

# HA17904A Series

## Dual Operational Amplifier

REJ03D0689-0200

Rev.2.00

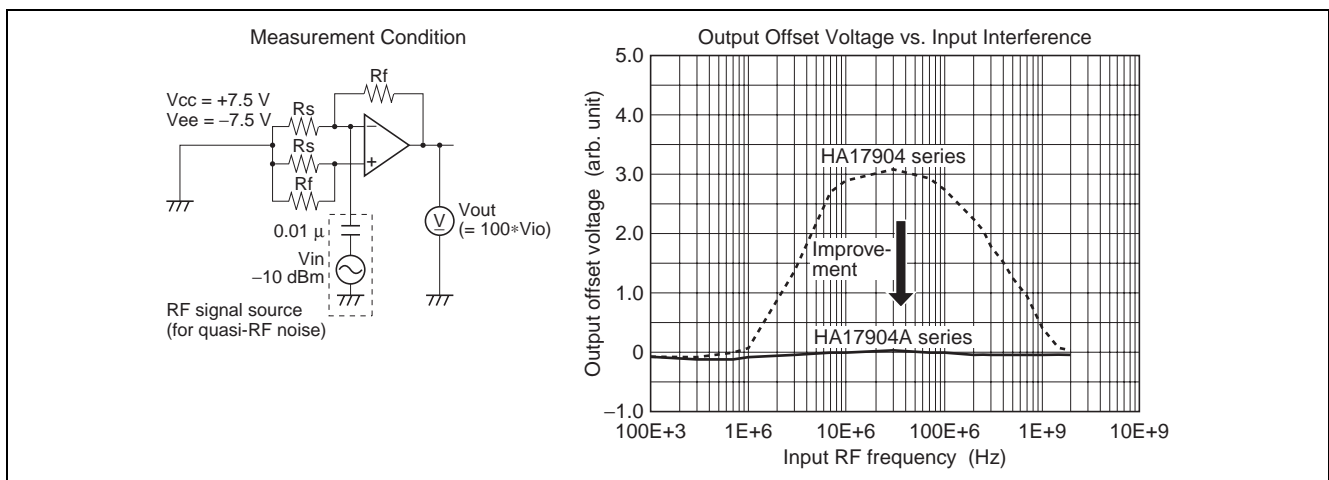
Mar 10, 2006

### Description

HA17904A series are dual operational amplifier that provide high gain and internal phase compensation, with single power supply. They can be widely applied to control equipments and to general use.

### Features

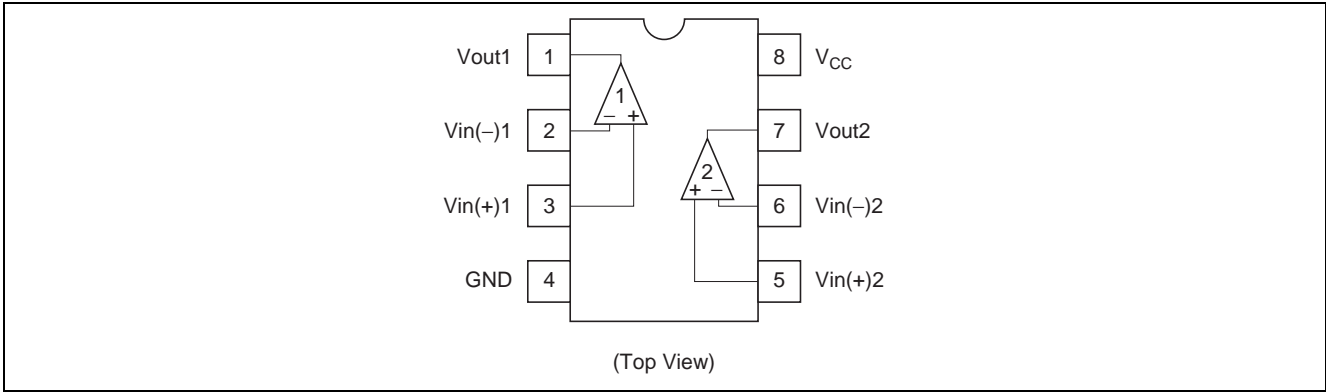
- Wide range of supply voltage, and single power supply used
- Wide range of common mode voltage, and possible to operate with an input about 0 V, and output around 0 V is available
- Frequency characteristics and input bias current are temperature compensated
- Low electro-magnetic susceptibility level



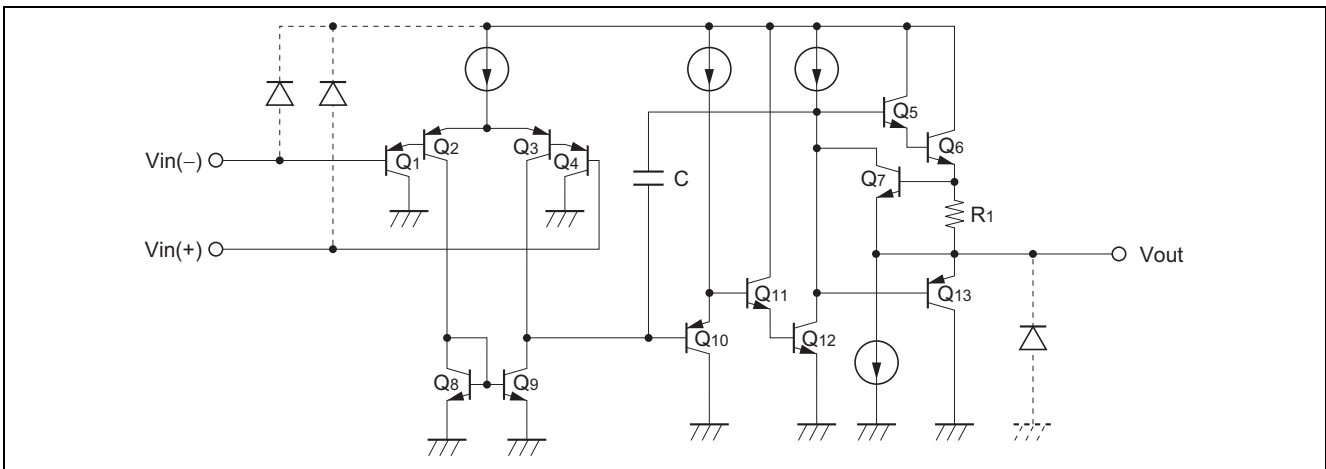
### Ordering Information

Type No.	Application	Package Name	Package Code
HA17904APS	Industrial use	DIP-8 pin	PRDP0008AF-B
HA17904AFP		SOP-8 pin (JEITA)	PRSP0008DE-B
HA17904ARP		SOP-8 pin (JEDEC)	PRSP0008DD-C
HA17904AT		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>	32	V
Output sink current	I <sub>osink</sub>	50	mA
Common mode input voltage	V <sub>CM</sub>	-0.3 to +V <sub>CC</sub>	V
Differential input voltage	V <sub>in(diff)</sub>	±V <sub>CC</sub>	V
Output voltage	V <sub>out</sub>	-0.3 to +V <sub>CC</sub>	V
Allowable power dissipation	DIP	P <sub>T</sub>	570 * <sup>1</sup>
	SOP		385 * <sup>2</sup>
	TSSOP		192 * <sup>3</sup>
Operating temperature	Topr	-40 to +85	°C
Storage temperature	Tstg	-55 to +125	°C

Notes: 1. HA17904APS:

This is the allowable values up to Ta = 50°C. Derate by 8.3 mW/°C.

2. HA17904AFP/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 &gt; 45°C, derate by 7.14 mW/°C.

3. HA17904AT:

These are the allowable values up to Ta = 25°C. Derate by 1.92 mW/°C above that temperature.

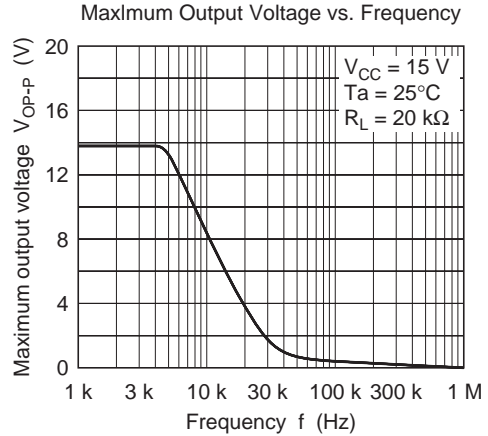
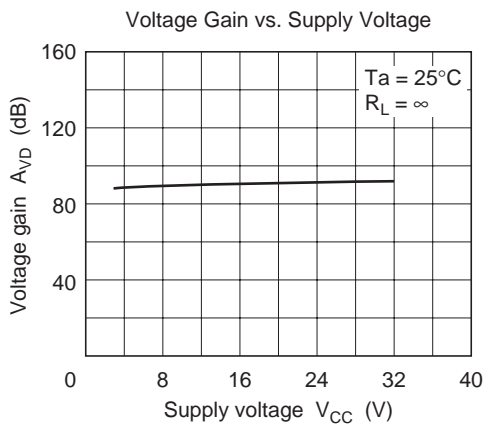
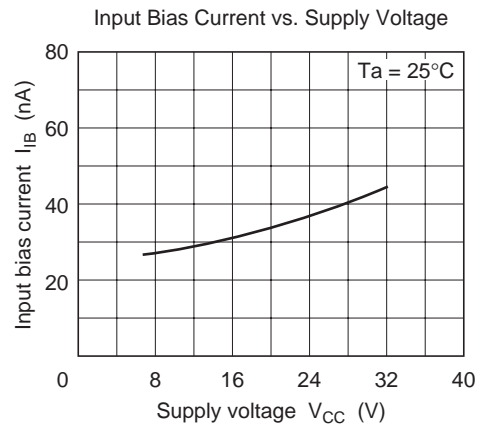
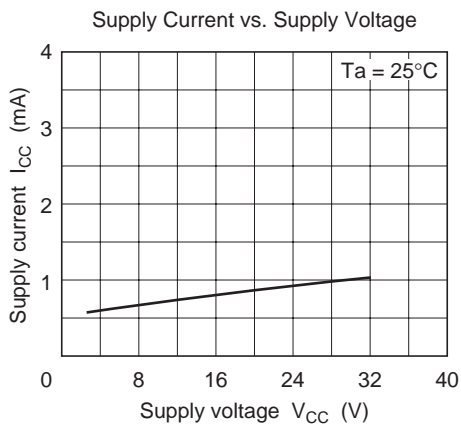
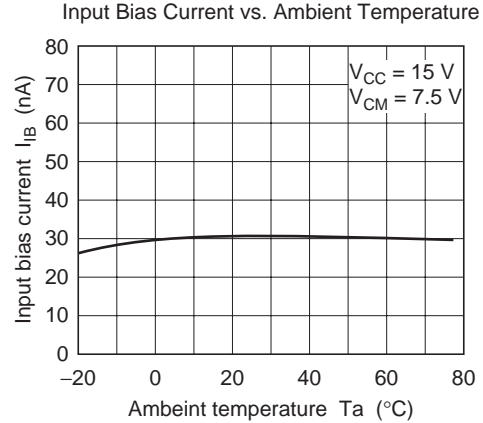
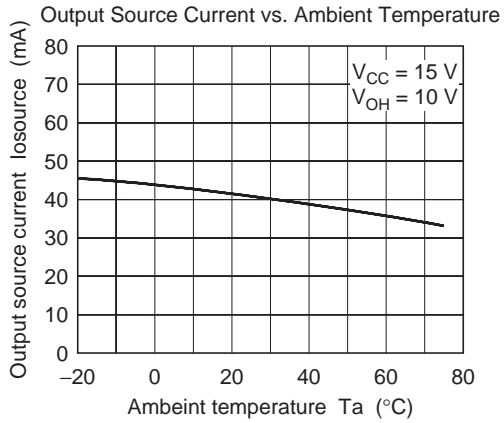
## Electrical Characteristics

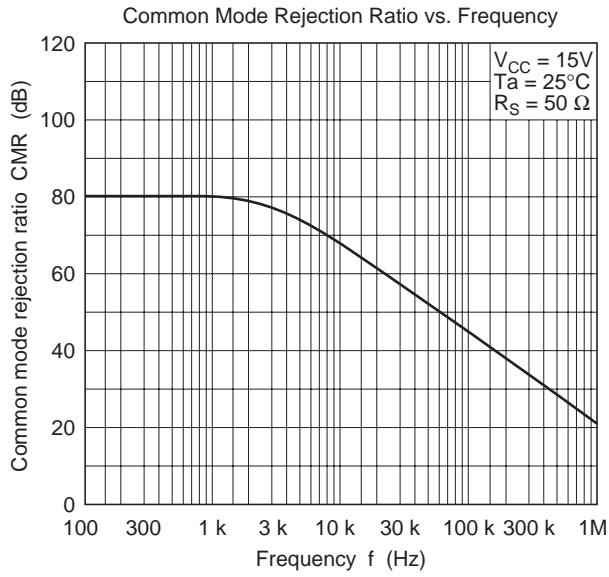
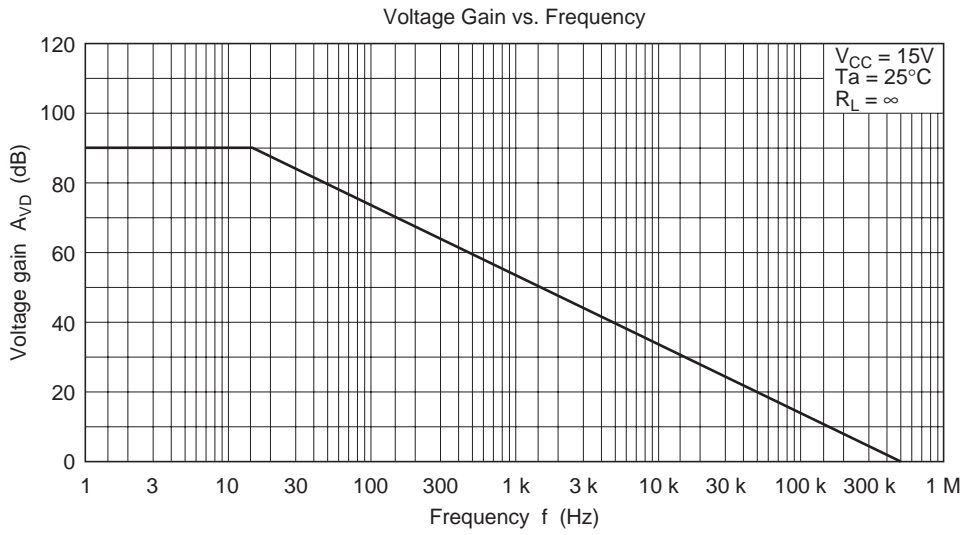
(V<sub>CC</sub> = +15 V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input offset voltage	V <sub>IO</sub>	—	3	7	mV	V <sub>CM</sub> = 7.5V, R <sub>S</sub> = 50Ω, R <sub>f</sub> = 50kΩ
Input offset current	I <sub>IO</sub>	—	5	50	nA	V <sub>CM</sub> = 7.5V, I <sub>IO</sub> =  I <sub>I(+)</sub> - I <sub>I(-)</sub>
Input bias current	I <sub>IB</sub>	—	30	250	nA	V <sub>CM</sub> = 7.5V
Power source rejection ratio	PSRR	—	93	—	dB	R <sub>S</sub> = 1kΩ, R <sub>f</sub> = 100kΩ
Voltage gain	A <sub>VD</sub>	75	90	—	dB	R <sub>L</sub> = ∞, R <sub>S</sub> = 1kΩ, R <sub>f</sub> = 100kΩ
Common mode rejection ratio	CMR	—	80	—	dB	R <sub>S</sub> = 50Ω, R <sub>f</sub> = 5kΩ
Common mode input voltage range	V <sub>CM(+)</sub>	13.5	—	—	V	R <sub>S</sub> = 1kΩ, R <sub>f</sub> = 100kΩ
	V <sub>CM(-)</sub>	—	—	-0.3	V	R <sub>S</sub> = 1kΩ, R <sub>f</sub> = 100kΩ
Peak-to-peak output voltage	V <sub>OP-P</sub>	—	13.6	—	V	f = 100Hz, R <sub>L</sub> = 20kΩ, R <sub>S</sub> = 1kΩ, R <sub>f</sub> = 100kΩ
Output source current	I <sub>osource</sub>	20	40	—	mA	V <sub>IN+</sub> = 1V, V <sub>IN-</sub> = 0V, V <sub>OH</sub> = 10V
Output sink current	I <sub>osink</sub>	10	20	—	mA	V <sub>IN-</sub> = 1V, V <sub>IN+</sub> = 0V, V <sub>OL</sub> = 2.5V
		15	50	—	μA	V <sub>IN-</sub> = 1V, V <sub>IN+</sub> = 0V, V <sub>out</sub> = 200mV
Supply current	I <sub>CC</sub>	—	0.8	2	mA	V <sub>IN</sub> = GND, R <sub>L</sub> = ∞
Slew rate	SR	—	0.2	—	V/μs	R <sub>L</sub> = ∞, V <sub>CM</sub> = 7.5V, f = 1.5kHz
Channel separation * <sup>1</sup>	CS	—	(120)	—	dB	f = 1kHz

Note: 1. Design spec.

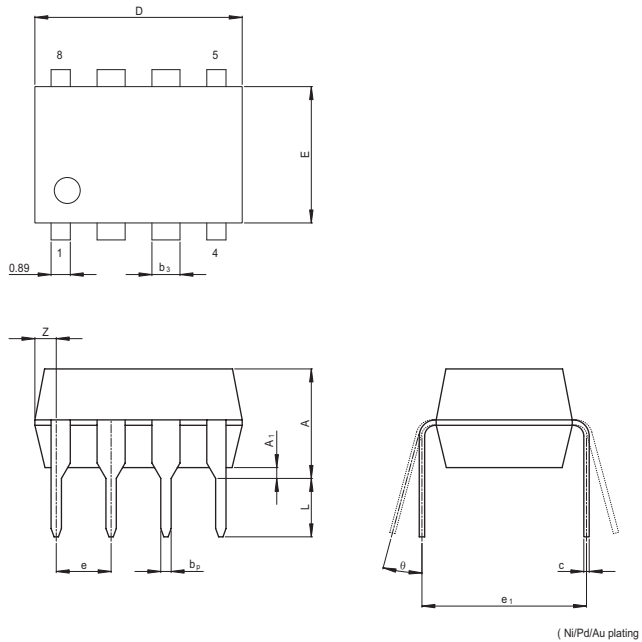
Characteristic Curves





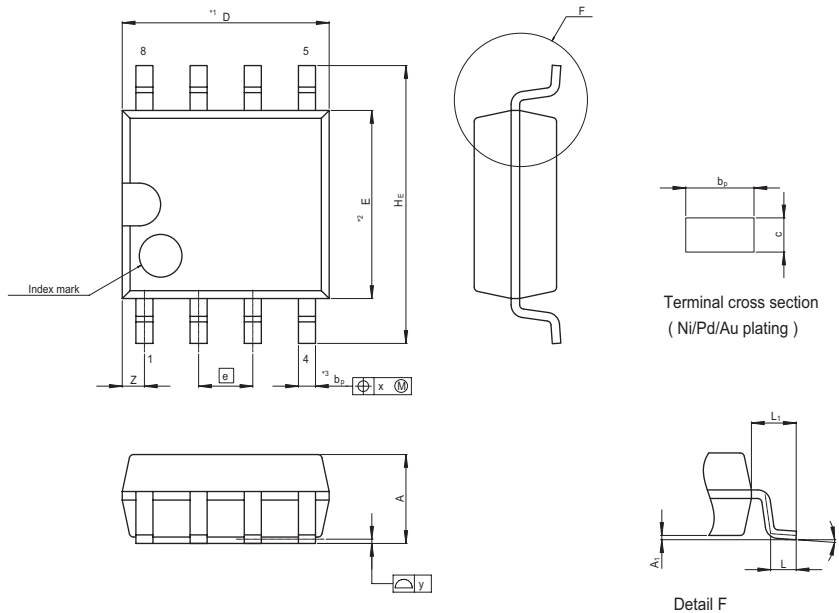
Package Dimensions

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
e1	—	7.62	—
D	—	9.60	10.6
E	—	6.30	7.4
A	—	—	5.06
A1	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

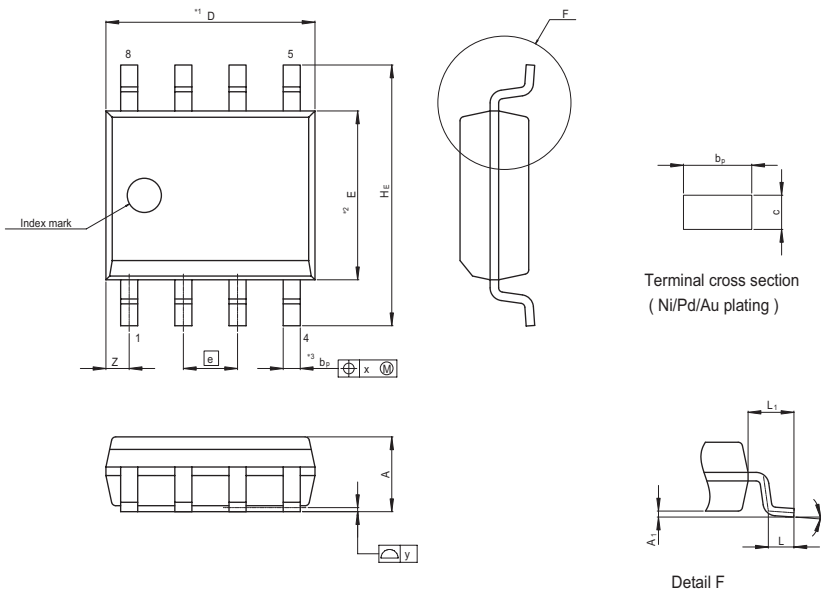


NOTE)  
 1. DIMENSIONS\*\*1 (Nom)\*\*AND\*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3\* DOES NOT INCLUDE TRIM OFFSET.

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	—

# HA17904A Series

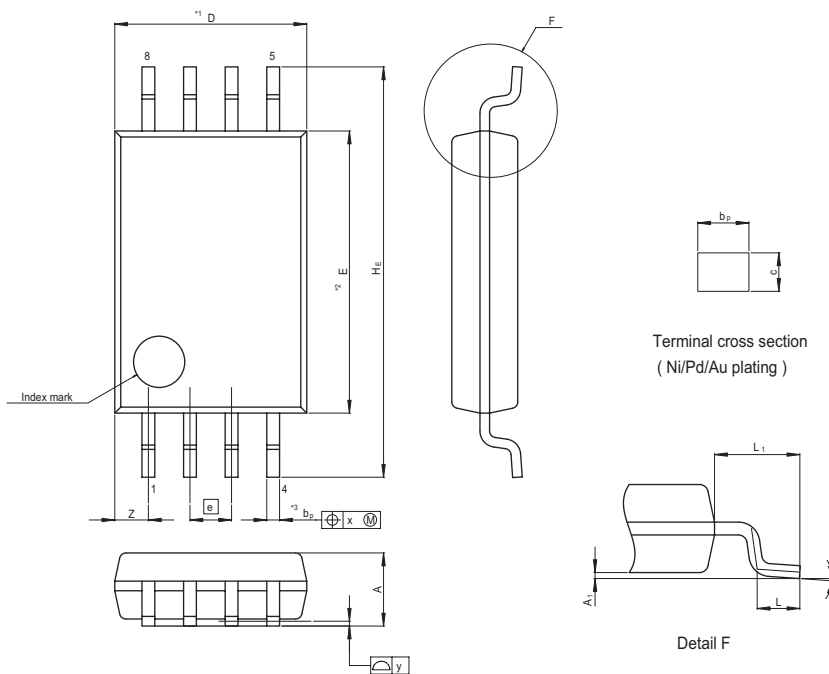
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-3.95x4.9-1.27	PRSP0008DD-C	FP-8DCV	0.085g



NOTE)  
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 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°
HE	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°
HE	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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