

(V) Preliminary Specifications

() **Final Specifications**

Module	10.1 Inch Color TFT-LCD
Model Name	G101STN01.2

Customer Date Checked & Approved by _____	Approved by <u>Grace Hung</u> <u>2014/12/19</u> Prepared by <u>ShengHsun Lin</u> <u>2014/12/19</u>
Note: This Specification is subject to change without notice.	General Display Business Division / AU Optonics corporation

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Record of Revision

Product Specification

AU OPTRONICS CORPORATION

G101STN01.2

Version and Date	Page	Old description	New Description
0.0 Aug 8, 2014	All	First draft specification	-
0.1 Dec. 2, 2014	All	NA	Update TBD Sepcification
	5/10/23	Storage: -20~70℃	-30~70℃
	6/12	IF=35 mA	IF=30 mA
	22	NA	Add Typical Application Circuit in Chapter 7
	24/25	2D Drawing	Update 2D Drawing



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) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD Module.
- 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 light bar edge. Instead, press at the far ends of the LED light bar 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 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.
- 13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
- 14) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
- 15) The data on this specification sheet is applicable when LCD module is placed in landscape position.
- 16) Continuous displaying fixed pattern may induce image sticking. It's 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 Color Active Matrix Liquid Crystal Display G101STN01.2 composed of a TFT-LCD display, a driver and power supply circuit, and a LED backlight. The screen format is intended to support Wide SVGA (1024(H) x 600(V)) screen and 262k/16.7M colors (RGB 18/24-bits). And PCBA is not embedded in G101STN01.2.

All input signals are RGB interface.

G101STN01.2 designed with wide viewing angle; wide temperature and long life LED backlight (30k hrs) is well suited for industrial applications.

G101STN01.2 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.)
Typical Power Consumption	[Watt]	2.48
Weight	[Grams]	340 (max.)
Physical Size	[mm]	235(H)x143(V)x5(T) (typ.)
Electrical Interface		RGB
Surface Treatment		AG, (3H)
Support Color		262K/16.7M colors
Color Gamut	[%]	45 (Typ.)
Temperature Range Operating Storage (Non-Operating)	[°C] [°C]	-10 to +60 -30 to +70
RoHS Compliance		RoHS Compliance

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]	I _F = 30 mA (center point)	280	350		1
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)	60	70		6
	[degree]	CR = 10 (Left)	60	70		
	[degree]	Vertical (Upper)	50	60		
	[degree]	CR = 10 (Lower)	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	0.09	0.140	0.190	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	

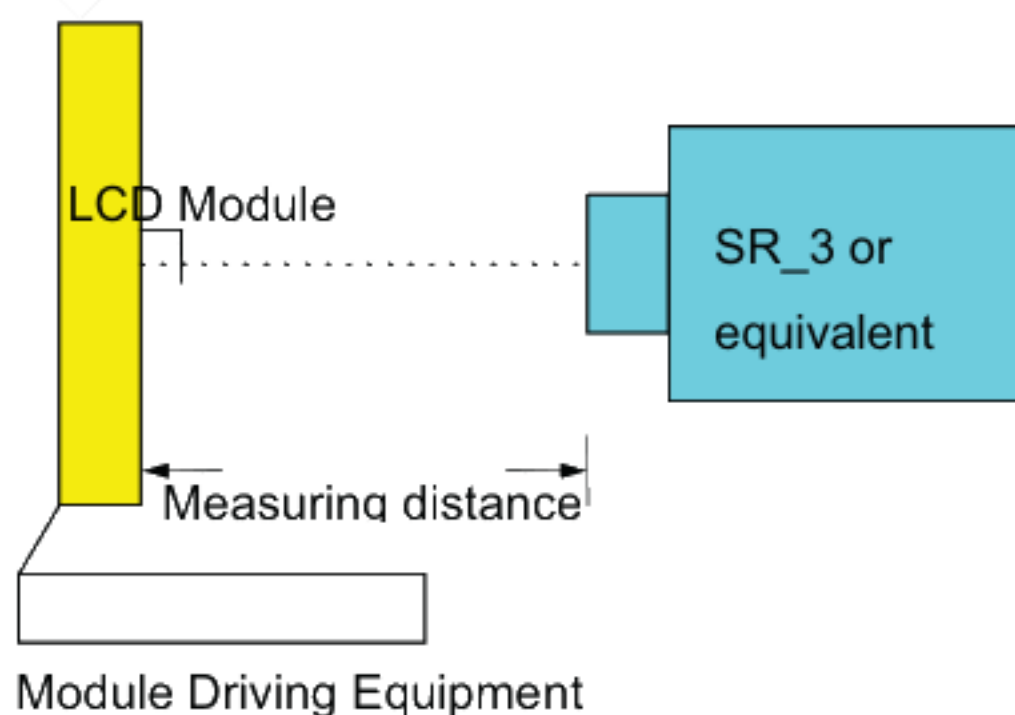
Note 1: Measurement method

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

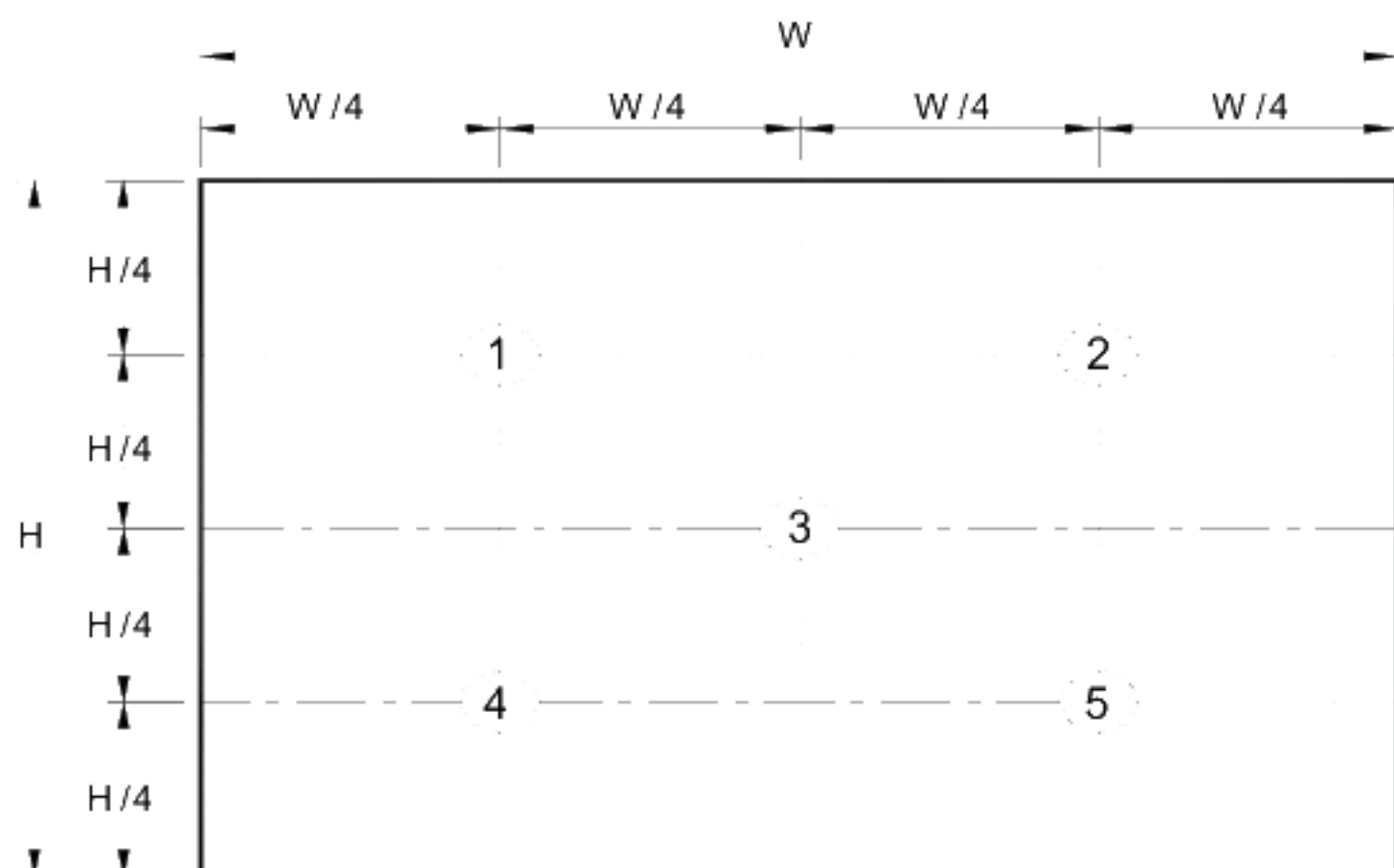
Aperture 1° with 50cm viewing distance

Test Point Center

Environment < 1 lux



Note 2: Definition of 5 points position (Display active area: 222.72(H) x 125.28(V))



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

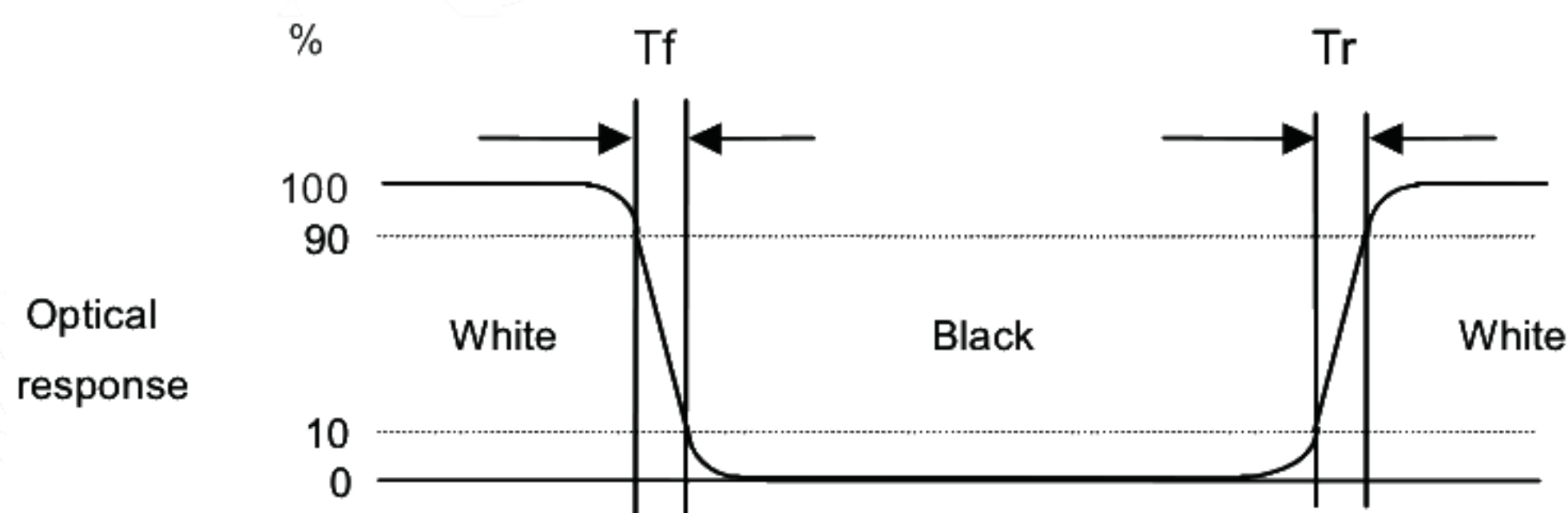
$$\delta_{W5} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

Note 4: Definition of contrast ratio (CR):

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

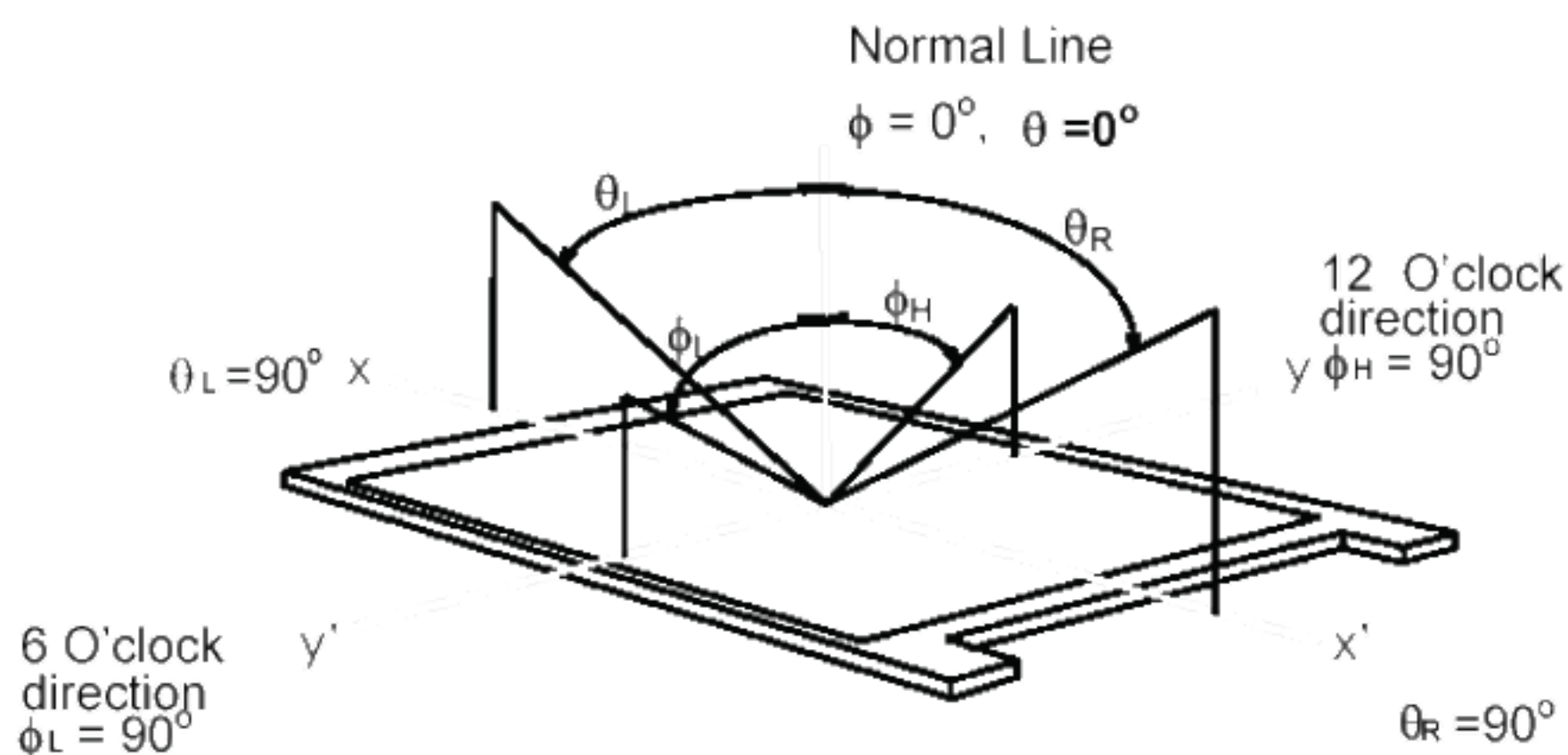
Note 5: Definition of response time:

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.



The diagram illustrates the electrical connections for the LED backlight system. On the left, a vertical bar represents the **FPCA Gold Finger**, which receives five inputs: **Digital input (Data/DCLK/DE/HS/VS)** (yellow), **VDD** (green), **AVDD** (purple), **VGL/VGH** (light blue), and **VCOM** (dark blue). The **Digital input** line connects to the **Source Driver IC with Tcon** (purple box) and the **Gate Driver IC** (red box). The **VDD** line connects to the **Source Driver IC with Tcon**. The **AVDD** line connects to a **Gamma Circuit** (white box), which then provides input to the **Source Driver IC with Tcon**. The **VGL/VGH** line connects to the **Gate Driver IC**. The **VCOM** line connects to the **LED light bar** (white box). The **LED light bar** is connected to an **LED** component, showing the **LED anode** (red) and **LED cathode** (black) terminals. The **Source Driver IC with Tcon** and **Gate Driver IC** are connected to the **TFT-LCD 1024 x 3 x 600 Pixel** panel.



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	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-10	60	[°C]
Storage Temperature	TST	-30	70	[°C]

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

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply		VDD	3.0	3.3	3.6	V	Note2
		IVDD	-	10.4	12.5	mA	
		AVDD	9.8	10	10.2	V	Note2
		IAVDD	-	13.4	16.1	mA	
		VGH	17.5	18	18.5	V	Note2
		IVGH	-	0.3	1	mA	
		VGL	-8.5	-8	-7.5	V	Note2
		IVGL	-	0.3	1	mA	
		VCOM	2.9	3.1	3.3	V	Note2
Input signal voltage	H Level	Vih	0.7×VDD	-	VDD	V	Note 1
	L Level	Vil	0	-	0.3×VDD	V	

Note 1 : Digital Data

Note 2 : Typical current test pattern





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
LED Forward Current	I_F		30		[mA]	$T_a = 25^\circ\text{C}$
LED Forward Voltage	V_F		25.6	31.7	[Volt]	$I_F = 30\text{mA}$, $T_a = 25^\circ\text{C}$
LED Power Consumption	P_{LED}		2.304	2.853	[Watt]	$I_F = 30\text{mA}$, $T_a = 25^\circ\text{C}$
Operation Life		30000	50000		Hrs	$I_F = 30\text{mA}$, $T_a = 25^\circ\text{C}$

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

Note 2: I_F , V_F are defined for one channel LED. There are three LED channels in back light unit.

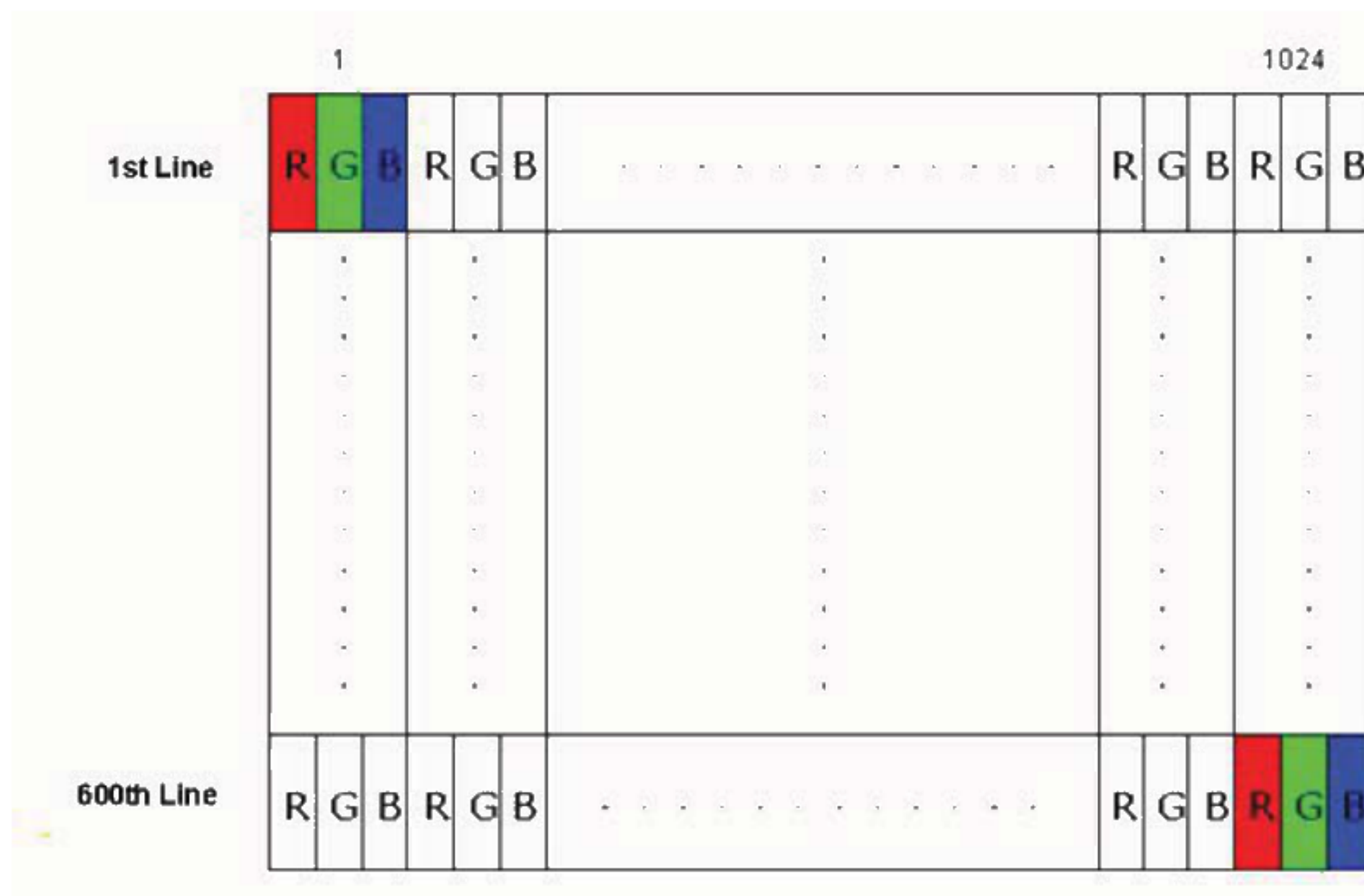
Note 3: If G101STN01.2 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 4: Operating life means brightness goes down to 50% initial brightness. LED operating life time is estimated data.

6. Signal Characteristic

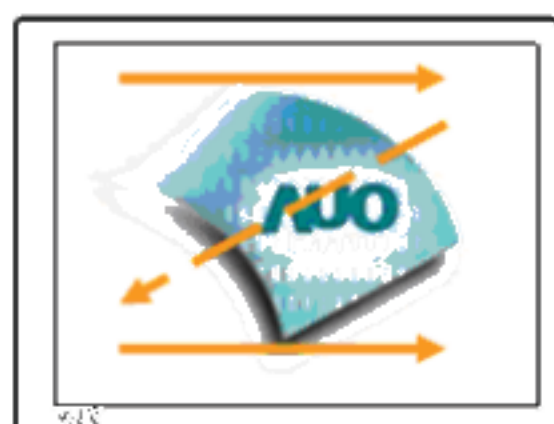
6.1 Pixel Format Image

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

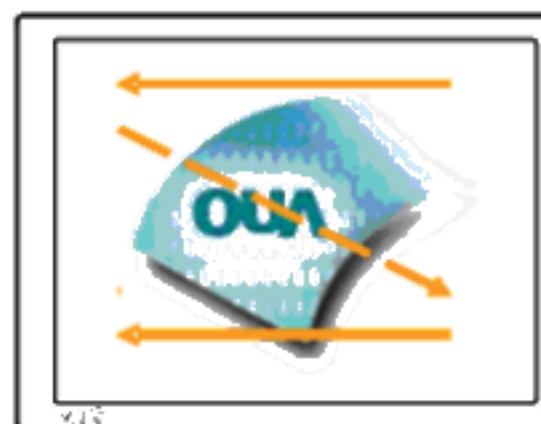


6.2 Scanning Direction

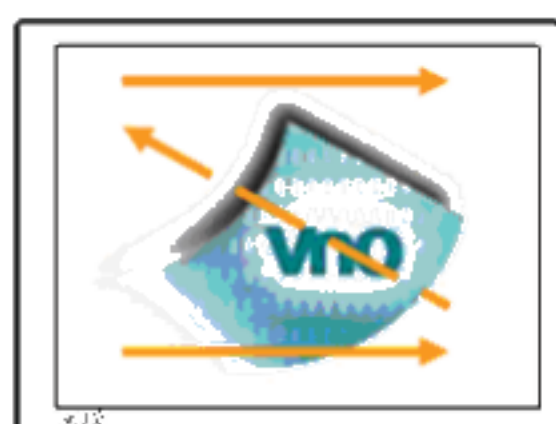
The following figures show the image seen from the front view. The arrow indicates the direction of scan.



SHLR = High; UPDN = Low



SHLR = Low; UPDN = Low



SHLR = High; UPDN = High



SHLR = Low; UPDN = High

6.3 Signal Description

Recommended connector: 089H50-000100-G2-R (STARCONN)

Pin no	Symbol	I/O	Function	Remark
1	NC	-	No connection	
2	NC	-	No connection	
3	NC	-	No connection	
4	NC	-	No connection	
5	GND	P	Power ground	
6	VCOM	P	Common voltage	
7	VDD	P	Digital Power	
8	MODE	I	DE/SYNC mode select	Note1
9	DE	I	Data Input Enable	
10	VS	I	Vertical sync input	
11	HS	I	Horizontal sync input	
12	R7	I	Blue data(MSB)	
13	R6	I	Blue data	
14	R5	I	Blue data	
15	R4	I	Blue data	
16	R3	I	Blue data	
17	R2	I	Blue data	
18	R1	I	Blue data	
19	R0	I	Blue data(LSB)	
20	G7	I	Green data(MSB)	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data(LSB)	
28	R7	I	Red data(MSB)	
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	
35	R0	I	Red data(LSB)	

Pin no	Symbol	I/O	Function	Remark
36	GND	P	Power ground	
37	DCLK	I	Clock input, falling latch	
38	GND	P	Power ground	
39	SHLR	I	Left or Right Display Control	Note2
40	UPDN	I	Up / Down Display Control	Note3
41	VGH	P	Positive Power for TFT	
42	VGL	P	Negative Power for TFT	
43	AVDD	P	Analog Power	
44	RESET	I	Global reset pin	
45	NC	-	No connection	
46	VCOM	P	Common Voltage	
47	DITHB	I	Dithering function	Note4
48	GND	P	Power ground	
49	NC	-	No connection	
50	NC	-	No connection	

Note1 : DE/SYNC mode select . Normally pull high.

When MODE = H , DE mode

When MODE = L , SYNC mode

Note2 : Source Driver internal shift register is controlled by this pin as shown below: Normally pull high.

SHLR=H: SO1→ SO2→ SO3→ ...→SO1024 (Default)

SHLR=L: SO1024→ SO1023→ SO2→...→SO1

Note3 : Gate Driver Up/down scan setting. Normally pull low.

When UPDN=H, G600→ G599→ ...→G1.

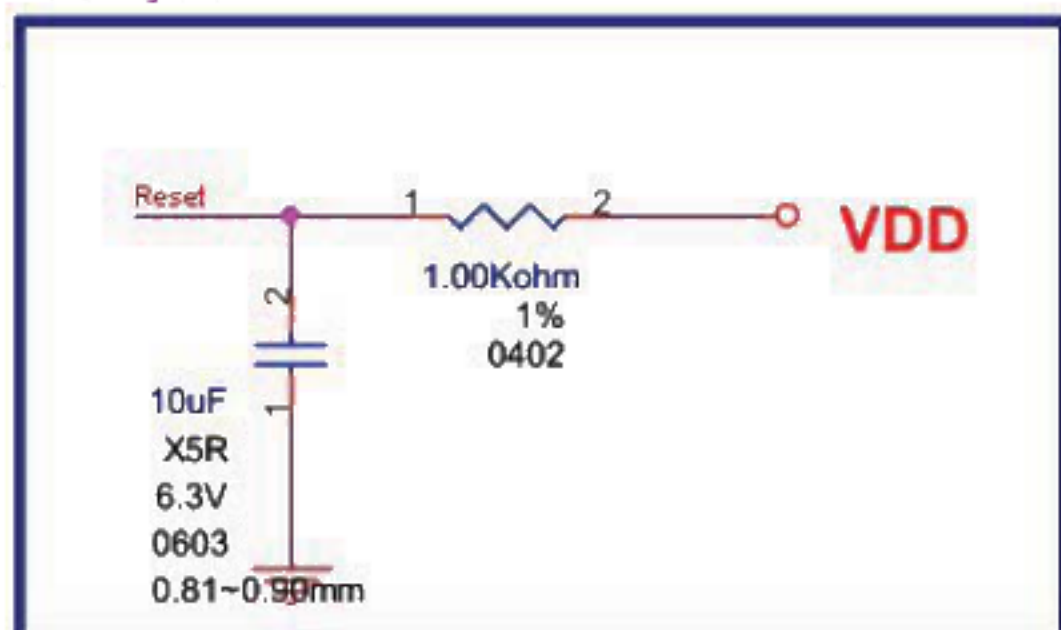
When UPDN=L, G1→ G2→ G3→ ...→G600 (Default))

Note4: Dithering function enable control .Normally pull low

When DITHB =H ,Enable internal dithering function

When DITHB =L , Disable internal dithering function .

Note5 : Global reset normally pulled high. Suggest to connecting with an RC (R=1K ohm, C=10uF) reset circuit for stability.



6.4 The Input Data Format

This product displays 16.7M colors in terms of the 256 grey levels on RGB respectively.

Display colors		Data signal (0 : Low level, 1: High level)																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮																								
	⋮																								
	bright	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	⋮																								
	⋮																								
	bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	⋮																								
	⋮																								
	bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
Blue		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6.5 Interface Timing

6.5.1 Timing Characteristics

Item	Symbol	Min	Typ	Max	Unit	Remark
Data setup time	Tdsu	6	-	-	ns	
Data hold time	Tdsd	6	-	-	ns	
VSD setup time	Tvst	6	-	-	ns	
VSD hold time	Tvhd	6	-	-	ns	
HSD setup time	Thst	6	-	-	ns	
HSD hold time	Thhd	6	-	-	ns	
DE setup time	Tesu	6	-	-	ns	
DE hold time	Tehd	6	-	-	ns	

(DE Mode)

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		Tdclk	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 _{dclk}
	Active	T _{HD}	1024	1024	1024	
	Blanking	T _{HB}	90	320	376	

(HV mode)

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		Tdclk	44.9	51.2	63	MHz
Horizontal Display Area		Thd	1024			T _{dclk}
HSYNC period		Th	1200	1344	1400	T _{dclk}
HYSNC Pulse Width		Thw	1	-	140	
HSYNC blanking		The	160	160	160	
HYNC front proch		Thf	16	160	216	

Signal		Symbol	Min.	Typ.	Max.	Unit
Vertical Display Area		Tvd	600			HSYNC
VSYNC period		Tv	624	635	750	HSYNC
VSYNC Pulse Width		Tvw	1	-	20	
VSYNC blanking		Tve	23	23	23	
VYNC front proch		Tvf	1	12	127	

6.5.2 Input Timing Diagram

a. Clock and Data Timing of Input :

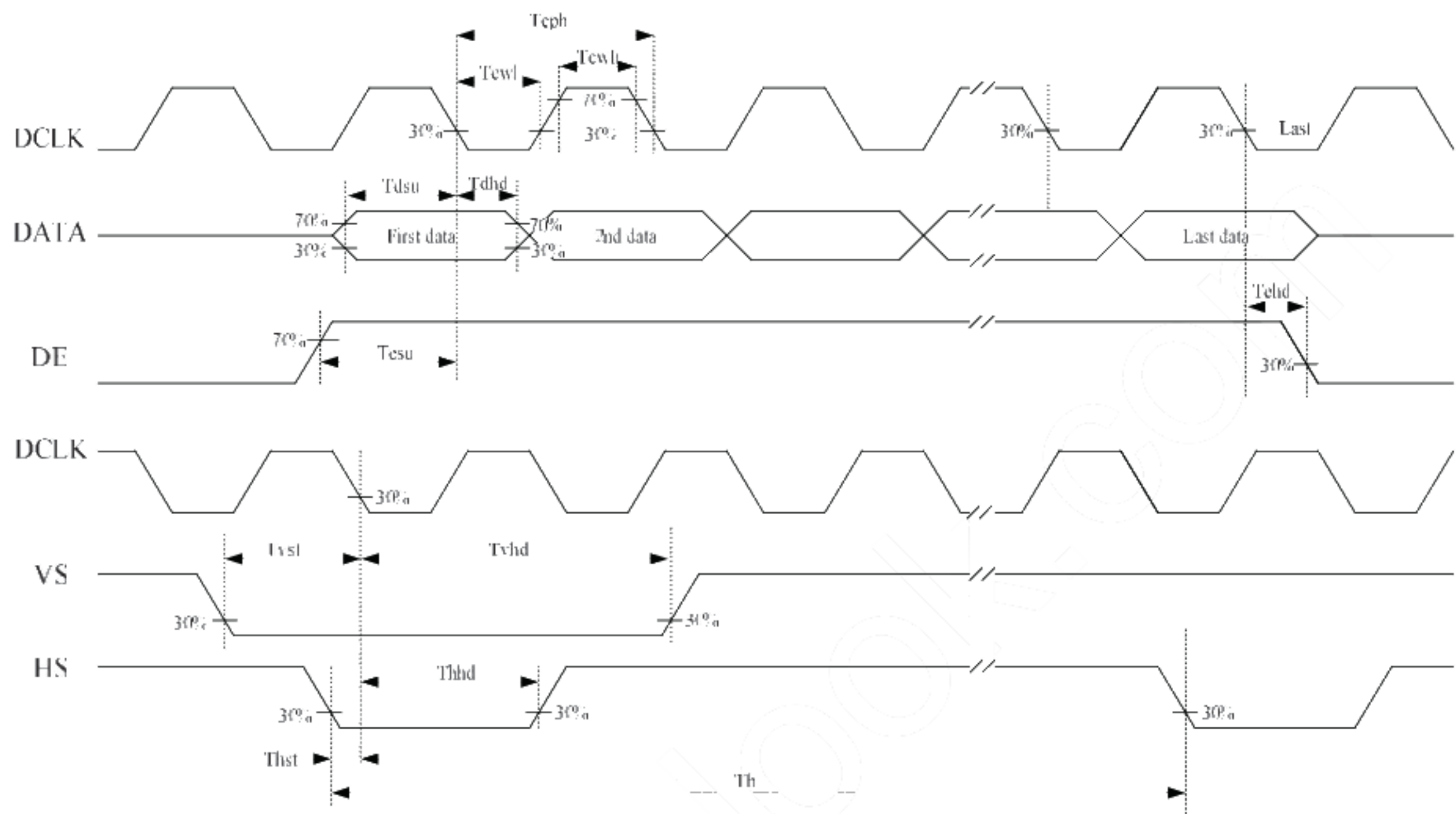
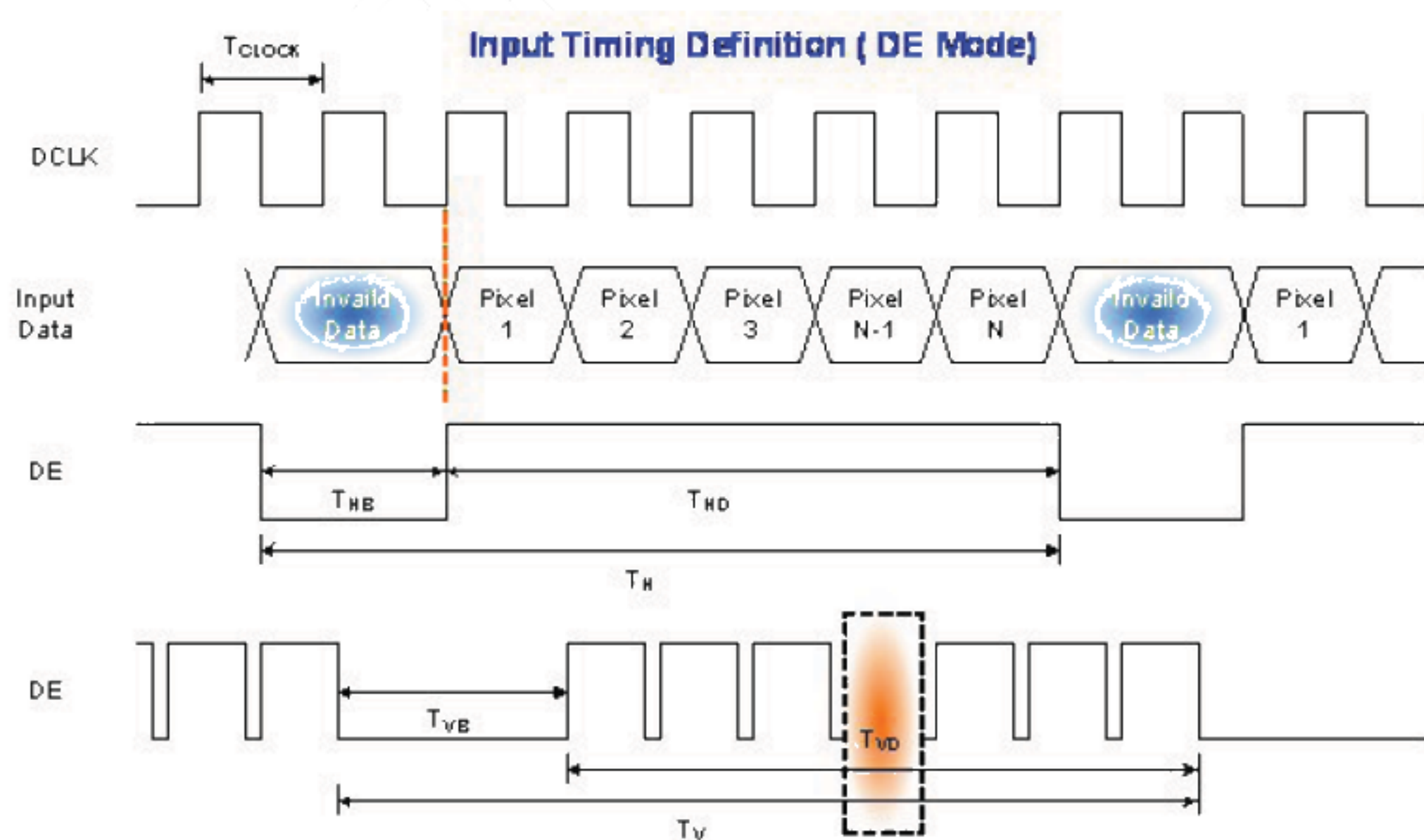


Fig. 6-6

b. Vertical Timing of Input (DE Mode)



c. Vertical Timing of Input (HV Mode)

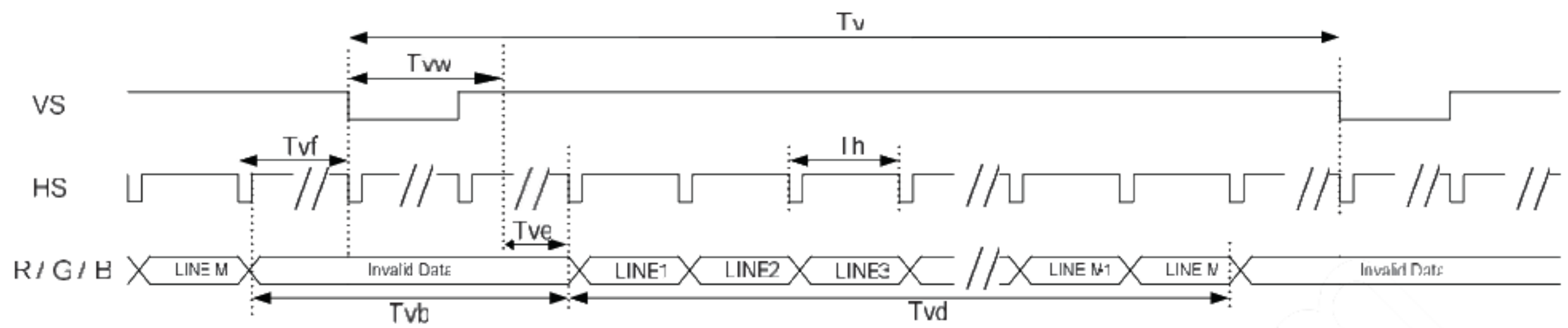
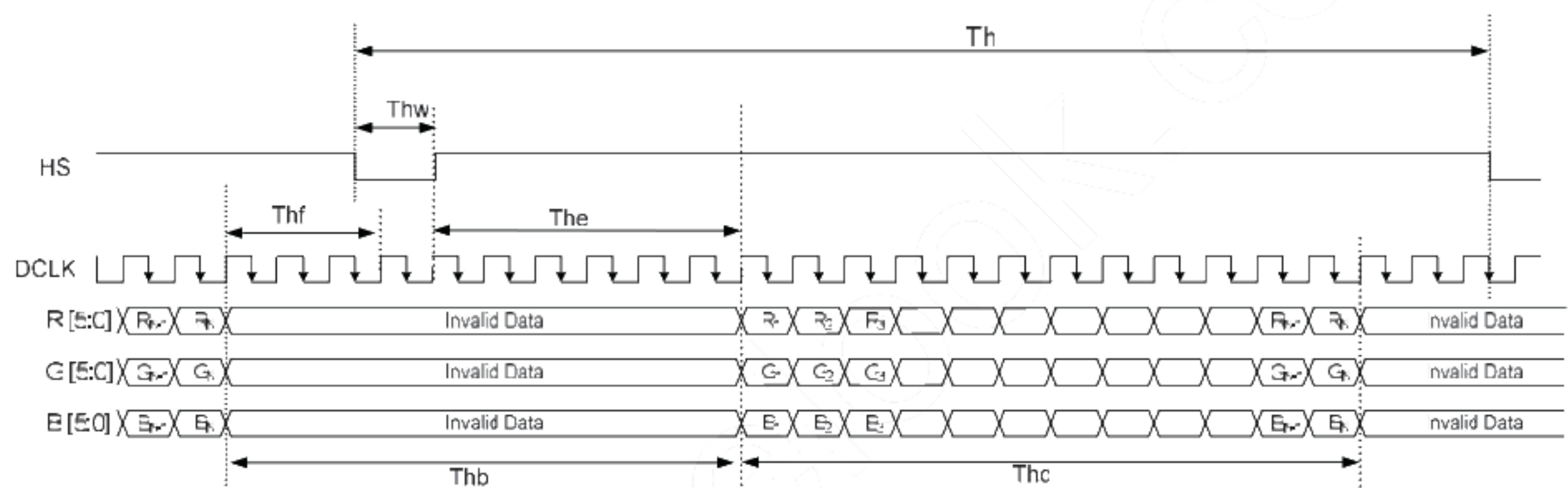


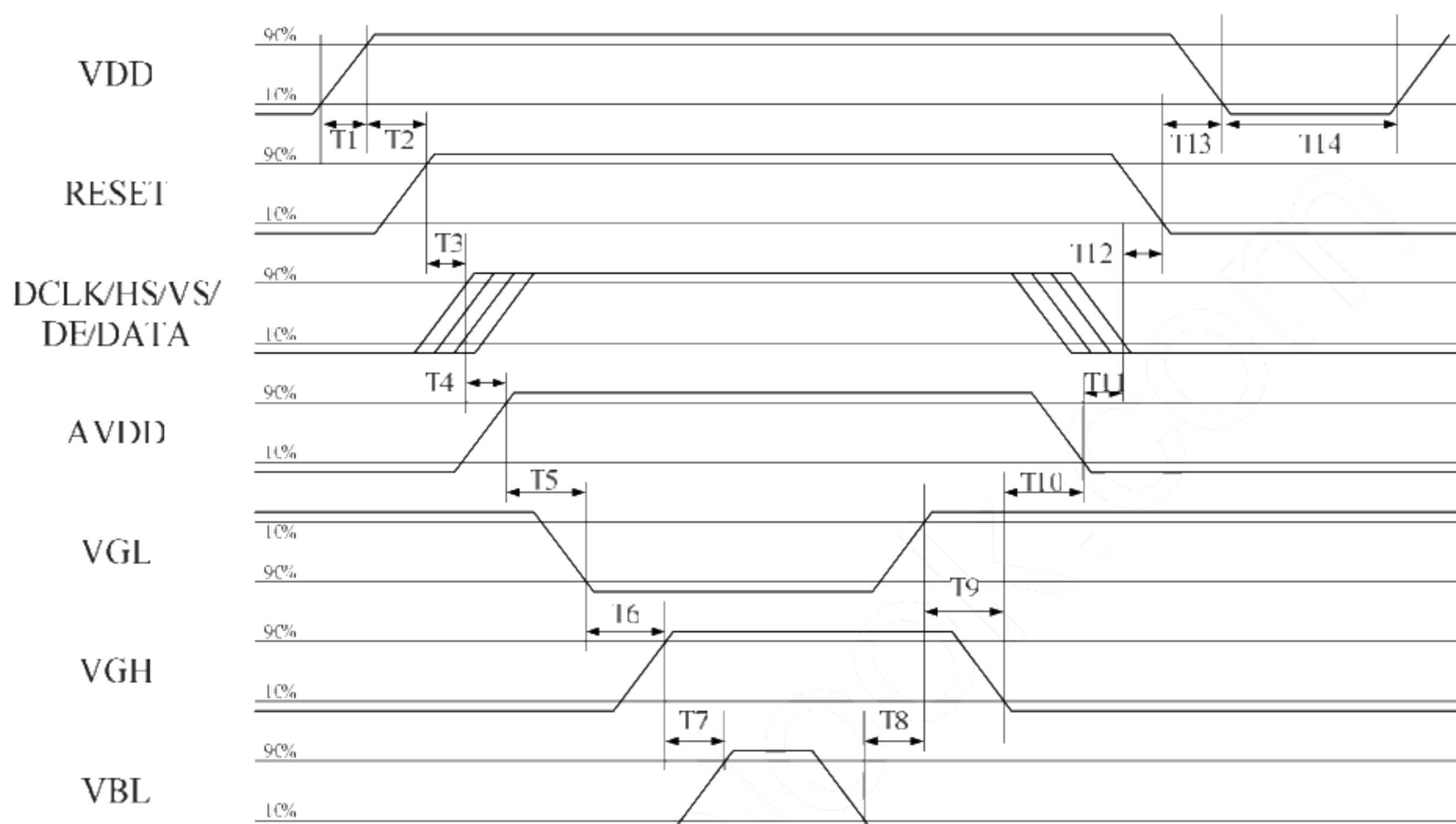
Fig. 6-8

d. Horizontal Timing of Input (HV Mode)



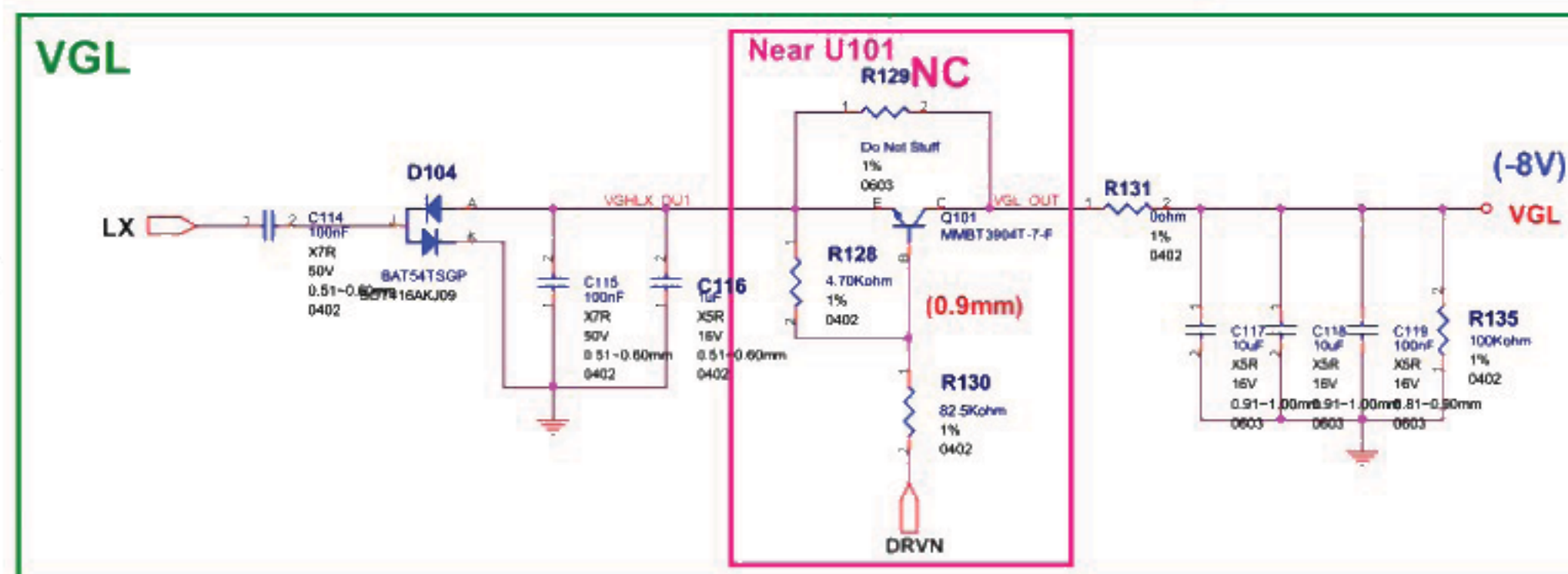
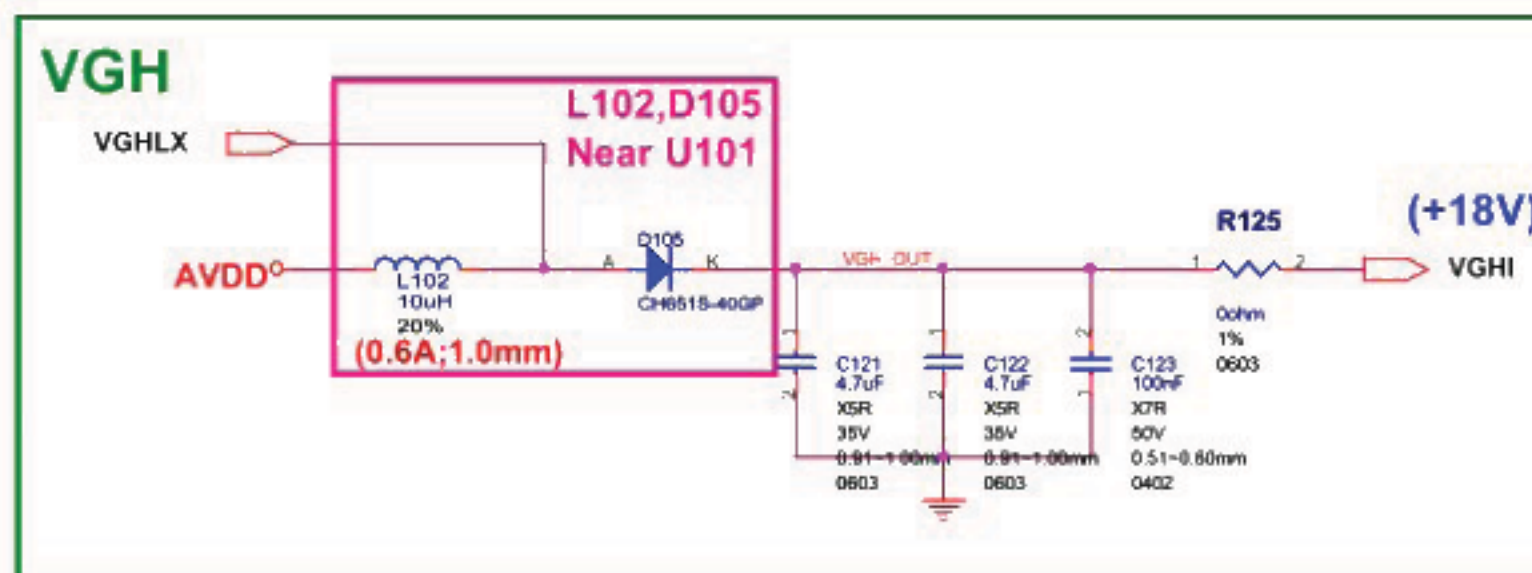
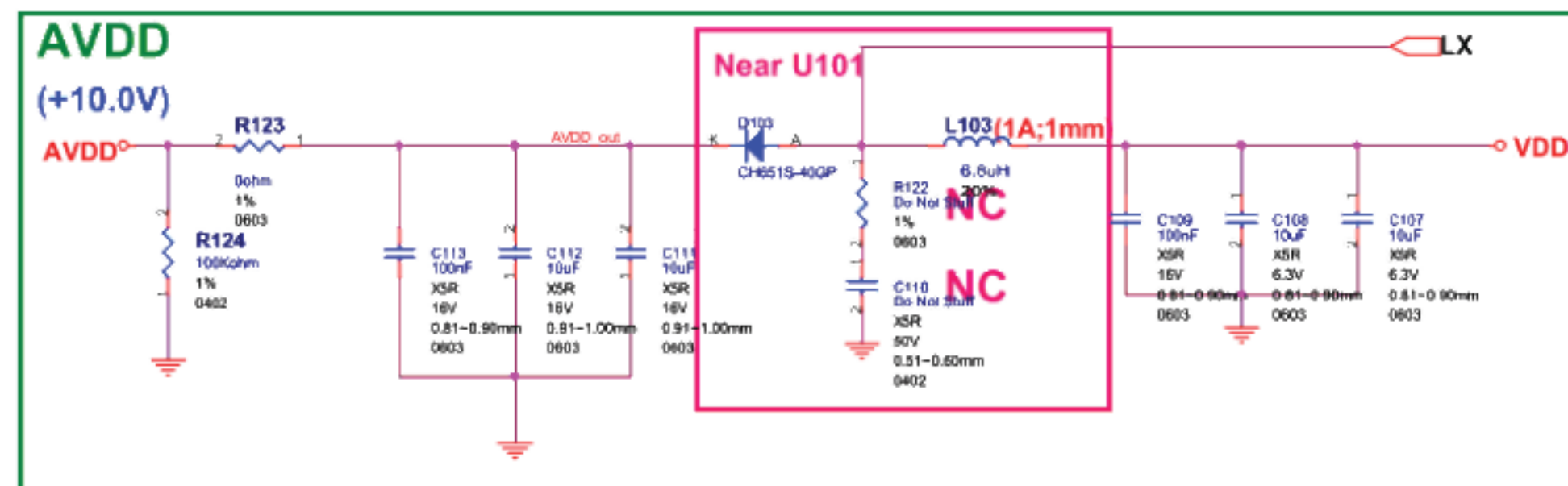
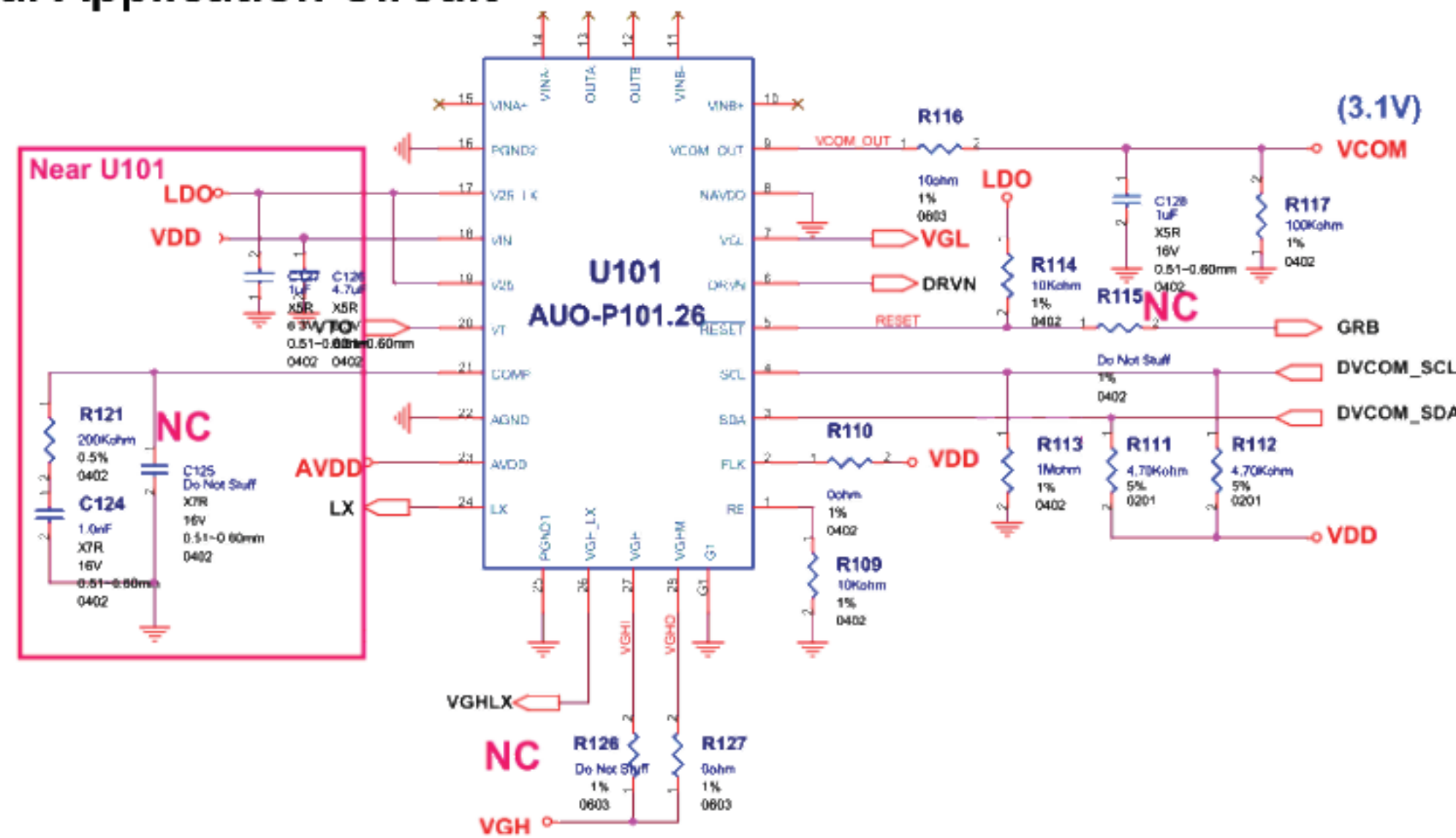
6.6 Power ON/OFF Sequence

The LCD adopts high voltage driver IC, so it could be permanently damaged under a wrong power on/off sequence. The suggested LCD power sequence is shown below:



Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	20	ms
T2	10	-	1000	us
T3	1	-	20	ms
T4	16	-	20	ms
T5	16	-	20	ms
T6	16	-	20	ms
T7	100	-	-	ms
T8	100	-	-	ms
T9	0	-	20	ms
T10	0	-	20	ms
T11	0	-	20	ms
T12	1	-	20	ms
T13	10	-	1000	us
T14	1000	-	-	ms

7. Typical Application Circuit





8. 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.

8.1 TFT LCD Module: Blacklight Connector

Connector Name / Designation	Signal Connector
Manufacturer	ENTERY or compatible
Connector Model Number	H201K-P02N-02B or compatible
Adaptable Plug	3802K-E02N-01R or compatible

Pin No.	Symbol	Description	Color
1	H	LED anode	Red
2	L	LED cathode	Black



9. 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	-30 °C, 300 hours	

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.



Product Specification

AU OPTRONICS CORPORATION

G101STN01.2

10. Mechanical Characteristics

10.1 LCM Outline Dimension (Front View)

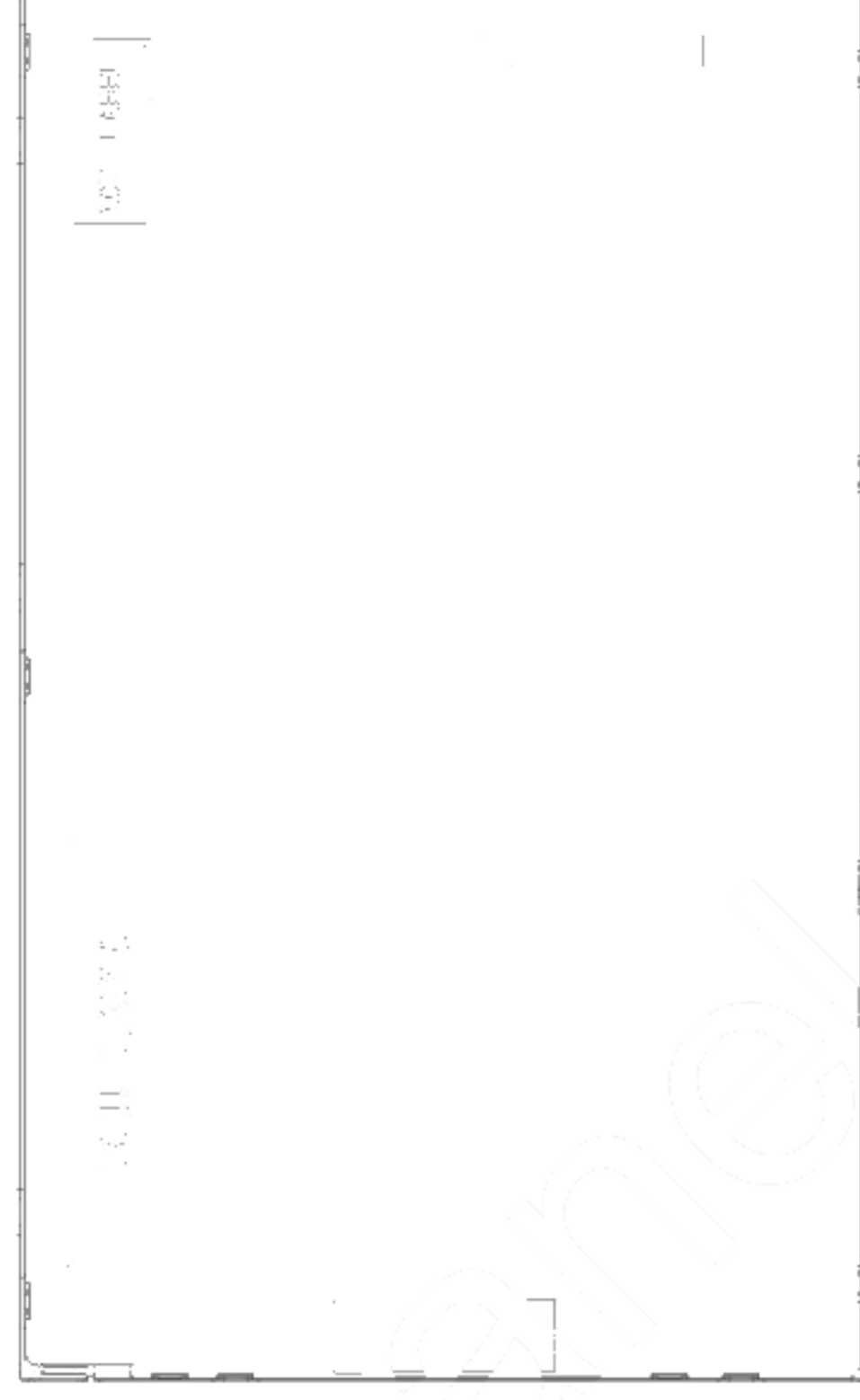


Product Specification

AU OPTRONICS CORPORATION

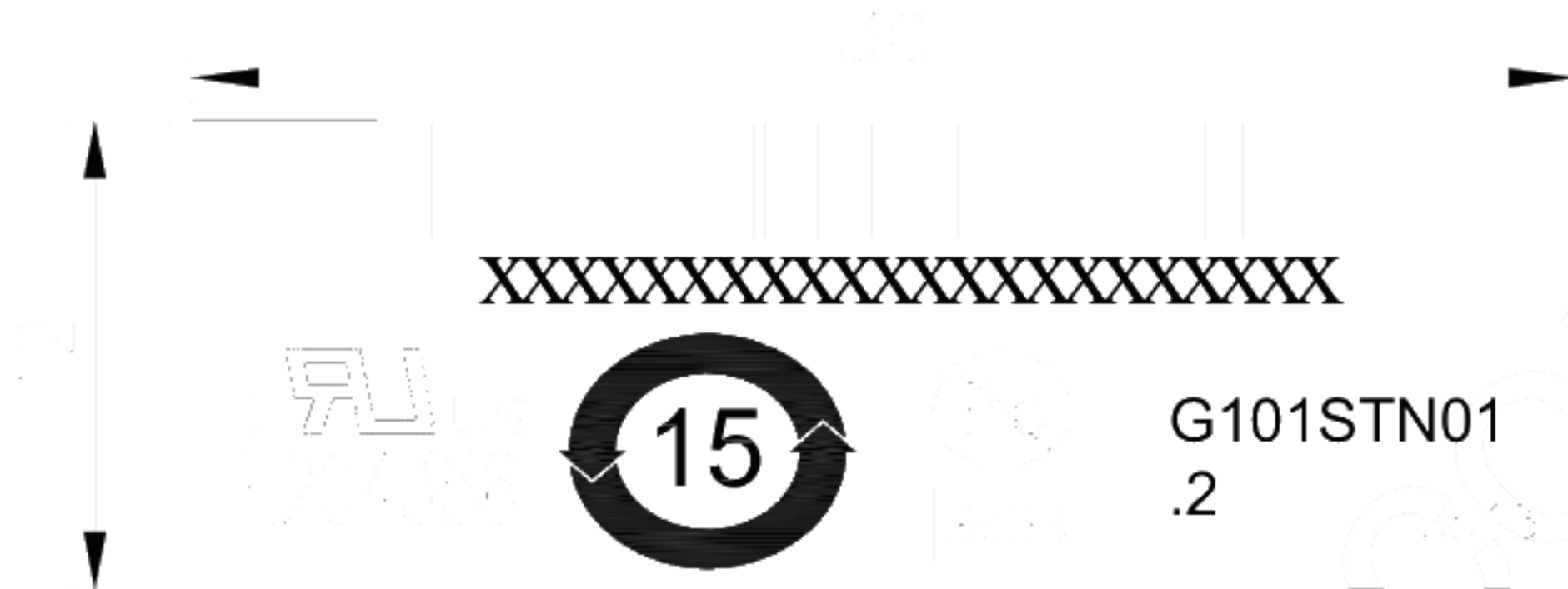
G101STN01.2

10.2 LCM Outline Dimension (Back View)

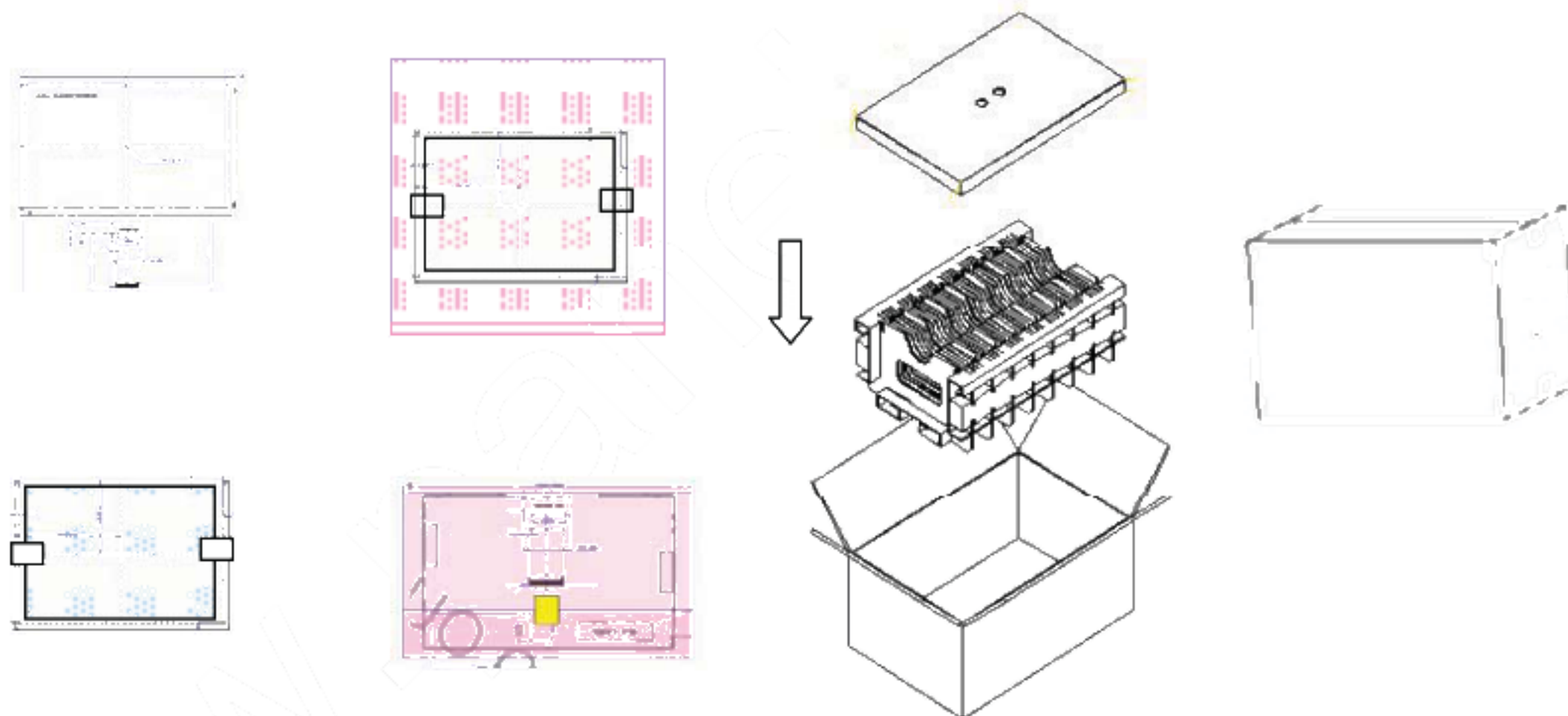


11. Label and Packaging

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



11.2 Carton Package



Max capacity : 35pcs TFT-LCD module per carton

Max weight: 9.9 kg per carton

Outside dimension of carton: 527*347*257mm

Pallet size : 1070mm*1070mm*135mm

Box stacked

Module by air : (2 *3) *5 layers , one pallet put 30 boxes , total 1050pcs module

Module by sea : (2 *3) *5 layers + (2 *3) *2 layers , two pallet put 42 boxes , total 1470pcs module

Module by sea_HQ : (2 *3) *5 layers+(2 *3) *3 layers, two pallet put 48 boxes, total 1680pcs module



12. Safety

12.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

12.2 Materials

12.2.1 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.

12.2.2 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.

12.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

12.4 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