

NHD-10.1-1024600AF-ASXV#-CTP

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

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

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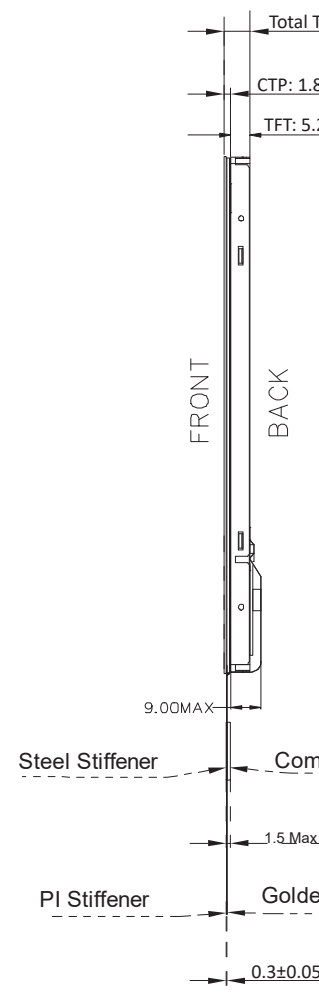
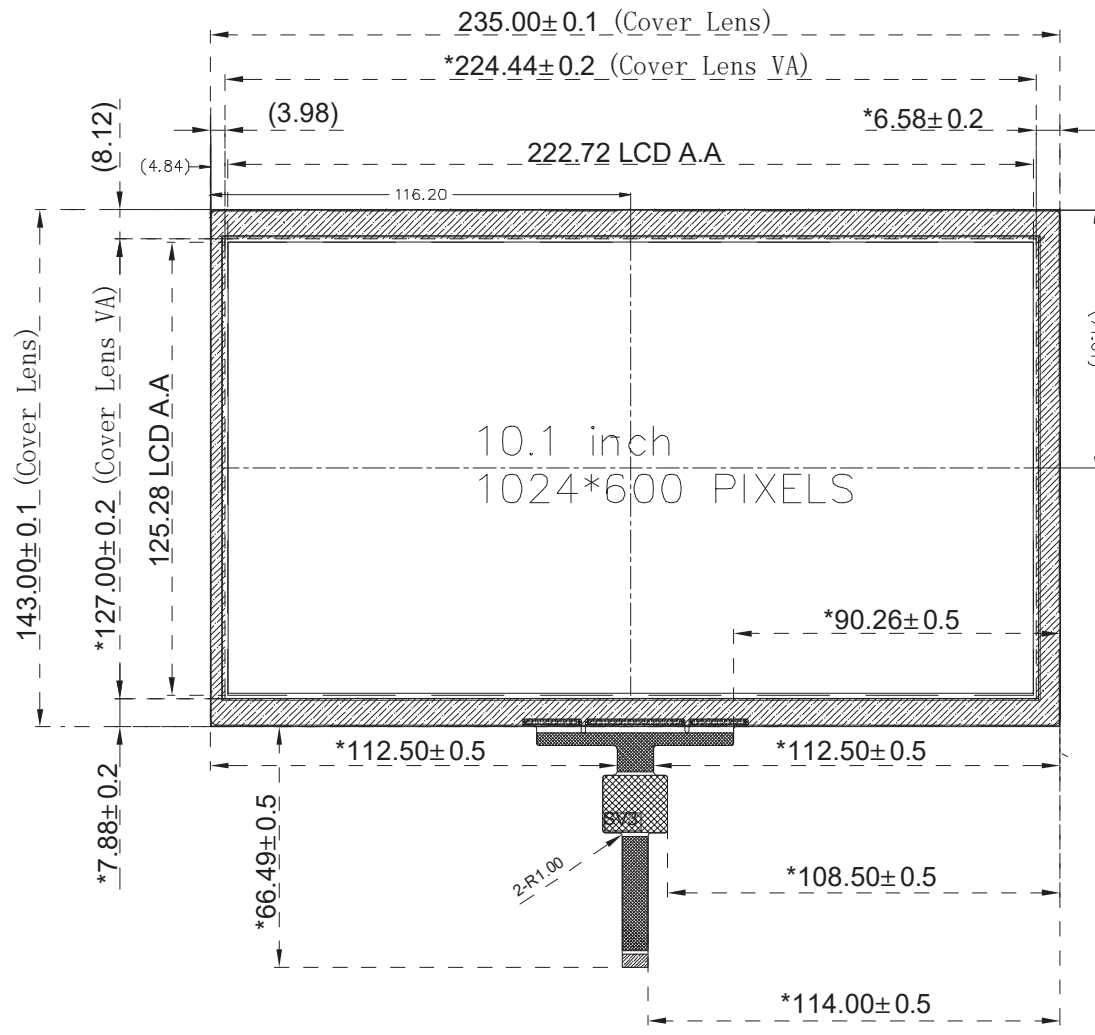
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Document Revision History

| Revision | Date | Description | Changed by |
|----------|----------|--|------------|
| - | 08/14/18 | Initial Release | NP |
| 1 | 7/10/19 | Mechanical Drawing & Backlight Characteristics Updated | SB |

Functions and Features

- 1024xRGBx600 Resolution
- LED Backlight
 - Built In-LED Driver
 - PWM Brightness Control
- RGB Interface
- 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



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 - RGB Interface |
| 6. Power Supply Voltage: | 3.3V |
| 7. Backlight: | White LED |
| 8. Luminance: | 700 cd/m ² (Typ) |
| 9. Touch Panel: | PCAP |

A
B
C
D
E
F

1 2 3 4

Pin Description

| Pin No. | Symbol | Connection | Function Description |
|---------|---------|--------------|---|
| 1 | LED_GND | Power Supply | Ground for Backlight Driver |
| 2-4 | LED_VDD | Power Supply | Supply Voltage for Backlight Driver |
| 5 | LED_PWM | MPU | Backlight PWM Signal Input (See Table Below) |
| 6 | LED_EN | MPU | Backlight Enable H: Backlight On; L: Backlight Off |
| 7 | GND | Power Supply | Ground |
| 8 | VDD | Power Supply | Supply voltage for LCD (+3.3V) |
| 9-16 | [R0-R7] | MPU | Red Data Signals |
| 17-24 | [G0-G7] | MPU | Green Data Signals |
| 25-32 | [B0-B7] | MPU | Blue Data Signals |
| 33 | GND | Power Supply | Ground |
| 34 | DCLK | MPU | Dot data Clock |
| 35 | HSYNC | MPU | Horizontal sync input |
| 36 | VSYNC | MPU | Vertical sync input |
| 37 | DEN | MPU | Data Enable signal |
| 38 | MODE | MPU | DE/SYNC mode select MODE= H: DE mode MODE= L: SYNC mode |
| 39 | /RESET | MPU | Active Low Reset Signal |
| 40 | /STBYB | MPU | Active Low Standby Signal |

LCD connector: 0.5mm pitch 40-Conductor FFC.

Recommended cable: 40 POS FFC **Molex P/N:** 15020-0435

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 Current for LCD | I _{DD} | V _{DD} = 3.3V | 50 | 120 | 180 | mA |
| "H" Level Input | V _{IH} | - | 0.7 * V _{DD} | - | V _{DD} | V |
| "L" Level Input | V _{IL} | - | GND | - | 0.3 * V _{DD} | V |
| "H" Level Output | V _{OH} | - | V _{DD} - 0.4 | - | V _{DD} | V |
| "L" Level Output | V _{OL} | - | GND | - | GND + 0.4 | V |
| Supply Voltage for Backlight Driver | LED_V _{DD} | - | 5 | 12.0 | 22.4 | V |
| Supply Current for Backlight Driver ¹ | LED_I _{DD} | - | 160 | 360 | 1200 | mA |
| Backlight Enable Voltage | 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 | - | 6.0 | - | 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} | - | 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 | - | 550 | 700 | 880 | 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 Material Characteristics:

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

Driver Information

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

Built-in HX8696 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 |
|-------------|-------------------------|-------|---------------------------------|--|
| 18h | Touch 5 Event Flag | [7:6] | 00b 01b 10b 11b | Put Down Put Up Contact Reserved |
| 18h | 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 |

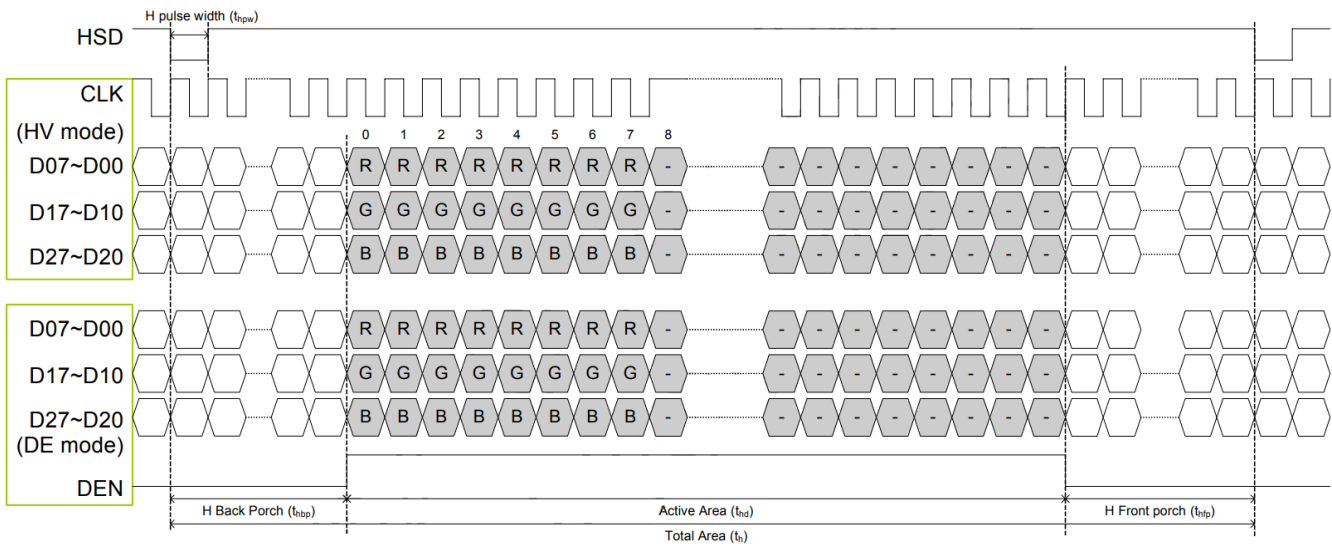
Timing Characteristics

DE Mode

| Parameter | Symbol | Spec | | | Unit |
|-------------------------|------------|------|------|------|------|
| | | Min. | Typ. | Max. | |
| DCLK Frequency | fclk | 40.8 | 51.2 | 67.2 | MHz |
| Horizontal Display Area | thd | 1024 | | | DCLK |
| HSD Period | th | 1114 | 1344 | 1600 | DCLK |
| HSD Blanking | thb+ thfp | 90 | 320 | 376 | DCLK |
| Vertical Display Area | tvd | 600 | | | TH |
| VSD Period | tv | 610 | 635 | 800 | TH |
| VSD Blanking | tvbp+ tvfp | 10 | 35 | 200 | TH |

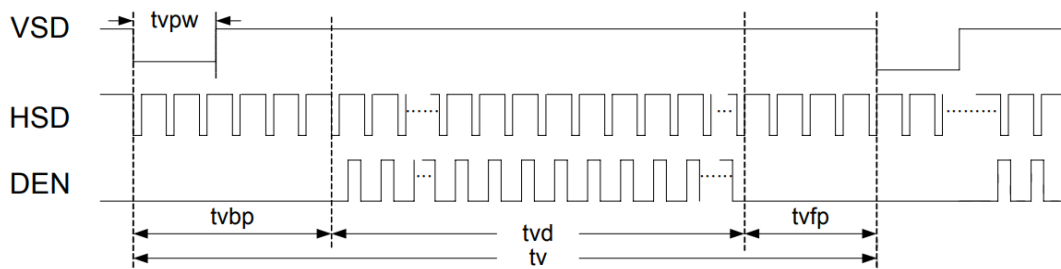
Horizontal Timing

| Parameter | Symbol | Spec | | | Unit |
|-------------------------|--------|------|------|------|------|
| | | Min. | Typ. | Max. | |
| DCLK Frequency | fclk | 44.9 | 51.2 | 63 | MHz |
| Horizontal Display Area | thd | 1024 | | | DCLK |
| HSD Period | th | 1200 | 1344 | 1400 | DCLK |
| HSD Pulse Width | thpw | 1 | - | 140 | DCLK |
| HSD Back Porch | thbp | 160 | | | DCLK |
| HSD Front Porch | thfp | 16 | 160 | 216 | DCLK |



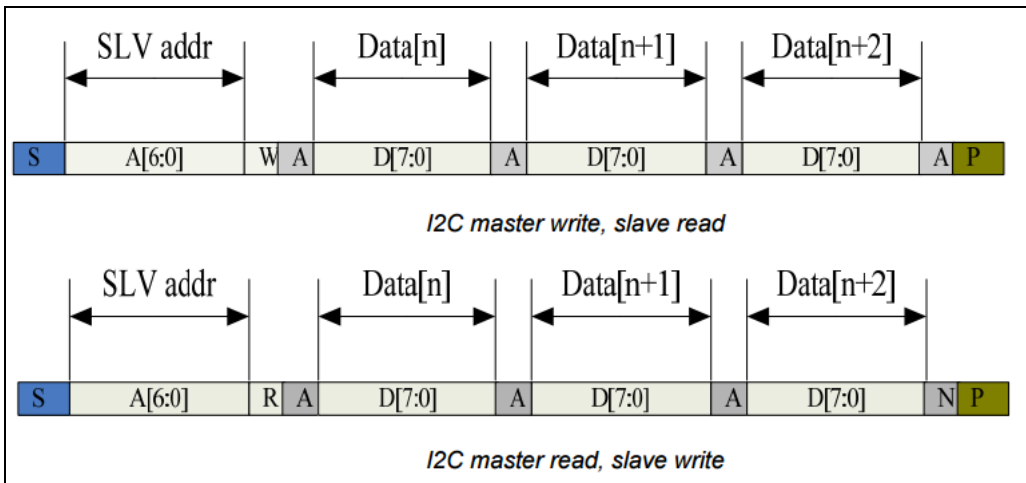
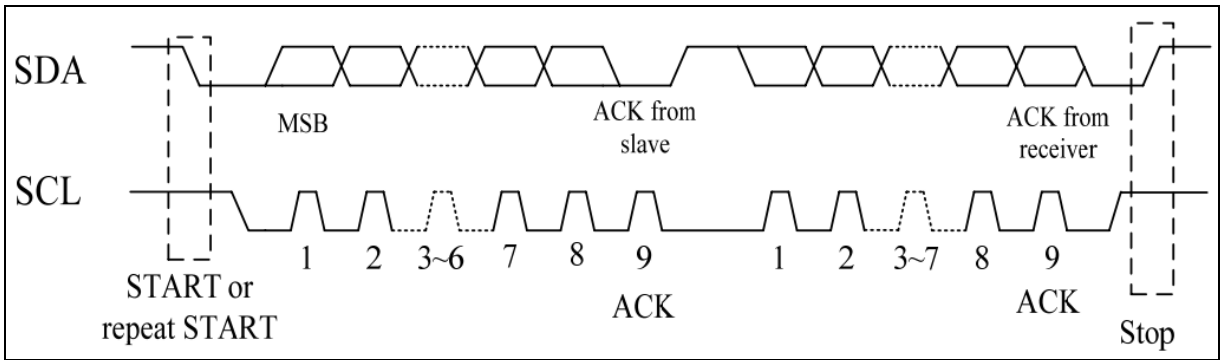
Vertical Timing

| Parameter | Symbol | Spec | | | Unit |
|-----------------------|--------|------|------|------|------|
| | | Min. | Typ. | Max. | |
| Vertical Display Area | tvd | 600 | | | TH |
| VSD Period | tv | 624 | 635 | 750 | TH |
| VSD Pulse Width | tvpw | 1 | - | 20 | TH |
| VSD Back Porch | tvbp | 23 | | | TH |
| VSD Front Porch | tvfp | 1 | 12 | 127 | TH |



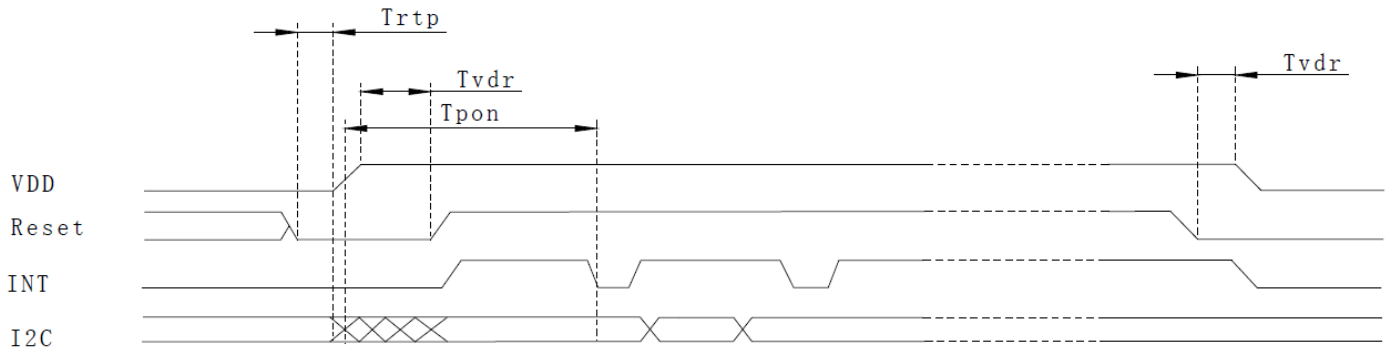
Timing Characteristics: Capacitive Touch Panel

Data Transfer Format

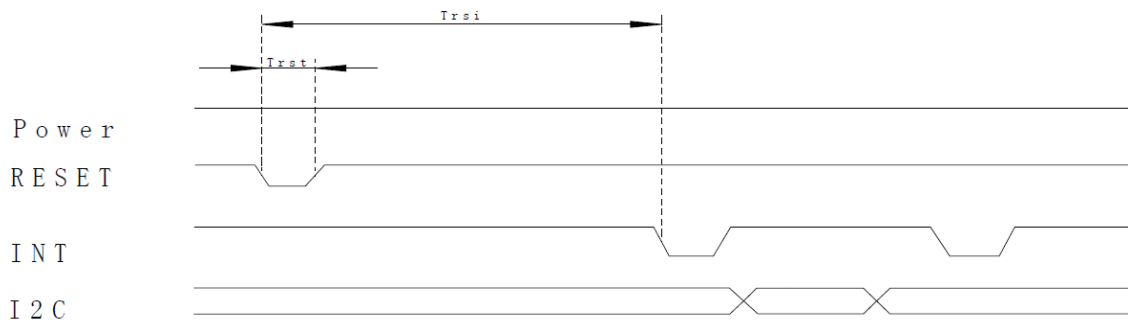


| Parameter | Min | Max | Unit |
|--|-----|-----|------|
| SCL Frequency | 0 | 400 | KHz |
| Bus free time between a STOP and START Condition | 1.3 | - | μs |
| Hold Time (repeated) START Condition | 0.6 | - | μs |
| Data Setup Time | 100 | - | ns |
| Setup Time for a repeated START Condition | 0.6 | - | 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, 90% 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

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