

Gate Driver Unit 2QG010DDC11N
■ Overview

2QG010DDC11N is a dual channel gate driver designed for Fuji Electric's IGBT power module 2MBI1800XXG170-50 .

This gate driver unit contains a built-in isolated DC/DC converter and gate drive circuit. It is ready to use by mounting it on the IGBT power module.

■ Features

- Ideal for drive of IGBT Power module 2MBI1800XXG170-50(Fuji Electric)
- Gate voltage : +15V/-10V
- Gate resistor : +0.22Ω/-1.5Ω(TYP)
- Short circuit detection voltage : 9.5V(TYP)
- ALL-IN-ONE (Built-in isolated DC / DC converter and gate drive circuit)
- Low parasitic capacitance (12pF(TYP)) ; highly resistant to common-mode noise.
- Fast response : About 130nsec(typ)
- The isolation for primary-secondary signal used fast response isolator.
- Dielectric withstand voltage : AC5000V
- Insulation distance (clearance / creepage) : 14mm/16mm (As for Gate driver PCB)
- DC/DC converter input voltage : 13~28V
- Power supply for gate driver input voltage : 13~28V
- Signal input voltage : 15V
- The DC / DC converter has built-in overheat protection and overload protection.
- Desaturation protection (Gate drive circuit)
- Soft turn-off function (Gate drive circuit)
- Fault signal output function (Gate drive circuit)
- Under-voltage lockout(UVLO) (Gate drive circuit)
- Direct mode / Half bridge mode can be switched. (Gate drive circuit)
- Active clamp protection function (Gate drive circuit)
- Safety standards : UL508(file no.E243511) (DC/DC converter only)
- Reinforced isolation according to IEC 60664-1 (IEC61800-5-1, IEC62477-1, IEC62109-1, etc.)
- UL compliant (UL1741, UL508, etc.)
- Insulating moistureproof coating

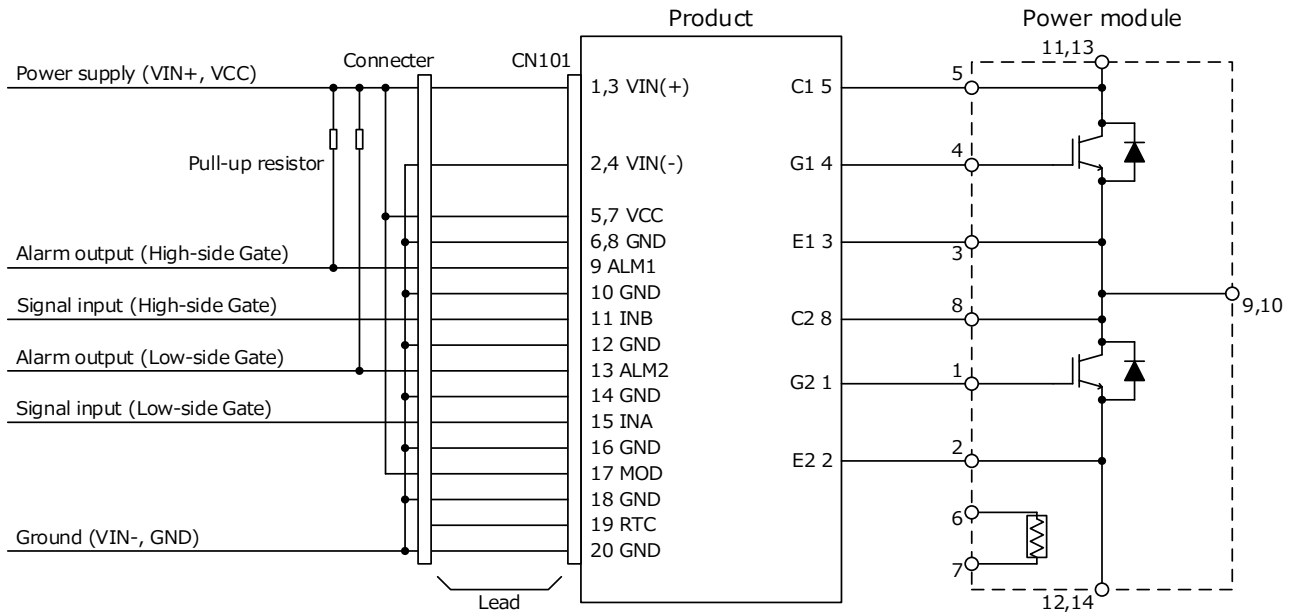
■ Application

Industrial inverter, power conditioner, etc. ...

■ Module information

| Part number | Part number (Uncoated) | Signal input voltage | Active clamp | Status |
|--------------|------------------------|----------------------|--------------|--------|
| 2QG010DDC11N | 2QG010DDN11N | 15V | Yes | Active |

*Uncoated type is sample only

■ Circuit Image

■ Pin Connection

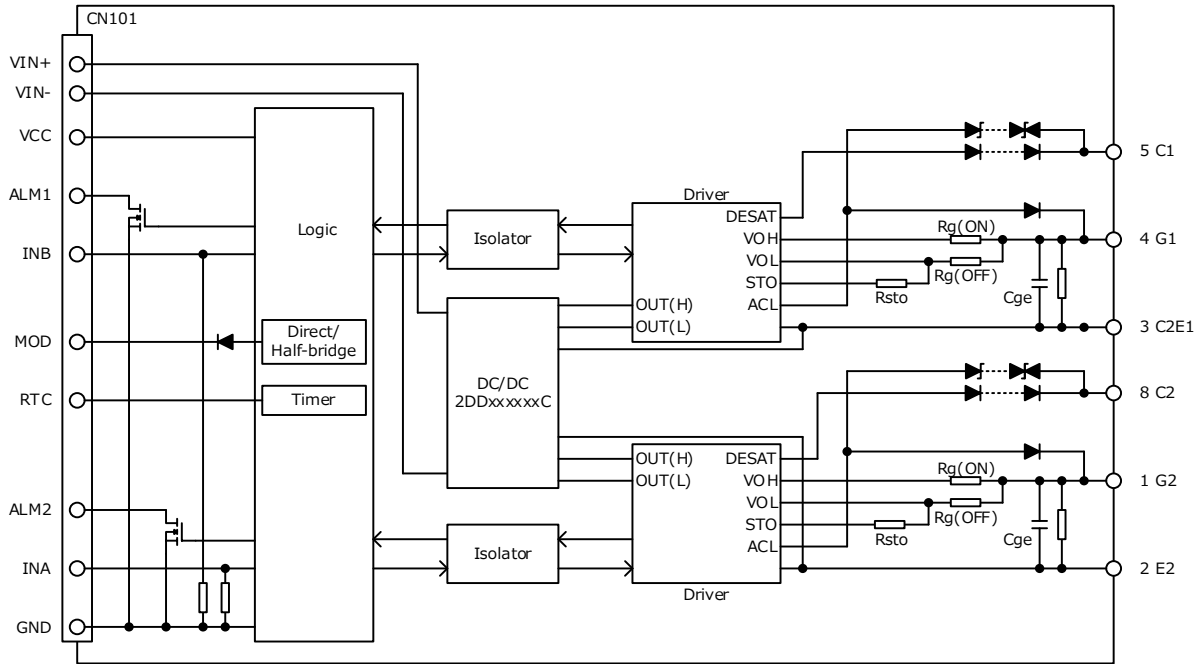
CN101 : RA-H201SD (JST)

| Pin No. | Name | Function | Pin No. | Name | Function |
|---------|--------|---|---------|--------|-------------------------------------|
| 1 | VIN(+) | Power supply for DC/DC converter(+) | 2 | VIN(-) | Power supply for DC/DC converter(-) |
| 3 | VIN(+) | Power supply for DC/DC converter(+) | 4 | VIN(-) | Power supply for DC/DC converter(-) |
| 5 | VCC | Power supply for drive circuit | 6 | GND | Ground for drive circuit |
| 7 | VCC | Power supply for drive circuit | 8 | GND | Ground for drive circuit |
| 9 | ALM1 | Alarm signal output 1 (High side) | 10 | GND | Ground for drive circuit |
| 11 | INB | Control input B (High side) | 12 | GND | Ground for drive circuit |
| 13 | ALM2 | Alarm signal output 2 (Low side) | 14 | GND | Ground for drive circuit |
| 15 | INA | Control input A (Low side) | 16 | GND | Ground for drive circuit |
| 17 | MOD | Mode select | 18 | GND | Ground for drive circuit |
| 19 | RTC | Recovery time of protection circuit control | 20 | GND | Ground for drive circuit |

※Reference receptacle : RA-S201T (JST)

Connection on the power module

| Pin No. | Name | CH | Function |
|---------|------|------|---------------------------------|
| 1 | G2 | 2(L) | Gate connection, Low side |
| 2 | E2 | 2(L) | Emitter connection, Low side |
| 3 | E1 | 1(H) | Emitter connection, High side |
| 4 | G1 | 1(H) | Gate connection, High side |
| 5 | C1 | 1(H) | Collector connection, High side |
| 8 | C2 | 2(L) | Collector connection, Low side |

Internal Block Diagram

I/O Condition Table

| No. | Status | Input | | | | | | Output | | | | |
|-----|-----------------------------|-----------------------------|-------|-------|------|-----|-----|--------|------|-------|-------|---|
| | | OUT(H) | C1(H) | C2(L) | MOD | INB | INA | ALM1 | ALM2 | G1(H) | G2(L) | |
| 1 | V _{OUT} UVLO | UVLO | X | X | X | X | X | L | L | L | L | |
| 2 | G-E short | ○ | X | X | X | X | X | L | L | SD | SD | |
| 3 | Normal operation | ○ | - | L | H | - | L | - | Hi-Z | - | L | |
| 4 | | ○ | - | L | H | - | H | - | Hi-Z | - | H | |
| 5 | | ○ | L | - | H | L | - | Hi-Z | - | L | - | |
| 6 | | ○ | L | - | H | H | - | Hi-Z | - | H | - | |
| 7 | | ○ | L | L | L | L | X | Hi-Z | Hi-Z | L | L | |
| 8 | | ○ | L | L | L | H | L | Hi-Z | Hi-Z | H | L | |
| 9 | | ○ | L | L | L | H | H | Hi-Z | Hi-Z | L | H | |
| 10 | | Short circuit detection (L) | ○ | - | Hi-Z | H | - | L | - | Hi-Z | - | L |
| 11 | | | ○ | - | Hi-Z | H | - | H | - | L | - | L |
| 12 | ○ | | - | Hi-Z | L | H | L | - | Hi-Z | - | L | |
| 13 | Short circuit detection (H) | ○ | - | Hi-Z | L | H | H | - | L | - | L | |
| 14 | | ○ | Hi-Z | - | H | L | - | Hi-Z | - | L | - | |
| 15 | | ○ | Hi-Z | - | H | H | - | L | - | L | - | |
| 16 | | ○ | Hi-Z | - | L | H | H | Hi-Z | - | L | - | |
| 17 | | ○ | Hi-Z | - | L | H | L | - | L | - | - | |

G-E short : Gate-Emitter short

○ : OUT(H) > UVLO, X : Don't care

SD : Shut down (Gate-Emitter short)

■ Absolute Maximum Ratings

| Item | Symbol | Min | Max | Unit | Conditions · Note | |
|---|-------------------|----------|-------------------------|------|-------------------------------------|-------------------------------------|
| Input voltage for DC/DC converter | V_{IN} | -0.3 | 28 | Vdc | Between VIN(+) to VIN(-) | |
| Input voltage for Gate driver | V_{CC} | -0.3 | 28 | Vdc | Between VCC to GND | |
| Input-side signal voltage | V_{SG} | -0.3 | $V_{CC}+0.3$ or 18 * | V | INA, INB *Whichever is less | |
| | V_{MOD} | -0.3 | 28 | V | MOD | |
| | V_{RTC} | -0.3 | 5 | V | RTC | |
| Maximum gate current | I_{GPEAK} | - | 43 | A | Excluding gate resistor | |
| Switching frequency | F_{SW} | - | 20 | kHz | See the permissible frequency curve | |
| Short circuit detection pin voltage | V_{SD} | 0 | 1700 | V | | |
| Alarm signal output pin maximum voltage | V_{ALM} | -0.3 | $V_{CC}+0.3$ or 28 * | V | ALM1,2 *Whichever is less | |
| Input-side signal maximum current | I_{ALM} | - | 5 | mA | ALM1,2 | |
| Operating temperature range | $V_{IN}=13.5-18V$ | T_{OP} | -40 | 85 | °C | See the permissible frequency curve |
| | $V_{IN}=18-26.4V$ | T_{OP} | -40 | 75 | °C | |
| Operating humidity | RH_{OP} | 20 | 95 | %RH | No condensation | |
| Storage temperature range | T_{STG} | -40 | 90 | °C | | |
| Storage humidity | RH_{STG} | 5 | 95 | %RH | No condensation | |

■ Recommended Operating Conditions

| Item | Symbol | Min | Max | Unit | Conditions · Note |
|---|---------------|------|-------------------------|------|-------------------------------------|
| Input voltage range for DC/DC converter | V_{IN} | 13.5 | 26.4 | Vdc | |
| Input voltage range for gate driver | V_{CC} | 13.5 | 26.4 | Vdc | |
| Driver circuit number | N | - | 2 | - | |
| Maximum gate charge | Q_G | - | 14000 | nC | *1 |
| Switching frequency ($Q_g=12500nC$) | F_{SW} | - | 8.8 | kHz | See the permissible frequency curve |
| MOD pin high input voltage | V_{MODH} | 3.3 | 26.4 | V | |
| MOD pin low input voltage | V_{MODL} | -0.3 | 0.5 | V | |
| Logic high level input voltage | V_{SGH} | 13 | $V_{CC}+0.3$ or 16 * | V | INA, INB *Whichever is less |
| Logic low level input voltage | V_{SGL} | -0.3 | 0.5 | V | INA, INB |
| Source current of control signal | I_{SG} | 3.3 | - | mA | INA, INB $V_{SG}=15V$ |
| For 2QGxxxDxx11N(Active clamp model) | | | | | |
| DC-link voltage | $V_{DC-LINK}$ | - | 1100 | V | *2 |

*1 If the gate charge exceeds the allowable value, the gate voltage at turn-on and turn-off will drop, which may affect the switching performance of the IGBT.

If you are considering using it under conditions other than the recommended conditions, please contact us.

*2 Use below the recommended DC link voltage.

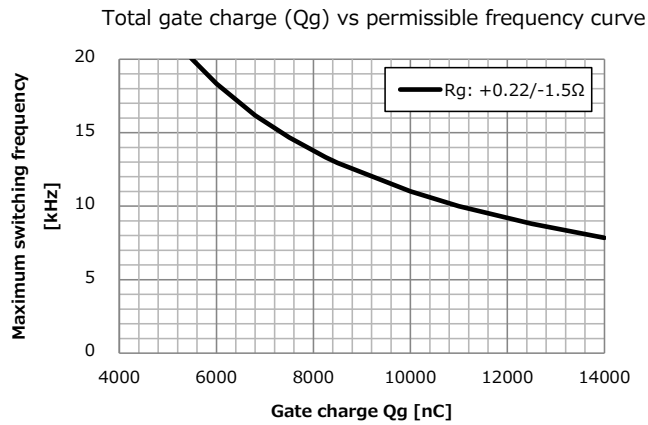
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■ Permissible frequency curve

Internal gate resistor of IGBT = 2.08Ω

*The permissible frequency curve changes with the ratio of the IGBT internal gate resistance to the gate resistance.

Therefore, as the internal resistance of the IGBT decreases, the allowable frequency also decreases.



Ta: -40~+85°C / VIN = 13.5~18V

Ta: -40~+75°C / VIN = 18~26.4V

■ Electrical Specification (Vin=Vcc=15V, Ta=25°C, Unless otherwise specified)

| Item | Symbol | Min | Typ | Max | Unit | Conditions · Note | |
|--------------------------------|--------------------|-------------------|------|------|------|-------------------------------------|--|
| DC/DC converter | | | | | | | |
| Start-up voltage | V _{START} | - | 11.5 | 12.5 | V | | |
| Input current | I _{IN} | - | 0.5 | - | A | Fsw=8.8kHz, Test load : 2.15Ω/500nF | |
| | | - | 0.5 | - | | Fsw=10kHz, Test load : 2.15Ω/440nF | |
| Standby power | P _{STBY} | - | 1.3 | - | W | No load | |
| Logic inputs | | | | | | | |
| Logic high level input voltage | V _{SGH} | - | 10.4 | 11.4 | V | INA, INB /Guaranteed by design | |
| Logic low level input voltage | V _{SGL} | 4.9 | 5.9 | - | V | INA, INB /Guaranteed by design | |
| Logic pull-down resistance | R _{SGD} | - | 4500 | - | Ω | INA, INB | |
| Gate driver output | | | | | | | |
| Output pin voltage(High) | V _{OUTH} | 14 | 15 | 16 | V | No load | |
| Output pin voltage(Low) | V _{OUTL} | -11 | -10 | -9 | V | No load | |
| Gate resistor | Rg(ON) | - | 0.22 | - | Ω | | |
| | Rg(OFF) | - | 1.5 | - | | | |
| Auxiliary gate capacitor | Cge | - | OPEN | - | nF | | |
| Delay time | Turn ON time | t _{PON} | - | 130 | - | ns | |
| | Turn OFF time | t _{POFF} | - | 130 | - | ns | |
| Dead time | t _{DEAD} | - | 3 | - | us | Half bridge mode | |

■ Protection

| Item | Symbol | Min | Typ | Max | Unit | Conditions · Note |
|-------------------------------------|-----------------------|------|------|------|------|-------------------------------------|
| DC/DC converter | | | | | | |
| Overload protection | - | 10.5 | - | - | W | Auto recovery |
| Overheat protection | - | 120 | - | 150 | °C | Auto recovery, Internal temperature |
| Gate driver | | | | | | |
| Output voltage(H) UVLO OFF voltage | V _{UVLOOFFH} | 13.2 | 13.5 | 13.8 | V | Guaranteed by design |
| Output voltage(H) UVLO ON voltage | V _{UVLOONH} | 12.2 | 12.5 | 12.8 | V | Guaranteed by design |
| Short circuit detection voltage | V _{SD} | - | 9.5 | - | V | |
| Short circuit detection filter time | t _{SHORTFIL} | - | 4.5 | - | us | Collector open |
| Alarm signal output L voltage | V _{ALML} | - | - | 0.5 | V | I _{ALM} =5mA |
| Alarm signal output time | t _{ALM} | - | 0.2 | - | us | |
| Restart time | t _{RESTART} | - | 110 | - | ms | |
| Soft turn-off resistance | R _{STO} | - | 12 | - | Ω | |
| Soft turn-off duration | t _{STO} | - | 4 | - | us | |

■ Insulation

| Item | Specification | Conditions · Note |
|---------------------------------------|-------------------------------|--------------------------------|
| Between Input-Output | | |
| Dielectric withstand voltage | AC5000V | 1min, Cutoff 2mA |
| Insulation resistance | 100MΩ or more | DC500V |
| Partial discharge extinction voltage | 1768V _{peak} or more | According to EN50178/IEC 60270 |
| Common-mode transient immunity (CMTI) | 70kV/us | |
| Minimum clearance distances | 14mm | As for Gate driver PCB |
| Minimum creepage distances | 16mm | |
| Between CH1-CH2 | | |
| Minimum clearance distances | 8mm | |
| Minimum creepage distances | 12mm | |

■ Storage Conditions

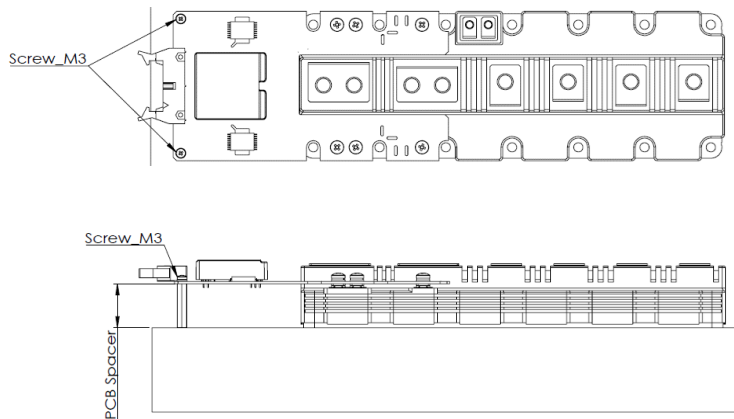
| Item | Min | Max | Unit | Conditions · Note |
|---------------------|-----|-----|------|-------------------|
| Storage temperature | -25 | 60 | °C | A packing state |

Usage Cautions

- Always mount fuse on the plus side of input for ensuring safety because the fuse is not built-in the product.
Please select the fuse considering conditions such as steady current, inrush current, and ambient temperature.
When using a fuse having large rated current or high capacity input electrolytic condenser, by combining another converter and input line and input electrolytic condenser, fuse may not blow off in the case of abnormality.
Do not combine high voltage line and fuse.
- Make sure the rise/fall time of the input signal is 500ns or less.
Also, keep input wiring as far as possible from noise sources.
To prevent malfunction due to noise, we recommend the highest possible signal voltage within the recommended range.
- Please do not apply excessive stress to this product when attaching to IGBT power module.
Please follow the device manufacturer's instructions on how to install the IGBT power module (type of screw used, material, tightening torque conditions, etc.).
Also, if the product is exposed to vibration or shock, the PCB should be fixed with spacers as shown in the figure below.
The screw header / washer diameter uses the following.

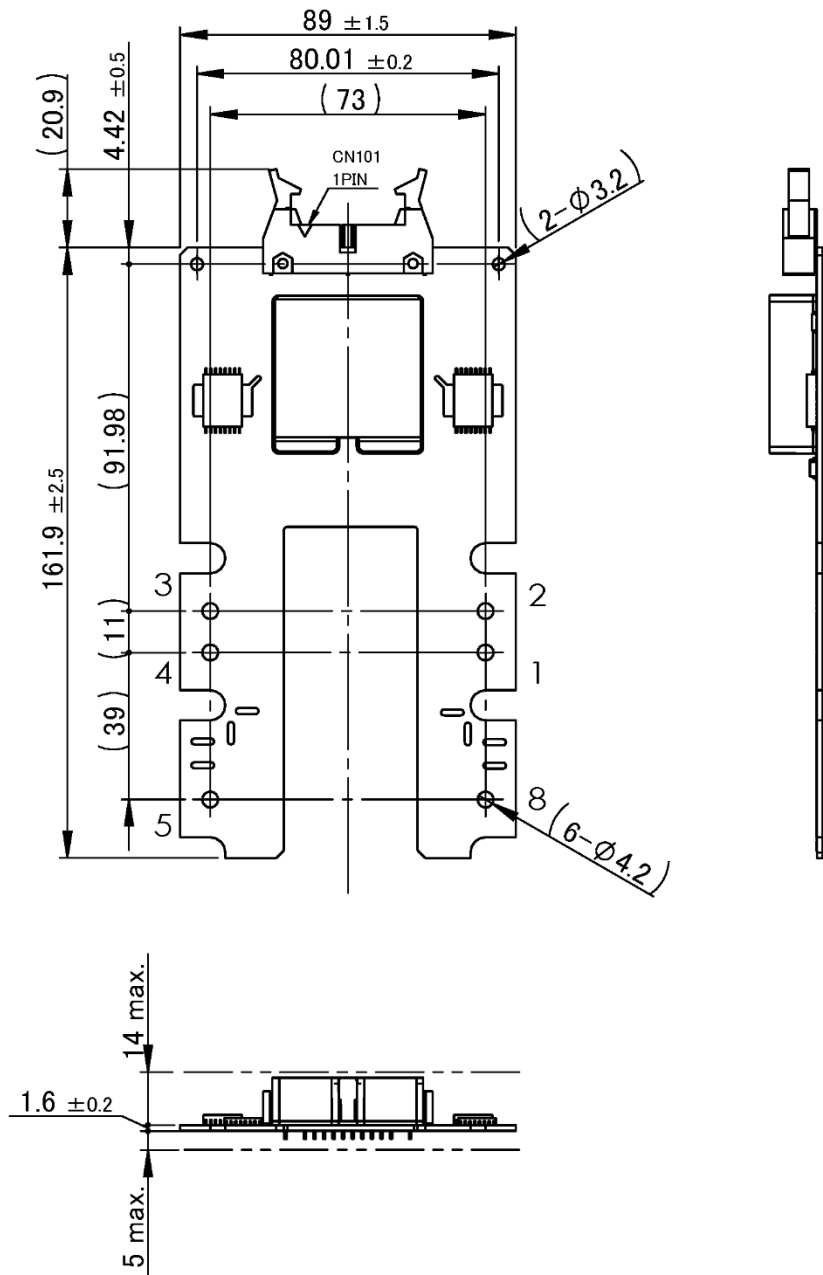
 - M3 (Printed circuit board fixed) : 7mm or less
 - M4 (Connection on the power module) : 9mm or less

*To maintain the reliability of parts near the metal terminal pad, the screw header including the washer must not exceed the available metal terminal pad of the gate driver.



- This product has DESAT protection for arm short circuit and load short circuit protection.
However, even if this protection works, the IGBT may be damaged if abnormally high current occurs due to IGBT's characteristics variations or the load short-circuit mode during parallel operation.
To ensure safety, be sure to check the short-circuit current at the unit in which this product is integrated, and evaluate whether it can protect under the condition that there is no damage to the IGBT.
- The coating material is applied to the product, so it may appear to be partially whitened.
This does not affect the characteristics of the product.

■ Outline Dimensional Drawing



Unit: mm

Note: 1. The dimensional tolerance without directions is ± 0.5 mm.

■ Product Weight

78.0g(typ)

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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.
 - Use in locations where condensation is liable to occur.
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