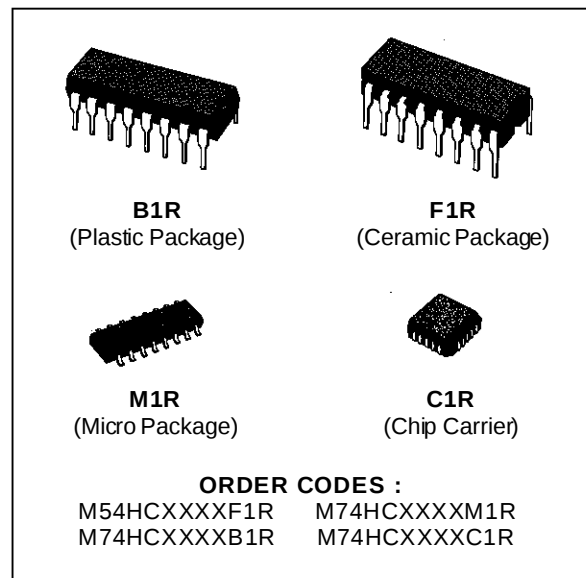


ANALOG MULTIPLEXER/DEMULTIPLEXER: SINGLE 8 CHANNEL, DUAL 4 CHANNEL, TRIPLE 2 CHANNEL

- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu A$ (MAX.) AT $T_A = 25^\circ C$
- **LOGIC LEVEL TRANSLATION TO ENABLE 5V LOGIC SIGNAL TO COMMUNICATE WITH $\pm 5V$ ANALOG SIGNAL**
- **LOW "ON" RESISTANCE:**
 70Ω TYP. ($V_{CC} - V_{EE} = 4.5 V$)
 50Ω TYP. ($V_{CC} - V_{EE} = 9 V$)
- **WIDE ANALOG INPUT VOLTAGE RANGE: $\pm 6V$**
- **FAST SWITCHING:**
 $t_{pd} = 15 ns$ (TYP.) AT $T_A = 25^\circ C$
- **LOW CROSSTALK BETWEEN SWITCHES**
- **HIGH ON/OFF OUTPUT VOLTAGE RATIO**
- **WIDE OPERATING VOLTAGE RANGE**
 $(V_{CC} - V_{EE}) = 2V$ TO $12V$
- **LOW SINE WAVE DISTORTION**
 0.02% AT $V_{CC} - V_{EE} = 9V$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (MIN.)
- **PIN AND FUNCTION COMPATIBLE WITH HCC/HCF4051/4052/4053B**

DESCRIPTION

These devices are analog multiplexer demultiplexers in high speed silicon gate C²MOS technology and they are pin compatible with the equivalent metal gate CMOS "4000B" series. These analog switches are bidirectional and digitally

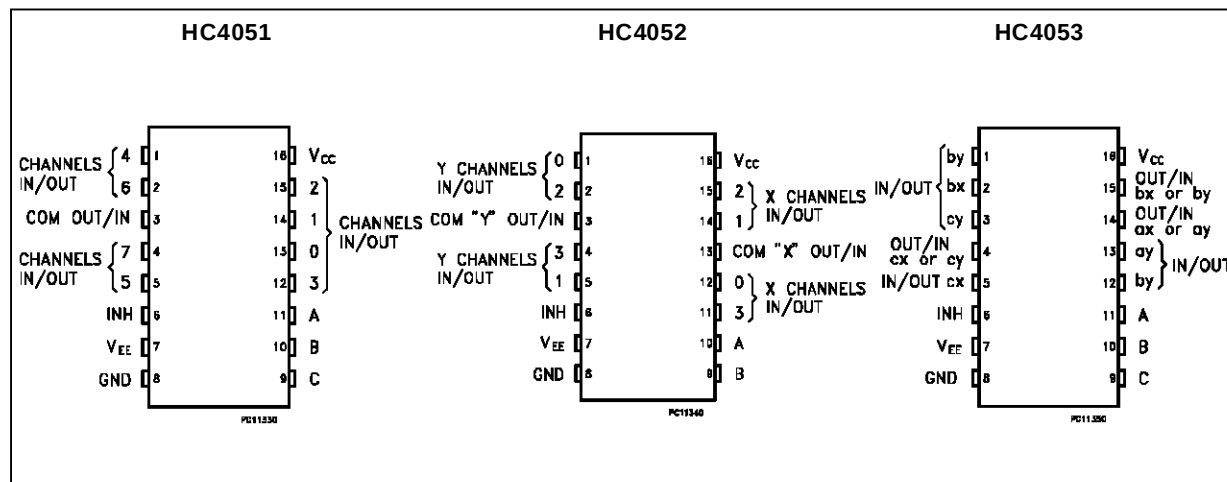


controlled.

A built-in level shifting is included to allow them an input range of up to $\pm 6V$ (peak) for an analog signal with digital control signal of 0 to 6V.

V_{EE} supply pin is provided for analog input signals. They have an inhibit (INH) input terminal to disable all the switches when high. For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND.

PIN CONNECTION (top view)



M54/M74HC4051/4052/4053

DESCRIPTION

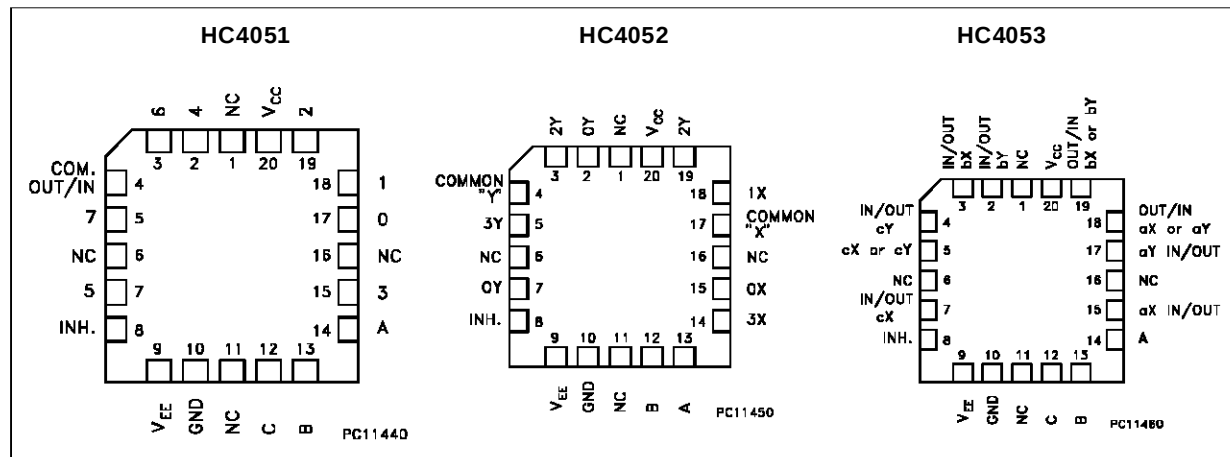
The HC4051 is a single 8 channel multiplexer demultiplexer having three binary control inputs A, B and C to select 1 of 8 to be turned on, and connected to the output.

The HC4052 has a pair of four channel multiplexer demultiplexer having two control inputs A and B that

select one of four channels of the two sections.

The HC4053 is a triple two channel multiplexer demultiplexer having three separate digital control inputs A, B and C to select independently one of a pair of channels.

CHIP CARRIER



TRUTH TABLE (HC4051)

INPUT STATES				"ON" CHANNEL
INHIBIT	C	B	A	
L	L	L	L	0
L	L	L	H	1
L	L	H	L	2
L	L	H	H	3
L	H	L	L	4
L	H	L	H	5
L	H	H	L	6
L	H	H	H	7
H	X	X	X	NONE

X: DON'T CARE

TRUTH TABLE (HC4052)

INPUT STATES			"ON" CHANNELS
INHIBIT	B	A	
L	L	L	0X, 0Y
L	L	H	1X, 1Y
L	H	L	2X, 2Y
L	H	H	3X, 3Y
H	X	X	NONE

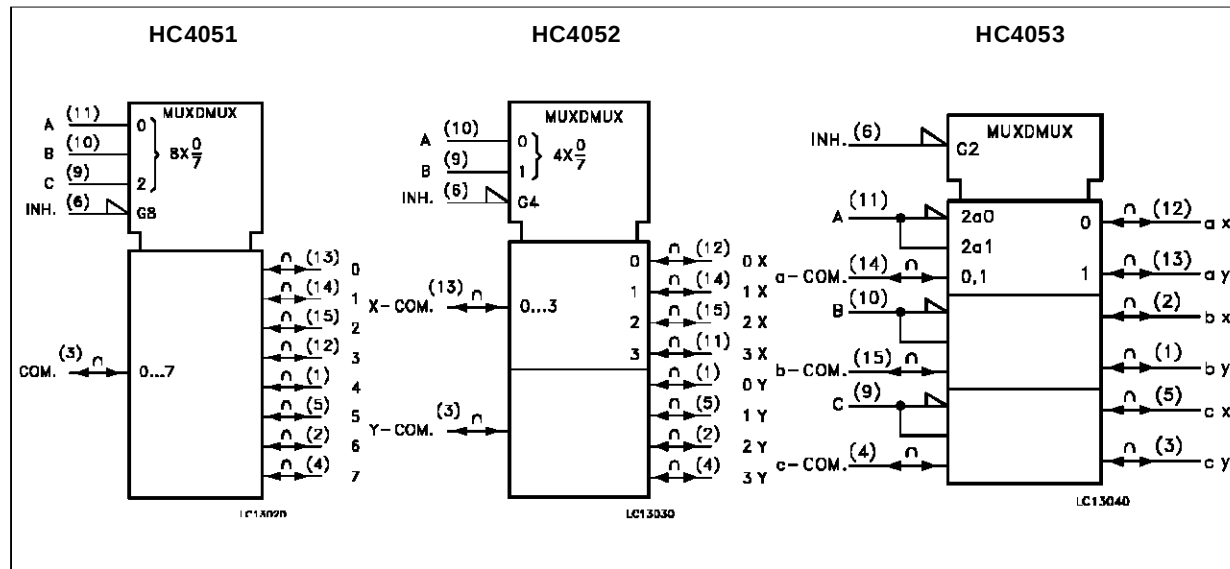
X: DON'T CARE

TRUTH TABLE (HC4053)

INPUT STATES		"ON" CHANNELS
INHIBIT	A or B or C	
L	L	ax or bx or cx
L	H	ay or by or cy
H	X	NONE

X: DON'T CARE

IEC LOGIC SYMBOLS



PIN DESCRIPTION (HC4051)

PIN No	SYMBOL	NAME AND FUNCTION
3	COM OUT/IN	Common Output/input
6	INH	INHIBIT Input
7	V _{EE}	Negative Supply Voltage
11, 10, 9	A, B, C	Select Inputs
13, 14, 15, 12, 1, 5, 2, 4	0 TO 7	Independent Input/Outputs
8	GND	Ground (0V)
16	V _{CC}	Positive Supply Voltage

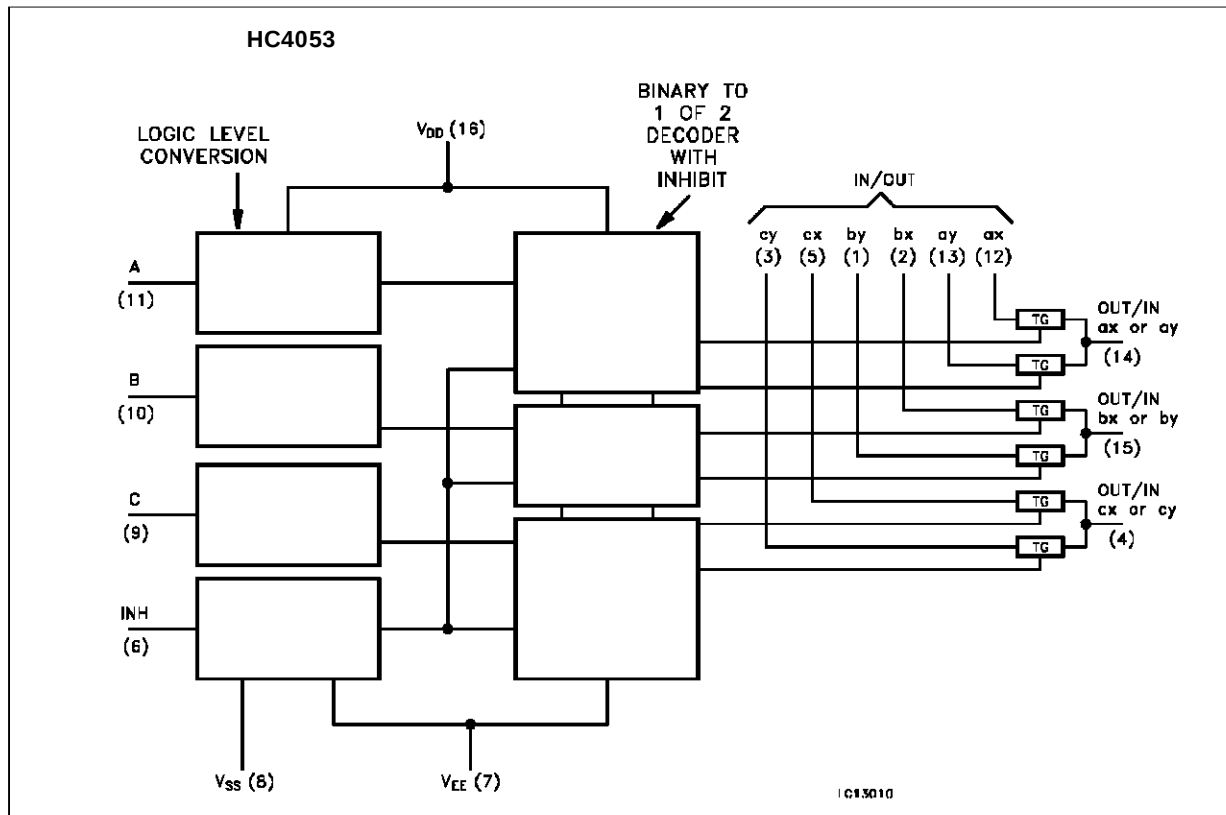
PIN DESCRIPTION (HC4052)

PIN No	SYMBOL	NAME AND FUNCTION
1, 5, 2, 4	0Y TO 3Y	Independent Input/Outputs
6	INH	INHIBIT Input
7	V _{EE}	Negative Supply Voltage
10, 9	A, B	Select Inputs
12, 14, 15, 11	0X TO 3X	Independent Input/Outputs
3	COM Y OUT/IN	Common X Output/input
13	COM X OUT/IN	Common Y Output/input
8	GND	Ground (0V)
16	V _{CC}	Positive Supply Voltage

PIN DESCRIPTION (HC4053)

PIN No	SYMBOL	NAME AND FUNCTION
2, 1	bx, by	Independent Input/Outputs
5, 3	cx, cy	Independent Input/Outputs
6	INH	INHIBIT Input
7	V _{EE}	Negative Supply Voltage
11, 10, 9	A, B, C	Select Inputs
12, 13	ax, ay	Independent Input/Outputs
14, 15, 4	ax TO cy	Common Output/input
8	GND	Ground (0V)
16	V _{CC}	Positive Supply Voltage

FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage Range	-0.5 to +7	V
V _{CC} - V _{EE}	Supply Voltage Range	-0.5 to 13	V
V _{IN}	Control Input Voltage	-0.5 to V _{CC} + 0.5	V
V _{I/O}	Switch I/O Voltage	V _{EE} - 0.5 to V _{CC} + 0.5	V
I _{CK}	Control Input Diode Current	± 20	mA
I _{IOK}	I/O Diode Current	± 20	mA
I _T	Switch Through Current	± 25	mA
I _{CC}	DC V _{CC} or Ground Current	± 50	mA
P _D	Power Dissipation	500 (*)	mW
T _{stg}	Storage Temperature	-65 to +150	°C
T _L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

(*) 500 mW: ≡ 65 °C derate to 300 mW by 10mW/°C: 65 °C to 85 °C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	2 to 6	V
V _{EE}	Supply Voltage	-6 to 0	V
V _{CC} - V _{EE}	Supply Voltage	2 to 12	V
V _{IN}	Input Voltage	0 to V _{CC}	V
V _{I/O}	Input/Output Voltage	V _{EE} to V _{CC}	V
T _{op}	Operating Temperature: M54HC Series M74HC Series	-55 to +125 -40 to +85	°C °C
t _r , t _f	Input Rise and Fall Time	V _{CC} = 2 V	ns
		V _{CC} = 4.5 V	
		V _{CC} = 6 V	

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions			Value						Unit		
		V _{CC} (V)	V _{EE} (V)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC			
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.	
V _{IHC}	High Level Control Input Voltage	2.0			1.5			1.5		1.5		V	
		4.5			3.15			3.15		3.15			
		6.0			4.2			4.2		4.2			
V _{ILC}	Low Level Control Input Voltage	2.0					0.5		0.5		0.5	V	
		4.5					1.35		1.35		1.35		
		6.0					1.8		1.8		1.8		
R _{ON}	ON Resistance	4.5	GND	V _{IN} = V _{IHC} or V _{ILC} V _{I/O} = V _{CC} to V _{EE} I _{I/O} ≤ 2 mA		85	180		225		270	Ω	
		4.5	-4.5			55	120		150		180		
		6.0	-6.0			50	100		125		150		
		2.0	GND	V _{IN} = V _{IHC} or V _{ILC} V _{I/O} = V _{CC} or V _{EE} I _{I/O} ≤ 2 mA		150							
		4.5	GND			70	150		190		230		
		4.5	-4.5			50	100		125		150		
		6.0	-6.0			45	80		100		120		
ΔR _{ON}	Difference of ON Resistance Between Switches	4.5	GND	V _{IN} = V _{IHC} or V _{ILC} V _{I/O} = V _{CC} or V _{EE} I _{I/O} ≤ 2 mA		10	30		35		45	Ω	
		4.5	-4.5			5	12		15		18		
		6.0	-6.0			5	10		12		15		
I _{OFF}	Input/Output Leakage Current (SWITCH OFF)	6.0	GND	V _{OS} = V _{CC} or GND V _{IS} = GND or V _{CC} V _{IN} = V _{ILC} or V _{IHC}			±0.06		±0.6		±1.2	μA	
		6.0	-6.0				±0.1		±1		±2		
I _{IZ}	Switch Input Leakage Current (SWITCH ON, OUTPUT OPEN)	6.0	GND	V _{OS} = V _{CC} or GND V _{IN} = V _{IHC} or V _{ILC}			±0.06		±0.6		±1.2	μA	
		6.0	-6.0				±0.1		±1		±2		
I _{IN}	Control Input Current	6.0	GND	V _{IN} = V _{CC} or GND			±0.1		±0.1		±1	μA	
I _{CC}	Quiescent Supply Current	6.0	GND	V _{IN} = V _{CC} or GND			4		40		80	μA	
		6.0	-6.0				8		80		160		

ANALOG SWITCH CHARACTERISTICS (GND = 0 V T_A = 25 °C)

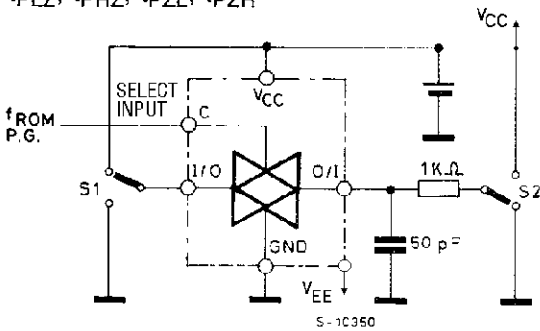
Symbol	Parameter	Test Conditions				Value	Unit
		V _{CC} (V)	V _{EE} (V)	V _{IN} (Vp-p)		Typ.	
	Sine Wave Distortion	2.25	2.25	4	f _{IN} = 1 KHz R _L = 10 KΩ C _L = 50 pF	0.025	%
		4.5	-4.5	8		0.020	
		6.0	-6.0	11		0.018	
f _{MAX}	Frequency Response (Switch ON)	2.25	-2.25	Adjust f _{IN} voltage to Obtain 0 dBm at V _{OS} . Increase f _{IN} Frequency until dB Meter Reads -3dB R _L = 50 Ω C _L = 10 pF f _{IN} = 1 KHz sine wave	ALL (*)	120	MHz
					HC4051 (**)	45	
					HC4052 (**)	70	
					HC4053 (**)	95	
		4.5	-4.5		ALL (*)	190	
					HC4051 (**)	70	
					HC4052 (**)	110	
					HC4053 (**)	150	
		6.0	-6.0		ALL (*)	200	
					HC4051 (**)	85	
					HC4052 (**)	140	
					HC4053 (**)	190	
	Feedthrough Attenuation (Switch OFF)	2.25	-2.25	V _{IN} is centered at (V _{CC} - V _{EE})/2. Adjust input for 0 dBm R _L = 600 Ω C _L = 50 pF f _{IN} = 1 KHz sine wave	-50	dB	
		4.5	-4.5		-50		
		6.0	-6.0		-50		
	Crosstalk (Control Input to Signal Output)	2.25	-2.25	Adjust R _L at set up so that I _S = 0A R _L = 600 Ω C _L = 50 pF f _{IN} = 1 MHz square wave	60	mV	
		4.5	-4.5		140		
		6.0	-6.0		200		
	Crosstalk (Between Any Switches)	2.25	-2.25	Adjust V _{IN} to Obtain 0 dBm at Input R _L = 600 Ω C _L = 50 pF f _{IN} = 1 MHz sine wave	-50	dB	
		4.5	-4.5		-50		
		6.0	-6.0		-50		

(*): Input COMMON Terminal, and measured at SWITCH Terminal.

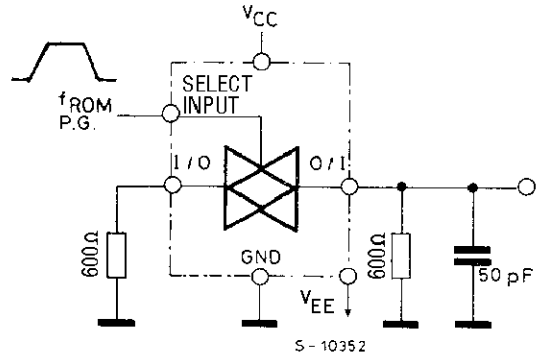
(**): Input SWITCH Terminal, and measured at COMMON Terminal.

NOTE: These characteristics are determined by design of devices.

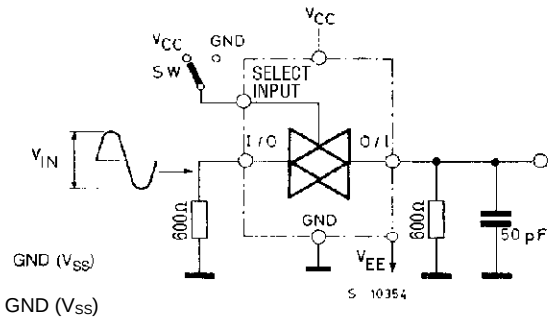
SWITCHING CHARACTERISTICS TEST CIRCUIT

 t_{PLZ} , t_{PHZ} , t_{PZL} , t_{PZH} . t_{PLZ} , t_{PHZ} , t_{PZL} , t_{PZH} 

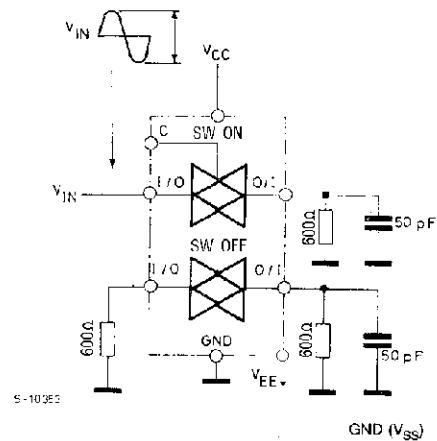
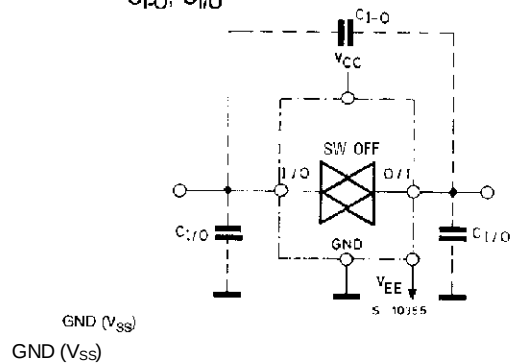
CROSSTALK (control to output)



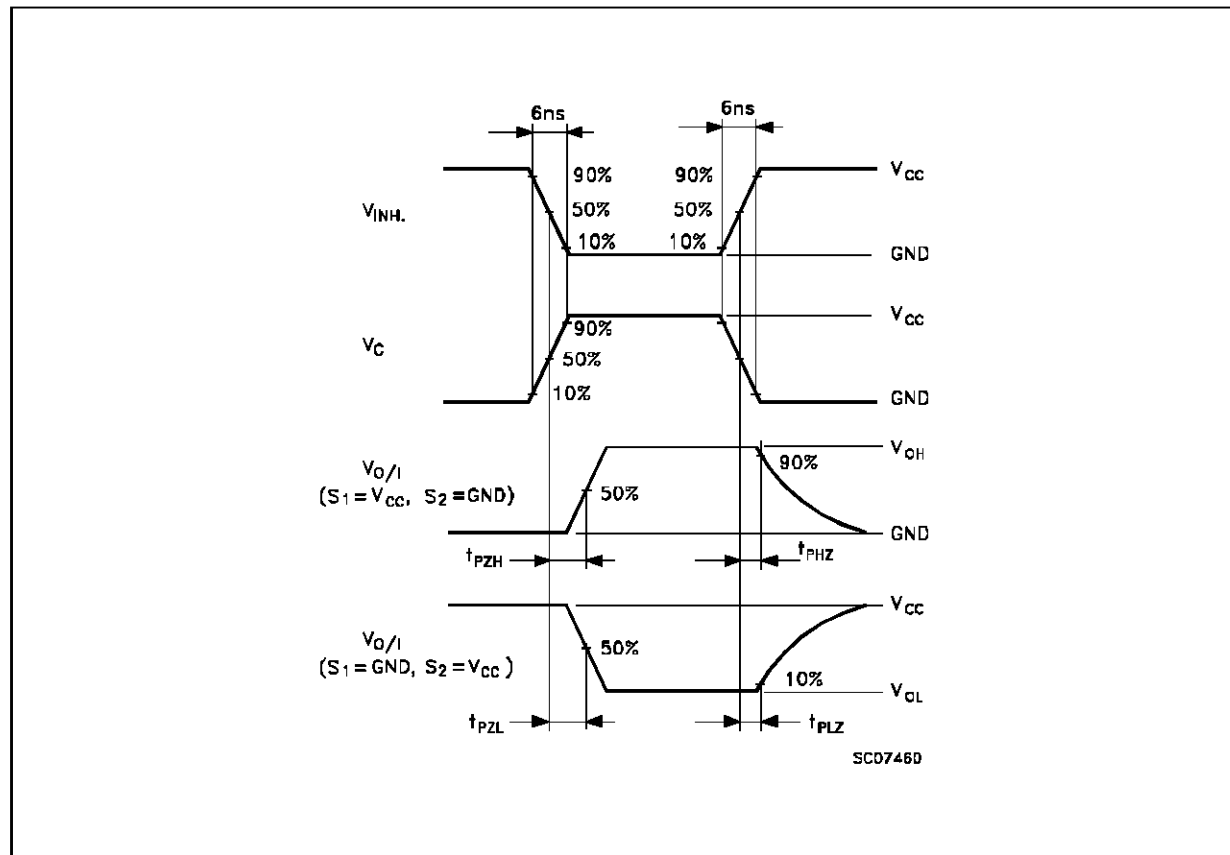
BANDWIDTH AND FEEDTHROUGH ATTENUATION



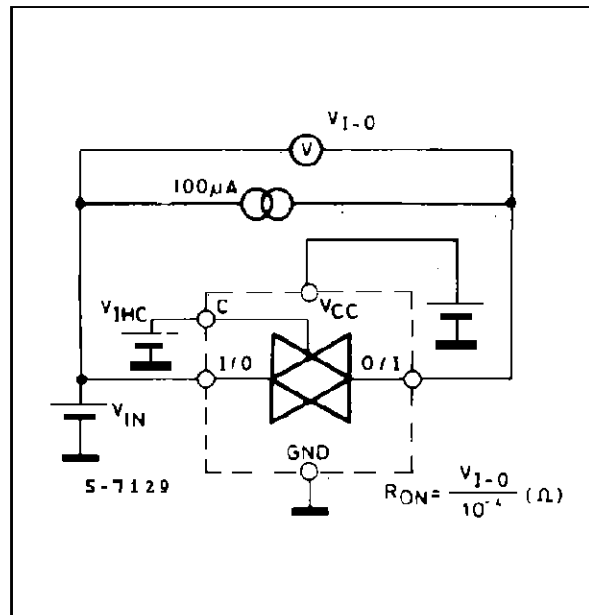
CROSSTALK BETWEEN ANY TWO SWITCHES

 C_{I-O} , $C_{I/O}$ C_{I-O} , $C_{I/O}$ 

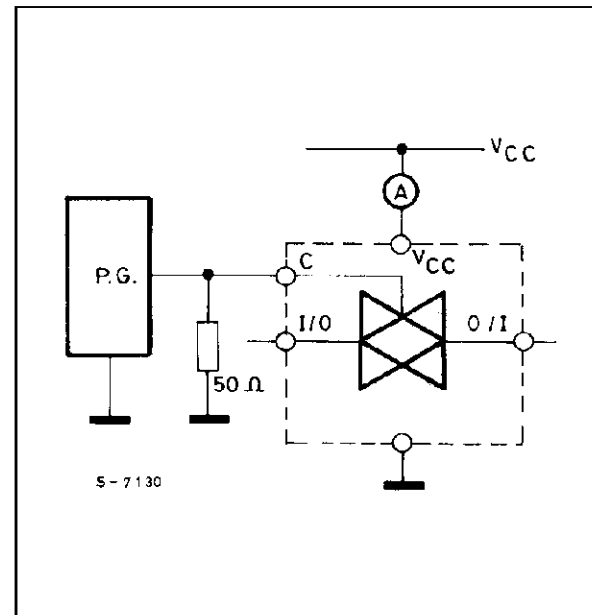
SWITCHING CHARACTERISTICS TEST WAVEFORM



CHANNEL RESISTANCE (R_{ON})

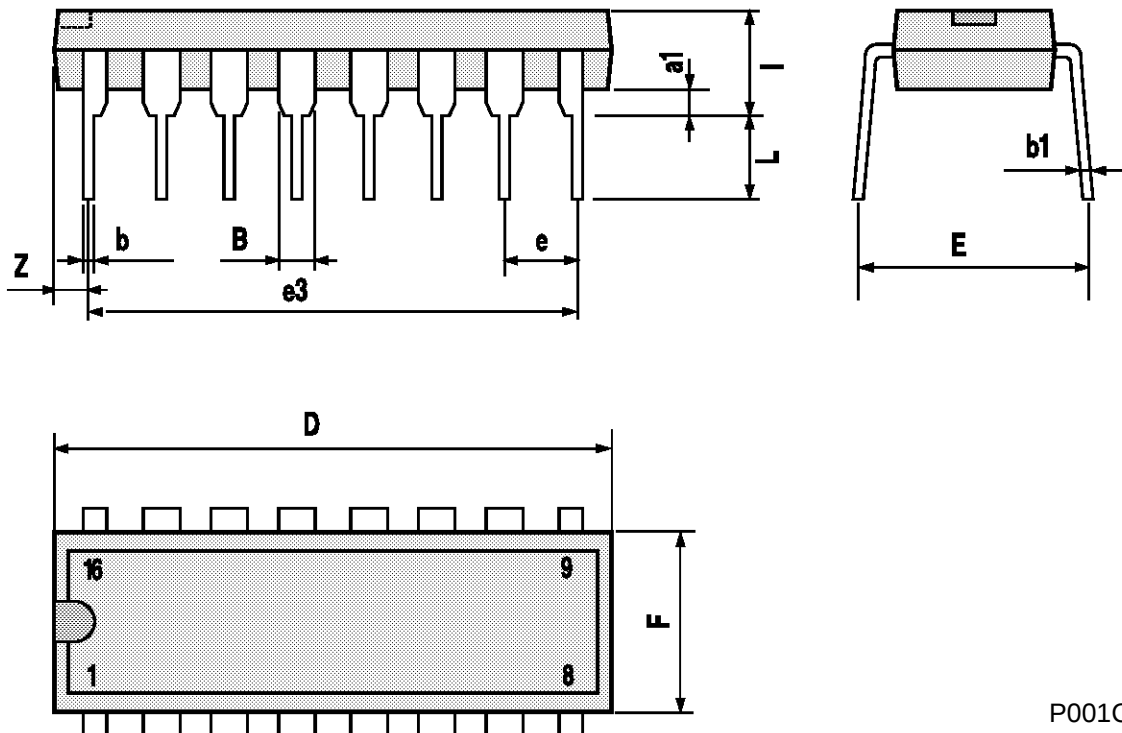


I_{CC} (Opr.)



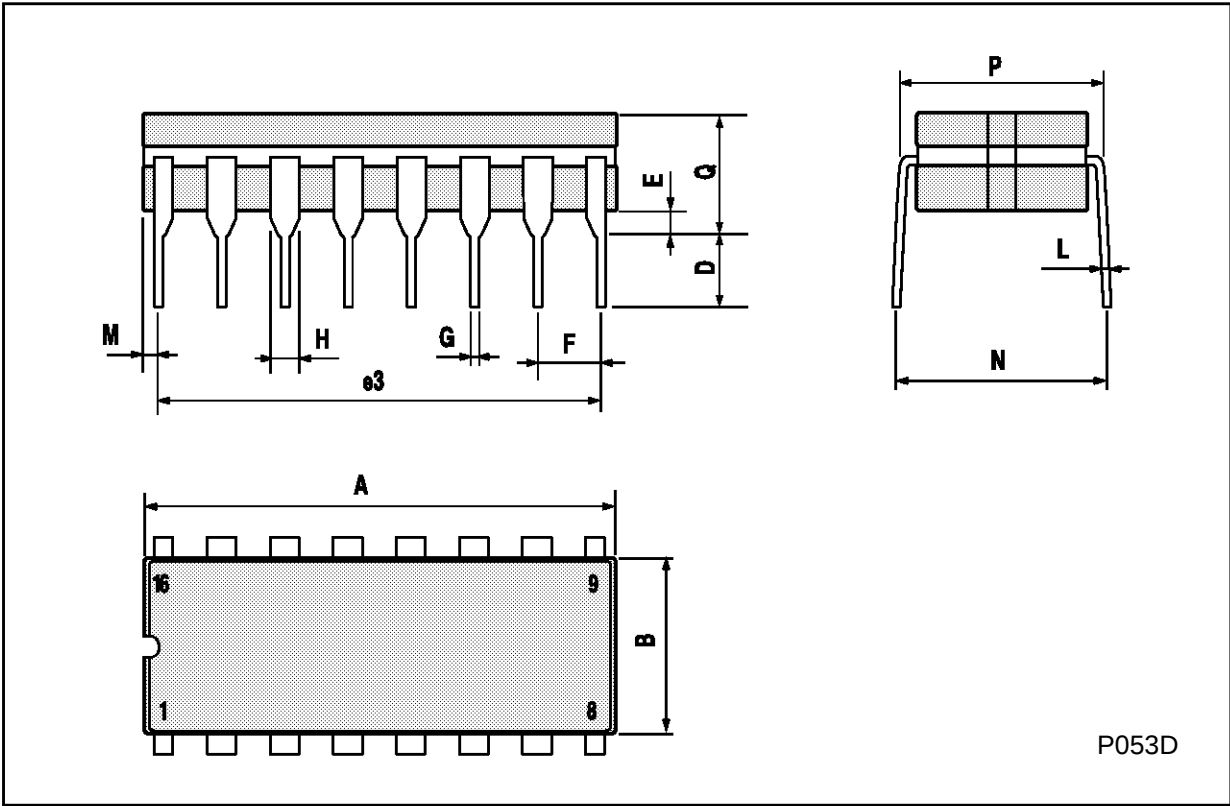
Plastic DIP16 (0.25) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



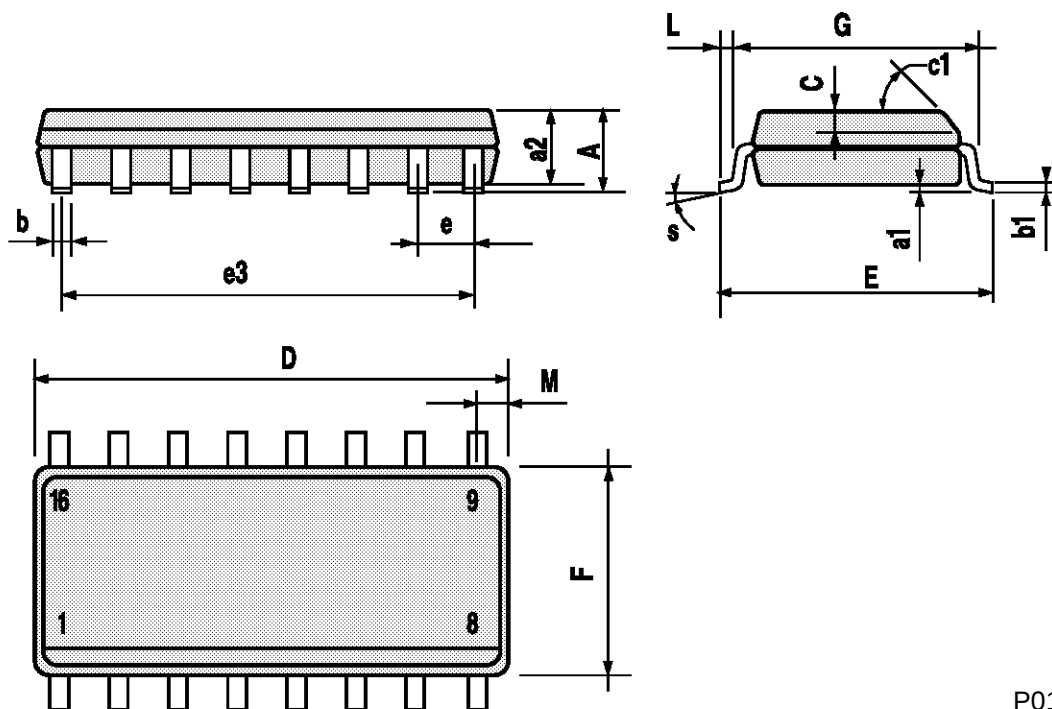
Ceramic DIP16/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



SO16 (Narrow) MECHANICAL DATA

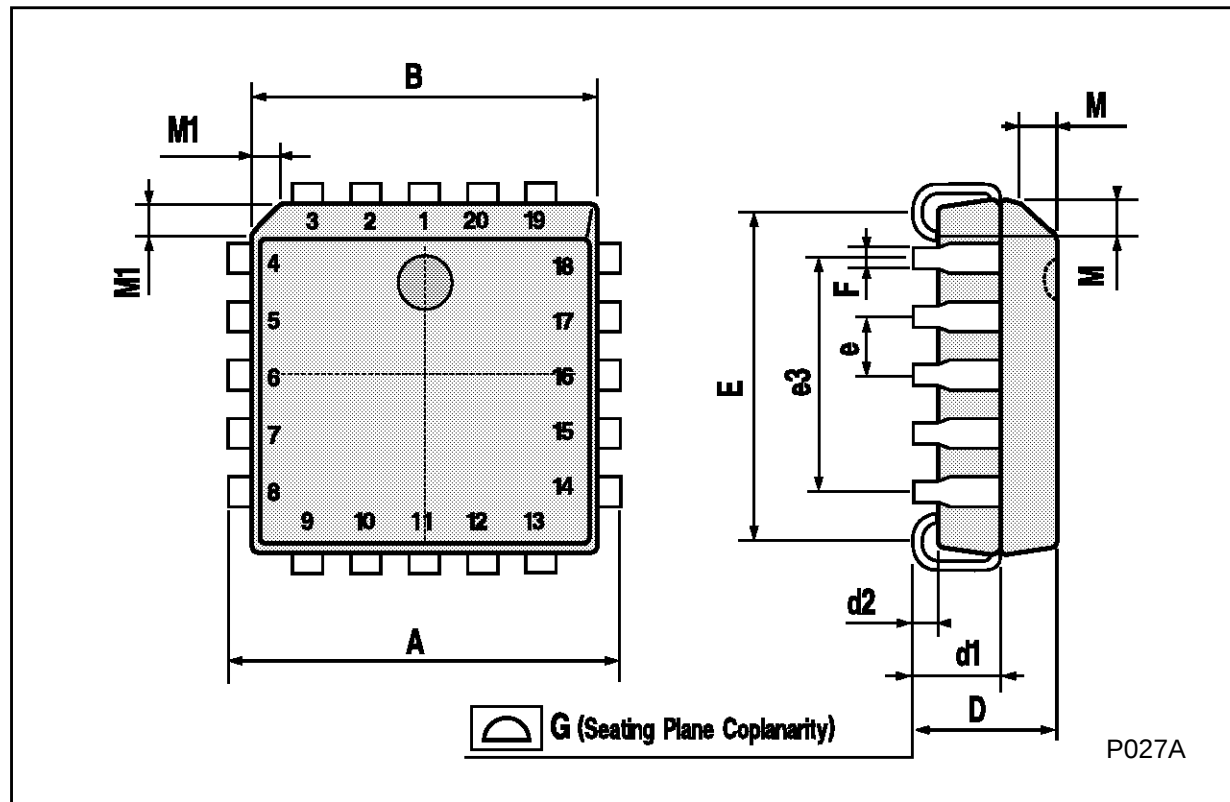
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



P013H

PLCC20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	



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