

Product Specification

NHD-10.1-1024600BF-LSXP-CTP

TFT Liquid Crystal Display

| | |
|-----------------|--------------------------------------|
| NHD- | Newhaven Display |
| 10.1- | 10.1" Diagonal |
| 1024600- | 1024xRGBx600 Pixels |
| BF- | Model |
| L- | LVDS Interface |
| S- | High Brightness, White LED Backlight |
| X- | TFT |
| P- | IPS, Wide Temperature |
| CTP- | Capacitive Touch Panel |

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Additional Resources

- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** https://www.newhavendisplay.com/quality_center.html
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>



Document Revision History

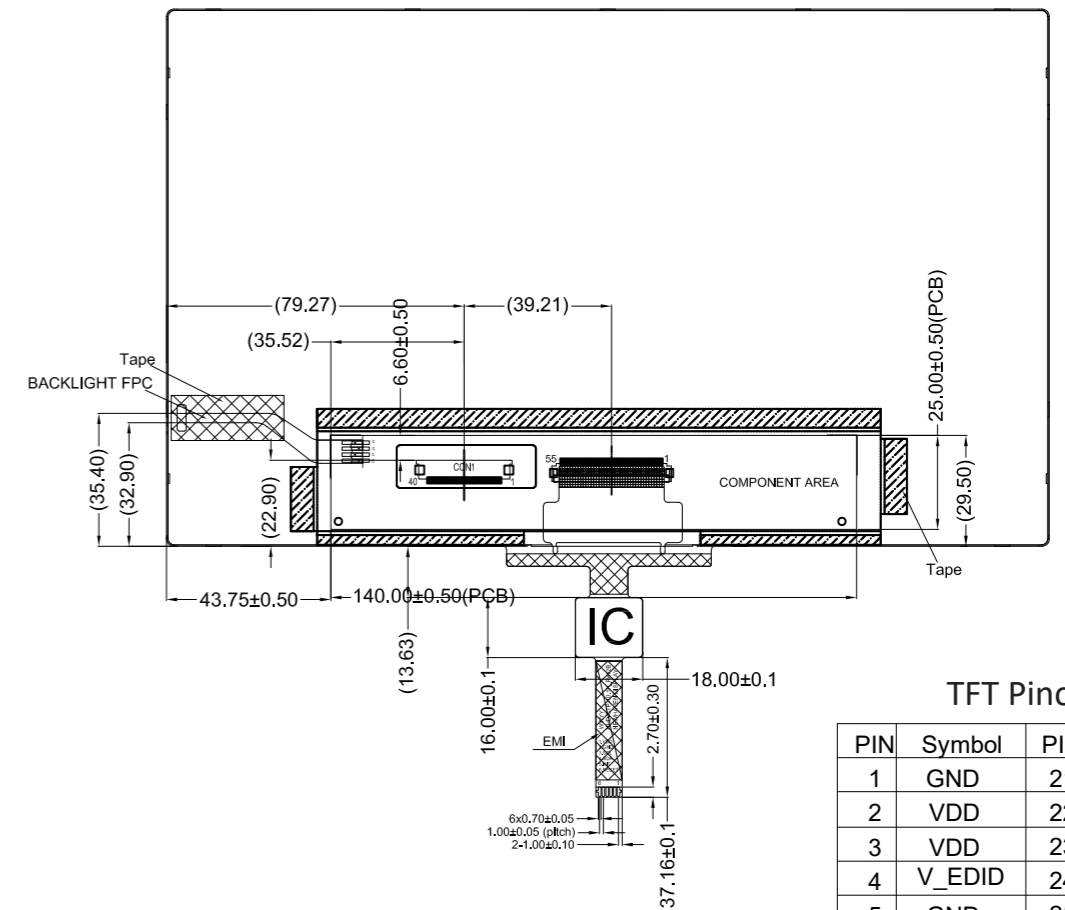
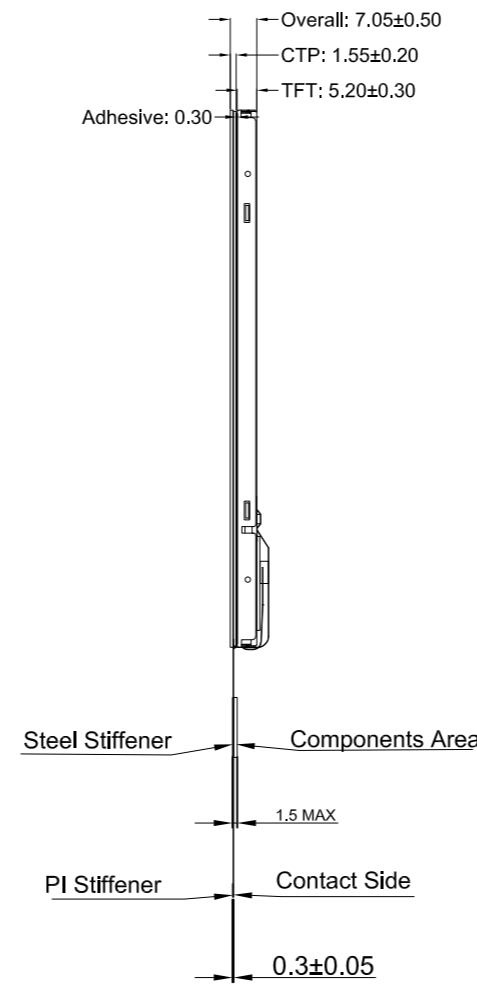
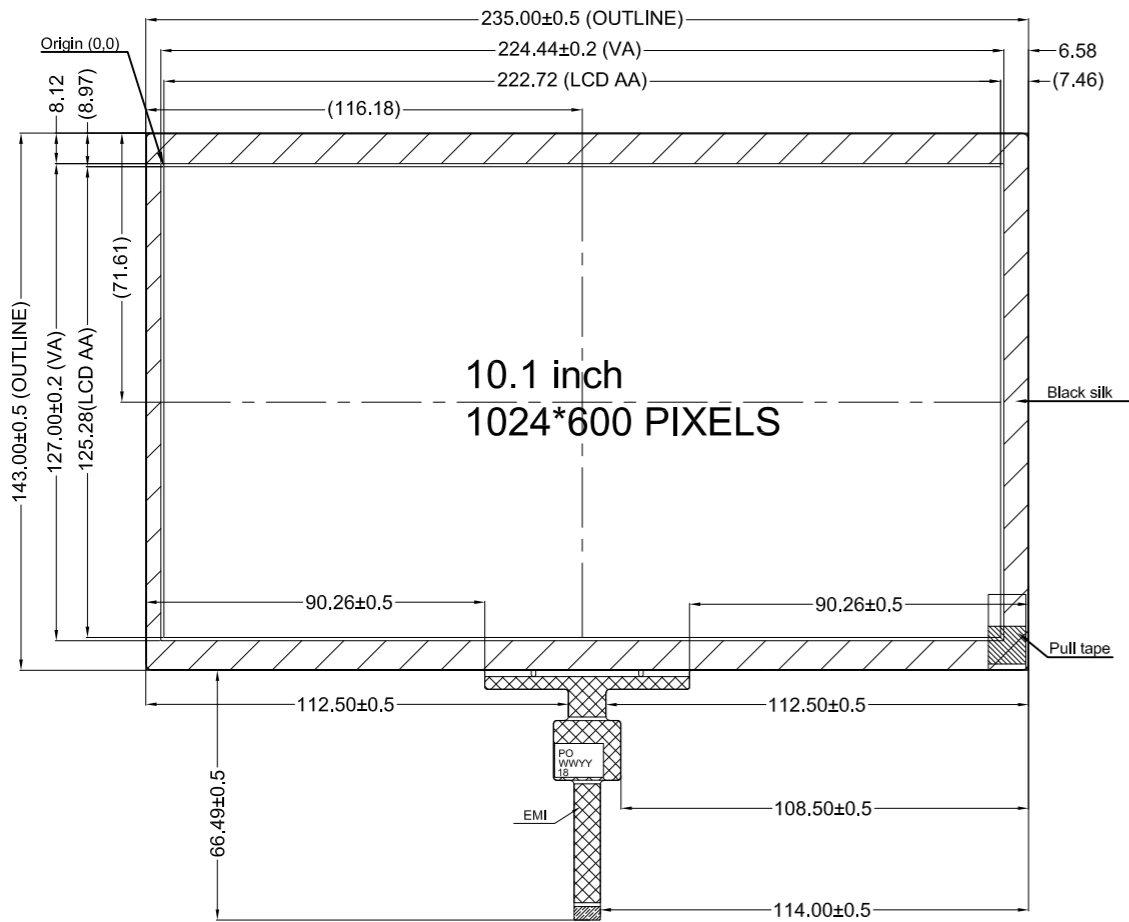
| Revision | Date | Description | Changed By |
|----------|------------|---|------------|
| 0 | 07/20/2022 | Preliminary Release | CJ |
| 1 | 09/08/2022 | Updated Operating and Storage Temperature Range, LCD Supply Current, Backlight Enable Voltage, Chromaticity Values, and Backlight PWM Frequency Range | JT |
| 2 | 10/28/2022 | Mechanical Drawing page updated | JT |

Mechanical Drawing

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

Newhaven Display
 NHD-10.1-1024600BF-LSXP-CTP
 Date Code

Part Label (type/format may vary)

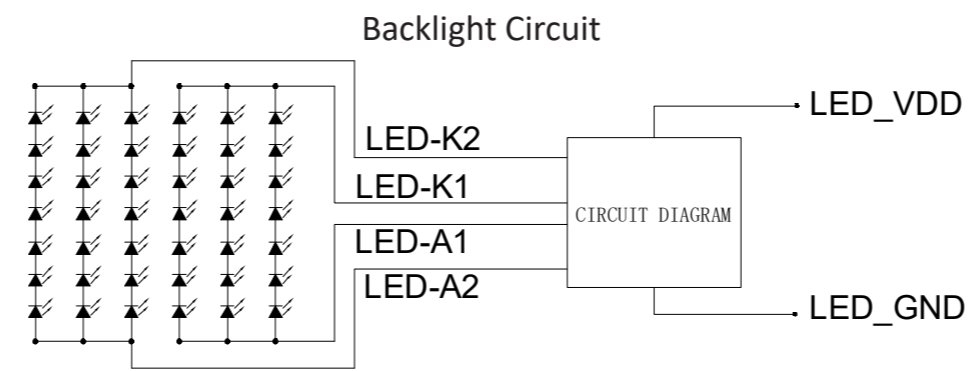


TFT Pinout

| PIN | Symbol | PIN | Symbol |
|-----|--------|-----|---------|
| 1 | GND | 21 | Rin3+ |
| 2 | VDD | 22 | GND |
| 3 | VDD | 23 | INSEL |
| 4 | V_EDID | 24 | GND |
| 5 | GND | 25 | GND |
| 6 | SCL | 26 | UPDN |
| 7 | SDA | 27 | SHLR |
| 8 | Rin0- | 28 | GND |
| 9 | Rin0+ | 29 | RESET |
| 10 | GND | 30 | STBYB |
| 11 | Rin1- | 31 | LED-GND |
| 12 | Rin1+ | 32 | LED-GND |
| 13 | GND | 33 | LED-GND |
| 14 | Rin2- | 34 | GND |
| 15 | Rin2+ | 35 | LED_PWM |
| 16 | GND | 36 | LED_EN |
| 17 | CLKIN- | 37 | BIST |
| 18 | CLKIN+ | 38 | LED_VDD |
| 19 | GND | 39 | LED_VDD |
| 20 | Rin3- | 40 | LED_VDD |

CTP Pinout

| PIN | SYMBOL |
|-----|--------|
| 1 | VDD |
| 2 | GND |
| 3 | SCL |
| 4 | SDA |
| 5 | INT |
| 6 | RESET |



- Product Description: 10.1" IPS TFT w/ Capacitive Touch**
1. TFT IC: HX8282-A11, CTP IC: FT5526EEZ-003, Backlight IC: MP3398EGF
 2. TFT Interface: LVDS, CTP Interface: I²C
 3. TFT Power Requirement: 3.3V, Backlight: 360mA/12.0V
 4. Optical Features: Full View, Normally Black, Transmissive, 700 cd/m²
 5. CTP Mating Connector: 6pin, 1.0mm pitch; Ex. Molex 52271-0679

| | | |
|---|--|--|
| Standard Tolerance: (Unless otherwise specified) Linear: ±0.3mm | | |
| | Drawing/Part Number: NHD-10.1-1024600BF-LSXP-CTP | Revision: - |
| Unless otherwise specified: • Dimensions are in Millimeters • Third Angle Projection | Drawn By: J.Thomas Drawn Date: 10/28/2022 | Approved By: J.Thomas Approved Date: 10/28/2022 |
| | Do Not Scale Drawing | |
| This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display. | | Sheet 1 of 1 |

Pin Description

TFT:

| Pin No. | Symbol | Connection | Function Description |
|---------|---------------------|--------------|---|
| 1 | GND | Power Supply | Ground |
| 2-3 | V _{DD} | Power Supply | Supply voltage for LCD (+3.3V) |
| 4 | V _{EDID} | Power Supply | Supply voltage for EDID (+3.3V) |
| 5 | GND | Power Supply | Ground |
| 6 | SCL | MPU | Serial Clock for EDID |
| 7 | SDA | MPU | Serial Data for EDID |
| 8 | Rin0- | MPU | -LVDS differential data input CH0 |
| 9 | Rin0+ | MPU | +LVDS differential data input CH0 |
| 10 | GND | Power Supply | Ground |
| 11 | Rin1- | MPU | -LVDS differential data input CH1 |
| 12 | Rin1+ | MPU | +LVDS differential data input CH1 |
| 13 | GND | Power Supply | Ground |
| 14 | Rin2- | MPU | -LVDS differential data input CH2 |
| 15 | Rin2+ | MPU | +LVDS differential data input CH2 |
| 16 | GND | Power Supply | Ground |
| 17 | CLKIN- | MPU | -LVDS differential Clock |
| 18 | CLKIN+ | MPU | +LVDS differential Clock |
| 19 | GND | Power Supply | Ground |
| 20 | Rin3- | MPU | -LVDS differential data input CH3 |
| 21 | Rin3+ | MPU | +LVDS differential data input CH3 |
| 22 | GND | Power Supply | Ground |
| 23 | INSEL (HSD) | MPU | Data Input Format: INSEL = L 8-Bit LVDS Input (Default) INSEL = H 6-Bit LVDS Input |
| 24-25 | GND | Power Supply | Ground |
| 26 | UPDN | MPU | Gate Driver Up/Down Scan Setting: UPDN = H: Reverse Scan UPDN = L: Normal Scan (Default) |
| 27 | SHLR | MPU | Gate Driver Left/Right Scan Setting: SHLR = H: Normal Scan (Default) SHLR = L: Reverse Scan |
| 28 | GND | Power Supply | Ground |
| 29 | RESET | MPU | Active Low Reset Signal |
| 30 | STBYB | MPU | Active Low Standby Signal |
| 31-33 | LED_GND | Power Supply | Ground for Backlight Driver |
| 34 | GND | Power Supply | Ground |
| 35 | LED_PWM | MPU | Backlight PWM Signal Input (See Table Below) |
| 36 | LED_EN | MPU | Backlight Enable H: Backlight On; L: Backlight Off |
| 37 | BIST | MPU | Built in Self-Test BIST = H: Self-Test Enabled BIST = L: Normal Operation (Default) |
| 38-40 | LED_V _{DD} | Power Supply | Supply Voltage for Backlight Driver |

Recommended TFT connector: 0.5mm pitch 40-Conductor FFC. **Molex P/N:** 15020-0435

Capacitive Touch Panel:

| Pin No. | Symbol | External Connection | Function Description |
|---------|-----------------|---------------------|--|
| 1 | V _{DD} | Power Supply | Supply voltage for Logic (3.3V) |
| 2 | V _{SS} | Power Supply | Ground |
| 3 | SCL | MPU | Serial I2C Clock (Requires 4.7kΩ pull-up resistor) |
| 4 | SDA | MPU | Serial I2C Data (Requires 4.7kΩ pull-up resistor) |
| 5 | /INT | MPU | Interrupt signal from touch panel module to host |
| 6 | /RESET | MPU | Active LOW Reset signal |

Recommended CTP Connector: 1.0mm pitch 6-Conductor FFC. **Molex P/N:** 52271-0679



Driver Information

TFT:

Source Driver HX8282-A11: <https://support.newhavendisplay.com/hc/en-us/articles/4414530594583-HX8282-A11>

Gate Driver HX8696-A01: <https://support.newhavendisplay.com/hc/en-us/articles/4414548297367-HX8696-A>

Backlight Driver IC: MP3398EGF

Capacitive Touch Panel:

Built-in FT5526EEZ-003 Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414392845079-FT5x26>

Electrical Characteristics

TFT:

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|----------------------|------------------------|--------|------|---------|------|
| Operating Temperature Range | T _{OP} | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | T _{ST} | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage for LCD | V _{DD} | - | 3.0 | 3.3 | 3.6 | V |
| Supply Voltage for EDID | V _{EDID} | - | 3.0 | 3.3 | 3.6 | V |
| Supply Current for LCD | I _{DD} | V _{DD} = 3.3V | 84.5 | 169 | 210 | mA |
| LVDS Differential input HIGH Voltage | RxVTH | - | - | - | +100 | mV |
| LVDS Differential input LOW Voltage | RxVTL | - | -100 | - | - | mV |
| LVDS Differential input Common Voltage | RxVCM | - | VID /2 | - | VDD-1.2 | V |
| LVDS Differential Voltage | VID | - | 200 | - | 600 | mV |
| Supply Voltage for Backlight Driver | LED_V _{LED} | - | 5.0 | 12.0 | 22.4 | V |
| Supply Current for Backlight Driver ¹ | LED_I _{LED} | - | 160 | 360 | 1200 | mA |
| Backlight Lifetime ² | - | T _{OP} = 25°C | 30,000 | - | - | Hrs. |
| Backlight Enable Voltage | LED_EN | - | 1.5 | 3.3 | 5.5 | V |
| Backlight PWM Voltage | LED_PWM | - | 1.5 | 3.3 | 5.5 | V |
| Backlight PWM Frequency | - | LED_PWM = 3.3V | 200 | - | 2000 | Hz |

¹Minimum supply current occurs when supply voltage is at max; maximum supply current when supply voltage is at minimum.

²Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions.

Capacitive Touch Panel:

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|-----------------|--------------|---------------------|------|---------------------|------|
| Operating Temperature Range | T _{OP} | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | T _{ST} | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage | V _{DD} | - | 3.0 | 3.3 | 3.6 | V |
| Supply Current – Operating | I _{DD} | - | 8 | 15 | 23 | mA |
| “H” Level input | V _{IH} | - | 0.7*V _{DD} | - | V _{DD} | V |
| “L” Level input | V _{IL} | - | V _{SS} | - | 0.3*V _{DD} | V |
| “H” Level output | V _{OH} | - | 0.7*V _{DD} | - | V _{DD} | V |
| “L” Level output | V _{OL} | - | V _{SS} | - | 0.3*V _{DD} | V |

Optical Characteristics

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|---------------------------------|------------------------|------|------|------|-------------------|
| Optimal Viewing Angles | Top | $\phi Y+$ | CR \geq 10 | - | 80 | - | $^{\circ}$ |
| | Bottom | $\phi Y-$ | | - | 80 | - | $^{\circ}$ |
| | Left | $\theta X-$ | | - | 80 | - | $^{\circ}$ |
| | Right | $\theta X+$ | | - | 80 | - | $^{\circ}$ |
| Contrast Ratio | | CR | - | 600 | 800 | - | - |
| Luminance | | Lv | - | 510 | 700 | 850 | cd/m ² |
| Response Time (Rise + Fall) | | T _R + T _F | T _{OP} = 25°C | - | 25 | 35 | ms |
| Chromaticity | Red | X _R | - | 0.57 | 0.60 | 0.63 | - |
| | | Y _R | - | 0.33 | 0.36 | 0.39 | - |
| | Green | X _G | - | 0.30 | 0.33 | 0.36 | - |
| | | Y _G | - | 0.51 | 0.54 | 0.57 | - |
| | Blue | X _B | - | 0.10 | 0.13 | 0.16 | - |
| | | Y _B | - | 0.05 | 0.08 | 0.11 | - |
| | White | X _W | - | 0.28 | 0.31 | 0.34 | - |
| | | Y _W | - | 0.30 | 0.33 | 0.36 | - |

Capacitive Touch Panel Material Characteristics

| Property | Requirement | Unit |
|---------------------|---------------|------|
| IC | FT5526EEZ-003 | - |
| ITO Glass thickness | 0.7 | mm |
| Surface Hardness | \geq 6 | H |
| Light transmission | >85% | - |
| Operating Humidity | 20~90 | RH |
| Storage Humidity | 20~90 | RH |

Capacitive Touch Panel Registers

| Register No. | Access | Register Name | Bits | Value | Description |
|--------------|--------|-------------------|-------|----------|---|
| 01h | RO | Gesture ID | [7:0] | 1Ch | Swipe Up |
| | | | | 14h | Swipe Down |
| | | | | 10h | Swipe Left |
| | | | | 18h | Swipe Right |
| | | | | 48h | Zoom In |
| | | | | 49h | Zoom Out |
| | | | | 00 | No gesture |
| 02h | RO | Touch Points | [7:0] | 0-Ah | 0: No touch detected 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 |

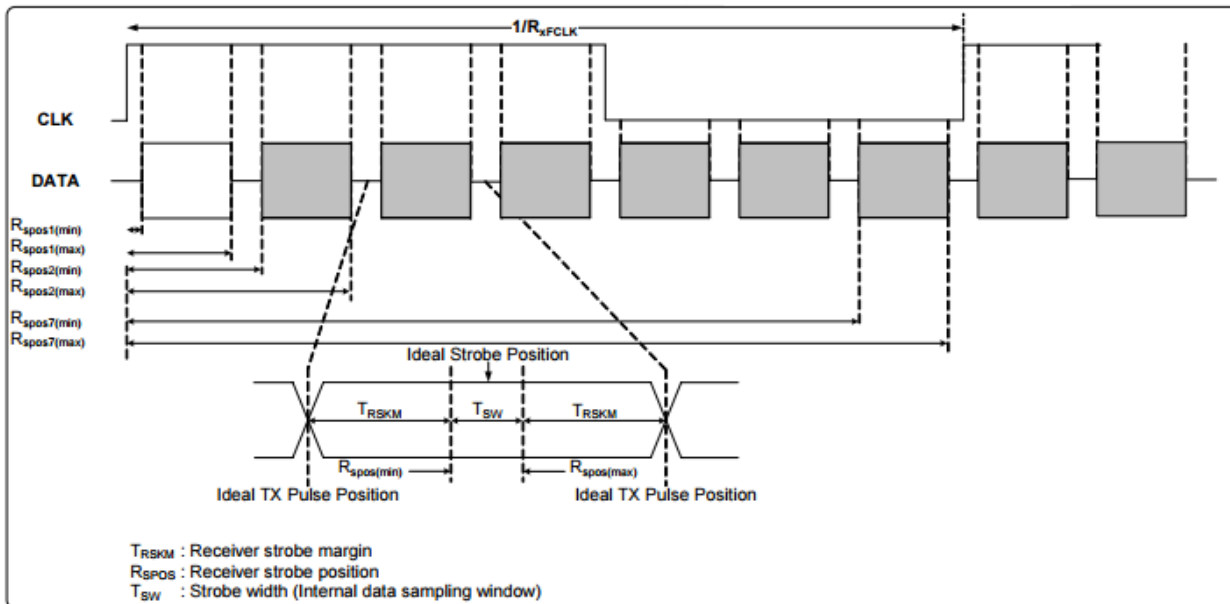
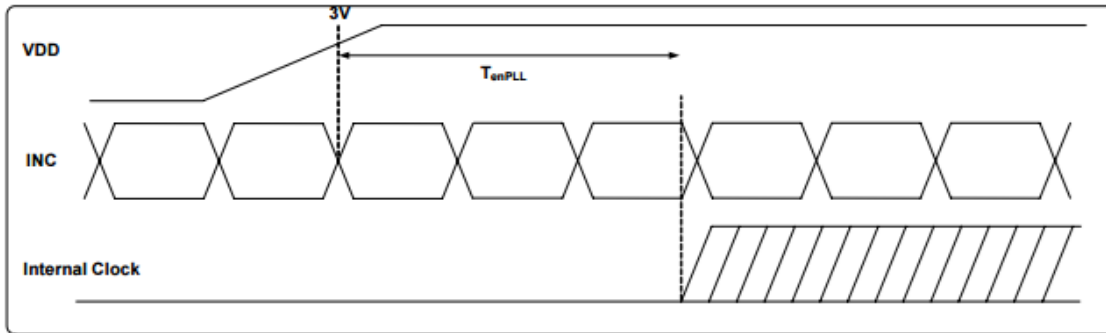
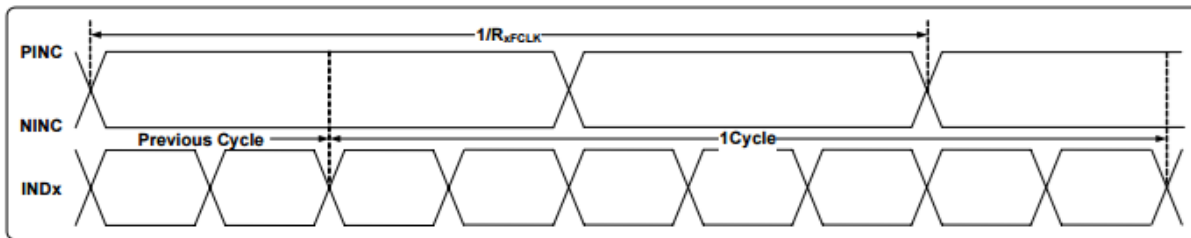


| Register No. | Access | Register Name | Bits | Value | Description |
|--------------|--------|--------------------|-------|--------|---|
| 3Dh | RO | TOUCH10_Weight | [7:0] | 00-FFh | Touch Weight |
| 3Eh | RO | TOUCH10_Misc | [3:0] | 00-0Fh | Touch Area |
| A1h | RO | ID_G_LIB_VERSION_H | [7:0] | 00-FFh | App library version high-byte Default: 0 |
| A2h | RO | ID_G_LIB_VERSION_L | [7:0] | 00-FFh | App library version low-byte Default: 2h |
| A3h | RO | ID_G_CHIPER_HIGH | [7:0] | 00-FFh | Chip Vendor ID Default: 0x54 |
| A6h | RO | ID_G_FIRMID | [7:0] | 00-FFh | Firmware ID Number Default: 18 |
| A8h | RO | ID_G_VENODRID | [7:0] | 00-FFh | CTPM Vendor's Chip ID Default: 79h |

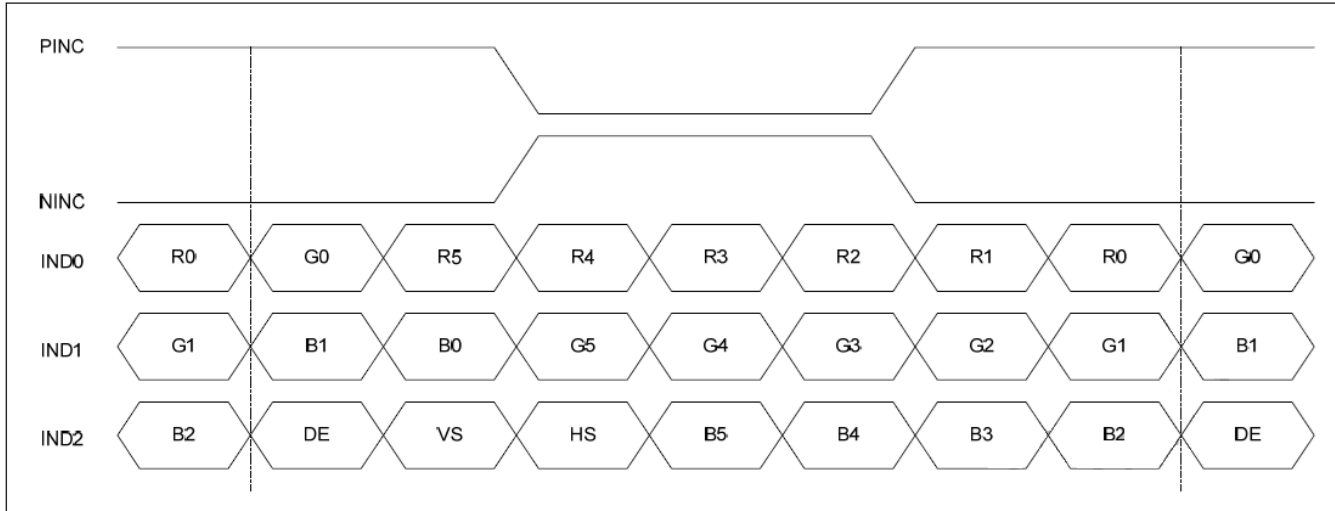
Timing Characteristics: TFT Display

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

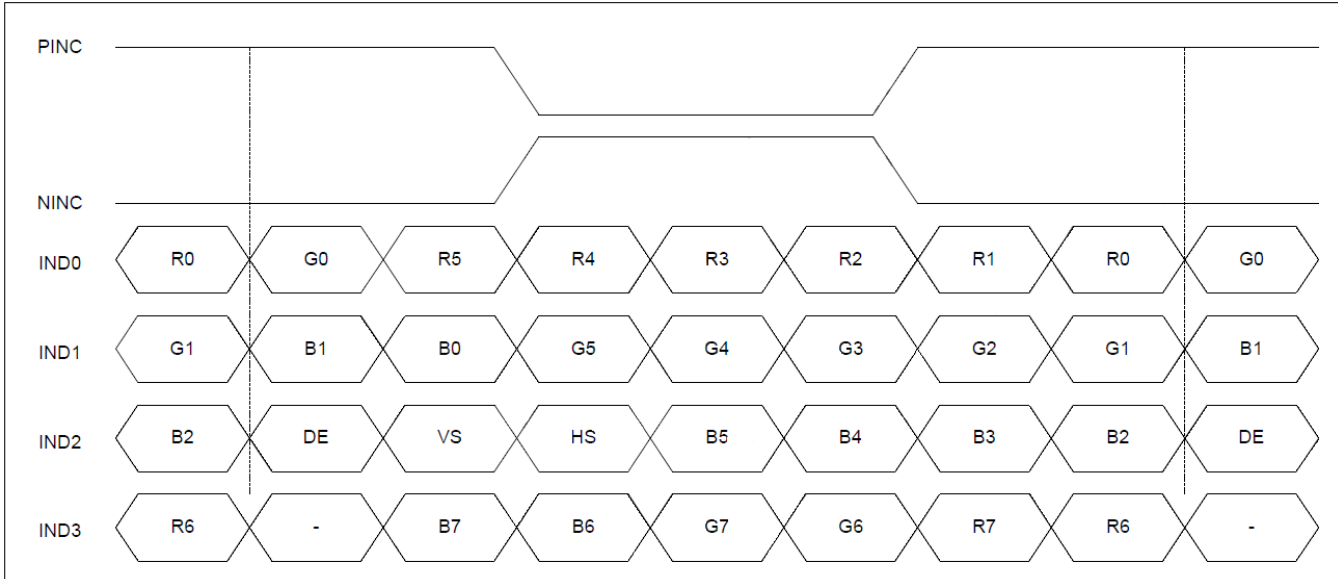
| Parameter | Symbol | Spec | | | Unit | Condition |
|----------------------|-------------------|------|------|------|------|---------------------|
| | | Min. | Typ. | Max. | | |
| Modulation Frequency | SSC _{MF} | 23 | - | 93 | KHz | - |
| Modulation Rate | SSC _{MR} | - | - | ±3 | % | LVDS Clock =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



6-Bit LVDS Data Input Format:



8-Bit LVDS Data Input Format:

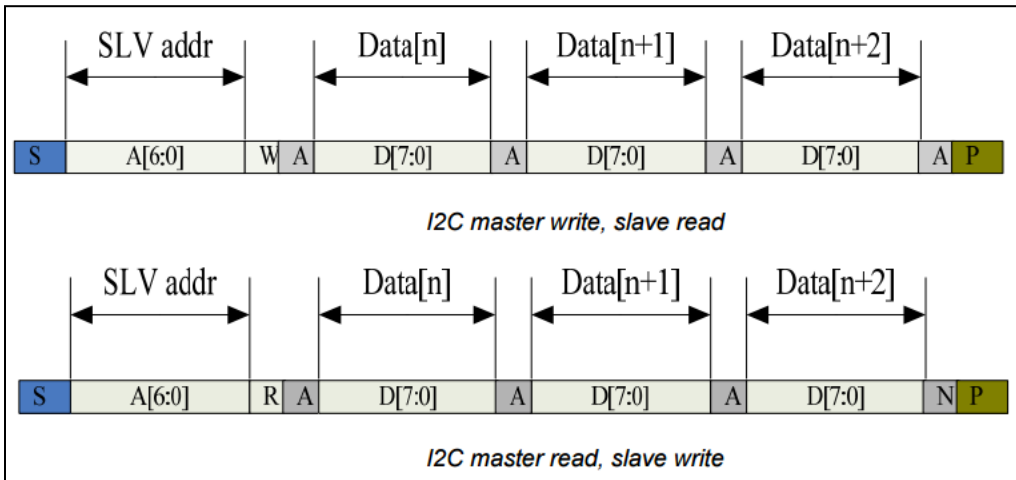
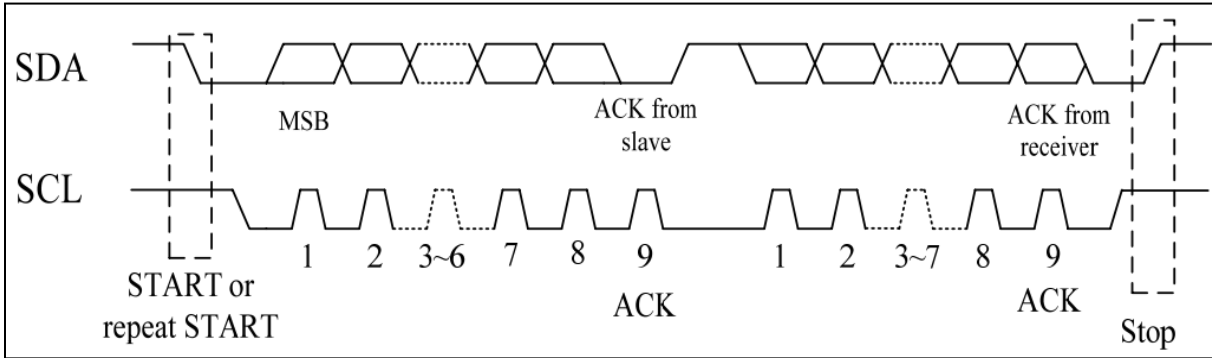


Horizontal & Vertical Timing (1024x600)

| Item | Symbol | Spec. | | | Unit | |
|----------------|-------------------------|------------------|------|------|------|----------------|
| | | Min. | Typ. | Max. | | |
| DCLK Frequency | F _{CLK} | 44.9 | 51.2 | 63 | MHz | |
| HSYNC | Horizontal Display Area | T _{HD} | 1024 | | | DCLK |
| | HSD Period | T _H | 1200 | 1344 | 1400 | DCLK |
| | HSD Pulse Width | T _{HPW} | 1 | - | 140 | DCLK |
| | HSD Back Porch | T _{HBP} | 160 | | | DCLK |
| | HSD Front Porch | T _{HFP} | 16 | 160 | 216 | DCLK |
| VSYNC | Vertical Display Area | T _{VD} | 600 | | | T _H |
| | VSD Period | T _V | 624 | 635 | 750 | T _H |
| | VSD Pulse Width | T _{VPW} | 1 | - | 20 | T _H |
| | VSD Back Porch | T _{VBP} | 23 | | | T _H |
| | VSD Front Porch | T _{VFP} | 1 | 12 | 127 | T _H |

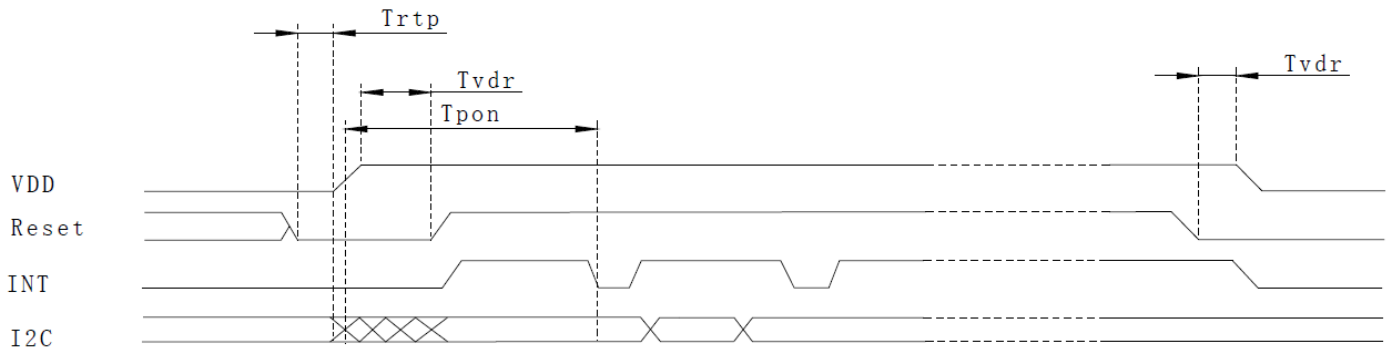
Timing Characteristics: Capacitive Touch Panel

Data Transfer Format

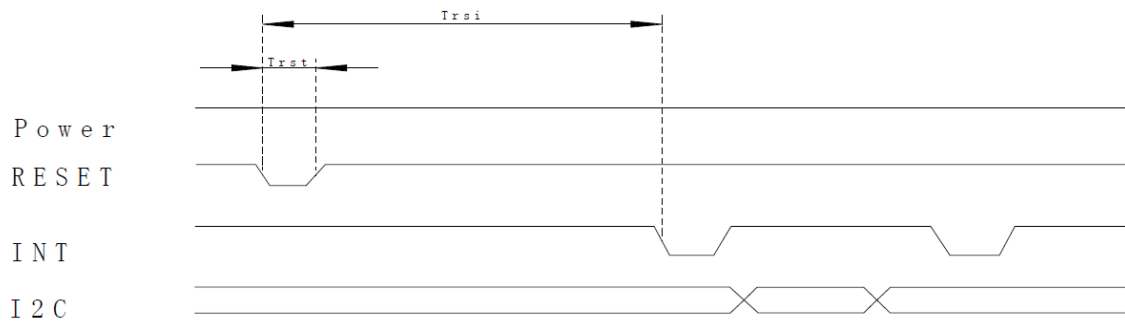


| Parameter | Min | Max | Unit |
|--|-----|-----|------|
| SCL Frequency | 0 | 400 | KHz |
| Bus free time between a STOP and START Condition | 1.3 | - | μs |
| Hold Time (repeated) START Condition | 0.6 | - | μs |
| Data Setup Time | 100 | - | ns |
| Setup Time for a repeated START Condition | 0.6 |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

Power ON Sequence



Reset Sequence



| Parameter | Description | Min | Max | Unit |
|-----------|---|-----|-----|---------|
| T_{ris} | Rise time from $0.1 \cdot V_{DD}$ to $0.9 \cdot V_{DD}$ | - | 5 | ms |
| T_{pdt} | Time for voltage supply below $0.3 \cdot V_{DD}$ | 5 | - | ms |
| T_{rtp} | Time to hold reset low Before Applying Power | 100 | - | μs |
| T_{pon} | Time of starting to report point after powering on | - | 200 | ms |
| T_{vdr} | Reset time after V_{DD} power on | 1 | - | ms |
| T_{rsi} | Time of starting to report point after Reset | - | 200 | ms |
| T_{rst} | Reset Time | 1 | - | ms |

Sample code to read touch data:

```
i2c_start();
i2c_tx(0x70);           //Slave Address (Write)
i2c_tx(0x00);          //Start reading address
i2c_stop();

i2c_start();
i2c_tx(0x71);          //Slave Address (Read)
for(i=0x00;i<0x1F;i++)
{touchdata_buffer[i] = i2c_rx(1);}
i2c_stop();
```

Sample code to overwrite default register values:

```
i2c_start();
i2c_tx(0x70);           //Slave Address (Write)
i2c_tx(0xA4);           //ID_G_Mode
i2c_tx(0x01);           //Disable interrupt status to host
i2c_stop();
```

Quality Information

| Test Item | Content of Test | Test Condition | Note |
|-------------------------------------|---|--|------|
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | +80°C, 240 hrs. | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C, 240 hrs. | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C, 120 hrs. | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C, 120 hrs. | 1,2 |
| High Temperature / Humidity Storage | Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time. | +50°C, 90% RH, 120 hrs. | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -30°C, 30min->25°C, 10min -> 80°C, 30min 10 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | Frequency: 250r/min Amplitude: 1 inch Time: 45 min | 3 |
| Static electricity test | Endurance test applying electric static discharge. | Air: V _s =8KV, Contact: V _s =4KV 10 Times | |

Note 1: No condensation to be observed.

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

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