Gate Driver Unit 2LG01xDxC11M

■Overview

2LG01xDxC11M is a dual channel gate driver designed for Mitsubishi Electric's IGBT power module CM1200DW-34T/ CM800DW-34T/ CM800DW-34TA .
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-34T/ CM800DW-34T/ CM800DW-34TA(Mitsubishi Electric)
- Gate voltage : +15V/-10V
- Gate resistor : +0.47Ω/-0.47Ω(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)
- 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. …

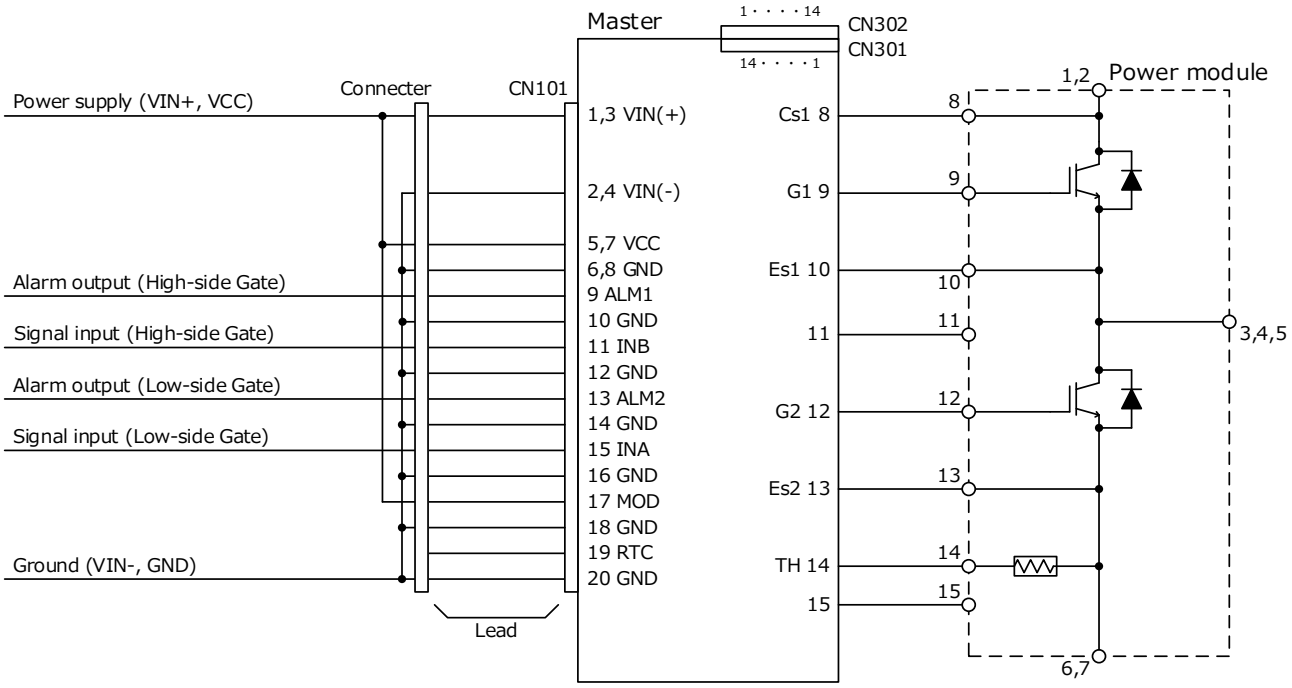
■ **Module Information**

Part number	Part number (Uncoated)	Signal input voltage	Active clamp	TH Isolated amplifier	Status
2LG01ADCC11M	2LG01ADCN11M	3.3～15V	Yes	Yes	Active
2LG010DCC11M	2LG010DCN11M	3.3～15V	Yes	None	Planning
2LG01ADDC11M	2LG01ADDN11M	15V	Yes	Yes	Active
2LG010DDC11M	2LG010DDN11M	15V	Yes	None	Planning

*Uncoated type is sample only

*Refer to the [2LG01xDZC11S] 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)

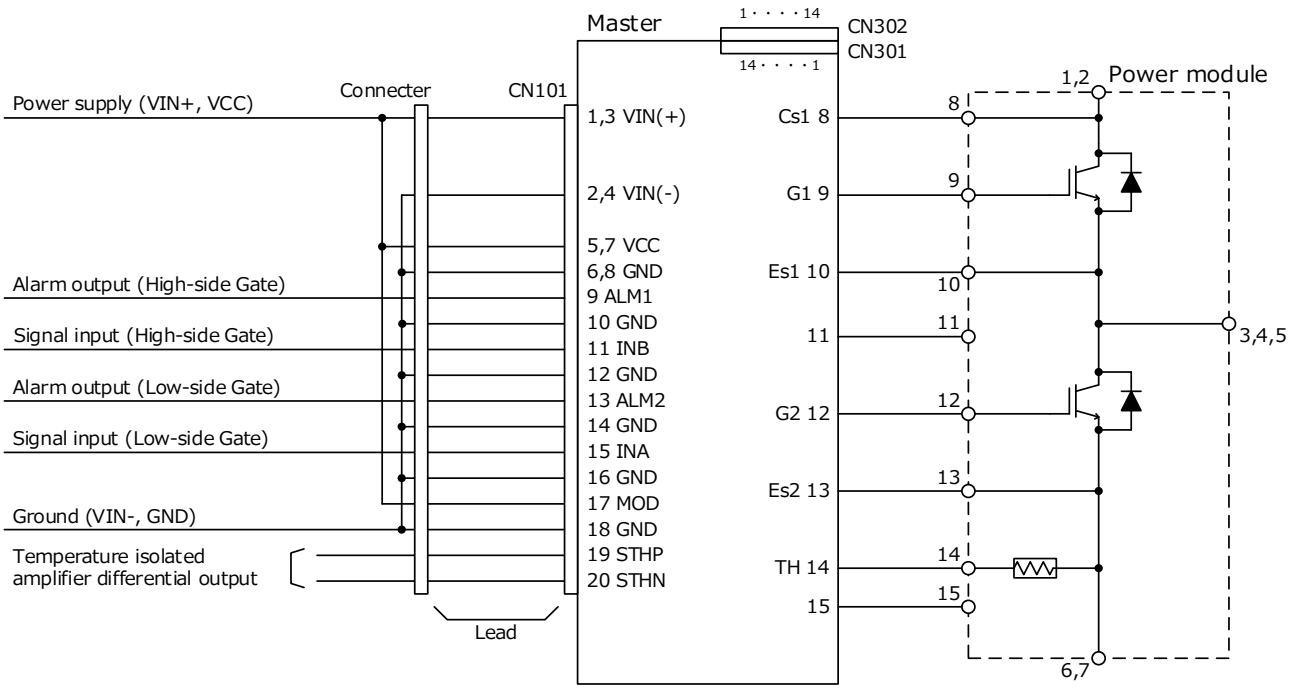
Pin No.	Name	Function	Pin No.	Name	Function
1	VIN(+)	Power supply for DC/DC converter(+)	2	VIN(-)	Power supply for DC/DC converter(-)
3	VIN(+)	Power supply for DC/DC converter(+)	4	VIN(-)	Power supply for DC/DC converter(-)
5	VCC	Power supply for signal control circuit	6	GND	Ground for drive circuit
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 2LG01xxZx11S 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 2LG01xxZx11S 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 2LG01xxZx11S 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 2LG01xxZx11S series
11	CC1B4	1	
12	CC1B3	1	
13	CC1B2	1	
14	CC1B1	1	

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

■I/O Condition Table

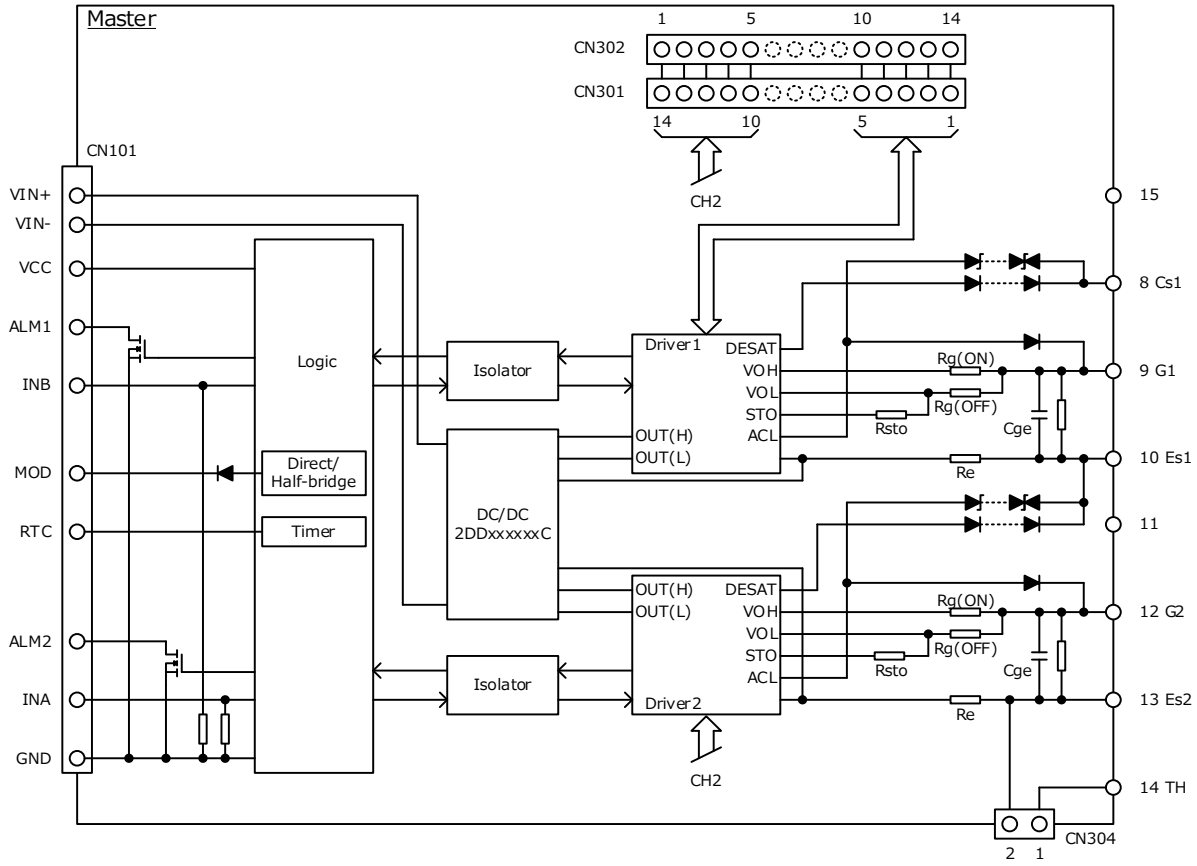
No.	Status	Input						Output			
		OUT(H)	Cs1(H)	Es1(L)	MOD	INB	INA	ALM1	ALM2	G1(H)	G2(L)
1	V_{OUT}UVLO	UVLO	X	X	X	X	X	L	L	L	L
2	G-E short	○	X	X	X	X	X	L	L	SD	SD
3	Normal operation	○	-	L	H	-	L	-	Hi-Z	-	L
4		○	-	L	H	-	H	-	Hi-Z	-	H
5		○	L	-	H	L	-	Hi-Z	-	L	-
6		○	L	-	H	H	-	Hi-Z	-	H	-
7		○	L	L	L	L	X	Hi-Z	Hi-Z	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

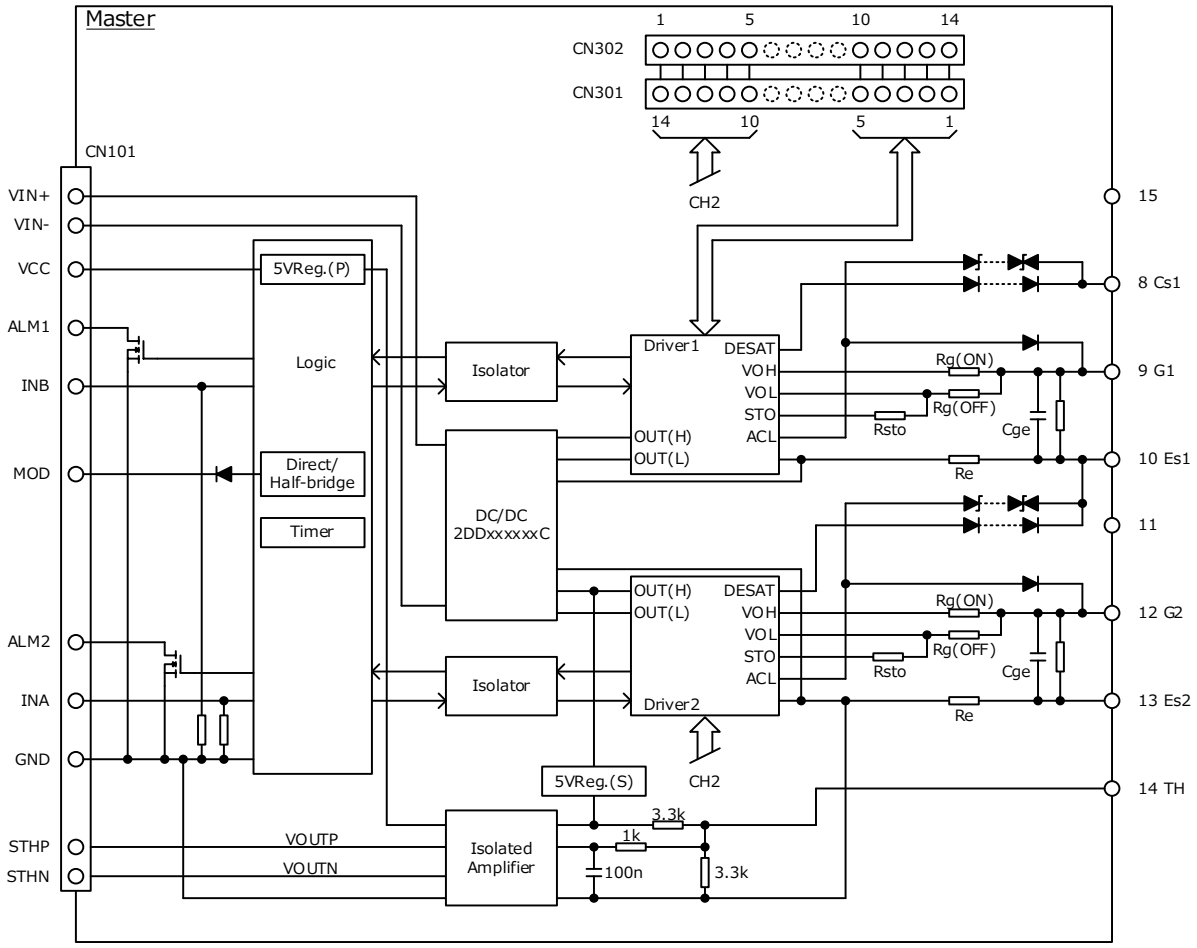
○ : OUT(H) > UVLO, X : Don't care

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	1700	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	℃	See the permissible frequency curve
	V_{IN}=18-26.4V	T_{OP}	-40	75	℃	
Operating humidity		RH_{OP}	20	95	%RH	No condensation
Storage temperature range		T_{STG}	-40	90	℃	
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}	-	7.5	kHz	Test load : 0.68Ω/560nF *2
	IGBT n : 2	F_{SW}	-	3.8	kHz	
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
For 2LGxxxDxx11M (Active clamp model)						
DC-link voltage		$V_{DC-LINK}$	-	1200	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 Conditions.

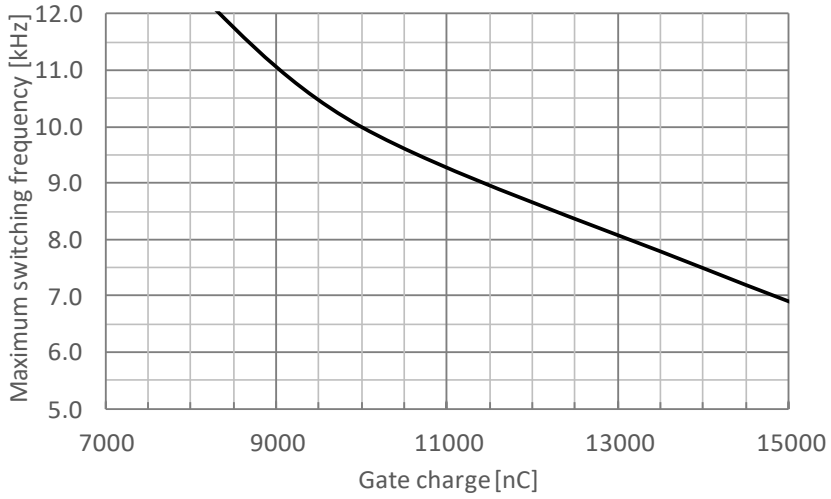
If you are considering using it under conditions other than the recommended conditions, please contact us.

■Permissible frequency curve

Internal gate resistor of IGBT = 0.68Ω

*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.

Total gate charge (Qg) vs permissible frequency curve



Rg: +0.47ohm/-0.47ohm

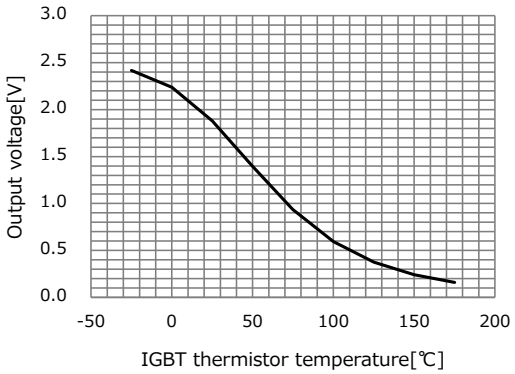
Ta:-40～+85℃ / VIN = 13.5～18V

Ta:-40～+75℃ / VIN = 18～26.4V

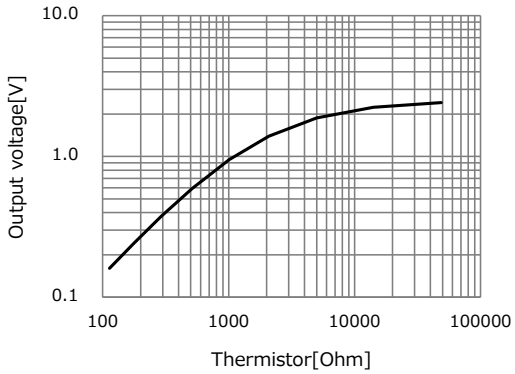
■Electrical Specification (Vin=Vcc=15V, Ta=25℃, Unless otherwise specified)

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}	-	0.5	-	A	Fsw=7.5kHz,Test load : 0.68Ω/560nF
	IGBT n : 6		-	0.75	-		Fsw=1.6kHz,Test load : 0.68Ω/560nF
Standby power	IGBT n : 1	P_{STBY}	-	1.6	-	W	No load
	IGBT n : 6		-	2.8	-	W	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)	-	0.47	-	Ω	
		Rg(OFF)	-	0.47	-		
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)



Thermistor signal output voltage
vs IGBT thermistor temperature



Thermistor signal output voltage
vs thermistor resistance value

■Protection

Item	Symbol	Min	Typ	Max	Unit	Conditions・Note
DC/DC converter						
Overload protection	-	10.5	-	-	W	Auto recovery
Overheat protection	-	120	-	150	℃	Auto recovery, Internal temperature
Gate driver						
Output voltage(H) UVLO OFF voltage	$V_{UVLOOHH}$	13.2	13.5	13.8	V	Guaranteed by design
Output voltage(H) UVLO ON voltage	$V_{UVLOOHL}$	12.2	12.5	12.8	V	Guaranteed by design
Short circuit detection voltage	V_{SD}	-	9.5	-	V	
Short circuit detection filter time	$t_{SHORTFIL}$	-	5.2	-	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}	-	10	-	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	℃	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.

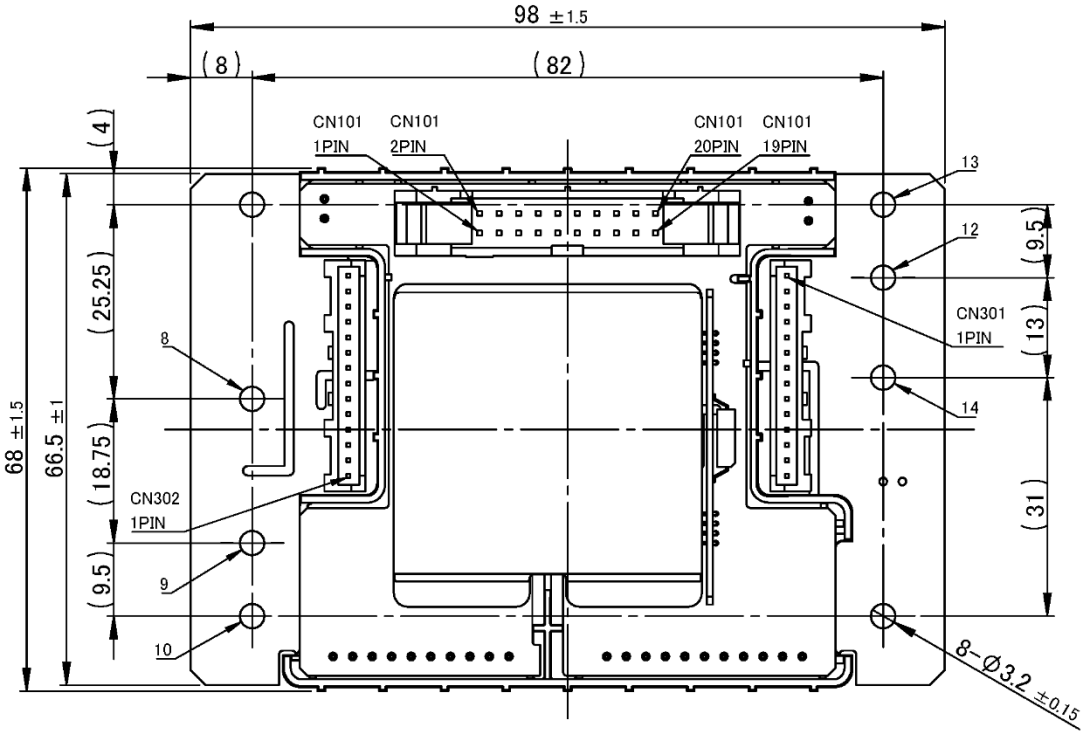
- Please do not apply excessive stress to this product when attaching to IGBT power module.
  Please follow the device manufacturer's instructions on how to install the IGBT power module
  (type of screw used, material, tightening torque conditions, etc.).
  Also, The screw header / washer diameter uses 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.

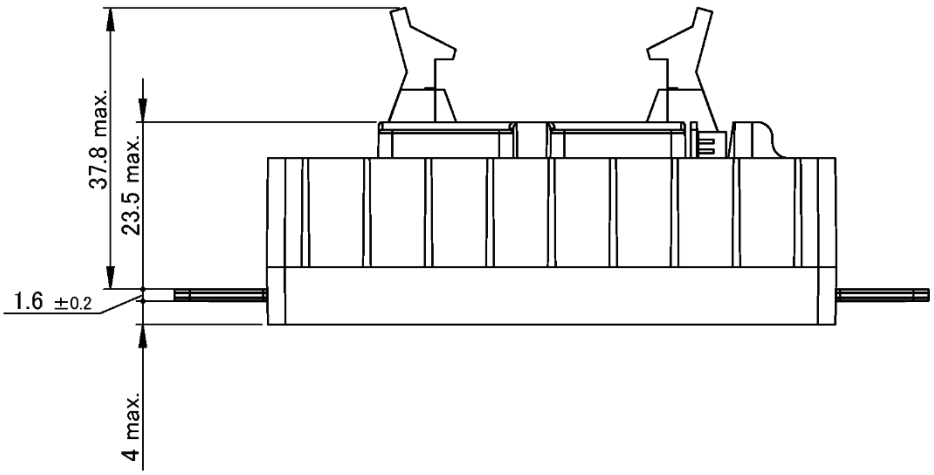
- This product has DESAT protection for arm short circuit and load short circuit protection.
  However, even if this protection works, the IGBT may be damaged if abnormally high current occurs due to IGBT's characteristics
  variations or the load short-circuit mode during parallel operation.
  To ensure 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

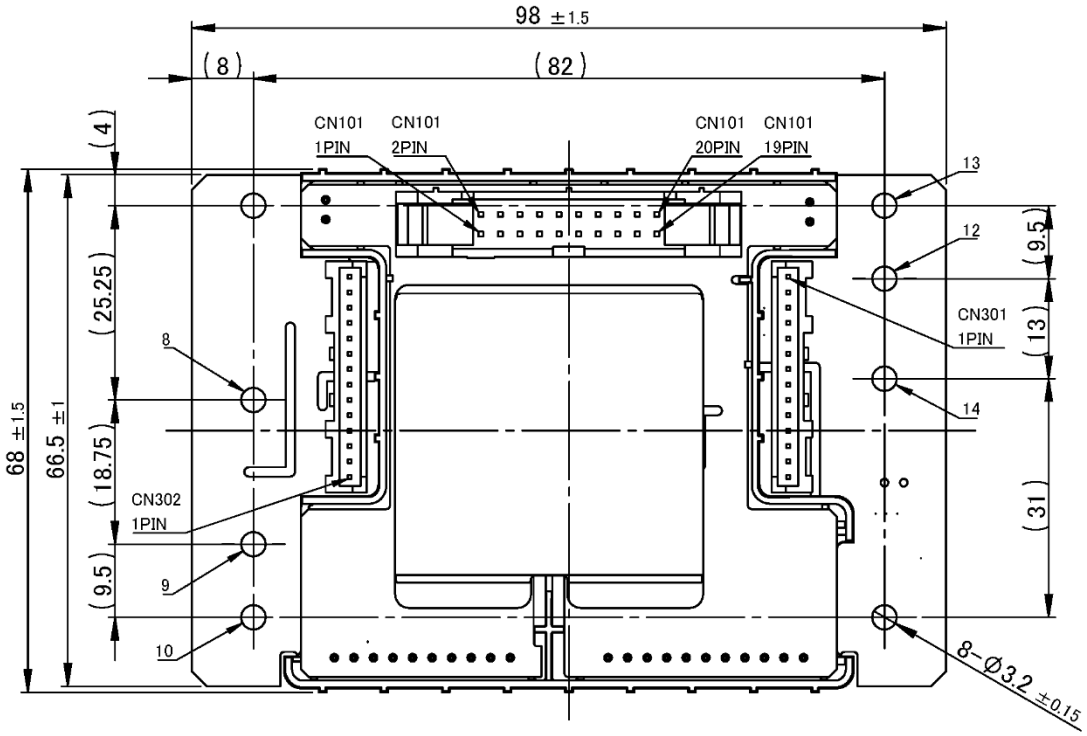
Note: 1. The dimensional tolerance without directions is ± 0.5mm.

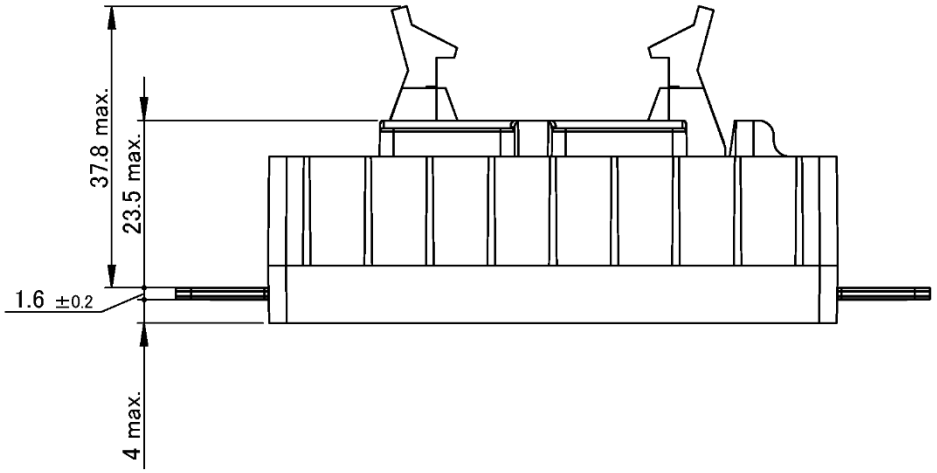
■Product Weight

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.

- This product is not designed to be connected in series or parallel.
  Do not operate this product in a series, parallel, or N+1 redundant configuration.

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