

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7S66F, TC7S66FU

Bilateral Switch

The TC7S66 is a high Speed C²MOS Bilateral Switch fabricated with silicon gate C²MOS technology.

It consists of a high speed switch capable of controlling either digital or analog signals while maintaining the C²MOS low power dissipation.

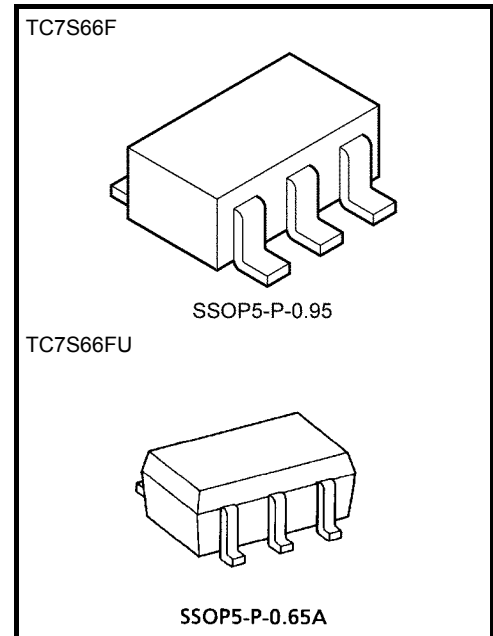
Control input (C) is provided to control the switch.

The switch turns ON while the C input is high, and the switch turns OFF while low.

Input is equipped with protection circuits against static discharge or transient excess voltage.

Features

- High speed: $t_{pd} = 7 \text{ ns (typ.) @} V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 1 \mu\text{A (max) @} T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Low ON resistance: $R_{ON} = 100 \Omega \text{ (typ.) @} V_{CC} = 9 \text{ V}$
- Low T.H.D: $\text{THD} = 0.05\% \text{ (typ.) @} V_{CC} = 5 \text{ V}$
- Pin and function compatible with TC4S66F



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

Absolute Maximum Ratings (Ta = 25°C)

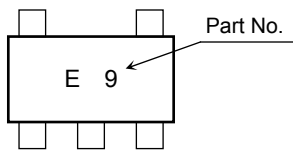
| Characteristics | Symbol | Rating | Unit |
|-----------------------------|------------|------------------------|------|
| DC Supply voltage | V_{CC} | -0.5 to 13 | V |
| Control input voltage | V_{IN} | -0.5 to $V_{CC} + 0.5$ | V |
| Switch I/O voltage | $V_{I/O}$ | -0.5 to $V_{CC} + 0.5$ | V |
| Control diode current | I_{CK} | ± 20 | mA |
| I/O diode current | $I_{I/OK}$ | ± 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 range | T_{stg} | -65 to 150 | °C |
| Lead temperature (10 s) | T_L | 260 | °C |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

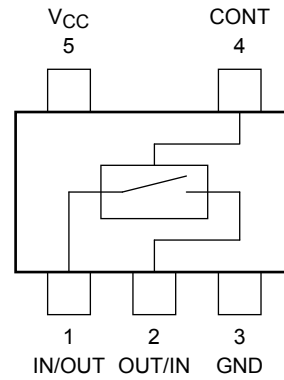
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Start of commercial production
 1991-06

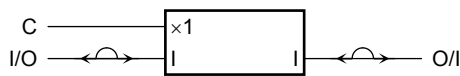
Marking



Pin Configuration (top view)



Logic Diagram



Truth Table

| Control | Switch Function |
|---------|-----------------|
| H | ON |
| L | OFF |

Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|------------|-------------------------------|------|
| Supply voltage | V_{CC} | 2 to 12 | V |
| Control input voltage | V_{IN} | 0 to V_{CC} | V |
| Switch I/O voltage | $V_{I/O}$ | 0 to V_{CC} | V |
| Operating temperature range | T_{opr} | -40 to 85 | °C |
| Input rise and fall time | t_r, t_f | 0 to 1000 ($V_{CC} = 2.0$ V) | ns |
| | | 0 to 500 ($V_{CC} = 4.5$ V) | |
| | | 0 to 400 ($V_{CC} = 6.0$ V) | |
| | | 0 to 250 ($V_{CC} = 10.0$ V) | |

Electrical Characteristics

DC Electrical Characteristics

| Characteristics | | Symbol | Test Condition | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|---|-----------------|--|--|--|------|------|------------------|-------|------|-----|
| | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| Control input voltage | High level | 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 | 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} V _{I/O} = V _{CC} to GND I _{I/O} ≤ 1 mA | 4.5 | — | 192 | 340 | — | 400 | Ω | |
| | | | 9.0 | — | 110 | 170 | — | 200 | | |
| | | | 12.0 | — | 90 | 160 | — | 180 | | |
| | | | V _{IN} = V _{IHC} V _{I/O} = V _{CC} or GND I _{I/O} ≤ 1 mA | 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 V _{IS} = GND or V _{CC} V _{IN} = V _{ILC} | 12.0 | — | — | ±100 | | — |
| Switch input leakage current (switch on, output open) | I _{IZ} | V _{OS} = V _{CC} or GND V _{IN} = V _{IHC} | 12.0 | — | — | ±100 | — | ±1000 | nA | |
| Control input current | I _{IN} | V _{IN} = V _{CC} or GND | 12.0 | — | — | ±100 | — | ±1000 | nA | |
| Quiescent 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 = 50 pF, input t_r = t_f = 6 ns)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|---|--------------------------------------|---|---------------------|-----|------|------------------|-----|------|-----|
| | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| Phase difference between input and output | φ _{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} t _{pZH} | R _L = 1 kΩ | 2.0 | — | 20 | 150 | — | 190 | ns |
| | | | 4.5 | — | 13 | 30 | — | 38 | |
| | | | 9.0 | — | 9 | 18 | — | 33 | |
| | | | 12.0 | — | 8 | 18 | — | 27 | |
| Output disable time | t _{pLZ} t _{pHZ} | R _L = 1 kΩ | 2.0 | — | 40 | 170 | — | 220 | ns |
| | | | 4.5 | — | 11 | 35 | — | 44 | |
| | | | 9.0 | — | 10 | 30 | — | 38 | |
| | | | 12.0 | — | 9 | 27 | — | 33 | |
| Maximum control input frequency | — | R _L = 1 kΩ C _L = 15 pF 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 | pF | |
| Switch terminal capacitance | C _{I/O} | — | — | 6 | — | — | — | pF | |
| Feedthrough capacitance | C _{IOS} | — | — | 0.5 | — | — | — | pF | |
| Power dissipation capacitance | C _{PD} | (Note) | — | 15 | — | — | — | pF | |

Note: 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:

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

Analog Switch Characteristics (GND = 0 V, Ta = 25°C) (Note)

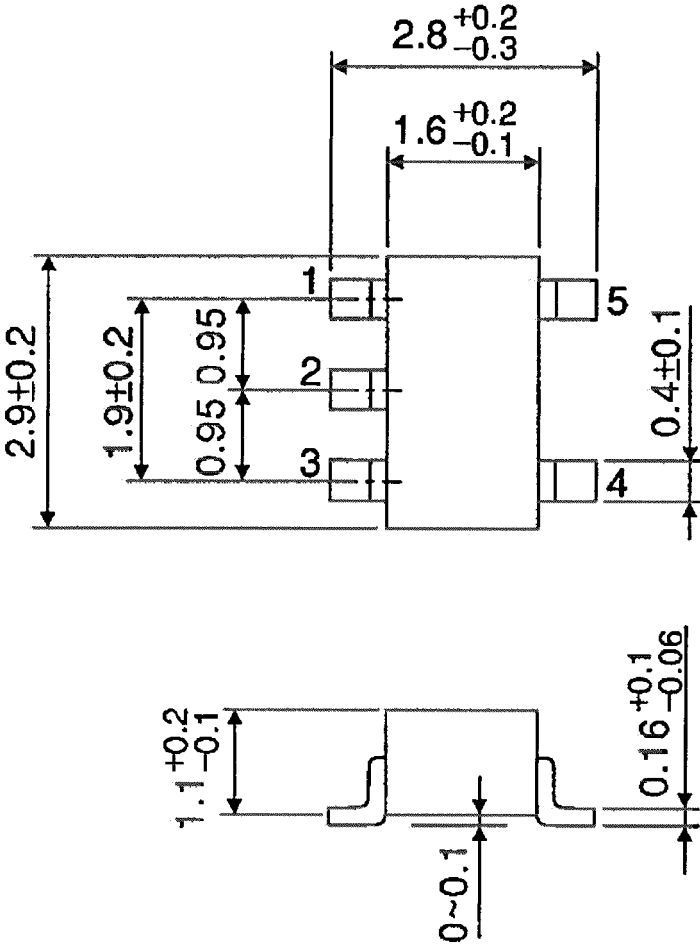
| Characteristics | Symbol | Test Condition | V _{CC} (V) | Typ. | Unit |
|---|------------------|--|---------------------|------|------|
| | | | | | |
| Total harmonic distortion (T.H.D) | — | f _{IN} = 1 kHz, V _{IN} = 4 V _{p-p} (V _{CC} = 4.5 V) R _L = 10 kΩ, V _{IN} = 8 V _{p-p} (V _{CC} = 9.0 V) C _L = 50 pF | 4.5 | 0.05 | % |
| | | | 9.0 | 0.04 | |
| Maximum propagation frequency (switch on) | f _{MAX} | Adjust f _{IN} voltage to obtain 0dBm at V _{OS} increase f _{IN} frequency until dB meter reads -3dB. R _L = 50 Ω, C _L = 10 pF f _{IN} = 1 MHz, Sine wave | 4.5 | 200 | MHz |
| | | | 9.0 | 200 | |
| Feedthrough (switch on) | — | V _{IN} is centered at V _{CC} /2 adjust input for 0dBm R _L = 600 Ω, C _L = 50 pF f _{IN} = 1 MHz, Sine wave | 4.5 | -60 | dB |
| | | | 9.0 | -60 | |
| Crosstalk (control switch) | — | R _L = 600 Ω, C _L = 50 pF f _{IN} = 1 MHz, Pulse (t _r = t _f = 6 ns) | 4.5 | 60 | mV |
| | | | 9.0 | 100 | |

Note: These characteristics are determined by design of devices.

Package Dimensions

SSOP5-P-0.95

Unit : mm

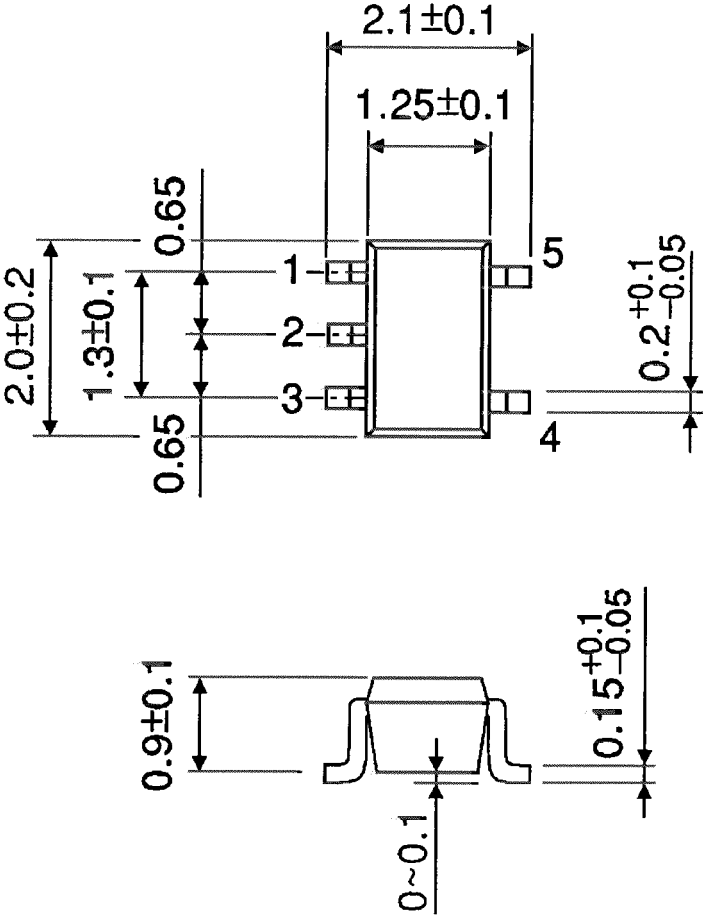


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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