TC4016BP/BF

C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

TC4016BP/TC4016BF QUAD BILATERAL SWITCH

TC4016BP/BF contains for circuits of independent bidirectional switches. When control input CONT is placed at "H" level, the impedance between the input and output of switch becomes low and when CONT is placed at "L" level, it becomes high. This can be used for switching analog and digital signals.

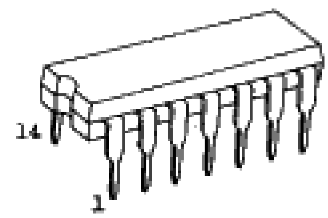
Resistance during ON, R_{ON}

$2.5 \times 10^2 \Omega$(TYP.) .... $V_{DD}-V_{SS}=10V$

$1.5 \times 10^2 \Omega$(TYP.) .... $V_{DD}-V_{SS}=15V$

Resistance during OFF, R_{OFF}

R_{OFF}(TYP.) $> 10^9 \Omega$



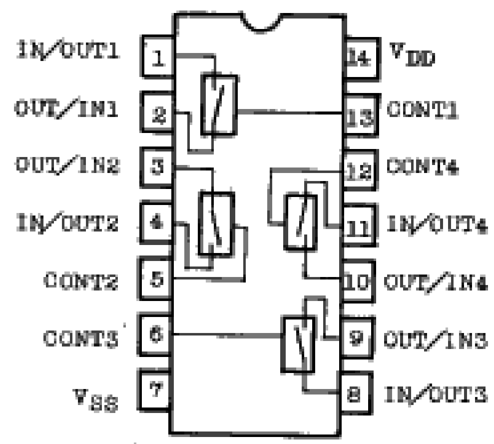
DIP14(3D14A-P)

MFP14(F14GB-P)

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNITS
DC Supply Voltage	V_{DD}	$V_{SS}-0.5 \sim V_{SS}+20$	V
Control Input Voltage	V_{CIN}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Switch I/O Voltage	$V_{I/O}$	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Control Input Current	I_C	±10	mA
Power Dissipation	P_D	300(DIP)/180(MFP)	mW
Operating Temperature Range	T_A	$-40 \sim 85$	°C
Storage Temperature Range	T_{stg}	$-65 \sim 150$	°C
Lead Temp./Time	T_{sol}	260°C · 10 sec	

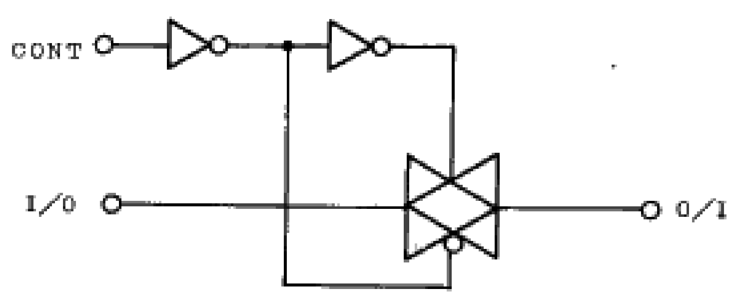
PIN ASSIGNMENT



(TOP VIEW)

LOGIC DIAGRAM

(1/4 TC4016BP/BF)



TRUTH TABLE

CONTROL	IMPEDANCE BETWEEN IN/OUT − OUT/IN ※
H	$1 \sim 20 \times 10^2 \Omega$
L	$> 10^9 \Omega$

※ SEE STATIC ELECTRICAL CHARACTERISTICS

RECOMMENDED OPERATING CONDITIONS

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

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	V_{SS} (V)	V_{DD} (V)	-40°C		25°C			85°C		UNITS
					MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
Control Input High Voltage	V_{IH}	|Iis|=10μA		5	3.5	-	3.5	2.4	-	3.5	-	V
				10	7.0	-	7.0	4.8	-	7.0	-	
				15	11.0	-	11.0	7.2	-	11.0	-	
Control Input Low Voltage	V_{IL}	|Iis|=10μA		5	-	1.0	-	1.7	1.0	-	1.0	
				10	-	1.0	-	1.7	1.0	-	1.0	
				15	-	1.0	-	1.7	1.0	-	1.0	
On-State Resistance	R_{ON}	V_{IN}=5V		5	-	-	-	300	-	-	-	Ω
		V_{IN}=2.5V		5	-	-	-	2000	-	-	-	
		V_{IN}=0.25V		5	-	-	-	300	-	-	-	
		V_{IN}=10V		10	-	600	-	180	660	-	840	
		V_{IN}=5V		10	-	600	-	300	660	-	840	
		V_{IN}=0.25V		10	-	600	-	130	660	-	840	
		V_{IN}=15V		15	-	370	-	140	400	-	520	
		V_{IN}=7.5V		15	-	370	-	160	400	-	520	
		V_{IN}=0.25V		15	-	370	-	100	400	-	520	
		V_{IN}=5V	-5	5	-	600	-	180	660	-	840	
		V_{IN}=±0.25V	-5	5	-	600	-	300	660	-	840	
		V_{IN}=-5V	-5	5	-	600	-	130	660	-	840	
		V_{IN}=7.5V	-7.5	7.5	-	370	-	140	400	-	520	
		V_{IN}=±0.25V	-7.5	7.5	-	370	-	160	400	-	520	
		V_{IN}=-7.5V	-7.5	7.5	-	370	-	100	400	-	520	
ΔOn-State Resistance (Between Any 2 Switches)	$R_{ON}\Delta$		-5	5	-	-	-	7	-	-	-	
			-7.5	7.5	-	-	-	5	-	-	-	
Input/Output Leakage Current	I_{OFF}	V_{IN}=18V, V_{OUT}=0V		18	-	±100	-	±0.1	±100	-	±1000	nA
		V_{IN}=0V, V_{OUT}=18V		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	I_{IH}	V_{IH}=18V		18	-	0.1	-	10^{-5}	0.1	-	1.0	
	I_{IL}	V_{IL}=0V		18	-	-0.1	-	-10^{-5}	-0.1	-	-1.0	

* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	V_{SS}(V)	V_{DD}(V)	MIN.	TYP.	MAX.	UNITS
Propagation Delay Time (IN - OUT)	t_{pLH} t_{pHL}	C_L=50pF	0	5	-	24	45	ns
			0	10	-	11	15	
			0	15	-	8	12	
Propagation Delay Time (CONTROL - OUT)	t_{pLH} t_{pHL}	R_L=1kΩ C_L=50pF	0	5	-	35	70	
			0	10	-	20	40	
			0	15	-	17	30	
Max. Control Input Repetition Rate	f_{MAX} (CONT)	R_L=1kΩ C_L=50pF	0	5	-	10	-	MHz
			0	10	-	12	-	
			0	15	-	12	-	
-3dB Cutoff Frequency	f_{MAX} (I - O)	R_L=1kΩ	-5	5	-	24	-	
		R_L=2kΩ			-	23	-	
		R_L=10kΩ			-	22	-	
		R_L=100kΩ			-	22	-	
		R_L=1MΩ			-	22	-	
		C_L=15pF (*1)						
Total Harmonic Distortion	-	R_L=10kΩ f=1MHz (*2)	-5	5	-	0.16	-	%
-50dB Feedthrough Frequency	-	R_L=1kΩ (*3)	-5	5	-	600	-	kHz
-50dB Crosstalk Frequency	-	R_L=1kΩ (*4)	-5	5	-	1	-	MHz
Crosstalk (CONTROL - OUT)	-	R_{IN}=1kΩ R_{OUT}=10kΩ C_L=15pF	0	5	-	50	-	mV
			0	10	-	100	-	
			0	15	-	150	-	
Input Capacitance	C_{IN}	Control Input			-	5	7.5	pF
		Switch I/O			-	5	-	
Feed through Capacitance	C_{IN-OUT}				-	0.5	-	

*1 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of $20\log_{10}\frac{V_{os}}{V_{is}}=-3dB$ shall be f_{MAX}.

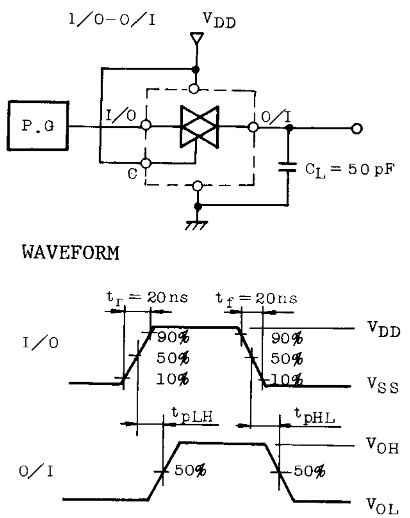
*2 V_{is} shall be sine wave of ±2.5Vp-p.

*3 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of $20\log_{10}\frac{V_{os}}{V_{is}}=-50dB$ shall be feed-through.

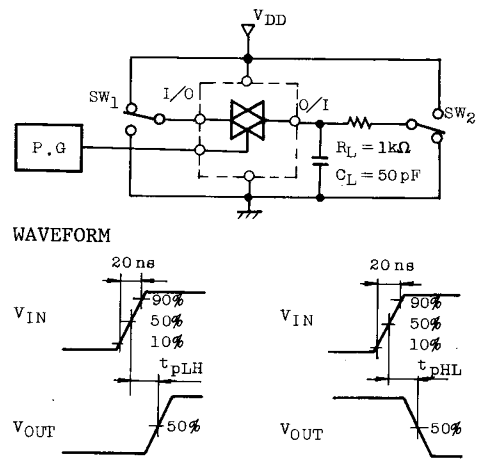
*4 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of $20\log_{10}\frac{V_{os}}{V_{is}}=-50dB$ shall be crosstalk.

CIRCUIT FOR MEASUREMENT OF ELECTRICAL CHARACTERISTICS

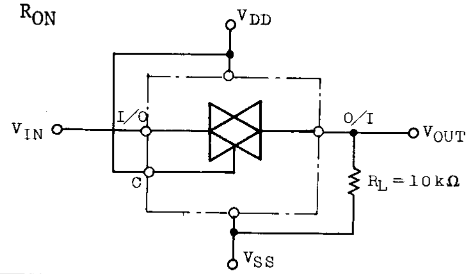
1. t_{pLH}, t_{pHL}



2. t_{pLH}, t_{pHL} (CONTROL − OUT)

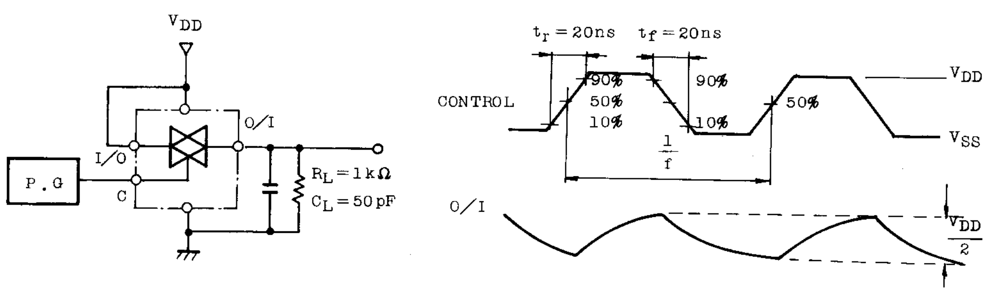


3. R_{ON}



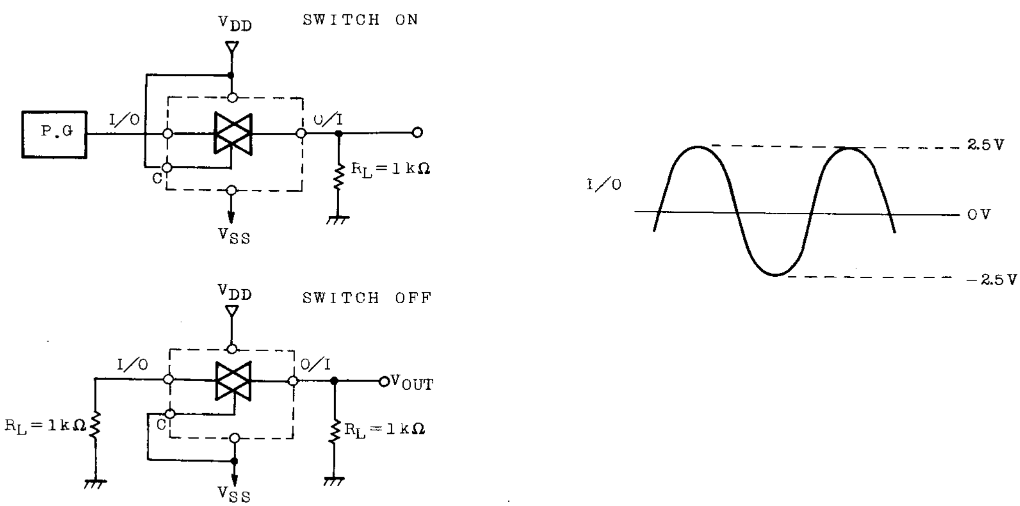
$$R_{ON} = 10 \times \frac{(V_{IN} - V_{OUT})}{V_{OUT}} \ [k\Omega]$$

4. f_{MAX} (C)

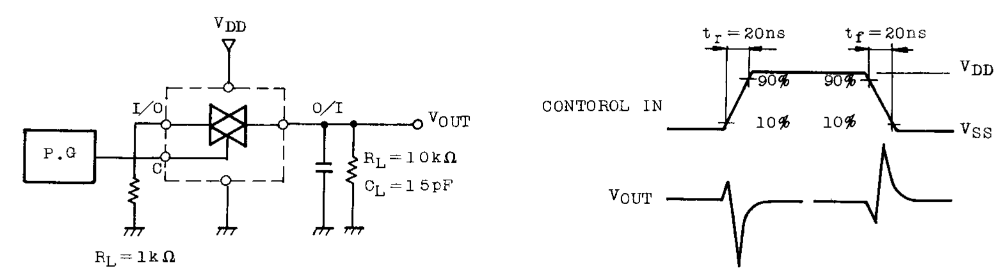


CIRCUIT FOR MEASUREMENT OF ELECTRICAL CHARACTERISTICS

5. CROSSTALK BETWEEN ANY TWO SWITCHES



6. CROSSTALK, CONTROL TO INPUT



7. TOTAL HARMONIC DISTORTION, f_{MAX}(I-O), FEEDTHROUGH