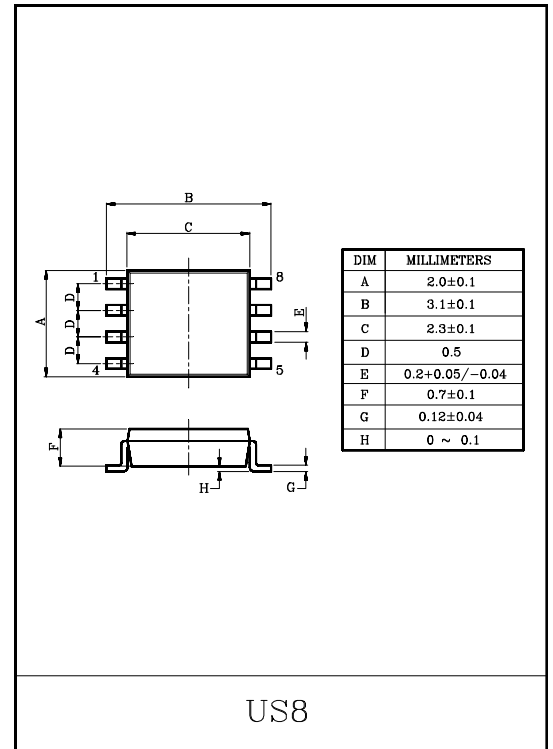## DUAL BILATERAL SWITCH

The KIC7W66FK is a high speed $C^2$MOS DUAL BILATERAL SWITCH fabricated with silicon gate $C^2$MOS 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.
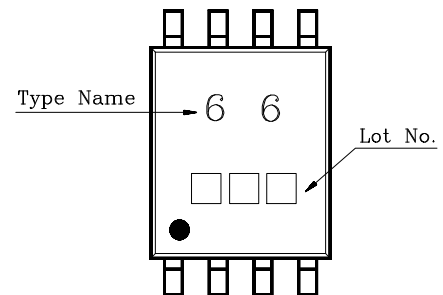
## FEATURES
- High Speed : $t_{pd}$=7ns(Typ.) at $V_{CC}$=5V.
- Low Power Dissipation : $I_{CC}$=1$\mu$A(Max.) at Ta=25℃.
- High Noise Immunity : $V_{NIH}$=$V_{NIL}$=28% $V_{CC}$(Min.).
- Low ON Resistance : $R_{ON}$=50$\Omega$(Typ.) at $V_{CC}$=9V
- High Degree of Linearity : THD=0.05(Typ.) at $V_{CC}$=5V



| DIM | MILLIMETERS |
|-----|-------------|
| A | 2.0±0.1 |
| B | 3.1±0.1 |
| C | 2.3±0.1 |
| D | 0.5 |
| E | 0.2+0.05/−0.04 |
| F | 0.7±0.1 |
| G | 0.12±0.04 |
| H | 0 ~ 0.1 |

US8

## MAXIMUM RATINGS (Ta=25℃)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|----------------|--------|--------|------|
| Supply Voltage Range | $V_{CC}$ | −0.5～10 | V |
| Control Input Voltage | $V_{IN}$ | −0.5～$V_{CC}$+0.5 | V |
| Switch I/O Voltage | $V_{I/O}$ | −0.5～$V_{CC}$+0.5 | V |
| Control Input Diode Current | $I_{CK}$ | ±20 | mA |
| I/O Diode Current | $I_{IOK}$ | ±20 | mA |
| Switch Through Current | $I_T$ | ±25 | mA |
| DC $V_{CC}$/Ground Current | $I_{CC}$ | ±50 | mA |
| Power Dissipation | $P_D$ | 200 | mW |
| Storage Temperature | $T_{stg}$ | −65～150 | ℃ |
| Lead Temperature (10s) | $T_L$ | 260 | ℃ |

## MARKING



Type Name → 6 6

Lot No.

## PIN CONNECTION(TOP VIEW)



| | |
|---|---|
| IN/OUT 1 — 1 | 8 — $V_{CC}$ |
| OUT/IN 1 — 2 | 7 — CONT 1 |
| CONT 2 — 3 | 6 — OUT/IN 2 |
| GND — 4 | 5 — IN/OUT 2 |
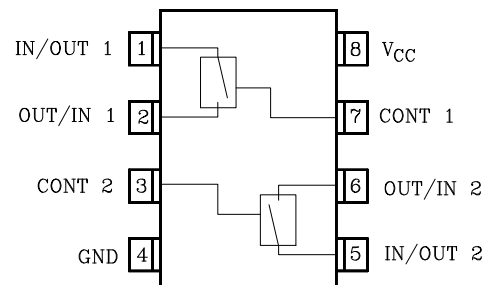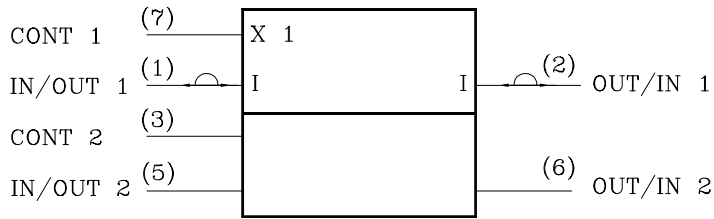
## LOGIC SYMBOL



## TRUTH TABLE

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

## LOGIC DIAGRAM
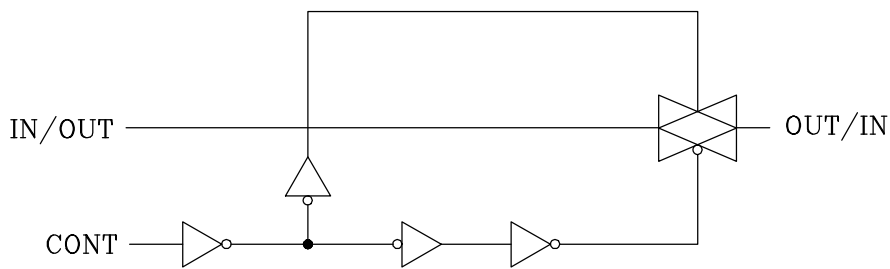


## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|----------------|--------|--------|------|
| Supply Voltage | $V_{CC}$ | $2 \sim 9$ | V |
| Control Input Voltage | $V_{IN}$ | $0 \sim V_{CC}$ | V |
| Switch I/O Voltage | $V_{I/O}$ | $0 \sim V_{CC}$ | V |
| Operating Temperature | $T_{opr}$ | $-40 \sim 85$ | ℃ |
| Input Rise and Fall Time | $t_r, t_f$ | $0 \sim 1000 \; (V_{CC}=2.0V)$<br>$0 \sim 500 \; (V_{CC}=4.5V)$<br>$0 \sim 400 \; (V_{CC}=6.0V)$<br>$0 \sim 250 \; (V_{CC}=9.0V)$ | ns |

# KIC7W66FK

## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | SYMBOL | TEST CONDITION | $V_{CC}$ | Ta=25℃ | | | Ta=-40~85℃ | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN. | TYP. | MAX. | MIN. | MAX. | |
| High-Level Control Input Voltage | $V_{IHC}$ | | 2.0<br>4.5<br>9.0 | 1.5<br>3.15<br>6.3 | –<br>–<br>– | –<br>–<br>– | 1.5<br>3.15<br>6.3 | –<br>–<br>– | V |
| Low-Level Control Input Voltage | $V_{ILC}$ | | 2.0<br>4.5<br>9.0 | –<br>–<br>– | –<br>–<br>– | 0.5<br>1.35<br>2.7 | –<br>–<br>– | 0.5<br>1.35<br>2.7 | V |
| ON Resistance | $R_{ON}$ | $V_{IN}=V_{IHC}$<br>$V_{I/O}=V_{CC}$ or GND<br>$I_{I/O}\leqq1mA$ | 4.5<br>9.0 | –<br>– | 96<br>55 | 170<br>85 | –<br>– | 200<br>100 | Ω |
| | | $V_{IN}=V_{IHC}$<br>$V_{I/O}=V_{CC}$ or GND<br>$I_{I/O}\leqq1mA$ | 2.0<br>4.5<br>9.0 | –<br>–<br>– | 160<br>70<br>50 | –<br>100<br>75 | –<br>–<br>– | –<br>130<br>95 | |
| Difference of ON Resistance Between Switches | $\varDelta R_{ON}$ | $V_{IN}=V_{IHC}$<br>$V_{I/O}=V_{CC}$ to GND<br>$I_{I/O}\leqq1mA$ | 4.5<br>9.0 | –<br>– | 10<br>5 | –<br>– | –<br>– | –<br>– | Ω |
| Input/Output Leakage Current (SWITCH OFF) | $I_{OFF}$ | $V_{OS}=V_{CC}$ or GND<br>$V_{I/S}=GND$ or $V_{CC}$<br>$V_{IN}=V_{ILC}$ | 9.0 | – | – | ±100 | – | ±1000 | nA |
| Switch Input Leakage Current (SWITCH ON OUTPUT OPEN) | $I_{IZ}$ | $V_{OS}=V_{CC}$ or GND<br>$V_{INH}=V_{IHC}$ | 9.0 | – | – | ±100 | – | ±1000 | nA |
| Control Input Current | $I_{IN}$ | $V_{IN}=V_{CC}$ or GND | 6.0 | – | – | ±100 | – | ±1000 | nA |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN}=V_{CC}$ or GND | 6.0<br>9.0 | –<br>– | –<br>– | 1.0<br>4.0 | –<br>– | 10.0<br>40.0 | $\mu A$ |

## AC ELECTRICAL CHARACTERISTICS (C$_L$=50pF, Input, t$_r$=t$_f$=6ns)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | V$_{CC}$ | Ta=25℃ MIN. | Ta=25℃ TYP. | Ta=25℃ MAX. | Ta=-40~85℃ MIN. | Ta=-40~85℃ MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Phase Difference Between Input and Output | $\phi$ I/O | | 2.0<br>4.5<br>9.0 | –<br>–<br>– | 10<br>4<br>3 | 50<br>10<br>8 | –<br>–<br>– | 65<br>13<br>10 | ns |
| Output Enable Time | t$_{pZL}$<br>t$_{pZH}$ | R$_L$=1kΩ | 2.0<br>4.5<br>9.0 | –<br>–<br>– | 18<br>8<br>6 | 100<br>20<br>12 | –<br>–<br>– | 125<br>25<br>22 | ns |
| Output Disable Time | t$_{pLZ}$<br>t$_{pHZ}$ | R$_L$=1kΩ | 2.0<br>4.5<br>9.0 | –<br>–<br>– | 20<br>10<br>8 | 115<br>23<br>20 | –<br>–<br>– | 145<br>29<br>25 | ns |
| Maximum Control Input Frequency | | R$_L$=1kΩ<br>CL=15pF<br>V$_{OUT}$=1/2V$_{CC}$ | 2.0<br>4.5<br>9.0 | –<br>–<br>– | 30<br>30<br>30 | –<br>–<br>– | –<br>–<br>– | –<br>–<br>– | MHz |
| Control Input Capacitance | C$_{IN}$ | | | – | 5 | 10 | – | 10 | pF |
| Switch Terminal Capacitance | C$_{I/O}$ | | | – | 6 | – | – | – | pF |
| Feed Through Capacitance | C$_{IOS}$ | | | – | 0.5 | – | – | – | pF |
| Power Dissipation Capacitance | C$_{PD}$ | (Note 1) | | – | 15 | – | – | – | pF |

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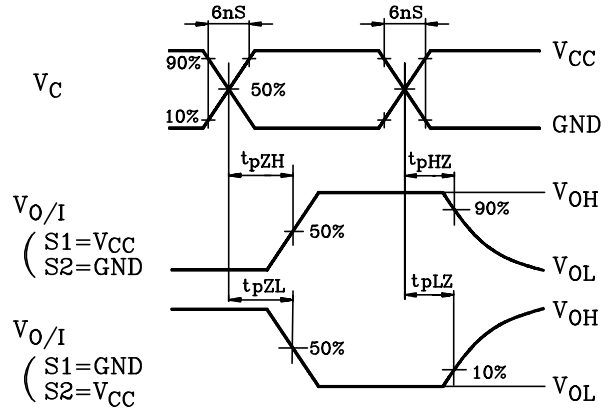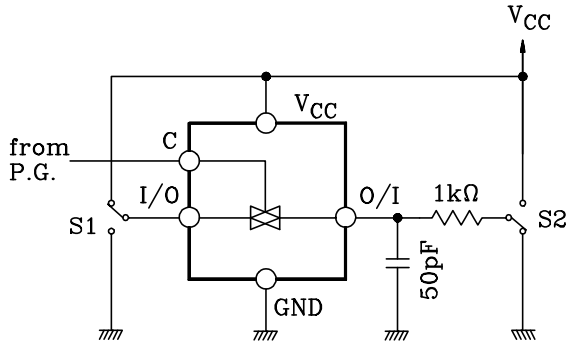
$$I_{CC(opr)}=C_{PD}\cdot V_{CC}\cdot f_{IN}+I_{CC}/2$$

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

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

## SWITCHING CHARACTERISTICS TEST CIRCUITS

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

$V_{CC}$

from P.G.

C

$V_{CC}$

I/O

O/I

$1k\Omega$

S1

S2

GND

50pF

$V_C$

6nS

6nS

90%

50%

10%

$V_{CC}$

GND

$V_{O/I}$ ( S1=$V_{CC}$ S2=GND )

$t_{pZH}$

$t_{pHZ}$

$V_{OH}$

50%

90%

$V_{OL}$

$V_{O/I}$ ( S1=GND S2=$V_{CC}$ )

$t_{pZL}$

$t_{pLZ}$

$V_{OH}$

50%

10%

$V_{OL}$

2. CROSS TALK (CONTROL INPUT-SWITCH OUTPUT)
   $f_{IN}$=1MHz, duty=50%, $t_r$=$t_f$=6ns

$V_{CC}$
GND

from P.G.

C

$V_{CC}$

$V_{CC}$

I/O

O/I

$600\Omega$

GND

$600\Omega$

50pF

3. FEEDTHROUGH ATTENUATION

$V_{CC}$

$0.1\mu F$

$V_{IN}$

C

$V_{CC}$

$V_{CC}$

$600\Omega$

I/O

O/I

GND

$600\Omega$

50pF

4. $C_{IOS}$ , $C_{I/O}$

$C_{IOS}$

$V_{CC}$

C

I/O

O/I

$C_{OS}$

$C_{I/O}$

GND
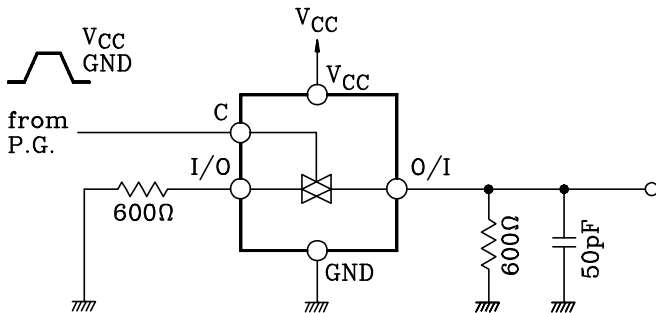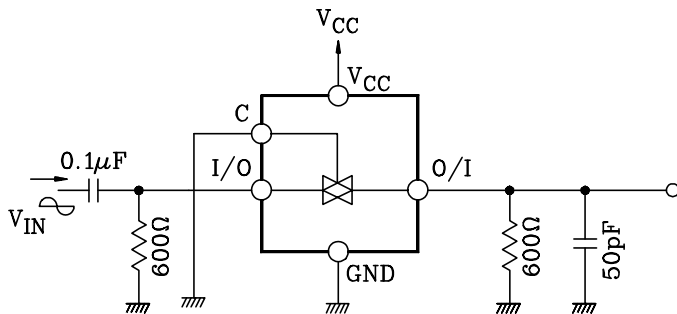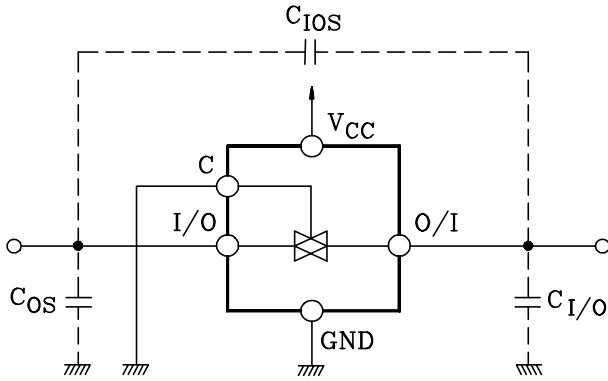
5. CROSS TALK (BETWEEN ANY TWO SWITCHES)

$V_{CC}$

$V_{CC}$

C

$V_{IN}$  0.1$\mu$F  600$\Omega$  I/O

O/I

600$\Omega$

50pF

C

$V_{CC}$

I/O

O/I

600$\Omega$

600$\Omega$

50pF

GND

3. FREQUENCY RESPONSE (SWITCH ON)

$V_{CC}$

C

0.1$\mu$F  I/O

O/I

600$\Omega$

50pF

GND