

**APPLICATION**

To drive IGBT modules for inverter or AC servo systems application.

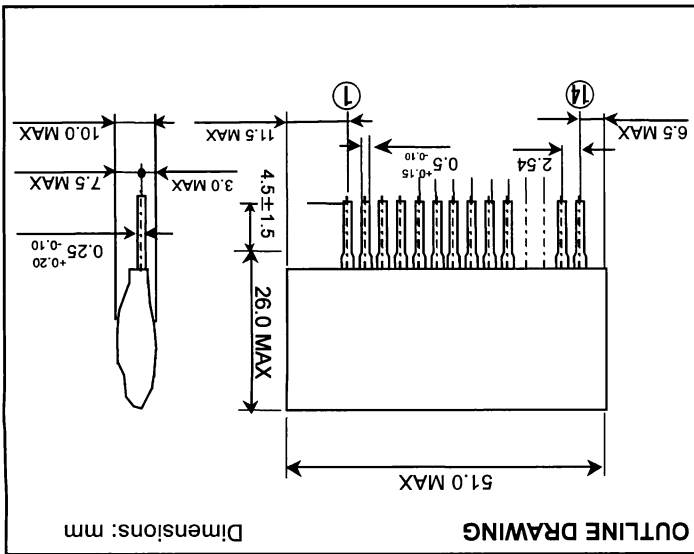
**FEATURES**

- TTL compatible input interface
- Built-in short circuit protection circuit (With a pin for fault out)
- Two supply driver topology (V<sub>iso</sub> = 250Vrms for 1minute)
- Electrical isolation between input and output with opto-coupler

**DESCRIPTION**

VLA503 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<sub>GES</sub> = 600V series up to 600A class  
 V<sub>GES</sub> = 1200V series up to 400A class



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

Symbol	Parameter	Conditions	Unit
V <sub>cc</sub>	Supply voltage	DC	V
V <sub>EE</sub>	Supply voltage		V
V <sub>i</sub>	Input signal voltage	Applied between: 13pin and 14pin 50% duty cycle, pulse width 1ms	V
V <sub>o</sub>	Output voltage	When the output voltage is "H"	V <sub>cc</sub>
I <sub>OH</sub>	Output current	Pulse width 2µs, f ≤ 20kHz	A
I <sub>OL</sub>	Output current		A
V <sub>iso</sub>	Isolation voltage	Sine wave voltage 60Hz, for 1min	V <sub>rms</sub>
T <sub>c</sub>	Case temperature	-	°C
T <sub>op</sub>	Operating temperature	No condensation allowable	°C
T <sub>stg</sub>	Storage temperature	No condensation allowable	°C
I <sub>fo</sub>	Fault output current	Applied 8pin	mA
V <sub>ri</sub>	Input voltage at 1pin	Applied 1pin	V

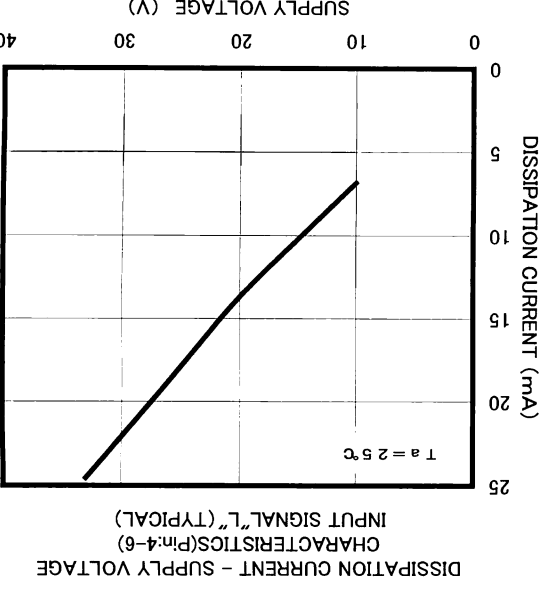
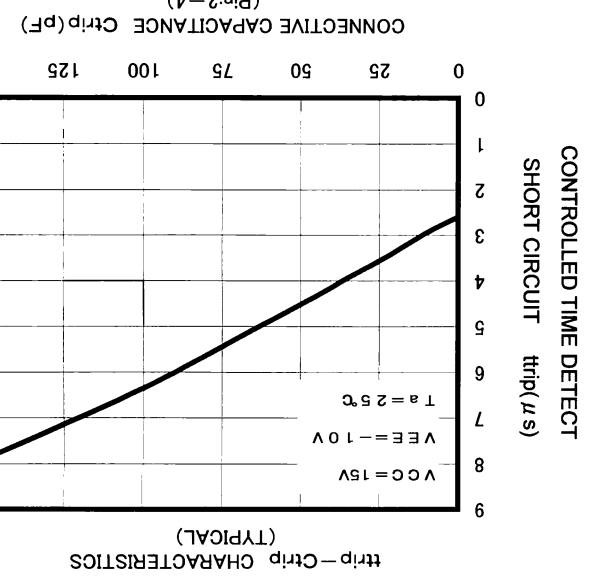
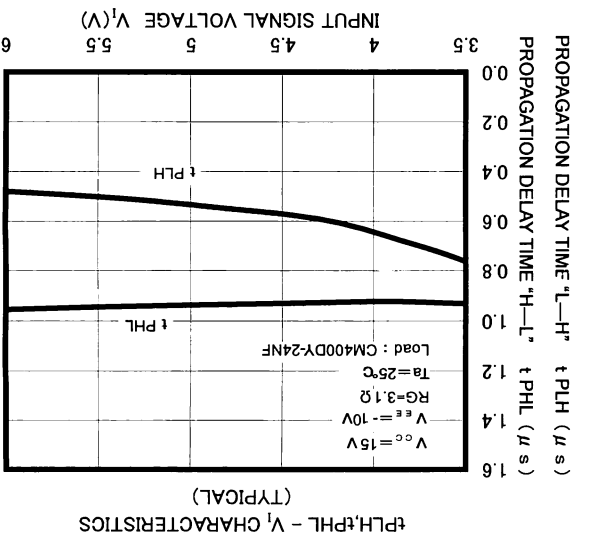
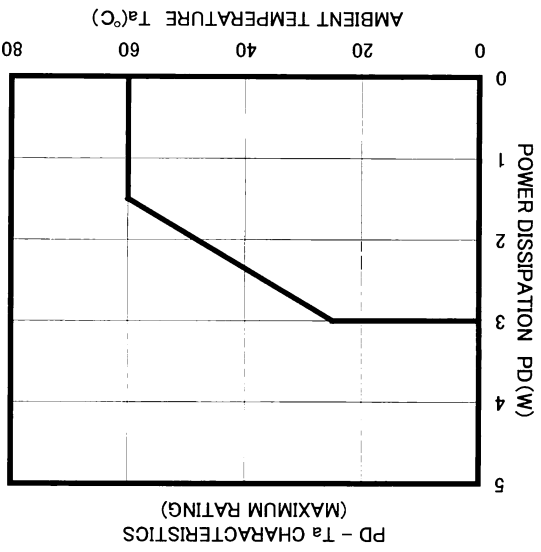
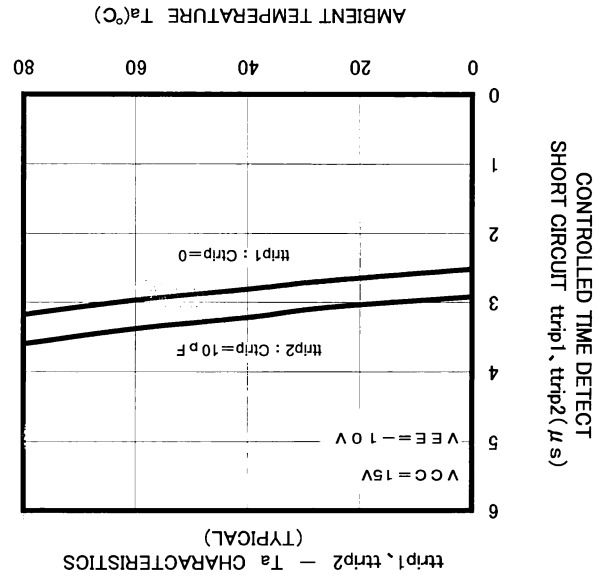
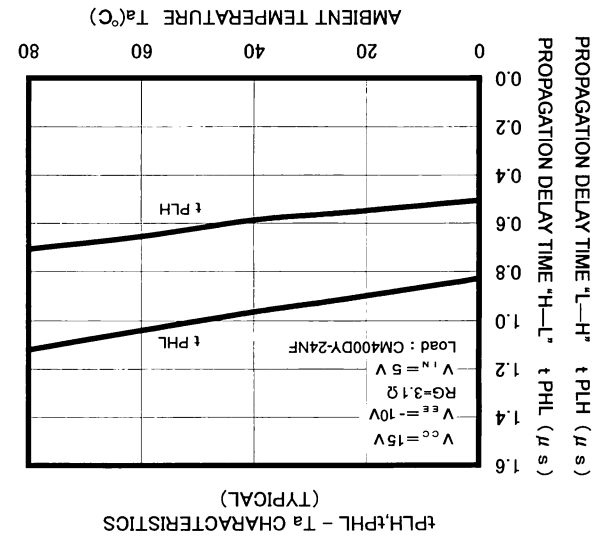
(\*1) Differs from H/C condition

**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>EE</sub>	Supply voltage	Recommended range	-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	2	-	-	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	-	0.3	1	µs
t <sub>PHL</sub>	"H-L" propagation time	I <sub>ih</sub> = 16mA	-	1.0	1.3	µs
t <sub>f</sub>	"H-L" fall time	I <sub>ih</sub> = 16mA	-	0.3	1	µs
t <sub>imer</sub>	Timer	Between start and cancel (under input sign "L")	1	-	2	ms
I <sub>fo</sub>	Fault output current	Applied 8pin, R = 4.7KΩ	-	5	-	mA
t <sub>trp1</sub>	Controlled time detect short circuit 1	Pin1: 15V and more, Pin2: open	-	2.6	-	µs
t <sub>trp2</sub>	Controlled time detect short circuit 2	Pin1: 15V and more, Pin2-4: 10pF (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.

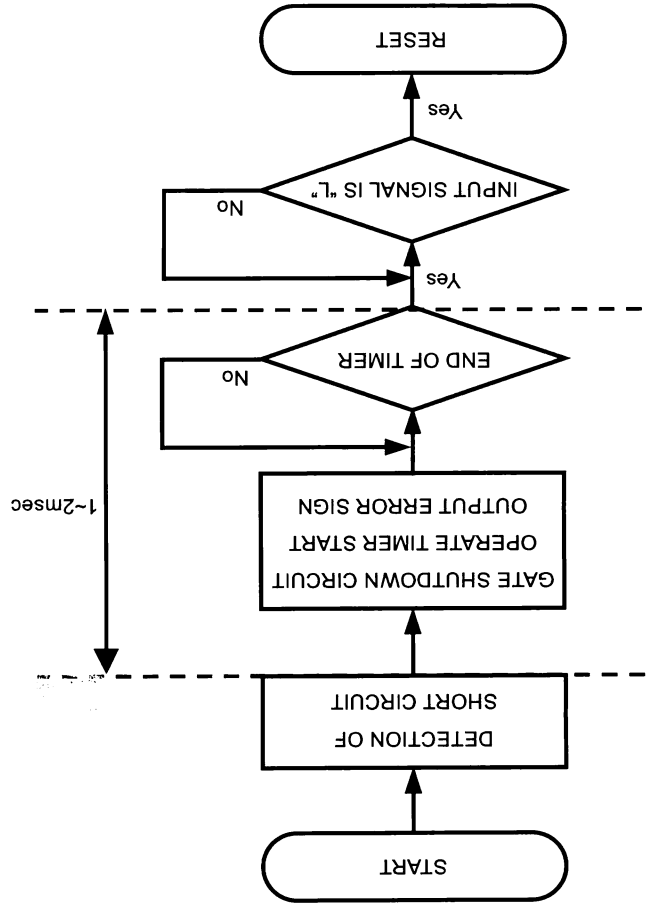
**PERFORMANCE CURVES**



**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 10µs or more.)
- (3) When the output rises, the controlled time detect short circuit(Typ 2.6µs) 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 pin 2 and 4.

**OPERATION FLOW ON DETECTING SHORTCIRCUIT**

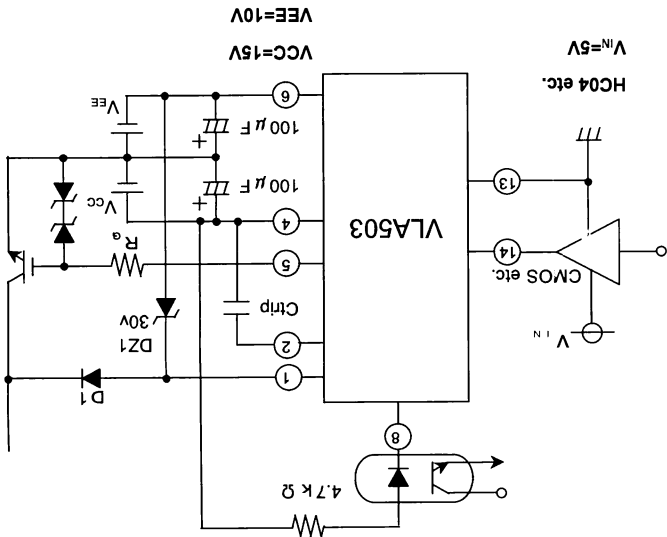


(\*) "L" output voltage with protection circuit operating is about  $-|V_{EE}| + 2V$ .

**PRECAUTION**

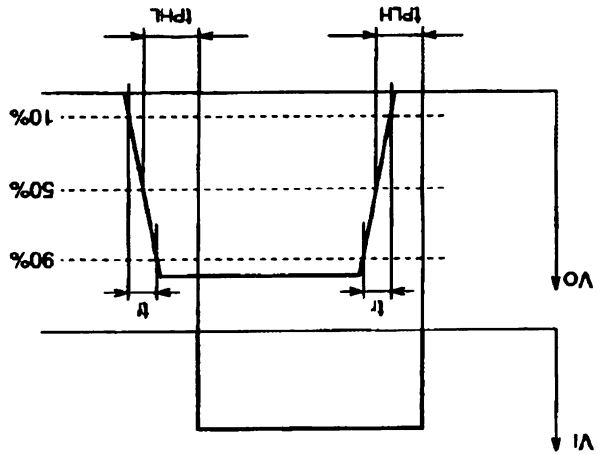
- (1) Voltage compensate capacitor are expected to be located as close as possible from the hybrid IC.
- (2) D1 requires the approximately the same voltage of power modules.
- (3) If reverse recovery time of D1 is long, pin1 is applied high voltage. In that case, counterplan for protection which insert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

**APPLICATION CIRCUIT EXAMPLE**

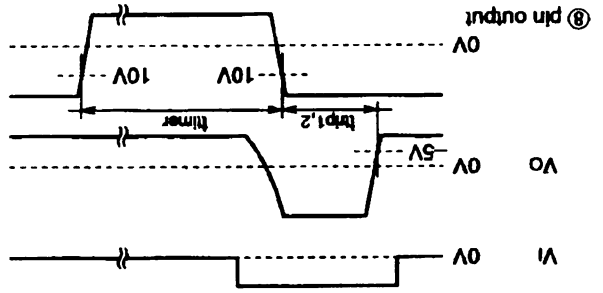


D1 : Fast recovery diode  
 Ctrip : Depend on Rg  
 VEE=10V  
 VCC=15V  
 (tr≤0.2µs)

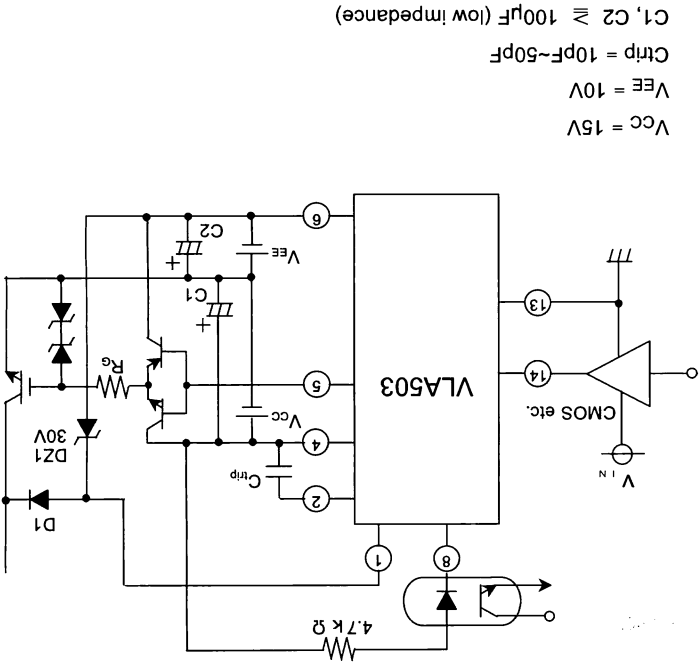
**DEFINITION OF CHARACTERISTICS**  
 (1) SWITCHING OPERATION



(2) OPERATION OF SHORT CIRCUIT PROTECTION

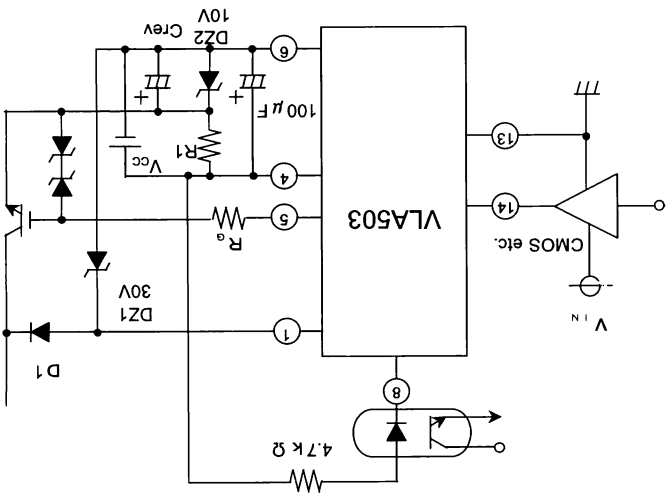


**APPLICATION EXAMPLE OF HIGH POWER MODULE**



$V_{CC} = 15V$   
 $V_{EE} = 10V$   
 $C_{trp} = 10pF \sim 50pF$   
 $C1, C2 \cong 100\mu F$  (low impedance)

**APPLICATION EXAMPLE OF SINGLE POWER SUPPLY**



$V_{CC} = 25V$   
 $C_{rev} = 100\mu F$   
 $R1 = 2.7k\Omega$   
 (\*) Don't input on-sign until the provided ( $R1 \times C_{rev}(s)$ ) time has been exceeded after supplied power to this hybrid IC.

**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	
<p><b>Packing</b></p> <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 deteriorate. Please take care in handling.</p>	<p><b>Carrying</b></p> <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>
<p><b>Storage</b></p> <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>	<p><b>Extended storage</b></p> <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> <p>To prevent any electrical damages, use Hics within the maximum ratings. The temperature, current, voltage, etc. must not exceed these conditions.</p>
<p><b>Maximum ratings</b></p> <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>	<p><b>Polarity</b></p>

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

- SAHAYA 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.

**Notes regarding these materials**

- These materials are intended as a reference to assist our customers in the selection of the SAHAYA products best suited to the customer's application; they don't convey any license under any intellectual property rights, or any other rights, belonging to SAHAYA or a third party.
- SAHAYA Electronics Corporation assumes no responsibility for any damage, or infringement of any third party's rights, originating in the use of any product data, diagrams, charts or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams and charts, represents information on products at the time of publication of these materials, and are subject to change by SAHAYA Electronics Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact SAHAYA Electronics Corporation or an authorized SAHAYA products distributor for the latest product information before purchasing product listed herein.
- SAHAYA Electronics Corporation products are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact SAHAYA electronics corporation or an authorized SAHAYA products distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater or in part these materials.
- The prior written approval of SAHAYA Electronics Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination. Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact SAHAYA Electronics Corporation or an authorized SAHAYA products distributor for further details on these materials or the products contained therein.

Marketing division, Marketing planning department  
6-41 Tsukuba, Isahaya, Nagasaki, 854-0065 Japan

