

# 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/HCT4353**

Triple 2-channel analog  
multiplexer/demultiplexer with latch

Product specification  
File under Integrated Circuits, IC06

December 1990

## Triple 2-channel analog multiplexer/demultiplexer with latch

## 74HC/HCT4353

### FEATURES

- Wide analog input voltage range:  $\pm 5$  V
- 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
- Address latches provided
- Output capability: non-standard
- $I_{CC}$  category: MSI

### GENERAL DESCRIPTION

The 74HC/HCT4353 are high-speed Si-gate CMOS devices. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4353 are triple 2-channel analog multiplexers/demultiplexers with two common enable inputs ( $\bar{E}_1$  and  $E_2$ ) and a latch enable input ( $\bar{LE}$ ). Each

multiplexer has two independent inputs/outputs ( $nY_0$  and  $nY_1$ ), a common input/output ( $nZ$ ) and select inputs ( $S_1$  to  $S_3$ ).

Each multiplexer/demultiplexer contains two bidirectional analog switches, each with one side connected to an independent input/output ( $nY_0$  and  $nY_1$ ) and the other side connected to a common input/output ( $nZ$ ).

With  $\bar{E}_1$  LOW and  $E_2$  HIGH, one of the two switches is selected (low impedance ON-state) by  $S_1$  to  $S_3$ .

The data at the select inputs may be latched by using the active LOW latch enable input ( $\bar{LE}$ ). When  $\bar{LE}$  is HIGH, the latch is transparent. When either of the two enable inputs,  $\bar{E}_1$  (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 ( $S_1$  to  $S_3$ ,  $\bar{LE}$ ,  $\bar{E}_1$  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 ( $nY_0$  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 $\bar{E}_1$ , $E_2$ or $S_n$ to $V_{os}$	$C_L = 50$ pF; $R_L = 1$ k $\Omega$ ; $V_{CC} = 5$ V	29	21	ns
$t_{PHZ}/t_{PLZ}$	turn "OFF" time $\bar{E}_1$ , $E_2$ or $S_n$ to $V_{os}$		20	22	ns
$C_I$	input capacitance		3.5	3.5	pF
$C_{PD}$	power dissipation capacitance per switch	notes 1 and 2	23	23	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

$C_L$  = output load capacitance in pF

$f_o$  = output frequency in MHz

$C_S$  = max. switch capacitance in pF

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

$V_{CC}$  = 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

### ORDERING INFORMATION

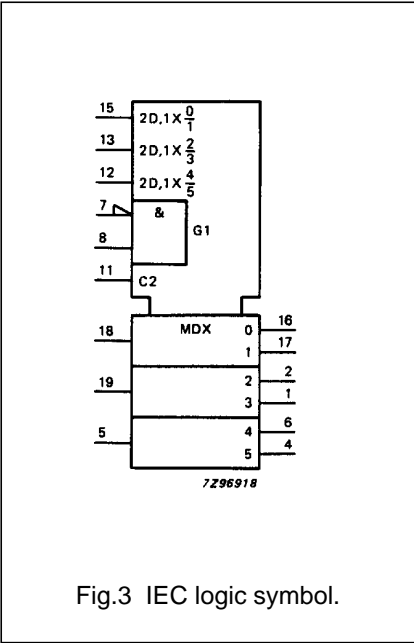
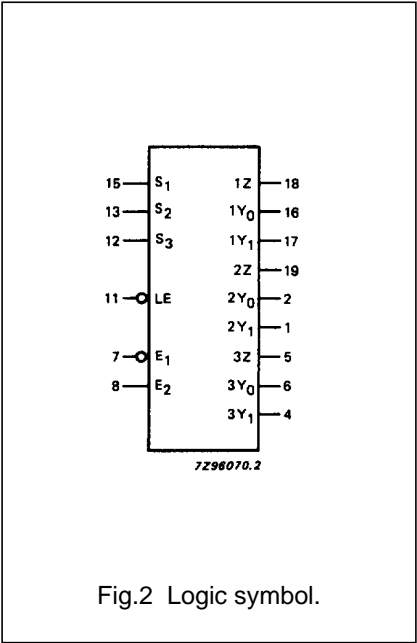
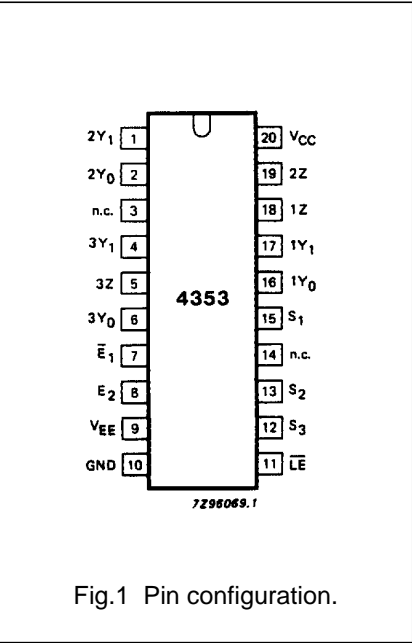
See "74HC/HCT/HCU/HCMOS Logic Package Information".

Triple 2-channel analog  
multiplexer/demultiplexer with latch

74HC/HCT4353

PIN DESCRIPTION

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



# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## FUNCTION TABLE

INPUTS				CHANNEL ON
$\overline{E}_1$	$E_2$	$\overline{LE}$	$S_n$	
H	H	X	X	none
X	L	X	X	none
L	H	H	L	$nY_0 - nZ$
L	H	H	H	$nY_1 - nZ$
L	H	L	X	(1)
X	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

↓ = HIGH-to-LOW  $\overline{LE}$  transition

## APPLICATIONS

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

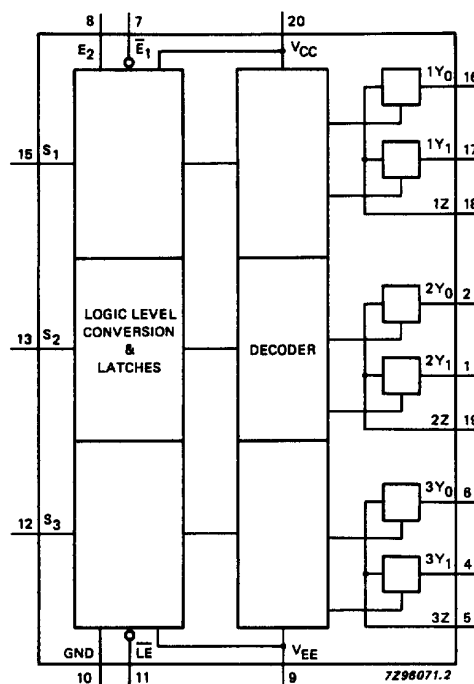


Fig.4 Functional diagram.

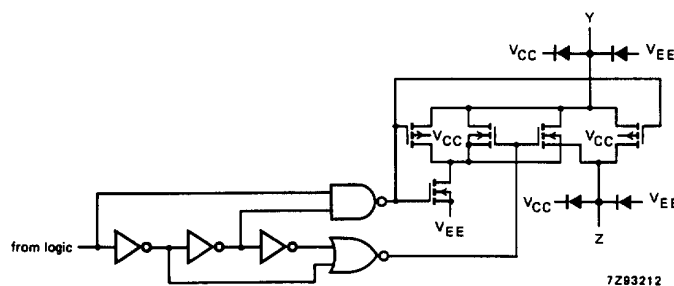


Fig.5 Schematic diagram (one switch).

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## 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

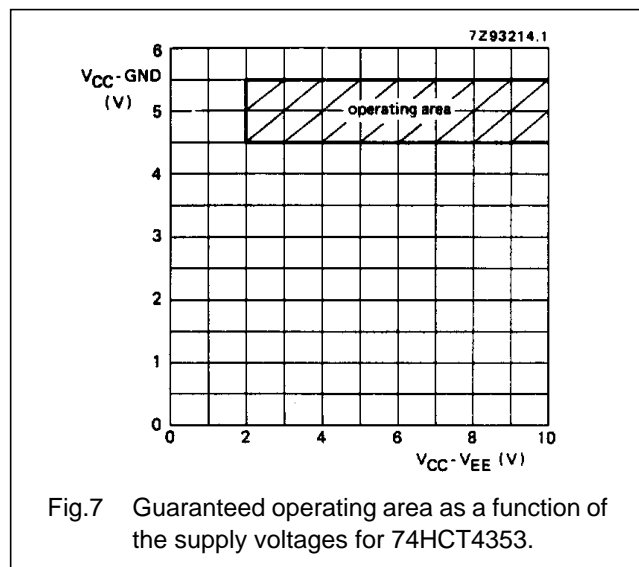
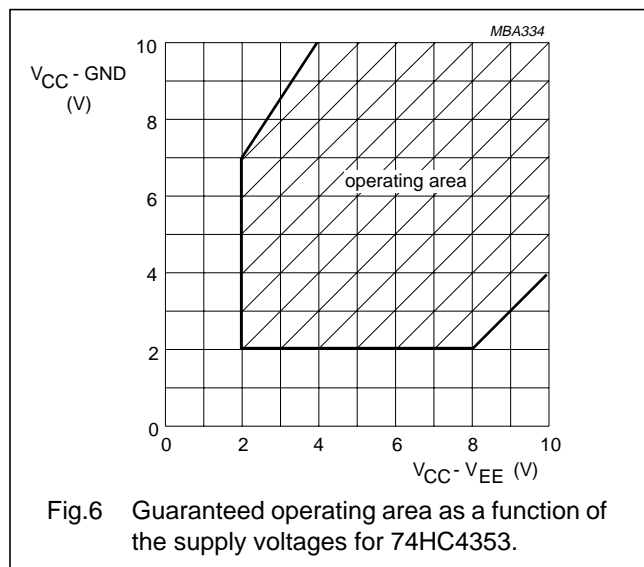
- To avoid drawing  $V_{CC}$  current out of terminals nZ, when switch current flows in terminals nY<sub>n</sub>, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminals nZ, no  $V_{CC}$  current will flow out of terminals nY<sub>n</sub>. In this case there is no limit for the voltage drop across the switch, but the voltages at nY<sub>n</sub> 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 CHARACTER- ISTICS
$T_{amb}$	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 with latch

## 74HC/HCT4353



### 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 <sub>amb</sub> (°C)							UNIT	TEST CONDITIONS				
		74HC/HCT								V <sub>CC</sub> (V)	V <sub>EE</sub> (V)	I <sub>S</sub> (μA)	V <sub>is</sub>	V <sub>I</sub>
		+25			−40 to +85		−40 to +125							
		min.	typ.	max.	min.	max.	min.	max.						
R <sub>ON</sub>	ON resistance (peak)		−	−		−		−	Ω	2.0	0	100	V <sub>CC</sub> to V <sub>EE</sub>	V <sub>IN</sub> or V <sub>IL</sub>
			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 <sub>ON</sub>	ON resistance (rail)		150	−		−		−	Ω	2.0	0	100	V <sub>EE</sub>	V <sub>IH</sub> or V <sub>IL</sub>
			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 <sub>ON</sub>	ON resistance		150	−		−		−	Ω	2.0	0	100	V <sub>CC</sub>	V <sub>IH</sub> or V <sub>IL</sub>
			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 <sub>ON</sub>	maximum ΔON resistance between any two channels		−						Ω	2.0	0		V <sub>CC</sub> to V <sub>EE</sub>	V <sub>IH</sub> or V <sub>IL</sub>
			9						Ω	4.5	0			
			8						Ω	6.0	0			
			6						Ω	4.5	−4.5			

### Notes to DC characteristics

- 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.

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## 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>	V <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>	V <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>	V <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 with latch

74HC/HCT4353

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

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)							UNIT	TEST CONDITIONS		
		74HC								V <sub>CC</sub> (V)	V <sub>EE</sub> (V)	OTHER
		+25			−40 to +85		−40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay V <sub>is</sub> to V <sub>os</sub>		14 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 <sub>L</sub> = ∞; C <sub>L</sub> = 50 pF (see Fig.18)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time E <sub>1</sub> ; E <sub>2</sub> to V <sub>os</sub>		61 22 18 18	250 50 43 40		315 63 54 50		375 75 64 60	ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time LE to V <sub>os</sub>		55 20 16 17	200 40 34 40		250 50 43 50		300 60 51 60	ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time S <sub>n</sub> to V <sub>os</sub>		61 22 18 17	225 45 38 40		280 56 48 50		340 68 58 60	ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PHZ</sub> / t <sub>PLZ</sub>	turn “OFF” time E <sub>1</sub> ; E <sub>2</sub> to V <sub>os</sub>		66 24 19 19	250 50 43 40		315 63 54 50		375 75 64 60	ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PHZ</sub> / t <sub>PLZ</sub>	turn “OFF” time S <sub>n</sub> to V <sub>os</sub> ; LE to V <sub>os</sub>		55 20 16 19	200 40 34 40		250 50 43 50		300 60 51 60	ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>su</sub>	set-up time S <sub>n</sub> to LE	60 12 10 18	17 6 5 8		75 15 13 23		90 18 15 27		ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.20)
t <sub>h</sub>	hold time S <sub>n</sub> to LE	5 5 5 5	−6 −2 −2 −3		5 5 5 5		5 5 5 5		ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.20)
t <sub>w</sub>	LE minimum pulse width HIGH	80 16 14 16	11 4 3 6		100 20 17 20		120 24 20 24		ns	2.0 4.5 6.0 4.5	0 0 0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.20)



# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## 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>	V <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>	V <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>	V <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 ( $\Delta I_{CC}$ ) 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
$\overline{E}_1, E_2$	0.50
$S_n$	0.50
$\overline{LE}$	1.5

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

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

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)							UNIT	TEST CONDITIONS		
		74HCT								V <sub>CC</sub> (V)	V <sub>EE</sub> (V)	OTHER
		+25			−40 to +85		−40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay V <sub>is</sub> to V <sub>os</sub>		5 4	12 8		15 10		18 12	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = ∞; C <sub>L</sub> = 50 pF (see Fig.18)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time E <sub>1</sub> to V <sub>os</sub>		26 22	55 45		69 56		83 68	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time E <sub>2</sub> to V <sub>os</sub>		22 18	50 40		63 50		75 60	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time LE to V <sub>os</sub>		21 17	45 40		56 50		68 60	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PZH</sub> / t <sub>PZL</sub>	turn “ON” time S <sub>n</sub> to V <sub>os</sub>		25 19	50 45		63 56		75 68	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PHZ</sub> / t <sub>PLZ</sub>	turn “OFF” time E <sub>1</sub> to V <sub>os</sub>		23 19	50 40		63 50		75 60	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PHZ</sub> / t <sub>PLZ</sub>	turn “OFF” time E <sub>2</sub> to V <sub>os</sub>		27 23	50 40		63 50		75 60	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PHZ</sub> / t <sub>PLZ</sub>	turn “OFF” time LE to V <sub>os</sub>		19 19	40 40		50 50		60 60	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>PHZ</sub> / t <sub>PLZ</sub>	turn “OFF” time S <sub>n</sub> to V <sub>os</sub>		22 22	45 45		56 56		68 68	ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.19)
t <sub>su</sub>	set-up time S <sub>n</sub> to LE	12 15	7 9		15 19		18 22		ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.20)
t <sub>h</sub>	hold time S <sub>n</sub> to LE	5 5	0 −2		5 5		5 5		ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.20)
t <sub>w</sub>	LE minimum pulse width HIGH	16 16	3 5		20 20		24 24		ns	4.5 4.5	0 −4.5	R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF (see Fig.20)

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

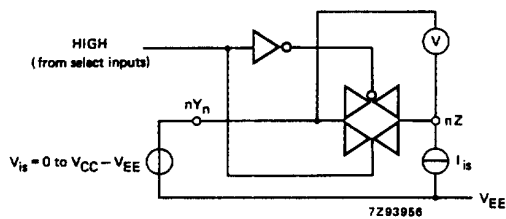
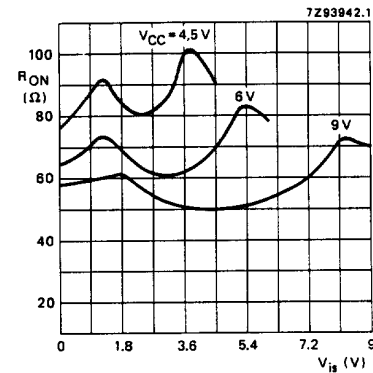
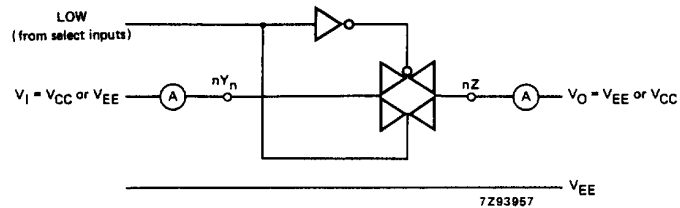
Fig.8 Test circuit for measuring  $R_{ON}$ .Fig.9 Typical  $R_{ON}$  as a function of input voltage  $V_{is}$  for  $V_{is} = 0$  to  $V_{CC} - V_{EE}$ .

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

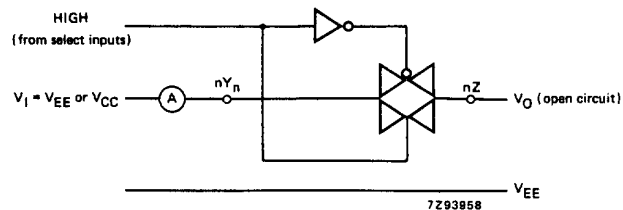


Fig.11 Test circuit for measuring ON-state current.

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## 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 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

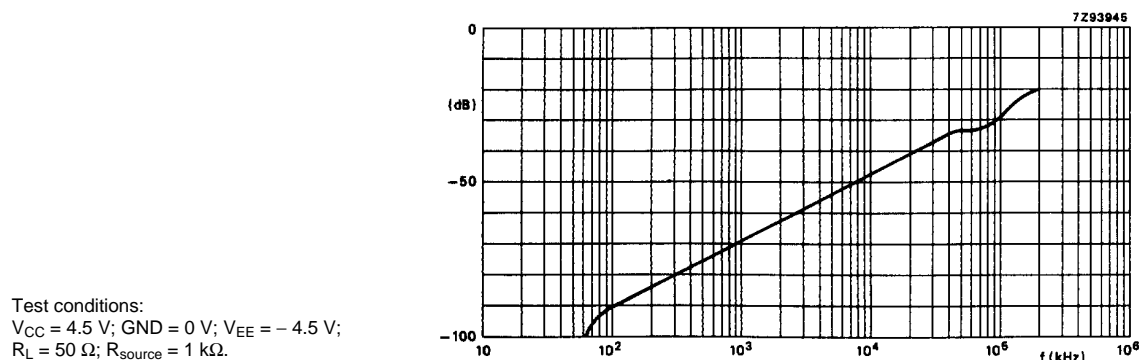
 $V_{is}$  is the input voltage at an  $nY_n$  or  $nZ$  terminal, whichever is assigned as an input. $V_{os}$  is the output voltage at an  $nY_n$  or  $nZ$  terminal, whichever is assigned as an output.

Fig.12 Typical switch "OFF" signal feed-through as a function of frequency.

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

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

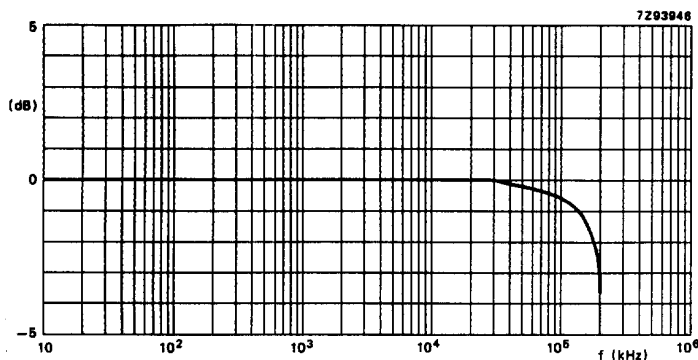


Fig.13 Typical frequency response.

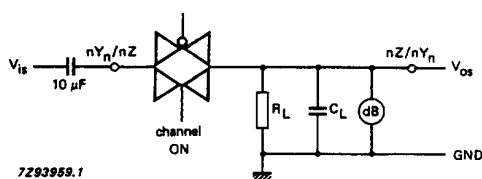


Fig.14 Test circuit for measuring sine-wave distortion and minimum frequency response.

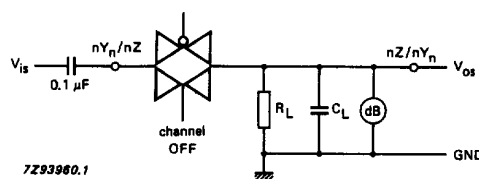


Fig.15 Test circuit for measuring switch "OFF" signal feed-through.

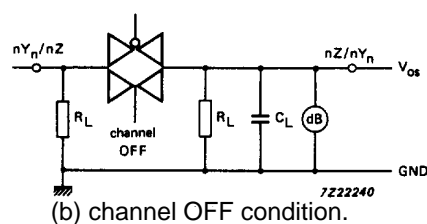
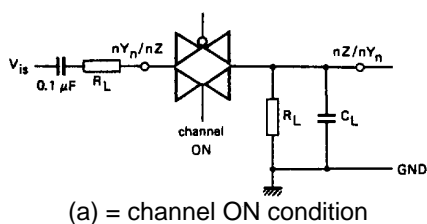
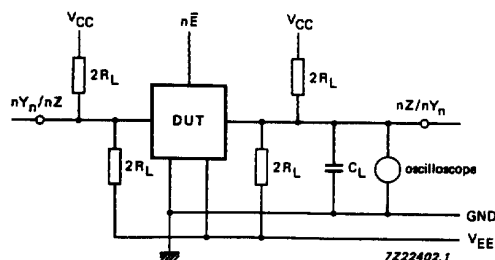


Fig.16 Test circuits for measuring crosstalk between any two switches/multiplexers.



The crosstalk is defined as follows  
 (oscilloscope output):

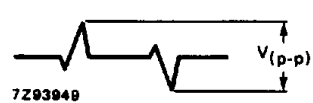


Fig.17 Test circuit for measuring crosstalk between control and any switch.

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## AC WAVEFORMS

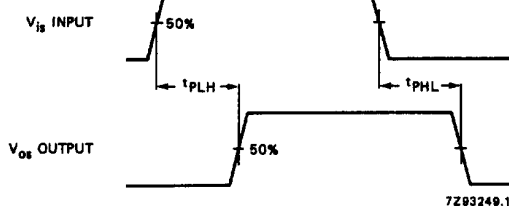
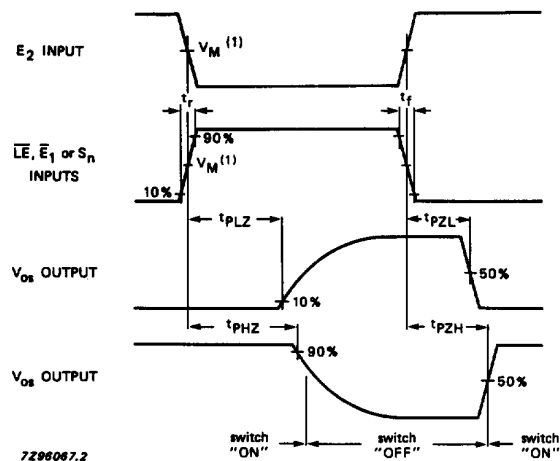
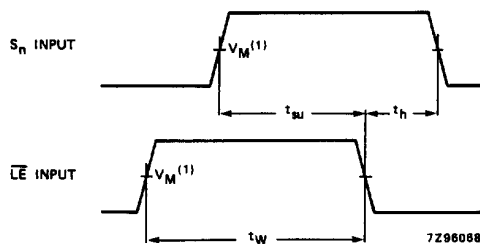


Fig.18 Waveforms showing the input ( $V_{is}$ ) to output ( $V_{os}$ ) propagation delays.



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

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



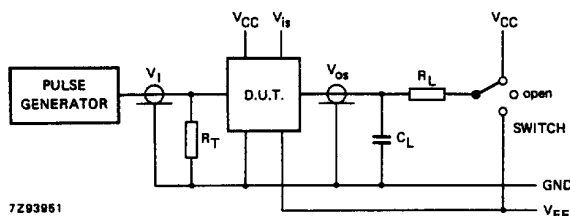
(1) HC :  $V_M = 50\%$ ;  $V_I = \text{GND to } V_{CC}$ .  
HCT :  $V_M = 1.3 \text{ V}$ ;  $V_I = \text{GND to } 3 \text{ V}$ .

Fig.20 Waveforms showing the set-up and hold times from  $S_n$  inputs to  $\overline{LE}$  input, and minimum pulse width of  $\overline{LE}$ .

# Triple 2-channel analog multiplexer/demultiplexer with latch

74HC/HCT4353

## TEST CIRCUIT AND WAVEFORMS



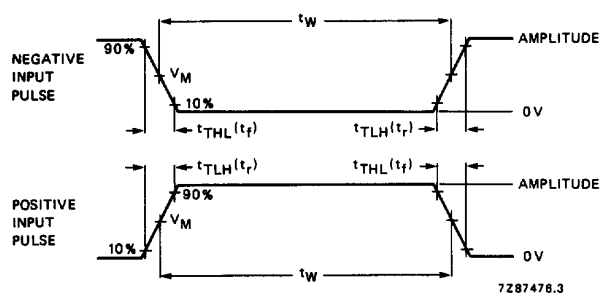
### Conditions

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 on t<sub>r</sub>, t<sub>f</sub> with 50% duty factor.

Fig.21 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 on t<sub>r</sub>, t<sub>f</sub> with 50% duty factor.

Fig.22 Input pulse definitions.

---

Triple 2-channel analog  
multiplexer/demultiplexer with latch

---

74HC/HCT4353

**PACKAGE OUTLINES**

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