

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT4067**

### 16-channel analog multiplexer/demultiplexer

Product specification  
File under Integrated Circuits, IC06

September 1993

## 16-channel analog multiplexer/demultiplexer

**74HC/HCT4067**

### FEATURES

- Low "ON" resistance:  
 80 Ω (typ.) at V<sub>CC</sub> = 4.5 V  
 70 Ω (typ.) at V<sub>CC</sub> = 6.0 V  
 60 Ω (typ.) at V<sub>CC</sub> = 9.0 V  
 typical "break before make" built-in
- Output capability: non-standard
- I<sub>CC</sub> category: MSI

### GENERAL DESCRIPTION

The 74HC/HCT4067 are high-speed Si-gate CMOS devices and are pin compatible with the "4067" of the "4000B" series. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4067 are 16-channel analog multiplexers/demultiplexers with four address inputs (S<sub>0</sub> to S<sub>3</sub>), an active LOW enable input (Ē), sixteen independent inputs/outputs (Y<sub>0</sub> to Y<sub>15</sub>) and a common input/output (Z). The "4067" contains sixteen bidirectional analog switches, each with one side connected to an independent input/output (Y<sub>0</sub> to Y<sub>15</sub>) and the other side connected to a common input/output (Z). With Ē LOW, one of the sixteen switches is selected (low impedance ON-state) by S<sub>0</sub> to S<sub>3</sub>. All unselected switches are in the high impedance OFF-state. With Ē HIGH, all switches are in the high impedance OFF-state, independent of S<sub>0</sub> to S<sub>3</sub>.

The analog inputs/outputs (Y<sub>0</sub> to Y<sub>15</sub>, and Z) can swing between V<sub>CC</sub> as a positive limit and GND as a negative limit. V<sub>CC</sub> to GND may not exceed 10 V.

### QUICK REFERENCE DATA

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t <sub>PZL</sub> / t <sub>PZH</sub>	turn-on time Ē to V <sub>os</sub> S <sub>n</sub> to V <sub>os</sub>	C <sub>L</sub> = 15 pF; R <sub>L</sub> = 1 kΩ; V <sub>CC</sub> = 5 V	26	32	ns
			29	33	ns
t <sub>PLZ</sub> / t <sub>PHZ</sub>	turn-off time Ē to V <sub>os</sub> S <sub>n</sub> to V <sub>os</sub>		27	26	ns
			29	30	ns
C <sub>I</sub>	input capacitance		3.5	3.5	pF
C <sub>PD</sub>	power dissipation capacitance per switch	notes 1 and 2	29	29	pF
C <sub>S</sub>	max. switch capacitance independent (Y)		5	5	pF
	common (Z)		45	45	pF

### Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum \{ (C_L + C_S) \times V_{CC}^2 \times f_o \} \text{ where:}$$

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

$$\sum \{ (C_L + C_S) \times V_{CC}^2 \times f_o \} = \text{sum of outputs}$$

C<sub>L</sub> = output load capacitance in pF

C<sub>S</sub> = max. switch capacitance in pF

V<sub>CC</sub> = supply voltage in V

2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>  
For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> - 1.5 V

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## ORDERING INFORMATION

See "74HC/HCT/HCU/HCMOS Logic Package Information".

## PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1	Z	common input/output
9, 8, 7, 6, 5, 4, 3, 2, 23, 22, 21, 20, 19, 18, 17, 16 10, 11, 14, 13	$Y_0$ to $Y_{15}$	independent inputs/outputs
12	$S_0$ to $S_3$	address inputs
15	GND	ground (0 V)
24	$\bar{E}$	enable input (active LOW)
	$V_{CC}$	positive supply voltage

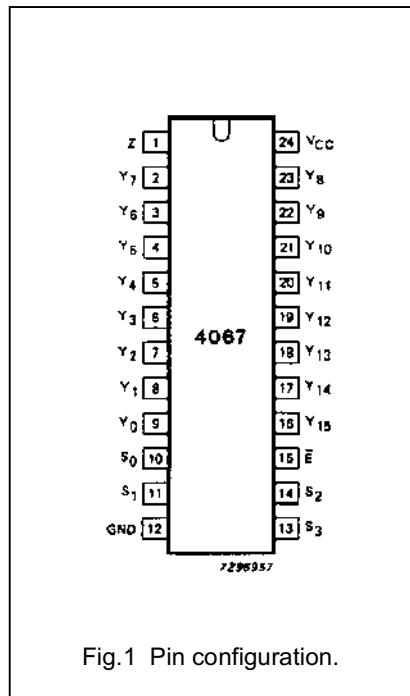


Fig.1 Pin configuration.

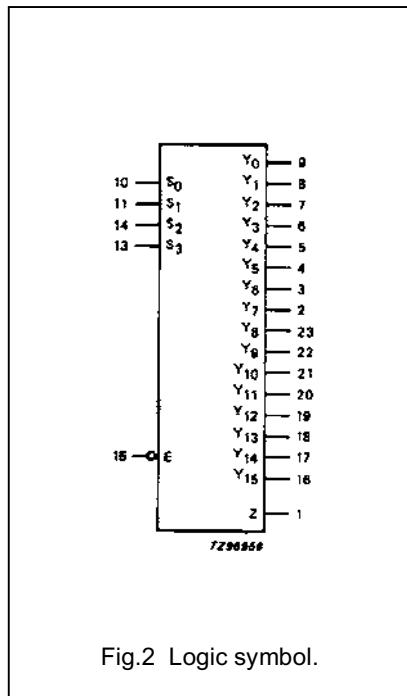


Fig.2 Logic symbol.

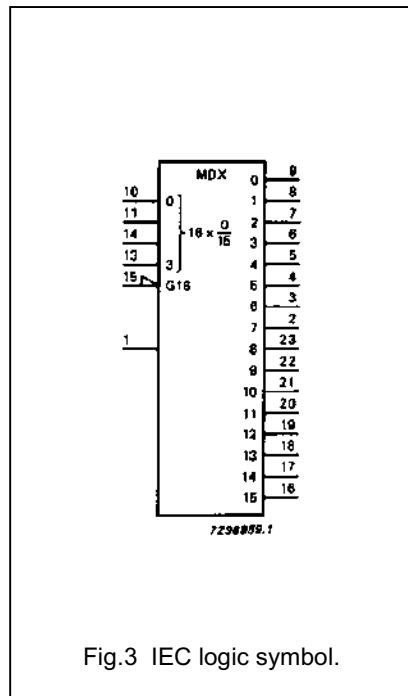


Fig.3 IEC logic symbol.

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### APPLICATIONS

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

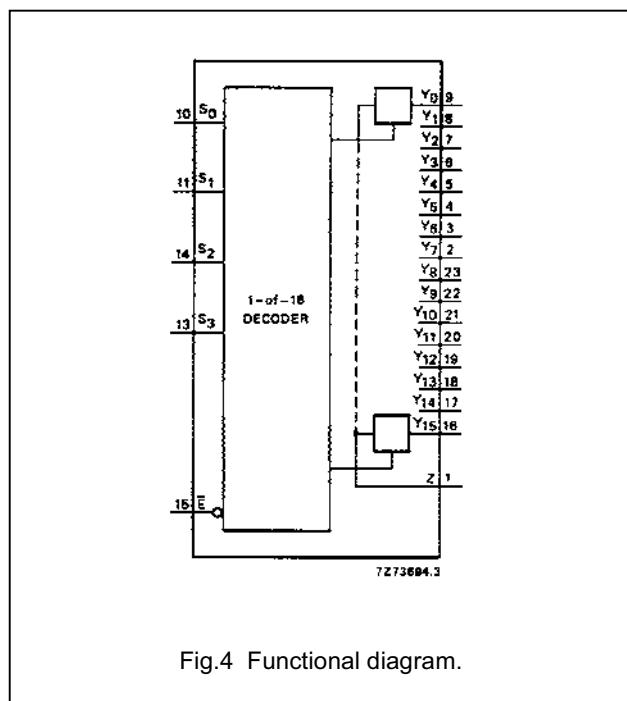


Fig.4 Functional diagram.

### FUNCTION TABLE

$\bar{E}$	INPUTS					CHANNEL ON
	$S_3$	$S_2$	$S_1$	$S_0$		
L	L	L	L	L	L	$Y_0 - Z$
L	L	L	L	H	H	$Y_1 - Z$
L	L	L	H	L	L	$Y_2 - Z$
L	L	L	H	H	H	$Y_3 - Z$
L	L	H	L	L	L	$Y_4 - Z$
L	L	H	L	H	H	$Y_5 - Z$
L	L	H	H	L	L	$Y_6 - Z$
L	L	H	H	H	H	$Y_7 - Z$
L	H	L	L	L	L	$Y_8 - Z$
L	H	L	L	H	H	$Y_9 - Z$
L	H	L	H	L	L	$Y_{10} - Z$
L	H	L	H	H	H	$Y_{11} - Z$
L	H	H	L	L	L	$Y_{12} - Z$
L	H	H	L	H	H	$Y_{13} - Z$
L	H	H	H	L	L	$Y_{14} - Z$
L	H	H	H	H	H	$Y_{15} - Z$
H	X	X	X	X	X	none

### Notes

1. H = HIGH voltage level  
L = LOW voltage level  
X = don't care

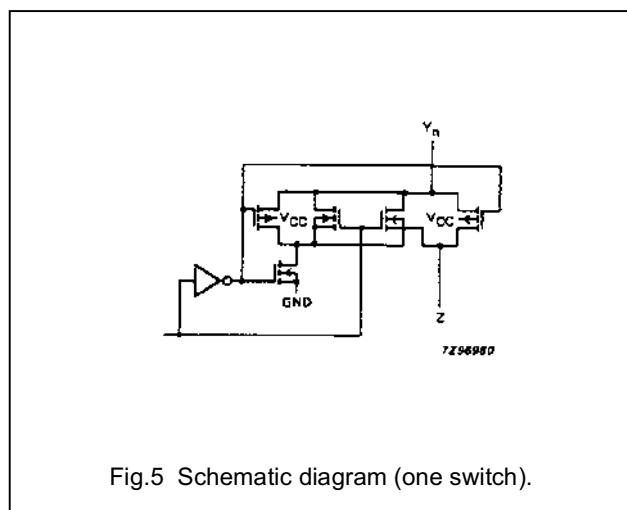


Fig.5 Schematic diagram (one switch).

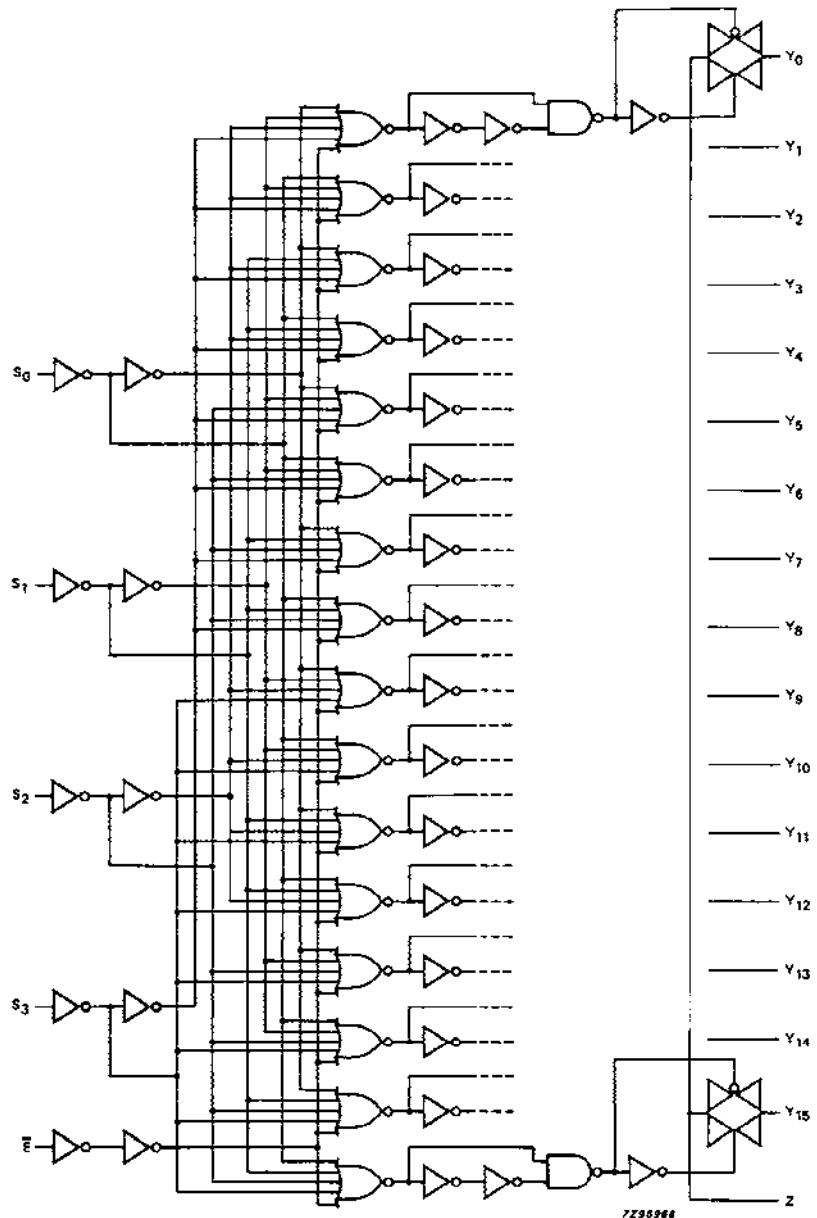
**16-channel analog  
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Fig.6 Logic diagram.

# 16-channel analog multiplexer/demultiplexer

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**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT	CONDITIONS
$V_{CC}$	DC supply voltage	-0.5	+11.0	V	
$\pm I_{IK}$	DC digital input diode current		20	mA	for $V_I < -0.5$ or $V_I > V_{CC} + 0.5$ V
$\pm I_{SK}$	DC switch diode current		20	mA	for $V_S < -0.5$ or $V_S > V_{CC} + 0.5$ V
$\pm I_S$	DC switch current		25	mA	for $-0.5$ V < $V_S$ < $V_{CC} + 0.5$ V
$\pm I_{CC}; \pm I_{GND}$	DC $V_{CC}$ or GND current		50	mA	
$T_{stg}$	storage temperature range	-65	+150	°C	
$P_{tot}$	power dissipation per package				for temperature range: -40 to +125 °C 74HC/HCT
	plastic DIL		750	mW	above +70 °C: derate linearly with 12 mW/K
$P_s$	plastic mini-pack (SO)		500	mW	above +70 °C: derate linearly with 8 mW/K
	power dissipation per switch		100	mW	

**Note**

1. To avoid drawing  $V_{CC}$  current out of terminal Z, when switch current flows in terminals  $Y_n$ , the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no  $V_{CC}$  current will flow out of terminals  $Y_n$ . In this case there is no limit for the voltage drop across the switch, but the voltages at  $Y_n$  and Z may not exceed  $V_{CC}$  or GND.

**RECOMMENDED OPERATING CONDITIONS**

SYMBOL	PARAMETER	74HC			74HCT			UNIT	CONDITIONS
		min.	typ.	max.	min.	typ.	max.		
$V_{CC}$	DC supply voltage	2.0	5.0	10.0	4.5	5.0	5.5	V	
$V_I$	DC input voltage range	GND		$V_{CC}$	GND		$V_{CC}$	V	
$V_S$	DC switch voltage range	GND		$V_{CC}$	GND		$V_{CC}$	V	
$T_{amb}$	operating ambient temperature range	-40		+85	-40		+85	°C	see DC and AC CHARACTERISTICS
$T_{amb}$	operating ambient temperature range	-40		+125	-40		+125	°C	
$t_r, t_f$	input rise and fall times		6.0	1000 500 400 250		6.0	500	ns	$V_{CC} = 2.0$ V $V_{CC} = 4.5$ V $V_{CC} = 6.0$ V $V_{CC} = 10.0$ V

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### DC CHARACTERISTICS FOR 74HC/HCT

For 74HC:  $V_{CC} - GND = 2.0, 4.5, 6.0 and 9.0 V$

For 74HCT:  $V_{CC} - GND = 4.5$  V

SYMBOL	PARAMETER	$T_{amb}$ ( $^{\circ}$ C)						UNIT	TEST CONDITIONS								
		74HC/HCT							V <sub>CC</sub> (V)	I <sub>S</sub> ( $\mu$ A)	V <sub>IS</sub>	V <sub>I</sub>					
		+25		-40 to +85		-40 to +125											
		min.	typ.	max.	min.	max.	min.										
R <sub>ON</sub>	ON-resistance (peak)	—	110	180	—	225	—	270	$\Omega$	2.0	100	$V_{CC}$ to GND	$V_{IH}$ or $V_{IL}$				
		95	160	—	200	—	240	$\Omega$	4.5	1000	—	—	—				
		75	130	—	165	—	195	$\Omega$	6.0	1000	—	—	—				
		—	—	—	—	—	—	$\Omega$	9.0	1000	—	—	—				
R <sub>ON</sub>	ON-resistance (rail)	150	—	—	—	—	—	$\Omega$	2.0	100	GND or $V_{CC}$	$V_{IH}$ or $V_{IL}$	$V_{IH}$ or $V_{IL}$				
		90	160	—	200	—	240	$\Omega$	4.5	1000	—	—	—				
		80	140	—	175	—	210	$\Omega$	6.0	1000	—	—	—				
		70	120	—	150	—	180	$\Omega$	9.0	1000	—	—	—				
$\Delta R_{ON}$	maximum variation of ON-resistance between any two channels	—	9	—	—	—	—	$\Omega$	2.0	—	$V_{CC}$ to GND	$V_{IH}$ or $V_{IL}$	$V_{IH}$ or $V_{IL}$				
		—	8	—	—	—	—	$\Omega$	4.5	—	—	—	—				
		—	6	—	—	—	—	$\Omega$	6.0	—	—	—	—				
		—	—	—	—	—	—	$\Omega$	9.0	—	—	—	—				

### Notes

- At supply voltages ( $V_{CC} - GND$ ) approaching 2 V, the analog switch ON-resistance becomes extremely non-linear. Therefore it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.
- For test circuit measuring  $R_{ON}$  see Fig.7.

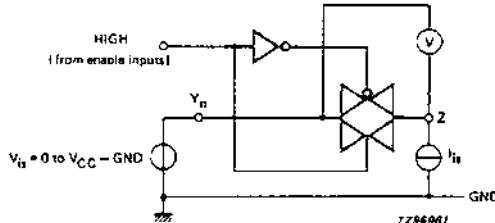


Fig.7 Test circuit for measuring ON-resistance ( $R_{ON}$ ).

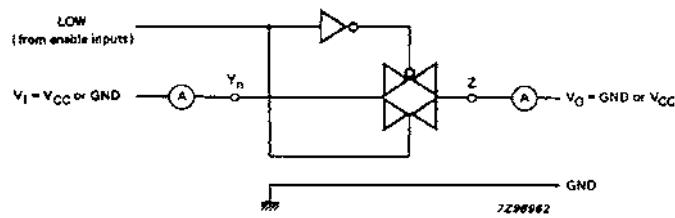


Fig.8 Test circuit for measuring OFF-state current.

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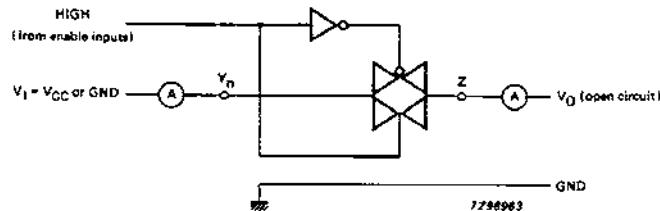


Fig.9 Test circuit for measuring ON-state current.

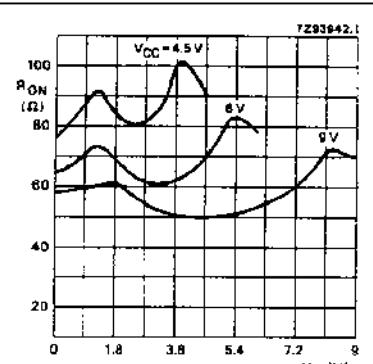


Fig.10 Typical ON-resistance ( $R_{ON}$ ) as a function of input voltage ( $V_{IS}$ ) for  $V_{IS} = 0$  to  $V_{CC} - GND$ .

### DC CHARACTERISTICS FOR 74HC

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	$T_{amb}$ ( $^{\circ}$ C)						UNIT	TEST CONDITIONS					
		74HC							V <sub>CC</sub> (V)	V <sub>I</sub>	OTHER			
		+25		-40 to +85		-40 to +125								
		min.	typ.	max.	min.	max.	min.	max.						
$V_{IH}$	HIGH level input voltage	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	2.0 4.5 6.0 9.0				
$V_{IL}$	LOW level input voltage		0.8 2.1 2.8 4.3	0.50 1.35 1.80 2.70		0.50 1.35 1.80 2.70		0.50 1.35 1.80 2.70	V	2.0 4.5 6.0 9.0				
$\pm I_L$	input leakage current			0.1 0.2		1.0 2.0		1.0 2.0	$\mu$ A	6.0 10.0	$V_{CC}$ or GND			
$\pm I_S$	analog switch OFF-state current per channel			0.1		1.0		1.0	$\mu$ A	10.0	$V_{IH}$ or $V_{IL}$	$ V_S  = V_{CC} - GND$ (see Fig.8)		
$\pm I_S$	analog switch OFF-state current all channels			0.8		8.0		8.0	$\mu$ A	10.0	$V_{IH}$ or $V_{IL}$	$ V_S  = V_{CC} - GND$ (see Fig.9)		
$\pm I_S$	analog switch ON-state current			0.8		8.0		8.0	$\mu$ A	10.0	$V_{IH}$ or $V_{IL}$	$ V_S  = V_{CC} - GND$ (see Fig.9)		
$I_{CC}$	quiescent supply current			8.0 16.0		80.0 160		160 320	$\mu$ A	6.0 10.0	$V_{CC}$ or GND	$V_{IS} = GND$ or $V_{CC}$ ; $V_{OS} = V_{CC}$ or GND		

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**AC CHARACTERISTICS FOR 74HC**GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

SYMBOL	PARAMETER	$T_{amb}$ (°C)						UNIT	TEST CONDITIONS			
		74HC							V <sub>cc</sub> (V)	OTHER		
		+25			−40 to +85		−40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
$t_{PHL}/t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$ ; $Y_n$ to Z		25 9 7 5	75 15 13 9		95 19 16 11		110 22 19 14	ns	2.0 4.5 6.0 9.0		
$t_{PHL}/t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$ ; Z to $Y_n$		18 6 5 4	60 12 10 8		75 15 13 10		90 18 15 12	ns	2.0 4.5 6.0 9.0		
$t_{PHZ}/t_{PLZ}$	turn-off time $\bar{E}$ to $Y_n$		74 27 22 20	250 50 43 38		315 63 54 48		375 75 64 57	ns	2.0 4.5 6.0 9.0		
$t_{PHZ}/t_{PLZ}$	turn-off time $S_n$ to $Y_n$		83 30 24 21	250 50 43 38		315 63 54 48		375 75 64 57	ns	2.0 4.5 6.0 9.0		
$t_{PHZ}/t_{PLZ}$	turn-off time $\bar{E}$ to Z		85 31 25 24	275 55 47 42		345 69 59 53		415 83 71 63	ns	2.0 4.5 6.0 9.0		
$t_{PHZ}/t_{PLZ}$	turn-off time $S_n$ to Z		94 34 27 25	290 58 47 45		365 73 62 56		435 87 74 68	ns	2.0 4.5 6.0 9.0		
$t_{PZH}/t_{PZL}$	turn-on time $\bar{E}$ to $Y_n$		80 29 23 17	275 55 47 42		345 69 59 53		415 83 71 63	ns	2.0 4.5 6.0 9.0		
$t_{PZH}/t_{PZL}$	turn-on time $S_n$ to $Y_n$		88 32 26 18	300 60 51 45		375 75 64 56		450 90 77 68	ns	2.0 4.5 6.0 9.0		
$t_{PZH}/t_{PZL}$	turn-on time $\bar{E}$ to Z		85 31 25 18	275 55 47 42		345 69 59 53		415 83 71 63	ns	2.0 4.5 6.0 9.0		
$t_{PZH}/t_{PZL}$	turn-on time $S_n$ to Z		94 34 27 19	300 60 51 45		375 75 64 56		450 90 77 68	ns	2.0 4.5 6.0 9.0		

$R_L = \infty$ ;  
 $C_L = 50$  pF  
(see Fig.16)

$R_L = 1$  kΩ;  
 $C_L = 50$  pF  
(see Fig.17)

# 16-channel analog multiplexer/demultiplexer

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## Note to AC CHARACTERISTICS FOR 74HC

1. Due to higher Z terminal capacitance (16 switches versus 1) the delay figures to the Z terminal are higher than those to the Y terminal.

## DC CHARACTERISTICS FOR 74HCT

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)						UNIT	TEST CONDITIONS					
		74HCY							V <sub>CC</sub> (V)	V <sub>I</sub>	OTHER			
		+25			−40 to +85		−40 to +125							
		min.	typ.	max.	min.	max.	min.	max.						
V <sub>IH</sub>	HIGH level input voltage	2.0	1.6		2.0		2.0		V	4.5 to 5.5				
V <sub>IL</sub>	LOW level input voltage		1.2	0.8		0.8		0.8	V	4.5 to 5.5				
±I <sub>I</sub>	input leakage current			0.1		1.0		1.0	µA	5.5	V <sub>CC</sub> or GND			
±I <sub>S</sub>	analog switch OFF-state current per channel			0.1		1.0		1.0	µA	5.5	V <sub>IH</sub> or V <sub>IL</sub>	V <sub>S</sub>   = V <sub>CC</sub> − GND (see Fig.8)		
±I <sub>S</sub>	analog switch OFF-state current all channels			0.8		8.0		8.0	µA	5.5	V <sub>IH</sub> or V <sub>IL</sub>	V <sub>S</sub>   = V <sub>CC</sub> − GND (see Fig.9)		
±I <sub>S</sub>	analog switch ON-state current			0.8		8.0		8.0	µA	5.5	V <sub>IH</sub> or V <sub>IL</sub>	V <sub>S</sub>   = V <sub>CC</sub> − GND (see Fig.9)		
I <sub>CC</sub>	quiescent supply current			8.0		80.0		160	µA	4.5 to 5.5	V <sub>CC</sub> or GND	V <sub>is</sub> = GND or V <sub>CC</sub> ; V <sub>os</sub> = V <sub>CC</sub> or GND		
ΔI <sub>CC</sub>	additional quiescent supply current per input pin for unit load coefficient is 1 (note 1)		100	360		450		490	µA	4.5 to 5.5	V <sub>CC</sub> −2.1 V	other inputs at V <sub>CC</sub> or GND		

### Note

1. The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given here.  
To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

INPUT	UNIT LOAD COEFFICIENT
Ē	0.6
S <sub>n</sub>	0.5

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**AC CHARACTERISTICS FOR 74HCT**GND = 0 V;  $t_r = t_f = 6$  ns

SYMBOL	PARAMETER	$T_{amb}$ ( $^{\circ}$ C)						UNIT	TEST CONDITIONS			
		74HCT							V <sub>cc</sub> (V)	OTHER		
		+25			−40 to +85		−40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
$t_{PHL}/t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$ ; $Y_n$ to Z		9	15		19		22	ns	4.5	$R_L = \infty$ ; $C_L = 50$ pF (see Fig.16)	
$t_{PHL}/t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$ ; Z to $Y_n$		6	12		15		18	ns	4.5		
$t_{PHZ}/t_{PLZ}$	turn-off time $\bar{E}$ to $Y_n$		26	55		69		83	ns	4.5		
$t_{PHZ}/t_{PLZ}$	turn-off time $S_n$ to $Y_n$		31	55		69		83	ns	4.5		
$t_{PHZ}/t_{PLZ}$	turn-off time $\bar{E}$ to Z		30	60		75		90	ns	4.5		
$t_{PHZ}/t_{PLZ}$	turn-off time $S_n$ to Z		35	60		75		90	ns	4.5		
$t_{PZH}/t_{PZL}$	turn-on time $\bar{E}$ to $Y_n$		32	60		75		90	ns	4.5		
$t_{PZH}/t_{PZL}$	turn-on time $S_n$ to $Y_n$		35	60		75		90	ns	4.5		
$t_{PZH}/t_{PZL}$	turn-on time $\bar{E}$ to Z		38	65		81		98	ns	4.5		
$t_{PZH}/t_{PZL}$	turn-on time $S_n$ to Z		38	65		81		98	ns	4.5		

**Note**

1. Due to higher Z terminal capacitance (16 switches versus 1) the delay figures to the Z terminal are higher than those to the Y terminal.

## 16-channel analog multiplexer/demultiplexer

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### ADDITIONAL AC CHARACTERISTICS FOR 74HC/HCT

Recommended conditions and typical values

GND = 0 V;  $t_r = t_f = 6$  ns

SYMBOL	PARAMETER	TYP.	UNIT	$V_{CC}$ (V)	$V_{IS(P-P)}$ (V)	CONDITIONS
	sine-wave distortion $f = 1$ kHz	0.04 0.02	% %	4.5 9.0	4.0 8.0	$R_L = 10$ k $\Omega$ ; $C_L = 50$ pF (see Fig.14)
	sine-wave distortion $f = 10$ kHz	0.12 0.06	% %	4.5 9.0	4.0 8.0	$R_L = 10$ k $\Omega$ ; $C_L = 50$ pF (see Fig.14)
	switch "OFF" signal feed-through	-50 -50	dB dB	4.5 9.0	note 3	$R_L = 600$ $\Omega$ ; $C_L = 50$ pF $f = 1$ MHz (see Figs 11 and 15)
$f_{max}$	minimum frequency response (-3 dB)	90 100	MHz MHz	4.5 9.0	note 4	$R_L = 50$ $\Omega$ ; $C_L = 10$ pF (see Figs 12 and 13)
$C_S$	maximum switch capacitance independent (Y) common (Z)	5 45	pF pF			

#### Notes

1.  $V_{IS}$  is the input voltage at  $Y_n$  or  $Z$  terminal, whichever is assigned as an input.
2.  $V_{OS}$  is the output voltage at  $Y_n$  or  $Z$  terminal, whichever is assigned as an output.
3. Adjust input voltage  $V_{IS}$  is 0 dBm level (0 dBm = 1 mW into 600  $\Omega$ ).
4. Adjust input voltage  $V_{IS}$  is 0 dBm level at  $V_{OS}$  for 1 MHz (0 dBm = 1 mW into 50  $\Omega$ ).

## 16-channel analog multiplexer/demultiplexer

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Test conditions:  
 $V_{CC} = 4.5 \text{ V}$ ;  $\text{GND} = 0 \text{ V}$ ;  
 $R_L = 50 \Omega$ ;  $R_{\text{source}} = 1 \text{ k}\Omega$ .

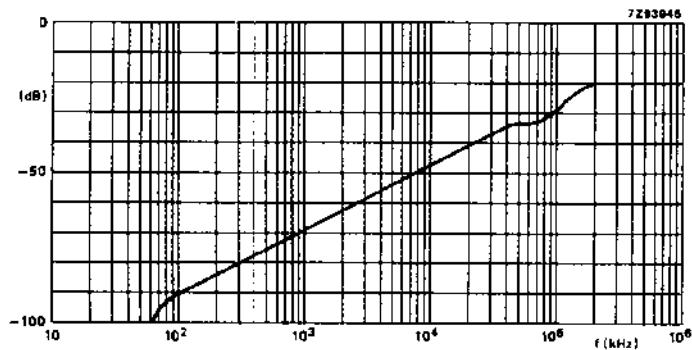


Fig.11 Typical switch "OFF" signal feed-through as a function of frequency.

Test conditions:  
 $V_{CC} = 4.5 \text{ V}$ ;  $\text{GND} = 0 \text{ V}$ ;  
 $R_L = 50 \Omega$ ;  $R_{\text{source}} = 1 \text{ k}\Omega$ .

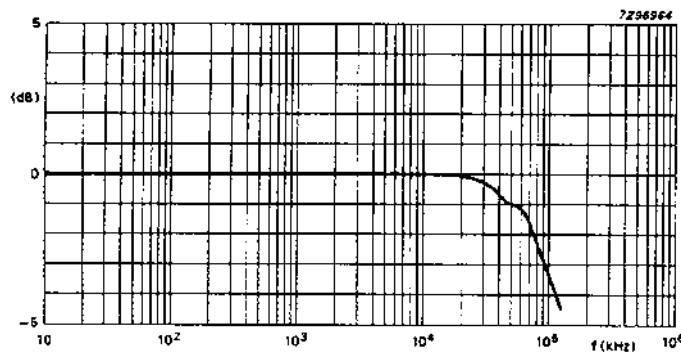


Fig.12 Typical frequency response.

Adjust input voltage to obtain  
 $0 \text{ dBm}$  at  $V_{os}$  when  $f_{in} = 1 \text{ MHz}$ .  
After set-up frequency of  $f_{in}$  is  
increased to obtain a reading of  
 $-3 \text{ dB}$  at  $V_{os}$ .

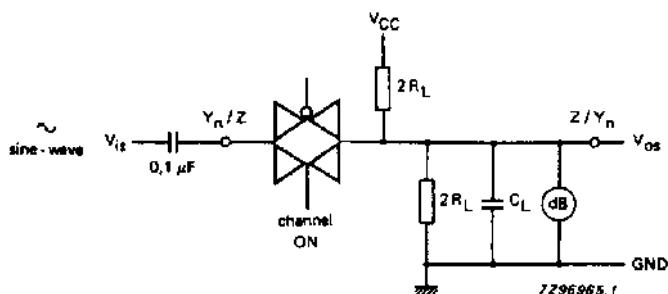


Fig.13 Test circuit for measuring minimum frequency response.

## 16-channel analog multiplexer/demultiplexer

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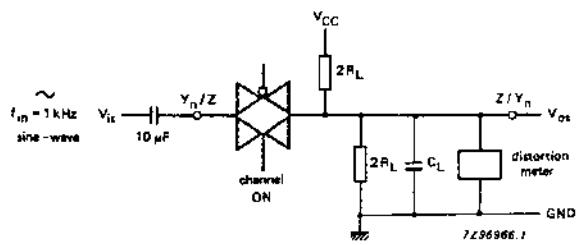


Fig.14 Test circuit for measuring sine-wave distortion.

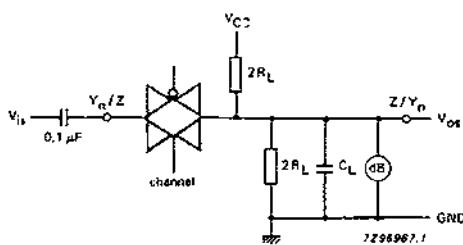


Fig.15 Test circuit for measuring switch "OFF" signal feed-through.

### AC WAVEFORMS

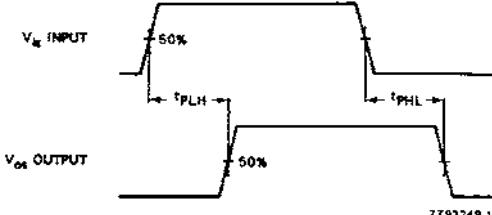
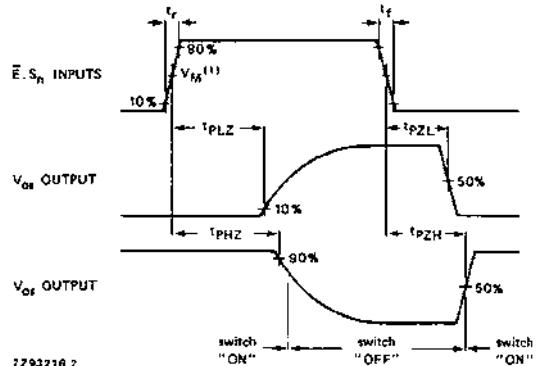


Fig.16 Waveforms showing the input ( $V_{IS}$ ) to output ( $V_{OS}$ ) propagation delays.



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

Fig.17 Waveforms showing the turn-on and turn-off times.

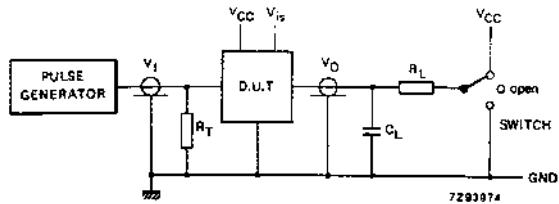
# 16-channel analog multiplexer/demultiplexer

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## TEST CIRCUIT AND WAVEFORMS

### Conditions

TEST	SWITCH	$V_{IS}$
$t_{PZH}$	GND	$V_{CC}$
$t_{PZL}$	$V_{CC}$	GND
$t_{PHZ}$	GND	$V_{CC}$
$t_{PLZ}$	$V_{CC}$	GND
others	open	pulse

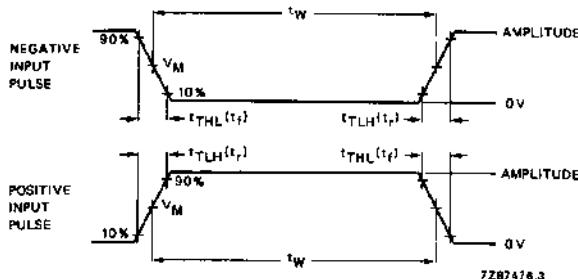


$C_L$  = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).

$R_T$  = 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 on  $t_r$ ,  $t_f$  with 50% duty factor.

Fig.18 Test circuit for measuring AC performance.



FAMILY	AMPLITUDE	$V_M$	$t_r, t_f$	
			$f_{max};$ PULSE WIDTH	OTHER
74HC	$V_{CC}$	50%	< 2 ns	6 ns
74HCT	3.0 V	1.3 V	< 2 ns	6 ns

Fig.19 Input pulse definitions.

## PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".