SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFK480272A0-4.3N12NTM-R
REVISION NO: V01

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		
CHECKED BY		
APPROVED BY		

Records of Revision

DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2017-03-09		V01	First Issue	

Contents

1. General Specification

Item	Contents	Unit
LCD TYPE	TFT/TRANSMISSIVE	
MODULE SIZE (W*H*T)	105.50*67.20*4.12	MM
ACTIVE SIZE (W*H)	95.04*53.86	MM
PIXEL PITCH (W*H)	0.198*0.198	MM
NUMBER OF DOTS	480*272	
DIVER IC	HX8257A	
INTERFACE TYPE	24BIT RGB	
TOP POLARIZER TYPE	ANTI-GLARE	
RECOMMEND VIEWING DIRECTION	12	O'CLOCK
GRAY SCALE INVERSION DIRECTION	6	O'CLOCK
BACKLIGHT TYPE	10-DIES WHITE LED	
TOUCH PANEL TYPE	RESISTIVE	

2. Mechanical Drawing

Pin	Symbol	Description
1	LED-	Power For LED
2	LED-	Power For LED
3	GND	Power ground
4	VDD	Power supply
5	R0	Blue data(LSB)
6	R1	Blue data
7	R2	Blue data
8	R3	Blue data
9	R4	Blue data
10	R5	Blue data
11	R6	Blue data
12	R7	Blue data(MSB)
13	G0	Blue data(LSB)
14	G1	Blue data
15	G2	Blue data
16	G3	Blue data
17	G4	Blue data
18	G5	Blue data
19	G6	Blue data
20	G7	Blue data(MSB)
21	B0	Blue data(LSB)
22	B1	Blue data
23	B2	Blue data
24	B3	Blue data
25	B4	Blue data
26	B5	Blue data
27	B6	Blue data
28	B7	Blue data(MSB)
29	GND	Power Ground
30	PCLK	Pixel clock
31	DISP	Display on/off
32	HSYNC	Horizontal sta sigal
33	VSYNC	Vertical snc sigal
34	DE	Data enable
35	NC	NC
36	GND	Power ground
37	XR	T/P right side
38	YD	T/P bottom side
39	XL	T/P left side
40	YU	T/P up side

Display Type	CMO 4.3 TFT NORMALLY WHITE,TRANSMISSIVE
Viewing Angle	12:00 CLOCK
LCD Driver IC	HX8257A
Logic Voltage	VDD=2.8~3.3V
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Interface	24bit-RGB
Backlight	10-LED WHITE 13.5~17V/40MA
Surface luminance	260cd/m2
White X/Y	--

MODULE SPEC.

DRAWING NO. AFK480272A0-4.3N12NTM-R

UNIT	mm	SCALE	FIT
3rd Angle		SHEET 1 OF 1	

ORIENT DISPLAY

TITLE		
DRAWN		2013.11.6
ME.CHECKED		
EE.CHECKED		
APPROVED		
CUSTOMER'S APPROVAL		
	SIGN	DATE

VOO.		Frist issue
VER.	SYMBOL	AMENDMENT

NOTES:
1.GENERAL TOLERANCE:±0.2
2.( )REFERENCE DIMENSION
3.RECOMMENDED CUSHION ADHERENT ARAE:TP V.A+1.6mm
4. REFERENCED DIMENSION: ( )
5. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

480*RGB*272 DOTS
View Direction

BEZEL

13.5~17V@40MA

DETAIL 351
DETAIL 31

3. Block Diagram

VDD
GND
DISP
DE

PCLK
HSYNC
VSYNC

Gate:272

"HIMAX"
HX8257A
(COG)
LCD
Controller/
Driver or
Equivalent

4.3″
TFT LCD Panel
480(RGB)*272

R[0:7]
G[0:7]
B[0:7]

24 BIT

Source:480*RGB

XR
YD
XL
YU

Touch Panel

LED A
LED K

BL Circuit(10-DIES LED)

4. Interface Pin Function

Pin No.	Symbol	Description
1	LED-	Cathode of LED backlight
2	LED+	Anode of LED backlight
3	GND	Power ground
4	VDD	Power supply
5~12	R0~R7	Red data bus
13~20	G0~G7	Green data bus
21~28	B0~B7	Blue data bus
29	GND	Power ground
30	PCLK	Clock pin of serial interface
31	DISP	Display on/off mode control
32	HSYNC	Horizontal sync signal; negative polarity
33	VSYNC	Vertical sync signal; negative polarity
34	DE	Data enable signal for RGB interface operation.
35	NC	No connect
36	GND	Power ground
37	XR	TP pin
38	YD	TP pin
39	XL	TP pin
40	YU	TP pin

5. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for analog	VDD	-0.3	4.5	V
Supply voltage for logic	VDD	-0.3	4.5	V
Supply current (One LED)	I_{LED}		30	mA
Operating temperature	T_{OP}	-20	+70	$^{\circ}C$
Storage temperature	T_{ST}	-30	+80	$^{\circ}C$

Note : The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

6. Electrical Characteristics

6.1 Input Power

Item	Symbol	Min	Typ.	Max	Unit	Applicable terminal
Supply Voltage for Analog	VDD	3.0	3.3	3.6	V	
Supply Voltage for Logic	VDD	3.0	3.3	3.6	V	
Input Voltage	V_{IL}	GND	-	0.3VDD	V	
	V_{IH}	0.7 VDD	-	VDD		
Input leakage Current	I_{LKG}	-1		1	μA	

6.2 Backlight Driving Conditions

Item	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	V_F	13.5	16	17	V	I_L =40mA
Current for LED Backlight	I_L		40	-	mA	
Power Consumption	P		0.64		W	
LED Life Time		30,000	50,000		Hr	Note

Note: Brightness to be decreased to 50% of the initial value at ambient temperature TA=25℃

7. Optical Characteristics

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN	TYP.	MAX		
Luminance		L	I_L =40mA	200	260	320	Cd/m^2	
Contrast Ratio		CR	θ=0°	400	500	-		
Response Time		T$_{ON}$	25℃	-	5	-	ms	
		T$_{OFF}$		-	15	-		
CIE Color Coordinate	Red	X$_R$	Viewing normal angle					
		Y$_R$						
	Green	X$_G$						
		Y$_G$						
	Blue	X$_B$						
		Y$_B$						
	White	X$_W$		0.277	0.297	0.317		
		Y$_W$		0.292	0.312	0.332		
Viewing Angle	Hor.	θ_{X+}	CR≥10	50	60		Degree	
		θ_{X-}		50	60			
	Ver.	θ_{Y+}		40	50			
		θ_{Y-}		50	60			
Uniformity		Un		80			%	

Note 1: Definition of Viewing Angle θx and θy:
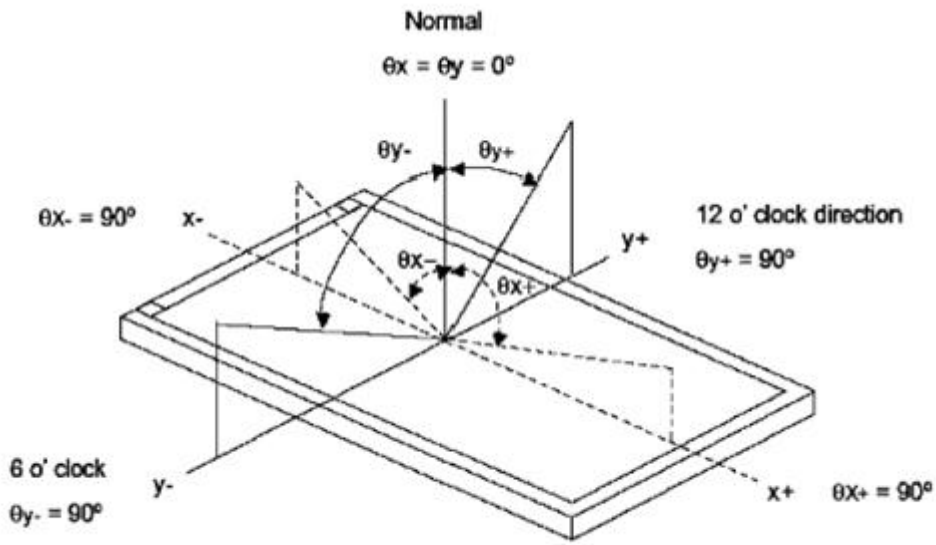
Note 2: Definition of contrast ratio CR:

$$CR = \frac{\text{Luminance of white state}}{\text{Luminance of black state}}$$

Note 3: Definition of Response Time(Tr,Tf)

Note 4: Definition of Luminance

①The Brightness Test Equipment Setup

Field=2° (As measuring "black" image, field=2° is the best testing condition)

BM-7

Field=2°

50cm

TFT-LCD Panel

The center of the screen

②The Brightness Test Point Setup

H/6

H/3

H/3

H/6

Active area
H

L/6   L/6   L/6   L/6

Unit: mm

L

Active area

---
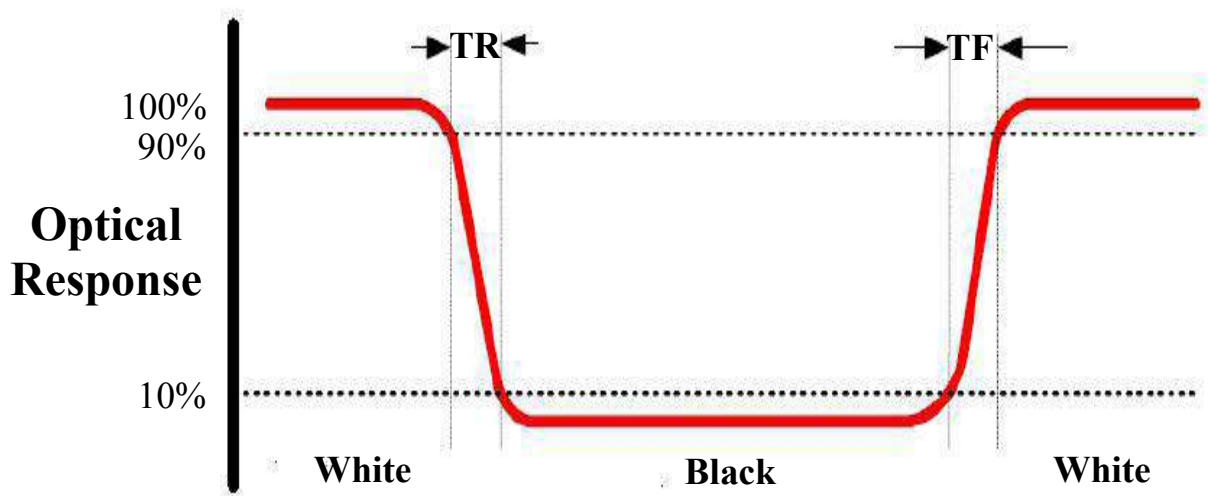
8. Timing Characteristics

8.1 Parallel RGB Timing Diagram
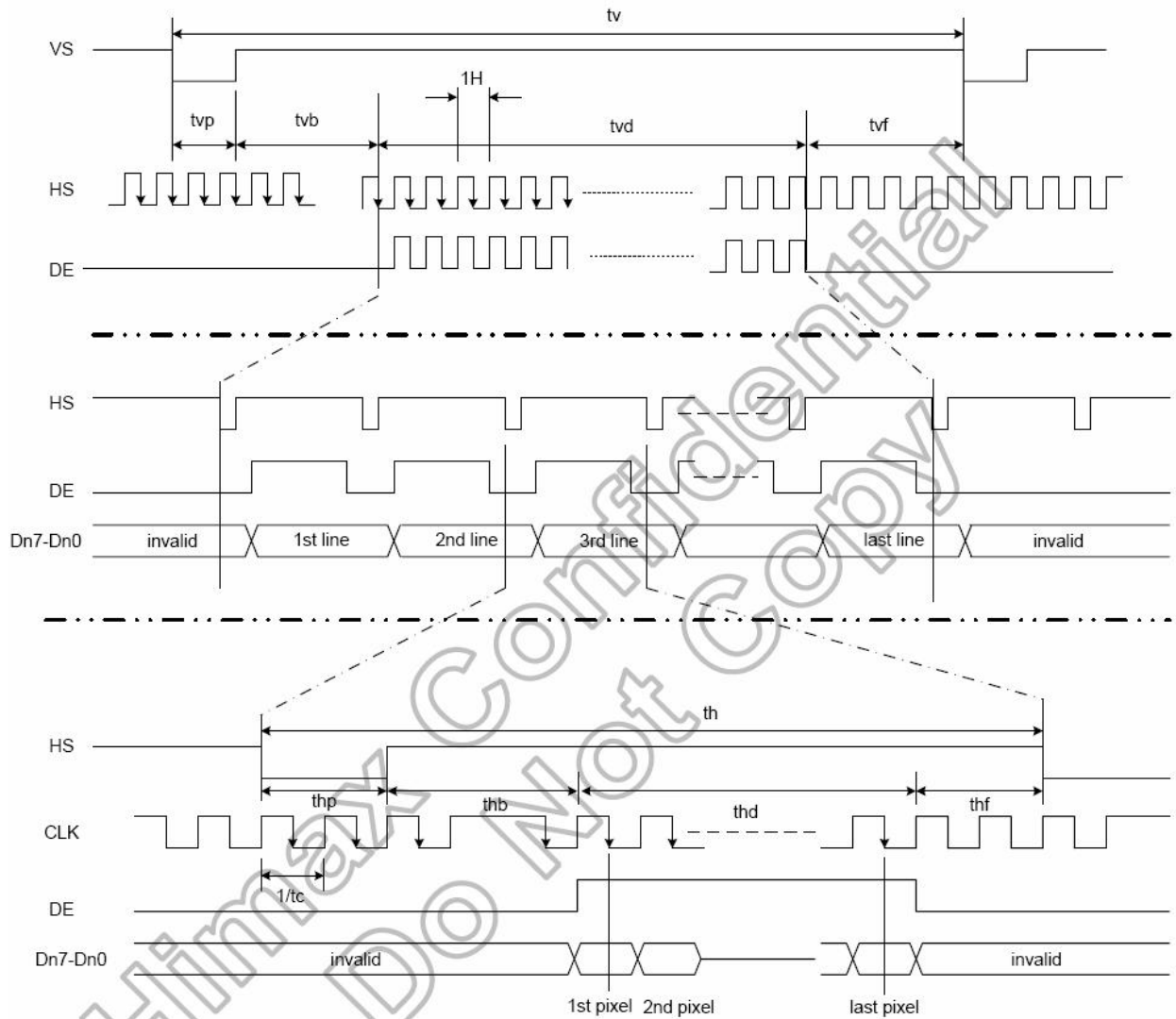
(480RGBx272, T_A=25°C, VDDIO=1.8V to 3.6V, DVSS= 0V)

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	f_{CLK}[1]	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp[2]	2	41	41	CLK
Horizontal back porch	thb[2]	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	399	H[1]
Vertical display period	tvd	272	272	272	H[1]
Vertical front porch	tvf	1	2	227	H[1]
Vertical pulse width	tvp[2]	1	10	11	H[1]
Vertical back porch	tvb[2]	1	2	11	H[1]

Note: (1) Unit: CLK=1/ f_{CLK} , H= th,
(2) It is necessary to keep tvp+tvb=12 and thp+thb=43 in sync mode. DE mode is unnecessary to keep it.

(480RGBx240, T_A=25°C, VDDIO=1.8V to 3.6V, DVSS= 0V)

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	f_{CLK}[1]	-	9.6	15	MHz
Hsync cycle	1/th	-	15.72	-	KHz
Vsync cycle	1/tv	-	60	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	612	-	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	30	-	CLK
Horizontal pulse width	thp	2	46	-	CLK
Horizontal back porch	thb	2	56	-	CLK
Vertical Signal					
Vertical cycle	tv	-	262	275	H[1]
Vertical display period	tvd	-	240	-	H[1]
Vertical front porch	tvf	1	4	-	H[1]
Vertical pulse width	tvp	1	3	-	H[1]
Vertical back porch	tvb	1	15	-	H[1]

Note: (1) Unit: CLK=1/ f_{CLK} , H=th,

9. Standard Specification for Reliability

9.1 Standard Specification for Reliability of LCD Module

No.	Item	Description
01	High temperature operation	The sample should be allowed to stand at 70℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
02	Low temperature operation	The sample should be allowed to stand at -20℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
03	High temperature storage	The sample should be allowed to stand at 80℃ for 240 hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 2 hours.
04	Low temperature storage	The sample should be allowed to stand at -30℃ for 240 hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 2 hours.
05	Moisture storage	The sample should be allowed to stand at 60℃,90%RH MAX for 240 hours under no-load condition, then taking it out and drying it at normal temperature for 2 hours.
06	Thermal shock storage	The sample should be allowed to stand the following 10 cycles : -30℃ for 30 minutes → normal temperature for 5 minutes → +80℃ for 30 minutes → normal temperature for 5 minutes, as one cycle.
07	Packing vibration	Frequency range : 10Hz ~ 55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min X,Y,Z 2 hours for each direction.
08	Packing drop test	According to ASTM-D-5327.
09	Electrical Static Discharge	Air: ±4KV 150pF/330Ω 5 times
		Contact: ±2KV 150pF/330Ω 5 time

*Sample size for each test item is 3~5pcs

9.2 Testing Conditions and Inspection Criteria

For the final test, the testing sample must be stored at room temperature for 24 hours. After the tests listed in Table 9.2, standard specifications for reliability will be executed in order to ensure stability.

No.	Item	Test Model	In section Criteria
01	Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
02	Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
03	Appearance	Visual inspection	Defect free.

9.3 MTBF

MTBF	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±5℃), normal humidity (50±10% RH), and in area not exposed to direct sun light.

10. Specification of Quality Assurance

This standard of Quality Assurance confirms to the quality of LCD module products supplied by ODNA.

10.1 Quality Test

Before delivering, the supplier should conduct the following tests to confirm the quality of products.

- Electrical-Optical Characteristics: According to the individual specification to test the product.
- Appearance Characteristics: According to the individual specification to test the product.
- Reliability Characteristics: According to the definition of reliability on the specification for testing products.

10.2 Delivery Test

Before delivering, the supplier should conduct the delivery test.

- Test method: According to MIL-STD105E.General Inspection Level Ⅱ take a single Time.
- The defects classify of AQL as following:
  Major defect: AQL = 0.65
  Minor defect: AQL = 2.5
  Total defects: AQL = 2.5

10.3 Non-conforming Analysis & Deal With Manners

10.3.1 Non-conforming Analysis

- Purchaser should provide the data detail of non-conforming sample and the non-conforming.
- After receiving the data detail from purchaser, the analysis of non-conforming should be finished within two weeks.
- If the analysis can't be finished on time, supplier must notice purchaser 3 days in advance.

10.3.2 Disposition of non-conforming

- If any product defect be found during assembling, supplier must change the good for every defect after confirmation.
- Both supplier and customer should analyze the reason and discuss the disposition of non-conforming when the reason of nonconforming is not sure.

10.4 Agreement items

   Both parties should negotiate together when the following problems happen.
- There is any problem of standard of quality assurance, and both sides should agree that it must be modified.
- There is any argument item which does not record in the standard of quality assurance.
- Any other special problem.

10.5 Standard of The Product Appearance Test

10.5.1 Manner of appearance test

- The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.
- When test the model of transmissive product must add the reflective plate.
- The test direction is base on around 10° of vertical line.
- Temperature: 25±5℃   Humidity: 60±10%RH
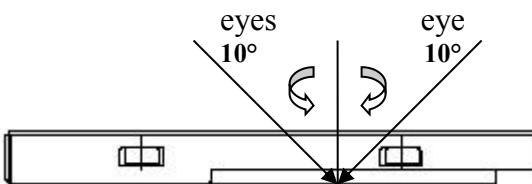
- Definition of area:
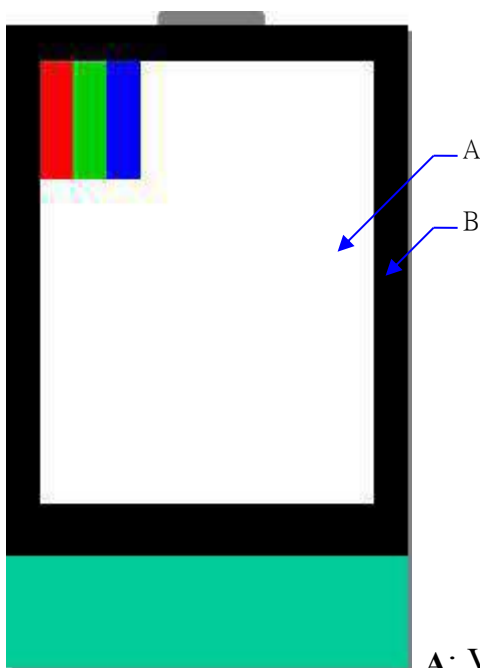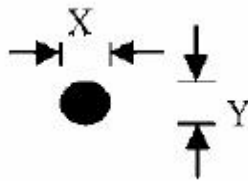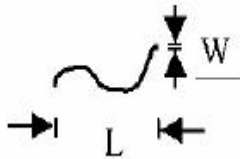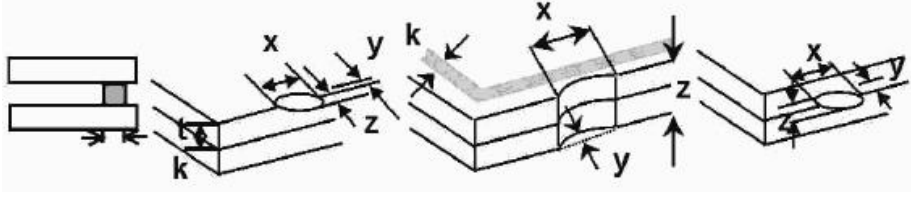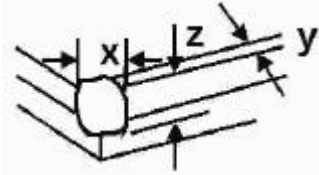
A: Viewing area B: Outside viewing area

10.5.2 Basic principle
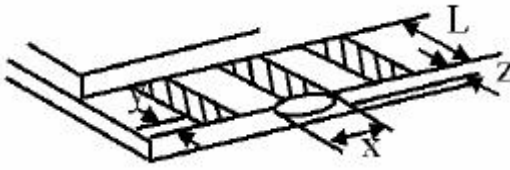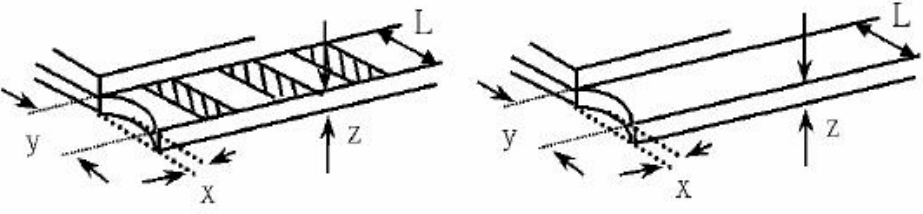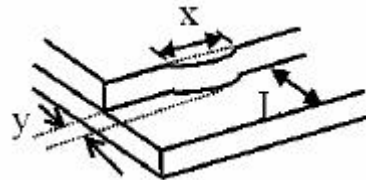
- When the standard can not be described, AQL will be applied.
- The sample of the lowest acceptable quality level must be negotiated by both supplier and customer when any dispute happened.
- New item must be added on time when it is necessary.
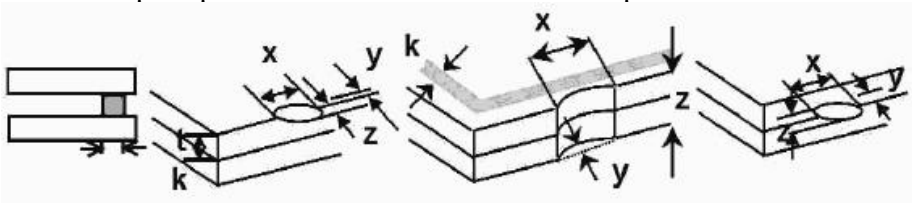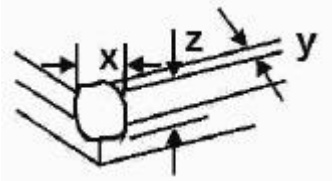
10.6 Inspection Specification
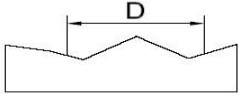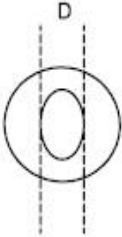
NO.	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product types. 1.8 Flicker	**0.65**
02	Black or White spots or Bright spots or Color spots on LCD (Display only)	2.1 White and black or color spots on display $\leqq$ 0.25mm, no more than Five spots. 2.2 Densely spaced: No more than three spots within 3mm.	**2.5**
03	LCD and Touch Panel black spots, white spots, contamination (non – display)	3.1 Round type: As following drawing $\Phi = (X+Y) / 2$ | Size(mm)	Acceptable Q'ty
---	---
$\Phi \leqq 0.10$	Accept no dense
$0.10 < \Phi \leqq 0.20$	2
$0.20 < \Phi \leqq 0.25$	2
$0.25 < \Phi \leqq 0.30$	1
$0.30 < \Phi$	0	 * Densely spaced: No more than two spots within 3mm.	**2.5**
		3.2 Line type: (As following drawing) | Length(mm)	Width(mm)	Acceptable Q'ty
---	---	---
---	$W \leqq 0.02$	Accept no dense
$L \leqq 3.0$	$0.02 < W \leqq 0.05$	2
$L \leqq 2.5$	$0.03 < W \leqq 0.08$	
---	$0.08 < W$	Rejection | * Densely spaced: No more than two lines within 3mm.	**2.5**

NO.	Item	Criterion			AQL
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction	Size Φ(mm)	Acceptable Q'ty	2.5
			Φ≦0.20	Accept no dense	
			0.20< Φ≦0.50	3	
			0.50< Φ≦1.00	2	
			1.00< Φ	0	
			Total Q'ty	3	
05	Scratches	Follow NO.3 -2 Line Type.			
06	Chipped glass	Symbols: ... (see below)			2.5

Item 06 — Chipped glass:

Symbols:
x: Chip length   y: Chip width   z: Chip thickness
k: Seal width   t: Glass thickness   a: LCD side length
L: Electrode pad length
6.1 General glass chip:
6.1.1 Chip on panel surface and crack between panels:

z: Chip thickness	y: Chip width	x: Chip length
Z≦1/2t	Not over viewing area	x≦1/8a
1/2t< z≦2t	Not exceed 1/3k	x≦1/8a

⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip
6.1.2 Corner crack:

z: Chip thickness	y: Chip width	x: Chip length
Z≦1/2t	Not over viewing area	x≦1/8a
1/2t< z≦2t	Not exceed 1/3k	x≦1/8a

⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip

NO.	Item	Criterion	AQL
08	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
09	Backlight elements	9.1 Illumination source flickers when lit. 9.2 Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards. 9.3 Backlight doesn't light or color is wrong.	2.5 2.5 0.65
10	Bezel	Bezel must comply with product specifications.	2.5
11	PCB、COB	11.1 COB seal may not have pinholes larger than 0.2mm or contamination. 11.2 COB seal surface may not have pinholes through to the IC. 11.3 The height of the COB should not exceed the height indicated in the assembly diagram. 11.4 There may not be more than 2mm of sealant outside the seal area on PCB. And there should be no more than three places. 11.5 Parts on PCB must be the same as on the production characteristic chart, There should be no wrong parts, missing parts or excess parts. 11.6 The jumper on the PCB should conform to the product characteristic chart.	2.5 2.5 2.5 2.5 0.65 0.65
12	FPC	12.1 FPC terminal damage ≦ 1/2 FPC terminal width and can not affect the function , we judge accept. 12.2 FPC alignment hole damage ≦ 1/2 alignment area and can not affect the function , we judge accept.	2.5 2.5
13	Soldering	13.1 No cold solder joints, missing solder connections, oxidation or icicle. 13.2 No short circuits in components on PCB or FPC.	2.5 0.65

NO.	Item	Criterion	AQL
07	Glass crack	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 7.2 Protrusion over terminal: 7.2.1 Chip on electrode pad: {table below} 7.2.2 Non-conductive portion: {table below} ⊙ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. ⊙ If the product will be heat sealed by the customer, the alignment mark must mot be damaged. 7.2.3 Substrate protuberance and internal crack {table below}	2.5

7.2.1

y: Chip width	x: Chip length	z: Chip thickness
$y \leqq 0.5mm$	$x \leqq 1/8a$	$0 < z \leqq t$

7.2.2

y: Chip width	x: Chip length	z: Chip thickness
$y \leqq L$	$x \leqq 1/8a$	$0 < z \leqq t$

7.2.3

y: width	x: length
$y \leqq 1/3L$	$X \leqq a$

NO.	Item	Criterion	AQL
14	Touch Panel Chipped glass	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Touch Panel Total thickness a: LCD side length L: Electrode pad length 14.1 General glass chip: 14.1.1 Chip on panel surface and crack between panels: | z: Chip thickness	y: Chip width	x: Chip length
---	---	---
$Z \leqq t$	$\leqq 1/2$ k and not over viewing area	$x \leqq 1/8a$ | ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip 14.1.2 Corner crack: | z: Chip thickness	y: Chip width	x: Chip length
---	---	---
$z \leqq t$	$\leqq 1/2$ k and not over viewing area	$x \leqq 1/8a$ | ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip	2.5

NO.	Item	Criterion	AQL
15	Touch Panel(Fish eye、dent and bubble on film)	<table><tr><td>SIZE(mm)</td><td>Acceptable Q'ty</td></tr><tr><td>Φ≦0.2</td><td>Accept no dense</td></tr><tr><td>0.2< D ≦0.4</td><td>5</td></tr><tr><td>0.4< D ≦0.5</td><td>2</td></tr><tr><td>0.5< D</td><td>0</td></tr></table>	2.5
16	Touch Panel Newton ring	Newton ring dimension ≦ 1/2 touch panel area and not affect font and line distortion(≦2.5%) , it is acceptable.	2.5
17	Touch Panel Linearity	Less than 2.5% is acceptable.	2.5
18	LCD Ripple	Touch the touch panel , can not see the LCD ripple. Pen: R 1.0mm silicon rubber. Operation Force: 80g	2.5
19	General appearance	19.1 Pin type must match type in specification sheet. 19.2 LCD pin loose or missing pins. 19.3 Product packaging must the same as specified on packaging specification sheet. 19.4 Product dimension and structure must conform to product specification sheet.	0.65 0.65 0.65 0.65

11. Handling Precaution

11.1 Handling of LCM

- Avoid external shock.
- Don't apply excessive force on the surface.
- Liquid in LCD is hazardous substance, do not lick or swallow. When the liquid is attaching to your hand, skin, cloth, etc., wash it thoroughly and immediately.
- Don't operate it above the absolute maximum rating.
- Don't disassemble the LCM.
- The operators should wear protections whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- The modules should be kept in antistatic bags or other containers resistant to static for storage.
- The module is coated with a film to protect the display surface, be careful when peeling off this protective film since static electricity may be generated.

11.2 Storage

- Store it in an ambient temperature of 25±10℃, and in a relative humidity of 50±10%RH. Don't expose to sunlight or fluorescent light.
- Store it in a clean environment, free from dust, active gas, and solvent.
- Store it in anti-static electricity container.
- Store it without any physical load.

11.3 Soldering

- Use only soldering irons with proper grounding and no leakage.
- Iron: no higher than 280±10℃ and less than 3 sec during hand soldering.
- Rewiring: no more than 2 times.

12. Packing Method

----TBD