# HA17902A Series

## Quad Operational Amplifier

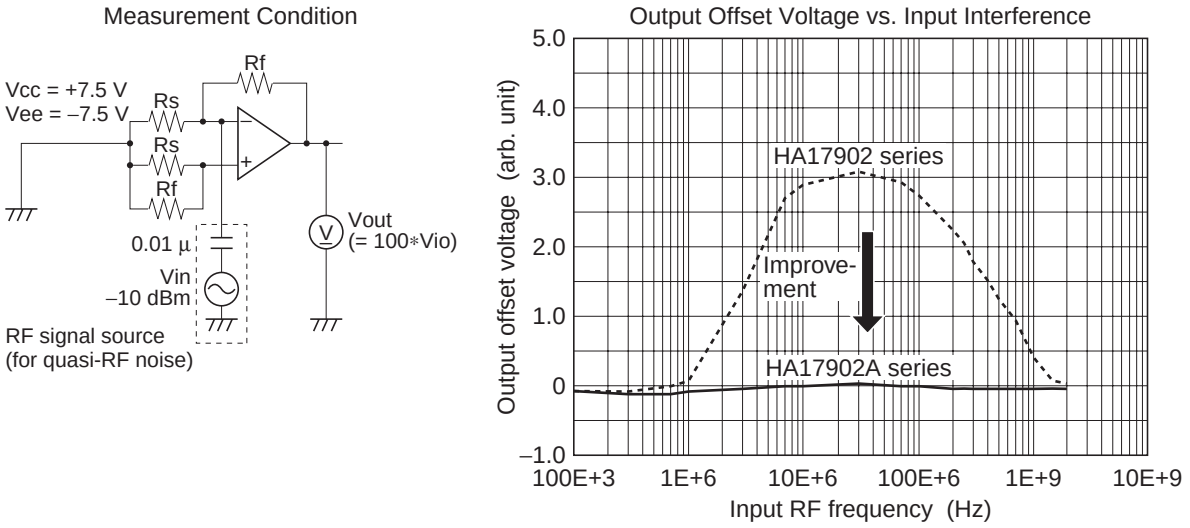
REJ03D0686-0200
Rev.2.00
Mar 10, 2006

## Description

HA17902A series are quad operational amplifier that provide high gain and internal phase compensation, with single power supply. They can be widely used to control equipments.

## Features

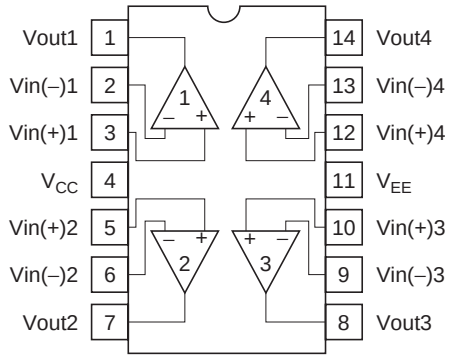
- Wide range of supply voltage, and single power supply used
- Internal phase compensation
- Wide range of common mode voltage, and possible to operate with an input about 0 V
- Low electro-magnetic susceptibility level




## Ordering Information

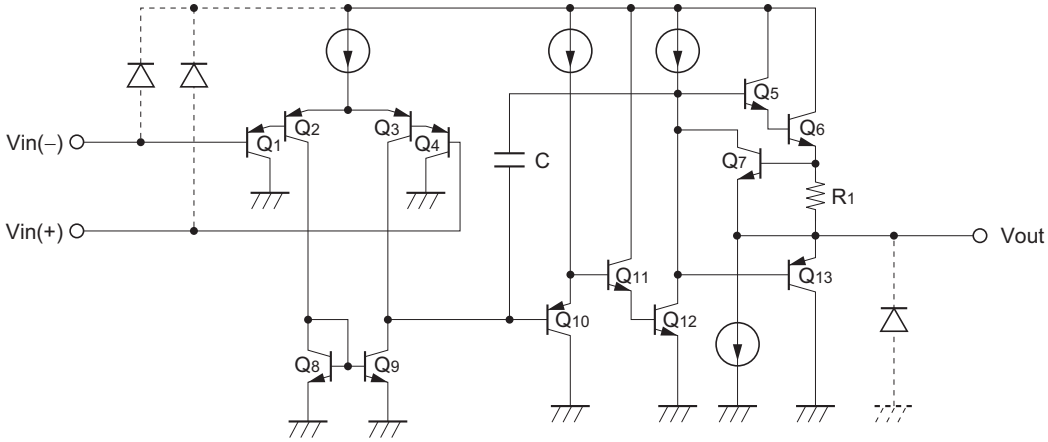
| Type No. | Application | Package Name | Package Code |
|---|---|---|---|
| HA17902AP | Industrial use | DIP-14 pin | PRDP0014AB-B |
| HA17902AFP | | SOP-14 pin (JEITA) | PRSP0014DF-B |
| HA17902ARP | | SOP-14 pin (JEDEC) | PRSP0014DE-A |
| HA17902AT | | TSSOP-14 pin | PTSP0014JA-B |

## Pin Arrangement




(Top view)

## Circuit Schematic (1/4)




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 | | $V_{CC}$ | 32 | V |
| Output sink current | | Iosink | 50 | mA |
| Common mode input voltage | | $V_{CM}$ | –0.3 to +$V_{CC}$ | V |
| Differential input voltage | | Vin(diff) | ±$V_{CC}$ | V |
| Output voltage | | Vout | –0.3 to +$V_{CC}$ | V |
| Allowable power dissipation | DIP | $P_T$ | 625 *2 | mW |
| | SOP | | 625 *3 | |
| | TSSOP | | 400 *4 | |
| Operating temperature | | Topr | –40 to +85 | °C |
| Storage temperature | | Tstg | –55 to +125 | °C |

Notes: 1. HA17902AP:
This is the allowable values up to Ta = 50°C. Derate by 8.3 mW/°C.
2. HA17902AFP/ARP:
When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.6 mmt with 10% wiring density, value at Ta ≤ 25°C. If Ta > 25°C, derated by 6.25 mW/°C.
When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.6 mmt with 30% wiring density. If Ta > 32°C, derated by 6.70 mW/°C.
3. HA17902AT:
These are the allowable values up to Ta = 25°C. Derate by 4 mW/°C above that temperature.

## Electrical Characteristics

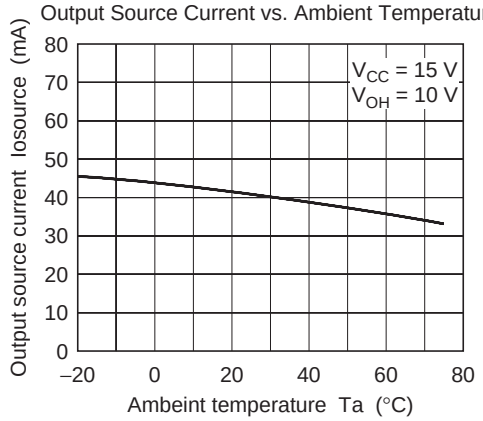
($V_{CC}$ = +15 V, Ta = 25°C)

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Input offset voltage | $V_{IO}$ | — | 2 | 7 | mV | $V_{CM}$ = 7.5 V, $R_S$ = 50 Ω, Rf = 50 kΩ |
| Input offset current | $I_{IO}$ | — | 5 | 50 | nA | $V_{CM}$ = 7.5 V, $I_{IO}$ = \| $I_{I(-)} - I_{I(+)}$ \| |
| Input bias current | $I_{IB}$ | — | 30 | 500 | nA | $V_{CM}$ = 7.5 V |
| Power source rejection ratio | PSRR | — | 93 | — | dB | f = 100 Hz, $R_S$ = 1 kΩ, Rj = 100 kΩ |
| Voltage gain | $A_{VD}$ | 75 | 90 | — | dB | $R_S$ = 1 kΩ, Rf = 100 kΩ, $R_L$ = ∞ |
| Common mode rejection ratio | CMR | — | 80 | — | dB | $R_S$ = 50 Ω, Rf = 5 kΩ |
| Common mode input voltage range | $V_{CM}$ | –0.3 | — | 13.5 | V | $R_S$ = 1 kΩ, Rf = 100 kΩ, f = 100 Hz |
| Maximum output voltage | $V_{OP-P}$ | — | 13.6 | — | V | f = 100 Hz, $R_S$ = 1 kΩ, Rf = 100 kΩ, $R_L$ = 20 kΩ |
| Output source current | Iosource | 20 | 40 | — | mA | $V_{IN}^+$ = 1 V, $V_{IN}^-$ = 0 V, $V_{OH}$ = 10 V |
| Output sink current | Iosink | 10 | 20 | — | mA | $V_{IN}$ = 0 V, $V_{IN}$ = 1 V, $V_{OL}$ = 2.5 V |
| Supply current | $I_{CC}$ | — | 0.8 | 2 | mA | $V_{IN}$ = GND, $R_L$ = ∞ |
| Slew rate | SR | — | 0.19 | — | V/µs | f = 1.5 kHz, $V_{CM}$ = 7.5 V, $R_L$ = ∞ |
| Channel separation *1 | CS | — | (120) | — | dB | f = 1 kHz |
| Output sink current | Iosink | 15 | 50 | — | µA | $V_{IN}^+$ = 0 V, $V_{IN}^-$ = 1 V, $V_{OL}$ = 200 mV |
| | | 3 | 9 | — | mA | $V_{IN}^+$ = 0 V, $V_{IN}^-$ = 1 V, $V_{OL}$ = 1 V |
| Output voltage | $V_{OH1}$ | 13.2 | 13.6 | — | V | $I_{OH}$ = –1 mA |
| | $V_{OH2}$ | 12.0 | 13.3 | — | V | $I_{OH}$ = –10 mA |
| Output voltage | $V_{OL1}$ | — | 0.8 | 1.0 | V | $I_{OL}$ = 1 mA |
| | $V_{OL2}$ | — | 1.1 | 1.8 | V | $I_{OL}$ = 10 mA |

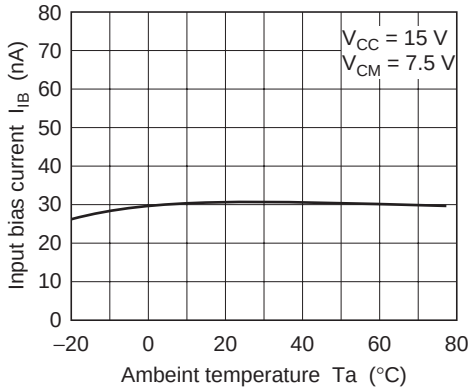
Note: 1. Design spec.

## Characteristic Curves

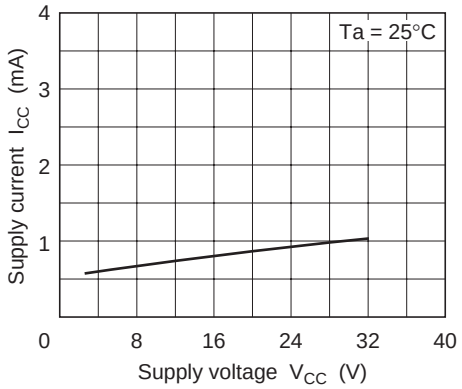
Output Source Current vs. Ambient Temperature



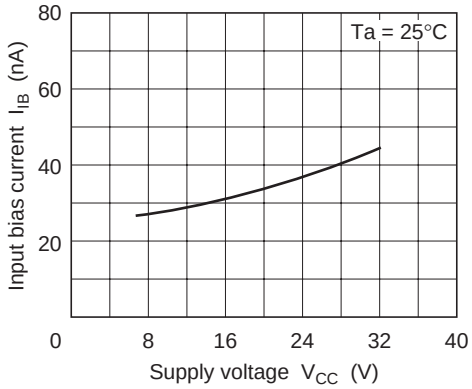

Input Bias Current vs. Ambient Temperature



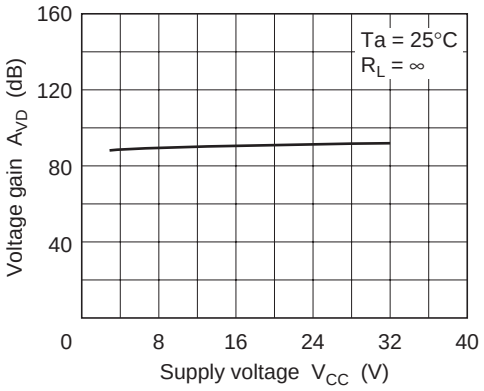

Supply Current vs. Supply Voltage



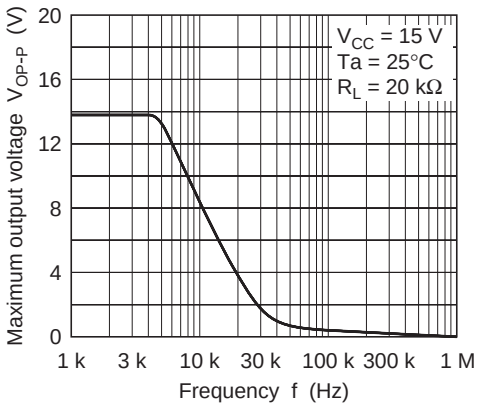

Input Bias Current vs. Supply Voltage



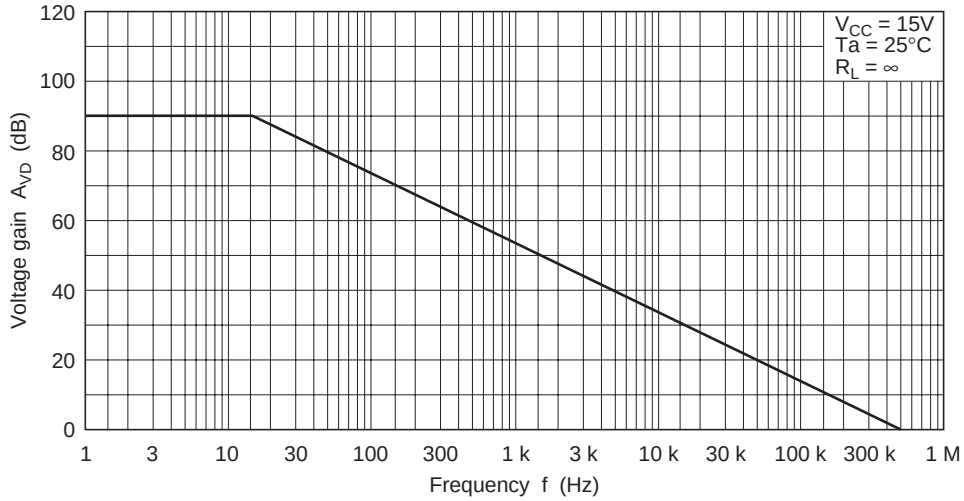

Voltage Gain vs. Supply Voltage



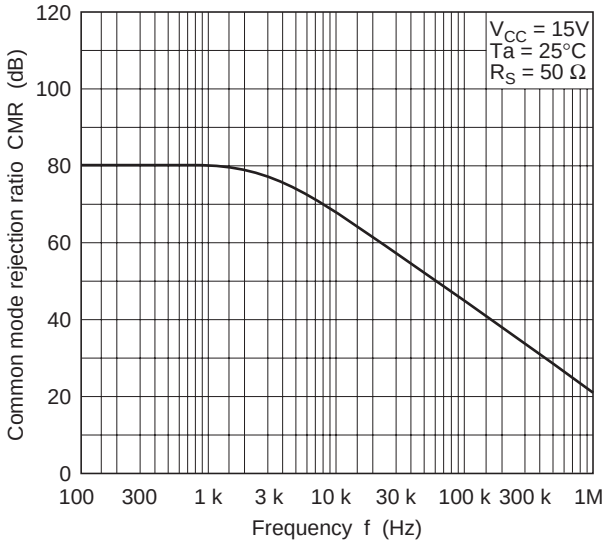

Maxlmum Output Voltage vs. Frequency



Voltage Gain vs. Frequency

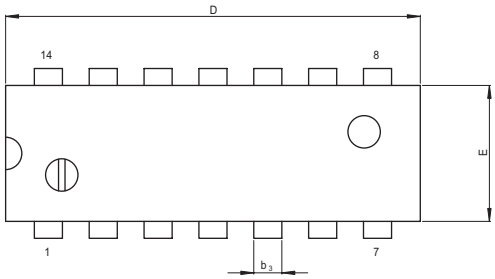


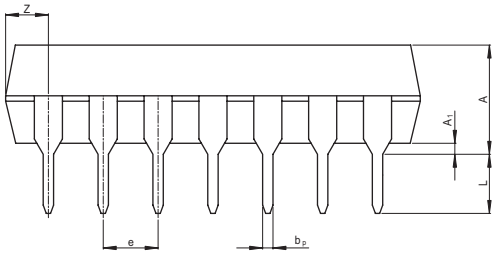

Common Mode Rejection Ratio vs. Frequency

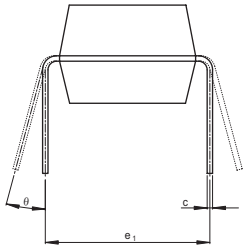


# Package Dimensions

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-DIP14-6.3x19.2-2.54 | PRDP0014AB-B | DP-14AV | 0.97g |



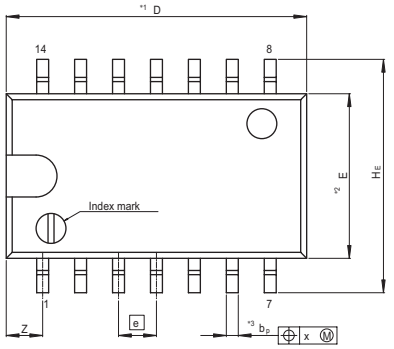



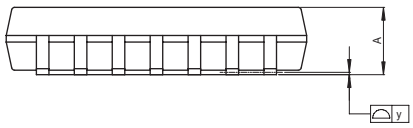



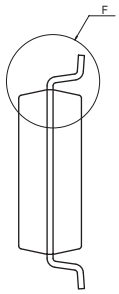

( Ni/Pd/Au plating )

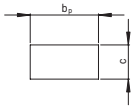
| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| $e_1$ | — | 7.62 | — |
| D | — | 19.2 | 20.32 |
| E | — | 6.3 | 7.4 |
| A | — | — | 5.06 |
| $A_1$ | 0.51 | — | — |
| $b_p$ | 0.40 | 0.48 | 0.56 |
| $b_3$ | — | 1.30 | — |
| c | 0.19 | 0.25 | 0.31 |
| θ | 0° | — | 15° |
| e | 2.29 | 2.54 | 2.79 |
| Z | — | — | 2.39 |
| L | 2.54 | — | — |

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP14-5.5x10.06-1.27 | PRSP0014DF-B | FP-14DAV | 0.23g |

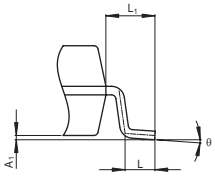



Terminal cross section
( Ni/Pd/Au plating )

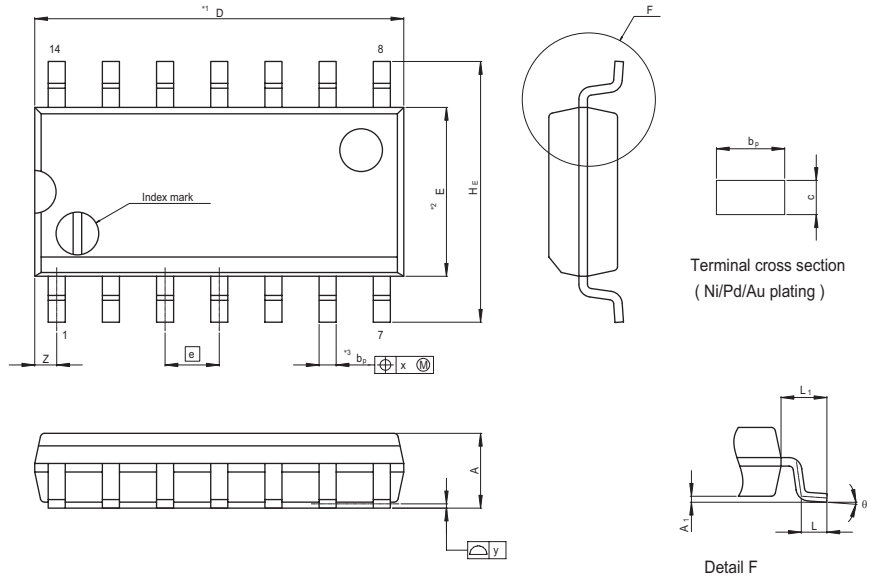



Detail F

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 | — | 10.06 | 10.5 |
| E | — | 5.50 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.00 | 0.10 | 0.20 |
| A | — | — | 2.20 |
| $b_p$ | 0.34 | 0.40 | 0.46 |
| $b_1$ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 7.50 | 7.80 | 8.00 |
| e | — | 1.27 | — |
| x | — | — | 0.12 |
| y | — | — | 0.15 |
| Z | — | — | 1.42 |
| L | 0.50 | 0.70 | 0.90 |
| $L_1$ | — | 1.15 | — |

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP14-3.95x8.65-1.27 | PRSP0014DE-A | FP-14DNV | 0.13g |



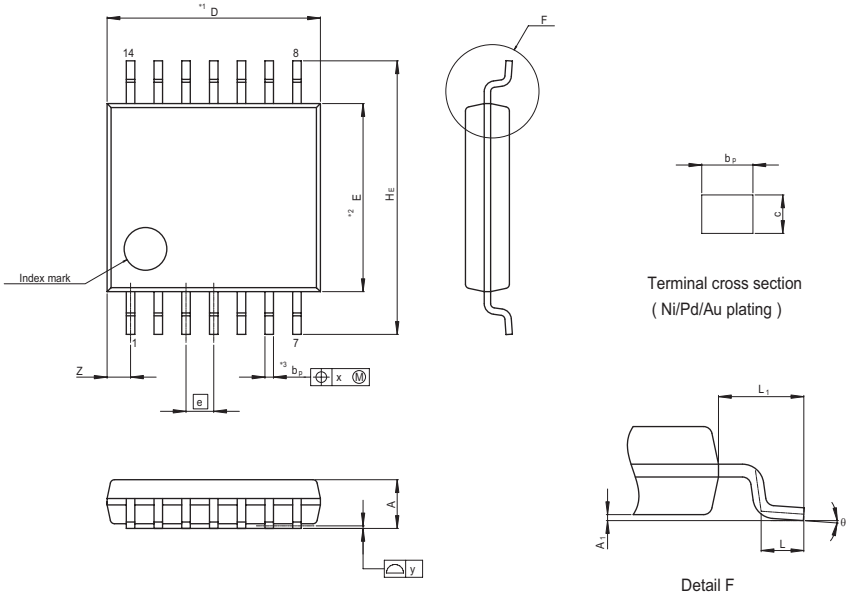

Terminal cross section
( Ni/Pd/Au plating )

Detail F

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 | — | 8.65 | 9.05 |
| E | — | 3.95 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.10 | 0.14 | 0.25 |
| A | — | — | 1.75 |
| $b_p$ | 0.34 | 0.40 | 0.46 |
| $b_1$ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 5.80 | 6.10 | 6.20 |
| e | — | 1.27 | — |
| x | — | — | 0.25 |
| y | — | — | 0.15 |
| Z | — | — | 0.635 |
| L | 0.40 | 0.60 | 1.27 |
| $L_1$ | — | 1.08 | — |

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-TSSOP14-4.4x5-0.65 | PTSP0014JA-B | TTP-14DV | 0.05g |




Terminal cross section
( Ni/Pd/Au plating )

Detail F

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 | — | 5.00 | 5.30 |
| E | — | 4.40 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.03 | 0.07 | 0.10 |
| A | — | — | 1.10 |
| $b_p$ | 0.15 | 0.20 | 0.25 |
| $b_1$ | — | — | — |
| c | 0.10 | 0.15 | 0.20 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 6.20 | 6.40 | 6.60 |
| e | — | 0.65 | — |
| x | — | — | 0.13 |
| y | — | — | 0.10 |
| Z | — | — | 0.83 |
| L | 0.4 | 0.5 | 0.6 |
| $L_1$ | — | 1.0 | — |

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