Specification

G104SN03 V1

Doc. No.: 01

Version December **2006**

Contents

Record of Revision

Version and Date	Page	Old description	New Description
0.1 Nov 23, 2006	All	First draft specification	-

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 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 (Notebook PC Bezel, for example), 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.
15) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
16) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
17) The data on this specification sheet is applicable when LCD module is placed in landscape position.
18) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.

2. General Description

G104SN03 V1 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display, a driver circuit, and a backlight system. The screen format is intended to support SVGA (800(H) x 600(V)) screen and 16.8M (RGB 8-bits) or 262K colors (RGB 6-bits). All input signals are LVDS interface compatible. Inverter card of backlight is not included.

G104SN03 V1 is designed for industrial display applications.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	10.4
Active Area	[mm]	211.2(H) x 158.4(V)
Pixels H x V		800x3(RGB) x 600
Pixel Pitch	[mm]	0.264 x 0.264
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 typ.
Typical Power Consumption	[Watt]	4.26W (IRCFL=5.0mA) 3.56W (IRCFL=3.8mA) All black pattern
Weight	[Grams]	300g(typ.)
Physical Size	[mm]	236.0(H)x 174.3(V) x 5.6(D) (typ.)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.8M / 262K colors

Temperature Range
   Operating
   Storage (Non-Operating)
	
	[^{o}C]
	[^{o}C]
		
		-20 to +70
		-30 to +80

RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature):

| Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m2]	IRCFL= 4.5mA (center point)	200	230	-	1
Uniformity	%	TBD		-	-	
Contrast Ratio			400	500	-	2
Response Time	[msec]	Rising	-	10	20	3
	[msec]	Falling	-	25	30	
	[msec]	Rising + Falling	-	35	50	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	60 60	70 70	- -	4
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	45 55	55 65	- -	
Color / Chromaticity Coordinates (CIE 1931)		Red x	TBD	TBD	TBD	
		Red y	TBD	TBD	TBD	
		Green x	TBD	TBD	TBD	
		Green y	TBD	TBD	TBD	
		Blue x	TBD	TBD	TBD	
		Blue y	TBD	TBD	TBD	
		White x	TBD	TBD	TBD	
		White y	TBD	TBD	TBD	
Color Gamut	%			45	-	

Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

Aperture 1° with 50cm viewing distance

Test Point Center

Environment *< 1 lux*

Module Driving Equipment
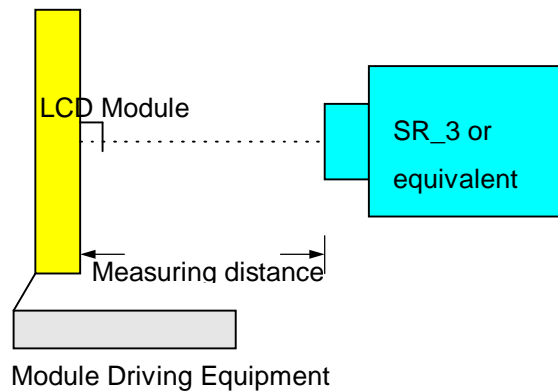
Note 2： Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 3: 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.
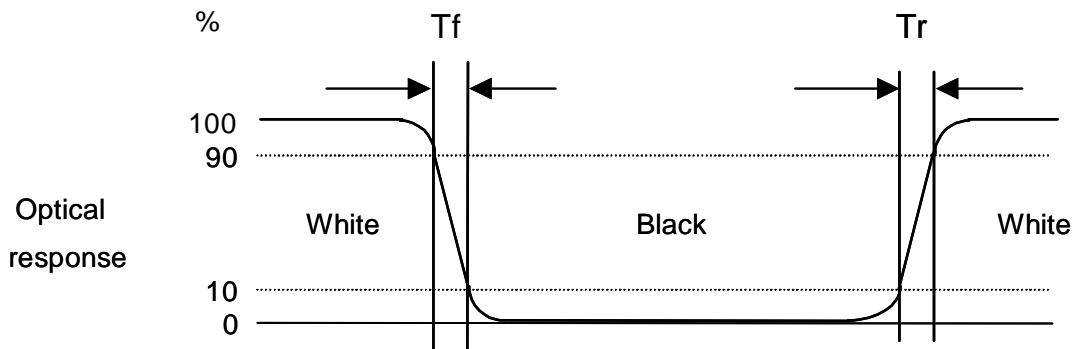
Note 4. Definition of viewing angle

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 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.
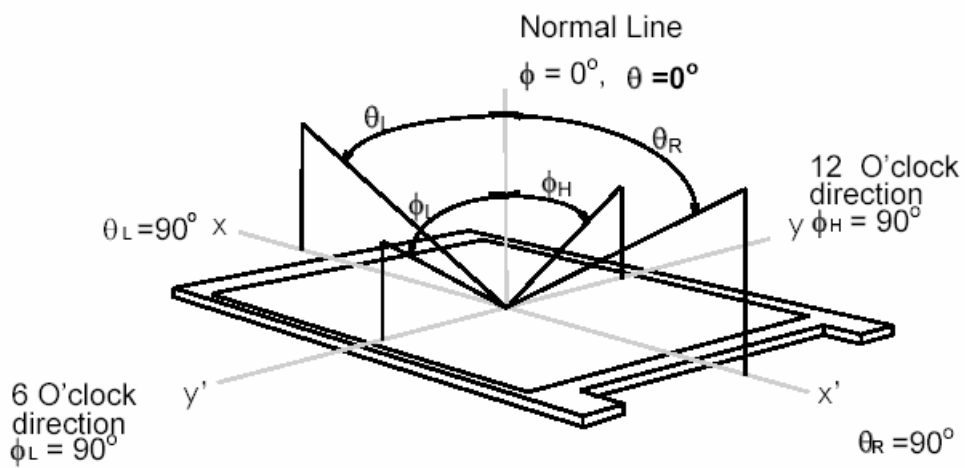
3. Functional Block Diagram

The following diagram shows the functional block of the 10.4 inch color TFT/LCD module:
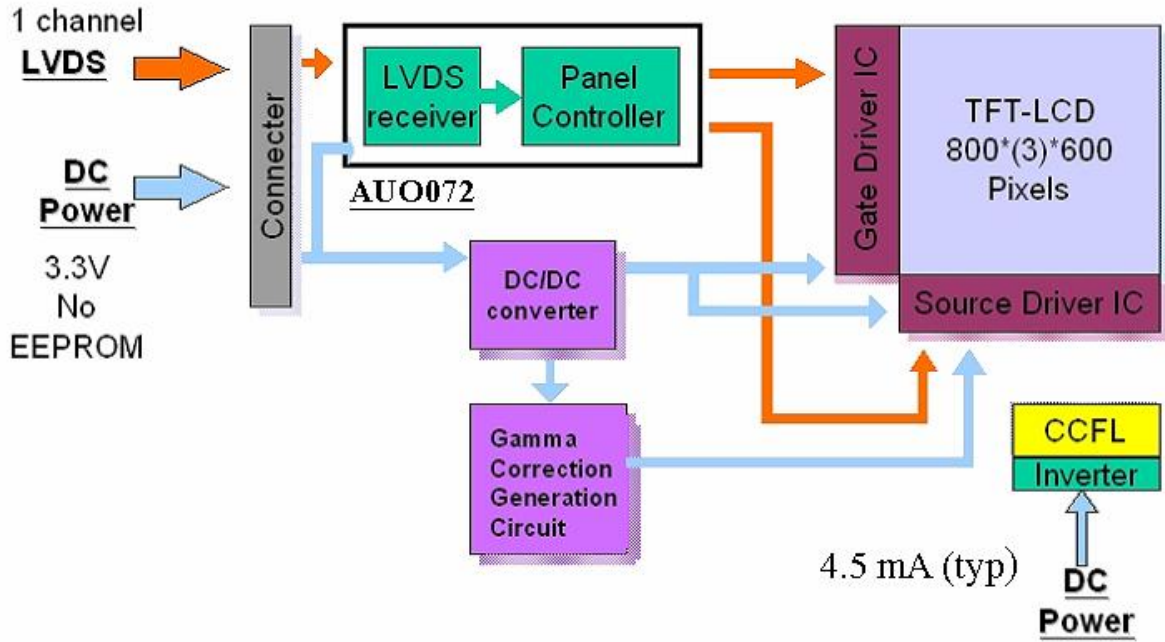
4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD Drive	Vin	-0.3	+4.0	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-20	+70	[^{o}C]
Operation Humidity	HOP	5	95	[%RH]
Storage Temperature	TST	-30	+80	[^{o}C]
Storage Humidity	HST	5	95	[%RH]

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

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
IDD	VDD Current	-	TBD	-	[mA]	All Black Pattern (VDD=3.3V, at 60Hz)
Irush	LCD Inrush Current	-	-	TBD	[A]	Note 1
PDD	VDD Power	-	TBD	-	[Watt]	All Black Pattern (VDD=3.3V, at 60Hz)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	TBD	[mV] p-p	All Black Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:
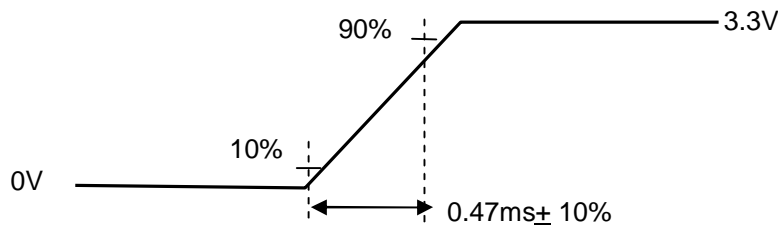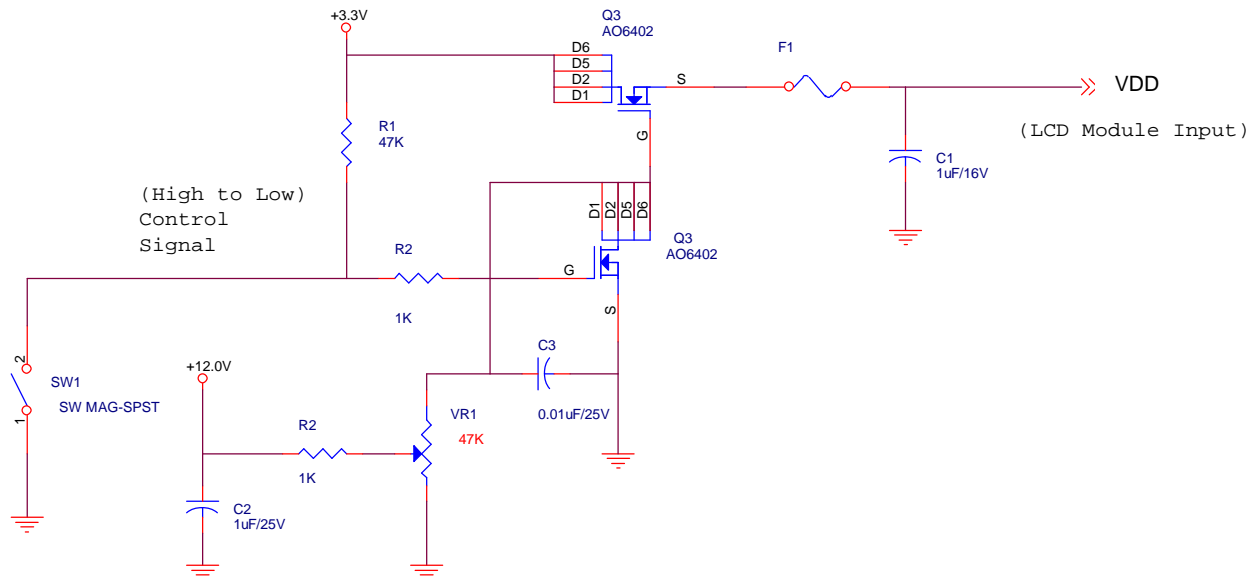
VDD rising time

5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
VTH	Differential Input High Threshold	-	-	100	[mV]	VCM=1.25V
VTL	Differential Input Low Threshold	100	-	-	[mV]	VCM=1.25V
｜VID｜	Input Differential Voltage	130	350	450	[mV]	
VICM	Differential Input Common Mode Voltage	TBD	-	TBD	[V]	VTH/VTL=+-100mV

Note: LVDS Signal Waveform.

Single-end Signal
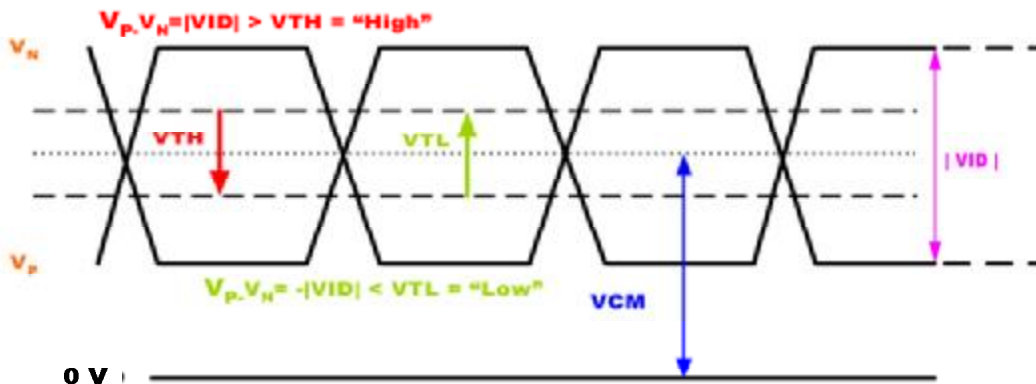
Differential Signal
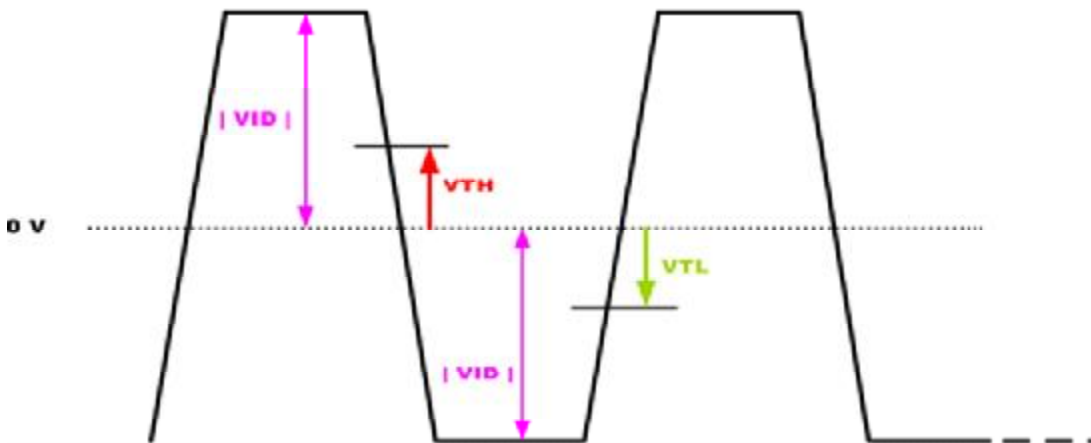
5.2 Backlight Unit

5.2.1 Parameter guideline for CCFL

Following characteristics are measured under a stable condition using an inverter at 25℃ (Room Temperature):

| Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
IRCFL	CCFL operation range	3.0	4.5	5.5	[mA] rms	(Ta=25°C) Note 1, 2
FCFL	CCFL Frequency	40	60	65	[KHz]	(Ta=25°C) Note 3
ViCFL (-20°C) (reference)	CCFL Ignition Voltage	-	-	TBD	[Volt] rms	(Ta= -20°C)
ViCFL (25°C) (reference)	CCFL Ignition Voltage	-	-	TBD	[Volt] rms	(Ta=25°C)
VCFL	CCFL Discharge Voltage	510	560	610	[Volt] rms	(Ta=25°C) Note 4 IRCFL=5mA
PCFL	CCFL Power consumption (inverter excluded)	-	2.52	-	[Watt]	(Ta=25°C) Note 4 IRCFL=5mA
Lamp Life			30,000		Hrs	(Ta=25°C) Note 2 IRCFL = 4.5mA

Note 1: IRCFL is defined as the return current of an inverter. (In Figure. 1)
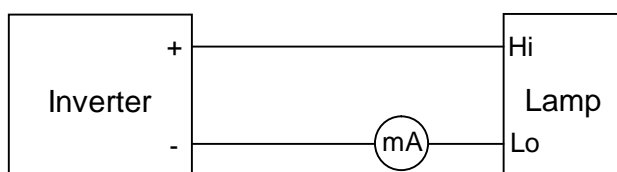
(Figure. 1: Measurement of return current)

A stable IRCFL is a current without flicker or biasing waveform provided by inverter that ensures the backlight perform to its specification. The ideal sine waveform should be symmetric in positive and negative polarities and the asymmetry rate of the inverter waveform should be below 10%.

It is recommended to use the inverter with detection circuit to avoid overvoltage, overcurrent, or mismatching waveform. The purpose is to avoid current flow into only one of the lamps when the other one is not in operation.

Note 2: The definition of lamp life means when any of following conditions happen:

a) Luminance falls to 50% or less of the initial value.

b) Normal lighting is no more available (flickering, pink lighting, no lighting, etc.)

c) Lamp voltage or lighting start voltage exceeds the specified value.

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

Higher frequency will induce higher leakage current and further impact lamp life.

Note 4: Calculator value for reference (IRCFLxVCFLx1=PCFL).

Note 5: The display is with dual lamp design, and the CCFL current in above table refers to each lamp

6. Signal Characteristic

6.1 Pixel Format Image

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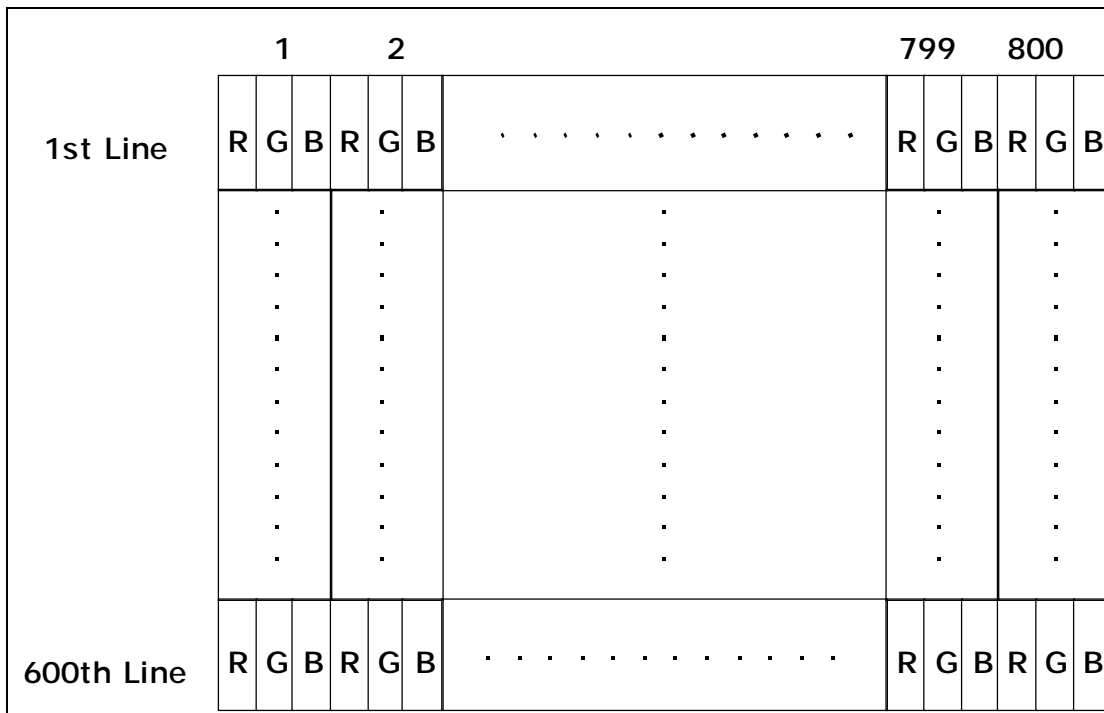
6.2 Scanning Direction

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

Fig. 1 Normal scan (Pin4, DPS = Low or NC)

Fig. 2 Reverse scan (Pin4, DPS = High)

6.3 Signal Description

The module uses a LVDS receiver embedded in AUO's ASIC. LVDS is a differential signal technology for LCD interface and a high-speed data transfer device.

(1)Input signal interface

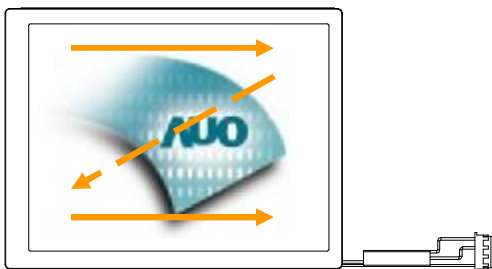| Pin no	Symbol	Function	Etc.
1	V_{CC}	+3.3 V power supply	
2	V_{CC}	+3.3 V power supply	
3	GND	Ground	
4	DPS	Reverse Scan Function [H: Enable; L/NC:Disable]	
5	RxIN0-	LVDS receiver signal channel 0	
6	RxIN0+		
7	GND	Ground	
8	RxIN1-	LVDS receiver signal channel 1	
9	RxIN1+		
10	GND	Ground	
11	RxIN2-	LVDS receiver signal channel 2	
12	RxIN2+		
13	GND	Ground	
14	CKIN-	LVDS receiver signal clock	
15	CKIN+		
16	GND	Ground	
17	RxIN3-	LVDS receiver signal channel 3	
18	RxIN3+		
19	AGMode	Aging Mode setting [H: Aging Mode; L/NC: Normal]	
20	SEL68	6/8 bits LVDS input setting [H: 8 bits; L/NC:6 bits]	

6.4 The Input Data Format

SEL68="L" or "Floating" for 6 bits LVDS input

CK							
DIN1	G0	R5	R4	R3	R2	R1	R0
DIN2	B1	B0	G5	G4	G3	G2	G1
DIN3	DE	VS	HS	B5	B4	B3	B2
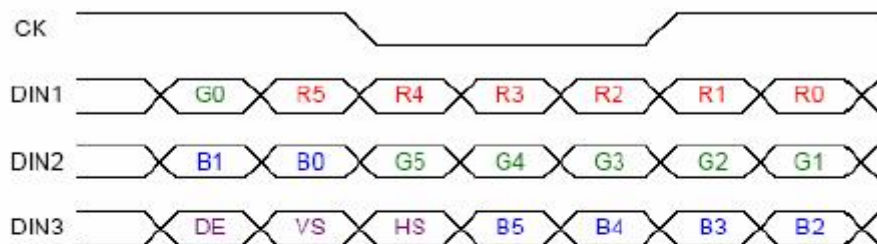
SEL68="H" for 8 bits LVDS input

CK							
DIN1	G0	R5	R4	R3	R2	R1	R0
DIN2	B1	B0	G5	G4	G3	G2	G1
DIN3	DE	VS	HS	B5	B4	B3	B2
DIN4	RSV	B7	B6	G7	G6	R7	R6
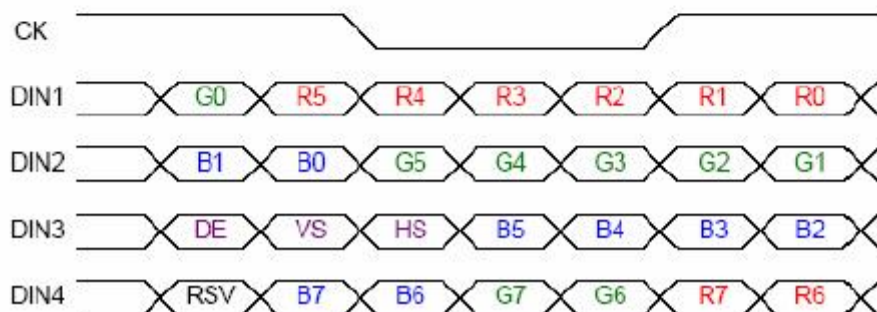
Signal Name	Description	Remark
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0	Red-pixel Data Each red pixel's brightness data consists of these pixel data. For 8Bits LVDS input MSB: R7 ; LSB: R0 For 6Bits LVDS input MSB: R5 ; LSB: R0
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 Green Data 6 Green Data 5 Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0	Green-pixel Data Each green pixel's brightness data consists of these pixel data For 8Bits LVDS input MSB: G7 ; LSB: G0 For 6Bits LVDS input MSB: G5 ; LSB: G0
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0	Blue-pixel Data Each blue pixel's brightness data consists of these pixel data For 8Bits LVDS input MSB: B7 ; LSB: B0 For 6Bits LVDS input MSB: B5 ; LSB: B0
CLK	Data Clock	The typical frequency is 40MHz. The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high.
DE	Display Timing	This signal is strobed at the falling edge of CLK. When the signal is high, the pixel data shall be valid to be displayed.
VSYNC	Vertical Sync	The signal is synchronized to CLK.
HSYNC	Horizontal Sync	The signal is synchronized to CLK.

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.
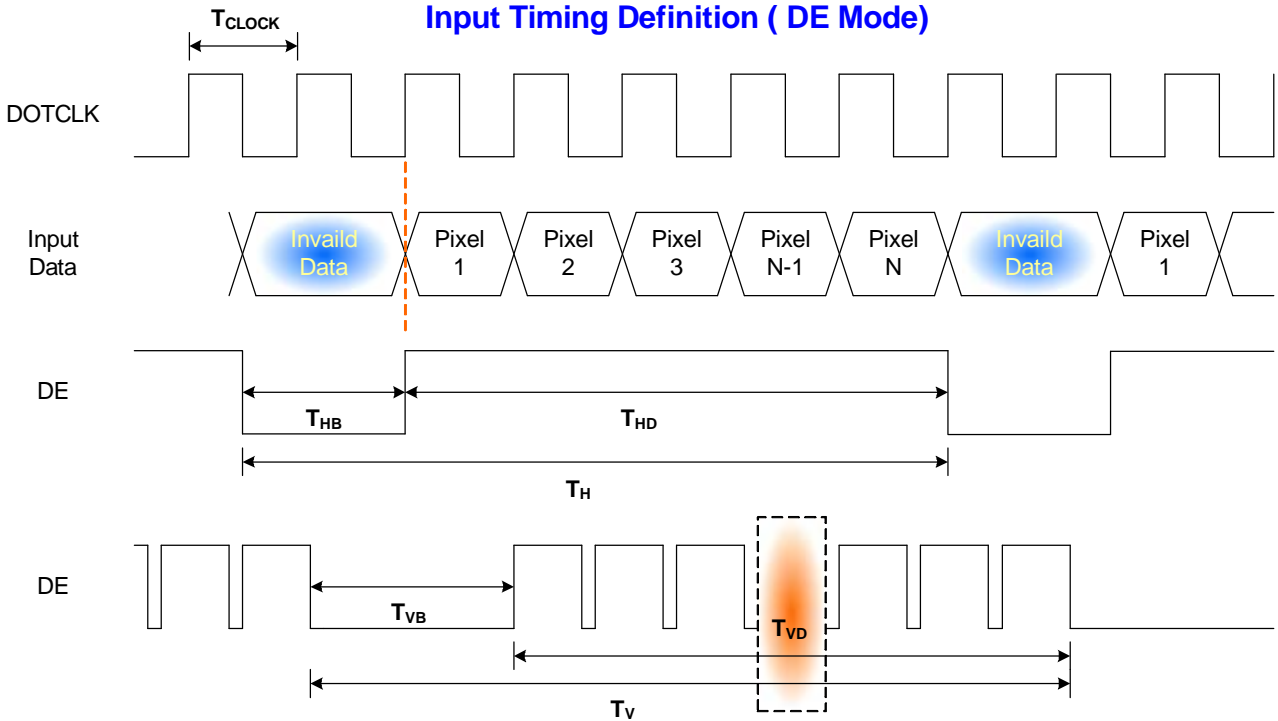
6.5 Interface Timing

6.5.1 Timing Characteristics

DE only mode

| Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency		$1/T_{Clock}$	30	40	50	MHz	
Vertical Section	Period	T_V	628	628	628	T_{Line}	
	Active	T_{VD}	600	600	600		
	Blanking	T_{VB}	28	28	28		
Horizontal Section	Period	T_H	960	1056	1060	T_{Clock}	
	Active	T_{HD}	800	800	800		
	Blanking	T_{HB}	160	256	260		

Note: Frame rate is 60 Hz.

6.5.2 Input Timing Diagram

6.6 Power ON/OFF Sequence

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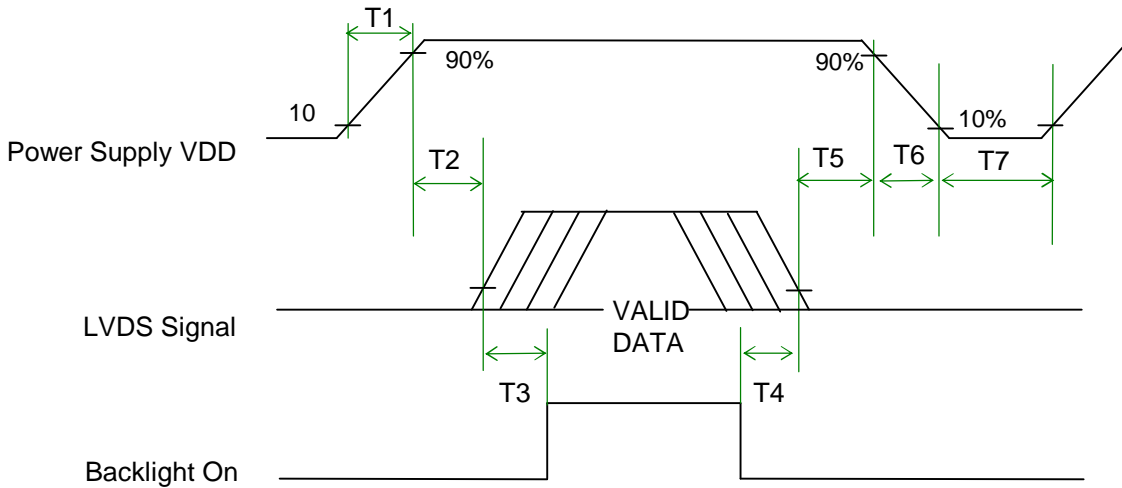
Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	180	-	-	ms
T4	180	-	-	ms
T5	0	-	50	ms
T6	0	-	10	ms
T7	500	-	-	Ms

The above on/off sequence should be applied to avoid abnormal function in the display.   Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

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 Module: LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	Hirose or compatible
Connector Model Number	HRS DF19G-20S-1C or compatible
Adaptable Plug	HRS DF19-20S-1F or compatible

7.2 Backlight Unit: Lamp Connector

Connector Name / Designation	Lamp Connector
Manufacturer	JST or compatible
Connector Model Number	BHSR-02VS-1 or compatible
Mating Model Number	SM02B-BHSS-1-TB or compatible

7.3 Lamp Connector Pin Assignment

Pin #	Symbol	Cable color	Signal Name
2	L	White	CCFL power supply(GND)
1	H	Pink	CCFL power supply(H.V.)

8. Reliability Test Criteria

| Items	Required Condition	Note
Temperature Humidity Bias	40℃/90%,300Hr	
High Temperature Operation	70℃,300Hr (center point of panel surface)	
Low Temperature Operation	-20℃,300Hr	
Hot Storage	80℃,300 hours	
Cold Storage	-30℃,300 hours	
Thermal Shock Test	-20℃/30 min ,60℃/30 min ,100cycles, 40℃ minimun ramp rate	
Hot Start Test	70℃/1 Hr min.　power on/off per 5 minutes, 5 times	
Cold Start Test	-20℃/1 Hr min.　power on/off per 5 minutes, 5 times	
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(+-X,+-Y,+-Z)	
Vibration Test (Non-Operating)	1.5G, 10~200~10Hz, Sine wave 30mins/axis, 3 direction (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact : ± 8KV/ operation, Class B Air : ± 15KV / operation, Class B	Note 1
EMI	30-230 MHz, limit 40 dBu V/m, 230-1000 MHz, limit 47 dBu V/m	

Note1: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost

．Self-recoverable. No hardware failures.

9. Mechanical Characteristics

9.1 LCM Outline Dimension (Front View)
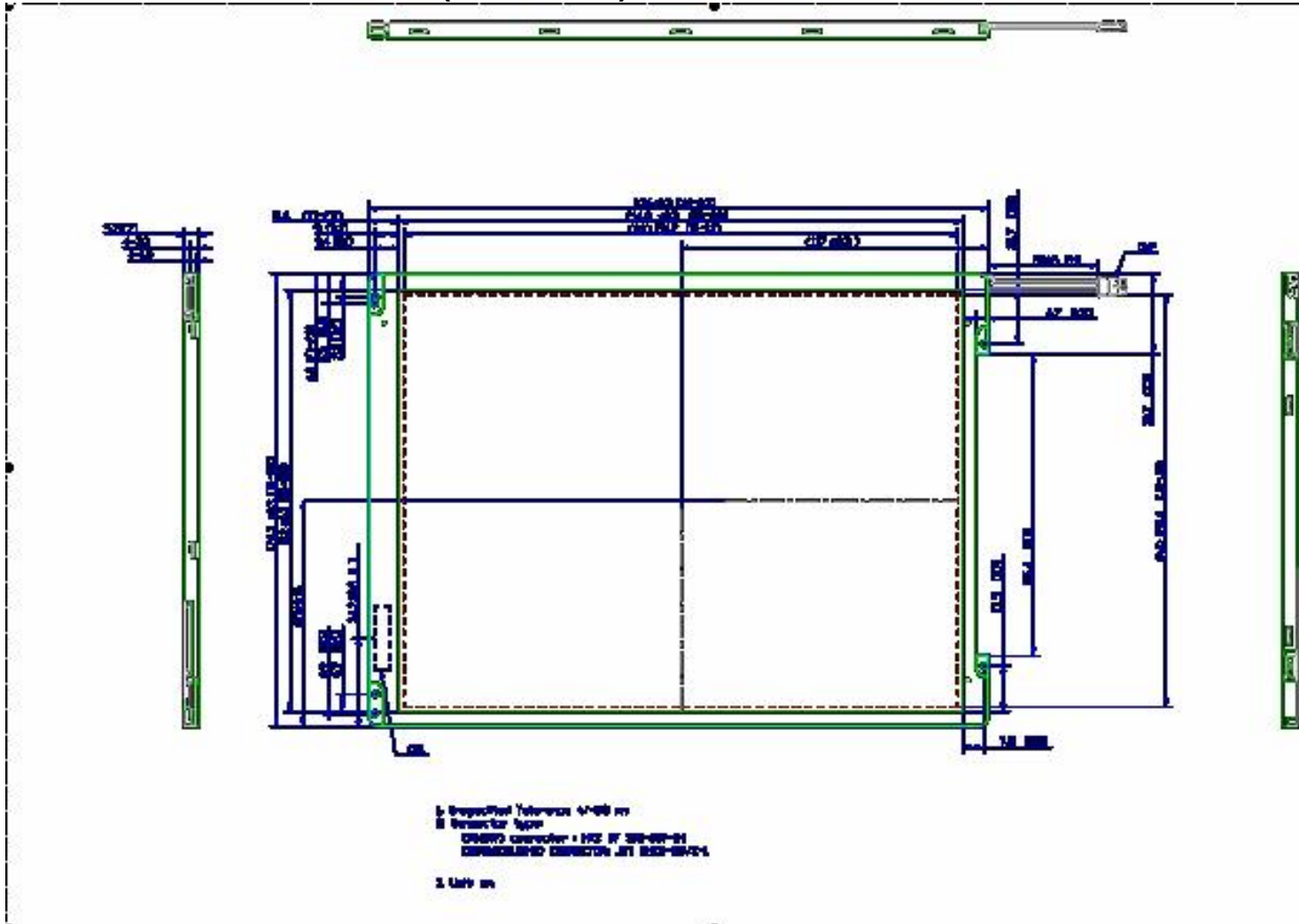
9.2 LCM Outline Dimension (Rear View)

Module Label
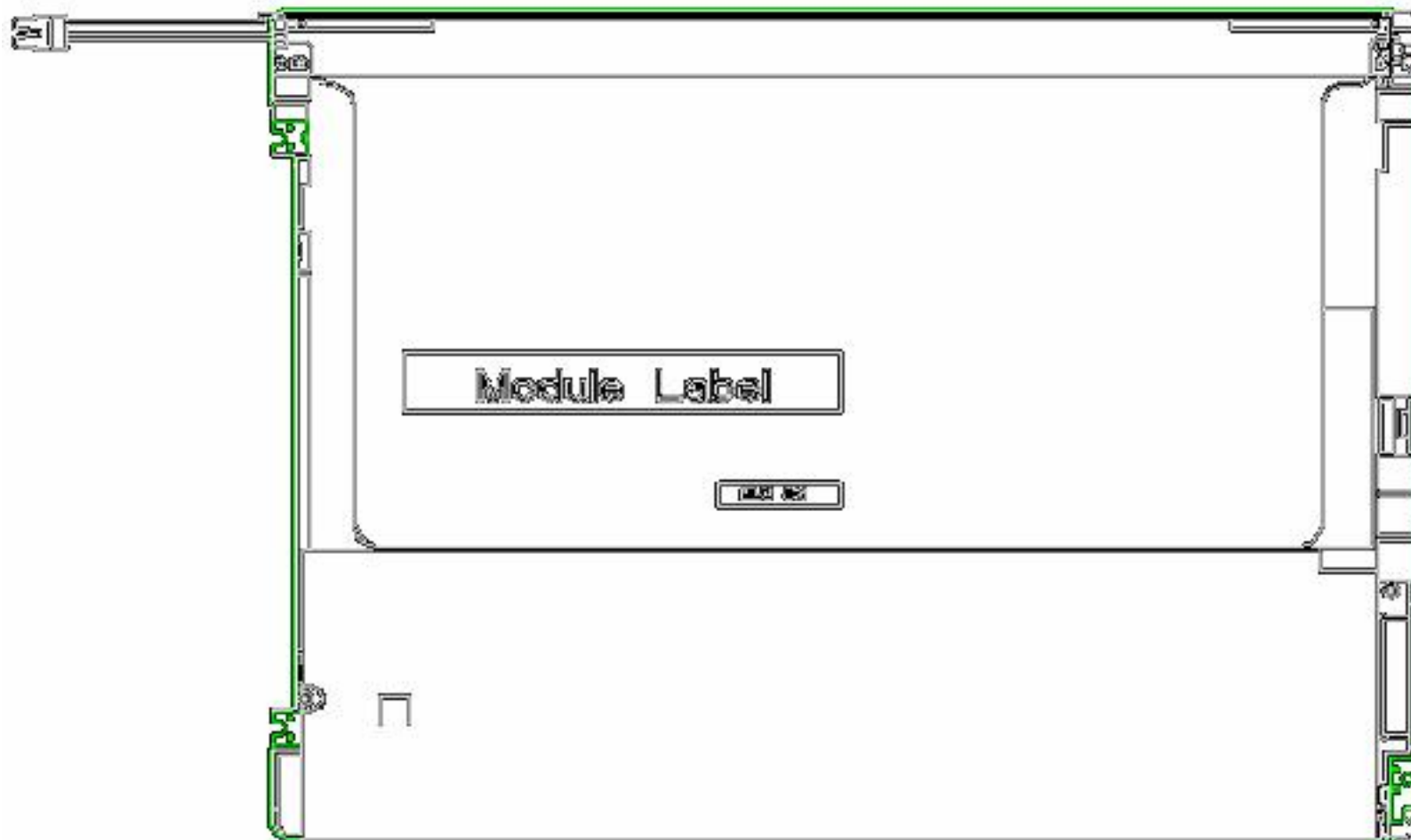
10. Label and Packaging

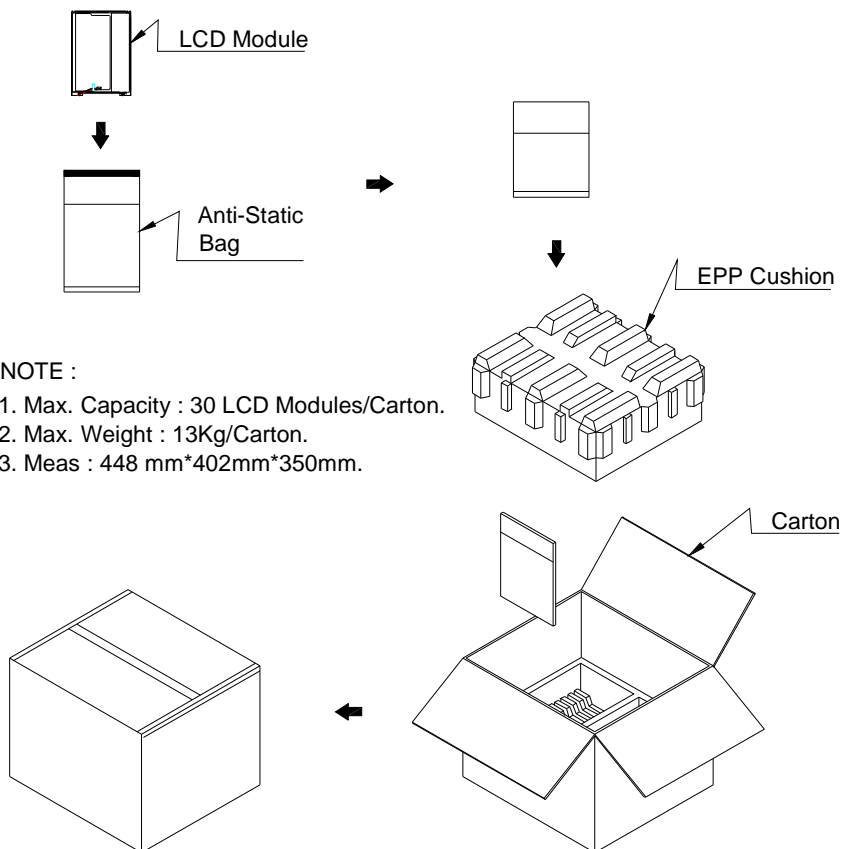## 10.1 Shipping Label (on the rear side of TFT-LCD display)

RoHS Compliance

XXXXXXXXXXX-XXXXX

Manufactured YY/MM
Model No: G104SN03
AU Optronics
MADE IN CHINA (S1)

V.1
0AXXG

cULus
E204356

10.2 Carton Package

LCD Module

Anti-Static
Bag

EPP Cushion

Carton

NOTE :
1. Max. Capacity : 30 LCD Modules/Carton.
2. Max. Weight : 13Kg/Carton.
3. Meas : 448 mm*402mm*350mm.

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

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.

11.3 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   U.S.A. Information Technology Equipment