

PRELIMINARY

**NEC** NEC LCD Technologies, Ltd.

# LED Driver Board 121PW02F

**PRELIMINARY DATA SHEET** 

DOD-PP-0901(1st edition)

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Please confirm the sales representative before  
starting to design your system.**

## INTRODUCTION

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Some electronic parts/components would fail or malfunction at a certain rate. In spite of every effort to enhance reliability of products by NEC, 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 quality grades: "**Standard**", "**Special**", and "**Specific**" of the highest grade of a quality assurance program at the choice of a customer. Each quality grade is designed for applications described below. Any customer who intends to use a product for application other than that of Standard quality grade is required to contact an NEC sales representative in advance.

The **Standard** quality grade applies to the products developed, designed and manufactured in accordance with the NEC standard quality assurance program, which are designed for such application as any failure or malfunction of the products (sets) or parts/components incorporated therein a customer uses are, directly or indirectly, free of any damage to death, human bodily injury or other property, like general electronic devices.

**Examples:** Computers, office automation equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment, industrial robots, etc.

The **Special** quality grade applies to the products developed, designed and manufactured in accordance with an NEC quality assurance program stricter than the standard one, which are designed for such application as any failure or malfunction of the products (sets) or parts/components incorporated therein a customer uses might directly cause any damage to death, human bodily injury or other property, or such application under more severe condition than that defined in the Standard quality grade without such direct damage.

**Examples:** Control systems for transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, medical equipment not specifically designed for life support, safety equipment, etc.

The **Specific** quality grade applies to the products developed, designed and manufactured in accordance with the standards or quality assurance program designated by a customer who requires an extremely higher level of reliability and quality for such products.

**Examples:** Military systems, aircraft control equipment, aerospace equipment, nuclear reactor control systems, medical equipment/devices/systems for life support, etc.

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

# PRELIMINARY

## CONTENTS

<b>INTRODUCTION .....</b>	<b>2</b>
<b>1. OUTLINE.....</b>	<b>4</b>
<b>2. SPECIFICATIONS.....</b>	<b>4</b>
2.1 GENERAL SPECIFICATIONS.....	4
2.2 ABSOLUTE MAXIMUM RATINGS .....	4
2.3 ELECTRICAL CHARACTERISTICS .....	5
2.4 FUSE.....	5
2.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS.....	6
2.6 LUMINANCE CONTROL.....	7
<b>3. RELIABILITY TEST.....</b>	<b>9</b>
<b>4. PRECAUTIONS .....</b>	<b>10</b>
4.1 MEANING OF CAUTION SIGNS .....	10
4.2 CAUTIONS .....	10
4.3 ATTENTIONS .....	10
4.3.1 Handling of the product .....	10
4.3.2 Environment.....	10
4.3.3 Other .....	10
<b>5. OUTLINE DRAWINGS .....</b>	<b>12</b>
<b>REVISION HISTORY .....</b>	<b>13</b>

# PRELIMINARY

## 1. OUTLINE

This 121PW01F LED Driver board is for LCD module. Adaptable LCD modules are as follows.

Adaptable LCD modules
NL8060BC31-47
NL8060BC31-47D

## 2. SPECIFICATIONS

### 2.1 GENERAL SPECIFICATIONS

Item	Specification	Unit
Size	See "5. OUTLINE DRAWINGS".	mm
Weight	6.0 (typ.)	g
Delivery unit	10 (min.)	set

### 2.2 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage		VDDDB	-0.3~15.0	V	Ta = 25°C
Input voltage	BRTC signal	VBC	-1.0~VDDDB+1.0	V	
	BRTI signal	VBI	-0.3~5.3	V	
	PWM select	PWMSEL	-0.3~5.3	V	
Storage temperature		Tst	-30~80	°C	-
Operating temperature		Top	-30~80	°C	-
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
Absolute humidity Note1		AH	≤ 70 Note2	g/m <sup>3</sup>	Ta > 70°C

Note1: No condensation

Note2: Water amount at Ta=50°C and RH=85%

# PRELIMINARY

## 2.3 ELECTRICAL CHARACTERISTICS

(Ta=25°C)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VDDB	10.8	12.0	13.2	V	Note1, Note2
Power supply current		IDDB		(380)	(800) Note2	mA	(At the maximum luminance control.) Note3
Input voltage	BRTC signal	High	VBCH	2.0	-	-	V
		Low	VBCL	-	-	0.8	V
	BRTI signal		VBI	0	-	2.5	V
Output voltage	Forward voltage (per circuit)	VL	21.2	(24.0)	27.2	V	Ta= +25°C at IL= 50mA /One circuit
Output current	Forward current (per circuit)	IL	-	50	-	mA	At maximum luminance control. (Note 3)
External PWM frequency (BRTH=Open, PWMSEL=GNDB)		f <sub>PWM</sub>	100	-	500	Hz	Note 4
External PWM pulse width		PW	200	-	-	μs	
Internal PWM frequency (PWMSEL=Open)		Ft	-	251	-	Hz	

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

Note2: This value excludes peak current such as overshoot current.

Note3: The power supply lines (VDDB and GNDB) may have ripple voltage during luminance control of LED. There is the possibility that the ripple voltage produces acoustic noise and signal wave noise in audio circuit and so on. Put a capacitor between the power supply lines (VDDB and GNDB) to reduce the noise if necessary.

Note 4: See 2.6 LUMINANCE CONTROL for the definition of f<sub>PWM</sub>. A recommended f<sub>PWM</sub> value is as follows

$$f_{PWM} = \frac{2n-1}{4} \times fv$$

(n = integer, fv = frame frequency of LCD module)

## 2.4 FUSE

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VDDB	FMC16252AB	Kamaya Electric Co.,Ltd	2.5A	5.0A 5s max	Note1
			32V		

Note1: The power supply capacity should be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

# PRELIMINARY

## 2.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

CN1 socket (Driver side): 53261-0871 (MOLEX Inc.)  
 Adaptable plug: 51021-0800 (MOLEX Inc.)

Pin No.	Symbol	Function	Remarks
1	VDDB	Power supply	Note1
2	VDDB	Power supply	
3	GNDB	Ground	
4	GNDB	Ground	
5	BRTC	Backlight ON/OFF signal	High or Open: Backlight ON Low: Backlight OFF
6	BRTI/PWM	Luminance control terminal	Note2
7	BRTH	Luminance control terminal	Note2
8	PWMSEL	Luminance control selector terminal	GNDB: External PWM control Note3 Open: Resistor control or Voltage control Note2

Note1: All GNDB and VDDB terminals must be connected to appropriate terminals.

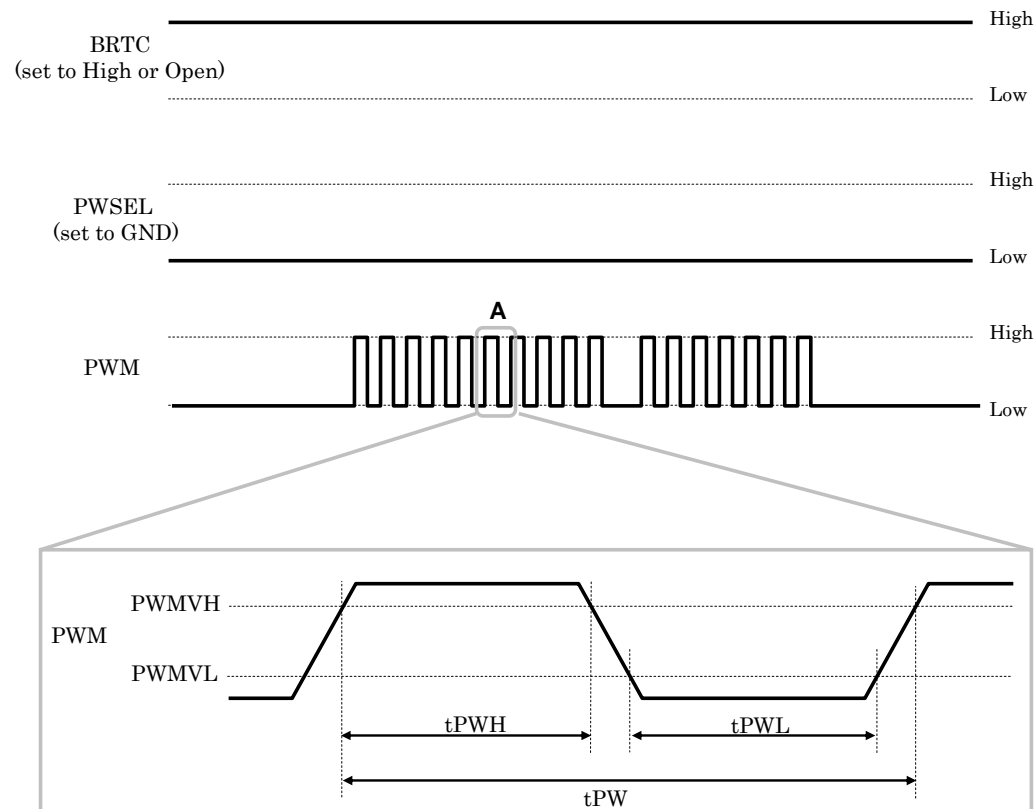
Note2: See "**2.6 LUMINANCE CONTROL**".

Note3: To enable external PWM control, PWMSEL (pin 8) must be set to the ground level of the circuit board.

CN2 socket (Driver side): SM12B-SRSS-TB (J.S.T. Mfg Co., Ltd.)  
 Adaptable plug: SHR-12V-S, SHR-12V-S-B (J.S.T. Mfg. Co., Ltd.)

Pin No.	Symbol	Function
1	A1	Anode 1
2	K1	Cathode 1
3	A2	Anode 2
4	K2	Cathode 2
5	A3	Anode 3
6	K3	Cathode 3
7	N.C.	-
8	N.C.	-
9	N.C.	-
10	N.C.	-
11	N.C.	-
12	N.C.	-

2.6 LUMINANCE CONTROL

Method	Adjustment and luminance ratio															
External PWM	<p>●Adjustment                      Backlight luminance can be controlled by duty ratio of the external PWM signal.                      To enable external PWM control, keep CN1 7pin High or Open, and CN1 8pin at a ground level of the circuit board (GNDB).                      The PWM signal must follow specification noted in the section 2.3 ELECTRICAL CHARACTERISTICS.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>Pin No</th> <th>Symbol</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">BRTC</td> <td style="text-align: center;">High or Open: Backlight ON(Note1) Low: Backlight OFF</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">BRTI/PWM</td> <td style="text-align: center;">See below</td> </tr> <tr> <td style="text-align: center;">7</td> <td style="text-align: center;">BRTH</td> <td style="text-align: center;">See below</td> </tr> <tr> <td style="text-align: center;">8</td> <td style="text-align: center;">PWMSEL</td> <td style="text-align: center;">GNDB (Note2)</td> </tr> </tbody> </table> <p style="margin-left: 40px;">Note1: Voltage level of pin No5 will be pulled up to high level internally when left Open.                      Note2: To enable external PWM control, PWMSEL (pin No8) must be set at the ground level of the circuit board.</p> <p style="text-align: center;"><u>Schematic diagram of external PWM settings</u></p>  <p style="margin-left: 40px;">Definitions of parameters are as follows.</p>	Pin No	Symbol	Remark	5	BRTC	High or Open: Backlight ON(Note1) Low: Backlight OFF	6	BRTI/PWM	See below	7	BRTH	See below	8	PWMSEL	GNDB (Note2)
Pin No	Symbol	Remark														
5	BRTC	High or Open: Backlight ON(Note1) Low: Backlight OFF														
6	BRTI/PWM	See below														
7	BRTH	See below														
8	PWMSEL	GNDB (Note2)														

# PRELIMINARY

$$f_{\text{PWM}} = \frac{1}{t_{\text{PW}}}, DL = \frac{t_{\text{PWH}}}{t_{\text{PW}}}$$

Interference noise may appear when the external PWM frequency and the vertical frame frequency of LCD module are close enough. To avoid interference noise, it is recommended choose the external PWM frequency  $f_{\text{PWM}}$  as follows.

$$f_{\text{PWM}} = \frac{2n-1}{4} \times fv$$

(n = integer, fv = frame frequency of LCD module)

• Relative Luminance

Backlight status	Luminance ratio
Off	0% (Backlight turned off)
On	Less than or equal to 10% (Min. Luminance) Note1
	100% (Max. Luminance)

Note1: This value varies depending on the pulse width.

• Adjustment

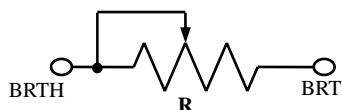
The variable resistor (**R**) for luminance control should be 10kΩ ±5%, 1/10W. Minimum point of the resistor is the minimum luminance. Also maximum point of the resistor is the maximum luminance.

The resistor (**R**) must be connected between BRTH-BRTI terminals.

Resistor control

Pin No	Symbol	Remark
5	BRTC	High or Open: Backlight ON Low: Backlight OFF
6	BRTI/PWM	See below
7	BRTH	See below
8	PWMSEL	Open

Schematic diagram of resistor control settings



• Relative Luminance Note1

Resistance	Luminance ratio
0Ω	10% (Min. luminance)
10kΩ	100% (Max. Luminance)



Voltage control	<ul style="list-style-type: none"> <li>• Adjustment</li> </ul> <p>Voltage control method works, when BRTH terminal is 0V and VBI voltage is applied between BRTI and BRTH terminal. This control method can carry out continuation adjustment of luminance.</p> <p>Luminance is the maximum when BRTI terminal is Open.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 15%;">Pin No</th> <th style="width: 25%;">Symbol</th> <th style="width: 60%;">Remark</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>BRTC</td> <td>High or Open: Backlight ON Low: Backlight OFF</td> </tr> <tr> <td>6</td> <td>BRTI/PWM</td> <td>Voltage</td> </tr> <tr> <td>7</td> <td>BRTH</td> <td>0V</td> </tr> <tr> <td>8</td> <td>PWMSEL</td> <td>Open</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• Relative Luminance Note1</li> </ul> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 40%;">BRTI signal (VBI)</th> <th style="width: 60%;">Luminance ratio</th> </tr> </thead> <tbody> <tr> <td>0V</td> <td>10% (Min. luminance)</td> </tr> <tr> <td>2.5V</td> <td>100% (Max. Luminance)</td> </tr> </tbody> </table>	Pin No	Symbol	Remark	5	BRTC	High or Open: Backlight ON Low: Backlight OFF	6	BRTI/PWM	Voltage	7	BRTH	0V	8	PWMSEL	Open	BRTI signal (VBI)	Luminance ratio	0V	10% (Min. luminance)	2.5V	100% (Max. Luminance)
Pin No	Symbol	Remark																				
5	BRTC	High or Open: Backlight ON Low: Backlight OFF																				
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BRTI signal (VBI)	Luminance ratio																					
0V	10% (Min. luminance)																					
2.5V	100% (Max. Luminance)																					

### 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"** carefully.



**This sign has the meaning that customer will be injured by himself or the product will sustain damage, if a customer does wrong operations.**



**This sign has the meaning that customer will be injured by himself, if a customer does wrong operations.**

### 4.2 CAUTIONS



- \* **Be sure to wait for a while after turning the power OFF before replacing. LED driver is still hot soon after shutting down.**
- \* **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

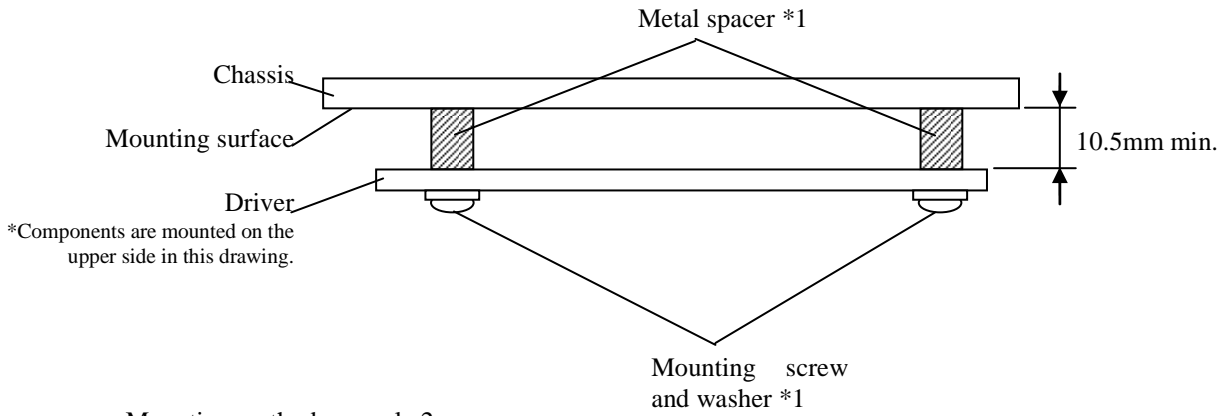
- ① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep a product in a packing box with antistatic pouch under room temperature to avoid dusts and sunlight, when storing the product.
- ② In order to prevent dew condensation occurred by temperature difference, the product packing box should be opened after enough time passed under the environment of an unpacking room. Take the sufficient time before unpacking because a situation of dew condensation is changed by the environmental temperature and humidity. (Recommended leaving time: 6 hours or more with packing state)
- ③ Do not operate in high magnetic field. Circuit boards may be broken down by it.
- ④ This product is not designed as radiation resistant.

#### 4.3.3 Other

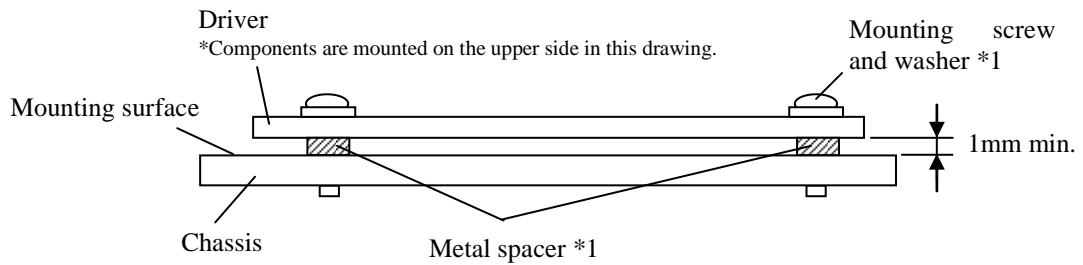
- ① All GNDB and VDDB terminals should be used without any non-connected lines.
- ② Do not disassemble a product.
- ③ Pack a product with original packing material, in order to avoid any damages during transportation, when returning the product to NEC.
- ④ Insert spacers between the LED Driver board and the chassis to secure spatial distance.

# PRELIMINARY

Mounting method example 1.



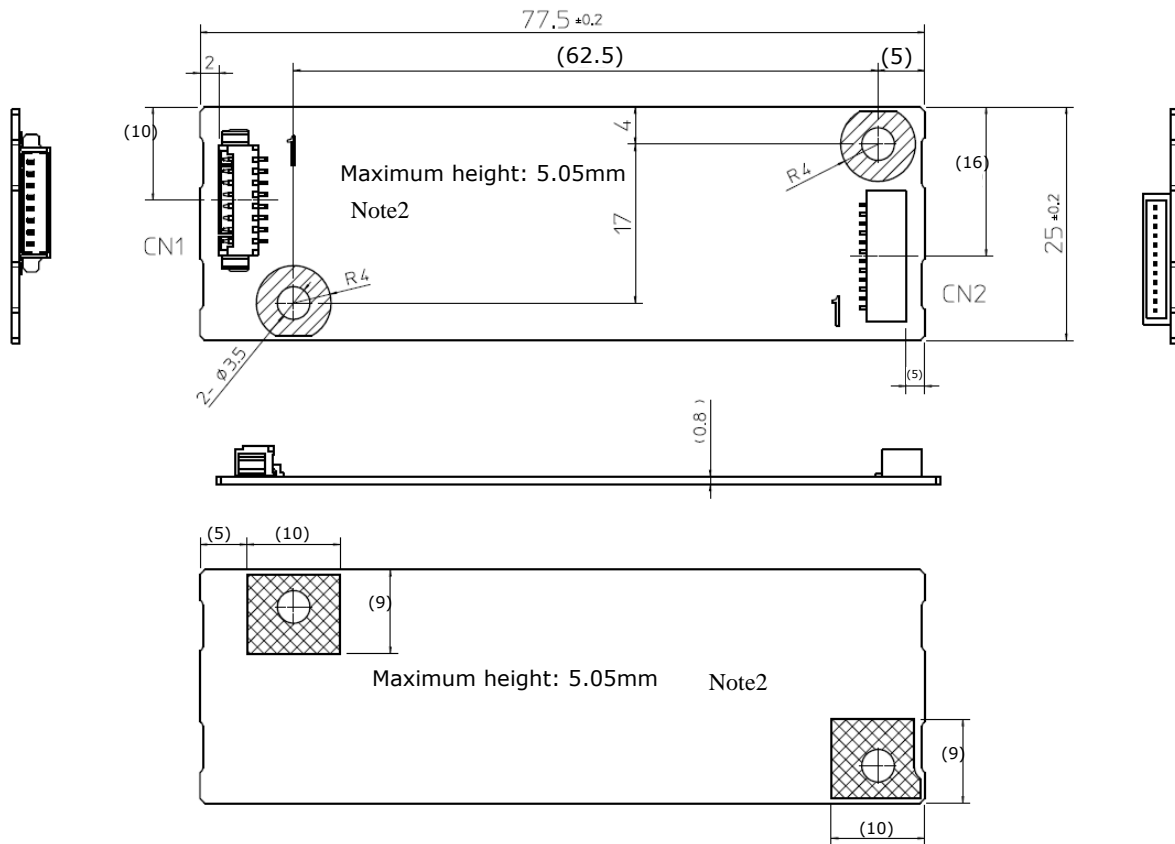
Mounting method example 2.



\*1: The conductive material (mounting screw, washer, metal 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.

Note2: This value excludes the thickness of the base boards.

# PRELIMINARY

## 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-0901	Dec. 4, 2009	<p><b>Revision contents</b> New issue</p> <p><b>Signature of writer</b></p> <table data-bbox="571 667 1430 801"><tr><td data-bbox="571 667 842 701"><i>Approved by</i></td><td data-bbox="847 667 1118 701"><i>Checked by</i></td><td data-bbox="1123 667 1430 701"><i>Prepared by</i></td></tr><tr><td data-bbox="571 707 842 757"></td><td data-bbox="847 707 1118 757">_____</td><td data-bbox="1123 707 1430 757"></td></tr><tr><td data-bbox="571 763 842 801">T. OGAWA</td><td data-bbox="847 763 1118 801">_____</td><td data-bbox="1123 763 1430 801">T. OGAWA</td></tr></table>	<i>Approved by</i>	<i>Checked by</i>	<i>Prepared by</i>		_____		T. OGAWA	_____	T. OGAWA
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