

# HA17903, HA17393 Series

## Dual Comparator

# HITACHI

### Description

HA17903 and HA17393 are comparators designed for car use and control system use.

They provide wide voltage range with single power source, and the change of supply current is small, because it is independent of the supply voltage. They can be widely applied, such as limit comparator, simple analog/digital converter, pulse/square wave/time delay generator, wide range VCO, MOS clock timer, multivibrator, high voltage logic gate, etc.

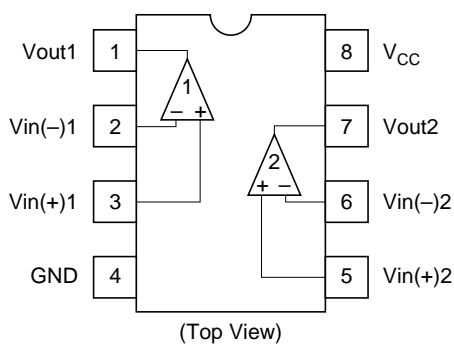
### Features

- Wide supply voltage: 2 to 36V
- Very low supply current: 0.8mA
- Small input bias: 25nA
- Small input offset current: 3nA
- Small input offset voltage: 2mV
- Common mode input voltage range including ground.
- Small output saturation voltage: 1mV (5μA)  
70mV (1mA)
- Output voltage is compatible with CMOS logic system.

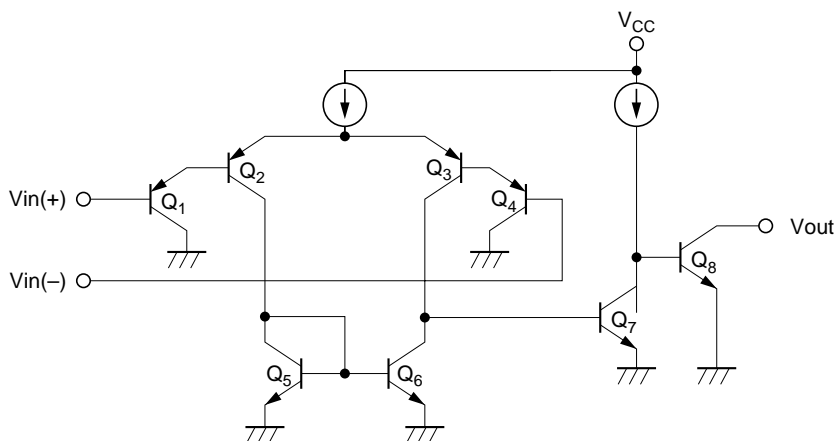
### Ordering Information

Type No.	Application	Package
HA17903PSJ	Car use	DP-8
HA17903FPJ		FP-8D
HA17903FPK		FP-8D
HA17903PS	Industrial use	DP-8
HA17903FP		FP-8D
HA17393	Commercial use	DP-8
HA17393F		FP-8D

## Pin Arrangement



### Circuit Schematic (1/2)



# HITACHI

## Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings							Unit
		HA17903 PS	HA17903 PSJ	HA17903 FP	HA17903 FPJ	HA17903 FPK	HA17393	HA17393 F	
Supply voltage	V <sub>CC</sub>	36	36	36	36	36	36	36	V
Dfferential input voltage	V <sub>IN(diff)</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V
Input voltage	V <sub>IN</sub>	−0.3 to + V <sub>CC</sub>	−0.3 to + V <sub>CC</sub>	−0.3 to + V <sub>CC</sub>	−0.3 to + V <sub>CC</sub>	−0.3 to + V <sub>CC</sub>	−0.3 to + V <sub>CC</sub>	−0.3 to + V <sub>CC</sub>	V
Output short current	I <sub>OS</sub> <sup>*3</sup>	constant	constant	constant	constant	constant	constant	constant	
Power dissipation	P <sub>T</sub>	570 <sup>*1</sup>	570 <sup>*1</sup>	385 <sup>*2</sup>	385 <sup>*1</sup>	385 <sup>*2</sup>	570 <sup>*1</sup>	385 <sup>*2</sup>	mW
Operating temperature	Topr	−20 to +75	−40 to +85	−20 to +75	−40 to +85	−40 to +125	−20 to +75	−20 to +75	°C
Storage temperature	Tstg	−55 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +150	−55 to +125	−55 to +125	°C

- Note:
1. These are the allowable values up to Ta = 55 °C. Derate by 8.3mW/°C above that temperature.
  2. These are the allowable values up to Ta = 45 °C mounting on 30% wiring density glass epoxy board. Derate by 7.14mW/°C above that temperature.
  3. Short circuit between the output and VCC will be a cause to destroy the circuit. The maximum output current is about 20mA for any supply voltage.

## Electrical Characteristics-1 ( $V_{CC} = 5V$ , $T_a = 25^{\circ}C$ )

Item	Symbol	Min	Typ	Max	Unit	Test condition
Input offset voltage* <sup>1</sup>	$V_{IO}$	—	2.0	5.0	mV	
Input bias current* <sup>2</sup>	$I_{IB}$	—	25	250	nA	$I_{IN(+)}$ or $I_{IN(-)}$
Input offset current	$I_{IO}$	—	3	50	nA	$ I_{IN(+)} - I_{IN(-)} $
Common mode input voltage* <sup>3</sup>	$V_{CM+}$	3.5	—	—	V	
	$V_{CM-}$	—	—	0	V	
Supply current	$I_{CC}$	—	0.8	2.0	mA	All comparators: $R_L = \infty$ , All channels on
Voltage gain	$A_{VD}$	—	200	—	V/mV	$V_{CC} = 15V$ , $R_L \geq 15k\Omega$
Response time* <sup>4</sup>	$t_R$	—	1.3	—	$\mu s$	$V_{RL} = 5V$ , $R_L = 5.1k\Omega$
Large signal response time	$t_{RI}$	—	300	—	ns	$V_{IN}$ = TTL Threshold width, $V_{REF} = 1.4V$
Out put sink current	$I_{osink}$	6	16	—	mA	$V_{IN(-)} \geq 1V$ , $V_{IN(+)} = 0$ , $V_O \leq 1.5V$
Output saturation voltage	$V_O(sat)$	—	—	400	mA	$V_{IN(-)} \geq 1V$ , $V_{IN(+)} = 0$ , $I_{osink} = 4mA$
Output leak current	$I_{LO}$	—	0.1	—	nA	$V_{IN(-)} = 0$ , $V_{IN(+)} \geq 1V$ , $V_O = 5V$

Notes: 1.  $V_{REF} = 1.4V$  and  $R_S = 50\Omega$ , when  $V_O = 1.4V$  at output switching point.  
2. Under linear operation.  
3. Common mode input voltage or each one of the input signal should not be less than  $-0.3V$ .  
4. This is a value to 100mV input step voltage with 5mV over drive.

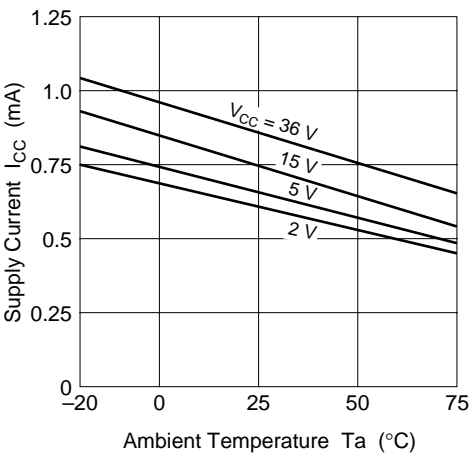
## Electrical Characteristics-2 ( $V_{CC} = 5V$ , $T_a = -40$ to $+125^{\circ}C$ )

Item	Symbol	Min	Typ	Max	Unit	Test condition
Input offset voltage* <sup>1</sup>	$V_{IO}$	—	—	5.0	mV	
Input offset current	$I_{IO}$	—	—	200	nA	$ I_{IN(+)} - I_{IN(-)} $
Input bias current	$I_{IB}$	—	—	500	nA	Output linear range
Common mode input voltage	$V_{CM}$	0	—	$V_{CC} - 2.0$	V	
Output saturation voltage	$V_O(sat)$	—	—	440	mV	$V_{IN(-)} \geq 1V$ , $V_{IN(+)} = 0$ , $I_{osink} \leq 4mA$
Output leak current	$I_{LO}$	—	1.0	—	$\mu A$	$V_{IN(-)} = 0$ , $V_{IN(+)} \geq 1V$ , $V_O = 30V$
Supply current	$I_{CC}$	—	—	4.0	mA	All comparators: $R_L = \infty$ , All channels on

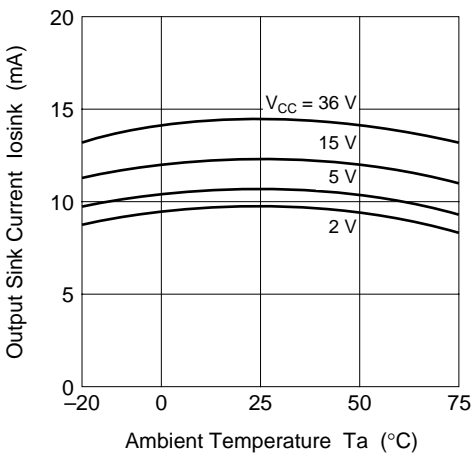
Note: 1.  $V_{REF} = 1.4V$  and  $R_S = 50\Omega$ , when  $V_O = 1.4V$  at the output switching point.

Characteristics Curve

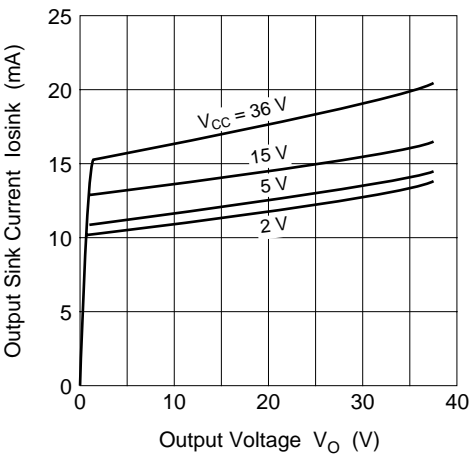
Supply Current vs. Ambient Temperature



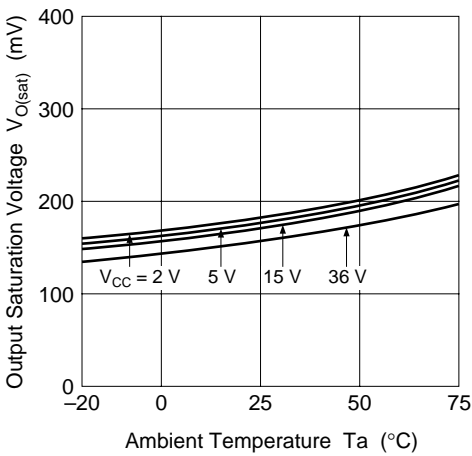
Output Sink Current vs. Ambient Temperature

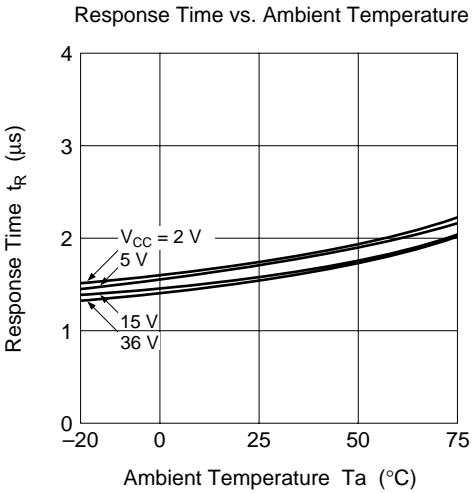
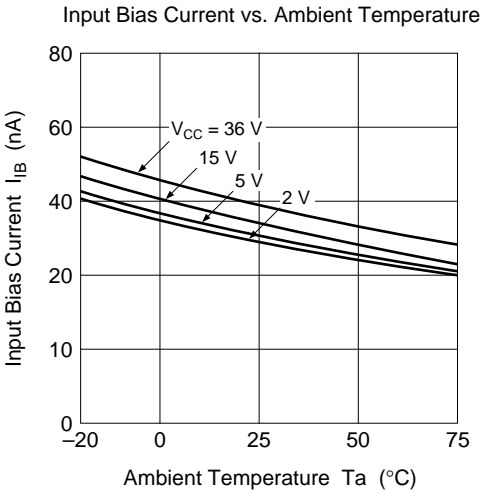
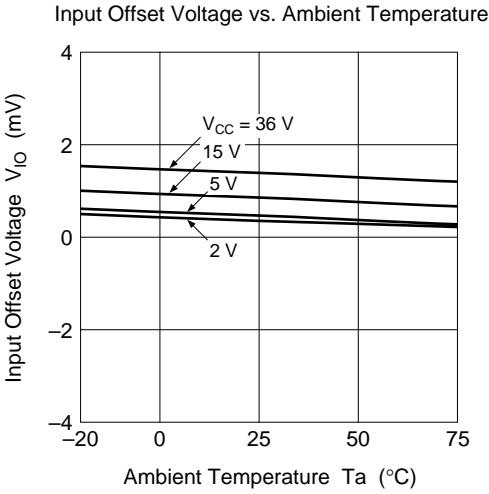
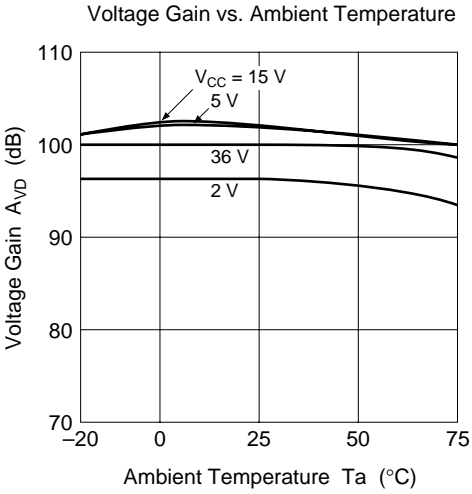


Output Sink Current vs. Output Voltage



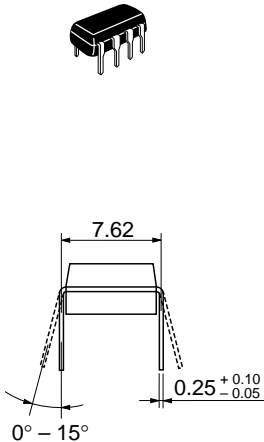
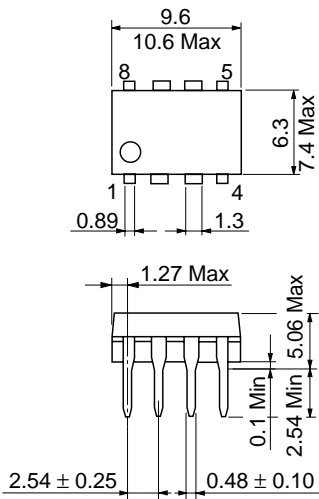
Output Saturation Voltage vs. Ambient Temperature





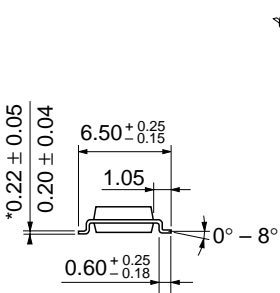
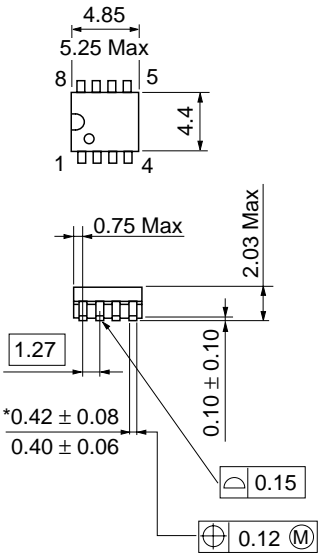
Package Dimensions

Unit: mm



Hitachi Code	DP-8
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.54 g

Unit: mm



Hitachi Code	FP-8D
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.10 g

\*Dimension including the plating thickness  
Base material dimension

**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      NorthAmerica      : <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 StraÙe 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., 1998. All rights reserved. Printed in Japan.