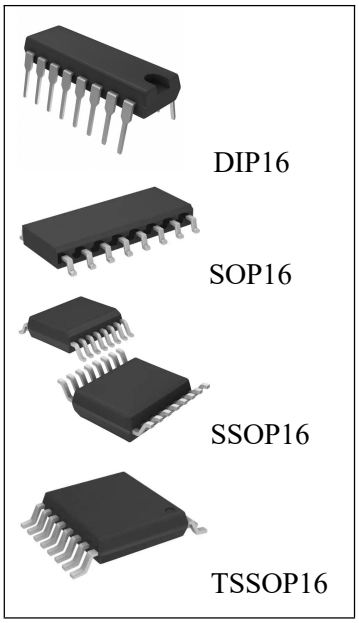
74HC4052

Dual 4-channel Analog Multiplexer/Demultiplexer



General Description：

The 74HC4052 is dual 4-channel analog multiplexers/demultiplexers with common select logic. Each multiplexer has four independent inputs/outputs (nY0 to nY3) and a common input/output (nZ). The common channel select logics include two digital select inputs (S0 and S1) and an active LOW enable input (E). With E LOW, one of the four switches is selected (low impedance ON-state) by S0 and S1. With E HIGH, all switches are in the high impedance OFF-state, independent of S0 and S1. Vcc and GND are the supply voltage pins for the digital control inputs (S0 and S1, and E). The analog inputs/outputs (nY0 to nY3, and nZ) can swing between Vcc as a positive limit and V EE as a negative limit. Vcc - V_{EE} may not exceed 10.0V. For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND (typically ground)

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Package Information

Part NO.	Order NO	Package Description	Package Marking	Package Option
74HC4052	74HC4052	DIP16	CHMC SXXXX 74HC4052	25/Tube
74HC4052	74HC4052F	SOP16	CHMC SXXXX 74HC4052	50/Tube 4000/Reel
74HC4052D	74HC4052D	SSOP16	CHMC 74HC4052D SXXXX	50/Tube 4000/Reel
74HC4052T	74HC4052T	TSSOP16	CHMC 74HC4052T SXXXX	96/Tube 3000/Reel

CHMC:Trademark 74HC4052/74HC4052D/74HC4052T:Part NO. SXXXX:Lot NO.

Features

- Wide analog input voltage range: ± 5 V.
- Low "ON" resistance: 80 Ω (typ.) at Vcc - V_{EE} = 4.5 V
  70 Ω (typ.) at Vcc - V_{EE} = 6.0 V 60 Ω (typ.) at Vcc - V_{EE} = 9.0 V
- Logic level translation: to enable 5 V logic to communicate with ± 5 V analog signals
- Typical "break before make" built in
- Output capability: non-standard
- Icc category: MSI

Applications

- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating

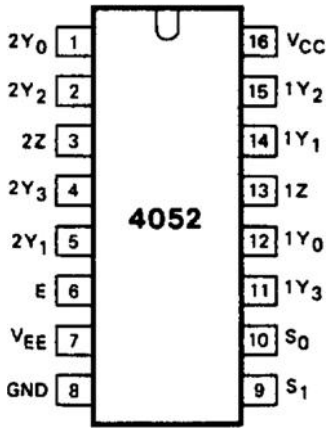


Fig.1 Pin configuration

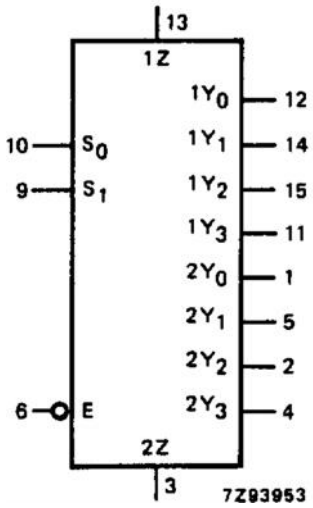


Fig.2 Logic symbol

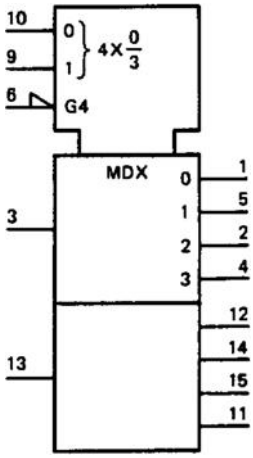


Fig.3 IEC logic symbol

Pin Description

Pin No.	Symbol	Descriptions
1,5,2,4	2Y0 to 2Y3	Independent inputs/outputs
6	E	Enable input (active low)
7	V_{EE}	Negative supply voltage
8	GND	Ground (0 V)
10 , 9	S 0 , S 1	Select inputs
12,14,15 , 11	1Y0 to 1Y3	Independent inputs/outputs
13 , 3	1 Z, 2 Z	Common inputs/ outputs
16	Vcc	Positive supply voltage

Function Table

Inputs			Channel On
E	S1	S0	
L	L	L	n Y 0 - n Z
L	L	H	nY1-nZ
L	H	L	n Y 2 - n Z
L	H	H	n Y 3 - n Z
H	X	X	none

H=HIGH voltage level

L=LOW voltage level X=don’t care

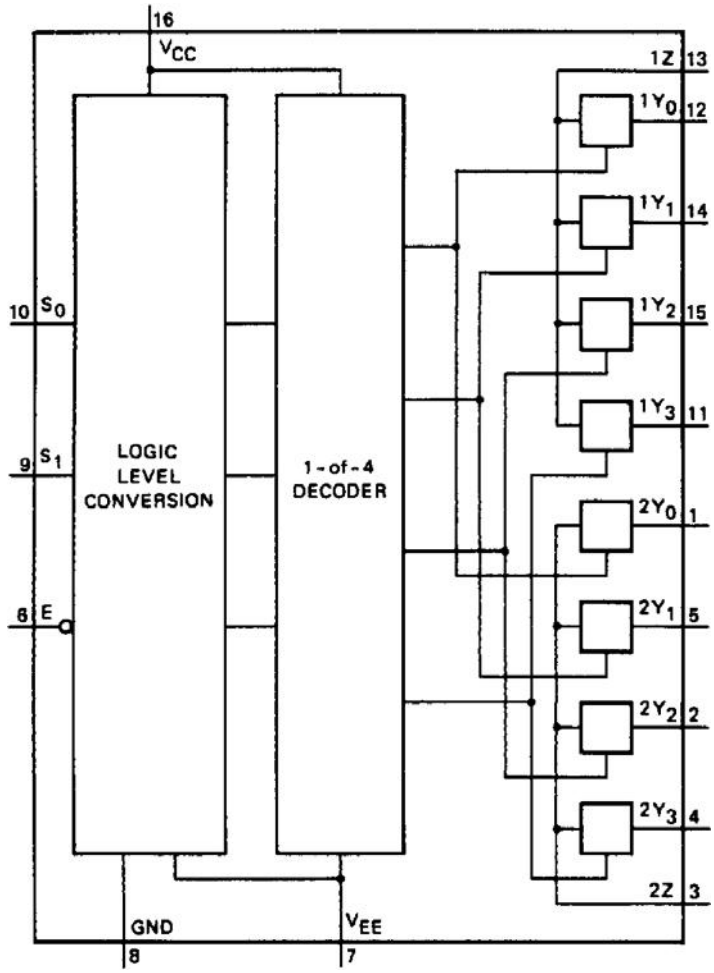


Fig.4 Functional diagram

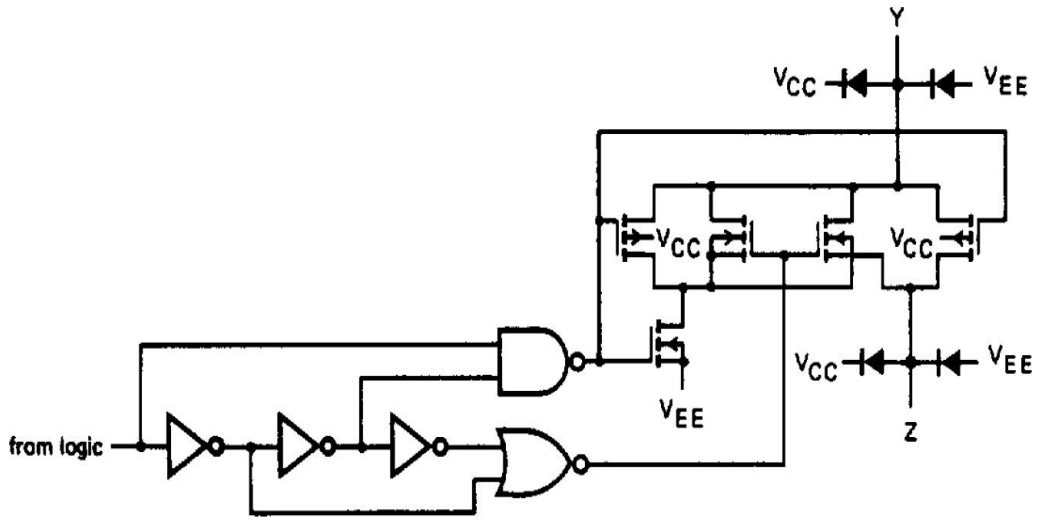


Fig.5 Schematic diagram (one switch)

Absolute Maximum Ratings (IEC134)

Vltages are referenced to V_{EE} =GND (ground=0V)

Characteristic		Conditions	Min.	Max.	Unit
DC supply voltage			-0.5	+11	V
DC digital input diode current		For V_I <-0.5V or V_I >Vcc+0.5V		20	mA
DC switch diode current		For V_S <-0.5V or V_S >Vcc+0.5V		20	mA
DC switch current		For –0.5V< V_S <Vcc+0.5V		25	mA
DC VEE current				20	mA
DC Vcc or GND current				50	mA
Storage temperature range			-65	+150	°C
Power dissipation	DIP16	Above +70°C:derate linearly with 12 mW/K		750	mW
	SOP16	Above +70°C:derate linearly with 8 mW/K		500	
	TSSOP16/ SSOP16	Above +70°C:derate linearly with 5 mW/K		350	
Power dissipation per switch				100	mW

* To avoid drawing Vcc current out of terminals nZ, when switch current flows in terminals nYn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminals nZ, no Vcc current will flow out of terminals nYn. In this case there is no limit for the voltage drop across the switch, but the voltages at nYn and nZ may not exceed Vcc or V_{EE}.

Recommended Operating Conditions

Characteristic	Symbol	Conditions	Min.	Typ.	Max.	Unit
DC supply voltage Vcc-GND	Vcc	See fig.6 and fig.7	2.0	5.0	10.0	V
DC supply voltage Vcc-V_{EE}	Vcc	See fig.6 and fig.7	2.0	5.0	10.0	V
DC input voltage range	V_I		GND		Vcc	V
DC switch voltage range	V_S		V_{EE}		Vcc	V
Operating ambient temperature range	Tamb	See DC and AC characteristics	-40		+85	°C
			-40		+125	
Input rise and fall times	tr,tf	Vcc=2.0V Vcc=4.5V Vcc=6.0V Vcc=10.0V		6.0	1000 500 400 250	ns

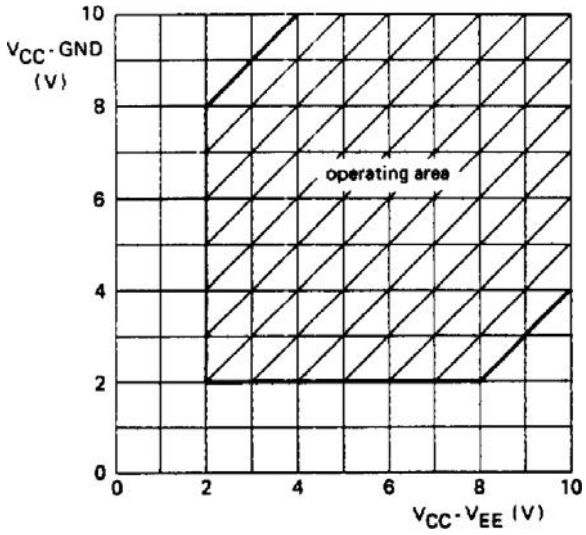


Fig.6 Guaranteed operating area as a function Of the supply voltage for 74HC4052

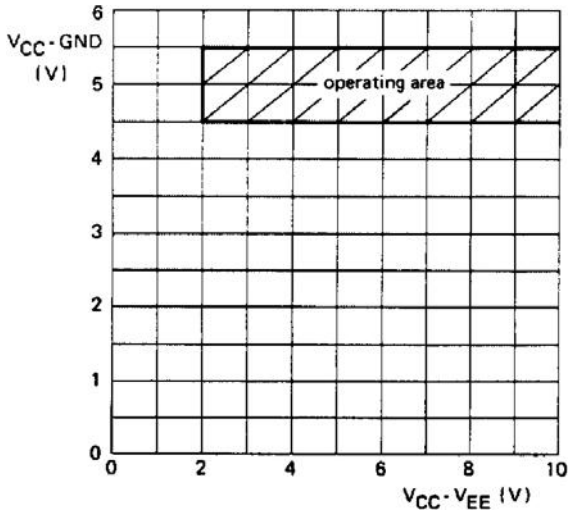


Fig.7 Guaranteed operating area as a function of the supply voltages for 74HC4052

DC Electrical Characteristics

(unless otherwise specified: Vcc-GND or Vcc-V_{EE} =2.0,4.5,6.0 and 9.0V,Ta=25 °C)

Characteristics	Symbol	Test conditions					Typ	Max	Unit
		Vcc (V)	V_{EE} (V)	I_S (μA)	Vis	V_I			
ON resistance (peak)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	Vcc To V_{EE}	V_{IH} Or V_{IL}	100 90 70	180 160 130	Ω
ON resistance (rail)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	V_{EE}	V_{IH} Or V_{IL}	150 80 70 60	140 120 105	Ω
ON resistance (rail)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	Vcc	V_{IH} Or V_{IL}	150 90 80 65	160 140 120	Ω
Maximum ΔON resistance between any two channels	ΔR_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5		Vcc To V_{EE}	V_{IH} Or V_{IL}	9 8 6		Ω

(unless otherwise specified: Vcc-GND or Vcc-V_{EE} =2.0,4.5,6.0 and 9.0V,Ta=-40 to +85 °C)

Characteristics	Symbol	Test conditions					Typ	Max	Unit
		Vcc (V)	V_{EE} (V)	I_S (μA)	Vis	V_I			
ON resistance (peak)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	Vcc To V_{EE}	V_{IH} Or V_{IL}		225 200 165	Ω
ON resistance (rail)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	V_{EE}	V_{IH} Or V_{IL}		175 150 130	Ω
ON resistance (rail)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	Vcc	V_{IH} Or V_{IL}		200 175 150	Ω
Maximum ΔON resistance between any two channels	ΔR_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5		Vcc To V_{EE}	V_{IH} Or V_{IL}			Ω

(unless otherwise specified: Vcc-GND or Vcc-V_{EE} =2.0,4.5,6.0 and 9.0V,Ta=-40 to + 125° C)

Characteristics	Symbol	Test conditions					Typ	Max	Unit
		Vcc (V)	V_{EE} (V)	I_S (μA)	Vis	V_I			
ON resistance (peak)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	Vcc To V_{EE}	V_{IH} Or V_{IL}		270 240 195	Ω
ON resistance (rail)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	V_{EE}	V_{IH} Or V_{IL}		210 180 160	Ω
ON resistance (rail)	R_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5	100 1000 1000 1000	Vcc	V_{IH} Or V_{IL}		240 210 180	Ω
Maximum ΔON resistance between any two channels	ΔR_{ON}	2.0 4.5 6.0 4.5	0 0 0 -4.5		Vcc To V_{EE}	V_{IH} Or V_{IL}			Ω

* 1. At supply voltages (Vcc- V_{EE}) approaching 2.0 V the Analog switch ON-resistance becomes extremely non-linear. There it is recommended that these devices be used to transmit digital signals only, when using these supply voltages

* 2. For test circuit measuring RON see Fig.8

DC Electrical Characteristics

(Voltages are referenced to GND ground=0V)

Characteristic s	Sym bol	Test conditions				+25 °C			-40 to +85		-40 to +125		Unit
		Vcc (V)	V_{EE} (V)	V_I	Other	i	yp	a			Mi	a	
High level input voltage	V_{IH}	2.0 4.5 6.0 9.0				1.5 3.15 4.2 6.3	1.2 2.4 3.2 4.7		1.5 3.15 4.2 6.3		1.5 3.15 4.2 6.3		V
Low level input voltage	V_{IL}	2.0 4.5 6.0 9.0					0.8 2.1 2.8 4.3	0.5 1.35 1.8 2.7		0.5 1.35 1.8 2.7		0.5 1.35 1.8 2.7	V
Input leakage current	$\pm I_I$	6.0 10.0	0 0	Vcc Or GND				0.1 0.2		1.0 2.0		1.0 2.0	μA
Analog switch OFF-state current per channel	$\pm I_S$	10.0	0	V_{IH} Or V_{IL}	$\lvert Vs \rvert$ = Vcc-V_{EE} Fig.10			0.1		1.0		1.0	μA
Analog switch OFF-state current all channels	$\pm I_S$	10.0	0	V_{IH} Or V_{IL}	$\lvert Vs \rvert$ = Vcc-V_{EE} Fig.10			0.2		2.0		2.0	μA
Analog switch ON-state current	$\pm I_S$	10.0	0	V_{IH} Or V_{IL}	$\lvert Vs \rvert$ = Vcc-V_{EE} Fig.11			0.2		2.0		2.0	μA
Quiescent supply current	Icc	6.0 10.0	0 0	Vcc Or GND	Vis= V_{EE} or Vcc Vos=Vcc or V_{EE}			8.0 16.0		80 160		160 320	μA

AC Characteristics: GND=0V; tr=tf=6ns; C_L =50pF

Characteristics	Sym bol	Test conditions			+25 °C			-40 to +85		-40 to +125		Unit
		Vcc (V)	V_{EE} (V)	Other	i	yp	a			Mi	a	
Propagation delay Vis to Vos	t_{PHL} / t_{PLH}	2.0 4.5 6.0 4.5	0 0 0 -4.5	R_L = ∞, C_L =50pF See fig.15		14 5 4 4	60 12 10 8		75 15 13 10		90 18 15 12	ns
Turn “ON” time E to Vos Sn to Vos	t_{PZH} / t_{PZL}	2.0 4.5 6.0 4.5	0 0 0 -4.5	R_L = ∞, C_L =50pF See f ig. 16,17,18		105 38 30 26	325 65 55 46		405 81 69 58		490 98 83 69	ns
Turn “OFF” t ime E to Vos Sn to Vos	t_{PHZ} / t_{PLZ}	2.0 4.5 6.0 4.5	0 0 0 -4.5	R_L =1k Ω, C_L =50pF See f ig. 16,17,18		74 27 22 22	250 50 43 38		315 63 54 48		375 75 64 57	ns

Additional AC Characteristics

Recommended conditions and typical values GND=0 V,Tamb=25 °C

Characteristics	Symbol	Test conditions				Typ.	Unit
		Vcc (V)	V_{EE} (V)	Vis (V)	Other		
Sine-wave distortion f=1kHz		2.25 4.5	-2.25 -4.5	4.0 8.0	R_L=10kΩ, C_L=50pF See fig.11	0.04 0.02	%
Sine-wave distortion f=10kHz		2.25 4.5	-2.25 -4.5	4.0 8.0	R_L=10kΩ, C_L=50pF See fig.11	0.12 0.06	%
Switch "OFF" signal feed-through		2.25 4.5	-2.25 -4.5	*1	R_L=600Ω, C_L=50pF f=1MHz See fig.9,12	-50 -50	dB
Crosstalk between any two switches/multiplexers		2.25 4.5	-2.25 -4.5	*1	R_L=600Ω, C_L=50pF f=1MHz See fig.13	-60 -60	dB
Crosstalk voltage between control and any switch (peak-to-peak value)	V(p-p)	4.5 4.5	0 -4.5		R_L=600Ω, C_L=50pF f=1MHz(E or Sn,square-wave between Vcc and GND, tr=tf=6ns) see fig.14	110 220	mV
Minimum frequency response (-3dB)	fmax	2.25 4.5	-2.25 -4.5	*2	R_L=50Ω, C_L=50pF See fig.10,11	170 180	MHz
Maximum switch capacitance independent (Y) common(Z)	Cs					5 12	pF

* Vis is the input voltage at an nYn or nZ terminal, whichever is assigned as an input

Vos is the output voltage at an nYn or nZ terminal, whichever is assigned as an output

*1. Adjust input voltage Vis to 0 dBm level (0 dBm = 1 mW into 600 Ω).

*2. Adjust input voltage Vis to 0 dBm level at V_{OS} for 1 MHz (0 dBm = 1 mW into 50Ω).

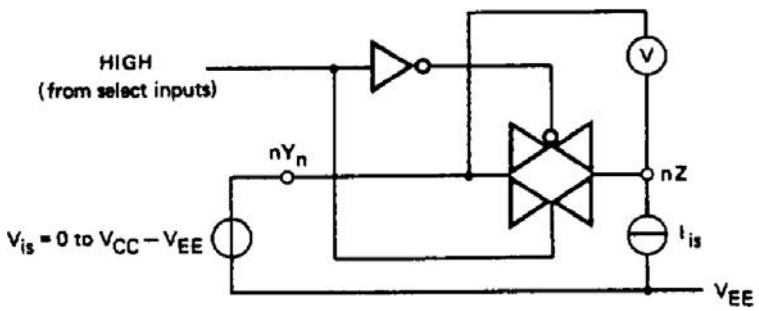


Fig. 8 Test circuit for measuring R_{ON}

Test conditions:
V_{CC} = 4.5 V; GND = 0 V; V_{EE} = –4.5 V;
R_L = 50 Ω; R_{source} = 1 kΩ.

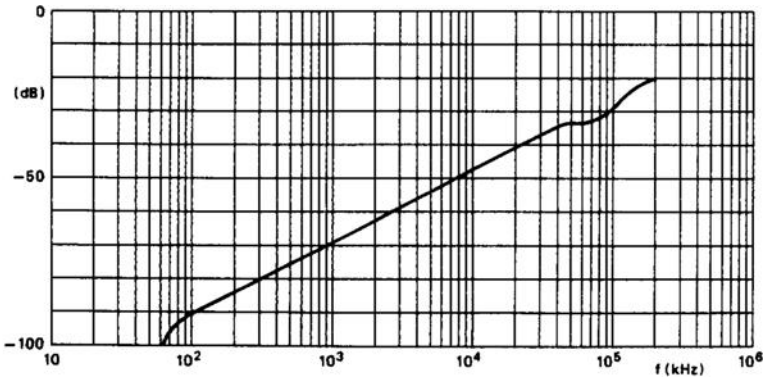


Fig.9 Typical switch " OFF" signal feed-through as a function of frequency

Test conditions:
V_{CC} = 4.5 V; GND = 0 V; V_{EE} = –4.5 V;
R_L = 50 Ω; R_{source} = 1 kΩ.

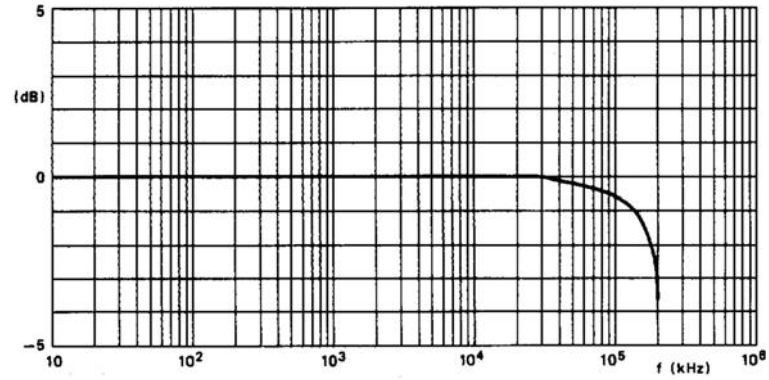


Fig.10 Typical frequency response

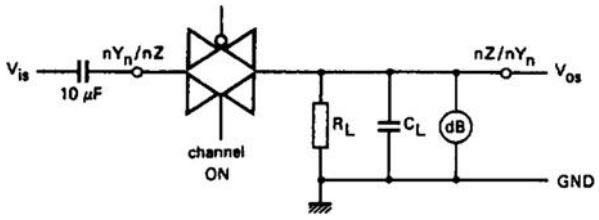


Fig.11 Test circuit for measuring sine-wave Distortion and minimum frequency response

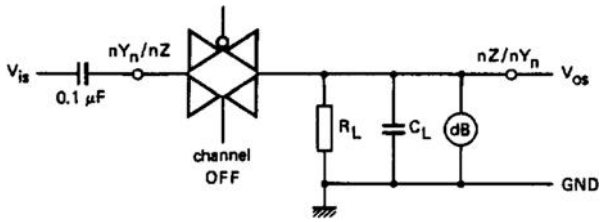


Fig.12 Test circuit for measuring switch " OFF" signal feed-through

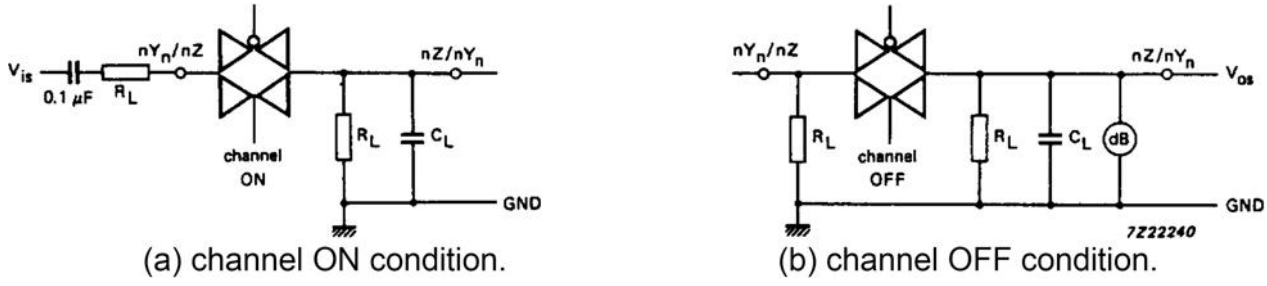


Fig.13 Test circuits for measuring crosstalk between any two switches/multiplexers

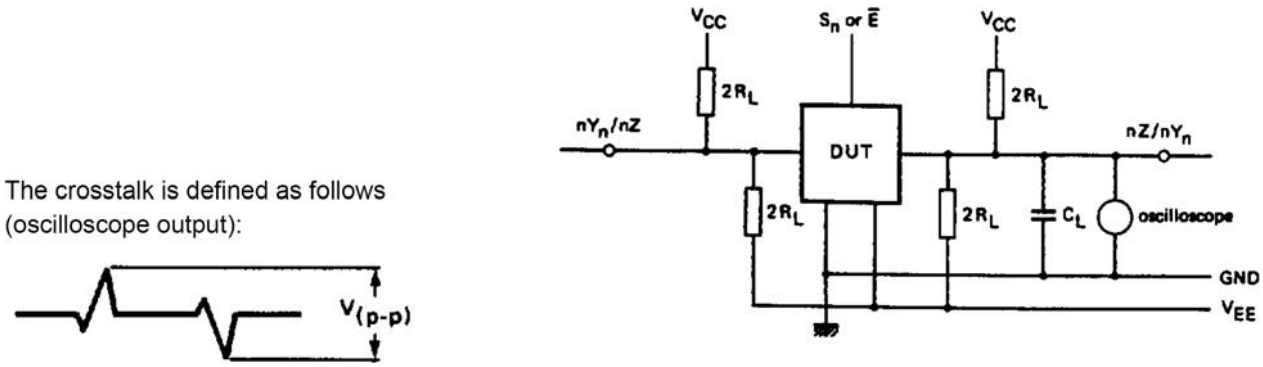


Fig.14 Test circuit for measuring crosstalk between control and any switch

AC WAVEFORMS

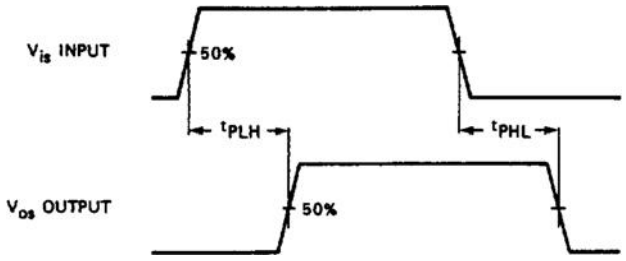
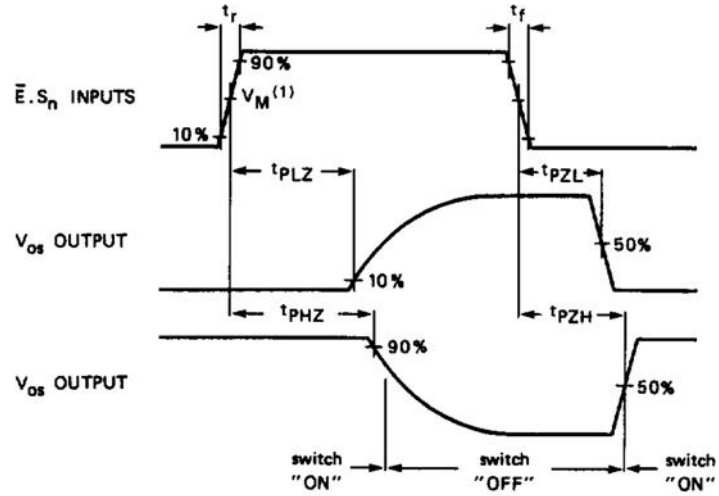


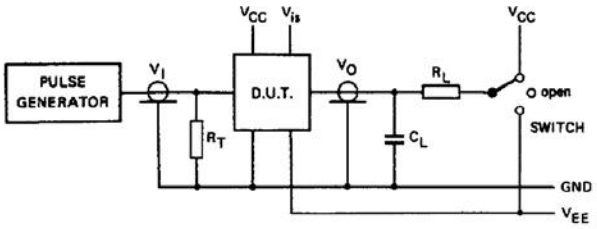
Fig.15 Waveforms showing the input(Vis) to output(Vos) propagation delays



(1) HC : V_M = 50%; V_I = GND to V_{CC}.
HCT: V_M = 1.3 V; V_I = GND to 3V.

Fig.16 Waveforms showing the turn-ON and turn-OFF times

Test Circuit And Waveforms



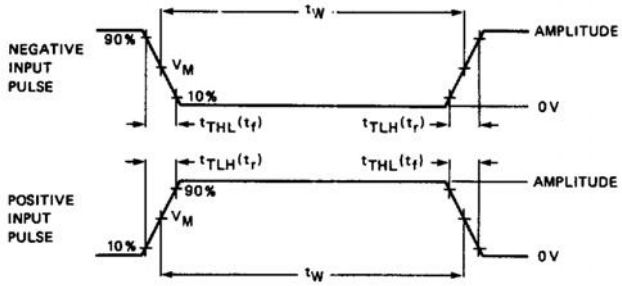
Conditions

TEST	SWITCH	V_{is}
t_{PZH}	V_{EE}	V_{CC}
t_{PZL}	V_{CC}	V_{EE}
t_{PHZ}	V_{EE}	V_{CC}
t_{PLZ}	V_{CC}	V_{EE}
others	open	pulse

AMPLITUDE	V_M	t_r; t_f	
		f_{max}; PULSE WIDTH	OTHER
V_{CC}	50%	< 2 ns	6 ns

C_L = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).
R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.
$t_r = t_f$ = 6 ns; when measuring f_{max}, there is no constraint to t_r, t_f with 50% duty factor.

Fig.17 Test circuit for measuring AC performance



Conditions

TEST	SWITCH	V_{is}
t_{PZH}	V_{EE}	V_{CC}
t_{PZL}	V_{CC}	V_{EE}
t_{PHZ}	V_{EE}	V_{CC}
t_{PLZ}	V_{CC}	V_{EE}
others	open	pulse

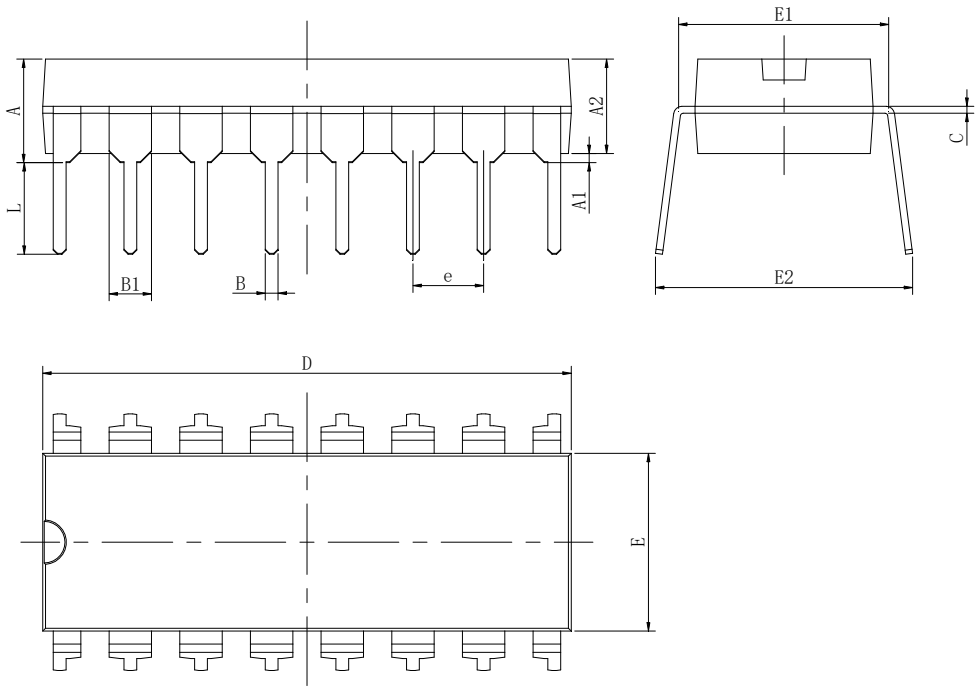
AMPLITUDE	V_M	t_r; t_f	
		f_{max}; PULSE WIDTH	OTHER
V_{CC}	50%	< 2 ns	6 ns

C_L = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).
R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.
$t_r = t_f$ = 6 ns; when measuring f_{max}, there is no constraint to t_r, t_f with 50% duty factor.

Fig.18 Input pulse definitions

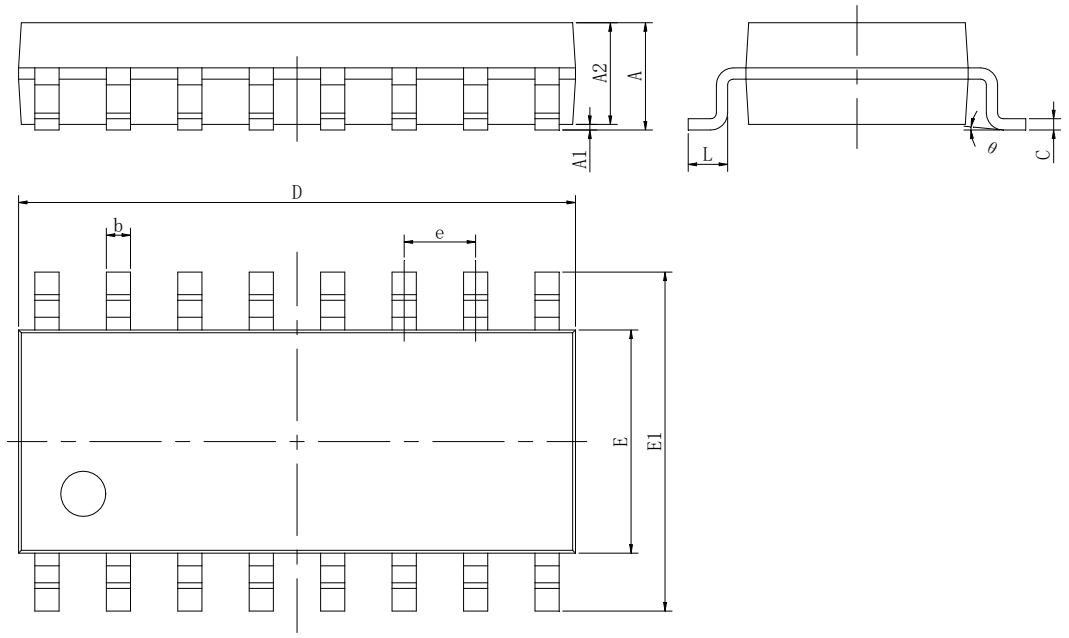
Outline Dimensions

DIP16 Unit: mm



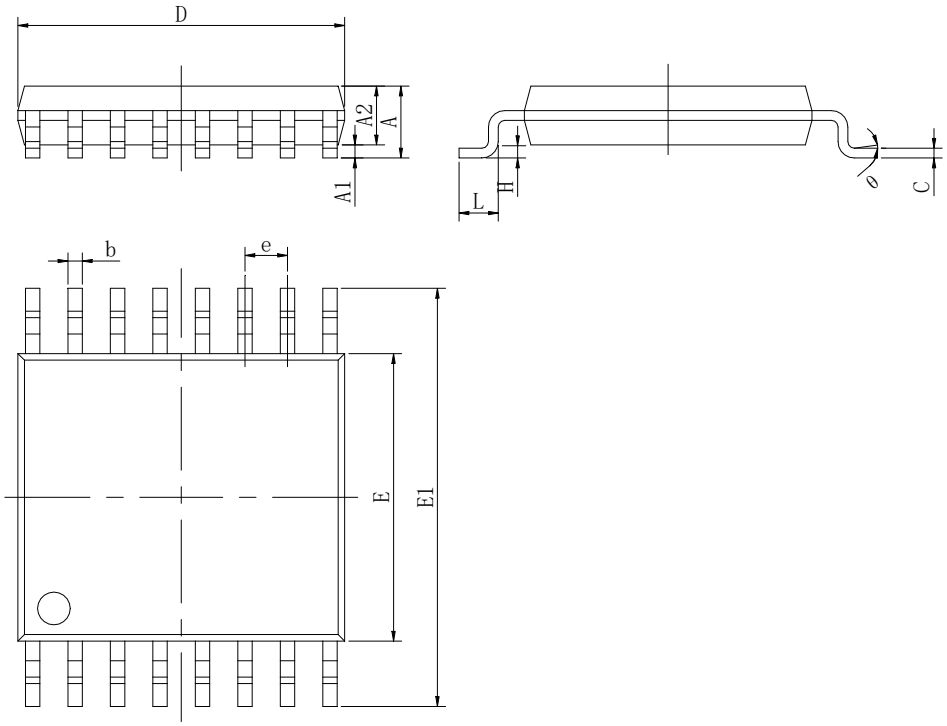
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524(BSC)		0.060(BSC)	
C	0.204	0.360	0.008	0.014
D	18.800	19.200	0.740	0.756
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540(BSC)		0.100(BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

SOP16 Unit: mm



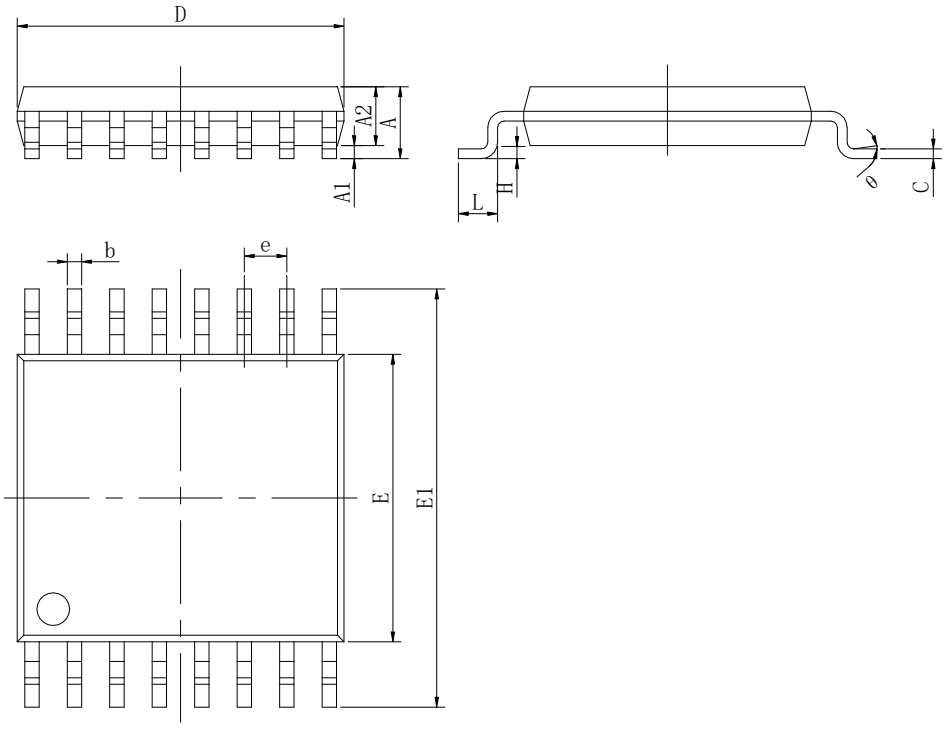
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)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

TSSOP16 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65（BSC）		0.026(BSC)	
L	0.500	0.700	0.02	0.028
H	0.25(TYP)		0.01(T YP)	
θ	1°	7°	1°	7°

SSOP16 Unit:mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	4.800	5.000	0.188	0.196
E	3.800	4.000	0.149	0.157
b	0.230	0.310	0.009	0.012
c	0.200	0.240	0.007	0.010
E1	5.800	6.200	0.228	0.244
A		1.750		0.069
A2	1.300	1.500	0.051	0.059
A1	0.100	0.225	0.003	0.009
e	0.635（BSC）		0.025(BSC)	
L	0.750	1.050	0.019	0.031
H	0.25(TYP)		0.01(T YP)	
θ	0°	8°	0°	8°

Statements

- Silicore Technology reserves the right to make changes without further notice to any products or specifications herein. Before customers place an order, customers need to confirm whether datasheet obtained is the latest version, and to verify the integrity of the relevant information.

- Failure or malfunction of any semiconductor products may occur under particular conditions, customers shall have obligation to comply with safety standards when customers use Silicore Technology products to do their system design and machine manufacturing, and take corresponding safety measures in order to avoid potential risk of failure that may cause personal injury or property damage.

- The product upgrades without end, Silicore Technology will wholeheartedly provide customers integrated circuits that have better performance and better quality.