

Circuit Diagram

Dimensions	Inches	Millimeters
A	1.73 Max.	44.0 Max.
B	1.02 Max.	26.0 Max.
C	0.33 Max.	8.5 Max.
D	0.21 Max.	5.5 Max.
E	0.1	2.54
F	0.02+0.006/-0.004	0.5+0.15/-0.1
G	0.17±0.06	4.5±1.5
H	0.01+0.008/-0.004	0.25+0.2/-0.1
J	0.24 Max.	6.5 Max.
K	0.12 Max.	3.0 Max.

Description:

VLA546-01R is a hybrid integrated circuit designed for driving n-channel IGBT modules in any gate-amplifier application. This device is a fully isolated gate drive circuit with an optically isolated gate drive amplifier that provides an over-current protection function based on desaturation detection.

Features:

- Electrical Isolation Between Input and Output via an Opto-coupler ($V_{iso} = 4000V_{rms}$ for 1 Minute)
- Two Supply Drive Topology
- Built in Short-circuit Protection with a Pin for Fault Output
- Variable Fall Time on Activity of Short-circuit Protection
- TTL Compatible Input Interface

Applications:

- To Drive IGBT Modules for Inverter or AC Servo Systems Application.

Recommended IGBT Modules:

V_{CES} = 600V Series up to 600A Class

V_{CES} = 1200V Series up to 400A Class

V_{CES} = 1700V Series up to 400A Class

VLA546-01R
IGBT Gate Driver
Absolute Maximum Ratings, $T_a = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Rating	Units
Supply Voltage (DC)	V_{CC}	18	V
Supply Voltage (DC)	V_{EE}	-15	V
Input Signal Voltage (Applied Between Pin 13 and Pin 14, 50% Duty Cycle, Pulse Width 1ms)	V_I	-1 ~ +7	V
Output Voltage (When Output Voltage is "H")	V_O	V_{CC}	V
Output Peak Current (Pulse Width 2 μ s)	I_{OHP}	-5	A
	I_{OLP}	5	A
Isolation Voltage (Sine Wave Voltage 60Hz, for 1 min.)	V_{iso}	4000	V_{rms}
Case Temperature	T_C	95	$^\circ\text{C}$
Operating Temperature (No Condensation Allowable)	T_{opr}	-20 ~ +85	$^\circ\text{C}$
Storage Temperature (No Condensation Allowable)	T_{stg}	-40 ~ +100 ^{*1}	$^\circ\text{C}$
Fault Output Current (Applied at Pin 8)	I_{FO}	20	mA
Input Voltage at Pin 1	V_{R1}	50	V

Electrical Characteristics, $T_a = 25^\circ\text{C}$, $V_{CC} = 15\text{V}$, $V_{EE} = -10\text{V}$, $R_G = 3.0\Omega$

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply Voltage	V_{CC}	Recommended Range	14	15	17	V
Supply Voltage	V_{EE}	Recommended Range	-7	—	-12	V
Pull-up Voltage on Primary Side	V_{IN}	Recommended Range	4.75	5	5.25	V
"H" Input Signal Current	I_{IH}	Recommended Range	10	13	16	mA
Switching Frequency	f	Recommended Range	—	—	20	kHz
Gate Resistance	R_G	Recommended Range	2	—	—	Ω
"H" Input Signal Current	I_H	$V_{IN} = 5\text{V}$, HC04 Drive	—	13	—	mA
"H" Output Voltage	V_{OH}	—	13	14	—	V
"L" Output Voltage	V_{OL}	—	-8	-9	—	V
"L-H" Propagation Time	t_{PLH}	$I_{IH} = 13\text{mA}$	0.2	0.4	1	μs
"L-H" Rise Time	t_r	$I_{IH} = 13\text{mA}$	—	0.3	1	μs
"H-L" Propagation Time	t_{PHL}	$I_{IH} = 13\text{mA}$	0.2	0.4	1	μs
"H-L" Fall Time	t_f	$I_{IH} = 13\text{mA}$	—	0.3	1	μs
Timer	t_{timer}	Between Start and Cancel (Under Input Sign "L")	1	—	2	ms
Fault Output Current	I_{FO}	Applied at Pin 8, $R = 4.7\text{k}\Omega$	—	5	—	mA
Controlled Time Detect Short-Circuit 1	t_{trip1}	Pin 1: 15V or more, Pin 2: Open	—	2.6	—	μs
Controlled Time Detect Short-Circuit 2 ^{*2}	t_{trip2}	Pin 1: 15V or more, Pins 2-4: 10pF (Connective Capacitance)	—	3	—	μs
SC Detect Voltage	V_{SC}	Collector Voltage of IGBT	15	—	—	V

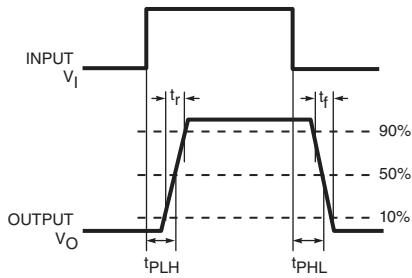
*1 Differs from H/C condition.

*2 The length of the wiring capacitor from Pin 2 to Pin 4 should be less than 5cm.

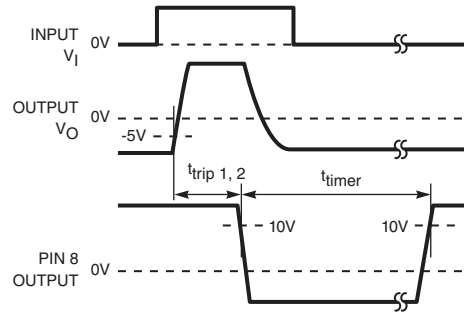
VLA546-01R
IGBT Gate Driver

Definition of Characteristics

SWITCHING OPERATION



SHORT CIRCUIT PROTECTION

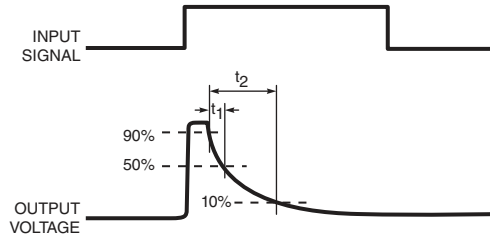


Operation of Protection Circuit

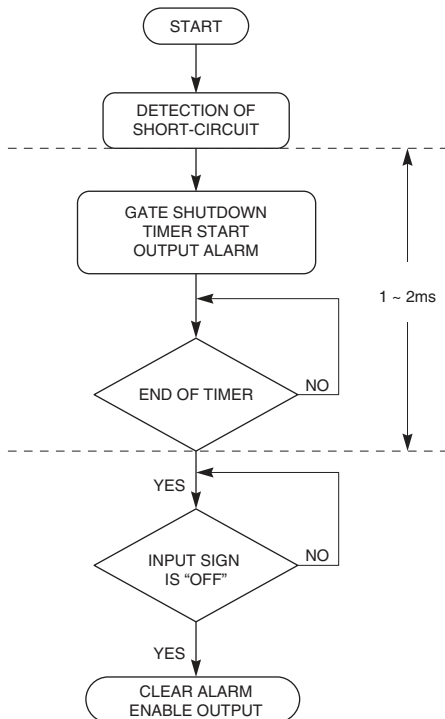
1. In the case where the gate voltage is "H" and the collector voltage is high, the hybrid IC will recognize a short-circuit condition and immediately reduce the gate voltage. Additionally, it will output an error signal ("L") which indicates that the protection circuit is operating at the same time from Pin 8.
2. The protection circuit resets if the input signal is "OFF" when the premised 1~2msec passed. ("OFF" period needs 10µm or more.)
3. When the output rises, the controlled time detect short-circuit (typically 2.6µs) is set up so that the on-time of the IGBT can be secured properly. It is possible to adjust this time by connecting a capacitor (C_{trip}) between Pin 2 and Pin 4.

Adjustment of Output Fall Time

When the protection circuit is operating, the speed of reverse bias can be adjusted by connecting a capacitor (C_s) between Pin 6 and Pin 7.

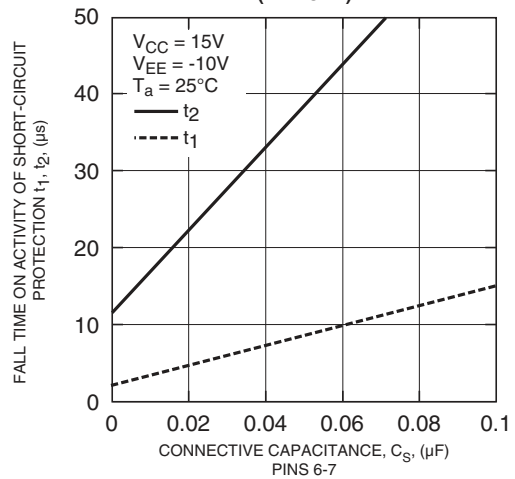


Operation Flow on Detecting Short Circuit



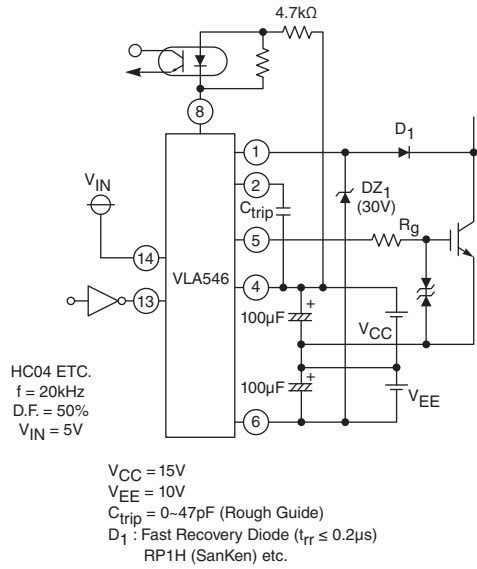
NOTE: Output voltage with protection circuit operating is about $-V_{EE} + 2V$

t₁, t₂ vs C_s CHARACTERISTICS (TYPICAL)

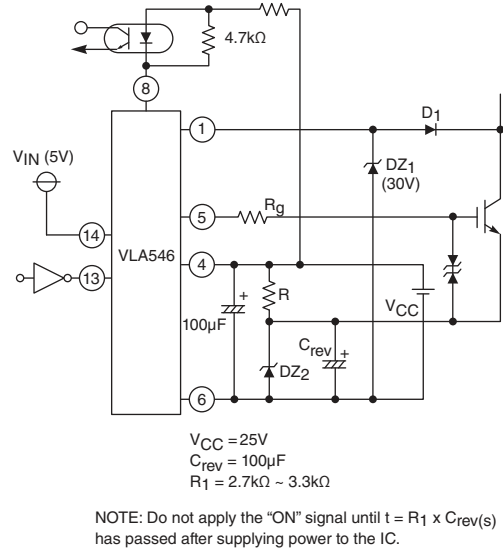


VLA546-01R
IGBT Gate Driver

Application Circuit Example



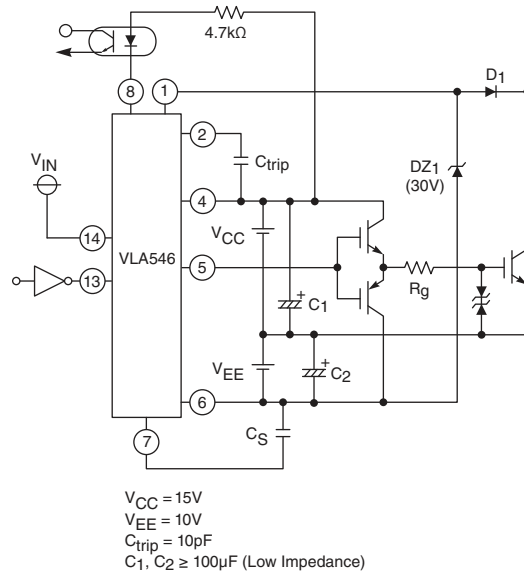
Application Example of Single Power Supply



Precaution

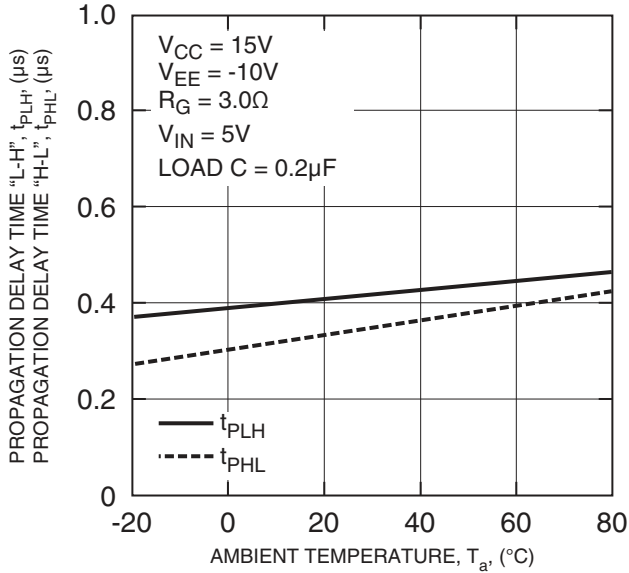
1. Voltage compensation capacitors are expected to be located as close as possible to the hybrid IC.
2. D₁ requires approximately the same voltage rating as the power module.
3. If reverse recovery time of D₁ is long, high voltage is applied to Pin1. In this case, a zener diode should be inserted between Pin 1 and Pin 6 for necessary protection, as shown above.
4. If Pin 2 is operating, C_{trip} is expected to be wired as close as possible to Pin 2 and Pin 4 and be less than 5cm.

Application Example of High Power Supply

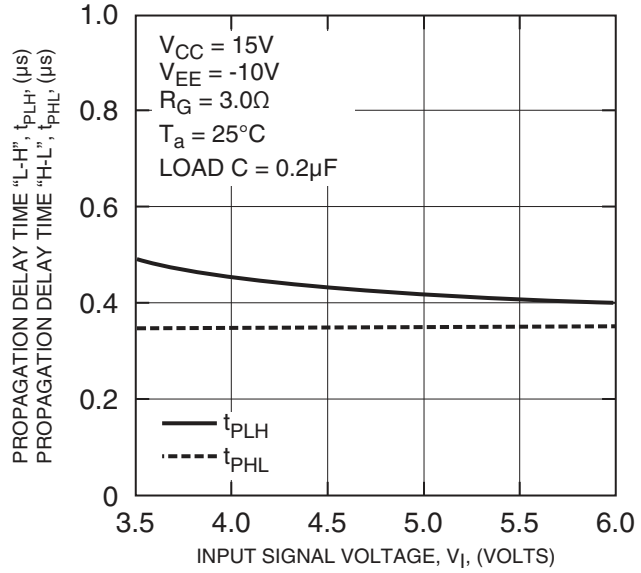


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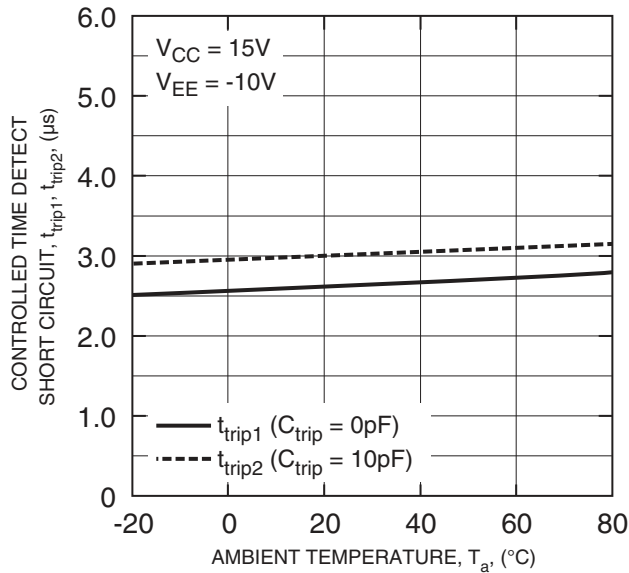
t_{PLH} , t_{PHL} - T_a CHARACTERISTICS
(TYPICAL)



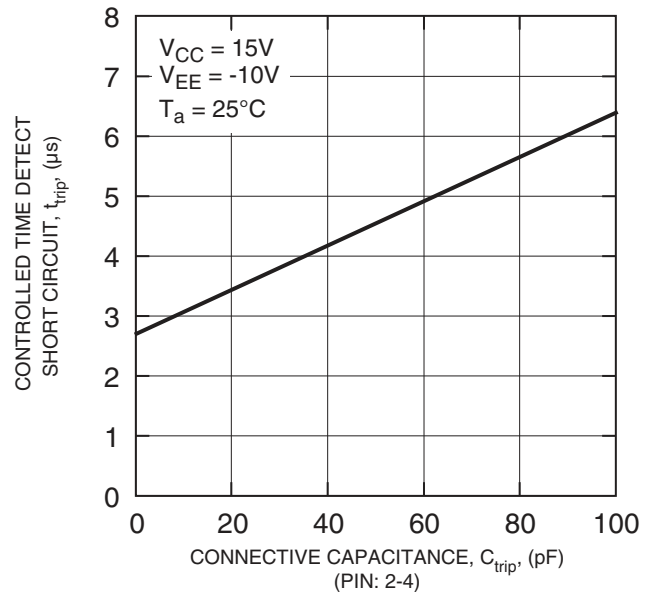
t_{PLH} , t_{PHL} - V_I CHARACTERISTICS
(TYPICAL)



t_{trip1} , t_{trip2} - T_a CHARACTERISTICS
(TYPICAL)

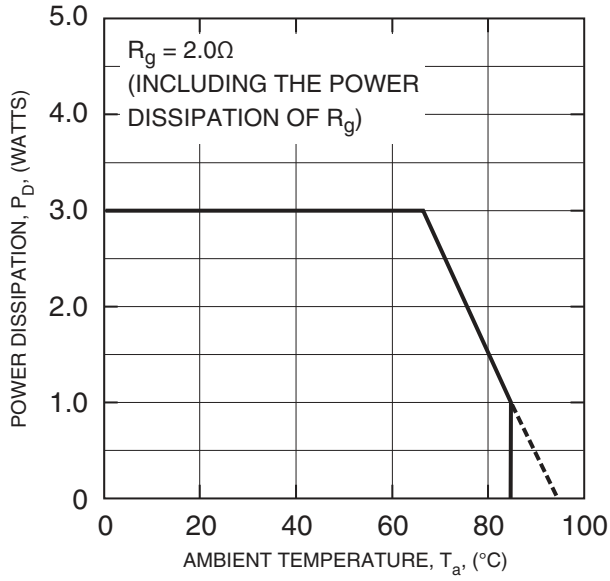


t_{trip} - C_{trip} CHARACTERISTICS
(TYPICAL)



VLA546-01R
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POWER DISSIPATION - AMBIENT TEMPERATURE CHARACTERISTICS (MAXIMUM RATING)



CONSUMPTION CURRENT - SUPPLY VOLTAGE (PIN: 4-6) INPUT SIGNAL "L" (TYPICAL)

