

# 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/HCT4053**

Triple 2-channel analog  
multiplexer/demultiplexer

Product specification  
File under Integrated Circuits, IC06

December 1990

## Triple 2-channel analog multiplexer/demultiplexer

## 74HC/HCT4053

### FEATURES

- Low “ON” resistance:  
80  $\Omega$  (typ.) at  $V_{CC} - V_{EE} = 4.5$  V  
70  $\Omega$  (typ.) at  $V_{CC} - V_{EE} = 6.0$  V  
60  $\Omega$  (typ.) at  $V_{CC} - V_{EE} = 9.0$  V
- Logic level translation:  
to enable 5 V logic to communicate with  $\pm 5$  V analog signals
- Typical “break before make” built in
- Output capability: non-standard
- $I_{CC}$  category: MSI

### GENERAL DESCRIPTION

The 74HC/HCT4053 are high-speed Si-gate CMOS devices and are pin compatible with the “4053” of the “4000B” series. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4053 are triple 2-channel analog multiplexers/demultiplexers with a common enable input ( $\bar{E}$ ). Each multiplexer/demultiplexer has two independent inputs/outputs ( $nY_0$  and  $nY_1$ ), a common input/output ( $nZ$ ) and three digital select inputs ( $S_1$  to  $S_3$ ).

With  $\bar{E}$  LOW, one of the two switches is selected (low impedance ON-state) by  $S_1$  to  $S_3$ . With  $\bar{E}$  HIGH, all switches are in the high impedance OFF-state, independent of  $S_1$  to  $S_3$ .

$V_{CC}$  and GND are the supply voltage pins for the digital control inputs ( $S_1$ , to  $S_3$ , and  $\bar{E}$ ). 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 ( $nY_0$  and  $nY_1$ , 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 $\bar{E}$ to $V_{OS}$ $S_n$ to $V_{OS}$	$C_L = 15$ pF; $R_L = 1$ k $\Omega$ ; $V_{CC} = 5$ V	17	23	ns
			21	21	ns
$t_{PHZ}/t_{PLZ}$	turn “OFF” time $\bar{E}$ to $V_{OS}$ $S_n$ to $V_{OS}$		18	20	ns
			17	19	ns
$C_I$	input capacitance		3.5	3.5	pF
$C_{PD}$	power dissipation capacitance per switch	notes 1 and 2	36	36	pF
$C_S$	max. switch capacitance independent (Y) common (Z)		5	5	pF
			8	8	pF

### Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ 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

# Triple 2-channel analog multiplexer/demultiplexer

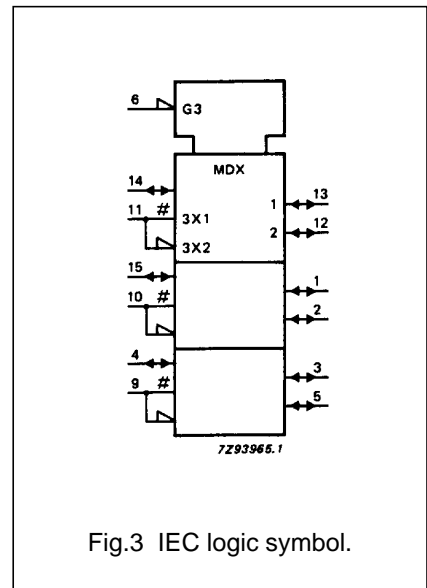
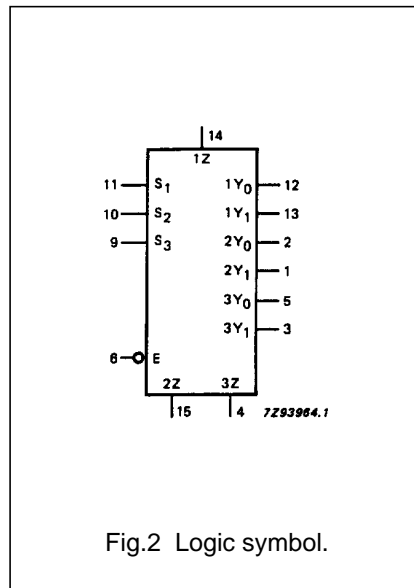
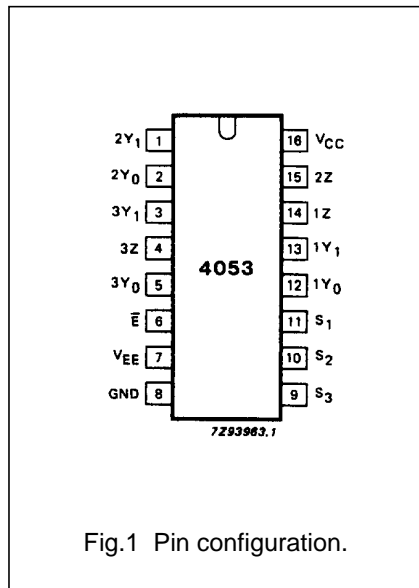
74HC/HCT4053

## ORDERING INFORMATION

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

## PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
2, 1	2Y <sub>0</sub> to, 2Y <sub>1</sub>	independent inputs/outputs
5, 3	3Y <sub>0</sub> to, 3Y <sub>1</sub>	independent inputs/outputs
6	$\bar{E}$	enable input (active LOW)
7	V <sub>EE</sub>	negative supply voltage
8	GND	ground (0 V)
11, 10, 9	S <sub>1</sub> to S <sub>3</sub>	select inputs
12, 13	1Y <sub>0</sub> , 1Y <sub>1</sub>	independent inputs/outputs
14, 15, 4	1Z to 3Z	common inputs/outputs
16	V <sub>CC</sub>	positive supply voltage



# Triple 2-channel analog multiplexer/demultiplexer

74HC/HCT4053

### APPLICATIONS

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

### FUNCTION TABLE

INPUTS		CHANNEL ON
$\bar{E}$	$S_n$	
L	L	$nY_0 - nZ$
L	H	$nY_1 - nZ$
H	X	none

### Note

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

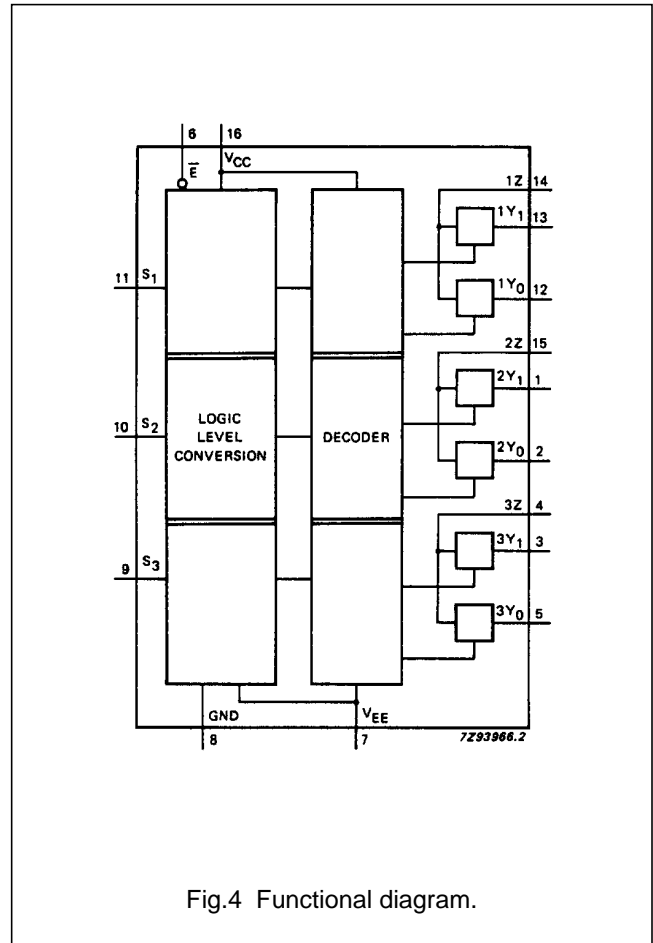


Fig.4 Functional diagram.

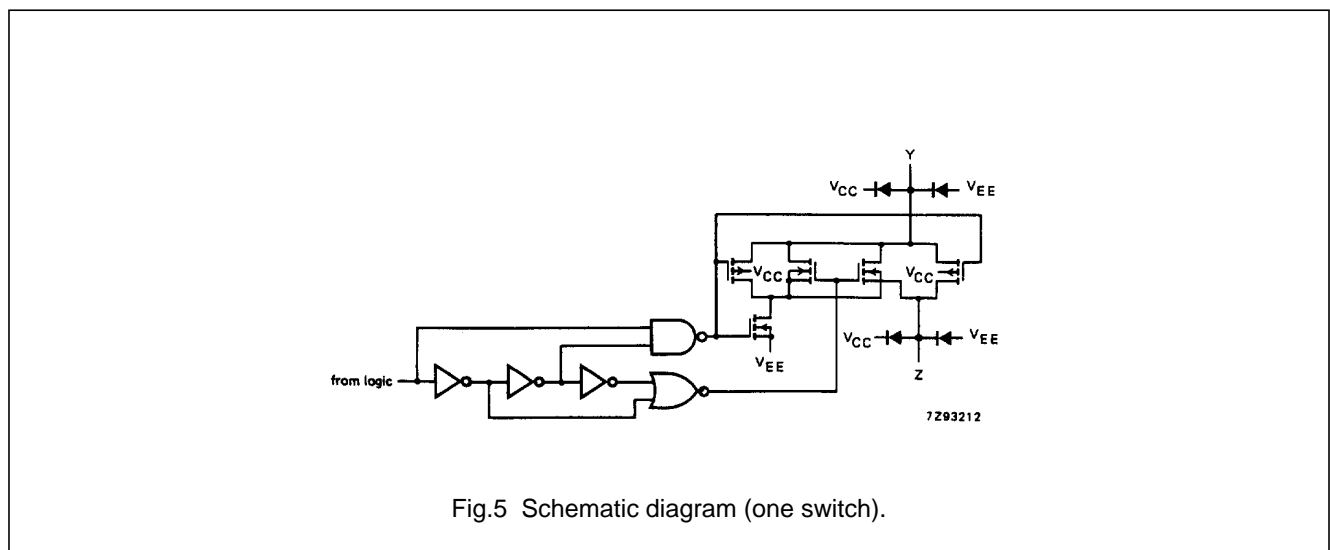


Fig.5 Schematic diagram (one switch).

# Triple 2-channel analog multiplexer/demultiplexer

74HC/HCT4053

## 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 8 mW/K
$P_S$	power dissipation per switch		100	mW	

### Note to ratings

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	$V_{CC} = 2.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$ $V_{CC} = 10.0 \text{ V}$

# Triple 2-channel analog multiplexer/demultiplexer

## 74HC/HCT4053

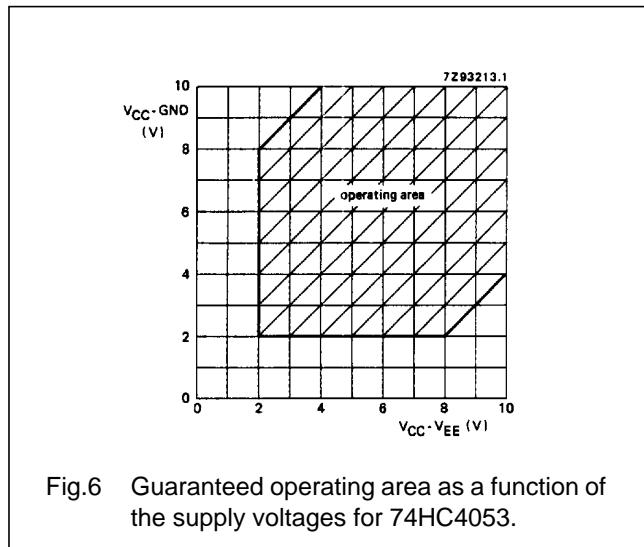


Fig.6 Guaranteed operating area as a function of the supply voltages for 74HC4053.

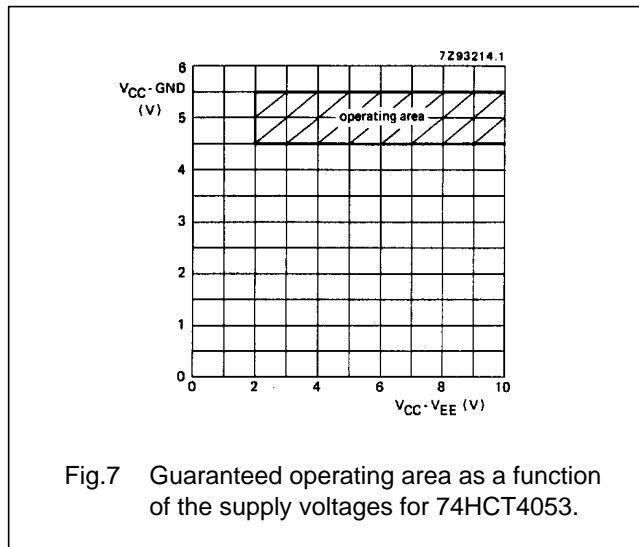


Fig.7 Guaranteed operating area as a function of the supply voltages for 74HCT4053.

### 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 $V_{EE}$	$V_{IH}$ 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		
$\Delta R_{ON}$	maximum $\Delta R_{ON}$ 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 to the characteristics

- At supply voltages ( $V_{CC} - V_{EE}$ ) approaching 2.0 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.8.

# Triple 2-channel analog multiplexer/demultiplexer

74HC/HCT4053

**DC CHARACTERISTICS FOR 74HC**

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)							UNIT	TEST CONDITIONS			
		74HC								V <sub>CC</sub> V	V <sub>EE</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	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 <sub>IL</sub>	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 <sub>I</sub>	input leakage current			0.1 0.2		1.0 2.0		1.0 2.0	µA	6.0 10.0	0 0	V <sub>CC</sub> or GND	
±I <sub>S</sub>	analog switch OFF-state current per channel			0.1		1.0		1.0	µA	10.0	0	V <sub>IH</sub> or V <sub>IL</sub>	M <sub>S</sub>   = V <sub>CC</sub> - V <sub>EE</sub> (see Fig.10)
±I <sub>S</sub>	analog switch OFF-state current all channels			0.1		1.0		1.0	µA	10.0	0	V <sub>IH</sub> or V <sub>IL</sub>	M <sub>S</sub>   = V <sub>CC</sub> - V <sub>EE</sub> (see Fig.10)
±I <sub>S</sub>	analog switch ON-state current			0.1		1.0		1.0	µA	10.0	0	V <sub>IH</sub> or V <sub>IL</sub>	M <sub>S</sub>   = V <sub>CC</sub> - V <sub>EE</sub> (see Fig.11)
I <sub>CC</sub>	quiescent supply current			8.0 16.0		80.0 160.0		160.0 320.0	µA	6.0 10.0	0 0	V <sub>CC</sub> or GND	V <sub>IS</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>OS</sub> = V <sub>CC</sub> or V <sub>EE</sub>

# Triple 2-channel analog multiplexer/demultiplexer

74HC/HCT4053

**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									$V_{CC}$ (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 $V_{os}$		15 5 4 4	60 12 10 8		75 15 13 10		90 18 15 12	ns	2.0 4.5 6.0 4.5	0 0 0 -4.5	$R_L = \infty$ ; $C_L = 50$ pF (see Fig.18)	
$t_{PZH}/t_{PZL}$	turn "ON" time $\bar{E}$ to $V_{os}$		60 20 16 15	220 44 37 31		275 55 47 39		330 66 56 47	ns	2.0 4.5 6.0 4.5	0 0 0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	
$t_{PZH}/t_{PZL}$	turn "ON" time $S_n$ to $V_{os}$		75 25 20 15	220 44 37 31		275 55 47 39		330 66 56 47	ns	2.0 4.5 6.0 4.5	0 0 0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	
$t_{PHZ}/t_{PLZ}$	turn "OFF" time $\bar{E}$ to $V_{os}$		63 21 17 15	210 42 36 29		265 53 45 36		315 63 54 44	ns	2.0 4.5 6.0 4.5	0 0 0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	
$t_{PHZ}/t_{PLZ}$	turn "OFF" time $S_n$ to $V_{os}$		60 20 16 15	210 42 36 29		265 53 45 36		315 63 54 44	ns	2.0 4.5 6.0 4.5	0 0 0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	



# Triple 2-channel analog multiplexer/demultiplexer

74HC/HCT4053

## DC CHARACTERISTICS FOR 74HCT

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)							UNIT	TEST CONDITIONS			
		74HCT								V <sub>CC</sub> (V)	V <sub>EE</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	0	V <sub>CC</sub> or GND	
±I <sub>S</sub>	analog switch OFF-state current per channel			0.1		1.0		1.0	µA	10.0	0	V <sub>IH</sub> or V <sub>IL</sub>	M <sub>S</sub>   = V <sub>CC</sub> - V <sub>EE</sub> Fig.10
±I <sub>S</sub>	analog switch OFF-state current all channels			0.1		1.0		1.0	µA	10.0	0	V <sub>IH</sub> or V <sub>IL</sub>	M <sub>S</sub>   = V <sub>CC</sub> - V <sub>EE</sub> Fig.10
±I <sub>S</sub>	analog switch ON-state current			0.1		1.0		1.0	µA	10.0	0	V <sub>IH</sub> or V <sub>IL</sub>	M <sub>S</sub>   = V <sub>CC</sub> - V <sub>EE</sub> Fig.11
I <sub>CC</sub>	quiescent supply current			8.0 16.0		80.0 160.0		160.0 320.0	µA	5.5 5.0	0 -5.0	V <sub>CC</sub> or GND	V <sub>IS</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>OS</sub> = V <sub>CC</sub> or V <sub>EE</sub>
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	0	V <sub>CC</sub> -2.1 V	other inputs at V <sub>CC</sub> or GND

### Note to HCT types

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

INPUT	UNIT LOAD COEFFICIENT
S <sub>n</sub>	0.50
E	0.50

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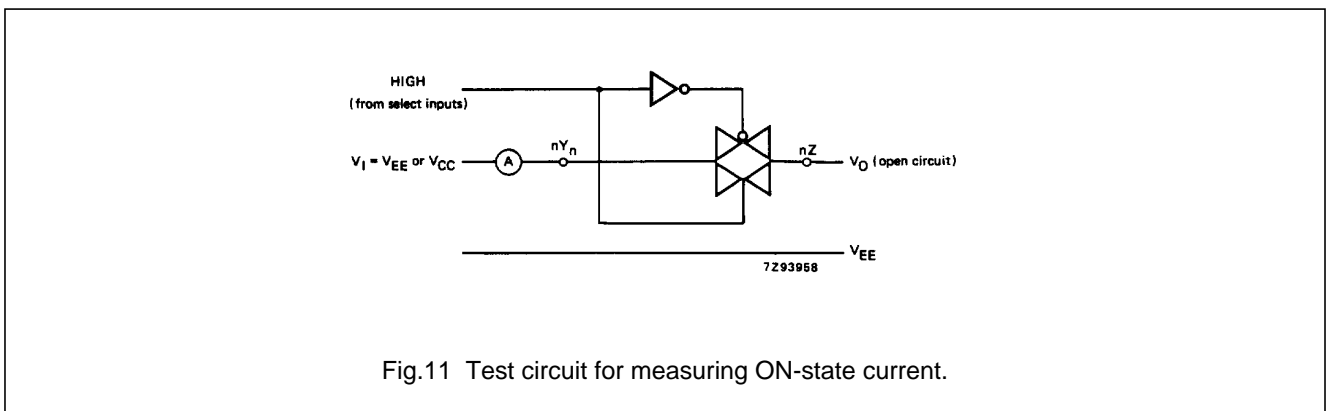
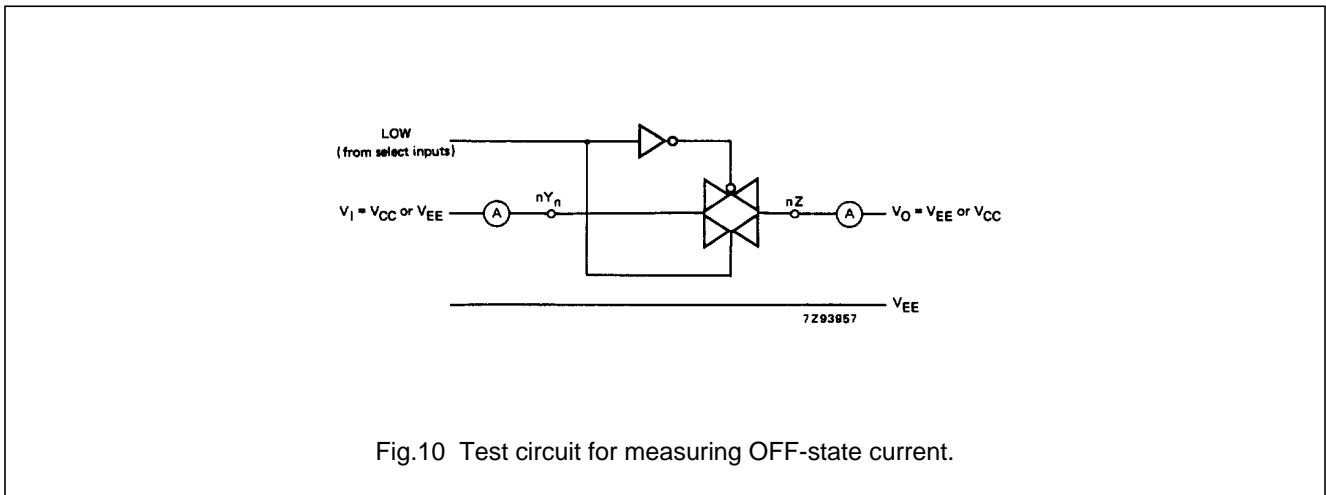
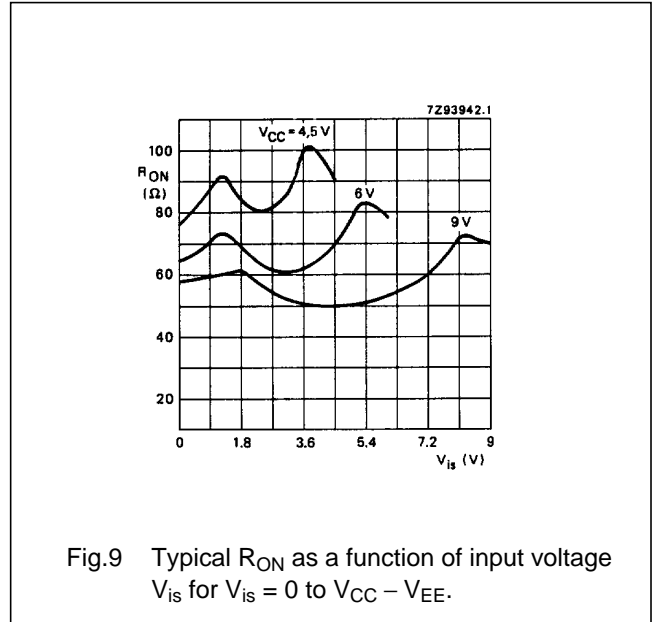
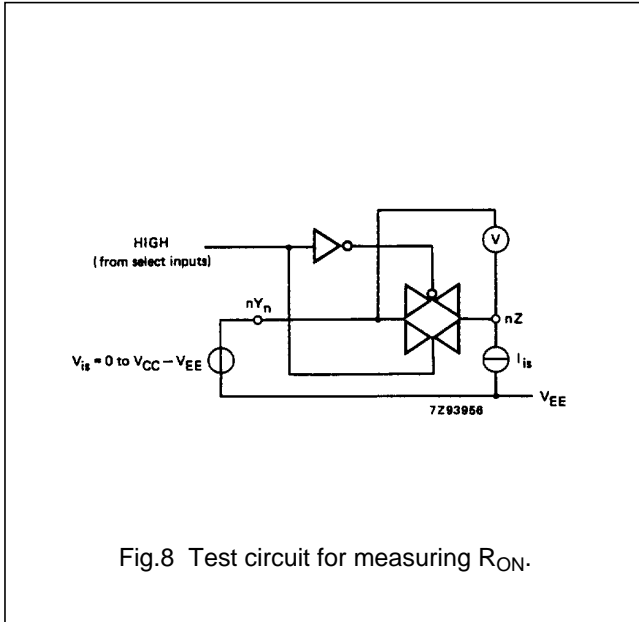
74HC/HCT4053

**AC CHARACTERISTICS FOR 74HCT**GND = 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 $V_{os}$		5 4	12 8		15 10		18 12	ns	4.5 4.5	0 -4.5	$R_L = \infty$ ; $C_L = 50$ pF (see Fig.18)	
$t_{PZH}/t_{PZL}$	turn "ON" time $\bar{E}$ to $V_{os}$		27 16	48 34		60 43		72 51	ns	4.5 4.5	0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	
$t_{PZH}/t_{PZL}$	turn "ON" time $S_n$ to $V_{os}$		25 16	48 34		60 43		72 51	ns	4.5 4.5	0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	
$t_{PHZ}/t_{PLZ}$	turn "OFF" time $\bar{E}$ to $V_{os}$		24 15	44 31		55 39		66 47	ns	4.5 4.5	0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	
$t_{PHZ}/t_{PLZ}$	turn "OFF" time $S_n$ to $V_{os}$		22 15	44 31		55 39		66 47	ns	4.5 4.5	0 -4.5	$R_L = 1$ k $\Omega$ ; $C_L = 50$ pF (see Figs 19, 20 and 21)	

Triple 2-channel analog  
multiplexer/demultiplexer

74HC/HCT4053



# Triple 2-channel analog multiplexer/demultiplexer

74HC/HCT4053

## 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 (Fig.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		$R_L = 600\text{ k}\Omega$ ; $C_L = 50\text{ pF}$ ; $f = 1\text{ MHz}$ ( $\bar{E}$ 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 Fig.13 and 14)
$C_S$	maximum switch capacitance independent (Y) common (Z)	5 8	pF pF				

### Notes to the AC characteristics

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

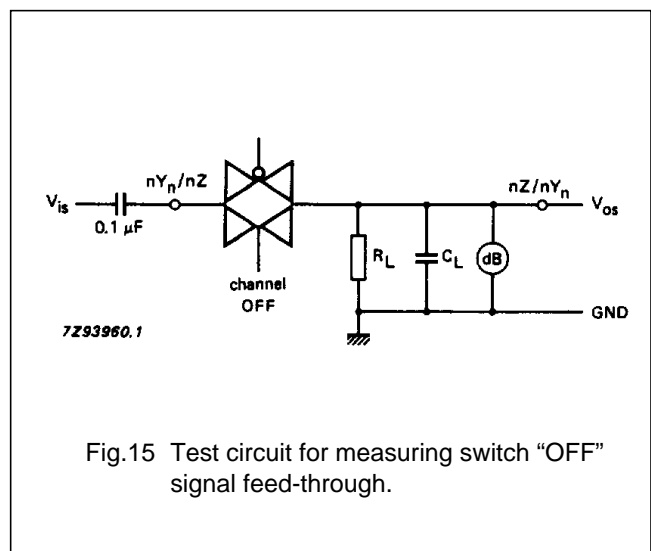
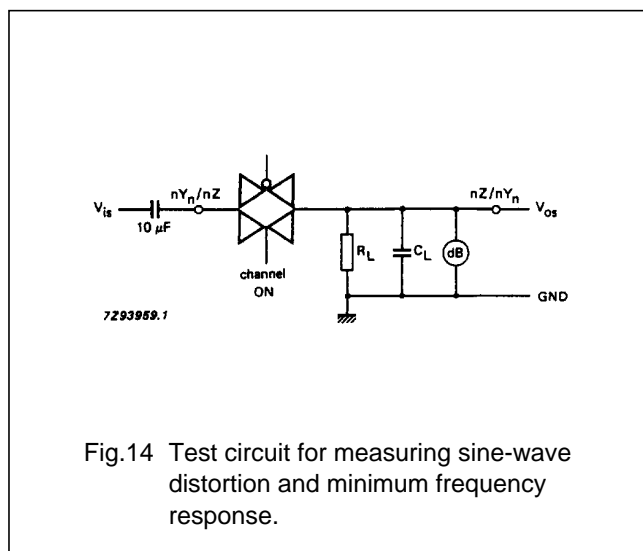
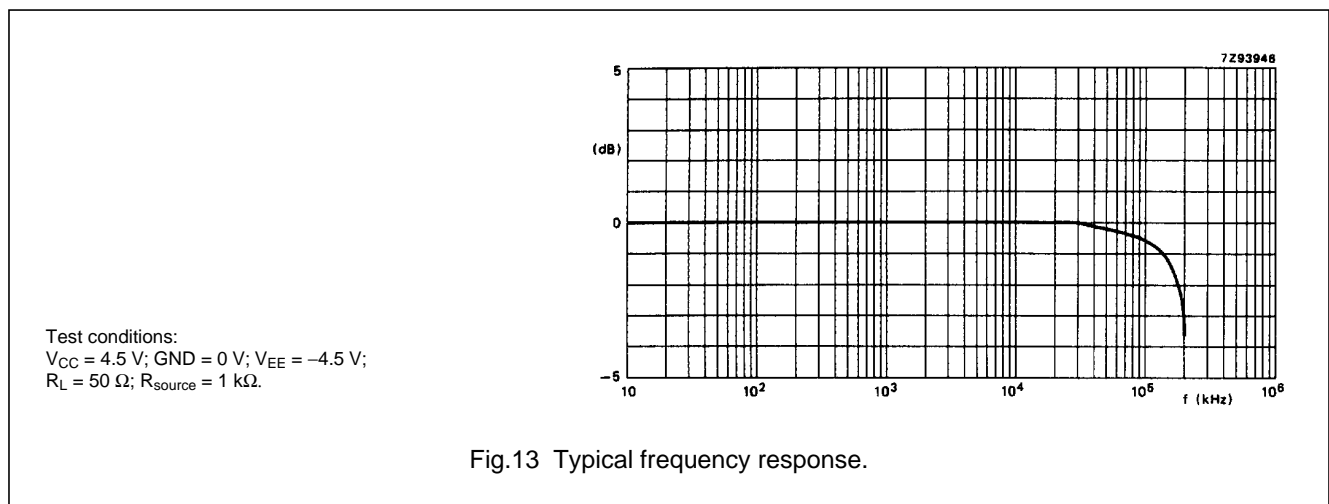
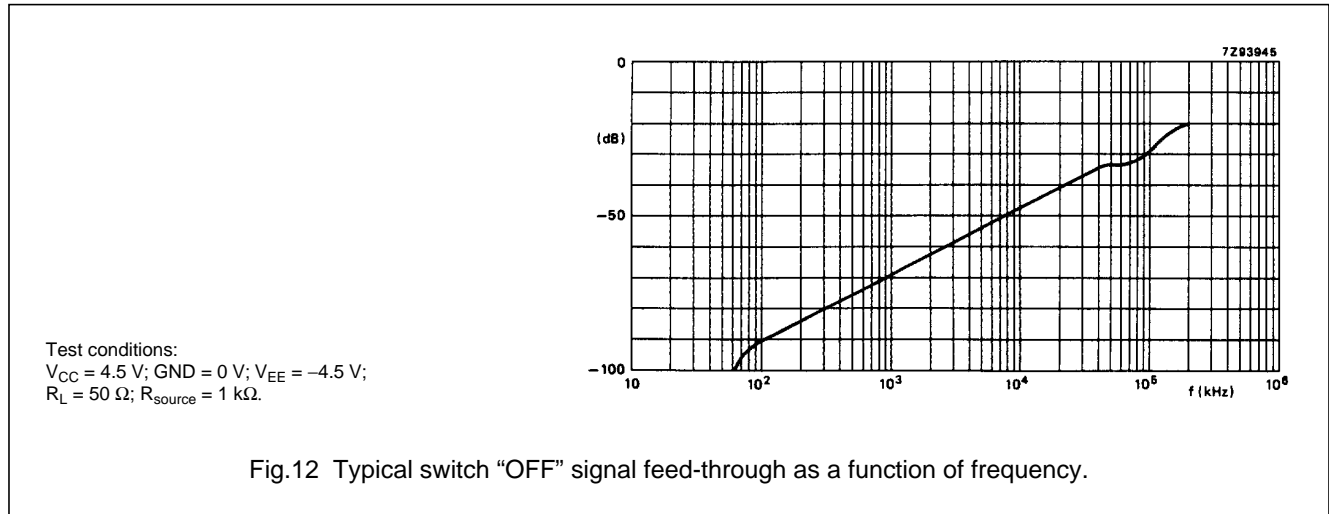
### General note

$V_{is}$  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

# Triple 2-channel analog multiplexer/demultiplexer

## 74HC/HCT4053



Triple 2-channel analog  
multiplexer/demultiplexer

74HC/HCT4053

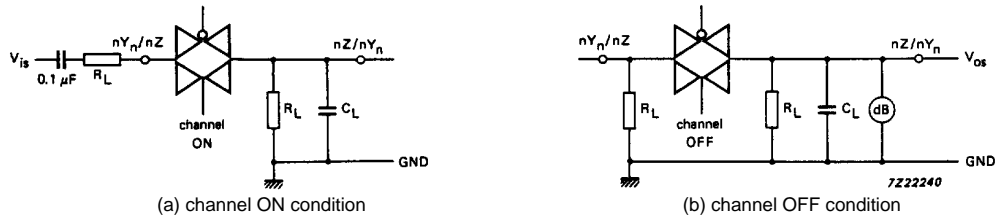


Fig.16 Test circuits for measuring crosstalk between any two switches/multiplexers.

The crosstalk is defined as follows  
(oscilloscope output):

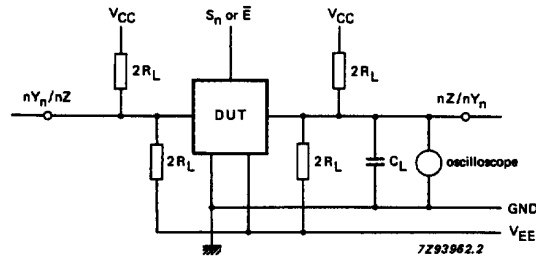
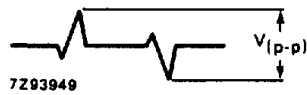


Fig.17 Test circuit for measuring crosstalk between control and any switch.

Triple 2-channel analog  
multiplexer/demultiplexer

74HC/HCT4053

AC WAVEFORMS

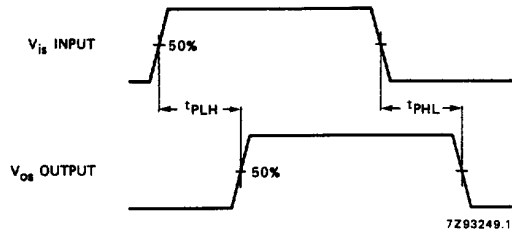
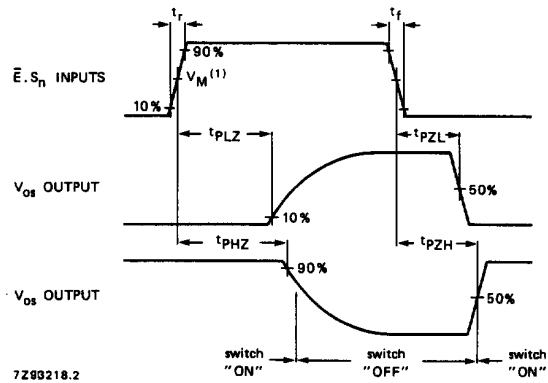


Fig.18 Waveforms showing the input ( $V_{is}$ ) to output ( $V_{os}$ ) propagation delays.



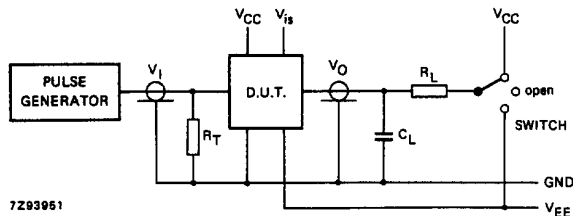
(1) HC :  $V_M = 50\%$ ;  $V_I = \text{GND to } V_{CC}$ .  
HCT:  $V_M = 1.3 V_I = \text{GND to } 3 \text{ V}$ .

Fig.19 Waveforms showing the turn-ON and turn-OFF times.

# Triple 2-channel analog multiplexer/demultiplexer

## 74HC/HCT4053

### TEST CIRCUIT AND WAVEFORMS



#### Conditions

TEST	SWITCH	V <sub>IS</sub>
t <sub>PZH</sub>	V <sub>EE</sub>	V <sub>CC</sub>
t <sub>PZL</sub>	V <sub>CC</sub>	V <sub>EE</sub>
t <sub>PHZ</sub>	V <sub>EE</sub>	V <sub>CC</sub>
t <sub>PLZ</sub>	V <sub>CC</sub>	V <sub>EE</sub>
others	open	pulse

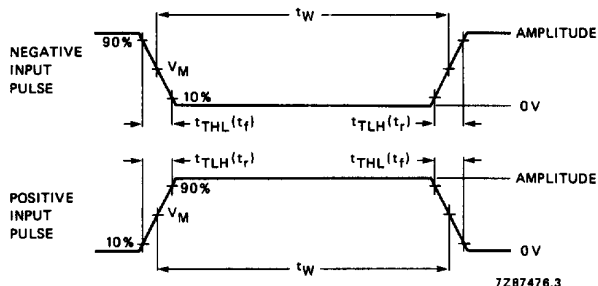
FAMILY	AMPLITUDE	V <sub>M</sub>	t <sub>r</sub> ; t <sub>f</sub>	
			f <sub>max</sub> ; PULSE WIDTH	OTHER
74HC	V <sub>CC</sub>	50%	<2 ns	6 ns
74HCT	3.0 V	1.3 V	<2 ns	6 ns

C<sub>L</sub> = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).

R<sub>T</sub> = termination resistance should be equal to the output impedance Z<sub>O</sub> of the pulse generator.

t<sub>r</sub> = t<sub>f</sub> = 6 ns; when measuring f<sub>max</sub>, there is no constraint to t<sub>r</sub>, t<sub>f</sub> with 50% duty factor.

Fig.20 Test circuit for measuring AC performance.



#### Conditions

TEST	SWITCH	V <sub>IS</sub>
t <sub>PZH</sub>	V <sub>EE</sub>	V <sub>CC</sub>
t <sub>PZL</sub>	V <sub>CC</sub>	V <sub>EE</sub>
t <sub>PHZ</sub>	V <sub>EE</sub>	V <sub>CC</sub>
t <sub>PLZ</sub>	V <sub>CC</sub>	V <sub>EE</sub>
others	open	pulse

FAMILY	AMPLITUDE	V <sub>M</sub>	t <sub>r</sub> ; t <sub>f</sub>	
			f <sub>max</sub> ; PULSE WIDTH	OTHER
74HC	V <sub>CC</sub>	50%	<2 ns	6 ns
74HCT	3.0 V	1.3 V	<2 ns	6 ns

C<sub>L</sub> = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).

R<sub>T</sub> = termination resistance should be equal to the output impedance Z<sub>O</sub> of the pulse generator.

t<sub>r</sub> = t<sub>f</sub> = 6 ns; when measuring f<sub>max</sub>, there is no constraint to t<sub>r</sub>, t<sub>f</sub> with 50% duty factor.

Fig.21 Input pulse definitions.



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Triple 2-channel analog  
multiplexer/demultiplexer

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74HC/HCT4053

**PACKAGE OUTLINES**

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

# 74HC/HCT4053; Triple 2-channel analog multiplexer/demultiplexer

Information as of 2003-04-22

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## General description

The 74HC/HCT4053 are high-speed Si-gate CMOS devices and are pin compatible with the '4053' of the '4000B' series. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4053 are triple 2-channel analog multiplexers/demultiplexers with a common enable input (E). Each multiplexer/demultiplexer has two independent inputs/outputs ( $nY_0$  and  $nY_1$ ), a common input/output ( $nZ$ ) and three digital select inputs ( $S_1$  to  $S_3$ ).

With E LOW, one of the two switches is selected (low impedance ON-state) by  $S_1$  to  $S_3$ . With E HIGH, all switches are in the high impedance OFF-state, independent of  $S_1$  to  $S_3$ .

$V_{CC}$  and GND are the supply voltage pins for the digital control inputs ( $S_1$ , to  $S_3$ , and E). 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 ( $nY_0$  and  $nY_1$ , 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).

## Features

- Low 'ON' resistance:
  - 80  $\Omega$  (typ.) at  $V_{CC} - V_{EE} = 4.5 \text{ V}$
  - 70  $\Omega$  (typ.) at  $V_{CC} - V_{EE} = 6.0 \text{ V}$
  - 60  $\Omega$  (typ.) at  $V_{CC} - V_{EE} = 9.0 \text{ V}$
- Logic level translation: to enable 5 V logic to communicate with  $\pm 5 \text{ V}$  analog signals
- Typical 'break before make' built in
- Output capability: non-standard
- $I_{CC}$  category: MSI

## Applications

[AN97022\\_1: TDA8752 Demonstration board documentation](#) (date 16-Dec-02)

## Datasheet

<u>Type number</u>	<u>Title</u>	<u>Publication release date</u>	<u>Datasheet status</u>	<u>Page count</u>	<u>File size (kB)</u>	<u>Datasheet</u>
74HC/HCT4053	Triple 2-channel analog multiplexer/demultiplexer	12/1/1990	Product specification	17	121	<a href="#">Download</a>

## Additional datasheet info

To complete the device datasheet with package and family information, also download the following PDF files. The "Logic Package Information" document is required to determine in which package(s) this device is available.

<u>Document</u>	<u>Description</u>
1 <a href="#">HCT_FAMILY_SPECIFICATIONS</a>	HC/T Family Specifications, The IC06 74HC/HCT/HCMOS Logic Family Specifications
2 <a href="#">HCT_PACKAGE_INFO</a>	HC/T Package Info, The IC06 74HC/HCT/HCMOS Logic Package Information

## ▣ Parametrics

Type number	Package	Description	Propagation Delay(ns)	Voltage	No. of Pins	Power Dissipation Considerations	Logic Switching Levels	Output Drive Capability
74HC4053D	<a href="#">SOT109</a> (SO16)	Triple 2-Channel Analog Multiplexer/Demultiplexer	10~15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HC4053DB	<a href="#">SOT338-1</a> (SSOP16)	Triple 2-Channel Analog Multiplexer/Demultiplexer	10~15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HC4053N	<a href="#">SOT38-1</a> (DIP16)	Triple 2-Channel Analog Multiplexer/Demultiplexer	10~15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HC4053PW	<a href="#">SOT403-1</a> (TSSOP16)	Triple 2-Channel Analog Multiplexer/Demultiplexer	10~15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HCT4053D	<a href="#">SOT109</a> (SO16)	Triple 2-Channel Analog Multiplexer/Demultiplexer; TTL Enabled	10~15	5 Volts +	16	Low Power or Battery Applications	TTL	Low
74HCT4053DB	<a href="#">SOT338-1</a> (SSOP16)	Triple 2-Channel Analog Multiplexer/Demultiplexer; TTL Enabled	10~15	5 Volts +	16	Low Power or Battery Applications	TTL	Low
74HCT4053N	<a href="#">SOT38-1</a> (DIP16)	Triple 2-Channel Analog Multiplexer/Demultiplexer; TTL Enabled	10~15	5 Volts +	16	Low Power or Battery Applications	TTL	Low
74HCT4053PW	<a href="#">SOT403-1</a> (TSSOP16)	Triple 2-Channel Analog Multiplexer/Demultiplexer; TTL Enabled	10~15	5 Volts +	16	Low Power or Battery Applications	TTL	Low


## ❑ Products, packages, availability and ordering

<u>Type number</u>	<u>North American type number</u>	<u>Ordering code (12NC)</u>	<u>Marking/Packing</u> <a href="#">Discretes packing info</a>	<u>Package</u>	<u>Device status</u>	<u>Buy online</u>
74HC4053D	74HC4053D	9337 148 40652	Standard Marking * Bulk Pack, CECC	<a href="#">SOT109</a> (SO16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
	74HC4053D-T	9337 148 40653	Standard Marking * Reel Pack, SMD, 13", CECC	<a href="#">SOT109</a> (SO16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
74HC4053DB	74HC4053DB	9351 668 00112	Standard Marking * Bulk Pack	<a href="#">SOT338-1</a> (SSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
	74HC4053DB-T	9351 668 00118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT338-1</a> (SSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
74HC4053N	74HC4053N	9336 697 60652	Standard Marking * Bulk Pack, CECC	<a href="#">SOT38-1</a> (DIP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
74HC4053PW	74HC4053PW	9351 869 40112	Standard Marking * Bulk Pack	<a href="#">SOT403-1</a> (TSSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
	74HC4053PW-T	9351 869 40118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT403-1</a> (TSSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
74HCT4053D	74HCT4053D	9337 153 20112	Standard Marking * Bulk Pack	<a href="#">SOT109</a> (SO16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
	74HCT4053D-T	9337 153 20118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT109</a> (SO16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
74HCT4053DB	74HCT4053DB	9351 667 80112	Standard Marking * Bulk Pack	<a href="#">SOT338-1</a> (SSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
	74HCT4053DB-T	9351 667 80118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT338-1</a> (SSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
74HCT4053N	74HCT4053N	9336 703 90112	Standard Marking * Bulk Pack	<a href="#">SOT38-1</a> (DIP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>

74HCT4053PW	74HCT4053PW	9351 884 80112	Standard Marking * Bulk Pack	<a href="#">SOT403-1</a> (TSSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>
	74HCT4053PW-T	9351 884 80118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT403-1</a> (TSSOP16)	Full production	<input type="text" value="order this"/> - <input type="text" value=""/>

Products in the above table are all in production. Some variants are discontinued; [click here](#) for information on these variants.

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 [74HC/HCT4053](#) links to the similar products page containing an overview of products that are similar in function or related to the type number(s) as listed on this page. The similar products page includes products from the same catalog tree(s), relevant selection guides and products from the same functional category.

## Support & tools

 [I<sup>2</sup>C Bus Solutions - Industrial/Motor Control Applications: Numeric Control Machine](#)(date 01-Jun-02)

 [HC/T Family Specifications, The IC06 74HC/HCT/HCMOS Logic Family Specifications](#)(date 01-Mar-98)

 [HC/T User Guide](#)(date 01-Nov-97)

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