

PRELIMINARY

NLT Technologies, Ltd.

# PCAP Touch panel Controller Board

## PTPW05

**PRELIMINARY DATA SHEET** 

**DOD-PP-1800 (2nd edition)**

**This PRELIMINARY DATA SHEET is updated document from DOD-PP-1745(1).**

**All information is subject to change without notice. Please confirm the sales representative before starting to design your system.**

## INTRODUCTION

The Copyright to this document belongs to NLT Technologies, Ltd. (hereinafter called "NLT"). No part of this document will be used, reproduced or copied without prior written consent of NLT.

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Some electronic products would fail or malfunction at a certain rate. In spite of every effort to enhance reliability of products by NLT, the possibility of failures and malfunction might not be avoided entirely. To prevent the risks of damage to death, human bodily injury or other property arising out thereof or in connection therewith, each customer is required to take sufficient measures in its safety designs and plans including, but not limited to, redundant system, fire-containment and anti-failure.

The products are classified into three grades: "**Standard**", "**Special**", and "**Specific**".

Each quality grade is designed for applications described below. Any customer who intends to use a product for application other than that of Standard is required to contact an NLT sales representative in advance.

The **Standard**: Applications as any failure, malfunction or error of the products are free from any damage to death, human bodily injury or other property (Products Safety Issue) and not related the safety of the public (Social Issues), like general electric devices.

Examples: Office equipment, audio and visual equipment, communication equipment, test and measurement equipment, personal electronic equipment, home electronic appliances, car navigation system (with no vehicle control functions), seat entertainment monitor for vehicles and airplanes, fish finder (except marine radar integrated type), PDA, etc.

The **Special**: Applications as any failure, malfunction or error of the products might directly cause any damage to death, human bodily injury or other property (Products Safety Issue) and the safety of the public (Social Issues) and required high level reliability by conventional wisdom.

Examples: Vehicle/train/ship control system, traffic signals system, traffic information control system, air traffic control system, surgery/operation equipment monitor, disaster/crime prevention system, etc.

The **Specific**: Applications as any failure, malfunction or error of the products might severe cause any damage to death, human bodily injury or other property (Products Safety Issue) and the safety of the public (Social Issues) and developed, designed and manufactured in accordance with the standards or quality assurance program designated by the customer who requires extremely high level reliability and quality.

Examples: Aerospace system (except seat entertainment monitor), nuclear control system, life support system, etc.

The quality grade of this product is the "**Standard**" unless otherwise specified in this document.

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# PRELIMINARY

## 1. OUTLINE

PTPW05 is PCAP touch panel controller board, which for the PCAP touch panel module made by NLT. The touch panel controller board adjusts for NLT PCAP module with FPC of PCAP sensor output terminals. This FPC has two terminal output parts. One has 40 terminals and another has 60 terminals.

Additionally, PCAP module data sheet or specification describes the suitable controller board name like “PTPW05”.

## 2. SPECIFICATIONS

### 2.1 GENERAL SPECIFICATIONS

Item	Specification	Unit
Size	See "5. OUTLINE DRAWINGS".	mm
Weight	(7) (typ.)	g
Interface	I <sup>2</sup> C	-

### 2.2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks
Power supply voltage	VDD	(-0.3 to +6.0)	V	Ta= 25°C
Input voltage	VI	(-0.3 to 3.5)		
Storage temperature	Tst	(-30 to +80)	°C	-
Operating temperature	Top	(-30 to +80)		-
Relative humidity Note1	RH	≤ 95	%	Ta ≤ 40°C
		≤ 85		40°C < Ta ≤ 50°C
		≤ 55		50°C < Ta ≤ 60°C
		≤ 36		60°C < Ta ≤ 70°C
		≤ 24		70°C < Ta ≤ 80°C
Absolute humidity Note1	AH	≤ 70 Note2	g/m <sup>3</sup>	-

Note1: No condensation

Note2: Water amount at Ta= 80°C and RH= 24%

## 2.3 ELECTRICAL CHARACTERISTICS

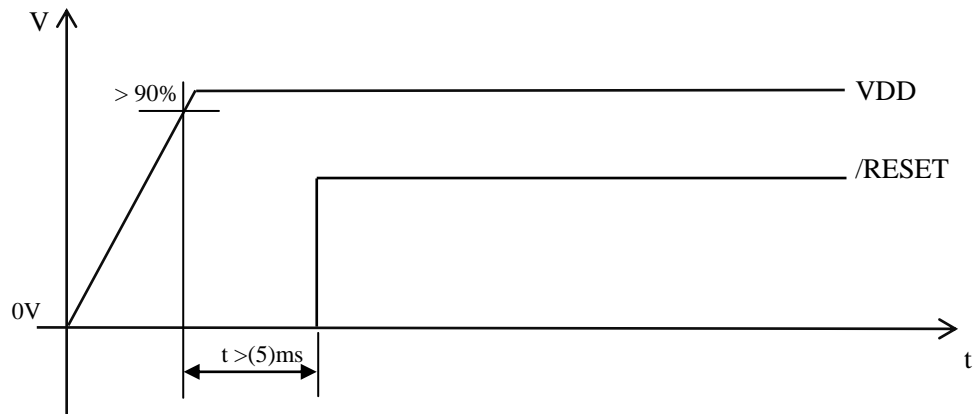
(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks	
Power supply voltage	VDD	(4.5)	5.0	(5.5)	V	Note1	
Power supply current	IDD	-	(110)	(130)	mA	-	
Input voltage	High	VIH	(2.5)	-	(3.5)	V	/RESET, SDA, SCL
	Low	VIL	-0.3	-	(0.9)	V	
Input leakage current	Iil	-	-	1	μA	-	
Output voltage	High	VOH	(2.8)	-	-	V	/CHG
	Low	VOL	-	-	(0.6)	V	

Note1: When designing of the power supply, take the measures for the prevention of surge voltage.

## 2.4 POWER SUPPLY VOLTAGE SEQUENCE

### (1) Power On Sequence



## 2.5 TOUCH PANEL SPECIFICATIONS

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks	
Accuracy	Center	Acrc	-	-	(1.5)	mm	Note1
	Boarder	Acrb	-	-	(2.5)	mm	Note1
Number of touch	NUM	1	-	16	Point	-	
Scan speed	Sspd	-	(100)	-	Hz	-	
Resolution	X	-	-	-	4,096	-	-
	Y	-	-	-	4,096	-	-

Note1: Input method is φ8mm conductive stylus

### 2.6 CONNECTIONS

CN1 socket (Controller board side): 53261-0871 (Molex)  
 Adaptable plug: 51021-0800 (Molex)

Pin No.	Symbol	Function	Remarks
1	VDD	Power supply	Note 1
2	N.C.	-	Keep this pin open.
3	N.C.	-	Keep this pin open.
4	GND	Ground	Note 1
5	/RESET	Reset	-
6	SDA	I <sup>2</sup> C data	-
7	SCL	I <sup>2</sup> C clock	-
8	/CHG	Interrupt signal output	-

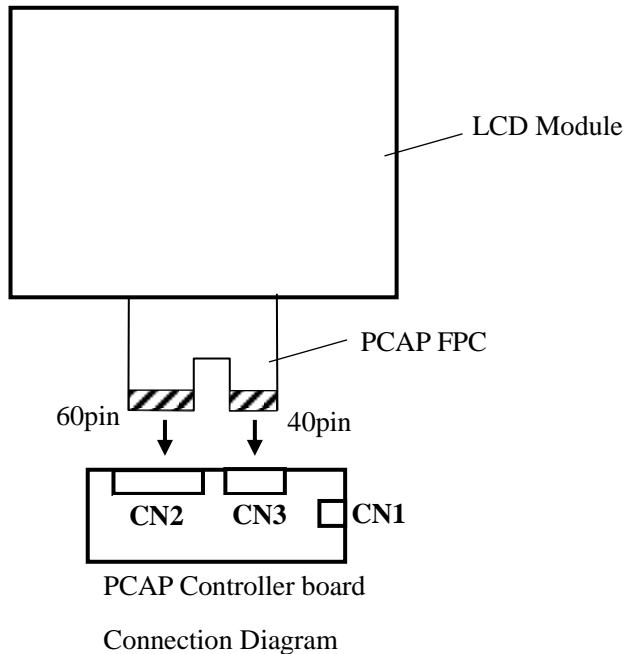
Note1: All GND and VDD terminals must be connected to appropriate terminals.

CN2 socket (Controller board side): FH28-60S-0.5SH(05) (Hirose Electric Co., Ltd.(HRS))

Please connect to the PCAP FPC (60pin) of the LCD module.  
 (Refer to below diagram.)

CN3 socket (Controller board side): FH28-40S-0.5SH(05) (Hirose Electric Co., Ltd.(HRS))

Please connect to the PCAP FPC (40pin) of the LCD module.  
 (Refer to below diagram.)



## 2.7 INTERFACE TIMING CHART (I<sup>2</sup>C)

### 2.7.1 Communications Protocol

The device can use an I<sup>2</sup>C-compatible interface for communication.

The I<sup>2</sup>C-compatible interface is used in conjunction with /CHG line. The /CHG line going active signifies that a new data packet is available. This provides an interrupt-style interface and allows the device to present data packets when internal changes have occurred.

### 2.7.2 I<sup>2</sup>C-compatible Addresses

The I<sup>2</sup>C-compatible device addresses are 0x4B. These are shifted left to form the SLA+W or SLA+R address when transmitted over the I<sup>2</sup>C-compatible interface, as shown in Figure 1.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Address: 0x4B							Read= 1 Write= 0

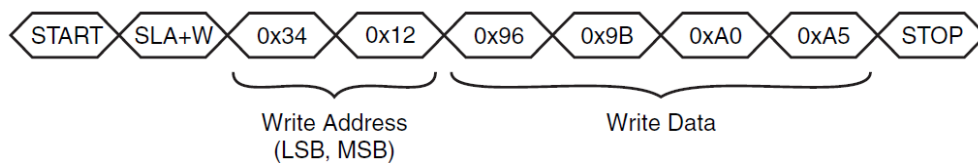
### 2.7.3 Write to the Device

A WRITE cycle to the device consists of a START condition followed by the I<sup>2</sup>C-compatible address of the device (SLA+W). The next two bytes are the address of the location into which the writing starts. The first byte is the Least Significant Byte (LSByte) of the address, and the second byte is the Most Significant Byte (MSByte). This Address is then stored as the address pointer.

Subsequent bytes in a multi-byte transfer form the actual data. These are written to the location of the address pointer, location of the address pointer +1, location of the address pointer +2, and so on. The address pointer returns to its starting value when the WRITE cycle's STOP condition is detected.

Figure 1 shows an example of writing four bytes of data to contiguous addresses starting at 0x1234.

**Figure1. Example of a Four-byte Write Starting at Address 0x1234**



### 2.7.4 Reading from the device

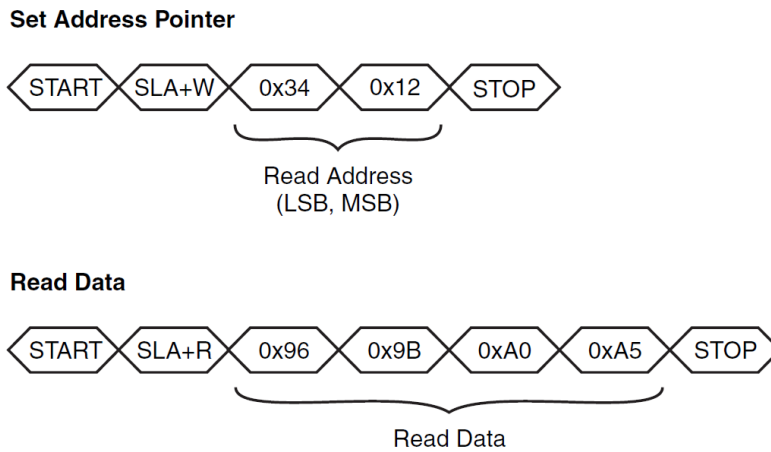
Two I<sup>2</sup>C-compatible bus activities must take place to read from the device. The first activity is an I<sup>2</sup>C-compatible write to set the address pointer (LSByte then MSByte). The second activity is the actual I<sup>2</sup>C-compatible read to receive the data. The address pointer returns to its starting value when the read cycle's NACK is detected.

It is not necessary to set the address pointer before every read. The address pointer is updated automatically after every read operation. The address pointer will be correct if the reads occur in order. In particular, when reading multiple messages from the Message Processor object, the address pointer is automatically reset to allow continuous reads (See “**2.7.5 Reading Status Messages with DMA**”).

The WRITE and READ cycles consist of a START condition followed by the I<sup>2</sup>C-compatible address of the device (SLA+W or SLA+R respectively).

Figure 2 shows an example of reading four bytes of data to continuous addresses starting at 0x1234.

**Figure2. Example of a Four-byte Read Starting at Address 0x1234**





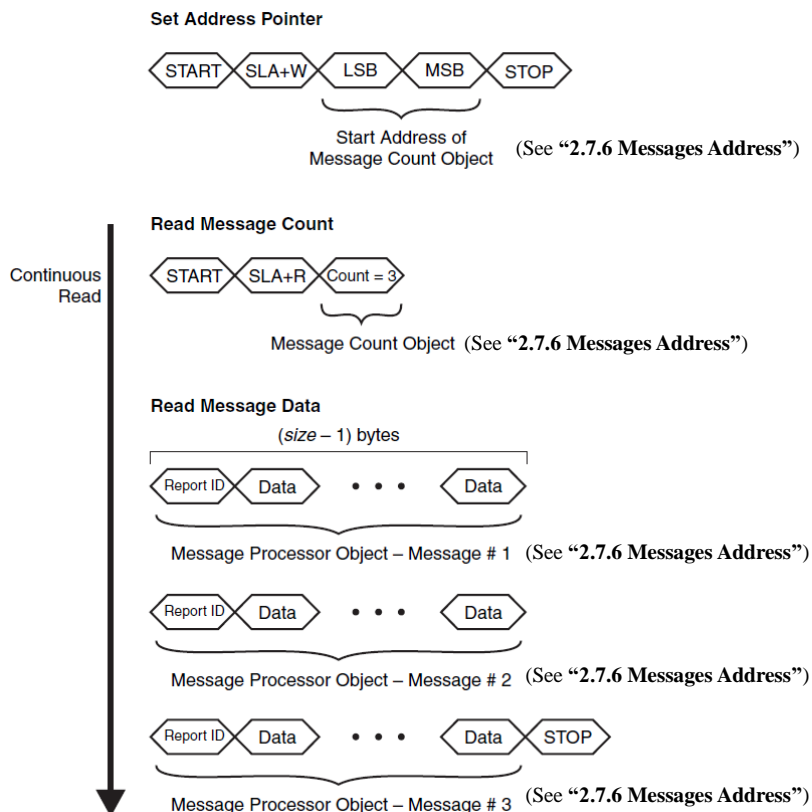
## 2.7.5 Reading Status Messages with DMA

The device facilitates the easy reading of multiple messages using a single continuous read operation. This allows the host hardware to use a direct memory access (DMA) controller for the fast reading of messages, as follows:

1. The host uses a write operation to set the address pointer to the start of the Message Count object, if necessary (Note1).
2. The host starts the read operation of the message by sending a START condition.
3. The host reads the Message Count object (one byte) to retrieve a count of the pending messages.
4. The host calculates the number of bytes to read by multiplying the message count by the size of the Message Processor object (Note2).
5. The host reads the calculated number of message bytes. It is important that the host does not send a STOP condition during the message reads, as this will terminate the continuous read operation and reset the address pointer. No START and STOP conditions must be sent between the messages.
6. The host sends a STOP condition at the end of the read operation after the last message has been read. The NACK condition immediately before the STOP condition resets the address pointer to the start of Message Count object.

Figure 3 shows an example of using a continuous read operation to read three messages from the device.

**Figure3. Continuous Message Read Example**



An alternative method of reading messages using the /CHG line is given in "2.7.7 /CHG line".

Note1: The STOP condition at the end of the read resets the address pointer to its initial location, so it may already be pointing at the Message Count object following a previous message read.

Note2: The host should have already read the size of the Message Processor object in its initialization code.

2.7.6 Message Address

**Message count object:**

**Address :0x012E**

Byte	Field	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Count	Message count							

**Message processor object:**

**Address :0x012F**

Byte	Field	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Report ID	Report ID (03h=Touch1 04h=Touch2 ... 12h=Touch16)							
1	STATUS	DETECT	PRESS	RELEASE	MOVE	Reserved	Reserved	Reserved	Reserved
2	XPOSMSB	X position MSByte							
3	YPOSMSB	Y position MSByte							
4	XYPOSMSB	X position lsbyte				Y position lsbyte			
5	TCHAREA	Size of touch area							
6	Reserved	-							
7	Reserved	-							

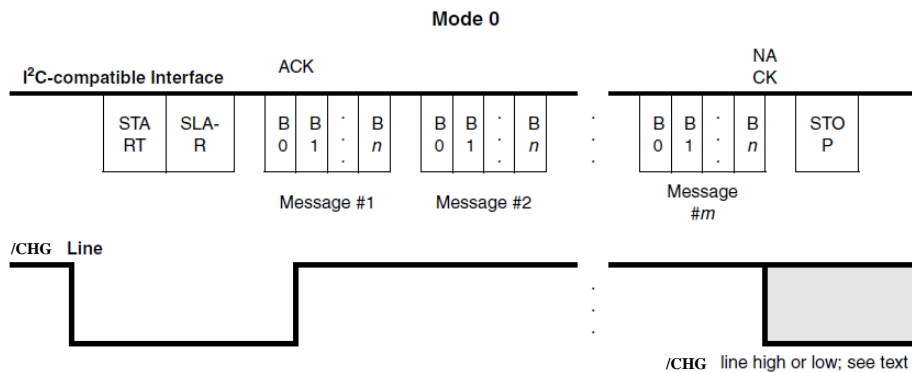
2

## 2.7.7 /CHG Line

The /CHG line is an active-low, open-drain output that is used to alert the host that a new message is available in the Message Processor object. This provides the host with an interrupt-style interface with the potential for fast response times. It reduces the need for wasteful I<sup>2</sup>C-compatible communications.

The /CHG line remains low as long as there are messages to be read. The host should be configured so that the /CHG line is connected to an interrupt line that is level-triggered. The host should not use an edge-triggered interrupt as this means adding extra software precautions.

The /CHG line should be allowed to float during normal usage. This is particularly important after power-up or reset.



1. The /CHG line goes low to indicate that a message is present.
2. The /CHG line goes high when the first byte of the first message (that is, its report ID) has been sent and acknowledged (ACK sent) and the next byte has been prepared in the buffer.
3. The STOP condition at the end of an I<sup>2</sup>C-compatible transfer causes the /CHG line to stay high if there are no more messages. Otherwise the /CHG line goes low to indicate a further message. Mode 0 allows the host to continually read messages. Messaging reading ends when a report ID of 255 (“invalid message”) is received. Alternatively the host ends the transfer by sending a NACK after receiving the last byte of a message, followed by a STOP condition. If and when there is another message present, the /CHG line goes low, as in step 1. In this mode the state of the /CHG line does not need to be checked during the I<sup>2</sup>C-compatible read.

**Note:** The state of the /CHG line should be checked only between messages and not between the bytes of a message. The precise point at which the /CHG line changes state cannot be predicted and so the state of the /CHG line cannot be guaranteed between bytes.

The /CHG line operation modes described above, this object allows the use of edge-based interrupts, as well as direct control over the state of the /CHG line.

### 3. RELIABILITY TEST

This test is in accordance with the Reliability Test of the adaptable LCD module. Refer to Reliability Test of the adaptable LCD module.

## 4. PRECAUTIONS

### 4.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "4.2 CAUTIONS" and "4.3 ATTENTIONS"!**



This sign has the meaning that a customer will be injured or the product will sustain damage if the customer practices wrong operations.



This sign has the meaning that a customer will be injured if the customer practices wrong operations.

### 4.2 CAUTIONS



\* Do not apply mechanical shock. It may damage products.

### 4.3 ATTENTIONS



#### 4.3.1 Handling of the product

- ① Do not touch or apply stress to exposed electronic parts. Doing so may cause damage or malfunctioning of products. Only hold the edge of the circuit board when unpacking.
- ② When handling the product, take measures of electrostatic discharge with such as earth band, ionic shower and so on, because the product may be damaged by electrostatic.
- ③ Do not plug or unplug the interface connectors while the product is operating.

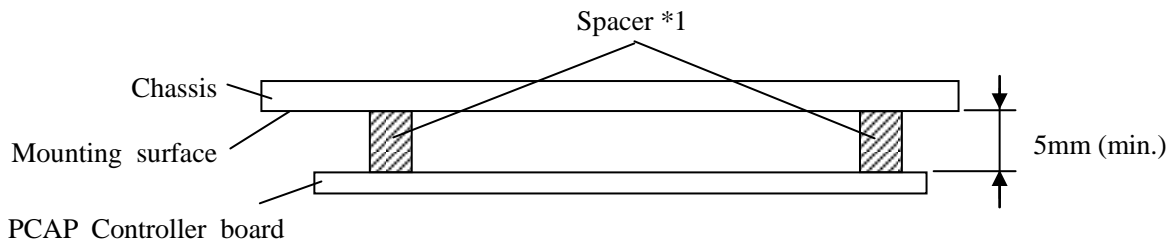
#### 4.3.2 Environment

- ① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in packing box with antistatic pouch in room temperature to avoid dusts and sunlight, when storing the product.
- ② In order to prevent dew condensation occurred by temperature difference, the product packing box must be opened after enough time being left under the environment of an unpacking room. Evaluate the storage time sufficiently because dew condensation is affected by the environmental temperature and humidity. (Recommended leaving time: 6 hours or more with the original packing state after a customer receives the package)
- ③ Do not operate in high magnetic field. If not, circuit boards may be broken.
- ④ This product is not designed as radiation hardened.

4.3.3 Others

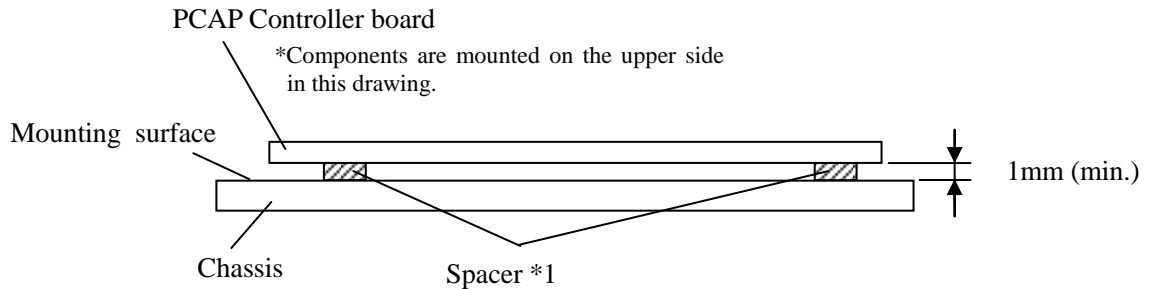
- ① All GND and VDD terminals should be used without any non-connected lines.
- ② Do not disassemble a product.
- ③ Pack the product with the original shipping package, in order to avoid any damages during transportation, when returning the product to NLT.
- ④ Insert spacers between the PCAP Controller board and the chassis to secure spatial distance.

Mounting method example 1



\*Components are mounted on the upper side in this drawing.

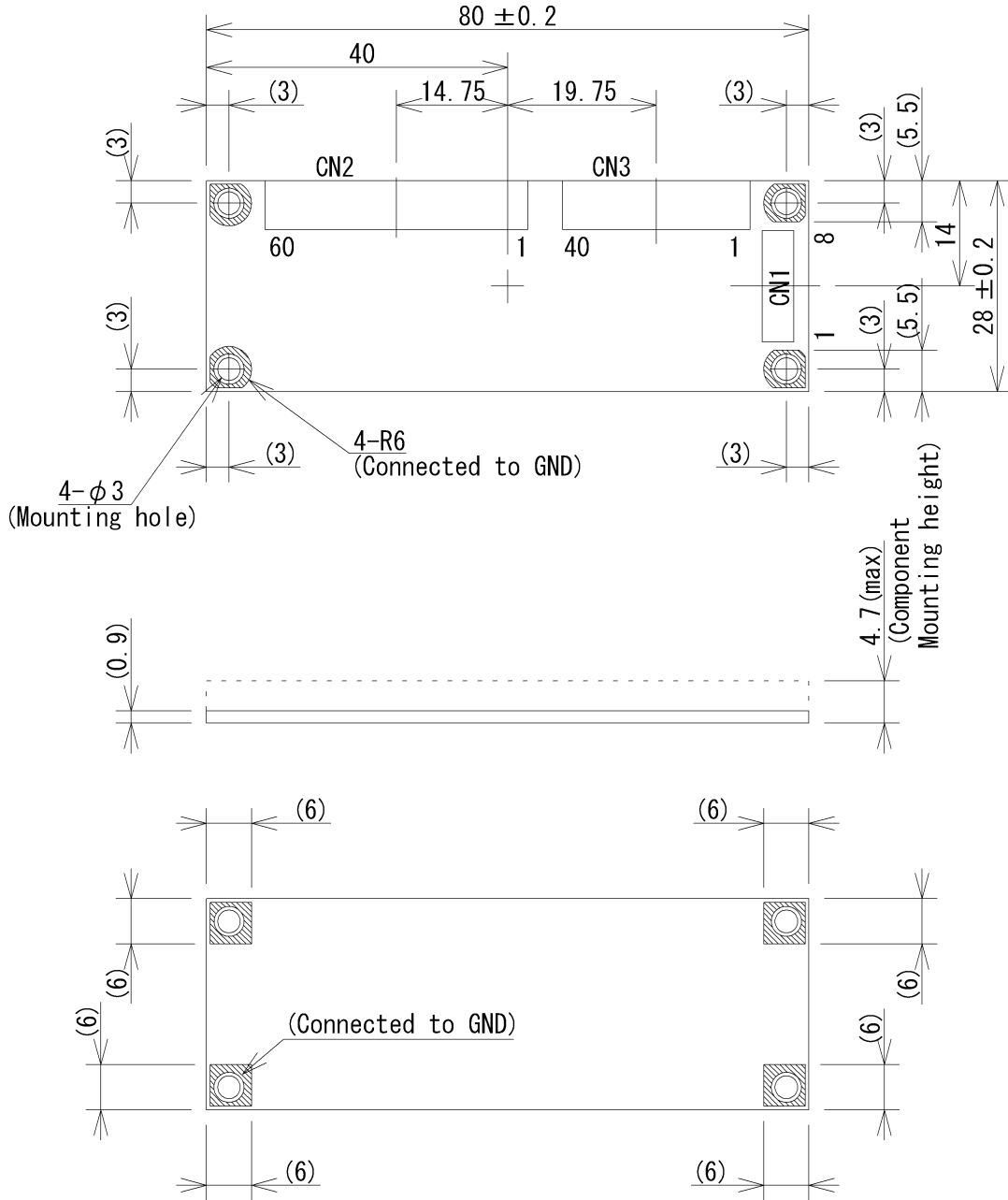
Mounting method example 2



\*1: The conductive material (mounting screw, washer, spacer and so on) is allowed to mount within the limits of 2.5mm radius from the center of mounting hole.

# PRELIMINARY

## 5. OUTLINE DRAWINGS



(Unit: mm)

Note1: The values in parentheses are for reference.



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NLT Technologies, Ltd.

PTPW05

## REVISION HISTORY

*The inside of latest specifications is revised to the clerical error and the major improvement of previous edition. Only a changed part such as functions, characteristic value and so on that may affect a design of customers, are described especially below.*

Edition	Document number	Prepared date	Revision contents and signature
1st edition	DOD-PP-1745	Sep. 13, 2013	<b>Revision contents</b>  New issue  <b>Writer</b>  <i>Approved by</i> <u>R. KAWASHIMA</u> <i>Checked by</i> _____ <i>Prepared by</i> <u>H. FUKUYOSHI</u>
2nd edition	DOD-PP-1800	Dec. 9, 2013	<b>Revision contents</b>  P10 Message Address • Message processor object - Report ID: Report ID (02h=Touch1 03h=Touch2 ... 11h=Touch16) → Report ID (03h=Touch1 04h=Touch2 ... 12h=Touch16) (Correction) P13 Others • Mounting method example1, 2 (Revised)  <b>Signature of writer</b> <i>Approved by</i>  <u>R. KAWASHIMA</u> <i>Checked by</i> _____ <i>Prepared by</i>  <u>E. YOSHIMURA</u>