# Noritake itron

# TFT LCD Module with
## Metallized Projective Capacitive Touch Panel
## (FLETAS touch panel)

# Specification

## Model: GTWV070VRB00P

This specification is subject to change without prior notice.

**This product complies with RoHS Directive**
**Please contact our sales consultant for details and to confirm the current status**

**FLETAS is a registered trademark of Noritake itron Corporation.**

# Notice for the Cautious Handling of LCD Modules

Handling and Usage Precautions:
Please carefully follow the appropriate product application notes and operation standards for proper usage, safe handling, and maximum performance.

## 【Construction】

| | |
|---|---|
| ❗ | The FLETAS touch panel is made of glass. When using this product, please be sure to install a protective overlay such as cover glass, acrylic plate, etc. |
| ❗ | Please handle the FLETAS touch panel very carefully as it may crack if it is pressed with excessive force. |
| ❗ | If this product is bent or twisted, it may cause the breakage of parts on the product board. Please handle it very carefully without bending or twisting. |
| 🚫 | Please do not hold the FPC or other cables on this product as it may disconnect vital components. |
| ❗ | The end faces of the FLETAS touch panel are not polished. Please handle it very carefully to avoid injury. |
| ❗ | The FLETAS touch panel is made of glass. It may be damaged by falling / impact / excessive vibration. In the unlikely event that the glass shatters, please handle the glass fragments very carefully to avoid injury. |
| ❗ | The LCD panel generates heat. Please provide clearance for heat dissipation between this product and its enclosure. Also, if a structure has electronic parts that are densely collected near this product, we recommend that it be cooled with a fan or something similar. |

## 【Cable Connection】

| | |
|---|---|
| 🚫 | Please do not remove the power cable and signal cable if the product is in an energized state. It may cause damage to the power supply circuit and/or the I/O circuit of this product. |
| 🚫 | As a rule of thumb, please do not input any signals while the product is not receiving adequate power. It may cause damage to the input/ output circuit. |
| ❗ | When plugging-in or unplugging the cable for this product, please do not apply excessive force, such as pulling the cable. Please plug-in or unplug in a straight direction (alignment) with the terminal, without bending or twisting forces. If it is not properly plugged-in or unplugged, damage may occur to the cable or connector. |
| ❗ | Please avoid sudden bending of the cable from the base of the insert connector part. It may cause damage to the cable or disconnection of the connector. If loads are expected on connectors and cables, please fix cables etc. |

## 【Electrostatic Charge】

| | |
|---|---|
| ❗ | Since we are using semiconductor products, please pay attention to the electrostatic breakdown during handling and transportation. (If it is judged that the product is defective due to electrostatic destruction during its return to our company, it may be repaired for a fee.) |

## 【Power】

| | |
|---|---|
| ❗ | Please use a fully stabilized power supply. If the poweSr supply's voltage is outside of the product's rated supply voltage, the operation of the power supply circuit may become unstable. |
| ❗ | In-rush current flows when turning the power on. Please use a power supply that can withstand more than twice the normal current. |
| ❗ | As a safety measure, we recommend using a power supply with overcurrent protection and a fuse. |
| ❗ | Please confirm that the power supply voltage is within the rating of the connector. Please use a power cable with the appropriate thickness and length. |

## 【Interface】

| | |
|---|---|
| ❗ | Please use an interface cable that has a length that has been thoroughly verified. |

## 【Implementation】

| | |
|---|---|
| ❗ | When installing this product, please make sure that the on-board electronic components and FPC do not touch the metal chassis. It may cause the product to malfunction. |
| ❗ | If you need to make the product drip-proof, please use waterproof measures for products by using rubber etc. |
| ❗ | Please handle the product carefully when you take it out from the case and when you install the product, since it is a precision part. |

【Storage and Operating Environment】

| | |
|---|---|
| ❗ | Please use this product within the environmental condition range stated in its specification.<br>Exceeding the stated temperature, humidity, vibration, and impact limitations (along with other stated limitations) may cause malfunction. |
| ❗ | Please do not exceed the absolute maximum ratings stated in the specification even for a moment. It may cause malfunction. |
| ❗ | Under a high temperature environment, the FLETAS touch panel surface also becomes hot.<br>If you touch the FLETAS panel with your bare hand, please be careful of burns, injury, etc. |
| ❗ | Malfunction may occur when the product is stored and / or used in environments with a lot of salt, sulfur, dust, etc. |

【Disposal】

| | |
|---|---|
| ❗ | When disposing of this product, please follow the relevant regulations. |

【Others】

| | |
|---|---|
| 🚫 | Do not reverse engineer this product (i.e. firmware disassembly). |
| 🚫 | Do not modify, disassemble, repair, replace parts, etc.<br>It may cause EMI failure, etc.<br>(We cannot assume responsibility for troubles caused by modifying these products.) |
| ❗ | This specification does not give license of the intellectual property rights that our company owns. Also, it does not guarantee the implementation of a third party's rights. |
| ❗ | Neither whole nor partial copying of these specifications is permitted without our approval. If necessary, please ask for assistance from one of our sales consultants. |
| ❗ | This product is designed with careful attention to EMI and ESD. However, the characteristics of EMI and ESD change when the product is incorporated into a system. Please be sure to perform testing with the finished product. When used in noisy environments, please take measurements against noise around the casing. |
| ❗ | This product is not designed for military, aerospace, medical, or other life-critical applications. If you choose to use this product for these applications, please ask us for prior consultation or we cannot accept responsibility for problems that may occur. |

❗ Image persistence may occur if the same screen is displayed for a prolonged period of time. The effect will gradually disappear by displaying a screensaver pattern, etc, or by powering off the display. The time needed for the effect to disappear is not fixed, as it depends on the exact usage, screen settings, power settings, and environmental temperature, etc.

To avoid image persistence, it is recommended to avoid displaying a fixed pattern or the same image for a prolonged period of time.
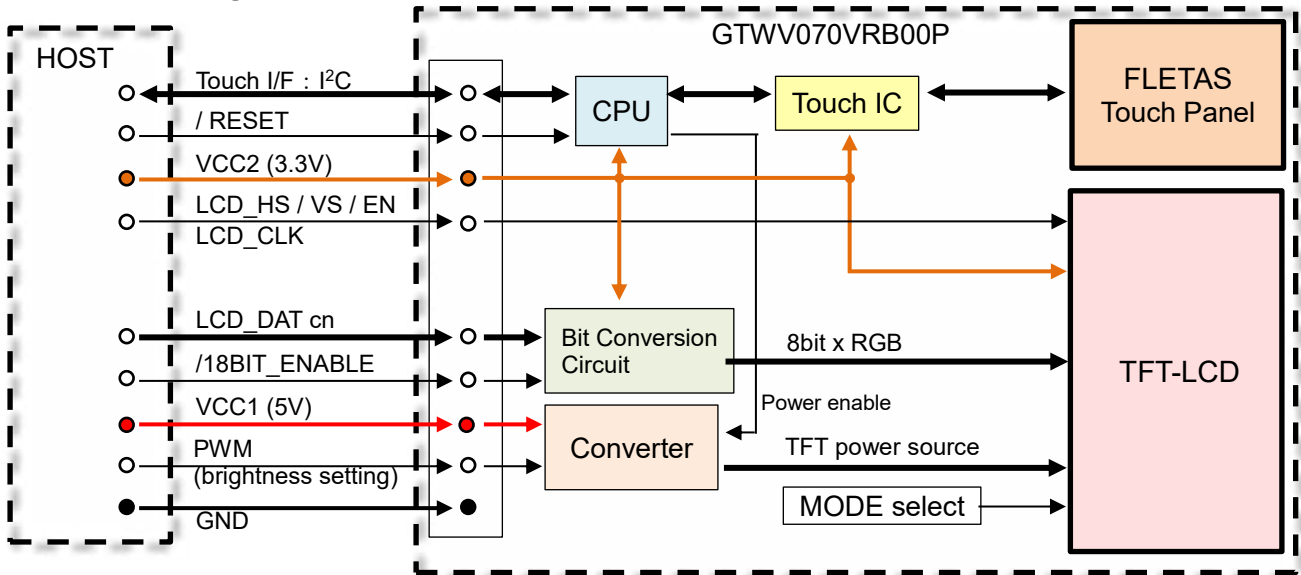
Contents

# 1　General description

This specification corresponds to the product specification of GTWV070VRB00P which is a TFT - LCD graphic display module with metallized projective capacitive touch (FLETAS touch panel).

## 1.1　Constitution

This product consists of a TFT-LCD, FLETAS touch panel, and control board (touch control, power supply, and display control).

## 1.2　Block Diagram

### 1.3    Basic Specification

| Item | | Content | Condition |
|---|---|---|---|
| Power Supply | For LCD backlight | Voltage VCC1: DC 5V +/- 5%   current ICC1 | |
| | For logic | Voltage VCC2: DC 3.3V +/- 3%   current ICC2 | |
| Display | Type | TFT-LCD | |
| | Size | 7.0 inches  (display area: 154.08 mm x 85.92 mm) | |
| | Number of pixels | 800 × RGB × 480 | |
| | Colors | 16.7M (24-bit color) / 256K (18-bit color) | |
| | Recommend viewing direction | 12 o'clock | |
| | Gray scale inversion direction | 6 o'clock | |
| | Brightness | Min. 500 cd/m$^2$ (nit)、    Typ. 850 cd/m$^2$ (nit)<br>Brightness changeable by PWM | 100% brightness/ White screen at the center of display (Factory status) |
| | Display signal interface | RGB parallel (24-bit / 18-bit) | |
| | Mode | DE mode(default) / SYNC mode | |
| FLETAS touch panel | Type | Metallized projective capacitive touch | |
| | Touch active area | 156.64 mm x 89.05 mm | |
| | Number of touches | Max. 10 points | |
| | Interface | I$^2$C (HID compliance, touch data acquisition by commands) | |
| Control | Display commands | Backlight Brightness Level Setting | I$^2$C interface |
| | Touch commands | Single / multi-touch mode selection, touch panel data transmit ON / OFF, Touch Parameter Setting, etc. | |
| | Other commands | Memory switch setting, initialization, etc. | |

## 2 Electrical Specifications

### 2.1 Absolute Maximum Rating

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|---|
| Power supply | Power supply voltage | VCC1 | -0.3 | — | +6.0 | V | — |
| | | VCC2 | -0.3 | — | +3.6 | V | — |
| I²C | Logic input voltage SCL,SDA | VIN1 | -0.3 | — | VCC2+0.3 | V | — |
| RESET | Logic input voltage /RESET | VIN2 | -0.3 | — | VCC2+0.3 | V | — |
| TFT-RGB | Logic input voltage LCD_DAT cn c=R/G/B, n=0-7 | VIN3 | -0.3 | — | VCC2+0.3 | V | — |
| TFT control | LCD_CLK, LCD_HSYNC, LCD_VSYNC, LCD_ENABLE /18BIT_ENABLE, PWM | VIN4 | -0.3 | — | VCC2+0.3 | V | — |

### 2.2 Electrical Ratings

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|---|
| Power supply | Power supply voltage | VCC1 | 4.75 | 5.0 | 5.25 | VDC | — |
| | | VCC2 | 3.2 | 3.3 | 3.4 | VDC | — |
| I²C | Logic input voltage SCL,SDA | VIH1 | 0.8VCC2 | — | VCC2 | VDC | Internal pull-up resistor 4.7kΩ |
| | | VIL1 | 0 | — | 0.2VCC2 | VDC | |
| RESET | Logic input voltage /RESET | VIH2 | 2.0 | — | VCC2 | VDC | — |
| | | VIL2 | 0 | — | 0.8 | VDC | — |
| TFT-RGB | Logic input voltage LCD_DAT cn c=R/G/B, n=0-7 | VIH3 | 0.8VCC2 | — | VCC2 | VDC | — |
| | | VIL3 | 0 | — | 0.2VCC2 | VDC | — |
| TFT control | LCD_CLK, LCD_HSYNC, LCD_VSYNC, LCD_ENABLE /18BIT_ENABLE, PWM | VIH4 | 0.8VCC2 | — | VCC2 | VDC | — |
| | | VIL4 | 0 | — | 0.2VCC2 | VDC | — |

The TFT-LCD driving voltage is generated by the on-board DC / DC converter.

### 2.3 Electrical Characteristics
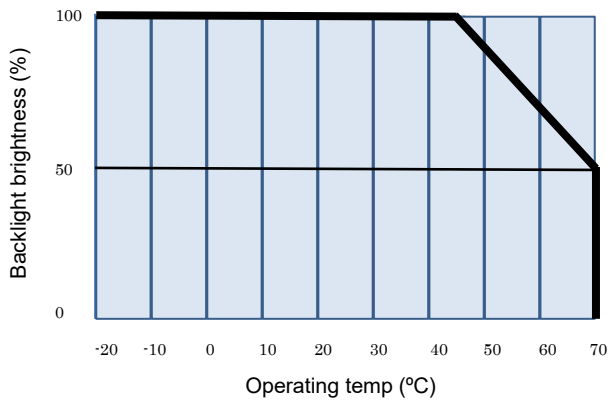
Measuring conditions: ambient temperature = 25ºC, VCC1 = 5.0VDC, VCC2 = 3.3VDC
*1 brightness 100%,   *2 brightness 50%, FPWM = 10kHz

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|---|
| I²C | Logic output voltage I²C INT | VOH1 | 2.7 | — | — | VDC | IOH=-2.0mA |
| | | VOL1 | 0 | — | 0.5 | VDC | IOL=1.5mA |
| Power supply | Power supply current | ICC1-1 | — | 500 | 650 | mADC | *1 |
| | | ICC1-2 | — | 255 | 330 | mADC | *2 |
| | | ICC2 | — | 35 | 45 | mADC | — |
| | Power consumption | P1 | — | 2.5 | 3.25 | W | *1 |
| | | | — | 1.28 | 1.65 | W | *2 |
| | | P2 | — | 0.12 | 0.15 | W | — |

・ The rise time of supply voltage should not exceed 100ms.
・ Inrush current at power-on may exceed twice normal current. It is recommended to use a power supply that can secure enough power capacity.

## 3   Environmental Specifications

| Parameter | Content |
|---|---|
| Operating Temperature | - 20ºC to + 70ºC |
| Storage Temperature | - 30ºC to + 80ºC |
| Operating Humidity | Temp. ≦60 ºC, 80% RH MAX. (No condensation)<br>Temp. > 60 ºC , absolute humidity shall be less than 80% RH at 60 ºC (No condensation) |
| Storage Humidity | Temp. ≦60 ºC, 80% RH MAX. (No condensation)<br>Temp. > 60 ºC , absolute humidity shall be less than 80% RH at 60 ºC (No condensation) |
| Vibration (non-operating) | 10-55-10Hz, all amplitude 1mm, 30 minutes, X-Y-Z |
| Shock (non-operating) | 392m/s$^2$ (40G) 9ms X-Y-Z, 3 times each direction |
| Brightness Derating |  |

## 4   Physical Specifications

| Parameter | Content |
|---|---|
| Number of pixels | 800 × RGB × 480 |
| Display area | 154.08mm × 85.92mm (X × Y) |
| Pixel pitch | 0.1926mm × 0.179mm (X × Y) |
| Weight | Approximately 200g |

## 5   Applicable Specifications

Applicable reliability specification:              TT-99-3102x
Applicable module production specification:       TT-98-3413x
Applicable touch panel production specification:  TT-17-3301x

 * The revision number is indicated by "x".

# 6 Interfaces

## 6.1 I²C : CN4

Working as an I²C slave.

Communication Parameters

| Communication speed | Max. 400Kbps |
|---|---|
| Format | I²C |
| Slave address(es) | Set by memory switch |
| Supported function | ACK response, clock stretch |
| Communication control signals | /IRQ (*1) |

*Note: If clock stretch is applied during processing of a command, the host (master) will not be able to send or receive any more data until command processing has finished.

*1 /IRQ signal indicates when data is available to be read by the host, but this signal can only be used by one of the I²C functions. The HID function has priority, such that the signal is controlled exclusively by the HID over I²C function, unless HID over I²C is disabled (by setting MSW46 = FFh (invalid)). If HID over I²C is disabled, the /IRQ signal is controlled by the Noritake original commands function.
For Noritake original commands, FFh is returned in response to a read if no data is available.

For technical details on HID over I²C, refer to the "HID Over I²C Protocol Specification" document:
http://msdn.microsoft.com/en-us/library/windows/hardware/hh852380.aspx

This product's HID descriptor address is 0x0001.
Slave address can be set with memory switch.

| Protocol | Slave address default |
|---|---|
| HID class standard (Touch screen) | 51h |
| Noritake original commands | 50h |

Data Write Sequence

| S (Sr) | Slave Address | | | R/*W | ACK | Data | | | ACK | ··· | Data | | | ACK | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b7 | ... | b1 | b0 | | b7 | ... | b0 | | | b7 | ... | b0 | | |

Data Read Sequence

| S (Sr) | Slave Address | | | R/*W | ACK | Data | | | ACK | ··· | Data | | | NACK | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b7 | ... | b1 | b0 | | b7 | ... | b0 | | | b7 | ... | b0 | | |
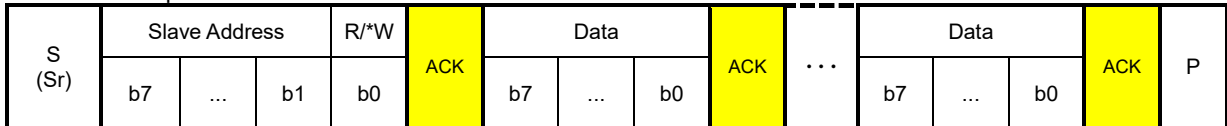
☐ Host (master) is transmitter, display module (slave) is receiver

▮ Host (master) is receiver, display module (slave) is transmitter

## I²C Timing
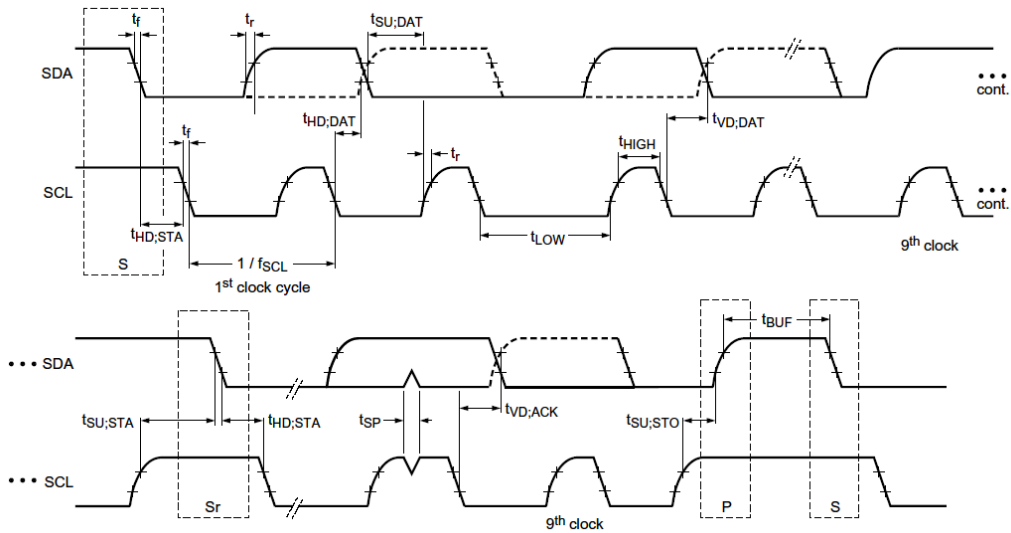


| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| SCL clock frequency | fSCL | - | 0 | - | 400 | kHz |
| Start condition hold time | tHD;STA | - | 0.6 | - | - | µs |
| SCL 'L' time | tLOW | - | 1.3 | - | - | µs |
| SCL 'H' time | tHIGH | - | 0.6 | - | - | µs |
| Start condition setup time | tSU;STA | - | 0.6 | - | - | µs |
| Data hold time | tHD;DAT | - | 0 | - | - | µs |
| Data setup time | tSU;DAT | - | 100 | - | - | ns |
| SCL, SDA rise time | Tr | - | 20 | - | 300 | ns |
| SCL, SDA fall time | Tf | - | 20 | - | 300 | ns |
| Stop condition setup time | tSU;STO | - | 0.6 | - | - | µs |
| Stop condition – start condition bus idle time | tBUF | - | 20 | - | - | µs |

### Data Write Sequence
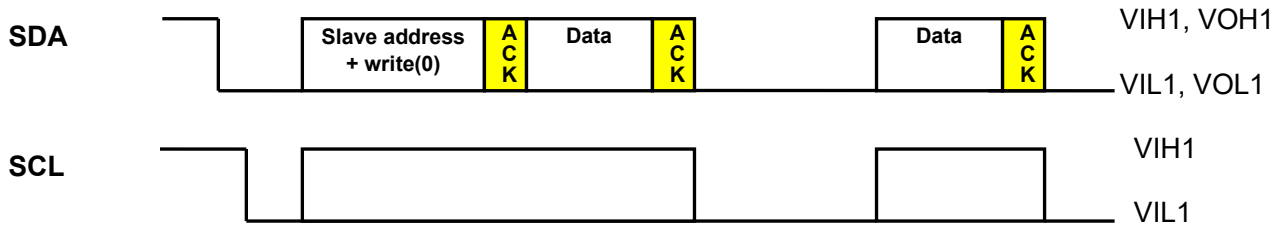


### Data Read Sequence
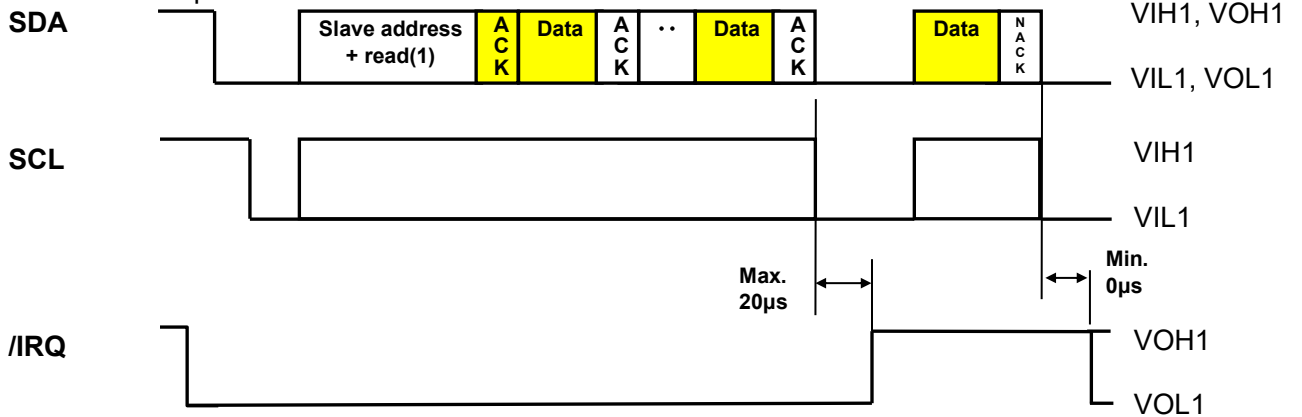
## 6.2    Display Interface: CN4

This product interface has RGB parallel. 8bit x RGB or 6bit x RGB are selectable.

| Display color select | Signal: /18BIT_ENABLE | LCD_DATR7–2 LCD_DATG7-2 LCD_DATB7-2 | LCD_DATR1–0 LCD_DATG1-0 LCD_DATB1-0 |
|---|---|---|---|
| 8bit x RGB | "H" | Valid | Valid |
| 6bit x RGB | "L" | Valid | Invalid |

Input signals for DE mode or SYNC mode (selected by "MODE" jumper)

| Input mode select | Jumper: "MODE" | LCD_ENABLE | LCD_HSYNC | LCD_VSYNC |
|---|---|---|---|---|
| DE mode | OPEN | DE signal | Not used *1 | Not used *1 |
| SYNC mode | SHORT | Not used *2 | HSYNC signal | VSYNC signal |

Refer to 14 Outline about jumper position.

*1 Leave unconnected or input "H".

*2 Leave unconnected or input "L".

### 6.2.1 AC Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| LCD_HSYNC setup time | Thst | 8 | — | — | ns | |
| LCD_HSYNC hold time | Thhd | 8 | — | — | ns | |
| LCD_VSYNC setup time | Tvst | 8 | — | — | ns | |
| LCD_VSYNC hold time | Tvhd | 8 | — | — | ns | |
| LCD_DAT setup time | Tdsu | 11 | — | — | ns | |
| LCD_DAT hold time | Tdhd | 8 | — | — | ns | |
| LCD_ENABLE setup time | Tesu | 8 | — | — | ns | |
| LCD_ENABLE hold time | Tehd | 8 | — | — | ns | |
| VCC2 power on slew rate | TPOR | — | — | 20 | ms | From 0 to 90% VCC2 |
| LCD_CLK cycle time | Tcoh | 30 | — | — | ns | |
| LCD_CLK pulse duty | Tcwh | 40 | 50 | 60 | % | Tcwh = T_HIGH / Tcoh *100 |

Timing Chart

**Power**

VCC2

**LCD Signal**

LCD_CLK

LCD_HSYNC
LCD_VSYNC

LCD_DAT

LCD_ENABLE
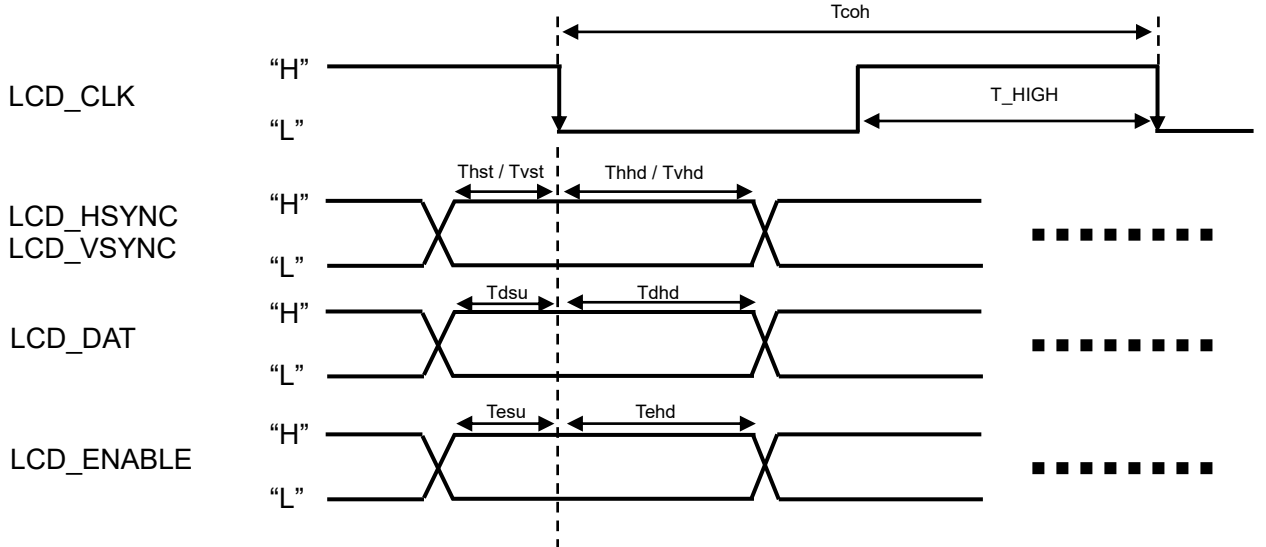
### 6.2.2 RGB Timing

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Horizontal display area | thd | 800 | 800 | 800 | DCLK | |
| LCD_CLK frequency | fclk | — | 30 | 33 | MHz | |
| One horizontal line | TH | 862 | 952 | 1031 | DCLK | |
| LCD_HSYNC pulse width | thpw | 1 | - | 40 | DCLK | |
| LCD_HSYNC blanking | thb | 46 | 46 | 46 | DCLK | |
| LCD_HSYNC front porch | thfp | 16 | 106 | 185 | DCLK | |

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Vertical display area | tvd | 480 | 480 | 480 | TH | |
| LCD_VSYNC period time | tv | 510 | 525 | 533 | TH | |
| LCD_VSYNC pulse width | tvpw | 1 | - | 20 | TH | |
| LCD_VSYNC blanking | tvb | 23 | 23 | 23 | TH | |
| LCD_VSYNC front porch | tvfp | 7 | 22 | 30 | TH | |

### 6.2.3 Data Input Format

### 6.2.4  PWM Control
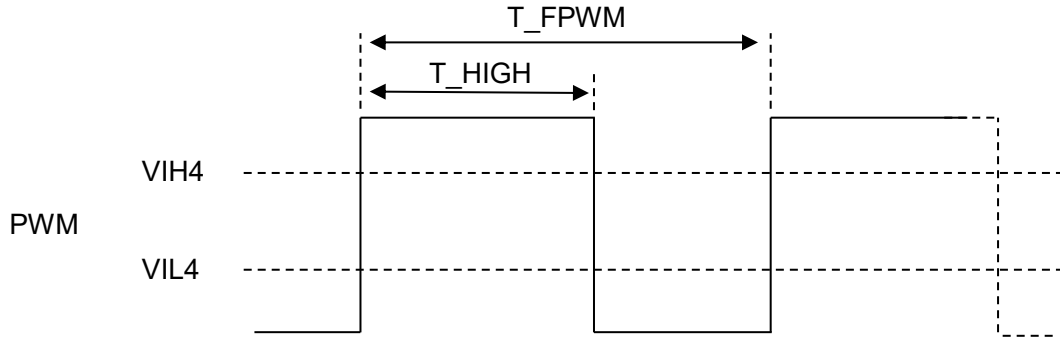


Frequency (= 1 / T_FPWM) range of PWM is 5 to 100kHz.
Brightness will be 100% when HIGH-duty ratio of PWM signal is 100% (= T_HIGH / T_FPWM * 100).
Backlight brightness level setting command must be 100% when using PWM control.

### 6.2.5  RESET

This product can be reset by inputting a LO signal to /RESET.

After a reset pulse, this product has an invalid data reception period for up to 200ms. After power on,
it's up to 200ms. Data loss may occur if these time period are not adhered to.
* Although /RESET is not a display signal the display disappears during reset.
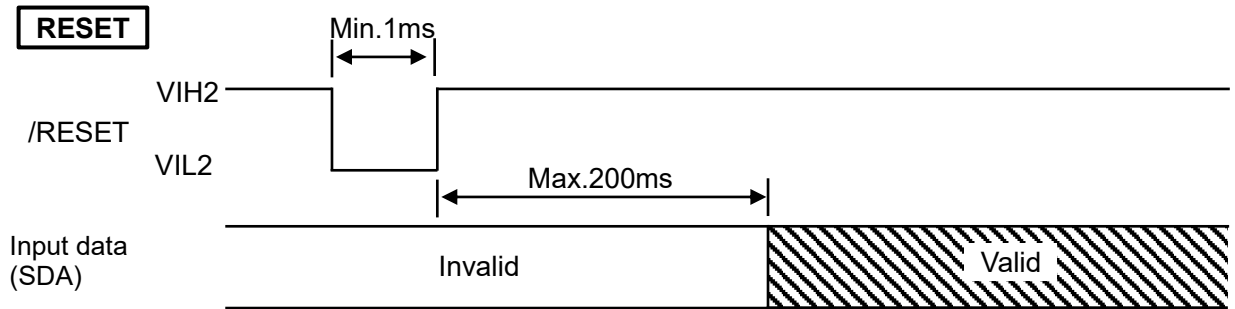
# 7 FLETAS Touch Panel

## 7.1 Outline

| | |
|---|---|
| Detection method: | Metallized Projective Capacitive Touch Panel (FLETAS touch panel) Multi-touch capable. |
| Substrate material: | Glass |
| Touch reporting methods: | HID class standard (touch screen), (10-point multi-touch) Noritake original commands (Refer to 7.2 - 9) |

### 7.1.1 Touch Detection

The touch sensor of this product quantifies the strength of the electric field between the electrodes and determines whether a touch is ON or OFF based on the observed changes.

<Touch detection flow>
1. If there is no human finger (or equivalent conductor) near the FLETAS touch panel, the OFF judgment is maintained.
2. Count Value decreases as a finger approaches the FLETAS touch panel.
3. When Count Value falls below the threshold, the judgment is ON.
4. Count Value increases when a finger leaves the FLETAS touch panel.
5. When Count Value exceeds the threshold, the judgment is OFF.

**A. Count Value**: A numerical value of the strength of the electric field between the electrodes
**B. Touch Reference**: Count Value when not touching
**C. Threshold**: Threshold for judging ON / OFF (a constant value from the touch reference)
**D. Touch Level**: Touch Reference - Count Value
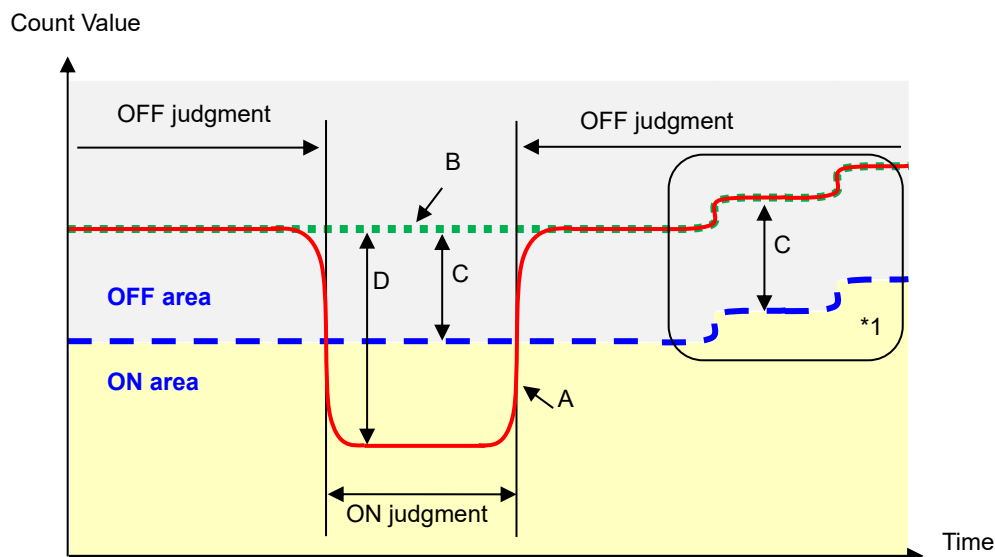


*1: Count Value at the time of non-touch (OFF state) may change due to changes in the surrounding environment.
Since the calibration function is provided, Count Value is used as the average value of Count Value, so that stable touch detection can be obtained without being affected by changes in the surrounding environment. It is also possible to turn off the calibration function. Please contact our sales representative for details.

*2: If the ON judgment period continues for 10s, Count Value is reset as Touch Reference and automatically switches from ON judgment to OFF judgment to prevent foreign objects or unexpected conductors from adhering and continuing the ON judgment. It is also possible to turn off the function. Please contact our sales representative for details.

## 7.2 Basic Operation

The display module features a touch panel for handling input by fingertip or touch pen, etc. FLETAS touch panel function sends data for the input position coordinates.

| Touch action (Contact by fingertip, touch pen, etc) | Touch sensed | Calculation (Input position) |
|---|---|---|
| Data transmit (I²C) | ← | Transmit buffer (1) (2) (Data format in coordinates mode: x, y) |
| Data transmit (I²C) | ← | HID touch report |
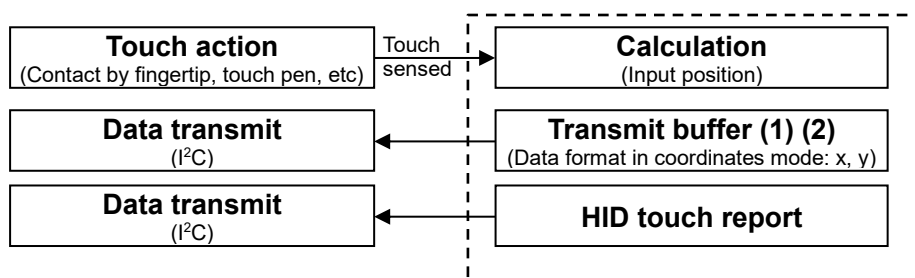
Notes:
(1) The number of simultaneous touches recognized depends on the touch mode.
   * For Noritake original format
(2) Touch information is queued when touch panel data transmit is ON and sufficient space is available in the transmit buffer (buffer capacity: 128 bytes). When there is insufficient space, touch actions are not queued, so the queued data should be periodically read.
   * For Noritake original format
(3) At power on, please wait enough time (min. 1s) and do not touch the panel until hardware calibration is finished.

## 7.3 Touch Modes

There are two touch modes. Single-touch mode (default) recognizes only one touch at a time, generating continuous touch reports while the touch continues, stopping the reports when touch is released. This mode is software-compatible with resistive touch panel modules. Multi-touch mode recognizes a maximum of 1 to 10 (configurable) touch(es), generating touch reports only when changes (touch / release / touch position change) occur.
   * For Noritake original format

### 7.4 Touch Data Read Format

FLETAS touch panel is configured as a display area. The (x, y) coordinate values of the input position (in 1-pixel units) are reported.

0 (0000h) $\leqq$ x $\leqq$ 799 (031Fh)

0 (0000h) $\leqq$ y $\leqq$ 479 (01DFh)

* The upper left is the origin (0, 0).

**Function:** Send touch data in the following format.

Transmitted data format (Single-touch mode):

| Transmitted data | Hex | Data length |
|---|---|---|
| (1) Header | 10h | 1 byte |
| (2) Identifier | 00h | 1 byte |
| (3) Data | 00h–FFh | 4 bytes<br>tXL: x-coordinate, lower byte<br>tXH: x-coordinate, upper byte<br>tYL: y-coordinate, lower byte<br>tYH: y-coordinate, upper byte |

Touch data is transmitted when FLETAS touch panel is touched.

Transmitted data format (Multi-touch mode):

| Transmitted data | Hex | Data length |
|---|---|---|
| (1) Header | 10h | 1 byte |
| (2) Identifier | 10h, 11h | 1 byte<br>10h: Released<br>11h: Touched |
| (3) Touch number | 01h–0Ah | 1 byte |
| (4) Data | 00h–FFh | 4 bytes<br>tXL: x-coordinate, lower byte<br>tXH: x-coordinate, upper byte<br>tYL: y-coordinate, lower byte<br>tYH: y-coordinate, upper byte |

Touch data is transmitted, for each detected touch, when FLETAS touch panel is touched or released, or a touch position changes.

When touch position changes, information for the new position is transmitted.

# 8    Commands List

| Command name | Hex code | Operation | Page |
|---|---|---|---|
| Touch Mode selection: Single-Touch Mode / Multi-Touch Mode | 1Fh 50h 01h n<br>Default: n = 00h | Select single / multi touch mode and maximum simultaneous touch detection (for multi-touch mode).<br>n: touch mode<br>00h: Single-touch mode<br>01h ≤ n ≤ 0Ah: Multi-touch mode<br>(n = maximum simultaneous touches) | P19 |
| Touch Panel Data Transmit ON/OFF | 1Fh 50h 20h m<br>Default: m = 00h (Transmit OFF) | Sets whether or not touch operation data is transmitted to the host.<br>m: Transmit ON/OFF<br>m = 00h: Transmit OFF<br>m = 01h: Transmit ON | P19 |
| Touch Panel Data Transmit ON/OFF for HID | 1Fh 50h 22h m<br>Default: m = 03h | Sets whether or not touch operation data is transmitted to the host via HID.<br>m: Transmit ON/OFF<br><table><tr><td>m</td><td>I²C</td></tr><tr><td>00h</td><td rowspan="2">OFF</td></tr><tr><td>01h</td></tr><tr><td>02h</td><td rowspan="2">ON</td></tr><tr><td>03h</td></tr></table> | P19 |
| Touch Parameter Setting | 1Fh 4Bh 70h a [b (c)]<br>Default:<br>Threshold setting<br>b = Memory switch setting<br>(default: 50h)<br>Gain setting<br>b = Memory switch setting<br>(default: 06h)<br>Touch standard references usage (on/off)<br>b = 00h | Touch parameter setting.<br>a : parameter selection / operating designation<br>a = 00h: Threshold setting<br>a = 04h: Gain setting<br>a = 06h: Touch standard references setting procedure<br>a = 07h: Touch standard references usage (on/off)<br>a = 08h: Touch standard references usage status read<br>b,c: set value | P19 |
| Touch Setting Package Data Store | 1Fh 28h 65h 1Ch a d[1] … d[1024] | Touch setting package data is stored.<br>a: Touch setting package data storing destination<br>01h ≤ a ≤ 04h<br>d: Package data<br>00h ≤ d ≤ FFh | P19 |
| Touch Setting Package Selection | 1Fh 4Bh 70h 10h a<br>Default: a = Memory switch setting<br>(default: 00h) | Select touch setting package to use.<br>a: Touch setting package data storing destination<br>00h ≤ a ≤ 04h | P21 |
| Backlight Brightness Level Setting | 1Fh 58h n<br>Default: n = Memory switch setting<br>(default: FFh) | Set display brightness level.<br>Brightness level ≑ (n / 255) × 100 [%] | P21 |
| Initialization | 1Bh 40h | Set various settings to the initial state. | P21 |
| Memory Switch Setting | 1Fh 28h 65h 03h a b<br>1Fh 28h 65h 03h a b c(1) d(1) [...c(b) d(b) ] | Set memory switch<br>- Single Memory switch setting (00h ≤ a ≤ 3Fh)<br>a: Memory switch number<br>b: Setting value<br>00h ≤ b ≤ FFh<br>- Multiple Memory switch setting (a = FFh)<br>b: Number of setting<br>01h ≤ b ≤ FFh<br>c: Memory switch number<br>00h ≤ c ≤ 3Fh<br>d: Setting value<br>00h ≤ d ≤ FFh | P22 |
| Memory Switch Data Send | 1Fh 28h 65h 04h a<br>1Fh 28h 65h 04h a b c(1) [...c(b)] | Send the contents of memory switch data.<br>- Single memory switch read (00h ≤ a ≤ 3Fh)<br>a: Memory switch number<br>- Multiple memory switch read (a = FFh)<br>b: Number of reads<br>01h ≤ b ≤ FFh<br>c: Memory switch number<br>00h ≤ c ≤ 3Fh<br>d: Setting value<br>00h ≤ c ≤ 3Fh | P22 |
| Product Status Send | 1Fh 28h 65h 40h a [ b c ] | Send product status information.<br>a: Information<br>a = 01h: Boot version information<br>a = 02h: Firmware version information<br>a = 20h: Memory checksum information<br>a = 30h: Product type information<br>a = 40h: Display x pixel information<br>a = 41h: Display y pixel information<br>a = 70h: Touch setting package name<br>a = 71h: Touch setting package ID<br>a = 72h: Touch sensitivity (current gain) setting value<br>a = 73h: Touch sensitivity (current threshold) setting value<br>b: Start address<br>c: Data length | P23 |

# 9 Commands

These commands can be sent by I²C.

The commands refer to operation using the optional Noritake original commands. These commands are not needed for the standard HID protocol.

## 9.1 US P 01h n (Touch Mode selection: Single-Touch Mode / Multi-Touch Mode)

**Code:** 1Fh 50h 01h n

n: touch mode

**Definable area:** 00h ≤ n ≤ 0Ah

00h: Single-touch mode

01h ≤ n ≤ 0Ah: Multi-touch mode (n = maximum simultaneous touches)

**Default:** n = 00h

**Function:** Select single / multi touch mode and maximum simultaneous touch detection (for multi-touch mode).

Refer to 7.4 Touch Data Read Format for transmitted data format

## 9.2 US P 20h m (Touch Panel Data Transmit ON / OFF)

**Code:** 1Fh 50h 20h m

m: Transmit ON/OFF

**Definable area:** 00h ≤ n ≤ 01h

m = 00h: Transmit OFF

m = 01h: Transmit ON

**Default:** m = 00h (Transmit OFF)

**Function:** Sets whether or not touch operation data is transmitted to the host.

When OFF, touch operation data is not placed in the transmit buffer.

Touch panel data is queued when touch panel data transmit is ON and sufficient space is available in the transmit buffer (buffer capacity: 128 bytes). When there is insufficient space, touch actions are not queued, so the queued data should be periodically read.

## 9.3 US P 22h m (Touch Panel Data Transmit ON / OFF for HID)

**Code:** 1Fh 50h 22h m

m: Transmit ON/OFF

**Definable area:** 00h ≤ m ≤ 03h

| m | I²C |
|-----|-----|
| 00h | OFF |
| 01h | |
| 02h | ON |
| 03h | |

**Default:** m = 03h

**Function:** Sets whether or not touch operation data is transmitted to the host via HID.

When transmit ON, the touch report is generated and transmitted according to HID.

When transmit OFF, no touch report is generated.

## 9.4 US K 70h （Touch Parameter Setting）

**Code:** 1Fh 4Bh 70h a [b [c]]

a : parameter selection / operation designation

b, c : set value

**Definable area:** a = 00h: Threshold setting ('c' not used)

00h ≤ b ≤ FFh : threshold value

a = 04h: Gain setting ('c' not used)

00h ≤ b ≤ 0Fh : gain value

a = 06h: Touch standard references setting procedure

00h ≤ b ≤ FFh : maximum allowable noise during measurement

(Setting fails if noise on any channel exceeds this value)

00h ≤ c ≤ FFh : number of measurements to make

a = 07h: Touch standard references usage (on/off) ('c' not used)

00h ≤ b ≤ 01h : 00h (off), 01h (on)

a = 08h: Touch standard references usage status read ('b', 'c' not used)

**Function:** Touch parameter setting.

### 9.4.1 Threshold and Gain (a = 00h / 04h)
These commands are used for adjusting touch sensitivity.
Decreasing the threshold value increases sensitivity.
Increasing the threshold value reduces sensitivity.
Optimum gain value depends on the touch sensor construction.  This should be left at the factory default value.
Settings take effect immediately, but they are not stored in non-volatile memory.

### 9.4.2 Touch Standard References Related Commands (a = 06h / 07h / 08h)
The touch standard references function is an optional function that can be used to help improve the reliability of touch detection with changing environmental conditions, such as water on the screen.  In order to improve the reliability of touch detection using this function, it is necessary to execute "touch standard references setting procedure" once (see below) for each module and confirm the result is "success".  To ensure that accurate reference values are measured, this command must be run in a controlled environment (for example, in the final stage of product assembly) with the product in its final form (mounting case, a cover, etc.), with no touches, moisture, or other foreign matter. If touch standard references have been successfully set as described above, the function can then be enabled with the "touch standard references usage" command.  If standard reference values are not set, or if "touch standard reference usage" has not been set to "on", this function is not used. (In this situation, touch detection operates with base-level performance).

a = 06h: Touch Standard Reference Setting Procedure
In order to measure accurate reference values, this procedure must be run in a controlled environment (no touches, moisture, foreign objects, or excessive noise) with the product in its actual usage configuration (casing, a cover, etc.).  When the touch standard references setting procedure command is executed, FLETAS touch panel is measured two (or more) times, and if the differences between the measurements (noise level) for all measurement points (channels) is less than b, the measurement is "successful".  If exceeded for any channel, measurement is "failed".   The noise level of the channel with the most noise and the x, y sensor position of that channel are provided in the response data.
If the measurement is successful, touch standard references usage is set to "on".  If it fails, it is set to "off".
The reference values are saved in the touch controller, but the touch standard reference usage setting is not saved, so it is necessary to issue the touch standard reference usage (on) command after a reset or restart.

Response data (4 bytes)
00h NNh NXh NYh = Success (noise is within the limit)
01h NNh NXh NYh = Failure (noise limit exceed)
02h zzh zzh zzh = Failure (other problems / defects)
NNh = Noise value of noisiest channel
NXh = Noisiest channel X
NYh = Noisiest channel Y
zzh = Undefined value on failure

| Transmitted data | Hex | Data length |
|---|---|---|
| Status | 00h～02h | 1 byte |
| NNh / zzh | 00h～FFh | 1 byte |
| NXh / zzh | 00h～15h | 1 byte |
| NYh / zzh | 00h～0Ch | 1 byte |

a = 07h: Touch Standard Reference Usage (ON/OFF) ('c' not used)
b = 00h: OFF (initial value)
b = 01h: ON
Note: "ON" setting has no effect if a valid reference values have not been stored in the touch controller using the above "Touch Standard References Setting Procedure" command.

a = 08h: Touch Standard Reference Usage Status Read ('b', 'c' not used)
        Response data (1 byte): 00h = off   01h = on

Note: The following data will be transmitted from the interface that is currently enabled.

| Transmitted data | Hex | Data length |
|---|---|---|
| Data | 00h/01h | 1 byte |

## 9.5 US ( e 1Ch a d[1] … d[1024]　　(Touch Setting Package Data Store)

**Code:**　　**1Fh　28h　65h　1Ch　a　d[1] … d[1024]**
        a:　　Touch setting package data storing destination
        d:　　Package data
**Definable area:**　　01h ≤ a ≤ 04h
        00h ≤ d ≤ FFh
**Function:**　Touch setting package data is stored.

After storing a Touch Setting Package, it can be enabled using the Touch Setting Package Selection command and/or selected as default on startup by setting memory switch (MSW63).
The sensitivity settings in the Touch Setting Package are not used unless enabled by setting memory switch (MSW62).
Please contact our sales consultant for provision of touch setting package data if required.

## 9.6 US K 70h 10h a　　(Touch Setting Package Selection)

**Code:**　　**1Fh　4Bh　70h　10h　a**
        a:　　Touch setting package data storing destination
**Definable area:**　　a = 00h:　　Factory default settings.
        01h ≤ a ≤ 04h:　Touch setting package 1 to 4.
**Default:**　　Memory switch setting MSW63 (default: a = 00h).
**Function:**　Select touch setting package to use.
After executing this command, the touch control will use the selected touch setting package. The desired Touch Setting Package must be stored in advance using the Touch Setting Package Data Store command.

## 9.7 US X n　　(Backlight Brightness Level Setting)

**Code:**　　**1Fh　58h　n**
        n:　　Brightness level setting
**Definable area:**　　00h ≤ n ≤ FFh
**Default:**　　Memory switch setting MSW5 (default: n = FFh).
**Function:**　Set display brightness level.

Brightness level ≒ (n / 255) × 100 [%]

## 9.8 ESC @　　(Initialization)

**Code:**　　**1Bh　40h**
**Function:**　Set various settings to the initial state.

Restores various software settings to power-on state.
The contents of the receive buffer are retained.
Any changes to MSW 5, 58, 59, 62, 63 take effect when executing this command, but changes to MSW 46, 47 do not take effect until the next power-on or reset.

## 9.9 US ( e 03h a b c(1) d(1) [… c(b) d(b)] (Memory Switch Setting)

**Code:** 1Fh 28h 65h 03h a b or
1Fh 28h 65h 03h a b c(1) d(1) [ … c(b) d(b) ]
Single Memory switch setting (a = 00h - 3Fh):
    a: Memory switch number
    b: Setting value

Multiple Memory switch setting (a = FFh):
    b: Number of settings
    c: Memory switch number
    d: Setting value

**Definable area:**

Single Memory switch setting:
    $00h \leq a \leq 3Fh$
    $00h \leq b \leq FFh$

Multiple Memory switch setting:
    $a = FFh$
    $01h \leq b \leq FFh$
    $00h \leq c \leq 3Fh$
    $00h \leq d \leq FFh$

**Function:** Set memory switch.

This command has single memory switch setting (a = 00h to 3Fh) and multiple memory switch setting (a = FFh).
Memory switch details: Refer to section 12 Memory Switch.

## 9.10 US ( e 04h a b c(1) [… c(b)] (Memory Switch Data Send)

**Code:** 1Fh 28h 65h 04h a
1Fh 28h 65h 04h a b c(1) [… c(b)]
Single memory switch read (a = 00h - 3Fh):
    a: Memory switch number

Multiple memory switch read (a = FFh):
    b: Number of reads
    c: Memory switch number

**Definable area:**

Single memory switch read:
    $00h \leq a \leq 3Fh$
Multiple memory switch read:
    $a = FFh$
    $01h \leq b \leq FFh$
    $00h \leq c \leq 3Fh$

**Function:** Send the contents of memory switch data.

A single memory switch can be read (a=00h–3Fh) or multiple memory switches can be read (a=FFh).
The following data is transmitted from the currently active interface:

| Transmitted data | Hex | Data length |
|---|---|---|
| (1) Header | 28h | 1 byte |
| (2) Identifier 1 | 65h | 1 byte |
| (3) Identifier 2 | 04h | 1 byte |
| (4) Data | 00h–FFh | 1 byte / b bytes |

Memory switch details: Refer to section 12 Memory Switch.

### 9.11 US ( e 40h a [b c]          (Product Status Send)
**Code:**      1Fh  28h  65h  40h  a  [b c]

a:     Information

**Definable area:**     a = 01h:   Boot version information (b, c not used)

a = 02h:   Firmware version information (b, c not used)

a = 20h:   Memory checksum information

00h ≤ b ≤ FFh: Start address (Effective address = b×10000h)

01h ≤ c ≤ FFh: Data length (Effective data length = c×10000h)

a = 30h:   Product type information (b, c not used)

a = 40h:   Display x pixel information (b, c not used)

a = 41h:   Display y pixel information (b, c not used)

a = 70h:   Touch setting package name (b, c not used)

a = 71h:   Touch setting package ID (b, c not used)

a = 72h:   Touch sensitivity (current gain) setting value (b, c not used)

a = 73h:   Touch sensitivity (current threshold) setting value (b, c not used)

**Function:**  Send product status information.

The following data is transmitted from the currently active interface:

| Transmitted data | Hex | Data length |
|---|---|---|
| (1) Header | 28h | 1 byte |
| (2) Identifier 1 | 65h | 1 byte |
| (3) Identifier 2 | 40h | 1 byte |
| (4) Data | 00h–FFh | a = 01h:   4 bytes<br>a = 02h:   4 bytes<br>a = 20h:   4 bytes<br>a = 30h:   15 bytes<br>a = 40h:   3 bytes<br>a = 41h:   3 bytes<br>a = 70h:   15 bytes<br>a = 71h:   4 bytes<br>a = 72h:   1 byte<br>a = 73h:   1 byte |

# 10   Connectors

## 10.1   CN4 (RGB Parallel, I²C, PWM, Power Supply）

Connector P/N: XF2M-5015-1A, or equivalent

| Pin No. | Signal name | I/O | Internal processing |
|---|---|---|---|
| 1 | VCC1 (5V) | Power | - |
| 2 | VCC1 (5V) | Power | - |
| 3 | VCC1 (5V) | Power | - |
| 4 | VCC2 (3.3V) | Power | - |
| 5 | VCC2 (3.3V) | Power | - |
| 6 | GND | Power | - |
| 7 | GND | Power | - |
| 8 | LCD_CLK | Input | Pull down: R=100KΩ |
| 9 | LCD_HSYNC | Input | Pull up with +3.3V: R=100KΩ |
| 10 | LCD_VSYNC | Input | Pull up with +3.3V: R=100KΩ |
| 11 | LCD_ENABLE | Input | Pull down: R=100KΩ |
| 12 | GND | Power | - |
| 13 | LCD_DATB2 | Input | Pull down: R=100KΩ |
| 14 | LCD_DATB3 | Input | Pull down: R=100KΩ |
| 15 | LCD_DATB4 | Input | Pull down: R=100KΩ |
| 16 | LCD_DATB5 | Input | Pull down: R=100KΩ |
| 17 | LCD_DATB6 | Input | Pull down: R=100KΩ |
| 18 | LCD_DATB7 | Input | Pull down: R=100KΩ |
| 19 | GND | Power | - |
| 20 | LCD_DATG2 | Input | Pull down: R=100KΩ |
| 21 | LCD_DATG3 | Input | Pull down: R=100KΩ |
| 22 | LCD_DATG4 | Input | Pull down: R=100KΩ |
| 23 | LCD_DATG5 | Input | Pull down: R=100KΩ |
| 24 | LCD_DATG6 | Input | Pull down: R=100KΩ |
| 25 | LCD_DATG7 | Input | Pull down: R=100KΩ |
| 26 | GND | Power | - |
| 27 | LCD_DATR2 | Input | Pull down: R=100KΩ |
| 28 | LCD_DATR3 | Input | Pull down: R=100KΩ |
| 29 | LCD_DATR4 | Input | Pull down: R=100KΩ |
| 30 | LCD_DATR5 | Input | Pull down: R=100KΩ |
| 31 | LCD_DATR6 | Input | Pull down: R=100KΩ |
| 32 | LCD_DATR7 | Input | Pull down: R=100KΩ |
| 33 | GND | Power | - |
| 34 | /RESET | Input | Pull Up with +3.3V: R=4.7KΩ |
| 35 | /18BIT_ENABLE | Input | Pull Up with +3.3V: R=4.7KΩ |
| 36 | NC | - | - |
| 37 | BOOT | Input | Pull Up with +3.3V: R=4.7KΩ *1 |
| 38 | GND | Power | - |
| 39 | I²C INT | Output | Connected CPU via series resistance |
| 40 | I²C SDA | I/O | Pull up with +3.3V: R=4.7KΩ |
| 41 | I²C SCL | I/O | Pull up with +3.3V: R=4.7KΩ |
| 42 | LCD_DATB0 | Input | Pull down: R=100KΩ |
| 43 | LCD_DATB1 | Input | Pull down: R=100KΩ |
| 44 | LCD_DATG0 | Input | Pull down: R=100KΩ |
| 45 | LCD_DATG1 | Input | Pull down: R=100KΩ |
| 46 | LCD_DATR0 | Input | Pull down: R=100KΩ |
| 47 | LCD_DATR1 | Input | Pull down: R=100KΩ |
| 48 | NC | - | - |
| 49 | PWM | Input | Pull down: R=100KΩ |
| 50 | GND | Power | - |

*1 Factory use only. Do not connect.

## 10.2    Connection Examples

Since this module has the same pin assignments as Armadillo-640 manufactured by Atmark Techno, Inc., direct connection is possible with it.

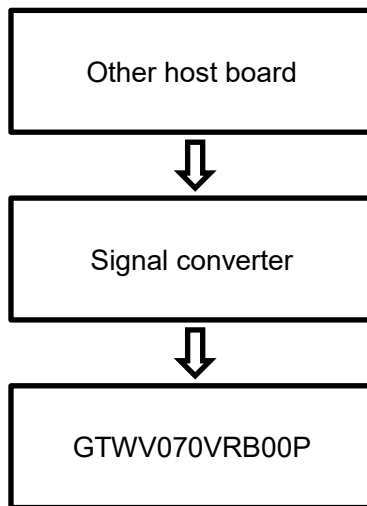< Connection example >
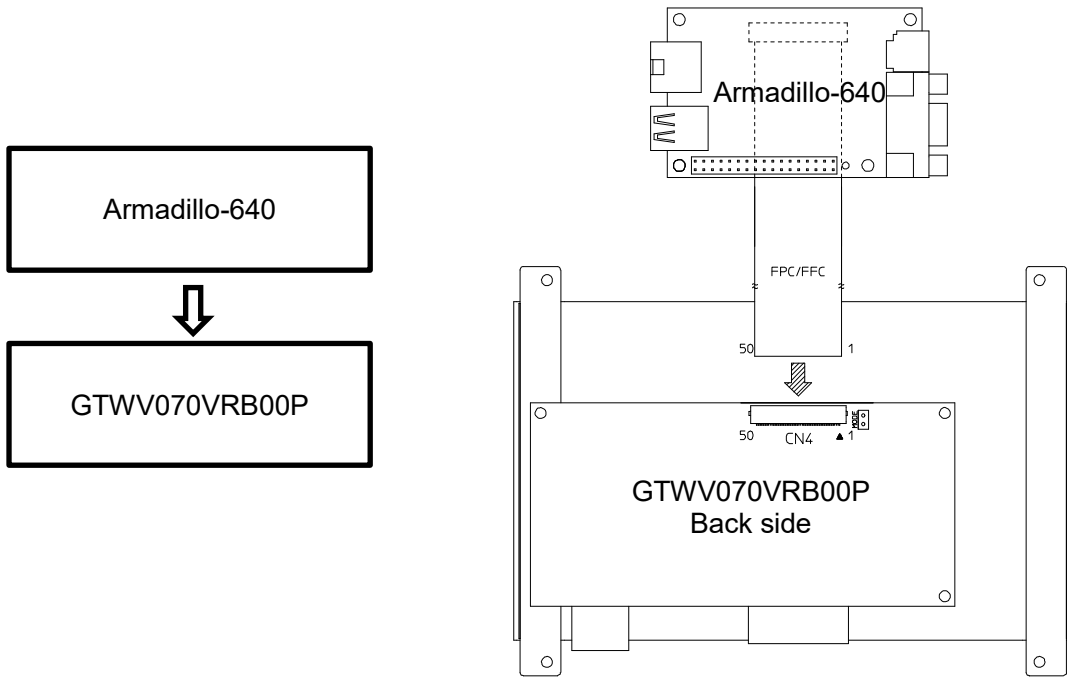


CN4 and Armadillo-640 have contacts on both sides. To avoid damage, be sure to correctly match the pin numbers when connecting the FPC / FFC cable.

< Connection with other host boards >

If the pin assignment of this product and host board are different, please convert the signal.



CN4 has contacts on both sides. To avoid damage, be sure to correctly match the pin numbers when connecting the FPC / FFC cable.

## 11    Installation Method

FLETAS touch panels are made of glass. When using this product, please be sure to install a protective overlay such as cover glass, acrylic plate, etc.  Since this touch panel is capacitive type, touch will not work if a conductive material is placed on the touch area or bezel area.  Please use non-conductive material like a glass or acrylic panel as a cover.  An example is shown below.
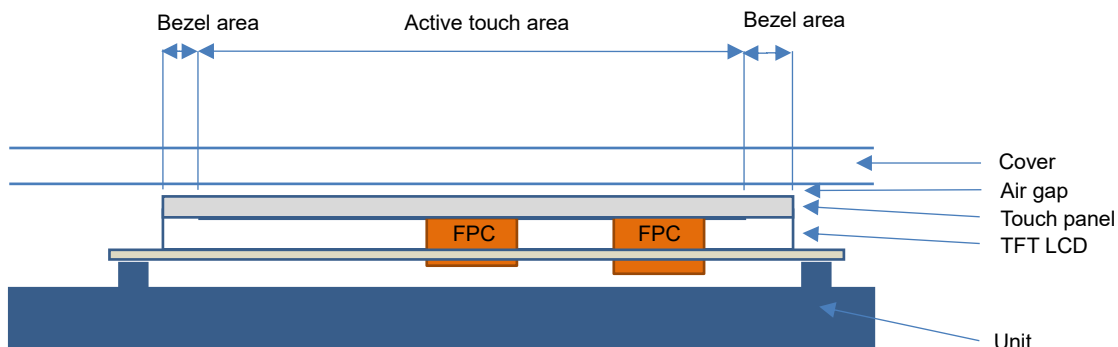
Installation example

- Edges and corners of the FLETAS touch panel are sharp, so please be careful with installation.
- Strong impact may cause destruction.
- Do not hold the cable (FPC) of the FLETAS touch panel, and do not install such that stress is applied to the cable.
- Please handle this product carefully because it is a precision part.  When holding this product, please touch PCB edge, not FLETAS touch panel.

## 12    Memory Switch

Each parameter shown in the below table is set by the value of each memory switch at power-on.

| Switch No. | Function | Valid range | Default |
|---|---|---|---|
| 0-4 | Reserved | - | - |
| 5 | Brightness level setting | 00h–FFh | FFh |
| 6-45 | Reserved | - | - |
| 46 | I2C slave address setting for HID (*1) | 08h–77h, FFh (invalid) | 51h |
| 47 | I2C slave address setting for Noritake original commands | 00h, 08h–77h, 88h–F7h (*2) | 50h |
| 48-57 | Reserved | - | - |
| 58 | Touch sensitivity (signal gain) setting (*3) | 00h–0Fh | 06h |
| 59 | Touch sensitivity (threshold) setting | 00h–FFh | 50h |
| 60-61 | Reserved | - | - |
| 62 | Touch sensitivity setting selection at startup<br>00h: Apply the setting values of memory switch 58 and 59<br>01h: Apply touch setting package value | 00h, 01h | 00h |
| 63 | Touch setting package selection at startup<br>00h: Factory setting<br>01h: Touch setting package 1<br>02h: Touch setting package 2<br>03h: Touch setting package 3<br>04h: Touch setting package 4 | 00h – 04h | 00h |

Note:   Module operates with default value if memory switch value is outside the valid range.
*1: If MSW46 value is the same as lower 7 bits of MSW47 value, MSW46 becomes invalid, and MSW47 takes precedence.
*2: If bit 7 is '1', this product will also respond on the general call address (00h).
*3: Generally, MSW58 should not be changed from the default value (06h). Touch sensitivity adjustments, if necessary, should be made by changing the threshold value only (MSW59).

## 13    **Lot No. / Firmware Version**

Lot No. and firmware version are displayed on this product. They are determined based on the following specifications.

Example:

Lot No.       Firmware version

18C22EH    F100

A  B  C        D

A: Production year           Indicated the last two digits of the Christian era.
B: Production month         Indicated by one letter of English character.
                                      January = A, February = B, March = C   …
C: Production date           Indicated the production date as one or two digits.
D: Firmware version         Indicated the firmware version.

Upper example is the product manufactured on March 22, 2018. The firmware version is F100

< Lot label position >



Lot label position

Back side

## 14 Outline



DS-2100-0100-00
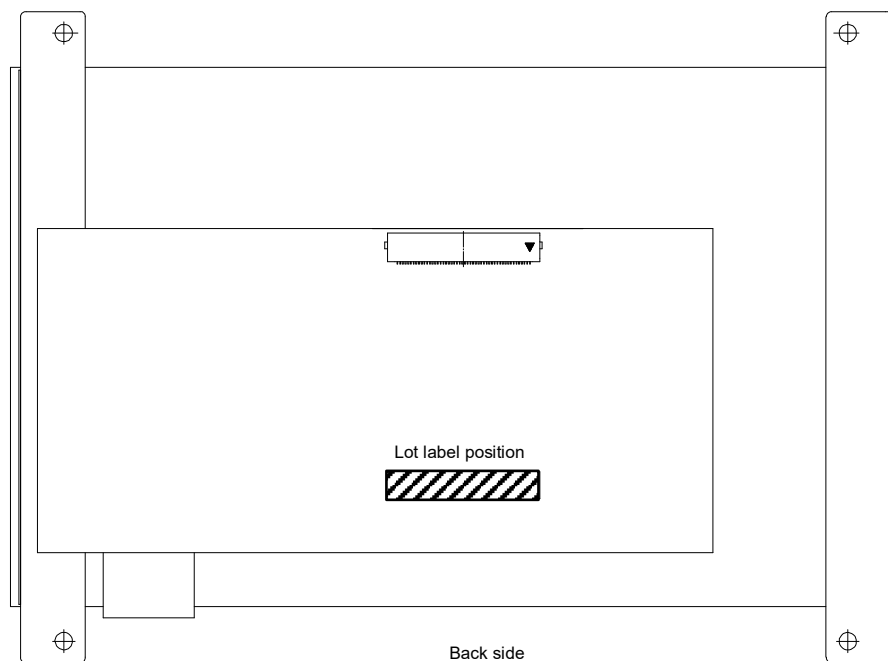
( ): Reference only
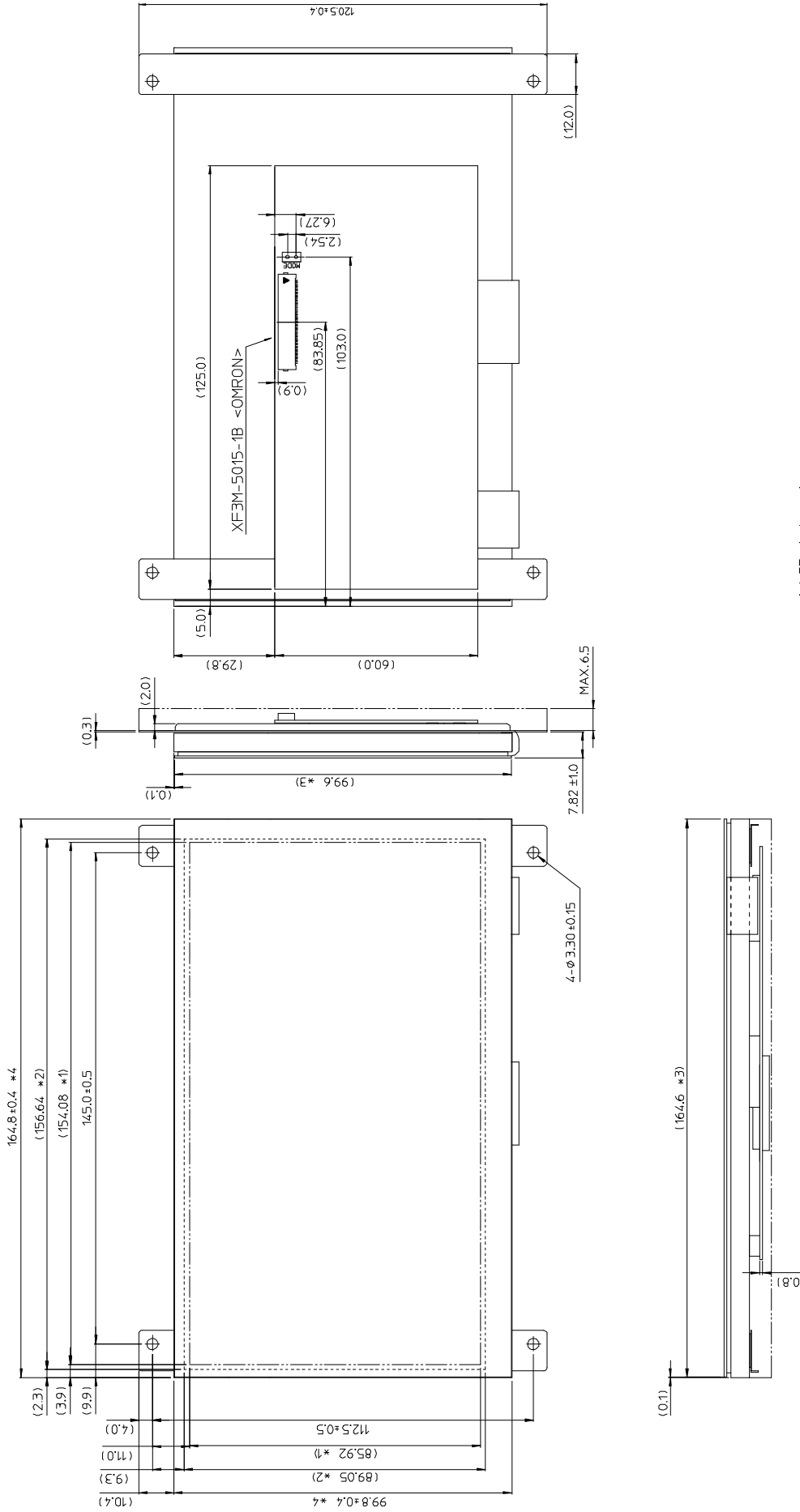
Unit: mm

*1 LCD Active Area
*2 Touch Panel Active Area
*3 Touch Panel Size
*4 LCD Size

XF3M-5015-1B <OMRON>

## 15 Firmware Version Revision History

| Firmware version | Spec.No. | Contents |
|---|---|---|
| F105a or later | DS-2100-0000-00 or later | Initial issue |

## Revision history

| Spec.No. | Date | Revision |
|---|---|---|
| DS-2100-0000-00 | Jun. 9, 2020 | Initial issue |
| | | |