



# 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	28" TFT	--
Dot arrangement	240(RGB)×320	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmission / Normally White	-
Gray Scale Inversion Direction	12 O'clock	--
Eyes Viewing Direction	6 O'clock	--
Driver IC	ST7789V	--
Module size	69.2(W)×50(H)×2.45(T)	mm
Active area	57.6(W)×43.2(H)	mm
Dot pitch	0.18 (W)×0.18(H)	mm
Interface	MCU8-bit Interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	4White LED	--
Weight	TBD	g

## 3. External Dimensions

FPC弯折示意图  
FPC展开出货

LEDK1  
LEDK2  
LEDK3  
LEDK4

RoHS

NOTES:

1. DISPLAY TYPE: 2.8" TFT
2. VIEWING DIRECTION: 12:00 (Gray inversion)
3. LCD DRIVE IC: S17789V
4. POLARIZER MODE: TRANSMISSIVE/POSITIVE
5. OPERATING TEMP: -20° C~+70° C
6. STORAGE TEMP: -30° C~+80° C
7. UNMARKER TOLERANCE: ±0.20
8. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

SW.	DESCRIPTION OF REVISION	REASON	REVISED BY	DATE
△	first issue	A	XG_SU	2018/01/24

MO	MFU Interface mode	Date pin
0(R2=0 ohm, R1=NC)	80-dbit parallel	DB7(70), DB6(15) fix to IOVCC or DNG

PIN	SYMBOL
1	DB0
2	DB1
3	DB2
4	DB3
5	GND
6	IDVCC
7	CSX
8	DCX
9	VRX
10	RDY
11	NC
12	NC
13	NC
14	NC
15	NC
16	LEDA
17	LEDK1
18	LEDK2
19	LEDK3
20	LEDK4
21	NC
22	DB4
23	DB8
24	DB9
25	DB10
26	DB11
27	DB12
28	DB13
29	DB14
30	DB15
31	RESETX
32	VCI
33	VCI
34	GND
35	DB5
36	DB6
37	DB7

TITLE: OUTLINE DIMENSION		Rev: A	
DRAWN BY:	BY:	SCALE: 1 : 1	SHEET NO: 1 OF 1
CHECKED BY:	BY:		
APPROVED BY:	BY:		

于都上晴电子有限公司

YU DU AMSON ELECTRONICS Co., Ltd.

## 4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1-4	DB0-DB3	Data Bus
5	GND	Ground
6	IOVCC	Logic Supply Voltage
7	CS	Chip select input pin ("Low" enable) in MPU I/F and SPI I/F
8	RS	Display data / command selection in 80-series MPU I/F. RS = "0" : Command      RS = "1" : Display data. SPI: This pin is used serial interface clock in SPI.
9	WR	MCU: Serves as a write signal and writes data at the rising edge.
10	RD	Reads strobe signal to write data when /RD is "Low" in MPU interface
11	NC	No connection
12	XR	No connection
13	YD	No connection
29	XL	No connection
30	YU	No connection
16	LEDA	LED backlight (Anode).
17-20	LEDK1-LEDK4	LED backlight (Cathode)
21	NC	No connection
22	DB4	Data Bus
23~30	DB8~DB15	Data Bus
31	RESET	Reset input pin, Active "L".
32	VCI	Analog Supply Voltage
33	VCI	Analog Supply Voltage
34	GND	Power ground
35~37	DB5~DB7	Data Bus

**Note:**

IM0	MPU Interface mode	Date pin
0 (R2=0 ohm ,R1=NC)	8080-8bit parallel	DB[7:0],DB[8:15] fix to IOVCC or DNG

## 5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	IOVCC	-0.3	4.6	V
Analog Supply Voltage	VCI	-0.3	4.6	V
Input Voltage	V <sub>in</sub>	-0.3	IOVCC+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
Logic Supply Voltage	IOVCC	1.65	2.8	3.3	V	-
Analog Supply Voltage	VCI	2.5	2.8	3.3	V	-
Input High Voltage	V <sub>IH</sub>	0.7IOVCC	-	IOVCC	V	-
Input Low Voltage	V <sub>IL</sub>	GND	-	0.3 IOVCC	V	-
Output High Voltage	V <sub>OH</sub>	0.8IOVCC	-	IOVCC	V	-
Output Low Voltage	V <sub>OL</sub>	GND	-	0.2IOVCC	V	-
I/O Leak Current	ILI	-0.1	-	0.1	uA	-

## 7. Timing Characteristics

### 7.1 MCU 8-bits Interface Timing Characteristics

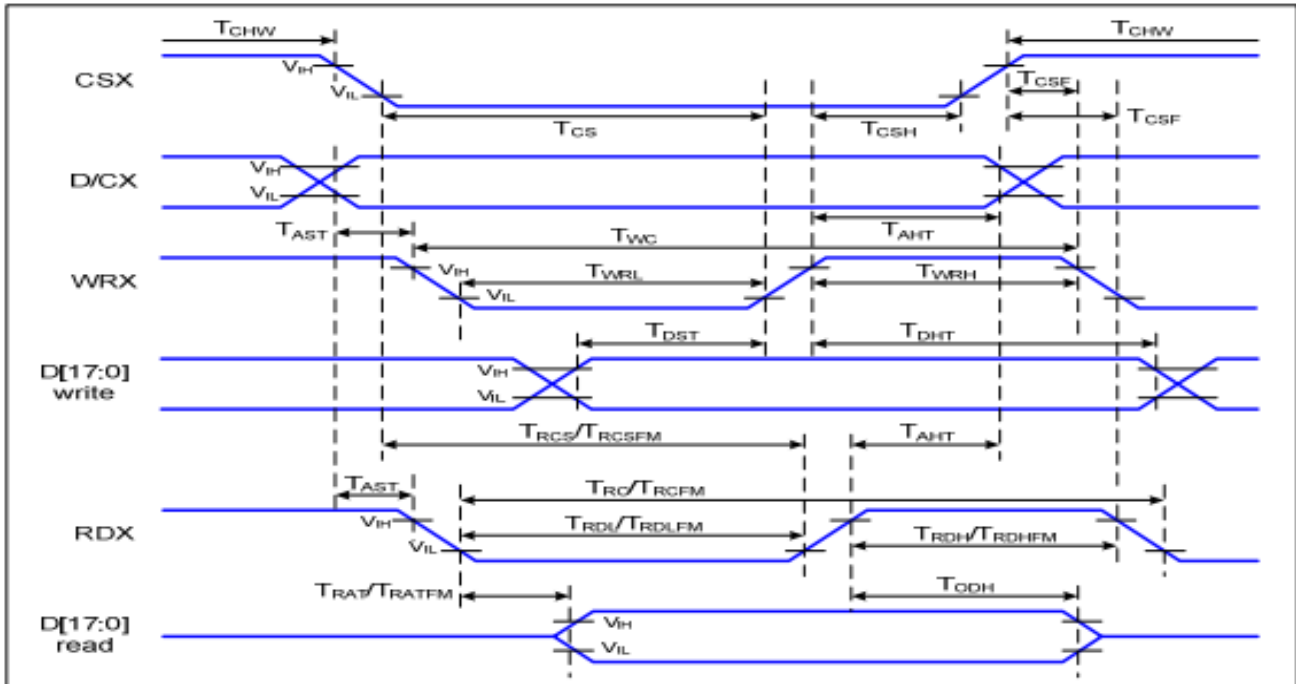


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

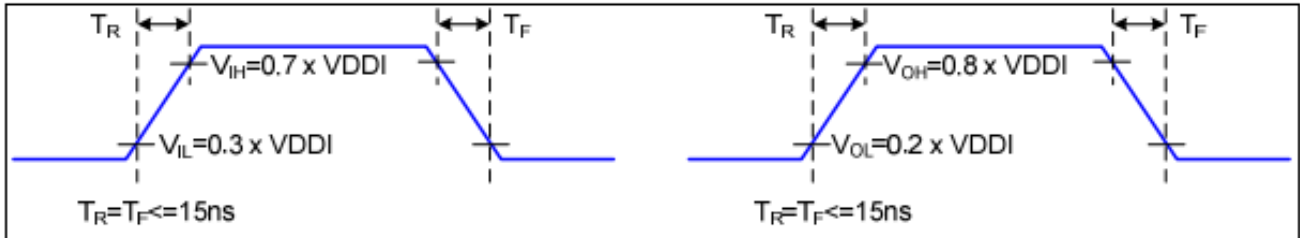
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 °C

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
	$T_{RDHF}$	Control pulse "H" duration (FM)	90		ns	
	$T_{RDLF}$	Control pulse "L" duration (FM)	355		ns	
D[17:0]	$T_{DST}$	Data setup time	10		ns	For CL=30pF

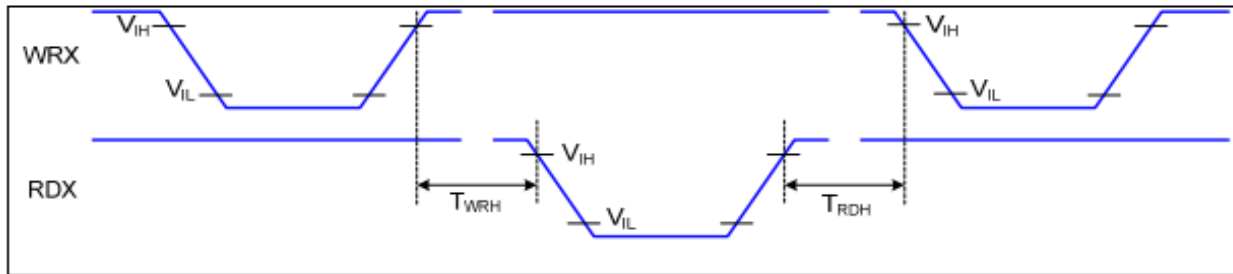


	$T_{DHT}$	Data hold time	10		ns
	$T_{RAT}$	Read access time (ID)		40	ns
	$T_{RATFM}$	Read access time (FM)		340	ns
	$T_{ODH}$	Output disable time	20	80	ns

**Table 4 8080 Parallel Interface Characteristics**



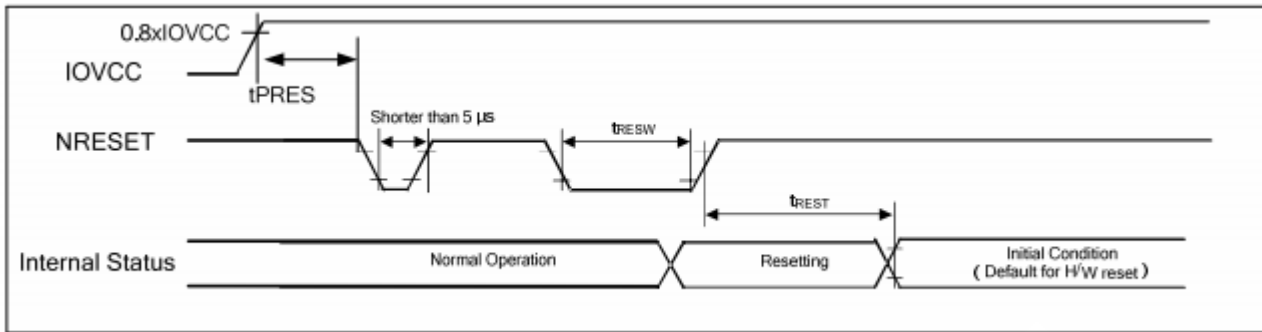
**Figure 2 Rising and Falling Timing for I/O Signal**



**Figure 3 Write-to-Read and Read-to-Write Timing**

*Note: The rising time and falling time ( $T_r$ ,  $T_f$ ) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for input signals.*

## 7.2 Reset Timing Characteristics

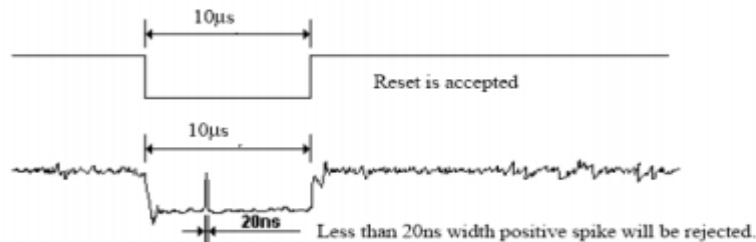


Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width <sup>(1)</sup>	NRESET	10	-	-	-	µs
tREST	Reset complete time <sup>(2)</sup>	-	5	-	-	When reset applied during STB OUT mode	ms
		-	120	-	-	When reset applied during STB mode	ms
tPRES	Reset goes high level after Power on time	NRESET & IOVCC	1	-	-	Reset goes high level after Power on	ms

**Note:** (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5 µs	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

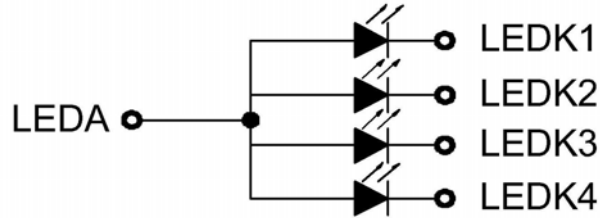
- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in STB Out –mode. The display remains the blank state in STB –mode) and then return to Default condition for H/W reset.
- (3) During Reset Complete Time, VMF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown below:



- (5) It is necessary to wait 5msec after releasing !RES before sending commands. Also STB Out

**8. Backlight Characteristic**

**LED Circuit:**

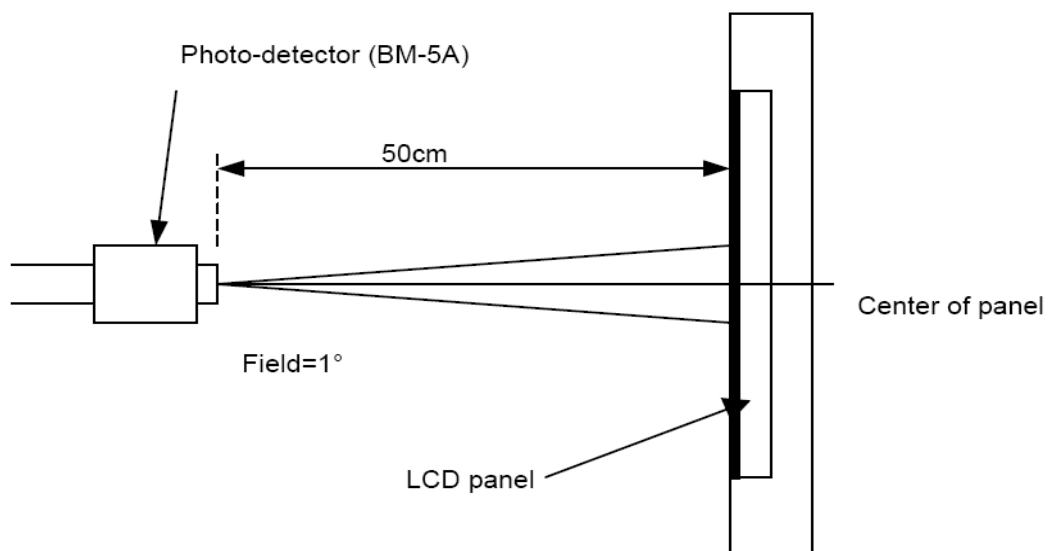


Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	2.9	3.2	3.5	V	If=80mA
Supply Current	If	-	80	--	mA	-
Luminous Intensity for LCM	-	200	250	-	cd/m <sup>2</sup>	If=80mA
Uniformity for LCM	-	80		-	%	If=80mA
Life Time	-	20000		-	Hr	If=80mA
Backlight Color	White					

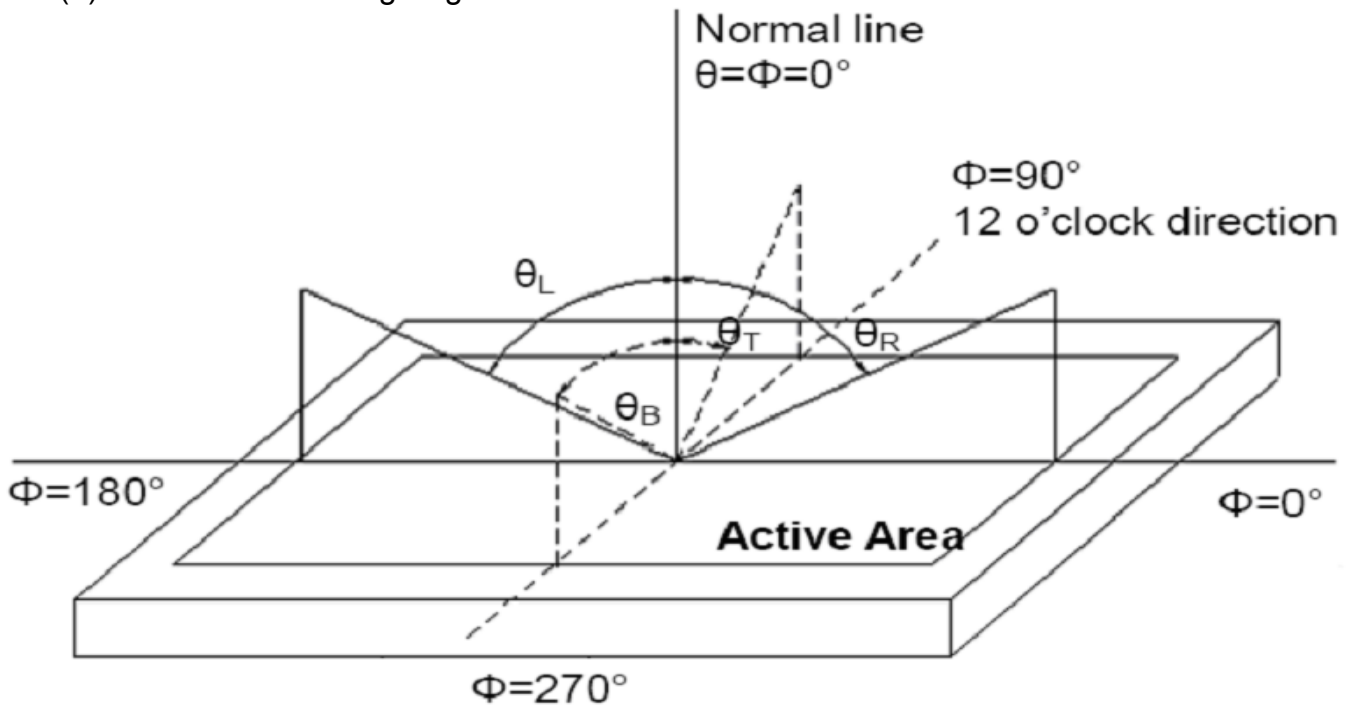
## 9. Optical Characteristics

Item	Conditions	Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	$\theta_L$	-	45	-	degree  (1),(2),(6)
		$\theta_R$	-	45	-	
	Vertical	$\theta_T$	-	50	-	
		$\theta_B$	-	20	-	
Contrast Ratio	Center	-	500	-	-	(1),(3),(6)
Response Time	Rising + Falling	-	16	-	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		-	

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



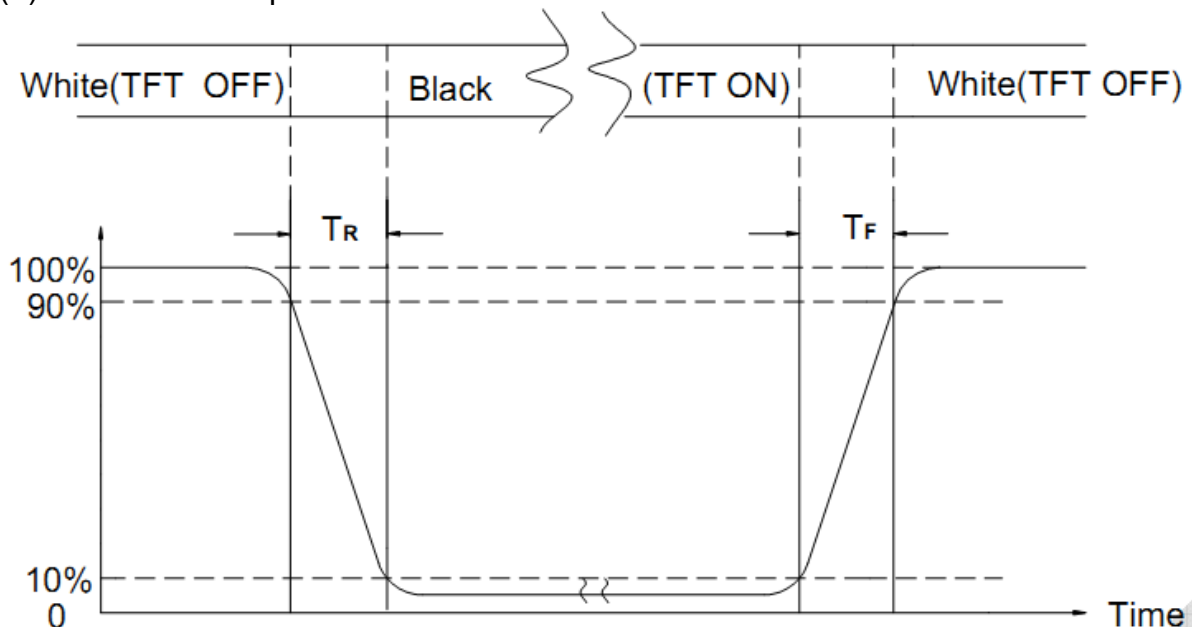
Note (3) Definition of Contrast Ratio (CR)

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
<input type="checkbox"/>	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.
<input type="checkbox"/>	Low Temperature Storage	-30°C±2°C×96Hours	
<input type="checkbox"/>	High Temperature Operating	70°C±2°C×96Hours	
<input type="checkbox"/>	Low Temperature Operating	-20°C±2°C×96Hours	
<input type="checkbox"/>	Temperature Cycle(Storage)	-20°C (30min) ← 25°C (5min) ← 70°C (30min) ← 1cycle → Total 10cycle	
<input type="checkbox"/>	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
<input type="checkbox"/>	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)	
<input type="checkbox"/>	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
<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.

## 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 °C TO 40°C ,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.

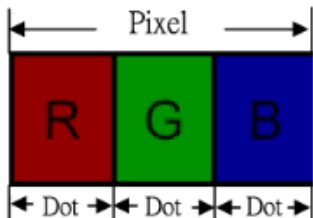
11.2.2. CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

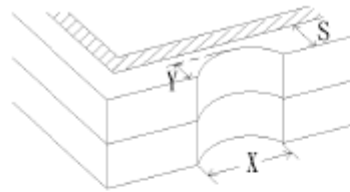
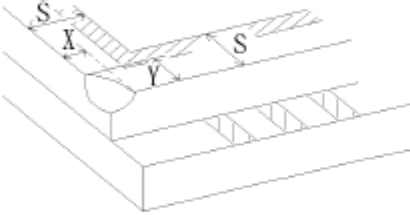
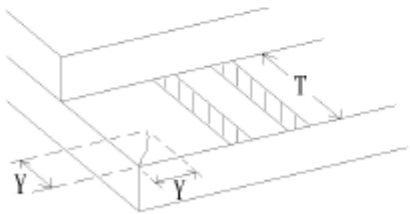
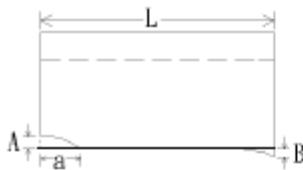
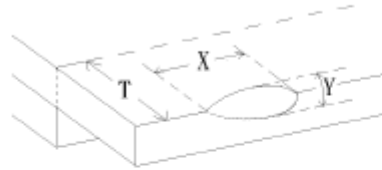
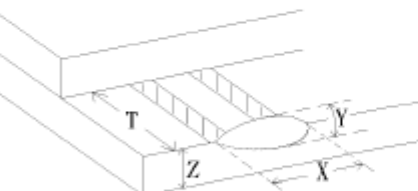
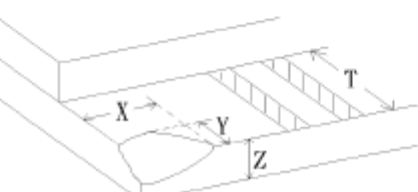
11.3. INSPECTION PLAN :

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	<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 0.1</math></td> <td>DISREGARD</td> </tr> <tr> <td><math>0.1 &lt; \Phi \leq 0.25</math></td> <td>3 (Distance&gt;5mm)</td> </tr> <tr> <td><math>0.25 &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>DISREGARD</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.03 &lt; W \leq 0.07</math></td> <td>3 (Distance&gt;5mm)</td> </tr> <tr> <td>-----</td> <td><math>0.07 &lt; W</math></td> <td>FOLLOW ROUND TYPE</td> </tr> </tbody> </table>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\Phi \leq 0.1$	DISREGARD	$0.1 < \Phi \leq 0.25$	3 (Distance>5mm)	$0.25 < \Phi$	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	$W \leq 0.03$	DISREGARD	$L \leq 5.0$	$0.03 < W \leq 0.07$	3 (Distance>5mm)	-----	$0.07 < W$	FOLLOW ROUND TYPE
DIAMETER (mm.)	ACCEPTABLE Q'TY																						
$\Phi \leq 0.1$	DISREGARD																						
$0.1 < \Phi \leq 0.25$	3 (Distance>5mm)																						
$0.25 < \Phi$	0																						
LENGTH	WIDTH	ACCEPTABLE Q'TY																					
-----	$W \leq 0.03$	DISREGARD																					
$L \leq 5.0$	$0.03 < W \leq 0.07$	3 (Distance>5mm)																					
-----	$0.07 < W$	FOLLOW ROUND TYPE																					
11.4.2	MINOR	BUBBLE IN POLARIZER DENT ON POLARIZER	<p style="text-align: right;">unit : mm.</p> <table border="1"> <thead> <tr> <th>DIAMETER</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td>DISREGARD</td> </tr> <tr> <td><math>0.2 &lt; \Phi \leq 0.5</math></td> <td>2 (Distance&gt;5mm)</td> </tr> <tr> <td><math>0.5 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table>	DIAMETER	ACCEPTABLE Q'TY	$\Phi \leq 0.2$	DISREGARD	$0.2 < \Phi \leq 0.5$	2 (Distance>5mm)	$0.5 < \Phi$	0												
DIAMETER	ACCEPTABLE Q'TY																						
$\Phi \leq 0.2$	DISREGARD																						
$0.2 < \Phi \leq 0.5$	2 (Distance>5mm)																						
$0.5 < \Phi$	0																						
11.4.3	MINOR	Dot Defect	<table border="1"> <thead> <tr> <th>Items</th> <th>ACC. Q'TY</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td><math>N \leq 4</math></td> </tr> <tr> <td>Dark dot</td> <td><math>N \leq 4</math></td> </tr> </tbody> </table> <p>Pixel Define :</p>  <p>Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.</p> <p>Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.</p>	Items	ACC. Q'TY	Bright dot	$N \leq 4$	Dark dot	$N \leq 4$														
Items	ACC. Q'TY																						
Bright dot	$N \leq 4$																						
Dark dot	$N \leq 4$																						

NO.	CLASS	ITEM	JUDGEMENT
11.4.4	MINOR	LCD GLASS CHIPPING	 $Y > S$ Reject
11.4.5	MINOR	LCD GLASS CHIPPING	 $X \text{ or } Y > S$ Reject
11.4.6	MAJOR	LCD GLASS GLASS CRACK	 $Y > (1/2) T$ Reject
11.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	 <ol style="list-style-type: none"> <li><math>a &gt; L/3</math>, <math>A &gt; 1.5\text{mm}</math>. Reject</li> <li>B: ACCORDING TO DIMENSION</li> </ol>
11.4.8	MINOR	LCD GLASS CHIPPING ( ON THE TERMINAL AREA )	 $\Phi = (x+y)/2 > 2.5 \text{ mm}$ 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 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 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