Chunghwa Picture Tubes, Ltd.
Technical Specification

Date ：2013/07/18

CPT TFT-LCD

CLAA101FP05 XG

ACCEPTED BY：

APPROVED BY	CHECKED BY	PREPARED BY
Herman Lee	Sean Lee	Product Planning Management General Division

1. OVERVIEW

CLAA101FP05 is 10.1" color (16：10) TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 8 bit digital data, 1920×RGB (3) ×1200, 16.7M-color images are displayed on the 10.1" diagonal screen. General specifications are summarized in the following table：

ITEM	SPECIFICATION
Display Area	216.576 (H) x 135.36 (V) (mm) (10.1-inch diagonal)
Number of Pixels	1920×RGB (3) ×1200
Pixel Pitch	0.1128 (H) × 0.1128 (V) (mm)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	HFFS
Number of Colors	16.7M (6bit +HiFRC)
Interface Signal	MIPI DSI (Video mode only)
Gamut	50% (Typ)
Response Time	30ms (Typ) / 45ms (Max)
Surface Treatment	HC
Viewing Angle	80°、80° / 80°、80° (Min) 89°、89° /89°、89° (Typ.)
Brightness	370 cd/m^2 (Center) (Typ)
Uniformity	5point：80%(min) 13point：70%(min)
Power Consumption	3.4W *1)
Module Size	227.72 (W)×148.65 (H)×2.25 (D) (mm) (Typical) (w/o PCB)
Module Weight	140g (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.

Note】

*1) Power Consumption with 80% LED efficiency.

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	Vin	0	5	V	
Operation Temperature	Top	0	50	℃	*1).*2).*3).*4)
Storage Temperature	Tstg	-20	60	℃	*1).*2).*3)

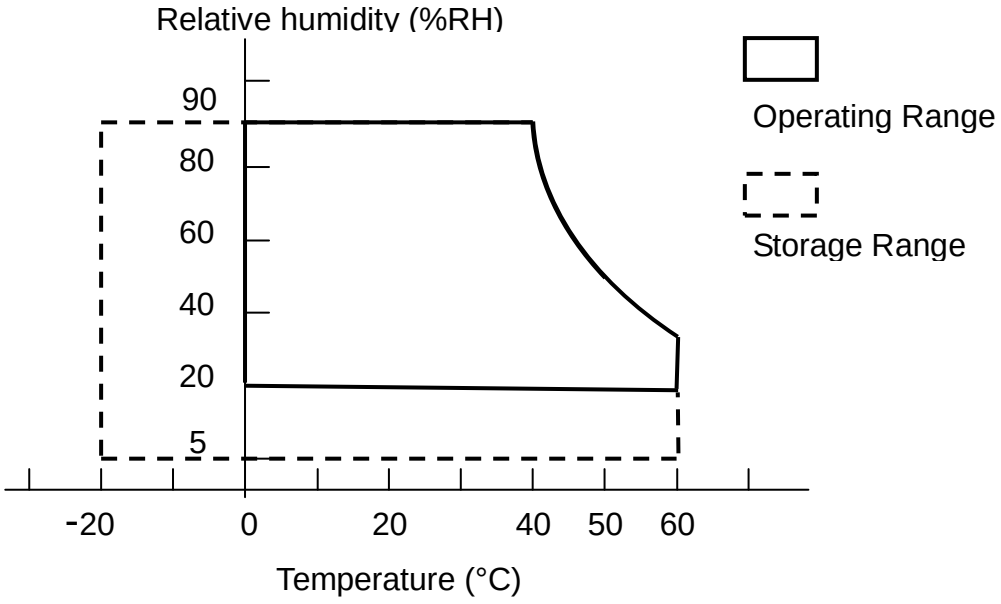
【Note】

*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
LCD Power Voltage	Vin	3.0	3.7	5	V	*1)
LCD Power Current	Iin	-	-	320	mA	*2)
PDD power	VDD power	-	-	0.95	W	*2)
Rush Current	Irush	-	-	2	A	*3)

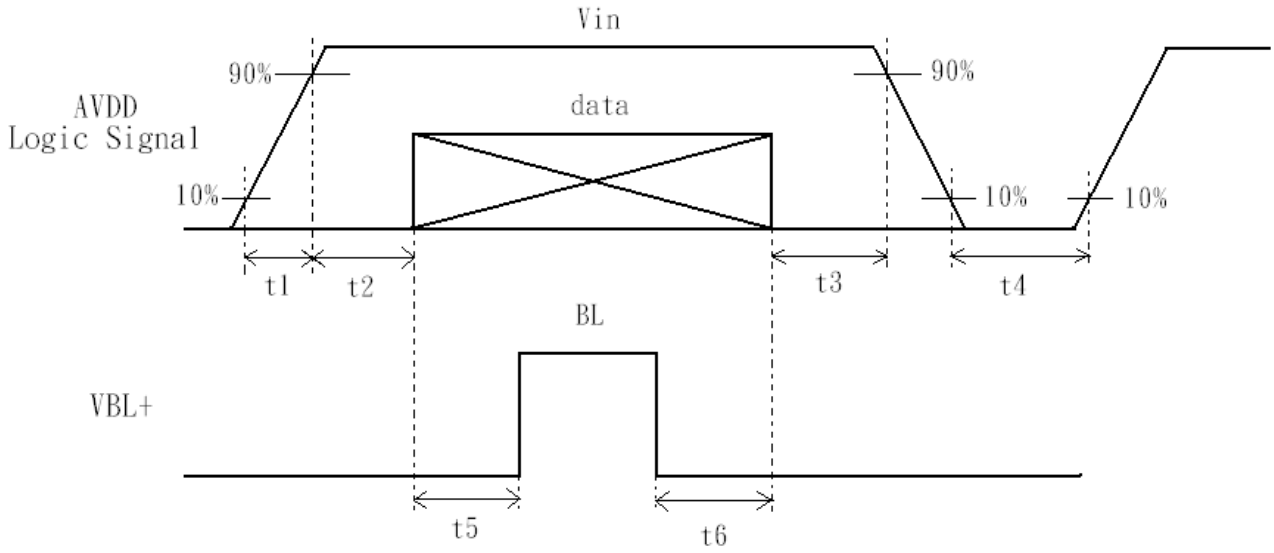
【Note】

*1) Power Sequence：

0.01 ms＜t1 ≦50 ms　　500 ms≦t4

100 ms≦t2 ≦150 ms　　200 ms≦t5

0.01 ms＜t3 ≦50 ms　　200 ms≦t6

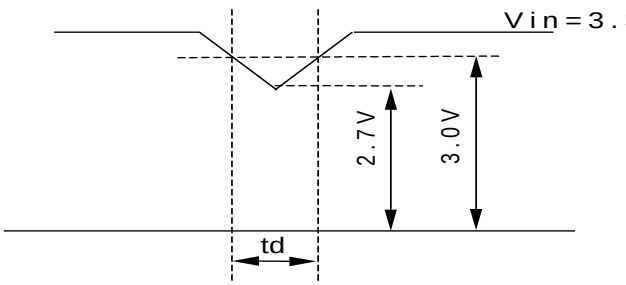


data:RGB DATA, DCLK, HD, VD, DENA

Vin-dip state

(1) when 3.0V＞Vin≧2.7V，td≦10 ms.

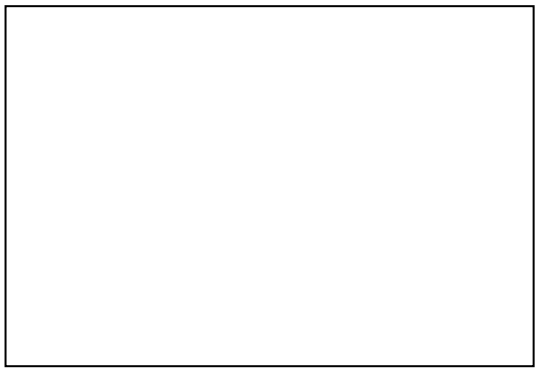
(2) when Vin＜2.7V，Vin-dip condition should as the Vin-turn-off condition.



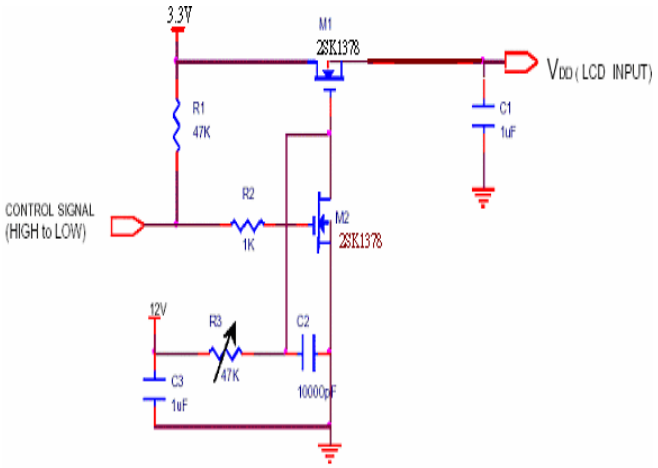
*2) Max value is White Pattern：1200 line mode.

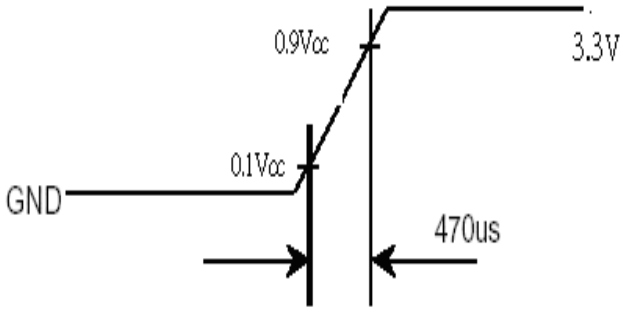
Circuit condition (Max)：VCC=3 V，f_V=60 Hz，f_H=74.1 kHz，f_{CLK}=154 MHz.

PDD=$V_{3.0}$ x I $_{white}$



*3) Irush measure condition





(B) BACK LIGHT

(a.) ELECTRICAL CHARACTERISTICS

Ta=25℃

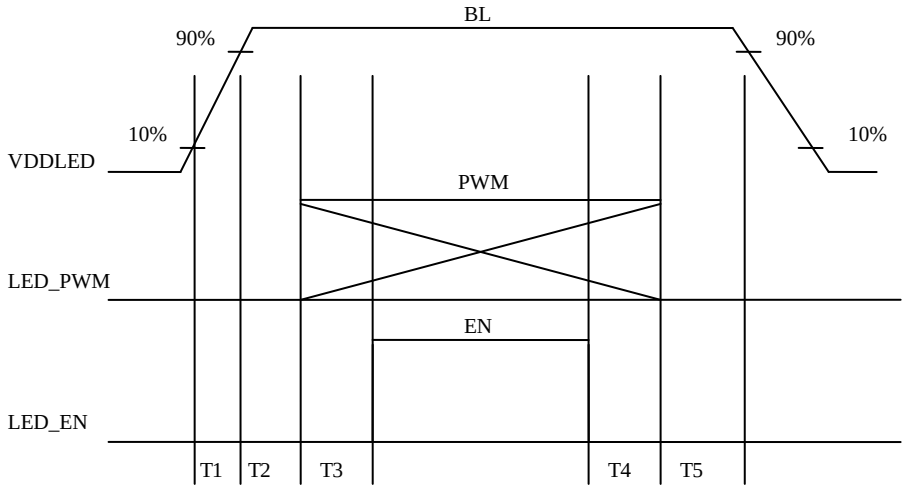
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VBL+	3	5	6	V	*5)
LED Driver Input Current	IBL+	-	-	820	mA	*1)*4)
Forward Voltage	V_F	13.05	14.05	15.05	V	21.5mA/each LED
Forward Current	I_F	-	-	129	mA	
Power Consumption	PLED	-	-	1.95	W	*2)*3)
PWM Frequency	PWM_BL	100	-	20K	Hz	
Duty ratio	Dim	5	-	100	%	

(b) LED Life-Time

ITEM	Condition	MIN	TYP	MAX	UNIT	NOTE
Life Time	IF=21.5mA、Ta=25℃	15000	-	-	hrs	*6)

Note:

LED ON/OFF Sequence：



0.5ms ≦ T1 ≦ 10ms

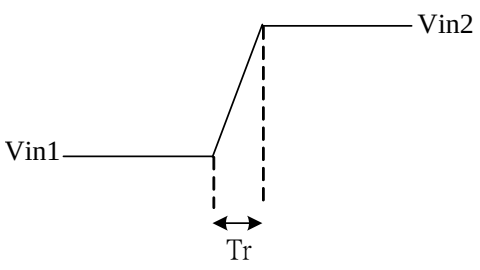
10ms ≦ T2

10ms ≦ T3

0ms ≦ T4

10ms ≦ T5

The LED power variation spec. is defined as the following figure.

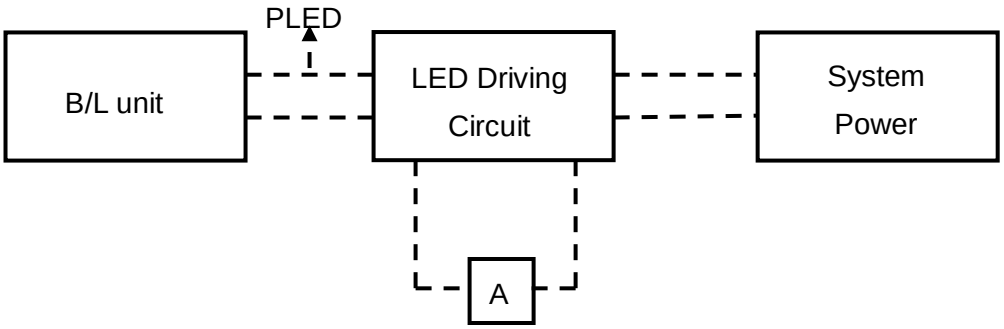


When LED input voltage is from Vin1 up to Vin2, the slew rate should be less than 20 V/ms.

Slew rate = (Vin2-Vin1) / Tr , Vin2 > Vin1

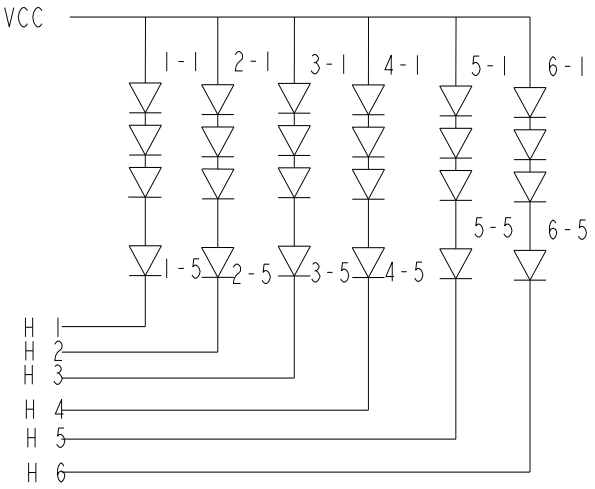
*1) Maximum LED Driver Input Current at 3V Input Voltage, PWM Duty 100%.

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

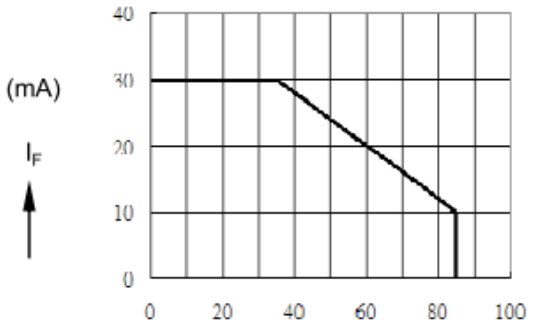


*3) Every LED string consists of 5 pcs LED .

*4) The architecture 5S6P as below figure



*5) The current vs. temperature curve of LED, please see the follow figure.



Ambient Temperature T_A (°C)

FIG.4 FORWARD CURRENT VS. AMBIENT TEMPERATURE

*6) The LED Life time define as the estimated time to 50% degradation of initial luminous intensity.

4. Connector Interface PIN & Function

CN (Interface signal)

Outlet connector: AYF533435 (PANASONIC)

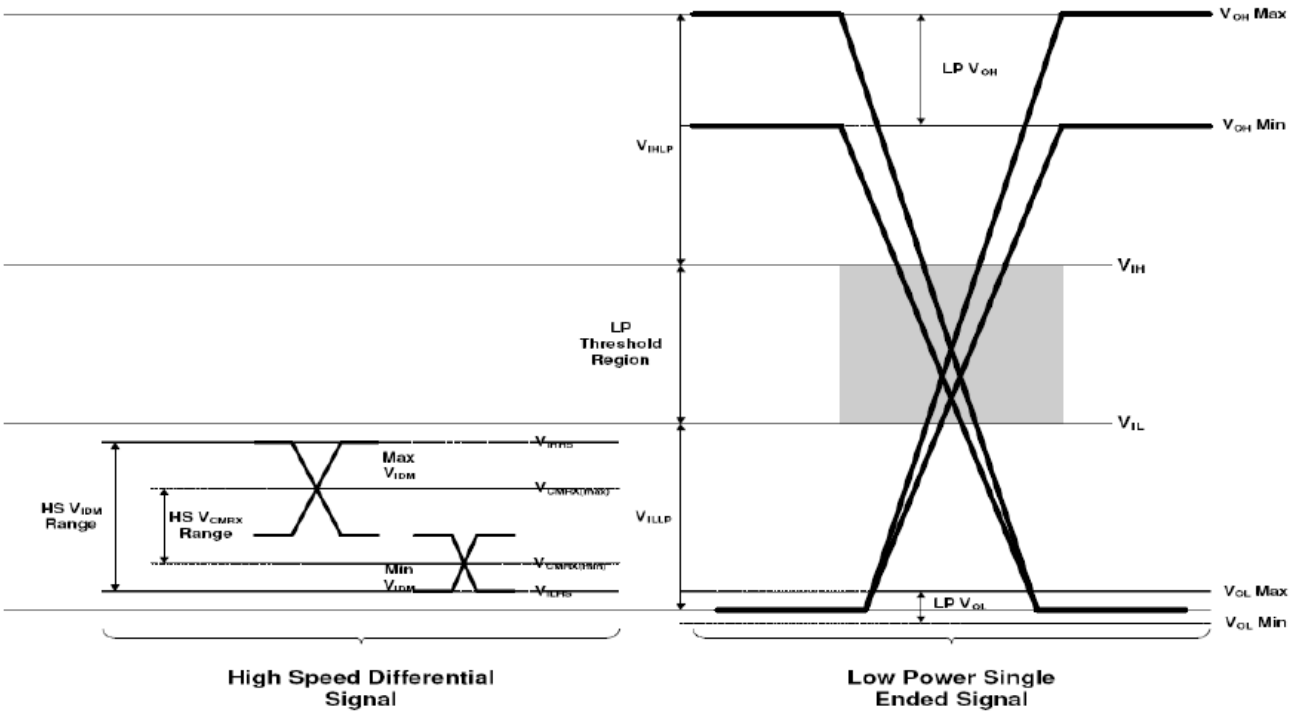
- Pin No. is 34 pin define of Plug connector

No.	Pin name	Description	Note
1	VDD	DC-DC circuit supply voltage (3V - 4.2V)	
2	VDD	DC-DC circuit supply voltage (3V - 4.2V)	
3	NC	Not Connection	
4	LED_EN	LED enable input	VIH =1.8V
5	LED_PWM	Backlight LED driver PWM	VIH =1.8V
6	EDID_SDA	EDID Data Input	VIH =1.8V
7	EDID_SCL	EDID Clock Input	VIH =1.8V
8	NC	Not Connection	
9	GND	Ground	
10	DSI_D2P/Rx-IN2P	MIPI data pair 2 positive signal	
11	DSI_D2N/Rx-IN2N	MIPI data pair 2 negative signal	
12	GND	Ground	
13	DSI_D1P/Rx-IN1P	MIPI data pair 1 positive signal	
14	DSI_D1N/Rx-IN1N	MIPI data pair 1 negative signal	
15	GND	Ground	
16	DSI_CLKP/Rx-CKLP	MIPI Clock positive signal	
17	DSI_CLKN/Rx-CKLN	MIPI Clock negative signal	
18	GND	Ground	
19	DSI_D0P/Rx-IN0P	MIPI data pair 0 positive signal	
20	DSI_D0N/Rx-IN0N	MIPI data pair 0 negative signal	
21	GND	Ground	
22	DSI_D3P/Rx-IN3P	MIPI data pair 3 positive signal	
23	DSI_D3N/Rx-IN3N	MIPI data pair 3 negative signal	
24	GND	Ground	
25	GND	Ground	
26	GND	Ground	
27	GND	Ground	
28	ID	ID Pin	short to GND
29	AGING	Aging Mode Power Supply	
30	NC	Not Connection	
31	LED+ (3V - 5V)	LED Power Supply (3V - 5V)	
32	LED+ (3V - 5V)	LED Power Supply (3V - 5V)	
33	LED+ (3V - 5V)	LED Power Supply (3V - 5V)	
34	LED+ (3V - 5V)	LED Power Supply (3V - 5V)	

5. INTERFACE TIMING CHART

(1)(a)MIPI Interface DC Characteristic

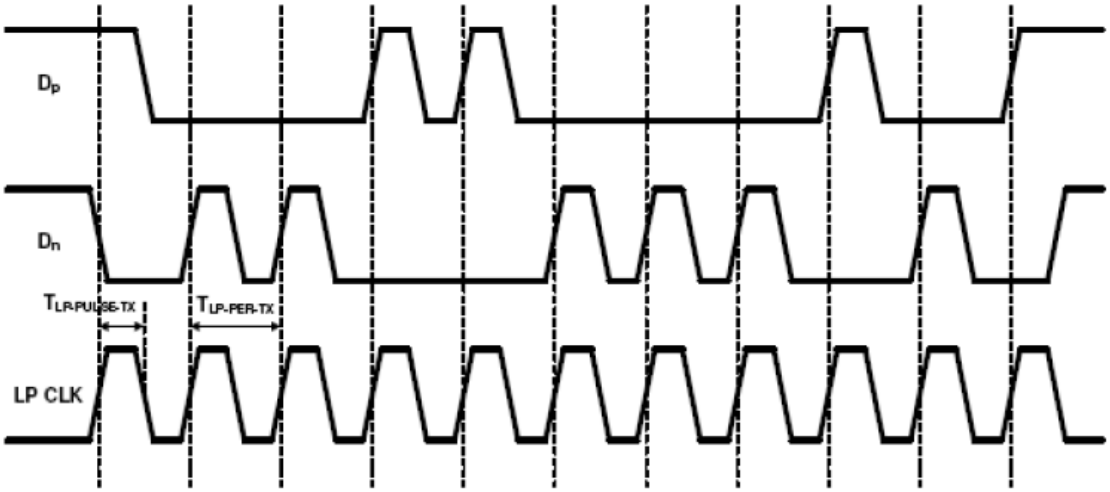
Parameter			Min.	Typ.	Max.	Unit	Remarks
Input data bit rate		BR_{MIPI}	200	-	1000	Mbps	
Differential Input impedance		Z_{ID}	80	100	125	Ω	
High speed Rx	Common-mode voltage	V_{CMRX}	70	-	330	mV	
	Differential input high threshold	V_{IDTH}	-	-	70	mV	
	Differential input low threshold	V_{IDTL}	-70	-	-	mV	
	Differential input voltage range	$\|V_{IDM}\|$	70	-	500	mV	
	Single-end input high voltage	V_{IHHS}	-	-	460	mV	
	Single-end input low voltage	V_{ILHS}	-40	-	-	mV	
Low Power Rx	Logic 1 input voltage	V_{IHLP}	880	-	-	mV	
	Logic 0 input voltage	V_{ILLP}	-	-	550	mV	
Low power Tx	Output high level	V_{OH}	1.08	1.2	1.32	V	
	Output low level	V_{OL}	-50	-	50	mV	



(b) MIPI Interface AC Characteristic

Parameter		Min.	Typ.	Max.	Unit	Remarks
Minimum pulse width response (LP Rx mode)	T_{MIN-RX}	50	-	-	ns	
Pulse width of the LP exclusive-OR clock	$T_{LP-PULSE-TX}$	50	55	58	ns	Note 1
15%~85% rise time and fall time (LP Tx mode)	T_{RLP} / T_{FLP}	-	-	25	ns	
30%~85% rise time and fall time of EOT (LP Tx mode)	T_{REOT}	-	-	35	ns	
Period of the LP exclusive-OR clock	$T_{LP-PER-TX}$	90	-	-	ns	
Data to clock setup time	T_{SETUP}	0.15	-	-	UI	
Data to clock setup time	T_{HOLD}	0.15	-	-	UI	

Note 1 : 1st clock pulse after STOP state or last clock pulse before STOP state/all other pulse



(c) Data mapping

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

(2) Timing Chart

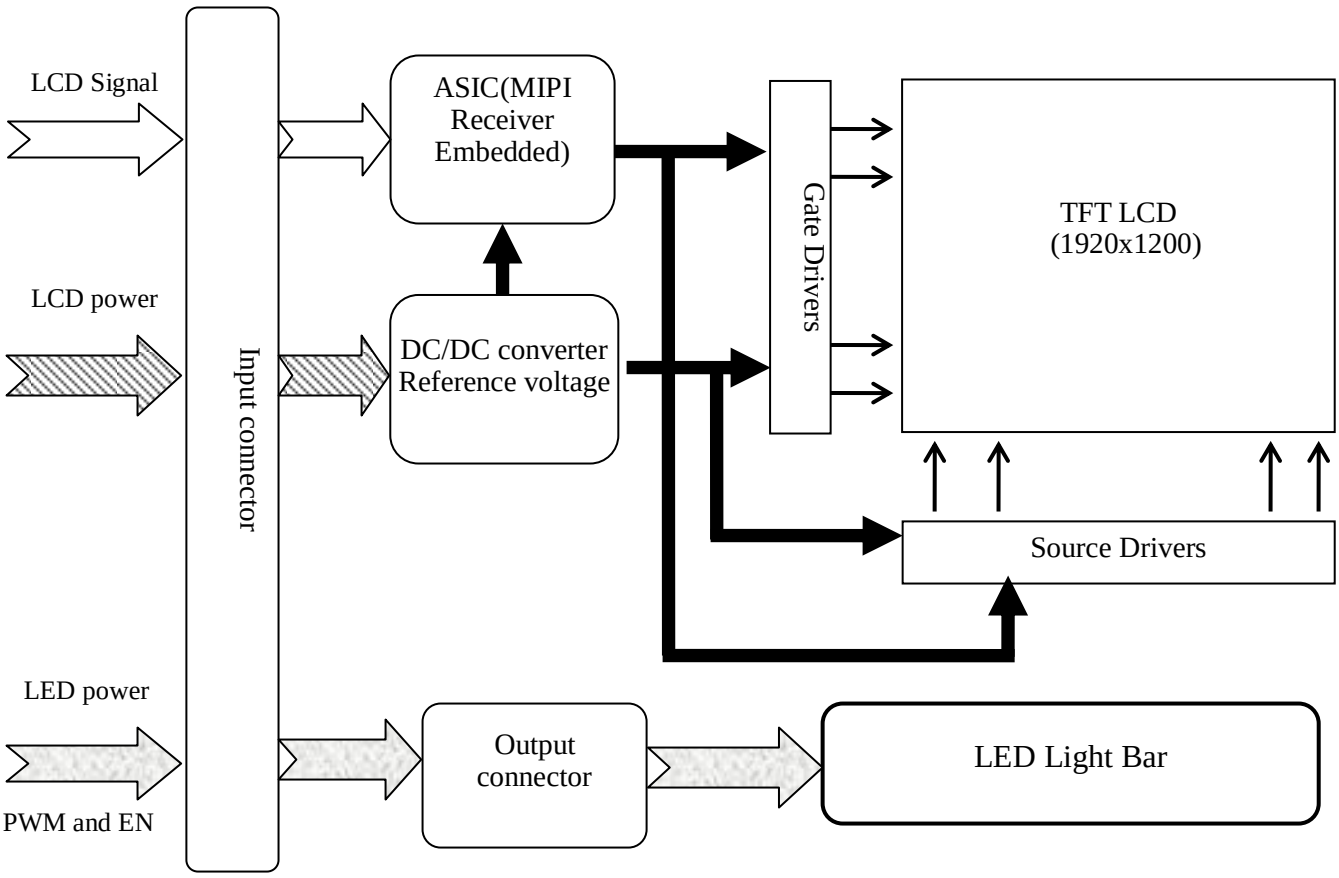
ITEM				SYNBOL	MIN	TYP	MAX	UNIT
LCD Timing	Frame Rate			-		60		Hz
	DCLK		Frequency	f_{CLK}	146.74	148.35	154	MHz
	DENA	Horizontal	Horizontal total time	t_H	2028	2040	2080	t_{CLK}
			Horizontal Active time	t_{HA}		1920		t_{CLK}
			Horizontal Blank time	t_{HB}	108	120	160	t_{CLK}
		Vertical	Vertical total time	t_V	1206	1212	1235	t_H
			Vertical Active time	t_{VA}		1200		t_H
			Vertical Blank time	t_{VB}	6	12	35	t_H

【Note】

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

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

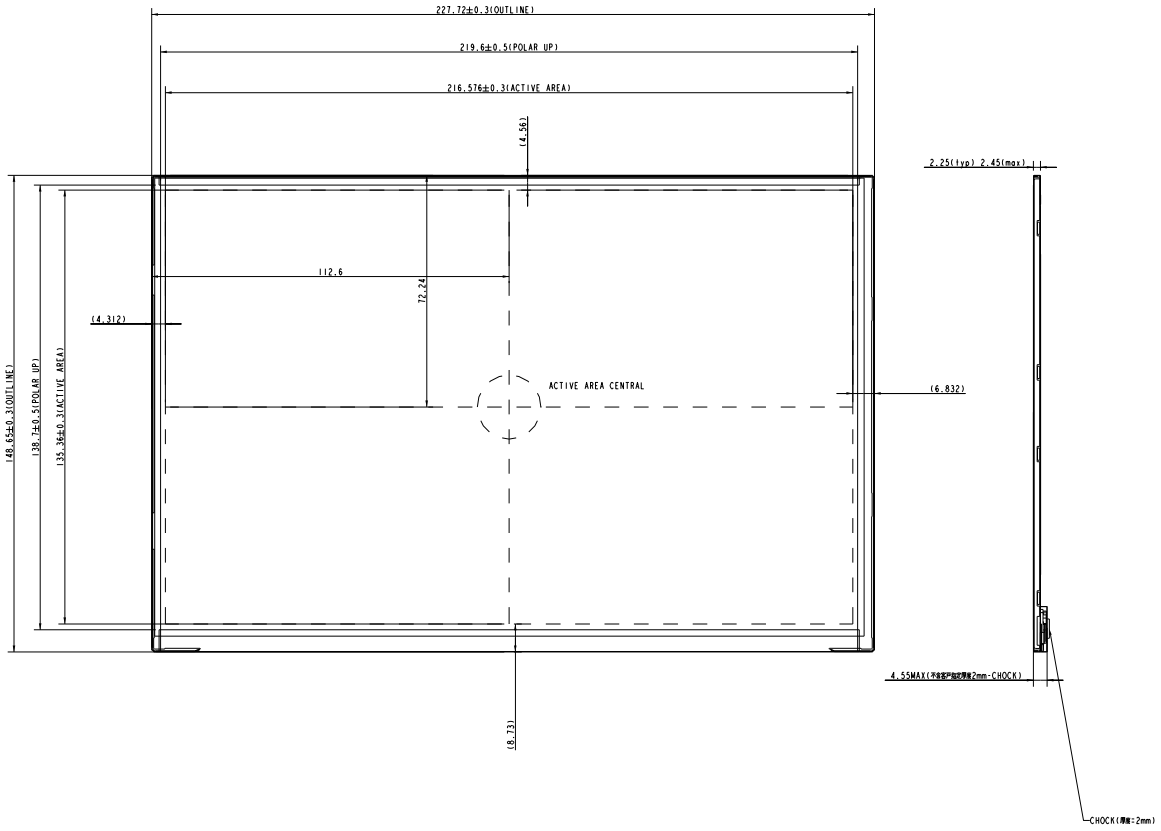
6. BLOCK DIAGRAM



7. MECHANICAL SPECIFICATION

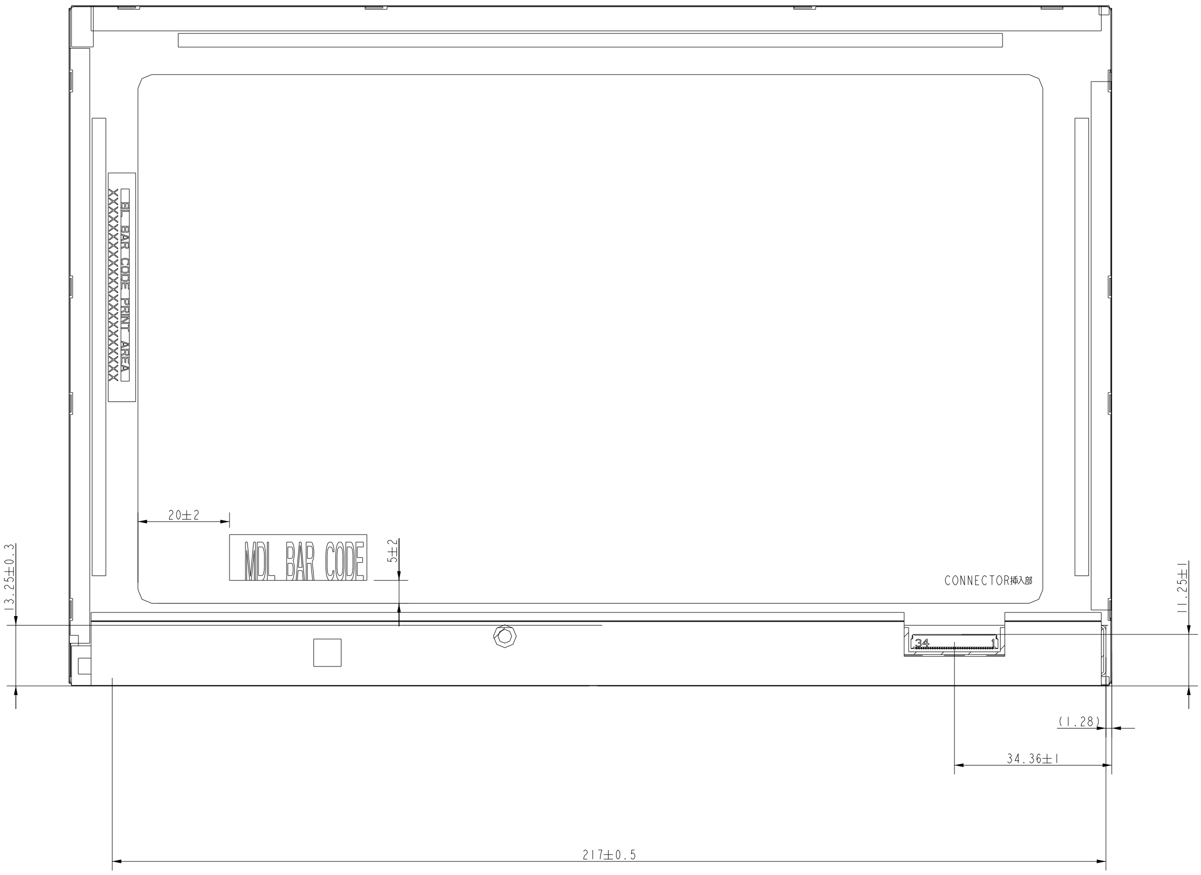
(1) Front side

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



(2) Rear side

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



8. OPTICAL CHARACTERISTICS

Ta=25℃，VDD=3.3V

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Contrast Ratio		CR	θ=ψ= 0°	600	800	--	--	*1) 2)
Luminance (center)		L	θ=ψ= 0°	270	370	--	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°	--	30	45	ms	*5)
		Tf						
Cross Talk		CT	θ=ψ= 0°	--	--	2.5	%	*6)
View Angle	Horizontal	ψ	CR≧10	80/-80	89/-89	--	°	*4)
	Vertical	θ		80/-80	89/-89	--	°	*4)
Color Coordinate	W	x	θ=ψ= 0°	0.283	0.313	0.343		*3)
		y		0.299	0.329	0.359		
	R	x		0.580	0.610	0.640		
		y		0.310	0.340	0.370		
	G	x		0.290	0.320	0.350		
		y		0.520	0.550	0.580		
	B	x		0.120	0.150	0.180		
		y		0.080	0.110	0.140		
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).

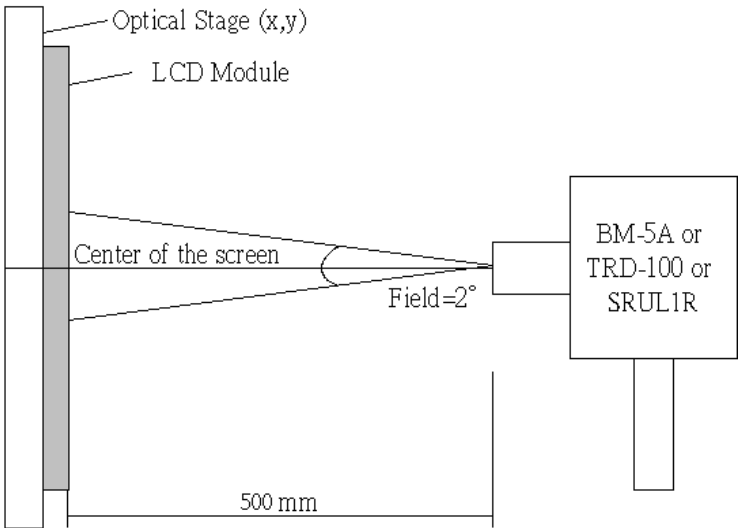
Measurement Condition: VCC=3.3V，Vadj=3.3V Duty 100% or IL= 21.5mA (each LE**Definition of these measurement items is as follows:**

***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 Uniformity: Δ L = (Lmin / Lmax) ×100%(Lmin & Lmax choose of position “5”, “10”, “11”, “12”, “13”.

13P Uniformity: Δ L = (Lmin / Lmax) ×100%(Lmin & Lmax choose of position “1”~”13”.

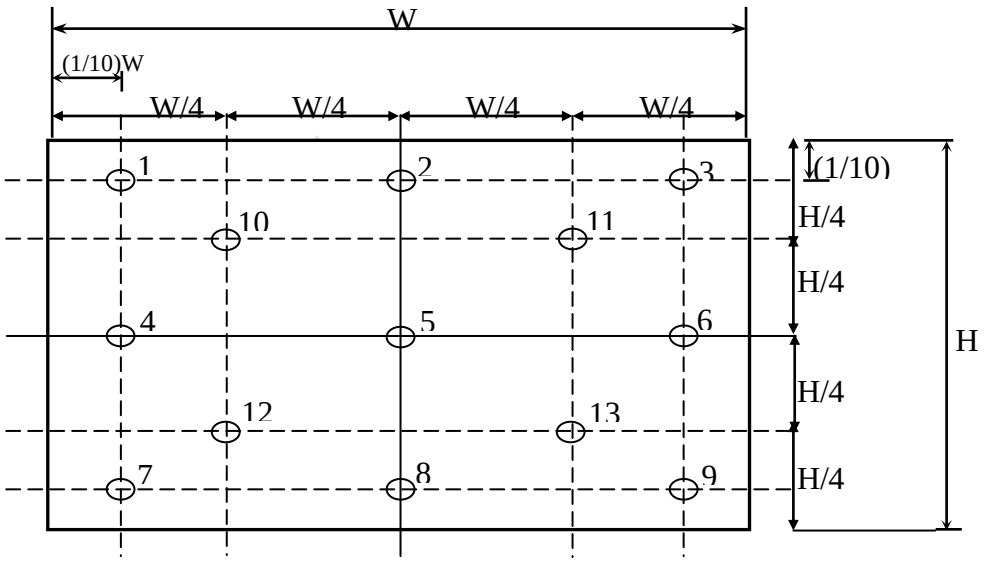
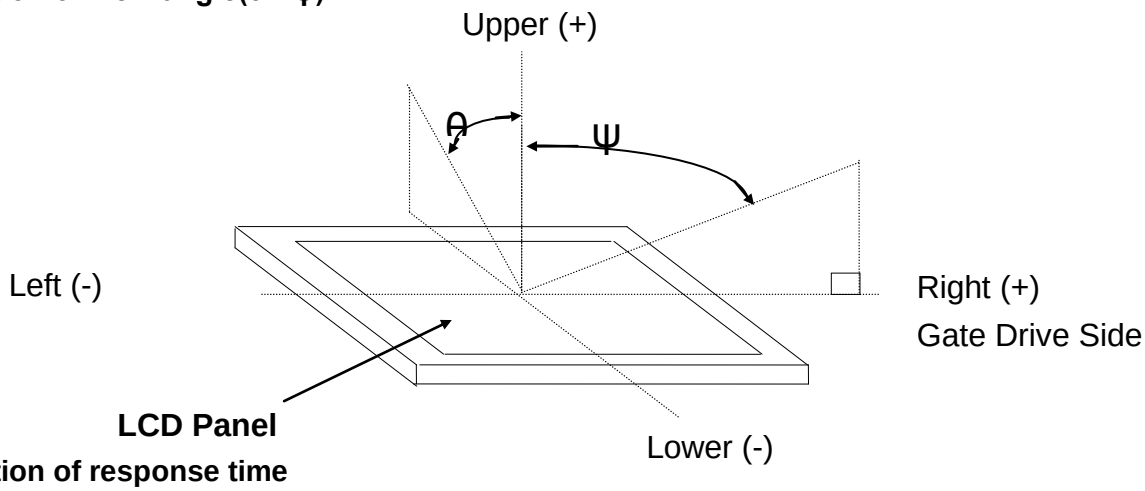
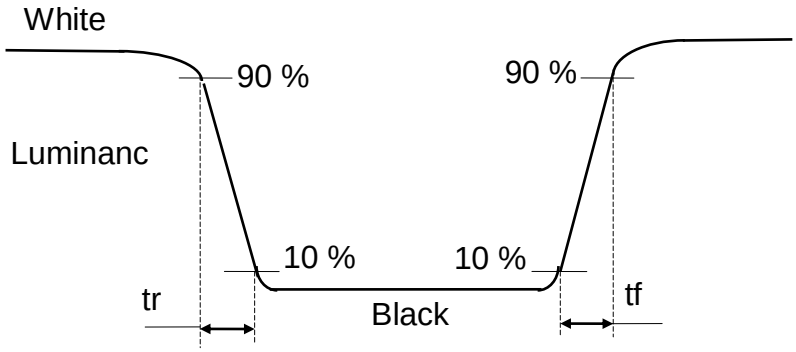


Fig.1 Measure point (Active area)

***4) Definition of view angle(θ，ψ)**



***5) Definition of response time**



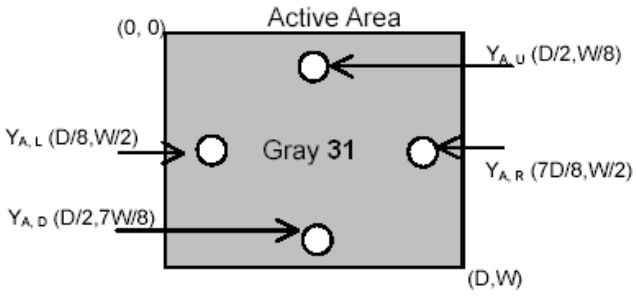
***6) Crosstalk Modulation Ratio**

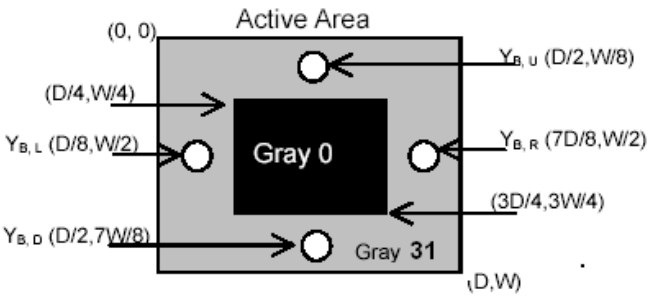
CT=｜Y_B-Y_A｜ / Y_{Ax}× 100%

Y_A、Y_B measure position and definition

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

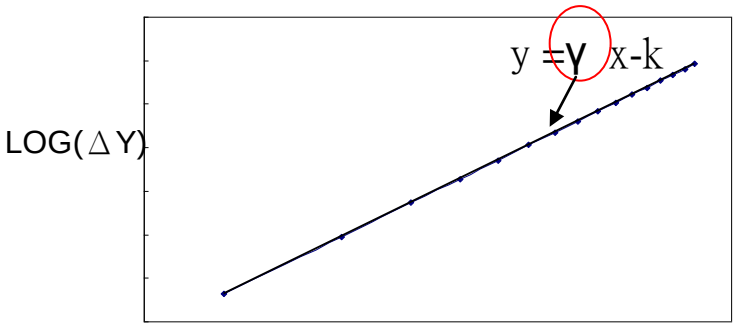
Y_B means luminance at gray level 31(include gray level 0 pattern)





***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).



LOG（Gray Level）

9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

Test Items	Conditions
High Temp. Storage Test	60℃，240 Hrs
High Temp. Operating Test	50℃，240Hrs
Low Temp. Storage Test	-20℃，240 Hrs
Low Temp. Operating Test	0℃，240 Hrs
High Temp/ High Humidity Operating Test	50℃，80% RH，240Hrs
High Temp./High Humidity Storage Test	60℃，90% RH ，240Hrs
Thermal Shock Test	-20℃(0.5 Hr)~60℃(0.5 Hr) 27 Cycles

(2) Shock & Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	980m/s2,Action time: 6ms, Time: 3 times for each direction, Direction :+/-X, +/-Y, +/-Z
Vibration (Non-Operation)	Frequency range: 10-55Hz, stroke:1.5mm, sweep time: 1 minute, test period: 2 hours for each direction of X, Y, Z
Package Drop test	Height: 60cm, 1 corner, 3 edges, 6 surfaces: 1 time for each direction

(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	±250 V
Interval	1 sec	1 sec	1 sec
Times(single point)	25	25	1

12. 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.

(2.1) 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.

(2.2) 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.

(2.3) 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.

(2.4) Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.

(2.5) Keep sufficient clearance between LCD module and the others parts, such as inverter and 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 wit inverter.

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 so on.

(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:

(3.1) 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.

(3.2) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.

(3.3) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.

(3.4) 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.)