

**Product Specification**

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# NHD-3.5-320240JF-ASXP-T

## TFT Liquid Crystal Display

<b>NHD -</b>	Newhaven Display
<b>3.5 -</b>	3.5" Diagonal
<b>320240 -</b>	320xRGBx240 Pixels
<b>JF -</b>	Model
<b>A -</b>	Built-in Driver / No Controller
<b>S -</b>	High Brightness, White LED Backlight
<b>X -</b>	TFT
<b>P -</b>	IPS, Wide Temperature
<b>T -</b>	4-Wire Resistive Touch Panel

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## Additional Resources

- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **Github:** <https://github.com/newhavendisplay>
- **Example Code:** [https://www.newhavendisplay.com/example\\_code.html](https://www.newhavendisplay.com/example_code.html)
- **Knowledge Center:** [https://www.newhavendisplay.com/knowledge\\_center.html](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](https://www.newhavendisplay.com/quality_center.html)
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>



## Document Revision History

Revision	Date	Description	Changed By
0	2/08/2022	Initial Release	CJ
1	4/13/2022	Updated Mechanical Drawing	CJ
2	6/6/2022	Updated to add the RGB Interface Mode Selection section	CJ
3	6/9/2022	Updated Optical Characteristics and Mechanical Drawing	CJ



## Pin Description

### TFT:

Pin No.	Symbol	External Connection	Function Description
1	LED_K	Power Supply	Backlight Cathode (Ground)
2	LED_K	Power Supply	Backlight Cathode (Ground)
3	LED_A	Power Supply	Backlight Anode (40mA @ 18.6V)
4	LED_A	Power Supply	Backlight Anode (40mA @ 18.6V)
5	NC	-	No Connect
6	NC	-	No Connect
7	NC	-	No Connect
8	/RESET	MPU	Active LOW Reset signal
9	/CS	MPU	Active LOW Serial Chip Select signal
10	SCK	MPU	Serial Clock signal
11	SDI	MPU	Serial Data signal
12-19	B0-B7	MPU	Blue Data signals
20-27	G0-G7	MPU	Green Data signals
28-35	R0-R7	MPU	Red Data signals
36	HSYNC	MPU	Horizontal (Line) Sync signal
37	VSYNC	MPU	Vertical (Frame) Sync signal
38	DOTCLK	MPU	Dot Clock signal
39	NC	-	No Connect
40	NC	-	No Connect
41	VDD	Power Supply	Supply Voltage for LCD and logic (3.3V)
42	VDD	Power Supply	Supply Voltage for LCD and logic (3.3V)
43-51	NC	-	No Connect
52	DEN	-	Data Enable signal (No Connect)
53	GND	Power Supply	Ground
54	GND	Power Supply	Ground

**Recommended LCD connector:** 0.5mm pitch 54-Conductor FFC. Molex p/n: 51296-5494

**Backlight connector:** on LCD connector **Mates with:** ---

### Resistive Touch Panel:

Pin No.	Symbol	External Connection	Function Description
1	Y1	Touch Controller	Left
2	X1	Touch Controller	Down
3	Y2	Touch Controller	Right
4	X2	Touch Controller	Up

**Recommended LCD connector:** 1.0mm pitch 4-Conductor FFC. Molex p/n: 52207-0485

## Driver/Controller Information

### TFT:

Built-in ST7272A driver. No controller.

Please download specification at:

[https://www.newhavendisplay.com/resources\\_dataFiles/datasheets/LCDs/ST7272A.pdf](https://www.newhavendisplay.com/resources_dataFiles/datasheets/LCDs/ST7272A.pdf)



## RGB Interface Mode Selection

The Sitronix ST7272A driver IC is user configurable for DE Mode, SYNC mode, or SYNC-DE mode RGB interface.

**DE Mode** is enabled when HSYNC and VSYNC signals are set to logic-low state, and DE signal is toggled high for valid pixel data. Data is clocked in using DCLK signal. DE mode is recommended to enable the ST7272A driver IC to synchronize the display image on TFT panel without depending on specific horizontal and vertical sync timing from host controller.

**SYNC mode** is enabled when the DE signal is set to logic-low state, and HSYNC and VSYNC signals are used to explicitly define the horizontal and vertical sync timing to synchronize the display image on TFT panel. Data is clocked in using DCLK signal. Any change to the HSYNC or VSYNC values may prevent the image from correctly appearing on the display.

**SYNC-DE Mode** is enabled when HSYNC and VSYNC signals are used to explicitly define the horizontal and vertical sync timing to synchronize the display image on TFT panel. DE signal is used as an additional indicator for transmission of valid pixel data. Data is clocked in using DCLK signal. Any change to the HSYNC or VSYNC values may prevent the image from correctly appearing on the display.

RGB Mode Selection Table	DCLK	HSYNC	VSYNC	DE
SYNC-DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input

## Electrical Characteristics

TFT:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	3.0	3.3	3.6	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3.3V	10	20	30	mA
"H" Level input	V <sub>IH</sub>	-	0.7 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	GND	-	0.3 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	V <sub>DD</sub> - 0.4	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	GND	-	GND + 0.4	V
Backlight Supply Current	I <sub>LED</sub>	-	30	40	50	mA
Backlight Supply Voltage	V <sub>LED</sub>	I <sub>LED</sub> = 40mA	17.4	18.6	19.8	V
Backlight Lifetime*	-	T <sub>OP</sub> = 25°C	30,000	50,000	-	Hrs.

\*Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions. The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	CR ≥ 10	70	80	-	°	
	Bottom		70	80	-	°	
	Left		70	80	-	°	
	Right		70	80	-	°	
Contrast Ratio	CR	-	640	800	-	-	
Luminance	L <sub>V</sub>	I <sub>LED</sub> = 40 mA	600	900	-	cd/m <sup>2</sup>	
Response Time (Rise + Fall)	T <sub>R</sub> + T <sub>F</sub>	T <sub>OP</sub> = 25°C	-	30	40	ms	
Chromaticity	Red	X <sub>R</sub>	-	0.582	0.632	0.682	-
		Y <sub>R</sub>	-	0.296	0.346	0.396	-
	Green	X <sub>G</sub>	-	0.311	0.361	0.411	-
		Y <sub>G</sub>	-	0.546	0.596	0.646	-
	Blue	X <sub>B</sub>	-	0.093	0.143	0.193	-
		Y <sub>B</sub>	-	0.031	0.081	0.131	-
White	X <sub>W</sub>	-	0.288	0.318	0.348	-	
	Y <sub>W</sub>	-	0.290	0.320	0.350	-	

## Touch Panel Characteristics

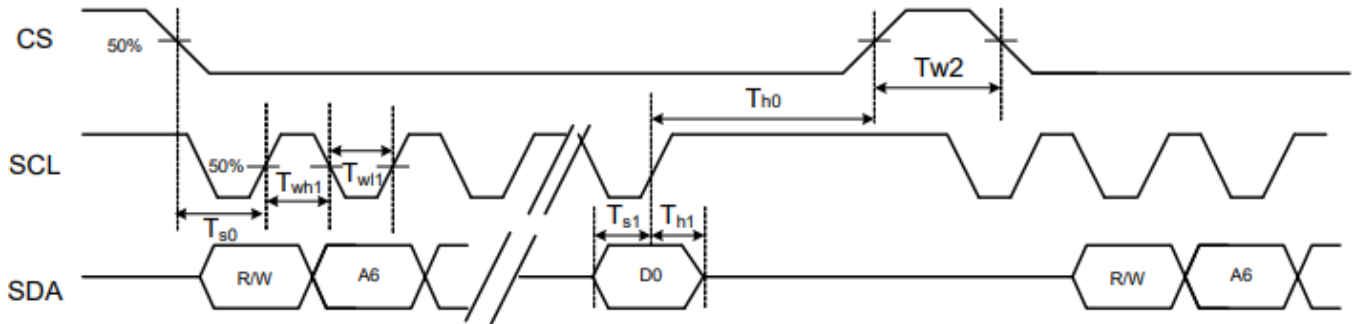
Item	Min.	Typ.	Max.	Unit
Linearity	-	-	1.5	%
Circuit Resistance – X-Axis	150	-	550	Ω
Circuit Resistance – Y-Axis	200	-	900	Ω
Insulation Resistance	20	-	-	MΩ
Operating Voltage	-	-	10	V
Response Time	-	-	15	ms
Transmittance	75	-	-	%
Activation Force	20	-	80	g
Pen Writing Durability	20,000	-	-	Times
Pitting Durability	1,000,000	-	-	Touches
Surface Hardness	3	-	-	H

# AC Characteristics

## System Operation AC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
VDD Power Source Slew Time	TPOR	-	-	20	ms	From 0V to 99% VDD
GRB Pulse Width	tRSTW	10	50	-	us	R=10Kohm, C=1uF
SD Output Stable Time	Tst	-	-	12	us	Output settled within +20mV Loading = 6.8k+28.2pF.
GD Output Rise and Fall Time	Tgst	-	-	6	us	Output settled (5%~95%), Loading = 4.7k+29.8pF

## System Bus Timing for 3-Wire SPI Interface

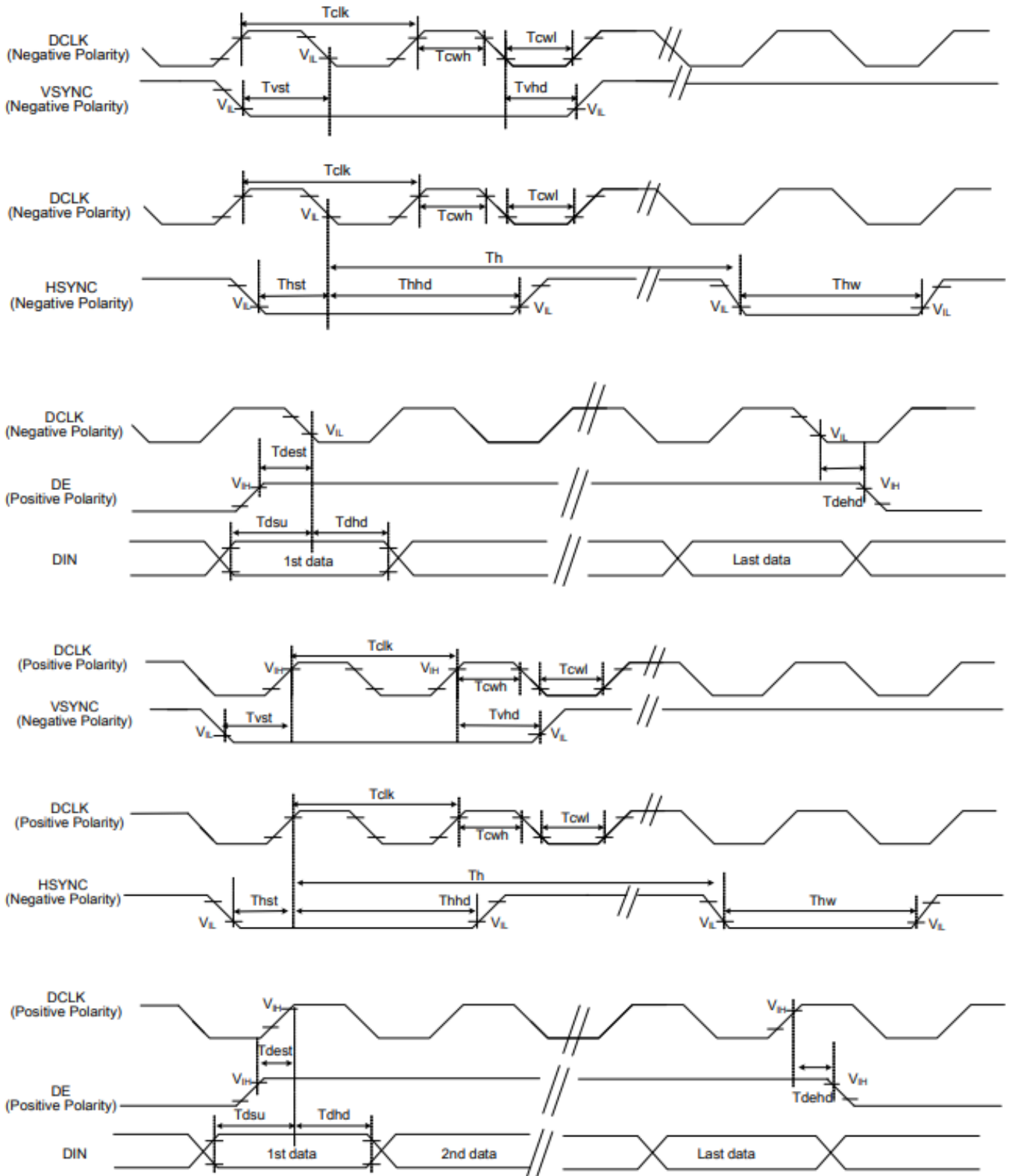


Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CS Input Setup Time	Ts0	50	-	-	ns	
Serial Data Input Setup Time	Ts1	50	-	-	ns	
CS Input Hold Time	Th0	50	-	-	ns	
Serial Data Input Hold Time	Th1	50	-	-	ns	
SCL Write Pulse High Width	Twh1	50	-	-	ns	
SCL Write Pulse Low Width	Twl1	50	-	-	ns	
SCL Read Pulse High Width	Trh1	300			ns	
SCL Read Pulse Low Width	Trl1	300			ns	
CS Pulse High Width	Tw2	400	-	-	ns	



# Timing Characteristics – TFT Display

## System Bus Timing for RGB Interface



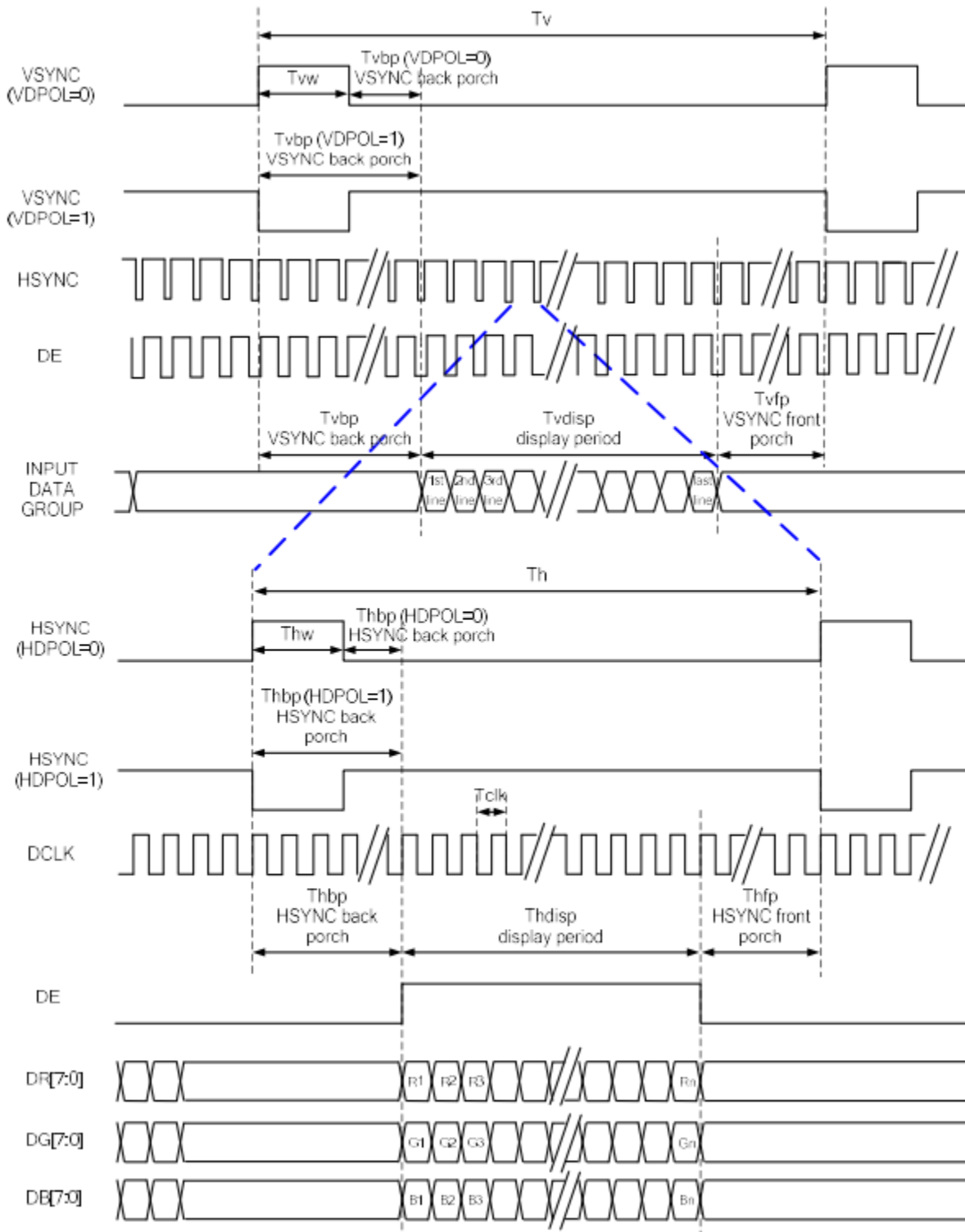
**Parallel 24-bit RGB Input Timing (V<sub>DD</sub> = 3.3V, GND = 0V, T<sub>OP</sub> = 25°C)**

Parallel 24-bit RGB Input Timing Table							
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
DCLK Frequency	Fclk	5	6	8	MHz		
DCLK Period	Tclk	125	167	200	ns		
HSYNC	Period Time	Th	325	371	438	DCLK	
	Display Period	Thdisp	-	320	-	DCLK	
	Back Porch	Thbp	3	43	43	DCLK	SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	244	260	289	HSYNC	
	Display Period	Tvdisp	-	240	-	HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

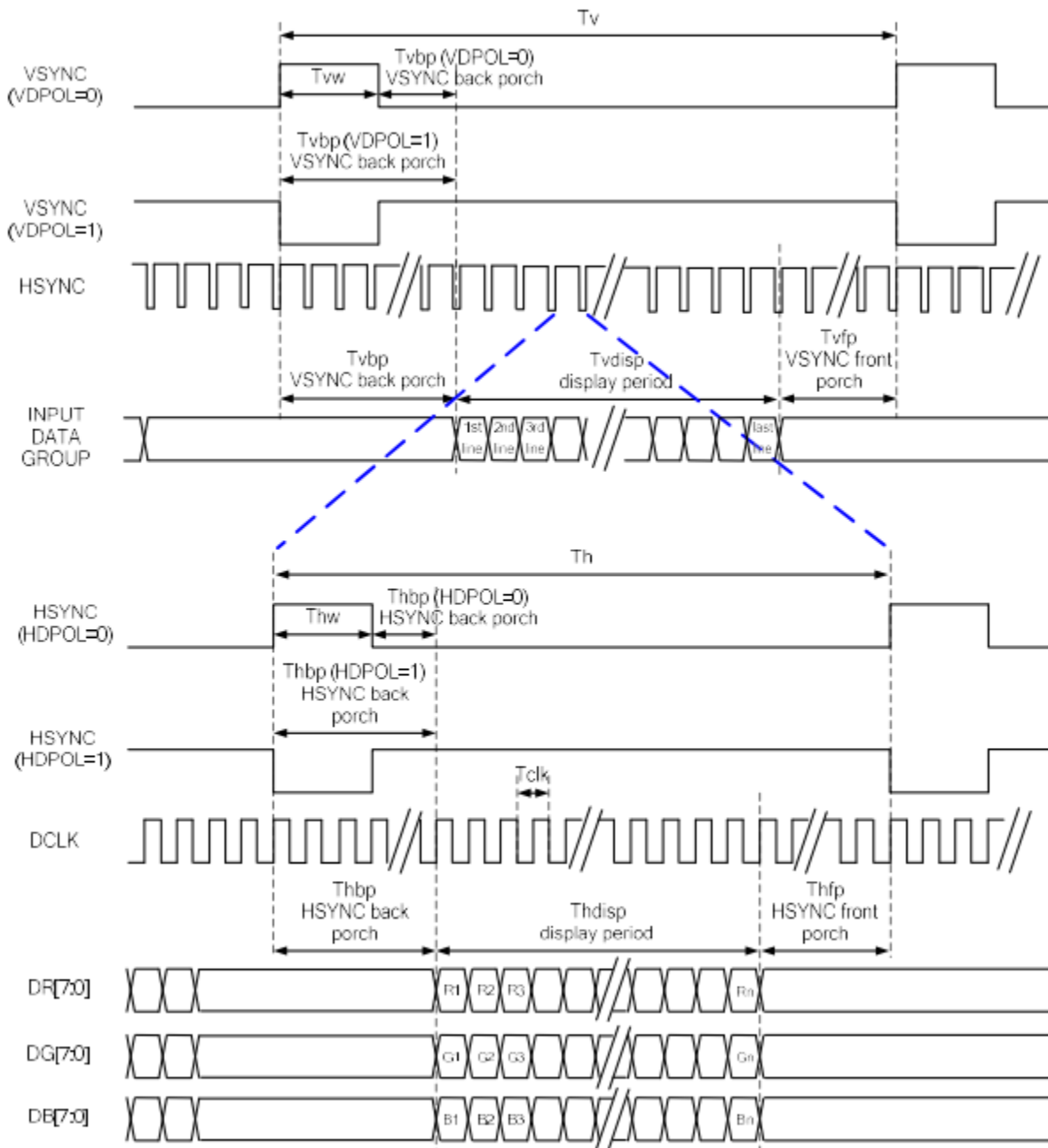
Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

**System Bus Timing**

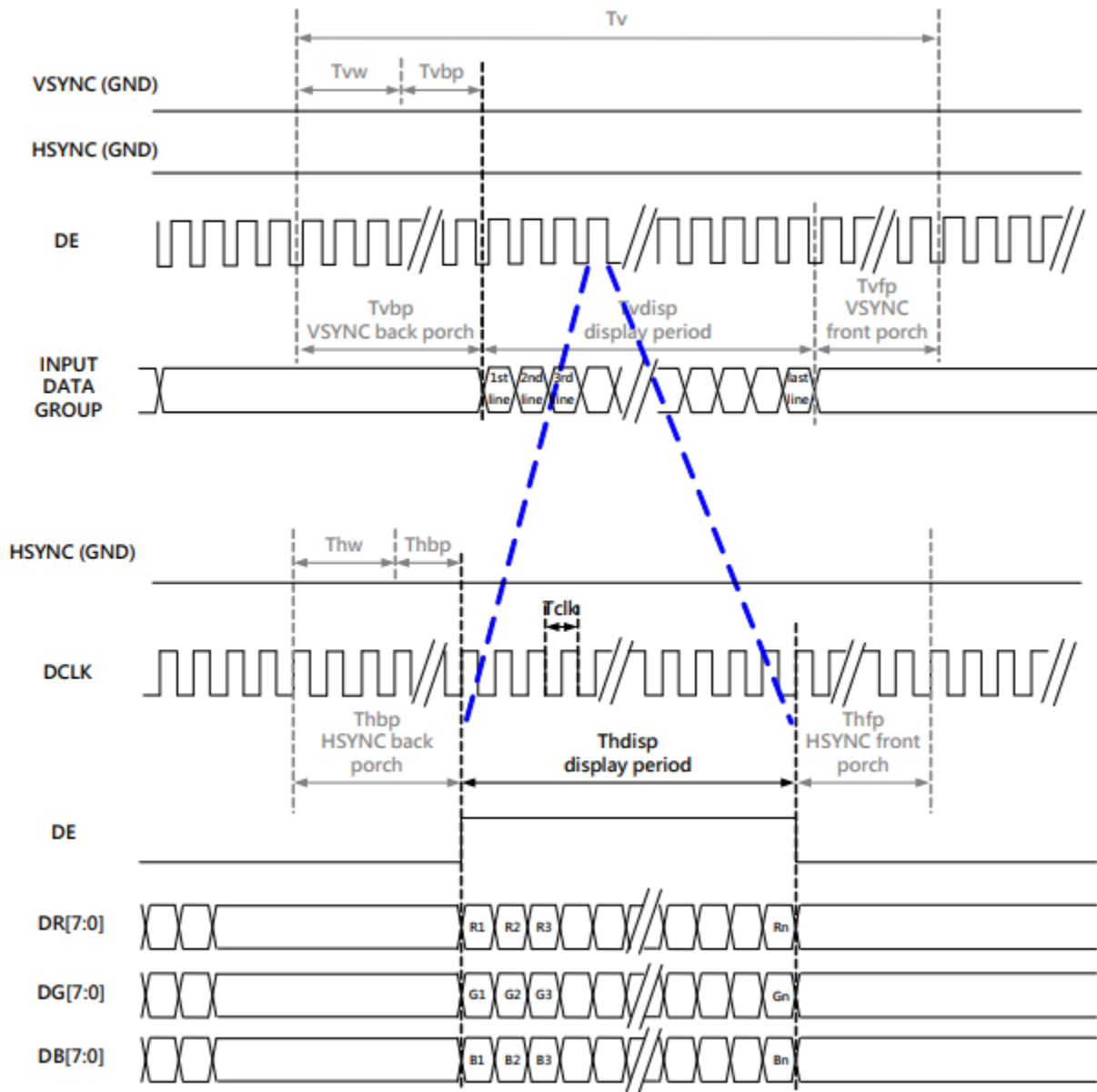
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	Tclk	40	50	60	%	
HSYNC Width	Thw	2	-	-	DCLK	
HSYNC Period	Th	55	60	65	us	
VSYNC Setup Time	Tvst	12	-	-	ns	
VSYNC Hold Time	Tvhd	12	-	-	ns	
HSYNC Setup Time	Thst	12	-	-	ns	
HSYNC Hold Time	Thhd	12	-	-	ns	
Data Setup Time	Tdsu	12	-	-	ns	
Data Hold Time	Tdhd	12	-	-	ns	
DE Setup Time	Tdest	12	-	-	ns	
DE Hold Time	Tdehd	12	-	-	ns	

**Parallel RGB Sync-DE Mode:**


### Parallel RGB Sync Mode:



Parallel RGB DE Mode:



## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C, 240hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C, 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 240hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 240hrs	1,2
High Temperature / Humidity Storage	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+60°C, 90% RH, 240hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	--30°C,30min -> 25°C,3min -> 80°C,30min = 1 cycle 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 5G Acceleration 60 sec in each of 3 directions (X, Y, Z) For 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8kV 150pF/330kΩ, 5 Times	
		Contact: ±4kV 150pF/330kΩ, 5 Times	

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 2 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.