ORIENT DISPLAY

Your Total LCD Solution Provider

http://www.orientdisplay.com

SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFK240320A0-3.5N6NFN
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
2015-11-24		V01	First Issue	

Contents

1. General Specification

Item	Contents	Unit
LCD TYPE	TFT/TRANSFLECTIVE	
MODULE SIZE (W*H*T)	64.00*85.00*2.93	MM
ACTIVE SIZE (W*H)	53.64*71.52	MM
PIXEL PITCH (W*H)	0.2235*0.2235	MM
NUMBER OF DOTS	240*320	
DIVER IC	ILI9341V	
INTERFACE TYPE	SPI+18BIT RGB	
TOP POLARIZER TYPE	ANTI-GLARE	
RECOMMEND VIEWING DIRECTION	6	O'CLOCK
GRAY SCALE INVERSION DIRECTION	12	O'CLOCK
COLORS	262K	
BACKLIGHT TYPE	6-DIES WHITE LED	
TOUCH PANEL TYPE	WITHOUT	

2. Mechanical Drawing

PIN DESCRIPTION

PIN NO	SYMBOL
1	VL1
2	GND
3	VL2
4	GND
5	VSHD
6	GND
7	GND
8	GND
9	VSYNC
10	GND
11	RESET
12	GND
13	GND
14	GND
15	CS
16	GND
17	SDO
18	SDI
19	GND
20	SCL
21	GND
22	B5
23	B4
24	B3
25	B2
26	B1
27	B0
28	ENAB
29	GND
30	HSYNC
31	GND
32	DCLK
33	GND
34	G5
35	G4
36	G3
37	G2
38	G1
39	G0
40	GND
41	R5
42	R4
43	R3
44	R2
45	R1
46	R0
47	GND
48	GND
49	GND
50	GND

Display Type	TFT / TRANSFLECTIVE,POSITIVE
Optimum Viewing Direction	6 O'CLOCK
Upper Ploarizer Type	Anti-Glare
LCD Driver IC	ILI9341V
Operating Voltage	VSHD=3.3V
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Interface	SPI+18 bit RGB
Backlight	6-CHIP WHITE LED
Surface luminance	150 cd/m² TYP.)
White X/Y	---

Pixtel Detail

R G B R
R G B R

LED CIRCUIT DIAGRAM
19.2V@20mA

LEDA
LEDK

View Direction
6 O'clock

240×RGB×320

NOTES:
1. General Tolerance: ±0.2
2. ( )reference dimension.
3. Recommended Case Open Area Should Be Less Than Module V.A
4. recommended cushion adherent area:TP V.A+1.6mm
5. ROHS MUST BE COMPLIANT

DRAWING NO. AFK240320A0-3.5N6NFN

TITLE MODULE SPEC.

UNIT	mm	SCALE	FIT
3rd Angle		SHEET 1 OF 1	

		SIGN	DATE
DRAWN			2015.11.23A
ME.CHECKED			
EE.CHECKED			
APPROVED			
CUSTOMER'S APPROVAL			

V00	First issue		
VER.	SYMBOL	AMENDMENT	SIGN

ORIENT DISPLAY

3. Block Diagram

VSHD
GND
SCL
SDI/O
CS

DCLK
HSYNC
VSYNC
ENAB
RESET

R[0:5]
G[0:5]
B[0:5]

18 BIT

"ILITEK"
ILI9341V
(COG)
LCD
Controller/
Driver or
Equivalent

Gate:320

3.5″
TFT LCD Panel
240(RGB)*320

Source:240*RGB

VL1

VL2

BL Circuit(6-Dies LED)

4. Interface Pin Function

Pin No.	Symbol	Description
1	VL1	Anode of LED(High voltage)
2	GND	Power ground
3	VL2	Cathode of LED(Low voltage)
4	GND	Power ground
5	VSHD	Power supply for digital
6	GND	Power ground
7	GND	Power ground
8	GND	Power ground
9	VSYNC	Vertical sync. in RGB mode
10	GND	Power ground
11	RESET	Reset(Low active)
12	GND	Power ground
13	GND	Power ground
14	GND	Power ground
15	CS	Chip select input(Low enable)
16	GND	Power ground
17	SDO	Serial data output
18	SDI	Serial data input
19	GND	Power ground
20	SCL	Serial interface clock
21	GND	Power ground
22~27	B5~B0	Blue data bus
28	ENAB	Display enable pin from controller
29	GND	Power ground
30	HSYNC	Horizontal sync. in RGB mode
31	GND	Power ground
32	DCLK	Pixel clock signal in RGB mode
33	GND	Power ground
33~38	G5~G0	Green data bus
40	GND	No connect
41~46	R5~R0	Red data bus
47~50	GND	Power ground

5. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for analog	VSHD	-0.3	4.5	V
Supply voltage for logic	VSHD	-0.3	4.5	V
Supply current (One LED)	I_{LED}		30	mA
Operating temperature	T_{OP}	-20	+70	°C
Storage temperature	T_{ST}	-30	+80	°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	VSHD	3.0	3.3	3.6	V	
Supply Voltage for Logic	VSHD	3.0	3.3	3.6	V	
Input Voltage	V_{IL}	GND	-	0.3VSHD	V	
	V_{IH}	0.7 VSHD	-	VSHD		
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	-	19.2	-	V	I_L =20mA
Current for LED Backlight	I_L		20	30	mA	
Power Consumption	P		0.384		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 =20mA		150		Cd/m^2	
Contrast Ratio		CR	θ=0°	100	150			
Response Time		T_{ON}	25℃		35		ms	
		T_{OFF}						
CIE Color Coordinate	Red	X_R	Viewing normal angle					
		Y_R						
	Green	X_G						
		Y_G						
	Blue	X_B						
		Y_B						
	White	X_W			0.310			
		Y_W			0.320			
Viewing Angle	Hor.	θ_{X+}	CR≥10		45		Degree	Driving backlight condition
		θ_{X-}			40			
	Ver.	θ_{Y+}			40			
		θ_{Y-}			55			
Uniformity		Un		80			%	

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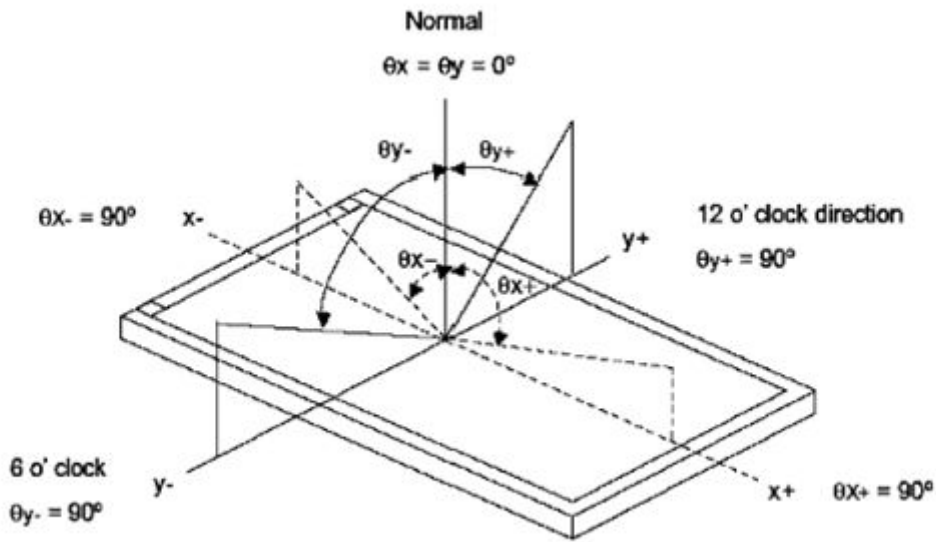
Note 2: Definition of contrast ratio CR:

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

Note 3: Definition of Response Time (Tr,Tf)
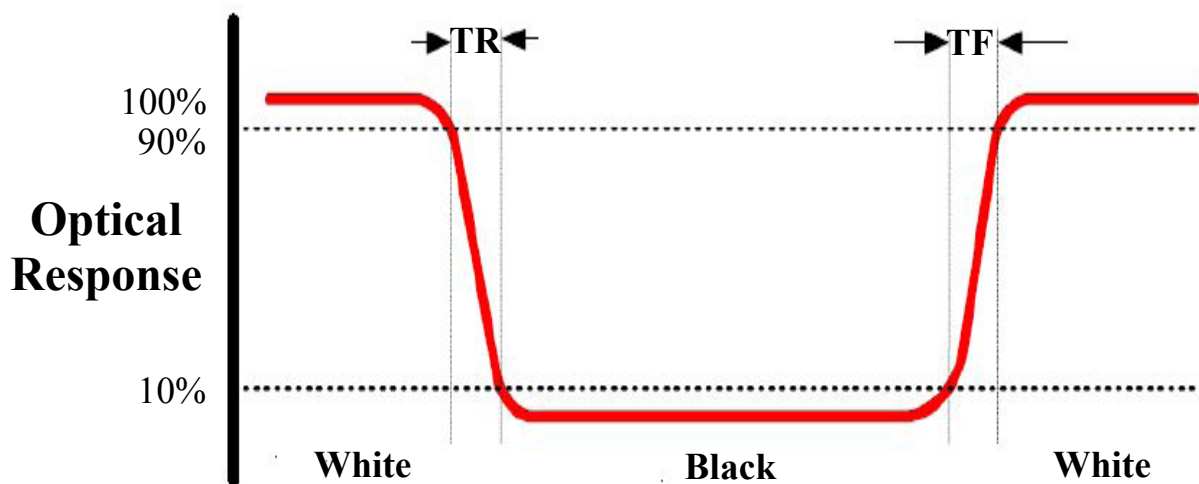
Note 4: Definition of Luminance
①The Brightness Test Equipment Setup

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
```
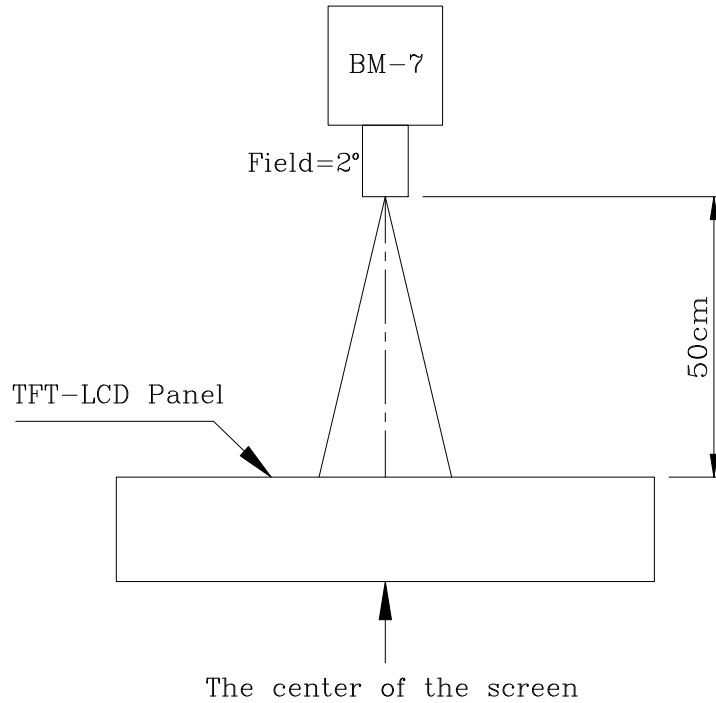
②The Brightness Test Point Setup

```
        ┌────────────────────────┐  ─┬─ H/6
        │   ⊕       ⊕      ⊕    │   │
        │                        │  ─┼─ H/3
        │                        │   │         Active area
        │   ⊕       ⊕      ⊕    │  ─┼─            H
        │                        │   │
        │                        │  ─┼─ H/3
        │   ⊕       ⊕      ⊕    │   │
        └────────────────────────┘  ─┴─ H/6
        L/6   L/6   L/6    L/6

                 L                  Unit: mm
           Active area
```
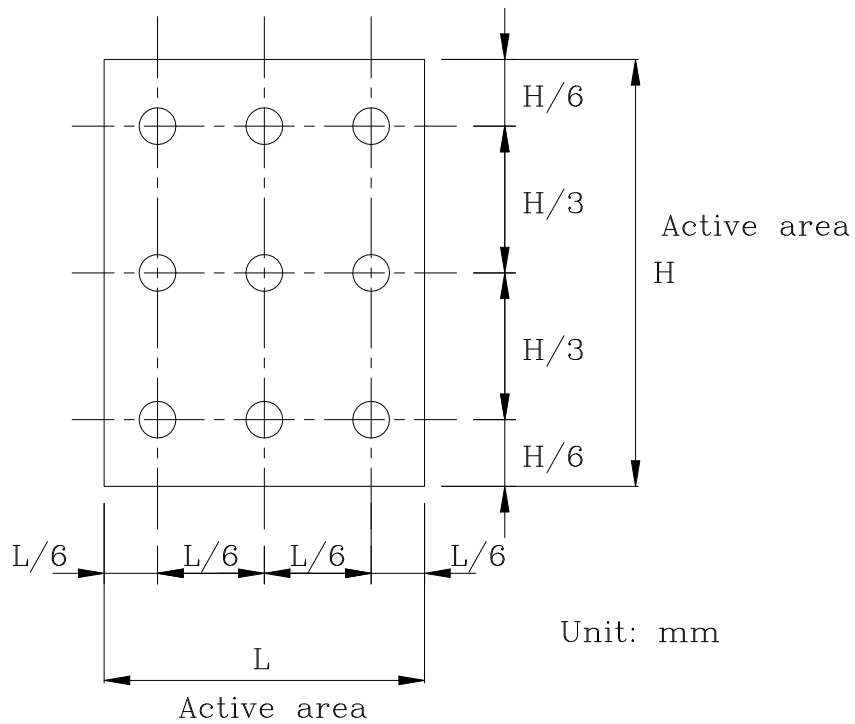
8. Timing Characteristics

8.1 3-WIRES SPI Timing Diagram
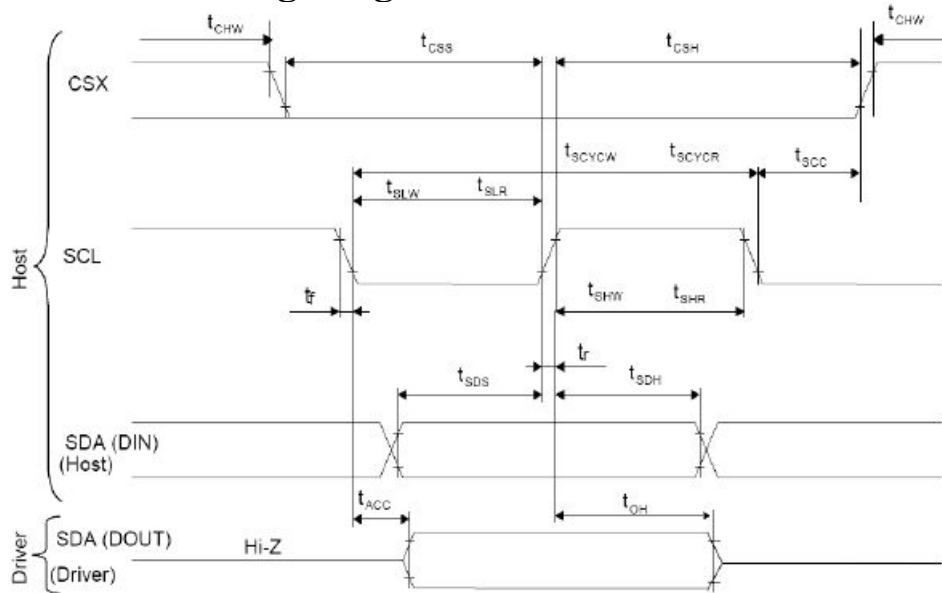
Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tscc	SCL-CSX	20	-	ns	
	tchw	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

Note: Ta = 25 °C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V
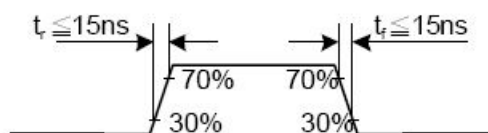
8.2 RGB Timing Diagram
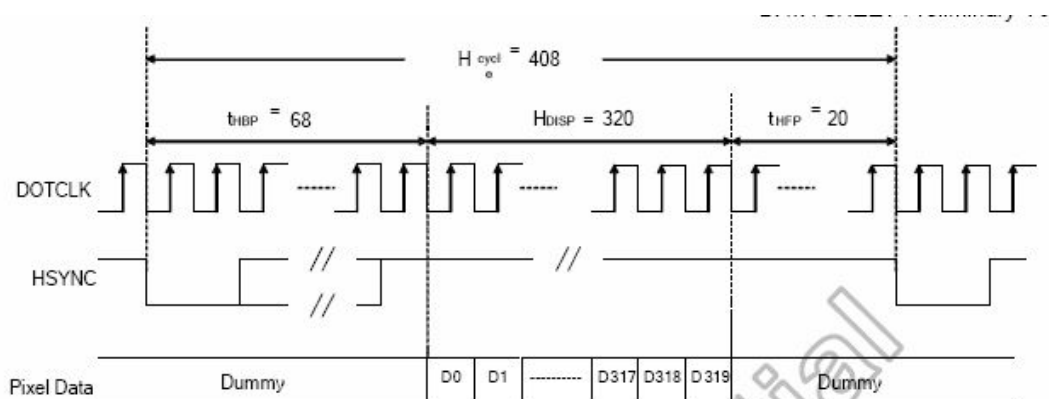
(a) Horizontal Data Transaction Timing
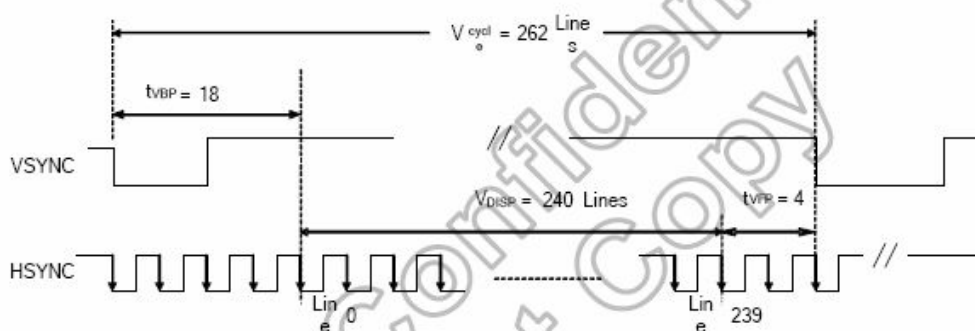
(b) Vertical Data Transaction Timing

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
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				

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
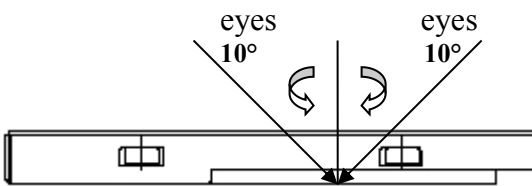
- Definition of area:
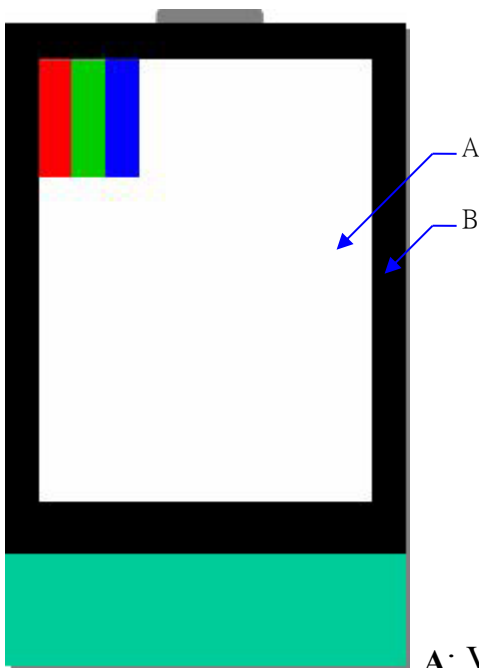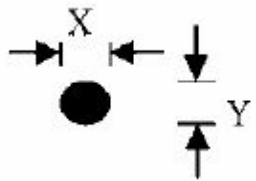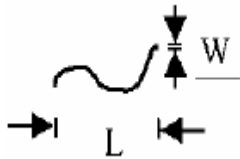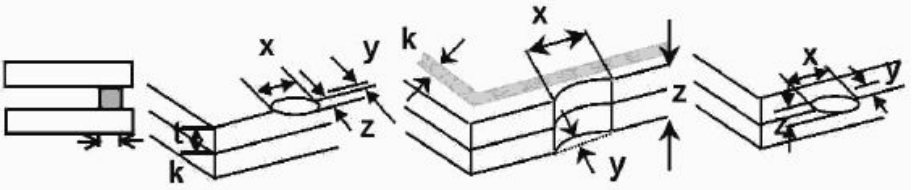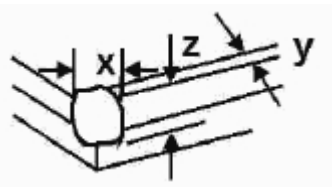
A: Viewing area B: Outside viewing area

10.5.2 Basic principle
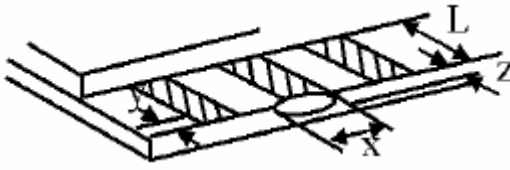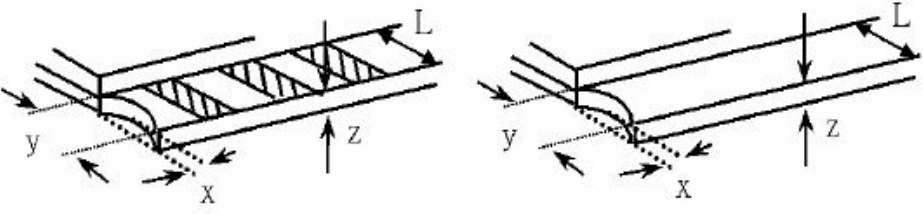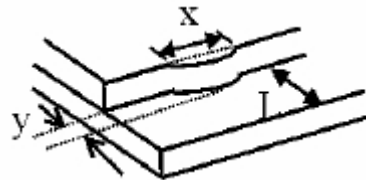
- When the standard cannot be described, AQL will be applied.
- The sample of the lowest acceptable quality level must be negotiated by both supplier and customer when any dispute happened.
- New item must be added on time when it is necessary.
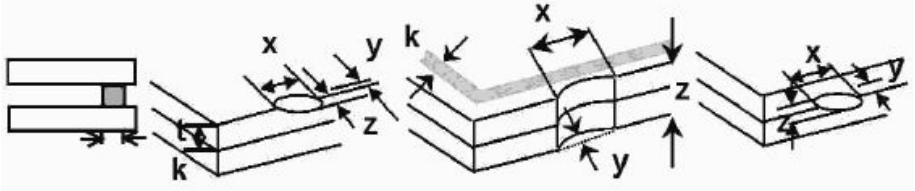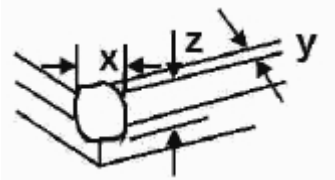
10.6 Inspection Specification
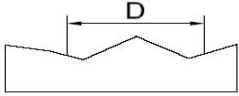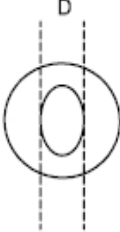
NO.	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product 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:
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: | | | 2.5 |

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><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td>y≦0.5mm</td><td>x≦1/8a</td><td>0< z≦t</td></tr></table> 7.2.2 Non-conductive portion: <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td>y≦L</td><td>x≦1/8a</td><td>0< z≦t</td></tr></table> ⊙ 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><tr><td>y: width</td><td>x: length</td></tr><tr><td>y≦1/3L</td><td>X≦a</td></tr></table>	2.5

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: ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip 14.1.2 Corner crack: ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip	2.5

Table for 14.1.1:

z: Chip thickness	y: Chip width	x: Chip length
$Z \leqq t$	$\leqq 1/2$ k and not over viewing area	$x \leqq 1/8a$

Table for 14.1.2:

z: Chip thickness	y: Chip width	x: Chip length
$z \leqq t$	$\leqq 1/2$ k and not over viewing area	$x \leqq 1/8a$

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, cannot 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