

# HD14052B, HD14053B

## Analog Multiplexers/Demultiplexers

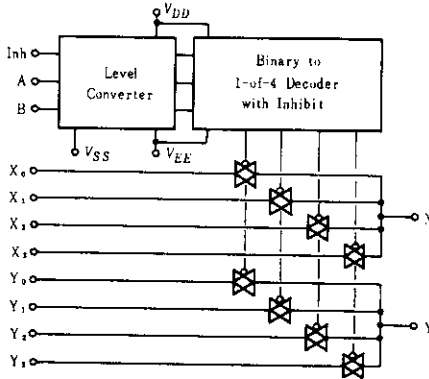
The HD14052B and HD14053B analog multiplexers are digitally controlled analog switches. The HD14052B effectively implement a 2P4T, and the HD14053B a triple SPDT. These devices feature low ON impedance and very low OFF leakage current. Control of analog signals up to the complete supply voltage range can be achieved.

### FEATURES

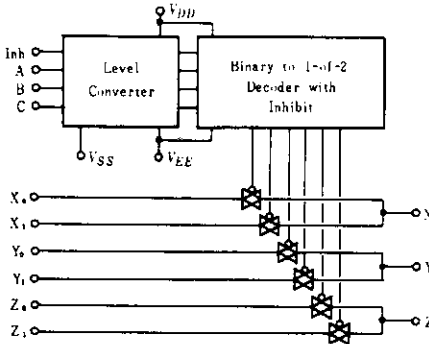
- High On/Off Output Voltage Ratio = 65dB typ.
- Quiescent Current = 5nA/pkg typ. @5V
- Low Crosstalk Between Switches = 80dB typ.
- Supply Voltage Range = 3 to 18V
- Linearized Transfer Characteristics,  $\Delta R_{on} < 60\Omega$  for  $V_{in} = V_{DD}$  to  $V_{EE}$  @15V
- Pin-for-Pin Replacement for CD4052/53 and MC14052B/53B

### BLOCK DIAGRAM

#### HD14052B



#### HD14053B

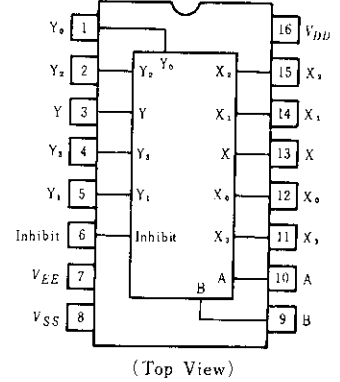


### MAXIMUM RATINGS (Voltages referenced to $V_{SS}$ )

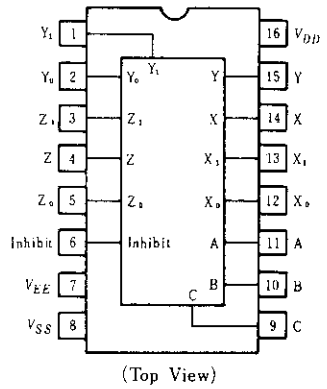
Characteristic	Symbol	Value	Unit
DC Supply Voltage	$V_{DD} - V_{EE}$	-0.5 ~ +18	V <sub>DC</sub>
Control Input Voltage	$V_{in}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V <sub>DC</sub>
Signal Voltage	$V_{sig}$	$V_{EE} - 0.5 \sim V_{DD} + 0.5$	V <sub>P-P</sub>
Control Input Current	$I_{in}$	±10	mA
Signal Current	$I_{sig}$	25	mA
Operating Temperature Range	$T_a$	-40 ~ +85	°C
Storage Temperature Range	$T_{stg}$	-65 ~ +150	°C
Power Dissipation	$P_D$	300	mW

### PIN ARRANGEMENT

#### HD14052B



#### HD14053B

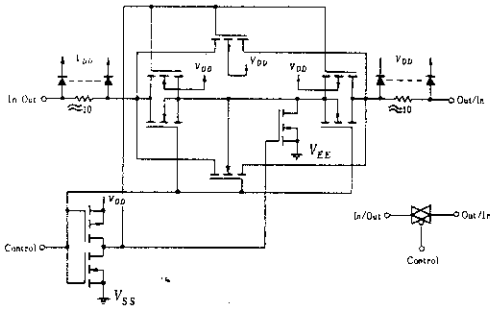


### TRUTH TABLE

Control Inputs				ON Switch		
Inhibit	Select					
	C*	B	A	HD14052B	HD14053B	
0	0	0	0	Y <sub>0</sub> X <sub>0</sub>	Z <sub>0</sub> Y <sub>0</sub>	X <sub>0</sub>
0	0	0	1	Y <sub>1</sub> X <sub>1</sub>	Z <sub>0</sub> Y <sub>0</sub>	X <sub>1</sub>
0	0	1	0	Y <sub>2</sub> X <sub>2</sub>	Z <sub>0</sub> Y <sub>1</sub>	X <sub>0</sub>
0	0	1	1	Y <sub>3</sub> X <sub>3</sub>	Z <sub>0</sub> Y <sub>1</sub>	X <sub>1</sub>
0	1	0	0		Z <sub>1</sub> Y <sub>0</sub>	X <sub>0</sub>
0	1	0	1		Z <sub>1</sub> Y <sub>0</sub>	X <sub>1</sub>
0	1	1	0		Z <sub>1</sub> Y <sub>1</sub>	X <sub>0</sub>
0	1	1	1		Z <sub>1</sub> Y <sub>1</sub>	X <sub>1</sub>
1	x	x	x	—	—	

\*Not applicable for HD14053B  
x = Don't Care

■ SWITCH CIRCUIT SCHEMATIC



■ ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V <sub>DD</sub> (V)	Test Conditions	-40°C		25°C			85°C		Unit	
				min	max	min	typ	max	min	max		
Input Voltage	V <sub>IL</sub>	5.0	R <sub>L</sub> =10 kΩ, V <sub>O</sub> =0.5V	—	1.5	—	2.25	1.5	—	1.5	V	
		10	SW入力 = V <sub>DD</sub> , V <sub>O</sub> =1.0V	—	3.0	—	4.50	3.0	—	3.0		
		15	V <sub>EE</sub> =V <sub>SS</sub> , V <sub>O</sub> =1.5V	—	4.0	—	6.75	4.0	—	4.0		
	V <sub>IH</sub>	5.0	R <sub>L</sub> =10 kΩ, V <sub>O</sub> =4.0V	3.5	—	3.5	2.75	—	3.5	—	V	
		10	SW入力 = V <sub>DD</sub> , V <sub>O</sub> =9.0V	7.0	—	7.0	5.50	—	7.0	—		
		15	V <sub>EE</sub> =V <sub>SS</sub> , V <sub>O</sub> =13.5V	11.0	—	11.0	8.25	—	11.0	—		
Input Current(Control, Inhibit)	I <sub>in</sub>	15		—	—	—	10	—	—	—	pA	
Input Capacitance	Control, Inhibit	C <sub>in</sub>	V <sub>in</sub> =0	—	—	—	5.0	—	—	—	pF	
	Switch Inputs	C <sub>in</sub>		—	—	—	10	—	—	—	pF	
Output Capacitance	HD14052B	C <sub>out</sub>	10	—	—	—	32	—	—	—	pF	
	HD14053B			—	—	—	17	—	—	—	—	
Feedthrough Capacitance	HD14052B	C <sub>in-out</sub>	10	—	—	—	0.12	—	—	—	pF	
	HD14053B			—	—	—	0.10	—	—	—	—	
Quiescent Current	I <sub>DD</sub>	5.0	Zero Signal, per Package	—	20	—	0.005	20	—	150	μA	
		10		—	40	—	0.010	40	—	300		
		15		—	80	—	0.015	80	—	600		
Total Supply Current*	I <sub>T</sub>	5.0	Dynamic + I <sub>DD</sub> , T <sub>a</sub> =25°C per Gate, f=1kHz	—	—	—	0.075	—	—	—	μA	
		10		—	—	—	0.210	—	—	—		
		15		—	—	—	0.375	—	—	—		
ON Resistance	R <sub>ON</sub>	5.0		—	880	—	250	1050	—	1200	Ω	
		10		—	450	—	120	500	—	520		
		15		—	250	—	80	280	—	300		
ΔON Resistance Between Any Two Channels	ΔR <sub>ON</sub>	5.0	Two Channels	—	—	—	25	—	—	—	Ω	
		10		—	—	—	10	—	—	—		
		15		—	—	—	5.0	—	—	—		
OFF Channel Leakage Current	Each Channel		15		—	1000	—	±0.01	1000	—	3000	nA
	All Channels OFF	HD14052B			—	1000	—	±0.04	1000	—	3000	
		HD14053B			—	1000	—	±0.02	1000	—	3000	

\* To calculate total supply current at frequency other than 1kHz.

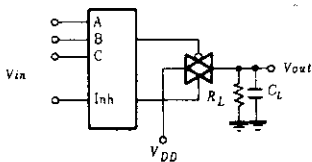
@V<sub>DD</sub>=5.0V, I<sub>T</sub>=(0.075μA/kHz)f+I<sub>DD</sub>, @V<sub>DD</sub>=10V, I<sub>T</sub>=(0.210μA/kHz)f+I<sub>DD</sub>, @V<sub>DD</sub>=15V, I<sub>T</sub>=(0.375μA/kHz)f+I<sub>DD</sub>

■ SWITCHING CHARACTERISTICS ( $C_L=50\text{pF}$ ,  $T_a=25^\circ\text{C}$ )

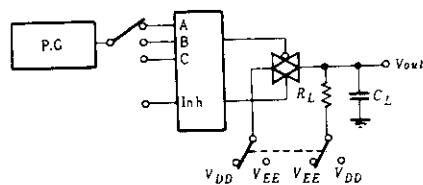
Characteristic		Symbol	$V_{DD}-V_{SS}$ (V)	Test Conditions	typ	max	Unit
Propagation Delay Time	Switch Input to Switch Output		5.0	$R_L=10\text{k}\Omega$	30	75	ns
			10		12	30	
			15		10	25	
			5.0		25	65	
			10		8.0	20	
			15		6.0	15	
	Control Input to Output		5.0		1400	2000	
			10		450	700	
			15		260	500	
			5.0		1400	2000	
			10		450	700	
			15		260	500	
Output Enable Time	HD14052B	$t_{ZH}$	5.0	950	2375	ns	
		$t_{ZL}$	10	325	800		
			15	230	575		
	HD14053B	$t_{HZ}$	5.0	1000	2500		
		$t_{LZ}$	10	350	875		
			15	215	540		
Sine Wave(Distortion)			10	$R_L=1\text{k}\Omega$ , $f=1\text{kHz}$	0.04	—	%
Bandwidth	HD14052B	BW	10	$R_L=1\text{k}\Omega$ , $V_{in}=1/2(V_{DD}-V_{SS})$ P-P, $20\log_{10}\frac{V_{out}}{V_{in}}=-3\text{dB}$	30	—	MHz
	HD14053B				55	—	
Feedthrough	HD14052B		10	$R_L=1\text{k}\Omega$ , $20\log_{10}\frac{V_{out}}{V_{in}}=-50\text{dB}$	3.5	—	MHz
	HD14053B				3.0	—	
Channel Separation			10	$R_L=1\text{k}\Omega$ , $V_{in}=1/2(V_{DD}-V_{SS})$ P-P, $20\log_{10}\frac{V_{out(B)}}{V_{in(A)}}=-50\text{dB}$	3.0	—	MHz
Feedthrough Control			10	$R_1=1\text{k}\Omega$ , $R_L=10\text{k}\Omega$ , Control, Inhibit $t_r=t_f=20\text{ns}$	30	—	mV
Maximum Control Frequency			10	$R_L=1\text{k}\Omega$ , $V_{out}=1/2V_{in}$	10	—	MHz

■ DC CHARACTERISTIC TEST CIRCUIT

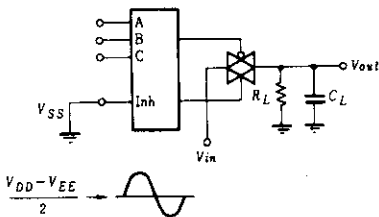
1. Input Voltage



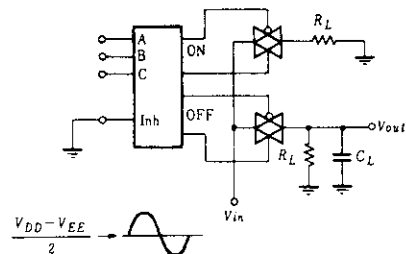
2. Propagation Delay Time



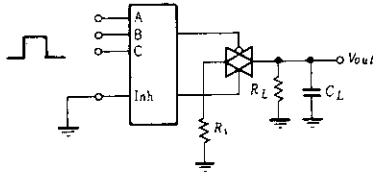
3. Bandwidth, Feedthrough



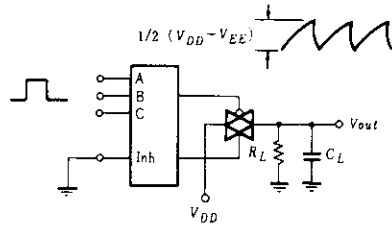
4. Crosstalk



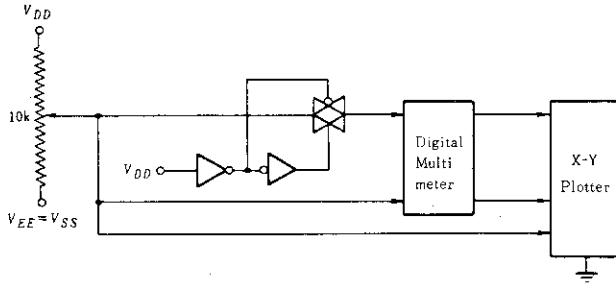
5. Feedthrough



6. Maximum Control Frequency



7. RON





Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

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