

# VLA567-01R

DRIVER FOR IGBT MODULES

## DESCRIPTION

VLA567-01R is the hybrid integrated circuit of 2ch IGBT drivers. This device include the isolated type DC-DC converter for Gate drive. Therefore design of the gate power supply is not required.

The system of built-in short circuit protection provide a margin to time by function to maintain reverse bias for a predetermined time after the detection of short circuit.

Recommended IGBT modules:

VCES = 600V series up to 600A class

VCES = 1200V series up to 600A class

(Please keep the condition not to deviate from the recommended range of electrical characteristics and maximum rating. )

## FEATURES

Low height, DIP structure

Built in the isolated DC-DC converter for gate drive

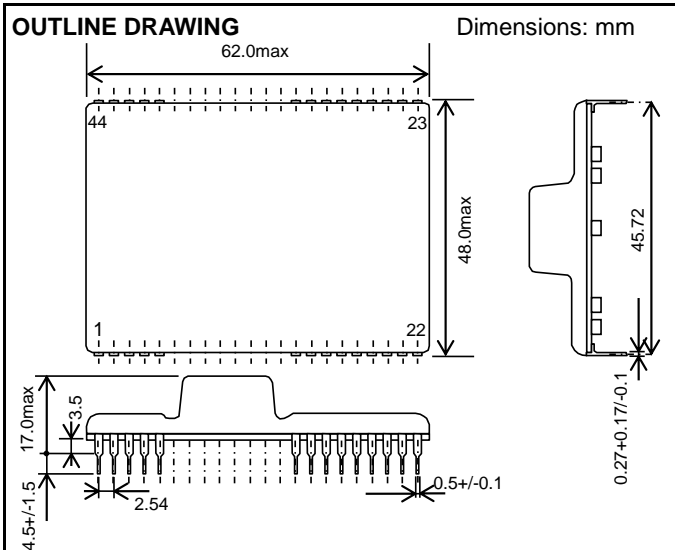
Output peak current is +/-8A(max)

Built in short circuit protection

Electrical isolation voltage is 2500Vrms (for 1 minute)

CMOS compatible input interface

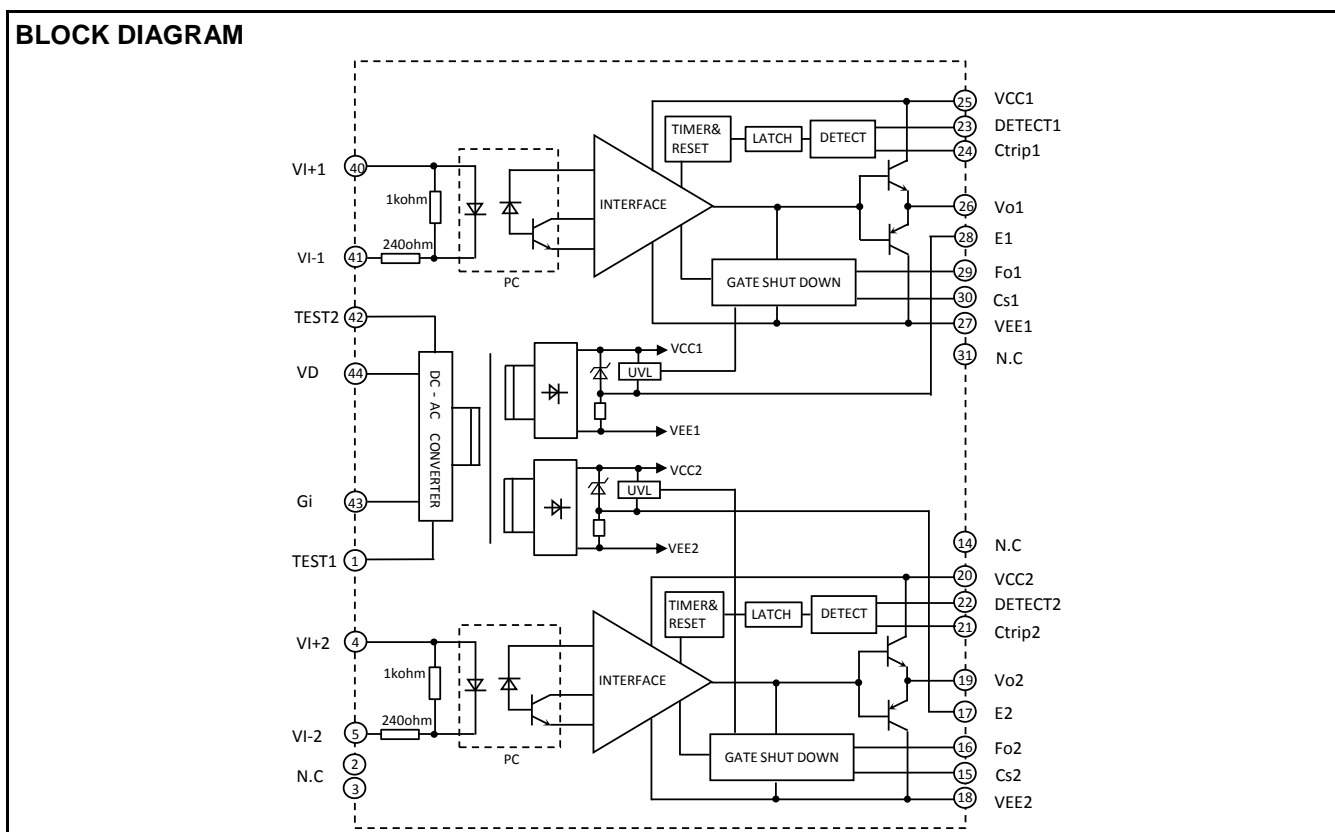
Adjustable fall time on activity of short circuit protection.



## APPLICATIONS

To drive IGBT modules for inverter or AC servo systems application

## BLOCK DIAGRAM



**MAXIMUM RATINGS** (Unless otherwise noted, Ta=25deg)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>D</sub>	Supply voltage	DC	16.5	V
V <sub>I</sub>	Input signal voltage	Applied between VI+ - VI- 50% Duty cycle , pulse width 1ms	-1 ~ +7	V
IOHP	Output peak current	Pulse width 2us	8	A
IOLP			-8	A
Topr	Operating temperature	No condensation allowable	-20 ~ 70	deg
Tstg	Storage temperature	No condensation allowable(*1)	-40 ~ 90	deg
IFo	Fault output current	Applied Fo-pin	20	mA
VR-DET	Input voltage at DETECT-pin	Applied DETECT-pin	50	V
I <sub>drive</sub>	Gate drive current	Gate average current (Per one circuit)	100	mA
Viso1	Isolation voltage between input and output	Sine wave voltage, 60Hz, 1min	2500	Vrms
Viso2	Isolation voltage between each output	Sine wave voltage, 60Hz, 1min	2500	Vrms

(\*1) Differs from heat cycle condition

**ELECTRICAL CHARACTERISTICS** (Unless otherwise noted, Ta=25deg, VD=15V, RG=2ohm)

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
VD	Supply voltage	Recommended range	14.2	15.0	15.8	V
V <sub>IN</sub>	Pull-up voltage on input side	Recommended range (In case of V <sub>IN</sub> =15V, please control the amount of "H" input current in recommended range.)	4.75	5.00	5.25	V
I <sub>IH</sub>	"H" input signal current(*3)	Recommended range	10	13	16	mA
f	Switching frequency	Recommended range	-	-	20	kHz
R <sub>G</sub>	Gate resistance	Recommended range	2	-	-	ohm
V <sub>CC</sub>	Gate positive supply voltage	—	-	16.8	-	V
V <sub>EE</sub>	Gate negative supply voltage	—	-	-8.5	-	V
η	Gate supply efficiency	VD=15V, Load current = 100mA × 2	70	79	-	%
V <sub>OH</sub>	"H" output voltage (*3)	RG=2ohm, f=10kHz, Load=0.22uF	13.5	15.5	16.5	V
V <sub>OL</sub>	"L" output voltage (*3)	RG=2ohm, f=10kHz, Load=0.22uF	-	-8.0	-	V
t <sub>PLH</sub>	"L-H" propagation time (*3)	I <sub>IH</sub> = 13mA	0.2	0.4	1	μs
t <sub>r</sub>	"L-H" rise time(*3)	I <sub>IH</sub> = 13mA	-	0.4	1	μs
t <sub>PHL</sub>	"H-L" propagation time (*3)	I <sub>IH</sub> = 13mA	0.2	0.4	1	μs
t <sub>f</sub>	"H-L" fall time(*3)	I <sub>IH</sub> = 13mA	-	0.3	1	μs
t <sub>timer</sub>	Timer	Between start and cancel (under input sign "L")	1	-	2	ms
I <sub>FO</sub>	Fault output current	Applied pin 16,29(*4)	-	5	-	mA
t <sub>trip1</sub>	Controlled time detect short circuit 1	Pin 22,23 : 15V and more, pin 21,24 : open	-	2.4	-	μs
t <sub>trip2</sub>	Controlled time detect short circuit 2 (*2)	Pin 22,23 : 15V and more, pin 17-21,24-28 : 47pF (connective capacitance)	-	3.2	-	μs
V <sub>SC</sub>	SC detect voltage	Collector voltage of module	15	-	-	V
UVLO_Vcc	Under voltage lock out	Voltage of Vcc	-	11.5	-	V

(\*2) Length of wiring of capacitor controlled time detect short-circuit is within 5cm from pin 17 and 21 (24 and 28) coming and going.

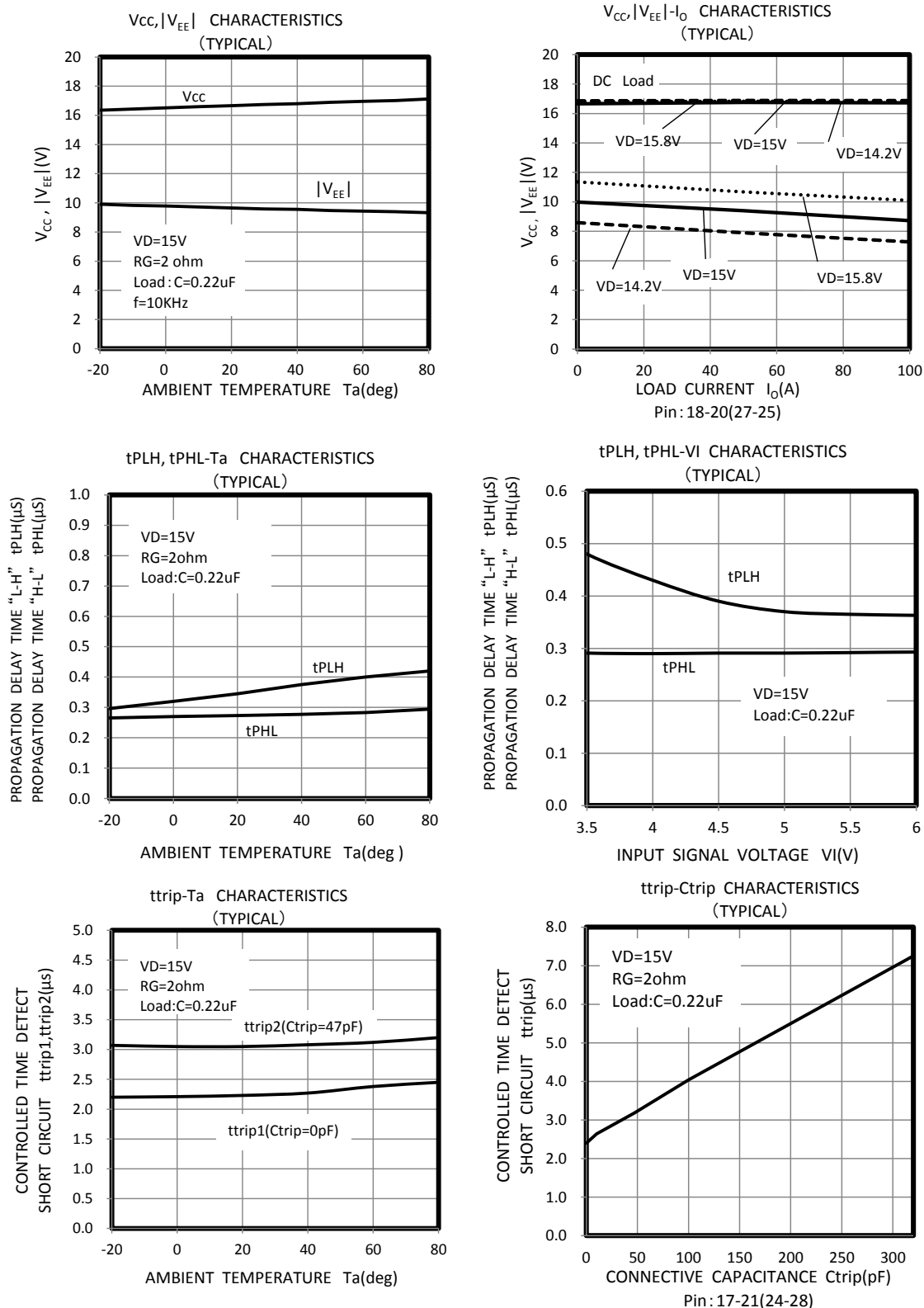
(\*3) When LED of PC is ON(luminescence), Vo is high.

(\*4) With pull up 4.7k ohm

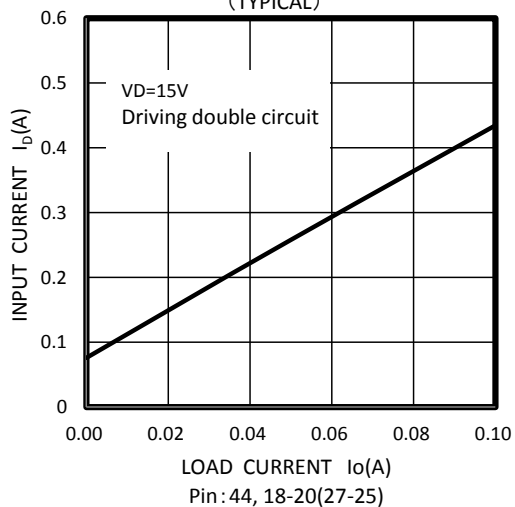
PERFORMANCE CURVES

(Unless otherwise noted, Ta=25deg, VD=15V, RG=2 ohm, driving only single circuit)

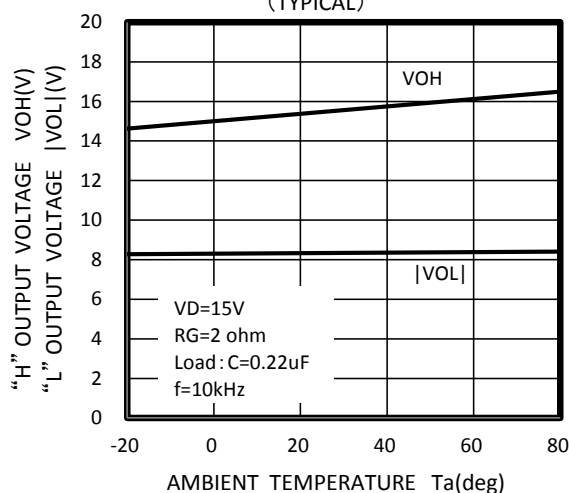
(ID: Input current for power supply, Idrive: gate average current, Io: DC load)



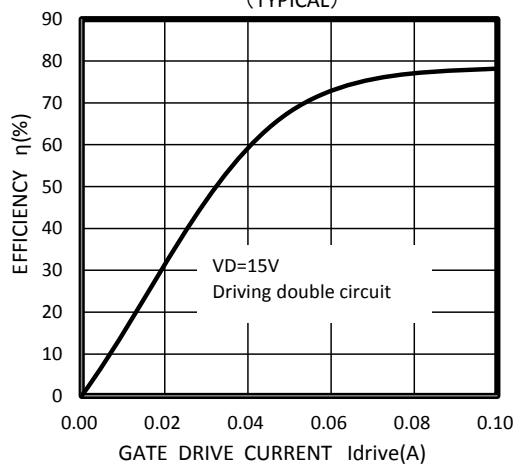
$I_b$ - $I_o$  CHARACTERISTICS  
(TYPICAL)



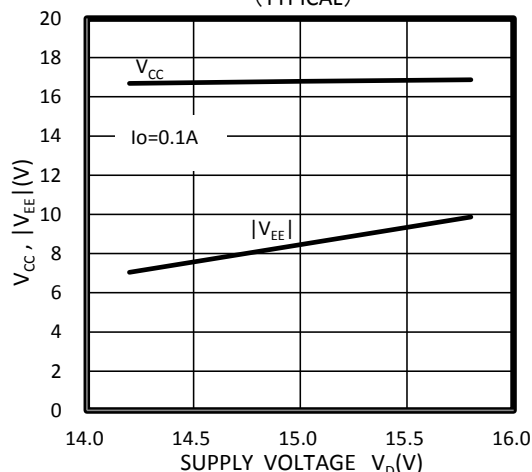
$V_{OH}$ ,  $|V_{OL}|$ - $T_a$  CHARACTERISTICS  
(TYPICAL)



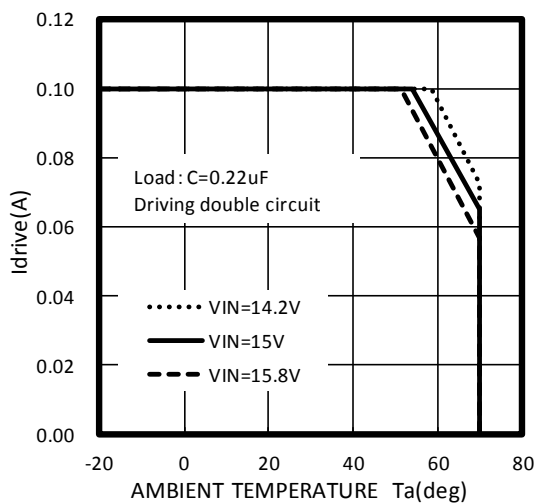
$\eta$ - $I_{drive}$  CHARACTERISTICS  
(TYPICAL)



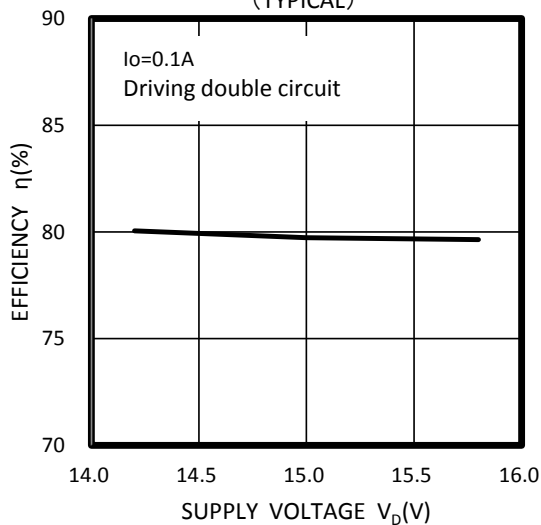
$V_{CC}$ ,  $|V_{EE}|$ - $V_D$  CHARACTERISTICS  
(TYPICAL)



DERATING CHARACTERISTICS

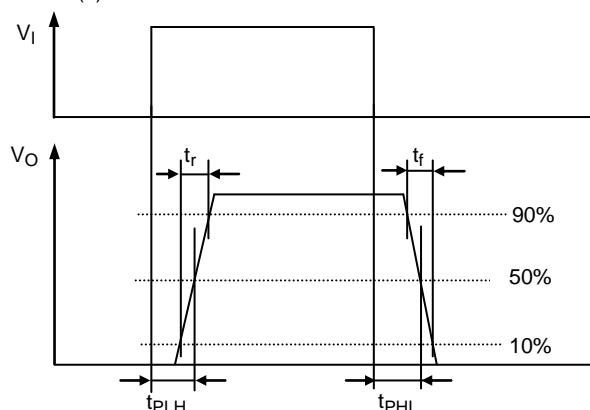


$\eta$ - $V_D$  CHARACTERISTICS  
(TYPICAL)

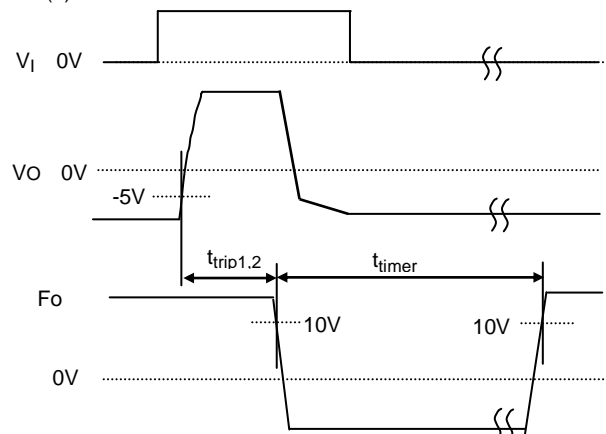


## DEFINITION OF CHARACTERISTICS

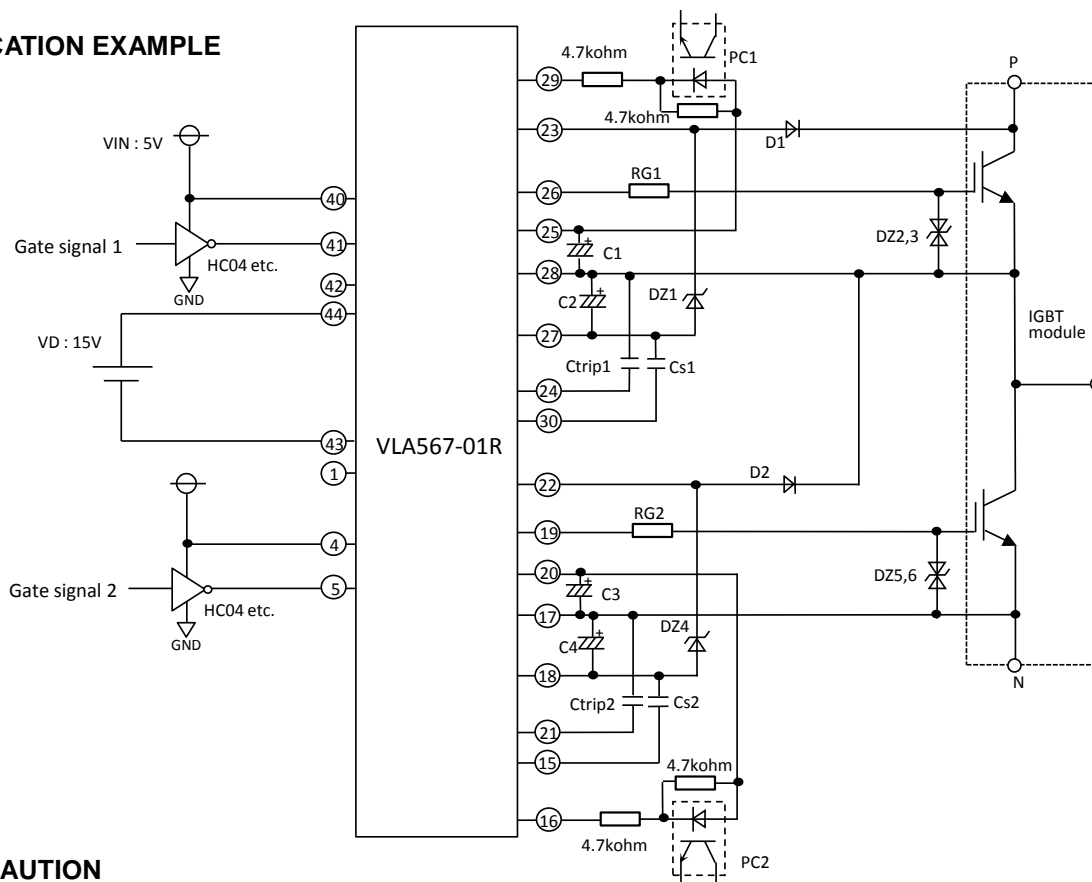
(1) SWITCHING OPERATION



(2) OPERATION OF SHORT CIRCUIT PROTECTION



## APPLICATION EXAMPLE



## PRECAUTION

- (1) Voltage compensate capacitors are expected to be located as close as possible from the hybrid IC.
- (2) D1 requires approximately the same voltage of power modules.
- (3) If reverse recovery time of D1 (D2) is long, pin23 (pin22) is applied high voltage. In that case, counterplan for protection which insert zener diode between pin 18 and 22 (pin 27 and 23) is necessary like above diagram.
- (4) In case pin 21 or 24 are operating, the Ctrip is expected to be wired as close as possible from pin. (Less than 5cm coming and going)  
※In case of not operating, please pin 21 or 24 are open.
- (5) Minimize the area of closed circuit of gate circuit and input gate signal circuit so as not to be affected by induction noise.
- (6) When the built in short-circuit protection circuit need not be used, please connect resistance of 4.7k ohm between pin 17 and 22 (pin 23 and 28). At that time, D1 (D2) and Dz1 (Dz4) are not require, and pin 16 and 29 are not necessary to be connected.
- (7) Pin 1 and 42 are for test pin, so pin 1 and 42 are not to be connected electrically to other line.

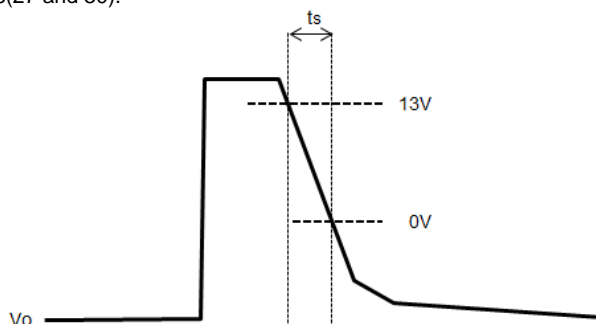
VD=15V +/-5%  
 VIN= 5V +/-5%  
 C1 ~ 4=100μF 50V(Low impedance)  
 Ctrip1,2 : Depended on RG1,2  
 (Please refer to the  
 " ttrip-Ctrip CHARACTERISTICS " in page3)  
 Cs1,2 : Please refer to the  
 " ts-Cs CHARACTERISTICS " in page6)  
 Z1,4 : 30V  
 DZ2,3,5,6 : 18V  
 D1,2 : First recovery diode( trr : 0.2μs max )  
 RP1H(Sanken) etc.  
 PC1,2:TLP785(TOSHIBA) etc.

**OPERATION OF PROTECTION CIRCUIT**

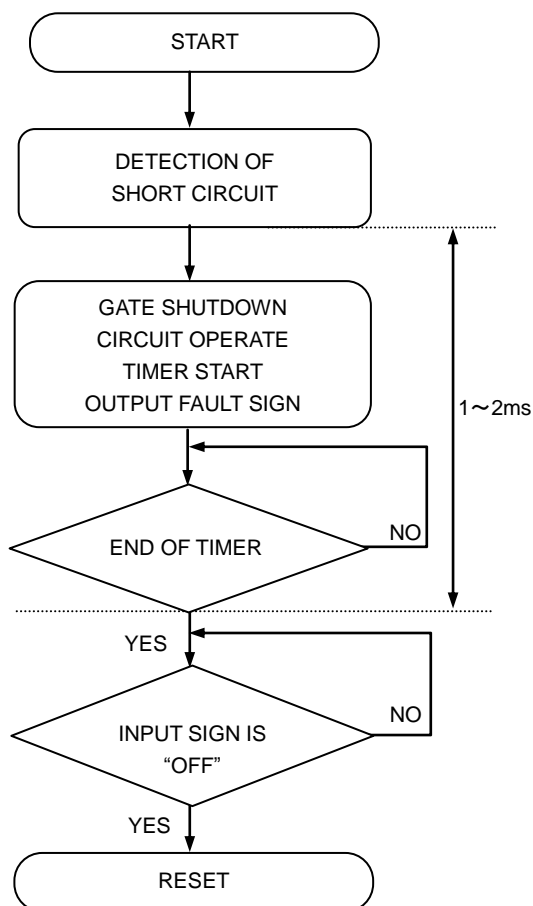
- (1) In case the gate voltage is "H" and the collector voltage is high, this hybrid IC will recognize the circuit as short circuit and immediately reduce the gate voltage. Besides, put out error signal ("L") which inform that protection circuit is operating at the same time from pin 29 or 16.
- (2) 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 controlled 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 (Ctrip) between pin17 and 21 (28 and 24).
- (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, by adding a capacitor to Cs terminal, it is possible to make gate shut down speed more slow.

**ADJUSTMENT OF OUTPUT FALL TIME**

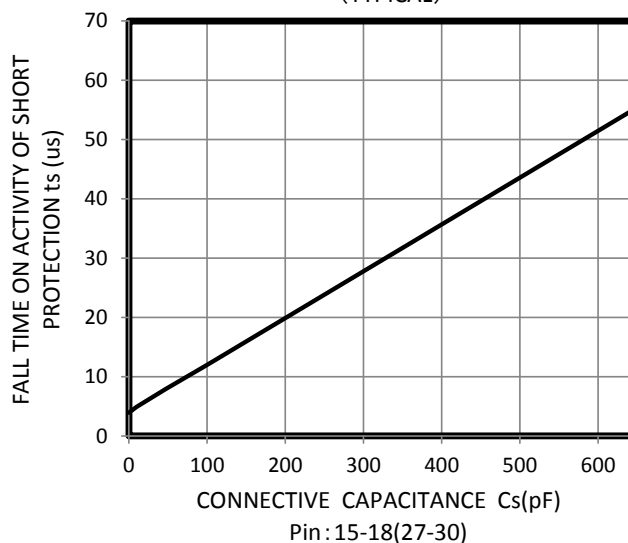
(When the protection circuit is operating)  
 In case you want to decrease the speed of reverse bias when the protection circuit is operating, you can adjust that speed by connecting the capacitor (Cs) between pin 15 and 18(27 and 30).



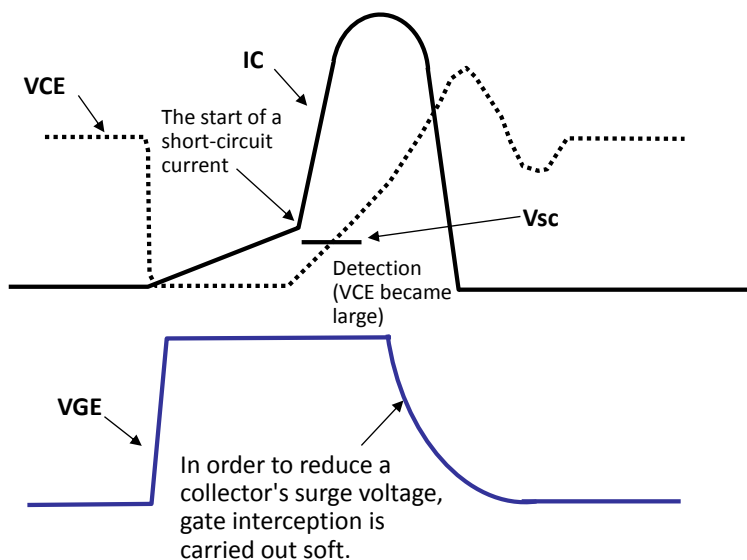
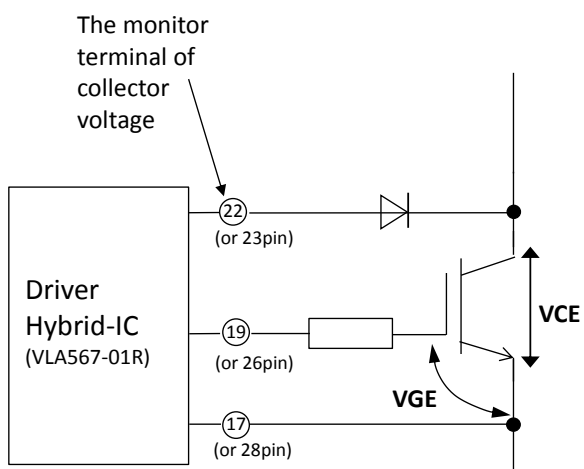
**OPERATION FLOW ON DETECTING SHORT CIRCUIT**



ts-Cs CHARACTERISTICS (TYPICAL)



Note : "L" output voltage(VOL) with protection circuit operating is about VEE +2V.



## 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 deteriorate. 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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