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TITLE: HM15X13-A02
Product Specification

Rev : 0

BOE-HYDIS TECHNOLOGY CO., LTD.

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		TFT-LCD PRODUCT		0	2003.01.08
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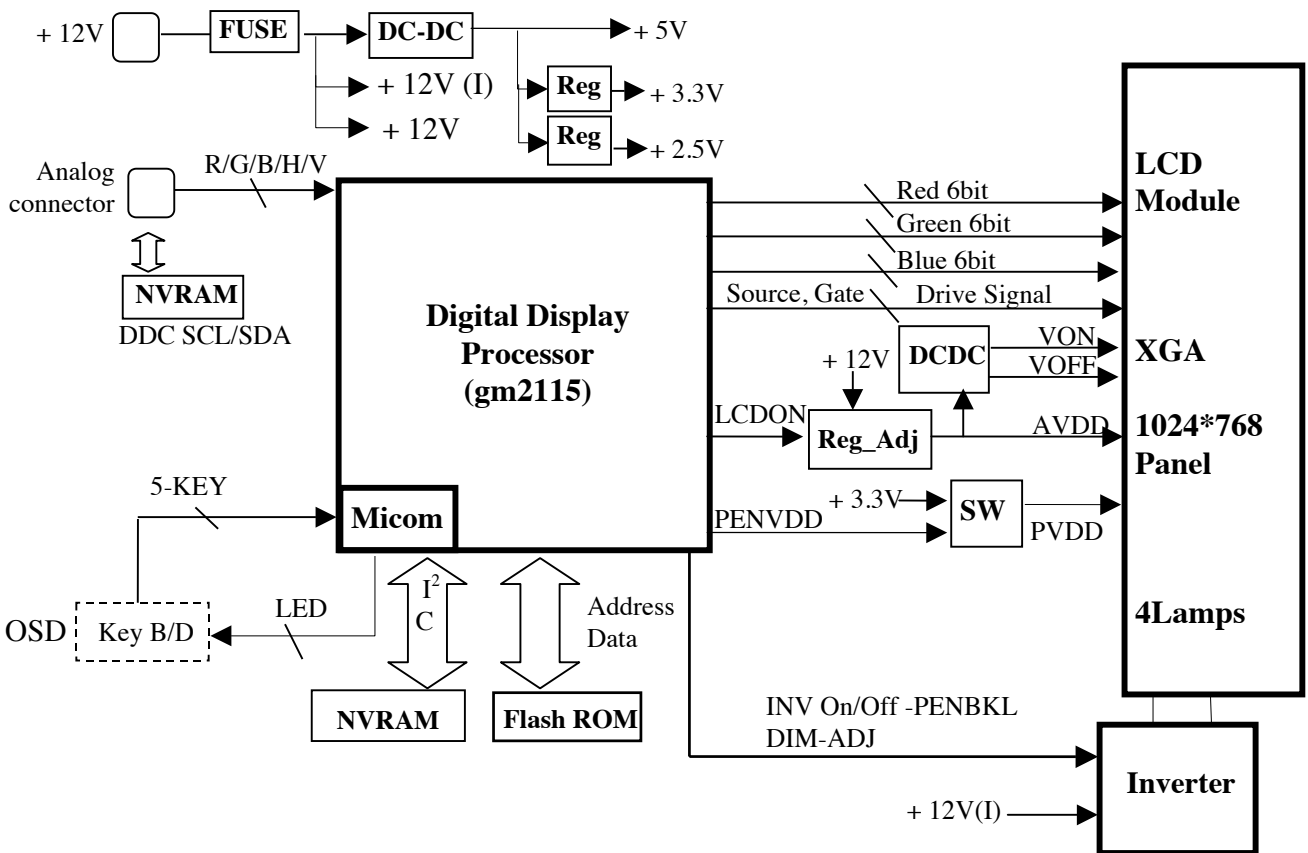
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1.0 GENERAL DESCRIPTION

1.1 Introduction

HM15X13-A02 is an Intelligent Module™ that is integrating conventional LCM and A/D board. This module has a 15.0 inch diagonally measured active area with XGA resolutions (1024 x 768) and can display 16,194,277 colors with Dithering. HM15X13-A02 accepts standard analog RGB and Sync signals from any XGA, SVGA, VGA video controller signals and supports from VGA to XGA resolutions at vertical refresh rate to 75Hz.



1.2 Features

- Desk-top type of PC Use
- Corresponding to DDC1 and DDC2B
- Corresponding to VESA DPMS
- Multi-scan function: XGA, SVGA, VGA
- 16.19M Colors (6bit + FRC2bit)
- High luminance, High Contrast Ratio, High speed Response

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1.3 General Specifications

Parameter	Specification	Unit	Remarks
Active area	304.128 (H) × 228.096(V)	mm	
Number of pixels	1024(H) × 768(V)	pixels	
Pixel pitch	0.297(H) × 0.297(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.19M (6bit + FRC2bit)	colors	
Display mode	Normally white		
Dimensional outline	331.6(H)±0.5×254.7(V)±0.5×20.0(D) Typ.	mm	
Weight	1,510 Max	g	
Back-light	Top/Bottom edge side 4-CCFL type		Note 1
Surface treatment	Haze 25, Anti-glare & hard-coating 3H		

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	5.0	V	Ta = 25°C V _{DD} =12V
RGB Input Voltage	V _{IN2}	-0.3	2.5	V	
Operating Temperature (Humidity)	T _{OP}	0	+50	°C	≤ 40 °C
	RH		80	%	
Storage Temperature (Humidity)	T _{ST}	-20	+60	°C	≤ 40 °C
	RH		90	%	

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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

- Maximum : Vertical Two Line Skip
- Typical : Eight Color Bar

Frequency : 75Hz, Ta = 25± 2°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Input Voltage	VDD	10.8	12.0	13.2	V	
Input Current	IDD	2.0	2.1	2.3	A	

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

Ta = 25± 2°C

Parameter		Min.	Typ.	Max.	Unit	Remarks
Maximum Amplitude (White- black)		0 (Black)	0.7 (White)	-	Vp-p	Note 1
Sync	Amplitude	2.0	3.3	5.0	Vp-p	Note 2
	H- Scan Frequency	24.8	-	60.0	KHz	
	V-Scan Frequency	56		75	Hz	

Note:

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

3.3 DPMS (Display Power Management Signaling)

Measuring condition: VDD=12.0V

Frequency : 75Hz, Ta = 25± 2°C

VESA DPMS	Signal			Power Consumption.	Unit	LED status
	Horizontal	Vertical	Video			
Power On	Pulses	Pulses	Active	27(Max)	W	Green
Standby	No Pulses	Pulses	Blanked	Less than 1	W	Amber
Suspend	Pulses	No Pulses	Blanked	Less than 1	W	Amber
Active Off	No Pulses	No Pulses	Blanked	Less than 1	W	Amber

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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) $f_v=60\text{Hz}$, $f_{DCLK}=32.5\text{MHz}$ @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	70	80	-	Deg.	Note 1	
		θ_9	70	80	-	Deg.		
	Vertical	θ_{12}	40	50	-	Deg.		
		θ_6	65	80	-	Deg.		
	Horizontal	θ_3	CR > 10	60	65	-	Deg.	Note 2
				θ_9	60	65	-	
		θ_{12}		35	45	-	Deg.	
				θ_6	50	65	-	
Luminance Contrast ratio	CR		300	350	-		Note 3	
Luminance of White	Y_w		200	250	-	cd/m^2	Note 4	
White luminance uniformity	ΔY		-	-	1.4		Note 5	
Color Chromaticity (CIE 1931)	White	$\theta = 0^\circ$ $\phi = 0^\circ$ IBL=6.0mA	x_w	0.274	0.304	0.334		Note 6
			y_w	0.304	0.334	0.364		
	Red		x_R	0.596	0.629	0.659		
			y_R	0.320	0.350	0.380		
	Green		x_G	0.237	0.267	0.297		
			y_G	0.583	0.613	0.643		
	Blue		x_B	0.111	0.141	0.171		
			y_B	0.053	0.083	0.113		
Color Reproduction			70			%		
Response Time (Rise + Decay)	T_{total}		-	25	30	ms	Note 7	
Cross Talk	CT		-	-	2.0	%	Note 8	
Lamp lifetime	Hr	IBL=6.0mA	50,000	-	-	hrs	Note 9	

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Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The other condition is note 1.
2. 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.

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

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 : $\Delta Y = \text{Maximum Luminance of 13 points} / \text{Minimum Luminance of 13 points}$ (see FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates 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).
8. Definition of lamp only lifetime is average life shall be defined as remained rate under 50% of total amount at the life test.

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5.0 INTERFACE CONNECTION

5.1 Connectors

Part	Description	Pin No	Module Side		User Side	
Analog	CN101	13	S12B-PH-SM3-TB	JST	PHR-12	JST
			Or 1294A-1203R	UJU	Or equivalent	-
Power	CN107	4	S4B-PH-SM3-TB	JST	PHR-4	JST
			Or 1294A-0403R	UJU	Or equivalent	-
OSD	CN102	8	53261-0890	Molex	51021-0800	Molex
					Or equivalent	

5.2 Pin Description

(1) Analog (R, G, B) input connector

Pin No	Symbol	Function	15pin D-sub
1	SCL	DDC Clock	15
2	SDA	DDC Data	12
3	+5V	+5V Power	9
4	VSY	Vertical Sync	14
5	HSY	Horizontal Sync	13
6	SGND	Sync Ground	10
7	B	Analog Blue	3
8	BGND	Blue Ground	8
9	G	Analog Green	2
10	GGND	Green Ground	7
11	R	Analog Red	1
12	RGND	Red Ground	6

(2) OSD input connector (Default)

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) Power input connector

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

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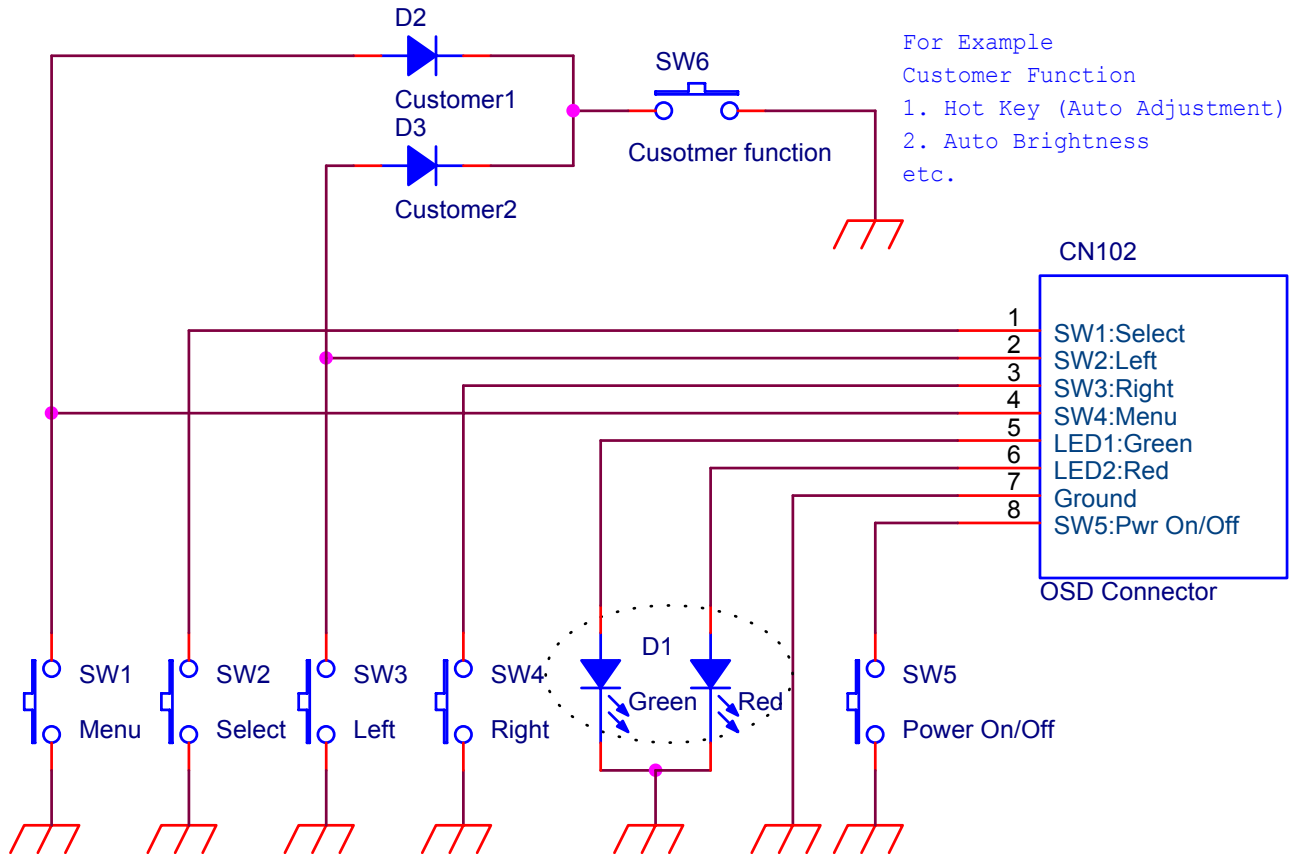
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Note: Recommended OSD keyboard interface is below.



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6.0 MONITOR MODES

Resolution	Horizontal (KHz)		Vertical (Hz)		Px1 Clk (MHz)	Horizontal			Vertical			Remark
						Total	Sync	BP	Total	Sync	BP	
640 x 350	31.47	+	70.09	-	25.175	800	96	48	449	2	60	VGA
640 x 400	24.83	-	56.42	-	21.053	848	64	84	440	8	32	PC98
	31.47	-	70.09	+	25.175	800	96	48	449	2	35	VGA
640 x 480	31.47	-	59.94	-	25.175	800	96	40	525	2	25	VGA
	37.86	-	72.81	-	31.500	832	40	120	520	3	20	VESA
	37.50	-	75.00	-	31.500	840	64	120	500	3	16	VESA
720 x 400	31.47	-	70.08	+	28.321	900	108	54	449	2	35	US text
800 x 600	35.16	+	56.25	+	36.000	1024	72	128	625	2	22	VESA
	37.88	+	60.32	+	40.000	1056	128	88	628	4	23	VESA
	48.08	+	72.19	+	50.000	1040	120	64	666	6	23	VESA
	46.88	+	75.00	+	49.500	1056	80	160	625	3	21	VESA
1024 x 768	48.36	-	60.00	-	65.000	1344	136	160	806	6	29	VESA
	56.48	-	70.07	-	75.000	1328	136	144	806	6	29	VESA
	60.02	+	75.03	+	78.750	1312	96	176	800	3	28	VESA

Note:

1. At 640x400-70Hz, OSD Resolution message is 720x400-70Hz.
2. If signal source is not satisfied with VESA timing mode, Auto adjustment cannot work correctly. In that case, use the Clock adjustment and then use Phase adjustment, manually.
3. Highest addressable resolutions are 1280x1024 at 75Hz, 1600x1200 at 60Hz.
 - Addressable means the monitor will sync up to this mode.
 - However, Hydis does not guarantee the image will be sized, shaped and centered correctly.
 - The following message will appear when in this mode "Please change to XGA"

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7.0 OSD FUNCTION

This OSD function is HYDIS's standard version.

OSD function is customized specification.

7.1 Main Function

No.	Menu	Function
1	Auto Adjust	Adjust the clock, phase and position automatically
2	Auto Contrast	Adjust the contrast automatically (Gain control)
3	Brightness	Adjust the Lamp Brightness (Dim control)
4	Contrast	Adjust the contrast (Gain control)
5	H-Position	Adjust the horizontal display position
6	V-Position	Adjust the vertical display position
7	Clock	Adjust the clock frequency
8	Phase	Adjust the clock phase
9	Language	Select the language (English etc)
10	Color Temperature	Warm
11		Standard
12		Cool
13		User Red
14		User Green
15		User Blue
16	OSD H-Position	Move the OSD position horizontally
17	OSD V-Position	Move the OSD position vertically
18	OSD Time	Adjust the OSD off time
21	All Reset	Return the value to factory status
22	Save & Exit	Save the set parameter and exit from OSD menu

Note:

1. If satisfactory results are not obtained using the Auto at Clock & Phase, use the Clock adjustment and then use phase, again

7.2 Factory Mode Function (Left + Right Key)

Item	Select Key	Function / Description	Remark
Self Test	-	Display aging test pattern	Note 1
Factory Reset	▶	Clear the EEPROM	Note 2
Model Name	-	Product model name	User Specification
Version	-	Firmware version	User Specification
CKS	-	Firmware checksum	

Note:

1. Without Signal, Self test pattern is Red, Green, Blue, Yellow, Magenta, Cyan, white, and Black.
2. If EEPROM is changed, it must be operate Factory Reset.

7.3 Display Item

Item	Functions
Out of Timing or Equivalent message	Displayed when H-Sync. Or V-Sync are out of range
No Signal or Equivalent message	Displayed when there is no signal

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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 ~ 300 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, 330 Ω, 15KV Contact : 150 pF, 330 Ω, 8KV

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9.0 ENVIRONMENT & SAFETY

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.	該液晶ディスプレイパネルは 光管が組みまれているので、地方自治の例又は規則に従って棄して下さい。
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9.2 Safety Label (Product Label)

HM15X13-A02

MADE IN KOREA □□□□□□□□□□□□□□□□

Model No.

Lot No.

How to express 'Lot No.'

OO	O	OO	O	OOOOOO	OOOOO
					A serial no. (00001~) (Updated monthly)
					A FG (finished good) code (The last 3 figures of 'Model No.' & Production control No.)
					A production month (1~9,X, Y, Z)
					A production year (The last two figures of the Christian Era)
					A class of product ('T' or 'Q')
					Indication No. for production line

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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

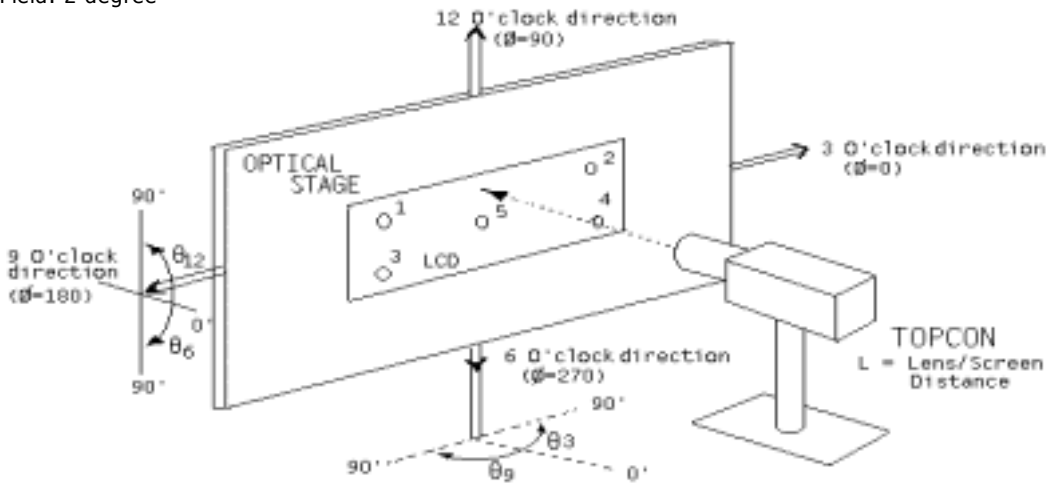
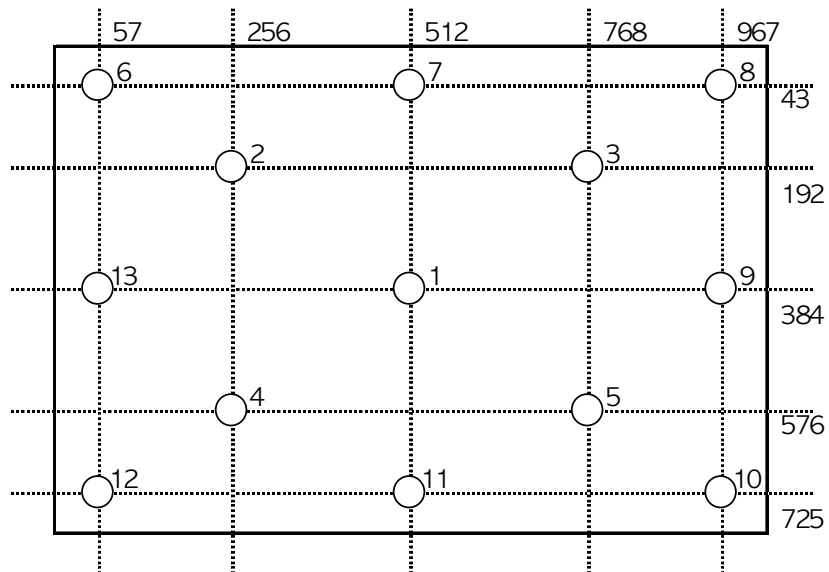


Figure 2. Average Luminance Measurement Locations & Uniformity Measurement Locations



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Figure 3. Response Time Testing

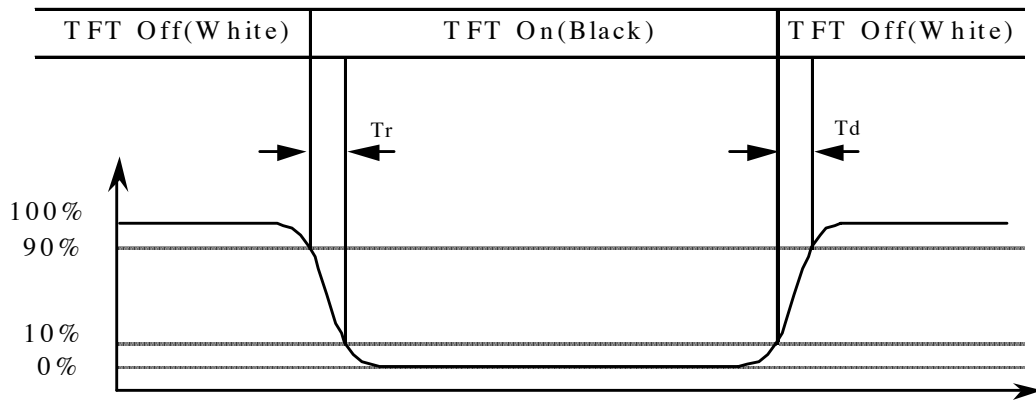
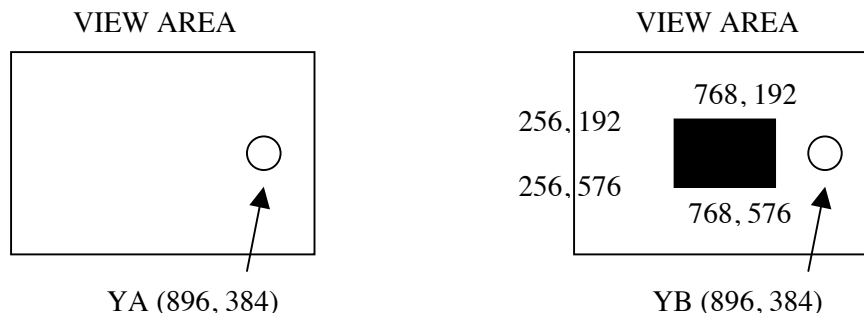


Figure 4. Cross Modulation Test Description



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

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.

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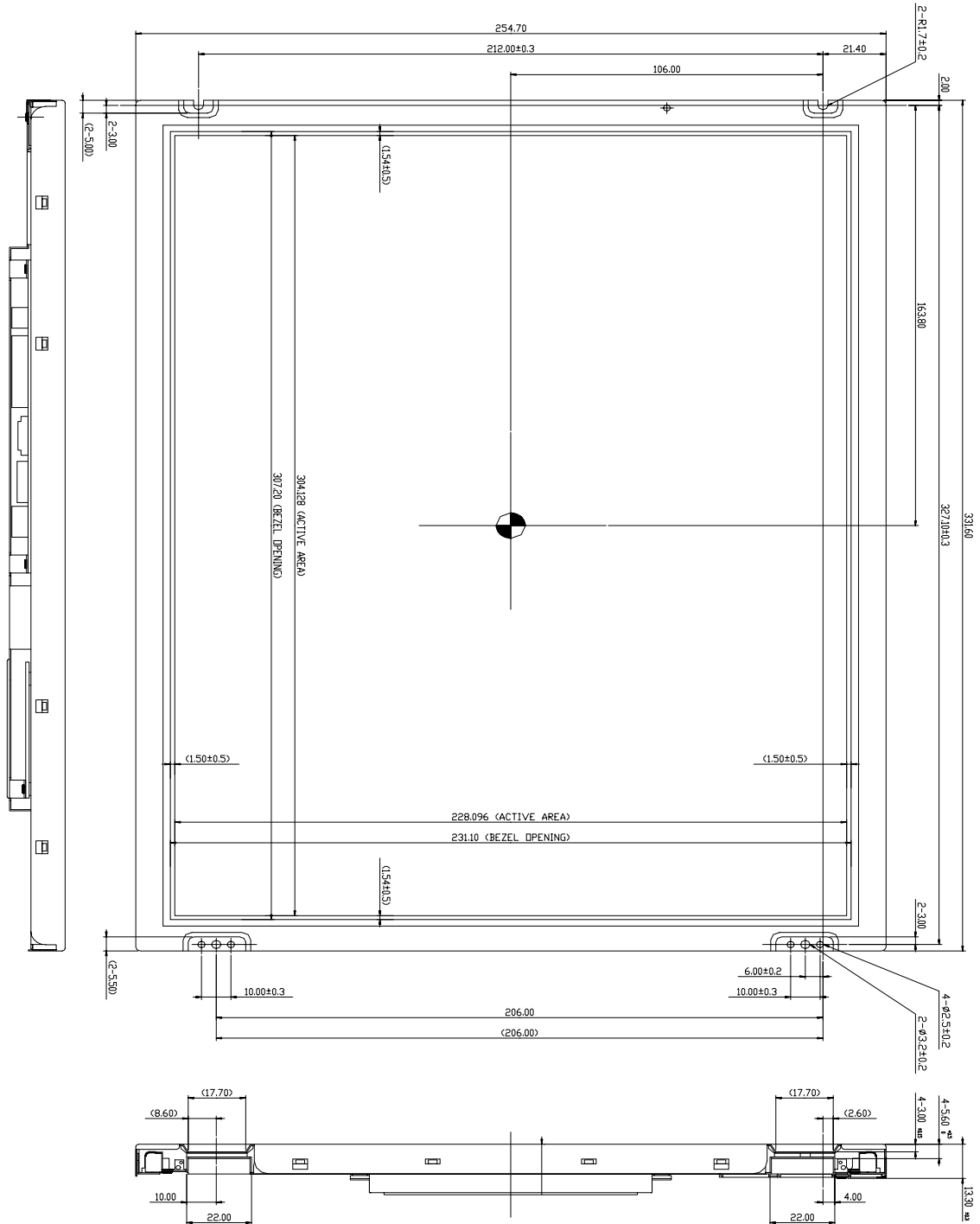
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Figure 5. TFT-LCD Module Outline Dimensions (Front view)



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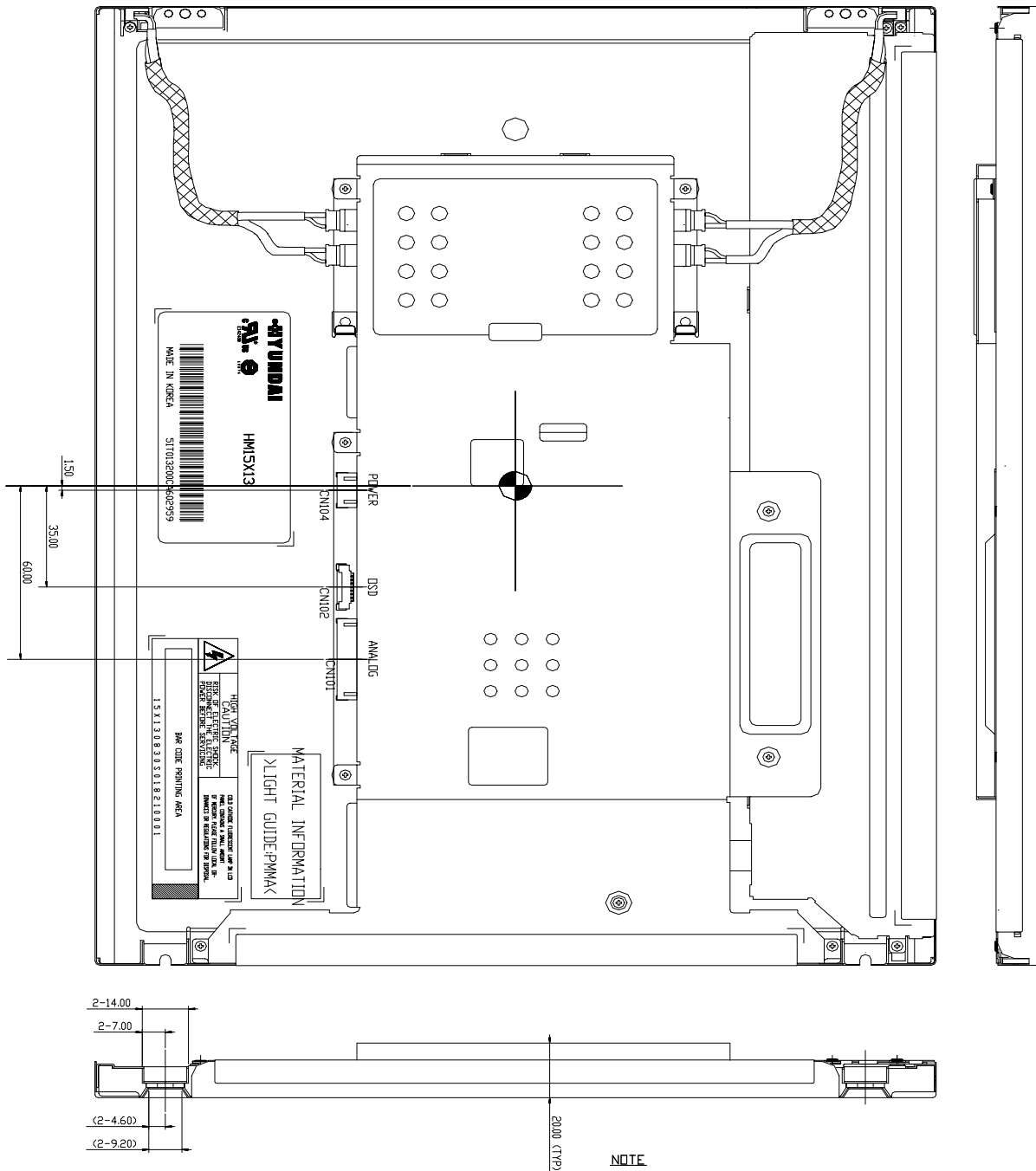
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Figure 6. TFT-LCD Module Outline Dimensions (Rear view)



NOTE

1. BACKLIGHT LAMP WIRE DIMENSION = 120mm ±0.5
2. CN101 : UJU 1294A-0203R (12PIN)
- CN102 : MOLEX 53261-0890 (8PIN)
- CN104 : UJU 1294A-0403R (4PIN)
3. GENERAL TOLERANCE: LINEAR - ±0.50

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Table 1. EDID Firmware Content

Address	No. Bytes	Description
00h	8	Header
08h	10	Vendor/Product Identification User define, Vendor=<HDS>, default=<blank>
12h	2	EDID Structure Version / Revision User define, Version #=1, Revision #=*
14h	5	Basic Display Parameters / Features Video input definition=Analog Image size=15.0", Gamma=2.6 Feature support = Standby, Suspend, Active off, RGB
19h	10	Color Characteristics Red x = 0.629, Red y = 0.350 Green x = 0.267, Green y = 0.613 Blue x = 0.141, Blue y = 0.080 White x = 0.304, White y = 0.334
23h	3	Established Timings Established timing I = 720x400@70Hz/ 640x480@60Hz, 72Hz, 75Hz / 800x600@56Hz, 60Hz Established timing II = 800x600@72Hz, 75Hz / 1024x768@60Hz, 70Hz, 75Hz Established timing III
26h	16	Standard Timing Identification Standard timing identification #1~#8, User define
36h	72	Detailed Timing Description Detailed timing description #1~#4 or Monitor Descriptor User define Monitor S/N, ASCII data string, Monitor range limits, Monitor name
7Eh	1	Extension Flag = 0 EDID extension blocks
7Fh	1	Checksum

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