

# TC7W66F, TC7W66FU, TC7W66FK

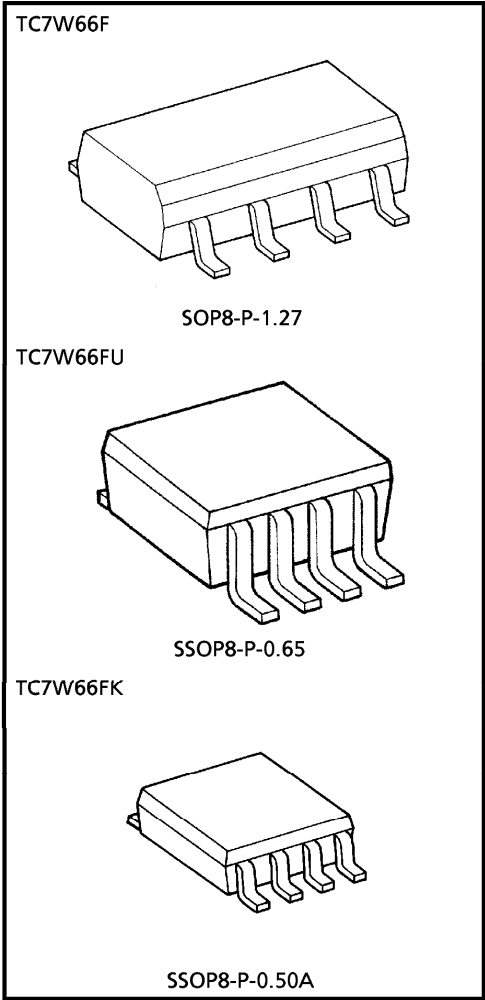
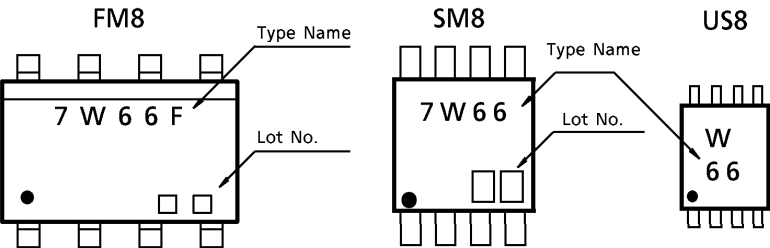
## DUAL BILATERAL SWITCH

The TC7W66 is a high speed CMOS DUAL BILATERAL SWITCH fabricated with silicon gate CMOS technology. It consists of four independent high speed switches capable of controlling either digital or analog signals while maintaining the CMOS low power dissipation. Control input (C) is provided to control the switch. The switch turns ON while the C input is high, and the switch turns OFF while low. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES

- High Speed .....  $t_{pd} = 7\text{ns (Typ.)}$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation .....  $I_{CC} = 1\mu\text{A (Max.)}$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity .....  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (Min.)}$
- Low ON Resistance .....  $R_{ON} = 50\Omega \text{ (Typ.)}$  at  $V_{CC} = 9\text{V}$
- High Degree of Linearity .....  $\text{THD} = 0.05 \text{ (Typ.)}$  at  $V_{CC} = 5\text{V}$
- Pin and Function Compatible with TC4W66

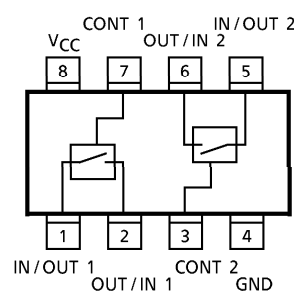
### MARKING



Weight

|               |                |
|---------------|----------------|
| SOP8-P-1.27   | : 0.05g (Typ.) |
| SSOP8-P-0.65  | : 0.02g (Typ.) |
| SSOP8-P-0.50A | : 0.01g (Typ.) |

PIN ASSIGNMENT (TOP VIEW)



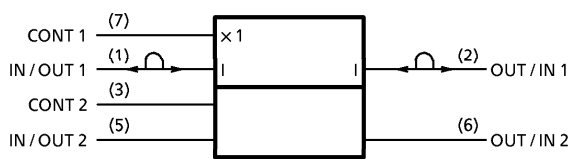
TRUTH TABLE

| CONTROL | SWITCH FUNCTION |
|---------|-----------------|
| H       | ON              |
| L       | OFF             |

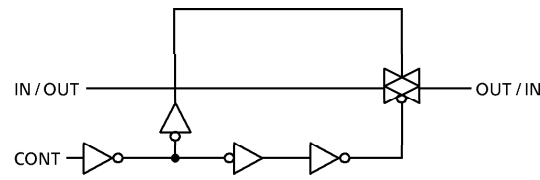
MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC              | SYMBOL | RATING                      | UNIT |
|-----------------------------|--------|-----------------------------|------|
| Supply Voltage Range        | VCC    | - 0.5~13                    | V    |
| Control Input Voltage       | VIN    | - 0.5~VCC + 0.5             | V    |
| Switch I/O Voltage          | VOU    | - 0.5~VCC + 0.5             | V    |
| Control Input Diode Current | IIK    | ± 20                        | mA   |
| I/O Diode Current           | IOK    | ± 20                        | mA   |
| Switch Through Current      | IOUT   | ± 25                        | mA   |
| DC VCC / GND Current        | ICC    | ± 25                        | mA   |
| Power Dissipation           | PD     | 300 (FM8, SM8)<br>200 (US8) | mW   |
| Storage Temperature         | Tstg   | - 65~150                    | °C   |
| Lead Temperature (10 s)     | TL     | 260                         | °C   |

LOGIC SYMBOL



LOGIC DIAGRAM (1 / 2 TC7W66)



## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC           | SYMBOL     | RATING                     | UNIT |
|--------------------------|------------|----------------------------|------|
| Supply Voltage           | $V_{CC}$   | 2~12                       | V    |
| Control Input Voltage    | $V_{IN}$   | 0~ $V_{CC}$                | V    |
| Switch I/O Voltage       | $V_{I/O}$  | 0~ $V_{CC}$                | V    |
| Operating Temperature    | $T_{opr}$  | -40~85                     | °C   |
| Input Rise and Fall Time | $t_r, t_f$ | 0~1000 ( $V_{CC} = 2.0V$ ) | ns   |
|                          |            | 0~500 ( $V_{CC} = 4.5V$ )  |      |
|                          |            | 0~400 ( $V_{CC} = 6.0V$ )  |      |
|                          |            | 0~250 ( $V_{CC} = 10.0V$ ) |      |

## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                       | SYMBOL          | TEST CONDITION                                                               | $T_a = 25^{\circ}C$ |      |      |           | $T_a = -40 \sim 85^{\circ}C$ |            | UNIT     |
|------------------------------------------------------|-----------------|------------------------------------------------------------------------------|---------------------|------|------|-----------|------------------------------|------------|----------|
|                                                      |                 |                                                                              | $V_{CC}$            | MIN. | TYP. | MAX.      | MIN.                         | MAX.       |          |
| High-Level Control Input Voltage                     | $V_{IHC}$       |                                                                              | 2.0                 | 1.5  | —    | —         | 1.5                          | —          | V        |
|                                                      |                 |                                                                              | 4.5                 | 3.15 | —    | —         | 3.15                         | —          |          |
|                                                      |                 |                                                                              | 9.0                 | 6.3  | —    | —         | 6.3                          | —          |          |
|                                                      |                 |                                                                              | 12.0                | 8.4  | —    | —         | 8.4                          | —          |          |
| Low-Level Control Input Voltage                      | $V_{ILC}$       |                                                                              | 2.0                 | —    | —    | 0.5       | —                            | 0.5        | V        |
|                                                      |                 |                                                                              | 4.5                 | —    | —    | 1.35      | —                            | 1.35       |          |
|                                                      |                 |                                                                              | 9.0                 | —    | —    | 2.7       | —                            | 2.7        |          |
|                                                      |                 |                                                                              | 12.0                | —    | —    | 3.6       | —                            | 3.6        |          |
| ON Resistance                                        | $R_{ON}$        | $V_{IN} = V_{IHC}$<br>$V_{I/O} = V_{CC}$ to GND<br>$I_{I/O} \leq 1mA$        | 4.5                 | —    | 96   | 170       | —                            | 200        | $\Omega$ |
|                                                      |                 |                                                                              | 9.0                 | —    | 55   | 85        | —                            | 100        |          |
|                                                      |                 |                                                                              | 12.0                | —    | 45   | 80        | —                            | 90         |          |
|                                                      |                 | $V_{IN} = V_{IHC}$<br>$V_{I/O} = V_{CC}$ or GND<br>$I_{I/O} \leq 1mA$        | 2.0                 | —    | 160  | —         | —                            | —          |          |
|                                                      |                 |                                                                              | 4.5                 | —    | 70   | 100       | —                            | 130        |          |
|                                                      |                 |                                                                              | 9.0                 | —    | 50   | 75        | —                            | 95         |          |
|                                                      |                 |                                                                              | 12.0                | —    | 45   | 70        | —                            | 90         |          |
|                                                      |                 |                                                                              |                     |      |      |           |                              |            |          |
| Difference of ON Resistance Between Switches         | $\Delta R_{ON}$ | $V_{IN} = V_{IHC}$<br>$V_{I/O} = V_{CC}$ to GND<br>$I_{I/O} \leq 1mA$        | 4.5                 | —    | 10   | —         | —                            | —          | $\Omega$ |
|                                                      |                 |                                                                              | 9.0                 | —    | 5    | —         | —                            | —          |          |
|                                                      |                 |                                                                              | 12.0                | —    | 5    | —         | —                            | —          |          |
| Input/Output Leakage Current (SWITCH OFF)            | $I_{OFF}$       | $V_{OS} = V_{CC}$ or GND<br>$V_{IS} = GND$ or $V_{CC}$<br>$V_{IN} = V_{ILC}$ | 12.0                | —    | —    | $\pm 100$ | —                            | $\pm 1000$ | nA       |
| Switch Input Leakage Current (SWITCH ON OUTPUT OPEN) | $I_{IZ}$        | $V_{OS} = V_{CC}$ or GND<br>$V_{INH} = V_{IHC}$                              | 12.0                | —    | —    | $\pm 100$ | —                            | $\pm 1000$ | nA       |
| Control Input Current                                | $I_{IN}$        | $V_{IN} = V_{CC}$ or GND                                                     | 6.0                 | —    | —    | $\pm 100$ | —                            | $\pm 1000$ | nA       |
| Quiescent Supply Current                             | $I_{CC}$        | $V_{IN} = V_{CC}$ or GND                                                     | 6.0                 | —    | —    | 1.0       | —                            | 10.0       | $\mu A$  |
|                                                      |                 |                                                                              | 9.0                 | —    | —    | 4.0       | —                            | 40.0       |          |
|                                                      |                 |                                                                              | 12.0                | —    | —    | 8.0       | —                            | 80.0       |          |

AC ELECTRICAL CHARACTERISTICS ( $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ )

| CHARACTERISTIC                                  | SYMBOL                 | TEST CONDITION                                            | V <sub>CC</sub> | Ta = 25°C |      |      | Ta = - 40~85°C |      | UNIT |
|-------------------------------------------------|------------------------|-----------------------------------------------------------|-----------------|-----------|------|------|----------------|------|------|
|                                                 |                        |                                                           |                 | MIN.      | TYP. | MAX. | MIN.           | MAX. |      |
| Phase Difference<br>Between Input<br>and Output | $\phi_{I/O}$           |                                                           | 2.0             | —         | 10   | 50   | —              | 65   | ns   |
|                                                 |                        |                                                           | 4.5             | —         | 4    | 10   | —              | 13   |      |
|                                                 |                        |                                                           | 9.0             | —         | 3    | 8    | —              | 10   |      |
|                                                 |                        |                                                           | 12.0            | —         | 3    | 7    | —              | 9    |      |
| Output Enable<br>Time                           | $t_{pZL}$<br>$t_{pZH}$ | $R_L = 1k\Omega$                                          | 2.0             | —         | 18   | 100  | —              | 125  | ns   |
|                                                 |                        |                                                           | 4.5             | —         | 8    | 20   | —              | 25   |      |
|                                                 |                        |                                                           | 9.0             | —         | 6    | 12   | —              | 22   |      |
|                                                 |                        |                                                           | 12.0            | —         | 6    | 12   | —              | 18   |      |
| Output Disable<br>Time                          | $t_{pLZ}$<br>$t_{pHZ}$ | $R_L = 1k\Omega$                                          | 2.0             | —         | 20   | 115  | —              | 145  | ns   |
|                                                 |                        |                                                           | 4.5             | —         | 10   | 23   | —              | 29   |      |
|                                                 |                        |                                                           | 9.0             | —         | 8    | 20   | —              | 25   |      |
|                                                 |                        |                                                           | 12.0            | —         | 8    | 18   | —              | 22   |      |
| Maximum Control<br>Input Frequency              |                        | $R_L = 1k\Omega$<br>$C_L = 15pF$<br>$V_{OUT} = 1/2V_{CC}$ | 2.0             | —         | 30   | —    | —              | —    | MHz  |
|                                                 |                        |                                                           | 4.5             | —         | 30   | —    | —              | —    |      |
|                                                 |                        |                                                           | 9.0             | —         | 30   | —    | —              | —    |      |
|                                                 |                        |                                                           | 12.0            | —         | 30   | —    | —              | —    |      |
| Control Input<br>Capacitance                    | $C_{IN}$               |                                                           |                 | —         | 5    | 10   | —              | 10   | pF   |
| Switch Terminal<br>Capacitance                  | $C_{I/O}$              |                                                           |                 | —         | 6    | —    | —              | —    | pF   |
| Feed Through<br>Capacitance                     | $C_{IOS}$              |                                                           |                 | —         | 0.5  | —    | —              | —    | pF   |
| Power Dissipation<br>Capacitance                | $C_{PD}$               | (Note 1)                                                  |                 | —         | 15   | —    | —              | —    | pF   |

(Note 1) :  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

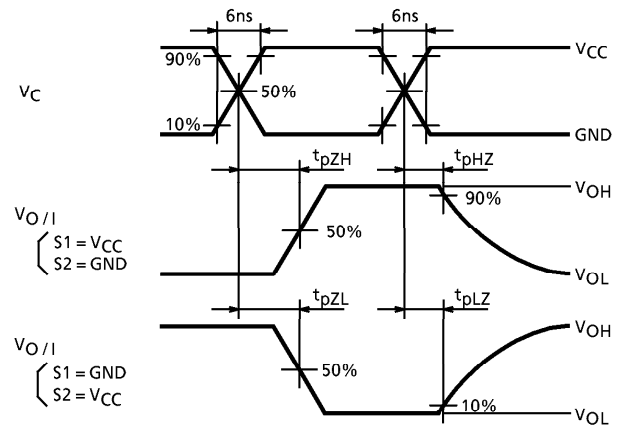
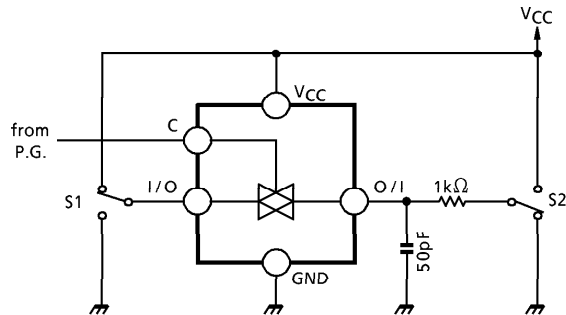
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

## ANALOG SWITCH CHARACTERISTICS (GND = 0V, Ta = 25°C)

| CHARACTERISTIC                                   | SYMBOL           | TEST CONDITION                                                                                                                                                                                                          | V <sub>CC</sub> | TYP. | UNIT |
|--------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|------|
|                                                  |                  |                                                                                                                                                                                                                         |                 |      |      |
| Sine Wave Distortion<br>(T.H.D)                  |                  | f <sub>IN</sub> = 1kHz, V <sub>IN</sub> = 4.0Vp-p @V <sub>CC</sub> = 4.5V<br>R <sub>L</sub> = 10kΩ, V <sub>IN</sub> = 8.0Vp-p @V <sub>CC</sub> = 9.0V<br>C <sub>L</sub> = 50pF                                          | 4.5             | 0.05 | %    |
|                                                  |                  |                                                                                                                                                                                                                         | 9.0             | 0.04 |      |
| Frequency Response<br>(Switch ON)                | f <sub>MAX</sub> | Adjust f <sub>IN</sub> voltage to obtain 0dBm at V <sub>OS</sub><br>Increase f <sub>IN</sub> Frequency until dB<br>Meter reads -3dB<br>R <sub>L</sub> = 50Ω, C <sub>L</sub> = 10pF<br>f <sub>IN</sub> = 1MHz, Sine Wave | 4.5             | 200  | MHz  |
|                                                  |                  |                                                                                                                                                                                                                         | 9.0             | 200  |      |
| Feedthrough Attenuation<br>(Switch OFF)          |                  | V <sub>in</sub> is centered at V <sub>CC</sub> /2<br>Adjust input for 0dBm<br>R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF<br>f <sub>IN</sub> = 1MHz, Sine Wave                                                         | 4.5             | -60  | dB   |
|                                                  |                  |                                                                                                                                                                                                                         | 9.0             | -60  |      |
| Crosstalk<br>(Control Input to Signal<br>Output) |                  | R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF<br>f <sub>IN</sub> = 1MHz, Square Wave (t <sub>r</sub> = t <sub>f</sub> = 6ns)                                                                                             | 4.5             | 60   | mV   |
|                                                  |                  |                                                                                                                                                                                                                         | 9.0             | 100  |      |
| Crosstalk<br>(Between any switches)              |                  | Adjust V <sub>IN</sub> to obtain 0dBm at Input<br>R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF<br>f <sub>IN</sub> = 1MHz, Sine Wave                                                                                     | 4.5             | -60  | dB   |
|                                                  |                  |                                                                                                                                                                                                                         | 9.0             | -60  |      |

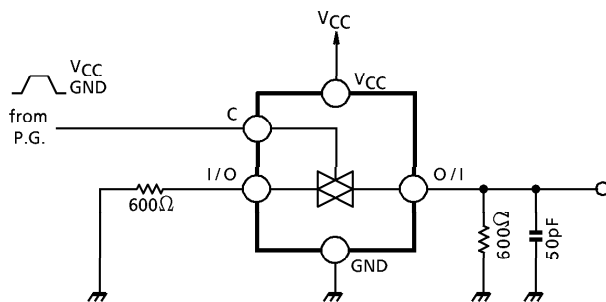
# SWITCHING CHARACTERISTICS TEST CIRCUITS

## 1. $t_{pLZ}$ , $t_{pHZ}$ , $t_{pZL}$ , $t_{pZH}$

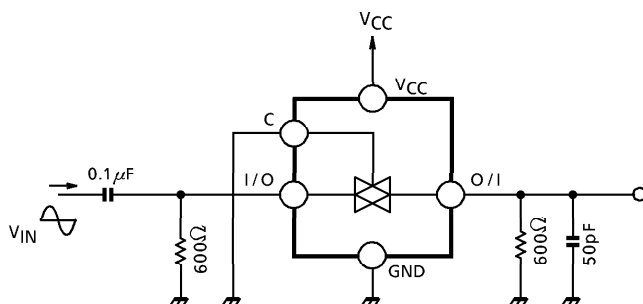


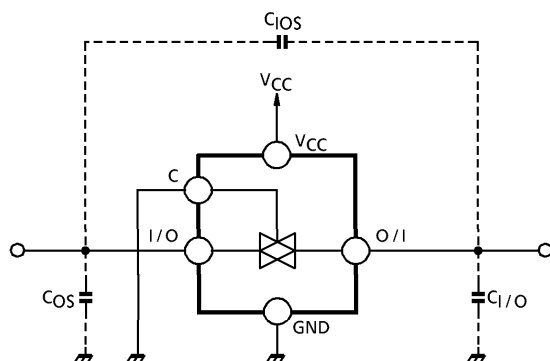
## 2. CROSS TALK (CONTROL INPUT-SWITCH OUTPUT)

$f_{in} = 1\text{MHz}$ , duty = 50%,  $t_r = t_f = 6\text{ns}$

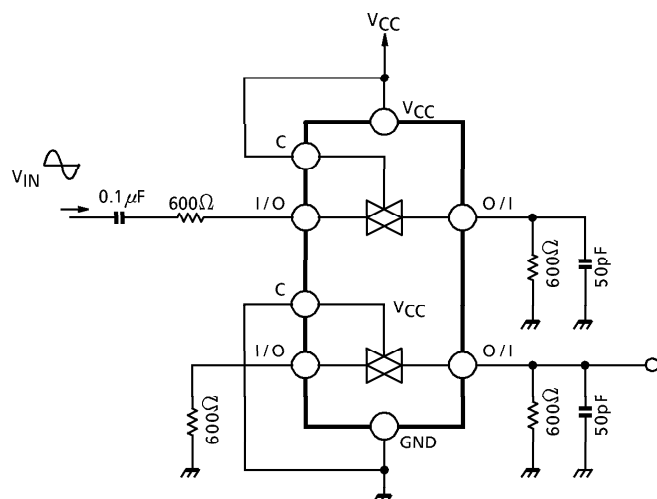


## 3. FEEDTHROUGH ATTENUATION

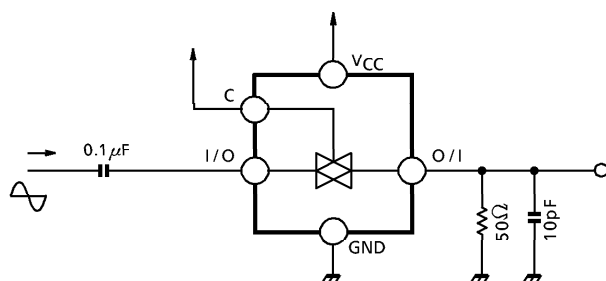


4. C<sub>LOS</sub>, C<sub>I/O</sub>

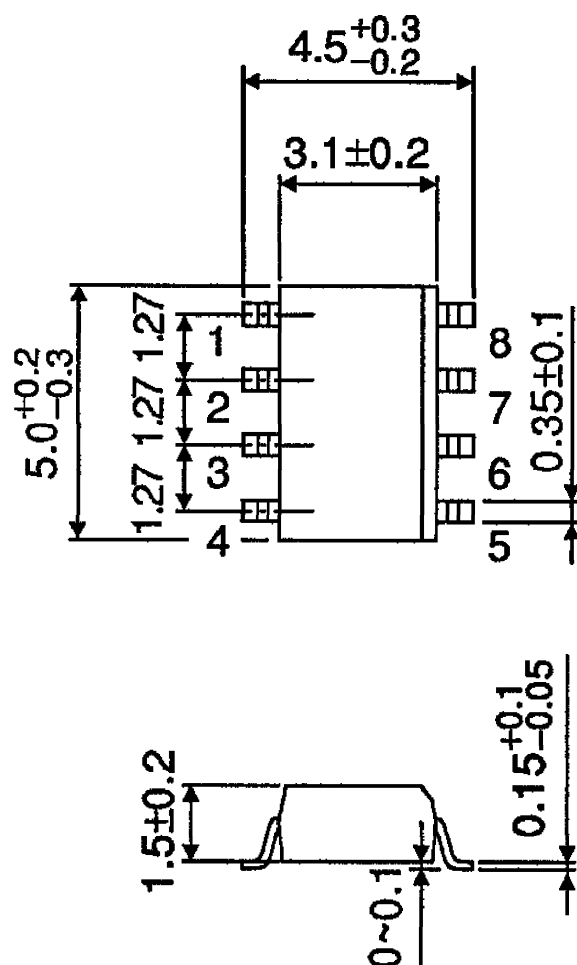
## 5. CROSS TALK (BETWEEN ANY TWO SWITCHES)



## 6. FREQUENCY RESPONSE (SWITCH ON)



## Unit : mm

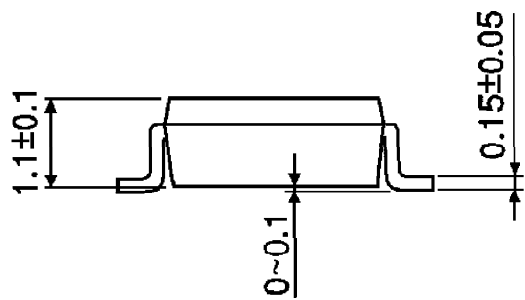
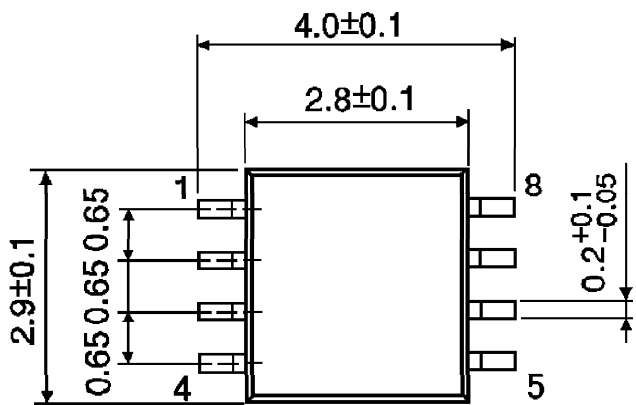


Weight : 0.05g (Typ.)



PACKAGE DIMENSIONS  
SSOP8-P-0.65

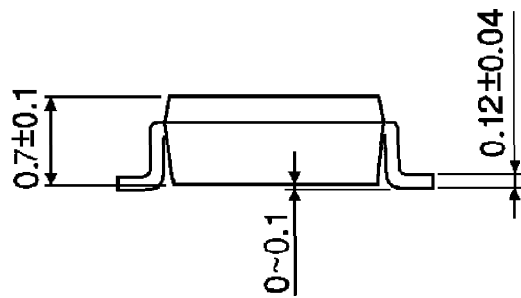
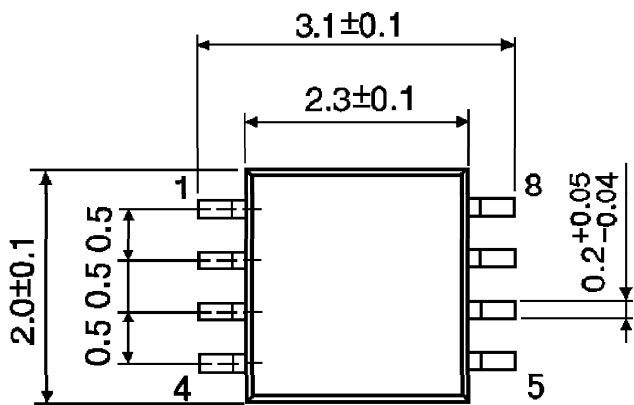
Unit : mm



Weight : 0.02g (Typ.)

PACKAGE DIMENSIONS  
SSOP8-P-0.50A

Unit : mm



Weight : 0.01g (Typ.)

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000707EBA

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