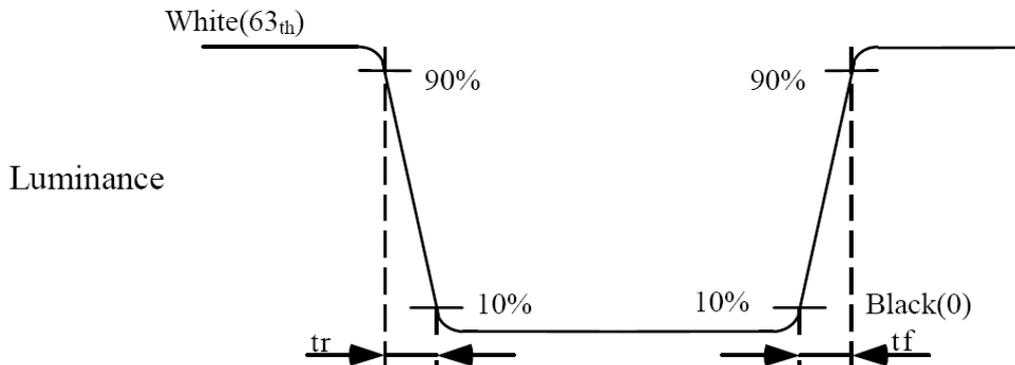
Note 3. Definition of Contrast Ratio:

$$CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$$

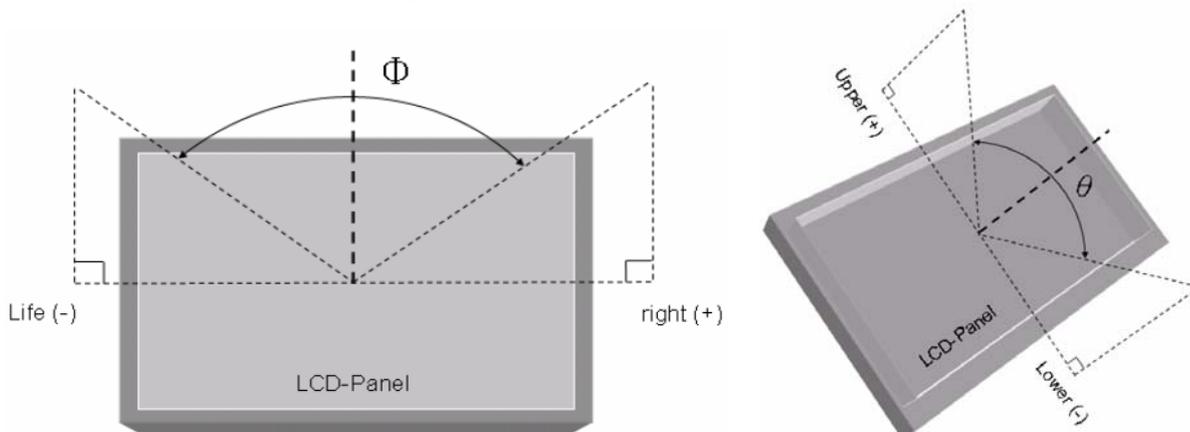
Measuring point



Note 4. Definition of response time: The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ , ψ):



Definition of Viewing Angle

Note 6. Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

11. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
<input type="checkbox"/>	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.
<input type="checkbox"/>	Low Temperature Storage	-30°C±2°C×200Hours	
<input type="checkbox"/>	High Temperature Operating	70°C±2°C×120Hours	
<input type="checkbox"/>	Low Temperature Operating	-20°C±2°C×120Hours	
<input type="checkbox"/>	Temperature Cycle(Storage)	$ \begin{array}{ccccc} -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 70^{\circ}\text{C} \\ (30\text{min}) & & (5\text{min}) & & (30\text{min}) \\ & \longleftarrow & & \longrightarrow & \\ & & \text{1cycle} & & \\ & & \text{Total 10cycle} & & \end{array} $	
<input type="checkbox"/>	Damp Proof Test (Storage)	50°C±5°C×90%RH×120Hours	
<input type="checkbox"/>	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition)	
<input type="checkbox"/>	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
<input type="checkbox"/>	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.

12. Inspection Standard

This standard apply to C-STN/TFT module

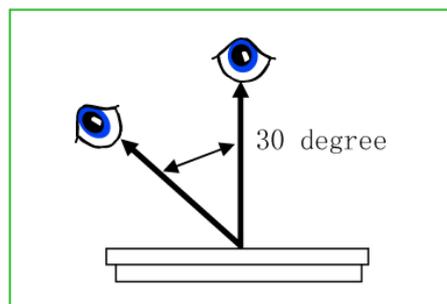
1. Spot check plan:

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

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

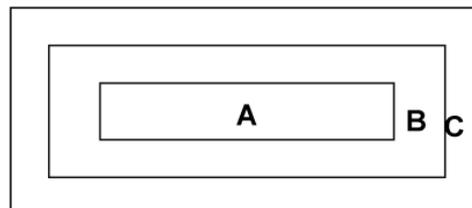
1A : major non-conformance : AQL 0.65 minor non-conformance : AQL 1.

2. Inspection condition:



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

3. LCD area define:



Area A: display area

Area B: VA area

Area C: out of VA area, not in sight after assembly

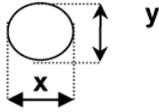
Remark: non-conformance at area C, but is OK that isn't influence reliability of product & assembly by customer.

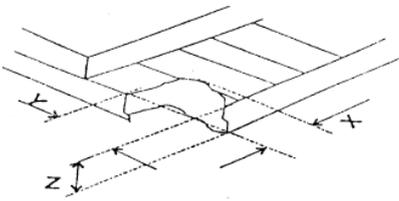
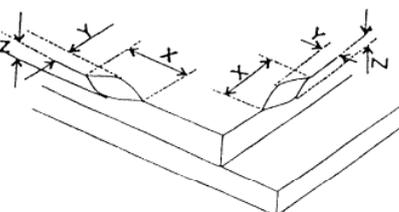
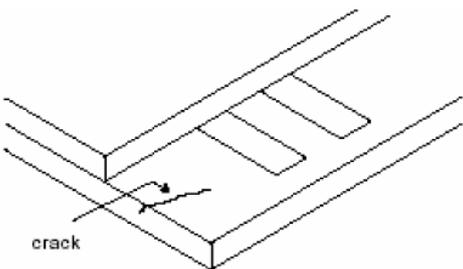
4. Inspection standard

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 <div style="display: flex; align-items: center; justify-content: center; margin-top: 10px;"> $\Phi = \frac{+y}{2} \times x$  </div>	Minor																														
		A grade <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2" style="width: 30%;">area size (mm)</th> <th colspan="3" style="text-align: center;">Most approve q'ty</th> </tr> <tr> <th style="width: 15%;">A</th> <th style="width: 15%;">B</th> <th style="width: 15%;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.10$</td> <td colspan="3" style="text-align: center;">ignore</td> </tr> <tr> <td style="text-align: center;">$0.10 < \Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">4</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.20$</td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">$0.20 < \Phi \leq 0.25$</td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$0.25 < \Phi$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p style="margin-top: 10px;">Most approve 4 damages, dot to dot $\geq 10\text{mm}$</p>		area size (mm)	Most approve q'ty			A	B	C	$\Phi \leq 0.10$	ignore			$0.10 < \Phi \leq 0.15$	4			$0.15 < \Phi \leq 0.20$	2			$0.20 < \Phi \leq 0.25$	1			$0.25 < \Phi$	0					
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4.2.2	Black or white line (power on)	A grade <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Size(mm)</th> <th colspan="3" style="text-align: center;">Most approve q'ty</th> </tr> <tr> <th style="width: 20%;">L(length)</th> <th style="width: 20%;">W(width)</th> <th style="width: 15%;">A</th> <th style="width: 15%;">B</th> <th style="width: 15%;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">ignore</td> <td style="text-align: center;">$W \leq 0.03$</td> <td colspan="3" style="text-align: center;">ignore</td> </tr> <tr> <td style="text-align: center;">$L \leq 5.0$</td> <td style="text-align: center;">$0.03 < W \leq 0.05$</td> <td colspan="3" style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">$L \leq 3.0$</td> <td style="text-align: center;">$0.05 < W \leq 0.07$</td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td></td> <td style="text-align: center;">$0.07 < W$</td> <td colspan="3" style="text-align: center;">Treat with dot non-conformance</td> </tr> </tbody> </table> <p style="margin-top: 10px;">Most approve 3 damages, line to line $\geq 10\text{mm}$</p>	Size(mm)		Most approve q'ty			L(length)	W(width)	A	B	C	ignore	$W \leq 0.03$	ignore			$L \leq 5.0$	$0.03 < W \leq 0.05$	3			$L \leq 3.0$	$0.05 < W \leq 0.07$	2				$0.07 < W$	Treat with dot non-conformance			Minor
Size(mm)		Most approve q'ty																															
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$L \leq 3.0$	$0.05 < W \leq 0.07$	2																															
	$0.07 < W$	Treat with dot non-conformance																															

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	<p>(i) crash at side (remark: S=ITO length)</p>  <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0</td> <td>≤S</td> <td>ignore</td> </tr> </tbody> </table> <p>Crash disallow extend to ITO or seal.</p> <p>(ii) commonly surface scathe</p>  <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤2.0</td> <td><frame edge</td> <td>ignore</td> </tr> </tbody> </table> <p>(iii) crack</p> <p>Disallow extend crack</p> 	X	Y	Z	≤3.0	≤S	ignore	X	Y	Z	≤2.0	<frame edge	ignore	Minor
X	Y	Z													
≤3.0	≤S	ignore													
X	Y	Z													
≤2.0	<frame edge	ignore													
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												

13. Handling Precautions

13.1 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.

13.2 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.

13.3 Caution against static charge

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

Connect any unused input terminal to VDD or 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.

13.4 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

13.5 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.

13.6 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.]

13.7 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.

14. Precaution for Use

14.1

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.

14.2

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.

15. Packing Method

TBD