

HD14052B, HD14053B

Analog Multiplexers/Demultiplexers

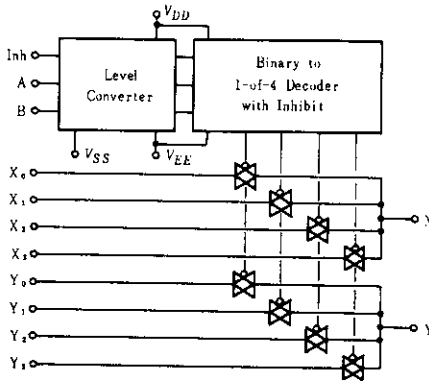
The HD14052B and HD14053B analog multiplexers are digitally controlled analog switches. The HD14052B effectively implement a 2P4T, and the HD14053B a triple SPDT. These devices feature low ON impedance and very low OFF leakage current. Control of analog signals up to the complete supply voltage range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

FEATURES

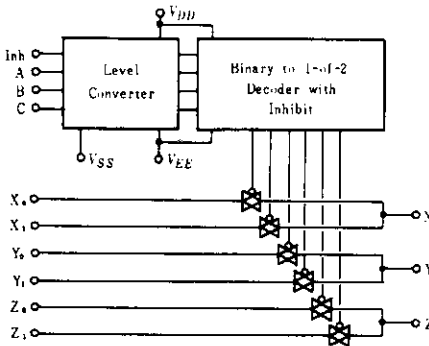
- High On/Off Output Voltage Ratio = 65dB typ.
- Quiescent Current = 5nA/pkg typ. @5V
- Low Crosstalk Between Switches = 80dB typ.
- Supply Voltage Range = 3 to 18V
- Linearized Transfer Characteristics, $\Delta R_{on} < 60\Omega$ for $V_{in} = V_{DD}$ to V_{EE} @15V
- Pin-for-Pin Replacement for CD4052/53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

BLOCK DIAGRAM

HD14052B



HD14053B

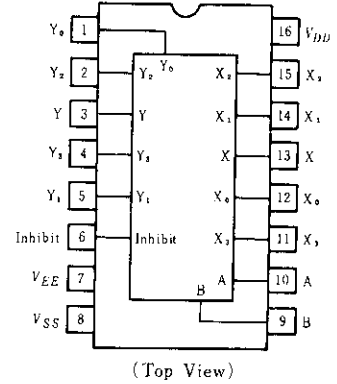


MAXIMUM RATINGS (Voltages referenced to V_{SS})

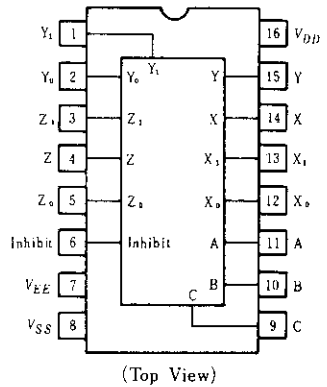
Characteristic	Symbol	Value	Unit
DC Supply Voltage	$V_{DD} - V_{EE}$	-0.5 ~ +18	V _{DC}
Control Input Voltage	V_{iA}	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V _{DC}
Signal Voltage	V_{s1B}	$V_{EE} - 0.5 \sim V_{DD} + 0.5$	V _{P-P}
Control Input Current	I_{iA}	±10	mA
Signal Current	I_{s1B}	25	mA
Operating Temperature Range	T_A	-40 ~ +85	°C
Storage Temperature Range	T_{stg}	-65 ~ +150	°C
Power Dissipation	P_D	300	mW

PIN ARRANGEMENT

HD14052B



HD14053B

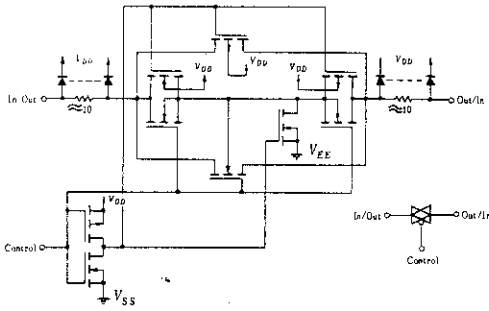


TRUTH TABLE

Control Inputs				ON Switch		
Inhibit	Select					
	C*	B	A	HD14052B	HD14053B	
0	0	0	0	Y 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°C		25°C			85°C		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	C _{in}		—	—	—	10	—	—	pF		
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} , T _a =25°C 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.

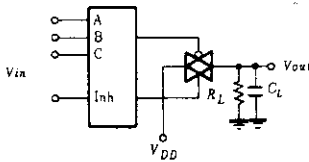
@V_{DD}=5.0V, I_T=(0.075μA/kHz)f+I_{DD}, @V_{DD}=10V, I_T=(0.210μA/kHz)f+I_{DD}, @V_{DD}=15V, I_T=(0.375μA/kHz)f+I_{DD}

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

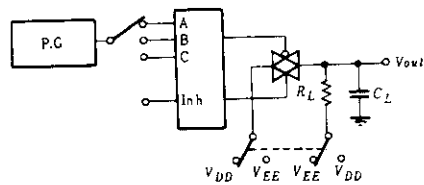
Characteristic		Symbol	$V_{DD}-V_{SS}$ (V)	Test Conditions	typ	max	Unit
Propagation Delay Time	Switch Input to Switch Output		5.0	$R_L=10\text{k}\Omega$	30	75	ns
			10		12	30	
			15		10	25	
			5.0		25	65	
			10		8.0	20	
			15		6.0	15	
	Control Input to Output		5.0		1400	2000	
			10		450	700	
			15		260	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

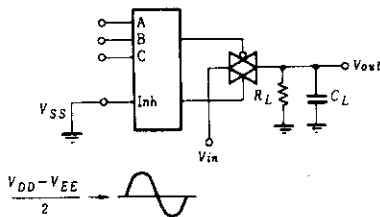
1. Input Voltage



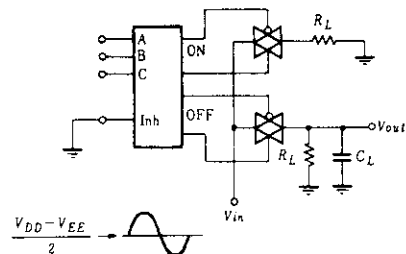
2. Propagation Delay Time



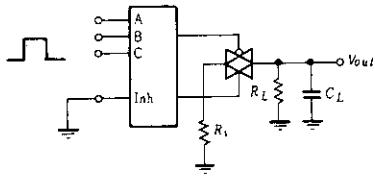
3. Bandwidth, Feedthrough



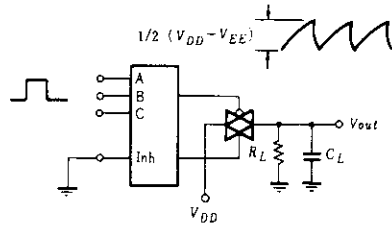
4. Crosstalk



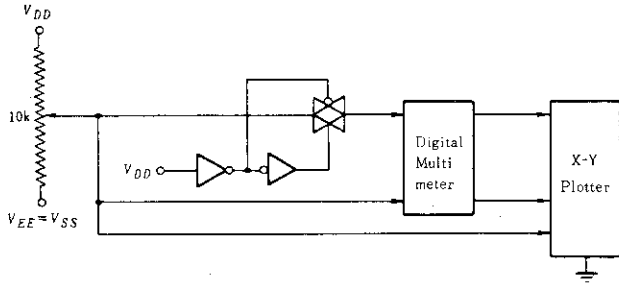
5. Feedthrough

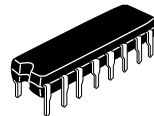
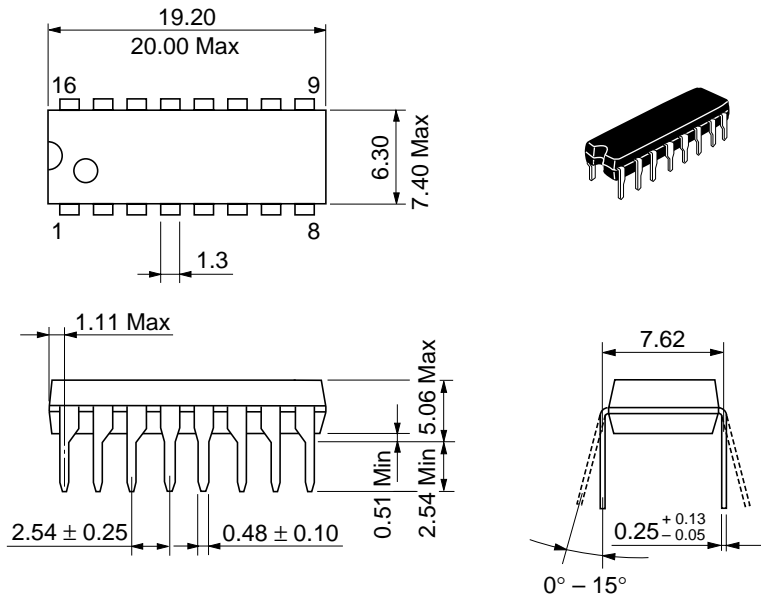


6. Maximum Control Frequency

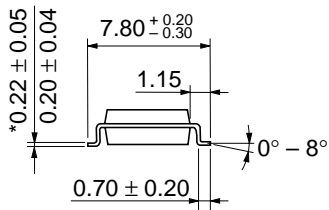
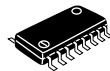
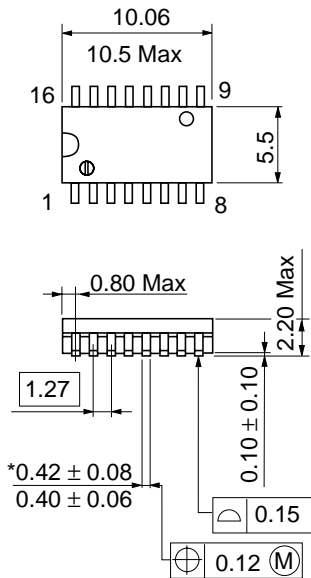


7. RON



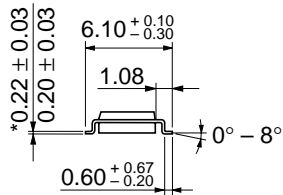
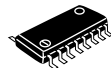
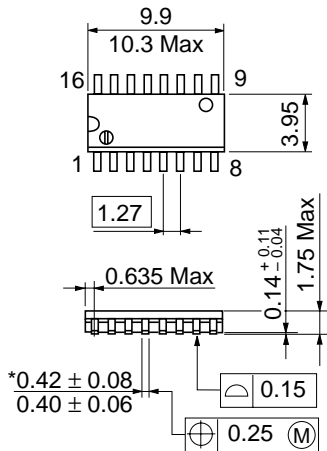


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



*Dimension including the plating thickness
Base material dimension

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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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