Chunghwa Picture Tubes, Ltd.
Technical Specification

To ：駿年

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CPT TFT-LCD

CLAA 215FA 04T

ACCEPTED BY：

APPROVED BY	CHECKED BY	PREPARED BY
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1. OVERVIEW

CLAA215FA04 V4T is 21.5” color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 6bits+Hi-FRC digital data, 1920×1080, 16.7M-color images are displayed on the 21.5” diagonal screen. Input power voltage is 5.0V for LCD driving. Converter for backlight is not included in this module. General specification is summarized in the following table:

ITEM	SPECIFICATION
Display Area(mm)	476.64 (H) × 268.11 (V) (21.53-inch diagonal)
Number of Pixels	1920 (H) × 1080(V)
Pixel Pitch(mm)	0.24825 (H) × 0.24825 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white, TN
Number of Colors	16.7M(6bits+Hi-FRC)
Brightness(cd/m^2)	250cd/m^2 (Typ.)(center, 60mA)
Viewing Angle(H/V)	170/160 (Typ.)
Surface Treatment	Anti-glare, 3H
Power consumption(W)	16.5W Without Converter(Typ.)
Module Size(mm)	495.6 (W) × 292.2 (H) ×11.4(D) (Typ.)
Module Weight(g)	2020g(Typ.)
Backlight Unit	LED (White-LED)

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	6	V	
LED Forward voltage	V_F	2.85	3.55	V	1). 2)
LED Forward current	I_F	57	63	mA	
Operation Temperature	Top	0	50	℃	3). 4). 5). 7)
Storage Temperature	Tstg	-20	60	℃	3). 4). 5). 7)

[Note]

1).Product life-time relate to LED, please operate production follow statement at page 8 〝(2)back light〞 .

2).When LED current over the definition of operating current ,product life-time will decay rapidly or operate unusual.

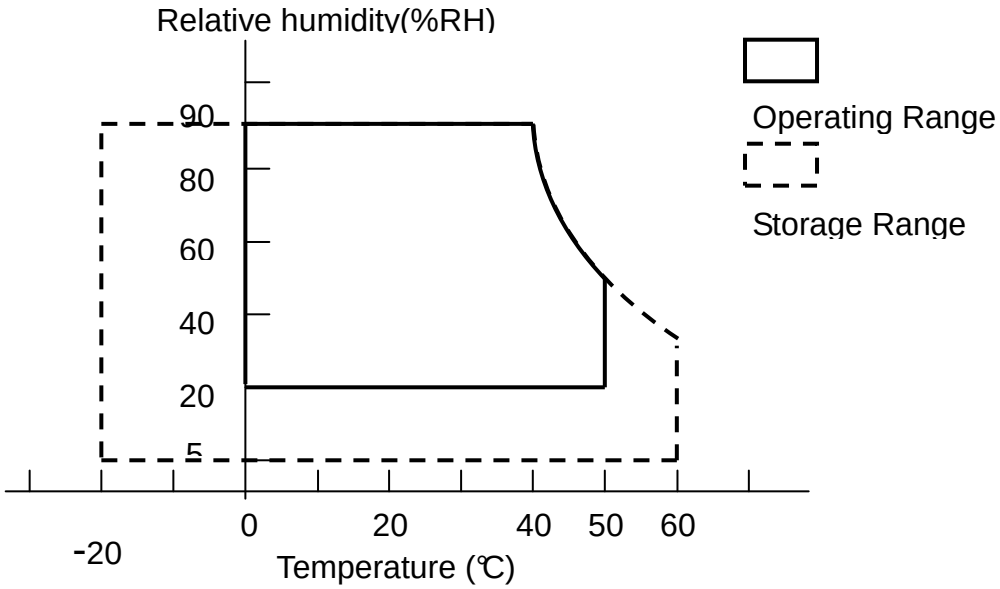
3)The relative temperature and humidity range are as below sketch, 90%RHMax.(Ta≦40℃).

4).The maximum wet bulb temperature ≦39℃(Ta＞40℃) and without dewing.

5).If you use the product in an environment which over the definition of temperature and humidity too long to effect the result of eye-etching.

6) Test Condition: IEC 1000-4-2 VESDt: Contact discharge to input connector; $VESD_C$: Contact discharge to module

7). If you operate the product in normal temperature range, the center surface of panel should be under 60℃.



3. ELECTRICAL CHARACTERISTICS

(1).TFT-LCD Ta=25℃

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Power Supply Voltage for LCD		VCC	4.5	5.0	5.5	V	*1)
Power Supply Current for LCD		ICC	--	1050	1950	mA	*2)
Permissive Ripple Voltage for Logic		VRP	--	--	100	mVp-p	VCC=5.0V
Differential Resistance		Zm	90	100	110	Ω	
LVDS: IN+，IN-	The same motion input Voltage	VCM	1.125	1.25	1.375	V	*3)
	Differential input Voltage	|VID|	200	350	600	mV	
	High electric potential threshold voltage	VTH	-	-	100	mV	
	Low electric potential threshold voltage	VTL	-100	-	-	mV	
LCD Irush Current		Irush	-	-	4	A	*4)
Power consumption		P	-	5	11	W	*2)

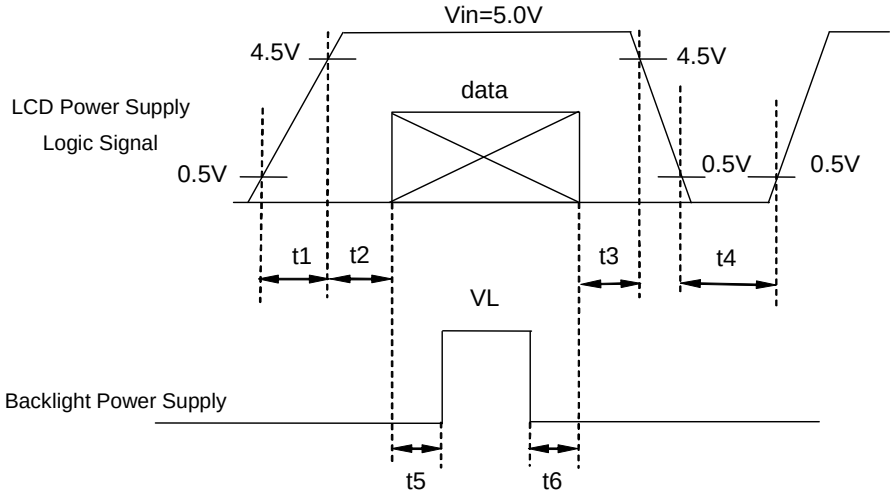
[Note]

*1)Power、data sequence

0.50ms≦t1≦10ms t4≧1 sec

0.01ms＜t2≦50ms t5≧200ms

0.01ms＜t3≦50ms t6≧200ms

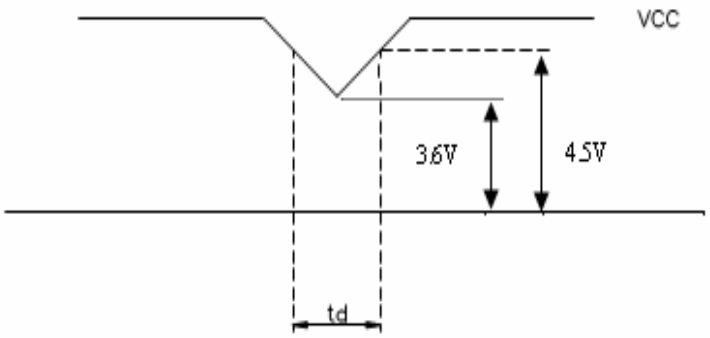


Data: RGB DATA, DCLK, DENA

VCC-dip conditions:

(1) When 3.6V≦Vcc(min)<4.5V: td≦10 ms

(2) When Vcc <3.6 V, VCC-dip conditions should also follow the VCC-turn-on conditions.



2). Typical value is measured when displaying horizontal gray scale line pattern:

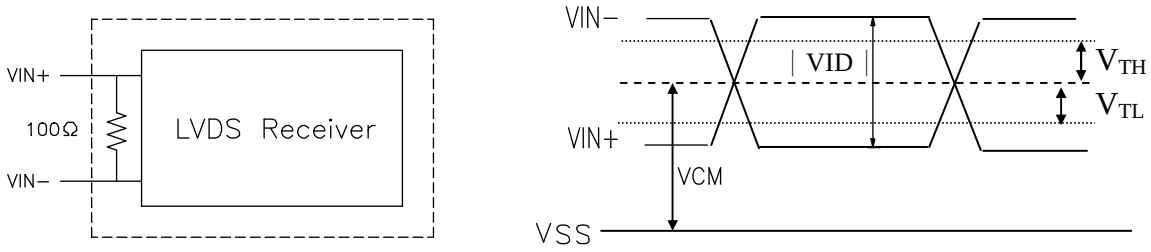
64 gray level, 1920 line mode

VCC=5.0 V，fH= 67.8 kHz，fV=60 Hz，fCLK=72 MHz

Maximun value is measured when displaying 2 line pattern:

VCC=5.0 V，fH= 66.9 kHz，fV=75 Hz，fCLK=90 MHz

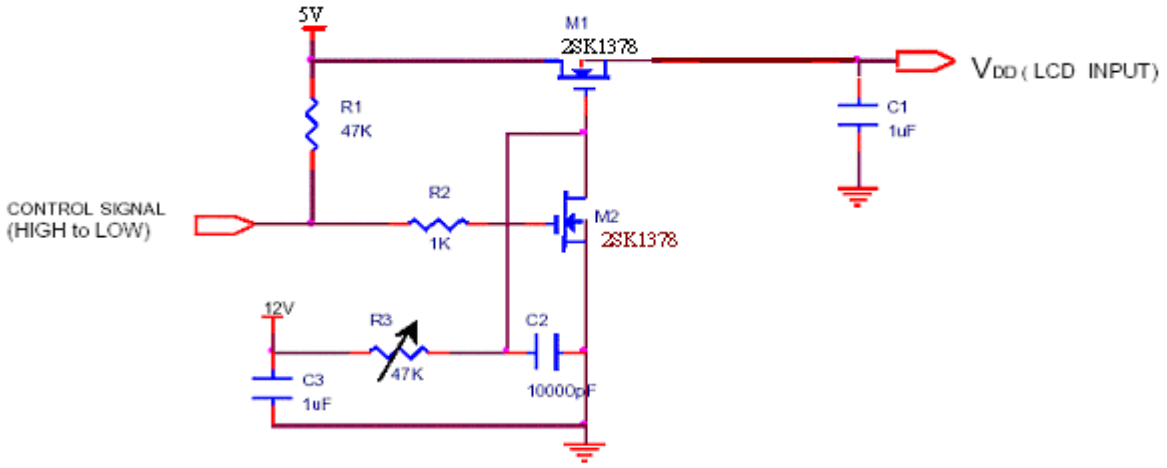
*3) LVDS Signal definition

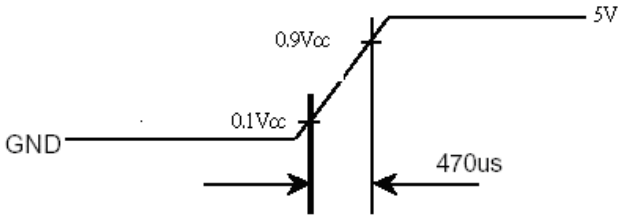


VIN+：Positive differential DATA & CLK Input

VIN-： Negative differential DATA & CLK Input

*4).Irush Measurement Condition





(2).Backlight

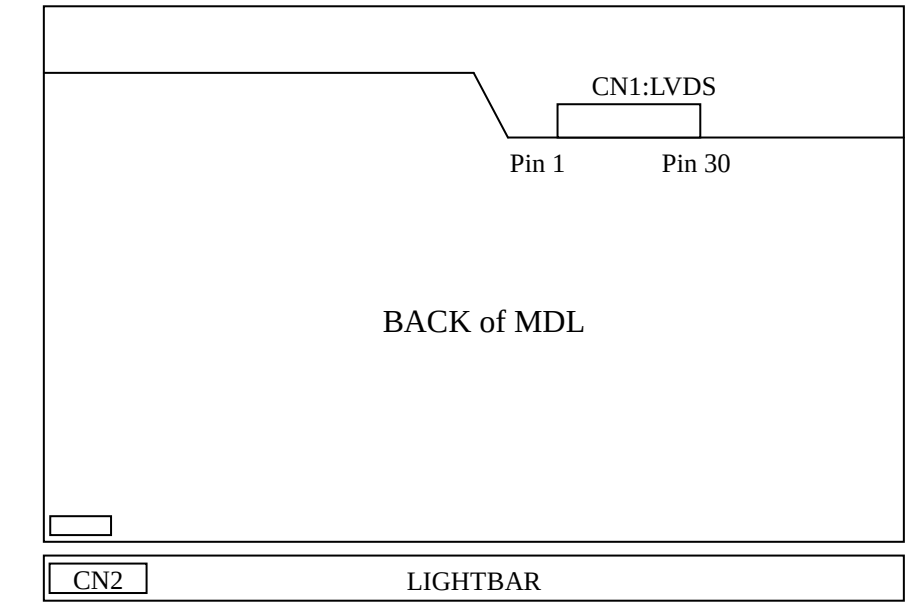
1. Electrical specification

Ta=25℃(Ta: ambient temperature)

Symbol	Parameter	Min	TYP	MAX	UNIT	REMARK
V_F	LED Operation Voltage (for reference)	40.7	48	55.25	V	
I_F	LED Operation Current	57	60	63	mA	1)
P_{out}	BLU Power	9.4	11.5	13.9	W	

2. CN2

Type Part Number	CI1406M1HRE-NH(CviLux) / 116B06-100000-M1-R(Starconn) or compatible



Pin	Name	Description
1	LED_04	String 15PcsLED，feedback 60mA
2	LED_03	String 15PcsLED，feedback 60mA
3	VLED+	Vin=48V，4Parallel 15String ; 60Pcs LED
4	VLED+	Vin=48V，4Parallel 15String ; 60Pcs LED
5	LED_02	String 15PcsLED，feedback 60mA
6	LED_01	String 15PcsLED，feedback 60mA

3. life time

ITEM	min	typ	max	UNIT	REMARK
LIFE TIME	30000	--	--	hrs	2)，3)，4)，5)

[Note]

1).If dimming function is required, it is strongly recommended to adopt pulse width modulation (PWM).If not, linear decrease of the driving current will affect the optical characteristics

2).Parameter guideline for LED driving is under stable conditions at 25℃ (Room Temperature) and I_F=60mA

3). Definition of the lamp life time: Luminance (L) under 50% of specification.

4). When the ambient temperature Ta overstep 25℃, it will serious damage life time.

5). When the LED operation current I_F overstep 60mA, it will serious damage life time.

4. INTERFACE PIN CONNECTION

(1) CN1

Type Part Number	093F30-0PT01A-M4(STARCONN) / MSCK2407P30H (STM) or compatible
Mating Housing Part Number	FI-X30HL(JAE) FI-X30H(JAE)

PIN NO.	REMARK	FUNCTION
1	RXO0-	minus signal of odd channel 0(LVDS)
2	RXO0+	plus signal of odd channel 0(LVDS)
3	RXO1-	minus signal of odd channel 1(LVDS)
4	RXO1+	plus signal of odd channel 1(LVDS)
5	RXO2-	minus signal of odd channel 2(LVDS)
6	RXO2+	plus signal of odd channel 2(LVDS)
7	GND	GND
8	RXOC-	minus signal of odd clock channel (LVDS)
9	RXOC+	plus signal of odd clock channel (LVDS)
10	RXO3-	minus signal of odd channel 3(LVDS)
11	RXO3+	plus signal of odd channel 3(LVDS)
12	RXE0-	minus signal of even channel 0(LVDS)
13	RXE0+	plus signal of even channel 0(LVDS)
14	GND	GND
15	RXE1-	minus signal of even channel 1(LVDS)
16	RXE1+	plus signal of even channel 1(LVDS)
17	GND	GND
18	RXE2-	minus signal of even channel 2(LVDS)
19	RXE2+	plus signal of even channel 2(LVDS)
20	RXEC-	minus signal of even clock channel (LVDS)
21	RXEC+	plus signal of even clock channel (LVDS)
22	RXE3-	minus signal of even channel 3(LVDS)
23	RXE3+	plus signal of even channel 3(LVDS)
24	GND	GND
25	NC	NC
26	NC	Test pin (Can’t connect to GND)
27	NC	NC
28	VCC	Power supply input voltage(5.0 V)
29	VCC	Power supply input voltage(5.0 V)
30	VCC	Power supply input voltage(5.0 V)

1) Keep the NC Pin and don’t connect it to GND or other signals.

2) GND Pin must connect to the ground, don’t let it be a vacant pin.

5. INTERFACE TIMING

(1) Timing Characteristic

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Freq.	f_{CLK}	55	72	90	MHz
			Cycle	t_{CLK}	18.18	13.89	11.11	ns
	DENA	Horizontal	Horizontal effective time	t_{HA}	960	960	960	t_{CLK}
			Horizontal blank time	t_{HB}	40	100	160	t_{CLK}
			Horizontal total time	t_H	1000	1060	1120	t_{CLK}
		Vertical	Vertical frame Rate	Fr	50	60	75	Hz
			Vertical total time	t_V	1090	1130	1230	t_H
			Vertical effective time	t_{VA}	1080	1080	1080	t_H
			Vertical blank time	t_{VB}	10	50	150	t_H

[Note]

*1) DENA (data enable) usually is positive

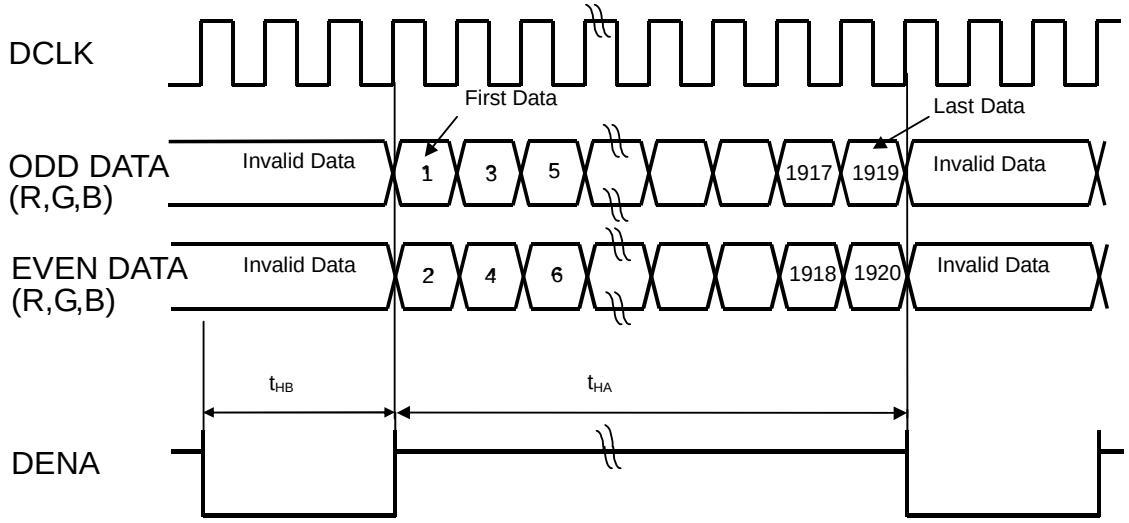
*2) DCLK still inputs during blanking

*3) DE mode only

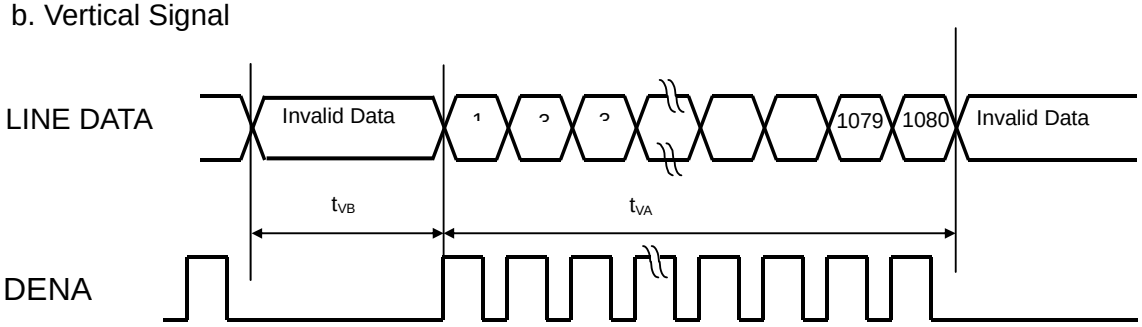
*4) It maybe cause flicker at 50Hz.

(2).Timing Chart

a. Horizontal Signal

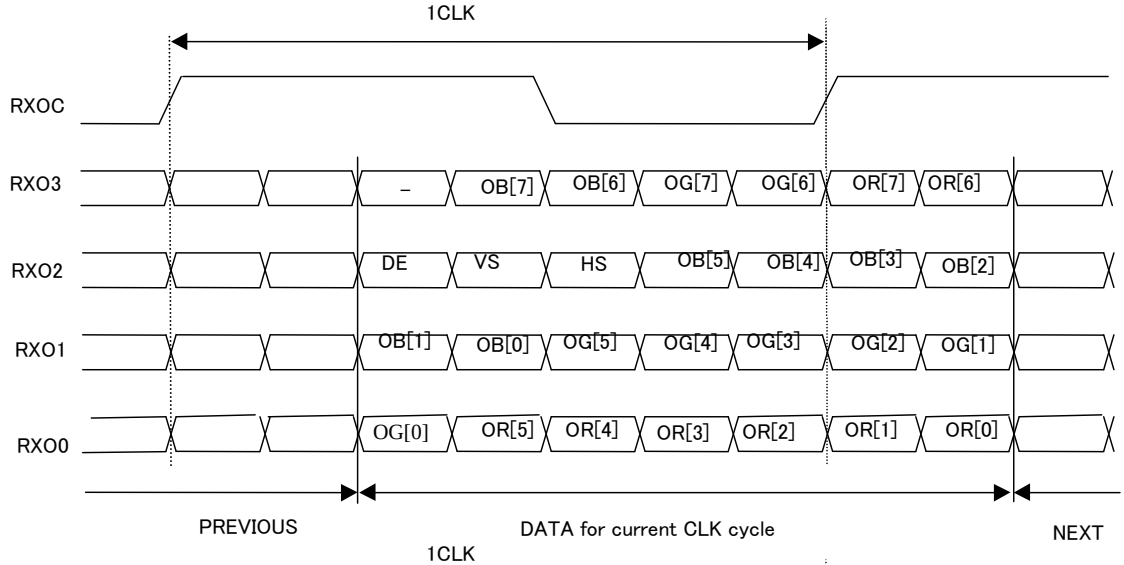


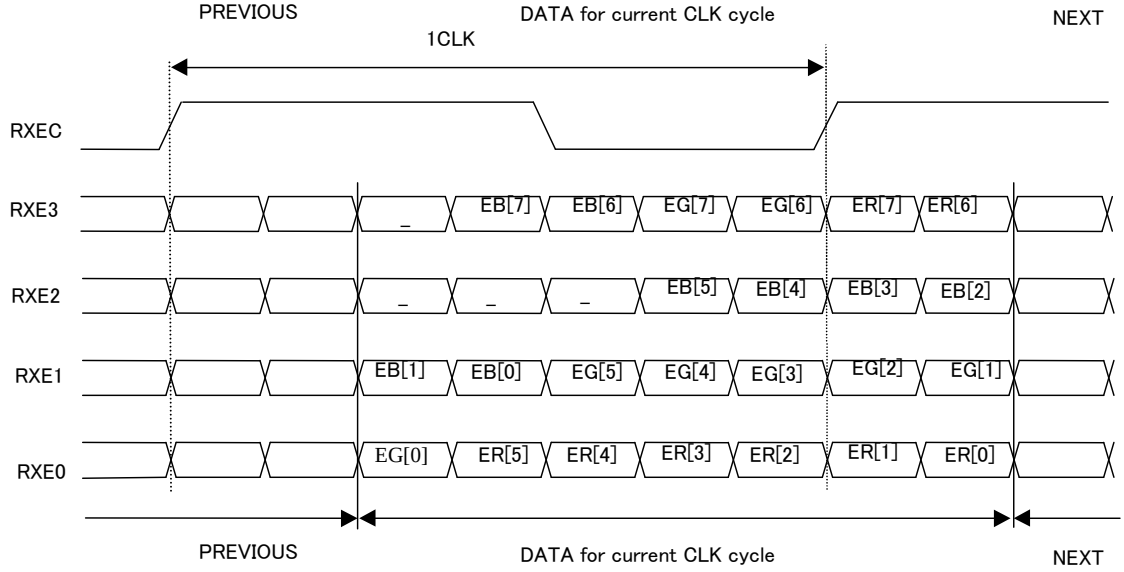
b. Vertical Signal



(3).LVDS Data

For 6Bit+Hi-FRC





Color Data Assignment

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							LSB
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(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(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(255)	0	0	0	0	0	0	1	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	RED(0)	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(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	GREEN(0)	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(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	BLUE(0)	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(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

[Note] 1) Definition of gray scale: Color (n): n indicates gray scale level; higher n means brighter level.

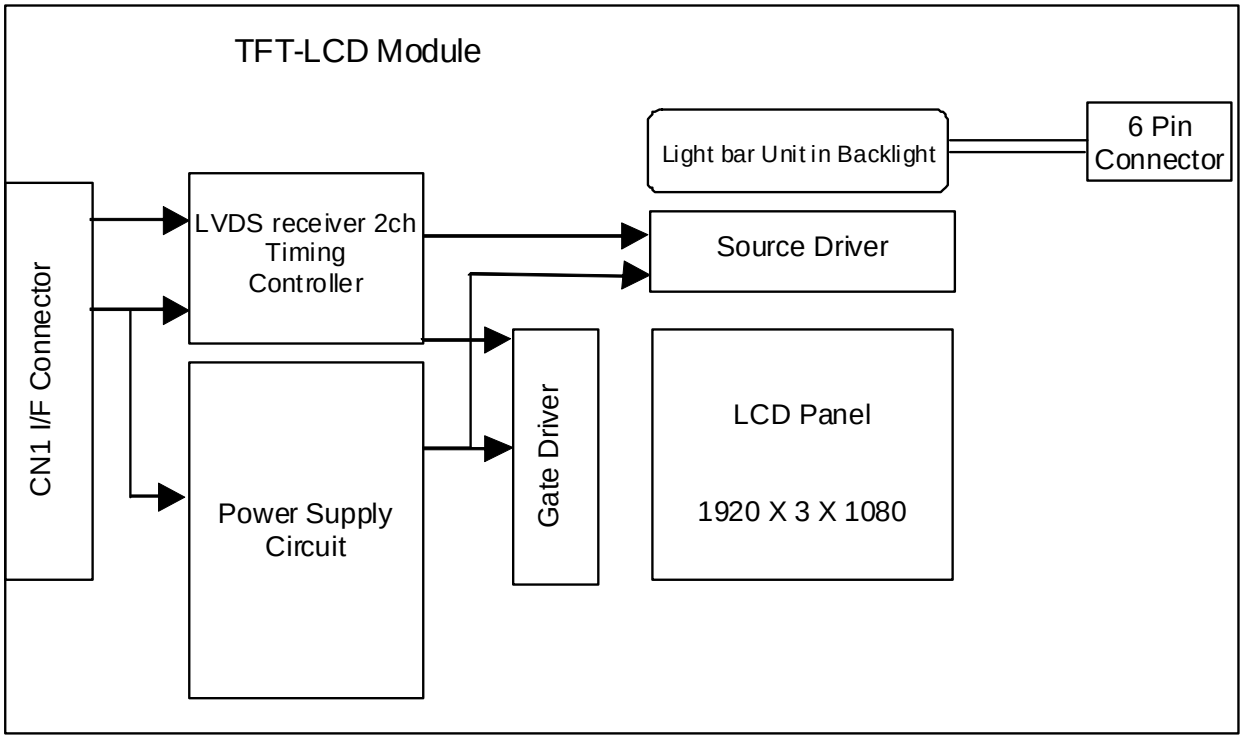
2) Data: 1-High, 0-Low.

3)For odd & even data also.

(4).Color Data Distribution

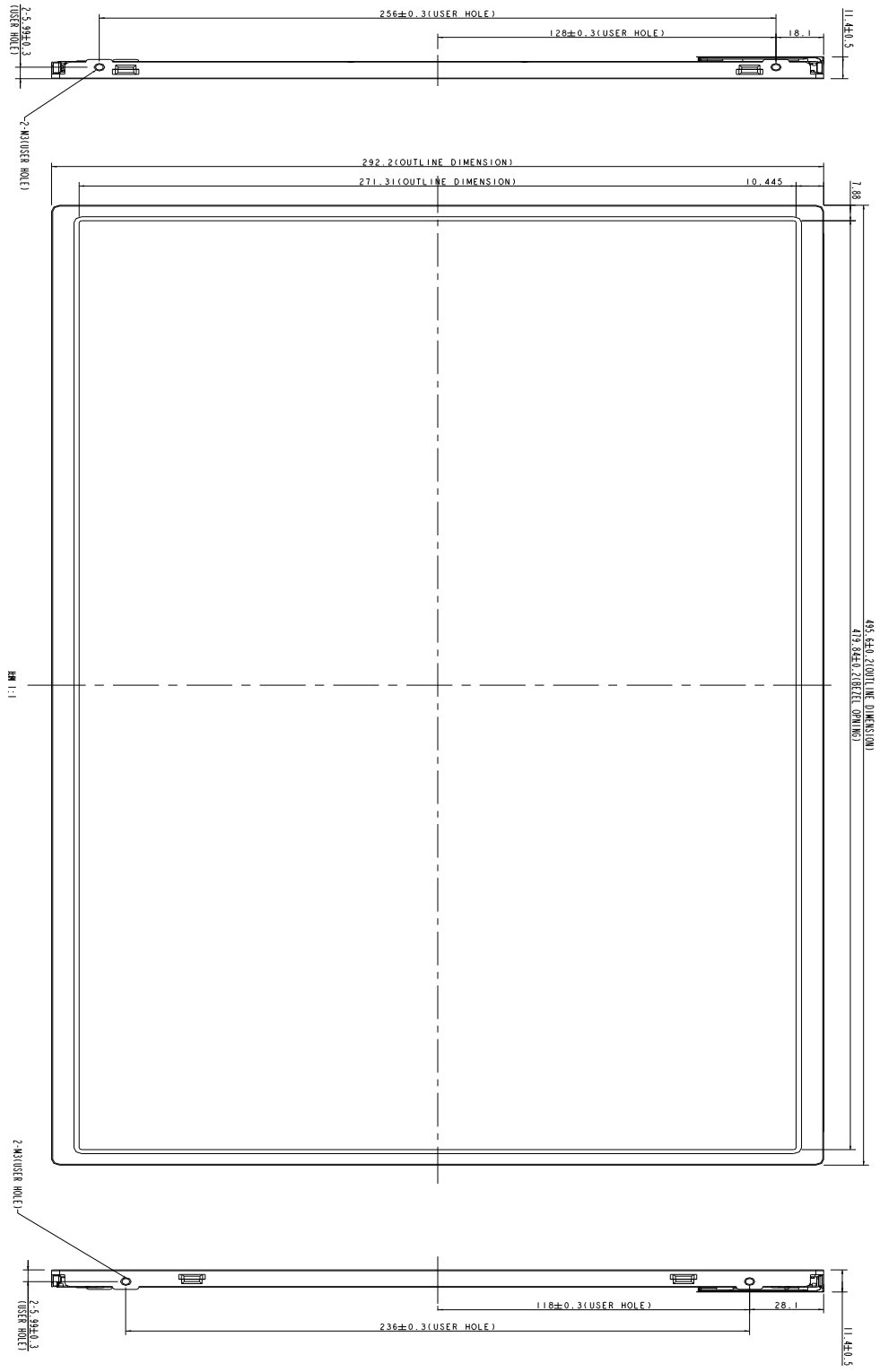
D(1,1)	D(2,1)	..	D(X,1)	..	D(1919,1)	D(1920,1)
D(1,2)	D(2,2)	..	D(X,2)	..	D(1919,2)	D(1920,2)
..	..	+	..	+	..	..
D(1,Y)	D(2,Y)	..	D(X,Y)	..	D(1919,Y)	D(1920,Y)
..	..	+	..	+	..	..
D(1,1079)	D(2, 1079)	..	D(X, 1079)	..	D(1919, 1079)	D(1920, 1079)
D(1, 1080)	D(2, 1080)	..	D(X, 1080)	..	D(1919, 1080)	D(1920,1080)

6. BLOCK DIAGRAM

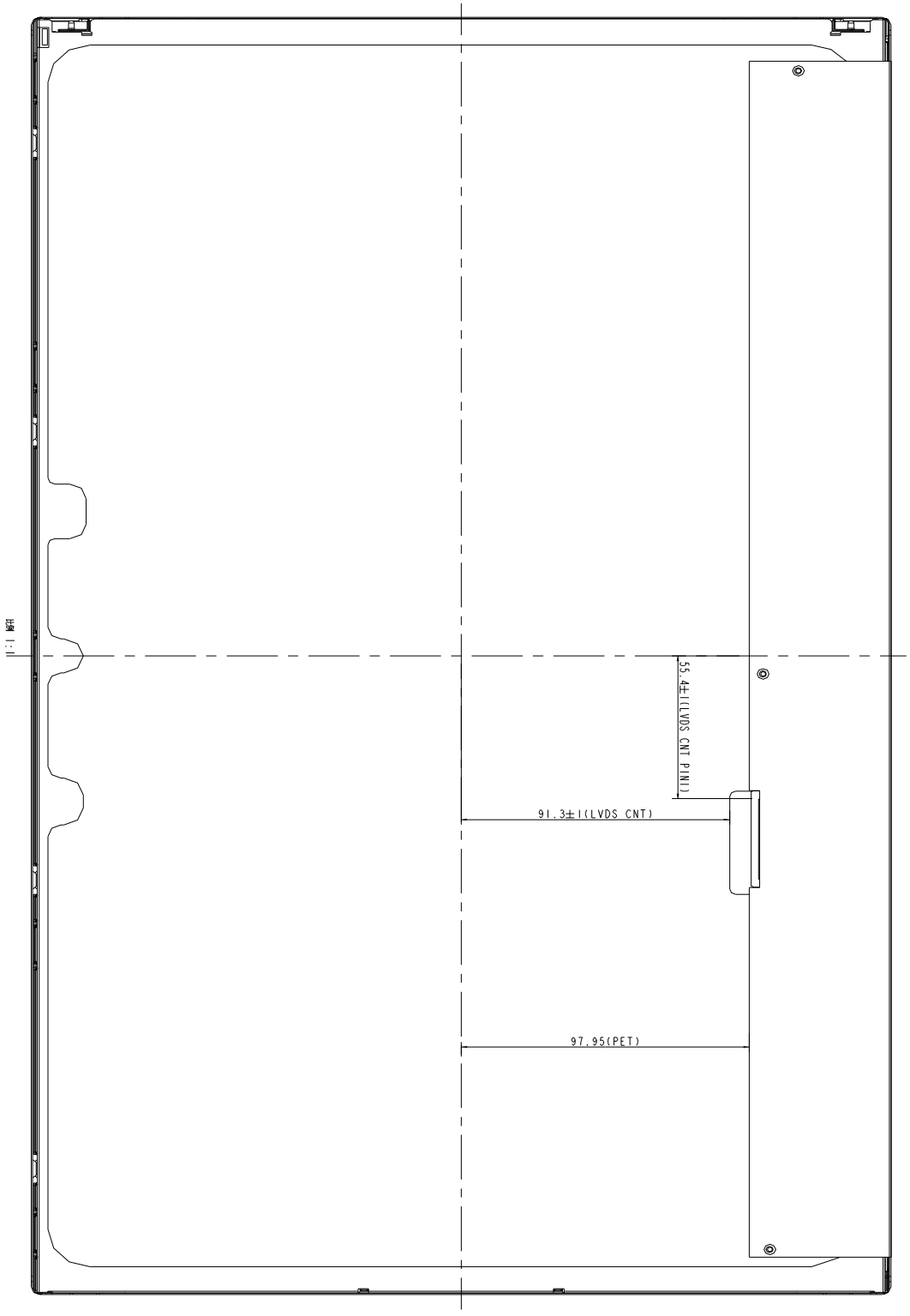


7. MECHANICAL SPECIFICATION

(1) Front side (Tolerance is ± 0.5mm unless noted) [Unit: mm]



(2)Rear side (Tolerance is ±0.5mm unless noted) [Unit: mm]



8. OPTICAL CHARACTERISTICS

Ta=25℃，VCC=5.0V

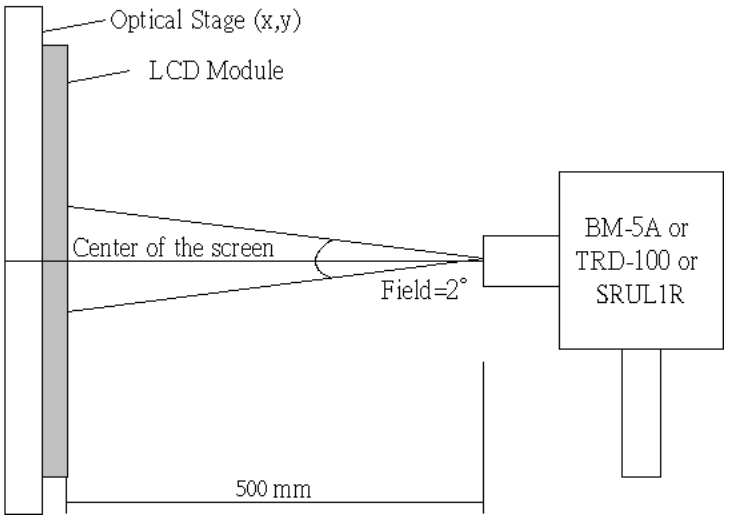
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast (CEN)		CR	θ=ψ= 0°	600	1000	--	--	*1) 2)
Luminance (CEN)		L	θ=ψ= 0°	150	250	--	cd/m2	*1) 3)
9P Uniformity		ΔL	θ=ψ= 0°	75	--	--	%	*1) 3)
Response Time		Tr+Tf	θ=ψ= 0°	--	5	10	ms	*5)
Cross talk		CT	θ=ψ= 0°	--	--	1.5	%	*6)
View angle	Horizontal	ψ	CR≧10	150	170	--	Deg.	*4)
	Vertical	θ		140	160	--	Deg.	
Color Coordinates	White	x	θ=ψ= 0° CPT BL	0.283	0.313	0.343	Color Coordinates	*3)
		y		0.299	0.329	0.359		
	Red	x		0.613	0.643	0.673		
		y		0.323	0.353	0.383		
	Green	x		0.299	0.329	0.359		
		y		0.599	0.629	0.659		
	Blue	x		0.124	0.154	0.184		
		y		0.027	0.057	0.087		
Gamut		CG	θ=ψ= 0°	68	72	--	%	
Gamma		γ	VESA	2.0	2.2	2.4	--	*7)

[Note]

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

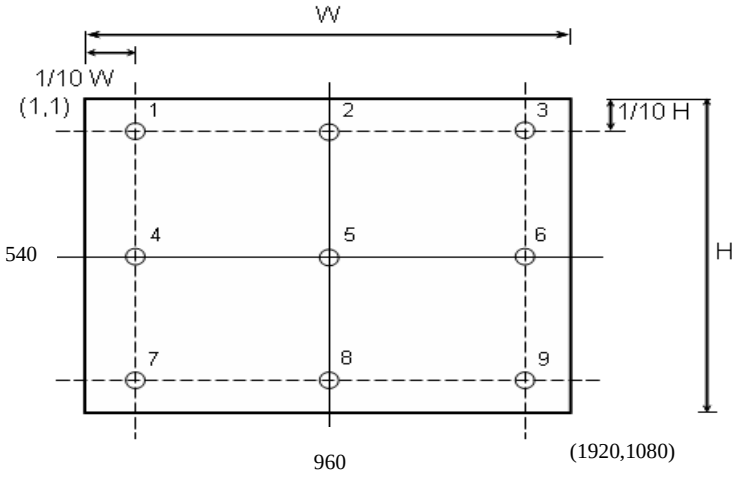
CR=ON (White) Luminance/OFF (Black) Luminance

3) Definition of Luminance and Luminance uniformity

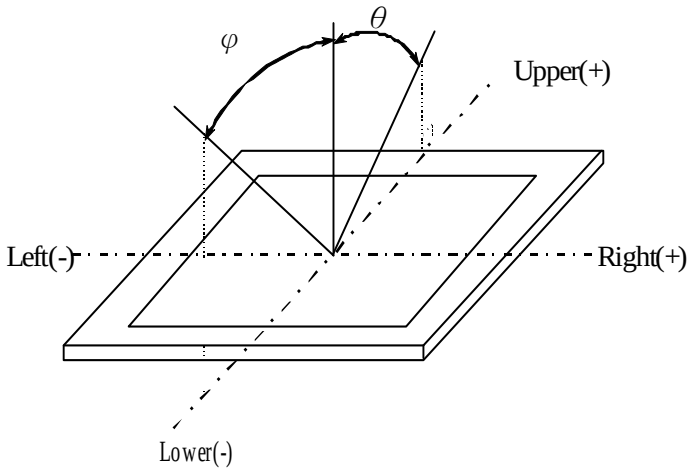
Central luminance: The white luminance is measured at the center position “5” on the screen, see Fig.1 below. And the measure time is 30 min after discharged.

9P Luminance (AVG): The white luminance is measured at measuring points 1 to 9, see Fig.1 below.

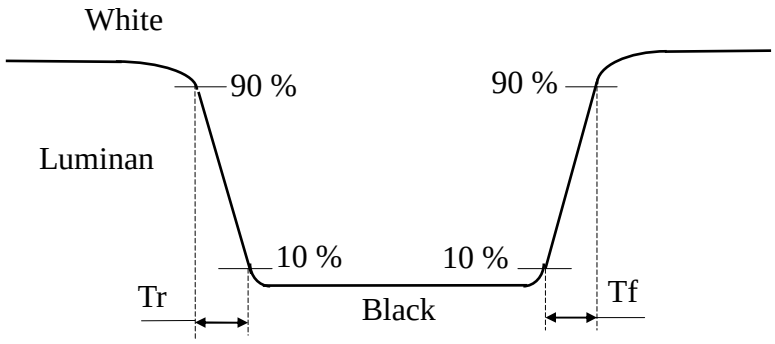
9P Uniformity: $\Delta L = (L_{MIN} / L_{MAX}) \times 100\%$



4).Definition of Viewing Angle (θ,ψ):



5) Definition of Response Time:



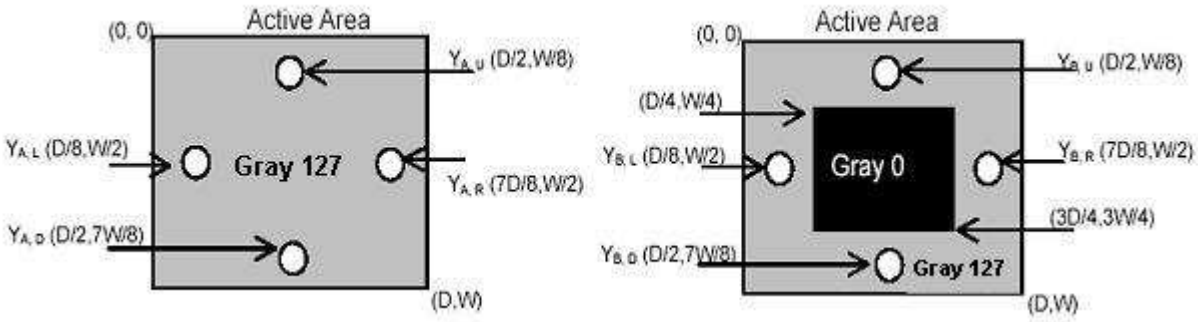
6) Definition of crosstalk:

$CT = | Y_B - Y_A | / Y_A \times 100\ (\%)$

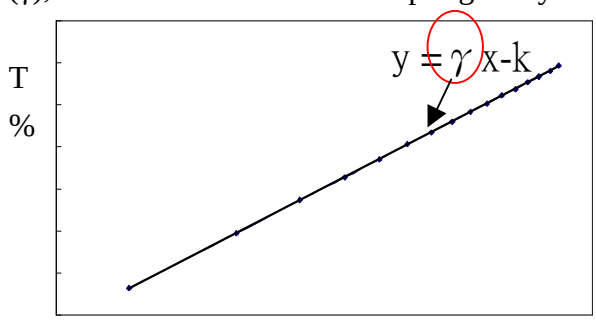
Y_A : The luminance of measured position at pattern A

Y_B : The luminance of measured position at pattern B with Gray level 0

Pattern A Pattern B



7) Definition of Gamma (γ), follow VESA standard sampling every 16 gray level (0,16,32,…..224,240,255)



Gray level (LOG)

9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	50℃; 90%RH; 240h (No condensation)
HIGH TEMPERATURE HIGH HUMIDITY STORAGE	60℃; 90%RH; 48h (No condensation)
HIGH TEMPERATURE OPERATION	50℃; 240h
HIGH TEMPERATURE STORAGE	60℃; 240h
LOW TEMPERATURE OPERATION	0℃; 240h
LOW TEMPERATURE STORAGE	-20℃; 240h
THERMAL SHOCK	BETWEEN -20 ℃ (1hr)AND 60 ℃ (1hr); 100 CYCLES

(2) Shock & Vibration

TEST ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 490m/s^2(50G) Waveform: 11ms Square wave Number of shocks: 1/2 shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8m/s^2(1.0G) zero to peak Waveform: sinusoidal Frequency range: 5 to 500 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 5 to 500Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) ESD

POSITION	**CONDITION(MDL turn off)**
Connector	1. 200 pF，0 Ω，±250 V 2. contact mode for each pin
Module	1. 150 pF，330 Ω，±15K V 2. Air mode, test 25 times for each test point 3. Contact mode, 25 times for each test point

(4) Low Pressure test

TEST ITEM	**CONDITION**
Low Pressure test (storage)	260 HPa(30000 ft)、24hr

(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.