PRODUCT SPECIFICATIONS

For Customer: _____ □ : APPROVAL FOR SPECIFICATION

Customer Model No. _____ □ : APPROVAL FOR SAMPLE

Module No.: B121VMZ

Customer :_____

Approved by	Notes

prepared by	Checked by	Approved by

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REVISED PAGE NO.
1.0	2015-07-10	First Release	

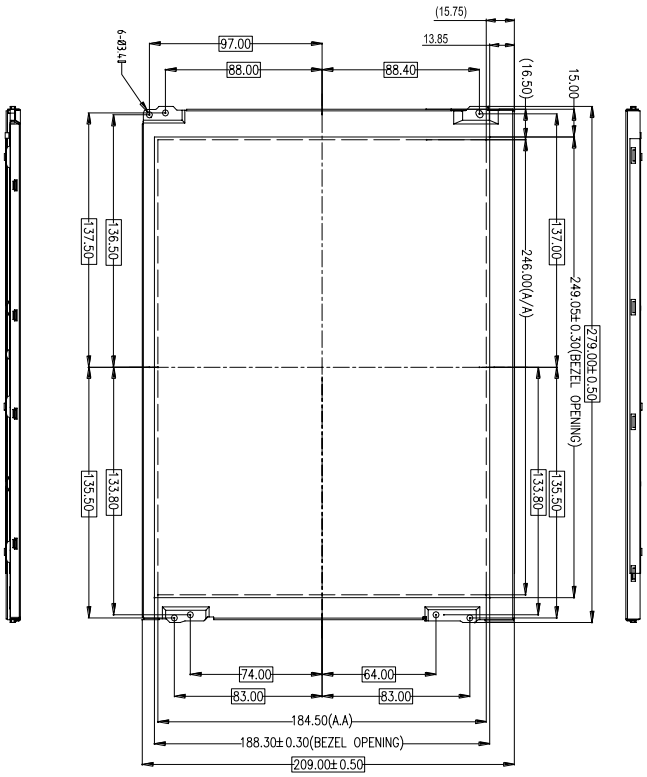
CONTENTS

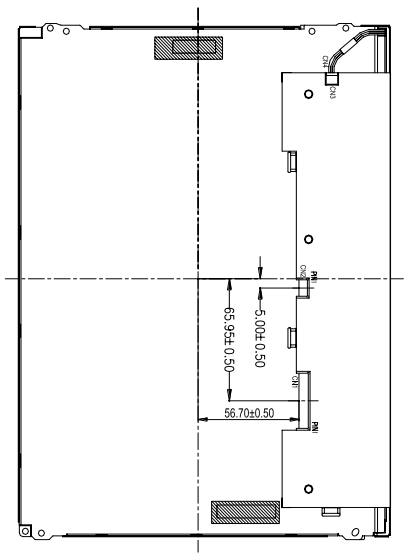
■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	TFT,Transmissive,Normally white	/
Size	12.1	Inch
Viewing direction	12:00(without image inversion and least brightness change)	O' Clock
Gray scale inversion direction	6:00 (contrast peak located at)	O' Clock
LCM (W × H × D)	279.0×209.0×9.0	mm^3
Active area (W×H)	246.0×184.5	mm^2
Pixel pitch (W×H)	0.3075×0.3075	mm^2
Number of dots	800 (RGB) × 600	/
Driver IC	Source:HX8245-C01/Gate:HX8677-G, T-con:HX8841	/
Backlight type	18 LEDs	/
Interface type	LVDS	/
Color depth	16.7M	/
Pixel configuration	R.G.B vertical stripe	/
Top polarizer surface treatment	TBD	/
Input voltage	3.3	V
With/Without TSP	Without TSP	/
TP surface treatment	TBD	/
Weight	TBD	g

Note 1: RoHS compliant;
Note 2: LCM weight tolerance: ± 5% .

■ EXTERNAL DIMENSIONS





NOTES:

1. DISPLAY TYPE: TFT,TRANSMISSIVE,NORMALLY WHITE.
2. OPERATING VOLTAGE: VDD=3.3V.
3. VIEWING DIRECTION: 12 O'CLOCK.
4. IC DRIVER: SOURCE:HX8245-C01/GATE:HX8677-G/T-CON:HX8841.
5. OPERATING TEMP: -20°C ~ 70°C.
6. STORAGE TEMP: -30°C ~ 80°C.
7. LED BACKLIGHT: 18-CHIP WHITE LED, If=160mA,Vf=27V.
8. SURFACE LUMINANCE: 450cd/m^2(TYP.)
9. CONNECTOR TYPE:
   CN1:MSB240420-E
   CN2(LED BLU_DRIVER CONNECTOR):3808K-F50N-02R
   CN3(LED BLU_LED BAR CONNECTOR_MATING):3808K-G03N-02R
   CN4(LED BLU_LED BAR CONNECTOR):H208K-03N-02B
10. GENERAL TOLERANCE: ±0.2.
11. RoHS COMPLIANT.

■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Power supply voltage	VDD	3.6	7.0	V
Operating temperature	T_{OP}	-20	70	°C
Storage temperature	T_{ST}	-30	80	°C

■ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Digital supply voltage	VDD	3.0	3.3	3.6	V
Current of VDD power supply	ICC	-	75	-	mA
Differential input high threshold	V_{TH}	-	-	+100	mV
Differential input low threshold	V_{TL}	-100	-	-	mV
Input voltage ' H ' level	V_{IH}	0.7VDD	-	VDD	V
Input voltage ' L ' level	V_{IL}	VSS	-	0.3VDD	V
Output voltage ' H ' level	V_{OH}	0.8VDD	-	VDD	V
Output voltage ' L ' level	V_{OL}	VSS	-	0.2VDD	V

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	-	27	28.8	V	Ta=25±2°C, 60%RH±5%
Forward current	If	-	160	-	mA	
Power consumption	W_{BL}	-	4.32	-	mW	
Operating life time	-	-	50000	-	Hrs	

Note :

Operating life time means brightness goes down to 50% initial brightness;

The life time of LED will be reduced if LED is driven by high current,high ambient temperature and humidity conditions;

Typical operating life time is an estimated data.

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf	θ=0° ∅=0° Ta=25℃	-	30	-	ms	FIG 1.	4
Contrast ratio		Cr		600	800	-	---	FIG 2.	1
Luminance uniformity		δ WHITE		75	80	-	%	FIG 2.	3
Surface Luminance		Lv		350	450	-	cd/m^2	FIG 2.	2
Viewing angle range		θ	∅ = 90°	55	65	-	deg	FIG 3.	6
			∅ = 270°	65	75	-	deg	FIG 3.	
			∅ = 0°	70	80	-	deg	FIG 3.	
			∅ = 180°	70	80	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	θ=0° ∅=0° Ta=25℃	-	TBD	-		FIG 2.	5
		y		-	TBD	-			
	Green	x		-	TBD	-			
		y		-	TBD	-			
	Blue	x		-	TBD	-			
		y		-	TBD	-			
	White	x		-	TBD	-			
		y		-	TBD	-			
NTSC	-	-	-	-	55	-	%	-	-

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P 3,P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

Lv = Average Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)

Note 3. The uniformity in surface luminance ，δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta\ \text{WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series.

Note 5. CIE (x, y) chromaticity，The x, y value is determined by measuring luminance at each test position 1 through 5,and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the conrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note 7. For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments For contrast ratio, Surface Luminance, Luminance uniformity, CIE The test data is base on TOPCON's BM-5 photo detector.

FIG. 1 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

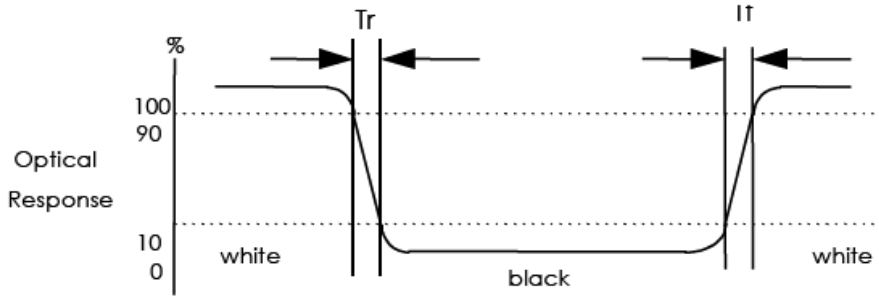
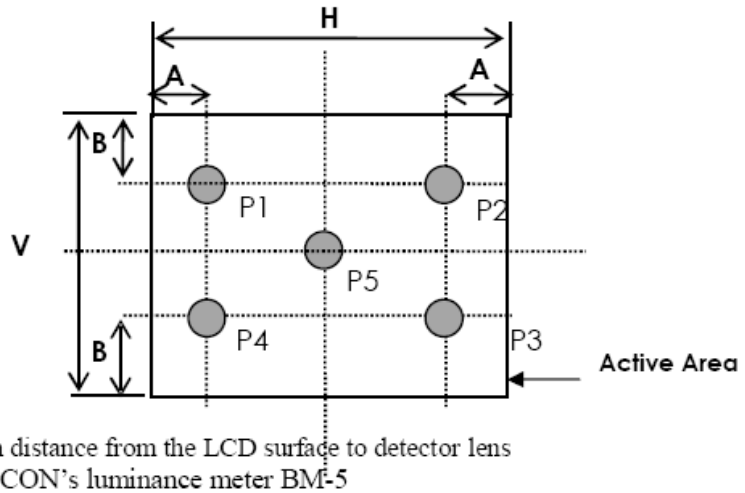
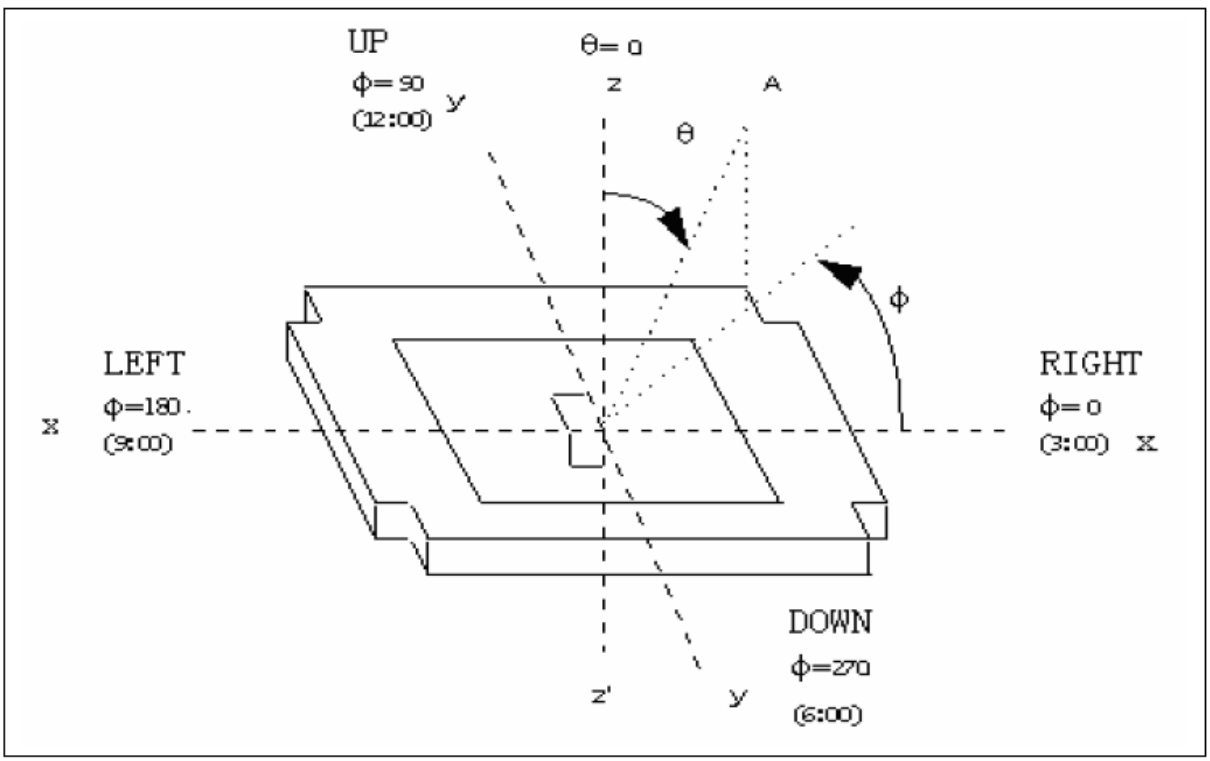


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity



A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=7mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

FIG. 3 The definition of viewing angle



■INTERFACE DESCRIPTION

1. 20Pin Data Connector

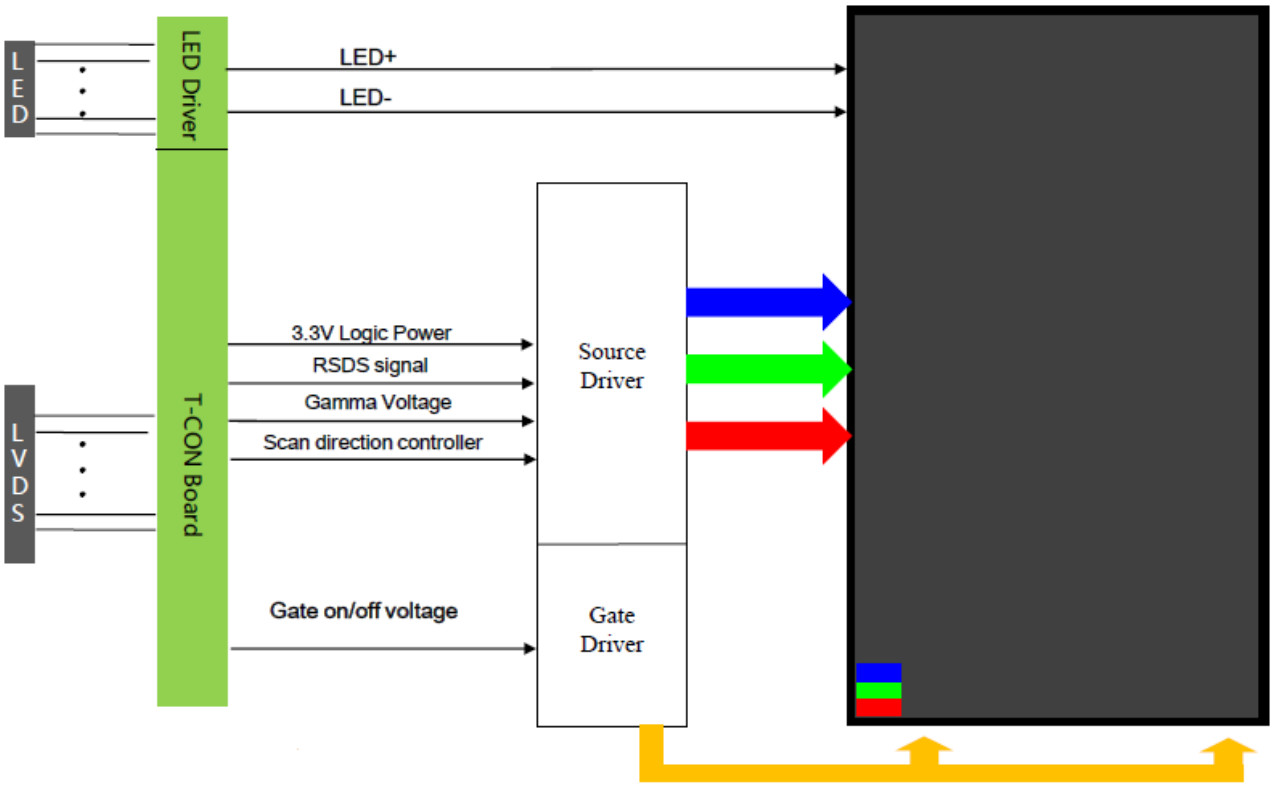
Input Signal Interface		
Pin No.	**Symbol**	**Description**
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	GND	Ground
4	SEL68	6/ 8bits LVDS data input selection [H: 8bits L/NC: 6bit]
5	RIN0-	LVDS receiver signal channel 0
6	RIN0+	LVDS Differential Data Input (R0, R1, R2, R3, R4, R5, G0)
7	GND	Ground
8	RIN1-	LVDS receiver signal channel 1
9	RIN1+	LVDS Differential Data Input (G1, G2, G3, G4, G5, B0, B1)
10	GND	Ground
11	RIN2-	LVDS receiver signal channel 2
12	RIN2+	LVDS Differential Data Input (B2, B3, B4, B5, HS, VS, DE)
13	GND	Ground
14	CLKIN-	LVDS receiver signal clock
15	CLKIN+	
16	GND	Ground
17	RIN3-	LVDS receiver signal channel 3, NC for 6 bit LVDS Input
18	RIN3+	LVDS Differential Data Input (R6, R7, G6, G7, B6, B7, RSV)
19	RSV	Reverse Scan Function [H: Enable; L/NC: Disable]
20	NC/GND	Reserved for AUO internal test. Please treat it as NC.

2. 5Pin B/L Power Connector

Pin No.	symbol	description
Pin1	VCC	12V input
Pin2	GND	GND
Pin3	On/OFF	5V-ON,0V-OFF
Pin4	Dimming	PWM
Pin5	NA	

Remark: PWM frequency 120~1Khz

■BLOCK DIAGRAM



■ APPLICATION NOTES

1. Signal Timing Specification

Ideal strobe position for LVDS input

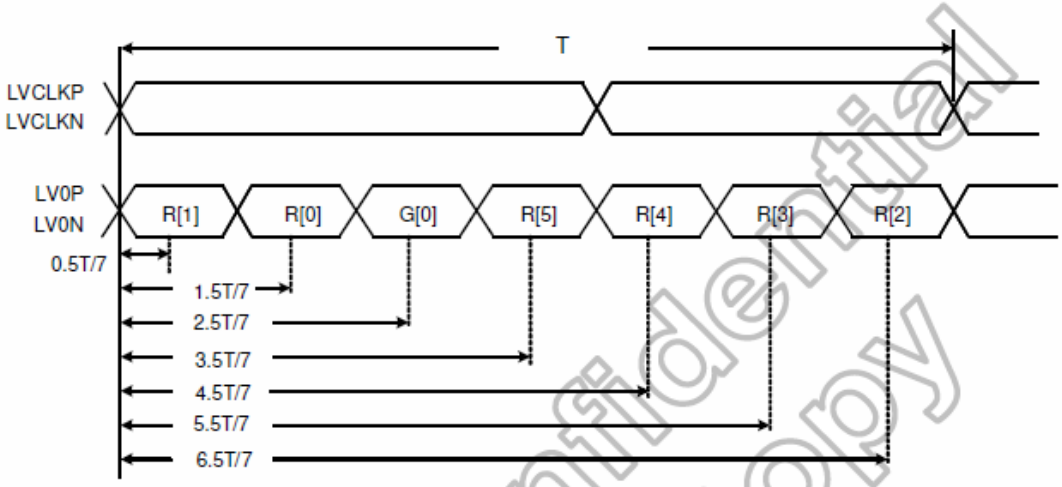


Figure 6.1: LVDS input data ideal strobe position

LVDS input data mapping

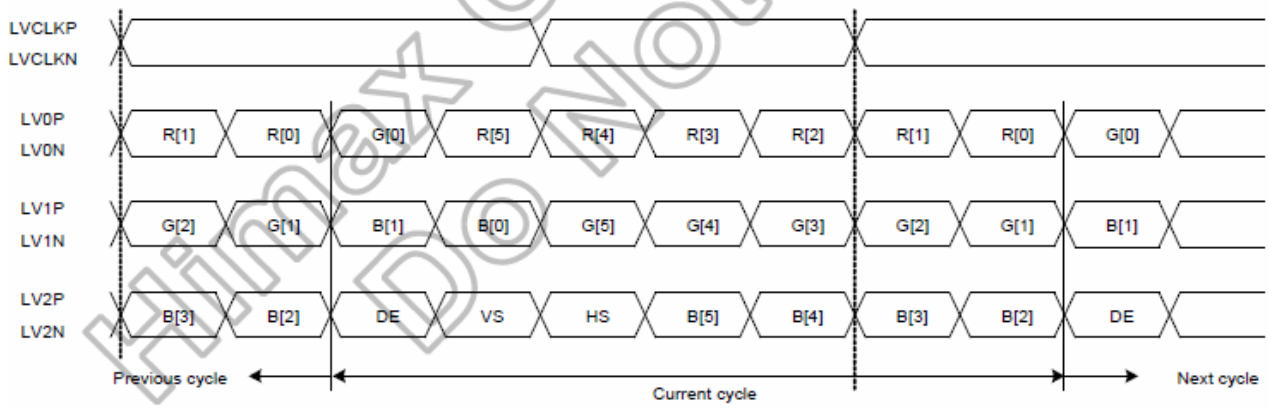


Figure 6.2: LVDS input data mapping

2. Power On/Off Sequence

Power up sequence

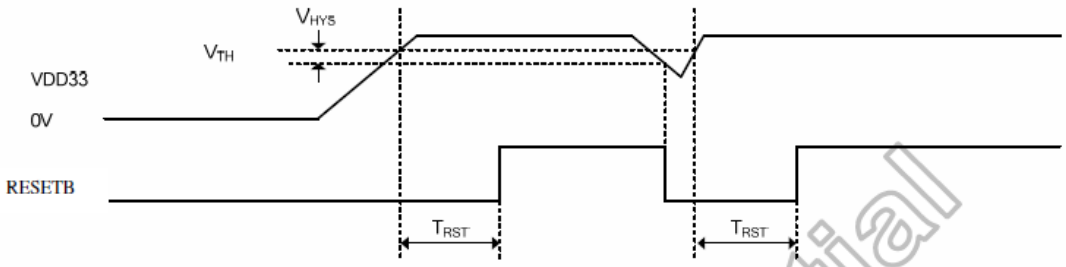


Figure 0.3: Power up sequence

Symbol	Parameter	Condition	Spec.			Unit
			Min.	Typ.	Max.	
V_{TH}	Reset threshold voltage	-	2	2.1	2.2	V
V_{HYS}	Hysteresis voltage	-	-	200	-	mV
T_{RST}	Reset duration @R=10KΩ, C=1μF	-	10	-	-	ms

■ RELIABILITY TEST

No.	Test Item	Test Condition	Duration
1	High temperature, high humidity operation test(THO)	60℃, 90%RH	240hrs
2	Low temperature operation test(LTO)	-20℃	240hrs
3	High temperature operation test(HTO)	70℃	240hrs
4	High temperature storage test(HTS)	80℃	240hrs
5	Low temperature storage test(LTS)	-30℃	240hrs
6	Thermal shock test (TST)	-30 ℃ →80℃ (Per 30min)	100hrs
7	Altitude test(ALT)	25℃,40000ft	12hrs
8	On/Off	On 30s / Off 30s	3000times
9	PCT	121℃ ,2ATM ,100%RH	12hr
10	ESD	150pF 330Ω ± 8KV(Air) / ± 6KV(Contact)	20points
11	Vibration	1.5G ,10/500/10,Sine,X/Y/ Z Direction	Total:30min

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 6
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

1. Scope

The incoming inspection standards shall be applied to TFT-LCD module (hereinafter called "module") that is supplied by factory.

2. Incoming Inspection Right

The customer shall inspect the modules within twenty working days since the delivery date. The results of the inspection (acceptance or rejection) shall be recorded in writing,and a copy of this writing will be promptly sent to the factory.

If the samples of module within a lot show a number of unacceptable defects in accordance with this incoming inspection standards,the customer must promptly notify factory in writing with- in three business days at the end of the inspection period. If does not notify factory within the insp- ection period,the modules shall be deemed to have been accepted by customer.

factory is only responsible for the defects which were found in IQC.

3. Inspction Instruments

3-1 Pattern generator: model CM50PE-II or equivalent.

3-2 Video board: factory uses CM50PE-II which integrates video board for outputting LVDS signal. If using other video board,the output of the signal should comply with the standard specifications provided by factory.

4. Inspction Conditions

	Display inspection	Appearance inspection	Note
Temperature	25±5℃	25±5℃	
Humidity	60±5% RH	60±5% RH	
View distance	30±10cm	30±10cm	Note1
Luminance	150±50 lux	500±100 lux	Note2
Inspection direction	0≤θL≤ 30° 0≤θR≤ 30° 0≤θU≤ 30° 0≤θD≤ 30°	0≤θL≤45° 0≤θR≤45° 0≤θU≤45° 0≤θD≤45°	Note3

Note1. Viewing distance：The distance between the inspector's eyes and screen

Note2. Inspection Luminance：The luminance at an inspection desk surface

Note3. Inspection direction：Viewing line should be perpendicular to the surface of the module.

Refer to the figure 1 as following：

Note4. ND filter use: put the ND filter between the inspector's eyes and screen , the viewing distance is 2 cm from the screen, inspection time is 3sec.

Note5.To normal view modules, θL / θR /θU / θD = 0°

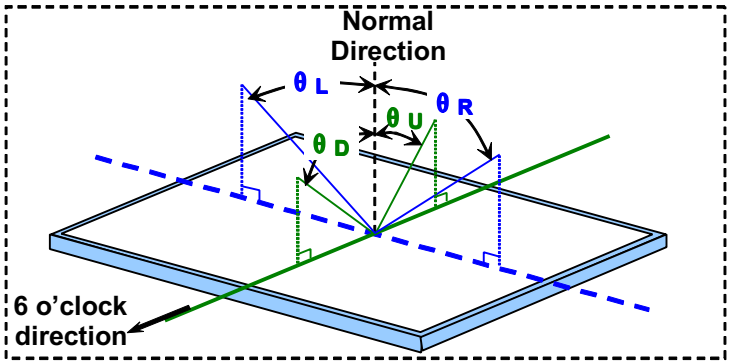


Figure 1: Inspection direction

5. Classification of Defects:

Defects are classified as major defects and minor defects according to the defect classification defined herein.

5-1. Major defects:

A major defect is a defect that is likely to result in failure, or to reduce the usability of the product for its intended purpose evidently.

5-2. Minor defects:

A minor defect is either a defect that is not likely to reduce the usability of the product for its intended purpose evidently, or a stray from an intended purpose with little bearing on the effective usage.

Specific criteria of judgment on major and minor defects shall be in accordance with "the Classification of Defect" table below.

Defect items	Criterion for defects	Severity
Line Defect	Not allowed any vertical, horizontal and cross line	Major
Display abnormal	Not allowed any display abnormal at any pattern	Major
Foreign Material	shall be in accordance with the item 6.3"Foreign Material "in this standard	Minor
Polarizer Defect	Shall be in accordance with the item 6.4"Polarizer Defect "in this standard	Minor
Dot Defect	Sha11 be in accordance with the item 6.1"Dot defect" in this standard	Minor
Mura	Shall be in accordance with the item 6.5"Mura defect" in this standard	Minor

6. Inspection Criteria

6-1. Display inspection

6-1-1. Dot Defect

A. Every dot is a Sub-Pixel (each Red, Green or Blue color).

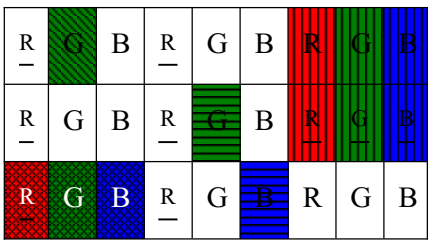
B. Dot defect is defined as that the defective area of the dot is larger than 50% of the dot area.

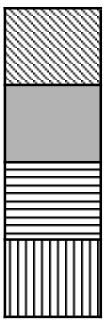
C. Dot defect isn't defined as that the defective area of the single dot defect less than 50% of the dot area

D. The luminance of the dots should be judged by ND 5%.

Defect items	Max. Number of Defect	Min. Distance between defects	Test condition
1) Bright Points (R, G, or B)	N ≤ 3	≥15mm	Black
2) Bright Point Pairs (2 bright sub-pixels in2 adjacent pixels or single pixel)	N ≤ 1	--	Black
3) 3 or More Bright Sub-Pixels in 2 Adjacent Pixels	N = 0	--	Black
4) Dark Points (R,G, or B)	N ≤ 3	≥15 mm	White& R/G/B Pattern
5) Dark Point Pairs (2 dark sub-pixels in 2 adjacent pixels or single pixel)	N ≤ 1	--	White& R/G/B Pattern
6) 3 or More Dark Sub-Pixels in 2 Adjacent Pixels	N = 0	--	White& R/G/B Pattern
7) Total Defective Sub-Pixels (bright and/or dark points)	N ≤ 5	--	Black/White /R/G/B

6-1-2. Pixel Definition





Defective Sub-Pixel

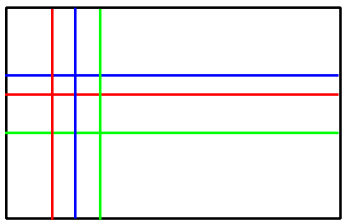
Defective Pixel

Defective Adjacent Sub-Pixels

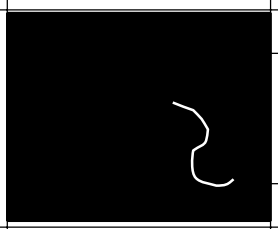
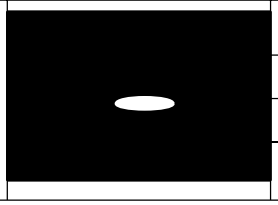
Defective Adjacent Pixels

6-2. Line Defects

Line defect ： Not allowed any vertical, horizontal and cross line at any Pattern

Defect item	Visual Description	Specifications	Test Condition
Line defect		Not allowed	Any video pattern

6-3. Foreign Material

Defect item	Visual Description	Line width(mm)	Line length(mm)	Judgement
Line shape		W ≤ 0.05	——	Allowed
		0.05< W≤ 0.1	L ≤ 0.7	
			0.7< L ≤ 1.0	N ≤ 4
			1.0 < L	N≤ 0
		0.1 < W	——	
Dot shape		Diameter(mm)		Judgement
		D ≤ 0.20		Allowed
		0.20 < D ≤ 0.50		N ≤ 3
		D >0.50		N = 0

Note1. D : diameter, W : width, L : length, N : count

Note2. Translucent edge is ignored in measuring the diameter of spot.

Note3. Line shape & Dot shape figure are as follows:

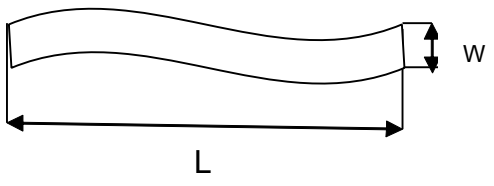
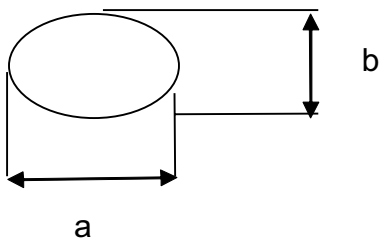


Figure 1



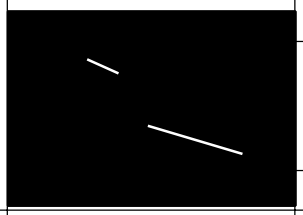
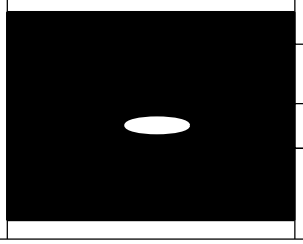
D=(a+b)/2

Figure 2

6-4. Polarizer Defects

A. Extraneous substances that can be wiped off such as Finger Prints , particles are not considered as defects.

B. Defects on the Black Matrix (outside the Active Area)are not considered defects.

Defect item	Visual Description	Line width(mm)	Line length(mm)	Judgement
Polarizer scratch		W ≤ 0.05	---	Allowed
		0.05 < W ≤ 0.1	L ≤ 0.7	
			0.7< L ≤ 5.0	N ≤ 4
			5.0 < L	N ≤ 0
		0.1 < W	---	
Bubbles, Wrinkles, Dent		Diameter(mm)		Judgment
		D ≤ 0.20		Allowed
		0.20 < D ≤ 0.50		N≤ 3
		D > 0.50		Note3

Note1. D : diameter, W : width, L : length, N : count

Note2. Translucent edge is ignored in measuring the diameter of spot.

Note3. D>0.50,judge by limit sample or equal to mura standard.

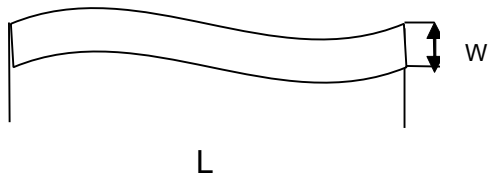


Figure 1

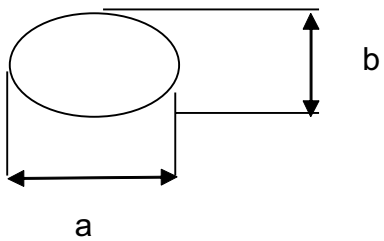
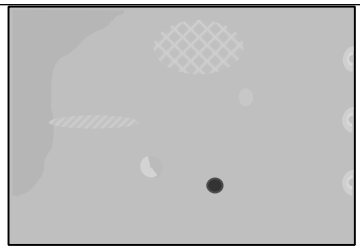


Figure 2

6-5. Mura

Defect item	Visual Description	Specifications	Test Condition
Mura		By Limit sample （equal to ND 8%）	128 Grayscale

6-6. Leak Light

Defect item	Visual Description	Specifications	Test Condition
Leak light		By Limit sample	Black

7. Inspection Judgment:

7-1. lf the number of defects is more than the applicable acceptance level, the lot shall be rejected and the buyer should inform the seller of the result of incoming inspection in writing.

7-2. Issue which is not defined in this criteria shall be discussed by both parties, Customer and Supplier, for better solutions.

■ PRECAUTIONS FOR USING LCD MODULES

Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control，Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated