

### DESCRIPTION

VLA542 is a hybrid integrated circuit designed for driving n-channel IGBT modules in any gate-amplifier application. This device operates as an isolation amplifier for these modules and provides the required electrical isolation between the input and output with an opto-coupler.

Recommended IGBT modules:

$V_{CES} = 600V$  series up to 600A class

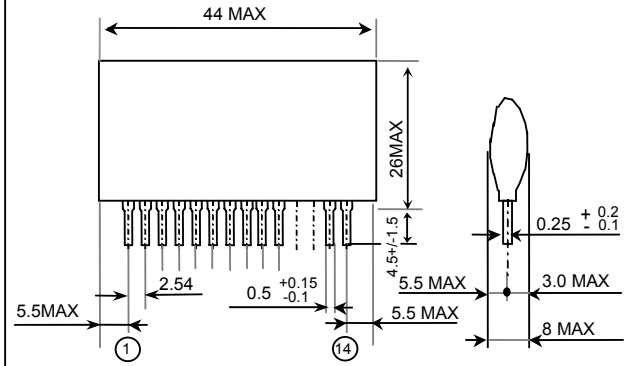
$V_{CES} = 1200V$  series up to 400A class

### FEATURES

- Electrical isolation between input and output with opto-coupler  
(Viso = 2500Vrms for 1minute)
- Two supply driver topology
- Built-in short circuit protection circuit(With a pin for fault out)
- CMOS compatible input interface

### OUTLINE DRAWING

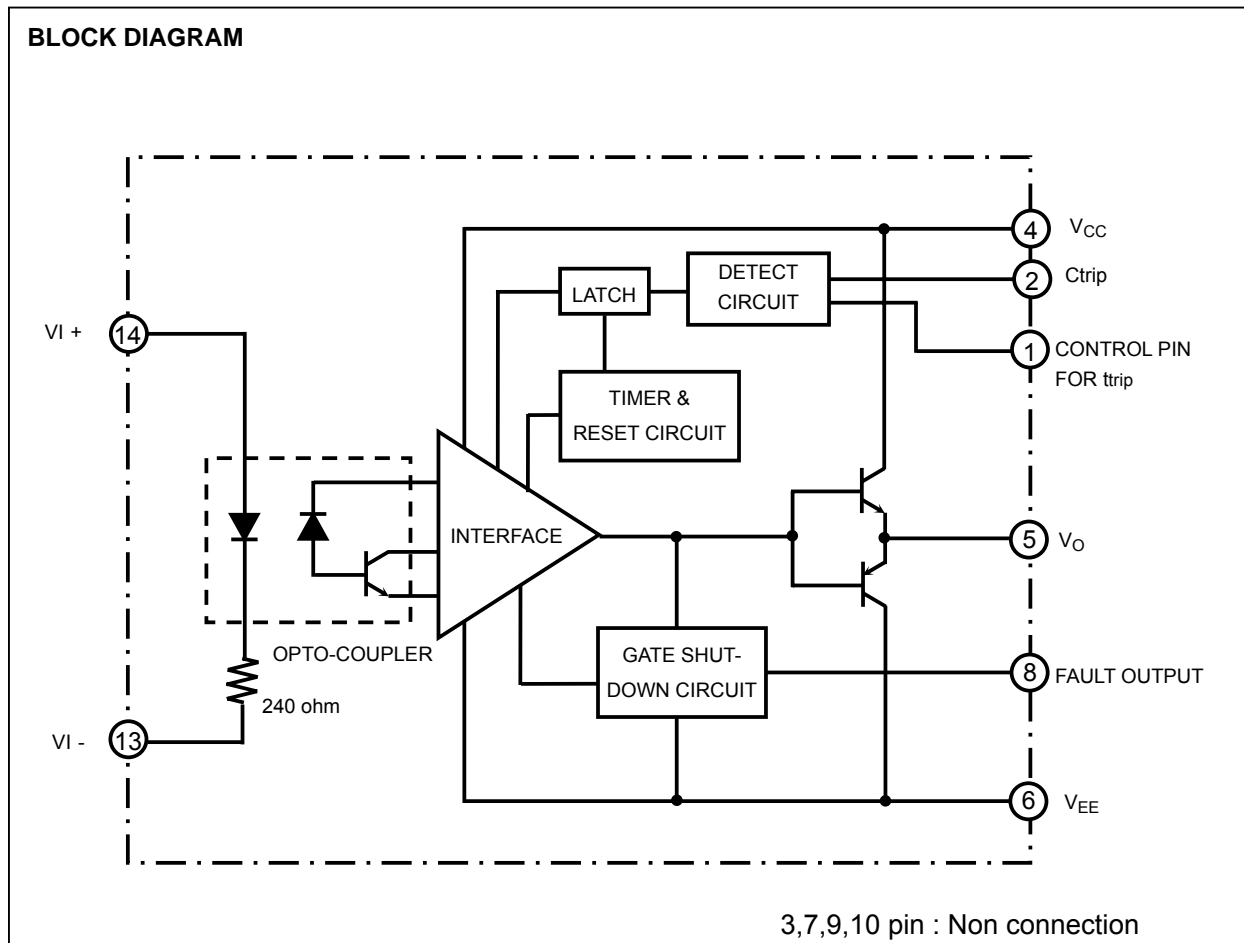
Dimensions : mm



### APPLICATIONS

To drive IGBT modules for inverter or AC servo systems application

### BLOCK DIAGRAM



## TENTATIVE

Hybrid IC for driving IGBT modules

MAXIMUM RATINGS (unless otherwise noted,  $T_a=25^\circ\text{C}$ )

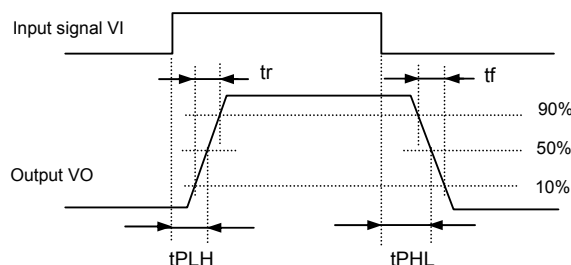
| Symbol    | Parameter             | Conditions  | Ratings         | Unit             |
|-----------|-----------------------|---|-----------------|------------------|
| $V_{CC}$  | Supply voltage        | DC  | 18              | V                |
| $V_{EE}$  |                       |   | -15             | V                |
| $V_I$     | Input signal voltage  | Applied between; 13pin and 14pin<br>50% duty cycle, pulse width 1ms | -1 ~ +7         | V                |
| $V_O$     | Output voltage        | When the output voltage is "H"                                      | $V_{CC}$        | V                |
| $I_{OHP}$ | Output peak current   | Pulse width 2 $\mu\text{s}$   | -5              | A                |
| $I_{OLP}$ |                       |   | 5               | A                |
| Viso      | Isolation voltage     | Sine wave voltage 60Hz, for 1minute                                 | 2500            | Vrms             |
| $T_C$     | Case temperature      | -   | 85              | $^\circ\text{C}$ |
| Topr      | Operating temperature | No condensation allowable   | -20 ~ +60       | $^\circ\text{C}$ |
| Tstg      | Storage temperature   | No condensation allowable   | -25 ~ +100 (*1) | $^\circ\text{C}$ |
| $I_{FO}$  | Fault output current  | Applied 8pin  | 20              | mA               |
| $V_{R1}$  | Input voltage at 1pin | Applied 1pin  | 50              | V                |

(\*1) Differs from H/C condition

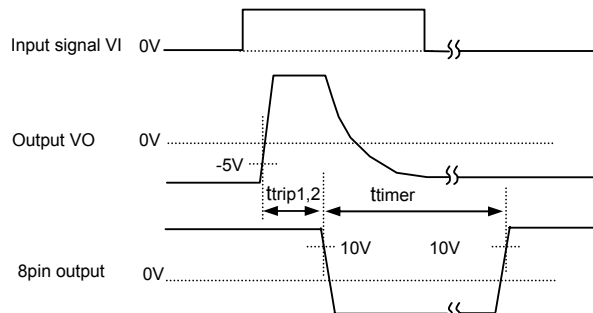
ELECTRICAL CHARACTERISTICS (unless otherwise noted,  $T_a=25^\circ\text{C}$ ,  $V_{CC} = 15\text{V}$ ,  $V_{EE} = -10\text{V}$ ,  $R_G = 3.3\ \text{ohm}$ )

| Symbol      | Parameter                                      | Conditions  | Limits |     |      | Unit          |
|-------------|--|---|--------|-----|------|---------------|
|             |  |   | Min    | Typ | Max  |               |
| $V_{CC}$    | Supply voltage                                 | Recommended range   | 14     | 15  | 17   | V             |
| $V_{EE}$    |  |   | -7     | -10 | -12  | V             |
| $V_{IN}$    | Pull-up voltage on primary 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   | 2      | -   | -    | ohm           |
| $I_{IH}$    | "H" input signal current                       | $V_{IN} = 5\text{V}$  | -      | 13  | -    | mA            |
| $V_{OH}$    | "H" output voltage                             | -   | 13     | 14  | -    | V             |
| $V_{OL}$    | "L" output voltage                             | -   | -8     | -9  | -    | V             |
| $t_{PLH}$   | "L-H" propagation time                         | $I_{IH}=13\text{mA}$  | -      | -   | 1    | $\mu\text{s}$ |
| $t_r$       | "L-H" rise time                                | $I_{IH}=13\text{mA}$  | -      | -   | 1    | $\mu\text{s}$ |
| $t_{PHL}$   | "H-L" propagation time                         | $I_{IH}=13\text{mA}$  | -      | -   | 1.3  | $\mu\text{s}$ |
| $t_f$       | "H-L" fall time                                | $I_{IH}=13\text{mA}$  | -      | -   | 1    | $\mu\text{s}$ |
| ttimer      | Timer  | Between start and cancel<br>(under input signal "OFF")      | 1      | -   | 2    | ms            |
| $I_{FO}$    | Fault output current                           | Applied 8pin, $R = 4.7\text{k ohm}$                         | -      | 5   | -    | mA            |
| $t_{trip1}$ | Controlled time detect short circuit 1         | Pin1: 15V and more, Pin2:open                               | -      | 2.6 | -    | $\mu\text{s}$ |
| $t_{trip2}$ | Controlled time detect short circuit 2<br>(*2) | Pin1: 15V and more, Pin2-4:10pF<br>(connective capacitance) | -      | 3   | -    | $\mu\text{s}$ |
| $V_{SC}$    | SC detect voltage                              | Collector voltage of IGBT module                            | 15     | -   | -    | V             |

(\*2) Length of wiring of capacitor controlled time detect short-circuit is within 5cm from pin2 and pin4 coming and going.

DEFINITION OF CHARACTERISTICS  
(1) SWITCHING OPERATION

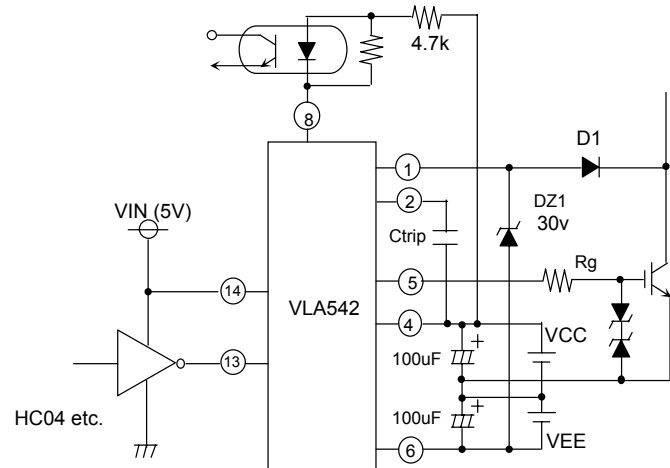
## (2) SHORT CIRCUIT PROTECTION



### 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 an error signal ("L") which inform that protection circuit is operating at the same time from pin8.
  - (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 (Typ 2.6us) 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 4.
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### APPLICATION CIRCUIT EXAMPLE



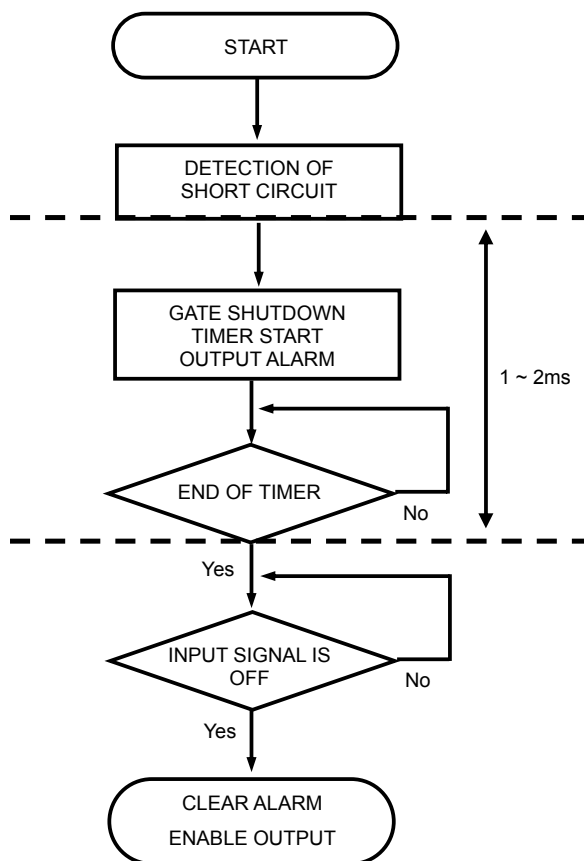
$V_{CC} = 15V$   $V_{EE} = 10V$

Ctrip = 0 ~ 39pF (Rough guide, 50V, ceramic)

D1: Fast recovery diode (trr ≤ 0.2us)

RP1H (SanKen) etc.

### OPERATION FLOW ON DETECTING SHORTCIRCUIT

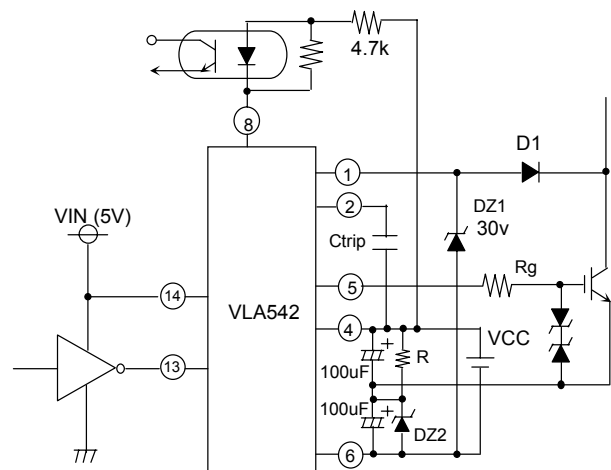


(\*) Output voltage with protection circuit operating is about  $-|V_{EE}|+2V$

### PRECAUTION

- (1) Voltage compensate capacitors are expected to be located as close as possible from the hybrid IC.
- (1) D1 requires approximately the same voltage of power modules.
- (2) If reverse recovery time of D1 is long, pin1 is applied high voltage. In that case, counterplan for protection which insert a zener diode between pin 1 and 6 is necessary like above diagram.
- (3) In case pin 2 is operating, the Ctrip is expected to be wired as close as possible from pin 2 and pin 4. (Less than 5cm coming and going)

### APPLICATION EXAMPLE OF SINGLE POWER SUPPLY



$V_{CC} = 24V$

DZ2 : 8.2V, 1/2W

R : 2.7k ~ 3.3kohm

**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          | <p>The materials used in packing Hics can only withstand normal external conditions.</p> <p>When exposed to outside shocks, rain and certain environmental contaminants, the packing materials will deteriorates. Please take care in handling.</p>   |
| 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 | <p>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.</p>   |
| Maximum ratings  | <p>To prevent any electrical damages, use Hics within the maximum ratings. The temperature, current, voltage, etc. must not exceed these conditions.</p>  |
| Polarity         | <p>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.</p>  |

# TENTATIVE

Hybrid IC for driving IGBT modules



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