

HD14052B, HD14053B

Analog Multiplexers/Demultiplexers

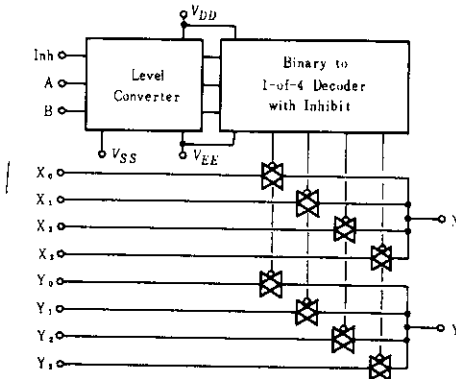
The HD14052B and HD14053B analog multiplexers are digitally controlled analog switches. The HD14052B effectively implement a 2P4T, and the HD14053B a triple SPDT. These devices feature low ON impedance and very low OFF leakage current. Control of analog signals up to the complete supply voltage range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

FEATURES

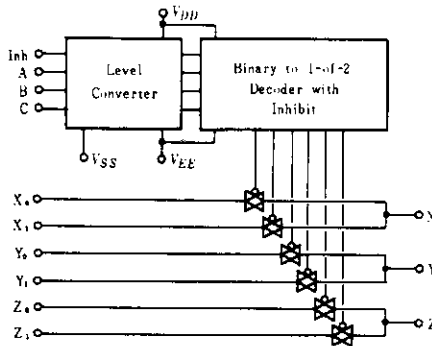
- High On/Off Output Voltage Ratio = 65dB typ.
- Quiescent Current = 5nA/pkg typ. @5V
- Low Crosstalk Between Switches = 80dB typ.
- Supply Voltage Range = 3 to 18V
- Linearized Transfer Characteristics, $\Delta R_{on} < 60\Omega$ for $V_{in} = V_{DD}$ to V_{EE} @15V
- Pin-for-Pin Replacement for CD4052/53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

BLOCK DIAGRAM

HD14052B



HD14053B

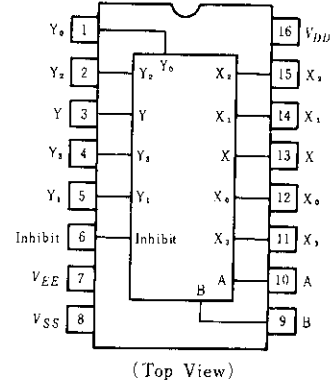


MAXIMUM RATINGS (Voltages referenced to V_{SS})

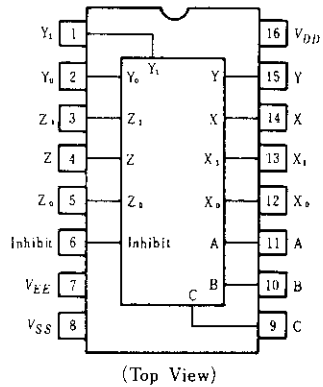
Characteristic	Symbol	Value	Unit
DC Supply Voltage	$V_{DD} - V_{EE}$	-0.5 ~ +18	V _{DC}
Control Input Voltage	V_{iA}	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V _{DC}
Signal Voltage	V_{siA}	$V_{EE} - 0.5 \sim V_{DD} + 0.5$	V _{P-P}
Control Input Current	I_{iA}	±10	mA
Signal Current	I_{siA}	25	mA
Operating Temperature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

PIN ARRANGEMENT

HD14052B



HD14053B

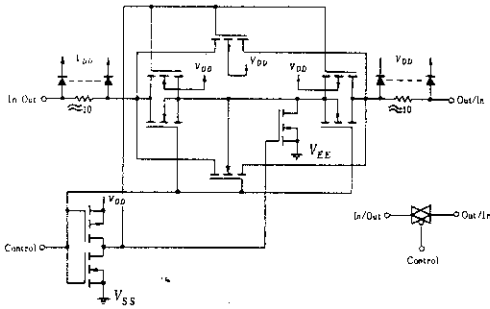


TRUTH TABLE

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

* Not applicable for HD14053B
x = Don't Care

SWITCH CIRCUIT SCHEMATIC



ELECTRICAL CHARACTERISTICS

Characteristic		Symbol	V _{DD} (V)	Test Conditions		-40℃		25℃			85℃		Unit
						min	max	min	typ	max	min	max	
Input Voltage		V _{IL}	5.0	R _L =10 kΩ	V _O =0.5V	—	1.5	—	2.25	1.5	—	1.5	V
			10	SW入力=V _{DD}	V _O =1.0V	—	3.0	—	4.50	3.0	—	3.0	
			15	V _{EE} =V _{SS}	V _O =1.5V	—	4.0	—	6.75	4.0	—	4.0	
		V _{IH}	5.0	R _L =10 kΩ	V _O =4.0V	3.5	—	3.5	2.75	—	3.5	—	V
			10	SW入力=V _{DD}	V _O =9.0V	7.0	—	7.0	5.50	—	7.0	—	
			15	V _{EE} =V _{SS}	V _O =13.5V	11.0	—	11.0	8.25	—	11.0	—	
Input Current(Control,Inhibit)		I _{in}	15			—	—	—	10	—	—	—	pA
Input Capacitance	Control,Inhibit	C _{in}		V _{in} =0	—	—	—	5.0	—	—	—	pF	
	Switch Inputs				—	—	—	10	—	—	—		
Output Capacitance	HD14052B	C _{out}	10		—	—	—	32	—	—	—	pF	
	HD14053B				—	—	—	17	—	—	—		
Feedthrough Capacitance	HD14052B	C _{in-out}	10		—	—	—	0.12	—	—	—	pF	
	HD14053B				—	—	—	0.10	—	—	—		
Quiescent Current		I _{DD}	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 _T	5.0	Dynamic+I _{DD} , Ta=25℃ per Gate f=1kHz	—	—	—	0.075	—	—	—	μA	
			10		—	—	—	0.210	—	—	—		
			15		—	—	—	0.375	—	—	—		
ON Resistance		R _{ON}	5.0		—	880	—	250	1050	—	1200	Ω	
			10		—	450	—	120	500	—	520		
			15		—	250	—	80	280	—	300		
ΔON Resistance Between Any Two Channels		ΔR _{ON}	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		

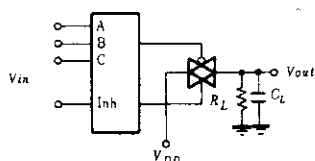
* To calculate total supply current at frequency other than 1kHz.
③ V_{DD}=5.0V I_T=(0.075μA/kHz)f+I_{DD}, @V_{DD}=10V, I_T=(0.210μA/kHz)f+I_{DD}, @V_{DD}=15V, I_T=(0.375μA/kHz)f+I_{DD}

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

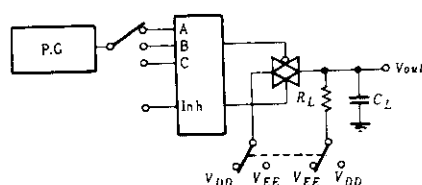
Characteristic			Symbol	$V_{DD}-V_{SS}$ (V)	Test Conditions	typ	max	Unit
Propagation Delay Time	Switch Input to Switch Output	HD14052B	t_{PLH} , t_{PHL}	5.0	$R_L=10\text{k}\Omega$	30	75	ns
				10		12	30	
				15		10	25	
		HD14053B		5.0		25	65	
				10		8.0	20	
				15		6.0	15	
	Control Input to Output	HD14052B		5.0		1400	2000	
				10		450	700	
				15		260	500	
		HD14053B		5.0		1400	2000	
				10		450	700	
				15		260	500	
Output Enable Time Output Disable Time	HD14052B	t_{ZH}	5.0	$R_L=10\text{k}\Omega$	950	2375	ns	
		t_{ZL}	10		325	800		
		t_{HZ}	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, $20\log_{10}\frac{V_{out(B)}}{V_{out(A)}}=-50\text{dB}$	3.0	—	MHz
Feedthrough Control				10	$R_L=1\text{ k}\Omega$, $R_L=10\text{k}\Omega$, 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

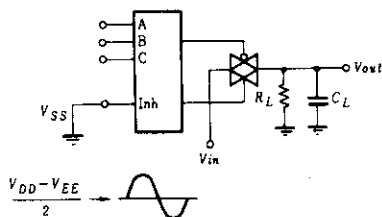
1. Input Voltage



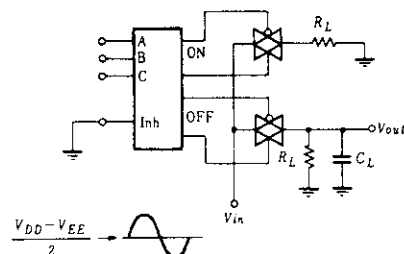
2. Propagation Delay Time



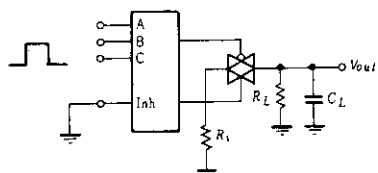
3. Bandwidth, Feedthrough



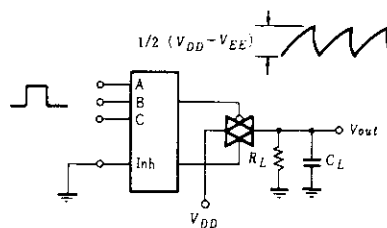
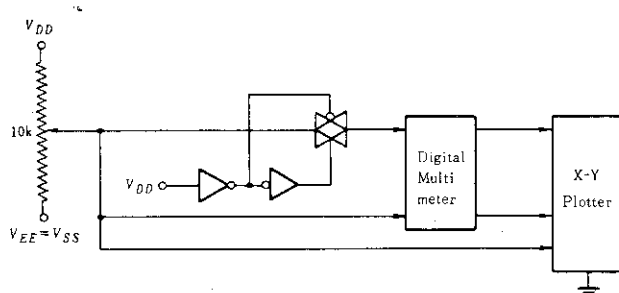
4. Crosstalk

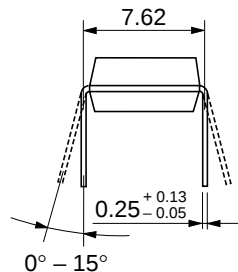
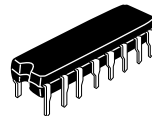
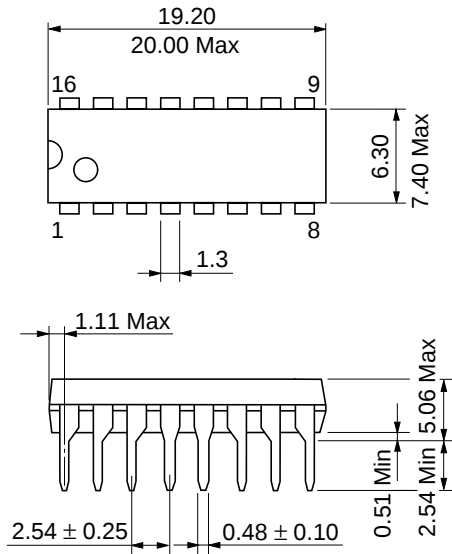


5. Feedthrough

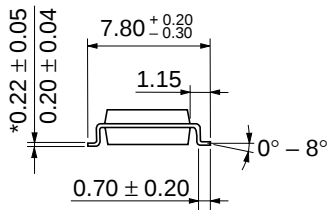
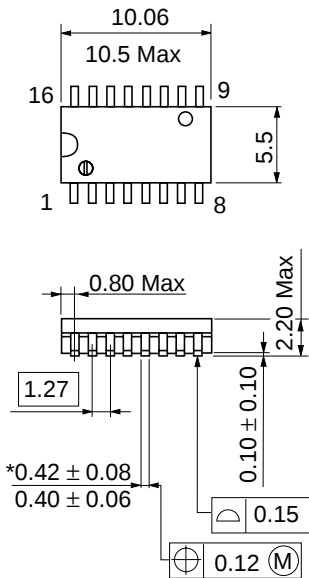


6. Maximum Control Frequency

7. R_{ON} 

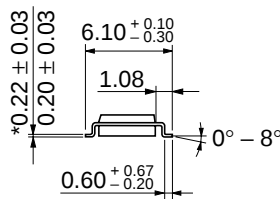
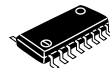
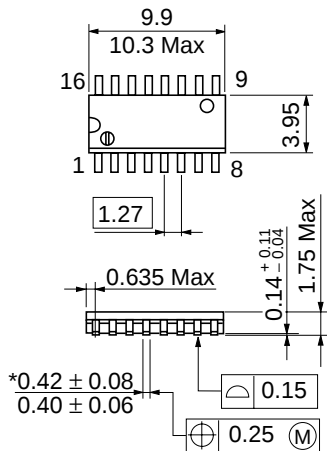


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



*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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