

# NHD-4.3-480272EF-ASXN#-CTP

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

|         |  |
|---------|--|
| NHD-    | Newhaven Display                       |
| 4.3-    | 4.3" Diagonal                          |
| 480272- | 480xRGBx272 Pixels                     |
| EF-     | Model                                  |
| A-      | Built-in Driver / No Controller        |
| S-      | Sunlight Readable                      |
| X-      | TFT                                    |
| N-      | TN, Wide Temperature                   |
| #-      | <b>RoHS Compliant</b>                  |
| CTP-    | Capacitive Touch Panel with Controller |

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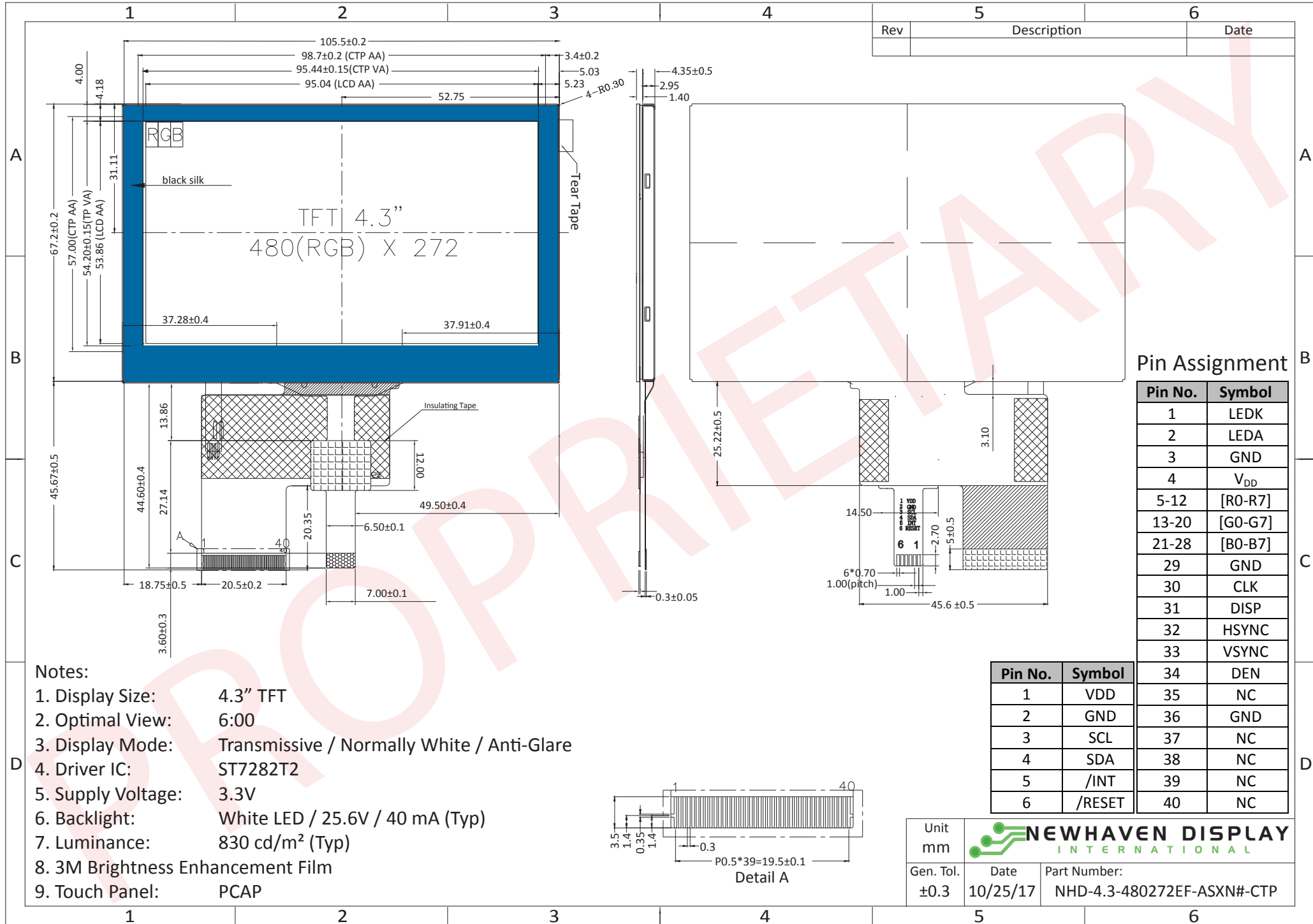
## Document Revision History

| Revision | Date     | Description  | Changed by |
|----------|----------|--|------------|
| 0        | 10/6/15  | Initial Release  | SB         |
| 1        | 1/10/17  | Mechanical Drawing, Electrical & Optical Char. Updated | SB         |
| 2        | 3/11/17  | Driver IC Updated                                      | SB         |
| 3        | 10/25/17 | CTP Cable Location Fixed                               | SB         |

## Functions and Features

- 480xRGBx272 resolution, up to 16.7M colors
- 16-LED backlight
- 24 bit RGB interface
- Sunlight Readable
- Capacitive touch panel with controller
  - 5 point multi-touch input
  - Gesture input
    - Zoom In/Out
    - Swipe Up/Down/Left/Right

# Mechanical Drawing



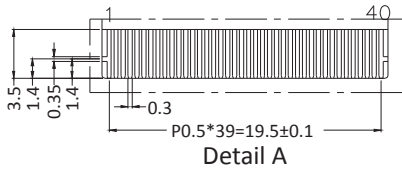
| Rev | Description | Date |
|-----|-------------|------|
|     |             |      |

### Pin Assignment

| Pin No. | Symbol          |
|---------|-----------------|
| 1       | LEDK            |
| 2       | LEDA            |
| 3       | GND             |
| 4       | V <sub>DD</sub> |
| 5-12    | [R0-R7]         |
| 13-20   | [G0-G7]         |
| 21-28   | [B0-B7]         |
| 29      | GND             |
| 30      | CLK             |
| 31      | DISP            |
| 32      | HSYNC           |
| 33      | VSYNC           |
| 34      | DEN             |
| 35      | NC              |
| 36      | GND             |
| 37      | NC              |
| 38      | NC              |
| 39      | NC              |
| 40      | NC              |

| Pin No. | Symbol |
|---------|--------|
| 1       | VDD    |
| 2       | GND    |
| 3       | SCL    |
| 4       | SDA    |
| 5       | /INT   |
| 6       | /RESET |

- Notes:**
- Display Size: 4.3" TFT
  - Optimal View: 6:00
  - Display Mode: Transmissive / Normally White / Anti-Glare
  - Driver IC: ST7282T2
  - Supply Voltage: 3.3V
  - Backlight: White LED / 25.6V / 40 mA (Typ)
  - Luminance: 830 cd/m<sup>2</sup> (Typ)
  - 3M Brightness Enhancement Film
  - Touch Panel: PCAP



Unit mm

Gen. Tol. ±0.3

Date 10/25/17

Part Number: NHD-4.3-480272EF-ASXN#-CTP

**NEWHAVEN DISPLAY INTERNATIONAL**

## Pin Description

### TFT:

| Pin No. | Symbol  | External Connection | Function Description                    |
|---------|---------|---------------------|---|
| 1       | LED-    | Power Supply        | Backlight Cathode (Ground)              |
| 2       | LED+    | Power Supply        | Backlight Anode (40mA @ 25.6V)          |
| 3       | GND     | Power Supply        | Ground                                  |
| 4       | VDD     | Power Supply        | Supply Voltage for LCD and logic (3.3V) |
| 5-12    | [R0-R7] | MPU                 | Red Data signals                        |
| 13-20   | [G0-G7] | MPU                 | Green Data signals                      |
| 21-28   | [B0-B7] | MPU                 | Blue Data signals                       |
| 29      | GND     | Power Supply        | Ground                                  |
| 30      | CLK     | MPU                 | Data sample Clock signal                |
| 31      | DISP    | MPU                 | Display ON/OFF signal                   |
| 32      | HSYNC   | MPU                 | Line synchronization signal             |
| 33      | VSYNC   | MPU                 | Frame synchronization signal            |
| 34      | DE      | MPU                 | Data Enable signal                      |
| 35      | NC      | -                   | No Connect                              |
| 36      | GND     | Power Supply        | Ground                                  |
| 37      | NC      | -                   | No Connect                              |
| 38      | NC      | -                   | No Connect                              |
| 39      | NC      | -                   | No Connect                              |
| 40      | NC      | -                   | No Connect                              |

**Recommended LCD connector:** 0.5mm pitch 40-Conductor FFC. Molex p/n: 54104-4033

**Backlight connector:** on LCD connector

**Mates with:** ---

### Capacitive Touch Panel:

| Pin No. | Symbol | External Connection | Function Description  |
|---------|--------|---------------------|---|
| 1       | VDD    | Power Supply        | Power supply for logic (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 T.P. module to host (Requires pull-up resistor) |
| 6       | /RESET | MPU                 | Active LOW Reset signal   |

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

## Electrical Characteristics

### TFT:

| 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   |
| 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                            | 12                    | 25     | 50                    | 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>  | -   | GND                   | -      | 0.3 * V <sub>DD</sub> | V    |
| "H" level output            | V <sub>OH</sub>  | -   | 0.9 * V <sub>DD</sub> | -      | V <sub>DD</sub>       | V    |
| "L" level output            | V <sub>OL</sub>  | -   | GND                   | -      | 0.1 * V <sub>DD</sub> | V    |
| Backlight Supply Current    | I <sub>LED</sub> | -   | -                     | 40     | 50                    | mA   |
| Backlight Supply Voltage    | V <sub>LED</sub> | I <sub>LED</sub> = 40 mA                          | 22.4                  | 25.6   | 2                     | V    |
| Backlight Lifetime*         | -                | I <sub>LED</sub> = 40mA<br>T <sub>OP</sub> = 25°C | 20,000                | 50,000 | -                     | Hrs. |

\*Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions. The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

### Capacitive Touch Panel:

| 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   |
| Supply Voltage              | V <sub>DD</sub> | -                      | 3.0                   | 3.3  | 3.6                   | V    |
| Supply Current (Operating)  | I <sub>DD</sub> | V <sub>DD</sub> = 3.3V | -                     | 6.0  | -                     | mA   |
| Supply Current (Hibernate)  | I <sub>DD</sub> | T <sub>OP</sub> = 25°C | -                     | 1.0  | -                     | µA   |
| "H" level input             | V <sub>IH</sub> | -                      | 0.7 * V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    |
| "L" level input             | V <sub>IL</sub> | -                      | GND                   | -    | 0.3 * V <sub>DD</sub> | V    |
| "H" level output            | V <sub>OH</sub> | -                      | 0.7 * V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    |
| "L" level output            | V <sub>OL</sub> | -                      | GND                   | -    | 0.3 * V <sub>DD</sub> | V    |

## Optical Characteristics

| Item                   | Symbol         | Condition                       | Min.                   | Typ.  | Max.  | Unit              |    |
|------------------------|----------------|---------------------------------|------------------------|-------|-------|-------------------|----|
| Optimal Viewing Angles | Top            | Cr ≥ 10                         | -                      | 55    | -     | °                 |    |
|                        | Bottom         |                                 | -                      | 75    | -     | °                 |    |
|                        | Left           |                                 | -                      | 75    | -     | °                 |    |
|                        | Right          |                                 | -                      | 75    | -     | °                 |    |
| Contrast Ratio         | CR             | -                               | 400                    | 500   | -     | -                 |    |
| Luminance              | L <sub>V</sub> | -                               | 660                    | 830   | -     | cd/m <sup>2</sup> |    |
| Response Time          | Rise + Fall    | T <sub>R</sub> + T <sub>F</sub> | T <sub>OP</sub> = 25°C | -     | 25    | 30                | ms |
| Chromaticity           | Red            | X <sub>R</sub>                  | -                      | 0.531 | 0.581 | 0.631             | -  |
|                        |                | Y <sub>R</sub>                  | -                      | 0.300 | 0.350 | 0.400             | -  |
|                        | Green          | X <sub>G</sub>                  | -                      | 0.263 | 0.313 | 0.363             | -  |
|                        |                | Y <sub>G</sub>                  | -                      | 0.568 | 0.618 | 0.668             | -  |
|                        | Blue           | X <sub>B</sub>                  | -                      | 0.093 | 0.143 | 0.193             | -  |
|                        |                | Y <sub>B</sub>                  | -                      | 0.050 | 0.100 | 0.150             | -  |
|                        | White          | X <sub>W</sub>                  | -                      | 0.233 | 0.283 | 0.333             | -  |
|                        |                | Y <sub>W</sub>                  | -                      | 0.286 | 0.336 | 0.386             | -  |

## Capacitive Touch Panel Material Characteristics

| Property            | Requirement | Unit |
|---------------------|-------------|------|
| IC                  | FT5306DE4   | -    |
| ITO Glass Thickness | 0.55        | mm   |
| Surface Hardness    | ≥6          | H    |
| Transparency        | 83% ± 5%    | -    |
| Operating Humidity  | 20~90       | RH   |
| Storage Humidity    | 20~90       | RH   |

## Driver/Controller Information

### TFT:

Built-in Sitronix ST7282T2 Driver.

Please download specification at <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/ST7282T2.pdf>

### Capacitive Touch Panel:

Built-in FocalTech FT5306

Please download specification at [http://www.newhavendisplay.com/app\\_notes/FT5x06.pdf](http://www.newhavendisplay.com/app_notes/FT5x06.pdf)

# Capacitive Touch Panel Registers

| Address | Name        | B7                              | B6 | B5 | B4                               | B3 | B2                               | B1 | B0 | Access |     |
|---------|-------------|---------------------------------|----|----|----------------------------------|----|----------------------------------|----|----|--------|-----|
| 00h     | DEVICE_MODE | Device Mode [2..0]              |    |    |                                  |    |                                  |    |    |        | R/W |
| 01h     | GEST_ID     | Gesture ID [7..0]               |    |    |                                  |    |                                  |    |    |        | R   |
| 02h     | TD_STATUS   |                                 |    |    | Touch Points [3..0]              |    |                                  |    |    |        | R   |
| 03h     | TOUCH1_XH   | Event Flag                      |    |    |                                  |    | 1st Touch X Position MSB [11..8] |    |    | R      |     |
| 04h     | TOUCH1_XL   | 1st Touch X Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 05h     | TOUCH1_YH   | Touch ID [3..0]                 |    |    | 1st Touch Y Position MSB [11..8] |    |                                  |    |    |        | R   |
| 06h     | TOUCH1_YL   | 1st Touch Y Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 07h     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 08h     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 09h     | TOUCH2_XH   | Event Flag                      |    |    |                                  |    | 2nd Touch X Position MSB [11..8] |    |    | R      |     |
| 0Ah     | TOUCH2_XL   | 2nd Touch X Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 0Bh     | TOUCH2_YH   | Touch ID [3..0]                 |    |    | 2nd Touch Y Position MSB [11..8] |    |                                  |    |    |        | R   |
| 0Ch     | TOUCH2_YL   | 2nd Touch Y Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 0Dh     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 0Eh     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 0Fh     | TOUCH3_XH   | Event Flag                      |    |    |                                  |    | 3rd Touch X Position MSB [11..8] |    |    | R      |     |
| 10h     | TOUCH3_XL   | 3rd Touch X Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 11h     | TOUCH3_YH   | Touch ID [3..0]                 |    |    | 3rd Touch Y Position MSB [11..8] |    |                                  |    |    |        | R   |
| 12h     | TOUCH3_YL   | 3rd Touch Y Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 13h     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 14h     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 15h     | TOUCH4_XH   | Event Flag                      |    |    |                                  |    | 4th Touch X Position MSB [11..8] |    |    | R      |     |
| 16h     | TOUCH4_XL   | 4th Touch X Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 17h     | TOUCH4_YH   | Touch ID [3..0]                 |    |    | 4th Touch Y Position MSB [11..8] |    |                                  |    |    |        | R   |
| 18h     | TOUCH4_YL   | 4th Touch Y Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 19h     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 1Ah     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |
| 1Bh     | TOUCH5_XH   | Event Flag                      |    |    |                                  |    | 5th Touch X Position MSB [11..8] |    |    | R      |     |
| 1Ch     | TOUCH5_XL   | 5th Touch X Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 1Dh     | TOUCH5_YH   | Touch ID [3..0]                 |    |    | 5th Touch Y Position MSB [11..8] |    |                                  |    |    |        | R   |
| 1Eh     | TOUCH5_YL   | 5th Touch Y Position LSB [7..0] |    |    |                                  |    |                                  |    |    |        | R   |
| 1Fh     |             |                                 |    |    |                                  |    |                                  |    |    |        | R   |

| Address | Name                    | B7  | B6 | B5 | B4 | B3 | B2 | B1                        | B0 | Access |
|---------|-------------------------|---|----|----|----|----|----|---------------------------|----|--------|
| 80h     | ID_G_THGROUP            | valid touching detect threshold                                 |    |    |    |    |    |                           |    | R/W    |
| 81h     | ID_G_THPEAK             | valid touching peak detect threshold                            |    |    |    |    |    |                           |    | R/W    |
| 82h     | ID_G_THCAL              | the threshold when calculating the focus of touching            |    |    |    |    |    |                           |    | R/W    |
| 83h     | ID_G_THWATER            | the threshold when there is surface water                       |    |    |    |    |    |                           |    | R/W    |
| 84h     | ID_G_TEMP               | the threshold of temperature compensation                       |    |    |    |    |    |                           |    | R/W    |
| 85h     | ID_G_THDIFF             | the threshold whether the coordinate is different from original |    |    |    |    |    |                           |    | R/W    |
| 86h     | ID_G_CTRL               |   |    |    |    |    |    | Power Control Mode [1..0] |    | R/W    |
| 87h     | ID_G_TIME_ENTER_MONITOR | the timer for entering monitor status                           |    |    |    |    |    |                           |    | R/W    |
| 88h     | ID_G_PERIODACTIVE       |   |    |    |    |    |    | Period Active [3..0]      |    | R/W    |
| 89h     | ID_G_PERIODMONITOR      | the timer of entering idle when in monitor status               |    |    |    |    |    |                           |    | R/W    |
| A0h     | ID_G_AUTO_CLB_MODE      | auto calibration mode   |    |    |    |    |    |                           |    | R/W    |
| A1h     | ID_G_LIB_VERSION_H      | Firmware Library Version H byte                                 |    |    |    |    |    |                           |    | R      |
| A2h     | ID_G_LIB_VERSION_L      | Firmware Library Version L byte                                 |    |    |    |    |    |                           |    | R      |
| A3h     | ID_G_CIPHER             | Chip vendor ID  |    |    |    |    |    |                           |    | R      |
| A4h     | ID_G_MODE               | the interrupt status to host                                    |    |    |    |    |    |                           |    | R      |
| A5h     | ID_G_PMODE              | Power Consume Mode  |    |    |    |    |    |                           |    |        |
| A6h     | ID_G_FIRMID             | Firmware ID   |    |    |    |    |    |                           |    | R      |
| A7h     | ID_G_STATE              | Running State   |    |    |    |    |    |                           |    |        |
| A8h     | ID_G_FT5201ID           | CTPM Vendor ID  |    |    |    |    |    |                           |    | R      |
| A9h     | ID_G_ERR                | Error Code  |    |    |    |    |    |                           |    | R      |
| AAh     | ID_G_CLB                | Configure TP module during calibration in Test Mode             |    |    |    |    |    |                           |    | R/W    |
| FEh     | LOG_MSG_CNT             | The log MSG count   |    |    |    |    |    |                           |    | R      |
| FFh     | LOG_CUR_CHA             | Current character of log message                                |    |    |    |    |    |                           |    | R      |

NOTE: Registers 80h – AFh have been configured for optimum settings and do not need to be modified.



| Register No | Register Name      | Bits  | Value  | Description   |
|-------------|--------------------|-------|--|---|
| 00h         | Device Mode        | [2:0] | 000b<br>100b<br>001b                         | Normal Operating Mode<br>Test Mode - read raw data (reserved)<br>System Information Mode (reserved)   |
| 01h         | Gesture ID         | [7:0] | 48h<br>49h<br>00h                            | Zoom In<br>Zoom Out<br>No Gesture   |
| 02h         | Touch Points       | [3:0] | 000b<br>001b<br>010b<br>011b<br>100b<br>101b | 0 touch points detected<br>1 touch point detected<br>2 touch points detected<br>3 touch points detected<br>4 touch points detected<br>5 touch points detected |
| 03h         | Touch 1 Event Flag | [7:6] | 00b<br>01b<br>10b<br>11b                     | Put Down<br>Put Up<br>Contact<br>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<br>01b<br>10b<br>11b                     | Put Down<br>Put Up<br>Contact<br>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<br>01b<br>10b<br>11b                     | Put Down<br>Put Up<br>Contact<br>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<br>01b<br>10b<br>11b                     | Put Down<br>Put Up<br>Contact<br>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<br>01b<br>10b<br>11b        | Put Down<br>Put Up<br>Contact<br>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<br>Actual value will be 4 times register's value<br>Recommended: 46h   |
| 81h         | ID_G_THPEAK             | [7:0] | 00h - FFh                       | valid touching peak detect threshold<br>Recommended: 3Ch   |
| 82h         | ID_G_THCAL              | [7:0] | 00h - FFh                       | Touch focus threshold<br>Recommended: 1Dh  |
| 83h         | ID_G_THWATER            | [7:0] | 00h - FFh                       | threshold when there is surface water<br>Recommended: D3h  |
| 84h         | ID_G_THTEMP             | [7:0] | 00h - FFh                       | threshold of temperature compensation<br>Recommended: EBh  |
| 85h         | ID_G_THDIFF             | [7:0] | 00h - FFh                       | Touch difference threshold<br>Actual value is 32 times the register's value<br>Recommended: A0h  |
| 86h         | ID_G_CTRL               | [1:0] | 00h<br>01h                      | Power Control Mode: Not Auto Jump<br>Power Control Mode: Auto Jump   |
| 87h         | ID_G_TIME_ENTER_MONITOR | [7:0] | 00h-FFh                         | Delay to enter 'Monitor' status (s)<br>Recommended: C8h  |
| 88h         | ID_G_PERIODACTIVE       | [3:0] | 3h-Eh                           | Period of 'Active' status (ms)<br>Recommended: 6h  |
| 89h         | ID_G_PERIODMONITOR      | [7:0] | 1Eh-FFh                         | Timer to enter 'idle' when in 'Monitor' (ms)<br>Recommended: 28h   |
| A0h         | ID_G_AUTO_CLB_MODE      | [7:0] | 00h<br>FFh                      | Auto calibration mode: Enable auto calibration<br>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] | 55h                             | Chip vendor ID   |
| A4h         | ID_G_MODE               | [0:0] | 00h<br>01h                      | Interrupt status: Enable interrupt to host<br>Interrupt status: Disable interrupt to host  |
| A5h         | ID_G_PMODE              | [1:0] | 00h<br>01h<br>03h               | 'Active' Mode<br>'Monitor' Mode<br>'Hibernate' Mode  |
| A6h         | ID_G_FIRMID             | [7:0] | 08h                             | Firmware ID  |
| A7h         | ID_G_STATE              | [7:0] | 00h<br>01h<br>02h<br>03h<br>04h | Running State: Configure<br>Running State: Work<br>Running State: Calibration<br>Running State: Factory<br>Running State: Auto-calibration         |
| A8h         | ID_G_FT5201ID           | [7:0] | 79h                             | CTPM Vendor's Chip ID  |
| A9h         | ID_G_ERR                | [7:0] | 00h<br>03h<br>05h<br>1Ah        | Error Code: OK<br>Error Code: Chip register writing inconsistent with reading<br>Error Code: Chip start fail<br>Error Code: Calibration match fail |

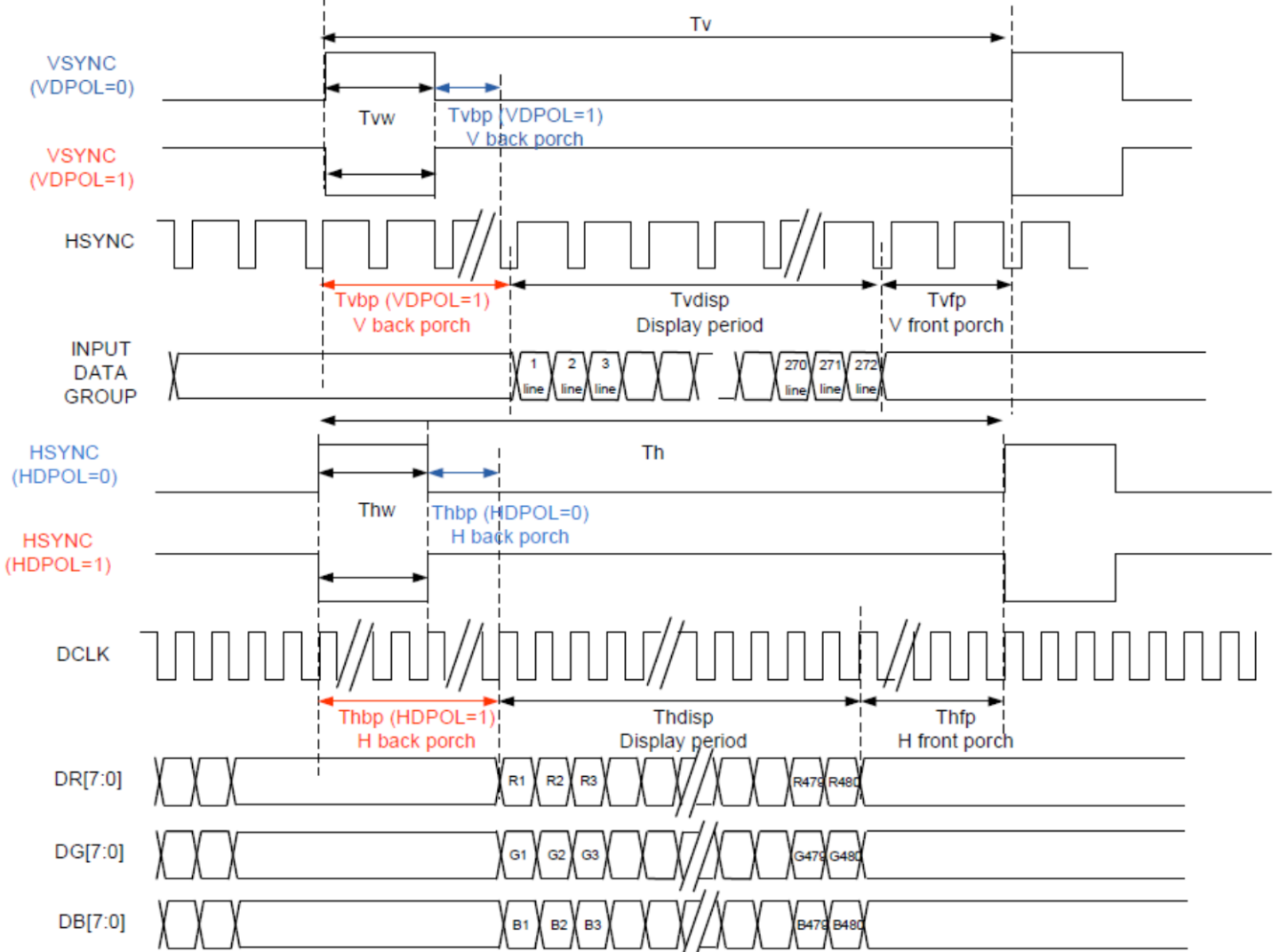
# Timing Characteristics – TFT Display

## Timing Characteristics

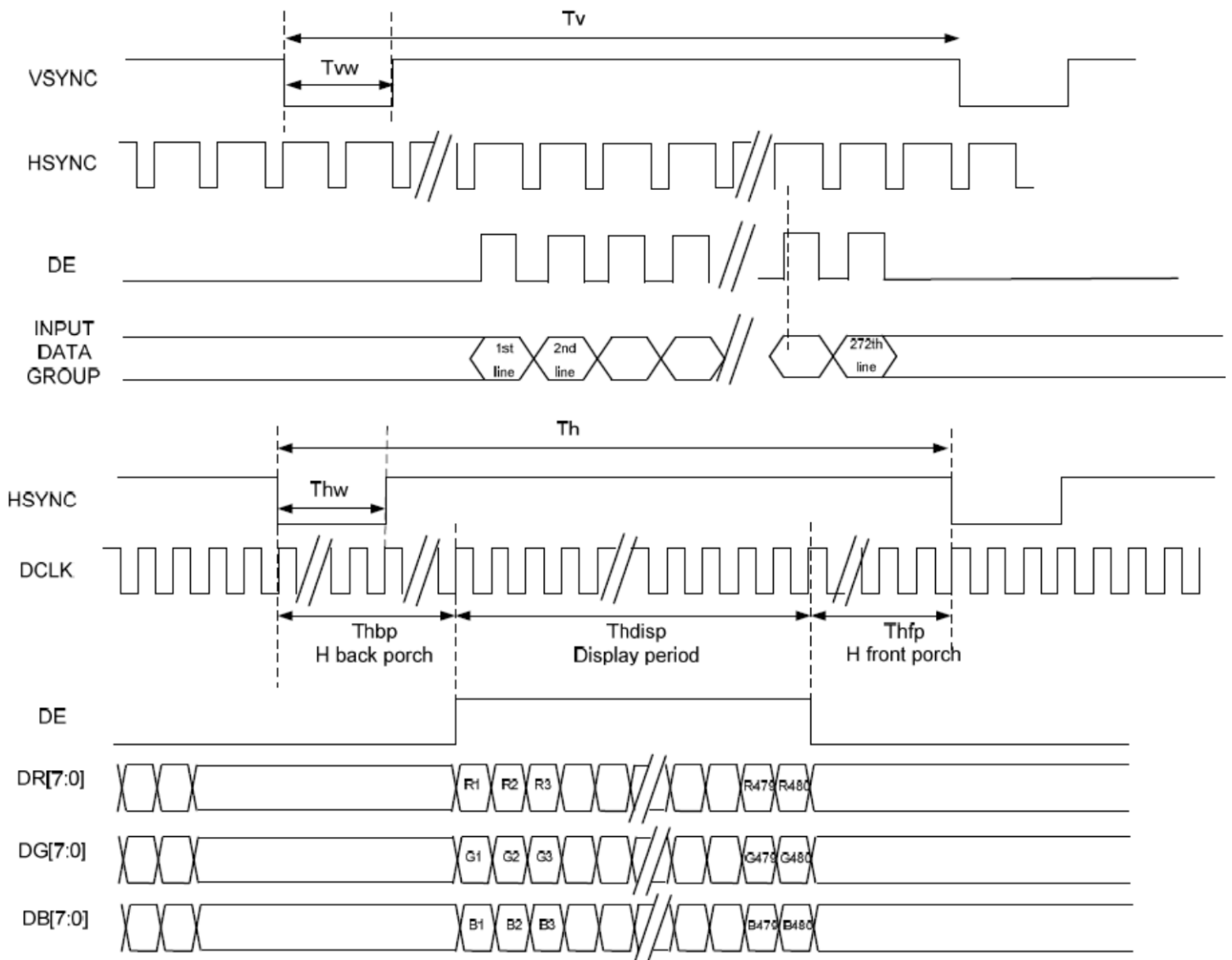
### Parallel RGB input timing requirement

| Item           |                | Symbol | Min. | Typ. | Max. | Unit    | Remark                     |
|----------------|----------------|--------|------|------|------|---------|----------------------------|
| DCLK Frequency |                | FCLK   | 9    | 12   | 15   | MHz     |                            |
| DCLK Period    |                | TCLK   | 10   | 50   | -    | $\mu$ S | R=10K $\Omega$ , 1 $\mu$ F |
| HSYNC          | Period Time    | Th     | 485  | 525  | 532  | DCLK    |                            |
|                | Display Period | Thdisp | -    | 480  | -    | DCLK    |                            |
|                | Back Porch     | Thbp   | 3    | 43   | 50   | DCLK    | By H_Blanking Setting      |
|                | Front Porch    | Thfp   | 2    | 2    | 2    | DCLK    |                            |
|                | Pulse Width    | Thw    | 1    | 1    | 1    | DCLK    |                            |
| VSYNC          | Period Time    | Tv     | 275  | 285  | 303  | H       |                            |
|                | Display Period | Tvdisp | -    | 272  | -    | H       |                            |
|                | Back Porch     | Tvbp   | 2    | 12   | 30   | H       | By V_Blanking Setting      |
|                | Front Porch    | Tvfp   | 1    | 1    | 1    | H       |                            |
|                | Pulse Width    | Tvw    | 1    | 1    | 1    | H       |                            |

- SYNC Mode Timing



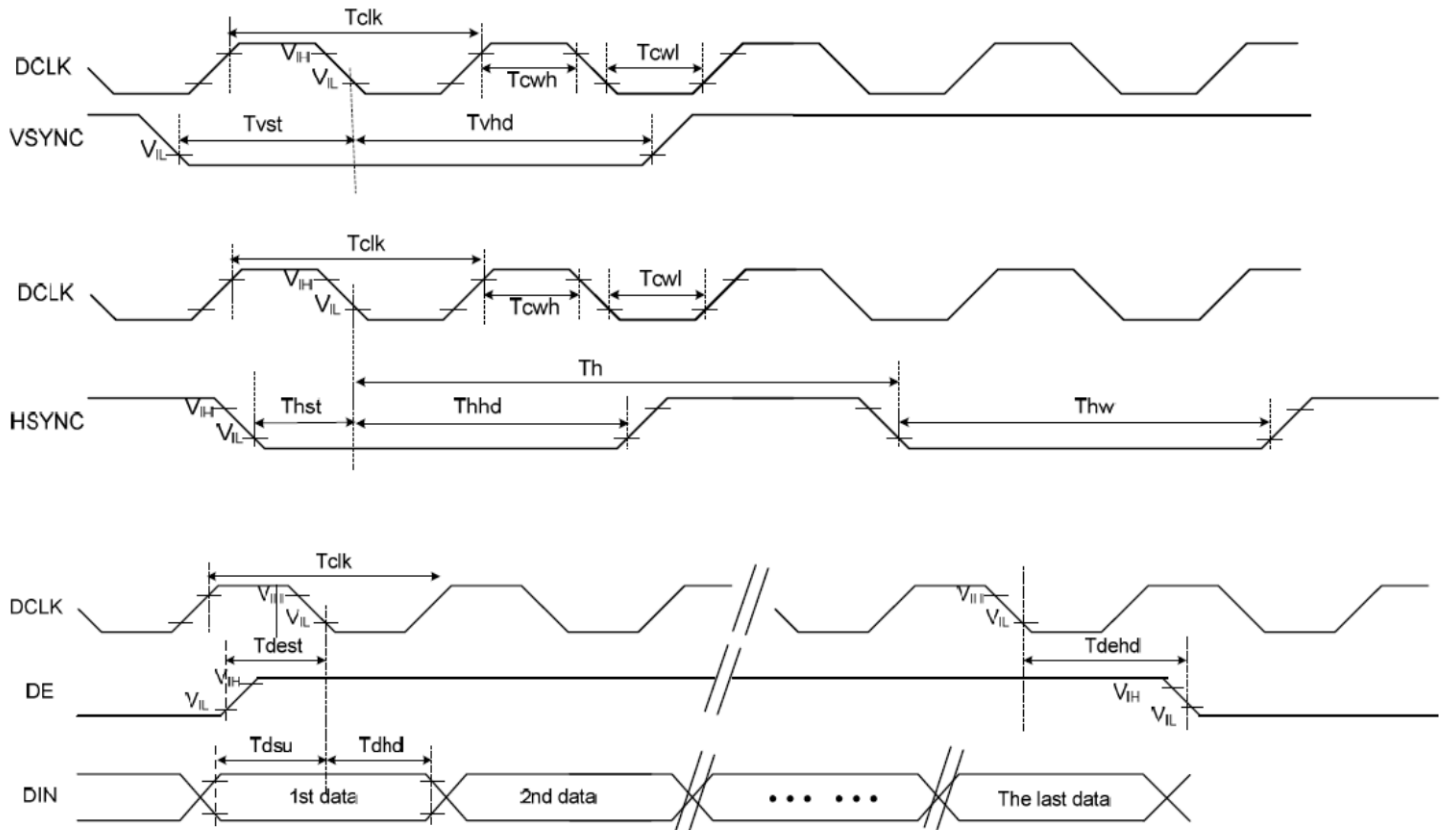
- SYNC-DE Mode Timing



## Input setup timing requirement

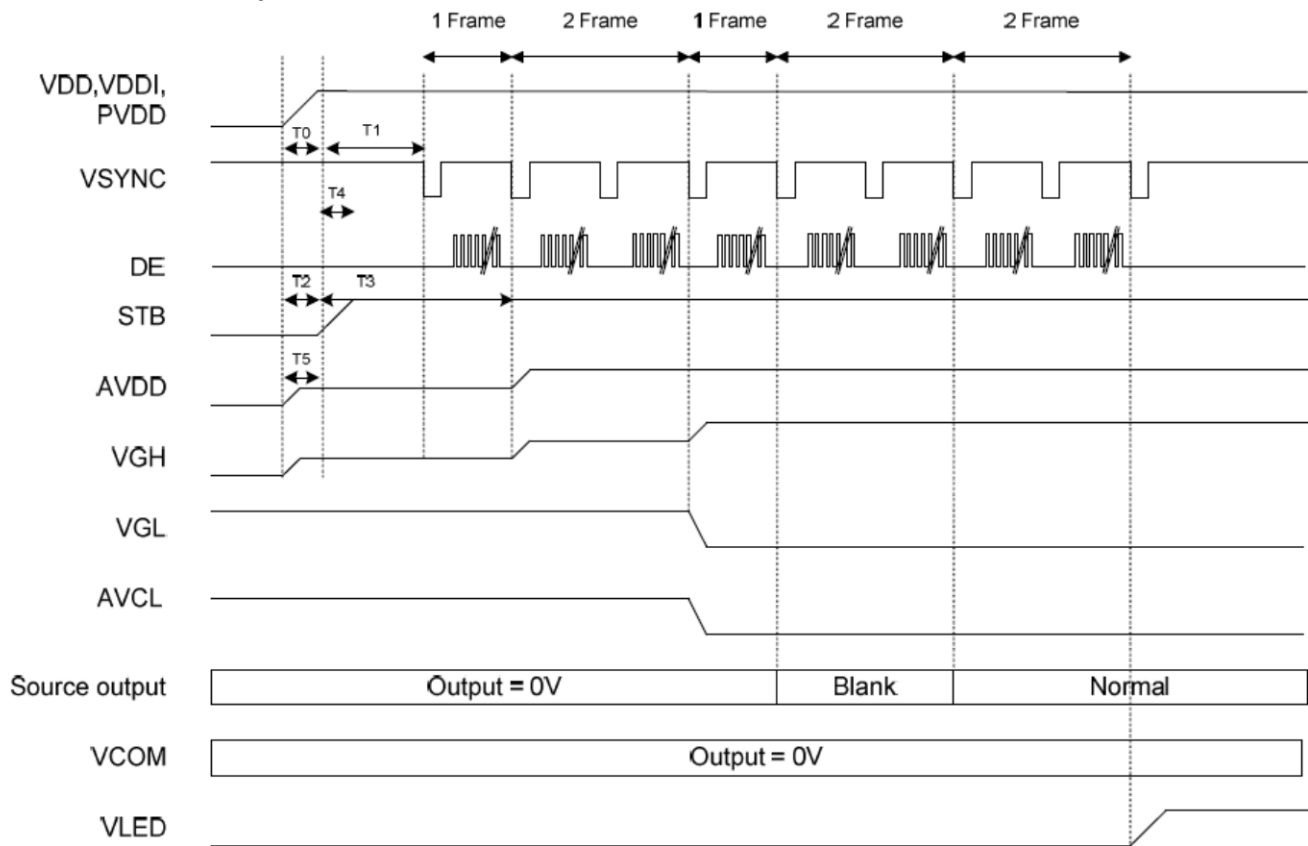
| Item                                   | Symbol | Min. | Typ. | Max. | Unit | Conditions   |
|--|--------|------|------|------|------|--|
| System Operation Timing                |        |      |      |      |      |  |
| V <sub>DD</sub> Power Source Slew Time | TPOR   | -    | -    | 20   | ms   | From 0V to 99% V <sub>DD</sub>                       |
| GRB Pulse Width                        | tRSTW  | 10   | 50   | -    | μS   | R=10KΩ, 1μF  |
| Input / Output Timing                  |        |      |      |      |      |  |
| CLK pulse Duty                         | TCW    | 40   | 50   | 60   | %    |  |
| Hsync Width                            | Thw    | 1    | -    | -    | DCLK |  |
| Hsync Period                           | Th     | 50   | 60   | 65   | μS   |  |
| Vsync setup time                       | Tvst   | 12   | -    | -    | ns   |  |
| Vsync hold time                        | Tvhd   | 12   | -    | -    | ns   |  |
| Hsync setup time                       | Thst   | 12   | -    | -    | ns   |  |
| Hsync hold time                        | Thhd   | 12   | -    | -    | ns   |  |
| Data setup time                        | Tdsu   | 12   | -    | -    | ns   |  |
| Data hold time                         | Tdhd   | 12   | -    | -    | ns   |  |
| SD output stable time                  | Tst    | -    | -    | 12   | μS   | Output settled within +20mV<br>Loading = 6.8k+28.2pF |
| GD output rise and fall time           | Tgst   | -    | -    | 6    | μS   | Output settled (5%~95%)<br>Loading = 4.7k+29.8pF     |

### - Clock And Data Input Timing Diagram



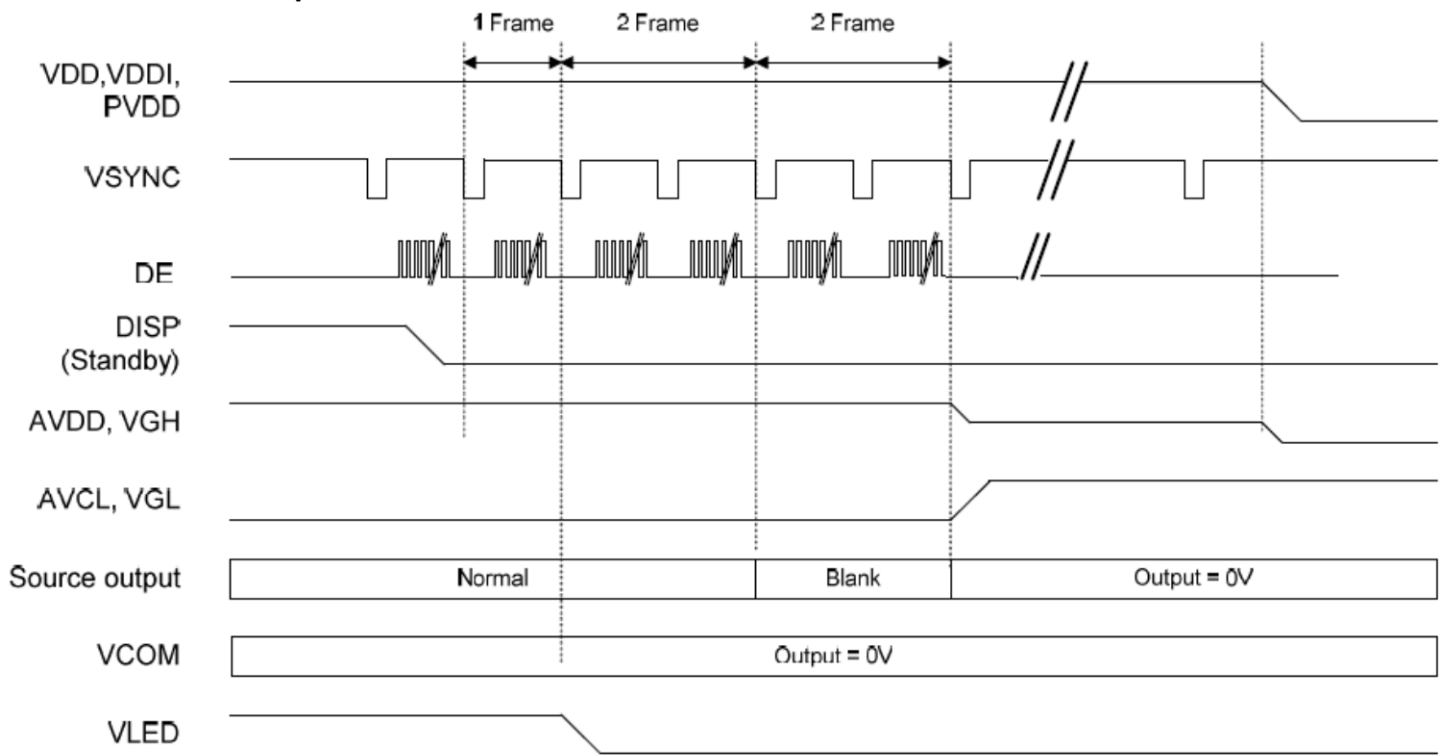
# Power On/Off Sequence

## - Power On Sequence



|    | Description  | Min. Time        |
|----|--|------------------|
| T0 | Determined by the external power                           |                  |
| T1 | Time from stable VDD, VDDI, PVDD set-up to the first VSYNC | T1=0             |
| T2 | Time from AVDD=0V to AVDD=3.3V                             | T2=T0            |
| T3 | Time from AVDD=3.3V to AVDD=6.0V                           | T3=T1+ (1*Frame) |
| T4 | Time from stable VDD, VDDI, PVDD set-up to DISP asserted   | T4=0             |
| T5 | Time from VGH=0V to VGH=3.3V                               | T5=T0            |

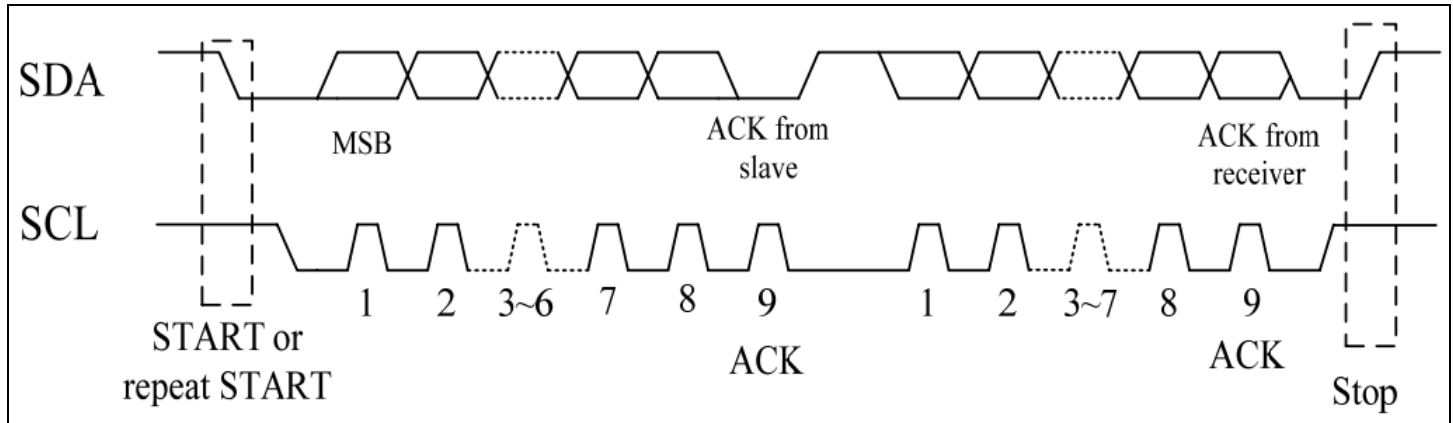
- **Power Off Sequence**



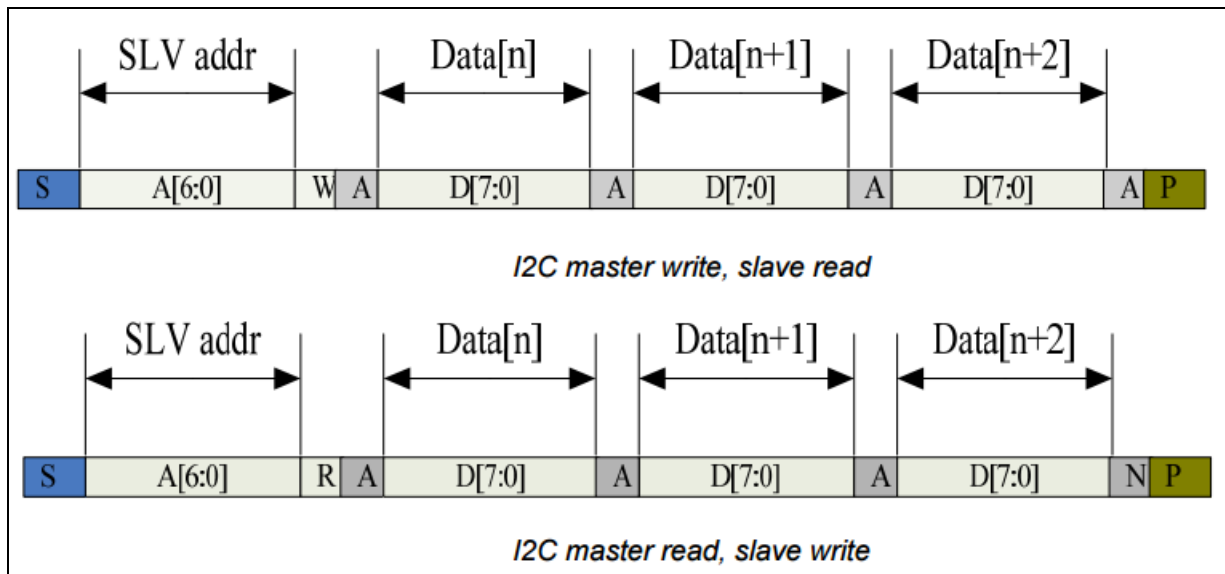


# Timing Characteristics – Capacitive Touch Panel

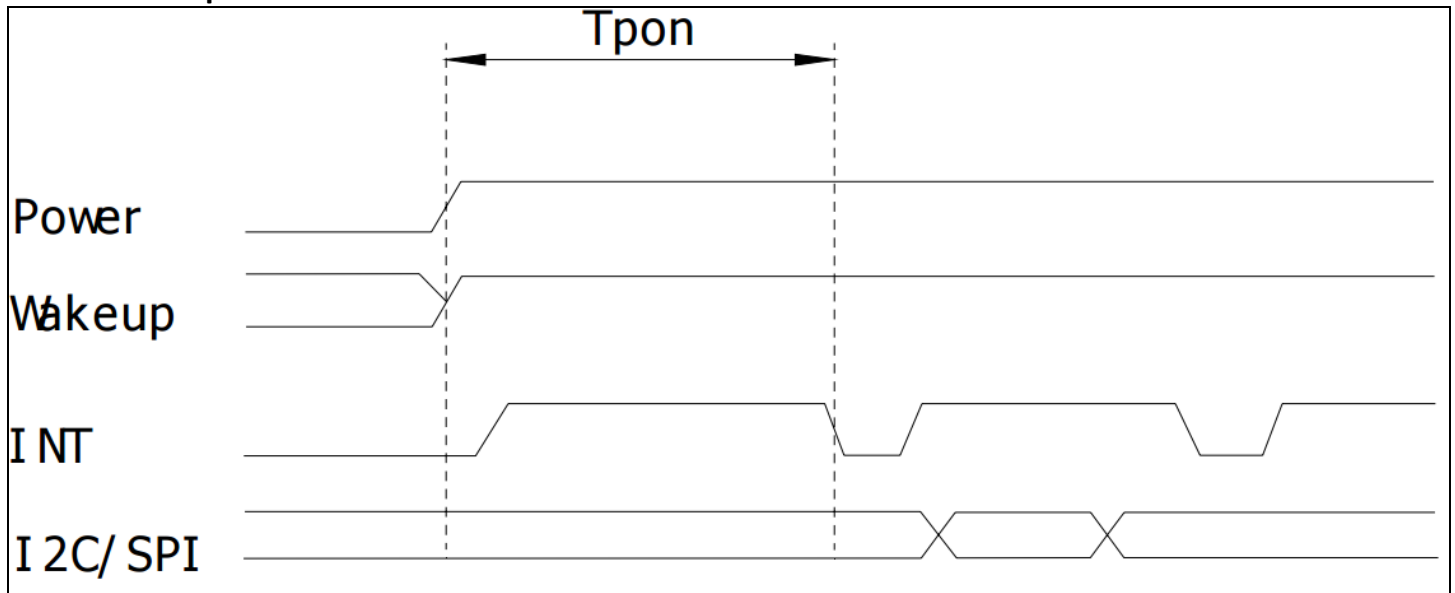
## Data Transfer Format



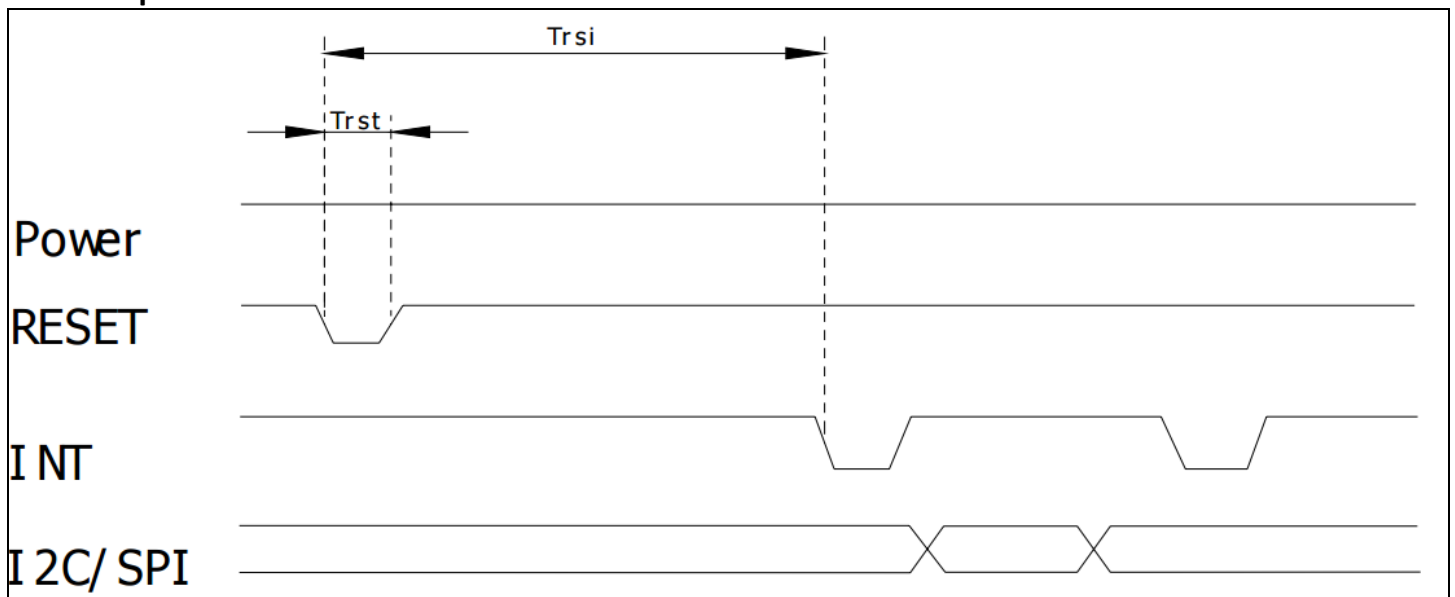
| Parameter  | Unit | Min | Max |
|--|------|-----|-----|
| SCL frequency                                    | KHz  | 0   | 400 |
| Bus free time between a STOP and START condition | us   | 4.7 | \   |
| Hold time (repeated) START condition             | us   | 4.0 | \   |
| Data setup time                                  | ns   | 250 | \   |
| Setup time for a repeated START condition        | us   | 4.7 | \   |
| Setup Time for STOP condition                    | us   | 4.0 | \   |



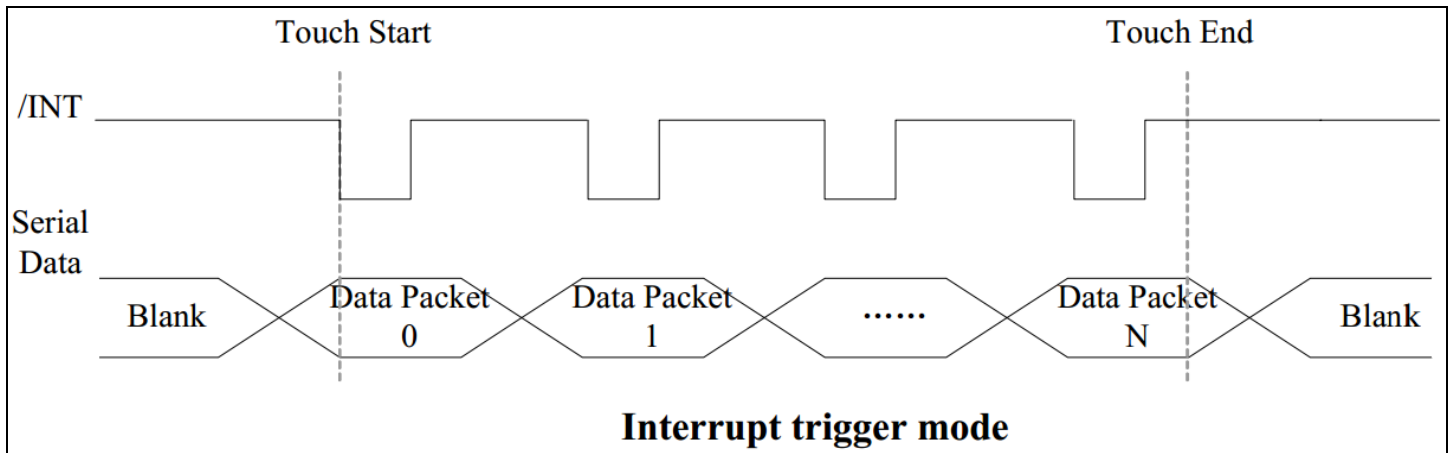
### Power ON Sequence



### Reset Sequence



| Parameter | Description  | Min | Max | Units |
|-----------|--|-----|-----|-------|
| $T_{ris}$ | Rise time from 0.1VDD to 0.9VDD                    | --  | 10  | ms    |
| $T_{pon}$ | Time of starting to report point after powering on | 300 | --  | ms    |
| $T_{rsi}$ | Time of starting to report point after resetting   | 300 | --  | ms    |
| $T_{rst}$ | Reset time   | 5   | --  | ms    |
| $T_{wai}$ | Time of starting to report point after waking      | 300 | --  | ms    |
| $T_{wak}$ | Wake up time                                       | 5   | --  | 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.   | +80°C , 96 Hrs.   | 2    |
| Low Temperature storage               | Endurance test applying the low storage temperature for a long time.  | -30°C , 96 Hrs.   | 1,2  |
| High Temperature Operation            | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.                    | +70°C , 96 Hrs.   | 2    |
| Low Temperature Operation             | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.                     | -20°C , 96 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 , 96 Hrs.  | 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<br>20 cycles  |      |
| Vibration test                        | Endurance test applying vibration to simulate transportation and use.   | 10-50Hz , 1.5mm amplitude.<br>30 Min. Each Direction<br>X,Y,Z   | 3    |
| Static electricity test               | Endurance test applying electric static discharge.  | Air: V <sub>S</sub> =±8KV, Contact: V <sub>S</sub> =±4KV<br>R <sub>S</sub> =330Ω C <sub>S</sub> =150pF<br>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.newhavendisply.com/specs/precautions.pdf](http://www.newhavendisply.com/specs/precautions.pdf)

## Warranty Information

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