

**DESCRIPTION**

M57959AL 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 200A class

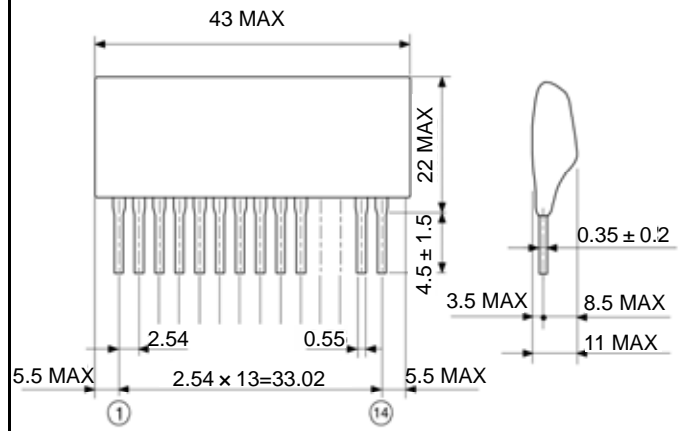
$V_{CES} = 1200V$  series up to 100A class

**FEATURES**

- Electrical isolation between input and output with opto-coupler  
( $V_{iso} = 2500V_{rms}$  for 1minute)
- Two supply driver topology
- Built-in short circuit protection circuit (With a pin for fault out)
- TTL compatible input interface

**OUTLINE DRAWING**

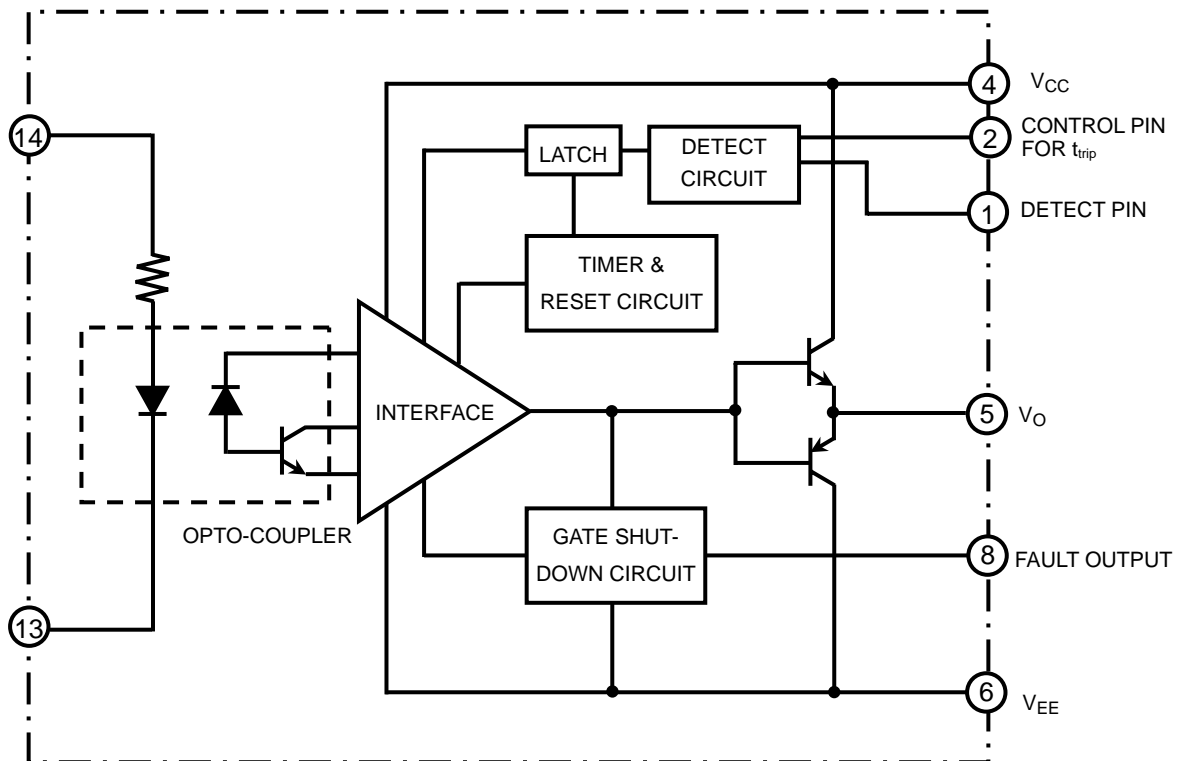
Dimensions: mm



**APPLICATIONS**

To drive IGBT modules for inverter or AC servo systems application

**BLOCK DIAGRAM**



**MAXIMUM RATINGS** (unless otherwise noted, Ta=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>CC</sub>	Supply voltage	DC	18	V
V <sub>EE</sub>			-15	V
V <sub>I</sub>	Input voltage	Applied between; 13pin and 14pin	-1 ~ +7	V
V <sub>O</sub>	Output voltage	When the output voltage is "H"	V <sub>CC</sub>	V
I <sub>OHP</sub>	Output current	Pulse width 2μs, f = 20kHz	-2	A
I <sub>OLP</sub>			2	A
V <sub>iso</sub>	Isolation voltage	Sine wave voltage 60Hz, for 1min	2500	V <sub>rms</sub>
T <sub>C</sub>	Case temperature		85	°C
T <sub>opr</sub>	Operating temperature	No condensation allowable	-20 ~ +60	°C
T <sub>stg</sub>	Storage temperature	No condensation allowable	-25 ~ +100 (*1)	°C
I <sub>FO</sub>	Fault output current	Applied 8pin	20	mA
V <sub>R1</sub>	Input voltage	Applied 1pin	50	V

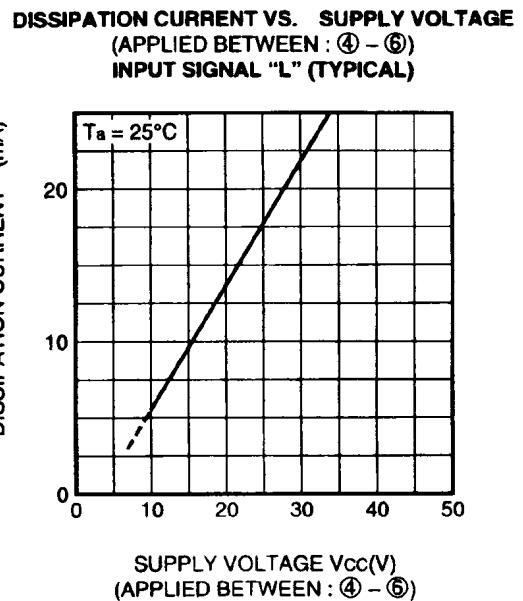
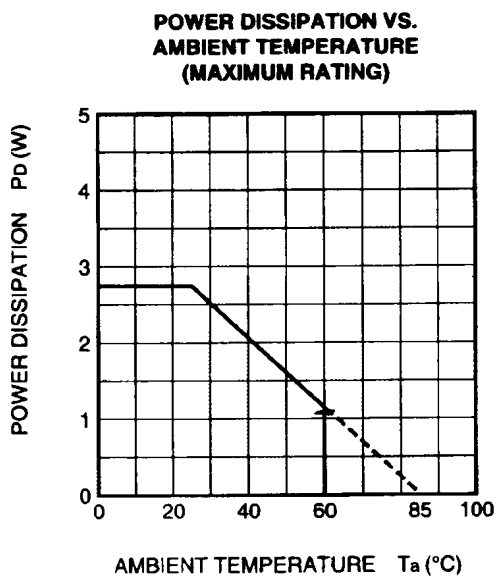
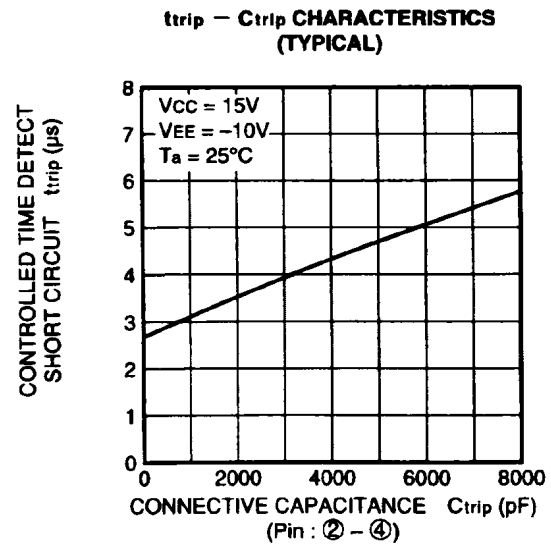
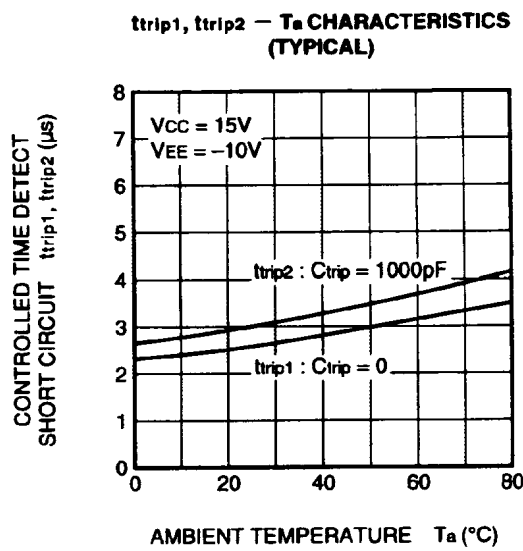
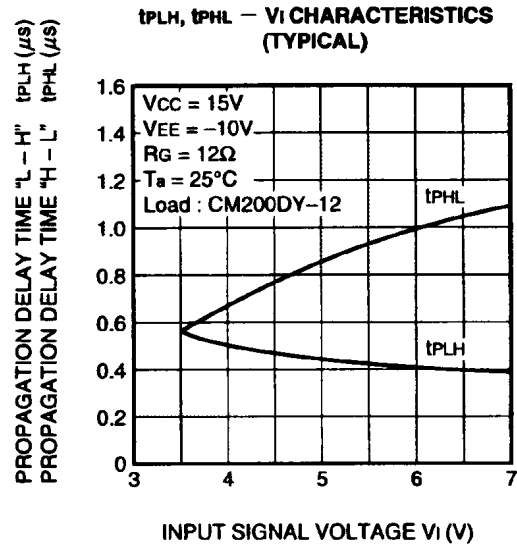
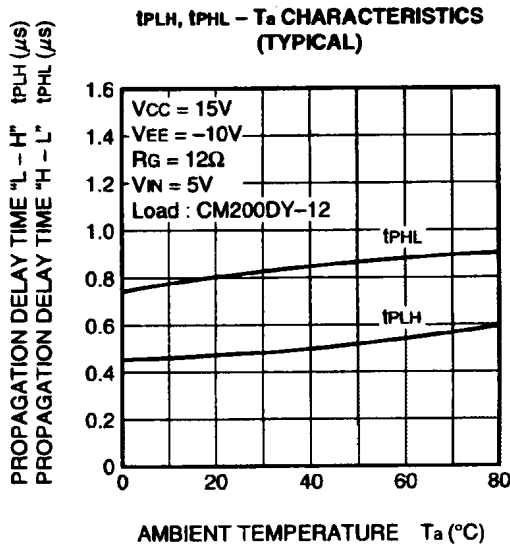
(\*1) Differs from H/C condition

**ELECTRICAL CHARACTERISTICS** (unless otherwise noted, Ta=25°C, V<sub>CC</sub> = 15V, V<sub>EE</sub> = -10V)

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
V <sub>CC</sub>	Supply voltage	Recommended range	14	15	—	V
V <sub>FF</sub>			-7	—	-10	V
V <sub>IN</sub>	Pull-up voltage on primary side	Recommended range	4.75	5	5.25	V
I <sub>IH</sub>	"H" input current	Recommended range	15.2	16	19	mA
f	Switching frequency	Recommended range	—	—	20	kHz
R <sub>G</sub>	Gate resistance	Recommended range	3	—	—	ohm
I <sub>IH</sub>	"H" input current	V <sub>IN</sub> = 5V	—	16	—	mA
V <sub>OH</sub>	"H" output voltage	—	13	14	—	V
V <sub>OL</sub>	"L" output voltage	—	-8	-9	—	V
t <sub>PLH</sub>	"L-H" propagation time	I <sub>IH</sub> = 16mA	—	0.5	1	μs
t <sub>r</sub>	"L-H" rise time	I <sub>IH</sub> = 16mA	—	0.5	1	μs
t <sub>PHL</sub>	"H-L" propagation time	I <sub>IH</sub> = 16mA	—	1	1.3	μs
t <sub>f</sub>	"H-L" fall time	I <sub>IH</sub> = 16mA	—	0.3	0.6	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 8pin, R = 4.7k	—	5	—	mA
t <sub>trip1</sub>	Controlled time detect short circuit 1	Pin1: 15V and more, Pin2:open	—	2.6	—	μs
t <sub>trip2</sub>	Controlled time detect short circuit 2 (*2)	Pin1: 15V and more, Pin2-4:1000pF (connective capacitance)	—	3	—	μs
V <sub>SC</sub>	SC detect voltage	Collector voltage of module	15	—	—	V

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

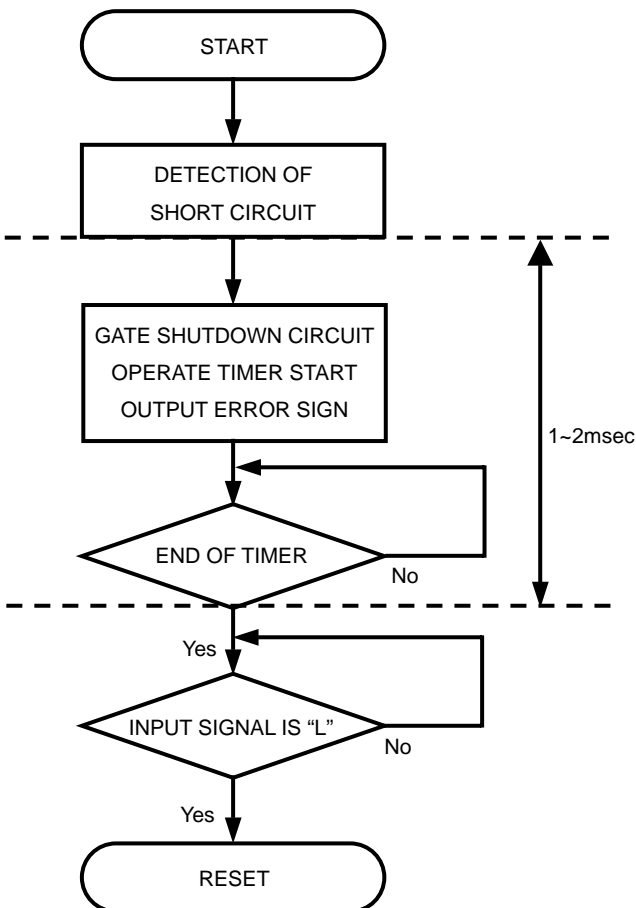
**TYPICAL CHARACTERISTICS**



**OPERATION OF PROTECTION CIRCUIT**

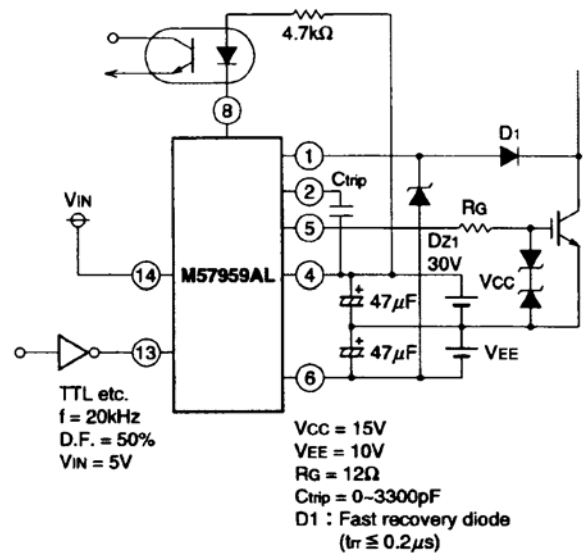
- (1) In case the gate voltage is "H" and the collector voltage is high, this hybrid IC will recognize the circuit as short circuit and immediately reduce the gate voltage. Besides, put out an error sign ("L") which inform that protection circuit is operating at the same time from pin8.
- (2) The protection circuit reset and resorted to ordinary condition if input sign is "L" when the premised 1~2msec passed. ("L" period needs up to 5μs.)
- (3) When we can see output form controlled time detect short circuit (Typ 2.6μs) is set up so that on-time of IGBT can be secured properly.

**OPERATION FLOW ON DETECTING SHORTCIRCUIT**



(\*) "L" output voltage with protection circuit operating is about -|V<sub>EE</sub>| + 2V.

**APPLICATION CIRCUIT EXAMPLE**

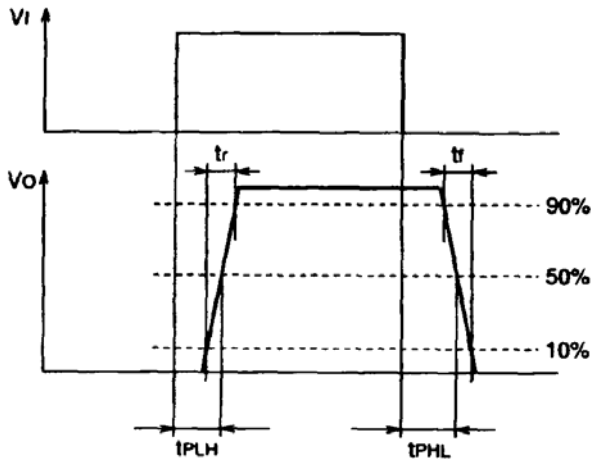


**PRECAUTION**

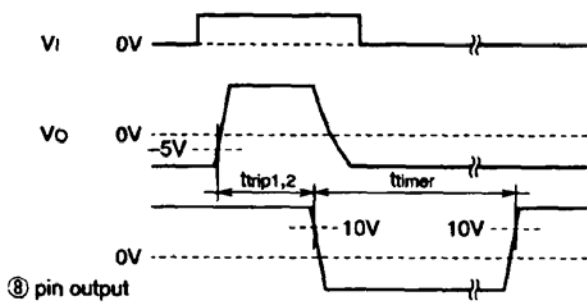
- (1) Because the pins 3,7,9 and 10 are pin dedicated to the test, the usage with electrical connections from the outside are not permitted. Please make sure not to use these pins under such kind of conditions.
- (2) Voltage compensate capacitor are expected to be located as close as possible from the hybrid IC.
- (3) D1 requires the approximately the same voltage of power modules.
- (4) 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 pins 1 and 6 are necessary like above diagram.
- (5) In case pin 2 is operating, the wiring is expected to be wired as close as possible from pins 2 and 4. (Standard length: 5cm and less)

**DEFINITION OF CHARACTERISTICS**

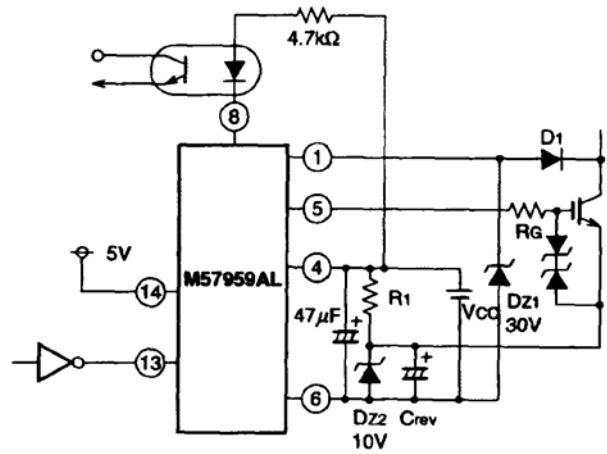
**(1) SWITCHING OPERATION**



**(2) OPERATION OF SHORT CIRCUIT PROTECTION**



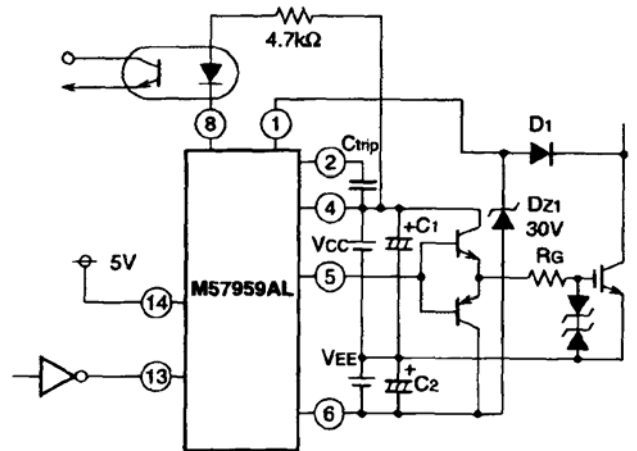
**APPLICATION EXAMPLE OF SINGLE POWER SUPPLY**



$V_{CC} = 15V$   
 $C_{rev} = 47\mu F$   
 $R1 = 2.7k$

(\* Don't input on-sig until the provided ( $R1 \times C_{rev}(s)$ ) time has been exceeded after supplied power to this hybrid IC.

**APPLICATION EXAMPLE OF HIGH POWER MODULE**



$V_{CC} = 15V$   
 $V_{EE} = 10V$   
 $C_{trip} = 1000pF$   
 $C1, C2 = 100\mu F$  (low impedance)

**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 contaminators, 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>



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**Keep safety first in your circuit designs!**

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