

# HA17358, HA17904 Series

Dual Operational Amplifier

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### Description

HA17904 and HA17358 are dual operational amplifiers which, provide internal phase compensation and high gain, and mono power source operation is possible. It can be widely applied to control equipment and to general use.

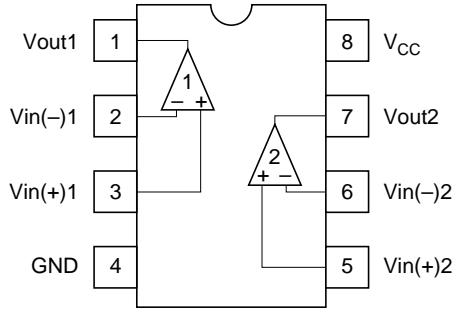
### Features

- Wide range of operating supply voltage and mono power source operation is possible.
- Wide range of common mode input voltage possible to operate with an input around 0V, and output around 0V is available.
- Frequency characteristics and input bias current are temperature compensated.

### Ordering Information

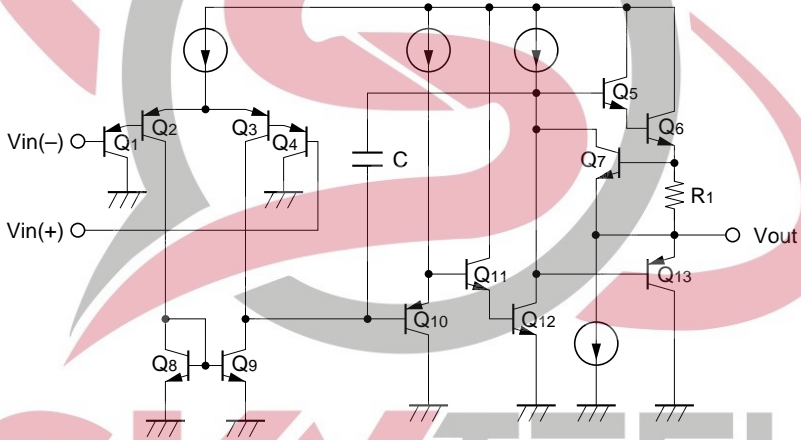
| Type No.   | Application    | Package |
|------------|----------------|---------|
| HA17904PSJ | Car use        | DP-8    |
| HA17904FPJ | Car use        | FP-8D   |
| HA17904FPK | Car use        |         |
| HA17904PS  | Industrial use | DP-8    |
| HA17904FP  | Industrial use | FP-8D   |
| HA17358    | Commercial use | DP-8    |
| HA17358F   | Commercial use | FP-8D   |

**Pin Arrangement**



(Top View)

**Circuit Schematic (1/2)**



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

| Item                             | Symbol                | Ratings                 |                         |                         |                         |                         |                         |                         | Unit |
|----------------------------------|-----------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------|
|                                  |                       | HA17358                 | HA17358<br>F            | HA17904<br>PS           | HA17904<br>FP           | HA17904<br>PSJ          | HA17904<br>FPJ          | HA17904<br>FPK          |      |
| Supply voltage                   | V <sub>CC</sub>       | 32                      | 32                      | 32                      | 32                      | 32                      | 32                      | 32                      | V    |
| Output sink current              | I <sub>O sink</sub>   | 50                      | 50                      | 50                      | 50                      | 50                      | 50                      | 50                      | mA   |
| Common-mode input voltage        | V <sub>CM</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    |
| Common-mode differential 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    |
| Power dissipation                | P <sub>T</sub>        | 570* <sup>1</sup>       | 385* <sup>2</sup>       | 570* <sup>1</sup>       | 385* <sup>2</sup>       | 570* <sup>1</sup>       | 385* <sup>2</sup>       | 385* <sup>2</sup>       | mW   |
| Operating temperature range      | Topr                  | -20 to +75              | -20 to +75              | -20 to +75              | -20 to +75              | -40 to +85              | -40 to +85              | -40 to +125             | °C   |
| Storage temperature range        | Tstg                  | -55 to +125             | -55 to +125             | -55 to +125             | -55 to +125             | -55 to +125             | -55 to +125             | -55 to +150             | °C   |

- Notes: 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.



## Electrical Characteristics 1 ( $V_{CC} = +15V$ , $T_a = 25^\circ C$ )

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

Note: As for the characteristic curve, refer to HA17902.

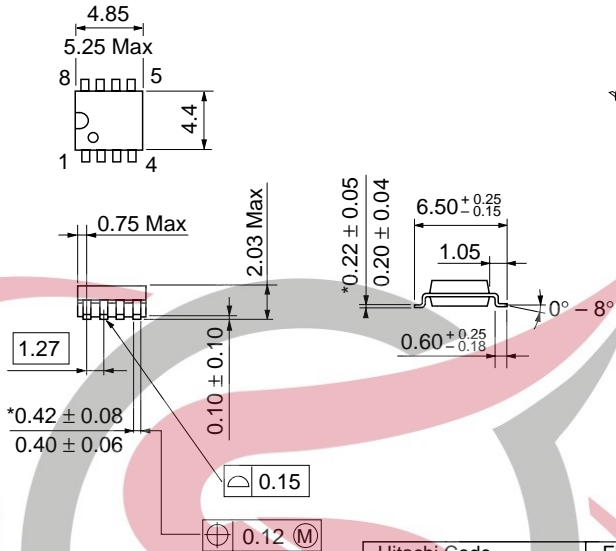
## Electrical Characteristics 2 ( $V_{CC} = +15V$ , $T_a = -40$ to $+125^\circ C$ )

| Item                            | Symbol   | Min | Typ | Max  | Unit | Test Conditions  |
|---------------------------------|----------|-----|-----|------|------|--|
| Input offset voltage            | $V_{IO}$ | —   | —   | 7    | mV   | $V_{CM} = 7.5V$ , $R_S = 50\Omega$ , $R_L = 50k\Omega$ |
| Input offset current            | $I_{IO}$ | —   | —   | 200  | nA   | $V_{CM} = 7.5V$ , $I_{IO} =  I_{I(+)} - I_{I(-)} $     |
| Input bias current              | $I_{IB}$ | —   | —   | 500  | nA   | $V_{CM} = 7.5V$  |
| Common mode input voltage range | $V_{CM}$ | 0   | —   | 13.0 | V    | $R_S = 1k\Omega$ , $R_f = 100k\Omega$                  |
| Supply current                  | $I_{CC}$ | —   | —   | 4    | mA   | $V_{IN} = GND$ , $R_L = \infty$                        |

Note: As for the characteristic curve, refer to HA17904FPK.

Package Dimensions

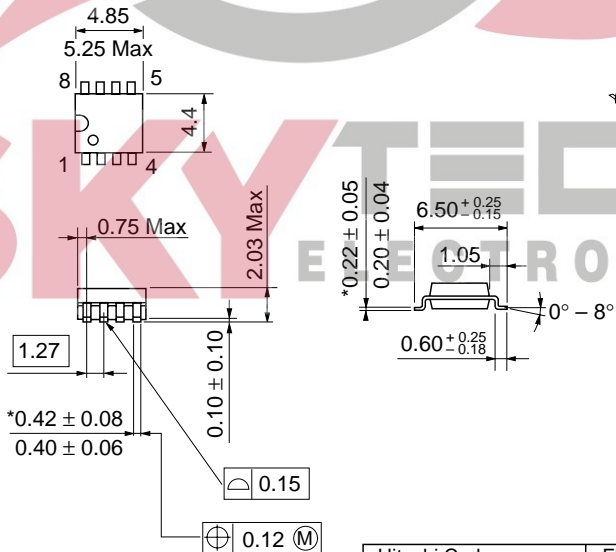
Unit: mm



\*Dimension including the plating thickness  
Base material dimension

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

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

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

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