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# Chunghwa Picture Tubes, Ltd.

## Product Specification

To :

Date : 101228

**TFT LCD**

**CLAA070MA21BW**

ACCEPTED BY : (V0.5)

Tentative

APPROVED BY	CHECKED BY	PREPARED BY
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**REVISION STATUS**

Revision Notice	Description	Page	Rev. Date
0.0	First revision (Tentative)	--	2010/02/04
0.1	Revise Mechanical Dimension	15~16	2010/02/24
0.1	Revise IL=105mA (Backlight current )	17	2010/02/24
0.2	Revise TFT-LCD Power Supply Voltage(Common Power Supply Voltage)	6	2010/04/13
0.2	Revise TFT-LCD Power Supply Voltage(Gamma Voltage)	6	2010/04/13
0.2	Revise Optical characteristics(Luminance Uniformity 、 Color Coordinate)	17	2010/04/13
0.3	Revise Mechanical Dimension Rear Side Lable Area	16	2010/4/22
0.3	Add the NTSC rate	17	2010/4/22
0.4	Revise the Luminance.	4	2010/05/31
0.4	Revise the Power consumption	4	2010/05/31
0.4	Revise the Module Weight	4	2010/05/31
0.4	Revise Common Power Supply Voltage and Gamma Voltage	6	2010/05/31
0.4	Revise Backlight(LED current, LED voltage, Power consumption, LED Lifetime)	8	2010/05/31
0.4	Revise Optical characteristics ( Luminance 、 NTSC ratio 、 Color Coordination)	17	2010/05/31
0.4	Revise Optical characteristics the Remark *1 IL=112mA ( Backlight current )	17	2010/05/31
0.4	Revise Reliability Test(Temperature and Humidity)	19	2010/05/31
0.5	Revise Mechanical Dimension Rear View	16	2010/06/08
0.5	Revised the Vertical Front Porch	11	2010/06/08

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## 1. OVERVIEW

**CLAA070MA21BW** is 7" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs , control circuit and LED backlight.

The 7" screen produces 800×RGB×600 resolution image. The LCD is drivered by a single input voltage (3.3 V).

General specification are summarized in the following table:

ITEM	SECIFICATION
Display Area (mm)	141.6(H)*106.2(V)
Number of Pixels	800(H) × 3(RGB) ×600(V)
Pixel Pitch (mm)	0.177 (H) × 0.177 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white, TN
Number of color	16.2M
Viewing Direction	3 o'clock
Response Time (Tr+Tf)	20 ms (typ)
Brightness (cd/m <sup>2</sup> )	215 nit (typ)
Viewing Angle (CR≥10)	120(H) / 140(V)
Electrical Interface	TTL
Power Consumption (W)	0.976 W(max.)
Outline Dimension (mm)	156.4(H)*122.25(V)*3.2(D)(w/o FPC)
Module Weight (g)	120g(typ)
Backlight	LED
Surface Treatment	Anti-Glare , Surface hardness: 3H

## 2. ABSOLUTE MAXIMUM RATINGS

The following values are maximum operation conditions. If exceeded, it may cause faulty operation or damage.

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Digital Power Supply Voltage	VCC	-0.3	5	V	
Analog Power Supply Voltage	AVDD	-0.5	15	V	
Gate On Voltage	VGH	-0.3	40	V	
Gate Off Voltage	VGL	-20	0.3	V	
ESD	VESDc	-200	+200	V	Note1
	VESDm	-15K	+15K	V	Note1
Operation Temperature	T <sub>op</sub>	-20	60	°C	Note2
Storage Temperature	T <sub>stg</sub>	-30	70	°C	Note2
Forward Current (per LED)	I <sub>f</sub>		30	mA	
Reverse Voltage (per LED)	VR		5	V	
Pulse forward current (per LED)	I <sub>fp</sub>		100	mA	Note3

【Note】 :

\*1) Test Conditions : IEC 61000-4-2

VESDc : Contact discharge to input connector

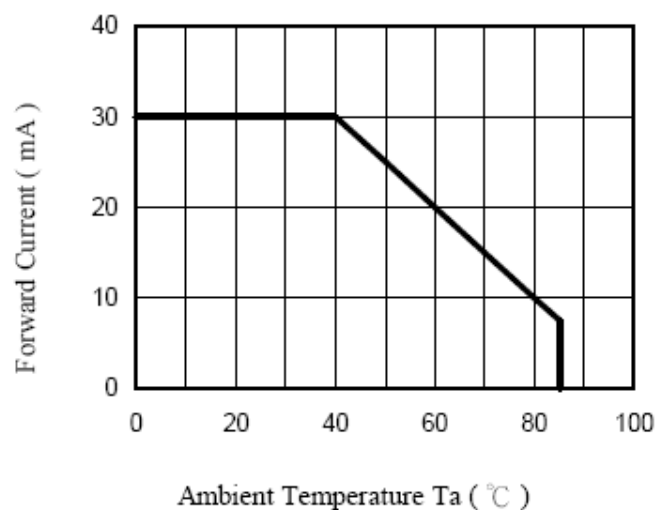
VESDm : Contact discharge to module

\*2) If users use the product out off the environmental operation range (temperature and humidity), it will have visual quality concerns.

\*3) I<sub>fp</sub> Conditions : Duty ≤ 1/10 @ Pulse Width ≤ 10msec.

\*4) Each one of the LED operation must meet the following diagram (Ambient Temperature /Allowable Forward Current)

Forward Current vs. Ambient Temperature



### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT-LCD Power Supply Voltage

Ta=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Digital Power Supply Voltage	VCC	3	3.3	3.6	V	
Analog Power Supply Voltage	AVDD	9.4	9.6	9.8	V	
Gate On Power Supply Voltage	VGH	17	18	19	V	
Gate Off Power Supply Voltage	VGL	-6.6	-6	-5.4	V	
Common Power Supply Voltage	VCOM	2.7	2.8	2.9	V	Note1
Gamma Voltage	V1	-	8.42	-	V	
	V2	-	7	-	V	
	V3	-	6.6	-	V	
	V4	-	6.36	-	V	
	V5	-	5.571	-	V	
	V6	-	3.975	-	V	
	V7	-	2.687	-	V	
	V8	-	2.261	-	V	
	V9	-	1.766	-	V	
	V10	-	0.235	-	V	
Input Signal Voltage	VIH	0.7VCC	-	VCC	V	
	VIL	GND	-	0.3VCC	V	

【Note】 : \*1) Please adjust VCOM to make the flicker level be minimum.

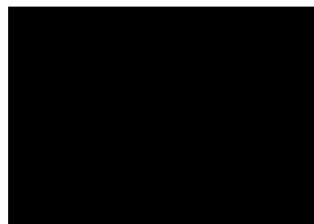
#### 3.2 TFT-LCD Current Consumption

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Gate on Power Supply Current	IVGH	VGH = 18V		0.3	0.4	mA	【Note1】
Gate off Power Supply Current	IVGL	VGL = -6V		0.3	0.4	mA	【Note1】
Digital Power Supply Current	IVCC	VCC = 3.3V		5	5.5	mA	【Note1】
Analog Power Supply Current	IAVDD	AVDD = 9.6V		13.2	19	mA	【Note1】
Total Power Consumption	PC			150	210	mW	【Note1】

【Note】 : \*1) Typical : Under 64 gray pattern , Maximum : Under black pattern °



(a) 64 Gray Pattern

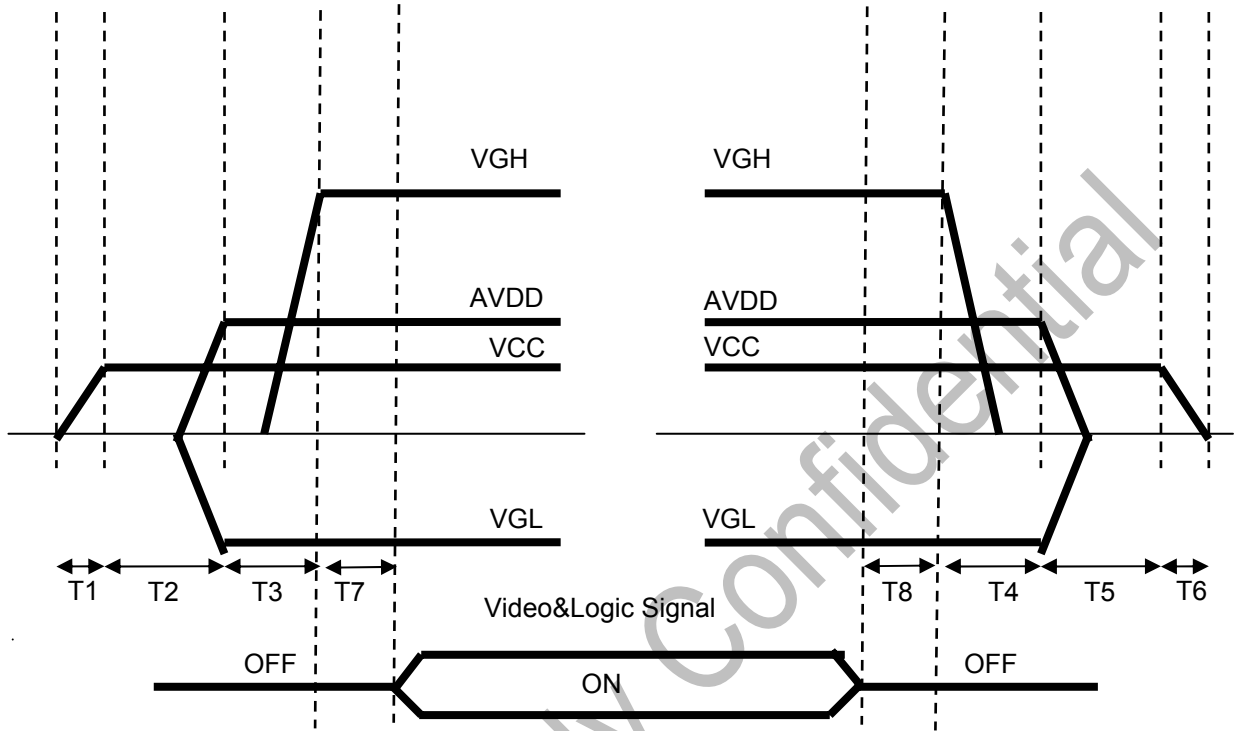


(b) Black Pattern

3.3 Power 、Signal Sequence

Power On : VCC→AVDD/VGL→VGH→Video & Logic Signal

Power Off : Video & Logic Signal→VGH→AVDD/VGL→VCC



$0 < T1 \leq 10\text{ms}$

$T2 > 20\text{ms}$

$T3 > 10\text{ms}$

$T4 > 0\text{ms}$

$T5 > 0\text{ms}$

$T6 > 0\text{ms}$

$0 < T7 \leq 10\text{ms}$

$0 < T8 \leq 10\text{ms}$



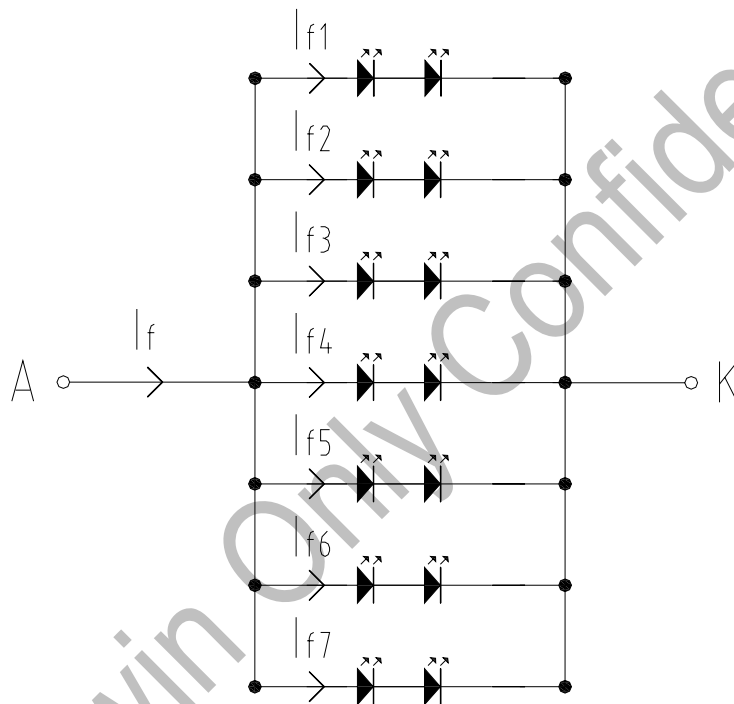
3.4 Backlight

Ta=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
LED current	IL	Ta=25°C Each serial=16mA	-	112	-	mA	
LED voltage	VL	Ta=25°C Each serial=16mA	5.64	6.24	6.84	V	
Power consumption	WL	Ta=25°C Each serial=16mA	-	0.7	-	W	
LED life time	Hr	Ta=25°C Each serial=16mA	20000			Hour	

【Note】 :

\*1)LED Circuit Diagram :



\*2) A : Anode(+) , K : Cathode(-)

\*3) LED control suggested fixed current.

\*4) Definition of the LED life time : Luminance will decay less than 50%

## 4. INTERFACE CONNECTION

### 4.1 CN1

Pin NO.	SYMBOL	DESCRIPTION
1	AGND	Analog Ground
2	VCC	Digital Power
3	AVDD	Analog Power
4	R0	Data Input(LSB)
5	R1	Data Input
6	R2	Data Input
7	R3	Data Input
8	R4	Data Input
9	R5	Data Input
10	R6	Data Input
11	R7	Data Input(MSB)
12	G0	Data Input(LSB)
13	G1	Data Input
14	G2	Data Input
15	G3	Data Input
16	G4	Data Input
17	G5	Data Input
18	G6	Data Input
19	G7	Data Input(MSB)
20	B0	Data Input(LSB)
21	B1	Data Input
22	B2	Data Input
23	B3	Data Input
24	B4	Data Input
25	B5	Data Input
26	B6	Data Input
27	B7	Data Input(MSB)
28	GND	Digital Ground
29	DCLK	Clock input
30	GND	Digital Ground
31	DE	Data Enable signal ◦ Active High to enable the data input bus under "DE Mode"
32	HSD	Horizontal sync input. Negative polarity
33	VSD	Vertical sync input. Negative polarity
34	MODE	DE/SYNC mode select. Normally pull high H: DE mode. L: HSD/VSD mode
35	RSTB	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high.(R=47K $\Omega$ · C=1 $\mu$ )
36	STBY	Standby mode, normally pull high STBYB="1", normal operation STBYB="0", timing control, source driver will turn off, all output are high-Z
37	SHLR	Left or Right Display Control
38	VCC	Digital Power
39	UPDN	Up / Down Display Control
40	AGND	Analog Ground
41	AVDD	Analog Power
42	VCOM	Common Voltage
43	V10	Gamma correction voltage reference
44	V9	Gamma correction voltage reference
45	V8	Gamma correction voltage reference
46	V7	Gamma correction voltage reference
47	V6	Gamma correction voltage reference
48	V5	Gamma correction voltage reference
49	V4	Gamma correction voltage reference
50	V3	Gamma correction voltage reference

51	V2	Gamma correction voltage reference
52	V1	Gamma correction voltage reference
53	VGH	Positive Power for TFT
54	VCC	Digital Power
55	VGL	Negative Power for TFT
56	GND	Digital Ground
57	LED-	Power for LED backlight (Cathode)
58	LED-	Power for LED backlight (Cathode)
59	LED+	Power for LED backlight (Anode)
60	LED+	Power for LED backlight (Anode)

【Note】 : \*1) Function is controled by UPDN and SHLR.

UPDN	SHLR	FUNCTION
0	1	Normal Display
0	0	Left / Right Contrary
1	1	Up / Down Reverse
1	0	Left / Right Contrary , Up / Down Reverse

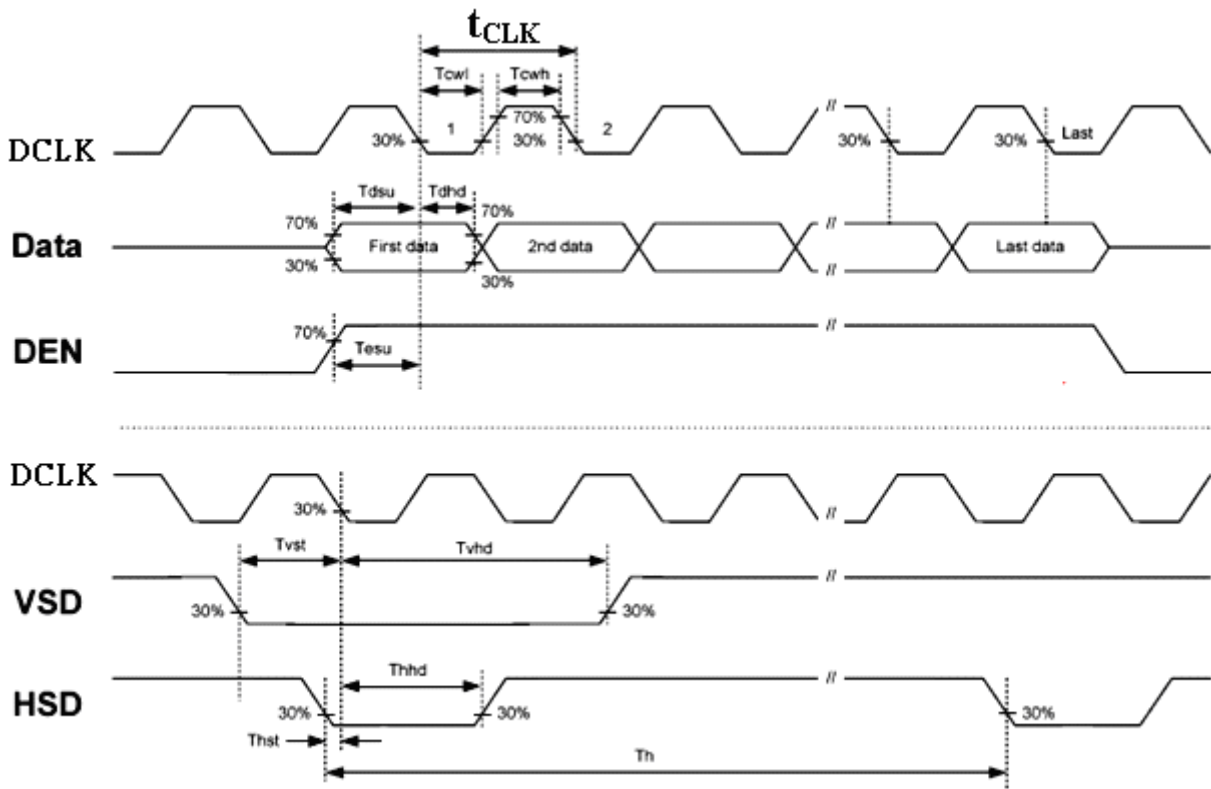
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## 5. INPUT SIGNAL

### 5.1 Timing Specification

	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
DCLK	Dot Clock	$1/t_{CLK}$	35	40	45	MHz	
	DCLK pulse duty	Tcwh	40	50	60	%	
DE	Setup Time	Tesu	8	-	-	ns	
	Hold time	Tehd	8	-	-	ns	
	Horizontal Period	$t_H$	980	1000	1020	$t_{CLK}$	
	Horizontal Valid	$t_{HA}$	800				
	Horizontal Blank	$t_{HB}$	180	200	220	$t_{CLK}$	
	Vertical Period	$t_V$	650	660	670	$t_H$	
	Vertical Valid	$t_{VA}$	600				
	Vertical Blank	$t_{VB}$	50	60	70	$t_H$	
SYNC	HSYNC Setup Time	Tst	8	-	-	ns	
	HSYNC Hold Time	Thd	8	-	-	ns	
	VSYNC Setup Time	Tvst	8	-	-	ns	
	VSYNC Hold Time	Tvhd	8	-	-	ns	
	Horizontal Period	th	980	1000	1020	$t_{CLK}$	
	Horizontal Pulse Width	thpw	-	40	-	$t_{CLK}$	thb + thpw=88DCLK is fixed
	Horizontal Back Porch	thb	-	48	-	$t_{CLK}$	
	Horizontal Front Porch	thfp	92	112	132	$t_{CLK}$	
	Horizontal Valid	thd	800				
	Vertical Period	tv	650	660	670	th	
	Vertical Pulse Width	tvpw	-	3	-	th	tvpw + tvb = 39th is fixed
	Vertical Back Porch	tvb	-	36	-	th	
	Vertical Front Porch	tvfp	11	21	31	th	
Vertical Valid	tvd	600					
DATA	Setup Time	Tdsu	8	-	-	ns	
	Hold Time	Tdhd	8	-	-	ns	

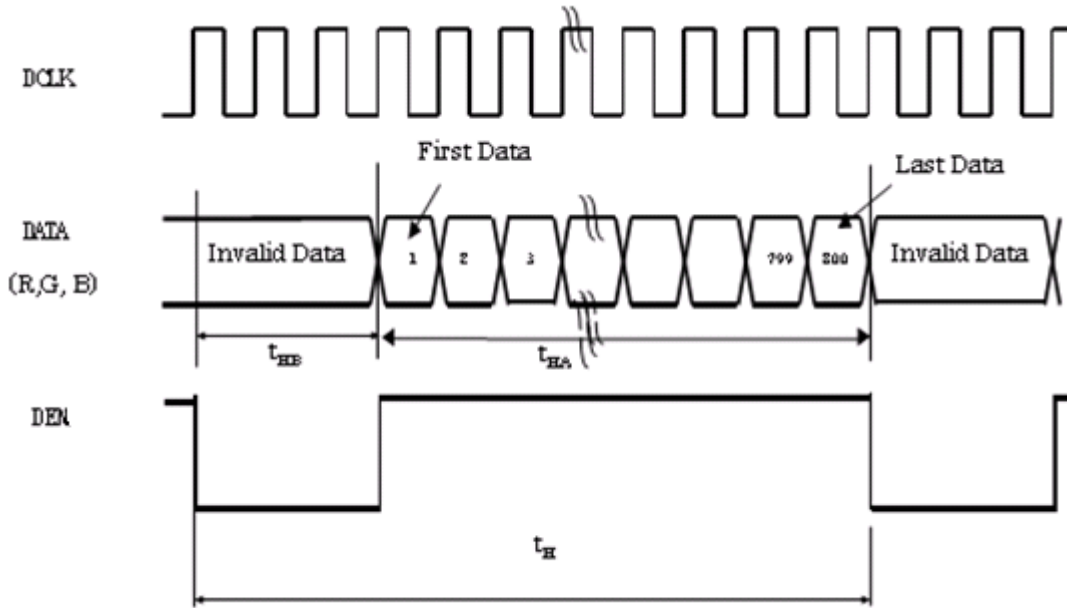
### 5.2 Timing Chart



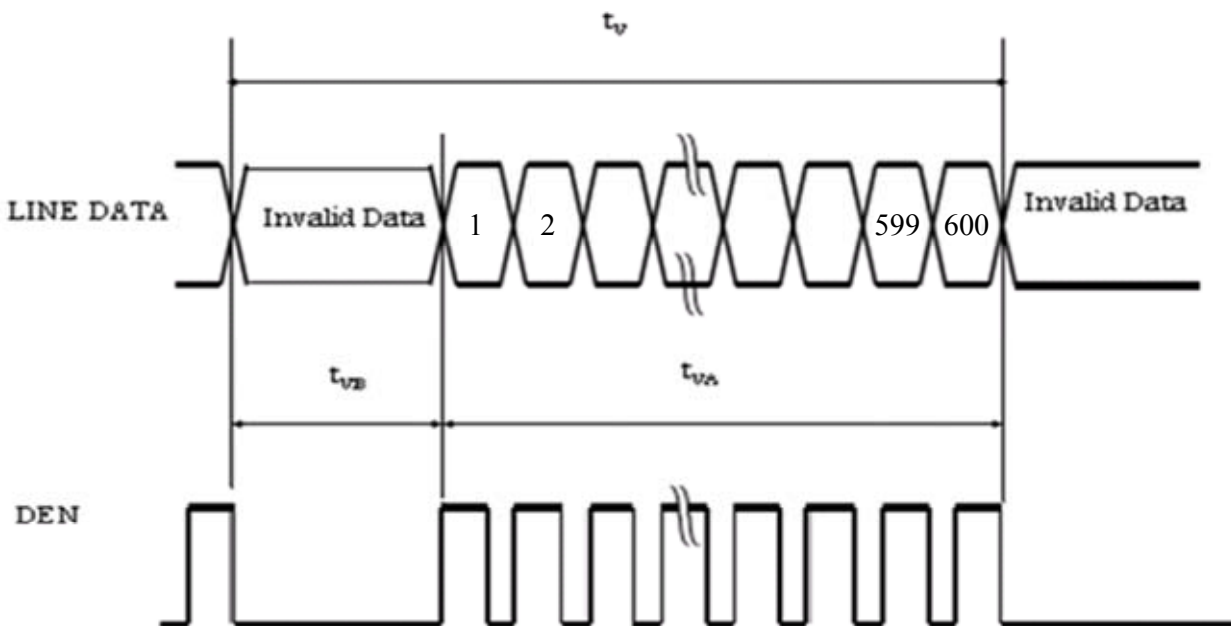
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**DE mode**

(1)Horizontal Timing :

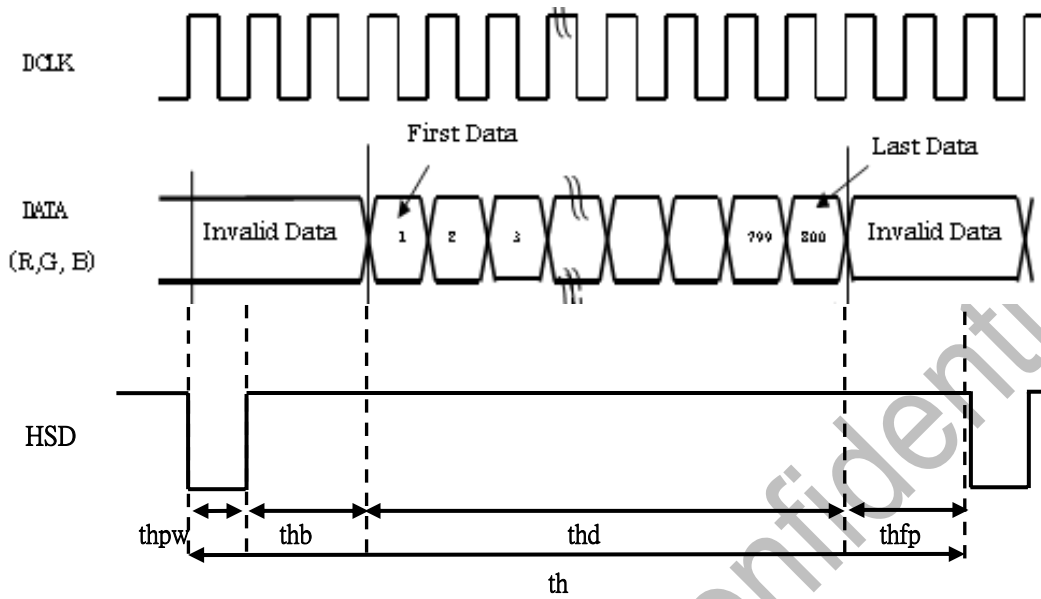


(2)Vertical Timing :

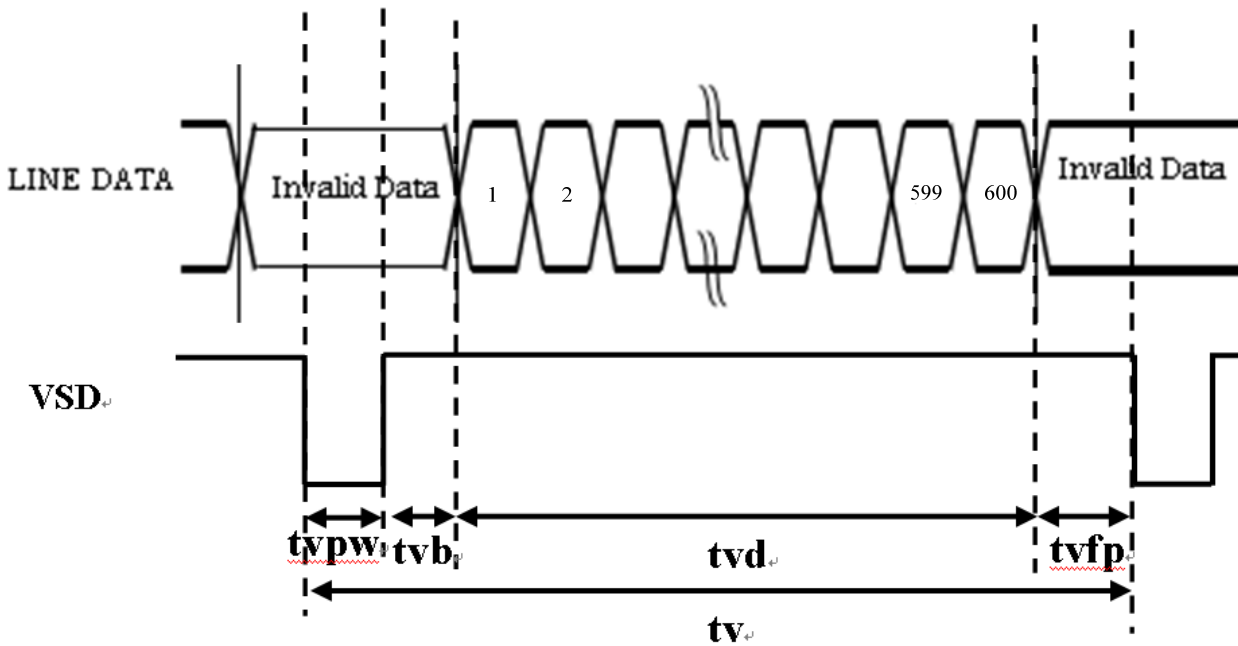


**SYNC mode**

(1)Horizontal Timing :

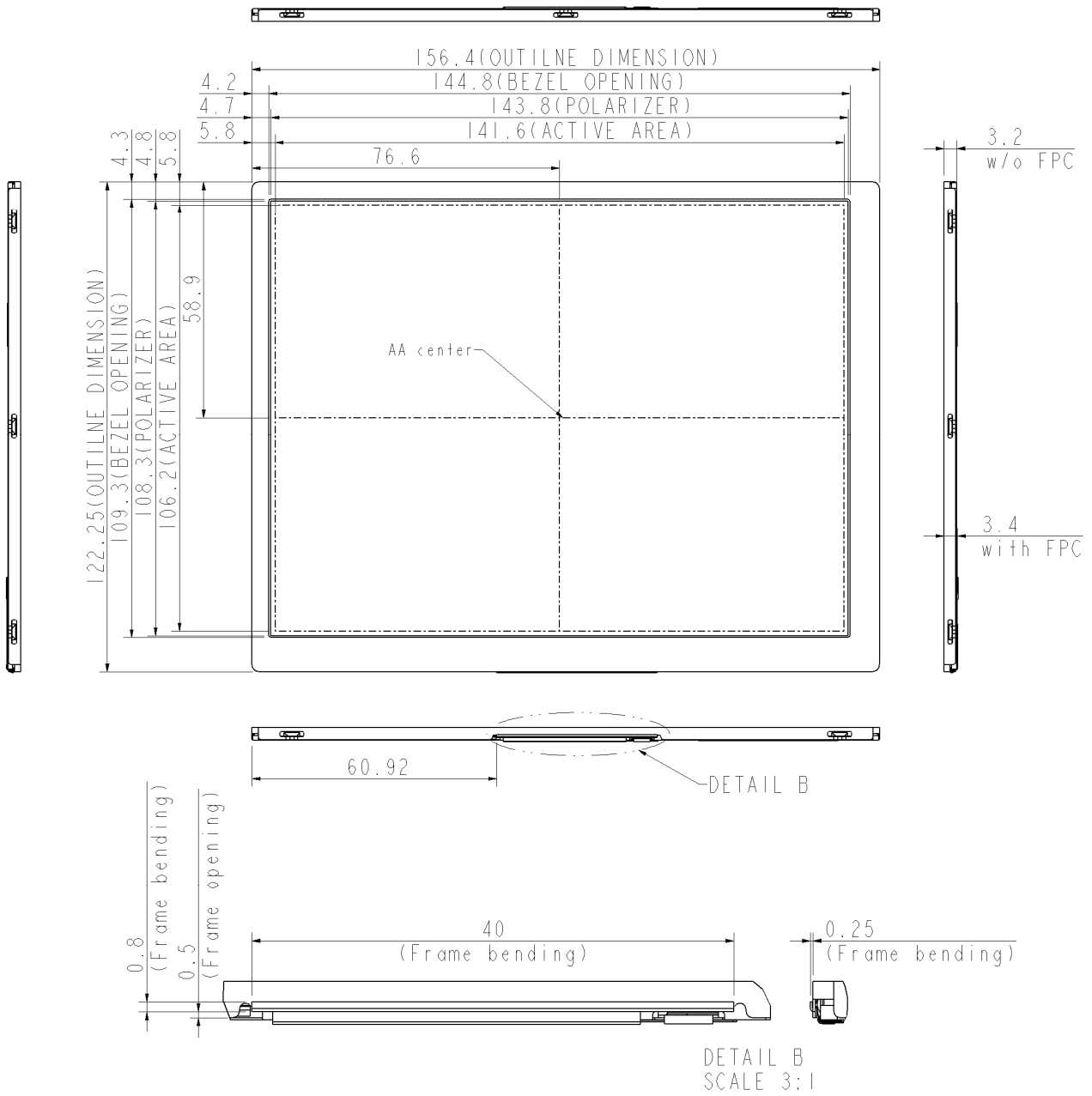


(2)Vertical Timing :



### 6. MECHANICAL DIMENSION

#### 6.1 Front Side

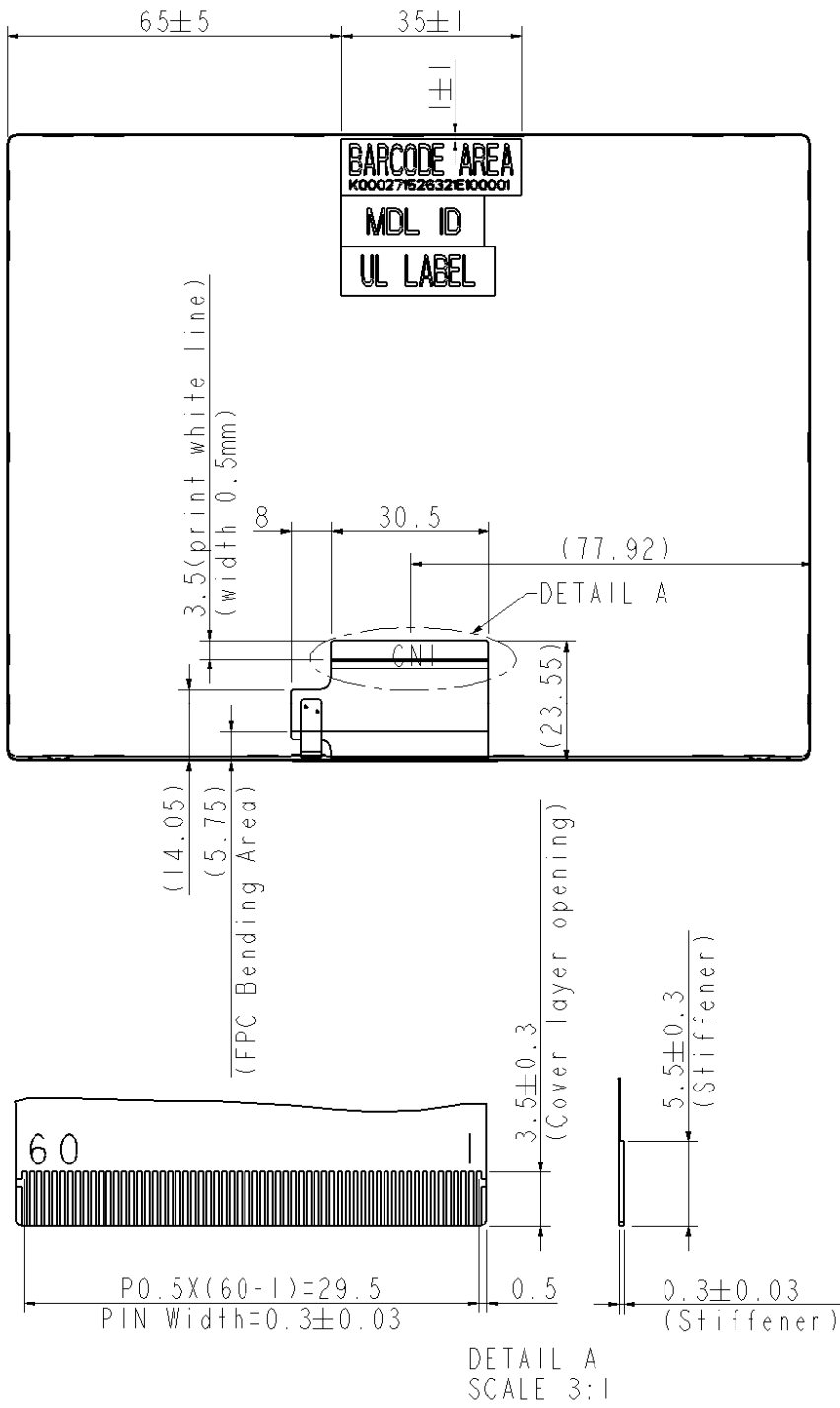


[Unit : mm]

NOTE : General Tolerance =  $\pm 0.3$  mm



6.2 Rear Side



[Unit : mm]

NOTE : General Tolerance = ±0.3 mm

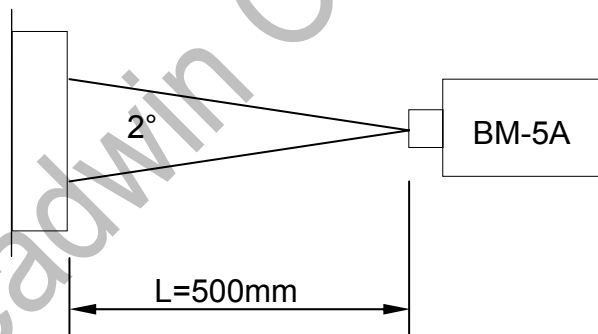
## 7. OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast (CEN)	CR	Point-5	400	500	-	-	*1)*2)*3)
Luminance (CEN)	Lw	Point-5	170	215		cd/m <sup>2</sup>	*1)*3)
Luminance Uniformity	ΔL		60	70	-	%	*1)*3)
Response Time (White - Black)	Tr +Tf	Point-5	-	20	35	ms	*1)*3)*5)
NTSC	-	Point-5		42		%	*1)*3)
View angle	Horizontal	CR ≥ 10 Point-5	100	120	-	°	*1)*2)*4)
	Vertical		120	140	-	°	*1)*2)*4)
Color Coordinate	White	Point-5	0.273	0.313	0.353	-	*1)*3)
			0.289	0.329	0.369		
	Red		0.541	0.581	0.621		
			0.296	0.336	0.376		
	Green		0.310	0.350	0.390		
			0.540	0.580	0.620		
	Blue		0.119	0.159	0.199		
			0.069	0.109	0.149		

### 【Note】 :

These items are measured by BM-5A (TOPCON) in the dark room. (no ambient light).

\*1) condition of measurement : 25 °C ± 2 °C , 60 ± 10%RH , dark room below 10 Lux , viewing cone=2° , VCC=3.3V or IL=112mA ( Backlight current ) , after 10 minutes operation .



\*2) Definition of contrast ratio :

$$\text{Contrast Ratio (CR)} = (\text{White}) \text{ Luminance of ON} \div (\text{Black}) \text{ Luminance of OFF}$$

\*3) Definition of Luminance Uniformity :

Measure maximum luminance L(MAX) and minimum luminance L(MIN) on the 9 points as Fig.8-1 (#1~#9point).

Luminance Uniformity is calculated with the following formula :

$$\Delta L = ( L(\text{MIN}) \div L(\text{MAX}) ) \times 100\%$$

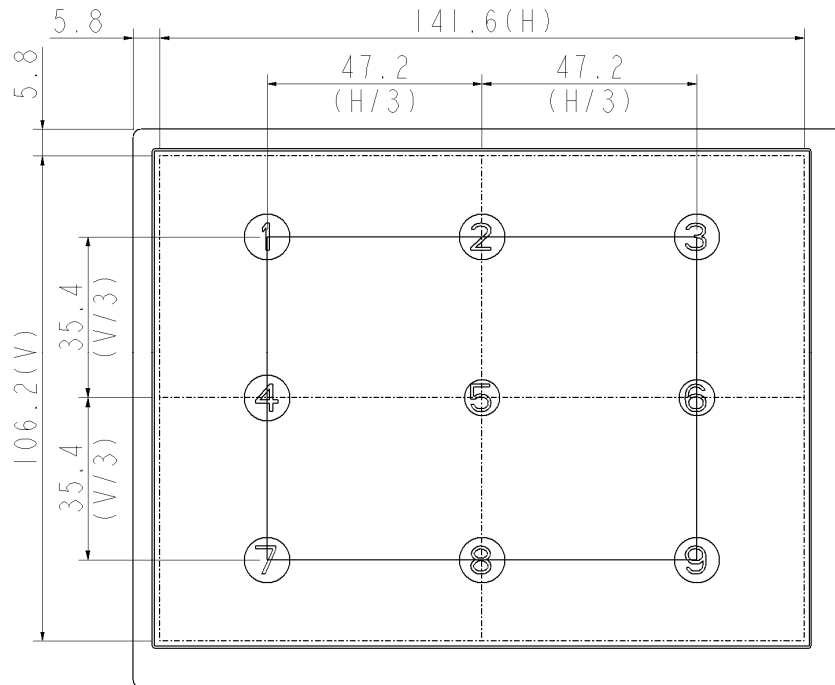


Fig.8-1 Measuring point

\*4) Definition of Viewing Angle( $\theta, \psi$ ), refer to Fig.8-2 as below :

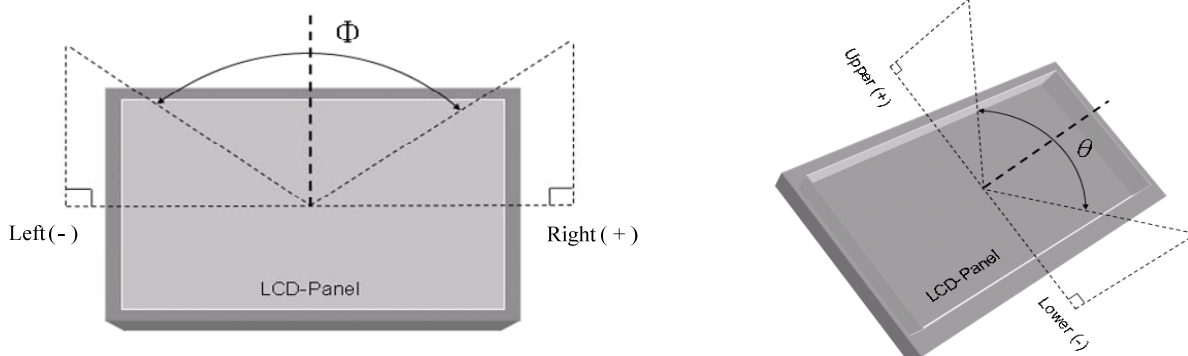


Fig.8-2 Definition of Viewing Angle

\*5) Definition of Response Time.

The response time is defined as the time interval between the 10% and 90% amplitudes. Refer to Fig.8-3 as below.

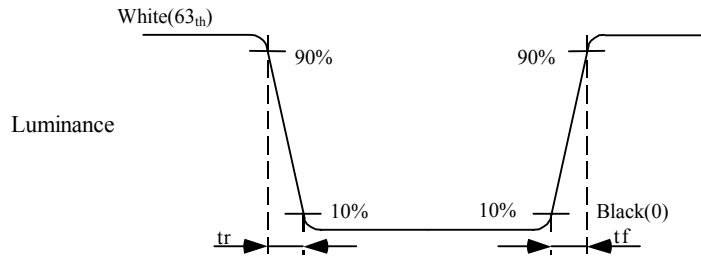


Fig.8-3 Definition of Response Time

## 8. RELIABILITY TEST

### 8.1 Temperature and Humidity

TEST ITEMS	CONDITIONS	REMARK
High Temperature Operation	60° C ; 240hrs	
High Temperature High Humidity Operation	40° C ; 90% RH ; 240hrs	No condensation
High Temperature Storage	70° C ; 240hrs	
Low Temperature Operation	-20° C ; 240hrs	
Low Temperature Storage	-30° C ; 240hrs	
Thermal Shock	-30° C (0.5hr)~70° C (0.5hr) 100 CYCLE	No operation

### 8.2 Shock and Vibration

ITEMS	CONDITIONS
Shock (Non-Operation)	<ul style="list-style-type: none"> <li>● Shock level: 980m/s<sup>2</sup>(equal to 100G).</li> <li>● Waveform: half sinusoidal wave,6ms.</li> <li>● Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of three shock inputs.</li> </ul>
Vibration (Non-Operation)	<ul style="list-style-type: none"> <li>● Frequency range : 8~33.3Hz</li> <li>● Stoke : 1.3 mm</li> <li>● Vibration : sinusoidal wave, perpendicular axis(both x, z axis:2Hrs, y axis 4Hrs).</li> <li>● Sweep : 2.9G, 33.3 Hz -400 Hz</li> <li>● Cycle : 15 min</li> </ul>

### 8.3 Electrostatic Discharge

TEST ITEM	CONDITIONS	Note
ESD	150pF , 330Ω , ±8kV&±15kV air	(1)
	200pF , 0Ω , ±200V contact test	(2)

Measure point :

- (1) LCD glass and metal bezel
- (2) IF connector pins

### 8.4 Judgment Standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

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