



# SmarterGlass

state-of-the-art display solutions

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# Chunghwa Picture Tubes, Ltd.

## Technical Specification

To : **Smarterglass**

Date : 160629

*CPT TFT-LCD*  
**CLAA150XQ01CW**

ACCEPTED BY : (V1.0)

APPROVED BY	CHECKED BY	PREPARED BY
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<small>SPEC_CLAA150XQ01CW_V1.0_Sm arterglass_160629</small>		

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Doc. No:	SPEC_CLAA150XQ01CW_V1.0_CPT_20160426	Issue Date:	2016/04/26
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**Modification Record List**

Revision Notice	Description	Page	Rev. Date
0.0	First revision (Tentative)	---	2014.12.10
0.1	Modify Power consumption & Module Weight & Timing spec.	p4&p14	2015.02.12
0.2	Modify Image Sticking	P23	2015.02.24
0.3	Modify Timing Specifications	P14	2015.04.21
0.4	Modify The relative humidity and temperature sketch	P5	2015.05.08
	Modify Converter Specification for Backlight	P8	2015.05.08
0.5	Modify MECHANICAL SPECIFICATION (rear side)	P18	2015.06.25
0.6	Add Optimum Viewing Direction	P4	2015.07.21
	Modify Color Coordinates	P18	2015.07.21
0.7	Modify Color Contrast Ratio minimum & Crosstalk	P19	2015.09.17
	Modify Response time	P19	2015.09.17
0.8	Modify MTBF	P23	2015.10.16
0.9	Modify Thermal Shock 、SHOCK 、VIBRATION	P23	2015.10.20
1.0	Modify electrical characteristic TFT LCD (A)TFT LCD : 1 Data time, LVDS clock to data skew, input data eye width	P6&P8	2016.04.26

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## 1. OVERVIEW

CLAA150XQ01CW is 15.0" 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), 1024×768, 16.7M-color images are displayed on the 15.0" diagonal screen.

General specifications are summarized in the following table:

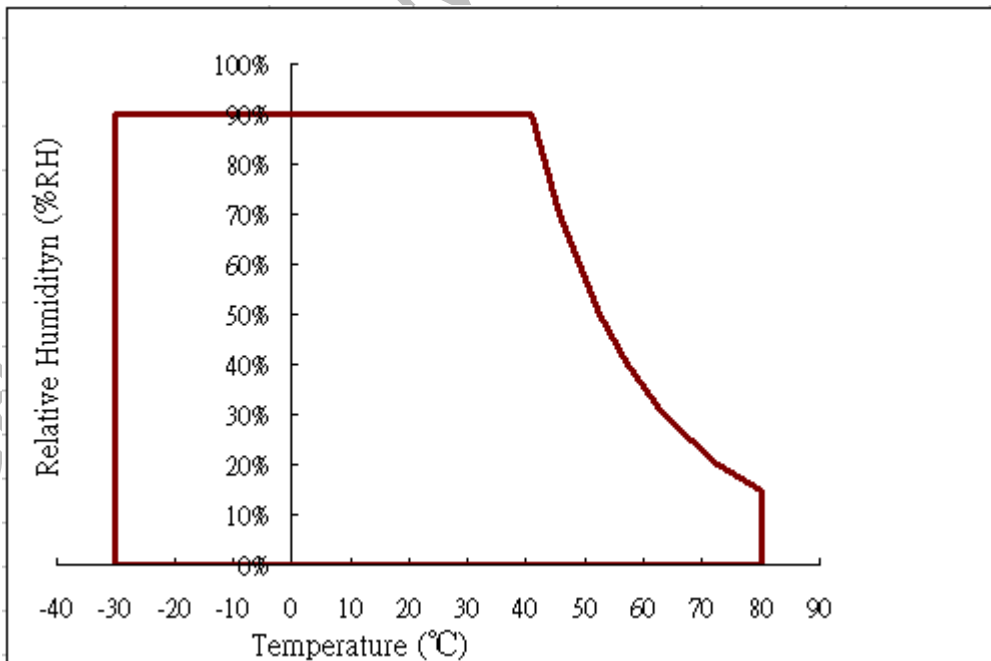
ITEM	SPECIFICATION
Display Area(mm)	304.1(W) × 228.1(H) (15.0-inch diagonal)
Number of Pixels	1024(H) × 768(V)
Pixel Pitch(mm)	0.297(W) × 0.297(H)
Color Pixel Arrangement	RGB vertical strip
Display Mode	Normally white, TN
Number of Colors	16.7M (6Bit+HFRC)
Brightness(cd/m <sup>2</sup> )	450 (typ.) (Center point, 100 mA)
Viewing Angle	160 /140(Typ.)
Surface Treatment	Anti-Glare, 3H
Optimum Viewing Direction	6 O'clock(Max. contrast ratio, Gray level inversion)
Power consumption(W)	8.3W (typ.)
Interface Connection	LVDS
Module Size(mm)	326.5 × 253.5 × 11.0(typ.)
Module Weight(g)	870(typ.)
Backlight Unit	LED:(white-LED)

## 2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	4.0	V	
Logic Input Voltage	VI	0	4.0	V	
Backlight Power Supply Voltage	VLED	0	14	V	
Backlight ON-OFF Voltage	LED_EN	0	7	V	
Backlight Dimming Control Input Voltage	LED_PWM	0	7	V	
Operation Temperature	Top	-30	80	°C	1). 2). 3).
Storage Temperature	Tstg	-30	80	°C	1). 2). 3).

[Note]

- 1).The relative humidity and temperature range are as below sketch,90%RH Max.
- 2).The maximum wet bulb temperature  $\leq 39^{\circ}\text{C}$  and without dewing.
- 3).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.



### 3. ELECTRICAL CHARACTERISTICS

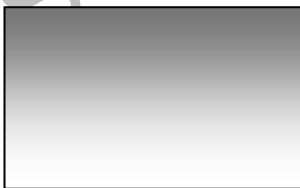
#### (1).TFT-LCD

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage		VCC	3.0	3.3	3.6	V	
LCD Power Current		ICC	-	330	400	mA	*1)
LCD Rush Current		VCC_Irush			2	A	*3)
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	
Logic Input Voltage	VIH	0.7*DVDD	-	DVDD	V	Logic Input Voltage	
	VIL	GND	-	0.3*DVDD	V		
Power consumption		P		1.09	1.44	W	
1 Data time		UI	-	tclk*1/7	-	tclk	*4)
LVDS clock to data skew		tskew	-	-	300	ps	
input data eye width		teyew	1409	-	-	ps	

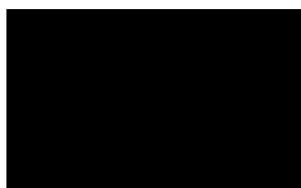
【Note】

\*1)TYP. specification : Gray-level test Pattern (TYP Freq. @3.3V)

MAX. specification : Black test Pattern (TYP Freq. @3.3V)



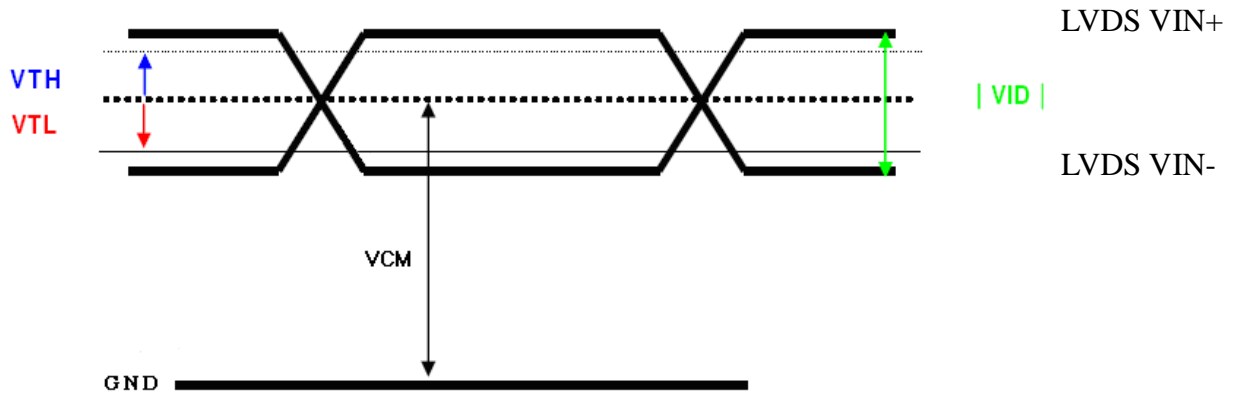
Gray-level Pattern



Black Pattern



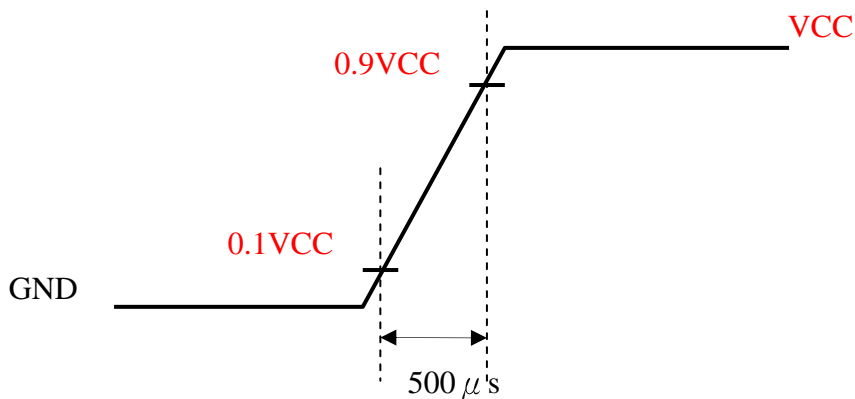
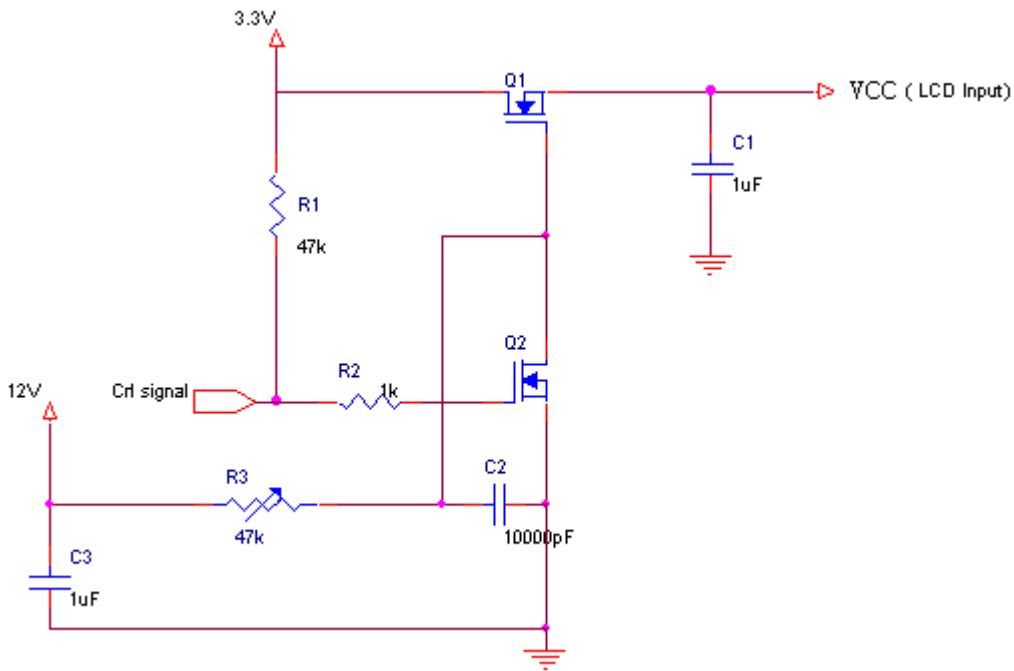
\*2) LVDS Signal Definite :



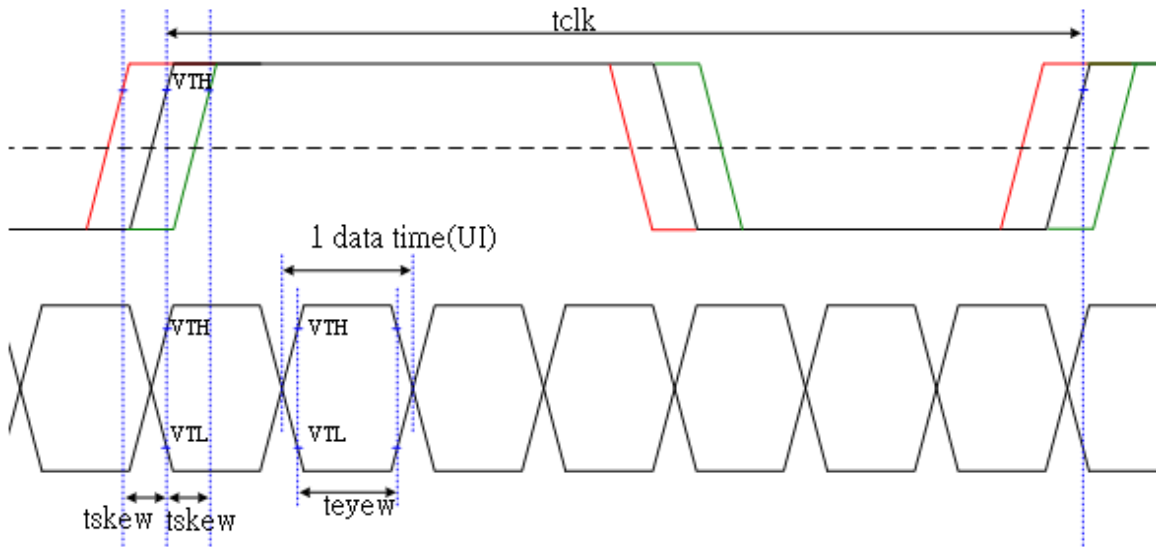
VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

\*3) Irush measure condition



\*4) Differential LVDS signal : The following conditon is base on operation frequency at MAX



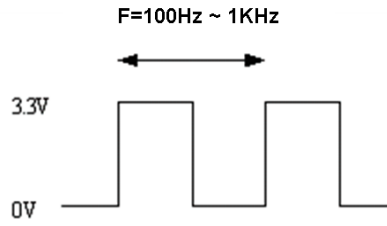
**(2).Converter Specification for Backlight**

Ta=25°C

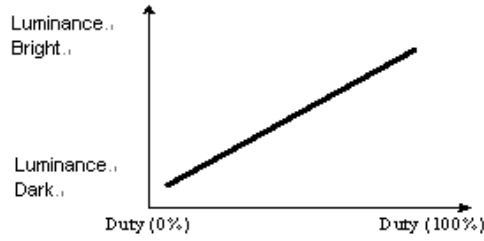
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VLED	10.8	12.0	13.2	V	
LED Driver Input Current	IVLED	-	600	650	mA	*1)
LED Rush Current	VLED_Irush			2	A	*3)
Dimming Control	High	2.4	--	5.5	V	Dimming Control
	Low	0		0.8		
PWM Frequency	LED_PWM	100	200	1K	Hz	*2)
Duty Ratio		5	-	100	%	
ON/OFF Control	High	2.4		5.5	V	ON/OFF Control
	Low	0		0.8		
Power Consumption (Backlight )	BLW	--	7.2	8.58	W	
LED Forward voltage (single LED)	VF	2.8	--	3.4	V	IF=100mA Ta=25°C
LED Forward current (single LED)	IF	--	100	--	mA	Ta=25°C
LIFE TIME(Backlight )		50000	70000		hr	*4)

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

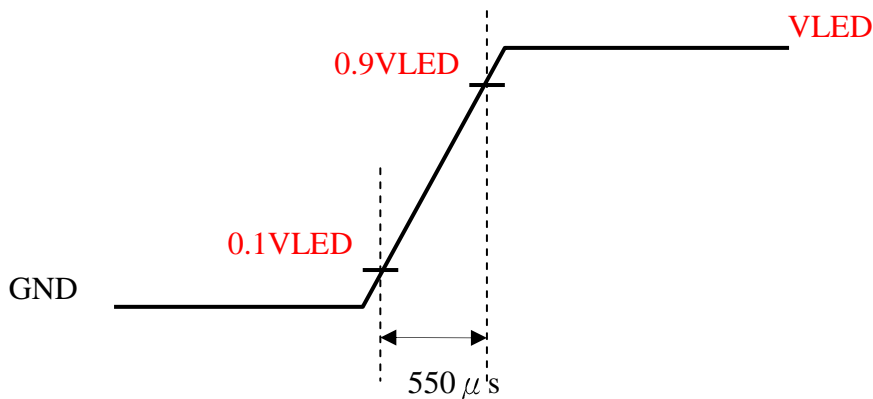
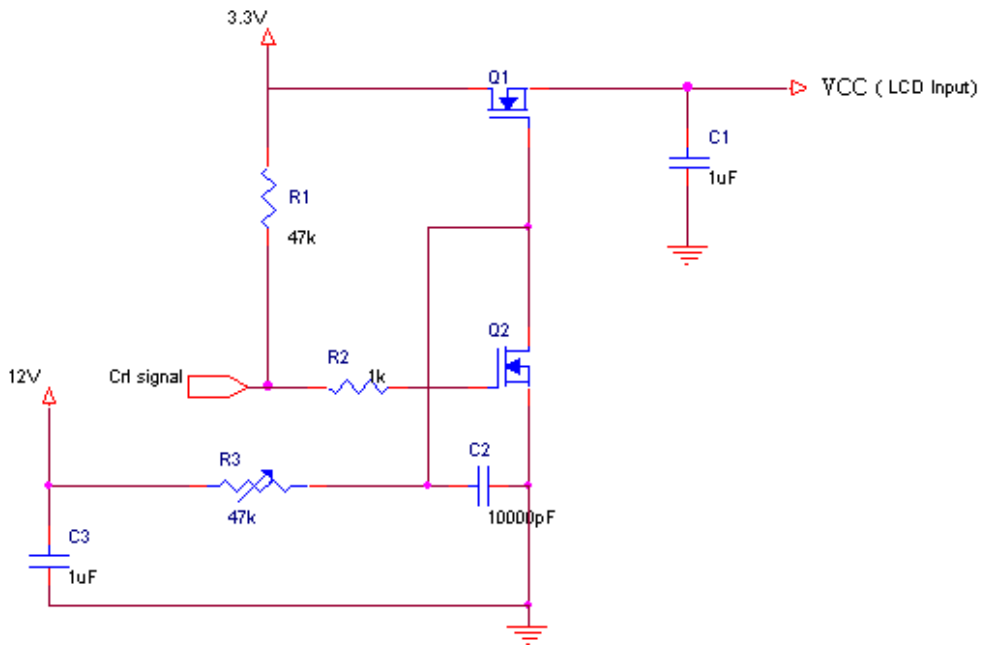
\*2) The ADJ adjust signal level is 0~3.3V , operation frequency:100Hz~1KHz ◦



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



\*3) Irush measure condition



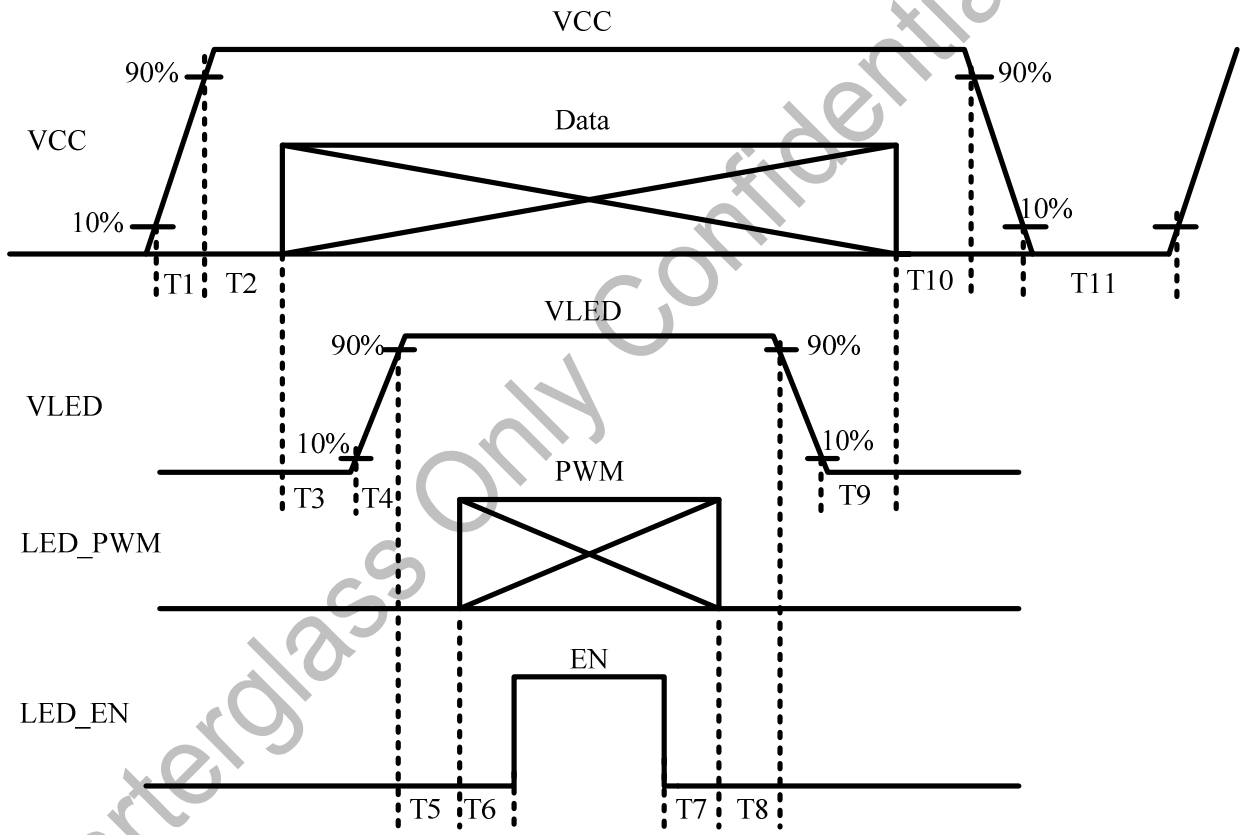
\*4). Definition of the LED life time: Luminance (L) under 50% of the initial value. LED life time is restricted under normal condition, ambient temperature=25°C and LED operation forward current=100mA.

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**(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

- (1) CN1 (Data Signal and Power Supply)  
 Outlet connector: MSB240420HD (STM)  
 Plug connector: P240240 (STM) or equivalent

PIN #	SYMBOL	FUNCTION
1	VCC	+3.3V Power Supply
2	VCC	+3.3V Power Supply
3	GND	GND
4	GND	GND
5	RXIN0-	Negative LVDS Differential Data Input
6	RXIN0+	Positive LVDS Differential Data Input
7	GND	GND
8	RXIN1-	Negative LVDS Differential Data Input
9	RXIN1+	Positive LVDS Differential Data Input
10	GND	GND
11	RXIN2-	Negative LVDS Differential Data Input
12	RXIN2+	Positive LVDS Differential Data Input
13	GND	GND
14	RXCLK IN-	Negative LVDS Differential Clock Input
15	RXCLK IN+	Positive LVDS Differential Clock Input
16	GND	GND
17	RXIN3-	Negative LVDS Differential Data Input
18	RXIN3+	Positive LVDS Differential Data Input
19	NC	NC
20	SEL	Input Mode Select :6-bits(3.3V) / VESA 8-bits(GND )

- 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: CR03-P05H2B-2-E3500 (CONN-TEK)

Plug connector: CR03-S05C3HF-018 or equivalent

PIN #	SYMBOL	FUNCTION
1	VLED	+12V Power Supply
2	GND	GND
3	LED_EN	ON : 5V / OFF: 0V & NC (*1)
4	LED_PWM	Light Dimming Control : PWM Input for Dimming: L : 0V / H : 5V Freq : 200-2000Hz Duty : 5%-100%
5	NC	NC

\*1) Enable High=2.4 to 5V, Low=0 to 0.8V or Open.

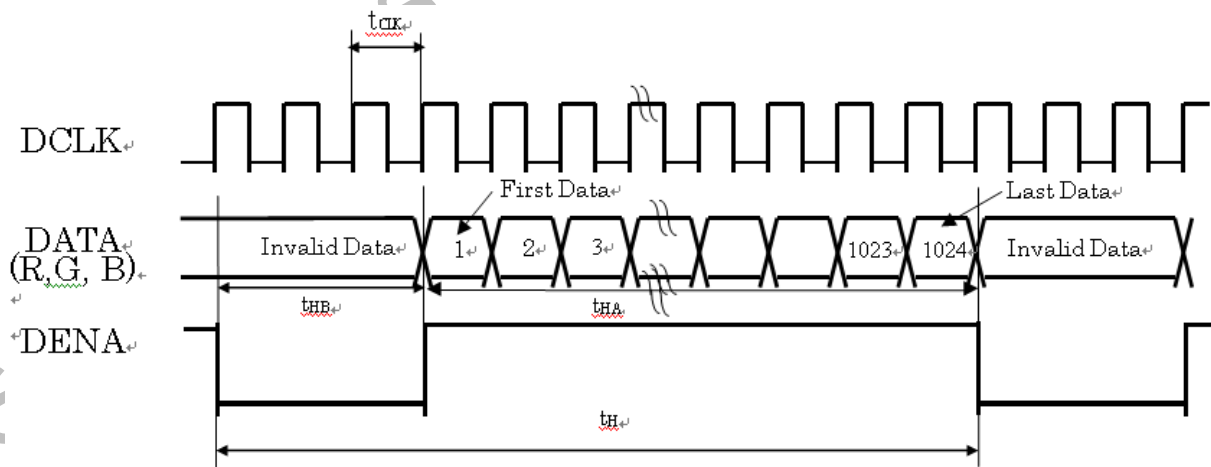
### 5. INTERFACE TIMING

(1) Timing Specifications

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT		
LCD Timing	DCLK	Frequency	$f_{CLK}$	52.14	65	71.1	MHz	
		Cycle	$t_{CLK}$	14.1	15.4	19.18	ns	
	DENA	Horizontal	Horizontal total time	$t_H$	1200	1344	1348	$t_{CLK}$
			Horizontal effective time	$t_{HA}$	1024			$t_{CLK}$
			Horizontal blank time	$t_{HB}$	176	320	324	$t_{CLK}$
		Vertical	Vertical total time	$t_V$	790	806	810	$t_H$
			Vertical effective time	$t_{VA}$	768			$t_H$
			Vertical blank time	$t_{VB}$	22	38	42	$t_H$
	Frame rate		FV	55	65	75	Hz	

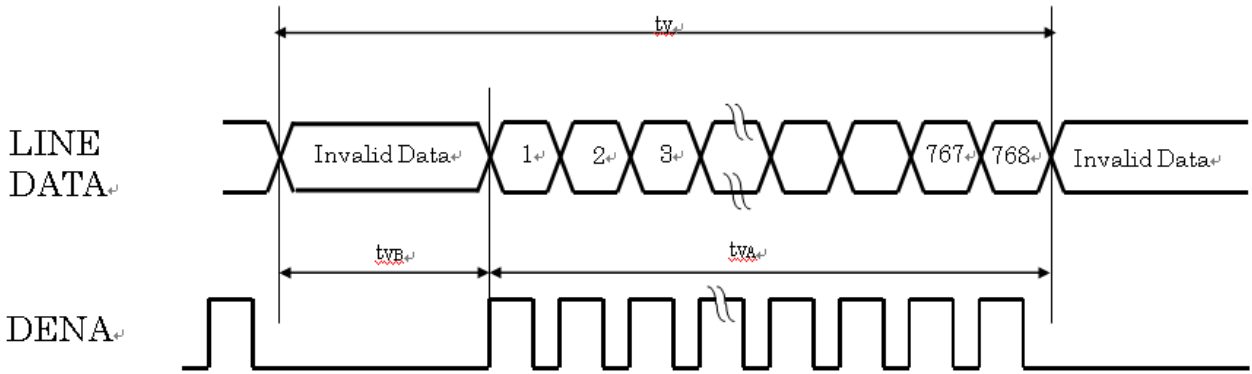
(2) Timing Chart

a. Horizontal Timing

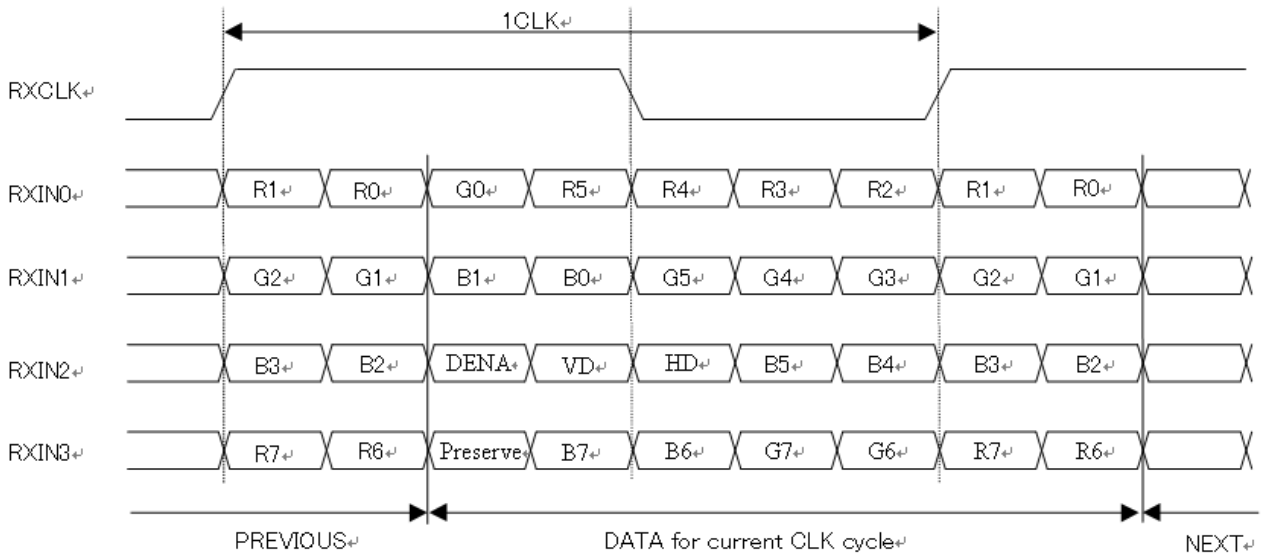




b. Vertical Timing



(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	0	1	1	1	1	1	1	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			
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]

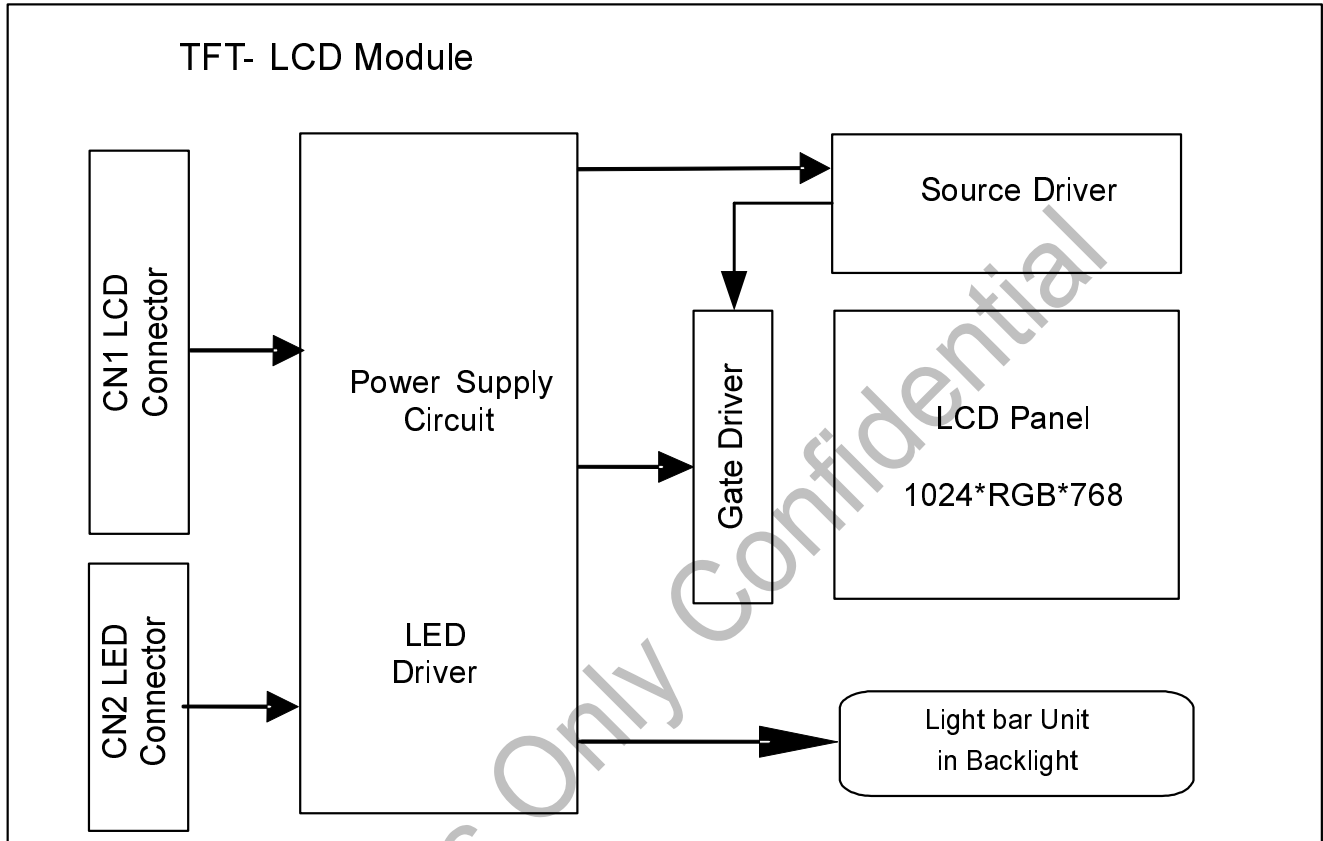
1) Definition of gray scale:

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.

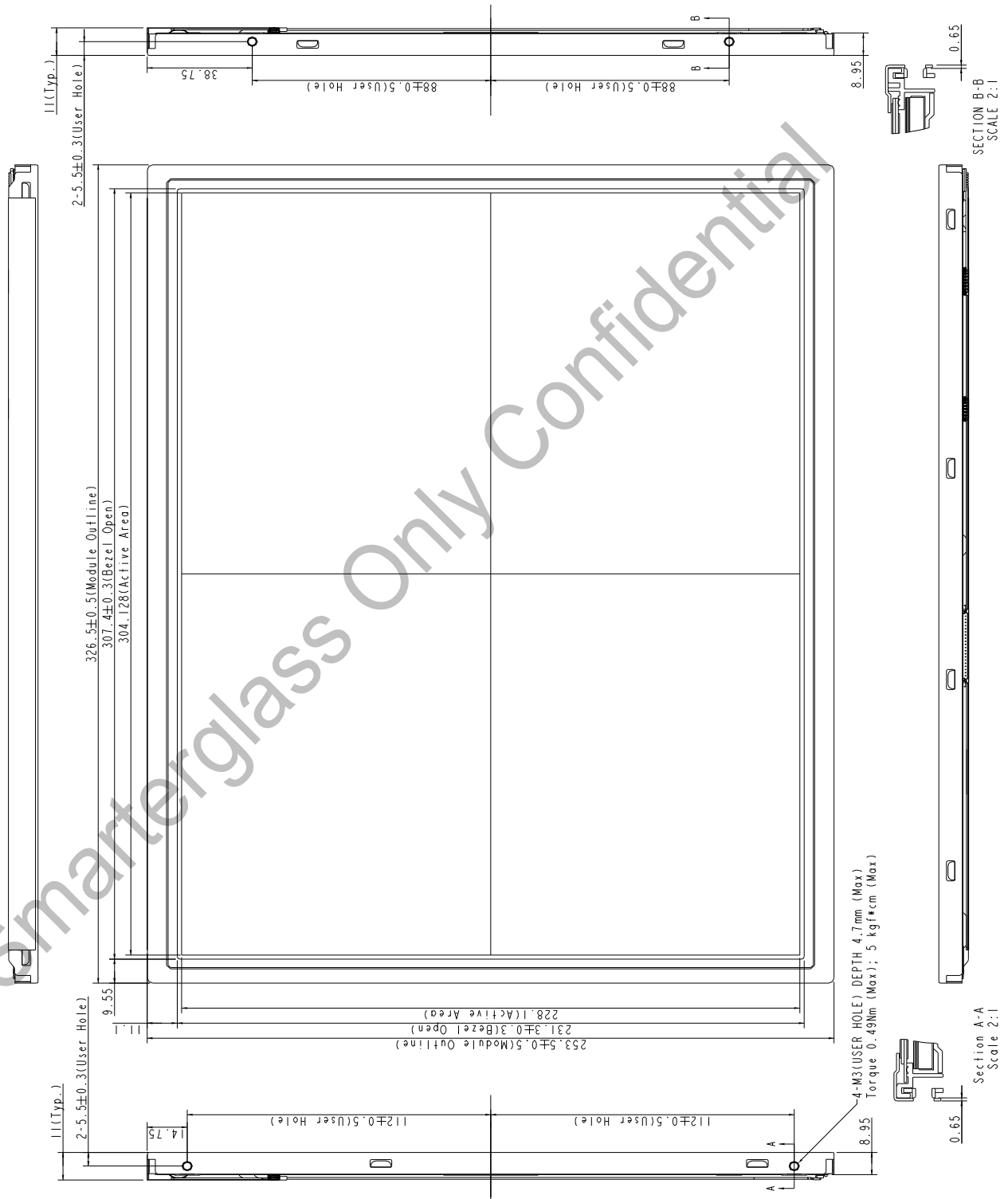
### 6. BLOCK DIAGRAM



### 7. MECHANICAL SPECIFICATION

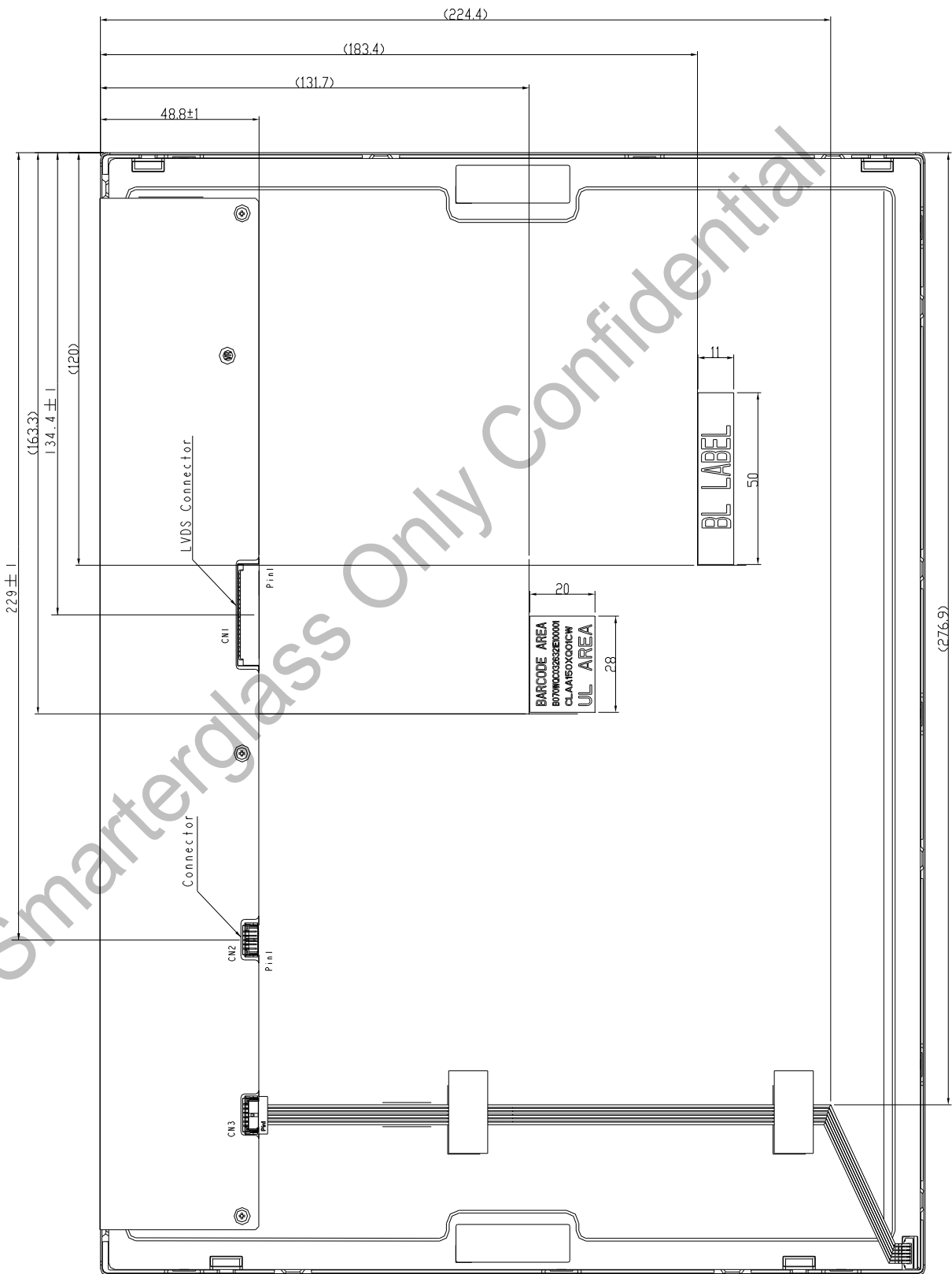
(1) Front side (Tolerance is ±0.5mm unless noted)

Unit: mm



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

Unit: mm:



**8. OPTICAL CHARACTERISTICS**

Ta=25°C , VCC=3.3

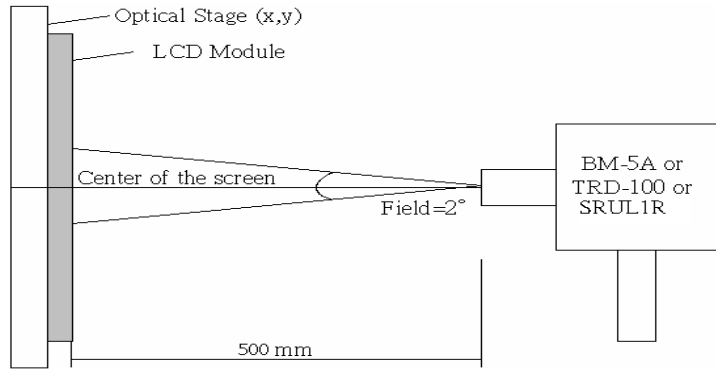
ITEM		SYMBOL	CONDITION	min	typ	max	UNIT	REMARK
Contrast Ratio		CR	$\theta = \psi = 0^\circ$	500	700	--	--	*1) 2)
Luminance(CEN)		L	$\theta = \psi = 0^\circ$	360	450	--	cd/m <sup>2</sup>	*1) 3)
9P Uniformity		$\Delta L$	$\theta = \psi = 0^\circ$	75	80	--	%	*1) 3)
Response Time		Tr	$\theta = \psi = 0^\circ$	--	10	15	ms	*5)
		Tf	$\theta = \psi = 0^\circ$	--	15	20		
Crosstalk		CT	$\theta = \psi = 0^\circ$	--	--	1	%	*6)
Viewing Angle	Horizontal	$\psi$	$CR \geq 10$	-70~70	-80~80	--	Deg.	*4)
	Vertical	$\theta$		-60~60	-70~70	--	Deg.	
Color Coordinates	White	X Y	$\theta = \psi = 0^\circ$	(0.263) (0.279)	(0.313) (0.329)	(0.363) (0.379)		*3)
	Red	X Y		(0.585) (0.294)	(0.635) (0.344)	(0.685) (0.394)		
	Green	X Y		(0.290) (0.556)	(0.340) (0.606)	(0.390) (0.656)		
	Blue	X Y		(0.103) (0.033)	(0.153) (0.083)	(0.203) (0.133)		
Gamut		CG	$\theta = \psi = 0^\circ$	60	63	--	--	--
Gamma		$\gamma$	VESA	2	2.2	2.4	--	*7)
Image Sticking		Tis	4hrs			5	min	*8)

[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:

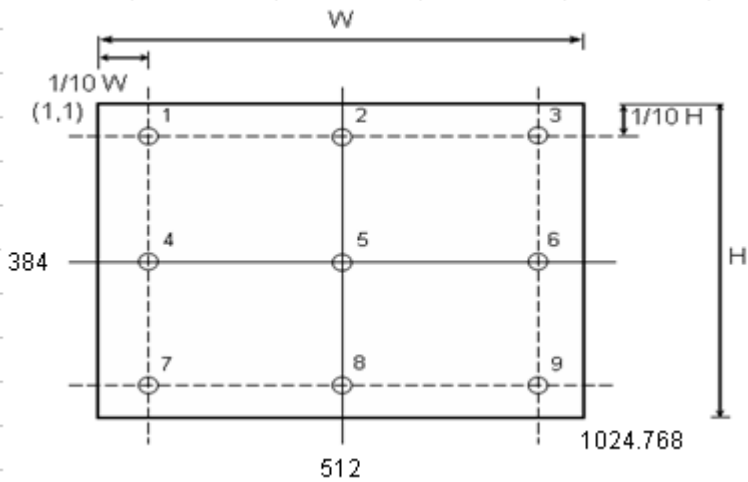
$$CR = \text{ON (White) Luminance} / \text{OFF (Black) Luminance}$$

3).Definition of Luminance and Luminance uniformity:

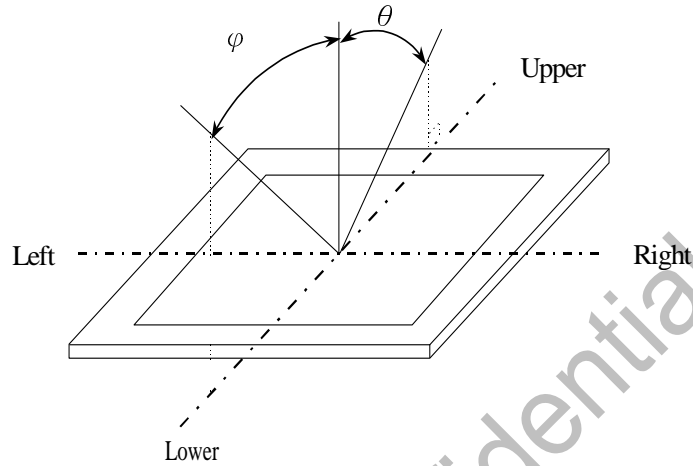
Center Luminance, &Color coordinate: measuring the luminance of the point no. 5

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

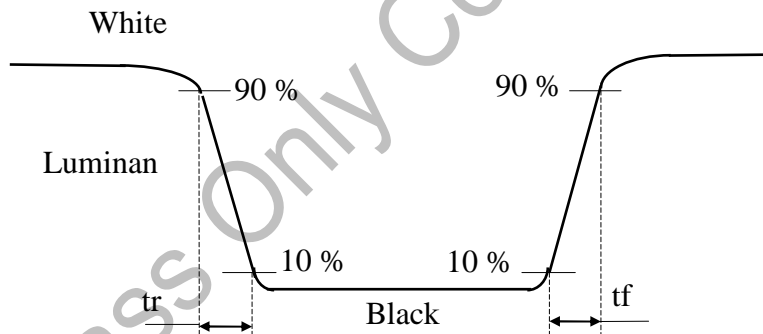
$$\text{Uniformity: } \Delta L = [L (\text{Min}) / L (\text{Max})] \times 100 \%$$



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



5) Definition of Response Time:

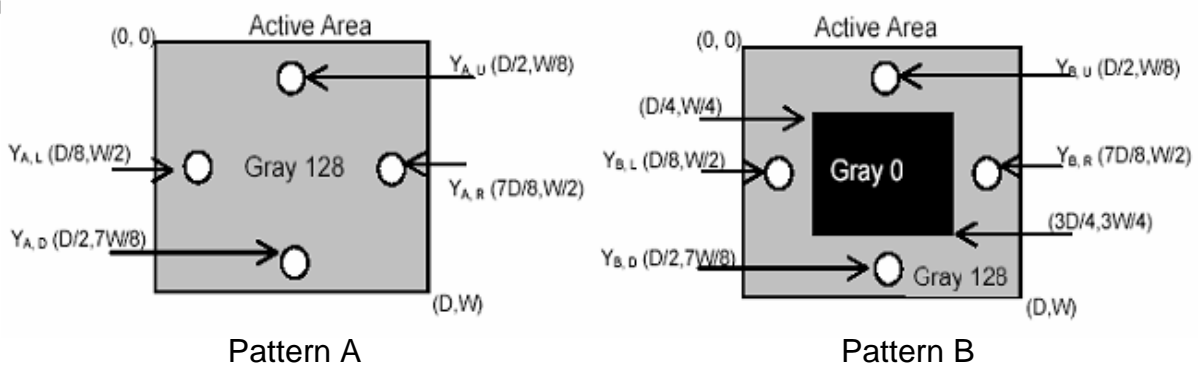


6) Definition of crosstalk:

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

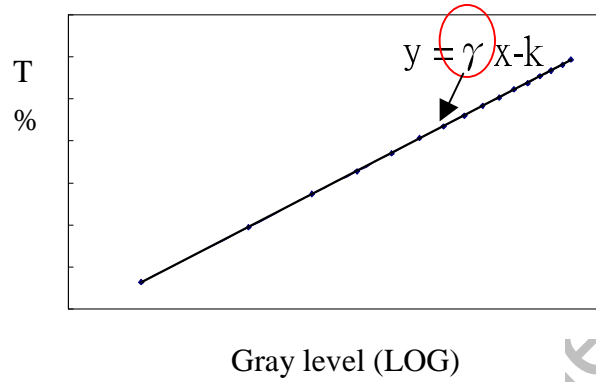
$Y_A$ : The luminance of measured position at pattern A

$Y_B$ : 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)

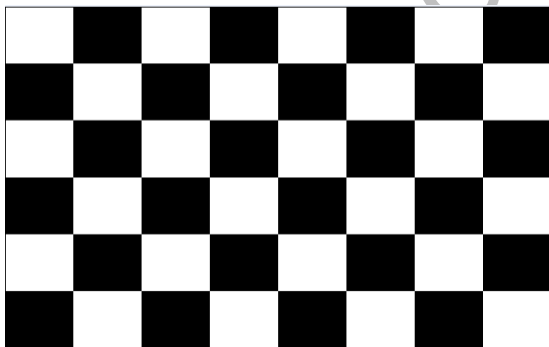


8) Image Sticking :

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(Cheess Board Pattern)



(b) judgment Pattern(128 Gray Pattern)

### 9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature High Humidity Operation	60°C ; 90%RH; 240hrs (No condensation)
High Temperature Operation	80°C ; 240hrs
High Temperature Storage	80°C ; 240hrs
Low Temperature Operation	-30°C ; 240hrs
Low Temperature Storage	-30°C ; 240hrs
Thermal Shock	Between -30°C (1hr) ~ 80°C (1hr); 100 Cycles
MTBF	Life assurance 30,000hrs

(2) Shock & Vibration

ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level:(150G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: (1.0G) zero to peak Waveform: sinusoidal Frequency range: 10 to 300 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 10 to 300Hz in each of three mutually,each x,y,z axis: 30 min.

(3) ESD

POSITION	CONDITION( MDL turn off)
Connector	1. 200 pF , 0 Ω , ±200 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:

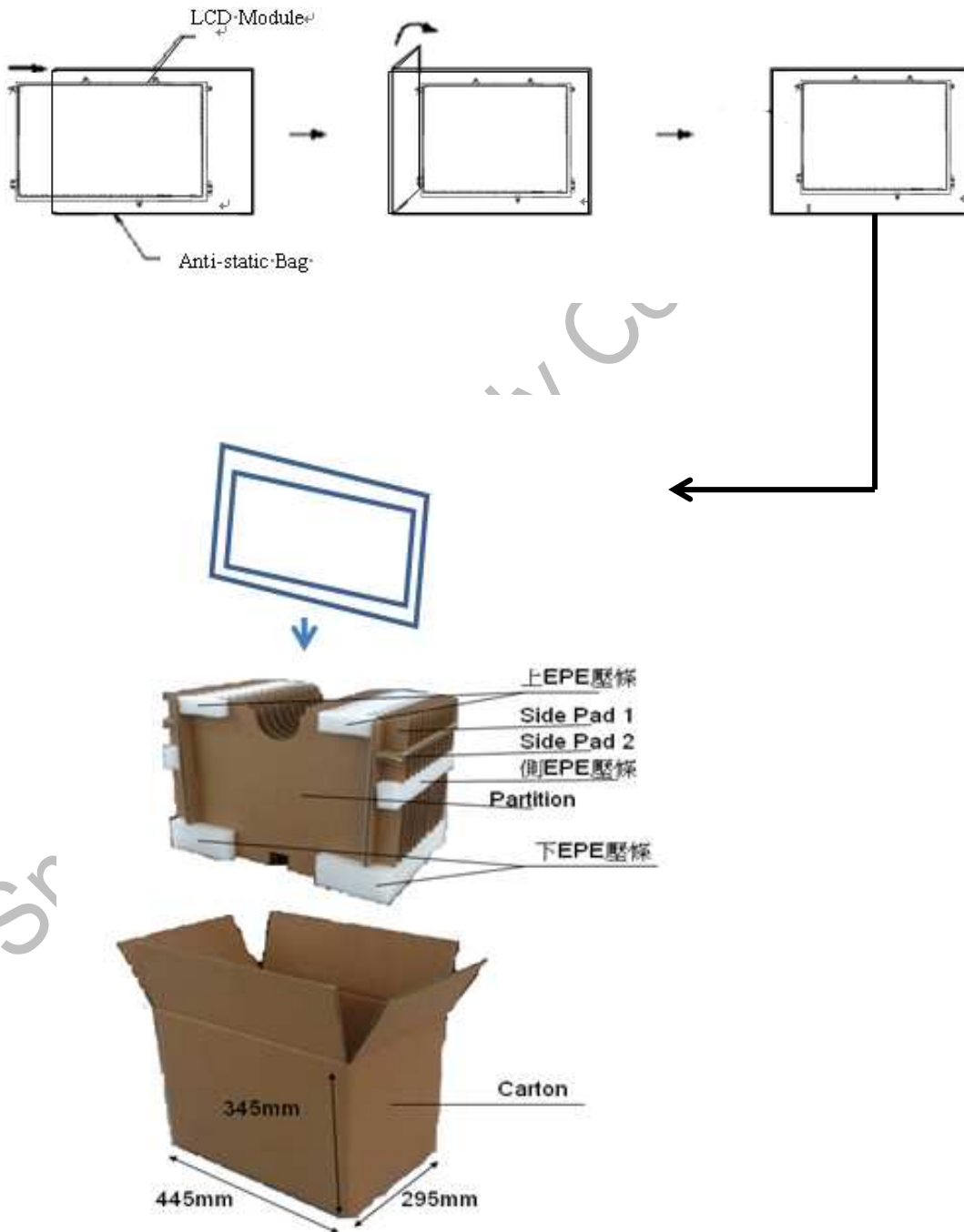
Pass: Normal display image with no line defect.

Fail: No display image or line defects

### 10. PACKING INFORMATION

(1).Packing order:

- 1) Box Dimension: 445mm(L) X 295mm(W) X 345mm(H)
- 2) Package Quantity in one Box : 10 pcs



## (2).Pallet Packing

- 1). 18 box (max.) / 1 pallet
- 2) Pallet: 1150(L) X 900(W) X 133(H) mm
- 3) Pallet stack: 1150(L) X 1000(W) X1051(H) mm
- 4) Angle boards: L 918 X 50 X 5 mm

