

# HD74AC194

4-bit Bidirectional Universal Shift Register

**HITACHI**

## Description

This bidirectional shift register is designed to incorporate virtually all of the features a system designer may want in a shift register. It features parallel inputs, parallel outputs, right shift and left shift serial inputs, operating mode control inputs, and a direct overriding clear line. The register has four distinct modes of operation: parallel (broadside) load, shift right (in the direction  $Q_0$  toward  $Q_3$ ); shift left; inhibit clock (do nothing).

Synchronous parallel loading is accomplished by applying the four bits of data and taking both mode control inputs,  $S_0$  and  $S_1$ , high. The data are loaded into their respective flip-flops and appear at the output after the positive transition of the clock input. During loading, serial data flow is inhibited. Shift right is accomplished synchronously with the rising edge of the clock pulse when  $S_0$  is high and  $S_1$  is low. Serial data for this mode is entered at the shift right data input. When  $S_0$  is low and  $S_1$  is high, data shifts left synchronously and new data is entered at the shift left serial input. Clocking of the flip-flops is inhibited when both mode control inputs are low. The mode control inputs should be changed only when the clock input is high.

## Features

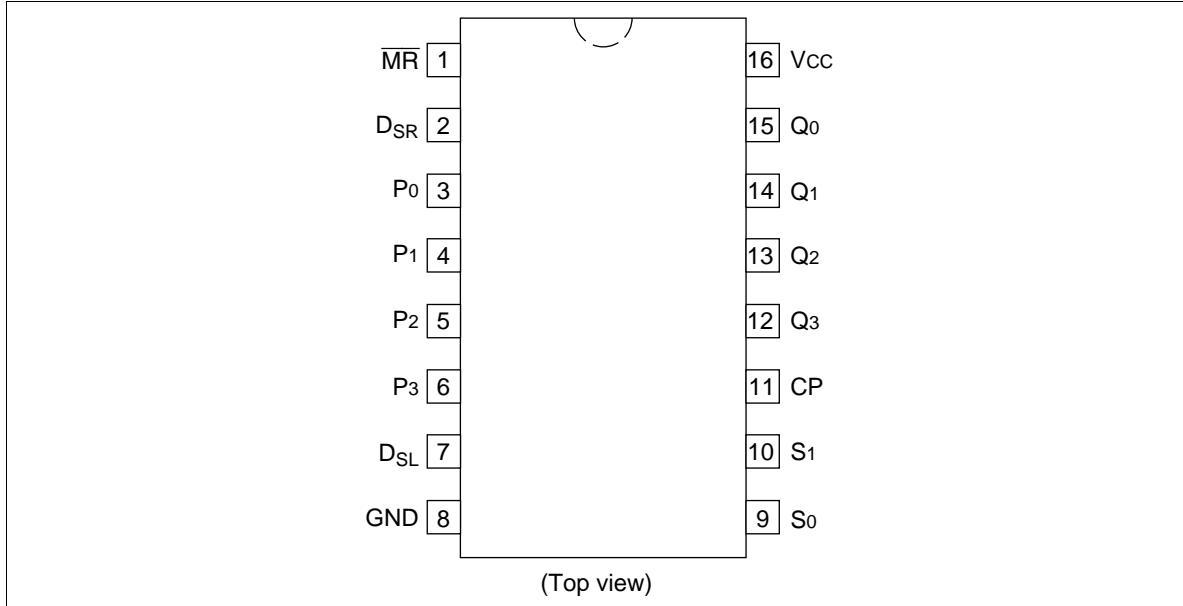
- Asynchronous Master Reset
- Hold (Do Nothing) Mode
- Outputs Source/Sink 24 mA

---

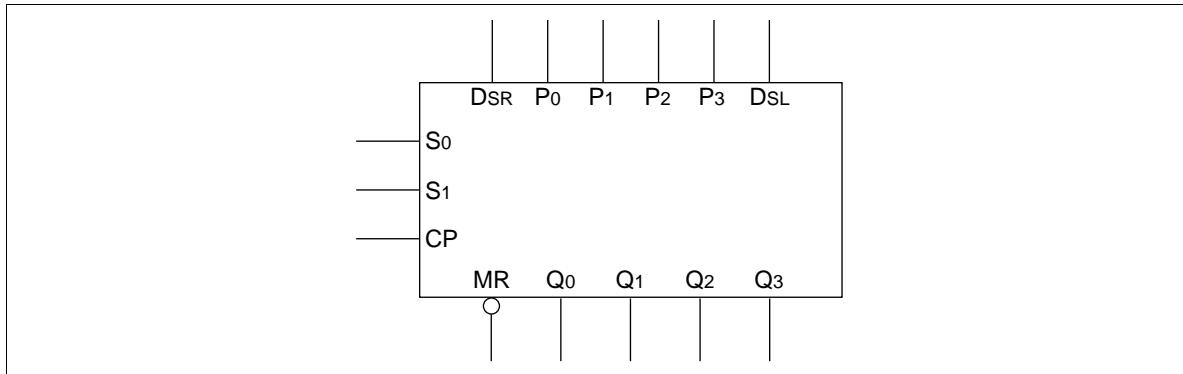
## HD74AC194

---

### Pin Arrangement



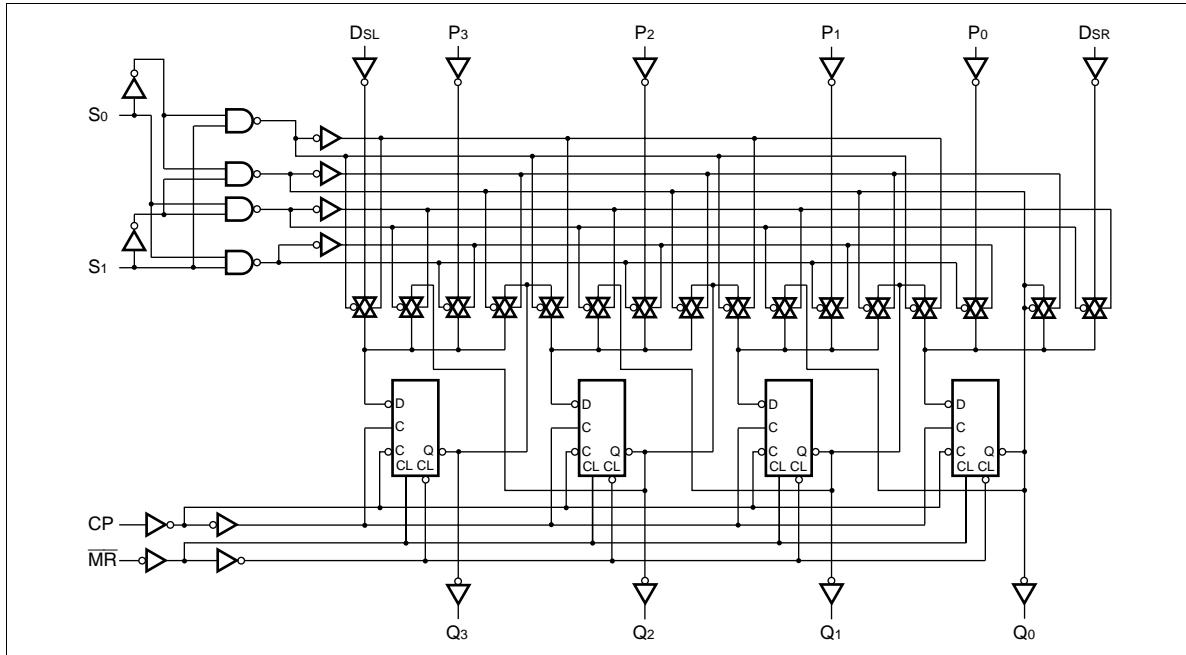
### Logic Symbol



### Pin Names

- $S_0, S_1$  Mode Control Inputs
- $P_0$  to  $P_3$  Parallel Data Inputs
- $D_{SR}$  Serial Data Input (Shift Right)
- $D_{SL}$  Serial Data Input (Shift Left)
- $CP$  Clock Pulse Input (Active Rising Edge)
- $\overline{MR}$  Asynchronous Master Reset Input (Active LOW)
- $Q_0$  to  $Q_3$  Parallel Outputs

**Logic Diagram**



**Mode Select Table**

Operating Mode	Inputs						Output			
	MR	S <sub>1</sub>	S <sub>0</sub>	D <sub>SR</sub>	D <sub>SL</sub>	P <sub>n</sub>	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
Reset	L	X	X	X	X	X	L	L	L	L
Hold	H	L	L	X	X	X	q <sub>0</sub>	q <sub>1</sub>	q <sub>2</sub>	q <sub>3</sub>
Shift Left	H	H	L	X	L	X	q <sub>1</sub>	q <sub>2</sub>	q <sub>3</sub>	L
	H	H	L	X	H	X	q <sub>1</sub>	q <sub>2</sub>	q <sub>3</sub>	H
Shift Right	H	L	H	L	X	X	L	q <sub>0</sub>	q <sub>1</sub>	q <sub>2</sub>
	H	L	H	H	X	X	H	q <sub>0</sub>	q <sub>1</sub>	q <sub>2</sub>
Parallel Load	H	H	H	X	X	P <sub>n</sub>	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>

H : HIGH Voltage Level

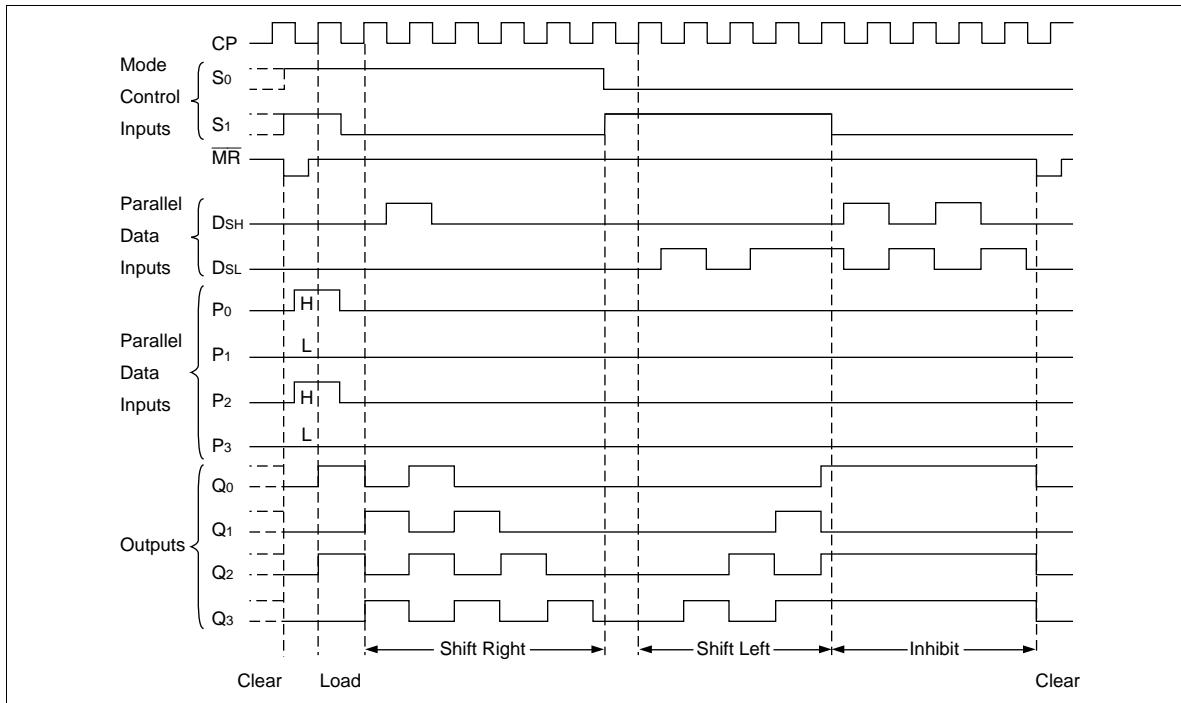
L : LOW Voltage Level

p<sub>n</sub> (q<sub>n</sub>) : Lower case letters indicate the state of the referenced input (or output) one setup time prior to the LOW-to-HIGH clock transition

X : Immaterial

## HD74AC194

### Timing Diagram



### DC Characteristics (unless otherwise specified)

Item	Symbol	Max	Unit	Condition
Maximum quiescent supply current	$I_{CC}$	80	$\mu A$	$V_{IN} = V_{CC}$ or ground, $V_{CC} = 5.5$ V, $T_a$ = Worst case
Maximum quiescent supply current	$I_{CC}$	8.0	$\mu A$	$V_{IN} = V_{CC}$ or ground, $V_{CC} = 5.5$ V, $T_a = 25^\circ C$

---

## HD74AC194

---

### AC Characteristics: HD74AC194

Item	Symbol	V <sub>cc</sub> (V) <sup>*1</sup>	Ta = +25°C C <sub>L</sub> = 50 pF			Ta = -40°C to +85°C C <sub>L</sub> = 50 pF			Unit
			Min	Typ	Max	Min	Max		
Maximum clock frequency	f <sub>max</sub>	3.3	7.5	—	65			MHz	
		5.0	100	—	85				
Propagation delay CP to Q <sub>n</sub>	t <sub>PLH</sub>	3.3	1.0	—	13.0	1.0	15.0	ns	
		5.0	1.0	—	10.0	1.0	11.5		
Propagation delay CP to Q <sub>n</sub>	t <sub>PHL</sub>	3.3	1.0	—	13.0	1.0	15.0	ns	
		5.0	1.0	—	10.0	1.0	11.5		
Propagation delay MR to Q <sub>n</sub>	t <sub>PHL</sub>	3.3	1.0	—	10.5	1.0	12.5	ns	
		5.0	1.0	—	8.0	1.0	9.0		

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V

Voltage Range 5.0 is 5.0 V ± 0.5 V

### AC Operating Requirements: HD74AC194

Item	Symbol	V <sub>cc</sub> (V) <sup>*1</sup>	Ta = +25°C C <sub>L</sub> = 50 pF		Ta = -40°C to +85°C C <sub>L</sub> = 50 pF		Unit
			Typ	Guaranteed Minimum	Typ	Guaranteed Minimum	
Setup time, HIGH or LOW	t <sub>su</sub>	3.3	—	5.5	7.0	ns	
Pn or D <sub>SR</sub> or D <sub>SL</sub> to CP		5.0	—	4.0	5.0		
Hold time, HIGH or LOW	t <sub>h</sub>	3.3	—	2.0	3.0	ns	
Pn or D <sub>SR</sub> or D <sub>SL</sub> to CP		5.0	—	1.5	2.0		
Setup time, HIGH or LOW	t <sub>su</sub>	3.3	—	6.0	7.5	ns	
S <sub>n</sub> to CP		5.0	—	4.5	5.5		
Hold time, HIGH or LOW	t <sub>h</sub>	3.3	—	0.0	0.0	ns	
S <sub>n</sub> to CP		5.0	—	0.0	0.0		
Recovery time	t <sub>rec</sub>	3.3	—	0.5	0.5	ns	
MR to CP		5.0	—	0.5	0.5		
Pulse width	t <sub>w</sub>	3.3	—	5.5	7.0	ns	
		5.0	—	4.5	5.0		

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V

Voltage Range 5.0 is 5.0 V ± 0.5 V

---

## **HD74AC194**

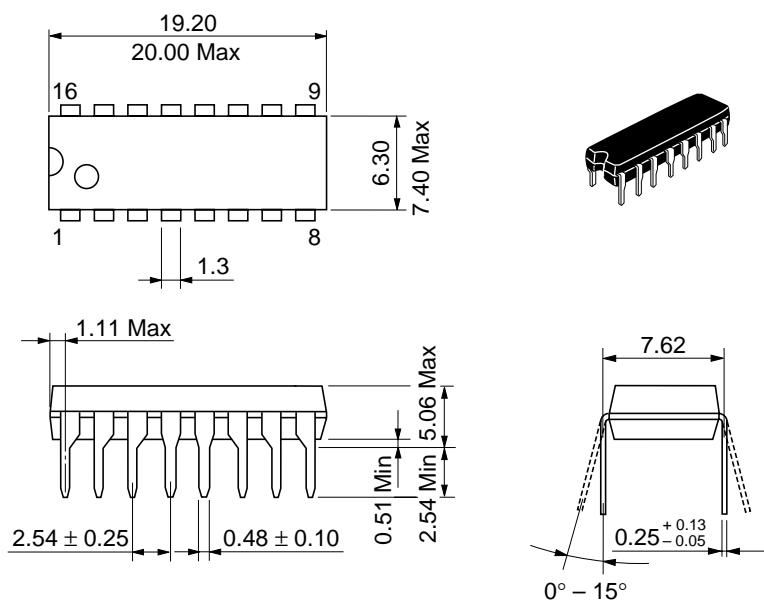
---

### **Capacitance**

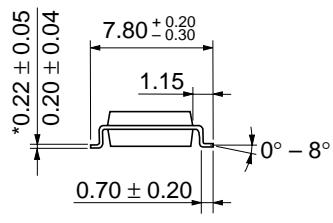
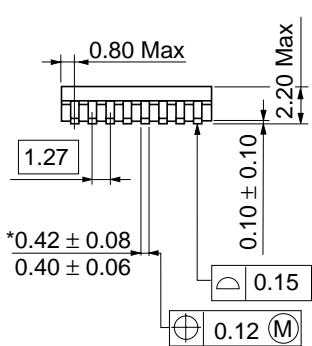
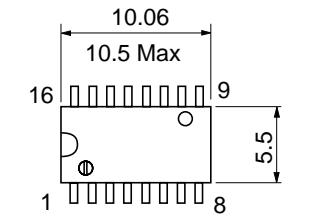
<b>Item</b>	<b>Symbol</b>	<b>Typ</b>	<b>Unit</b>	<b>Condition</b>
Input capacitance	$C_{IN}$	4.5	pF	$V_{CC} = 5.5\text{ V}$
Power dissipation capacitance	$C_{PD}$	100	pF	$V_{CC} = 5.0\text{ V}$

---

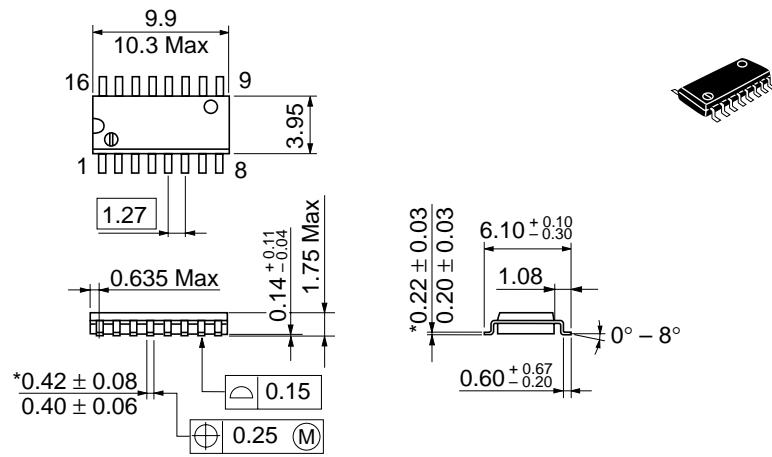
Unit: mm



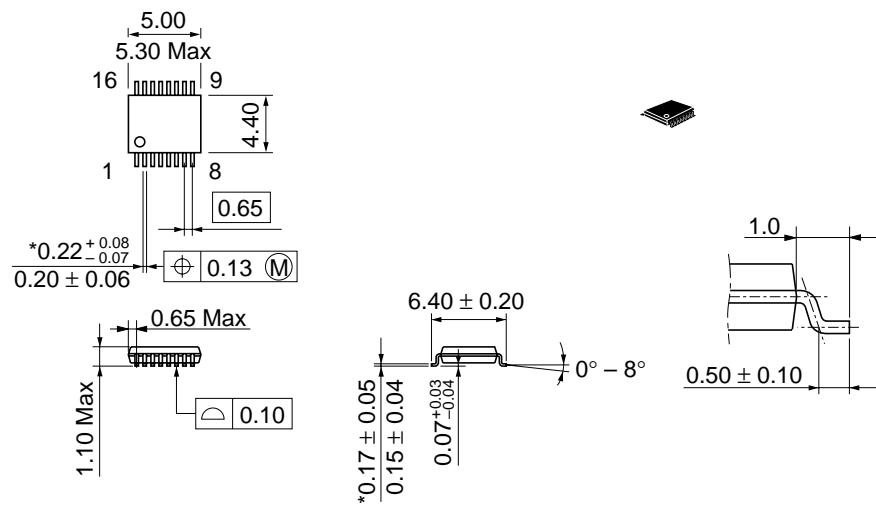
Unit: mm



Unit: mm



Unit: mm



---

---

## 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, 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	NorthAmerica	: <a href="http://semiconductor.hitachi.com/">http://semiconductor.hitachi.com/</a>
	Europe	: <a href="http://www.hitachi-eu.com/hel/ecg">http://www.hitachi-eu.com/hel/ecg</a>
	Asia (Singapore)	: <a href="http://www.has.hitachi.com.sg/grp3/sicd/index.htm">http://www.has.hitachi.com.sg/grp3/sicd/index.htm</a>
	Asia (Taiwan)	: <a href="http://www.hitachi.com.tw/E/Product/SICD_Frame.htm">http://www.hitachi.com.tw/E/Product/SICD_Frame.htm</a>
	Asia (HongKong)	: <a href="http://www.hitachi.com.hk/eng/bo/grp3/index.htm">http://www.hitachi.com.hk/eng/bo/grp3/index.htm</a>
	Japan	: <a href="http://www.hitachi.co.jp/Sicd/idx.htm">http://www.hitachi.co.jp/Sicd/idx.htm</a>

**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
--	---	--	--