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# HA17903A Series

## Dual Comparators

REJ03D0807-0100

Rev.1.00

Mar 10, 2005

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### Description

The HA17903A series products are comparators designed for general purpose, especially for power control systems.

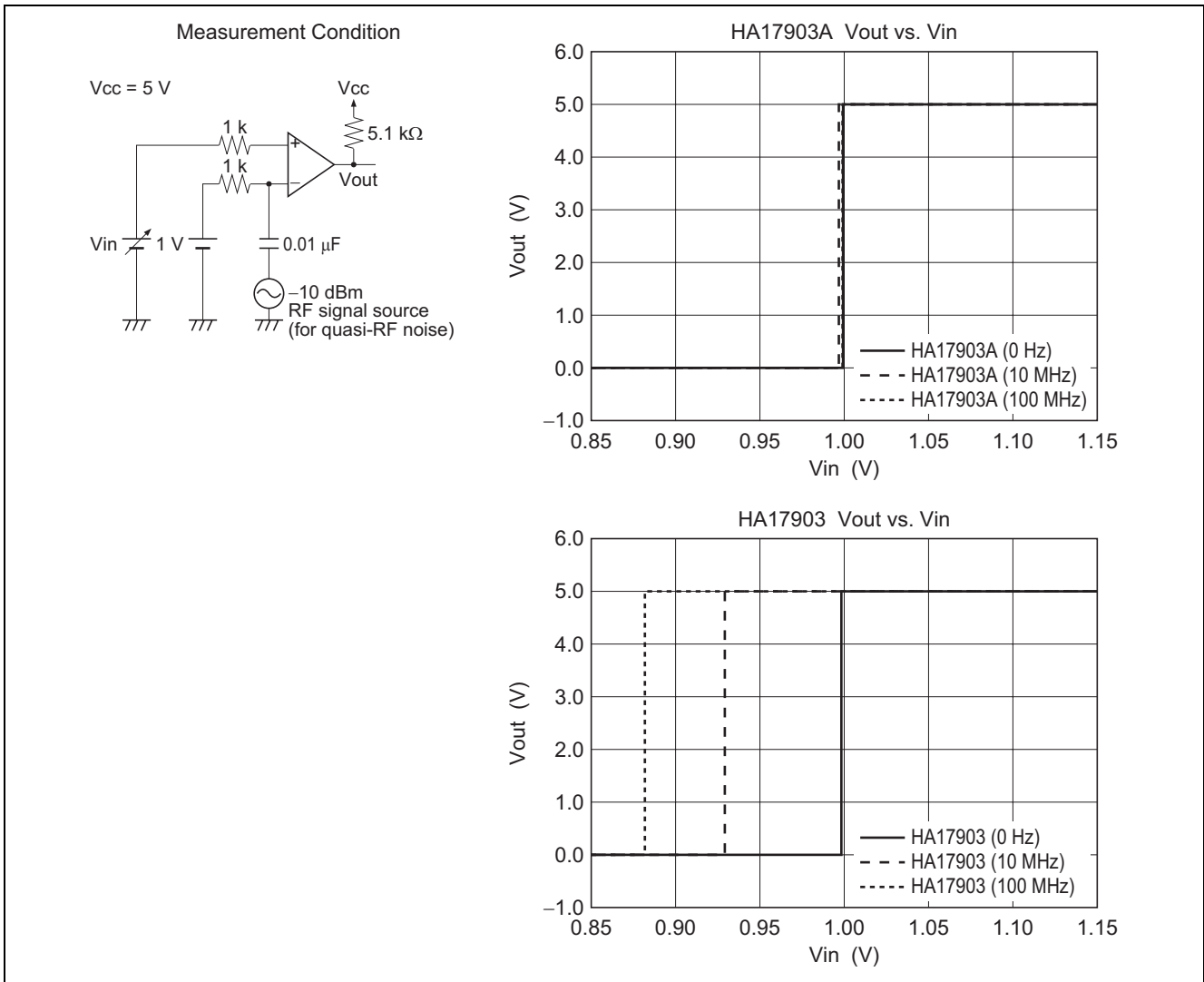
These ICs operate from a single power-supply voltage over a wide range of voltages, and feature a reduced power-supply current since the supply current is independent of the supply voltage.

These comparators have the merit which ground is included in the common-mode input voltage range at a single-voltage power supply operation. These products have a wide range of applications, including limit comparators, simple A/D converters, pulse/square-wave/time delay generators, wide range VCO circuits, MOS clock timers, multivibrators, and high-voltage logic gates.

### Features

- Wide power-supply voltage range : 2 to 36 V
- Very low supply current : 0.8 mA Typ.
- Low input bias current : 25 nA Typ.
- Low input offset current : 3 nA Typ.
- Low input offset voltage : 2 mV Typ.
- The common-mode input voltage range includes ground
- Output voltages compatible with CMOS logic systems

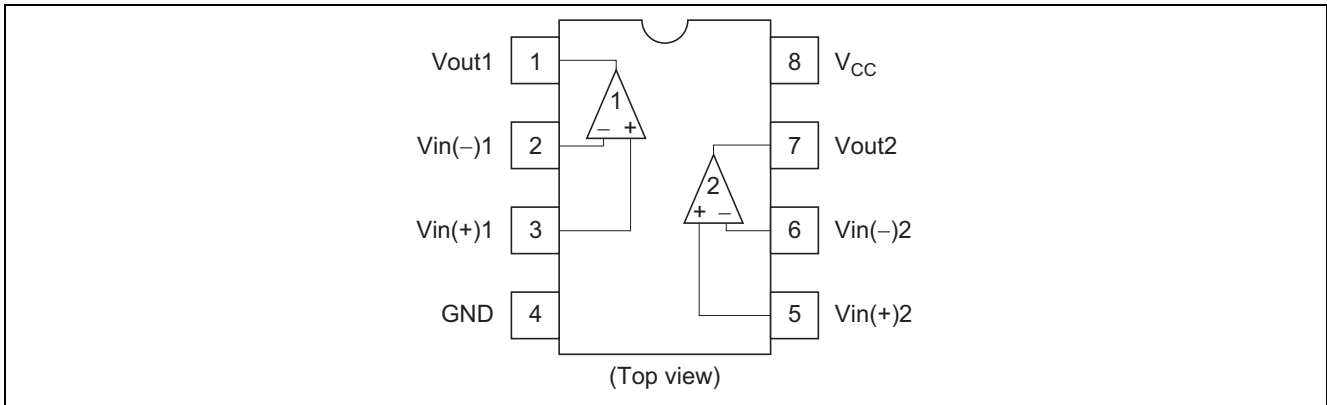
- Low electro-magnetic susceptibility



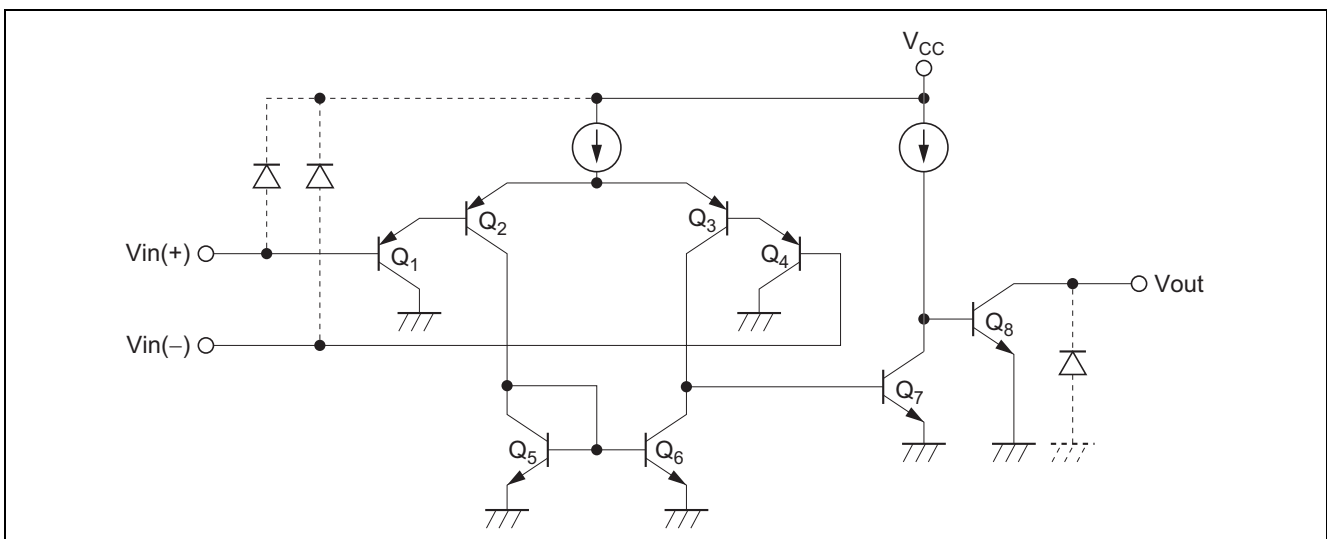
### Ordering Information

Type No.	Application	Package Name	Package Code
HA17903APS	Industry use	DIP-8 pin	PRDP0008AF-B
HA17903AFP		SOP-8 pin (JEITA)	PRSP0008DE-B
HA17903ARP		SOP-8 pin (JEDEC)	PRSP0008DD-C
HA17903AT		TSSOP-8 pin	PTSP0008JC-B

## Pin Arrangement



## Circuit Schematic (1/2)



Note: If Input/Output terminals voltage over the absolute maximum ratings, there is possibility of mis-operation, characteristics deterioration and destruction, because of the current's flowing to parasitic diode in IC.  
 The Input/Output terminals are recommended to be protected with the clamp circuit which using the diode with low forward voltage (like schottky barrier diode) when there is a possibility for the Input/Output terminals voltage exceeds the absolute maximum ratings.

## Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Power supply voltage	V <sub>CC</sub>	36	V
Differential input voltage	V <sub>in(diff)</sub>	±V <sub>CC</sub>	V
Input voltage	V <sub>in</sub>	-0.3 to +V <sub>CC</sub>	V
Output pin voltage	V <sub>out</sub>	-0.3 to +36	V
Output short current	I <sub>os</sub> *1	constant	
Allowable power dissipation	DIP	P <sub>T</sub>	570 *2
	SOP		385 *3
	TSSOP		192 *4
Operating temperature	Topr	-40 to +85	°C
Storage temperature	Tstg	-55 to +125	°C

- Notes: 1. Short circuit between the output and V<sub>CC</sub> will be a cause to destroy the circuit. The maximum output current is about 20 mA for any supply voltage.
2. HA17903APS:  
These are the allowable values up to Ta = 55°C. Derate by 8.3mW/°C above that temperature.
3. HA17903AFP/ARP:  
These are the allowable values up to Ta = 25°C mounting in air.  
When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.5 mm with 30% wiring density, the allowable value is 570 mW up to Ta = 45°C. If Ta > 45°C, derate by 7.14 mW/°C.
4. HA17903AT:  
These are the allowable values up to Ta = 25°C. Derate by 1.92 mW/°C above that temperature.

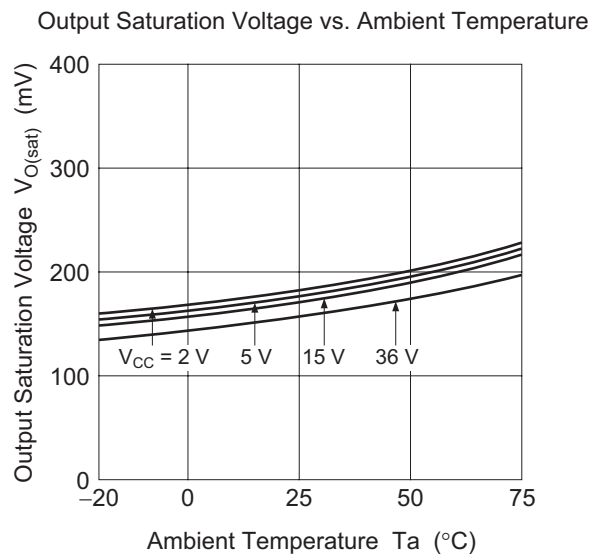
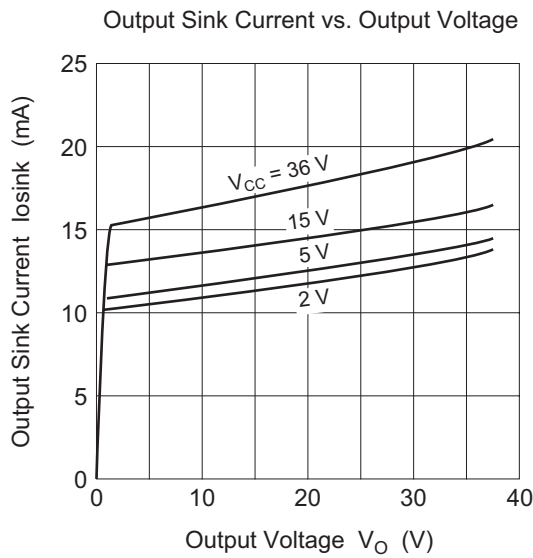
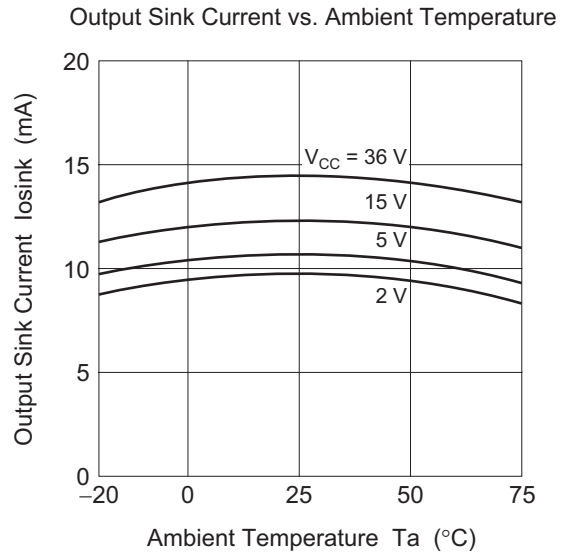
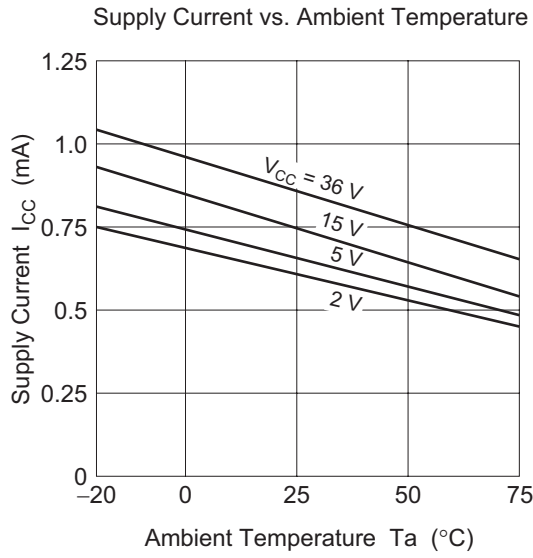
## Electrical Characteristics

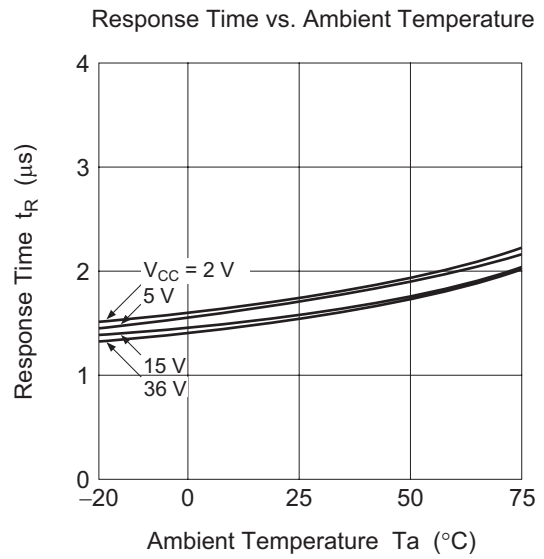
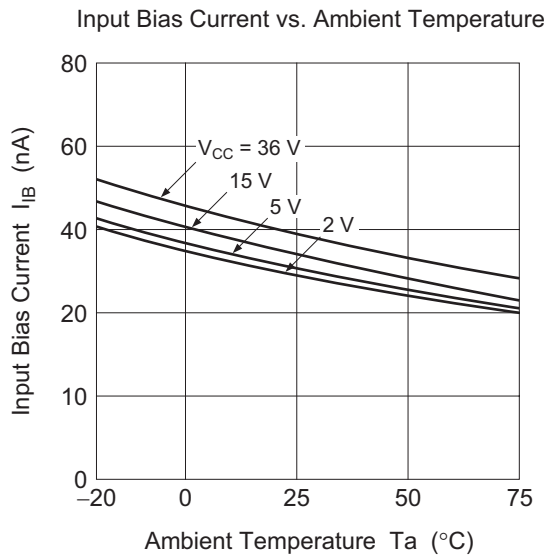
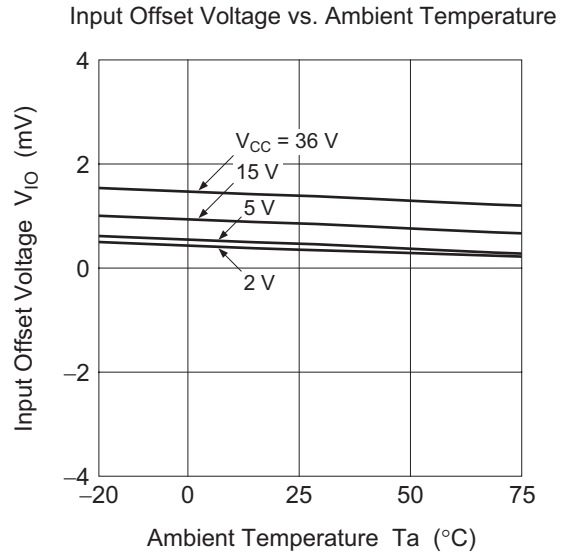
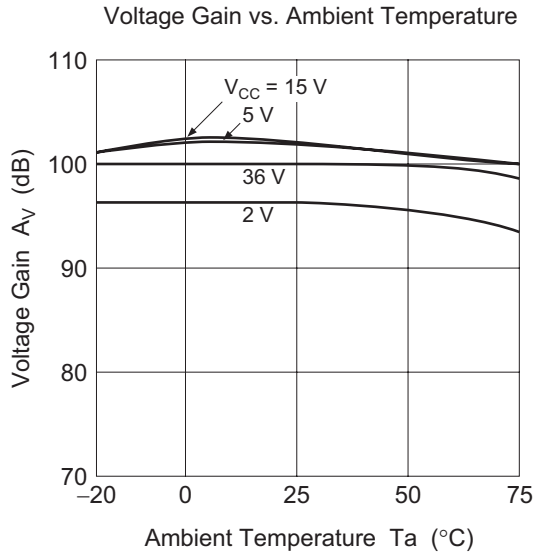
(V<sub>CC</sub> = 5 V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input offset voltage *1	V <sub>IO</sub>	—	2	5	mV	
Input offset current	I <sub>IO</sub>	—	3	50	nA	I <sub>IN(+)</sub> - I <sub>IN(-)</sub>
Input bias current *2	I <sub>IB</sub>	—	25	250	nA	I <sub>IN(+)</sub> or I <sub>IN(-)</sub>
Common mode input voltage *3	V <sub>CM+</sub>	3.5	—	—	V	
	V <sub>CM-</sub>	—	—	0	V	
Supply current	I <sub>CC</sub>	—	0.8	2.0	mA	All comparators: R <sub>L</sub> = ∞, All channels on
Voltage gain *5	A <sub>VD</sub>	—	(200)	—	V/mV	V <sub>CC</sub> = 15V, R <sub>L</sub> ≥ 15kΩ
Response time *4,5	t <sub>R</sub>	—	(1.3)	—	μs	V <sub>RL</sub> = 5V, R <sub>L</sub> = 5.1kΩ
Large signal response time *5	t <sub>RI</sub>	—	(300)	—	ns	V <sub>IN</sub> = TTL Threshold width, V <sub>REF</sub> = 1.4V
Output sink current	I <sub>O(sink)</sub>	6	16	—	mA	V <sub>IN(-)</sub> ≥ 1V, V <sub>IN(+)</sub> = 0, V <sub>O</sub> ≤ 1.5V
Output saturation voltage	V <sub>O(sat)</sub>	—	—	400	mV	V <sub>IN(-)</sub> ≥ 1V, V <sub>IN(+)</sub> = 0, I <sub>osink</sub> = 4mA
Output leak current *5	I <sub>LO</sub>	—	(0.1)	—	nA	V <sub>IN(-)</sub> = 0, V <sub>IN(+)</sub> ≥ 1V, V <sub>O</sub> = 5V

- Notes: 1. V<sub>REF</sub> = 1.4 V and R<sub>S</sub> = 50 Ω, when V<sub>O</sub> = 1.4 V 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 -0.3 V.
4. This is a value to 100 mV input step voltage with 5 mV over drive.
5. Design spec.

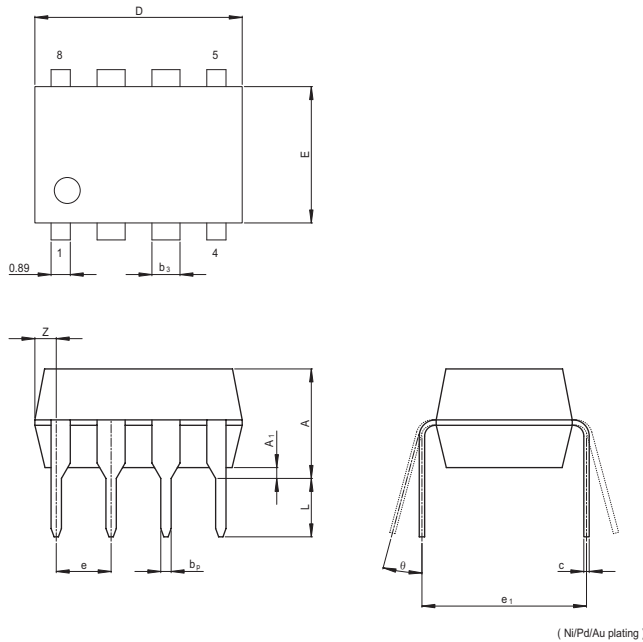
Characteristic Curves





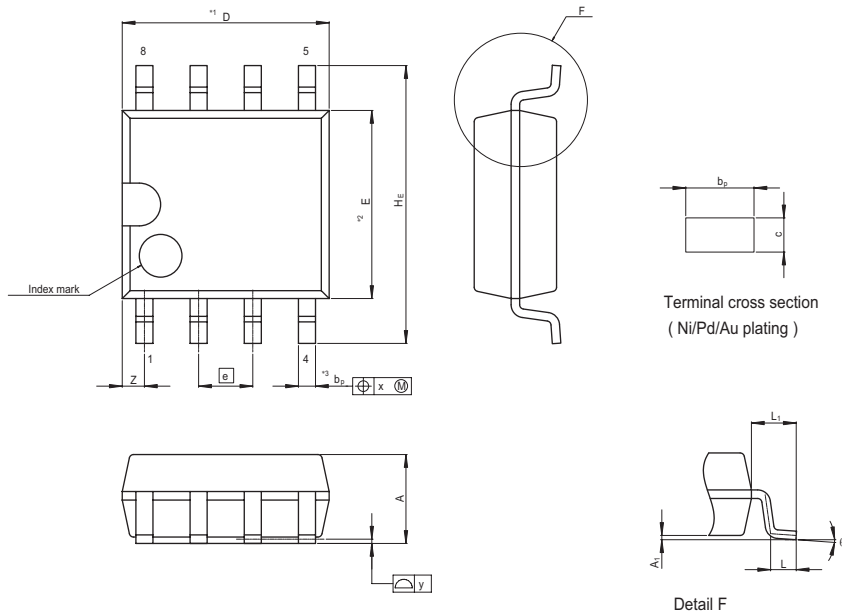
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP8-6.3x9.6-2.54	PRDP0008AF-B	DP-8FV	0.54g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e <sub>1</sub>	—	7.62	—
D	—	9.60	10.6
E	—	6.30	7.4
A	—	—	5.06
A <sub>1</sub>	0.5	—	—
b <sub>p</sub>	0.40	0.48	0.56
b <sub>3</sub>	—	1.30	—
c	0.19	0.25	0.31
θ	0°	—	15°
e	2.29	2.54	2.79
Z	—	—	1.27
L	2.54	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-4.4x4.85-1.27	PRSP0008DE-B	FP-8DGV	0.1g

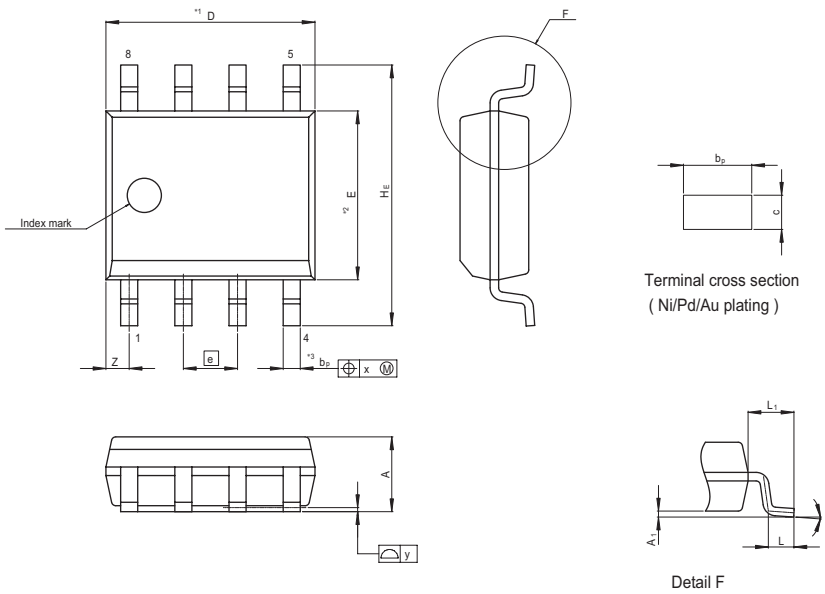


NOTE)  
 1. DIMENSIONS\*\*1 (Nom)\*AND\*\*2 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3 DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	4.85	5.25
E	—	4.4	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.00	0.1	0.20
A	—	—	2.03
b <sub>p</sub>	0.35	0.4	0.45
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	6.35	6.5	6.75
Ⓧ	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.75
L	0.42	0.60	0.85
L <sub>1</sub>	—	1.05	—

# HA17903A Series

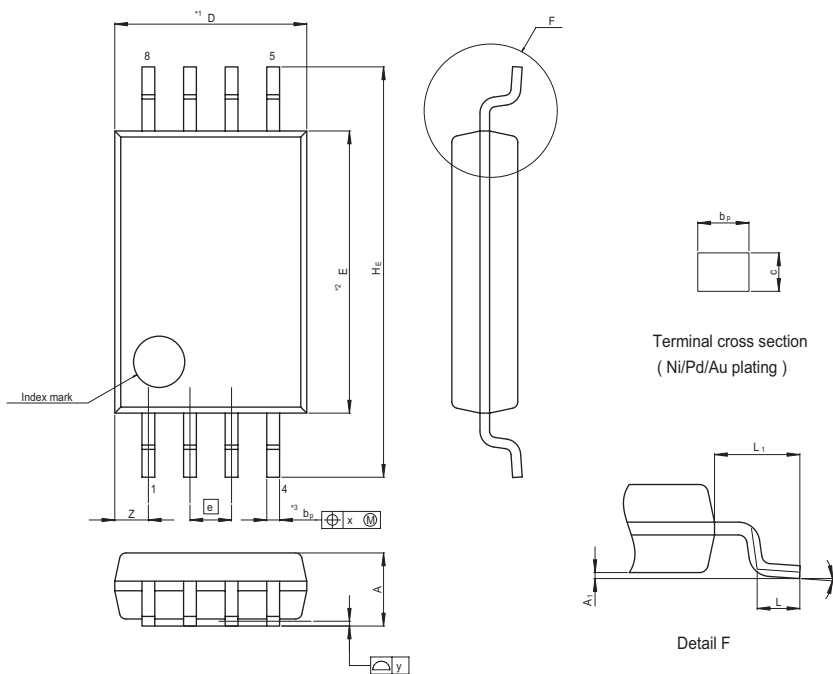
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-3.95x4.9-1.27	PRSP0008DD-C	FP-8DCV	0.085g



NOTE)  
1. DIMENSIONS\*\*1 (Nom)\*\*AND\*\*2\*  
DO NOT INCLUDE MOLD FLASH.  
2. DIMENSION\*\*3\*DOES NOT  
INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	4.90	5.30
E	—	3.95	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.10	0.14	0.25
A	—	—	1.75
b <sub>P</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	5.80	6.10	6.20
Ⓜ	—	1.27	—
x	—	—	0.25
y	—	—	0.10
Z	—	—	0.75
L	0.40	0.60	1.27
L <sub>1</sub>	—	1.08	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP8-4.4x3-0.65	PTSP0008JC-B	TTP-8DAV	0.034g



NOTE)  
1. DIMENSIONS\*\*1 (Nom)\*\*AND\*\*2\*  
DO NOT INCLUDE MOLD FLASH.  
2. DIMENSION\*\*3\*DOES NOT  
INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	3.00	3.30
E	—	4.40	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.03	0.07	0.10
A	—	—	1.10
b <sub>P</sub>	0.15	0.20	0.25
b <sub>1</sub>	—	—	—
c	0.10	0.15	0.20
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	6.20	6.40	6.60
Ⓜ	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.805
L	0.40	0.50	0.60
L <sub>1</sub>	—	1.00	—



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