

IGBT Gate Drive Unit VLA555-01R/-02R



Sep.2013

IGBT Gate Drive Unit VLA555-01R/-02R

Feature

- >Directly mountable on the New-MPD
- >Built in the isolated DC-DC converter for gate drive
- >Output peak current is +/-24A(max)
- >Built in short circuit protection with soft shut down
- >Built in collector clamp circuit
- >Electrical isolation voltage is 4000Vrms
(for 1 minute)
- >fiber optic interface

Recommended IGBT Modules

MITSUBISHI New Mega Power Dual IGBT module

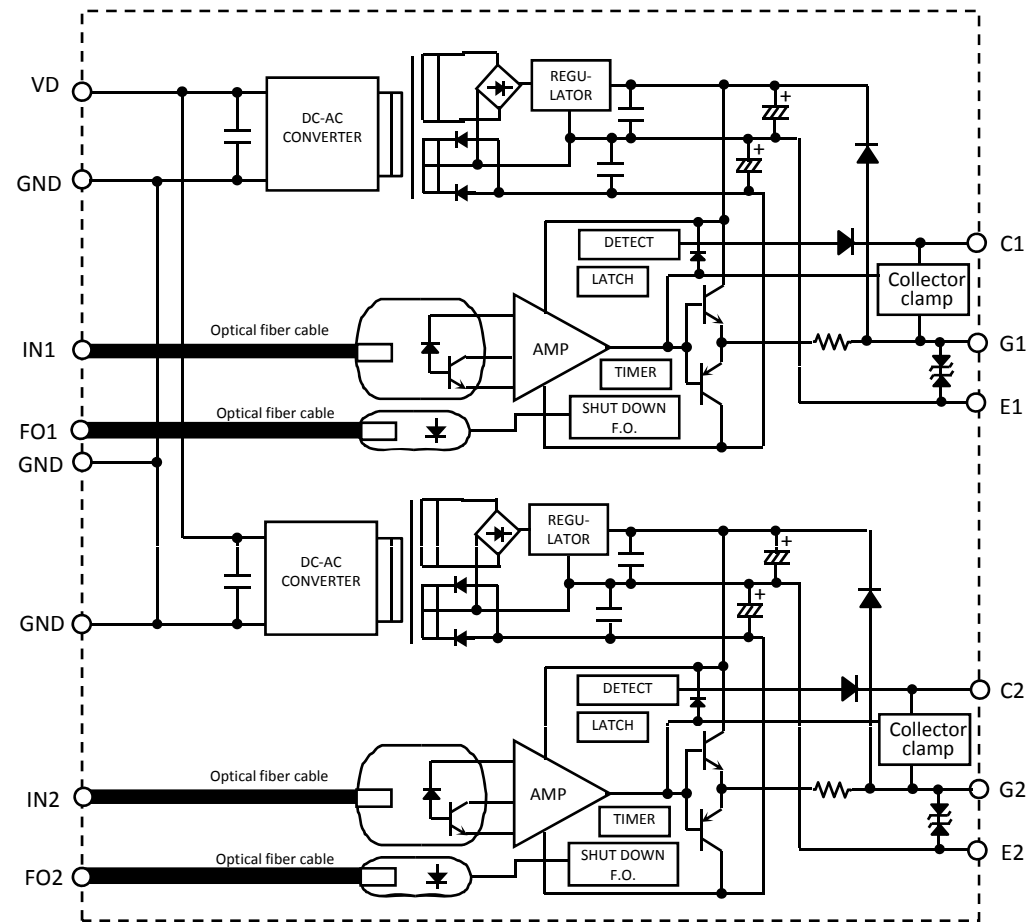
CM2500DY-24S ➔ VLA555-01R

CM1800DY-34S ➔ VLA555-02R



Drive unit with New-MPD
(Image photo)

Block Diagram



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

Symbol	Parameter	Conditions	Ratings	Unit
VD	Supply voltage	DC	-1 ~ 16.5	V
VI	Input signal voltage	Applied between IN+ and IN- 50% Duty cycle , pulse width 1ms	-7 ~ +7	V
ID(PULSE)	Input current (PULSE)	At the power supply start-up, PW 10msec	4	A
IOHP	Output peak current	Pulse width 3us	-24	A
IOLP			24	A
Viso	Isolation voltage	Sine wave voltage 60Hz, for 1min	4000	Vrms
Topr	Operating temperature	No condensation allowable	-30 ~ 70	deg C
Tstg	Storage temperature	No condensation allowable	-40 ~ 85	deg C
Idrive	Gate drive current	Gate average current (Per one circuit)	210	mA
VDC_Link	Main circuit voltage	The voltage between P and N	840 (-01R)	V
			1200 (-02R)	

Electrical characteristics (unless otherwise noted, Ta=25 degC, VD=15V, f=3kHz)

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
VD	Supply voltage	Recommended range	14.2	15	15.8	V
VIN	Pull-up voltage on input side	Recommended range (for input signal)	4.75	5	5.25	V
IIH	"H" input signal current	Recommended range	10	12	16	mA
f	Switching frequency	Recommended range	-	-	10	kHz
RG	Gate resistance	Recommended range	0	-	-	ohm
VOH	Plus bias output voltage	-	14	15.3	16.5	V
VOL	Minus bias output voltage	-	-5.5	-7	-11	V
tPLH	"L-H" propagation time	IIH = 12mA	0.3	-	1	us
tPHL	"H-L" propagation time	IIH = 12mA	0.3	-	1	us
Vz (*1)	Clamp zener voltage	Total zener voltage in collector clamp circuit at Iz = 1mA , Tj=25 deg C	901	950 (-01R)	999	V
			1284	1350 (-02R)	1419	
VSC	SC detect voltage	-	15	-	-	V

*1 : It depends on the condition of use, but actual clamp voltage of collector rises to around 250V from Vz.

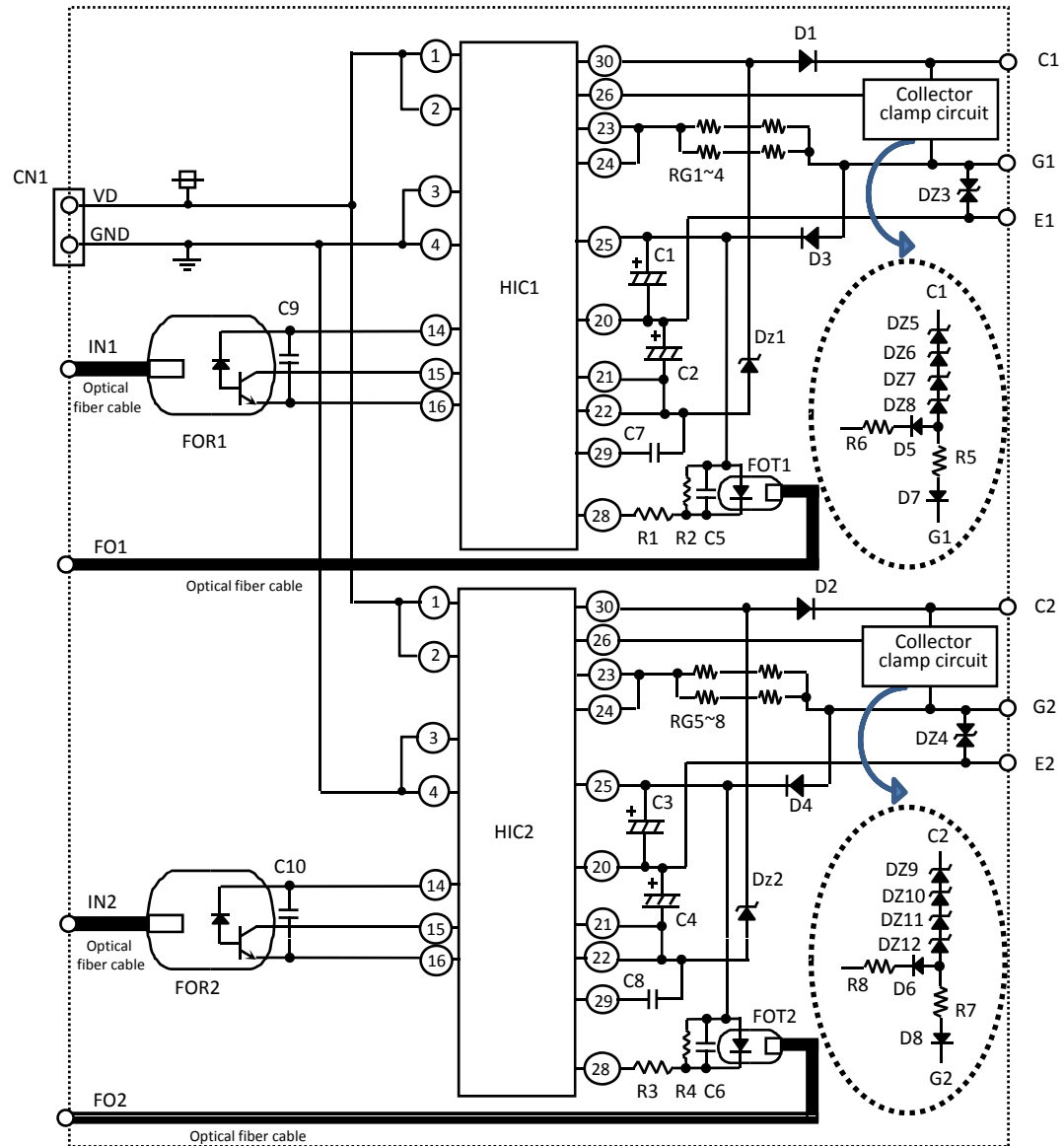
Inner circuit

HIC1,2	VLA554-01R	ISAHAYA
FOR1,2	HFBR-2532Z	AVAGO
FOT1,2	HFBR-1532Z	AVAGO
D1,2	RP1H	SanKen
D3 ~ 8	SBD VRM=60V, IFSM >60A class	
DZ1,2	Vz=30V 0.5~1W class	
DZ3,4	Vz=18V Bidirectional,	
C1,2,3,4	470uF,35V Low impedance	
C5,6	Unmounting(0.1μF, 10V)	
C7,8	Unmounting	
C9,10	Unmounting(4.7μF, 10V)	
RG	Gate Resistor	
R1,3	1.2kohm,500mW	
R2,4	2.4kohm,250mW	
R5,7	1W class	
R6,8	1W class	
CN1	5045-02A	MOLEX

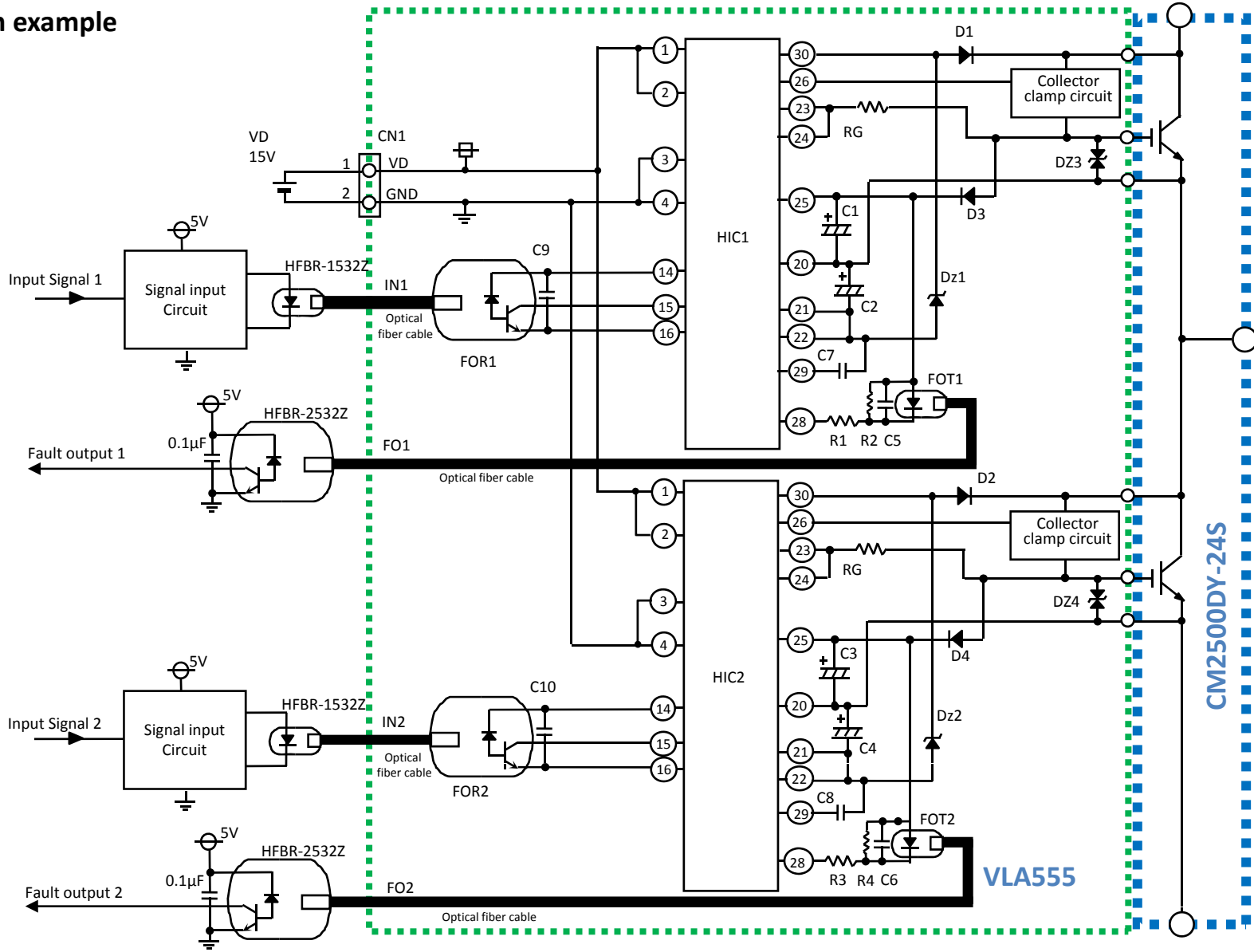
DZ5~8 / 9~12 Total zener voltage
 950V (at I_z=1mA) → -01R
 1350V (at I_z=1mA) → -02R

Note

- 1) Gate Resistor is not installed at the time of shipment.
Please solder the chosen resistor.
- 2) C7,8 is not installed at the time of shipment.
Please solder the chosen condenser if needed.
(50V,ceramic)



Application example



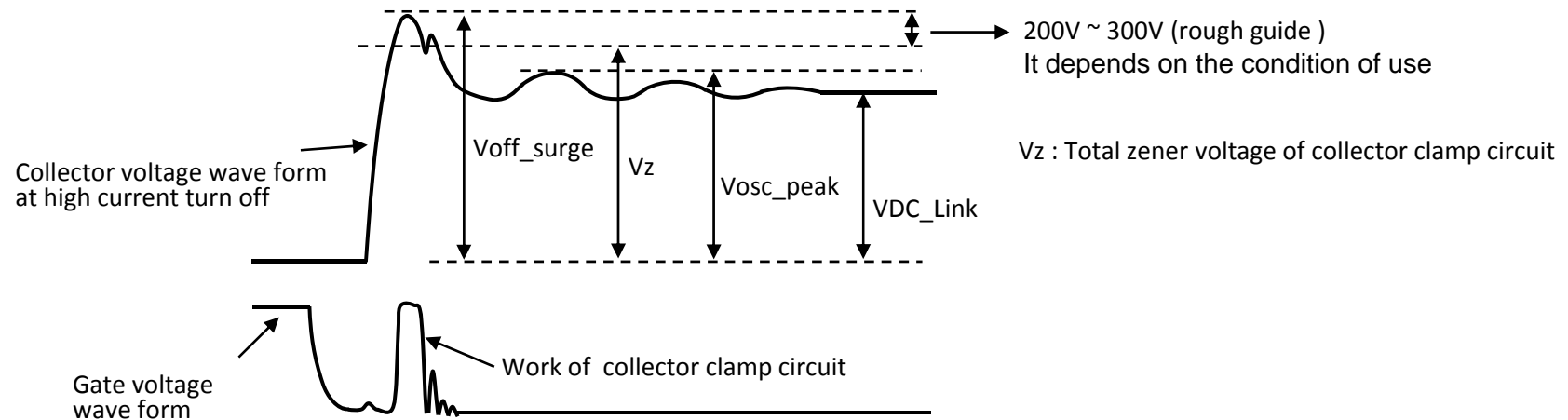
Note about collector clamp circuit (1)

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.

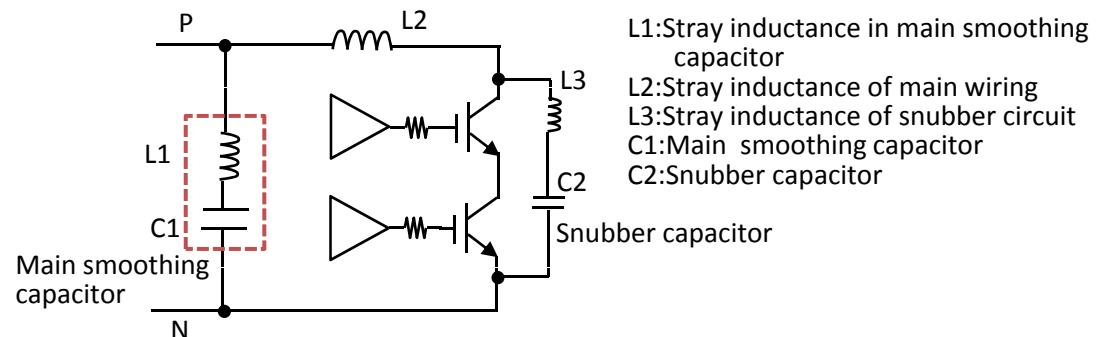
Finally each parameter must be the following relation. Please keep this condition.

$$VDC_Link < Vosc_peak < Vz < Voff_surge$$



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 gate resistor
- (4) Limiting maximum collector current
- (5) Reducing the VDC_Link

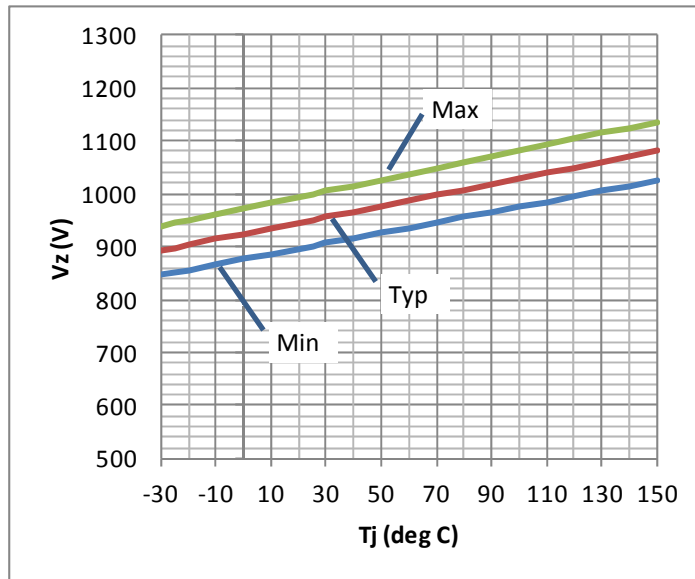


Note about collector clamp circuit (2)

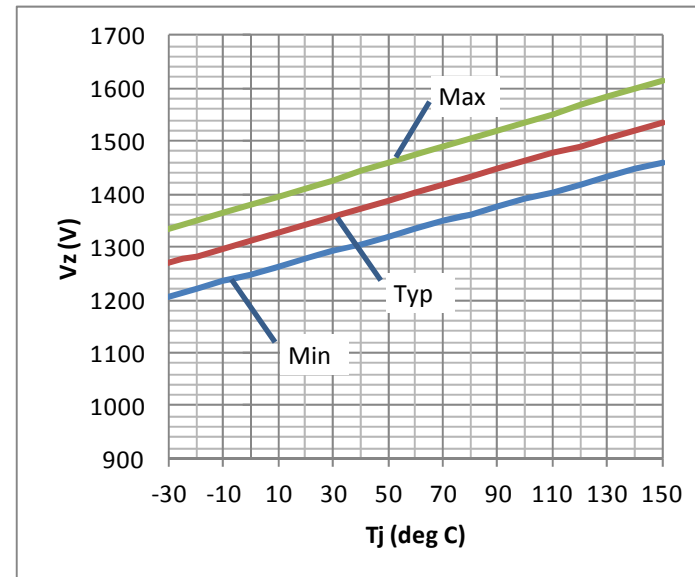
The total zener voltage in the collector clamp circuit has the tolerance and fluctuation by temperature such as the following chart.

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

Total zener voltage characteristic of VLA555-01R



Total zener voltage characteristic of VLA555-02R



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.

Capacity for power supply on input side

This product has isolated DCDC converter built in for gate drive.
When you chose the power supply on input side,
please select the product that can supply the current capacity proven
by next 3steps.

1st step : Calculation for gate average current

$$I_{drive} = (Q1 + |Q2|) \times f$$

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

2nd step : Reading required current from performance curve

If the result of calculation for I_{drive} is 100mA

I_D is about 270mA by performance curve.

I_D : Consumption current of DCDC converter in this unit (per 1 circuit)

3rd step : Securing the margin

$$I_{out} = I_D \times n \times (1 + \text{margin})$$

I_{out} : Output current of input power supply

n : element number (in this case $n=2$, this unit has 2 elements)

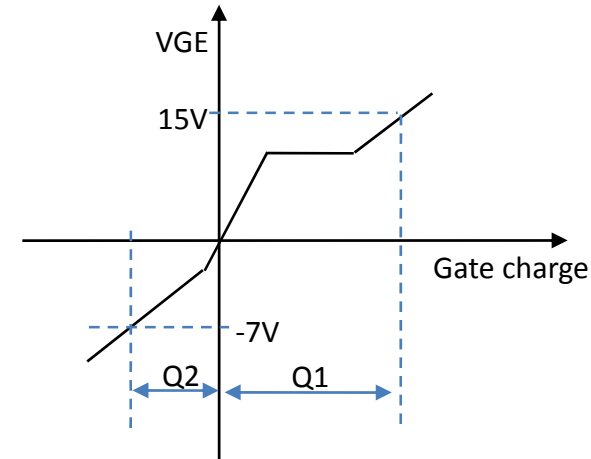
Margin : 0.4

If the result of I_D is 270mA, please prepare the power supply
that has the following spec.

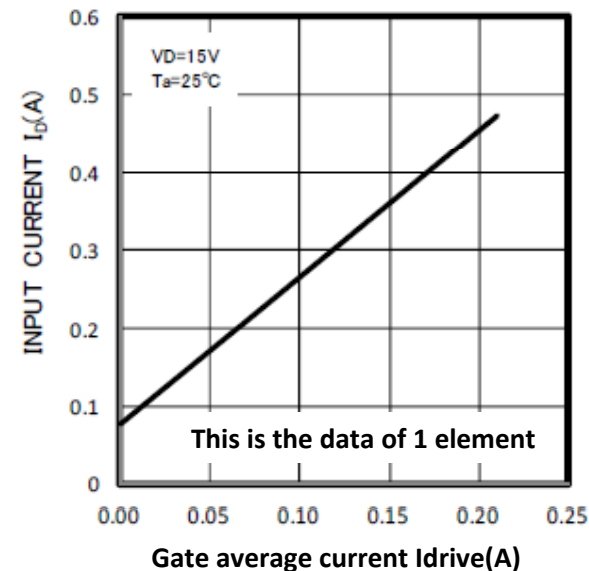
Output voltage : 15V

Output current : more than 756mA

Gate charge characteristic of IGBT



$I_D - I_{drive}$ performance curve (Typical)

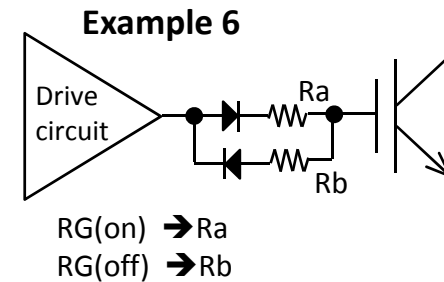
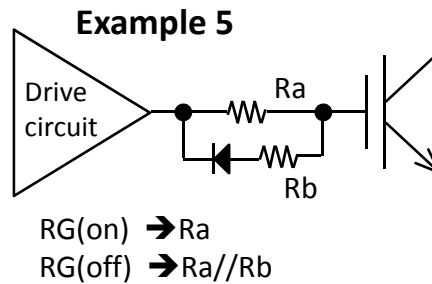
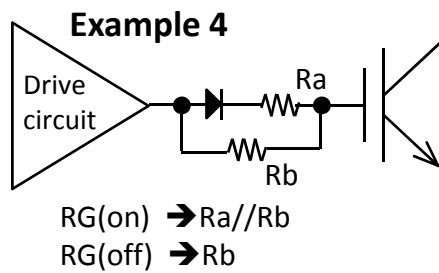
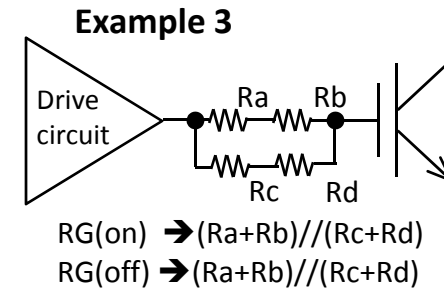
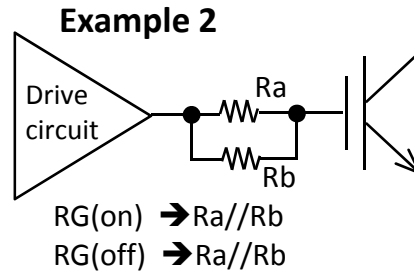
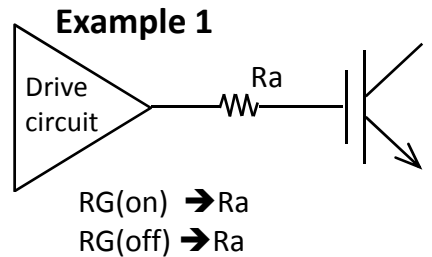
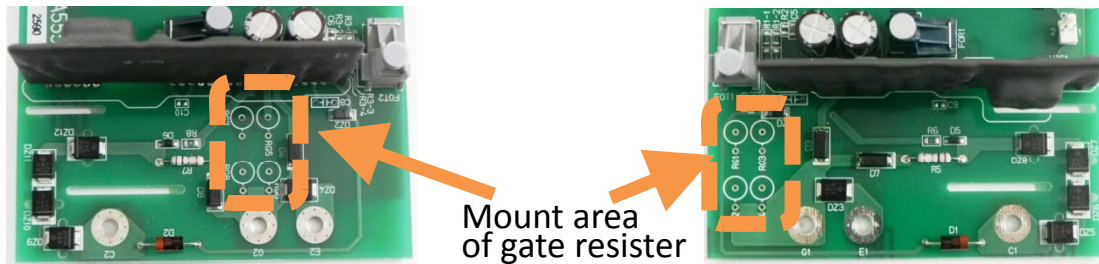


About mounting gate resistor

It is possible to install up to 4 resistors for 1 element in mount area of gate resistor.

And there are some variations by combining resistor with SBD.

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



Details of connector

CN1 : 5045-02A (MOLEX)	
Pin N.o.	Signal
1	VD
2	GND

We recommend following parts for this connector.

Housing	Strain relief	Maker
5051-02	#2759 or #5159	MOLEX

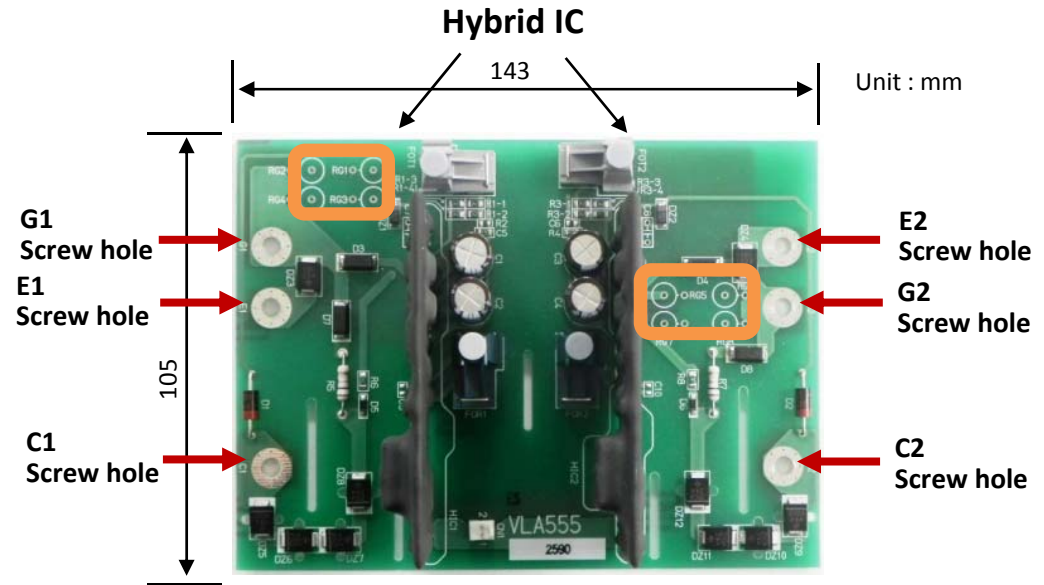
Details of fiber optic connector

Part N.o.	Part Name	Function	Signal Rate	Structure	Maker
FOR1	HFBR-2532Z	Receiver	1MBd (high performance)	Horizontal Package	AVAGO
FOR2					
FOT1	HFBR-1532Z	Transmitter			
FOT2					

Outline & Size

Note

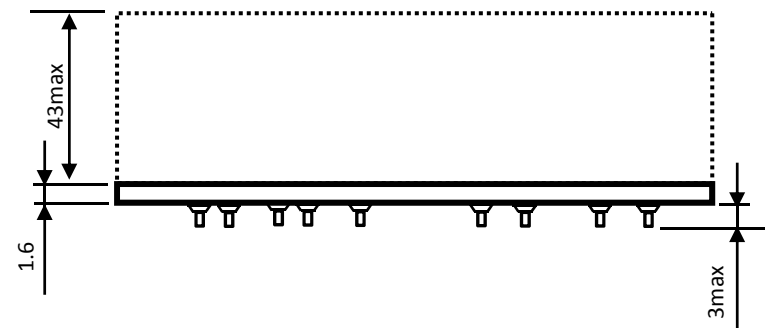
- 1) The screw hole fits to the screw hole position of CM2500DY-24S and CM1800DY-34S.
- 2) There is not Gate Resistors at the initial state. So please solder the chosen resistor.



 : Gate resistor mount part (Initial is open)

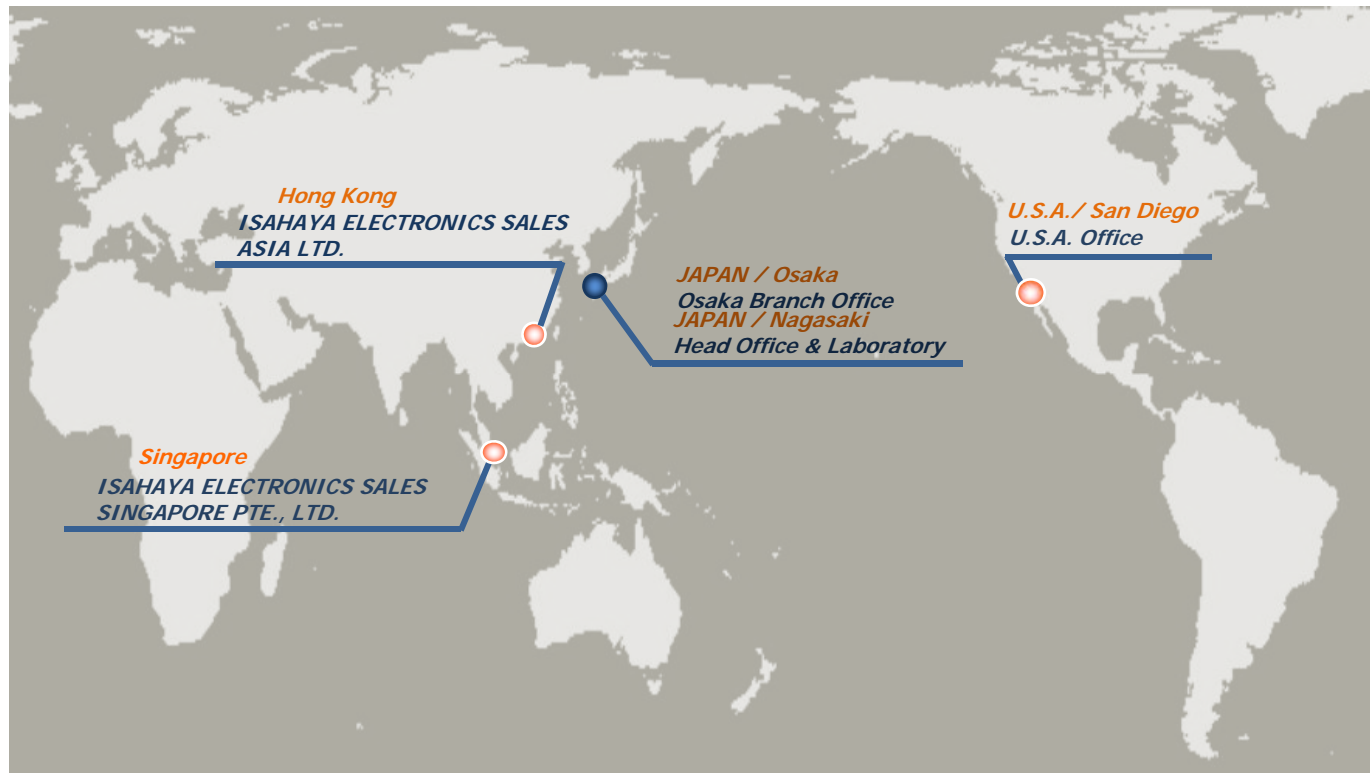
Clearance & Creepage

< On mother board >	Clearance	Creepage
Input side - Output side →	18 mm	
< In Hybrid IC >		
Input side - Output side →	8 mm	8 mm



This is just a Image photo

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