TITLE :

HT14P12-100
Product Specification

REV. O

BOE HYDIS TECHNOLOGY CO., LTD.

REVISION HISTORY

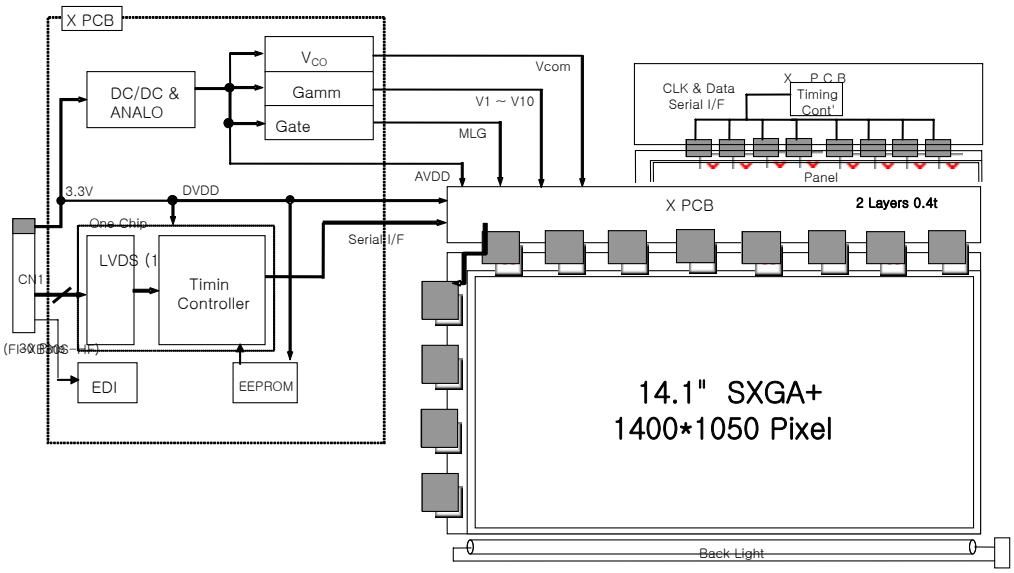
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
O		Initial Release	04.08.25	K.H.KIM

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HT14P12 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 14.1inch diagonally measured active area with SXGA+ resolutions (1400 horizontal by 1050 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe and this module can display 262,144 colors. The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for Notebook PC. The DC/AC inverter for back-light driving is not built in this model.



1.2 Features

- SPWG Style B (Except Thickness)" Form Factor
- Thin and light weight
- 3.3 V power supply
- Single and Dual selectable LVDS Interface
- Single CCFL (Bottom side/Horizontal Direction)
- 262,144 colors
- Data enable signal mode
- Side Mounting Frame

1.3 General Specifications

The followings are general specifications at the model HT14P12. (listed in Table 1.)

<Table 1. General Specifications>

Parameter	Specifications	Unit	Remarks
Active area	285.6(H) * 214.2(V)	mm	
Number of pixels	1400(H) * 1050(V)	Pixels	
Pixel pitch	0.204(H) * 0.204(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	262,144	Colors	
Display mode	Normally White		
Dimensional outline	299(W) *228(V)* 5.5(D)max./5.2(typ)	mm	
Weight	405 typ.	g	
Back-light	CCFL, Horizontal-lamp type		Note 1

Note 1. CCFL (Cold Cathode Fluorescent Lamp)

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

Parameter	Symbol	Min.	Max.	Unit	Remarks
Logic Power Supply	V_{DD}	VSS-0.3	4.0	V	Ta = 25 ±2 ℃
Logic Input Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
Back-light Lamp Current	IBL	2.0	7.0	mA	
Back-light Frequency	FBL	40	80	KHz	
Operating Temperature	T_{OP}	0	+50	℃	Note 1
Storage Temperature	T_{SP}	-20	+60	℃	

Note 1. Temperature and relative humidity range are shown in the figure below.

* 95 [%] RH Max. (40℃ ≥Ta)

* Maximum wet-bulb temperature at 39 ℃ or less.(Ta＞40℃) No condensation

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

Ta = 25 ±2 ℃

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1.
Power Supply Current	I_{DD}	-	425		mA	
Differential Input Voltage	V_{IH}	-	-	+100	mV	Note 2.
	V_{IL}	-100	-	-	mV	
Lamp Current	I_{BL}	2.0	6.0	7.0	mA_{rms}	At I_{BL} = 6.0 mA,
Lamp Voltage	V_{BL}	-	625	-	V_{rms}	Note 3.
Lamp operating frequency	F_L	40	60	80	KHz	Note 4.
Lamp Starting Voltage	Ta = 25℃	-	-	1050	V_{rms}	Note 5.
	Ta = 0℃	-	-	1470	V_{rms}	
Lamp Life Time		10,000	15,000	-	Hrs	Note 6.
Power Consumption	P_D	-	1.4	1.7	W	
	P_{BL}	-	3.8	-	W	Note 7.
	P_{total}	-	5.2	-	W	

Notes: 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25℃.
a) Typ. : Window98 @ 50Hz

2. LVDS common mode voltage, VCM = 1.2 [V].
3. Reference value, which is measured with Samsung Electric SIC130 Inverter.
(V_{BLMIN} is value at I_{BLMIN} and V_{BLMAX} is at I_{BLMAX})
4. The lamp frequency should be selected as different as possible from the horizontal synchronous frequency and its harmonics to avoid interference which may cause line flow on the display
5. The inverter open voltage should be supply more than the maximum value of lamp starting voltage.
6. Life Time (Hr) of a lamp can be defined as the time in witch it continues to operate under the condition Ta = 25 ±2 [℃] and Il = 6.0[mArms] until one of the following event occurs.
* When the brightness becomes 50[%] or lower than it's original.
* When the effective ignition length becomes 80[%] or lower than it's original value.
7. Refer to $V_{BL} \times I_{BL\ to\ Calculate}$. (at I_{BL} = 6.0 [mA])

4.0 OPTICAL SPECIFICATIONS

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25 ± 2℃) with the equipment of Luminance meter system (Goniometer system and TOPCONE BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θand Φequal to 0°. We refer to $\theta_{Ø=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$ (= θ_6) as the 6 o'clock direction ("bottom"). While scanning θand / or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed 30 minutes after lighting at rating with the back-light CCFL being run at a 4.5mArms current after 30 minutes warm-up period. VDD shall be 3.3+/- 0.15V at 25°C. Optimum viewing angle direction is 6 o'clock.

4.2 Optical Specifications

<Table 4. Optical Specifications>

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	40	45	-	Deg.	Note 1
		Θ_9		40	45	-	Deg.	
	Vertical	Θ_{12}		10	15	-	Deg.	
		Θ_6		25	35	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	150	200	-	-	Note 2
Luminance of white	1 Point	Y_w	Θ = 0° IBL = 6mA	120	150		cd/m^2	Note 3
	5 Point			112	140			
White Luminance uniformity	5 Point	ΔY5		0.85				Note 4
	13 Point	ΔY13		0.65				
White Chromaticity		x_w	Θ = 0°	0.285	0.313	0.341		Note 5
		y_w		0.309	0.329	0.349		
Reproduction of color	Red	x_R	Θ = 0°	0.554	0.584	0.614		
		y_R		0.308	0.338	0.368		
	Green	x_G		0.262	0.292	0.322		
		y_G		0.532	0.562	0.592		
	Blue	x_B		0.116	0.146	0.176		
		y_B		0.095	0.125	0.155		
Response Time	Rise(T_r)	$T_r + T_d$			25/25		ms	Note 6
	Decay(T_d)							
Cross Talk		CT		-	-	2.0	%	Note 7

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE1 shown in Appendix).
2. Contrast measurements shall be made at viewing angle of Θ= 0° and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (see FIGURE1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically as CR = Luminance when displaying a white raster / Luminance when displaying a black raster.
3. Luminance of white is defined as arithmetic center of one point across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

   The luminance of white is varied by the Back-light Current, IBL.

   (IBL = 6.0 mArms, FL = 63 KHz)
4. The White luminance uniformity on LCD surface at 5 points is then expressed as : ΔY = Maximum Luminance of 5 points / Minimum Luminance of 5 points, at IBL = 6mA. (see FIGURE .3).
5. The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue, and white. Measurements shall be made at the center of the panel.
6. The electro-optical response time measurements shall be made as shown in FIGURE 4 (shown in Appendix) by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Td and 90% to 10% is Tr.
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark (Refer to FIGURE 5).

5.0 INTERFACE CONNECTION

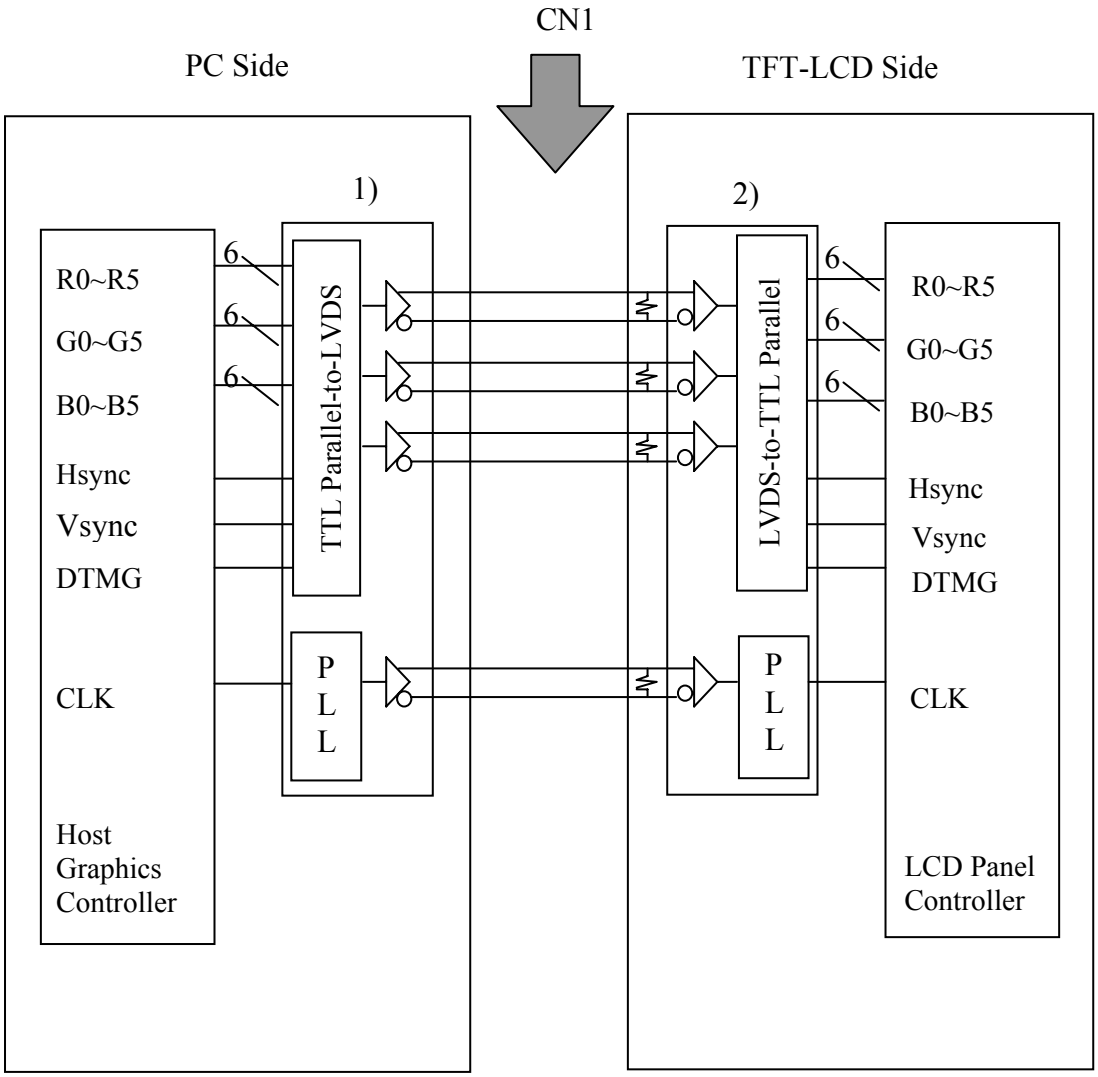
5.1 Electrical Interface Connection

The electronics interface connector is a model FI-XB30S-HF10 manufactured by JAE or equivalent. The mating connector part number is FI-X30H or FI-X30M or equivalent. The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignment for the Interface Connector>

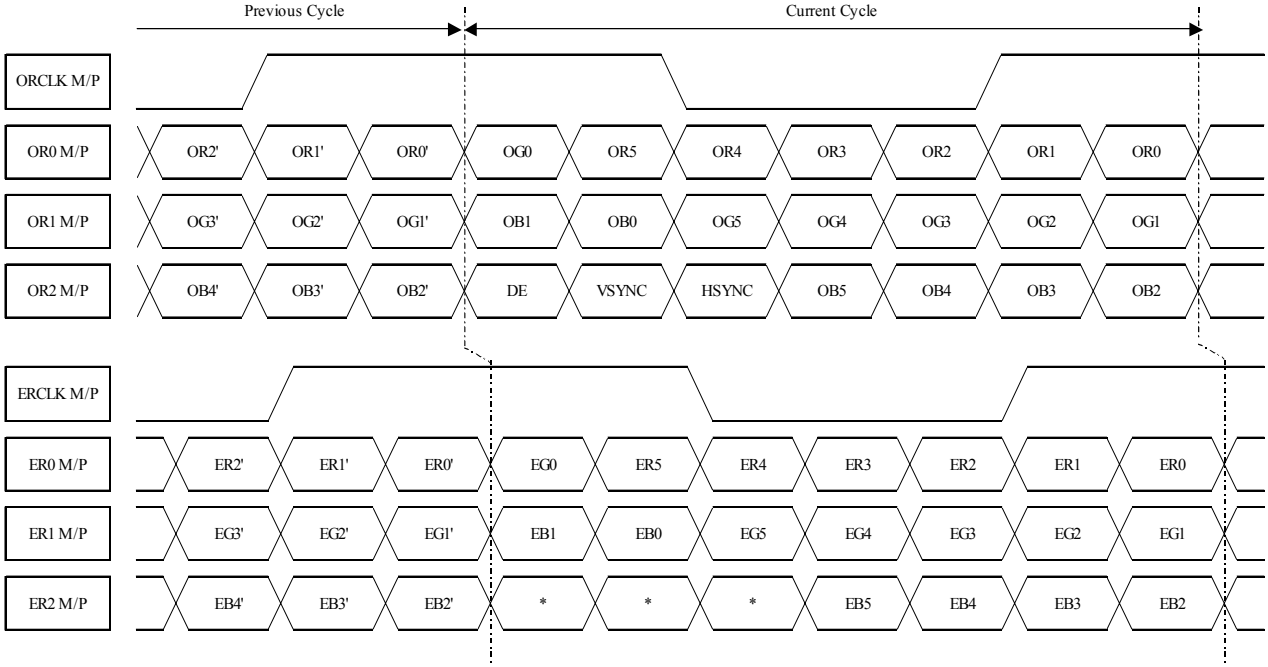
Terminal	Symbol	Functions
1	CH_SEL	L: Dual input, H : Single input
2	VDD	Power Supply : +3.3V (typical)
3	VDD	Power Supply : +3.3V (typical)
4	V_{EDID}	Reserved (for V_{EDID})
5	NC	Reserved (for Supplier test point)
6	CLK_{EDID}	Reserved (for Ckl_{EDID})
7	$DATA_{EDID}$-	Reserved (for $DATA_{EDID}$)
8	O_RIN0-	-LVDS differential data input (R0~R5,G0) (Odd pixel)
9	O_RIN0+	+LVDS differential data input (R0~R5,G0) (Odd pixel)
10	VSS	GND
11	O_RIN1-	-LVDS differential data input (G1~G5,B0,B1) (Odd pixel)
12	O_RIN1+	+LVDS differential data input (G1~G5,B0,B1) (Odd pixel)
13	VSS	GND
14	O_RIN2-	-LVDS differential data input (B2~B5,HS,VS,DE) (Odd pixel)
15	O_RIN2+	+LVDS differential data input (B2~B5,HS,VS,DE) (Odd pixel)
16	VSS	GND
17	O_CLKIN-	-LVDS differential Clock input (Odd pixel)
18	O_CLKIN+	+LVDS differential Clock input (Odd pixel)
19	VSS	GND
20	E_RIN0-	-LVDS differential data input (R0~R5,G0) (Even pixel)
21	E_RIN0+	+LVDS differential data input (R0~R5,G0) (Even pixel)
22	VSS	GND
23	E_RIN1-	-LVDS differential data input (G1~G5,B0,B1) (Even pixel)
24	E_RIN1+	+LVDS differential data input (G1~G5,B0,B1) (Even pixel)
25	VSS	GND
26	E_RIN2-	-LVDS differential data input (B2~B5,HS,VS,DE) (Even pixel)
27	E_RIN2+	+LVDS differential data input (B2~B5,HS,VS,DE) (Even pixel)
28	VSS	GND
29	E_CLKIN-	-LVDS differential Clock input (Even pixel)
30	E_CLKIN+	+LVDS differential Clock input (Even pixel)

5.2 LVDS Interface



NOTE 1. LVDS cable impedance is 100 ohms per signal line
when two are used differentially…
2. Transmitter: Thine THC63LVDM63A, or equivalent.
Transmitter is not contained in Module.

5.3 LVDS Input signal



Pin connection in case of using Thine THC63LVDM63A

LVDS Tx #1 for Odd				LVDS Tx #2 for Even			
Input signal	Transmitter #1-1	Input signal	Transmitter #1-2	Input signal	Transmitter #2-1	Input signal	Transmitter #2-2
DCLK	CLK IN(26)	GO4	IN10(10)	DCLK	CLK IN(26)	GE4	IN10(10)
RO0	IN0(44)	GO5	IN11(12)	RE0	IN0(44)	GE5	IN11(12)
RO1	IN1(45)	BO0	IN12(13)	RE1	IN1(45)	BE0	IN12(13)
RO2	IN2(47)	BO1	IN13(15)	RE2	IN2(47)	BE1	IN13(15)
RO3	IN3(48)	BO2	IN14(16)	RE3	IN3(48)	BE2	IN14(16)
RO4	IN4(1)	BO3	IN15(18)	RE4	IN4(1)	BE3	IN15(18)
RO5	IN5(3)	BO4	IN16(19)	RE5	IN5(3)	BE4	IN16(19)
GO0	IN6(4)	BO5	IN17(20)	GE0	IN6(4)	BE5	IN17(20)
GO1	IN7(6)	Hsync	IN18(22)	GE1	IN7(6)	Hsync	IN18(22)
GO2	IN8(7)	Vsync	IN19(23)	GE2	IN8(7)	Vsync	IN19(23)
GO3	IN9(9)	DE	IN20(25)	GE3	IN9(9)	DE	IN20(25)

5.4 Back-light Interface

The Back-light interface connector is a model BHSR-02VS-1 manufactured by JST or equivalent. The connector interface pin assignments are listed in Table 7.

<Table 7. Back-light Electrical Interface>

Terminal	Symbol	Function
1	VL	CCFL Power Supply(High Voltage)
2	GL	CCFL Power Supply(GND Side)

6.0 SIGNAL TIMING SPECIFICATION

6.1 The specification of the signal timing parameter is listed in Table 8.

<Table 8. Signal Timing Specification>

Items	Symbol	Min.	Typ.	Max.	Unit	Remarks
Frame Period	t1	1055*t3	1066*t3 20	1578*t3	Line ms	 50 [Hz]
Vertical Display Term	t2		1050*t3 19.7		Line ms	 50 [Hz]
One Line Scanning Time	t3	800*t5	844*t5 18.76	1688*t5	Clock us	 53.3kHz
Horizontal Display Term	t4		700*t5 15.55		Clock us	
Clock Period	t5		22.22		ns	45 [MHz]
Clock “L” Time	t6	5.0				
Clock “H” Time	t7	5.0				
Setup Time	t8	3.5				
Hold Time	t9	3.5				

6.2 Hang Up Free Function

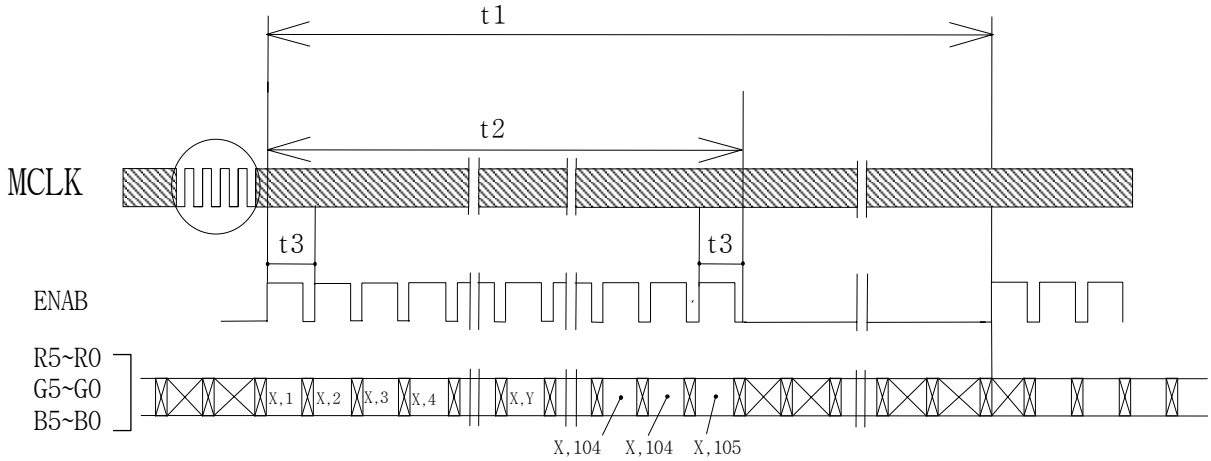
Black data ouput (including no damage) at abnormal signal and self recover when normal signal Returns
This function can be removed by control pin.

<Hang Up Free checking specification>

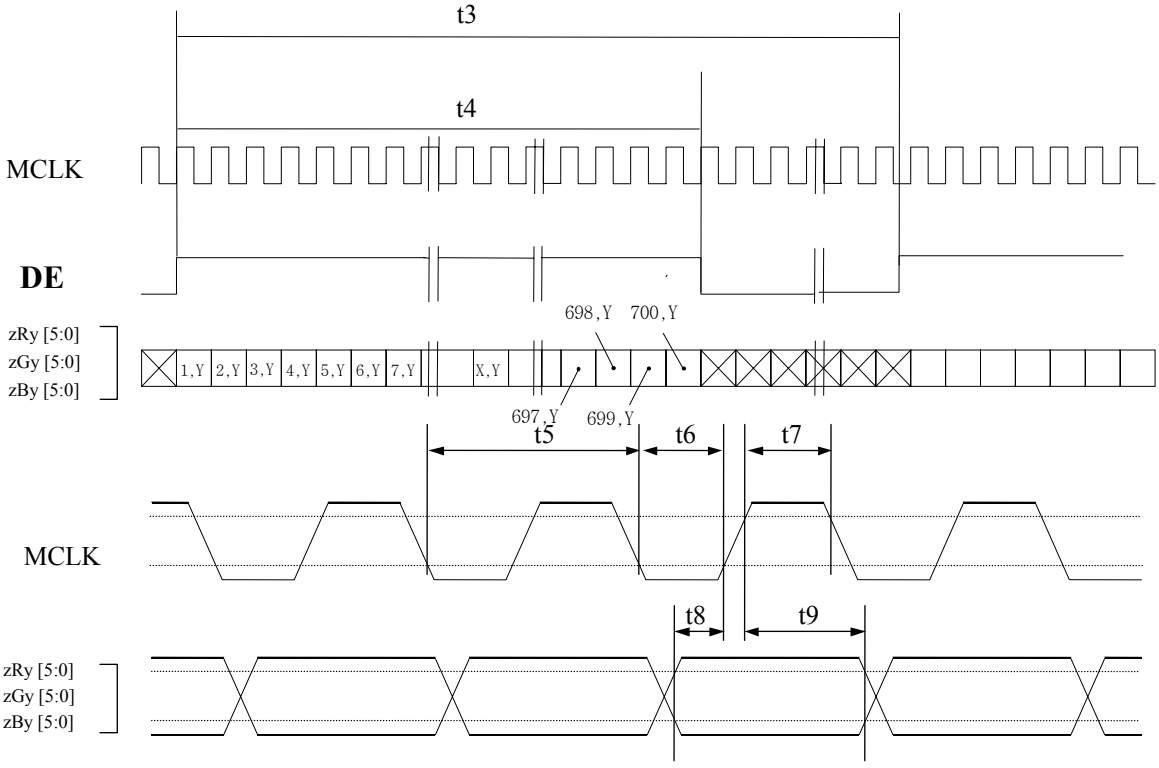
a. External Clock is not exist.
b. External DE is not exist.
c. Horizontal total width is more than 1688 External Clock.
d. Horizontal total width is less than 800 External Clock.
e. Horizontal active width is not equal 700 External Clock.
f. Vertical Blank width is more than 512 Line.
g. Vertical Blank width is less than 11 Line.
h. Vertical active width is not equal 1050 Line.

7.0 SIGNAL TIMING WAVEFORMS

7.1 Vertical Timing Waveforms
(t1 ~ t5 : referenced by table 8.)



7.2 Horizontal Timing Waveforms



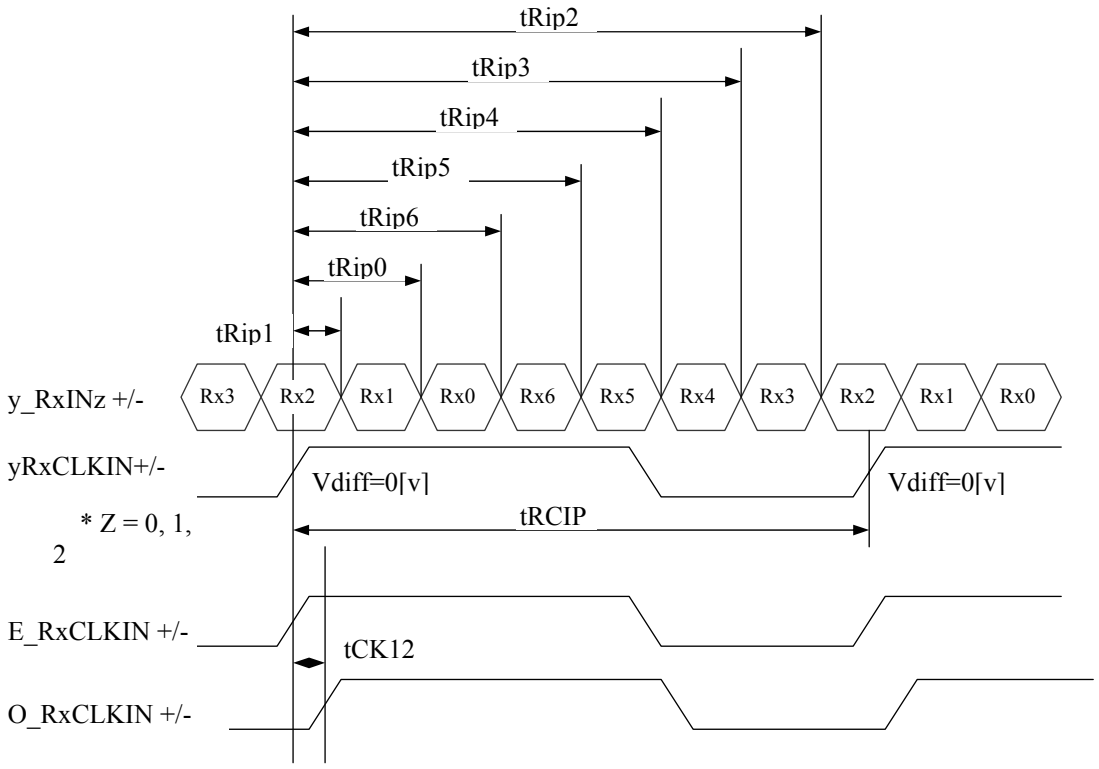
>> z = F(First Block), S(Second Block)
>> y = O(Odd Pixel Data), E(Even Pixel Data)

7.3 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is listed in Table 9.

<Table 9. LVDS Rx Interface Timing Specification>

Items	Symbol	Min.	Typ.	Max.	Unit	Remarks
PLL set	tRPLL	-	-	10.0	msec	
CLKIN Period	tRCIP	14.7	18.6	32.4	nsec	
Skew Time	tCK12	-3/7 *tRCIP	-	3/7*tRCIP	nsec	Note 1
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	TRIP0	1*tRICP/7-0.4	1*tRICP/7	1*tRICP/7+0.4	nsec	
Input Data 2	TRIP6	2*tRICP/7-0.4	2*tRICP/7	2*tRICP/7+0.4	nsec	
Input Data 3	TRIP5	3*tRICP/7-0.4	3*tRICP/7	3*tRICP/7+0.4	nsec	
Input Data 4	TRIP4	4*tRICP/7-0.4	4*tRICP/7	4*tRICP/7+0.4	nsec	
Input Data 5	TRIP3	5*tRICP/7-0.4	5*tRICP/7	5*tRICP/7+0.4	nsec	
Input Data 6	TRIP2	6*tRICP/7-0.4	6*tRICP/7	6*tRICP/7+0.4	nsec	



8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

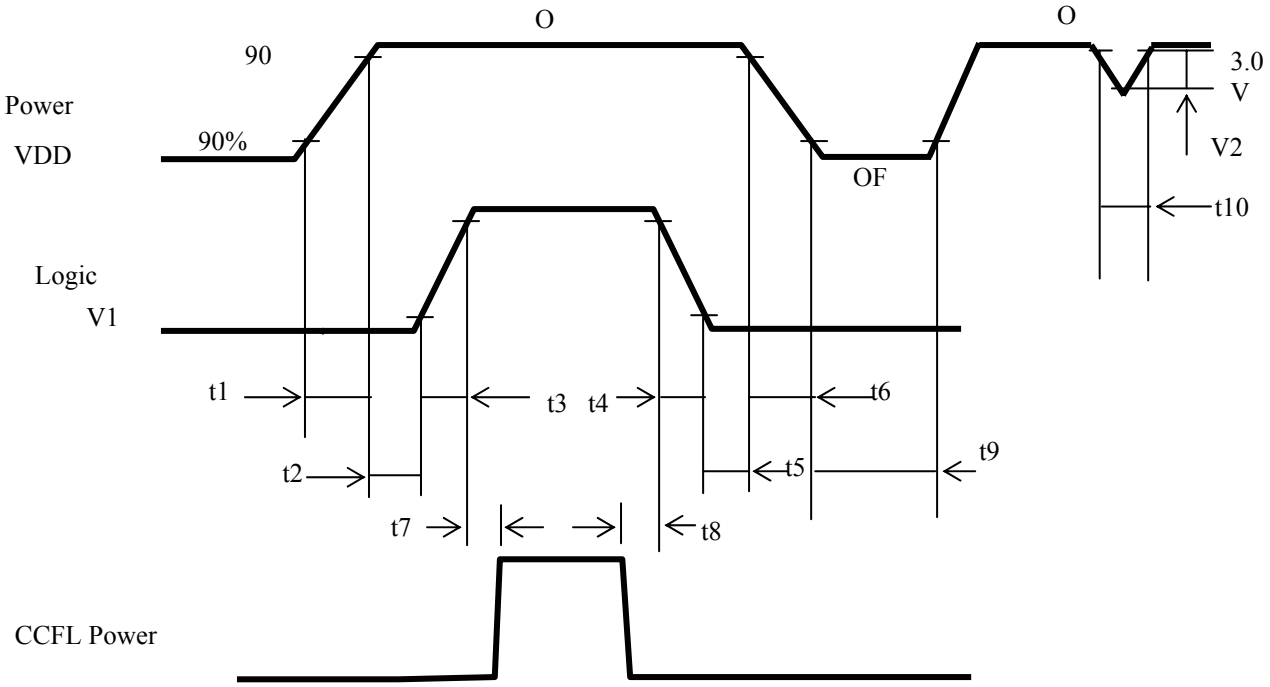
Each color is displayed in sixty-four gray scales from a 6 bit data signal input. A total of 262,144 colors are derived from the resultant 18 bit data. Table 9. shows the input signals, basic display colors and gray scale for each color.

<Table 9. Input signals, Basic display colors and Gray scale for each color.>

	Colors & Gray scale	Data signal																	
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Light Blue	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Purple	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
Gray scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△ ▽			↓						↓						↓			
	Brighter	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	▽	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray scale of Green	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	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	△ ▽			↓						↓						↓			
	Brighter	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray scale of Blue	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	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	△ ▽			↓						↓						↓			
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Gray scale of White & Black	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
	△ ▽			↓						↓						↓			
	Brighter	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1
	▽	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

9.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



t1 ≤ 10 ms	0 ≤ t4 ≤ 50 ms
0 ≤ t2 ≤ 50 ms	0 ≤ t5 ≤ 50 ms
0 ≤ t3 ≤ 50 ms	t6 ≤ 10 ms
t7 ≥200 ms	t8 ≥ 0 ms
t9 ≥100ms	t10 ≤ 10 ms (Note2.)

2.4 V ≤ V2 ≤ 3.0V (Note3.)

* SET 0V ≤ V1(t) ≤ VDD(t)
HERE, V1(t), VDD(t) indicate the transitive state of V1, VDD
when the power supply is turned ON or OFF
Note1. : Do not keep the interface signal high-impedance when power is on.
Note2. : Momentary Voltage Drop Time.

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model 14.1" SXGA+ Coral. Other parameters are shown in Table 10.

<Table 10. Dimensional Parameters.>

Parameter	Specification	Unit
Active area	285.6(H) * 214.2(V)	mm
Number of pixels	1400(H)*1050(V)	pixels
	(1 pixel = R + G + B dots)	
Pixel pitch	0.204(H)*0.204(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	262,144	colors
Display mode	Normally Black	
Dimensional outline	299.0±0.3(W) * 228.0±0.3(V) * 5.2 ±0.3 (D)	mm
Weight	405.0 (Typ).	g
Back-light	CCFL, Horizontal-lamp type	

10.2 Mounting

See FIGURE 7. (shown in Appendix)

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux

11.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 12. Reliability test>

No	Test Items	Conditions
1	High temperature storage test	Ta = 60 ℃, 240 hrs
2	Low temperature storage test	Ta = -20 ℃, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 ℃, 80 %RH, 240 hrs
4	High temperature operation test	Ta = 60 ℃, 240hrs
5	Low temperature operation test	Ta = 0 ℃, 240 hrs
6	On/Off operation test	Ta = 25 ℃, 1 min. On/Off, 3000 cycle
7	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle
8	Vibration test (non-operating)	1.5G,10~200Hz for X,Y,Z axis 30 minutes for each axis
9	Shock test (non-operating)	50G,18msec,trapezoidal 220G,2msec,half sine
10	Electrostatic discharge test	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV
11	Altitude test	53.3 Kpa (alititude 5000m),24 hrs
12	Open/Shot test	DS 518 , Open/Shot Test plan

12.0 HANDLING & CAUTIONS

12.1 Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

12.2 Cautions for handling the module

- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

12.3 Cautions for the operation

- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

12.4 Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

12.5 Cautions for the module characteristics

- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

12.6 Other cautions

- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

13.0 PACKING INFORMATION

BOE HYDIS provides the standard shipping container for customers, unless customer specifies their packing information.

14.0 PRODUCT LABEL

1	2	3	4	5	6
X X	X	X X	X	1 0 0 - X X X	X X X X X

Type designation

No 1. Control Number

No 2. Rank / Grade

No 3. Year (04 : 2004, 05 : 2005, …)

No 4. Month (1, 2, 3,…, 9, X, Y, Z)

No 5. Product Identification

No 6. Serial Number

15.0 APPENDIX

Figure 1. Measurement Set Up

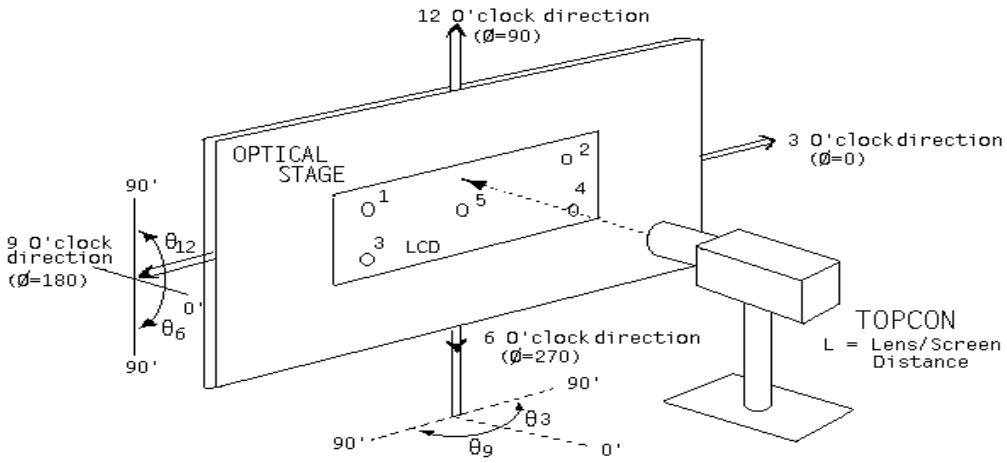


Figure 2, 3. Average Luminance Measurement & Uniformity Measurement Locations

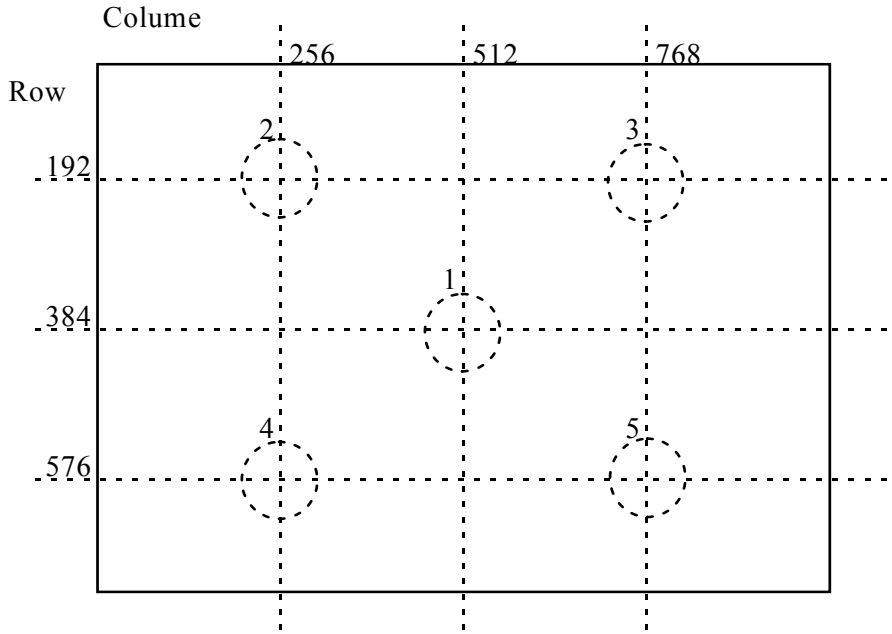


Figure 4. Response Time Testing

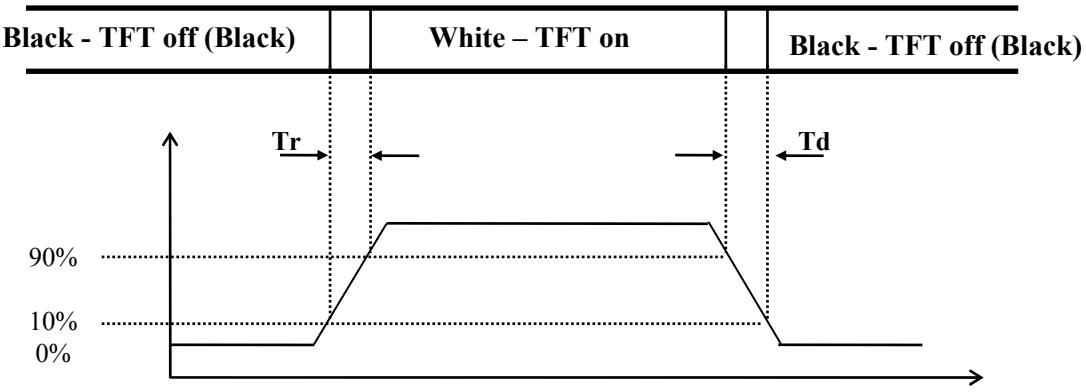
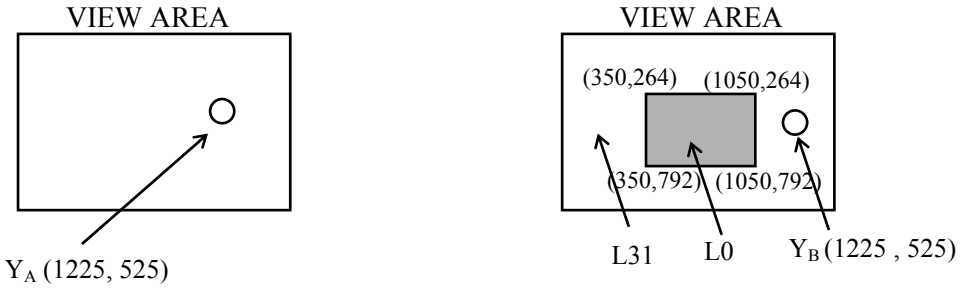


Figure 5. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_B} \right| \times 100$$

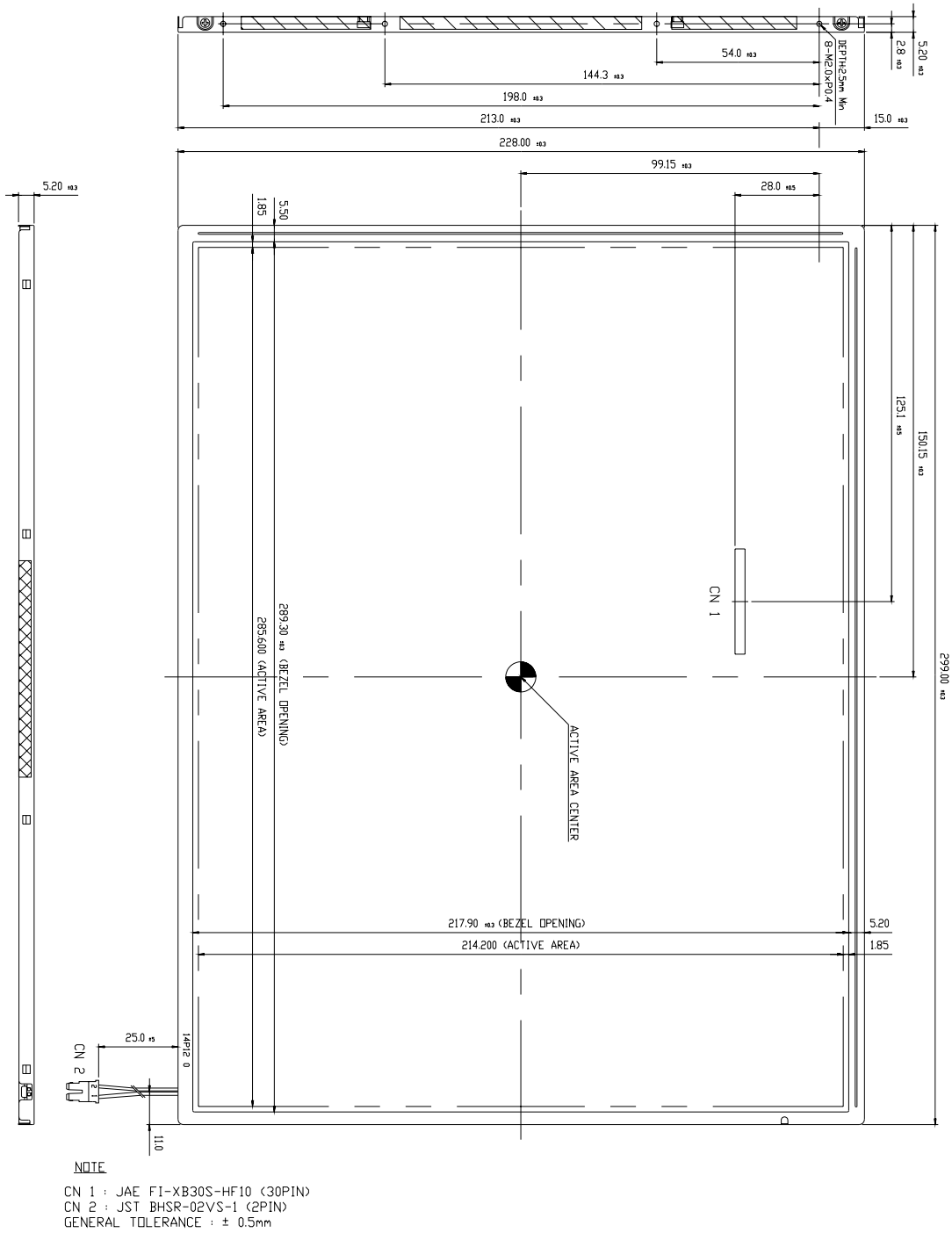
Where:

Y_A = Initial luminance of measured area (cd/m^2)

Y_B = Subsequent luminance of measured area (cd/m^2)

The location measured will be exactly the same in both patterns

Figure 6. TFT-LCD Module Outline Dimensions (Front view)



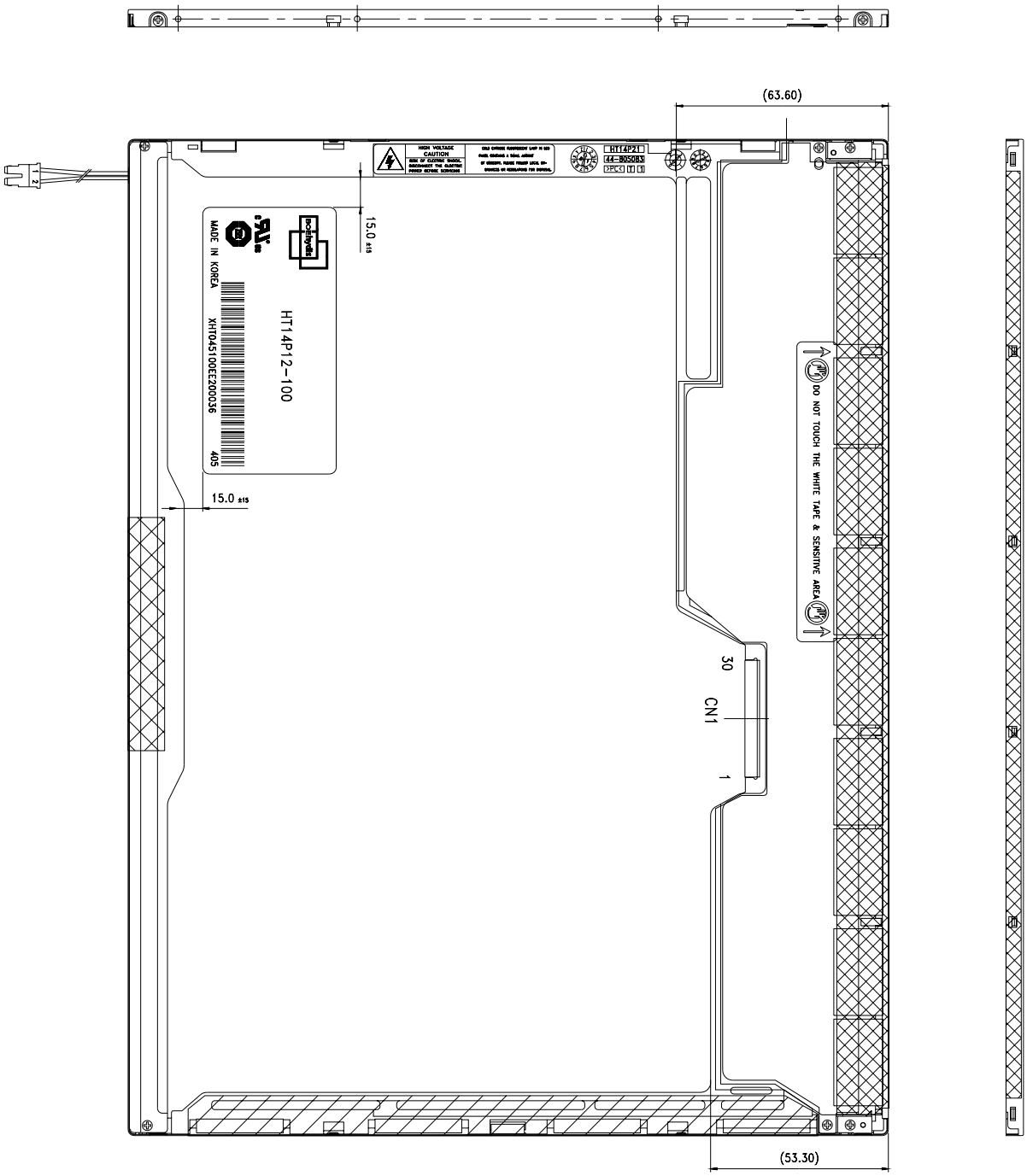


Figure 7. TFT-LCD Module Outline Dimensions (Rear view)