Chunghwa Picture Tubes, Ltd.
Technical Specification

To :

Date : 2010.04.06

CPT TFT-LCD

CLAA 185WA04

ACCEPTED BY :

APPROVED BY	CHECKED BY	PREPARED BY
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1. OVERVIEW

CLAA185WA04 is 18.51" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 6bit+Hi-FRC digital data, 1366*768, 16.7M-color images are displayed on the 18.51" diagonal screen. Input power voltage is 5.0V for LCD driving. Converter for backlight is not included in this module. General specification are summarized in the following table:

ITEM	SPECIFICATION
Display Area(mm)	409.8(H)x230.4(V)
Number of Pixels	1366(H)x768(V)
Pixel Pitch(mm)	0.3(H)x0.3 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white, TN
Number of Colors	16.7M(6 Bit+Hi-FRC)
Brightness(cd/m^2)	250cd/m^2 (Typ.)(center, 20mA)
Viewing Angle(H/V)	160/160 (Typ.)
Surface Treatment	Anti-glare, 3H
Power consumption(W)	10W(typ)(Without Converter)
Module Size(mm)	430.37(W)x254.6(H)x11(D)
Module Weight(g)	1500(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	
Lightbar Input	V_{LED}	3.0	40	V	
Lightbar Current	I_{LED}	--	30	mA	2). 3).
static electricity	VESDt	-200	200	V	7)
	VESDc	-8000	8000	V	
Operation Temperature	Top	0	50	℃	4). 5). 6). 8)
Storage Temperature	Tstg	-20	60	℃	4). 5). 6). 8)

[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).LED current ripple peak-to-peak must be less then 1.5mA.

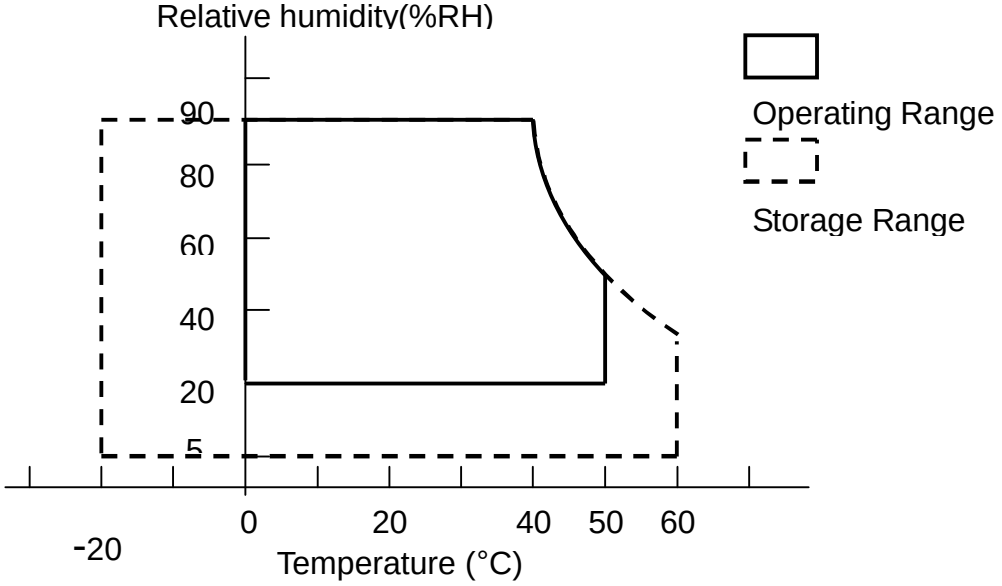
4).The relative temperature and humidity range are as below sketch, 90%RHMax.(Ta≦40℃).

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

6).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.

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

8). 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	-	700	1000	mA	*2)
Permissive Input Ripple Voltage		VRP	-	-	100	mVp-p	Vcc=5.0V
Differential impedance		Zm	90	100	110	Ω	
Logic input voltage LVDS:IN+，IN-	Common Mode Voltag	VCM	1.125	1.25	1.375	V	
	Differential Input Voltage	|VID|	250	350	450	mV	
	Threshold Voltage(High)	VTH	-	-	100	mV	*3)
	Threshold Voltage(Low)	VTL	-100	-	-	mV	
LCD Inrush Current		Inrush			3	A	*4)
Power consumption		P		3.5	5.5	W	*2)

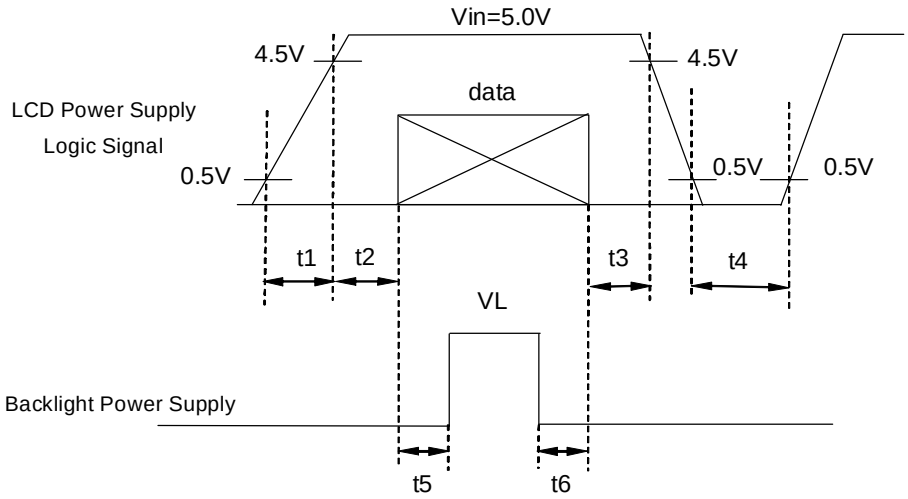
[Note]

1).VCC-turn-on conditions:

0.5ms≦t1≦10ms　　1 sec≦t4

0 ＜t2≦20ms　　200ms≦t5

0＜t3≦50ms　　200ms≦t6

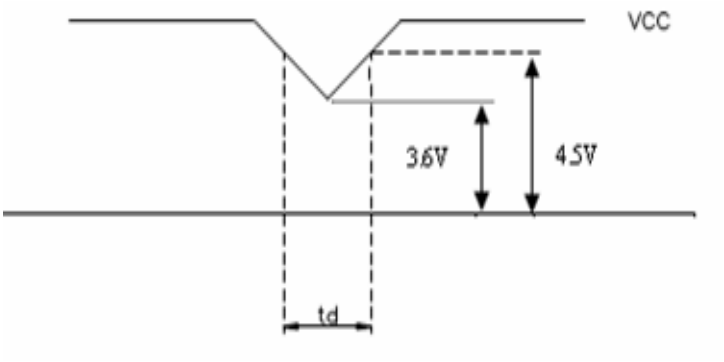


Data: RGB DATA, DCLK, DENA

VCC-dip conditions:

(1) When 3.6V≦Vcc(min)<4.5V: td≦10 ms

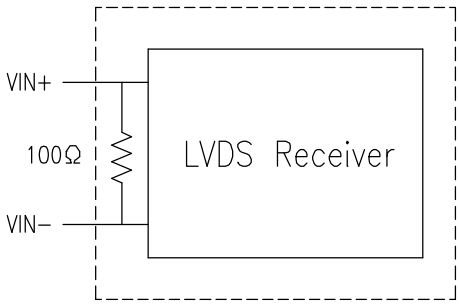
(2) When Vcc <3.6 V, VCC-dip conditions should also follow the VCC-turn-on conditions.

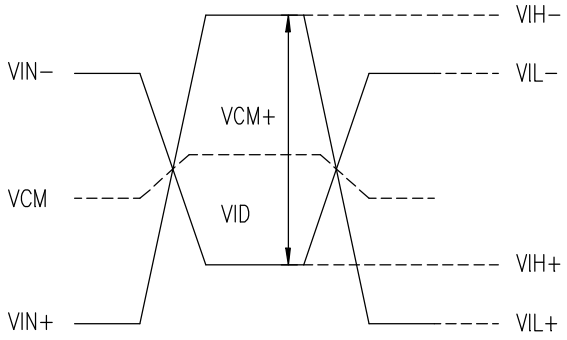


2).Typical current situation: 256 gray scale level, VCC=5.0V, Fh=47.28KHz, Fv=60Hz, Fclk=67.1 MHz.

Maxmum current situation: CS Open scale level, VCC=5.0V, Fh=47.28KHz, Fv=60Hz, Fclk=67.1 MHz.

3).LVDS Signal definition:





VID = VIN_+ – VIN- ,

△VCM = | VCM_+–VCM- | ,

△VID = | VID_+–VID- | ,

VID+ = | VIH_+–VIH- | ,

VID- = | VIL_+–VIL- | ,

VCM =(VIN_+ +VIN-)/2,

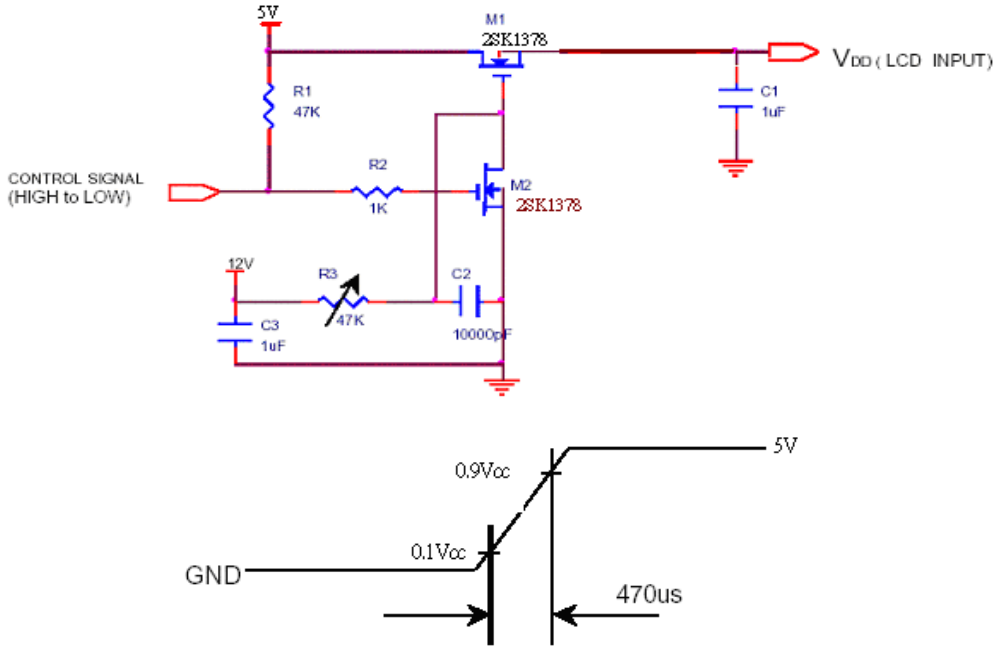
VCM+ =(VIH_+ +VIH-)/2,

VCM- =(VIL_+ +VIL-)/2,

VIN_+ = Positive differential DATA & CLK Input

VIN- = Negative differential DATA & CLK Inpu

4).Irush Measurement Condition



(2).Backlight

1. Electrical specification

Ta=25℃（Ta：Ambient Temperature）

Symbol	Parameter	Min.	Typ.	Max.	Unit	REMARK
V_{LED}	LED Operation Voltage (for reference)	-	36	40	V	
I_{LED}	LED Operation Current	-	20	30	mA	
P_{out}	BLU Power	-	5.76	9.6	W	

2. life time

ITEM	min	typ	max	UNIT	REMARK
LIFE TIME	20000	30,000	-	hrs	1)，2)，3)

[Note]

1).Parameter guideline for LED driving is under stable conditions at 25℃ (Room Temperature) and I_{LED}=20mA

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

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

4. INTERFACE PIN CONNECTION

(1)CN1 (Data Signal and Power Supply)

Used connector: 093G30-B2001A (STARCONN) or compatible

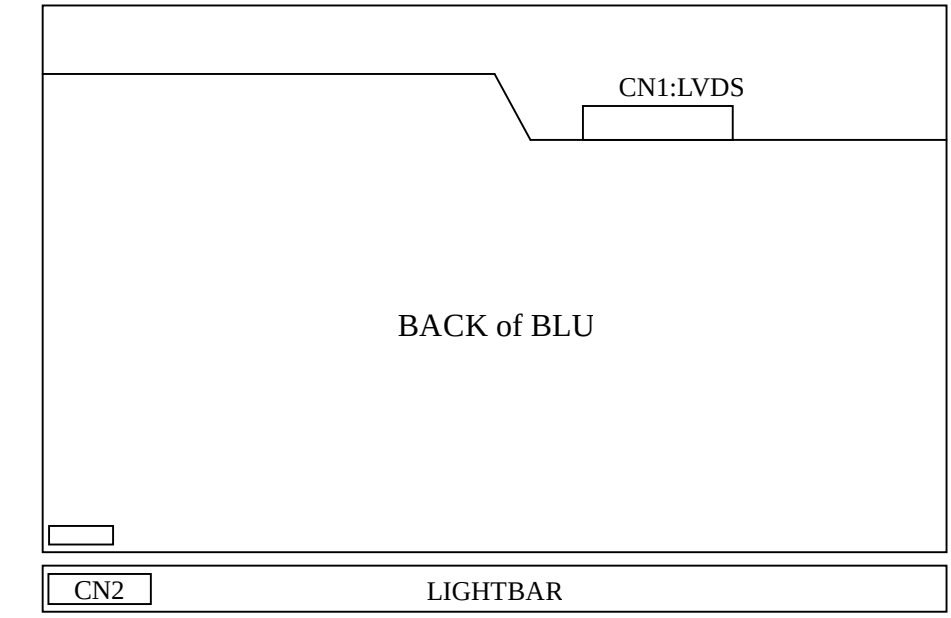
PIN NO.	REMARK	FUNCTION
1	NC	NC
2	NC	NC
3	NC	NC
4	GND	Power ground
5	RXIN0-	Negative LVDS differential data input(0)
6	RXIN0+	Positive LVDS differential data input(0)
7	GND	Power ground
8	RXIN1-	Negative LVDS differential data input(1)
9	RXIN1+	Positive LVDS differential data input(1)
10	GND	Power ground
11	RXIN2-	Negative LVDS differential data input(2)
12	RXIN2+	Positive LVDS differential data input(2)
13	GND	Power ground
14	RXCLKIN-	Negative LVDS differential clock input(clock)
15	RXCLKIN+	Positive LVDS differential clock input(clock)
16	GND	Power ground
17	RXIN3-	Negative LVDS differential data input(3)
18	RXIN3+	Positive LVDS differential data input(3)
19	GND	Power ground
20	NC	NC
21	NC	NC
22	NC	NC
23	GND	Power ground
24	GND	Power ground
25	GND	Power ground
26	VCC	Power supply input voltage(5.0 V)
27	VCC	Power supply input voltage(5.0 V)
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)

(2) CN2 (BACKLIGHT)

Used connector: 7083K-F10Y-00R(ENTERY) or compatible

Flexible Flat Cable spec(reference)：10pin，pitch=0.5mm，thickness=0.3mm

Pin No	Symbol	Description
1	I_{LED}	LED Current
2	I_{LED}	LED Current
3	I_{LED}	LED Current
4	I_{LED}	LED Current
5	V_{LED}	LED Input
6	V_{LED}	LED Input
7	I_{LED}	LED Current
8	I_{LED}	LED Current
9	I_{LED}	LED Current
10	I_{LED}	LED Current



5. INTERFACE TIMING

(1) Timing Characteristic

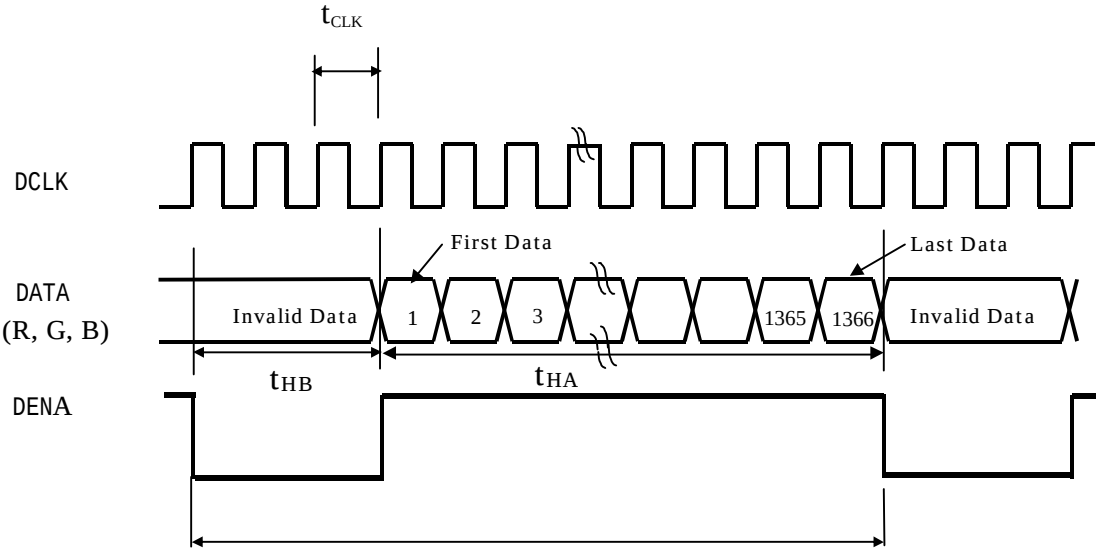
ITEM			SYMBOL	MIN	TYP	MAX	UNIT
LCD Timing	DCLK	Frequency	f_{CLK}	54.5	67.1	89.0	MHz
		Period	t_{CLK}	18.4	14.9	11.9	ns
	DENA	Horizontal Active Time	t_{HA}	1366	1366	1366	t_{CLK}
		Horizontal Total Time	t_H	1406	1420	1936	t_{CLK}
		Vertical Active Time	t_{VA}	768	768	768	t_H
		Vertical Total Time	t_V	776	788	888	t_H
		Vertical Frame Rate	Fr	50	60	75	Hz

[Note]

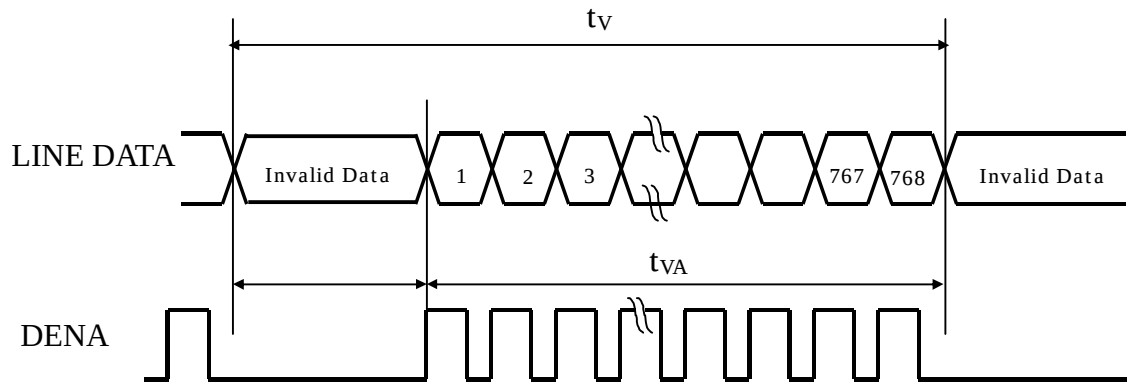
1) DENA should always be positive polarity as shown in the timing specification.
2) CLK IN should appear during all blanking period
3) As t_H =1936、t_V =888，f_{CLK} can't be over 89MHz.

(2) Timing Chart

a. Horizontal Timing

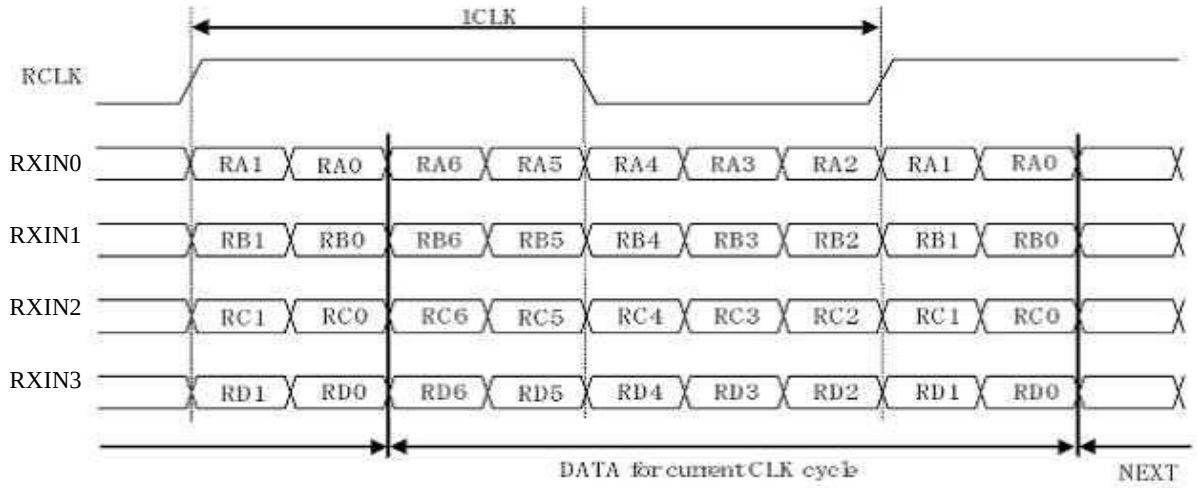


b. Vertical Timing



(3) LVDS DATA

(a) Timing Chart



(b) Data mapping

Cell	Input Pin*)	Data(6 bit+Hi-FRC)
RA0	**Tx1N0**	**RI0**
RA1	**Tx1N1**	**RI1**
RA2	**Tx1N2**	**RI2**
RA3	**Tx1N3**	**RI3**
RA4	**Tx1N4**	**RI4**
RA5	**Tx1N6**	**RI5**
RA6	**Tx1N7**	**GI0**
RB0	**Tx1N8**	**GI1**
RB1	**Tx1N9**	**GI2**
RB2	**Tx1N12**	**GI3**
RB3	**Tx1N13**	**GI4**
RB4	**Tx1N14**	**GI5**
RB5	**Tx1N15**	**BI0**
RB6	**Tx1N18**	**BI1**
RC0	**Tx1N19**	**BI2**
RC1	**Tx1N20**	**BI3**
RC2	**Tx1N21**	**BI4**
RC3	**Tx1N22**	**BI5**
RC4	**Tx1N24**	**RSVD**
RC5	**Tx1N25**	**RSVD**
RC6	**Tx1N26**	**DENA**
RD0	**Tx1N27**	**RI6**
RD1	**Tx1N5**	**RI7**
RD2	**Tx1N10**	**GI6**
RD3	**Tx1N11**	**GI7**
RD4	**Tx1N16**	**BI6**
RD5	**Tx1N17**	**BI7**
RD6	**Tx1N23**	**(RSVD)**
Ref-RCLK	**TxCLKIN**	**DCLKI**

*)：DS90C383MTD

(4) 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	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	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

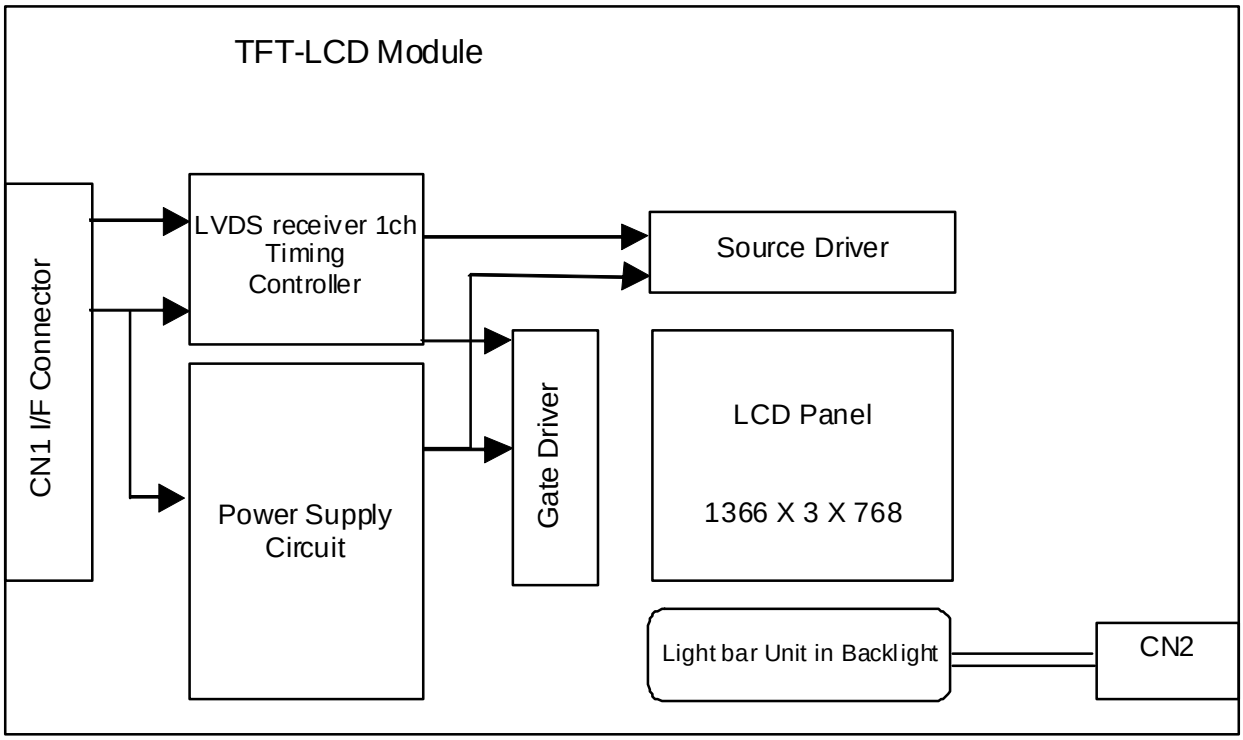
[Note]

1) Definition of gray scale: Color (n): n indicates gray scale level.
   Higher n means brighter level.
2) Data: 1-High, 0-Low.
3) This assignment is applied to both odd and even data.

(5) Color Data Assignment

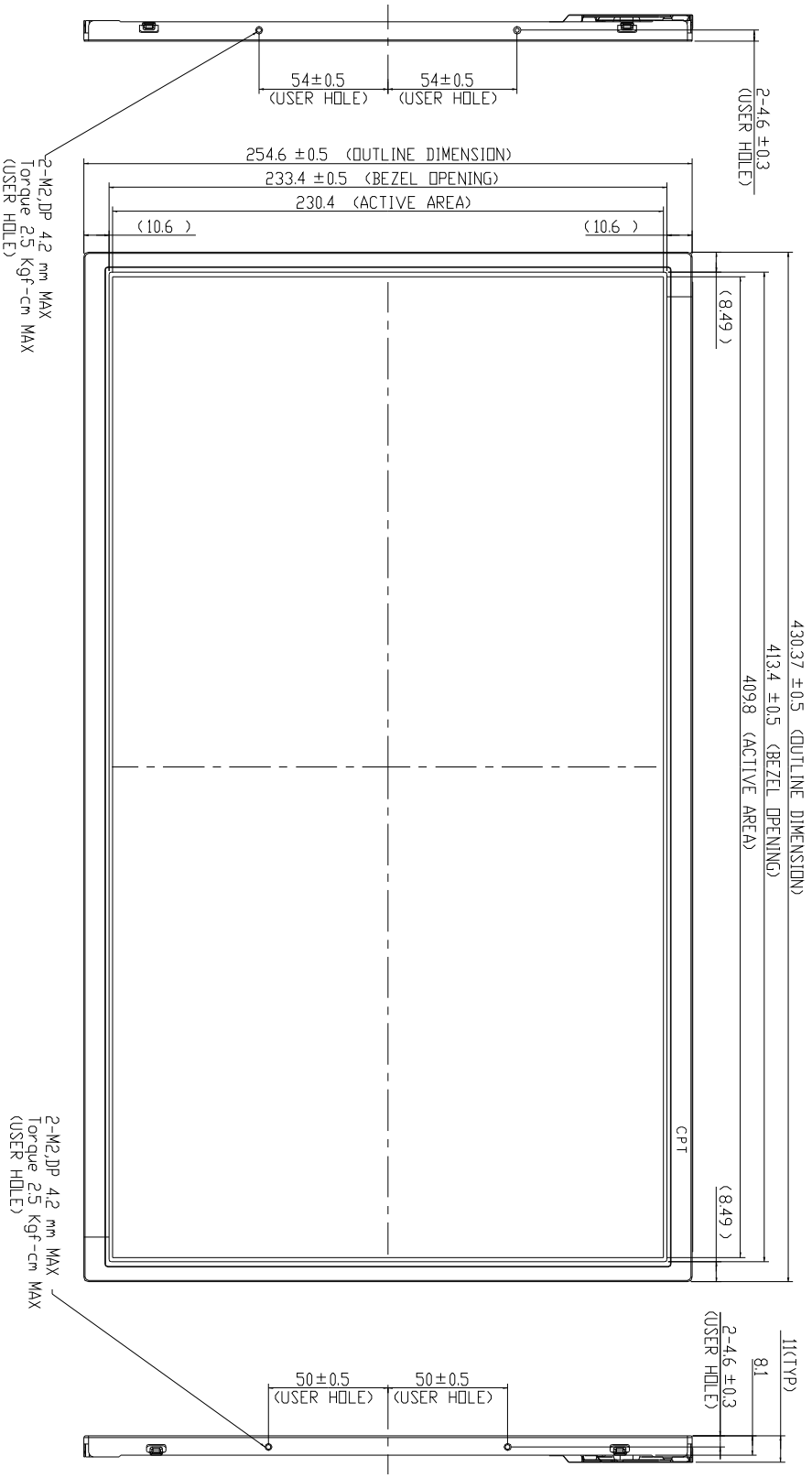
D(1,1)	D(2,1)	--	D(X,1)	--	D(1365,1)	D(1366,1)
D(1,2)	D(2,2)	--	D(X,2)	--	D(1365,2)	D(1366,2)
|	|	+	..	+	|	|
D(1,Y)	D(2,Y)	--	D(X,Y)	--	D(1365,Y)	D(1366,Y)
|	|	+	..	+	|	|
D(1,767)	D(2, 767)	--	D(X, 767)	--	D(1365,767)	D(1366,767)
D(1,768)	D(2, 768)	--	D(X, 768)	--	D(1365,768)	D(1366,768)

6. BLOCK DIAGRAM

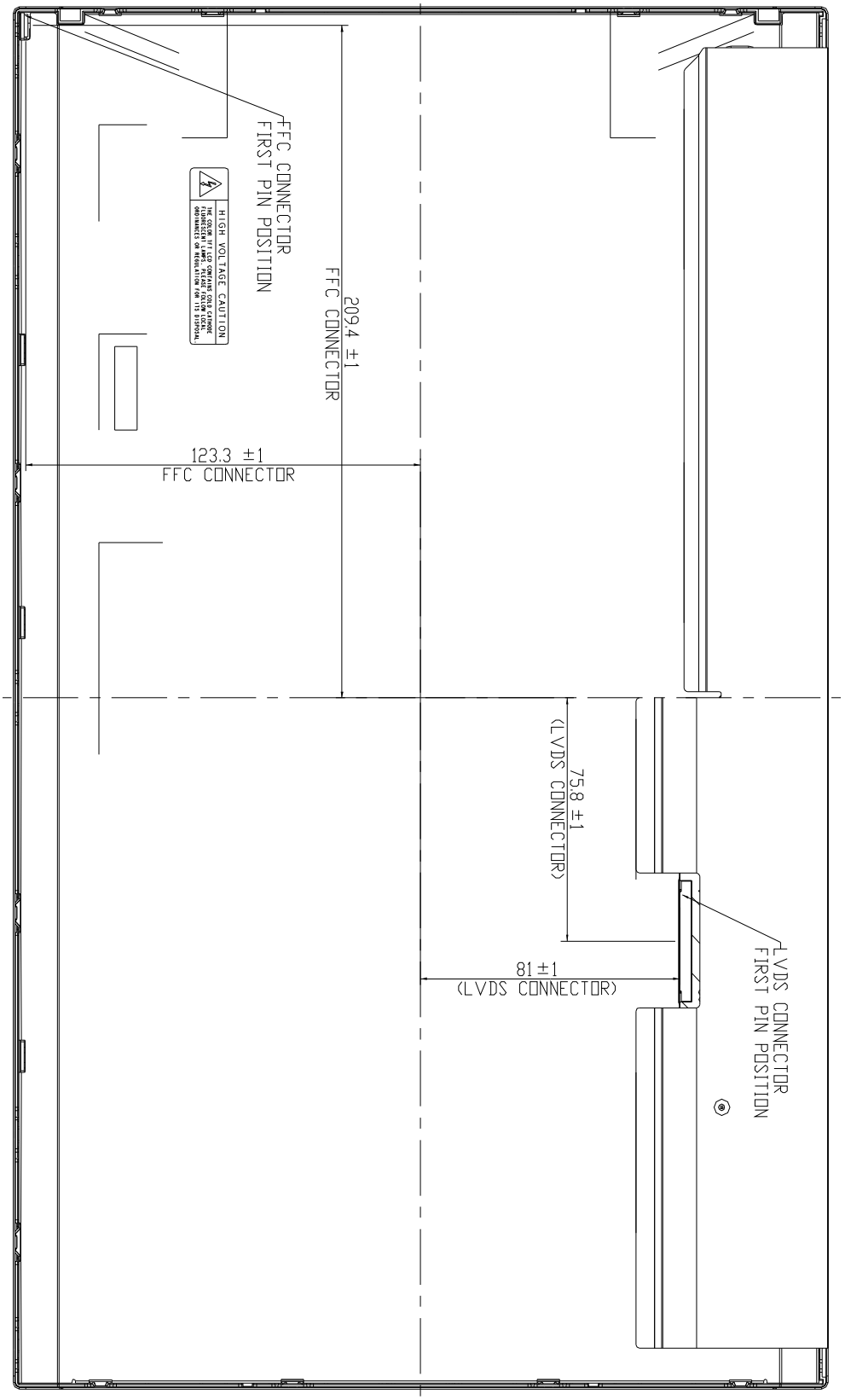


7. MECHANICAL SPECIFICATION

(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 Ratio		CR	θ=ψ= 0°	700	1000	--	--	*1) 2)
Luminance(CEN)		L	θ=ψ= 0°	200	250	--	cd/m^2	*1) 3)
9P Uniformity		ΔL	θ=ψ= 0°	70	--	--	%	*1) 3)
Response Time		Tr	θ=ψ= 0°	--	5	10	ms	*5)
		Tf	θ=ψ= 0°	--			ms	
Crosstalk		CT	θ=ψ= 0°	0	--	1.5	%	*6)
Viewing Angle	Horizontal	Ψ(L/R)	CR≧10	140	160	--	Deg	*4)
	Vertical	θ(U/D)		140	160	--	Deg	
Color Coordinates	White	X Y	θ=ψ= 0°	0.254 0.289	0.304 0.339	0.354 0.389	--	*1)
	Red	X Y		0.589 0.295	0.639 0.345	0.689 0.395		
	Green	X Y		0.279 0.568	0.329 0.618	0.379 0.668		
	Blue	X Y		0.100 0.027	0.150 0.077	0.200 0.127		
Gamma		γ	VESA	2.0	2.2	2.4	--	*7)

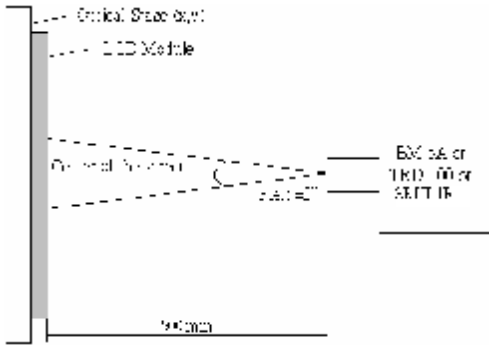
[Note]

All optical specification condition:

Equipment: Color coordinate and color gamut are measured by SRUL1R, and all the other items are measured by BM-5A (TOPCON).

Condition: I_{LED} =20 mA

1).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:

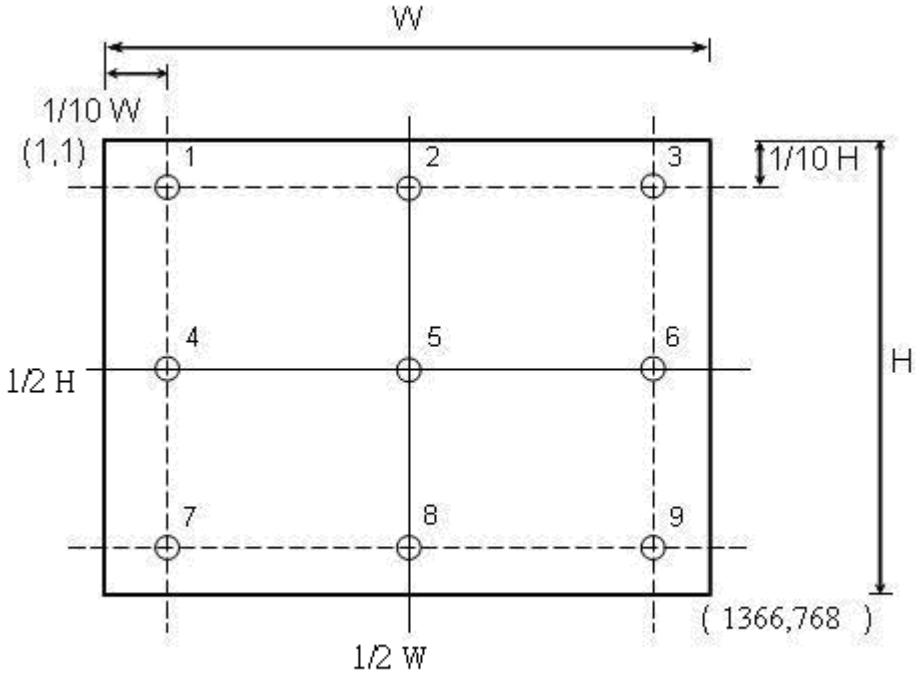
CR=ON (White) Luminance/OFF (Black) Luminance

3).Definition of Luminance and Luminance uniformity:

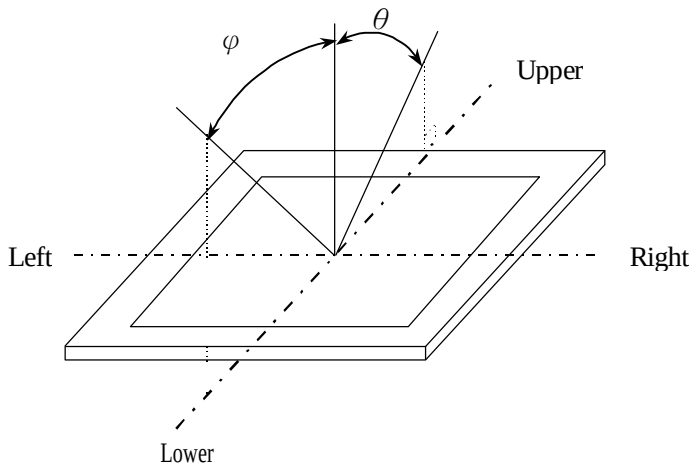
Center Luminance: measuring the luminance of the point no. 5

Average Luminance: measuring average luminance of points no.1-no.9

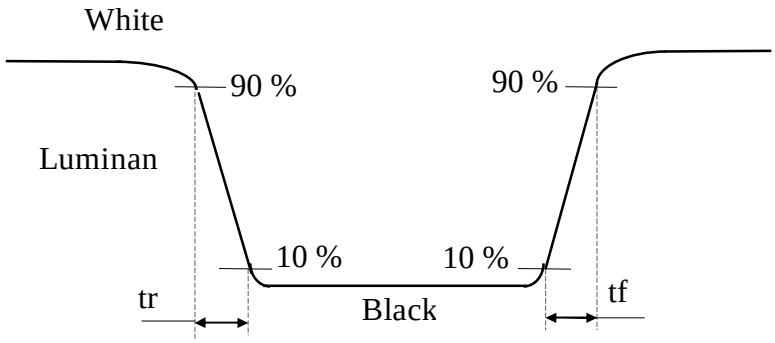
Uniformity: ΔL= [L (Min)/L (Max)] ×100 %



4).Definition of Viewing Angle (θ,ψ):



5) Definition of Response Time:

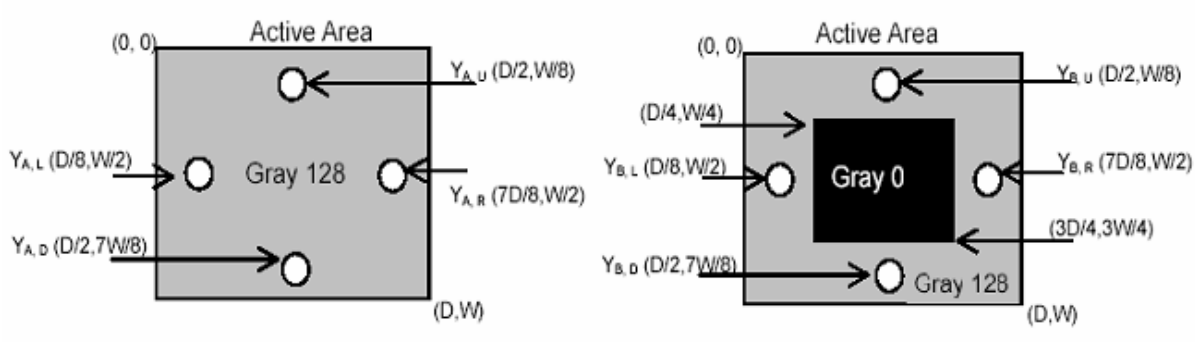


6) Definition of crosstalk:

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

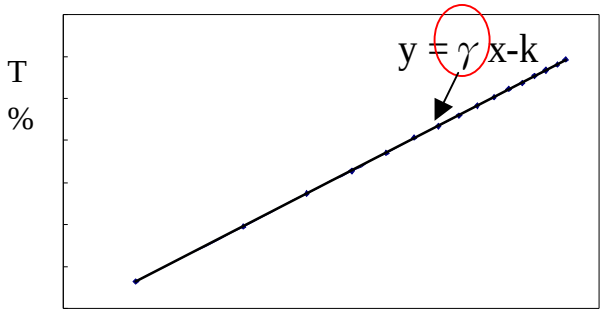
Y_A: The luminance of measured position at pattern A

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

ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level:1470m/s^2(150G) Waveform: half sinusoidal wave, 2ms 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)	260HPa (30000 ft.)；24 Hr

(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.

10. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling- TFT-LCD products;

(1) ASSEMBLY PRECAUTION

1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
2) Please design display housing in accordance with the following guide lines.
   a) Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
   b) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
   c) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
   d) Keep sufficient clearance between LCD module and the others parts, such as speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.
3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
5) Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with power board.

(2) OPERATING PRECAUTIONS

1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the

characteristics specification.

3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
4) A condensation might happen on the surface and inside of LCD module in case of sudden charge of ambient temperature.
5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.
6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

(3) PRECAUTFONSWITHELECTROSTATICS

1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and soon.
2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

1) When you store LCDs for a long time, it is recommended to keep the temperature between 0℃ ~40℃ without the exposure of sunlight and to keep the humidity less than 90%RH.
2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60℃ 90%RH.
3) Please do not leave the LCDs in the environment of low temperature; below -20℃.

(5) SAFETY PRECAUTIONS

1) When you waste LCDS, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

(6) OTHERS

1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays.
2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
3) For the. Packaging box, please pay attention to the followings:
   a) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
   b) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
   c) Please handle packaging box with care not to give them sudden shock and vibrations. And

also please do not throw them up.

d) Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)