PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH0154DF03-F01 Version: 1.0

【 】 Preliminary Specification

【 ◆ 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

●It signifies that you fully understand and accept all the contents of this specification if you sign and send back the first page of this specifications.

Designed by	R&D Checked by	Quality Department by	Approved by
LEO			

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Revise Records

Rev.	Date	Contents	Written	Approved
A	2017/05/03	Preliminary Specification	Leo	Liu

Contents

1. General Description and Features

KWH0154DF03-F01 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It iscomposed of a color TFT-LCD panel, driver IC, FPC and a back light unit. The module display area contains 240x240 pixels and can display up to 262K colors.

1.1. Features

- 240 x 240 pixels resolution.
- Display in 262K colors.
- SPI Interface
- RoHS Compliance

1.2. LCD Module

Item	Specification	Unit
Screen Size	1.54 inches	Diagonal
Display Resolution	240 x RGB x 240	Dot
Active Area	27.72(H) x 27.72(V)	mm
Outline Dimension	31.5(H) x 35.0(V) x 2.3(T)	mm
Display Mode	IPS	--
Pixel Arrangement	RGB Stripe	--
Pixel Size	0.1155(H) × 0.1155(V)	mm
Surface Treatment	Anti-Glare	--
Display Color	262K	--
Viewin Direction	IPS	--
Input Interface	4SPI	--

2. Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	31.3	31.5	31.7	mm	--
	Vertical (V)	34.8	35.0	35.2	mm	
	Thickness (T)	2.2	2.3	2.4	mm	(1)
Weight		--	TBD	--	g	--

Note (1) Not include Component.
Refer to the Outline Dimension for further information.

3. Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-30	80	°C	(1)
Operating temperature	T_{OPR}	-20	70	°C	(1,2,3)

Note (1) 90 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

The following are maximun values which, if exceeded, may cause faulty operation or damage to the unit.

(V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Logic power supply	V_{DD}	-0.3	+1.8v	V	
Logic input voltage	V_{IN}	-0.3	1.8v	V	
Power Supply Current	I_{CC}	-	TBD	mA	

4. Electrical Characteristics

4.1. TFT-LCD Module

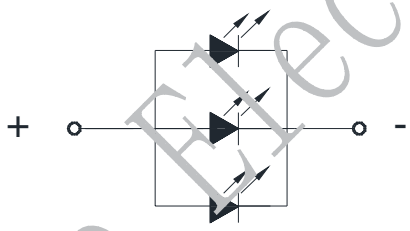
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Supply voltage for logic	V_{CC}	1.65	1.8	3.3	V	
Input Current	I_{DD}	-	9.94	14.91	mA	
Input voltage ' H ' level	V_{IH}	$0.7V_{CC}$	-	V_{CC}	V	
Input voltage ' L ' level	V_{IL}	V_{SS}	0	$0.3V_{CC}$	V	
Output voltage ' H ' level	V_{OH}	$0.8\ V_{CC}$	--	V_{CC}	V	
Output voltage ' L ' level	V_{IL}	0	0	$0.2V_{CC}$	V	

4.2. Backlight Unit

(Ta=25±2°C)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Total Input Voltage	V_L	2.8	3	3.2	V	
LED Total Input Current	I_L	-	45	-	mA	(1)
Power Consumption	P_{BL}	-	135	144	mW	(2)
Life time	-	50,000	-	-	Hrs	(3)

Note (1) Circuit diagram



(2) Where IL = 45mA, VL = 3, P_{BL} = VB × IB

(3) The environmental conducted under ambient air flow ,at Ta=25±2° C, 60%RH±5%

5. Input Terminal Pin Assignment

5.1. Pin Assignment (LCD)

Pin No.	Symbol	Function	Remark
1	LEDK	Backlight power supply negative	
2	LEDK	Backlight power supply negative	
3	GND	Ground	
4	GND	Ground	
5	FMARK	Synchronies MCU to frame rate	
6	SDA	-When IM3: Low, SPI interface input/output pin. -When IM3: High, SPI interface input pin. -The data is latched on the rising edge of the SCL signal.	
7	RS	-This pin is used to be serial interface clock. -If not used, please fix this pin at VDDI or DGND.	
8	WR	-Second Data lane in 2 data lane serial interface. -If not used, please fix this pin at VDDI or DGND.	
9	CS	chip select signal input(low active)	
10	RESET	-This signal will reset the device and it must be applied to properly initialize the chip.	
11	IOVCC	Power supply to interface pins (1.8V/2.8V)	
12	IOVCC	Power supply to interface pins (1.8V/2.8V)	
13	VCC	Power supply(2.8V)	
14	VCC	Power supply(2.8V)	
15	GND	Ground	
16	GND	Ground	
17	NC	NC	
18	NC	NC	
19	NC	NC	
20	NC	NC	
21	NC	NC	
22	NC	NC	
23	LEDA	Backlight power supply positive	
24	LEDA	Backlight power supply positive	

6. Optical Characteristics

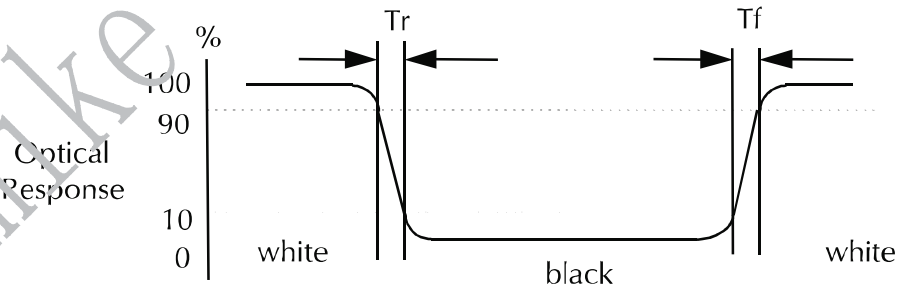
Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		B		320	400	--	cd/m^2	
Response Time (White - Black)		Tr +Tf	θ=0°	--	30	40	ms	
Contrast ratio		CR	At optimized viewing angle	300	500	--	--	
Luminance Uniformity		ΔL		80	85		%	
Color Chromaticity (CIE 1931)	White	Wx	θ=0° Normal Viewing Angle	0.273	0.313	0.353	--	BM-7A
		Wy		0.289	0.329	0.369		
Viewing Angle	Ver.	θ_U	CR≥10	--	80	--	Degree	
		θ_D		--	80	--		
	Hor.	θ_R		--	80	--		
		θ_L		--	80	--		

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 1° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

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

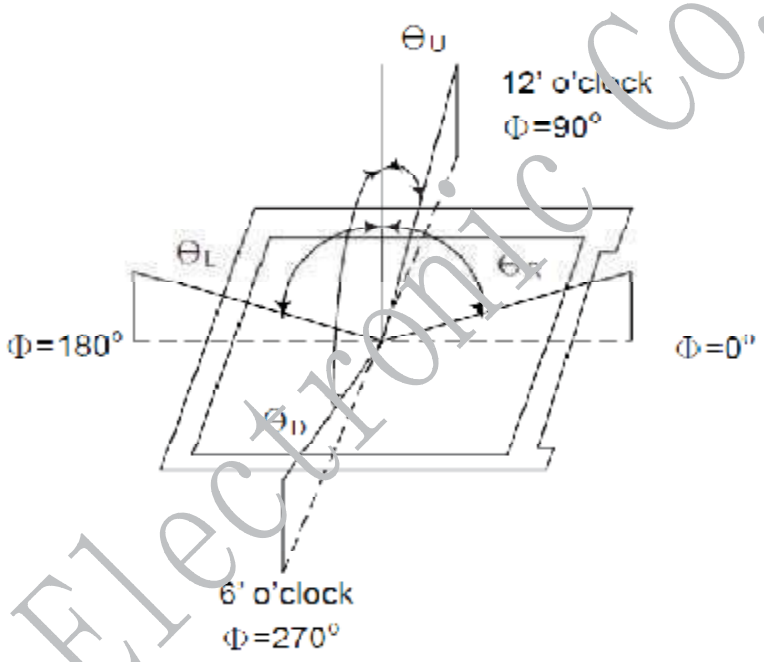


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type

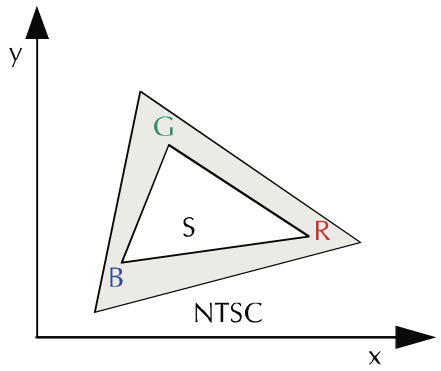
g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



7. Reliability Condition

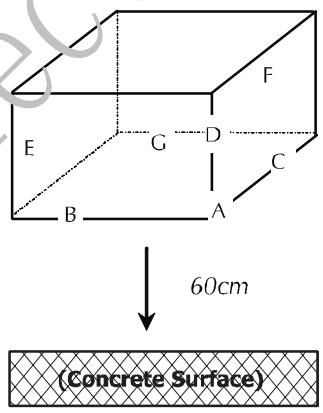
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C.

Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

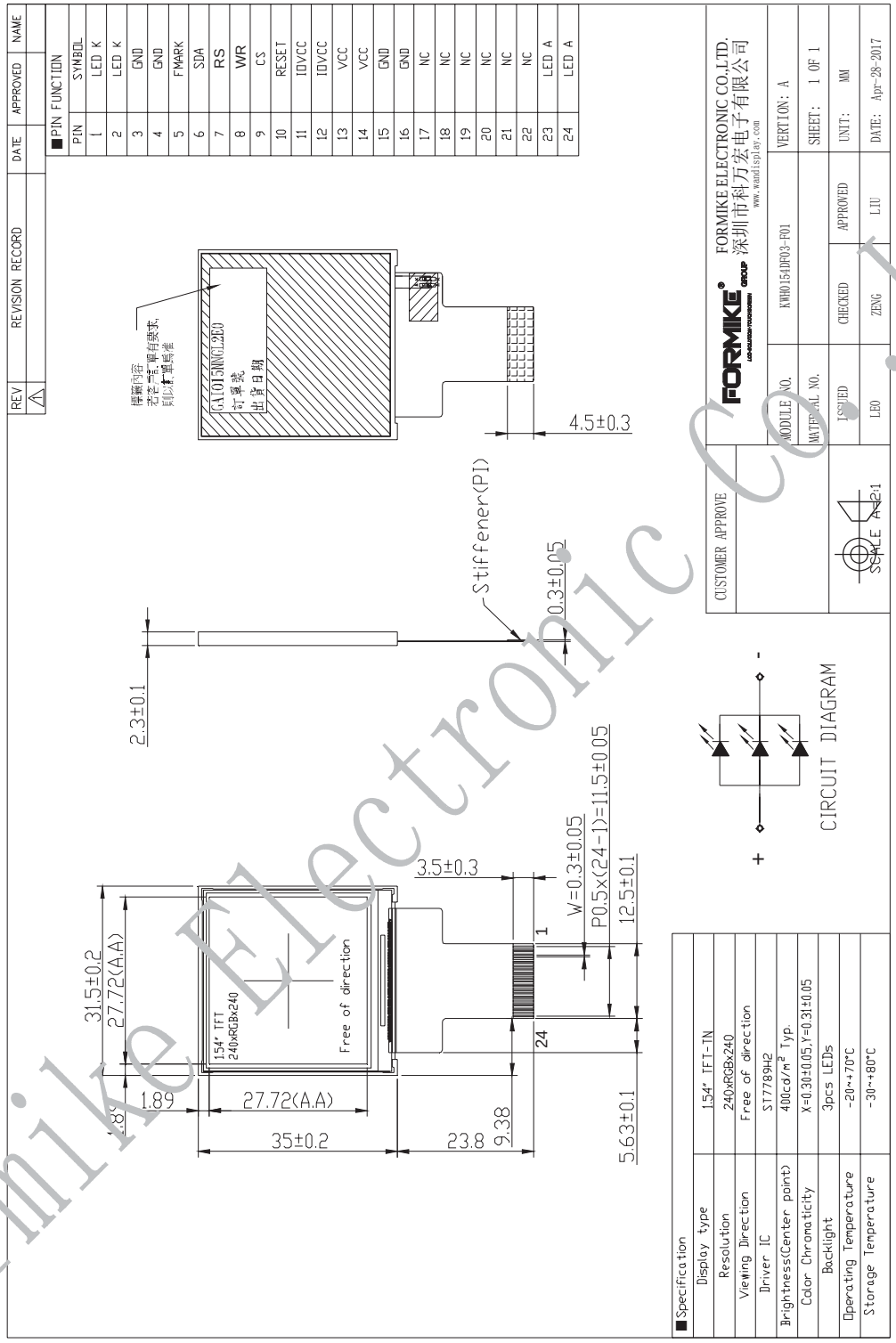
No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 120hrs (Operation state).	
2	Low Temperature Operating	-20°C±2°C, 120hrs (Operation state).	1
3	High Temperature Storage	80°C±2°C, 120hrs.	2
4	Low Temperature Storage	-30°C±2°C, 120hrs.	1,2
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 120hrs.	1,2
6	Vibration Test	Total fixed amplitude: 1.5mm. Vibration Frequency: 10~55Hz. One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	3
7.	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  *Dropping method corner dropping:* *A corner: Once edge dropping.* *B, C, D edge: Once face dropping.* *E, F, G face: Once.*	

Notes: 1. No dew condensation to be observed.

2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.

8. DIMANSIONAL OUTLINE



9. Incoming Inspection Standards

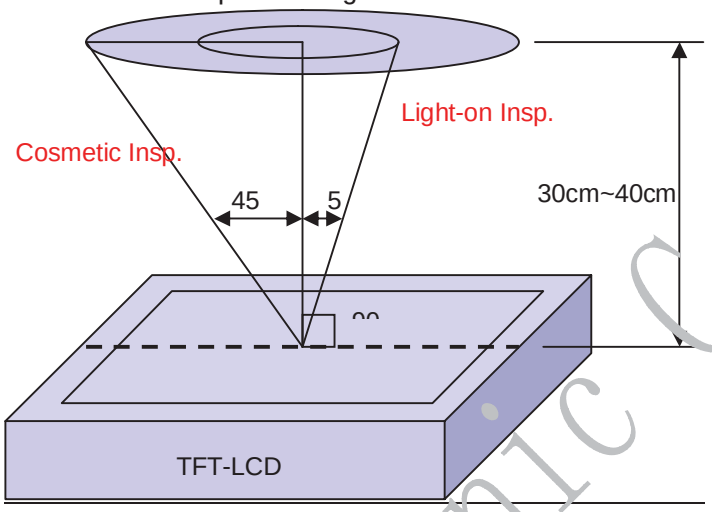
9.1. Inspection and Environment Conditions

9.1.1. Inspection Conditions:

(1)Inspection Distance: 35 cm±5cm

(2)View Angle : Light-on Inspection Angle：±5°

Cosmetic Inspection Angle：±45°



(perpendicular to LCD panel surface)

9.1.2. Environment Conditions:

Ambient Temperature		23℃±5℃
Ambient Humidity		55±10%RH
Ambient Illumination	Cosmetic Inspection	more than 600 Lux
	Functional Inspection	300~500 Lux

9.1.3. Sampling Conditions:

(1) Lot Size: Quantity of shipment lot per model

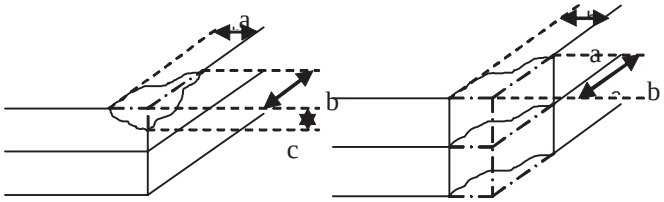
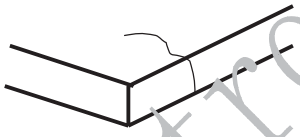
(2) Sampling Method:

Sampling Plan		MIL-STD-105E
		Normal Inspection, Single Sampling
		Level II
AQL	Major Defect	1.0%
	Minor Defect	1.5%

(3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.

9.1.4. Inspection Criteria

9.1.4.1. Cosmetic Inspection(Panel):

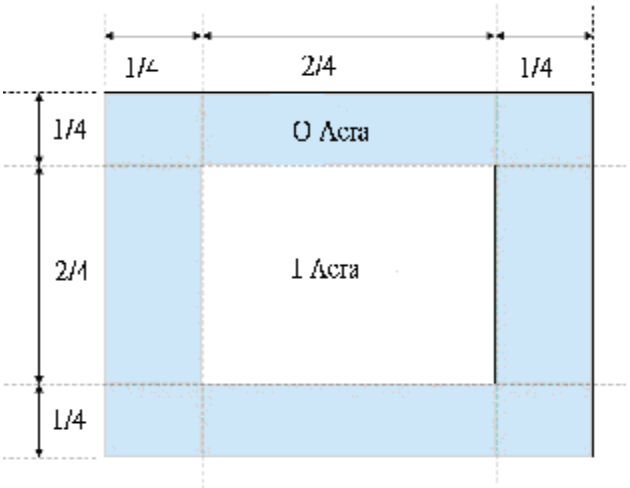
Item	Judgment Criteria	Classification
Chipping on Panel	 a≦3.0mm、b≦3.0mm、c≦t (Bottom glass thickness)	MA
Scratch on Panel *Note-2	W≦0.05mm or L< 5mm: Ignored 0.05mm<W≦0.1mm and L≦5mm: N≦5 W>0.1mm or L>5mm: Not allowed	MI
Bubble or Dent on Panel *Note-3	D≦0.2mm: Ignored 0.2mm<D≦0.3mm: N≦5 D>0.3mm: Not allowed	MI
Panel Crack	 Not Allowed crack	MA
Bezel Deformation	Obvious deformation is not allowed.	MI
Bezel Oxidation	Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate)	MI
Bezel Scratch	L≦20mm , W≦0.2 , N≦3	MI
Metal Squash Dent /Flange(Front Side)	D(W)≦1,L≦3,N≦3;	MI
B/L High Voltage Wire Denudation	Not allowed	MA
Polarizer flaw or leak out resin	Defect is defined as the active area.	MI

Outline Dimension	Must in Spec, refer to related product spec.	MI

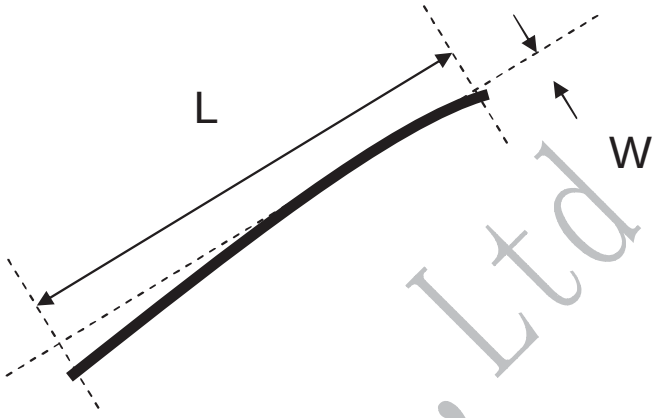
9.1.4.2. Functional Inspection:

Item	Judgment Criteria				Classification
	Area(Note1)		I	O	
Point Defect	Bright dot	Random	1		MI
		2 dots adjacent	0	0	
		3 dots adjacent or more	0	0	
	Dark dot	Random	2		
		2 dots adjacent	0		
		3 dots adjacent or more	0	0	
	Total Dot Defect		3		
	Distance	Distance between Bright and Bright dot	L≧5mm		
		Distance between Bright and Dark dot	L≧5mm		
		Distance between Dark dot	L≧5mm		
	(1) It is defined as Point Defect if defect area＞0.5dot (2) It is ignored if defect area≦0.5dot (3)Weak point defect will be defined as Bright Dot if it can be observed through ND filter 5%(Full Screen Black Inspection)				
Line Defect	Obvious vertical or horizontal line defect is not allowed.				MA
Mura	Not allowed if it can be observed through ND Filter 5 %				MI
Foreign Material in spot shape *Note-3	D≦0.2mm: Ignored 0.2mm<D≦0. 3mm: N≦3 D>0.3mm: Not allowed				MI
Foreign Material in line or spiral shape *Note-4	W≦0.05mm or L≦3mm: Ignored 0.05mm<W≦0.1mm and 1.0mm<L≦2mm: N≦4 W>0.1mm or L>5mm: Not allowed				MI
Display Function Abnormal	No Malfunction can be allowed				MA

Note-1： I/O Area Definition

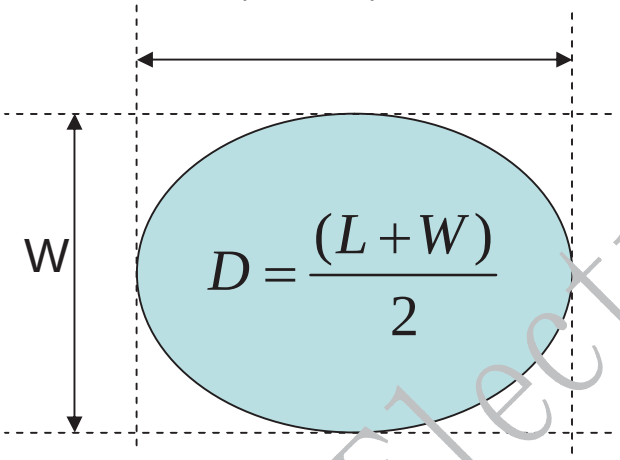


Note-2： Polarizer Scratch



Note-3：Spot Foreign Material

(W ≧L / 4)



Note-4：Line or Spiral Foreign Material

(W<L / 4)