

2DD Series

Isolation Type DC/DC Converter

Rev.2.1
Jun, 2019

Overview

2DD series are insulated DC/DC converters for gate drivers such as SiC MOSFET and IGBT.

The high breakdown voltage and low parasitic capacitance make it suitable for gate drives such as SiC MOSFET and IGBT.

Features

- Ideal for gate drive power supply
- Ideal for half-bridge operation by dual output
- Low parasitic capacitance (about 9 pF); highly resistant to common-mode noise.
- Input-to-Output dielectric withstand voltage : AC5000V
- Output-to-Output dielectric withstand voltage : AC4000V
- Input-to-Output insulation distance : 14mm (clearance·creepage)
- Output-to-Output insulation distance : 12mm (clearance·creepage)
- Incorporating overcurrent protection and overheating protection
- Filling structure

The example of application circuits and parts value which are indicated to this application note aim at assistance of a design. Therefore, external parts variation or user operating conditions are not fully taken into consideration. Please take parts variation, operating conditions into consideration when designing.

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1. Application examples

1.1 Circuit example

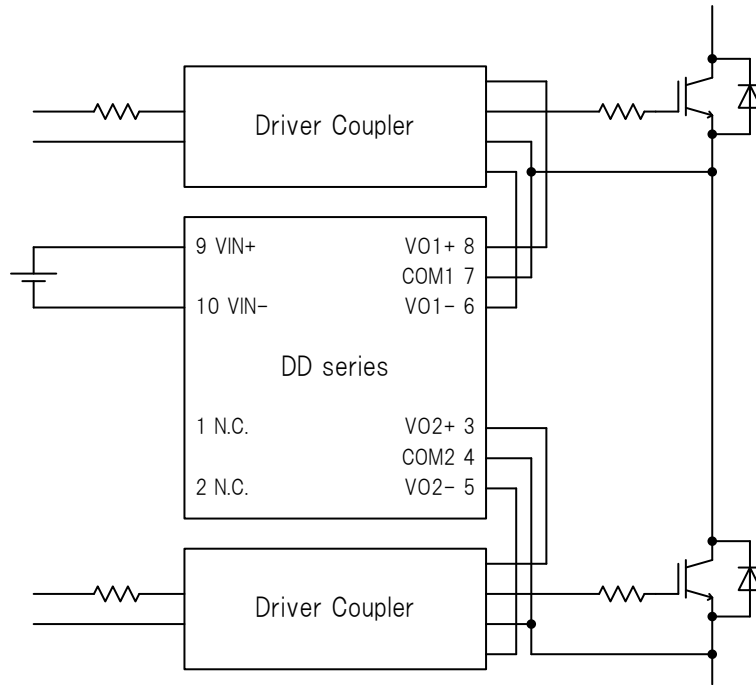


Figure 1.1 Circuit example

1.2 Block diagram

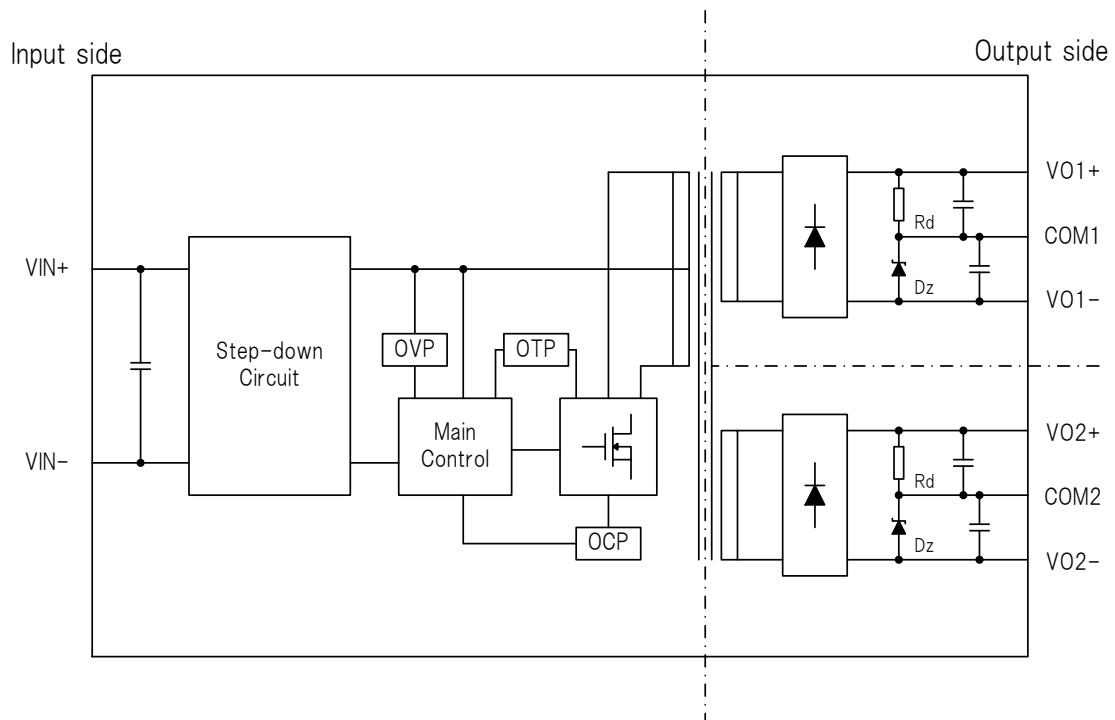


Figure 1.2 Internal block diagram(2DD151008C, 2DD180407C, 2DD180206C)

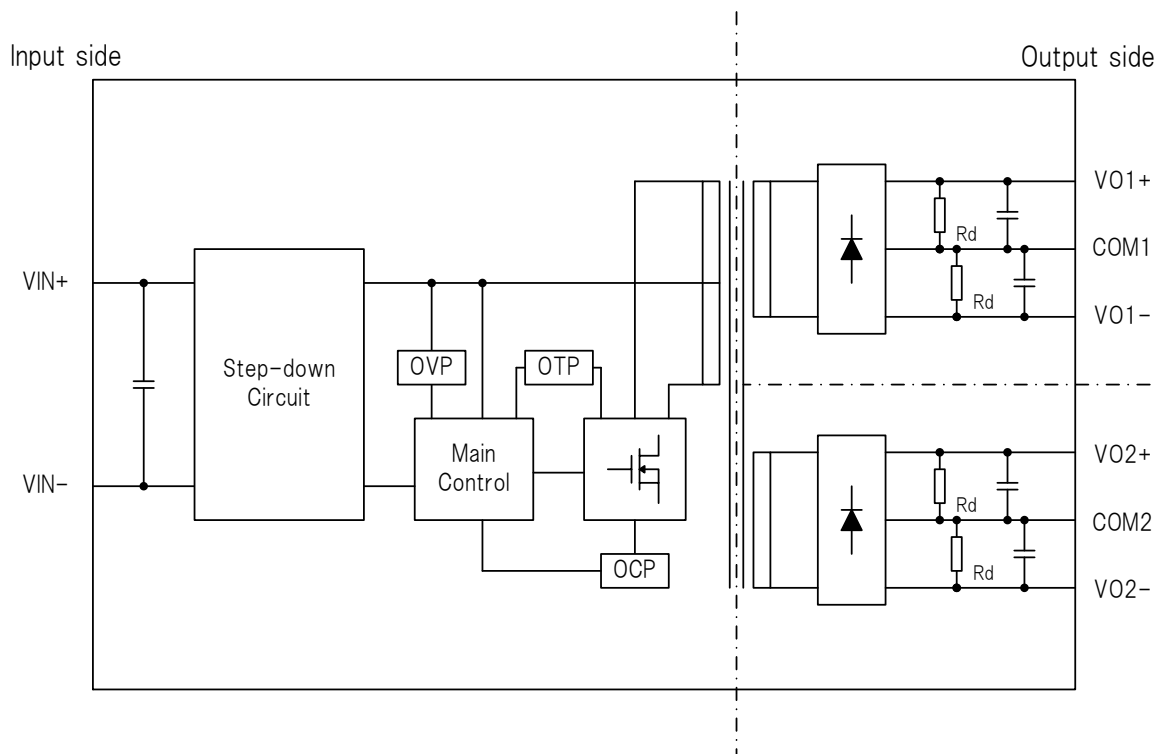


Figure 1.3 Internal block diagram (2DD151507C)

2. Pin functions and descriptions

2.1 Pin functions

Pin No.	Name	Explanation of pins
1	N.C.	Unused ※Don't connect with other circuits.
2	N.C.	Unused ※Don't connect with other circuits.
3	VO2+	Output2 plus
4	COM2	Output2 common
5	VO2-	Output2 minus
6	VO1-	Output1 minus
7	COM1	Output1 common
8	VO1+	Output1 plus
9	VIN+	Input plus
10	VIN-	Input minus

3. Selection and description of external components

3.1 Abnormal input current protection

The DC/DC converter incorporated in the module does not have a fuse or the function of detecting abnormalities in input current.

In order to ensure safety, be sure to install a fuse on the plus side of input.

In order to share an input line and an input electrolytic capacitor with another converter, when selecting a fuse with the high fusing current characteristic, there is a case which a fuse does not blow out at the time of abnormalities. Please perform a safety check enough in such a case.

3.2 COM sink current

The output voltage accuracy may be affected by the COM sink current.

If you want to maintain the accuracy of the output voltage, adjust the current value between VO+~COM and COM~VO- by adding a resistor or the like so that the current value is the same between VO+~COM and COM~VO-.

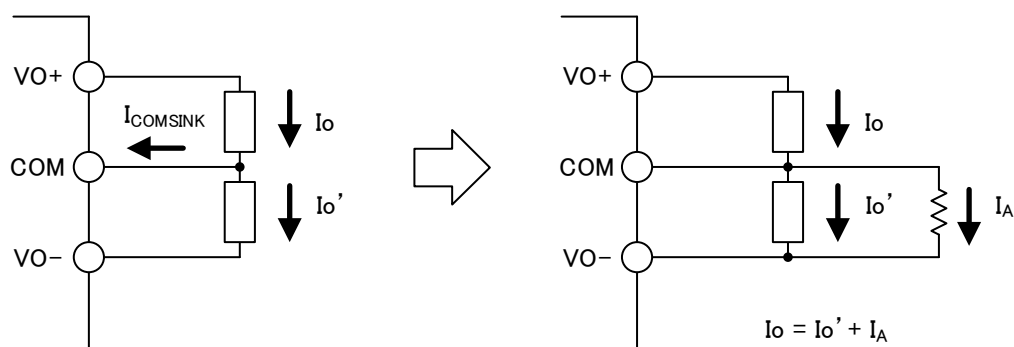


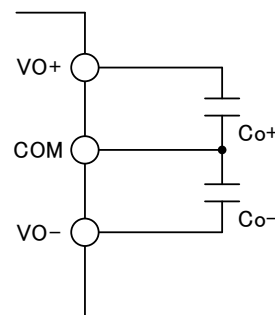
Figure 3.2 Output current adjustment example

3.3 Output smoothing capacitor

When adding the output smoothing capacitor, select the capacitor by paying attention the following:

- ① When arranging output smoothing capacitor between VO+ and COM and between COM and VO-, select the following capacity balance. To suppress the occurrence of overshoot and undershoot.

Model	Capacity ratio Co+:Co-
2DD151507C	1:1
2DD151008C	1:1
2DD180407C	1:2
2DD180206C	1:4



- ② If the capacitance is too large, the overcurrent protection function may operate and startup failure.
 A recommended value is shown in the following table.
 Please ask us, when the capacity more than the following table is required.

Model	Recommendation capacitor	
	CR mode	CC mode
2DD151507C	$\leq 470 \mu F$	$\leq 200 \mu F$
2DD151008C	$\leq 470 \mu F$	$\leq 47 \mu F$
2DD180407C	$\leq 470 \mu F$	$\leq 100 \mu F$
2DD180206C	$\leq 470 \mu F$	$\leq 200 \mu F$

4. Protection functions

4.1 Overload protection function

An overload protection function is protection when an output short circuit or overload occurs. The operation mode is automatic reset operation. Note that an overload decreases output voltage.

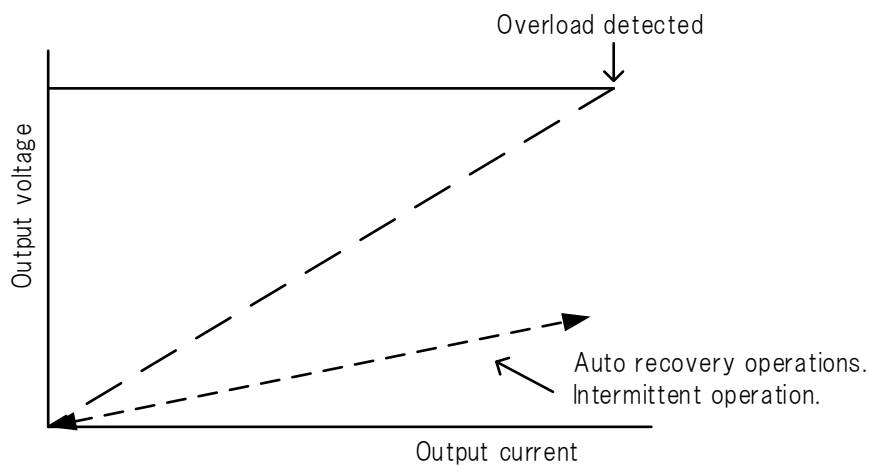


Figure 4.1 Overload protection function

- Auto recovery operations

In case of output short circuit or overload, intermittent operation continues

After the output short-circuit or overload is eliminated, operation is automatically restored to normal.

- Between VO+~COM and COM~VO-

Overload protection does not work at an output short-circuit or overload between VO+~COM and COM~VO-.

Note that VO+ voltage rise in case of output short-circuit or overload between COM~VO-.

4.2 Overheat protection function

This module has an overheat protection function to prevent damage and smoke even if the module overheats for some reason. The operating mode is set for operation stop. Operation is auto restored when the internal temperature of the module becomes normal.

5. Peripheral board design, wiring, and setting for the module

5.1 Input line

Since the input current flow by VIN+, VIN- line, make the pattern wide and short.

Laying out the large current is effective to reduce the noise by laying out the pattern so that it is as small as possible. By placing the + side and - side patterns so that they overlap on both sides, the current loop can be reduced.

5.2 Areas where components and wiring patterns may be placed

The peripheral areas of the module where components nor patterns may be placed are shown in the figure below. Ensure clearance and creepage with each section according to applicable safety standards.

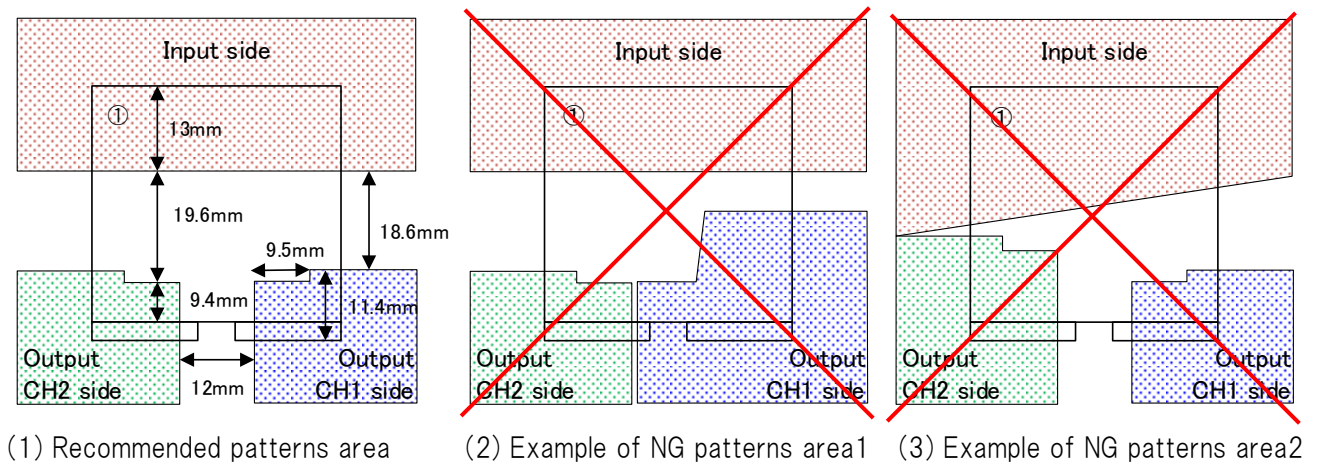


Figure 5.1 Areas where components and wiring patterns may be placed

5.3 Wiring

If multiple modules are driven and there is current flow of between adjacent modules, then wiring should branch from close to the power supply to each module. (Figure 5.2(1))

If it cannot branch from close to the power supply, measures such as adding a capacitor in the immediate vicinity of Module. (Figure 5.2(2))

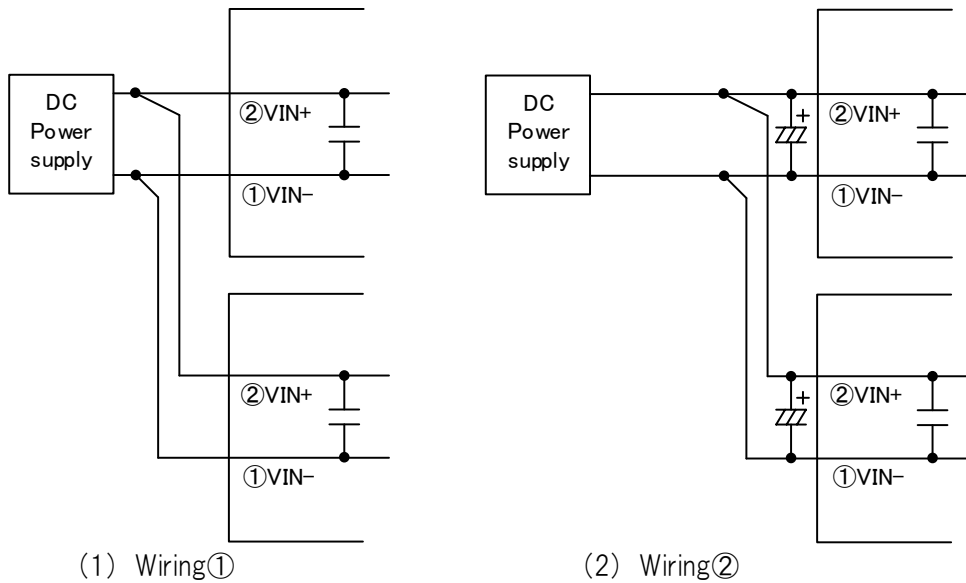


Figure 5.2 DC/DC converter Wiring

5.4 Caution at component mounting

Please mount so that the hole in the bottom of the following figure is not closed.
The output voltage accuracy may be affected.

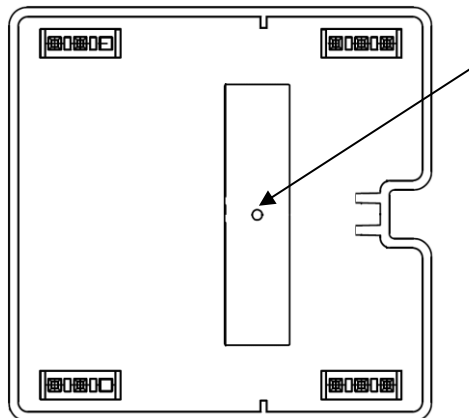
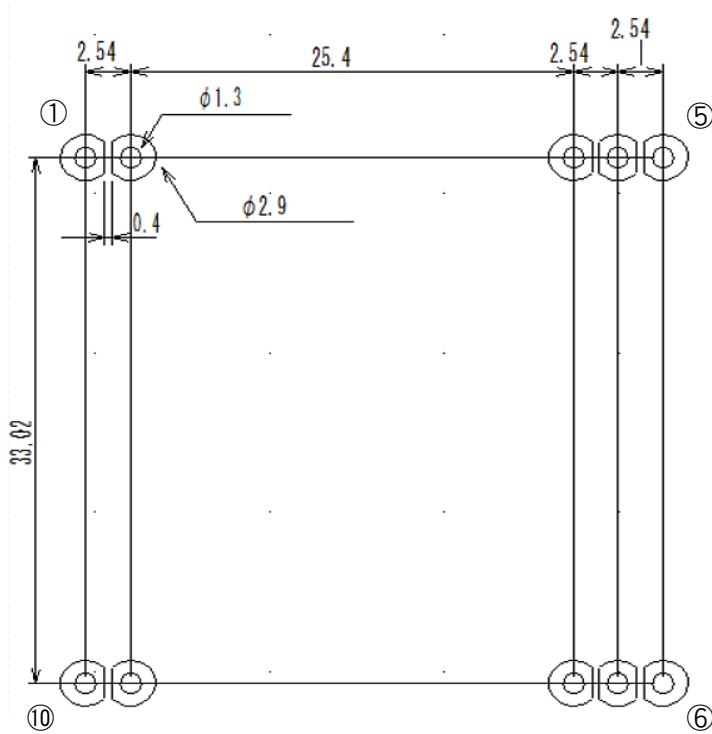


Figure 5.3 DC/DC converter bottom

6. Recommended hole diameter, land size, and pin pitch



· Component side view

· Numbers with a circle are pin numbers

In order to ensure resistance to vibration and drop impact, provide all pins with a land, and solder them.

Unit : mm

7. Recommended soldering conditions (lead-free solder)

(1) Flow soldering: $255 \pm 3^\circ \text{C}$, 5 seconds or less, $110 \pm 10^\circ \text{C}$ for preheat end

(2) Soldering iron: 350°C (MAX), 4 seconds or less

8. Temperature derating

Reduce output power according to the input power derating chart below. If heat is generated from a peripheral component, the temperature of the heat should be regarded as the ambient temperature.

If there is no heat-generating component around the module, the temperature at a point that is 20 mm away from the module and 20 mm above the circuit board should be regarded as the ambient temperature.

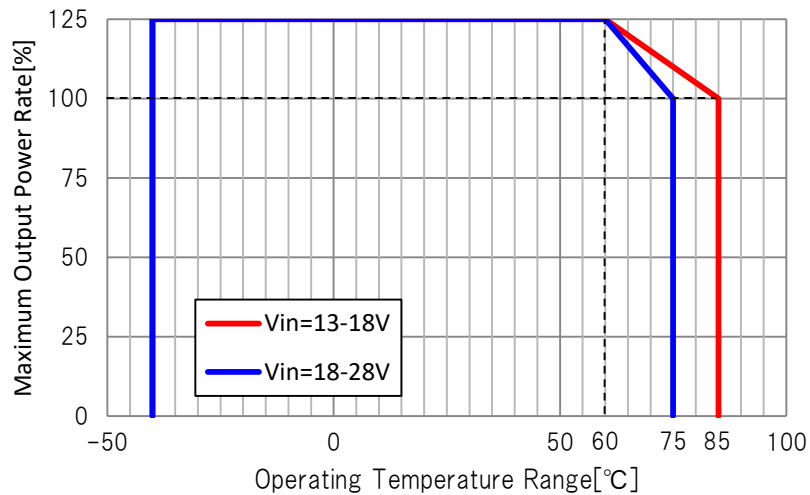


Figure 8.1 Temperature derating diagram

Point where the ambient temperature is measured if there is a heat-generating component near the module

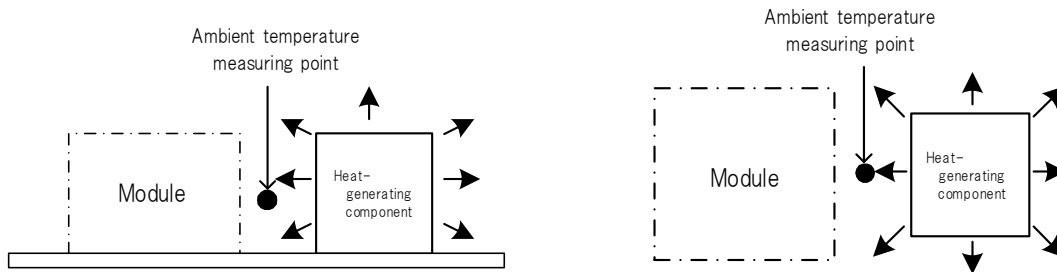


Figure 8.2 Ambient temperature measuring point when there is a heat-generating component near the module

Point where the ambient temperature is measured if there are no effects of heat-generating components

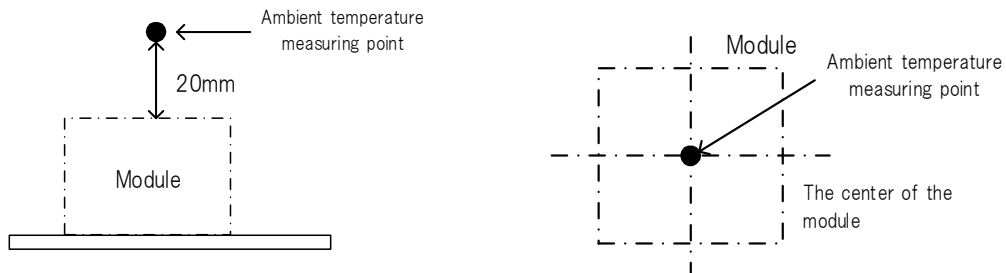


Figure 8.3 Ambient temperature measuring point when there are no effects of heat-generating components

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 - Use that involves exposure to direct sunlight, outdoor exposure, or dusty conditions.
 - Use in locations where corrosive gases such as salt air, C12, H2S, NH3, SO2, or NO2, are present.
 - Use in environments with strong static electricity or electromagnetic radiation.
 - Use that involves placing inflammable material next to the product.
 - Use of this product either sealed with a resin filling or coated with resin.
 - Use of water or a water soluble detergent for flux cleaning.
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