

# SPECIFICATION FOR TFT MODULE

**Module No. : TFT050A102C**

**Customer No. :**

**Rev No. : A**

GTK	PREPARED BY	CHECKED BY	APPROVED BY
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DATE	2022.04.29	2022.04.29	2022.04.29

CUSTOMER APPROVAL	SIGNATURE	DATE

Notes :

- 1、 Please contact GTK before assigning your product based on this module specification.
  - 2、 To improve the quality of product, and this product specification is subject to change without any notice.
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## REVISION RECORD

Rev No.	Rev date	Contents	Remarks
O	2022-01-10	First release	Preliminary
A	2022-04-29	Update ALL content	All page

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## 1. GENERAL INFORMATION

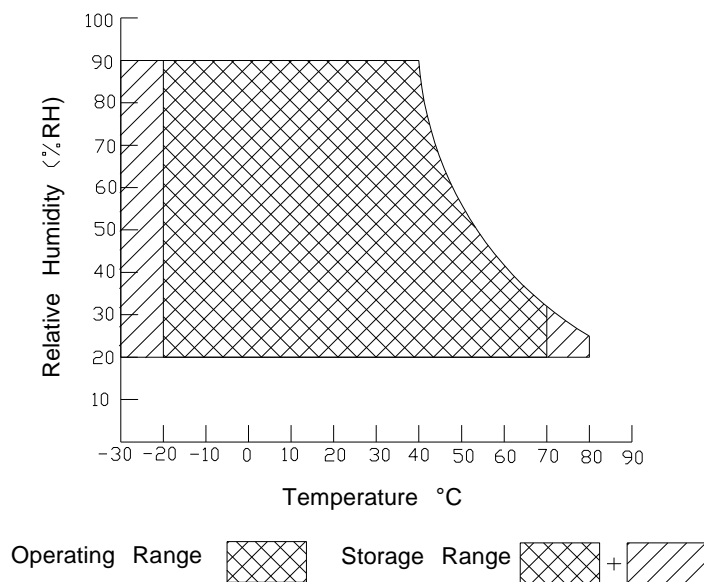
No.	Item	Contents	Unit
1	LCD size	5.0 inch (Diagonal)	/
2	Display mode	TN/NORMALLY WHITE/TRANSFLECTIVE	/
3	Viewing direction(eye)	6 O'clock	/
4	Gray scale inversion direction	12 O'clock	/
5	Resolution(H*V)	800 *480 Pixels	/
6	Module size (L*W*H)	120.70*75.90*3.00	mm
7	Active area (L*W)	108.00*64.80	mm
8	Pixel pitch (L*W)	0.135*0.135	mm
9	Interface type	RGB 24bit interface	/
10	Color Depth	16.2M	/
11	Module power consumption	TBD(Appr)	W
12	Back light type	EDGE&WHITE LED	/
13	Driver IC	ILI5960+ILI6123H-9G OR COMPATIBLE	/
14	Weight	TBD(Appr)	G

## 2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Power supply input voltage for TFT	VDD	-0.3	5.0	V	
Backlight current (normal temp.)	ILED	-	TBD	mA	
Operation temperature	Top	-20	+70	°C	Note1
Storage temperature	Tst	-30	+80	°C	Note1
Humidity	RH	20%	90%	RH	Note1

Note1 :

- 1).The relative humidity and temperature range are as below sketch,90%RH Max.
- 2).The maximum wet bulb temperature  $\leq 40^{\circ}\text{C}$  and without dewing.



### 3. ELECTRICAL CHARACTERISTICS

#### DC CHARACTERISTICS(at Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply input voltage	VDD	3.1	3.3	3.5	V	
I/O logic voltage	VDDIO	-	-	-	V	
Input voltage 'H' level	VIH	0.7VDD	-	VDD	V	
Input voltage 'L' level	VIL	VSS	-	0.3VDD	V	
Power supply current	IVDD	-	-	TBD	mA	
TFT gate on voltage	VGH	-	-	-	V	
TFT gate off voltage	VGL	-	-	-	V	
Analog power supply voltage	AVDD	-	-	-	V	
TFT common electrode voltage	VCOM	-	-	-	V	Note1

Note1 : The value is just the reference value. The customer can optimize the setting value by the different D-IC  
VCOM must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc..

### 4. BACKLIGHT CHARACTERISTICS

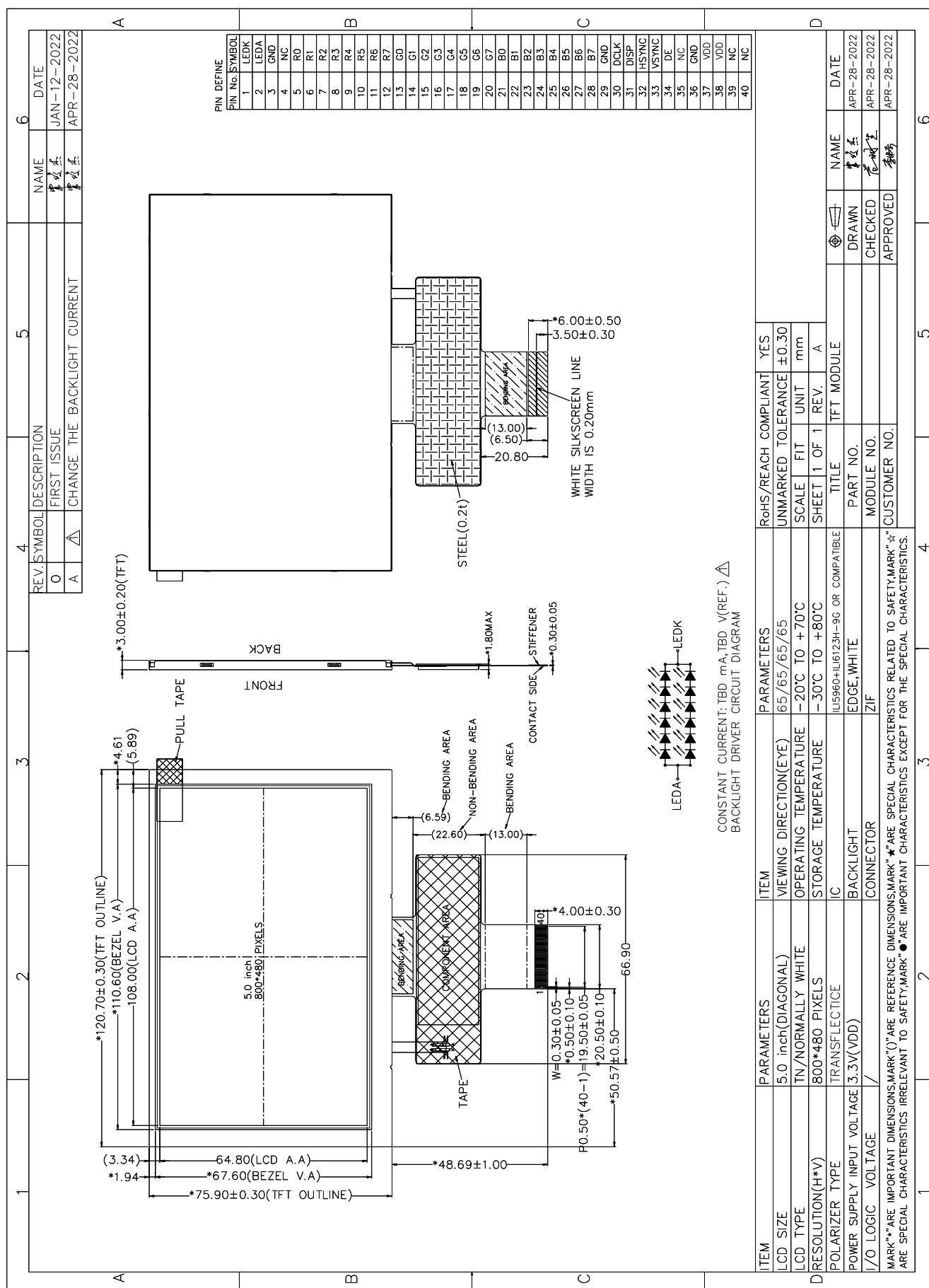
#### (at Ta=25°C,RH=60%)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED forward voltage	VF	-	TBD	-	V	
LED forward current	IF	-	TBD	-	mA	TBD
LED power consumption	PLED	-	TBD	-	W	Note1
Number of LED	-		12		PCS	
Connection mode	-	6 in series 2 in parallel			/	
LED life-time	-	-	30000	-	Hrs	Note2

Note1 : Calculator value for reference :  $IF \times VF = PLED$

Note2 : The LED life-time define as the estimated time to 50% degradation of initial brightness at Ta=25°C and IF =TBD mA. The LED lifetime could be decreased if operating IF is larger than TBD mA.

## 5. EXTERNAL DIMENSIONS



## 6. ELECTRO - OPTICAL CHARACTERISTICS

### 6.1 Optical Specification(Transmittance, FOG+Backlight)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time	Tr+ Tf	-	-	30	-	ms	FIG.1	Note 1
Contrast ratio	Cr		-	40	-	-	FIG.2	Note 2
Surface luminance	Lv	$\theta=0^\circ$	-	40	-	cd/m <sup>2</sup>	FIG.2	Note 3
Luminance uniformity	Yu	$\theta=0^\circ$	75	80	-	%	FIG.2	Note 4
NTSC	-	$\theta=0^\circ$	-	3.5	-	%	FIG.2	Note 5
Viewing angle	$\theta$	$\phi=90^\circ$	-	65	-	deg	FIG.3	Note 6
		$\phi=270^\circ$	-	65	-	deg	FIG.3	
		$\phi=0^\circ$	-	35	-	deg	FIG.3	
		$\phi=180^\circ$	-	55	-	deg	FIG.3	
CIE (x,y) chromaticity	Red x	$\theta=0^\circ$ $\phi=0^\circ$ Ta=25°C	Typ +0.05	TBD	Typ +0.05	-	FIG.2 CIE1931	Note 5
	Red y			TBD		-		
	Green x			TBD		-		
	Green y			TBD		-		
	Blue x			TBD		-		
	Blue y			TBD		-		
	White x			TBD		-		
	White y			TBD		-		

### 6.2 Optical Specification(Reflective, FOG+D65 light)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time	Tr+ Tf	-	-	30	-	ms	FIG.1	-
Contrast ratio	Cr		-	TBD	-	-	-	-
Surface luminance	Lv	$\theta=0^\circ$	-	TBD	-	cd/m <sup>2</sup>	-	-
Luminance uniformity	Yu	$\theta=0^\circ$	-	TBD	-	%	-	-
NTSC	-	$\theta=0^\circ$	-	TBD	-	%	-	-
Viewing angle	$\theta$	$\phi=90^\circ$	-	65	-	deg	-	-
		$\phi=270^\circ$	-	65	-	deg	-	
		$\phi=0^\circ$	-	65	-	deg	-	
		$\phi=180^\circ$	-	65	-	deg	-	
CIE (x,y) chromaticity	Red x	$\theta=0^\circ$ $\phi=0^\circ$ Ta=25°C	Typ -0.05	TBD	Typ +0.05	-	-	-
	Red y			TBD		-		
	Green x			TBD		-		
	Green y			TBD		-		
	Blue x			TBD		-		
	Blue y			TBD		-		
	White x			TBD		-		
	White y			TBD		-		

#### Note1. Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black”state.Rise time (T<sub>ON</sub>) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T<sub>OFF</sub>) is the time between photo detector output intensity changed from 10% to 90%. For additional information see FIG1.

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**Note2.Definition of contrast ratio**

Contrast ratio(Cr) is defined mathematically by the following formula.  
For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Measured at the center area of the LCD

**Note3.Definition of surface luminance**

Surface luminance is the luminance with all pixels displaying white.

For more information see FIG.2.

$L_v$  = Average Surface Luminance with all white pixels( $P_1, P_2, P_3, \dots, P_n$ )

**Note4.Definition of luminance uniformity**

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

$$Y_u = \frac{\text{Minimum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}{\text{Maximum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}$$

**Note5. Definition of color chromaticity (CIE1931)**

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

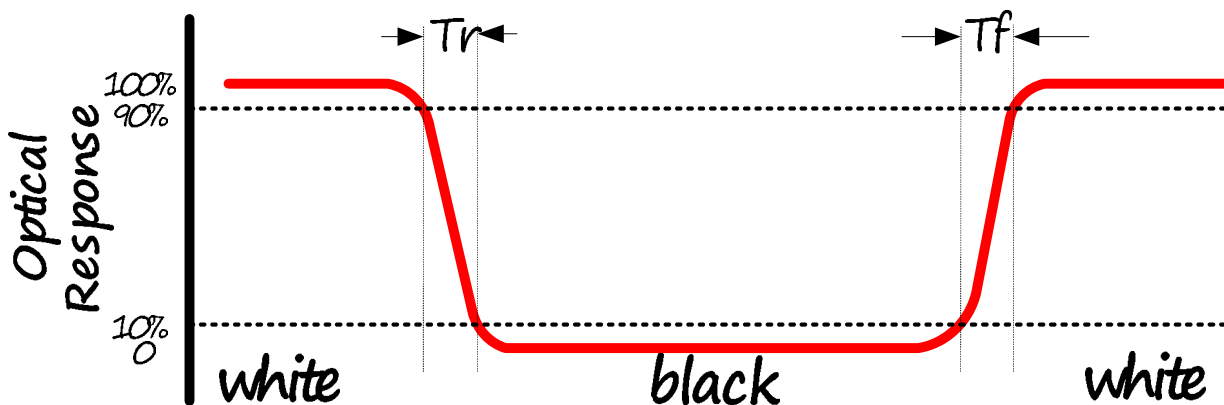
**Note6. Definition of viewing angle**

Viewing angle is the angle at which the contrast ratio is greater than 10. angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.

For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope or DMS series Instruments or compatible. For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is base on TOPCON's BM-5 or BM-7 photo detector or compatible.

**FIG.1. The definition of response Time**





**FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity**

Note : The TFT module should be stabilized at a given temperature for 10 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 10 minutes in a windless room.

H,V : Active area

Light spot size  $\varnothing=5\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCM surface to detector lens.

Test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-7 or compatible ,see Figure b.

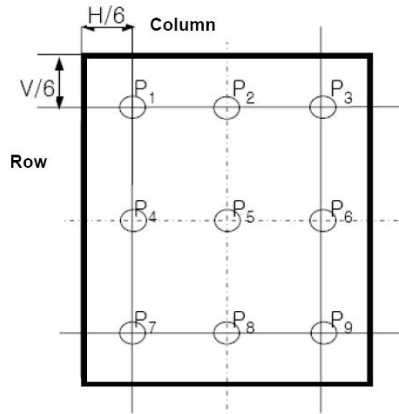


Figure a

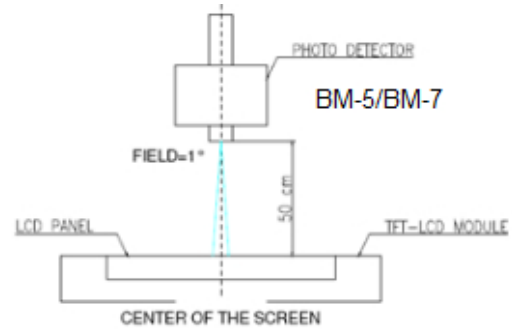
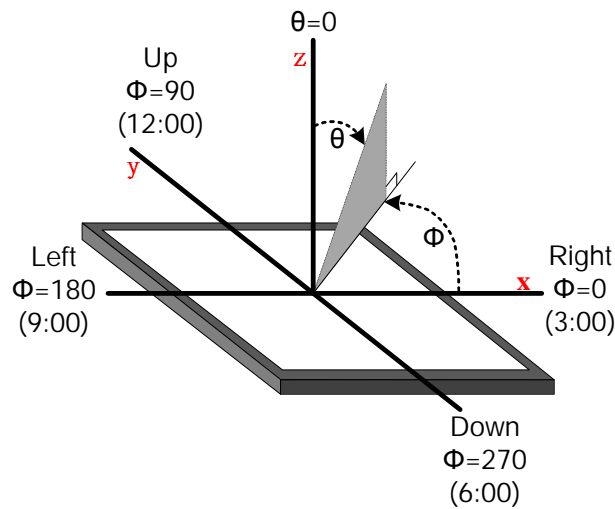


Figure b

**FIG.3. The definition of viewing angle**



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## 7. INTERFACE DESCRIPTION

### Module Interface description

Interface No.	Name	I/O or connect to	Description
1	LEDK	P	Power for LED backlight(Cathode)
2	LEDA	P	Power for LED backlight(Anode)
3	GND	P	Ground
4	NC	/	/
5-12	Red(0-7)	I	Red data
13-20	Green(0-7)	I	Green data
21-28	Blue(0-7)	I	Blue data
29	GND	I	Ground
30	DCLK	I	Dot clock
31	DISP	I	Display on/off
32	HSYNC	I	Horizontal sync input.
33	VSYNC	I	Vertical sync input
34	DE	I	Data enable
35	NC	/	/
36	GND	P	Power ground
37-38	VDD	P	Power for LCD
39	NC	/	/
40	NC	/	/

**I:** input, **O:** output, **P:** Power, **NC:** No connection

## 8. AC CHARACTERISTICS

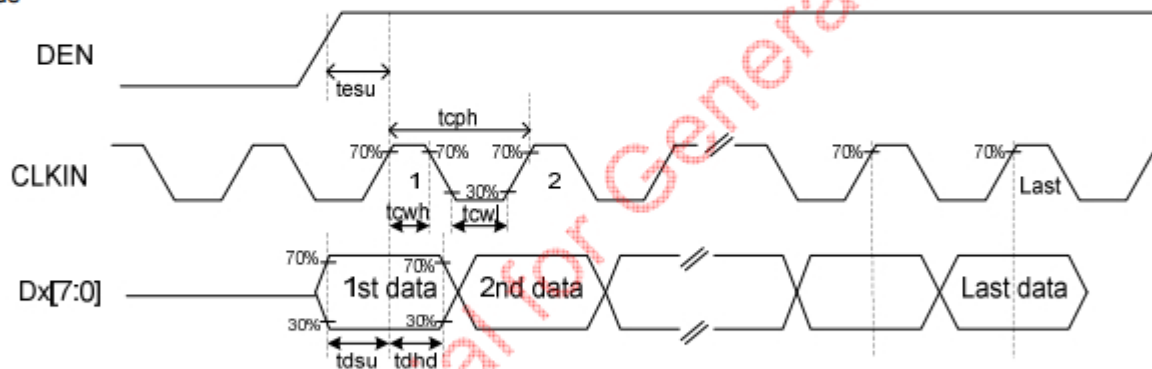
ILI6123H

### 16.1. Parallel 24-bit RGB Mode

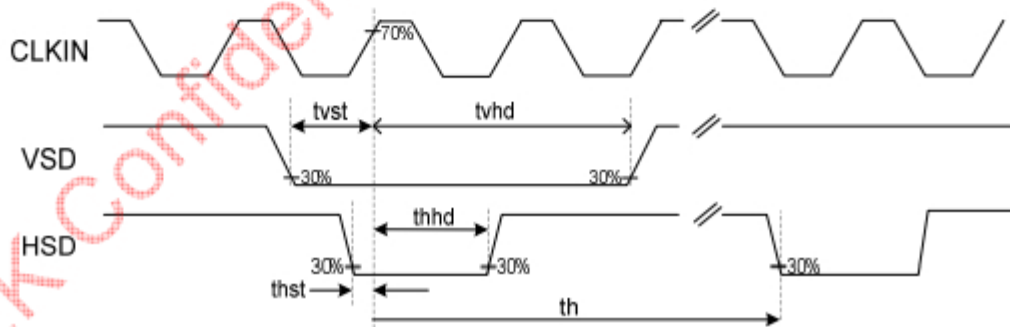
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN Frequency	Fclk	-	40	50	MHz	VDD = 3.0V ~3.6V
CLKIN Cycle Time	Tclk	20	25	-	ns	
CLKIN Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso	-	64	-	CLKIN	
Time from HSD to LD	Thld	-	64	-	CLKIN	
Time from HSD to STV	Thstv	-	2	-	CLKIN	
Time from HSD to CKV	Thckv	-	20	-	CLKIN	
Time from HSD to OEV	Thoev	-	4	-	CLKIN	
LD Pulse Width	Twld	-	10	-	CLKIN	
CKV Pulse Width	Twckv	-	66	-	CLKIN	
OEV Pulse Width	Twoev	-	74	-	CLKIN	

### 16.2. Input Clock and Data Timing Diagram

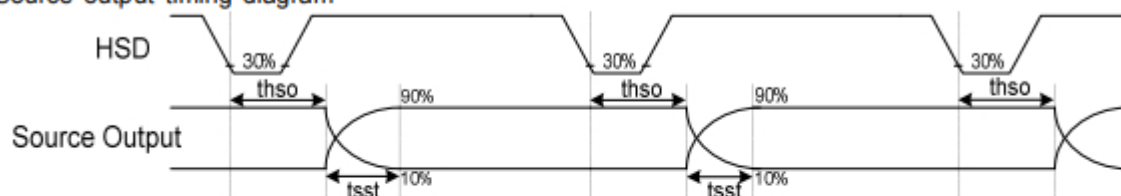
DE Mode



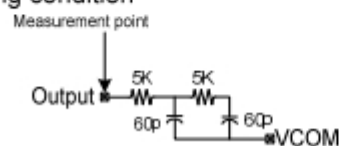
HV Mode



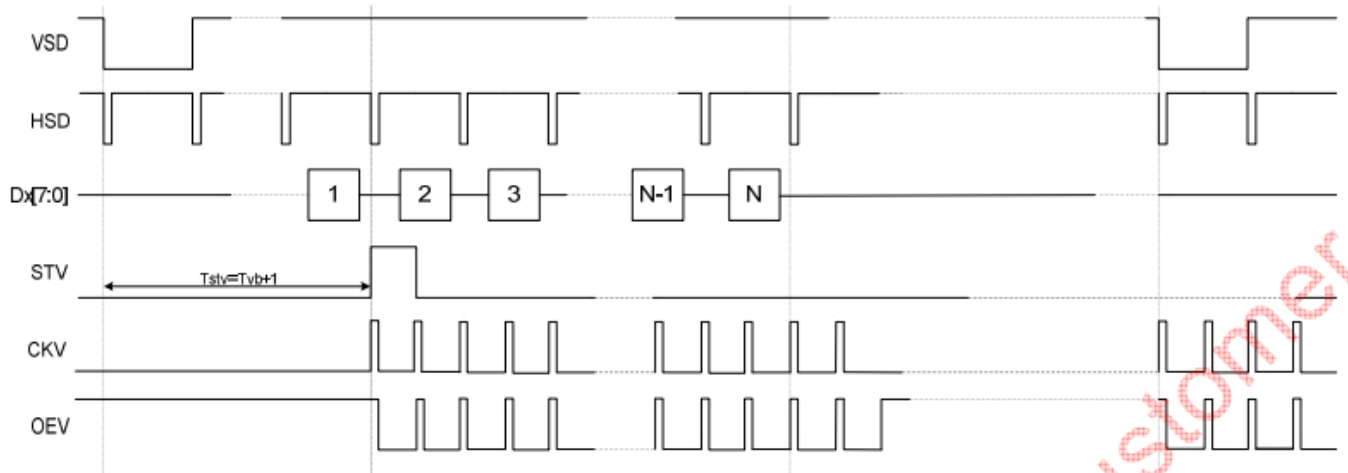
Source output timing diagram



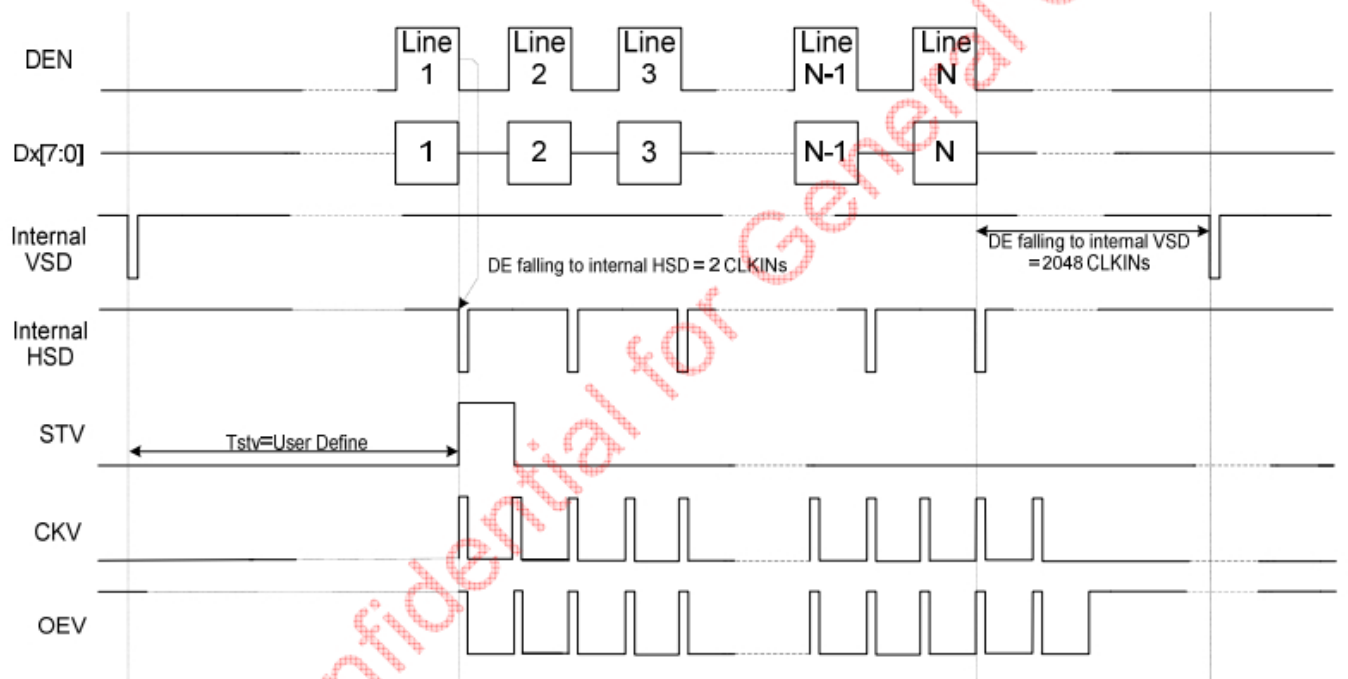
Output Loading condition



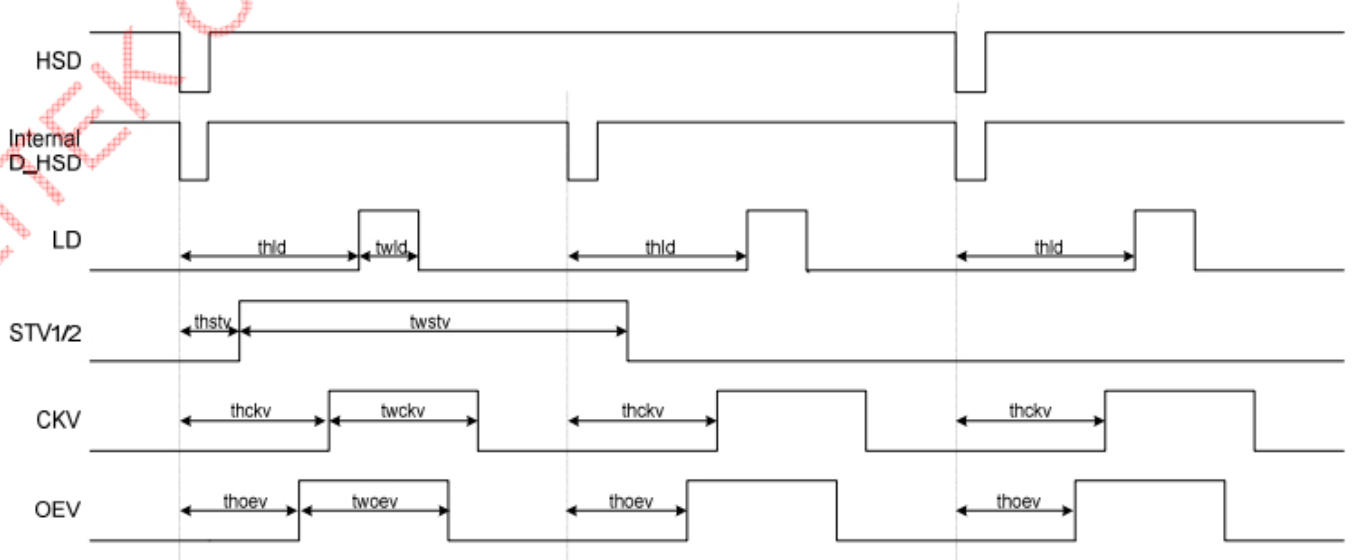
### Vertical Timing Diagram of HV Mode (Dual Gate)



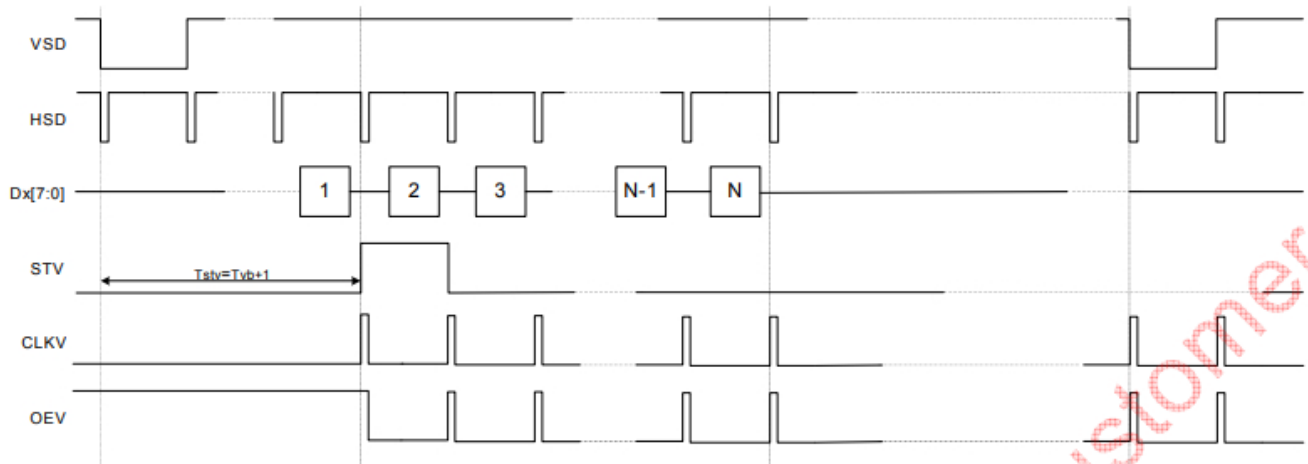
### Vertical Timing Diagram of DE Mode (Dual Gate)



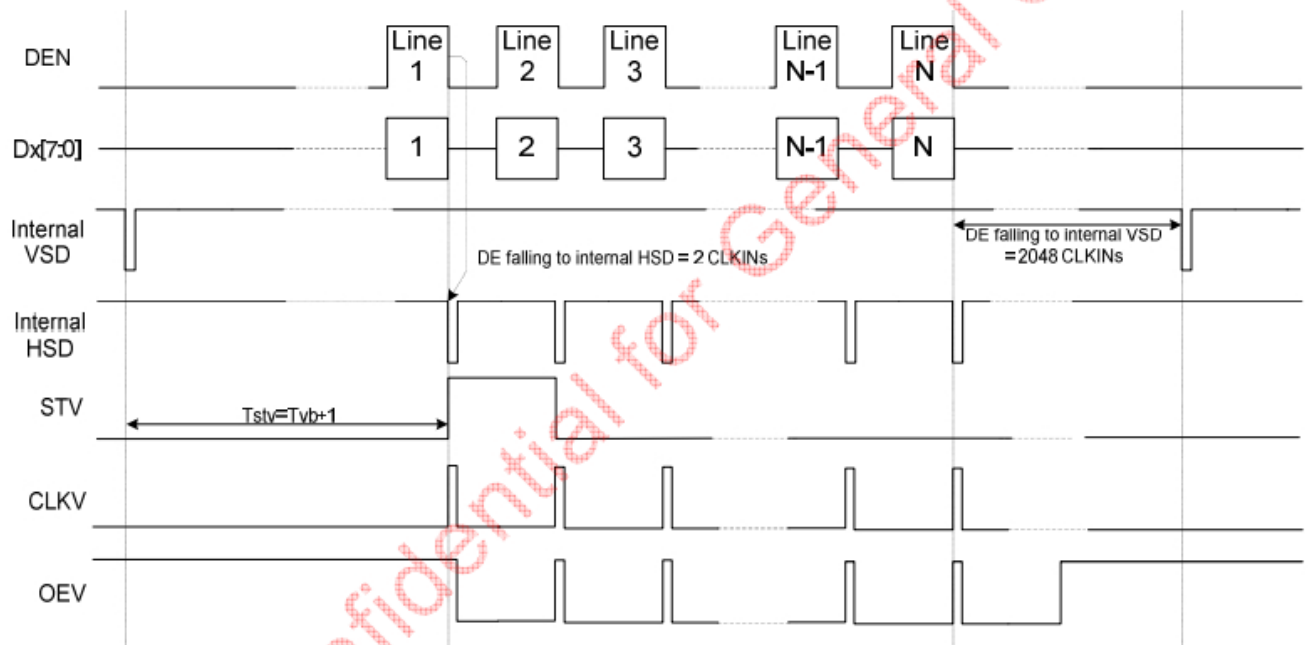
### Gate Output Timing Diagram (Dual Gate)



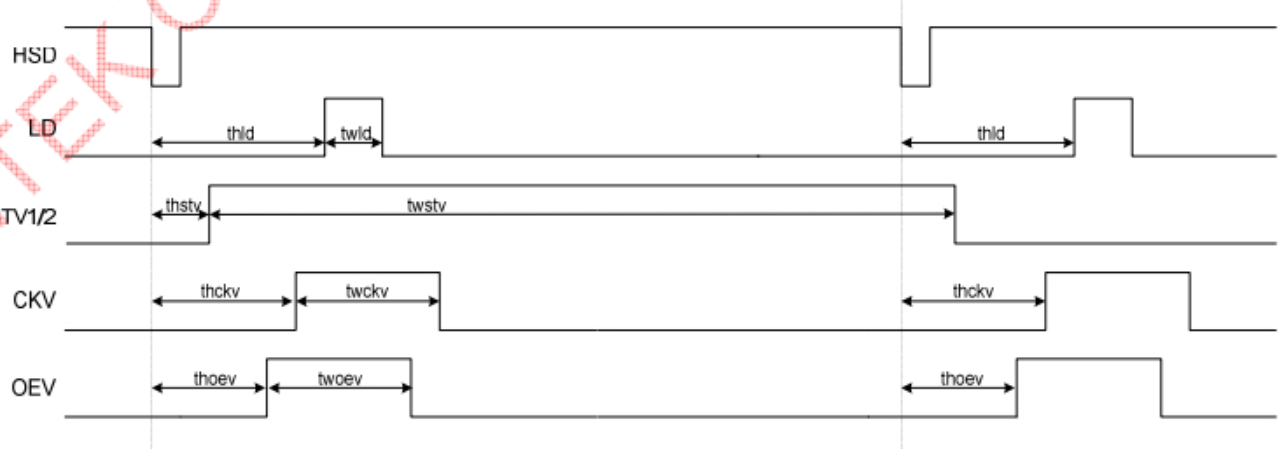
### Vertical Timing Diagram of HV Mode (Cascade)



### Vertical Timing Diagram of DE Mode (Cascade)



### Gate Output Timing Diagram (Cascade)

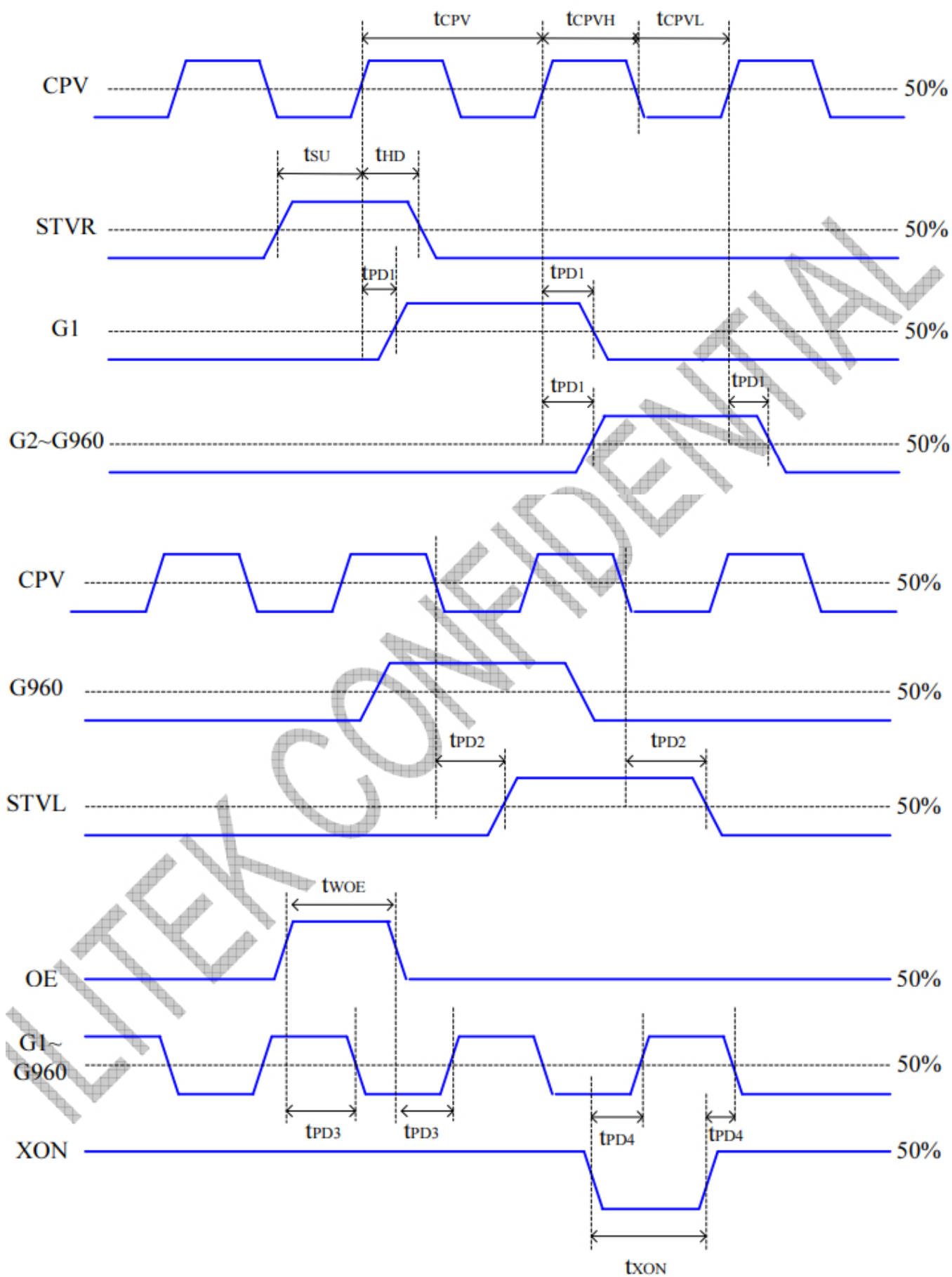


( VGH=25V, VEE=-15V, VDD=3.3V, VSS=0V, TA=25°C)

Parameter	Symbol	Condition	Spec			Unit
			Min	Typ	Max	
CPV period	tCPV	-	5	-	-	μs
CPV pulse width	tCPVH, tCPVL	50% duty cycle	2.5	-	-	μs
OE pulse width	tWOE	-	1	-	-	μs
XON pulse width	tXON	-	10	-	-	μs
Data setup time	tSU	-	0.7	-	-	μs
Data hold time	tHD	-	0.7	-	-	μs
CPV to output delay time	tPD1	CL=200pF	-	-	1	μs
Start pulse output delay time	tPD2	CL=20pF	-	-	0.8	μs
OE to output delay time	tPD3	CL=200pF	-	-	0.8	μs
XON to output delay time	tPD4	CL=200pF	-	-	30	μs
Power-On Reset Slew Time	tPOR	From 10% to 90% VDD	-	-		ms
VDD to VEE Time	tDTE	From 10% VDD to 90% VEE	0			ms
VEE to VDD Time	tETD	From 10% VEE to 90% VDD	0			ms
VEE to VGH Time	tETG	From 10% VEE to 10% VGH	1			ms
VGH to VEE Time	tGTE	From 10% VGH to 10% VEE	1			ms
VGH Rising Time	tGGR (1)	From 10% to 90% VGH	teef			ms

Note: The measurement point for all of signals is 50% with input and output amplitude.

Note(1):teef=> VEE Falling Time, From 10% to 90% VEE



## 9. POWER SEQUENCE

To prevent the device damage from latch up and Improve subjective display effect, the power ON/OFF sequence shown below must be followed.

ILI6123H

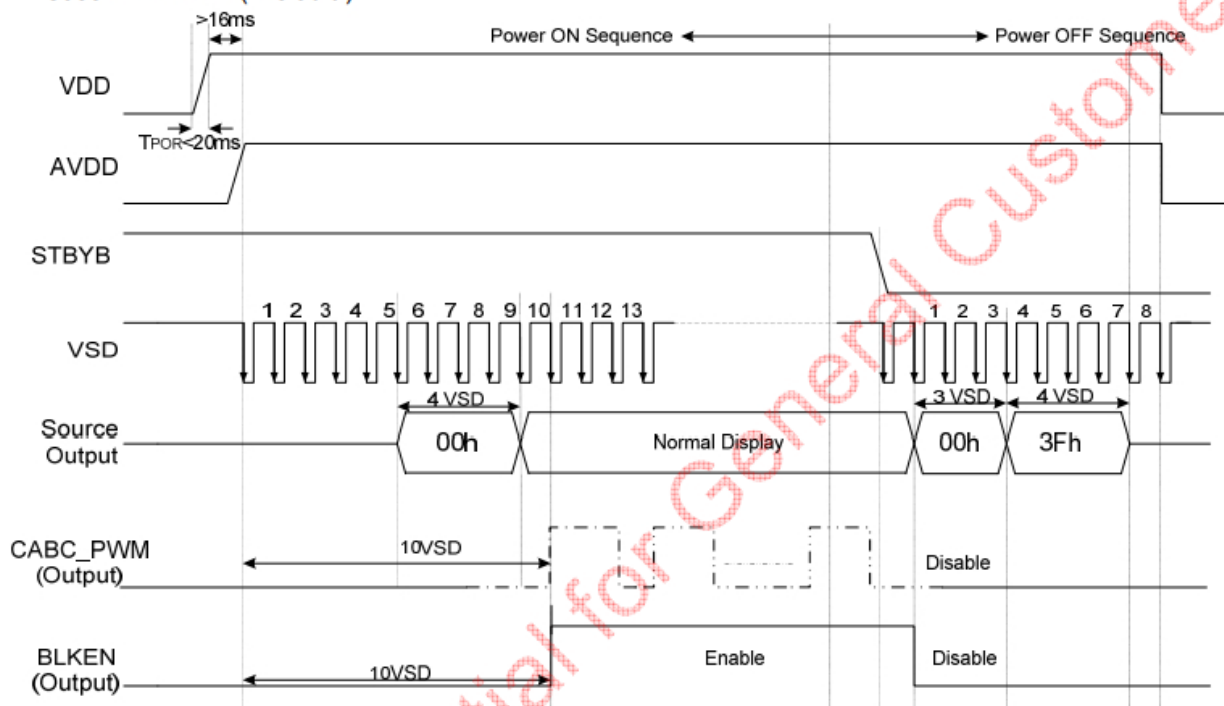
To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.

Power ON: VDD, DGND → AVDD, AGND → V1 to V14

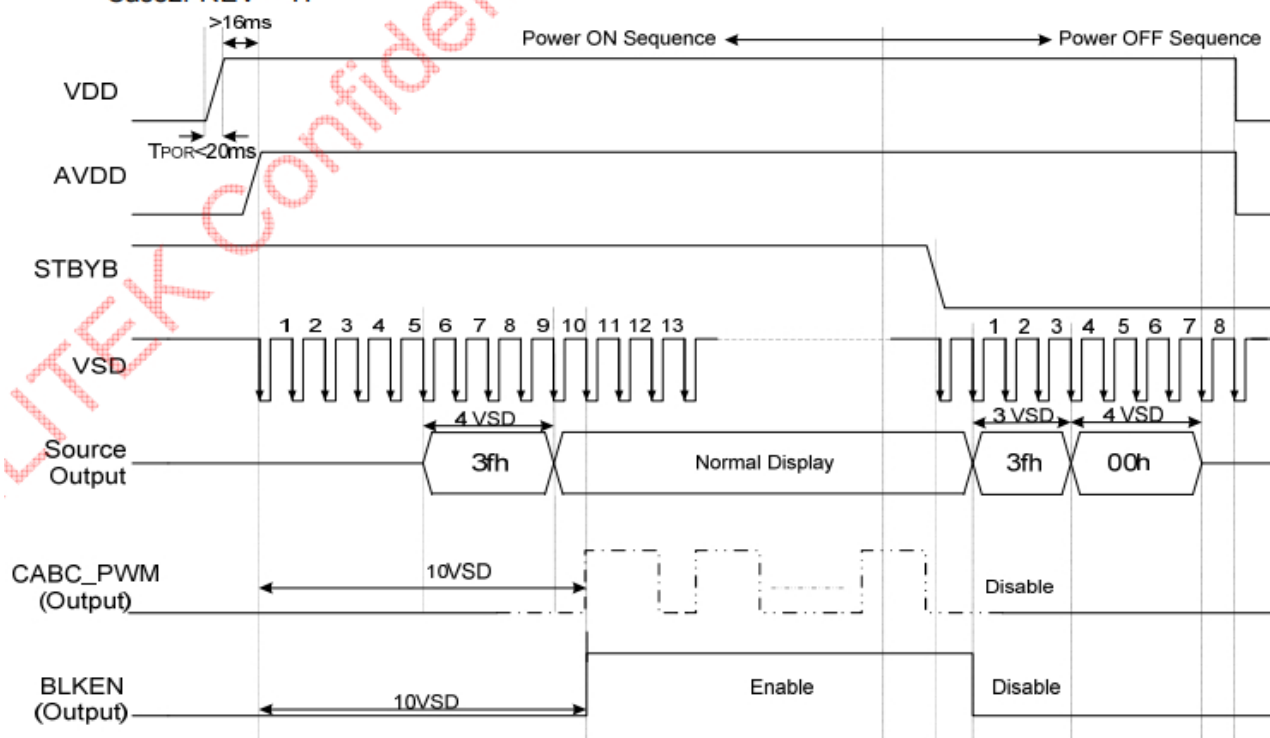
Power OFF: V1 to V14 → AVDD, AGND → VDD, DGND

In order to prevent ILI6123 from power ON reset fail, the rising time ( $t_{POR}$ ) of the digital power supply VDD should be maintained within given specifications. The power ON/OFF timing sequence is illustrated as below:

Case1: REV = L ( Default )



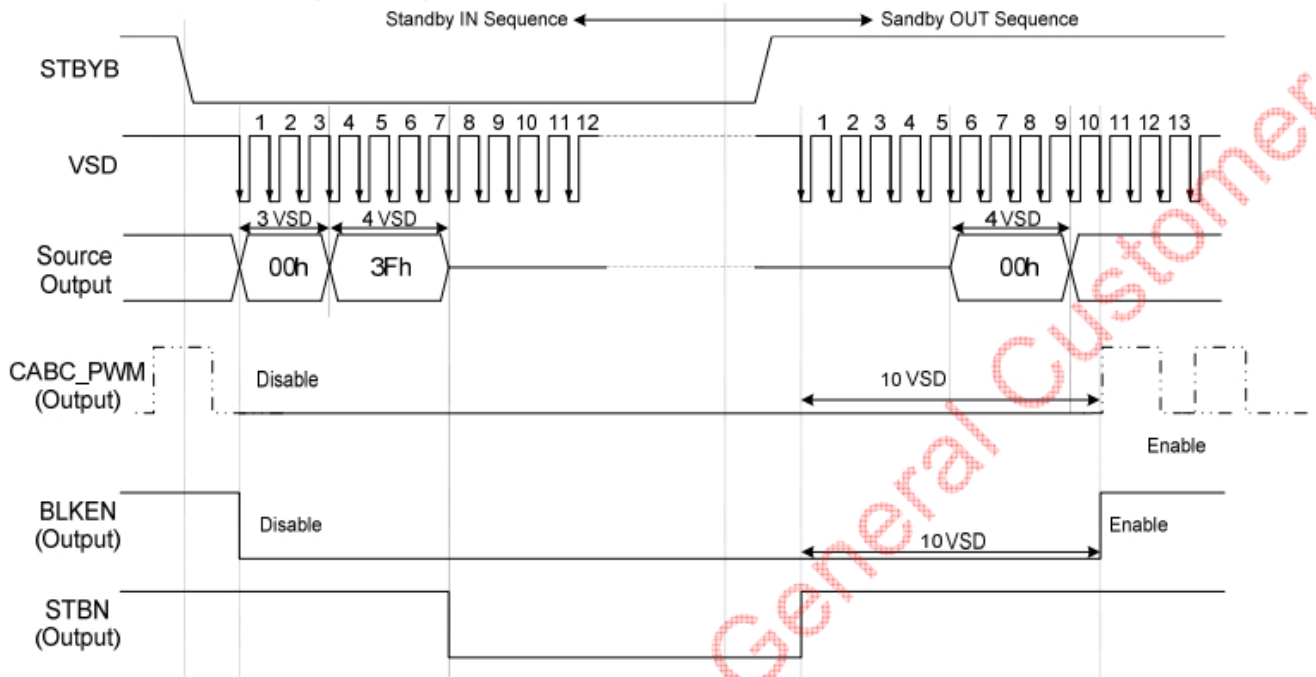
Case2: REV = H



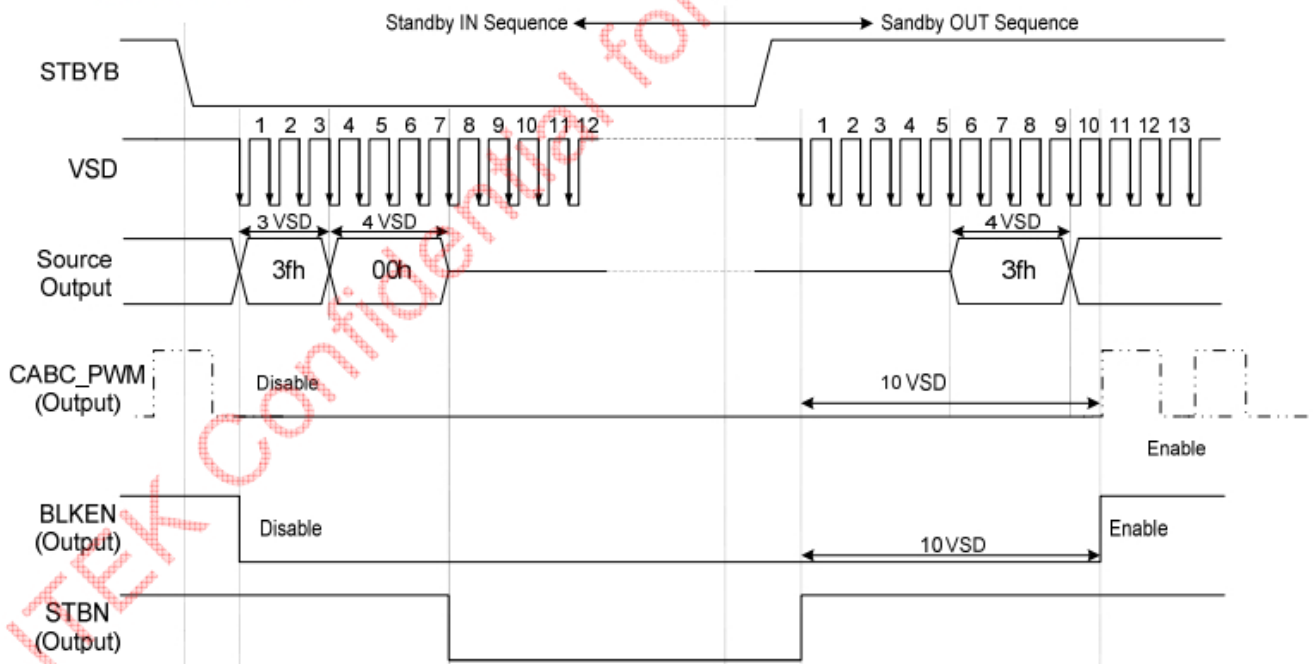


ILI6123 supports Standby mode for saving power consumption, the source driver will turn off and all source output channel will be Hi-Z state when chip in Standby mode. The Standby mode can be controlled via STBYB pin and the Standby ON/FF timing sequence is illustrated as below:

Case1: REV = L ( Default )



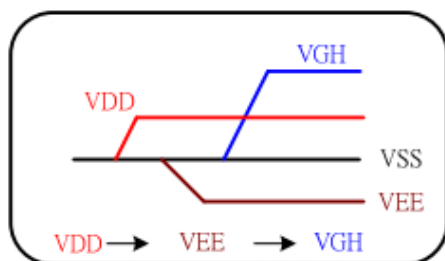
Case2: REV = H



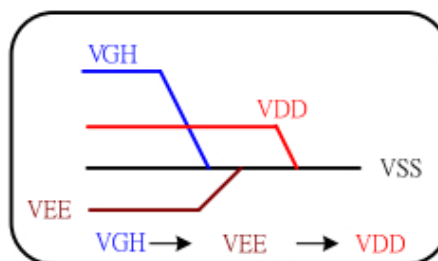
To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.

Power ON: VDD → VEE → VGH

Power OFF: VGH → VEE → VDD



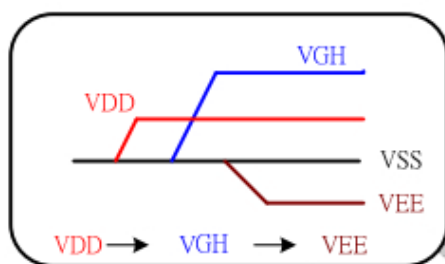
Power ON Sequence



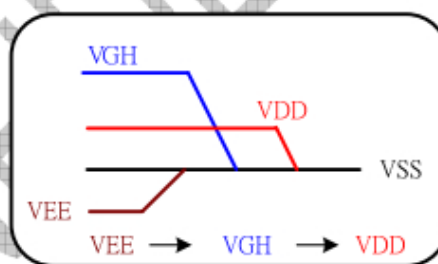
Power OFF Sequence

Power ON: VDD → VGH → VEE

Power OFF: VEE → VGH → VDD

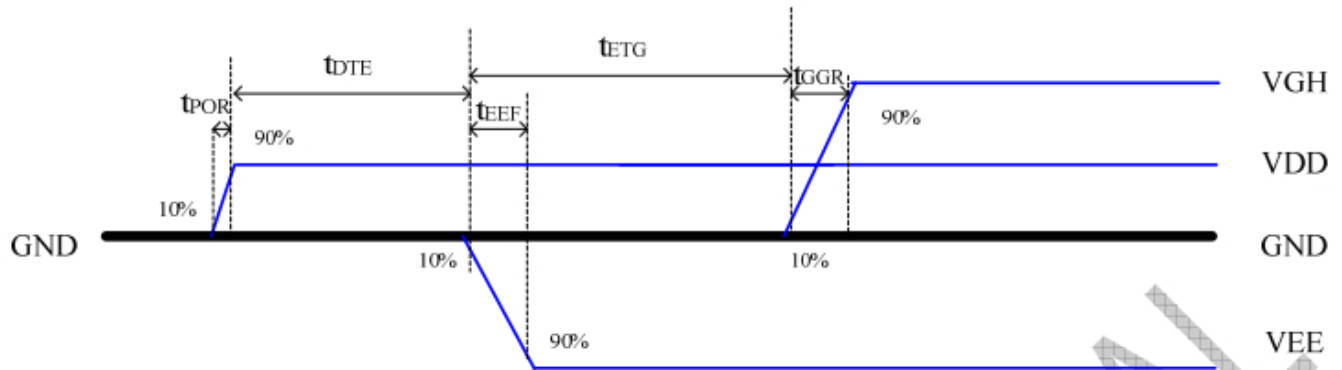


Power ON Sequence

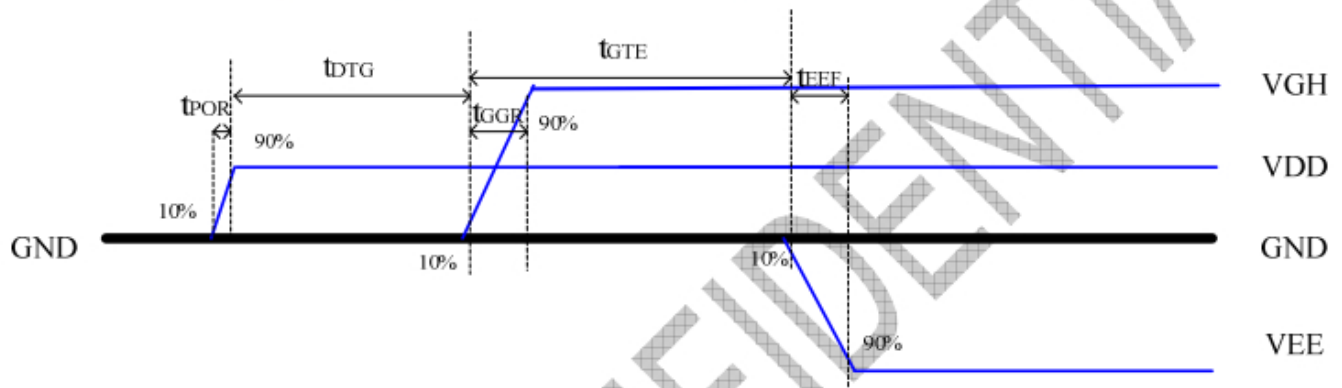


Power OFF Sequence

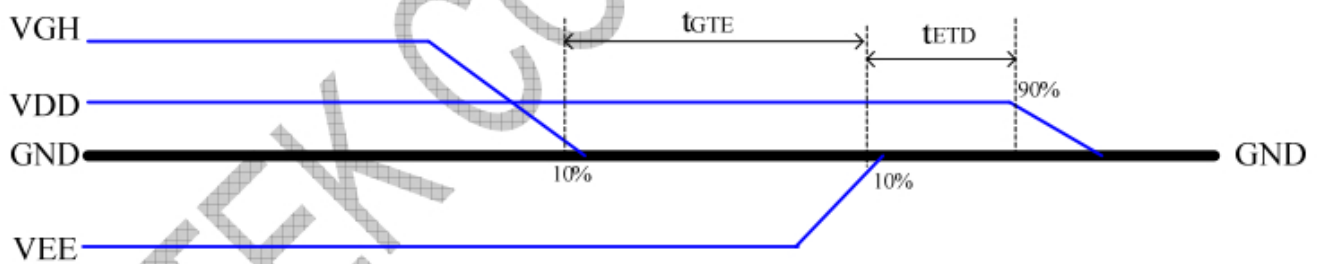
### Power on sequence (VDD → VEE → VGH)



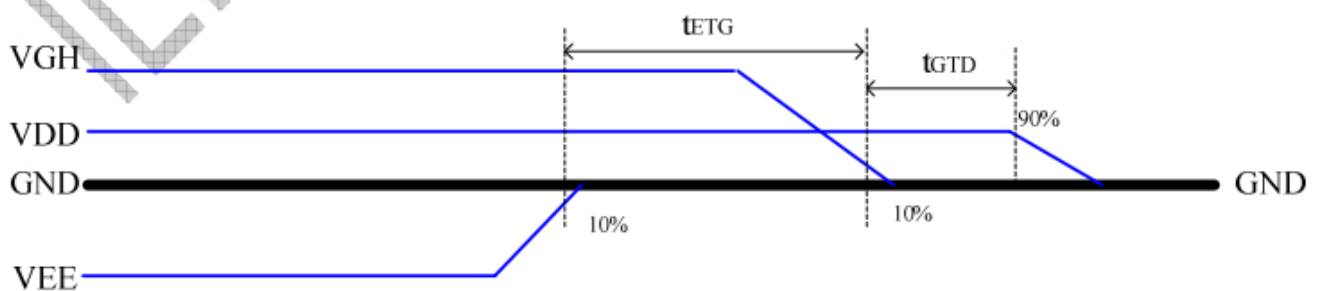
### Power on sequence (VDD → VGH → VEE)



### Power off sequence (VGH → VEE → VDD)



### Power off sequence (VEE → VGH → VDD)



## 10. RELIABILITY TEST CONDITIONS

No.	Test item	Test condition		Inspection after test
11.1	High temperature storage test	+80°C/240 hours		Inspection after 2~4hours storage at room temperature, the sample shall be free from defects : 1.Current changing value before test and after test is 50% larger; 2. Function defect : Non-display,abnormal-d isplay,missing lines, Short lines,ITO corrosion; 3.Visual defect : Air bubble in the LCD,Seal leak,Glass crack.
11.2	Low temperature storage test	-30°C/240 hours		
11.3	High temperature operating test	+70°C/120 hours		
11.4	Low temperature operating test	-20°C/120 hours		
11.5	Temperature cycle storage test	-30°C ~ 25°C ~ +80°C/10cycles (30min.) (10min.) (30min.)		
11.6	High temperature high humidity test	+50°C*90% RH/120 hours		
11.7	Vibration test	Frequency : 250 r/min Amplitude : 1 inch Time: 45min		
11.8	Drop test	Drop direction: 1 corner/3 edges/6 sides 10 times		
		Packing weight(kg)	Drop height(cm)	
		<11	80±1.6	
		11 ≦ G<21	60±1.2	
		21 ≦ G<31	50±1.0	
		31 ≦ G<40	40±0.8	

### Remark :

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 3~5pcs.
- 3.For High temperature high humidity test, Pure water(Resistance>10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.B/L evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence B/L has.
- 6.Failure judgment criterion: Basic specification, Electrical characteristic, Mechanical characteristic, Optical characteristic.
- 7.After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

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## 11.INSPECTION CRITERION

TBD

## 12. HANDLING PRECAUTIONS

### 12.1 Mounting method

The LCD module consists of two thin glass plates with polarizes which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

### 12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly :

- .Isopropyl alcohol
- .Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent :

- .Water
- .Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated :

- .Soldering flux
- .Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

### 12.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you :

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### 12.4 Packing

Module employs LCD elements and must be treated as such.

- .Avoid intense shock and falls from a height.
- .To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

### 12.5 Caution for operation

- .It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- .An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- .Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- .If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- .A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
- .Usage under the maximum operating temperature, 50%Rh or less is required.
- .When fixed patterns are displayed for a long time, remnant image is likely to occur.

### 12.6 Storage

In the case of storing for a long period of time for instance, for years for the purpose of replacement use, the following ways are recommended.

- .Storing in an ambient temperature 10°C to 30°C, and in a relative humidity of 45% to 75%. Don't expose to sunlight or fluorescent light.
- .Storing in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- .Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.

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- .Storing with no touch on polarizer surface by the anything else.

It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

### **12.7 Safety**

- .It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- .When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

## **13. PRECAUTION FOR USE**

**13.1** A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

**13.2** On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- .When a question is arisen in this specification.
- .When a new problem is arisen which is not specified in this specifications.
- .When an inspection specifications change or operating condition change in customer is reported to GTK, and some problem is arisen in this specification due to the change.
- .When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

## **14. PACKING SPECIFICATION**

Please consult our technical department for detail information.

## **15. INITIALIZATION CODE**

Please consult our technical department for detail information.

## **16. HSF COMPLIANCE**

- .This products complies with ROHS 2011/65/EU and 2015/863/EU 、 REACH 1907/2006/EC requirements, and the packaging complies with 94-62-EC.