

Model Name: P650QVF03.0

Issue Date : 2018/02/07

() Preliminary Specifications

(*) Final Specifications

Customer Signature	Date	AUO	Date
Approved By		Approval By PM Director Jacky Su <i>Jacky Su</i>	
Note		Reviewed By RD Director Eugene CC Chen <i>陳品川</i>	
		Reviewed By Project Leader Jerry Lin <i>JERRY Lin</i>	
		Prepared By PM FC Tsao <i>FC Tsao</i>	

Contents

1. General Description	4
1.1. Display Characteristics.....	4
1.2. Optical Characteristics	5
1.3. Mechanical Characteristics	8
1.3.1. Placement Suggestions.....	8
2. Absolute Maximum Ratings	12
3. Electrical Specification	13
3.1. Electrical Characteristics.....	13
3.1.1 Input Power.....	13
3.3 Input Data Format	16
3.3.2 Color Input Data Reference	17
3.4 Signal Timing Specification	18
3.4.1.2 Signal Timing Waveforms.....	20
3.4.2.1 V by One.....	21
3.4.3 Power Sequence for LCD	24
3.5 Backlight Specification.....	25
3.5.1 Electrical specification	25
3.5.2 Input Pin Assignment.....	26
3.5.3 Power Sequence for Backlight.....	29
3.5.4 LED Operating Life Time	30
4. Reliability Test Items	31
5. International Standard	32
5.1. Safety	32
5.2. EMC	32
6. Packing	33
6.1. Definition of Label.....	33
6.2. Packing Methods.....	34
6.3. Pallet and Shipment Information	35
7. Precautions	36
7.1. Mounting Precautions.....	36
7.2. Operating Precautions.....	36
7.3. Operating Condition for Public Information Display	37
7.4. Electrostatic Discharge Control	37
7.5. Precautions for Strong Light Exposure	37
7.6. Storage.....	38
7.7. Handling Precautions for Protection Film	38

1. General Description

This specification applies to the 65 inch Color TFT-LCD Module P650QVF03.0. This LCD module has a TFT active matrix type liquid crystal panel 3840x2160 pixels, and diagonal size of 64.5 inch. This module supports 3840x2160 mode. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 10-bit gray scale signal for each dot.

The P650QVF03.0 has been designed to apply the 10-bit 8 Lanes V by one interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

* General Information

1.1. Display Characteristics

Items	Specification	Unit	Note
Active Screen Size	64.53	inch	
Display Area	1428.48 (H) x 803.52 (V)	mm	
Outline Dimension	1450.38(H) x 825.42(V) x 23(D)	mm	D: front bezel to back bezel
Driver Element	a-Si TFT active matrix		
Bezel Opening	1430.78 x 805.82	mm	
Display Colors	10 bit	Colors	
Number of Pixels	3840x2160	Pixel	
Pixel Pitch	0.372 (H) x 0.372(W)	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Anti-glare, 3H		Haze=44%
Rotate Function	Unachievable		Note 1
Display Orientation	Landscape & Portrait		Note 2

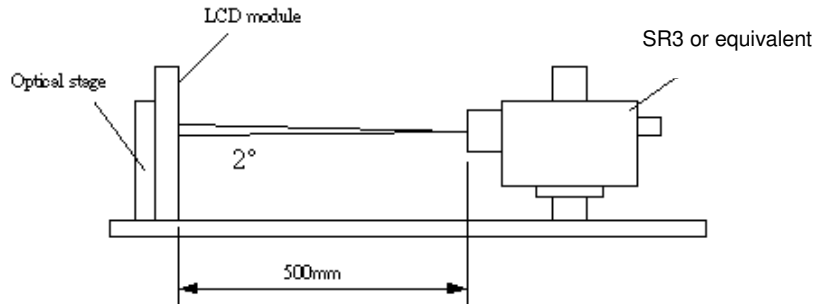
Note 1: Rotate Function refers to LCD display could be able to rotate. This function does not work in this model.

Note 2: Please refer to 1.3.1 Placement Suggestions.

1.2. Optical Characteristics

Optical characteristics are determined on the back-light of measured unit is 'ON' and stabilized after 45~60 minutes in a dark environment at 25°C. The values are specified at 50cm distance from the LCD surface at a viewing angle of ϕ and θ equal to 0°.

Fig.1 presents additional information concerning the measurement equipment and method.



Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max		
Contrast Ratio	CR	3200	4000	--		1
Surface Luminance (White)	$L_{WH}(2D)$	560	700	--	cd/m ²	2
Luminance Variation	$\delta_{WHITE(9P)}$	--	--	1.3		3
Response Time (G to G)	T_Y	--	8	--	ms	4
Color Gamut	NTSC		72		%	
Color Coordinates						
Red	R_X	Typ.-0.03	0.649	Typ.+0.03		
	R_Y		0.332			
Green	G_X		0.310			
	G_Y		0.614			
Blue	B_X		0.155			
	B_Y		0.068			
White	W_X		0.28			
	W_Y		0.29			
Viewing Angle						
x axis, right($\phi=0^\circ$)	θ_r	--	89	--	degree	5
x axis, left($\phi=180^\circ$)	θ_l	--	89	--	degree	
y axis, up($\phi=90^\circ$)	θ_u	--	89	--	degree	
y axis, down ($\phi=270^\circ$)	θ_d	--	89	--	degree	

Note:

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

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{\text{on5}}}{\text{Surface Luminance of } L_{\text{off5}}}$$

2. Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2. LED input $V_{\text{DDB}} = 24\text{V}$, $I_{\text{DDB}} = 10.5\text{A}$, $L_{\text{WH}} = L_{\text{on5}}$ where L_{on5} is the luminance with all pixels displaying white at center 5 location.

3. The variation in surface luminance, δ_{WHITE} is defined (center of Screen) as:

$$\delta_{\text{WHITE(9P)}} = \frac{\text{Maximum}(L_{\text{on1}}, L_{\text{on2}}, \dots, L_{\text{on9}})}{\text{Minimum}(L_{\text{on1}}, L_{\text{on2}}, \dots, L_{\text{on9}})}$$

4. Response time T_{γ} is the average time required for display transition by switching the input signal for five luminance ratio (0%, 25%, 50%, 75%, 100% brightness matrix) and is based on $F_v = 60\text{Hz}$ to optimize.

Measured Response Time		Target				
		0%	25%	50%	75%	100%
Start	0%		0% to 25%	0% to 50%	0% to 75%	0% to 100%
	25%	25% to 0%		25% to 50%	25% to 75%	25% to 100%
	50%	50% to 0%	50% to 25%		50% to 75%	50% to 100%
	75%	75% to 0%	75% to 25%	75% to 50%		75% to 100%
	100%	100% to 0%	100% to 25%	100% to 50%	100% to 75%	

T_{γ} is determined by 10% to 90% brightness difference of rising or falling period. (As illustrated)

The response time is defined as the following figure and shall be measured by switching the input signal for “any level of gray(bright)” and “any level of gray(dark)”.

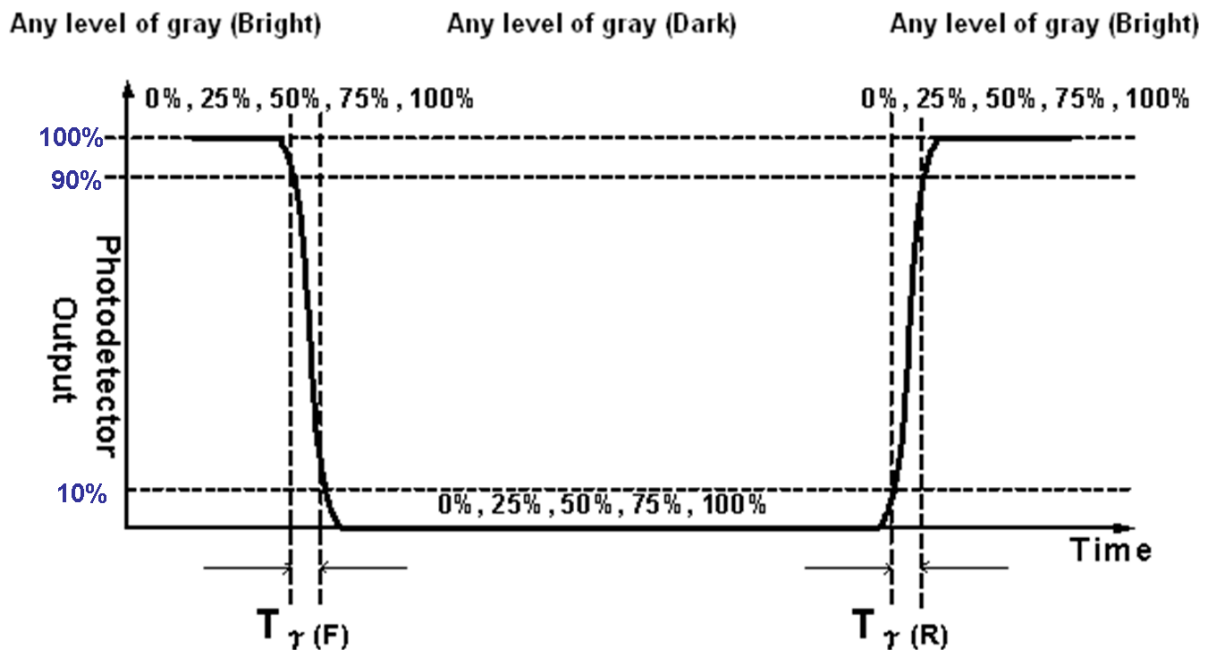
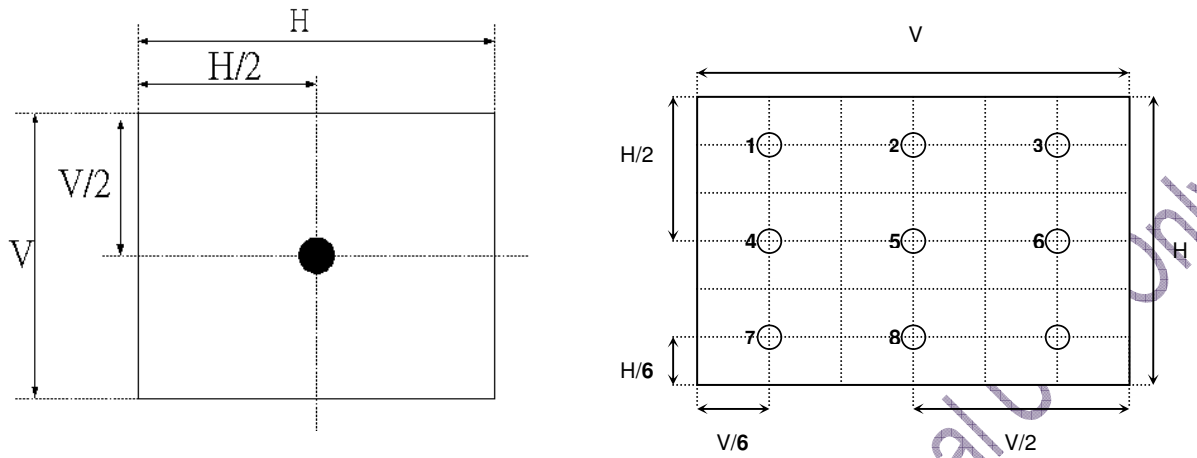
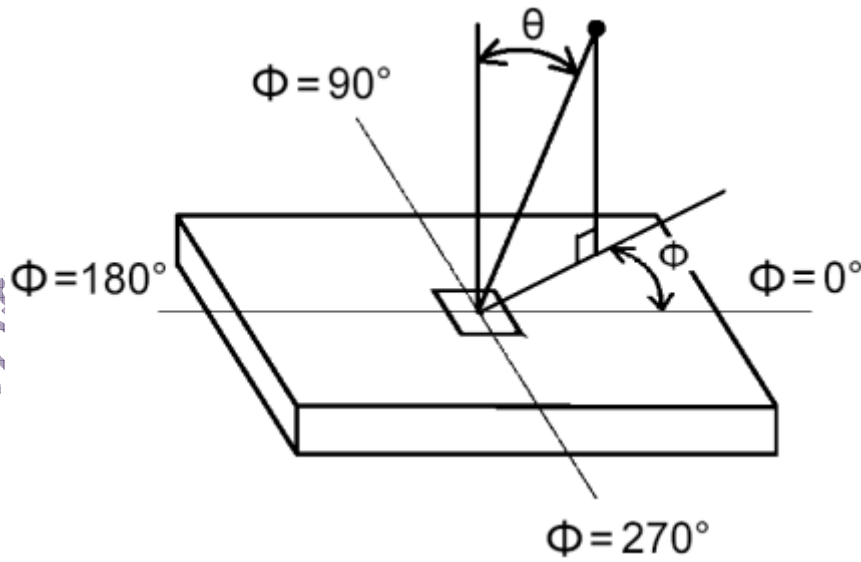


FIG. 2 Luminance



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 FIG3.

FIG.3 Viewing Angle



1.3. Mechanical Characteristics

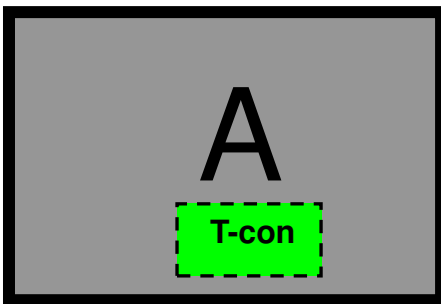
The contents provide general mechanical characteristics for the model P650QVF03.0. In addition, the figures in the next page are detailed mechanical drawing of the LCD.

Item	Dimension	Unit	Note	
Outline Dimension	Horizontal	1450.38	mm	
	Vertical	825.42	mm	
	Depth (Dmin)	23	mm	front bezel to back bezel
	Depth (Dmax)	41.4	mm	to wall mount
Weight	24500	G	w/ DB	

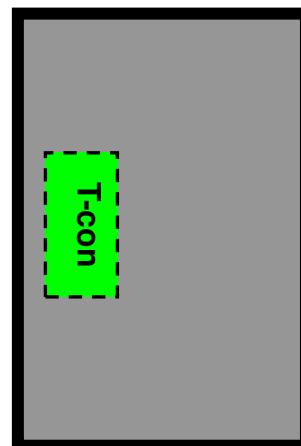
1.3.1. Placement Suggestions

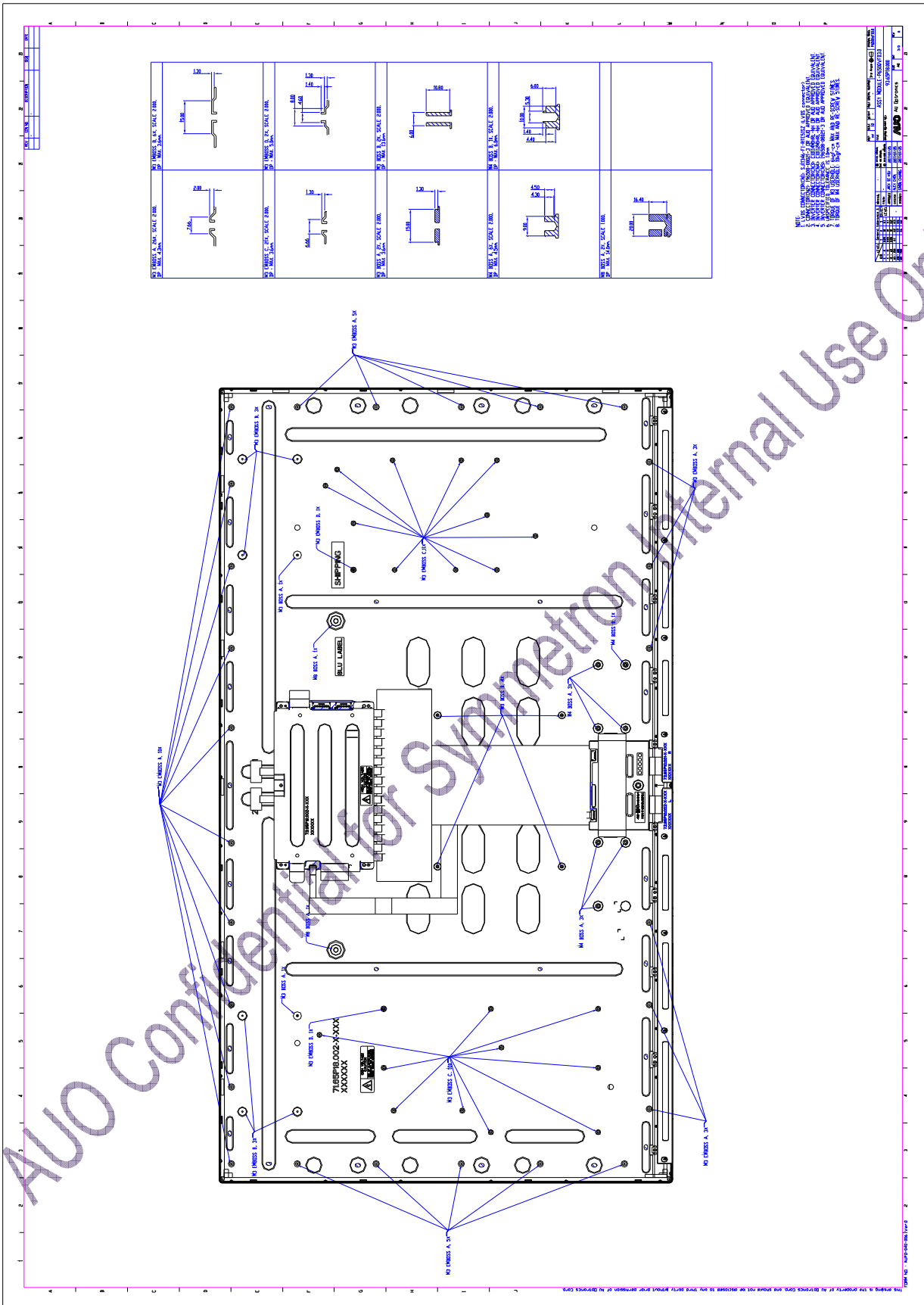
1. Landscape Mode: The default placement is T-Con Side on the lower side and the image is shown upright via viewing from the front.
2. Portrait Mode: The default placement is that T-Con side has to be placed on the left side via viewing from the front.

Landscape (Front view)



Portrait (Front view)





2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit

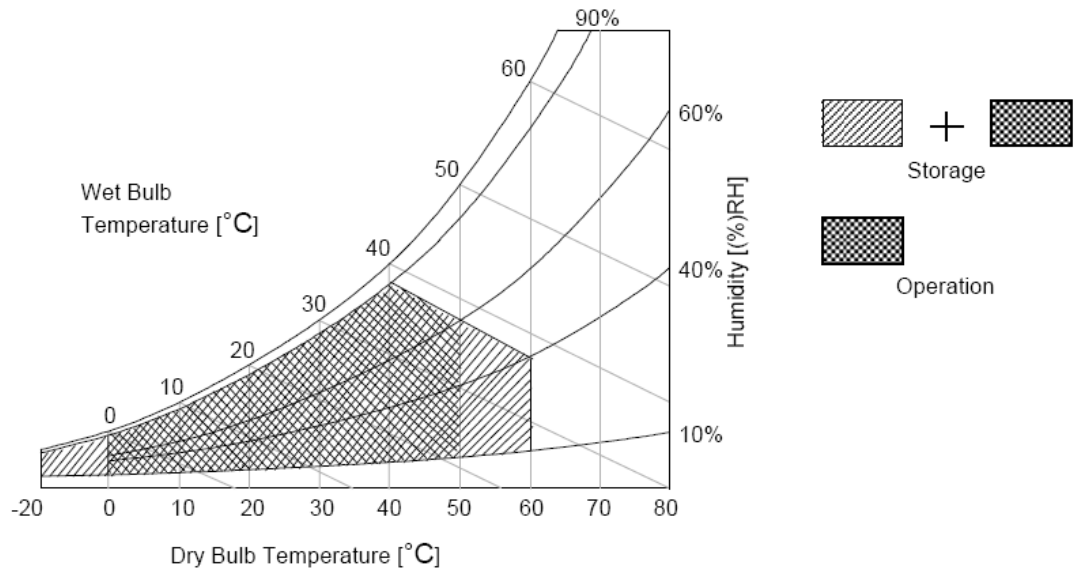
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vcc	-0.3	14	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	4	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 2
Panel Surface Temperature	PST	---	65	[°C]	Note 3

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39°C and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 3: Surface temperature is measured at 50°C Dry condition



3. Electrical Specification

The P650QVF03.0 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The other is to power Back Light Unit.

3.1. Electrical Characteristics

3.1.1 Input Power

Item	Symbol	Min.	Typ.	Max	Unit	Note
Power Supply Input Voltage	V_{DD}	10.8	12	13.2	V	1
Power Supply Input Current	Black pattern	-	1.25	1.5	A	2
	White pattern	-	3.4	4.08	A	
	H-strip pattern	-	3.28	3.94	A	
Power Consumption	Black pattern	-	15	18	Watt	2
	White pattern	-	40.8	49.0	Watt	
	H-strip pattern	-	39.4	47.3	Watt	
Inrush Current	I_{RUSH}	--	--	5	A	3

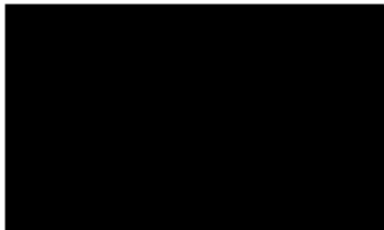
Note1. The ripple voltage should be fewer than 5% of VDD.

Note2. Test Condition:

(1) $V_{DD} = 12.0V$, (2) $F_v = 60Hz$, (3) $F_{clk} = 74.25MHz$, (4) Temperature = 25 °C

(5) Power dissipation check pattern. (Only for power design)

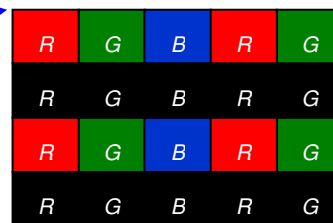
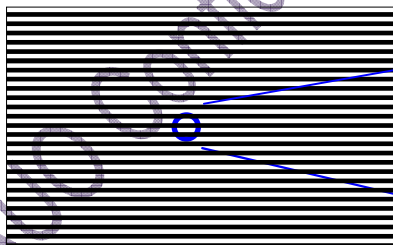
a. Black pattern



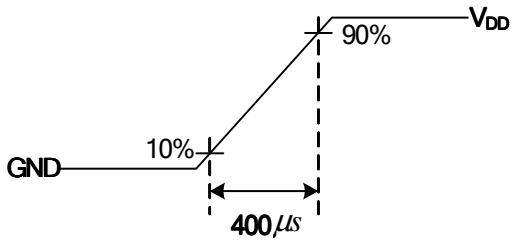
b. White pattern



c. H-Strip pattern



Note3. Measurement condition : Rising time = 400us



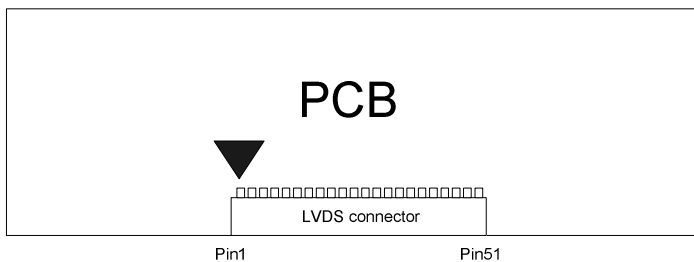
AUO Confidential for Symmetron Internal Use Only

3.2 input Connections

- LCD connector: (JAE) SJ11346-FI-RTE51SZ-HF

PIN	Symbol	Description	Note	PIN	Symbol	Description	Note
1	VDD	12V_PW		26	LCOKN	Vx1 LOCK	
2	VDD	12V_PW		27	GND	Ground	
3	VDD	12V_PW		28	RxN0	Vx1 lane 0	
4	VDD	12V_PW		29	RxP0	Vx1 lane 0	
5	VDD	12V_PW		30	GND	Ground	
6	VDD	12V_PW		31	RxN1	Vx1 lane 1	
7	VDD	12V_PW		32	RxP1	Vx1 lane 1	
8	VDD	12V_PW		33	GND	Ground	
9	NC	No connection	2	34	RxN2	Vx1 lane 2	
10	GND	Ground		35	RxP2	Vx1 lane2	
11	GND	Ground		36	GND	Ground	
12	GND	Ground		37	RxN3	Vx1 lane 3	
13	GND	Ground		38	RxP3	Vx1 lane 3	
14	GND	Ground		39	GND	Ground	
15	LDC	Local Dimming ON/OFF		40	RxN4	Vx1 lane 4	
16	NC	No connection	2	41	RxP4	Vx1 lane 4	
17	NC	No connection	2	42	GND	Ground	
18	NC	No connection	2	43	RxN5	Vx1 lane 5	
19	NC	No connection	2	44	RxP5	Vx1 lane 5	
20	NC	No connection	2	45	GND	Ground	
21	GND	Ground		46	RxN6	Vx1 lane 6	
22	NC	No connection	2	47	RxP6	Vx1 lane 6	
23	NC	No connection	2	48	GND	Ground	
24	GND	Ground		49	RxN7	Vx1 lane 7	
25	HTPDN	Vx1 HTPDN		50	RxP7	Vx1 lane 7	
				51	GND	Ground	

Note1. Pin number start from the left side as the following figure.



Note2. Please leave this pin unoccupied. It can not be connected by any signal (Low/GND/High).

3.3 Input Data Format

3.3.1 V by one Data mapping

Mode	Packer input & Unpacker output		30bpp RGB /YCbCr444 (10bit)
4byte mode	Byte0	D[0]	R/Cr[2]
		D[1]	R/Cr[3]
		D[2]	R/Cr[4]
		D[3]	R/Cr[5]
		D[4]	R/Cr[6]
		D[5]	R/Cr[7]
		D[6]	R/Cr[8]
		D[7]	R/Cr[9]
	Byte1	D[8]	G/Y[2]
		D[9]	G/Y[3]
		D[10]	G/Y[4]
		D[11]	G/Y[5]
		D[12]	G/Y[6]
		D[13]	G/Y[7]
		D[14]	G/Y[8]
		D[15]	G/Y[9]
	Byte2	D[16]	B/Cb[2]
		D[17]	B/Cb[3]
		D[18]	B/Cb[4]
		D[19]	B/Cb[5]
		D[20]	B/Cb[6]
		D[21]	B/Cb[7]
		D[22]	B/Cb[8]
		D[23]	B/Cb[9]
	Byte3	D[24]	--
		D[25]	--
		D[26]	B/Cb[0]
		D[27]	B/Cb[1]
D[28]		G/Y[0]	
D[29]		G/Y[1]	
D[30]		R/Cr[0]	
D[31]		R/Cr[1]	

3.3.2 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 10 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 DATA REFERENCE

Color		Input Color Data																													
		RED										GREEN										BLUE									
		MSB					LSB					MSB					LSB					MSB				LSB					
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	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	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	RED(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RED(001)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

	RED(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RED(1023)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	GREEN(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	GREEN(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	

	GREEN(1022)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
	GREEN(1023)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
B	BLUE(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	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	0	0	0	0	0	1	

	BLUE(1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	
	BLUE(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	

3.4 Signal Timing Specification

3.4.1 Input Timing

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

3.4.1.1 Timing table

Timing Table (DE only Mode)

60Hz

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	2250	2250	2360	Th
	Active	Tdisp (v)	2160			
	Blanking	Tblk (v)	90	90	200	Th
Horizontal Section	Period	Th	550	550	600	Tclk
	Active	Tdisp (h)	480			
	Blanking	Tblk (h)	70	70	120	Tclk
Clock	Frequency	Fclk=1/Tclk	73.359	74.250	75.092	MHz
Vertical Frequency	Frequency	Fv	59	60	60.69	Hz
Horizontal Frequency	Frequency	Fh	122.27	135.00	136.53	KHz

50Hz

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	2200	2250	2360	Th
	Active	Tdisp (v)	2160			
	Blanking	Tblk (v)	40	90	200	Th
Horizontal Section	Period	Th	600	660	680	Tclk
	Active	Tdisp (h)	480			
	Blanking	Tblk (h)	120	180	200	Tclk
Clock	Frequency	Fclk=1/Tclk	73.359	74.250	75.092	MHz
Vertical Frequency	Frequency	Fv	49	50	51	Hz
Horizontal Frequency	Frequency	Fh	107.88	112.50	125.15	KHz

48Hz

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	2200	2252	2360	Th
	Active	Tdisp (v)	2160			
	Blanking	Tblk (v)	40	92	200	Th
Horizontal Section	Period	Th	600	687	700	Tclk
	Active	Tdisp (h)	480			
	Blanking	Tblk (h)	120	207	220	Tclk
Clock	Frequency	Fclk=1/Tclk	73.359	74.250	75.092	MHz
Vertical Frequency	Frequency	Fv	47	47.99	49	Hz
Horizontal Frequency	Frequency	Fh	104.80	108.08	125.15	KHz

Note1. Display position is specific by the rise of DE signal only.

Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

Note2. Vertical display position is specified by the rise of DE after a “Low” level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of 1st DE is displayed at the top line of screen

Note3. If a period of DE “High” is less than 3840 DCLK or less than 2160 lines, the rest of the screen displays black.

Note4. The display position does not fit to the screen if a period of DE “High” and the effective data period do not synchronize with each other.

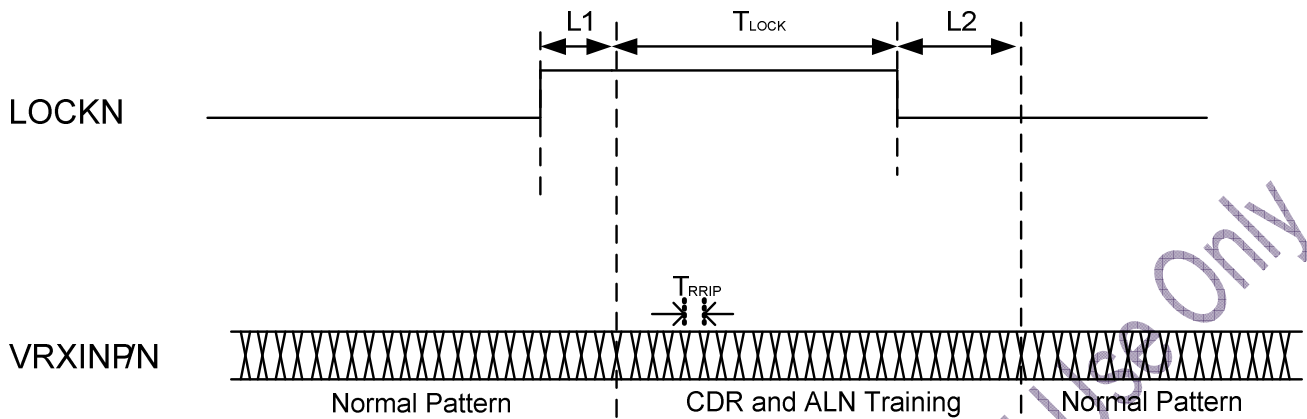
3.4.2 Input interface characteristics

3.4.2.1 V by One

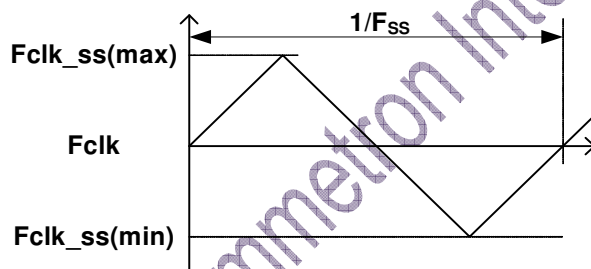
Item		Symbol	Min.	Typ.	Max	Unit	Note
V-by-one Interface	VRXINP/N input each bit Period	T _{RRIP} (UI)	310	--	379	ps	10bit 1
	Receiver Clock : Spread Spectrum Modulation range	Fclk _{ss}	Fclk -0.5%	--	Fclk +0.5%	MHz	2
	Receiver Clock : Spread Spectrum Modulation frequency	F _{ss}	30			KHz	2
	CDR training pattern time	T _{LOCK}	--	500	--	us	1
	Latency from LOCKN 'HIGH' to clock training pattern	L1	0	--	--	us	1
	Latency from LOCKN 'LOW' to normal 8b10b data	L2	--	--	70	us	1
	CML Differential Input High Threshold	V _{RTH}	+50	--	--	mV _{DC}	
	CML Differential Input Low Threshold	V _{RTL}	--	--	-50	mV _{DC}	
	CML Common mode Bias Voltage	V _{RCT}	0.8	0.9	1.0	mV _{DC}	
	Intra-pair skew	T _{INTRA}	--	--	0.3	UI	3
	Inter-pair skew	T _{INTER}	--	--	5	UI	4
	Eye diagram at receiver	A_X	--	0.25	--	UI	5
		A_Y	--	0	--	mV	
		B_X	--	0.3	--	UI	
		B_Y	--	50	--	mV	
C_X		--	0.7	--	UI		
C_Y		--	50	--	mV		
D_X		--	0.75	--	UI		
D_Y		--	0	--	mV		
E_X	--	0.7	--	UI			
E_Y	--	-50	--	mV			
F_X	--	0.3	--	UI			
F_Y	--	-50	--	mV			

Note :

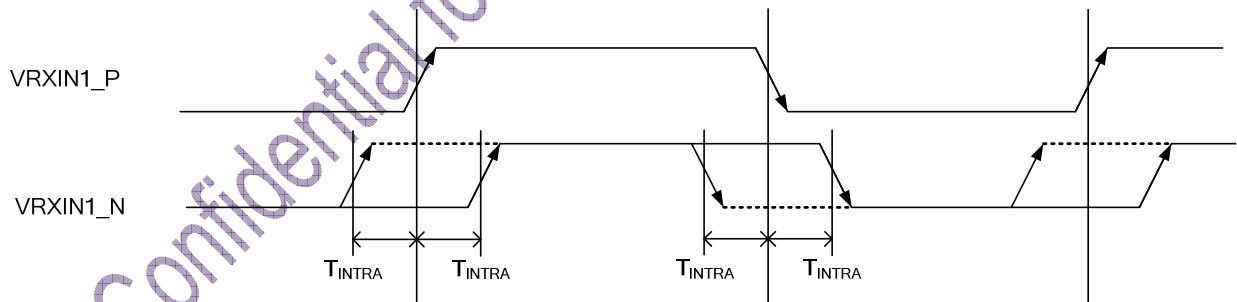
1. V-by-one Signal diagram



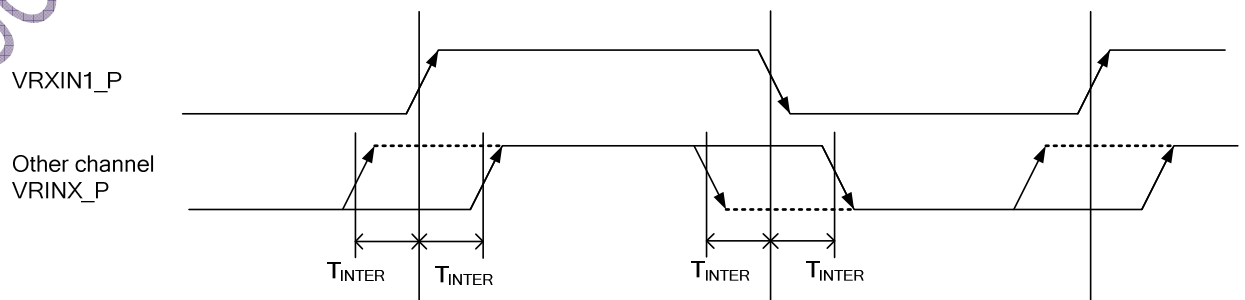
2. Receiver Clock SSCG (Spread spectrum clock generator) is defined as below figures.



3. V-by-one Intra-pair Skew

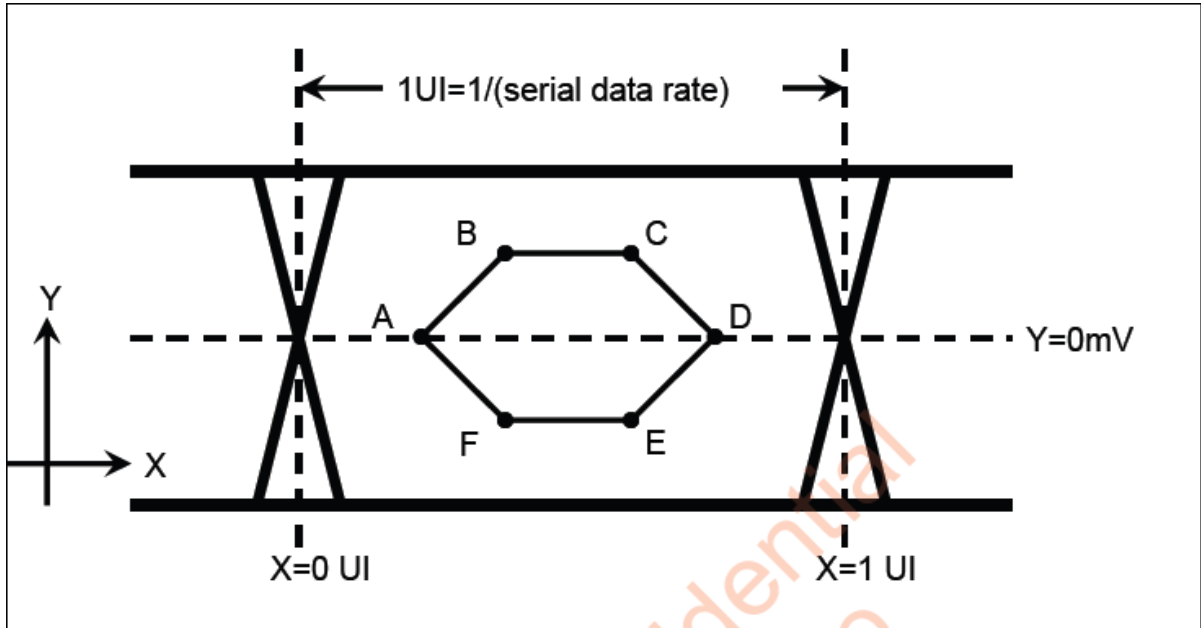


4. V-by-one Inter-pair Skew



5. Eye diagram at receiver

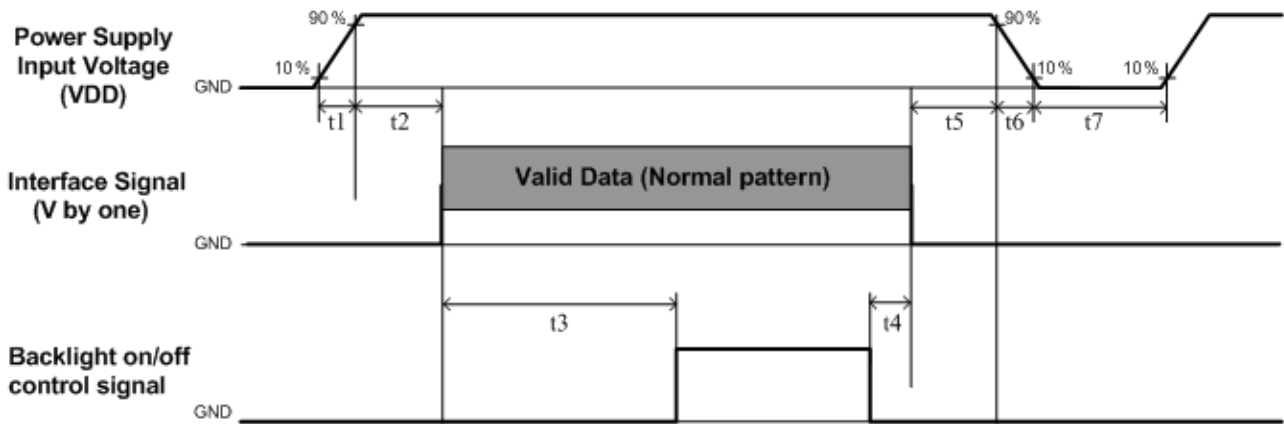
Eye Mask



Example of Eye diagram



3.4.3 Power Sequence for LCD



Parameter	Min.	Typ.	Max	Unit
t1	0.4	---	30	ms
t2	40	---	---	ms
t3	800	---	---	ms
t4	0 ^{*1}	---	---	ms
t5	0	---	---	ms
t6	---	---	--- ^{*2}	ms
t7	1000	---	---	ms

Note:

- (1) t4=0 : concern for residual pattern before BLU turn off.
- (2) t6 : voltage of VDD must decay smoothly after power-off. (customer system decide this value)
- (3) When the power supply input voltage(VDD) is off, be sure to pull down the valid and the invalid data to 0V.

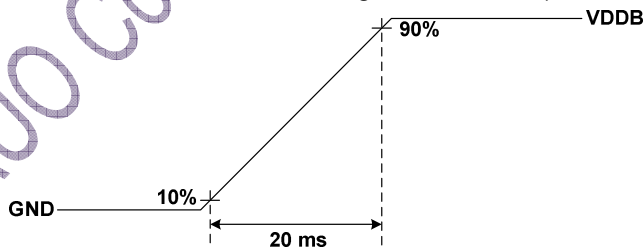
3.5 Backlight Specification

3.5.1 Electrical specification

	Item	Symbol	Condition	Spec			Unit	Note	
				Min	Typ	Max			
1	Input Voltage	V _{DDB}	-	22.8	24	25.2	VDC	-	
2	Input Current	I _{DDB}	V _{DDB} =24V	-	10.5	12.6	ADC	1	
3	Input Power	P _{DDB}	V _{DDB} =24V		255	305	W	1	
4	Inrush Current	I _{RUSH}	V _{DDB} =24V			12.5	ADC	2	
5	On/off control voltage	V _{B_{LON}}	ON	V _{DDB} =24V	2.7	-	3.4	VDC	-
			OFF		0	-	0.8		-
6	On/Off control current	I _{B_{LON}}	V _{DDB} =24V	-	-	1.5	mA	-	
7	External PWM Control Voltage	V _{EPWM}	MAX	V _{DDB} =24V	2.7	-	3.4	VDC	-
			MIN	V _{DDB} =24V	0	-	0.8		-
8	External PWM Control Current	I _{EPWM}	V _{DDB} =24V	-	-	2	mADC	-	
9	External PWM Duty ratio	D _{EPWM}	V _{DDB} =24V	5	-	100	%	3	
10	External PWM Frequency	F _{EPWM}	V _{DDB} =24V	200	-	20K	Hz	-	
11	DET status signal	DET	HI	V _{DDB} =24V	Open Collector			VDC	4
			Lo		0	-	0.8	VDC	4
12	Input Impedance	DET	-	300	-	-	Kohm		
		V _{B_{LON}}		300	-	-			
		PDIM		7	-	-			

Note 1 : Dimming ratio= 100% (MAX) (Ta=25±5°C , Turn on for 45minutes)

Note 2: Measurement condition Rising time = 20ms (V_{DDB} : 10%~90%);



Note 3: Less than 5% dimming control is functional well and no backlight shutdown happened

Note 4: Normal : 0~0.8V ; Abnormal : Open collector

3.5.2 Input Pin Assignment

LED DB connector: CI0114M1HRL-NH(CviLux) or equivalent
CI0112M1HRL-NH(CviLux) or equivalent

Pin	Symbol	Description	Note
1	VDDDB	Power Supply Input Voltage	
2	VDDDB	Power Supply Input Voltage	
3	VDDDB	Power Supply Input Voltage	
4	VDDDB	Power Supply Input Voltage	
5	VDDDB	Power Supply Input Voltage	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	DET	BLU status detection.	1
12	VBLOn	BLU On-Off control.	2,3
13	NC	NC	4
14	PDIM	External PWM	2, 5

Pin	Symbol	Description	Note
1	VDDB	Power Supply Input Voltage	
2	VDDB	Power Supply Input Voltage	
3	VDDB	Power Supply Input Voltage	
4	VDDB	Power Supply Input Voltage	
5	VDDB	Power Supply Input Voltage	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	NC	NC	4
12	NC	NC	4

Note1. DET status

DET	BLU status
0 ~ 0.8V	Normal
Open collector	Abnormal

Recommend pull high R > 10K ohm, pull high voltage VDD = 3.3V

Note2. input control signal threshold voltage definition

Item	Symbol	Min.	Typ.	Max.	Unit
Input High Threshold Voltage	VIH	2.7	-	3.4	V
Input Low Threshold Voltage	VIL	0	-	0.8	V

Note3. VBLON

Mode selection

WP	Note
H or OPEN	BL On
L	BL Off

Note4. Please leave this pin unoccupied. It can not be connected by any signal (Low/GND/High).

Note5. PDIM

PWM Dimming range:

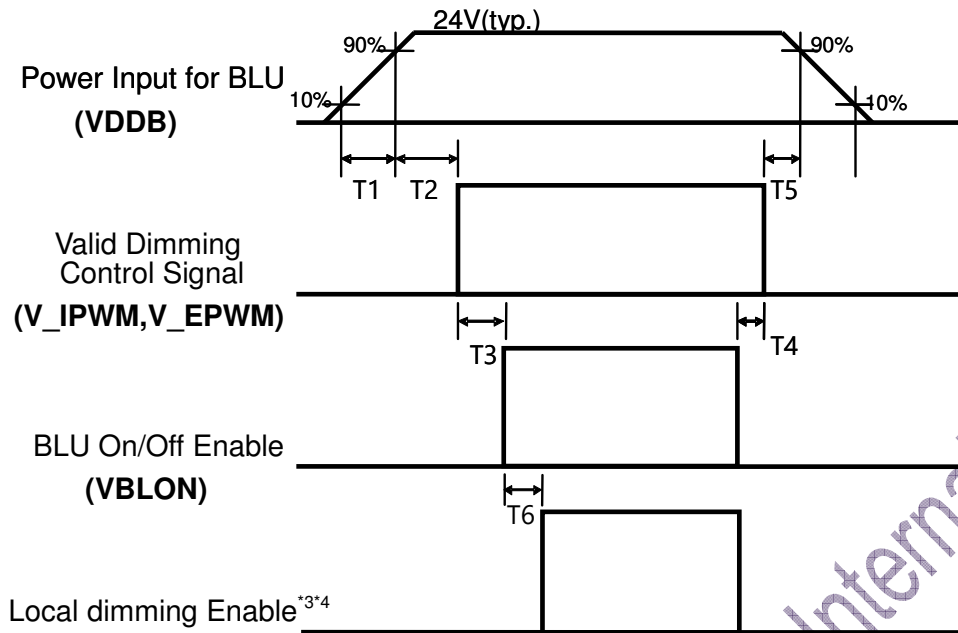


Performance guaranteed dimming range: 0%, 5~100%

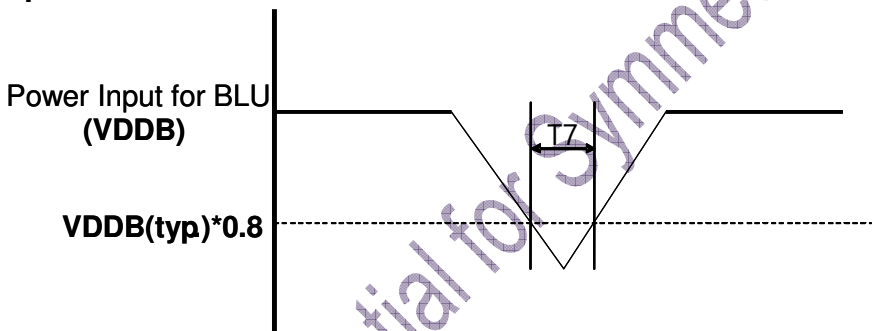
IF External PWM function less than 5% dimming ratio, Judge condition as below:

- (1) Backlight module must be lighted ON normally.
- (2) All protection function must work normally.
- (3) Uniformity and flicker could not be guaranteed

3.5.3 Power Sequence for Backlight



Dip condition



Parameter	Min	Typ	Max	Units
T1	20	-	-	ms ⁻¹
T2	250	-	-	ms
T3	200	-	-	ms
T4	0	-	-	ms
T5	0	-	-	ms
T6	1200	-	-	ms ⁻²
T7	-	-	1000	ms ⁻²

Note:1. T1 describes rising time of 0V to 24V and this parameter does not applied at restarting time. Even though T1 is over the specified value, there is no problem if I2t spec of fuse is satisfied.

Note:2. T6 describes VDDB dip condition and VDDB couldn't lower than 10% VDDB.

Note:3. Local dimming function ON/OFF, will follow VBL ON pin High/Low

Note:4. Local dimming code written to the drive board time is 1.2 seconds.

3.5.4 LED Operating Life Time

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max		
Backlight Operating Life Time(MTTF)		50000	60000	-	Hour	1

Note:

- The lifetime (MTTF) is defined as the time which luminance of LED is 50% compared to its original value.
[Operating condition: Continuous operating at Ta = 25±2°C, for single lamp/LED only]

AUO Confidential for Symmetron Internal Use Only

4. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60°C, 500hrs
2	Low temperature storage test	3	-20°C, 500hrs
3	High temperature operation test	3	50°C, 500hrs
4	Low temperature operation test	3	-5°C, 500hrs
5	Vibration test (With carton)	1(PKG)	Random wave (1.04Grms 2~200Hz) Duration : X,Y,Z 20min per axes
6	Drop test (With carton)	1(PKG)	Height: 25.4 cm Direction: Only bottom flat twice (ASTMD4169-I)

5. International Standard

5.1. Safety

- (1) **UL 60950-1; Standard for Safety of Information Technology Equipment Including electrical Business Equipment.**
- (2) **IEC 60950-1; Standard for Safety of International Electrotechnical Commission**
- (3) **EN 60950-1; European Committee for Electrotechnical Standardization (CENELEC), EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.**

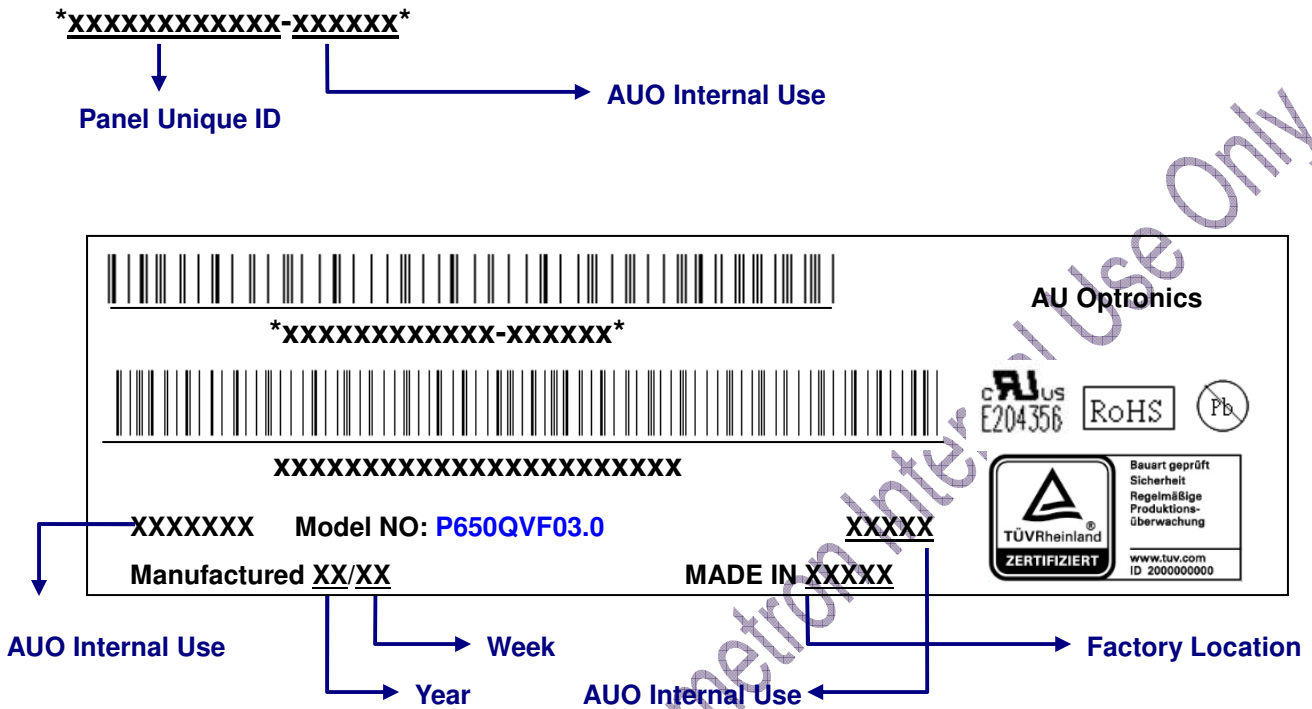
5.2. EMC

- (1) **ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz.” American National standards Institute(ANSI), 1992**
- (2) **C.I.S.P.R “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.” International Special committee on Radio Interference.**
- (3) **EN 55022 “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.” European Committee for Electrotechnical Standardization. (CENELEC), 1998**



6. Packing

6.1. Definition of Label

A. Panel Label:

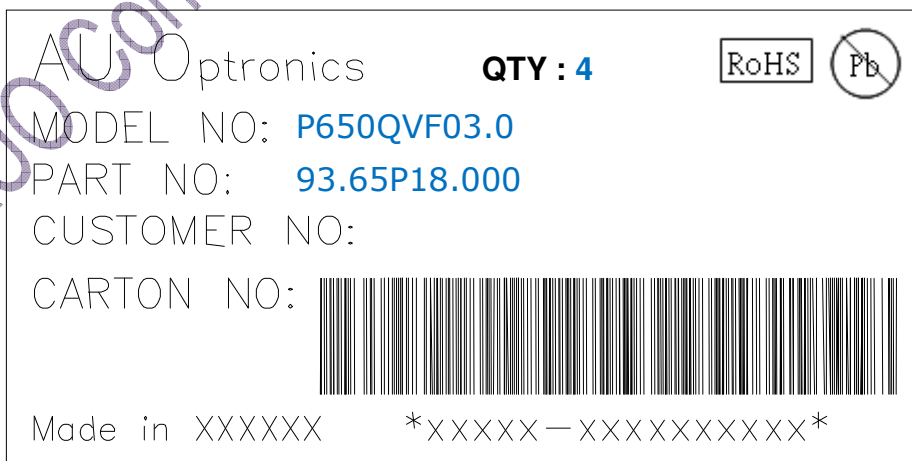


Green mark description

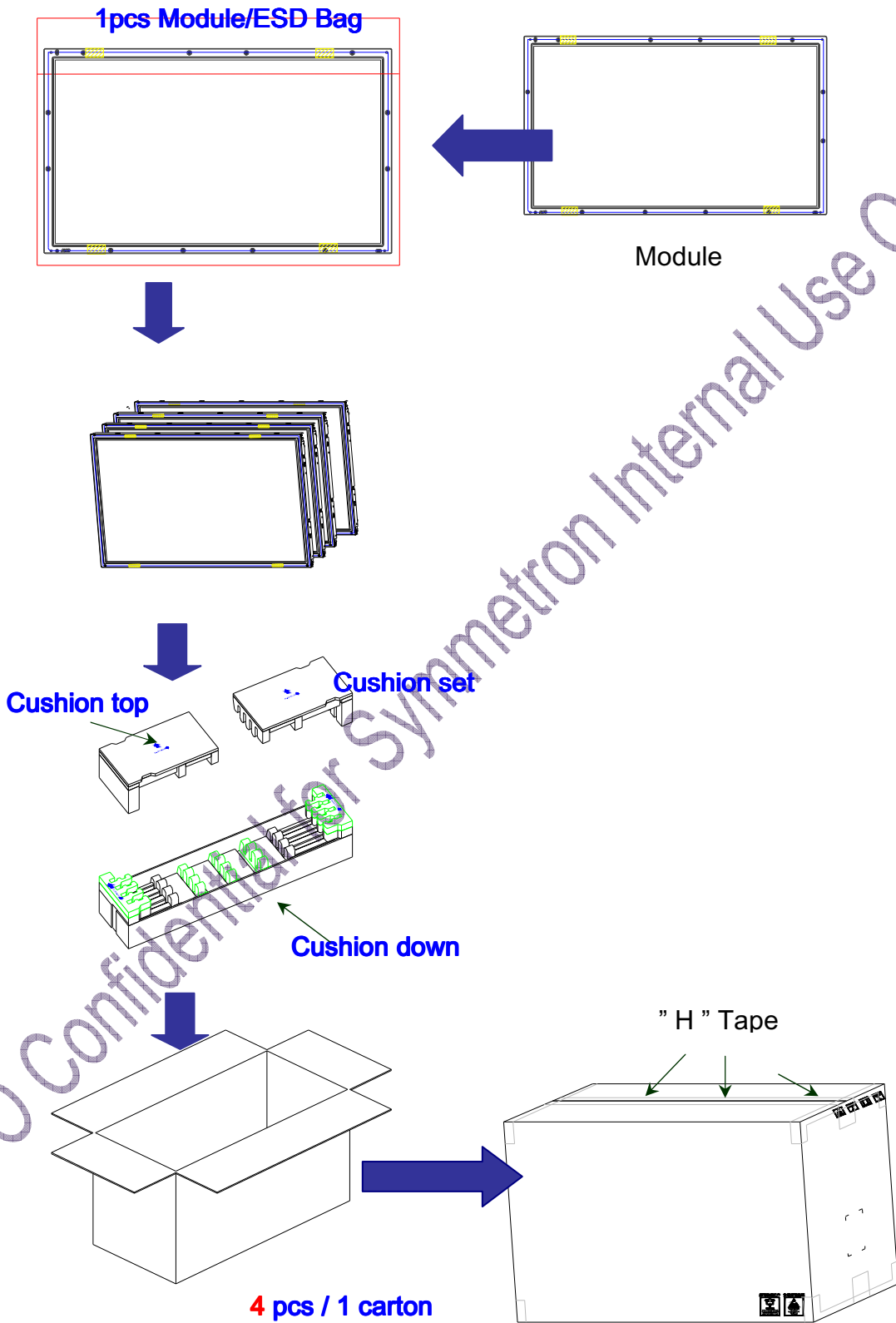
- (1) For Pb Free Product, AUO will add  for identification.
- (2) For RoHs compatible products, AUO will add  for identification.

Note: The green Mark will be present only when the green documents have been ready by AUO internal green team. (definition of green design follows the AUO green design checklist.)

B. Carton Label:

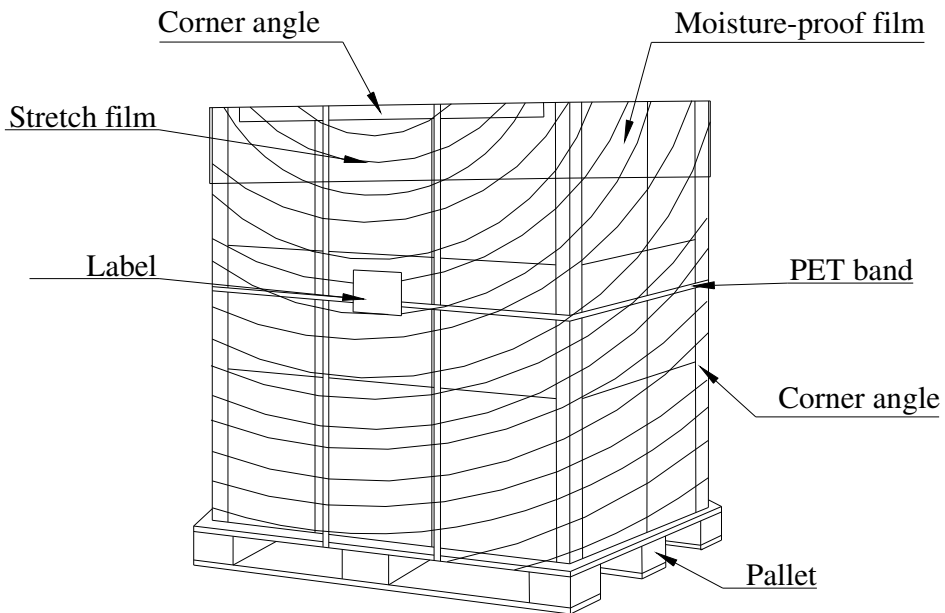


6.2. Packing Methods



6.3. Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing Box	4 pcs/box	1565(L)mm*380(W)mm*978 (H)mm	114	
2	Pallet	1	1660(L)mm*1150(W)mm*138(H)mm	33.8	
3	Boxes per Pallet	3 boxes/Pallet (By Air) ; 3 Boxes/Pallet (By Sea 40ft Normal) ;			
4	Panels per Pallet	12pcs/pallet(By Air) ; 12 pcs/Pallet (By Sea 40ft Normal)			
5	Pallet after packing	12 (by Air)	1660(L)mm*1150(W)mm*1116(H)mm	321.8(by Air)	
		24 (by Sea)	1660(L)mm*1150(W)mm*2232(H)mm	643.6(by Sea)	40ft HQ



7. Precautions

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

7.1. Mounting Precautions

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to 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 transparent protective plate to the surface in order to protect the polarizer. 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 broken by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer 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 of 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 soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene 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.
- (10) To keep display functional well as a digital signage application, especially the component of TFT is very sensitive with sunlight, it is necessary to set up blocking device protecting panel from radiation of ambient environment.

7.2. 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 may become 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) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

7.3. Operating Condition for Public Information Display

The device listed in the product specification is designed and manufactured for PID (Public Information Display) application. To optimize module's lifetime and function, below operating usages are required.

- (1) Normal operating condition
 - A. Operating temperature: 0~50°C
 - B. Operating humidity: 10~90%
 - C. Display pattern: dynamic pattern (Real display).
Note) Long-term static display would cause image sticking.
- (1) Operation usage to protect against image sticking due to long-term static display.
 - A. Suitable operating time: under 24 hours a day.
(* The moving picture can be allowed for 24 hours a day)
 - B. Liquid Crystal refresh time is required. Cycling display between 5 minutes' information (static) display and 10 seconds' moving image.
 - C. Periodically change background and character (image) color.
 - D. Avoid combination of background and character with large different luminance.
- (2) Periodically adopt one of the following actions after long time display.
 - A. Running the screen saver (motion picture or black pattern)
 - B. Power off the system for a while
- (3) LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly recommended.
- (4) Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions, such as high temperature/humidity, display stationary patterns, or long operation time etc..., it is strongly recommended to contact AUO for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

7.4. 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 interface pin directly.

7.5. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

7.6. Storage

When storing modules as spares for a long time, the following precautions are necessary.

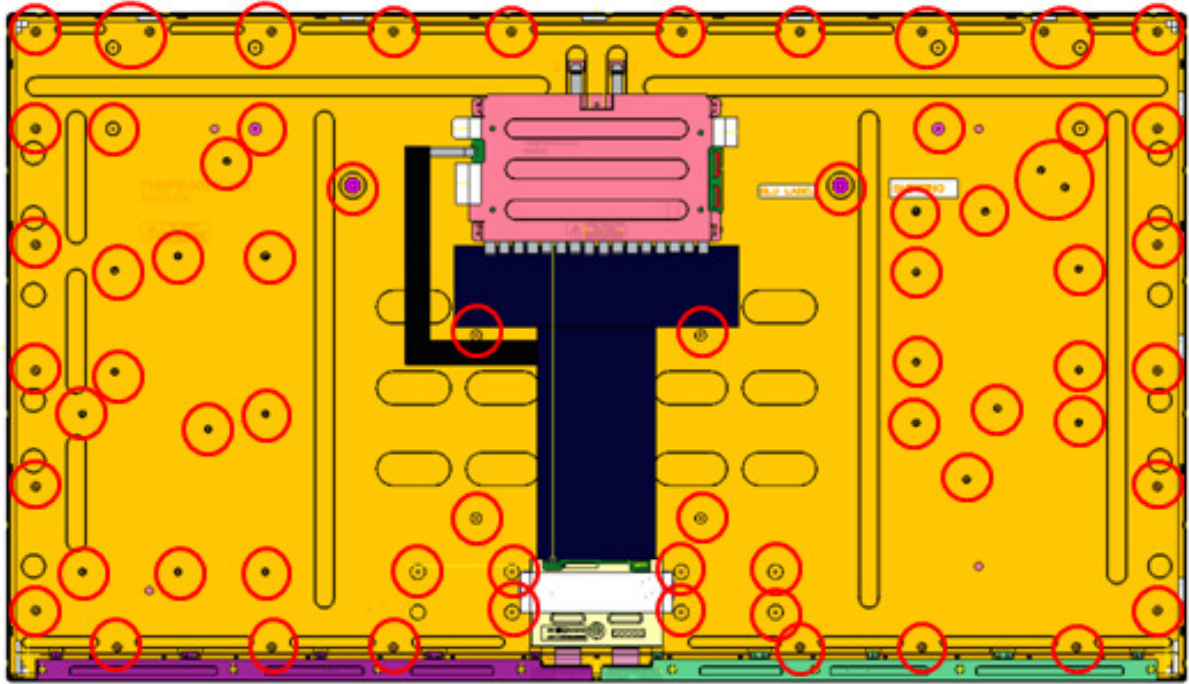
- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- (3) Storage condition is guaranteed under packing conditions.
- (4) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition.

7.7. Handling Precautions for Protection Film

- (1) The protection film is attached to the bezel with a small masking tape. 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) 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 bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

7.8. Dust Resistance

- (1) AUO module dust test is conducted with marked holes (see Figure 1) sealed to comply with JIS D0207 .
- (2) Module users should design set with these holes used/sealed(if not used) or covered by set mechanism to prevent dust from entering. The AUO testing procedure cannot replicate all different real world scenarios, module users should apply set dust resistance solution to meet users' requirement.



AUO Confidential for Symmetron Inc