Chunghwa Picture Tubes, Ltd.
Technical Specification

To

Date :

CPT TFT-LCD

CLAA070ND02A

ACCEPTED BY：

APPROVED BY	CHECKED BY	PREPARED BY

Niche Business Division
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Modification Record List

NO.	Issue Date	Modification Index
1	2011/02/16	First Version
2	2011/02/25	P4 / P14 Response time from 16ms to 20ms P6. Define the gate/ digital.. current

Table of Content

1. OVERVIEW

CLAA070ND02A is 7" color (17：10) TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight. By applying 8 bit digital data, 1024×RGB (3) ×600, 16.7M-color images are displayed on the 7" diagonal screen. General specifications are summarized in the following table :

ITEM	SPECIFICATION
Display Area	153.6(H)×90.0(V)(mm) (7-inch diagonal)
Number of Pixels	1024×3(H)×600(V)
Pixel Pitch	0.150 (H)×0.150(V) (mm)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white
Number of Colors	16.7M(HFRC)
Gamut	45%(Min)/50%(Typ)
Optimum Viewing Angle	6 o'clock
Response Time	(20)ms (Typ)/(40)ms(Max)
Surface Treatment	HC + Anti-Reflection < 2 %　3H
Viewing Angle	70°、70°/50°、70°(Min)
Brightness	300 cd/m^2 (center) (Min)/350 cd/m^2 (center) (Typ)
Uniformity	5point：80% 13point：70 %
Backlight Power Consumption	(1.20)W (Typ)
Panel Power Consumption	(0.45)W (Typ)
Module Size	166.05(W)×105.69 (H)×3.5 (D) (mm) (Max)
Module Weight	(120) g(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.
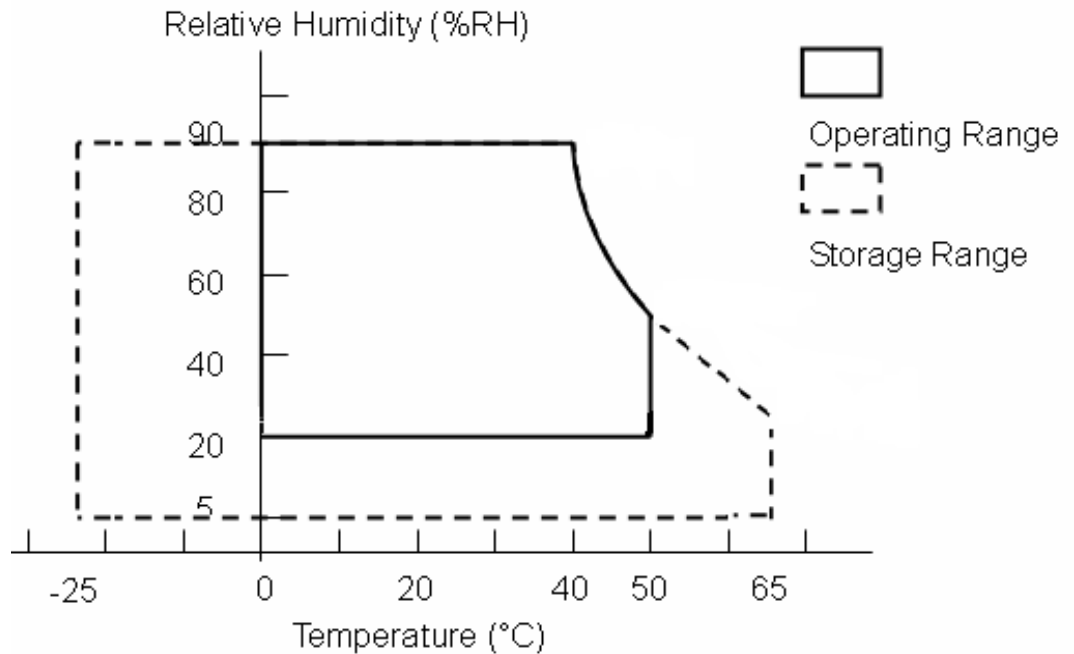
2. ABSOLUTE MAXIMUM RATINGS

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	DVDD	-0.3	5.0	V	
	AVDD	6.5	13.5	V	
	VGH	-0.3	42	V	
	VGL	-20	0.3	V	
	VGH-VGL	-	40.0	V	
Operation Temperature	Top	0	50	℃	*1).*2).*3).*4)
Storage Temperature	Tstg	-25	65	℃	*1).*2).*3)

【Note】

*1) The relative temperature and humidity range are as below sketch, 90%RH Max. (Ta≦40℃)

*2) The maximum wet bulb temperature ≦39℃(Ta＞40℃) 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.

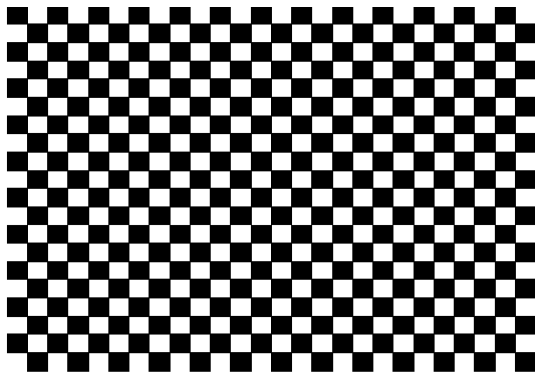*4) If you operate LCD in normal temperature range, the center surface of panel should be under 50℃.

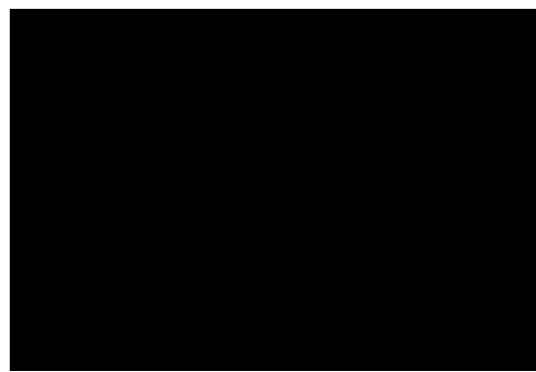## 3. ELECTRICAL CHARACTERISTICS
(A) TFT LCD

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Power Voltage		DVDD	3.0	3.3	3.6	V	*1).*5)
		AVDD	(10.8)	(11)	(11.2)	V	
		VGH	(19.7)	(20)	(20.3)	V	*5)
		VGL	(-6.5)	(-6.8)	(-7.1)	V	*5)
		VCOM	(3.2)	(3.7)	(4.2)	V	
Rush Current		Irush	-	-	2	A	*4)
Gate on power current		IVGH		(0.28)	(0.30)	mA	*2)
Gate off power current		IVGL		(0.29)	(0.31)	mA	*2)
Digital power current		IVDD		(31.3)	(35.0)	mA	*2)
Analog power current		IAVDD		(15.4)	(20.0)	mA	*2)
Logic Input Voltage (LVDS: IN+,IN-)	Common Voltage	VCM	1.125	1.25	1.375	V	*3)
	Differential Input Voltage	∣VID∣	250	350	450	mV	*3)
	Threshold Voltage (HIGH)	VTH	-	-	100	mV	*3) When VCM =+1.2V
	Threshold Voltage (LOW)	VTL	-100	-	-	mV	

【Note】

*1) Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.

*2) Typical value is Mosaic (32*36 Checker board) Pattern：600 line mode.

Circuit condition (Typ)：VDD=3.3 V，f_V=60 Hz，f_H=38.1 kHz，f_{CLK}=51.2 MHz.

Max value is Black Pattern：600 line mode.

Circuit condition (Max)：VDD=3.3 V，f_V=60 Hz，f_H=38.1 kHz，f_{CLK}=51.2 MHz
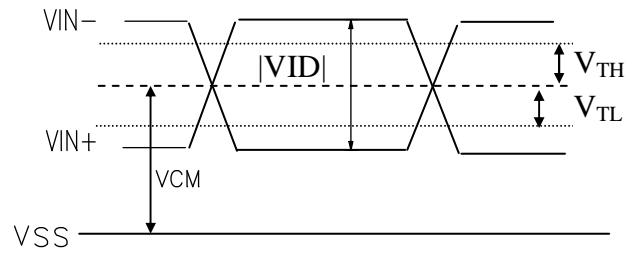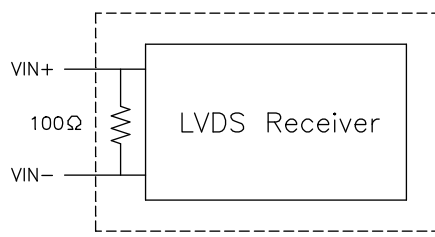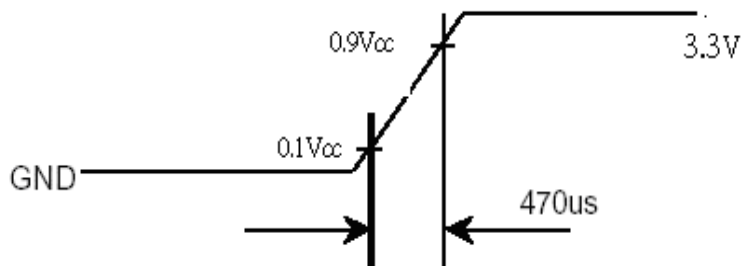

Mosaic Pattern
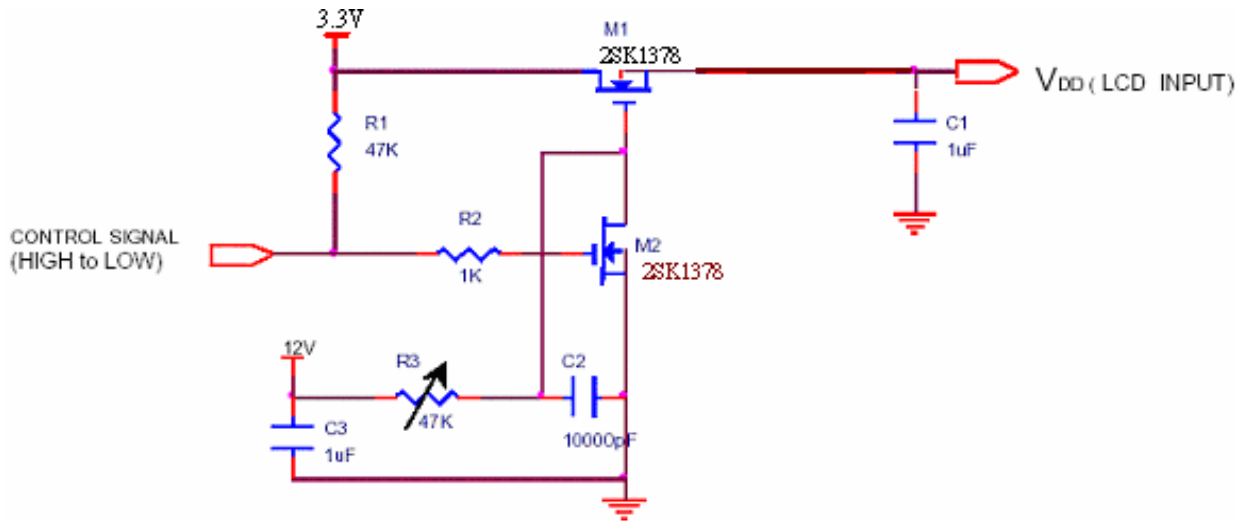

Black Pattern

*3) LVDS Signal Definite：

VIN+：Positive differential DATA & CLK Input

VIN-：Negative differential DATA & CLK Input

*4) Irush measure condition
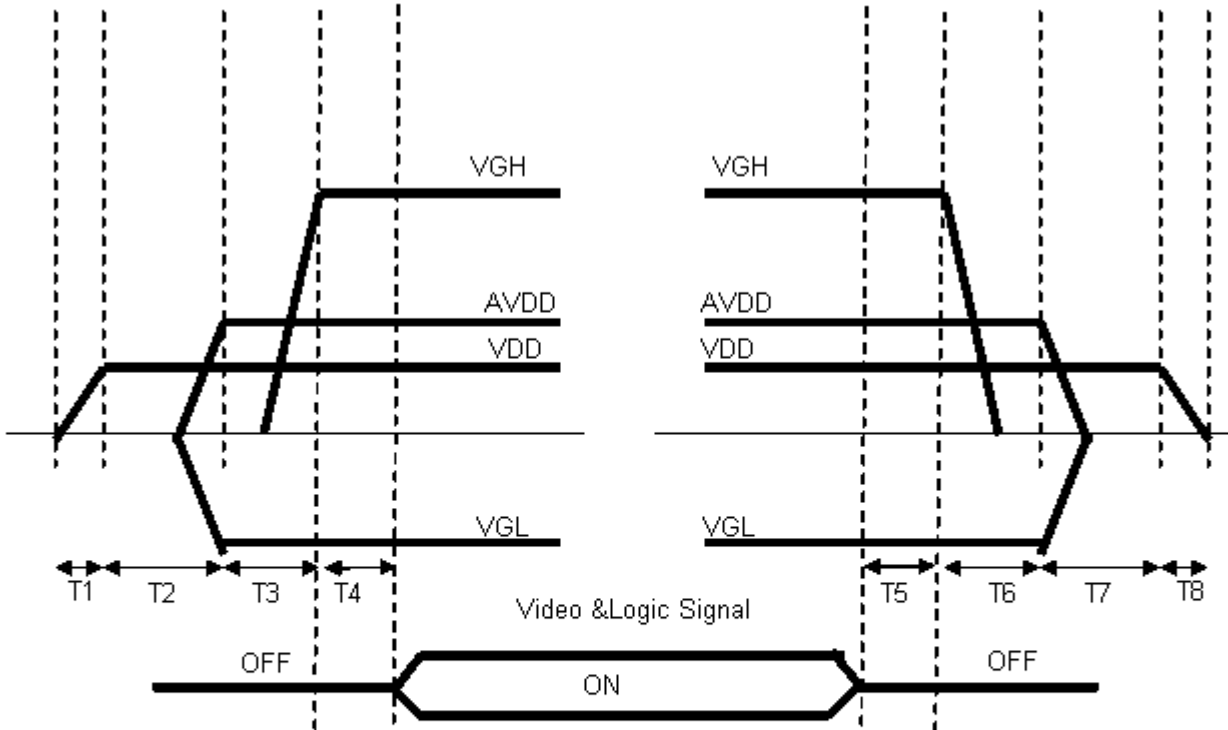

*5) Be sure to apply DVDD and VGL to the LCD first ,and then apply VGH.

*6) Power Sequence

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

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

$0 < T1 \leqq 10ms$
$20ms < T2$
$10ms < T3$
$0 < T4 \leqq 10ms$

$0 < T5 \leqq 10ms$
$0 < T6$
$0 < T7$
$0 < T8$

(C) BACK LIGHT

(a.)   ELECTRICAL CHARACTERISTICS   Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Forward Voltage	V_F	--	(8.7)	(9.0)	V	
Forward Current	I_F	--	(120)	(124)	mA	

(b.)   LED LIFE – TIME

ITEM	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Life Time	I_F=20mA、Ta=25℃	15000			hrs	*3)

【Note】

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

4. Connector Interface PIN & Function

CN (Interface signal)

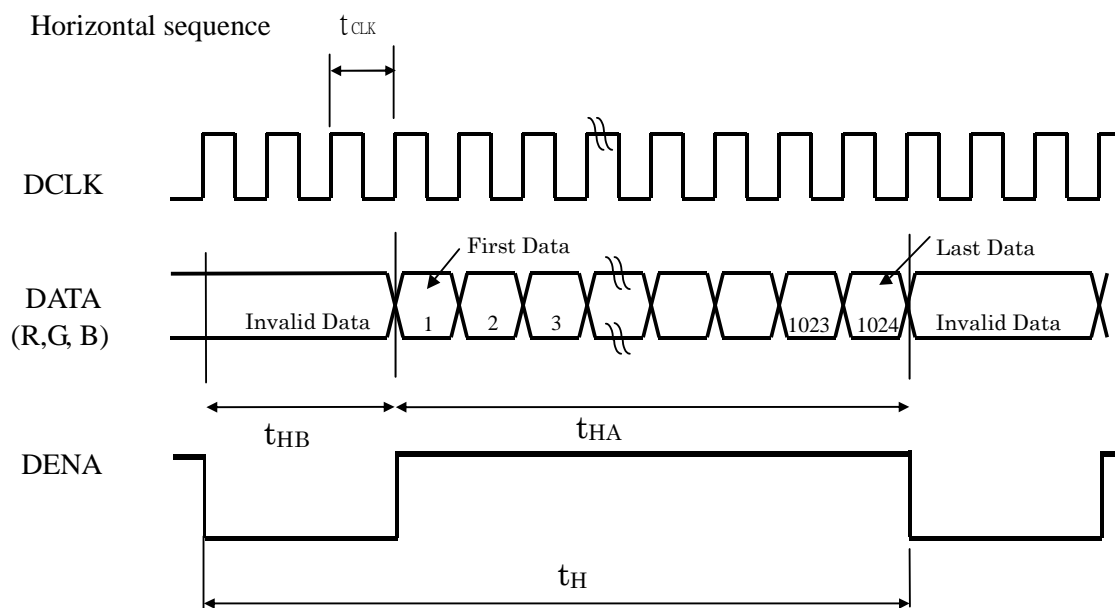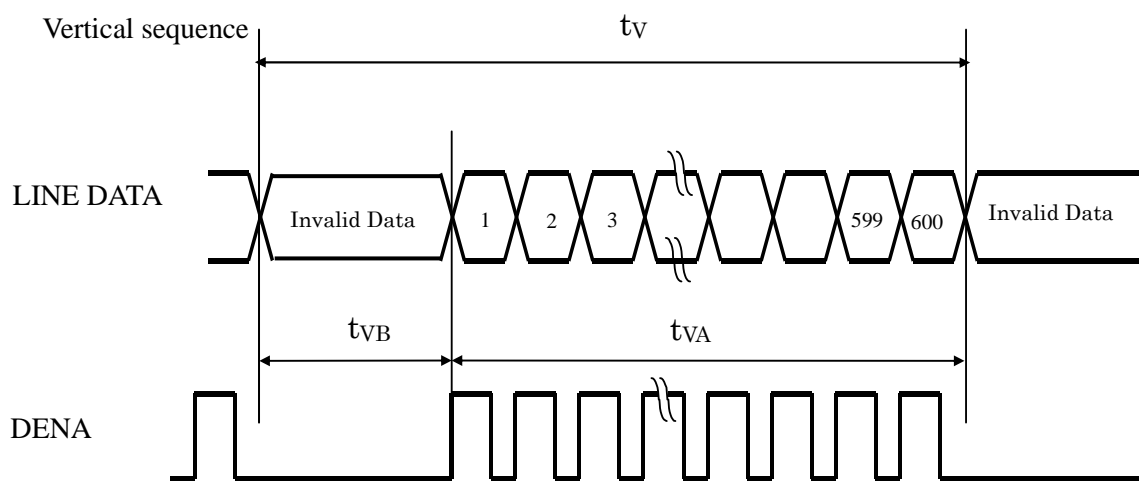| Pin No.	SYMBOL	I/O	FUNCTION	NOTE
1	VCOM	P	Common voltage	
2	VDD	P	Digital power	
3	VDD	P	Digital power	
4	NC	---	Not connect	
5	Rest	I	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=100KΩ，C=1μF)	
6	STBYB	I	Standby mode, normally pull high STBYB="1", normal operation STBYB="0",timing control, source driver will turn off, all output are high-Z	
7	GND	P	Ground	
8	RXIN0-	I	Negative LVDS differential data inputs	
9	RXIN0+	I	Positive LVDS differential data inputs	
10	GND	P	Ground	
11	RXIN1-	I	Negative LVDS differential data inputs	
12	RXIN1+	I	Positive LVDS differential data inputs	
13	GND	P	Ground	
14	RXIN2-	I	Negative LVDS differential data inputs	
15	RXIN2+	I	Positive LVDS differential data inputs	
16	GND	P	Ground	
17	RXCLKIN-	I	Negative LVDS differential clock inputs	
18	RXCLKIN+	I	Positive LVDS differential clock inputs	
19	GND	P	Ground	
20	RXIN3-	I	Negative LVDS differential data inputs	
21	RXIN3+	I	Positive LVDS differential data inputs	
22	GND	P	Ground	
23	NC	---	Not connect	
24	NC	---	Not connect	
25	GND	P	Ground	
26	NC	---	Not connect	
27	DIMO	O	Backlight CABC controller signal output	
28	SELB	I	6bit/8bit mode select H : 6bit / L : 8bit	
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31	LED-	P	LED Cathode	
32	LED-	P	LED Cathode	
33	L/R	I	Horizontal inversion	*1)
34	U/D	I	Vertical inversion	*1)
35	VGL	P	Negative power for TFT	
36	GND	---	Ground	
37	GND	---	Ground	
38	VGH	P	Positive power for TFT	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

I：input , O：output , P：Power

【Note】

*1)：When   L/R="0" , set right to left scan dirction

When   L/R="1" , set left to right scan dirction

When   U/D="0" , set top to bottom scan dirction

When   U/D="1" , set bottom to top scan dirction
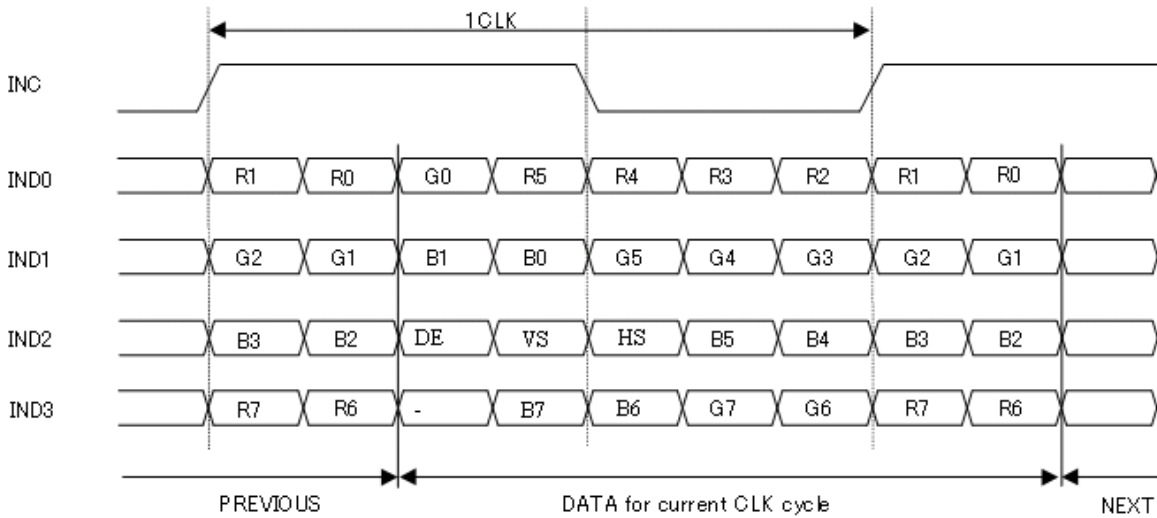
5. INTERFACE TIMING CHART

(A) LVDS input time sequence

Horizontal sequence

t_{CLK}

DCLK

DATA
(R, G, B)

Invalid Data | 1 | 2 | 3 | ... | 1023 | 1024 | Invalid Data

First Data

Last Data

t_{HB}

t_{HA}

DENA

t_H

(B) LCD input time sequence

Vertical sequence

t_V

LINE DATA

Invalid Data | 1 | 2 | 3 | ... | 599 | 600 | Invalid Data

t_{VB}

t_{VA}

DENA

(C) LVDS Input Data mapping

(D) Timing Chart

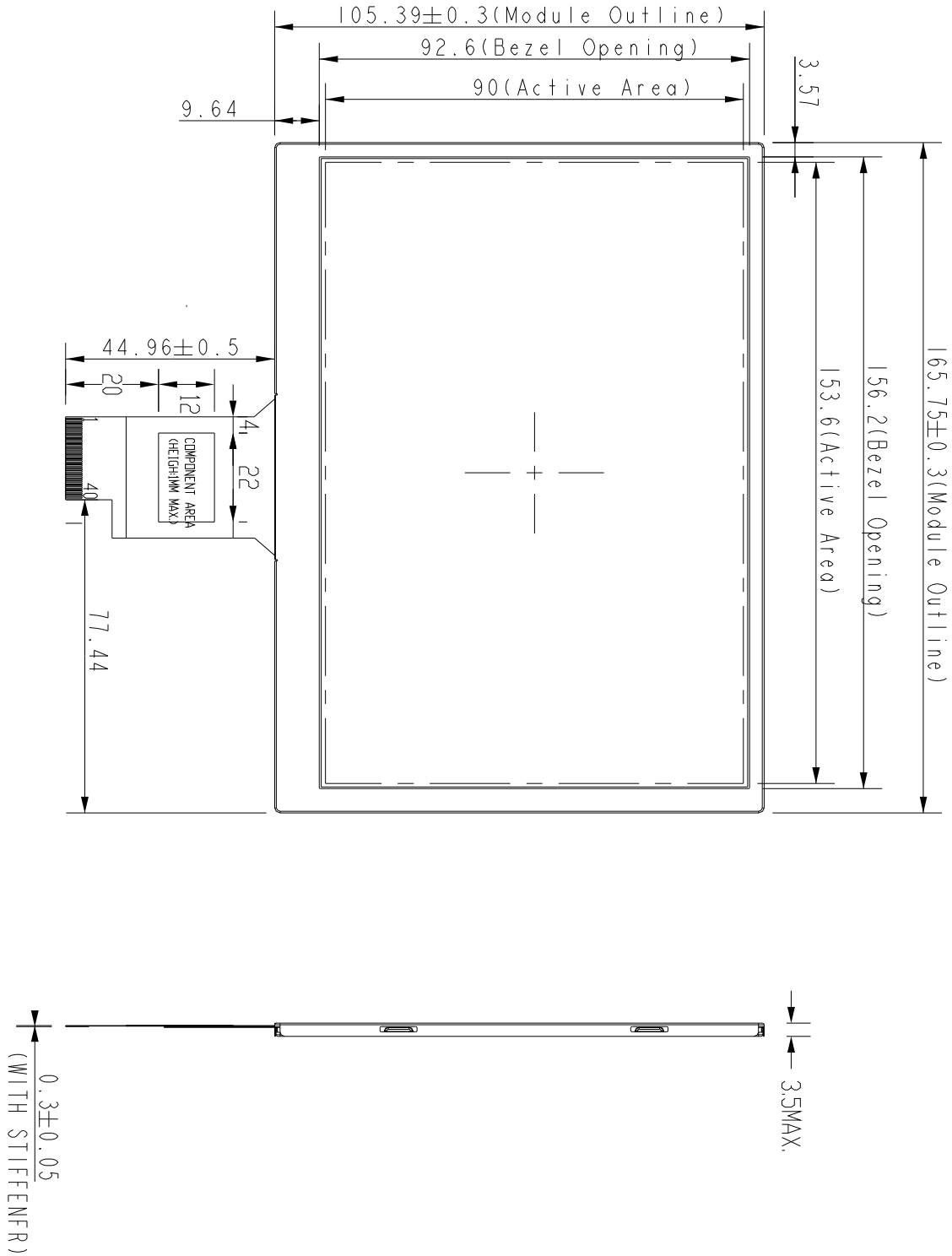| ITEM				SYNBOL	MIN	TYP	MAX	UNIT
LCD Timing		Frame Rate		-	60	60	60	Hz
	DCLK		Frequency	f_{CLK}	40.8	51.2	67.2	MHz
	DENA	Horizontal	Horizontal Total time	t_H	1114	1344	1400	t_{CLK}
			Horizontal Active time	t_{HA}		1024		t_{CLK}
			Horizontal Blank time	t_{HB}	90	320	376	t_{CLK}
		Vertical	Vertical Total time	t_V	610	635	800	t_H
			Vertical Active time	t_{VA}		600		t_H
			Vertical Blank time	t_{VB}	10	35	200	t_H

【Note】

*1) DENA (DATA ENABLE) usually is positive.

*2) During the whole blank period, DCLK should keep input.

6. MECHANICAL SPECIFICATION

(A) Front side

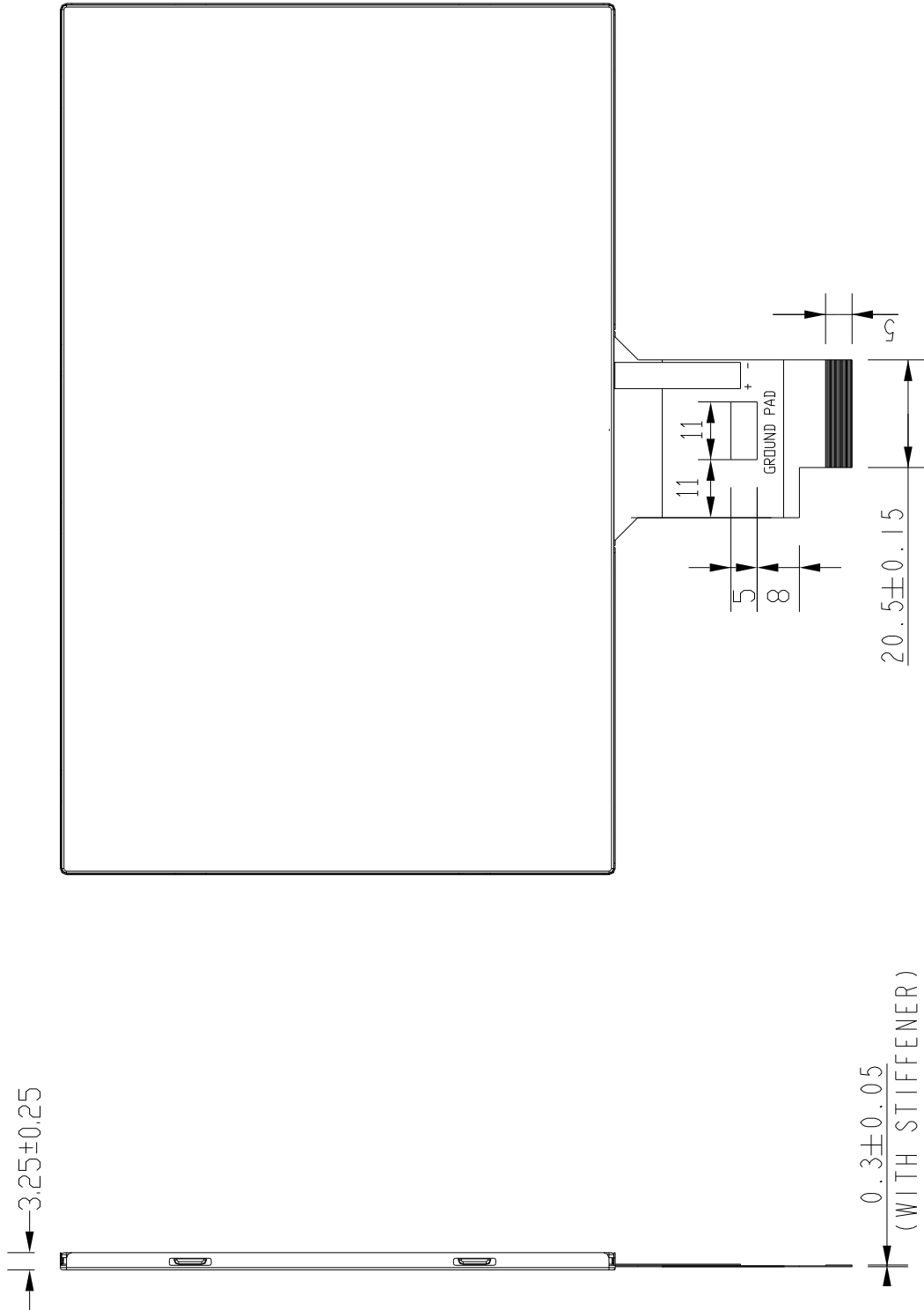The tolerance, not show in the figure, is ±0.5 mm.   [Unit：mm]

(B) Rear side

The tolerance, not show in the figure, is ±0.5 mm. [Unit：mm]

7. OPTICAL CHARACTERISTICS

Ta=25℃，VDD=3.3V

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Contrast Ratio		CR	θ=ψ= 0°	(500)	700	--	--	*1) 2)
Luminance (5P)		L	θ=ψ= 0°	(300)	350	--	cd/m^2	*1) 3)
Uniformity(5P)		ΔL	θ=ψ= 0°	80	--	--	%	*1) 3)
Uniformity(13P)		ΔL	θ=ψ= 0°	70	--	--	%	*1) 3)
Response Time	Tr	θ=ψ= 0°	--	(20)	(40)	ms	*5)
	Tf							
Cross Talk		CT	θ=ψ= 0°	--	--	1	%	*6)
View Angle	Horizontal	ψ	CR≧10	70/-70	80/-80	--	°	*4)
	Vertical	θ		50/-70	60/-80	--	°	*4)
Color Coordinate	W	x	θ=ψ= 0°	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			θ=ψ= 0°	45%	50%	--	%	
Gamma		γ	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).

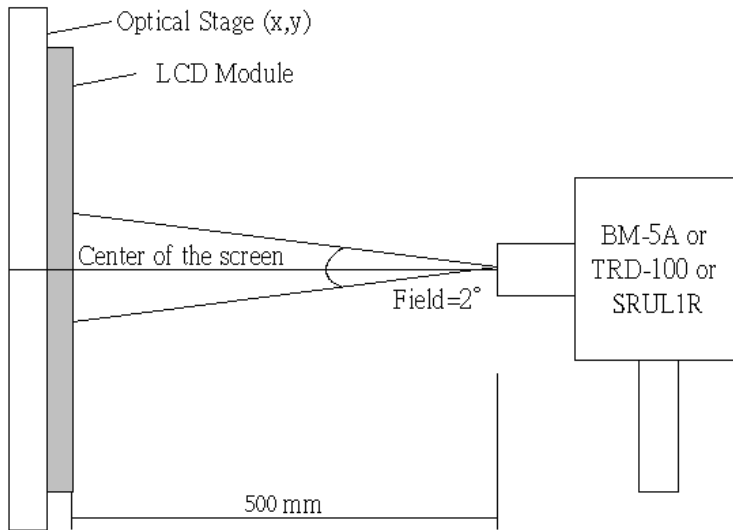Measurement Condition: IL= 12mA (each LED)

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: Δ L = (Lmin / Lmax) ×100%
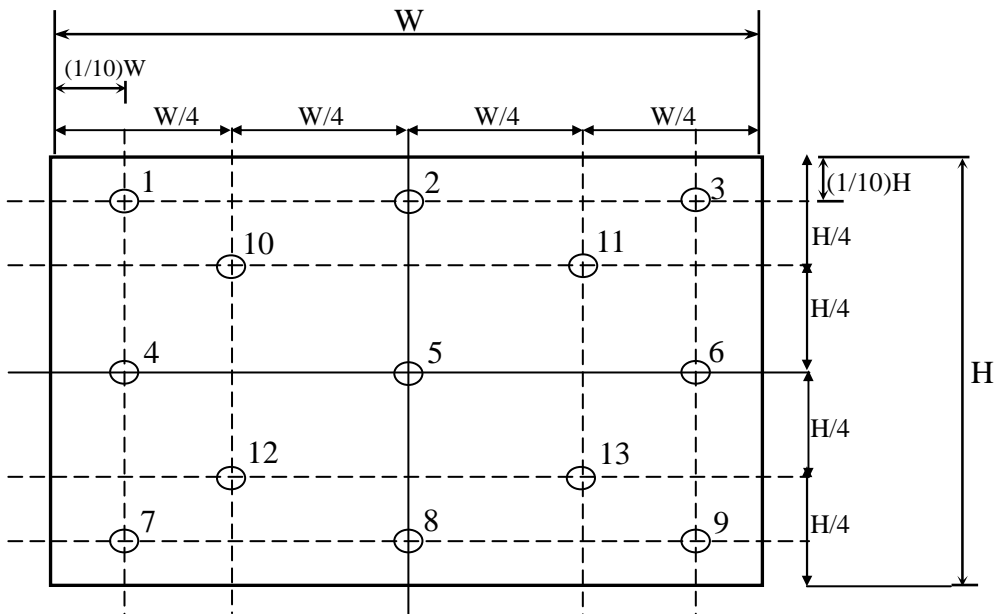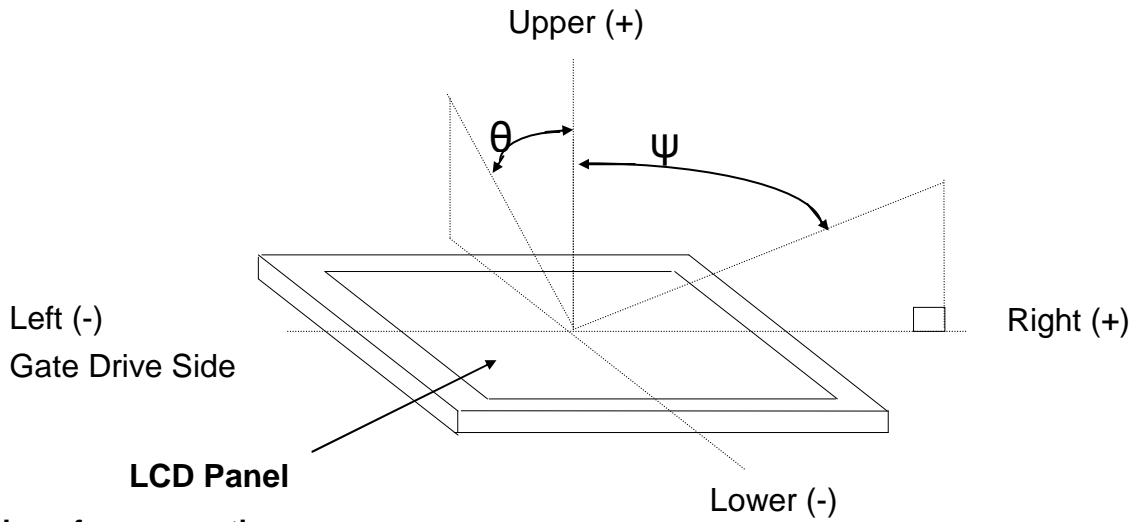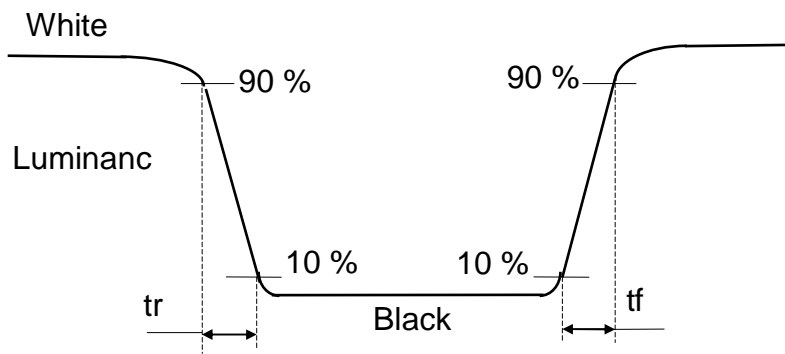
13P Uniformity: Δ L = (Lmin / Lmax) ×100%

Fig.1 Measure point (Active area)

*4) Definition of view angle(θ，ψ)

Upper (+)

θ   ψ

Left (-)   Right (+)
Gate Drive Side

LCD Panel
                                                                    Lower (-)

*5) Definition of response time

White

90 %   90 %

Luminanc

10 %   10 %

tr   Black   tf
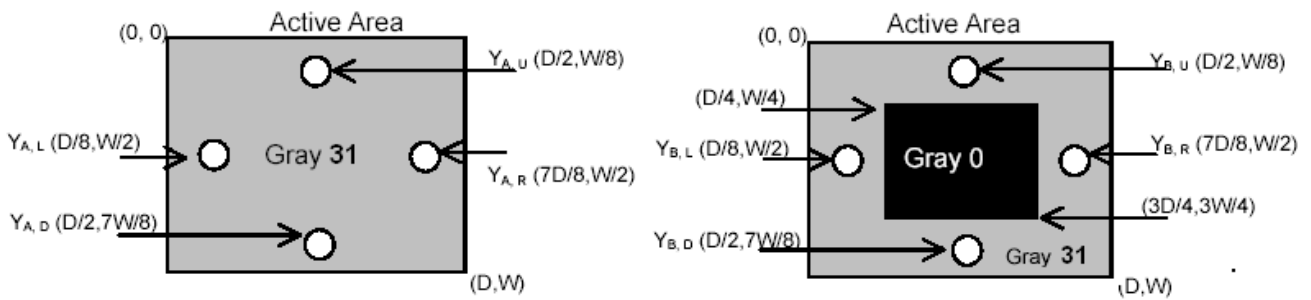
*6) Crosstalk Modulation Ratio

CT=｜Y_B-Y_A｜/ Y_{Ax}× 100%

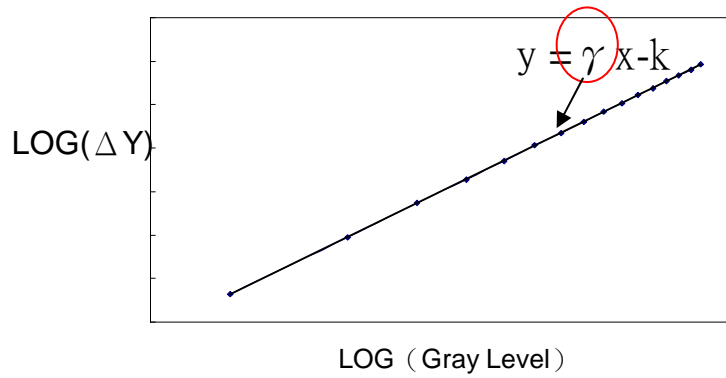Y_A、Y_B measure position and definition

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 γ (from gray level: 0、4、8-----60、63).

$$y = \gamma x - k$$

LOG($\triangle$Y)

LOG（Gray Level）

8. RELIABILITY TEST CONDITIONS

(A) 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	-30°C；250 Hrs
Thermal Shock	-40°C (0.5 Hr)～65°C (0.5 Hr), Ramp<20°C, 100 CYCLES
Temperature & Pressure Storage	-30°C；260hPa，24 Hrs

(B) 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/s2, 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

(C) 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

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

(E) 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.