Gate Driver Unit 2PG010DxC11N

■Overview

2PG010DxC11N is a dual channel gate driver designed for Fuji Electric's IGBT
power module 2MBI1800XXF170-50 .
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 2MBI1800XXF170-50(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 : 3.3V～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)
- ・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

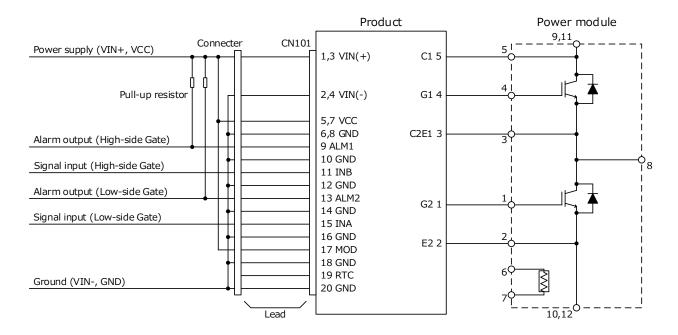## ■Application

Industrial inverter, power conditioner, etc. …

■Module information

Part number	Part number (Uncoated)	Signal input voltage	Active clamp	Status
2PG010DCC11N	2PG010DCN11N	3.3 to 15V	Yes	Active
2PG010DDC11N	2PG010DDN11N	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

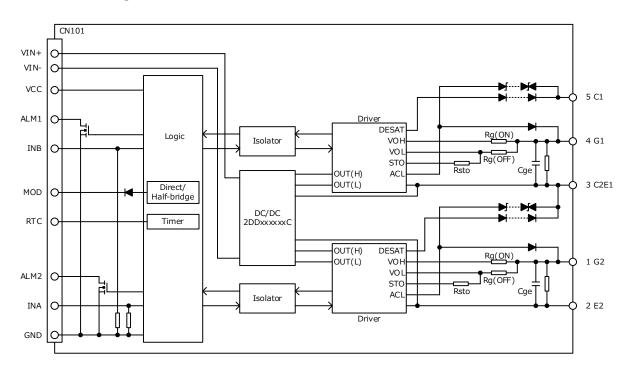※Reference receptacle : RA-S201T (JST)

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	C2E1	1(H)	Emitter connection, High side
4	G1	1(H)	Gate connection, High side
5	C1	1(H)	Collector connection, High 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		○	-	L	H	-	L	-	Hi-Z	-	L
4		○	-	L	H	-	H	-	Hi-Z	-	H
5	Normal operation	○	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)

■ **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	℃	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

■ **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 (Qg=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	
2PGxxxxCx11N					
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
2PGxxxxDx11N					
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 2PGxxxDxx11N(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.

　If you are considering using it under conditions other than the recommended conditions, please contact us.
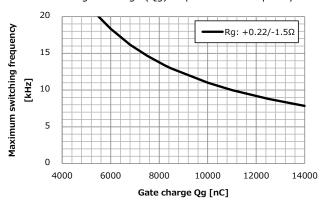
■ **Permissible frequency curve**

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.

Total gate charge (Qg) vs permissible frequency curve

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		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 for 2PGxxxxCx11N							
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
Logic inputs for 2PGxxxxDx11N							
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	℃	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	$t_{SHORTFIL}$	-	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	1768Vpeak 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	℃	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

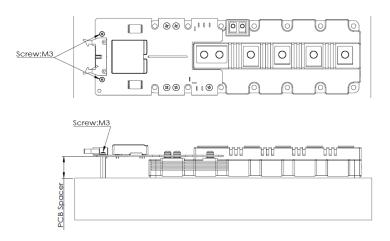(type of screw used, material, tightening torque conditions, etc.).

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 ± 0.5mm.

■Product Weight

81.0g(typ)

■ **Important Notice**

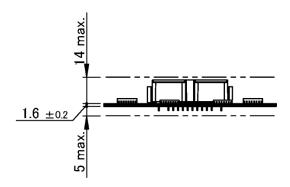- This information and product are subject to change without prior notice for the purpose of improvements, etc.
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  - ・ Use in locations where corrosive gases such as salt air, C12, H2S, NH3, SO2, or NO2, are present.
  - ・ Use in environments with strong 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.
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