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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# NHD-3.5-320240MF-ASXV#

## TFT (Thin-Film-Transistor) Color Liquid Crystal Display Module

NHD-	Newhaven Display
3.5-	3.5" Diagonal
320240-	320xRGBx240 Pixels
MF-	Model
A-	Built-in Driver / No Controller
S-	High Brightness, White LED Backlight
X-	TFT
V-	MVA, Wide Temperature
#	<b>RoHS Compliant</b>

**Newhaven Display International, Inc.**

2661 Galvin Ct.

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

[www.newhavendisplay.com](http://www.newhavendisplay.com)

[nhtech@newhavendisplay.com](mailto:nhtech@newhavendisplay.com)

[nhsales@newhavendisplay.com](mailto:nhsales@newhavendisplay.com)

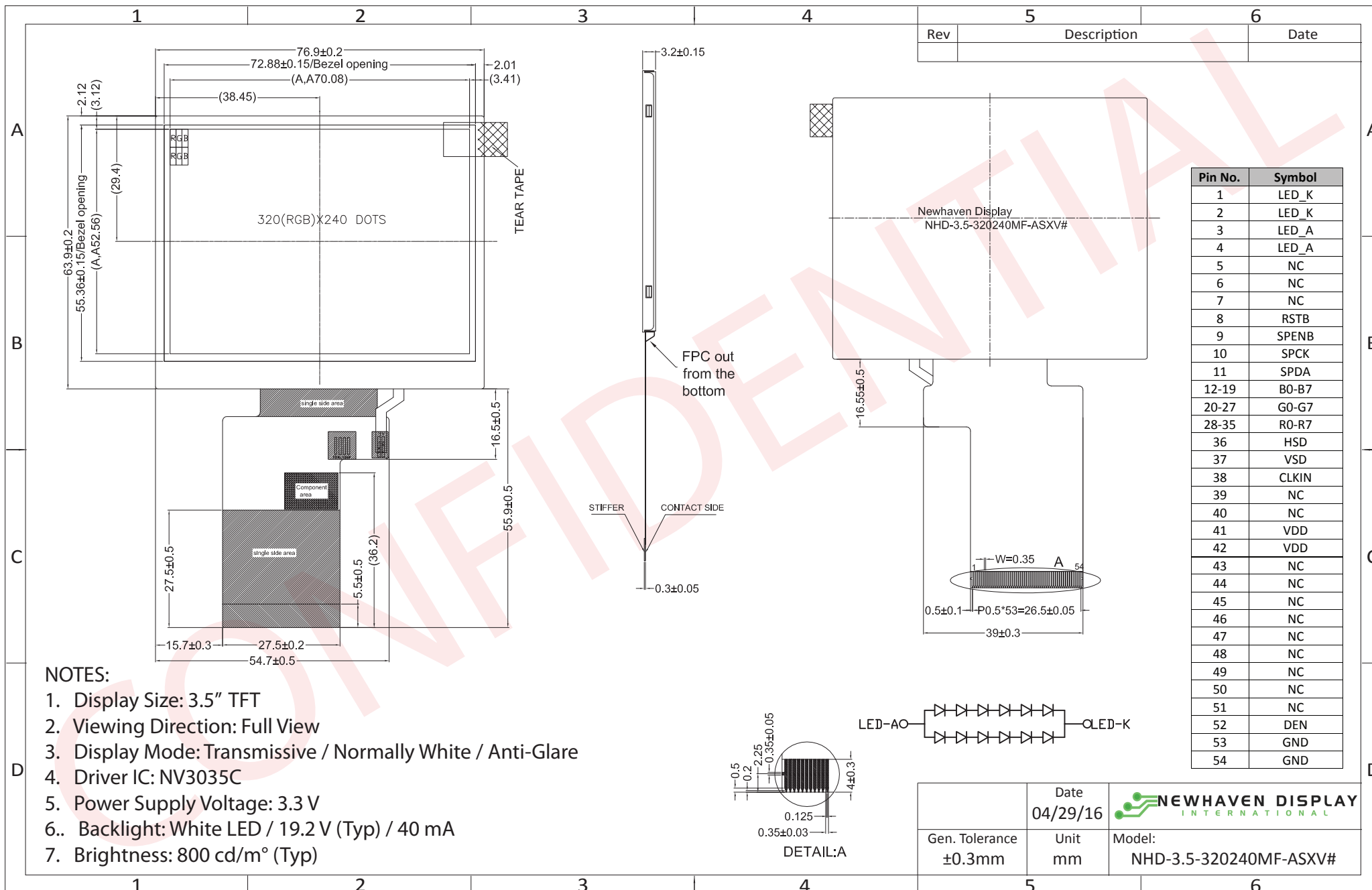
## Document Revision History

Revision	Date	Description	Changed by
0	4/29/16	Initial Release	SB
1	6/30/16	Added Chromaticity	SB
2	9/23/16	Updated $I_{LED}$ , $I_{DD}$ , and Chromaticity Values	SB

## Functions and Features

- 320xRGBx240 resolution
- LED backlight
- 3.3V power supply
- 24-bit Parallel digital RGB interface (6.4MHz)
- Premium high brightness display

# Mechanical Drawing



**NOTES:**

1. Display Size: 3.5" TFT
2. Viewing Direction: Full View
3. Display Mode: Transmissive / Normally White / Anti-Glare
4. Driver IC: NV3035C
5. Power Supply Voltage: 3.3 V
- 6.. Backlight: White LED / 19.2 V (Typ) / 40 mA
7. Brightness: 800 cd/m<sup>2</sup> (Typ)

The drawing contained herein is the exclusive property of Newhaven Display International, Inc. and shall not be copied, reproduced, and/or disclosed in any format without permission.

## Pin Description

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 @ 19.2V)
4	LED_A	Power Supply	Backlight Anode (40mA @ 19.2V)
5	NC	-	No Connect
6	NC	-	No Connect
7	NC	-	No Connect
8	RSTB	MPU	Active LOW Reset signal
9	SPENB	MPU	Active LOW Serial Chip Select signal
10	SPCK	MPU	Serial Clock signal
11	SPDA	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	HSD	MPU	Horizontal (Line) Sync signal
37	VSD	MPU	Vertical (Frame) Sync signal
38	CLKIN	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	NC	-	No Connect
44	NC	-	No Connect
45	NC	-	No Connect
46	NC	-	No Connect
47	NC	-	No Connect
48	NC	-	No Connect
49	NC	-	No Connect
50	NC	-	No Connect
51	NC	-	No Connect
52	DEN	-	Data Enable signal (No Connect)
53	GND	Power Supply	Ground
54	GND	Power Supply	Ground

**Recommended connector:** 54pin, 0.5mm pitch, FFC connector. Molex P/N 51296-5494



## Electrical Characteristics

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
Digital 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	5	10	20	mA
"H" Level input	V <sub>IH</sub>	-	0.8*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.2*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>	-	V <sub>SS</sub>	-	V <sub>SS</sub> +0.4	V
Backlight Supply Voltage	V <sub>LED</sub>	-	17.4	19.2	19.8	V
Backlight Supply Current	I <sub>LED</sub>	V <sub>LED</sub> =19.2V	30	40	50	mA
Backlight Lifetime*	-	I <sub>LED</sub> = 40 mA T <sub>OP</sub> = 25° C	20,000	50,000	-	Hrs.

\*Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	CR ≥ 10	-	70	-	°	
	Bottom		-	70	-	°	
	Left		-	70	-	°	
	Right		-	70	-	°	
Contrast Ratio	CR	-	200	350	-	-	
Luminance	L <sub>V</sub>	I <sub>LED</sub> = 40 mA	640	800	-	cd/m <sup>2</sup>	
Response Time	Rise	T <sub>OP</sub> = 25° C	-	25	40	ms	
	Fall		-	25	40	ms	
Chromaticity	Red	X <sub>R</sub>	-	0.554	0.604	0.654	-
		Y <sub>R</sub>	-	0.298	0.345	0.395	-
	Green	X <sub>G</sub>	-	0.263	0.313	0.363	-
		Y <sub>G</sub>	-	0.552	0.602	0.652	-
	Blue	X <sub>B</sub>	-	0.094	0.144	0.194	-
		Y <sub>B</sub>	-	0.056	0.106	0.156	-
White	X <sub>W</sub>	-	0.229	0.279	0.329	-	
	Y <sub>W</sub>	-	0.271	0.321	0.371	-	

## Driver Information

Built-in NV3035C driver. No controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/NV3035C.pdf](http://www.newhavendisplay.com/app_notes/NV3035C.pdf)

Note: To achieve optimum VCOM and VGL settings, the SPI interface may be used to set the following registers:

ROEh = 6Bh

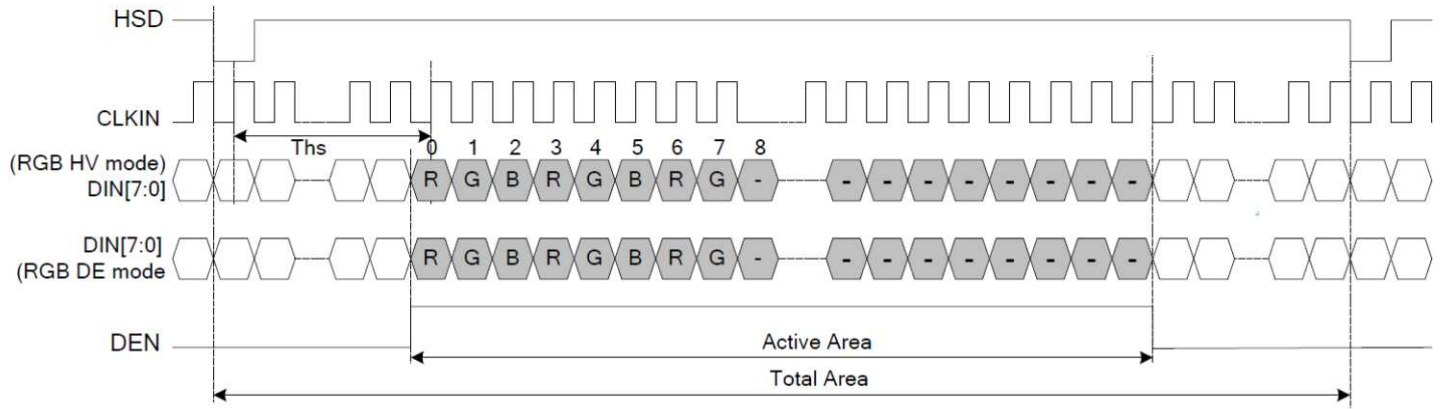
ROFh = 24h

## Timing Characteristics

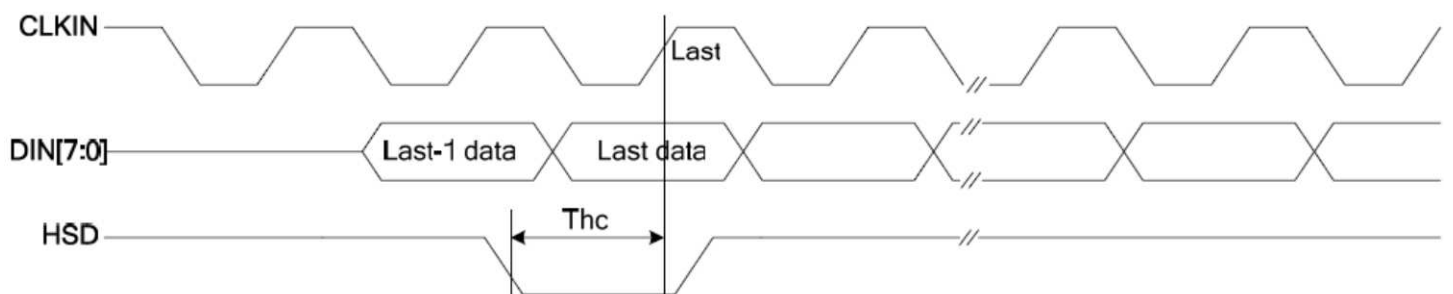
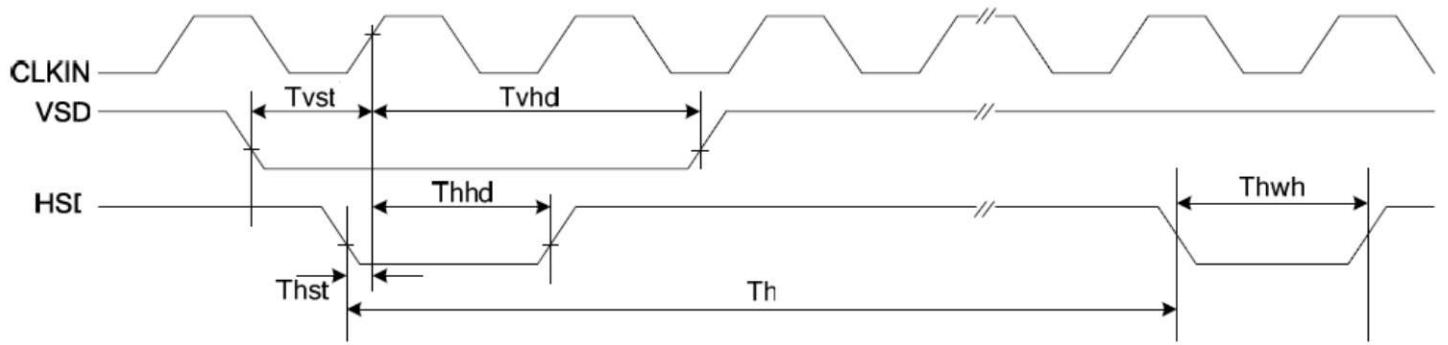
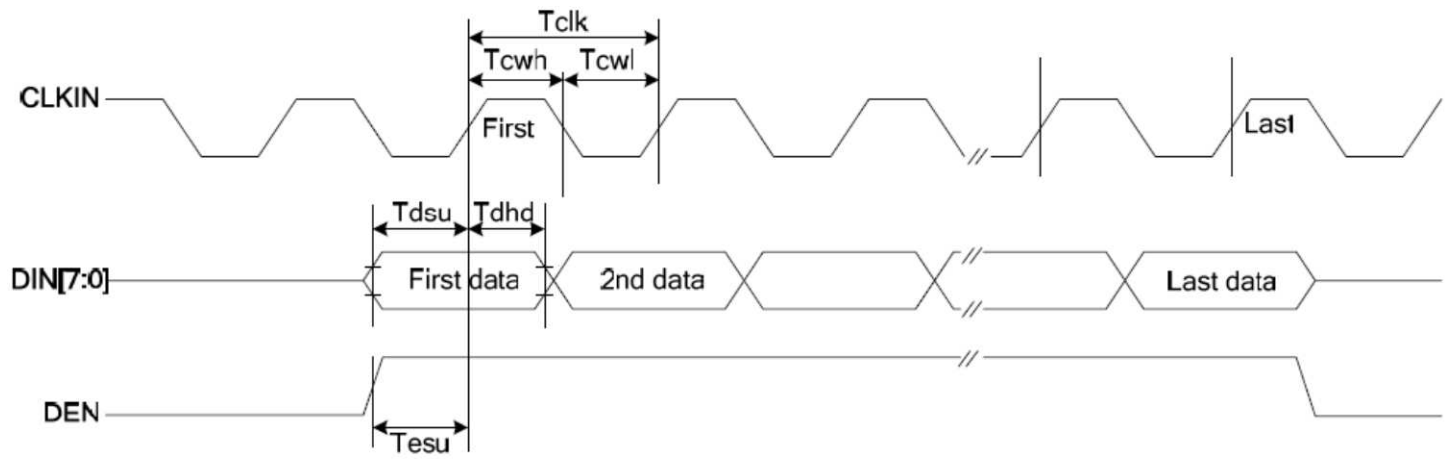
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
<b>System Operation Timing</b>						
VDD power source slew time	T <sub>POR</sub>			1000	us	From 0V to 90% VDD
RSTB active pulse width	T <sub>RSTB</sub>	40			us	VDD=3.3V
<b>Input Output Timing</b>						
CLKIN clock time	Tclk	-		35.7	ns	Please refer to timing table(P25)
HSD to CLKIN	Thc	-	-	1	CLKIN	
HSD width	Thwh	1	-	-	CLKIN	
VSD width	Tvwh	1	-	-	Th	
HSD period time	Th	60	63.56	67	us	
VSD setup time	Tvst	12	-	-	ns	
VSD hold time	Tvhd	12	-	-	ns	
HSD setup time	Thst	12	-	-	ns	
HSD hold time	Thhd	12	-	-	ns	
Data set-up time	Tdsu	12	-	-	ns	DIN[23:0] to CLKIN
Data hold time	Tdhd	12	-	-	ns	DIN[23:0] to CLKIN
DEN setup time	Tesd	12	-	-	ns	DEN to CLKIN
Time that VSD to 1 <sup>st</sup> line data input	Tvs	2	13	127	Th	@CIR601/8bit RGB HV mode Control by HDLY[6:0] setting Tvs=HDLY[6:0]
Time that CCIR_V to 1 <sup>st</sup> line data input	Tvs	12	20	28	Th	@CCIR656 NTSC mode Control by HDLY[6:0] setting Tvs=HDLY[6:0]
Time that CCIR_V to 1 <sup>st</sup> line data input	Tvs	17	25	33	Th	@CCIR656 PAL mode Control by HDLY[6:0] setting Tvs=HDLY[6:0]
Time that VSD to 1 <sup>st</sup> line data input	Tvs	2	13	127	Th	@24bit RGB HV mode Control by HDLY[6:0] setting Tvs=HDLY[6:0]
Source output stable time 1	Tst	-	25	30	us	96% final, CL=30pF, RL=2K
Gate output stable time	Tgst	-	500	1000	ns	96% final, CL=40pF
VCOMOUT output stable time	Test	-	4	8	us	96% final, CL=33nF, RL=100ohm
<b>3-wire serial communication AC timing</b>						
Serial clock	Tspck	320	-	-	ns	
SPCK pulse duty	Tscdut	40	50	60	%	Tckh/Tspck
Serial data setup time	Tisu	120	-	-	ns	
Serial data hold time	Tihd	120	-	-	ns	
Serial clock high/low	Tssw	120	-	-	ns	
Chip select distinguish	Tcd	1	-	-	us	
SPENA to VSD	Tcv	1	-	-	us	
SPENB input setup time	Teck	150	-	-	Ns	
SPENB input hold time	Tcke	150	-	-	ns	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	6.1	6.4	8.0	MHz	VDD=3.0~3.6V
CLKIN cycle time	Tclk	125	156	164	ns	
CLKIN pulse duty	Tcwh	40	50	60	%	Tclk
Time that HSD to 1 <sup>st</sup> data input(NTSC)	Ths	40	70	255	CLKIN	DDLY=70,Offset=0(fixed)

## Input Data Format

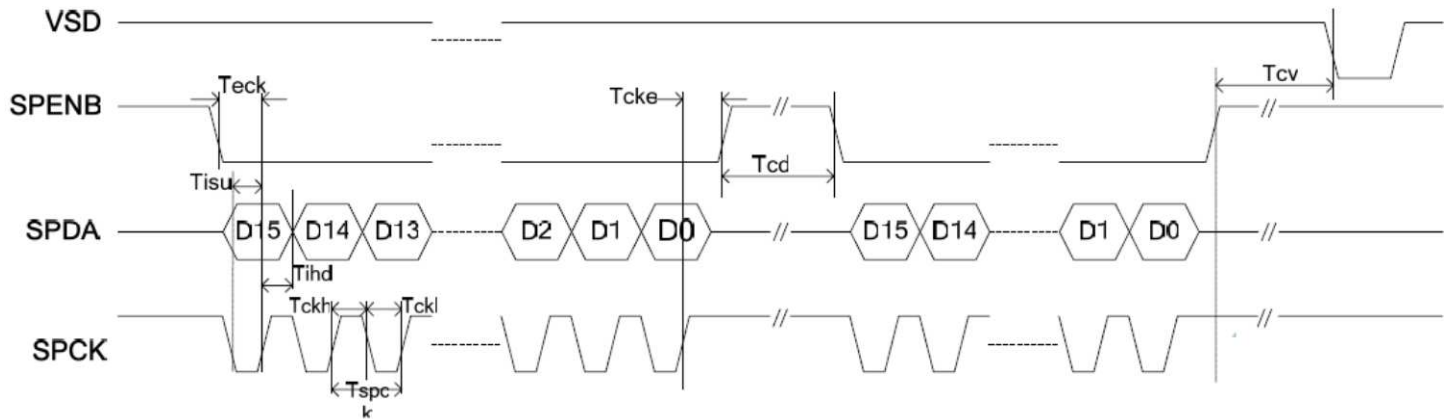


## Clock and Data Input Timing Diagram

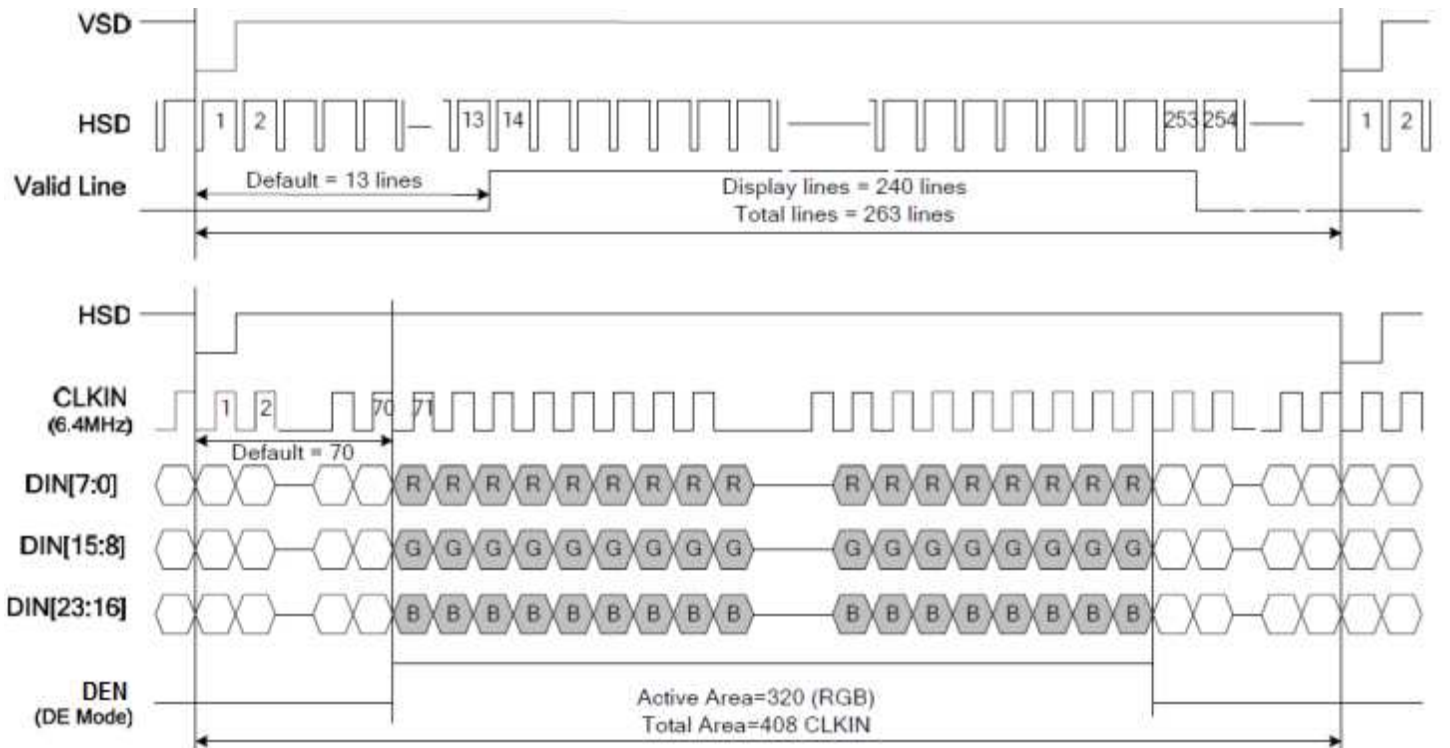




### 3-wire Timing Diagram



### Input Data Timing



## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+70°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.	+60°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 Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+60°C , 90% RH , 160hrs	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,5min -> 80°C,30min = 1 cycle 100 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=4KV, RS=330kΩ, CS=150pF Five times	

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

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

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

## Precautions for using LCDs/LCMs

See Precautions at [www.newhavendisplay.com/specs/precautions.pdf](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)