

# HD74LV540A

Octal Inverted Buffers / Drivers with 3-state Outputs

## HITACHI

ADE-205-277 (Z)

1st Edition

April 1999

### Description

The HD74LV540A has eight inverter drivers with three state outputs in a 20 pin package. When  $\overline{OE1}$  and  $\overline{OE2}$  is low level, this drivers set up output is enable. Low-voltage operation is suitable for battery-powered products (e.g., notebook computers), and the low-power consumption extends the battery life.

### Features

- $V_{CC} = 2.0\text{ V}$  to  $5.5\text{ V}$  operation
- All inputs  $V_{IH}$  (Max.) =  $5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O$  (Max.) =  $5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$ )
- Typical  $V_{OL}$  ground bounce  $< 0.8\text{ V}$  (@  $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Typical  $V_{OH}$  undershoot  $> 2.3\text{ V}$  (@  $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Output current  $\pm 8\text{ mA}$  (@  $V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 16\text{ mA}$  (@  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

### Function Table

#### Inputs

$\overline{OE1}$	$\overline{OE2}$	A	Output $\overline{Y}$
L	L	L	H
L	L	H	L
H	X	X	Z
X	H	X	Z

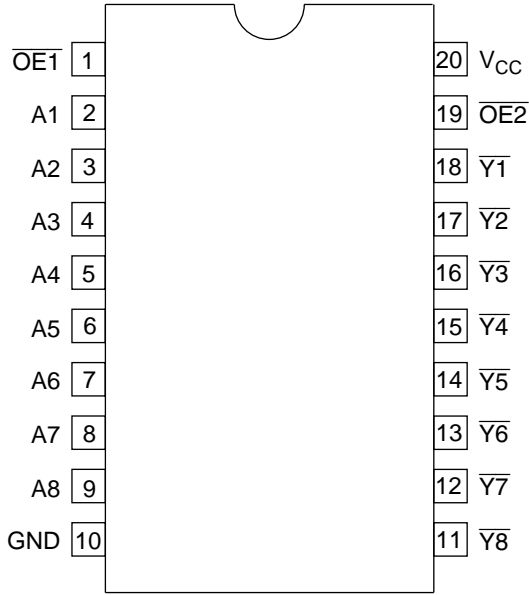
Note: H: High level

L: Low level

X: Immaterial

Z: High impedance

## Pin Arrangement



(Top view)

**Absolute Maximum Ratings**

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V	
Input voltage range* <sup>1</sup>	$V_I$	-0.5 to 7.0	V	
Output voltage range* <sup>1,2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$ -0.5 to 7.0	V	Output: H or L $V_{CC}$ : OFF or Output: Z
Input clamp current	$I_{IK}$	-20	mA	$V_I < 0$
Output clamp current	$I_{OK}$	$\pm 50$	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	$\pm 35$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 70$	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* <sup>3</sup>	$P_T$	835	mW	SOP
		757		TSSOP
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$	

Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

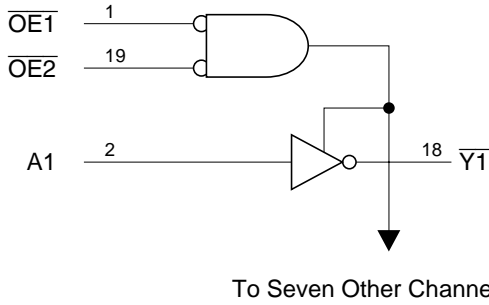
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of  $150^\circ\text{C}$ .

## Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	2.0	5.5	V	
Input voltage range	$V_I$	0	5.5	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	H or L
		0	5.5		High impedance state
Output current	$I_{OH}$	—	-50	$\mu A$	$V_{CC} = 2.0 V$
		—	-2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	-8		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	-16	$V_{CC} = 4.5 \text{ to } 5.5 V$	
	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0 V$
		—	2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	8		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	16	$V_{CC} = 4.5 \text{ to } 5.5 V$	
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3 \text{ to } 2.7 V$
		0	100		$V_{CC} = 3.0 \text{ to } 3.6 V$
		0	20		$V_{CC} = 4.5 \text{ to } 5.5 V$
Operating free-air temperature	$T_a$	-40	85	$^{\circ}C$	

Note: Unused or floating inputs must be held high or low.

## Logic Diagram



**DC Electrical Characteristics**

- $T_a = -40$  to  $85^\circ\text{C}$

Item	Symbol	$V_{CC}$ (V)*	Min	Typ	Max	Unit	Test Conditions
Input voltage	$V_{IH}$	2.0	1.5	—	—	V	
		2.3 to 2.7	$V_{CC} \times 0.7$	—	—		
		3.0 to 3.6	$V_{CC} \times 0.7$	—	—		
		4.5 to 5.5	$V_{CC} \times 0.7$	—	—		
	$V_{IL}$	2.0	—	—	0.5		
		2.3 to 2.7	—	—	$V_{CC} \times 0.3$		
		3.0 to 3.6	—	—	$V_{CC} \times 0.3$		
		4.5 to 5.5	—	—	$V_{CC} \times 0.3$		
Output voltage	$V_{OH}$	Min to Max	$V_{CC} - 0.1$	—	—	V	$I_{OH} = -50 \mu\text{A}$
		2.3	2.0	—	—		$I_{OH} = -2 \text{ mA}$
		3.0	2.48	—	—		$I_{OH} = -8 \text{ mA}$
		4.5	3.8	—	—		$I_{OH} = -16 \text{ mA}$
	$V_{OL}$	Min to Max	—	—	0.1		$I_{OL} = 50 \mu\text{A}$
		2.3	—	—	0.4		$I_{OL} = 2 \text{ mA}$
		3.0	—	—	0.44		$I_{OL} = 8 \text{ mA}$
		4.5	—	—	0.55		$I_{OL} = 16 \text{ mA}$
Input current	$I_{IN}$	0 to 5.5	—	—	$\pm 1$	$\mu\text{A}$	$V_{IN} = 5.5 \text{ V or GND}$
Off-state output current	$I_{OZ}$	5.5	—	—	$\pm 5$	$\mu\text{A}$	$V_O = V_{CC} \text{ or GND}$
Quiescent supply current	$I_{CC}$	5.5	—	—	20	$\mu\text{A}$	$V_{IN} = V_{CC} \text{ or GND, } I_O = 0$
Output leakage current	$I_{OFF}$	0	—	—	5	$\mu\text{A}$	$V_I \text{ or } V_O = 0 \text{ V to } 5.5 \text{ V}$
Input capacitance	$C_{IN}$	3.3	—	3	—	pF	$V_I = V_{CC} \text{ or GND}$

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

## Switching Characteristics

- $V_{CC} = 2.5 \pm 0.2 \text{ V}$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$	—	7.4	12.0	1.0	14.5	ns	$C_L = 15 \text{ pF}$	A	$\bar{Y}$
	$t_{PHL}$	—	9.3	16.8	1.0	18.5		$C_L = 50 \text{ pF}$		
Enable time	$t_{ZH}$	—	8.2	17.4	1.0	21.0	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	$t_{ZL}$	—	9.6	22.2	1.0	25.5		$C_L = 50 \text{ pF}$		
Disable time	$t_{HZ}$	—	7.5	16.0	1.0	19.0	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	$t_{LZ}$	—	10.5	22.3	1.0	25.5		$C_L = 50 \text{ pF}$		

- $V_{CC} = 3.3 \pm 0.3 \text{ V}$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$	—	5.3	7.0	1.0	8.5	ns	$C_L = 15 \text{ pF}$	A	$\bar{Y}$
	$t_{PHL}$	—	6.8	10.5	1.0	12.0		$C_L = 50 \text{ pF}$		
Enable time	$t_{ZH}$	—	6.2	10.5	1.0	12.5	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	$t_{ZL}$	—	7.6	14.0	1.0	16.0		$C_L = 50 \text{ pF}$		
Disable time	$t_{HZ}$	—	5.3	10.5	1.0	12.5	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	$t_{LZ}$	—	7.0	15.4	1.0	17.5		$C_L = 50 \text{ pF}$		

**Switching Characteristics (cont)**

- $V_{CC} = 5.0 \pm 0.5 \text{ V}$

**Ta = 25°C**                      **Ta = -40 to 85°C**

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propa- gation delay time	$t_{PLH}$	—	3.8	5.0	1.0	6.0	ns	$C_L = 15 \text{ pF}$	A	$\bar{Y}$
	$t_{PHL}$	—	5.0	7.0	1.0	8.0				
Enable time	$t_{ZH}$	—	4.6	7.2	1.0	8.5	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	$t_{ZL}$	—	5.8	9.2	1.0	10.5				
Disable time	$t_{HZ}$	—	3.6	6.8	1.0	8.0	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	$t_{LZ}$	—	5.3	8.8	1.0	10.0				

## Output-skew Characteristics

Item	Symbol	V <sub>CC</sub> = (V)	Ta = 25°C		Ta = -40 to 85°C		Unit
			Min	Max	Min	Max	
Output skew	t <sub>sk(O)</sub>	2.3 to 2.7	—	2.0	—	2.0	ns
		3.0 to 3.6	—	1.5	—	1.5	
		4.5 to 5.5	—	1.0	—	1.0	

Note: Skew between any outputs of the same package switching in the same direction. This parameter is warranted but not production tested.

## Operating Characteristics

- C<sub>L</sub> = 50 pF

Item	Symbol	V <sub>CC</sub> = (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C <sub>PD</sub>	3.3	—	23.0	—	pF	f = 10 MHz
		5.0	—	27.5	—		

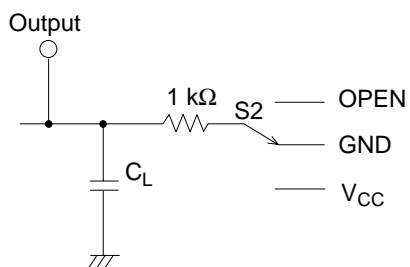
## Noise Characteristics

- C<sub>L</sub> = 50 pF

Item	Symbol	V <sub>CC</sub> = (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic V <sub>OL</sub>	V <sub>OL(P)</sub>	3.3	—	0.4	0.8	V	
Quiet output, minimum dynamic V <sub>OL</sub>	V <sub>OL(V)</sub>	3.3	—	-0.3	-0.8		
Quiet output, minimum dynamic V <sub>OH</sub>	V <sub>OH(V)</sub>	3.3	—	2.9	—	V	
High-level dynamic input voltage	V <sub>IH(D)</sub>	3.3	2.31	—	—		
Low-level dynamic input voltage	V <sub>IL(D)</sub>	3.3	—	—	0.99		



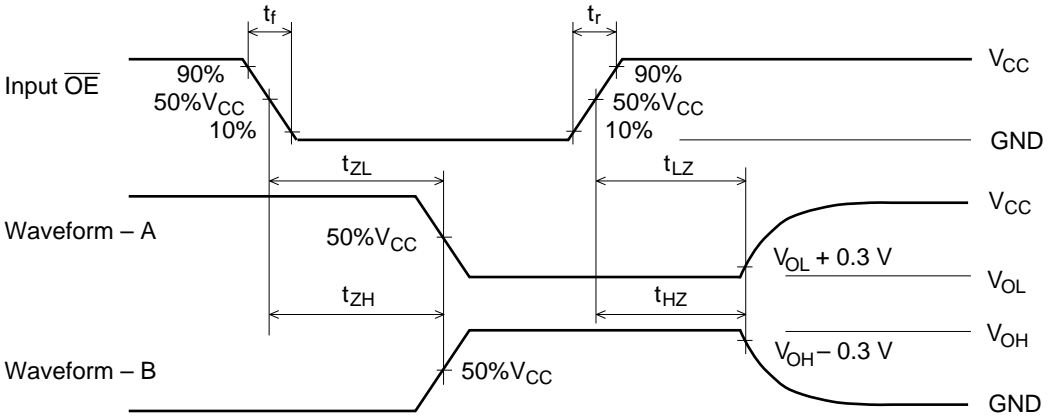
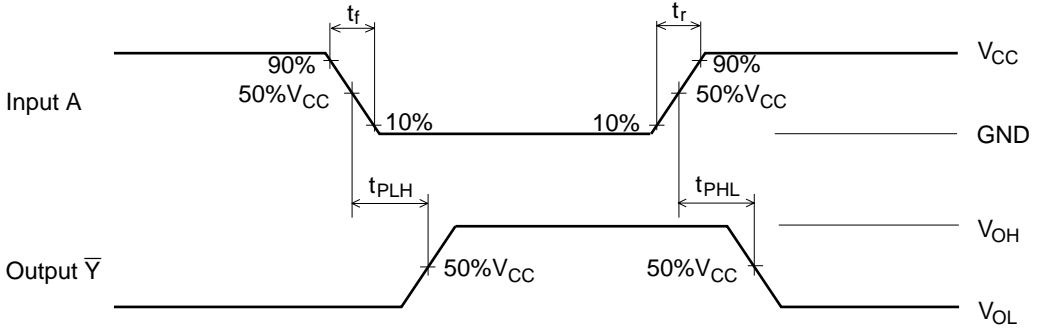
Test Circuit



TEST	S2
$t_{PLH}/t_{PHL}$	OPEN
$t_{ZH}/t_{HZ}$	GND
$t_{ZL}/t_{LZ}$	VCC

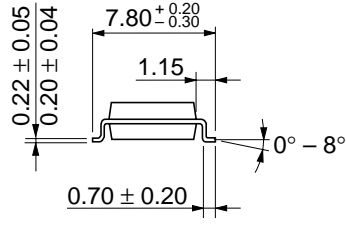
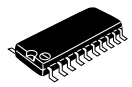
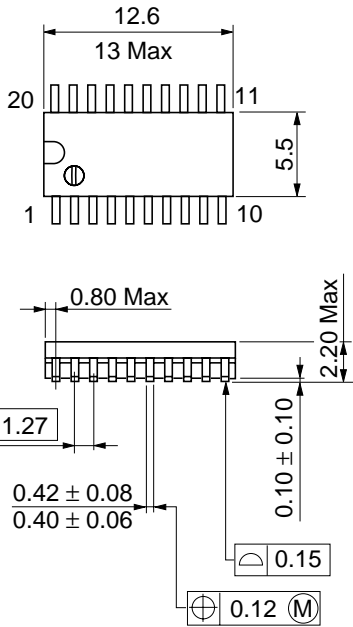
Note:  $C_L$  includes the probe and jig capacitance.

• Waveform



- Notes:
1.  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$
  2. Input waveform:  $\text{PRR} \leq 1 \text{ MHz}$ , duty cycle 50%
  3. Waveform-A is for an output with internal conditions such that the output is low except when disabled by the output control.
  4. Waveform-B is for an output with internal conditions such that the output is high except when disabled by the output control.

Package Dimensions

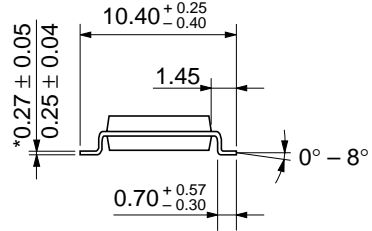
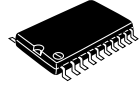
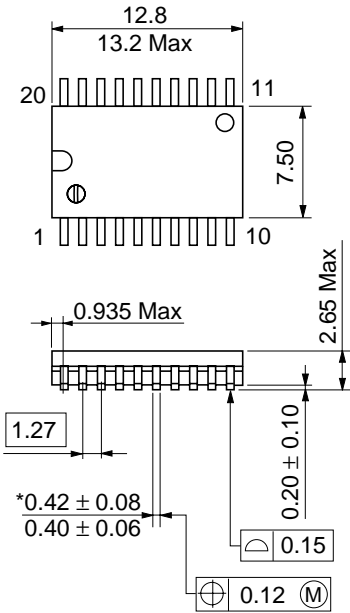


Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-20DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.31 g

# HD74LV540A

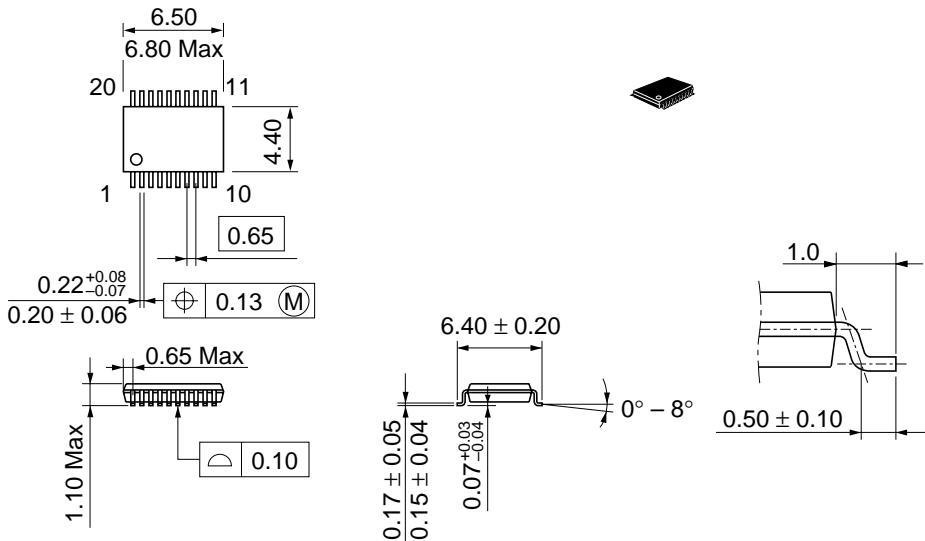
Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-20DB
JEDEC	Conforms
EIAJ	—
Weight (reference value)	0.52 g

**HITACHI**



Dimension including the plating thickness  
Base material dimension

Hitachi Code	TTP-20DA
JEDEC	—
EIAJ	—
Weight (reference value)	0.07 g

## Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

# HITACHI

## Hitachi, Ltd.

Semiconductor & Integrated Circuits.  
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan  
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL      North America      : <http://semiconductor.hitachi.com/>  
             Europe                 : <http://www.hitachi-eu.com/hel/ecg>  
             Asia (Singapore)        : <http://www.has.hitachi.com.sg/grp3/sicd/index.htm>  
             Asia (Taiwan)             : [http://www.hitachi.com.tw/E/Product/SICD\\_Frame.htm](http://www.hitachi.com.tw/E/Product/SICD_Frame.htm)  
             Asia (HongKong)         : <http://www.hitachi.com.hk/eng/bo/grp3/index.htm>  
             Japan                        : <http://www.hitachi.co.jp/Sicd/indx.htm>

## For further information write to:

Hitachi Semiconductor  
(America) Inc.  
179 East Tasman Drive,  
San Jose, CA 95134  
Tel: <1> (408) 433-1990  
Fax: <1> (408) 433-0223

Hitachi Europe GmbH  
Electronic components Group  
Dornacher Straße 3  
D-85622 Feldkirchen, Munich  
Germany  
Tel: <49> (89) 9 9180-0  
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.  
Electronic Components Group.  
Whitebrook Park  
Lower Cookham Road  
Maidenhead  
Berkshire SL6 8YA, United Kingdom  
Tel: <44> (1628) 585000  
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.  
16 Collyer Quay #20-00  
Hitachi Tower  
Singapore 049318  
Tel: 535-2100  
Fax: 535-1533

Hitachi Asia Ltd.  
Taipei Branch Office  
3F, Hung Kuo Building, No.167,  
Tun-Hwa North Road, Taipei (105)  
Tel: <886> (2) 2718-3666  
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.  
Group III (Electronic Components)  
7/F., North Tower, World Finance Centre,  
Harbour City, Canton Road, Tsim Sha Tsui,  
Kowloon, Hong Kong  
Tel: <852> (2) 735 9218  
Fax: <852> (2) 730 0281  
Telex: 40815 HITEC HX

Copyright ' Hitachi, Ltd., 1999. All rights reserved. Printed in Japan.

## HITACHI