

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/HCT4352

Dual 4-channel analog
multiplexer/demultiplexer with latch

Product specification
File under Integrated Circuits, IC06

December 1990

Dual 4-channel analog multiplexer/demultiplexer with latch

74HC/HCT4352

FEATURES

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

GENERAL DESCRIPTION

The 74HC/HCT4352 are high-speed Si-gate CMOS devices. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4352 are dual 4-channel analog multiplexers/demultiplexers with common select logic.

Each multiplexer has four independent inputs/outputs (nY_0 to nY_3) and a common input/output (nZ).

The common channel select logics include two select inputs (S_0 and S_1), an active LOW enable input ($\overline{E}_1$), an active HIGH enable input (E_2) and a latch enable input ($\overline{LE}$).

With $\overline{E}_1$ LOW and E_2 HIGH, one of the four switches is selected (low impedance ON-state) by S_0 and S_1 . The data at the select inputs may be latched by using the active LOW latch enable input ($\overline{LE}$). When $\overline{LE}$ is HIGH, the latch is transparent. When either of the two enable inputs, $\overline{E}_1$ (active LOW) and E_2 (active HIGH), is inactive, all analog switches are turned off.

V_{CC} and GND are the supply voltage pins for the digital control inputs (S_0 , S_1 , $\overline{LE}$, $\overline{E}_1$ and E_2). The V_{CC} to GND ranges are 2.0 to 10.0 V for HC and 4.5 to 5.5 V for HCT. The analog inputs/outputs (nY_0 to nY_3 , and nZ) can swing between V_{CC} as a positive limit and V_{EE} as a negative limit. $V_{CC} - V_{EE}$ may not exceed 10.0 V.

For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND (typically ground).

QUICK REFERENCE DATA

$V_{EE} = \text{GND} = 0$ V; $T_{\text{amb}} = 25$ °C; $t_r = t_f = 6$ ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t_{PZH}/t_{PZL}	turn "ON" time $\overline{E}_1$, E_2 or S_n to V_{OS}	$C_L = 15$ pF; $R_L = 1$ k Ω ; $V_{CC} = 5$ V	31	33	ns
t_{PHZ}/t_{PLZ}	turn "OFF" time $\overline{E}_1$, E_2 or S_n to V_{OS}		20	20	ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per switch	notes 1 and 2	55	55	pF
C_S	max. switch capacitance independent (Y)		5	5	pF
	common (Z)		12	12	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W):

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

f_i = input frequency in MHz

f_o = output frequency in MHz

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

C_L = output load capacitance in pF

C_S = max. switch capacitance in pF

V_{CC} = supply voltage in V

2. For HC the condition is $V_I = \text{GND}$ to V_{CC}
For HCT the condition is $V_I = \text{GND}$ to $V_{CC} - 1.5$ V

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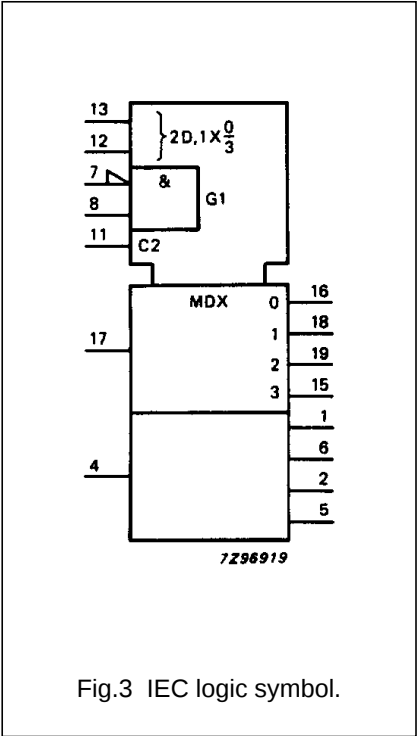
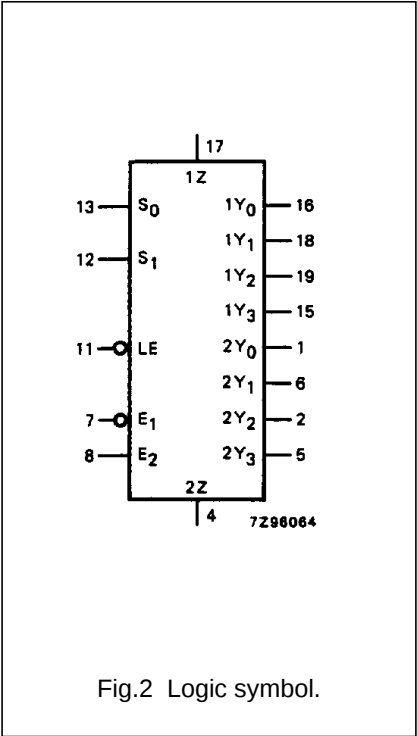
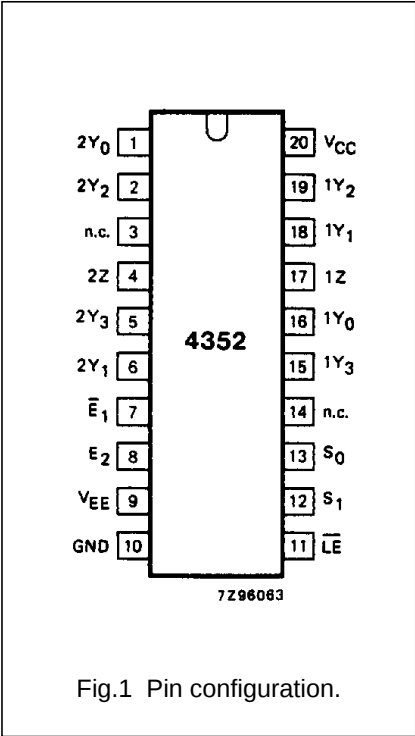
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ORDERING INFORMATION

See “74HC/HCT/HCU/HCMOS Logic Package Information”.

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 6, 2, 5	2Y ₀ to 2Y ₃	independent inputs/outputs
3, 14	n.c.	not connected
7	$\overline{E}_1$	enable input (active LOW)
8	E ₂	enable input (active HIGH)
9	V _{EE}	negative supply voltage
10	GND	ground (0 V)
11	$\overline{LE}$	latch enable input (active LOW)
13, 12	S ₀ , S ₁	select inputs
16, 18, 19, 15	1Y ₀ to 1Y ₃	independent inputs/outputs
17, 4	1Z, 2Z	common inputs/outputs
20	V _{CC}	positive supply voltage



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FUNCTION TABLE

INPUTS					CHANNEL ON
$\overline{E}_1$	E_2	$\overline{LE}$	S_1	S_0	
H	X	X	X	X	none
X	L	X	X	X	none
L	H	H	L	L	$nY_0 - nZ$
L	H	H	L	H	$nY_1 - nZ$
L	H	H	H	L	$nY_2 - nZ$
L	H	H	H	H	$nY_3 - nZ$
L	H	L	X	X	(1)
X	X	$\downarrow$	X	X	(2)

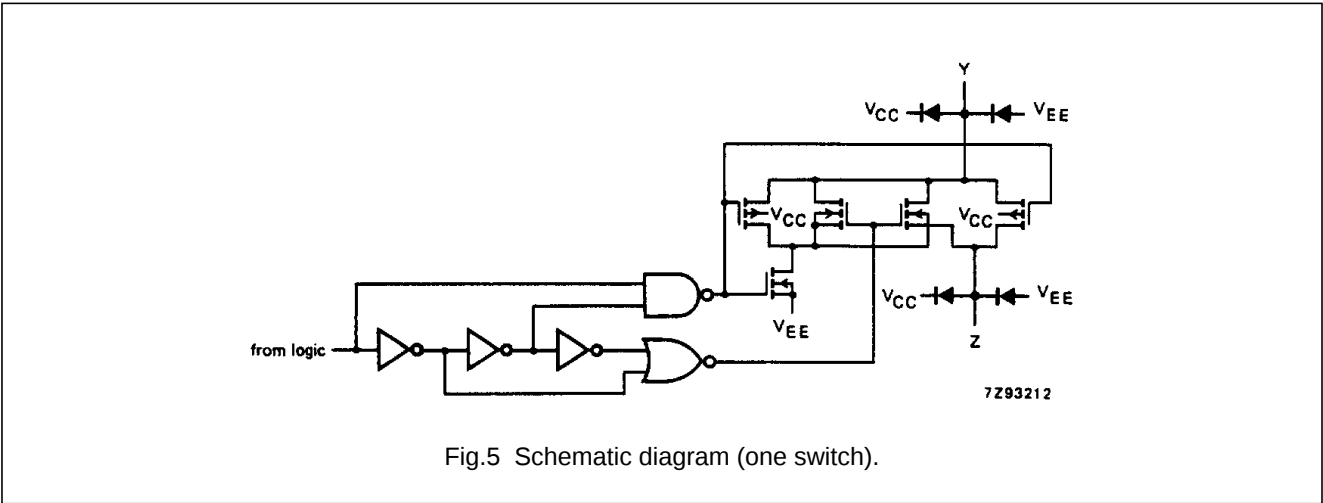
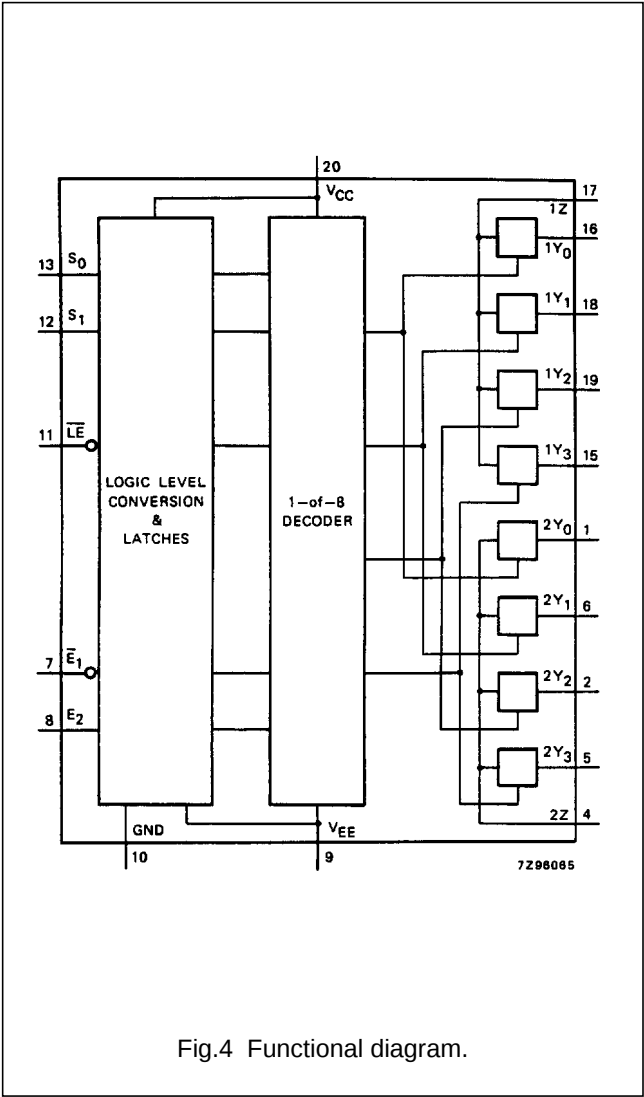
Notes

- 1. Last selected channel "ON".
- 2. Selected channels latched.

H = HIGH voltage level
L = LOW voltage level
X = don't care
 $\downarrow$ = HIGH-to-LOW $\overline{LE}$ transition

APPLICATIONS

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



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RATINGS

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

Voltages are referenced to $V_{EE} = \text{GND}$ (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 $V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$
$\pm I_{SK}$	DC switch diode current		20	mA	for $V_S < -0.5 \text{ V}$ or $V_S > V_{CC} + 0.5 \text{ V}$
$\pm I_S$	DC switch current		25	mA	for $-0.5 \text{ V} < V_S < V_{CC} + 0.5 \text{ V}$
$\pm I_{EE}$	DC V_{EE} current		20	mA	
$\pm I_{CC}$; $\pm I_{GND}$	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
	plastic mini-pack (SO)		500	mW	above +70 °C: derate linearly with 6 mW/K
P_S	power dissipation per switch		100	mW	

Note

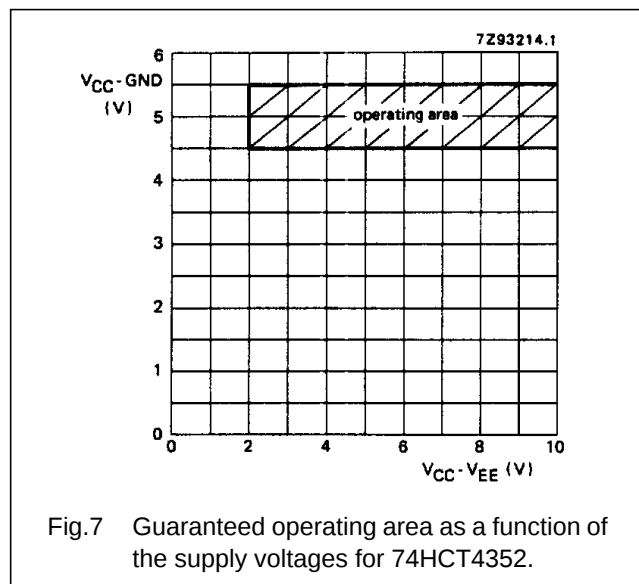
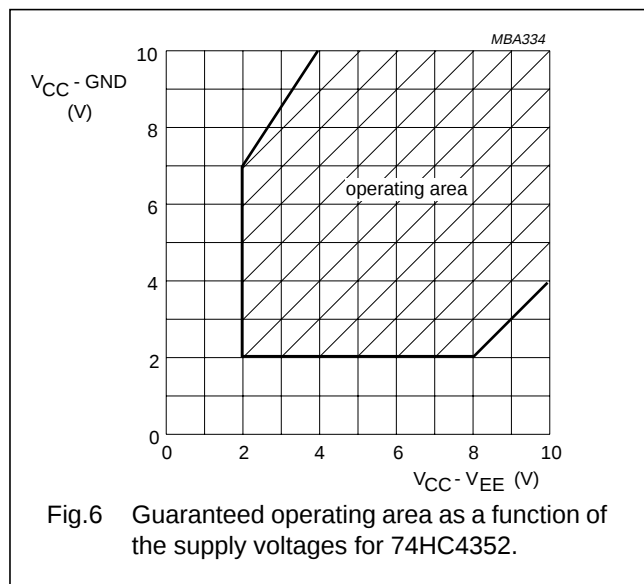
- To avoid drawing V_{CC} current out of terminals nZ, when switch current flows in terminals nY_n, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminals nZ, no V_{CC} current will flow out of terminals nY_n. In this case there is no limit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

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	74HC			74HCT			UNIT	CONDITIONS
		min.	typ.	max.	min.	typ.	max.		
V_{CC}	DC supply voltage $V_{CC}-\text{GND}$	2.0	5.0	10.0	4.5	5.0	5.5	V	see Figs 6 and 7
V_{CC}	DC supply voltage $V_{CC}-V_{EE}$	2.0	5.0	10.0	2.0	5.0	10.0	V	see Figs 6 and 7
V_I	DC input voltage range	GND		V_{CC}	GND		V_{CC}	V	
V_S	DC switch voltage range	V_{EE}		V_{CC}	V_{EE}		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	$V_{CC} = 2.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$ $V_{CC} = 10.0 \text{ V}$

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DC CHARACTERISTICS FOR 74HC/HCT

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

For 74HCT: $V_{CC} - GND = 4.5$ and 5.5 V; $V_{CC} - V_{EE} = 2.0, 4.5, 6.0$ and 9.0 V

SYMBOL	PARAMETER	T _{amb} (°C)							UNIT	TEST CONDITIONS				
		74HC/HCT								V _{CC} (V)	V _{EE} (V)	I _S (μA)	V _{is}	V _I
		+25			−40 to +85		−40 to +125							
		min.	typ.	max.	min.	max.	min.	max.						
R _{ON}	ON resistance (peak)		—	—		—		—	Ω	2.0	0	100	V _{CC} to V _{EE}	V _{IN} or V _{IL}
			100	180		225		270	Ω	4.5	0	1000		
			90	160		200		240	Ω	6.0	0	1000		
			70	130		165		195	Ω	4.5	−4.5	1000		
R _{ON}	ON resistance (rail)		150	—		—		—	Ω	2.0	0	100	V _{EE}	V _{IH} or V _{IL}
			80	140		175		210	Ω	4.5	0	1000		
			70	120		150		180	Ω	6.0	0	1000		
			60	105		130		160	Ω	4.5	−4.5	1000		
R _{ON}	ON resistance (rail)		150	—		—		—	Ω	2.0	0	100	V _{CC}	V _{IH} or V _{IL}
			90	160		200		240	Ω	4.5	0	1000		
			80	140		175		210	Ω	6.0	0	1000		
			65	120		150		180	Ω	4.5	−4.5	1000		
ΔR _{ON}	maximum ΔON resistance between any two channels		—						Ω	2.0	0		V _{CC} to V _{EE}	V _{IH} or V _{IL}
			9						Ω	4.5	0			
			8						Ω	6.0	0			
			6						Ω	4.5	−4.5			

Notes

- At supply voltages ($V_{CC} - V_{EE}$) 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.
- For test circuit measuring R_{ON} see Fig.8.

Dual 4-channel analog multiplexer/demultiplexer with latch

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DC CHARACTERISTICS FOR 74HC

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	T _{amb} (°C)							UNIT	TEST CONDITIONS			
		74HC								V _{CC} (V)	V _{EE} (V)	V _I	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	0.5 1.35 1.8 2.7		0.5 1.35 1.8 2.7		0.5 1.35 1.8 2.7	V	2.0 4.5 6.0 9.0			
±I _I	input leakage current			0.1 0.2		1.0 2.0		1.0 2.0	μA	6.0 10.0	0 0	V _{CC} or GND	
±I _S	analog switch OFF-state current per channel			0.1		1.0		1.0	μA	10.0	0	V _{IH} or V _{IL}	V _S = V _{CC} − V _{EE} (see Fig.10)
±I _S	analog switch OFF-state current all channels			0.2		2.0		2.0	μA	10.0	0	V _{IH} or V _{IL}	V _S = V _{CC} − V _{EE} (see Fig.10)
±I _S	analog switch ON-state current			0.2		2.0		2.0	μA	10.0	0	V _{IH} or V _{IL}	V _S = V _{CC} − V _{EE} (see Fig.11)
I _{CC}	quiescent supply current			8.0 16.0		80.0 160.0		160.0 320.0	μA	6.0 10.0	0 0	V _{CC} or GND	V _{IS} = V _{EE} or V _{CC} ; V _{OS} = V _{CC} or V _{EE}

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

SYMBOL	PARAMETER	T _{amb} (°C)							UNIT	TEST CONDITIONS		
		74HC								V _{CC} (V)	V _{EE} (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}		17	60		75		90	ns	2.0	0	R _L = ∞; C _L = 50 pF (see Fig.18)
			6	12		15		18		4.5	0	
			5	10		13		15		6.0	0	
			5	8		10		12		4.5	−4.5	
t _{PZH} / t _{PZL}	turn “ON” time E ₁ ; E ₂ to V _{os} LE to V _{os}		99	325		405		490	ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
			36	65		81		98		4.5	0	
			29	55		69		83		6.0	0	
			25	46		58		69		4.5	−4.5	
t _{PZH} / t _{PZL}	turn “ON” time S _n to V _{os}		99	325		405		490	ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
			36	65		81		98		4.5	0	
			29	55		69		80		6.0	0	
			25	46		58		69		4.5	−4.5	
t _{PHZ} / t _{PLZ}	turn “OFF” time E ₁ ; E ₂ to V _{os} LE to V _{os}		58	200		250		300	ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
			21	40		50		60		4.5	0	
			17	34		43		51		6.0	0	
			21	40		50		60		4.5	−4.5	
t _{PHZ} / t _{PLZ}	turn “OFF” time S _n to V _{os}		63	200		250		300	ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
			23	40		50		60		4.5	0	
			18	34		43		51		6.0	0	
			24	40		50		60		4.5	−4.5	
t _{su}	set-up time S _n to LE	90	17		115		135		ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.20)
		18	6		23		27			4.5	0	
		15	5		20		23			6.0	0	
		18	9		23		27			4.5	−4.5	
t _h	hold time S _n to LE	5	−6		5		5		ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.20)
		5	−2		5		5			4.5	0	
		5	−2		5		5			6.0	0	
		5	−3		5		5			4.5	−4.5	
t _w	LE minimum pulse width HIGH	80	11		100		120		ns	2.0	0	R _L = 1 kΩ; C _L = 50 pF (see Fig.20)
		16	4		20		24			4.5	0	
		14	3		17		20			6.0	0	
		16	4		20		24			4.5	−4.5	

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DC CHARACTERISTICS FOR 74HCT

Voltages are referenced to GND (ground = 0)

SYMBOL	PARAMETER	T _{amb} (°C)							UNIT	TEST CONDITIONS			
		74HCT								V _{CC} (V)	V _{EE} (V)	V _I	OTHER
		+25			−40 to +85		−40 to +125						
		min.	typ.	max.	min.	max.	min.	max.					
V _{IH}	HIGH level input voltage	2.0	1.6		2.0		2.0		V	4.5 to 5.5			
V _{IL}	LOW level input voltage		1.2	0.8		0.8		0.8	V	4.5 to 5.5			
±I _I	input leakage current			0.1		1.0		1.0	μA	5.5	0	V _{CC} or GND	
±I _S	analog switch OFF-state current per channel			0.1		1.0		1.0	μA	10.0	0	V _{IH} or V _{IL}	V _S = V _{CC} − V _{EE} (see Fig.10)
±I _S	analog switch OFF-state current all channels			0.2		2.0		2.0	μA	10.0	0	V _{IH} or V _{IL}	V _S = V _{CC} − V _{EE} (see Fig.10)
±I _S	analog switch ON-state current			0.2		2.0		2.0	μA	10.0	0	V _{IH} or V _{IL}	V _S = V _{CC} − V _{EE} (see Fig.11)
I _{CC}	quiescent supply current			8.0 16.0		80.0 160.0		160.0 320.0	μA	5.5 5.0	0 −5.0	V _{CC} or GND	V _{IS} = V _{EE} or V _{CC} ; V _{OS} = V _{CC} or V _{EE}
ΔI _{CC}	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	0	V _{CC} − 2.1 V	other inputs at V _{CC} or GND

Note to HCT types

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

INPUT	UNIT LOAD COEFFICIENT
$\overline{E}_1, E_2$	0.50
S_n	0.50
$\overline{LE}$	1.5

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

SYMBOL	PARAMETER	T _{amb} (°C)							UNIT	TEST CONDITIONS		
		74HCT								V _{CC} (V)	V _{EE} (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}		6 5	12 8		15 10		18 12	ns	4.5 4.5	0 −4.5	R _L = ∞; C _L = 50 pF (see Fig.18)
t _{PZH} / t _{PZL}	turn “ON” time E ₁ , E ₂ to V _{os} LE to V _{os}		38 28	65 46		81 58		98 69	ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
t _{PZH} / t _{PZL}	turn “ON” time S _n to V _{os}		38 27	65 46		81 58		98 69	ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
t _{PHZ} / t _{PLZ}	turn “OFF” time E ₁ to V _{os} LE to V _{os}		20 20	40 40		50 50		60 60	ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
t _{PHZ} / t _{PLZ}	turn “OFF” time E ₂ , S _n to V _{os}		25 25	43 43		54 54		65 65	ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.19)
t _{su}	set-up time S _n to LE	16 18	7 9		20 23		24 27		ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.20)
t _h	hold time S _n to LE	5 5	−1 −1		5 5		5 5		ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.20)
t _w	LE minimum pulse width HIGH	16 16	3 4		20 20		24 24		ns	4.5 4.5	0 −4.5	R _L = 1 kΩ; C _L = 50 pF (see Fig.20)

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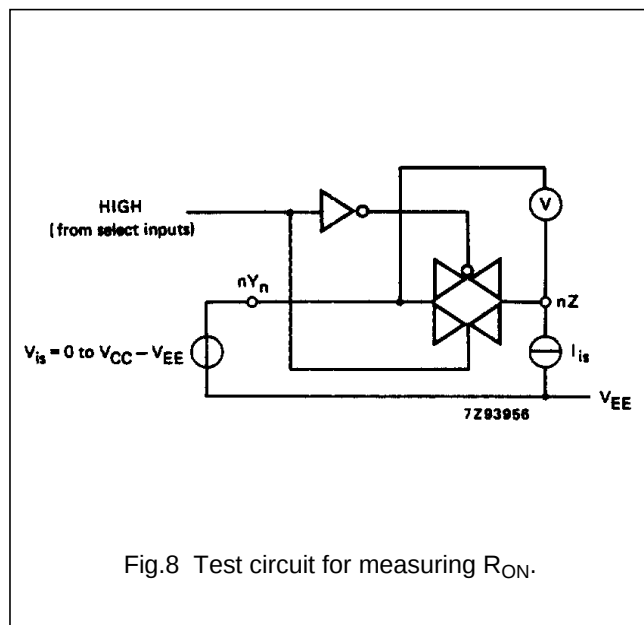
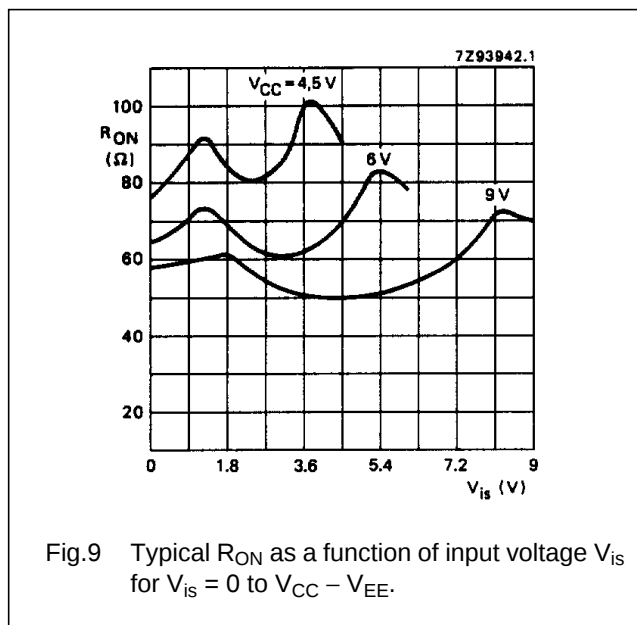
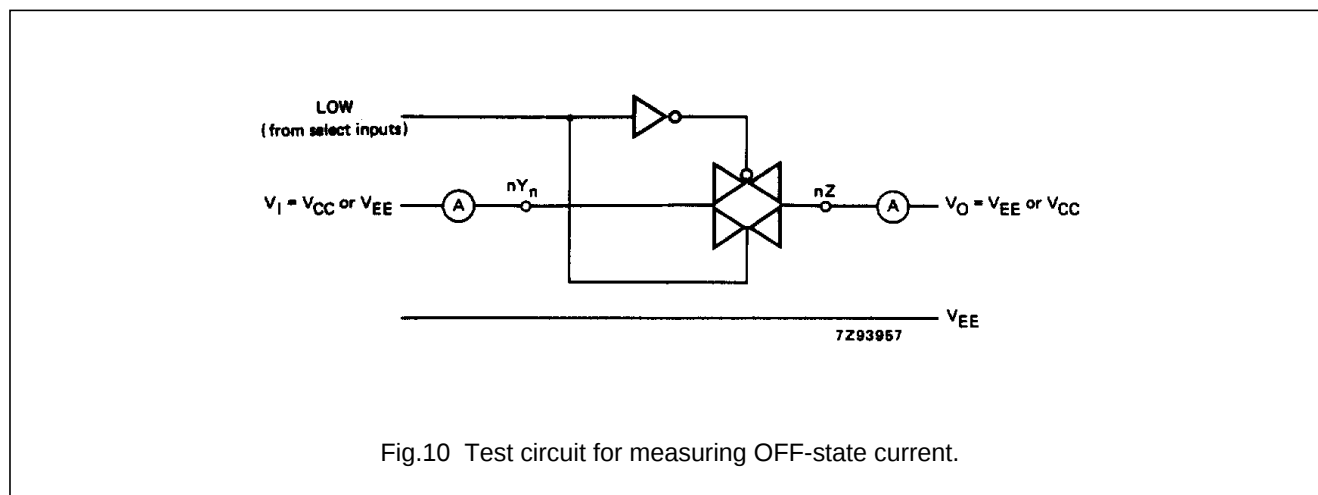
Fig.8 Test circuit for measuring R_{ON} .Fig.9 Typical R_{ON} as a function of input voltage V_{is} for $V_{is} = 0$ to $V_{CC} - V_{EE}$.

Fig.10 Test circuit for measuring OFF-state current.

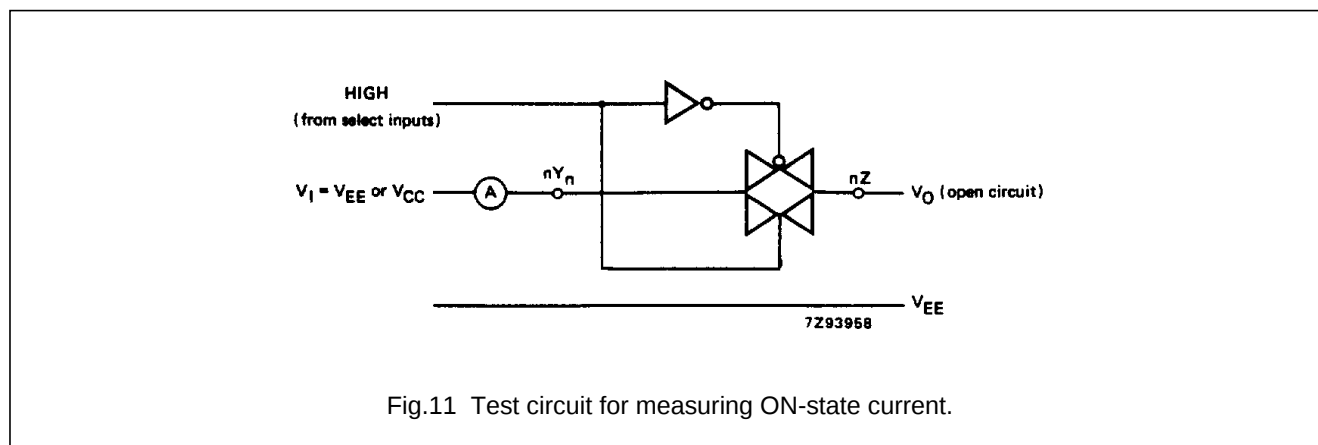


Fig.11 Test circuit for measuring ON-state current.

Dual 4-channel analog multiplexer/demultiplexer with latch

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ADDITIONAL AC CHARACTERISTICS FOR 74HC/HCT

Recommended conditions and typical values

GND = 0 V; $T_{amb} = 25\text{ }^{\circ}\text{C}$

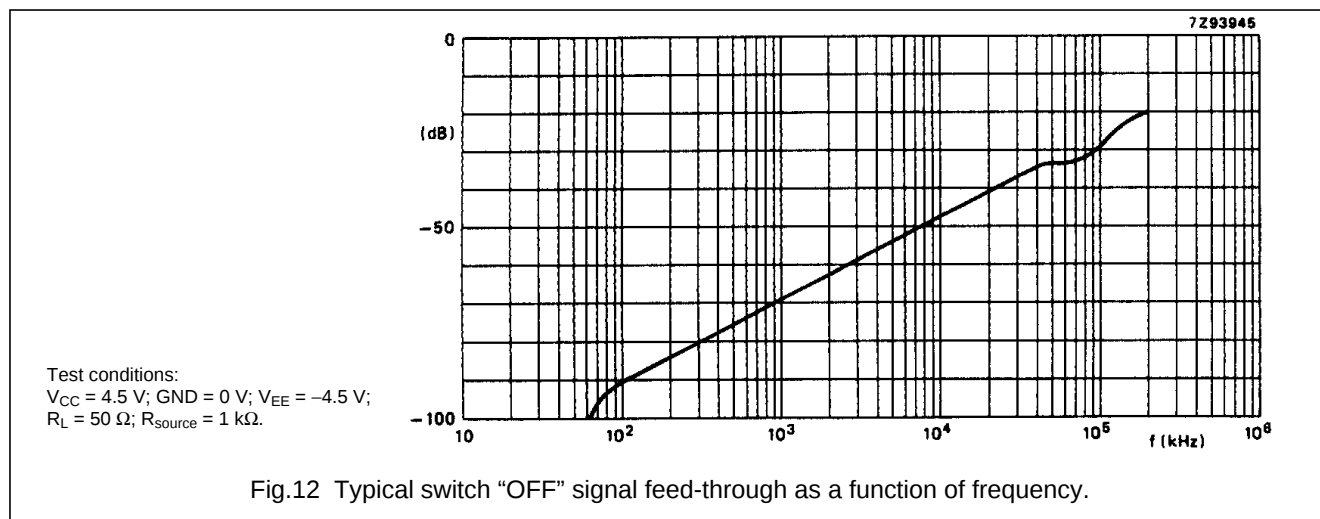
SYMBOL	PARAMETER	typ.	UNIT	V_{CC} (V)	V_{EE} (V)	$V_{is(p-p)}$ (V)	CONDITIONS
	sine-wave distortion $f = 1\text{ kHz}$	0.04 0.02	% %	2.25 4.5	-2.25 -4.5	4.0 8.0	$R_L = 10\text{ k}\Omega$; $C_L = 50\text{ pF}$ (see Fig.14)
	sine-wave distortion $f = 10\text{ kHz}$	0.12 0.06	% %	2.25 4.5	-2.25 -4.5	4.0 8.0	$R_L = 10\text{ k}\Omega$; $C_L = 50\text{ pF}$ (see Fig.14)
	switch "OFF" signal feed-through	-50 -50	dB dB	2.25 4.5	-2.25 -4.5	note 1	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$ $f = 1\text{ MHz}$ (see Figs 12 and 15)
	crosstalk between any two switches/ multiplexers	-60 -60	dB dB	2.25 4.5	-2.25 -4.5	note 1	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; $f = 1\text{ MHz}$ (see Fig.16)
$V_{(p-p)}$	crosstalk voltage between control and any switch (peak-to-peak value)	110 220	mV mV	4.5 4.5	0 -4.5		$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; $f = 1\text{ MHz}$ ($\bar{E}_1$, E_2 or S_n , square-wave between V_{CC} and GND, $t_r = t_f = 6\text{ ns}$) (see Fig.17)
f_{max}	minimum frequency response (-3dB)	160 170	MHz MHz	2.25 4.5	-2.25 -4.5	note 2	$R_L = 50\text{ }\Omega$; $C_L = 10\text{ pF}$ (see Figs 13 and 14)
C_S	maximum switch capacitance independent (Y) common (Z)	5 12	pF pF				

Notes

1. Adjust input voltage V_{is} to 0 dBm level (0 dBm = 1 mW into 600 Ω).
2. Adjust input voltage V_{is} to 0 dBm level at V_{os} for 1 MHz (0 dBm = 1 mW into 50 Ω).

V_{is} is the input voltage at an nY_n or nZ terminal, whichever is assigned as an input.

V_{os} is the output voltage at an nY_n or nZ terminal, whichever is assigned as an output.



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

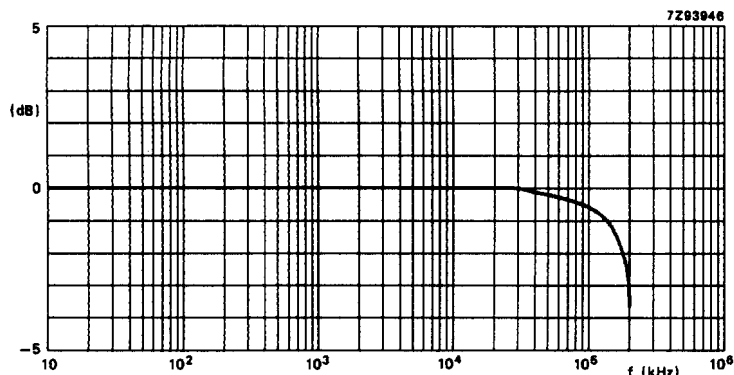


Fig.13 Typical frequency response.

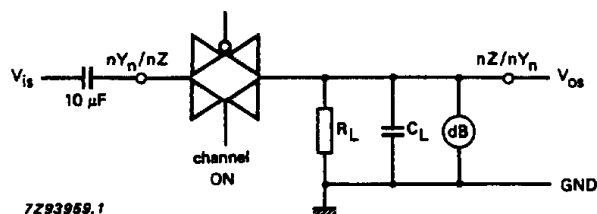


Fig.14 Test circuit for measuring sine-wave distortion and minimum frequency response.

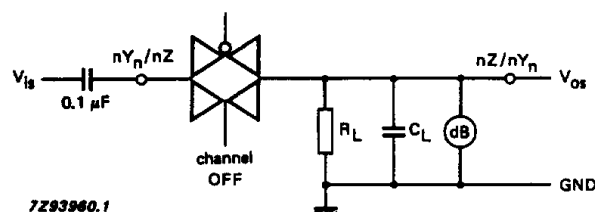
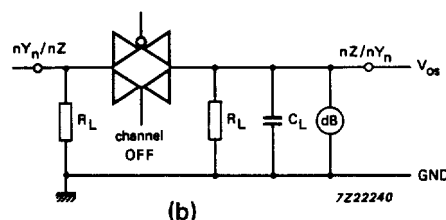
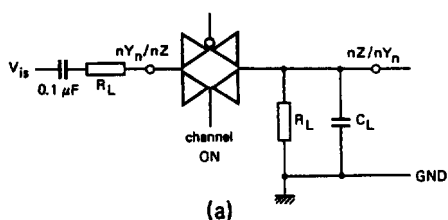
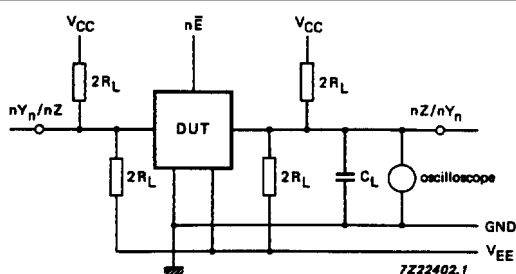


Fig.15 Test circuit for measuring switch "OFF" signal feed-through.

Fig.16 Test circuits for measuring crosstalk between any two switches/multiplexers.
(a) channel ON condition; (b) channel OFF condition.

The crosstalk is defined as follows (oscilloscope output):

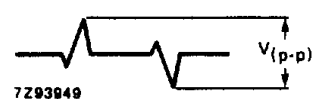
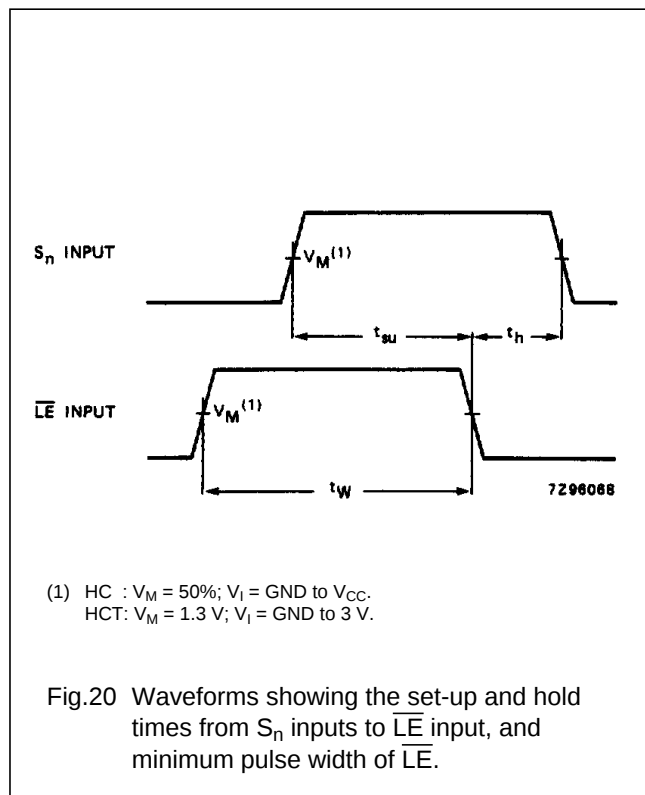
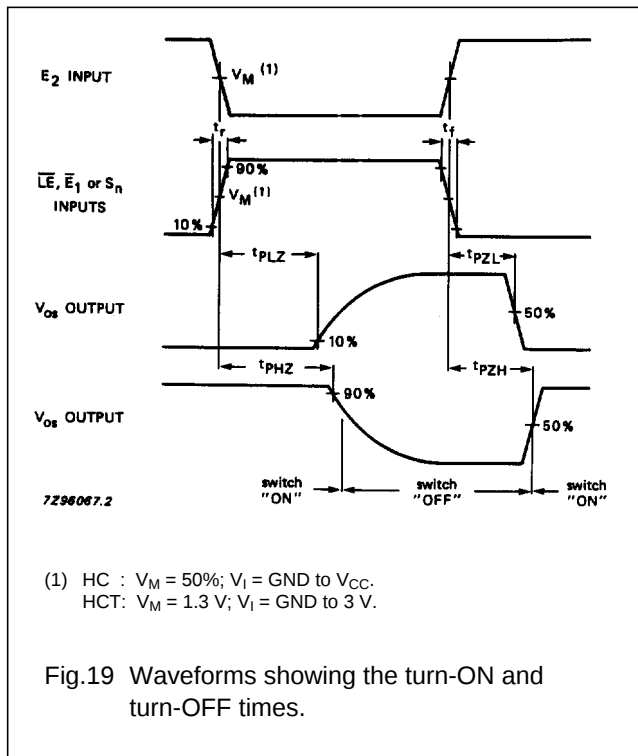
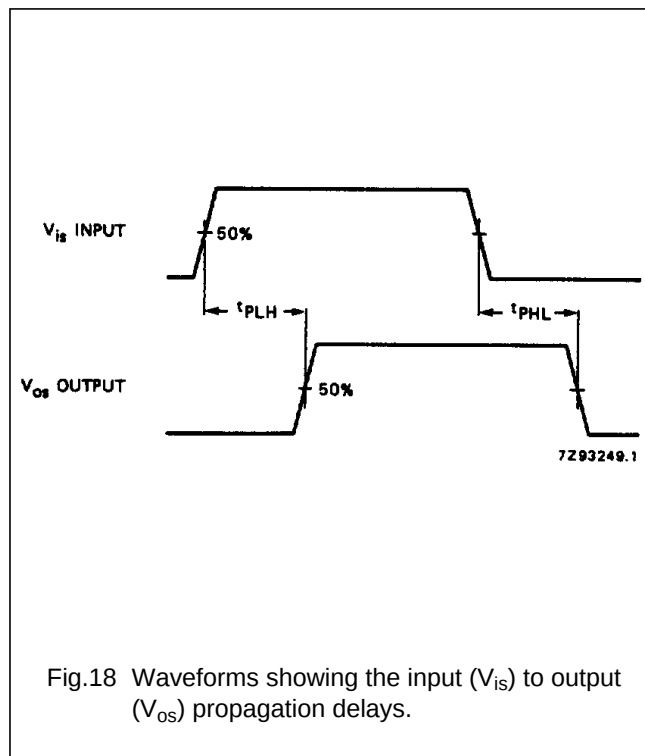


Fig.17 Test circuit for measuring crosstalk between control and any switch.

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AC WAVEFORMS



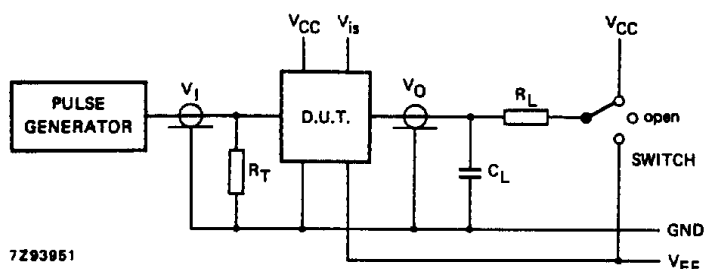
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TEST CIRCUIT AND WAVEFORMS

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



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

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

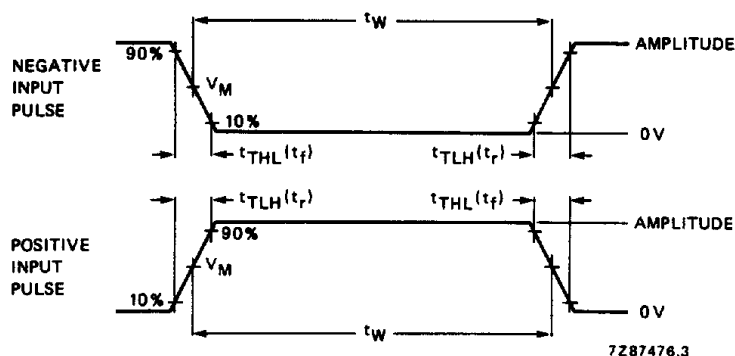
R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.

t_r = t_f = 6 ns; when measuring f_{max} , there is no constraint on t_r, t_f with 50% duty factor.

Fig.21 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



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

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.22 Input pulse definitions.

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PACKAGE OUTLINES

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