(V) Preliminary Specification
( ) Final Specification

Module	19.0" WXGA Color TFT-LCD
Model Name	M190PP01 V0

Customer	Date	Prepared by	Date
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Approved by		**Approved by**	
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Note: This Specification is subject to change without notice.		Desktop Display Business Group / AU Optronics corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2008/02/13	All	First Edition for Customer	-	
0.2 2008/09/01	12	5.1.1 Power Specification IDD: 0.9A(typ); PDD: 4.5W(typ)	5.1.1 Power Specification IDD: 1.0A(typ); PDD: 5.0W(typ)	Modify
	13	5.2 Backlight Unit FCFL: 50 [KHz] VCFL: 771 [Volt]rms	5.2 Backlight Unit FCFL: 55 [KHz] VCFL: 718 [Volt]rms	Modify
	20	6.4 EEPROM Memory Placement – 16K	1. Change from 16K to 4K 2. Update the memory placement	Modify
	21	6.5 Power On/Off Sequence	Re-define the signal definitions and values	Modify

1.0 Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7) Do not open or modify the Module Assembly.
8) Do not press the reflector sheet at the back of the module to any directions.
9) In case if a Module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of the CCFL reflector edge. Instead, press at the far ends of the CCFL Reflector edge softly. Otherwise the TFT Module may be damaged.
10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
12) Cold cathode fluorescent lamp in LCD contains a small amount of mercury. Please follow local ordinances or regulations for disposal.
13) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
14) The LCD module is designed so that the CCFL in it is supplied by Limited Current Circuit (IEC60950 or UL1950). Do not connect the CCFL in Hazardous Voltage Circuit.

2.0 General Description

This specification applies to the 19 inch-wide Color a-Si TFT-LCD Module M190PP01 V0.

The display supports the WXGA (1440(H) x 900(V)) screen format and 16.7M colors (RGB 6-bits + Hi-FRC data).

All input signals are 1 Lane Displayport interface compatible.

This module doesn't contain an inverter board for backlight.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25 ℃ condition:

ITEMS	Unit	SPECIFICATIONS
Screen Diagonal	[mm]	482.6 (19.0"Wide)
Active Area	[mm]	408.24 (H) x 255.15(V)
Pixels H x V		1440(x3) x 900
Pixel Pitch	[mm]	0.2835(per one triad) x 0.2835
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN Mode, Normally White
White Luminance (Center)	[cd/m^2]	300 cd/m2 @ 6.5mA (Typ)
Contrast Ratio		1000 (Typ.)
Optical Response Time	[msec]	5ms (Typ., on/off)
Nominal Input Voltage VDD	[Volt]	+5.0 V
Power Consumption (VDD line + CCFL line)	[Watt]	24 W (Typ.)
Weight	[Grams]	2120 (Typ.)
Physical Size	[mm]	428.0(W) x 278.0(H) x 18.5(D) (Typ)
Electrical Interface		1 Lane Displayport (HDCP v1.3 ; EDID1.4)
Support Color		16.7M colors (RGB 6-bit + Hi_FRC)
Surface Treatment		Anti-Glare, 3H
Temperature Range Operating Storage (Shipping)	 [°C] [°C]	 0 to +50 -20 to +60
RoHS Compliance		RoHS Compliance

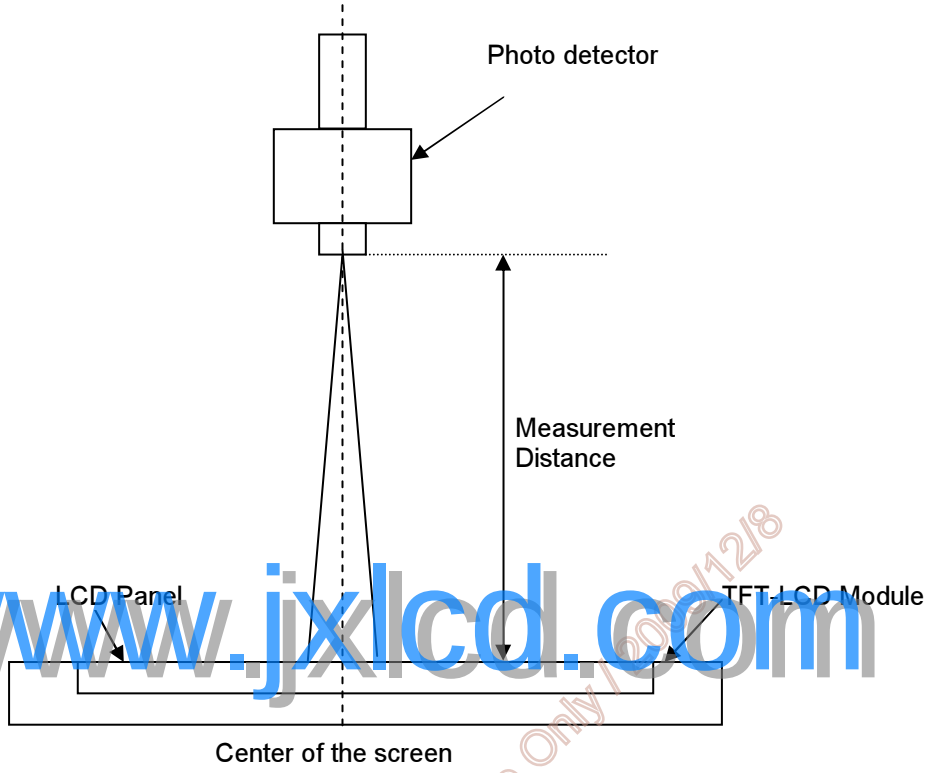
2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃.

Item	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	150	170	- -	*1,3*
	[degree] [degree]	Vertical (Up) CR = 10 (Down)	140	160	- -	
Contrast ratio		Normal Direction	600	1000	-	*1*
Response Time	[msec]	Raising Time	-	3.4	7.4	*1,2*
	[msec]	Falling Time	-	1.6	2.6	
	[msec]	Raising + Falling	-	5	10	
Color / Chromaticity Coordinates (CIE)		Red x	0.620	0.650	0.680	*1*
		Red y	0.310	0.340	0.370	
		Green x	0.260	0.290	0.320	
		Green y	0.580	0.610	0.640	
		Blue x	0.120	0.150	0.180	
		Blue y	0.040	0.070	0.100	
Color Coordinates (CIE) White		White x	0.283	0.313	0.343	*1*
		White y	0.299	0.329	0.359	
Central Luminance (I_L=6mA)	[cd/m^2]		240	300	-	*1*
Luminance Uniformity	[%]		75	80	-	*1,4*
Crosstalk (At 60Hz)	[%]				1.5	*1,5*
Flicker	dB				-20	*1,6*

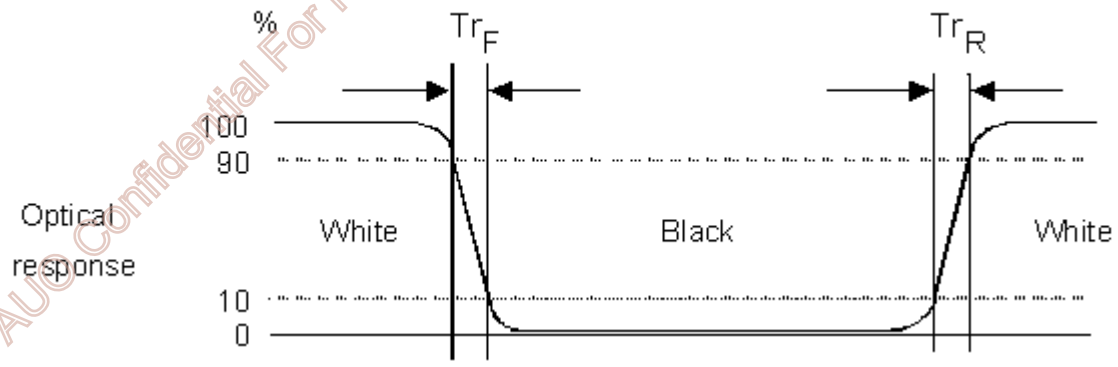
***Note 1*: Measurement method**

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.

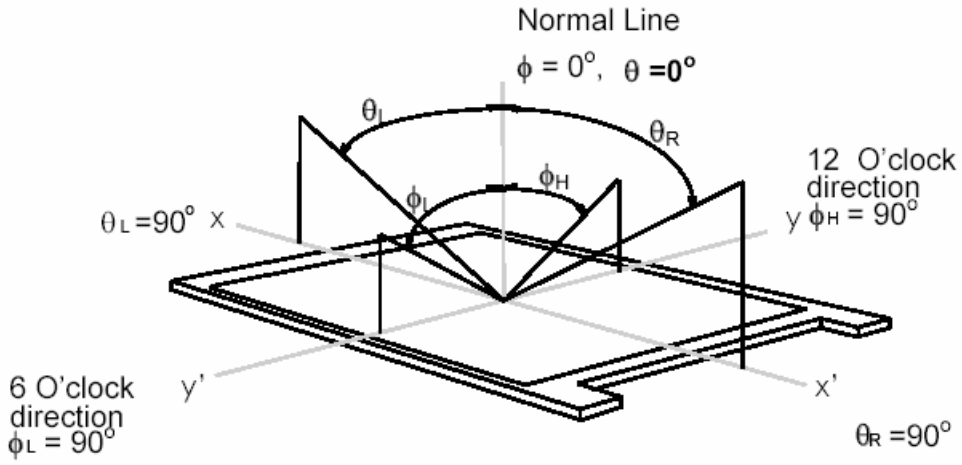


***Note 2:* Definition of Response time** measured by Westar TRD-100A

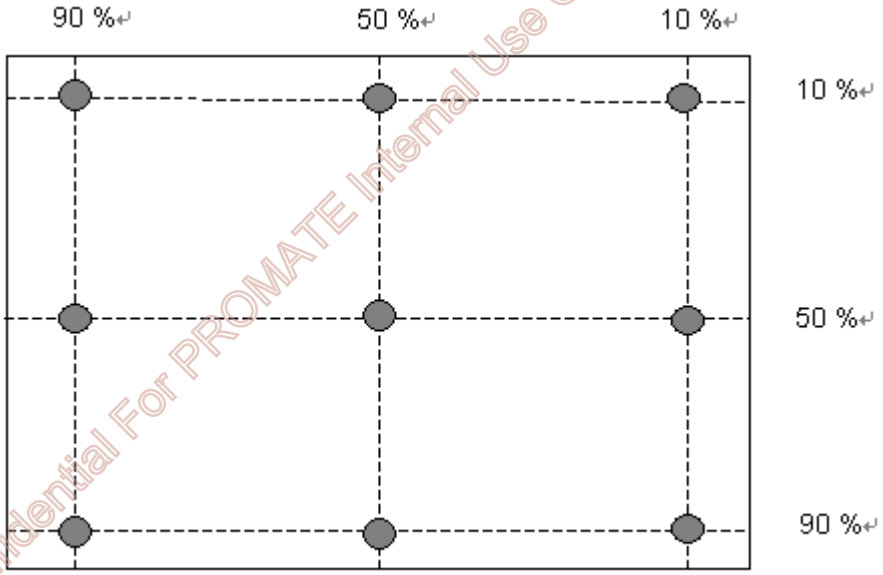
The output signals of photodetector are measured when the input signals are changed from "Black" to "White" (rising time), and from "White" to "Black "(falling time), respectively. The response time is interval between the 10% and 90% of amplitudes.



Note 3:* Definition of viewing angle*: measured by TOPCON SR-3
Viewing angle is the measurement of contrast ratio □10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



***Note 4:* Luminance uniformity of these 9 points is defined as below** measured by TOPCON SR-3



$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1 - 9)}}{\text{Maximum Luminance in 9 Points (1 - 9)}}$$

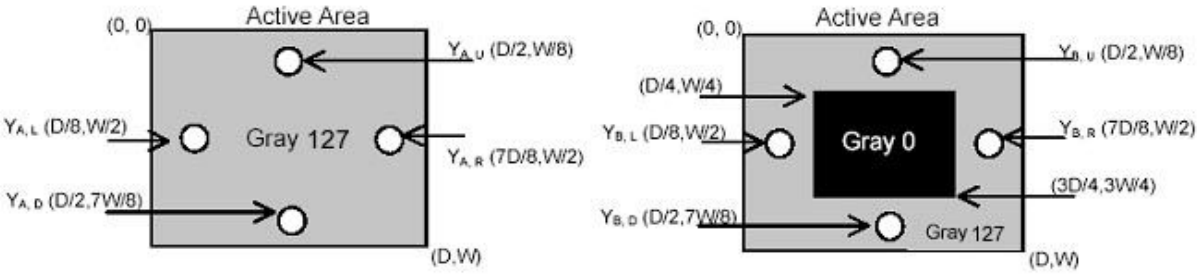
Note 5: **Crosstalk is defined as below :** measured by TOPCON SR-3

CT = | YB – YA | / YA × 100 (%)

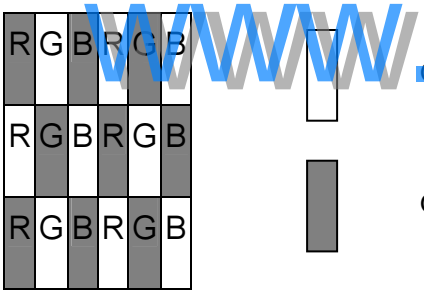
Where

YA = Luminance of measured location without gray level 0 pattern (cd/m2)

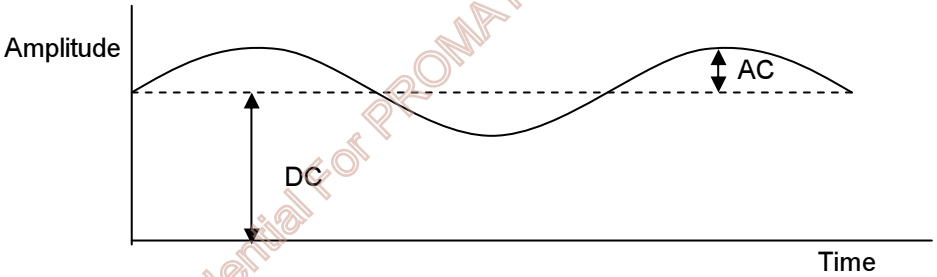
YB = Luminance of measured location with gray level 0 pattern (cd/m2)



Note 6: **Test Paterm: Subchecker Pattern** measured by TOPCON SR-3



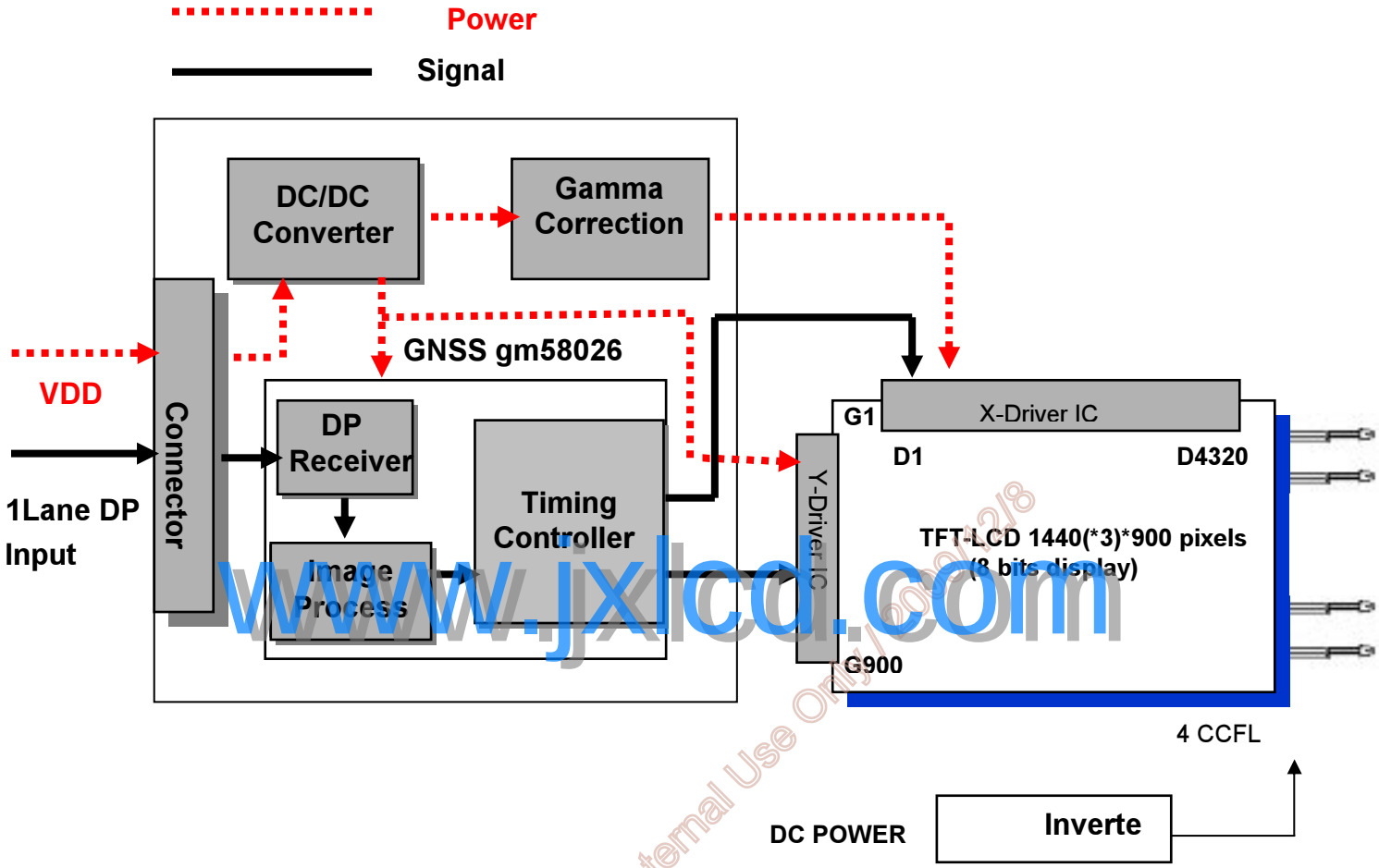
Method: Record dBV & DC value with (WESTAR)TRD-100



$$\text{Flicker (dB)} = 20\log\frac{\text{AC Level(at 30 Hz)}}{\text{DC Level}}$$

3.0 Functional Block Diagram

The following diagram shows the functional block of the 19.0 inch-wide Color TFT-LCD Module:



I/F PCB Interface:

JAE FI-XB30SSL-HF15 or compatible

Mating Type:

FI-X30HL-T (Locked Type)

FI-X30S-H (Unlocked Type)

4.0 Absolute Maximum Ratings

Absolute maximum ratings of the module is as following:

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	-0.3	5.5	[Volt]	***Note 1,2***

4.2 Backlight Unit

Item	Symbol	Min	Max	Unit	Conditions
CCFL Current	ICFL	2.0	8.0	[mA] rms	***Note 1,2***

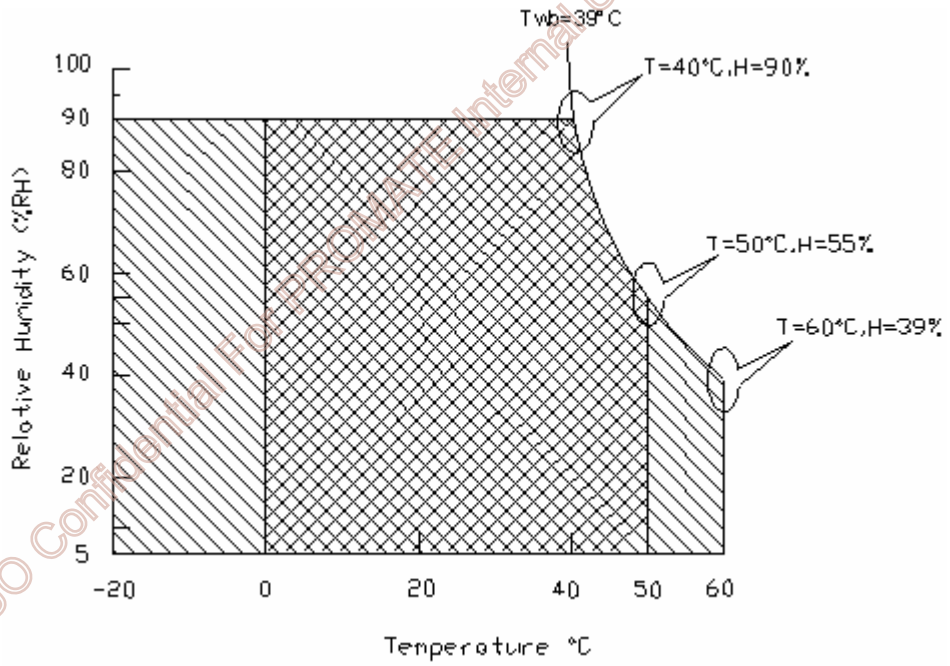
4.3 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	***Note 3***
Operation Humidity	HOP	5	90	[%RH]	
Storage Temperature	TST	-20	+60	[°C]	
Storage Humidity	HST	5	90	[%RH]	

Note 1: With in Ta (25°C)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality perfermance, please refer to AUO IIS(Incoming Inspection Standard).



Operating Range Storage Range

5.0 Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows;

Symbol	Parameter	Min	Typ	Max	Units	Condition
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	±10%
IDD	VDD current	-	1.0	1.4	[A]	VDD=5V , All Black Pattern, at 60Hz
PDD	VDD Power	-	5.0	7.7	[Watt]	VDD=5V , All Black Pattern, at 60Hz
VDDrp	Allowable logic/LCD Drive Ripple Voltage	-	-	200	[mV] p-p	VDD=5.0, All pattern at 60Hz

5.1.2 Signal Electrical Characteristics

Input signals shall be one lane Displayport operated at 2.7Gbps to support 1440×900 @ 8 bits per color.
It is recommended to refer the specifications of VESA Displayport1.1 in details.

5.2 Backlight Unit

Parameter guideline for CCFL Inverter is under stable conditions at 25□ (Room Temperature):

Parameter	Min.□	Typ.	Max.□	Unit	Condition
CCFL Operation Current(ICFL)	3.0	6.5	8.0	[mA] rms	***Note 2***
CCFL Frequency(FCFL)	40	55	80	[KHz]	***Note 3,4***
CCFL Ignition Voltage(ViCFL, Ta= 0□)	1700	-	-	[Volt] rms	***Note 5***
CCFL Ignition Voltage(ViCFL, Ta= 25□)	1250	-	-	[Volt] rms	
CCFL Operation Voltage (VCFL)	-	718 (@ 6.5mA)	848	[Volt] rms	***Note 6***
CCFL Power Consumption(PCFL)	-	20.04	22.04	[Watt]	***Note 6***
CCFL Life Time(LTCFL)	40,000	50,000	-	[Hour]	***Note 7***

Note 1: Typ. are AUO recommended design points.

*1 All of characteristics listed are measured under the condition using the AUO test inverter.

*2 In case of using an inverter other than listed, it is recommended to check the inverter carefully. Sometimes, interfering noise stripes appear on the screen, and substandard luminance or flicker at low power may happen.

*3 In designing an inverter, it is suggested to check safety circuit very carefully. Impedance of CCFL, for instance, becomes more than 1 [M ohm] when CCFL is damaged.

*4 Generally, CCFL has some amount of delay time after applying kick-off voltage. It is recommended to keep on applying kick-off voltage for 1 [Sec] until discharge.

*5 Reducing CCFL current increases CCFL discharge voltage and generally increases CCFL discharge frequency. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.

Note 2: It should be employed the inverter which has “Duty Dimming”, if IRCFL is less than 3mA.

Note 3: CCFL discharge frequency should be carefully determined to avoid interference between inverter and TFT LCD.

Note 4: The frequency range will not affect to lamp life and reliability characteristics.

Note 5: CCFL inverter should be able to give out a power that has a generating capacity of over 1,700 voltage. Lamp units need 1,700 voltage minimum for ignition.

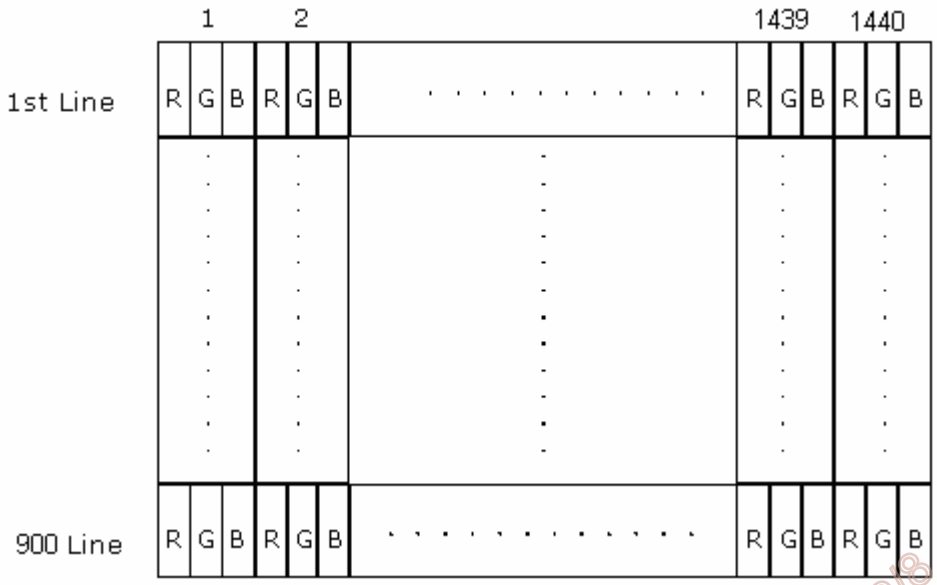
Note 6: The variance of CCFL power consumption is ±10%. Calculator value for reference (ISCFL × VCFL × 4 = PCFL)

Note 7: Definition of life: brightness becomes 50%. The typical life time of CCFL is under the condition at 6.5 mA lamp current.

6.0 Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.

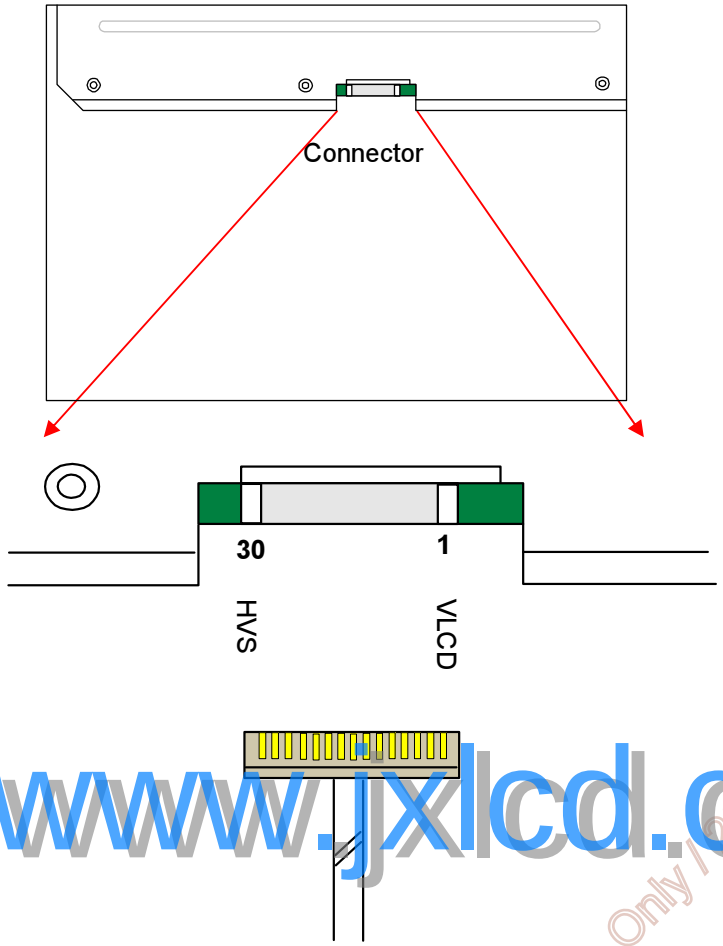


6.2 Signal Description

The following table shows the pin assignment for this module.

PIN #	NAME	In/Out	Min.	Typ.	Max.	Unit	DESCRIPTION
1	VLCD	In	4.5	5	5.5	[Volt]	LCD Power
2	VLCD	In	4.5	5	5.5	[Volt]	LCD Power
3	VLCD	In	4.5	5	5.5	[Volt]	LCD Power
4	N/C						
5	N/C						
6	GND	GND					Power Ground
7	GND	GND					Power Ground
8	GND	GND					Power Ground
9	LPM	Out					Low Power Mode
10	BKL On/Off	Out					Inverter On/Off: 3.3V On; 0V Off
11	Invt Dim	Out					PWM for Inverter
12	Keypad	In					LBADC Button detect
13	3.3V ref	Out					Keypad Ref Voltage
14	3.3V GND	GND					3.3V Keypa ref GND
15	LED 1	Out					LED 1(Green) Control
16	LED 2	Out					LED 2(Orange) Control
17	H_GND	In					High Speed GND, DP Interface
18	Lane 1_N	In					DP Main Link CH-N
19	Lane 1_P	In					DP Main Link CH-P
20	H_GND	In					DP Ground
21	Lane_0_N	In					DP Main Link CH-N
22	Lane_0_P	In					DP Main Link CH-P
23	H_GND	In					High Speed GND, DP Interface
24	AUX_CH_P	In/Out					DP AUX CH-P
25	AUX_CH_N	In/Out					DP AUX CH-N
26	H_GND	In					High Speed GND, DP Interface
27	HPD	Out					Hot Plug Detect
28	N/C						
29	N/C						
30	HVS	In					High Voltage Stress Control

Note1: Start from left side



6.3 Timing Characteristics

This module only support two modes – Safe mode and Native mode.

6.3.1 Safe mode: 640×480@60Hz;

GPU always detects the panel native resolution through the AUX CH as stored in the EDID and scales the desktop output to fit into the LCD native video format. However, some data formats may not be supported because the driver is damaged or not loaded. The LCD needs to display the safe mode display either from the top left corner of the screen, centered on the active center of LCD screen or Scaled to fill screen.

At this time it is envisioned most controllers will scale the image to full or near full screen.

Timing Name	=	**640 x 480 @ 60Hz;**					
Hor Pixels	=	**640;**	// Pixels				
Ver Pixels	=	**480;**	// Lines				
Hor Frequency	=	31.469;	// KHz	=	31.8 usec	/	line
Ver Frequency	=	59.940;	// Hz	=	16.7 msec	/	frame
Pixel Clock	=	**25.175;**	// MHz	=	39.7 nsec	±	0.5%
Character Width	=	**8;**	// Pixels	=	317.8 nsec		
Scan Type	=	**NONINTERLACED;**			// H Phase	=	2.0 %
Hor Sync Polarity	=	NEGATIVE;	// HBlank	=	18.0% of HTotal		
Ver Sync Polarity	=	NEGATIVE;	// VBlank	=	5.5% of VTotal		
Hor Total Time	=	31.778;	// (usec)	=	100 chars	=	800 Pixels
Hor Addr Time	=	25.422;	// (usec)	=	80 chars	=	640 Pixels
Hor Blank Start	=	25.740;	// (usec)	=	81 chars	=	648 Pixels
Hor Blank Time	=	5.720;	// (usec)	=	18 chars	=	144 Pixels
Hor Sync Start	=	26.058;	// (usec)	=	82 chars	=	656 Pixels
// H Right Border	=	0.318;	// (usec)	=	**1** chars	=	8 Pixels
// H Front Porch	=	0.318;	// (usec)	=	**1** chars	=	8 Pixels
Hor Sync Time	=	3.813;	// (usec)	=	**12** chars	=	96 Pixels
// H Back Porch	=	1.589;	// (usec)	=	**5** chars	=	40 Pixels
// H Left Border	=	0.318;	// (usec)	=	**1** chars	=	8 Pixels
Ver Total Time	=	16.683;	// (msec)	=	525 lines		HT – (1.06xHA)
Ver Addr Time	=	15.253;	// (msec)	=	480 lines		= 4.83
Ver Blank Start	=	15.507;	// (msec)	=	488 lines		
Ver Blank Time	=	0.922;	// (msec)	=	29 lines		
Ver Sync Start	=	15.571;	// (msec)	=	490 lines		
// V Bottom Border	=	0.254;	// (msec)	=	**8** lines		
// V Front Porch	=	0.064;	// (msec)	=	**2** lines		
Ver Sync Time	=	0.064;	// (msec)	=	**2** lines		
// V Back Porch	=	0.794;	// (msec)	=	**25** lines		
// V Top Border	=	0.254;	// (msec)	=	**8** lines		

6.3.2 Native mode:

(1) 1440×900@60Hz – Reduce Blanking

Format: 1440 x 900 @ 60 Hz - Reduced Blanking

VESA CVT Name: 1.30MA-R

HOR PIXELS	1,440	PIXELS		
VER PIXELS	900	LINES		
HOR FREQUENCY	55.469	kHz		
ACTUAL VER FREQUENCY	59.901	Hz		
PIXEL CLOCK	88.750	MHz		1 PIXELS
CHARACTER WIDTH	90.141	ns		8 PIXELS
SCAN TYPE	NON-INT			
ASPECT RATIO	16:10			
HSYNC POLARITY	POSITIVE			
VSYNC POLARITY	NEGATIVE			
HOR TOTAL	18.028	us	200 CHARS	1,600 PIXELS
HOR ADDR	16.225	us	180 CHARS	1,440 PIXELS
HOR BLANK	1.803	us	20 CHARS	160 PIXELS
HOR BLANK+MARGIN	1.803	us	20 CHARS	160 PIXELS
PREDICTED H BLANK DUTY CYCLE (from GTF blanking formula)	24.598	%		
ACTUAL HOR BLANK DUTY CYCLE	10.000	%		
ACT. HOR BLNK+MARGIN DUTY CYCLE	10.000	%		
H LEFT MARGIN	0.000	us	0 CHARS	0 PIXELS
H FRONT PORCH	0.541	us	6 CHARS	48 PIXELS
HOR SYNC	0.361	us	4 CHARS	32 PIXELS
H BACK PORCH	0.901	us	10 CHARS	80 PIXELS
H RIGHT MARGIN	0.000	us	0 CHARS	0 PIXELS
VER TOTAL	16.694	ms		926.0 LINES
VER ADDR	16.225	ms		900.0 LINES
VER BLANK	0.469	ms		26.0 LINES
V TOP MARGIN	0.000	us		0.0 LINES
V FRONT PORCH	54.085	us		3.0 LINES
VER SYNC	108.169	us		6.0 LINES
V BACK PORCH	306.479	us		17.0 LINES
V BOTTOM MARGIN	0.000	us		0.0 LINES

(2) 800×600@60Hz

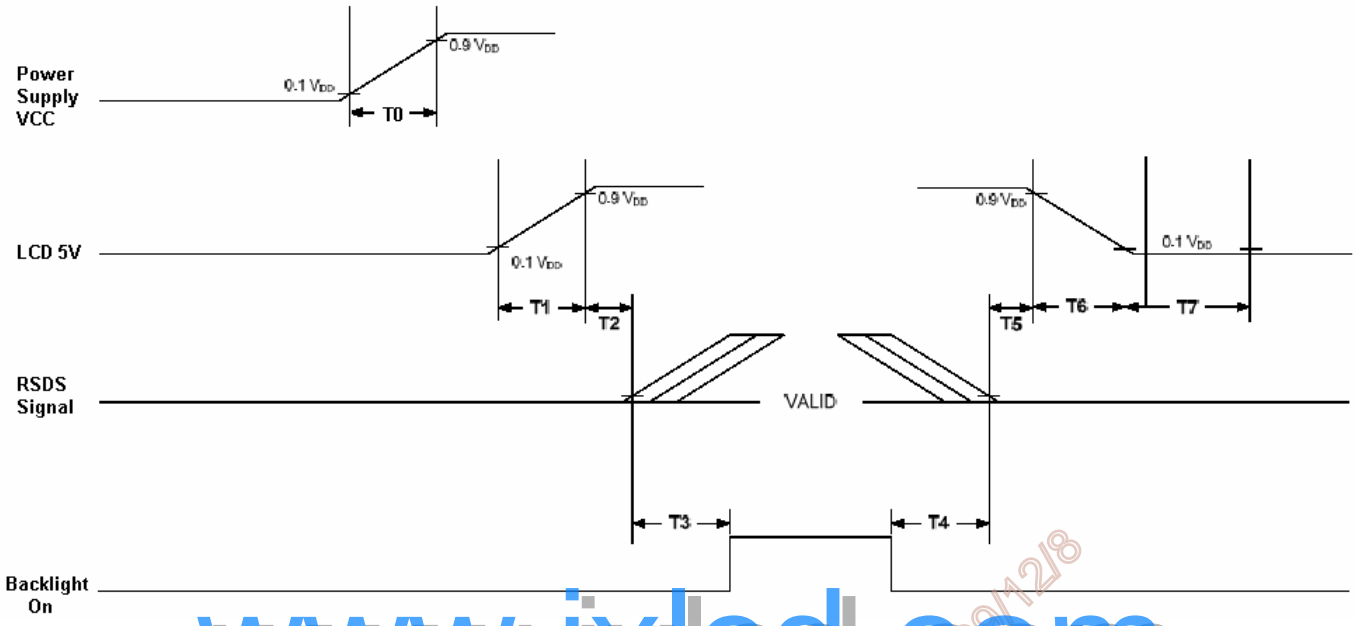
Timing Name	= **800 x 600 @ 60Hz;**					
Hor Pixels	= **800;**	// Pixels				
Ver Pixels	= **600;**	// Lines				
Hor Frequency	= 37.879;	// kHz	=	26.4 usec	/	line
Ver Frequency	= 60.317;	// Hz	=	16.6 msec	/	frame
Pixel Clock	= **40.000;**	// MHz	=	25.0 nsec		±0.5%
Character Width	= **8;**	// Pixels	=	200.0 nsec		
Scan Type	= **NONINTERLACED;**			// H Phase	=	2.3 %
Hor Sync Polarity	= **POSITIVE;**	// HBlank	=	24.2% of HTotal		
Ver Sync Polarity	= **POSITIVE;**	// VBlank	=	4.5% of VTotal		
Hor Total Time	= 26.400;	// (usec)	=	132 chars	=	1056 Pixels
Hor Addr Time	= 20.000;	// (usec)	=	100 chars	=	800 Pixels
Hor Blank Start	= 20.000;	// (usec)	=	100 chars	=	800 Pixels
Hor Blank Time	= 6.400;	// (usec)	=	32 chars	=	256 Pixels
Hor Sync Start	= 21.000;	// (usec)	=	105 chars	=	840 Pixels
// H Right Border	= 0.000;	// (usec)	=	**0** chars	=	0 Pixels
// H Front Porch	= 1.000;	// (usec)	=	**5** chars	=	40 Pixels
Hor Sync Time	= 3.200;	// (usec)	=	**16** chars	=	128 Pixels
// H Back Porch	= 2.200;	// (usec)	=	**11** chars	=	88 Pixels
// H Left Border	= 0.000;	// (usec)	=	**0** chars	=	0 Pixels
Ver Total Time	= 16.579;	// (msec)	=	628 lines		HT – (1.06xHA)
Ver Addr Time	= 15.840;	// (msec)	=	600 lines		= 52
Ver Blank Start	= 15.840;	// (msec)	=	600 lines		
Ver Blank Time	= 0.739;	// (msec)	=	28 lines		
Ver Sync Start	= 15.866;	// (msec)	=	601 lines		
// V Bottom Border	= 0.000;	// (msec)	=	**0** lines		
// V Front Porch	= 0.026;	// (msec)	=	**1** lines		
Ver Sync Time	= 0.106;	// (msec)	=	**4** lines		
// V Back Porch	= 0.607;	// (msec)	=	**23** lines		
// V Top Border	= 0.000;	// (msec)	=	**0** lines		

6.4 EEPROM Memory Placement – 4K

Address	Name	7	6	5	4	3	2	1	0
0	Customer Used	Customer Definition							
255									
256	T-CON Used	T-CON Definition							
383									
384	Mode Enable 2	**CM enable**							
385	Color Matrix	Coef_11 value [7:0]							
386		Coef_11 value [10:8]							
387		Color Matrix setting Coef_21~33 [8][11]							
388		Offset 1 value [7:0]							
389		Offset 1 value [9:8]							
390		Color Matrix setting [2][10]							
:									
509	Reserved	Checksum[7:0]							
510		Checksum[15:8]							
511									CHECKSUM_OK

6.5 Power ON/OFF Sequence

Vin power and lamp on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when Vin is off.



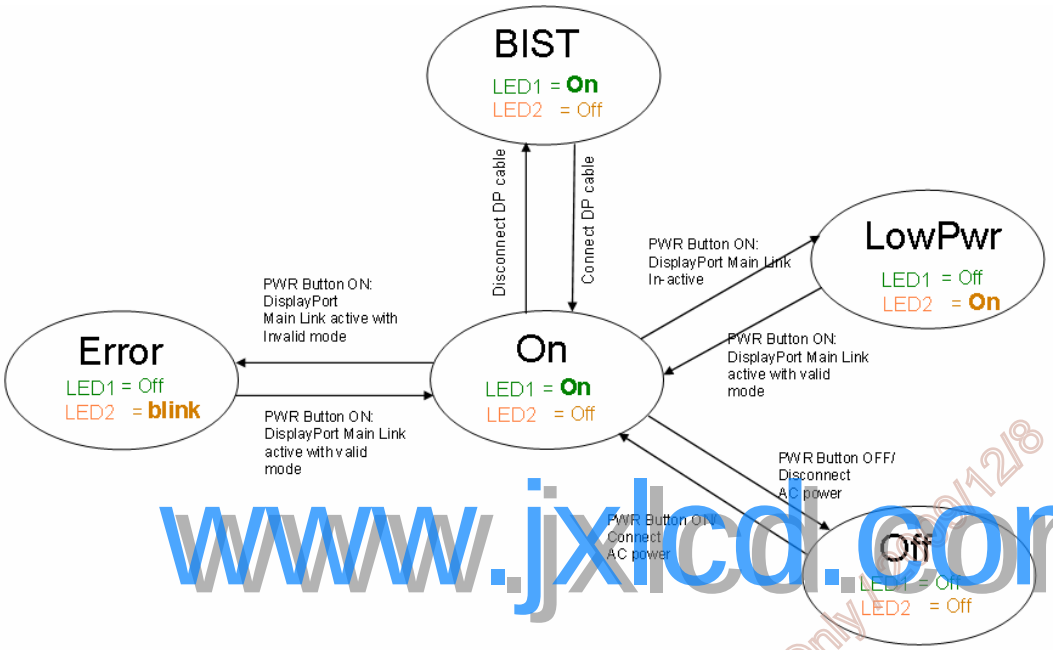
Symbol	Values		Unit
	Min	Max	
T0	0.5	25	[ms]
T1	-	25	[ms]
T2	-	50	[ms]
T3	500	-	[ms]
T4	200	-	[ms]
T5	-	50	[ms]
T6	-	1000	[ms]
T7	1000	-	[ms]

7.0 Mode States

7.1 Kick-Off Condition

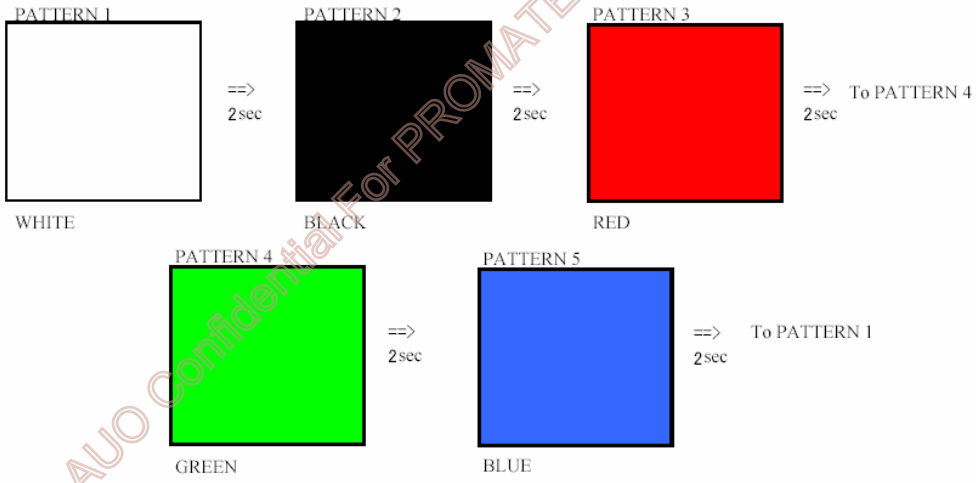
While operating the LCD module, it will start from checking the AC power status. Then, it will receive MCCS command SET_POWER “Sink Control register of DPCD (Displayport Configuration Data)”

Base on the following diagram to do the mode states switch.



7.2 BIST Mode

BIST mode will activate when video cable is disconnected from PC and power up button activated. The interval time between each pattern is 2 sec.



7.3 Low Power Mode

Low power mode (LowPwr) will be kicked off follow the following conditions:

1. Check AC power status
2. Receive MCCS command SET_POWER
3. Main link power down, wait 15sec and enter to the LowPwr (low power-down state)
4. Turn-on the LED2 ON
5. Turn off LCD Backlight

7.4 Error Mode (Failure Detection Mode)

When LCD inputs detect abnormal (non-VESA standard timing), LCD screen should display black.

8.0 Connector & Pin Assignment

Physical interface is described as for the connector on module.
These connectors are capable of accommodating the following signals and will be following components.

8.1 TFT LCD Module

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	JAE or compatible
Type Part Number	FI-XB30SSL-HF15
Mating Housing Part Number	FI-X30HL-T (Locked Type)
	FI-X30S-H (Unlocked Type)

8.1.1 Pin Assignment

Pin#	Signal Name	Pin#	Signal Name
1	VLCD	2	VLCD
3	VLCD	4	N/C
5	N/C	6	GND
7	GND	8	GND
9	LPM	10	BKL On/Off
11	Invt Dim	12	Keypad
13	3.3v ref	14	3.3v GND
15	LED 1	16	LED 2
17	H_GND	18	Lane 1_N
19	Lane 1_P	20	H_GND
21	Lane 0_N	22	Lane 0_P
23	H_GND	24	AUX_CH_P
25	AUX_CH_N	26	H_GND
27	HPD	28	N/C
29	N/C	30	HVS

8.2 Backlight Unit

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

Connector Name / Designation	Lamp Connector / Backlight lamp
Manufacturer	YEON HO
Type Part Number	35001HS-02L
Mating Type Part Number	35001WR-02LP or equivalent

8.2.1 Signal for Lamp connector

	Connector No.	Pin No.	Input	Color	Function
Upper	CN1	1	Hot1	Blue	High Voltage (Lamp 1)
		2	Cold1	Black	Low Voltage (Lamp 1)
	CN2	1	Hot2	Pink	High Voltage (Lamp 2)
		2	Cold2	White	Low Voltage (Lamp 2)

	Connector No.	Pin No.	Input	Color	Function
Lower	CN3	1	Hot1	Blue	High Voltage (Lamp 3)
		2	Cold1	Black	Low Voltage (Lamp 3)
	CN4	1	Hot2	Pink	High Voltage (Lamp 4)
		2	Cold2	White	Low Voltage (Lamp 4)

9.0 Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50□, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50□, 50%RH, 300hours	
Low Temperature Operation (LTO)	Ta= 0□, 300hours	
High Temperature Storage (HTS)	Ta= 60□, 300hours	
Low Temperature Storage (LTS)	Ta= -20□, 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave: Half-sine Frequency: 10 - 200 - 10 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Drop Test	Height: 60 cm, package test	
Thermal Shock Test (TST)	-20□/30min, 60□/30min, 100 cycles	***Note:1***
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point. Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	***Note: 2***
Altitude Test	Operation:10,000 ft Non-Operation:30,000 ft	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20℃ to 60℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

10.0 Shipping Label

The label is on the panel as shown below:

11.0 Mechanical Characteristics