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	2012-07-10	NEW ISSUE	
B	2014-12-09	Modify brightness	

Table of Contents

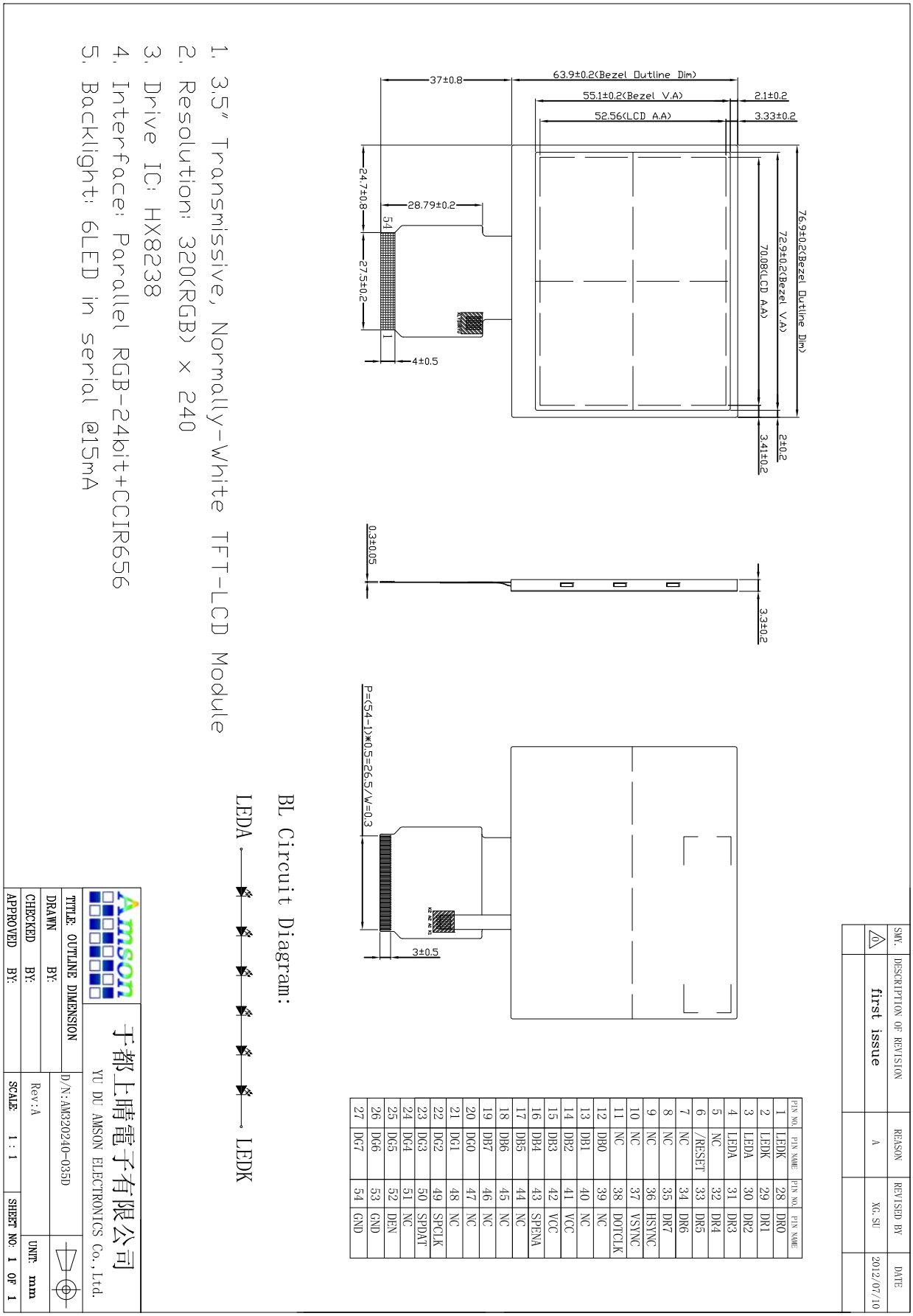
1. Scope

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	3.5”TFT	--
Dot arrangement	320(RGB)×240	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmissive / Normally White	--
Viewing Direction	6 o’clock(Gray scale inversion)	--
Driver IC	HX8238-D	--
Module size	76.9(W)×63.9(H)×3.3(T)	mm
Active area	70.08(W)×52.56(H)	mm
Dot pitch	0.219(W)×0.219(H)	mm
Interface	24 bits RGB with Serial Interface / CCIR656	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	6 White LED	--
Weight	TBD	g

3. External Dimensions



PIN NO.	PIN NAME	PIN NO.	PIN NAME
1	LEDK	28	DR0
2	LEDK	29	DR1
3	LEDA	30	DR2
4	LEDA	31	DR3
5	NC	32	DR4
6	/RESET	33	DR5
7	NC	34	DR6
8	NC	35	DR7
9	NC	36	HSYNC
10	NC	37	VSYNC
11	NC	38	DOTCLK
12	DB0	39	NC
13	DB1	40	NC
14	DB2	41	VCC
15	DB3	42	VCC
16	DB4	43	SPENA
17	DB5	44	NC
18	DB6	45	NC
19	DB7	46	NC
20	DG0	47	NC
21	DG1	48	NC
22	DG2	49	SPCLK
23	DG3	50	SPDAT
24	DG4	51	NC
25	DG5	52	DEN
26	DG6	53	GND
27	DG7	54	GND

4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1	LEDK	LED backlight cathode
2	LEDK	LED backlight cathode
3	LEDA	LED backlight anode
4	LEDA	LED backlight anode
5	NC	No Connection
6	/RESET	System Reset
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection
10	NC	No Connection
11	NC	No Connection
12	DB0	RGB Data Bus
13	DB1	
14	DB2	
15	DB3	
16	DB4	
17	DB5	
18	DB6	
19	DB7	
20	DG0	
21	DG1	
22	DG2	
23	DG3	
24	DG4	
25	DG5	
26	DG6	
27	DG7	
28	DR0	
29	DR1	
30	DR2	
31	DR3	
32	DR4	
33	DR5	
34	DR6	
35	DR7	
36	HSYNC	Line synchronizing signal for RGB interface operation
37	VSYNC	Frame synchronizing signal for RGB interface operation
38	DOTCLK	Dot Clock
39	NC	No Connection.

40	NC	No Connection.
41	VCC	Power supply.
42	VCC	Power supply.
43	SPENA	SPI ENABLE
44	NC	No Connection.
45	NC	No Connection.
46	NC	No Connection.
47	NC	No Connection.
48	NC	No Connection.
49	SPCLK	SERIAL CLOCK SIGNAL
50	SPDAT	SERIAL DATA SIGNAL
51	NC	No Connection.
52	DEN	Display enable pin from controller
53	GND	Power ground
54	GND	Power ground

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VCC	-0.3	4.0	V
Input Voltage	Vin	GND-0.3	4.0	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	--	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage	VCC	2.5	--	3.6	V	--
Input High Voltage	V_{IH}	0.8 VCC	--	VCC	V	Digital input pins
Input Low Voltage	V_{IL}	0	--	0.2 VCC	V	Digital input pins
Output High Voltage	V_{OH}	0.9 VCC	--	VCC	V	Digital output pins
Output Low Voltage	V_{OL}	0	--	0.1 VCC	V	Digital output pins
Logic Input Current	I_{IL}/I_{IH}	-1	--	1	uA	--

7. Timing Characteristics

7.1 Pixel Timing Characteristics

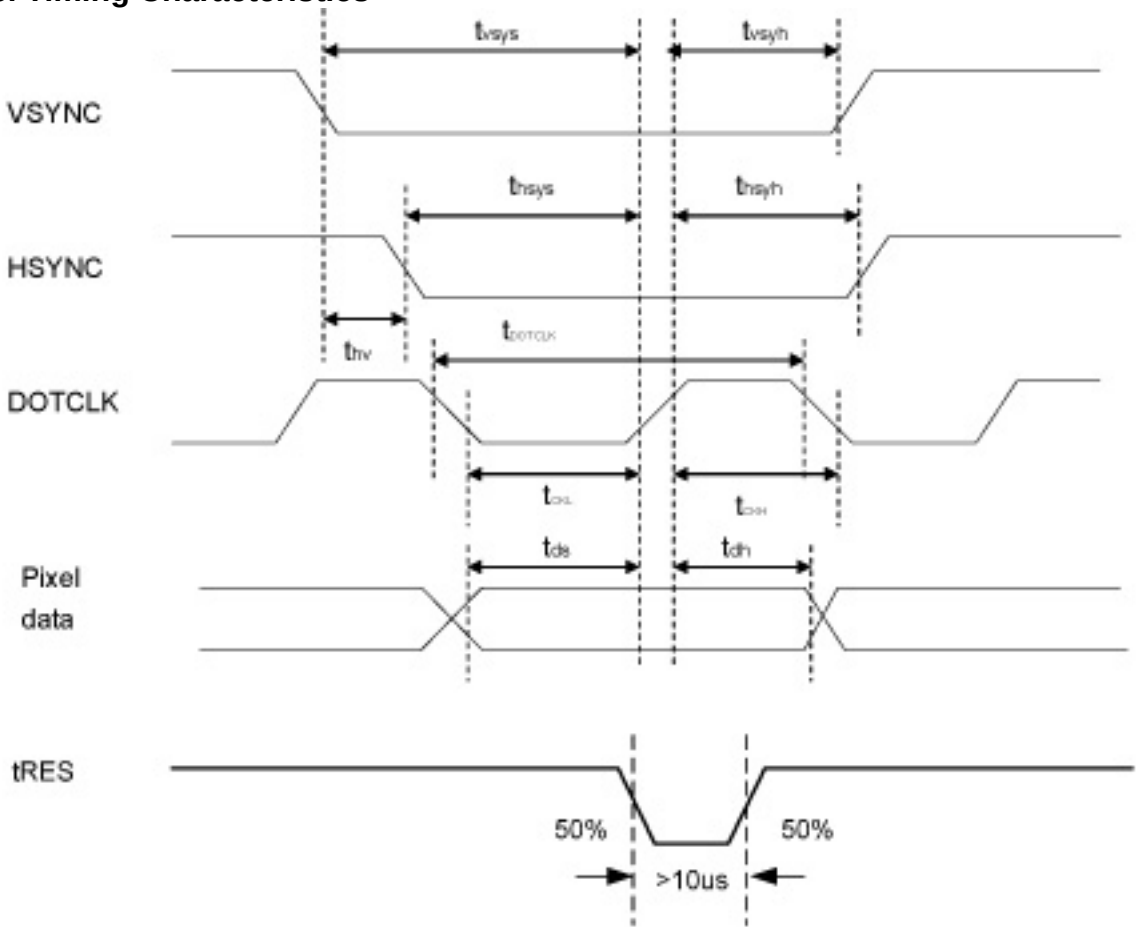


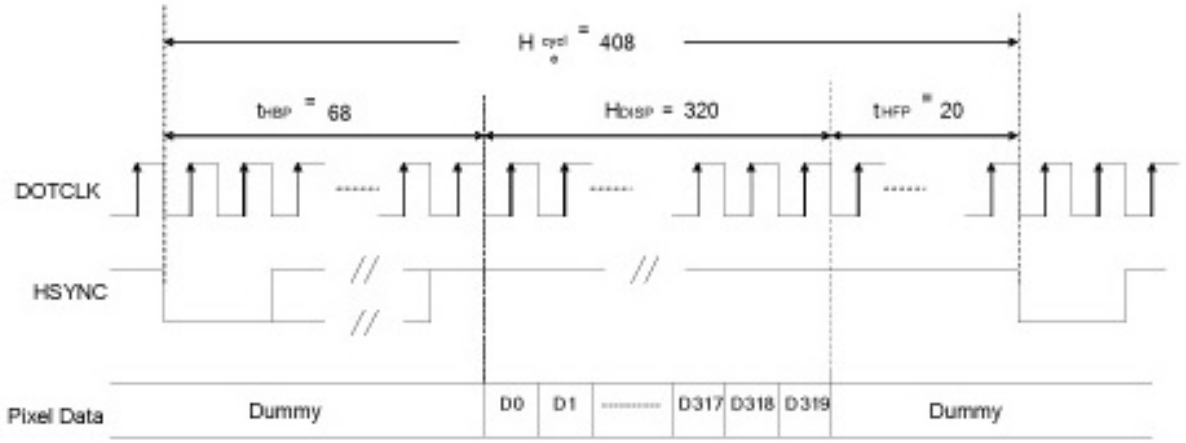
Figure 7. 1 Pixel Timing

Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	tvsys	20	10	-	-	-	-	ns
Vertical Sync Hold Time	tvsyh	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	thsys	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	thsyh	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1		-		240		tDOTCLK
DOTCLK Low Period	tCKL	50	15	-	-	-	-	ns
DOTCLK High Period	tCKH	50	15	-	-	-	-	ns
Data Setup Time	tds	12	10	-	-	-	-	ns
Data hold Time	tdh	12	10	-	-	-	-	ns
Reset pulse width	tRES	10		-		-		μs

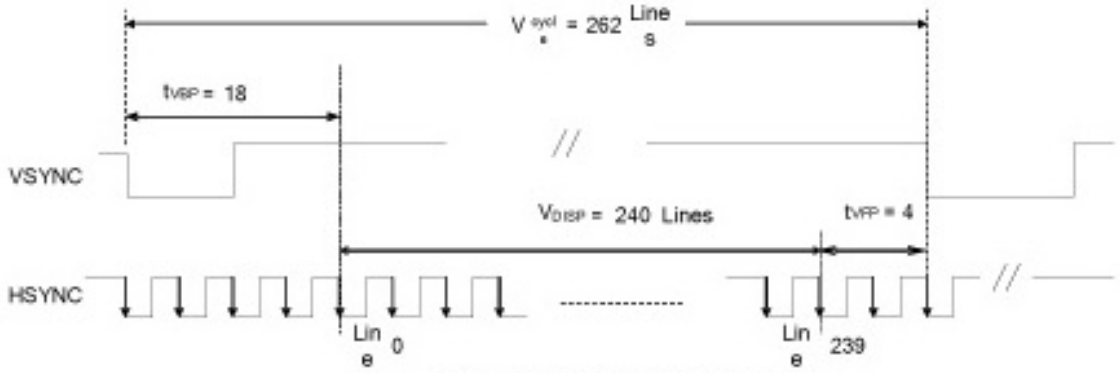
Note: External clock source must be provided to DOTCLK pin of HX8238-D. The driver will not operate if absent of the clocking signal.

Table 7. 1 Pixel Timing

7.2 RGB Interface Timing Characteristics



(a) Horizontal Data Transaction Timing



(b) Vertical Data Transaction Timing

Figure 7. 2 Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)

Characteristics		Symbol	Min.		Typ.		Max.		Unit
			24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency		fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period		tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)		fH	-		14.9		22.35		KHz
Vertical Frequency (Refresh)		fV	-		60		90		Hz
Horizontal Back Porch		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch		tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area		HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle		Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch		tVBP	-		18		-		Lines
Vertical Front Porch		tVFP	-		4		-		Lines
Vertical Data Start Point		tVBP	-		18		-		Lines
Vertical Blanking Period		tVBP + tVFP	-		22		-		Lines
Vertical Display Area	NTSC	VDISP	-		240		-		Lines
	PAL				280(PALM=0)				
	PAL				288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-		262		350		Lines
	PAL				313				

Table 7. 2 Data Transaction Timing in Normal Operating Mode

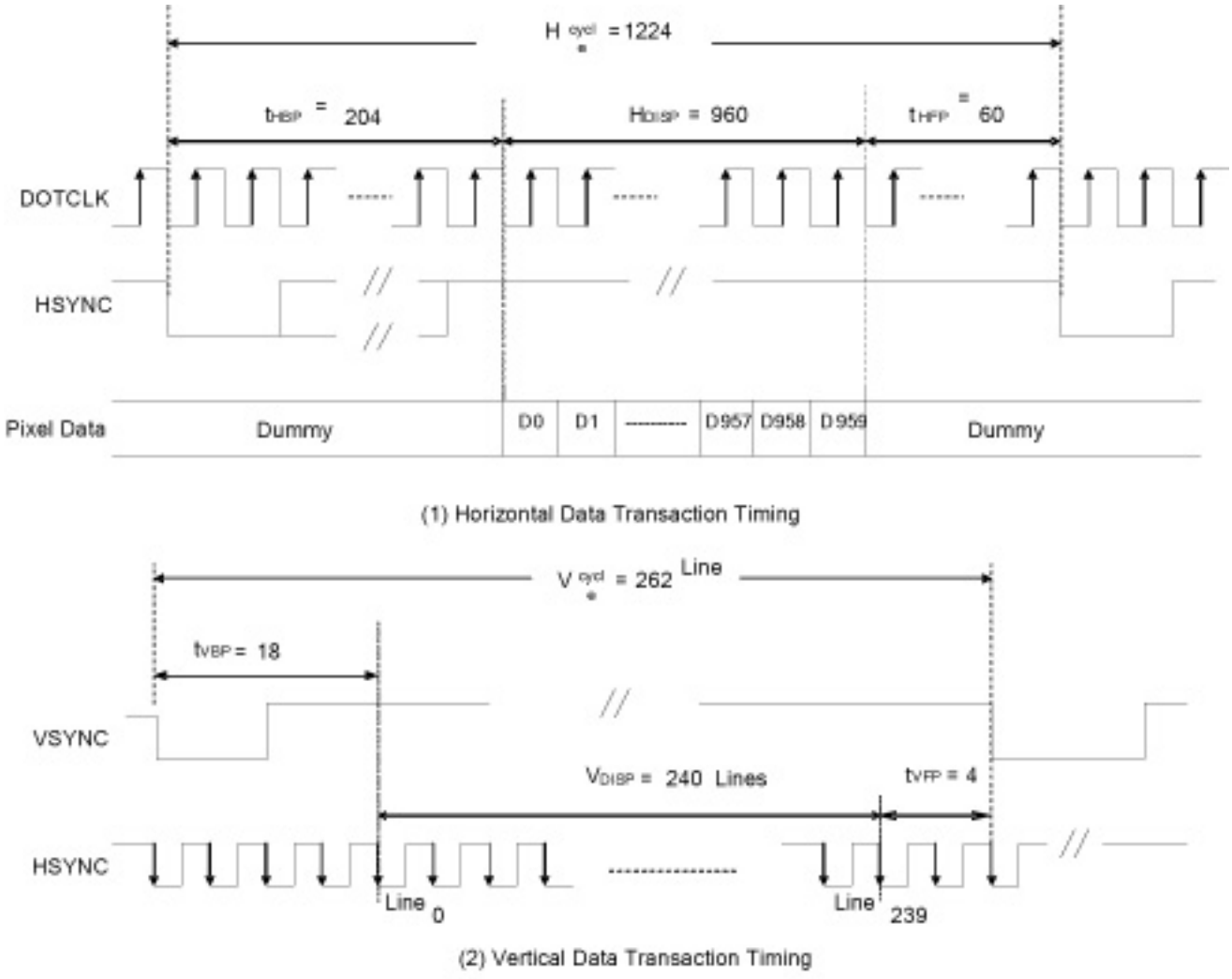
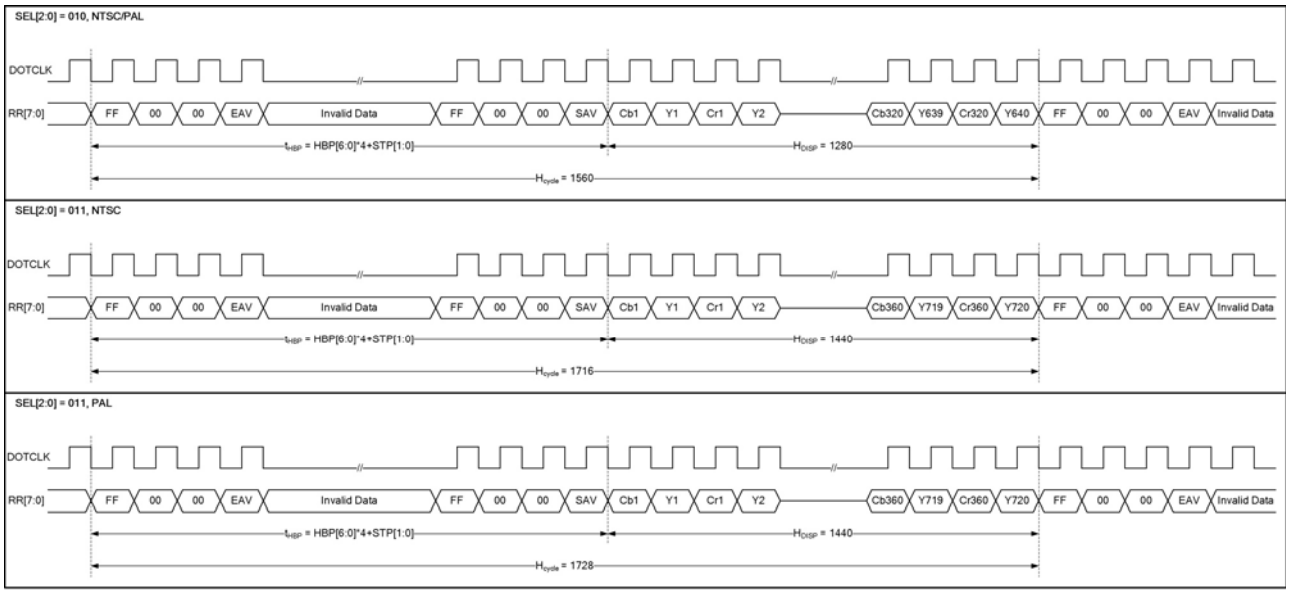


Figure 7. 3 Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)

7.3 CCIR656 Timing Characteristics



Figur 7.4 CCIR656 Horizontal Timing

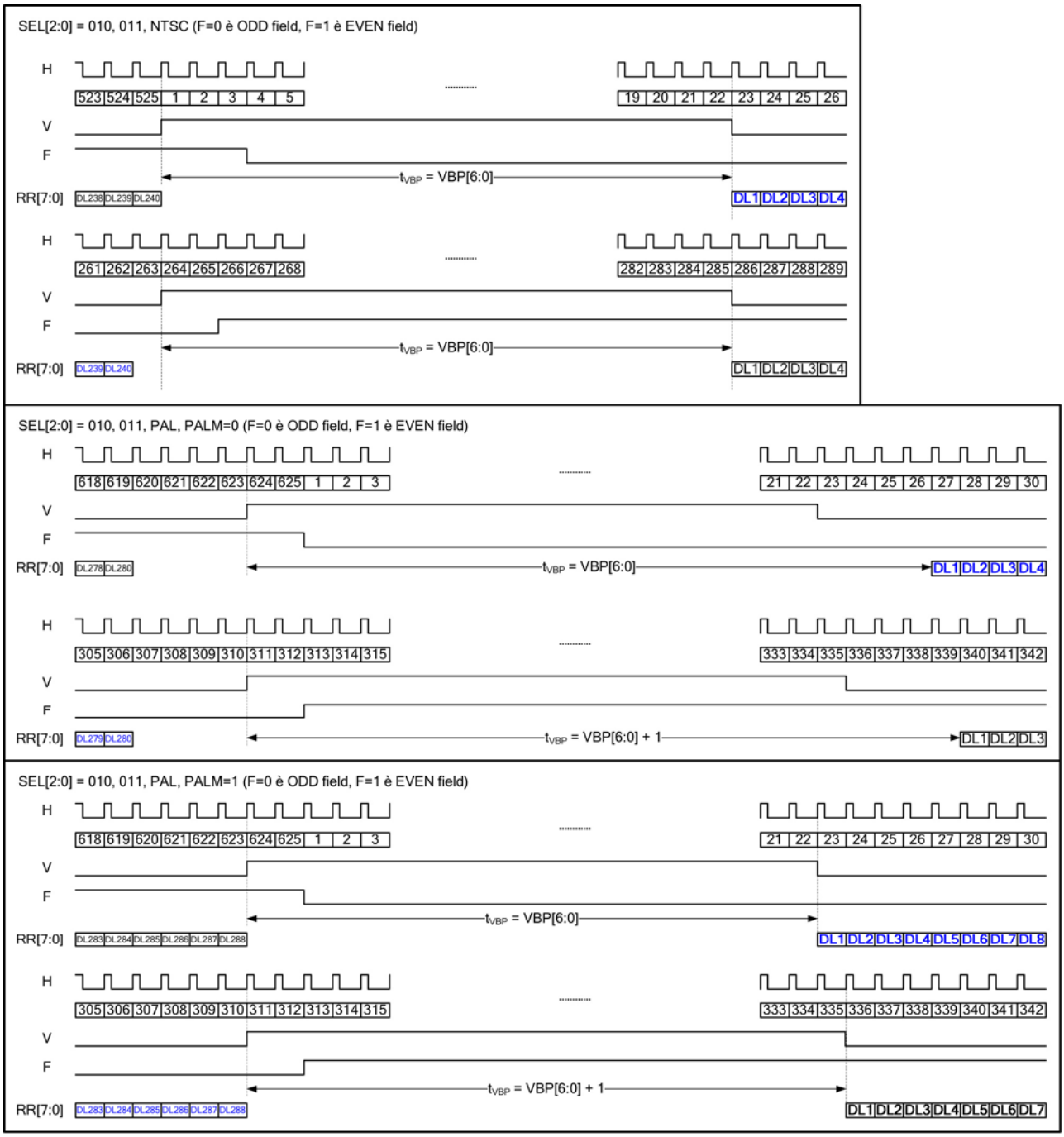


Figure 7.5 CCIR656 Vertical Timing

8. Backlight Characteristics

BL Circuit Diagram:

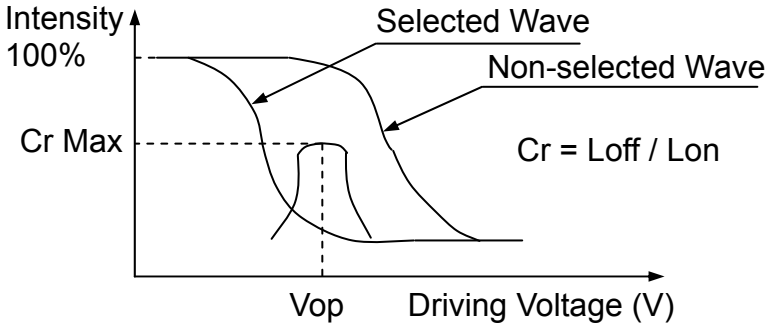
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	18	19.2	20	V	If=15mA
Supply Current	If	--	15	--	mA	--
Luminous Intensity for LCM	--	200	250	--	Cd/m^2	If=15mA
Uniformity for LCM	--	80	--	--	%	If=15mA
Life Time	--	50000	--	--	Hr	If=15mA
Backlight Color	White					

9. Optical Characteristics

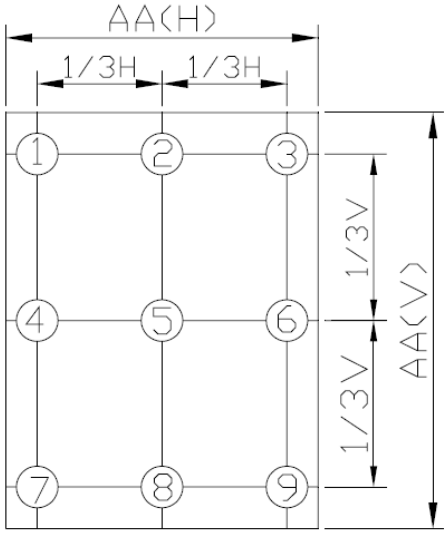
(Note1，Note2) (Using Normal Polarizer +CPT Backlight, reference only)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Brightness		BL	θ =φ= 0°	200	250	--	cd/m²	Note2
Contrast Ratio		CR	θ =φ= 0°	150	250	--	--	Note3
Response Time		Tr+ Tf	θ =φ= 0°	--	50	70	ms	Note4
Viewing Angle	Upper	θ	CR≧10	--	45	--	--	Note 5
	Down			--	45	--	--	
	Right	φ		--	35	--	--	
	Left			--	15	--	--	
Color Filter Chromaticity	White	X	θ =φ= 0°	0.264	0.294	0.324	--	Note 6
		y		0.304	0.334	0.364	--	
	Red	X	θ =φ= 0°	0.603	0.633	0.663	--	
		y		0.296	0.326	0.356	--	
	Green	X	θ =φ= 0°	0.267	0.297	0.327	--	
		y		0.547	0.577	0.607	--	
	Blue	X	θ =φ= 0°	0.103	0.133	0.163	--	
		y		0.099	0.129	0.159	--	

Note1: Definition of Operation Voltage (Vop)



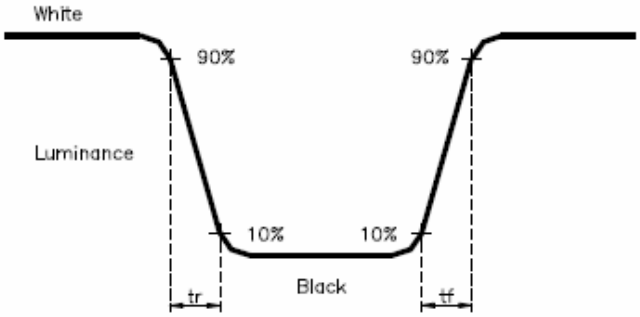
Note2: Definition of Luminance Uniformity：L = L(MIN) / L (MAX) × 100%



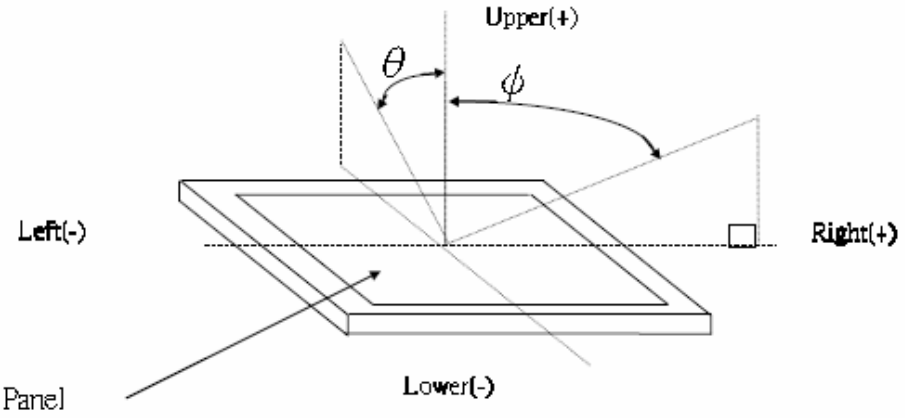
Note 3. Definition of Contrast Ratio：

CR = White Luminance (ON) / Black Luminance (OFF)

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)：



Note 6. Light source: C light.

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)	
□	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

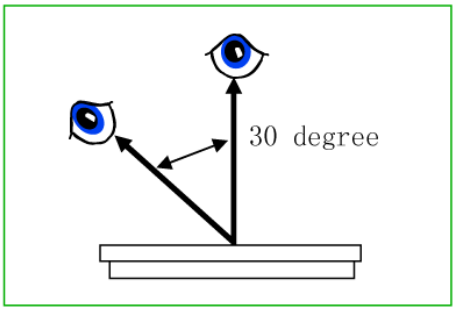
1. **Spot check plan：**

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

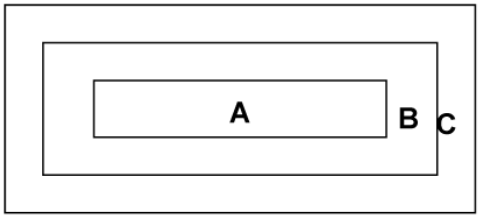
1A：major non-conformance： AQL 0.65 minor non-conformance： AQL 1.

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

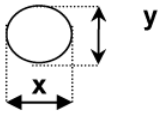
Remark: non-conformance at area C, but is OK that isn’t influence reliability of product & assembly by customer.

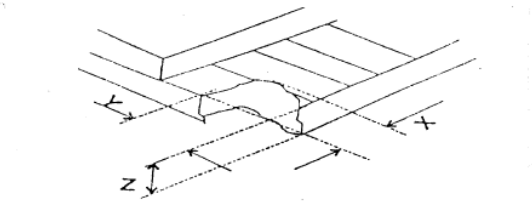
4. Inspection standard

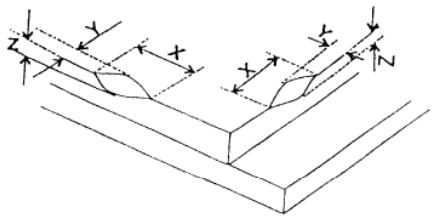
4.1 Major non-conformance

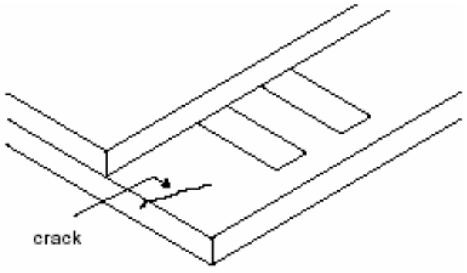
NO.	Item	Inspection standard	Rate
4.1.1	Function non-conformance	1) No display, display abnormally 2) Miss line, short 3) B/L no function or function abnormally 4) TP no function	major
4.1.2	miss	No matter miss what component	
4.1.3	Out of size	Module dimension out of spec	

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 VDDIO 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

TBD