

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

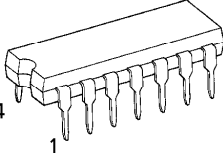
TC4066BP, TC4066BF, TC4066BFN, TC4066BFT

TC4066B QUAD BILATERAL SWITCH

TC4066B contains four independent circuits of bidirectional switches. When control input CONT is set to “H” level, the impedance between input and output of the switch becomes low and when it is set to “L” level, the impedance becomes high. This can be applied for switching of analog signals and digital signals.

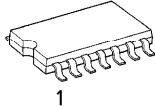
- ON-resistance, Ron  
250Ω (TYP.) ..... VDD - VSS=5V  
110Ω (TYP.) ..... VDD - VSS=10V  
70Ω (TYP.) ..... VDD - VSS=15V
- OFF-resistance, Roff  
Roff (TYP.) >10<sup>9</sup>Ω

(Note) The JEDEC SOP (FN) is not available in Japan.



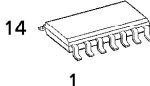
14  
1

P (DIP14-P-300-2.54)  
Weight : 0.96g (Typ.)



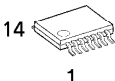
14  
1

F (SOP14-P-300-1.27)  
Weight : 0.18g (Typ.)



14  
1

FN (SOL14-P-150-1.27)  
Weight : 0.12g (Typ.)



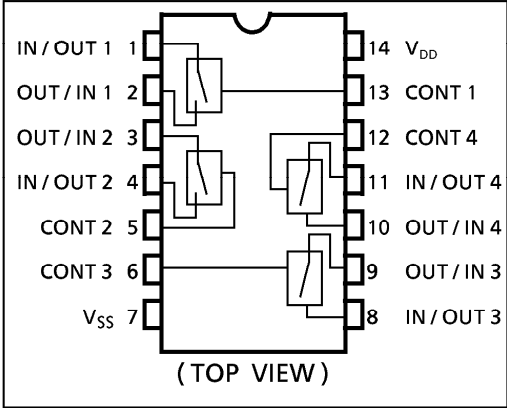
14  
1

FT (TSSOP14-P-0044-0.65)  
Weight : 0.06g (Typ.)

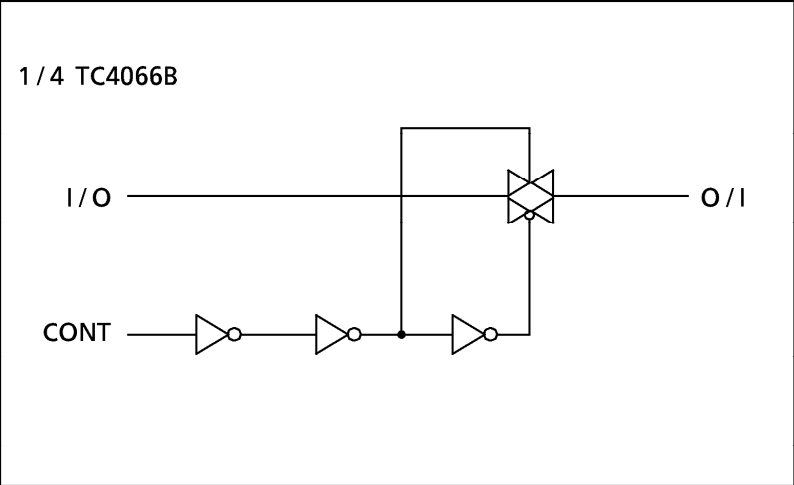
MAXIMUM RATINGS

| CHARACTERISTIC                            | SYMBOL           | RATING                                      | UNIT |
|-------------------------------------------|------------------|---------------------------------------------|------|
| DC Supply Voltage                         | V <sub>DD</sub>  | V <sub>SS</sub> - 0.5~V <sub>SS</sub> + 20  | V    |
| Control Input Voltage                     | V <sub>CIN</sub> | V <sub>SS</sub> - 0.5~V <sub>DD</sub> + 0.5 | V    |
| Switch I/O Voltage                        | V <sub>I/O</sub> | V <sub>SS</sub> - 0.5~V <sub>DD</sub> + 0.5 | V    |
| Potential difference across I/O during ON | I <sub>I/O</sub> | ± 0.5                                       | V    |
| Control Input Current                     | I <sub>CIN</sub> | ± 10                                        | mA   |
| Power Dissipation                         | P <sub>D</sub>   | 300 (DIP) / 180 (SOIC)                      | mW   |
| Operating Temperature Range               | T <sub>opr</sub> | - 40~85                                     | °C   |
| Storage Temperature Range                 | T <sub>stg</sub> | - 65~150                                    | °C   |

PIN ASSIGNMENT



LOGIC DIAGRAM



TRUTH TABLE

| CONTROL | Impedance Between<br>IN / OUT - OUT / IN   * |
|---------|----------------------------------------------|
| H       | 0.5~5 × 10 <sup>2</sup> Ω                    |
| L       | > 10 <sup>9</sup> Ω                          |

\* See Static Electrical Characteristics

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

RECOMMENDED OPERATING CONDITIONS ( $V_{SS} = 0V$ )

| CHARACTERISTIC    | SYMBOL           | TEST CONDITION | MIN. | TYP. | MAX.     | UNIT |
|-------------------|------------------|----------------|------|------|----------|------|
| DC Supply Voltage | $V_{DD}$         |                | 3    | —    | 18       | V    |
| Input Voltage     | $V_{DD}/V_{OUT}$ |                | 0    | —    | $V_{DD}$ |      |

STATIC ELECTRICAL CHARACTERISTICS (In case not specifically appointed,  $V_{SS} = 0V$ )

| CHARACTERISTIC                                        | SYM-BOL        | TEST CONDITION                                               | $V_{DD}$<br>(V) | - 40°C |           | 25°C |           |            | 85°C |            | UNIT     |
|-------------------------------------------------------|----------------|--------------------------------------------------------------|-----------------|--------|-----------|------|-----------|------------|------|------------|----------|
|                                                       |                |                                                              |                 | MIN.   | MAX.      | MIN. | TYP.      | MAX.       | MIN. | MAX.       |          |
| Control Input High Voltage                            | $V_{IH}$       | $ I_{IS}  < 10\mu A$                                         | 5               | 3.5    | —         | 3.5  | 2.75      | —          | 3.5  | —          | V        |
|                                                       |                |                                                              | 10              | 7.0    | —         | 7.0  | 5.50      | —          | 7.0  | —          |          |
|                                                       |                |                                                              | 15              | 11.0   | —         | 11.0 | 8.25      | —          | 11.0 | —          |          |
| Control Input Low Voltage                             | $V_{IL}$       | $ I_{IS}  < 10\mu A$                                         | 5               | —      | 1.5       | —    | 2.25      | 1.5        | —    | 1.5        | V        |
|                                                       |                |                                                              | 10              | —      | 3.0       | —    | 4.50      | 3.0        | —    | 3.0        |          |
|                                                       |                |                                                              | 15              | —      | 4.0       | —    | 6.75      | 4.0        | —    | 4.0        |          |
| On-State Resistance                                   | $R_{ON}$       | $0 \leq V_{IS} \leq V_{DD}$<br>$R_L = 10k\Omega$             | 5               | —      | 800       | —    | 290       | 950        | —    | 1200       | $\Omega$ |
|                                                       |                |                                                              | 10              | —      | 210       | —    | 120       | 250        | —    | 300        |          |
|                                                       |                |                                                              | 15              | —      | 140       | —    | 85        | 160        | —    | 200        |          |
| $\Delta$ On-State Resistance (Between Any 2 Switches) | $R_{ON\Delta}$ |                                                              | 5               | —      | —         | —    | 10        | —          | —    | —          | $\Omega$ |
|                                                       |                |                                                              | 10              | —      | —         | —    | 6         | —          | —    | —          |          |
|                                                       |                |                                                              | 15              | —      | —         | —    | 4         | —          | —    | —          |          |
| Input / Output Leakage Current                        | $I_{OFF}$      | $V_{IN} = 18V, V_{OUT} = 0V$<br>$V_{IN} = 0V, V_{OUT} = 18V$ | 18              | —      | $\pm 100$ | —    | $\pm 0.1$ | $\pm 100$  | —    | $\pm 1000$ | nA       |
|                                                       |                |                                                              | 18              | —      | $\pm 100$ | —    | $\pm 0.1$ | $\pm 100$  | —    | $\pm 1000$ |          |
| Quiescent Supply Current                              | $I_{DD}$       | $V_{IN} = V_{SS}, V_{DD} *$                                  | 5               | —      | 0.25      | —    | 0.001     | 0.25       | —    | 7.5        | $\mu A$  |
|                                                       |                |                                                              | 10              | —      | 0.50      | —    | 0.001     | 0.50       | —    | 15.0       |          |
|                                                       |                |                                                              | 15              | —      | 1.00      | —    | 0.002     | 1.00       | —    | 30.0       |          |
| Input Current                                         | "H" Level      | $I_{IH}$                                                     | $V_{IH} = 18V$  | 18     | —         | 0.1  | —         | $10^{-5}$  | 0.1  | —          | $\mu A$  |
|                                                       | "L" Level      | $I_{IL}$                                                     | $V_{IL} = 0V$   | 18     | —         | -0.1 | —         | $-10^{-5}$ | -0.1 | —          |          |

\* All valid input combinations.

961001EBA2'

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## DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)

| CHARACTERISTIC                           | SYMBOL                               | TEST CONDITION                                                                | V <sub>SS</sub> (V) | V <sub>DD</sub> (V) | MIN. | TYP. | MAX. | UNIT |
|------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------|---------------------|---------------------|------|------|------|------|
|                                          |                                      |                                                                               |                     |                     |      |      |      |      |
| Phase Difference between Input to Output | $\phi$ I - O                         | CL = 50pF                                                                     | 0                   | 5                   | —    | 15   | 40   | ns   |
|                                          |                                      |                                                                               | 0                   | 10                  | —    | 8    | 20   |      |
|                                          |                                      |                                                                               | 0                   | 15                  | —    | 5    | 15   |      |
| Propagation Delay Time (CONTROL - OUT)   | t <sub>pZL</sub><br>t <sub>pZH</sub> | RL = 1k $\Omega$<br>CL = 50pF                                                 | 0                   | 5                   | —    | 55   | 120  |      |
|                                          |                                      |                                                                               | 0                   | 10                  | —    | 25   | 40   |      |
|                                          |                                      |                                                                               | 0                   | 15                  | —    | 20   | 30   |      |
| Propagation Delay Time (CONTROL - OUT)   | t <sub>pLZ</sub><br>t <sub>pHZ</sub> | RL = 1k $\Omega$<br>CL = 50pF                                                 | 0                   | 5                   | —    | 45   | 80   |      |
|                                          |                                      |                                                                               | 0                   | 10                  | —    | 30   | 70   |      |
|                                          |                                      |                                                                               | 0                   | 15                  | —    | 25   | 60   |      |
| Max. Control Input Repetition Rate       | f <sub>MAX</sub> (C)                 | RL = 1k $\Omega$<br>CL = 50pF                                                 | 0                   | 5                   | —    | 10   | —    | MHz  |
|                                          |                                      |                                                                               | 0                   | 10                  | —    | 12   | —    |      |
|                                          |                                      |                                                                               | 0                   | 15                  | —    | 12   | —    |      |
| - 3dB Cutoff Frequency                   | f <sub>MAX</sub> (I - O)             | RL = 1k $\Omega$<br>CL = 15pF (* 1)                                           | - 5                 | 5                   | —    | 30   | —    |      |
| Total Harmonic Distortion                | —                                    | RL = 10k $\Omega$<br>f = 1kHz (* 2)                                           | - 5                 | 5                   | —    | 0.03 | —    | %    |
| - 50dB Feed through Frequency            | —                                    | RL = 1k $\Omega$ (* 3)                                                        | - 5                 | 5                   | —    | 600  | —    | kHz  |
| - 50dB Crosstalk Frequency               | —                                    | RL = 1k $\Omega$ (* 4)                                                        | - 5                 | 5                   | —    | 1    | —    | MHz  |
| Crosstalk (CONTROL - OUT)                | —                                    | R <sub>IN</sub> = 1k $\Omega$<br>R <sub>OUT</sub> = 10k $\Omega$<br>CL = 15pF | 0                   | 5                   | —    | 200  | —    | mV   |
|                                          |                                      |                                                                               | 0                   | 10                  | —    | 400  | —    |      |
|                                          |                                      |                                                                               | 0                   | 15                  | —    | 600  | —    |      |
| Input Capacitance                        | C <sub>IN</sub>                      | Control Input                                                                 | —                   | —                   | —    | 5    | 7.5  | pF   |
|                                          |                                      | Switch I / O                                                                  | —                   | —                   | —    | 10   | —    |      |
| Feed through Capacitance                 | C <sub>IN - OUT</sub>                | —                                                                             | —                   | —                   | —    | 0.5  | —    |      |

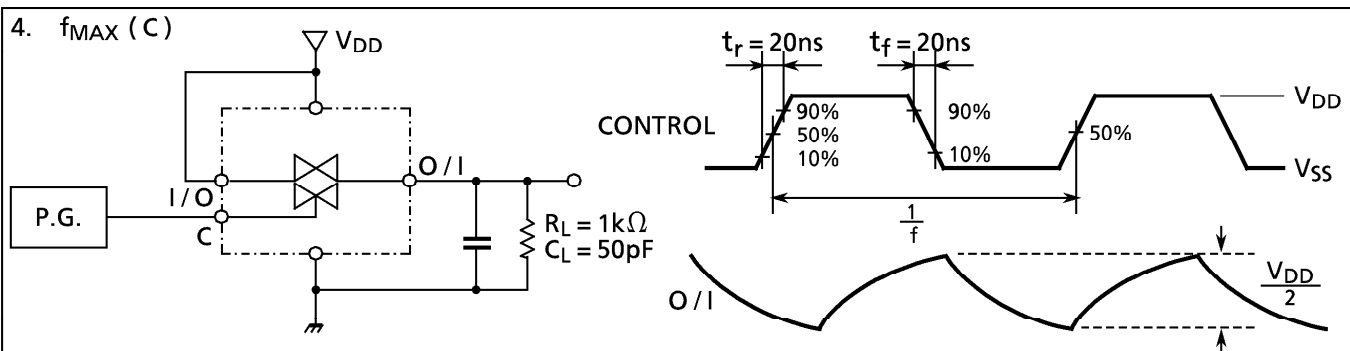
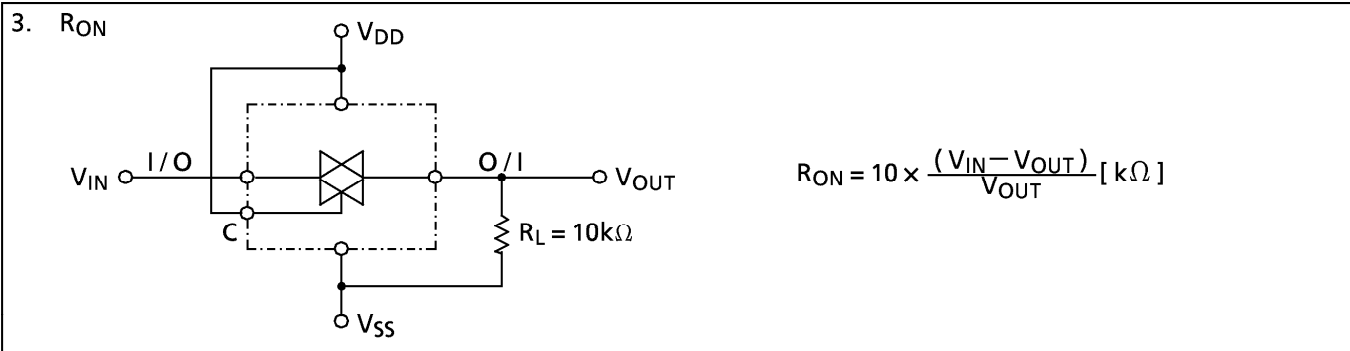
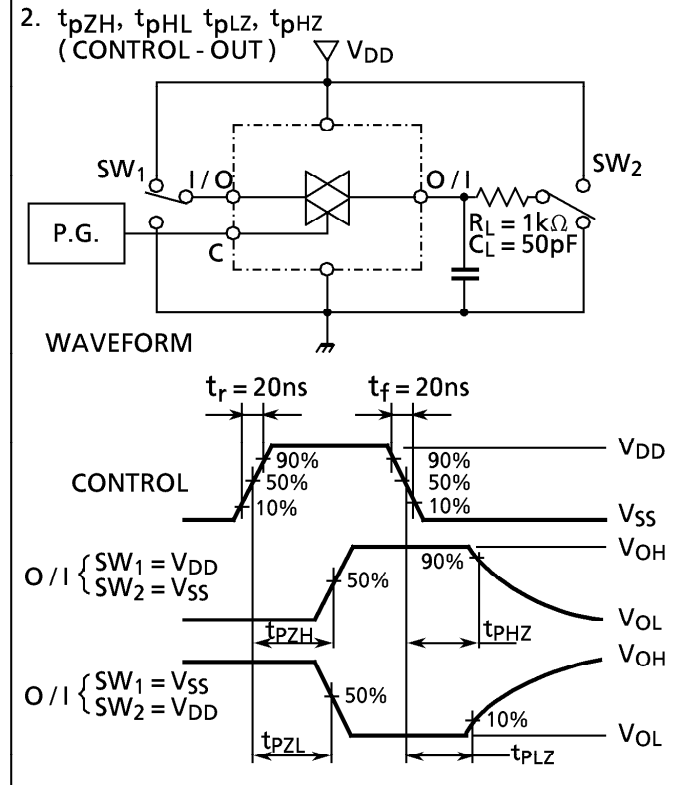
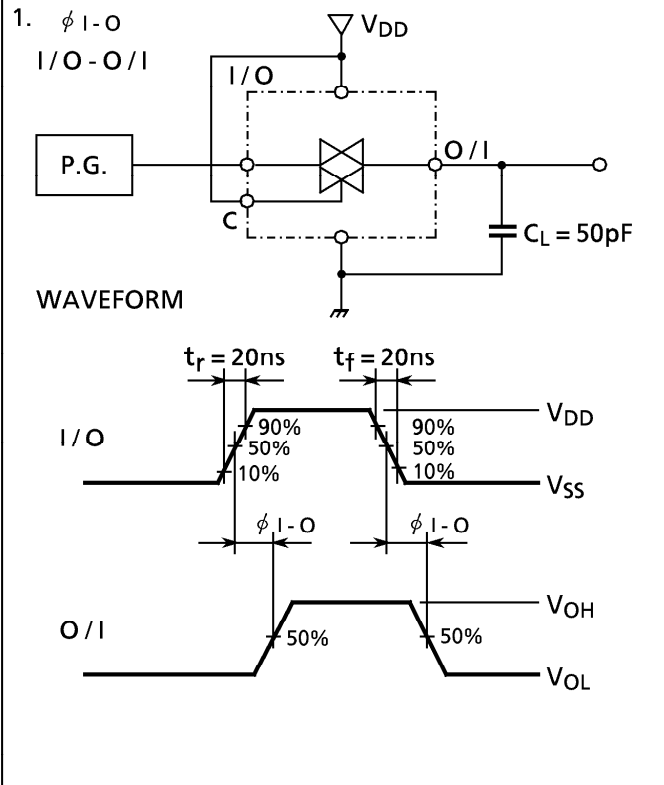
\* 1 Sine wave of  $\pm 2.5V_{p-p}$  shall be used for V<sub>is</sub> and the frequency  $20 \log_{10} \frac{V_{os}}{V_{is}} = -3dB$  Shall be f<sub>MAX</sub>.

\* 2 V<sub>is</sub> shall be sine wave of  $\pm 2.5V_{p-p}$

\* 3 Sine wave of  $\pm 2.5V_{p-p}$  shall be used for V<sub>is</sub> and the frequency of  $20 \log_{10} \frac{V_{OUT}}{V_{is}} = -50dB$  shall be feed-through.

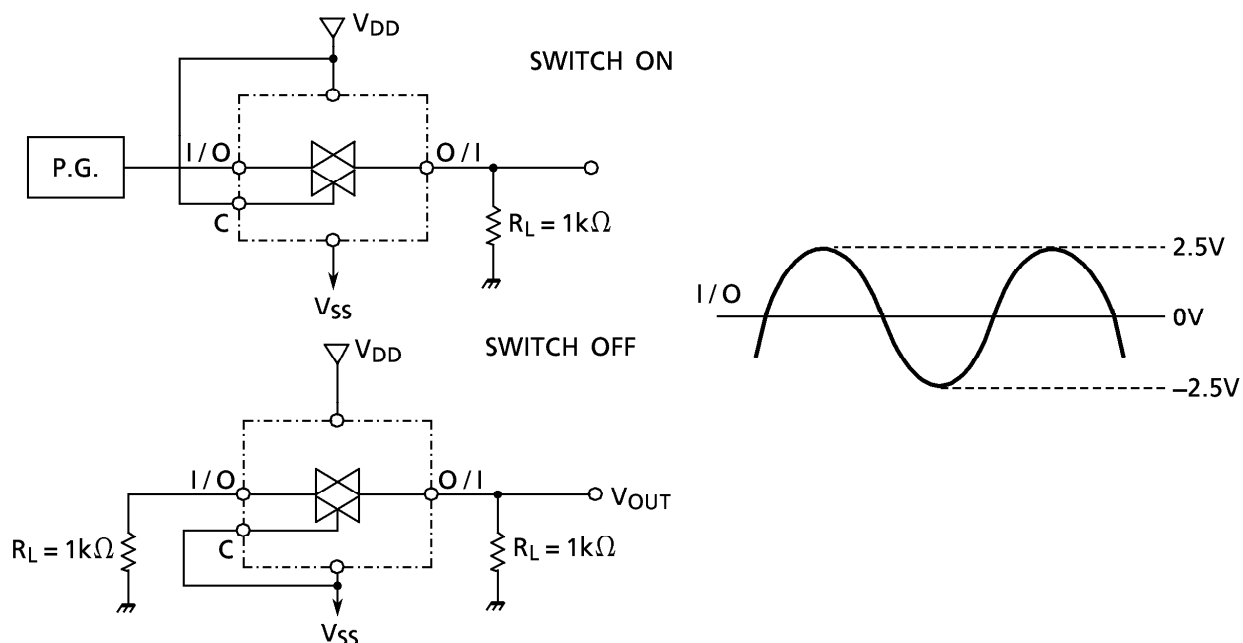
\* 4 Sine wave of  $\pm 2.5V_{p-p}$  shall be used for V<sub>is</sub> and the frequency of  $20 \log_{10} \frac{V_{OUT}}{V_{is}} = -50dB$  shall be crosstalk.

**CIRCUIT FOR MEASUREMENT OF ELECTRICAL CHARACTERISTICS**

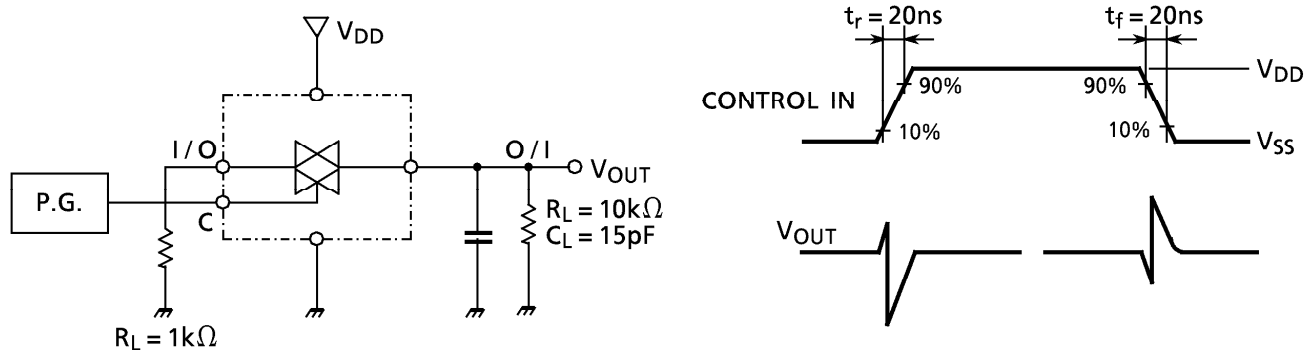
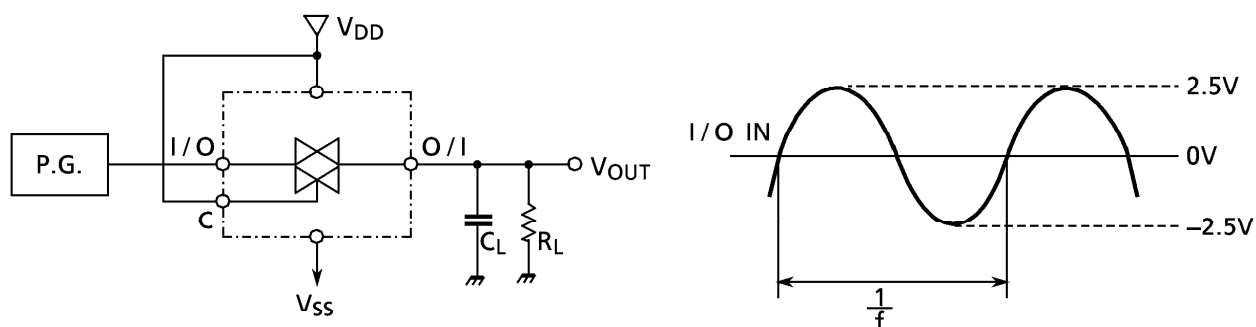


## CIRCUIT FOR MEASUREMENT OF ELECTRICAL CHARACTERISTICS

## 5. CROSSTALK BETWEEN ANY TWO SWITCHES

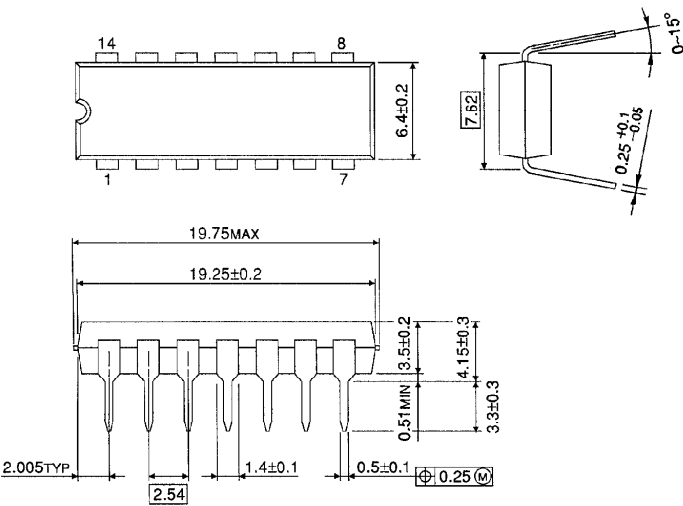


## 6. CROSSTALK, CONTROL TO INPUT

7. TOTAL HARMONIC DISTORTION,  $f_{MAX}$  (I - O), FEEDTHROUGH

DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)

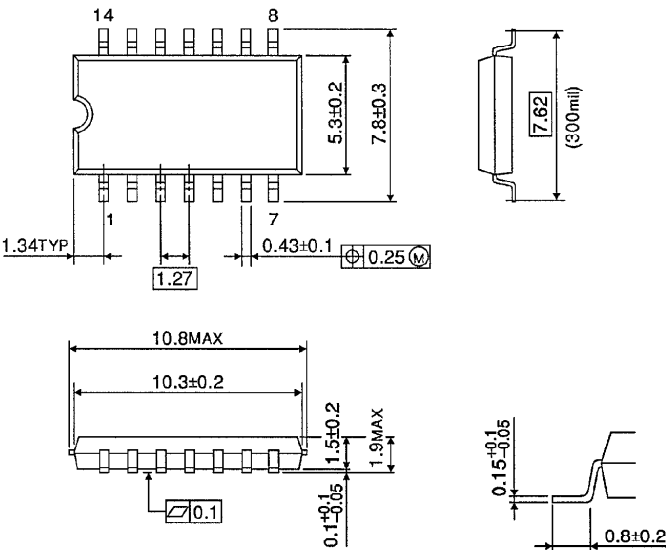
Unit in mm



Weight : 0.96g (Typ.)

SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27)

Unit in mm

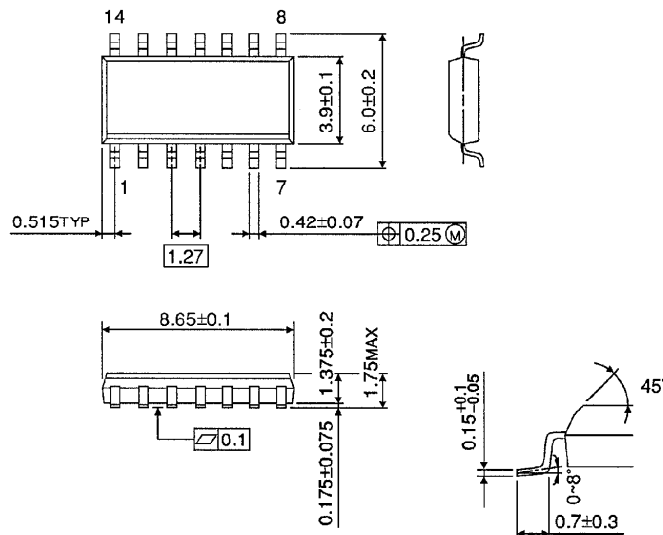


Weight : 0.18g (Typ.)

## SOP 14PIN (150mil BODY) OUTLINE DRAWING (SOL14-P-150-1.27)

Unit in mm

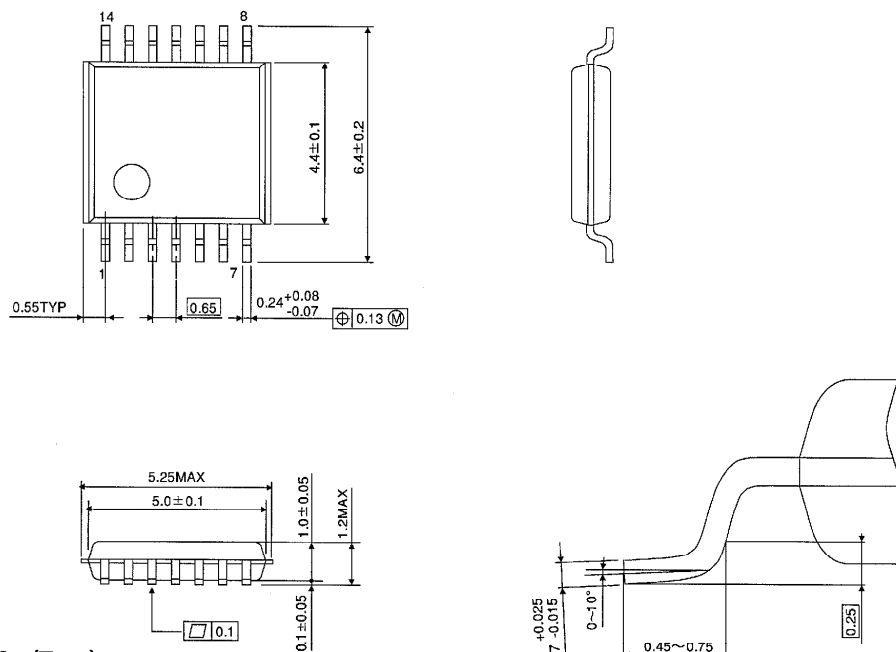
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

## TSSOP 14PIN (170mil BODY) OUTLINE DRAWING (TSSOP14-P-0044-0.65)

Unit in mm



Weight : 0.06g (Typ.)