

# 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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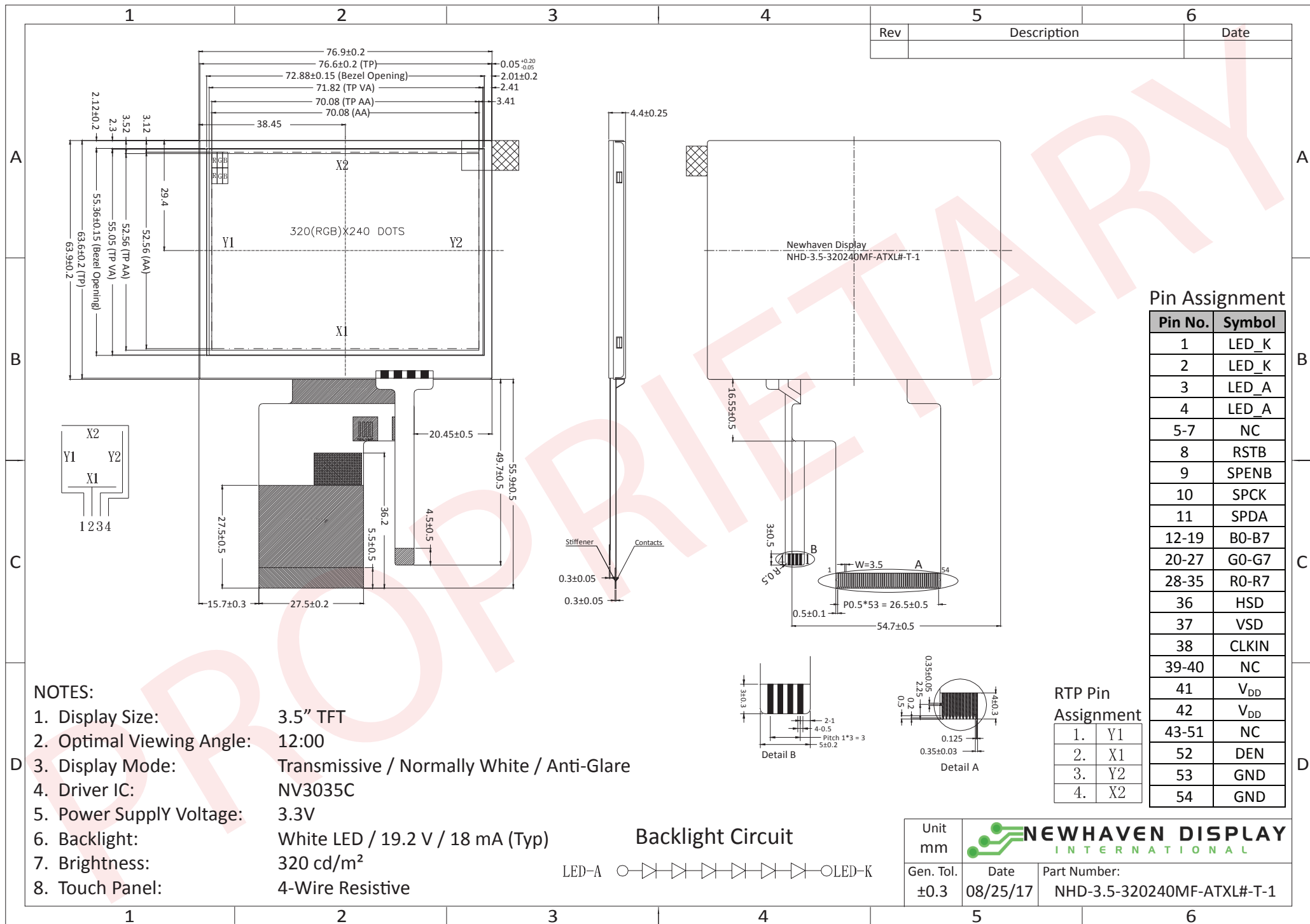
## Document Revision History

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

## 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



Rev	Description	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

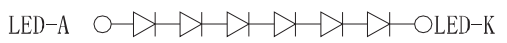
### RTP Pin Assignment

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: NV3035C
- 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



Unit mm		
Gen. Tol. ±0.3	Date 08/25/17	Part Number: NHD-3.5-320240MF-ATXL#-T-1

## 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 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

## 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

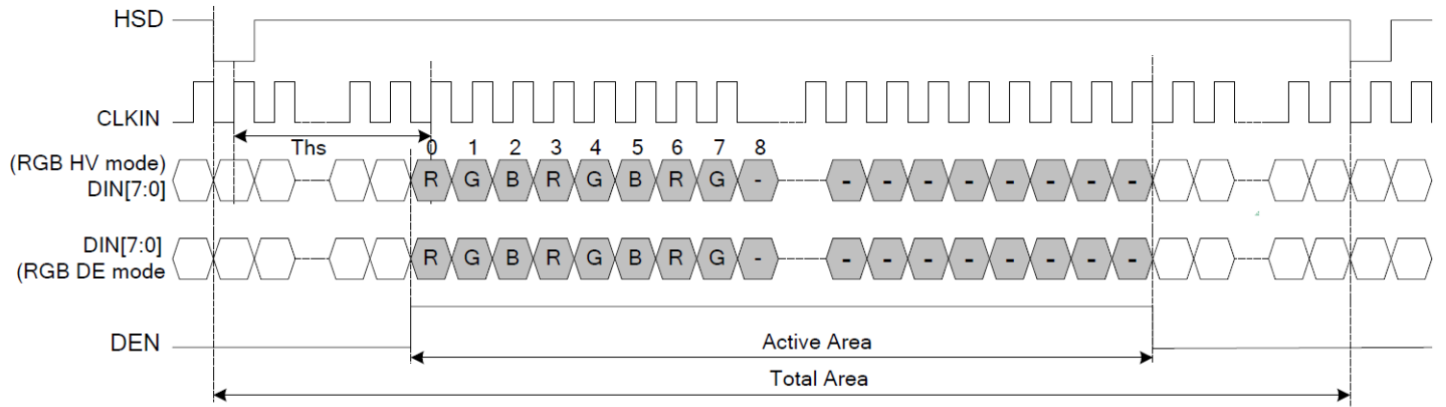
Item	Min.	Typ.	Max.	Unit
Linearity	-	-	1.5	%
Circuit Resistance – X-Axis	200	-	900	Ω
Circuit Resistance – Y-Axis	200	-	900	Ω
Insulation Resistance	20	-	-	MΩ
Operating Voltage	-	-	5	V
Chattering	-	-	10	Ms
Transmittance	75	-	-	%
Activation Force	70	-	120	g
Pen Writing Durability	100,000	-	-	Characters
Pitting Durability	1,000,000	-	-	Touches
Surface Hardness	3	-	-	H
Haze	-	7	-	%

## Timing Characteristics

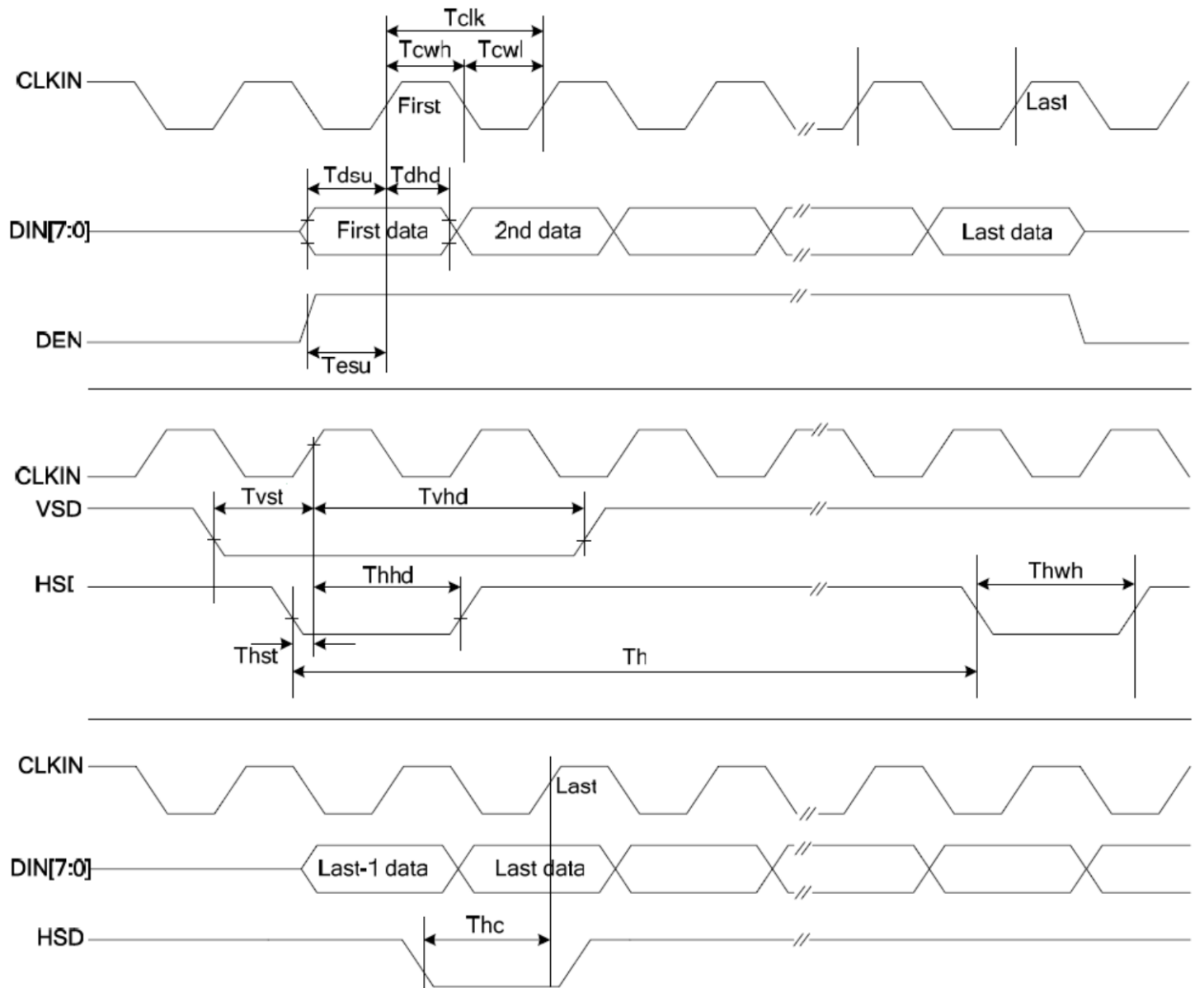
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
<b>System Operation Timing</b>						
VDD power source slew time	T <sub>POR</sub>			1000	us	From 0V to 90% VDD
RSTB active pulse width	T <sub>RSTB</sub>	40			us	VDD=3.3V
<b>Input Output Timing</b>						
CLKIN clock time	Tclk	-		35.7	ns	Please refer to timing table(P25)
HSD to CLKIN	T <sub>hc</sub>	-	-	1	CLKIN	
HSD width	T <sub>hwh</sub>	1	-	-	CLKIN	
VSD width	T <sub>vwh</sub>	1	-	-	Th	
HSD period time	T <sub>h</sub>	60	63.56	67	us	
VSD setup time	T <sub>vst</sub>	12	-	-	ns	
VSD hold time	T <sub>vhd</sub>	12	-	-	ns	
HSD setup time	T <sub>hst</sub>	12	-	-	ns	
HSD hold time	T <sub>hhd</sub>	12	-	-	ns	
Data set-up time	T <sub>dsu</sub>	12	-	-	ns	DIN[23:0] to CLKIN
Data hold time	T <sub>dhd</sub>	12	-	-	ns	DIN[23:0] to CLKIN
DEN setup time	T <sub>esd</sub>	12	-		ns	DEN to CLKIN
Time that VSD to 1 <sup>st</sup> line data input	T <sub>vs</sub>	2	13	127	Th	@CIR601/8bit RGB HV mode Control by HDLY[6:0] setting T <sub>vs</sub> =HDLY[6:0]
Time that CCIR_V to 1 <sup>st</sup> line data input	T <sub>vs</sub>	12	20	28	Th	@CCIR656 NTSC mode Control by HDLY[6:0] setting T <sub>vs</sub> =HDLY[6:0]
Time that CCIR_V to 1 <sup>st</sup> line data input	T <sub>vs</sub>	17	25	33	Th	@CCIR656 PAL mode Control by HDLY[6:0] setting T <sub>vs</sub> =HDLY[6:0]
Time that VSD to 1 <sup>st</sup> line data input	T <sub>vs</sub>	2	13	127	Th	@24bit RGB HV mode Control by HDLY[6:0] setting T <sub>vs</sub> =HDLY[6:0]
Source output stable time 1	T <sub>st</sub>	-	25	30	us	96% final, CL=30pF, RL=2K
Gate output stable time	T <sub>gst</sub>	-	500	1000	ns	96% final, CL=40pF
VCOMOUT output stable time	T <sub>est</sub>	-	4	8	us	96% final, CL=33nF, RL=100ohm
<b>3-wire serial communication AC timing</b>						
Serial clock	T <sub>spck</sub>	320	-	-	ns	
SPCK pulse duty	T <sub>scdut</sub>	40	50	60	%	T <sub>ckh</sub> /T <sub>spck</sub>
Serial data setup time	T <sub>isdu</sub>	120	-	-	ns	
Serial data hold time	T <sub>ihdu</sub>	120	-	-	ns	
Serial clock high/low	T <sub>ssw</sub>	120	-	-	ns	
Chip select distinguish	T <sub>cd</sub>	1	-	-	us	
SPENA to VSD	T <sub>cv</sub>	1	-	-	us	
SPENB input setup time	T <sub>eck</sub>	150	-	-	Ns	
SPENB input hold time	T <sub>cke</sub>	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	T <sub>cwh</sub>	40	50	60	%	Tclk
Time that HSD to 1 <sup>st</sup> data input(NTSC)	T <sub>hs</sub>	40	70	255	CLKIN	DDLY=70,Offset=0(fixed)

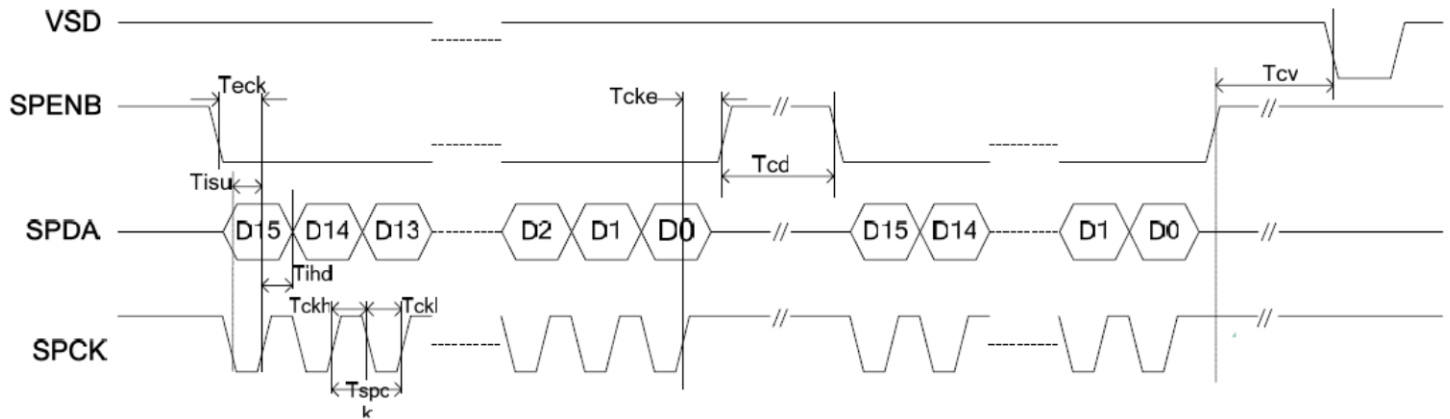
## Input Data Format



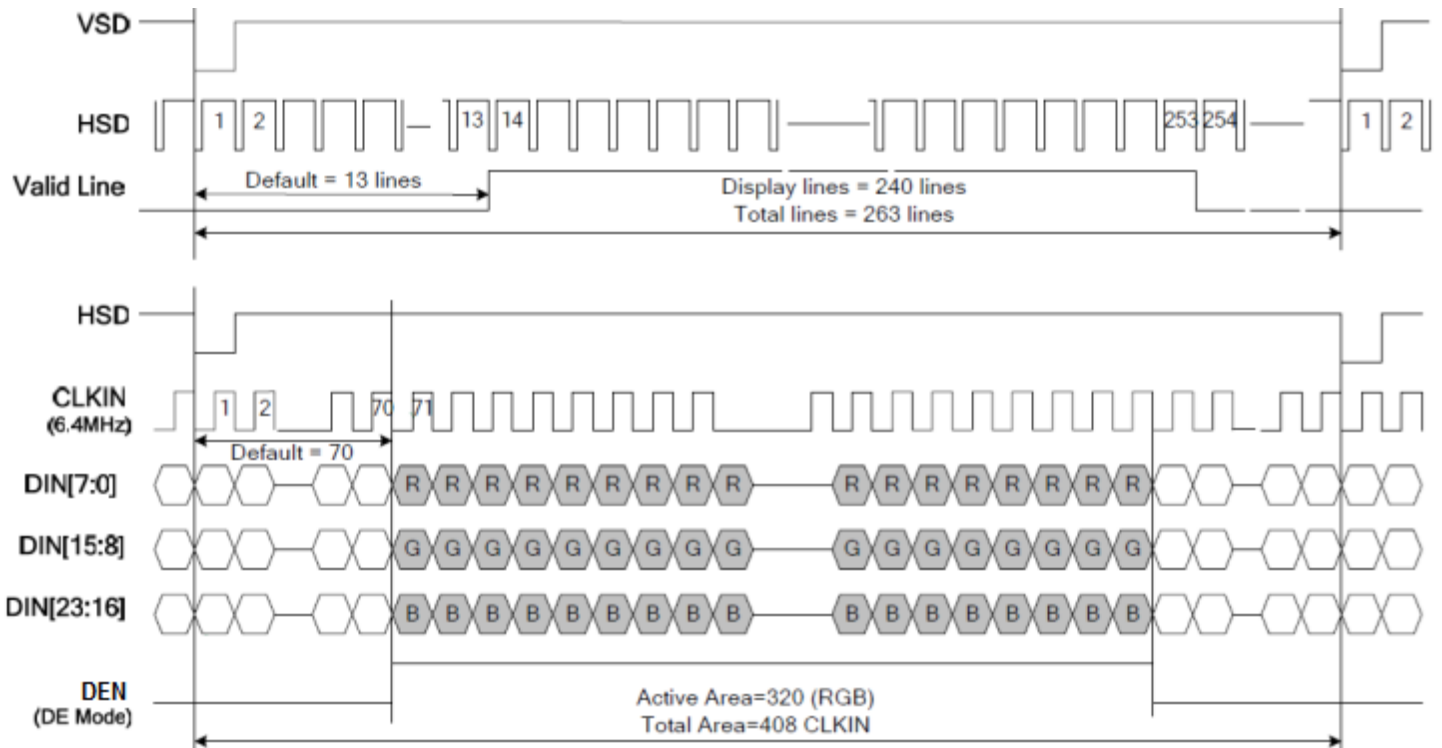
## Clock and Data Input Timing Diagram



### 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.	-20°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.	-10°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.	+50°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.	-20°C,30min -> 25°C,5min -> 70°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.newhavendisply.com/specs/precautions.pdf](http://www.newhavendisply.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

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