

TOSHIBA CMOS LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC75W54FU, TC75W54FK

## DUAL OPERATIONAL AMPLIFIER

TC75W54 is a CMOS operational amplifier with low supply voltage, low supply current.

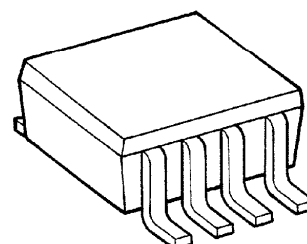
### FEATURES

- Low supply voltage :  $V_{DD} = \pm 0.9 \sim 3.5V$  or  $1.8 \sim 7V$
- Low supply current :  $I_{DD} (V_{DD} = 3V) = 200 \mu A$  (Typ.)
- The internally phase compensated operational amplifier.
- Small package

### MAXIMUM RATINGS ( $T_a = 25^\circ C$ )

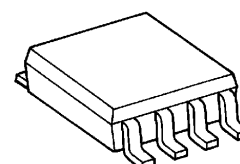
| CHARACTERISTIC             | SYMBOL           | RATING               | N          |
|----------------------------|------------------|----------------------|------------|
| Supply Voltage             | $V_{DD}, V_{SS}$ | 7                    | V          |
| Differential Input Voltage | $DV_{IN}$        | $\pm 7$              | V          |
| Input Voltage              | $V_{IN}$         | $V_{DD} \sim V_{SS}$ | V          |
| Power Dissipation          | $P_D$            | 250 (SM8)            | mW         |
|                            |                  | 200 (US8)            |            |
| Operating Temperature      | $T_{opr}$        | $-40 \sim 85$        | $^\circ C$ |
| Storage Temperature        | $T_{stg}$        | $-55 \sim 125$       | $^\circ C$ |

TC75W54FU



SSOP8-P-0.65

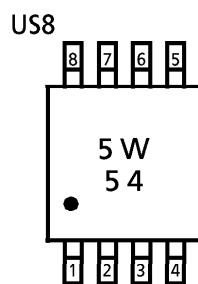
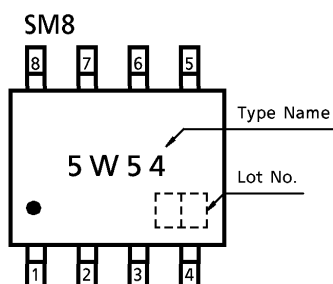
TC75W54FK



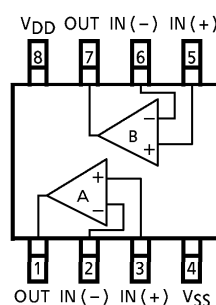
SSOP8-P-0.50A

Weight  
 SSOP8-P-0.65 : 0.021g (Typ.)  
 SSOP8-P-0.50A : 0.01g (Typ.)

### MARKING (TOP VIEW)



### PIN CONNECTION (TOP VIEW)



980508EBA1

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## ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS ( $V_{DD} = 3.0V$ ,  $V_{SS} = GND$ ,  $T_a = 25^\circ C$ )

| CHARACTERISTIC                           | SYMBOL       | TEST CIR-CUIT | TEST CONDITION           | MIN. | TYP. | MAX. | UNIT    |
|------------------------------------------|--------------|---------------|--------------------------|------|------|------|---------|
| Input Offset Voltage                     | $V_{IO}$     | 1             | $R_S = 1k\Omega$         | —    | 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             | $R_L \geq 100k\Omega$    | 2.9  | —    | —    | V       |
|                                          | $V_{OL}$     | 4             | $R_L \geq 100k\Omega$    | —    | —    | 0.1  |         |
| Common Mode Input Signal Rejection Ratio | CMRR         | 2             | $V_{IN} = 0.0 \sim 2.1V$ | 60   | 70   | —    | dB      |
| Supply Voltage Rejection Ratio           | SVRR         | 1             | $V_{DD} = 1.8 \sim 7.0V$ | 60   | 70   | —    | dB      |
| Supply Current                           | $I_{DD}$     | 5             | —                        | —    | 200  | 400  | $\mu A$ |
| Source Current                           | $I_{source}$ | 6             | —                        | 100  | 200  | —    | $\mu A$ |
| Sink Current                             | $I_{sink}$   | 7             | —                        | 200  | 700  | —    | $\mu A$ |

DC CHARACTERISTICS ( $V_{DD} = 1.8V$ ,  $V_{SS} = GND$ ,  $T_a = 25^\circ C$ )

| CHARACTERISTIC            | SYMBOL       | TEST CIR-CUIT | TEST CONDITION        | MIN. | TYP. | MAX. | UNIT    |
|---------------------------|--------------|---------------|-----------------------|------|------|------|---------|
| Input Offset Voltage      | $V_{IO}$     | 1             | $R_S = 10k\Omega$     | —    | 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             | $R_L \geq 100k\Omega$ | 1.7  | —    | —    | V       |
|                           | $V_{OL}$     | 4             | $R_L \geq 100k\Omega$ | —    | —    | 0.1  |         |
| Supply Current            | $I_{DD}$     | 5             | —                     | —    | 160  | 320  | $\mu A$ |
| Source Current            | $I_{source}$ | 6             | —                     | 80   | 160  | —    | $\mu A$ |
| Sink Current              | $I_{sink}$   | 7             | —                     | 200  | 600  | —    | $\mu A$ |

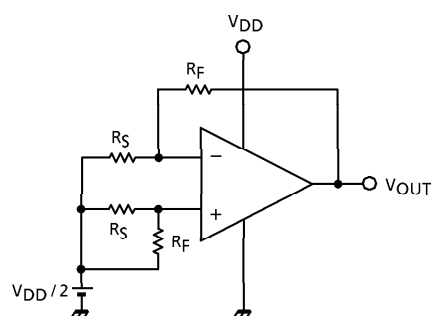
AC CHARACTERISTICS ( $V_{DD} = 3.0V$ ,  $V_{SS} = GND$ ,  $T_a = 25^\circ C$ )

| CHARACTERISTIC             | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT        |
|----------------------------|--------|---------------|----------------|------|------|------|-------------|
| Slew Rate                  | SR     | —             | —              | —    | 0.7  | —    | $V / \mu s$ |
| Unity Gain Cross Frequency | $f_T$  | —             | —              | —    | 0.9  | —    | MHz         |

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

| CHARACTERISTIC             | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT        |
|----------------------------|--------|---------------|----------------|------|------|------|-------------|
| Slew Rate                  | SR     | —             | —              | —    | 0.6  | —    | $V / \mu s$ |
| Unity Gain Cross Frequency | $f_T$  | —             | —              | —    | 0.8  | —    | MHz         |

**TEST CIRCUIT**

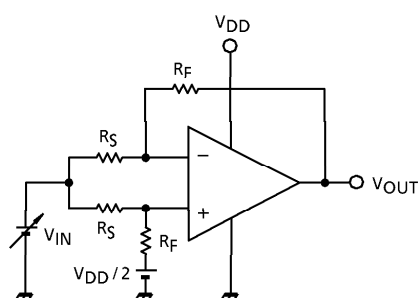
 1. SVRR,  $V_{IO}$ 


- SVRR  
 $V_{DD} = 1.8V : V_{DD} = V_{DD1}, V_{OUT} = V_{OUT1}$   
 $V_{DD} = 7.0V : V_{DD} = V_{DD2}, V_{OUT} = V_{OUT2}$   

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

- $V_{IO}$   

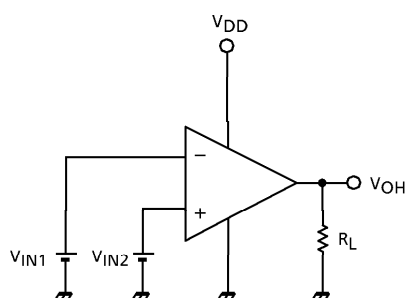
$$V_{IO} = \left( V_{OUT} - \frac{V_{DD}}{2} \right) \times \frac{R_S}{R_F + R_S}$$

 2. CMRR,  $CMV_{IN}$ 


- CMRR  
 $V_{IN} = 0.0V : V_{IN} = V_{IN1}, V_{OUT} = V_{OUT1}$   
 $V_{IN} = 2.1V : V_{IN} = V_{IN2}, V_{OUT} = V_{OUT2}$   

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

- $CMV_{IN}$

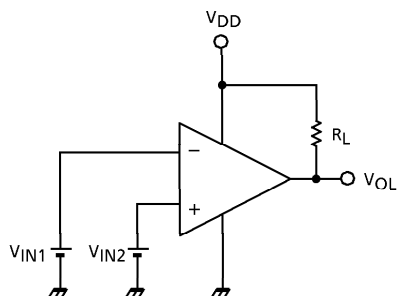
 3.  $V_{OH}$ 


- $V_{OH}$   

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

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

4.  $V_{OL}$

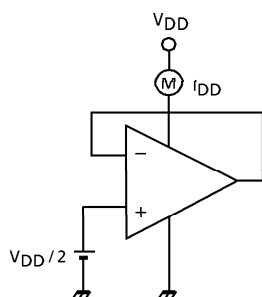


•  $V_{OL}$

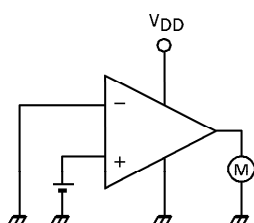
$$V_{IN1} = \frac{V_{DD}}{2} + 0.05V$$

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

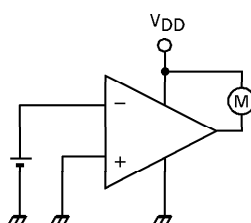
5.  $I_{DD}$

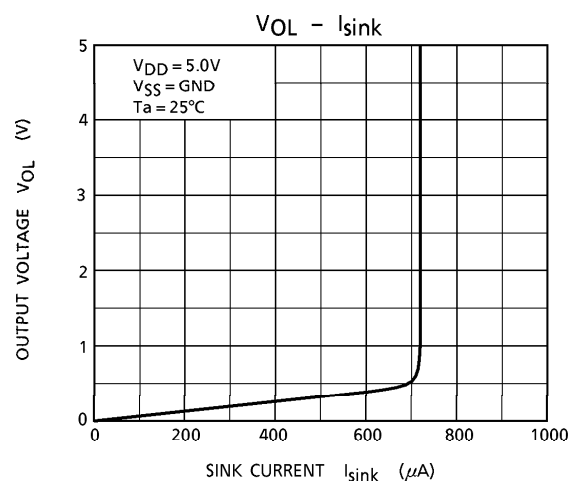
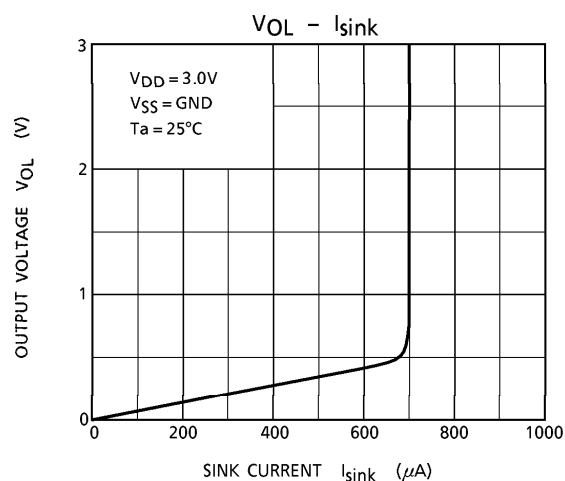
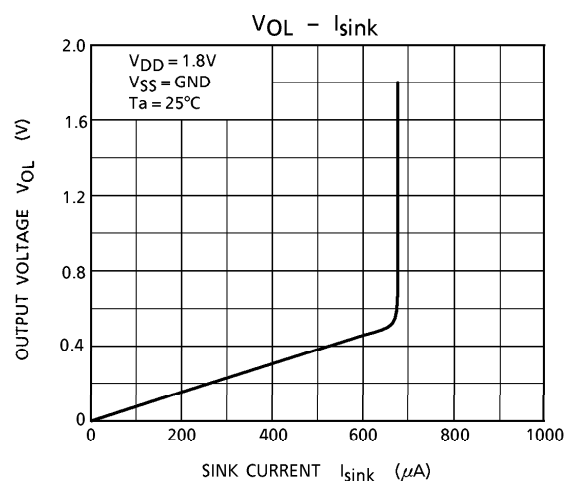
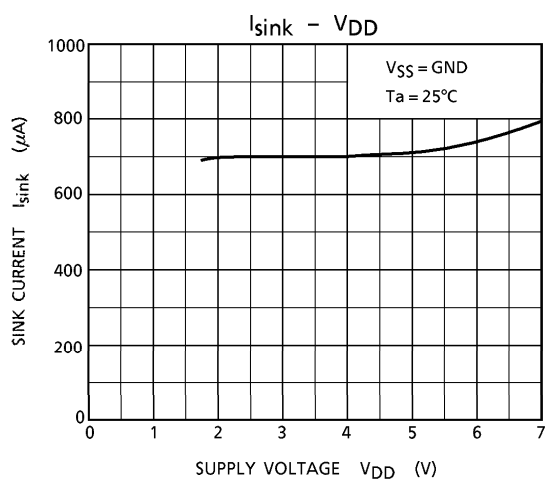
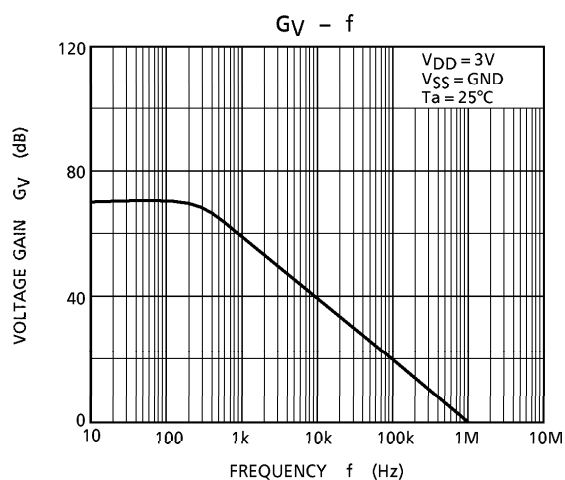
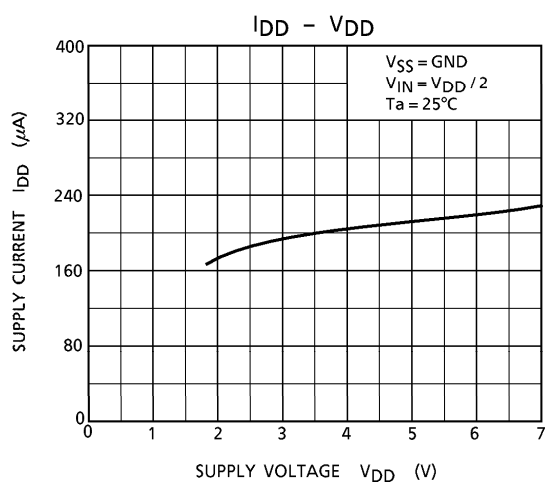


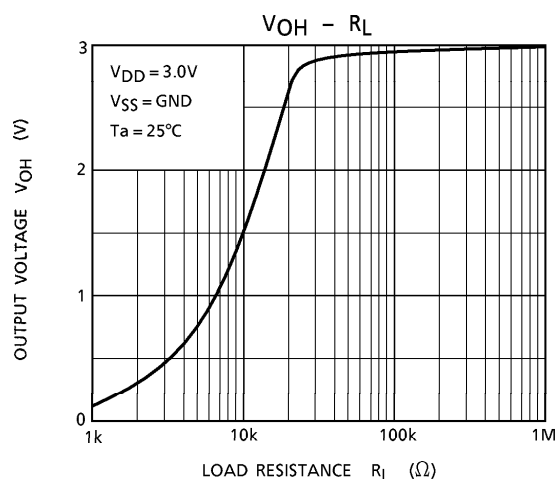
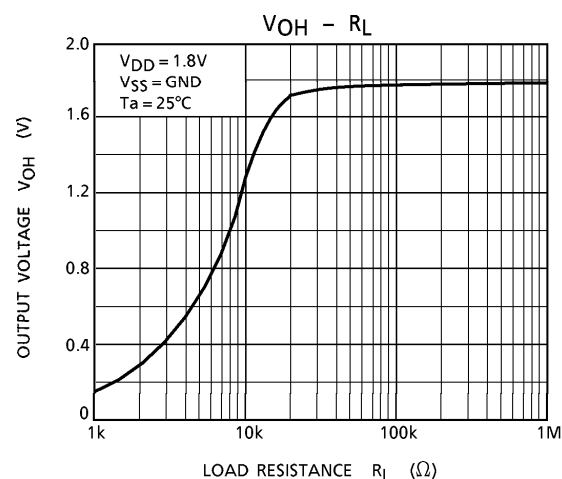
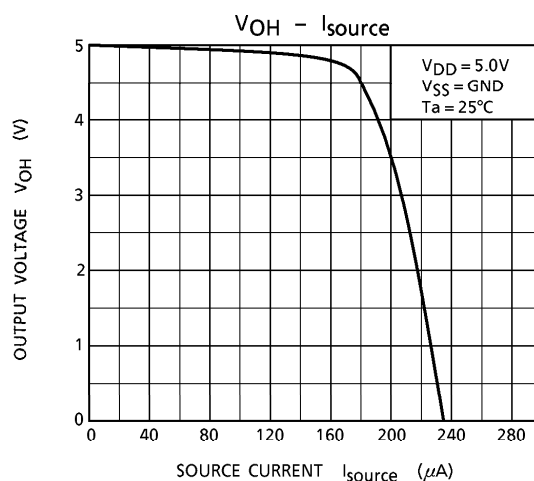
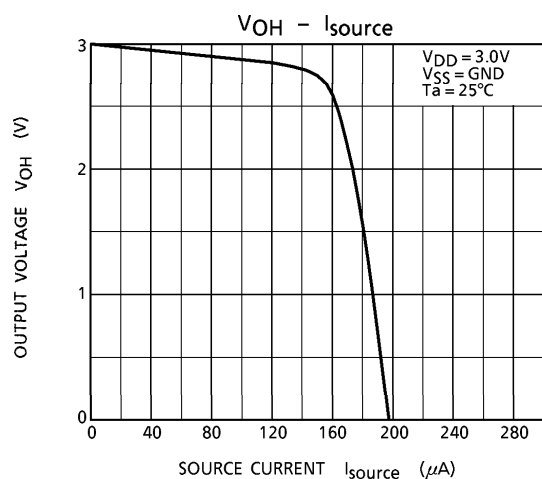
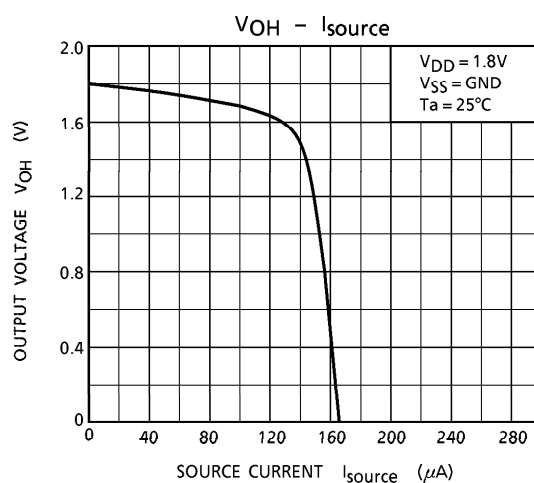
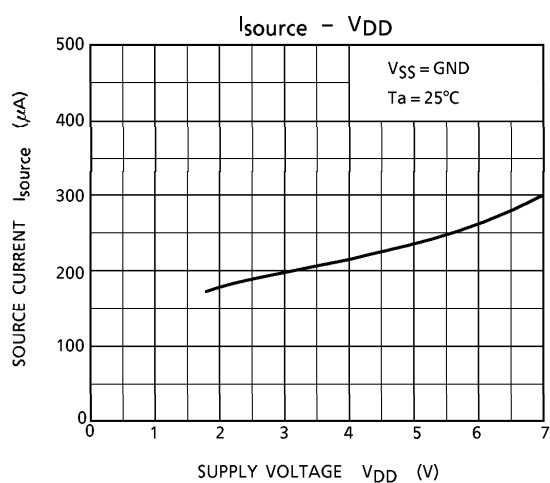
6.  $I_{source}$

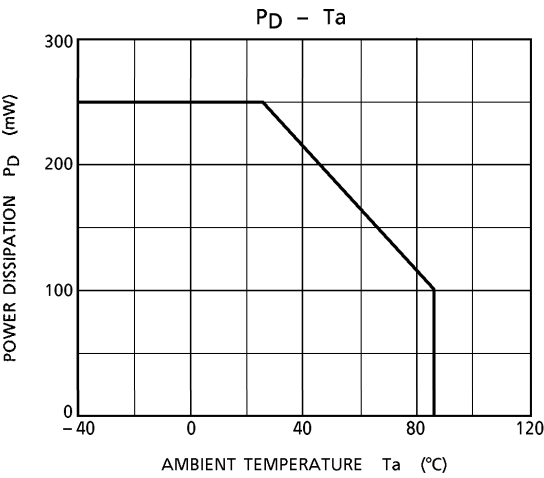
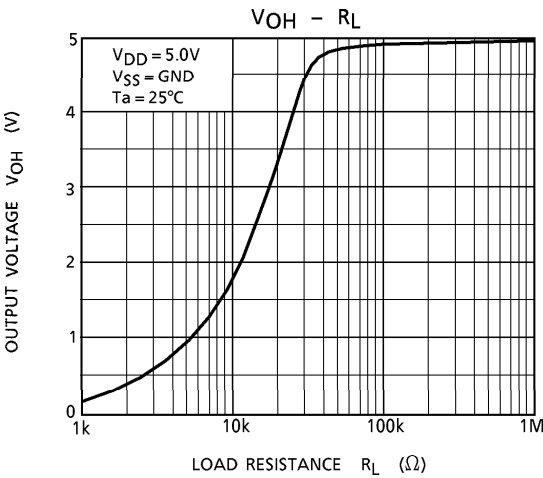


7.  $I_{sink}$



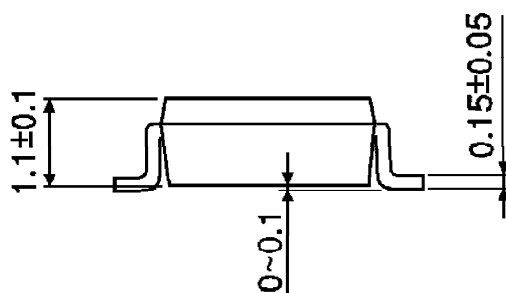
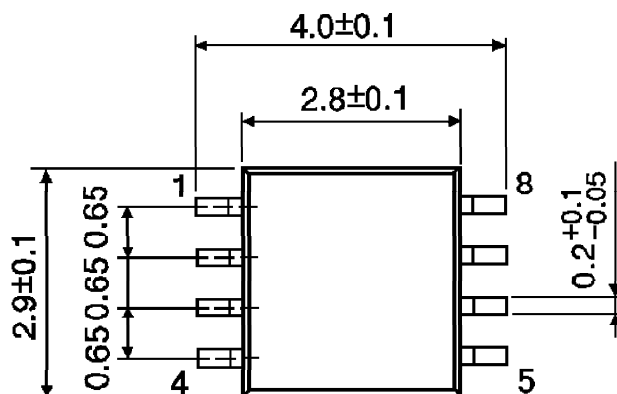






OUTLINE DRAWING  
SSOP8-P-0.65

Unit : mm

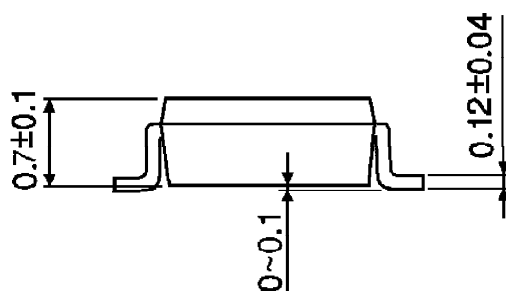
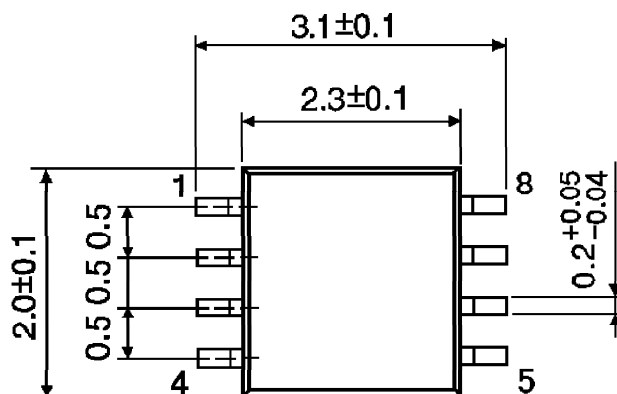


Weight : 0.021g (Typ.)



OUTLINE DRAWING  
SSOP8-P-0.50A

Unit : mm



Weight : 0.01g (Typ.)