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SPEC. NUMBER

PRODUCT GROUP

REV.

DATE

PAGE

TFT-LCD

0

2019.07.31

1 /32

ZV055FHM-NB0-18P0 Product Specification Rev.P0

Buyer	
Supplier	BEIJING BOE Optoelectronics Technology CO., LTD
FG-Code	ZV055FHM-NB0-18P0(5.5FHD 0.4t Cell)

ITEM	SIGNATURE	DATE
Approved	_____	_____
Reviewed	_____	_____
Prepared	_____	_____

ITEM	SIGNATURE	DATE
Approved	_____	_____
Reviewed	_____	_____
Prepared	刘晓阳	2019/7/31

**Beijing BOE
Optoelectronics Technology Co., Ltd.**

BEIJING BOE OPTOELECTRONICS TECHNOLOGY



PRODUCT GROUP

REV.

DATE

TFT- LCD PRODUCT

0

2019.07.31

SPEC. NUMBER

ZV055FHM-NB0-18P0 Product Specification

PAGE

2 /32

REVISION HISTORY

REV.	ECN NO.	PAGE	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		3	Initial Release	2019/7/31	刘晓阳

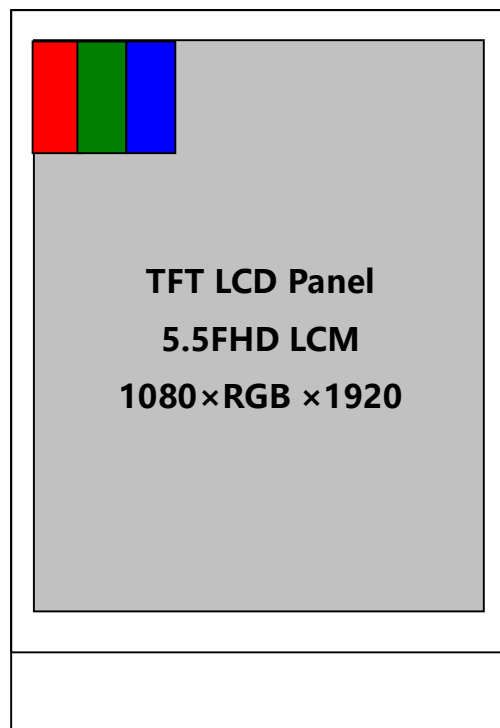
Contents

NO.	ITEMS	PAGE
1.0	General Description	4
2.0	Absolute Maximum Ratings	7
3.0	Electrical Specifications.	8
4.0	Optical Specifications.	10
5.0	Reliability Test	12
6.0	Pin Assignment & Mechanical Characteristics	13
7.0	Power ON/OFF Control	16
8.0	Timing	22
9.0	Mechanical Characteristics	24
10.0	Packing Information	26
11.0	Handling & Cautions	31

1.0 GENERAL DESCRIPTION

1.1 Introduction

ZV055FHM-NB0-18P0 is a color active matrix TFT LCD Q-Panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 5.5 inch diagonally measured active area with FHD resolutions (1080 horizontal by 1920 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.



1.2 Features

- High PPI: 403
- Cell Thickness: 0.4t
- High Luminance: 1000nit Typ.
- Thin and light weight

1.3 Application

● -

1.4 General Specification (H: horizontal length, V: vertical length)

The followings are general specifications at the ZV055FHM-NB0-18P0

<Table 1. General Specifications>

Parameter	ITEMS	Unit	Remark
Active Area	68.04(H) × 120.96(V)	mm	
LCM Outline	70.44(W) × 128.79(V) × 1.81(D)		
Number of pixels	1080 (H) × 1920 (V)	pixels	
Pixel pitch	0.063(H) × 0.063(V)	mm	
PPI	403		
Pixel arrangement	RGB Horizontal Stripe		
Transmittance	4.05%(typ)		with APF
Color Gamut	72% Typ.		C Light(CF)
Display colors	16.7M		
Display mode	ADS Normally Black		
Contrast Ratio	Typ.1500:1 Min. 1200:1		
Luminance	850 Min.; 1000 Typ.	nit	Center
Response Time	25 Typ.; 35 Max.	ms	Tr+Tf, 25°C
Viewing Angle(U/D/L/R)	80/80/80/80	Deg.	CR>10
Cross Talk	3% Max.		
Flicker	< 10%		灰黑Pattern
Driver IC	HX8398-A		
Weight	-	gram	

Note:

1. This product's compatible IC is NT3552、HX8398, and ILI9885A-03, Please contact IC manufacturer and verify it when you choose any one of them. The information we suppose about IC just for reference

2.For Luminance, it is allowed to be in the range of 850~900nit, the proportion ≤3%

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 3.

<Table 3. Absolute Maximum Ratings >

Parameter	Symbol	Min.	Max.	Unit	Remarks
Logic voltage	VCC_LCD	-0.3	4	V	
Analog voltage	VSP	-0.3	6.6	V	
Analog voltage	VSN	0	-6.6	V	
LED forward current	I _{LED}	-	20	mA	
Operating Temperature (Humidity)	T _{OP}	-20	+70	°C	[Note1]
	RH(60°)		90	%	
Storage Temperature (Humidity)	T _{ST}	-30	+80	°C	
	RH(60°)		90	%	

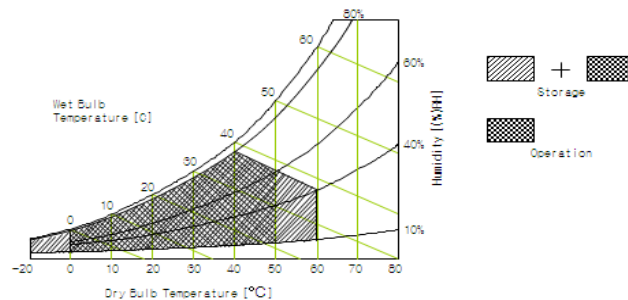
Note:

1. Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature.

2. Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications-LCD

<Table 4. Electrical specifications >

Parameter		Symbol	Min	Typ	Max	Unit	Remark
Logic voltage		VCC_LCD	1.65	1.8	1.95	V	
Analog voltage		VSP	5.44	5.54	5.64	V	
Analog voltage		VSN	-5.64	-5.54	-5.54	V	
Input signal voltage	High level	V _{IH}	0.7xV _{C_LCD}	-	VCC_LCD	V	
	Low level	V _{IL}	GND		0.3xVCC_LCD	V	
Current consumption		I _{VCC_LCD}	-	26	40	mA	Note
		I _{VSP}	-	7	15	mA	
		I _{VSN}	-	7	15	mA	
Power consumption		P _{VCC_LCD}		46.8	78	mW	
		P _{VSP}		38.78	84.6	mW	
		P _{VSN}		38.78	84.6	mW	

Note:

Display White Pattern

4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

4.2 Optical Specifications

<Table 6. Optical Specifications >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	$\Theta 3$	CR > 10	-	80	-	Deg.	Note1
		$\Theta 9$		-	80	-	Deg.	
	Vertical	$\Theta 12$		-	80	-	Deg.	
		$\Theta 6$		-	80	-	Deg.	
Contrast ratio		CR	$\Theta = 0^\circ$	1200	1500	-		Note2
Transmittance		Tr		3.5	4.05		%	Note3
Color Gamut		CG		65	70		%	
Reproduction of color	Red	Rx	$\Theta = 0^\circ$	0.6219	0.6419	0.6619		Note4 (with T P)
		Ry		0.3164	0.3364	0.3564		
	Green	Gx		0.2938	0.3138	0.3338		
		Gy		0.5788	0.5988	0.6188		
	Blue	Bx		0.1285	0.1485	0.1685		
		By		0.0264	0.0464	0.0664		

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
White Chromaticity	W _x	Θ = 0°	0.2786	0.2986	0.3186		
	W _y		0.2796	0.2996	0.3196		
Response Time (Rising + Falling)	T _r + T _f	T _a = 25° C Θ = 0°		25	35	ms	Note 5
Uniformity				80		%	Note 6

Note:

- 1.Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o' clock direction and the vertical or 6, 12 o' clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).
- 2.Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGUR 1)
Luminance Contrast Ratio (CR) is defined mathematically.

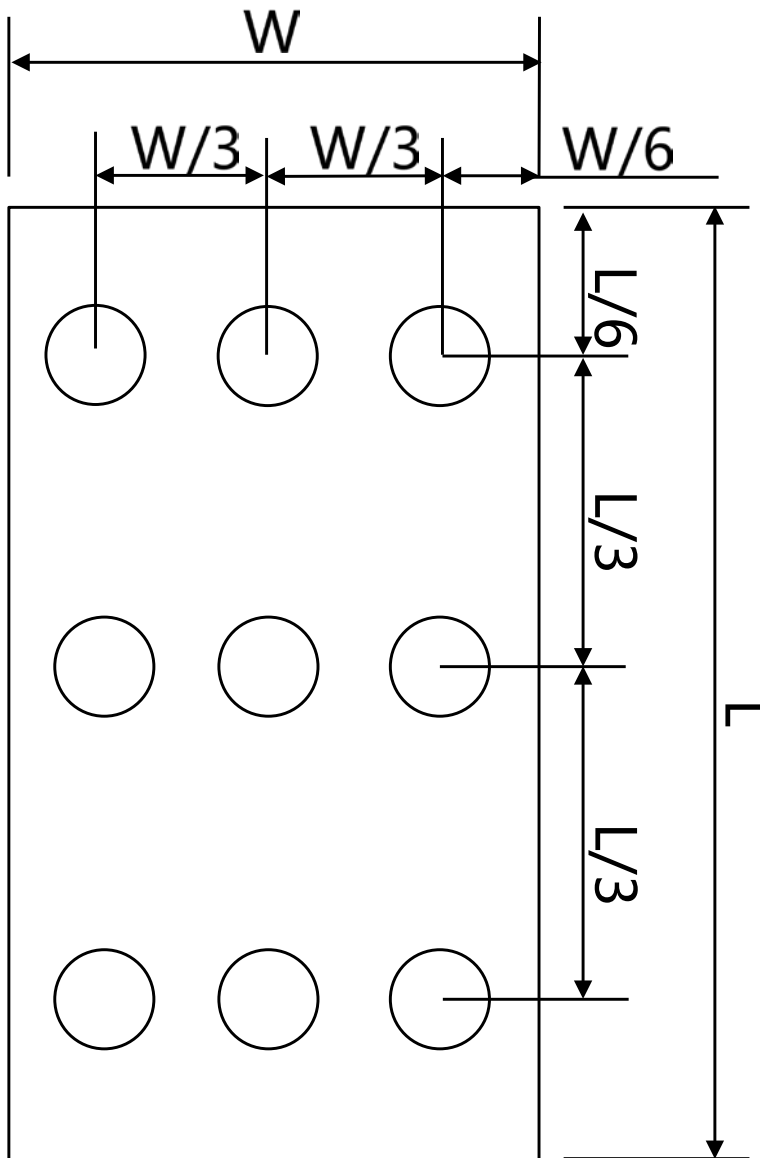
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

- 3.Transmittance is the Value without APF and without CG.
- 4.The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
- 5.The electro-optical response time measurements shall be made as FIGURE 2 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r, and 90% to 10% is T_f.

Note:

6. Definition of uniformity, measuring 9 points (W×H)

$$\text{Uniformity} = \frac{\text{Min. luminance of measured point}}{\text{Max. luminance of measured point}}$$



5.0 Reliability Test

The Reliability test items and its conditions are shown in below.

<Table 7. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature storage test	Ta = 80±2 °C, 240 hrs
2	Low temperature storage test	Ta = -30±2 °C, 240 hrs
3	High temperature & high humidity (operation test)	Ta = 60±2 °C, 90±3%RH, 240hrs
4	High temperature & high humidity (storage test)	Ta = 60±2 °C, 90%RH, 240hrs
5	Low temperature operation test	Ta = -20±2 °C, 240hrs
6	High temperature operation test	Ta = 70±2 °C, 240hrs
7	Thermal Shock Test	Ta = -30 °C ~ 80°C, 1h/Cycle, 24Cycles
8	Salt spray testing	5%±1% PH.6.5~7.2 35°C 24hrs
9	Afterimage	6*8 1Hr 25°C 30s or same as competitor
10	Packing VIB	10-55-10HZ 1.5mm, +X+Y±Z, 1h/direction
11	Packing Drop	1Angle,3Edge,6Face H=60cm 1/direction

6.0 Pin Assignment & Mechanical Characteristics

6.1 Dimension Requirements

Mechanical outlines for the panel (H: horizontal length, V: Vertical length)

<Table 8. Dimensional Parameters>

Parameter	ITEMS	Unit	Remark
Dimensional Outline	70.04(W)×127.16 (V) × 0.4(D)	mm	
CF size	70.04(H) × 124.26(V)	mm	
Active area	68.04(H) ×120.96(V)	mm	
Border(L/R/U/D)	1.0/1.0/1.0/2.3	mm	
Number of pixels	1080 (H) ×1920 (V)	pixels	
	1pixel=R+G+B dots		
Pixel pitch	0.063(H) × 0.063(V)	mm	
Pixel Arrangement	RGB Horizontal Stripe		
Pad Area	2.9	mm	
Glass Edge to FPC	0.15	mm	Note1
FPC Pad Width	0.6	mm	
FPC to D-IC	0.5	mm	
D-IC Width	1.0	mm	
D-IC to CF Edge	0.65	mm	

Note:

1. The size specified is calculated by IC–driver HX8398A, the size maybe changed if customer use other IC.

6.0 Pin Assignment & Mechanical Characteristics

This LCD employs one interface connections, a 40 pin connector is used for the LCD module electronics interface.

6.2 Pin assignment for LCD module

Connector : DF40C-40DP-0.4V (51) (Hirose)

<Table 9. Pin Assignment for LCD Module Connector>

Pin No.	Symbol	Description	remark
1	GND	Ground	
2	GND	Ground	
3	NC	Not connect	
4	LCD_RST	LCD reset	
5	NC	Not connect	
6	LCD_TE	LCD Tearing effect output	
7	NC	Not connect	
8	LCD_ID	LCD_ID signal	
9	NC	Not connect	
10	GND	Ground	
11	NC	Not connect	
12	MIPI_TXO_D0N	MIPI data lane 0 negative end input/output pin	
13	GND	Ground	
14	MIPI_TXO_D0P	MIPI data lane 0 positive end input/output pin	
15	VCC_LED+	Backlight LED+	
16	GND	Ground	
17	VCC_LED+	Backlight LED+	
18	MIPI_TXO_D1N	MIPI data lane 1 negative end input/output pin	
19	GND	Ground	
20	MIPI_TXO_D1P	MIPI data lane 1 positive end input/output pin	
21	VCC_LED_3-	Backlight LED3-	
22	GND	Ground	
23	VCC_LED_2-	Backlight LED2-	
24	MIPI_TXO_CLKN	MIPI DSI clock lane negative end input pin	
25	VCC_LED_1-	Backlight LED1-	

6.0 INPUT TERMINAL PIN ASSIGNMENT

This LCD employs one interface connections, a 40 pin connector is used for the LCD module electronics interface.

6.2 Pin assignment for LCD module

Connector : DF40C-40DP-0.4V (51) (Hirose)

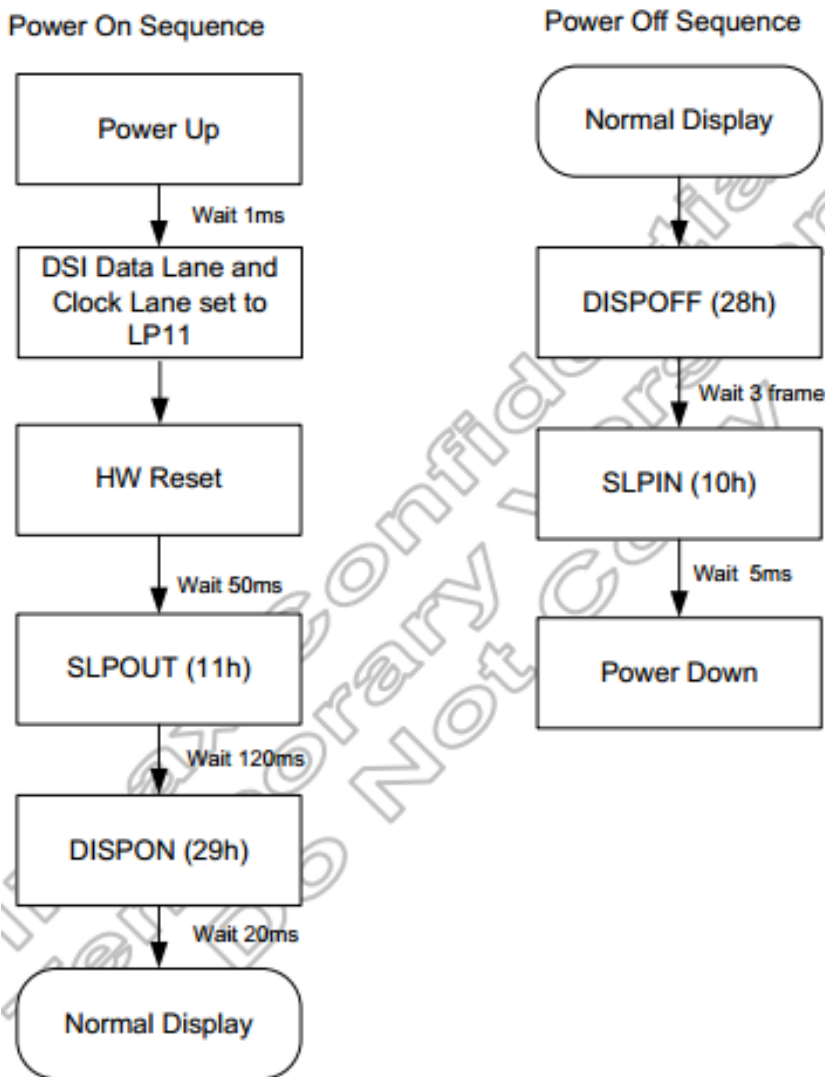
<Table 9. Pin Assignment for LCD Module Connector>

Pin No.	Symbol	Description	remark
26	MIPI_TXO_CLKP	MIPI DSI clock lane positive end input pin	
27	GND	Ground	
28	GND	Ground	
29	7P0_PWM_OUT	PWM out for brightness of backlight	
30	MIPI_TXO_D2N	MIPI data lane 2 negative end input/output pin	
31	VCC_LCD	LCD power	
32	MIPI_TXO_D2P	MIPI data lane 2 positive end input/output pin	
33	GND	Ground	
34	GND	Ground	
35	VSP	LCD power	
36	MIPI_TXO_D3N	MIPI data lane 3 negative end input/output pin	
37	VSN	LCD power	
38	MIPI_TXO_D3P	MIPI data lane 3 positive end input/output pin	
39	GND	Ground	
40	GND	Ground	

7.0 POWER ON/OFF CONTROL

7.1 Power Sequence

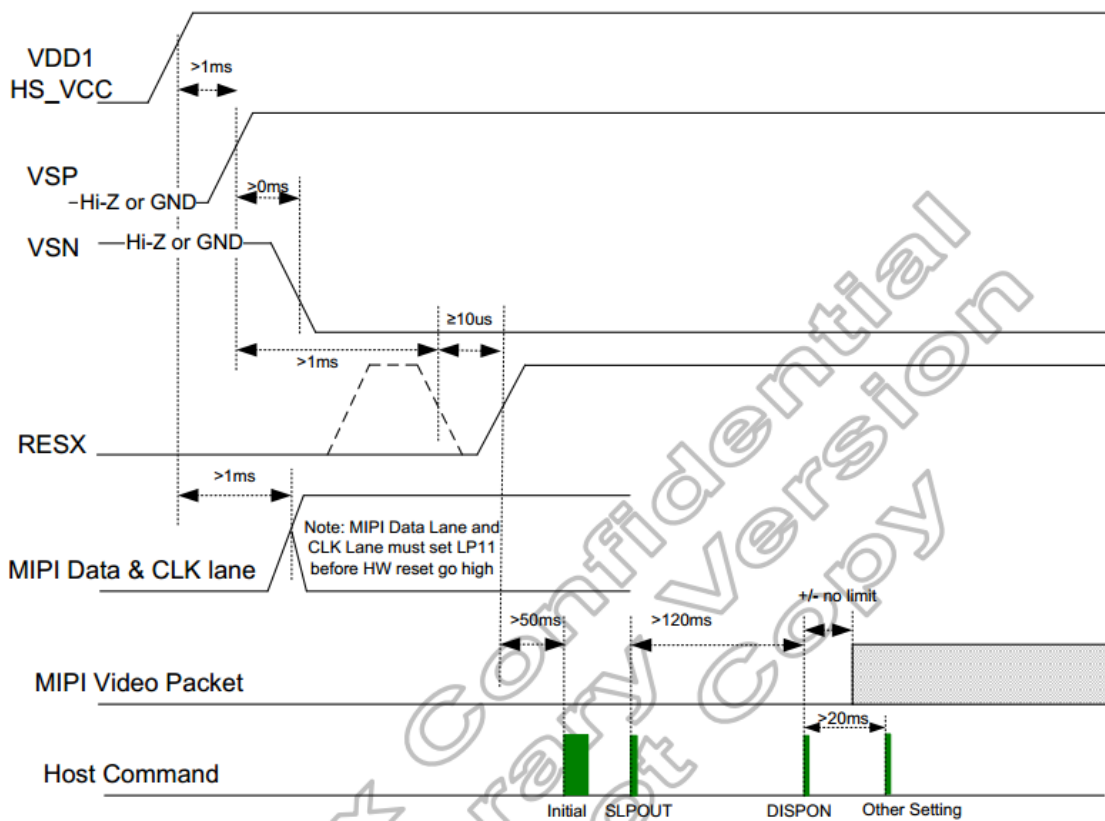
<Table 10. Power sequence>



7.0 POWER ON/OFF CONTROL

7.1.1 Power on Sequence

<Table 11. Power on sequence>

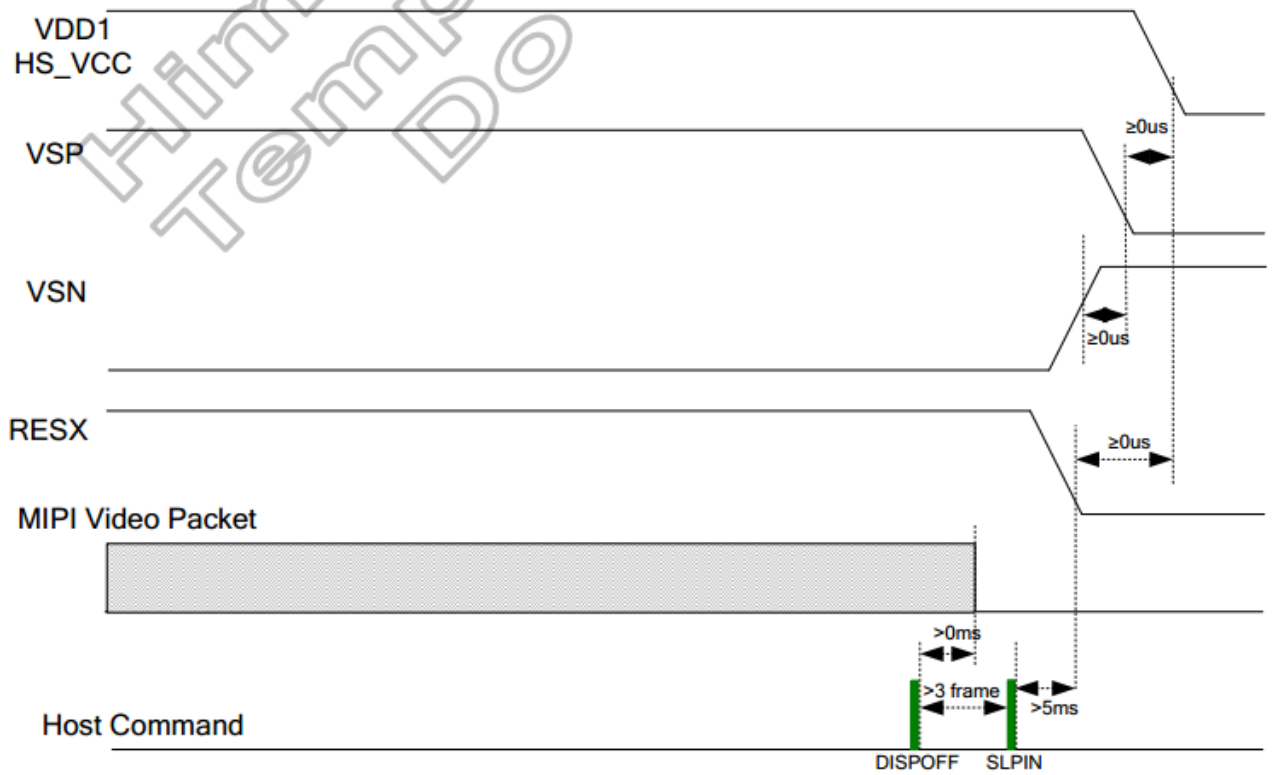


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7.0 POWER ON/OFF CONTROL

7.1.2 Power off Sequence

<Table 13. Power off sequence>



7.0 POWER ON/OFF CONTROL

7.1.3 Power Sequence LCD reset

<Table 14. Reset sequence>

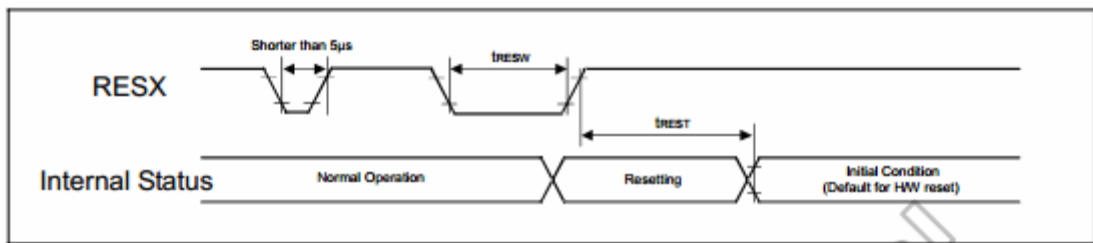


Figure 8.12: Reset input timing

Symbol	Parameter	Related pins	Spec.			Unit	Note
			Min.	Typ.	Max.		
t_{RESW}	Reset low pulse width ⁽¹⁾	RESX	10	-	-	μs	-
t_{REST}	Reset complete time ⁽²⁾	-	-	-	50	ms	-

Note: (1) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5 μs	Reset Rejected
Longer than 10 μs	Reset
Between 5 μs and 10 μs	Reset Start

(2) During Reset Complete Time, OTP will be latched to internal register during this period. This loading is done every time when there is HW reset complete time (t_{REST}) within 50ms after a rising edge of RESX.

(3) Spike Rejection also applies during a valid reset pulse as shown below:

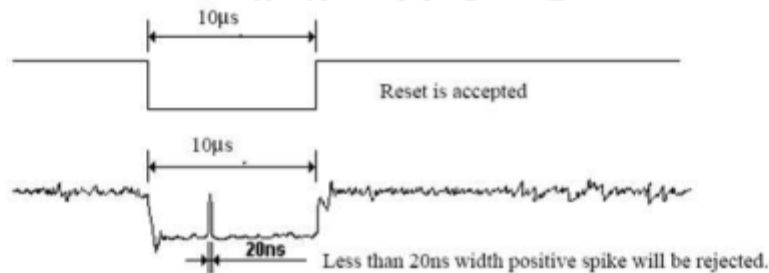
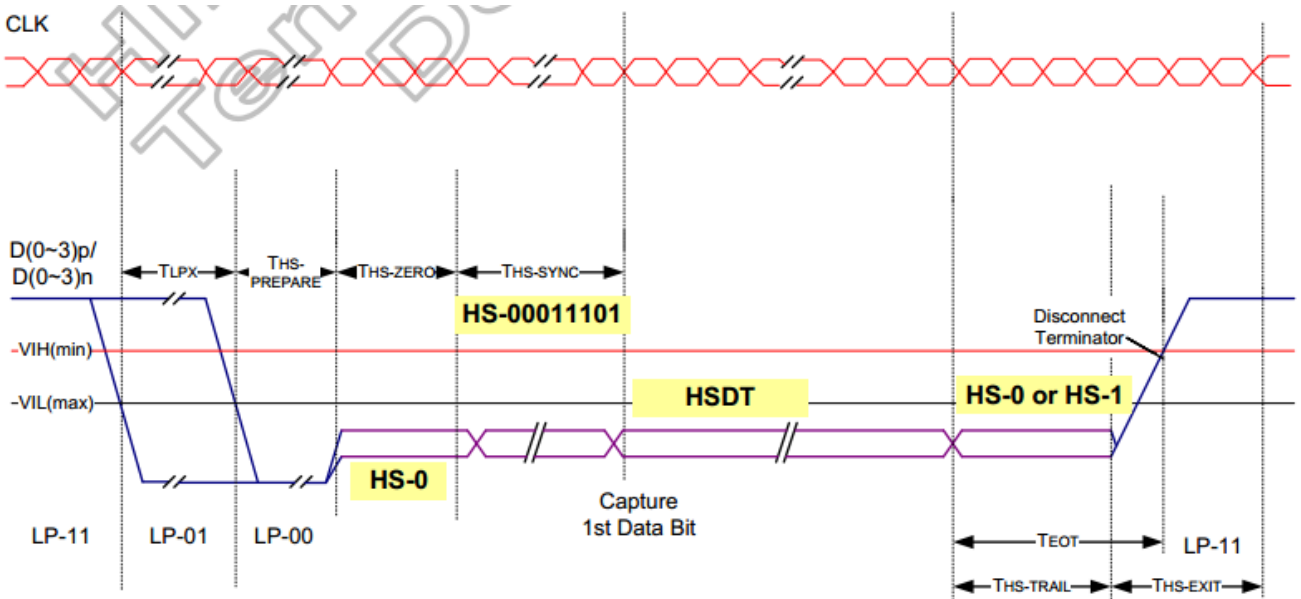


Table 8.16: Reset timing

7.0 POWER ON/OFF CONTROL

7.1.4 Power Sequence Read/Write Timing characteristics

<Table 15. Reset sequence>

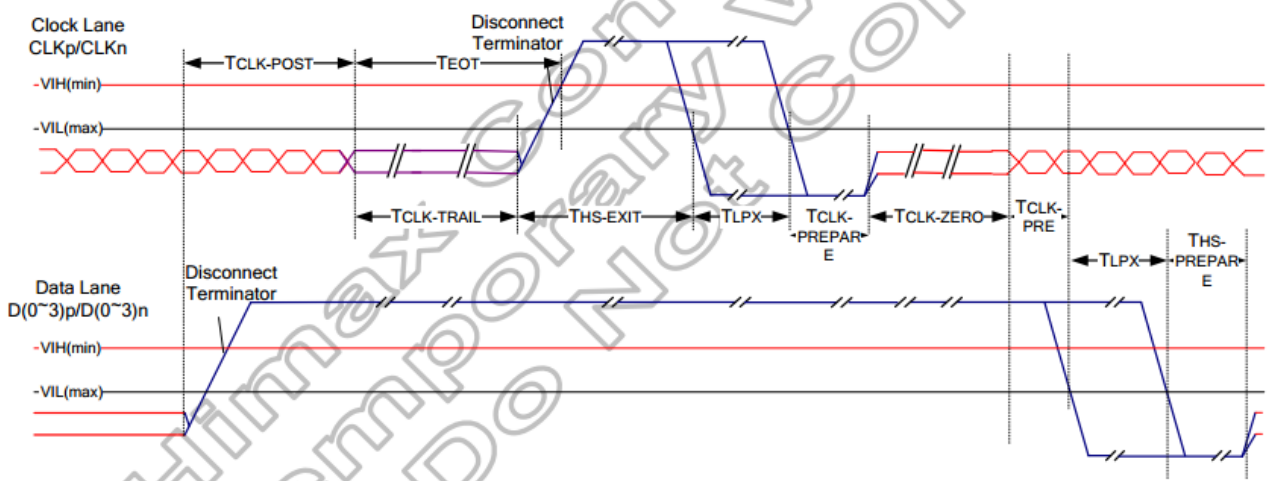


Parameter	Description	Min.	Typ.	Max.	Unit
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.	$40+4*UI$	-	$85+6*UI$	ns
$T_{HS-PREPARE} + T_{HS-ZERO}$	THS-PREPARE + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.	$145+10*UI$	-	-	ns
T_{EOT}	Transmitted time interval from the start of THS-TRAIL or TCLK-TRAIL, to the start of the LP-11 state following a HS burst.	-	-	$105ns+12*UI$	ns
$T_{HS-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst.	$60ns+4*UI$	-	-	ns
$T_{HS-EXIT}$	Time that the transmitter drives LP-11 following a HS burst.	100	-	-	ns

7.0 POWER ON/OFF CONTROL

7.1.5 Power Sequence Read/Write Timing characteristics

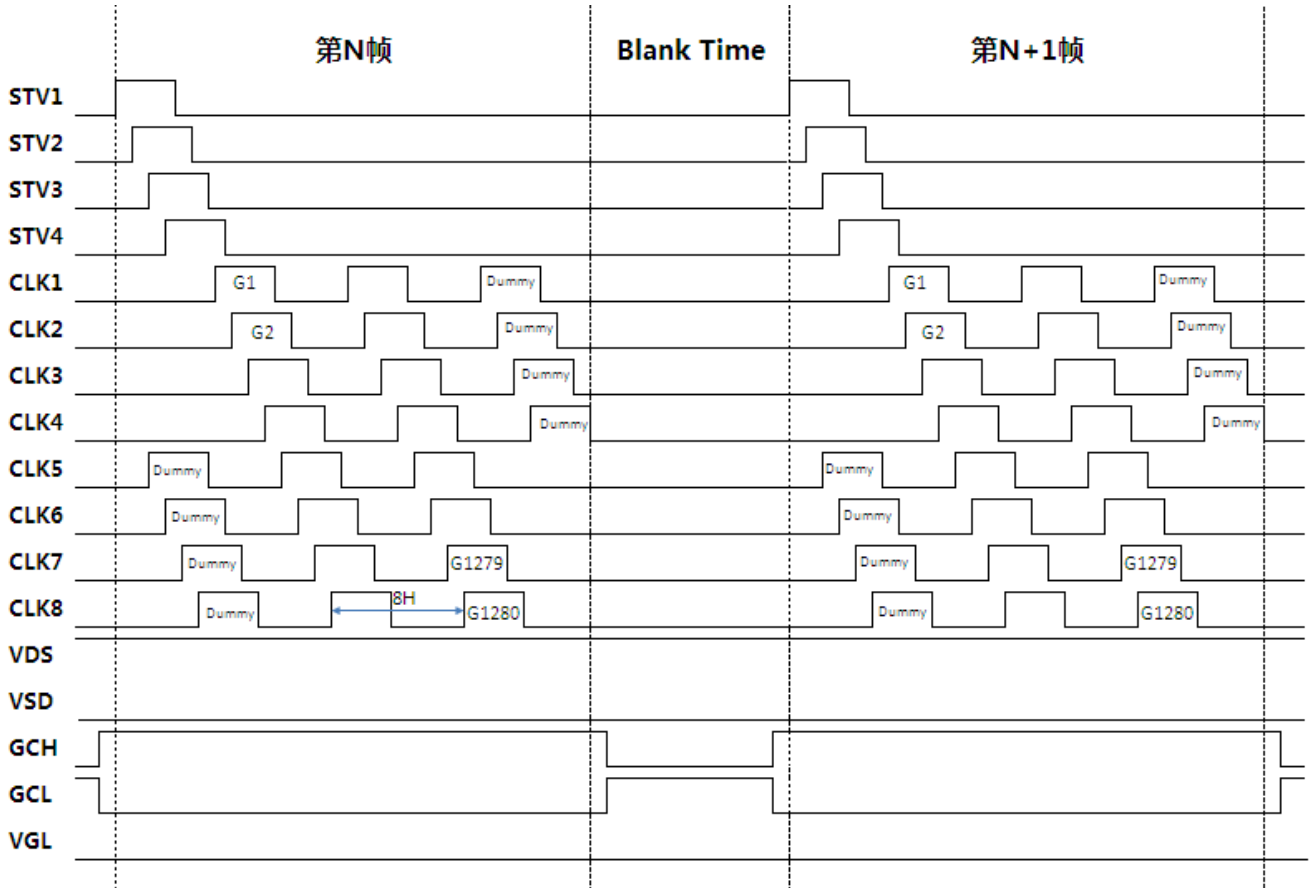
<Table 16. Reset sequence>



Parameter	Description	Min.	Typ.	Max.	Unit
$T_{CLK-POST}$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode.	$60+52*UI$	-	-	ns
$T_{CLK-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst.	60	-	-	ns
$T_{CLK-PREPARE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	38	-	95	ns
$T_{CLK-PREPARE} + T_{CLK-ZERO}$	$T_{CLK-PREPARE}$ + time that the transmitter drives the HS-0 state prior to starting the Clock.	300	-	-	ns
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	$8*UI$	-	-	ns

8.0 Timing

8.1 Forward



CLK 信号Duty cycle=45%，并且在40%-50%之间可调。

VGH=12V, VGL=-12V

GCH=VGH, 一帧结束后, 下一帧开启前翻转一次, 时间范围可调

GCL=VGL, 一帧结束后, 下一帧开启前翻转一次, 时间范围可调

VDS=VGH, VSD=VGL正扫

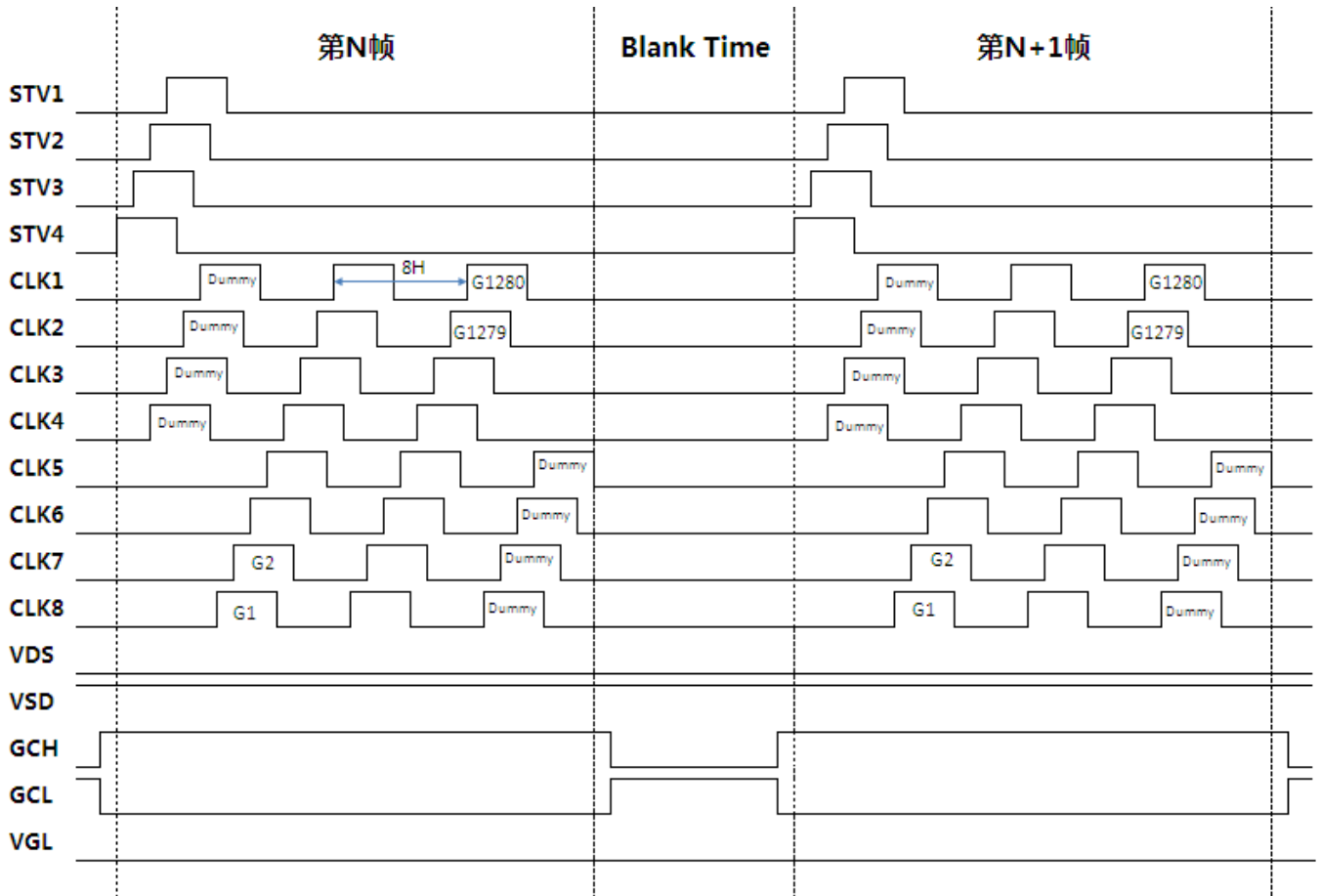
VDS=VGL, VSD=VGH反扫

SW 常开25V

Source = ±5V

8.0 Timing

8.1 Backward



CLK 信号Duty cycle=45%，并且在40%-50%之间可调。

VGH=12V, VGL=-12V

GCH=VGH, 一帧结束后, 下一帧开启前翻转一次, 时间范围可调

GCL=VGL, 一帧结束后, 下一帧开启前翻转一次, 时间范围可调

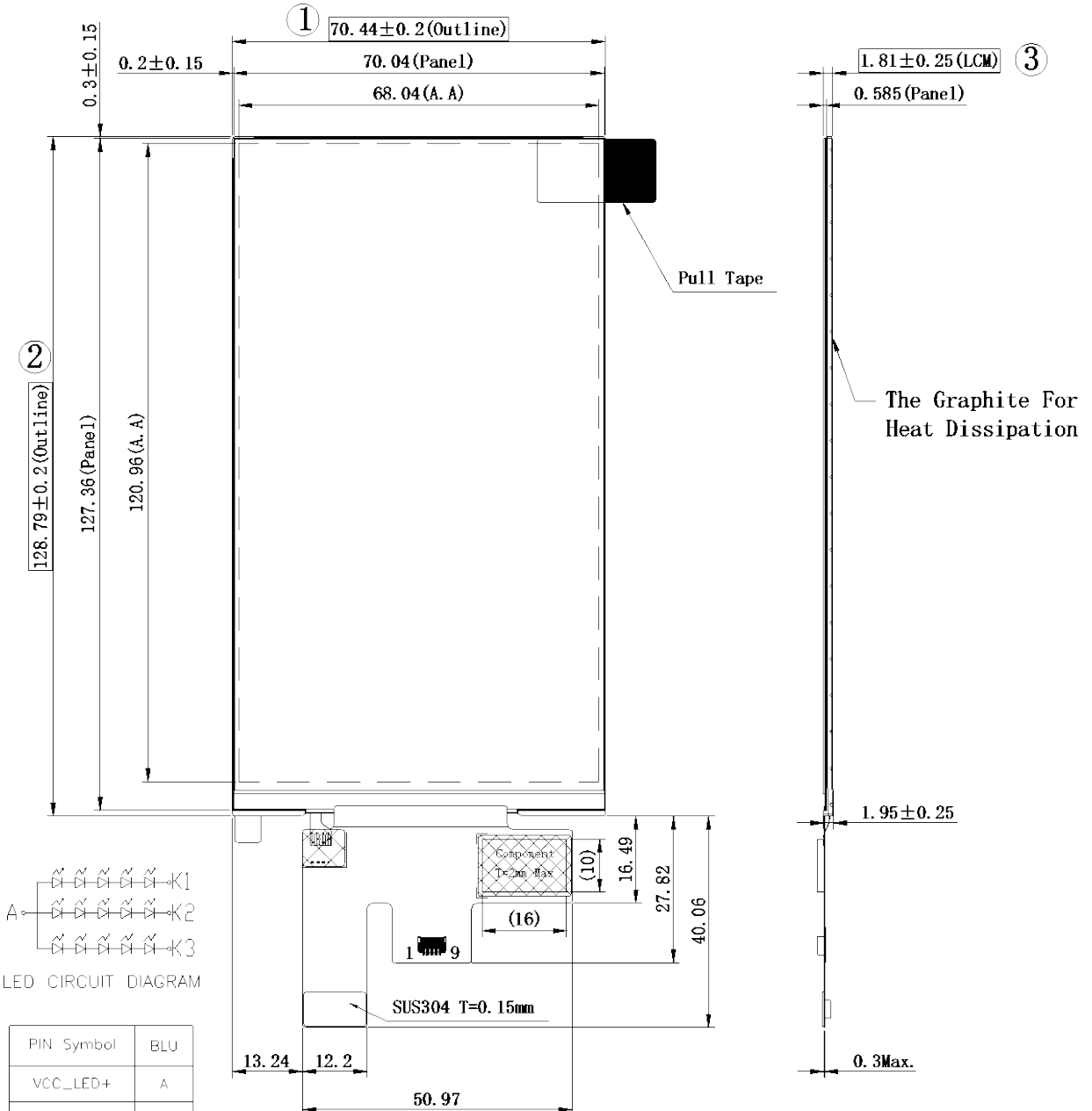
VDS=VGH, VSD=VGL正扫

VDS=VGL, VSD=VGH反扫

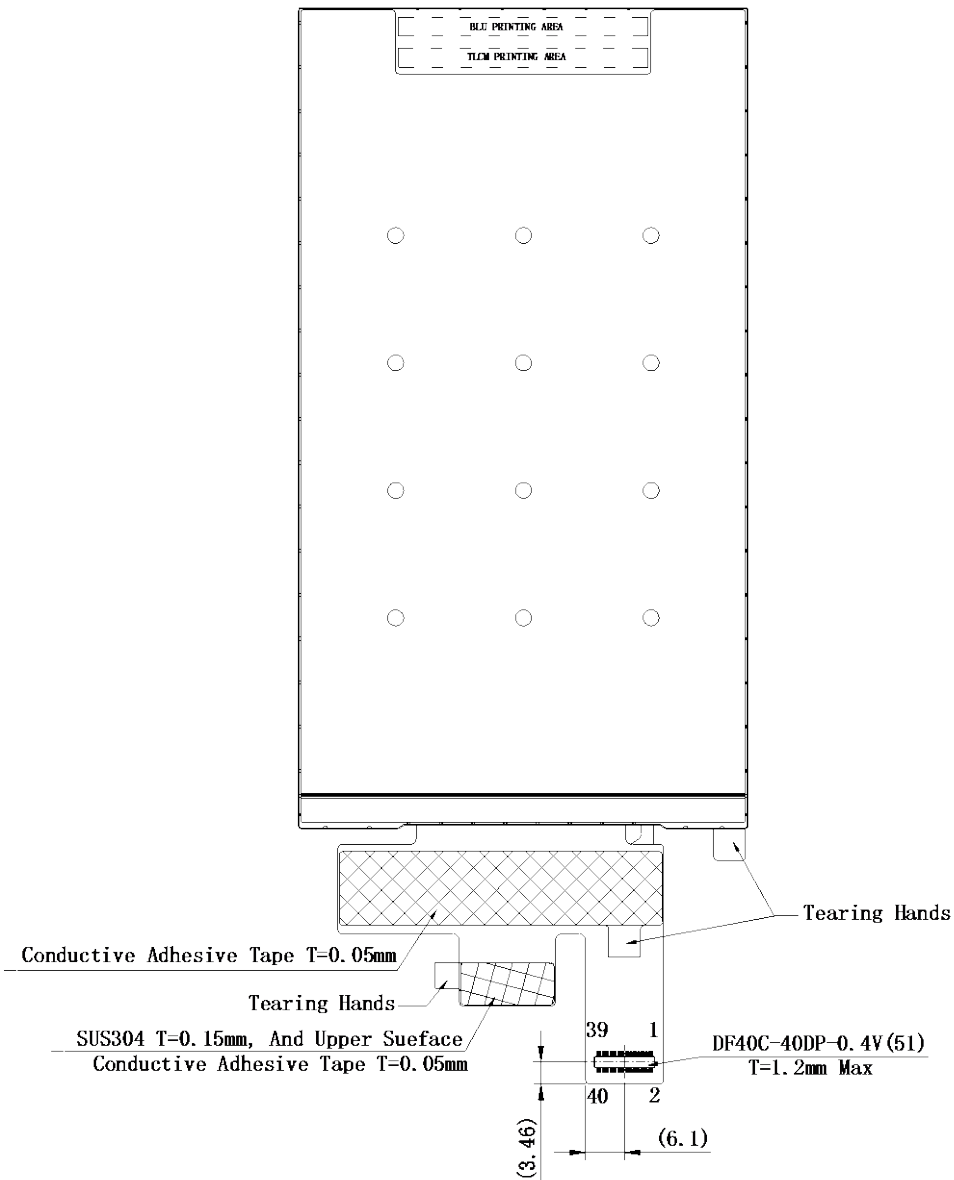
SW 常开25V

Source = ±5V

9.0 Mechanical Characteristics (unit : mm)



9.0 Mechanical Characteristics (unit : mm)

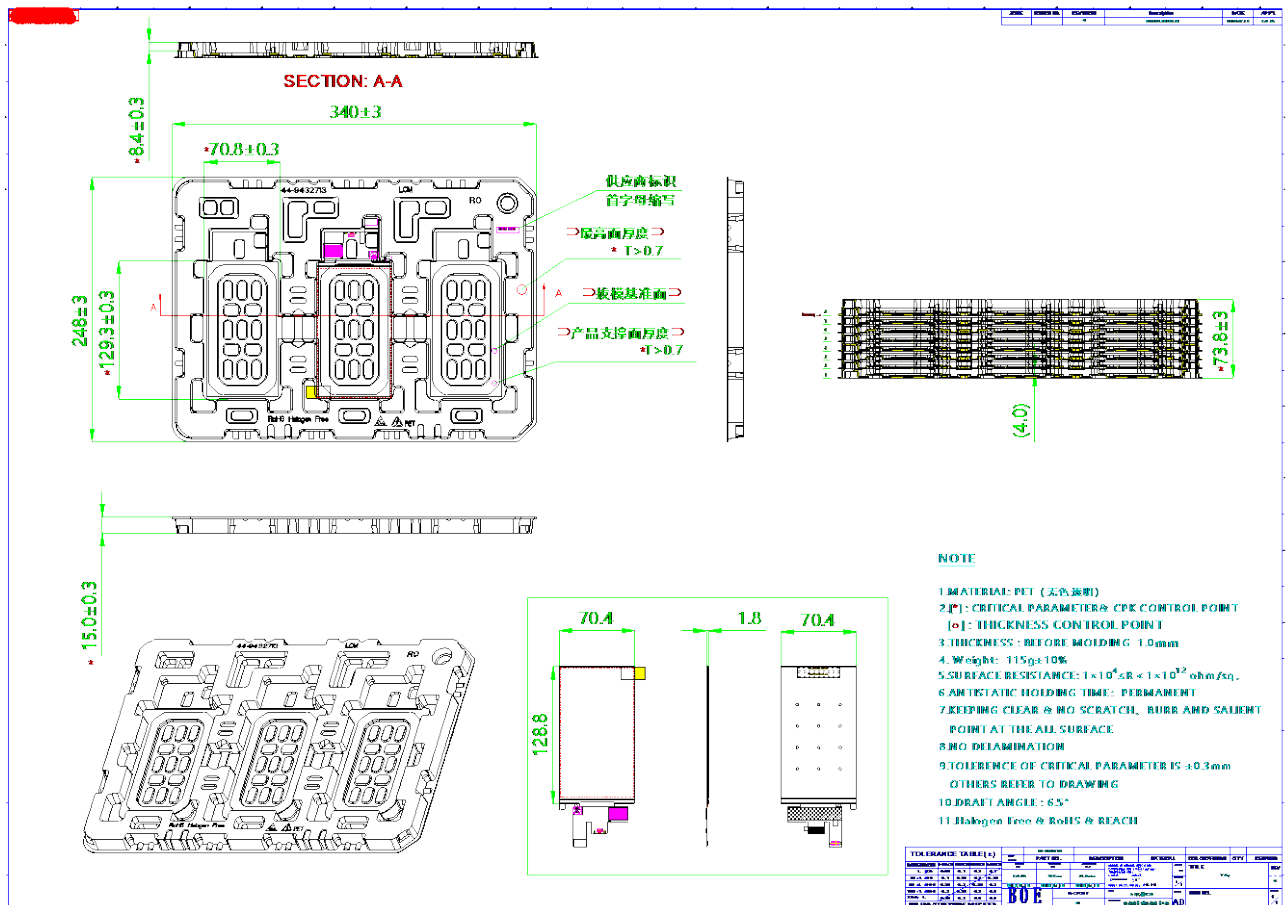


10.0 PACKING INFORMATION

10.1 Packing Description

Packing Condition	Contents
Packing Type	Tray packing type (See the picture under the form)
Material Model	PET ($1*10^4\Omega < R < 1*10^{12}\Omega$)
Number of TLCM per Tray	3 pcs
Stacking Mode	7+1 (Superposition)
Number of TLCM per Box	126 pcs

10.2 Tray Drawing



10.0 PACKING INFORMATION

10.3 Inner Box Label Format



Serial number marked part needs to print, show as follows:

1. FG-CODE(Before 12 bit) --- ZV055FHM-NB0
2. Product quantity---21
3. Box ID
4. Date
5. FG-Code After four --18P0
6. Total Size:110×56mm

Box Label Naming Rule :

Digit	1	2	3	4	5	6	7	8	9	10
Code	0	5	5	1	9	8	0	0	0	1
Description	Product Model			Year		Month (0,-9, XYZ)	Box Serial Number			

10.0 PACKING INFORMATION

10.4 Outer Box Label Format



Serial number marked part needs to print, show as follows:

1. FG-CODE(Before 12 bit) --- ZV055FHM-NB0
2. Product quantity---126
3. Box ID
4. Date
5. FG-Code After four --18P0
6. Total Size:110×56mm

Box Label Naming Rule :

Digit	1	2	3	4	5	6	7	8	9	10
Code	0	5	5	1	9	8	0	0	0	1
Description	Product Model			Year		Month (0,-9, XYZ)		Box Serial Number		

10.0 PACKING INFORMATION

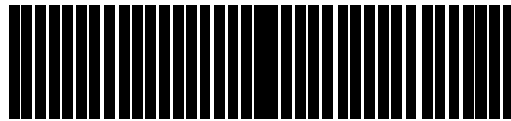
10.5 Pallet Label Format

MODEL : XXXXXXXX – XXX ①

QTY : XXXX ②

PACK DATE : XXXX/XX/XX ③

PALLET : XXXXXXXXXXXXX ④



XXXXXX ⑤

Serial number marked part needs to print, show as follows:

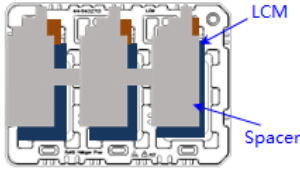
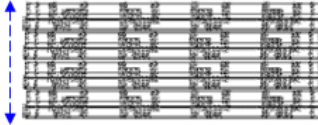
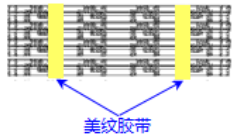

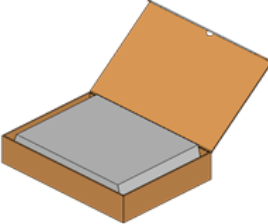
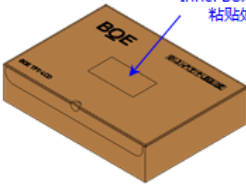

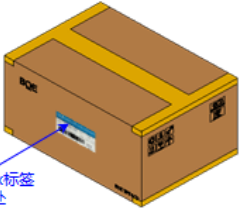

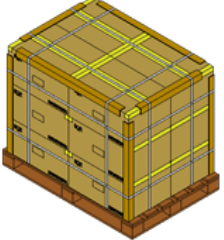
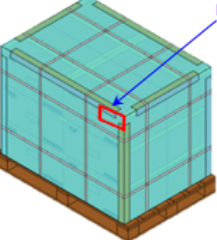
1. FG-CODE(Before 12 bit) --- ZV055FHM-NB0
2. Product quantity---1512
3. Packing Date
4. Pallet ID
5. FG-Code After four +Product Grade + Revision Code---18P0P0

Total Size:100×80mm

Pallet Label Naming Rule :

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12
Code	2	0	1	9	8	A	I	0	0	0	0	1
Description	Year			Month (0,-9, XYZ)		MODEL TYPE		Box Serial Number				

10.0 PACKING INFORMATION

<p>将3EA LCM放入Tray中，在LCM上放1EA Spacer。</p> <p>3 LCM/ 1 Spacer/ Tray</p>	<p>将盛装LCM的Tray叠码7层，然后整摞上面加放1个空Tray作盖。</p> <p>21 LCM/ 8Tray</p>	<p>用美纹胶带平行于Tray的宽边方向捆绑两道，每道至少缠绕3圈美纹胶带</p>
 <p>LCM</p> <p>Spacer</p> <p>Step 1</p>	 <p>7+1层</p> <p>Step 2</p>	 <p>美纹胶带</p> <p>Step 3</p>
<p>将7层 Tray放入一个Shielding Bag中，并抽真空。（真空标准：Appendix）</p> <p>21 LCM/ Shielding Bag</p>	<p>将抽完真空的一包产品放入 Inner Box中。</p> <p>21 LCM/ Inner box</p>	<p>用封箱胶带对Inner Box进行封箱，并在Box的Mark框处粘贴Box标签。（标签粘贴位置详见Label and Position）</p> <p>21 LCM/ Inner box</p>
 <p>7+1层</p> <p>Step 4</p>	 <p>Step 5</p>	 <p>Inner Box 标签 粘贴处</p> <p>Step 6</p>
<p>将封好的Inner Box装入Outer Box。</p> <p>6 Inner Box/ Outer Box</p>	<p>采用“H”形封箱方式，对Box进行封箱，并在Outer Box的Mark处粘贴相应Box标签。（标签粘贴位置详见Label and Position）</p> <p>126 LCM/ Outer Box</p>	<p>按“田”字型对Outer Box进行三层码拍。</p> <p>12 Box/ Pallet</p>
 <p>Step 7</p>	 <p>Outer Box 标签 粘贴处</p> <p>Step 8</p>	 <p>Step 9</p>
<p>放置护角，用打包带打包，长、宽、高边各打2道。</p> <p>1512 LCM/ Pallet</p>	<p>缠绕拉伸膜，缠绕层数不少于3层，除底面外的5个面需要全部覆盖，并在Pallet的Mark处粘贴相应Pallet标签。（标签粘贴位置详见Label and Position）</p> <p>1512 LCM/ Pallet</p>	
 <p>Step 10</p>	 <p>Pallet 标签 粘贴处</p> <p>Step 11</p>	

11.0 Handling & Cautions

11.1 Mounting Method



- The panel of the LCD consists of two thin glasses with polarizers which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCD module with the specified mounting parts.

11.2 caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizers or it leads the polarizers to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent (recommended below) to clean the LCD 's surface with wipe lightly.
-IPA(Isopropyl Alcohol), Ethyl Alcohol, Trichlorotrifluoroethane
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers and others. Do not use the following solvent.
-Water, Ketone, Aromatics
- It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint. To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

11.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

11.4 Caution For operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

11.5 Packaging

- Modules use LCD element, 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 directly to sunshine or high temperature/humidity for long periods.

11.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCD' s surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizers.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
 - Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
 - Store in a dark place where neither exposure to direct sunlight nor light is.
 - Keep temperature in the specified storage temperature range.
 - Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation LCD when it was delivered.

11.7 Safety

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water an soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.