

NHD-10.1-1024600AF-LSXV#-CTP

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

NHD-	Newhaven Display
10.1-	10.1" Diagonal
1024600-	1024xRGBx600 Pixels
AF-	Model
L-	LVDS Interface
S-	High Brightness, White LED Backlight
X-	TFT
V-	MVA, Transmissive, Standard Temperature
#-	RoHS Compliant
CTP-	Capacitive Touch Panel with Controller

Newhaven Display International, Inc.

2661 Galvin Ct.

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com

nhsales@newhavendisplay.com

Document Revision History

Revision	Date	Description	Changed by
0	5/17/17	Initial Release	SB
1	8/14/17	Backlight Characteristics Added, Pin Descriptions Updated	SB
2	11/8/17	CTP Characteristics Updated	SB
3	3/6/18	Backlight Characteristics Updated	SB
4	7/1/18	Backlight Redesign	SB
5	5/6/19	Display Thickness Correction	SB
6	7/10/19	Electrical Characteristics Updated	SB

Functions and Features

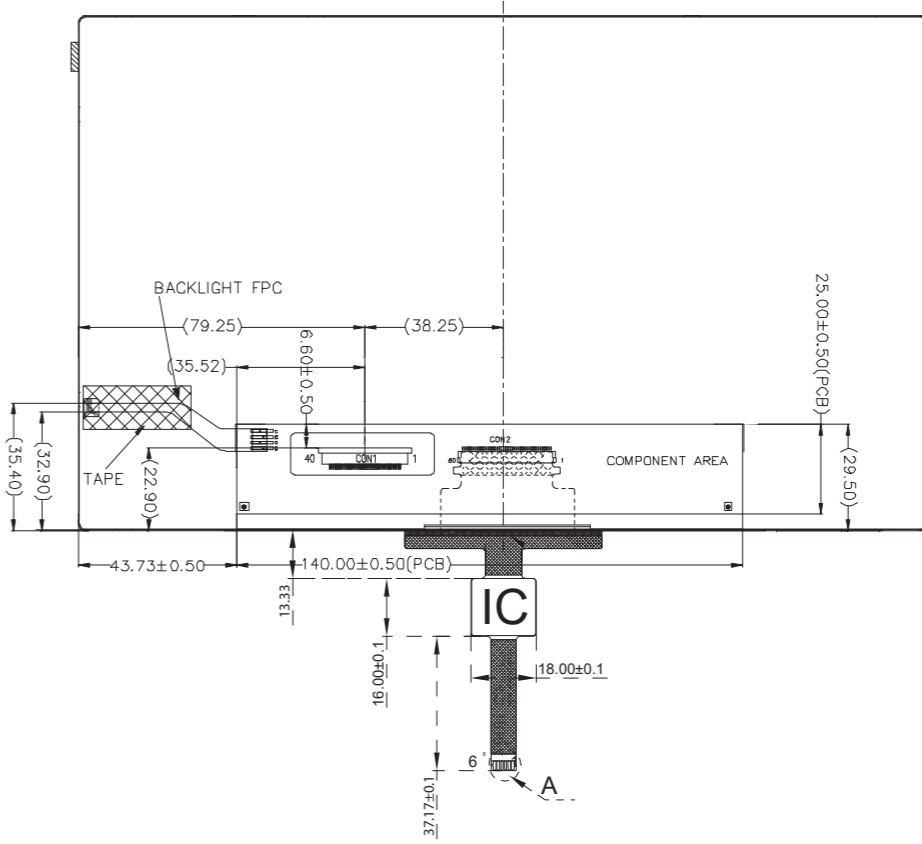
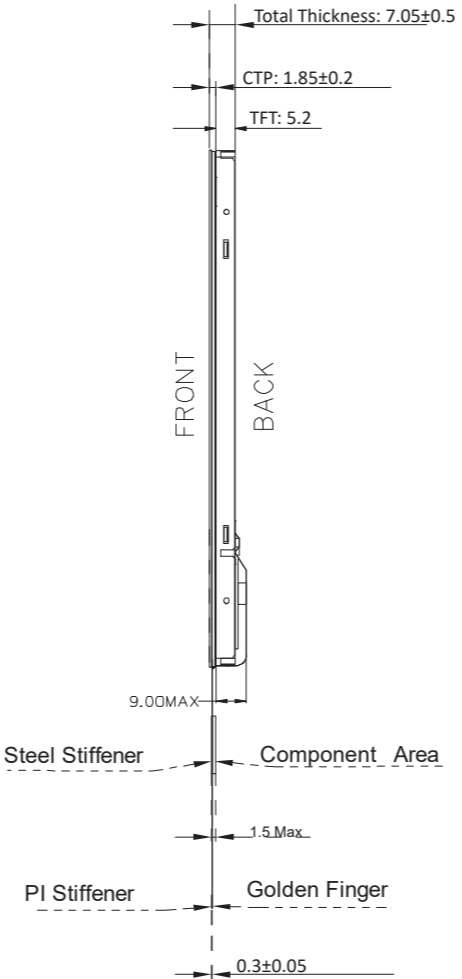
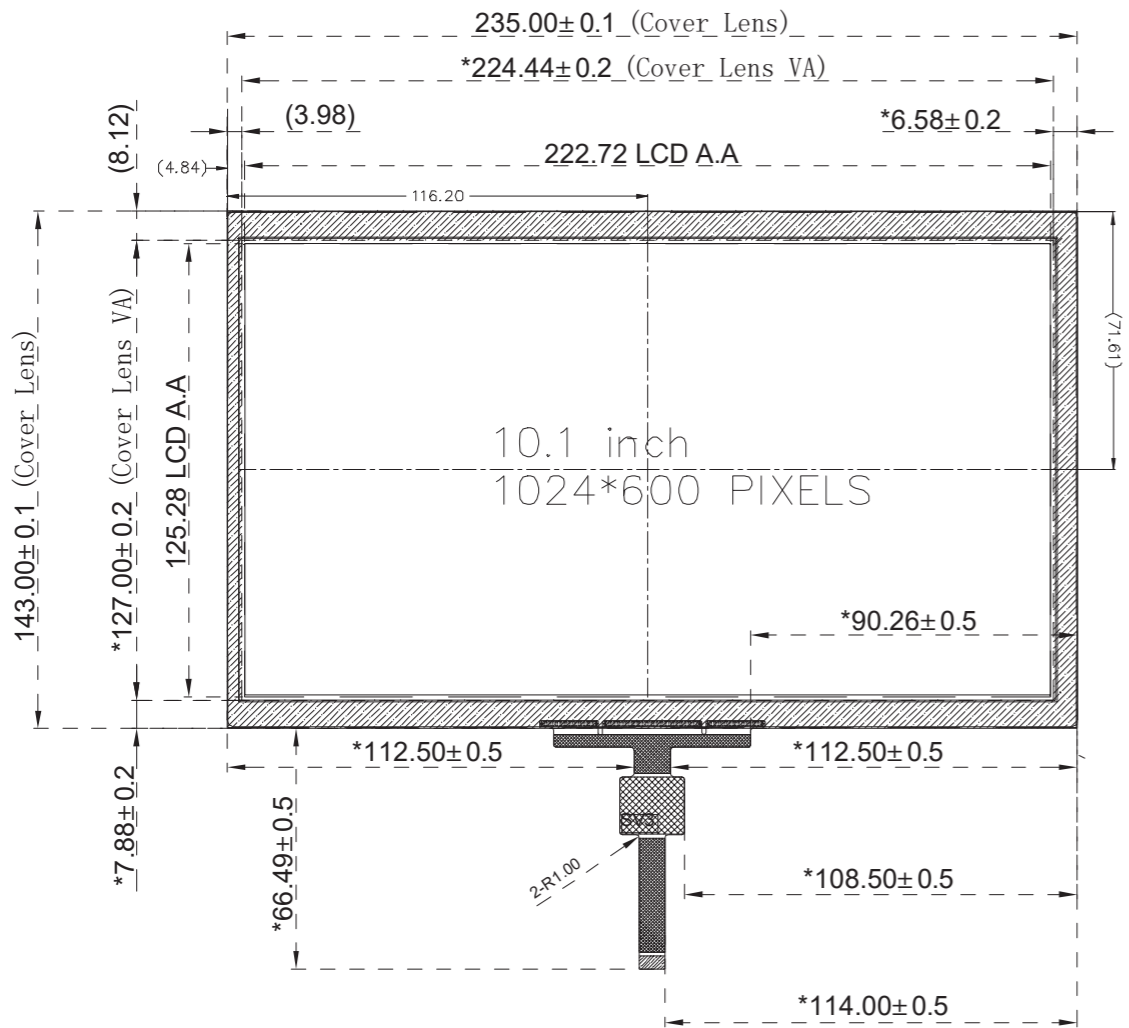
- 1024xRGBx600 resolution
- LED backlight
 - Built-in LED driver
 - PWM brightness control
- LVDS interface
 - 4 LVDS Channels
- 262K colors
- Wide Viewing Angles
- Capacitive touch panel with controller
 - 10-point multi-touch input
 - Gesture input
 - Zoom In/Out
 - Swipe Up/Down/Left/Right

SYMBOL	REVISION	DATE

Pin Assignment

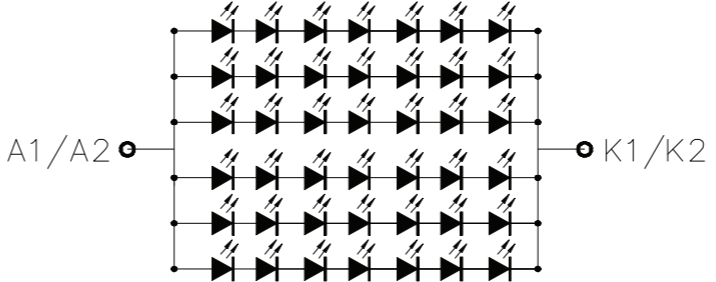
PIN No.	SYMBOL
1	GND
2	VDD
3	VDD
4	V_EDID
5	GND
6	SCL
7	SDA
8	Rin0-
9	Rin0+
10	GND
11	Rin1-
12	Rin1+
13	GND
14	Rin2-
15	Rin2+
16	GND
17	CLKIN-
18	CLKIN+
19	GND
20	Rin3-
21	Rin3+
22	GND
23	INSEL
24	GND
25	GND
26	UPDN
27	SHLR
28	GND
29	RESET
30	STBYB
31	LED-GND
32	LED-GND
33	LED-GND
34	GND
35	LED_PWM
36	LED_EN
37	BIST
38	LED_VDD
39	LED_VDD
40	LED_VDD

PIN	SYMBOL
PIN1	VDD
PIN2	GND
PIN3	SCL
PIN4	SDA
PIN5	INT
PIN6	RESET



- Notes:**
1. Display Size: 10.1" TFT
 2. Display Resolution: 1024 x 600 Pixels
 3. Display Mode: Transmissive / Normally White / Anti-Glare
 4. Optimal View: Full View
 5. Driver IC: HX8282 - LVDS Interface
 6. Power Supply Voltage: 3.3V
 7. Backlight: White LED
 8. Luminance: 700 cd/m² (Typ)
 9. Touch Panel: PCAP

Backlight Circuit



STANDARD TOLERANCES (UNLESS OTHERWISE SPECIFIED) LINEAR: XX. ±0.3 mm XX.X ±0.3 mm XX.XX ±0.3 mm			DRAWING/PART NUMBER: NHD-10.1-1024600AF-LSXV#-CTP	REVISION: 1C
	UNLESS OTHERWISE SPECIFIED - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: S. Baxi	CHECKED BY: S. Baxi	APPROVED BY: S. Baxi
	DRAWN DATE: 5/6/19	CHECKED DATE: 5/6/19	APPROVED DATE: 5/6/19	SCALE: NS
DO NOT SCALE DRAWING			SHEET 1 OF 1	
THIS DRAWING IS SOLELY THE PROPERTY OF NEWHAVEN DISPLAY INTERNATIONAL, INC. THE INFORMATION IT CONTAINS IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR PART WITHOUT WRITTEN APPROVAL FROM NEWHAVEN DISPLAY.				

Pin Description

TFT:

Pin No.	Symbol	Connection	Function Description
1	GND	Power Supply	Ground
2-3	V _{DD}	Power Supply	Supply voltage for LCD (+3.3V)
4	V _{EDID}	Power Supply	Supply voltage for EDID (+3.3V)
5	GND	Power Supply	Ground
6	SCL	MPU	Serial Clock
7	SDA	MPU	Serial Data
8	Rin0-	MPU	-LVDS differential data input CH0
9	Rin0+	MPU	+LVDS differential data input CH0
10	GND	Power Supply	Ground
11	Rin1-	MPU	-LVDS differential data input CH1
12	Rin1+	MPU	+LVDS differential data input CH1
13	GND	Power Supply	Ground
14	Rin2-	MPU	-LVDS differential data input CH2
15	Rin2+	MPU	+LVDS differential data input CH2
16	GND	Power Supply	Ground
17	CLKIN-	MPU	-LVDS differential Clock
18	CLKIN+	MPU	+LVDS differential Clock
19	GND	Power Supply	Ground
20	Rin3-	MPU	-LVDS differential data input CH3
21	Rin3+	MPU	+LVDS differential data input CH3
22	GND	Power Supply	Ground
23	INSEL (HSD)	MPU	Data Input Format: INSEL = L 8-Bit LVDS Input (Default) INSEL = H 6-Bit LVDS Input
24-25	GND	Power Supply	Ground
26	UPDN	MPU	Gate Driver Up/Down Scan Setting: UPDN = H: Reverse Scan UPDN = L: Normal Scan (Default)
27	SHLR	MPU	Gate Driver Left/Right Scan Setting: SHLR = H: Normal Scan (Default) SHLR = L: Reverse Scan
28	GND	Power Supply	Ground
29	RESET	MPU	Active Low Reset Signal
30	STBYB	MPU	Active Low Standby Signal
31-33	LED_GND	Power Supply	Ground for Backlight Driver
34	GND	Power Supply	Ground
35	LED_PWM	MPU	Backlight PWM Signal Input (See Table on Page 6)
36	LED_EN	MPU	Backlight Enable; H: Backlight On; L: Backlight Off
37	BIST	MPU	Built in Self-Test BIST = H: Self-Test Enabled BIST = L: Normal Operation (Default)
38-40	LED_V _{DD}	Power Supply	Supply Voltage for Backlight Driver

LCD connector: 0.5mm pitch 40-Conductor FFC.

Recommended cable: 40 POS FFC

Capacitive Touch Panel:

Pin No.	Symbol	External Connection	Function Description
1	VDD	Power Supply	Power Supply (3.3V)
2	GND	Power Supply	Ground
3	SCL	MPU	Serial I2C Clock (Requires pull-up resistor)
4	SDA	MPU	Serial I2C Data (Requires pull-up resistor)
5	/INT	MPU	Interrupt signal from touch panel module to host
6	/RESET	MPU	Active LOW Reset signal.

Recommended connector: 1.0mm pitch 6-Conductor FFC. Molex p/n: 52271-0679

Electrical Characteristics (T_{OP} = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T _{OP}	Absolute Max	0	-	+50	°C
Storage Temperature Range	T _{ST}	Absolute Max	-20	-	+60	°C
Supply Voltage for LCD	V _{DD}	-	3.0	3.3	3.6	V
Supply Voltage for EDID	V _{EDID}	-	3.0	3.3	3.6	V
Supply Current for LCD	I _{DD}	V _{DD} = 3.3V	50	120	180	mA
LVDS Differential input HIGH Voltage	RxVTH	-	-	-	+100	mV
LVDS Differential input LOW Voltage	RxVTL	-	-100	-	-	mV
LVDS Differential input Common Voltage	RxVCM	-	0.7	-	1.6	V
LVDS Differential Voltage	VID	-	200	-	600	mV
Supply Voltage for Backlight Driver	LED_V _{DD}	-	5.0	12.0	22.4	V
Supply Current for Backlight Driver ¹	LED_I _{DD}	-	160	360	1200	mA
Backlight Enable	LED_EN	-	2.5	3.3	5.5	V
Backlight PWM Voltage	LED_PWM	I _{PWM} ≤ 5 mA	2.5	3.3	5.5	V
Backlight Lifetime ²	-	T _{OP} = 25° C	20,000	50,000	-	Hrs.

¹Minimum supply current occurs when supply voltage is at max; maximum supply current when supply voltage is at minimum.

²Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions.

Capacitive Touch Panel:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T _{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T _{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V _{DD}	-	3.0	3.3	3.6	V
Supply Current – Operating	I _{DD}	T _{OP} =25°C, V _{DD} =3.3V	8	15	23	mA
Supply Current – Hibernate	I _{DD}		-	1.0	-	μA
“H” Level Input	V _{OH}	-	0.7 * V _{DD}	-	V _{DD}	V
“L” Level Input	V _{IL}	-	V _{SS}	-	0.3 * V _{DD}	V
“H” Level Output	V _{OH}	-	0.7 * V _{DD}	-	V _{DD}	V
“L” Level Output	V _{OL}	-	V _{SS}	-	0.3 * V _{DD}	V

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	CR ≥ 10	-	75	-	°	
	Bottom		-	75	-	°	
	Left		-	75	-	°	
	Right		-	75	-	°	
Contrast Ratio	CR	-	450	750	-	-	
Luminance	L _v	-	500	700	-	cd/m ²	
Response Time	Rise + Fall	T _R + T _F	T _{OP} = 25°C		-	8	ms
Chromaticity	Red	X _R	-	0.565	0.605	0.635	-
		Y _R	-	0.309	0.349	0.379	-
	Green	X _G	-	0.286	0.326	0.356	-
		Y _G	-	0.565	0.605	0.635	-
	Blue	X _B	-	0.112	0.152	0.182	-
		Y _B	-	0.075	0.115	0.145	-
White	X _W	-	0.257	0.297	0.327	-	
	Y _W	-	0.283	0.323	0.353	-	

LED_PWM Signal Operating Frequency:

PWM Frequency (F)	Duty Cycle (Min.)	Duty Cycle (Max.)
100Hz < F < 500Hz	5%	100%
500Hz < F < 20KHz	10%	100%

Capacitive Touch Panel Characteristics:

Property	Requirement	Unit
Surface Hardness	≥6	H
Light transmission	≥82%	-
Operating Humidity	20~85%	RH
Storage Humidity	20~85%	RH
Number of Touches	10	-

Driver Information

Built-in HX8282-A14 Source Driver: <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/HX8282-A01.pdf>

Built-in HX8696-A00 Gate Driver: <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/HX8696-A.pdf>

Capacitive Touch Panel:

Built-in FocalTech FT5526EEZ controller.

Please download specification at <http://www.newhavendisplay.com/appnotes/datasheets/touchpanel/FT5x26.pdf>

Capacitive Touch Panel Registers

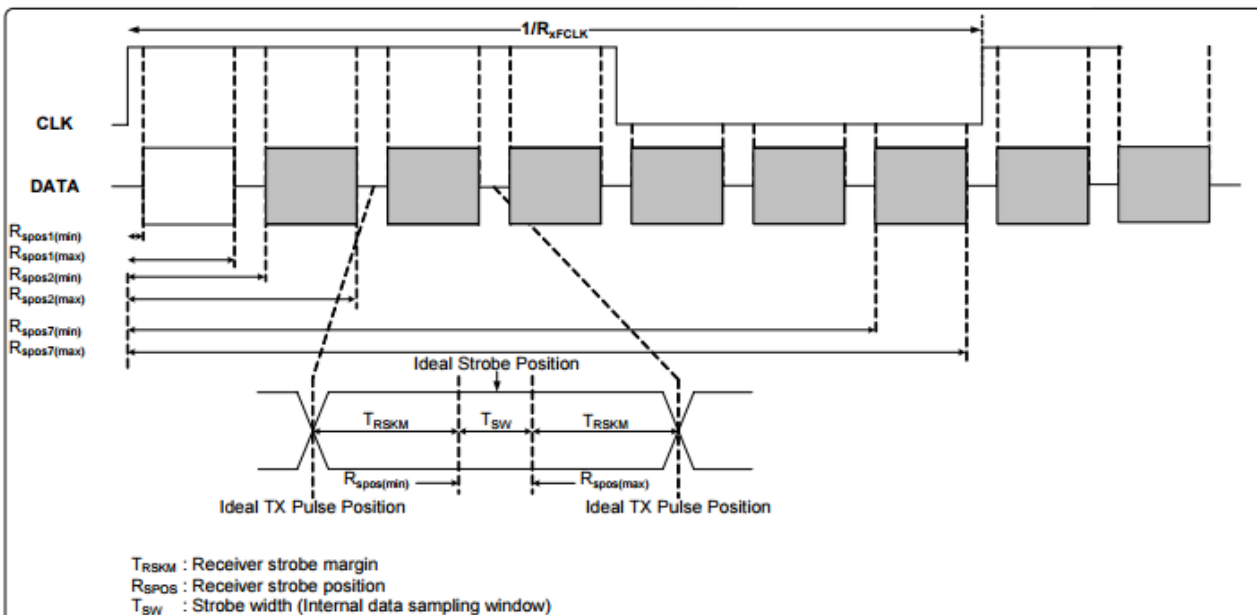
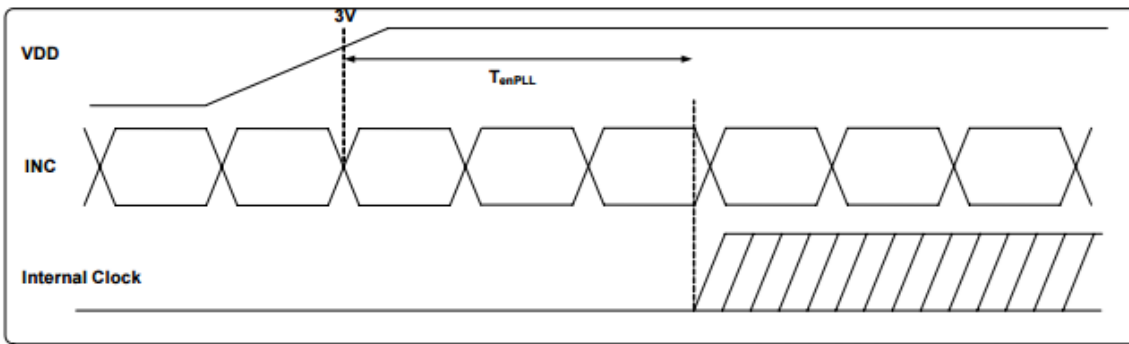
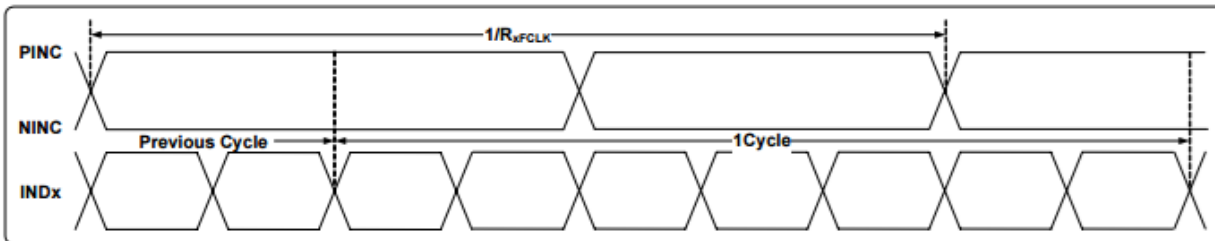
Register No	Register Name	Bits	Value	Description
00h	Device Mode	[2:0]	000b 100b 001b	Normal Operating Mode Test Mode - read raw data (reserved) System Information Mode (reserved)
01h	Gesture ID	[7:0]	48h 49h 00h	Zoom In Zoom Out No Gesture
02h	Touch Points	[3:0]	000b 001b 010b 011b 100b 101b	0 touch points detected 1 touch point detected 2 touch points detected 3 touch points detected 4 touch points detected 5 touch points detected
03h	Touch 1 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
03h	TOUCH1_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
04h	TOUCH1_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
05h	TOUCH1_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
06h	TOUCH1_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
09h	Touch 2 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
09h	TOUCH2_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
0Ah	TOUCH2_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
0Bh	TOUCH2_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
0Ch	TOUCH2_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
0Fh	Touch 3 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
0Fh	TOUCH3_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
10h	TOUCH3_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
11h	TOUCH3_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
12h	TOUCH3_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
15h	Touch 4 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
15h	TOUCH4_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
16h	TOUCH4_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
17h	TOUCH4_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
18h	TOUCH4_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate

Register No	Register Name	Bits	Value	Description
1Bh	Touch 5 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
1Bh	TOUCH5_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
1Ch	TOUCH5_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
1Dh	TOUCH5_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
1Eh	TOUCH5_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
80h	ID_G_THGROUP	[7:0]	00h - FFh	Valid touching detect threshold Actual value will be 4 times register's value Recommended: 46h
81h	ID_G_THPEAK	[7:0]	00h - FFh	valid touching peak detect threshold Recommended: 3Ch
82h	ID_G_THCAL	[7:0]	00h - FFh	Touch focus threshold Recommended: 1Dh
83h	ID_G_THWATER	[7:0]	00h - FFh	threshold when there is surface water Recommended: D3h
84h	ID_G_THTEMP	[7:0]	00h - FFh	threshold of temperature compensation Recommended: EBh
85h	ID_G_THDIFF	[7:0]	00h - FFh	Touch difference threshold Actual value is 32 times the register's value Recommended: A0h
86h	ID_G_CTRL	[1:0]	00h 01h	Power Control Mode: Not Auto Jump Power Control Mode: Auto Jump
87h	ID_G_TIME_ENTER_MONITOR	[7:0]	00h-FFh	Delay to enter 'Monitor' status (s) Recommended: C8h
88h	ID_G_PERIODACTIVE	[3:0]	3h-Eh	Period of 'Active' status (ms) Recommended: 6h
89h	ID_G_PERIODMONITOR	[7:0]	1Eh-FFh	Timer to enter 'idle' when in 'Monitor' (ms) Recommended: 28h
A0h	ID_G_AUTO_CLB_MODE	[7:0]	00h FFh	Auto calibration mode: Enable auto calibration Auto calibration mode: Disable auto calibration
A1h	ID_G_LIB_VERSION_H	[7:0]	30h	Firmware Library Version H byte
A2h	ID_G_LIB_VERSION_L	[7:0]	01h	Firmware Library Version L byte
A3h	ID_G_CIPHER	[7:0]	54h	Chip vendor ID
A4h	ID_G_MODE	[0:0]	00h 01h	Interrupt status: Enable interrupt to host Interrupt status: Disable interrupt to host
A5h	ID_G_PMODE	[1:0]	00h 01h 03h	'Active' Mode 'Monitor' Mode 'Hibernate' Mode
A6h	ID_G_FIRMID	[7:0]	06h	Firmware ID
A7h	ID_G_STATE	[7:0]	00h 01h 02h 03h 04h	Running State: Configure Running State: Work Running State: Calibration Running State: Factory Running State: Auto-calibration
A8h	ID_G_FT5201ID	[7:0]	79h	CTPM Vendor's Chip ID
A9h	ID_G_ERR	[7:0]	00h 03h 05h 1Ah	Error Code: OK Error Code: Chip register writing inconsistent with reading Error Code: Chip start fail Error Code: Calibration match fail

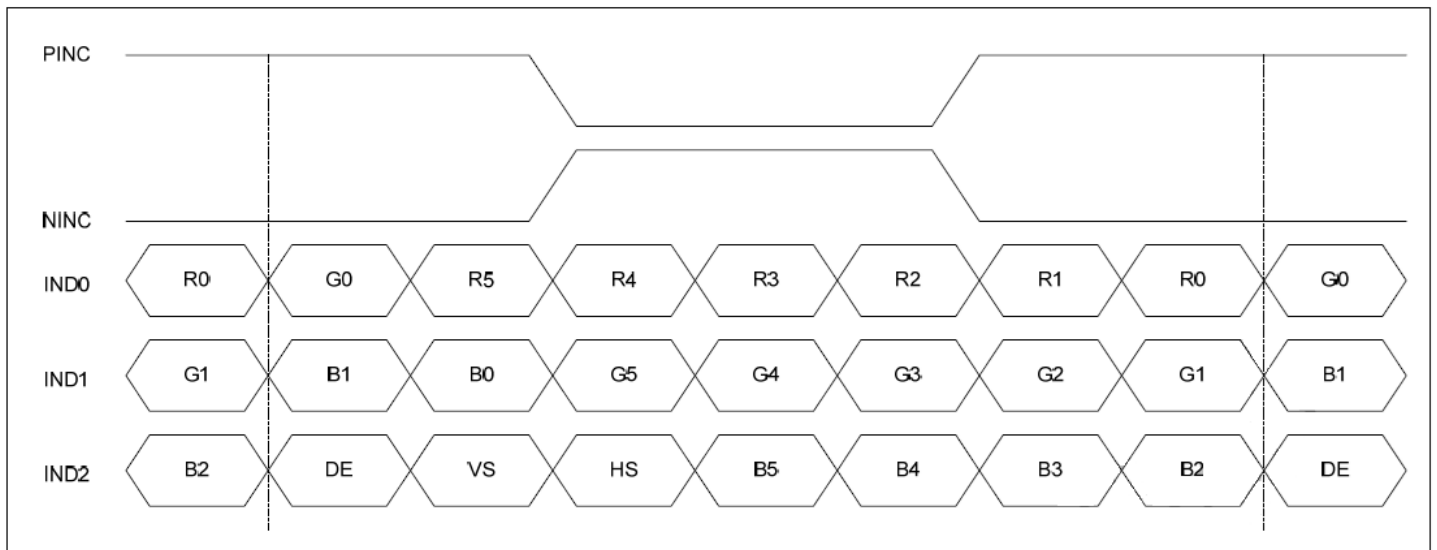
Timing Characteristics: Display

Parameter	Symbol	Spec			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R _{XFLK}	20	-	71	MHz	-
Input data skew margin	T _{RSKM}	500	-	-	pS	VID = 400mV R _{XVCM} = 1.2V R _{XFLK} = 71MHz
Clock high time	T _{LVCH}	-	4/(7 * R _{XFLK})	-	nS	-
Clock low time	T _{LVCL}	-	3/(7 * R _{XFLK})	-	nS	-
PLL wake-up time	T _{emPLL}	-	-	150	μS	-

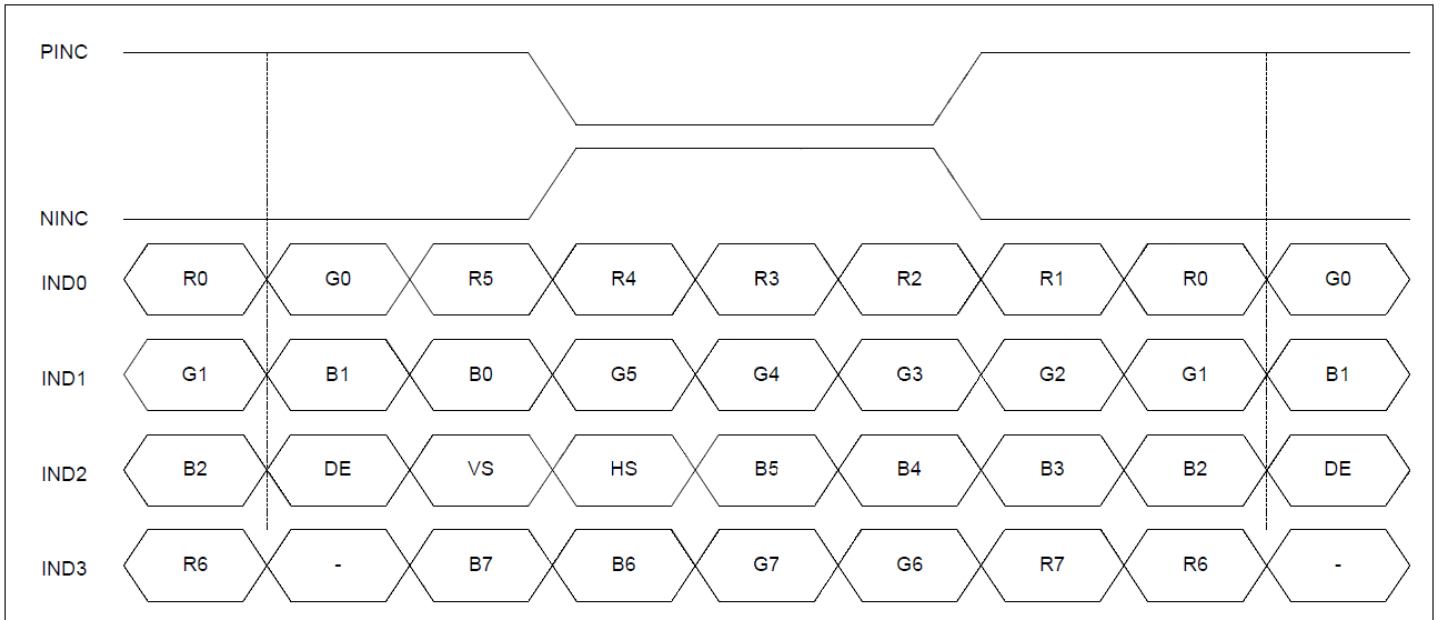
Parameter	Symbol	Spec			Unit	Condition
		Min.	Typ.	Max.		
Modulation Frequency	SSC _{MF}	23	-	93	KHz	-
Modulation Rate	SSC _{MR}	-	-	±3	%	LVDS Clock = 71 MHz



6-bit LVDS data input format:

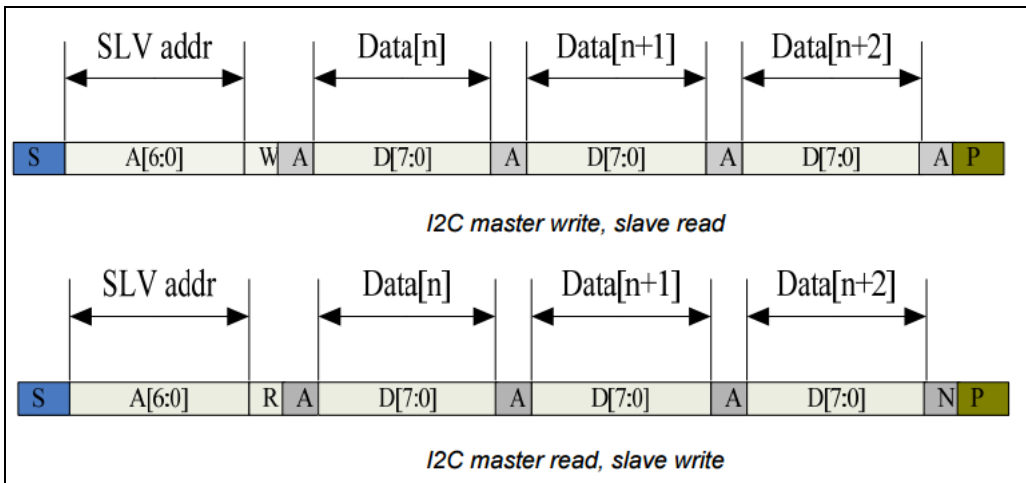
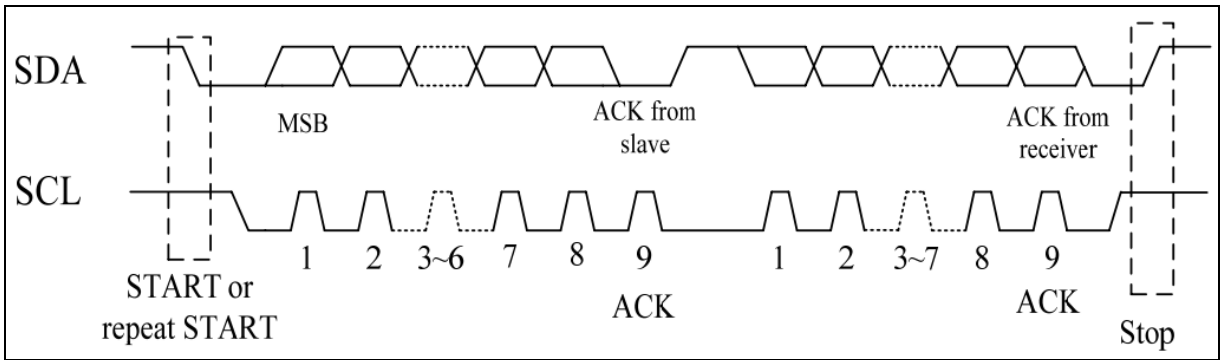


8-Bit LVDS Data Input Format:



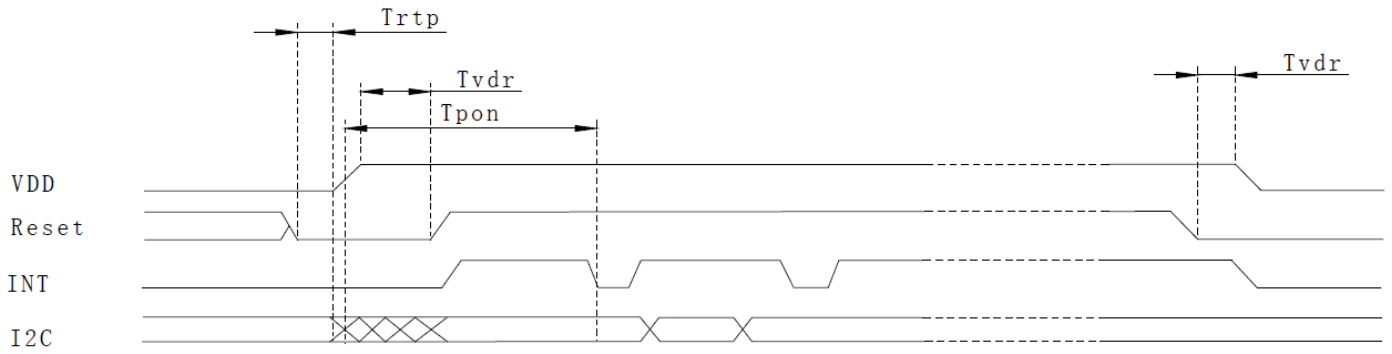
Timing Characteristics: Capacitive Touch Panel

Data Transfer Format

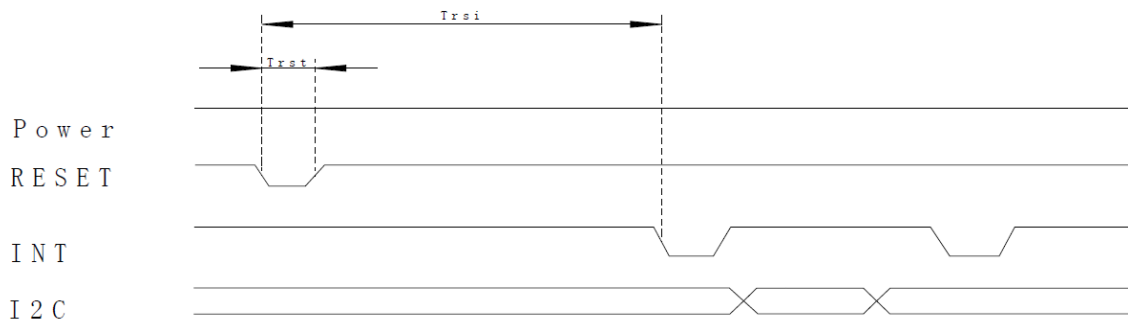


Parameter	Min	Max	Unit
SCL Frequency	0	400	KHz
Bus free time between a STOP and START Condition	1.3	-	μs
Hold Time (repeated) START Condition	0.6	-	μs
Data Setup Time	100	-	ns
Setup Time for a repeated START Condition	0.6	-	μs
Setup Time for STOP Condition	0.6	-	μs

Power ON Sequence



Reset Sequence



Parameter	Description	Min	Max	Unit
T_{ris}	Rise time from $0.1 \cdot V_{DD}$ to $0.9 \cdot V_{DD}$	-	5	ms
T_{pdt}	Time for voltage supply below $0.3 \cdot V_{DD}$	5	-	ms
T_{rtp}	Time to hold reset low Before Applying Power	100	-	μs
T_{pon}	Time of starting to report point after powering on	-	200	ms
T_{vdr}	Reset time after V_{DD} power on	1	-	ms
T_{rsi}	Time of starting to report point after Reset	-	200	ms
T_{rst}	Reset Time	1	-	ms

Sample code to read touch data:

```
i2c_start();
i2c_tx(0x70);           //Slave Address (Write)
i2c_tx(0x00);         //Start reading address
i2c_stop();

i2c_start();
i2c_tx(0x71);         //Slave Address (Read)
for(i=0x00;i<0x1F;i++)
{touchdata_buffer[i] = i2c_rx(1);}
i2c_stop();
```

Sample code to overwrite default register values:

```
i2c_start();
i2c_tx(0x70);         //Slave Address (Write)
i2c_tx(0xA4);         //ID_G_Mode
i2c_tx(0x01);         //Disable interrupt status to host
i2c_stop();
```

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+60°C , 240 hrs.	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-20°C , 240 hrs.	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+50°C, 120 hrs.	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	0°C , 120 hrs.	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 , 85% RH , 120 hrs.	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	0°C, 30min->25°C, 5min -> 50°C, 30min 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 1.5mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: V _s =8KV, Contact: V _s =4KV 10 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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms