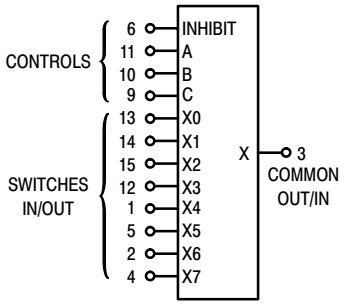
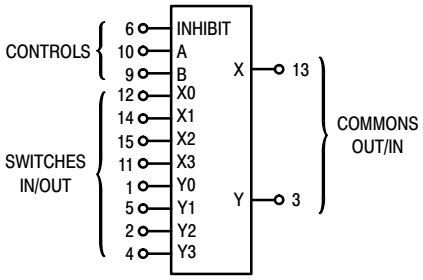
MC14051B
8-Channel Analog
Multiplexer/Demultiplexer



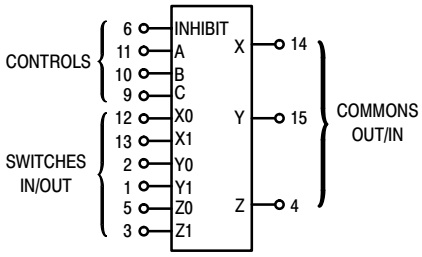
V_{DD} = PIN 16
V_{SS} = PIN 8
V_{EE} = PIN 7

MC14052B
Dual 4-Channel Analog
Multiplexer/Demultiplexer



V_{DD} = PIN 16
V_{SS} = PIN 8
V_{EE} = PIN 7

MC14053B
Triple 2-Channel Analog
Multiplexer/Demultiplexer

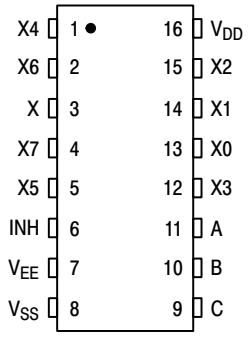


V_{DD} = PIN 16
V_{SS} = PIN 8
V_{EE} = PIN 7

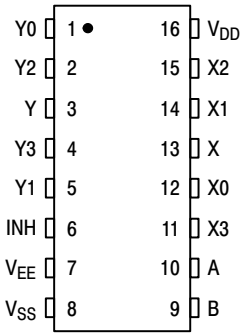
Note: Control Inputs referenced to V_{SS}, Analog Inputs and Outputs reference to V_{EE}. V_{EE} must be 3 V_{SS}.

PIN ASSIGMENT

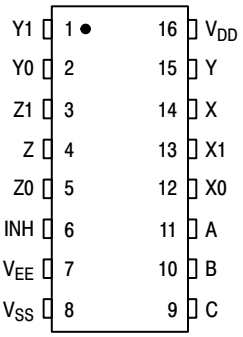
MC14051B



MC14052B



MC14053B



ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V_{DD}	Test Conditions	- 55 C		25 C			125 C		Unit
				Min	Max	Min	Typ (Note 2)	Max	Min	Max	
SUPPLY REQUIREMENTS (Voltages Referenced to V_{EE})											
Power Supply Voltage Range	V_{DD}	-	V_{DD} ± 3.0 . V_{SS} . V_{EE}	3.0	18	3.0	-	18	3.0	18	V
Quiescent Current Per Package	I_{DD}	5.0 10 15	Control Inputs: V_{in} = V_{SS} or V_{DD}, Switch I/O: V_{EE} $V_{I/O}$ V_{DD}, and ΔV_{switch} 500 mV (Note 3)	- - -	5.0 10 20	- - -	0.005 0.010 0.015	5.0 10 20	- - -	150 300 600	μA
Total Supply Current (Dynamic Plus Quiescent, Per Package	$I_{D(AV)}$	5.0 10 15	T_A = 25 C only (The channel component, (V_{in} ± V_{out})/R_{on}, is not included.)	Typical			(0.07 μA/kHz) f + I_{DD} (0.20 μA/kHz) f + I_{DD} (0.36 μA/kHz) f + I_{DD}				μA
CONTROL INPUTS Ð INHIBIT, A, B, C (Voltages Referenced to V_{SS})											
Low-Level Input Voltage	V_{IL}	5.0 10 15	R_{on} = per spec, I_{off} = per spec	- - -	1.5 3.0 4.0	- - -	2.25 4.50 6.75	1.5 3.0 4.0	- - -	1.5 3.0 4.0	V
High-Level Input Voltage	V_{IH}	5.0 10 15	R_{on} = per spec, I_{off} = per spec	3.5 7.0 11	- - -	3.5 7.0 11	2.75 5.50 8.25	- - -	3.5 7.0 11	- - -	V
Input Leakage Current	I_{in}	15	V_{in} = 0 or V_{DD}	-	+ 0.1	-	+0.00001	+ 0.1	-	1.0	μA
Input Capacitance	C_{in}	-		-	-	-	5.0	7.5	-	-	pF
SWITCHES IN/OUT AND COMMONS OUT/IN Ð X, Y, Z (Voltages Referenced to V_{EE})											
Recommended Peak-to-Peak Voltage Into or Out of the Switch	$V_{I/O}$	-	Channel On or Off	0	V_{DD}	0	-	V_{DD}	0	V_{DD}	V_{PP}
Recommended Static or Dynamic Voltage Across the Switch (Note 3) (Figure 5)	ΔV_{switch}	-	Channel On	0	600	0	-	600	0	300	mV
Output Offset Voltage	V_{OO}	-	V_{in} = 0 V, No Load	-	-	-	10	-	-	-	μV
ON Resistance	R_{on}	5.0 10 15	ΔV_{switch} 500 mV (Note 3) V_{in} = V_{IL} or V_{IH} (Control), and V_{in} = 0 to V_{DD} (Switch)	- - -	800 400 220	- - -	250 120 80	1050 500 280	- - -	1200 520 300	Ω
ΔON Resistance Between Any Two Channels in the Same Package	ΔR_{on}	5.0 10 15		- - -	70 50 45	- - -	25 10 10	70 50 45	- - -	135 95 65	Ω
Off-Channel Leakage Current (Figure 10)	I_{off}	15	V_{in} = V_{IL} or V_{IH} (Control) Channel to Channel or Any One Channel	-	+ 100	-	+ 0.05	+ 100	-	+1000	nA
Capacitance, Switch I/O	$C_{I/O}$	-	Inhibit = V_{DD}	-	-	-	10	-	-	-	pF
Capacitance, Common O/I	$C_{O/I}$	-	Inhibit = V_{DD} (MC14051B) (MC14052B) (MC14053B)	 - - -	 - - -	 - - -	 60 32 17	 - - -	 - - -	 - - -	pF
Capacitance, Feedthrough (Channel Off)	$C_{I/O}$	- -	Pins Not Adjacent Pins Adjacent	- -	- -	- -	0.15 0.47	- -	- -	- -	pF

2. Data labeled ªTypº is not to be used for design purposes, but is intended as an indication of the IC's potential performance.
3. For voltage drops across the switch (ΔV_{switch}) > 600 mV (> 300 mV at high temperature), excessive V_{DD} current may be drawn, i.e. the current out of the switch may contain both V_{DD} and switch input components. The reliability of the device will be unaffected unless the Maximum Ratings are exceeded. (See first page of this data sheet.)

ELECTRICAL CHARACTERISTICS (Note 4) (C_L = 50 pF, T_A = 25 C) (V_{EE} V_{SS} unless otherwise indicated)

Characteristic	Symbol	$V_{DD} \pm V_{EE}$ Vdc	Typ (Note 5) All Types	Max	Unit
Propagation Delay Times (Figure 6)	t_{PLH}, t_{PHL}				ns
Switch Input to Switch Output (R_L = 10 kΩ)					
MC14051					
t_{PLH}, t_{PHL} = (0.17 ns/pF) C_L + 26.5 ns		5.0	35	90	
t_{PLH}, t_{PHL} = (0.08 ns/pF) C_L + 11 ns		10	15	40	
t_{PLH}, t_{PHL} = (0.06 ns/pF) C_L + 9.0 ns		15	12	30	
MC14052					ns
t_{PLH}, t_{PHL} = (0.17 ns/pF) C_L + 21.5 ns		5.0	30	75	
t_{PLH}, t_{PHL} = (0.08 ns/pF) C_L + 8.0 ns		10	12	30	
t_{PLH}, t_{PHL} = (0.06 ns/pF) C_L + 7.0 ns		15	10	25	
MC14053					ns
t_{PLH}, t_{PHL} = (0.17 ns/pF) C_L + 16.5 ns		5.0	25	65	
t_{PLH}, t_{PHL} = (0.08 ns/pF) C_L + 4.0 ns		10	8.0	20	
t_{PLH}, t_{PHL} = (0.06 ns/pF) C_L + 3.0 ns		15	6.0	15	
Inhibit to Output (R_L = 10 kΩ, V_{EE} = V_{SS})	t_{PHZ}, t_{PLZ},				ns
Output ª1º or ª0º to High Impedance, or	t_{PZH}, t_{PZL}				
High Impedance to ª1º or ª0º Level					
MC14051B		5.0	350	700	
		10	170	340	
		15	140	280	
MC14052B		5.0	300	600	ns
		10	155	310	
		15	125	250	
MC14053B		5.0	275	550	ns
		10	140	280	
		15	110	220	
Control Input to Output (R_L = 10 kΩ, V_{EE} = V_{SS})	t_{PLH}, t_{PHL}				ns
MC14051B		5.0	360	720	
		10	160	320	
		15	120	240	
MC14052B		5.0	325	650	ns
		10	130	260	
		15	90	180	
MC14053B		5.0	300	600	ns
		10	120	240	
		15	80	160	
Second Harmonic Distortion (R_L = 10KΩ, f = 1 kHz) V_{in} = 5 V_{PP}	-	10	0.07	-	%
Bandwidth (Figure 7) (R_L = 1 kΩ, V_{in} = 1/2 (V_{DD}-V_{EE}) p-p, C_L = 50pF 20 Log (V_{out}/V_{in}) = - 3 dB)	BW	10	17	-	MHz
Off Channel Feedthrough Attenuation (Figure 7) R_L = 1KΩ, V_{in} = 1/2 (V_{DD} - V_{EE}) p-p f_{in} = 4.5 MHz Ð MC14051B f_{in} = 30 MHz Ð MC14052B f_{in} = 55 MHz Ð MC14053B	-	10	± 50	-	dB
Channel Separation (Figure 8) (R_L = 1 kΩ, V_{in} = 1/2 (V_{DD}-V_{EE}) p-p, f_{in} = 3.0 MHz	-	10	± 50	-	dB
Crosstalk, Control Input to Common O/I (Figure 9) (R_1 = 1 kΩ, R_L = 10 kΩ Control t_{TLH} = t_{THL} = 20 ns, Inhibit = V_{SS})	-	10	75	-	mV

4. The formulas given are for the typical characteristics only at 25 C.
5. Data labelled ªTypº is not lo be used for design purposes but In intended as an indication of the IC's potential performance.

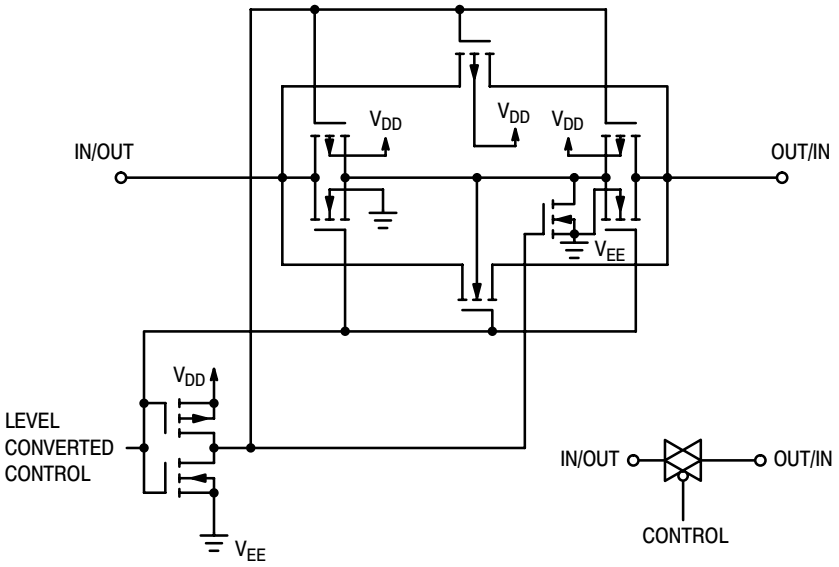


Figure 1. Switch Circuit Schematic

TRUTH TABLE

Control Inputs				ON Switches					
	Select								
Inhibit	C*	B	A	MC14051B	MC14052B		MC14053B		
0	0	0	0	X0	Y0	X0	Z0	Y0	X0
0	0	0	1	X1	Y1	X1	Z0	Y0	X1
0	0	1	0	X2	Y2	X2	Z0	Y1	X0
0	0	1	1	X3	Y3	X3	Z0	Y1	X1
0	1	0	0	X4			Z1	Y0	X0
0	1	0	1	X5			Z1	Y0	X1
0	1	1	0	X6			Z1	Y1	X0
0	1	1	1	X7			Z1	Y1	X1
1	x	x	x	None	None		None		

*Not applicable for MC14052
x = Don't Care

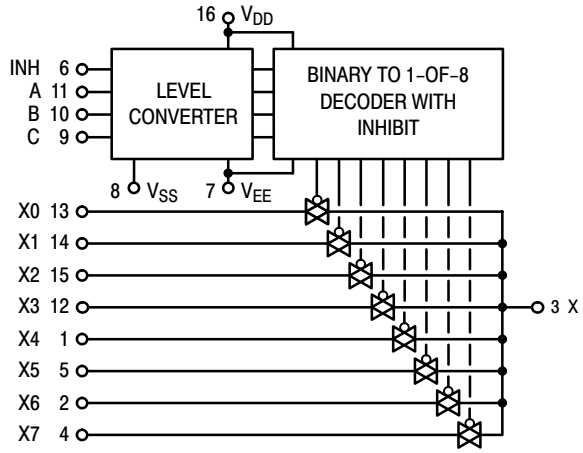


Figure 2. MC14051B Functional Diagram

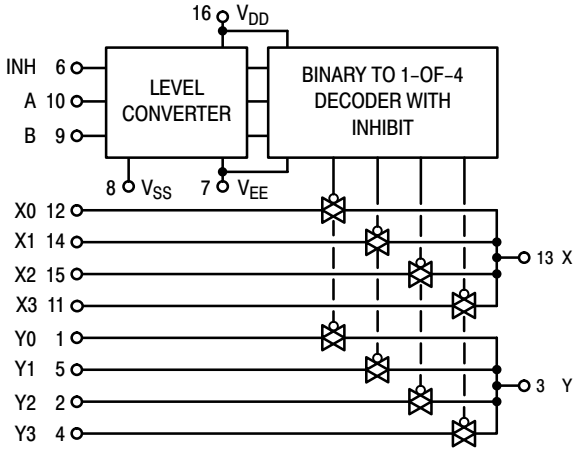


Figure 3. MC14052B Functional Diagram

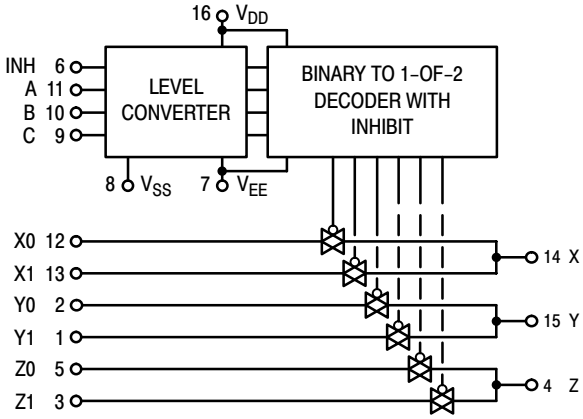


Figure 4. MC14053B Functional Diagram

TEST CIRCUITS

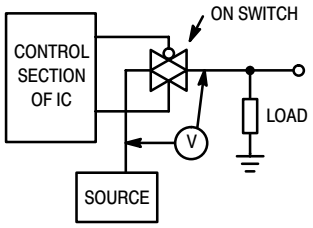


Figure 5. ΔV Across Switch

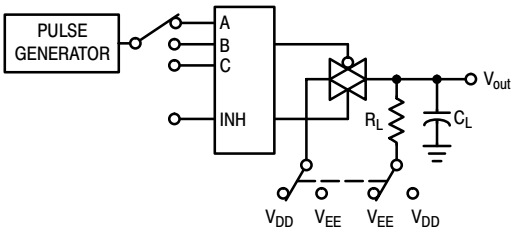


Figure 6. Propagation Delay Times, Control and Inhibit to Output

A, B, and C inputs used to turn ON or OFF the switch under test.

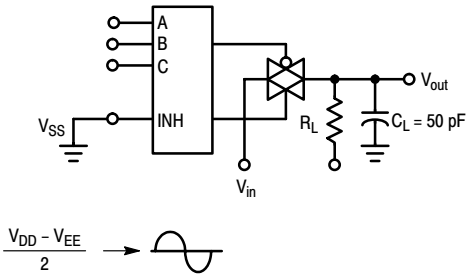


Figure 7. Bandwidth and Off-Channel Feedthrough Attenuation

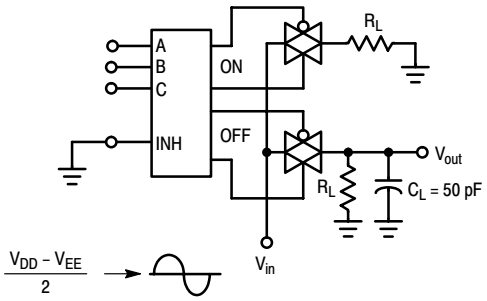


Figure 8. Channel Separation (Adjacent Channels Used For Setup)

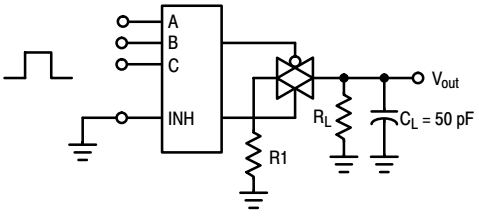


Figure 9. Crosstalk, Control Input to Common O/I

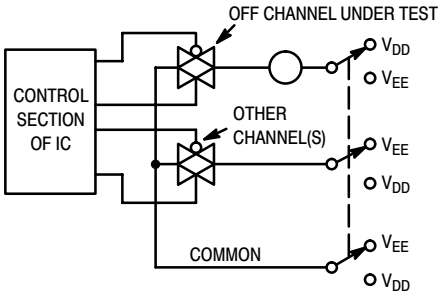


Figure 10. Off Channel Leakage

NOTE: See also Figures 7 and 8 in the MC14016B data sheet.

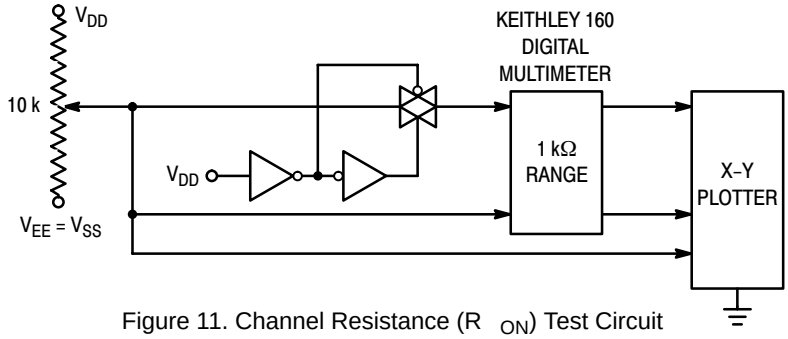


Figure 11. Channel Resistance (R_{ON}) Test Circuit

TYPICAL RESISTANCE CHARACTERISTICS

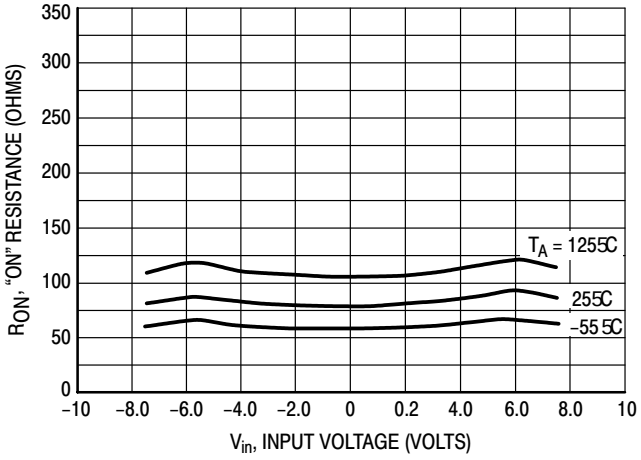


Figure 12. V_{DD} = 7.5 V, V_{EE} = - 7.5 V

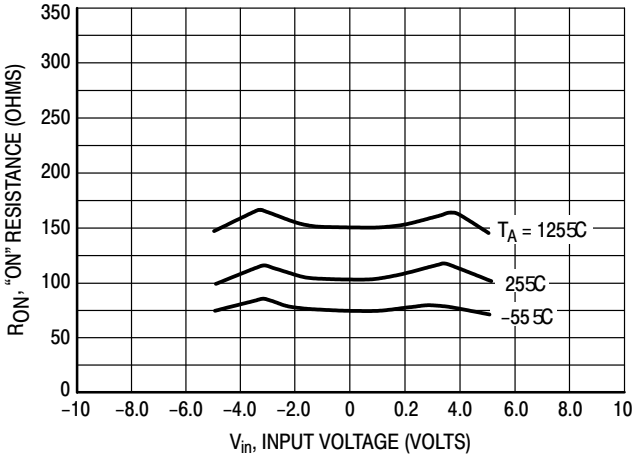


Figure 13. V_{DD} = 5.0 V, V_{EE} = - 5.0 V

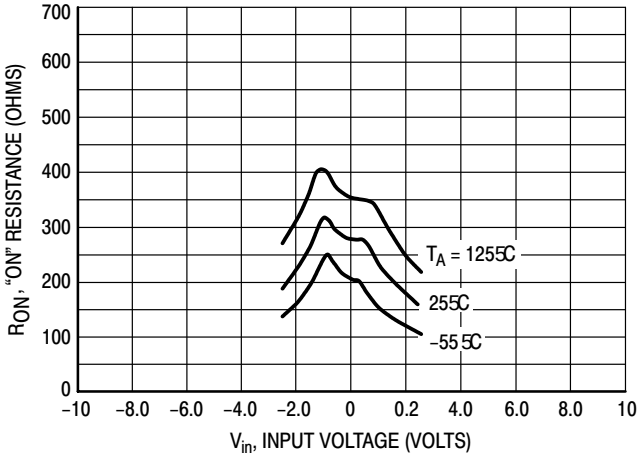


Figure 14. V_{DD} = 2.5 V, V_{EE} = - 2.5 V

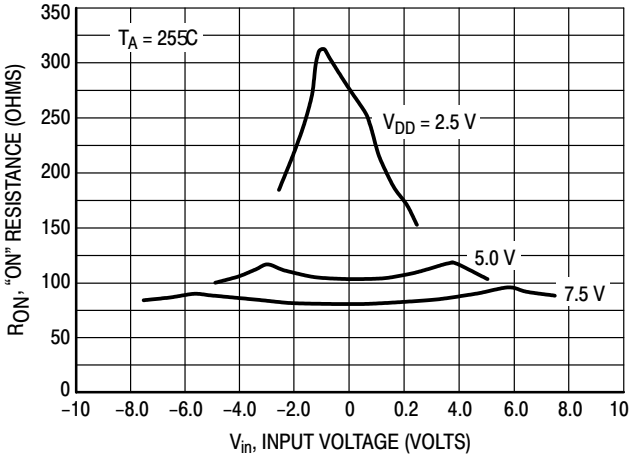


Figure 15. Comparison at 25 5C, V_{DD} = - V_{EE}

APPLICATIONS INFORMATION

Figure A illustrates use of the on-chip level converter detailed in Figures 2, 3, and 4. The 0-to-5 V Digital Control signal is used to directly control a 9 V_{p-p} analog signal.

The digital control logic levels are determined by V_{DD} and V_{SS}. The V_{DD} voltage is the logic high voltage; the V_{SS} voltage is logic low. For the example, V_{DD} = + 5 V = logic high at the control inputs; V_{SS} = GND = 0 V = logic low.

The maximum analog signal level is determined by V_{DD} and V_{EE}. The V_{DD} voltage determines the maximum recommended peak above V_{SS}. The V_{EE} voltage determines the maximum swing below V_{SS}. For the example, V_{DD} - V_{SS} = 5 V maximum swing above V_{SS}; V_{SS} - V_{EE} = 5 V maximum swing below V_{SS}. The example shows a ± 4.5 V signal which allows a 1/2 volt margin at each peak. If voltage transients above V_{DD} and/or below V_{EE} are anticipated on the analog channels, external diodes (Dx) are recommended as shown in Figure B. These diodes should be small signal types able to absorb the maximum anticipated current surges during clipping.

The *absolute* maximum potential difference between V_{DD} and V_{EE} is 18.0 V. Most parameters are specified up to 15 V which is the *recommended* maximum difference between V_{DD} and V_{EE}.

Balanced supplies are not required. However, V_{SS} must be greater than or equal to V_{EE}. For example, V_{DD} = + 10 V, V_{SS} = + 5 V, and V_{EE} = ± 3 V is acceptable. See the Table below.

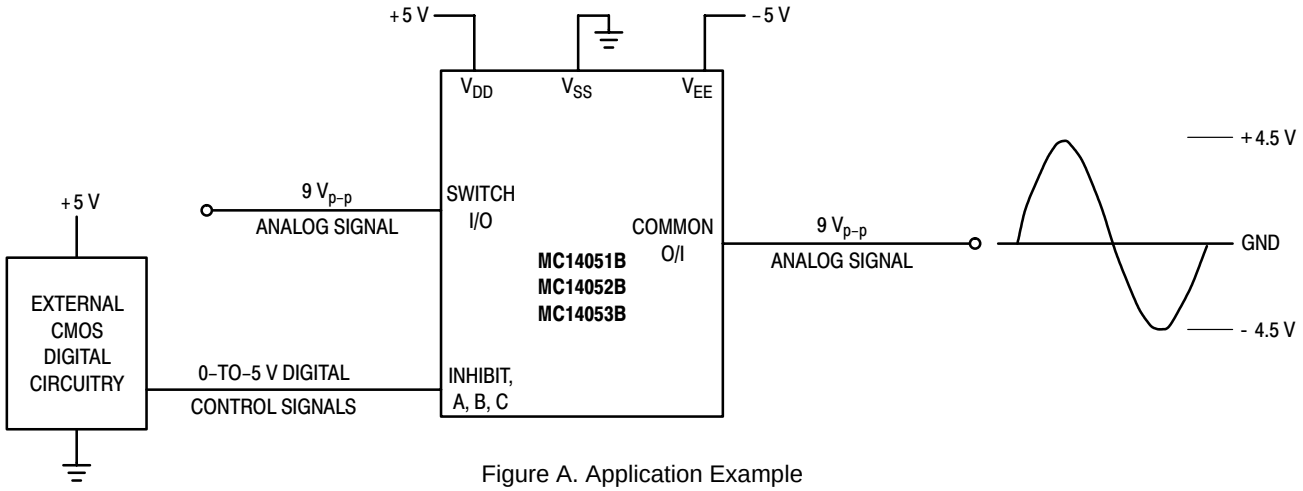


Figure A. Application Example

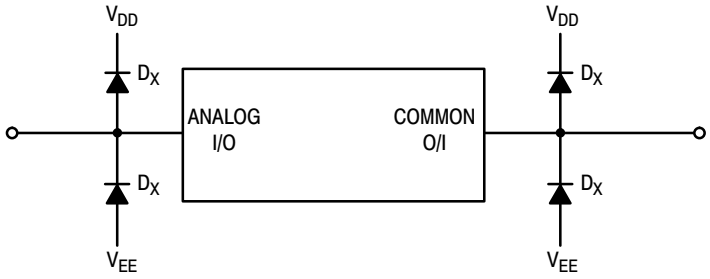


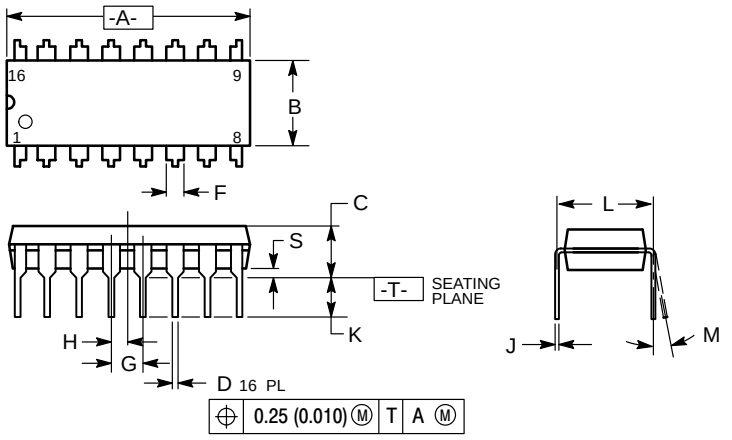
Figure B. External Germanium or Schottky Clipping Diodes

POSSIBLE SUPPLY CONNECTIONS

V_{DD} In Volts	V_{SS} In Volts	V_{EE} In Volts	Control Inputs Logic High/Logic Low In Volts	Maximum Analog Signal Range In Volts
+ 8	0	± 8	+ 8/0	+ 8 to ± 8 = 16 $V_{p\pm p}$
+ 5	0	± 12	+ 5/0	+ 5 to ± 12 = 17 $V_{p\pm p}$
+ 5	0	0	+ 5/0	+ 5 to 0 = 5 $V_{p\pm p}$
+ 5	0	± 5	+ 5/0	+ 5 to ± 5 = 10 $V_{p\pm p}$
+ 10	+ 5	± 5	+ 10/ + 5	+ 10 to ± 5 = 15 $V_{p\pm p}$

PACKAGE DIMENSIONS

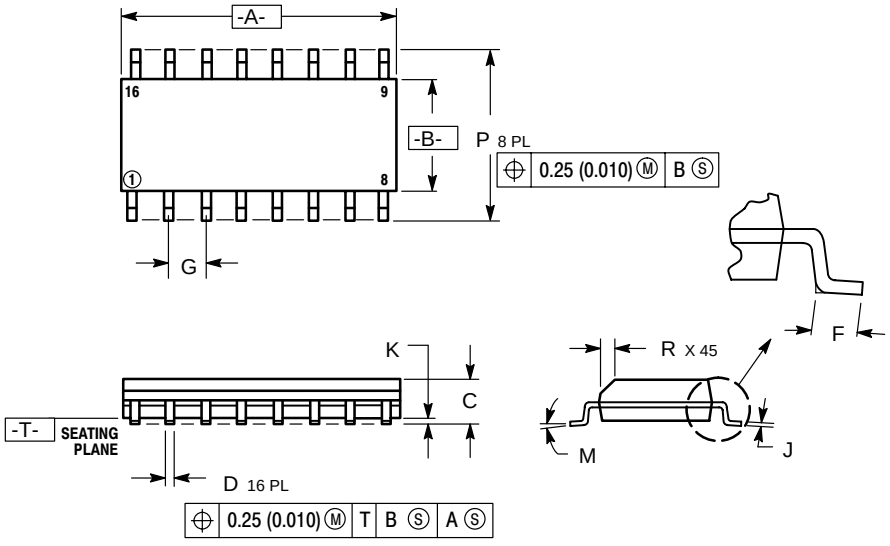
PDIP-16
P SUFFIX
PLASTIC DIP PACKAGE
CASE 648-08
ISSUE T



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0	10	0	10
S	0.020	0.040	0.51	1.01

SOIC-16
D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B-05
ISSUE J

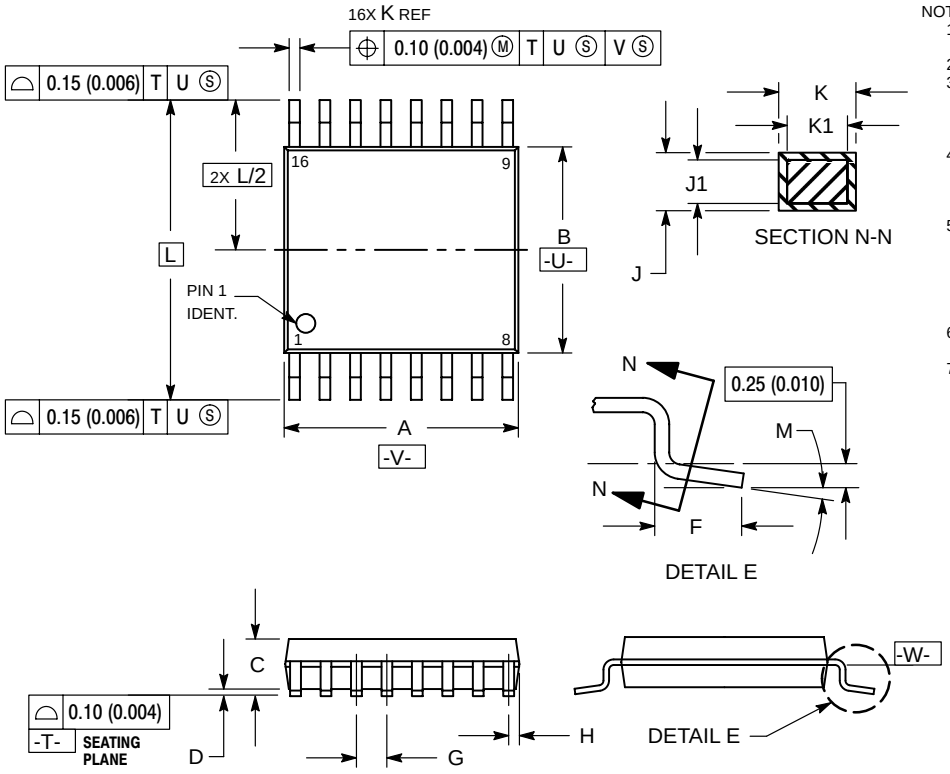


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0	7	0	7
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

PACKAGE DIMENSIONS

TSSOP-16
DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 948F-01
ISSUE A

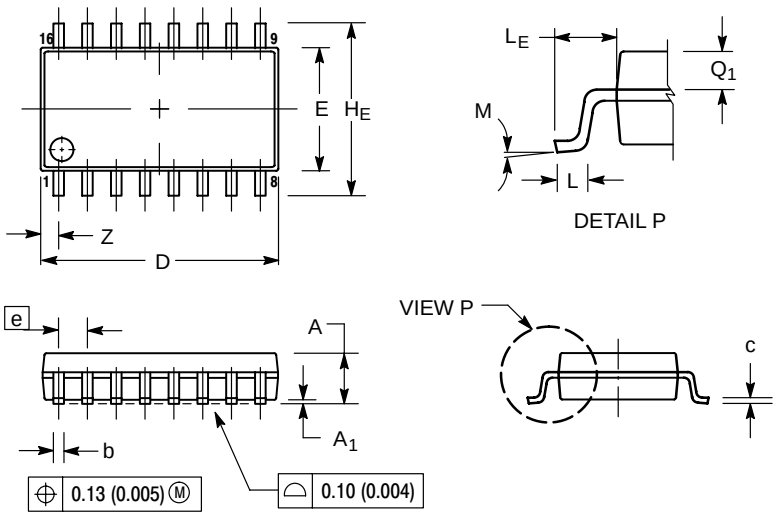


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0	8	0	8

PACKAGE DIMENSIONS

SOEIAJ-16
F SUFFIX
PLASTIC EIAJ SOIC PACKAGE
CASE 966-01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A_1	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	9.90	10.50	0.390	0.413
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
H_E	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L_E	1.10	1.50	0.043	0.059
M	0	10	0	10
Q_1	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

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