

Gate Driver Unit 2LG02xCxC11M

■ Overview

2LG02xCxC11M is a dual channel gate driver designed for Mitsubishi Electric's IGBT power module CM1200DW-24T/ CM800DW-24T .

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 CM1200DW-24T/ CM800DW-24T(Mitsubishi Electric)
- Gate voltage : +15V/-10V
- Gate resistor : +1.5Ω/-4.7Ω(TYP)
- Short circuit detection voltage : 9.5V(TYP)
- ALL-IN-ONE (Built-in isolated DC / DC converter and gate drive circuit)
- Low parasitic capacitance (18pF(TYP)) ; highly resistant to common-mode noise.
- Fast response : about 140ns(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 module PCB)
- DC/DC converter input voltage : 13~28V
- Power supply for gate driver input voltage : 13~28V
- Signal input voltage : 3.3~15V or 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)
- Parallel drive possible by connected a slave unit
- Thermistor isolated amplifier output function (Option)
- Safety standards : UL508(file no.E243511) (DC/DC converter only)
- UL1741, UL508, IEC62109-1, EN50178 compliant (Reinforced isolation according to IEC 60664-1)
- UL compliant (UL1741, UL508, etc.)
- Insulating moistureproof coating

■ Application

Industrial inverter, power conditioner, etc. ...

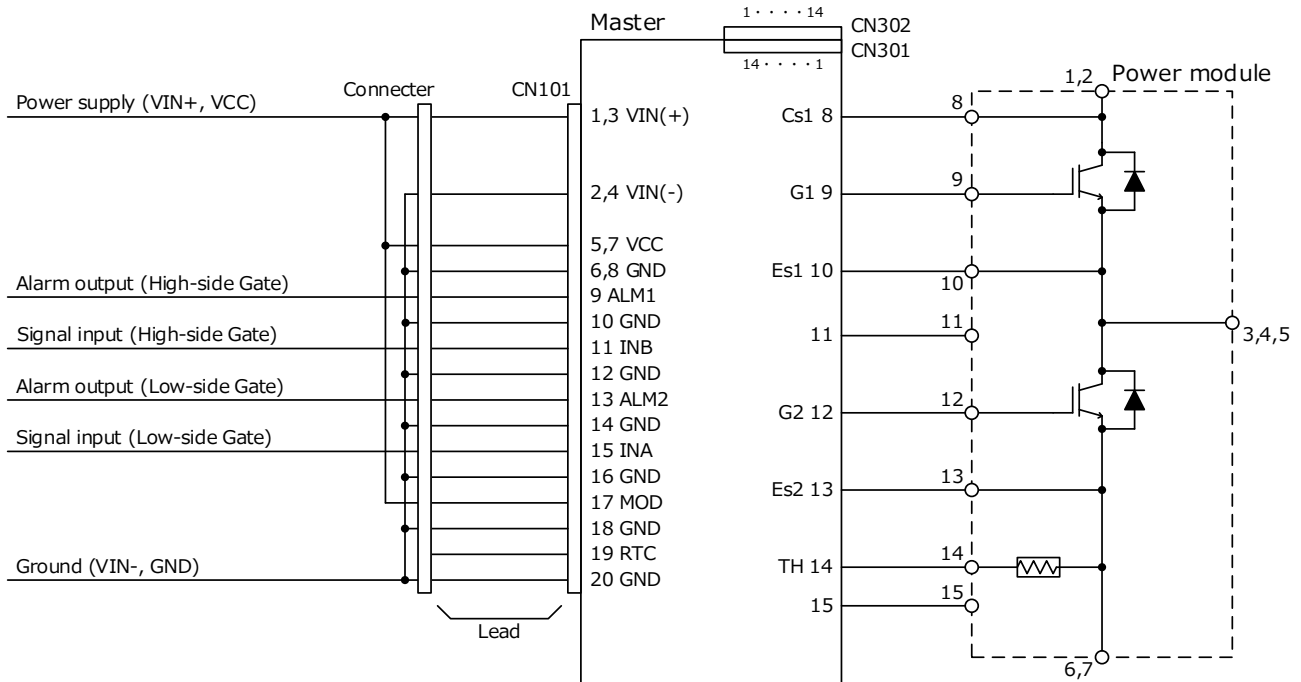
■ Module Information

| Part number | Part number (Uncoated) | Signal input voltage | Active clamp | TH Isolated amplifier | Status |
|--------------|------------------------|----------------------|--------------|-----------------------|----------|
| 2LG02ACCC11M | 2LG02ACCN11M | 3.3~15V | None | Yes | Planning |
| 2LG020CCC11M | 2LG020CCN11M | 3.3~15V | None | None | Planning |
| 2LG02ACDC11M | 2LG02ACDN11M | 15V | None | Yes | Planning |
| 2LG020CDC11M | 2LG020CDN11M | 15V | None | None | Planning |

*Uncoated type is sample only

*Refer to the [2LG02xCZC11S] data sheet for slave units.

■ Circuit Image (No thermistor isolated amplifier output function)



■ Pin Connection (No thermistor isolated amplifier output function)

CN101 : RA-H201TD (JST)

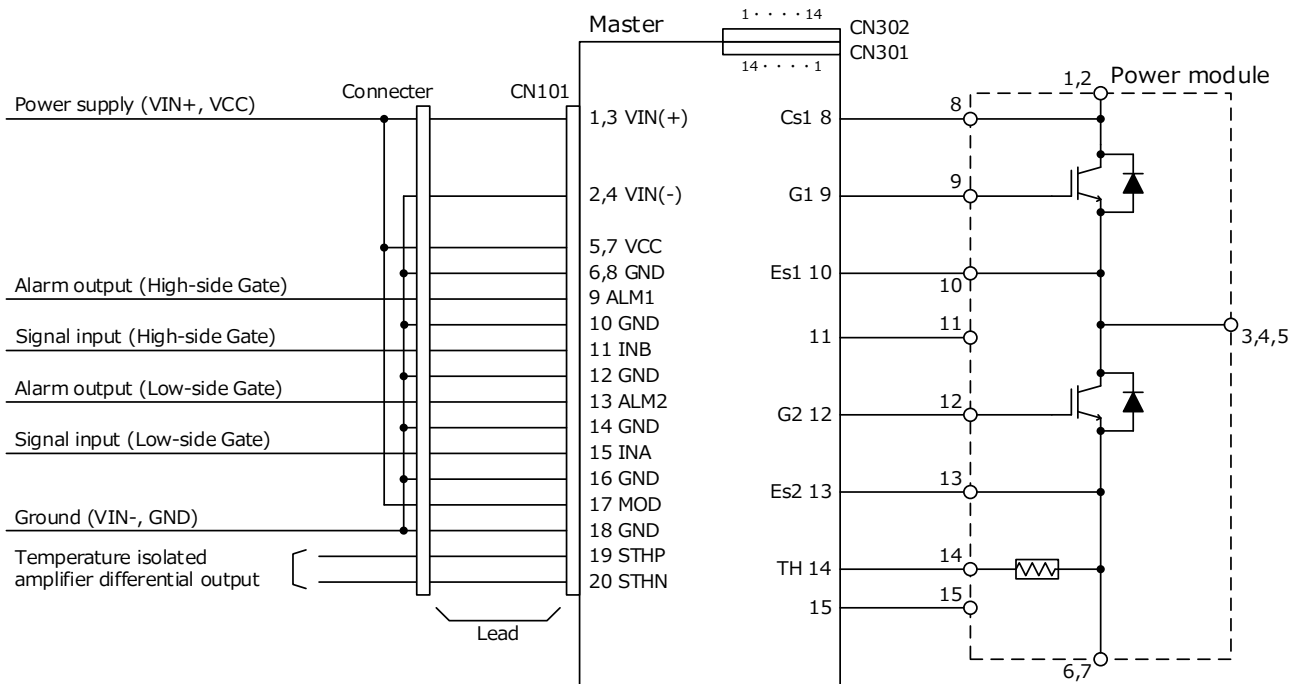
| Pin No. | Name | Function | Pin No. | Name | Function |
|---------|--------|--|---------|--------|-------------------------------------|
| 1 | VIN(+) | Power supply for DC/DC converter(+) | 2 | VIN(-) | Power supply for DC/DC converter(-) |
| 3 | VIN(+) | Power supply for DC/DC converter(+) | 4 | VIN(-) | Power supply for DC/DC converter(-) |
| 5 | VCC | Power supply for signal control circuit | 6 | GND | Ground for drive circuit |
| 7 | VCC | Power supply for signal control 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 | Restart time of protection circuit control | 20 | GND | Ground for drive circuit |

※Reference receptacle : RA-S201T (JST)

Connection on the power module

| No. | Name | CH | Function | No. | Name | CH | Function |
|-----|------|------|--------------------------------------|-----|------|------|--------------------------------------|
| 8 | Cs1 | 1(H) | Collector connection, High side | 12 | G2 | 2(L) | Gate connection, Low side |
| 9 | G1 | 1(H) | Gate connection, High side | 13 | Es2 | 2(L) | Emitter connection, Low side |
| 10 | Es1 | 1(H) | Emitter connection, High side | 14 | TH | 2(L) | Thermistor connection, Low side |
| 11 | None | - | Electrical connection is not allowed | 15 | None | - | Electrical connection is not allowed |

■ Circuit Image (With thermistor isolated amplifier output function)



■ Pin Connection (With thermistor isolated amplifier output function)

CN101 : RA-H201TD (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 signal control circuit | 6 | GND | Ground for drive circuit |
| 7 | VCC | Power supply for signal control 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 | STHP | Noninverting analog output of the isolated amplifier | 20 | STHN | Inverting analog output of the isolated amplifier |

※Reference receptacle : RA-S201T (JST)

Connection on the power module

| No. | Name | CH | Function | No. | Name | CH | Function |
|-----|------|------|--------------------------------------|-----|------|------|--------------------------------------|
| 8 | Cs1 | 1(H) | Collector connection, High side | 12 | G2 | 2(L) | Gate connection, Low side |
| 9 | G1 | 1(H) | Gate connection, High side | 13 | Es2 | 2(L) | Emitter connection, Low side |
| 10 | Es1 | 1(H) | Emitter connection, High side | 14 | TH | 2(L) | Thermistor connection, Low side |
| 11 | None | - | Electrical connection is not allowed | 15 | None | - | Electrical connection is not allowed |

■ Pin Connection for Parallel

CN301 : B10(14-6.7.8.9)B-PASK(LF)(SN) (JST)

| Pin No. | Name | CH | Function |
|---------|-------|----|---|
| 1 | CC1A1 | 1 | Connect the communication line for parallel drive 2LG02xxZx11S series |
| 2 | CC1A2 | 1 | |
| 3 | CC1A3 | 1 | |
| 4 | CC1A4 | 1 | |
| 5 | CC1A5 | 1 | |
| 6 | None | - | Pin removal for insulation distance between CH1 and CH2 |
| 7 | None | - | |
| 8 | None | - | |
| 9 | None | - | |
| 10 | CC2A5 | 2 | Connect the communication line for parallel drive 2LG02xxZx11S series |
| 11 | CC2A4 | 2 | |
| 12 | CC2A3 | 2 | |
| 13 | CC2A2 | 2 | |
| 14 | CC2A1 | 2 | |

※Recommend receptacle : PAP-14V-S (JST)

CN302 : B10(14-6.7.8.9)B-PASK(LF)(SN) (JST)

| Pin No. | Name | CH | Function |
|---------|-------|----|---|
| 1 | CC2B1 | 2 | Connect the communication line for parallel drive 2LG02xxZx11S series |
| 2 | CC2B2 | 2 | |
| 3 | CC2B3 | 2 | |
| 4 | CC2B4 | 2 | |
| 5 | CC2B5 | 2 | |
| 6 | None | - | Pin removal for insulation distance between CH1 and CH2 |
| 7 | None | - | |
| 8 | None | - | |
| 9 | None | - | |
| 10 | CC1B5 | 1 | Connect the communication line for parallel drive 2LG02xxZx11S series |
| 11 | CC1B4 | 1 | |
| 12 | CC1B3 | 1 | |
| 13 | CC1B2 | 1 | |
| 14 | CC1B1 | 1 | |

※Recommend receptacle : PAP-14V-S (JST)

■ I/O Condition Table

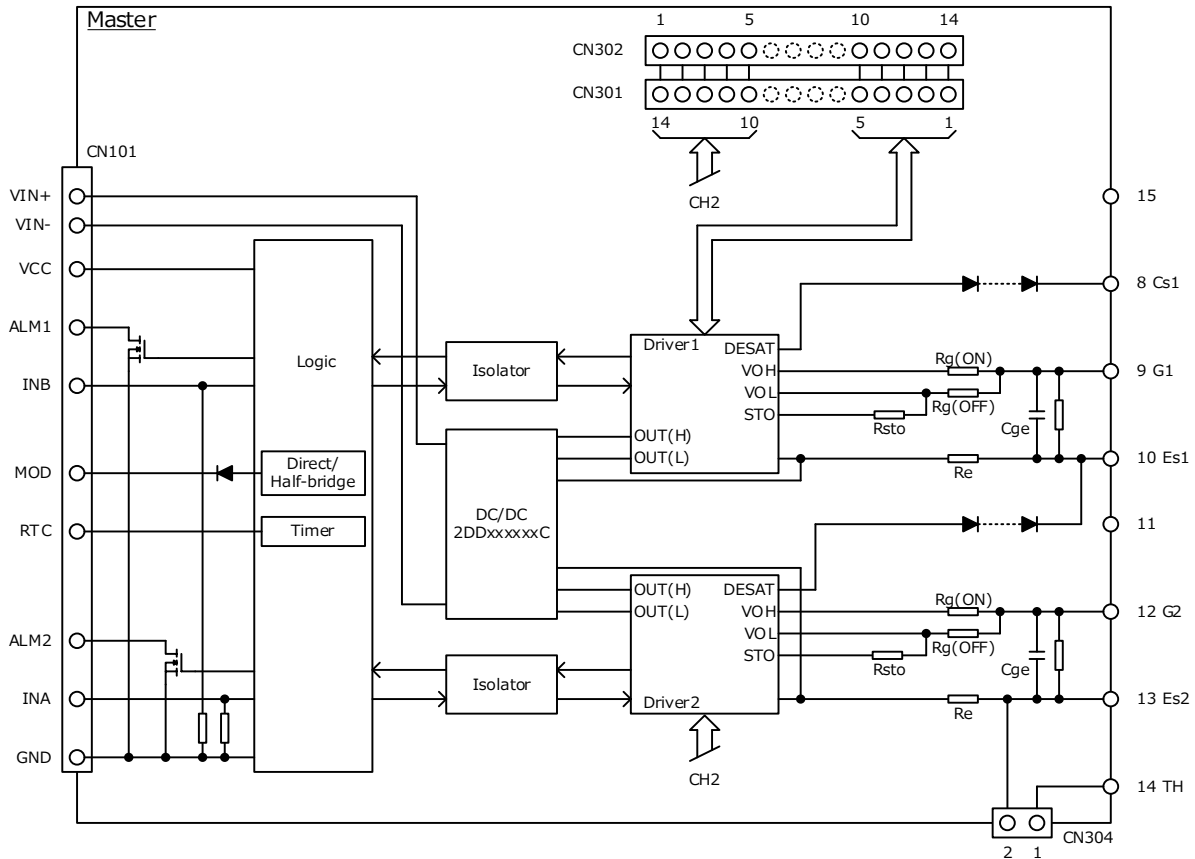
| No. | Status | Input | | | | | Output | | | | |
|-----|-----------------------------|--------|--------|--------|-----|-----|--------|------|------|-------|-------|
| | | OUT(H) | Cs1(H) | Es1(L) | MOD | INB | INA | ALM1 | ALM2 | G1(H) | G2(L) |
| 1 | V _{OUT} UVLO | UVLO | X | X | X | X | X | L | L | 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 | | ○ | - | Hi-Z | L | H | H | - | L | - | L |
| 14 | Short circuit detection (H) | ○ | 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 | - | L | - |

G-E short : Gate-Emitter short

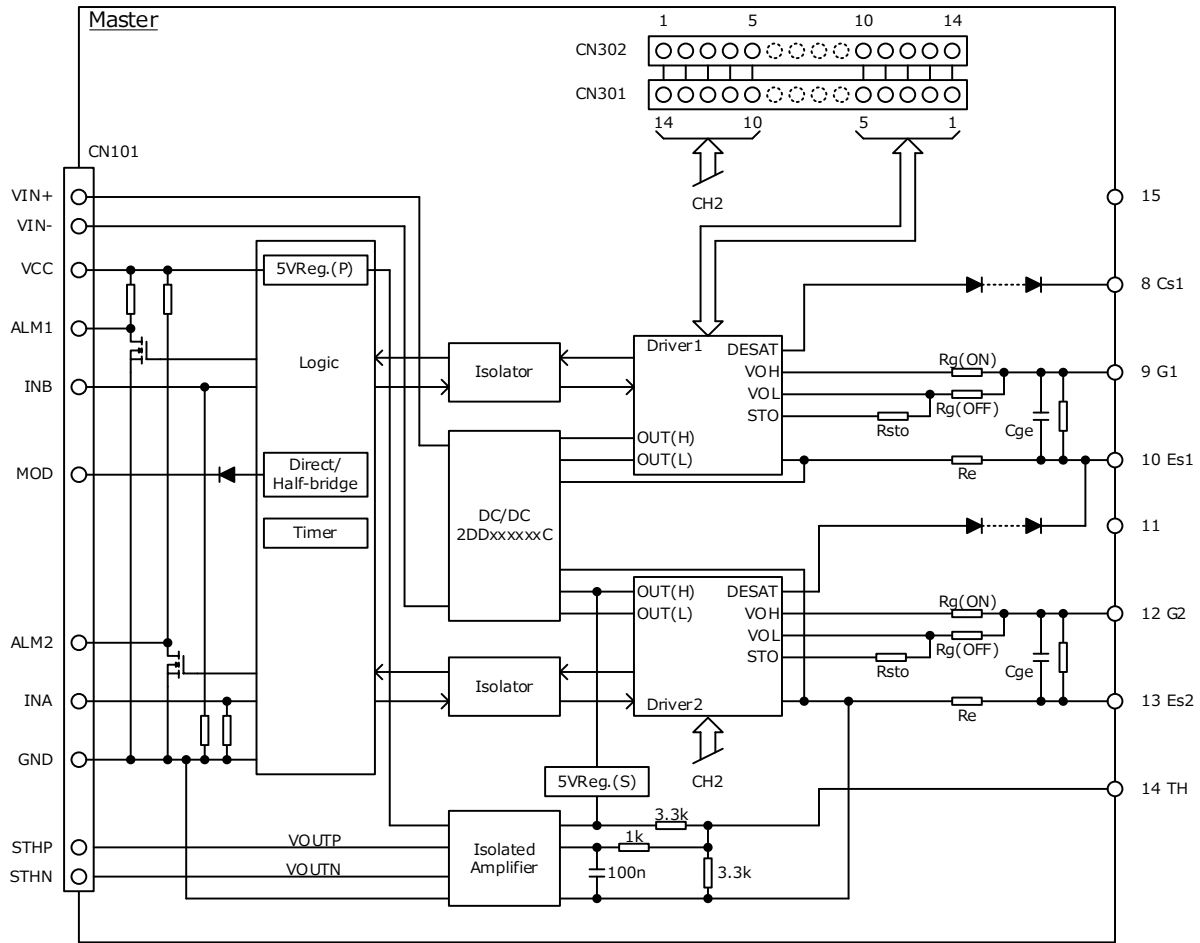
○ : OUT(H) > UVLO, X : Don't care

SD : Shut down (Gate-Emitter short)

Internal Block Diagram (No thermistor isolated amplifier output function)



Internal Block Diagram (With thermistor isolated amplifier output function)



■ 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 | 1200 | V | | |
| Alarm signal output pin maximum voltage | V_{ALM} | - | $V_{CC}+0.3$ 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 | |
| With thermistor isolated amplifier output function | | | | | | |
| Output voltage of isolated amplifier | V_{STHO} | -0.3 | 5.3 | V | STHP, STHN | |

■ 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 | IGBT n : 1 | F _{SW} | - | 3 | kHz Test load : 0.33Ω/560nF *2 |
| | IGBT n : 2 | F _{SW} | - | 2.8 | |
| MOD pin high input voltage | V _{MODH} | 3.3 | 26.4 | V | |
| MOD pin low input voltage | V _{MODL} | -0.3 | 0.5 | V | |
| 2LGxxxxDx11M | | | | | |
| 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 |
| 2LGxxxxCx11M | | | | | |
| Logic high level input voltage | V _{SGH} | 3.3 | 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} | 3.2 | - | mA | INA, INB V _{SG} =15V |

*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.

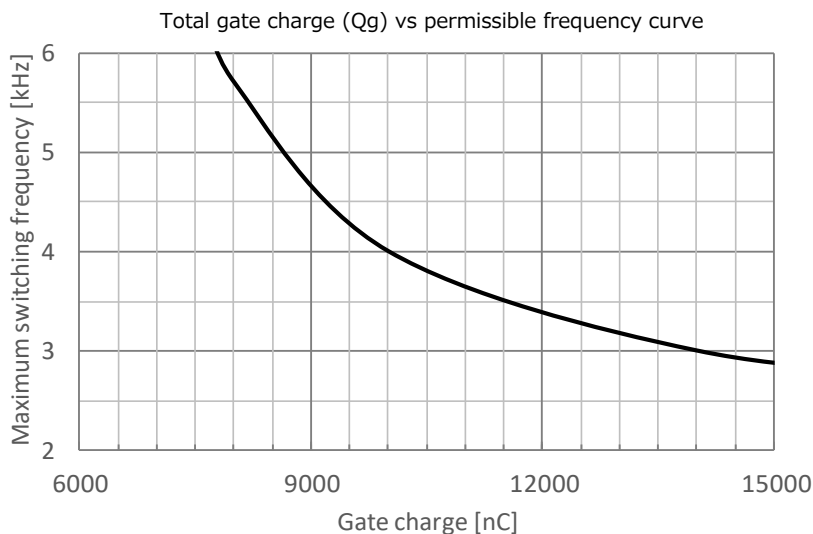
If you are considering using it under conditions other than the recommended conditions, please contact us.

■ Permissible frequency curve

Internal gate resistor of IGBT = 0.33Ω

*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.



Rg: +1.5ohm/-4.7ohm

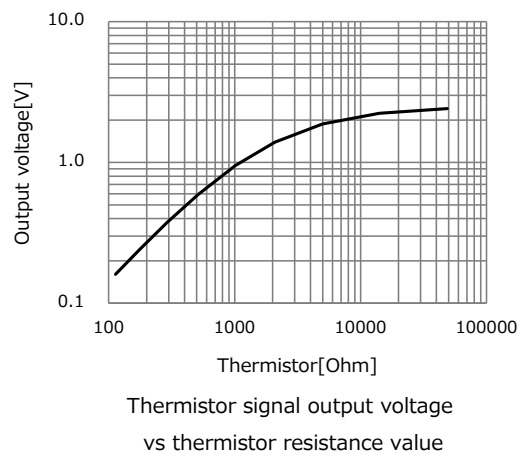
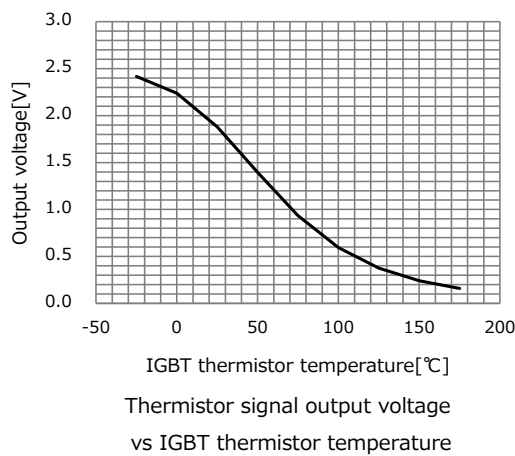
Ta: -40~+85°C / VIN = 13.5~18V

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 | IGBT n : 1 | I _{IN} | - | 0.3 | - | A | Fsw=3.0kHz, Test load : 0.33Ω/560nF |
| | IGBT n : 6 | | - | 0.75 | - | | Fsw=1.6kHz, Test load : 0.33Ω/560nF |
| Standby power | IGBT n : 1 | P _{STBY} | - | 1.6 | - | W | No load |
| | IGBT n : 6 | | - | 2.8 | - | | No load |
| Logic 2LG010xDx11M | | | | | | | |
| 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 | |
| Logic 2LG010xCx11M | | | | | | | |
| Logic high level input voltage | V _{SGH} | - | 2.1 | 2.3 | V | INA, INB / Guaranteed by design | |
| Logic low level input voltage | V _{SGL} | 1 | 1.2 | - | V | INA, INB / Guaranteed by design | |
| Logic pull-down resistance | R _{SGD} | - | 4700 | - | 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) | - | 1.5 | - | Ω | | |
| | Rg(OFF) | - | 4.7 | - | | | |
| Auxiliary gate capacitor | Cge | - | OPEN | - | nF | | |
| Emitter resistor | Re | - | 0.1 | - | Ω | | |
| Delay time | Turn ON time | t _{PON} | - | 140 | - | ns | |
| | Turn OFF time | t _{POFF} | - | 140 | - | ns | |
| Dead time | t _{DEAD} | - | 3 | - | us | Half bridge mode | |
| 2LG01Axxx11M (With thermistor isolated amplifier output function) | | | | | | | |
| Thermistor signal output voltage | TH = 5000Ω | V _{STHP-N} | - | 1.88 | - | V | STHP-STHN |
| | TH = 300Ω | | - | 0.39 | - | V | |

■ Thermistor Signal Output Voltage Curve (With thermistor isolated amplifier output function)



■ 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} | - | 6.6 | - | 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} | - | 7.5 | - | Ω | |
| Soft turn-off duration | t _{STO} | - | 6 | - | 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 | 1875Vpeak 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 | Excluding electrical connections point |
| Minimum creepage distances | 8mm | |
| Between Input-Thermistor (With thermistor isolated amplifier output function) | | |
| Minimum clearance distances | 8.5mm | |
| Minimum creepage distances | 8.5mm | |

■ 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, a high signal voltage within the recommended range is recommended.

- 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, The screw header / washer diameter uses the following.

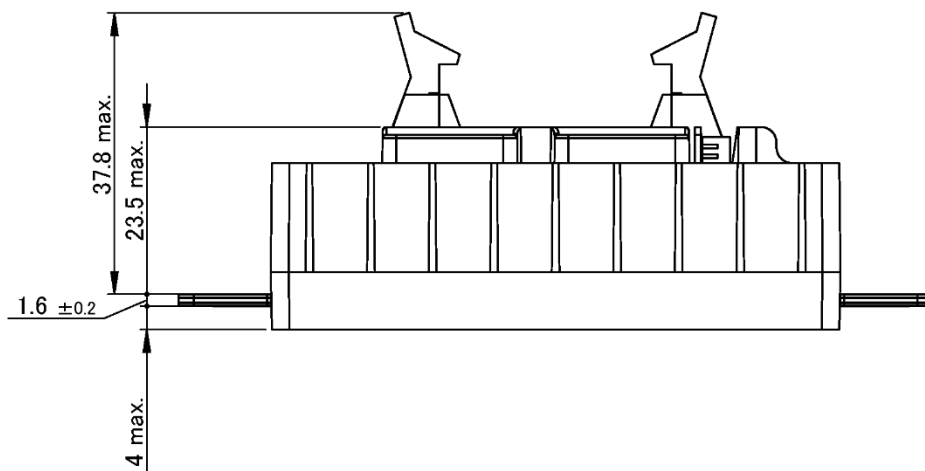
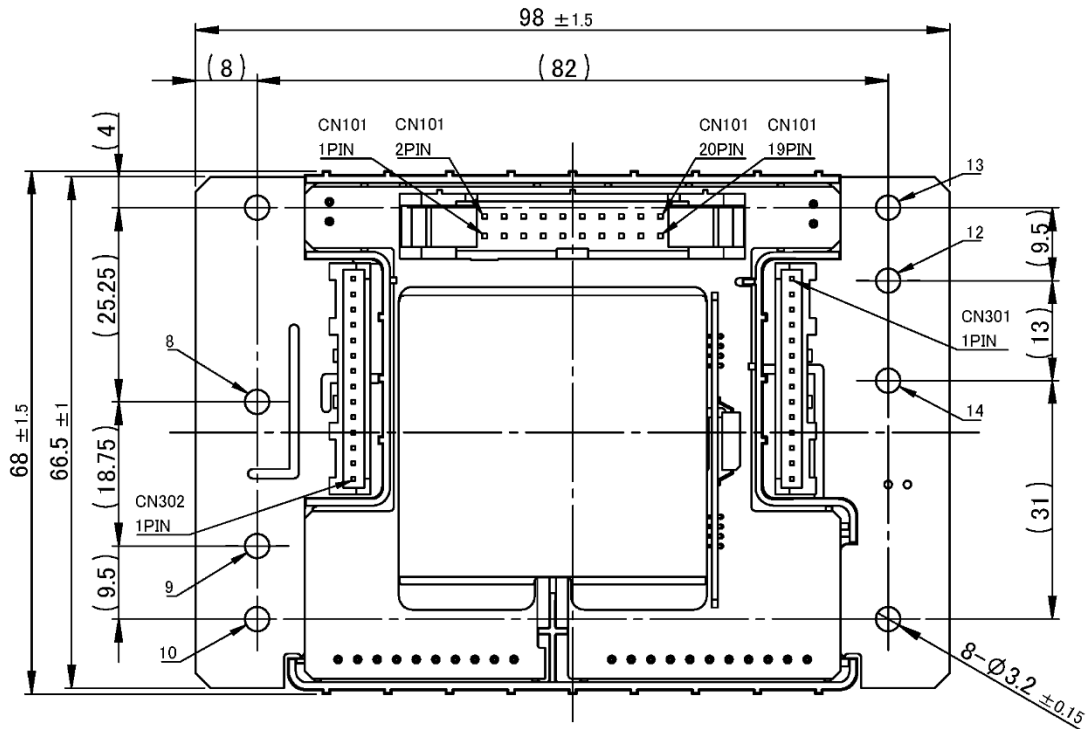
| | |
|-----------------|---|
| M3: 6mm or less | *To maintain the reliability of parts near the metal terminal pad, the screw header including the washer must not exceed the available metal terminal pad of the gate driver. |
|-----------------|---|

- 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.

With Thermistor insulation circuit

■ Outline Dimensional Drawing



Unit: mm

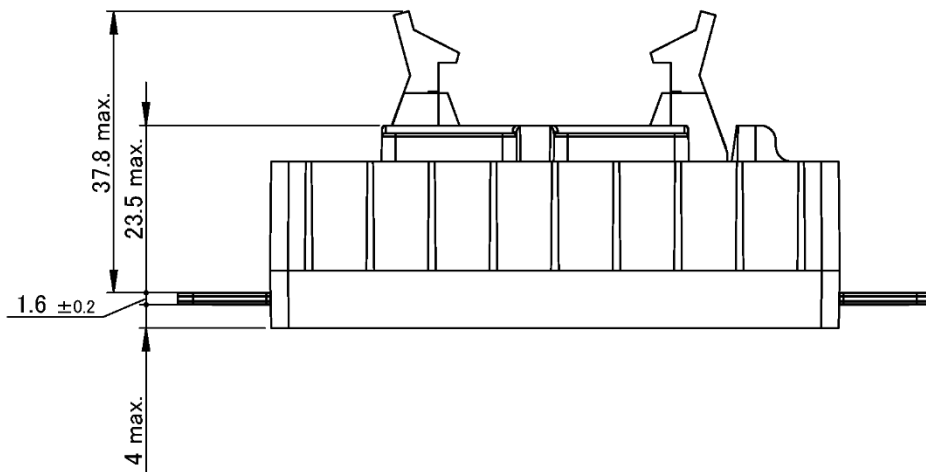
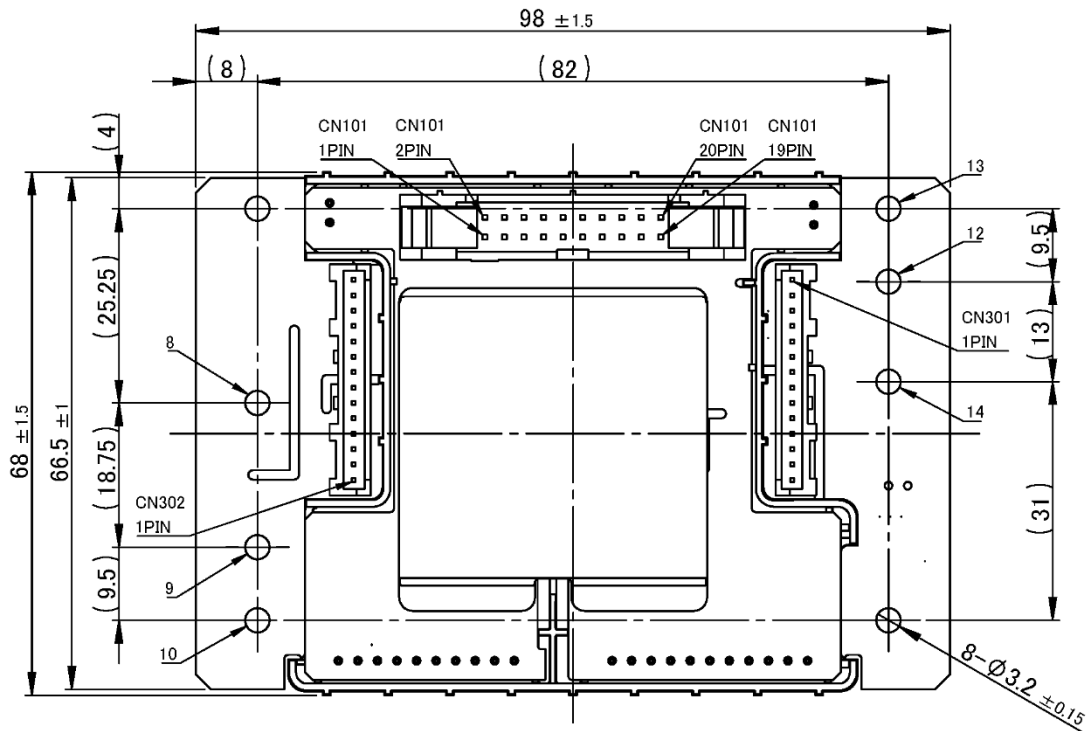
Note: 1. The dimensional tolerance without directions is ± 0.5mm.

■ Product Weight

96.0g(typ)

Without Thermistor insulation circuit

■ Outline Dimensional Drawing



Unit: mm

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

■ Product Weight

96.0g(typ)

■ Important Notice

- This information and product are subject to change without prior notice for the purpose of improvements, etc. Ensure that you are in possession of the most up-to-date information when using this product.
- The operation examples and circuit examples shown in this document are for reference purposes only, and TAMURA Corporation disclaims all responsibility for any violations of industrial property rights, intellectual property rights and any other rights owned by TAMURA Corporation or third parties that these may entail.
- The circuit examples and part constants listed in this document are provided as reference for the verification of characteristics. You are to perform design, verification, and judgment at your own responsibility, taking into account the various conditions.
- TAMURA has evaluated the efficiency and performance of this product in a usage environment determined by us. Depending on your usage environment or usage method, there is the possibility that this product will not perform sufficiently as shown in the specifications, or may malfunction.
When applying this product to your devices or systems, please ensure that you conduct evaluations of their state when integrated with this product. You are responsible for judging its applicability.
TAMURA bears no responsibility whatsoever for any problems with your devices, systems or this product which are caused by your usage environment or usage method.
- TAMURA Corporation constantly strives to improve quality and reliability, but malfunction or failures are bound to occur with some probability in power products. To ensure that failures do not cause accidents resulting in injury or death, fire accidents, social damage, and so on, you are to thoroughly verify the safety of their designs in devices and/or systems, at your own responsibility.
- This product is intended for use in consumer electronics (electric home appliances, business equipment, Information equipment, communication terminal equipment, measuring devices, and so on.) If considering use of this product in equipment or devices that require high reliability (medical devices, transportation equipment, traffic signal control equipment, fire and crime prevention equipment, aeronautics and space devices, nuclear power control, fuel control, in-vehicle equipment, safety devices, and so on), please consult a TAMURA sales representative in advance. Do not use this product for such applications without written permission from TAMURA Corporation.
- This product is intended for use in environments where consumer electronics are commonly used. It is not designed for use in special environments such as listed below, and if such use is considered, you are to perform thorough safety and reliability checks at your own responsibility.
 - Use in liquids such as water, oil, chemical solutions, or organic solvents, and use in locations where the product will be exposed to such liquids.
 - 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.
- This product is not designed to resist radiation.
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