TC74HC4016AP/AF

QUAD BILATERAL SWITCH

The TC74HC4016A is a high speed CMOS QUAD BILATERAL SWITCH fabricated with silicon gate C^2MOS technology.

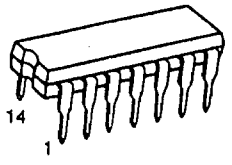
It consists of four independent high speed switches capable of controlling either digital or analog signals while maintaining the CMOS low power dissipation.

A Control (xC) is provide to independently control each switch. The switch is turned ON by setting the corresponding control input high. Conversely, a low on a control input turns the corresponding switch OFF.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed ..... tpd= ns(typ.)atV_{CC}=5V
- Low Power Dissipation ..... I_{CC}=1μA(Max.)at Ta=25℃
- High Noise Immunity ..... V_{NIH}=V_{NIL}=28% V_{CC}(Min.)
- Low ON Resistance ..... R_{ON}= Ω(typ.)at V_{CC}=9V
- High Degree of Linearity ··· THD= %(typ.)at V_{CC}=5V
- Pin and Function Compatible with 4016B



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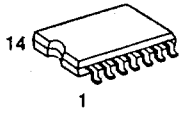

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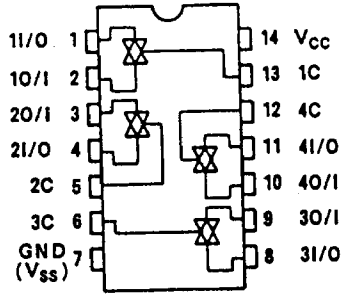
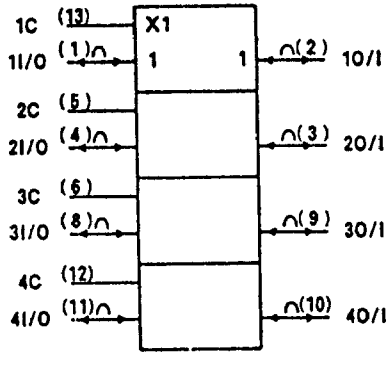
PIN ASSIGNMENT



(Top View)

IEC LOGIC SYMBOL



TRUTH TABLE

INPUT	SWITCH FUNCTION
H	ON
L	OFF

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	−0.5 ~ 13	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}/ GND Current	I_{CC}	±50	mA
Power Dissipation	P_D	500(DIP)*/180(SOIC)	mW
Storage Temperature	Tstg	−65 ~150	℃
Lead Temperature 10sec	T_L	300	℃

*500mW in the range of Ta= −40℃~ 65℃. From Ta=65℃ to 85℃ a derating factor of −10mW/℃ shall be applied until 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	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	℃
Input Rise and Fall Time	t_r, t_f	0 ~ 1000(V_{CC} = 2.0V) 0 ~ 500(V_{CC} = 4.5V) 0 ~ 400(V_{CC} = 6.0V) 0 ~ 250(V_{CC} =10.0V)	ns

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	Ta=25℃ MIN.	Ta=25℃ TYP.	Ta=25℃ MAX.	Ta=−40 ~85℃ MIN.	Ta=−40 ~85℃ MAX.	UNIT
High−Level Control Input Voltage	V_{IHC}		2.0 4.5 9.0 12.0	1.5 3.15 6.3 8.4	− − − −	− − − −	1.5 3.15 6.3 8.4	− − − −	V
Low−Level Control Input Voltage	V_{ILC}		2.0 4.5 9.0 12.0	− − − −	− − − −	0.5 1.35 2.7 3.6	− − − −	0.5 1.35 2.7 3.6	V
ON Resistance	R_{ON}	V_{IN} =V_{IHC} $V_{I/O}$ =V_{CC} to GND $V_{I/O}$ ≤1mA	4.5 9.0 12.0	− − −	115 55 45	230 110 90	− − −	290 140 115	Ω
		V_{IN} =V_{IHC} $V_{I/O}$ =V_{CC} or GND $V_{I/O}$ ≤1mA	2.0 4.5 9.0 12.0	− − − −	120 60 45 40	− 120 90 80	− − − −	− 150 115 100	Ω
Difference of ON Resistance Between Switches	$\triangle R_{ON}$	V_{IN} =V_{IHC} $V_{I/O}$ =V_{CC} to GND $V_{I/O}$ ≤1mA	4.5 9.0 12.0	− − −	10 5 5	− − −	− − −	− − −	Ω
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	−	±1000	nA
Switch Input Leakage Current (SWITCH ON, OUTPUT OPEN)	I_{IZ}	V_{OS} =V_{CC} or GND V_{INH}=V_{IHC}	12.0	−	−	±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 9.0 12.0	− − −	− − −	1.0 4.0 8.0	− − −	10.0 40.0 80.0	μA

AC ELECTRICAL CHARACTERISTICS(C_L=50pF, Input $t_r=t_f$=6ns, GND=0V)

PARAMETER	SYMBOL	TEST CONDITION		Ta=25℃			Ta=−40 ~85℃		UNIT
			V_{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
Phase difference between Input and Output	$\phi_{I/O}$		2.0	−	20	50	−	65	ns
			4.5	−	5	10	−	13	
			9.0	−	4	8	−	10	
			12.0	−	3	7	−	9	
Output Enable Time	t_{pZL} t_{pZH}	R_L=1kΩ	2.0	−	40	100	−	125	
			4.5	−	10	20	−	25	
			9.0	−	8	15	−	19	
			12.0	−	7	14	−	18	
Output Disable Time	t_{pLZ} t_{pHZ}	R_L=1kΩ	2.0	−	60	150	−	190	
			4.5	−	15	30	−	38	
			9.0	−	10	26	−	33	
			12.0	−	8	24	−	30	
Maximum Control Input Frequency		R_L=1kΩ C_L=15pF V_{OUT}=1/2V_{CC}	2.0	−	20	−	−	−	MHz
			4.5	−	20	−	−	−	
			9.0	−	20	−	−	−	
			12.0	−	20	−	−	−	
Control Input Capacitance	C_{IN}		−	−	5	10	−	10	pF
Switch Terminal Capacitance	$C_{I/O}$		−	−	6	−	−	−	
Feed through Capacitance	C_{IOS}		−	−	0.5	−	−	−	
Power Dissipation Capacitance	C_{PD}	(1)	−	−	15	−	−	−	

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

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per channel)}$$

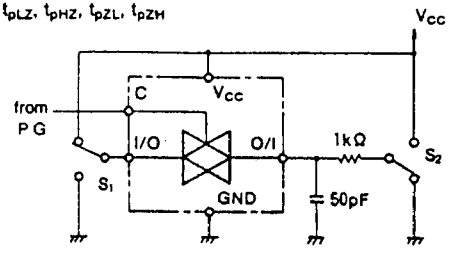
ANALOG SWITCH CHARACTERISTICS(GND=0V, Ta=25℃)

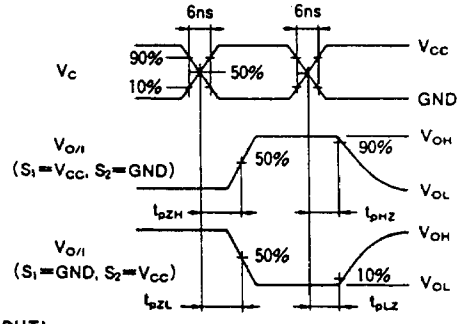
PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	TYP.	UNIT
Sine Wave Distortion (T.H.D)		f_{IN} =1kHz, R_L=10kΩ, C_L=50pF; V_{IN} =4.0V_{P-P} @V_{CC}=4.5V; V_{IN} =8.0V_{P-P} @V_{CC}=9.0V	4.5	0.027	%
			9.0	0.011	
Frequency Response (Switch ON)	f_{MAX}	Adjust f_{IN} Voltage to obtain 0dBm at Vos; Increase f_{IN} Frequency until dB Meter reads −3dB; R_L=50Ω, C_L=10pF; f_{IN}=1MHz, Sine Wave	4.5	150	MHz
			9.0	200	
Feedthrough Attenuation (Switch OFF)		Vin is centered at V_{CC}/2; Adjust input for 0dBm; R_L=600Ω, C_L=50pF; f_{IN}=1MHz, Sine Wave	4.5	−50	dB
			9.0	−50	
Crosstalk (Control Input to Signal Output)		R_L =600Ω, C_L=50pF; f_{IN} =1MHz, Square Wave ($t_r = t_f$ = 6 ns)	4.5	95	mV
			9.0	225	
Crosstalk (Between any switches)		Adjust V_{IN} to obtain 0dBm at Input; R_L =600Ω, C_L=50pF; f_{IN} =1MHz, Sine Wave	4.5	−50	dB
			9.0	−50	

NOTE: These characteristics are determined by design of devices.

SWITCHING CHARACTERISTICS TEST CIRCUITS

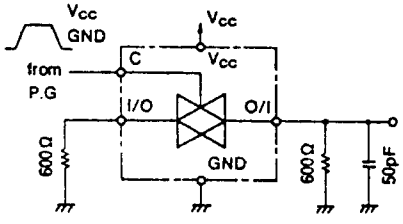
1. t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}



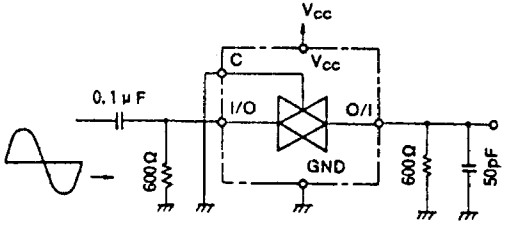


2. CROSS TALK (CONTROL INPUT-SWITCH OUTPUT)

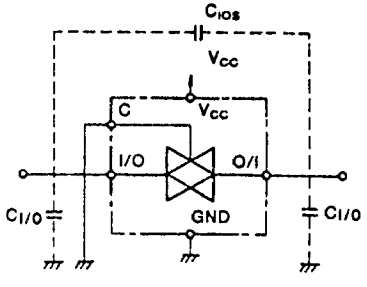
fin=1MHz duty=50% tr=tf=6ns



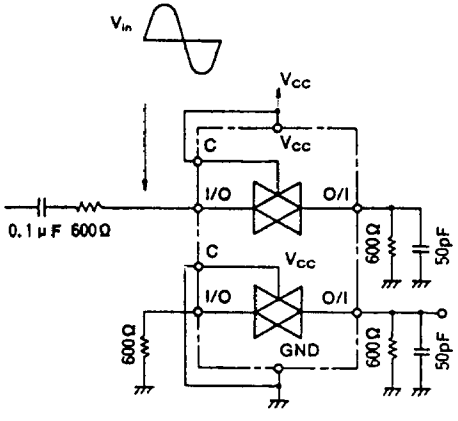
3. FEEDTHROUGH ATTENUATION



4. Clos, C I/O



5. CROSSTALK(BETWEEN ANY TWO SWITCHES)



6. FREQUENCY RESPONSE(SWITCH ON)