

To all our customers

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Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

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Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

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# HA17904A Series

## Dual Operational Amplifier



ADE-204-069 (Z)

Rev.0  
May 2001

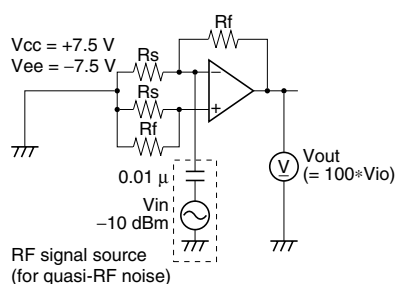
### Description

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.

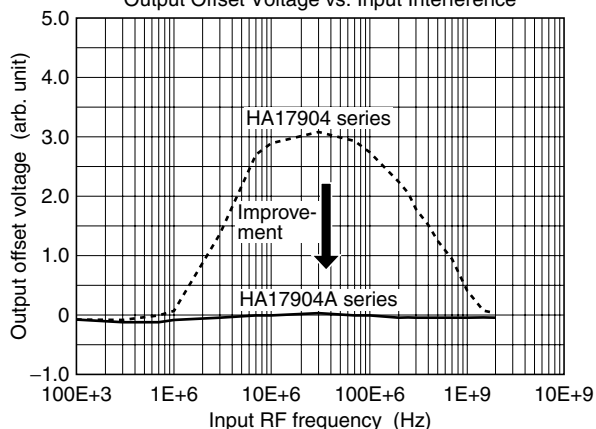
### Features

- 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

Measurement Condition



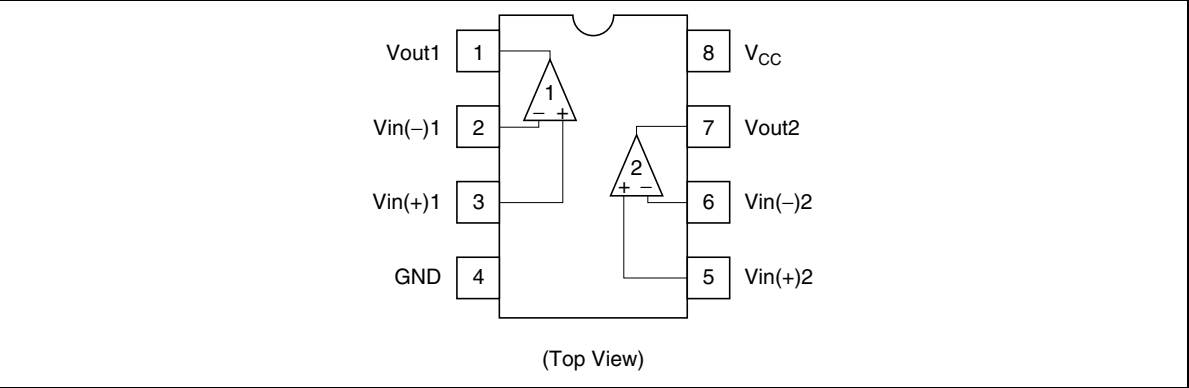
Output Offset Voltage vs. Input Interference



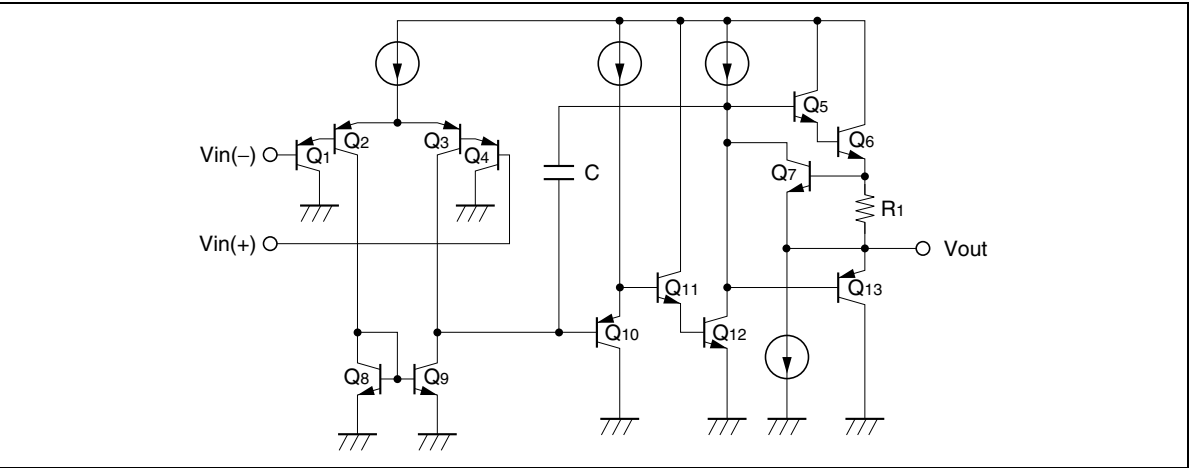
Ordering Information

| Type No.   | Application    | Package |
|------------|----------------|---------|
| HA17904APS | Industrial use | DP-8B   |
| HA17904AFP |                | FP-8D   |

Pin Arrangement



Circuit Schematic (1/2)



## Absolute Maximum Ratings

(Ta = 25°C)

| Item                       | Symbol          | Ratings           |                   | Unit |
|----------------------------|-----------------|-------------------|-------------------|------|
|                            |                 | HA17904APS        | HA17904AFP        |      |
| Supply voltage             | $V_{CC}$        | 32                | 32                | V    |
| Sink current               | $I_{sink}$      | 50                | 50                | mA   |
| Power dissipation          | $P_T$           | 570 <sup>*1</sup> | 385 <sup>*2</sup> | mW   |
| Common mode input voltage  | $V_{CM}$        | -0.3 to $V_{CC}$  | -0.3 to $V_{CC}$  | V    |
| Differential input voltage | $V_{in} (diff)$ | $\pm V_{CC}$      | $\pm V_{CC}$      | V    |
| Operating temperature      | $T_{opr}$       | -40 to +85        | -40 to +85        | °C   |
| Storage temperature        | $T_{stg}$       | -55 to +125       | -55 to +125       | °C   |

Notes: 1. This is the allowable values up to Ta = 50°C. Derate by 8.3 mW/°C.

2. 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 mmt 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.

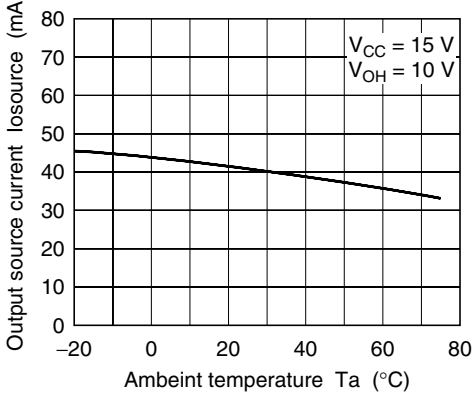
## Electrical Characteristics

( $V_{CC} = +15\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

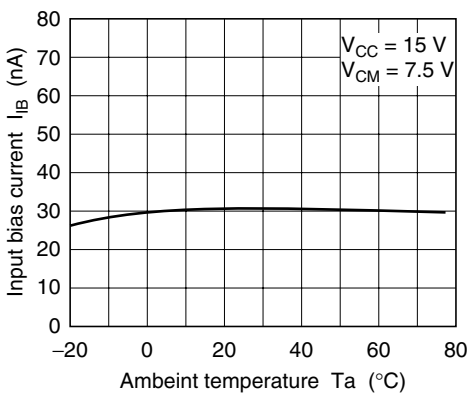
| Item                            | Symbol        | Min  | Typ  | Max  | Unit             | Test Conditions                                                                                     |
|---------------------------------|---------------|------|------|------|------------------|-----------------------------------------------------------------------------------------------------|
| Input offset voltage            | $V_{IO}$      | —    | 3    | 7    | mV               | $V_{CM} = 7.5\text{V}$ , $R_S = 50\Omega$ , $R_f = 50\text{k}\Omega$                                |
| Input offset current            | $I_{IO}$      | —    | 5    | 50   | nA               | $V_{CM} = 7.5\text{V}$ , $I_{IO} =  I_{I(+)} - I_{I(-)} $                                           |
| Input bias current              | $I_{IB}$      | —    | 30   | 250  | nA               | $V_{CM} = 7.5\text{V}$                                                                              |
| Power source rejection ratio    | PSRR          | —    | 93   | —    | dB               | $R_S = 1\text{k}\Omega$ , $R_f = 100\text{k}\Omega$                                                 |
| Voltage gain                    | $A_{VD}$      | 75   | 90   | —    | dB               | $R_L = \infty$ , $R_S = 1\text{k}\Omega$ , $R_f = 100\text{k}\Omega$                                |
| Common mode rejection ratio     | CMR           | —    | 80   | —    | dB               | $R_S = 50\Omega$ , $R_f = 5\text{k}\Omega$                                                          |
| Common mode input voltage range | $V_{CM(+)}$   | 13.5 | —    | —    | V                | $R_S = 1\text{k}\Omega$ , $R_f = 100\text{k}\Omega$                                                 |
|                                 | $V_{CM(-)}$   | —    | —    | -0.3 | V                | $R_S = 1\text{k}\Omega$ , $R_f = 100\text{k}\Omega$                                                 |
| Peak-to-peak output voltage     | $V_{op-p}$    | —    | 13.6 | —    | V                | $f = 100\text{Hz}$ , $R_L = 20\text{k}\Omega$ , $R_S = 1\text{k}\Omega$ , $R_f = 100\text{k}\Omega$ |
| Output source current           | $I_{osource}$ | 20   | 40   | —    | mA               | $V_{IN}^+ = 1\text{V}$ , $V_{IN}^- = 0\text{V}$ , $V_{OH} = 10\text{V}$                             |
| Output sink current             | $I_{osink}$   | 10   | 20   | —    | mA               | $V_{IN}^- = 1\text{V}$ , $V_{IN}^+ = 0\text{V}$ , $V_{OL} = 2.5\text{V}$                            |
| Output sink current             | $I_{osink}$   | 15   | 50   | —    | $\mu\text{A}$    | $V_{IN}^- = 1\text{V}$ , $V_{IN}^+ = 0\text{V}$ , $V_{out} = 200\text{mV}$                          |
| Supply current                  | $I_{CC}$      | —    | 0.8  | 2    | mA               | $V_{IN} = \text{GND}$ , $R_L = \infty$                                                              |
| Slew rate                       | SR            | —    | 0.2  | —    | V/ $\mu\text{s}$ | $R_L = \infty$ , $V_{CM} = 7.5\text{V}$ , $f = 1.5\text{kHz}$                                       |
| Channel separation              | CS            | —    | 120  | —    | dB               | $f = 1\text{kHz}$                                                                                   |

Characteristic Curves

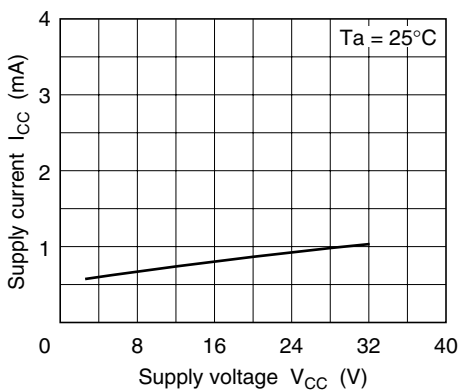
Output Source Current vs. Ambient Temperature



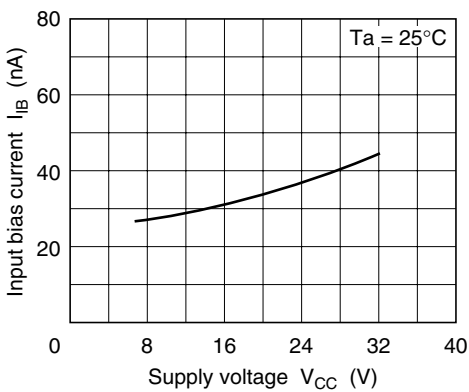
Input Bias Current vs. Ambient Temperature



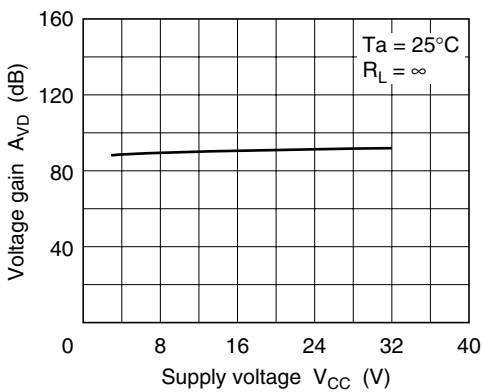
Supply Current vs. Supply Voltage



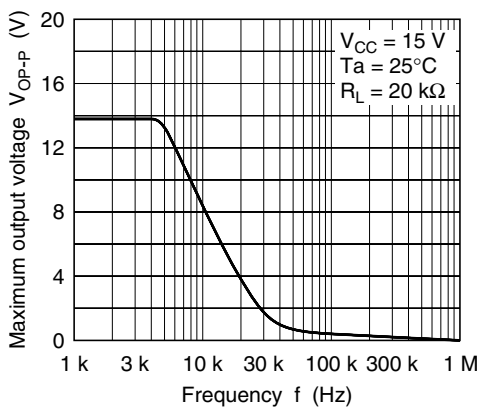
Input Bias Current vs. Supply Voltage

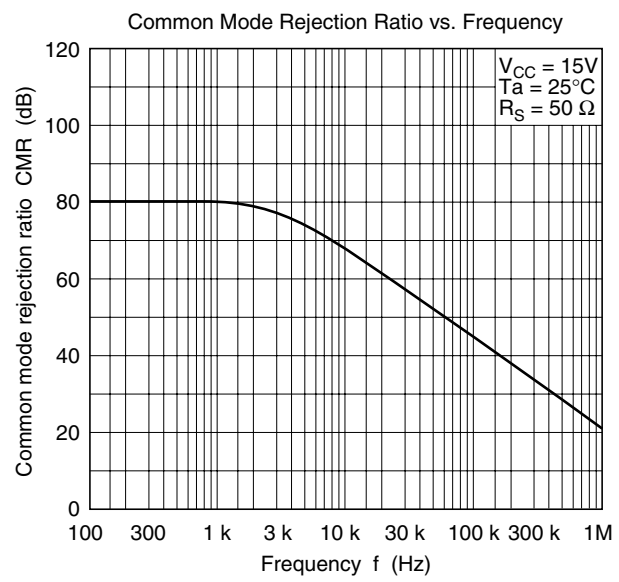
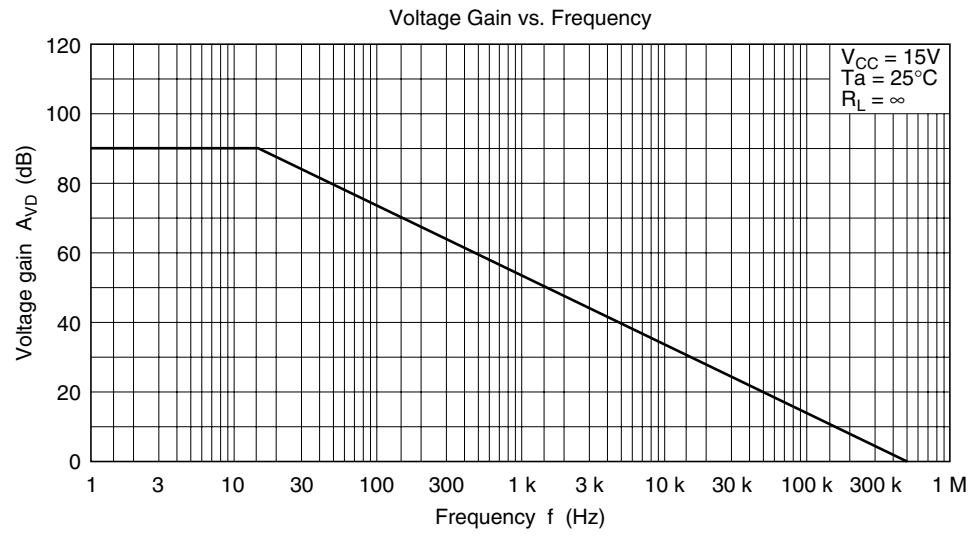


Voltage Gain vs. Supply Voltage



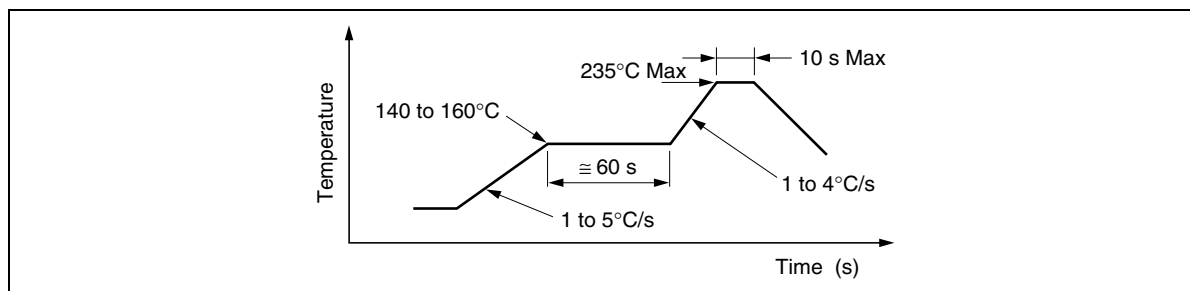
Maximum Output Voltage vs. Frequency





## Solder Mounting Method

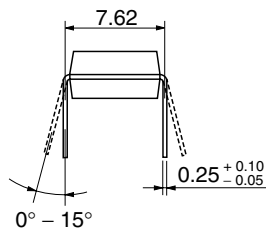
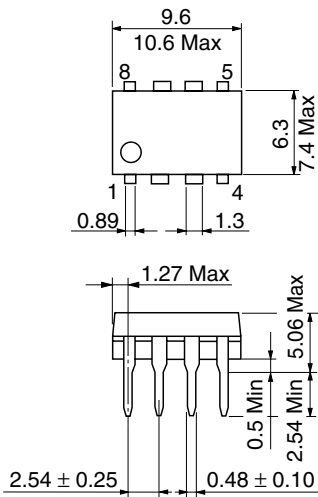
1. Small and light surface-mount packages require special attentions on solder mounting.  
On solder mounting, pre-heating before soldering is needed.  
The following figure show an example of infrared rays reflow.
2. The difference of thermal expansion coefficient between mounted substrates and IC leads may cause a failure like solder peeling or solder wet, and electrical characteristics may change by thermal stress.  
Therefore, mounting should be done after sufficient confirmation for especially in case of ceramic substrates.



**Figure 1 An Example of Infrared Rays Reflow Conditions**

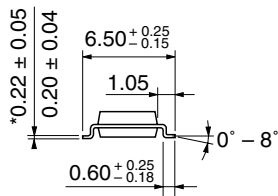
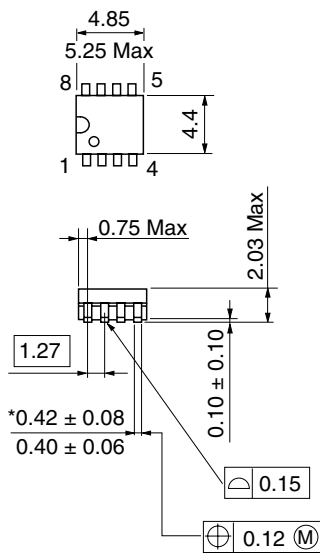
Package Dimensions

Unit: mm



|                        |          |
|------------------------|----------|
| Hitachi Code           | DP-8B    |
| JEDEC                  | Conforms |
| EIAJ                   | Conforms |
| Mass (reference value) | 0.51 g   |

Unit: mm



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

\*Dimension including the plating thickness  
Base material dimension

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