Chunghwa Picture Tubes, Ltd.
Technology Specification

To ：永盛
Date : 130522

TFT LCD

CLAA140UA01 CN

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REVISION STATUS

Revision Notice	Description	Page	Rev. Date
Ver. 0.0	First revision (Tentative)	-	2012.12.24

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1. OVERVIEW

CLAA140UA01CW is 14.0” color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs ,control circuit and LED backlight. By applying 1600RGBx900 images are displayed on the 14.0” diagonal screen. Display 16.2M colors by R.G.B signal input.

General specification are summarized in the following table:

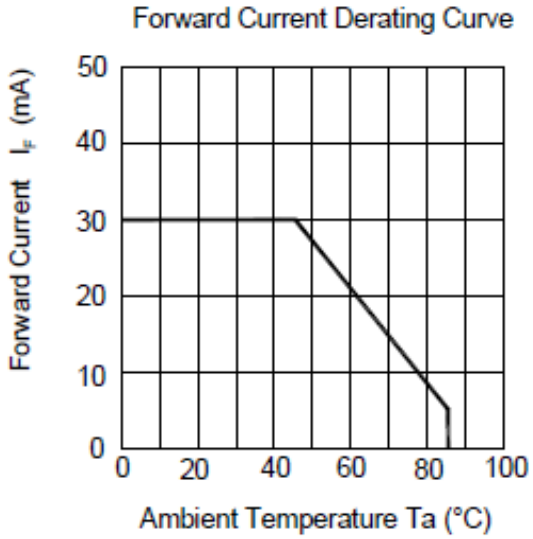
ITEM	SPECIFICATION
Display Area (mm)	309.6(H) x 174.15(V)
Number of Pixels	1600xRGBx900
Pixel Pitch (mm)	0.1935(H) x 0.1935(V)
Color Pixel Arrangement	Stripe RGB
Display Mode	Normally white
Number of Colors	16.2M
Optimum Viewing Direction	6 O'clock
Brightness (cd/m^2)	250 (typ)
Response Time (ms)	20 (typ)
NTSC	45% (typ)
Contrast Ratio	500 (typ)
Viewing Angle(H/V)--CR>10	R:45 / L:45 / U:15 / D:35
Power Consumption (W)	4W (max)
Interface connection	eDP
Module Size (mm)	323.46 x 204.12 x 3.0 (w/PWB)
Module Weight (g)	231g (typ)
Backlight Unit	LED
Surface Treatment	Anti-Glare

2. ABSOLUTE MAXIMUM RATINGS

The following are maximun values which, if exceeded, may cause faulty operation or damage to the unit.

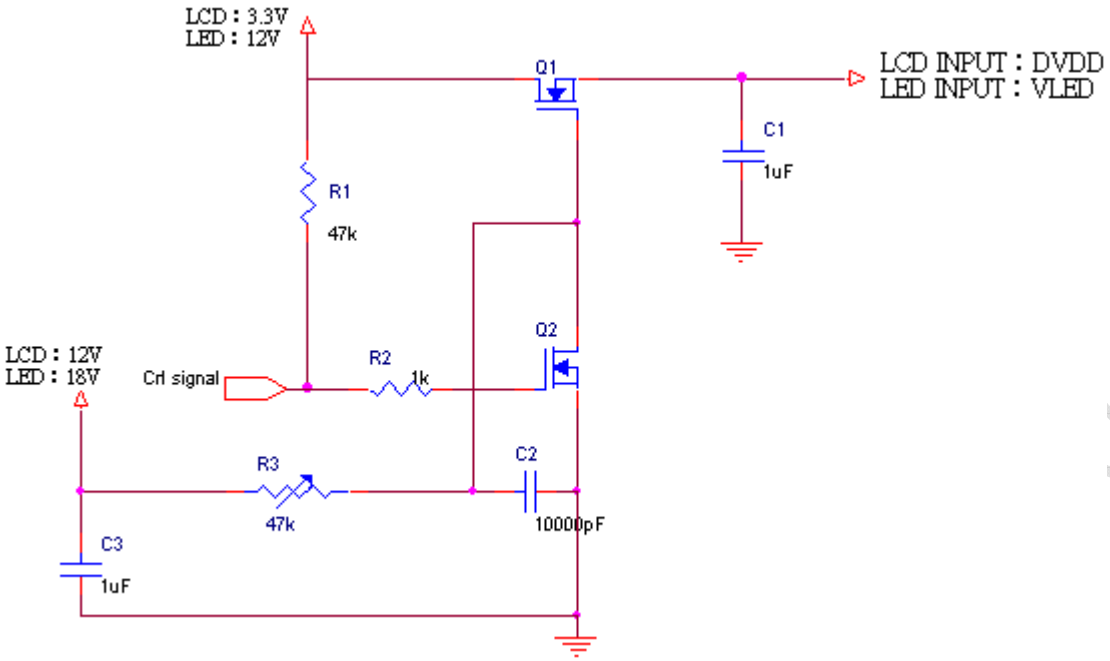
ITEM	SYMBOL	CONDITIONS	MIN	MAX	UNIT	NOTE
Digital Power Supply Voltage	DVDD VDD_LVDS		-0.3	4	V	
Singnal Input Voltage	NIN0 ~ NIN2 PIN0 ~ PIN2 NINC,PINC		-0.3	DVDD	V	
ICC Rush current	I_{CC}RUSH	-		1	A	Note 4
ILED Rush current	I_{LED}RUSH			1	A	Note 4
Forward Current （per LED）	If			30	mA	Note1
Reverse Voltage（per LED）	VR			5	V	
Pulse forward current（per LED）	Ifp			100	mA	Note2
Operating temperature	Topa		0	60	℃	Note3
Storage temperature	Tstg		-20	60	℃	

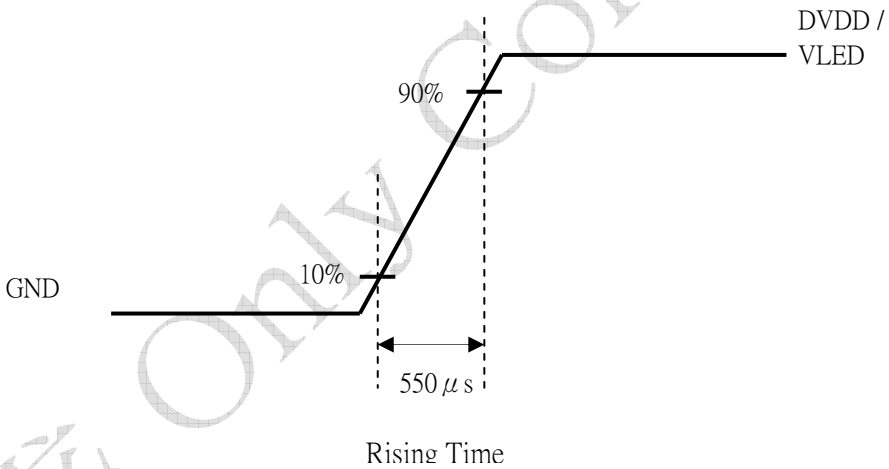
Note1: Each LED operating must under the condition as below drawing.
(Ambient Temperature /Allowable Forward Current)



Note2: Ifp Conditions ： Pulse Width≦10msec，Duty≦1/10。
Note3: If users use the product out off the environmemtal operation range（temperature and humidity）, it will have visual quality concerns.

Note 4: :The input pulse-current measurement system is as below:
Control signal(Crl)：
1) LCD：High (+3.3V)→Low (GND)
2) LED：High(+12V)→Low(GND)
Supply Voltage of rising time should be from R3 and C2 tune to 550 μs.





Rising Time

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage	LCD_VCC	3.0	3.3	3.6	V	
Backlight Supply Voltage For LED	BL_PWR	5	12	21	V	

3.2 TFT-LCD Current Consumption

ITEM	SYMBOL	MIN	TYPE	MAX	UNIT	NOTE
LCD Supply current	I_{LCD}	--	350	420	mA	Note1
LED Supply current	I_{LED}	--	210	510	mA	Note2

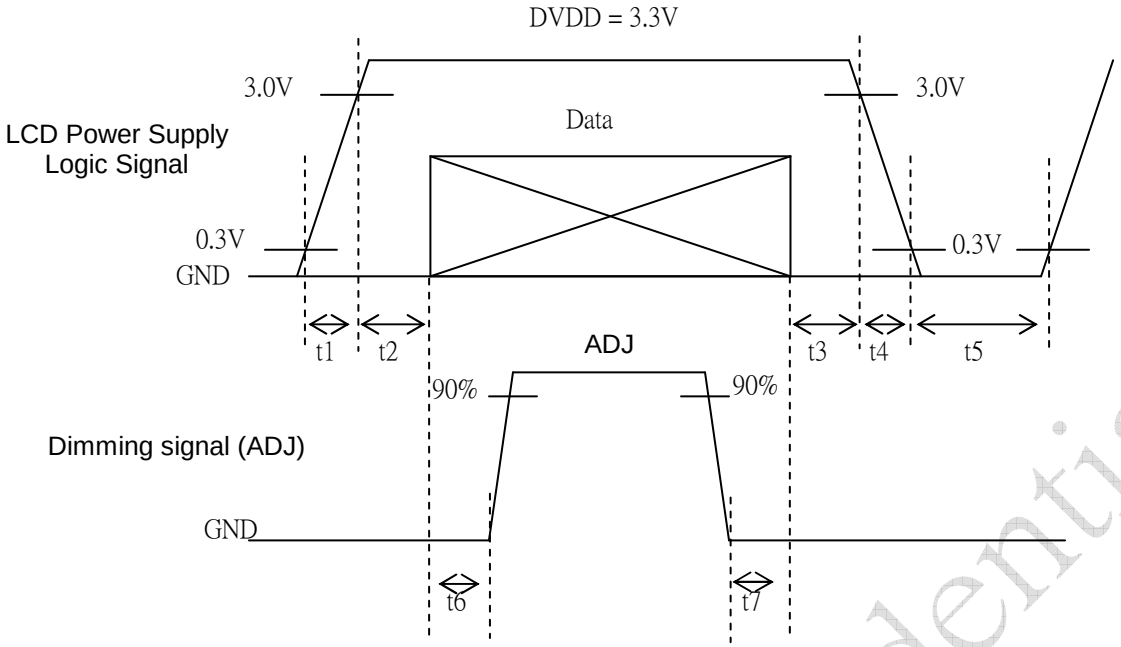
Note1: Typical: Under 64 gray pattern at Typ Freq.
Maximum: Under black pattern at Max Freq.

64 gray pattern

Black Pattern

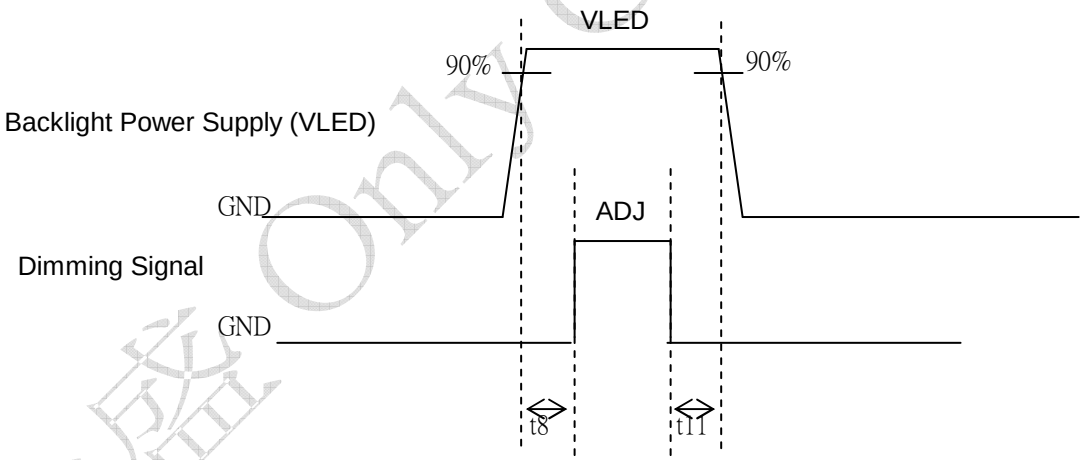
Note2: Typical: When VLED is 12V
Maximum: When VLED is 5V

3.3 Power、Signal sequence



Logic signal：RGB data, DCLK, DENA
Power：DVDD / ADJ

0.5<t1≦10ms　　200ms≦t5
0＜t2≦50ms　　200ms≦t6
0＜t3≦50ms　　200ms≦t7
0＜t4≦10ms



10ms≦t8
10ms≦t11

3.4 Backlight

Ta=25℃

ITEM	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
LED Lifetime	--	Ta=25℃ IF=20mA	30000	--	--	Hr	
		Ta=60℃ IF=20mA	15000	--	--	Hr	

Note：

*1) Definition of Led lifetime：Luminance < Initial luminance 50%.

4. INTERFACE CONNECTION

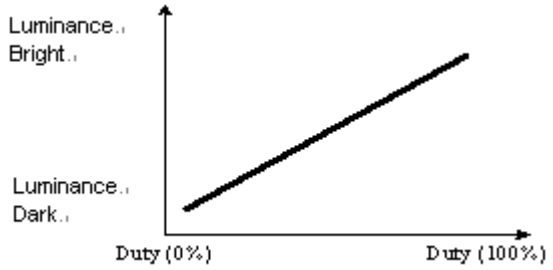
4.1 CN1 (Input Signal)

PIN NO	SYMBOL	DESCRIPTION
1	NC	Reserved
2	H_GND	High Speed Ground
3	LAN1_N	Complement Signal Link Lane 1(NC_Reserved for test)
4	LAN1_P	True Signal Link Lane 1(NC_Reserved for test)
5	H_GND	High Speed Ground
6	LAN0_N	Complement Signal Link Lane 0
7	LAN0_P	True Signal Link Lane 0
8	H_GND	High Speed Ground
9	AUX_P	True Signal Auxiliary Ch.
10	AUX_N	Complement Signal Auxiliary Ch.
11	H_GND	High Speed Ground
12	LCD_VCC	LCD logic and driver power(Power Supply,3.3V typocal)
13	LCD_VCC	LCD logic and driver power(Power Supply,3.3V typocal)
14	NC	Reserved (BIST function)
15	LCD_GND	LCD logic and driver ground
16	LCD_GND	LCD logic and driver ground
17	NC or HPD	HPD signal pin(Optional in sink device)(2.4V~2.6V)
18	BL_GND	Backlight ground
19	BL_GND	Backlight ground
20	BL_GND	Backlight ground
21	BL_GND	Backlight ground
22	BL_ENABLE	Backlight On/Off enable pin(+3.3V Input)
23	BL_PWM_DIM	System PWM signal input for dimming(+3.3V Swing)
24	NC	Reserved(For EDID SCL)
25	NC	Reserved(For EDID SDA)
26	BL_PWR	Backlight power (5V ~ 21V LED power)
27	BL_PWR	Backlight power (5V ~ 21V LED power)
28	BL_PWR	Backlight power (5V ~ 21V LED power)
29	BL_PWR	Backlight power (5V ~ 21V LED power)
30	NC	Reserved(Reserved For EDID test)

Remarks：

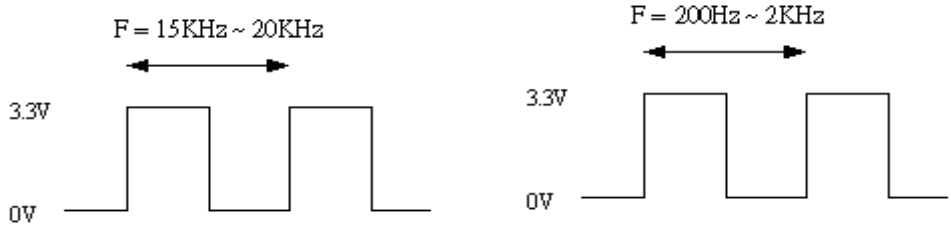
1) Mating connector：I-PEX 20453-030T

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



3) The ADJ adjust signal level is 0~3.3V，operation frequency:15KHz~20KHz，Duty range：10%～100%.
operation frequency:200Hz~2KHz，Duty range：1%～100%.

* When frequency at 200Hz~2KHz, it may cause the audible noise happened



5. INPUT SIGNAL

5.1 Timing Specification

ITEM				SYNBOL	MIN	TYP	MAX	UNIT
LCD Timing	Frame Rate			-	55	60	60	Hz
	DCLK		Frequency	f_{CLK}	88.04	97.786	108	MHz
			Period	t_{CLK}	11.35	10.22	9.26	ns
	DENA	Horizontal	Horizontal total time	t_H	1740	1760	1800	t_{CLK}
			Horizontal Active time	t_{HA}	1600	1600	1600	t_{CLK}
			Horizontal Blank time	t_{HB}	140	160	200	t_{CLK}
		Vertical	Vertical total time	t_V	920	926	1000	t_H
			Vertical Active time	t_{VA}	900	900	900	t_H
			Vertical Blank time	t_{VB}	20	26	100	t_H

【Note】

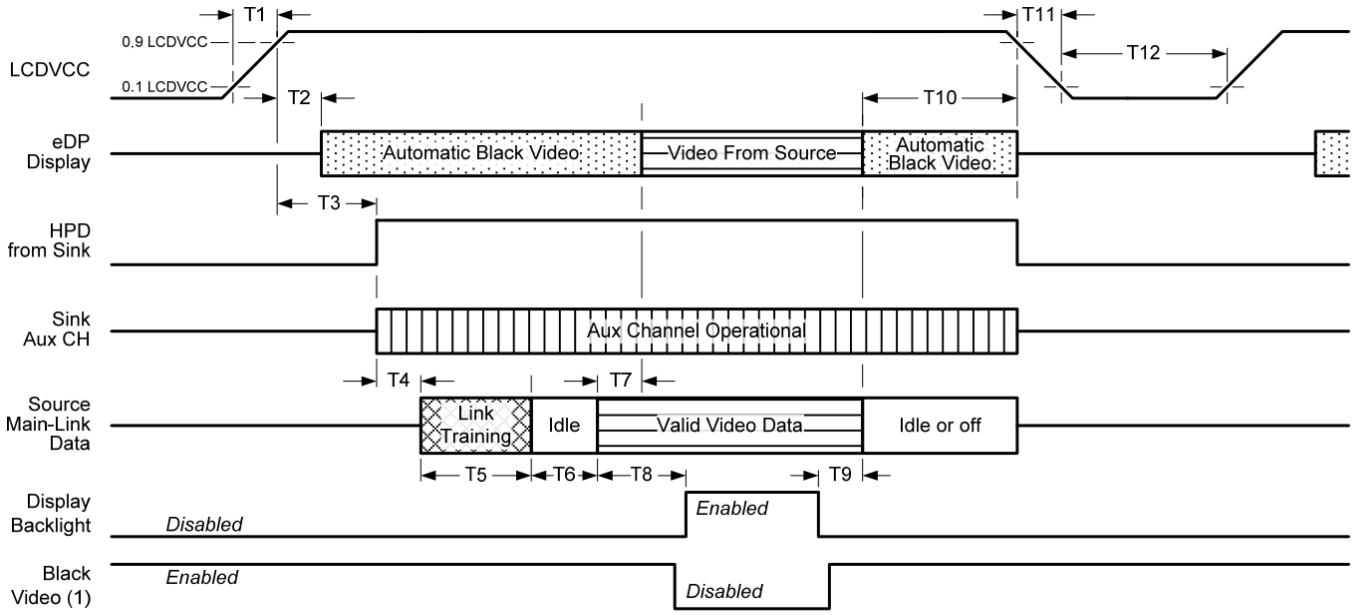
*1) DENA (DATA ENABLE) usually is positive.

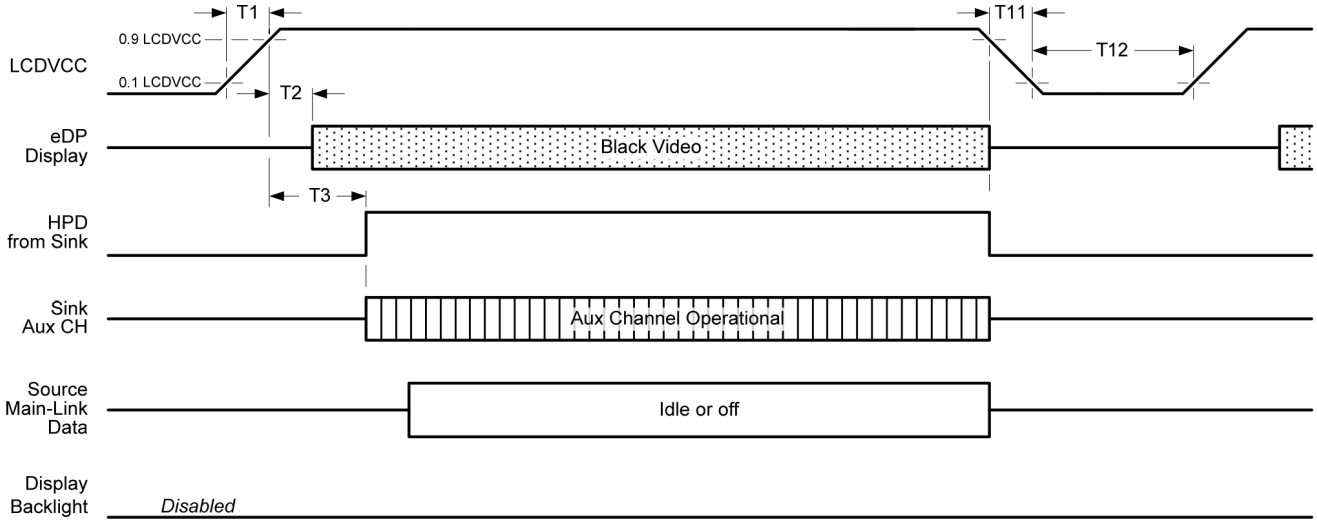
*2) During the whole blank period, DCLK should keep input.

5.2 Timing sequence(Timing chart)

(1) eDP input time sequence and signal definite：

The VESA Display Port related AC specification is compliant with the specification in the VESA Display Port Standard v1.2a.





Timing Parameter	Description	Required By	Limits		Notes
			Min	Max	
T1	Power rail rise time, 10% to 90%	Source	0.5ms	10ms	
T2	Delay from LCDVCC to automatic black video generation	Sink	0ms	200ms	Automatic black video generation prevents display noise until valid video data is received from the Source (see note 1 below)
T3	Delay from LCDVCC to HPD high	Sink	0ms	200ms	Sink AUX Channel must be operational upon HPD high
T4	Delay from HPD high to link training initialization	Source	-	-	Allows for Source to read Link capability and initialize
T5	Link training duration	Source	-	-	Dependant on Source link training protocol
T6	Link idle	Source	-	-	Min accounts for required BS-Idle pattern. Max allows for Source frame synchronization.
T7	Delay from valid video data from Source to video on display	Sink	0ms	50ms	Max value allows for Sink to validate video data and timing. At the end of T7, Sink will indicate the detection of valid video data by setting the SINK_STATUS bit to logic 1 (DPCD 00205h, bit 0), and Sink will no longer generate automatic black video.
T8	Delay from valid video data from Source to backlight enable	Source	-	-	Source must assure display video is stable
T9	Delay from backlight disable to end of valid video data	Source	-	-	Source must assure backlight is no longer illuminated (see note 1 below). At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display black video.
T10	Delay from end of valid video data from Source to power off	Source	0ms	500ms	
T11	Power rail fall time, 90% to 10%	Source	-	10ms	
T12	Power off time	Source	500ms	-	

5.3 DATA mapping

Color	Input Data	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	RED(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	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

【Note】

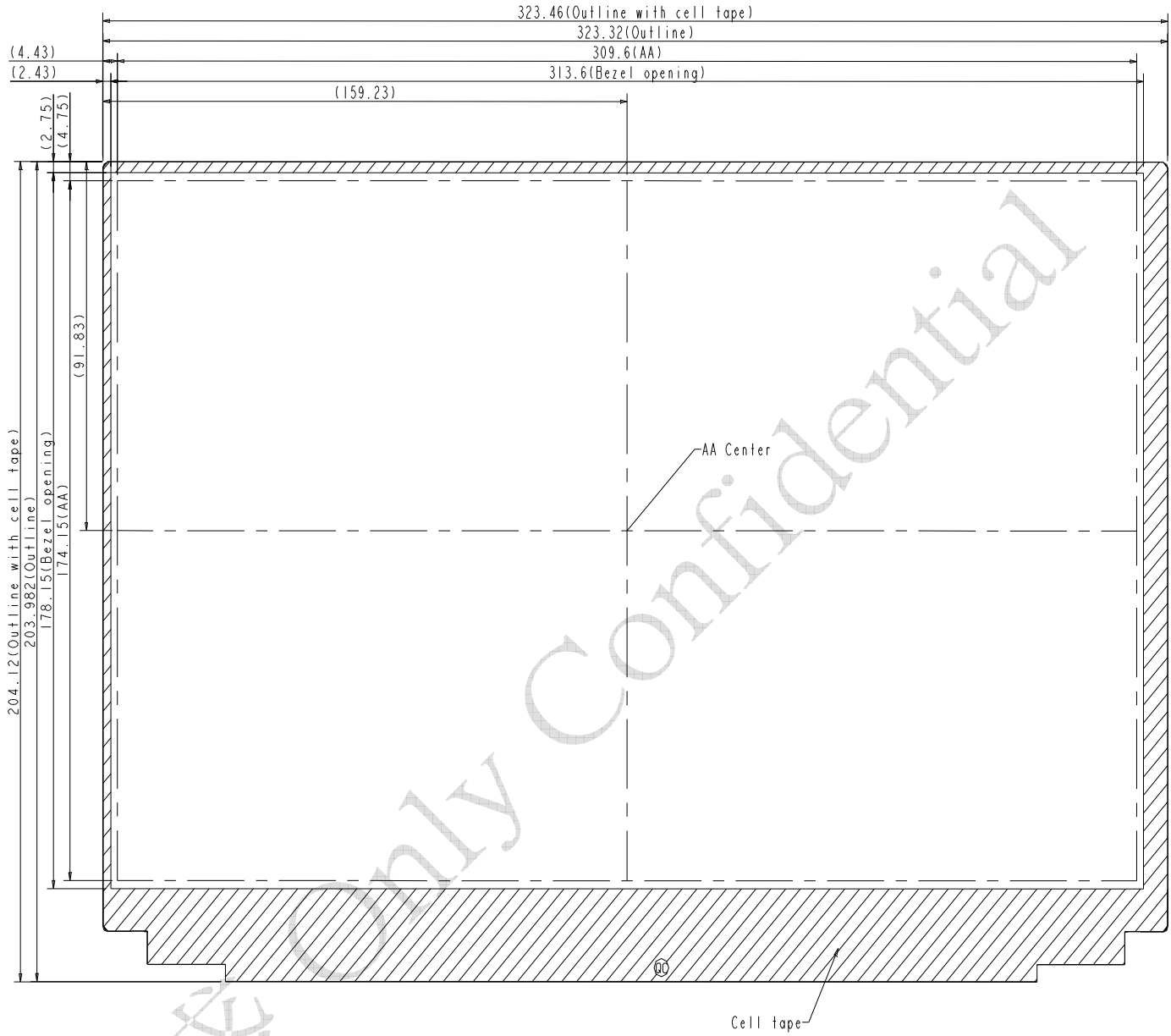
1) Gray level:
Color(n)：n is level order; higher n means brighter level.

2) DATA:
1: high，0: low

6. MECHANICAL DIMENSION

6.1 Front Side

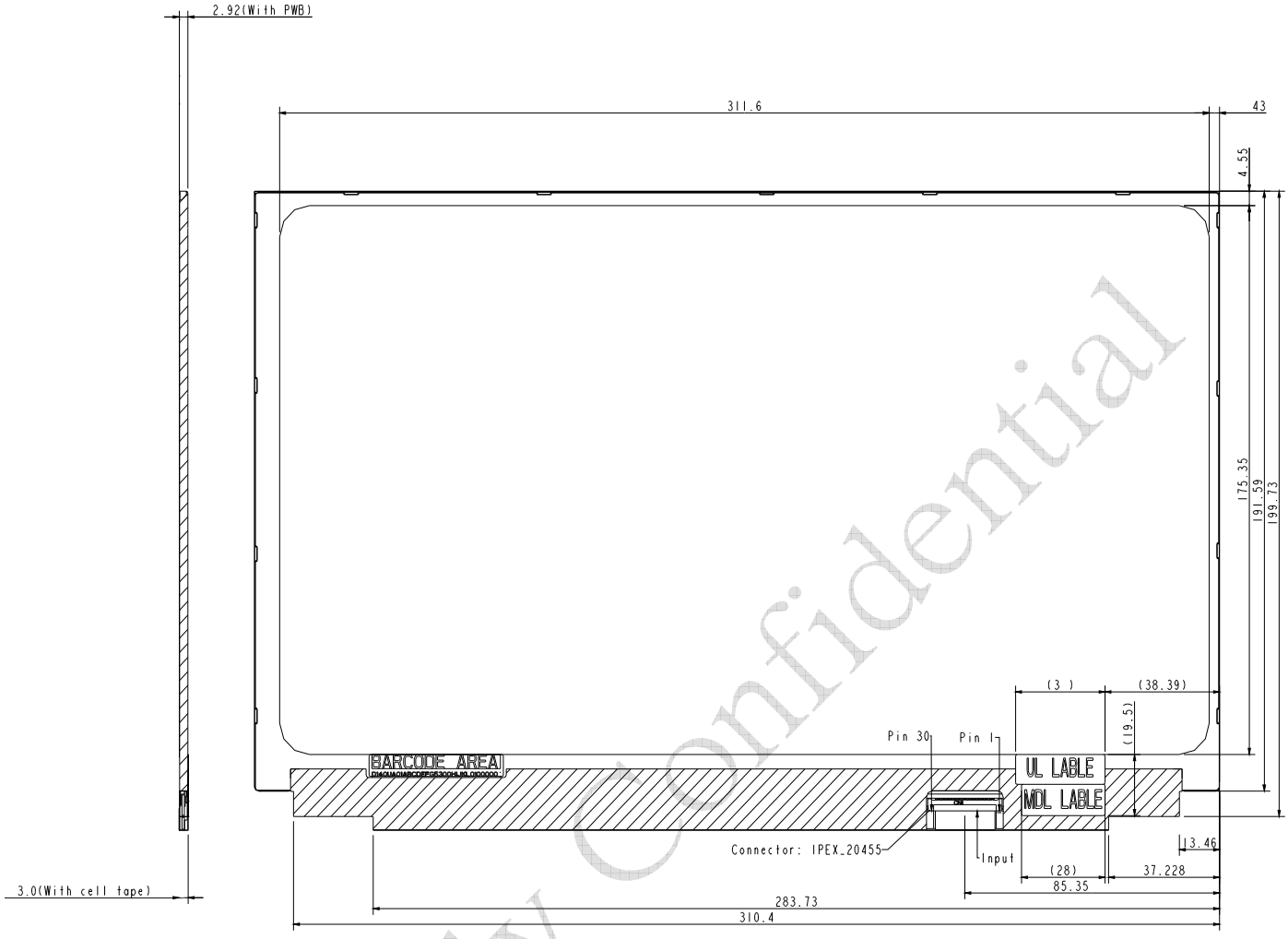
[Unit：mm]



Note: General tolerance ±0.3mm

6.2 Rear Side

[Unit：mm]



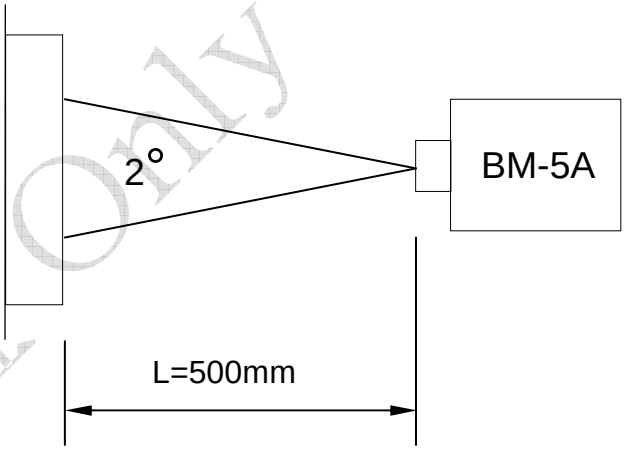
Remark：Un-indication tolerance is ±0.3mm

7. OPTICAL CHARACTERISTICS

Ta = 25℃, VCC=3.3V

ITEM		SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
Constrast Ratio		CR	Point-5	300	500	--	--	1, 2, 3
Luminance(CEN)		Lw	Point-5	200	250	--	cd/m^2	1, 3
Luminance Uniformity		ΔL	13 points	60	--	--	%	1, 3
Response Time (White - Black)		Tr +Tf	Point-5	--	20	35	ms	1, 3, 5
NTSC		-	Point-5	40	45	--	%	1, 3
Viewing Angle	Horizontal		CR≧10 Point-5	R:35 /L:35	R:45 /L:45	--	°	1, 3
	Vertical			U:5 /D:25	U:15 /D:35	--	°	1, 2, 4
Color Coordinate	White	Wx Wy	Point-5	0.273 0.289	0.313 0.329	0.353 0.369	--	1, 3
	Red	Rx Ry		(0.523) (0.302)	(0.563) (0.342)	(0.603) (0.382)		
	Green	Gx Gy		(0.295) (0.520)	(0.335) (0.560)	(0.375) (0.600)		
	Blue	Bx By		(0.106) (0.069)	(0.146) (0.109)	(0.186) (0.149)		

Note1: Measure condition：25℃±2℃，60±10%RH，under10 Lux in the dark room.BM-5A (TOPCON)，viewing angle2°，VLED=12V，measurement after lighting on 10 mins.



Note2: Definition of contrast ratio：

Contrast Ratio (CR)= (White) Luminance of ON ÷ (Black) Luminance of OFF

Note3: Central luminance: The white luminance is measured at the center position "5" on the screen, see Fig.7-1.
13P Uniformity: Δ L = (Lmin / Lmax) ×100%

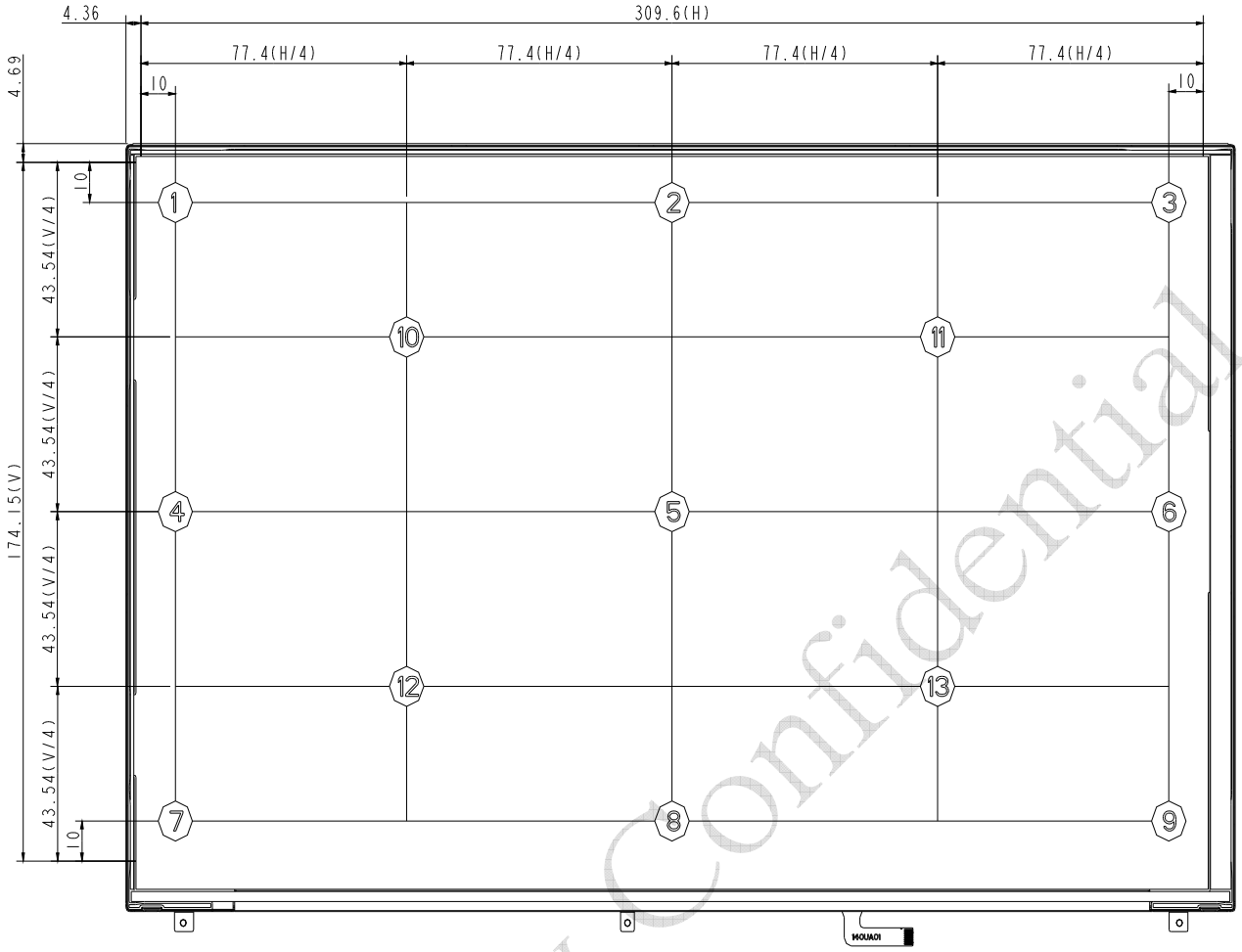


Fig.7-1 Measuring point

Note 4: Definition of Viewing Angle(θ,ψ),refer to Fig.7-2 as below：

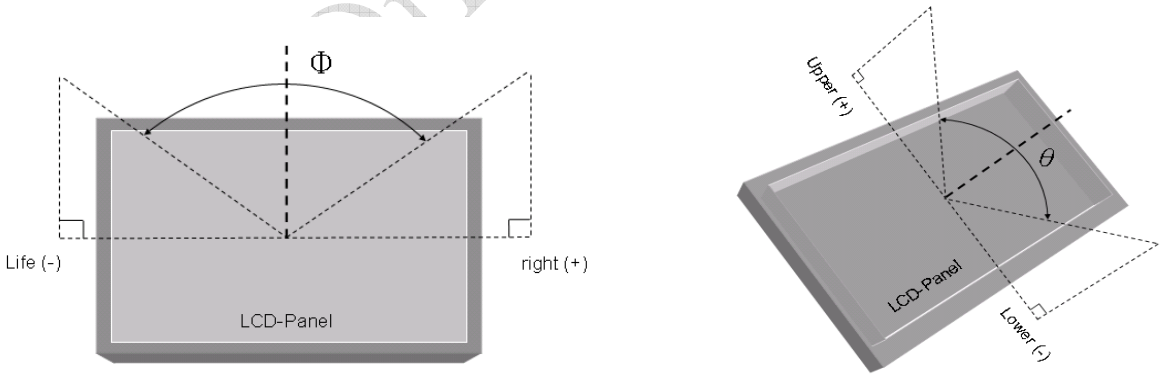


Fig.7-2 Definition of Viewing Angle

Note5: Definition of Response Time.(White-Black)

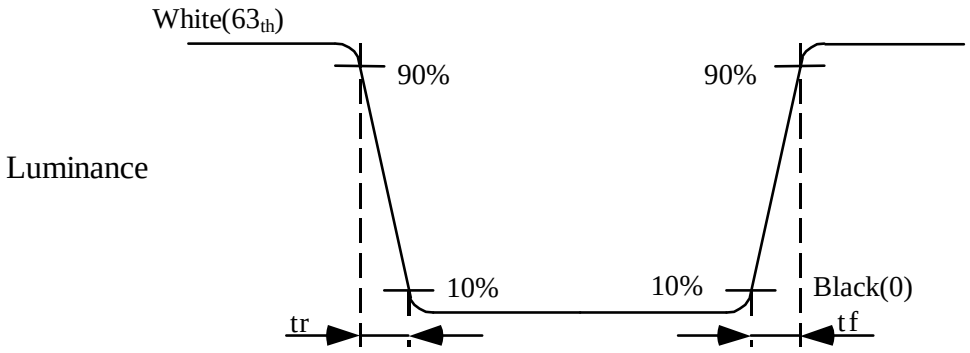


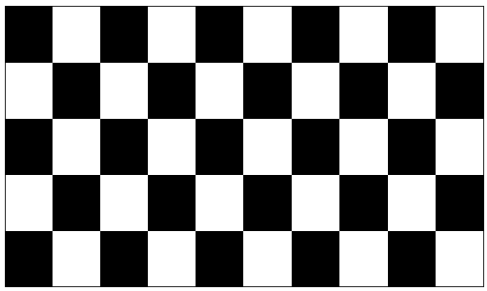
Fig.7-3 Definition of Response Time(White-Black)

8. RELIABILITY TEST

8.1. Temperature and humidity

TEST ITEMS	CONDITIONS	NOTE
High Temperature Operation	60℃, 500h	
High Temperature Storage	60℃, 72h	
High Temperature High Humidity Storage	40℃, 90%, 96h	No condensation
Low Temperature Operation	0℃, 500h	
Low Temperature Storage	-20℃, 72h	
Thermal Shock (No operation)	-20℃(30min) <=> 60℃(30min), 100cycle	
Push Test	TBD	
Image Sticking	25℃；4Hrs	
MTBF	within B/L：20,000 HRs (min) lift time.	

Note：
Condition of Image Sticking test：25 ℃± 2 ℃
Operation with test pattern sustained for 4 hrs, then change to gray pattern immediately.
After 5 mins, the mura must be disappeared completely .



8.2. Shock and Vibration

TEST ITEMS	CONDITIONS
Shock (Non-operation)	● Shock level : 2156m/s2 (150G), Waveform : half sinusoidal wave, 2ms, 6 axis (± X,± Y,± Z) per cycle
Vibration (Non-operation)	● Vibration level : 14.7m/s2 (1.5G), sinusoidal wave (each x, y, z axis : 1hr, total 3hrs) ● Frequency range : 5～500 Hz ● Sweep speed : 0.5 Octave/min.

8.3 Electrostatic Discharge

TEST ITEM	CONDITIONS	Note
ESD	150pF，330Ω，±8kV&±15kV air& contact test	1
	200pF，0Ω，±250V contact test	2

Note: Measure
1: LCD glass and metal bezel
2: IF connector pins

8.4. 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-uniform