

**Gate Driver Module 2CG010BBC12N**
**■ Overview**

Gate driver 2CG010BBC12N is a dual channel gate driver designed for IGBT and SiC MOSFET.

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

**■ Features**

- Ideal for drive of IGBT and SiC MOSFET
- Gate voltage : +15V/-15V
- ALL-IN-ONE (Built-in isolated DC / DC converter and gate drive circuit)
- Low parasitic capacitance (about 12pF) ; highly resistant to common-mode noise.
- Fast response : about 100nsec(typ)
- The isolation for primary-secondary signal used fast response isolator.
- Input-to-Output dielectric withstand voltage : AC5000V
- Output CH1-to-Output CH2 dielectric withstand voltage : AC4000V
- Input-to-Output insulation distance : 14mm (clearance), 16mm(creepage) (As for Gate driver module PCB)
- Output CH1-to-Output CH2 insulation distance : 7mm (clearance), 12mm(creepage)
- DC/DC converter input voltage :13~28V
- Signal input voltage : 3.3V,5V
- Overload protection (DC/DC converter)
- Overheat protection (DC/DC converter)
- Half bridge mode (Gate drive circuit)
- Desaturation protection (Gate drive circuit)
- Soft turn-off function (Gate drive circuit)
- Fault signal output function (Gate drive circuit)
- Miller function (Gate drive circuit)
- Under-voltage lockout(UVLO) (Gate drive circuit)
- Insulating moistureproof coating
- 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.)

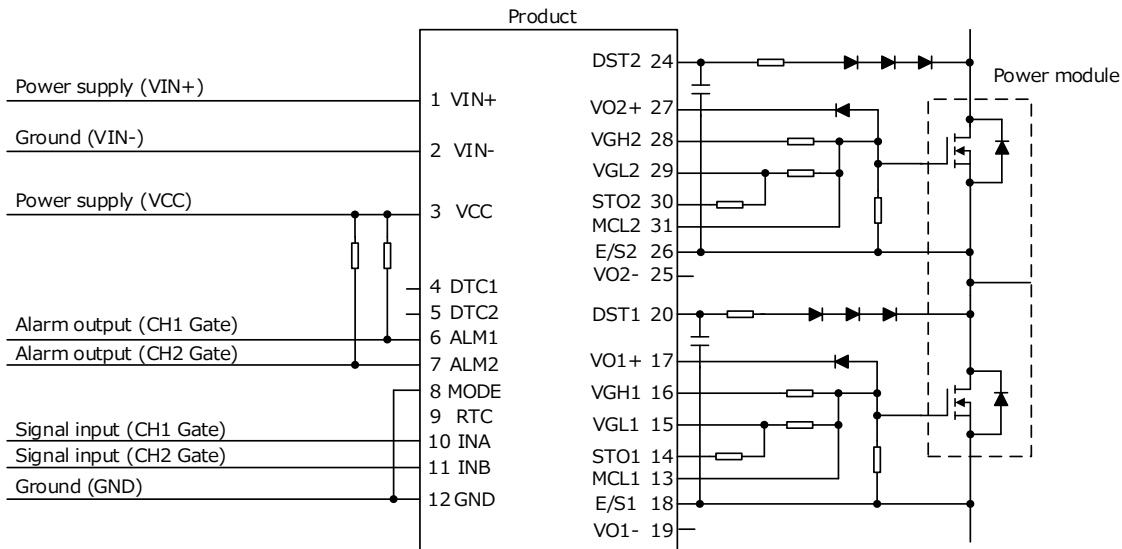
**■ Application**

Industrial inverter, power conditioner, etc ...

**■ Module information**

Part number	Output voltage	Miller clamp	Status
2CG010BBC11N	+15V/-10V	Yes	Active
2CG010BBC12N	+15V/-15V	Yes	Active
2CG010BBC13N	+18V/-4V	Yes	Active
2CG010BBC14N	+18V/-2V	Yes	Active

## ■ Circuit Image



## ■ Pin Connection

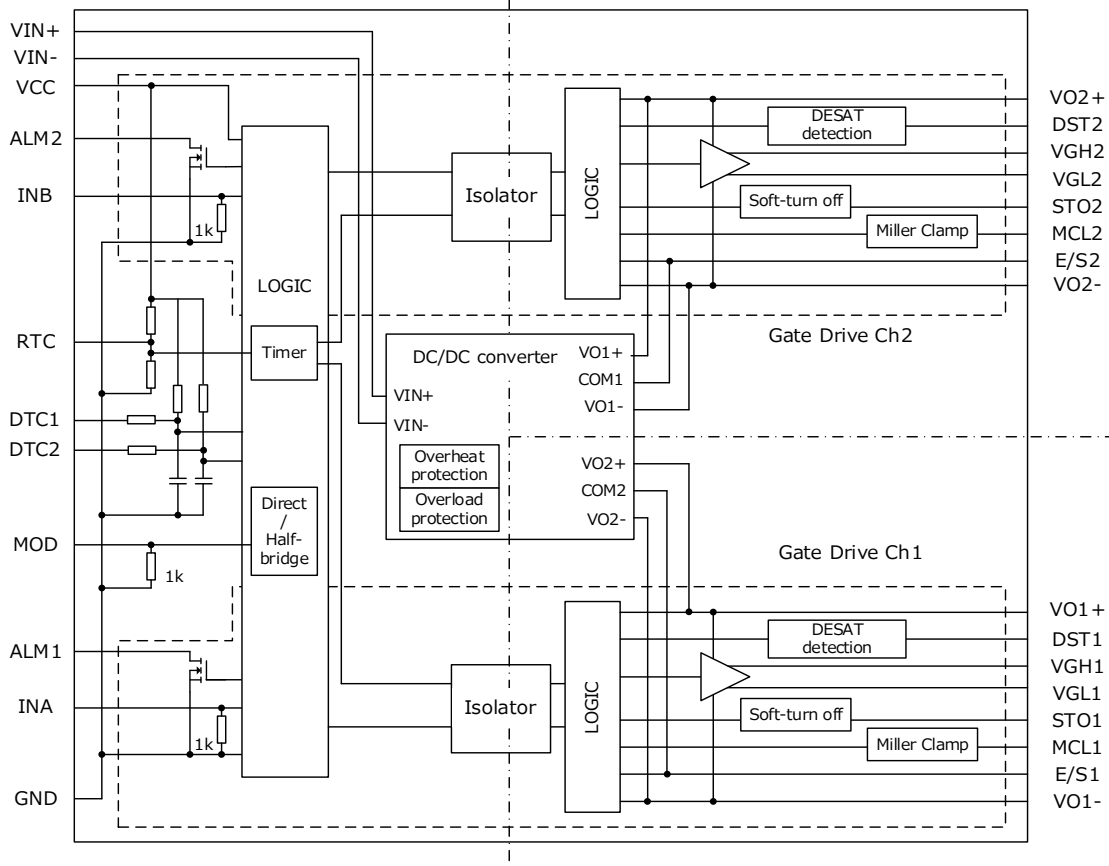
### Input

Pin No.	Name	CH	Function
1	VIN+	Common	Power supply for DC/DC converter(+)
2	VIN-	Common	Power supply for DC/DC converter(-)
3	VCC	-	Power supply for drive circuit
4	DTC1	1	Dead time adjustment
5	DTC2	2	Dead time adjustment
6	ALM1	1	Alarm signal output
7	ALM2	2	Alarm signal output
8	MOD	-	Mode select
9	RTC	-	Recovery time of protection circuit control
10	INA	1	Control input A
11	INB	2	Control input B
12	GND	-	Ground for drive circuit

### Output

Pin No.	Name	CH	Function
13	MCL1	1	Miller clamp pin
14	STO1	1	Soft turn off pin
15	VGL1	1	Gate OFF side pin
16	VGH1	1	Gate ON side pin
17	VO1+	1	DC/DC converter output pin
18	E/S1	1	Emitter · source connection pin
19	VO1-	1	DC/DC converter output pin
20	DST1	1	Desaturation protection pin
21	NONE	-	None
22	NONE	-	None
23	NONE	-	None
24	DST2	2	Desaturation protection pin
25	VO2-	2	DC/DC converter output pin
26	E/S2	2	Emitter · source connection pin
27	VO2+	2	DC/DC converter output pin
28	VGH2	2	Gate ON side pin
29	VGL2	2	Gate OFF side pin
30	STO2	2	Soft turn off pin
31	MCL2	2	Miller clamp pin

Internal Block Diagram



I/O Condition Table

No.	Status	Input								Output(CH2)					Output(CH1)				
		VO+	DST2	DST1	MCL2	MCL1	MOD	INB	INA	ALM2	VGH2	VGL2	STO2	MCL2	ALM1	VGH1	VGL1	STO1	MCL1
1	VOx+ UVLO	UVLO	X	X	X	X	X	X	X	L	Hi-Z	Hi-Z	L	L	L	Hi-Z	Hi-Z	L	L
2	ES-VOx- short	X	X	X	X	X	X	X	X	L	Hi-Z	SD	SD	SD	L	Hi-Z	SD	SD	SD
3	Normal operation (Direct Mode)	○	-	L	-	H	L	-	L	-	-	-	-	-	Hi-Z	Hi-Z	L	L	Hi-Z
4		○	-	L	-	L	L	-	L	-	-	-	-	-	Hi-Z	Hi-Z	L	L	L
5		○	-	L	-	H	L	-	H	-	-	-	-	-	Hi-Z	H	Hi-Z	Hi-Z	Hi-Z
6		○	L	-	H	-	L	L	-	Hi-Z	Hi-Z	L	L	Hi-Z	-	-	-	-	-
7		○	L	-	L	-	L	L	-	Hi-Z	Hi-Z	L	L	L	-	-	-	-	-
8	○	L	-	H	-	L	H	-	Hi-Z	H	Hi-Z	Hi-Z	Hi-Z	-	-	-	-	-	
9	Normal operation (Half-bridge Mode)	○	L	L	L	L	H	L	X	Hi-Z	Hi-Z	L	L	L	Hi-Z	Hi-Z	L	L	L
10		○	L	L	H	L	H	H	L	Hi-Z	H	Hi-Z	Hi-Z	Hi-Z	Hi-Z	Hi-Z	L	L	L
11		○	L	L	L	H	H	H	H	Hi-Z	Hi-Z	L	L	L	Hi-Z	H	Hi-Z	Hi-Z	Hi-Z
12	Desaturation protection1	○	-	Hi-Z	-	L	L	-	L	-	-	-	-	-	Hi-Z	Hi-Z	L	L	L
13		○	-	Hi-Z	-	H	L	-	H	-	-	-	-	-	L	Hi-Z	Hi-Z	L	Hi-Z
14		○	-	Hi-Z	-	L	H	H	L	-	-	-	-	-	Hi-Z	Hi-Z	L	L	L
15	○	-	Hi-Z	-	H	H	H	H	-	-	-	-	-	L	Hi-Z	Hi-Z	L	Hi-Z	
16	Desaturation protection2	○	Hi-Z	-	L	-	L	L	-	Hi-Z	Hi-Z	L	L	L	-	-	-	-	-
17		○	Hi-Z	-	H	-	L	H	-	L	Hi-Z	Hi-Z	L	Hi-Z	-	-	-	-	-
18		○	Hi-Z	-	L	-	H	H	H	Hi-Z	Hi-Z	L	L	L	-	-	-	-	-
19	○	Hi-Z	-	H	-	H	H	L	L	Hi-Z	Hi-Z	L	Hi-Z	-	-	-	-	-	

○ : VOx+ UVLO > UVLO, X : Don't care, SD : Shut down

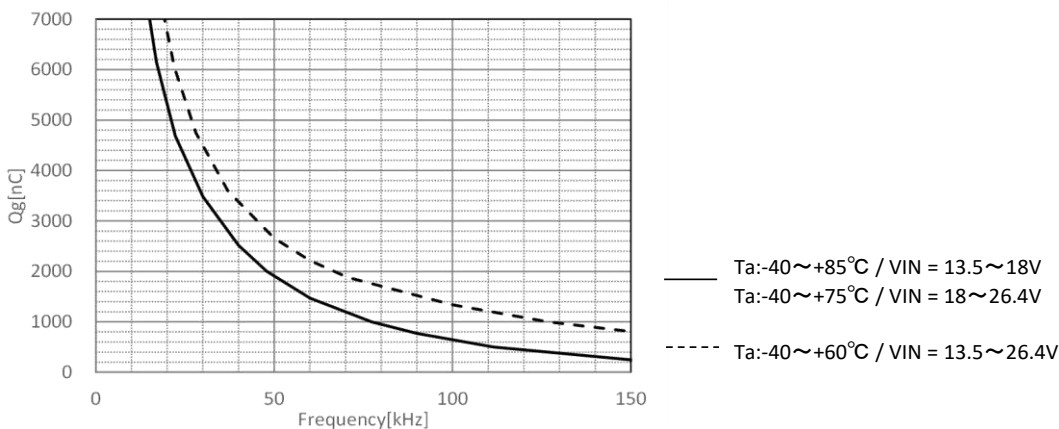
**■ Absolute Maximum Ratings**

Item	Symbol	Min	Max	Unit	Conditions · Note	
Input voltage for DC/DC converter	$V_{IN}$	-0.3	28	Vdc	Between VIN+ to VIN-	
Input-side signal voltage	$V_{CC}, V_{SG}$	-0.3	5.5	V	VCC, RTC, MOD, INA, INB	
	$V_{ALM}$	-0.3	28	V	ALM1, ALM2	
Input-side signal maximum current	$I_{ALM}$	-	5	mA	ALM1, ALM2	
DESAT pin input voltage	$V_{DESAT}$	-0.3	$V_{GH}+0.3$	V		
Miller clamp pin input voltage	$V_{CLAMP}$	$V_{GL}-0.3$	$V_{GH}+0.3$	V		
Maximum gate current	$I_{GPEAK}$	-	43	A		
DC/DC converter output power	$P_{OUT}$	-	3.3	W	Per output circuit	
Switching frequency	$F_{SW}$	-	150	kHz	See the permissible frequency curve	
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-side signal voltage range	$V_{CC}, V_{SG}$	3	5.5	Vdc	
Driver circuit number	N	-	2	-	
Logic high level input voltage	$V_{SGH}$	$V_{CC} \times 0.7$	-	V	MOD, INA, INB
Logic low level input voltage	$V_{SGL}$	-	$V_{CC} \times 0.3$	V	MOD, INA, INB
Source current of control signal	$I_{SG}$	5	-	mA	MOD, INA, INB $V_{SG}=5V$
Maximum gate drive capability ( 150 kHz)	$Q_{MAX}$	-	210	nC	Gate current (ave) = 31mA Reference value
Maximum gate drive capability ( 30 kHz)	$Q_{MAX}$	-	3500	nC	Gate current (ave) = 105mA Reference value
Maximum gate charge amount	$Q_G$	-	7000	nC	
Minimum input pulse width	$t_{INMSK}$	60	-	ns	

**■ Permissible frequency curve**

 Total gate charge ( $Q_g$ ) vs permissible frequency curve


**■ Electrical Specification (Vin=24V, Vcc=5V, Ta=25°C, Unless otherwise specified)**

Item	Symbol	Min	Typ	Max	Unit	Conditions · Note	
DC/DC converter							
Start-up voltage	V <sub>START</sub>	-	-	13	V		
Input current	I <sub>IN</sub>	-	0.35	-	A	Fsw=14.5kHz / Test load: 233nF	
Standby power	P <sub>STBY</sub>	-	1.2	-	W	No load	
Logic inputs							
Logic high level input voltage	V <sub>SGH</sub>	V <sub>CC</sub> × 0.7	-	-	V	MOD, INA, INB / Guaranteed by design	
Logic low level input voltage	V <sub>SGL</sub>	-	-	V <sub>CC</sub> × 0.3	V	MOD, INA, INB / Guaranteed by design	
Logic pull-down resistance	R <sub>SGD</sub>	-	1000	-	Ω	MOD, INA, INB	
Gate driver output							
Gate ON side pin / output voltage(+)	V <sub>GH</sub> , V <sub>O+</sub>	14	15	16	V	No load	
Gate OFF side pin / output voltage(-)	V <sub>GL</sub> , V <sub>O-</sub>	-16	-15	-14	V	No load	
Miller clamp voltage	V <sub>CLAMP</sub>	-	1.2	-	V	I <sub>CLAMP</sub> =500mA, Guaranteed by design	
Miller clamp ON threshold voltage	V <sub>CLPON</sub>	-	V <sub>GL</sub> +2	-	V		
Delay time	Turn ON time	t <sub>PON</sub>	-	100	-	ns	
	Turn OFF time	t <sub>POFF</sub>	-	100	-	ns	
Dead time	t <sub>DEAD</sub>	-	4.1	-	us	Half bridge mode	

**■ Protection**

Item	Symbol	Min	Typ	Max	Unit	Conditions · Note
DC/DC converter						
Overload protection	-	8.8	-	-	W	Auto recovery
Overheat protection	-	120	-	150	°C	Auto recovery, Internal temperature
Gate driver						
Output voltage(H) UVLO OFF voltage	V <sub>UVLOGHH</sub>	13.2	13.5	13.8	V	Guaranteed by design
Output voltage(H) UVLO ON voltage	V <sub>UVLOGHL</sub>	12.2	12.5	12.8	V	Guaranteed by design
DESAT charge current	I <sub>DESAT</sub>	200	240	280	uA	Guaranteed by design
DESAT detection voltage	V <sub>DESAT</sub>	6.0	6.35	7.0	V	Guaranteed by design
DESAT detection filter time	t <sub>DSTFIL</sub>	-	400	-	ns	DSTxpin open
DESAT detection time	t <sub>DSTOUT</sub>	-	450	-	ns	DSTxpin open
Alarm signal output L voltage	V <sub>ALML</sub>	-	-	0.5	V	I <sub>ALM</sub> =5mA
Alarm signal output time	t <sub>ALM</sub>	-	650	-	ns	
Restart time	t <sub>RESTART</sub>	-	110	-	ms	
Soft turn off duration	t <sub>STO</sub>	-	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 volt.	1768Vpeak or more	According to EN50178/IEC 60270
Common-mode transient immunity (CMTI)	70kV/us	
Minimum clearance distances	14mm	
Minimum creepage distances	16mm	As for Gate driver module PCB
Between CH1-CH2		
Dielectric withstand voltage	AC4000V	1min, Cutoff 2mA
Insulation resistance	100MΩ or more	DC500V
Partial discharge extinction volt.	1700Vpeak or more	According to EN50178/IEC 60270
Minimum clearance distances	7mm	
Minimum creepage distances	12mm	As for Gate driver module PCB

**■ Storage Conditions**

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

※If you want to use past the long period there is a concern that the solder non-wetting by terminal oxidation to occur.  
Therefore, please use from taking enough tests.

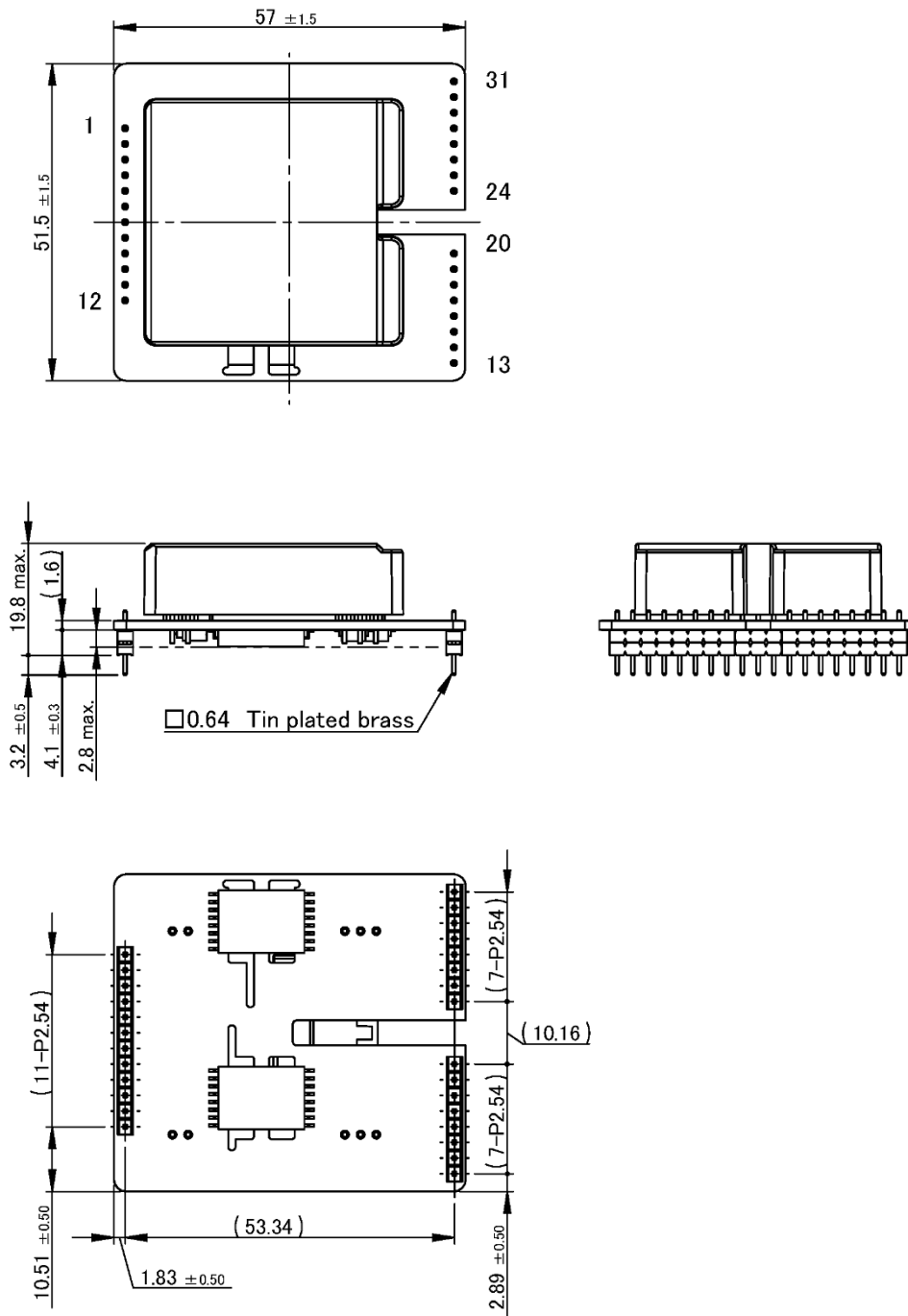
**■ Recommended Soldering Condition**

- Flow soldering condition : 255±3°C Less than 3sec  
Temperature of preheating 110°C~130°C  
End temperature of preheating 110°C±10°C
- Soldering condition of hand work : 360°C(MAX) Less than 3sec

**■ 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.
- 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  $\pm 0.5\text{mm}$ .

## ■ Product Weight

45.0g(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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