() Preliminary Specification
(V) Final Specification

Module	**27” Color TFT-LCD**
Model Name	**M270HVN02 series open cell**

Customer	Date	Approved by	Date
		Howard Lee	2013/7/17
Approved by		**Prepared by**	
		Derec Yang	2013/7/15
Note: This Specification is subject to change without notice.		AU Optronics corporation	

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Record of Revision

Version Date	Page	Old description	New Description	Remark
1.0 2012/12/6	All	final Edition for Customer	-	
1.1 2013/4/12	5		To define the maximun value of responese time	
	15	Panel drawing	Change to the Opencell drawing	
	14/19	Pin25/Pin 27 is ground pin	Re-define the Pin assignment Pin25/Pin27 as NC	
	20	ESD Contact Discharge： +-8KV	ESD Contact Discharge： +-15KV	
1.2 2013/7/15	1	M270HVN02.0 open cell	Modify the model naming :M270HVN02 series open cell	

1.0 Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
3) When the cell surface is soiled, wipe it with absorbent cotton or other soft cloth.
4) Since the cell is made of glass, it may break or crack if dropped or bumped on hard surface.
5) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
6) Do not press or pat the panel surface by fingers, hand or tooling.
7) Please handle TFT cell with care. The FPCs can only sustain for quite limited stress.
8) The cell package tray is packed in clean room. Please do pack & unpack it in clean room.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT cell.
10) Pls avoid touching COF position while you are doing mechanical design.
11) When storing modules as spares for a long time, the following precaution is necessary:
Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

2.0 General Description

This specification applies to the 27 inch-wide Color a-Si TFT-LCD Module M270HVN02 series open cell The display supports the Full HD - 1920(H) x 1080(V) screen format and 16.7M colors (RGB 8-bits data). All input signals are 2-channel LVDS interface and this module doesn't contain an inverter board for backlight.

2.1 Display Characteristics

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

ITEMS	Unit	SPECIFICATIONS	
Screen Diagonal	[mm]	685.65(27.0")	
Active Area	[mm]	597.6 (H) x 336.15 (V)	
Pixels H x V		1920(x3) x 1080	
Pixel Pitch	[um]	311.25 (per one triad) ×311.25	
Pixel Arrangement		R.G.B. Vertical island	
Display Mode		VA Mode, Normally Black	
Optical Response Time	[msec]	12ms (Typ., on/off)	
Nominal Input Voltage VDD	[Volt]	5 V (Typ)	
Power Consumption (VDD line)	[Watt]	5.1 (Typ) VDD line : PDD (typ), All white pattern at 60Hz	
Open Cell Weight	[Grams]	630 (Typ.)	
Electrical Interface		Dual channel LVDS	
Support Color		16.7M colors (RGB 8-bit)	
Surface Treatment		Anti-Glare, 3H	
Cell transmittance		3.25% (typ) 2.76% (min)	(base on AUO LED Backlight without DBEF-D)
Cell thickness	[mm]	1.4 (the thickness of polarizer film is 0.2 mm each side)	

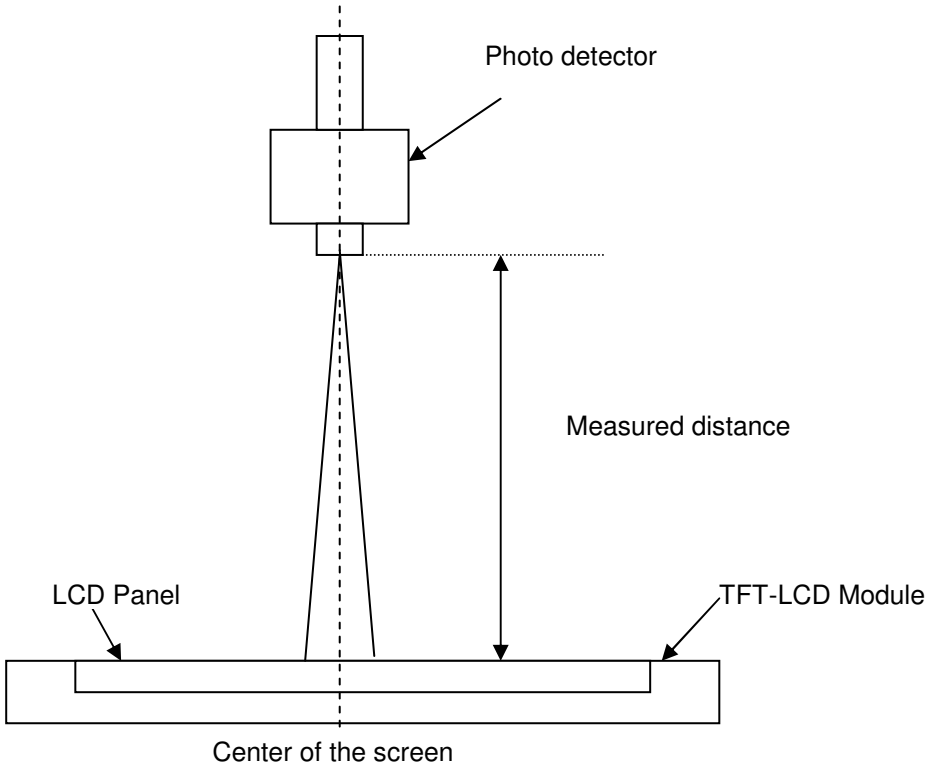
2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃:

Item	Unit	Conditions	Min.	Typ.	Max.	Note
Response Time	[msec]	Raising Time (T_{rR})		7	17	***4***
		Falling Time (T_{rF})		5	7	
		Raising + Falling		12	24	
Crosstalk (in 60Hz)	[%]				1.5	***8***
Flicker	dB				-20	***9***

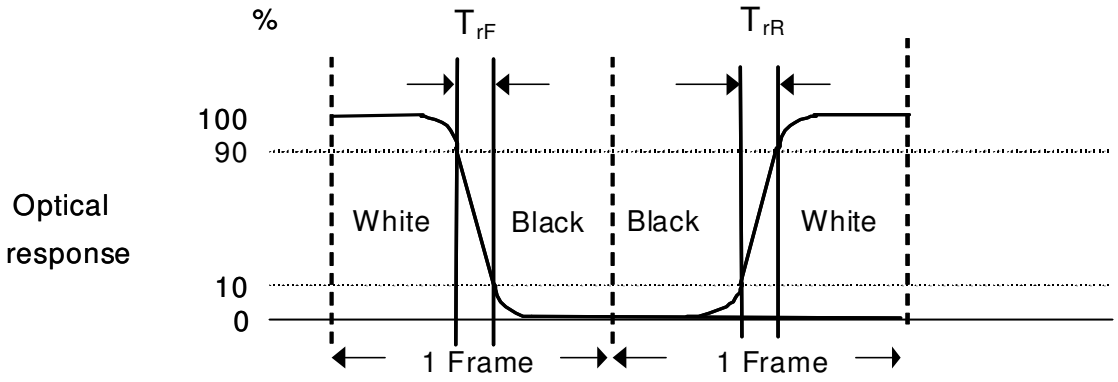
Note 1: **Measurement method**

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring (at surface 35℃). 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 2: **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, T_{rR}), and from "Full White" to "Full Black" (falling time, T_{rF}), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.



$T_{rR} + T_{rF}$ = 12 msec (typ.).

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

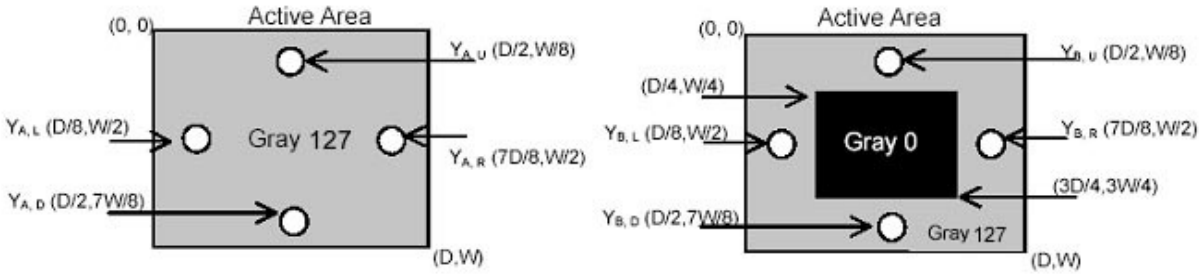
Note 3: **Crosstalk is defined as below and** measured by TOPCON SR-3

CT = | YB – YA | / YA × 100 (%)

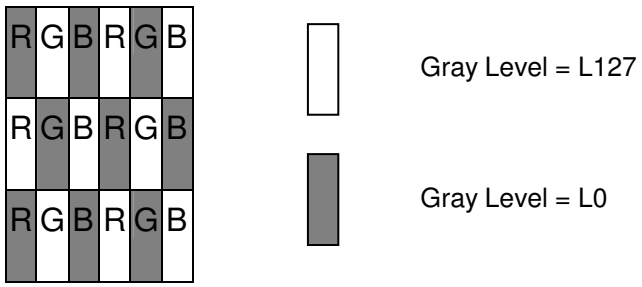
Where

YA = Luminance of measured location without gray level 0 pattern (cd/m2)

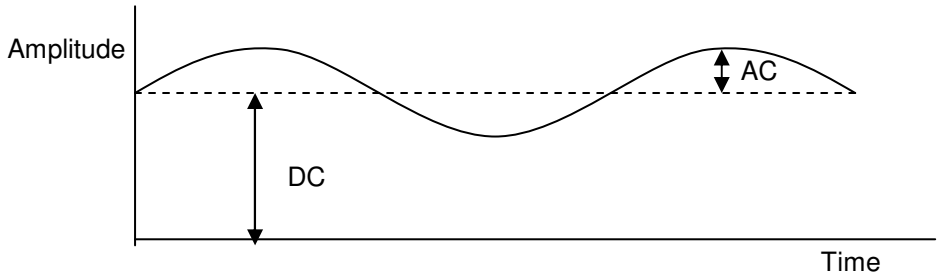
YB = Luminance of measured location with gray level 0 pattern (cd/m2)



Note 4: **Test Patern: Subchecker Pattern** measured by TOPCON SR-3



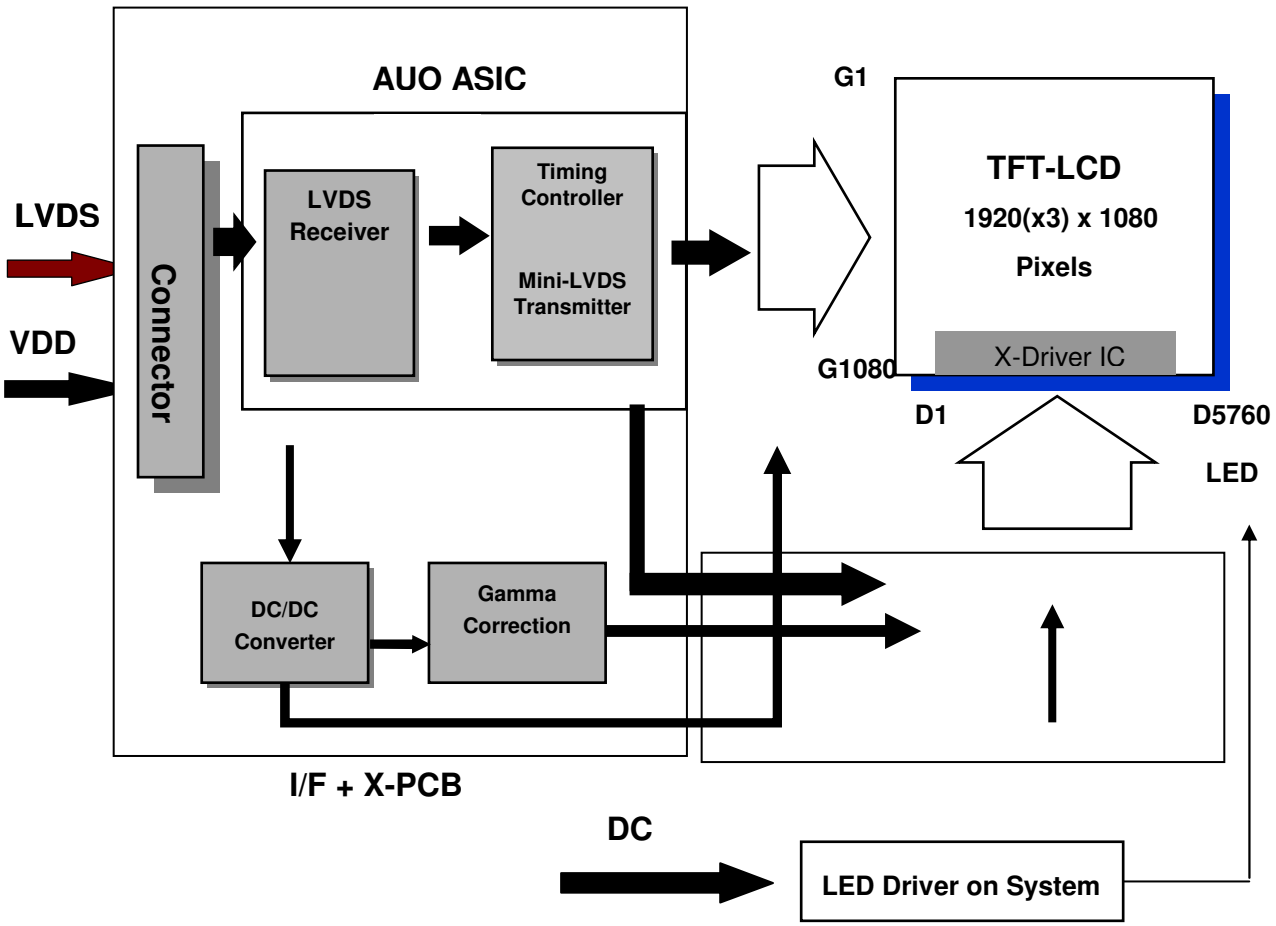
Method: Record dBV & DC value with TRD-100



$$\text{Flicker (dB)} = 20\log\frac{\text{AC Level(at 30 Hz)}}{\text{DC Level}}$$

3.0 Functional Block Diagram

The following diagram shows the functional block of the 27 inch Color TFT-LCD Module:



4.0 Absolute Maximum Ratings

Absolute maximum ratings of the module are listed as following:

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	**-0.3**	6	[Volt]	***Note 1,2***

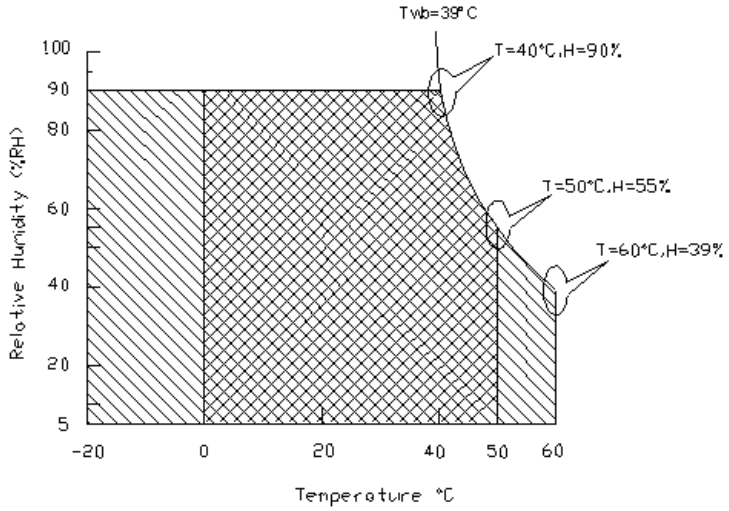
4.2 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	***Note 3***
Glass surface temperature (operation)	TGS	0	+65	[°C]	***Note 3, Note 4***
Operation Humidity	HOP	5	90	[%RH]	***Note 3***
Storage Temperature	TST	-20	+60	[°C]	
Storage Humidity	HST	5	90	[%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. 90% RH Max (Ta ≦39℃)
2. Max wet-bulb temperature at 39℃ or less. (Ta ≦39℃)
3. No condensation

Note 4: *Function Judged only*



Operating Range Storage Range

5.0 Electrical characteristics

5.1 TFT LCD Module

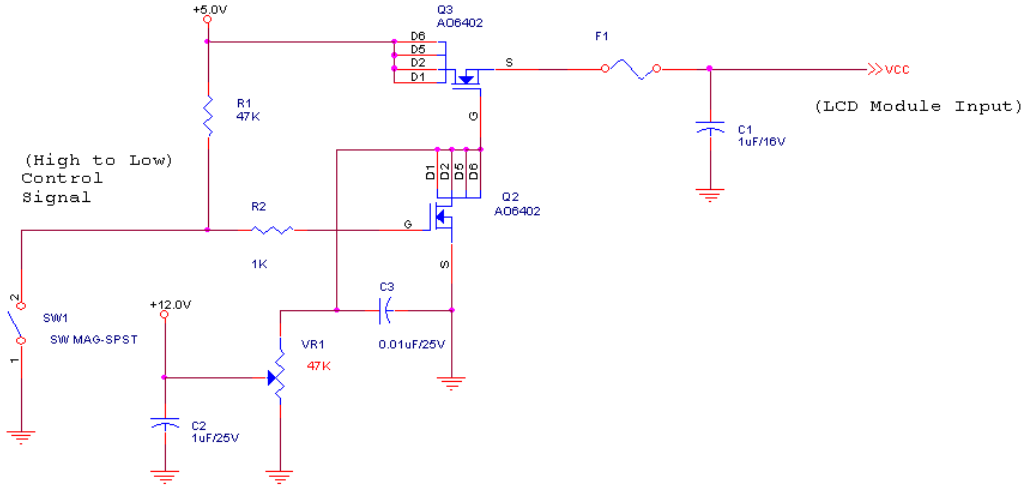
5.1.1 Power Specification

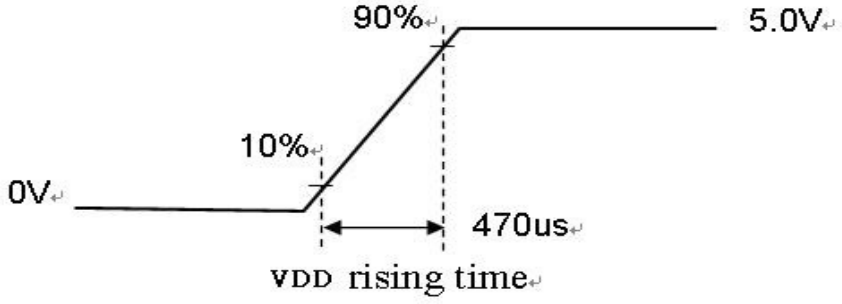
Input power specifications are as following:

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD	Input Current	-	**1.02**	**1.22**	[A]	VDD= 5.0V, All Black Pattern At 60Hz
			1.21	**1.45**	[A]	VDD= 5.0V, All Black Pattern At 75Hz
PDD	VDD Power	-	**5.1**	**6.12**	[Watt]	VDD= 5.0V, All Black Pattern At 60Hz
			6.05	**7.26**	[Watt]	VDD= 5.0V, All Black Pattern At 75Hz
IRush	Inrush Current	-	-	3	[A]	**Note 1**
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	500	[mV] p-p	VDD= 5.0V, All Black Pattern At 75Hz

Note 1: Measurement conditions:

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



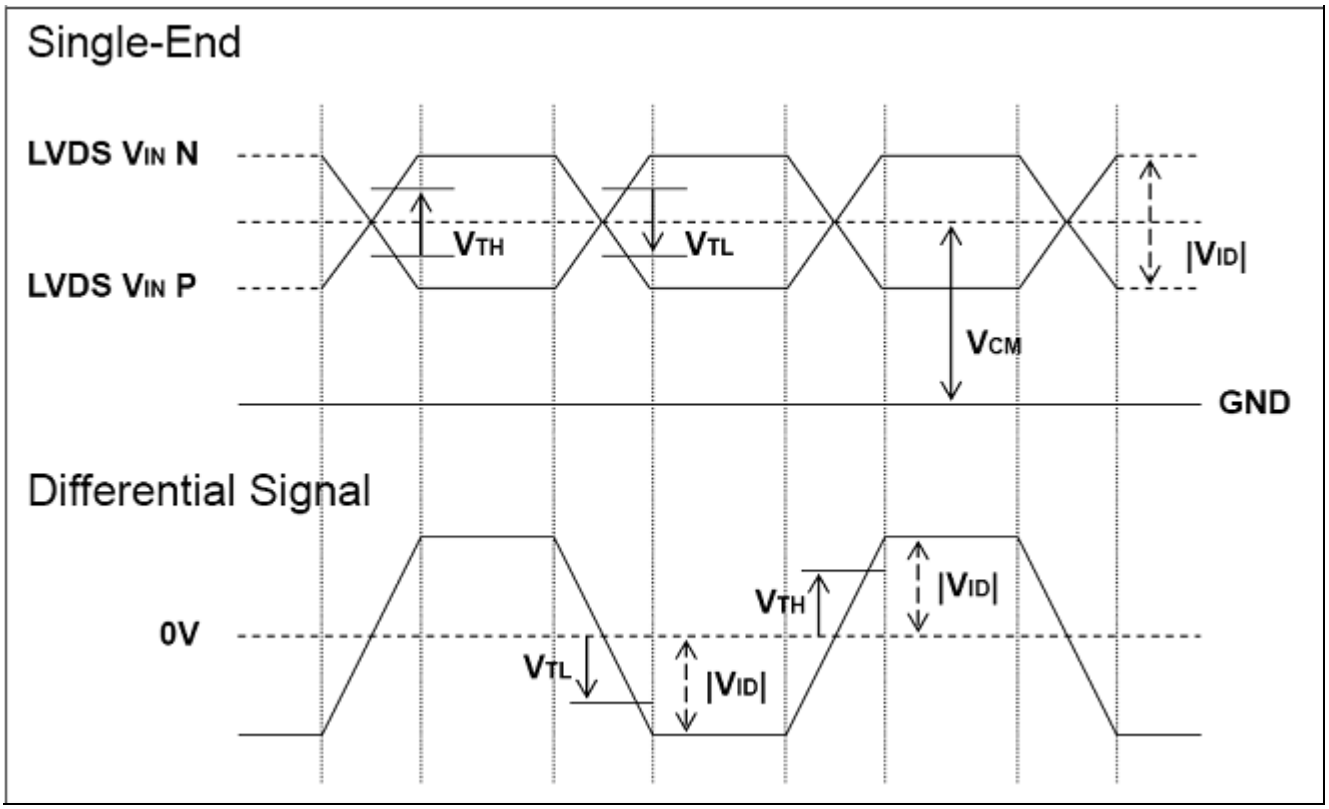


5.1.2 Signal Electrical Characteristics

1. DC Characteristics of each signal are as following:

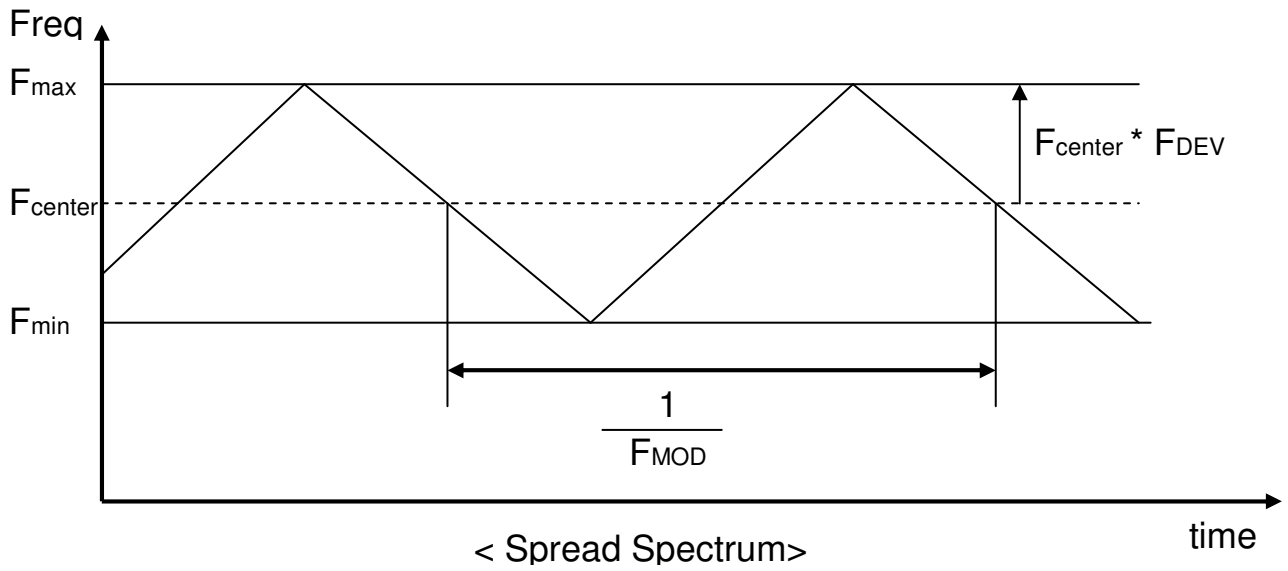
Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{TH}	Differential Input High Threshold	-	-	+100	[mV]	V_{CM} = 1.2V ***Note 1***
V_{TL}	Differential Input Low Threshold	-100	-	-	[mV]	V_{CM} = 1.2V ***Note 1***
$\lvert V_{ID} \rvert$	Input Differential Voltage	100	-	600	[mV]	***Note 1***
V_{CM}	Differential Input Common Mode Voltage	+1.0	+1.2	+1.5	[V]	V_{TH}-V_{TL} = 200MV (max) ***Note 1***

Note 1: LVDS Signal Waveform



2. AC characteristics

Description	Symbol	Min	Max	Unit	Note
Maximum deviation of input clock frequency during SSC	F_{DEV}	-	± 3	%	
Maximum modulation frequency of input clock during SSC	F_{MOD}	-	200	KHz	

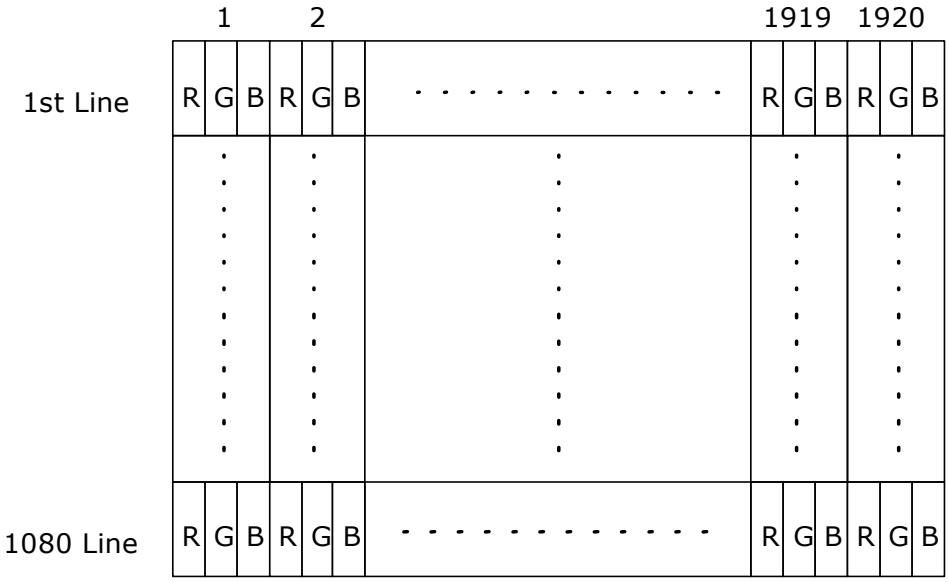


< Spread Spectrum>

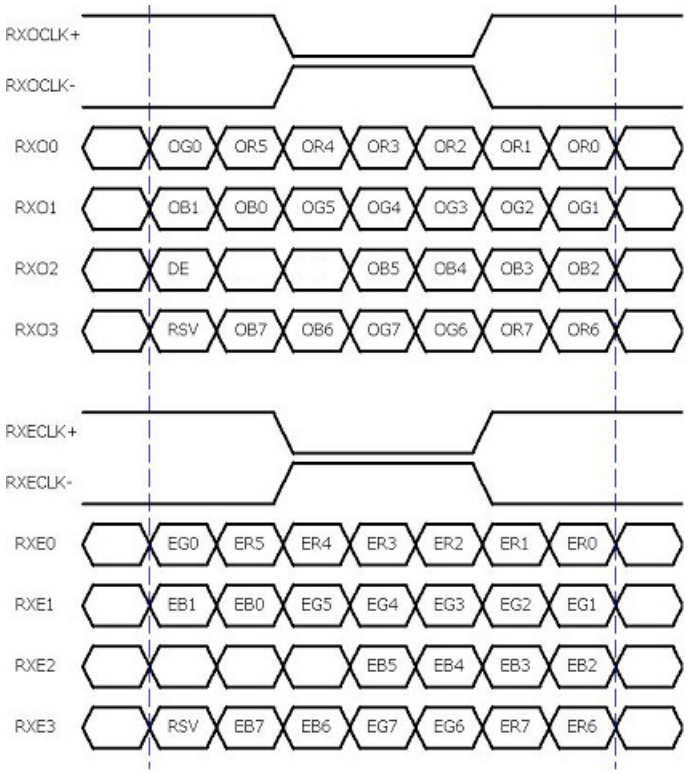
6.0 Signal Characteristics

6.1 Pixel Format Definition

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



6.2 The input data format

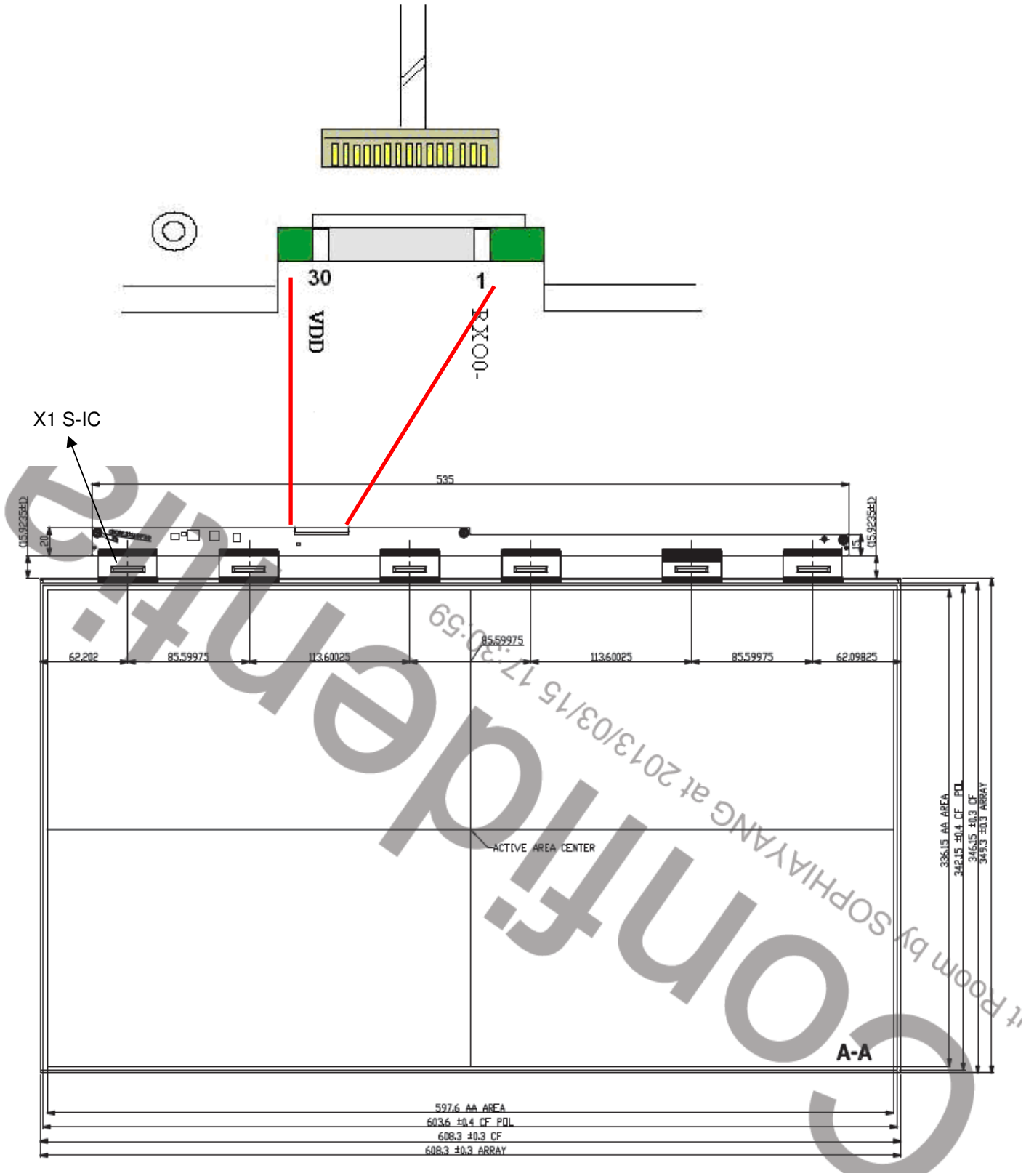


Note1: Normally, DE, VS, HS on EVEN channel are not used.
Note2: Please follow PSWG.
Note3: 8-bit in

6.3 Signal Description

PIN #	SIGNAL NAME	DESCRIPTION
1	RXO0-	Negative LVDS differential data input (Odd data)
2	RXO0+	Positive LVDS differential data input (Odd data)
3	RXO1-	Negative LVDS differential data input (Odd data)
4	RXO1+	Positive LVDS differential data input (Odd data)
5	RXO2-	Negative LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG)
6	RXO2+	Positive LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG)
7	GND	Power Ground
8	RXOCLK-	Negative LVDS differential clock input (Odd clock)
9	RXOCLK+	Positive LVDS differential clock input (Odd clock)
10	RXO3-	Negative LVDS differential data input (Odd data)
11	RXO3+	Positive LVDS differential data input (Odd data)
12	RXE0-	Negative LVDS differential data input (Even data)
13	RXE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RXE1-	Negative LVDS differential data input (Even data)
16	RXE1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RXE2-	Negative LVDS differential data input (Even data)
19	RXE2+	Positive LVDS differential data input (Even data)
20	RXECLK-	Negative LVDS differential clock input (Even clock)
21	RXECLK+	Positive LVDS differential clock input (Even clock)
22	RXE3-	Negative LVDS differential data input (Even data)
23	RXE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No contact
26	NC	No contact
27	NC	No contact
28	VDD	+5.0V Power Supply
29	VDD	+5.0V Power Supply
30	VDD	+5.0V Power Supply

Note 1: Input signals of odd and even clock shall be the same timing.



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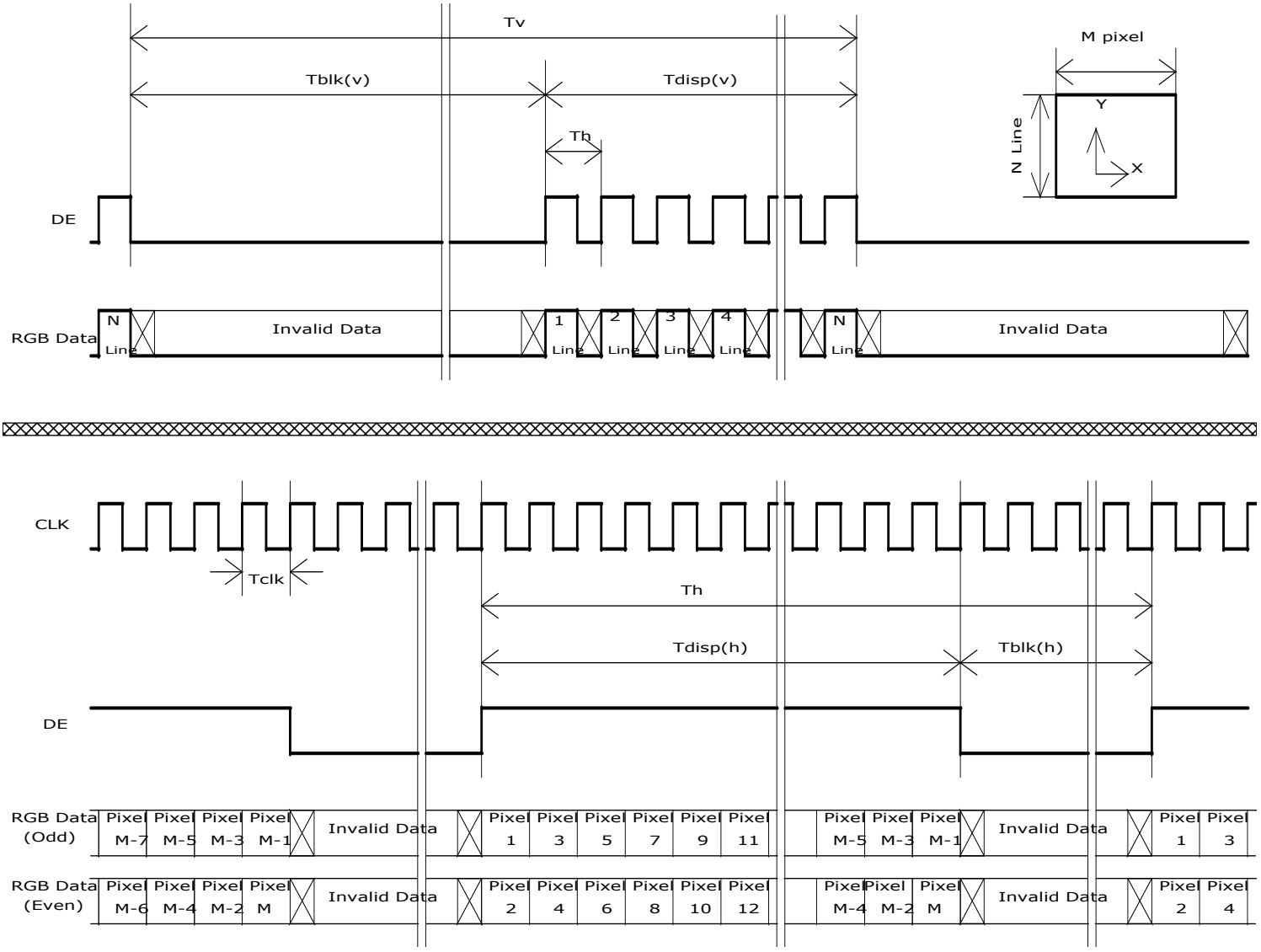
6.4 Timing Characteristics

The input signal timing specifications are shown as the following table

Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	Tv	1092	1130	1793	Th
	Active	Tdisp(v)	1080	1080	1080	Th
	Blanking	Tblk(v)	12	50	713	Th
Horizontal Section	Period	Th	1004	1050	1100	Tclk
	Active	Tdisp(h)	960	960	960	Tclk
	Blanking	Tblk(h)	44	90	140	Tclk
Clock	Period	Tclk	11.1	14.0	18.2	ns
	Frequency	Freq	54.8	71.2	90.0	MHz
Frame rate	Frame rate	VFreq	50	60	76	Hz
Hsync Frequency	Hsync Frequency	HFreq	55	68	90	KHz

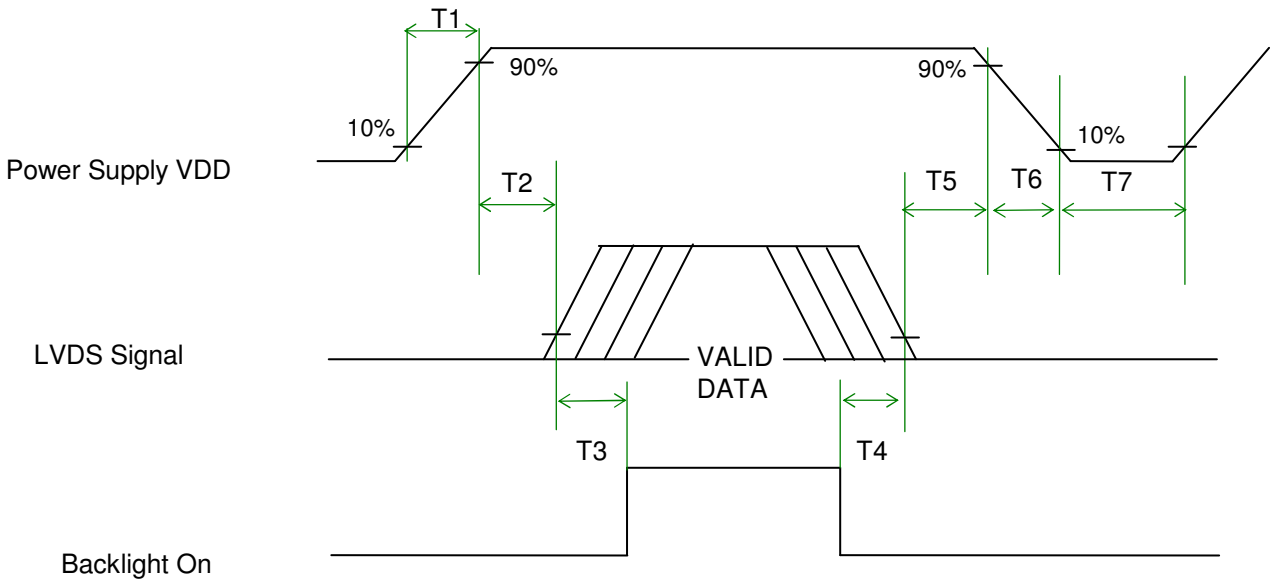
Note : DE mode only

6.5 Timing diagram



6.6 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 when VDD is off.



Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	-	50	[ms]
T3	500	-	-	[ms]
T4	100	-	-	[ms]
T5	0		50	[ms] *Note1,2*
T6	5	-	100	[ms] *Note1,2*
T7	1000	-	-	[ms]

Note1 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note2 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

7.0 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

Connector Name / Designation	Interface Connector / Interface Card
Manufacturer	STM P-TWO
Type Part Number	MSCKT2407P30HB AL230F-A0G1D-P
Mating Housing Part Number	FI-X30HL (Locked Type)

7.1.1 Pin Assignment

Pin#	Signal Name	Pin#	Signal Name
1	RXO0-	2	RXO0+
3	RXO1-	4	RXO1+
5	RXO2-	6	RXO2+
7	GND	8	RXOCLK-
9	RXOCLK+	10	RXO3-
11	RXO3+	12	RXE0-
13	RXE0+	14	GND
15	RXE1-	16	RXE1+
17	GND	18	RXE2-
19	RXE2+	20	RXECLK-
21	RXECLK+	22	RXE3-
23	RXE3+	24	GND
25	NC	26	NC
27	NC	28	VDD
29	VDD	30	VDD

8.0 Reliability Test

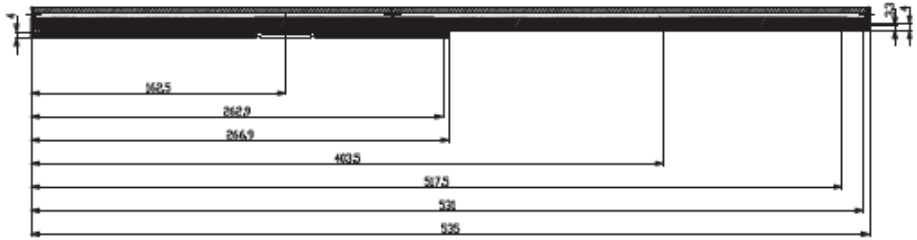
Environment test conditions are listed as following table.

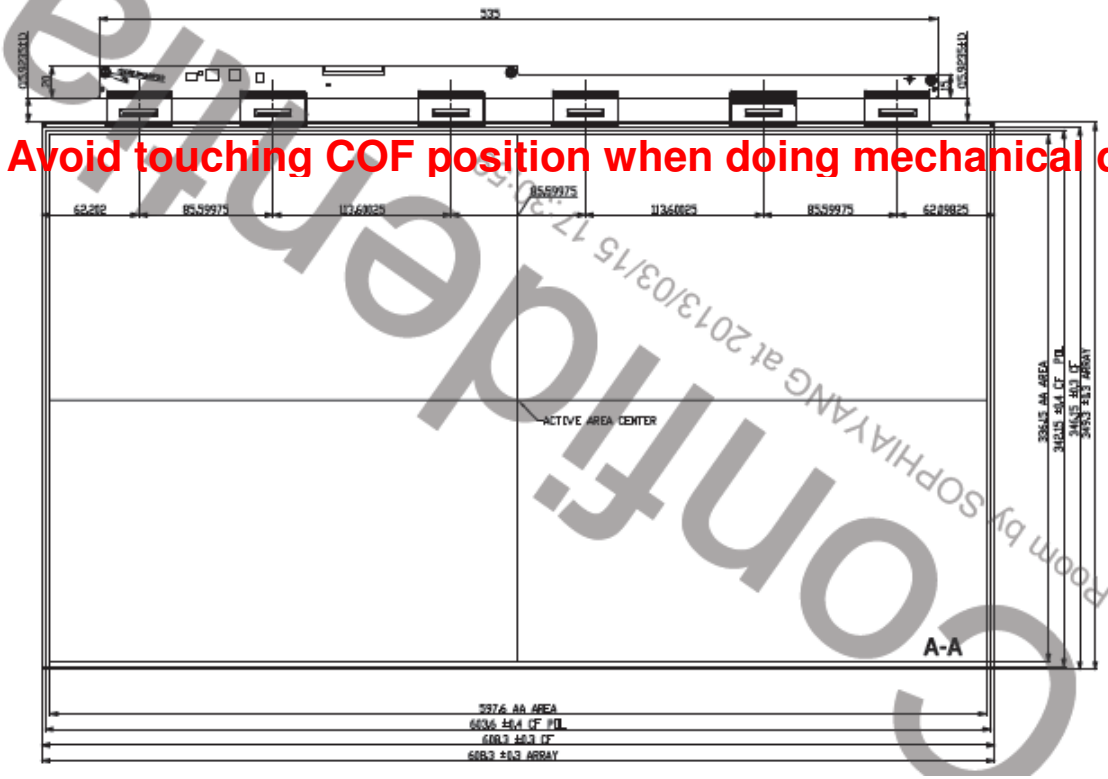
Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50℃, 50%RH, 300hours	
Low Temperature Operation (LTO)	Ta= 0℃, 300hours	
High Temperature Storage (HTS)	Ta= 60℃, 300hours	
Low Temperature Storage (LTS)	Ta= -20℃, 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Random Frequency: 10 - 200 Hz Sweep: 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: 60 cm, package test	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	***1***
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point.	***2***
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	
Altitude Test	Operation:18,000 ft Non-Operation:40,000 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℃ to 60℃, 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: EN61000-4-2, ESD class B: Certain performance degradation allowed
No data lost
Self-recoverable
No hardware failures.

9.0 Mechanical Characteristics





Avoid touching COF position when doing mechanical design





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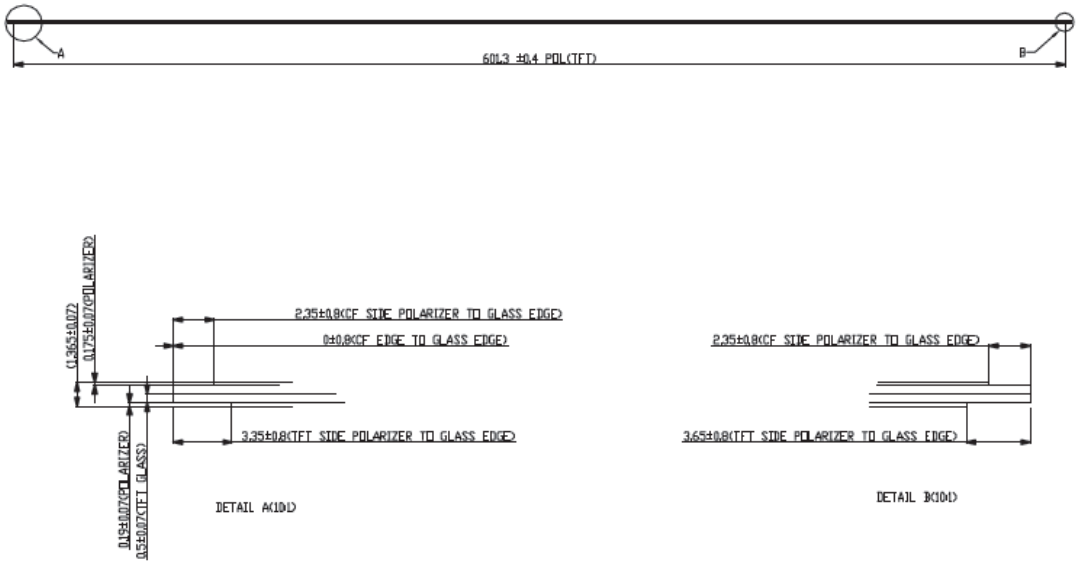
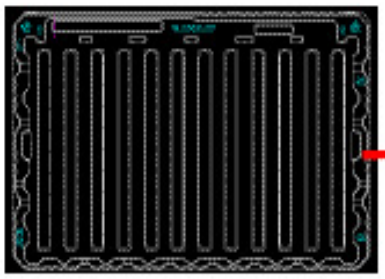
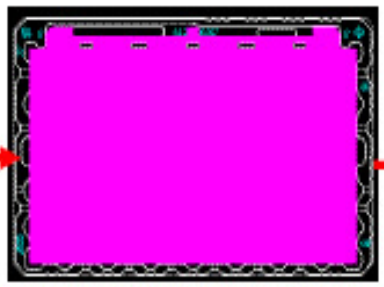

A
601.3 ±0.4 POL(TFT)
B
2.35±0.8(CF SIDE POLARIZER TO GLASS EDGE)
0±0.8(CF EDGE TO GLASS EDGE)
3.35±0.8(TFT SIDE POLARIZER TO GLASS EDGE)
DETAIL A(10:1)
2.35±0.8(CF SIDE POLARIZER TO GLASS EDGE)
3.65±0.8(TFT SIDE POLARIZER TO GLASS EDGE)
DETAIL B(10:1)
2±0.8(CF SIDE POLARIZER TO GLASS EDGE)
3.2±0.8(TFT SIDE POLARIZER TO GLASS EDGE)
DETAIL D(10:1)

AUO

10. Packing Specification



1pcs PET TRAY



First put 1PCS EPE SPACER into PET TRAY
Total Put 3pcs SKD and 4 PCS SPACER



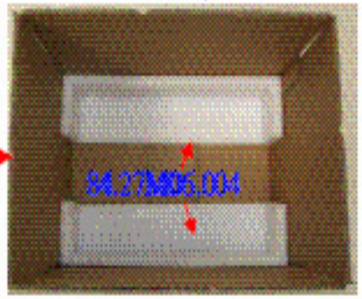
Put 6pcs Tray Stack
(5PCS TRAY Loading SKD + 1PCS vacant TRAY)



Put 1 pcs PP BOARD and put 6pcs Tray Stack in the ANTI-STATIC bag



Packing ANTI-STATIC bag



Put EPE bottom Cushion into Carton



Put First Stack Package and EPE bottom Cushion into Carton



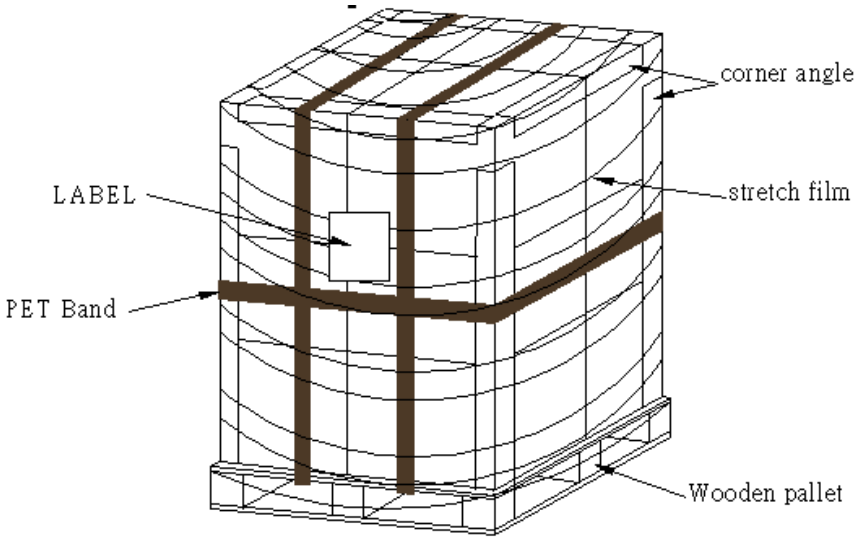
Put Second Stack Package into Carton



Put TOP EPE Cushion into Carton



H Tape Fix



2. Pallet and shipment information

	Item	Specification			Remark
		Q'ty	Dimension	Weight(kg)	
1	Panel	1	608.3(H)mm x349.3(V)mm x 1.455(D)mm	0.63	
2	Cushion	1		0.35	
3	TRAY	1	670 (L)mm x 420(W)mm x 17.5(H)mm	1.61	without Panel & cushion
4	Packing Box	30 pcs/Box	736 (H)mm x486(V)mm x 262(D)mm	26.03	with panel & cushion
5	Pallet	1	980(L)mm x 740(W)mm x 138(H)mm	14.3	
6	Pallet after Packing	18 boxes/pallet	980(L)mm x 740(W)mm x 1448(H)mm	260.3	