

# NHD-3.5-320240MF-ATXL#-CTP-1

## 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        |
| T-      | White LED Backlight                    |
| X-      | TFT                                    |
| L-      | 12:00 Optimal View, Wide Temperature   |
| #-      | <b>RoHS Compliant</b>                  |
| CTP-1   | Capacitive Touch Panel with Controller |

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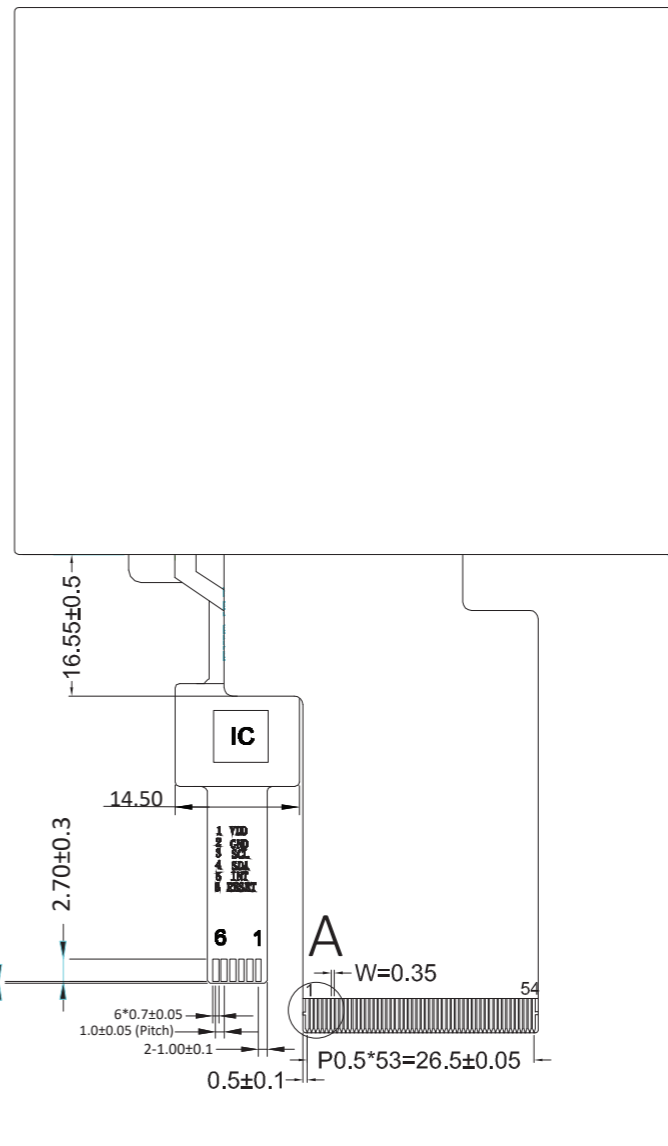
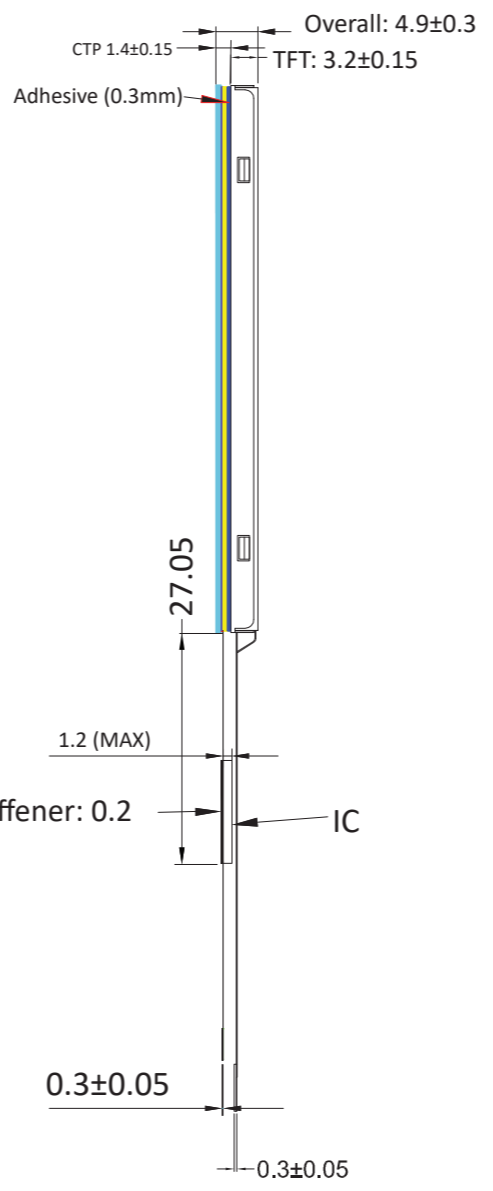
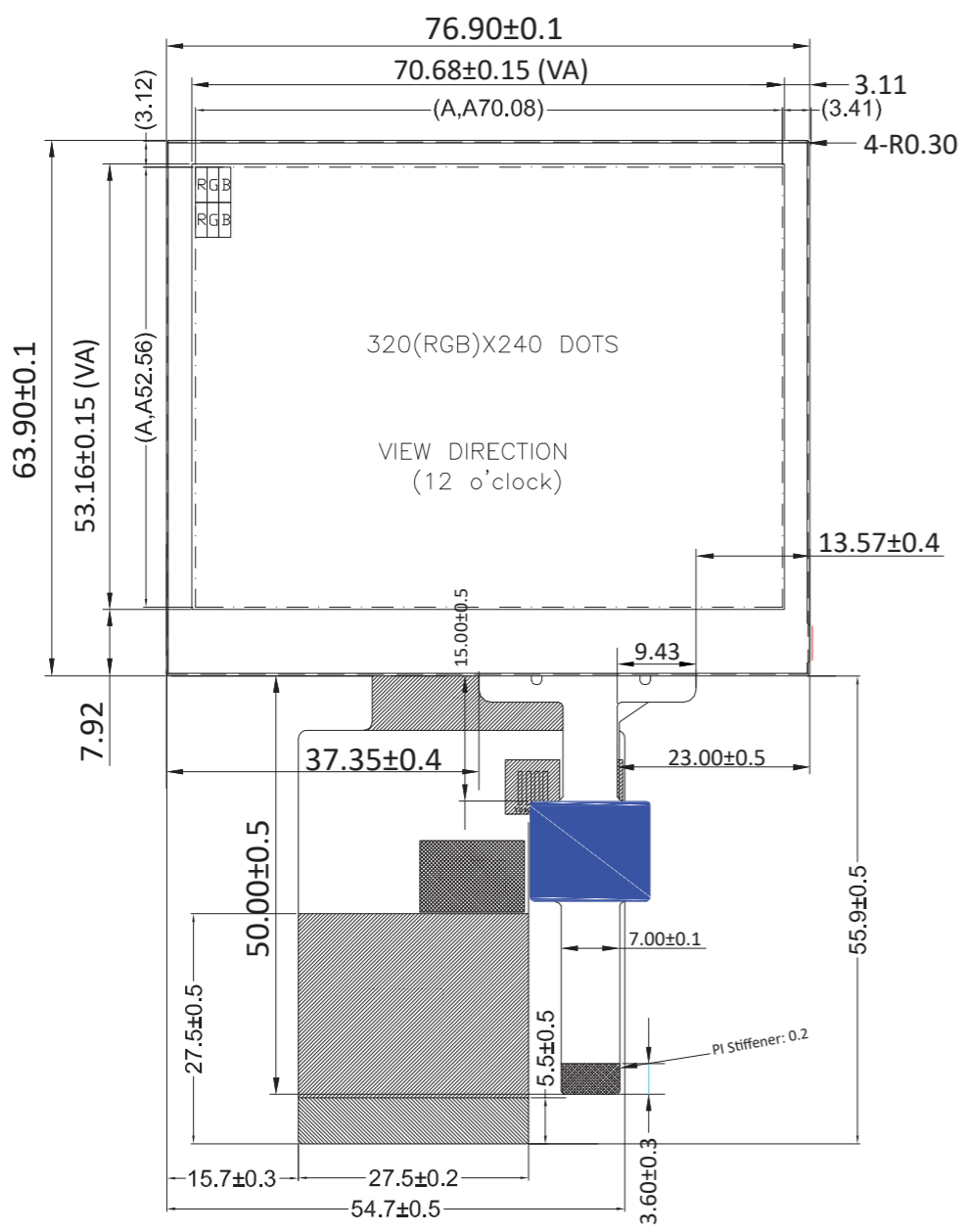
## Document Revision History

| Revision | Date       | Description  | Changed by |
|----------|------------|--|------------|
| 0        | 2/1/2012   | Initial Release  | SB         |
| 1        | 12/11/2012 | Timing characteristics updated   | AK         |
| 2        | 4/25/2014  | Optical characteristics updated  | ML         |
| 3        | 5/30/2014  | Driver information updated   | AK         |
| 4        | 4/1/2015   | CTP mechanical dimensions updated  | AK         |
| 5        | 12/03/15   | Luminance Updated, Backlight Lifetime Added, Datasheet Reformat                | SB         |
| 6        | 7/5/16     | Chromaticity Added   | SB         |
| 7        | 12/8/16    | V <sub>DD</sub> , I <sub>DD</sub> , and Chromaticity Updated                   | SB         |
| 8        | 7/20/18    | CTP Adhesive Increased from 0.18 to 0.3mm, & Backlight Characteristics Updated | SB         |
| 9        | 3/14/19    | CTP Driver & Panel Updated   | SB         |
| 10       | 5/2/19     | CTP Timing Note Added  | SB         |

## Functions and Features

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

|        |   |   |   |          |   |   |      |
|--------|---|---|---|----------|---|---|------|
| 1      | 2 | 3 | 4 | 5        | 6 | 7 | 8    |
| SYMBOL |   |   |   | REVISION |   |   | DATE |
|        |   |   |   |          |   |   |      |



### TFT

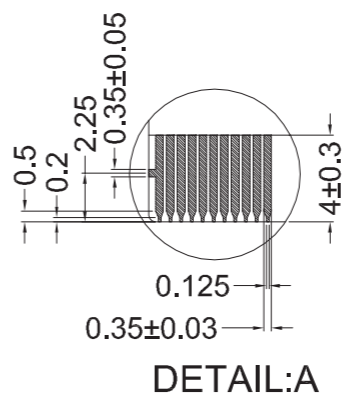
| Pin No. | Symbol |
|---------|--------|
| 1       | LED_K  |
| 2       | LED_K  |
| 3       | LED_A  |
| 4       | LED_A  |
| 5       | NC     |
| 6       | NC     |
| 7       | NC     |
| 8       | RSTB   |
| 9       | SPENB  |
| 10      | SPCK   |
| 11      | SPDA   |
| 12-19   | B0-B7  |
| 20-27   | 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: 12:00
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)/ 18mA
7. Brightness: 330 cd/m<sup>2</sup> (Typ)
8. Touch Panel: Capacitive Touch



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-3.5-320240MF-ATXL#-CTP-1

REVISION: 1.0

SIZE: A3

SCALE: NS

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

DRAWN BY: S. Baxi

APPROVED BY: S. Baxi

DRAWN DATE: 03/14/19

APPROVED DATE: 03/14/19

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SHEET 1 OF 1

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## 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 (18mA @ 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 (3.0V)                  |
| 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                          |

**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     | 20                   | 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> | -   | -                    | 18     | 20                   | mA   |
| Backlight Supply Voltage    | V <sub>LED</sub> | I <sub>LED</sub> = 18 mA                            | 18.0                 | 19.2   | 20.4                 | V    |
| Backlight Lifetime*         | -                | I <sub>LED</sub> = 18 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> |                        | -                   | 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> = 18mA | 265            | 330   | -     | cd/m <sup>2</sup> |    |
| Response Time          | Rise           | T <sub>OP</sub> =25°C   | -              | 25    | 40    | ms                |    |
|                        | Fall           |                         | T <sub>F</sub> | -     | 25    | 40                | ms |
| Chromaticity           | Red            | X <sub>R</sub>          | -              | 0.556 | 0.606 | 0.656             | -  |
|                        |                | Y <sub>R</sub>          | -              | 0.302 | 0.352 | 0.402             | -  |
|                        | Green          | X <sub>G</sub>          | -              | 0.268 | 0.318 | 0.368             | -  |
|                        |                | Y <sub>G</sub>          | -              | 0.541 | 0.591 | 0.641             | -  |
|                        | Blue           | X <sub>B</sub>          | -              | 0.093 | 0.143 | 0.193             | -  |
|                        |                | Y <sub>B</sub>          | -              | 0.052 | 0.102 | 0.152             | -  |
| White                  | X <sub>W</sub> | -                       | 0.230          | 0.280 | 0.330 | -                 |    |
|                        | Y <sub>W</sub> | -                       | 0.256          | 0.306 | 0.356 | -                 |    |

## 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: To achieve optimum VCOM and VGL settings, the SPI interface may be used to set the following registers:

ROEh = 6Bh

ROFh = 24h

### 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 |



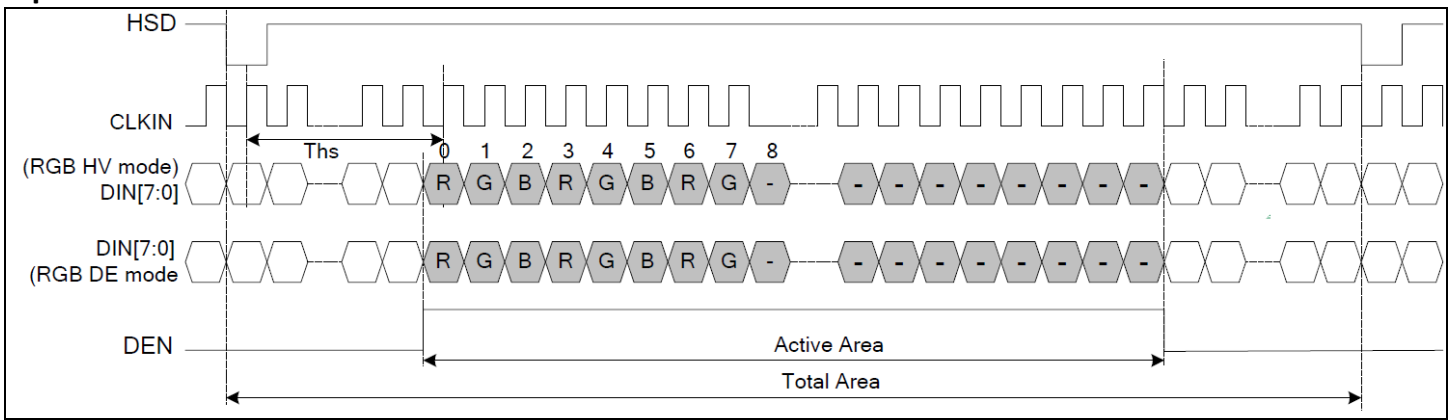
| Register No. | Access | Register Name      | Bits  | Value       | Description  |
|--------------|--------|--------------------|-------|-------------|--|
| 3Dh          | RO     | TOUCH10_Weight     | [7:0] | 00-FFh      | Touch Weight   |
| 3Eh          | RO     | TOUCH10_Misc       | [3:0] | 00-0Fh      | 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

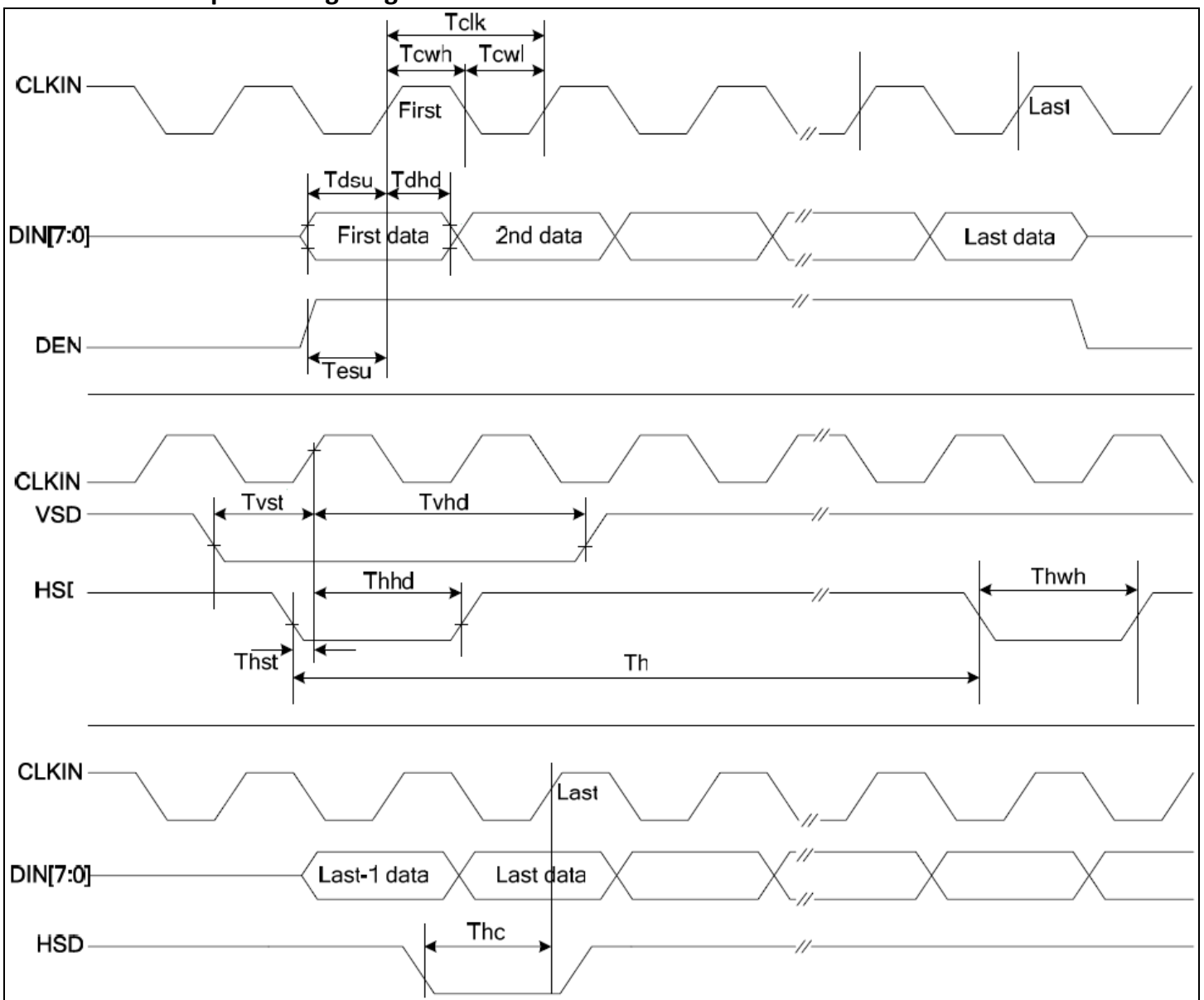
| Parameter   | Symbol            | Min. | Typ.  | Max. | Unit  | Conditions  |
|---|-------------------|------|-------|------|-------|---|
| <b>System Operation Timing</b>                      |                   |      |       |      |       |   |
| VDD power source slew time                          | 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  | Thc               | -    | -     | 1    | CLKIN |   |
| HSD width   | Thwh              | 1    | -     | -    | CLKIN |   |
| VSD width   | Tvwh              | 1    | -     | -    | Th    |   |
| HSD period time                                     | Th                | 60   | 63.56 | 67   | us    |   |
| VSD setup time                                      | Tvst              | 12   | -     | -    | ns    |   |
| VSD hold time                                       | Tvhd              | 12   | -     | -    | ns    |   |
| HSD setup time                                      | Thst              | 12   | -     | -    | ns    |   |
| HSD hold time                                       | Thhd              | 12   | -     | -    | ns    |   |
| Data set-up time                                    | Tdsu              | 12   | -     | -    | ns    | DIN[23:0] to CLKIN  |
| Data hold time                                      | Tdhd              | 12   | -     | -    | ns    | DIN[23:0] to CLKIN  |
| DEN setup time                                      | Tesd              | 12   | -     |      | ns    | DEN to CLKIN  |
| Time that VSD to 1 <sup>st</sup> line data input    | Tvs               | 2    | 13    | 127  | Th    | @CIR601/8bit RGB HV mode<br>Control by HDLY[6:0] setting<br>Tvs=HDLY[6:0] |
| Time that CCIR_V to 1 <sup>st</sup> line data input | Tvs               | 12   | 20    | 28   | Th    | @CCIR656 NTSC mode Control by<br>HDLY[6:0] setting Tvs=HDLY[6:0]          |
| Time that CCIR_V to 1 <sup>st</sup> line data input | Tvs               | 17   | 25    | 33   | Th    | @CCIR656 PAL mode Control by<br>HDLY[6:0] setting Tvs=HDLY[6:0]           |
| Time that VSD to 1 <sup>st</sup> line data input    | Tvs               | 2    | 13    | 127  | Th    | @24bit RGB HV mode Control by<br>HDLY[6:0] setting Tvs=HDLY[6:0]          |
| Source output stable time 1                         | Tst               | -    | 25    | 30   | us    | 96% final, CL=30pF, RL=2K   |
| Gate output stable time                             | Tgst              | -    | 500   | 1000 | ns    | 96% final, CL=40pF  |
| VCOMOUT output stable time                          | Tcst              | -    | 4     | 8    | us    | 96% final, CL=33nF, RL=100ohm   |
| <b>3-wire serial communication AC timing</b>        |                   |      |       |      |       |   |
| Serial clock  | Tspck             | 320  | -     | -    | ns    |   |
| SPCK pulse duty                                     | Tscdut            | 40   | 50    | 60   | %     | Tckh/Tspck  |
| Serial data setup time                              | Tisu              | 120  | -     | -    | ns    |   |
| Serial data hold time                               | Tihd              | 120  | -     | -    | ns    |   |
| Serial clock high/low                               | Tssw              | 120  | -     | -    | ns    |   |
| Chip select distinguish                             | Tcd               | 1    | -     | -    | us    |   |
| SPENA to VSD  | Tev               | 1    | -     | -    | us    |   |
| SPENB input setup time                              | Teck              | 150  | -     | -    | Ns    |   |
| SPENB input hold time                               | Tcke              | 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                                  | Tcwh   | 40   | 50   | 60   | %     | Tclk                    |
| Time that HSD to 1 <sup>st</sup> data input(NTSC) | Ths    | 40   | 70   | 255  | CLKIN | DDLY=70,Offset=0(fixed) |

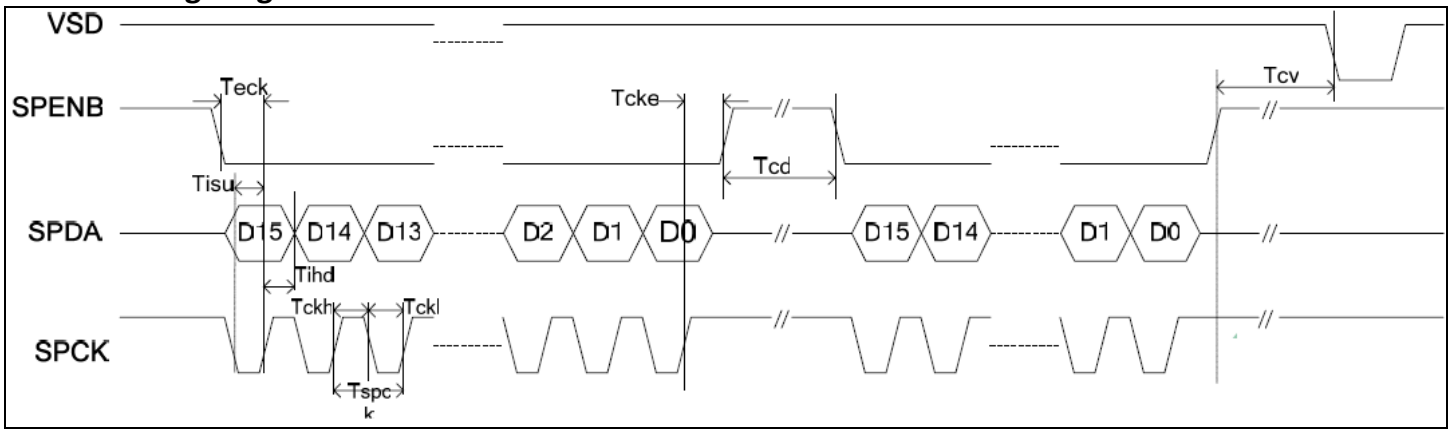
## Input Data Format



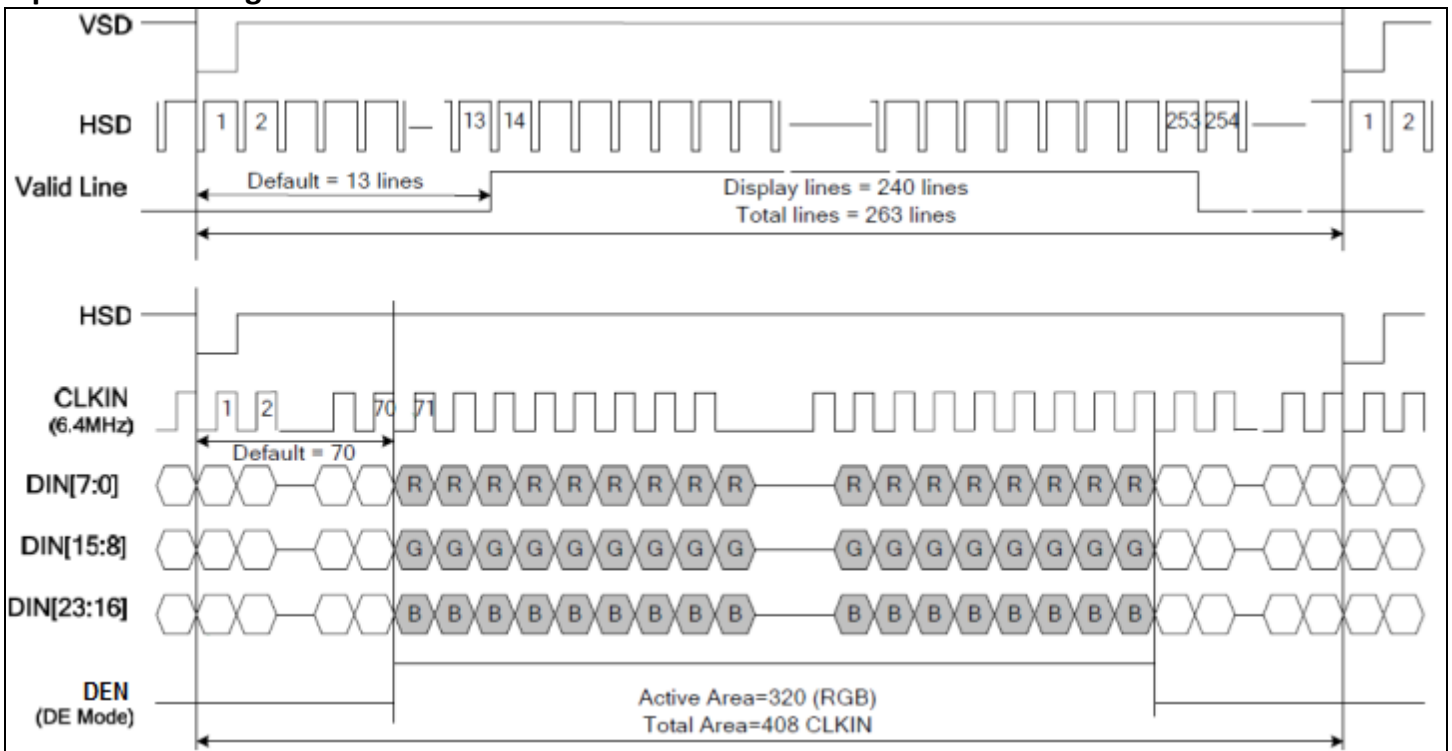
## Clock and Data Input Timing Diagram



### 3-wire Timing Diagram



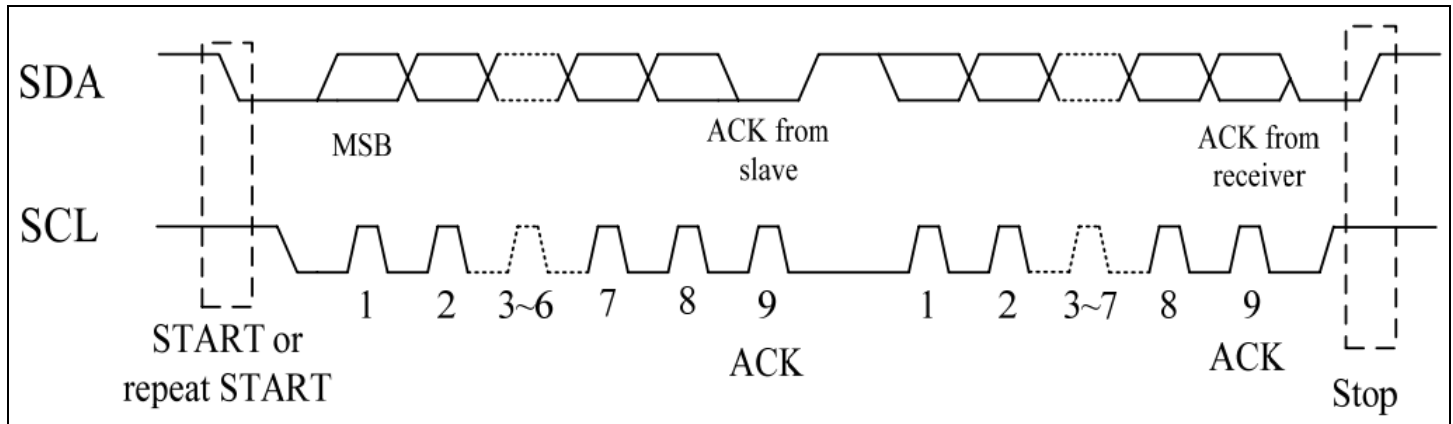
### Input Data Timing



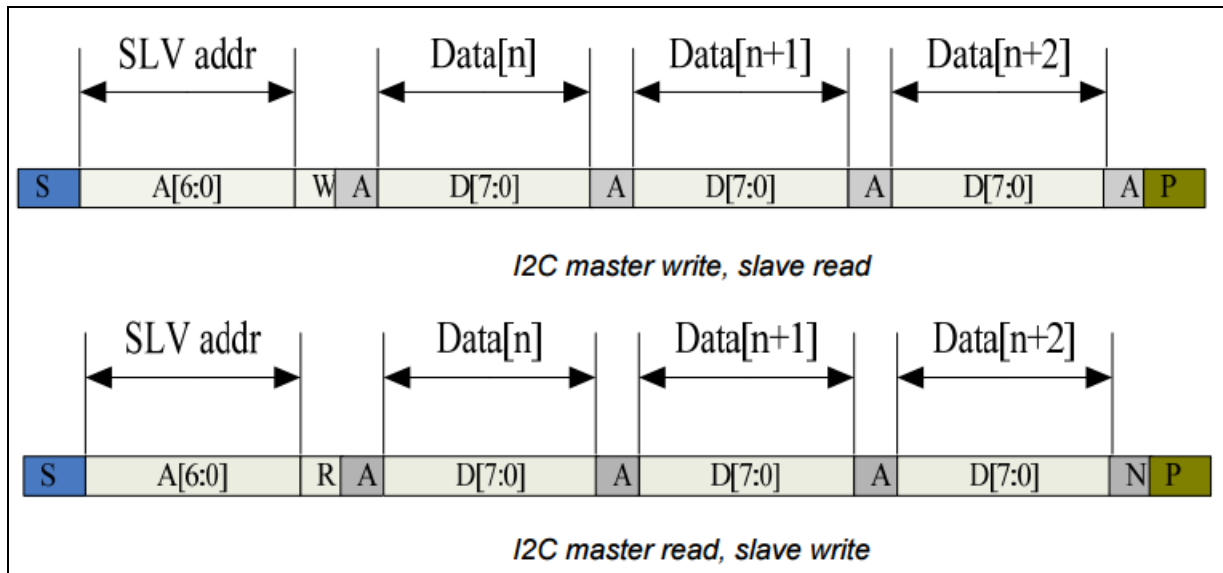
## Timing Characteristics – Capacitive Touch Panel

## Timing Characteristics – Capacitive Touch Panel

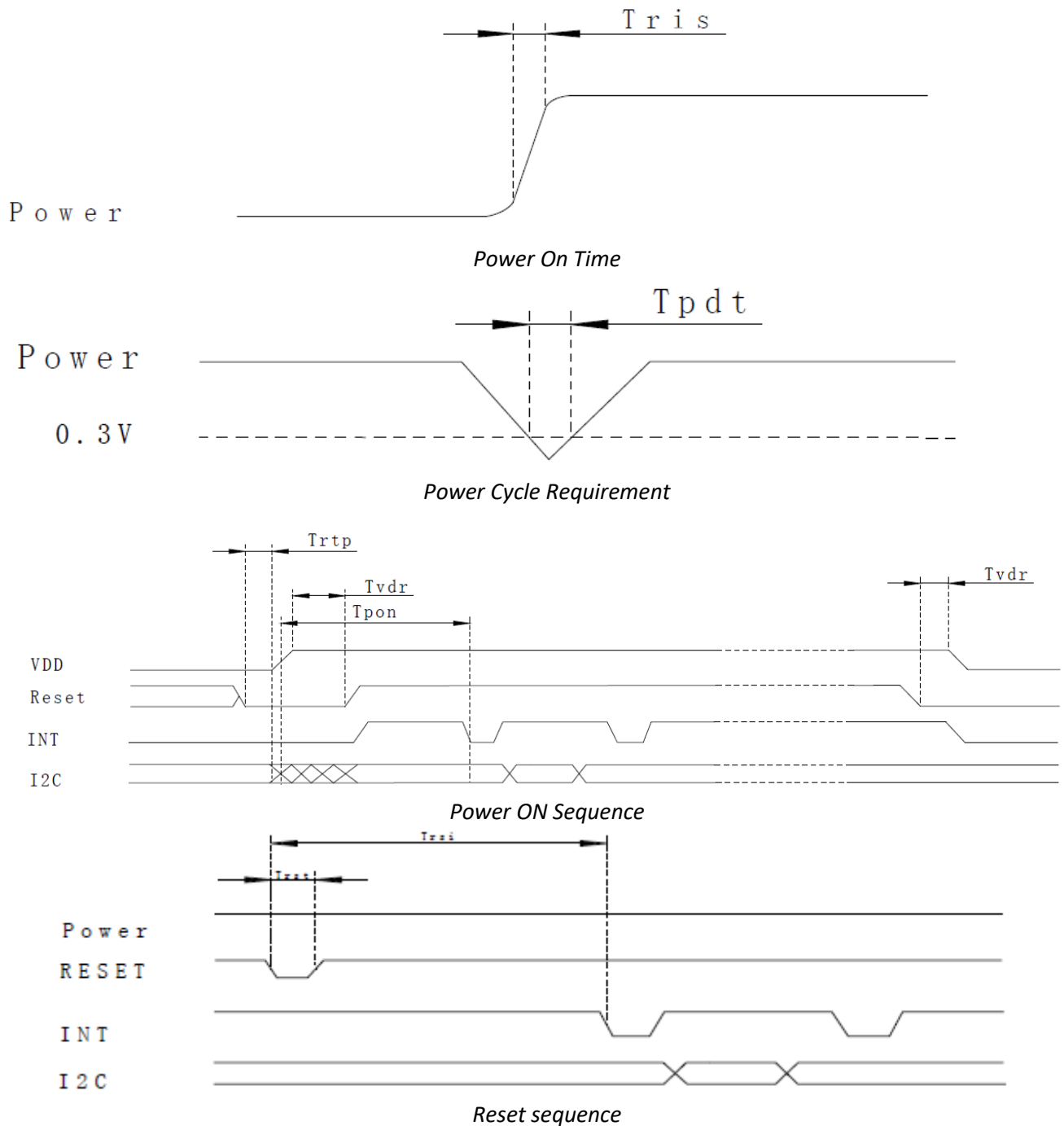
### Data Transfer Format



| 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   |

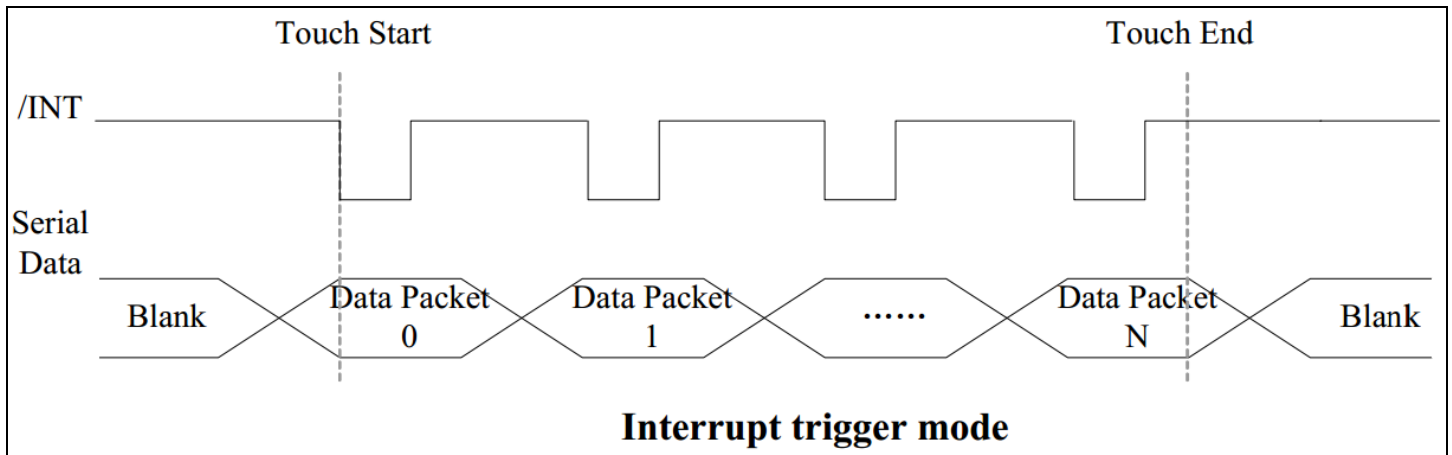


## Power ON/Reset Sequence



| 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)