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Powerex Inc.
VLA541-01R

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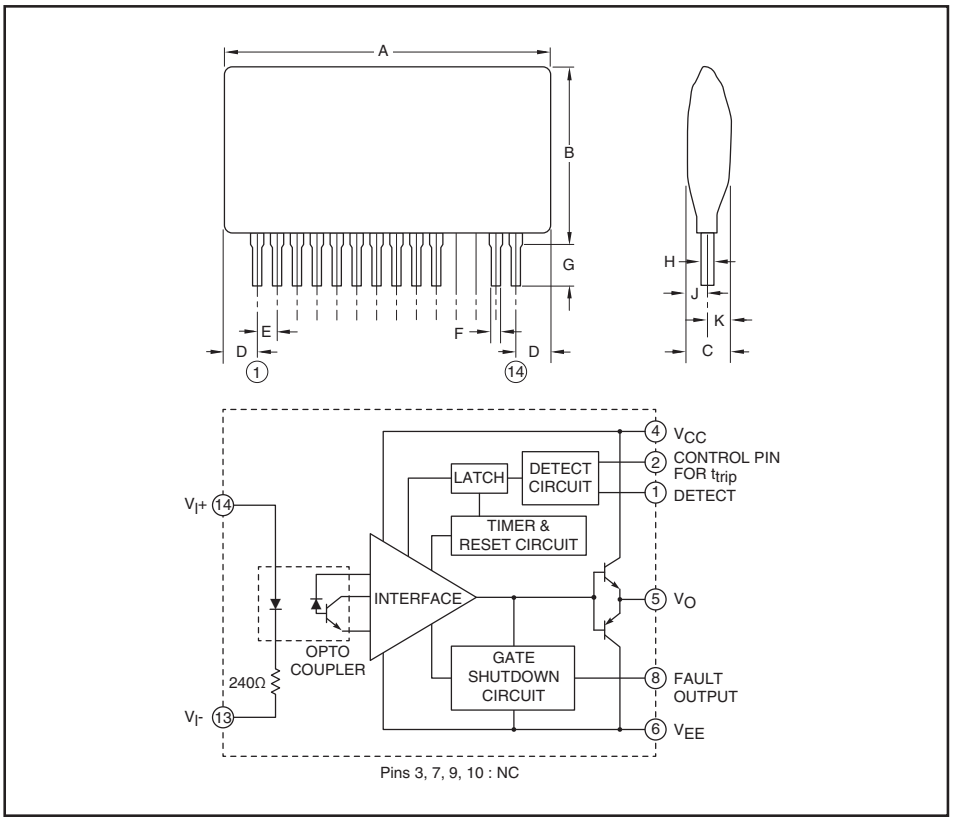
VLA541-01R

IGBT Gate Driver



Circuit Diagram

Dimensions	Inches	Millimeters
A	1.73 Max.	44.0 Max.
B	1.02 Max.	26.0 Max.
C	0.31 Max.	8.0 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	0.21 Max.	5.5 Max.
K	0.12 Max.	3.0 Max.

Description:
VLA541-01R 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} = 2500V_{rms} for 1 Minute)
- ☐ Two Supply Drive Topology
- ☐ Built in Short-Circuit Protection with a pin for Fault Output
- ☐ CMOS Compatible Input Interface

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

Recommended IGBT Modules:
V_{CES} = 600V Series up to 200A Class
V_{CES} = 1200V Series up to 150A Class

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Absolute Maximum Ratings, T_a = 25°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 2µs)	I_{OHP}	-3	A
	I_{OLP}	3	A
Isolation Voltage (Sine Wave Voltage 60Hz, for 1 min.)	V_{iso}	2500	V_{rms}
Case Temperature	T_C	95	°C
Operating Temperature (No Condensation Allowable)	T_{opr}	-20 ~ +70	°C
Storage Temperature (No Condensation Allowable)	T_{stg}	-40 ~ 100*1	°C
Fault Output Current (Applied at Pin 8)	I_{FO}	20	mA
Input Voltage at Pin 1 (Applied at Pin 1)	V_{R1}	50	V

Electrical Characteristics, T_a = 25°C, V_{CC} = 15V, V_{EE} = -10V, R_G = 10Ω

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
		V_{IN} = 5V, HC04 Drive	—	13	—	mA
Switching Frequency	f	Recommended Range	—	—	20	kHz
Gate Resistance	R_G	Recommended Range	3	—	—	Ω
"H" Output Voltage	V_{OH}	—	13	14	—	V
"L" Output Voltage	V_{OL}	—	-8	-9	—	V
"L-H" Propagation Time	t_{PLH}	I_{IH} = 13mA	0.2	0.4	1	µs
"L-H" Rise Time	t_r	I_{IH} = 13mA	—	0.3	1	µs
"H-L" Propagation Time	t_{PHL}	I_{IH} = 13mA	0.2	0.4	1	µs
"H-L" Fall Time	t_f	I_{IH} = 13mA	—	0.3	1	µs
Timer	t_{timer}	Between Start and Cancel (Under Input Sign "OFF")	1	—	2	ms
Fault Output Current	I_{FO}	Applied at Pin 8, R = 4.7kΩ	—	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 capacitor from Pin 2 to Pin 4 should be less than 5cm.

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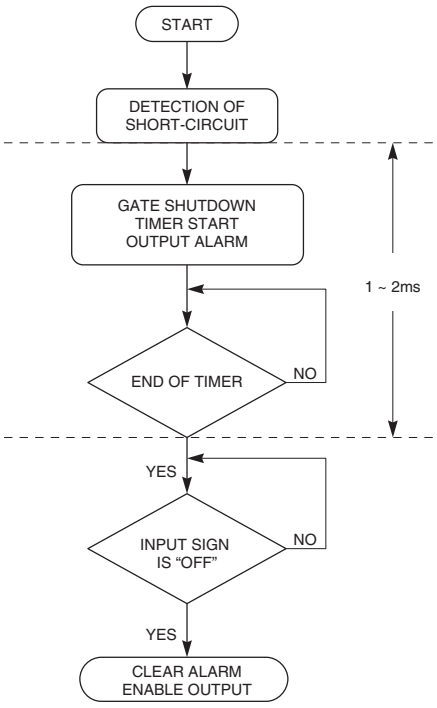
Operation of Protection Circuit

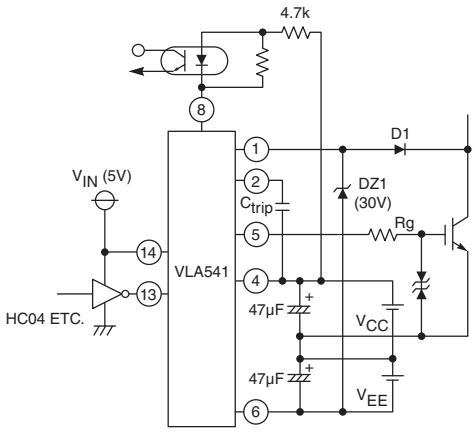
1. In the case where the gate voltage is "H" and the collector voltage is high, the hybrid IC will recognize a short-circuit condition and immediately reduce the gate voltage. Additionally, it will output an error signal ("L") which indicates that the protection circuit is operating at the same time 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 the capacitor (C_{trip}) between Pin 2 and Pin 4.

Operation Flow on Detecting Short Circuit



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

Application Circuit Example

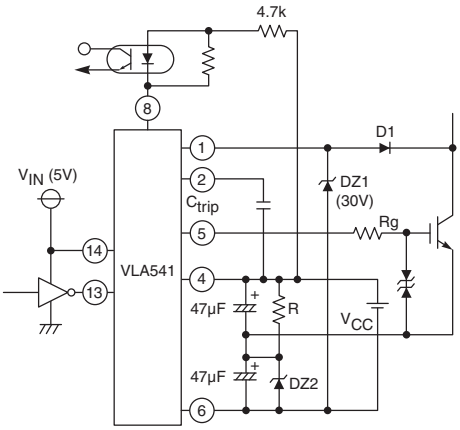


V_{CC} = 15V
V_{EE} = 10V
C_{trip} = 0~47pF (Rough Guide, 50V, Ceramic)
D1 : Fast Recovery Diode ($t_{rr} \leq 0.2\mu s$)
RP1H (SanKen) etc.

Precaution

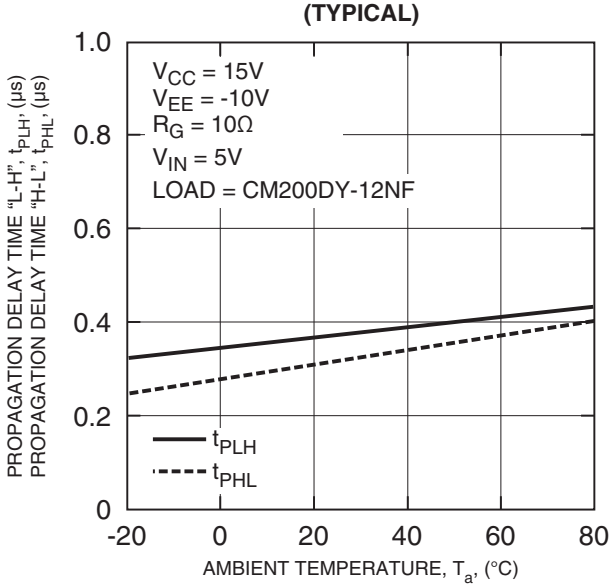
1. Voltage compensation capacitors are expected to be located as close as possible to the hybrid IC.
2. D_1 requires approximately the same voltage rating as the power modules.
3. If reverse recovery time of D_1 is long, Pin 1 is applied a high voltage. In that case, a zener diode between Pin 1 and Pin 6 is inserted for necessary protection as shown above.
4. In case Pin 2 is operating, the C_{trip} is expected to be wired as close as possible to Pin 2 and Pin 4 (less than 5cm).

Application Example of Single Power Supply

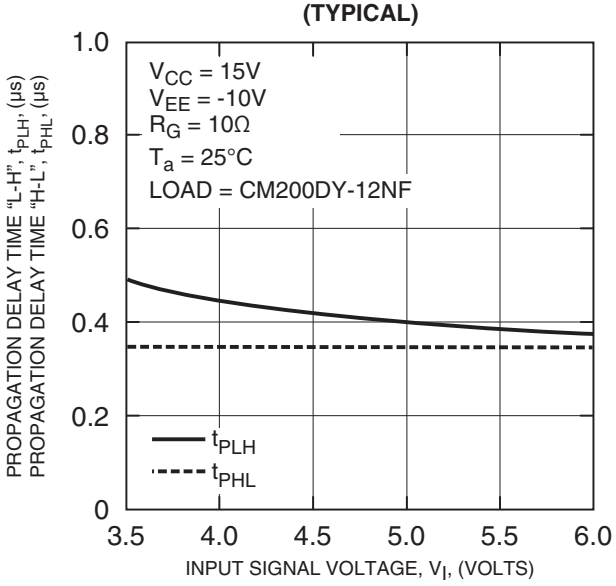


V_{CC} = 24V
DZ2 : 8.2V, 1/2W
R : 2.7k ~ 3.3kΩ

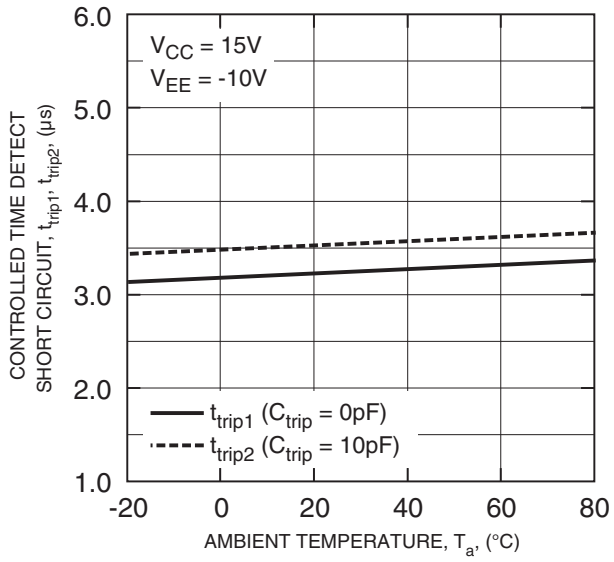
t_{PLH}, t_{PHL}-T_a CHARACTERISTICS (TYPICAL)



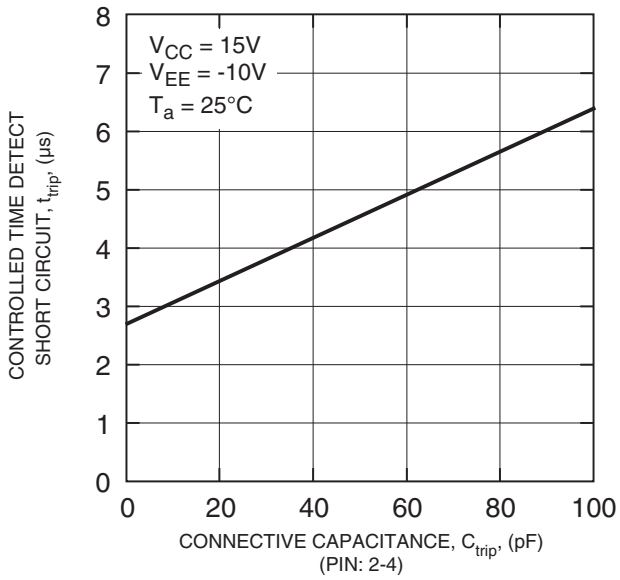
t_{PLH}, t_{PHL}-V_I CHARACTERISTICS (TYPICAL)



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



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



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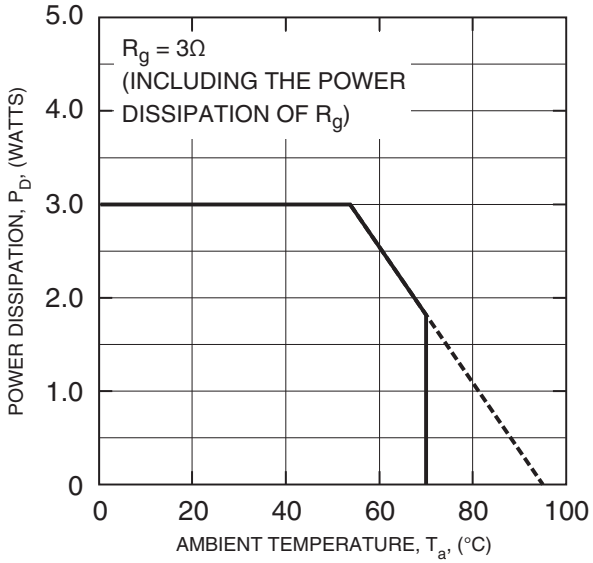
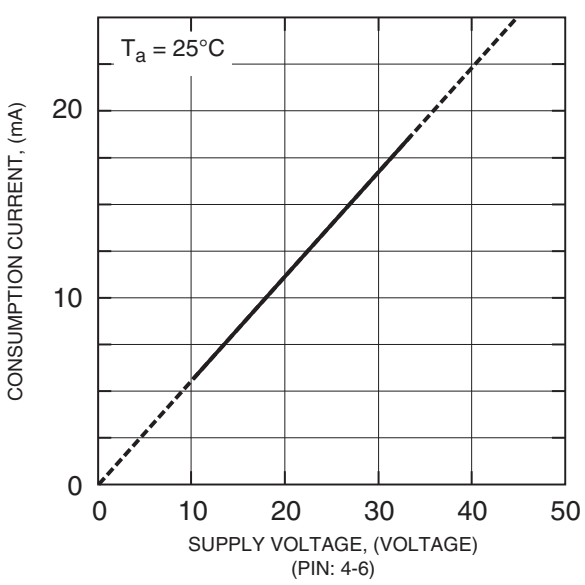
POWER DISSIPATION - AMBIENT TEMPERATURE CHARACTERISTICS (MAXIMUM RATING)

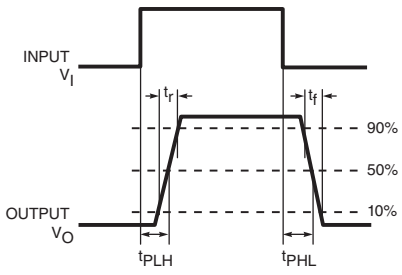


DISSIPATION CURRENT - SUPPLY VOLTAGE (PIN: 4-6) INPUT SIGNAL "L" (TYPICAL)



Definition of Characteristics

SWITCHING OPERATION



OPERATION OF SHORT CIRCUIT PROTECTION