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.

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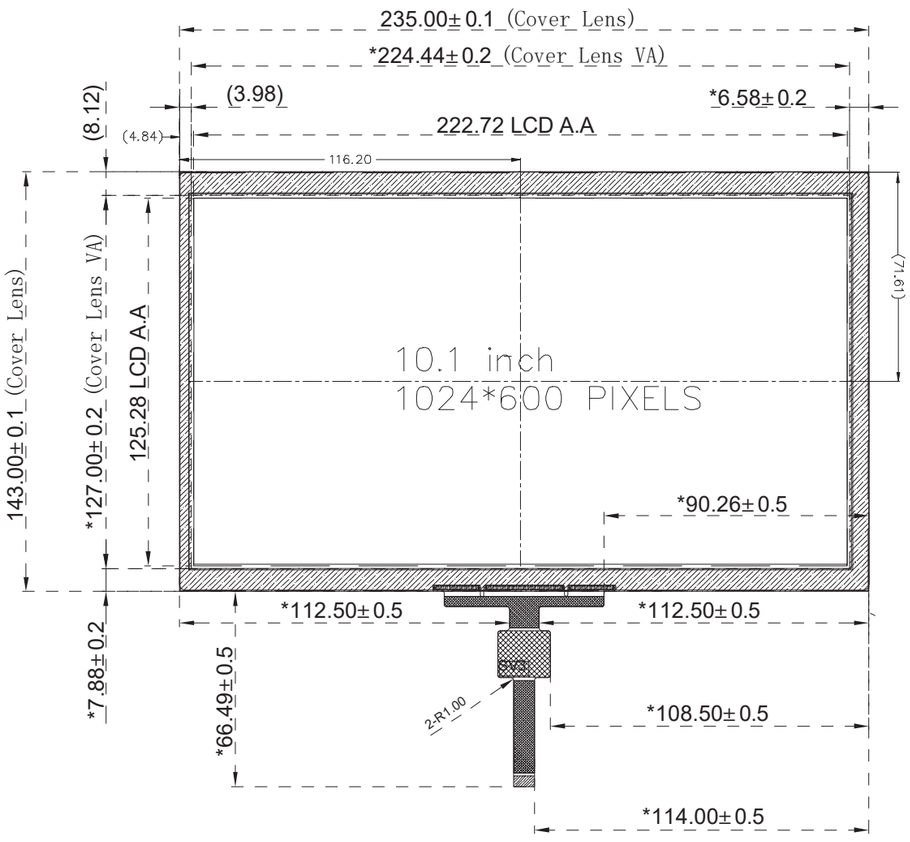
Document Revision History

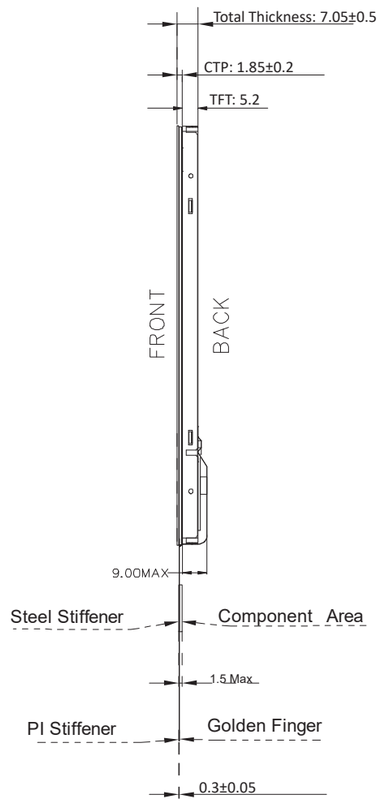
Revision	Date	Description	Changed by
0	5/17/17	Initial Release	SB
1	8/14/17	Backlight Characteristics Added, Pin Descriptions Updated	SB
2	11/8/17	CTP Characteristics Updated	SB
3	3/6/18	Backlight Characteristics Updated	SB
4	7/1/18	Backlight Redesign	SB
5	5/6/19	Display Thickness Correction	SB
6	7/10/19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

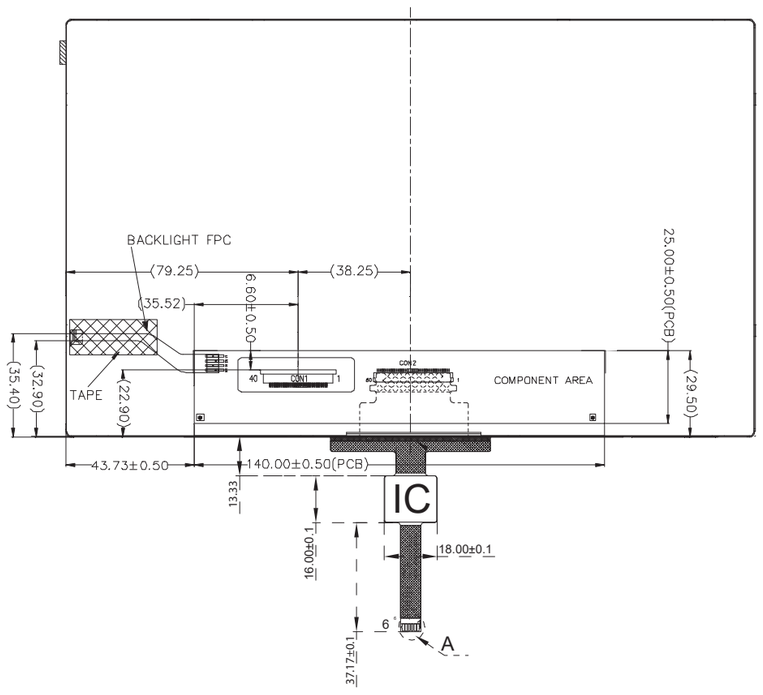
Functions and Features

- 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

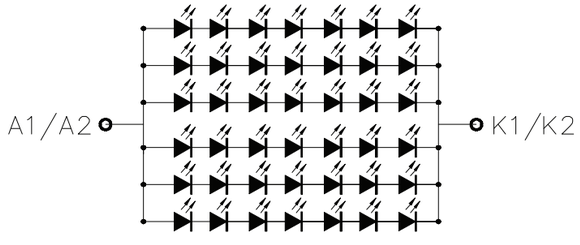
PIN No.	SYMBOL
1	GND
2	VDD
3	VDD
4	V_EDID
5	GND
6	SCL
7	SDA
8	Rin0−
9	Rin0+
10	GND
11	Rin1−
12	Rin1+
13	GND
14	Rin2−
15	Rin2+
16	GND
17	CLKIN−
18	CLKIN+
19	GND
20	Rin3−
21	Rin3+
22	GND
23	INSEL
24	GND
25	GND
26	UPDN
27	SHLR
28	GND
29	RESET
30	STBYB
31	LED−GND
32	LED−GND
33	LED−GND
34	GND
35	LED_PWM
36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

UNLESS OTHERWISE SPECIFIED
- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-10.1-1024600AF-LSXV#-CTP
REVISION: 1C
SIZE: A3
SCALE: NS

DRAWN BY:	CHECKED BY:	APPROVED BY:
S. Baxi	S. Baxi	S. Baxi
DRAWN DATE:	CHECKED DATE:	APPROVED DATE:
5/6/19	5/6/19	5/6/19

DO NOT SCALE DRAWING | SHEET 1 OF 1

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.

[1]Minimum supply current occurs when supply voltage is at max; maximum supply current when supply voltage is at minimum.
[2]Backlight 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_{OH}	-	VS_S	-	0.3 * V_{DD}	V

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥10	-	75	-	º
	Bottom	φY-		-	75	-	º
	Left	θX-		-	75	-	º
	Right	θX+		-	75	-	º
Contrast Ratio		CR	-	450	750	-	-
Luminance		L_V	-	500	700	-	cd/m²
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

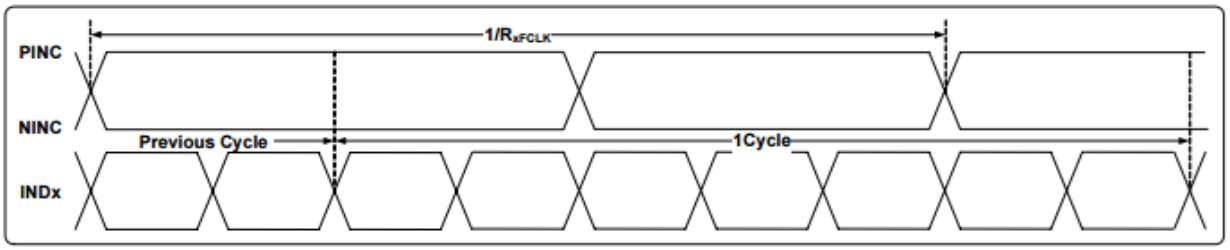
Register No	Register Name	Bits	Value	Description
00h	Device Mode	[2:0]	000b	Normal Operating Mode
			100b	Test Mode - read raw data (reserved)
			001b	System Information Mode (reserved)
01h	Gesture ID	[7:0]	48h	Zoom In
			49h	Zoom Out
			00h	No Gesture
02h	Touch Points	[3:0]	000b	0 touch points detected
			001b	1 touch point detected
			010b	2 touch points detected
			011b	3 touch points detected
			100b	4 touch points detected
			101b	5 touch points detected
03h	Touch 1 Event Flag	[7:6]	00b	Put Down
			01b	Put Up
			10b	Contact
			11b	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	Put Down
			01b	Put Up
			10b	Contact
			11b	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	Put Down
			01b	Put Up
			10b	Contact
			11b	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	Put Down
			01b	Put Up
			10b	Contact
			11b	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

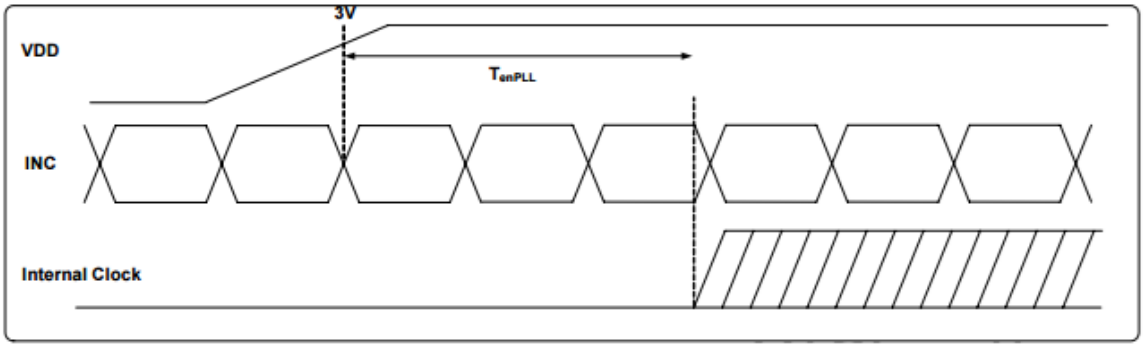
Register No	Register Name	Bits	Value	Description
1Bh	Touch 5 Event Flag	[7:6]	00b	Put Down
			01b	Put Up
			10b	Contact
			11b	Reserved
1Bh	TOUCH5_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
1Ch	TOUCH5_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
1Dh	TOUCH5_YH	[3:0]	0h - 1h	Upper 4 bits 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 Recommended: 46h
				Actual value will be 4 times register's value
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 Recommended: A0h
				Actual value is 32 times the register's value
86h	ID_G_CTRL	[1:0]	00h	Power Control Mode: Not Auto Jump
			01h	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	Auto calibration mode: Enable auto calibration
			FFh	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	Interrupt status: Enable interrupt to host
			01h	Interrupt status: Disable interrupt to host
A5h	ID_G_PMODE	[1:0]	00h	'Active' Mode
			01h	'Monitor' Mode
			03h	'Hibernate' Mode
A6h	ID_G_FIRMID	[7:0]	06h	Firmware ID
A7h	ID_G_STATE	[7:0]	00h	Running State: Configure
			01h	Running State: Work
			02h	Running State: Calibration
			03h	Running State: Factory
			04h	Running State: Auto-calibration
A8h	ID_G_FT5201ID	[7:0]	79h	CTPM Vendor's Chip ID
A9h	ID_G_ERR	[7:0]	00h	Error Code: OK
			03h	Error Code: Chip register writing inconsistent with reading
			05h	Error Code: Chip start fail
			1Ah	Error Code: Calibration match fail

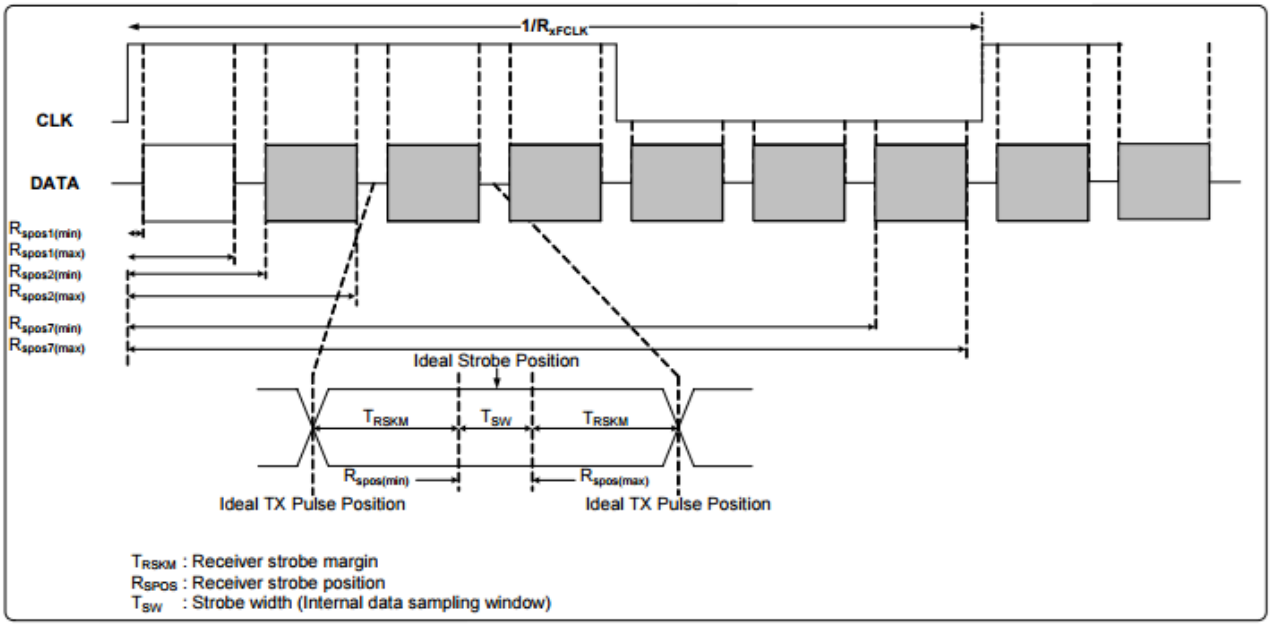
Timing Characteristics: Display

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

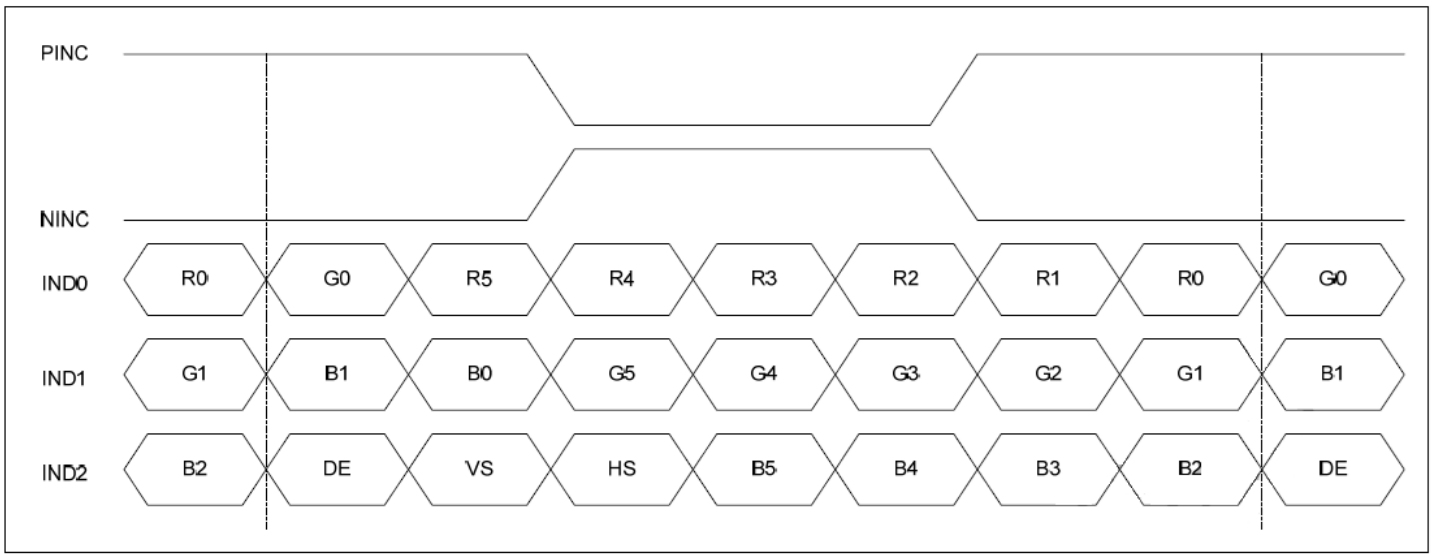
Parameter	Symbol	Spec			Unit	Condition
		Min.	Typ.	Max.		
Modulation Frequency	SSC_{MF}	23	-	93	KHz	-
Modulation Rate	SSC_{MR}	-	-	±3	%	LVDS Clock = 71 MHz



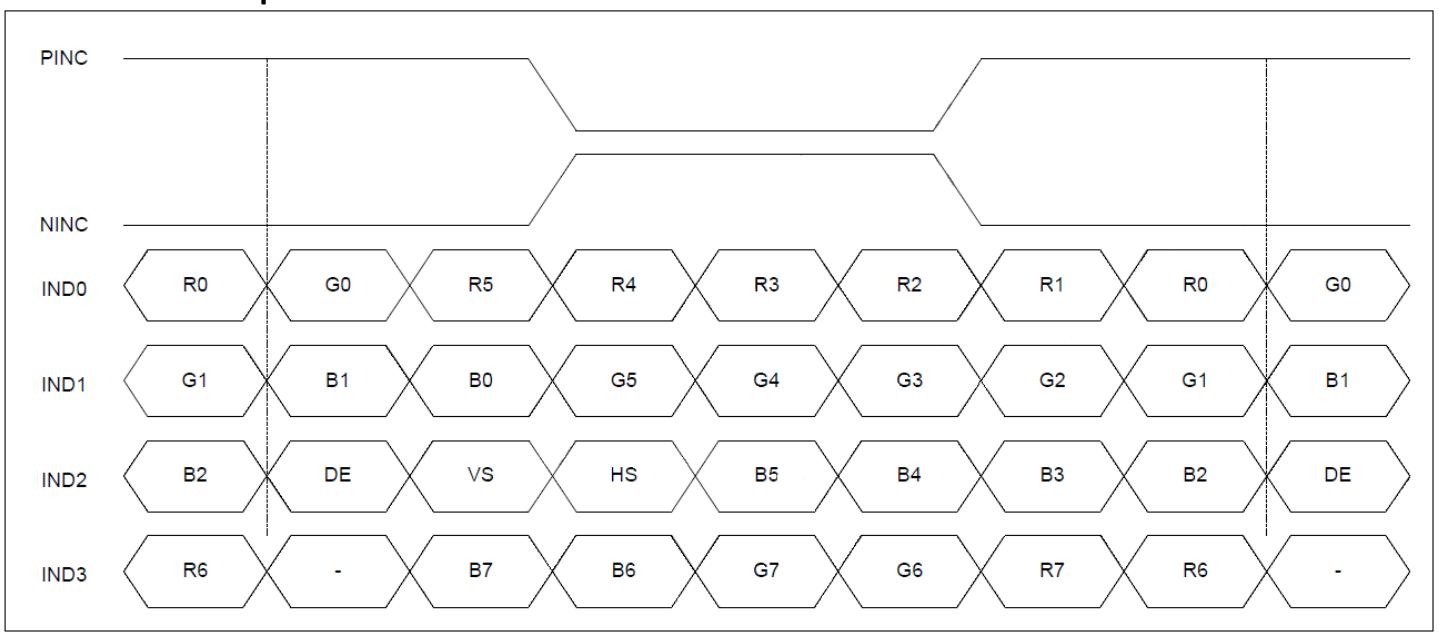




6-bit LVDS data input format:

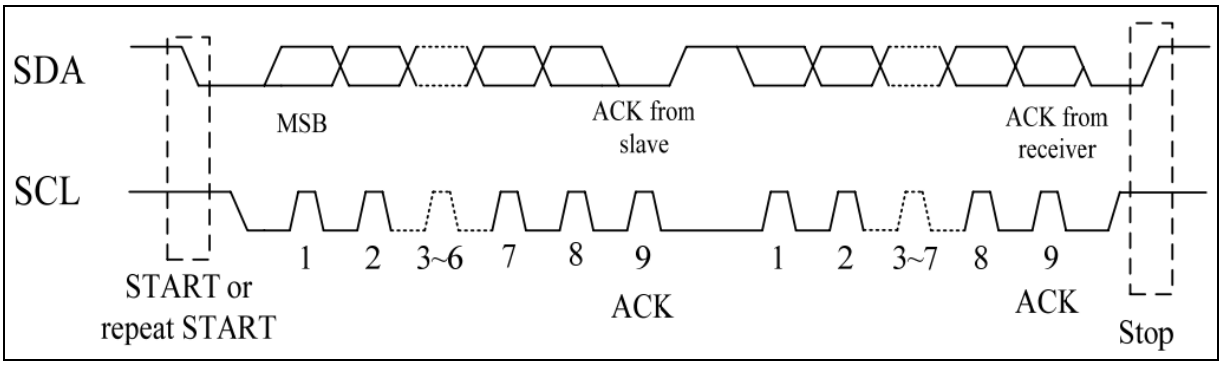


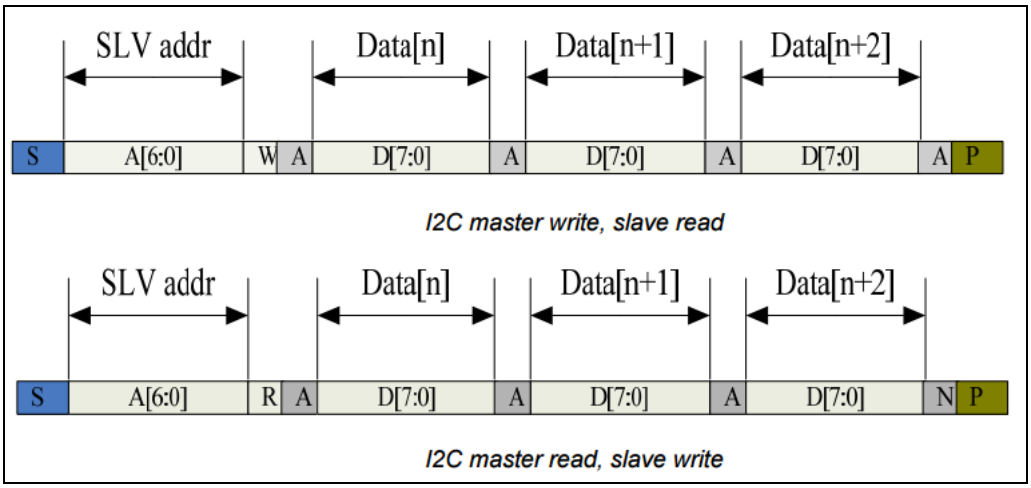
8-Bit LVDS Data Input Format:



Timing Characteristics: Capacitive Touch Panel

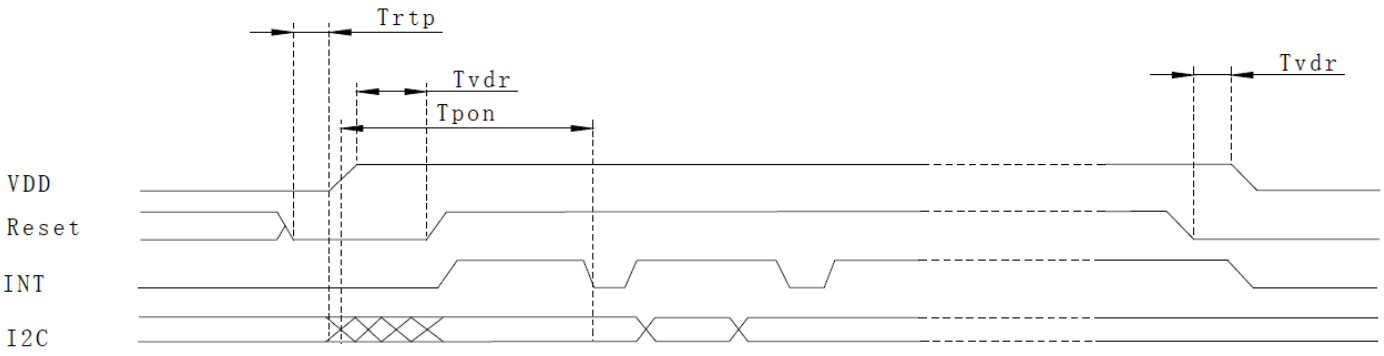
Data Transfer Format



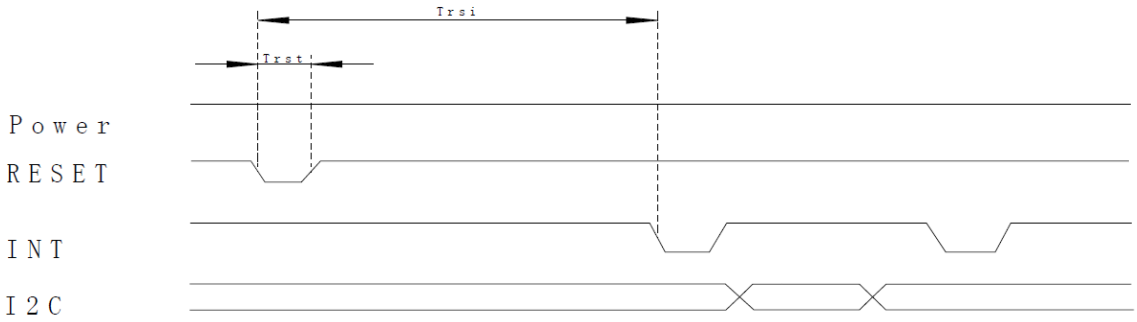


Parameter	Min	Max	Unit
SCL Frequency	0	400	KHz
Bus free time between a STOP and START Condition	1.3	-	µs
Hold Time (repeated) START Condition	0.6	-	µs
Data Setup Time	100	-	ns
Setup Time for a repeated START Condition	0.6	-	µs
Setup Time for STOP Condition	0.6	-	µs

Power ON Sequence



Reset Sequence



Parameter	Description	Min	Max	Unit
T_{ris}	Rise time from 0.1*V_{DD} to 0.9*V_{DD}	-	5	ms
T_{pdt}	Time for voltage supply below 0.3*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