

# NHD-3.5-320240MF-ASXN#-CTP

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

|         |  |
|---------|--|
| NHD-    | Newhaven Display                       |
| 3.5-    | 3.5" Diagonal                          |
| 320240- | 320xRGBx240 Pixels                     |
| MF-     | Model                                  |
| A-      | Built-in Driver / No Controller        |
| S-      | Sunlight Readable                      |
| X-      | TFT                                    |
| N-      | TN, Wide Temperature                   |
| #-      | <b>RoHS Compliant</b>                  |
| CTP-    | Capacitive Touch Panel with Controller |

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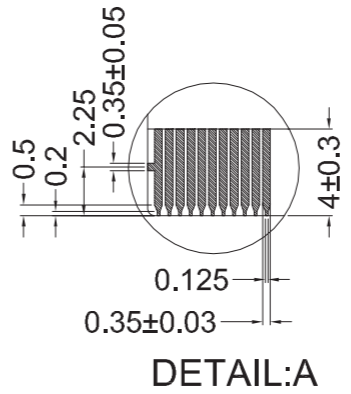
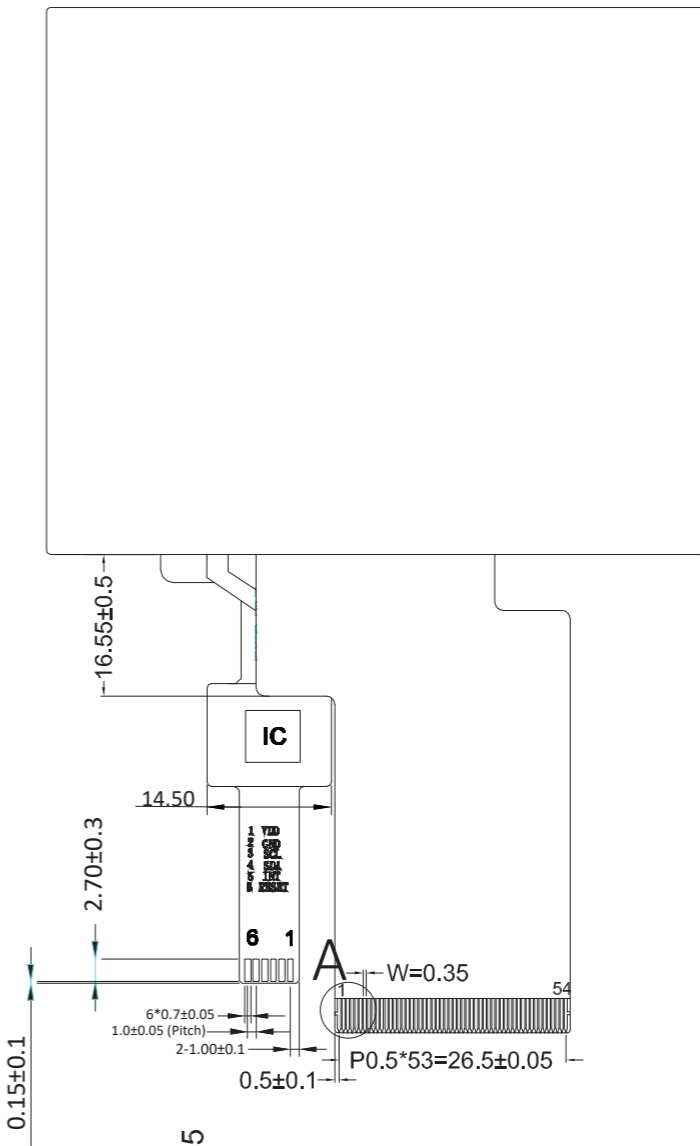
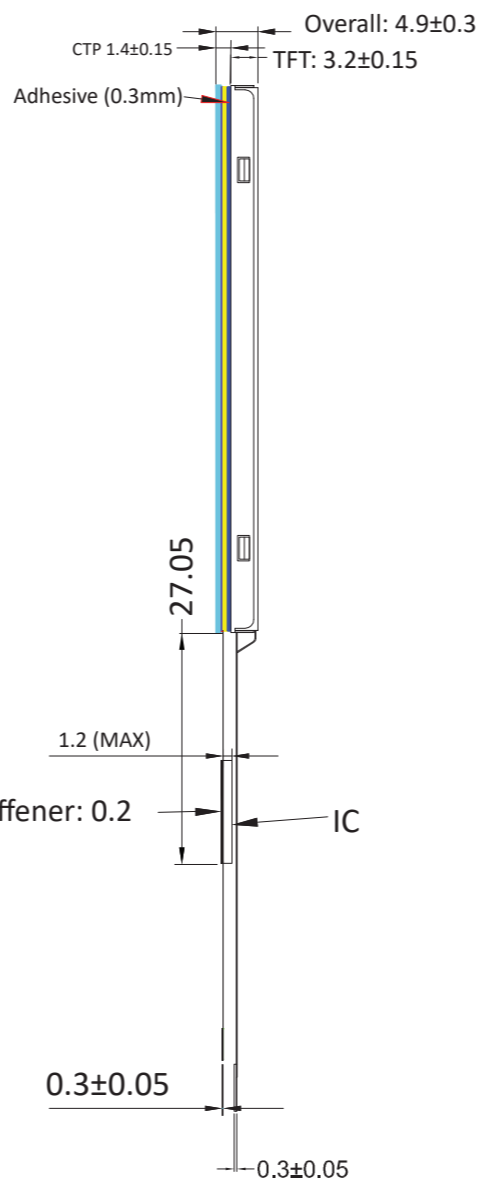
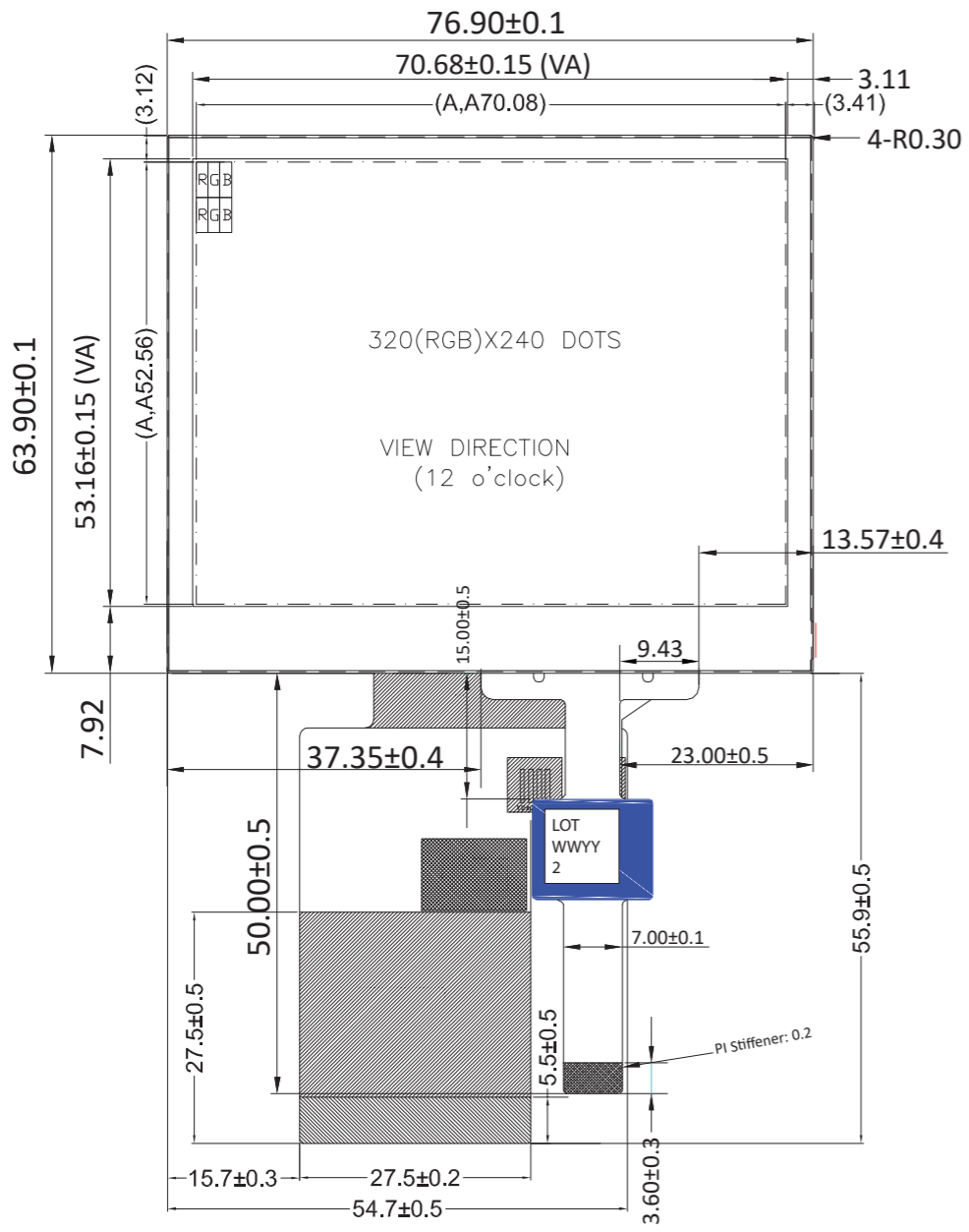
## Document Revision History

| Revision | Date    | Description   | Changed by |
|----------|---------|---|------------|
| 0        | 4/29/16 | Initial Release   | SB         |
| 1        | 6/30/16 | Added Chromaticity  | SB         |
| 2        | 9/22/16 | Backlight and Supply Current Updated  | SB         |
| 3        | 7/20/18 | CTP Adhesive Tape Thickness Increased from 0.18 to 0.3 mm, Backlight Characteristics updated. | SB         |
| 4        | 3/14/19 | CTP Driver & Panel Updated  | SB         |
| 5        | 5/2/19  | CTP Timing Note Added   | SB         |
| 6        | 12/2/19 | Drawing Updated to show CTP Label   | SB         |
| 7        | 6/30/20 | Revised Note on Manual Register Configuration   | AS         |

## Functions and Features

- 320xRGBx240 resolution
- LED backlight
- 3.3V power supply
- 24-bit Parallel digital RGB interface (6.4MHz)
- Sunlight readable
- Capacitive touch panel with controller
  - 10-Point multi-touch input
  - Gesture input
    - Zoom In/Out
    - Swipe Up/Down/Left/Right

| SYMBOL | REVISION | DATE |
|--------|----------|------|
|        |          |      |



### TFT

| Pin No. | Symbol |
|---------|--------|
| 1       | LED_K  |
| 2       | LED_K  |
| 3       | LED_A  |
| 4       | LED_A  |
| 5       | NC     |
| 6       | NC     |
| 7       | NC     |
| 8       | RSTB   |
| 9       | SPENB  |
| 10      | SPCK   |
| 11      | SPDA   |
| 12-19   | B0-B7  |
| 20-27   | G0-G7  |
| 28-35   | R0-R7  |
| 36      | HSD    |
| 37      | VSD    |
| 38      | CLKIN  |
| 39      | NC     |
| 40      | NC     |
| 41      | VDD    |
| 42      | VDD    |
| 43      | NC     |
| 44      | NC     |
| 45      | NC     |
| 46      | NC     |
| 47      | NC     |
| 48      | NC     |
| 49      | NC     |
| 50      | NC     |
| 51      | NC     |
| 52      | DEN    |
| 53      | GND    |
| 54      | GND    |

### CTP

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

### NOTES:

1. Display Size: 3.5 TFT
2. Optimal Viewing Direction: 12 O'CLOCK
3. Display Mode: Transmissive / Normally White / Anti-Glare
4. Driver IC: NV3035C
5. Power Supply Voltage: 3.3V
6. Backlight: White LED/ 19.2 V (Typ)/ 40mA
7. Brightness: 830 cd/m<sup>2</sup> (Typ)
8. Touch Panel: Capacitive Touch

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

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

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**NEWHAVEN DISPLAY INTERNATIONAL**

DRAWING/PART NUMBER: NHD-3.5-320240MF-ASXN#-CTP

REVISION: 1.0

SIZE: A3

SCALE: NS

SHEET 1 OF 1

DRAWN BY: S. Baxi

APPROVED BY: S. Baxi

DRAWN DATE: 12/2/19

APPROVED DATE: 12/2/19

## Pin Description

### TFT:

| Pin No. | Symbol          | External Connection | Function Description                    |
|---------|-----------------|---------------------|---|
| 1-2     | LED_K           | Power Supply        | Backlight Cathode (Ground)              |
| 3-4     | LED_A           | Power Supply        | Backlight Anode (40mA @ 19.2V)          |
| 5-7     | NC              | -                   | No Connect                              |
| 8       | RSTB            | MPU                 | Active LOW Reset signal                 |
| 9       | SPENB           | MPU                 | Active LOW Serial Chip Select signal    |
| 10      | SPCK            | MPU                 | Serial Clock signal                     |
| 11      | SPDA            | MPU                 | Serial Data signal                      |
| 12-19   | B0-B7           | MPU                 | Blue Data signals                       |
| 20-27   | G0-G7           | MPU                 | Green Data signals                      |
| 28-35   | R0-R7           | MPU                 | Red Data signals                        |
| 36      | HSD             | MPU                 | Horizontal (Line) Sync signal           |
| 37      | VSD             | MPU                 | Vertical (Frame) Sync signal            |
| 38      | CLKIN           | MPU                 | Dot Clock signal                        |
| 39-40   | NC              | -                   | No Connect                              |
| 41-42   | V <sub>DD</sub> | Power Supply        | Supply Voltage for LCD and logic (3.3V) |
| 43-51   | NC              | -                   | No Connect                              |
| 52      | DEN             | -                   | Data Enable signal (No Connect)         |
| 53-54   | GND             | Power Supply        | Ground                                  |

**Recommended connector:** 54pin, 0.5mm pitch, FFC connector. Molex P/N 51296-5494

### Capacitive Touch Panel:

| Pin No. | Symbol          | External Connection | Function Description                                     |
|---------|-----------------|---------------------|--|
| 1       | V <sub>DD</sub> | Power Supply        | Supply voltage for Logic (3.3V)                          |
| 2       | V <sub>SS</sub> | 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 (Do not tie to V <sub>CC</sub> ) |

**Recommended connector:** 6pin, 1.0mm pitch, FFC connector. 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                               | 5                     | 10     | 15                    | mA   |
| "H" Level input             | V <sub>IH</sub>  | -   | 0.8 * V <sub>DD</sub> | -      | V <sub>DD</sub>       | V    |
| "L" Level input             | V <sub>IL</sub>  | -   | V <sub>SS</sub>       | -      | 0.2 * V <sub>DD</sub> | V    |
| "H" Level output            | V <sub>OH</sub>  | -   | V <sub>DD</sub> - 0.4 | -      | V <sub>DD</sub>       | V    |
| "L" Level output            | V <sub>OL</sub>  | -   | V <sub>SS</sub>       | -      | V <sub>SS</sub> + 0.4 | V    |
| Backlight Supply Current    | I <sub>LED</sub> | -   | -                     | 40     | 50                    | mA   |
| Backlight Supply Voltage    | V <sub>LED</sub> | I <sub>LED</sub> = 40 mA                            | 17.4                  | 19.2   | 19.8                  | V    |
| Backlight Lifetime*         | -                | I <sub>LED</sub> = 40 mA<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> | -                     | 2.8                 | 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> | V <sub>DD</sub> =3.3V | -                   | 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> | -                     | V <sub>SS</sub>     | -    | 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> | -                     | V <sub>SS</sub>     | -    | 0.3*V <sub>DD</sub> | V    |

## Optical Characteristics

| Item                   | Symbol         | Condition                | Min.  | Typ.  | Max.  | Unit              |   |
|------------------------|----------------|--------------------------|-------|-------|-------|-------------------|---|
| Optimal Viewing Angles | Top            | CR ≥ 10                  | -     | 60    | -     | °                 |   |
|                        | Bottom         |                          | -     | 40    | -     | °                 |   |
|                        | Left           |                          | -     | 60    | -     | °                 |   |
|                        | Right          |                          | -     | 60    | -     | °                 |   |
| Contrast Ratio         | CR             | -                        | 200   | 350   | -     | -                 |   |
| Luminance              | L <sub>V</sub> | I <sub>LED</sub> = 40 mA | 660   | 830   | -     | cd/m <sup>2</sup> |   |
| Response Time          | Rise           | T <sub>OP</sub> = 25°C   | -     | 25    | 40    | ms                |   |
|                        | Fall           |                          | -     | 25    | 40    | ms                |   |
| Chromaticity           | Red            | X <sub>R</sub>           | -     | 0.547 | 0.597 | 0.647             | - |
|                        |                | Y <sub>R</sub>           | -     | 0.283 | 0.333 | 0.383             | - |
|                        | Green          | X <sub>G</sub>           | -     | 0.274 | 0.324 | 0.374             | - |
|                        |                | Y <sub>G</sub>           | -     | 0.574 | 0.624 | 0.674             | - |
|                        | Blue           | X <sub>B</sub>           | -     | 0.096 | 0.146 | 0.196             | - |
|                        |                | Y <sub>B</sub>           | -     | 0.072 | 0.122 | 0.172             | - |
| White                  | X <sub>W</sub> | -                        | 0.247 | 0.297 | 0.347 | -                 |   |
|                        | Y <sub>W</sub> | -                        | 0.315 | 0.365 | 0.415 | -                 |   |

## Capacitive Touch Panel Material Characteristics:

| Property            | Requirement | Unit |
|---------------------|-------------|------|
| IC                  | FT5426      | -    |
| ITO Glass thickness | 0.55        | mm   |
| Surface Hardness    | ≥6          | H    |
| Light transmission  | 83% ± 5%    | -    |
| Operating Humidity  | 20~90       | RH   |
| Storage Humidity    | 20~90       | RH   |

## Driver/Controller Information

### TFT:

Built-in NV3035C driver. No controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/NV3035C.pdf](http://www.newhavendisplay.com/app_notes/NV3035C.pdf)

NOTE: Control registers accessible via the display's 3-wire SPI interface are used to set optimal functionality of the driver IC and TFT panel during manufacturing of the display. These control registers are not intended for use during normal operation of the display. Changing these register values may result in undesired visual artifacts and improper functionality of the display.

### Capacitive Touch Panel:

Built-in FocalTech FT5426 controller.

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

## CTP Touch Panel Registers

| Register No. | Access | Register Name     | Bits  | Value    | Description   |
|--------------|--------|-------------------|-------|----------|---|
| 01h          | RO     | Gesture ID        | [7:0] | 10       | Swipe Up  |
|              |        |                   |       | 18h      | Swipe Down  |
|              |        |                   |       | 1Ch      | Swipe Left  |
|              |        |                   |       | 14h      | Swipe Right   |
|              |        |                   |       | 48h      | Zoom Out  |
|              |        |                   |       | 49h      | Zoom In   |
|              |        |                   |       | 00       | No gesture  |
| 02h          | RO     | Touch Points      | [7:0] | 0-Ah     | 0: No touch detected<br>A: 10 touch points detected |
| 03h          | RO     | TOUCH1_Event_Flag | [7:6] | 0        | Put Down  |
|              |        |                   |       | 1        | Put Up  |
|              |        |                   |       | 2        | Contact   |
|              |        |                   |       | 3        | Reserved  |
| 03h          | RO     | TOUCH1_XH         | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate                  |
| 04h          | RO     | TOUCH1_XL         | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate                  |
| 05h          | RO     | TOUCH1_YH         | [3:0] | 0 -1     | Upper 4 bits of Y touch coordinate                  |
| 06h          | RO     | TOUCH1_YL         | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate                  |
| 07h          | RO     | TOUCH1_Weight     | [7:0] |          | Touch Weight  |
| 08h          | RO     | TOUCH1_Misc       | [3:0] | 00-0Fh   | Touch Area  |
| 09h          | RO     | TOUCH2_Event_Flag | [7:6] | 0        | Put Down  |
|              |        |                   |       | 1        | Put Up  |
|              |        |                   |       | 2        | Contact   |
|              |        |                   |       | 3        | Reserved  |
| 09h          | RO     | TOUCH1_XH         | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate                  |
| 0Ah          | RO     | TOUCH2_XL         | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate                  |
| 0Bh          | RO     | TOUCH2_YH         | [3:0] | 0 -1     | Upper 4 bits of Y touch coordinate                  |
| 0Ch          | RO     | TOUCH2_YL         | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate                  |
| 0Dh          | RO     | TOUCH2_Weight     | [7:0] |          | Touch Weight  |
| 0Eh          | RO     | TOUCH2_Misc       | [3:0] | 00-0Fh   | Touch Area  |
| 0Fh          | RO     | TOUCH3_Event_Flag | [7:6] | 0        | Put Down  |
|              |        |                   |       | 1        | Put Up  |
|              |        |                   |       | 2        | Contact   |
|              |        |                   |       | 3        | Reserved  |
| 0Fh          | RO     | TOUCH3_XH         | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate                  |
| 10           | RO     | TOUCH3_XL         | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate                  |
| 11h          | RO     | TOUCH3_YH         | [3:0] | 0 -1     | Upper 4 bits of Y touch coordinate                  |
| 12h          | RO     | TOUCH3_YL         | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate                  |
| 13h          | RO     | TOUCH3_Weight     | [7:0] |          | Touch Weight  |
| 14h          | RO     | TOUCH3_Misc       | [3:0] | 00-0Fh   | Touch Area  |
| 15h          | RO     | TOUCH4_Event_Flag | [7:6] | 0        | Put Down  |
|              |        |                   |       | 1        | Put Up  |
|              |        |                   |       | 2        | Contact   |
|              |        |                   |       | 3        | Reserved  |
| 15h          | RO     | TOUCH4_XH         | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate                  |
| 16h          | RO     | TOUCH4_XL         | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate                  |
| 17h          | RO     | TOUCH4_YH         | [3:0] | 0 -1     | Upper 4 bits of Y touch coordinate                  |
| 18h          | RO     | TOUCH4_YL         | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate                  |
| 1Ah          | RO     | TOUCH4_Misc       | [3:0] | 00-0Fh   | Touch Area  |
| 1Bh          | RO     | TOUCH5_Event_Flag | [7:6] | 0        | Put Down  |
|              |        |                   |       | 1        | Put Up  |
|              |        |                   |       | 2        | Contact   |
|              |        |                   |       | 3        | Reserved  |

| Register No. | Access | Register Name      | Bits  | Value    | Description                        |
|--------------|--------|--------------------|-------|----------|------------------------------------|
| 1Bh          | RO     | TOUCH5_XH          | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate |
| 1Ch          | RO     | TOUCH5_XL          | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate |
| 1Dh          | RO     | TOUCH5_YH          | [3:0] | 0 -1     | Upper 4 bits of Y touch coordinate |
| 1Eh          | RO     | TOUCH5_YL          | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate |
| 1Fh          | RO     | TOUCH5_Weight      | [7:0] |          | Touch Weight                       |
| 20           | RO     | TOUCH5_Misc        | [3:0] | 00-0Fh   | Touch Area                         |
| 21h          | RO     | TOUCH6_Event_Flag  | [7:6] | 0        | Put Down                           |
|              |        |                    |       | 1        | Put Up                             |
|              |        |                    |       | 2        | Contact                            |
|              |        |                    |       | 3        | Reserved                           |
| 21h          | RO     | TOUCH6_XH          | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate |
| 22h          | RO     | TOUCH6_XL          | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate |
| 23h          | RO     | TOUCH6_YH          | [3:0] | 0 -1     | Upper 4 bits of Y touch coordinate |
| 24h          | RO     | TOUCH6_YL          | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate |
| 25h          | RO     | TOUCH6_Weight      | [7:0] |          | Touch Weight                       |
| 26h          | RO     | TOUCH6_Misc        | [3:0] | 00-0Fh   | Touch Area                         |
| 27h          | RO     | TOUCH7_Event_Flag  | [7:6] | 0        | Put Down                           |
|              |        |                    |       | 1        | Put Up                             |
|              |        |                    |       | 2        | Contact                            |
|              |        |                    |       | 3        | Reserved                           |
| 27h          | RO     | TOUCH7_XH          | [3:0] | 0 -1     | Upper 4 bits of X touch coordinate |
| 28h          | RO     | TOUCH7_XL          | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate |
| 29h          | RO     | TOUCH7_YH          | [3:0] | 0 - 1    | Upper 4 bits of Y touch coordinate |
| 2Ah          | RO     | TOUCH7_YL          | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate |
| 2Bh          | RO     | TOUCH7_Weight      | [7:0] |          | Touch Weight                       |
| 2Ch          | RO     | TOUCH7_Misc        | [3:0] | 00-0Fh   | Touch Area                         |
| 2Dh          | RO     | TOUCH8_Event_Flag  | [7:6] | 0        | Put Down                           |
|              |        |                    |       | 1        | Put Up                             |
|              |        |                    |       | 2        | Contact                            |
|              |        |                    |       | 3        | Reserved                           |
| 2Dh          | RO     | TOUCH8_XH          | [3:0] | 0 - 1    | Upper 4 bits of X touch coordinate |
| 2Eh          | RO     | TOUCH8_XL          | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate |
| 2Fh          | RO     | TOUCH8_YH          | [3:0] | 0 - 1    | Upper 4 bits of Y touch coordinate |
| 30           | RO     | TOUCH8_YL          | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate |
| 31h          | RO     | TOUCH8_Weight      | [7:0] |          | Touch Weight                       |
| 32h          | RO     | TOUCH8_Misc        | [3:0] | 00-0Fh   | Touch Area                         |
| 33h          | RO     | TOUCH9_Event_Flag  | [7:6] | 0        | Put Down                           |
|              |        |                    |       | 1        | Put Up                             |
|              |        |                    |       | 2        | Contact                            |
|              |        |                    |       | 3        | Reserved                           |
| 33h          | RO     | TOUCH9_XH          | [3:0] | 0 - 1    | Upper 4 bits of X touch coordinate |
| 34h          | RO     | TOUCH9_XL          | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate |
| 35h          | RO     | TOUCH9_YH          | [3:0] | 0 - 1    | Upper 4 bits of Y touch coordinate |
| 36h          | RO     | TOUCH9_YL          | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate |
| 37h          | RO     | TOUCH9_Weight      | [7:0] |          | Touch Weight                       |
| 38h          | RO     | TOUCH9_Misc        | [3:0] | 00 - 0Fh | Touch Area                         |
| 39h          | RO     | TOUCH10_Event_Flag | [7:6] | 0        | Put Down                           |
|              |        |                    |       | 1        | Put Up                             |
|              |        |                    |       | 2        | Contact                            |
|              |        |                    |       | 3        | Reserved                           |
| 39h          | RO     | TOUCH10_XH         | [3:0] | 0 - 1    | Upper 4 bits of X touch coordinate |
| 3Ah          | RO     | TOUCH10_XL         | [7:0] | 00 - FFh | Lower 8 bits of X touch coordinate |
| 3Bh          | RO     | TOUCH10_YH         | [3:0] | 0 - 1    | Upper 4 bits of Y touch coordinate |
| 3Ch          | RO     | TOUCH10_YL         | [7:0] | 00 - FFh | Lower 8 bits of Y touch coordinate |



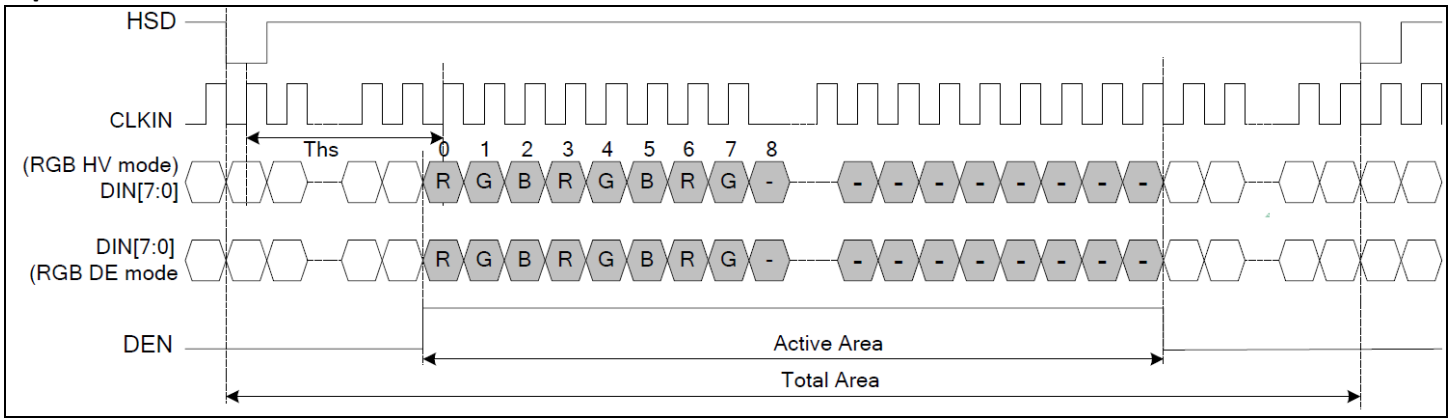
| Register No. | Access | Register Name      | Bits  | Value       | Description  |
|--------------|--------|--------------------|-------|-------------|--|
| 3Dh          | RO     | TOUCH10_Weight     | [7:0] | 00-FFh      | Touch Weight   |
| 3Eh          | RO     | TOUCH10_Misc       | [3:0] | 00-0Fh      | Touch Area   |
| 80h          | RW     | ID_G_MC_THGROUP    | [7:0] | 00-FFh      | Mutual-Capacitive touch Threshold / 4<br>Default: 4Bh                    |
| 81h          | RW     | ID_G_MC_THPEAK     | [7:0] | 00-FFh      | Mutual-Capacitive Peak Threshold / 4<br>Default: 46h                     |
| 85h          | RW     | ID_G_THDIFF        | [7:0] | 00-FFh      | Points Filtering Range Threshold / 16<br>Default: A0                     |
| 86h          | RW     | ID_G_CTRL          | [1:0] | 0-1         | Allowed to switch to monitor mode or not<br>(1: Allowed, 0: Not Allowed) |
| 88h          | RW     | ID_G_PERIODACTIVE  | [3:0] | 3h-Eh       | Period of Active Status  |
| 89h          | RW     | ID_G_PERIODMONITOR | [7:0] | 1Eh-FFh     | Timer to enter "idle" while in Monitor (ms)                              |
| A1h          | RO     | ID_G_LIB_VERSION_H | [7:0] | 00-FFh      | App library version high-byte<br>Default: 0                              |
| A2h          | RO     | ID_G_LIB_VERSION_L | [7:0] | 00-FFh      | App library version low-byte<br>Default: 2h                              |
| A3h          | RO     | ID_G_CHIPER_HIGH   | [7:0] | 00-FFh      | Chip Vendor ID<br>Default: 54h   |
| A4h          | RW     | ID_G_MODE          | [0]   | 0<br>1      | INT Trigger Mode<br>INT Polling Mode                                     |
| A5h          | RW     | ID_G_PMODE         | [1:0] | 0<br>1<br>3 | Active<br>Monitor<br>Sleep   |
| A6h          | RO     | ID_G_FIRMID        | [7:0] | 00-FFh      | Firmware ID Number<br>Default: 2   |
| A8h          | RO     | ID_G_VENODRID      | [7:0] | 00-FFh      | CTPM Vendor's Chip ID<br>Default: 79h                                    |
| C0h          | RW     | ID_G_GLOVE_MODE_EN | [0]   | 0<br>1      | Glove Mode Switch Disable<br>Glove Mode Switch Enable                    |
| C1h          | RW     | ID_G_COVER_MODE_EN | [0]   | 0<br>1      | Cover Mode Switch Disable<br>Cover Mode Switch Enable                    |

## Timing Characteristics – TFT Display

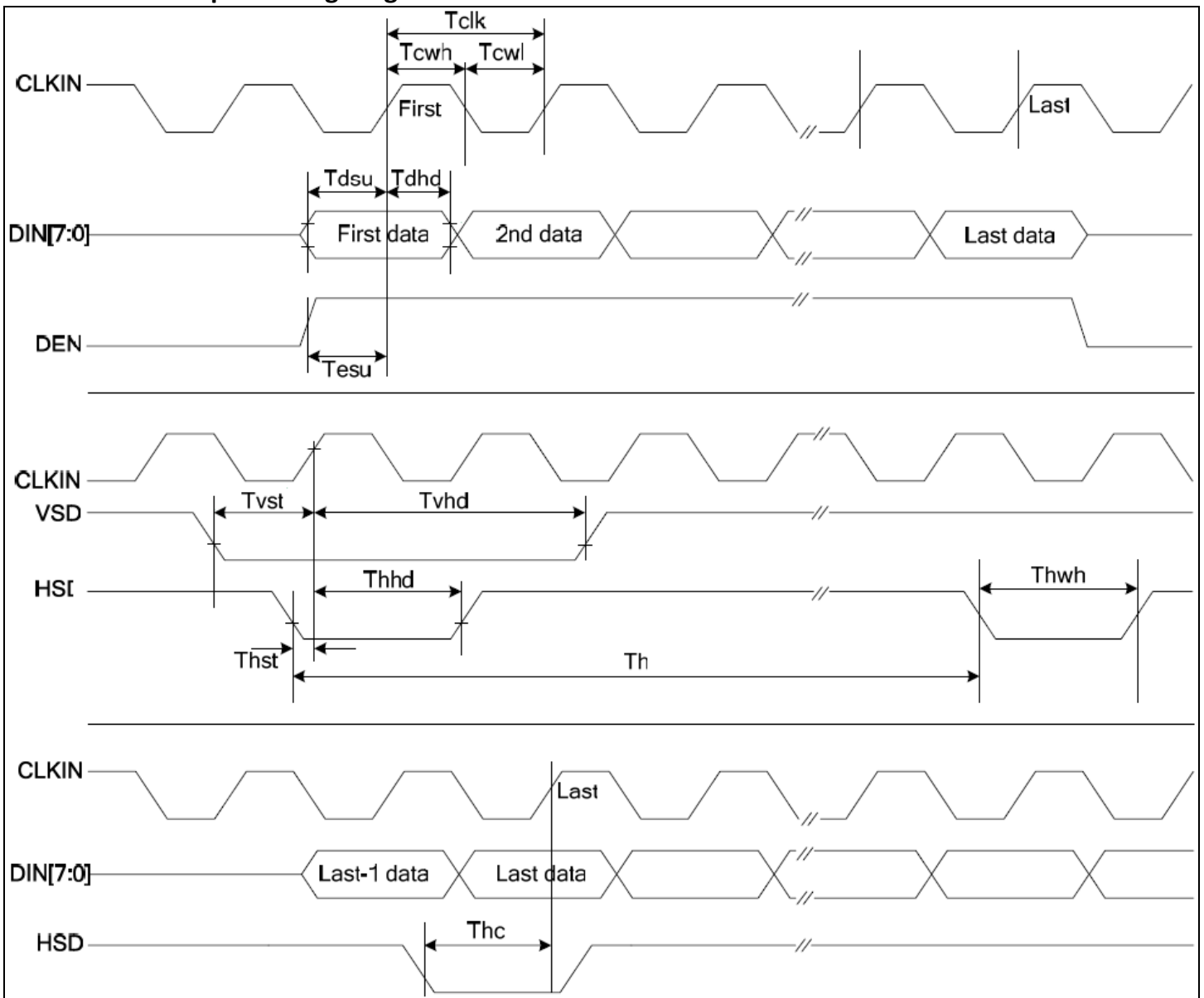
| Parameter   | Symbol             | Min. | Typ.  | Max. | Unit  | Conditions   |
|---|--------------------|------|-------|------|-------|--|
| <b>System Operation Timing</b>                      |                    |      |       |      |       |  |
| VDD power source slew time                    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

| Parameter   | Symbol           | Min. | Typ. | Max. | Unit  | Conditions              |
|---|------------------|------|------|------|-------|-------------------------|
| CLKIN frequency                                   | Fclk             | 6.1  | 6.4  | 8.0  | MHz   | VDD=3.0~3.6V            |
| CLKIN cycle time                                  | Tclk             | 125  | 156  | 164  | ns    |                         |
| CLKIN pulse duty                                  | T <sub>cwh</sub> | 40   | 50   | 60   | %     | Tclk                    |
| Time that HSD to 1 <sup>st</sup> data input(NTSC) | T <sub>hs</sub>  | 40   | 70   | 255  | CLKIN | DDLY=70,Offset=0(fixed) |

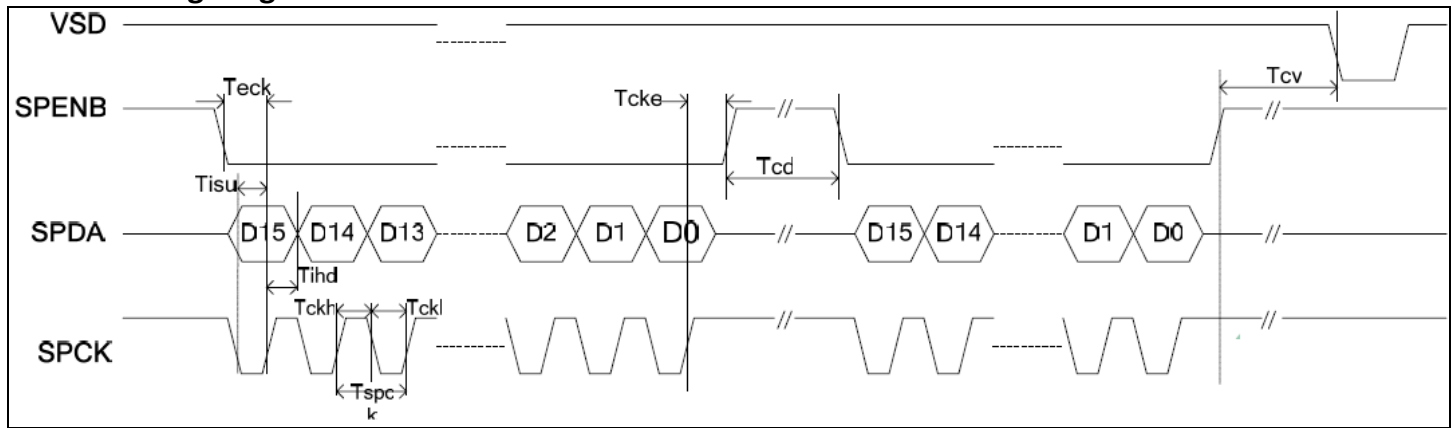
## Input Data Format



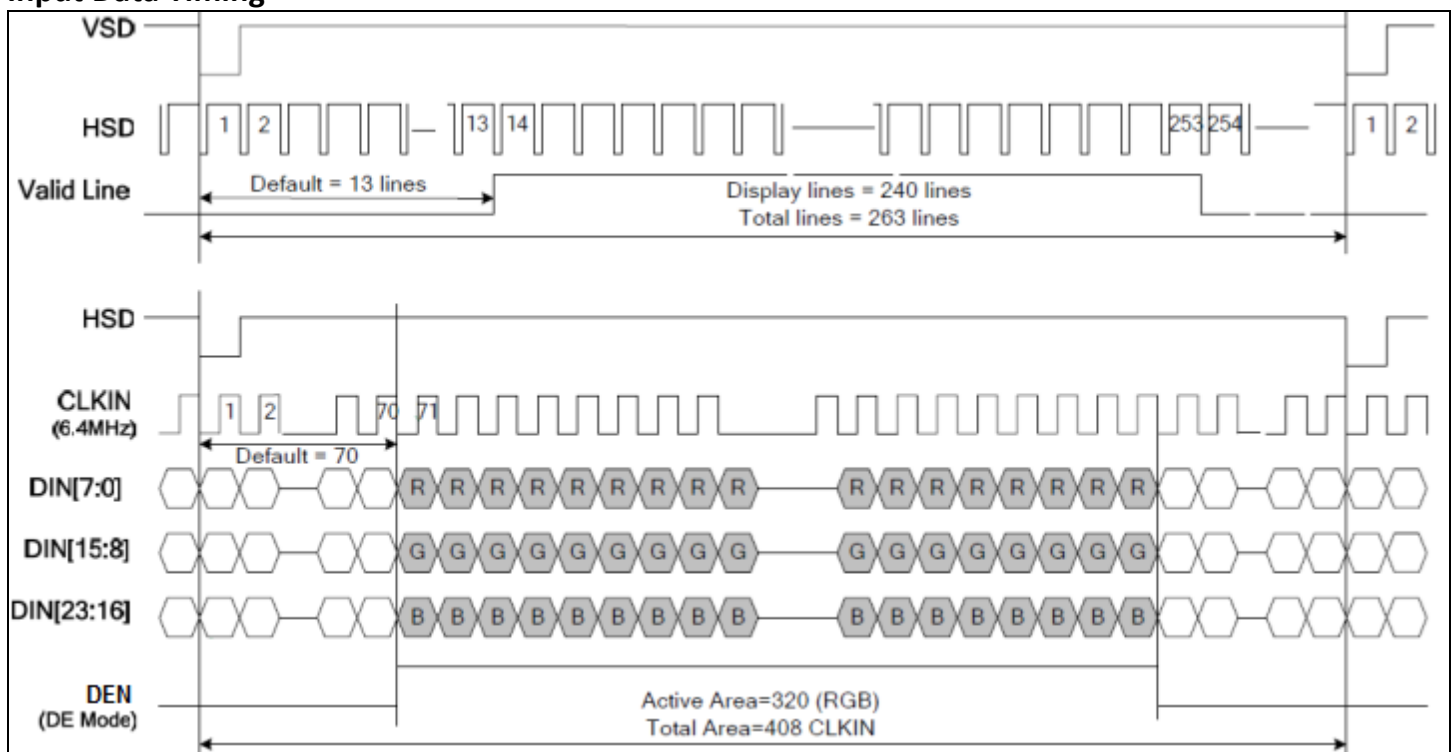
## Clock and Data Input Timing Diagram



### 3-wire Timing Diagram

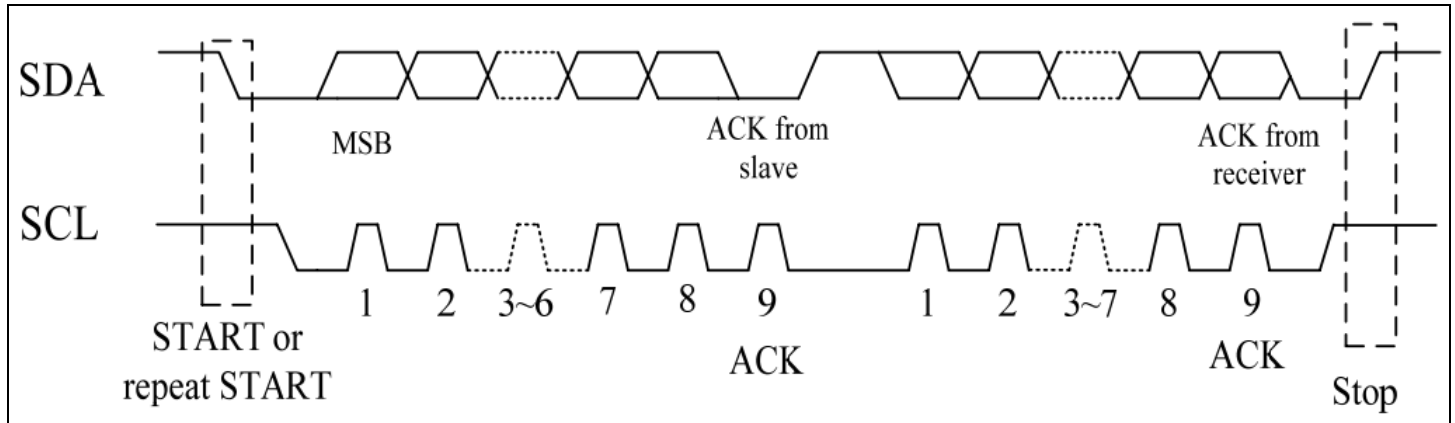


### Input Data Timing

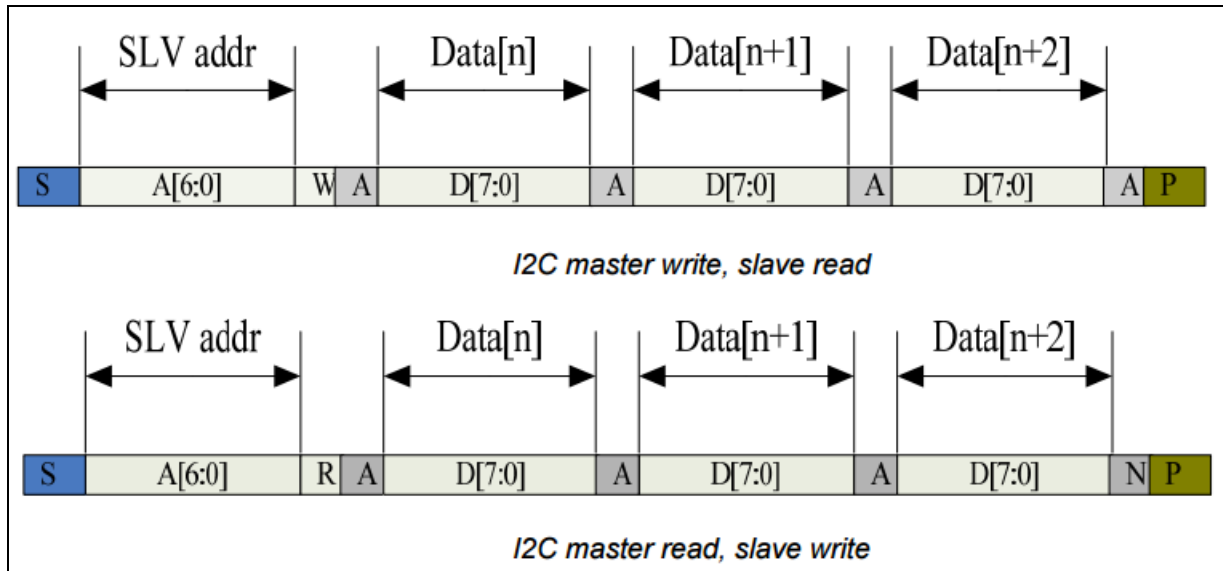


# Timing Characteristics – Capacitive Touch Panel

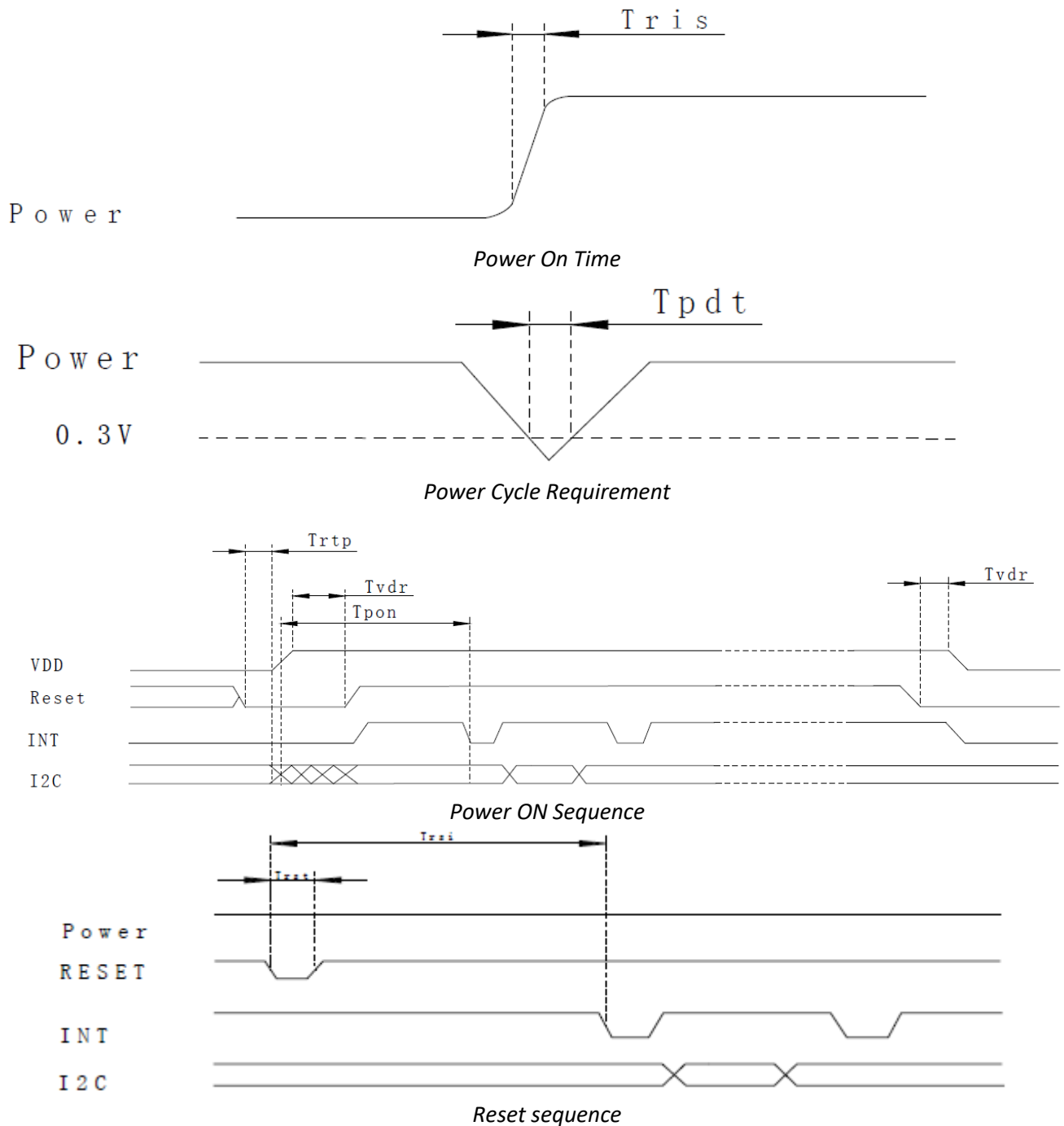
## Data Transfer Format



| Parameter                                      | Min | Max | Unit |
|--|-----|-----|------|
| SCL Frequency                                  | 0   | 400 | KHz  |
| Bus free time between a STOP & 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 a STOP condition                | 0.6 | -   | μs   |

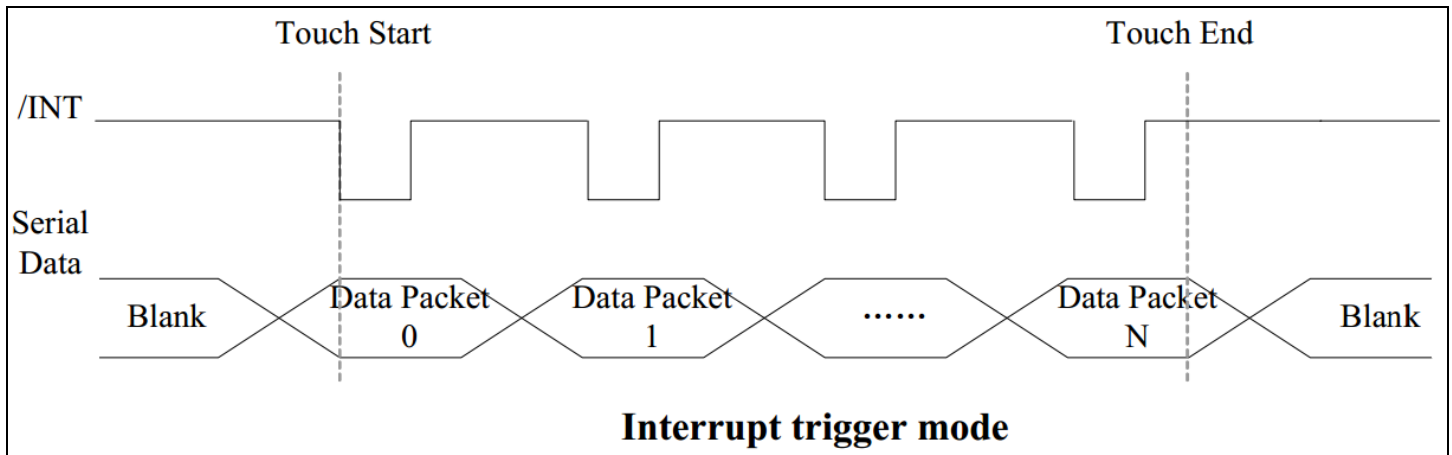


## Power ON/Reset Sequence



| Parameter   | Description   | Min | Max | Unit |
|-------------|---|-----|-----|------|
| $T_{ris}$   | Rise time from 0.1V <sub>DD</sub> to 0.9V <sub>DD</sub> | -   | 5   | ms   |
| $T_{pdt}$   | Time of the voltage of supply being below 0.3V          | 5   | -   | ms   |
| $T_{rtp}$   | Time of resetting to be low before powering on          | 100 | -   | μs   |
| $T_{pon}$   | Time to start reporting after power on                  | -   | 200 | ms   |
| $T_{vdr}^*$ | Reset time after applying V <sub>DD</sub>               | 1   | -   | ms   |
| $T_{rsi}$   | Time to start reporting after reset                     | -   | 200 | ms   |
| $T_{rst}^*$ | Reset Time  | 1   | -   | ms   |

\*If Reset is tied to V<sub>CC</sub> data corruption can occur.



### 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.   | +70°C , 240hrs  | 2    |
| Low Temperature storage               | Endurance test applying the low storage temperature for a long time.  | -30°C , 240hrs  | 1,2  |
| High Temperature Operation            | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.                    | +60°C , 240hrs  | 2    |
| Low Temperature Operation             | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.                     | -20°C , 240hrs  | 1,2  |
| High Temperature / Humidity Operation | Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time. | +60°C , 90% RH , 160hrs   | 1,2  |
| Thermal Shock resistance              | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.                  | -30°C,30min -> 25°C,5min -> 80°C,30min = 1 cycle<br>100 cycles                      |      |
| Vibration test                        | Endurance test applying vibration to simulate transportation and use.   | 10-55Hz , 15mm amplitude.<br>60 sec in each of 3 directions X,Y,Z<br>For 15 minutes | 3    |
| Static electricity test               | Endurance test applying electric static discharge.  | VS=4KV, RS=330kΩ, CS=150pF<br>Five times  |      |

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.

## Precautions for using LCDs/LCMs

See Precautions at [www.newhavendisplay.com/specs/precautions.pdf](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

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