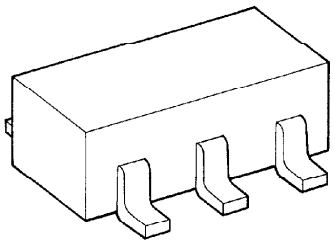
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7S66F, TC7S66FU

## BILATERAL SWITCH

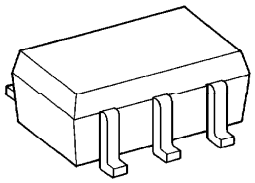
The TC7S66 is a high Speed $C^2MOS$ BILATERAL SWITCH fabricated with silicon gate $C^2MOS$ technology.
It consists of a high speed switch capable of controlling either digital or analog signals while maintaining the $C^2MOS$ low power dissipation.
Control input (C) is provided to control the switch
The switch turns ON while the C linput is high, and the switch turns OFF while low.
Input is equipped with protection circuits against static discharge or transient excess voltage.

TC7S66F



SSOP5-P-0.95

TC7S66FU



SSOP5-P-0.65A

Weight SSOP5-P-0.95 : 0.016g (Typ.)
SSOP5-P-0.65A : 0.006g (Typ.)

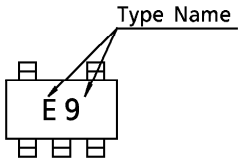
### FEATURES

- High Speed ..... $t_{pd}$ = 7ns (Typ.) at $V_{CC}$ = 5V
- Low Power Dissipation ..... $I_{CC}$ = 1$\mu$A (Max.) at Ta = 25°C
- High Noise Immunity ..... $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (Min.)
- Low ON Resistance ..... $R_{ON}$ = 100Ω (Typ.) at $V_{CC}$ = 9V
- Low T.H.D ..... THD = 0.05% (Typ.) at $V_{CC}$ = 5V
- Pin and Function Compatible with TC4S66F

### MAXIMUM RATINGS

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| DC Supply Voltage | $V_{CC}$ | −0.5~13 | V |
| Control Input Voltage | $V_{IN}$ | −0.5~$V_{CC}$+0.5 | V |
| Swith I/O Voltage | $V_{I/O}$ | −0.5~$V_{CC}$+0.5 | V |
| Control Diode Current | $I_{CK}$ | ±20 | mA |
| Output Diode Current | $I_{IOK}$ | ±20 | mA |
| Through I/O Current | $I_T$ | ±12.5 | mA |
| DC $V_{CC}$/Ground Current | $I_{CC}$ | ±25 | mA |
| Power Dissipation | $P_D$ | 200 | mW |
| Storage Temperature | $T_{stg}$ | −65~150 | °C |
| Lead Temperature (10s) | $T_L$ | 260 | °C |

### MARKING

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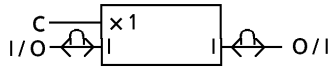
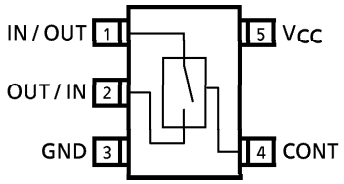
**LOGIC DIAGRAM**




**PIN ASSIGNMENT** (TOP VIEW)




**TRUTH TABLE**

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

**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)<br>0~ 500 ($V_{CC}$ = 4.5V)<br>0~ 400 ($V_{CC}$ = 6.0V)<br>0~ 250 ($V_{CC}$ = 10.0V) | ns |

**DC ELECTRICAL CHARACTERISTICS**

| PARAMETER | SYMBOL | TEST CONDITION | | Ta = 25°C | | | Ta = −40~85°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 | |
| | | | 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>$V_{I/O}$ ≦ 1mA | 4.5 | — | 192 | 340 | — | 400 | Ω |
| | | | 9.0 | — | 110 | 170 | — | 200 | |
| | | | 12.0 | — | 90 | 160 | — | 180 | |
| | | $V_{IN}$ = $V_{IHC}$<br>$V_{I/O}$ = $V_{CC}$ or GND<br>$V_{I/O}$ ≦ 1mA | 2.0 | — | 320 | — | — | — | |
| | | | 4.5 | — | 140 | 200 | — | 260 | |
| | | | 9.0 | — | 100 | 150 | — | 190 | |
| | | | 12.0 | — | 90 | 140 | — | 180 | |
| 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 | — | — | ±100 | — | ±1000 | nA |

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**DC ELECTRICAL CHARACTERISTICS**

| PARAMETER | SYMBOL | TEST CONDITION | | Ta = 25°C | | | Ta = −40~85°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Switch Input Leakage Current (SW ON, Output OPEN) | $I_{IZ}$ | $V_{OS} = V_{CC}$ or GND<br>$V_{IN} = V_{IHC}$ | 12.0 | — | — | ± 100 | — | ± 1000 | nA |
| Control Input Current | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND | 12.0 | — | — | ± 100 | — | ± 1000 | |
| Quiscent Device Current | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 1.0 | — | 10.0 | μA |
| | | | 9.0 | — | | 4.0 | — | 40.0 | |
| | | | 12.0 | — | | 8.0 | — | 80.0 | |

**AC ELECTRICAL CHARACTERISTICS** ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

| PARAMETER | SYMBOL | TEST CONDITION | | Ta = 25°C | | | Ta = −40~85°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Phase difference between input and output | $\phi_{I-O}$ | — | 2.0 | — | 20 | 75 | — | 100 | ns |
| | | | 4.5 | — | 7 | 15 | — | 20 | |
| | | | 9.0 | — | 4 | 12 | — | 15 | |
| | | | 12.0 | — | 4 | 11 | — | 14 | |
| Output Enable Time | $t_{PZL}$<br>$t_{PZH}$ | $R_L = 1k\Omega$ | 2.0 | — | 20 | 150 | — | 190 | |
| | | | 4.5 | — | 13 | 30 | — | 38 | |
| | | | 9.0 | — | 9 | 18 | — | 33 | |
| | | | 12.0 | — | 8 | 18 | — | 27 | |
| Output Disable Time | $t_{PLZ}$<br>$t_{PHZ}$ | $R_L = 1k\Omega$ | 2.0 | — | 40 | 170 | — | 220 | |
| | | | 4.5 | — | 11 | 35 | — | 44 | |
| | | | 9.0 | — | 10 | 30 | — | 38 | |
| | | | 12.0 | — | 9 | 27 | — | 33 | |
| Maximum Control Input Frequency | — | $R_L = 1k\Omega$<br>$C_L = 15pF$<br>$V_{OUT} = 1/2\ V_{CC}$ | 2.0 | — | 30 | — | — | — | MHz |
| | | | 4.5 | — | 30 | — | — | — | |
| | | | 9.0 | — | 30 | — | — | — | |
| | | | 12.0 | — | 30 | — | — | — | |
| Control Input Capacitance | $C_{IN}$ | — | — | — | 5 | 10 | — | 10 | — |
| Switch Terminal Capacitance | $C_{I/O}$ | — | — | — | 6 | — | — | — | pF |
| Feedthrough Capacitance | $C_{IOS}$ | — | — | — | 0.5 | — | — | — | — |
| Power Dissipation Capacitance | $C_{PD}$ | (Note 1) | — | — | 15 | — | — | — | — |

Note 1 : $C_{PD}$ is defined as the value of internal equivalent Capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the equation :

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

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

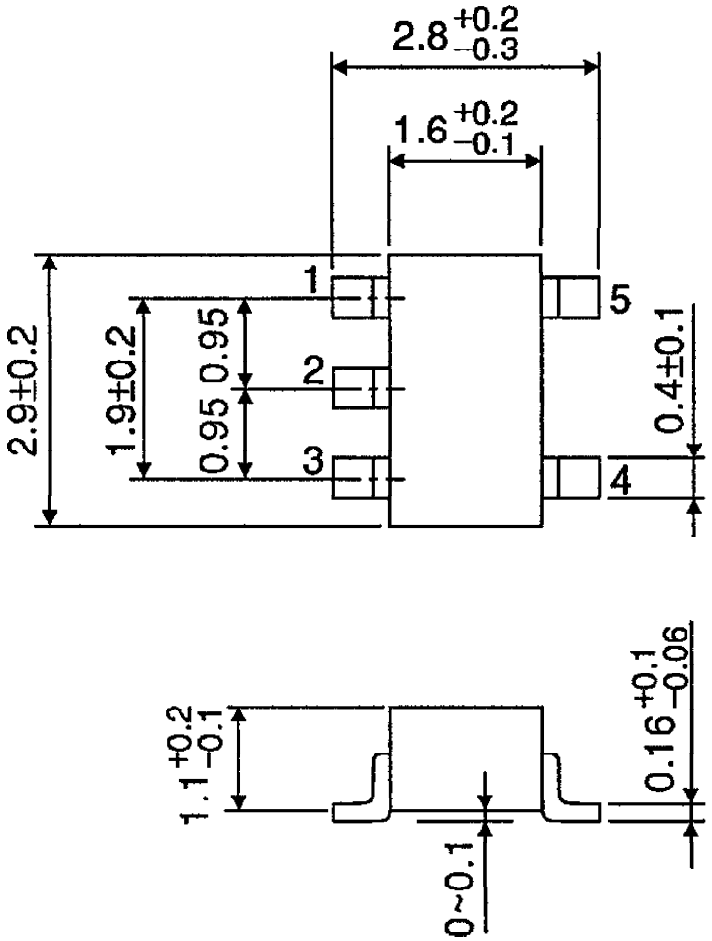
| PARAMETER | SYMBOL | TEST CONDITION | $V_{CC}$ | TYP. | UNIT |
|---|---|---|---|---|---|
| Total Harmonic Distortion (T.H.D) | — | $f_{IN}$ = 1kHz $V_{IN}$ = 4$V_{PP}$ ($V_{CC}$ = 4.5V)<br>$R_L$ = 10kΩ $V_{IN}$ = 8$V_{PP}$ ($V_{CC}$ = 9.0V)<br>$C_L$ = 50pF | 4.5<br>9.0 | 0.05<br>0.04 | % |
| Maximum Propagation Frequency (SWITCH ON) | $f_{MAX}$ | Adjust $f_{IN}$ voltage to obtain 0dBm at $V_{OS}$<br>Increase $f_{IN}$ frequency until dB Meter reads −3dB. $R_L$ = 50Ω $C_L$ = 10pF,<br>$f_{IN}$ = 1MHz, Sine Wave | 4.5<br>9.0 | 200<br>200 | MHz |
| Feedthrough (SWITCH ON) | — | $V_{in}$ is ceintered at $V_{CC}$ / 2 Adjust input for 0dBm<br>$R_L$ = 600Ω, $C_L$ = 50pF<br>$f_{IN}$ = 1MHz, Sine Wave | 4.5<br>9.0 | −60<br>−60 | dB |
| Crosstalk (CONTROL SWITCH) | — | $R_L$ = 600Ω, $C_L$ = 50pF<br>IN = 1MHz, PULSE ($t_r = t_f$ = 6ns) | 4.5<br>9.0 | 60<br>100 | mV |

Note : These characteristics are determined by design of devices.

**OUTLINE DRAWING**

SSOP5-P-0.95

Unit : mm

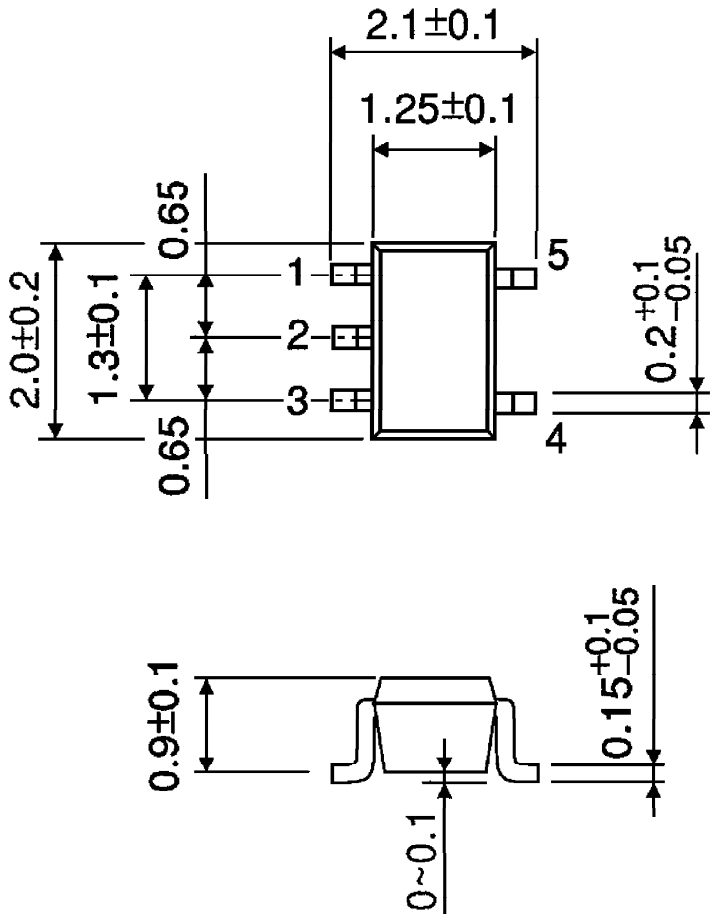



Weight : 0.016g (Typ.)

**OUTLINE DRAWING**

SSOP5-P-0.65A

Unit : mm




Weight : 0.006g (Typ.)