

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

**Specification**

Model: GTWV070VHA00P

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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 the product. 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 electronic parts are densely located 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.



Do not input any signals while the product is not powered. 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 by pulling the cable. Please plug-in or unplug in a straight direction (alignment) with the terminal, without bending or twisting. 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 plug. It may cause damage to the cable or disconnection of the connector. If loads are expected on connectors and cables, use cable ties, etc.

### **[Electrostatic Charge]**



This product uses semiconductor components, so please take precautions against electrostatic discharge during handling and transportation. (If it is judged that the product is defective due to electrostatic destruction during its return to our company, repair may be chargeable.)

### **[Power]**



Please use a fully stabilized power supply. If the power 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.

Exceeding the stated temperature, humidity, vibration, and impact limitations (or 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.

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.

It may cause EMI failure, etc.  
(We cannot assume responsibility for trouble 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

<b>Notice for the Cautious Handling of LCD Modules</b> .....	<b>2</b>
<b>1 General description</b> .....	<b>5</b>
1.1 Constitution .....	5
1.2 Block Diagram .....	5
1.3 Basic Specification .....	6
<b>2 Electrical Specifications</b> .....	<b>7</b>
2.1 Absolute Maximum Rating .....	7
2.2 Electrical Ratings .....	7
2.3 Electrical Characteristics .....	8
<b>3 Environmental Specifications</b> .....	<b>9</b>
<b>4 Physical Specifications</b> .....	<b>9</b>
<b>5 Applicable Specifications</b> .....	<b>9</b>
<b>6 Interfaces</b> .....	<b>10</b>
6.1 USB Interface: CN2 .....	10
6.1.1 USB Interface – Summary .....	10
6.1.2 USB Interface – Technical Details .....	10
6.1.3 USB Connection Indicator .....	10
6.2 UART: CN5 .....	11
6.3 I <sup>2</sup> C: CN5 .....	11
6.4 DVI: CN1 .....	13
6.5 RESET .....	13
6.6 GPIO .....	13
<b>7 FLETAS Touch Panel</b> .....	<b>14</b>
7.1 Outline .....	14
7.1.1 Touch Detection .....	14
7.2 Basic Operation .....	15
7.3 Touch Modes .....	15
7.4 Touch Data Read Format .....	16
<b>8 Power Saving Commands Summary</b> .....	<b>17</b>
<b>9 Commands List</b> .....	<b>18</b>
<b>10 Commands</b> .....	<b>20</b>
10.1 US P 01h n (Touch Mode selection: Single-Touch Mode / Multi-Touch Mode) .....	20
10.2 US P 20h m (Touch Panel Data Transmit ON/OFF) .....	20
10.3 US P 22h m (Touch Panel Data Transmit ON/OFF for HID) .....	20
10.4 US K 70h a [b (c)] (Touch Parameter Setting) .....	20
10.4.1 Threshold and Gain (a = 00h / 04h) .....	21
10.4.2 Touch Standard References Related Commands (a = 06h / 07h / 08h) .....	21
10.5 US ( e 1Ch a d[1] ... d[1024] (Touch Setting Package Data Store) .....	22
10.6 US K 70h 10h a (Touch Setting Package Selection) .....	22
10.7 US X n (Backlight Brightness Level Setting) .....	22
10.8 ESC @ (Initialization) .....	22
10.9 US ( e 03h a b c(1) d(1) [... c(b) d(b)] (Memory Switch Setting) .....	23
10.10 US ( e 04h a b c(1) [... c(b)] (Memory Switch Data Send) .....	23
10.11 US ( e 40h a [b c] (Product Status Send) .....	24
10.12 US ( a 40h p (Display Power Control) .....	24
10.13 US ( a 48h m w (Power Saving Mode) .....	25
10.14 US ( a 49h p (Touch Scan Period Setting at Power Saving Mode) .....	25
10.15 US K 70h a (Touch Level Read) .....	25
<b>11 Connectors</b> .....	<b>26</b>
11.1 DVI: CN1 .....	26
11.2 USB: CN2 .....	26
11.3 UART, I <sup>2</sup> C: CN5 .....	26
11.4 Power connector: CN7 .....	26
11.5 Connector and LED Position .....	27
<b>12 Installation Method</b> .....	<b>27</b>
<b>13 Memory Switch</b> .....	<b>28</b>
<b>14 Outline</b> .....	<b>29</b>
<b>15 Firmware Version Revision History</b> .....	<b>30</b>
<b>Revision history</b> .....	<b>31</b>

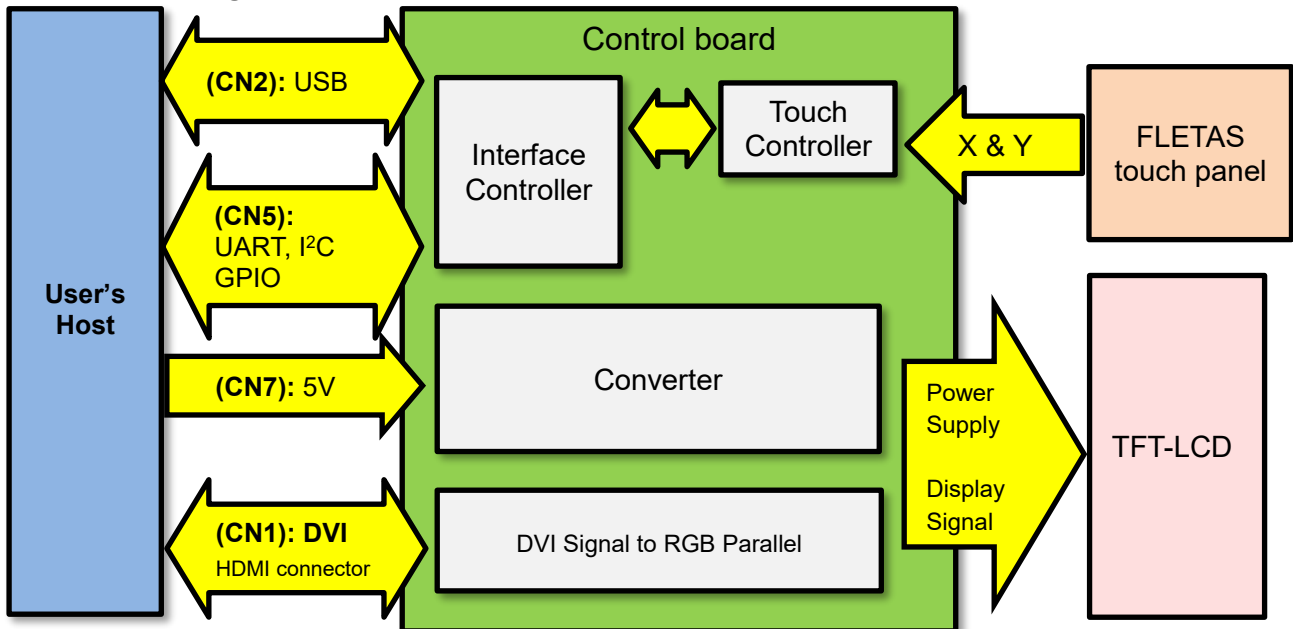
## 1 General description

This specification corresponds to the product specification of GTWV070VHA00P, which is TFT - LCD graphic display module with metallized projective capacitive touch (FLETAS touch panel).

### 1.1 Constitution

This product consists of 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	Input voltage	DC 5V +/- 5%	VCC - GND
	Current	TYP.640mA, MAX.830mA	Backlight brightness 100%
Display	Type	TFT-LCD	
	Size	7.0 inches (display area: 154.08 mm x 85.92 mm)	
	Number of pixels	800 x RGB x 480	
	Colors	16.7M (24-bit color)	
	Recommend viewing direction	12 o'clock	
	Gray scale inversion direction	6 o'clock	
	Brightness	Min. 500 cd/m <sup>2</sup> (nit)、 Typ. 850 cd/m <sup>2</sup> (nit)	100% brightness/ White screen at the center of display (Factory status)
	Display signal interface	DVI	HDMI connector Type A
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	USB (HID compliance, full speed 12Mbps.) I2C (HID compliance, touch data acquisition by commands) UART (touch data acquisition by commands)	
Control	Display commands	Backlight (display brightness) adjustment	UART, I <sup>2</sup> C, USB interface
	Touch commands	Touch sensitivity adjustment, touch mode selection, touch data send, etc.	
	Other commands	Memory switch setting, initialize, etc.	

## 2 Electrical Specifications

### 2.1 Absolute Maximum Rating

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Power supply	Power supply voltage	VCC	-0.3	—	+6.0	V	-
UART	Logic input voltage RXD	VIN1	-0.3	—	3.6	V	VCC=5V
I <sup>2</sup> C	Logic input voltage SCL,SDA	VIN2	-0.3	—	3.6	V	VCC=5V
Common	Logic input voltage /RESET	VIN3	-0.3	—	5.0	V	VCC=5V
GPIO	Logic input voltage GPIO	VIN4	-0.3	—	3.6	V	VCC=5V

### 2.2 Electrical Ratings

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Power supply	Power supply voltage	VCC	4.75	5.0	5.25	VDC	—
UART	Logic input voltage RXD	VIH1	2.7	—	—	VDC	—
		VIL1	—	—	0.6	VDC	—
I <sup>2</sup> C	Logic input voltage SCL,SDA	VIH2	2.7	—	—	VDC	Pull-up resistor 10kΩ
		VIL2	—	—	0.6	VDC	
Common	Logic input voltage /RESET	VIH3	1.5	—	—	VDC	—
		VIL3	—	—	0.3	VDC	—
GPIO	Logic input voltage GPIO	VIH4	2.7	—	—	VDC	—
		VIL4	—	—	0.6	VDC	—

The on-board DC / DC converter generate internal power for logic (3.3V) and TFT-LCD drive.

## 2.3 Electrical Characteristics

Logic input/ output condition

Measuring conditions: ambient temperature = 25°C, VCC=5.0VDC

TMDS clock frequency = 33MHz, refresh rate = 60Hz

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
UART	Logic output voltage TXD *2	VOH1	2.7	—	—	VDC	IOH1 = -2.0mA
		VOL1	—	—	0.5	VDC	IOL1 = 1.5mA
I <sup>2</sup> C	Logic output voltage SCL, SDA	VOL2	0	—	0.5	VDC	IOL2 = 8.0mA
	Logic output voltage /IRQ *3	VOH3	2.7	—	—	VDC	IOH3 = -4.0mA
		VOL3	0	—	0.5	VDC	IOL3 = 8.0mA
	Pull-up resistor SDA, SCL *4	Rp	—	10	—	kΩ	Internal pull-up voltage 3.3V
Power supply	Power supply current	ICC-1	—	640	830	mADC	Brightness 100% All black display Touch interface: valid
		ICC-2	—	380	—	mADC	Brightness 50% All white display Touch interface: valid
		ICC-3	—	50	70	mADC	Brightness 0% No connection Touch interface: valid
		ICC-4	—	20	30	mADC	Power down mode *1 No connection
	Power consumption	P-1	—	3.2	4.2	W	Brightness 100% All black display Touch interface: valid
		P-2	—	1.9	—	W	Brightness 50% All white display Touch interface: valid
		P-3	—	0.3	0.4	W	Brightness 0% No connection Touch interface: valid
		P-4	—	0.1	0.2	W	Power down mode *1 No connection

- 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.
- \*1 Power down mode: please refer to 10.13 Power Saving Mode.
- \*2 Output is high-impedance (Hi-Z) + pull-up resistor (10kΩ typ.) during power-on, reset input, and display internal initialization.  
Pull-up resistor is connected to internal power (3.3V).
- \*3 Output is high-impedance (Hi-Z) during power-on, reset input, and display internal initialization.
- \*4 Pull-up resistor for SDA, SCL are connected to internal power (3.3V).



### 3 Environmental Specifications

Parameter	Content																						
Operating temperature	- 20°C to + 70°C																						
Storage temperature	- 30°C to + 80°C																						
Operating humidity	Temp. $\leq 60$ °C, 80% RH MAX. (No condensation) Temp. $> 60$ °C , absolute humidity shall be less than 80% RH at 60 °C(No condensation)																						
Storage humidity	Temp. $\leq 60$ °C, 80% RH MAX. (No condensation) Temp. $> 60$ °C , absolute humidity shall be less than 80% RH at 60 °C(No condensation)																						
Vibration (non-operating)	10-55-10Hz, all amplitude 1mm, 30 minutes, X-Y-Z																						
Shock (non-operating)	392m/s <sup>2</sup> (40G) 9ms X-Y-Z, 3 times each direction																						
Brightness derating	<table border="1"> <caption>Brightness Derating Data</caption> <thead> <tr> <th>Operating temp (°C)</th> <th>Backlight brightness (%)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>100</td></tr> <tr><td>-10</td><td>100</td></tr> <tr><td>0</td><td>100</td></tr> <tr><td>10</td><td>100</td></tr> <tr><td>20</td><td>100</td></tr> <tr><td>30</td><td>100</td></tr> <tr><td>40</td><td>100</td></tr> <tr><td>50</td><td>75</td></tr> <tr><td>60</td><td>50</td></tr> <tr><td>70</td><td>50</td></tr> </tbody> </table>	Operating temp (°C)	Backlight brightness (%)	-20	100	-10	100	0	100	10	100	20	100	30	100	40	100	50	75	60	50	70	50
Operating temp (°C)	Backlight brightness (%)																						
-20	100																						
-10	100																						
0	100																						
10	100																						
20	100																						
30	100																						
40	100																						
50	75																						
60	50																						
70	50																						

### 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 255g

### 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

Interface *2		Protocol	Connector details
USB	HID *1	HID class standard (Touch screen)	11.2
	WinUSB *1		
UART		Noritake original commands *3	11.3
I <sup>2</sup> C			
DVI		DVI signal	11.1

\*1 Both protocols are available simultaneously.

\*2 All interfaces are available simultaneously.

\*3 If multiple interfaces are used and there is data to be transmitted from this product, transmit data is transmitted from the interface on which data was most recently received.

### 6.1 USB Interface: CN2

#### 6.1.1 USB Interface – Summary

The USB interface is USB 2.0 full-speed (12 Mbps) capable. The USB interface implements a HID class interface for the touch screen, and a WinUSB-compatible interface for Noritake original commands, both of which may be used simultaneously. The display module can be used as a HID and/or WinUSB device, using the standard HID and/or WinUSB drivers respectively. Alternatively, refer to USB Interface – technical details (below) if using the USB interface with a custom driver or embedded system, etc.

Refer to the [USB 2.0 Specification](http://www.usb.org/developers/docs/usb20_docs/) ([http://www.usb.org/developers/docs/usb20\\_docs/](http://www.usb.org/developers/docs/usb20_docs/)) for further details.

#### 6.1.2 USB Interface – Technical Details

The device has a single configuration, with two interfaces, supporting three endpoints for data transfer:

Endpoint	Type	Maximum packet size
Endpoint 0	Control	64 bytes
Endpoint 1	Bulk IN	64 bytes
Endpoint 2	Bulk OUT	64 bytes
Endpoint 3	Interrupt IN	64 bytes

Vendor ID: 0EDA (hex)

Product ID: 12DE (hex)

Device class: 00 (hex) (refer to Interface class)

Interface 0: Class: 03 (hex) (HID)

Interface 1: Class: FF (hex) (vendor-specific)

Interface 0 uses endpoint 3 (interrupt IN) for sending touch reports to the host.

Interface 1 uses endpoints 1 (bulk IN) and 2 (bulk OUT) for bi-directional data transfer.

Refer to the device class definition HID for further details.

<https://www.usb.org/hid>

WinUSB compatibility:

The USB interface supports Microsoft OS String Descriptors, which enable automatic recognition of WinUSB compatibility for applicable operating systems (manual configuration, using an .inf file, is also possible). The GUID below is used by applications on the host in order to access the device.

Device Interface GUID : 6120D798-D192-4463-B0DE-2B65ED2F4870

Refer to WinUSB documentation from Microsoft for further details:

[https://msdn.microsoft.com/en-us/library/windows/hardware/ff540196\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/windows/hardware/ff540196(v=vs.85).aspx)

#### 6.1.3 USB Connection Indicator

LED1 is illuminated when USB cable is inserted and VBUS signal is supplied.

USB cable can be plugged in and unplugged even when it is energized.

### 6.2 UART: CN5

Interface conditions:

Baud rate	4,800 to 115,200bps (set by memory switch) <b>Default setting: 38,400bps</b>
Parity	None, even, odd (set by memory switch) <b>Default setting: None</b>
Format	Start (1 bit) + Data (8 bit) + Parity (0 or 1 bit) + Stop (1 bit)
Communication control signal	-
Transmit buffer	128 bytes
Receive buffer	512 bytes

### 6.3 I<sup>2</sup>C: CN5

Working as an I<sup>2</sup>C slave.

Communication parameters

Communication speed	Max. 400Kbps
Format	I <sup>2</sup> C
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 I<sup>2</sup>C functions. The HID function has priority, such that the signal is controlled exclusively by the HID over I<sup>2</sup>C function, unless HID over I<sup>2</sup>C is disabled (by setting MSW46 = FFh (invalid)). If HID over I<sup>2</sup>C 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.

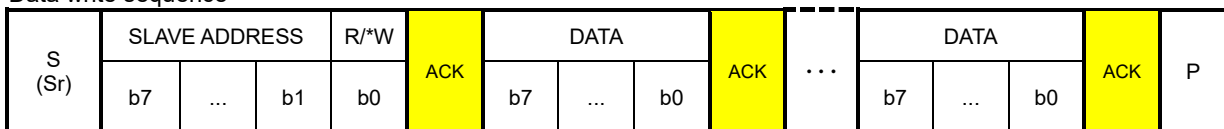
For technical details on HID over I<sup>2</sup>C, refer to the "HID Over I<sup>2</sup>C Protocol Specification" document: <http://msdn.microsoft.com/en-us/library/windows/hardware/hh852380.aspx>

This product's HID descriptor address is 0x0001.

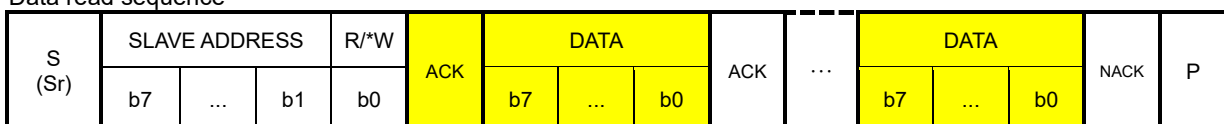
Slave address can be set with memory switch.

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

Data write sequence



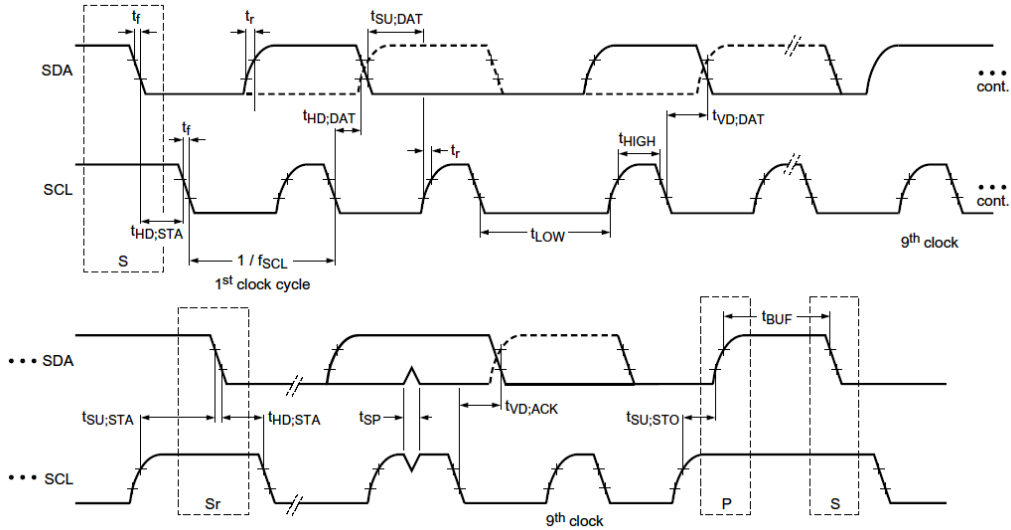
Data read sequence



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

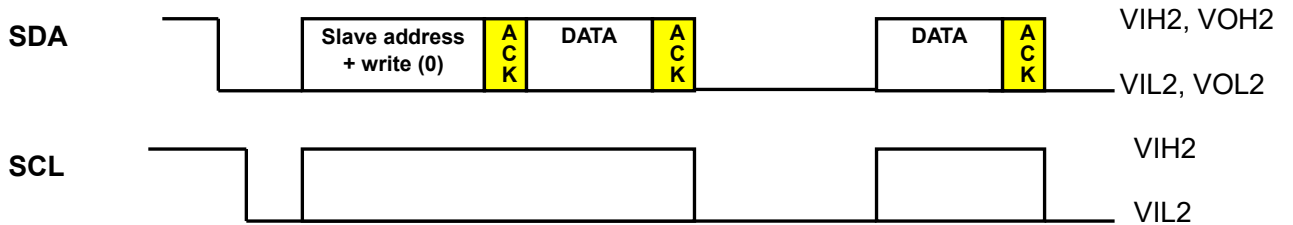
Host (master) is receiver, display module (slave) is transmitter

I<sup>2</sup>C Timing

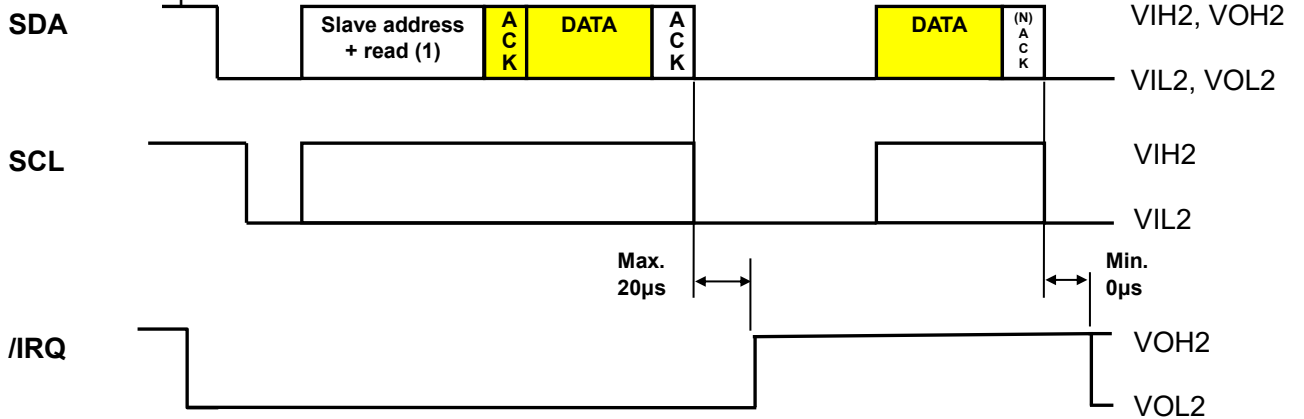


Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
SCL clock frequency	fSCL	-	0	-	400	kHz
Start condition hold time	tHD;STA	-	0.6	-	-	µs
SCL 'L' time	tLOW	-	1.3	-	-	µs
SCL 'H' time	tHIGH	-	0.6	-	-	µs
Start condition setup time	tSU;STA	-	0.6	-	-	µs
Data hold time	tHD;DAT	-	0	-	-	µs
Data setup time	tSU;DAT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



**6.4 DVI: CN1**

HDMI connector (Type A) for video signal input. This product receives DVI signals from the customer host and displays the image by converting it to a signal suitable for the display unit (TFT - LCD).

There is no audio signal output function etc. This product does not support communication standards such as HDCP.

LED2 is illuminated when the display signal is active.

HDMI cable can be plugged in and unplugged even when it is powered.

EDID is supported for plug and play operation when connecting to EDID compatible equipment.

TMDS clock frequency should be within the allowable range.

Parameter	Min.	Typ.	Max.	Unit
TMDS clock frequency	-	33.3	50.0	MHz

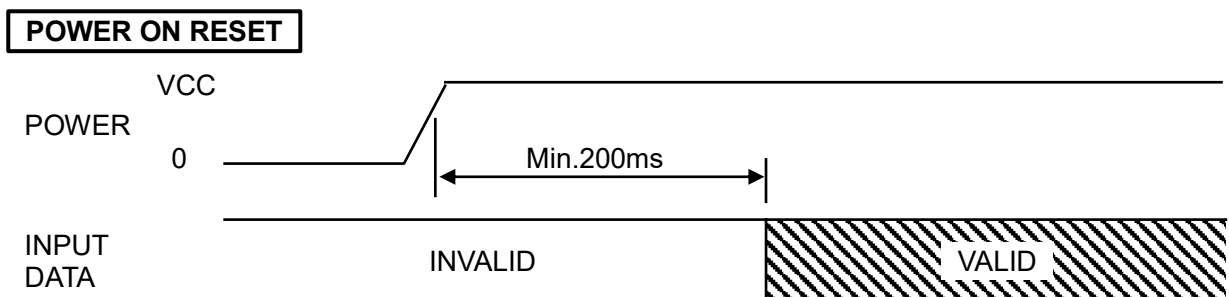
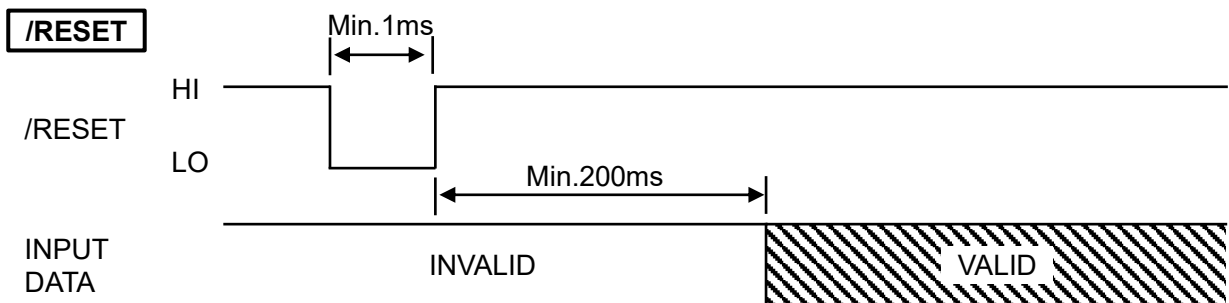
If EDID is not supported, or host settings cause TMDS clock frequency to be outside the allowable range, display image distortion may occur.

**6.5 RESET**

Reset pulse (active low) should be longer than 1ms.

After a reset pulse, a minimum of 200ms must be allowed before attempting to send data. After power on, a minimum of 200ms must be allowed. Data loss may occur if these time periods are not adhered to.

\* /RESET is for the reset signal of the touch system, but the display OFF during reset.



**6.6 GPIO**

The GPIO pins on this product have no function, except for the pin that can be configured as input for wakeup from low power mode.

## 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 - 10)

#### 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>

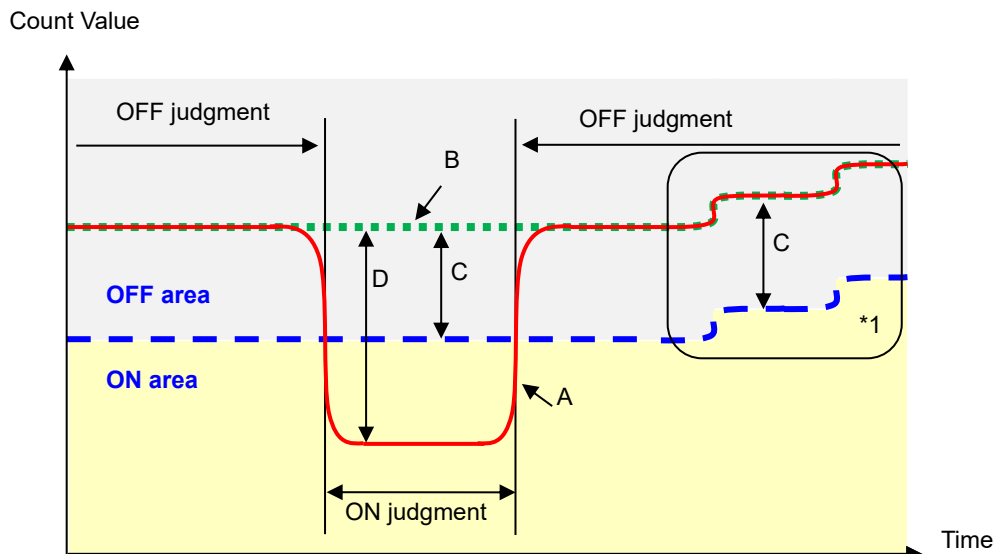
1. If there is no human finger (or equivalent conductor) near the FLETAS touch panel, the OFF judgment is maintained.
2. Count Value decreases as a finger approaches the FLETAS touch panel.
3. When Count Value falls below the threshold, the judgment is ON.
4. Count Value increases when a finger leaves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



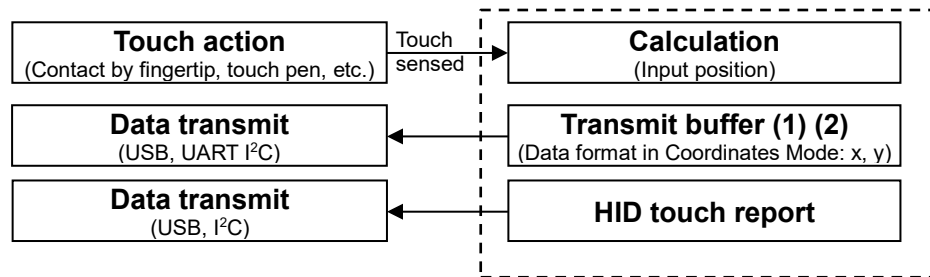
\*1: Count Value at the time of non-touch (OFF state) may change due to changes in the surrounding environment.

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.



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
- \* 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) touches, 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.

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

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

\* 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 tXL: x-coordinate, lower byte tXH: x-coordinate, upper byte tYL: y-coordinate, lower byte 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 10h: Released 11h: Touched
(3) Touch number	01h–0Ah	1 byte
(4) Data	00h–FFh	4 bytes tXL: x-coordinate, lower byte tXH: x-coordinate, upper byte tYL: y-coordinate, lower byte tYH: y-coordinate, upper byte

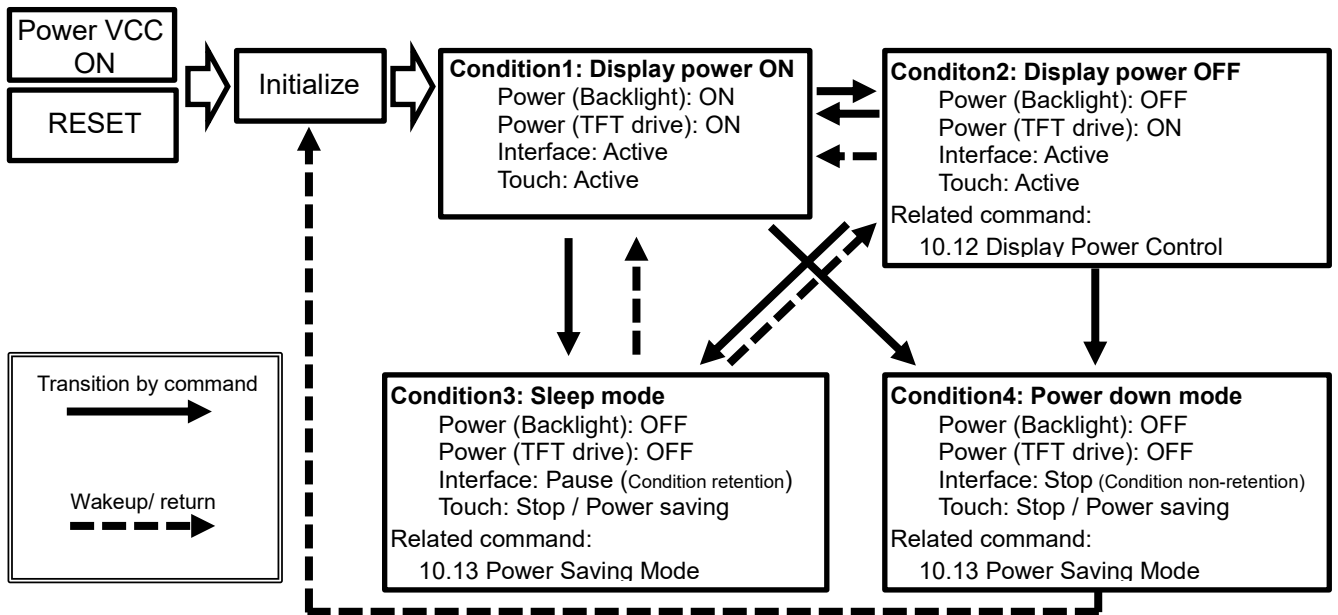
Touch data is transmitted, for each detected touch, when FLETAS touch panel is touched or released, or a touch position changes.

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



### 8 Power Saving Commands Summary

The following diagram and table provide a summary of the available power saving states, and the possible transitions between states. Refer to the applicable command descriptions for further details.



Commands	Parameter	Power		Interface controller	Touch controller	Wakeup/ return method
		Backlight	TFT drive			
Display power control	OFF p = 00h	OFF	ON	Active	Active	Display Power Control command
	ON p = 01h	ON	ON	Active	Active	-
	Auto-ON p = 80h	OFF→ON	ON	Active	Active	Display Power Control command, touch
Power Saving Mode Power down mode m = 00h	No wakeup set w = 00h	OFF	OFF	Stop	Stop	-
	Wakeup by touch b0 = 1	OFF	OFF	Stop	Power saving	Touch
	Wakeup by GPIO input b4 = 1, b5, b6	OFF	OFF	Stop	Stop	GPIO input
	Wakeup by USB VBUS rising b7 = 1	OFF	OFF	Stop	Stop	VBUS rising edge
Power Saving Mode Sleep mode m = 01h	No wakeup set w = 00h	OFF	OFF	Pause (Condition retention)	Stop	-
	Wakeup by touch b0 = 1	OFF	OFF	Pause (Condition retention)	Power saving	Touch
	Wakeup by GPIO input b4 = 1, b5, b6	OFF	OFF	Pause (Condition retention)	Stop	GPIO input
	Wakeup by USB VBUS rising b7 = 1	OFF	OFF	Pause (Condition retention)	Stop	VBUS rising edge

\* Regardless of the current power saving state, external reset input or power cycling VCC will result in a return to normal operation.

\* Multiple wakeup methods can be selected at the same time when using the Power Saving Mode Shift command, in which case any of the selected methods can cause a wakeup.

## 9 Commands List

Command Name	Hex Code	Function	Page															
Touch Mode selection: Single-Touch Mode / Multi-Touch Mode	1Fh 50h 01h n Default: n = 00h	Select single / multi touch mode and maximum simultaneous touch detection (for multi-touch mode). n: touch mode 00h: Single-touch mode 01h ≤ n ≤ 0Ah: Multi-touch mode (n = maximum simultaneous touches)	P20															
Touch Panel Data Transmit ON/OFF	1Fh 50h 20h m Default: m = 00h (Transmit OFF)	Sets whether or not touch operation data is transmitted to the host. m: Transmit ON/OFF m = 00h: Transmit OFF m = 01h: Transmit ON	P20															
Touch Panel Data Transmit ON/OFF for HID	1Fh 50h 22h m Default: m = 03h	Sets whether or not touch operation data is transmitted to the host via HID. m: Transmit ON/OFF <table border="1" data-bbox="869 548 1125 660"> <thead> <tr> <th>m</th> <th>USB</th> <th>I<sup>2</sup>C</th> </tr> </thead> <tbody> <tr> <td>00h</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>01h</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>02h</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>03h</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table>	m	USB	I <sup>2</sup> C	00h	OFF	OFF	01h	ON	OFF	02h	OFF	ON	03h	ON	ON	P20
m	USB	I <sup>2</sup> C																
00h	OFF	OFF																
01h	ON	OFF																
02h	OFF	ON																
03h	ON	ON																
Touch Parameter Setting	1Fh 4Bh 70h a [b (c)] Default: Threshold setting b = Memory switch setting (default: 50h) Gain setting b = Memory switch setting (default: 06h) Touch standard references usage (on/off) b = 00h	Touch parameter setting. a : parameter selection / operating designation a = 00h: Threshold setting a = 04h: Gain setting a = 06h: Touch standard references setting procedure a = 07h: Touch standard references usage (on/off) a = 08h: Touch standard references usage status read b,c: set value	P20															
Touch Setting Package Data Store	1Fh 28h 65h 1Ch a d[1] ... d[1024]	Touch setting package data is stored. a: Touch setting package data storing destination 01h ≤ a ≤ 04h d: Package data 00h ≤ d ≤ FFh	P22															
Touch Setting Package Selection	1Fh 4Bh 70h 10h a Default: a = Memory switch setting (default: 00h)	Select touch setting package to use. a: Touch setting package data storing destination 01h ≤ a ≤ 04h	P22															
Backlight Brightness Level Setting	1Fh 58h n Default: n = Memory switch setting (default: FFh)	Set display brightness level. Brightness level $\approx (n / 255) \times 100$ [%]	P22															
Initialization	1Bh 40h	Set various settings to the initial state.	P22															
Memory Switch Setting	1Fh 28h 65h 03h a b 1Fh 28h 65h 03h a b c(1) d(1) [...c(b) d(b) ]	Set memory switch - Single Memory switch setting (00h ≤ a ≤ 3Fh) a: Memory switch number b: Setting value 00h ≤ b ≤ FFh - Multiple Memory switch setting (a = FFh) b: Number of setting 01h ≤ b ≤ FFh c: Memory switch number 00h ≤ c ≤ 3Fh d: Setting value 00h ≤ d ≤ FFh	P23															
Memory Switch Data Send	1Fh 28h 65h 04h a 1Fh 28h 65h 04h a b c(1) [...c(b)]	Send the contents of memory switch data. - Single memory switch read (00h ≤ a ≤ 3Fh) a: Memory switch number - Multiple memory switch read (a = FFh) b: Number of reads 01h ≤ b ≤ FFh c: Memory switch number 00h ≤ c ≤ 3Fh d: Setting value 00h ≤ c ≤ 3Fh	P23															
Product Status Send	1Fh 28h 65h 40h a [ b c ]	Send product status information. a: Information a = 01h: Boot version information a = 02h: Firmware version information a = 20h: Memory checksum information a = 30h: Product type information a = 40h: Display x pixel information a = 41h: Display y pixel information a = 70h: Touch setting package name a = 71h: Touch setting package ID a = 72h: Touch sensitivity (current gain) setting value a = 73h: Touch sensitivity (current threshold) setting value b: Start address c: Data length	P24															

Command Name	Hex Code	Function	Page
Display power Control	1Fh 28h 61h 40h p Default: p = 01h	Control backlight ON / OFF / Auto-ON. p: Set backlight ON / OFF / Auto-ON p = 00h: Backlight OFF p = 01h: Backlight ON p = 80h: Backlight OFF, Automatic ON when touch detected.	P24
Power Saving Mode	1Fh 28h 61h 48h m w	Transition to power saving mode and set the wakeup method m: mode m = 00h: Power down mode m = 01h: Sleep mode w: Wakeup method w = b7, b6, b5, b4, b3, b2, b1, b0	P25
Touch Scan Period Setting at Power Saving Mode	1Fh 28h 61h 49h p Default: p = Memory switch setting (default: 20h)	Set the touch scan period for power saving mode. p: Touch scan period 05h (5ms) ≤ p ≤ FEh (254ms)	P25
Touch Level Read	1Fh 4Bh 70h a	Send touch level information of FLETAS touch panel when sending the command. a: Read mode This command is used internally by the product tool "GT-1Pass" for adjusting sensitivity. The data transfer details are proprietary (not disclosed).	P25

## 10 Commands

These commands can be sent by USB (WinUSB-compatible interface), UART and I<sup>2</sup>C.

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

### 10.1 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

### 10.2 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.

### 10.3 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	USB	I <sup>2</sup> C
00h	OFF	OFF
01h	ON	OFF
02h	OFF	ON
03h	ON	ON

**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 (USB or I<sup>2</sup>C).

When transmit OFF, no touch report is generated.

### 10.4 US K 70h a [b (c)] (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.

#### 10.4.1 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.

#### 10.4.2 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

### 10.5 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.

### 10.6 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.

### 10.7 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  $\doteq (n / 255) \times 100$  [%]

### 10.8 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 MSW5, 58, 59, 61, 62, 63 take effect when executing this command, but changes to MSW46, 47, 48, 49 do not take effect until the next power-on or reset.

**10.9 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 13 Memory Switch.

**10.10 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 13 Memory Switch.

**10.11 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 a = 02h: 4 bytes a = 20h: 4 bytes a = 30h: 15 bytes a = 40h: 3 bytes a = 41h: 3 bytes a = 70h: 15 bytes a = 71h: 4 bytes a = 72h: 1 byte a = 73h: 1 byte

**10.12 US ( a 40h p (Display Power Control)****Code:** 1Fh 28h 61h 40h p

p: Set backlight ON / OFF / Auto-ON

**Definable area:**

- p = 00h: Backlight OFF (brightness level: 0%)
- p = 01h: Backlight ON (brightness level: setting before OFF)
- p = 80h: Backlight OFF, automatic ON when touch detected.

**Default:** p = 01h**Function:** Control backlight ON / OFF / Auto-ON.

To change from backlight OFF (p = 00h) to backlight ON (p=01h), set this command to backlight ON or set the initialization command.



**10.13 US ( a 48h m w (Power Saving Mode)****Code:** 1Fh 28h 61h 48h m w

m: Mode

w: Wakeup method

**Definable area:** m = 00h: Power down mode

m = 01h: Sleep mode

w = b7(upper bit), b6, b5, b4, b3, b2, b1, b0(lower bit)

bit	0	1
b7	No wakeup on USB VBUS	Wakeup on USB VBUS rising edge
b6	Refer to the following list	
b5		
b4		
b3		
b2	Reserved	
b1		
b0		

\* If w = 00h (no wakeup methods are set), return to normal operation is only possible by next power-on or reset.

b4	b5	b6	GPIO wakeup condition
0	-	-	No wakeup on GPIO input
1	0	0	Wakeup on GPIO LO level
1	0	1	Wakeup on GPIO falling edge
1	1	0	Wakeup on GPIO HI level
1	1	1	Wakeup on GPIO rising edge

**Function:** Transition to power saving mode and set the wakeup method

The communication interfaces (USB/ UART/ I2C) do not function during power saving mode. Current consumption is lowest if wakeup condition is limited to GPIO input (b0 = 0, b7 = 0). The current value of volatile settings (e.g., Backlight Brightness Level Setting) are retained in sleep mode, but are not retained in power down mode. On exiting power down mode, settings are restored to initial defaults.

**10.14 US ( a 49h p (Touch Scan Period Setting at Power Saving Mode)****Code:** 1Fh 28h 61h 49h p

p: Touch scan period

**Definable area:** 05h (5ms) ≤ p ≤ FEh (254ms)**Default:** Memory switch setting MSW61 (default: p = 20h).**Function:** Set the touch scan period for power saving mode.

Higher values result in lower power consumption during power saving mode at the expense of longer response time for touch detection.

Touch controller is stopped if wakeup on touch is not set when entering power saving mode (b0 = 0).

**10.15 US K 70h a (Touch Level Read)****Code:** 1Fh 4Bh 70h a

a: Read mode

**Function:** Send touch level information of FLETAS touch panel when sending the command.

This command is used internally by the product tool "GT-1Pass" for adjusting sensitivity.

The data transfer details are proprietary (not disclosed).

## 11 Connectors

### 11.1 DVI: CN1

Connector: TCX3253-611187(HDMI connector Type A), or equivalent

Pin No.	Terminal	Content	Pin No.	Terminal	Content
1	TMDS data2 +	Data lane	2	TMDS data2 shield	Shield
3	TMDS data2 -		4	TMDS data1 +	Data lane
5	TMDS data1 shield	Shield	6	TMDS data1 -	
7	TMDS data0 +	Data lane	8	TMDS data0 shield	Shield
9	TMDS data0 -		10	TMDS clock +	
11	TMDS clock shield	Shield	12	TMDS clock -	No connection
13	NC	No connection	14	NC	
15	SCL	DDC clock	16	SDA	DDC power
17	DDC/ CEC ground	Ground	18	VCC	
19	Hot plug detect	-			

### 11.2 USB: CN2

Connector: ZX62-AB-5PA (Micro USB), or equivalent

Pin No.	Terminal	Content
1	VBUS	VBUS
2	D-	Data -
3	D+	Data +
4	ID	NC
5	GND	Ground

### 11.3 UART, I<sup>2</sup>C: CN5

Connector: JST SM12GB-GHS-TB, or equivalent

Pin No.	Terminal	Content
1	IC	Internal connection
2	GPIO	For power saving mode wakeup *3
3	IC	Internal connection
4	IC	Internal connection
5	SDA	I <sup>2</sup> C data
6	/IRQ *1	Interrupt output (I <sup>2</sup> C data available)
7	SCL	I <sup>2</sup> C clock
8	/RESET	Reset input
9	NC	No connection
10	GND	Ground
11	TXD *2	UART send
12	RXD	UART receive

\*1 Output is high-impedance (Hi-Z) during power-on, reset input, and display internal initialization.

\*2 Output is high-impedance (Hi-Z) + pull-up resistor (10kΩ typ.) during power-on, reset input, and display internal initialization.

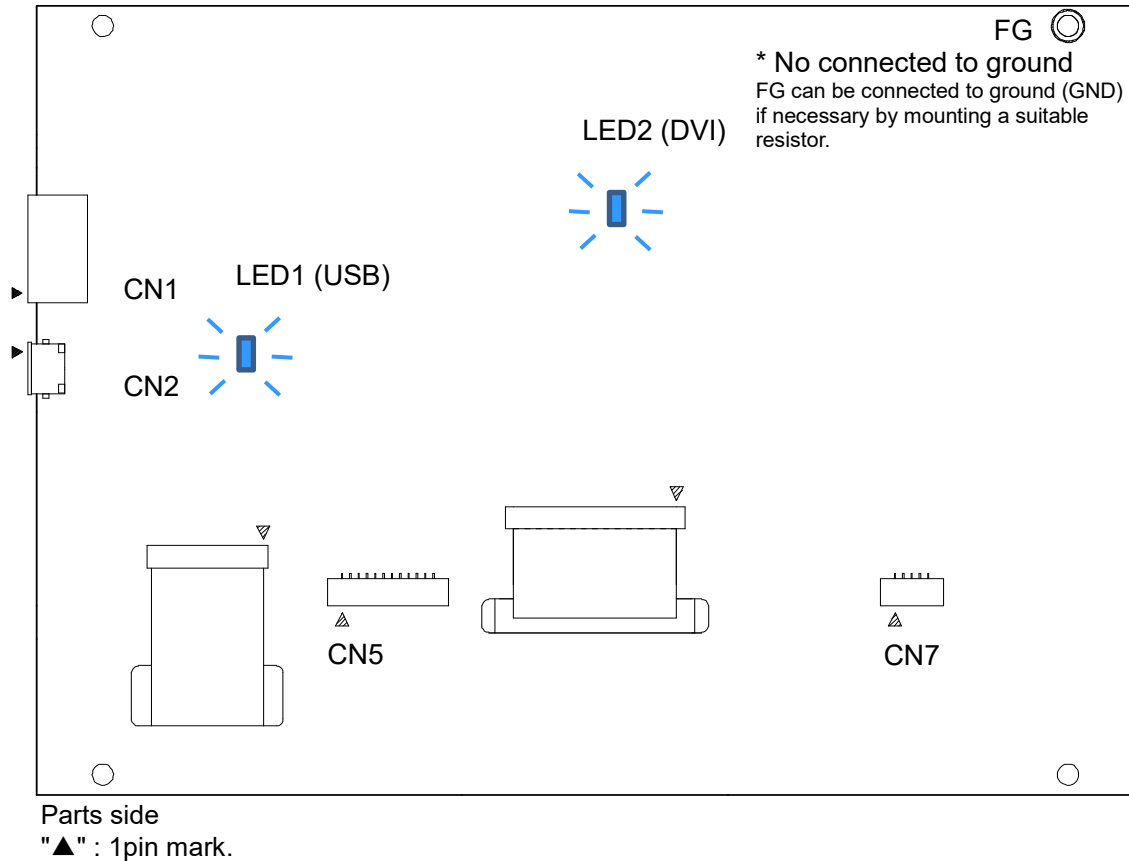
\*3 GPIO is input only.

### 11.4 Power connector: CN7

Connector: JST SM05B-GHS-TB, or equivalent

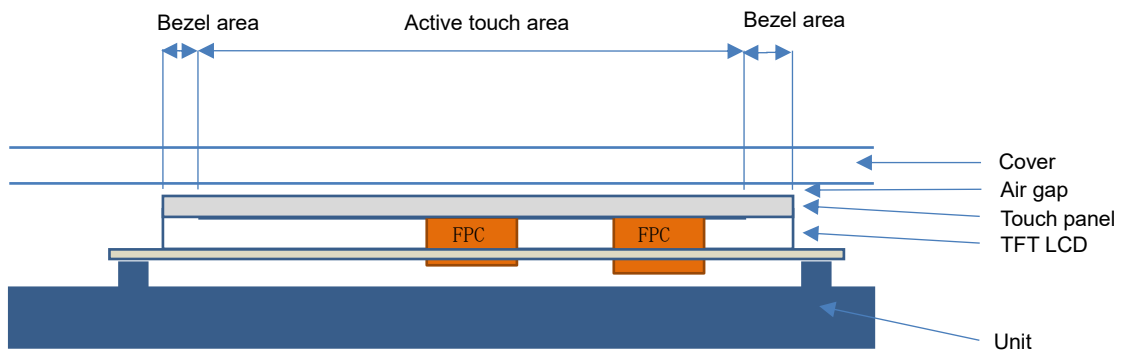
Pin No.	Terminal	Content
1	VCC	+5V
2	GND	Ground
3	VCC	+5V
4	GND	Ground
5	NC	No connection

## 11.5 Connector and LED Position



## 12 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.

## 13 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	I <sup>2</sup> C slave address setting for HID (*1)	08h–77h, FFh (invalid)	51h
47	I <sup>2</sup> C slave address setting for Noritake original commands	00h, 08h–77h, 88h–F7h (*2)	50h
48	UART baud rate setting 00h: 38,400bps (default) 01h: 4,800bps 02h: 9,600bps 03h: 19,200bps 04h: 38,400bps 05h: 57,600bps 06h: 115,200bps	00h–06h	00h
49	UART parity 00h: None (default) 01h: Even 02h: Odd	00h–02h	00h
50-57	Reserved	-	-
58	Touch sensitivity (signal gain) setting (*3)	00h–0Fh	06h
59	Touch sensitivity (threshold) setting	00h–FFh	50h
60	Reserved	-	-
61	Touch scan period setting at power saving mode (ms)	05h (5ms)–FEh (254ms)	20h (32ms)
62	Touch sensitivity setting selection at startup 00h: Apply the setting values of memory switch 58 and 59 01h: Apply touch setting package value	00h, 01h	00h
63	Touch setting package selection at startup 00h: Factory setting 01h: Touch setting package 1 02h: Touch setting package 2 03h: Touch setting package 3 04h: Touch setting package 4	00h – 04h	00h

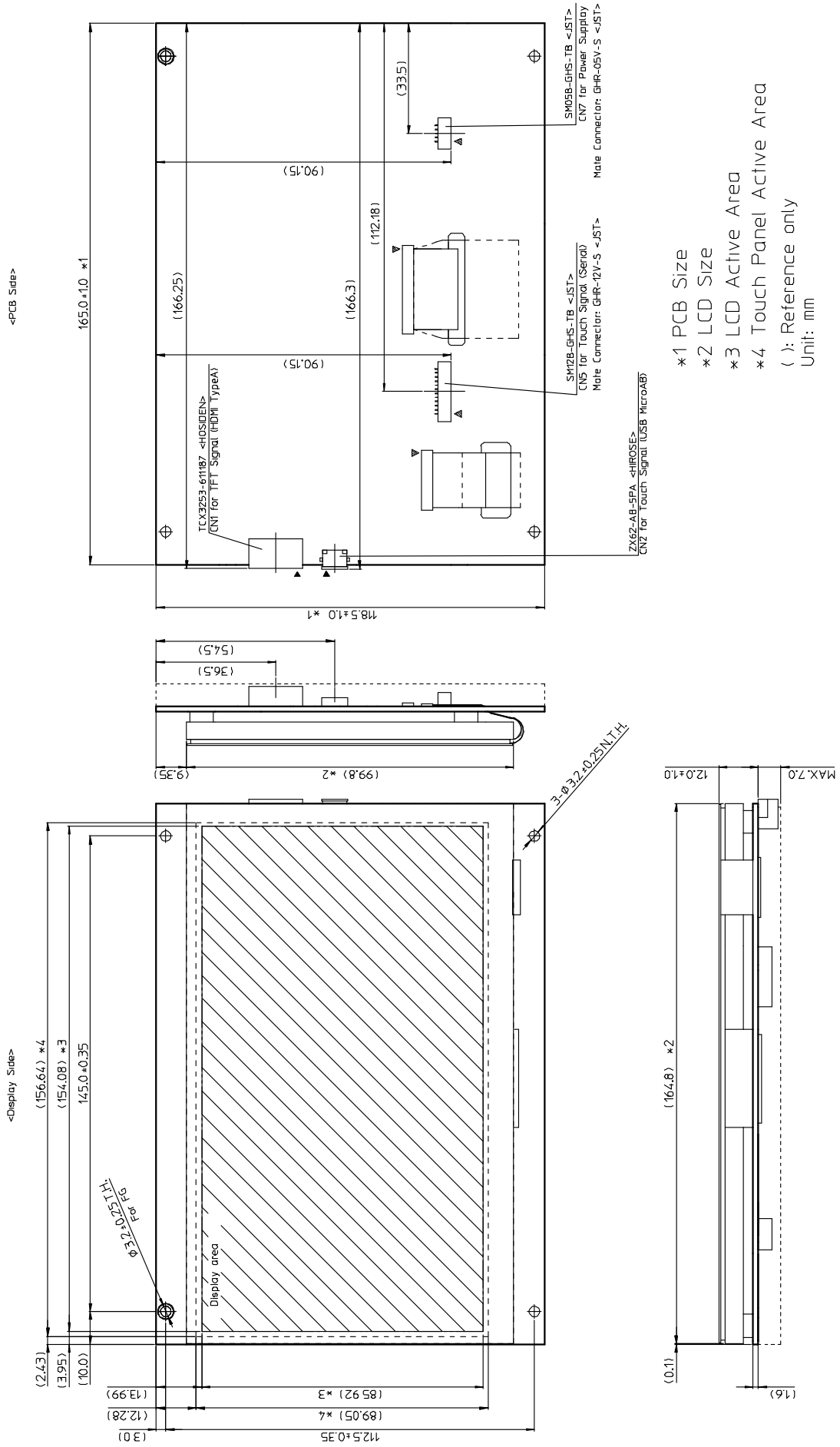
Note: Module operates with default value if memory switch value is outside the valid range.

\*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).

14 Outline



**15 Firmware Version Revision History**

Firmware version	Contents
F150a or later	Initial issue

## Revision history

Spec. No.	Date	Revision
DS-2076-0000-00	Sep. 27, 2019	Initial issue
DS-2076-0000-01	Apr. 7, 2019	<p>1.2 Block Diagram GPIO added to CN5.</p> <p>1.3 Basic Specification Brightness Condition Added "White screen at the center of display". Control Condition Added "USB".</p> <p>2.1 Absolute Maximum Rating I<sup>2</sup>C Condition Revised "—" → "VCC=5V". GPIO added.</p> <p>2.2 Electrical Ratings GPIO added.</p> <p>2.3 Electrical Characteristics Corrected logic output voltage symbol of SCL, SDA. VOH2 → VOL2. *2, *3, *4 added. Power supply Condition Added "Touch interface: valid". Revised "DVI suspend mode" → "No connection"</p> <p>3 Environmental Specifications Storage humidity added.</p> <p>6.3 I<sup>2</sup>C: CN5 *1 revised "(by setting MSW46 invalid)" → "(by setting MSW46 = FFh (invalid))." Added "Slave address can be set with memory switch".</p> <p>6.6 GPIO added.</p> <p>7.1.1 Touch Detection added.</p> <p>7.2 Basic Operation Notes revised. "* At power on, ... time" → "* At power on, ... time (min. 1s)".</p> <p>8 Power Saving Commands Summary Completely revised</p> <p>9 Touch Detection deleted.</p> <p>9 Commands List Revised "Operation" → "Function"</p> <p>10.8 ESC @ (Initialization) revised.</p> <p>11.1 DVI: CN1 Added content.</p> <p>11.3 UART, I<sup>2</sup>C: CN5 *1, *2, *3 added.</p> <p>11.5 Connector and LED Position FG Revised the note.</p> <p>12 Installation Method Revised the note.</p> <p>Overall fix 9 Commands list 10 Commands</p>

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