() Preliminary Specification
(V) Final Specification

Module	15” XGA TFT-LCD Module
Model Name	G150XTN04.0

Customer	**Date**	**Checked & Approved by**	**Date**
		Vito Huang	06/20/2013
Approved by		**Prepared by**	**Date**
		Vivian Huang	06/20/2013
Note: This Specification is subject to change without notice.		Audio-Video Display Business Unit / AU Optronics corporation	

2. General Description

G150XTN04.0 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD panel, a driver circuit, and a backlight system. The screen format is intended to support the XGA (1024(H) x 768(V)) screen and 16.7M colors. All input signals are 1-channel LVDS interface.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	15.0"
Active Area	[mm]	304.128 (H) x 228.096 (V)
Pixels H x V		1024 x 768
Pixel Pitch	[mm]	0.297 (per one triad) x 0.297
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
White Luminance	[cd/m^2]	400 (center, Typ)
Contrast Ratio		700 : 1 (Typ)
Optical ResponseTime	[msec]	12 (Typ, on/off)
Nominal Input Voltage VDD	[Volt]	+3.3
Power Consumption	[Watt]	7.4 (Typ)
Weight	[Grams]	860
Physical Size (H x V x D)	[mm]	326 (H) x 252 (V) x 10.7(D) (Typ)
Electrical Interface		one channel LVDS
Surface Treatment		Hard-coating (3H), Anti-Glare treatment
Support Color		16.2M / 262K colors
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 0 to +70 -20 to +70
RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

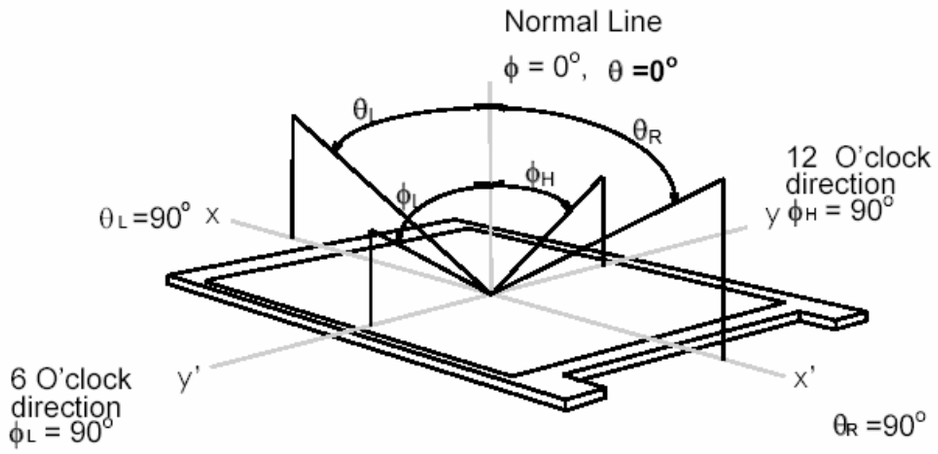
The optical characteristics are measured under stable conditions at 25℃ (Room Temperature).

Item	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing Angle	[degree]	Horizontal (Right) CR = 10 (Left)	60 60	70 70	-	1
		Vertical (Up) CR = 10 (Down)	55 50	65 60	-	
Contrast Ratio		Normal Direction	450	700	-	
Optical Response Time	[msec]	Raising Time (TrR)	-	8	11	2
		Falling Time (TrF)	-	4	6	
		Rising + Falling	-	12	17	
Color / Chromaticity Coordinates (CIE)		Red x	0.59	0.64	0.69	
		Red y	0.30	0.35	0.40	
		Green x	0.28	0.33	0.38	
		Green y	0.58	0.63	0.68	
		Blue x	0.09	0.14	0.19	
		Blue y	0.01	0.06	0.11	
		White x	0.26	0.31	0.36	
		White y	0.28	0.33	0.38	
Central Luminance	[cd/m^2]		320	400	-	3
Luminance Uniformity	[%]	9 Points	70	-	-	4,5
NTSC	%		-	72	-	

Optical Equipment: BM-5A, BM-7, PR880, or equivalent

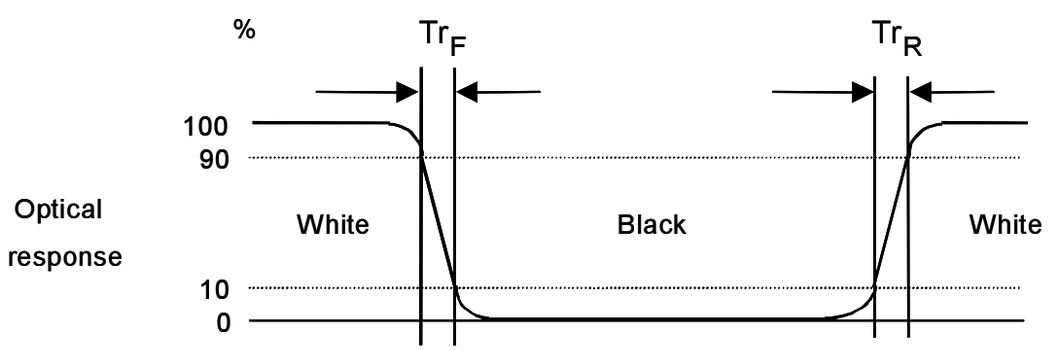
Note 1: Definition of viewing angle

Viewing angle is the measurement of contrast ratio≧10, or ≧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.



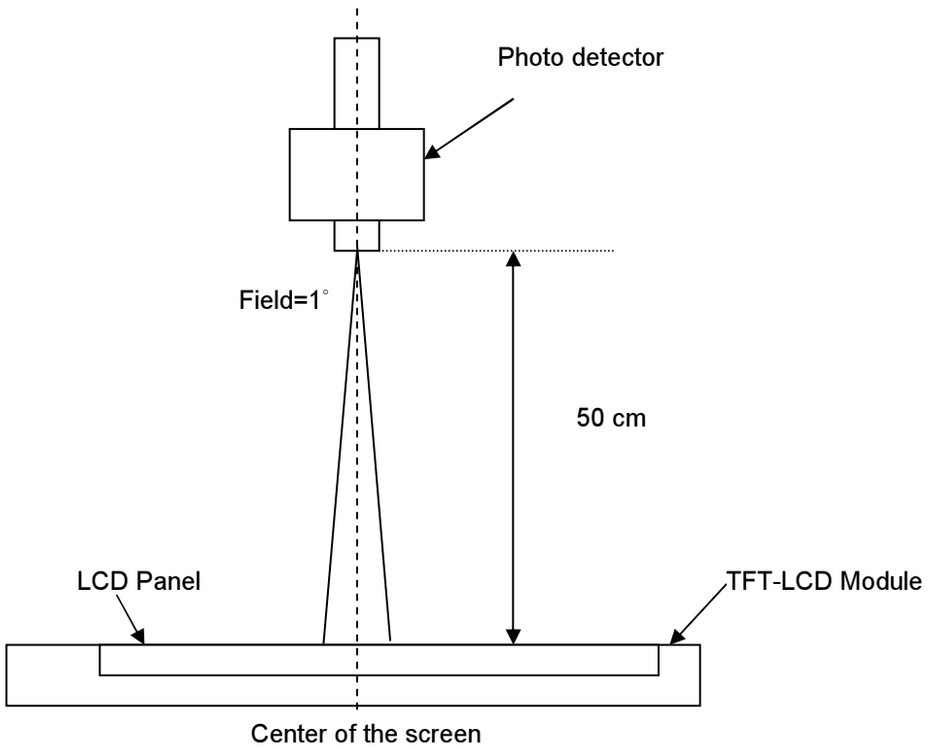
Note 2: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.

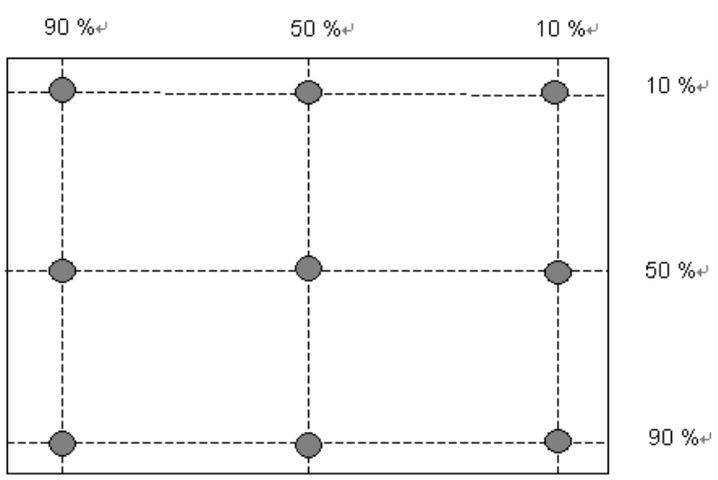


Note 3: Measurement method

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



Note 4: 9 points position

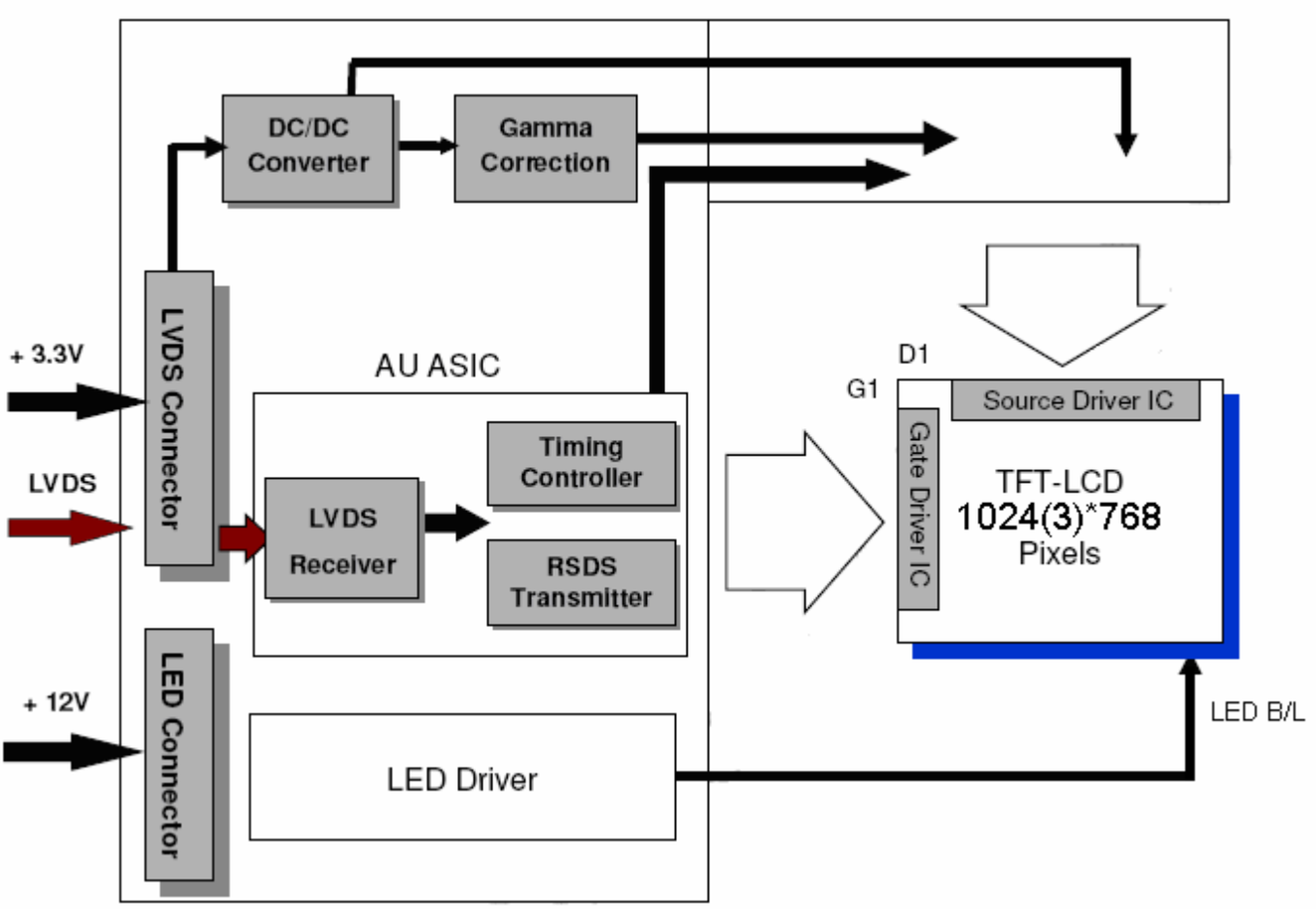


Note 5:

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

3. Functional Block Diagram

The following diagram shows the functional block of the 15.0 inches wide Color TFT-LCD Module:



4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	-0.3	+4.0	[Volt]	***Note 1,2***

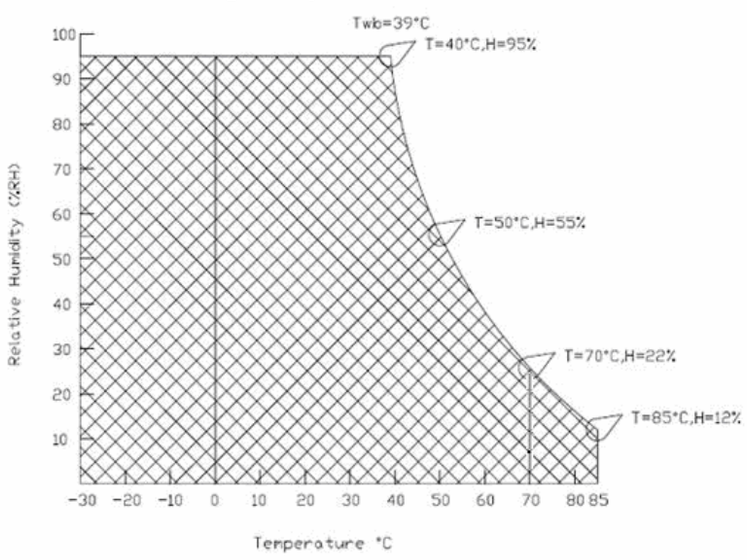
4.2 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+70	[°C]	***Note 3***
Operation Humidity	HOP	5	95	[%RH]	***Note 3***
Storage Temperature	TST	-20	+70	[°C]	
Storage Humidity	HST	5	95	[%RH]	

Note 1: With in Ta (25℃)
Note 2: Permanent damage to the device may occur if exceeding maximum values
Note 3: Temperature and relative humidity range are shown as the below figure.

1. 95% RH Max (Ta ≦39℃)
2. Max wet-bulb temperature at 39℃ or less. (Ta ≦39℃)
3. No condensation

Note 4: Function Judged only



5. Electrical characteristics

5.1 TFT LCD Module

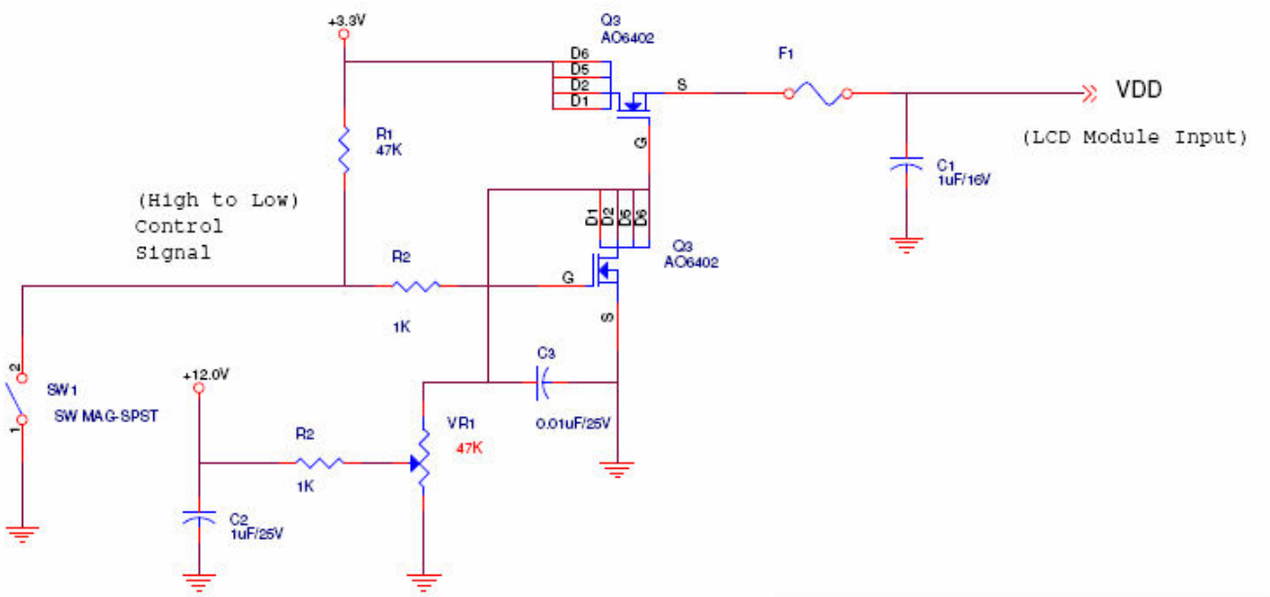
5.1.1 Power Specification

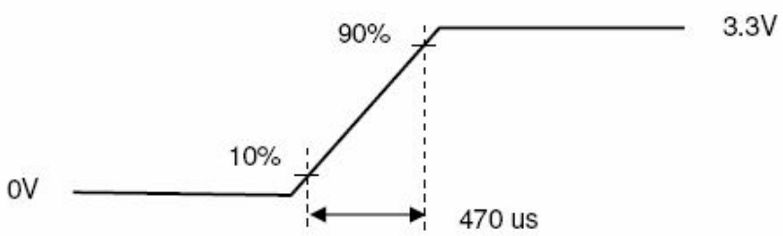
Input power specifications are as follows:

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	+/-10%
IDD	Input Current	_	460	490	[mA]	VDD= 3.3V, All Black Pattern At 60Hz,
PDD	VDD Power	_	1.52	1.76	[Watt]	VDD= 3.3V, All Black Pattern At 60Hz

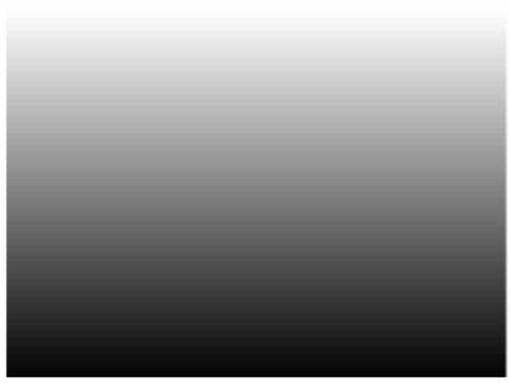
Note 1: Measurement conditions:

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





VDD rising time



64 Gray pattern

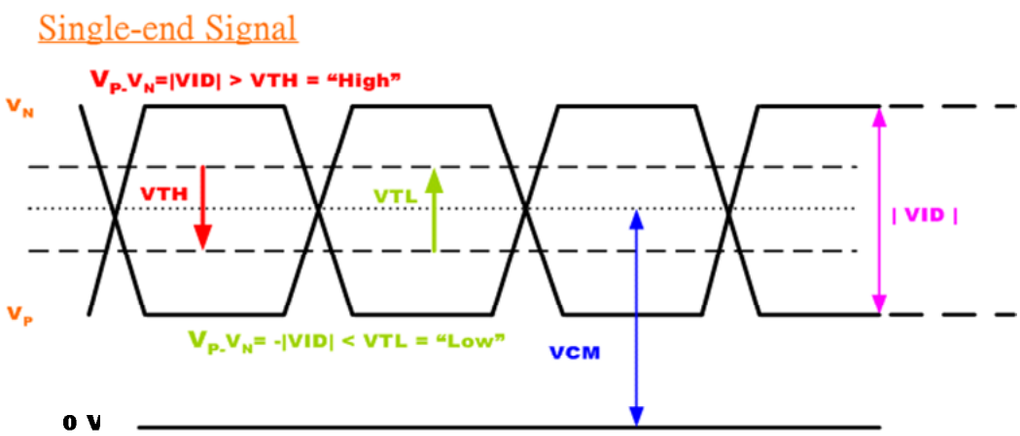
5.1.2 Signal Electrical Characteristics

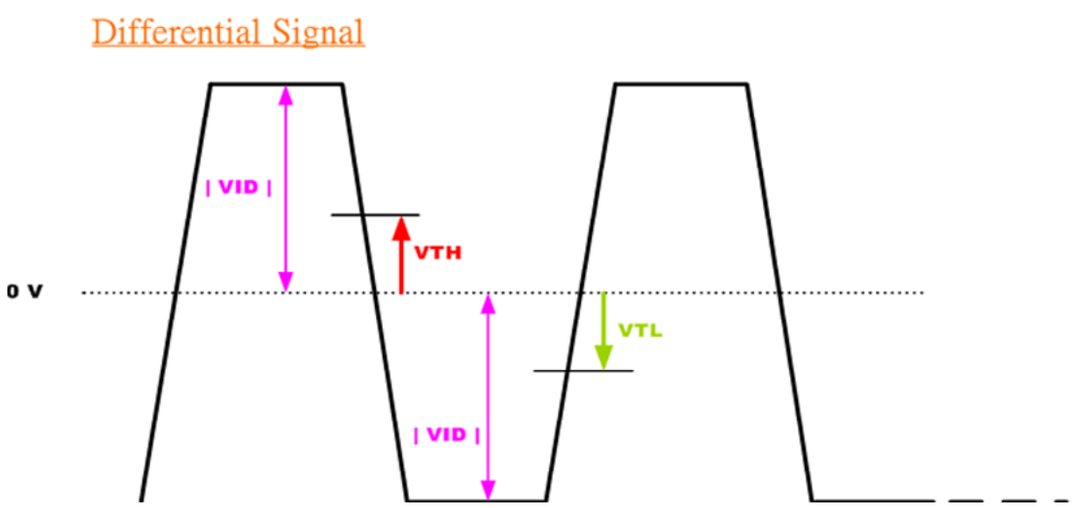
Input signals shall be low or Hi-Z state when VDD is off.

Each signal characteristics are as follows;

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{TH}	Differential Input High Threshold	-	-	+100	[mV]	V_{CM} = 1.2V ***Note 1***
V_{TL}	Differential Input Low Threshold	-100	-	-	[mV]	V_{CM} = 1.2V ***Note 1***
$\lvert V_{ID} \rvert$	Input Differential Voltage	100	400	600	[mV]	***Note 1***
V_{CM}	Differential Input Common Mode Voltage	+1.1	-	+1.45	[V]	V_{TH}-V_{TL} = 200mV (max) ***Note 1***

Note1: LVDS Signal Waveform





5.1.3 Backlight unit

Parameter guideline for LED driving is under stable conditions at 25℃ (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	13.2	[Volt]	
I_{VCC}	Input Current	-	0.49	-	[A]	100% PWM Duty
P_{VCC}	Power Consumption	5.30	5.88	6.47	[Watt]	100% PWM Duty
F_{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5	[Volt]	
	Dimming duty cycle	5	-	100	%	
I_F	LED Forward Current	-	60	-	[mA]	Ta = 25℃
V_F	LED Forward Voltage	-	-	-	[Volt]	I_F = 60mA, Ta = 0℃
		30	34	36	[Volt]	I_F = 60mA, Ta = 25℃
		-	(33)	(35)	[Volt]	I_F = 60mA, Ta = 70℃
P_{LED}	LED Power Consumption	-	(6.12)	6.48	[Watt]	I_F = 60mA, Ta = 25℃
LED Life Time		25,000	30,000	-	Hrs	I_F= 60mA, Ta= 25℃

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

Note 2: VCC, I_{VCC}, P_{VCC} are defined for LED backlight.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for one channel LED. There are three LED channel in back light unit.

Note 4: If G150XTN04.0 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

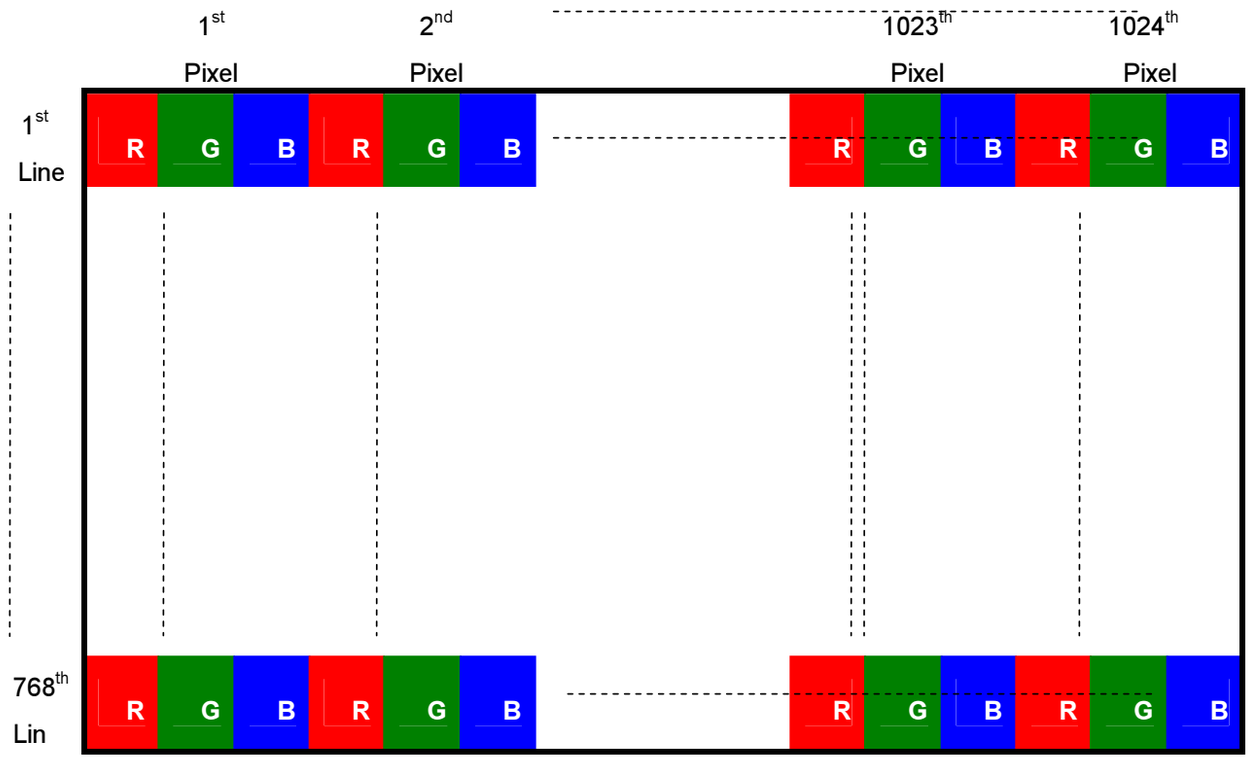
Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Note 6: LED lifetime is definition: brightness is decreased to 50% of the initial value. LED lifetime is restricted under normal condition, ambient temperature = 25℃ and LED operating IF = 60mA.

6. Signal Characteristic

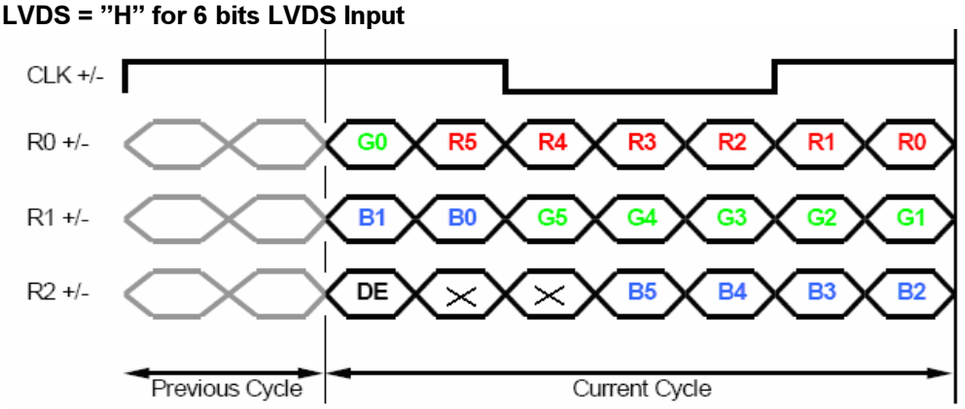
6.1 Pixel Format Image

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

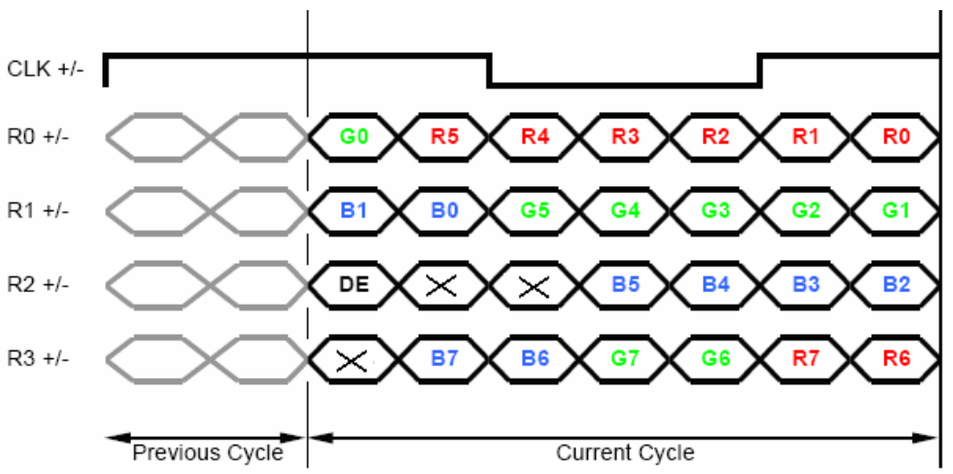


6.2 The Input Data Format

SEL LVDS = ”H” for 6 bits LVDS Input



SEL LVDS = “L” for8 bits LVDS Input



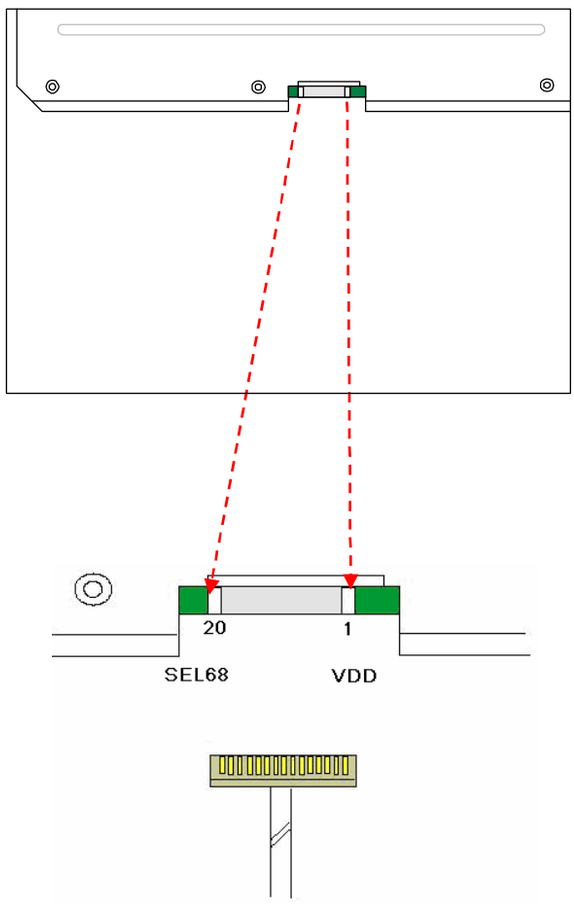
Note1: Please follow PSWG.
Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

6.3 Signal Description

The module using one LVDS receiver SN75LVDS82(Texas Instruments). LVDS is a differential signal technology for LCD interface and high speed data transfer device. LVDS transmitters shall be SN75LVDS83(negative edge sampling). The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

DF14H-20P-1.25H (HIROSE)		
Pin No.	**Symbol**	**Description**
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	VSS	Ground
4	VSS	Ground
5	Rin0-	- LVDS differential data input (R0-R5, G0)
6	Rin0+	+ LVDS differential data input (R0-R5, G0)
7	VSS	Ground
8	Rin1-	- LVDS differential data input (G1-G5, B0-B1)
9	Rin1+	+ LVDS differential data input (G1-G5, B0-B1)
10	VSS	Ground
11	Rin2-	- LVDS differential data input (B2-B5, HS, VS, DE)
12	Rin2+	+ LVDS differential data input (B2-B5, HS, VS, DE)
13	VSS	Ground
14	ClkIN-	- LVDS differential clock input
15	ClkIN+	+ LVDS differential clock input
16	VSS	Ground
17	Rin3-	- LVDS differential data input (R6-R7, G6-G7,B6-B7)
18	Rin3+	- LVDS differential data input (R6-R7, G6-G7,B6-B7)
19	RL/UD	H: 180 degree rotation/ L: Normal mode
20	SEL LVDS	L: 8 bit / H: 6bit *(**Note 1**)*

Note1: Start from left side



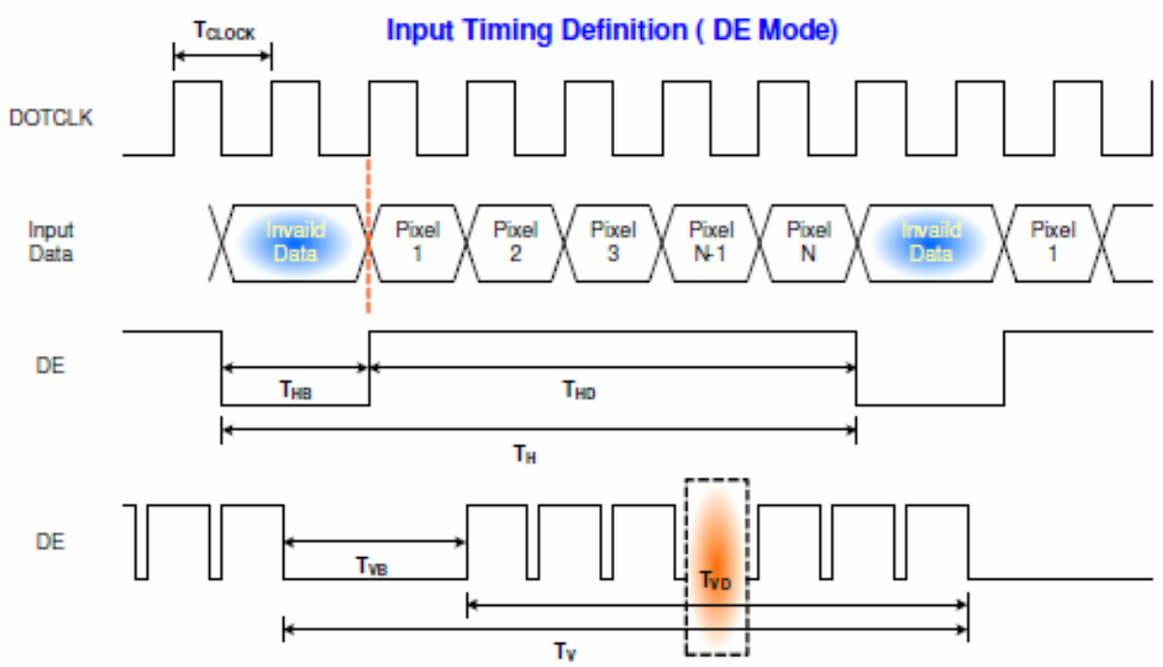
6.4 Interface Timing

6.4.1 Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	Tv	776	806	1024	Th
	Active	Tdisp(v)	768	768	768	Th
	Blanking	Tbp(v)+Tfp(v)+PWvs	8	38	256	Th
Horizontal Section	Period	Th	1054	1344	2048	Tclk
	Active	Tdisp(h)	1024	1024	1024	Tclk
	Blanking	Tbp(h)+Tfp(h)+PWhs	30	320	1024	Tclk
Clock	Frequency	Freq.	50	65	81	MHz
Frame Rate	Frequency	1/Tv	50	60	75	Hz

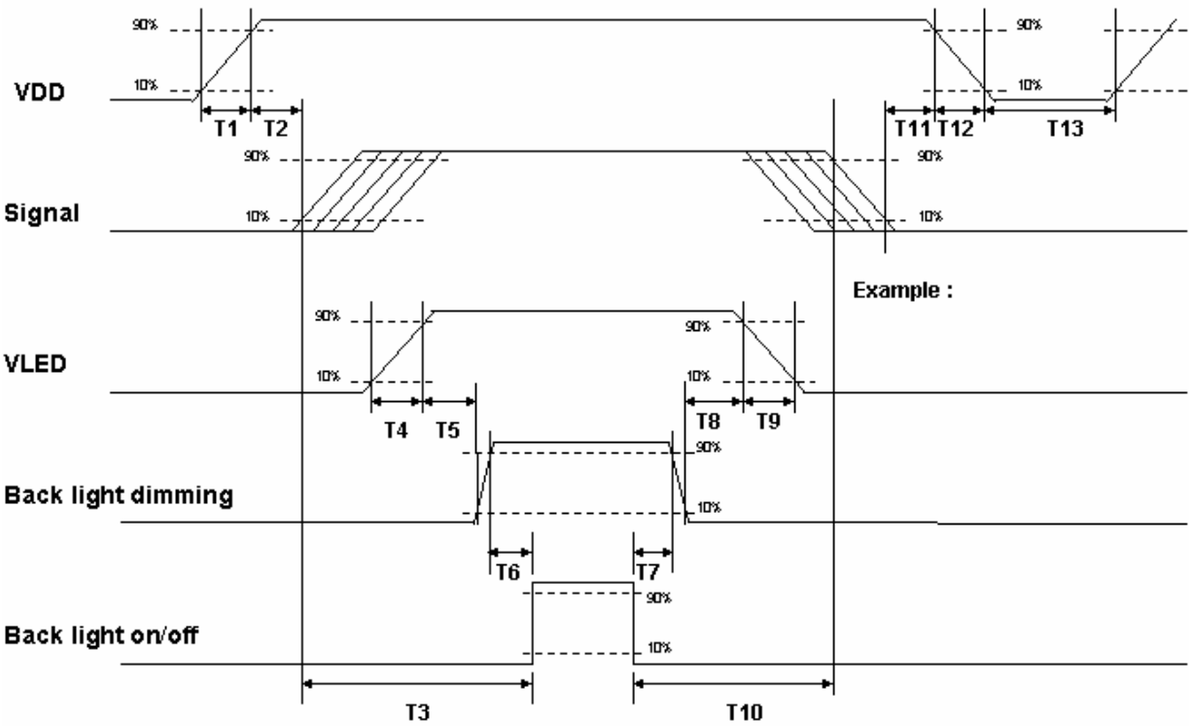
Note: DE mode only
Note: Typical value refer to VESA STANDARD

6.4.2 Timing Diagram



6.5 Power ON/OFF Sequence

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



Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	220	-	-	[ms]
T4	0.5	-	10	[ms]
T5	10	-	-	[ms]
T6	10	-	-	[ms]
T7	0	-	-	[ms]
T8	10	-	-	[ms]
T9	100	-	-	[ms]
T10	110	-	-	[ms]
T11	0	16	50	[ms]
T12	-	-	10	[ms]
T13	1000	-	-	[ms]

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

7.1.1 Connector

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	HIROSE
Type Part Number	HRS DF14H-20P-1.25H
Mating Housing Part Number	HRS DF14-20S-1.25C

7.1.2 Pin Assignment

Pin#	Signal Name	Pin#	Signal Name
1	VDD	2	VDD
3	VSS	4	VSS
5	Rin0-	6	Rin0+
7	VSS	8	Rin1-
9	Rin1+	10	VSS
11	Rin2-	12	Rin2+
13	VSS	14	ClkIN-
15	ClkIN+	16	VSS
17	Rin3-	18	Rin3+
19	RL/UD	20	SEL LVDS

7.2 Backlight Unit

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

7.2.1 Connector

Connector Name / Designation	Light Bar Connector
Manufacturer	JST
Type Part Number	SM06B-SHLS-TF
Mating Housing Part Number	SHLP-06V-BK-B(HF)

7.2.2 Pin Assignment

Pin No.	Symbol	Description
Pin1	VLED	12V input
Pin2	VLED	12V input
Pin3	GND	GND
Pin4	GND	GND
Pin5	On/OFF	0-3.3V (above 3.0V ON, 0V:OFF)
Pin6	Dimming	PWM

8. Reliability Test

Environment test conditions are listed as following table.

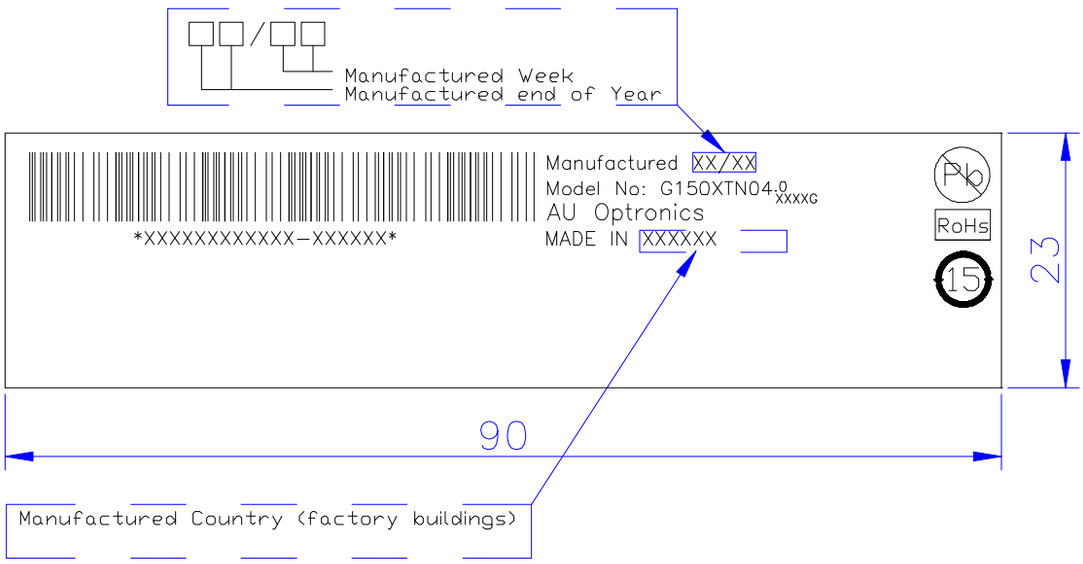
No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 70℃ 240Hrs	
2	Low temperature storage	Ta= -20℃ 240Hrs	
3	High temperature operation	Tp= 70℃ 240Hrs	
4	Low temperature operation	Ta= 0℃ 240Hrs	
5	High temperature and high humidity	Tp= 50℃, 80% RH 240Hrs	Operation
6	Thermal shock	-20°C to +60°C, Ramp ≤20°C/min, Duration at Temp. = 30min, Test Cycles = 50	Non-operation
7	Vibration	Frequency range : 8~33.3Hz Stoke : 1.3mm Sweep : 3.0G, 33.3 ~ 400Hz Cycle : 15 minutes 2 hours for each direction of X,Z 4 hours for Y direction	JIS D1601, A-10 Condition A
8	Mechanical shock	100G, 6ms, ±X,±Y,±Z 1 time for each direction	JIS C0041, A-7 Condition C
9	Vibration (with carton)	Random vibration: 0.015G^2/Hz from 5~200Hz –6dB/octave from 200~500Hz	IEC 68-34
10	Drop (with carton)	Height: 100cm 1 corner, 3 edges, 6 surfaces	JIS Z0202
11	Electro Static discharge (ESD)	Contact Discharge: ±8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point. Air Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point.	Operation & Non-operation

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

Note2:

- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.
- No function failure occurs.

9. Shipping Label



Unit: mm

10. Packing Form

10.1 Packaging material

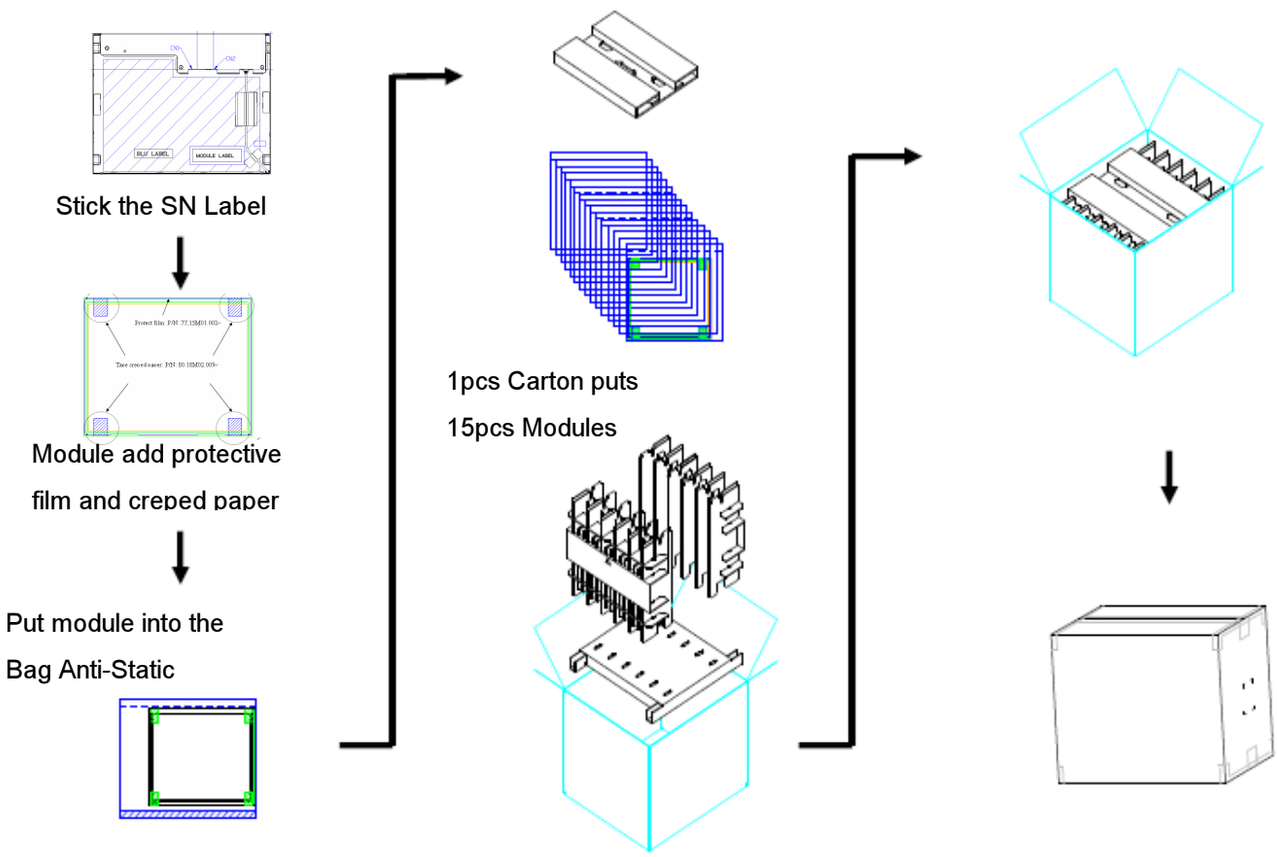
FILM PROTECT
BAG ANTI-STATIC
TAPE
TAPE CREPED PAPER
PACKING CARTON
LABEL SPEC
LABEL CARTON.
CUSHION PACKING

10.2 Packing instruction

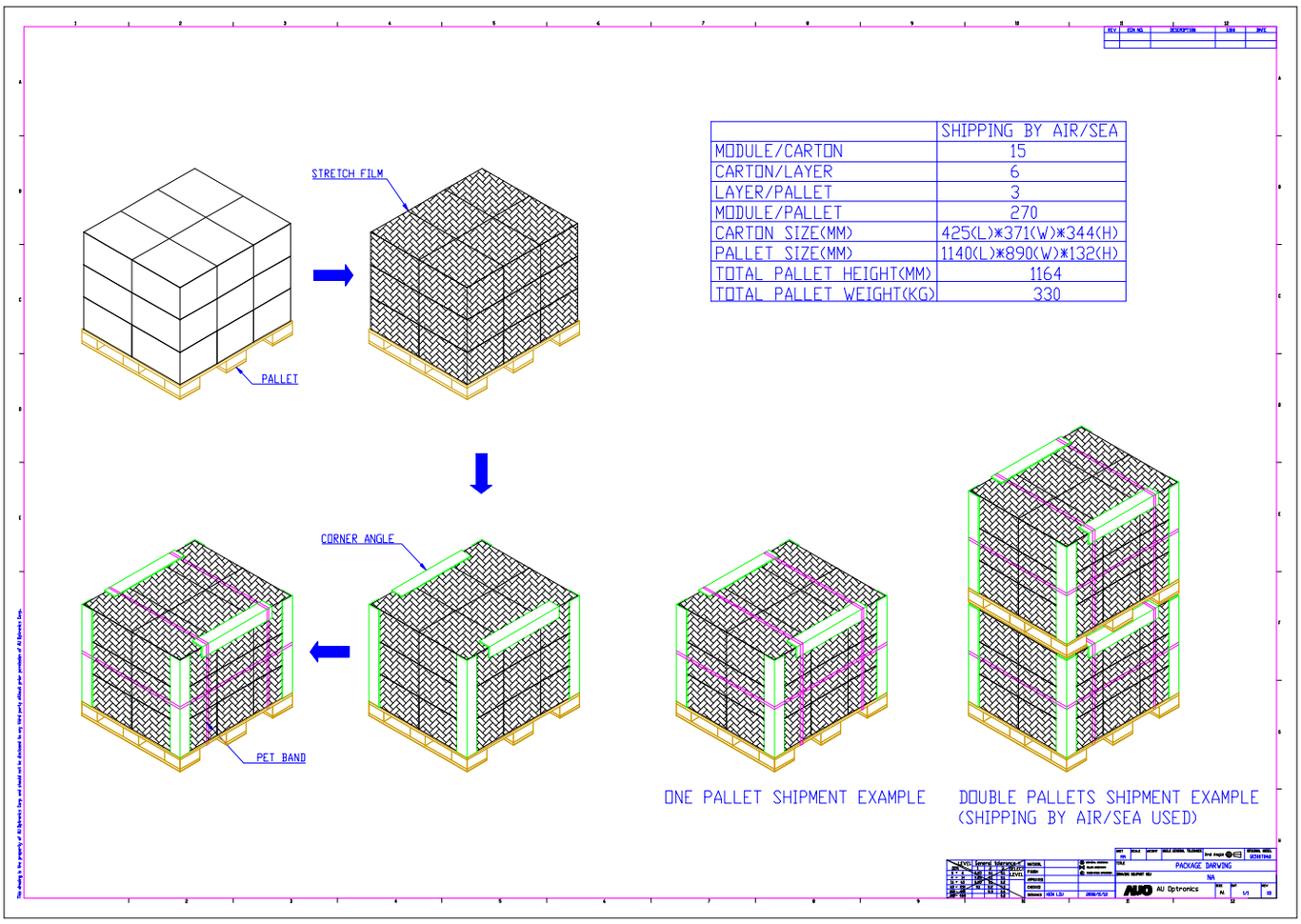
Max capacity：15pcs TFT-LCD module per carton

Max weight: 16.8 kg per carton

Outside dimension of carton: 425mm (L)*371mm(W)*344mm(H)

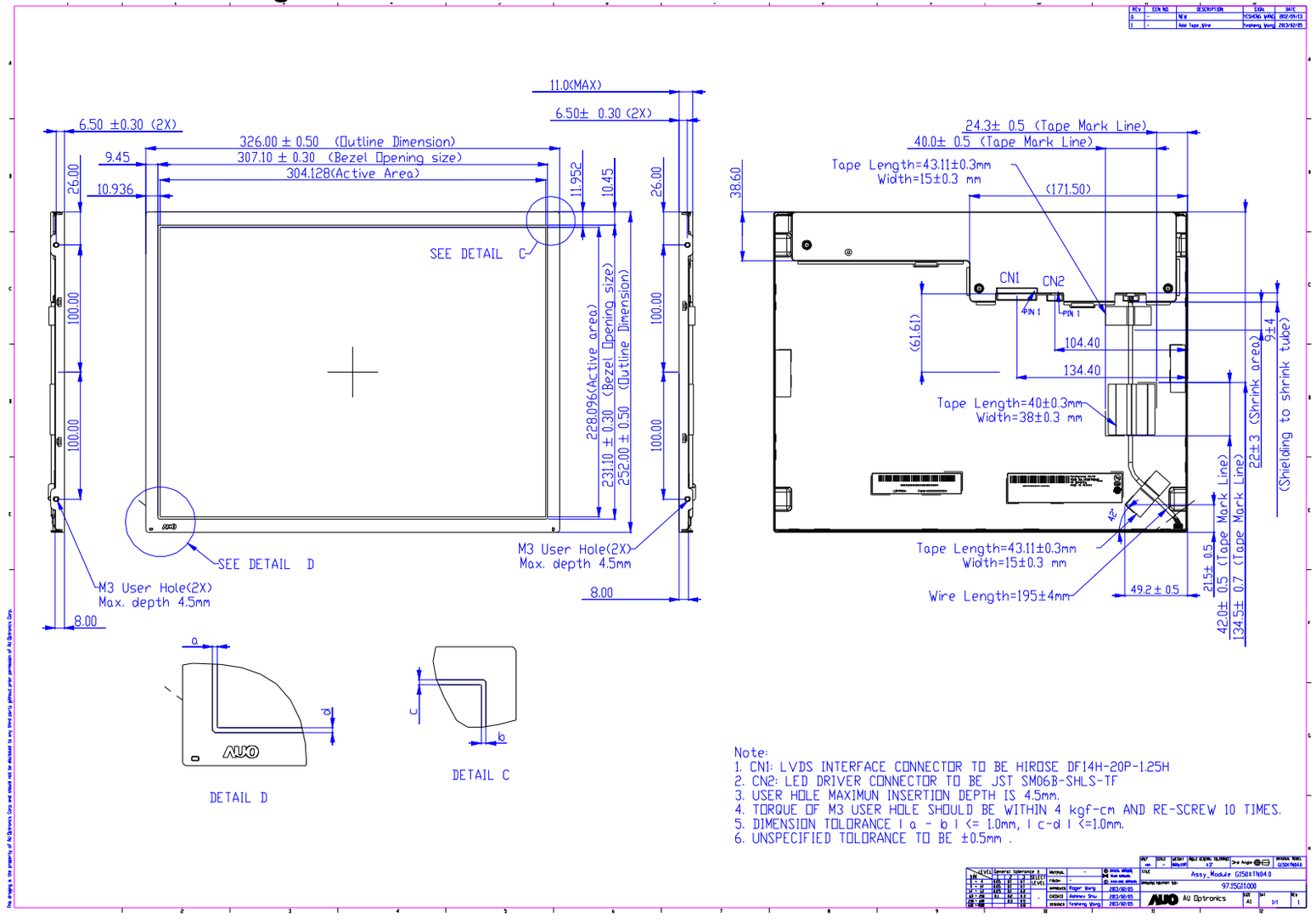


10.3 Palletizing



	SHIPPING BY AIR/SEA
MODULE/CARTON	15
CARTON/LAYER	6
LAYER/PALLET	3
MODULE/PALLET	270
CARTON SIZE(MM)	425(L)*371(W)*344(H)
PALLET SIZE(MM)	1140(L)*890(W)*132(H)
TOTAL PALLET HEIGHT(MM)	1164
TOTAL PALLET WEIGHT(KG)	330

11. Outline Drawing



Note:
1. CN1: LVDS INTERFACE CONNECTOR TO BE HIROSE DF14H-20P-1.25H
2. CN2: LED DRIVER CONNECTOR TO BE JST SM06B-SHLS-TF
3. USER HOLE MAXIMUN INSERTION DEPTH IS 4.5mm.
4. TORQUE OF M3 USER HOLE SHOULD BE WITHIN 4 kgf-cm AND RE-SCREW 10 TIMES.
5. DIMENSION TOLORANCE | a - b | <= 1.0mm, | c-d | <=1.0mm.
6. UNSPECIFIED TOLORANCE TO BE ±0.5mm .