

Model Name: P460HW02 V0

Issue Date : 2010/06/21

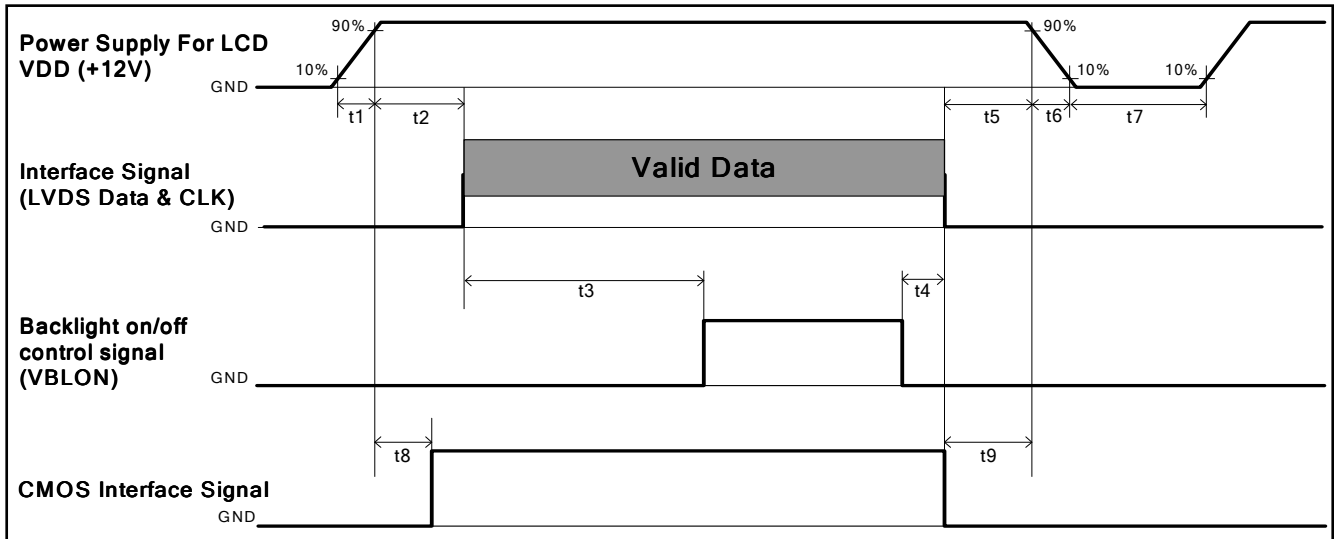
()Preliminary Specifications
(*)Final Specifications

Customer Signature	Date	AUO	Date
Approved By _____		Approval By PM Director <i>Michael Goan</i> _____	
Note		Reviewed By RD Director <i>Eugene Chen</i> _____	
		Reviewed By Project Leader <i>Mingyu Wu</i> _____	
		Prepared By PM <i>Travis Huang</i> _____	

Contents

No		
		CONTENTS
		RECORD OF REVISIONS
1		GENERAL DESCRIPTION
2		ABSOLUTE MAXIMUM RATINGS
3		ELECTRICAL SPECIFICATION
	3-1	ELECTRICAL CHARACTERISTICS
	3-2	INTERFACE CONNECTIONS
	3-3	SIGNAL TIMING SPECIFICATION
	3-4	SIGNAL TIMING WAVEFORM
	3-5	COLOR INPUT DATA REFERENCE
	3-6	POWER SEQUENCE
	3-7	BACKLIGHT SPECIFICATION
4		OPTICAL SPECIFICATION
5		MECHANICAL CHARACTERISTICS
6		RELIABILITY TEST ITEMS
7		INTERNATIONAL STANDARD
	7-1	SAFETY
	7-2	EMC
8		PACKING
	8-1	DEFINITION OF LABEL
	8-2	PACKING METHODS
	8-3	PALLET AND SHIPMENT INFORMATION
9		PRECAUTION
	9-1	MOUNTING PRECAUTIONS
	9-2	OPERATING PRECAUTIONS
	9-3	ELECTROSTATIC DISCHARGE CONTROL
	9-4	PRECAUTIONS FOR STRONG LIGHT EXPOSURE
	9-5	STORAGE
	9-6	HANDLING PRECAUTIONS FOR PROTECT FILM

3.5 Power Sequence for LCD



Parameter	Values			Unit
	Min.	Typ.	Max.	
t1	0.4	---	30	ms
t2	0.1	---	50	ms
t3	450	---	---	ms
t4	0 ^{*1}	---	---	ms
t5	0	---	---	ms
t6	---	---	--- ^{*2}	ms
t7	500	---	---	ms
t8	10	---	50	ms
t9	0	---	---	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)

3.7 Backlight Specification

The backlight unit contains 20 CCFLs (Cold Cathode Fluorescent Lamp)

3.7.1: Electrical specification

Item	Symbol	Condition	Spec			Unit	Note	
			Min	Typ	Max			
Input Voltage	V _{DDB}	-	21.6	24	26.4	VDC	-	
Input Current	I _{DDB}	V _{DDB} =24V	7.74	8.6	9.46	ADC	1	
Input Power	P _{DDB}	V _{DDB} =24V	--	206.4	227.04	W	1	
Inrush Current	I _{RUSH}	V _{DDB} =24V	-	-	14.6	ADC	2	
On/Off control voltage	V _{B_{LON}}	ON	V _{DDB} =24V	2	-	5.5	VDC	-
		OFF		0	-	0.8		-
On/Off control current	I _{B_{LON}}	V _{DDB} =24V	-	-	1.5	mA	-	
Dimming Control Voltage	V _{DIM}	MAX	V _{DDB} =24V	3.0	-	3.3	VDC	-
		MIN		-	0	-	VDC	-
Dimming Control Current	I _{DIM}	V _{DDB} =24V	-	-	2	mADC	-	
Internal Dimming Ratio	DIM_R	V _{DDB} =24V	10	-	100	%	3	
External PWM Control Voltage	V _{EPWM}	MAX	V _{DDB} =24V	2	-	3.3	VDC	-
		MIN	V _{DDB} =24V	0	-	0.8		-
External PWM Control Current	I _{EPWM}	V _{DDB} =24V	-	-	2	mADC	-	
External PWM Duty ratio	D _{EPWM}	V _{DDB} =24V	10	-	100	%	3	
External PWM Frequency	F _{EPWM}	V _{DDB} =24V	140	180	240	Hz	-	

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%);

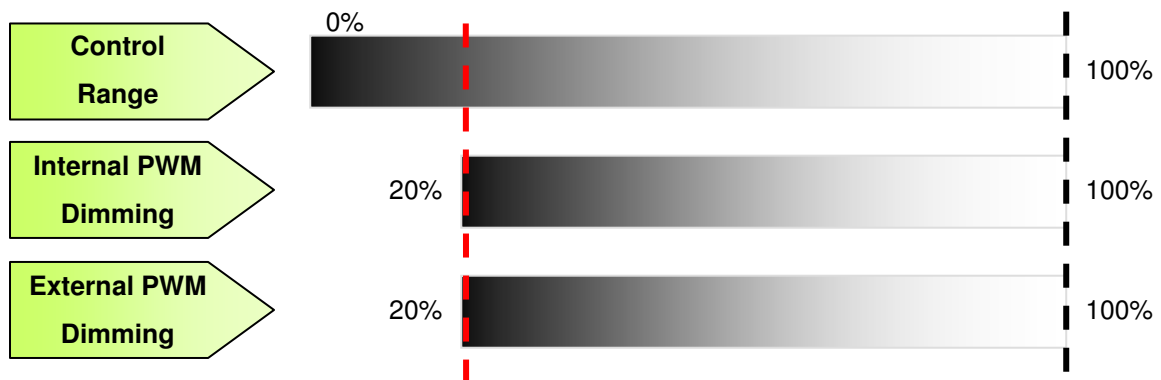
Note 3: Less than 10% dimming control is functional well and no backlight shutdown happened.

3.7.2: Input Pin Assignment

CN2: **CI0114M1HRL-NH**

Pin No	Symbol	Description
1	VDDDB	Operating Voltage Supply, +24V DC regulated
2	VDDDB	Operating Voltage Supply, +24V DC regulated
3	VDDDB	Operating Voltage Supply, +24V DC regulated
4	VDDDB	Operating Voltage Supply, +24V DC regulated
5	VDDDB	Operating Voltage Supply, +24V DC regulated
6	BLGND	Ground and Current Return
7	BLGND	Ground and Current Return
8	BLGND	Ground and Current Return
9	BLGND	Ground and Current Return
10	BLGND	Ground and Current Return
11	DET⁽²⁾	BLU status detection: Normal : 0~0.8V ; Abnormal : Open collector
12	VBLON	BL On-Off control: High/Open (2.0V~5.5V) for BL On , Low (GND) for off
13	Internal PWM⁽¹⁾(VDIM)	Internal PWM (0~3.3V, 20~100% Duty) < NC ; when External PWM mode > ⁽⁴⁾
14	External PWM⁽³⁾(PDIM)	External PWM (20%~100% Duty ratio) < NC ; when internal PWM mode > ⁽⁴⁾

Note (1) **Simultaneous Dimming Method with PWM control**



PWM Dimming: include Internal and External PWM Dimming

Note (2) DET is detect function. When backlight is normal operating, DET is GND(0V). when backlight is abnormal, DET is Open Collector.

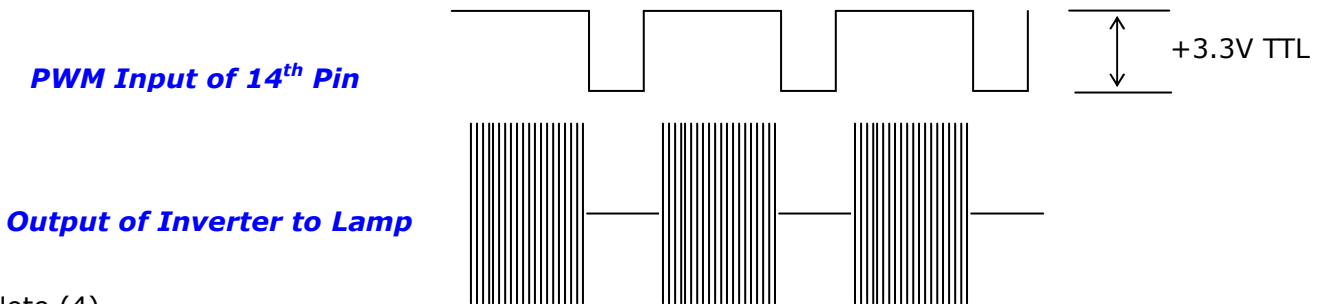
Note (3) **PWM Dimming**

This PWM control is the most popular control method in LCD Dimming Control. This Signal is defined as ordinary +3.3V TTL Level Specification for details. Duty Ratio have to supported for enough range of Luminance Variation, i.e... 100% Duty like +3.3V DC Signal or Open of this input pin(13th Pin of

Inverter Connector) should represent 100% Luminance of Backlight.

For the given oscillating frequency of Inverter, this PWM Signal should define active period of supplying AC Voltage and longer duty means AC voltage will be supplied longer.

Proper Dimming Range should be defined by Manufacturer with Supplement Data, and any kind of improper interference on Screen can not be acceptable.



Note (4)

PWM dimming function is included internal PWM and external PWM.

Internal PWM: input voltage 0(GND) ~3.3V to pin 13th, and duty ratio of output voltage/current of inverter is from 20% to 100%. When use pin 13th to control backlight luminance, the pin 14th will be NC and can not be affect by noise!

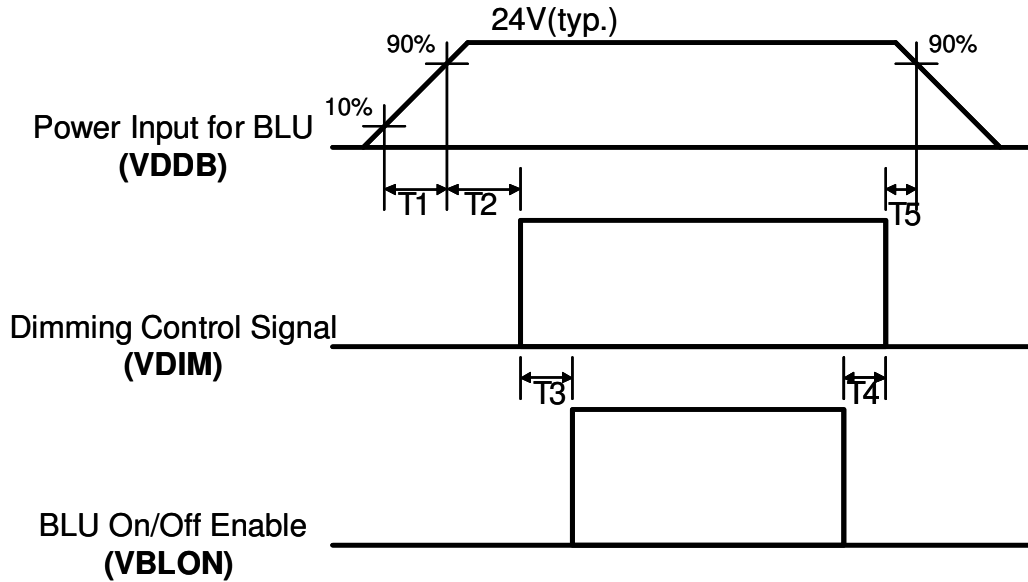
External PWM: input duty ratio 10% ~100% to pin 14th, and duty ratio of output voltage/current of inverter is from 10% to 100%. When use pin 14th to control backlight luminance, the pin 13th will be NC and can not be affect by noise!

Pin 13th and pin 14th can not be used at the same time!

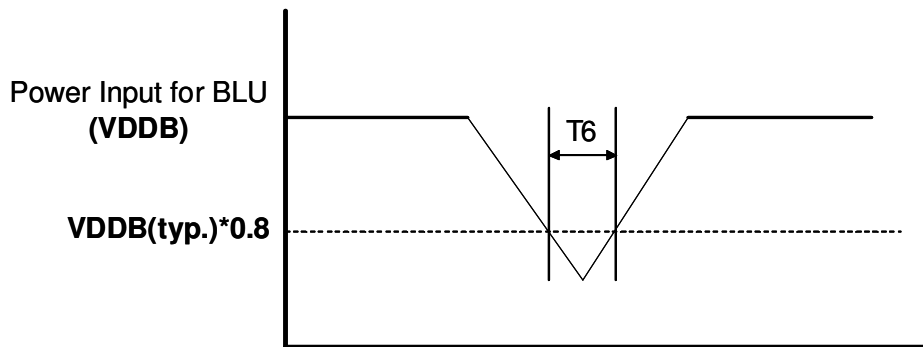
CN3: CI0110M1HRL-LF

Pin No	Symbol	Description
1	VDDDB	Operating Voltage Supply, +24V DC regulated
2	VDDDB	Operating Voltage Supply, +24V DC regulated
3	VDDDB	Operating Voltage Supply, +24V DC regulated
4	VDDDB	Operating Voltage Supply, +24V DC regulated
5	VDDDB	Operating Voltage Supply, +24V DC regulated
6	BLGND	Ground and Current Return
7	BLGND	Ground and Current Return
8	BLGND	Ground and Current Return
9	BLGND	Ground and Current Return
10	BLGND	Ground and Current Return

3.7.3 Power Sequence for Inverter



Dip condition for Inverter

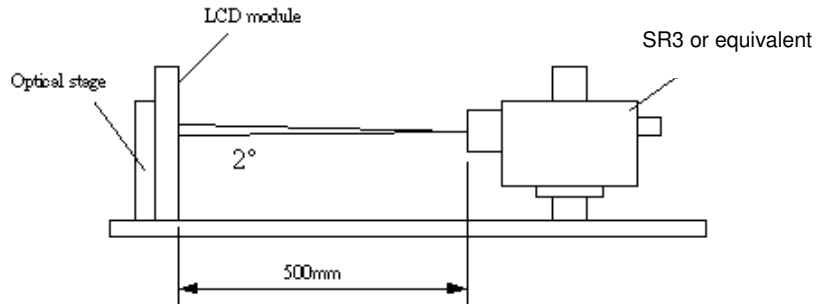


Parameter	Value			Units
	Min	Typ	Max	
T1	20	-	-	ms
T2	500	-	-	ms
T3	250	-	-	ms
T4	0	-	-	ms
T5	1	-	-	ms
T6	-	-	10	ms

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes 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°.

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}	1200	1500	--	cd/m ²	2
Luminance Variation	$\delta_{\text{WHITE}(\theta P)}$	--	--	1.3		3
Response Time (G to G)	T _Y	--	8.0	--	Ms	4
Color Gamut	NTSC		72		%	
Color Coordinates						
	Red	R _X	Typ.-0.03	0.640	Typ.+0.03	
		R _Y		0.330		
	Green	G _X		0.290		
		G _Y		0.600		
	Blue	B _X		0.150		
		B _Y		0.060		
	White	W _X		0.295		
	W _Y	0.305				
Viewing Angle						
	x axis, right($\phi=0^\circ$)	θ_r	--	89	--	degree
	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:

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

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. When lamp current $I_H = 15.5\text{mA}$. $L_{WH} = L_{on5}$ 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:

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

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%	

4. 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. 2 Luminance

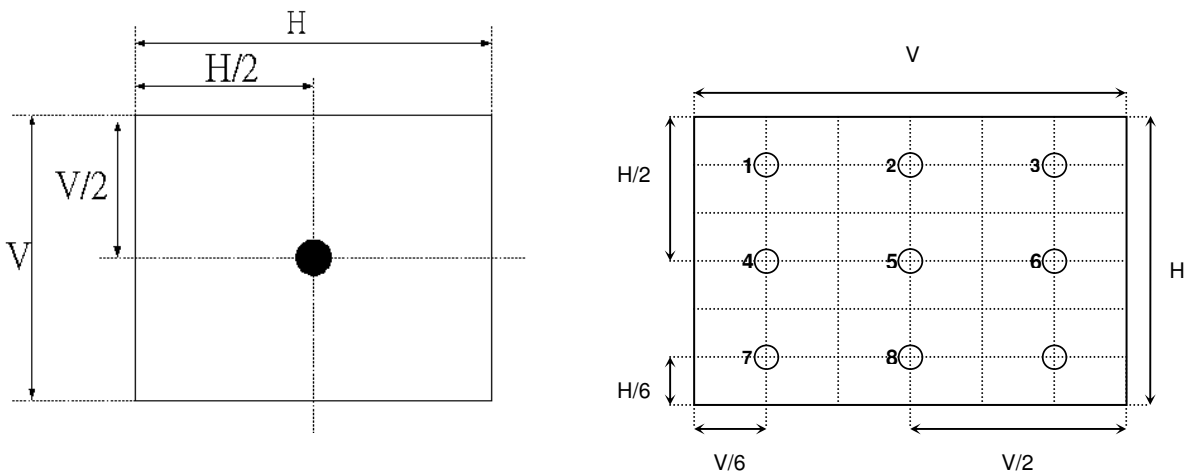
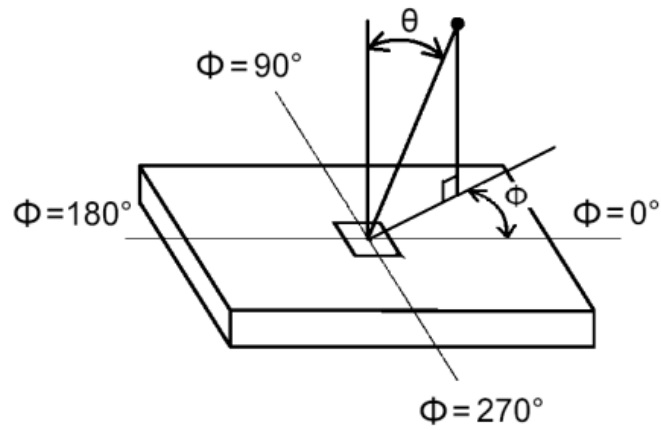


FIG.3 Viewing Angle



5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model P460HW02 V0. In addition the figures in the next page are detailed mechanical drawing of the LCD.

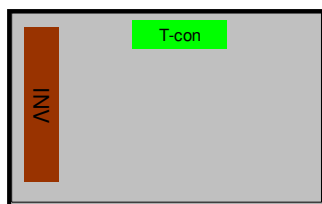
Outline Dimension	Horizontal	1048.4mm
	Vertical	605.0mm
	Depth	57.80mm (w/ inverter & shielding)
Bezel Opening	Horizontal	1024 mm
	Vertical	581 mm
Active Display Area	Horizontal	1018.08 mm
	Vertical	572.67 mm
Weight	13000 g(Typ.)	
Surface Treatment	AG, Haze=11%, 3H	

5.1 Placement suggestions:

The Suggestion placement is as following:

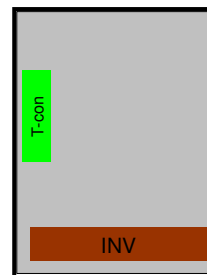
1. Landscape mode: The T-con side has to be placed as the upper side.
2. Portrait mode: The inverter side has to be placed as the lower side.

Landscape mode



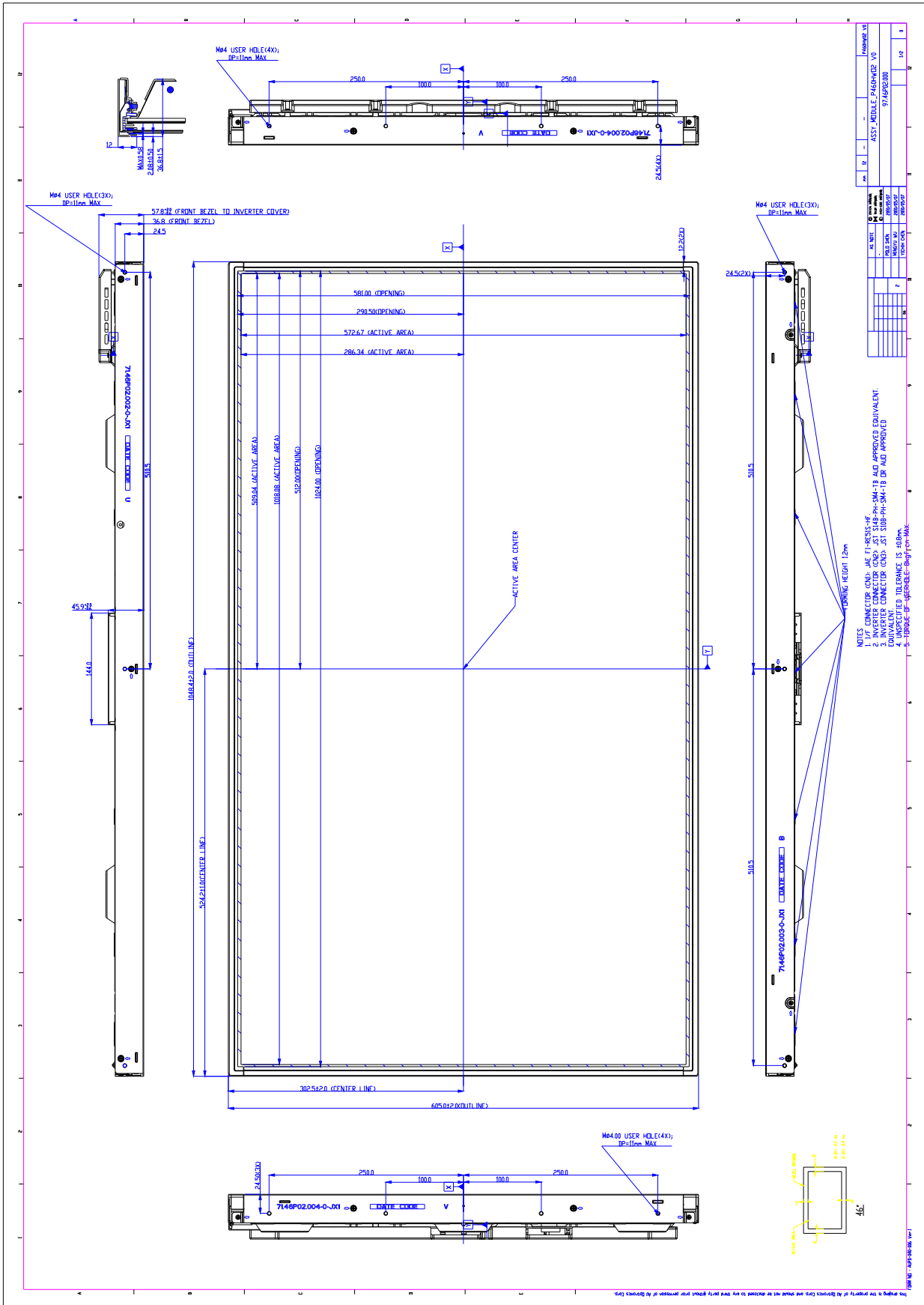
Backside

Portrait mode

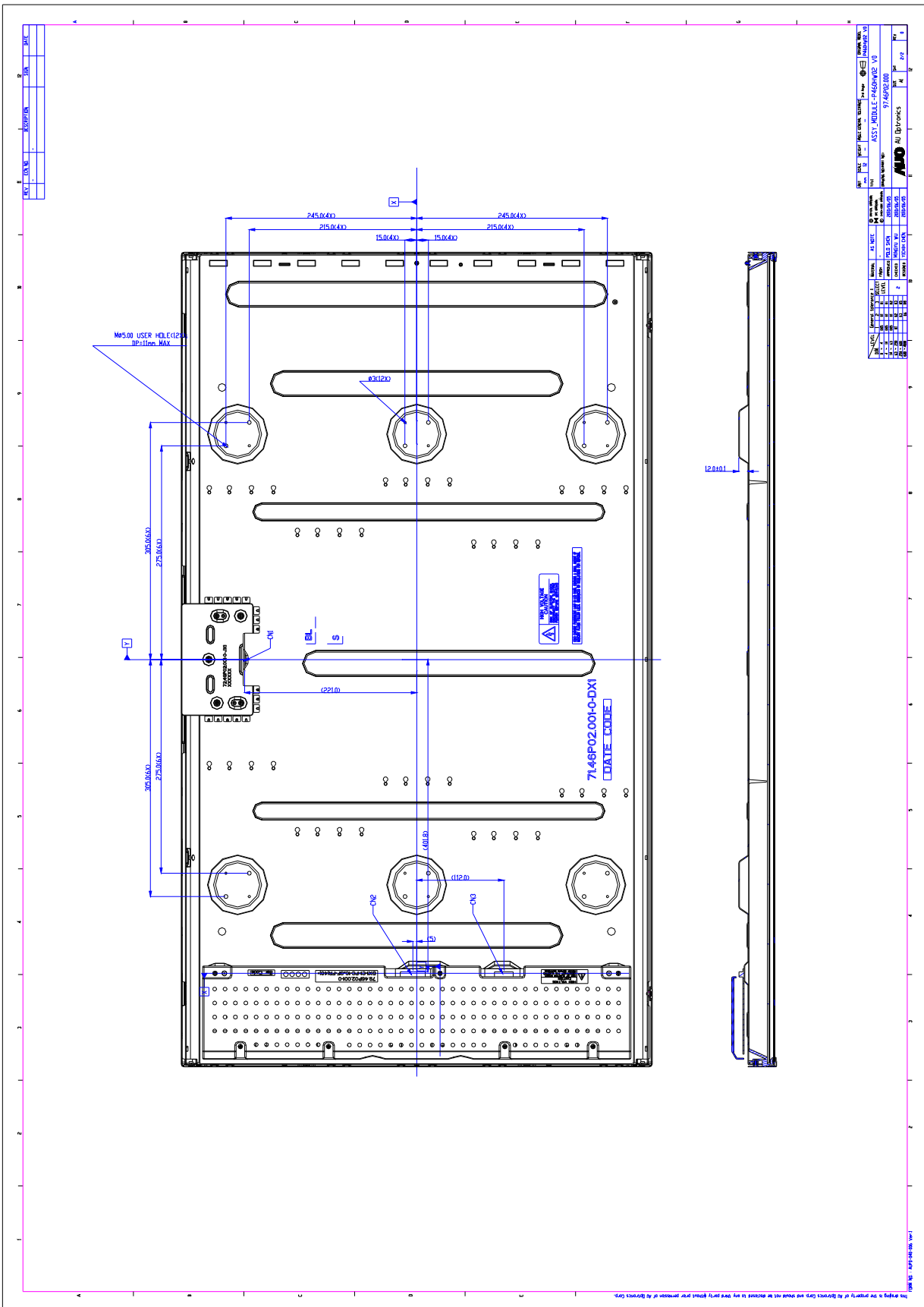


Backside

Front View



Back View



6. 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 (non-operation)	3	Wave form : random Vibration level : 1.5G RMS Bandwidth: 10-500Hz Duration: X, Y, Z 30min One time for each direction
6	Shock test (non-operation)	3	Shock level: 40G Waveform: half sine wave, 11ms Direction: ±X, ±Y, ±Z, One time each direction
7	Vibration test (With carton)	1(PCK)	Random wave (1.5G RMS, 10-200Hz) 30mins/ Per each X,Y,Z axes
8	Drop test (With carton)	1(PCK)	Drop Height: 25.4 cm, 6 Flats (ASTMD4169-I)

7. International Standard

7.1 Safety

- (1) UL 60950-1, UL 60065; Standard for Safety of Information Technology Equipment Including electrical Business Equipment.
- (2) IEC 60950-1 : 2005, IEC 60065:2001 ; Standard for Safety of International Electrotechnical Commission
- (3) EN 60950 : 2001+A11, EN 60065:2002+A1:2006; European Committee for Electrotechnical Standardization (CENELEC), EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

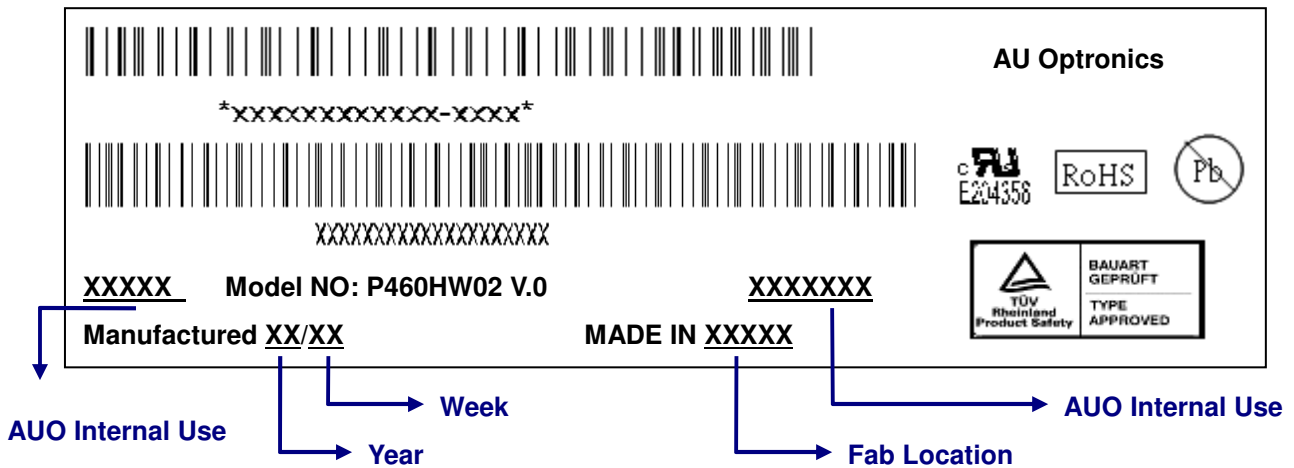
7.2 EMC

- (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



8. Packing

8-1 Definition of Label :

A. Panel Label:



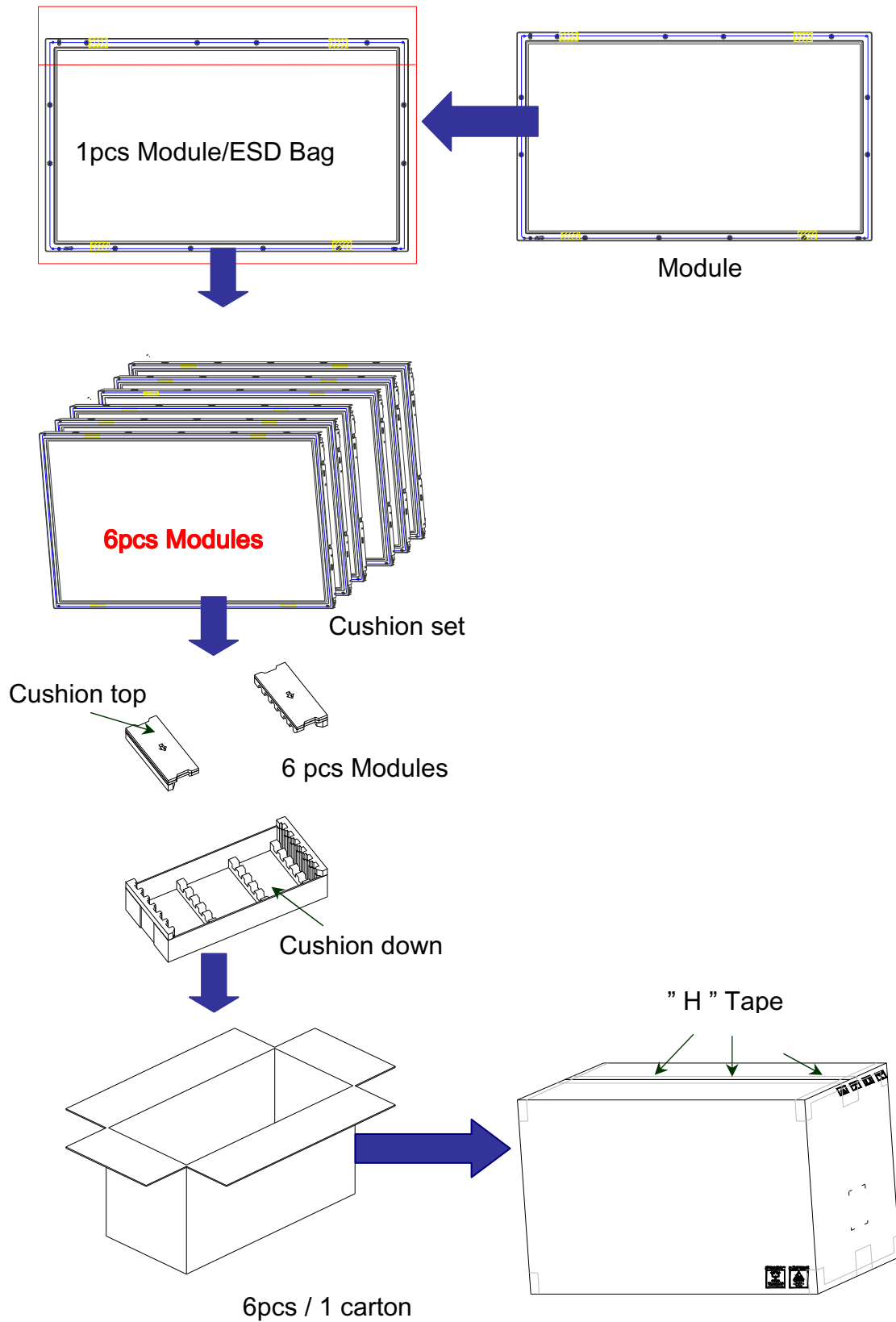
Green mark description

- (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:

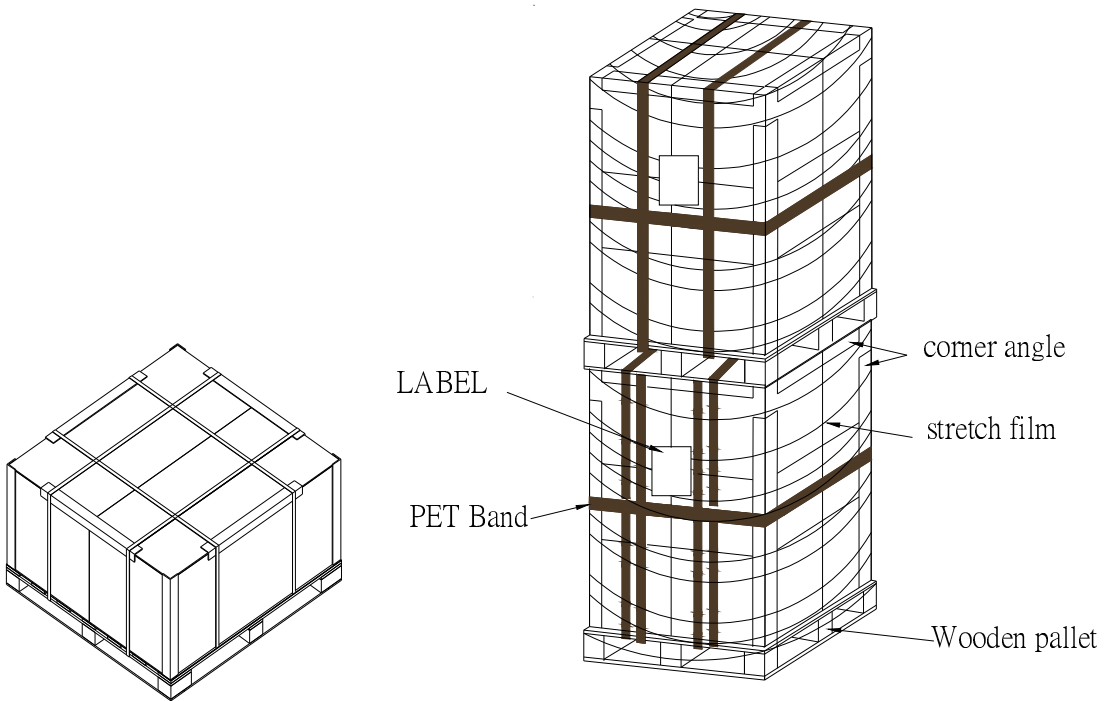


8-2 Packing Methods:



8-3 Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing Box	6 pcs/box	1160(L)mm*547(W)mm*680(H)mm	97	
2	Pallet	1	1180(L)mm*1150(W)mm*132(H)mm	18	
3	Boxes per Pallet	2 boxes/Pallet (By Air) ; 2 Boxes/Pallet (By Sea)			
4	Panels per Pallet	14pcs/pallet(By Air) ; 14 pcs/Pallet (By Sea)			
5	Pallet after packing	12(by Air)	1180(L)mm*1150(W)mm*812(H)mm (by Air)	212 (by Air)	
		36(by Sea)	1180(L)mm*1150(W)mm*2436(H)mm (by Sea)	626 (by Sea)	40ft HQ



9. PRECAUTIONS

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

9-1 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.

9-2 OPERATING PRECAUTIONS

- (1) The device listed in the product specification sheets was designed and manufactured for TV application
- (2) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (3) Response time depends on the temperature. (In lower temperature, it becomes longer..)
- (4) Brightness of CCFL 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.
- (5) 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.
- (6) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (7) 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.

9-3 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 interface pin directly.

9-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5 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.

9-6 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.