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**TITLE: HM15X11-200 (Kingoal)
Product Specification**

Rev. 0

**LCD SBU
Hynix Semiconductor, Inc.**

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		TFT-LCD PRODUCT	0	2001.05.03
REVISION HISTORY				
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
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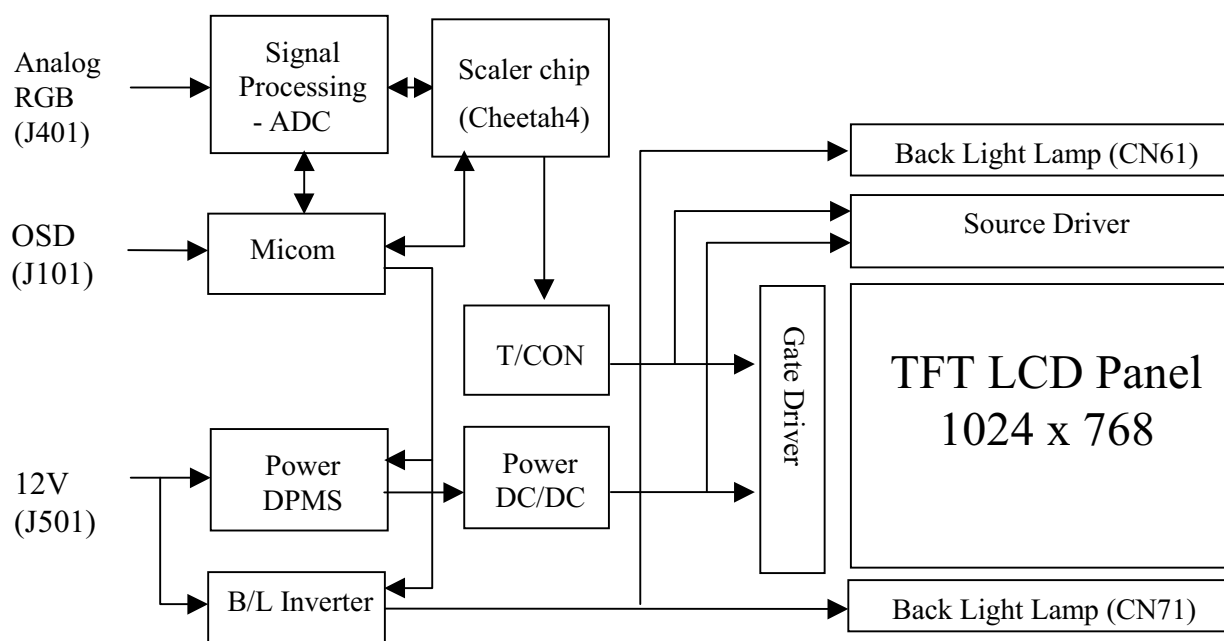
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1.0 GENERAL DESCRIPTION

1.1 Introduction

HM15X11-200 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 15.0 inch diagonally measured active area with XGA resolutions (1024 x 768) and can display 16,777,216 colors with Dithering. HM15X11-200 accepts has standard analog RGB and Sync signals from any XGA, SVGA, VGA video controller signals and supports from XGA to VGA resolutions at vertical refresh rate to 75Hz.



1.2 Features

- Desk-top type of PC Use
- Display terminals for control system
- Monitors for process controller
- Analog RGB, Separated Sync
- Corresponding to DDC1 and DDC2B
- Corresponding to VESA DPMS
- Multi-scan function: XGA, SVGA, VGA
- On Screen Display
- 16,777,216 Colors (using the Dithering)
- High luminance, High Contrast Ratio, High speed Response
- Wide viewing angle
- Incorporated backlight (4 lamps, Inverter Include)
- Language Selection (English, German, Italian, French, Spanish)

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1.3 General Specifications

Parameter	Specification	Unit	Remarks
Active area	304.128 (H) x 228.096(V)	mm	
Number of pixels	1024(H) x 768(V)	pixels	
Pixel pitch	0.297(H) x 0.297(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16,777,216 (using the Dithering)	colors	
Display mode	Normally white		
Dimensional outline	350.0± 0.5(H) x 266.5± 0.5(V) x 24.5(D) Typ.	mm	
Weight	1650	g	
Back-light	Top/Bottom edge side 4-CCFL type		Note 1

Note:

1. CCFL (Cold Cathode Fluorescent Lamp)

2.0 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Input Voltage	V _{DD}	-0.3	14.0	V	Ta = 25°C
Backlight Power Supply Voltage	V _{DDB}	-0.3	14.0	V	
Logic Input Voltage	V _{IN1}	-0.3	4.6	V	Ta = 25°C
RGB Input Voltage	V _{IN2}	-6.0	6.0	V	
Operating Temperature (Humidity)	T _{OP}	0	+50	°C	V _{DD} =12V
	RH		80	%	
Storage Temperature (Humidity)	T _{ST}	-20	+60	°C	≤ 40 °C
	RH		90	%	

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3.0 ELECTRICAL SPECIFICATIONS

Measuring condition: $f_v=75\text{Hz}$, $f_{\text{DCLK}}=40\text{MHz}$ @ after RESET

$T_a = 25 \pm 2^\circ\text{C}$

Parameter			Min.	Typ.	Max.	Unit	Remarks
Input Voltage		V_{DD}	10.8	12.0	13.2	V	
Logic Supply	Logic Current	I_{DDL}	-	0.45	-	A	Power On Vertical Color Bar
			-	0.68	-	A	Power On Vertical 2 Skip
			-	0.25	-	A	Power Saving mode
				0.06		A	Power Off
Inverter Supply	Inverter Current	I_{DDB}	-	0.95	-	A	Power On Brightness = Min
			-	1.75	-	A	Power On Brightness = Max
Back-Light Lamp	Voltage	V_{BL}	-	620	-	Vrms	
	Current	I_{BL}	2.5	6.5	-	mArms	per CCFL
	Frequency	F_L	55	60	65	KHz	
	Start Voltage	V_s	-	-	780	Vrms	25°C
			-	-	1160	Vrms	0°C
	Life Time	Hr	25,000	35,000	-	hrs	IBL = 6.5 mA

Note:

1. Definition of lamp lifetime is average life shall be defined as remained rate under 50% of total amount at the life test.

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3.1 Video signal (R, G, B) input and Sync Signal Input

 $T_a = 25 \pm 2^\circ\text{C}$

Parameter		Min.	Typ.	Max.	Unit	Remarks
Maximum Amplitude (white- black)		0 (black)	0.7 (white)	-	Vp-p	Note 1
Sync	Amplitude	0.2	0.3	-	Vp-p	Note 2
	H- Scan Frequency	24.8	-	60	KHz	71.8KHz @SUN
	V-Scan Frequency	56		75	Hz	76.1Hz @SUN

Note:

1. Contrast adjustment is needed if the amplitude exceeds 0.7 Vp-p.
Impedance is 75 Ohm $\pm$ 5%. @Max 50pF
2. Polarity is positive and negative at TTL level
Impedance is 470-Ohm min. @Max 1000pF

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4.0 OPTICAL SPECIFICATIONS

The measurement shall be executed after 30 minutes warm-up period.

Measuring equipment: TOPCON-BM5.

Measuring condition: 1) $f_v=60\text{Hz}$, $f_{\text{DCLK}}=32.5\text{MHz}$ @after RESET

2) Contrast, Brightness = maximum

$T_a = 25 \pm 2^\circ\text{C}$

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	θ_3	CR > 5	75	80	-	Deg.	Note 1
		θ_9		75	80	-	Deg.	
	Vertical	θ_{12}		45	50	-	Deg.	
		θ_6		75	80	-	Deg.	
	Horizontal	θ_3	CR > 10	50	55	-	Deg.	Note 2
		θ_9		50	55	-	Deg.	
	Vertical	θ_{12}		30	35	-	Deg.	
		θ_6		50	55	-	Deg.	
Luminance Contrast ratio		CR		200	250	-		Note 3
Luminance of White		Y_w		200	220	-	cd/m ²	Note 4
White luminance uniformity		ΔY		-	-	1.45		Note 5
Reproduction Of color	White	x_w	$\theta = 0^\circ$ $\phi = 0^\circ$	0.283	0.313	0.343		Note 6
		y_w		0.300	0.330	0.360		
	Red	x_R		0.602	0.632	0.662		
		y_R		0.301	0.331	0.361		
	Green	x_G		0.257	0.287	0.317		
		y_G		0.578	0.608	0.638		
	Blue	x_B		0.115	0.145	0.175		
		y_B		0.073	0.103	0.133		
Response Time (Rise + Decay)		Ttotal		-	40	50	ms	Note 7
Cross Talk		CT		-	-	2.0	%	Note 8
Luminance Control range		-	Maximum Luminance (100%)	-	50 -100	-	%	-

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Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 5. 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 (see FIGURE 1 shown in Appendix).
2. Viewing angle is the angle at which the contrast ratio is greater than 10. The other condition is note 1.
3. Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ 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.

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

4. 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.
5. The White luminance uniformity on LCD surface is then expressed as : $\Delta Y = \text{Maximum Luminance of five points} / \text{Minimum Luminance of five points}$ (see FIGURE 2 shown in Appendix).
6. 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.
7. 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.
8. 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).

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5.0 INTERFACE CONNECTION

5.1 ADC Board Side

(1) J501: S6B-PH-SM3-TB (JST)

Power input connector

Pin No	Symbol	Function
1	VDD	+12V Power Supply
2	VDD	+12V Power Supply
3	GND	Ground
4	GND	Ground
5	NC	No Connection
6	NC	No Connection

(2) J101: S8B-PH-SM3-TB (JST)

OSD input connector

Pin No	Symbol	Function
1	SW1	OSD Select
2	SW2	OSD Left (-)
3	SW3	OSD Right (+)
4	SW4	OSD Menu
5	LED1	LED Green
6	LED2	LED Red
7	GND	Ground
8	POWER	On / Off

(3) J401: S12B-PH-SM3-TB (JST)

Analog (R, G, B) input connector:

Pin No	Symbol	Function
1	SCL	DDC Clock
2	SDA	DDC Data
3	NC	No Connection
4	VSX	Vertical Sync
5	HSX	Horizontal Sync
6	GND	Ground
7	B	Analog Blue
8	GND	Ground
9	G	Analog Green
10	GND	Ground
11	R	Analog Red
12	GND	Ground

(4) J502: S5B-PH-SM3-TB (JST)

Backlight power connector:

Pin No	Symbol	Function
1	CBKLT	0/3.3V DC (High Active)
2	NC	No Connection
3	CBTNS	0.0~3.0VDC
4	GND	Ground
5	VDDDB	+12V Power Supply

5.2 Inverter Side
(1) J1: 53261-0809 (Molex)

Inverter power input connector

Pin No	Symbol	Function
1	VDDDB	+12V Power Supply
2	VDDDB	+12V Power Supply
3	GND	Ground
4	GND	Ground
5	CBKLT	0/3.3V DC (High Active)
6	GND	Ground
7	CBTNS	0.0~3.5VDC
8	GND	Ground

(2) J2, J3: SM03 (4.0) B-BHS-1-TB (JST)

Back light mating connector

Pin No	Symbol	Function
1	HOT	High Voltage
2	HOT	High Voltage
3	NC	No Connection
4	COLD	Ground

5.3 Lamp Side
(1) CN61, CN71: BHR-04VS-1 (JST)

Back light connector

Pin No	Symbol	Function
1	HOT	High Voltage (Pink)
2	HOT	High Voltage (Pink)
3	NC	No Connection
4	COLD	Ground (White)



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6.0 MONITOR MODES

Resolution	Horizontal Freq. (KHz) & Polarity		Vertical Freq. (Hz) & Polarity		Pixel Clock (MHz)	Remark
640 x 480	31.5	+/-	60.0	+/-	25.175	VESA IBM-AT PC-9800
	37.9	+/-	72.0	+/-	31.5	
	37.5	+/-	75.0	+/-	31.5	
800 x 600	35.1	+/-	56.0	+/-	36.0	
	37.9	+/-	60.0	+/-	40.0	
	48.1	+/-	72.0	+/-	50.0	
	46.9	+/-	75.0	+/-	49.5	
1024 x 768	48.4	+/-	60.0	+/-	65.0	
	56.5	+/-	70.0	+/-	75.0	
	60.0	+/-	75.0	+/-	78.75	
720 x 400	31.5	+/-	70.0	+/-	28.3	US Text
640 x 400	24.8	+/-	56.4	+/-	21.053	PC-9800
	31.5	+/-	70.0	+/-	25.175	
600 x 480	35.0	+/-	66.7	+/-	30.2	Power MAC
832 x 624	49.7	+/-	74.6	+/-	57.3	
1024 x 768	60.2	+/-	75.0	+/-	80.0	

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7.0 OSD FUNCTION

7.1 Menu Item

HM15X11-200 is provided the standard OSD program that is supported the auto-adjustment, the auto-gain control and the multi-language function. The OSD program is controlled by a five kinds of switch, menu switch, select switch, + switch, - switch and power on/off switch.

OSD Items

No.	Menu Item	Description	Value Range	Remark	
1	Brightness	B/L brightness control (+/- switch)	0 to 100	Note 1	
2	Contrast	Contrast ratio control (+/- switch)	0 to 100		
3	H Position	Horizontal position control (+/- switch)	0 to 127		
4	V Position	Vertical position control (+/- switch)	0 to 57		
5	Phase	Clock phase control (+/- switch)	0 to 31		
6	Clock	Clock number control (+/- switch)	0 to 72		
7	Auto	Auto-Adjustment (select switch)	-		
8	Language	Language select (+/- switch)	-		
9	Color	Color control	Warm		-
			STD		-
			Cool		-
			User		Red
		Green			0 to 100
		Blue			0 to 100
10	OSD Position	OSD menu position control			
11	Mode	Mode selection		720/640	
12	Time	OSD enable time control		0 to 60	
13	Reset	Display parameter initialize		-	
14	Auto-Balance function (Hot key: select & - switch)				

Note:

- The detail information of menu items and operating method are in the OSD Manual.

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8.0 RELIABILITY TEST

No	Test Items	Conditions
1	High temperature storage test	Ta = 60 °C, 240 hrs
2	Low temperature storage test	Ta = -20 °C, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 °C, 80 %RH, 240 hrs
4	High temperature operation test	Ta = 50 °C, 240 hrs
5	Low temperature operation test	Ta = 0 °C, 240 hrs
6	Thermal shock	Ta = -20 °C ↔ 60 °C (30 min), 100 cycle
7	Vibration test (non-operating)	Frequency : 10 ~ 500 Hz Gravity/AMP : 1.5G Period : X, Y, Z 30 min
8	Shock test (non-operating)	Gravity : 150G Pulse width : 6ms, half sine wave ± X, ± Y, ± Z Once for each direction
9	Electrostatic discharge test	Air : 150 pF, 330Ω, 15KV Contact : 150 pF, 330Ω, 8KV

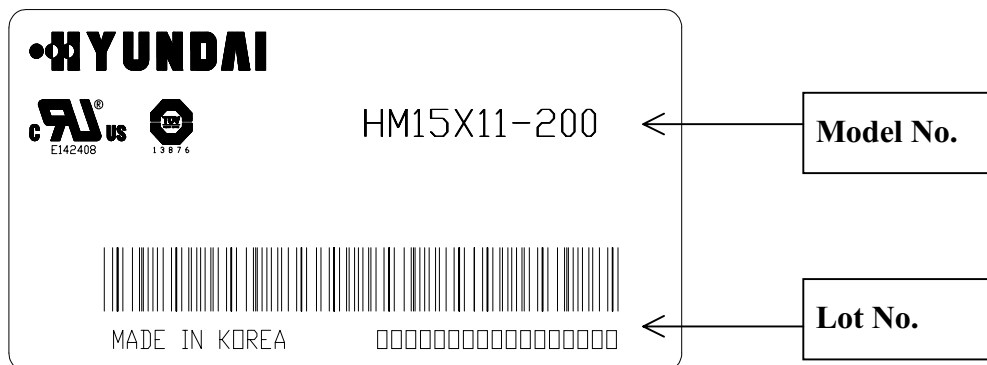
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9.1 Mercury Disposal Label

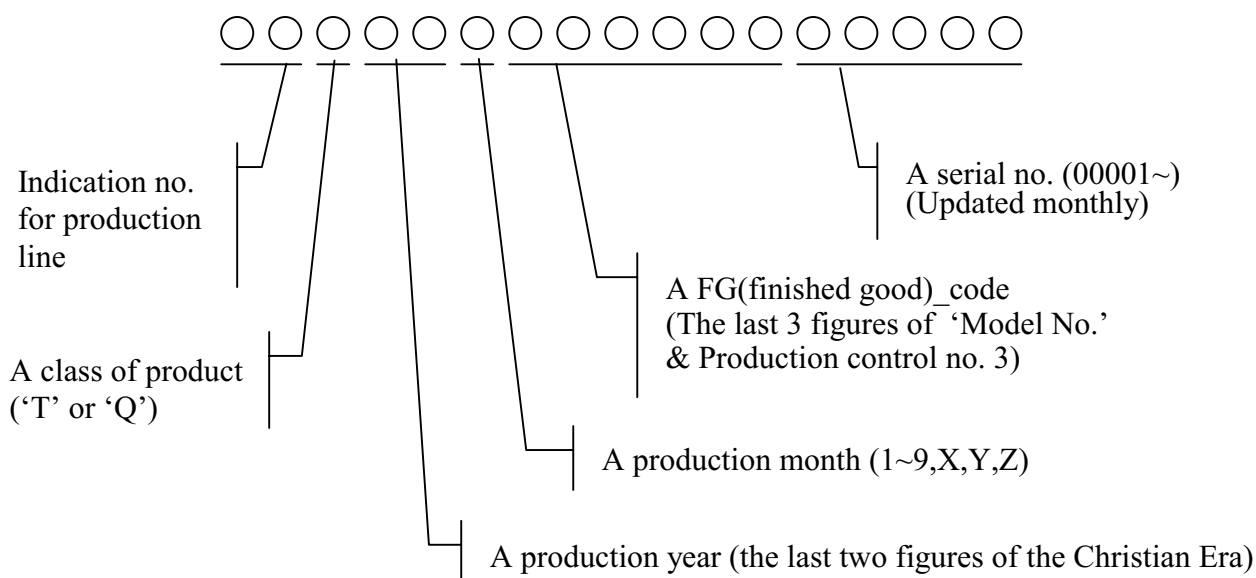
Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, Please follow local ordinances or regulation for disposal.

? □□□ディスプレイパネルは? 光管が□み? まれていまして、□□□□? の? 例□は規□に? って? 棄して□さい。

9.2 Safety Label (Product Label)



How to express 'Lot No.'



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10.0 HANDLING & CAUTIONS**10.1 Cautions when taking out the module**

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

10.2 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 backlight 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.

10.3 Cautions for the operation

- When the module is operating, do not lose synchronous signals. If these signals were lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence were applied, the module would be damaged.

10.4 Cautions for the atmosphere

- Dewdrop 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.

10.5 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.

10.6 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 using the original shipping packages.

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11.0 APPENDIX

Figure 1. Measurement Set Up

Measuring distance: 50Cm
Field: 2 degree

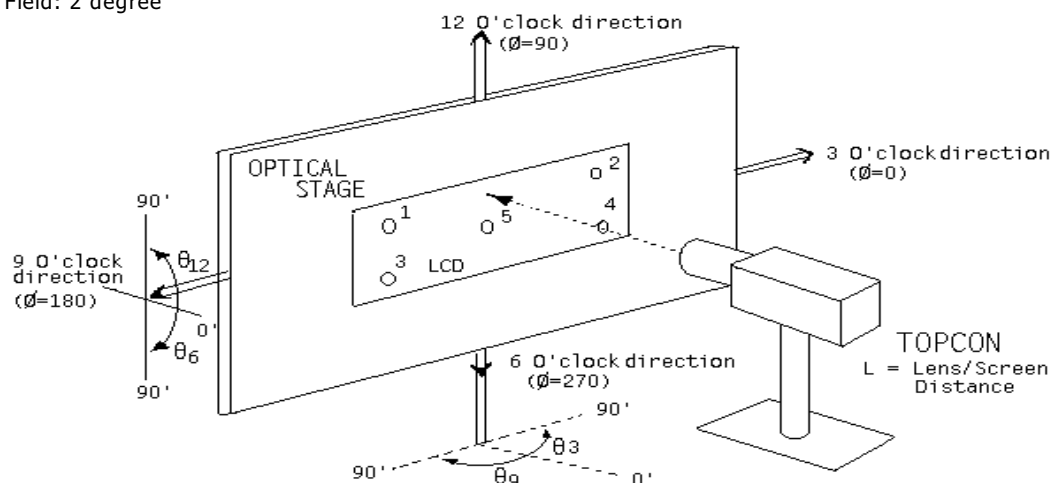
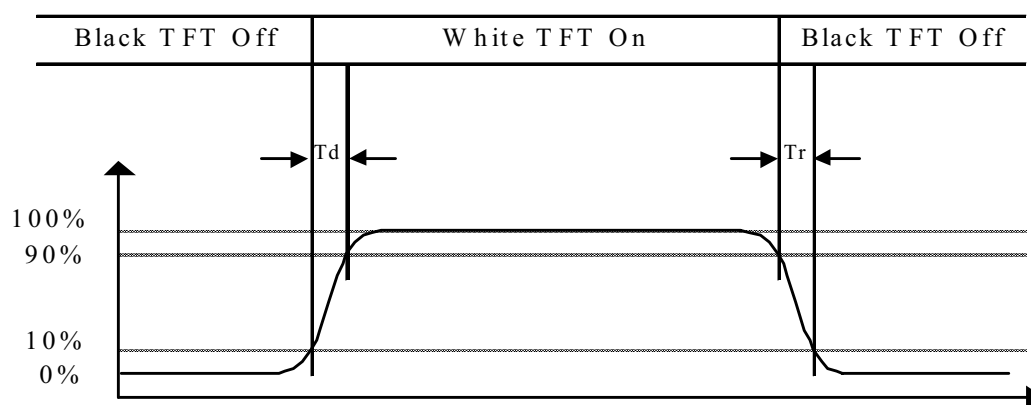
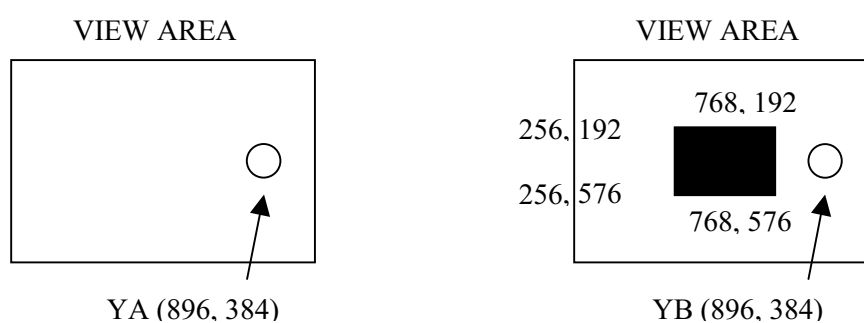


Figure 2. Average Luminance Measurement Locations & Uniformity Measurement Locations

		Column	256	512	768
	Row		2		3
	192			1	
	384		4		5
	576				

Figure 3. Response Time Testing

Figure 4. Cross Modulation Test Description


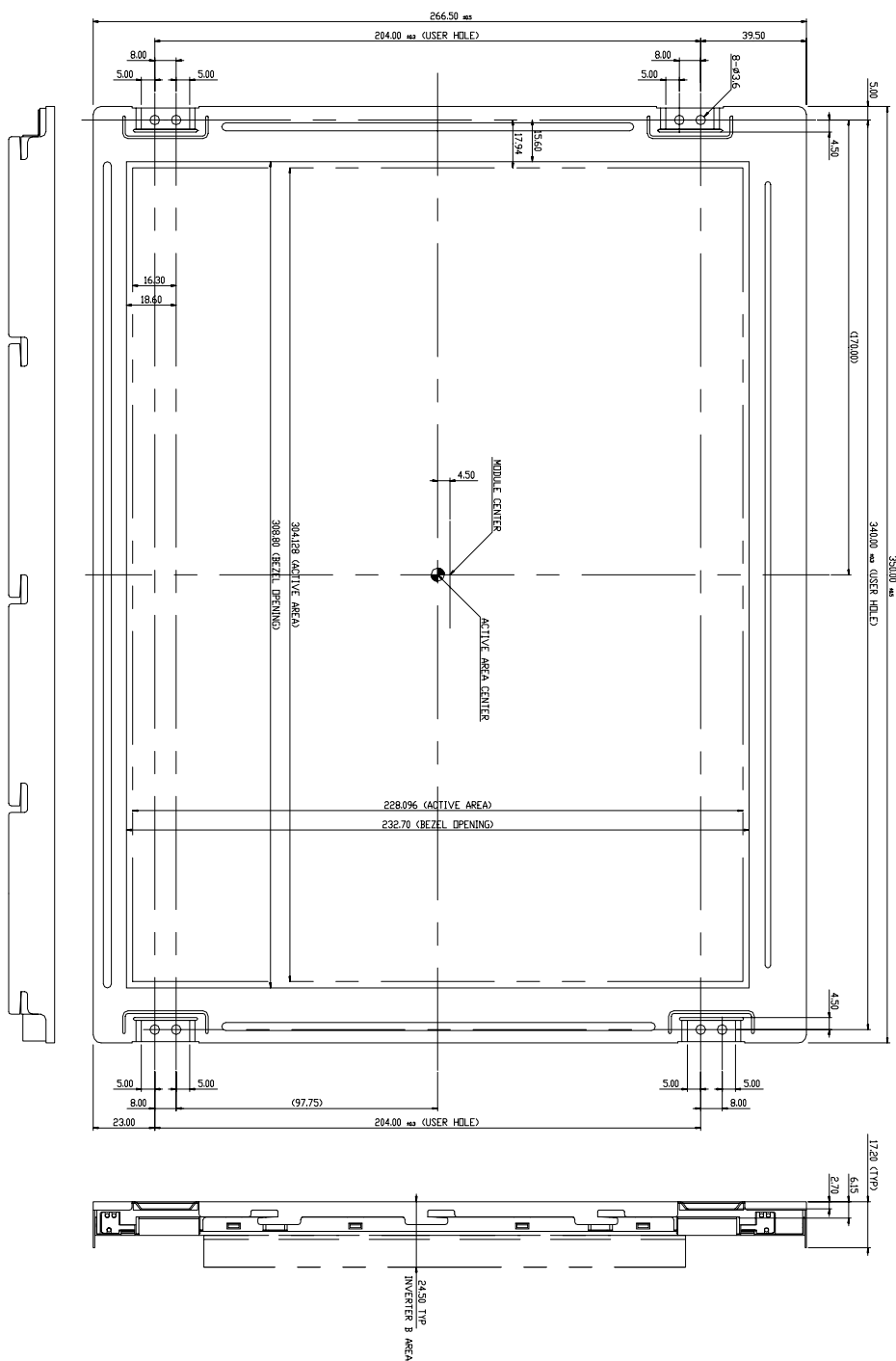
$$\text{Cross-Talk} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

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)


NOTE

1.J401 : JST S12B-PH-SM3-TB
2.J901 : JAE F1-SEB20P-HF10
3.J501 : JST S6B-PH-SM3-TB
4.J502 : JST S5B-PH-SM3-TB, MATE CN - PHR-5P
5.J101 : JST S8B-PH-SM3-TB
6.J102 : JST S2B-PH-SM3-TB
7.J1 : MOLEX 53261-0890, MATE CN - 51021-0180
8.J2,J3 : JST SM04K40B-BHS-TB
9.CN61,71 : JST BHR-04VS-1
10.OTHER SPECIFICATION: REFERS TO SPEC SHEET
11.GENERAL TOLERANCE: ±0.5
12.CONTROL PCB'S SHIELD COVER INCLUDES EMI GASKET