Vertex LCD Inc.
www.vertexlcd.com

Vertex LCD Inc.
600 S. Jefferson St. Unit K Placentia, CA 92870
TEL: 714-223-7111 FAX: 714-223-7711

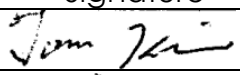
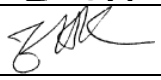
FINAL PRODUCT INFORMATION

(All information in this technical data sheet is subject to change without notice.)

Updated: 05/01/2009

13.89" SQUARE High Bright TFT-LCD

LVM150SQXSB-L01

PRODUCT ENGINEERING DEPT. Vertex LCD Inc.			
	Name	Signature	Date
CREATED BY	Tom Kim		5/01/2009
REVIEWED BY	Eric Kim		5/22/2009
APPROVED BY	Ed Kang		5/22/2009

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Revision History

Rev	ECN No.	Description of changes	Date	Prepared
0		Initial Release	05/01/09	Tom Kim

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1. General Description

LVM150SQXSB-L01 is 13.89" Square Color Active Matrix Liquid Crystal Display with an integral LED backlight system. The matrix employs Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has about 19.6 inches diagonally measured active display area (1200 horizontal by 1200 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes.

The LVM150SQXSB-L01 is intended to support applications where high brightness, broad viewing angle are critical factors. In combination with the vertical arrangement of the sub-pixels, the LVM150SQXSB-L01 characteristics provide an excellent flat panel display for office or industrial automation products or daylight applications.

General Specification

General specifications are summarized in the following table:

ITEM	SPECIFICATION
Active screen size	Approximate 19.6 inches(49.8Cm) diagonal 352.8(H) X 352.8(V) mm
Outline dimensions	406(H) × 422.2(V) × 40.2(D) mm Typ.
Pixel pitch	0.294(H) mm × 0.294(V) mm
Pixel format	1200(H) X 1200(V) pixels
Color Pixel Arrangement	RGB stripe arrangement
Color depth	8-bit, 16.7M colors
Brightness	600 cd/m^2
Power Consumption	Approximate Total 47.65 Watt, typ (9.25 Watt @Vcc, 38.4 Watt @LED)
Weight	5 Kg (typ.)
Display operating mode	transmissive mode, normally Black
Surface treatments	Anti-glare, Haze value: 25%, 3H.
Backlight Unit	White LED

2. Absolute Maximum Rating

Parameter	Symbol	Values		Units	Notes
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+6.0	V	at 25°C
Signal Voltage	V_{IN}	-0.3	+3.6	V	at 25°C
Operating Temperature	T_{OP}	0	+45	°C	Note 1
Storage Temperature	T_{ST}	-20	+60	°C	Note 1

Note 1. Humidity Less than 90% RH at Ta ≤ 40 °C. No condensation.

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3. Electrical Characteristics

The LVM150SQXSB-L01 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input, which powers the LED, is typically generated by a LED driver. The LED Driver is an external unit to the LCD.

Parameter	Symbol	Condition	Values			Units	Notes
			Min.	Typ.	Max.		
MODULE:							
Power Supply Logic Voltage	V_{CC}		4.75	5.0	5.25	Vdc	Vcc = 5.0 V
Ripple Voltage	V_{RP1}		-	-	50	mV	
LDI Supply Current	I_{CC}		-	1.85	2.72	A	1, 3, 4
LDI Supply Rush Current	I_{SCC}		-	-	2.9	A	2
Power Consumption	P_C		-	9.25	-	Watts	2, 3, 4
LED Backlight:							
Operating Voltage	V_{BL}	(I_{BL} = 1.6A)	23.5	24	25.5	Vdc	6
Power Consumption				38.4		Watts	6
Life Time			20,000	30,000		Hrs	5

Notes: 1. This typical value indicates the current consumption on condition that color-bar-pattern is displayed and Vcc=5.0V. The maximum value indicates the consumption under displaying 2-pixel checker pattern and Vcc=4.75V. Rush current is not included in either case.

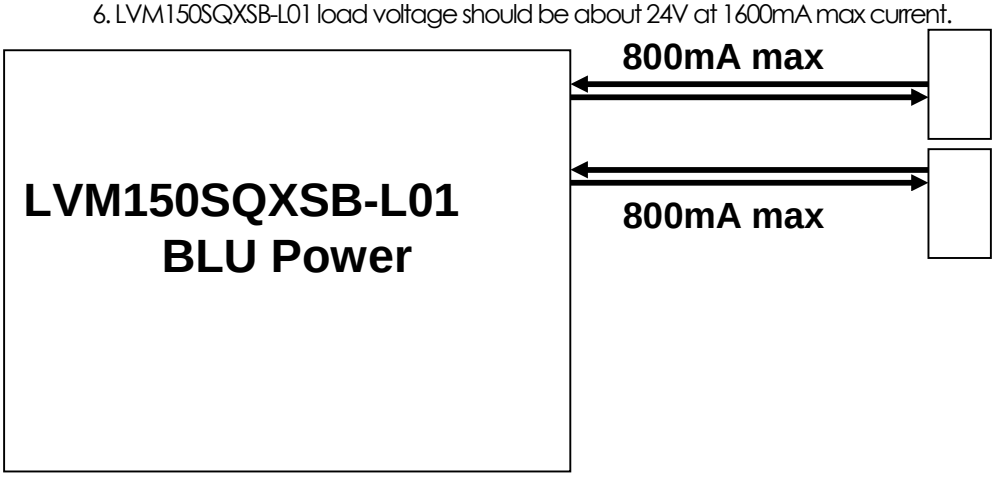
2. These items prescribe the surge current to internal DC/DC. The current value for charging capacitors on the Vcc line is excluded.

3. The current draw and power consumption specified is for 5.0 Vdc at 25°C.

4. Logic level are specified for Vcc of 5.0 Vdc at 25°C. The values specified apply to all logic inputs.

5. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical LED current & at ambient temperature of 25°C.

6. LVM150SQXSB-L01 load voltage should be about 24V at 1600mA max current.



4. Interface Connections

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CN 1(interface signal): LVM150SQXSB-L01 uses 31-pin connector for module electronics.
Used connector: FI-WE31P-HF [JAE] or equivalent connectors
Matching side: FI-W31M, FI-C3-A3-15000(Contact) [JAE]

Pin	Symbol	Function	I/O
1	Vcc	+5.0V Power supply	-
2	Vcc	+5.0V Power supply	-
3	Vcc	+5.0V Power supply	-
4	Vcc	+5.0V Power supply	-
5	GND	Ground	-
6	GND	Ground	-
7	GND	Ground	-
8	SSELEC	SS circuit select	I
9	GMCH	Gamma control(High)	I
10	GMCL	Gamma control(Low)	I
11	A0M	Negative differential input	I
12	A0P	Positive differential input	I
13	A1M	Negative differential input	I
14	A1P	Positive differential input	I
15	A2M	Negative differential input	I
16	A2P	Positive differential input	I
17	CLKM	Negative differential input	I
18	CLKP	Positive differential input	I
19	A3M	Negative differential input	I
20	A3P	Positive differential input	I
21	A4M	Negative differential input	I
22	A4P	Positive differential input	I
23	A5M	Negative differential input	I
24	A5P	Positive differential input	I
25	A6M	Negative differential input	I
26	A6P	Positive differential input	I
27	A7M	Negative differential input	I
28	A7P	Positive differential input	I
29	PD	LVDS Core power down	I
30	LVDSGND	LVDS Ground	-
31	LVDSGND	LVDS Ground	-

CN 2(backlight): LVM150SQXSB-L01 employs Molex 51004-0200 or equivalent connectors for the LED backlight.

Pin	Symbol	Description	Notes
1	V	Lamp power input	PINK (or Red)
2	Ground	Ground	WHITE (or Black)

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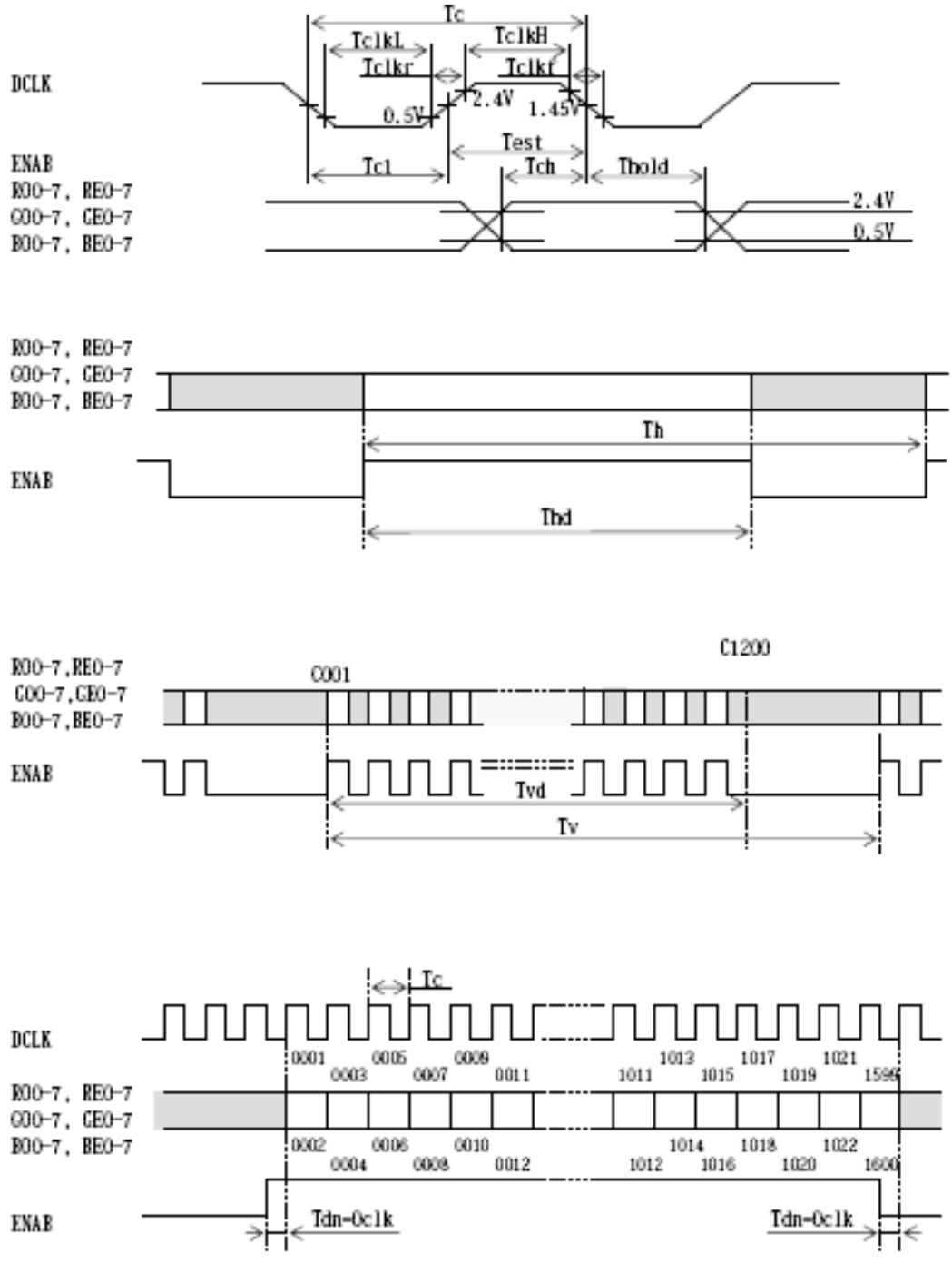
5.1 Outline of input signal Timings



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5.2 Timing Characteristics (T= 0 ~ 45℃ , Vcc=5±0.25V)

ITEM		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK signal (Clock)	Period	Tc	11.765	12.345	12.956	ns	
	Frequency	1/Tc	77.18	81.000	85.0	MHz	
	Duty	Tch/Tc	45	50	55	%	
	High Time	Tc1kH	3.5	-	-	ns	
	Low Time	Tc1kL	3.5	-	-	ns	
	Rise Time	Tclkr	-	-	4	ns	
	Fall Time	Tclkf	-	-	4	ns	
DCLK-Data Timing	Setup Time	Tset	3	-	-	ns	
	Hold Time	Thold	2	-	-	ns	
ENAB signal	Horizontal period	Th	865	1080	1130	DCLK	Note 2
		Th	11.3	13.3	14.65	μs	
	Hor. Display period	Thd	800	800	800	DCLK	
	Blacking	-	Th-800	280	Th-800	DCLK	
	Vertical period	Tv	1220	1250	1280	Th	Note 2
		Tv	57.1	60	62.9	Hz	
	Ver. Display period	Tvd	1200	1200	1200	Th	
	Blacking	-	TV-1200	50	Tv-1200	Th	
	Data-ENAB timing	Tdn	-	0	-	DCLK	Note 3

Note : 1. The rise timing of ENAB specifies horizontal display position. The data latched at falling edge of DCLK after the rise of ENAB is displayed at the left edge of the screen. The first ENAB pulse after its remaining at "Low" level for the period equivalent to four times of Hsync period specifies vertical display position. The data latched during the first ENAB pulse is displayed at the top line of the screen.
2. If ENAB remains at "High" level for the period of less than 800 DCLK or the number of ENAB pulse in a frame period becomes less than 1200, the rest of the screen stays black.
3. The display position does not fit to the screen if the ENAB period and the effective data period do not synchronize with each other.
4. As this product contains SS (Spread Spectrum) function in internal circuit.

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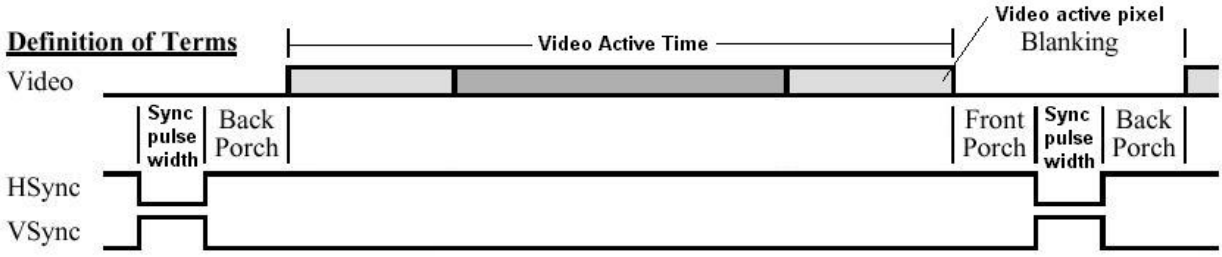
5.3 Signal Timing Square Monitor

Signal Timing for 1200 x 1200 Resolution					
Horizontal Sync period:	13.411	µs	Horizontal sync pulse width (Pulsbreite)	1.062	µs
Horizontal display enable back porch period	1.726	µs	Horizontal display enable front porch period	0.664	µs
Horizontal video active time	9.959	µs	Number of horizontal active pixel	1200	
Vertical Sync period	16.696	ms	Vertical Sync pulse width	134.108	µs
Vertical display enable back porch period	429.145	µs	Vertical display enable front porch period	40.232	µs
Vertical video active time	16.093	ms	Number of vertical active pixel	1200	



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6. Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Color		Input Color Data (0: Low level, 1: High level)																							
		Red								Green								Blue							
	Odd	RO7	RO6	RO5	RO4	RO3	RO2	RO1	RO0	GO7	GO6	GO5	GO4	GO3	GO2	GO1	GO0	BO7	BO6	BO5	BO4	BO3	BO2	BO1	BO0
	Even	RE7	RE6	RE5	RE4	RE3	RE2	RE1	RE0	GE7	GE6	GE5	GE4	GE3	GE2	GE1	GE0	BE7	BE6	BE5	BE4	BE3	BE2	BE1	BE0
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
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	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
	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	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Red(254)	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(255) Bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(000)Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

	Green(254)	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(255)Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(000) Dark	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(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	Blue(254)	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(255) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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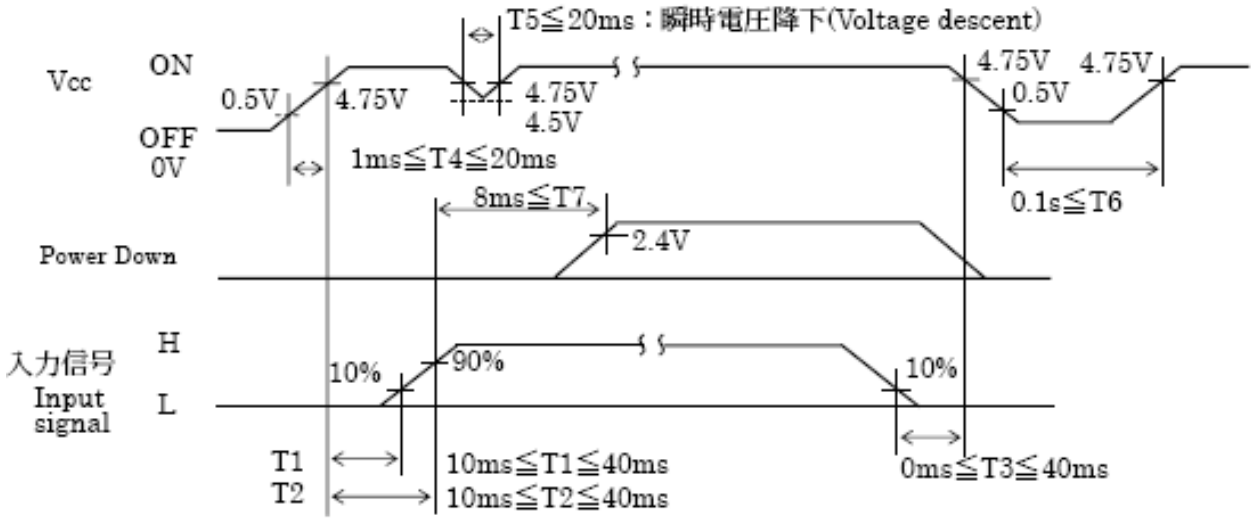
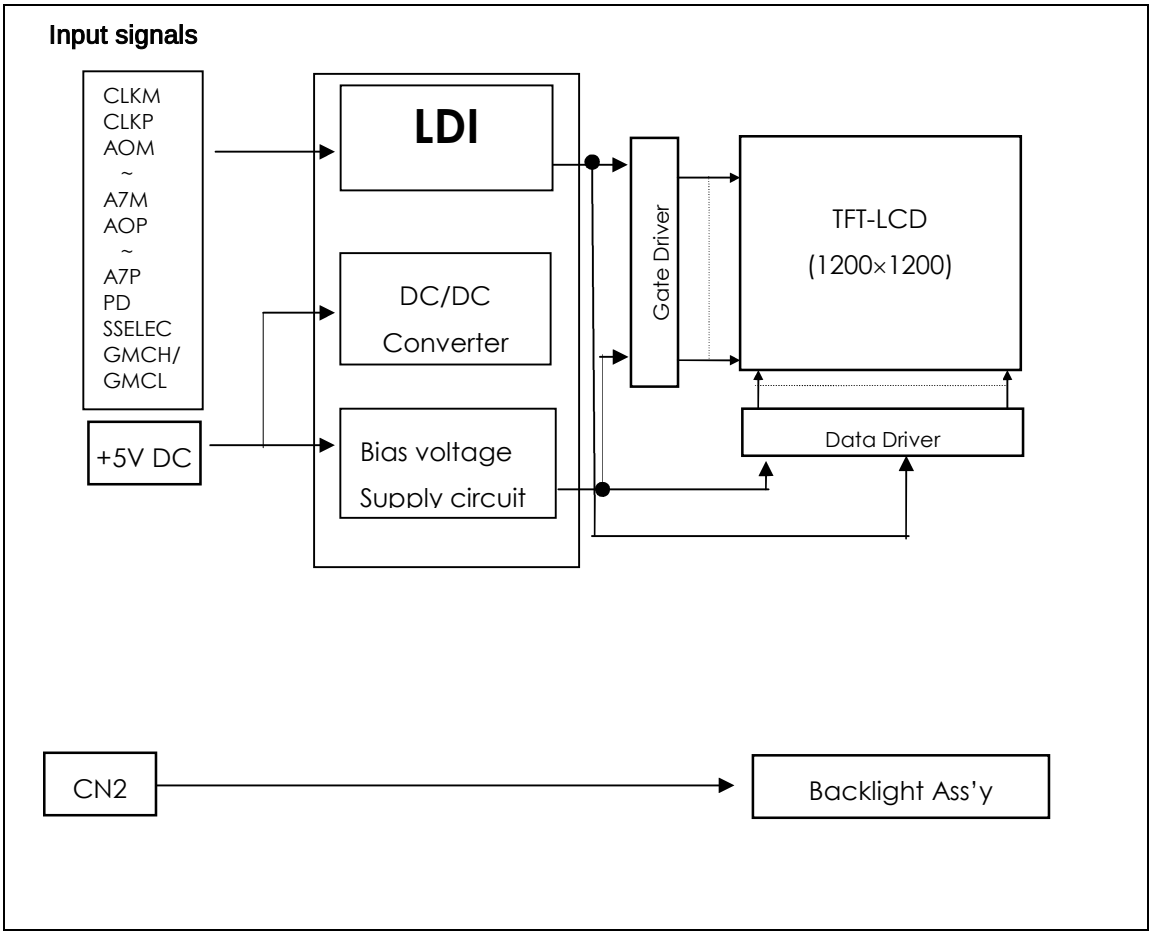
7. Power Sequence



8. Block Diagram



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9. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Appendix A presents additional information concerning the measurement equipment and method.

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR	-	TBD	-		1
Surface Luminance, white	L_{WH}	-	600	-	cd/m²	2
Luminance Variation	δ_{WHITE}	-	75	-	%	3
Response Time				25@25□		
Rise Time	Tr_R	-	10@25□	35@25□	msec	4
Fall Time	Tr_D	-	20@25□		msec	
CIE Color Coordinates				0.666		
Red	x_G	0.566	0.616	0.427		
	y_G	0.327	0.377	0.373		
Green	x_B	0.273	0.323	0.658		
	y_B	0.558	0.608	0.196		
Blue	x_W	0.096	0.146	0.182		
	y_W	0.082	0.132	0.354		
White	x_W	0.254	0.304	0.411		
	y_W	0.311	0.361			
Viewing Angle(CR≧10)						
x axis, right (ø=0°)	θ x		85		degree	5
x axis, left(ø=180°)	θ x		85			
y axis, up(ø=90°)	θ y		85			
y axis, down (ø=270°)	θ y		85			

Notes: 1. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see Appendix B.
3. The variation in surface Luminance, δ_{WHITE} is determined by measuring L_{ON} at each test position 1 through 9, and then dividing the minimum L_{ON} of 9 points luminance by maximum L_{ON} of 9 points luminance. For more information see Appendix B.
   δ_{WHITE} = Minimum (L_{ON1}, L_{ON2}, ...L_{ON5}) ÷ Maximum (L_{ON1}, L_{ON2}, ...L_{ON5})
4. Response time is the time required for the display to transition from white to black (Rise Time, Tr_R) and from black to white (Decay Time, Tr_D). For additional information see Appendix C.
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x-axis and the vertical or y-axis with respect to the z-axis which is normal to the LCD surface. For more information see Appendix D.

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10. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LVM150SQXSB-L01. In addition, the figure below is a detailed mechanical drawing of the LCD. Note that dimensions are given for reference purposes only.

Outside dimensions:		
	Horizontal	406.0 ± 1.0 mm
	Vertical	422.2 ± 1.0 mm
	Depth	40.2 ± 1.0 mm
Bezel opening area:		
	Horizontal	359.0 ± 1.0 mm
	Vertical	359.0 ± 1.0 mm
Active Display area:		
	Horizontal	352.8 mm
	Vertical	352.8 mm
Weight (approximate):		5 Kg (Typ)

Surface Treatment: Anti-glare, Haze value: 25%, 3H.

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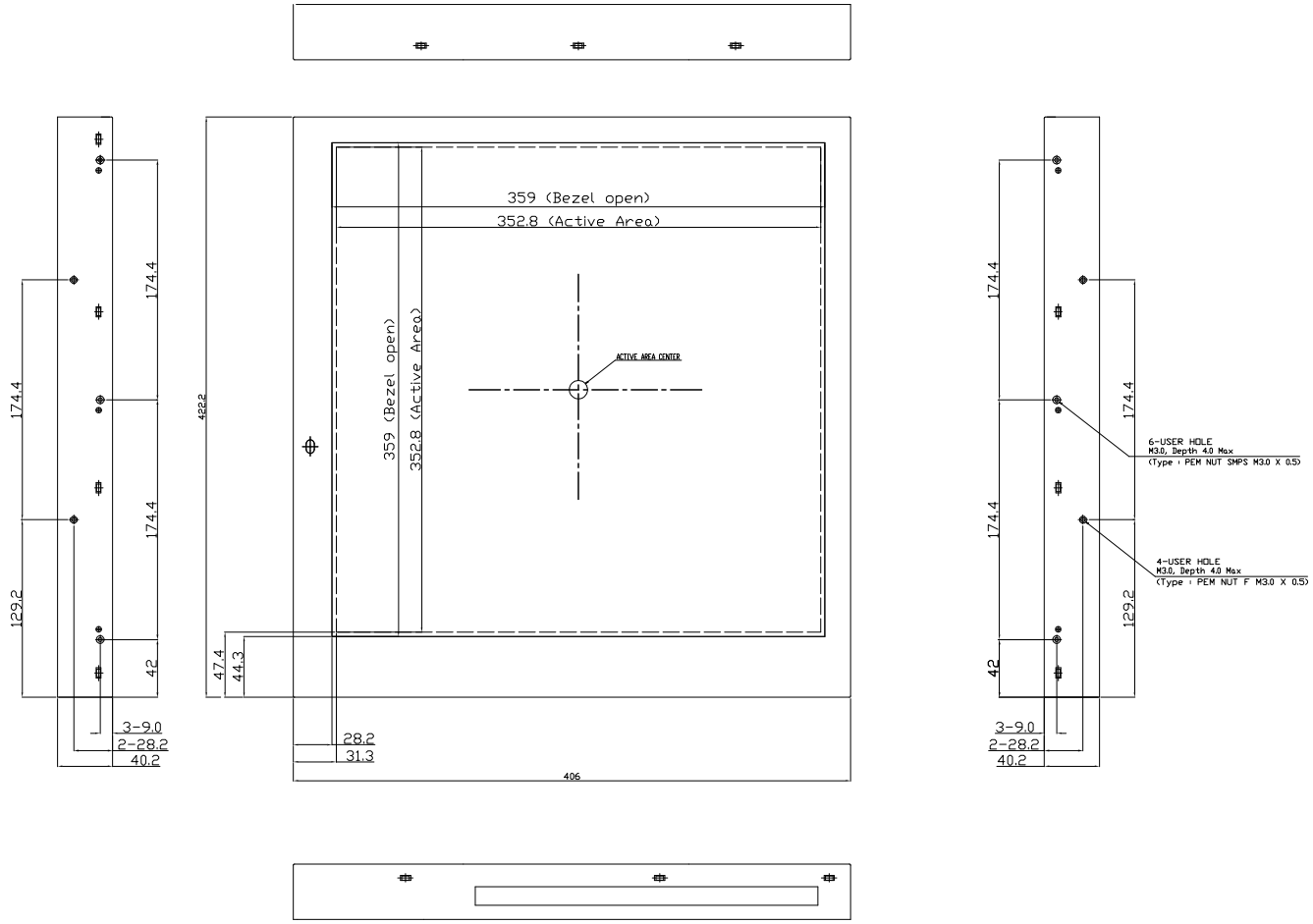
11. Mechanical Specification

<FRONT VIEW>



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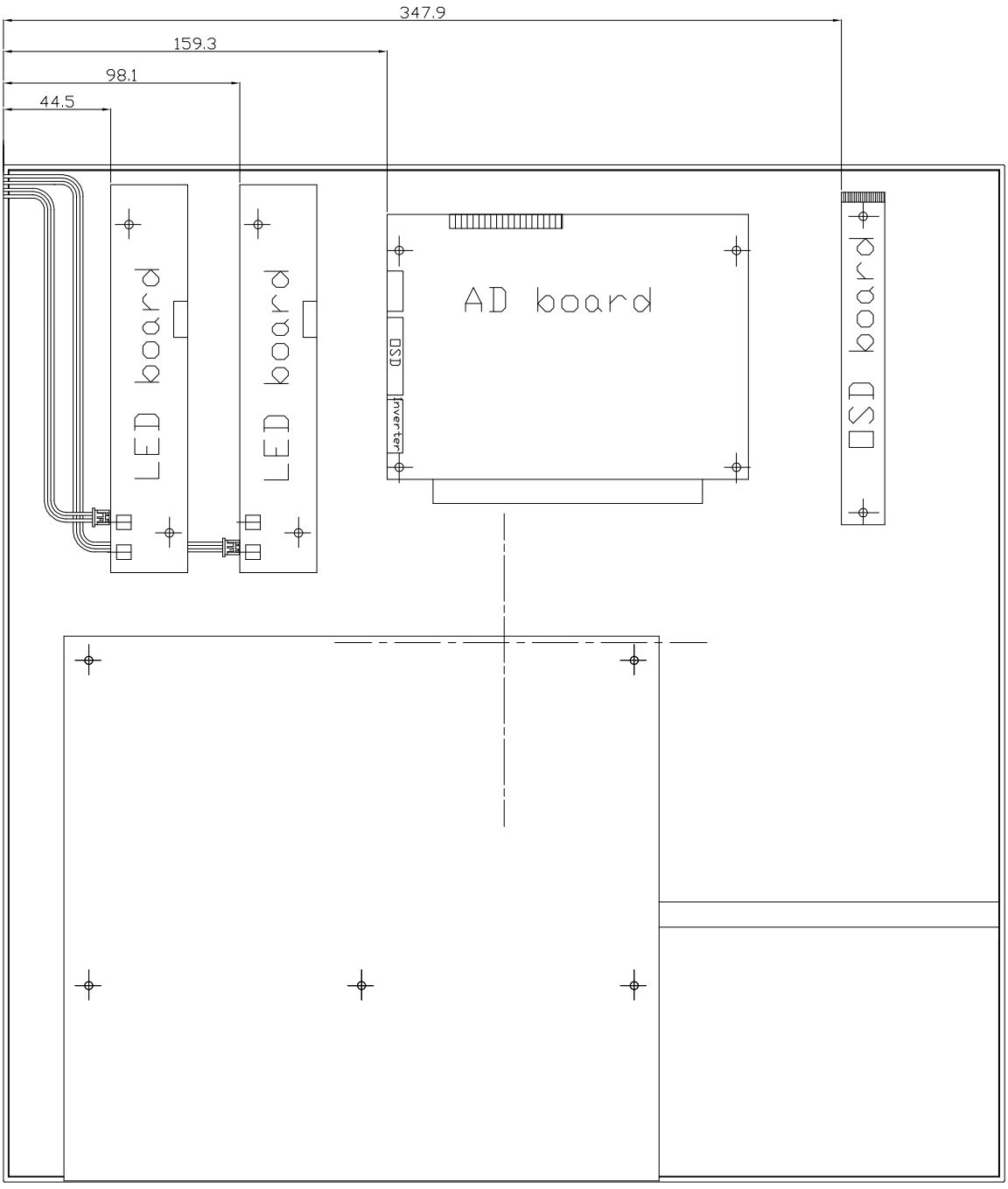
<BACK VIEW>



12. Reliability

- Environment test condition

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 60 °C 72h
2	Low temperature storage test	Ta = -20 °C 72h
4	High temperature operation test	Ta = 45 °C 72h
5	Low temperature operation test	Ta = 0 °C 72h
6	Vibration test (non-operating)	Frequency 10 ~ 300~10 Hz Gravity/AMP: 9.8m/s² Period: X, Y, Z 30 min.
7	Shock test (non-operating)	Max. gravity: 147m/s² Pulse width: 2ms, half sine wave Direction: ± X, ± Y, ± Z once for each direction

Result Evaluation Criteria

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

13. Packing Form

a) Package quantity in one box: TBD pcs.
b) Box Size: TBD (mm)

14. PRECAUTIONS

Please pay attention to the followings when you use this TFT/LCD module.

14-1. MOUNTING PRECAUTIONS

(1) You must mount a module using holes arranged in the corners.
(2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach the surface with a transparent protective plate in order to protect the polarizer LC cell.
Transparent protective plate should have sufficient strength in order to resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter cause circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And Please do not rub with dust clothes with chemical treatment.
Do not touch the surface df polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluen and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

14-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage : V = ± 200mV (Over and under shoot voltage).
(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) A module has high frequency circuit. It might be necessary to shield the electromagnetic noise in your integrating system.
(7) When a Backlight unit is operating, it may make sounds. It might be necessary to shield your integrating system to cut down the noise.
(8) Please reference the thermal map for optimum thermal design to maximize the MTBF of LED life. (TBD)

14-3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc . . And don't touch I/F pin directly.

14-4. STORAGE

When storing modules for a long time, the following precautions should be followed.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

14-5. HANDLING PRECAUTIONS FOR PROTECTION FILM

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion- blown equipment or in such a condition, etc..
(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal- hexane.

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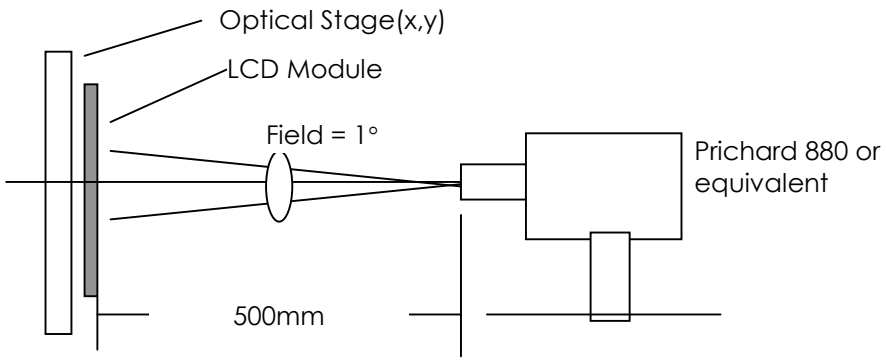
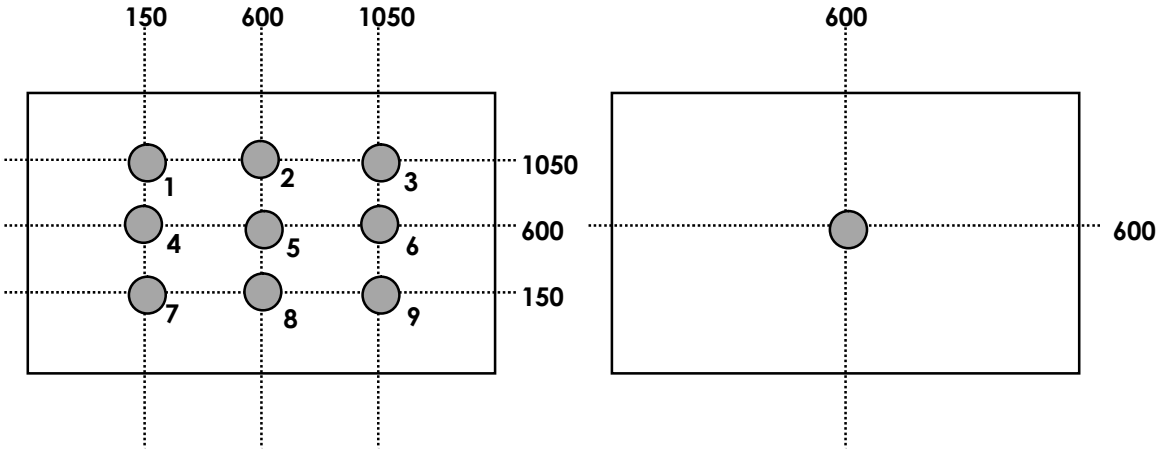
A. Optical Characteristic Measurement Equipment and Method



B. Luminance

<measuring point for luminance variation> <measuring point for surface luminance >



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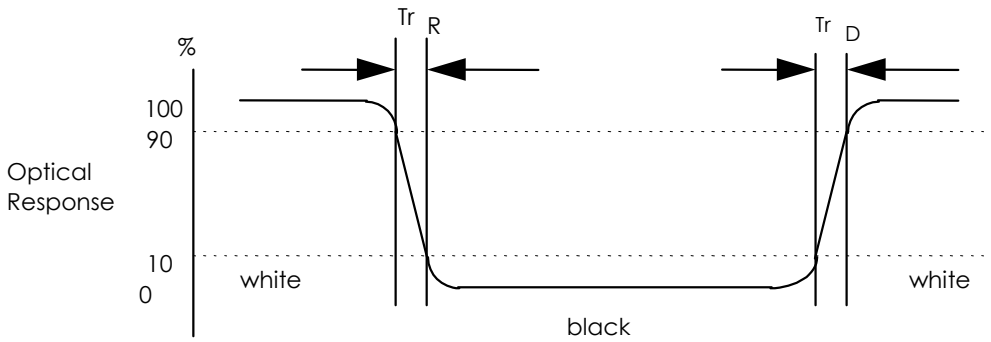
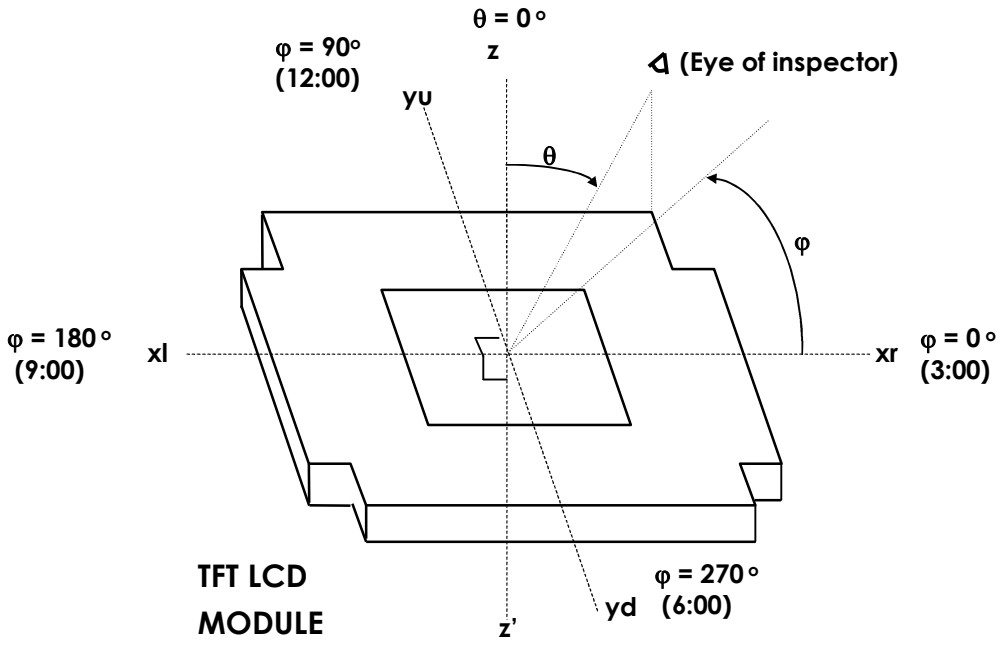
C. Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



D. Viewing angle

<Definition of viewing angle range>



A/D BOARD DATA SHEET:

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1. General Description

A/D Board is an advanced TFT-LCD Monitor Control Board. This design enables a full conventional CRT monitor and/or video replacement with a large size Active Matrix LCD module. It is suitable for video resolution up to WUXGA @ 60Hz (1200 vertical by 1920 horizontal pixel array) in all video modes, the full display area of the module is used.
The design is implemented as a single printed circuit board.
A/D Board is designed to support various TFT-LCDs up to WUXGA resolution by BIOS option.

2. Features

- Designed to give state-of-the-art picture quality
- Analog RGB / DVI (Digital Video Interface) / YPbPr Component(OPTIONAL) / CVBS / S-video / with Audio In&Out(OPTIONAL).
- Various input combination, e.g., PC monitor only
- Full CRT multi-sync monitor compatibility
- Multi-sync capability up to WUXGA resolution @ 60Hz, compatible standard SVGA, XGA and SXGA VESA timing.
- Expand DOS,VGA,SVGA,XGA, SXGA, UXGA and WUXGA to full screen display
- True color (16.7M) data processing and display driving
- Single control operated & transparent On-Screen-Display (hereafter 'OSD') user interface
- Full control of all relevant display and interface parameters via OSD
- PIP & PBP function available.(OPTIONAL)
- VESA DDC 1/2B compliant
- Compatible with VESA DPMS power saving modes
- Form factor: 110mm (L) x 150mm (W) x 18mm(H)
- +12V or +24V DC single power
- Operating temperature: 0°C to 50°C
- The IR & RS232 function (full remote control)integrated.
- OSD & Power Switch Board : FOSD-xxx
- VIDEO PZeusSSING

1. Improved de-interlacer, for standard NTSC/PAL
2. Film mode for 3:2/2:2 pull-down content including 1080i sources
3. Full 10-bit data processing
4. Embedded 3D comb filter for NTSC/PAL
5. Per-pixel 3D noise reduction
6. Digital 2d peaking

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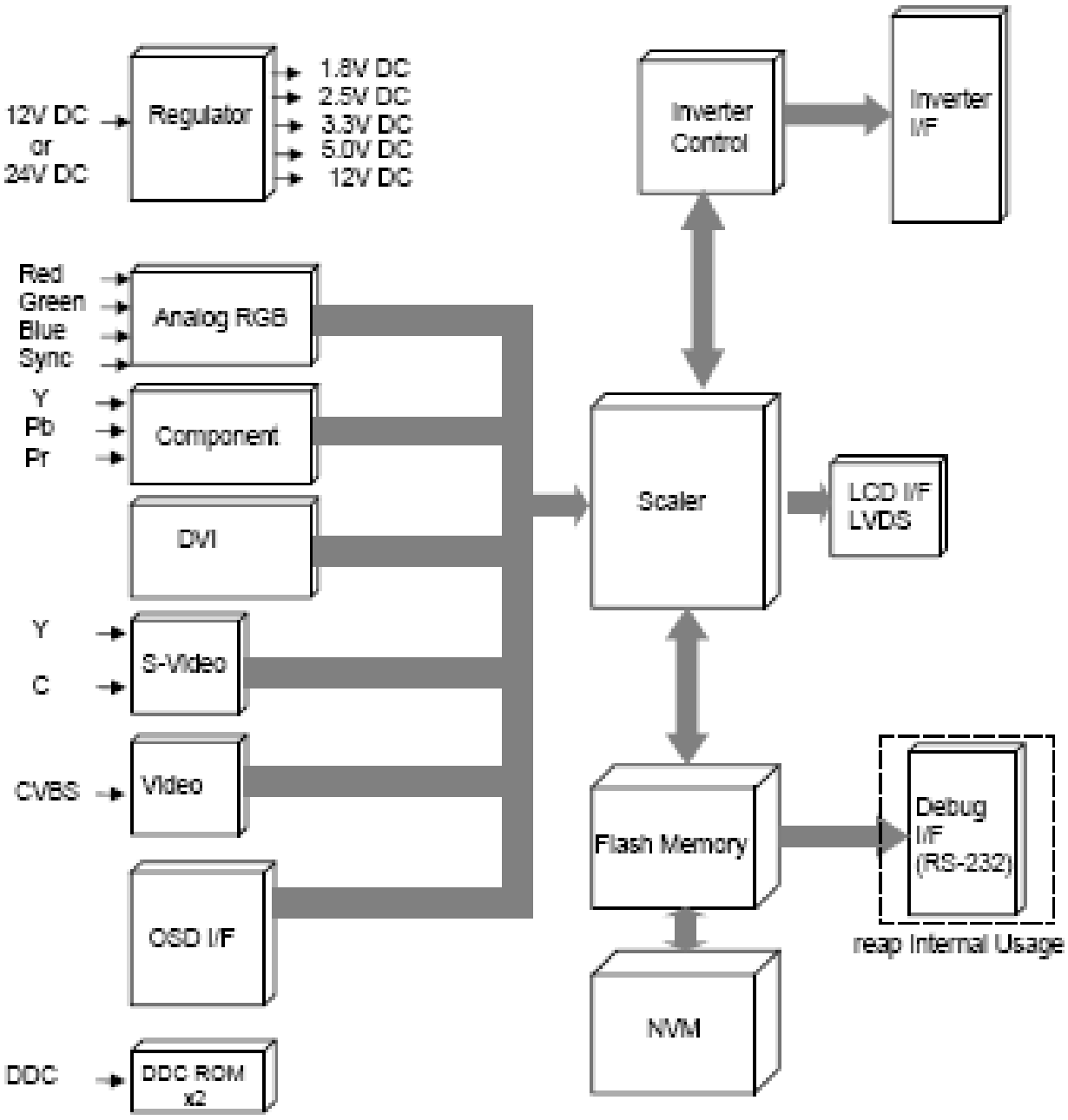
3. Block Diagram



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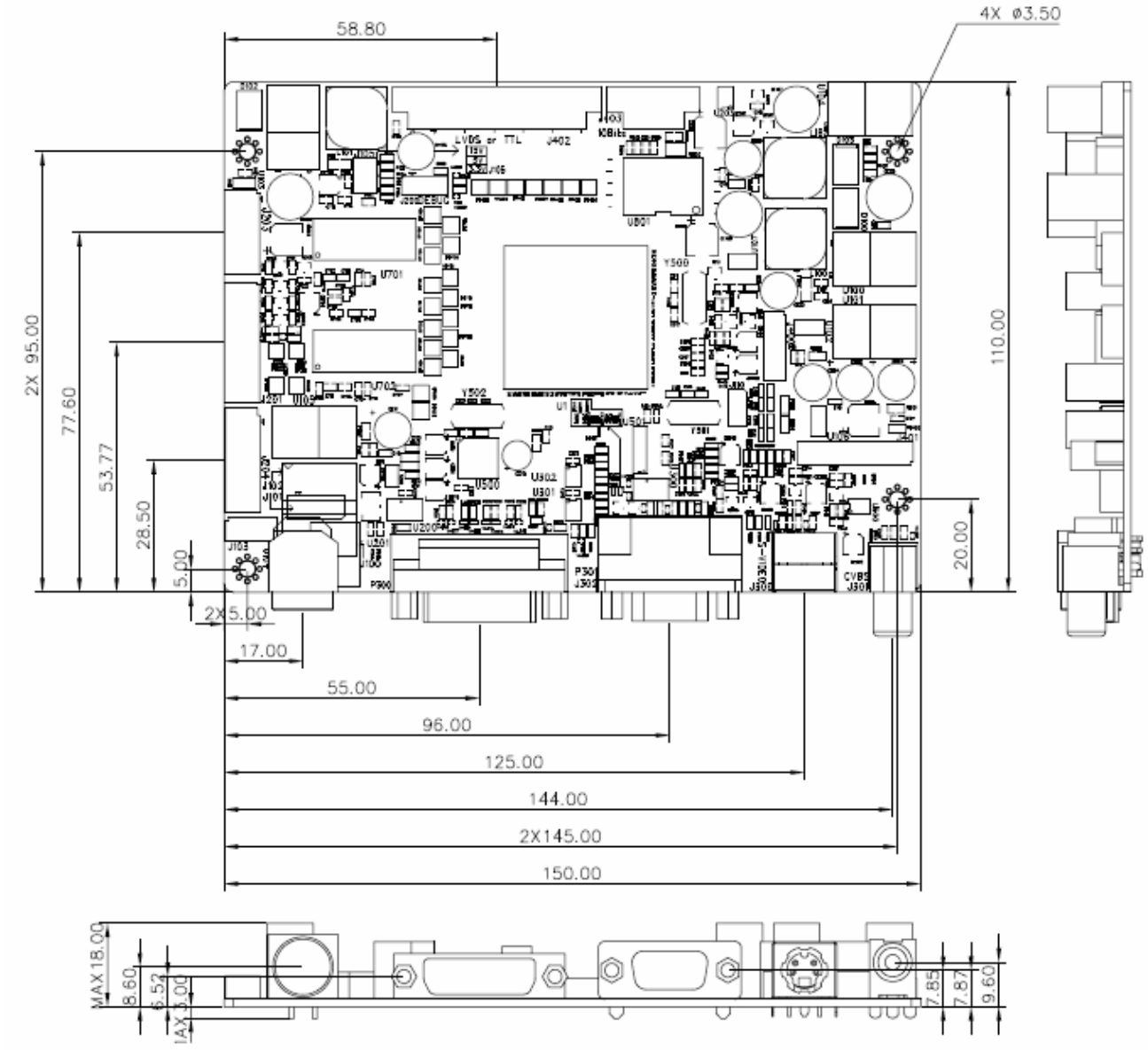
4. Outline Dimensions

4.1 Standard Connectors with round DIN4P for high current

-Dimension : 110mm (L) x 150mm (W) x 18mm(H)



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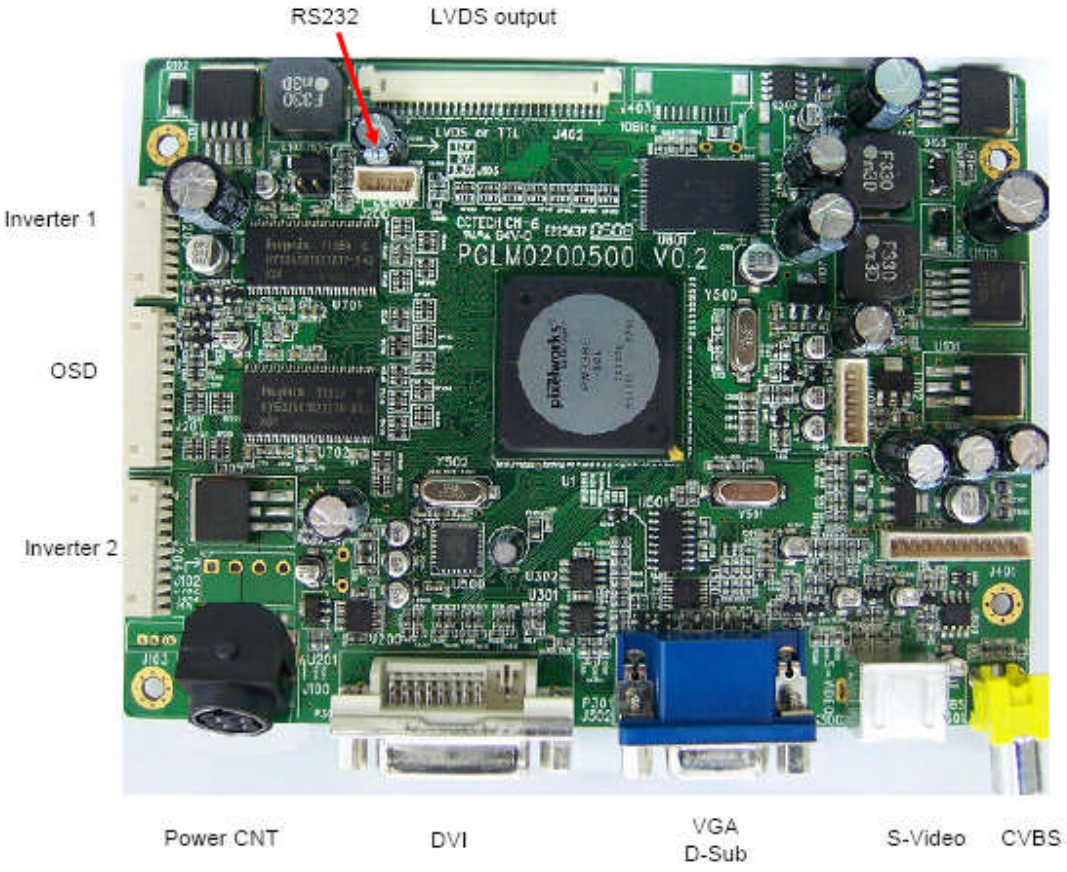
4.1.1 Actual connecters location

-Analog, DVI, and Video



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5. Connectors Information

5.1 Input Connectors

-Power Input Connector

Connector : DC12V Jack (J100)

Pin	Symbol	Description
1	Ground	Ground
2	Ground	Ground
3	Vin	+12V DC

-Power Input Connector (Alternative)

Connector : Molex 09-75-2044 (J102)

Pin	Symbol	Description
1	VCC	Power
2	VCC	Power
3	Ground	Ground
4	Ground	Ground

-Analog RGB Input Connector

Connector : Mini D_Sub 15pin(P301)

Pin	Symbol	Description	Pin	Symbol	Description
1	RED	Analog Red	9	NC	+5V DC
2	GREEN	Analog Green	10	SGND	Sync GND
3	BLUE	Analog Blue	11	NC	No Connection
4	GND	No Connection	12	SDA	DDC Serial Data
5	GND	Digital GND	13	HSYNC	Horizontal Sync
6	RGND	Red Return	14	VSYNC	Vertical Sync
7	GGND	Green Return	15	SCL	DDC Data Clock
8	BGND	Blue Return			

-DVI-D Input Connector

Connector : DVI-D (P300)

Pin	Symbol	Pin	Symbol	Pin	Symbol
1	T.M.D.S. Data 2-	9	T.M.D.S. Data 1-	17	T.M.D.S. Data 0-
2	T.M.D.S. Data 2+	10	T.M.D.S. Data 1+	18	T.M.D.S. Data 0+
3	T.M.D.S. Data2/4 Shield	11	T.M.D.S. Data1/3 Shield	19	T.M.D.S. Data 0/5 Shield
4	T.M.D.S. Data 4-	12	T.M.D.S. Data 3-	20	T.M.D.S. Data 5-
5	T.M.D.S. Data 4+	13	T.M.D.S. Data 3+	21	T.M.D.S. Data 5+
6	DDC Clock	14	+5V Power	22	T.M.D.S. Clock Shield
7	DDC Data	15	GND (Return for +5V,	23	T.M.D.S. Clock+
8	N/C		HSync, and V-Sync)	24	T.M.D.S. Clock-
		16	Hot Plug Detect		

-Component Input Connector (A/D Board side)

Input Connector : Molex 53014-0610 (J400)

Pin	Symbol	Description	Pin	Symbol	Description
1	Pr	Pr	4	GND	Y return

2 3	GND Y	Pr return Y	5 6	Pb GND	Pb Pb return

-Component Input Connector (Component daughter board side)

Input Connector : Molex 53014-0710 (J4)

Pin	Symbol	Description	Pin	Symbol	Description
1 2 3 4	GND Pb GND Y	Pr return Pb Y return Y	5 6 7 8	Pb GND N.C.	Pr Pr return N.C.

-S-Video input Connector

Connector :MiniDin-4p (J300)

Pin	Symbol	Description	Pin	Symbol	Description
1 2 3	GND1 GND2 S-VIDEO	GND1 GND2 LUMINANCE	4 5	S-VIDEO GND3	CHROMA GND3

-CVBS Connector : RCA yellow (J301)

Pin	Symbol	Description	Pin	Symbol	Description
1,3	CVBS	Video signal	2	GND	Video return

-OSD, LED Interface Connector :

Connector : 53015-1210 made by Molex (J201)

Pin	Symbol	Description	Pin	Symbol	Description
1	LED 1	LED 1	7	KEY2	Increase
2	LED 0	LED 0	8	KEY3	Decrease
3	Vcc	Vcc 5V	9	KEY4	Down
4	IR	Remote control	10	KEY5	Menu
5	GND	GND	11	KEY6	Source Select
6	KEY1	Power	12	KEY7	Up

-RS-232C Connector :

Connector : 53015-0410 made by Molex (J200)

Pin	Symbol	Description
1	GND	GND
2	RX	TXD
3	TX	RXD
4	VCC	VCC

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5.2 Output Connectors

-LVDS Output Connector (J402) : 8Bits Data

Pin	Symbol	Pin	Symbol
1	Tx0- E	16	Tx1+ O
2	Tx0+ E	17	GND
3	Tx1- E	18	Tx2- O
4	Tx1+ E	19	Tx2+ O
5	GND	20	TxCLK- O
6	Tx2- E	21	TxCLK+ O
7	Tx2+ E	22	Tx3- O
8	TxCLK- E	23	Tx3- O
9	TxCLK+ E	24	GND
10	Tx3- E	25	3.3V (LVDS option)
11	Tx3+ E	26	GND
12	GND	27	VCC
13	Tx0- O	28	VCC
14	Tx0+ O	29	VCC
15	Tx1- O	30	

-LVDS Output Connector (J403) : 10Bits Data Option

Pin	Symbol	Pin	Symbol
1	Tx4- E	6	TTL DCLK
2	Tx4+ E	7	TTL DVS
3	Tx4- O	8	TTL DHS
4	Tx4+ O	9	TTL DEN
5	GND	10	GND

-Backlight Connector

Connector : 53015-0810 made by Molex (J203)

Pin	Symbol	Description	Pin	Symbol	Description
1	BRIGHT	Brightness Adjustment	5	GND	Ground
2	ON/OFF	Backlight On/Off	6	GND	Ground
3	GND	Ground	7	12V	12V
4	5V	5V (Not Use)	8	12V	12V

-Backlight Power Connector (For Large size panel)
Connector : 53015-1010 made by Molex(J204)

Pin	Symbol	Description	Pin	Symbol	Description
1	VDD	INV PWR	6	GND	Ground
2	VDD	INV PWR	7	GND	Ground
3	VDD	INV PWR	8	GND	Ground
4	VDD	INV PWR	9	GND	Ground
5	VDD	INV PWR	10	GND	Ground

6. Reference Data

Video Input Timing;
Supported vertical refresh rates for each modes are as follows:
640 x 350 70Hz
640 x 400 70Hz
700 x 560 55~75Hz
720 x 350 70Hz
720 x 400 70Hz
640 x 480 60~75Hz
800 x 600 60~75Hz
1024 x 768 60~75Hz
1152 x 864 60~75Hz
1280 x 1024 60~75Hz
1280 x 768 60~75Hz
1366 x 768 60~75Hz
1440 x 900 60~75Hz
1600 x1200 60~75Hz
1680 x1050 60~75Hz
1920 x1080 60Hz
1920 x1200 60Hz
Sync. : H/V Separated TTL, Composite Sync

-Electrical Parameters Reference A/D Board, t_A 25 ° C

Description	Symbol	Values			Units	
		Min.	Typ.	Max.		
+12V (+24V) DC Power Supply	V_{DD}	10.8	12.0	24.5	V	
Video Input Signal (w.r.t. GND)	$V_{i(RGB)}$	0.5	0.7	1.0	Vpp	
Video Sample Rate MHz	fs			80	MHz	
Horizontal Sync. Frequency	f_{HS}	30		60	KHz	
Vertical Sync Frequency	f_{vs}	56		75	Hz	
Sync Input High Level	F_{SIH}	2.5			V	
Sync Input Low Level	V_{SIL}			0.8	VDC	
I_{DD2} Supply Current +12V (with LCD & Inverter)	I_{DD2}		3	3.5	A	

Note 1. Power consumption measuring condition is 2 pixel check board pattern @ SXGA 75Hz and maximum brightness with Samsung LTM170E6 & inverter at tA 25°C.

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7. Supported Input Formats

7.1 Video Mode Support

The A/D Board series can support any video mode within the following input constraints:

- Signal sample frequency with the input ≤ 80MHz
- Horizontal sync frequency between 30KHz and 80KHz

The modes are detected with the presentation of the input and previous alignments for setup are Automatically recalled. The emulation of a true multi-sync monitor is implemented.
The factory preset supported modes are as follows:

Mode	Resolution	Refresh rate	H-freq.	Pixel freq.	Remarks
VGA	640 x 350	70Hz	31.47KHz	25.175MHz	VESA Standard
VGA	720 x 400	59.94Hz	31.469KHz	25.175MHz	IBM VGA 3H
VGA	640 x 480	60Hz	31.5KHz	25.175MHz	Industry Standard
VGA	640 x 480	72Hz	37.9KHz	31.5MHz	VESA Standard
VGA	640 x 480	75Hz	37.5KHz	31.5MHz	VESA Standard
SVGA	800 x 600	60Hz	37.9KHz	40MHz	VESA Guidelines
SVGA	800 x 600	72Hz	48.1KHz	50MHz	VESA Standard
SVGA	800 x 600	75Hz	46.9Khz	49.5MHz	VESA Standard
XGA	1024 x 768	60Hz	48.4KHz	65MHz	VESA Guidelines
XGA	1024 x 768	70Hz	56.5KHz	75MHz	VESA Standard
XGA	1024 x 768	75Hz	60KHz	78.75MHz	VESA Standard
SXGA	1280 x 1024	60Hz	64KHz	108MHz	VESA Standard
SXGA	1280 x 1024	75Hz	80KHz	135MHz	VESA Standard
WXGA	1280 x 768	60~75Hz	47.7~65KHz	80.14MHz	Not Standard
WXGA	1366 x 768	60~75Hz	47.7~65KHZ	80MHz	Not Standard
WSXGA	1440 x 900	60~75Hz	65KHz	150MHz	Not Standard
WSXGA	1680 x1050	60Hz	70KHz	150MHz	Not Standard
UXGA	1600 x1200	60Hz	75KHz	162MHz	Not Standard
WUXGA	1920 x1080	60Hz	95KHz	190MHz	Not Standard
WUXGA	1920 x1200	60Hz	95KHz	190MHz	Not Standard

Notes:
1. All mentioned modes are non-interlaced. The maximum and minimum frame rates are determined by the TFT-LCD.
2. Factory preset modes are overwritten by additional user alignments for automatic recall. The factory preset modes can be recalled at any time.

7.2 LCD Panel & I/O Support

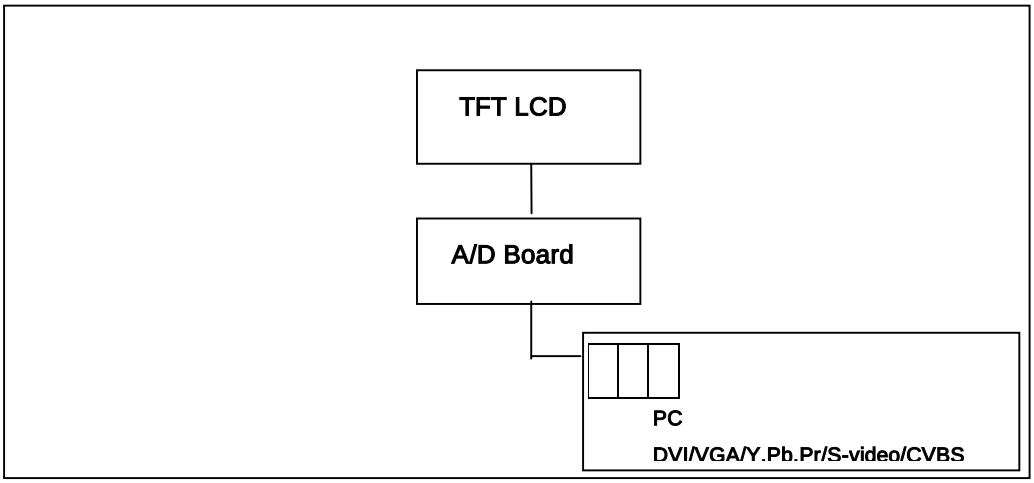
A/D Board is an advanced and general application for a TFT-LCD Monitor Control board.
Therefore, the application of this board is not limited to panel manufacturers or models.

Furthermore, this board operates with any LVDS interface panel ranging from VGA to WUXGA that can be driven with three or less timing signals. The usual timing signals to a panel are H-sync, V-sync and Data Enable.
For backlight intensity control mechanism, a built-in DC dimming drive signal is installed into the CCFL inverter control port. The CCFL inverter DC power, generally 12V DC, is attached to the same port.
Users can design their own key pad board by using OSD & power tact switch as well as a two-color LED. On/off power switch and OSD input signal are detected and executed by the micro controller.

7.3 DVI (Digital Video Interface)

A/D Board has one DVI input port, which complies with VESA DVI standard. Therefore, users can make direct interface to the DVI output of Digital VGA cards. The signal source can be switched through OSD.

High-end Multi-media Display System

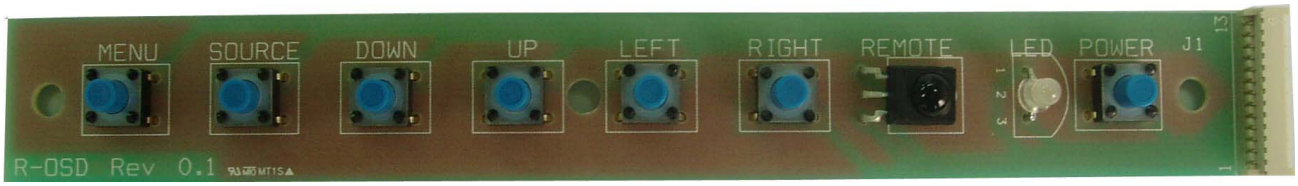


8. OSD (On Screen Display)

8.1 OSD Board Dimension

8.1.1 OSD Board with 7 Buttons

Part number : ROSD-7R



MENU / SOURCE / DOWN / UP / LEFT / RIGHT / (REMOTE) / (LED) / POWER

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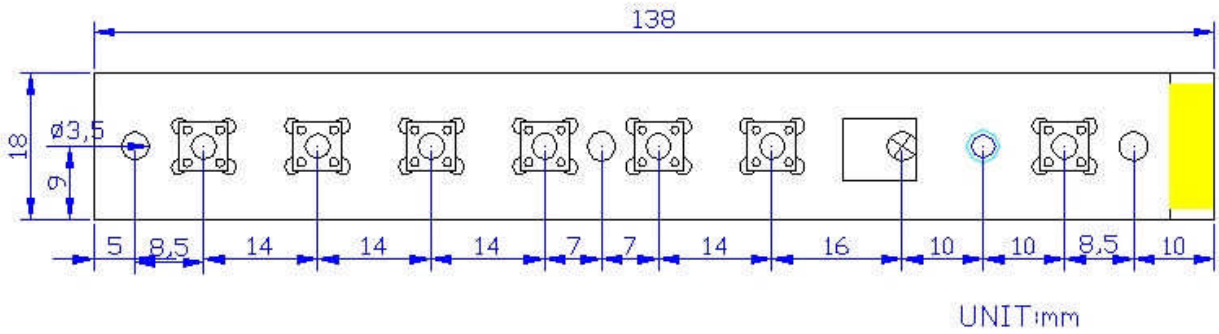
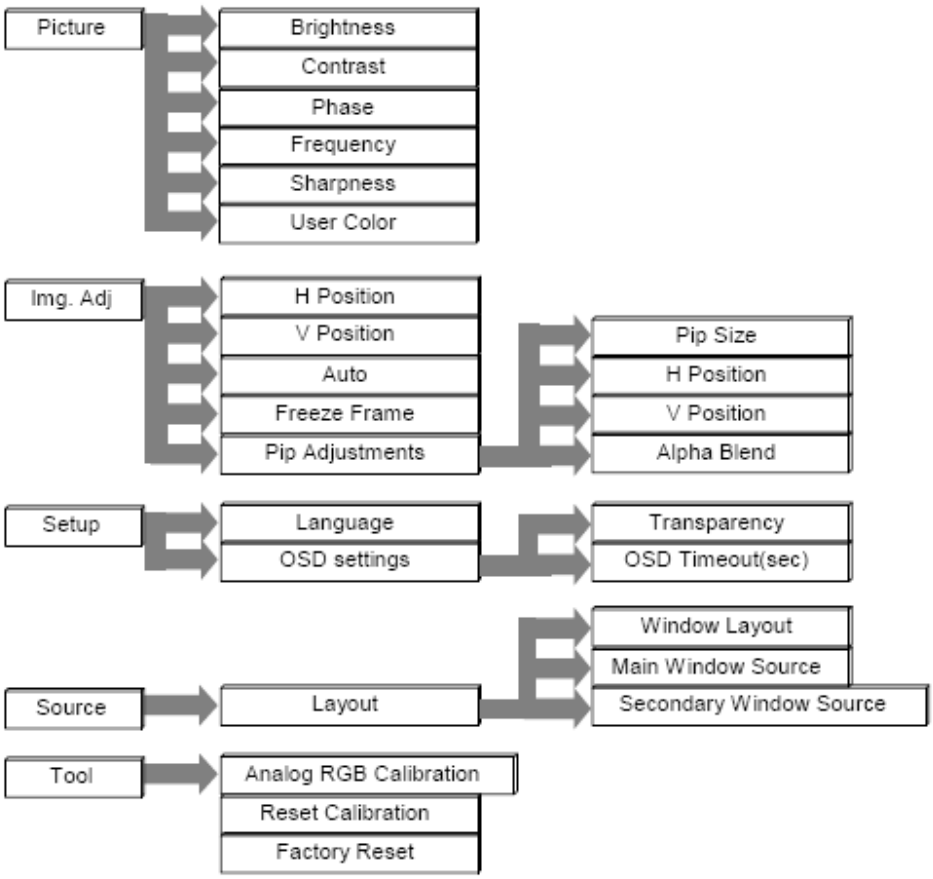


8.2 Summary of OSD Menu

Analog RGB



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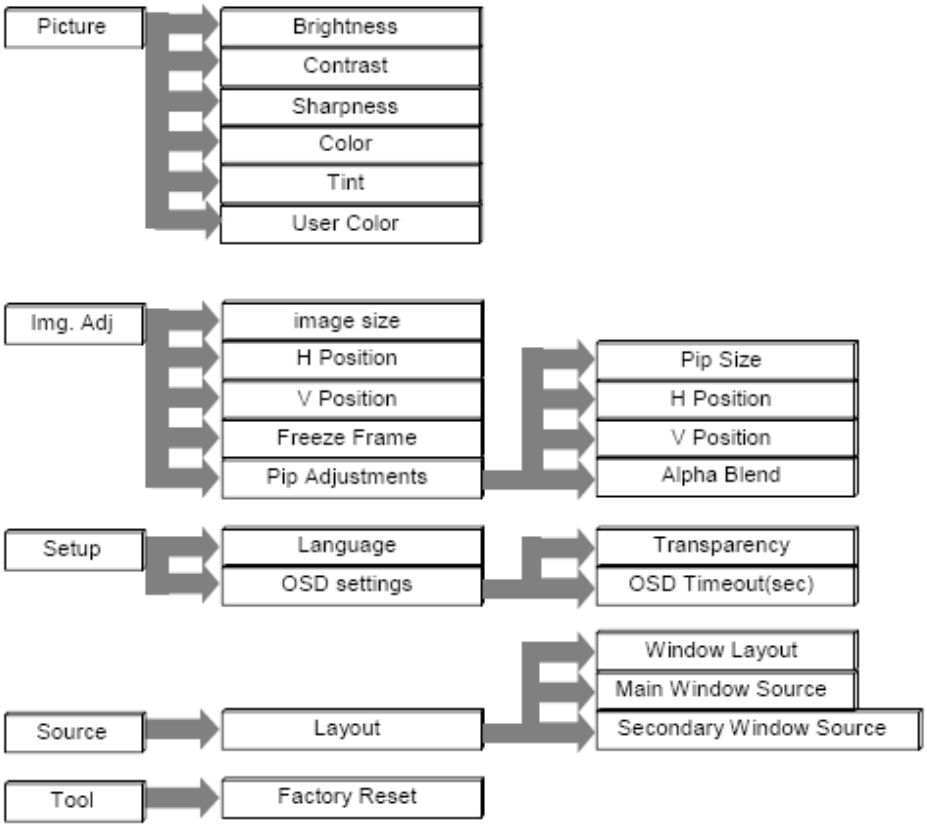
Video / S-video



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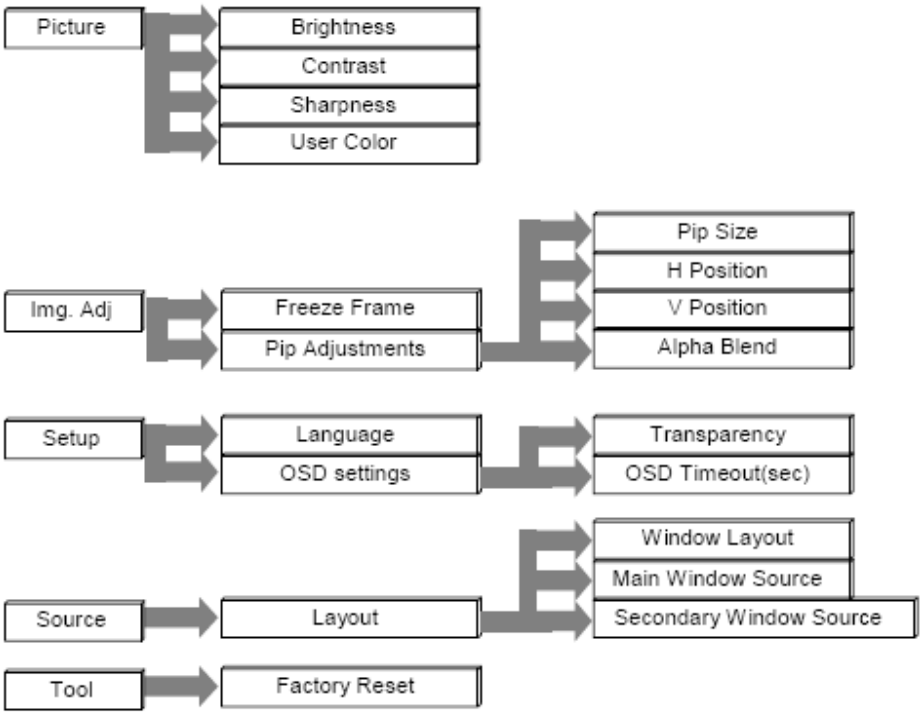
DVI



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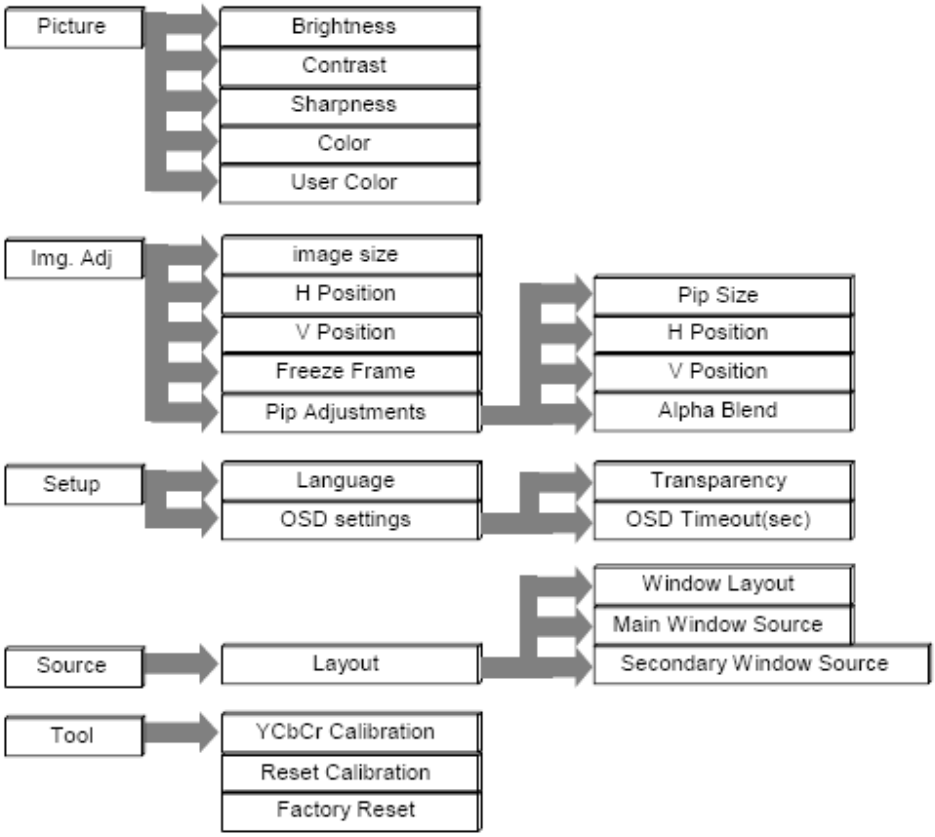
Component



OSD Key Description

- MENU : Menu Key
- DOWN : Down Key (HOT key : Auto Config)
- UP : Up Key
- DECREASE : Decrease Key, Left Key
- INCREASE : Increase Key, Right Key
- SOURCE : Source Select Key

8.3 OSD Menu enables user to manipulate the image and settings

- Brightness : Adjust brightness of the screen (used to pwm control)
- Contrast : Adjust distinction
- Phase : Adjust the phase of the screen
- Frequency : Adjust the horizontal size of the screen
- Sharpness : Adjust the sharpness
- Color : Adjust the Color
- Tint : Adjust tint
- User Color : Adjust R,G,B value of color temperature

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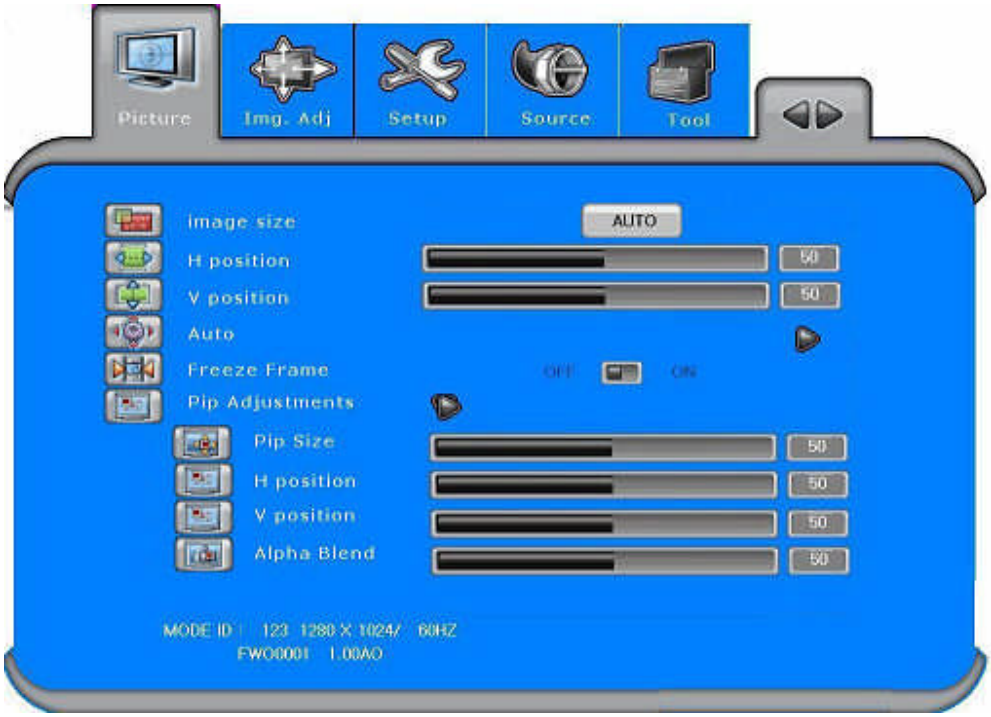

- Image size : Select display output aspect ratio
- H Position : Adjust Horizontal screen Position
- V Position : Adjust Vertical screen Position
- Auto : Execute auto adjust for phase, clock, position
- Freeze Frame : Choose freeze display
- Pip Size : Select PIP screen size
- H Position : Adjust PIP H screen Position
- V Position : Adjust PIP V screen Position
- Alpha Blend : Adjust PIP screen blending level

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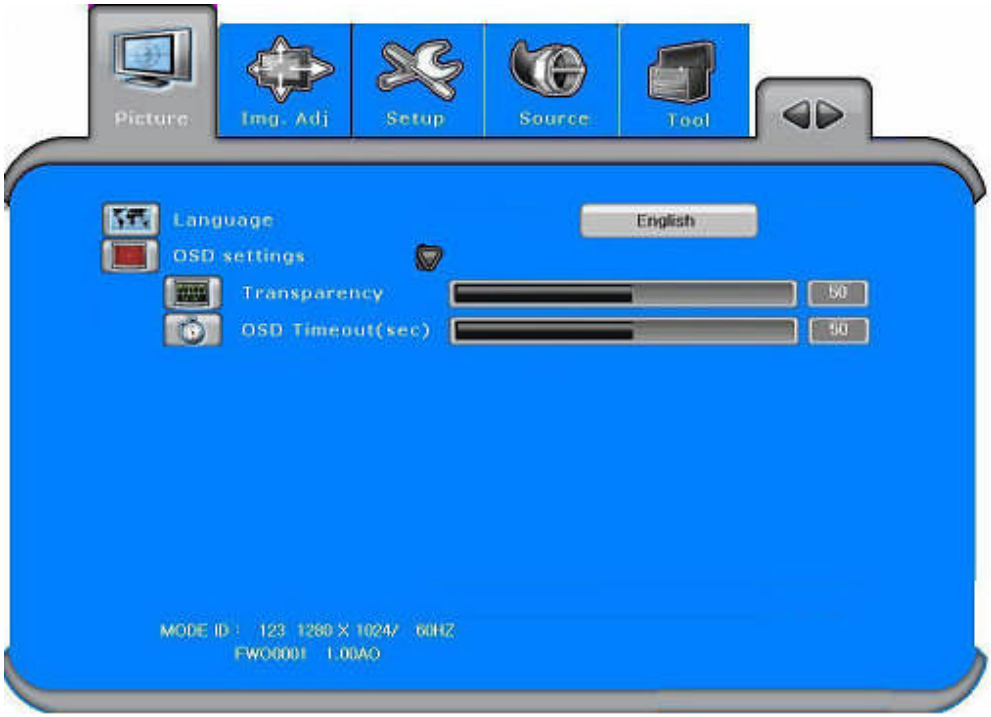

• Language : Select various language (Now we support English only)
• Transparency : Choose OSD Transparent level
• Osd Timer : Adjust OSD turn-off time

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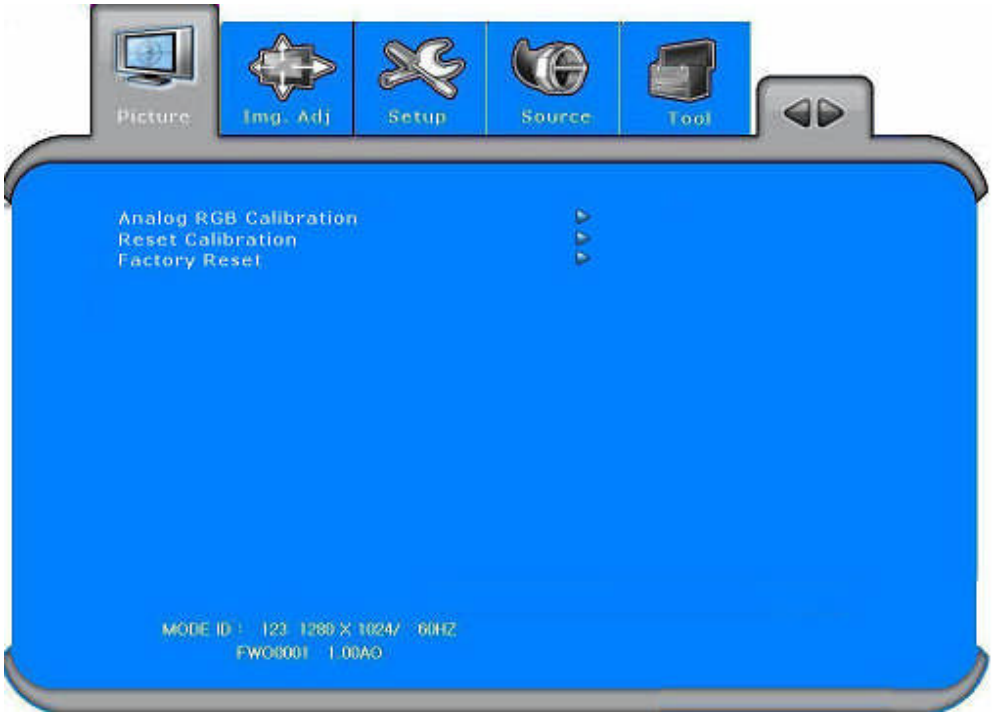
• Window Layout : Execute PIP (picture in picture)
• Main Window Source : Select Main input source
• Secondary Window Source : Select PIP input source



• Analog RGB Calibration : Adjust R,G,B color balance
• Reset Calibration : Reset R,G,B color balance
• Factory Reset : Change set up value to the initial value forwarding at the factory

CN2

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DRV02-2L2C-B1◆◆◆-❖○

Data Sheet Rev B. BYI 2007-09-28

◆◆◆ LCD Panel Size

❖ LCD Manufacture

○ Part Number

LED BLU DRIVER

Rev A. J3 pin orders are reversed.
Rev B. J3 pin orders are corrected.
Rev B1. output setting revised.

Max. Height	Reference
13 mm	C7,C8,C9,C14,C15
10 mm	L1
7 mm	Q1, J1, J2, J3

Specifications:

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
VIN	Input Supply Voltage	11	12	13	VDC
IIN	Input Supply Current	-	-	1.5	ADC
IOUT_18V	Output Drive Current @18V	-	-	0.8	ADC
IOUT_24V	Output Drive Current @24V	-	-	0.6	ADC

INPUT

J3, MOLEX 53261-0871

PIN #	DESCRIPTION	REMARK
1	+12V	
2	+12V	
3	GND	
4	GND	
5	ON/OFF	0V = off, 5V = on
6	DIMMING	0V = min, 5V = max
7	5V OUT	See Figure 1.
8	GND	See Figure 1.

OUTPUT

J1, J2 MOLEX 53015-0210

PIN #	DESCRIPTION	REMARK
1	ANODE	
2	CATHODE	

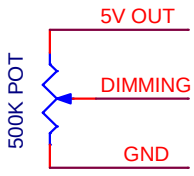

Figure 1