

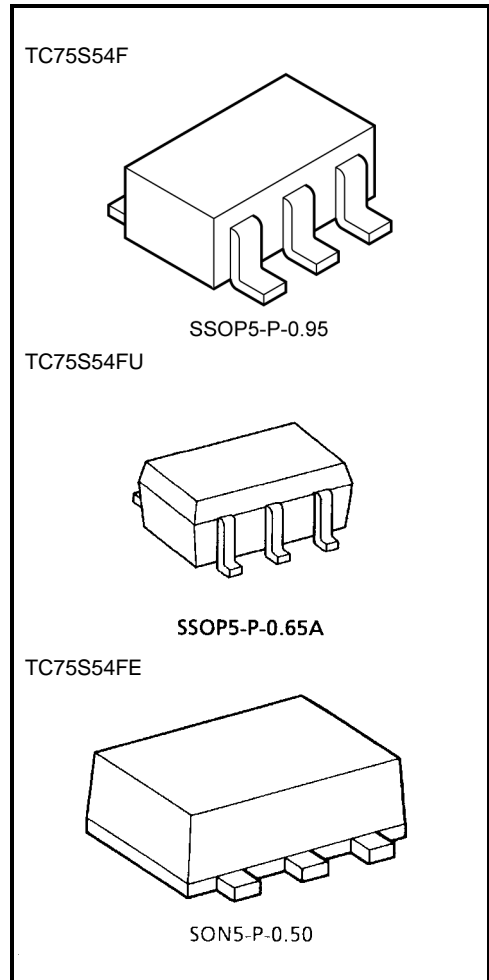
TC75S54F, TC75S54FU, TC75S54FE

Single Operational Amplifier

The TC75S54F/TC75S54FU/TC75S54FE is a CMOS single-operation amplifier which incorporates a phase compensation circuit. It is designed for use with a low-voltage, low-current power supply; this differentiates this device from conventional general-purpose bipolar op-amps.

Features

- Low-voltage operation : $V_{DD} = \pm 0.9 \sim 3.5 \text{ V}$ or $1.8 \sim 7 \text{ V}$
- Low-current power supply : $I_{DD} (V_{DD} = 3 \text{ V}) = 100 \mu\text{A}$ (typ.)
- Built-in phase-compensated op-amp, obviating the need for any external device
- Ultra-compact package



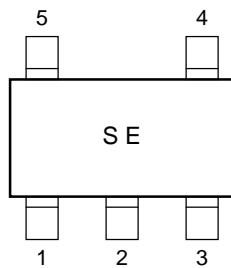
Weight

- SSOP5-P-0.95 : 0.014 g (typ.)
- SSOP5-P-0.65A : 0.006 g (typ.)
- SON5-P-0.50 : 0.003 g (typ.)

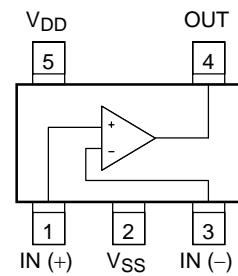
Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|----------------------------|-------------|------------------|-------------------|------|
| Supply voltage | | V_{DD}, V_{SS} | 7 | V |
| Differential input voltage | | DV_{IN} | ± 7 | V |
| Input voltage | | V_{IN} | $V_{DD} - V_{SS}$ | V |
| Power dissipation | TC75S54F/FU | P_D | 200 | mW |
| | TC75S54FE | | 100 | |
| Operating temperature | | T_{opr} | -40~85 | °C |
| Storage temperature | | T_{stg} | -55~125 | °C |

Marking (top view)



Pin Connection (top view)



Electrical Characteristics

DC Characteristics (V_{DD} = 3.0 V, V_{SS} = GND, Ta = 25°C)

| Characteristics | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|--|---------------------|--------------|-----------------------------|-----|------|-----|------|
| Input offset voltage | V _{IO} | 1 | R _S = 1 kΩ | — | 2 | 10 | mV |
| Input offset current | I _{IO} | — | — | — | 1 | — | pA |
| Input bias current | I _I | — | — | — | 1 | — | pA |
| Common mode input voltage | CMV _{IN} | 2 | — | 0.0 | — | 2.1 | V |
| Voltage gain(open loop) | G _V | — | — | 60 | 70 | — | dB |
| Maximum output voltage | V _{OH} | 3 | R _L ≥ 100 kΩ | 2.9 | — | — | V |
| | V _{OL} | 4 | R _L ≥ 100 kΩ | — | — | 0.1 | |
| Common mode input signal rejection ratio | CMRR | 2 | V _{IN} = 0.0~2.1 V | 60 | 70 | — | dB |
| Supply voltage rejection ratio | SVRR | 1 | V _{DD} = 1.8~7.0 V | 60 | 70 | — | dB |
| Supply current | I _{DD} | 5 | — | — | 100 | 200 | μA |
| Source current | I _{source} | 6 | — | 100 | 200 | — | μA |
| Sink current | I _{sink} | 7 | — | 200 | 700 | — | μA |

DC Characteristics (V_{DD} = 1.8 V, V_{SS} = GND, Ta = 25°C)

| Characteristics | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|---------------------------|---------------------|--------------|-------------------------|-----|------|-----|------|
| Input offset voltage | V _{IO} | 1 | R _S = 10 kΩ | — | 2 | 10 | mV |
| Input offset current | I _{IO} | — | — | — | 1 | — | pA |
| Input bias current | I _I | — | — | — | 1 | — | pA |
| Common mode input voltage | CMV _{IN} | 2 | — | 0.2 | — | 0.9 | V |
| Voltage gain (open loop) | G _V | — | — | 60 | 70 | — | dB |
| Maximum output voltage | V _{OH} | 3 | R _L ≥ 100 kΩ | 1.7 | — | — | V |
| | V _{OL} | 4 | R _L ≥ 100 kΩ | — | — | 0.1 | |
| Supply current | I _{DD} | 5 | — | — | 80 | 160 | μA |
| Source current | I _{source} | 6 | — | 80 | 160 | — | μA |
| Sink current | I _{sink} | 7 | — | 200 | 600 | — | μA |

AC Characteristics ($V_{DD} = 3.0\text{ V}$, $V_{SS} = \text{GND}$, $T_a = 25^\circ\text{C}$)

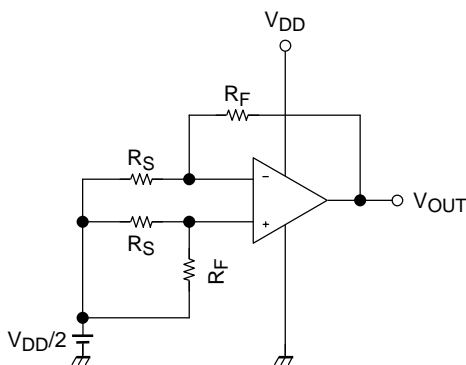
| Characteristics | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|----------------------------|--------|--------------|----------------|-----|------|-----|------------------|
| Slew rate | SR | — | — | — | 0.7 | — | V/ μs |
| Unity gain cross frequency | f_T | — | — | — | 0.9 | — | MHz |

AC Characteristics ($V_{DD} = 1.8\text{ V}$, $V_{SS} = \text{GND}$, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|----------------------------|--------|--------------|----------------|-----|------|-----|------------------|
| Slew rate | SR | — | — | — | 0.6 | — | V/ μs |
| Unity gain cross frequency | f_T | — | — | — | 0.8 | — | MHz |

Test Circuit

1. SVRR, V_{IO}



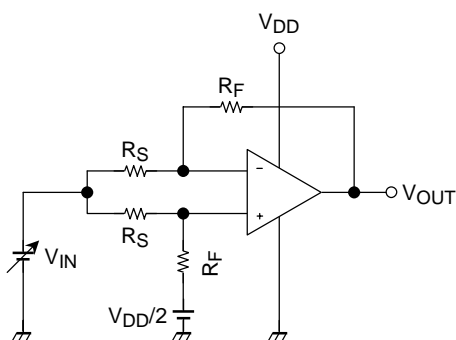
- SVRR**
 For each of the two V_{DD} values, measure the V_{OUT} value, as indicated below, and calculate the value of SVRR using the equation shown.
 When $V_{DD} = 1.8\text{ V}$, $V_{DD} = V_{DD1}$ and $V_{OUT} = V_{OUT1}$
 When $V_{DD} = 7.0\text{ V}$, $V_{DD} = V_{DD2}$ and $V_{OUT} = V_{OUT2}$

$$SVRR = 20 \lambda \log \left(\left| \frac{V_{OUT1} - V_{OUT2}}{V_{DD1} - V_{DD2}} \right| \times \frac{R_S}{R_F + R_S} \right)$$

- V_{IO}**
 Measure the value of V_{OUT} and calculate the value of V_{IO} using the following equation.

$$V_{IO} = \left(V_{OUT} - \frac{V_{DD}}{2} \right) \times \frac{R_S}{R_F + R_S}$$

2. CMRR, CMV_{IN}

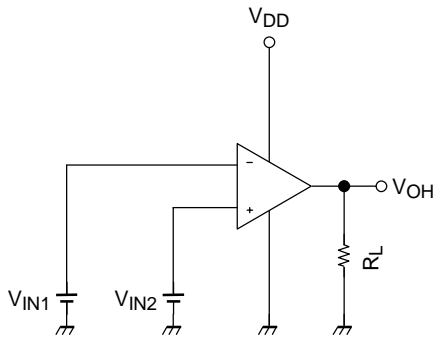


- CMRR**
 Measure the V_{OUT} value, as indicated below, and calculate the value of the CMRR using the equation shown.
 When $V_{IN} = 0.0\text{ V}$, $V_{IN} = V_{IN1}$ and $V_{OUT} = V_{OUT1}$
 When $V_{IN} = 2.1\text{ V}$, $V_{IN} = V_{IN2}$ and $V_{OUT} = V_{OUT2}$

$$CMRR = 20 \lambda \log \left(\left| \frac{V_{OUT1} - V_{OUT2}}{V_{IN1} - V_{IN2}} \right| \times \frac{R_S}{R_F + R_S} \right)$$

- CMV_{IN}**
 Input range within which the CMRR specification guarantees V_{OUT} value (as varied by the V_{IN} value).

3. V_{OH}

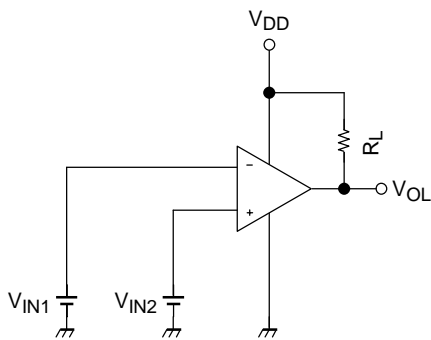


- V_{OH}

$$V_{IN1} = \frac{V_{DD}}{2} - 0.05 \text{ V}$$

$$V_{IN2} = \frac{V_{DD}}{2} + 0.05 \text{ V}$$

4. V_{OL}

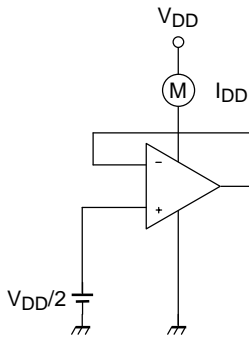


- V_{OL}

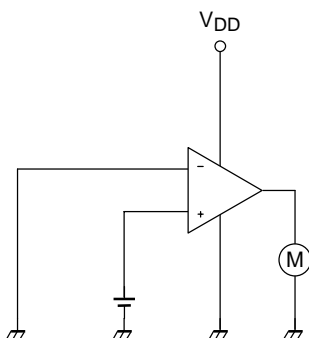
$$V_{IN1} = \frac{V_{DD}}{2} + 0.05 \text{ V}$$

$$V_{IN2} = \frac{V_{DD}}{2} - 0.05 \text{ V}$$

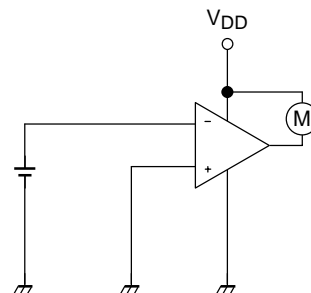
5. I_{DD}

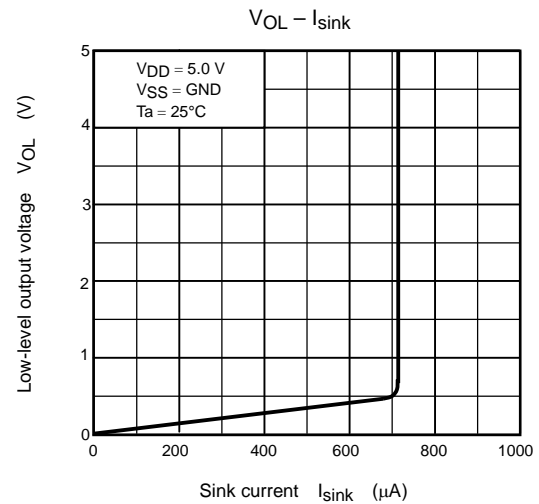
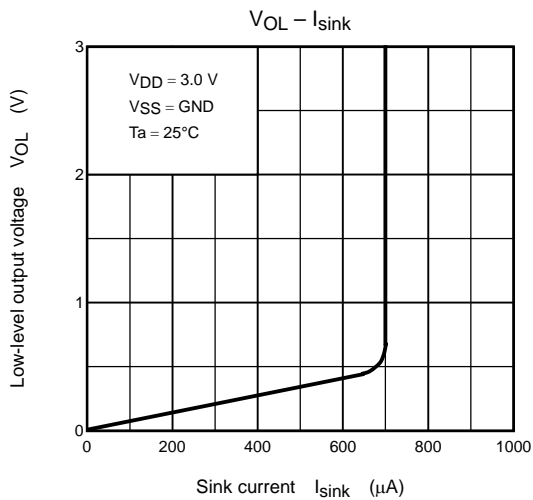
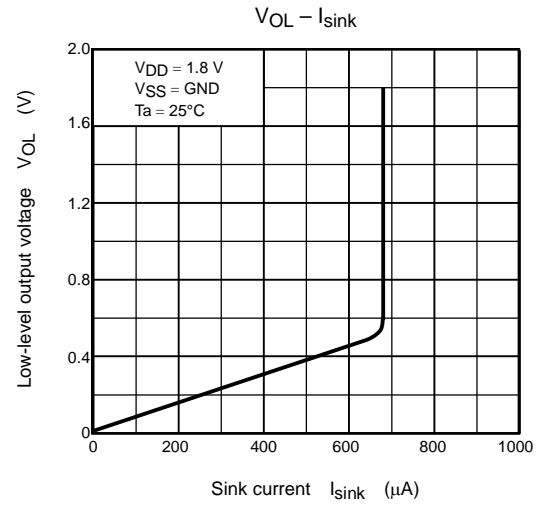
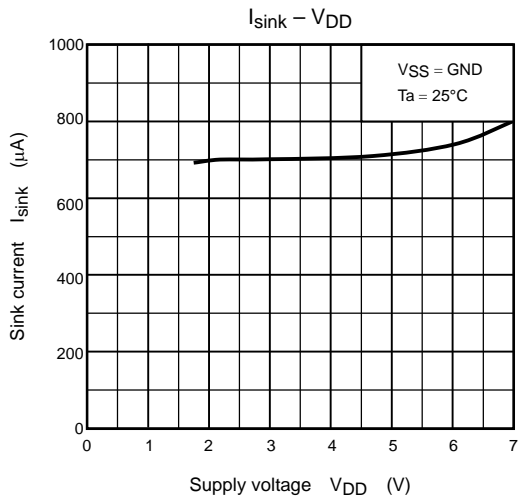
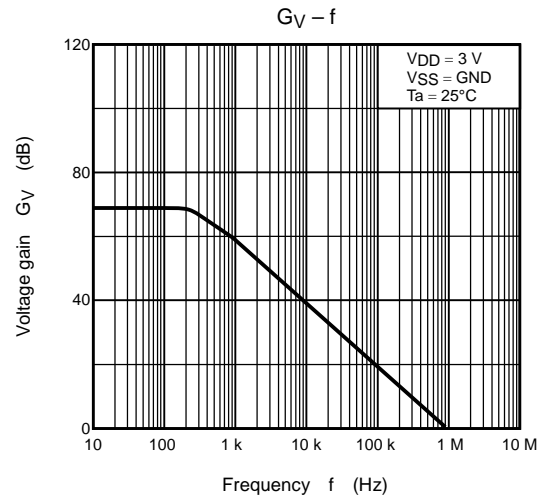
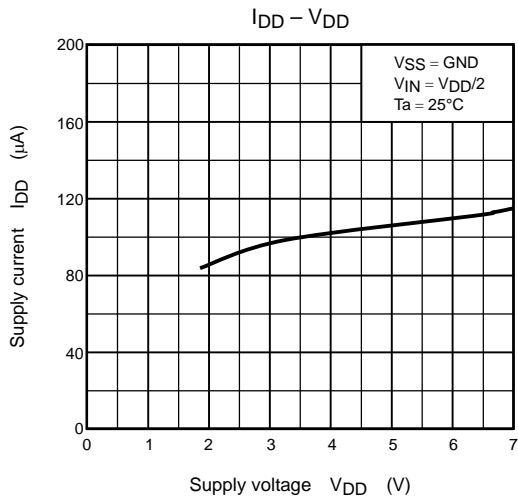


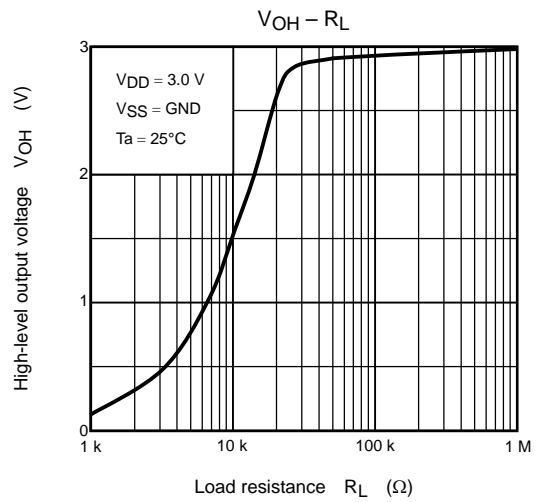
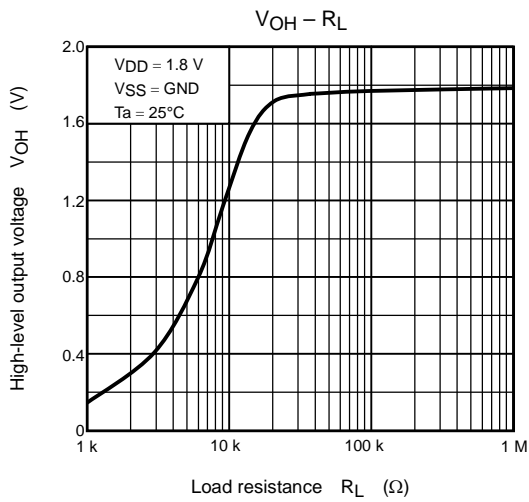
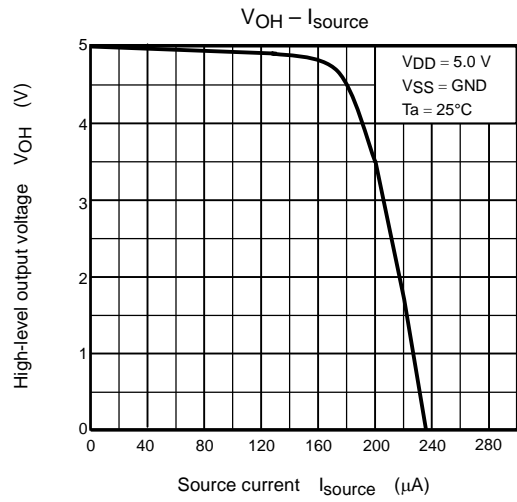
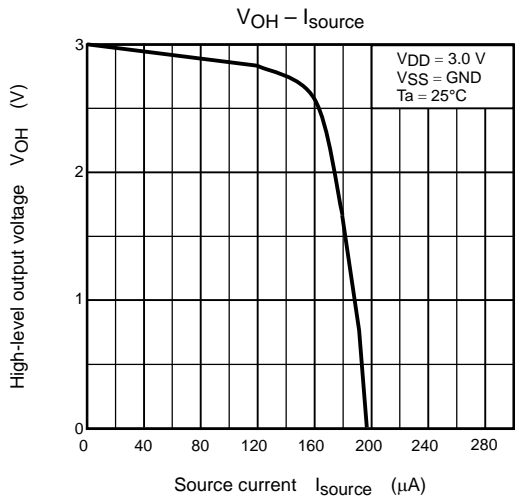
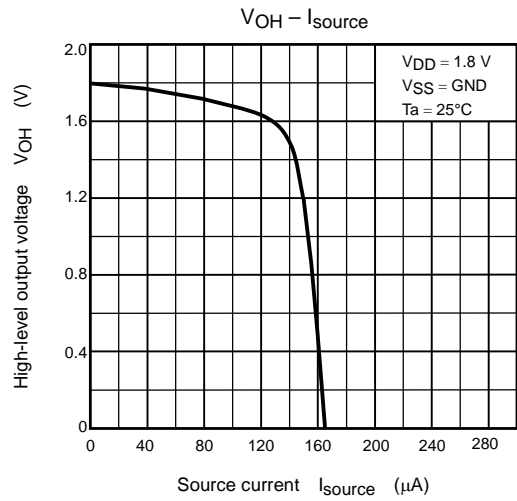
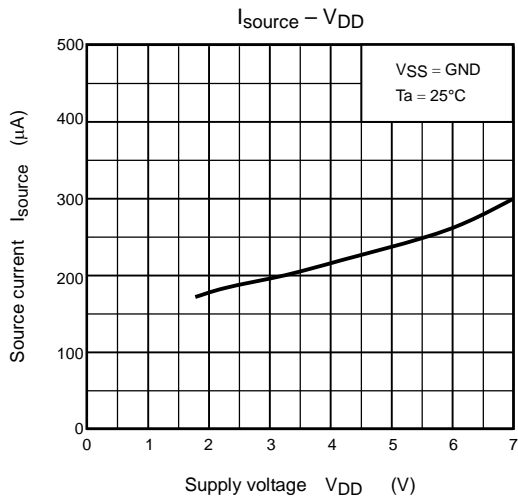
6. I_{source}

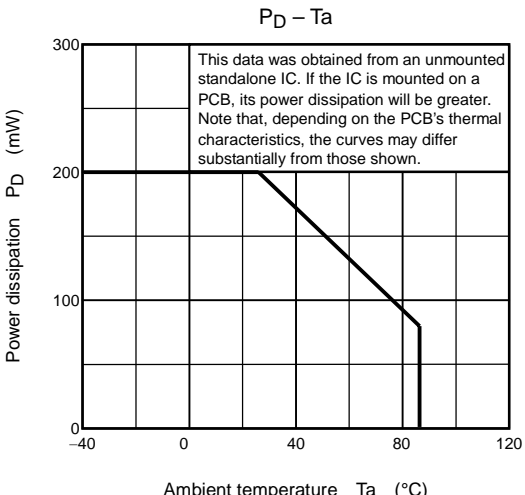
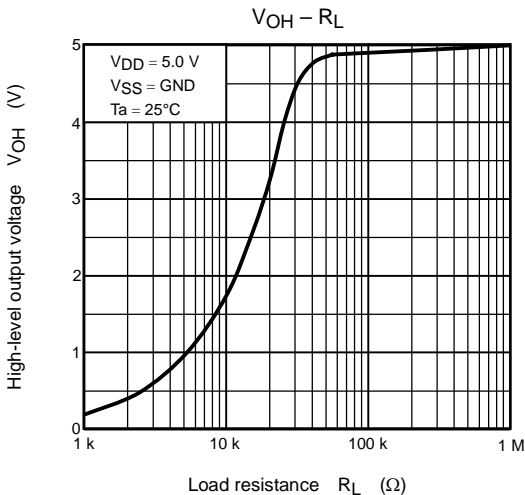


7. I_{sink}





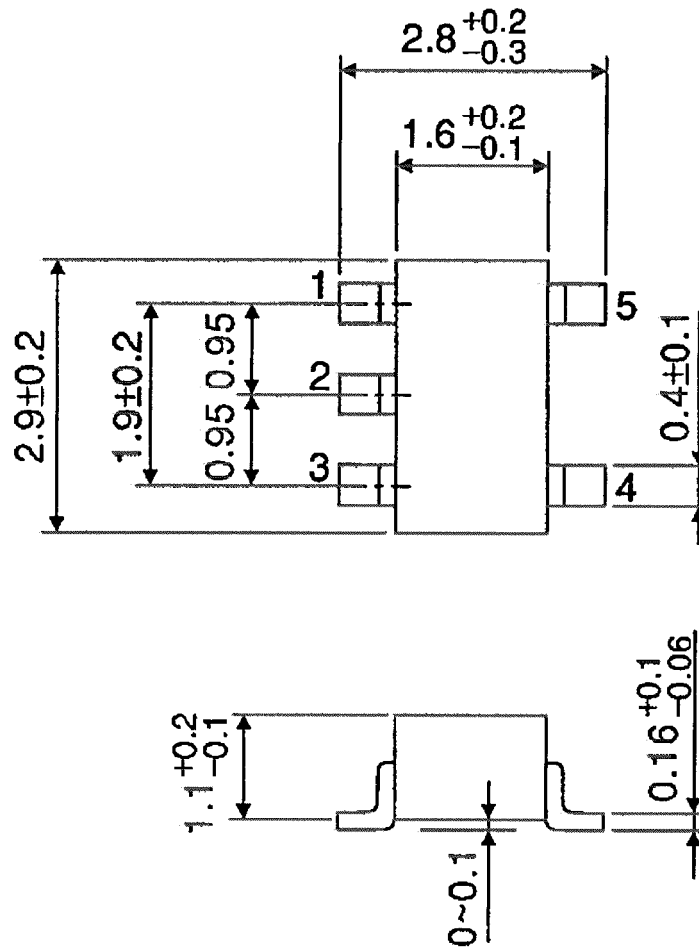




Package Dimensions

SSOP5-P-0.95

Unit : mm

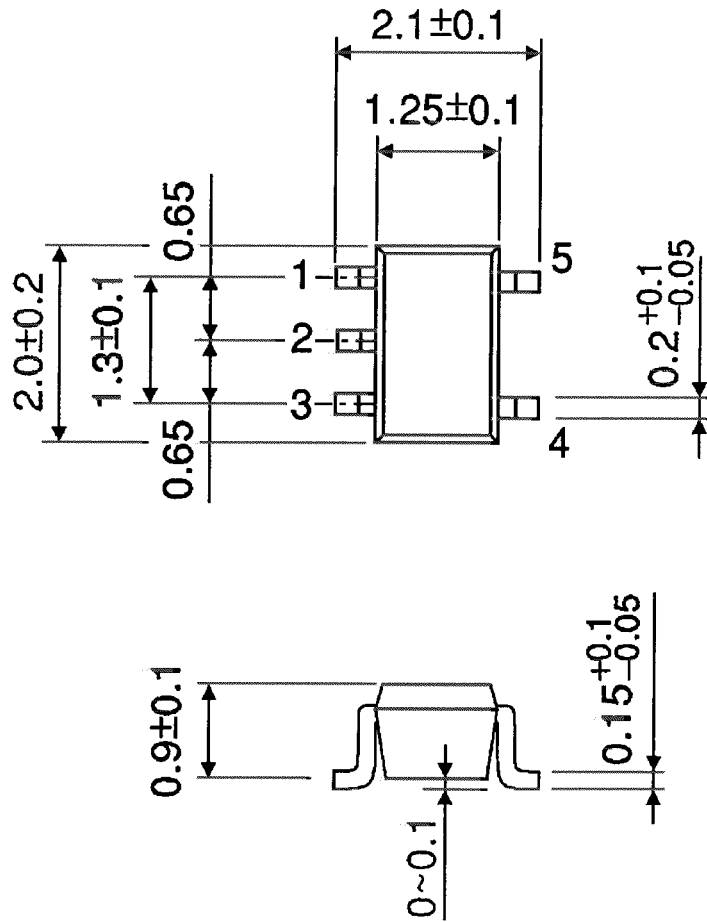


Weight: 0.014 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm

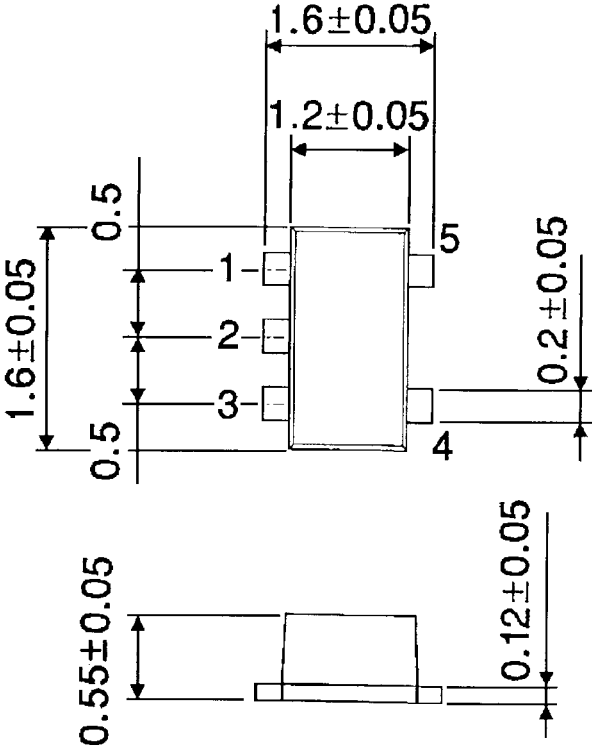


Weight: 0.006 g (typ.)

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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