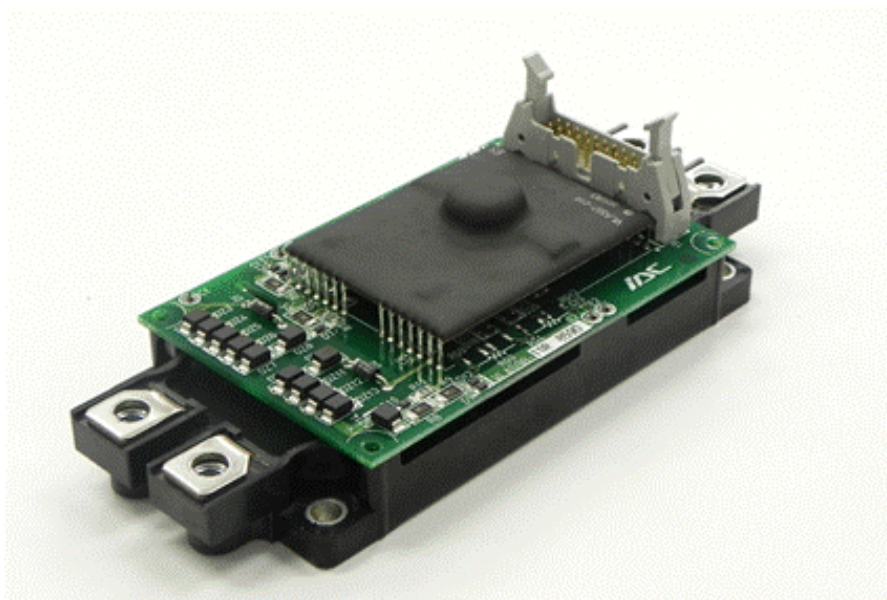


Tentative

IGBT Gate Drive Unit VLA598-11R

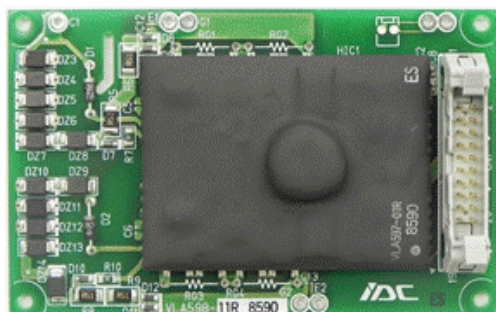


Aug.2018

IGBT Gate Drive Unit VLA598-11R

Tentative

Outline (Image)



Size : 64 x 101 mm

Features

- >Directly mountable on the IGBT module
- >Built in the isolated DC-DC converter for gate drive
- >Output peak current is +/-10A(max)
- >Electrical isolation voltage is 4000Vrms (for 1 minute)
- >Built in short circuit protection with soft shut down
- >Built in collector clamp circuit
- >One way power supply system for drivers and input signal (VD=15V)

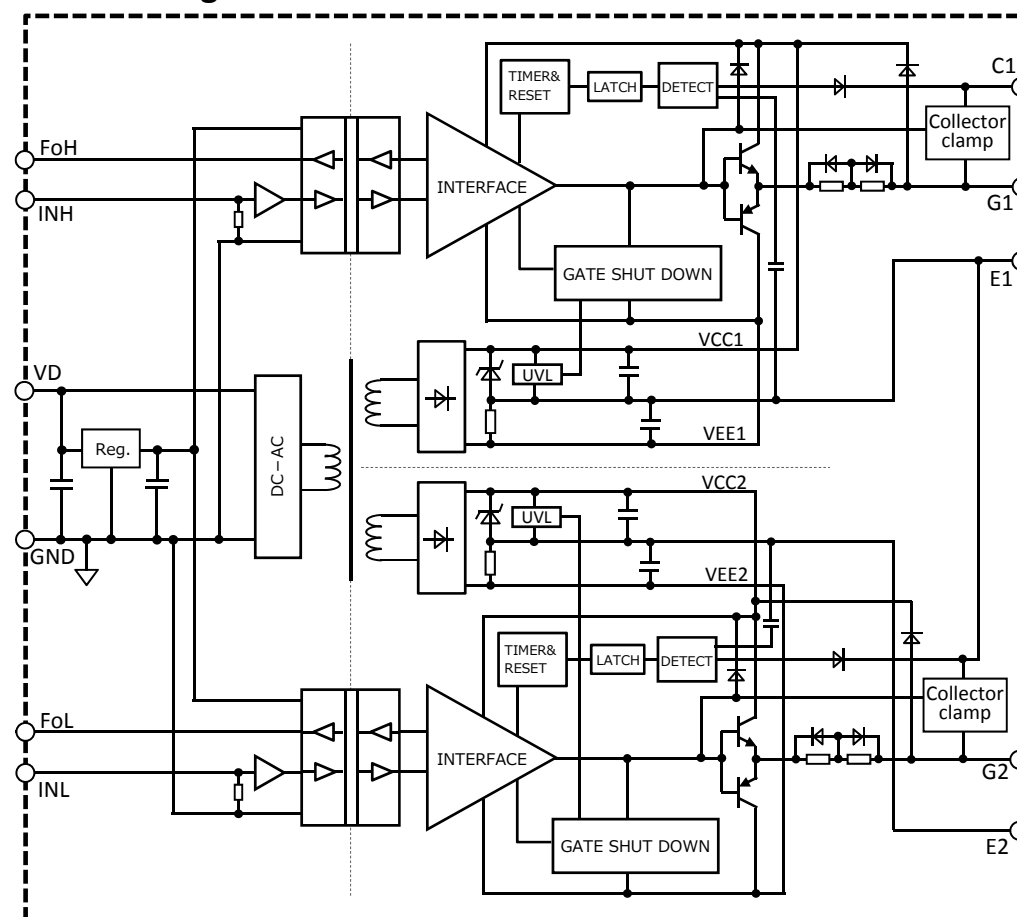
Targeted IGBT Modules

VCES:1700V series ~ 600A class

Applications

To drive IGBT modules for inverter or AC servo system application

Block Diagram



Tentative

Maximum ratings (unless otherwise noted, Ta=25C)

Symbol	Item	Conditions	Ratings	Unit
VD	Supply voltage	DC	-1 ~ 16.5	V
VI	Input signal voltage	Applied between GND - INH,INL	19	V
I_Fo	Fo output current	Sink and source current of Fo terminal	+/-10	mA
IOHP	Output peak current	Pulse width 3us	-10	A
IOLP			10	A
Viso	Isolation voltage between primary and secondary	Sine wave voltage 60Hz, for 1min	4000	Vrms
Topr	Operating temperature	No condensation allowable	-40 ~ 85	deg C
Tstg	Storage temperature	No condensation allowable	-40 ~ 85	deg C
I _{drive}	Gate drive current	Gate average current (Per one circuit)	72	mA
VDC_Link	Main circuit voltage	The power supply voltage between P and N	1200	V

Electrical characteristics (unless otherwise noted, Ta=25 degC, VD=15V, f=5kHz)

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
VD	Supply voltage	Recommended range	14.5	15	15.5	V
f	Switching frequency	Recommended range It is limited by gate average current (max:72mA)	-	-	14	kHz
RG	Gate resistance	Recommended range	1	-	-	ohm
VI	Input signal voltage	Recommended range	4.5	-	15.5	V
I_Fo	Fo output current	Recommended range	-4	-	4	mA
VI_H	Input signal high threshold	-	1.8	2.1	2.4	V
VI_L	Input signal low threshold	-	0.9	1.2	1.5	V
VOH	Plus bias output voltage	Input "H"(High active)	13.5	15.2	16.5	V
VOL	Minus bias output voltage	Input "L"	-	-8	-	V
tPLH	"L-H" propagation time	RG=2.2Ω, f=5kHz, C_load:0.22uF	-	TBD	-	us
tPHL	"H-L" propagation time	RG=2.2Ω, f=5kHz, C_load:0.22uF	-	TBD	-	us
t _{timer}	Timer	Between start and cancel of protection (Under input signal is off state)	1	-	2	ms
UVLO+_VCC	Under voltage lock out	VCC voltage (Operation start)	-	TBD	-	V
UVLO-_VCC	Under voltage lock out	VCC voltage (Operation stop)	-	TBD	-	V
Vz (*1)	Clamp zener voltage	Total zener voltage in collector clamp circuit at I _z = 1mA , T _j =25 deg C	1282	1350	1418	V
VSC	SC detect voltage	Collector voltage of IGBT	15	-	-	V

*1 : It depends on the condition of use, but actual clamp voltage of collector approximately rises by 300V from 200V to Vz.



Tentative

Calculation for gate drive current (gate average current)

This product has isolated DCDC converter built in for gate drive.
 The maximum output average current is 72mA per one channel.
 This current means maximum gate average current.
 When you decide the switching frequency,
 please check the gate average current by next formula.

$$I_{drive} = (Q1 + |Q2|) \times f \quad \leftarrow \text{It must be less than 72mA}$$

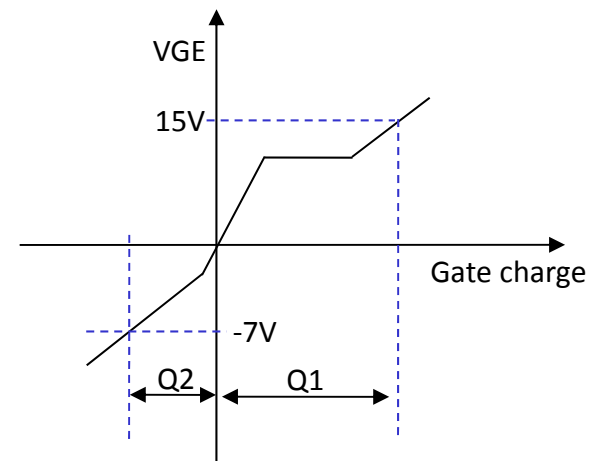
I_{drive} : Gate average current

$Q1$: Gate charge at +15V (Read from data sheet of IGBT)

$Q2$: Gate charge at -7V (Read from data sheet of IGBT)

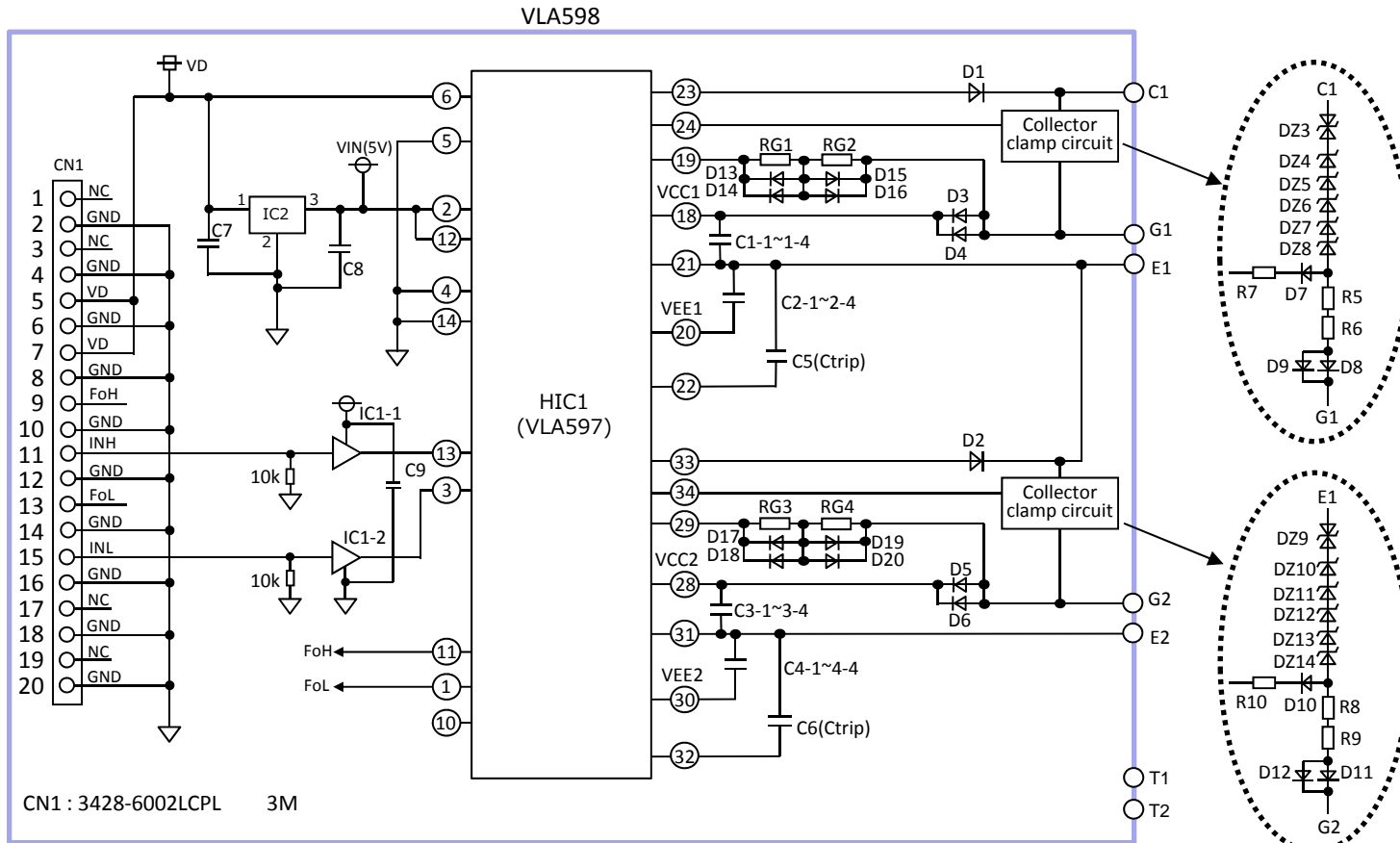
f : Switching frequency of IGBT

Gate charge characteristic of IGBT



Circuit diagram

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CN1	
PinN.o.	Pin name
1	NC
2	GND
3	NC
4	GND
5	VD
6	GND
7	VD
8	GND
9	FoH
10	GND
11	INH
12	GND
13	FoL
14	GND
15	INL
16	GND
17	NC
18	GND
19	NC
20	GND

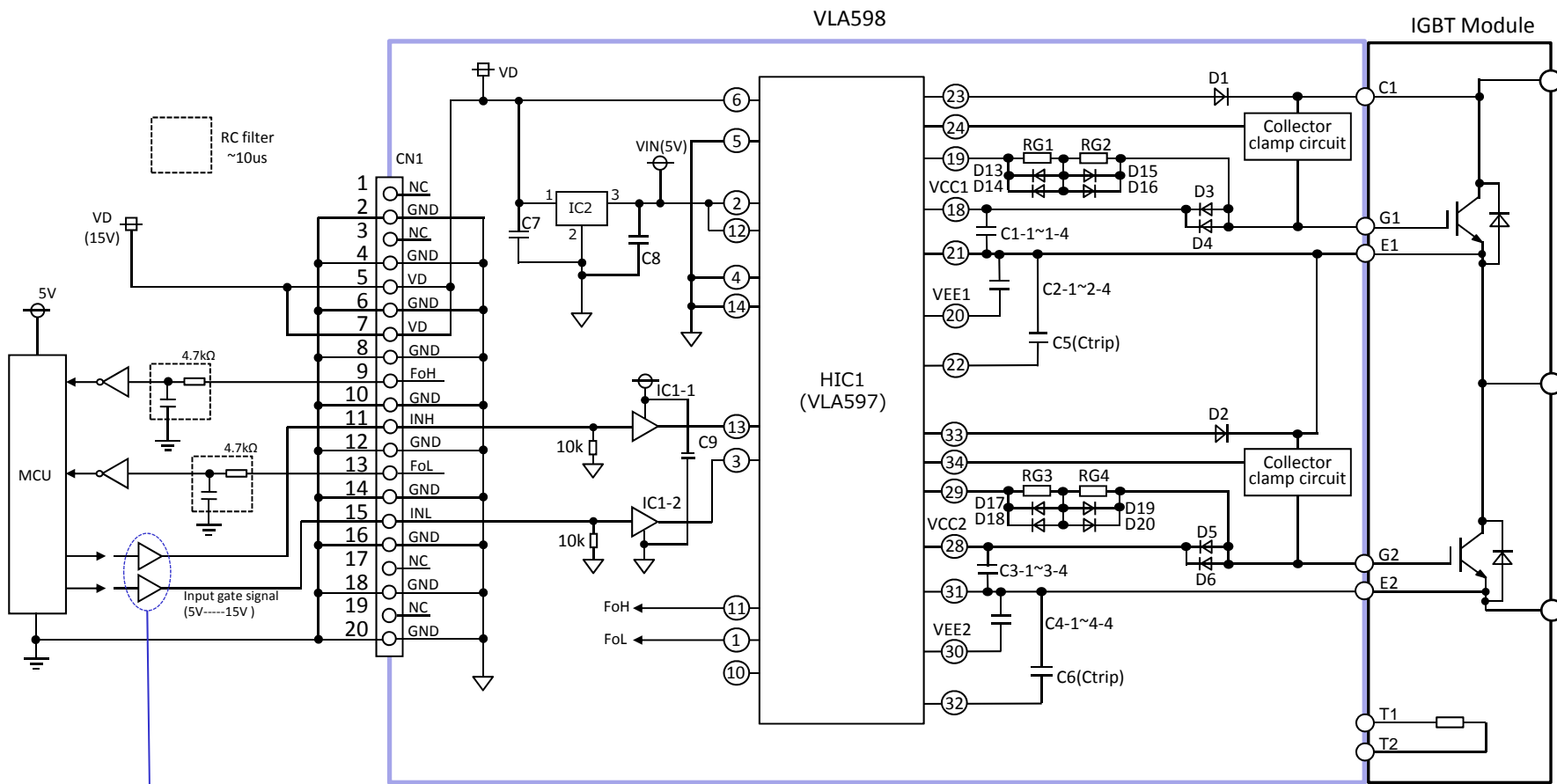
Note

- 1) There is not Gate Resistors at the initial state.
So please solder the chosen resistor.



Application example

Tentative

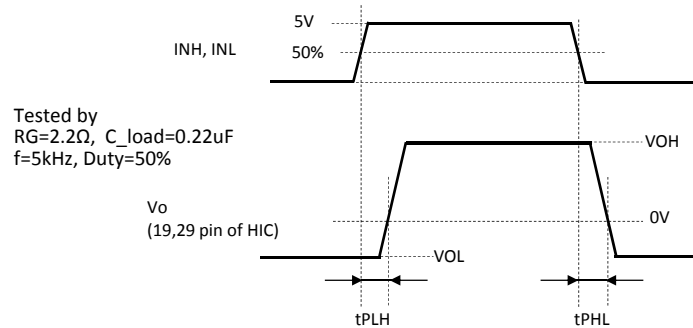


Note) About the IC which drives gate signal on input side, it is not recommended to use the one whose output is open collector or open drain type.

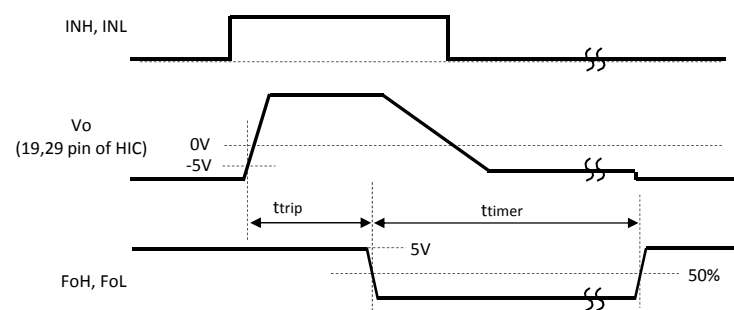


Definition of characteristics

Switching operation

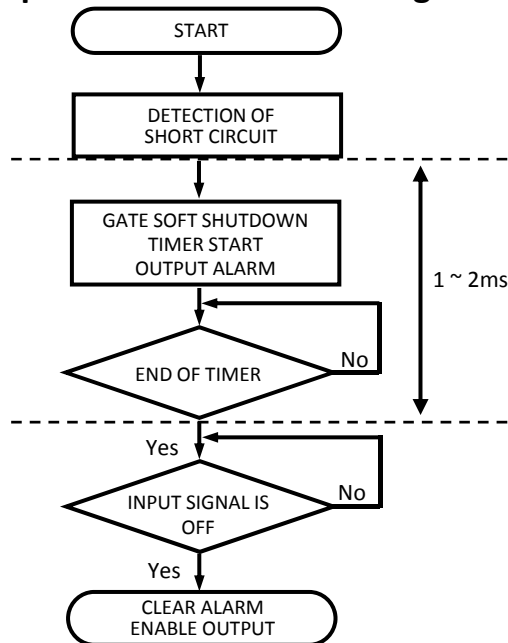


Operation of short circuit protection



Tentative

Operation flow on detecting short circuit



Operation of protection circuit

- (1) In case the gate voltage is "H" and the collector voltage is high, this drive unit will recognize the circuit as short circuit and reduce the gate voltage (soft shut down). Besides, put out error signal ("L") which inform that protection circuit is operating at the same time from Fo terminal (9,13 pin of CN1).
- (2) The protection circuit reset and resort to ordinary condition if input signal is "OFF" when the premised 1~2msec passed. ("OFF" period needs 10us or more)
- (3) When the output rises, the masked time detect short circuit (ttrip) is set up so that on-time of IGBT can be secured properly.

Latch & Timer reset system in short-circuit protection circuit

Once the short-circuit protection circuit starts, it shuts down the gate output and keeps alarm output, causing the latch status. This status is canceled if the input signal is OFF when specific time elapses after the activation of the short-circuit protection circuit. Then, gate output depending on input signals becomes possible. If the input signal is ON when specific time elapses, the latch status is not canceled: it is canceled when the signal becomes OFF.

As mentioned above, on the latch & timer reset system, the latch status is resulted after activation of the protection circuit and shutdown of the gate output. Therefore, during this period, gate output is not made no matter how much input signals are received. For this reason, it is possible to safely stop the entire equipment by sending error signals to the microcomputer during this period to stop all gate signals.

About mounting gate resistor

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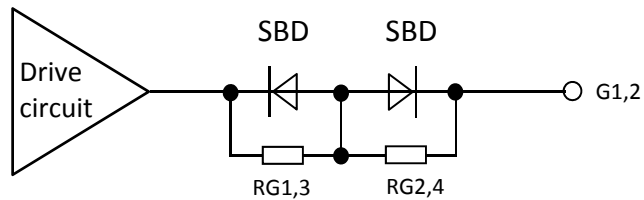
There is not Gate Resistors at the initial state.

It is possible to install up to 2 resistors in mount area of gate resistor per one channel.

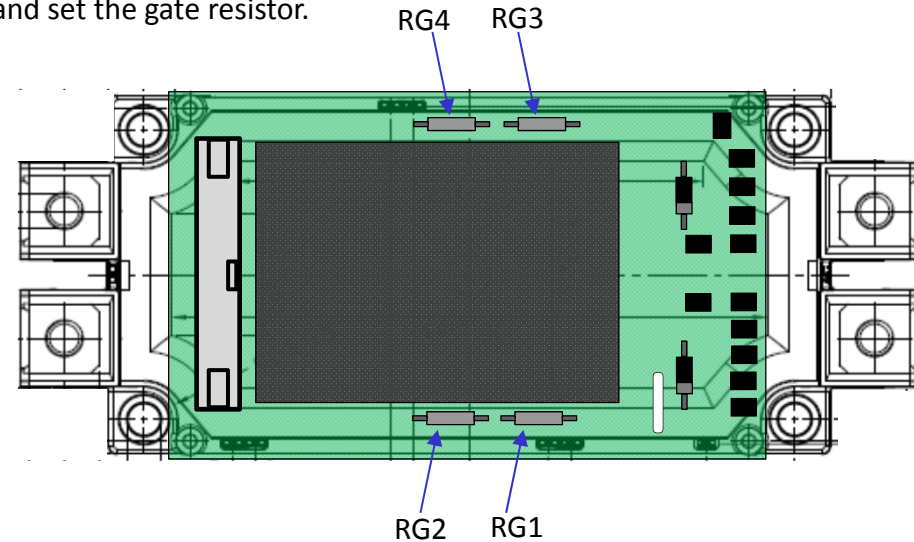
And there are some variations by combining resistor.

There are some examples in the following chart, please refer to it and set the gate resistor.

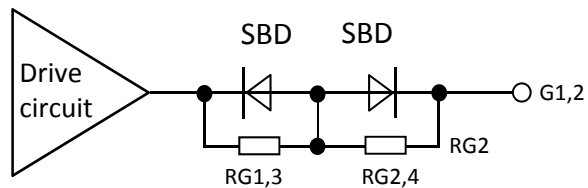
And please solder the chosen resistor.



Layout pattern connection on substrate

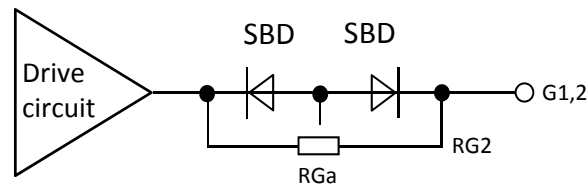


Example 1



RG_on → RG1,3
RG_off → RG2,4

Example 2



RG_on → RGa
RG_off → RGa

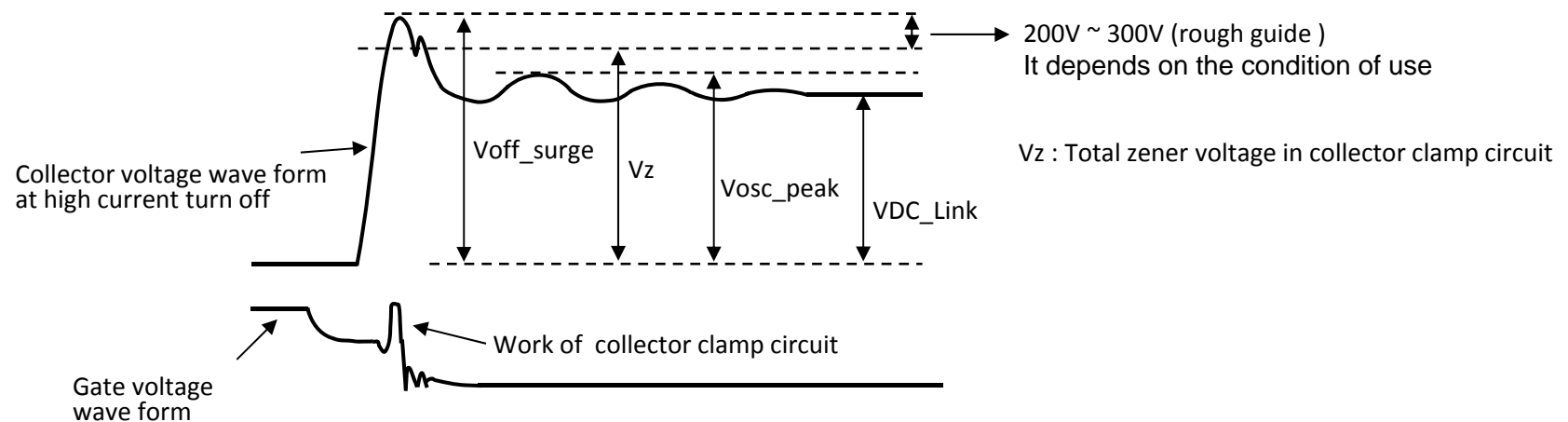
Note about collector clamp circuit (1)

The following chart is the collector voltage wave form of IGBT at high current turn off.
This drive unit has collector clamp circuit built in.

As for this clamp circuit, there is effectiveness to control the surge voltage on collector at high current turn off, but the surge voltage may go over the maximum rating of collector voltage depending on the condition of use. Therefore please confirm it in the actual machine evaluation.

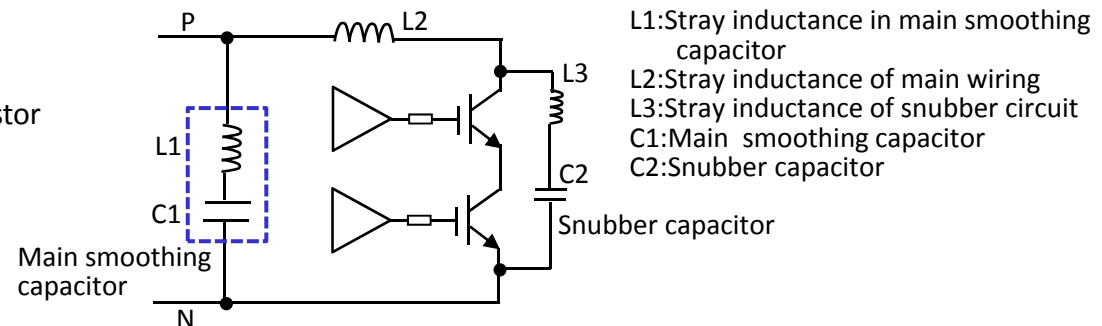
Finally each parameter must be the following relation. Please keep this condition.

$$\text{VDC_Link} < \text{Vosc_peak} < \text{Vz} < \text{Voff_surge}$$



The next countermeasures are effective to suppress the rise and oscillation of the collector voltage.

- (1) Reducing the value of L1,L2 and L3
- (2) Increasing the value of C2
- (3) Increasing the resistance of off gate resistor
- (4) Limiting maximum collector current
- (5) Reducing the VDC_Link



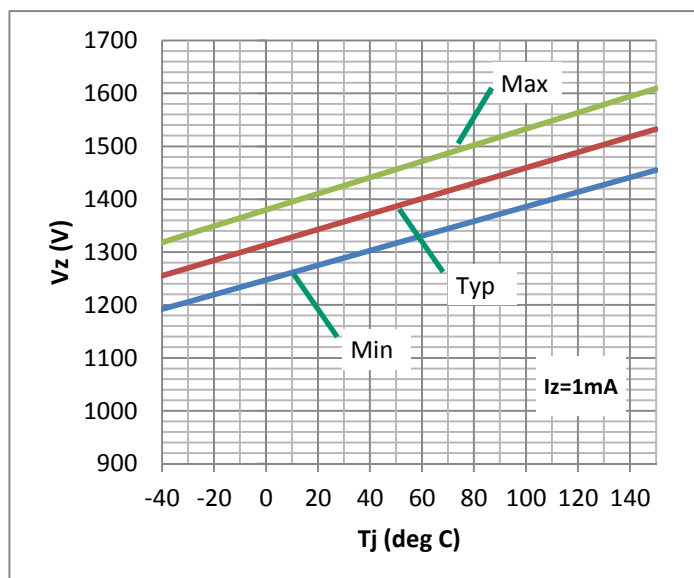
Note about collector clamp circuit (2)

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The total zener voltage in the collector clamp circuit has the tolerance and fluctuation by temperature such as the following chart.

Please keep the main circuit so that the DC_Link voltage does not exceed this zener voltage.

Total zener voltage characteristic



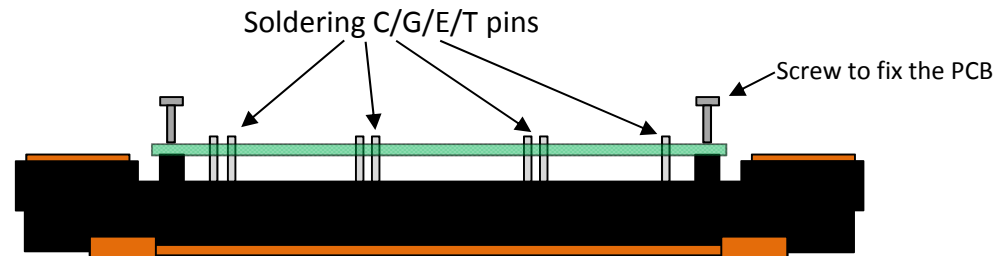
Note about collector clamp circuit (3)

When the collector clamp circuit operates repeatedly, it may be destroyed for heat.

Therefore please keep it to work non-consecutively.

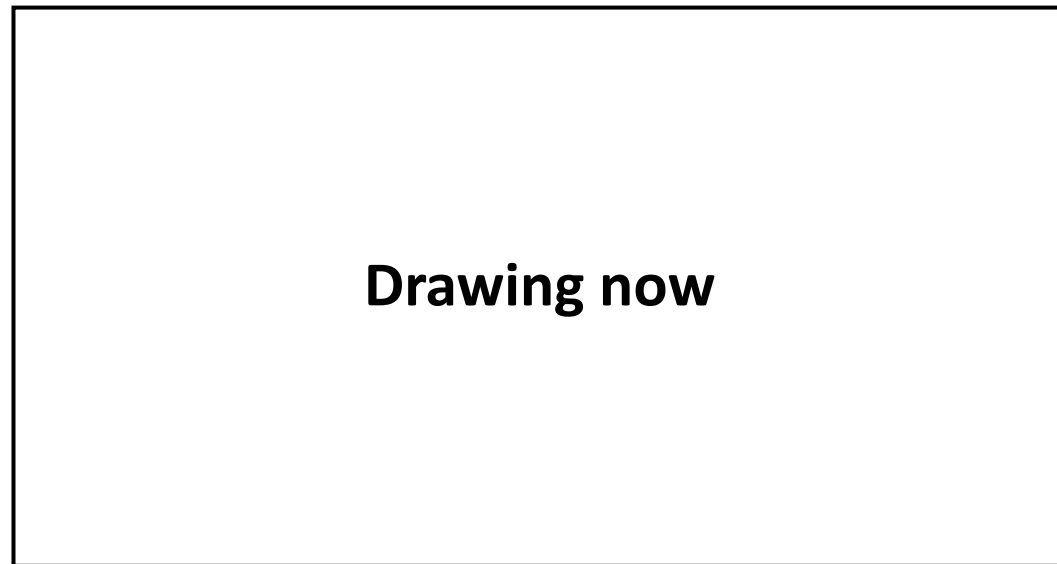
Installation of the PCB on IGBT module

Tentative



Note) Temperature of soldering iron tip : 360°C (max) under 5 seconds

Outline & Size



Note

1) There is not Gate Resistors at the initial state. So please solder the chosen resistor.

Keep safety first in your circuit designs!

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