

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

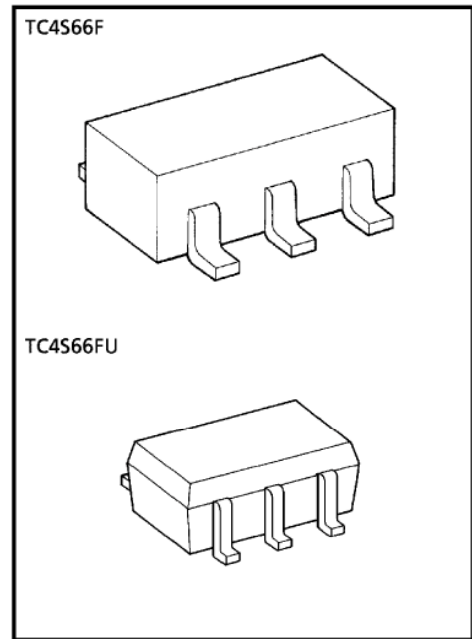
TC4S66F, TC4S66FU

BILATERAL SWITCH

TC4S66F/FU contains one circuit 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 switch becomes high. This can be applied for switching of analog signals and digital signals.

FEATURES

- ON-resistance (R_{ON})
 - 300 Ω (Typ.) $V_{DD} - V_{SS} = 5\text{ V}$
 - 110 Ω (Typ.) $V_{DD} - V_{SS} = 10\text{ V}$
 - 70 Ω (Typ.) $V_{DD} - V_{SS} = 15\text{ V}$
- OFF-resistance (R_{OFF})
 - R_{OFF} (Typ.) $> 10^9\ \Omega$



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

Absolute Maximum Ratings

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|-------------|----------------------------------|--------------------|
| DC Supply Voltage | V_{DD} | $V_{SS} - 0.5 \sim V_{SS} + 20$ | V |
| Control Input Voltage | $V_{C\ IN}$ | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Switch I/O Voltage | $V_{I/O}$ | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Power Dissipation | P_D | 200 | mW |
| Potential difference across I/O during ON | $V_I - V_O$ | ± 0.5 | V |
| Control Input Current | $I_{C\ IN}$ | ± 10 | mA |
| Operating Temperature Range | T_{opr} | -40~85 | $^{\circ}\text{C}$ |
| Storage Temperature | T_{stg} | -65~150 | $^{\circ}\text{C}$ |
| Lead Temperature (10 s) | T_L | 260 | $^{\circ}\text{C}$ |

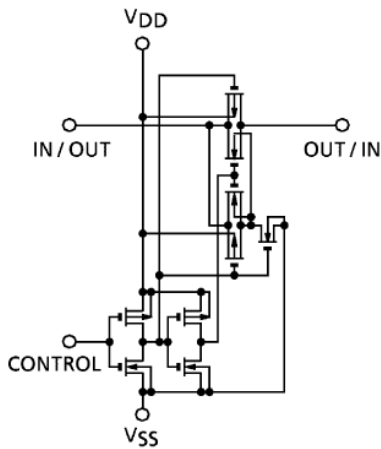
TRUTH TABLE

| CONTROL | IMPEDANCE BETWEEN IN/OUT-OUT/IN * |
|---------|-----------------------------------|
| H | $0.5 \sim 5 \times 10^2\ \Omega$ |
| L | $> 10^9\ \Omega$ |

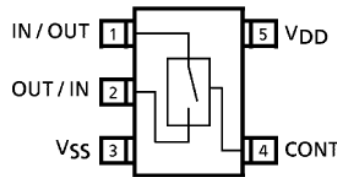
* : See static electrical characteristics.

Start of commercial production
1988-01

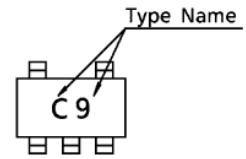
CIRCUIT DIAGRAM



PIN ASSIGNMENT (TOP VIEW)



MARKING



Operating Ranges ($V_{SS} = 0\text{ V}$)

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

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

| CHARACTERISTIC | SYM-BOL | TEST CONDITION | V_{DD} (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\text{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\text{A}$ | 5 | — | 1.5 | — | 2.25 | 1.5 | — | 1.5 | V |
| | | | 10 | — | 3.0 | — | 4.5 | 3.0 | — | 3.0 | |
| | | | 15 | — | 4.0 | — | 6.75 | 4.0 | — | 4.0 | |
| On-State Resistance | R_{ON} | $0 \leq V_{IS} \leq V_{DD}$ $R_L = 10\ \text{k}\Omega$ | 5 | — | 800 | — | 290 | 950 | — | 1200 | Ω |
| | | | 10 | — | 210 | — | 120 | 250 | — | 300 | |
| | | | 15 | — | 140 | — | 85 | 160 | — | 200 | |
| Input/Output Leakage Current | I_{OFF} | $V_{IN} = 18\text{ V}$ $V_{OUT} = 0\text{ V}$ $V_{IN} = 0\text{ V}$ $V_{OUT} = 18\text{ V}$ | 18 | — | ± 100 | — | ± 0.1 | ± 100 | — | ± 1000 | nA |
| | | | 18 | — | ± 100 | — | ± 0.1 | ± 100 | — | ± 1000 | |
| Quiescent Device Current | I_{DD} | $V_{IN} = V_{DD}, V_{SS}$ | 5 | — | 0.25 | — | 0.001 | 0.25 | — | 7.5 | μA |
| | | | 10 | — | 0.5 | — | 0.001 | 0.5 | — | 15 | |
| | | | 15 | — | 1.0 | — | 0.002 | 1.0 | — | 30 | |
| Input Current | H Level | I_{IH} | $V_{IH} = 18\text{ V}$ | 18 | — | 0.1 | — | 10^{-5} | 0.1 | — | μA |
| | L Level | I_{OL} | $V_{IL} = 0\text{ V}$ | 18 | — | -0.1 | — | -10^{-5} | -0.1 | — | |

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{SS} (V) / V _{DD} (V) | | MIN. | TYP. | MAX. | UNIT |
|--------------------------------------|--------------------------------------|--|---|---------------------|------|------|------|------|
| | | | V _{SS} (V) | V _{DD} (V) | | | | |
| Propagation Delay Time (IN-OUT) | t _{pLH} t _{pHL} | C _L = 50 pF | 0 | 5 | — | 15 | 40 | ns |
| | | | 0 | 10 | — | 8 | 20 | |
| | | | 0 | 15 | — | 5 | 15 | |
| Propagation Delay Time (CONTROL-OUT) | t _{pZL} t _{pZH} | R _L = 1 kΩ | 0 | 5 | — | 55 | 120 | |
| | | C _L = 50 pF | 0 | 10 | — | 25 | 40 | |
| | | | 0 | 15 | — | 20 | 30 | |
| Propagation Delay Time (CONTROL-OUT) | t _{pLZ} t _{pHZ} | R _L = 1 kΩ | 0 | 5 | — | 45 | 80 | |
| | | C _L = 50 pF | 0 | 10 | — | 30 | 70 | |
| | | | 0 | 15 | — | 25 | 60 | |
| Max. Control Input Repetition Rate | f _{MAX} (C) | R _L = 1 kΩ C _L = 50 pF | 0 | 5 | — | 10 | — | MHz |
| | | | 0 | 10 | — | 12 | — | |
| | | | 0 | 15 | — | 12 | — | |
| -3dB Cut Off Frequency | f _{MAX} (I/O) | R _L = 1 kΩ C _L = 50 pF (*1) | -5 | 5 | — | 30 | — | |
| Total Harmonic Distortion | — | R _L = 10 kΩ f = 1 kHz (*2) | -5 | 5 | — | 0.03 | — | % |
| -50dB Feedthrough Frequency | — | R _L = 1 kΩ (*3) | -5 | 5 | — | 600 | — | kHz |
| Crosstalk (CONTROL-OUT) | — | R _{IN} = 1 kΩ | 0 | 5 | — | 200 | — | mV |
| | | R _{OUT} = 10 kΩ | 0 | 10 | — | 400 | — | |
| | | | C _L = 15 pF | 0 | 15 | — | 600 | |
| Input Capacitance | C _{IN} | Control Input | — | — | — | 5 | 7.5 | pF |
| | | Switch I/O | — | — | — | 10 | — | |
| Feedthrough Capacitance | C _{IN-OUT} | — | — | — | — | 0.5 | — | |

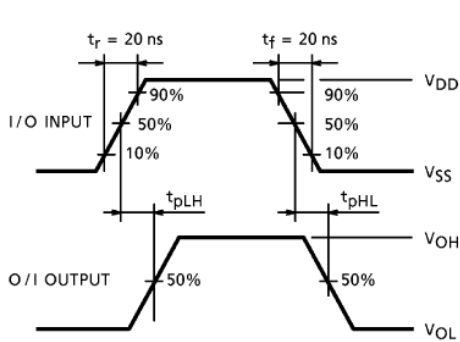
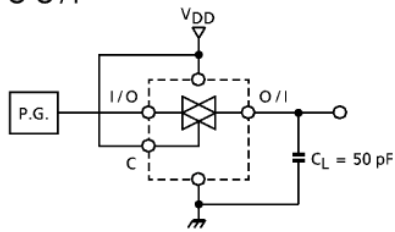
*1 : The frequency at $20\log_{10} \frac{V_{OS}}{V_{IS}} = -3 \text{ dB}$ shall be f_{MAX} (I/O) using sine wave of ±2.5 V_{p-p} for V_{IS}.

*2 : V_{IS} shall be sine wave of ±2.5 V.

*3 : The frequency at $20\log_{10} \frac{V_{OS}}{V_{IS}} = 50 \text{ dB}$ shall be the feed through using of ±2.5 V_{p-p}.

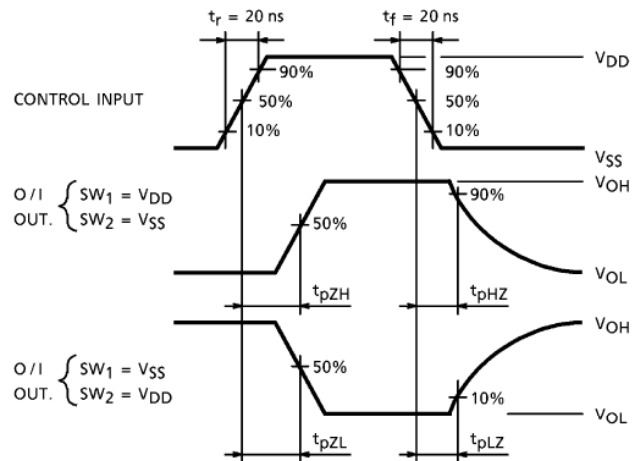
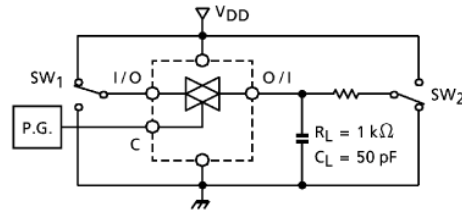
1. t_{pLH} , t_{pHL}

I/O-O/I

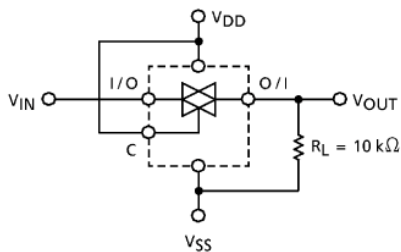


2. t_{pZL} , t_{pZH} , t_{pLZ} , t_{pHZ}

CONTROL-O/I

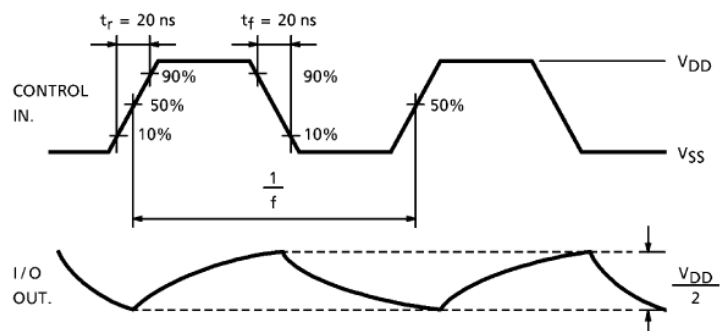
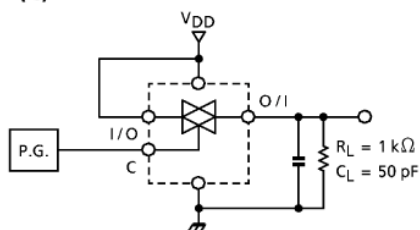


3. RON

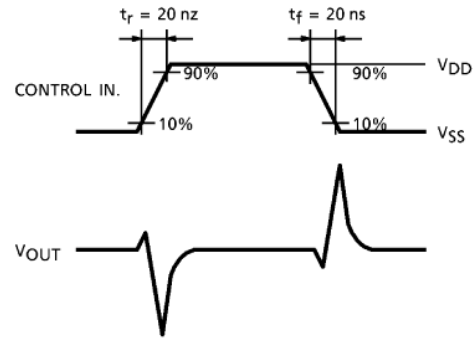
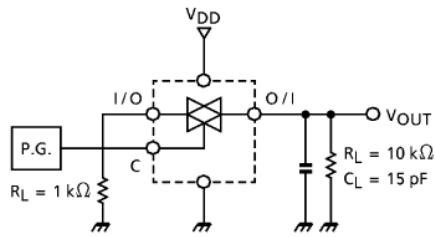


$$R_{ON} = 10 \times \frac{(V_{IN} - V_{OUT})}{V_{OUT}} \text{ (k}\Omega\text{)}$$

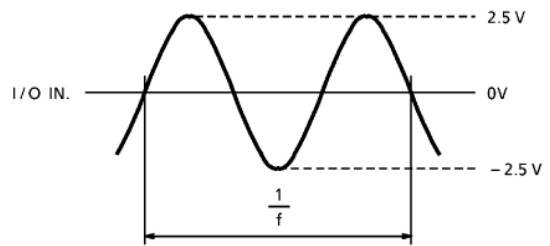
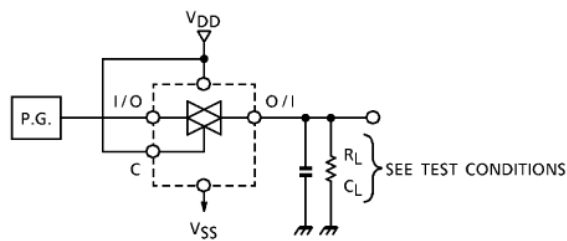
4. $f_{MAX}(C)$



5. CROSSTALK (CONTROL INPUT)

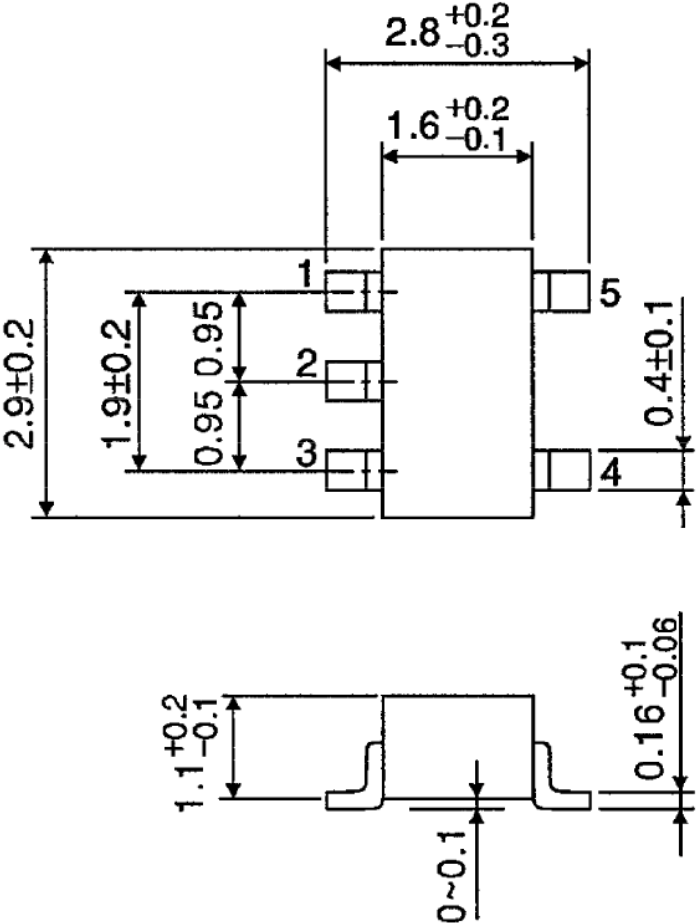


6. TOTAL HARMONIC DISTORTION, f_{MAX} (I/O-O/I), FEEDTHROUGH (SWITCH OFF)



PACKAGE DIMENSIONS
SSOP5-P-0.95

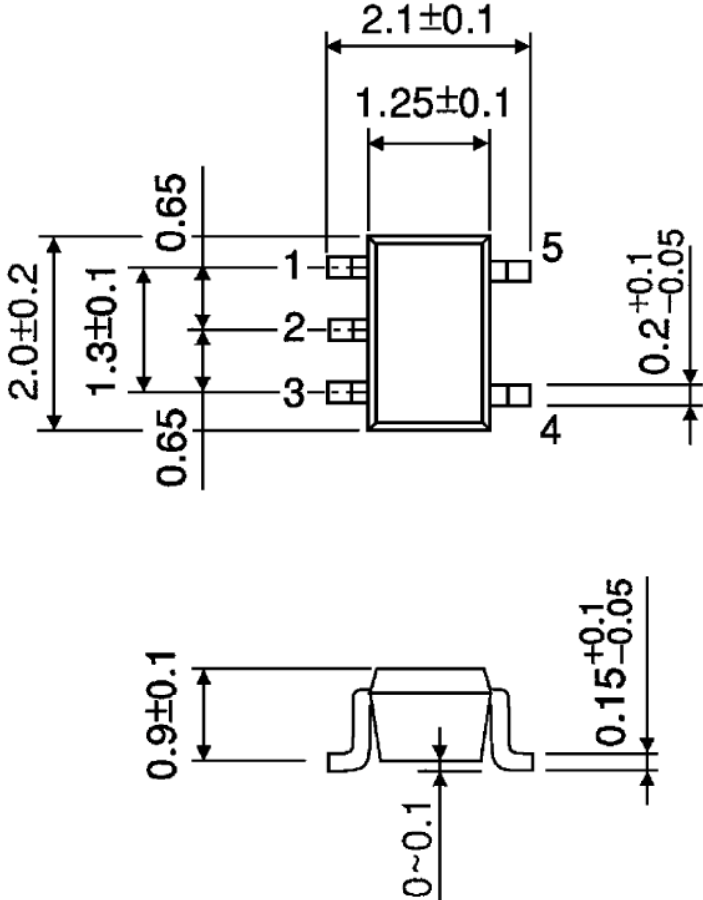
Unit : mm



Weight : 0.016 g (Typ.)

PACKAGE DIMENSIONS
SSOP5-P-0.65A

Unit : mm



Weight : 0.006 g (Typ.)

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