TITLE : HT201V01-100

Preliminary Product Specification

P1

BOE TFT-LCD SBU

BEIJING BOE OPTOELECTRONICS TECHNOLOGY

BOE HYDIS TECHNOLOGY

REVISION HISTORY

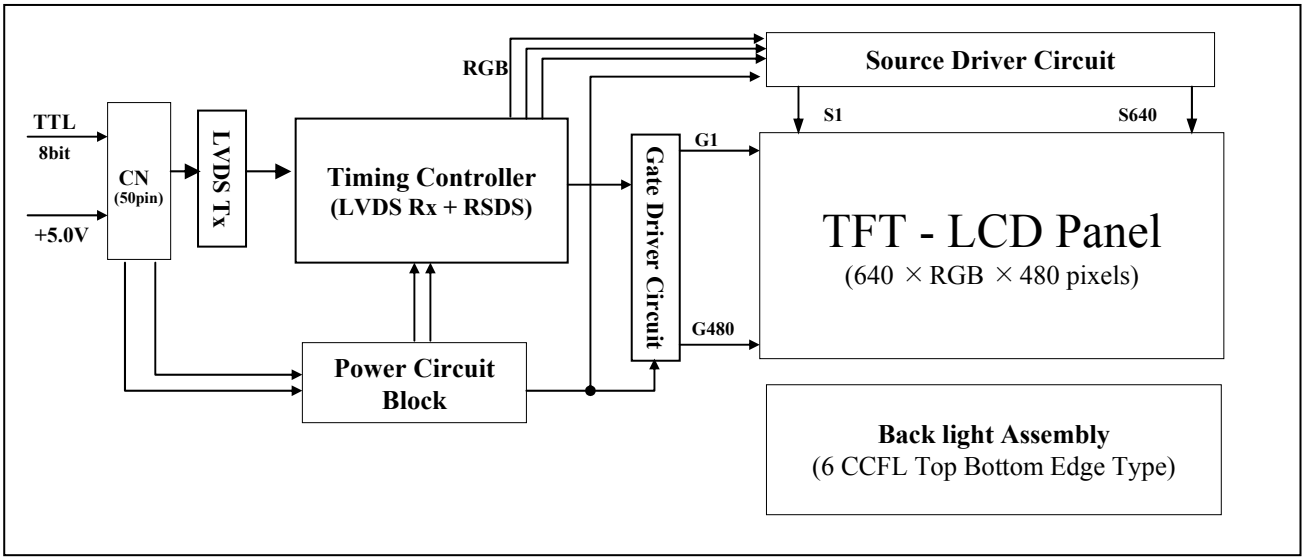
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		Initial Release	05.06.10.	W.K. Chang
P1		Change Brightness 500 nit → 450 nit typ.	05.07.20	W.K. Chang
		Change View angle 160/140 typ. (CR>5)		
		→ 150/130 typ. (CR>10)		

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HT201V01-100 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 20.1 inch diagonally measured active area with VGA resolutions (640 horizontal by 480 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16,777,216 colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- TTL Interface with 1 pixel / clock
- High-speed response
- Low power consumption
- 8-bit color depth, display 16,777,216 colors
- Incorporated edge type back-light (Four lamps)
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only Mode
- RoHS Compliant

1.3 Application

- TV use

1.4 General Specification

The followings are general specifications at the model HT201V01-100.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	408(H) × 306(V)	mm	
Number of pixels	640(H) × 480(V)	pixels	
Pixel pitch	0.6375(H) × 0.6375(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16,777,216	colors	
Display mode	Normally White		
Dimensional outline	448.6 × 339.6 × 25.0 (max.)	mm	
Weight	3200 (typ.)	g	
Surface Treatment	Haze 25%, 3H		
Back-light	Top/Bottom edge side, 6-CCFL type		

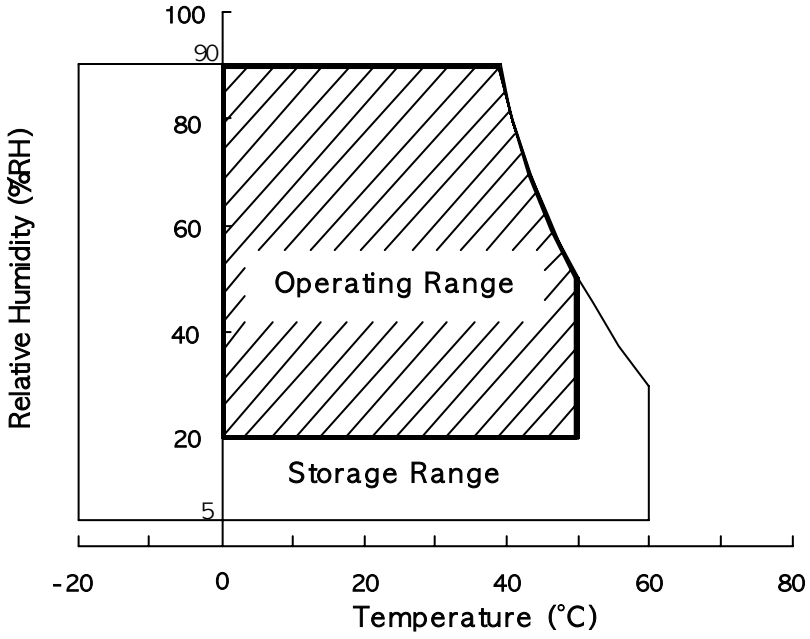
2.0 ABSOLUTE MAXIMUM RATINGS

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> [VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	VSS-0.5	6.5	V	Ta = 25 ℃
Logic Supply Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
Back-light Lamp Current	I_{BL}	3	7	mA	
Back-light Lamp frequency	F_L	40	70	kHz	
Operating Temperature	T_{OP}	0	+50	℃	1)
Storage Temperature	T_{ST}	-20	+60	℃	1)

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ^{O}C max. and no condensation of water.



3.0 ELECTRICAL SPECIFICATIONS

3.1Electrical Specifications

< Table 3. Electrical specifications > [Ta =25±2 ℃]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	4.5	5.0	5.5	V	Note1
Power Supply Current	I_{DD}	-	TBD	1.2	A	
Permissible Input Ripple Voltage	V_{RF}			100	mV	V_{DD} = 5.0V
In Rush Current	Irush	-	-	3.0	A	Note 2
Back-light Lamp Voltage	V_{BL}		755		V_{rms}	
Back-light Lamp Current	I_{BL}	3.0	6.5	7.0	mA_{rms}	
Back-light Lamp operating Frequency	F_L	40	-	70	KHz	Note 3
Lamp Start Up Voltage				1450	V_{rms}	Note 4
Lamp Life		50000			Hrs	I_{BL}= 8.0mA
Power Consumption	P_D	-	TBD	6	W	
	P_{BL}		29.4		W	I_{BL}=6.5mA, Note 5
	P_{total}		TBD		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 VDD=5.0V, Frame rate=75Hz and Clock frequency = 67.5MHz. Test Pattern of power supply current
a) Typ : Color Bar pattern
b) Max : Vertical 2 line pattern

2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

3. 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

4. The voltage above this value should be applied to the lamps for more than 1 second to start-up. Otherwise the lamps may not be turned on.

5. Calculated value for reference (V_{BL} × I_{BL}) ×6 excluding inverter loss.

4.0 OPTICAL SPECIFICATION

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 θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 5.0V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 25.18MHz, I_{BL} = 6.5mA, Ta =25±2 ℃]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	-	75	-	Deg.	Note 1
		Θ_9		-	75	-	Deg.	
	Vertical	Θ_{12}		-	70	-	Deg.	
		Θ_6		-	60	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	550	700			Note 2
Luminance of White		Y_w		350	450		cd/m^2	Note 3
White luminance uniformity		Δ Y		75	80		%	Note 4
Reproduction of color	White	W_x		0.250	0.280	0.310		Note 5
		W_y		0.260	0.290	0.320		
	Red	R_x			TBD			
		R_y			TBD			
	Green	G_x			TBD			
		G_y			TBD			
	Blue	B_x			TBD			
		B_y			TBD			
Response Time	Rise	T_r			8	12	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 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.
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 FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as 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.
4. The White luminance uniformity on LCD surface is then expressed as :
   ΔY = (Minimum Luminance of 9points / Maximum Luminance of 9points) * 100
   (See FIGURE 2 shown in Appendix).
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 FIGURE 3 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 (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

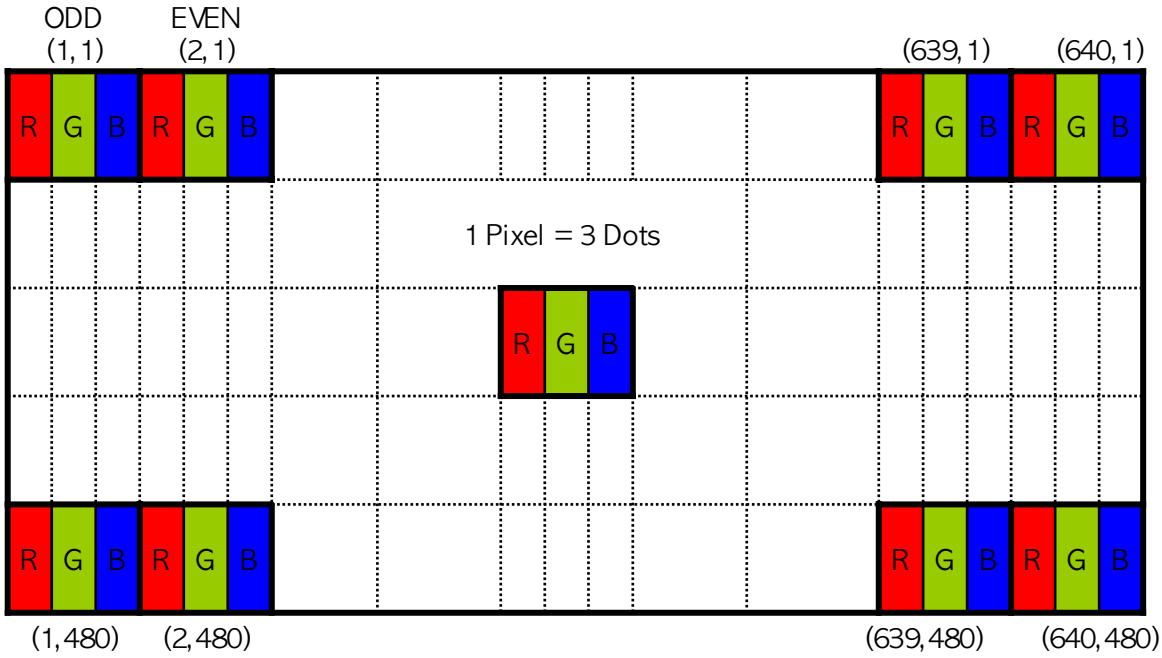
5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

- CN11 Module Side Connector :
  User Side Connector : Hirose FH12-50S-0.5SH or Equivalent

Pin No	Symbol	Function	Remark	Pin No	Symbol	Function	Remark
1	NC	NO CONNECTION		26	R0	RED DATA	
2	NC	NO CONNECTION		27	GND	GROUND	
3	NC	NO CONNECTION		28	G7	GREEN DATA (G7 : MSB)	
4	GND	GROUND		29	G6		
5	GND	GROUND		30	G5		
6	VCC	POWER SUPPLY (+ 5.0V)		31	G4		
7	VCC			32	GND	GROUND	
8	VCC			33	G3	GREEN DATA	
9	VCC			34	G2		
10	GND	GROUND		35	G1		
11	NC	NO CONNECTION		36	G0		
12	NC	NO CONNECTION		37	GND	GROUND	
13	GND	GROUND		38	B7	BLUE DATA (B7 : MSB)	
14	DE	DATA ENABLE		39	B6		
15	GND	GROUND		40	B5		
16	DCLK	DOT CLOCK		41	B4		
17	GND	GROUND		42	GND	GROUND	
18	R7	RED DATA (R7 : MSB)		43	B3	BLUE DATA	
19	R6			44	B2		
20	R5			45	B1		
21	R4			46	B0		
22	GND	GROUND		47	GND	GROUND	
23	R3	RED DATA		48	GND	GROUND	
24	R2			49	NC	NO CONNECTION	
25	R1			50	NC	NO CONNECTION	

5.2 Data Input Format



Display Position of Input Data (V-H)

5.3 Back-light Interface Connection

● CN21, 22, 23 CN24, 25, 26	Module Side Connector			BHSR-02VS-1 (JST) or equivalent	
	User Side Connector			SM02-BHSS-1-TB (JST) or equivalent	
Lamp Position	CN NO.	PIN NO.	INPUT	COLOR	FUNCTION
Center	CN23 CN26	1	HOT	White	High Voltage
		2	COLD	White	Ground
Outer	CN21 CN22 CN24 CN25	1	HOT	Pink	High Voltage
		2	COLD	Blue	Ground
		1	HOT	Blue	High Voltage
		2	COLD	Pink	Ground

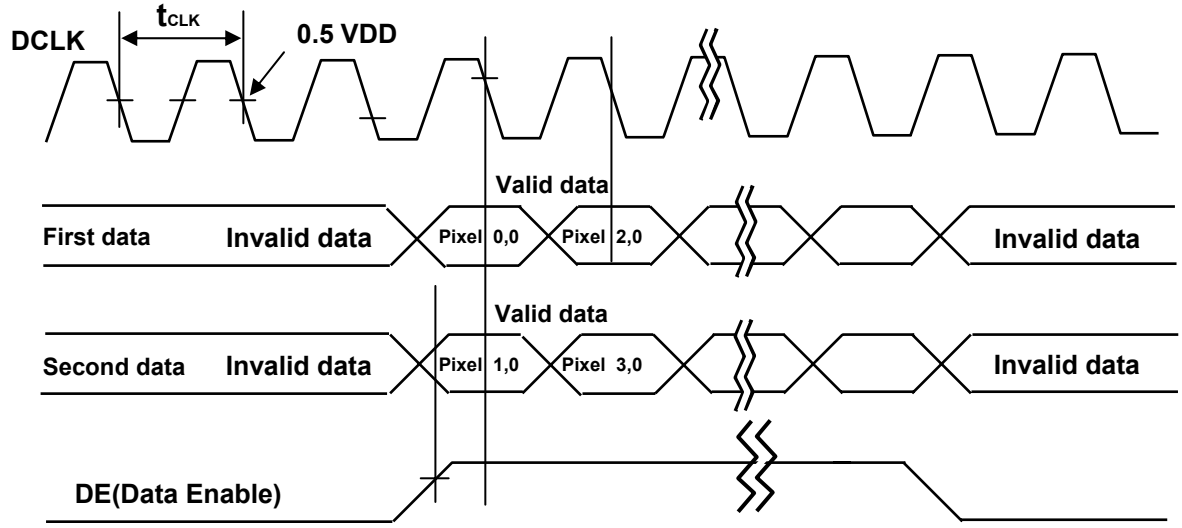
6.0 SIGNAL TIMING SPECIFICATION

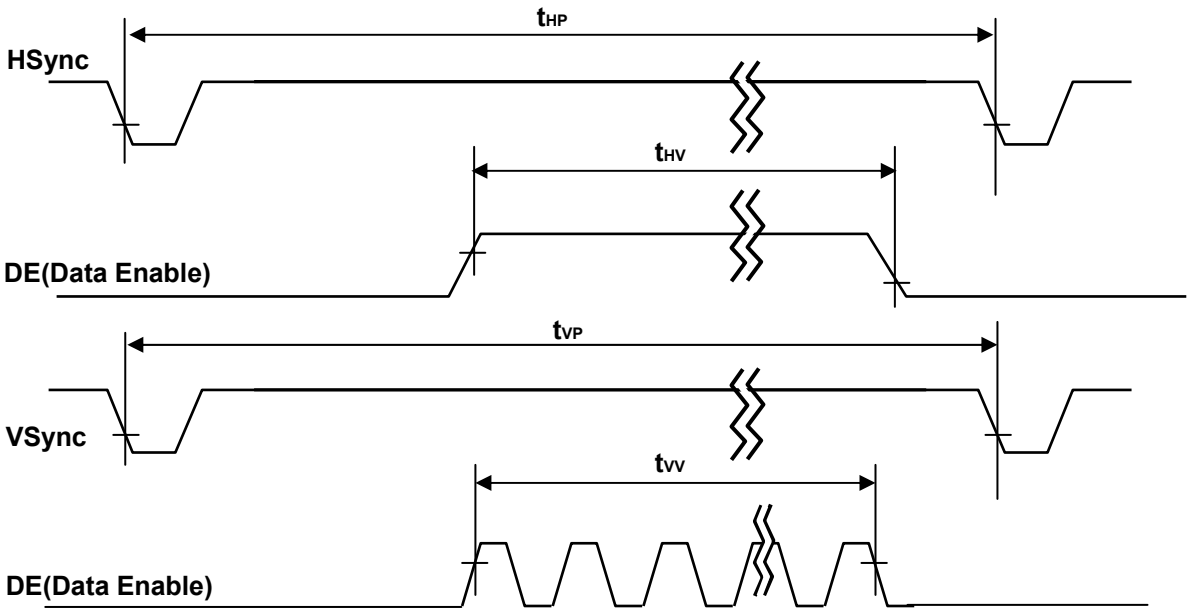
6.1 The HT201V01-100 is operated by the DE only mode (TTL Input)

ITEM	Symbol		Min	Typ	Max	Unit	Note
CLK	Period	t_{CLK}		39.7		ns	
	Frequency	-	20	25.18	35	MHz	
Hsync	Frequency	f_H		31.5		KHz	
Vsync	Frequency	f_V		60		Hz	
Horizontal Active Display Term	Valid	t_{HV}	-	640	-	t_{CLK}	
	Total	t_{HP}	680	800	1056		
Vertical Active Display Term	Valid	t_{VV}	-	480	-	t_{HP}	
	Total	t_{VP}	485	525	627		

7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms



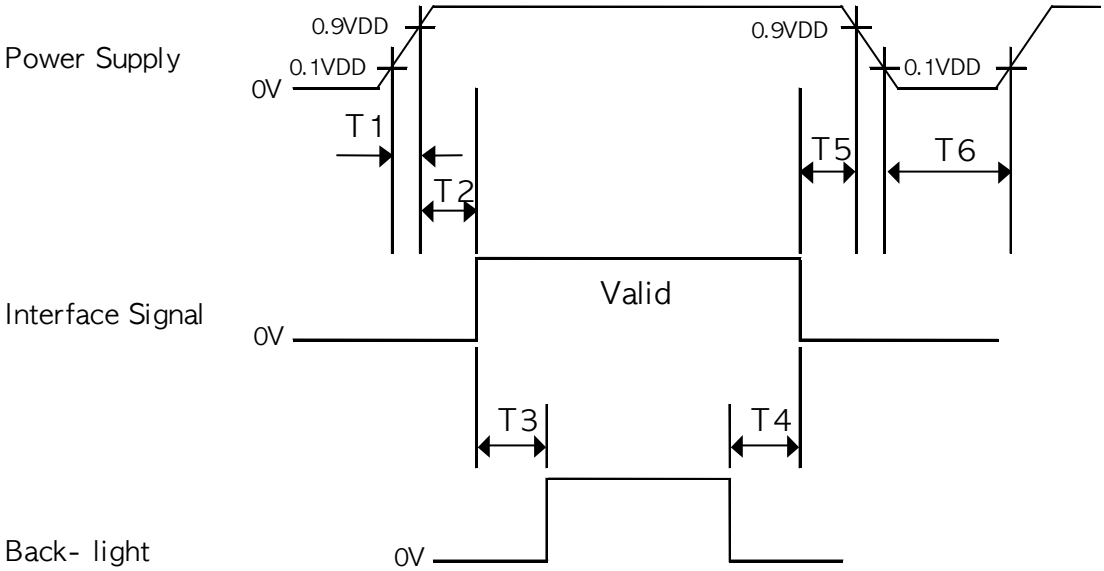


8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		RED DATA								GREEN DATA								BLUE 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
Basic Colors	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	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
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	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
Gray Scale of RED	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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	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	1	1	1	1	1	1	1	1	0	0	0	0	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	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	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of WHITE	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	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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

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 ≤ T2 ≤ 50 ms
- 200ms ≤ T3
- 200ms ≤ T4
- 0 ≤ T5 ≤ 50ms
- 0 ≤ T6 ≤ 10ms
- 1sec ≤ T6

Notes:

1. When the power supply VDD is 0V, Keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model HT190E01-100. Other parameters are shown in Table 5.

<Table 5. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	448.6 × 339.6 × 25.0 (max.)	mm
Weight	3200 (typ.)	gram
Active area	408(H) × 306(V)	mm
Pixel pitch	0.6375(H) ×0.6375(V)	mm
Number of pixels	640(H) × 480(V) (1 pixel = R + G + B dots)	pixels
Back-light	Top / Bottom edge side 6-CCFL type	

10.2 Mounting

See FIGURE 5. (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 RELIABLITY TEST

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

<Table 6. Reliability Test Parameters >

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, 240hrs	
4	High temperature operation test	Ta = 50 ℃ , 240hrs	
5	Low temperature operation test	Ta = 0 ℃ , 240hrs	
6	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency Gravity / AMP Period	10 ~ 300 Hz, Sweep rate 30 min 1.5 G ±X, ±Y, ±Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	±X, ±Y, ±Z Once for each
9	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV	

12.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(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.

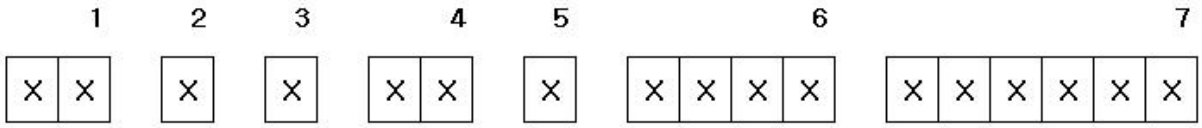
(3) Cautions for the operation
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(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.

(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.

(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 PRODUCT SERIAL NUMBER



Type

No 1. Control

No 2. Rank

No 3. Line Classification(BOE HYDIS : H, LCM : L, BOE OT : A/B/C)

No 4. Year(2001 : 01, 2002 : 02,…)

No 5. Month(1, 2, 3, …,9 X, Y, Z)

No 6. FG Code

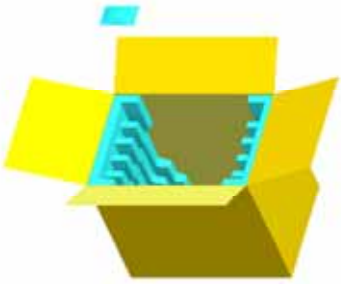
No 7. Serial No.

14.0 Packing

14.1 Packing Order

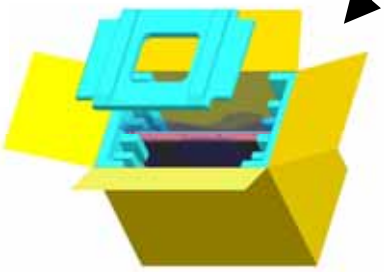
Put Pad into the box.

Put silica gels in the box.



As shown in the figure, place the Modules bundled by shielding bag in the box.

Place a cover on the top of the box.



After sealing the box, attach Packing Label on the attach position sign area of the box.

14.2 Packing Note

- Box Dimension : 346mm(W) × 526mm(D) × 448mm(H)
- Package Quantity in one Box : 5pcs

14.3 Box label

- Label Size : 108 mm (L) × 56 mm (W)
- Contents

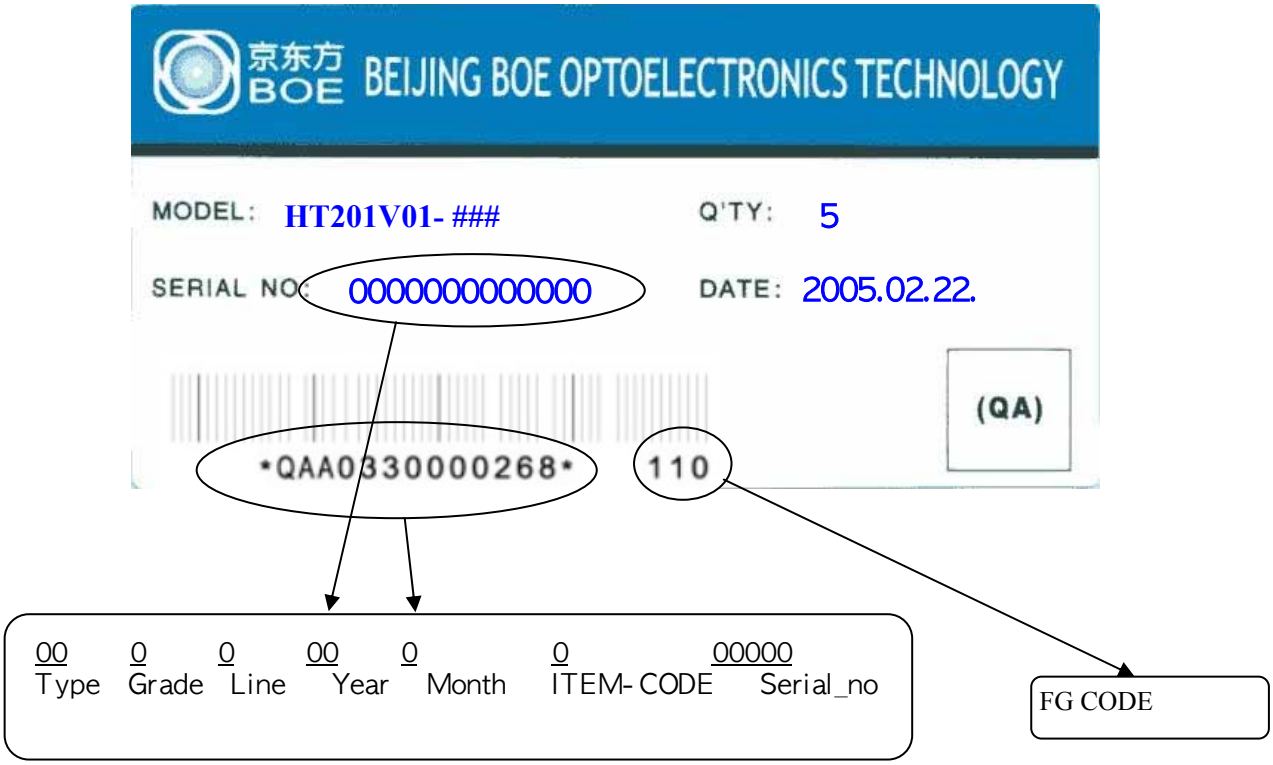
  Model : HT201V01

  Q`ty : Module Q`ty in one box

  Serial No. : Box Serial No. See next page for detail description.

  Date : Packing Date

  FG Code : FG Code of Product



15.0 APPENDIX

Figure 1. Measurement Set Up

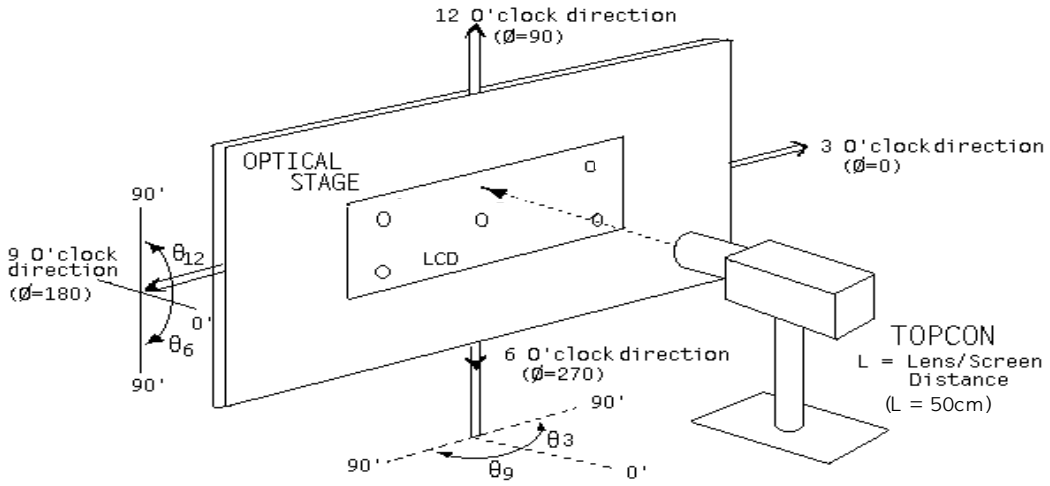


Figure 2. White Luminance and Uniformity Measurement Locations (5 points)

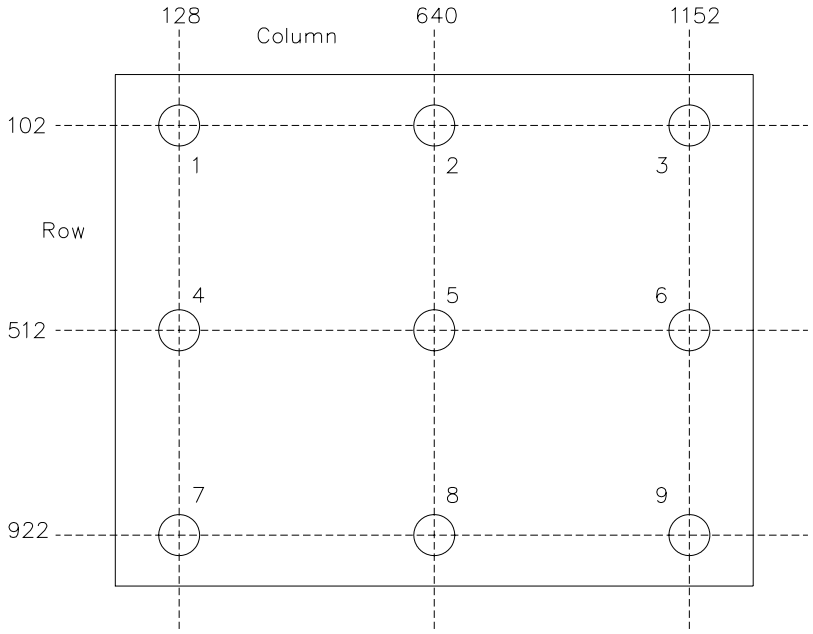


Figure 3. Response Time Testing

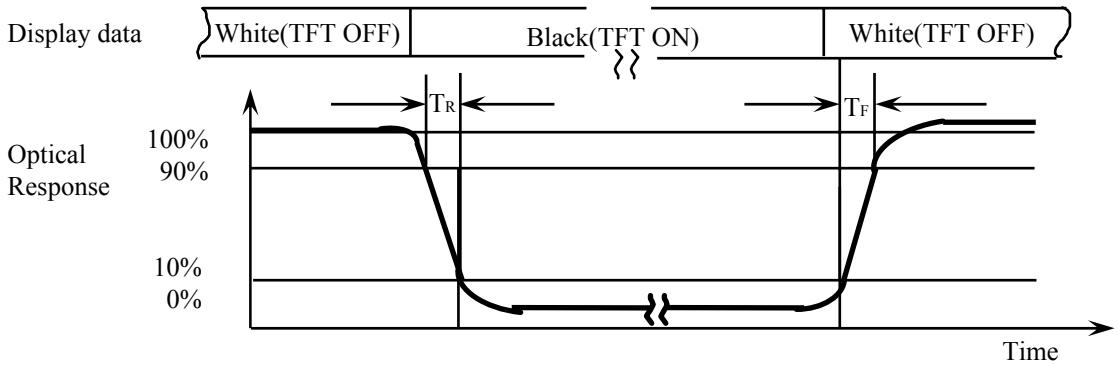
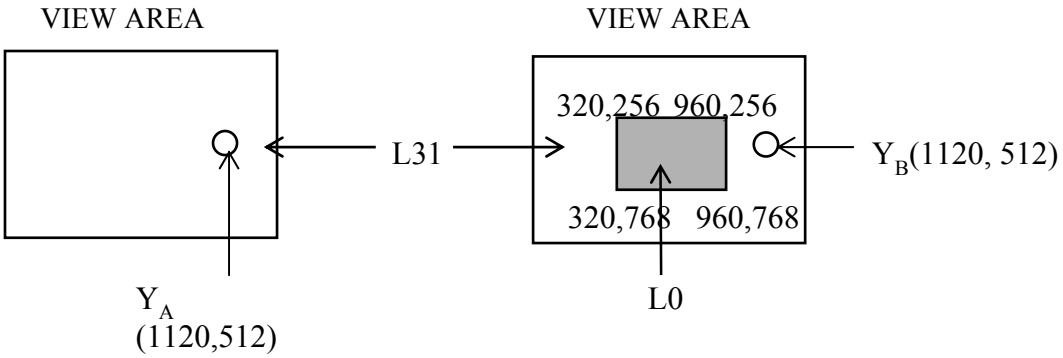


Figure 4. Cross Modulation Test Description



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

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 5. TFT-LCD Module Outline Dimensions (Front view)

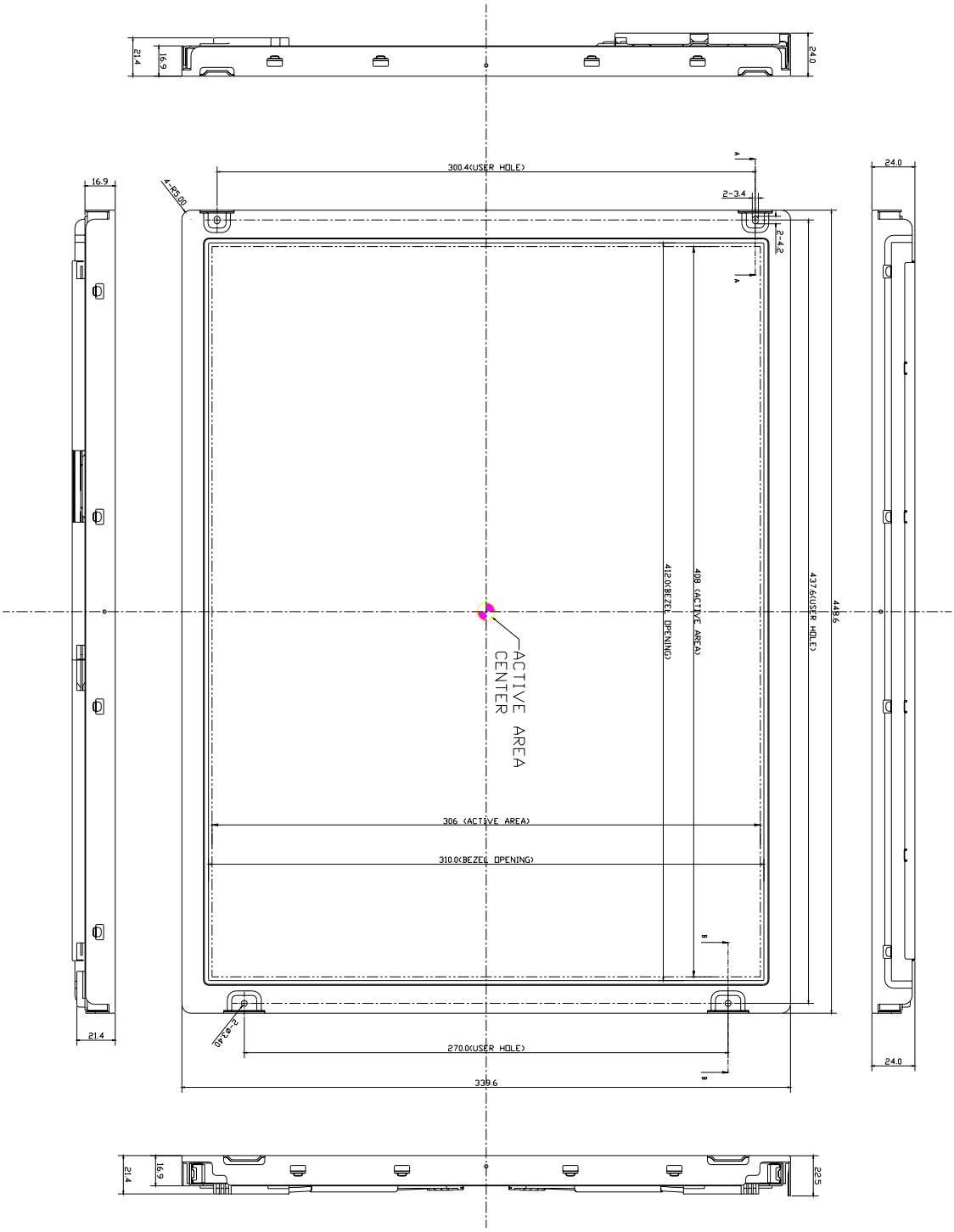


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)