(V) Preliminary Specifications
() Final Specifications

Module	18.5 Inch Color TFT-LCD
Model Name	G185XTN01.1

Customer	Date		Approved by	Date
				2017/11/02
Checked & Approved by			**Prepared by**	
				2017/11/02
Note: This Specification is subject to change without notice.			General Display Business Unit / AU Optronics corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description
0.0 2017/11/02	All	First Preliminary Edition	

1. Operating Precautions

1) Since front polarizer is easily damaged, please be cautious and 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 soft cloth.
5) Since the panel is made of glass, it may be broken or cracked 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 nor modify the module assembly.
8) Do not press the reflector sheet at the back of the module to any direction.
9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED Reflector edge. Instead, press at the far ends of the LED 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) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950-1 or UL60950-1), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time.
14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when TFT-LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or moving content periodically if fixed pattern is displayed on the screen.

2. General Description

This specification applies to the 18.5 inch-wide Color a-Si TFT-LCD Module G185XTN01.1. The display supports the HD - 1366(H) x 768(V) screen format and 16.7M colors, RGB 6-bit + 3FRC). All input signals are eDP interface and this module contains with an LED driver for backlight.

2.1 Display Characteristics

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

| Items	Unit	Specifications
Screen Diagonal	[inch]	18.5"
Active Area	[mm]	409.8 (H) x 230.4 (V)
Pixels H x V		1366(x3) x 768
Pixel Pitch	[mm]	300 (per one triad) × 300
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	+5.0 V (Typ)
LCD Power Consumption	[Watt]	2.25W (Typ.)(all black pattern)
LED Power Consumption	[Watt]	6.36W (Typ.)(all black pattern)
Optical Response Time	[msec]	8ms (Typ., on/off)
Weight	[Grams]	1440 (Max.)
Physical Size	[mm]	430.4 (W) x 254.7 (H) Typ. x 10.6(D)Typ
Electrical Interface		1 lanes eDP1.2
Surface Treatment		Anti-Glare, 3H
Support Color		16.7M colors, RGB 6-bit +3FRC
Temperature Range Operating Storage (Non-Operating)	[°C] [°C]	0 to +60(+60°C as panel surface temperature) -20 to +60
RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 ^{o}C:

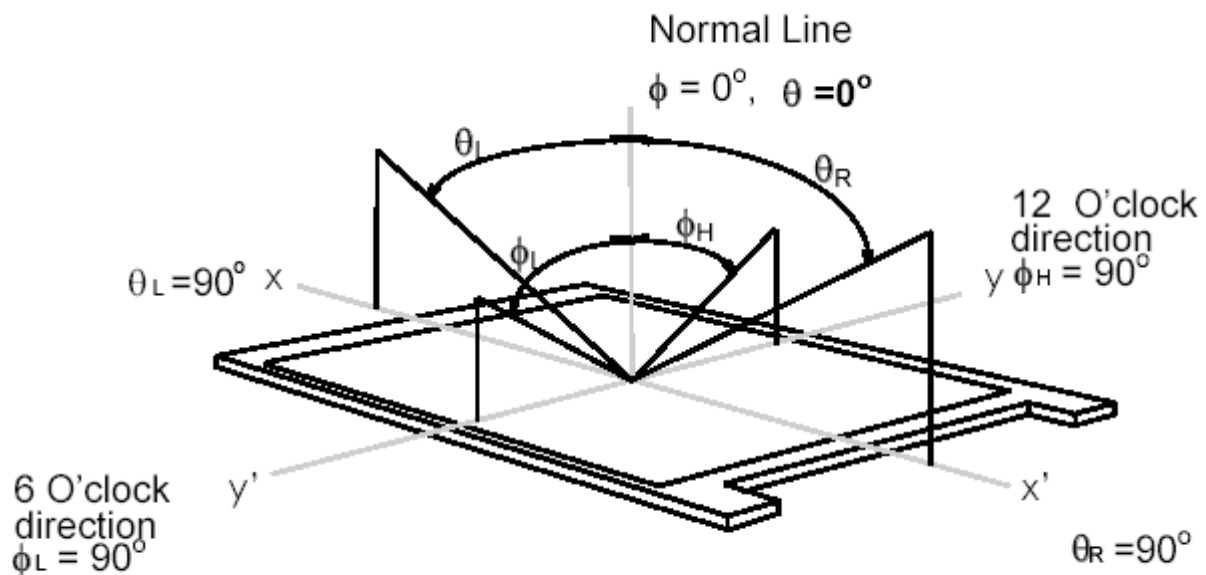| Item	Unit	Conditions		Min.	Typ.	Max.	Note
Viewing Angle	[degree]	Horizontal (Right) CR = 10 (Left)		150	170	- -	1,2
		Vertical (Up) CR = 10 (Down)		140	160	- -	
Contrast ratio		Normal Direction		600	1000	-	3
Response Time	[msec]	Raising Time (T_{rR})		-	5		4
		Falling Time (T_{rF})		-	3		
		Raising + Falling		-	8		
Color / Chromaticity Coordinates (CIE)		Red x		0.594	0.644	0.694	5
		Red y		0.283	0.333	0.383	
		Green x		0.270	0.320	0.370	
		Green y		0.567	0.617	0.667	
		Blue x		0.109	0.159	0.209	
		Blue y		0.018	0.068	0.118	
Color Coordinates (CIE) White		White x		0.263	0.313	0.363	
		White y		0.279	0.329	0.379	
Central Luminance	[cd/m^2]			360	450	-	6
Luminance Uniformity	[%]			65	70	-	7
Crosstalk (in 60Hz)	[%]					2	8
Flicker	dB					-20	9
Color Gamut	%				70		

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring (at surface 35 ^{o}C). In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and

dark room.

Photo detector

Measured distance

LCD Panel

TFT-LCD Module

Center of the screen
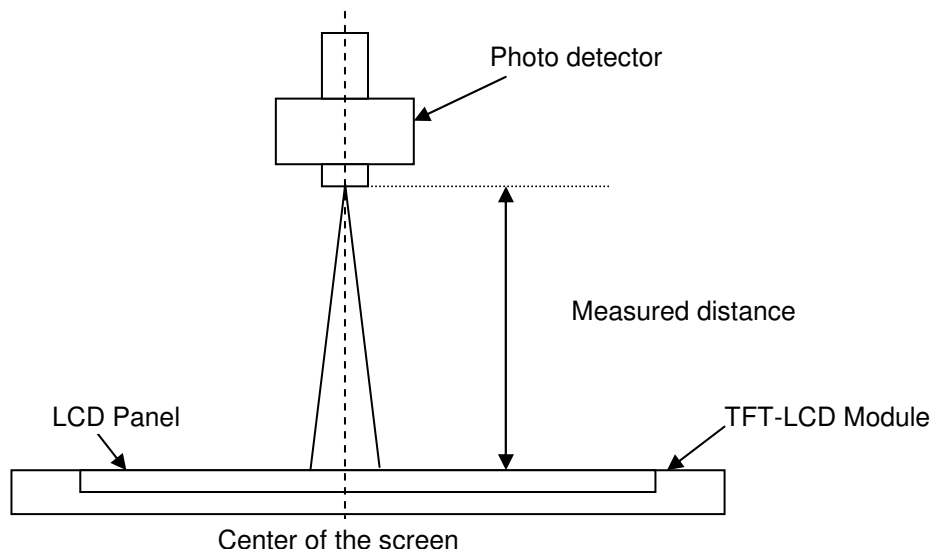
***Note 2:* Definition of viewing angle** measured by ELDIM (EZContrast 88)

Viewing angle is the measurement of contrast ratio ≥ 10 and ≥ 5, 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.

Normal Line

$\phi = 0°, \quad \theta = 0°$

θ_l

θ_R

ϕ_H

12 O'clock direction

$\theta_L = 90°$ x

ϕ_l

ϕ_I

y $\phi_H = 90°$

6 O'clock direction

$\phi_L = 90°$

y'

x'

$\theta_R = 90°$

***Note 3:* Contrast ratio** is measured by TOPCON SR-3

***Note 4:* Definition of Response time** measured by Westar TRD-100A

The output signals of photo detector are measured when the input signals are changed from "Full Black" to "Full White" (rising time, Tr_R), and from "Full White" to "Full Black" (falling time, Tf_F), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.
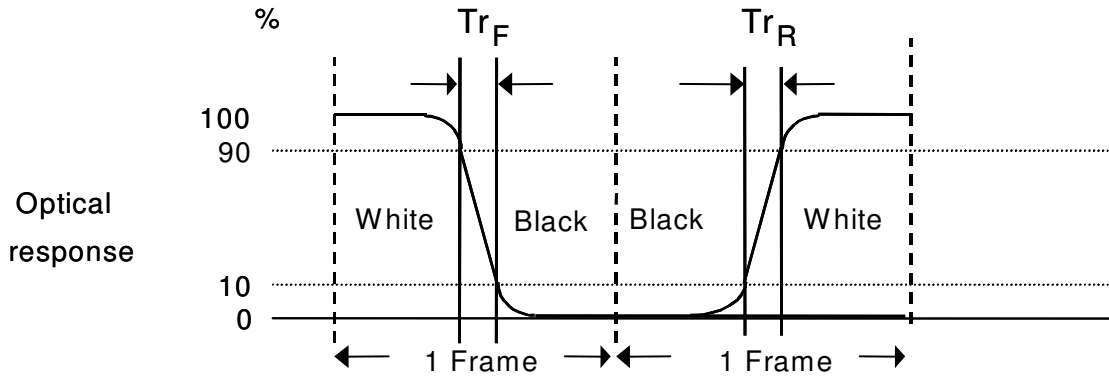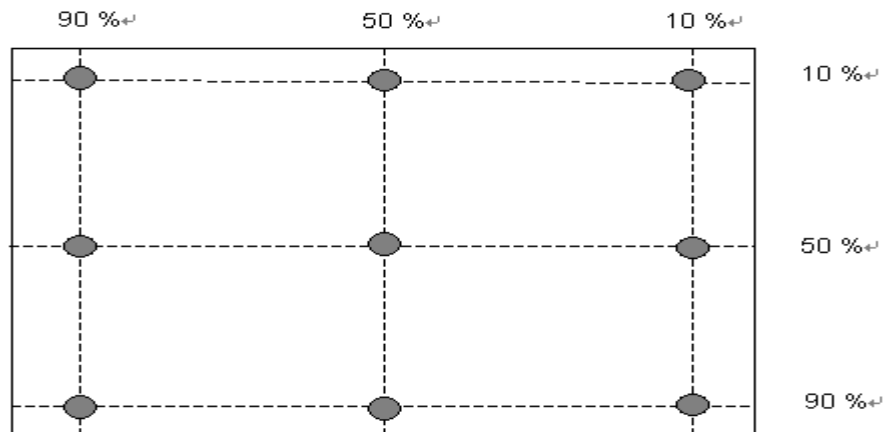

$Tr_R + Tf_F = 8$ msec (typ.).

Note 5: Color chromaticity and coordinates (CIE) is measured by TOPCON SR-3
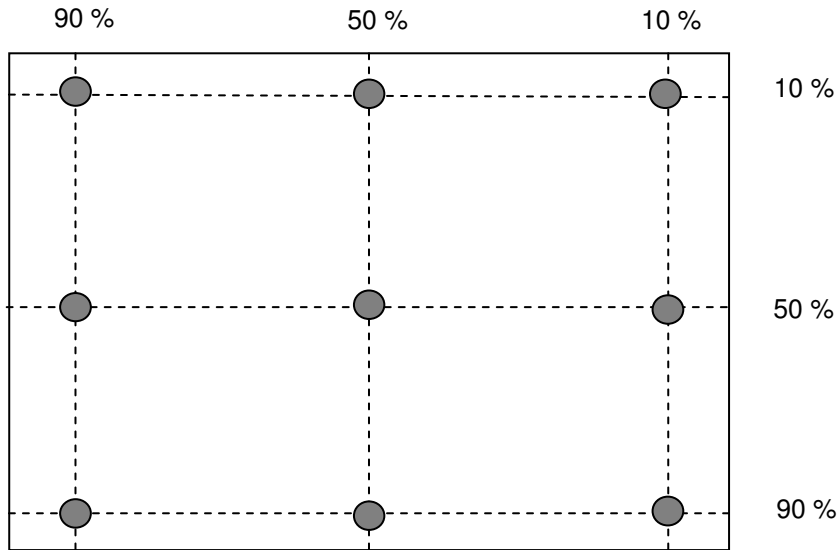
Note 6: Central luminance is measured by TOPCON SR-3

Note 7: Luminance uniformity of these 9 points is defined as below and 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 2: Definition of 9 points position (Display active area : 344.232(H) x 193.536(V))

Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4： Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$
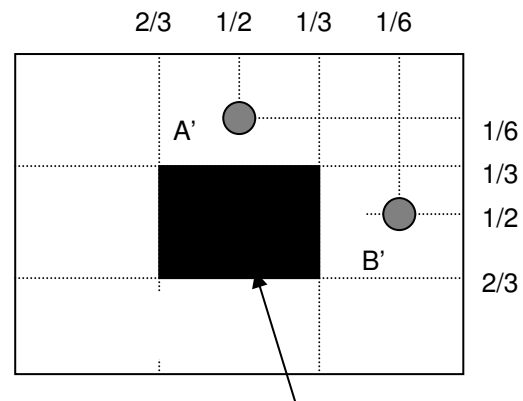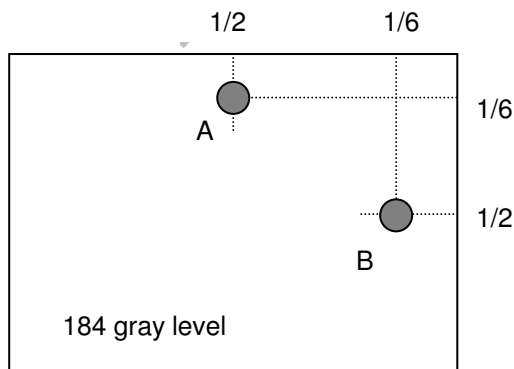
Note 5： Definition of cross talk (CT)

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: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.
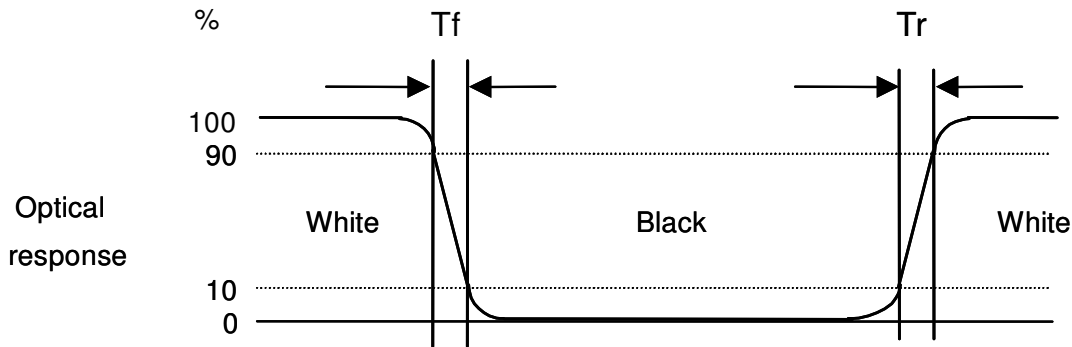
Note 7: Definition of viewing angle

Viewing angle is the measurement of contrast ratio $\geq$ 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 below: 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 to its center to develop the desired measurement viewing angle.
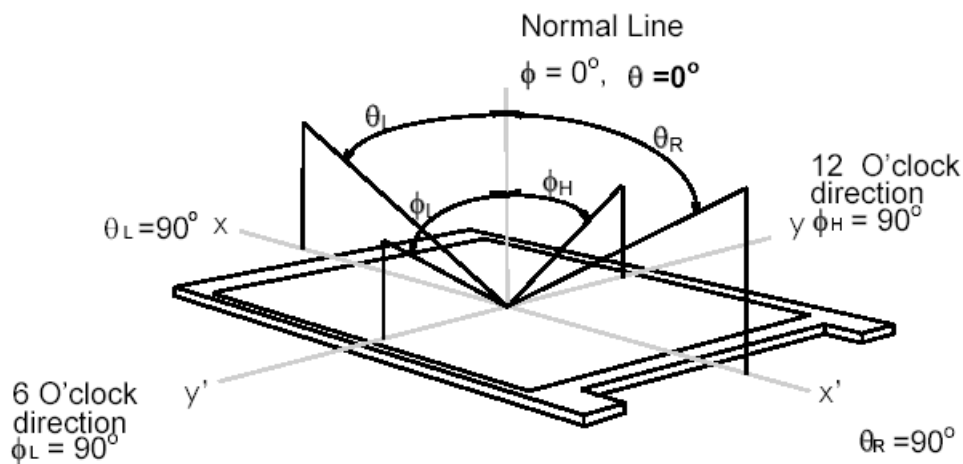
Note 8: Note 8: Definition of Gamma Value

Generally, Gamma Value is defined as the slope of a Gray Level – Luminance curve in log-log space, that is

γ = d log(Luminance) / d log(Gray Level)

The Gamma Value defined in this spec is Linear Regression (γ1, γ2, γ3…, γ16). γ1 to γ16 are the section gamma of the following 17 sampling points, GL(0), GL(16), GL(32), GL(48), GL(64), GL(80), GL(96), GL(112), GL(128), GL(144), GL(160), GL(176), GL(192), GL(208), GL(224), GL(240) and GL(255), in 8 bits input.

3. Functional Block Diagram

The following diagram shows the functional block of the 18.5 inch color TFT/LCD module:
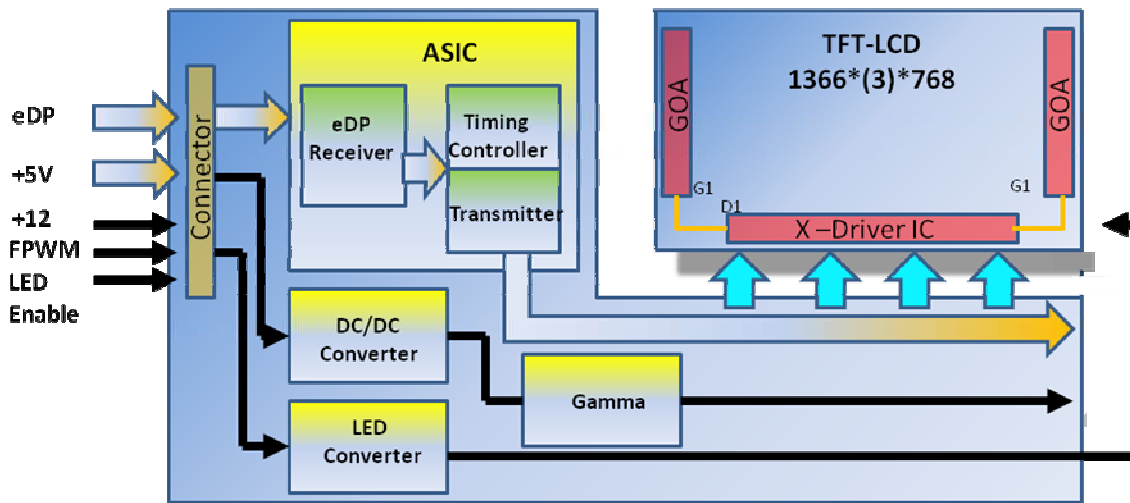
4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	0	6.0	[Volt]	**Note 1,2**

4.2 Absolute Ratings of Touch Sensor

Item	Symbol	Rating	Unit	Conditions
Voltage from VCCIO to AGND and DGND	-	+6.0	[Volt]	**-**
Voltage from any pin to AGND and DGND	-	+4.0	[Volt]	**-**

4.3 Absolute Ratings of Environment

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

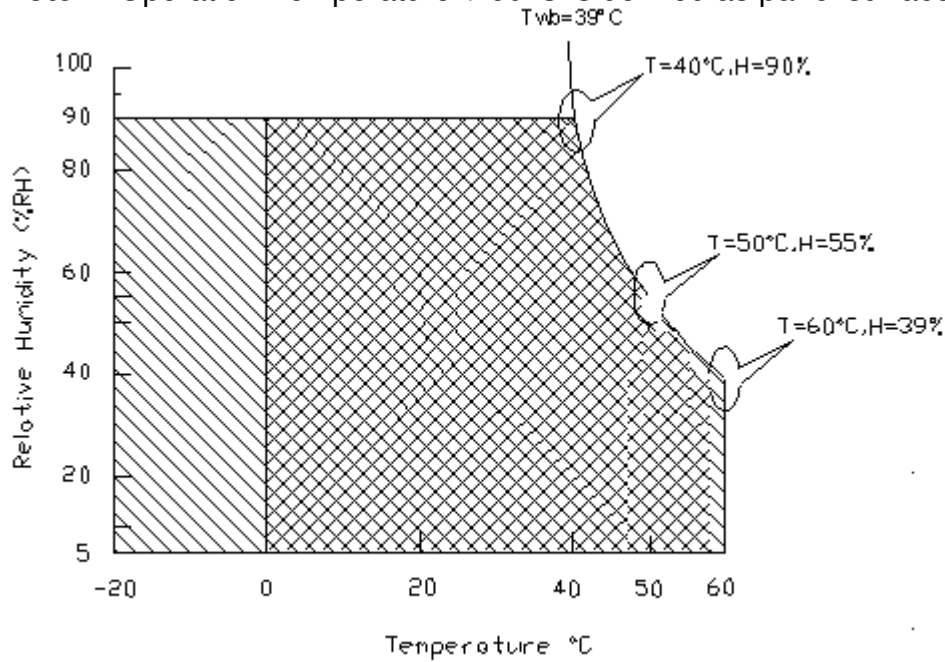Note: Maximum Wet-Bulb should be 39℃ and no condensation.

Note 1: With in Ta (25 ^{o}C)
Note 2: Permanent damage to the device may occur if exceeding maximum values
Note 3: For quality perfermance, please refer to AUO IIS(Incoming Inspection Standard).
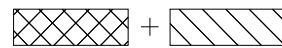
Note 4: Operation Temperature + 60°C is defined as panel surface termperature.

Operating Range   [XXXXX]   Storage Range   [XXXXX] + [\\\\\]

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD	Input Current	-	0.45	0.54	[A]	VDD= 5.0V, All Black Pattern At 60Hz
PDD	VDD Power	-	2.25	2.7	[Watt]	VDD= 5.0V, All Black Pattern At 60Hz
IRush	Inrush Current	-	-	3	[A]	**Note 1**
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	300	[mV] p-p	VDD= 5.0V, All Black Pattern At 60Hz

Note 1: Measurement conditions:

The duration of rising time of power input is 470 us.

VDD rising time
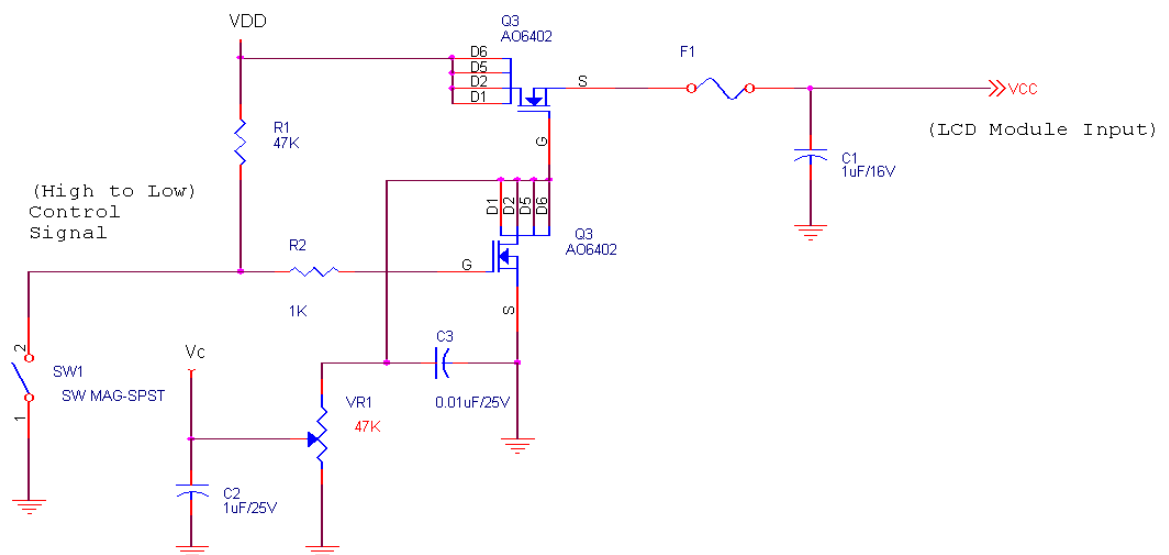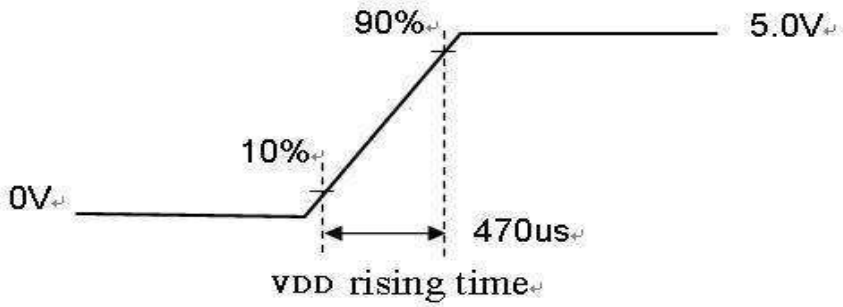
5.1.2 Signal Electrical Characteristics

Signal electrical characteristics are as follows:
Display Port main link signal:

Differential pair VD+ , VD- Which is one Display port Main link

VCM of Display port Main link

$Vdiff_{P-P} = [(VD+) - (VD-)] \times 2$
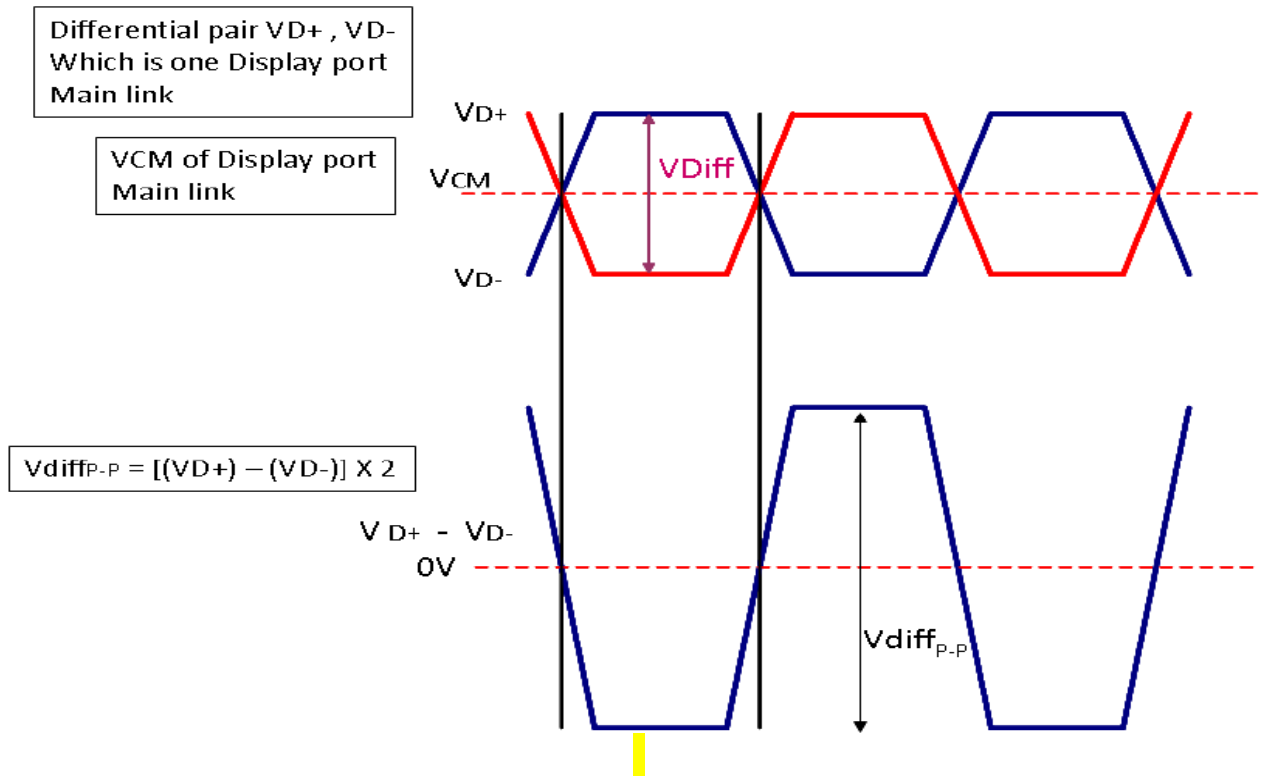
Display port main link					
		Min	Typ	Max	unit
VCM	RX input DC Common Mode Voltage		0		V
VDiff$_{P-P}$	Peak-to-peak Voltage at a receiving Device	150		1320	mV

Follow as VESA display port standard V1.1a

Display Port AUX_CH signal:

Differential AUX+ , AUX-
Which is Display pot AUX_CH
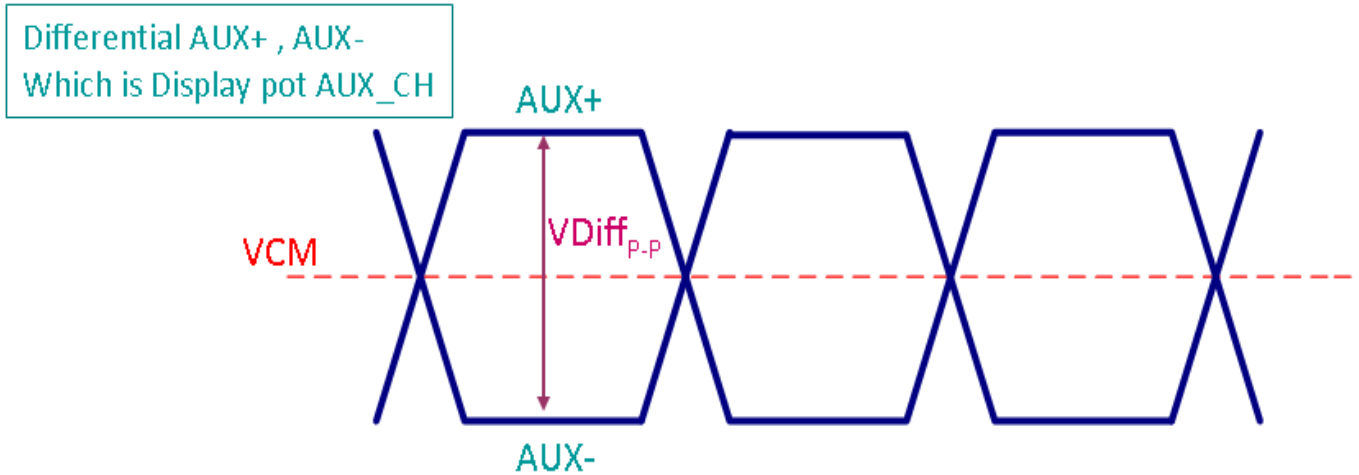
Display port AUX_CH					
		Min	Typ	Max	unit
VCM	AUX DC Common Mode Voltage		0		V
VDiff$_{P-P}$	AUX Peak-to-peak Voltage at a receiving Device	0.4	0.6-	0.8	V

Follow as VESA display port standard V1.1a.

Display Port VHPD signal:

Display port VHPD					
		Min	Typ	Max	unit
VHPD	HPD Voltage	2.25	-	2.75	V

Follow as VESA display port standard V1.1a.

5.2 Backlight Unit

Following characteristics are measured under stable condition using a LED driving board at 25℃ (Room Temperature).

Symbol	Parameter	Min	Typ	Max	Unit	Remark
Vcc	Input Voltage	10.8	12	13.2	Volt	
Ivcc	Input Current	-	0.53	0.64	A	
PLED	Power Consumption	-	6.36	7.68	Watt	
FPWM	PWM Dimming Frequency	200	-	20k	Hz	
	Swing Voltage	2.3	--	0.8	V	
	Dimming Duty Cycle	5	-	100	%	
Enable	High-level	2.3	--	--	V	
	Low-level	--	--	0.8	V	
I_F	LED Forward Current	-	45	--	mA	Ta = 25°C,Note 4
Operating Life		50,000	-	-	Hrs	Ta = 25°C

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: If module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: Operating life means brightness goes down to 50% initial brightness. Min. operating life time is estimated data.

Note 4: I_F are defined for one channel LED. There are six LED channel in back light unit.

6. Signal Characteristic
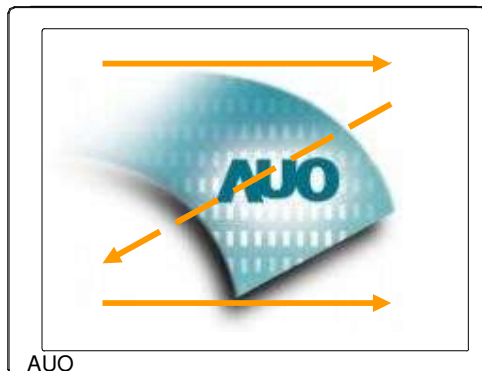
6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.

6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.

6.3 Signal Description

Basically, interface timings should match the 1366x768 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-		60	-	Hz
Clock frequency		$1/ T_{Clock}$	50	72.8	77	MHz
Vertical Section	Period	T_V	783	806	968	T_{Line}
	Active	T_{VD}	768			
	Blanking	T_{VB}	15	38	200	
Horizontal Section	Period	T_H	1466	1506	1866	T_{Clock}
	Active	T_{HD}	1366			
	Blanking	T_{HB}	100	140	500	

Note 1 : DE mode only

Note 2 : The maximum clock frequency = $T_V*T_H*60 < 77MHz$

6.4 Power ON/OFF Sequence

Display Port panel power sequence:
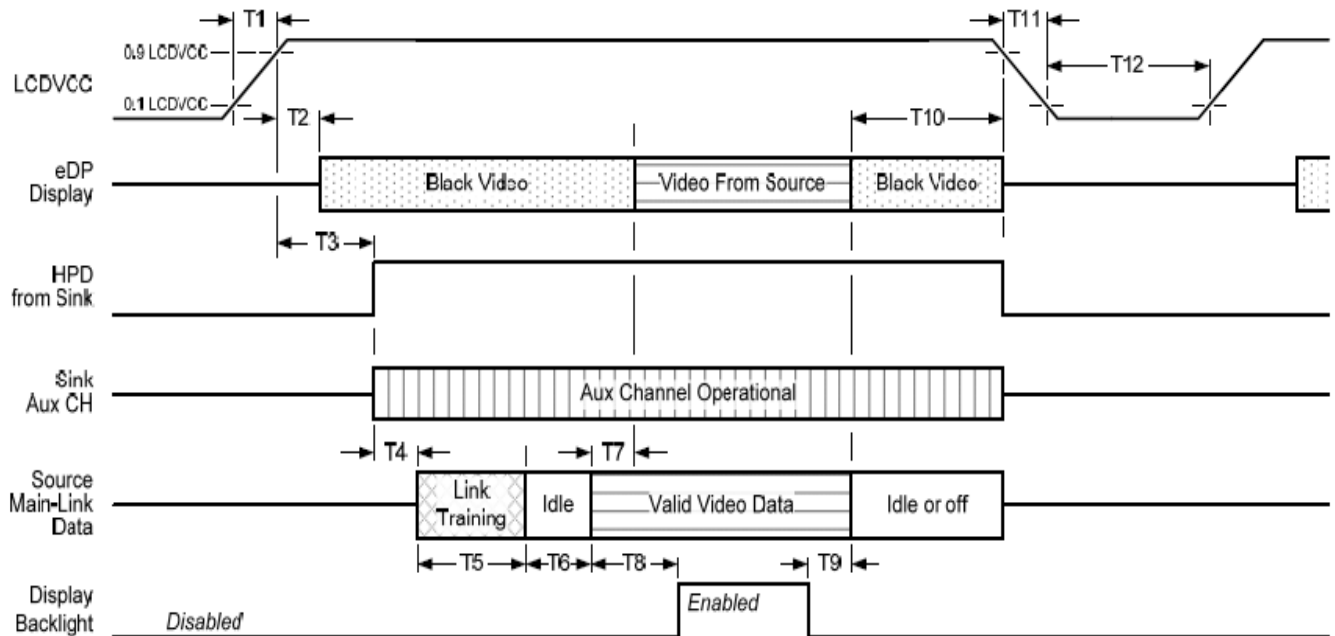
Display port interface power up/down sequence, normal system operation

Display Port AUX_CH transaction only:

Display port interface power up/down sequence, AUX_CH transaction only

Display Port panel power sequence timing parameter:

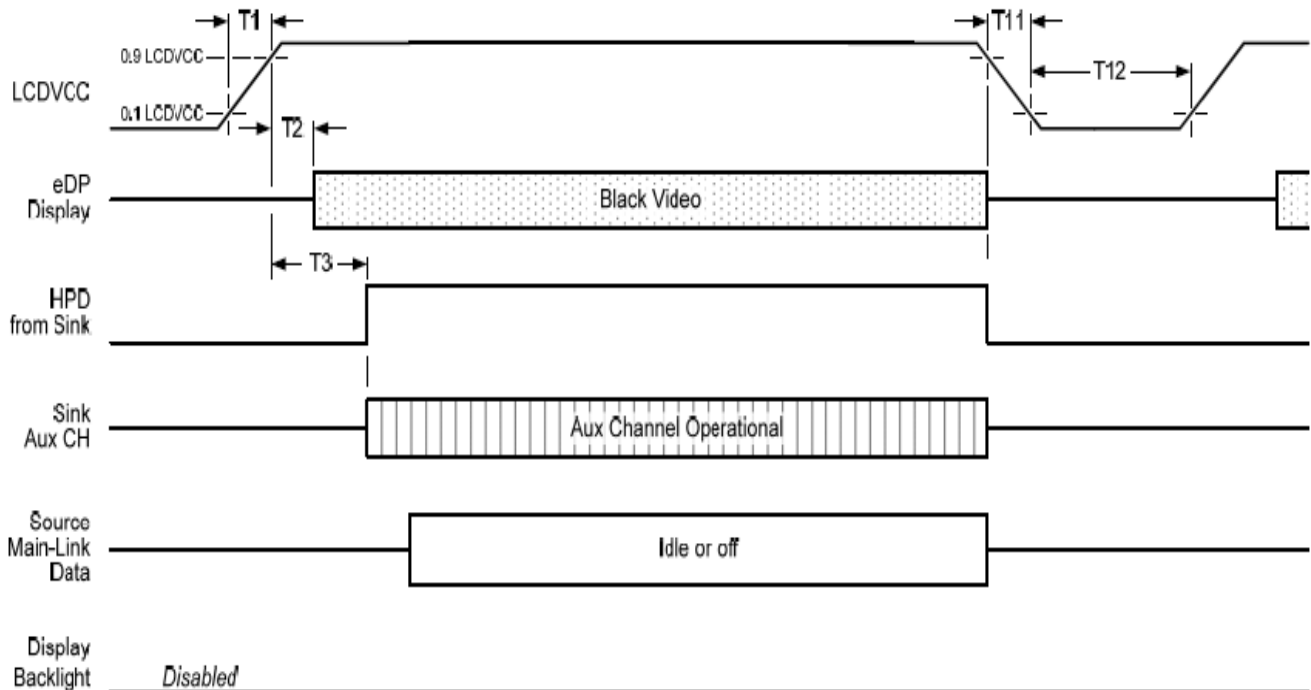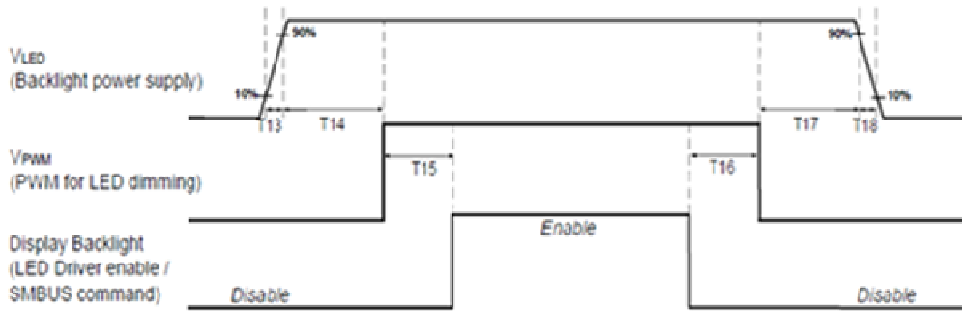| Timing parameter	Description	Reqd. by	Limits			Notes
			Min.	Typ.	Max.	
T1	power rail rise time, 10% to 90%	source	0.5ms		10ms	
T2	delay from LCDVDD to black video generation	sink	0ms		200ms	prevents display noise until valid video data is received from the source
T3	delay from LCDVDD to HPD high	sink	0ms		200ms	sink AUX_CH must be operational upon HPD high.
T4	delay from HPD high to link training initialization	source				allows for source to read link capability and initialize.
T5	link training duration	source				dependant on source link to read training protocol.
T6	link idle	source				Min accounts for required BS-Idle pattern. Max allows for source frame synchronization.
T7	delay from valid video data from source to video on display	sink	0ms		50ms	max allows sink validate video data and timing.
T8	delay from valid video data from source to backlight enable	source				source must assure display video is stable.
T9	delay from backlight disable to end of valid video data	source				source must assure backlight is no longer illuminated.
T10	delay from end of valid video data from source to power off	source	0ms		500ms	
T11	power rail fall time, 905 to 10%	source			200ms	
T12	power off time	source	500ms			

Note1: The sink must include the ability to generate black video autonomously. The sink must automatically enable black video under the following conditions:
 -upon LCDVDD power on (with in T2 max)-when the "Novideostream_Flag" (VB-ID Bit 3) is received from the source (at the end of T9).
 -when no main link data, or invalid video data, is received from the source. Black video must be displayed within 64ms (typ) from the start of either condition. Video data can be deemed invalid based on MSA and timing information, for example.

Note 2: The sink may implement the ability to disable the black video function, as described in Note 1, above, for system development and debugging purpose.

Note 3: The sink must support AUX_CH polling by the source immediately following LCDVDD power on without causing damage to the sink device (the source can re-try if the sink is not ready). The sink must be able to respond to an AUX_CH transaction with the time specified within T3 max.

Display Port panel B/L power sequence timing parameter:

	Min (ms)	Max (ms)
T13	0.5	10
T14	10	-
T15	10	-
T16	10	-
T17	-	-
T18	-	200
T19	1*	-
T20	1*	-

Seamless change: T19/T20 = 5xT$_{PWM}$*

*T$_{PWM}$= 1/PWM Frequency

Note : When the adapter is hot plugged, the backlight power supply sequence is shown as below.

7. 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.

7.1 TFT-LCD Signal: eDP Interface

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	IPEX or Compatible
Type Part Number	IPEX 20455-030E-12 or Compatible
Mating Housing Part Number	IPEX 20453-030T-11 or Compatible

7.1.1 Pin Assignment (1 Lanes)

  eDP lane is a differential signal technology for LCD interface and high speed data transfer device.

PIN NO	Symbol	Function
1	NC	No Connect
2	H_GND	High Speed Ground
3	Lane 1_N	NC
4	Lane 1_P	NC
5	H_GND	High Speed Ground
6	Lane0_N	Comp Signal Link Lane 0
7	Lane0_P	True Signal Link Lane 0
8	H_GND	High Speed Ground
9	AUX_CH_P	True Signal Auxiliary Ch.
10	AUX_CH_N	Comp Signal Auxiliary Ch.
11	H_GND	High Speed Ground
12	VDD	LCD logic and driver power
13	VDD	LCD logic and driver power
14	NC	No connect
15	LCD GND	LCD logic and driver ground
16	LCD GND	LCD logic and driver ground
17	HPD	HPD signal pin
18	BL_GND	Backlight_ground
19	BL_GND	Backlight_ground
20	BL_GND	Backlight_ground
21	BL_GND	Backlight_ground
22	BL_Enable	Backlight On / Off
23	FPWM	System PWM signal Input
24	NC	No connect
25	NC	No connect
26	VCC	Backlight power (+12V)
27	VCC	Backlight power(+12V)
28	VCC	Backlight power(+12V)
29	VCC	Backlight power (+12V)
30	NC	No Connect
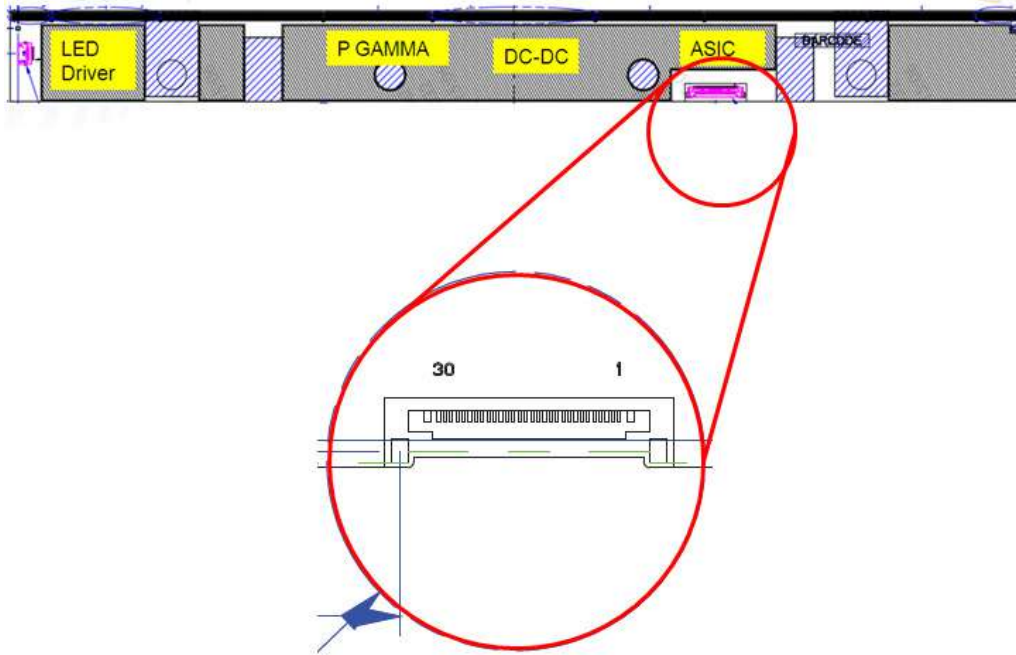
Note: PCB device side up

8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50 ^{o}C, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 60 ^{o}C, 300hours, For panel surface temp.	
Low Temperature Operation (LTO)	Ta= 0 ^{o}C, 300hours	
High Temperature Storage (HTS)	Ta= 60 ^{o}C, 300hours	
Low Temperature Storage (LTS)	Ta= -20 ^{o}C, 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: sine Frequency: 10 - 200 Hz Duration: 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: 46 cm, package test	
Thermal Shock Test (TST)	-20 ^{o}C /30min, 60 ^{o}C /30min, 100 cycles	*1*
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact: ± 8KV operation, Class B	*2*
	Air: ± 15KV operation, Class B	
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 ^{o}C to 60 ^{o}C, 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.
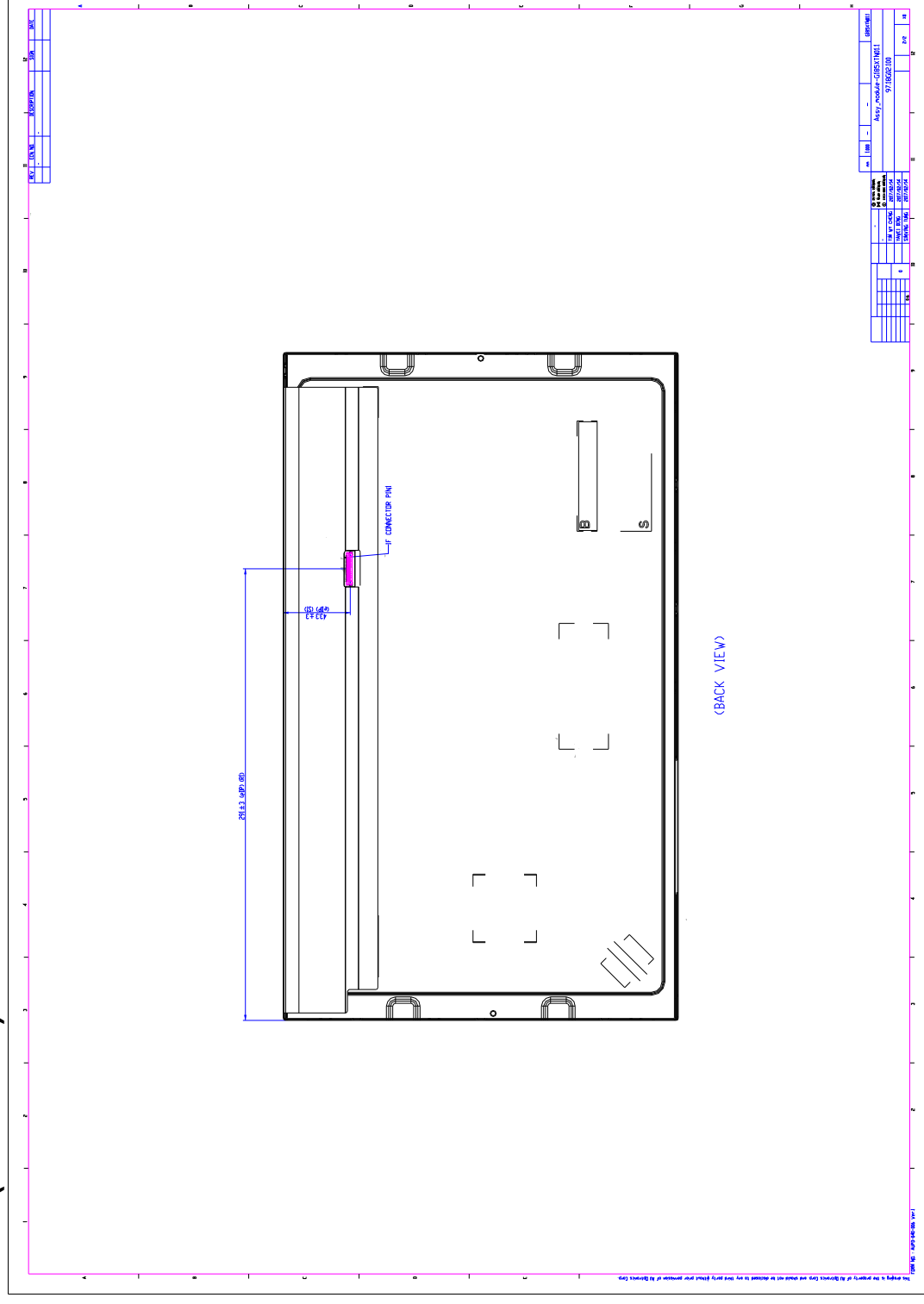
Note 2: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost, self-recoverable, no hardware fail

![AUO logo]

Product Specification

AU OPTRONICS CORPORATION

G185XTN01.1

9. Mechanical Characteristics
9.1 Outline Dimension (Front View)

(FRONT VIEW)

Document version 0.0

Product Specification

G185XTN01.1

AU OPTRONICS CORPORATION
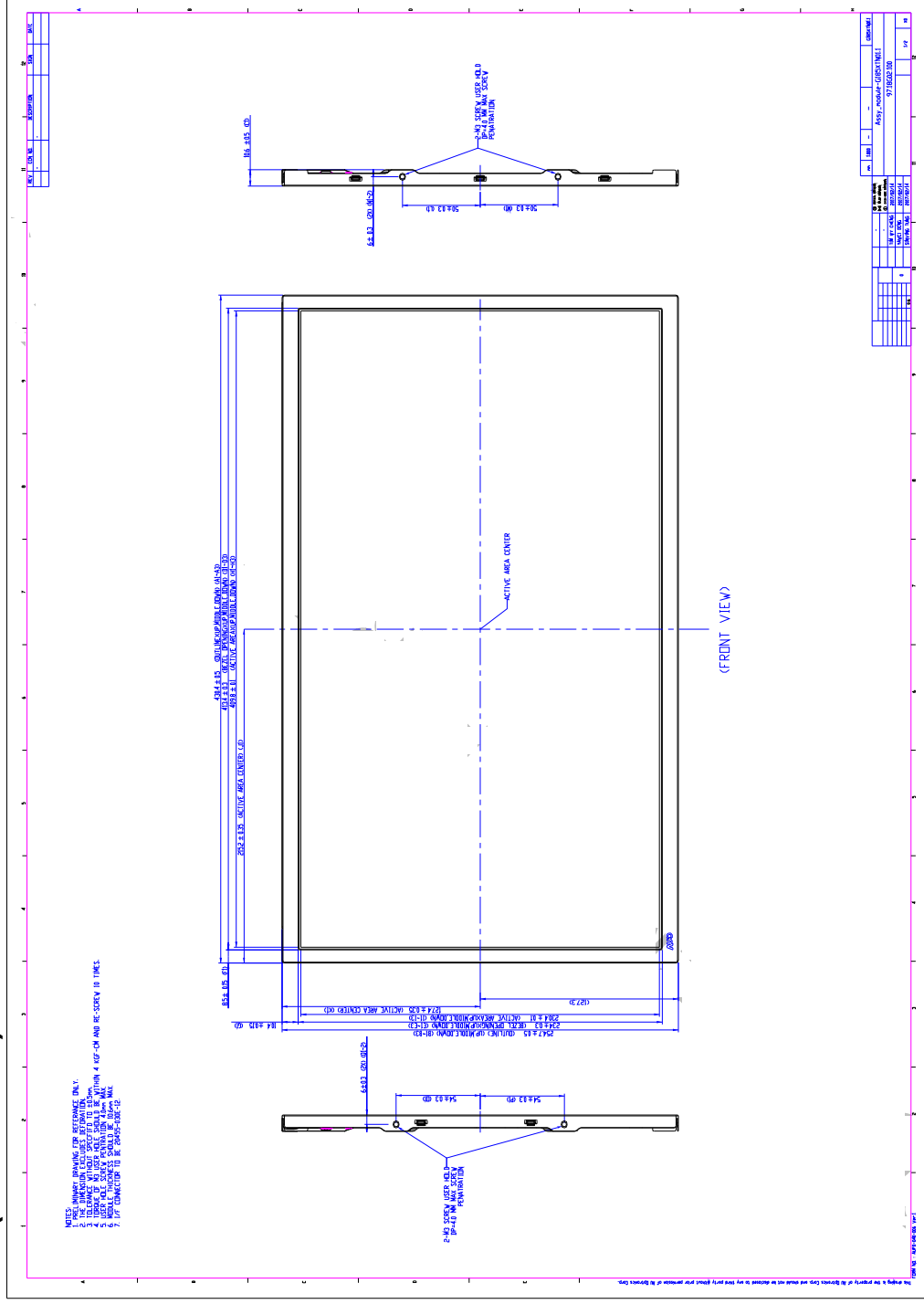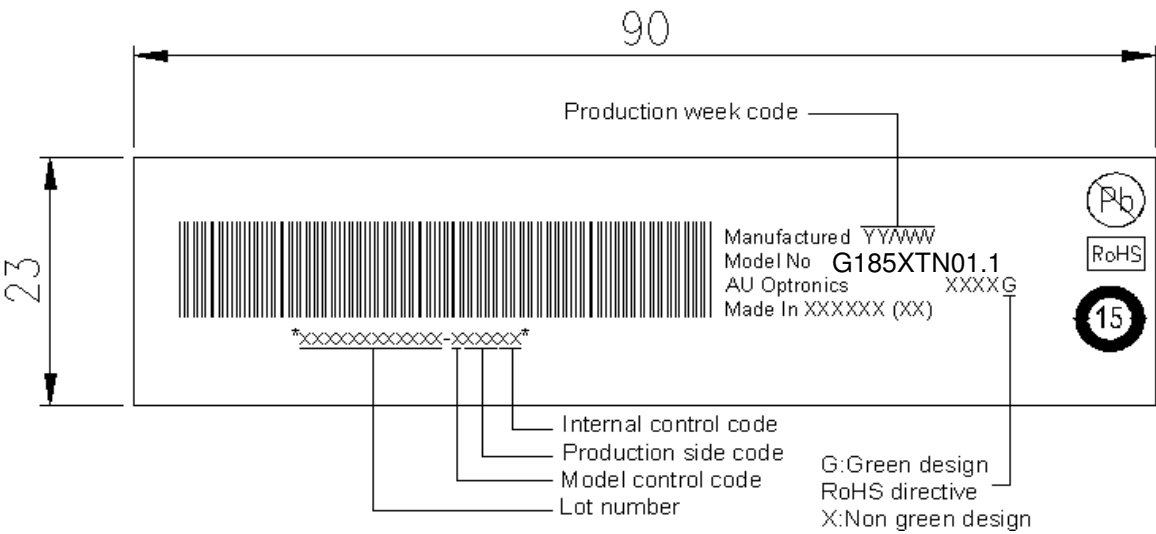
9.2 Outline Dimension (Back View)
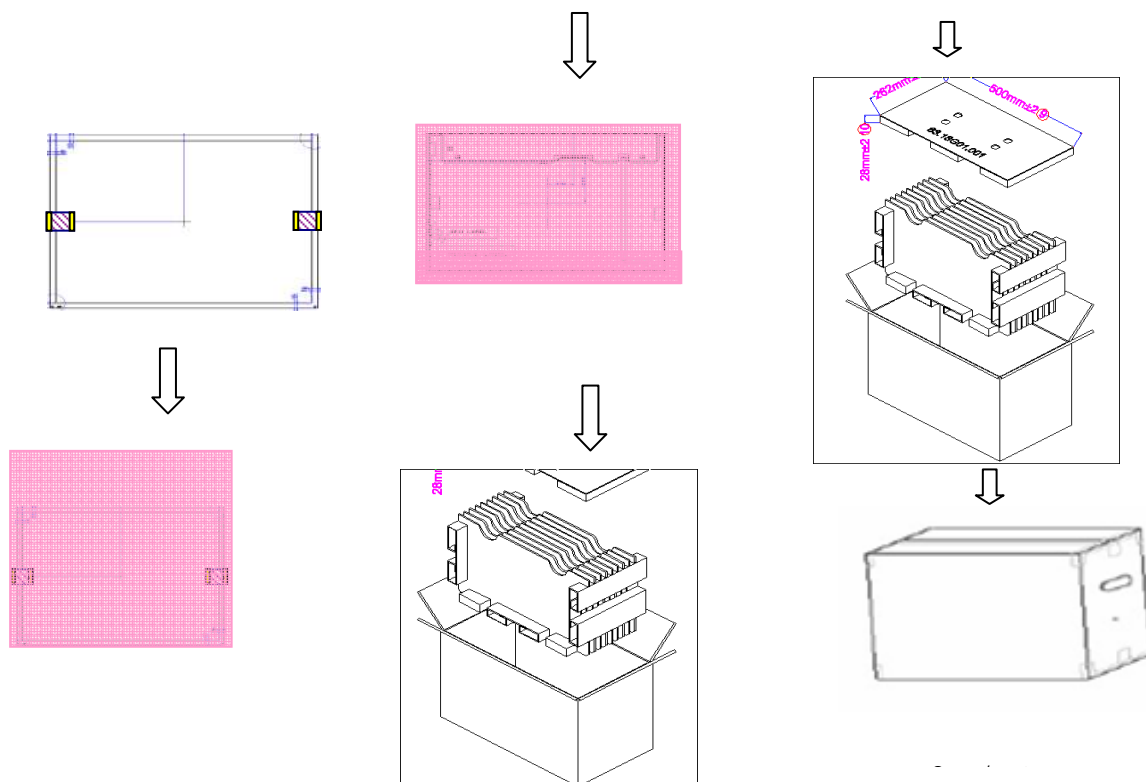

(BACK VIEW)

Document version 0.0

10. Label and Packaging

10.1 Shipping Label (on the rear side of TFT-LCD display)

10.2 Carton Package

Max capacity：8 TFT-LCD module per carton

Max weight: 15.0 kg per carton

Outside dimension of carton: 520mm(L)* 280mm(W)*355mm(H)
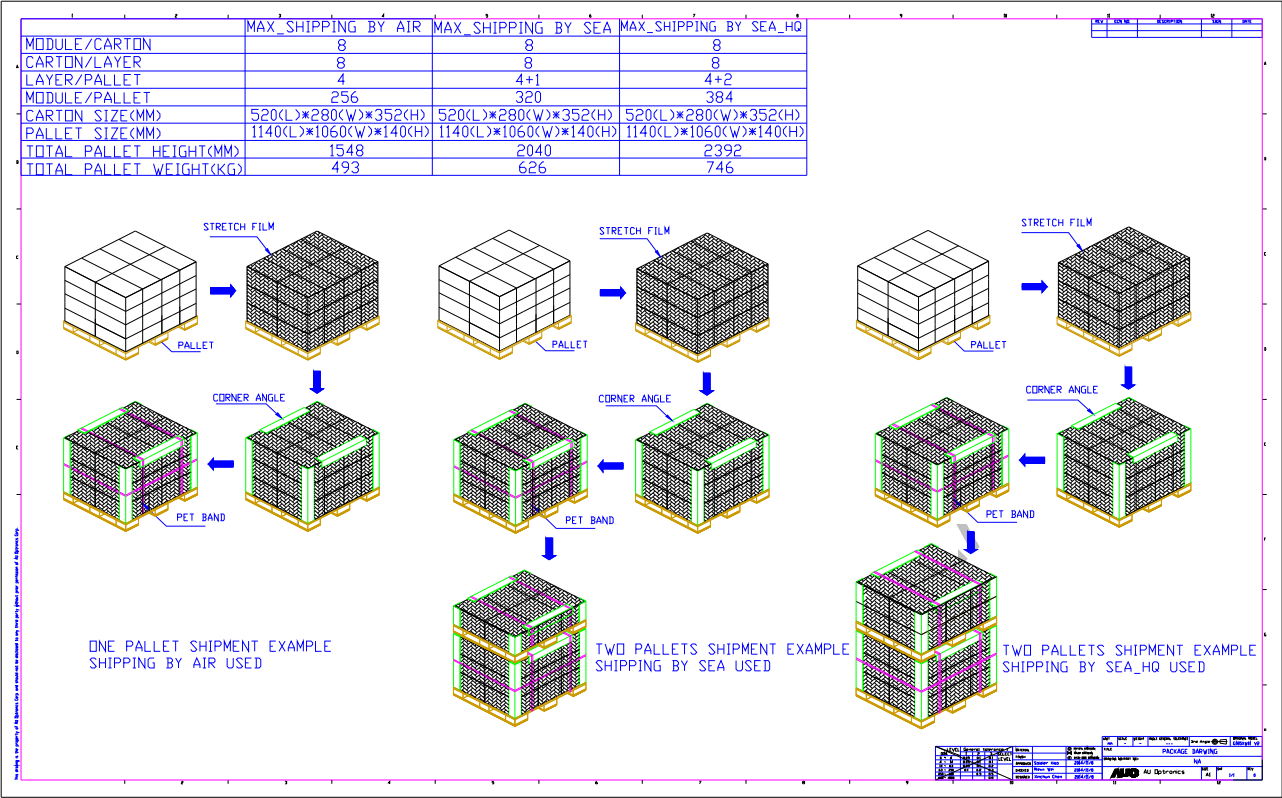
Pallet size： 1150 mm *1070 mm * 135mm

Box stacked

By air_max：(2 *4) *4 layers，one pallet put 32 boxes，total 256pcs module

By sea_max：(2 *4) *4 layers + (2 *4) *1 layers , two pallet put 40 boxes，total320pcs module

By sea_HQ_max：(2 *4) *4 layers+(2 *4) *2 layers, two pallet put 48 boxes, total 384pcs module

10.3 Palletizing

Palletizing

	MAX_SHIPPING BY AIR	MAX_SHIPPING BY SEA	MAX_SHIPPING BY SEA_HQ
MODULE/CARTON	8	8	8
CARTON/LAYER	8	8	8
LAYER/PALLET	4	4+1	4+2
MODULE/PALLET	256	320	384
CARTON SIZE(MM)	520(L)*280(W)*352(H)	520(L)*280(W)*352(H)	520(L)*280(W)*352(H)
PALLET SIZE(MM)	1140(L)*1060(W)*140(H)	1140(L)*1060(W)*140(H)	1140(L)*1060(W)*140(H)
TOTAL PALLET HEIGHT(MM)	1548	2040	2392
TOTAL PALLET WEIGHT(KG)	493	626	746

ONE PALLET SHIPMENT EXAMPLE
SHIPPING BY AIR USED

TWO PALLETS SHIPMENT EXAMPLE
SHIPPING BY SEA USED

TWO PALLETS SHIPMENT EXAMPLE
SHIPPING BY SEA_HQ USED

11 Safety

11.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

11.2 Materials

11.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

11.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

11.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

11.4 National Test Lab Requirement

The display module will satisfy all requirements for compliance to:

UL 60950-1, Second Edition   U.S.A. Information Technology Equipment