

# NHD-3.5-320240MF-ATXL#-T-1

## 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
T-	White LED Backlight
X-	TFT
L-	12:00 Optimal View, Wide Temperature
#-	<b>RoHS Compliant</b>
T-1	4-wire Resistive Touch Panel

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## Document Revision History

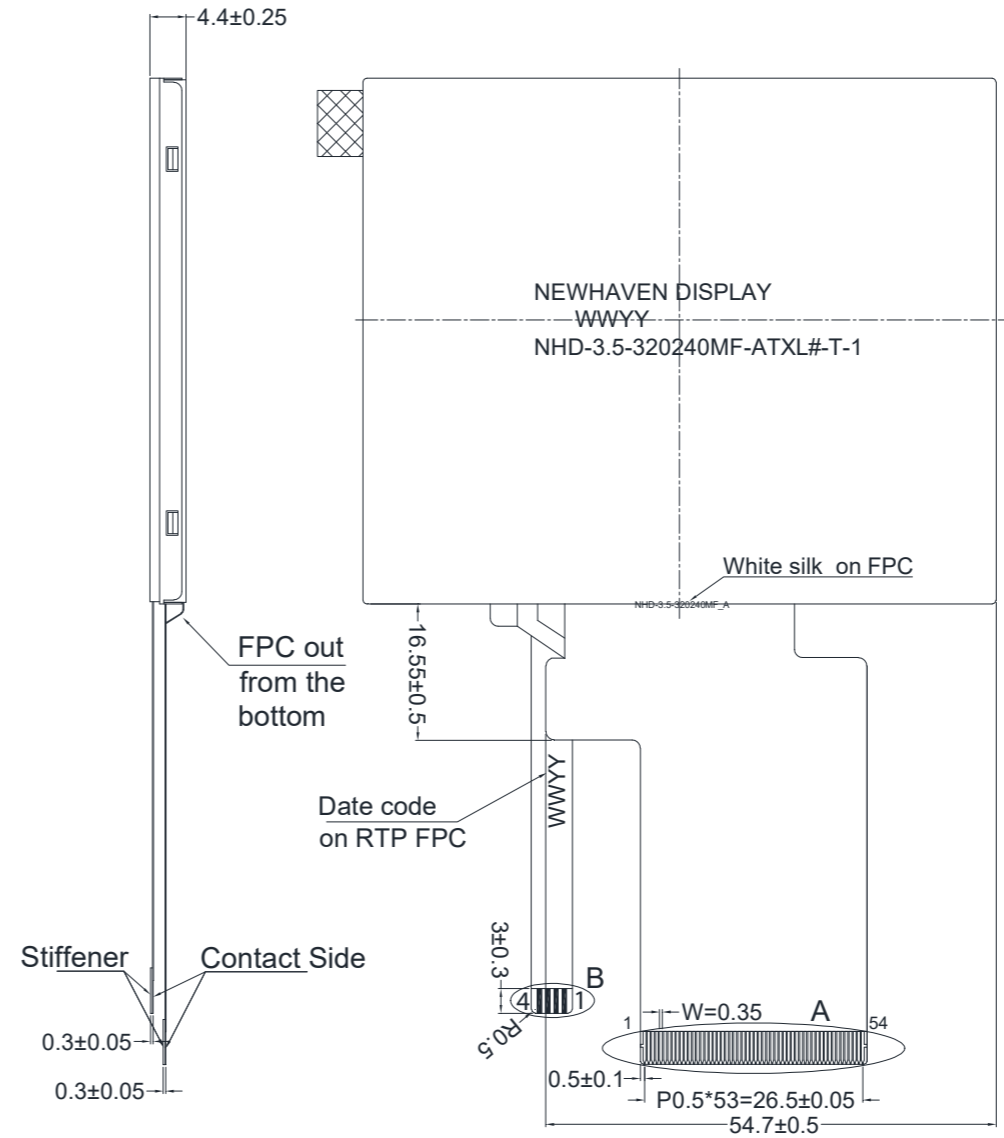
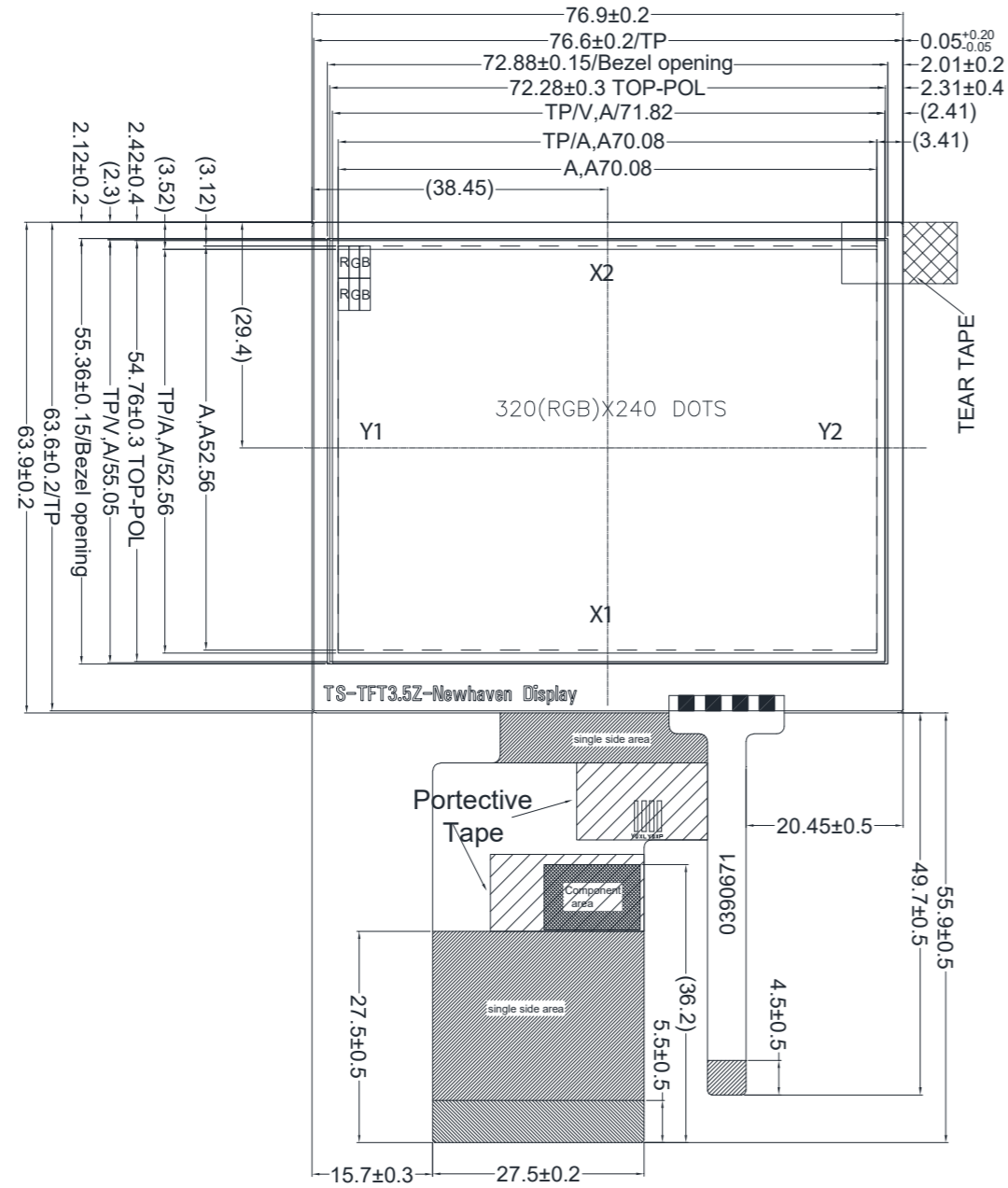
Revision	Date	Description	Changed by
0	7/8/2009	Initial Release	CL
1	7/29/09	MECHANICAL DRAWING UPDATE	CL
2	5/27/10	Touch Panel Characteristics Updated	BE
3	1/25/11	Viewing angle updated	AK
4	1/26/11	Mechanical Drawing updated	AK
5	3/31/11	Pin description / Note updated	AK
6	4/8/11	Contrast removed from electrical characteristics	BE
7	11/29/11	Electrical characteristics updated	AK
8	12/11/12	Timing characteristics & Mechanical drawing updated	AK
9	4/25/14	Optical characteristics updated	ML
10	5/30/14	Driver information updated	AK
11	12/03/15	Backlight Lifetime Information Added, Datasheet Reformat	SB
12	7/5/16	Added Chromaticity	SB
13	7/28/16	Updated Current Draw	SB
14	10/14/16	Backlight Voltage & Chromaticity Updated	SB
15	8/25/17	Mechanical Drawing Updated, Removed Paper Label	SB
16	6/30/20	Revised Note on Manual Register Configuration	AS
17	7/31/20	Updated 2D Mechanical Drawing, Driver IC Part Number to NV3035GTC, Timing Charts & Quality Information	AS
18	1/13/21	Updated 2D Mechanical Drawing	AS
19	3/2/21	Updated RTP Material Characteristics	AS

## Functions and Features

- 320xRGBx240 resolution
- LED backlight
- 24-bit Digital RGB interface (6.4MHz)
- 3.3V power supply
- With 4-Wire resistive Touch Panel

# Mechanical Drawing

SYMBOL	REVISION	DATE



## Pin Assignment

Pin No.	Symbol
1	LED_K
2	LED_K
3	LED_A
4	LED_A
5-7	NC
8	RSTB
9	SPENB
10	SPCK
11	SPDA
12-19	B0-B7
20-27	G0-G7
28-35	R0-R7
36	HSD
37	VSD
38	CLKIN
39-40	NC
41	V <sub>DD</sub>
42	V <sub>DD</sub>
43-51	NC
52	DEN
53	GND
54	GND

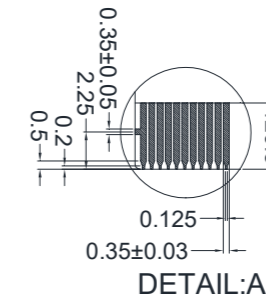
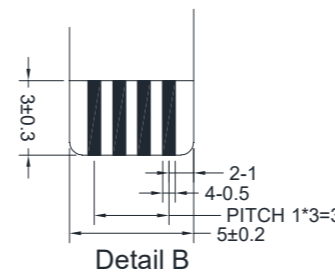
## RTP Pin Assignment

1.	Y1
2.	X1
3.	Y2
4.	X2

## NOTES:

- Display Size: 3.5" TFT
- Optimal Viewing Angle: 12:00
- Display Mode: Transmissive / Normally White / Anti-Glare
- Driver IC: NV3035GTC
- Power Supply Voltage: 3.3V
- Backlight: White LED / 19.2 V / 18 mA (Typ)
- Brightness: 320 cd/m<sup>2</sup>
- Touch Panel: 4-Wire Resistive

## Backlight Circuit



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)			
LINEAR: ±0.3mm		DRAWING/PART NUMBER: NHD-3.5-320240MF-ATXL#-T-1	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION		DRAWN BY: A. Shah	APPROVED BY: A. Shah
		DRAWN DATE: 1/13/21	APPROVED DATE: 1/31/21
		DO NOT SCALE DRAWING	
		SHEET 1 OF 1	
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## Pin Description

### LCD:

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 (18mA @ 19.2V)
4	LED_A	Power Supply	Backlight Anode (18mA @ 19.2V)
5-7	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
39-40	NC	-	No Connect
41	V <sub>DD</sub>	Power Supply	Supply Voltage for LCD and logic (3.3V)
42	V <sub>DD</sub>	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 connector:** 54pin, 0.5mm pitch, FFC connector. Molex P/N 51296-5494

### 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 connector:** 4pin, 1.0mm pitch, FFC connector. Molex P/N 52207-0485

## Driver Information

Built-in NV3035GTC driver. No controller.

Please download specification at

[https://www.newhavendisplay.com/resources\\_dataFiles/datasheets/LCDs/NV3035GTC.pdf](https://www.newhavendisplay.com/resources_dataFiles/datasheets/LCDs/NV3035GTC.pdf)

**NOTE:** Control registers accessible via the display's 3-wire SPI interface are used to set optimal functionality of the driver IC and TFT panel during manufacturing of the display. These control registers are not intended for use during normal operation of the display. Changing these register values may result in undesired visual artifacts and improper functionality of the display.

## 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	-	10	15	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>	-	16.8	19.2	20.4	V
Backlight Supply Current	I <sub>LED</sub>	V <sub>LED</sub> =19.2V	-	18	20	mA
Backlight Lifetime*	-	I <sub>LED</sub> = 18 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	-	60	-	°	
	Bottom		-	40	-	°	
	Left		-	60	-	°	
	Right		-	60	-	°	
Contrast Ratio	CR	-	200	350	-	-	
Luminance	L <sub>V</sub>	I <sub>LED</sub> = 18 mA	250	320	-	cd/m <sup>2</sup>	
Response Times	Rise	T <sub>OP</sub> =25°C	-	25	40	ms	
	Fall		-	25	40	ms	
Chromaticity	Red	X <sub>R</sub>	-	0.551	0.601	0.651	-
		Y <sub>R</sub>	-	0.304	0.354	0.404	-
	Green	X <sub>G</sub>	-	0.273	0.323	0.373	-
		Y <sub>G</sub>	-	0.540	0.590	0.640	-
	Blue	X <sub>B</sub>	-	0.095	0.145	0.195	-
		Y <sub>B</sub>	-	0.055	0.105	0.155	-
White	X <sub>W</sub>	-	0.238	0.288	0.338	-	
	Y <sub>W</sub>	-	0.270	0.320	0.370	-	

## Touch Panel Characteristics

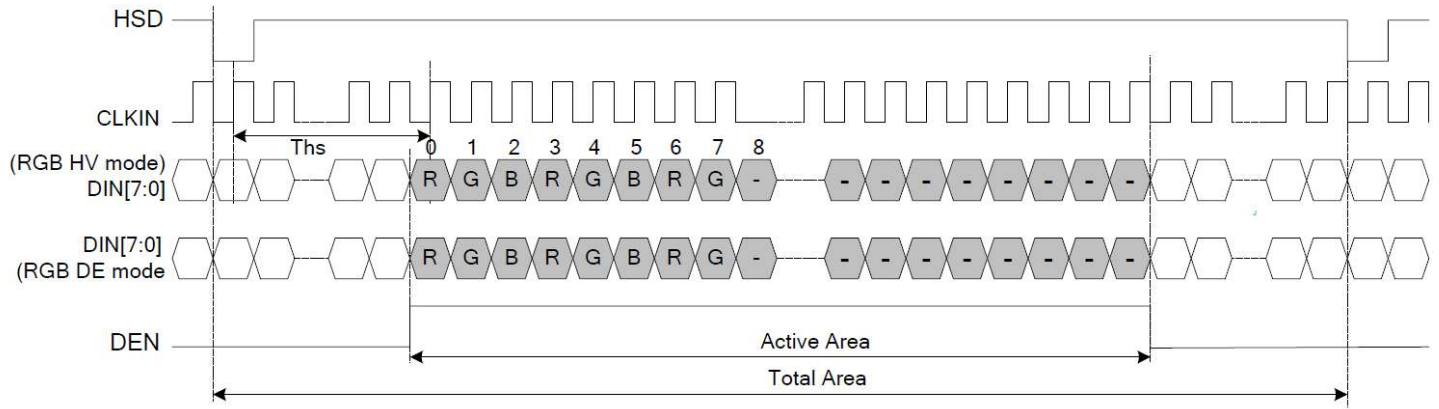
Item	Min.	Typ.	Max.	Unit
Linearity	-	-	1.5	%
Circuit Resistance – X-Axis	150	-	550	Ω
Circuit Resistance – Y-Axis	200	-	900	Ω
Insulation Resistance	20	-	-	MΩ
Operating Voltage	-	-	5	V
Chattering	-	-	15	Ms
Transmittance	75	-	-	%
Activation Force	20	-	80	g
Pen Writing Durability	20,000	-	-	Characters
Pitting Durability	1,000,000	-	-	Touches
Surface Hardness	3	-	-	H
Haze	2	4	6	%

# Timing Characteristics

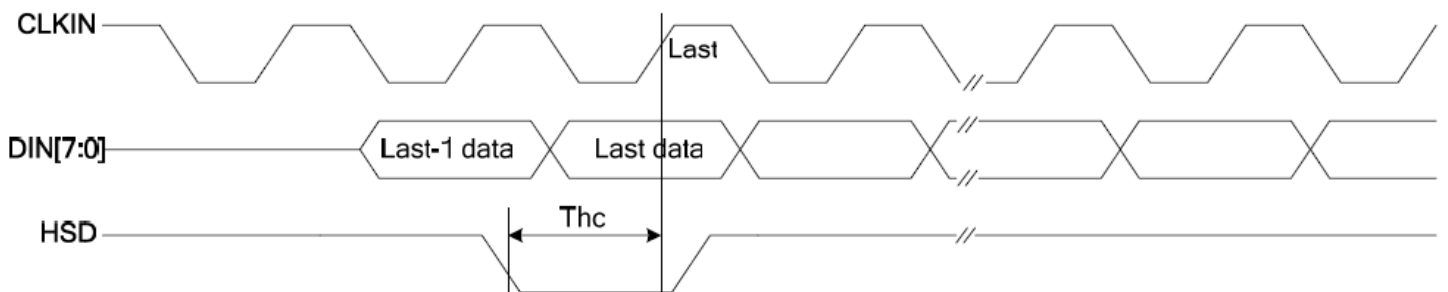
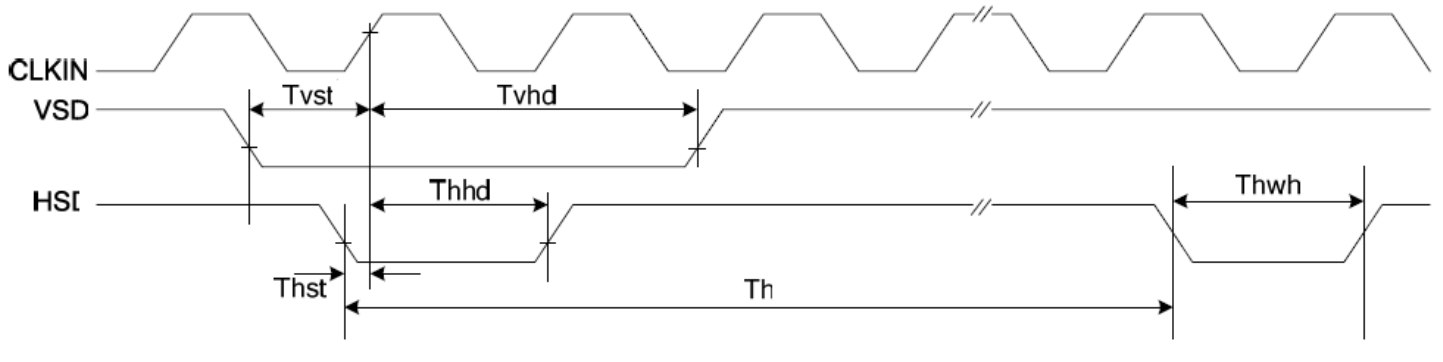
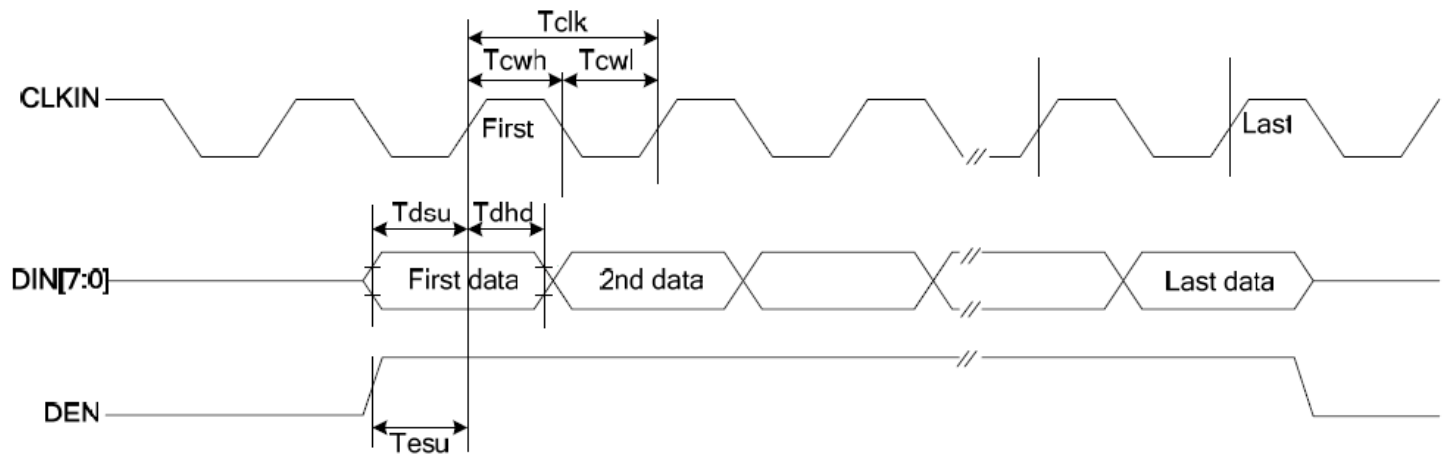
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
<b>System Operation Timing</b>						
VDD Power Source Slew Time	TPOR			1000	us	From 0V to 90% VDD
RSTB active pulse Width	TRSTB	40			us	VDD = 3.3V
<b>Input Output Timing</b>						
CLKIN clock time	Tclk	35.7		-	ns	Please refer to timing table (P25)
HSD to 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	8	-	-	ns	
VSD hold time	Tvhd	10	-	-	ns	
HSD setup time	Thst	8	-	-	ns	
HSD hold time	Thhd	10	-	-	ns	
Data set-up time	Tdsu	8	-	-	ns	DIN[23:0] to CLKIN
Data hold time	Tdhd	10	-	-	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	@C1R601/8bit 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=2KΩ
Gate output stable time	Tgst	-	500	1000	ns	96% final, CL=40pF
VCOMOUT output stable time	Tcst	-	4	8	us	96% final, CL=33nF, RL=100Ω
<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)

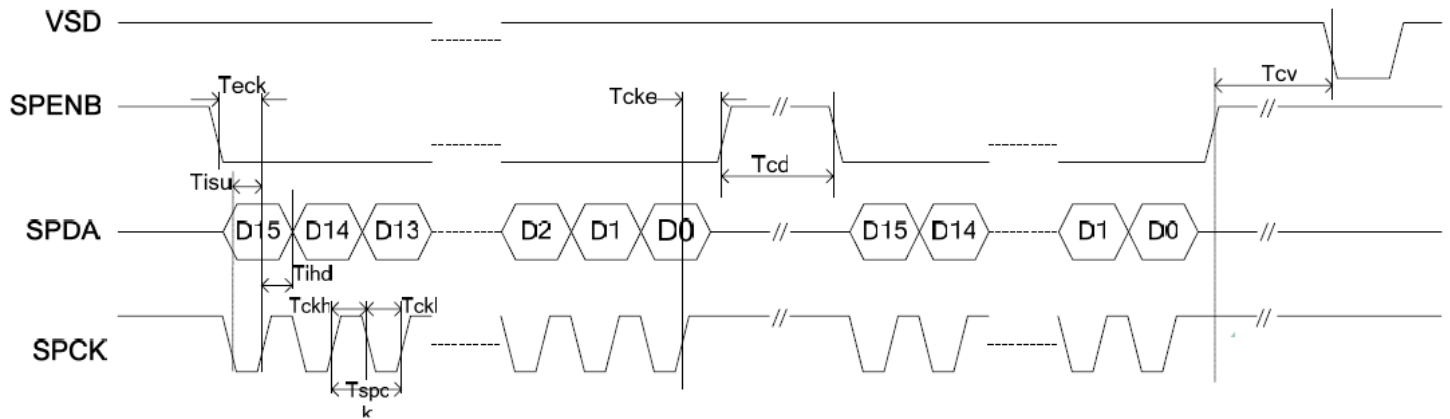
## Input Data Format



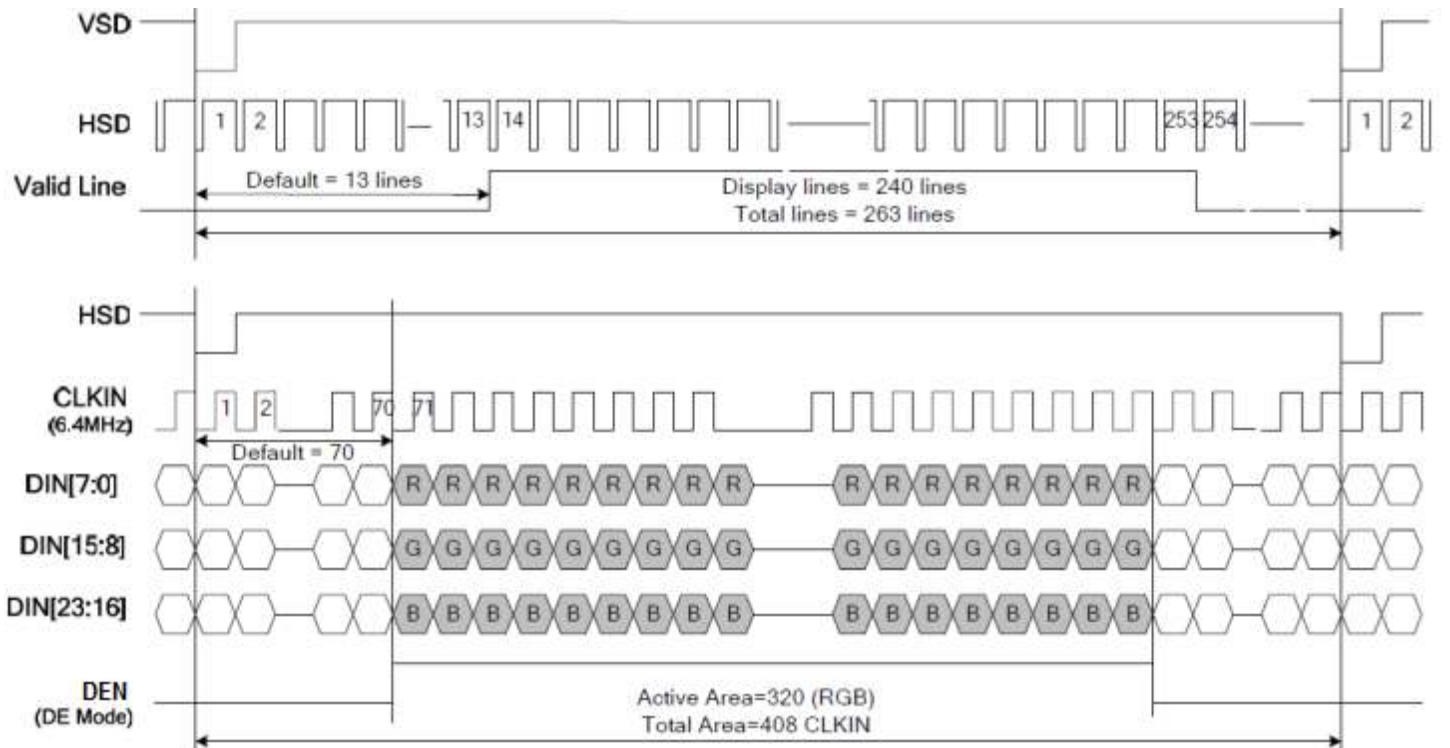
## Clock and Data Input Timing Diagram



### 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.	+80°C , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 96hrs	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.	+50°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-20°C,60min -> 25°C,5min -> 70°C,60min = 1 cycle 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz , 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/330Ω, 5 Times Contact: ±4kV 150pF/330Ω, 5 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)