

## DUAL BILATERAL SWITCH

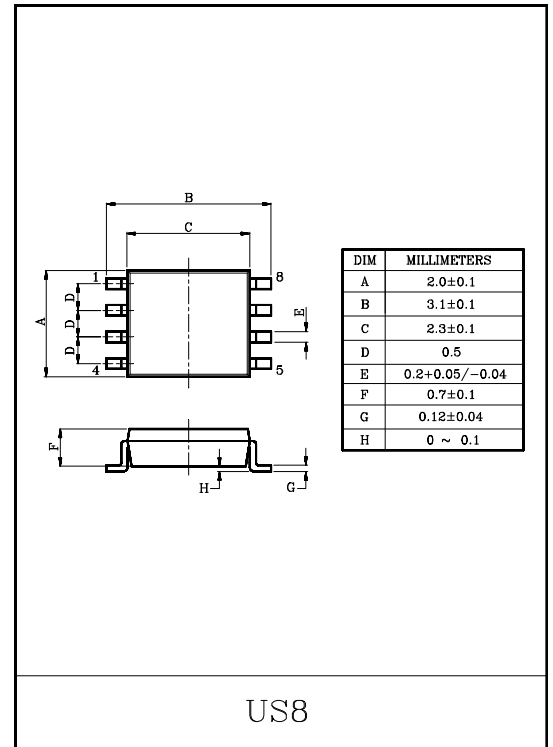
The KIC7W66FK is a high speed C<sup>2</sup>MOS DUAL BILATERAL SWITCH fabricated with silicon gate C<sup>2</sup>MOS technology. It consists of four independent high speed switches capable of controlling either digital or analog signals while maintaining the CMOS low power dissipation. Control input (C) 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

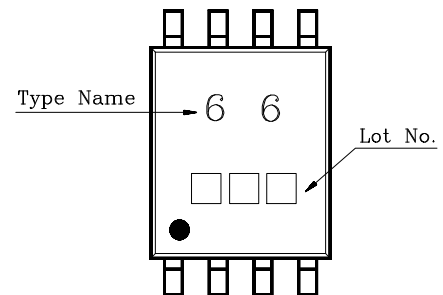
- High Speed :  $t_{pd}=7ns$ (Typ.) at  $V_{CC}=5V$ .
- Low Power Dissipation :  $I_{CC}=1\mu A$ (Max.) at  $T_a=25^\circ C$ .
- High Noise Immunity :  $V_{NIH}=V_{NIL}=28\% V_{CC}(\text{Min.})$ .
- Low ON Resistance :  $R_{ON}=50\Omega$ (Typ.) at  $V_{CC}=9V$
- High Degree of Linearity :  $THD=0.05$ (Typ.) at  $V_{CC}=5V$

### MAXIMUM RATINGS ( $T_a=25^\circ C$ )

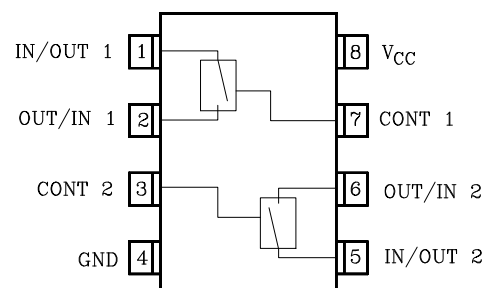
| CHARACTERISTIC              | SYMBOL    | RATING             | UNIT       |
|-----------------------------|-----------|--------------------|------------|
| Supply Voltage Range        | $V_{CC}$  | -0.5~10            | V          |
| Control Input Voltage       | $V_{IN}$  | -0.5~ $V_{CC}+0.5$ | V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



### MARKING

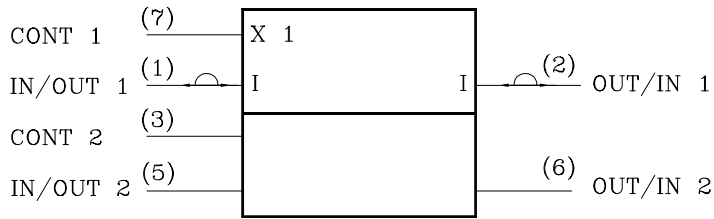


### PIN CONNECTION(TOP VIEW)



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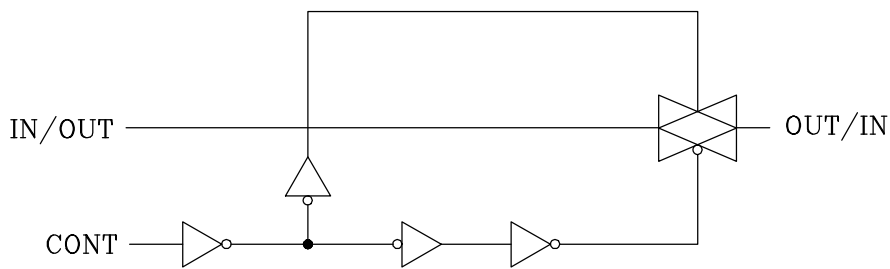
## LOGIC SYMBOL



## TRUTH TABLE

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

## LOGIC DIAGRAM



## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC           | SYMBOL     | RATING   | UNIT |
|--------------------------|------------|--|------|
| Supply Voltage           | $V_{CC}$   | 2~9  | 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 ( $V_{CC}=9.0V$ ) | ns   |

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## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                       | SYMBOL           | TEST CONDITION   | V <sub>CC</sub>  | Ta=25°C  |      |      | Ta=-40~85°C |       | UNIT |
|--|------------------|--|------------------|--|------|------|-------------|-------|------|
|  |                  |  |                  | MIN.   | TYP. | MAX. | MIN.        | MAX.  |      |
| High-Level Control Input Voltage                     | V <sub>IHC</sub> |  | 2.0              | 1.5  | -    | -    | 1.5         | -     | V    |
|  |                  |  | 4.5              | 3.15   | -    | -    | 3.15        | -     |      |
|  |                  |  | 9.0              | 6.3  | -    | -    | 6.3         | -     |      |
| Low-Level Control Input Voltage                      | V <sub>ILC</sub> |  | 2.0              | -  | -    | 0.5  | -           | 0.5   | V    |
|  |                  |  | 4.5              | -  | -    | 1.35 | -           | 1.35  |      |
|  |                  |  | 9.0              | -  | -    | 2.7  | -           | 2.7   |      |
| ON Resistance  | R <sub>ON</sub>  | V <sub>IN</sub> =V <sub>IHC</sub><br>V <sub>I/O</sub> =V <sub>CC</sub> or GND<br>I <sub>I/O</sub> ≤1mA                   | 4.5              | -  | 96   | 170  | -           | 200   | Ω    |
|  |                  |  | 9.0              | -  | 55   | 85   | -           | 100   |      |
|  |                  |  | 2.0              | -  | 160  | -    | -           | -     |      |
|  |                  | 4.5  | -                | 70   | 100  | -    | 130         |       |      |
|  |                  | 9.0  | -                | 50   | 75   | -    | 95          |       |      |
|  |                  | Difference of ON Resistance Between Switches   | ΔR <sub>ON</sub> | V <sub>IN</sub> =V <sub>IHC</sub><br>V <sub>I/O</sub> =V <sub>CC</sub> to GND<br>I <sub>I/O</sub> ≤1mA | 4.5  | -    | 10          | -     |      |
| 9.0  | -                |  |                  |  | 5    | -    | -           | -     |      |
| 9.0  | -                |  |                  |  | -    | -    | -           | -     |      |
| Input/Output Leakage Current (SWITCH OFF)            | I <sub>OFF</sub> | V <sub>OS</sub> =V <sub>CC</sub> or GND<br>V <sub>I/S</sub> =GND or V <sub>CC</sub><br>V <sub>IN</sub> =V <sub>ILC</sub> | 9.0              | -  | -    | ±100 | -           | ±1000 | nA   |
| Switch Input Leakage Current (SWITCH ON OUTPUT OPEN) | I <sub>IZ</sub>  | V <sub>OS</sub> =V <sub>CC</sub> or GND<br>V <sub>INH</sub> =V <sub>IHC</sub>  | 9.0              | -  | -    | ±100 | -           | ±1000 | nA   |
| Control Input Current                                | I <sub>IN</sub>  | V <sub>IN</sub> =V <sub>CC</sub> or GND  | 6.0              | -  | -    | ±100 | -           | ±1000 | nA   |
| Quiescent Supply Current                             | I <sub>CC</sub>  | V <sub>IN</sub> =V <sub>CC</sub> or GND  | 6.0              | -  | -    | 1.0  | -           | 10.0  | μA   |
|  |                  |  | 9.0              | -  | -    | 4.0  | -           | 40.0  |      |

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## AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub>=50pF, Input, t<sub>r</sub>=t<sub>f</sub>=6ns)

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

Note 1 : C<sub>PD</sub> 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 :

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

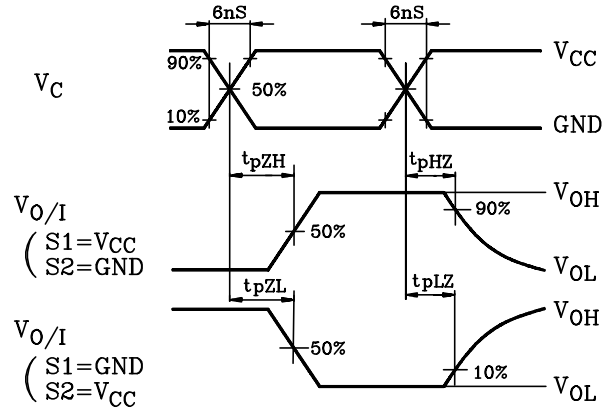
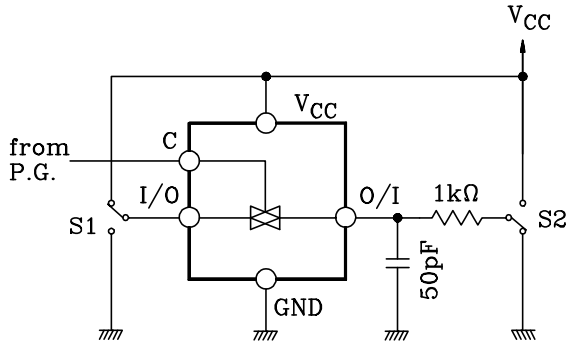
## ANALOG SWITCH CHARACTERISTICS (GND=0V, Ta=25°C)

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

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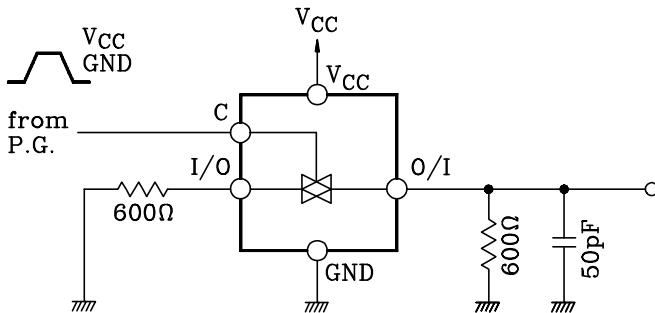
## SWITCHING CHARACTERISTICS TEST CIRCUITS

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

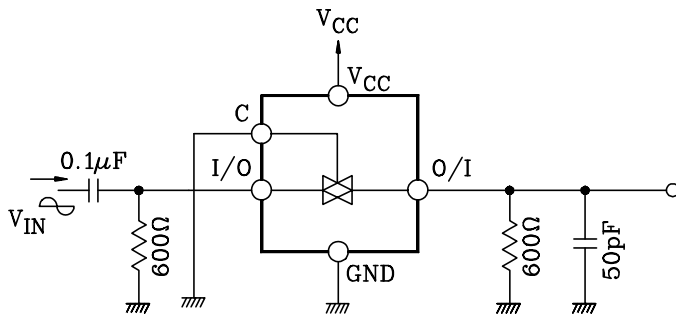


2. CROSS TALK (CONTROL INPUT-SWITCH OUTPUT)

$f_{IN}=1\text{MHz}$ , duty=50%,  $t_r=t_f=6\text{ns}$

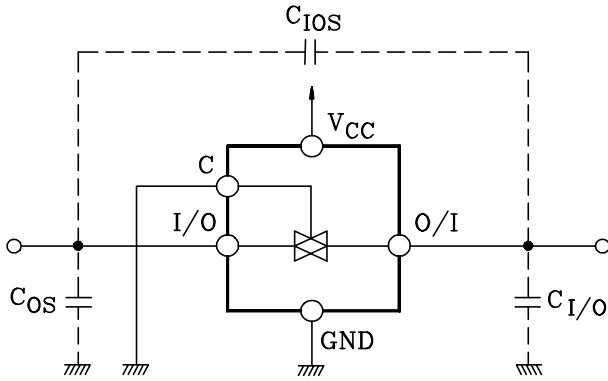


3. FEEDTHROUGH ATTENUATION

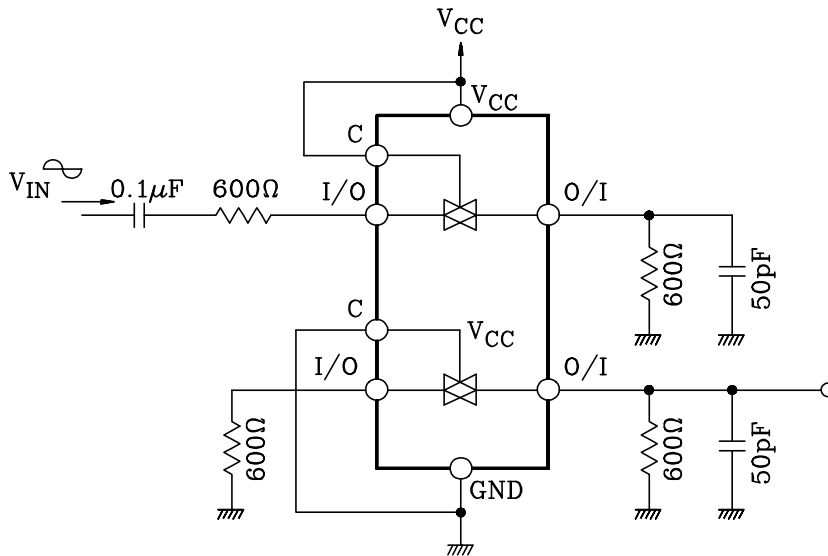


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## 4. $C_{IOS}$ , $C_{I/O}$



## 5. CROSS TALK (BETWEEN ANY TWO SWITCHES)



## 3. FREQUENCY RESPONSE (SWITCH ON)

