



# SmarterGlass

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# Chunghwa Picture Tubes, Ltd.

## Technical Specification

To : **Smarterglass**

Date : 160629

*CPT TFT-LCD*

**CLAA170EC01CW**

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SPEC_CLAA170EC01_V1.4_Smarterglass_160629		

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## 1. OVERVIEW

CLAA170EC01CW is 17.0" color 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 (6Bit+HFRC), 1280×RGBX3 X1024, 16.7M-color images are displayed on the 17.0" diagonal screen.

General specifications are summarized in the following table:

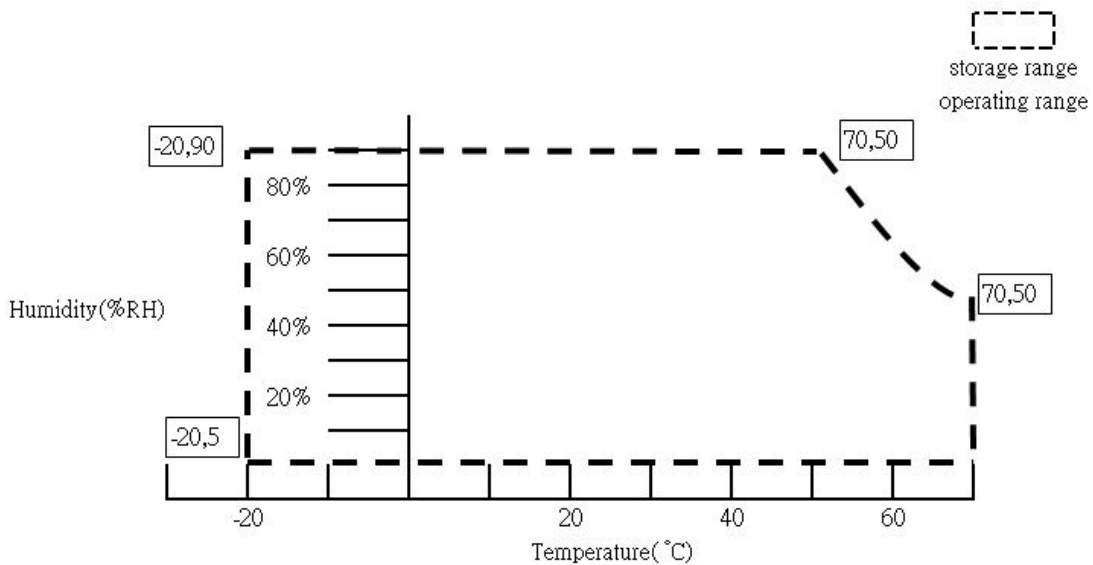
ITEM	SPECIFICATION
Display Area(mm)	337.92(W) × 270.336(H) (17.0-inch diagonal)
Number of Pixels	1280(H) × 1024(V)
Pixel Pitch(mm)	0.264(W) × 0.264(H)
Color Pixel Arrangement	RGB vertical strip
Display Mode	Normally white, TN
Number of Colors	16.7M (6Bit+HFRC)
Brightness(cd/m <sup>2</sup> )	450 (typ.) (Center point, 110 mA)
Viewing Angle	160 /140(Typ.)
Optimum Viewing Direction	6 O'clock(Max contrast ratio, Gray level inversion)
Surface Treatment	Anti-Glare, 3H
Power consumption(W)	TFT LCD Cell=1.4W · Backlight=12W(Typ)
Interface Connection	LVDS
Module Size(mm)	358.5 × 296.5 × 11.5 (typ)
Module Weight(g)	1100(typ.)
Backlight Unit	LED:(white-LED)

## 2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	6.0	V	
Logic Input Voltage	VI	0	6.0	V	
Backlight Power Supply Voltage	VLED	0	15	V	
Backlight ON-OFF Voltage	LED_EN	0	6	V	
Backlight Dimming Control Input Voltage	LED_PWM	0	6	V	
LED Forward voltage	VF	2.8	6.0	V	1). 2)
LED Forward current	IF	--	6.0	mA	
Operation Temperature	Top	-20	70	°C	3). 4). 5). 6).
Storage Temperature	Tstg	-30	80	°C	3). 4). 5). 6).

[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.( $T_a \leq 40^\circ\text{C}$ ).
- 4).The maximum wet bulb temperature  $\leq 39^\circ\text{C}$  ( $T_a > 40^\circ\text{C}$ ) 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) If you operate the product in normal temperature range, the center surface of front side panel should be under  $80^\circ\text{C}$



### 3. ELECTRICAL CHARACTERISTICS

#### (1).TFT-LCD

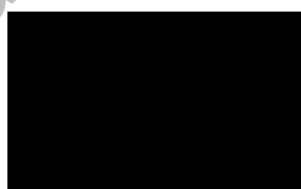
ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage		VCC	4.5	5.0	5.5	V	
LCD Power Current		ICC	-	290	500	mA	*1)
LCD Rush Current		VCC_Irush			3	A	*4)
Logic Input Voltage (LVDS: IN+,IN-)	Common Voltage	VCM	$\frac{ VID }{2}$	-	$2.4 - \frac{ VID }{2}$	V	Logic Input Voltage (LVDS: IN+,IN-)
	Differential Input Voltage	VID	200	-	600	mV	*2)
	Threshold Voltage (HIGH)	VTH	-	-	100	mV	
	Threshold Voltage (LOW)	VTL	-100	-	-	mV	
1 Data time		UI	-	tclk*1/7	-	tclk	*3)
LVDS clock to data skew		tskew	-	-	300	ps	*3)
input data eye width		teyew	1516	-	-	ps	*3)
Logic Input Voltage	VIH	0.7*DVDD	-	DVDD	V		Logic Input Voltage
	VIL	GND	-	0.3*DVDD	V		
Power consumption		P		1.4	1.8	W	

**【Note】**

- \*1)TYP. specification : Gray-level test Pattern (TYP Freq. @5.0V)
- MAX. specification : Black test Pattern (TYP Freq. @5.0V)

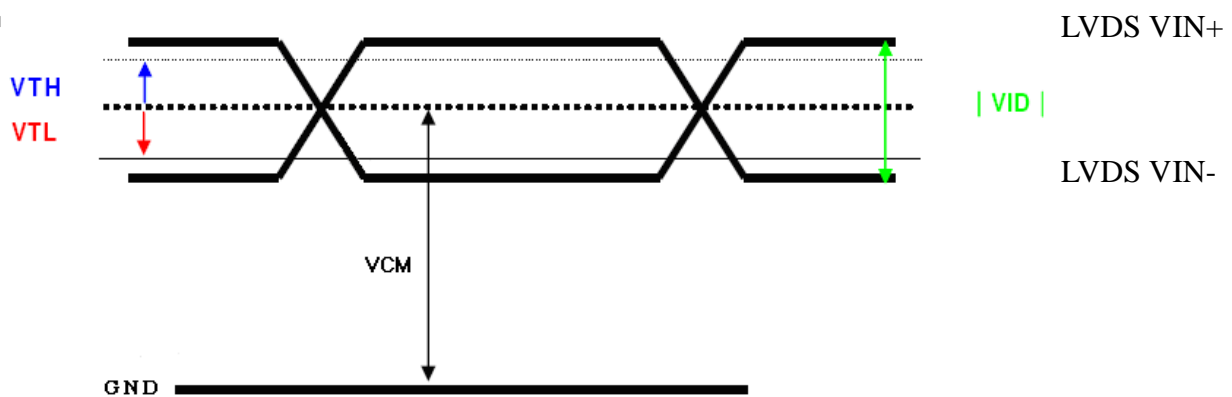


Gray-level Pattern



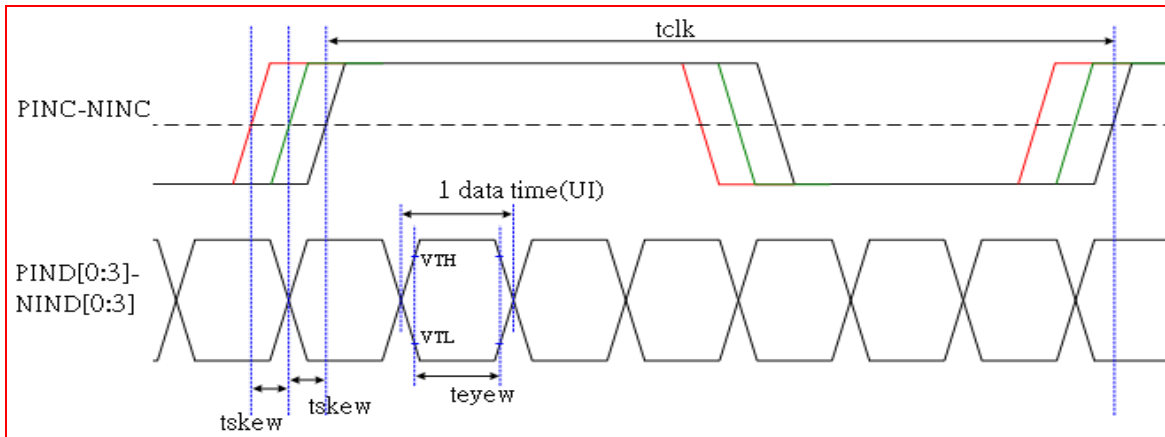
Black Pattern

- \*2) LVDS Signal Definite :

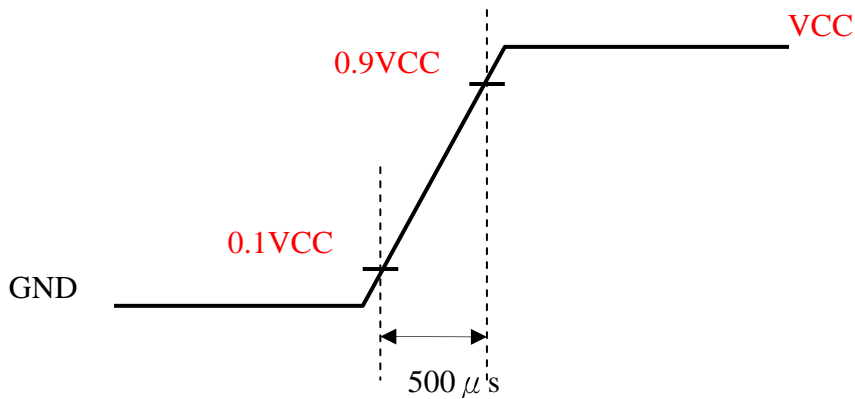
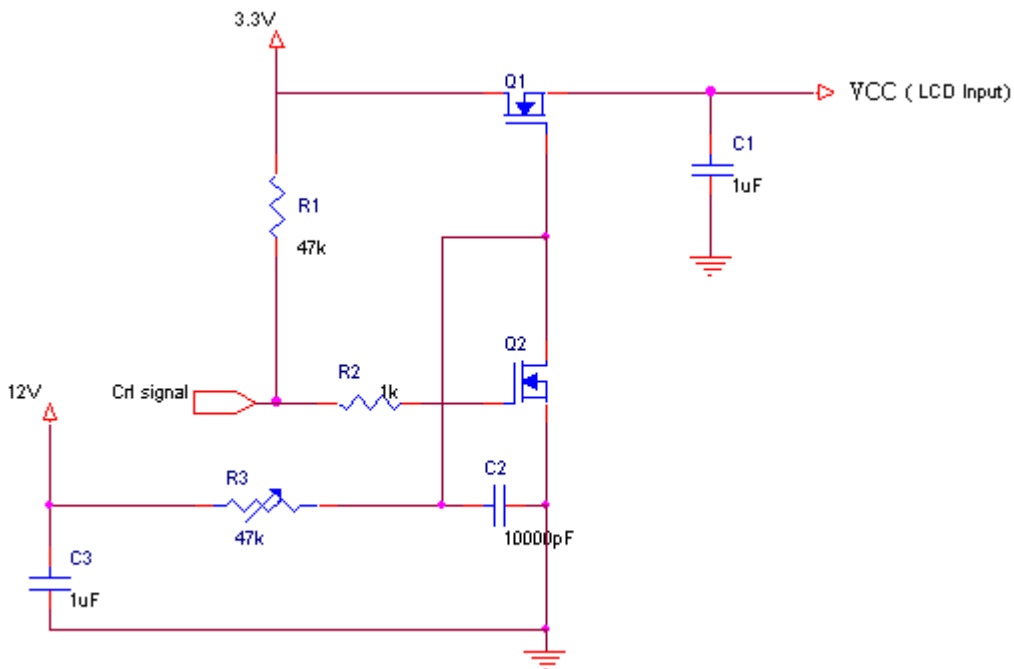


VIN+ : Positive differential DATA & CLK Input  
 VIN- : Negative differential DATA & CLK Input

\*3)The following conditon is base on operation frequency at 67.5MHz



\*4) Irush measure condition





**(2) Backlight**

1. Electrical specification

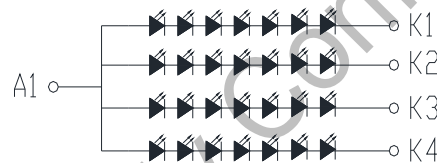
1-1 single

LED<sub>Ta</sub>=25°C (Ta: ambient temperature)

Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks
Forward Voltage	VF	Ta=25°C Each serial=110mA	2.8	3.1	3.4	V	1) 2) 3)
Forward Current	IF	Ta=25°C Each serial=110mA	--	110	--	mA	1) 2) 3)
Lifetime(Backlight)	-		50000	70000	--	Hr	4) 5)

Remarks :

\*1)LED Circuit Diagram :



\*2) A : Anode(+) , K : Cathode(-)

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

\*4) When the ambient temperature Ta overstep 25°C , it will serious damage life time.

\*5) When the LED operation current IF overstep 110mA, it will serious damage life time.

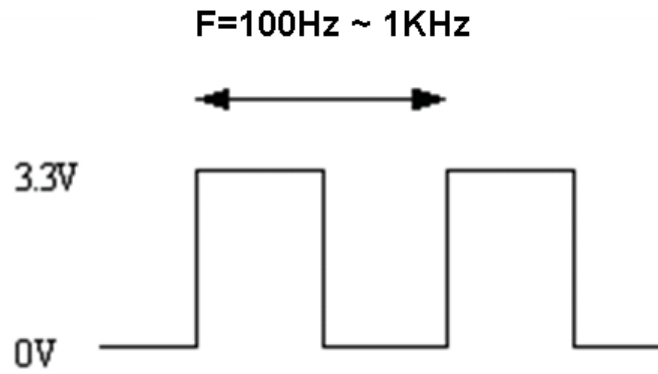
**(3).Converter Specification for Backlight**

Ta=25°C

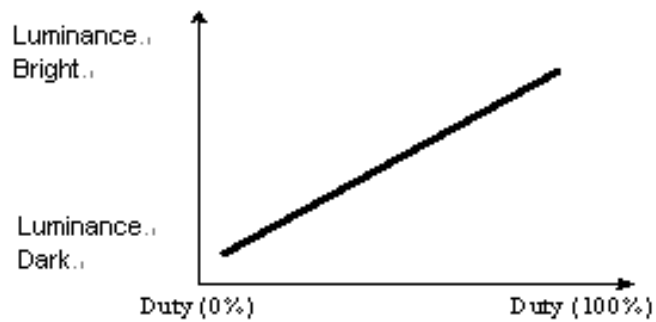
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VLED	10.8	12.0	13.2	V	
LED Driver Input Current	IVLED	-	1180	1600	mA	*1)
LED Rush Current	VLED_Irush			3	A	*3)
Dimming Control	High	2.4	--	5.5	V	Dimming Control
	Low	0		0.8		
PWM Frequency	LED_PWM	100	200	1K	Hz	*2)
Duty Ratio		5	-	100	%	
ON/OFF Control	High	2.4		5.5	V	ON/OFF Control
	Low	0		0.8		
Power Consumption (Backlight)	BLW	--	12	14	W	

\*1) Maximum LED Driver Input Current at 10.8V Input Voltage/PWM Duty 100%.

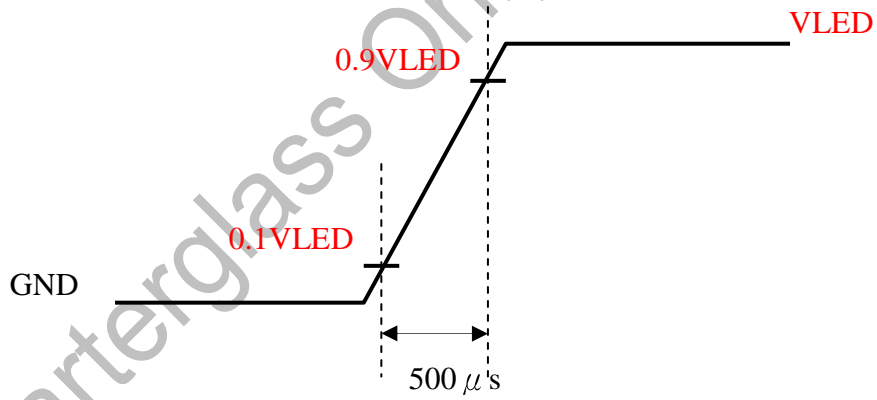
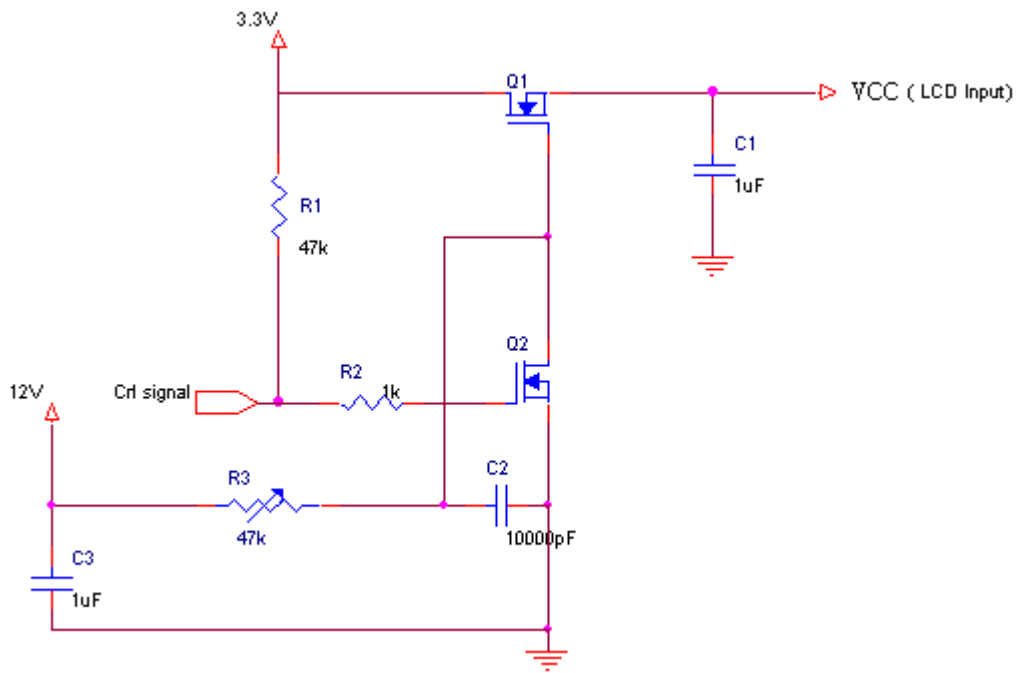
\*2) The ADJ adjust signal level is 0~3.3V , operation frequency:100Hz~1KHz ◦



The ADJ can adjust LED BL brightness , where Duty and Luminance are in direct ratio.



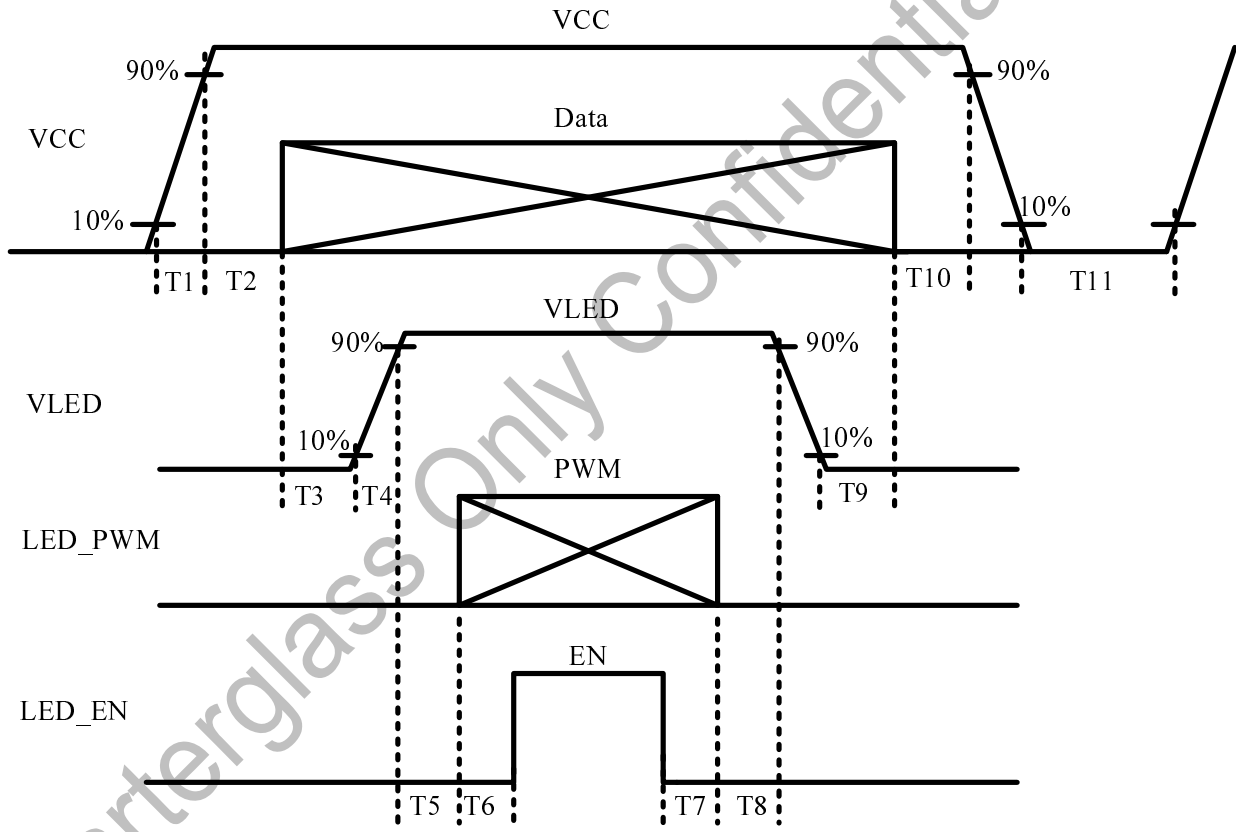
\*3) Irush measure condition



**(4). Power and Signal sequence**

Power Sequence :

$0.50\text{ ms} \leq T1 \leq 10\text{ ms}$	$200\text{ ms} \leq T3$	$10\text{ ms} \leq T8$
$0.01\text{ ms} < T2 \leq 50\text{ ms}$	$10\text{ ms} \leq T5$	$200\text{ ms} \leq T9$
$0.50\text{ ms} \leq T4 \leq 10\text{ ms}$	$10\text{ ms} \leq T6$	$500\text{ ms} \leq T11$
$0.01\text{ ms} < T10 \leq 50\text{ ms}$	$0\text{ ms} \leq T7$	



Data: NIND0 ~ NIND3 , PIND0 ~ PIND3 , NINC , PINC , DENA

## 4. INTERFACE PIN CONNECTION

Used connector: 093G30-B2001A-M4(STARCONN) or equivalent

PIN NO.	SYMOBL	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	ground
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	ground
15	RXE1-	minus signal of even channel 1(LVDS)
16	RXE1+	plus signal of even channel 1(LVDS)
17	GND	ground
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	ground
25	GND	ground
26	GND	ground
27	GND	ground
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) Please 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.

## (2) CN2 (Backlight)

Outlet connector : 3806K-F06Y-03R (ENTERY)

Plug connector : H208K-D06N-22B (ENTERY) or equivalent

PIN #	SYMBOL	FUNCTION
1	VLED	+12V Power Supply
2	VLED	+12V Power Supply
3	GND	GND
4	GND	GND
5	LED_EN	ON : 5V / OFF: 0V (*1)
6	LED_PWM	Light Dimming Control : PWM Input for Dimming: L : 0V / H : 5V Freq : 100-1000Hz Duty : 5%-100%

\*1) Enable High=5.5 to 2.4, Low=0 to 0.8V

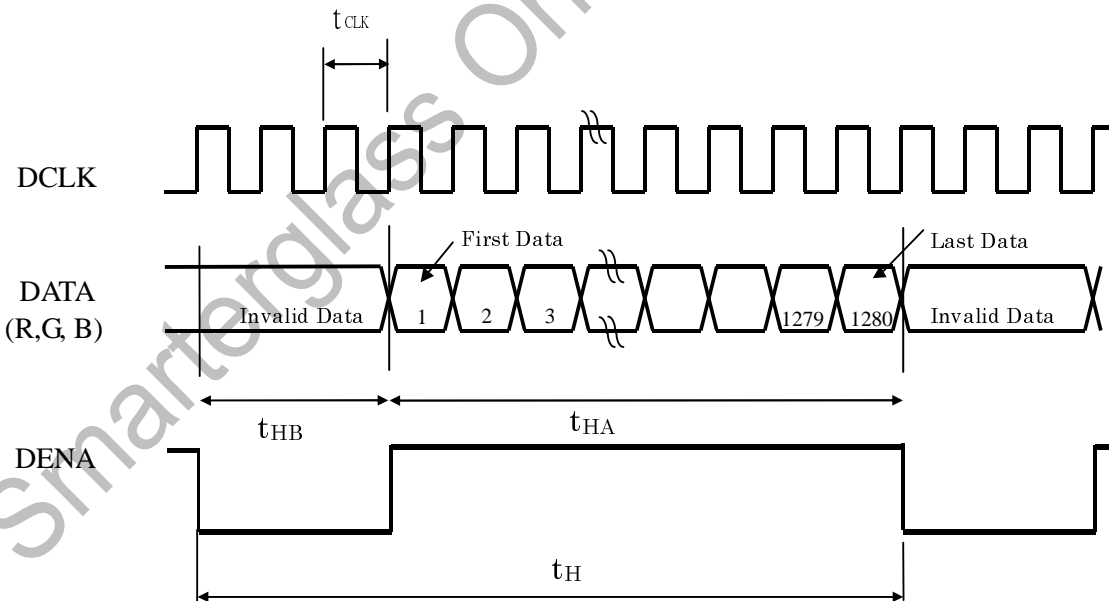
### 5. INTERFACE TIMING

(1) Timing Specifications

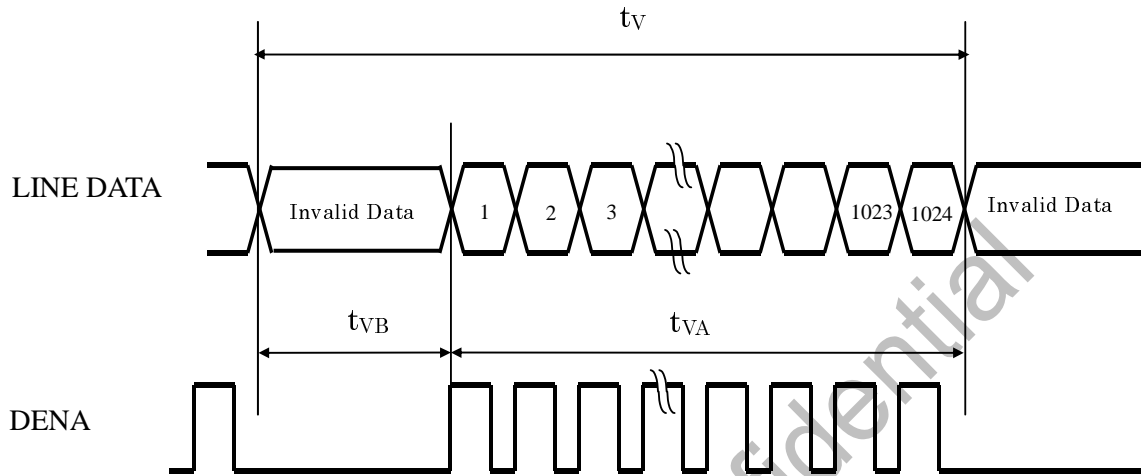
ITEM		SYMBOL	MIN	TYP	MAX	UNIT	
LCD Timing	DCLK	Frequency	$f_{CLK}$	<b>44</b>	54	<b>67.5</b>	MHz
		Period	$t_{CLK}$	<b>14.81</b>	18.52	<b>22.2</b>	ns
	DATA Enable DENA	Horizontal Active Time	$t_{HA}$	<b>640</b>			tCLK
		Horizontal Blank Time	$t_{HB}$	<b>140</b>	204	-	tCLK
		Horizontal Total Time	$t_H$	<b>780</b>	844	<b>2047</b>	tCLK
		Vertical Active Time	$t_{VA}$	<b>1024</b>			tH
		Vertical Blank Time	$t_{VB}$	<b>8</b>	42	<b>126</b>	tH
		Vertical Total Time	$t_V$	<b>1032</b>	1066	<b>1150</b>	tH
	Vertical Frame Rate	Fr	<b>50</b>	60	<b>75</b>	Hz	

(2) Timing Chart

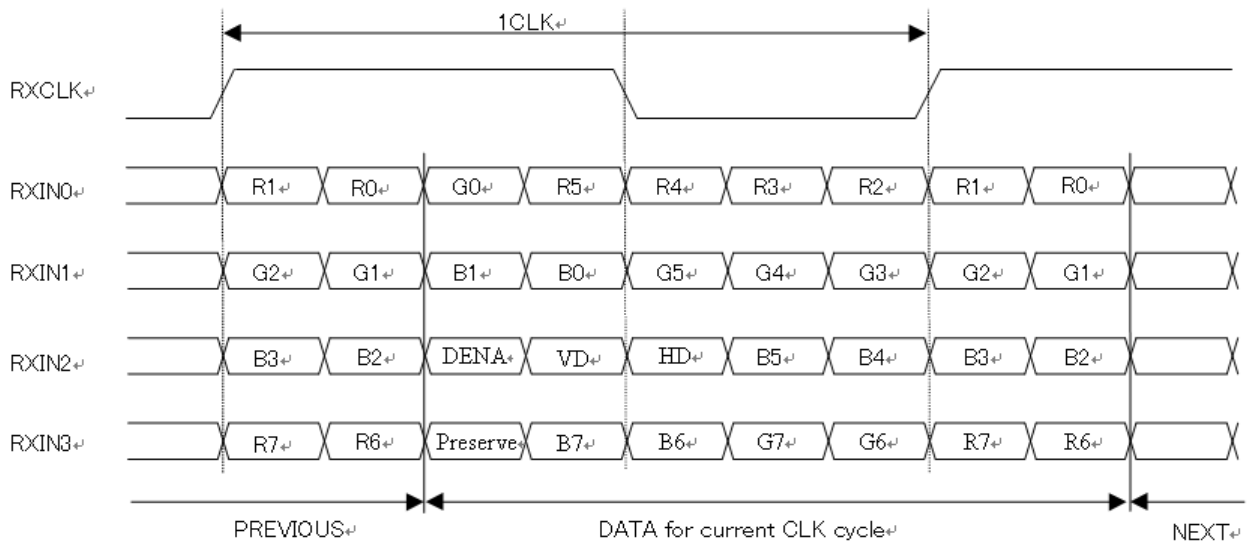
a. Horizontal Timing



b. Vertical Timing



(3) LVDS DATA (VESA) : Timing Chart





(4) Color Data Assignment

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	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	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	
	GREEN(255)	0	0	0	0	0	0	0	0	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	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	
	MAGENTA	1	1	1	1	1	1	1	1	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	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	
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		
	RED(1)	0	0	0	0	0	0	0	1	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		
	RED(254)	1	1	1	1	1	1	1	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		
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		
	GREEN(1)	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	1	0	0	0	0	0	0	0	0		
	GREEN(254)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0		
	GREEN(255)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	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		
	BLUE(1)	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	1	0		
	BLUE(254)	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	1	1	1	1	1	1	1	1		

[Note]

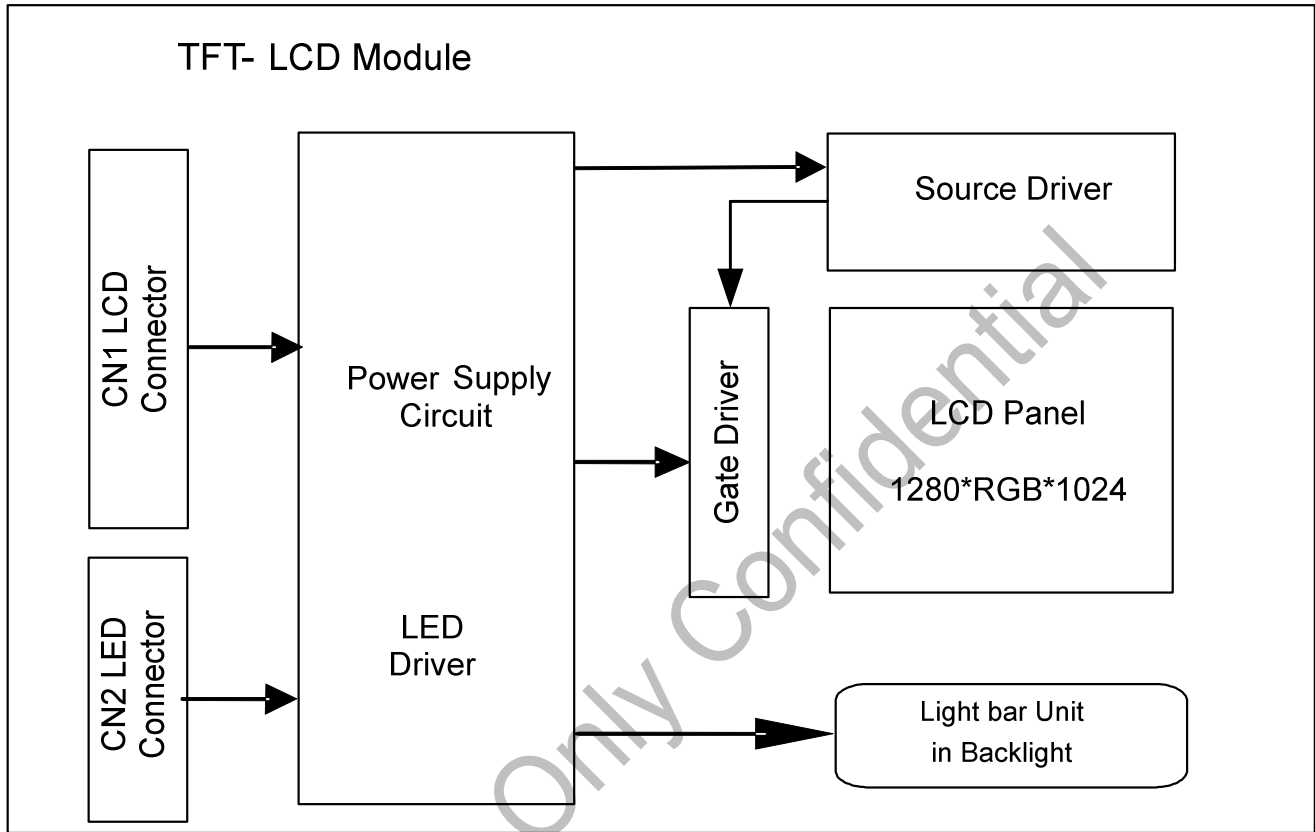
1) Definition of gray scale:

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.

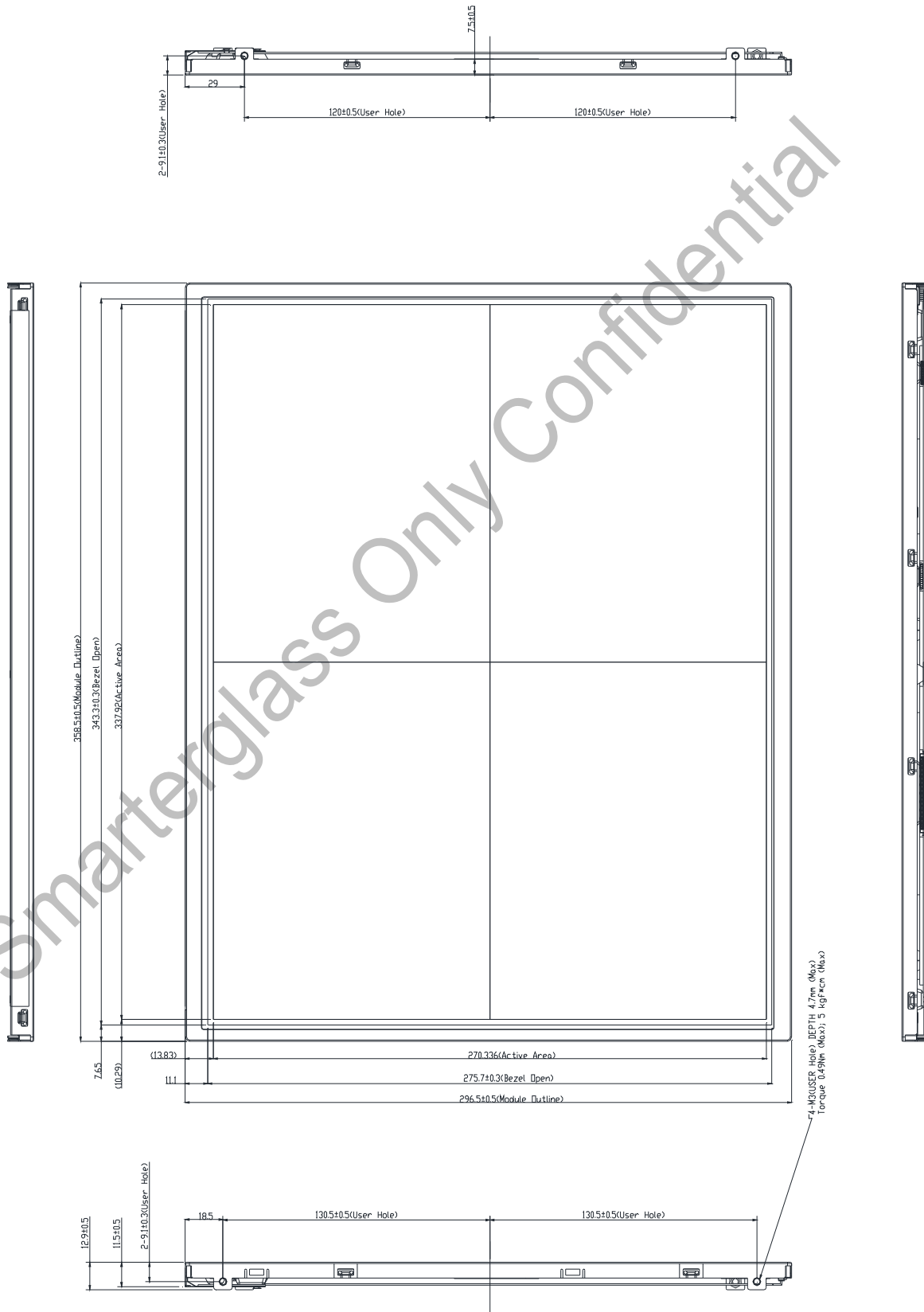
### 6. BLOCK DIAGRAM



### 7. MECHANICAL SPECIFICATION

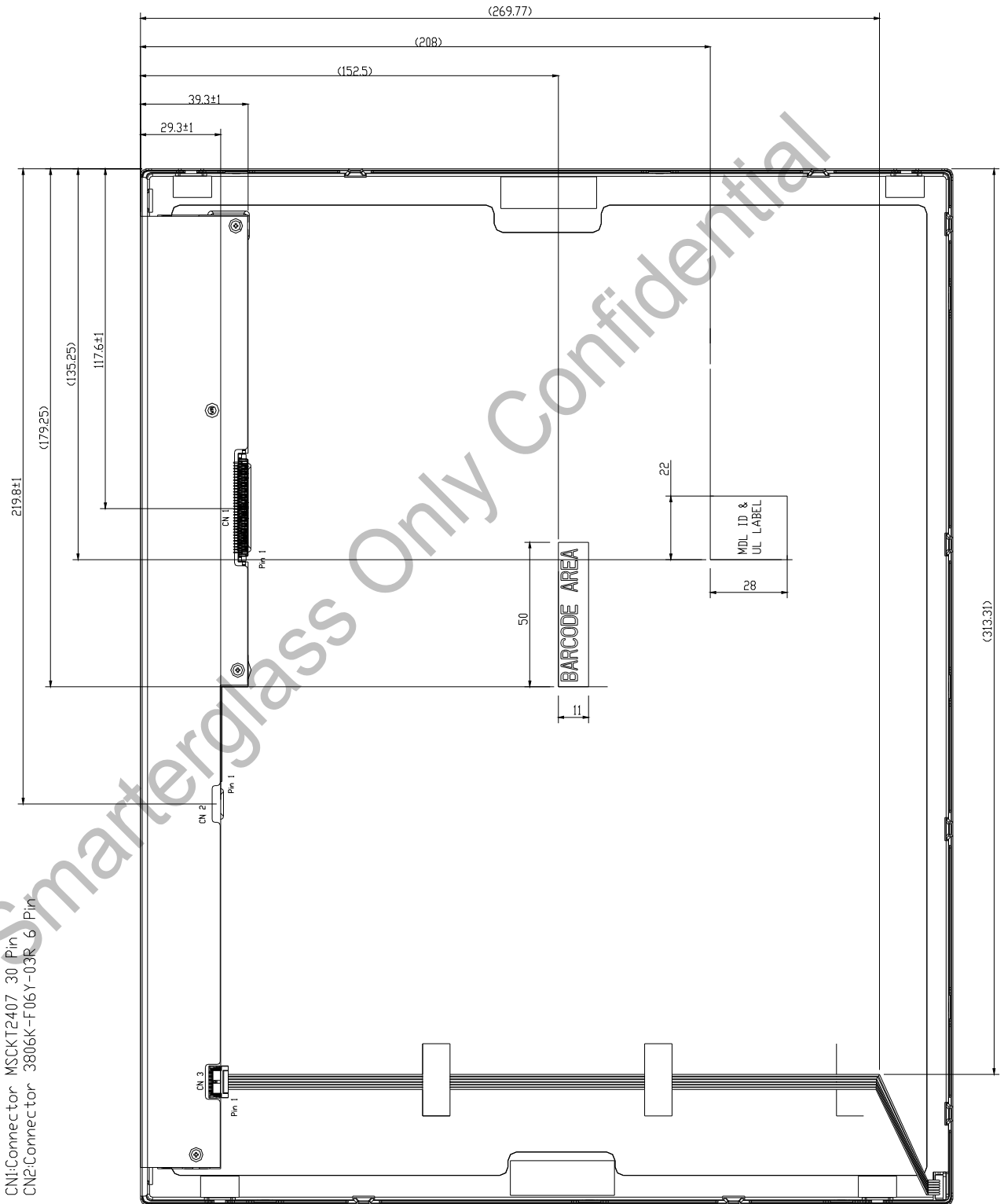
(1) Front side (Tolerance is  $\pm 0.5\text{mm}$  unless noted)

Unit: mm



(2) Rear side (Tolerance is  $\pm 0.5\text{mm}$  unless noted)

Unit: mm:



CN1:Connector MSCKT2407 30 Pin  
CN2:Connector 3806K-F06Y-03R-6 Pin

## 8. OPTICAL CHARACTERISTICS

Ta=25°C , VCC=3.3

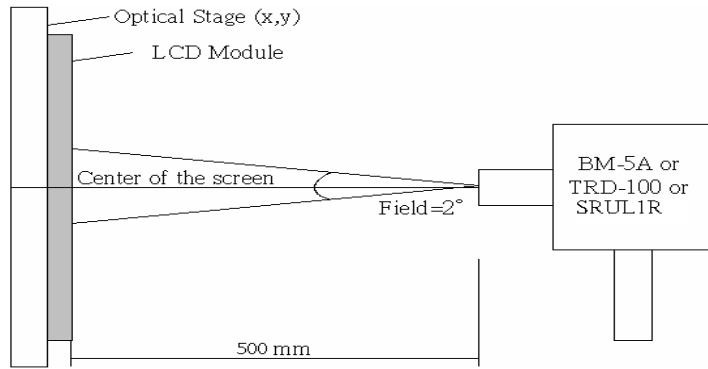
ITEM		SYMBOL	CONDITION	min	typ	max	UNIT	REMARK
Contrast Ratio		CR	$\theta = \psi = 0^\circ$	500	700	--	--	*1) 2)
Luminance(CEN)		L	$\theta = \psi = 0^\circ$	360	450	--	cd/m <sup>2</sup>	*1) 3)
9P Uniformity		$\Delta L$	$\theta = \psi = 0^\circ$	75	80	--	%	*1) 3)
Response Time		Tr	$\theta = \psi = 0^\circ$	--	10	15	ms	*5)
		Tf	$\theta = \psi = 0^\circ$	--	15	25		
Crosstalk		CT	$\theta = \psi = 0^\circ$	--	--	--	%	*6)
Viewing Angle	Horizontal	$\psi$	$CR \geq 10$	-70~70	-80~80	--	Deg.	*4)
	Vertical	$\theta$		-60~60	-70~70	--	Deg.	
Color Chromaticity	W	x	$\theta = \psi = 0^\circ$	0.263	0.313	0.363	--	*3)
		y		0.279	0.329	0.379		
	R	x		0.579	0.629	0.679		
		y		0.295	0.345	0.395		
	G	x		0.259	0.309	0.359		
		y		0.587	0.637	0.687		
	B	x		0.104	0.154	0.204		
		y		0.010	0.060	0.110		
Gamut	CG	$\theta = \psi = 0^\circ$	67	72	--	--	Gamut	
Gamma	$\gamma$	VESA	2	2.2	2.4	--	*7)	Gamma

[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:

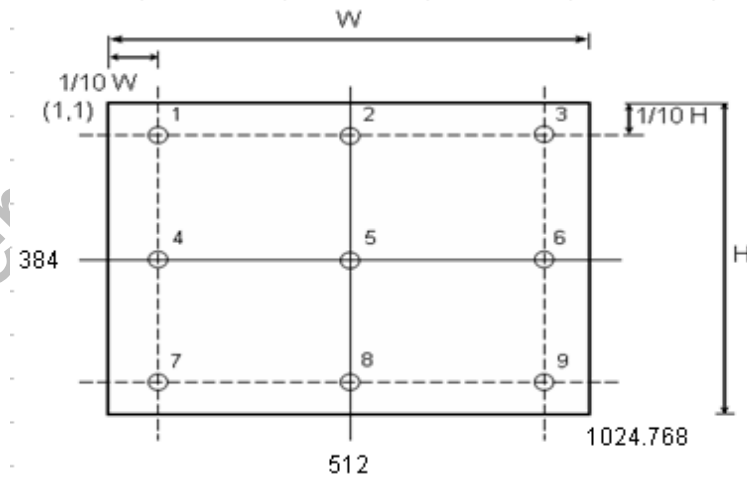
$$CR = \text{ON (White) Luminance} / \text{OFF (Black) Luminance}$$

3).Definition of Luminance and Luminance uniformity:

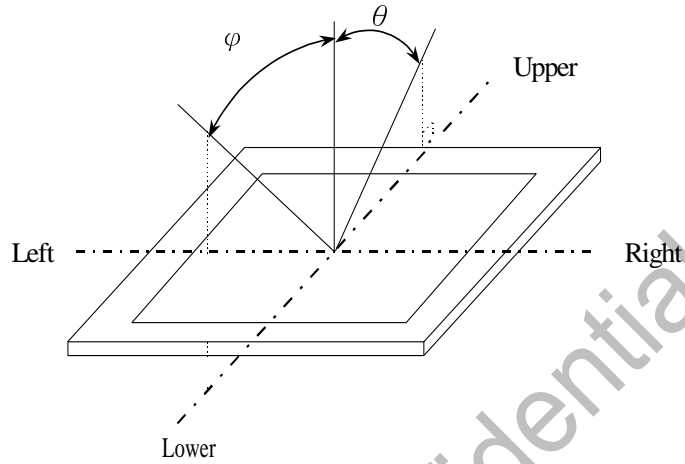
Center Luminance, &Color coordinate: measuring the luminance of the point no. 5

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

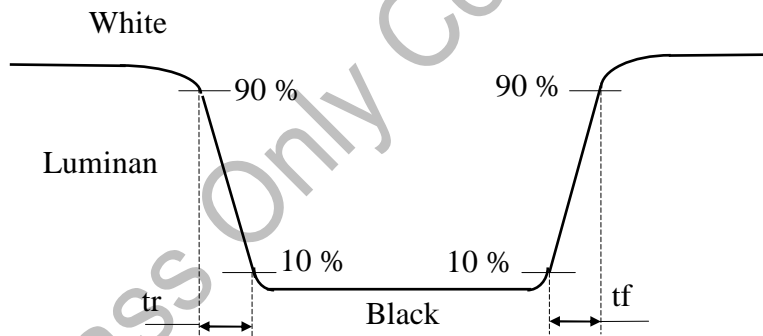
$$\text{Uniformity: } \Delta L = [L (\text{Min}) / L (\text{Max})] \times 100 \%$$



4).Definition of Viewing Angle ( $\theta, \psi$ ):



5) Definition of Response Time:

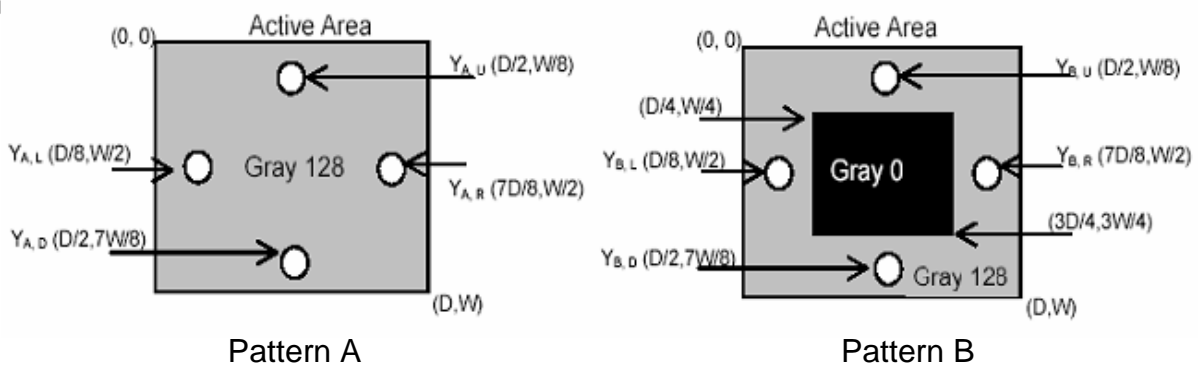


6) Definition of crosstalk:

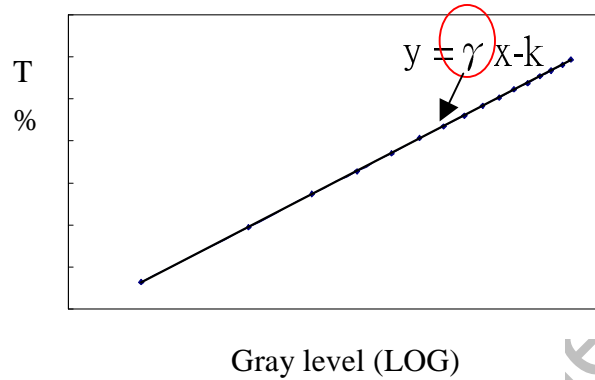
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

$Y_A$ : The luminance of measured position at pattern A

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



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



### 9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS	REMARK
High Temperature High Humidity Operation	60°C; 90%RH; 240hrs (No condensation)	
High Temperature Operation	70°C; 240hrs	
High Temperature Storage	80°C; 240hrs	
Low Temperature Operation	-20°C; 240hrs	
Low Temperature Storage	-30°C; 240hrs	
Thermal Shock	Between -30°C (1hr) ~ 80°C (1hr); 100 Cycles	
Image Sticking	25 °C ± 2 °C ; 4hrs	Note 1
MTBF	Life assurance 30,000hrs	

[Note]

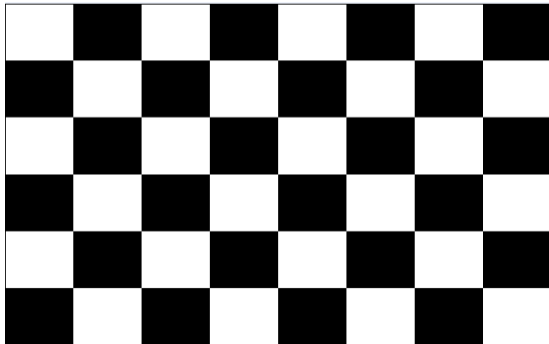
Definition of these measurement items is as follows:

1) Image Sticking :

Condition of image sticking test: 25°C



Operation with test pattern sustained for 4hrs, then change to gray pattern immediately.  
 After 5 min, the Mura must be disappeared completely.



(a) Test Pattern(Chess Board Pattern)



(b) judgment Pattern(Mid-Gray Pattern)

(2) Shock & Vibration

ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 1470 m/s <sup>2</sup> (150 G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock each direction-
VIBRATION (NON-OPERATION)	Sweep:1G, 10~300Hz Vibration : sinusoidal wave, 30min /axis

(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 (Air mode) , ±8K V (Contact mode) 2. Air mode, test 25 times for each test point 3. Contact mode, 25 times for each test point

(4) Judgment standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no line defect.

Fail: No display image or line defects

**10. WARRANTY**

- (1). The period is within 12 months since the date of shipping out under normal using and storage conditions.
- (2). The warranty will be avoided in case of defect induced by customer