

## GAU220P-15402



Built in core HIC(VLA591)

### FEATURES

- >Universal gate drive prototype board built in dual channel output core HIC (VLA591)
- >Built in the isolated DC-DC converter for gate drive
- >Output peak gate current is +/-20A(max)
- >Electrical isolation voltage is 4000Vrms(for 1 minute)
- >Built in short circuit protection with soft shut down
- >One way power supply system for gate drivers and input signal (VD=15V)
- >Adjustable fall time of gate voltage on activity of short circuit protection

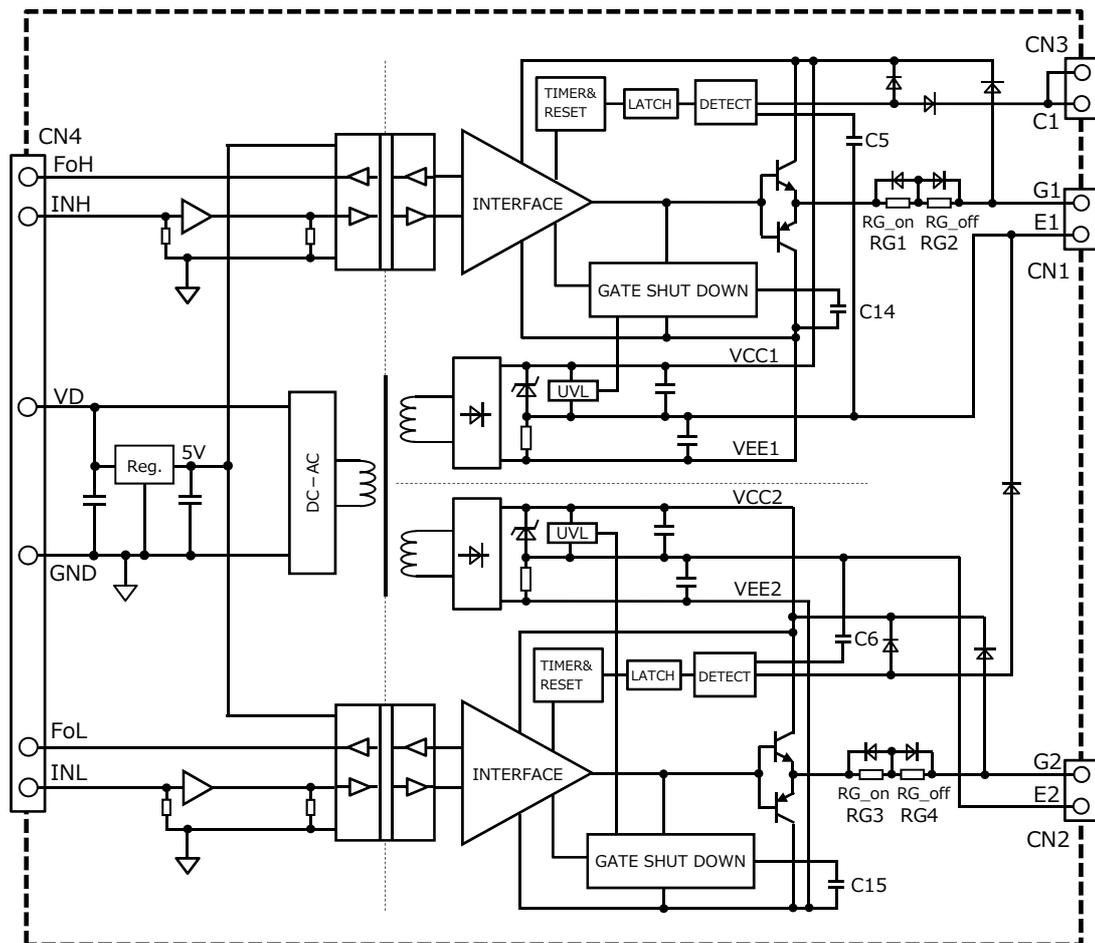
### TARGETED IGBT MODULES

- $V_{CES} = 650V$  series up to 600A class
- $V_{CES} = 1200V$  series up to 1800A class
- $V_{CES} = 1700V$  series up to 1800A class

### APPLICATIONS

Inverter, Servo, UPS, or Wind power etc.

### BLOCK DIAGRAM



\* There is not Gate Resistors at the initial state. So please solder the chosen resistor.

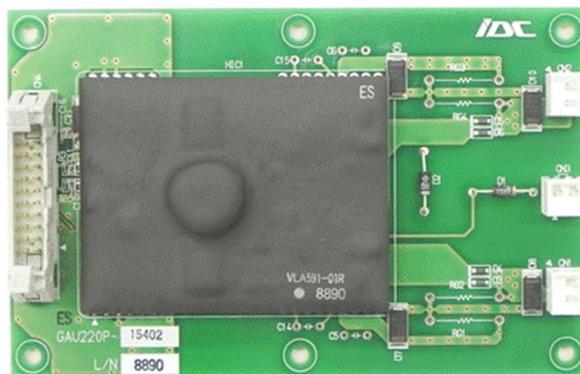


## MAXIMUM RATINGS (unless otherwise noted, Ta=25 °C)

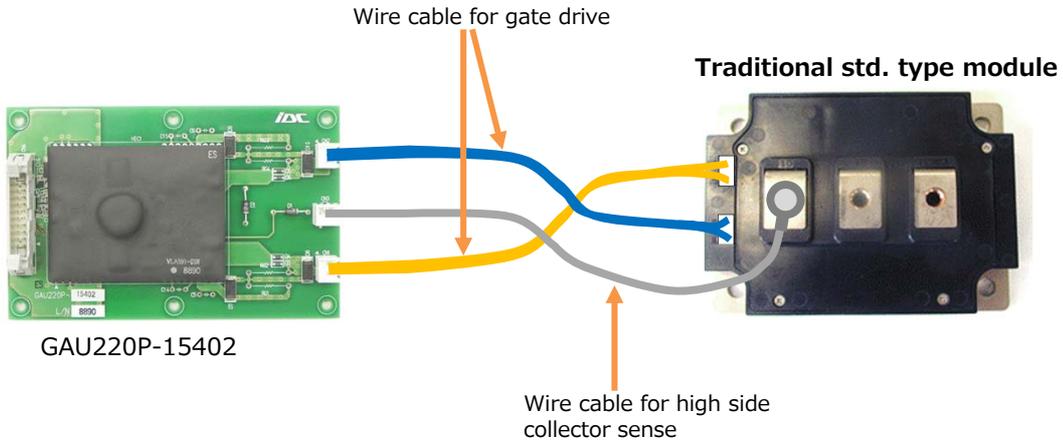
Symbol	Item	Conditions	Ratings	Unit
VD	Supply voltage	DC	-1 ~ 16.5	V
VI	Input signal voltage	Applied between GND - INH,INL	19	V
I_Fo	Fo output current	Sink and source current of Fo terminal	+/-10	mA
IOHP	Output peak current	Pulse width 3us	-20	A
IOLP			20	A
Viso	Isolation voltage between primary and 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 ~ 90	deg C
Idrive	Gate drive current	Gate average current (Per one circuit)	100	mA
VCN3	CN3 voltage	Terminal voltage of CN3	1700	V
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=3kHz)

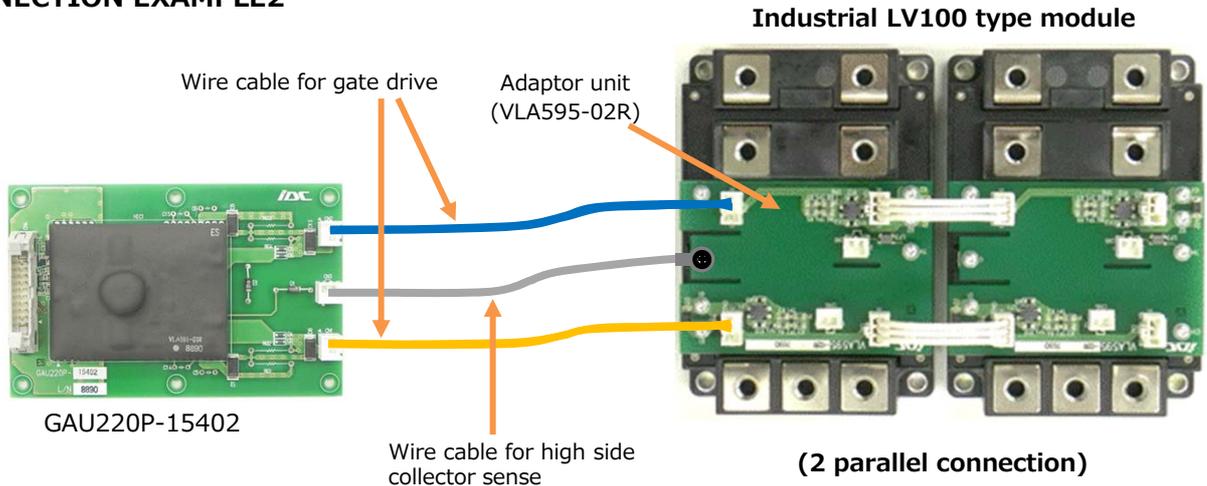
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
VD	Supply voltage	Recommended range	14.5	15	15.5	V
f	Switching frequency	Recommended range It is limited by gate average current (max:100mA/1circuit)	-	-	20	kHz
RG	Gate resistance	Recommended range	0.5	-	-	ohm
VI	Input signal voltage	Recommended range	4.5	-	15.5	V
I_Fo	Fo output current	Recommended range	-4	-	4	mA
VI_H	Input signal high threshold	-	1.5	1.8	2.1	V
VI_L	Input signal low threshold	-	0.8	1.1	1.4	V
VOH	Plus bias output voltage	Input "H"(High active)	13.5	15.2	16.5	V
VOL	Minus bias output voltage	Input "L"	-6	-8	-11	V
tPLH	"L-H" propagation time	RG=1.5Ω, f=3kHz, C_load:0.33uF, VI=5V	-	0.29	-	us
tPHL	"H-L" propagation time	RG=1.5Ω, f=3kHz, C_load:0.33uF, VI=5V	-	0.15	-	us
ttimer	Timer	Between start and cancel of protection (Under input signal is off state)	1	-	2	ms
ttrip	Masked time detect short circuit	Detect pin:over than 15V or open, C5,6:open	-	2.9	-	us
UVLO+_VCC	Under voltage lock out	VCC voltage (Operation start)	-	12.6	-	V
UVLO-_VCC	Under voltage lock out	VCC voltage (Operation stop)	-	11.7	-	V
VSC	SC detect voltage	Collector voltage of IGBT	15	-	-	V



## CONNECTION EXAMPLE1



## CONNECTION EXAMPLE2



## 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 100mA per one channel. This current means maximum gate average current.

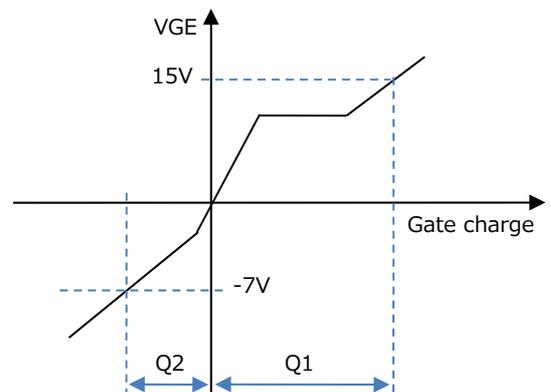
**When you decide the switching frequency, please check the gate average current by next formula.**

$$I_{drive} = (Q_1 + |Q_2|) \times f \times N$$

$I_{drive}$  : Gate average current  
 $Q_1$  : Gate charge at +15V (Read from data sheet of IGBT)  
 $Q_2$  : Gate charge at -7V (Read from data sheet of IGBT)  
 $f$  : Switching frequency of IGBT module  
 $N$  : Parallel number of IGBT module

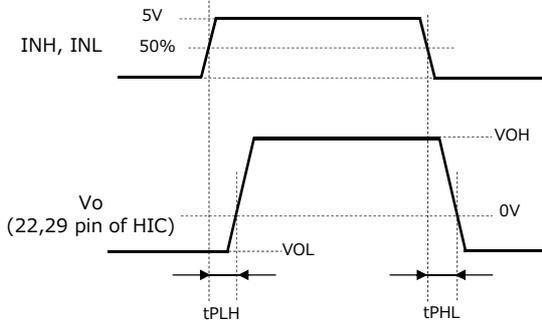
← It must be less than 100mA

### Gate charge characteristic of IGBT

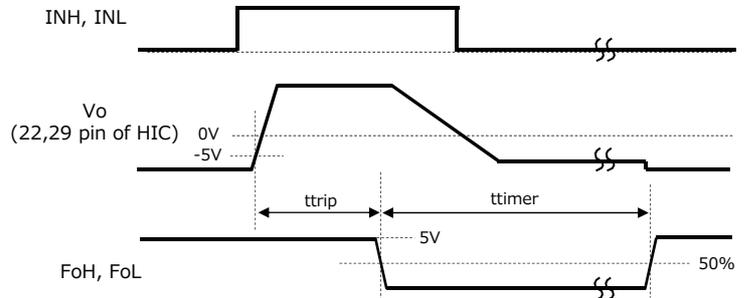


## DEFINITION OF CHARACTERISTICS

### NORMAL SWITCHING OPERATION

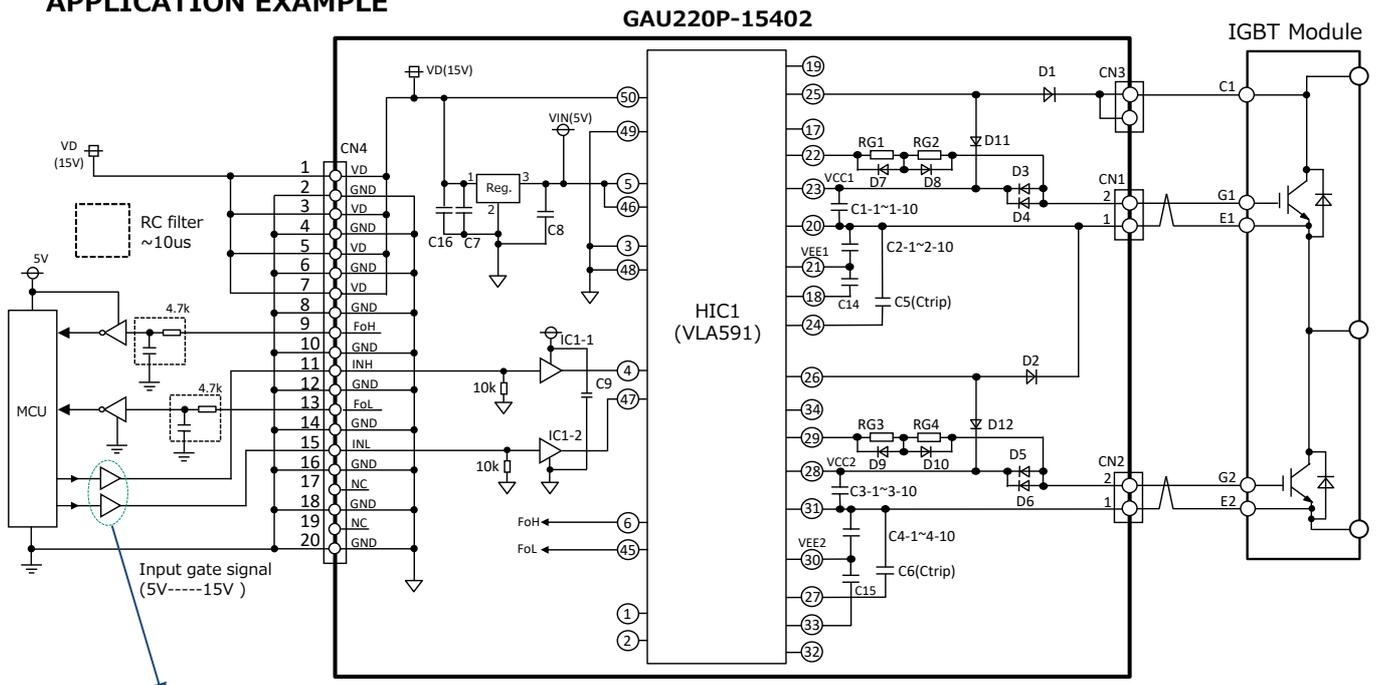


### OPERATION OF SHORT CIRCUIT PROTECTION



\*Tested by  $R_G=1.5\Omega$ ,  $C_{load}=0.33\mu F$ ,  $f=3kHz$ , ON Duty=50%

## APPLICATION EXAMPLE



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.

### Note

- 1) Gate Resistor is not installed at the time of shipment. Please solder the chosen resistor.
- 2) When you confirm the gate output without connecting IGBT, please invalidate the short-circuit protection function. If connect resistance of 4.7k ohm between the C1(E1) and E1(E2) without main power supply, the short circuit protection becomes invalid.
- 3) C5(6) is not installed at the time of shipment. But if needed, please solder the chosen condenser. → (rough guide is 33~75pF, 50V, ceramic)
- 4) C14(15) is not installed at the time of shipment. Generally this is not be needed but a special case. But if needed, please solder the chosen condenser. → (lough guide is 10~39pF, 50V, ceramic)

### OPERATION OF PROTECTION CIRCUIT

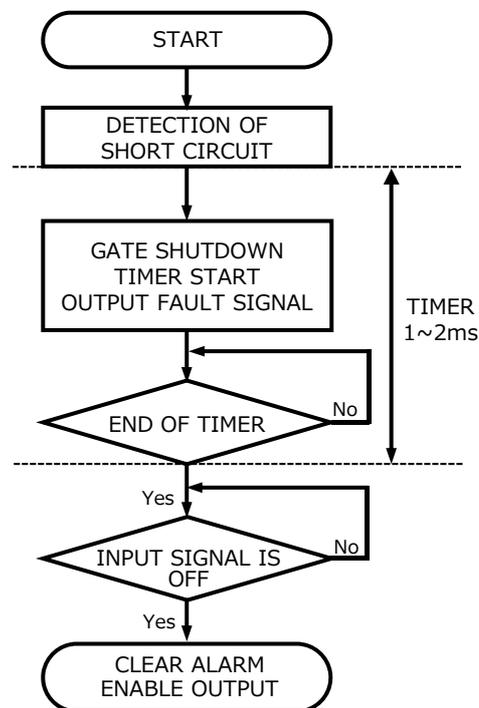
- (1) In case the gate voltage is "H" and the collector voltage is high, this drive unit will recognize the circuit as short circuit and reduce the gate voltage. Besides, put out fault signal ("L") which inform that protection circuit is operating at the same time from Fo terminal (9,13 pin of CN4).
- (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. It is possible to adjust that time by connecting the capacitor C5(C6) (If needed Ctrip, lough guide is 33~75pF)
- (4) When the short circuit protection works, the soft gate shut down circuit works to suppress collector surge voltage of IGBT. Furthermore, when it is necessary to be more soft, it is possible to make gate shut down speed more slow by adding capacitor C14(15). (Generally no need but if needed, lough guide is 10~39pF)

### LATCH & TIMER RESET SYSTEM IN SHORT CIRCUIT PROTECTION CIRCUIT

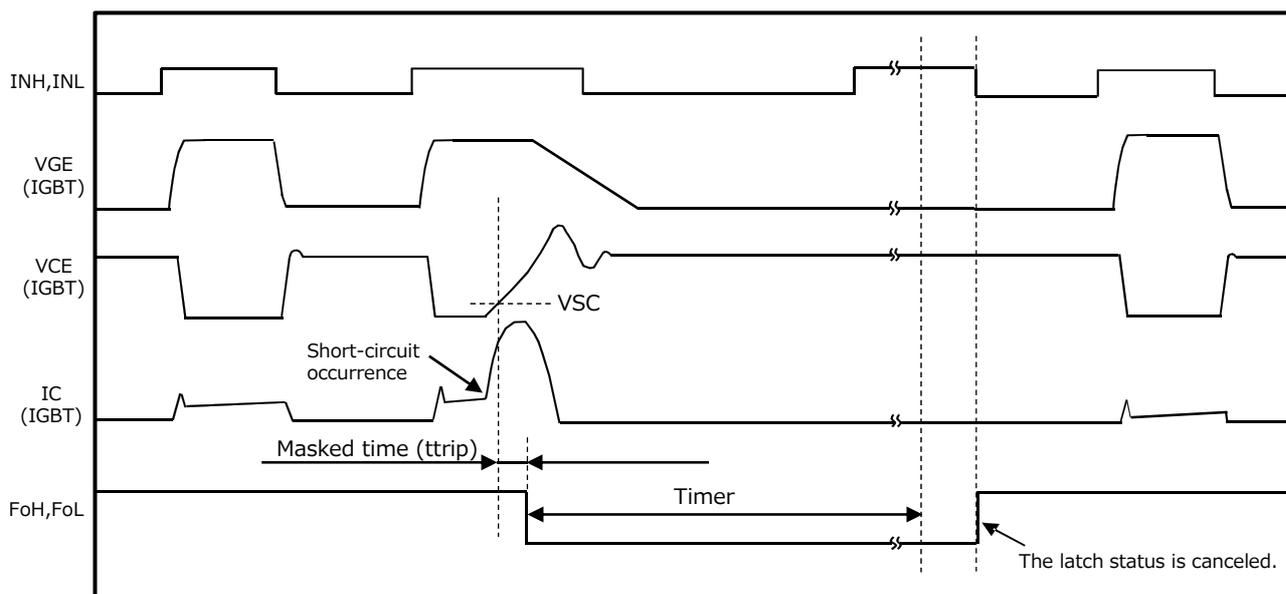
Once the short-circuit protection circuit starts, it shuts down the gate output and keeps alarm output, causing the latch status. This status is canceled if the input signal is OFF when specific time elapses after the activation of the short-circuit protection circuit. Then, gate output depending on 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.

OPERATION FLOW ON DETECTING SHORT CIRCUIT

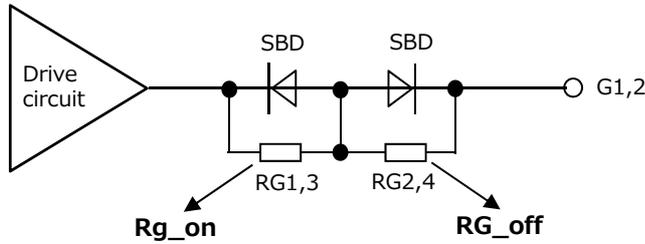


### TIMING CHART

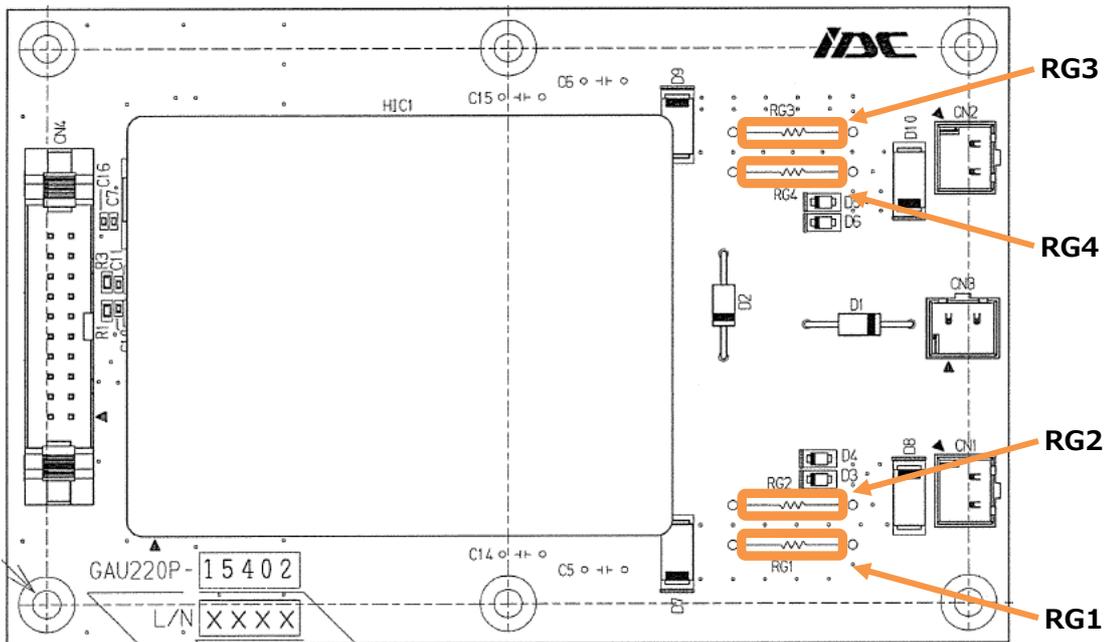


## ABOUT MOUNTING GATE RESISTORS

There is not gate resistors at the initial state.  
 It is possible to install 2 resistors in mount area of gate resistors per one channel.  
 Please refer to following chart and set the gate resistors.  
 And please solder the chosen resistors.



Layout pattern connection on substrate



## THE WAY TO CALCULATE GATE RESISTANCE VALUE OF PARALLEL CONNECTION

$R_{G\_ON}/1\text{elem.} = \text{Gate ON resistance value per one element} = R_b + (N \times R_{g\_on})$

$R_{G\_OFF}/1\text{elem.} = \text{Gate OFF resistance value per one element} = R_b + (N \times R_{g\_off})$

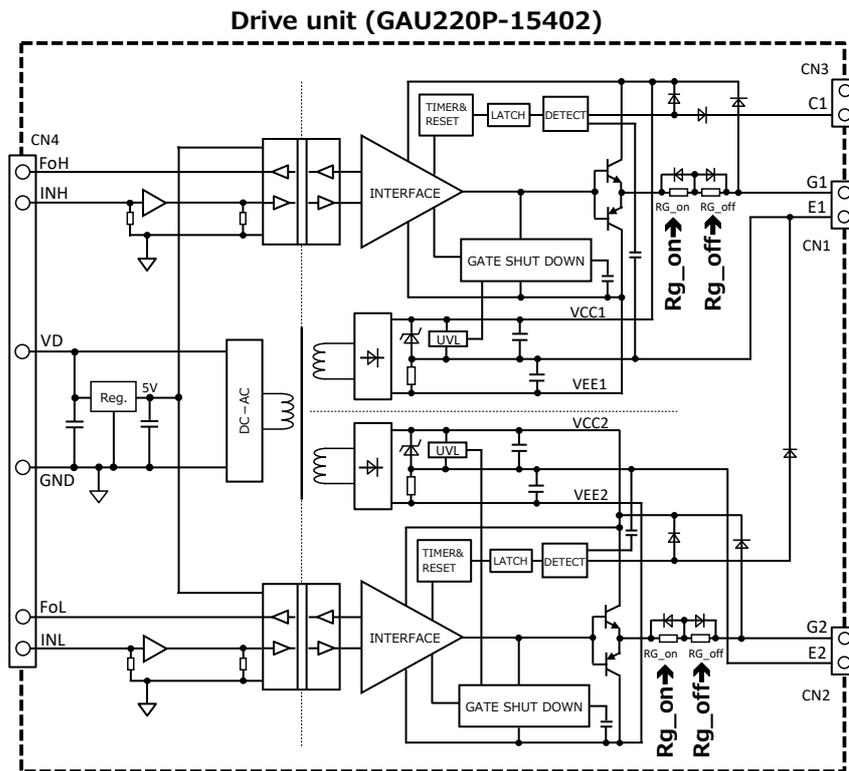
### Example of using adaptor unit VLA595-02R

$R_b$  : 0.1Ω (Compound value of 4 chip resistors on VLA595-02R)

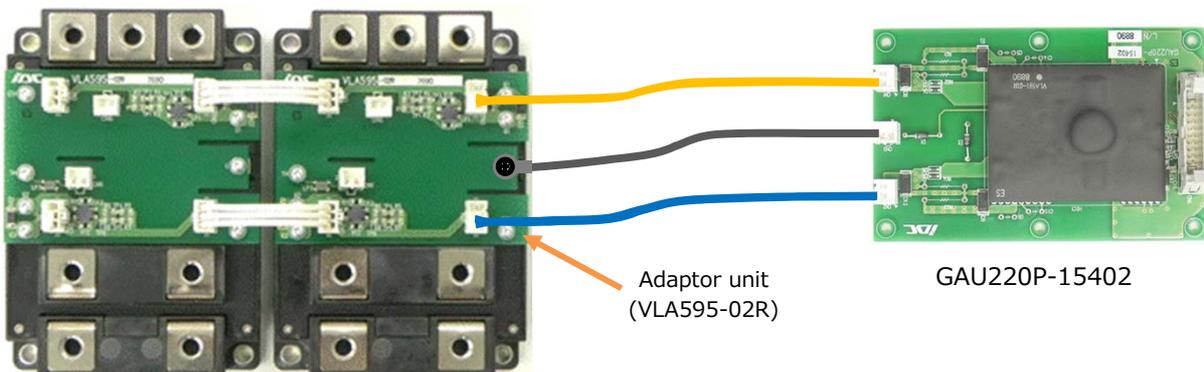
$N$  : Parallel number of IGBT module

$R_{g\_on}$  : Gate ON resistance value on GAU220P-15402

$R_{g\_off}$  : Gate OFF resistance value on GAU220P-15402



Industrial LV100 type module  
(2 parallel connection)



Adaptor unit  
(VLA595-02R)

GAU220P-15402

## FOR SAFETY USING

Great detail and careful attention are given to the production activity of Hics, such as the development, the quality of production, and in its reliability. However the reliability of Hics depends not only on their own factors but also in their condition of usage. When handling Hics, please note the following cautions.

CAUTIONS	
Packing	The materials used in packing Hics can only withstand normal external conditions. When exposed to outside shocks, rain and certain environmental contaminants, the packing materials will deteriorates. Please take care in handling.
Carrying	<ol style="list-style-type: none"> <li>1) Don't stack boxes too high. Avoid placing heavy materials on boxes.</li> <li>2) Boxes must be positioned correctly during transportation to avoid breakage.</li> <li>3) Don't throw or drop boxes.</li> <li>4) Keep boxes dry. Avoid rain or snow.</li> <li>5) Minimal vibration and shock during transportation is desirable.</li> </ol>
Storage	<p>When storing Hics, please observe the following notices or possible deterioration of their electrical characteristics, risk of solder ability, and external damage may occur.</p> <ol style="list-style-type: none"> <li>1) Devices must be stored where fluctuation of temperature and humidity is minimal, and must not be exposed to direct sunlight. Store at the normal temperature of 5 to 30 degrees Celsius with humidity at 40 to 60%.</li> <li>2) Avoid locations where corrosive gasses are generated or where much dust accumulates.</li> <li>3) Storage cases must be static proof.</li> <li>4) Avoid putting weight on boxes.</li> </ol>
Extended storage	When extended storage is necessary, Hics must be kept non-processed. When using Hics which have been stored for more than one year or under severe conditions, be sure to check that the exterior is free from flaw and other damages.
Maximum ratings	To prevent any electrical damages, use Hics within the maximum ratings. The temperature, current, voltage, etc. must not exceed these conditions.
Polarity	To protect Hics from destruction and deterioration due to wrong insertion, make sure of polarity in inserting leads into the board holes, conforming to the external view for the terminal arrangement.

**Keep safety first in your circuit designs!**

·ISAHAYA Electronics Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (1) placement of substitutive, auxiliary circuits, (2) use of non-flammable material or (3) prevention against any malfunction or mishap.

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