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	2012-11-13	NEW ISSUE	

Table of Contents

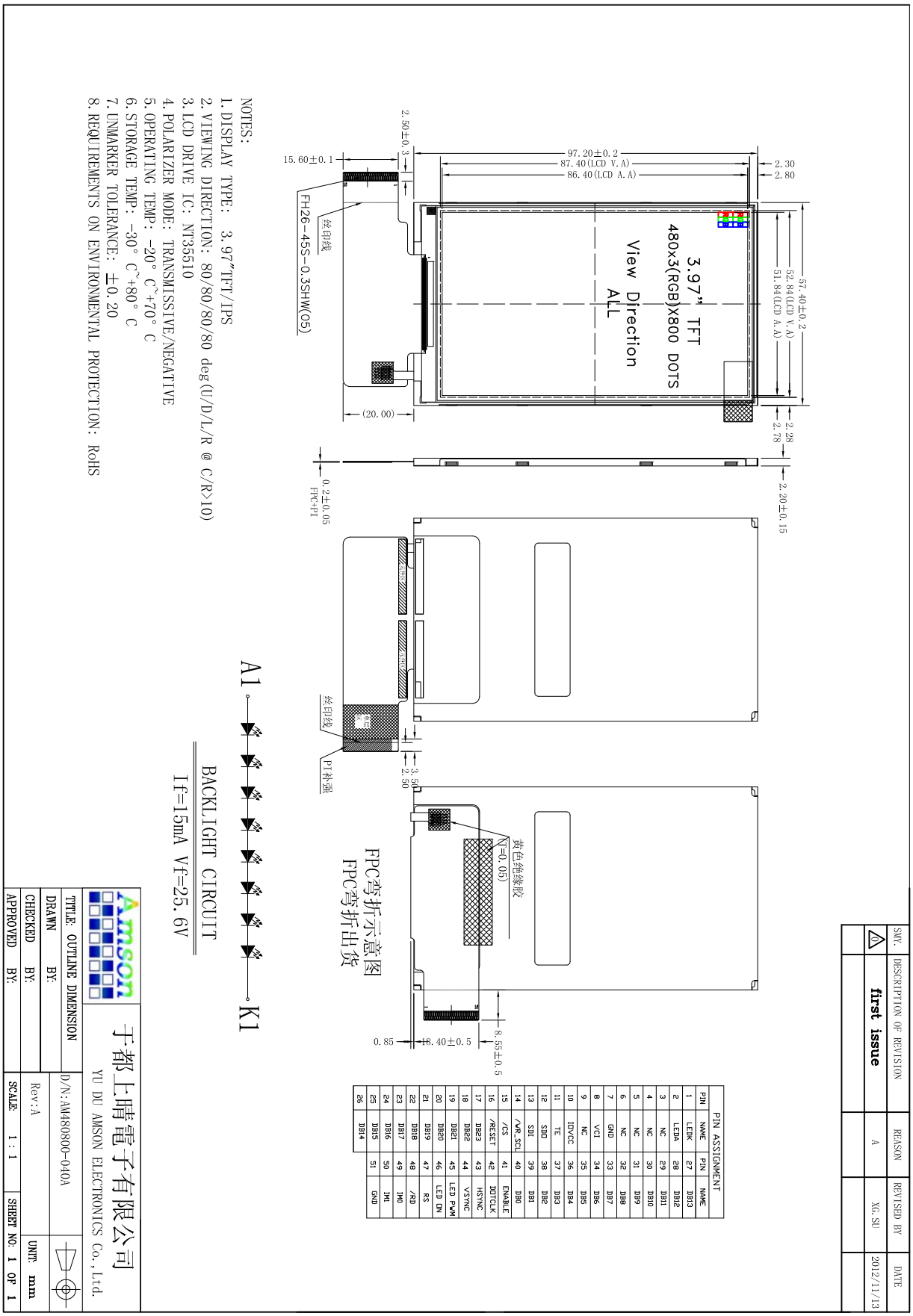
1. Scope

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	4.0”TFT	--
Dot arrangement	480(RGB)×800	dots
Color filter array	RGB vertical stripe	--
Display mode	Transmission / Normally Black	--
Viewing Direction	80/80/80/80 deg(U/D/L/R @ C/R>10)	--
Driver IC	NT35510	--
Module size	57.4(W)×97.2(H)×2.2(T)	mm
Active area	51.84(W)×86.40(H)	mm
Dot pitch	0.108(W)×0.108(H)	mm
Interface	8-/16-/24-bit i80-series system interface 16-/18-/24-bit RGB interface 3-line SPI interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	8 White LED In Serial	--
Weight	TBD	g

3. External Dimensions



PIN	NAME	PIN	NAME
1	LEDK	27	DB13
2	LEDA	28	DB12
3	NC	29	DB11
4	NC	30	DB10
5	NC	31	DB9
6	NC	32	DB8
7	GND	33	DB7
8	VCI	34	DB6
9	NC	35	DB5
10	IOVCC	36	DB4
11	TE	37	DB3
12	SIO	38	DB2
13	SDI	39	DB1
14	/VR_SCL	40	DB0
15	/CS	41	ENABLE
16	/RESET	42	DOTCLK
17	DB23	43	HSYNC
18	DB22	44	VSYNC
19	DB21	45	LED PWM
20	DB20	46	LED DN
21	DB19	47	RS
22	DB18	48	/RD
23	DB17	49	IM0
24	DB16	50	IM1
25	DB15	51	GND
26	DB14		

PIN ASSIGNMENT

NOTES:
1. DISPLAY TYPE: 3.97"TFT/IPS
2. VIEWING DIRECTION: 80/80/80/80 deg(U/D/L/R @ C/R>10)
3. LCD DRIVE IC: NT35510
4. POLARIZER MODE: TRANSMISSIVE/NEGATIVE
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

SMY.	DESCRIPTION OF REVISION	REASON	REVISED BY	DATE
	first issue	A	XG.SU	2012/11/13

TITTLE: OUTLINE DIMENSION	宇都上晴電子有限公司	
DRAWN BY:	YU DU AMSON ELECTRONICS Co., Ltd.	
CHECKED BY:	D/N:AM480800-040A	
APPROVED BY:	Rev:A	UNIT: mm
SCALE: 1:1		SHEET NO: 1 OF 1

4. Interface Description

Pin	Symbol	Description.
1	LEDK	LED backlight (Cathode).
2	LEDA	LED backlight (Anode).
3	NC	No connection.
4	NC	No connection.
5	NC	No connection.
6	NC	No connection.
7	GND	Power ground
8	VCC	Analog supply voltage to the analog circuit.
9	NC	No connection.
10	IOVCC	Logic supply voltage to the logic circuit.
11	TE	Tearing effect output pin to synchronize MCU to frame writing.
12	SDO	Serial output signal in SPI I/F.
13	SDI	Serial input signal in SPI I/F.
14	WRX(SCL)	Writes strobe signal to write data when WRX is “Low” in MPU I/F. A synchronous clock signal in SPI I/F.
15	CSX	Chip select input pin (“Low” enable) in MPU I/F and SPI I/F.
16	NRESET	Reset input pin, Active “L”.
17	DB23	24-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] and DB[8:1] is used. 24-bit I/F: DB[23:0] is used. 24-bit input data bus for RGB I/F. 16-bit/pixel: DB[20:16]=R[4:0], DB[13:8]=G[5:0] and DB[5:1]=B[4:0]; 18-bit/pixel: DB[21:16]=R[5:0], DB[13:8]=G[5:0] and DB[5:0]=B[5:0]; 24-bit/pixel: DB[23:16]=R[7:0], DB[15:8]=G[7:0] and DB[7:0]=B[7:0]. Connect unused pins to GND.
18	DB22	
19	DB21	
20	DB20	
21	DB19	
22	DB18	
23	DB17	
24	DB16	
25	DB15	
26	DB14	
27	DB13	
28	DB12	
29	DB11	
30	DB10	
31	DB09	
32	DB08	
33	DB06	
34	DB07	
35	DB05	
36	DB04	
37	DB03	
38	DB02	
39	DB01	
40	DB00	

41	ENABLE	Data enable signal in RGB I/F mode
42	DOTCLK	Pixel clock signal in RGB I/F.
43	HSYNC	Horizontal sync signal in RGB I/F.
44	VSYNC	Vertical sync signal in RGB I/F.
45	LEDPWM	Connect to the external LED driver. If not used, please open this pin.
46	LEDON	Connect to the external LED driver. If not used, please open this pin.
47	DCX	Display data / command selection in 80-series MPU I/F. DCX = ”0” : Command DCX = ”1” : Display data or Parameter
48	RDX	Reads strobe signal to write data when RD is “Low” in MPU interface.
49	IM0	System interface Mode IM[1,0]=00, i80-system 8-bit MPU interface : DB[7:0] is used. IM[1,0]=01, i80-system 16-bit MPU interface : DB[15:0] is used. IM[1,0]=10, i80-system 24-bit MPU interface : DB[24:0] is used. IM[1,0]=11, RGB+SPI interface
50	IM1	
51	GND	Power ground

5. Absolute Maximum Ratings

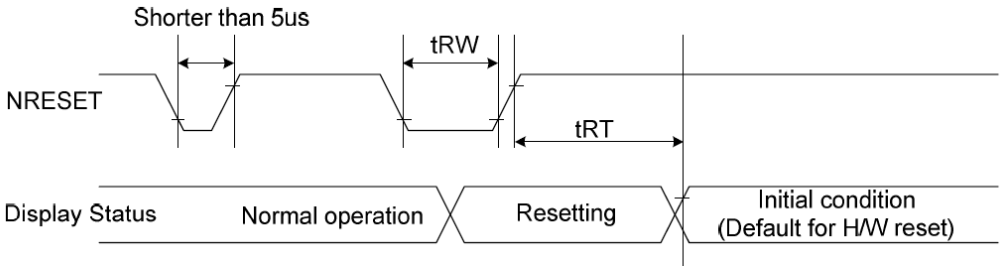
Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	IOVCC	-0.3	4.6	V
Analog Supply Voltage	VCC	-0.3	4.6	V
Input Voltage	Vin	-0.3	IOVCC+0.3	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	-
Analog Supply Voltage	VCC	2.5	2.8	3.3	V	-
Input High Voltage	V_{IH}	0.7IOVCC	-	IOVCC	V	Digital input pins
Input Low Voltage	V_{IL}	-0.3	-	0.3IOVCC	V	Digital input pins
Output High Voltage	V_{OH}	0.8IOVCC	-	IOVCC	V	Digital output pins
Output Low Voltage	V_{OL}	0	-	0.2IOVCC	V	Digital output pins
I/O Leak Current	ILI	-1.0	-	1.0	mA	-

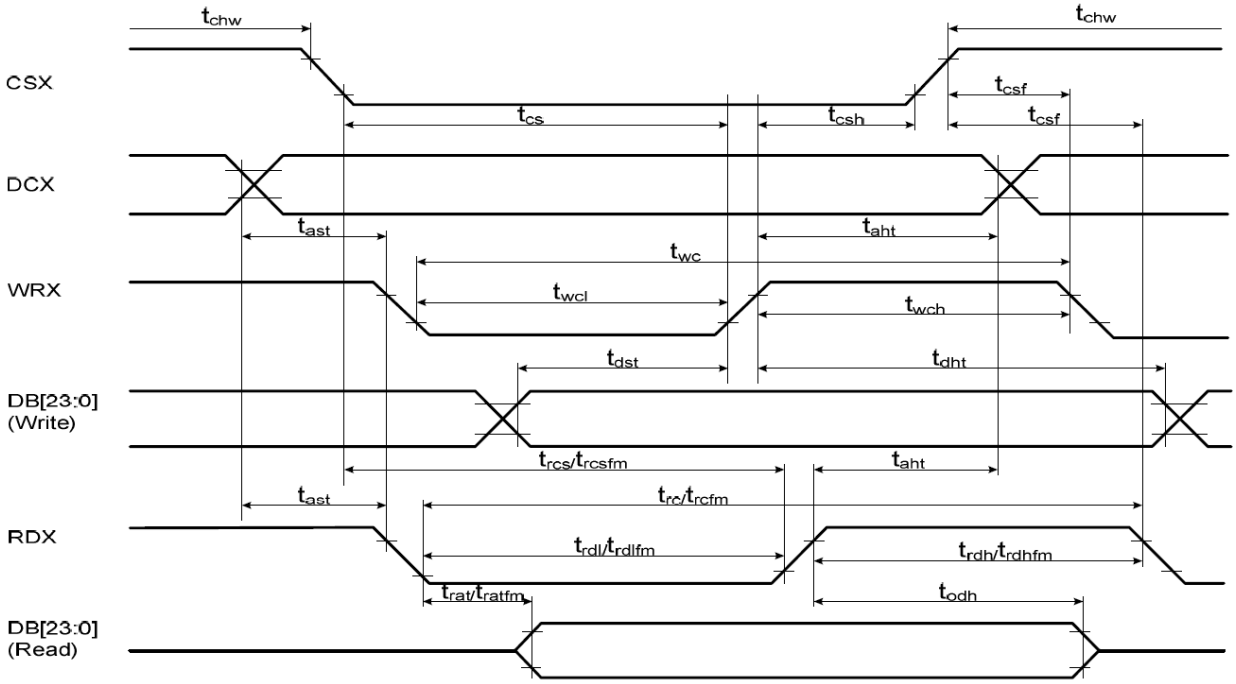
7. Timing Characteristics

7.1 Reset Timing Characteristics



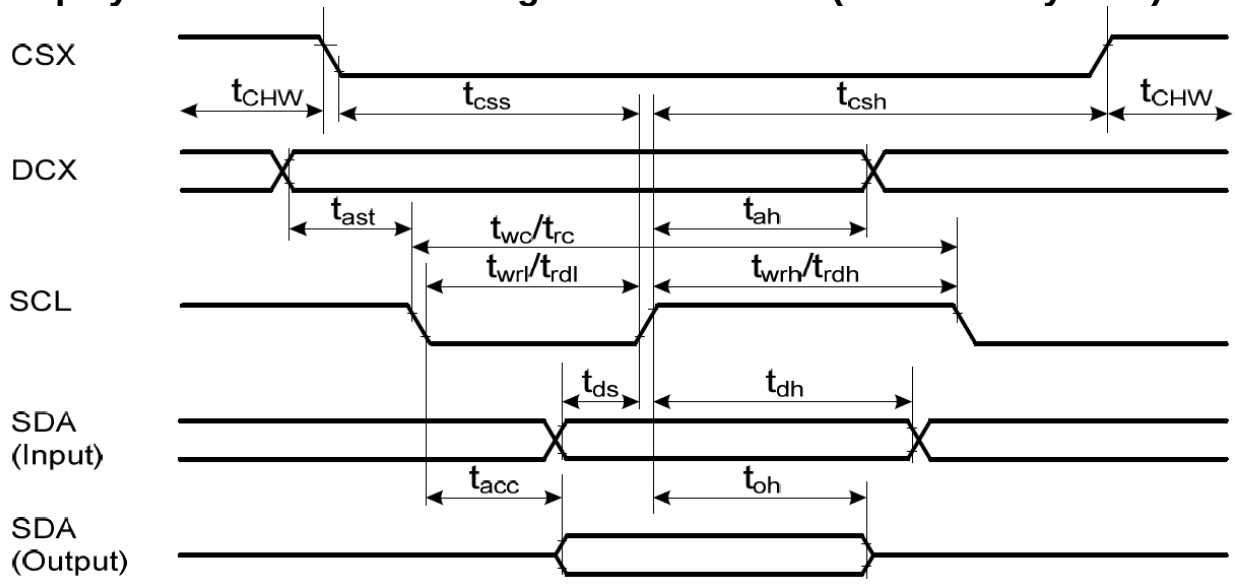
Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		us
	tRT	Reset cancel		5 (note 1,5)	ms
				120 (note 1,6,7)	ms

7.2 i80-System Interface Timing Characteristics



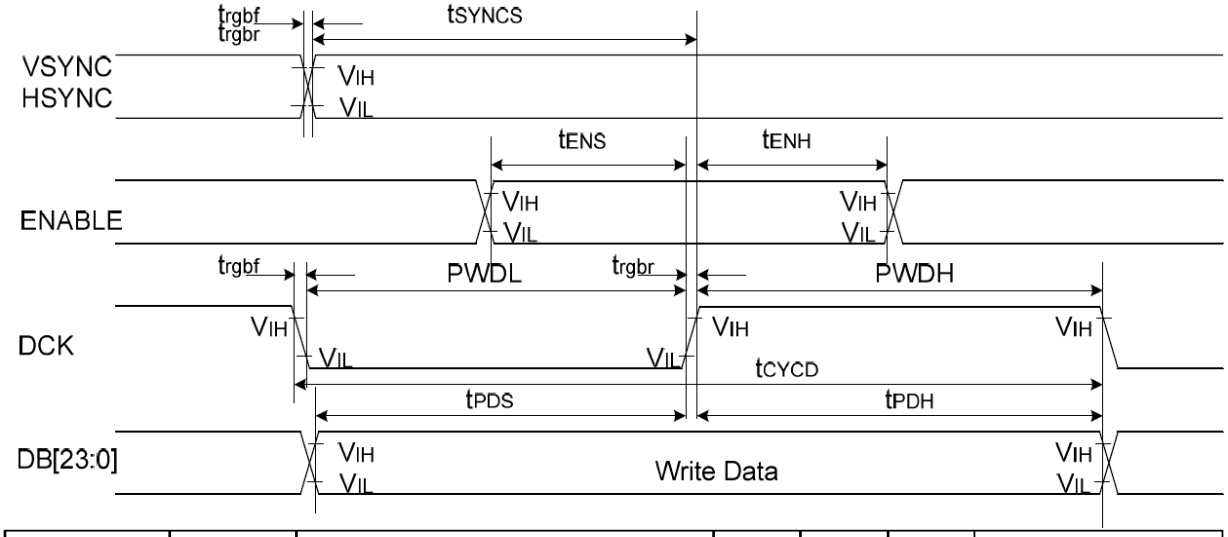
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	taht	Address hold time (Write/Read)	10	-	ns	-
CSX	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	10	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read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

7.3 Display Serial Interface Timing Characteristics (3-line SPI system)



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	15	-	ns	
	tcsh	Chip select hold time (Read)	15	-	ns	
	tCHW	CS "H" pulse width	40	-	ns	
SCL	twc	Serial clock cycle (Write)	30	-	ns	
	twrh	SCL "H" pulse width (Write)	10	-	ns	
	twrl	SCL "L" pulse width (Write)	10	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL "H" pulse width (Read)	60	-	ns	
	trdl	SCL "L" pulse width (Read)	60	-	ns	
DCX	tas	DCX setup time	10	-	ns	
	tah	DCX hold time (Write/Read)	10	-	ns	
SDA (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA (Output)	tacc	Access time (Read)	10	50	ns	CL = 30pF (maximum) CL = 8pF (minimum)
	toh	Output disable time (Read)	15	50	ns	

7.4 Parallel 24/18/16-bit RGB Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	5	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	5	-	ns	
	t_{ENH}	ENABLE hold time	5	-	ns	
DB [17:0]	t_{POS}	Data setup time	5	-	ns	
	t_{PDH}	Data hold time	5	-	ns	
DCK	PWDH	DCK high-level period	13	-	ns	
	PWDL	DCK low-level period	13	-	ns	
	t_{CYCD}	DCK cycle time	28	-	ns	
	t_{rgbr} , t_{rgbf}	DCK,HSYNC,VSYNC rise/fall time	-	15	ns	

8. Backlight Characteristics

LED CIRCUIT:

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	23.2.0	25.6	28.0	V	If=20mA
Supply Current	If	--	20	25	mA	--
Luminous Intensity for LCM (With TP)	--	350	400	--	Cd/m^2	If=20mA
Uniformity for LCM	--	80	--	--	%	If=20mA
Life Time	--	50000	--	--	Hr	If=20mA
Backlight Color	White					

9. Optical Characteristics

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Threshold Voltage		Vsat					V	Fig.1
		Vth					V	
Viewing Angle	Horiz-ontal	Θ3	CR>10		85		Deg.	Note 1
		Θ9			85		Deg.	
	Vertical	Θ12			85		Deg.	
		Θ6			85		Deg.	
Contrast Ratio		CR	Θ= 0°	650	900			Note 2
Transmittance		T(%)	Θ= 0°		5.3%			Note 3 Base on C light With APF
Reprod-uction of color	Red	Rx	Θ= 0°	0.620	0.640	0.660		Note 4 *Color Filter Glass (with ITO) Based on C light
		Ry		0.315	0.335	0.355		
	Green	Gx		0.295	0.325	0.345		
		Gy		0.576	0.606	0.626		
	Blue	Bx		0.128	0.148	0.168		
		By		0.025	0.045	0.065		
White		Wx	Θ= 0°	0.268	0.288	0.308		
		Wy		0.299	0.319	0.339		
Response Time		Tr+Tf	Ta= 25° C Θ= 0°		35		ms	Note 5

Note 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).

Note 2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically. CR = White Luminance (ON) / Black Luminance (OFF)

Note 3. Transmittance is the value with DBEF Polarizer.

Note 4. The color chromaticity coordinates specified in Table1 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the C/F. Measurement condition is C - light source & Halogen Lamp

Note 5. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr , and 90% to 10% is Tf.

Fig.1 The definition of Vth & Vsat

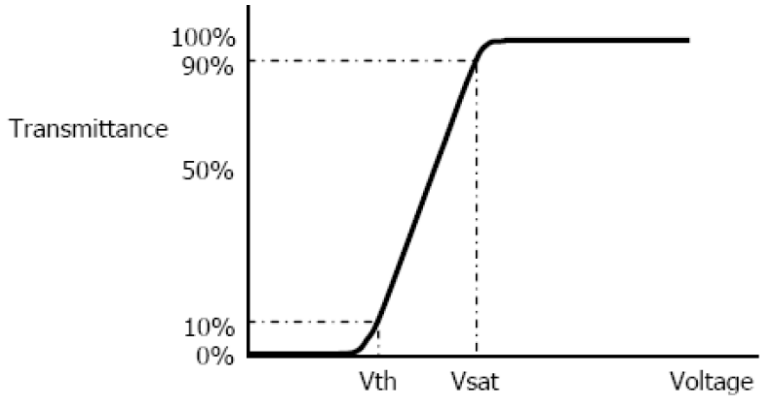


Fig.2 Measurement Set Up

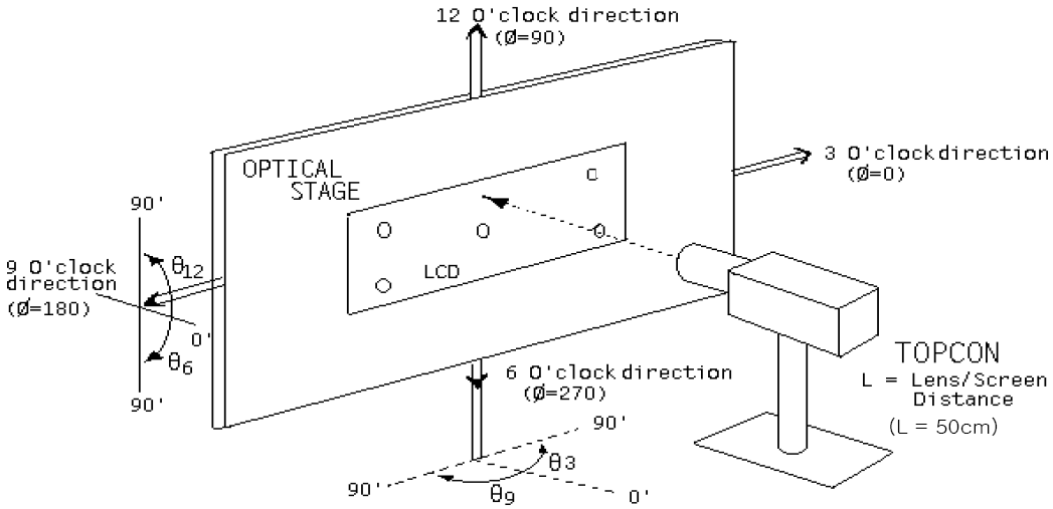
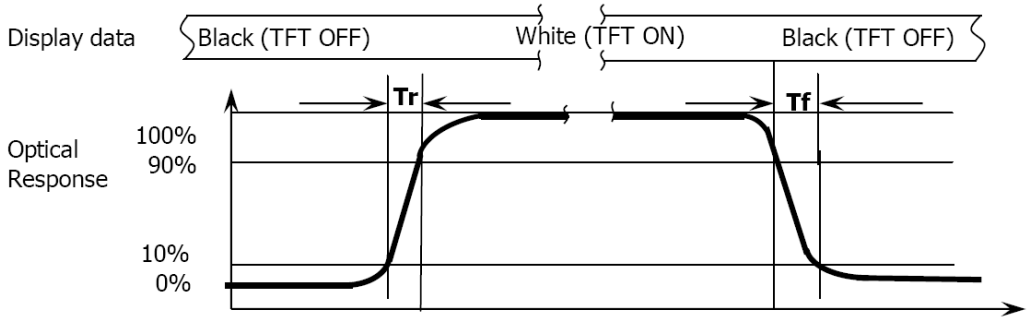


Fig.3 Response Time Testing



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 (30min) ⟺ 25°C (5min) ⟺ 70°C (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)	
□	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
□	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

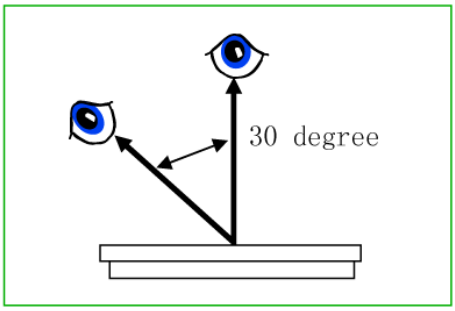
1. **Spot check plan：**

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

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

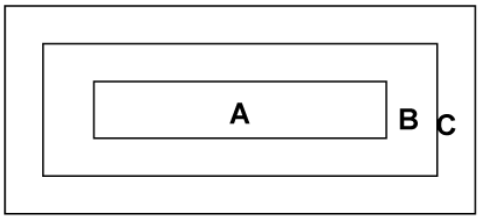
1A：major non-conformance： AQL 0.65 minor non-conformance： AQL 1.

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

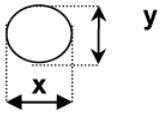
Remark: non-conformance at area C, but is OK that isn’t influence reliability of product & assembly by customer.

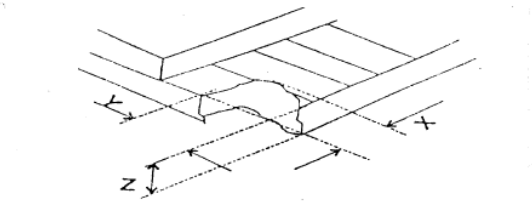
4. Inspection standard

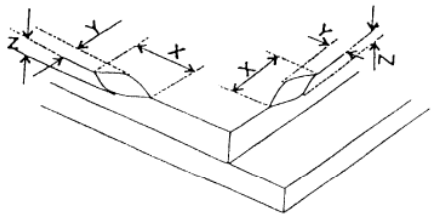
4.1 Major non-conformance

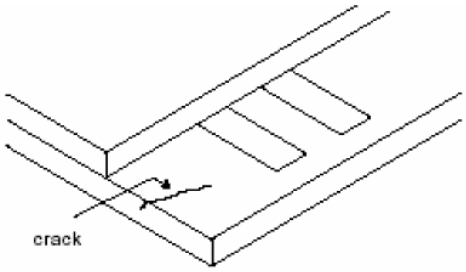
NO.	Item	Inspection standard	Rate
4.1.1	Function non-conformance	1) No display, display abnormally 2) Miss line, short 3) B/L no function or function abnormally 4) TP no function	major
4.1.2	miss	No matter miss what component	
4.1.3	Out of size	Module dimension out of spec	

4.2 Appearance non-conformance

<table>
<tr><th>NO.</th><th>Item</th><th>Inspection standard</th><th>Rate</th></tr>
<tr><td rowspan="2">4.2.1</td><td rowspan="2">Black or white spot（power on）</td><td>dot non-conformance define Φ
$\Phi = \frac{+y)}{2} \quad x \quad ($
 
</td><td rowspan="2">Minor</td></tr>
<tr><td>A grade
<table>
<tr><th rowspan="2">area / size（mm）</th><th colspan="3">Most approve q'ty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">ignore</td><td rowspan="5">ignore</td></tr>
<tr><td>0.10＜Φ≤0.15</td><td colspan="2">4</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td colspan="2">2</td></tr>
<tr><td>0.20＜Φ≤0.25</td><td colspan="2">1</td></tr>
<tr><td>0.25＜Φ</td><td colspan="2">0</td></tr>
</table>
Most approve 4 damages, dot to dot ⩾10mm</td></tr>
<tr><td>4.2.2</td><td>Black or white line（power on）</td><td>A grade
<table>
<tr><th colspan="2">Size(mm)</th><th colspan="3">Most approve q'ty</th></tr>
<tr><th>L(length）</th><th>W(width)</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>ignore</td><td>W≤0.03</td><td colspan="2">ignore</td><td rowspan="4">ignore</td></tr>
<tr><td>L≤5.0</td><td>0.03＜ W≤0.05</td><td colspan="2">3</td></tr>
<tr><td>L≤3.0</td><td>0.05＜ W≤0.07</td><td colspan="2">2</td></tr>
<tr><td></td><td>0.07＜W</td><td colspan="2">Treat with dot non-conformance</td></tr>
</table>
Most approve 3 damages, line to line ⩾10mm</td><td>Minor</td></tr>
</table>

<table>
<tr><td>4.2.3</td><td>Polarizer position</td><td>1) Polarizer attach meet drawing, disallow out of LCD.
2) Polarizer must cover display area（special require unless）</td><td>Minor</td></tr>
<tr><td rowspan="3">4.2.4</td><td rowspan="3">LCD non-conformance</td><td>(i) crash at side（remark: S=ITO length）
 

<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0</td><td>≤S</td><td>ignore</td></tr></table>Crash disallow extend to ITO or seal.</td><td rowspan="3">Minor</td></tr>
<tr><td>(ii) commonly surface scathe
 

<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤2.0</td><td><frame edge</td><td>ignore</td></tr></table></td></tr>
<tr><td>(iii) crack
Disallow extend crack
 
</td></tr>
<tr><td>4.2.5</td><td>Contrast voltage warp</td><td>VOP/Vlcd voltage of confirmed sample±0.15V</td><td>Minor</td></tr>
<tr><td>4.2.6</td><td>color</td><td>Color & luminance of module scope reference spec</td><td>Minor</td></tr>
<tr><td>4.2.7</td><td>Cross talk</td><td>Reference confirmed limit sample</td><td>Minor</td></tr>
</table>

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 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.

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