M4066BP

QUADRUPLE BILATERAL SWITCH

DESCRIPTION

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

FEATURES

- Low ON resistance: 50Ω (typical, at V_{DD} = 15V)
- High off-state resistance:
  $10^9\Omega$ or greater (typical)
- Small variations in ON resistance between switches in the same package:
  10Ω (typical, at V_{DD} = 15V)
- Wide operating voltage range: V_{DD} = 3 ~ 18V
- Wide operating temperature range:
  T_a = −40 ~ +85°C

APPLICATIONS

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

FUNCTIONAL DESCRIPTION

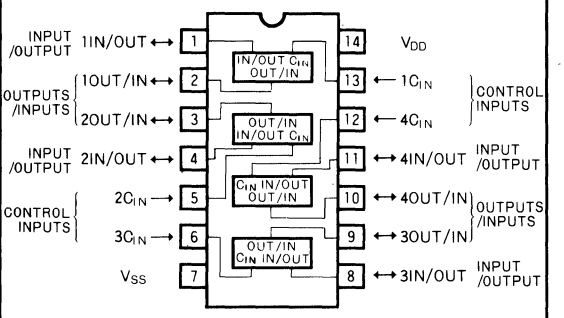
The control input (C_{IN}) can be used to change the input-to-output impedance (IN/OUT – OUT/IN) of the switches.

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.

FUNCTION TABLE

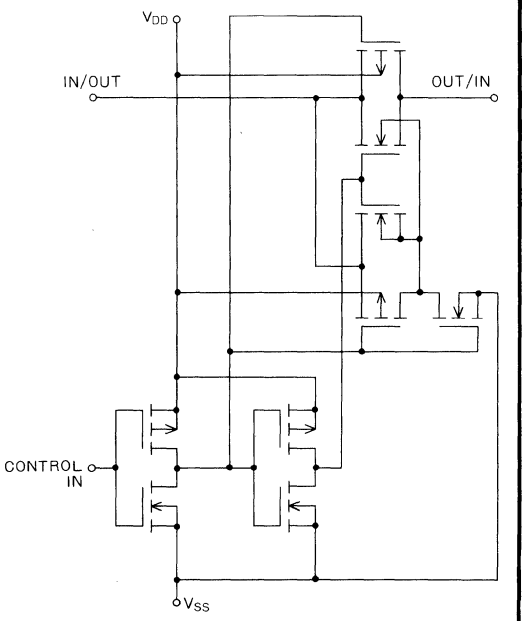
Input C_{IN}	INPUT/OUTPUT and OUTPUT/INPUT resistance (V_{DD} = 10V, 15V)
H	0.5~ 3 ×10² Ω
L	> 10^9 Ω typical

PIN CONFIGURATION (TOP VIEW)

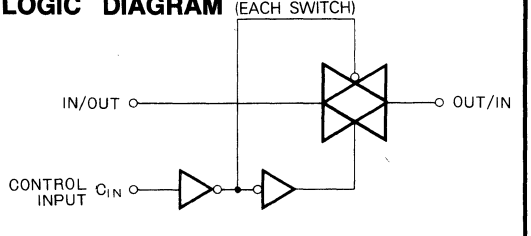


Outline 14P4

CIRCUIT SCHEMATIC (EACH SWITCH)



LOGIC DIAGRAM (EACH SWITCH)



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

Symbol	Parameter	Conditions	Limits	Unit
V_{DD}	Supply voltage		$V_{SS}-0.5 \sim V_{SS}+20$	V
V_I	Input voltage		$V_{SS}-0.5 \sim V_{DD}+0.5$	V
$V_{I/O}$	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°C, 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

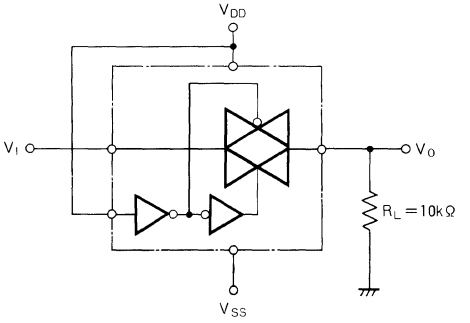
Symbol	Parameter	Test conditions	V_{SS}(V)	V_{DD}(V)	Limits −40℃ Min	Limits −40℃ Max	Limits 25℃ Min	Limits 25℃ Typ	Limits 25℃ Max	Limits 85℃ Min	Limits 85℃ Max	Unit
V_{IH}	High-level input voltage (C_{IN})	Input-to-output current = 10μA	0	5	3.5		3.5			3.5		V
			0	10	7.0		7.0			7.0		
			0	15	11.0		11.0			11.0		
V_{IL}	Low-level input voltage (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 = 5 V	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 = 5 V	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 = 5 V	−5	5		210			250		300	
		V_I = ±0.25V	−5	5		210			250		300	
		V_I = − 5 V	−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 resistanse variations between switches of the same package		−2.5	2.5				30				
			−5	5				15				
			−7.5	7.5				10				
I_{OFF}	Input-to-output off-state leakage current	$V_{I/O}$=10V, $V_{O/I}$=0 V	0	10					125			nA
		$V_{I/O}$=0 V, $V_{O/I}$=10V	0	10					−125			
		$V_{I/O}$=18V, $V_{O/I}$=0 V	0	18		250			250		1000	
		$V_{I/O}$=0 V, $V_{O/I}$=18V	0	18		−250			−250		−1000	
I_{DD}	Quiescent supply current	$V_{I(CIN)}$ = V_{DD}, V_{SS}	0	5		1			1		7.5	μA
			0	10		2			2		15	
			0	15		4			4		30	
I_{IH}	High-level input current (C_{IN})	V_{IH}=18V	0	18		0.3			0.3		1.0	μA
I_{IL}	Low-level input current (C_{IN})	V_{IL} = 0 V	0	18		−0.3			−0.3		−1.0	

SWITCHING CHARACTERISTICS (T_a=25℃)

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

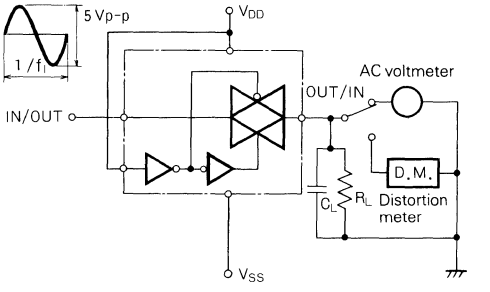
TEST CIRCUITS

1 ON resistance (R_{ON})



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

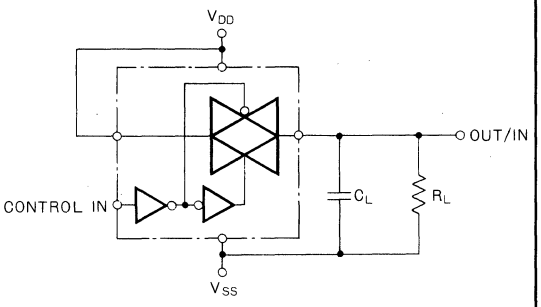
2 Maximum transfer frequency (fmax (I/O))
Sinewave distortion



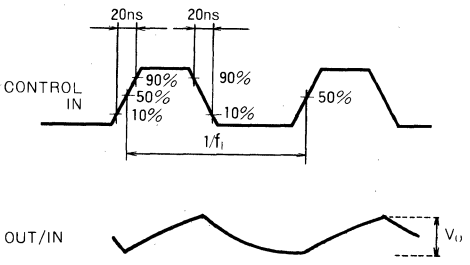
fmax (I/O) is taken as that frequency f_i at which, using a sinewave input of ±2.5Vp-p, 20 $\log_{10}(V_O/V_I)$ = −3dB.

3

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



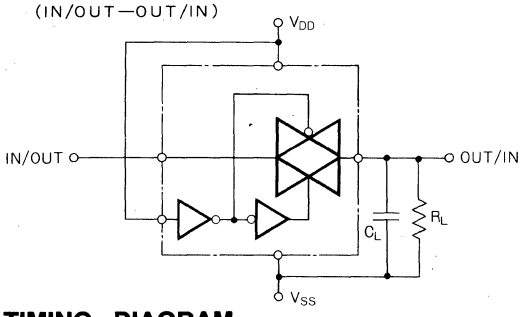
TIMING DIAGRAM



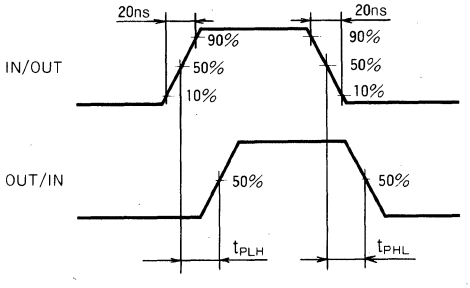
fmax (C_{IN}) is taken as that frequency f_i at which the output amplitude V_O is 1/2 that at 1kHz.

4

Low-level to high-level and high-level to low-level output propagation time
(IN/OUT—OUT/IN)

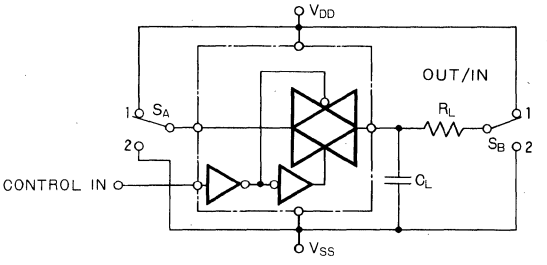


TIMING DIAGRAM



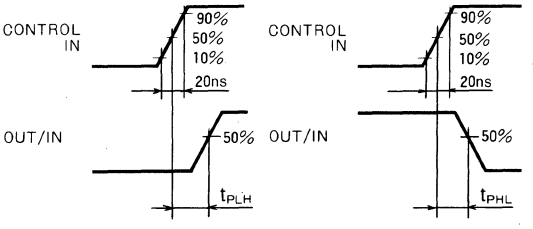
5

Low-level to high-level and high-level to low-level output propagation time
(CONTROL IN—OUT/IN)



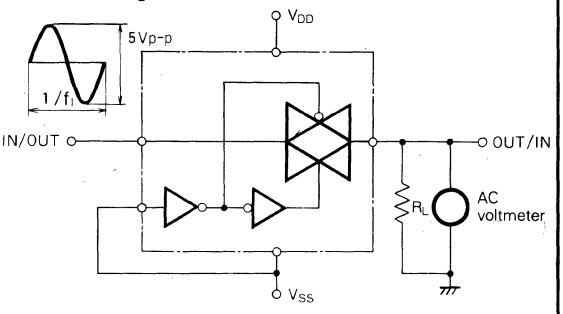
$S_A = 1$, $S_B = 2$ $S_A = 2$, $S_B = 1$

TIMING DIAGRAM



6

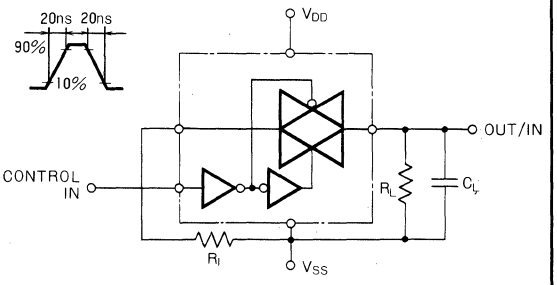
Feedthrough



The feedthrough is taken as that frequency f_i at which, using a sinewave input of ±2.5Vp-p, $20 \log_{10} (V_O/V_I) = -50$dB.

7

Crosstalk



TYPICAL PERFORMANCE CHARACTERISTICS

Analog switch "ON" resistance characteristics

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