

Features

- Various levels of digital and analog signals:
- Number: 3V to 20V;- Simulation: $\leq 20V_P-P$
- 15VP-P signal input range at VDD-VEE=18V Internally, with a low on resistance of 125 ohms(typ)
- At VDD-VEE=18V and channel leakage current of $\pm 10pA$ (typ)When, it has a high turn off resistance
- Binary address on-chip decoding
- Rated values of 5V, 10V, and 15V parameters
- 100% testing was conducted for static current at 20V
- The maximum input current within the entire packaging temperature range is 1 μA at 18V and 100nA at 18V and 25°C
- Small Packaging: SOP-16

Applications

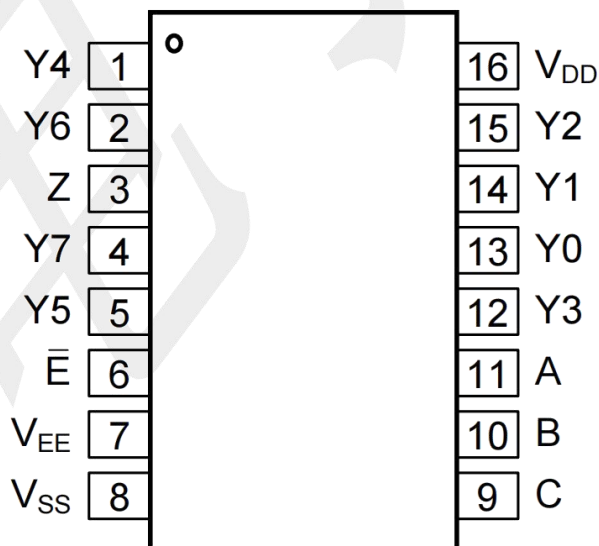
- Sensors
- Programmable logic circuits
- Consumer audio
- Electrical appliances
- Television
- Factory automation
- Signal gating
- Analog to digital and digital to analog conversion

General Description

This is an analog multiplexer and a multi-channel signal separator, both of which are digital controllers A simulated switch with low on impedance and extremely low off leakage current.

These multiplexer circuits operate throughout the entire VDD-VSS and VDD-VEE Within the voltage range of the power supply, the static power consumption is extremely low and not affected by control signals The logical status of the number is affected.

PIN CONFIGURATIONS



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION	PIN NO.	PIN NAME	DESCRIPTION
1	Y4	Channel 4 in/out	9	C	Channel select C.
2	Y6	Channel 6 in/out	10	B	Channel select B.
3	Z	Common out/in	11	A	Channel select A.
4	Y7	Channel 7 in/out	12	Y3	Channel 3 in/out
5	Y5	Channel 5 in/out	13	Y0	Channel 0 in/out
6	$\bar{E}$	Disables all channels	14	Y1	Channel 1 in/out
7	VEE	Negative power input	15	Y2	Channel 2 in/out
8	VSS	Ground	16	VDD	Positive power input



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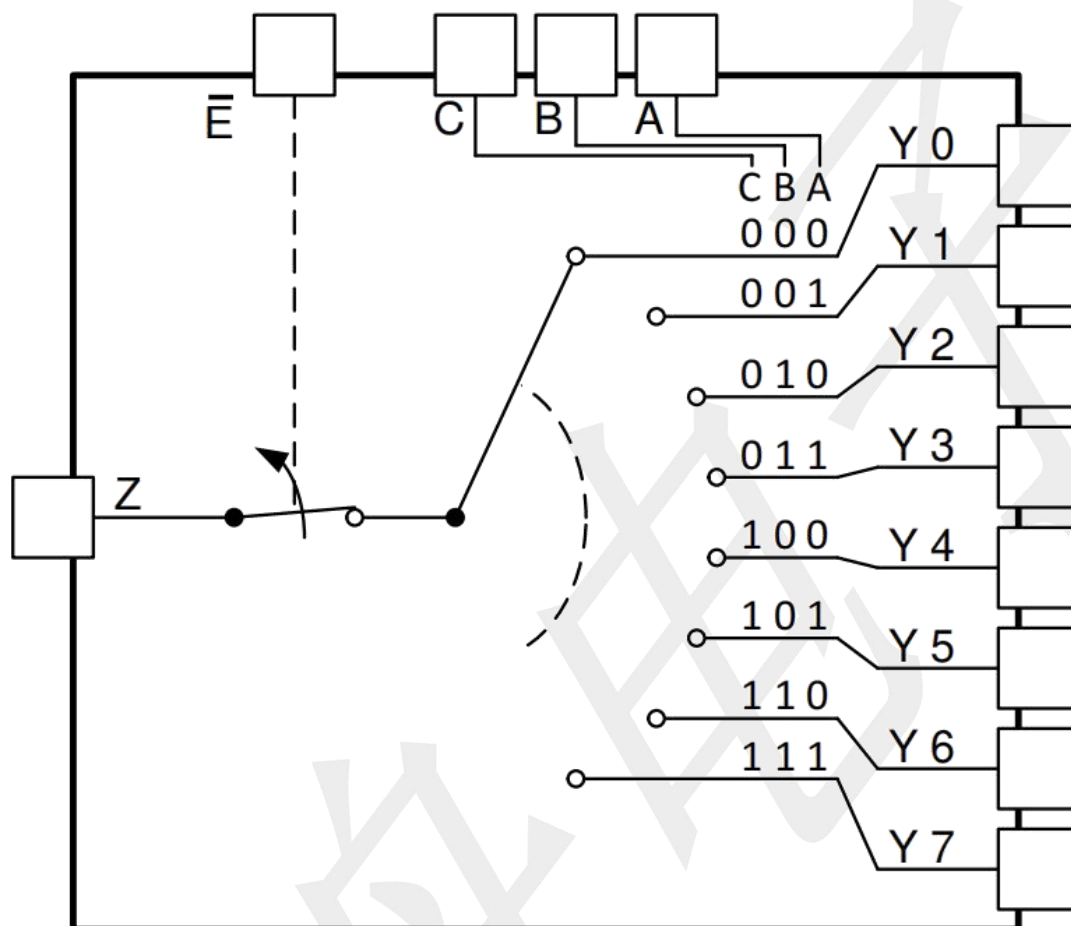
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CD4051BM96-TP

CMOS single channel with logic level conversion function
8-channel analog multiplexer or multi-channel signal separator

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BLOCK DIAGRAM



Function Table

INPUT STATES				ON CHANNEL(Y)
$\bar{E}$	C	B	A	
0	0	0	0	Y0 TO Z
0	0	0	1	Y1 TO Z
0	0	1	0	Y2 TO Z
0	0	1	1	Y3 TO Z
0	1	0	0	Y4 TO Z
0	1	0	1	Y5 TO Z
0	1	1	0	Y6 TO Z
0	1	1	1	Y7 TO Z
1	X	X	X	None

X = Do not care

Absolute Maximum Ratings

(Unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
V+ to V-, Voltages Referenced to Vss Terminal	Supply Voltage VDD	-0.5 ~ +20	V
DC Input Voltage	DC VIN	-0.3 ~ VDD+0.5	V
DC Input Current (Any One Input)	DC IIN	±10	mA
Storage Temperature Range	TSTG	-55 ~ +150	°C
Operating Junction Temperature	TJ	150	°C
Lead Temperature (Soldering, 10 seconds)	TL	260	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied. All voltages are with respect to ground, unless otherwise specified.

Recommend operating ratings

(Unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Operating Temperature	TA	-55 ~ +125	°C
Junction to Ambient	RθJA	116.5	°C/W

ESD Ratings

			VALUE	UNIT
V(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001, all pins (1)	±3000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins (2)	±2000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

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CD4051BM96-TPCMOS single channel with logic level conversion function
8-channel analog multiplexer or multi-channel signal separatorWWW.TECHPUBLIC.COM

Electrical Characteristics

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5 \text{ V}$, and $R_L = 100 \Omega$, (unless otherwise noted) ⁽¹⁾

PARAMETER	TEST CONDITIONS					MIN	TYP	MAX	UNIT
SIGNAL INPUTS (V _{IS}) AND OUTPUTS (V _{OS})									
	V _{IS} (V)	V _{EE} (V)	V _{SS} (V)	V _{DD} (V)	TEMP				
Quiescent Device Current, I _{DD} Max	0 V	0 V	0 V	5 V	- 55°C			60	μA
					- 40°C			60	
					25°C	17	60		
					85°			150	
					125°C			150	
		0 V	0 V	10 V	- 55°C			60	
					- 40°C			60	
					25°C	18	60		
					85°C			300	
					125°C			300	
	0 V	0 V	15 V	- 55°C			60		
				- 40°C			60		
				25°C	18	60			
				85°C			600		
				125°C			600		
	0 V	0 V	20 V	- 55°C			100		
				- 40°C			100		
				25°C	18	100			
				85°C			3000		
				125°C			3000		
Drain to Source ON Resistance r _{ON} Max0 ≤ V _{IS} ≤ V _{DD}	0 V	0 V	5 V	- 55°C			800	Ω	
				- 40°C			850		
				25°C	470	1050			
				85°C			1200		
				125°C			1300		
	0 V	0 V	10 V	- 55°C			310		
				- 40°C			300		
				25°C	180	400			
				85°			520		
				125°C			550		

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8-channel analog multiplexer or multi-channel signal separator****WWW.TECHPUBLIC.COM**

Electrical Characteristics

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5 \text{ V}$, and $R_L = 100 \Omega$, (unless otherwise noted) ⁽¹⁾

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
SIGNAL INPUTS (V _{IS}) AND OUTPUTS (V _{OS})									
Drain to Source ON Resistance r _{ON} Max0 ≤ V _{IS} ≤ V _{DD}			0 V	0	15 V	- 55°C	200		Ω
						- 40°C	210		
						25°C	125	240	
						85°C	300		
						125°C	300		
Change in ON Resistance(Between Any Two Channels), Δ R _{ON}			0 V	0 V	5 V	25°C	15		Ω
			0 V	0 V	10 V		10		
			0 V	0 V	15 V		5		
OFF Channel Leakage Current: Any Channel OFF (Max) or ALL Channels OFF (COMMON OUT/IN) (Max)			0 V	0 V	18 V	- 55°C	± 100		nA
						- 40°C	± 100		
						25°C	± 0.3	100 ⁽²⁾	
						85°C	± 1000 ⁽²⁾		
						125°C	± 1000 ⁽²⁾		
ON Channel Leakage Current: Any Channel ON (Max) or ALL Channels ON (COMMON OUT/IN) (Max)		5 or 0	- 5 V	0 V	10.5 V	85°C	± 300		nA
		5	0 V	0 V	18 V	85°C	± 300		
Capacitance	Input, C _{IS}		0 V	0 V	10 V	25°C	5		pF
	Output, C _{OS}						30		
	Feed through, C _{IOS}						0.2		
Prop Delay		V _{DD}	R _L = 200 k Ω		5 V	25°C	30	60	ns
			C _L = 50 pF		10 V		15	30	
			t _r , t _r = 20 ns		15 V		10	20	

Electrical Characteristics

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5 \text{ V}$, and $R_L = 100 \Omega$, (unless otherwise noted) ⁽¹⁾

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
CONTROL (ADDRESS OR INHIBIT), V _c							
Input Low Voltage, V _{IL} , Max	5 V	- 55°C	0.8		V		
		- 40°C	0.8				
		25°C	0.8				
		85°C	0.8				
		125°C	0.8				
	10 V	- 55°C	0.8				
		- 40°C	0.8				
		25°C	0.8				
		85°C	0.8				
		125°C	0.8				
	15 V	- 55°C	0.8				
		- 40°C	0.8				
		25°C	0.8				
		85°C	0.8				
		125°C	0.8				
Input High Voltage, V _{IH} , Min	5 V	- 55°C	3.5		V		
		- 40°C	3.5				
		25°C	3.5				
		85°C	3.5				
		125°C	3.5				
	10 V	- 55°C	7				
		- 40°C	7				
		25°C	7				
		85°C	7				
		125°C	7				
	15 V	- 55°C	11				
		- 40°C	11				
		25°C	11				
		85°C	11				
		125°C	11				

Electrical Characteristics

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5 \text{ V}$, and $R_L = 100 \Omega$, (unless otherwise noted) ⁽¹⁾

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
CONTROL (ADDRESS OR INHIBIT), V _c									
Input current, I _{IN} (Max)		V _{IN} = 0, 18			18 V	- 55°C		±1	μA
						- 40°C		±1	
						25°C	±0.6	±1	
						85°C		±1	
						125°C		±1	
Propagation Delay Time	Address-to-Signal OUT (Channels ON or OFF) (See Figure 10, Figure 11, and Figure 15)	t _r , t _f =	0 V	0 V	5 V		450	720	ns
		20ns, C _L	0 V	0 V	10 V		160	320	
		= 50pF,	0 V	0 V	15 V		120	240	
		R _L =	- 5 V	0 V	5 V		225	450	
Propagation Delay Time	Inhibit-to-Signal OUT (Channel Turning ON) (See Figure 11)	t _r , t _f =	0 V	0 V	5 V		400	720	ns
		20ns, C _L	0 V	0 V	10 V		160	320	
		= 50pF,	0 V	0 V	15 V		120	240	
		R _L = 1kΩ	- 10 V	0 V	5 V		200	400	
Propagation Delay Time	Inhibit-to-Signal OUT (Channel Turning OFF) (See Figure 17)	t _r , t _f =	0 V	0 V	5 V		200	450	ns
		20ns, C _L	0 V	0 V	10 V		90	210	
		= 50pF,	0 V	0 V	15 V		70	160	
		R _L = 10kΩ	- 10 V	0 V	5 V		130	300	
Input Capacitance, C _{IN} (Any Address or Inhibit Input)			- 5 V	0 V	5 V	25°C	5	7.5	pF

(1) Peak-to-Peak voltage symmetrical about $(V_{\text{DD}} - V_{\text{EE}}) / 2$.

(2) Determined by minimum feasible leakage measurement for automatic testing.

AC Performance Characteristics

$V_{DD} = +15\text{ V}$, $V_{SS} = V_{EE} = 0\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS					TYP	UNIT
	V _{IS} (V)	V _{DD} (V)	R _L (kΩ)				
Cutoff (- 3dB) Frequency Channel ON (Sine Wave Input)	5 ⁽¹⁾	10	1	V _{OS} at Common OUT/IN	CD4051	20	MHz
	V _{EE} = V _{SS} , 20Log(V _{OS} /V _{IS}) = - 3 dB			V _{OS} at Any Channel		60	
Total Harmonic Distortion, THD	2 ⁽¹⁾	5	10			0.3%	%
	3 ⁽¹⁾	10	10			0.2%	
	5 ⁽¹⁾	15	10			0.12%	
	V _{EE} = V _{SS} , f _{IS} = 1 kHz Sine Wave						
- 40dB Feedthrough Frequency (All Channels OFF)	5 ⁽¹⁾	10	1	V _{OS} at Common OUT/IN	CD4053	8	MHz
					CD4052	10	
	V _{EE} = V _{SS} ,				CD4051	12	
	20Log(V _{OS} /V _{IS}) = - 40 dB			V _{OS} at Any Channel		8	
- 40dB Signal Crosstalk Frequency	5 ⁽¹⁾	10	1			3	MHz
	V _{EE} = V _{SS} , 20Log(V _{OS} /V _{IS}) = - 3 dB			Between Sections, CD4052 Only	Measured on Common	6	
					Measured on Any Channel	10	
				Between Any Two Sections, CD4053 Only	In Pin 2, Out Pin 14	2.5	
					In Pin 15, Out Pin 14	6	
	Address-or-Inhibit-to- Signal Crosstalk		10	10 ⁽²⁾			
V _{EE} = 0, V _{SS} = 0, t _r , t _f = 20 ns, mV _{PEAK} V _{CC} = V _{DD} - V _{SS} (Square Wave)					65	mV _{PEAK}	

(1) Peak-to-Peak voltage symmetrical about $(V_{DD} - V_{EE}) / 2$.

(2) Both ends of channel.



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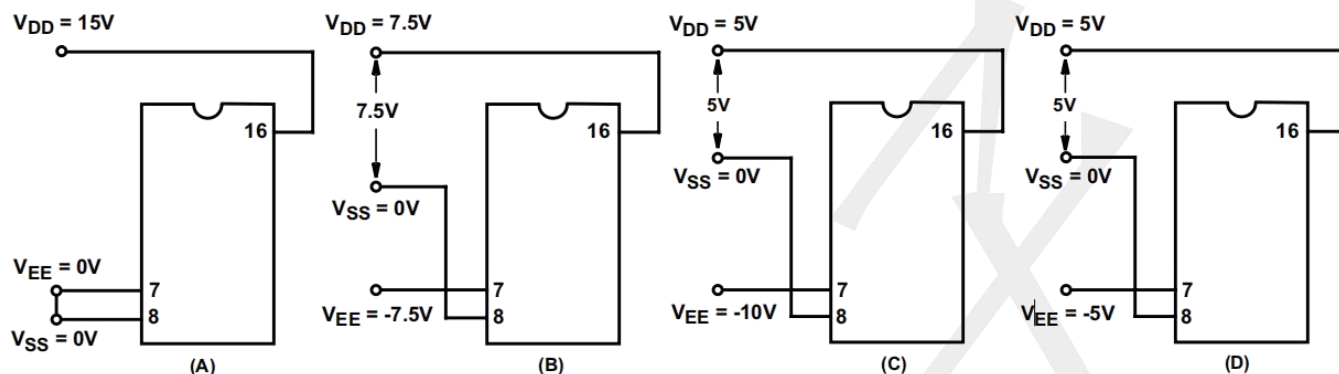
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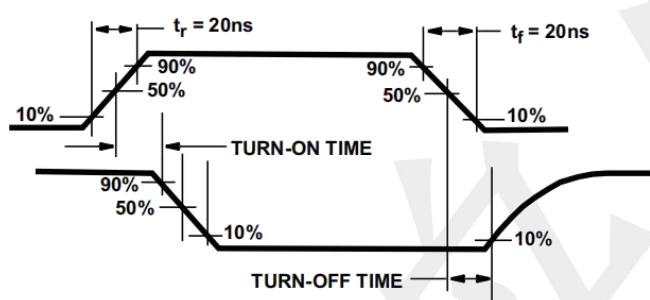
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Parameter Measurement Information

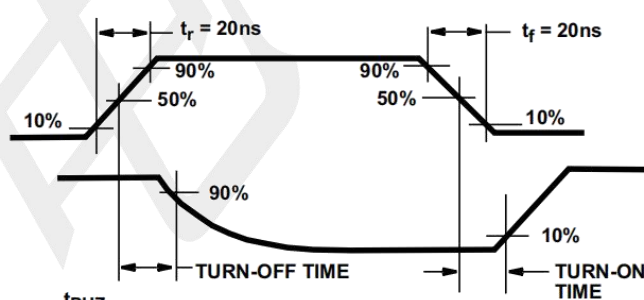


Typical Bias Voltages

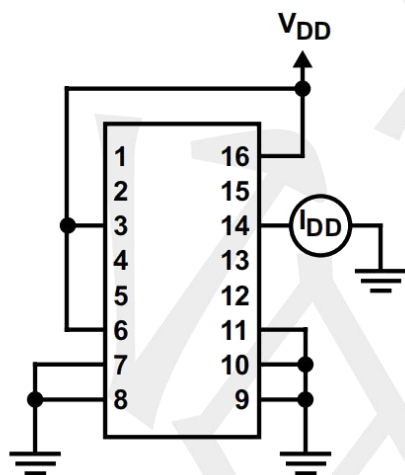
The ADDRESS (digital-control inputs) and INHIBIT logic levels are: 0 = VSS and 1 = VDD. The analog signal (through the TG) may swing from VEE to VDD.



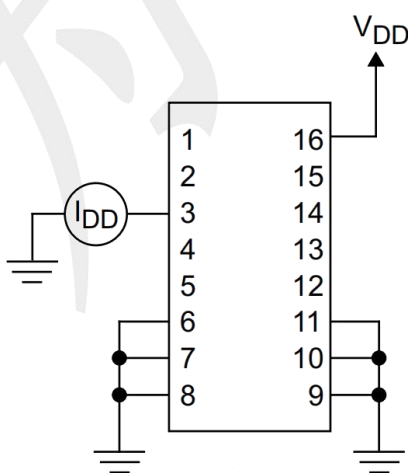
Waveforms, Channel Being Turned ON ($R_L = 1 k\Omega$)



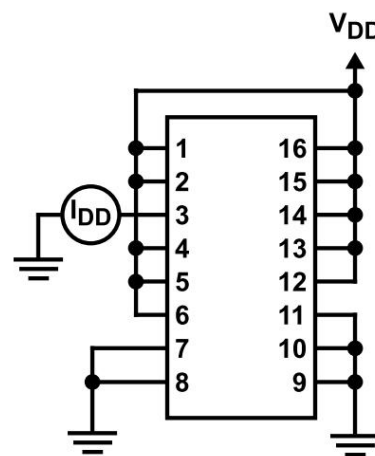
Waveforms, Channel Being Turned OFF ($R_L = 1 k\Omega$)



OFF Channel Leakage Current – Any Channel OFF



On Channel Leakage Current – Any Channel On



OFF Channel Leakage Current – All Channels OFF



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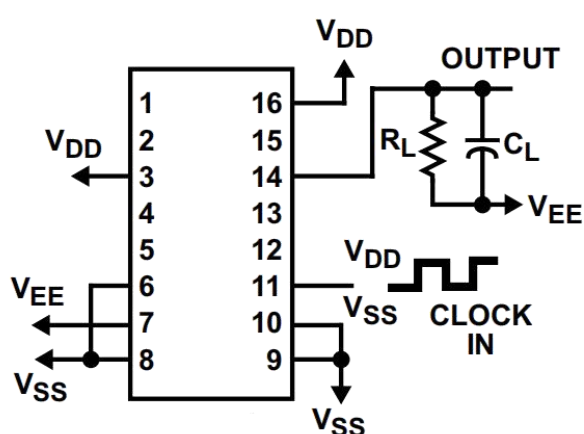
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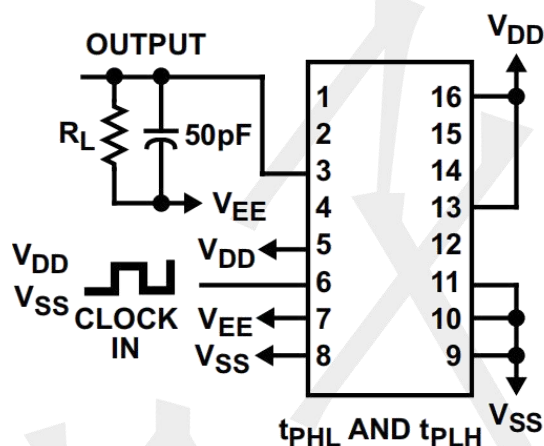
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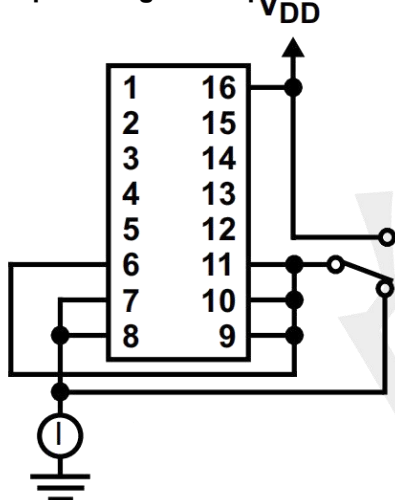
Parameter Measurement Information



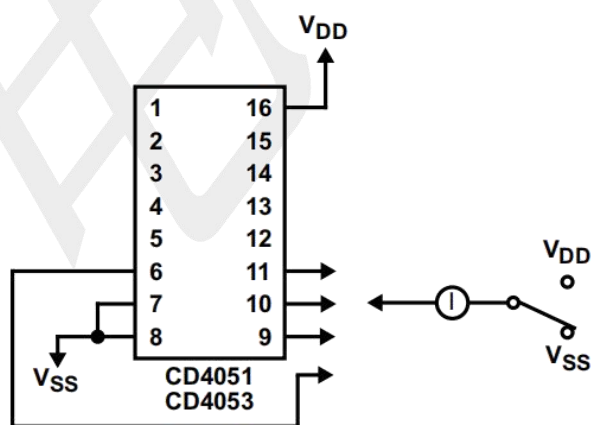
Propagation Delay – Address
Input to Signal Output



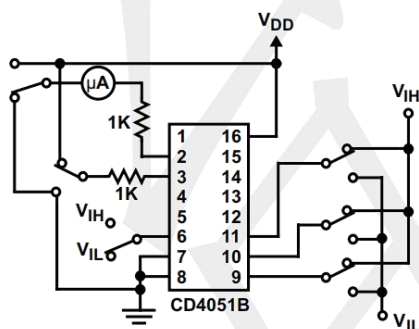
Propagation Delay – Inhibit
Input to Signal Output



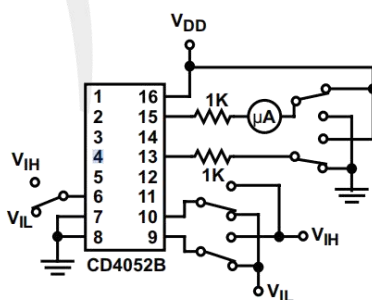
Quiescent Device Current



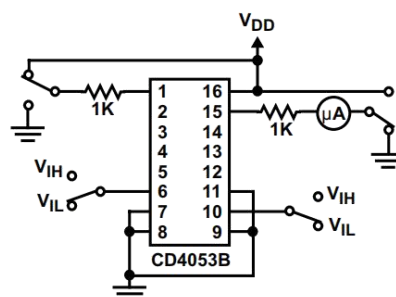
Input Current



MEASURE $< 2\mu\text{A}$ ON ALL
"OFF" CHANNELS (e.g., CHANNEL 6)



MEASURE $< 2\mu\text{A}$ ON ALL
"OFF" CHANNELS (e.g., CHANNEL 2x)



MEASURE $< 2\mu\text{A}$ ON ALL
"OFF" CHANNELS (e.g., CHANNEL by)

Input Voltage Test Circuits (Noise Immunity)



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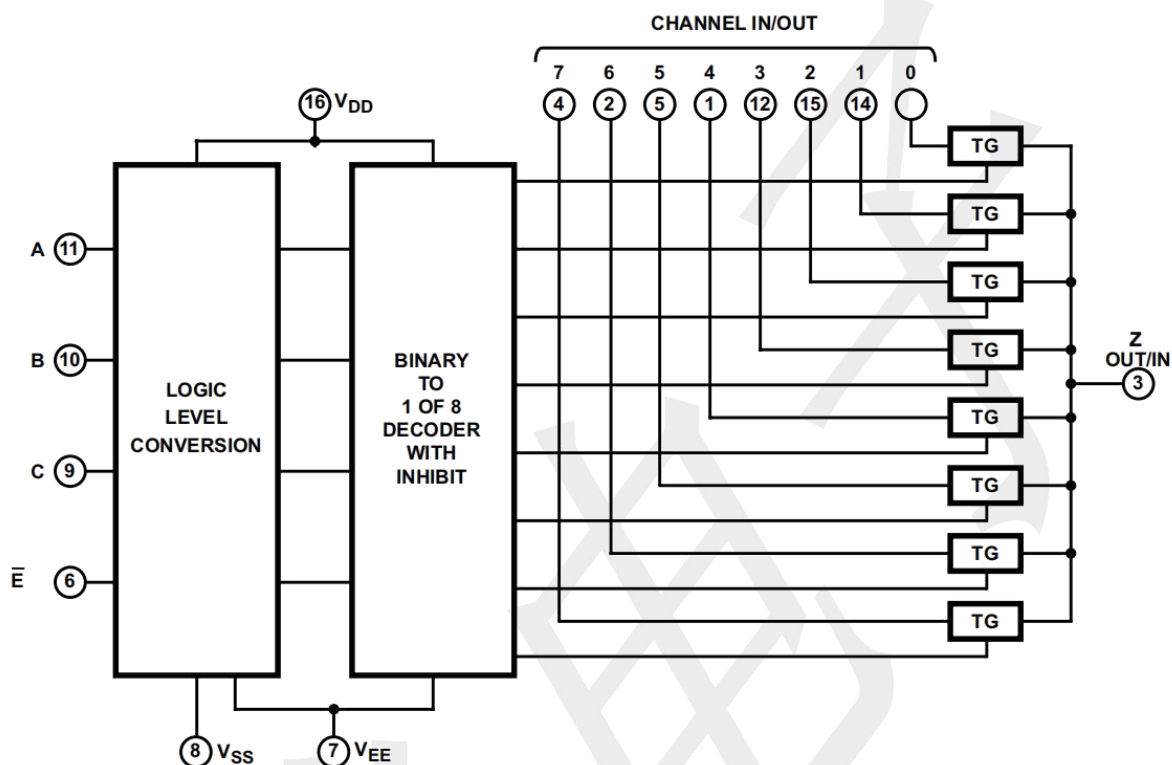
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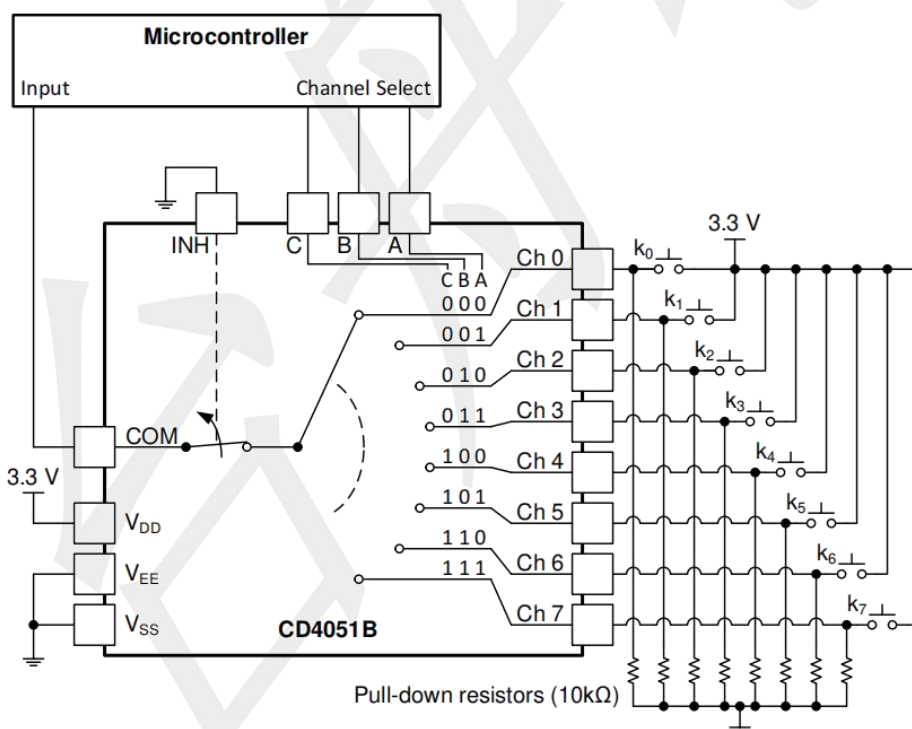
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Functional Block Diagrams



All inputs are protected by standard CMOS protection network.



Being Used to Help Read Button Presses on a Keypad



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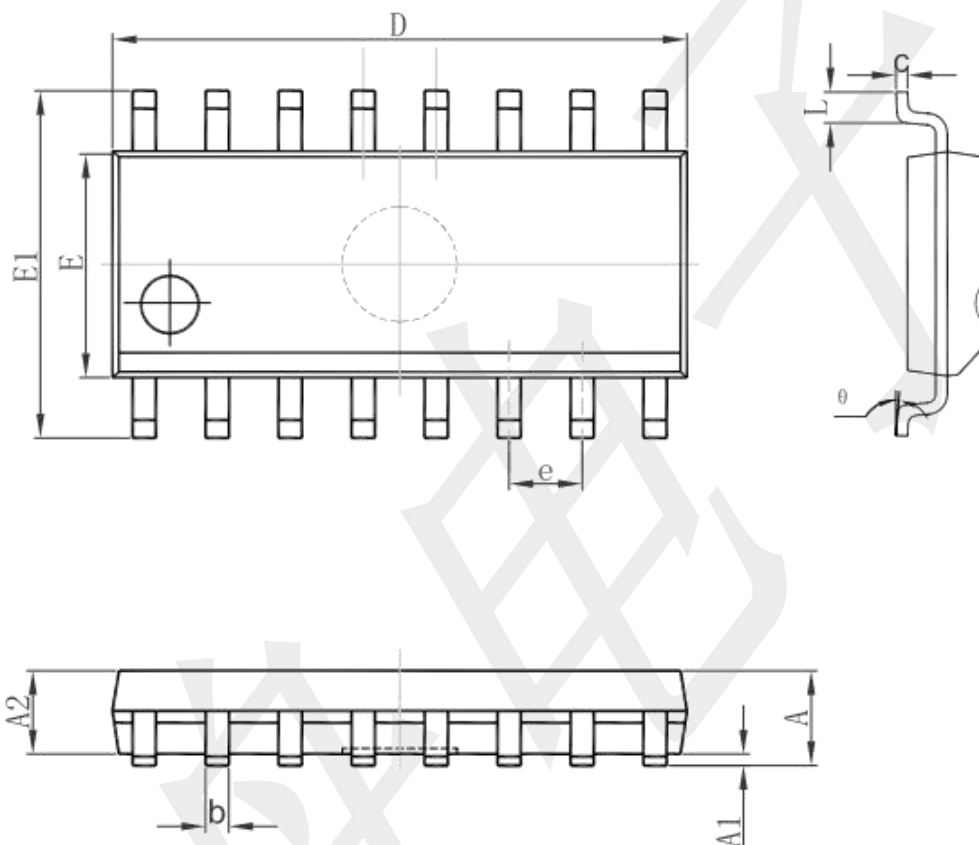
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Package information

SOP-16



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°