( ) Preliminary Specification

(V) Final Specification

Module	22” WSXGA+ Color TFT-LCD
Model Name	G220SVN01.0

Customer	**Date**	**Checked & Approved by**	**Date**
		Vito Huang	2013/07/09
Approved by		**Prepared by**	
		Jimmy Tsai	2013/07/09
Note: This Specification is subject to change without notice.		General Display Business Division / AU Optronics corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2012/10/23	All	First Edition for Customer	All	
1.0 2013/03/07	All	First Edition for Customer	All	
1.1 2013/03/15	11	Symbol / Parameter / Min / Typ / Max / Units / Remark VDD / Logic/LCD Drive Voltage / 4.6 / 5.0 / 5.5 / [Volt] / ±10% IDD / VDD Current / - / 1200 / TBD / [mA] / VDD= 5.0V, All White Pattern At 60Hz Irush / LCD Inrush Current / - / - / 3.5 / [A] / Note 1 PDD / VDD Power / - / 6 / TBD / [Watt] / VDD= 5.0V, All White Pattern At 60Hz	Symbol / Parameter / Min / Typ / Max / Units / Remark VDD / Logic/LCD Drive Voltage / 4.5 / 5.0 / 5.5 / [Volt] / ±10% IDD / VDD Current / - / 1200 / 1300 / [mA] / VDD= 5.0V, All White Pattern At 60Hz Irush / LCD Inrush Current / - / - / 3.5 / [A] / Note 1 PDD / VDD Power / - / 6 / 6.5 / [Watt] / VDD= 5.0V, All White Pattern At 60Hz
	13	Symbol / Parameter / Min / Typ / Max / Unit / Remark VLED / Input Voltage / 10.8 / 12 / 12.6 / Volt / - ILED / Input Current / - / 1.5 / - / A / 100% Dimming	Symbol / Parameter / Min. / Typ. / Max. / Unit / Remark VLED / Input Voltage / 10.8 / 12 / 12.6 / Volt / - ILED / Input Current / - / 1.5 / 2.5 / A / 100% Dimming PLED / Power consumption / - / 18 / 25.2 / Watt / 100% Dimming
1.2 2013/07/09	6	Color Chromaticity (CIExyLight Source C, 2° Field of View) / Red x / ??? / ??? / ??? Red y / ??? / ??? / ??? Green x / ??? / ??? / ??? Green y / ??? / ??? / ??? Blue x / ??? / ??? / ??? Blue y / ??? / ??? / ??? White x / 0.263 / 0.313 / 0.363 White y / 0.279 / 0.329 / 0.379 Color Gamut / % / - / - / 72 / - / -	Red x / 0.586 / 0.636 / 0.686 Red y / 0.296 / 0.346 / 0.396 Green x / 0.277 / 0.327 / 0.377 Green y / 0.570 / 0.620 / 0.670 Blue x / 0.103 / 0.153 / 0.203 Blue y / 0.001 / 0.051 / 0.101 White x / 0.263 / 0.313 / 0.363 White y / 0.279 / 0.329 / 0.379 - / - / 70 / -	

1. Operating Precautions

1) Since front polarizer is easily damaged, pay attention 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 other soft cloth.
5) Since the panel is made of glass, it may break or crack 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 or modify the Module Assembly.
8) In case if a Module has to be put back into the packing container slot after once it was taken out from the container, take it easily, or the TFT Module may be damaged.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
10) After installation of the TFT Module into an enclosure, 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.
11) 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.
12) Severe temperature condition may result in different luminance, response time and LED life time.
13) The data on this specification sheet is applicable when LCD module is placed in landscape position.
14) Continuous displaying fixed pattern may induce image sticking. It is recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.

2. General Description

This specification applies to the 22 inch-wide Color TFT-LCD Module G220SVN01.0.

The display supports the WSXGA+ (1680(H) x 1050(V)) screen format and 16.7M colors. All input signals are 2 Channels LVDS interface compatible.

LED driver of backlight is included. G220SVN01.0 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]	22
Active Area	[mm]	473.76 (H) x 296.1(V)
Pixels H x V		1680x3(RGB) x 1050
Pixel Pitch	[mm]	0.282x 0.282
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		P-MVA Mode,Normally Black
Nominal Input Voltage VDD	[Volt]	+5.0 V
Typical Power Consumption	[Watt]	28W (Typ) (6 W Cell + 22W LED B/L) (All white pattern)
Weight	[Grams]	2,100 (Typ)
Physical Size	[mm]	493.7(W) x 320.1(H) x 15.75(D) (Max)
Electrical Interface		Dual Channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.7M colors (6-bits + HiFRC)
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 0 to +50 -20 to +60
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]	LED current = 60 mA	200	250	-	1
Uniformity	%	9 Points	75	80	-	1, 2, 3
Contrast Ratio			1600	2000	-	4
Cross talk	%		-	-	1.5	5
Response Time	[msec]	Rising	-	15	-	6
		Falling	-	5	-	
		Rising + Falling	-	20	-	
		Gray to Gray	-	8	-	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	75	89	-	7
			75	89	-	
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	75	89	-	
			75	89	-	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.586	0.636	0.686	
		Red y	0.296	0.346	0.396	
		Green x	0.277	0.327	0.377	
		Green y	0.570	0.620	0.670	
		Blue x	0.103	0.153	0.203	
		Blue y	0.001	0.051	0.101	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%			70	-	

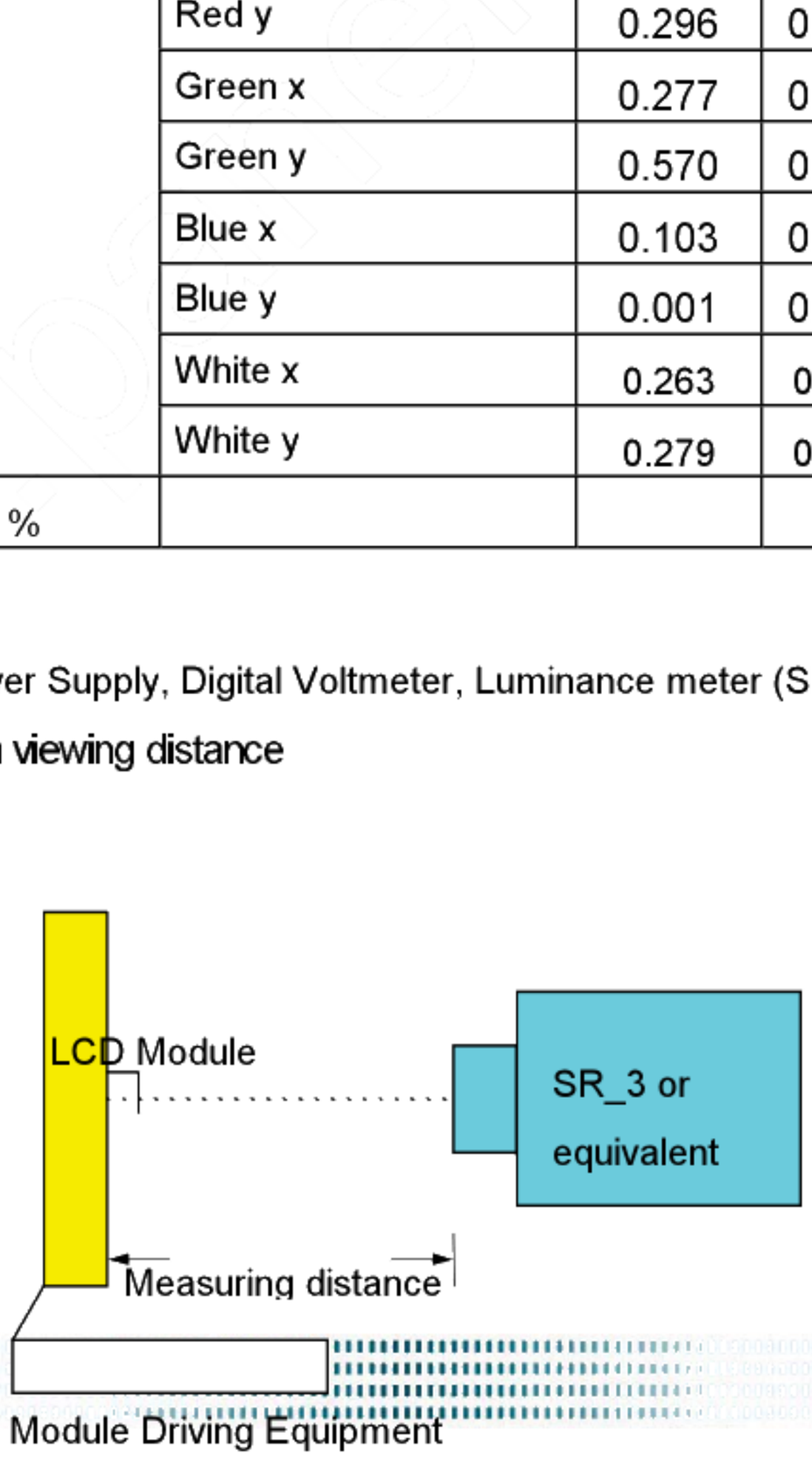
Note 1: Measurement method

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

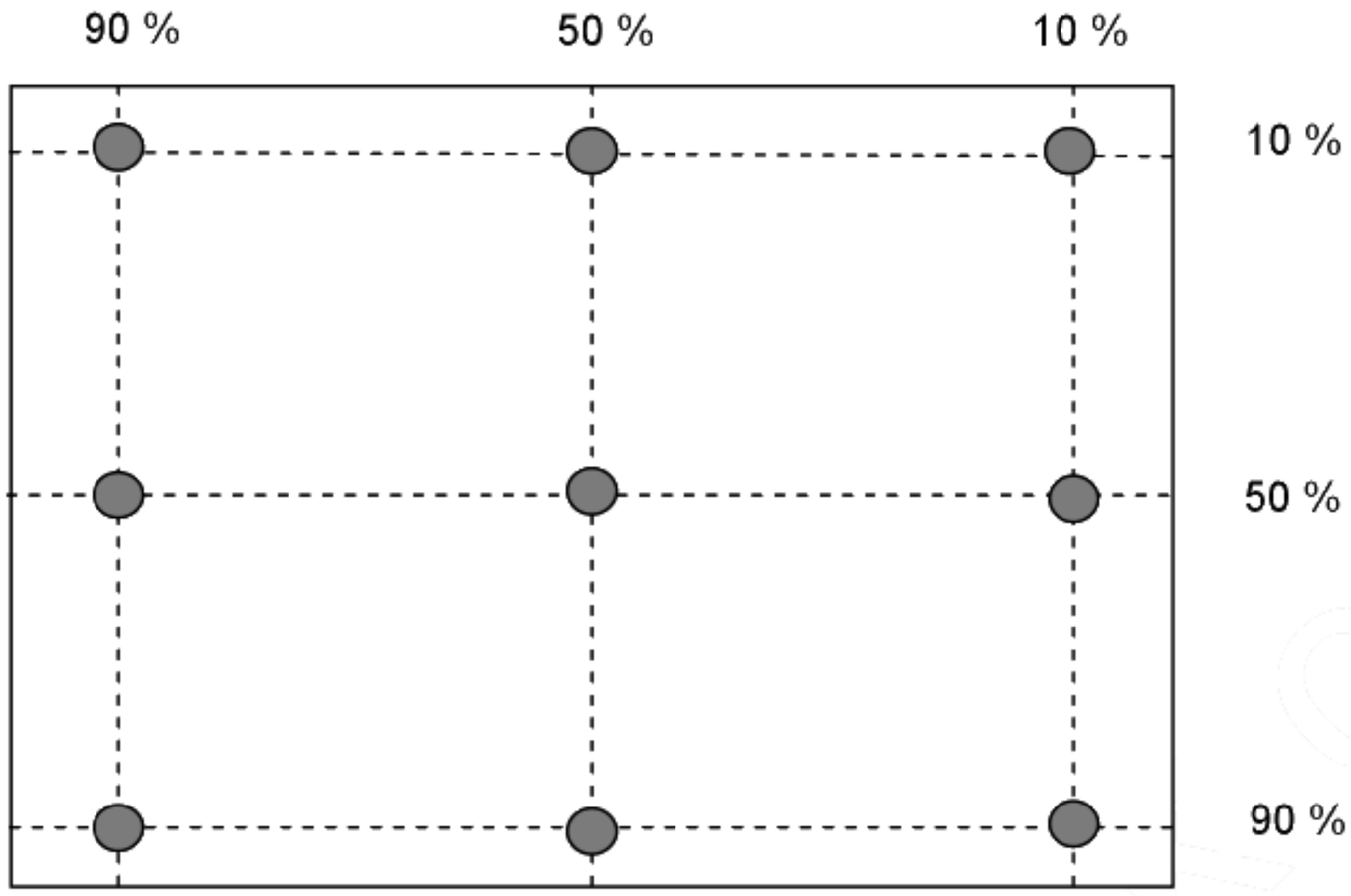
Aperture 1□with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2: Definition of 9 points position (Display active area : 473.76(H) x 296.10(V))



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

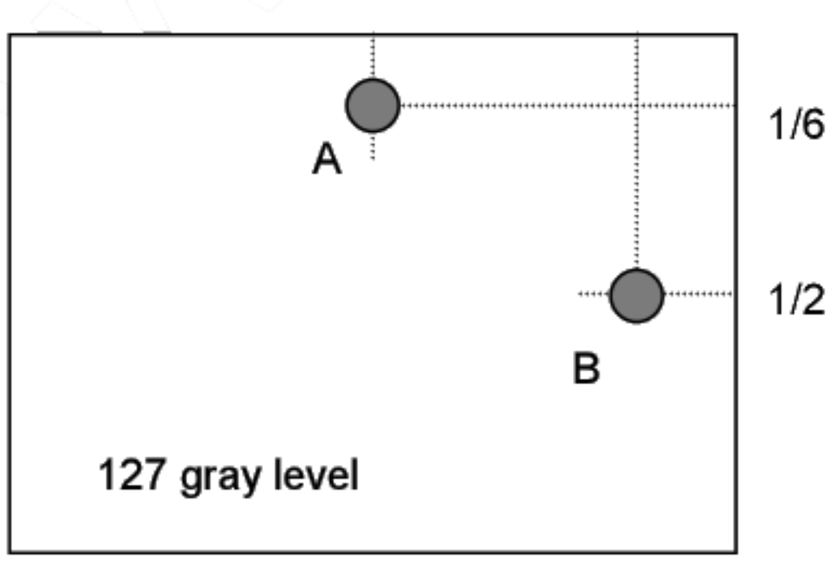
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

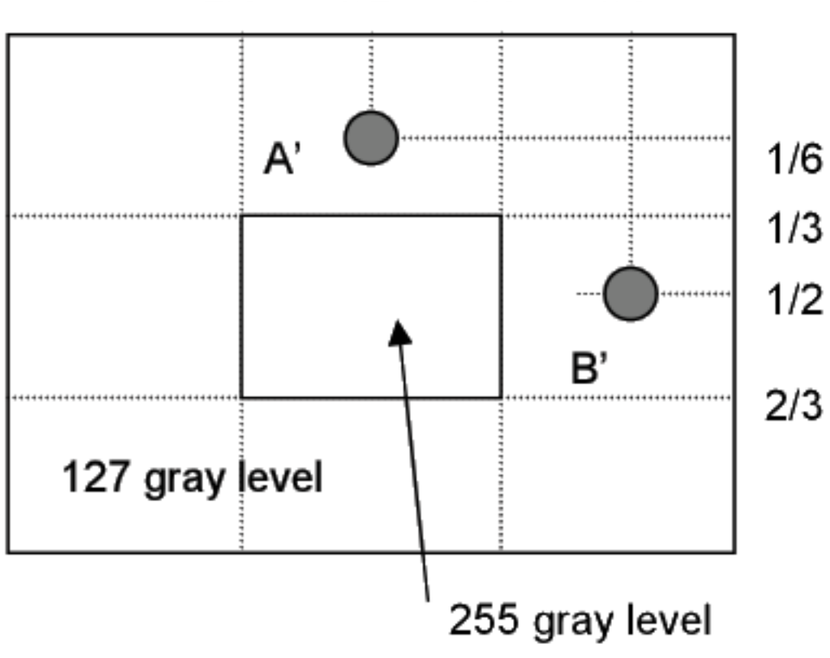
Note 4： Definition of contrast ratio (CR):

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

Note 5： Definition of cross talk (CT)

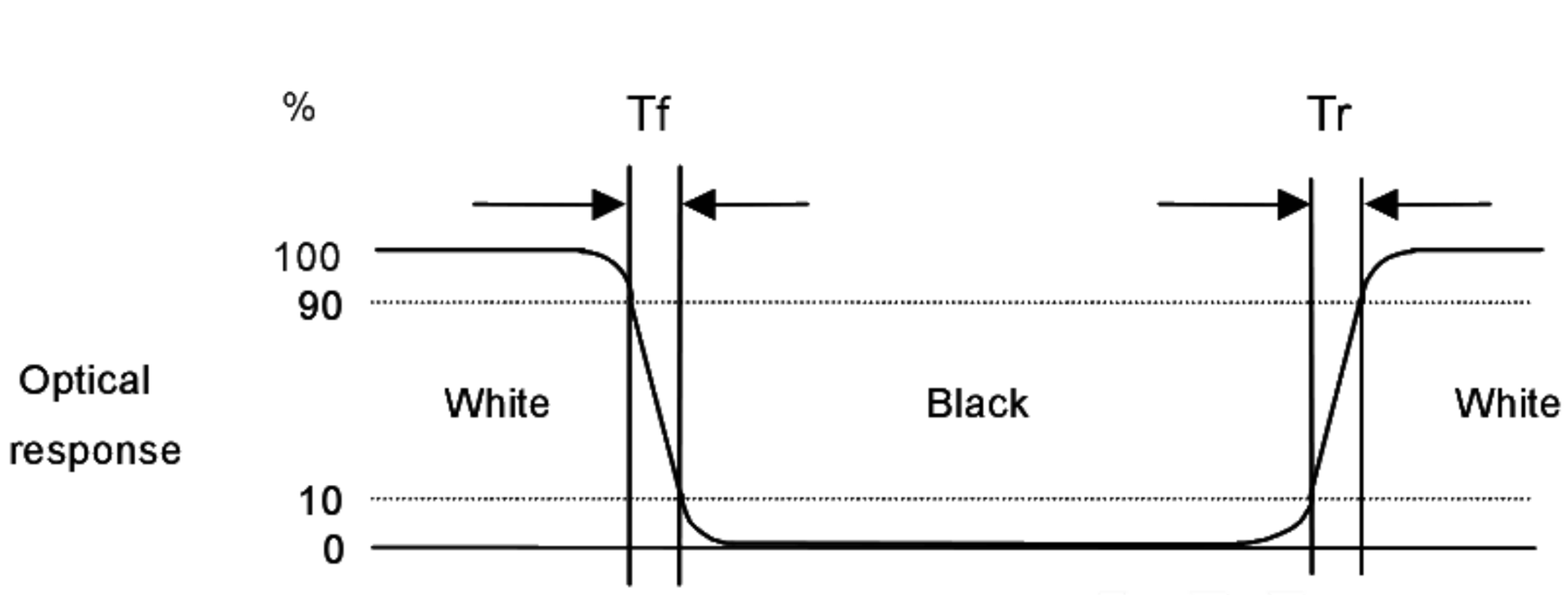
CT = | YB – YA | / YA × 100 (%)
Where
YA = Luminance of measured location without gray level 255 pattern (cd/m2)
YB = Luminance of measured location with gray level 255 pattern (cd/m2)





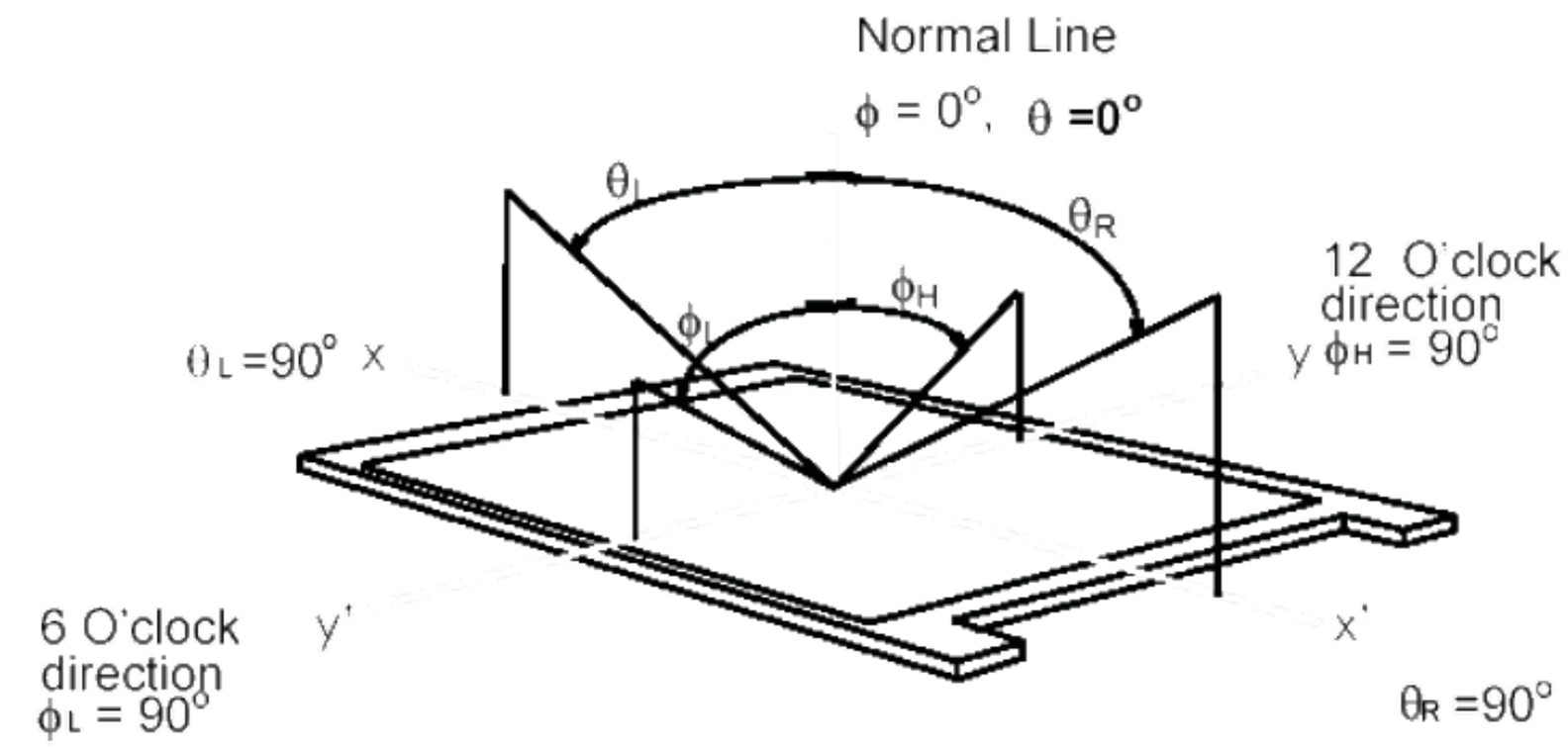
Note 6: Definition of response time:

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.



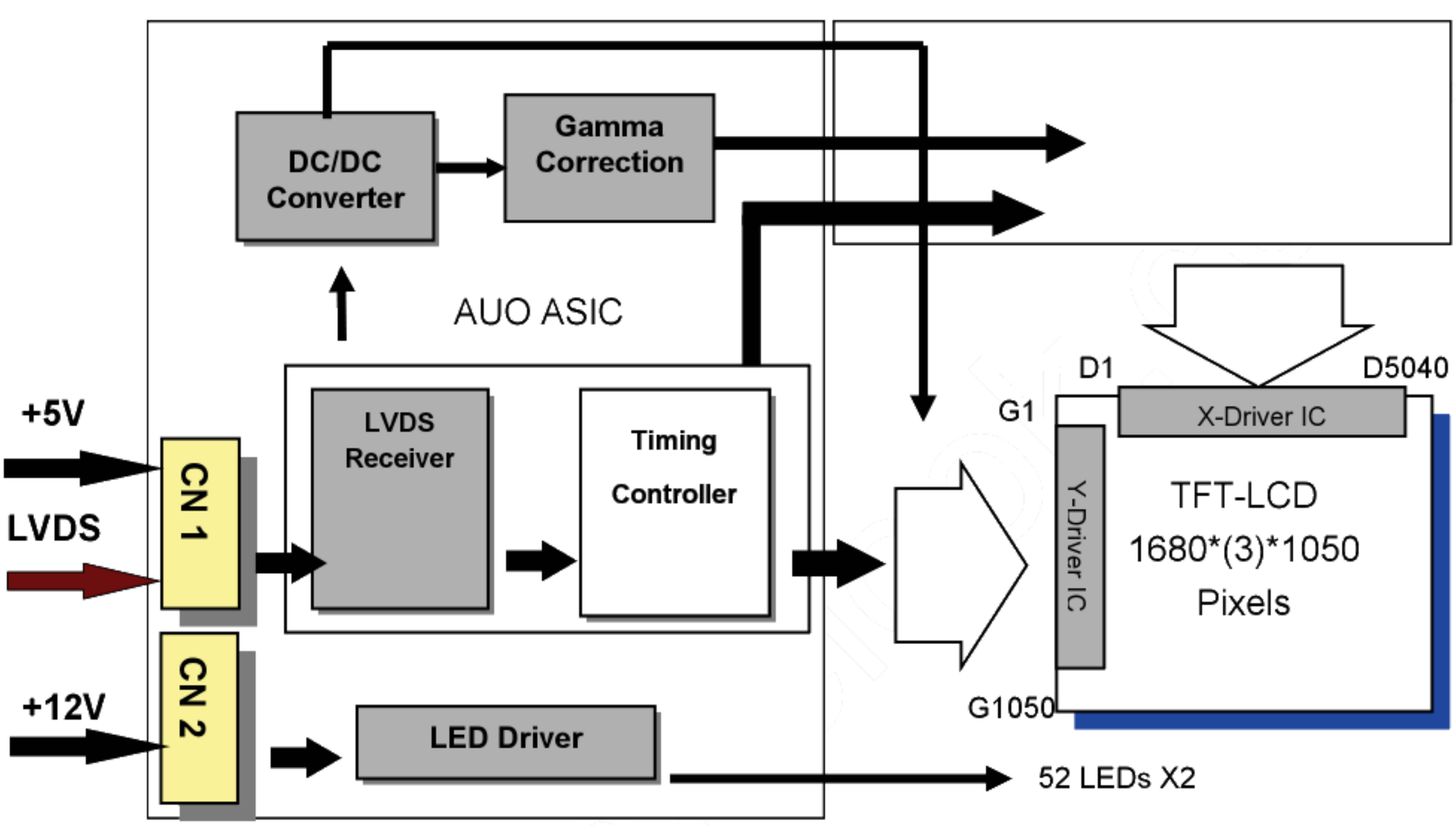
Note 7: Definition of viewing angle

Viewing angle is the measurement of contrast ratio □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 22 inches wide Color TFT-LCD Module:



LVDS Connector (CN1): JAE (FI-XPB30SRLAHF11) or equivalent.
LED Connector (CN2): STM MS24049HJ or equivalent.

4. Absolute Maximum Ratings

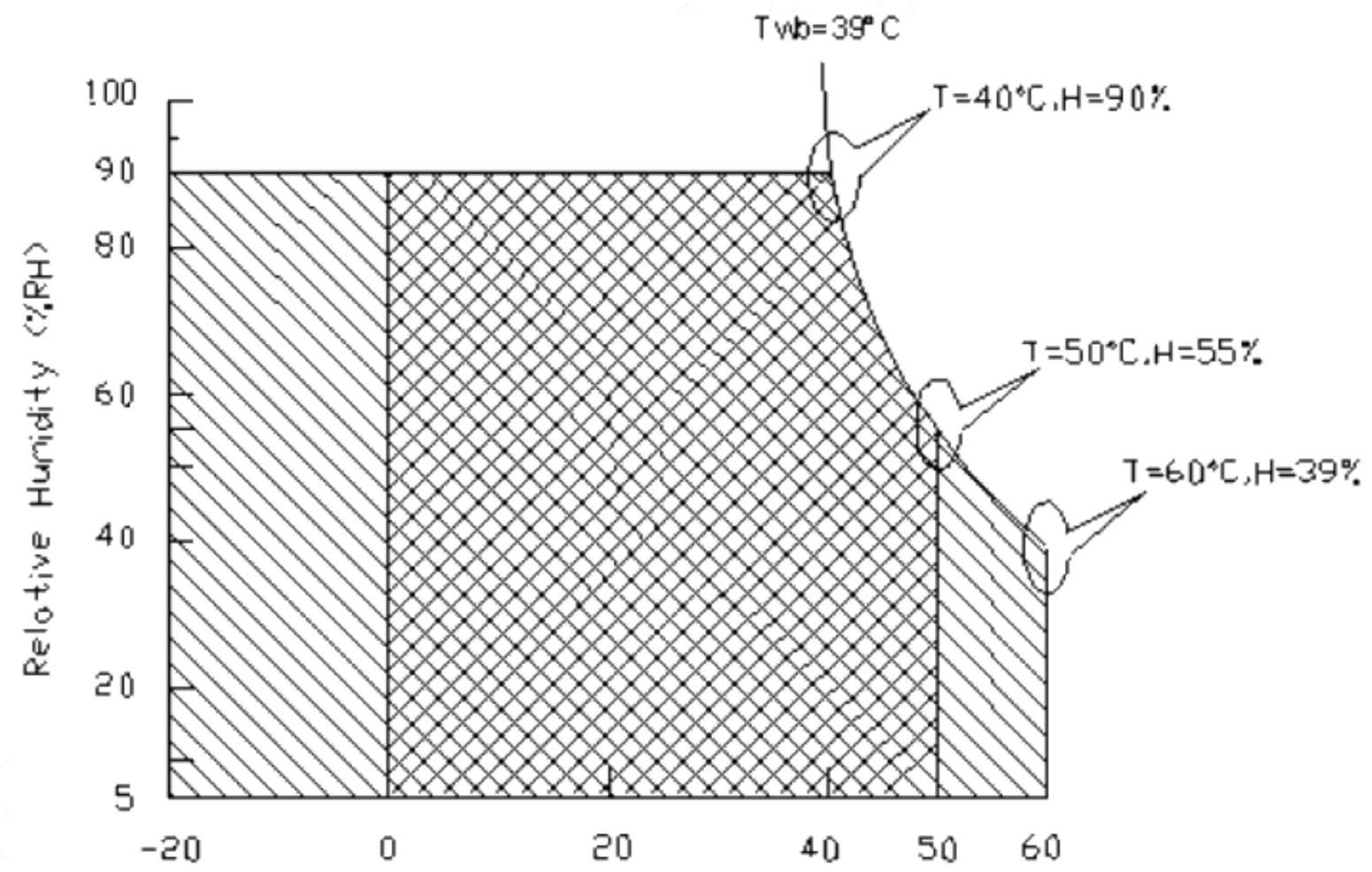
4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	VDD	-0.3	+5.5	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	0	+50	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-20	+60	[°C]
Storage Humidity	HST	8	90	[%RH]

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



Operating Range

Storage Range

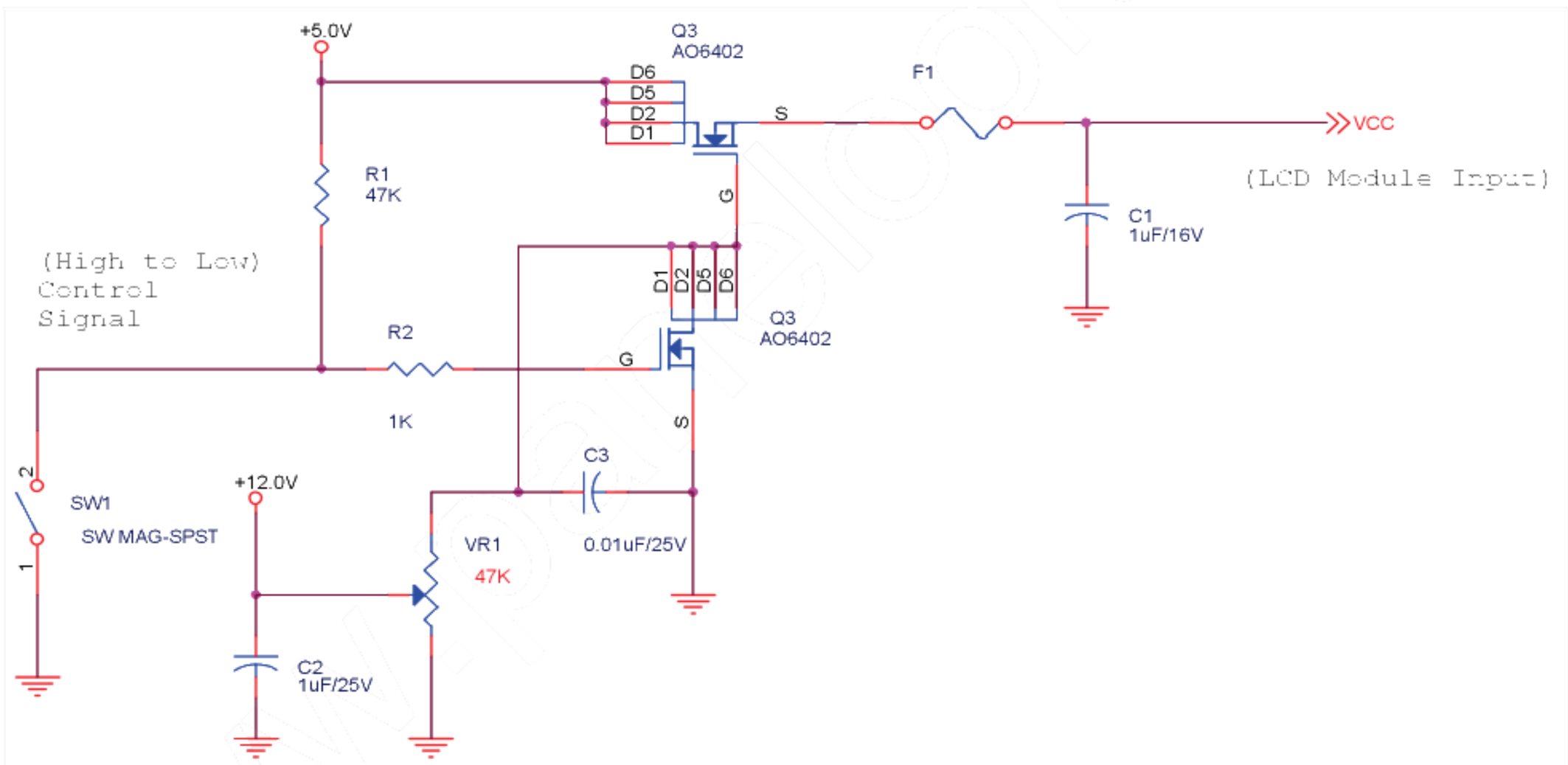
5. Electrical Characteristics

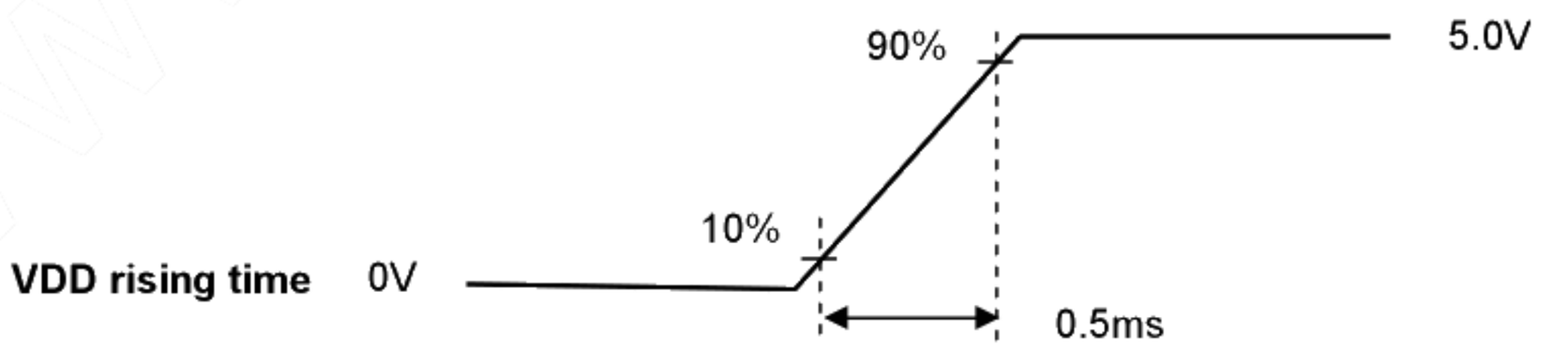
5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	±10%
IDD	VDD Current	-	1200	1300	[mA]	VDD= 5.0V, All White Pattern At 60Hz
Irush	LCD Inrush Current	-	-	3.5	[A]	Note 1
PDD	VDD Power	-	6	6.5	[Watt]	VDD= 5.0V, All White Pattern At 60Hz

Note 1: Measurement condition:



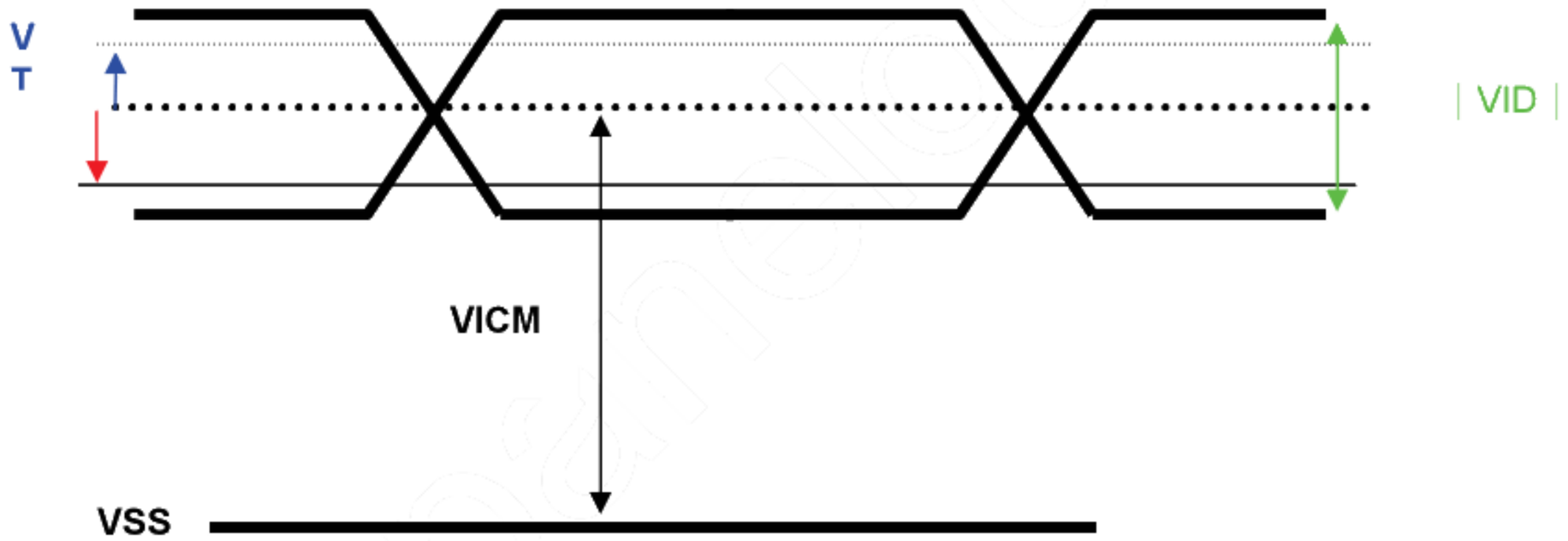


5.1.2 Signal Electrical Characteristics

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=1.2V
VTL	Differential Input Low Threshold	-100	-	-	[mV]	VCM=1.2V
| VID |	Input Differential Voltage	100	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	0.3	-	1.25	[V]	VTH/VTL=±100mV

Note: LVDS Signal Waveform.



5.2 Backlight Unit

5.2.1 LED Light Bar

Following characteristics are measured under stable condition at 25□ (Room Temperature).

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
V_{LED}	Input Voltage	10.8	12	12.6	Volt	
I_{LED}	Input Current	-	1.8	2.1	A	100% Dimming
P_{LED}	Power Consumption	-	21.6	25.2	Watt	100% Dimming
$I_{INRUSH\ LED}$	Inrush Current	-	-	5.1	A	V_{LED} rising time ~ 470us
F_{PWM}	PWM Dimming Frequency	200	-	20K	Hz	Note 1,2
$V_{PWM\ DIM}$	Swing Voltage High	3.0	3.3	5	Volt	
	Swing Voltage Low	-	-	0.8	Volt	
D_{PWM}	Dimming Duty Cycle	10	-	100	%	
I_F	LED Forward Current	-	60	-	mA	Ta = 25℃
$V_{LED\ ON/OFF}$	On Control Voltage	3.0	3.3	5	Volt	Note 3, 4
	Off Control Voltage	-	-	0.8	Volt	
Operating Life		30,000	-	-	Hrs	Note 5, 6

Note 1: PWM dimming function can be operated by PWM signal. PWM duty cycle can adjust white Luminance.
(PWM High: ON and PWM Low: OFF)

Note 2: PWM signal can not be floating and pull-down to ground when waiting.

Note 3: Enable ($V_{LED\ On/Off}$) must be turned on late than V_{LED} and PWM Signal.

Note 4: Enable ($V_{LED\ On/Off}$) must be turned off early than V_{LED} and PWM Signal.

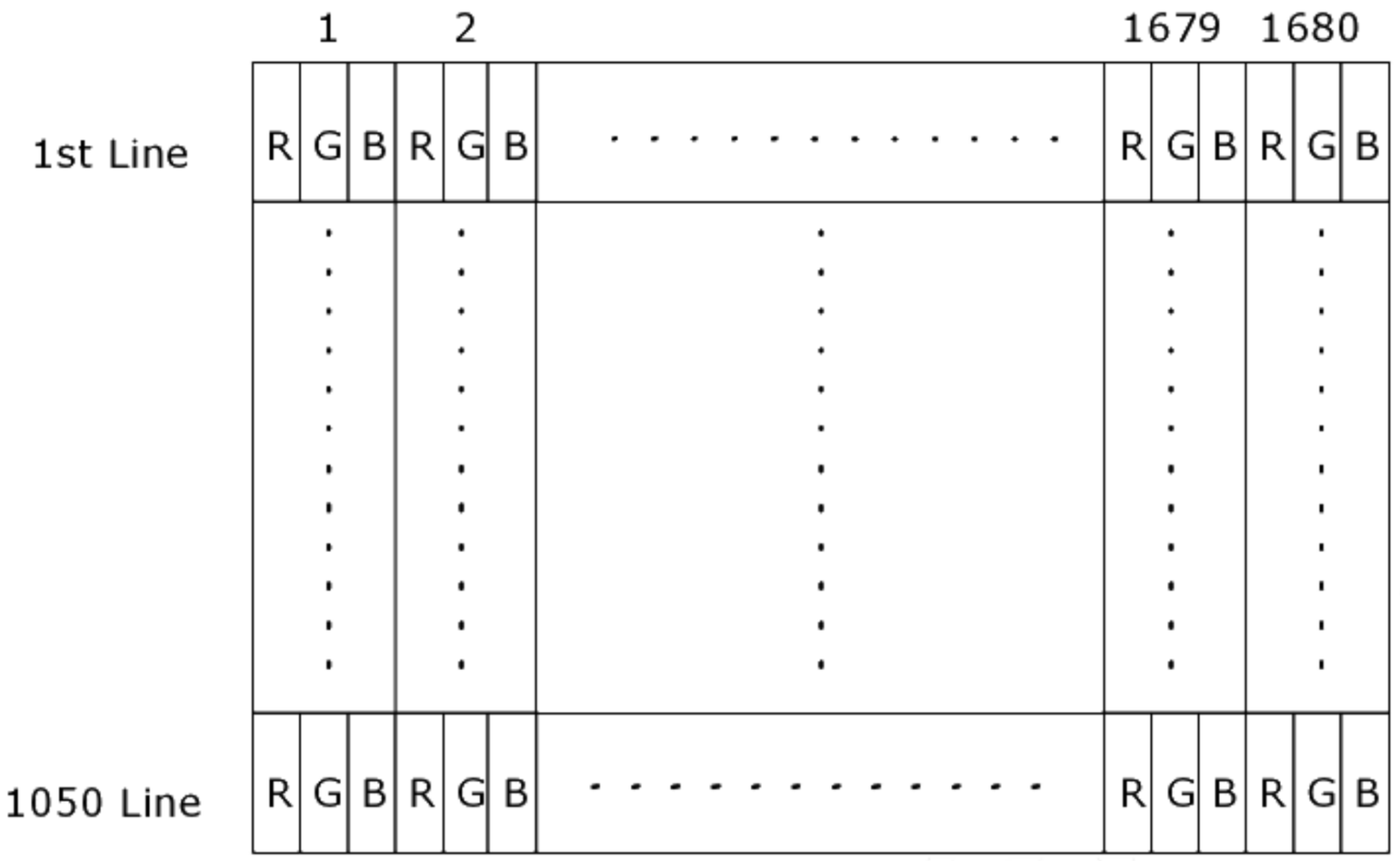
Note 5: One LED light bar structure: (4 strings x 13pcs / string =52 pcs of LED); Tow LED light bars / Module

Note 6: Definition of life time : brightness becomes 50% of its original value.
The minimum life time of LED unit is on the condition of I_F = 60mA and 25±2□(Room temperature).

6. Signal Characteristic

6.1 Pixel Format Image

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

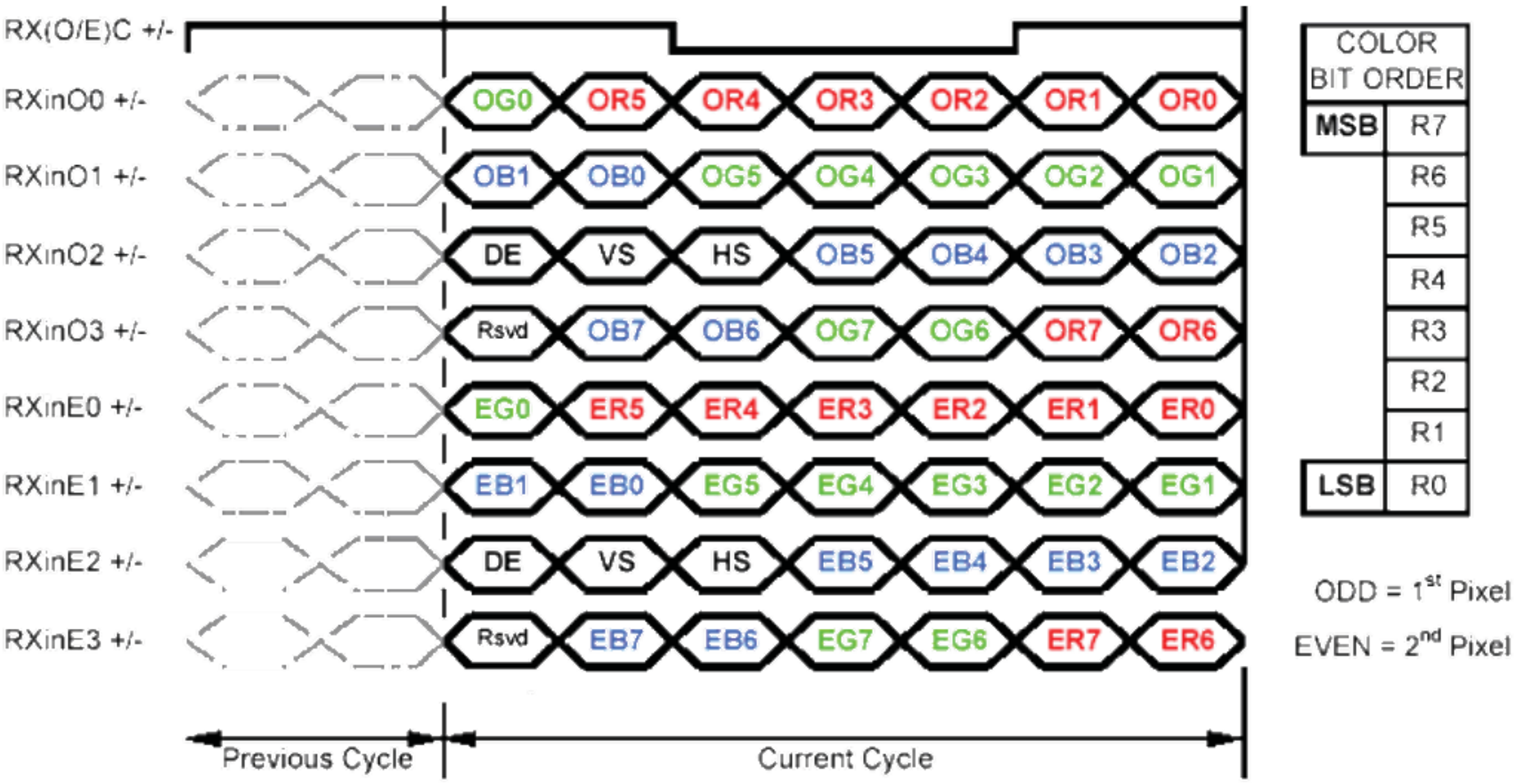


6.2 Signal Description

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

PIN #	SIGNAL NAME	DESCRIPTION
1	RXinO0-	Negative LVDS differential data input (Odd data)
2	RXinO0+	Positive LVDS differential data input (Odd data)
3	RXinO1-	Negative LVDS differential data input (Odd data)
4	RXinO1+	Positive LVDS differential data input (Odd data)
5	RXinO2-	Negative LVDS differential data input (Odd data, H-Sync, V-Sync, DSPTMG)
6	RXinO2+	Positive LVDS differential data input (Odd data, H-Sync, V-Sync, DSPTMG)
7	GND	Power Ground
8	RxOCLKIN-	Negative LVDS differential clock input (Odd clock)
9	RxOCLKIN+	Positive LVDS differential clock input (Odd clock)
10	RXinO3-	Negative LVDS differential data input (Odd data)
11	RXinO3+	Positive LVDS differential data input (Odd data)
12	RXinE0-	Negative LVDS differential data input (Even data)
13	RXinE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RXinE1-	Positive LVDS differential data input (Even data)
16	RXinE1+	Negative LVDS differential data input (Even data)
17	GND	Power Ground
18	RXinE2-	Negative LVDS differential data input (Even data)
19	RXinE2+	Positive LVDS differential data input (Even data)
20	RxECLKIN-	Negative LVDS differential clock input (Even clock)
21	RxECLKIN+	Positive LVDS differential clock input (Even clock)
22	RXinE3-	Negative LVDS differential data input (Even data)
23	RXinE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No contact (For AUO test only)
26	NC	No contact (For AUO test only)
27	NC	No contact (For AUO test only)
28	VCC	+5.0V Power Supply
29	VCC	+5.0V Power Supply
30	VCC	+5.0V Power Supply

6.3 The Input Data Format



Note1: 8-bits signal input.
Note2: L:NS alike H:Thine alike

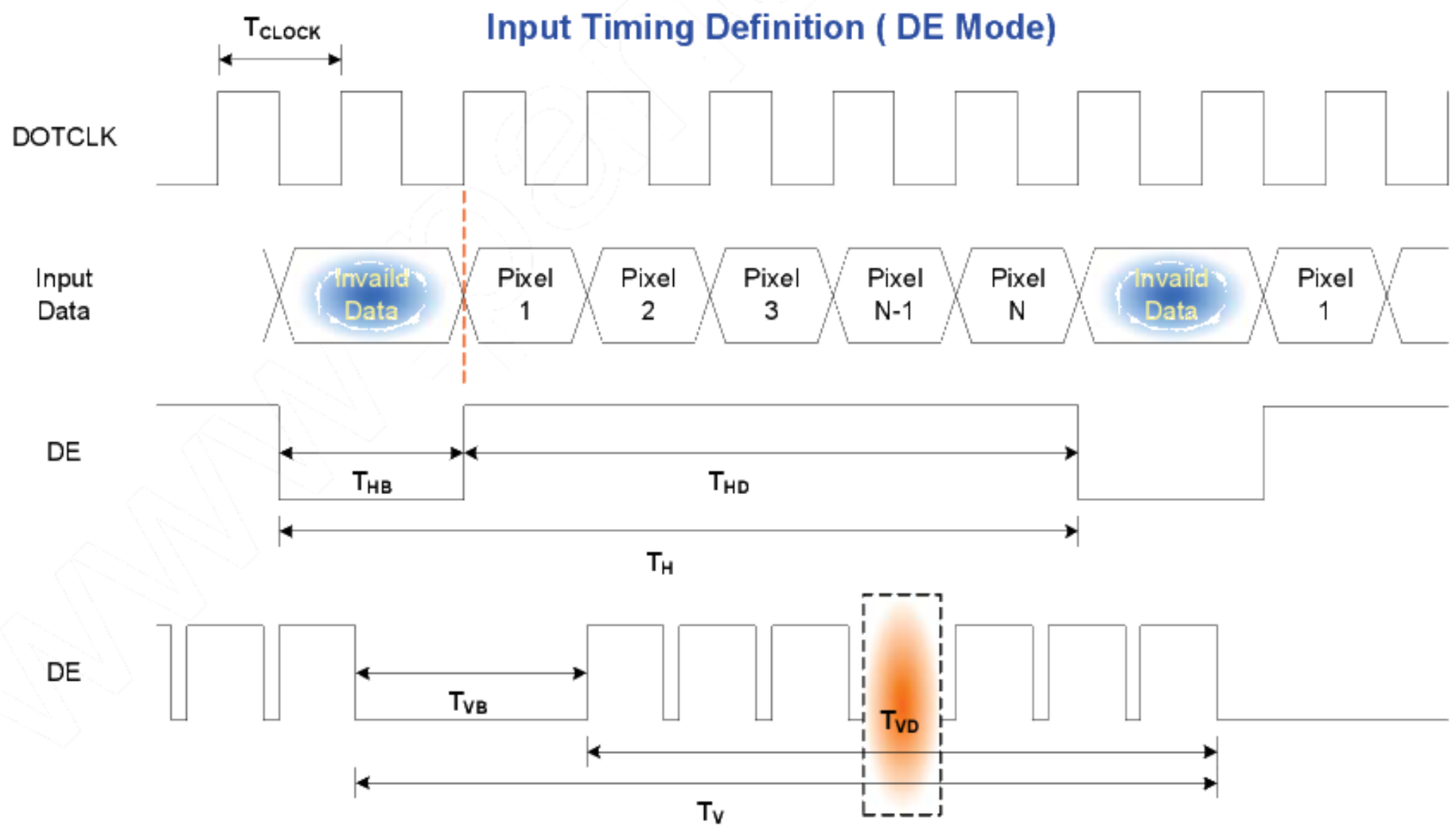
6.4 Interface Timing

6.4.1 Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
Clock	Frequency	1/ T_{Clock}	46.6	72.1	82.5	MHz
Frame Rate	Frequency	1/Tv	50	60	75	Hz
Vertical Section	Period	T_V	1058	1066	2040	T_line
	Active	T_{VD}	1050	1050	1050	
	Blanking	T_{VB}	8	16	997	
Horizontal Section	Period	T_H	880	1128	2040	T_clock
	Active	T_{HD}	840	840	840	
	Blanking	T_{HB}	40	288	1200	

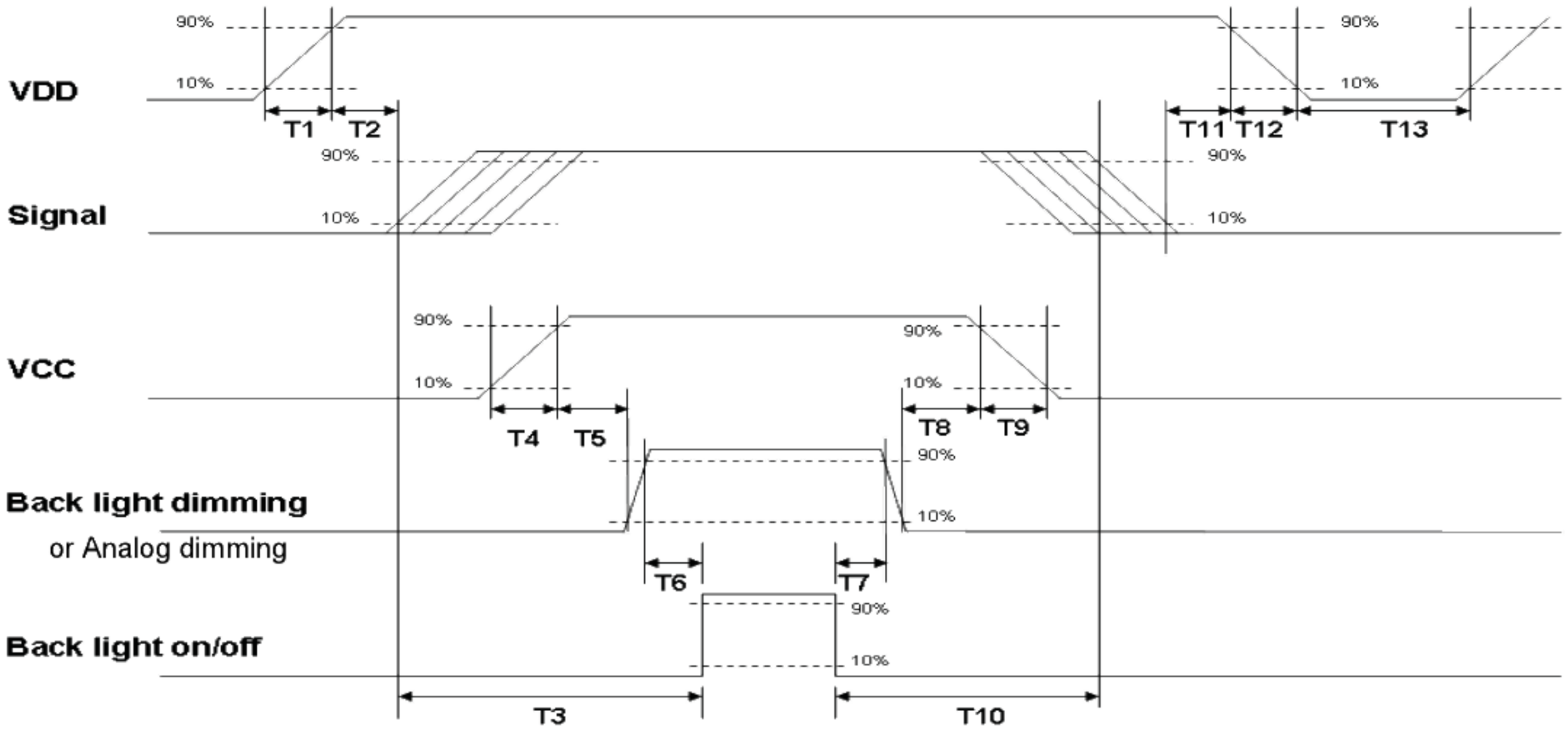
Note: DE mode only.
Note : Typical value refer to VESA STANDARD

6.4.2 Input Timing Diagram



6.5 Power ON/OFF Sequence

VDD power and B/L 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	30	40	50	[ms]
T3	200	--	--	[ms]
T4	0.5	--	10	[ms]
T5	10	--	--	[ms]
T6	10	--	--	[ms]
T7	0	--	--	[ms]
T8	10	--	--	[ms]
T9	--	--	10	[ms]
T10	110	--	--	[ms]
T11	0	16	50	[ms]
T12	--	--	10	[ms]
T13	1000	--	--	[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 (CN1)

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	LVDS: JAE or compatible
Type Part Number	LVDS : JAE (FI-XPB30SRLAHF11) or equivalent.
Mating Housing Part Number	FI-X30H (JAE) or compatible

Pin#	Signal Name	Pin#	Signal Name
1	RxOIN0-	2	RxOIN0+
3	RxOIN1-	4	RxOIN1+
5	RxOIN2-	6	RxOIN2+
7	GND	8	RxOCLKIN-
9	RxOCLKIN+	10	RxOIN3-
11	RxOIN3+	12	RxEIN0-
13	RxEIN0+	14	GND
15	RxEIN1-	16	RxEIN1+
17	GND	18	RxEIN2-
19	RxEIN2+	20	RxECLKIN-
21	RxECLKIN+	22	RxEIN3-
23	RxEIN3+	24	GND
25	NC	26	NC
27	NC	28	VCC
29	VCC	30	VCC

7.2 LED Backlight Unit: LED Driver Connector (CN2)

Connector Name / Designation	LED Connector
Manufacturer	STM
Connector Model Number	MS24049HJ
Mating Model Number	P2404

PIN #	SIGNAL NAME	DESCRIPTION
1	V12	Input voltage, 12V
2	V12	Input voltage, 12V
3	V12	Input voltage, 12V
4	-	NC
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	BL_EN	Back light enable, 5V
9	BL_DIM_P	Back light dimming, 3.3V

8. Reliability Test

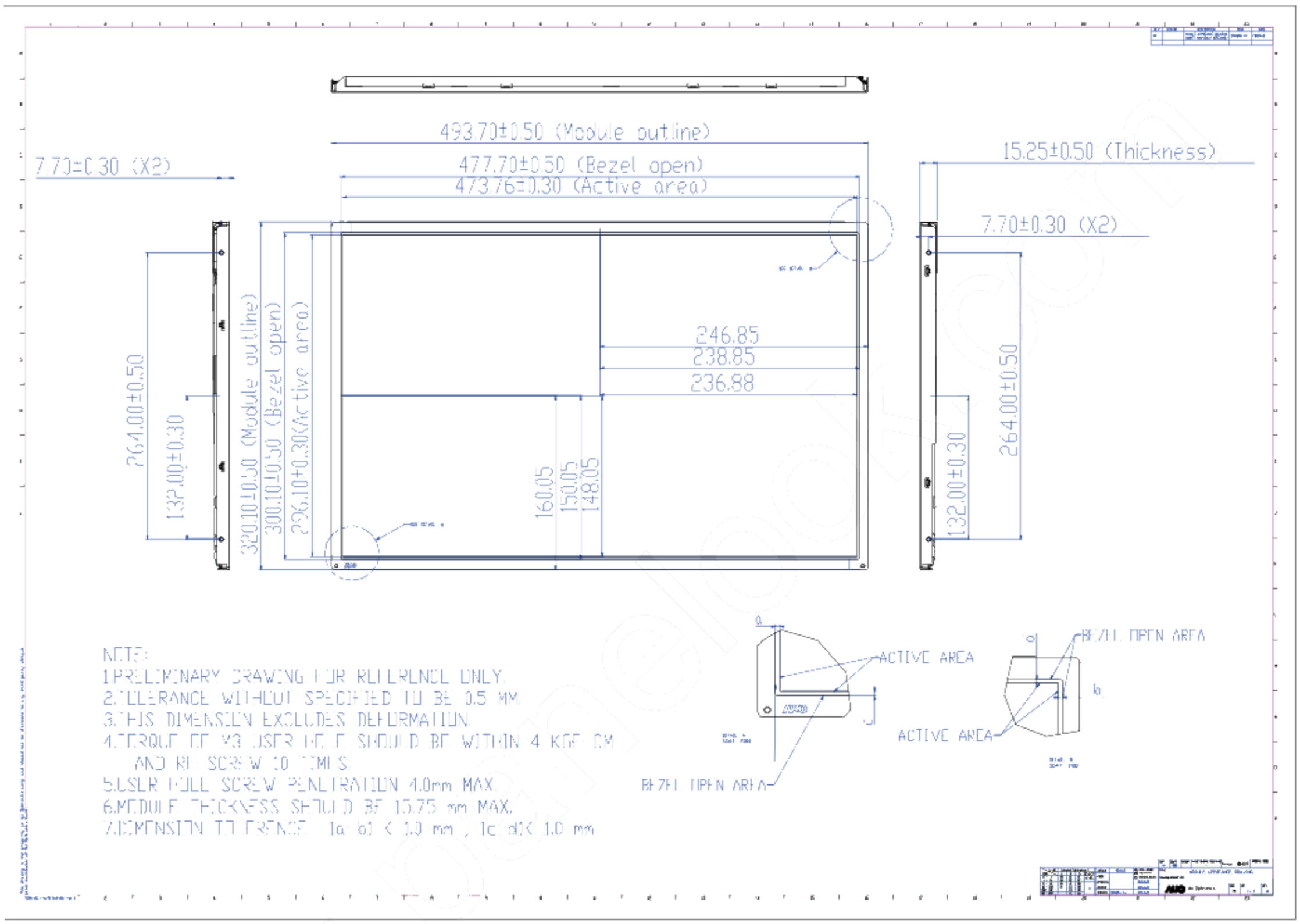
Environment test conditions are listed as following table.

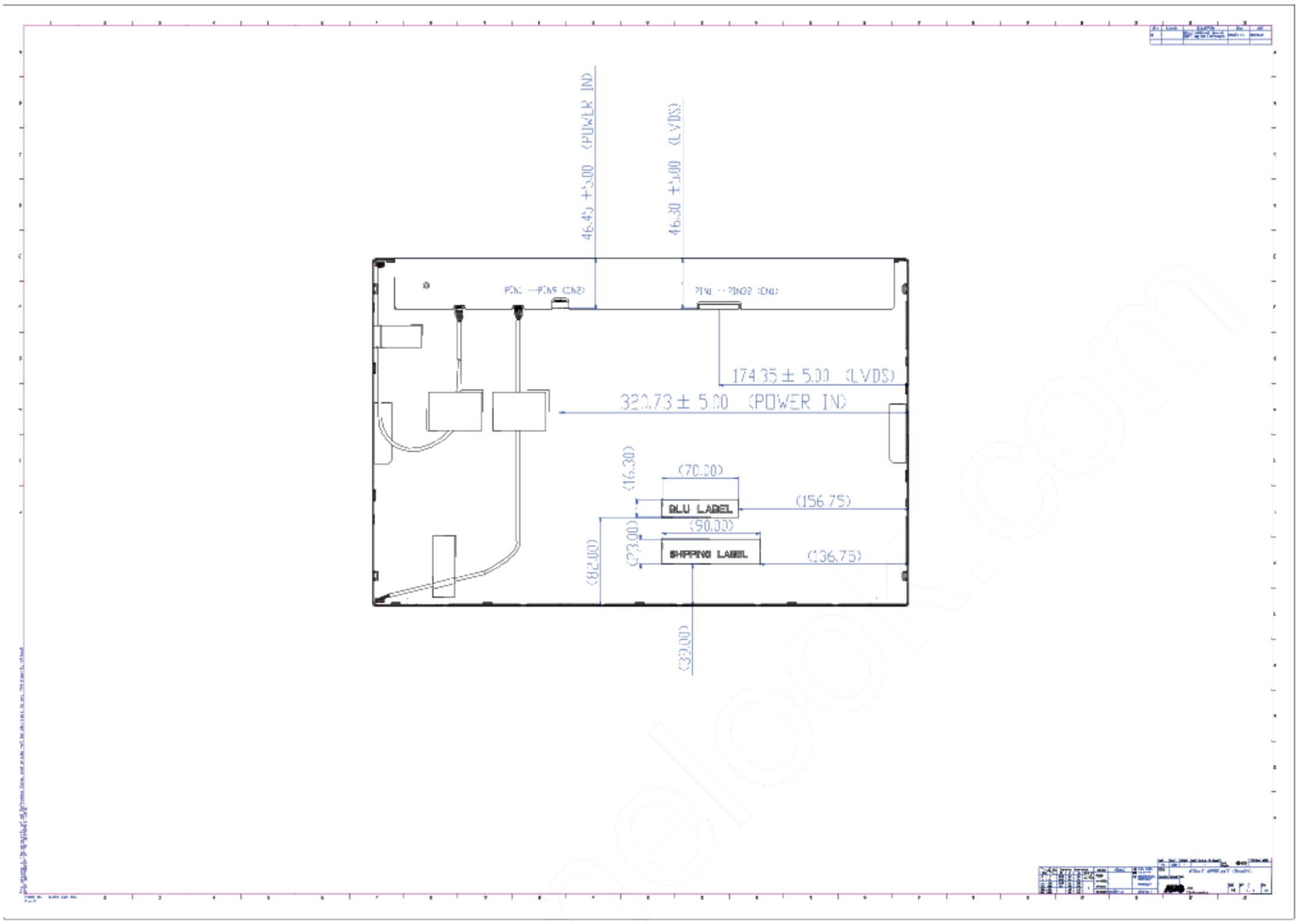
Items	Required Condition	Note
Temperature Humidity Bias	Ta= 50□, 80%RH, 300hours	
High Temperature Operation	Ta= 50□, 300hours	
Low Temperature Operation	Ta= 0□, 300hours	
High Temperature Storage	Ta= 60□, 300hours	
Low Temperature Storage	Ta= -20□, 300hours	
Thermal Shock Test	-20□/30min, 60□/30min, 100 cycles	
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(±X, ±Y, ±Z)	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, P-P) 30 mins/axis (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point.	Note 1
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	

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

. Self-recoverable. No hardware failures.

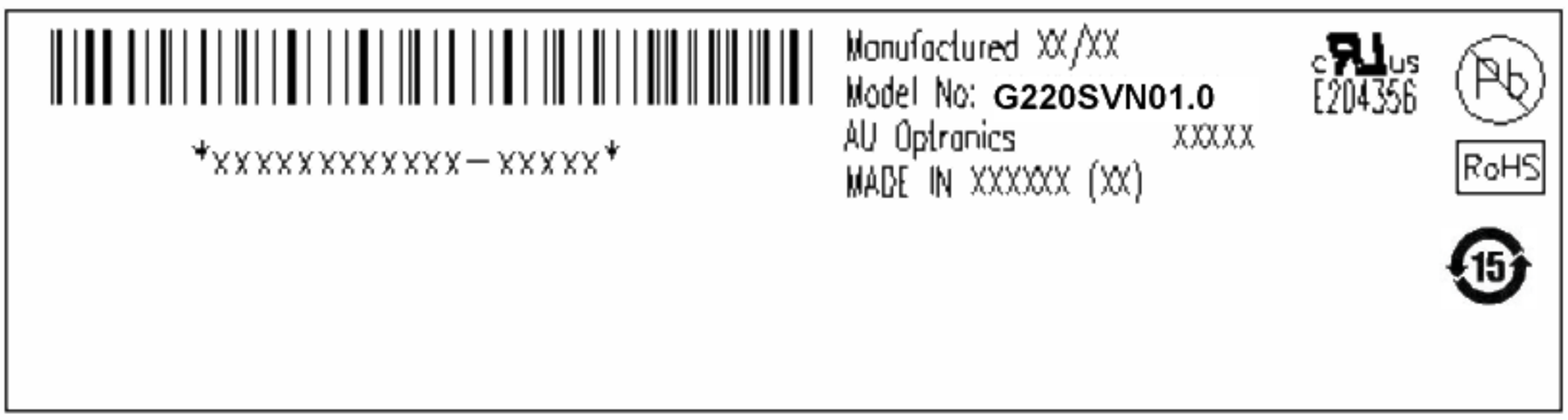
9. Mechanical Characteristics





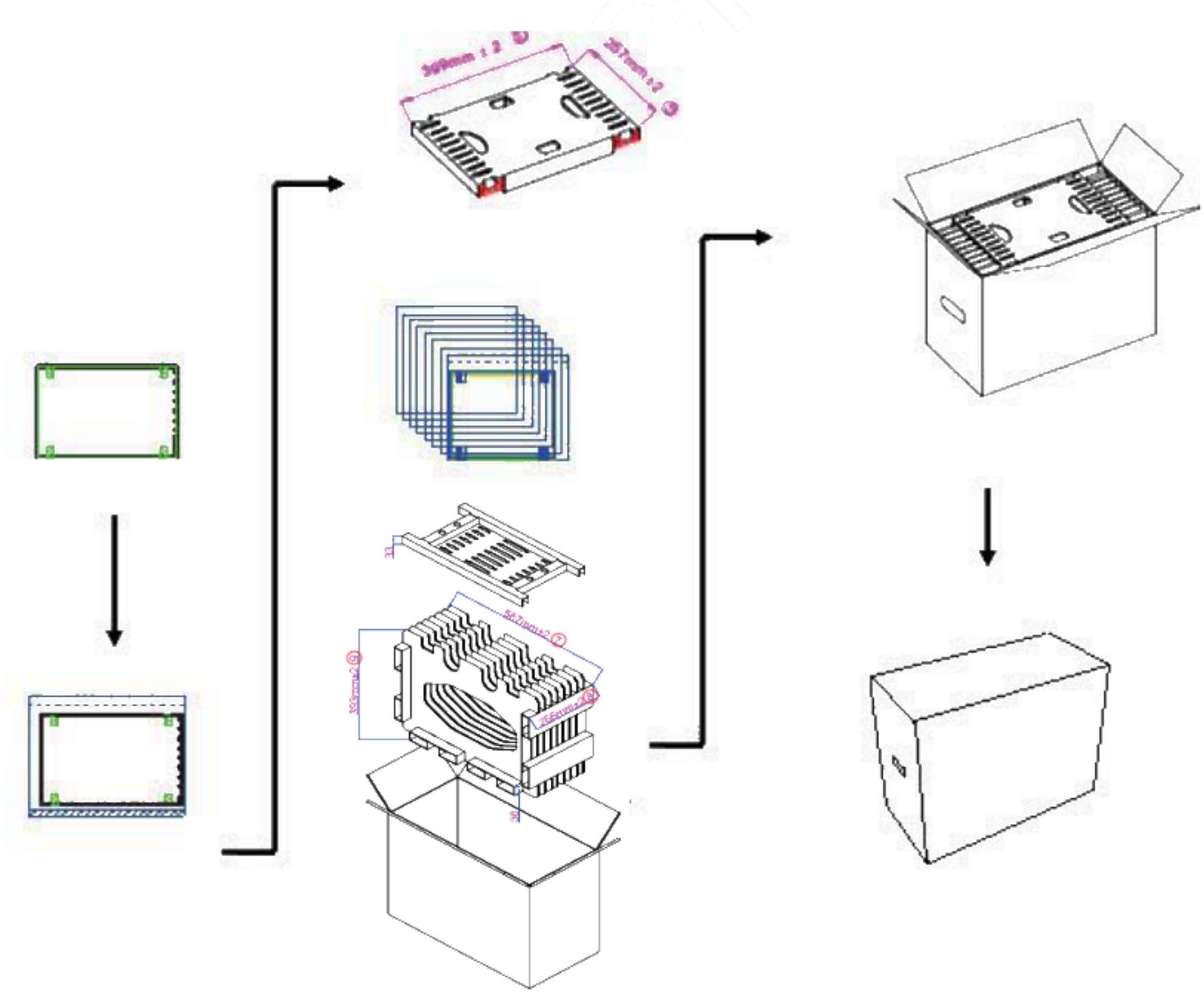
10. Label and Packaging

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



10.2 Carton Package

- The outside dimension of carton is 585mm*284mm*429mm, carton and cushion weight are 2510g.
- 7 pieces per carton box.
- 2*4 boxes per layer.
- By air, double pallets, one pallet occupies 2 layers and another 1 layer. Total: 24 boxes.
- By sea, double pallets, 2 layer/pallet. Total: 32 boxes.
- Pallet size (not include carton boxes): 1180 mm * 1150 mm * 132 mm



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 1950, First Edition	U.S.A. Information Technology Equipment