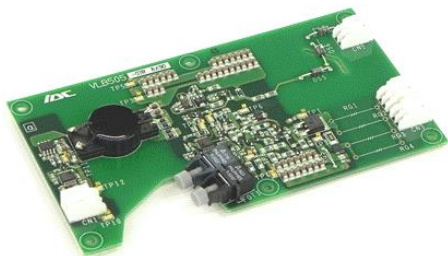


VLB505-01R



FEATURES

- >Single channel simple and easy gate drive system
- >Wire connection to MOSFET module
- >Built in the isolated DC-DC converter for gate drive
- >Output peak current is +/-36A(max)
- >Built in short circuit protection
- >Electrical isolation voltage is 6000Vrms (for 1 minute)
- >Fiber optic interface

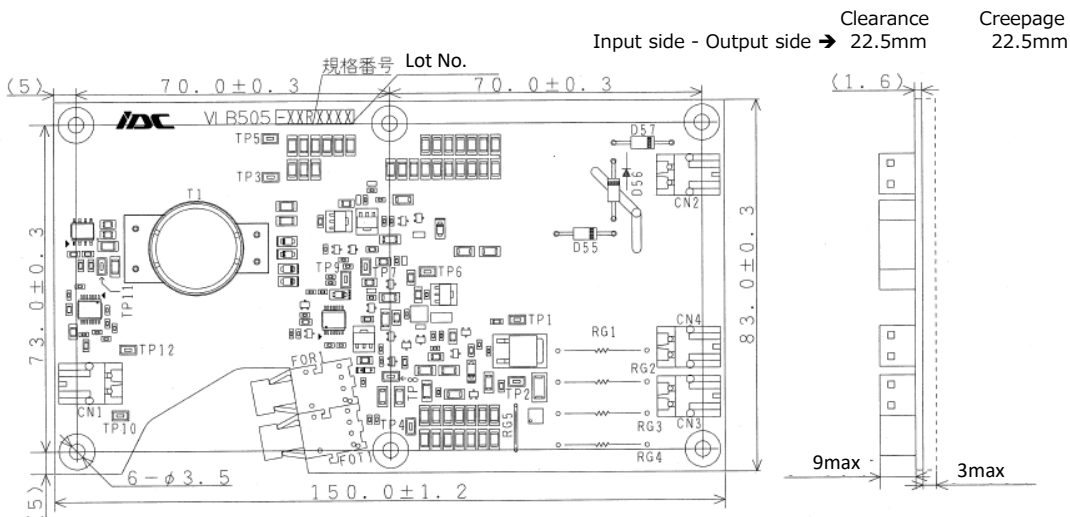
TARGETED SiC-MOSFET MODULES

FMF750DC-66A (Mitsubishi)
 VCES=3.3kV series 750A class

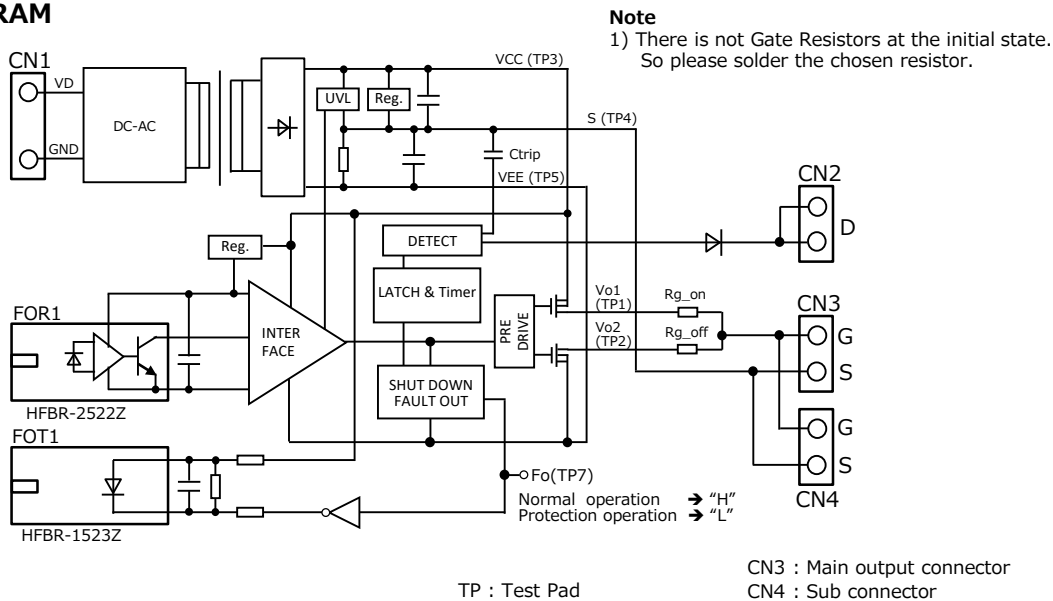
APPLICATIONS

Medium voltage inverter , HVDC infrastructure , Traction or Wind power etc.

OUTLINE



BLOCK DIAGRAM



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

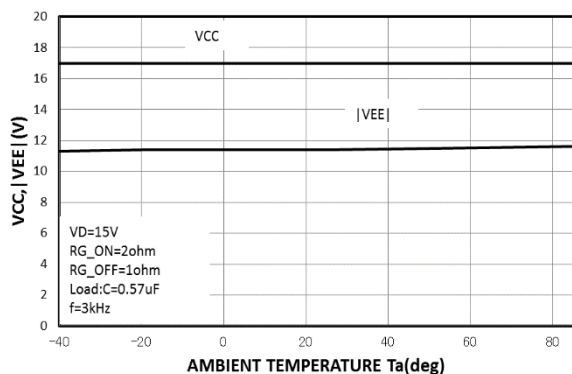
Symbol	Parameter	Conditions	Ratings	Unit
VD	Supply voltage	Between VD and GND	16	V
IOHP	Output peak current	Pulse width 3 μ s	-36	A
IOLP			36	A
Viso	Isolation voltage between primary and secondary	Sine wave voltage 60Hz, for 1min	6000	Vrms
Tc	Case temperature	Surface temperature of power MOSFET	100	deg C
Topr	Operating temperature	No condensation allowable	-40 ~ 85	deg C
Tstg	Storage temperature	No condensation allowable	-40 ~ 85	deg C
Idrive	Gate drive current	Gate average current	200	mA
VC	Peak collector voltage	Peak terminal voltage of CN2	3300	V

ELECTRICAL CHARACTERISTICS (unless otherwise noted, Ta=25°C, VD=15V, Rg_on=2 Ω , Rg_off=1 Ω , f=3kHz)

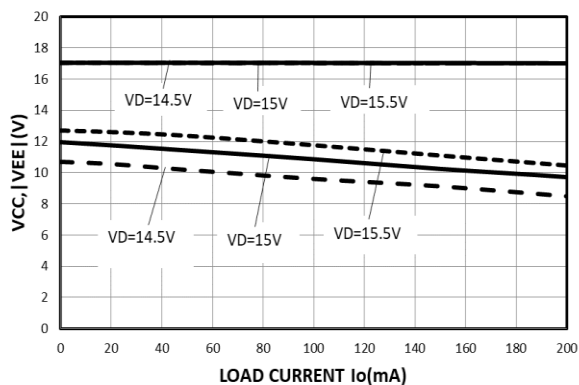
Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
VD	Supply voltage	Recommended range	14.5	15	15.5	V
f	Switching frequency	Recommended range It is limited by gate average current (max:200mA)	-	-	10	kHz
RG	Gate resistance	Recommended range (Total compound value)	0.22	-	-	Ω
VOH	Plus bias output voltage	Idrive = 0 ~ 200mA	16	17	18	V
VOL	Minus bias output voltage	Idrive = 0 ~ 200mA	-	-11	-	V
tPLH	"L-H" propagation time	IF=30mA, Fiber length=50cm, C_load:0.57 μ F	0.2	0.4	0.8	us
tPHL	"H-L" propagation time	IF=30mA, Fiber length=50cm, C_load:0.57 μ F	0.1	0.3	0.5	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 terminal (CN2) : over than 15V or open	-	3	-	us
VSC	SC detect voltage	Drain voltage of MOSFET	15	-	-	V
UVLO+_VCC	Under voltage lock out (Operation start)	VCC voltage	-	14.4	-	V
UVLO-_VCC	Under voltage lock out (Operation stop)	VCC voltage	-	13.8	-	V

PERFORMANCE CURVES (Unless otherwise noted, Ta=25deg, VD=15V, RG_on=2Ω, RG_off=1Ω, f=3kHz)
 (ID: Input current for power supply, Idrive: gate average current, Io: DC load)

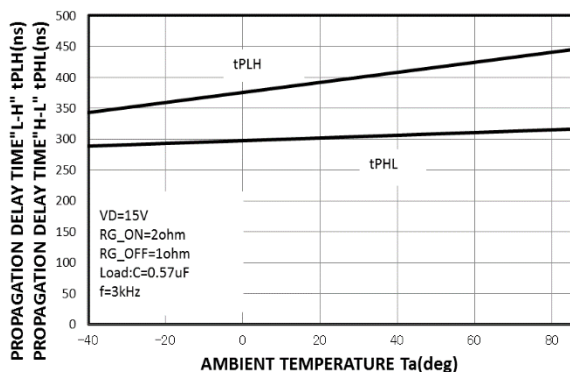
VCC, |VEE| -Ta CHARACTERISTICS (TYPICAL)



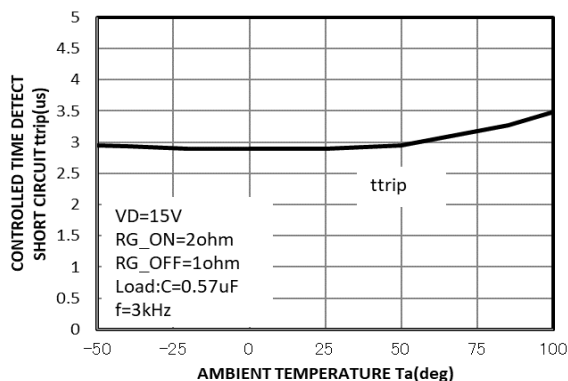
VCC, |VEE| -Io CHARACTERISTICS (TYPICAL)



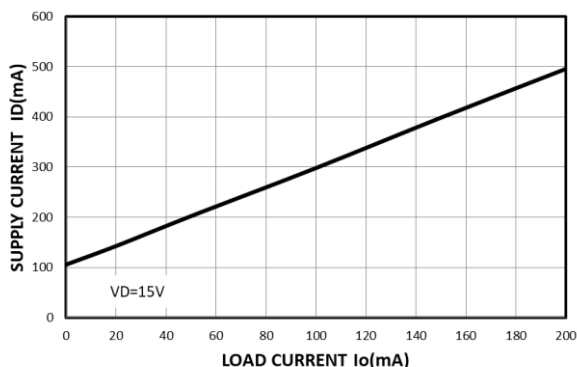
tPLH, tPHL -Ta CHARACTERISTICS (TYPICAL)



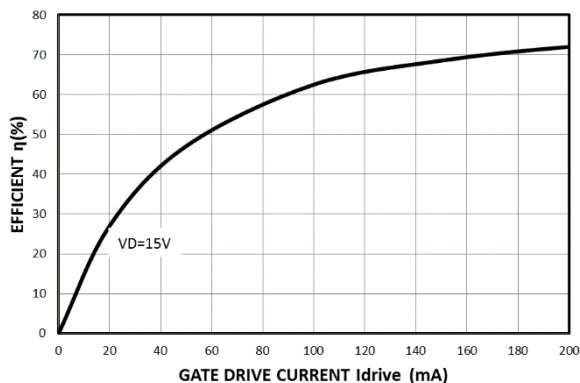
Ttrip -Ta CHARACTERISTICS (TYPICAL)



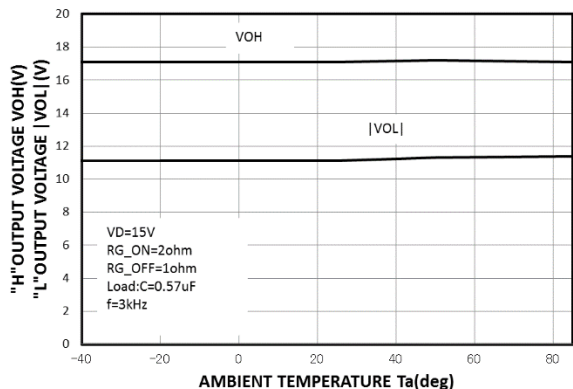
ID -Io CHARACTERISTICS (TYPICAL)



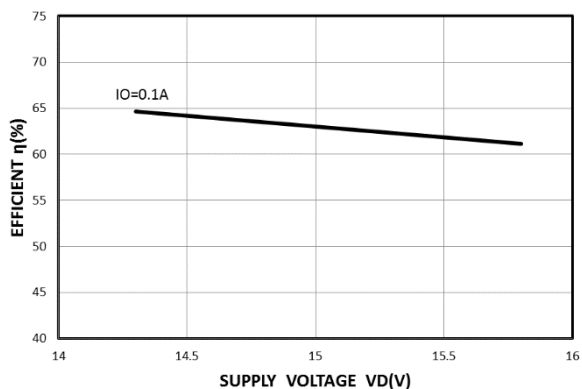
η - Idrive CHARACTERISTICS (TYPICAL)



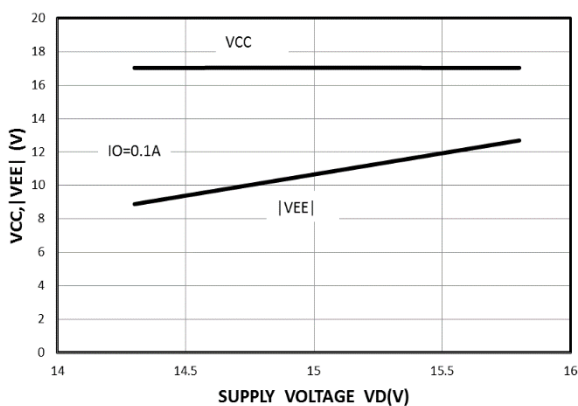
VOH, |VOL| -Ta CHARACTERISTICS (TYPICAL)



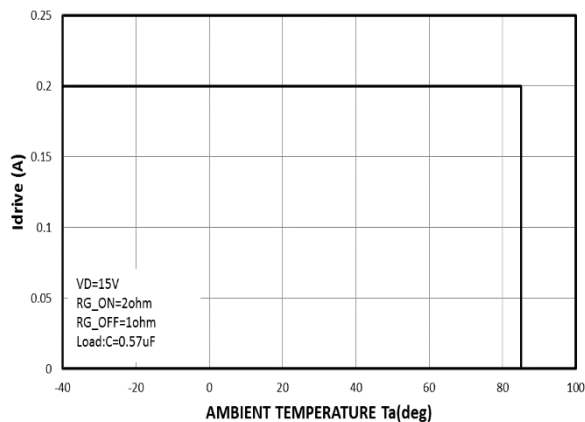
η -VD CHARACTERISTICS (TYPICAL)



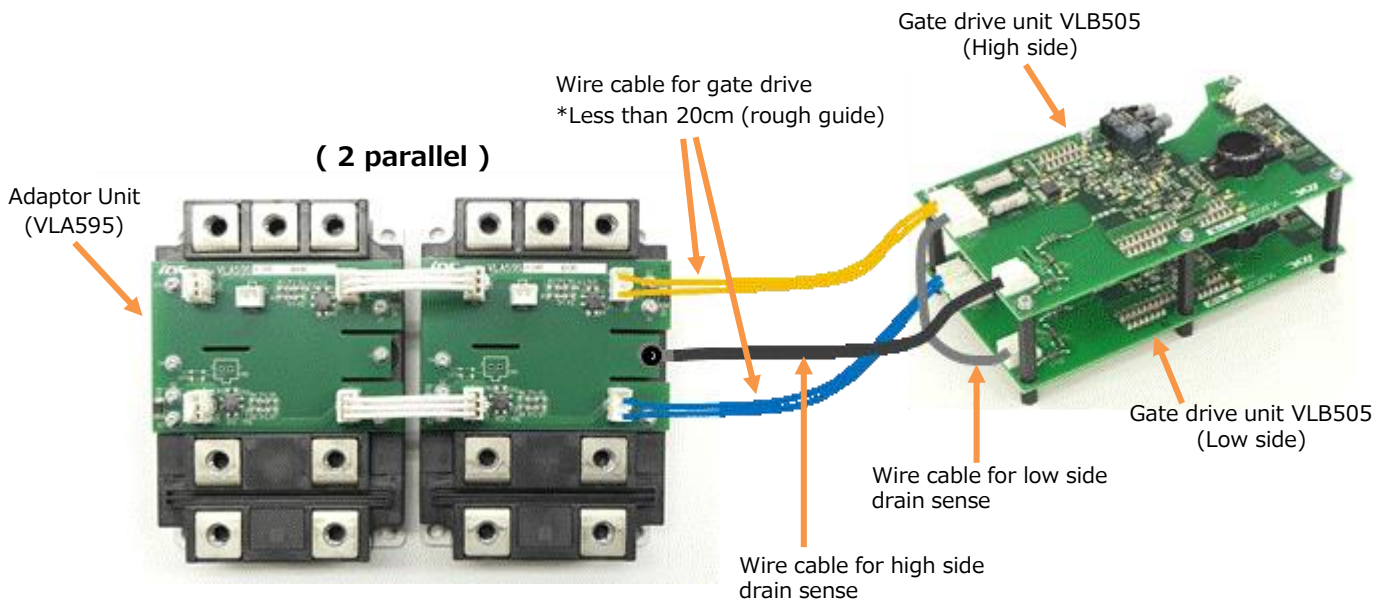
VCC, |VEE| -VD CHARACTERISTICS (TYPICAL)



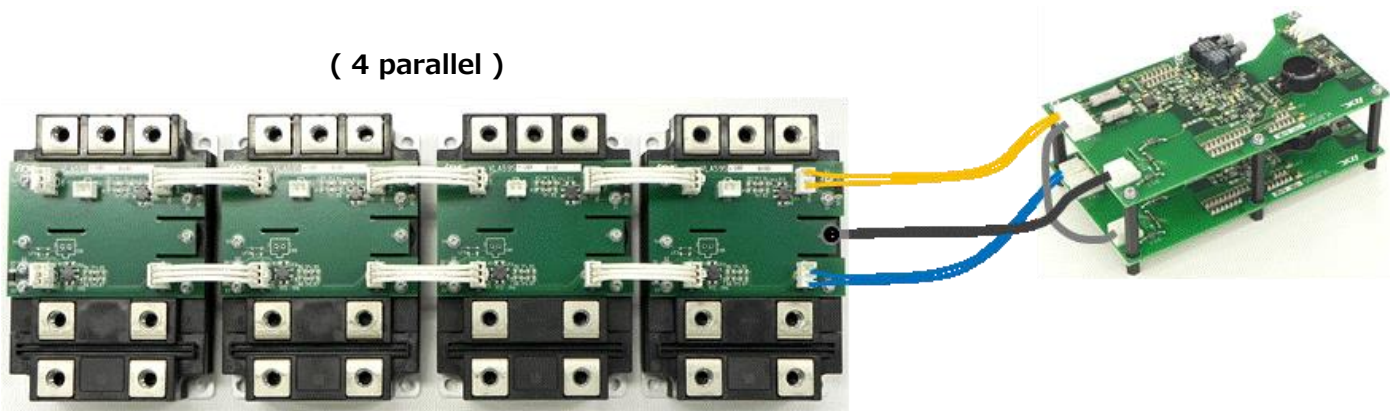
DERATING CHARACTERISTICS



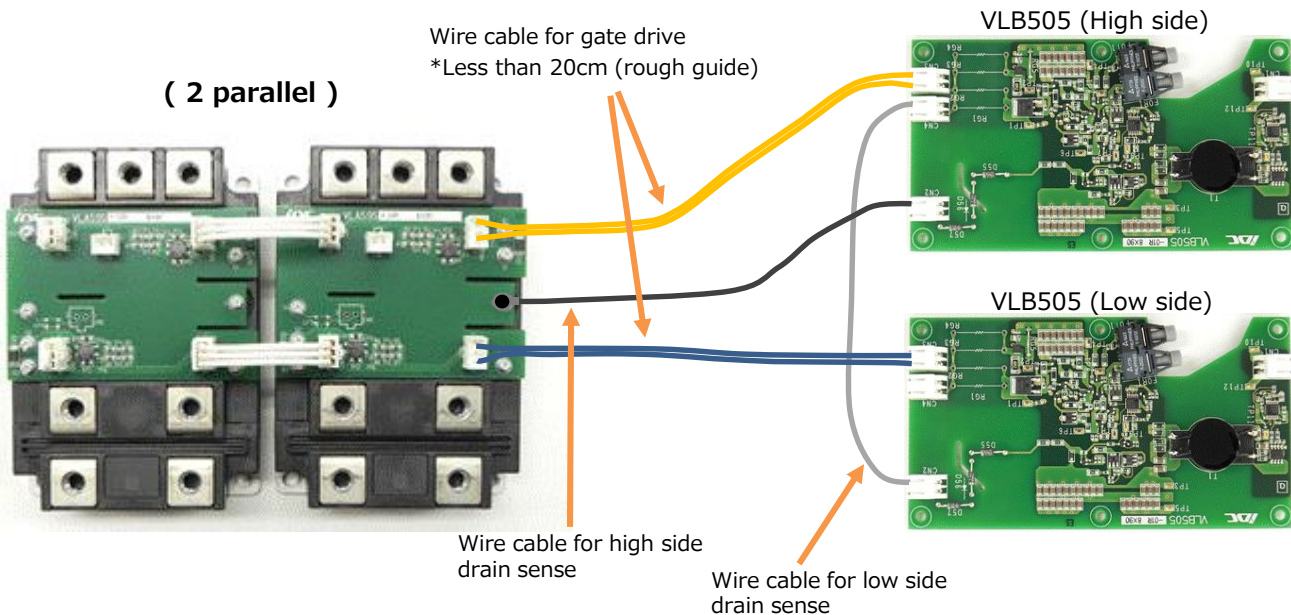
CONNECTION EXAMPLE 1



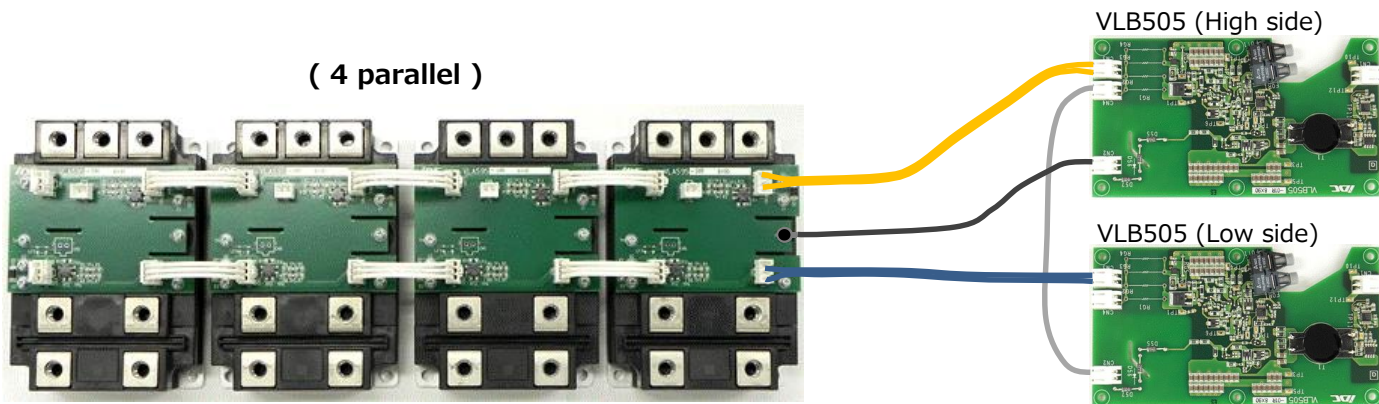
Note) When gate drive cable exceeds 20cm, please make it a twisted pair.



CONNECTION EXAMPLE2

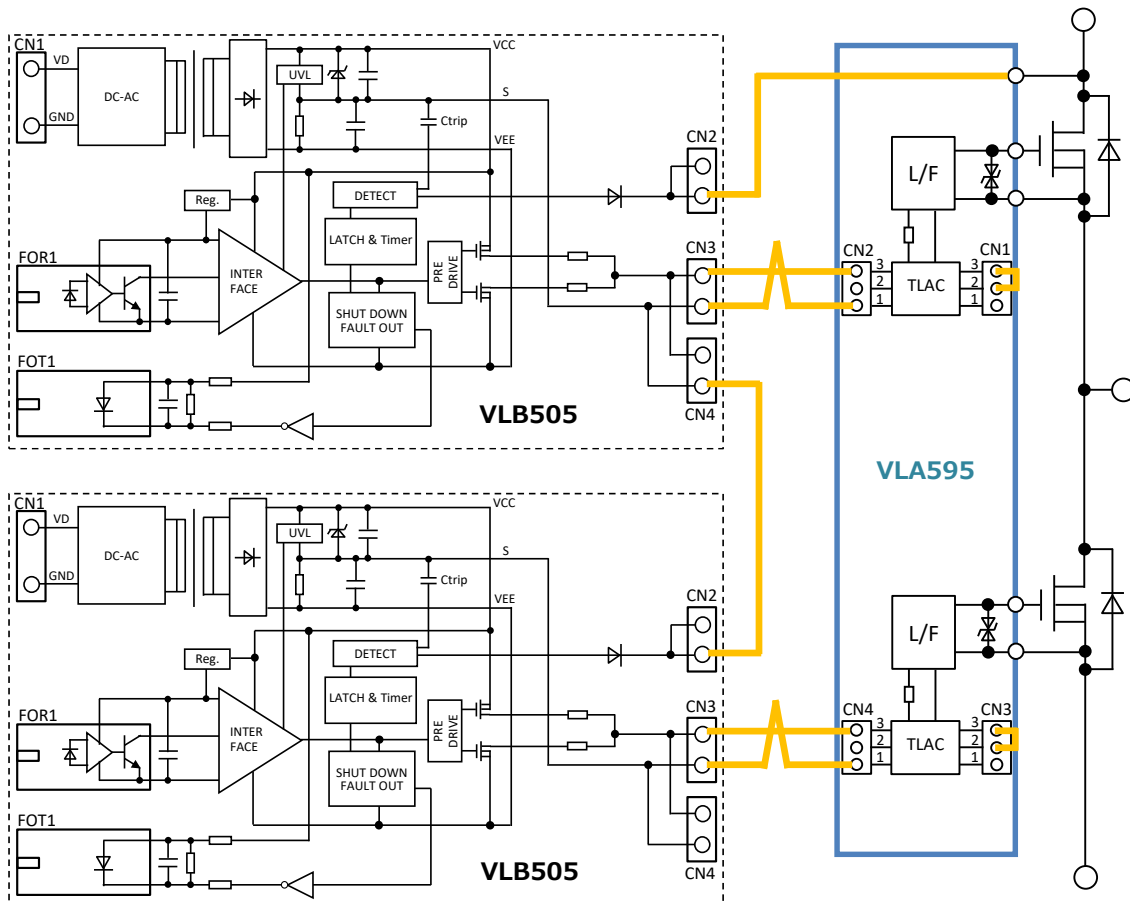


Note) When gate drive cable exceeds 20cm, please make it a twisted pair.



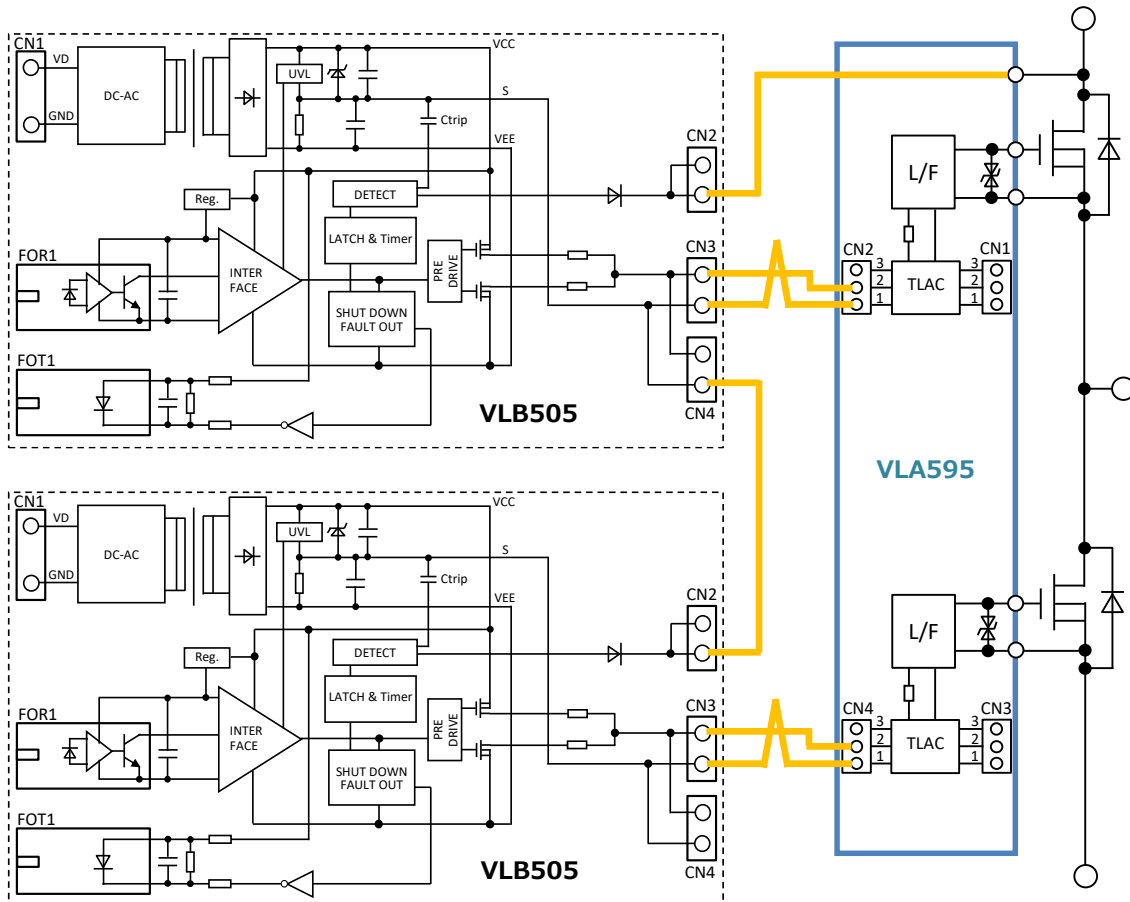
APPLICATION EXAMPLE1

(single connection 1)



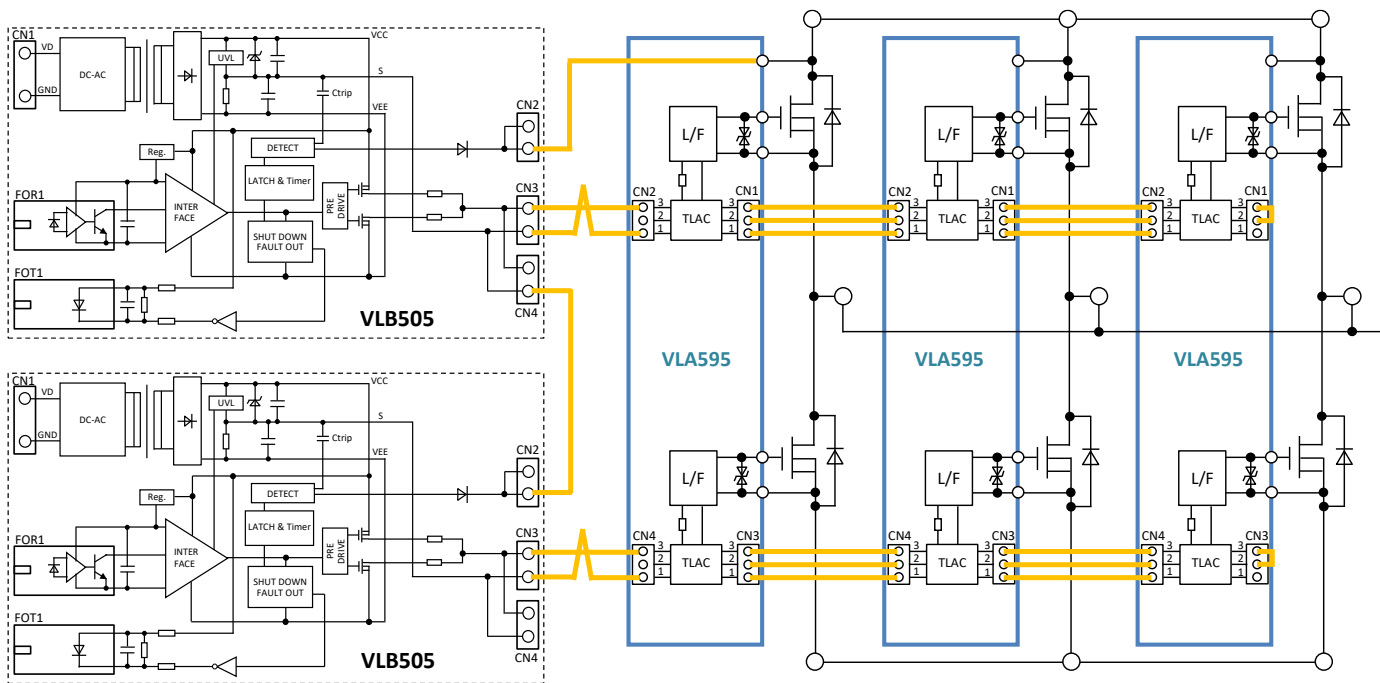
APPLICATION EXAMPLE2

(single connection 2)



APPLICATION EXAMPLE3

(3 parallel connection)



CALCULATION FOR GATE DRIVE CURRENT (GATE AVERAGE CURRENT)

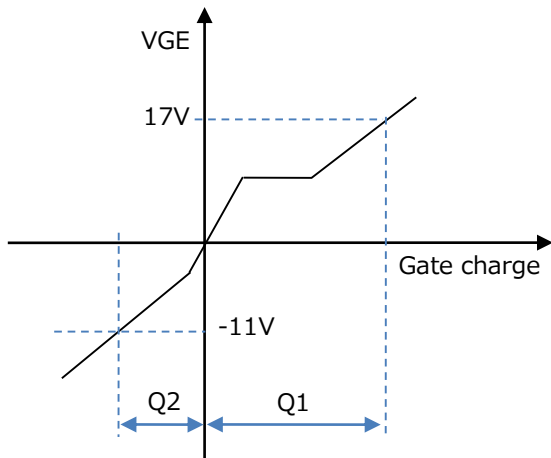
This product has isolated DCDC converter built in for gate drive.
 The maximum output average current is 200mA.
 This current means maximum gate average current.

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

$$I_{drive} = (Q1 + |Q2|) \times f \times N \quad \leftarrow \text{It must be less than 200mA}$$

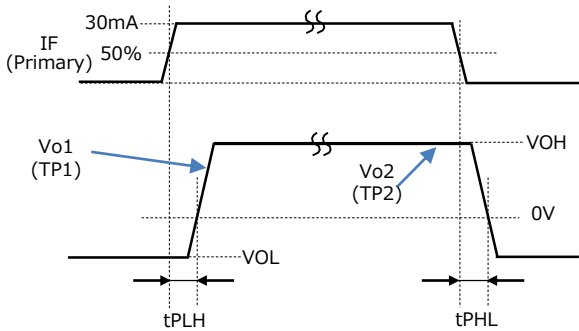
- I_{drive} : Gate average current
- $Q1$: Gate charge at +17V (Read from data sheet of MOSFET)
- $Q2$: Gate charge at -11V (Read from data sheet of MOSFET)
- f : Switching frequency of MOSFET
- N : Parallel number

Gate charge characteristic of MOSFET



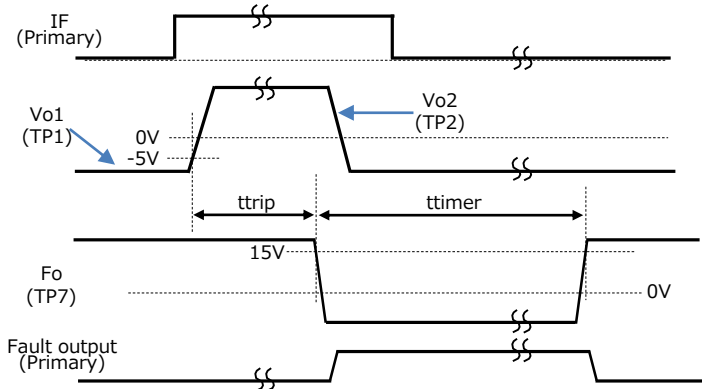
DEFINITION OF CHARACTERISTICS

Normal switching operation

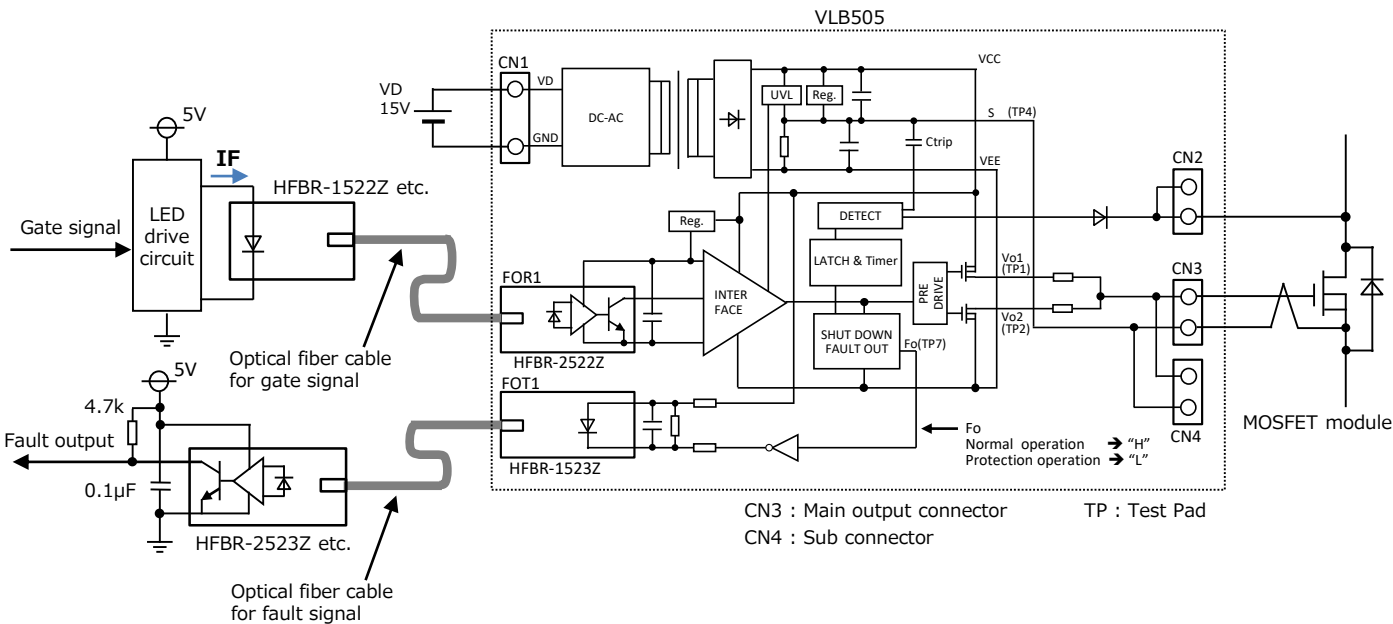


Tested by
 $f=3\text{kHz}$, Duty=50%

Operation of short circuit protection



INTERFACE APPLICATION EXAMPLE



OPERATION OF PROTECTION CIRCUIT

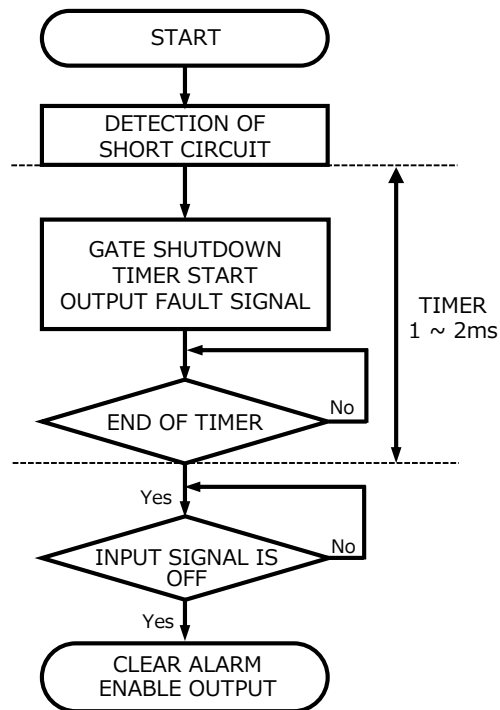
- (1) In case the gate voltage is "H" and the drain voltage is high, this drive unit will recognize the circuit as short circuit and reduce the gate voltage. Besides, put out fault signal ("L") which inform that protection circuit is operating at the same time from Fo terminal (Test Pad7).
- (2) The 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 MOSFET can be secured properly.

LATCH & TIMER RESET SYSTEM IN SHORT CIRCUIT PROTECTION CIRCUIT

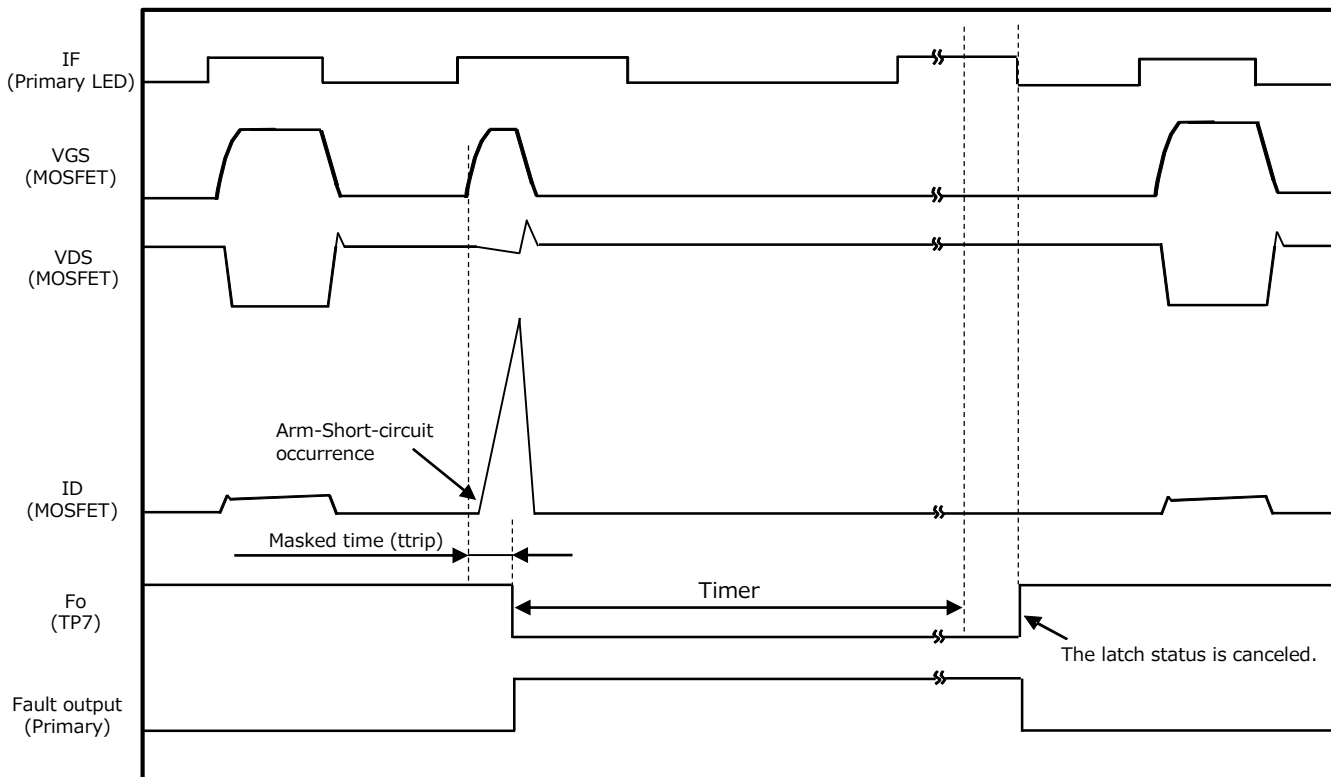
Once the short-circuit protection circuit starts, it shuts down the gate output and keeps fault output, causing the latch status. This status is canceled if the input signal is OFF when specific time elapses after the activation of the short-circuit protection circuit. Then, gate output depending on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

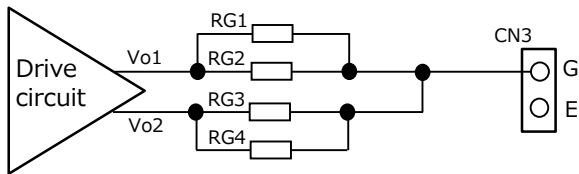


TIMING CHART

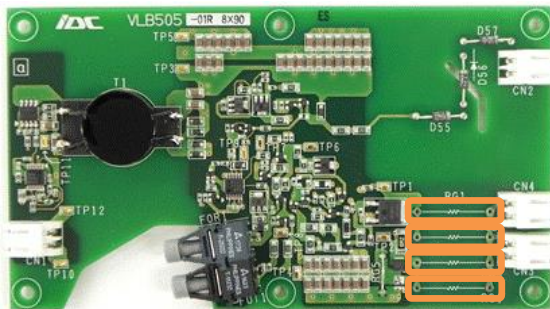


ABOUT MOUNTING GATE RESISTORS

There is not Gate Resistors on this unit at the initial state.
 It is possible to install up to 4 resistors in mount area of gate resistor.
 And there are some variations by combining resistors.
 There are some examples in the following chart, please refer to it and set the gate resistors.
 And please solder the chosen resistors.

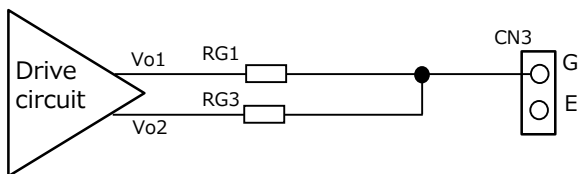


Layout pattern connection on substrate



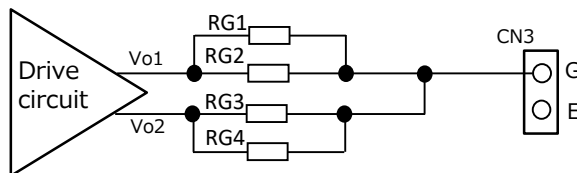
: Gate resistor mount part (Initial is open)

Example 1



Rg_on → RG1
 Rg_off → RG3

Example 2



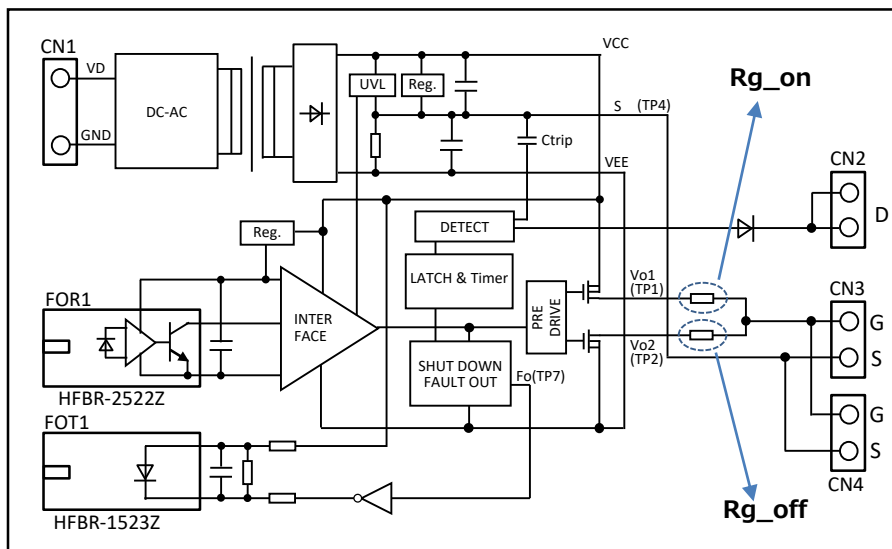
Rg_on → RG1//RG2
 Rg_off → RG3//RG4

THE WAY TO CALCULATE GATE RESISTANCE VALUE OF PARALLEL CONNECTION

RG_ON/1elem. = Gate ON resistance value per one element = $R_b + (N \times R_{g_on})$

RG_OFF/1elem. = Gate OFF resistance value per one element = $R_b + (N \times R_{g_off})$

- Note) R_b : Balance resistance value on adaptor unit
- N : Parallel number of modules
- R_{g_on} : Gate ON resistance value on VLB505
- R_{g_off} : Gate OFF resistance value on VLB505



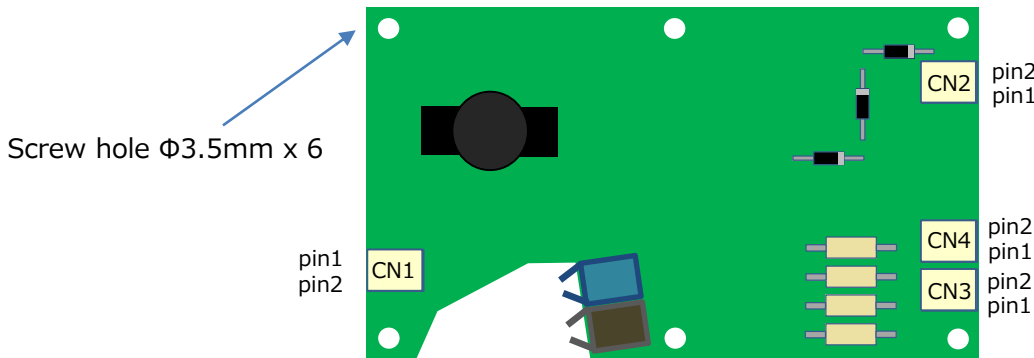
DETAILS OF CONNECTOR

CN1 : 53259-0229 (Molex)	
Pin No.	Signal
1	VD
2	GND

CN3: 53259-0229 (Molex)	
Pin No.	Signal
1	Source
2	Gate

CN2: 53259-0229 (Molex)	
Pin No.	Signal
1	Drain
2	Drain

CN4: 53259-0229 (Molex)	
Pin No.	Signal
1	Source
2	Gate

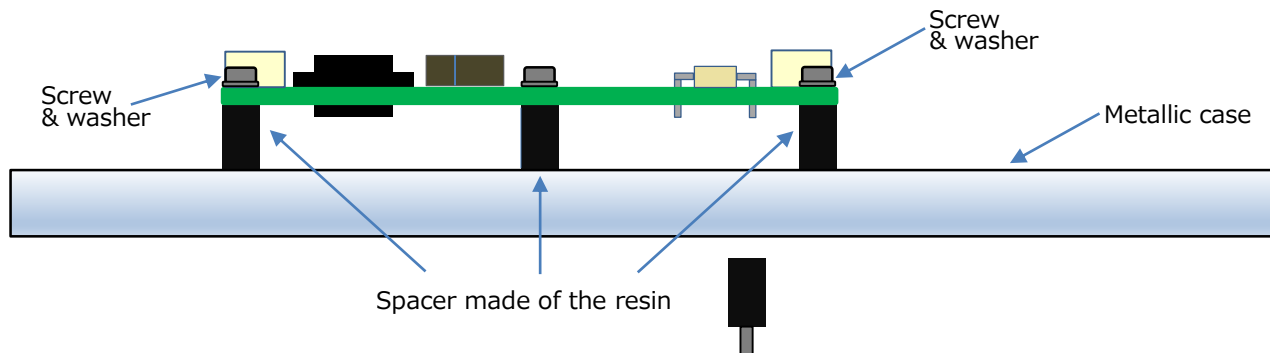


We recommend following parts or equivalent product for wire cable

HOUSING	TERMINAL	Maker
51067-0200	50217-8100	Molex

INSTALLATION OF THE DRIVE UNIT ON METALLIC CASE

When fixing this drive unit on a metallic case, please use the spacer made of the resin.



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 it's 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 contaminators, the packing materials will deteriorates. Please take care in handling.
Carrying	<ol style="list-style-type: none"> 1) Don't stack boxes too high. Avoid placing heavy materials on boxes. 2) Boxes must be positioned correctly during transportation to avoid breakage. 3) Don't throw or drop boxes. 4) Keep boxes dry. Avoid rain or snow. 5) Minimal vibration and shock during transportation is desirable.
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"> 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%. 2) Avoid locations where corrosive gasses are generated or where much dust accumulates. 3) Storage cases must be static proof. 4) Avoid putting weight on boxes.
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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