Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 800480E1 TMH-PW-N

(C1-TOUCH)

5“ TFT + PCT

Product Specification ***Ver.: 0***

21.07.2016

Revise Records

Rev.	Date	Contents	Written	Approved
0	21.07.2016	Preliminary Specification	MH	MH

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

Contents

1. General Description and Features

This 5" TFT is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit, a projected capacitive touch Panel and a back-light unit. Graphics and texts can be displayed on a WVGA 800 (W) x 3 x 480 (H) dots (15:9 aspect ratio) with 16.7M colors by supplying 24 bits data signal (8 bits/each color). The following table described the features:

1.1 Features

- Transmissive and Backlight with 14 LEDs (425cd/m2).
- TN (Twisted Nematic) Mode.
- Digital 24-Bit-RGB (8 bits/color) Data Transfer.
- Data Enable Mode.
- Projected Capacitive Touch Screen Panel.
- ROHS Compliance

1.2 LCD Module

Item	Specification	Unit
Screen Size	5.0 Inches	Diagonal
Display Resolution	800 x RGB x 480	Pixel
Active Area	108.00 x 64.80	mm
Outline Dimension	118.50 x 77.55 x 5.05	mm
Display Mode	Normally White Mode / Transmissive	--
Pixel Arrangement	R,G,B Vertical Stripe	--
Pixel Size	0.135 x 0.135	mm
Display Color	16.7 Million	--
Viewing Direction	6 o'clock	--
Input Interface	Digital 24-Bit-RGB (8 bits/color) Data Transfer	--

2. Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	118.35	118.5	118.65	mm	
	Vertical (V)	77.40	77.55	77.70	mm	
	Thickness (T)	4.85	5.05	5.35	mm	(1)
Weight		--	TBD	--	g	--

Note (1) Not Include Component. Refer to the Outline Dimension Drawing as attached.

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) 95 % 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°C, 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

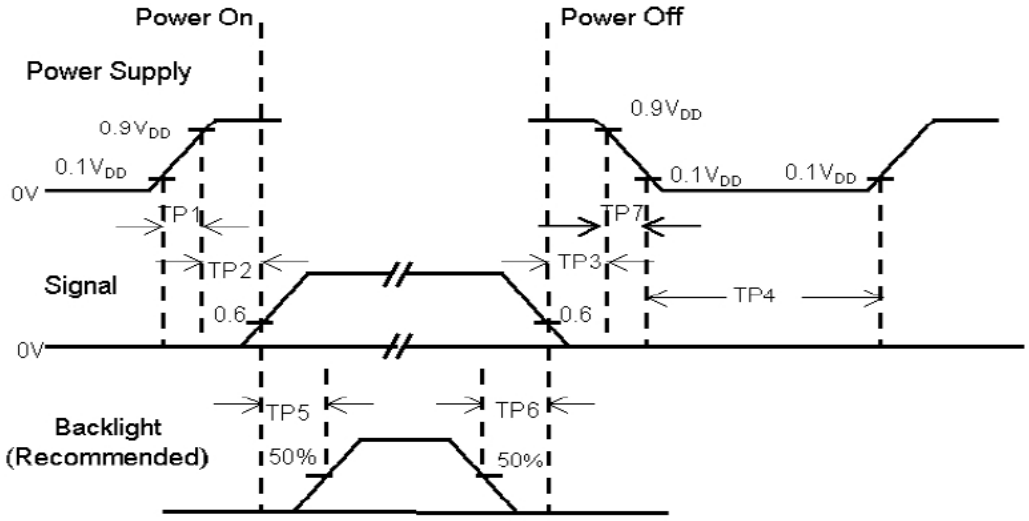
Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.1.2 Electrical Absolute Maximum Ratings

(V_{SS}=GND=0)

Parameter	Symbol	Min.	Max.	Unit	Remark
Digital Supply Voltage	VDD	-0.5	5.0	V	

Display On/Off Sequence:



Note :

(1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.
(2) Apply the lamp volatge within the LCD operation range. When the back-light turns on before the LCD operation or the LCD truns off before the back-light turns off, the display may momentarily become white.
(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.
(4) TP4 should be measured after the module has been fully discharged between power off and on period.
(5) Interface signal shall not be kept at high impedance when the power is on.

3.1.3 DC Electrical Characteristics of the TFT LCD

(Ta=25±2°C, V_{SS}=GND=0)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply		VDD	3.0	3.3	3.6	V	
Input Voltage for Logic	H Level	VIH	0.7xVDD	-	VDD	V	
	L Level	VIL	0	-	0.3xVDD	V	
Power Supply Current		IDD	-	TBD	-	mA	Note 1

Note1: The specified power consumption is under the conditions at VDD=3.3V,
FV=60Hz, whereas a power dissipation check pattern below is displayed.

Black Pattern / 0 Gray

Active Area

3.2 AC Timing Characteristic of The LCD

3.2.1 Timing Condition (DE mode)

Horizontal input timing

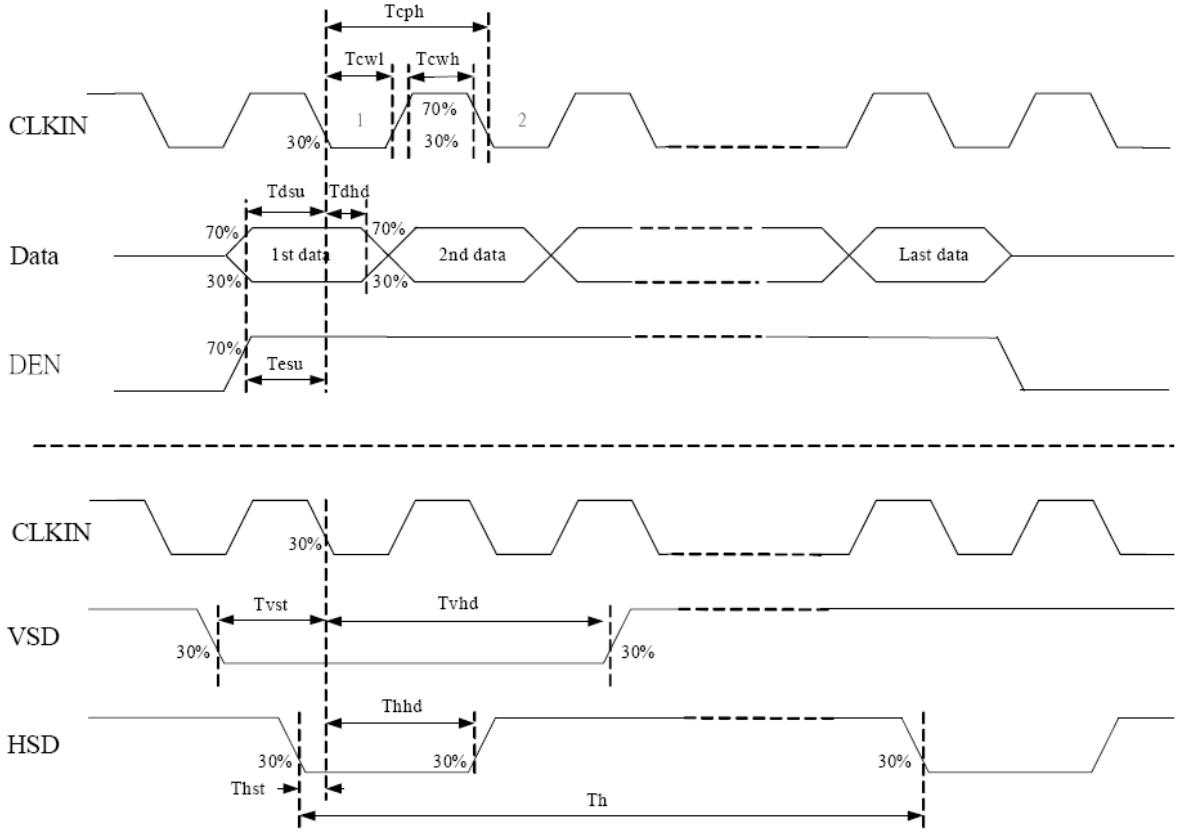
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	thd		800		DCLK
DCLK Frequency	fclk	-	30	50	MHZ
One Horizontal Line	th	889	928	1143	DCLK
HS pulse width	thpw	1	48	255	DCLK
HS Back Porch (Blanking)	thb		88		DCLK
HS Front Porch	thfb	1	40	255	DCLK
DE mode Blanking	th-thd	85	128	512	DCLK

Vertical input timing

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		480		H
VS period time	tv	513	525	767	H
VS pulse width	tvpw	3	3	255	H
VS Back Porch (Blanjing)	tvb		32		H
VS Front Porch	tvfb	1	13	255	H
DE mode Blanking	tv-tvd	4	45	255	H

Timing Characteristic

3.2.2.1 DE and RGB Input Timing



3.3 Backlight Unit

The Backlight system is an edge-lighting type with 24 white LED (Light Emitting Diode)s. The characteristics of 14 white LEDs are shown in the following tables.

(Ta= Room Temp)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Voltage	V_f	(19.6)	(22.4)	(23.8)	V	
Forward Current	I_f	-	40	-	mA	(1)
Power Consumption	P_{BL}	-	896	-	mW	(2)
LED Lifetime	-	50000	-	-	hr	(3)

Note (1) LEDs in 7 series x 2 parallel type.

(2) Where I_f = 40mA, V_f = 22.4V, $P_{BL} = V_F \times I_f$

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

4. Optical Characteristics

4.1 Optical characteristic of the LCD

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods.

Measuring equipment: BM-7A

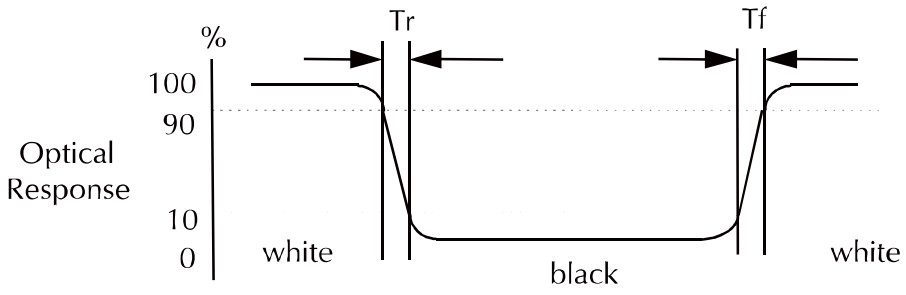
Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		B		380	425	--	cd/m^2	
Response Time		T_r	θ=0°	-	5	--	ms	.
		T_f		--	15	--	ms	
Contrast Ratio		CR	At optimized viewing angle	--	350	--	--	
Luminance Uniformity		△L		70	80		%	
Color Chromaticity (CIE 1931)	White	Wx	θ=0° Normal Viewing Angle	0.281	0.311	0.341	--	BM-7A
		Wy		0.294	0.324	0.354		
Viewing Angle (6H)	Hor.	θ_R	CR≥10	60	65	--	Degree	
		θ_L		60	65	--		
	Ver.	θ_U		45	50	--		
		θ_D		55	60	--		

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 2° 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".

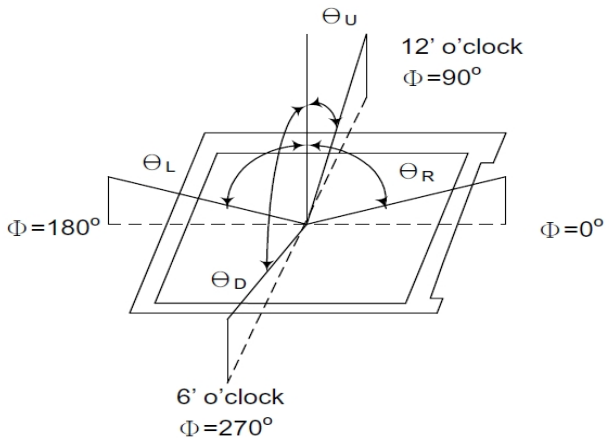


c. Definition of contrast ratio:

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

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

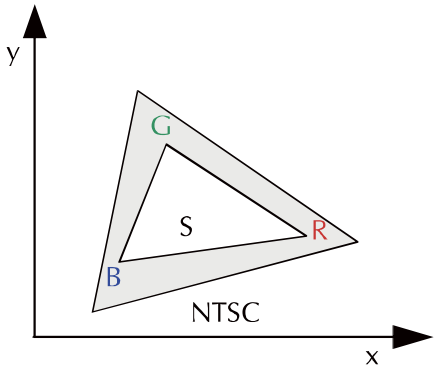
g. Definition of White Uniformity

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

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



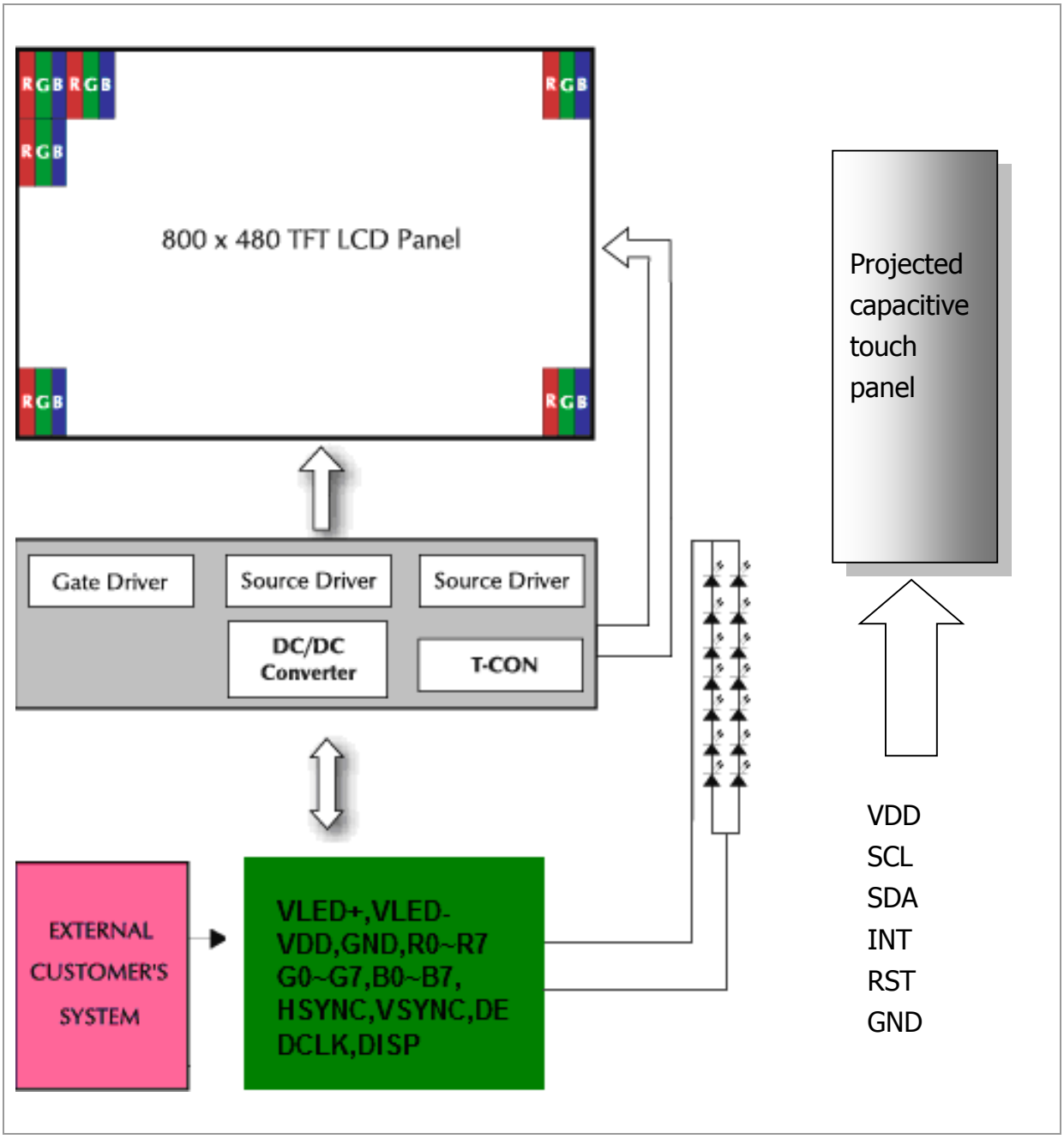
5. I/O Terminal

5.1 Pin Assignment

Pin No.	Symbol	I/O	Function	Remark
1	VLED-	P	Power for LED backlight cathode	
2	VLED+	P	Power for LED backlight anode	
3	GND	P	Power Ground	
4	VDD	P	Power Supply	
5	R0	I	Red data signal (LSB)	
6	R1	I	Red data signal	
7	R2	I	Red data signal	
8	R3	I	Red data signal	
9	R4	I	Red data signal	
10	R5	I	Red data signal	
11	R6	I	Red data signal	
12	R7	I	Red data signal (MSB)	
13	G0	I	Green data signal (LSB)	
14	G1	I	Green data signal	
15	G2	I	Green data signal	
16	G3	I	Green data signal	
17	G4	I	Green data signal	
18	G5	I	Green data signal	
19	G6	I	Green data signal	
20	G7	I	Green data signal (MSB)	
21	B0	I	Blue data signal (LSB)	
22	B1	I	Blue data signal	
23	B2	I	Blue data signal	
24	B3	I	Blue data signal	
25	B4	I	Blue data signal	
26	B5	I	Blue data signal	
27	B6	I	Blue data signal	
28	B7	I	Blue data signal (MSB)	
29	DGND	P	Digital ground	
30	DCLK	I	Pixel clock	
31	DISP	I	Display on/ off	
32	HSYNC	I	Horizontal sync signal	
33	VSYNC	I	Vertical sync signal	
34	DE	I	Data Enable signal	
35	NC	I	No Connect	
36	GND	P	Power Ground	
37	NC	-	No Connect	
38	NC	-	No Connect	
39	NC	-	No Connect	
40	NC	-	No Connect	

I: Input, O: Output, P: Power Notes: 1) NC Pin must be retained; this pin can't contact GND or other signal.
2) GND Pin must ground contact, can not be floating.
3) Connector Part No: FH12A-40S-0.5SH(55) or equivalent.

5.2 Block Diagram



6. Displayed Color and Input Data

	Color & Gray Scale	Data Signal																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(127)	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(127)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(127)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16.7M color display can be achieved on the screen.

7. Touch Screen Panel Specifications

7.1 Features

Item	Specification	Unit
Screen Size	5.0 Inches	Diagonal
Type	Transparent Type Projected Capacitive Touch Panel	--
Input Mode	Human's Finger	--
Sensor Active Area	118.50 × 77.55	mm
Interface	I2C	--
Cover Glass Pencil-Hardness	6H(min) by JIS K5400	--
Digital Power Supply	2.8 ~ 3.6	V
Power Consumption	TBD	mA
IC solution	IC：ILI2115	

7.2 Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Condition
System Power Supply Voltage	VCC	2.8	3.3	3.6	V	
Charge Pump Power Supply Voltage	VDD3	2.8	3.3	3.6	V	
$\overline{RSTN}$ High Voltage larger than 2.6V	VDDIO_1	2.8	3.3	3.6	V	
$\overline{RSTN}$ High Voltage smaller than 2.6V	VDDIO_2	1.65	1.8	1.95	V	
RSTN Slew Rate	V_{rstn}/T_{slew}	10			V/mS	
Input High Voltage	V_{IH}	0.7*VDDIO	—	VDDIO	V	(*1)
Input Low Voltage	V_{IL}	-0.3	—	0.3*VDDIO	V	
Output High Voltage	V_{OH}	2.8	3.3	3.58	V	VDDIO_1
		1.65	1.8	1.95		VDDIO_2
		1.17		1.8		Power on (*2)
Output Low Voltage	V_{OL}	0	—	0.3	V	
Input Leakage Current	I_I	—	1	—	μA	
I2C Pull-High/Low Impedance	R_{po}	1.425k	4.7K	7.875k	Ω	Standard mode (*3)
		1.425k	1.5k	1.575k	Ω	Fast mode (*3)
Operation Mode Current	I_{Op}	—	TBD	—	mA	(*4)
Standby Current	I_{Idle}	—	TBD	—	mA	(*4)
Sleeping Current	I_{Sleep}	—	20	—	μA	

Note (1) The interface power voltage level (VDDIO_1 or VDDIO_2) is detected by ILI2115 automatically and the voltage level is determined by $\overline{RSTN}$ pin.

Note (2) During power on stage.

Note (3) The pull high/low impedance was defined under Cb (total capacitance load for each SDA/SCL lines) 400pF for standard mode and 300pF for fast mode. If Cb smaller than 400pF/300pF we can chose higher impedance for saving sink power. The Min. impedance was defined under Id (sink current) of 3mA. All the above condition was defined under ILI2116 I.C. with internal pull high impendence of 4.7k to 5.3k.

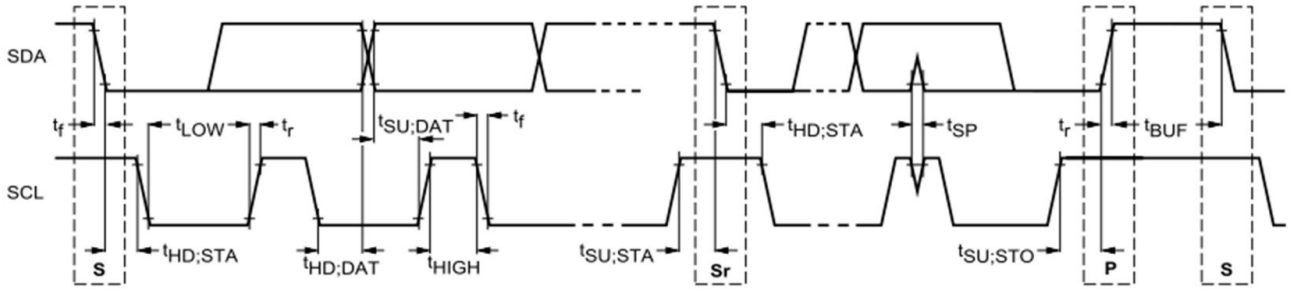
Note (4) The power consumption depends on sensor loading condition.

7.3 Pin Assignments and Definitions.

Item	Name	I/O	Unit
1	VCC	P	Power supply 3.3V
2	SCL	I	I2C Clock
3	SDA	I/O	I2C Data
4	INT	I	Interrupt request to the host
5	RST	I	External Reset, active low
6	GND	P	Ground

7.4 FUNCTIONAL DESCRIPTION

7.4.1 AC Characteristics of the SDA and SCL on I2C interface



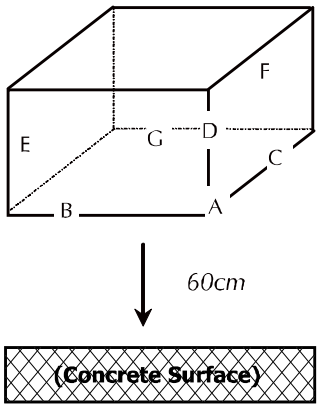
The timing of I2C Interface

Symbol	Parameter	Standard Mode			Fast Mode		
		Min	Max	Unit	Min	Max	Unit
f_{SCL}	SCL clock frequency	0	100	KHz	0	400	KHz
$t_{HD;STA}$	Hold time (repeated) START condition. After this period, the first clock pulse is generated	4.0	–	µs	0.6	–	µs
t_{LOW}	LOW period of the SCL clock	4.7	–	µs	1.3	–	µs
t_{HIGH}	HIGH period of the SCL clock	4.0	–	µs	0.6	–	µs
$t_{SU;STA}$	Set-up time for a repeated START condition	4.7	–	µs	0.6	–	µs
$t_{HD;DAT}$	Data hold time For I2C Device	5.0 0	– 3.45	µs µs	– 0	– 0.9	µs µs
$t_{SU;DAT}$	Data set-up time	250	–	ns	100	–	ns
t_r	Rise time of both SDA and SCL signals	–	1000	ns	–	300	ns
t_f	Fall time of both SDA and SCL signals	–	300	ns	–	300	ns
C_b	Capacitance load for each SDA/SCL lines		400	pF		300	pF
$t_{SU;STO}$	Set-up time for STOP condition	4.0	–	µs	0.6	–	µs
t_{BUF}	Bus free time between a STOP and START condition	4.7	–	µs	1.3	–	µs

8. Reliability Condition

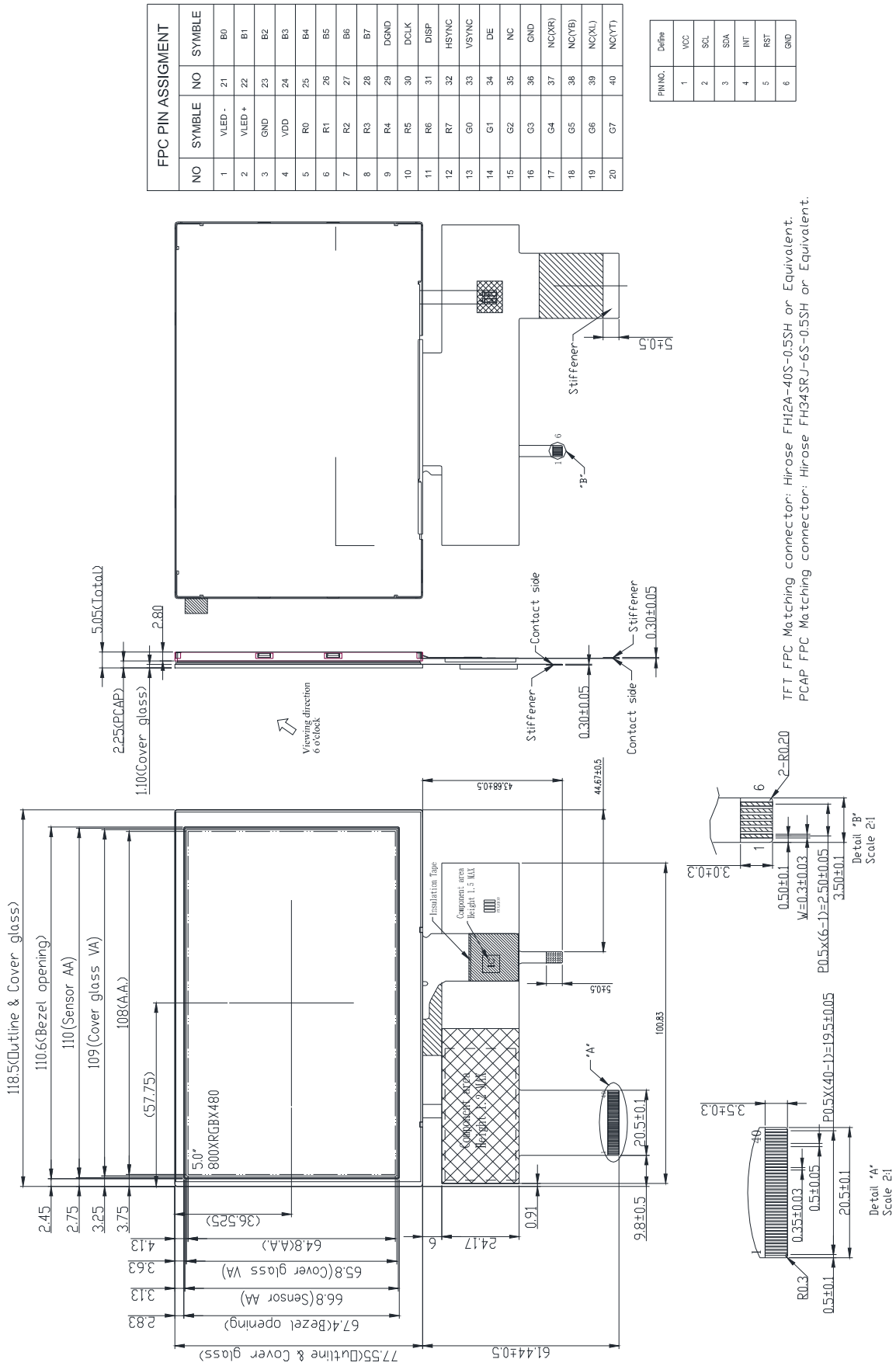
No change on display and in operation under the following test condition.

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, 240hrs (Operation state).	
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state).	1
3	High Temperature Storage	80°C±2°C, 240hrs.	2
4	Low Temperature Storage	-30°C±2°C, 240hrs.	1,2
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs.	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.

9. Dimensional Outlines



10. Incoming Inspection Standards

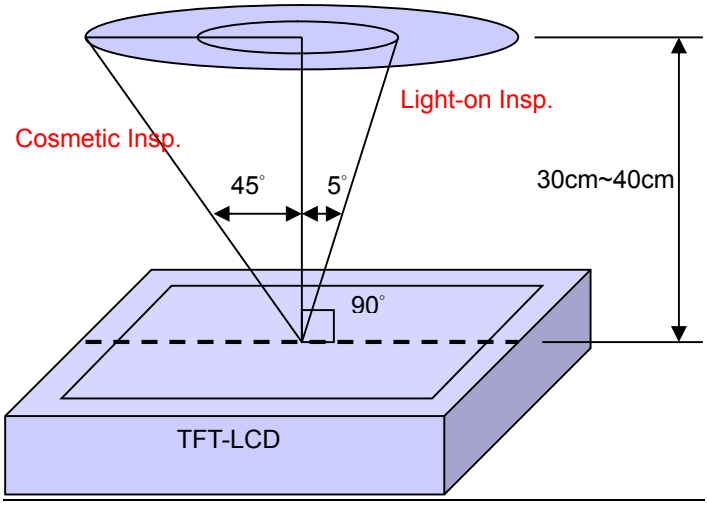
10.1 Inspection and Environment Conditions

10.1.1 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)

10.1.2 Environment Conditions:

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

10.1.3 Sampling Conditions:

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

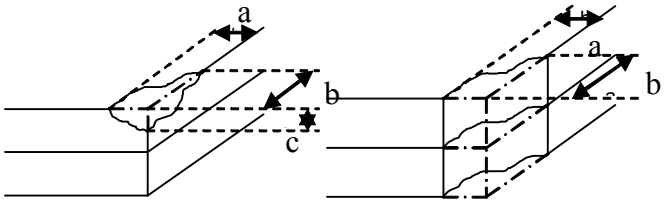
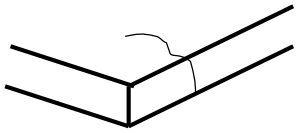
(2) Sampling Method:

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.

10.1.4 Inspection Criteria

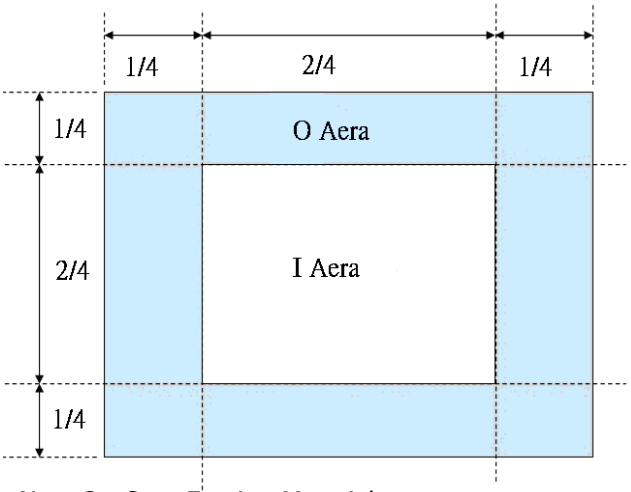
10.1.4.1 Cosmetic Inspection(Panel):

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

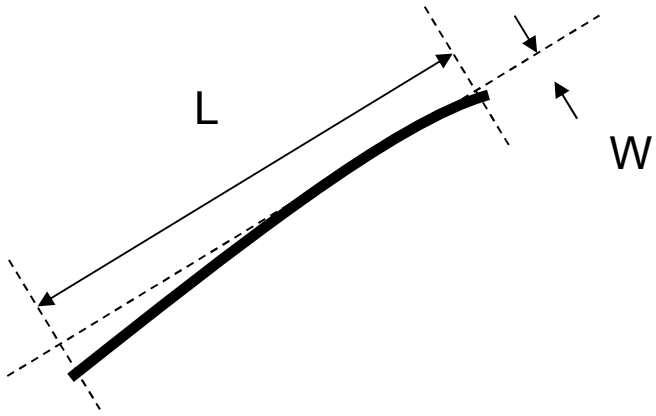
10.1.4.2 Functional Inspection:

<table>
<tr><th rowspan="2">Item</th><th colspan="3">Judgment Criteria</th><th rowspan="2">Classification</th></tr>
<tr><th colspan="2">Area(Note1)</th><th>I</th><th>O</th></tr>
<tr><td rowspan="11">Point Defect</td><td rowspan="3">Bright dot</td><td>Random</td><td colspan="2">2</td><td rowspan="11">MI</td></tr>
<tr><td>2 dots adjacent</td><td>0</td><td>0</td></tr>
<tr><td>3 dots adjacent or more</td><td>0</td><td>0</td></tr>
<tr><td rowspan="3">Dark dot</td><td>Random</td><td colspan="2">3</td></tr>
<tr><td>2 dots adjacent</td><td colspan="2">0</td></tr>
<tr><td>3 dots adjacent or more</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">Total Dot Defect</td><td colspan="2">5</td></tr>
<tr><td rowspan="3">Distance</td><td>Distance between Bright and Bright dot</td><td colspan="2">L≧5mm</td></tr>
<tr><td>Distance between Bright and Dark dot</td><td colspan="2">L≧5mm</td></tr>
<tr><td>Distance between Dark dot</td><td colspan="2">L≧5mm</td></tr>
<tr><td colspan="4">(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)</td></tr>
<tr><td>Line Defect</td><td colspan="3">Obvious vertical or horizontal line defect is not allowed.</td><td>MA</td></tr>
<tr><td>Mura</td><td colspan="3">Not allowed if it can be observed through ND Filter 5 %</td><td>MI</td></tr>
<tr><td>Foreign Material in spot shape *Note-3</td><td colspan="3">D≦0.2mm: Ignored
0.2mm<D≦0.5mm: N≦8
D>0.5mm: Not allowed</td><td>MI</td></tr>
<tr><td>Foreign Material in line or spiral shape *Note-4</td><td colspan="3">W≦0.05mm or L≦5mm: Ignored
0.05mm<W≦0.2mm and L1.0mm≦5mm: N≦8
W>0.2mm or L>5mm: Not allowed</td><td>MI</td></tr>
<tr><td>Display Function Abnormal</td><td colspan="3">No Malfunction can be allowed</td><td>MA</td></tr>
</table>

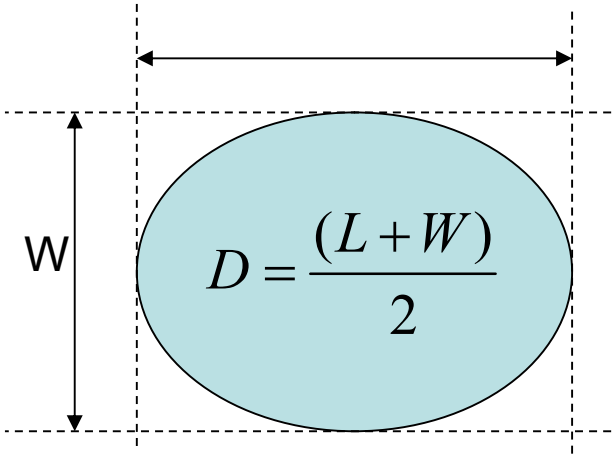
Note-1： I/O Area Definition



Note-2： Polarizer Scratch



Note-3：Spot Foreign Material
(W ≧L / 4)



Note-4：Line or Spiral Foreign Material
(W<L / 4)