

(V) Preliminary Specifications

(I) Final Specifications

Module	15 Inch Color TFT-LCD
Model Name	G150XTN03.1

Customer	Date
Checked & Approved by	
_____	_____
Note: This Specification is subject to change without notice.	

Approved by	Date
<u>Vito Huang</u>	<u>2013/7/18</u>
Prepared by	
<u>Wennie Lee</u>	<u>2013/7/18</u>
General Display Business Division / AU Optronics corporation	

Contents

1. Operating Precautions	4
2. General Description	5
2.1 Display Characteristics	5
2.2 Optical Characteristics	6
3. Functional Block Diagram	9
4. Absolute Maximum Ratings	10
4.1 Absolute Ratings of TFT LCD Module	10
4.2 Absolute Ratings of Environment	10
5. Electrical Characteristics	11
5.1 TFT LCD Module	11
5.2 Backlight Unit	13
6. Signal Characteristic	14
6.1 Pixel Format Image	14
6.2 Scanning Direction	14
6.3 Signal Description	15
6.4 The Input Data Format	16
6.5 Interface Timing	17
6.6 Power ON/OFF Sequence	18
7. Connector & Pin Assignment	19
7.1 TFT LCD Module: LVDS Connector	19
7.2 LED Backlight Unit: LED Driver Connector	21
7.3 LED Driver Connector Pin Assignment	21
8. Reliability Test Criteria	22
9. Mechanical Characteristics	23
9.1 LCM Outline Dimension (Front View)	23
9.2 CM Outline Dimension (Rear View)	24
10. Label and Packaging	25
10.1 Shipping Label (on the rear side of TFT-LCD display)	25
10.2 Carton Package	25
10.3 Palletizing	26
11 Safety	27
11.1 Sharp Edge Requirements	27
11.2 Materials	27
11.3 Capacitors	27
11.4 National Test Lab Requirement	27

**Record of Revision**

Version and Date	Page	Old description	New Description
0.0 2013/7/18	All	First Version	

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

G150XTN03.1 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 XGA (1024(H) x 768(V)) screen and 262K / 16.2M (RGB 6/8-bits) colours. All input signals are LVDS interface compatible.

G150XTN03.1 is designed for industrial display applications

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	15
Active Area	[mm]	304.128(H) x 228.096(V)
Pixels H x V		1024x3(RGB) x 768
Pixel Pitch	[mm]	0.297 x 0.297
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 typ.
Typical Power Consumption	[Watt]	10.9 W (Typ.), (all black pattern)
Weight	[Grams]	1200g (max.)
Physical Size	[mm]	326.5(H) x 253.5(V) x 12 (D)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.2M / 262K colors
Temperature Range Operating Storage (Non-Operating)	[°C] [°C]	0 to +65 (+65 °C as panel surface temperature) -20 to +65
RoHS Compliance		RoHS Compliance
Light Bar Unit		LED, Non-Replaceable

2.2 Optical Characteristics

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

Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m ²]		200	250	-	1
Uniformity	%	9 Points	75	80	-	1, 2, 3
Contrast Ratio			400	500	-	4
Cross talk	%		-	-	1.5	5
Response Time	[msec]	Rising	-	5.7		6
	[msec]	Falling	-	2.3		
	[msec]	Raising + Falling	-	8		
Viewing Angle	[degree]	Horizontal (Right)		45	-	7
	[degree]	CR = 10 (Left)		45	-	
	[degree]	Vertical (Upper)		15	-	
	[degree]	CR = 10 (Lower)		30	-	
Color / Chromaticity Coordinates (CIE 1931)		Red x		TBD		
		Red y		TBD		
		Green x		TBD		
		Green y		TBD		
		Blue x		TBD		
		Blue y		TBD		
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%			60	-	

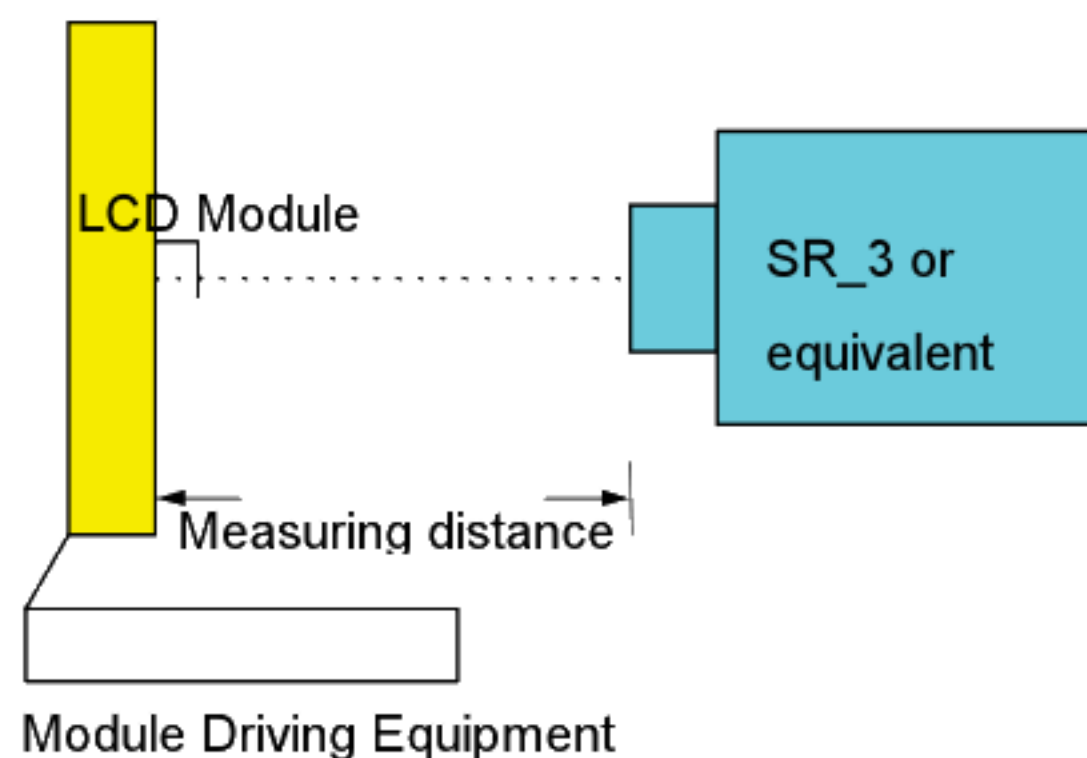
Note 1: Measurement method

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

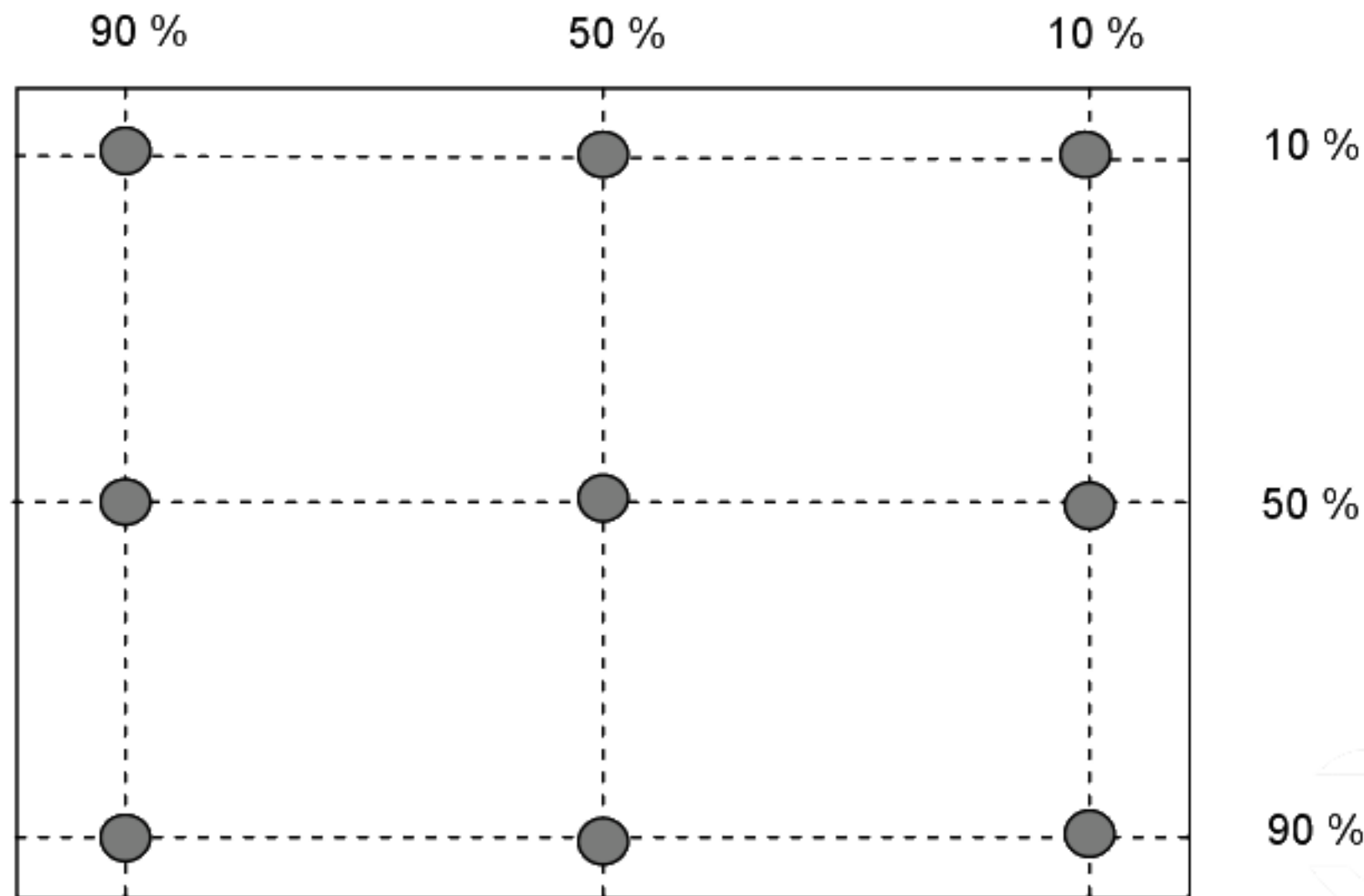
Aperture 1" with 50cm viewing distance

Test Point Center

Environment < 1 lux



Note 2: Definition of 9 points position (Display active area: 304.128(H) x 228.096(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):

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

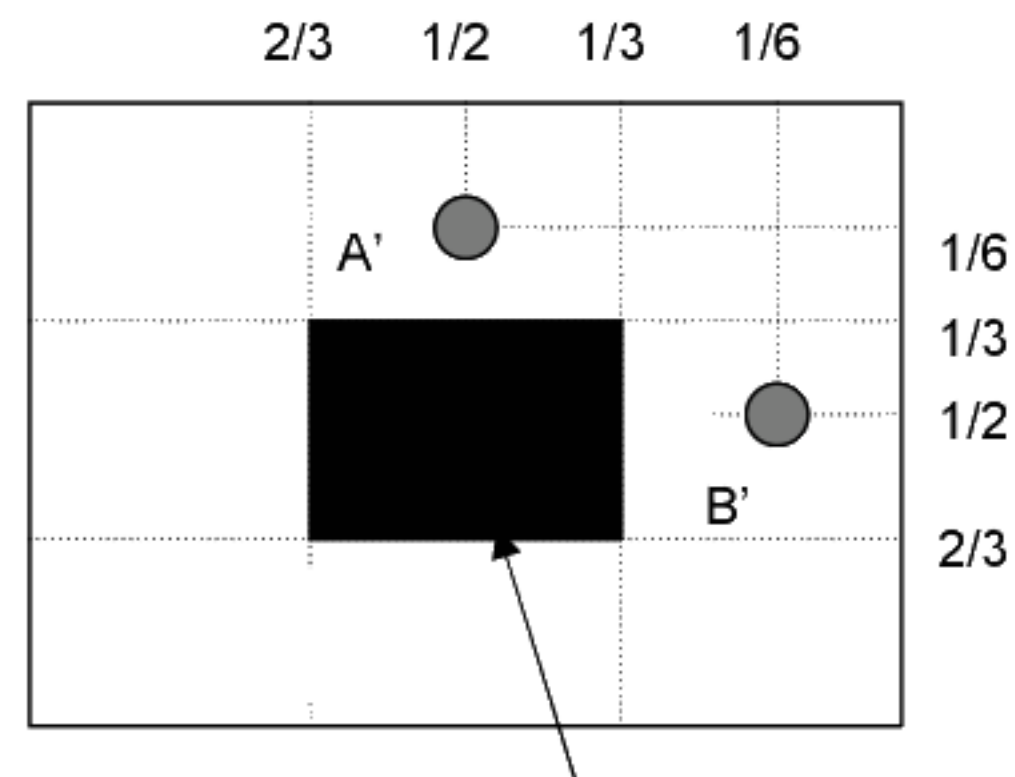
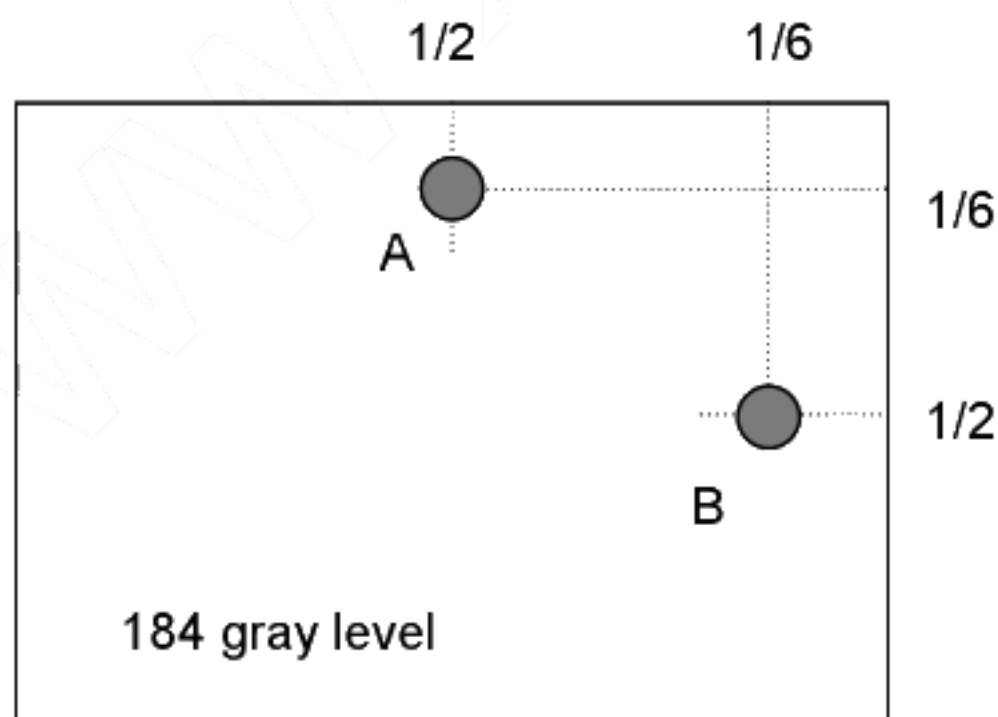
Note 5 : Definition of cross talk (CT)

$$CT = |YB - YA| / YA \times 100 (\%)$$

Where

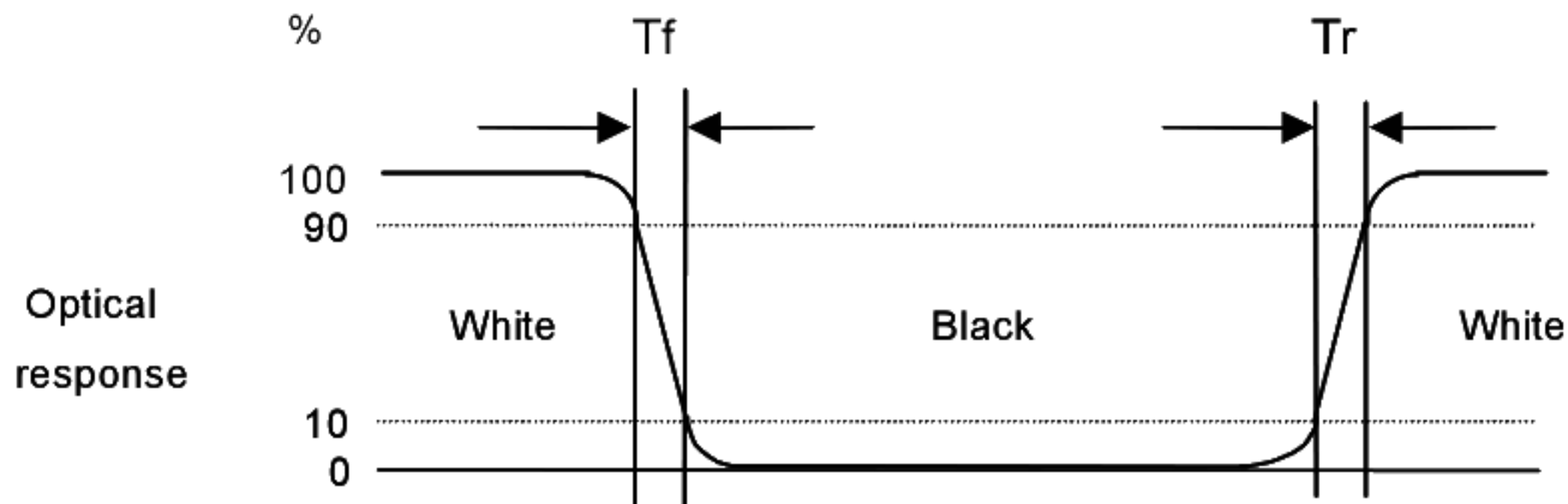
YA = Luminance of measured location without gray level 0 pattern (cd/m2)

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



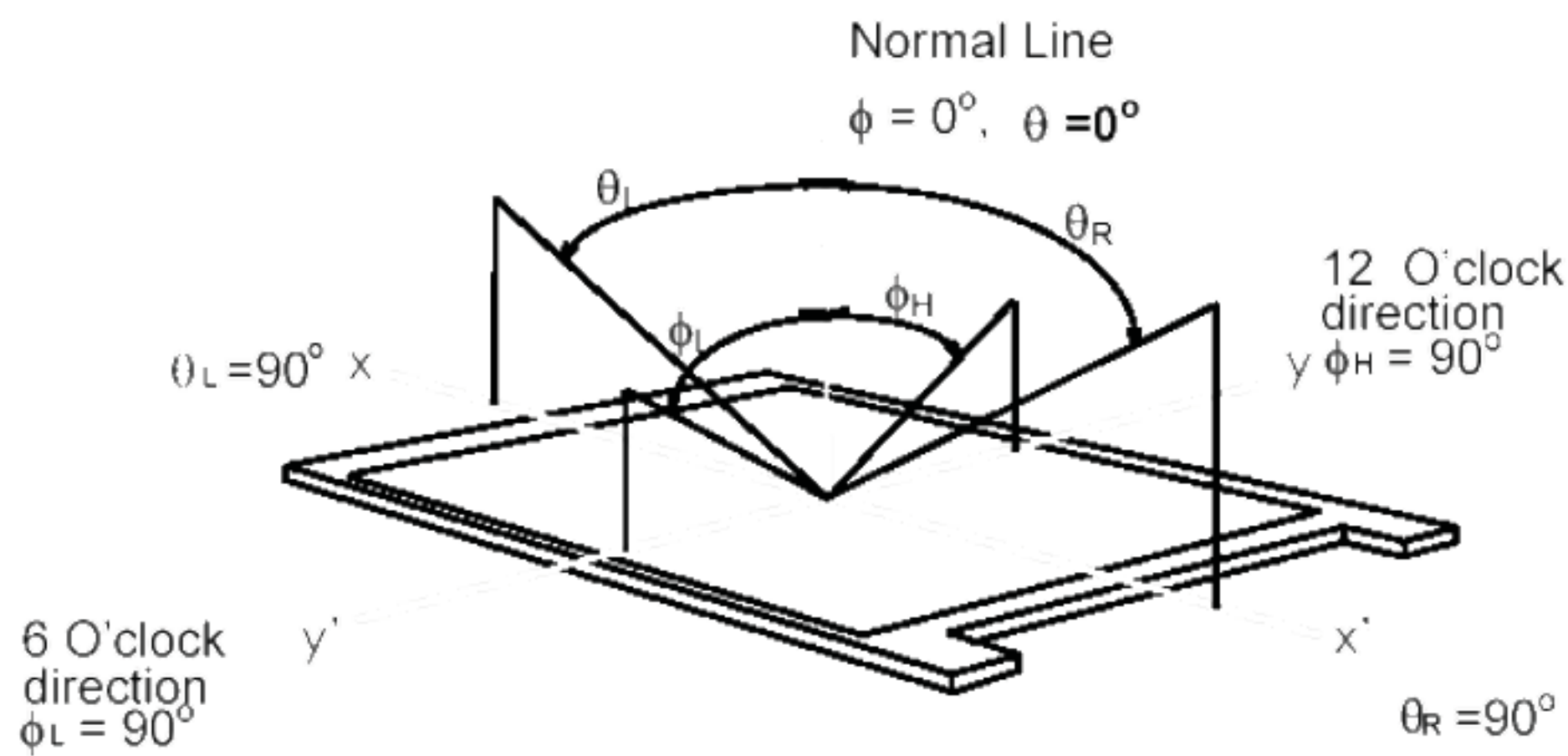
Note 6: Definition of response time:

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.



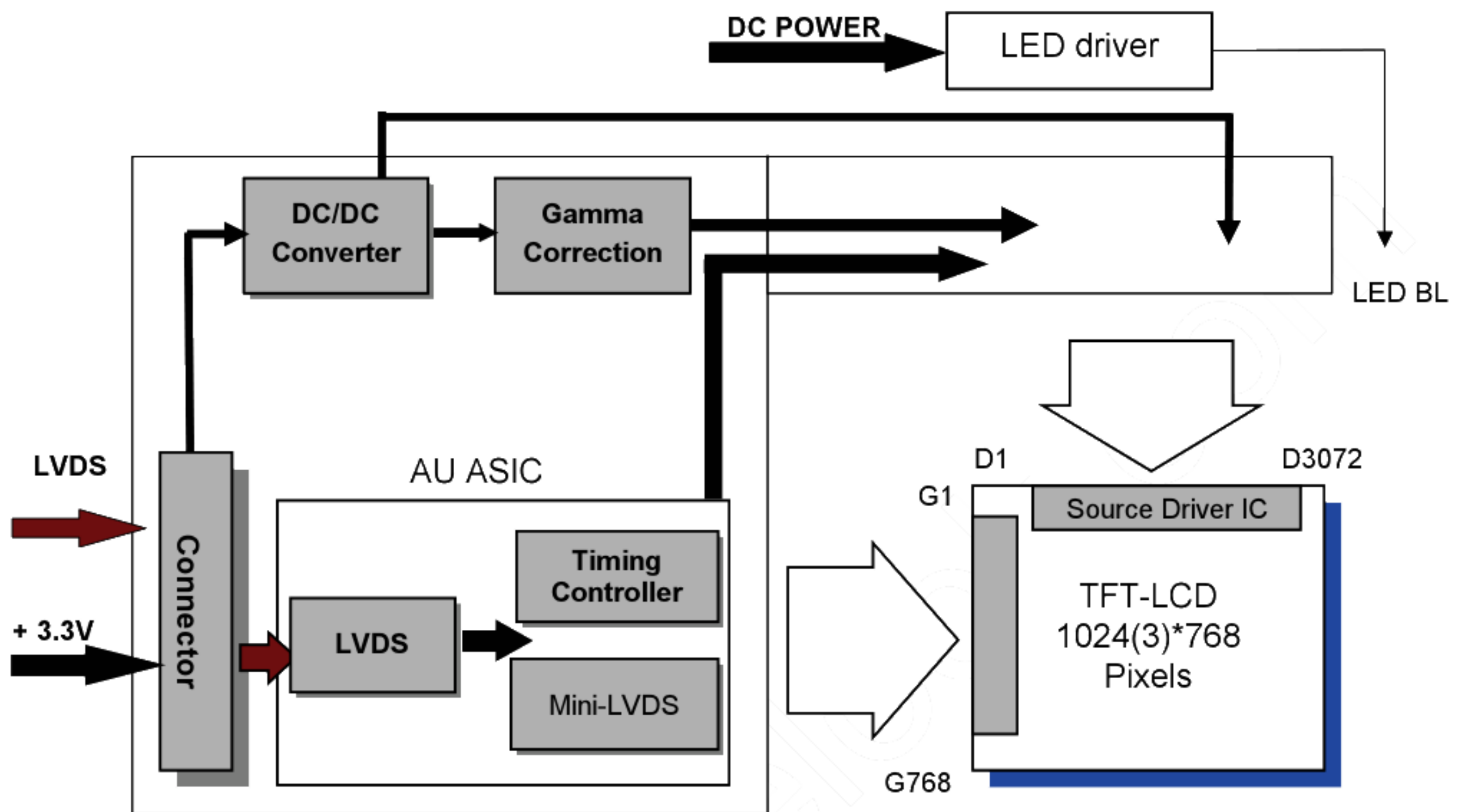
Note 7: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≥ 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 15 inch color TFT/LCD module:



MSB240420E

Entery 3808K-F05N-02

Mating Type: P240420

H208K-P05N-02B

4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

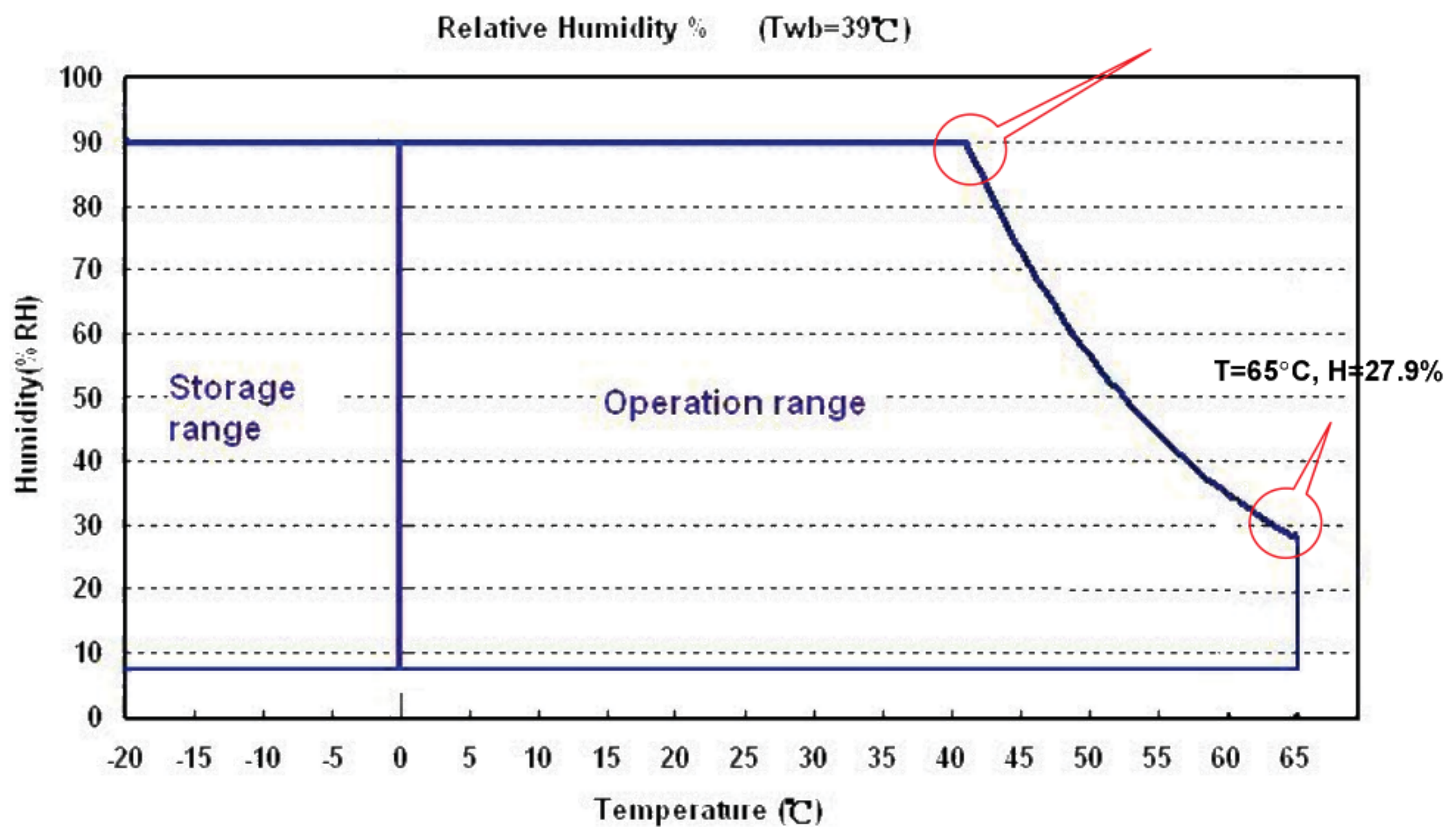
Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	V _{in}	-0.3	+3.6	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	T _{OP}	0	+65*	[°C]
Operation Humidity	H _{OP}	8	90	[%RH]
Storage Temperature	T _{ST}	-20	+65	[°C]
Storage Humidity	H _{ST}	8	90	[%RH]

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

* 65 °C is panel surface temperature



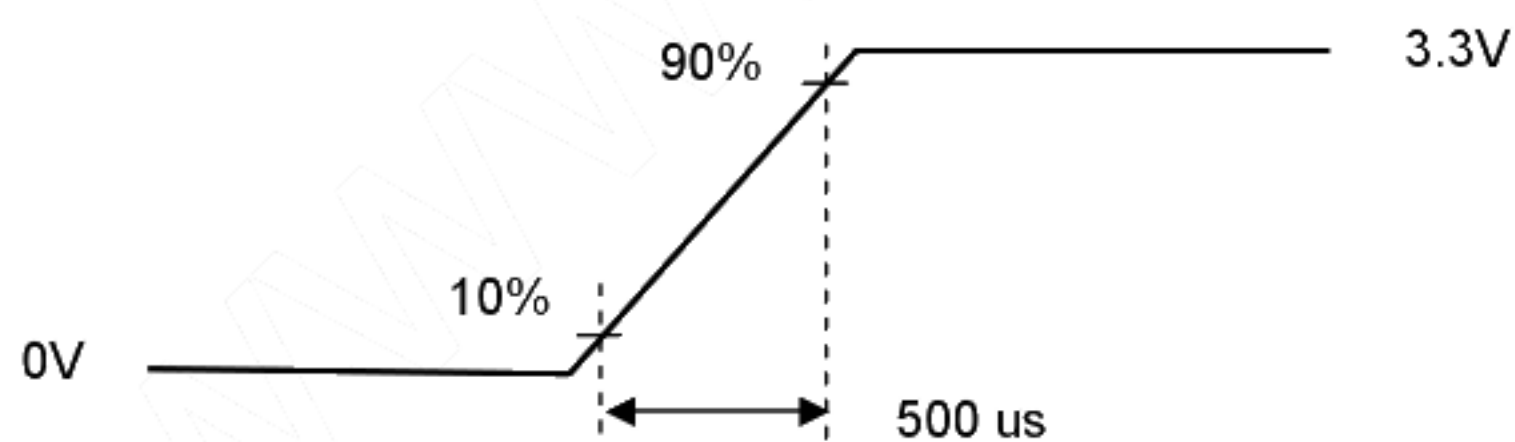
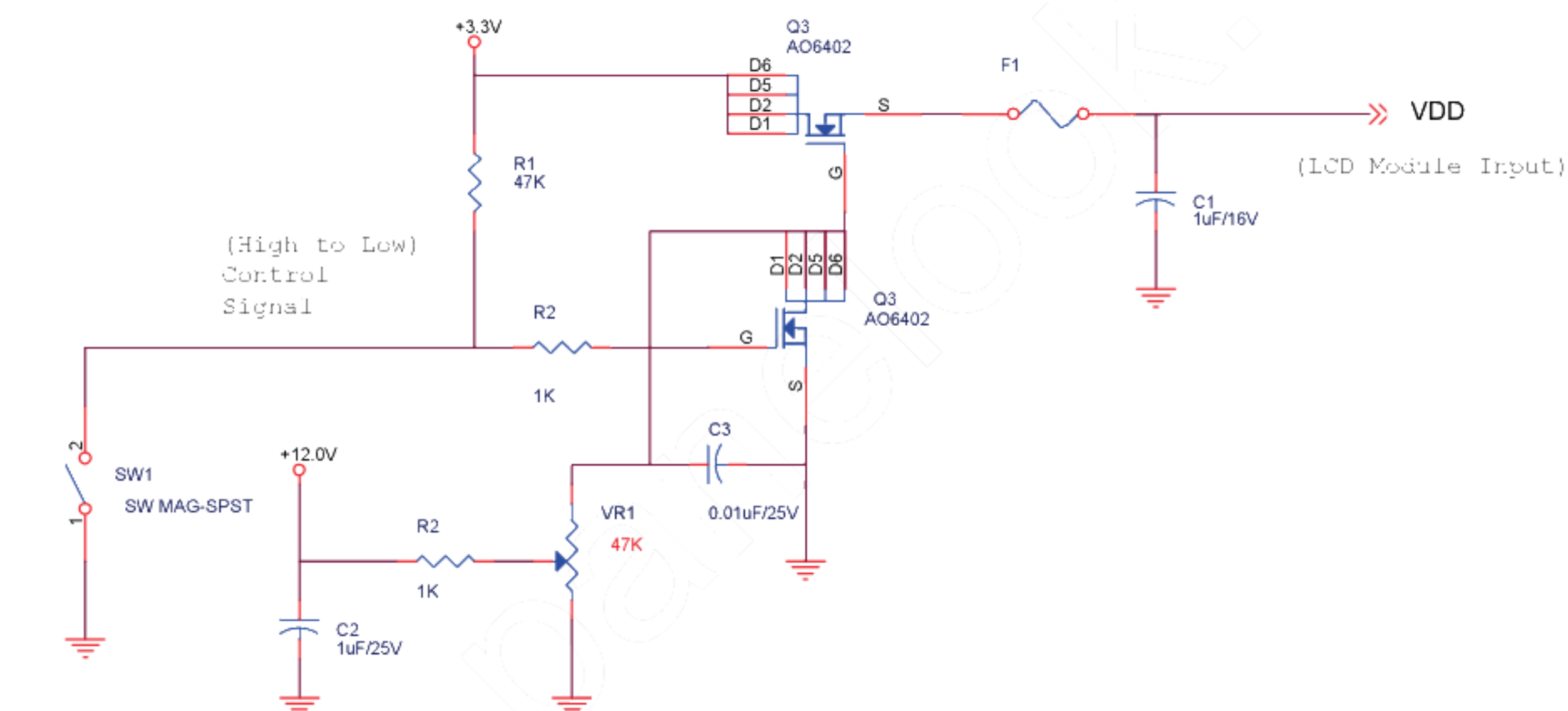
5. Electrical Characteristics

5.1 TFT LCD Module

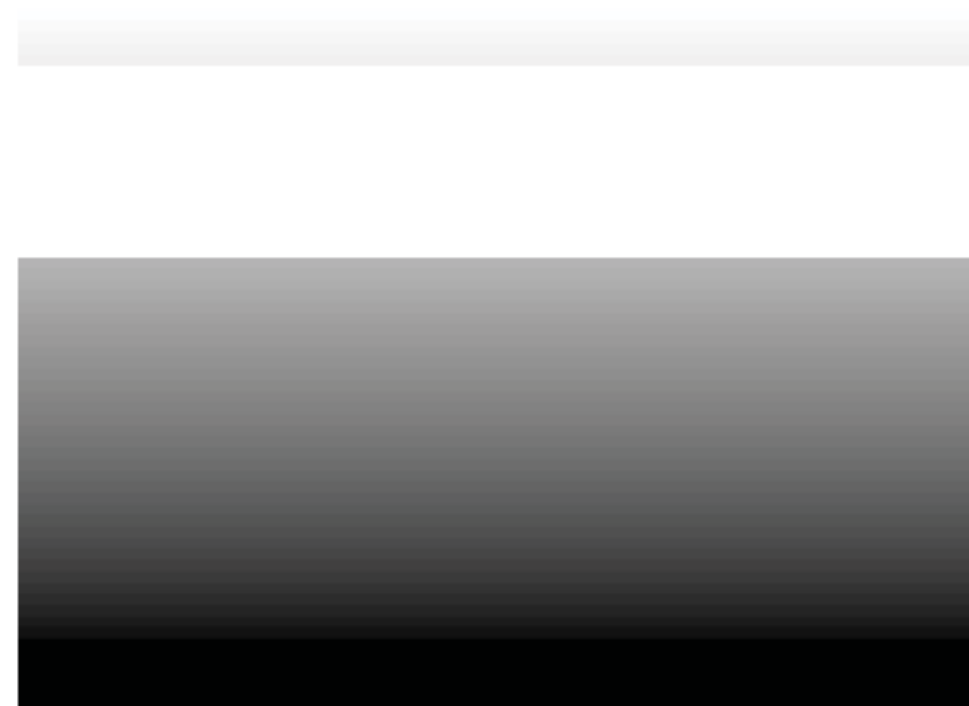
5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	± 10%
IDD	VDD Current	-	1.1	1.4	[A]	
Irush	LCD Inrush Current	-		3	[A]	Note 1
PDD	VDD Power	-	3.3	5	[Watt]	

Note 1: Measurement condition:



VDD rising time



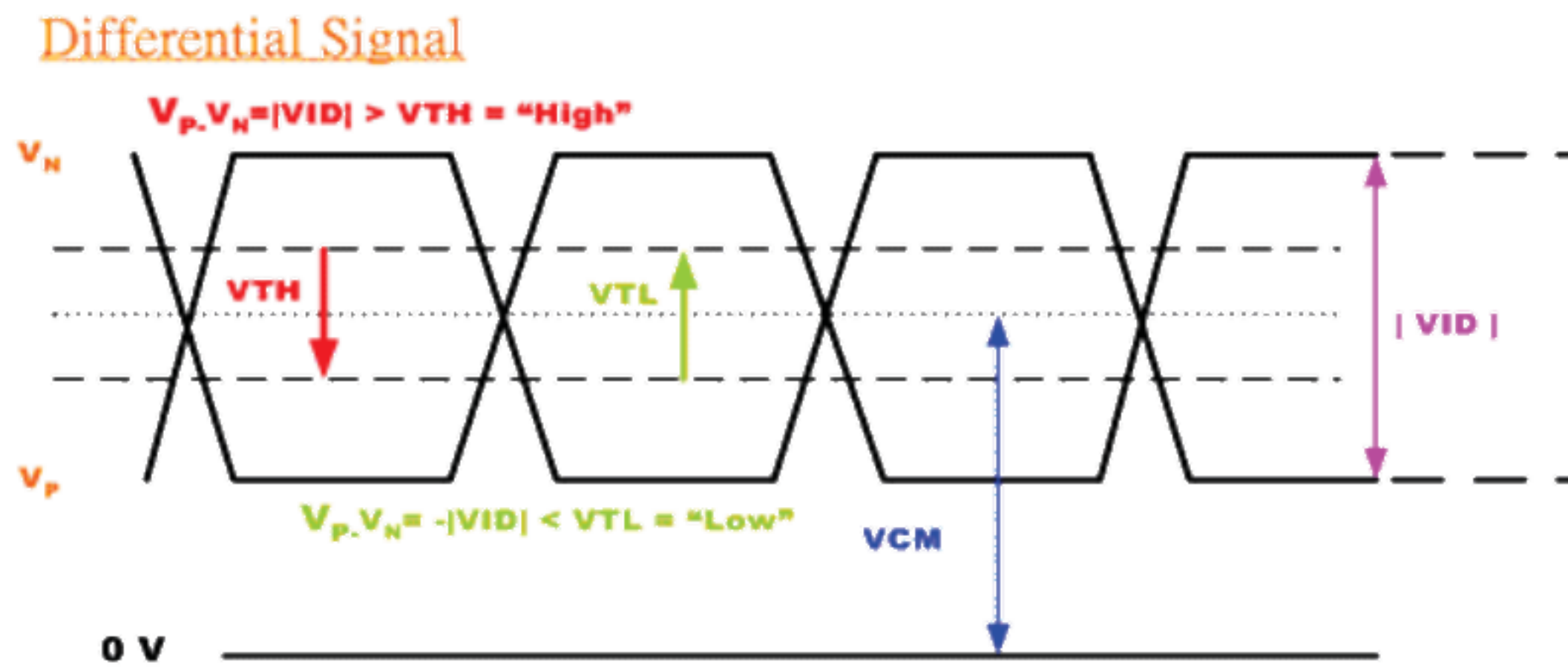
64 Gray pattern

5.1.2 Signal Electrical Characteristics

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

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
V _{TH}	Differential Input High Threshold	-	-	100	[mV]	V _{CM} =1.2V
V _{TL}	Differential Input Low Threshold	-100	-	-	[mV]	V _{CM} =1.2V
V _{ID}	Input Differential Voltage	100	400	600	[mV]	
V _{ICM}	Differential Input Common Mode Voltage	1.1		1.45	[V]	V _{TH} /V _{TL} =±100mV

Note: LVDS Signal Waveform.



5.2 Backlight Unit

5.2.1 Parameter guideline for LED

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
V _{cc}	Input Voltage	10.8	12	13.2	Volt	
I _{vcc}	Input Current	-	0.7	-	A	100% Dimming
P _{LED}	Power Consumption	-	8.4	10	Watt	100% Dimming
I _{rush}	Inrush Current	-		2	A	
V _{LED on/off}	On Control Voltage	2.5	3.3	5.5	Volt	
	Off Control Voltage	-	-	0.8	Volt	
F _{PWM}	PWM Dimming Frequency	200	-	20K	Hz	
	High Voltage	2.5	3.3	5.5	Volt	
	Low Voltage	-	-	0.8	Volt	
	Dimming Duty Cycle	5	-	100	%	
I _F	LED Forward Current	-	60		mA	Ta = 25℃
Operating Life		30000		-	Hrs	Ta = 25℃

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

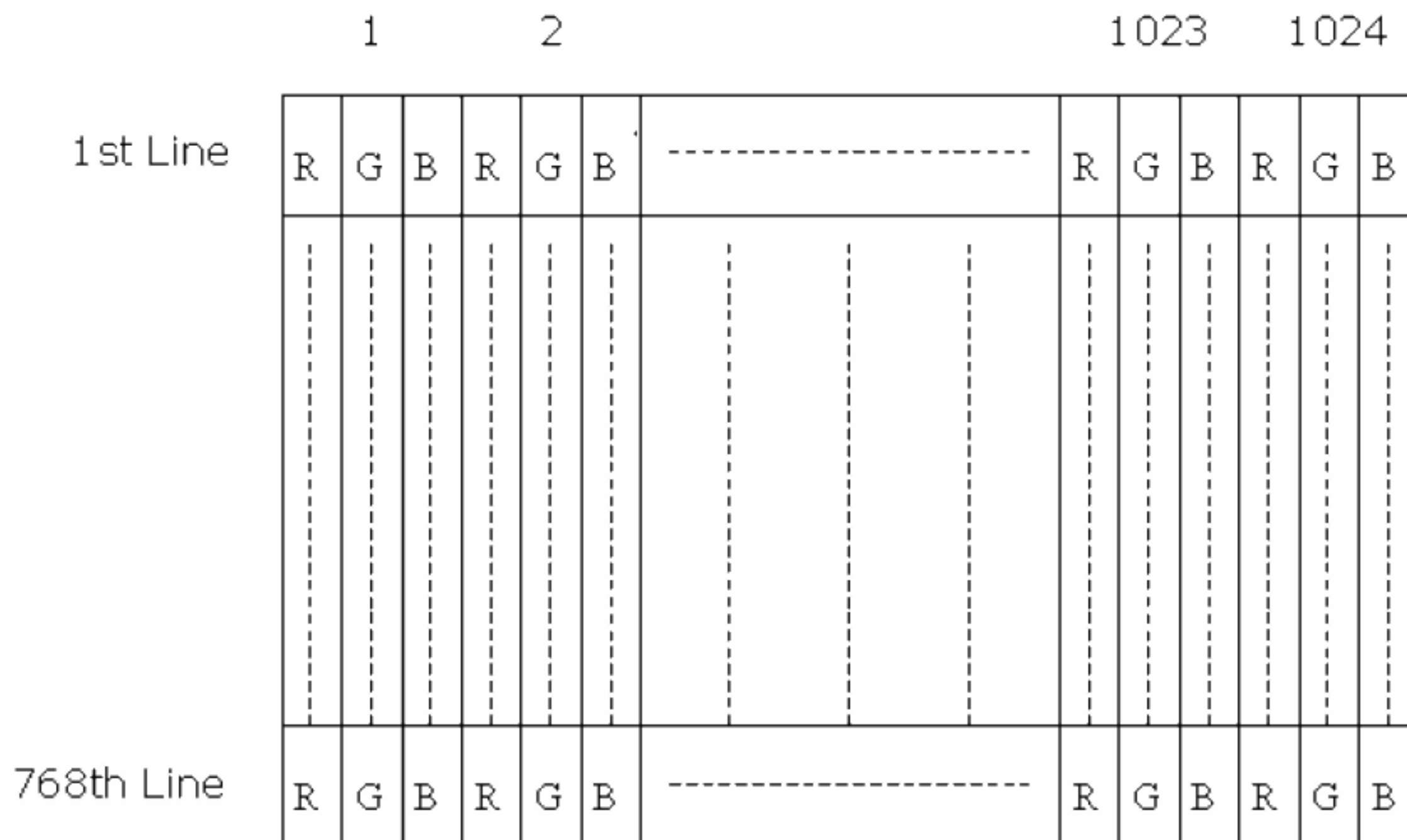
Note 2: If G150XTN03.1 module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: Definition of life time: LED brightness becomes 50% of its original value. The minimum life time of LED unit is on the condition of I_{RLED} = 60 mA and 25 ± 2℃ (Room temperature).

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

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.

MSB240420HE(STM)		
Pin No.	Symbol	Description
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	NC	No Connect
4	NC	No Connect
5	Rin1-	- LVDS differential data input (R0-R5, G0)
6	Rin1+	+ LVDS differential data input (R0-R5, G0)
7	VSS	Ground
8	Rin2-	- LVDS differential data input (G1-G5, B0-B1)
9	Rin2+	+ LVDS differential data input (G1-G5, B0-B1)
10	VSS	Ground
11	Rin3-	- LVDS differential data input (B2-B5, HS, VS, DE)
12	Rin3+	+ 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	GND	Ground
17	Rin4-	- LVDS differential data input (R6-R7, G6-G7, B6-B7)
18	Rin4+	+ LVDS differential data input (R6-R7, G6-G7, B6-B7)
19	VSS	Ground
20	SEL6/8	Select 6 or 8 Bits LVDS Input

Note 1: Input signals shall be in low status when VDD is off.

Note 2: For 6 bits mode, please keep the Pin 17& Pin 18 NC or make sure that the voltage of Pin 18 is always higher than the voltage of Pin 17.

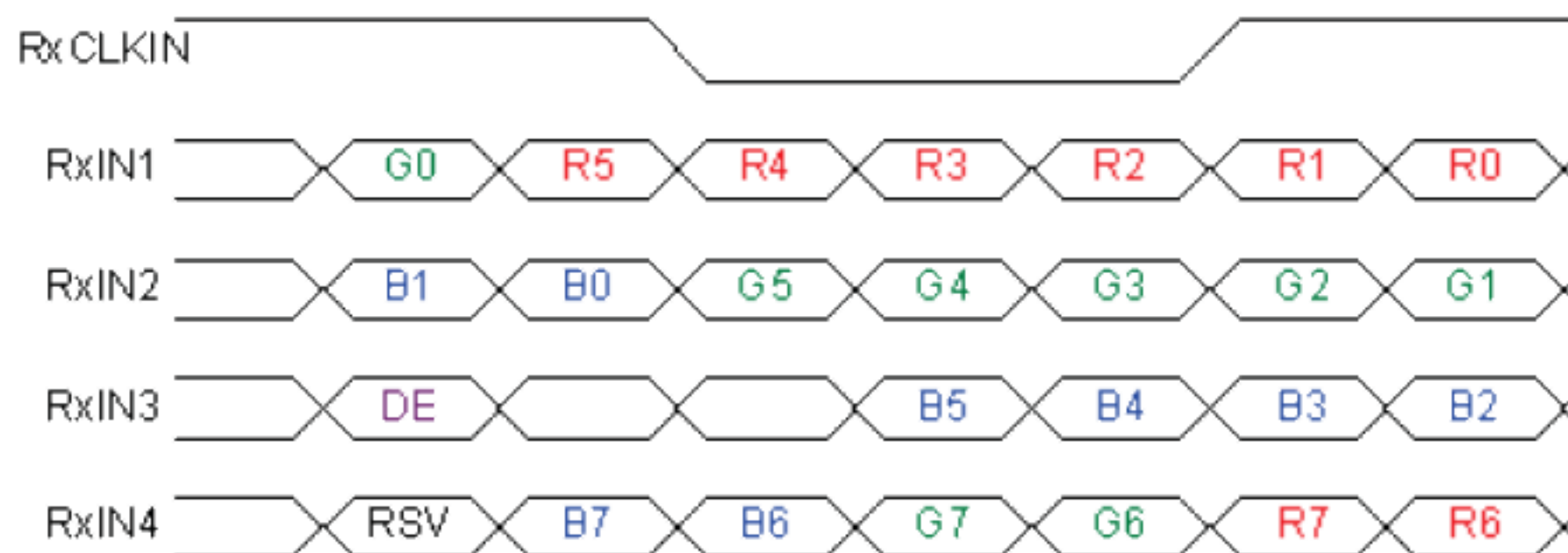
6.4 The Input Data Format

6.4.1 SEL68

SEL68 = "High" for 6 bits LVDS Input



SEL68 = "Low" or "NC" for 8 bits LVDS Input



Note1: Please follow PSWG.

Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

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 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 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 For 8Bits LVDS input MSB: B7 ; LSB: B0 For 6Bits LVDS input MSB: B5 ; LSB: B0
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	When the signal is high, the pixel data shall be valid to be displayed.

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

6.5 Interface Timing

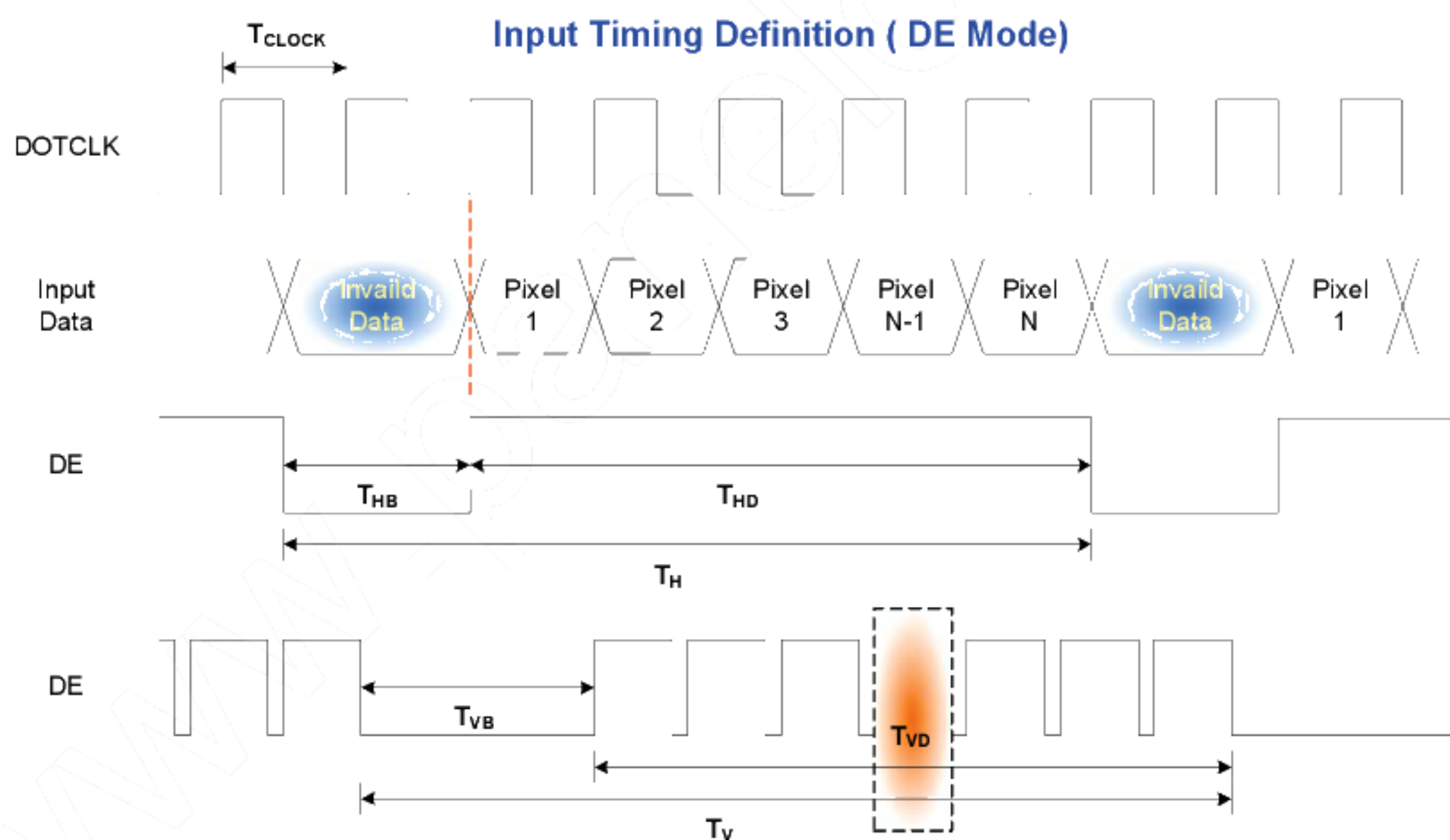
6.5.1 Timing Characteristics

Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Timing	Clock frequency	$1/T_{\text{Clock}}$	50	65	81	MHz
Vsync Timing	Vertical Section	Period	T_V	783	806	968
		Active	T_{VD}	768	768	768
		Blanking	T_{VB}	15	38	200
Hsync Timing	Horizontal Section	Period	T_H	1224	1344	2024
		Active	T_{HD}	1024	1024	1024
		Blanking	T_{HB}	200	320	1000

Note: Support DE mode only.

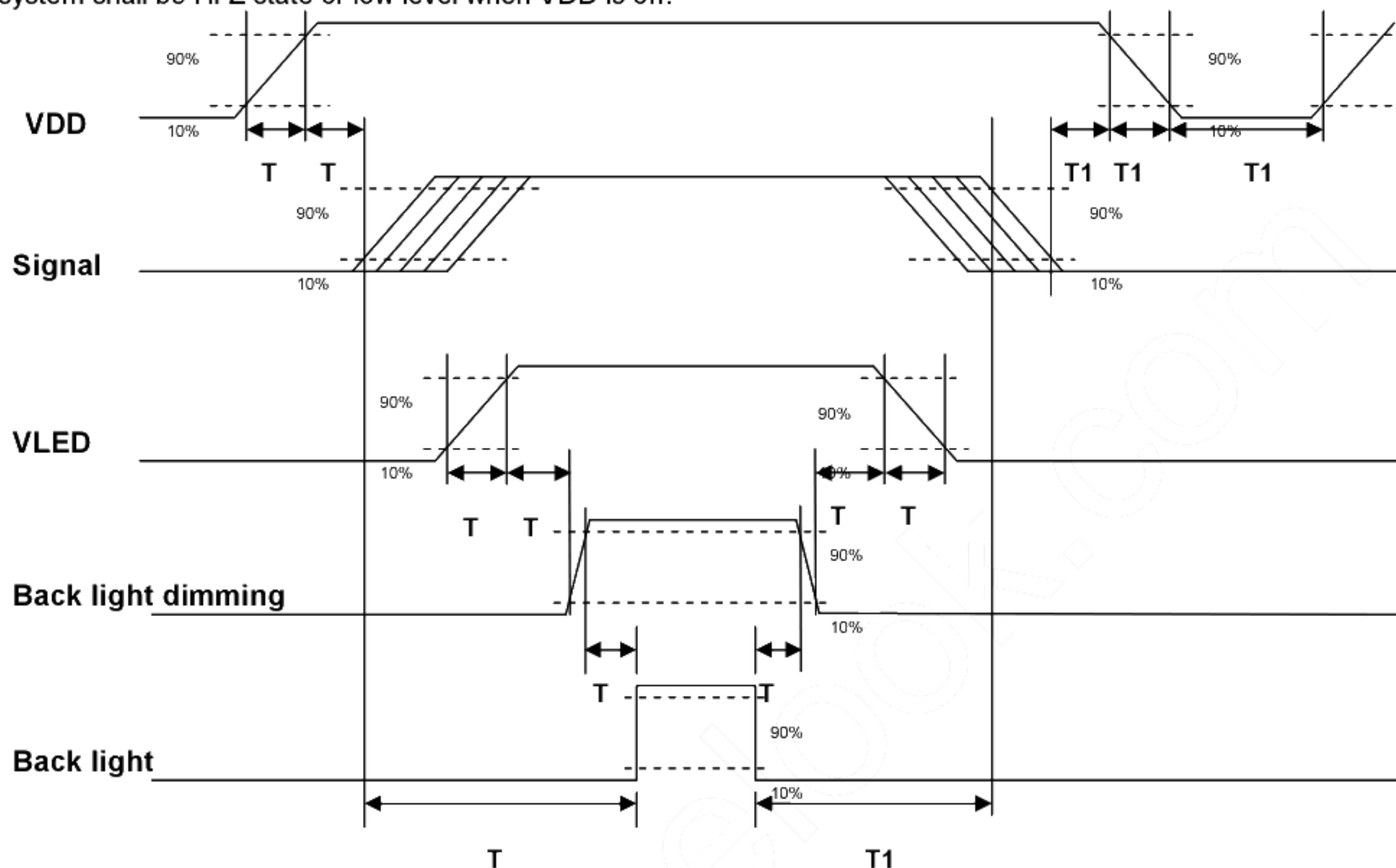
Note : Typical value refer to VESA STANDARD

6.5.2 Input Timing Diagram



6.6 Power ON/OFF Sequence

VDD power and backlight 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 Sequence Timing

Parameter	Value			Unit
	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

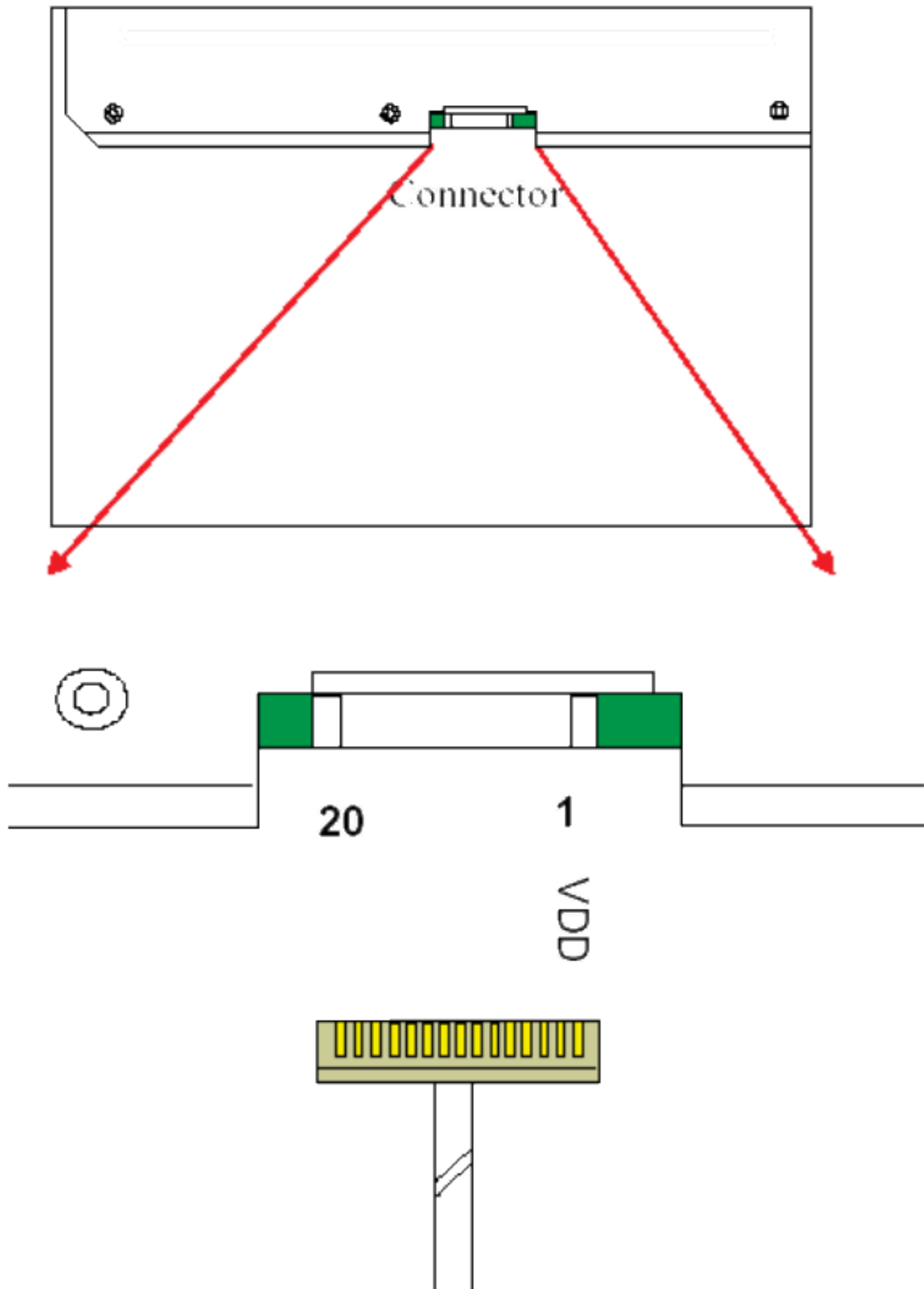
Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Module: LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB240420HE
Adaptable Plug	P240420

Pin#	Signal Name	Pin#	Signal Name
1	VDD	2	VDD
3	NC	4	NC
5	Rin0-	6	Rin0+
7	VSS	8	Rin1-
9	Rin1+	10	VSS
11	Rin2-	12	Rin2+
13	VSS	14	ClkIN-
15	ClkIN+	16	GND
17	Rin3-	18	Rin3+
19	VSS	20	SEL68

7.1.1 Connector Illustration



7.2 LED Backlight Unit: LED Driver Connector

Connector Name / Designation	LED Connector
Manufacturer	Entery or compatible
Connector Model Number	3808K-F05N-02 or compatible
Mating Model Number	H208K-P05N-02B or compatible

7.3 LED Driver Connector Pin Assignment

Pin#	Symbol	Signal Name
1	Vcc	12V
2	GND	GND
3	Enable	VLED On/Off
4	Dimming	PWM Dimming
5	NC	NC

8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	50□/80%,300 hours	
High Temperature Operation	60□,300 hours	
Low Temperature Operation	0□,300 hours	
Hot Storage	65□,300 hours	
Cold Storage	-20□,300 hours	
Thermal Shock Test	-20□/30 min ,60□/30 min ,100cycles	
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 Air Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point	Note 1

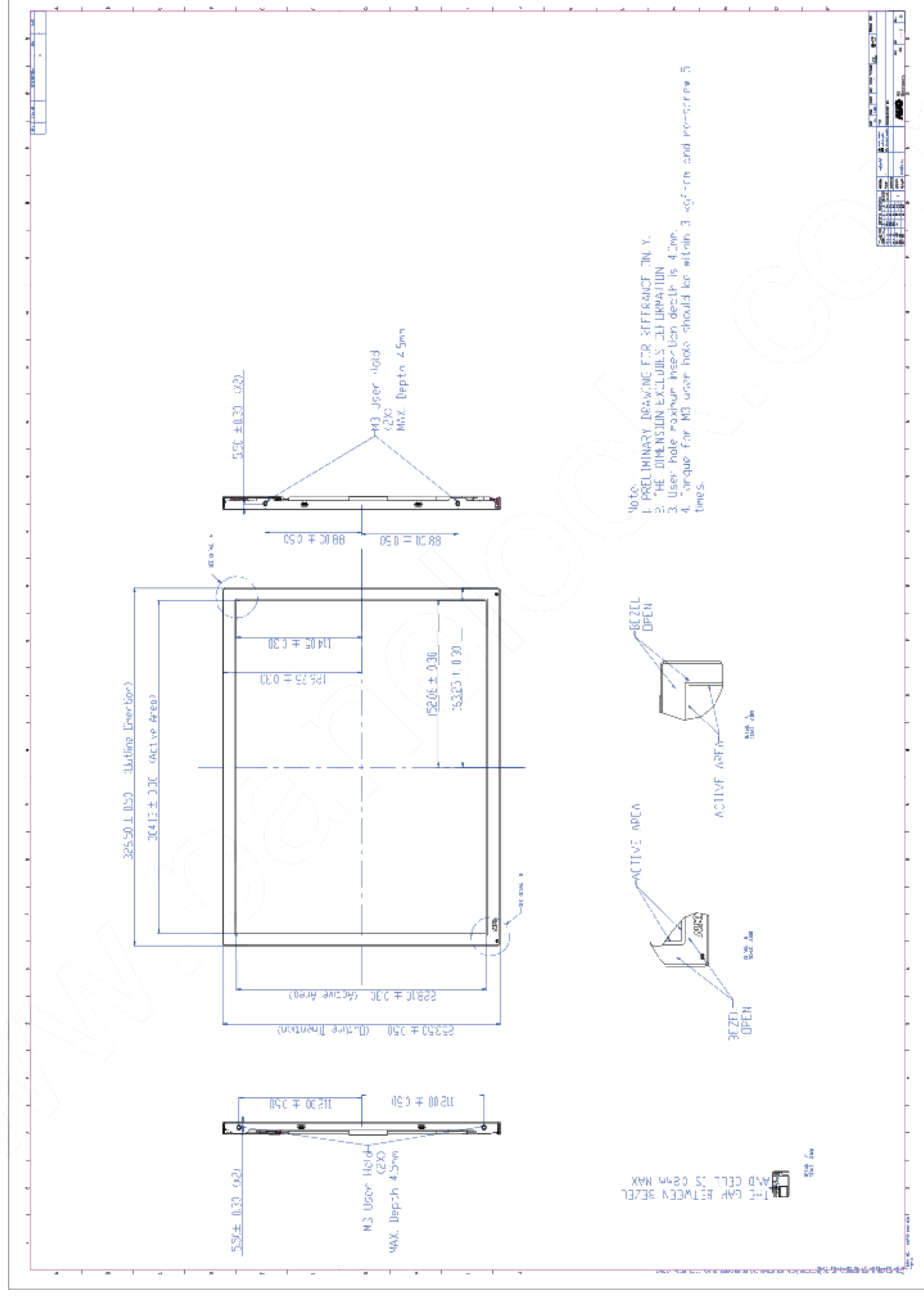
Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost
Self-recoverable. No hardware failures.

Note 2:

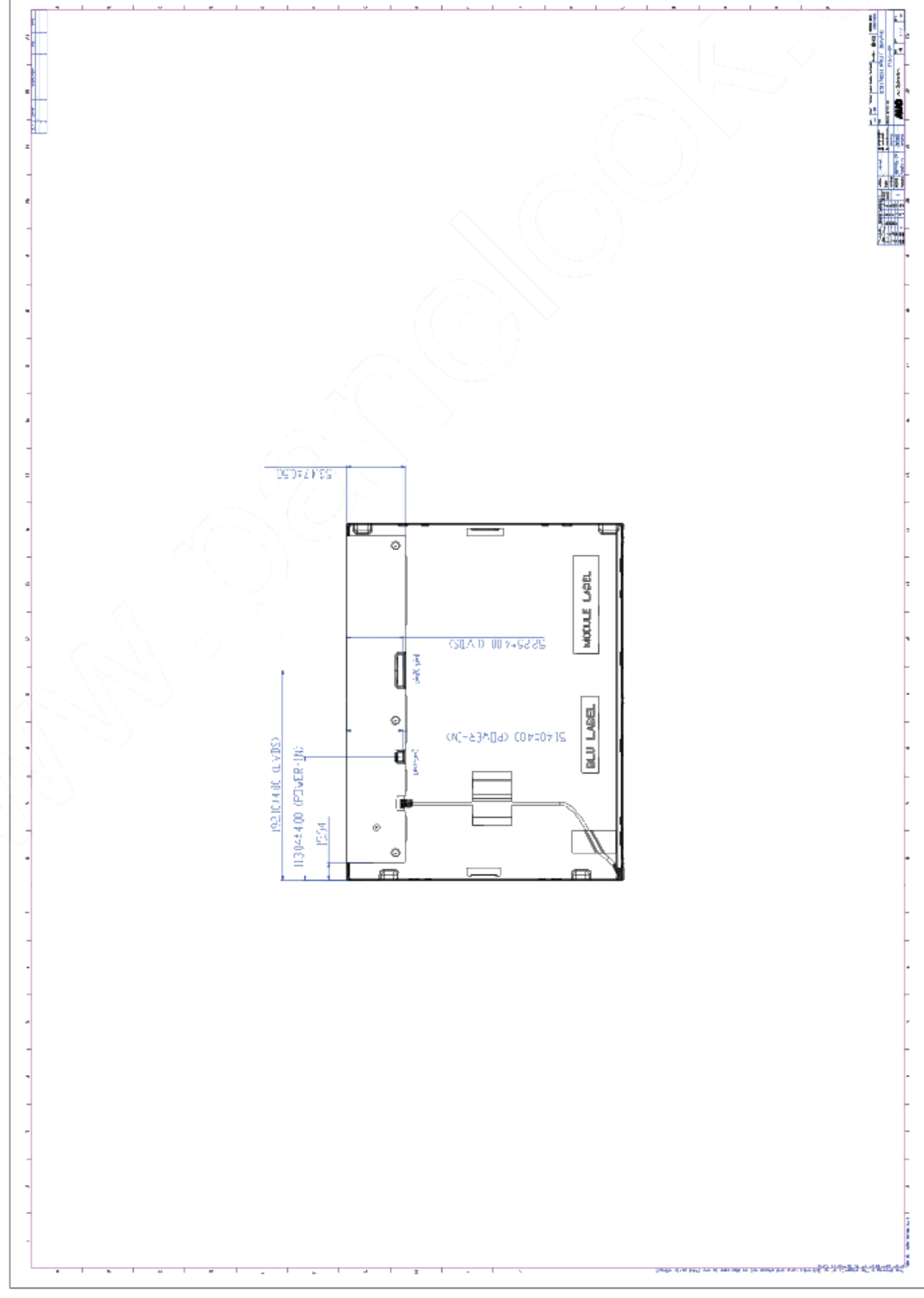
- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test,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

9. Mechanical Characteristics

9.1 LCM Outline Dimension (Front View)

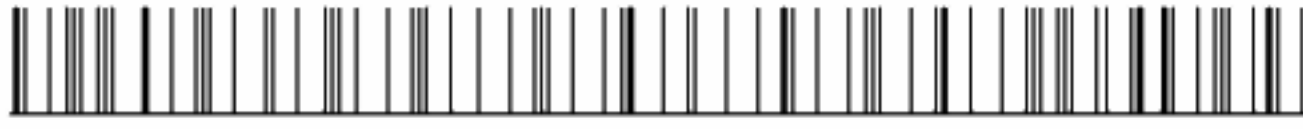


9.2 CM Outline Dimension (Rear View)



10. Label and Packaging

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

	Manufactured XX/XX Model No: G150XTN03.1 AU Optronics MADE IN XXXXXX (XX)	  
XXXXXXXXXXXX-XXXXX		

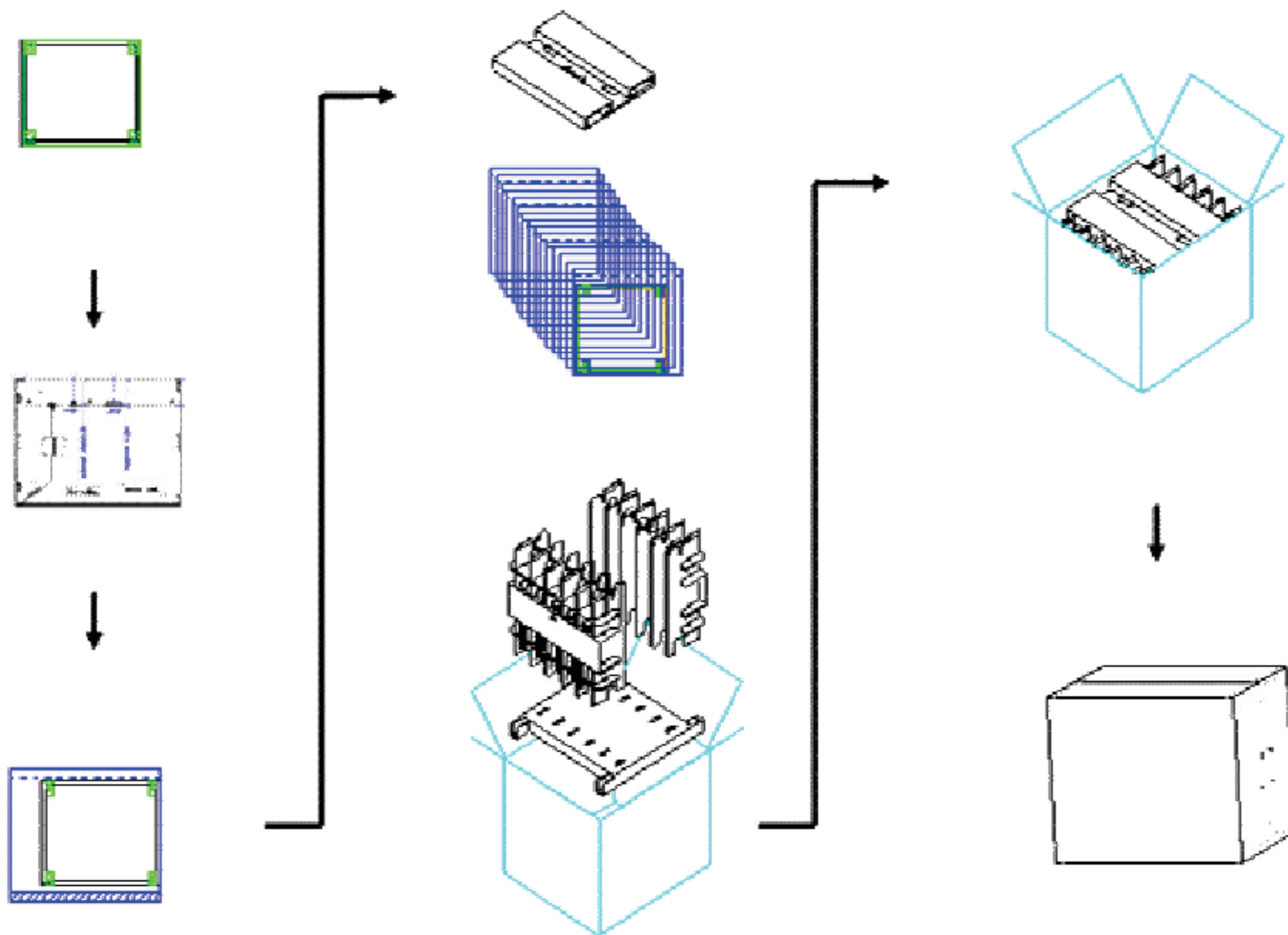
10.2 Carton Package

Max capacity : 15 TFT-LCD module per carton

Max weight: 20 kg per carton

Outside dimension of carton: 434mm(L)* 380mm(W)*353mm(H)

Pallet size : 1140 mm * 890 mm * 135mm

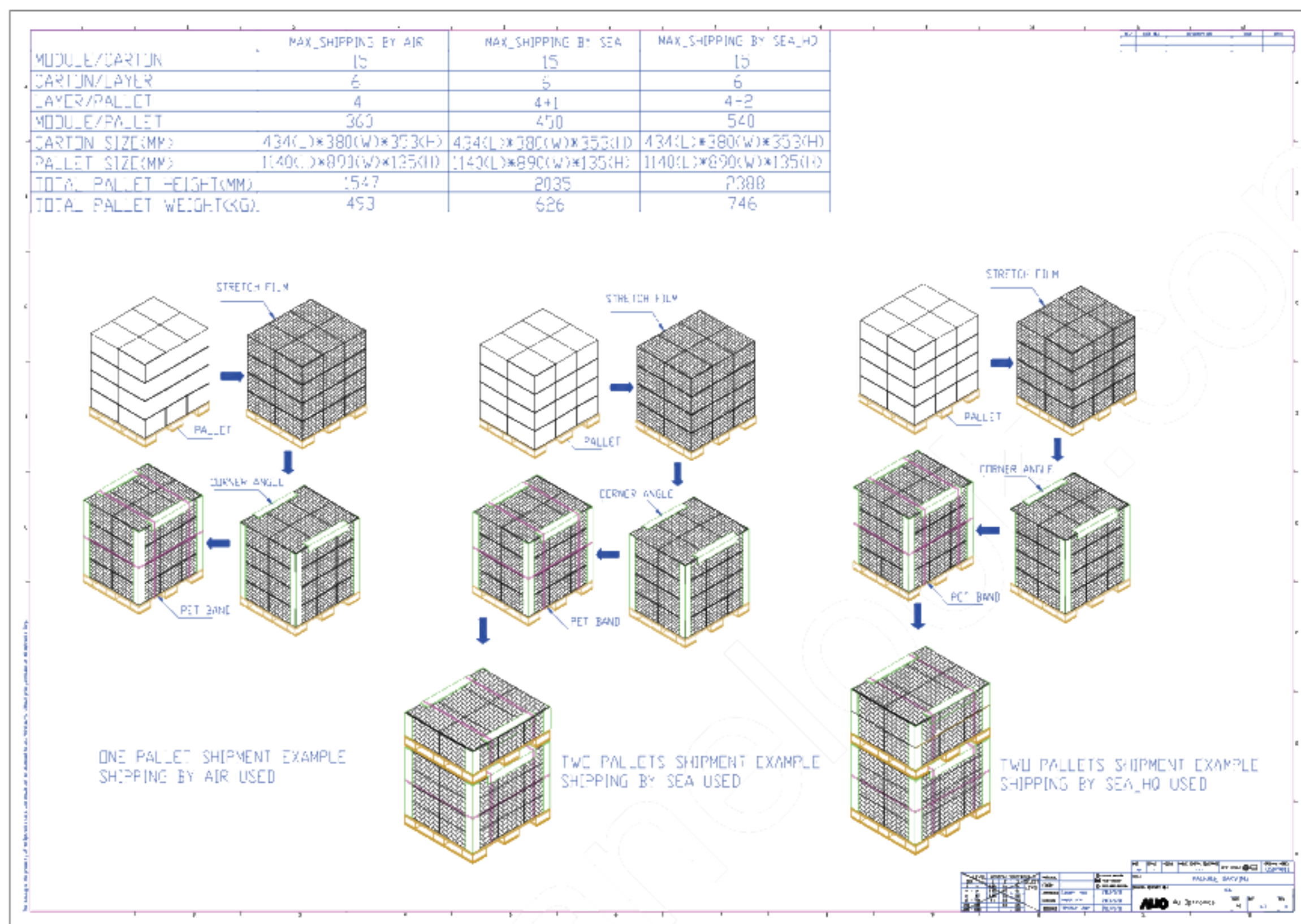


10.3 Palletizing

Module by air_Max: (2 *3) *4 layers , one pallet put 24 boxes , total 360pcs module

Module by sea_Max: (2 *3) *4 layers + (2 *3) *1 layers , two pallet put 30 boxes , total 450pcs module

Module by sea_HQ_Max: (2 *3) *4 layers+(2 *3) *2 layers, two pallet put 36 boxes, total 540pcs module



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