M4066BP
M4066BFP

QUADRUPLE BILATERAL SWITCH

DESCRIPTION
The M4066BP is a semiconductor integrated circuit consisting of four independent bilateral analog switches.

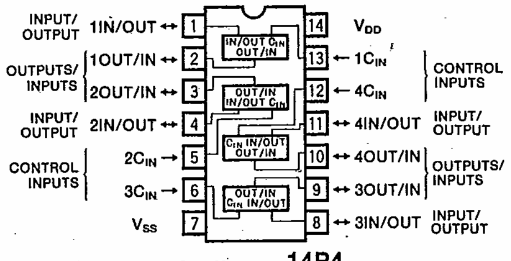
FEATURES
- Low ON resistance: 50Ω typ. (V_{DD}=15V)
- High OFF resistance: 10^9Ω or greater (typ)
- Small differences in ON resistance between each switch in the package: 10Ω typ. (V_{DD}=15V)
- Linearized transfer characteristics: 0.07% distortion (typ)
- Wide operating voltage range: V_{DD}=3~18V
- Wide operating temperature range: Ta=−40~+85℃

APPLICATION
General purpose, for use in industrial and consumer digital equipment.

FUNCTIONAL DESCRIPTION
The control input (C_{IN}) can be used to change the input-to-output impedance (IN/OUT-OUT/IN) of the switches.
When (C_{IN}) is made high, the input-to-output switch impedance is low and when set to low, this impedance is high. While this device is compatible with the M4016BP, the lower ON resistance and better transfer characteristics allow a larger input voltage range.

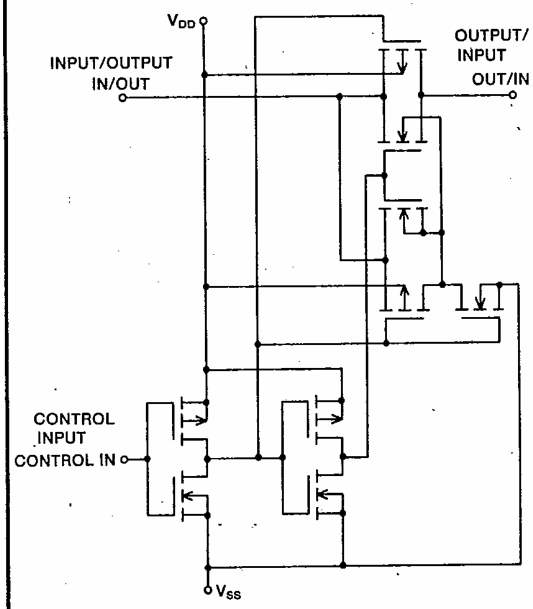
Input C_{IN}	Input/output and output/input resistance (V_{DD}=10V, 15V)
H	0.5~3×10^2Ω
L	>10^9Ω (typ)

PIN CONFIGURATION (TOP VIEW)

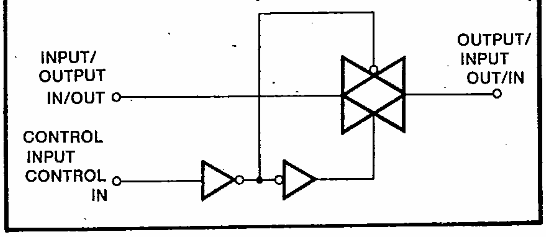


Outline 14P4 14P2N

CIRCUIT SCHEMATIC (EACH SWITCH)



LOGIC DIAGRAM (EACH SWITCH)



ABSOLUTE MAXIMUM RATINGS (T_a=−40~+85℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DD}	Supply voltage		V_{SS}−0.5~V_{SS}+20	V
V_I	Input voltage		V_{SS}−0.5~V_{DD}+0.5	V
V_{IO}	Input-to-output voltage		±0.5	V
I_I	Input current	Control inputs	±10	mA
I_O	Output current	Switch-off	±10	mA
Topr	Operating temperature range		−40~+85	℃
Tstg	Storage temperature range		−65~+150	℃

RECOMMENDED OPERATING CONDITIONS (T_a=−40~+85℃, V_{SS}=0V, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{DD}	Supply voltage	3		18	V
V_I	Input voltage	0		V_{DD}	V

ELECTRICAL CHARACTERISTICS

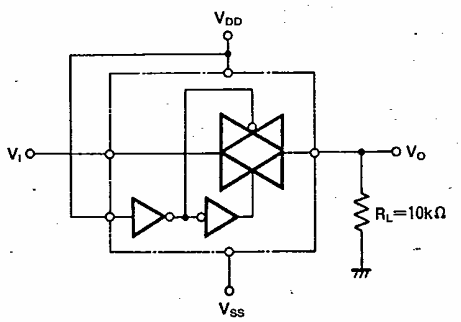
Symbol	Parameter	Test conditions			Limits							Unit
					−40℃		25℃			85℃		
			V_{SS}(V)	V_{DD}(V)	Min	Max	Min	Typ	Max	Min	Max	
V_{IH}	"H" input voltage (C_{IN})	Input-to-output current=10μA	0	5	3.5		3.5			3.5		V
			0	10	7.0		7.0			7.0		
			0	15	11.0		11.0			11.0		
V_{IL}	"L" input current (C_{IN})	Input-to-output current=10μA	0	5		1.5			1.5		1.5	V
			0	10		2.0			2.0		2.0	
			0	15		2.5			2.5		2.5	
R_{ON}	ON resistance	V_I=5V	0	5		500			600		800	Ω
		V_I=2.5V	0	5		850			950		1300	
		V_I=0.25V	0	5		500			600		800	
		V_I=10V	0	10		210			250		300	
		V_I=5V	0	10		210			250		300	
		V_I=0.25V	0	10		210			250		300	
		V_I=15V	0	15		140			160		200	
		V_I=7.5V	0	15		140			160		200	
		V_I=0.25V	0	15		140			160		200	
		V_I=5V	−5	5		210			250		300	
		V_I=±0.25V	−5	5		210			250		300	
		V_I=−5V	−5	5		210			250		300	
		V_I=7.5V	−7.5	7.5		140			160		200	
		V_I=±0.25V	−7.5	7.5		140			160		200	
	Test circuit 1	V_I=−7.5V	−7.5	7.5		140			160		200	
ΔR_{ON}	ON resistance variations between switches of the same package		−2.5	2.5				30				Ω
			−5	5				15				
			−7.5	7.5				10				
I_{OFF}	Input/output off-state leakage current	$V_{I/O}$=10V, $V_{O/I}$=0V	0	10					125			nA
		$V_{I/O}$=0V, $V_{O/I}$=10V	0	10					−125			
		$V_{I/O}$=18V, $V_{O/I}$=0V	0	18		250			250		1000	
		$V_{I/O}$=0V, $V_{O/I}$=18V	0	18		−250			−250		−1000	
I_{DD}	Quiescent supply current	$V_I(C_{IN})$=V_{DD}, V_{SS}	0	5		1			1		7.5	μA
			0	10		2			2		15	
			0	15		4			4		30	
I_{IH}	"H" input current (C_{IN})	V_I=18V	0	18		0.3			0.3		1.0	μA
I_{IL}	"L" input current (C_{IN})	V_{IL}=0V	0	18		−0.3			−0.3		−1.0	μA

SWITCHING CHARACTERISTICS (T_a=25°C)

Symbol	Parameter	Test conditions	V_{SS}(V)	V_{DD}(V)	Limits Min	Limits Typ	Limits Max	Unit
fmax(I/O)	Maximum transfer frequency	R_L=10kΩ C_L=15pF Test circuit 2	−5	5		25		MHz
fmax(C_{IN})	Maximum control frequency	R_L=300Ω C_L=15pF Test circuit 3	0	5		6		MHz
			0	10		18		
			0	15		22		
t_{PLH}	"L-H" and "H-L" output propagation time (IN/OUT-OUT/IN)	R_L=10kΩ C_L=50pF Test circuit 4	0	5			45	ns
			0	10			30	
			0	15			20	
t_{PHL}			0	5			45	ns
			0	10			30	
			0	15			20	
t_{PLH}	"L-H" and "H-L" output propagation time (CONTROL IN-OUT/IN)	R_L=10kΩ C_L=50pF Test circuit 5	0	5			200	ns
			0	10			70	
			0	15			60	
t_{PHL}			0	5			200	ns
			0	10			70	
			0	15			60	
—	Sine-wave distortion	R_L=10kΩ f_i=1kHz Test circuit 2	−5	5		0.07		%
—	Feedthrough (switch off)	R_L=1kΩ Test circuit 6	−5	5		500		kHz
—	Crosstalk (CONTROL IN-OUT/IN)	R_i=1kΩ R_L=10kΩ C_L=15pF Test circuit 7	0	5		200		mV
			0	10		300		
			0	15		400		
C_I	Input capacitance	Control input					7.5	pF
		Switch input/output				10		

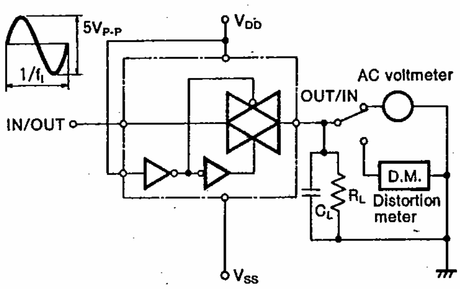
TEST CIRCUITS

1 ON resistance (R_{ON})



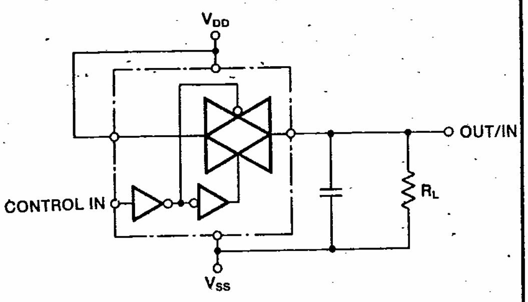
$$R_{ON}=10\times\frac{(V_I-V_O)}{V_O}\ (k\Omega)$$

2 Maximum transfer frequency (fmax(I/O))
Sine-wave distortion

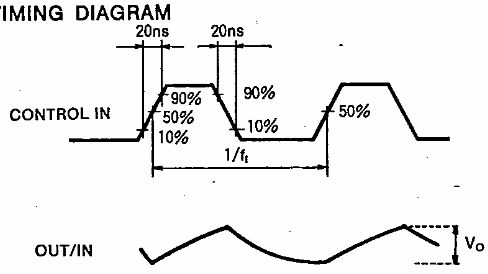


fmax (I/O) is taken as that frequency f_i at which, using a sine-wave input of 2.5V_{P-P}, 20 $\log_{10}(V_O/V_I)$=−3dB.

3 Maximum control frequency (fmax(C_{IN}))

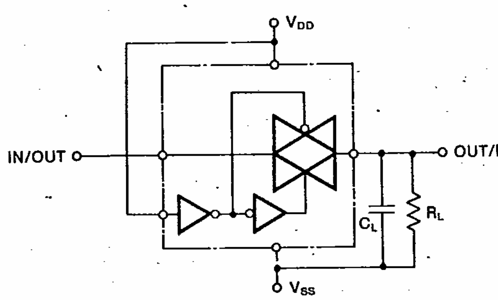


TIMING DIAGRAM

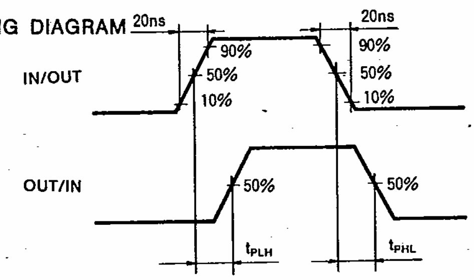


fmax(C_{IN}) is taken as that frequency f_i at which the output amplitude (V_O) is 1/2 that at 1kHz.

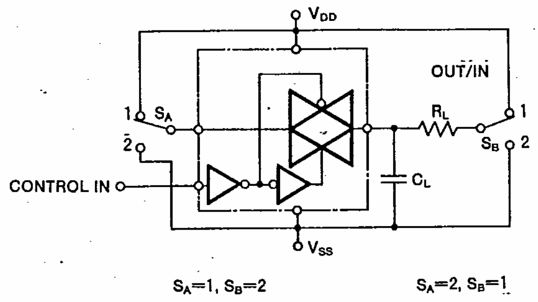
4 "L-H" and "H-L" output propagation time (IN/OUT-OUT/IN)



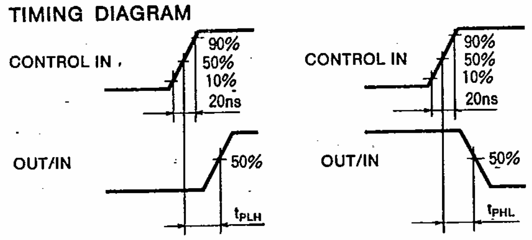
TIMING DIAGRAM



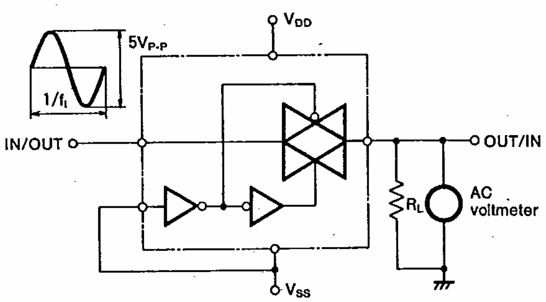
5 "L-H" and "H-L" output propagation time (CONTROL IN-OUT/IN)



TIMING DIAGRAM



6 Feedthrough



The feedthrough is taken as that frequency f_i at which, using a sine-wave input of 2.5V_{P-P}, 20 $\log_{10}(V_O/V_I)$=−50dB.

7 Crosstalk