

MAXIMUM RATINGS (unless otherwise noted, Ta=25deg)

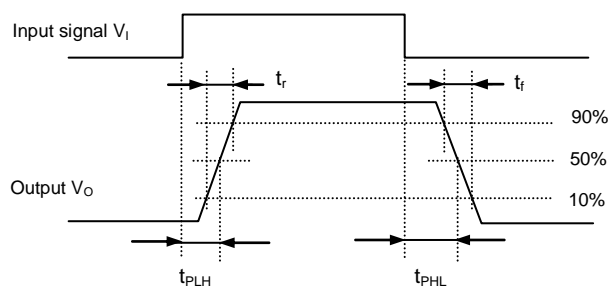
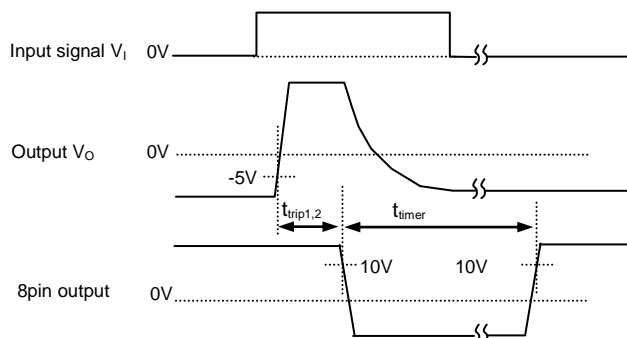
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage	DC	18	V
V_{EE}			-15	V
V_I	Input voltage	Applied between; 13pin and 14pin	-1 ~ +7	V
V_O	Output voltage	When the output voltage is "H"	V_{CC}	V
I_{OHP}	Output current	Pulse width 3 μ s	-15	A
I_{OLP}			15	A
Viso	Isolation voltage	Sine wave voltage 60Hz, for 1min	4000	Vrms
T_{c1}	Case temperature1	Surface temperature(opto-coupler mounting part)	85	deg
T_{c2}	Case temperature2	Surface temperature(exceptingopto-coupler mounting part)	100	deg
Topr	Operating temperature	No condensation allowable	-25 ~ +70	deg
Tstg	Storage temperature	No condensation allowable	-40 ~ +100	deg
I_{FO}	Fault output current	Applied 8 pin	20	mA
V_{R-DET}	Input voltage at DETECT-Pin	Applied 1 pin	50	V

(*1) Differs from H/C condition

ELECTRICAL CHARACTERISTICS (Unless otherwise noted, Ta=25deg, $V_{CC}=15V$, $V_{EE}=-10V$, $R_G=0.51ohm$, $f=10Khz$, Load=0.57 μ F)

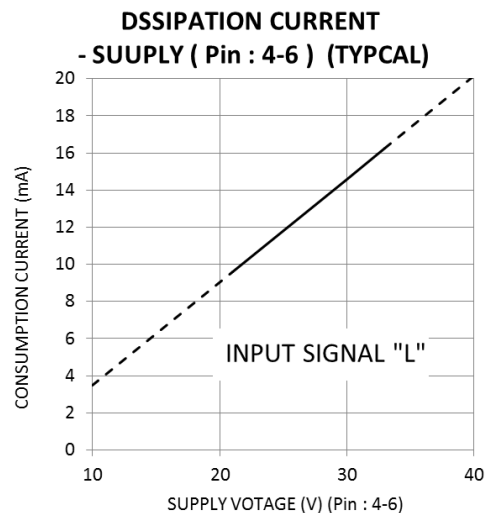
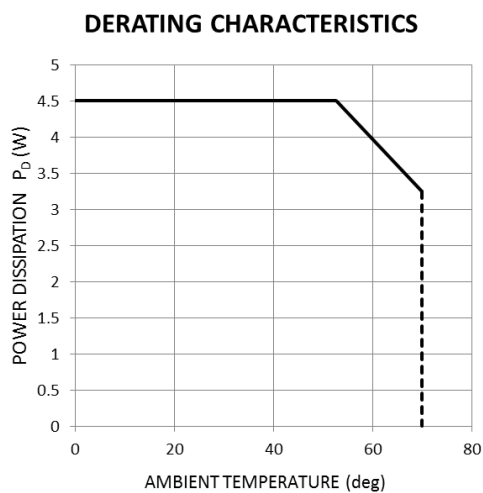
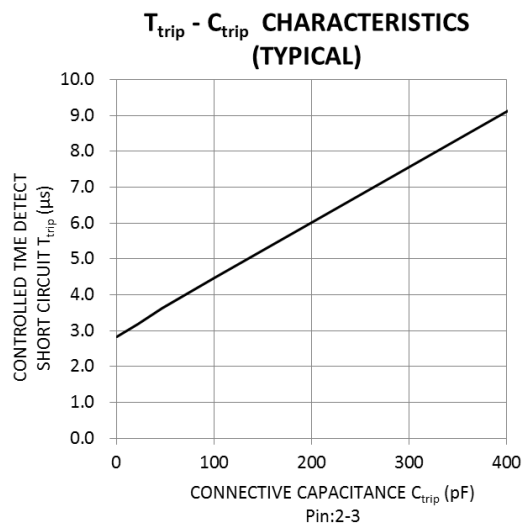
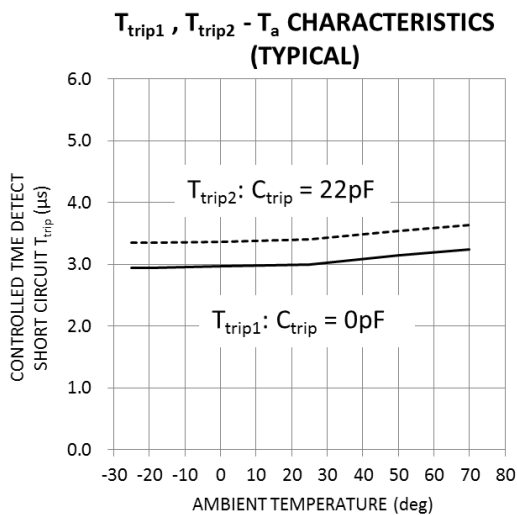
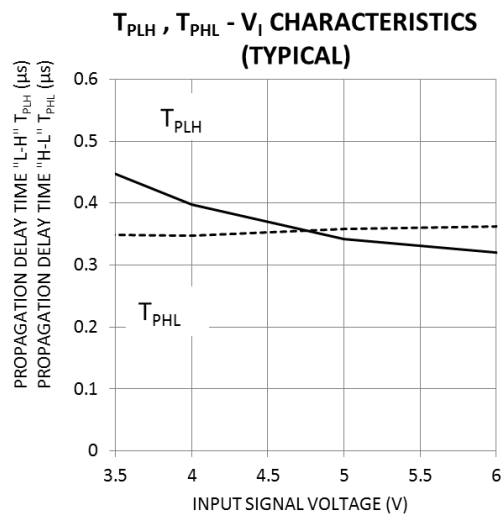
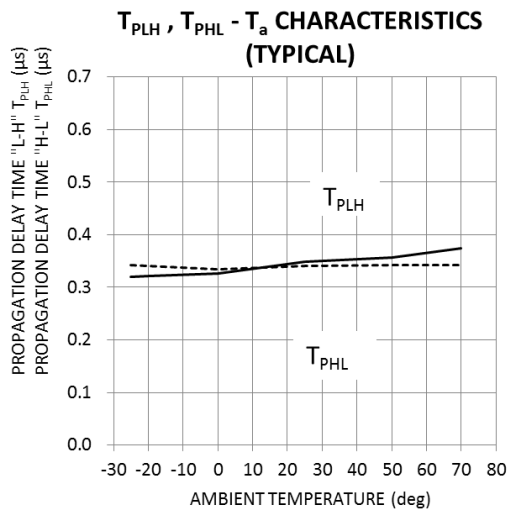
Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
V_{CC}	Supply voltage	Recommended range	14	15	17	V
V_{EE}			-7	-	-12	V
V_{IN}	Pull-up voltage on input side	Recommended range	4.75	5	5.25	V
I_{IH}	"H" input signal current	Recommended range	10	13	16	mA
f	Switching frequency	Recommended range	-	-	20	kHz
R_G	Gate resistance	Recommended range	0.51	-	-	ohm
I_{IH}	"H" input signal current	$V_{IN} = 5V$ HC04 drive	-	13	-	mA
V_{OH}	"H" output voltage	$R_G=0.51ohm$, $f=10KHz$, Load=0.57 μ F	13	14	-	V
V_{OL}	"L" output voltage	$R_G=0.51ohm$, $f=10KHz$, Load=0.57 μ F	-8	-9	-	V
t_{PLH}	"L-H" propagation time	$I_{IH} = 13mA$	0.2	0.4	1	μ s
t_r	"L-H" rise time	$I_{IH} = 13mA$	-	0.4	1	μ s
t_{PHL}	"H-L" propagation time	$I_{IH} = 13mA$	0.2	0.3	1	μ s
t_f	"H-L" fall time	$I_{IH} = 13mA$	-	0.2	1	μ s
t_{timer}	Timer	Between start and cancel (under input sign "off")	1	-	2	ms
I_{FO}	Fault output current	Applied 8pin, With pull up 4.7kohm	-	5	-	mA
t_{trip1}	Controlled time detect short circuit 1	Pin1: 15V and more, Pin 2:open	-	3	-	μ s
t_{trip2}	Controlled time detect short circuit 2 (*2)	Pin1: 15V and more, Pin 2-3: 22pF	-	3.4	-	μ s
V_{SC}	SC detect voltage	Collector voltage of module	15	-	-	V
UVLO+ V_{CC}	Under voltage lock out (Operation start)	Voltage of V_{CC}	11.5	12.5	13.5	V
UVLO- V_{CC}	Under voltage lock out (Operation stop)	Voltage of V_{CC}	10.5	11.5	12.7	V

(*2) Length of wiring of capacitor controlled time detect short-circuit is within 5cm from pin 2 and pin 3 coming and going.

DEFINITION OF CHARACTERISTICS**(1) SWITCHING OPERATION****(2) SHORT CIRCUIT PROTECTION**

PERFORMANCE CURVES

(Unless otherwise noted, $T_a=25\text{deg}$, $V_{CC}=15\text{V}$, $V_{EE}=-10\text{V}$, $R_G=0.51\text{ohm}$, $f=10\text{Khz}$, $\text{Load}=0.57\mu\text{F}$)

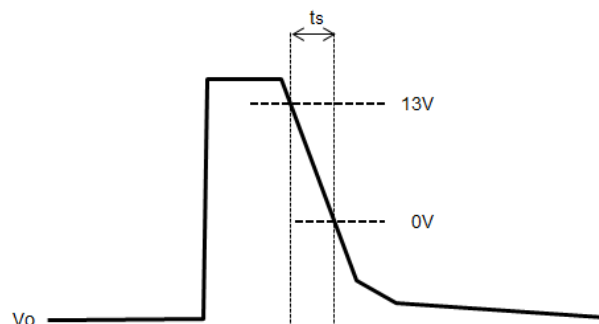


OPERATION OF PROTECTION CIRCUIT

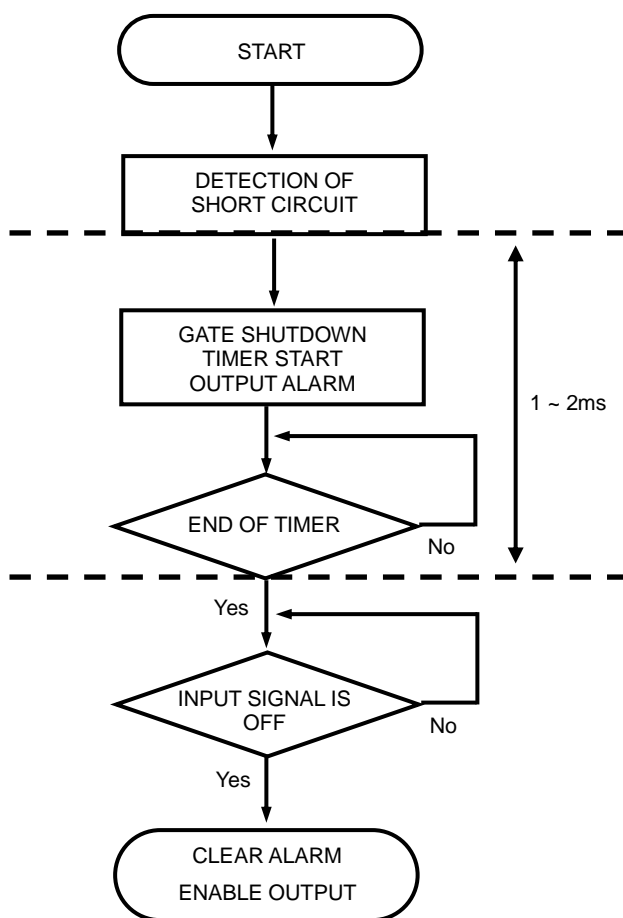
- (1) In case the gate voltage is "H" and the collector voltage is high, this hybrid IC will recognize the circuit as short circuit and immediately reduce the gate voltage. Besides, put out error signal ("L") which inform that protection circuit is operating at the same time from pin 8.
- (2) The protection 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 pin2 and 3.
- (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

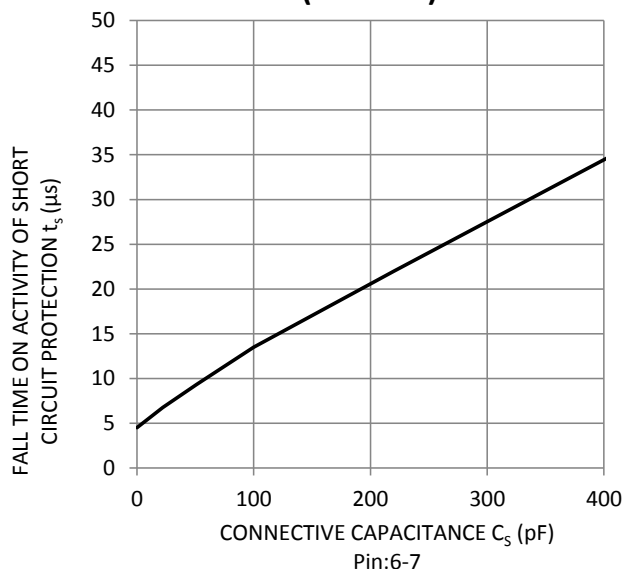
(When the protection circuit is operating)
 In case you want to decrease the speed of reverse bias when the protection circuit is operating, you can adjust that speed by connecting the capacitor (Cs) between pin 6 and 7.(Please refer to under figures.)



OPERATION FLOW ON DETECTING SHORTCIRCUIT

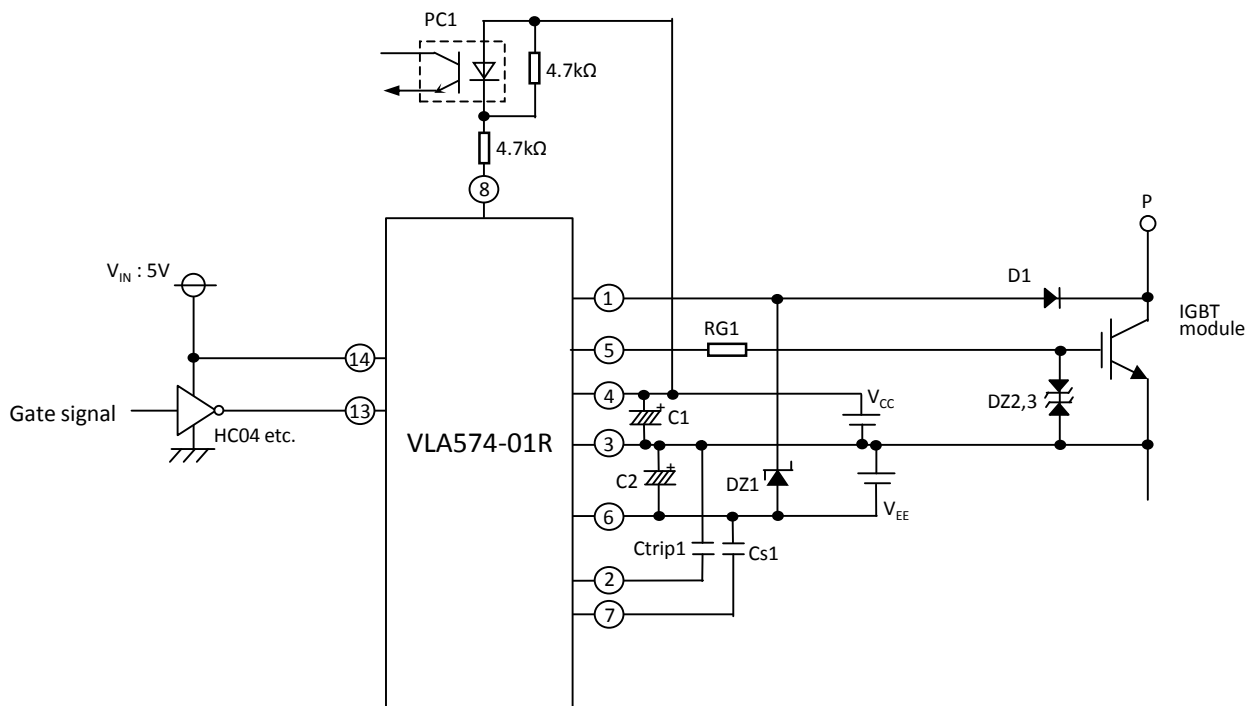


$t_s - C_s$ CHARACTERISTICS (TYPICAL)



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

APPLICATION CIRCUIT 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 is long, pin1 is applied high voltage.
In that case, counterplan for protection which insert zener diode between pin 6 and 1 is necessary like above diagram.
- (4) In case pin 2 are operating, the C_{trip} is expected to be wired as close as possible from pin. (Less than 5cm coming and going)
※In case of not operating, please pin 2 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 1 and 3.
At that time, D1 and Dz1 are not require, and pin 8 are not necessary to be connected.

$V_{CC} = 16V$
 $V_{EE} = -8V$
 $V_{IN} = 5V \pm 5\%$
 $C_{1,2} = 1000\mu F$ 35V(Low impedance)
 C_{trip} : Depended on R_{G1}
 (Aim : $0 \sim 150pF$, 50V, Ceramic)
 C_S : Depend on surge voltage
 $DZ1$: 30V, 0.5~1W
 $DZ2,3$: 18V, over than 0.5W
 $D1,2$: First recovery diode($t_{rr} : 0.2\mu s$ max)
 RP1H(Sanken) etc.
 PC1 : TLP785(TOSHIBA) etc.

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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