

(V) Preliminary Specifications
() Final Specifications

Module	10.1 Inch Color TFT-LCD
Model Name	G101STT01.0
Note ()	OGS P-cap touch TTL module

Customer _____ Date _____ Checked & Approved by _____ Note: This Specification is subject to change without notice.	Approved by Grace Hung Date 2016/01/15 Prepared by Kevin Tseng Date 2016/01/15 Audio-Video Business Unit / AU Optronics corporation
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Record of Revision

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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.
- 17) In order not to damage the touch panel, please remove the protected film as slow as possible in an environment with a humidity range from 60% to 80%

2. General Description

This specification applies to the Color Active Matrix Liquid Crystal Display G101STT01.0 composed of a TFT-LCD display, a driver and power supply circuit, and a LED backlight system. The screen format is intended to support Wide SVGA (1024(H) x 600(V)) screen and 262k colors (RGB 6-bits). And LED driving board for backlight unit is included in G101STT01.0.

All input signals are LVDS interface.

G101STT01.0 designed with wide viewing angle; wide temperature and long life LED backlight (**50K hrs Typ.**) is well suited for industrial applications.

G101STT01.0 is a RoHS product.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	10.1
Active Area	[mm]	222.72(H) x 125.28(V)
Pixels H x V		1024 (RGB)x 600
Pixel Pitch	[mm]	0.2175(H)x0.2088(V)
Pixel Arrangement		R. G. B. Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 (Typ.)
LCD Power Consumption	[Watt]	TBD (Typ.), TBD (Max.) (all black pattern)
LED Power Consumption	[Watt]	TBD (Typ.), TBD (Max.) (all black pattern)
Weight	[Grams]	450 (Max.)
Physical Size	[mm]	249.56(H)x168.2(V)x8.8(T) (Typ.)
Electrical Interface		LVDS
Surface Treatment		Anti-Glare, 3H
Support Color		262K colors
Temperature Range Operating Storage (Non-Operating)	[°C] [°C]	-10 to +60(+60°C as panel surface temperature) -20 to +70
RoHS Compliance		RoHS Compliance

2.2 General Touch Characteristics

2.2.1 Touch Features

Item		Specifications
Type		Projected Capacitive Touch Panel
Structure		Glass
Panel Size		10.1 inch
Total Thickness		1.25 ± 0.15 mm (sensor 1.1mm & ASF 0.15mm)
Input Mode		Multi Finger , 10 points
Temperature Range	Operating	-20°C ~ + 70 °C
	Storage	-40°C ~ + 80 °C

2.2.2 Touch Dimensions

Item		Specifications
Sensor Glass	O.D.	249.56 mm * 168.2 mm
	Thickness	1.1 mm
TP Active Area		226.34 mm * 128.1 mm
Total Weight		170g (max.)

2.2.3 Touch Characteristics

Item		Specifications
Substrate Material		SDL CS Glass
Chemical Strength		≥ 400 mpa
Surface Hardness		≥ 7H
Interface		USB
Touch Resolution		Same with display resolution
Single / Multi-touch Accuracy		1 mm
Linearity		+/- 1 mm
The smallest distance between 2 points		5 mm
Channel (X * Y)		52 * 32
Report Rate (points /sec)		>100Hz
Power Consumption		TBD mW (typ.)
Operating System		Android 4.2

Note: Touch drivers can be support the QNX 6.5 SP1 version.

2.3 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]	I _{LED} = 38 mA (center point)		385		1 (With TP)
Uniformity	%	5 points	75	80		2,3
Contrast Ratio			400	500		4
Response Time	[msec]	Rising		7	10	5
	[msec]	Falling		9	18	
	[msec]	Rising + Falling		16	28	
Viewing Angle	[degree]	Horizontal (Right) CR = 10 (Left)	60	70		6
	[degree]		60	70		
	[degree]	Vertical (Upper) CR = 10 (Lower)	50	60		
	[degree]		50	60		
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.524	0.574	0.624	
		Red y	0.285	0.335	0.385	
		Green x	0.280	0.330	0.380	
		Green y	0.525	0.575	0.625	
		Blue x	0.108	0.158	0.208	
		Blue y	0.090	0.140	0.190	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%		42	45		

Note 1:

The White Luminance of the pure LCD (Without Touch Panel) is 450 nits(Typ.).

The Touch Panel Optical Characteristics: Transmittance(%) = 85%±3% ; Haze = 3% (Max.).

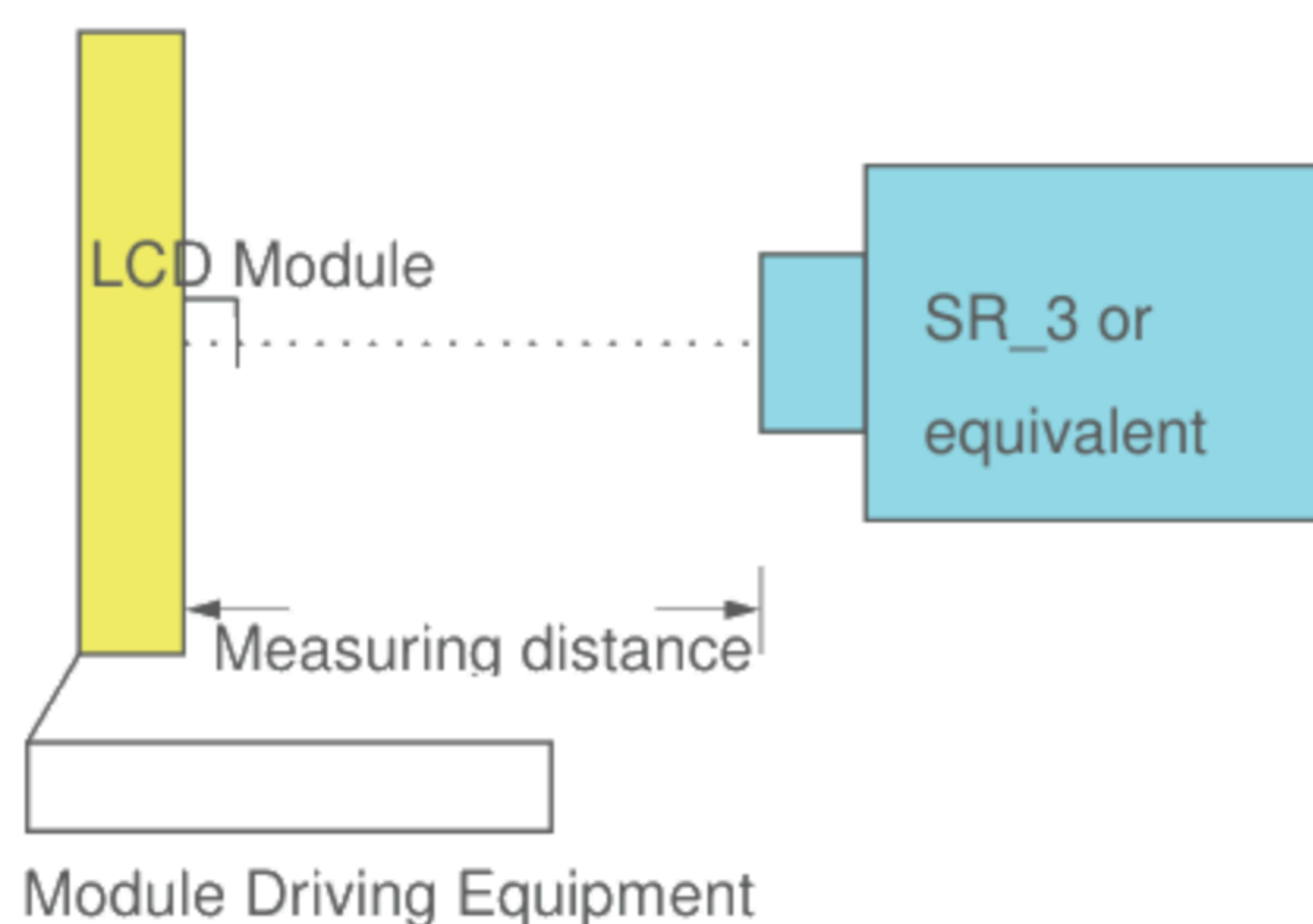
Measurement method:

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

Aperture 1° with 50cm viewing distance

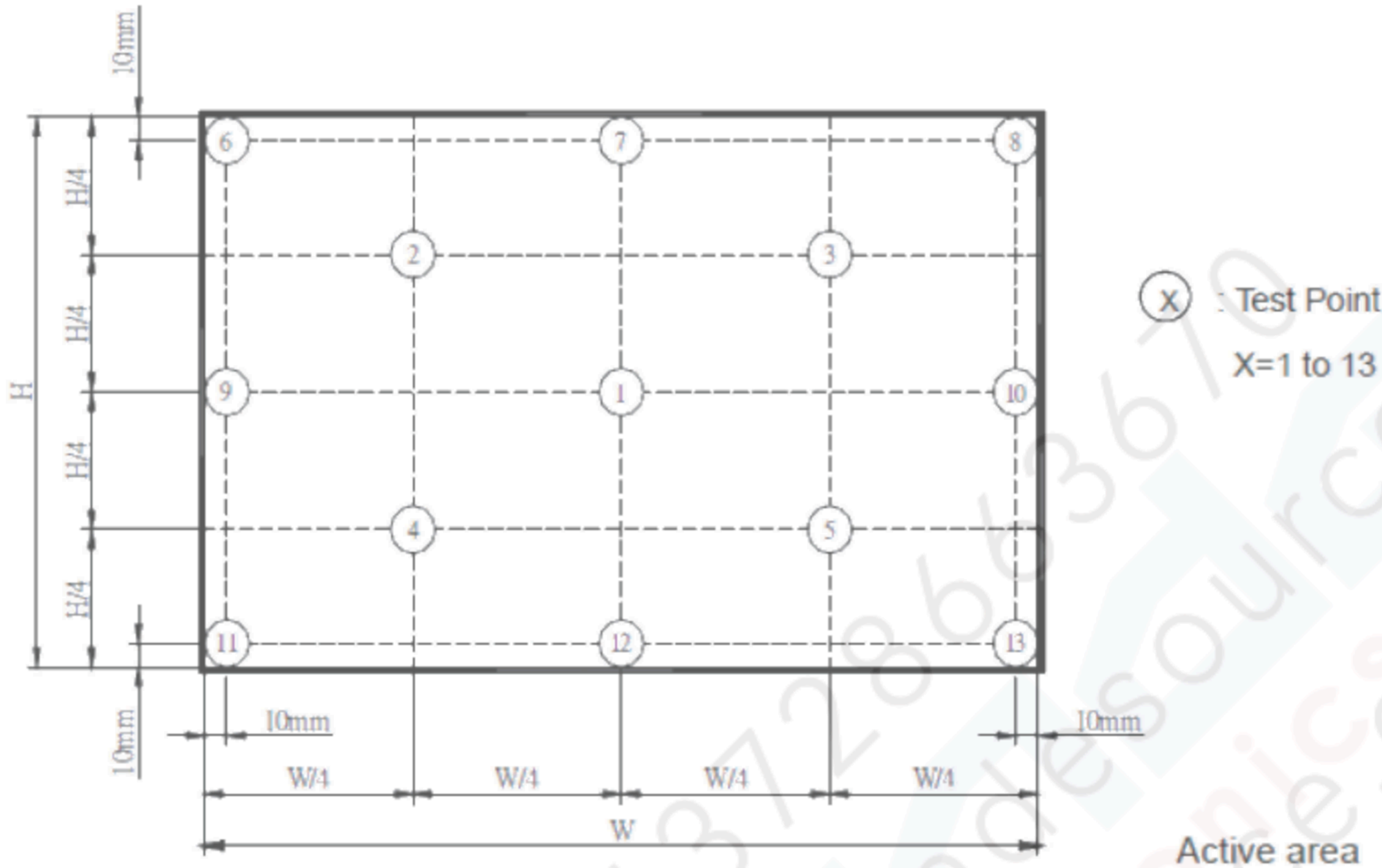
Test Point Center

Environment < 1 lux



Note 2: Definition of 5 points position (Display active area: 222.72(H) x 125.28(V))
Measure the luminance of gray level 63 at 5 points

$$\delta W_{5p} = \{ \text{Minimum } [L(1) \sim L(5)] / \text{Maximum } [L(1) \sim L(5)] \} * 100\%$$



Note 3: The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

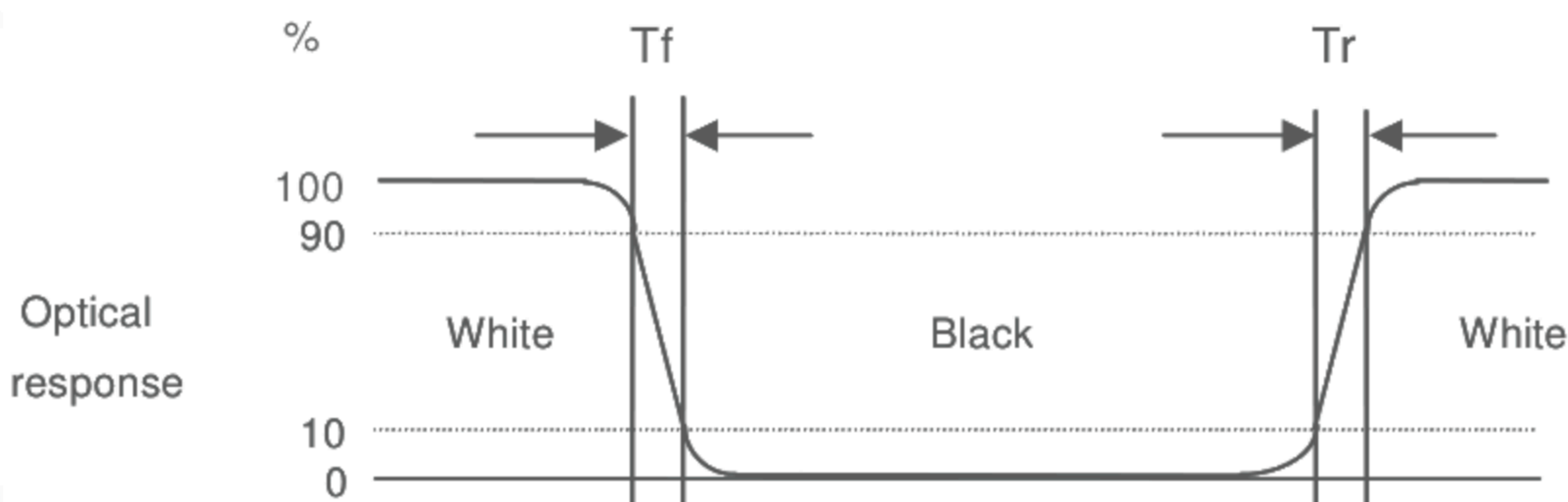
$$\delta W_5 = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

Note 4: Definition of contrast ratio (CR):

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

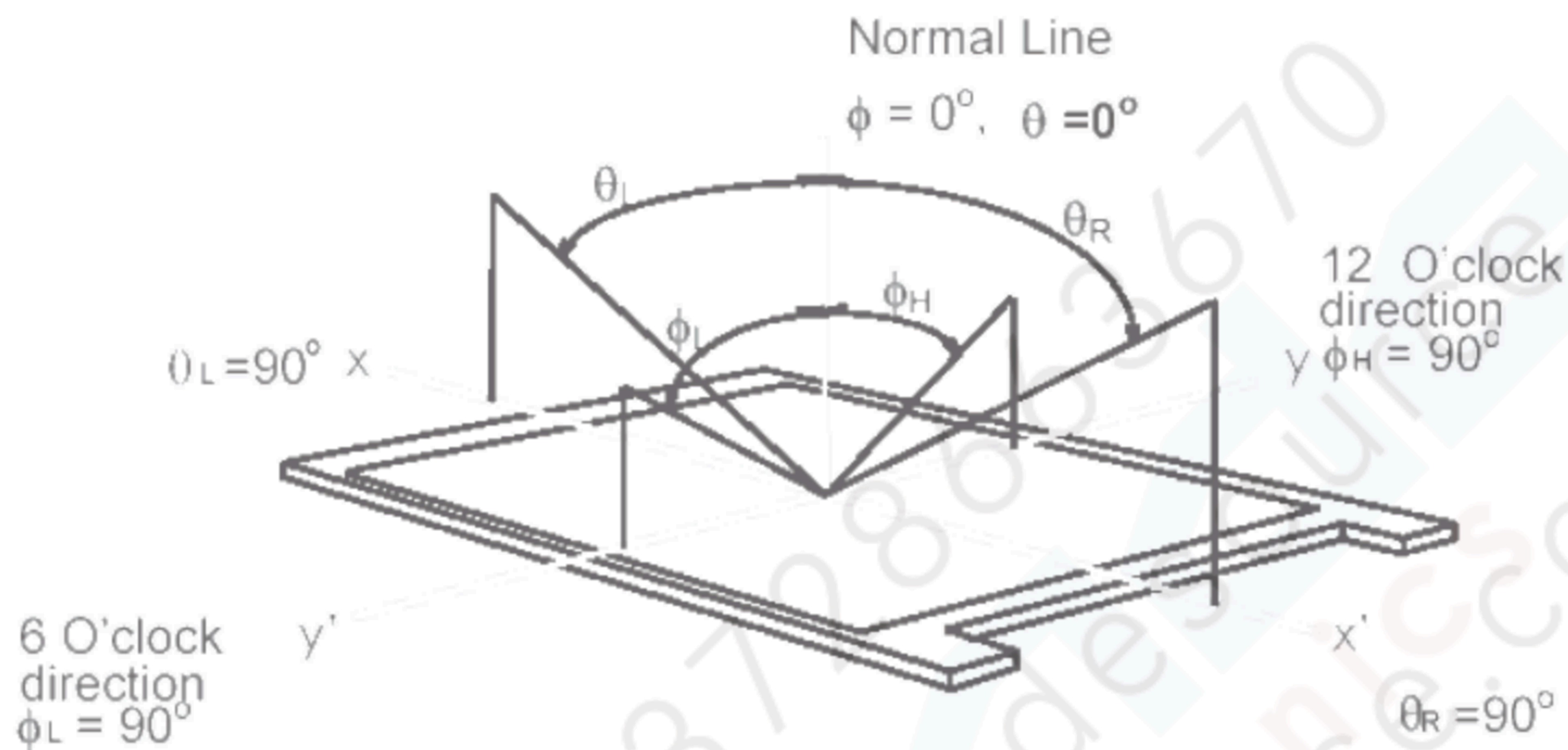
Note 5: Definition of response time:

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.



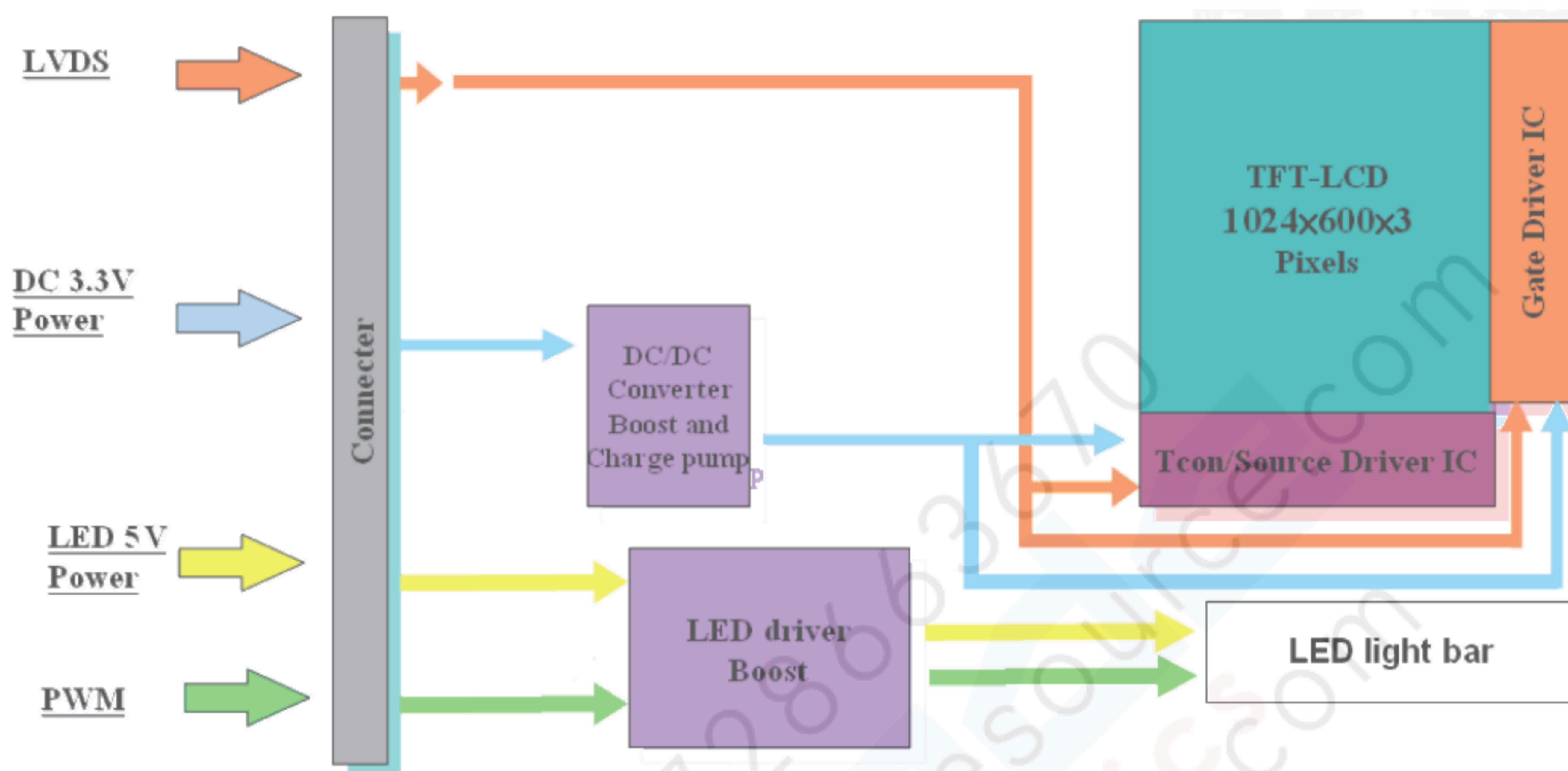
Note 6: Definition of viewing angle

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 10.1 inch color TFT/LCD module:



4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD drive Voltage	VCC	-0.3	4	[Volt]	Note 1,2
Converter Input Voltage	LED_VCC	0	6	[Volt]	
Converter Control Signal Voltage	LED_PWM	-0.3	5.3	[Volt]	

4.2 Absolute Ratings of Touch Sensor

Item	Symbol	Rating	Unit	Conditions
Voltage from VCCIO to AGND and DGND	-	+6.0	[Volt]	-
Voltage from any pin to AGND and DGND	-	+4.0	[Volt]	-

(EERD提供)

4.3 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	-10	+60	[°C]	Note 3
Storage Temperature	TST	-20	+70	[°C]	

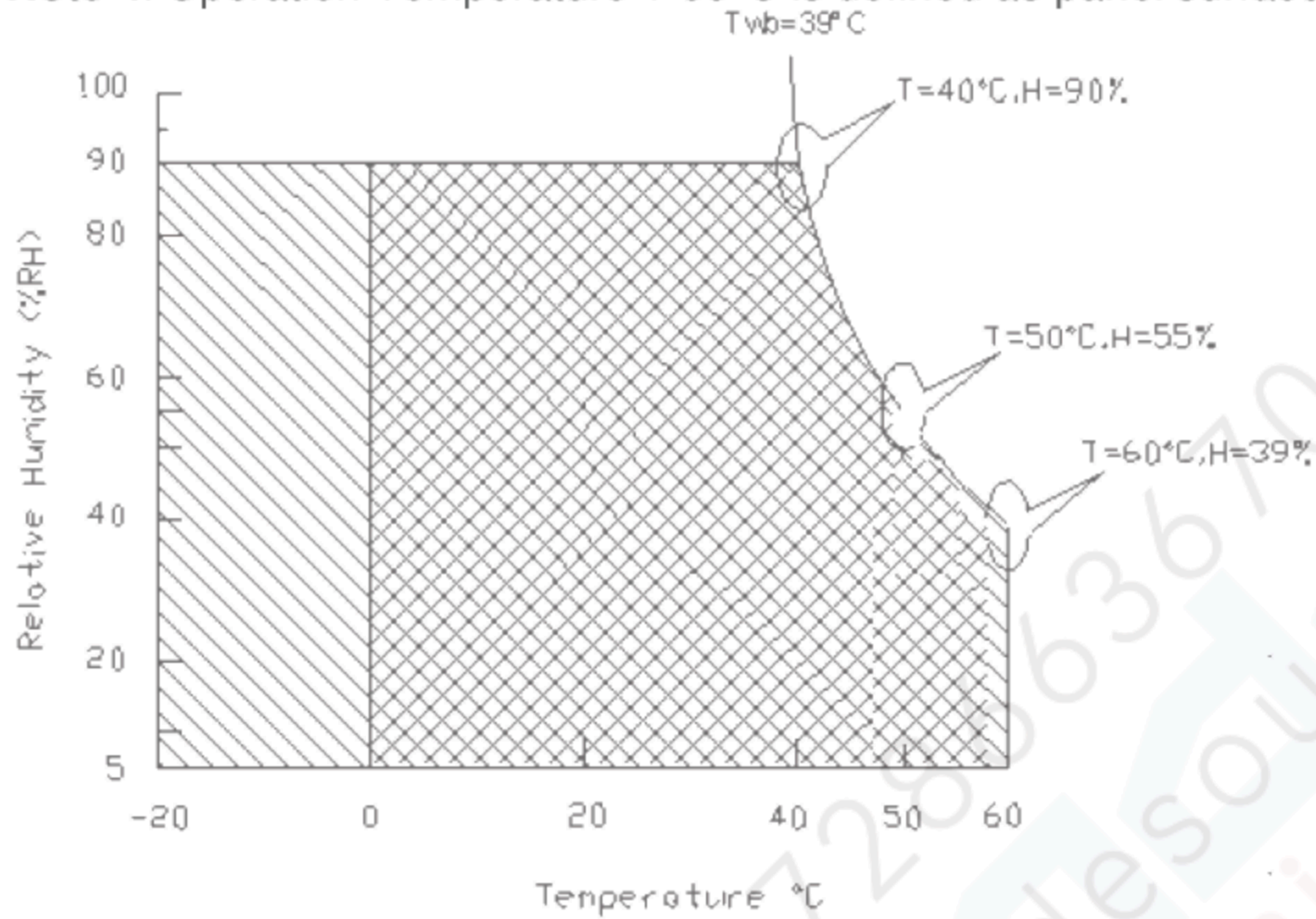
Note: Maximum Wet-Bulb should be 39°C and no condensation.

Note 1: With in T_a (25°C)

Note 2: Permanent damage to the device may occur if exceeding maximum values

Note 3: For quality performance, please refer to AUO IIS(Incoming Inspection Standard).

Note 4: Operation Temperature + 60°C is defined as panel surface temperature.



Operating Range

Storage Range

5. Electrical Characteristics

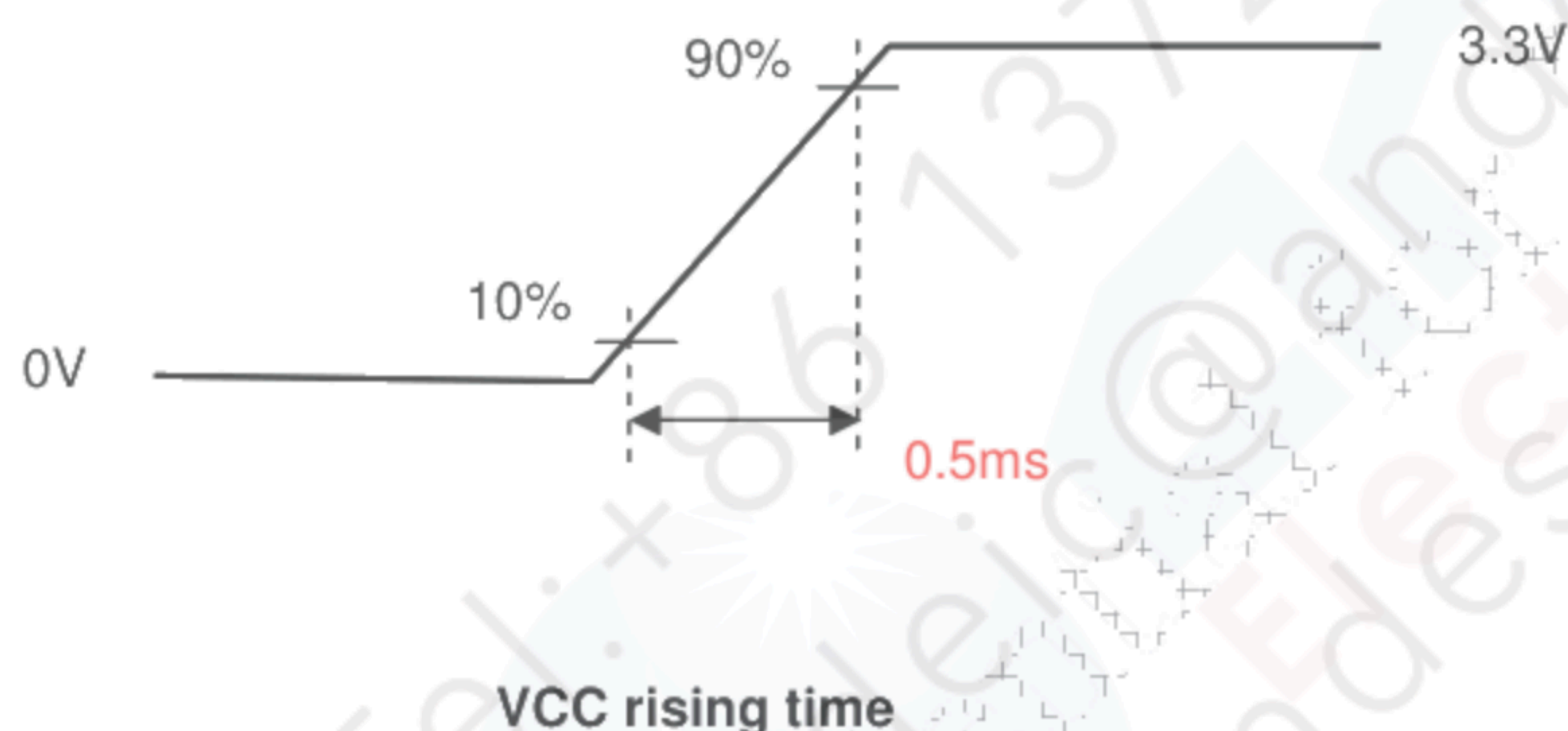
5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are shown as follows;

Symbol	Parameter	Min	Typ	Max	Units	Remark
VCC	Logic/LCD Drive Voltage	3	3.3	3.6	[Volt]	
I _{VCC}	VCC Current	-	TBD	TBD	[mA]	Black Pattern (VCC=3.3V, at 60Hz)
I _{rush}	LCD Inrush Current	-	-	TBD	[A]	Note 1.
P _{VCC}	VCC Power	-	TBD	TBD	[Watt]	Black Pattern (VCC=3.3V, at 60Hz)
VCC _{rp}	Allowable Logic/LCD Drive Ripple Voltage			100	[mV] p-p	

Note 1: Measurement condition:



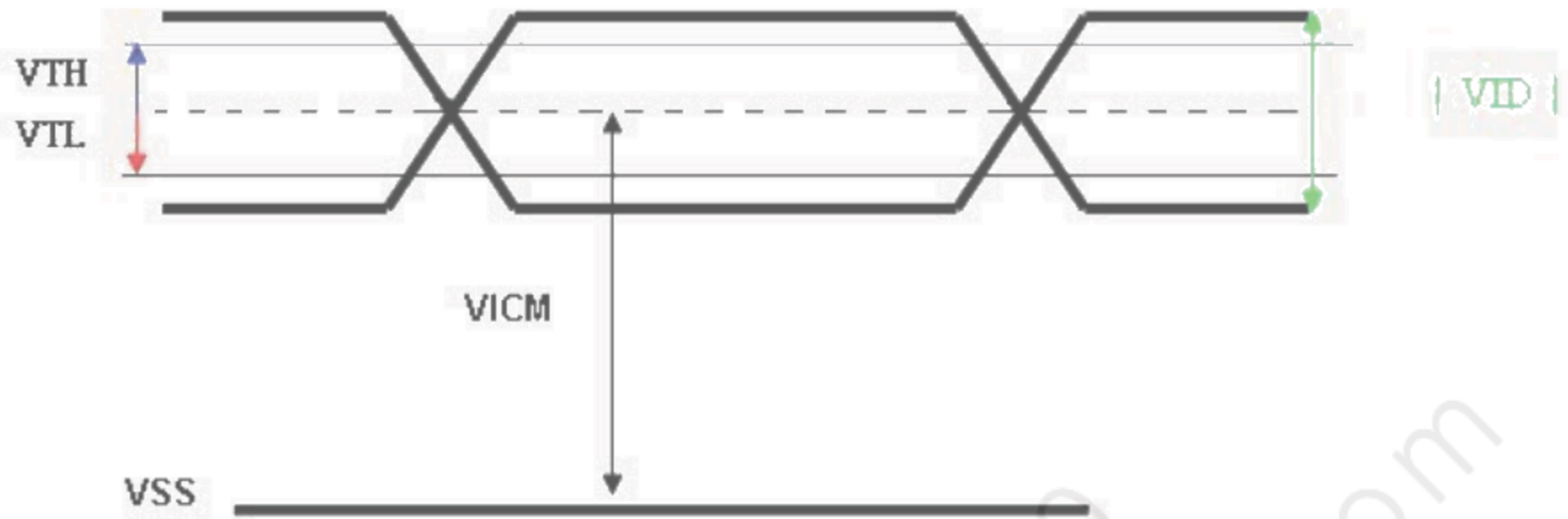
Black pattern

5.1.2 Signal Electrical Characteristics

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

Symbol	Parameter	Min	Typ	Max	Units	Condition
V _{TH}	Differential Input High Threshold	-	+50	+100	[mV]	V _{ICM} = 1.2V Note 1
V _{TL}	Differential Input Low Threshold	-100	-50	-	[mV]	V _{ICM} = 1.2V Note 1
V _{ID}	Input Differential Voltage	100	-	600	[mV]	Note 1
V _{ICM}	Differential Input Common Mode Voltage	+1.0	+1.2	+1.5	[V]	V _{TH} -V _{TL} = 200MV (max) Note 1

Note: LVDS Signal Waveform.



5.2 Backlight Unit

5.2.1 Parameter guideline for LED

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

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Input Voltage	LED_VCC	4.5	5	5.5	[Volt]	
Inrush Current	I_{LED RUSH}	-	TBD	TBD	[A]	
Input Current	I_{LED}	-	TBD		[mA]	Note 2
Power Consumption	P_{LED}	-	TBD	TBD	[Watt]	Note 2
PWM Control Frequency	F_{PWM}	19K	20K	21K	[Hz]	PWM Control
PWM Control Duty Ratio	D_{PWM}	5	-	100	[%]	
PWM Control Level	High Level	V_{IH}	3.0	-	3.3	
	Low Level	V_{IL}	0	-	0.3	
LED Forward Current	I_F	-	38	-	[mA]	Ta = 25°C
LED Forward Voltage	V_F	-	24.61	27.69	[Volt]	I _F = 38mA, Ta = 25°C
LED Power Consumption	P_{LED}		0.935	1.052	[Watt]	I _F = 38mA, Ta = 25°C
Operation Life		30,000	50,000		Hrs	I _F = 38mA, Ta = 25°C

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

Note 2: I_{LED RUSH}, I_{LED}, P_{LED} are defined for LED backlight and tested when LED_VCC = 5V and 100% duty of PWM dimming.

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

Note 4: If G101STN01.1 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. LED operating life time is estimated data.

5.3 Touch Sensor

5.3.1 Power Specification

Items	Symbol	Specifications			Unit	Notes
		Min.	Typ.	Max.		
Touch Panel Power Supply	VTSP	3	3.3	3.6	V	Ripple <100mV
Input voltage	VIH	VCCIOx 0.7	-	VCCIO	V	VCCIO=1.8V or 3.3V
	VIL	0	-	VCCIOx 0.3	V	
Normal mode Current consumption @ Report rate 100Hz	INORMAL	TBD	TBD	TBD	mA	
Idle mode Current consumption	IIDLE	TBD	TBD	TBD	mA	
Sleep mode Current consumption	ISLEEP	TBD	TBD	TBD	uA	

5.3.2 Touch Driver

Name / Designation	TP controller
Manufacturer	eGalax_eMPIA Technology Inc.
Type / Part Number	EXC- 3062

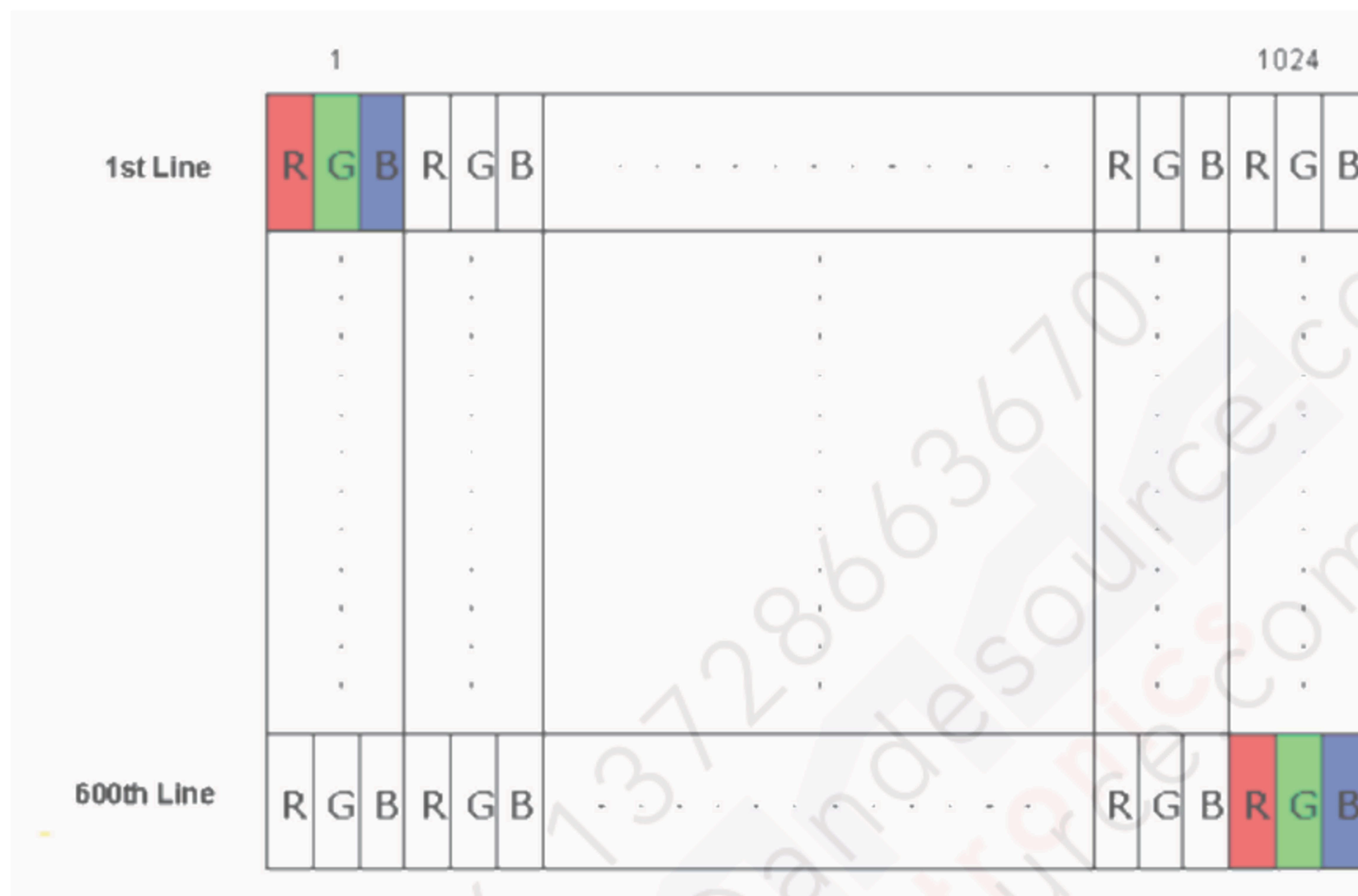
5.3.3 Touch Pin Assignment

CONNECTOR PINOUT	
PIN NO.	DESIGNATION
1	GND_EARTH
2	VDD
3	GND
4	D+
5	D-

6. Signal Characteristic

6.1 Pixel Format Image

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



6.2 The input data format

RCLK

RIN0

RIN1

RIN2

Signal Name	Description	
R5 R4 R3 R2 R1 R0	Red Data 5 (MSB) Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB) Red-pixel Data	Red-pixel Data Each red pixel's brightness data consists of these 6 bits pixel data.
G5 G4	Green Data 5 (MSB) Green Data 4	Green-pixel Data Each green pixel's brightness data consists of these 6 bits

G3 G2 G1 G0	Green Data 3 Green Data 2 Green Data 1 Green Data 0 (LSB) Green-pixel Data	pixel data.
B5 B4 B3 B2 B1 B0	Blue Data 5 (MSB) Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB) Blue-pixel Data	Blue-pixel Data Each blue pixel's brightness data consists of these 6 bits pixel data.
RCLK	Data Clock	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 RCLK. 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 VCC is off.

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.

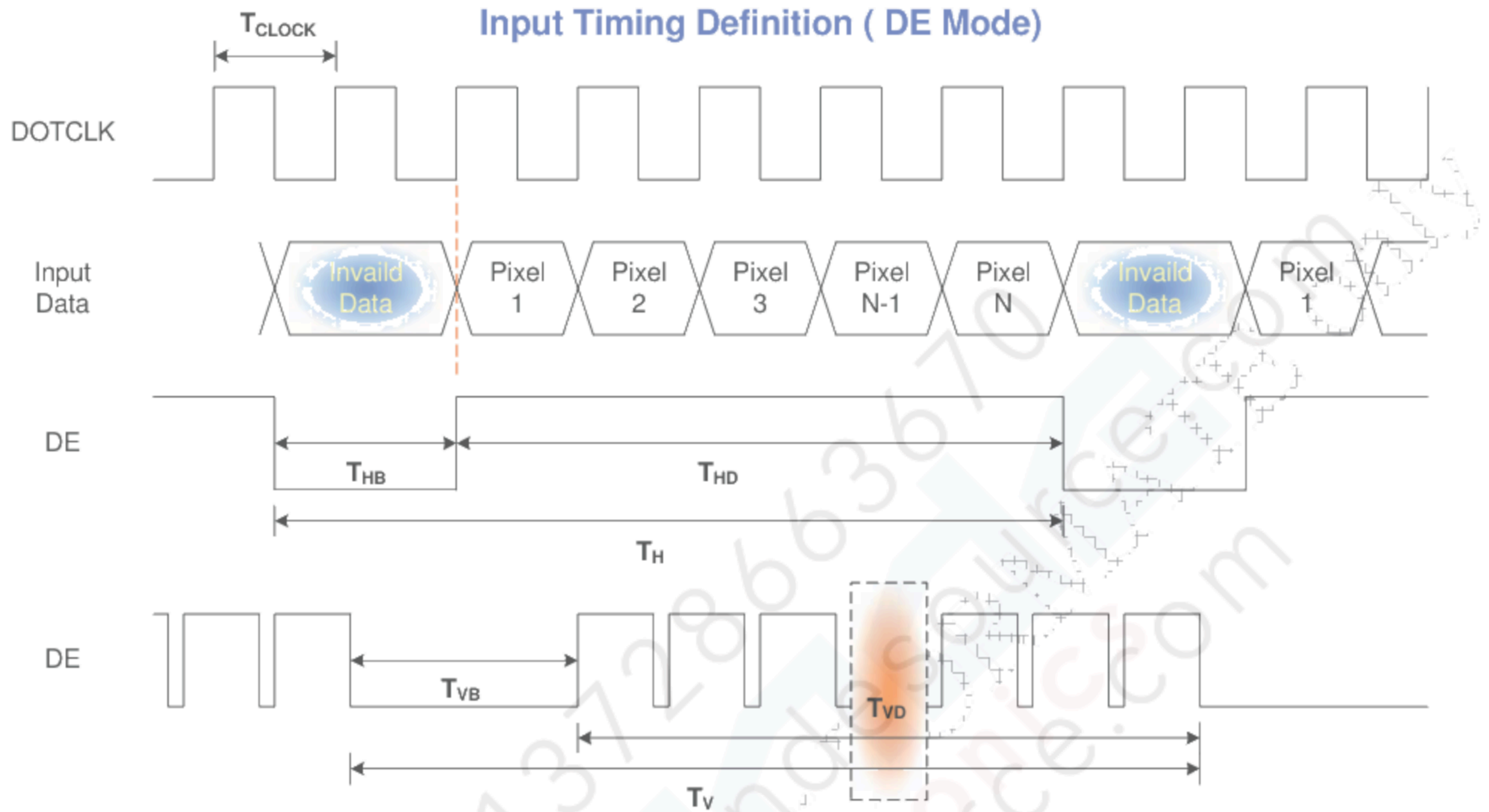
Pin no	Symbol	I/O	Function	Remark
1	VCC	P	Power Supply Logic voltage +3.3V	
2	VCC	P	Power Supply Logic voltage +3.3V	
3	VSS	P	Ground	
4	VSS	P	Ground	
5	RIN0-	I	Negative LVDS differential data input	
6	RIN0+	I	Positive LVDS differential data input	
7	VSS	P	Ground	
8	RIN1-	I	Negative LVDS differential data input	
9	RIN1+	I	Positive LVDS differential data input	
10	VSS	P	Ground	
11	RIN2-	I	Negative LVDS differential data input	
12	RIN2+	I	Positive LVDS differential data input	
13	VSS	P	Ground	
14	RCLK-	I	Negative LVDS differential data input	
15	RCLK+	I	Positive LVDS differential data input	
16	VSS	P	Ground	
17	LED_VCC	P	Power Supply LED voltage +5V	
18	LED_VCC	P	Power Supply LED voltage +5V	
19	LED_PWM	I	Back-light Dimming control	
20	VSS	P	Ground	

6.4 Timing Characteristics

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		$1/T_{\text{Clock}}$	40.8	51.2	67.2	MHz
Vertical Section	Period	T_V	610	635	800	T_{Line}
	Active	T_{VD}	600	600	600	
	Blanking	T_{VB}	10	35	200	
Horizontal Section	Period	T_H	1114	1344	1400	T_{Clock}
	Active	T_{HD}	1024	1024	1024	
	Blanking	T_{HB}	90	320	376	
Frame Rate		F	50	60	70	Hz

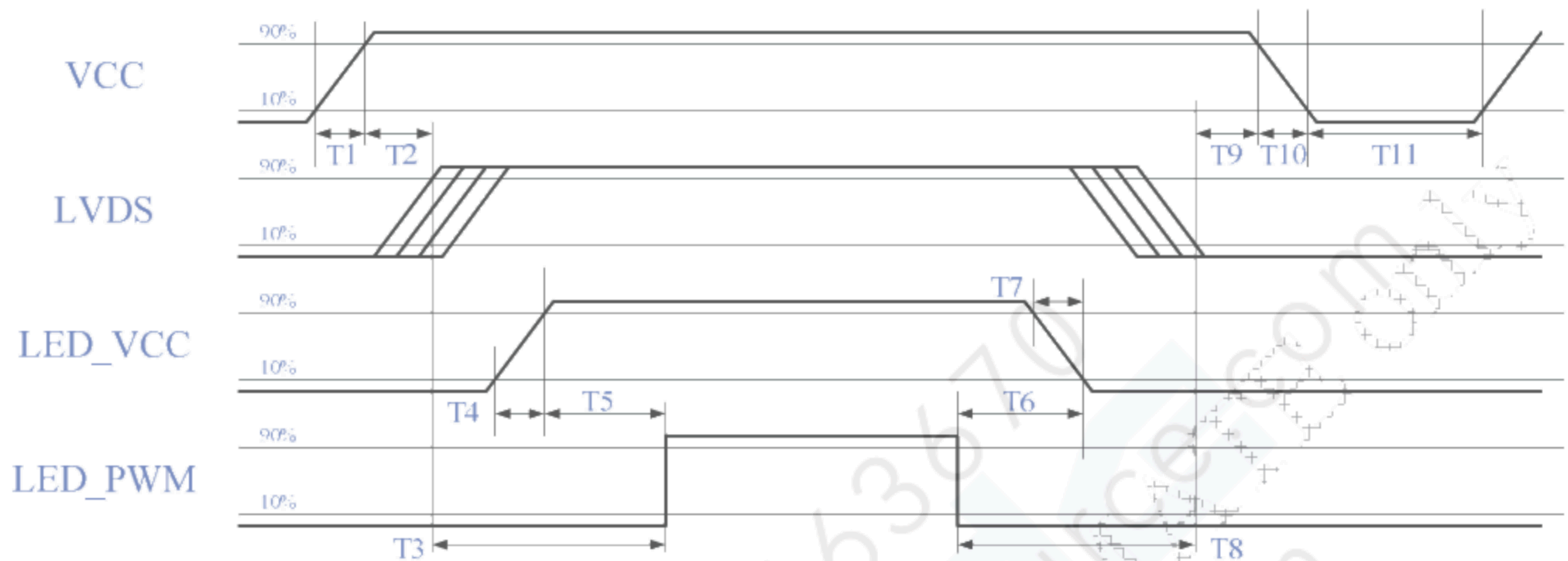
Note : DE mode.

6.5 Input Timing Diagram



6.6 Power ON/OFF Sequence

VCC 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 VCC is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	-	50	[ms]
T3	200	-	-	[ms]
T4	0.5	-	10	[ms]
T5	10	-	-	[ms]
T6	10	-	-	[ms]
T7	0	-	10	[ms]
T8	200	-	-	[ms]
T9	0	-	50	[ms]
T10	0	-	10	[ms]
T11	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 Signal: LVDS Interface

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB24013P20HA or compatible
Adaptable Plug	P24013P20 or compatible

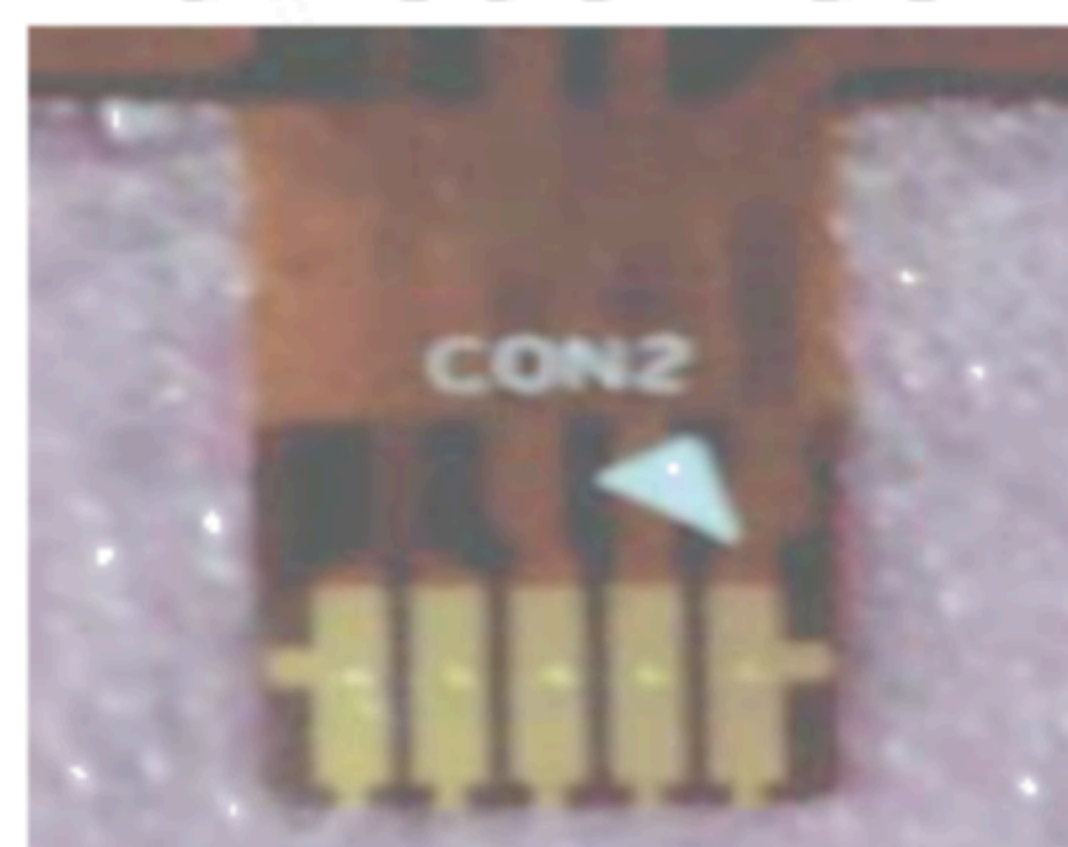
7.1.1 Pin Assignment

Pin No.	Symbol	Pin No.	Symbol
1	VCC	11	RIN2-
2	VCC	12	RIN2+
3	VSS	13	VSS
4	VSS	14	RCLK-
5	RIN0-	15	RCLK+
6	RIN0+	16	VSS
7	VSS	17	LED_VCC
8	RIN1-	18	LED_VCC
9	RIN1+	19	LED_PWM
10	VSS	20	VSS

7.2 Touch Signal : Touch Sensor Pin Assignment

CONNECTOR PINOUT	
Pin No.	Designation
1	GND_EARTH
2	VDD
3	GND
4	D+
5	D-

7.3 Touch Connector Illustration



8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	40 °C /90%,300Hr	
High Temperature Operation	60 °C, 300Hr	
Low Temperature Operation	-10 °C, 300Hr	
Hot Storage	70 °C, 300 hours	
Cold Storage	-20 °C, 300 hours	
Thermal Shock Test	-30 °C /30 min ,70 °C /30 min ,100cycles	
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)	
ESD	Contact Discharge = ± 8 kV, class B (R=330,C=150pF) Air Discharge = ± 15 kV, class B (R=330,C=150pF) 1sec, 9 points, 25 times/point	Note1

Note 1: According to EN61000-4-2 , ESD Class B: Some performance degradation allowed. No data lost

. Self-recoverable. No hardware failures.

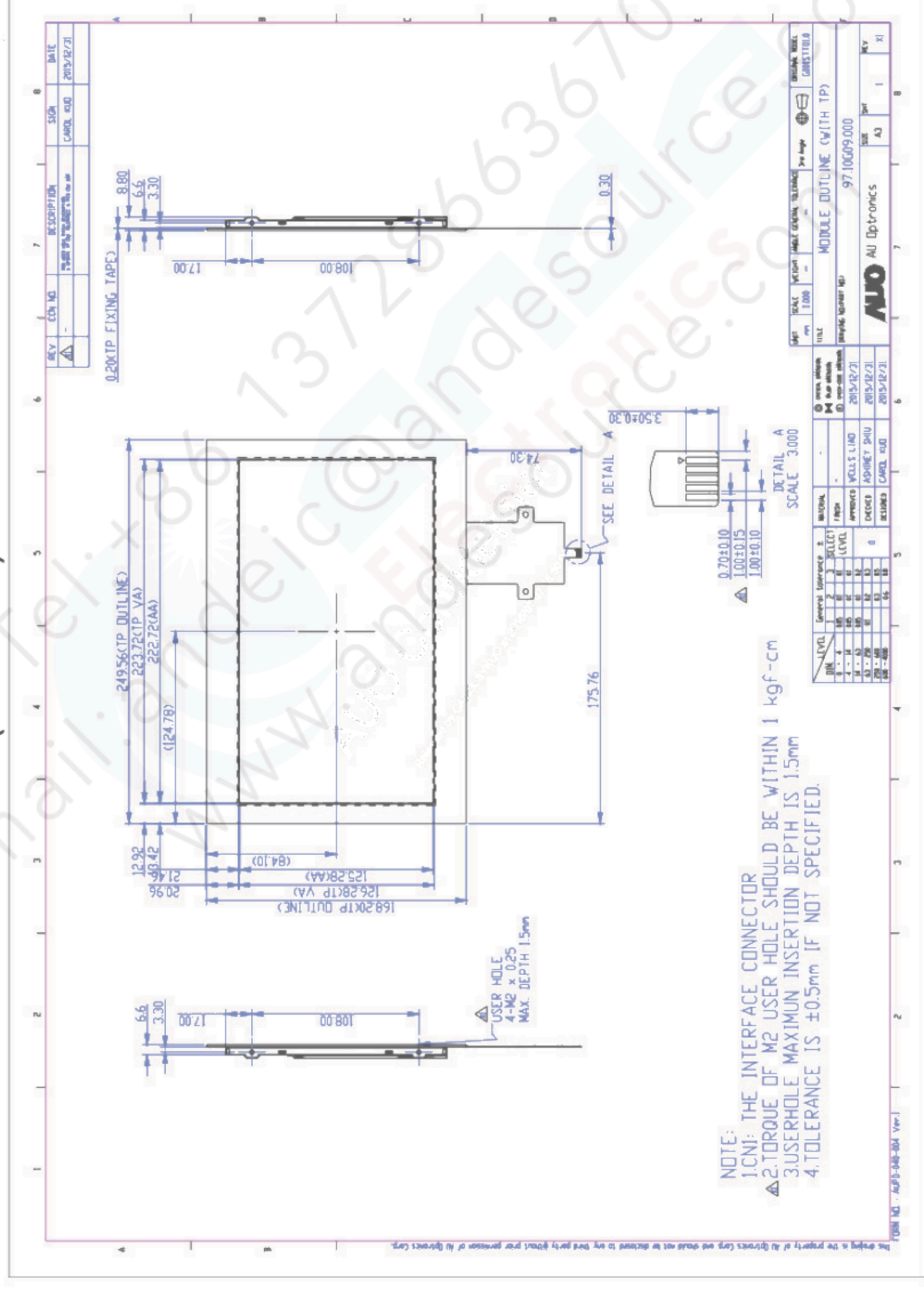
Note 2: After reliability test, it is no function defect and occurrence of any new defective shall not be allowed.

Note 3:

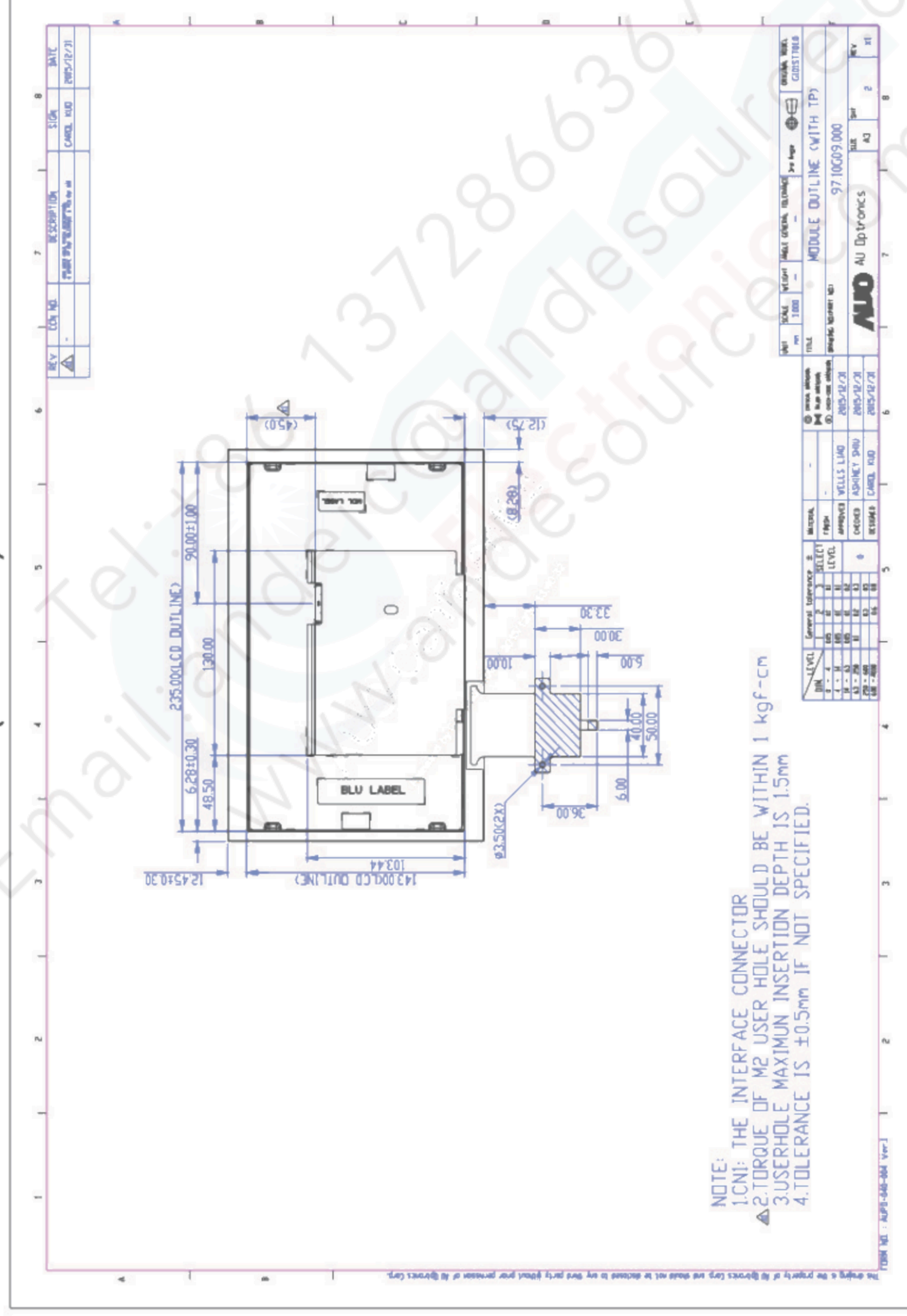
- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

9. Mechanical Characteristics

9.1 Total solution Outline Dimension (Front View)

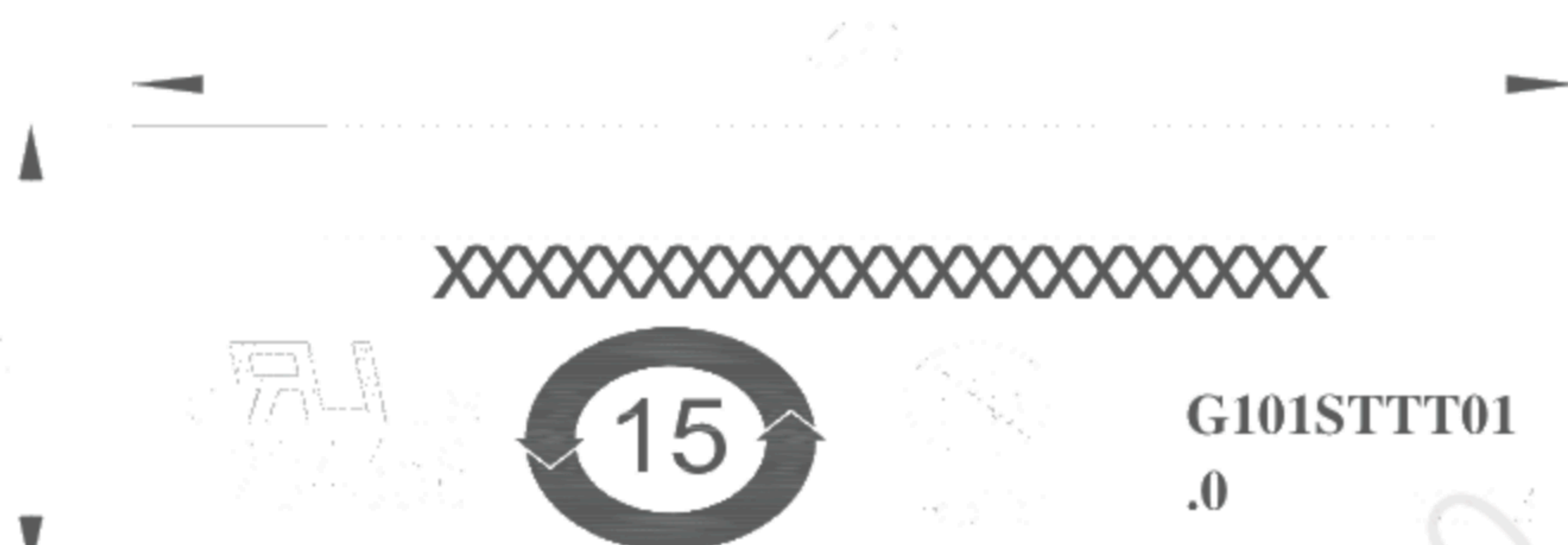


9.2 Total solution Outline Dimension (Rear View)

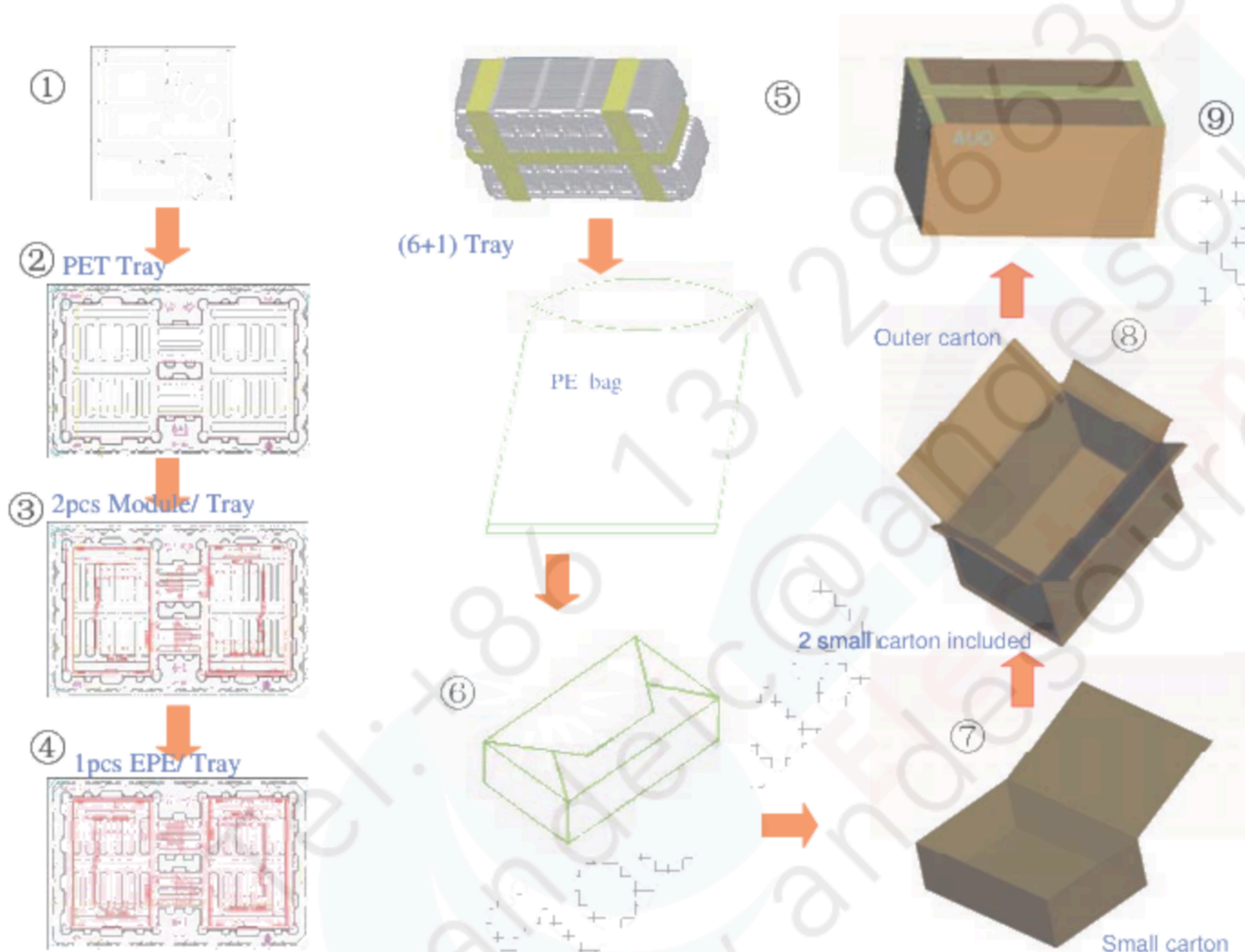


10. Label and Packaging

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



10.2 Carton Package



10.3 Palletizing

Max capacity : 24 TFT-LCD module per carton

Max weight: 12.0 kg per carton

Outside dimension of carton: 520(L)*340(W)*250(H)mm

Pallet size : 1,070mm*1,070mm*135mm

Box stacked_Max

Module by air : (2 *3) *5 layers , one pallet put 30 boxes , total 720 pcs module

Module by sea:(2 *3) *5 layers + (2 *3) *2 layers , two pallet put 42 boxes ,total 1,008 pcs module

Module by sea_HQ : (2 *3) *5 layers+(2 *3) *3 layers, two pallet put 48 boxes, total 1,152 pcs module