



# Chunghwa Picture Tubes, Ltd.

## Technical Specification

To : **SCL**

Date : **2011/05/19**

*CPT TFT-LCD*  
**CLAA101NC05**

**ACCEPTED BY :**  
( TENTATIVE )

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### **Modification Record List**

Revision Notice	Description	Rev. Date
1.0	First revision(Tentative)	2011/05/19

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## 1. OVERVIEW

**CLAA101NC01** is 10.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight. By applying 6 bit digital data, 1024×RGB (3) ×600, 262K-color images are displayed on the 10.1" diagonal screen. general specifications are summarized in the following table :

ITEM	SPECIFICATION
Display Area (mm)	222.72 (H)x125.28 (V) (10.1-inch diagonal)
Number of Pixels	1024 x3(H)x600 (V)
Pixel Pitch (mm)	0.2175 (H)x0.2088(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white
Number of Colors	262,144(6bits)(LVDS)
Gamut	42%(min)/45%(Typ)
Optimum Viewing Angle	6 o'clock
Response Time (ms)	20ms (Typ)
Surface Treatment	Anti Glare type , Hardness : 3H
Viewing Angle	40°、40°/15°、30°(Min)
Brightness (cd/m <sup>2</sup> )	200 cd/m <sup>2</sup> (5point)/20 mA (Typ) 180 cd/m <sup>2</sup> (5point)/20 mA (Min)
Uniformity	5point : 80 %(Min)
Consumption of Power (W)	2.1W (Typ)
Module Size (mm)	235.5(W)x143.5(H)x5.2(D) (Max)
Module Weight (g)	190 (max)

The LCD Products listed on this document are not suitable for use of aerospace equipment, submarine cable, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for applications listed above or those not included in the "Standard" list as follows, please contact our sales in advance.

Standard : Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tool, Industrial robot, Audio and Visual equipment, Other consumer products.

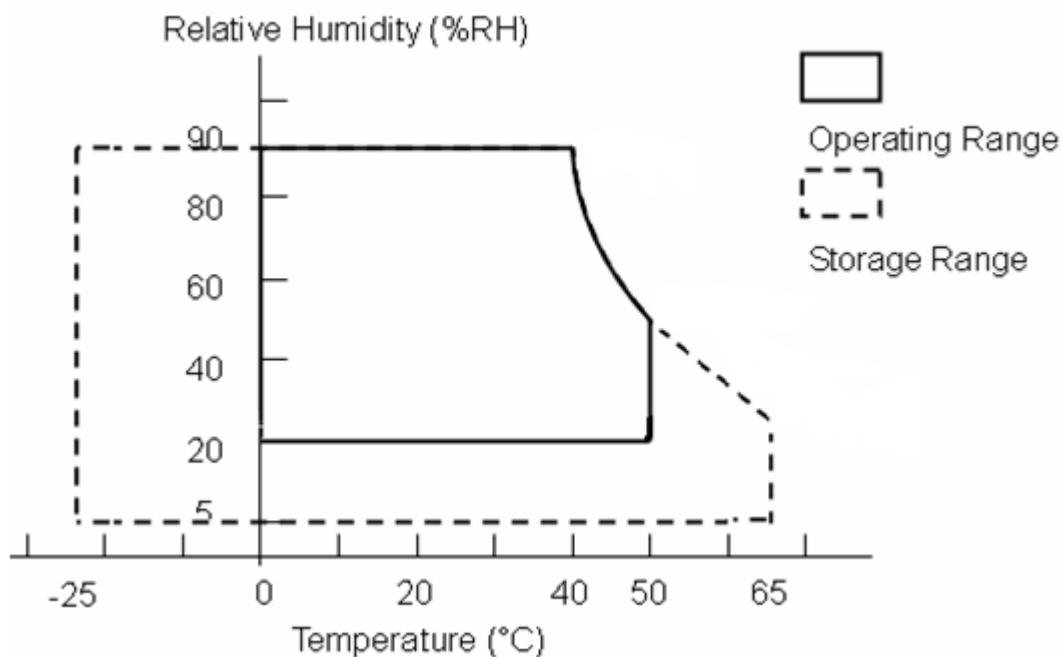
## 2. ABSOLUTE MAXIMUM RATINGS

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

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
LCD Power Voltage	VCC	0	4.0	V	
Operation Temperature	Top	0	50	°C	*1).*2).*3).*4)
Storage Temperature	Tstg	-25	65	°C	*1).*2).*3)

### 【Note】

- \*1) The relative temperature and humidity range are as below sketch, 90%RH Max. ( $T_a \leq 40^\circ\text{C}$ )
- \*2) The maximum wet bulb temperature  $\leq 39^\circ\text{C}$  ( $T_a > 40^\circ\text{C}$ ) and without dewing.
- \*3) If product in environment which over the definition of the relative temperature and humidity out of range too long, it will affect visual of LCD.
- \*4) If you operate LCD in normal temperature range, the center surface of panel should be under  $50^\circ\text{C}$ .



### 3. ELECTRICAL CHARACTERISTICS

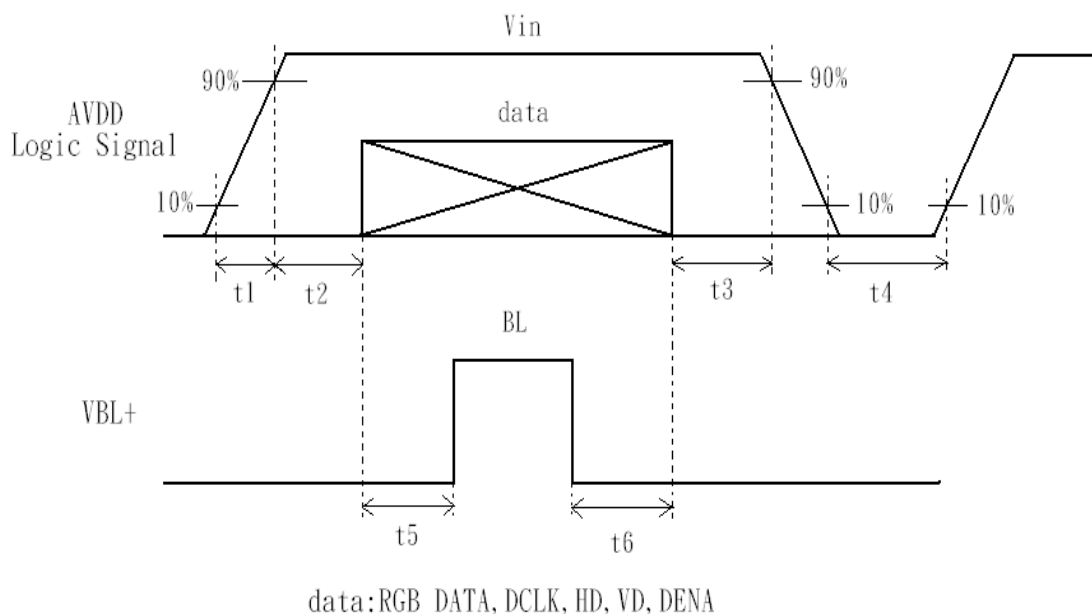
#### (A) TFT LCD

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage		VCC	3.0	3.3	3.6	V	*1)
LCD Power Current		ICC	(TBD)	(TBD)	(TBD)	mA	*2)
Rush Current		Irush	-	-	2	A	*4)
Logic Input Voltage (LVDS: IN+,IN-)	Common Voltage	VCM	VID   /2	-	2.4 - (   VID   /2)	V	*3)
	Differential Input Voltage	VID	100	-	600	mV	*3)
	Threshold Voltage(HIGH)	VTH	-	-	100	mV	*3) VCM =1.2V
	Threshold Voltage(LOW)	VTL	-100	-	-	mV	

**【Note】**

\*1) Power Sequence :

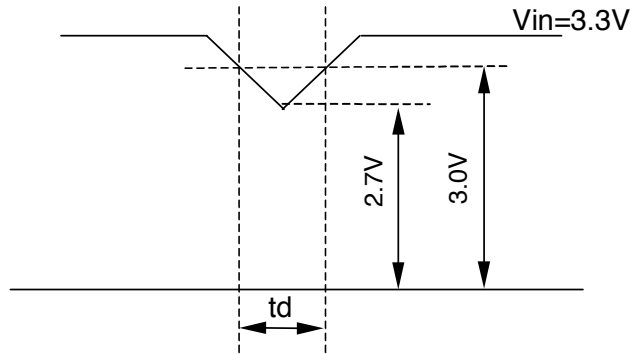
- |  |                         |
|--|-------------------------|
| $0.50\text{ ms} \leq t1 \leq 10\text{ ms}$ | $500\text{ ms} \leq t4$ |
| $0.01\text{ ms} < t2 \leq 50\text{ ms}$    | $200\text{ ms} \leq t5$ |
| $0.01\text{ ms} < t3 \leq 50\text{ ms}$    | $200\text{ ms} \leq t6$ |



VCC-dip state

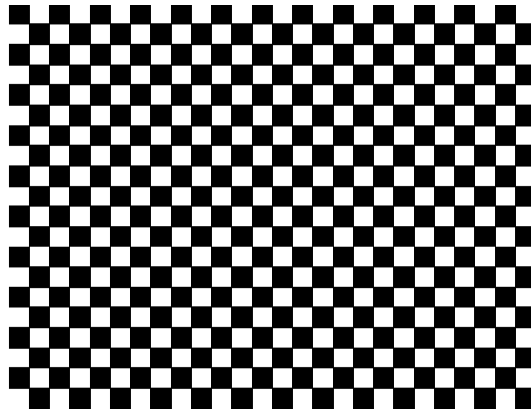
(1) when  $3.0V > VCC \geq 2.7V$ ,  $t_d \leq 10$  ms.

(2) when  $VCC < 2.7V$ , VCC-dip condition should as the VCC-turn-off condition.



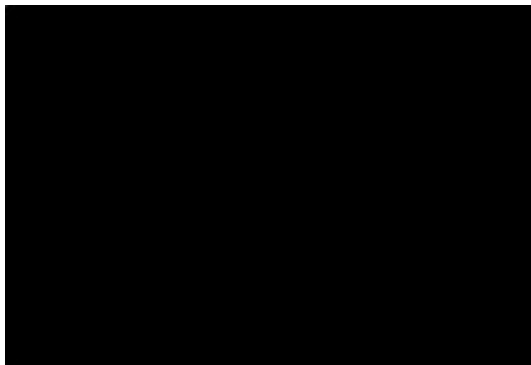
\*2) Typical value is Mosaic (32\*36 Checker board) Pattern : 768 line mode.

Circuit condition (Typ) :  $VCC=3.3$  V ,  $f_V=60$  Hz ,  $f_H=48.35$  kHz ,  $f_{CLK}=58.03$  MHz.

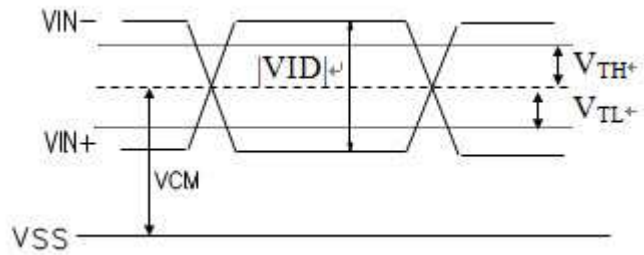
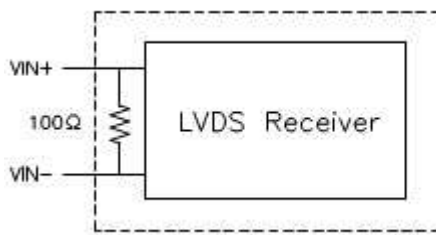


Max value is Black Pattern : 768 line mode.

Circuit condition (Max) :  $VDD=3.3$  V ,  $f_V=60$  Hz ,  $f_H=48.35$  kHz ,  $f_{CLK}=58.03$  MHz.



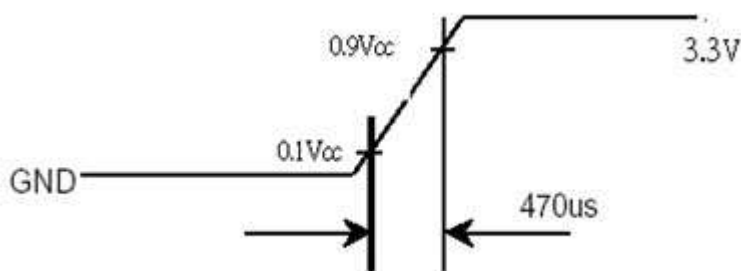
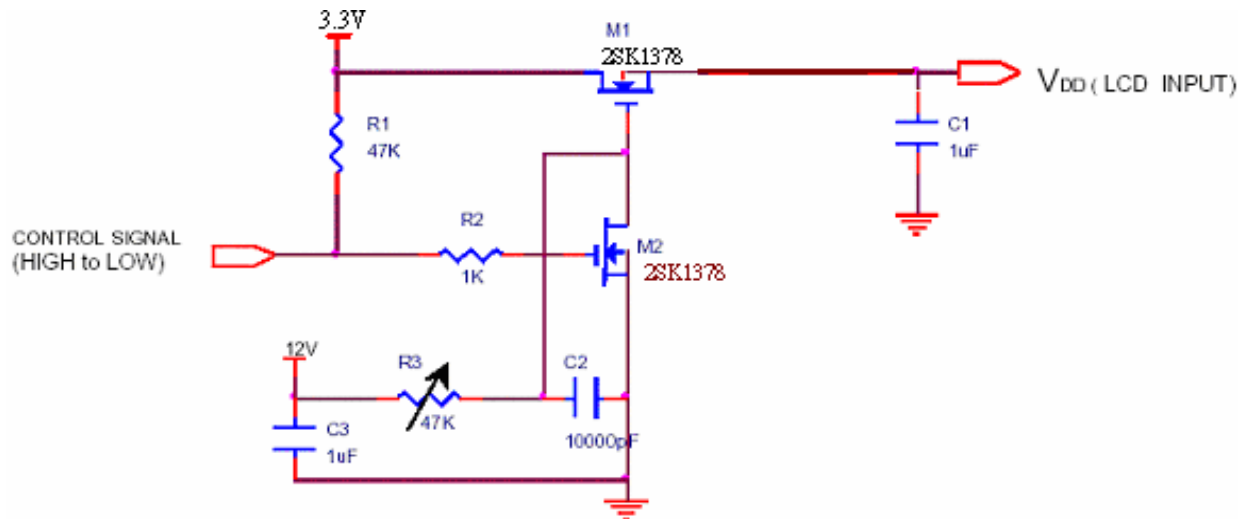
\*3) LVDS Signal Definite :



VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

\*4) Irush measure condition





**(B) BACK LIGHT**

(a.) ELECTRICAL CHARACTERISTICS

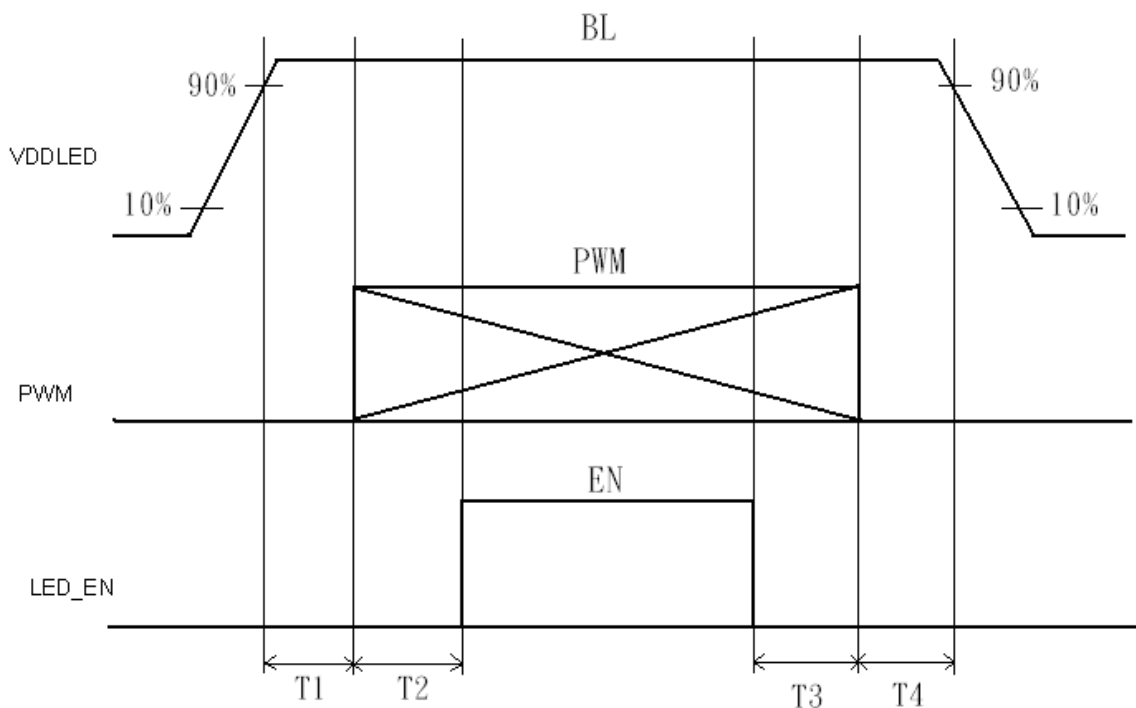
Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VBL+	5	-	19	V	
LED Driver Input Current	IBL+	-	-	TBD	mA	*1)
Forward Voltage	VF	3.0	3.2	3.5	V	*2) I <sub>F</sub> =20mA
Forward Current	IF	18	20	22	mA	*2)
Power consumption	PLED	-	TBD	TBD	W	*2)*3) I <sub>F</sub> =20mA
PWM Frequency	PWM_BL	180	200	1k	Hz	
Duty ratio	Dim	10		100	%	

(b.) LED LIFE – TIME

ITEM	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Life Time	I <sub>F</sub> =20mA · Ta=25°C	15000			hrs	*4)

(c.) LED ON/OFF Sequence :



10ms ≤ T1

0ms ≤ T3

10ms ≤ T2

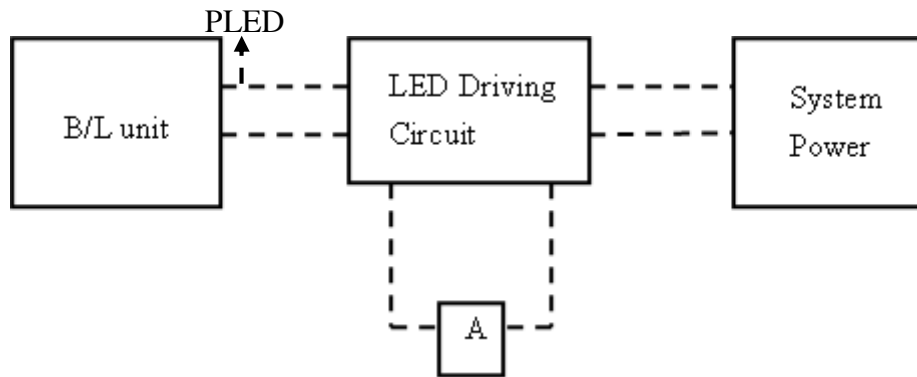
10ms ≤ T4

\*1) Typical value :  $V_{BL+} = 12V$  , Duty=100% ◦

Max value :  $V_{BL+} = 5V$  , Duty=100% ◦

\*2) Measure method : a. LED current is measured by utilizing a current meter as show below.

b. we set up system power input voltage at 12v to measurement PLED.



\*3) Calculator value for reference  $I_F \cdot V_F = P_{LED}$

\*4) Life time means that estimated time to 50% degradation of initial luminous intensity.

## 4. Connector Interface PIN & Function

### CN (Interface signal)

Connector type : CN1(Input signal) JAE\_HD1S04HA 1-R6000 / TYCO5-2069716-3 or compatible

Pin No.	SYMBOL	FUNCTION
1	NC	NC
2	V <sub>CC</sub>	+3.3V Power
3	V <sub>CC</sub>	+3.3V Power
4	V_EDID	EDID 3.3V Power
5	NC	NC
6	CLK_EDID	EDID Clock
7	DATA_EDID	EDID Data
8	RXIN0-	LVDS Signal(-) – channel 0
9	RXIN0+	LVDS Signal(+)- channel 0
10	GND	Ground
11	RXIN1-	LVDS Signal(-) – channel 1
12	RXIN1+	LVDS Signal(+)- channel 1
13	GND	Ground
14	RXIN2-	LVDS Signal(-) – channel 2
15	RXIN2+	LVDS Signal(+)- channel 2
16	GND	Ground
17	RXCLKIN-	LVDS Clock Signal(-)
18	RXCLKIN+	LVDS Clock Signal(+)
19	GND	Ground
20	NC	NC
21	NC	NC
22	GND	Ground
23	NC	NC
24	NC	NC
25	GND	Ground
26	NC	NC
27	NC	NC
28	GND	Ground
29	NC	NC
30	NC	NC
31	VSSLED	Ground – LED
32	VSSLED	Ground – LED
33	VSSLED	Ground – LED
34	NC	NC
35	PWM	System PWM Signal Input (+3.3V Swing)
36	LED_EN	LED enable pin (+3.3V Input)
37	NC	NC(Please let it floating for CPT test only)
38	V <sub>LED</sub>	Power Supply for LED(V <sub>LED</sub> =5V ~ 19V)
39	V <sub>LED</sub>	Power Supply for LED(V <sub>LED</sub> =5V ~ 19V)
40	V <sub>LED</sub>	Power Supply for LED(V <sub>LED</sub> =5V ~ 19V)

## 5. INTERFACE TIMING CHART

### (A) Timing Chart

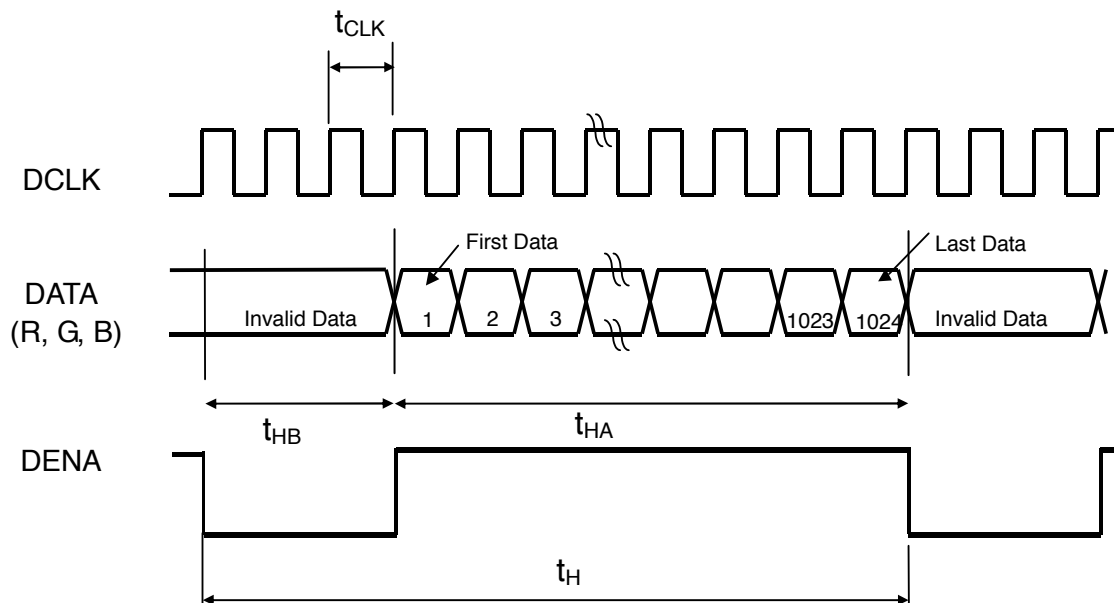
ITEM		SYMBOL	MIN	TYP	MAX	UNIT		
LCD Timing	Frame Rate		-	(60)	60	(60)	Hz	
	DCLK	Frequency	$f_{CLK}$	42.59	45	61.51	MHz	
		Period	$t_{CLK}$	21.06	22.22	23.47	ns	
	DENA	Horizontal	Horizontal Total time	$t_H$	1160	1200	1620	$t_{CLK}$
			Horizontal Active time	$t_{HA}$	1024			
			Horizontal Blank time	$t_{HB}$	136	176	578	$t_{CLK}$
		Vertical	Vertical Total time	$t_V$	612	625	640	$t_H$
			Vertical Active time	$t_{VA}$	600			
			Vertical Blank time	$t_{VB}$	12	25	40	$t_H$

**【Note】**

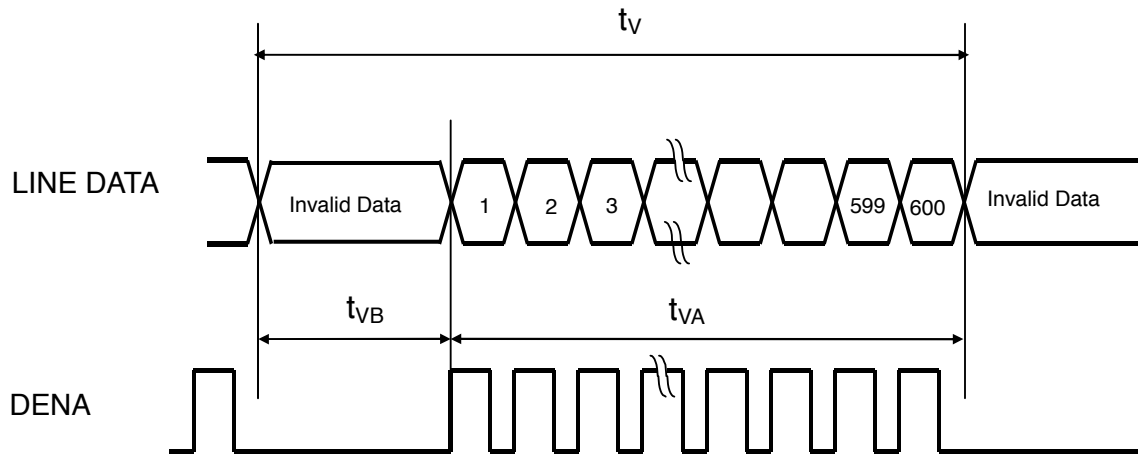
- \*1) DENA (DATA ENABLE) usually is positive.
- \*2) During the whole blank period, DCLK should keep input.

### (B) Time Sequence

#### (a.) Horizontal sequence



(b.) Vertical sequence



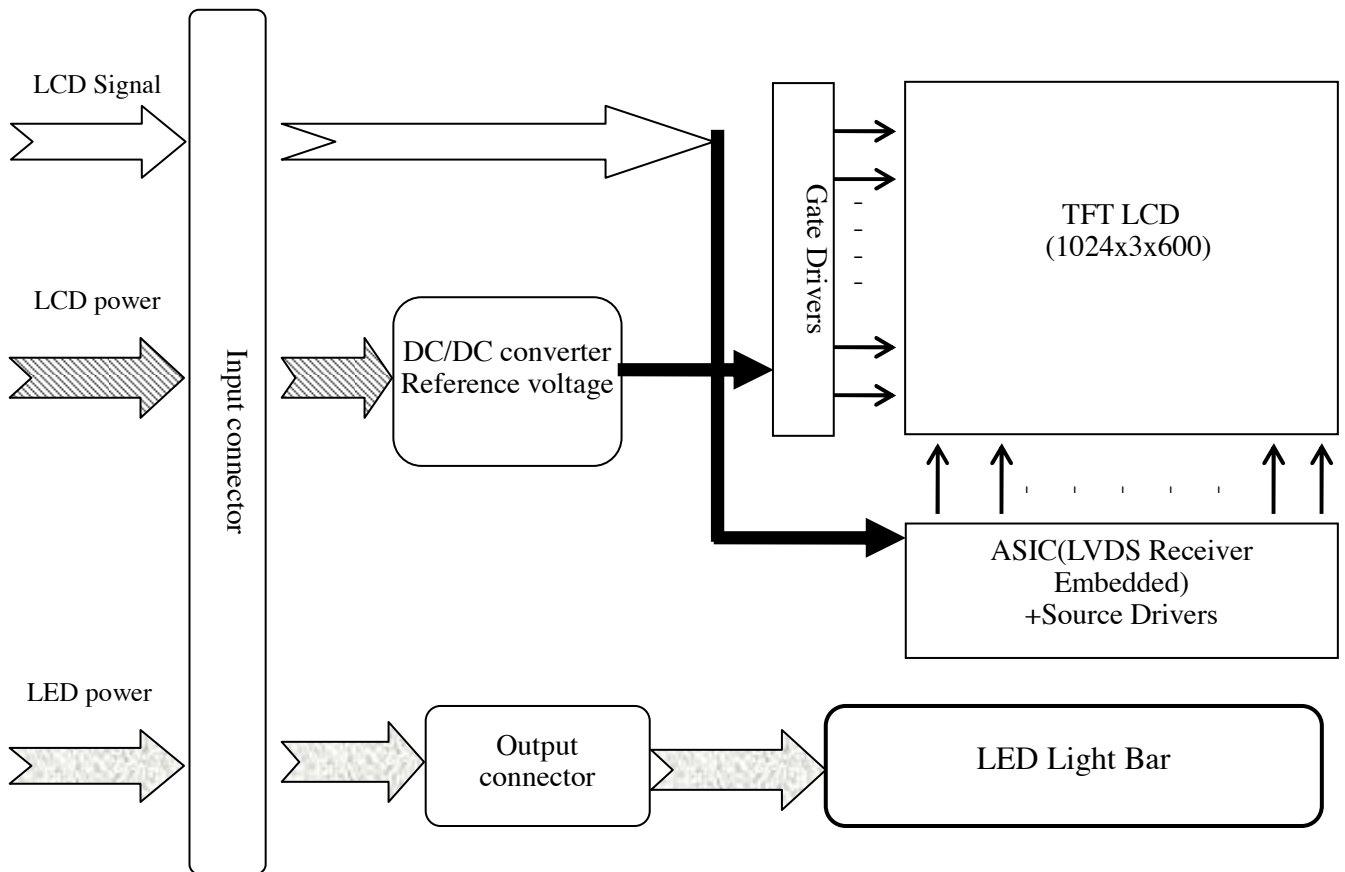
(3) DATA mapping

COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		R5 MSB	R4	R3	R2	R1	R0 LSB	G5 MSB	G4	G3	G2	G1	G0 LSB	B5 MSB	B4	B3	B2	B1	B0 LSB
BASIC COLOR	BLACK	0	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	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	RED(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	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(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	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE(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	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

【Note】

- 1) Gray level : Color(n) : n is level order; higher n means brighter level.
- 2) DATA : 1: high , 0: low

### 6. BLOCK DIAGRAM

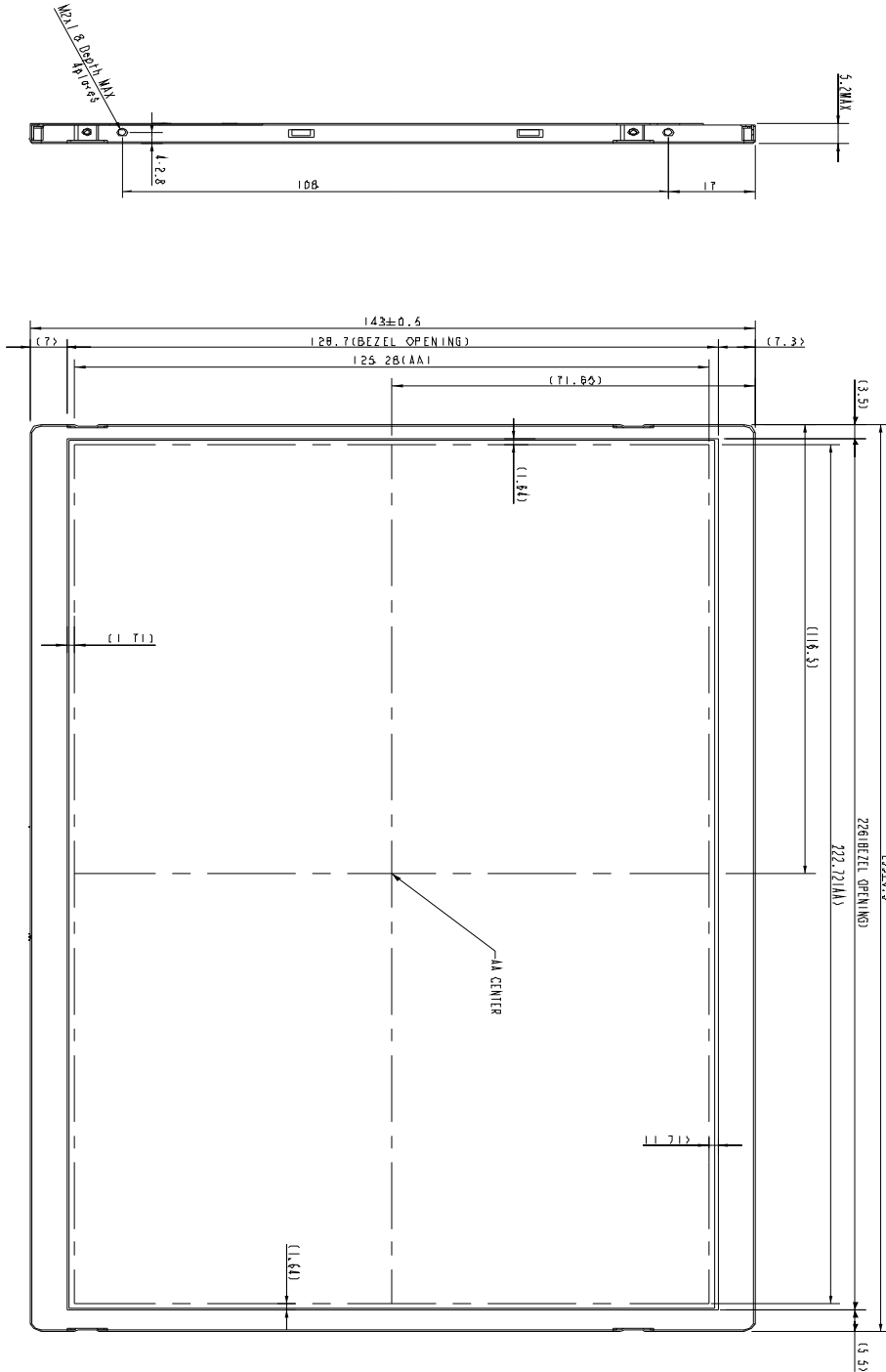


## 7. MECHANICAL SPECIFICATION

### (1) Front side

The tolerance, not show in the figure, is  $\pm 0.5$  mm.

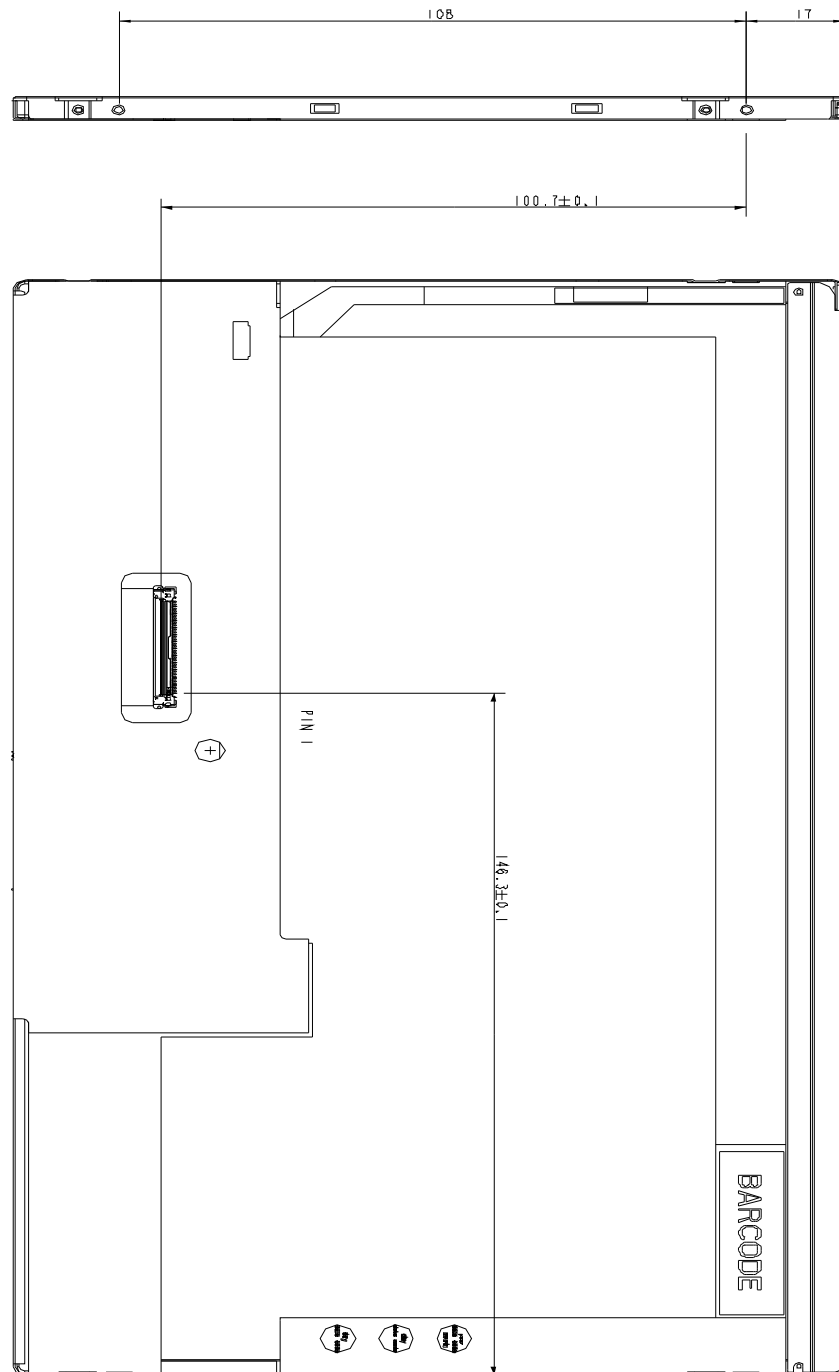
[Unit : mm]



(2) Rear side

The tolerance, not show in the figure, is  $\pm 0.5$  mm.

[Unit : mm]





## 8. OPTICAL CHARACTERISTICS

Ta=25°C , VDD=3.3V

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE	
Contrast Ratio	CR	$\theta = \psi = 0^\circ$	400	500	-	--	*1) 2)	
Luminance (5P)	L	$\theta = \psi = 0^\circ$	180	200	-	cd/m <sup>2</sup>	*1) 3)	
Uniformity(5P)	$\Delta L$	$\theta = \psi = 0^\circ$	80	-	-	%	*1) 3)	
Response Time	Tr	$\theta = \psi = 0^\circ$	-	(20)	-	ms	*5)	
	Tf							
Cross Talk	CT	$\theta = \psi = 0^\circ$	-	-	1	%	*6)	
View Angle	Horizontal	$\psi$	$CR \geq 10$	40/-40	-	-	°	*4)
	Vertical	$\theta$		15/-30	-	-	°	*4)
Color Coordinate	W	x	$\theta = \psi = 0^\circ$	0.283	0.313	0.343	*3)	
		y		0.299	0.329	0.359		
	R	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
	G	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
	B	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
Gamut		$\theta = \psi = 0^\circ$	(42)	45	-	%		
Gamma	$\gamma$	GL	2.0	2.2	2.4		*7)	

Color coordinate and color gamut are measured by SRUL1R, response time is measured by TRD-100, and all the other items are measured by BM-5A (TOPCON). All these items are measured under the dark room condition (no ambient light).

Measurement Condition: IL= 20mA (each LED)

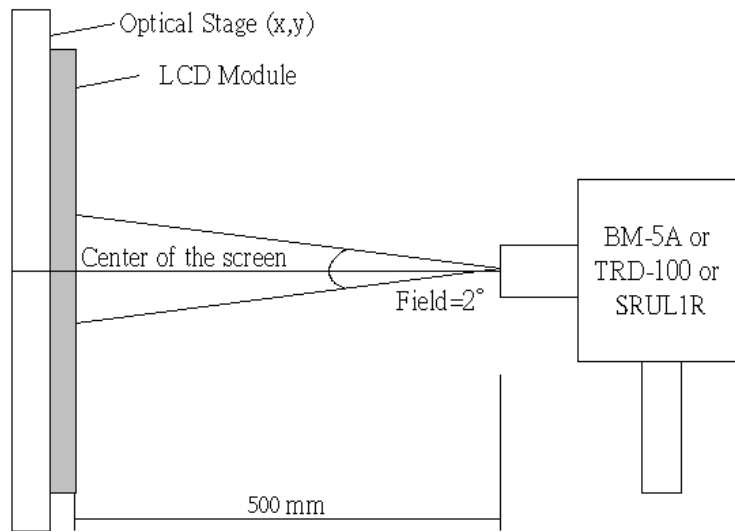
**Definition of these measurement items is as follows:**

**\*1) Setup of Measurement Equipment**

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.

**\*2) Definition of Contrast Ratio**

CR=ON (White) Luminance/OFF (Black) Luminance



**\*3) Definition of Luminance and Luminance uniformity**

- Central luminance : The white luminance is measured at the center position "5" on the screen, see Fig.1 below.
- 5P Luminance (AVG): The white luminance is measured at measuring points 5 · 10 · 11 · 12 · 13, see Fig.1 below.
- 5P Uniformity:  $\Delta L = (L_{min} / L_{max}) \times 100\%$
- 13P Uniformity:  $\Delta L = (L_{min} / L_{max}) \times 100\%$

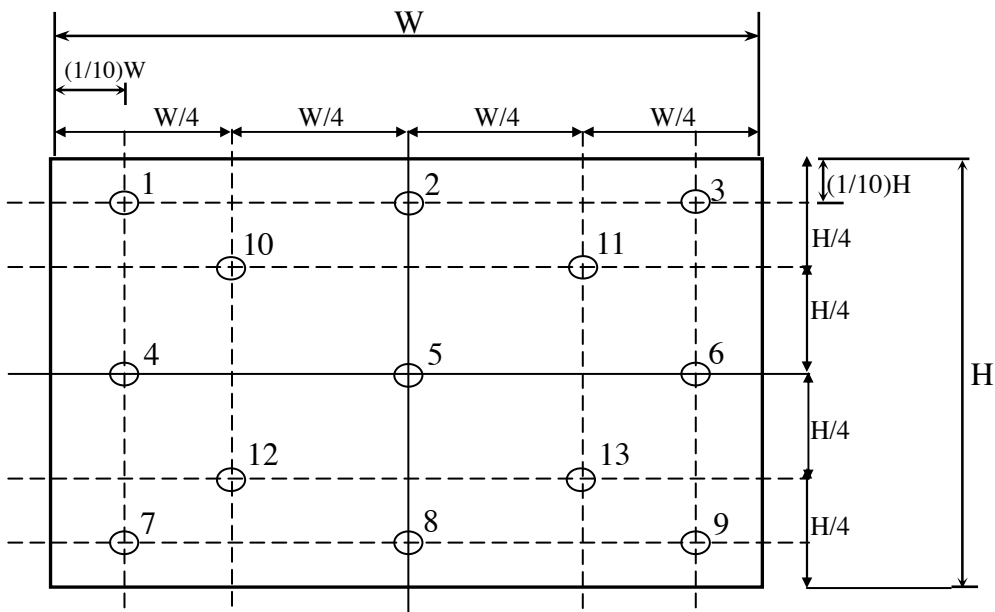
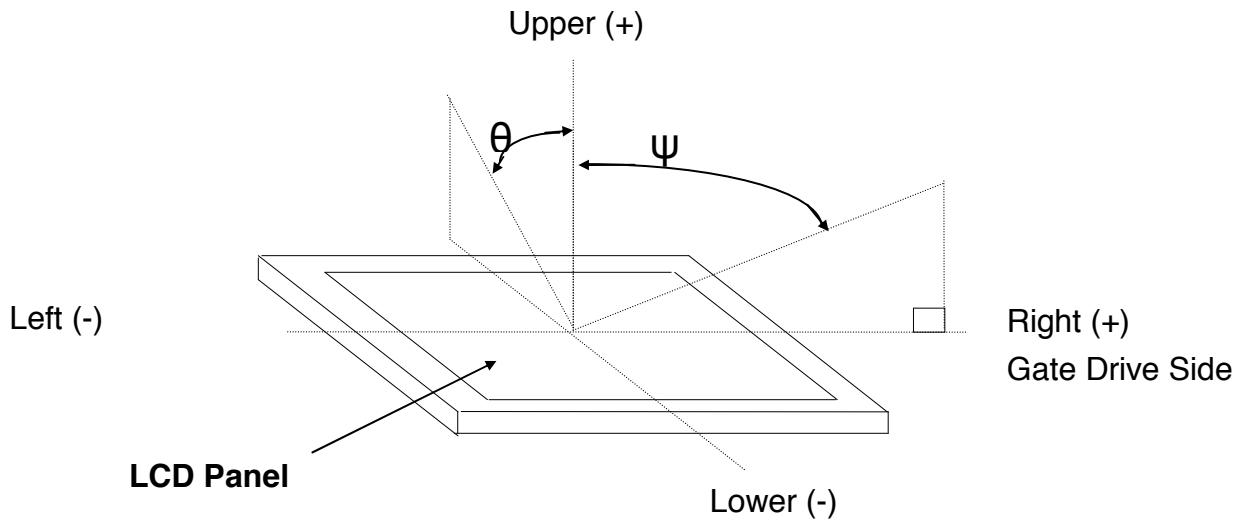
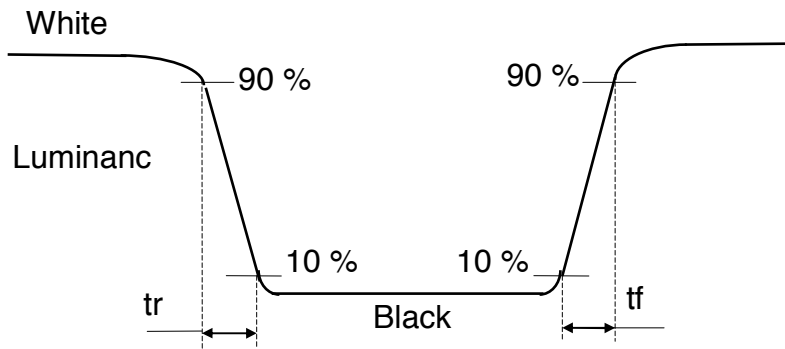


Fig.1 Measure point (Active area)

**\*4) Definition of view angle( $\theta$  ,  $\psi$ )**



**\*5) Definition of response time**



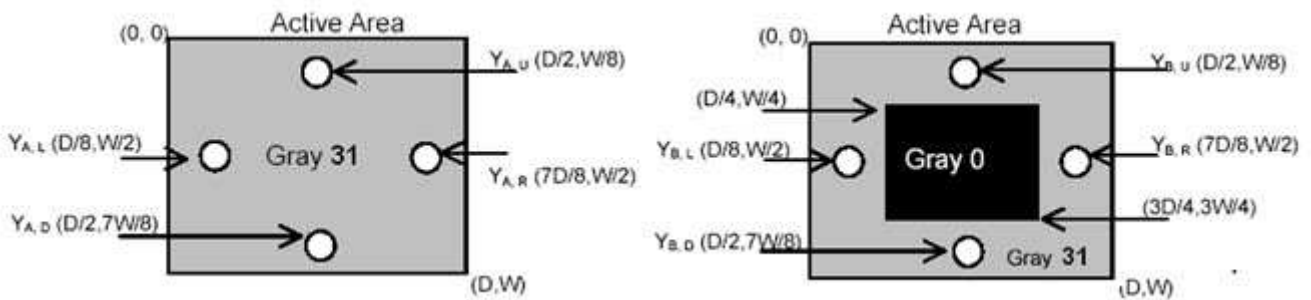
**\*6) Crosstalk Modulation Ratio**

$$CT = \frac{|Y_B - Y_A|}{Y_{Ax}} \times 100\%$$

$Y_A$  ,  $Y_B$  measure position and definition

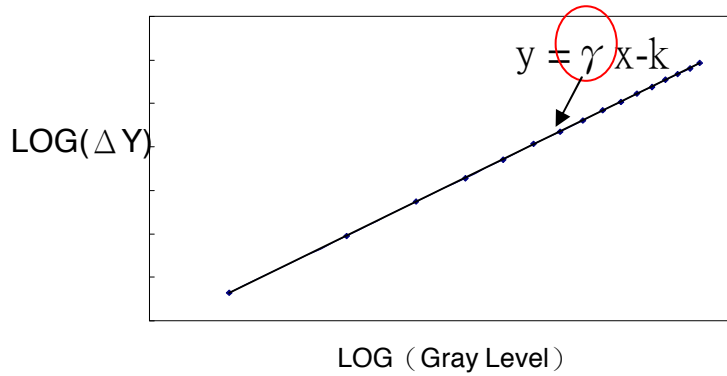
$Y_A$  means luminance at gray level 31(exclude gray level 0 pattern)

$Y_B$  means luminance at gray level 31(include gray level 0 pattern)



**\*7) Definition of Gamma (VESA)**

Based on Customer Sample, take the average value as a standard center value and the variation range of gamma value caused by loop voltage error should be between +/- 0.2. the bellow figure shows how to obtain the gamma curve and  $\gamma$  (from gray level: 0 \ 4 \ 8-----60 \ 63).



## 9. RELIABILITY TEST CONDITIONS

### (1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature Operation	50° C ; 250Hrs
High Temperature Storage	65° C ; 250Hrs
High Temperature High Humidity Operation	40° C ; 95% RH ; 240Hrs
High Temperature High Humidity Storage	60° C ; 90% RH ; 48 Hrs
Low Temperature Operation	0° C ; 250 Hrs
Low Temperature Storage	-25° C ; 250 Hrs
Thermal Shock	-40° C (0.5 Hr) ~ 65° C (0.5 Hr), Ramp < 20° C , 100 CYCLES
Temperature & Pressure Storage	-0° C ; 260hPa , 24 Hrs

### (2) Shock & Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	210G, 3ms, half sin ewave, ± X, ± Y, ± Z 1time each
Vibration (Non-Operation)	Vibration level: 14.7m/s <sup>2</sup> , 1.5G, sinusoidal wave (each x, y, z axis: 1hr, total 3 hrs) Frequency range: 5Hz to 500 Hz Sweep speed : 0.5 Octave/min

### (3) ESD

	Surface discharge(Panel display area · Frame · PWB · Panel back side)		Electrics capacity of Connector
	Contact	Air	Contact
Capacity	150 pF	150 pF	200 pF
Resistance	330 Ω	330 Ω	0 Ω
Voltage	±8kV/±15kV	±8kV/±15kV	±250 V
Interval	1 sec	1 sec	1 sec
Times(single point)	25	25	1

(4) MTBF without B/L: 200,000 Hrs (min) lifetimes.

### (5) 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.