

1. General Description

The 74HC4053;74HCT4053 is a triple single-pole double-throw analog switch (3×SPDT) suitable for use in analog or digital 2:1 multiplexer/demultiplexer applications. Each switch features a digital select input (S_n), two independent inputs/outputs ($nY0$ and $nY1$) and a common input/output (nZ). A digital enable input ($\overline{E}$) is common to all switches. When $\overline{E}$ is HIGH, the switches are turned off. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and Benefits

- Wide analog input voltage range from -4.5V to +4.5V
- Wide supply voltage range
74HC4053: from 3V to 9V
74HCT4053: from 4.5V to 5.5V
- Low ON resistance:
80 Ω (typical) at $V_{CC} - V_{EE} = 4.5V$
70 Ω (typical) at $V_{CC} - V_{EE} = 6.0V$
60 Ω (typical) at $V_{CC} - V_{EE} = 9.0V$
- Typical "break before make" built-in
- Input levels:
For 74HC4052: CMOS level
For 74HCT4052: TTL level
- Specified from -40°C to +125°C
- Packaging information: SOP16/TSSOP16

3. Applications

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

4. Ordering Information

Table 1. Ordering information

Type number	Package		
	Name	Description	Quantity
74HC4053D	SOP-16	plastic small outline package; 16 leads; body width 3.9 mm	2500
74HCT4053D			
74HC4053PW	TSSOP-16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	2500
74HCT4053PW			

5. Function Diagram

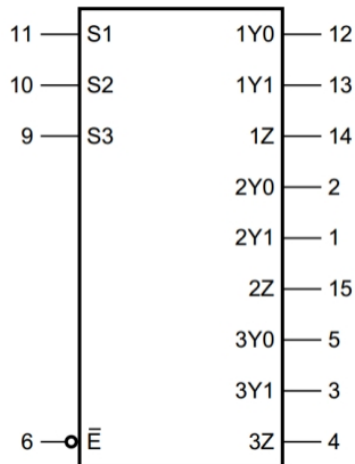


Fig. 1. Logic symbol

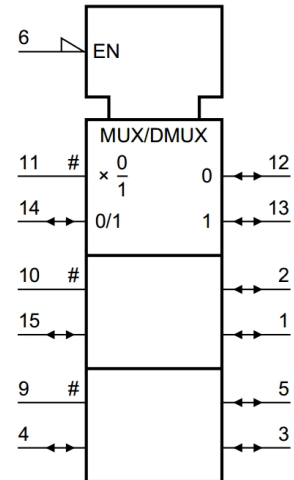


Fig. 2. IEC logic symbol

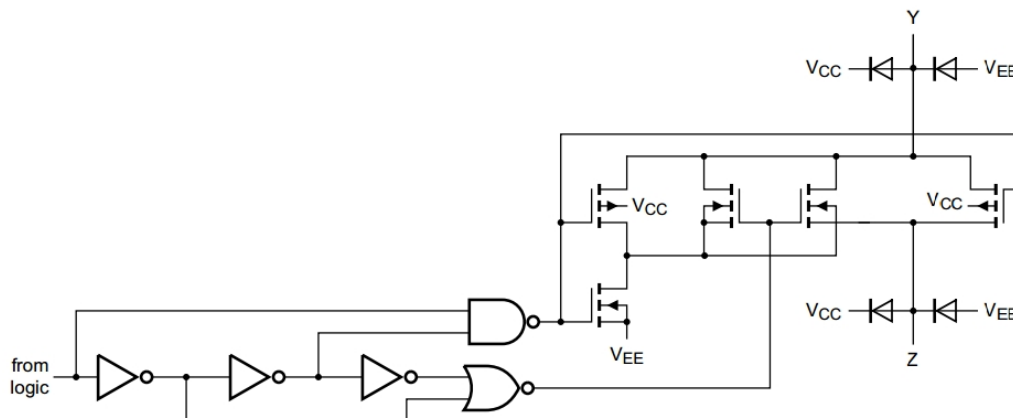


Fig. 3. Schematic diagram (one switch)

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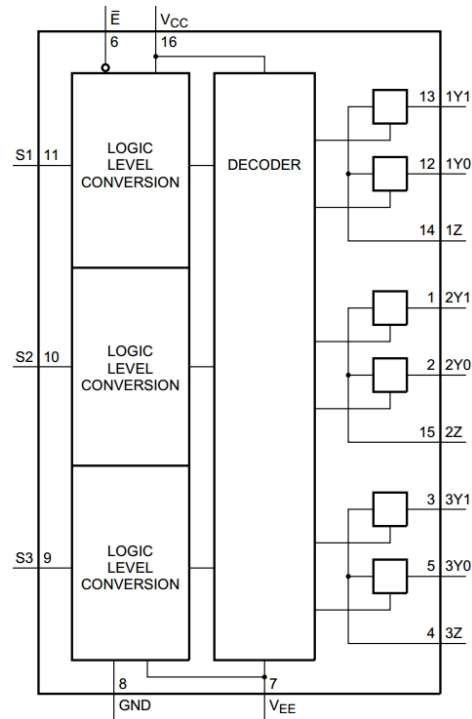
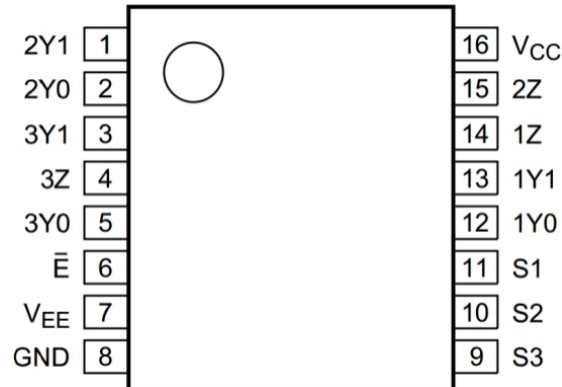


Fig. 4. Functional diagram

6. Pinning Information

Pinning



Pin description

Table 2. Pin description

Symbol	Pin	Description
2Y1	1	independent input or output
2Y0	2	independent input or output
3Y1	3	independent input or output
3Z	4	common output or input
3Y0	5	independent input or output
$\bar{E}$	6	enable input (active LOW)
V_{EE}	7	supply voltage
GND	8	ground supply voltage
S3	9	select input
S2	10	select input
S1	11	select input
1Y0	12	independent input or output
1Y1	13	independent input or output
1Z	14	common output or input
2Z	15	common output or input
V_{CC}	16	supply voltage

7. Functional Description

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

Table 3. Function table

Input		Channel ON
$\overline{E}$	S_n	
L	L	nY0 to nZ
L	H	nY1 to nZ
H	X	switches off

8. Absolute Maximum Ratings

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Table 4. Absolute Maximum Ratings

Symbol	Parameter	Conditions	Min.	Max.	Unit
V_{CC}	supply voltage	[1]	-0.5	+11.0	V
I_{IK}	input clamping current	$V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$	-	± 20	mA
I_{SK}	switch clamping current	$V_{SW} < -0.5 \text{ V}$ or $V_{SW} > V_{CC} + 0.5 \text{ V}$	-	± 20	mA
I_{SW}	switch current	$-0.5 \text{ V} < V_{SW} < V_{CC} + 0.5 \text{ V}$	-	± 25	mA
I_{EE}	supply current	-	-	± 20	mA
I_{CC}	supply current	-	-	50	mA
I_{GND}	ground current	-	-	-50	mA
T_{stg}	storage temperature	-	-65	+150	°C
P_{tot}	total power dissipation	-	-	500	mW
P	power dissipation	per switch	-	100	mW
T_L	Soldering temperature	10s	260		°C

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

9. Recommended Operating Conditions

Table 5. Recommended Operating Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
74HC4053						
V _{CC}	supply voltage	V _{CC} - GND	3.0	5.0	9.0	V
		V _{CC} - V _{EE}	3.0	5.0	9.0	V
V _I	input voltage	-	0	-	V _{CC}	V
V _{SW}	switch voltage	-	V _{EE}	-	V _{CC}	V
T _{amb}	ambient temperature	in free air	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 4.5 V	-	1.67	139	ns/V
		V _{CC} = 6.0 V	-	-	83	ns/V
		V _{CC} = 9.0 V	-	-	31	ns/V
74HCT4053						
V _{CC}	supply voltage	V _{CC} - GND	4.5	5.0	5.5	V
		V _{CC} - V _E	3.0	5.0	9.0	V
V _I	input voltage	-	0	-	V _{CC}	V
V _{SW}	switch voltage	-	V _{EE}	-	V _{CC}	V
T _{amb}	ambient temperature	in free air	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 4.5 V	-	1.67	139	ns/V
		V _{CC} = 6.0 V	-	-	-	ns/V

10. Electrical Characteristics

Table 6. DC Characteristics 1

T_{amb}=25°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
R _{ON(peak)}	ON resistance (peak)	V _{is} = V _{CC} to V _{EE} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	100	180	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	90	160	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	70	130	Ω
R _{ON(rail)}	ON resistance (rail)	V _{is} = V _{EE} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	80	140	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	70	120	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	60	105	Ω
		V _{is} = V _{CC} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	90	160	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	80	140	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	65	120	Ω
ΔR _{ON}	ON resistance mismatch between channels	V _{is} = V _{CC} to V _{EE}	V _{CC} = 4.5 V; V _{EE} = 0 V	-	9	-	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	8	-	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	6	-	Ω
74HC4053							
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V		3.15	2.4	-	V
		V _{CC} = 6.0 V		4.2	3.2	-	V
		V _{CC} = 9.0 V		6.3	4.7	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V		-	2.1	1.35	V
		V _{CC} = 6.0 V		-	2.8	1.8	V
		V _{CC} = 9.0 V		-	4.3	2.7	V
I _I	input leakage current	V _{EE} = 0 V; V _I = V _{CC} or GND	V _{CC} = 6.0 V	-	-	±1.0	uA
			V _{CC} = 9.0 V	-	-	±1.0	uA
I _{S(OFF)}	OFF-state leakage current	V _{CC} = 9.0 V; V _{EE} = 0 V; V _I = V _{IH} or V _{IL} ; V _{SW} = V _{CC} - V _{EE} ; see Figure 7	per channel	-	-	±1.0	uA
			all channels	-	-	±1.0	uA
I _{S(ON)}	ON-state leakage current	V _I = V _{IH} or V _{IL} ; V _{SW} = V _{CC} -V _{EE} ;V _{CC} = 9.0 V; V _{EE} = 0 V; see Figure 8		-	-	±1.0	uA
I _{CC}	supply current	V _{EE} = 0 V; V _I = V _{CC} or GND; V _{is} = V _{EE} or V _{CC} ; V _{OS} = V _{CC} or V _{EE}	V _{CC} = 6.0 V	-	-	8.0	uA
			V _{CC} = 9.0 V	-	-	16.0	uA
C _I	input	-		-	3.5	-	pF

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	capacitance					
C_{SW}	switch	independent pins nYn	-	5	-	pF
	capacitance	common pins nZ	-	8	-	pF
74HCT4053						
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	1.6	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	1.2	0.8	V
I_I	input leakage current	$V_I = V_{CC} \text{ or GND; } V_{CC} = 5.5 \text{ V; } V_{EE} = 0 \text{ V}$	-	-	± 1.0	μA
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 9.0 \text{ V; } V_{EE} = 0 \text{ V; } V_I = V_{IH} \text{ or } V_{IL; } V_{SW} = V_{CC} - V_{EE}; \text{ see Figure 7}$	per channel	-	-	± 1.0
			all channels	-	-	± 1.0
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 9.0 \text{ V; } V_{EE} = 0 \text{ V; } V_I = V_{IH} \text{ or } V_{IL; } V_{SW} = V_{CC} - V_{EE}; \text{ see Figure 8}$	-	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC} \text{ or GND; } V_{IS} = V_{EE} \text{ or } V_{CC; } V_{OS} = V_{CC} \text{ or } V_{EE};$	$V_{CC} = 5.5 \text{ V; } V_{EE} = 0 \text{ V}$	-	-	8.0
			$V_{CC} = 4.5 \text{ V; } V_{EE} = -4.5 \text{ V}$	-	-	16.0
ΔI_{CC}	additional supply current	per input; $V_I = V_{CC} - 2.1 \text{ V; other inputs at } V_{CC} \text{ or GND; } V_{CC} = 4.5 \text{ V to } 5.5 \text{ V; } V_{EE} = 0 \text{ V}$	-	50	180	μA
C_I	input capacitance	-	-	3.5	-	pF
C_{SW}	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	8	-	pF

[1] $V_I = V_{IH} \text{ or } V_{IL};$ for test circuit see Figure 5.

[2] V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

[3] V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

Table 7. DC Characteristics 2

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Tamb = -40°C to + 85°C, voltages are referenced to GND (ground=0V) , unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
R _{ON(peak)}	ON resistance (peak)	V _{is} = V _{CC} to V _{EE} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	225	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	200	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	165	Ω
R _{ON(rail)}	ON resistance (rail)	V _{is} = V _{EE} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	175	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	150	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	130	Ω
		V _{is} = V _{CC} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	200	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	175	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	150	Ω
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V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V		3.15	-	-	V
		V _{CC} = 6.0 V		4.2	-	-	V
		V _{CC} = 9.0 V		6.3	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V		-	-	1.35	V
		V _{CC} = 6.0 V		-	-	1.8	V
		V _{CC} = 9.0 V		-	-	2.7	V
I _I	input leakage current	V _{EE} = 0 V; V _I = V _{CC} or GND	V _{CC} = 6.0 V	-	-	±1.0	uA
			V _{CC} = 9.0 V	-	-	±2.0	uA
I _{S(OFF)}	OFF-state leakage current	V _{CC} = 9.0 V; V _{EE} = 0 V; V _I = V _{IH} or V _{IL} ; V _{SW} = V _{CC} - V _{EE} ; see Figure 7	per channel	-	-	±1.0	uA
			all channels	-	-	±1.0	uA
I _{S(ON)}	ON-state leakage current	V _I = V _{IH} or V _{IL} ; V _{SW} = V _{CC} -V _{EE} ;V _{CC} = 9.0 V; V _{EE} = 0 V; see Figure 8		-	-	±1.0	uA
I _{CC}	supply current	V _{EE} = 0 V; V _I = V _{CC} or GND; V _{is} = V _{EE} or V _{CC} ; V _{os} = V _{CC} or V _{EE}	V _{CC} = 6.0 V	-	-	80.0	uA
			V _{CC} = 9.0 V	-	-	160.0	uA
74HCT4053							
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5		2.0	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V		-	-	0.8	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V; V _{EE} = 0 V		-	-	±1.0	uA

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$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 9.0\text{ V}; V_{EE} = 0\text{ V};$ $V_I = V_{IH}\text{ or }V_{IL};$ $ V_{SW} = V_{CC} - V_{EE};$ see Figure 7	per channel	-	-	± 1.0	μA
			all channels	-	-	± 1.0	μA
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 9.0\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{IH}\text{ or }V_{IL};$ $ V_{SW} = V_{CC} - V_{EE};$ see Figure 8		-	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC}\text{ or GND}; V_{IS} =$ $V_{EE}\text{ or }V_{CC}; V_{OS} = V_{CC}\text{ or }V_{EE}$	$V_{CC} = 5.5\text{ V}; V_{EE} = 0\text{ V}$	-	-	80.0	μA
			$V_{CC} = 4.5\text{ V};$ $V_{EE} = -4.5\text{ V}$	-	-	160	μA
ΔI_{CC}	additional supply current	per input; $V_I = V_{CC} - 2.1\text{ V};$ other inputs at V_{CC} or GND; $V_{CC} = 4.5\text{ V to }5.5\text{ V}; V_{EE} = 0\text{ V}$		-	-	225	μA

[1] $V_I = V_{IH}\text{ or }V_{IL};$ for test circuit see Figure 5.

[2] V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

[3] V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

Table 8. DC Characteristics 3

$T_{amb} = -40^\circ\text{C to }+125^\circ\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
R _{ON(peak)}	ON resistance (peak)	V _{is} = V _{CC} to V _{EE} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	270	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	240	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	195	Ω
R _{ON(rail)}	ON resistance (rail)	V _{is} = V _{EE} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	210	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	180	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	160	Ω
		V _{is} = V _{CC} ; I _{SW} = 1000 uA	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	240	Ω
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	210	Ω
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	180	Ω
74HC4053							
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V		3.15	-	-	V
		V _{CC} = 6.0 V		4.2	-	-	V
		V _{CC} = 9.0 V		6.3	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V		-	-	1.35	V
		V _{CC} = 6.0 V		-	-	1.8	V
		V _{CC} = 9.0 V		-	-	2.7	V
I _I	input leakage current	V _{EE} = 0 V; V _I = V _{CC} or GND	V _{CC} = 6.0 V	-	-	±1.0	uA
			V _{CC} = 9.0 V	-	-	±2.0	uA

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$I_{S(OFF)}$	OFF-state leakage current	$V_{CC}= 9.0\text{ V}; V_{EE}= 0\text{ V};$ $V_I= V_{IH}\text{ or }V_{IL};$ $ V_{SW} = V_{CC}- V_{EE};$ see Figure 7	per channel	-	-	± 1.0	μA
			all channels	-	-	± 1.0	μA
$I_{S(ON)}$	ON-state leakage current	$V_I= V_{IH}\text{ or }V_{IL};$ $ V_{SW} = V_{CC}-V_{EE};$ $V_{CC}= 9.0\text{ V};$ $V_{EE}= 0\text{ V};$ see Figure 8		-	-	± 1.0	μA
I_{CC}	supply current	$V_{EE}= 0\text{ V};$	$V_{CC}= 6.0\text{ V}$	-	-	160.0	μA
		$V_I = V_{CC}\text{ or GND};$ $V_{IS} = V_{EE}\text{ or }V_{CC};$ $V_{OS} = V_{CC}\text{ or }V_{EE}$	$V_{CC}= 9.0\text{ V}$	-	-	320.0	μA
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V_{IH}	HIGH-level input voltage	$V_{CC}= 4.5\text{ V to }5.5\text{ V}$		2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC}= 4.5\text{ V to }5.5\text{ V}$		-	-	0.8	V
I_I	input leakage current	$V_I = V_{CC}\text{ or GND}; V_{CC}= 5.5\text{ V}; V_{EE}= 0\text{ V}$		-	-	± 1.0	μA
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC}= 9.0\text{ V}; V_{EE}= 0\text{ V};$ $V_I= V_{IH}\text{ or }V_{IL};$ $ V_{SW} = V_{CC}- V_{EE};$ see Figure 7	per channel	-	-	± 1.0	μA
			all channels	-	-	± 1.0	μA
$I_{S(ON)}$	ON-state leakage current	$V_{CC}= 9.0\text{ V}; V_{EE}= 0\text{ V}; V_I= V_{IH}\text{ or }V_{IL};$ $ V_{SW} = V_{CC}-V_{EE};$ see Figure 8		-	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC}\text{ or GND}; V_{IS} =$ $V_{EE}\text{ or }V_{CC}; V_{OS} = V_{CC}\text{ or }$ V_{EE}	$V_{CC}= 5.5\text{V}; V_{EE}= 0\text{ V}$	-	-	160.0	μA
			$V_{CC}= 4.5\text{V};$ $V_{EE}= -4.5\text{V}$	-	-	320	μA
ΔI_{CC}	additional supply current	per input; $V_I = V_{CC}- 2.1\text{V};$ other inputs at V_{CC} or GND; $V_{CC}= 4.5\text{ V to }5.5\text{ V}; V_{EE}= 0\text{ V}$		-	-	245	μA

[1] $V_I=V_{IH}\text{ or }V_{IL};$ for test circuit see Figure 5.

[2] V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

[3] V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

Table 9. AC Characteristics 1

$T_{amb}=25^\circ\text{C}$, GND = 0 V; $t_r=t_f=6\text{ ns}$; $C_L=50\text{ pF}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
74HC4053							
t _{pd}	propagation delay	V _{is} to V _{os} ; R _L = ∞ Ω; see Figure 9 ^[1]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	5	12	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	4	10	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	4	8	ns

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t _{on}	turn-on time	$\overline{E}$ to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	20	44	ns
			V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	-	17	-	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	16	37	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	15	31	ns
		Sn to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	25	44	ns
			V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	-	21	-	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	20	37	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	15	31	ns
t _{off}	turn-off time	$\overline{E}$ to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	21	42	ns
			V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	-	18	-	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	17	36	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	15	29	ns
		Sn to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	20	42	ns
			V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	-	17	-	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	16	36	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	15	29	ns
C _{PD}	power dissipation capacitance	per switch;V _I = GND to V _{CC} ^[1]		-	36	-	pF
74HCT4053							
t _{pd}	propagation delay	V _{is} to V _{os} ; R _L = ∞ Ω; see Figure 9 ^[1]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	5	12	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	4	8	ns
t _{on}	turn-on time	$\overline{E}$ to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	27	48	ns
			V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	-	23	-	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	16	34	ns
		Sn to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	25	48	ns
			V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	-	21	-	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	16	34	ns

t_{off}	turn-off time	$\overline{E}$ to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 10 ^[3]	$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	24	44	ns
			$V_{CC} = 5.0\text{ V}; V_{EE} = 0\text{ V}; C_L = 15\text{ pF}$	-	20	-	ns
			$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	15	31	ns
		Sn to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 10 ^[3]	$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	22	44	ns
			$V_{CC} = 5.0\text{ V}; V_{EE} = 0\text{ V}; C_L = 15\text{ pF}$	-	19	-	ns
			$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	15	31	ns
C_{PD}	power dissipation capacitance	per switch; $V_I = \text{GND to } V_{CC}-1.5\text{V}^{[4]}$		-	36	-	pF

[1] t_{pd} is the same as t_{PHL} and t_{PLH} .

[2] t_{on} is the same as t_{PZH} and t_{PZL} .

[3] t_{off} is the same as t_{PHZ} and t_{PLZ} .

[4] C_{PD} is used to determine the dynamic power dissipation (PD in μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

N = number of inputs switching;

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

C_L = output load capacitance in pF;

C_{SW} = switch capacitance in pF;

V_{CC} = supply voltage in V.

[5] For test circuit see Figure 11.

[6] V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

[7] V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

Table 10. AC Characteristics 2

$T_{amb} = -40^\circ\text{C}$ to $+85^\circ\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
74HC4053						
t_{pd}	propagation delay	V_{IS} to V_{OS} ; $R_L = \infty\ \Omega$; see Figure 9 ^[1]	$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	-	15 ns
			$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	13 ns
			$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	-	10 ns
t_{on}	turn-on time	$\overline{E}$ to V_{OS} ; $R_L = \infty\ \Omega$; see Figure 10 ^[2]	$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	-	55 ns
			$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	47 ns
			$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	-	39 ns
		Sn to V_{OS} ; $R_L = \infty\ \Omega$; see Figure 10 ^[2]	$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	-	55 ns
			$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	47 ns
			$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	-	39 ns

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t _{off}	turn-off time	$\overline{E}$ to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	53	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	45	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	36	ns
		Sn to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	53	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	45	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	36	ns
74HCT4053							
t _{pd}	propagation delay	V _{is} to V _{os} ; R _L = ∞ Ω; see Figure 9 ^[1]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	15	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	10	ns
t _{on}	turn-on time	$\overline{E}$ to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	60	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	43	ns
		Sn to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	60	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	43	ns
t _{off}	turn-off time	$\overline{E}$ to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	55	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	39	ns
		Sn to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	55	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	39	ns

[1] All typical values are measured at $T_{amb} = 25^\circ\text{C}$.

[2] t_{pd} is the same as t_{PHL} and t_{PLH} .

[3] t_{on} is the same as t_{pZH} and t_{pZL} .

[4] t_{off} is the same as t_{pHZ} and t_{pLZ} .

[5] For test circuit see Figure 11.

[6] V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

[7] V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

Table 11. AC Characteristics 3

$T_{amb} = -40^\circ\text{C} \sim +125^\circ\text{C}$; $GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
74HC4053							
t _{pd}	propagation delay	V _{is} to V _{os} ; R _L = ∞ Ω; see Figure 9 ^[1]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	18	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	15	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	12	ns

t _{on}	turn-on time	$\overline{E}$ to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	66	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	56	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	47	ns
		Sn to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	66	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	56	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	47	ns
t _{off}	turn-off time	$\overline{E}$ to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	63	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	54	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	44	ns
		Sn to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	63	ns
			V _{CC} = 6.0 V; V _{EE} = 0 V	-	-	54	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	44	ns
74HCT4053							
t _{pd}	propagation delay	V _{is} to V _{os} ; R _L = ∞ Ω; see Figure 9 ^[1]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	18	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	12	ns
t _{on}	turn-on time	$\overline{E}$ to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	72	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	51	ns
		Sn to V _{os} ; R _L = ∞ Ω; see Figure 10 ^[2]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	72	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	51	ns
t _{off}	turn-off time	$\overline{E}$ to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	66	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	47	ns
		Sn to V _{os} ; R _L = 1 kΩ; see Figure 10 ^[3]	V _{CC} = 4.5 V; V _{EE} = 0 V	-	-	66	ns
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-	47	ns

[1] t_{pd} is the same as t_{PHL} and t_{PLH} .

[2] t_{on} is the same as t_{pZH} and t_{pZL} .

[3] t_{off} is the same as t_{pHZ} and t_{pLZ} .

[4] For test circuit see Figure 11.

[5] V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

[6] V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

Table 12. AC Characteristics 4T_{amb} = 25 °C; GND = 0V; C_L = 50pF; recommended conditions and typical values.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
d _{sin}	sine-wave distortion	f _i = 1 kHz; R _L = 10 kΩ; see Figure 12	V _{is} = 4.0 V (p-p); V _{CC} = 2.25 V; V _{EE} = -2.25 V	-	0.04	-	%
			V _{is} = 8.0 V (p-p); V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	0.02	-	%
		f _i = 10 kHz; R _L = 10 kΩ; see Figure 12	V _{is} = 4.0 V (p-p); V _{CC} = 2.25 V; V _{EE} = -2.25 V	-	0.12	-	%
			V _{is} = 8.0 V (p-p); V _{CC} = 4.5 V; V _{EE} = -4.5 V ₁	-	0.06	-	%
α _{iso}	isolation (OFF-state)	R _L = 600 Ω; f _i = 1 MHz; see Figure 13	V _{CC} = 2.25 V; ^[1] V _{EE} = -2.25 V	-	-50	-	dB
			V _{CC} = 4.5 V; ^[1] V _{EE} = -4.5 V	-	-50	-	dB
Xtalk	crosstalk	between two switches/multiplexers; R _L = 600 Ω;f _i = 1 MHz; see Figure 14	V _{CC} = 2.25 V; ^[1] V _{EE} = -2.25 V	-	-60	-	dB
			V _{CC} = 4.5 V; ^[1] V _{EE} = -4.5 V	-	-60	-	dB
V _{ct}	crosstalk voltage	peak-to-peak value; between control and any switch; R _L = 600 Ω; f _i = 1MHz; $\overline{E}$ or Sn square wave between V _{CC} and GND; t _r = t _f = 6 ns; see Figure 15	V _{CC} = 4.5 V; V _{EE} = 0 V	-	110	-	mV
			V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	220	-	mV
f _(-3dB)	-3dB frequency response	R _L = 50 Ω; see Figure 16	V _{CC} = 2.25 V; ^[2] V _{EE} = -2.25 V	-	160	-	MHz
			V _{CC} = 4.5 V; ^[2] V _{EE} = -4.5 V	-	170	-	MHz

[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).[3] V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.[4] V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

10.1. Waveforms and test circuit

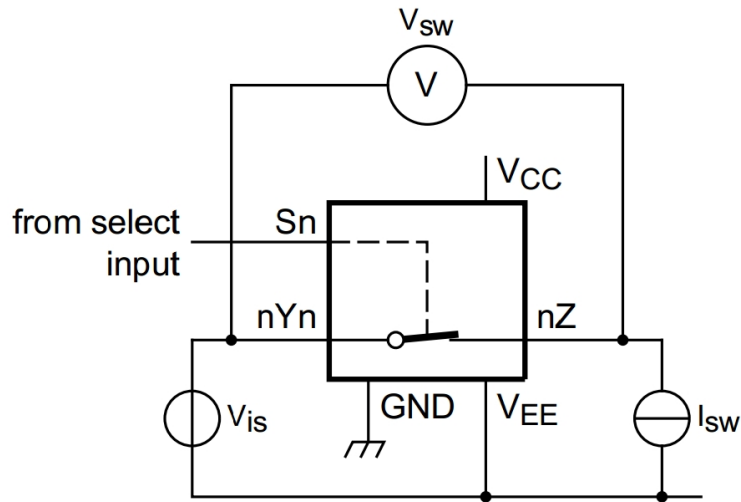


Fig. 5. Test circuit for measuring R_{ON}

$V_{is} = 0V$ to $(V_{CC} - V_{EE})$

$R_{ON} = V_{SW} / I_{SW}$

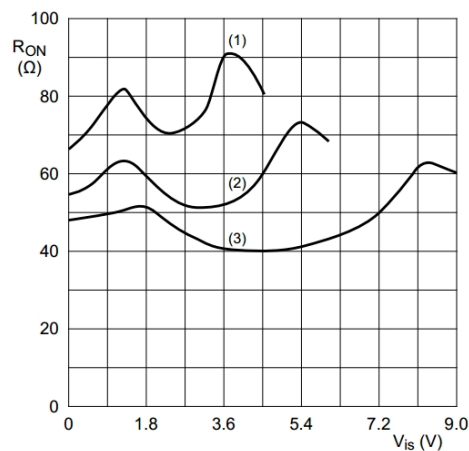


Fig. 6. Typical R_{ON} as a function of input voltage V_{is}

$V_{is} = 0V$ to $(V_{CC} - V_{EE})$

(1) $V_{CC} = 4.5V$

(2) $V_{CC} = 6V$

(3) $V_{CC} = 9V$

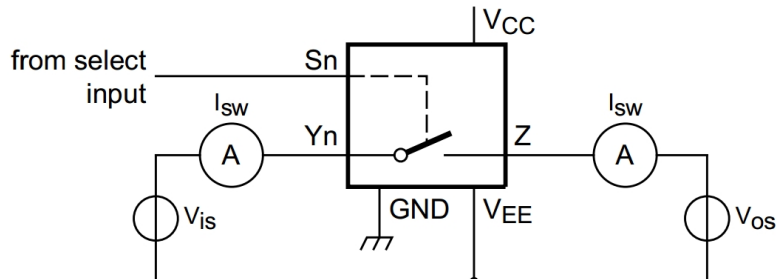


Fig. 7. Test circuit for measuring OFF-state current

$V_{is} = V_{CC}$ and $V_{os} = V_{EE}$

$V_{is} = V_{EE}$ and $V_{os} = V_{CC}$

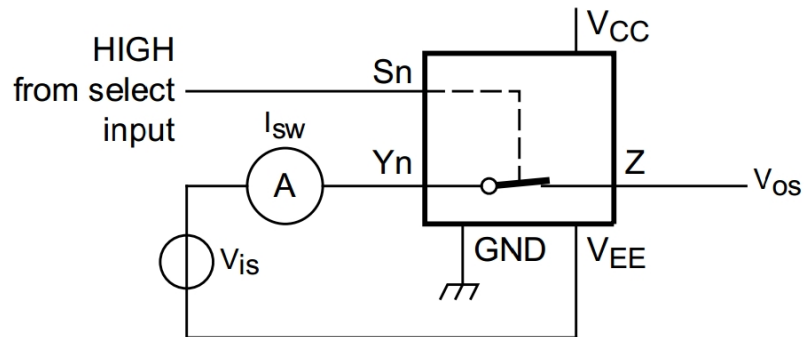


Fig. 8. Test circuit for measuring ON-state current

$V_{is} = V_{CC}$ and $V_{os} = \text{open-circui}$

$V_{is} = V_{EE}$ and $V_{os} = \text{open-circui}$

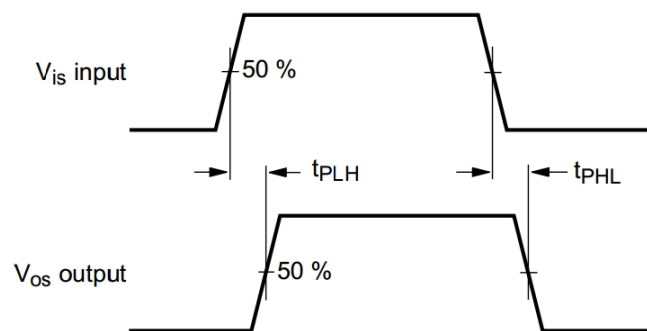


Fig. 9. Input (V_{is}) to output (V_{os}) propagation delays

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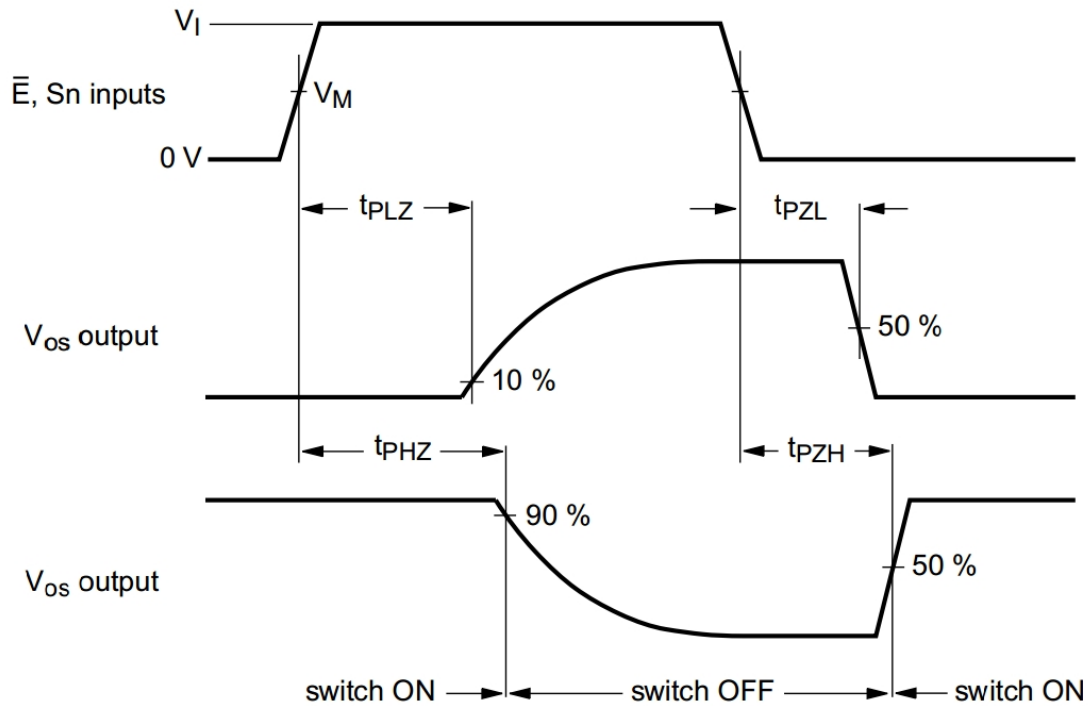


Fig. 10. Turn-on and turn-off times

For 74HC4052: $V_M = 0.5 \times V_{CC}$.

For 74HCT4052: $V_M = 1.3$ V.

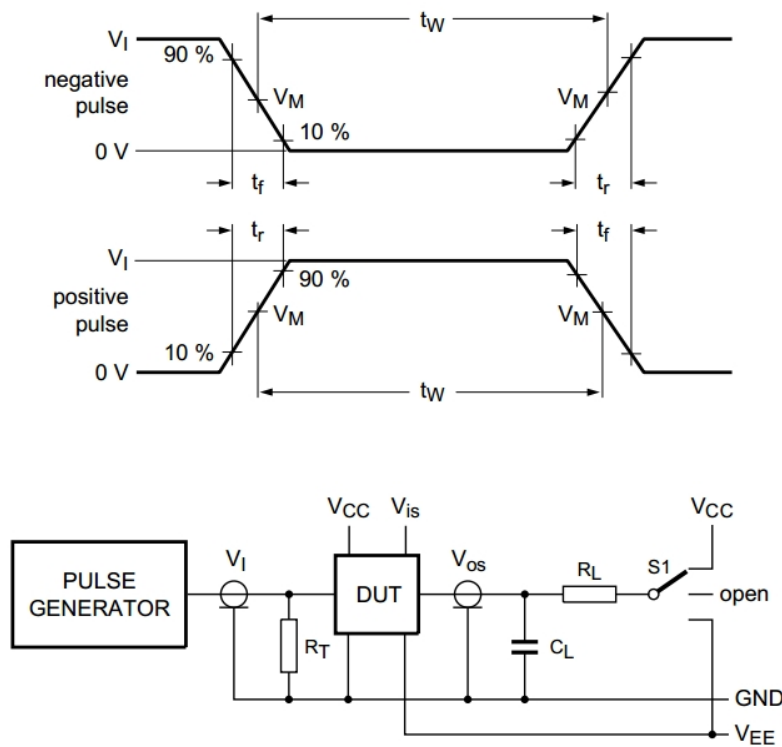


Fig. 11. Test circuit for measuring switching times

Definitions for test circuit:

R_L =Load resistance.

C_L =Load capacitance including jig and probe capacitance.

R_T =Termination resistance should be equal to the output impedance Z_o of the pulse generator.

S1=Test selection switch.

Table 13. Test Data

Test	Input				Load		S1 position
	V _I	V _{is}	t _r , t _f		C _L	R _L	
			at f _{max}	other ^[1]			
t _{PHL} , t _{PLH}	[2]	Pulse	< 2ns	6ns	50pF	1kΩ	open
t _{PZH} , t _{PHZ}	[2]	V _{CC}	< 2ns	6ns	50pF	1kΩ	V _{EE}
t _{PZL} , t _{PLZ}	[2]	V _{EE}	< 2ns	6ns	50pF	1kΩ	V _{CC}

[1] $t_r = t_f = 6$ ns; when measuring f_{max} , there is no constraint to t_r and t_f with 50 % duty factor.

[2] V_I values:

For 74HC4053: $V_I = V_{CC}$

For 74HCT4053: $V_I = 3V$

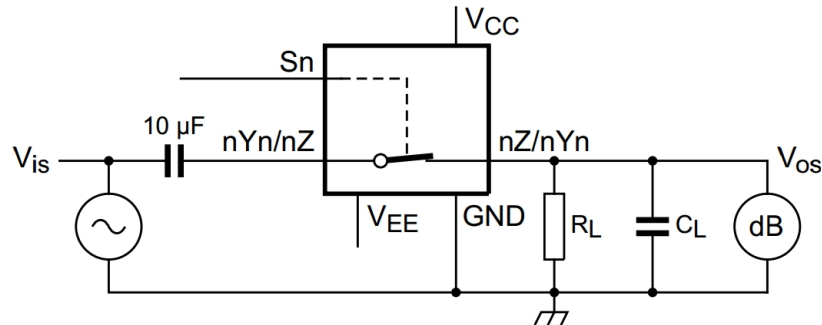
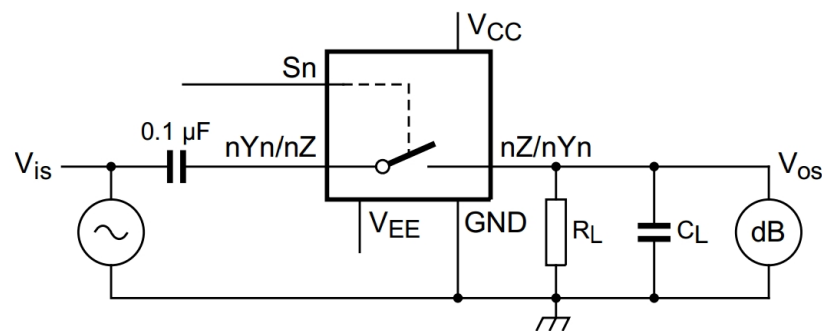
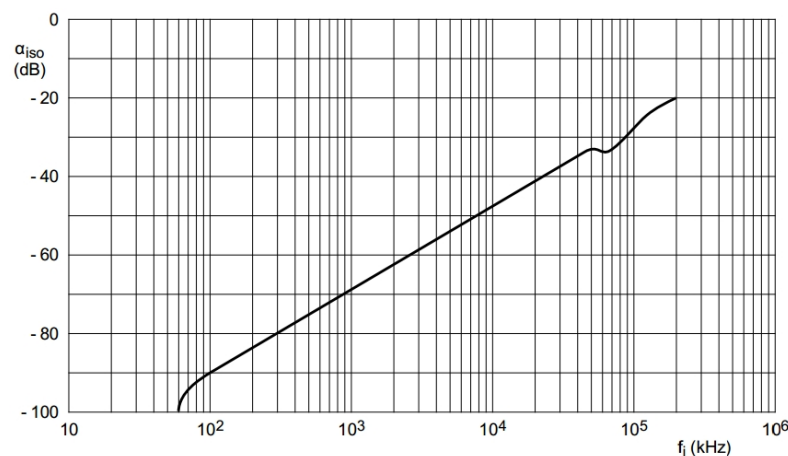


Fig. 12. Test circuit for measuring sine-wave distortion



a. Test circuit

$V_{CC} = 4.5 \text{ V}$; $GND = 0 \text{ V}$; $V_{EE} = -4.5 \text{ V}$; $R_L = 600 \Omega$; $R_S = 1 \text{ k}\Omega$



b. Isolation (OFF-state) as a function of frequency

Fig. 13. Test circuit for measuring isolation (OFF-state)

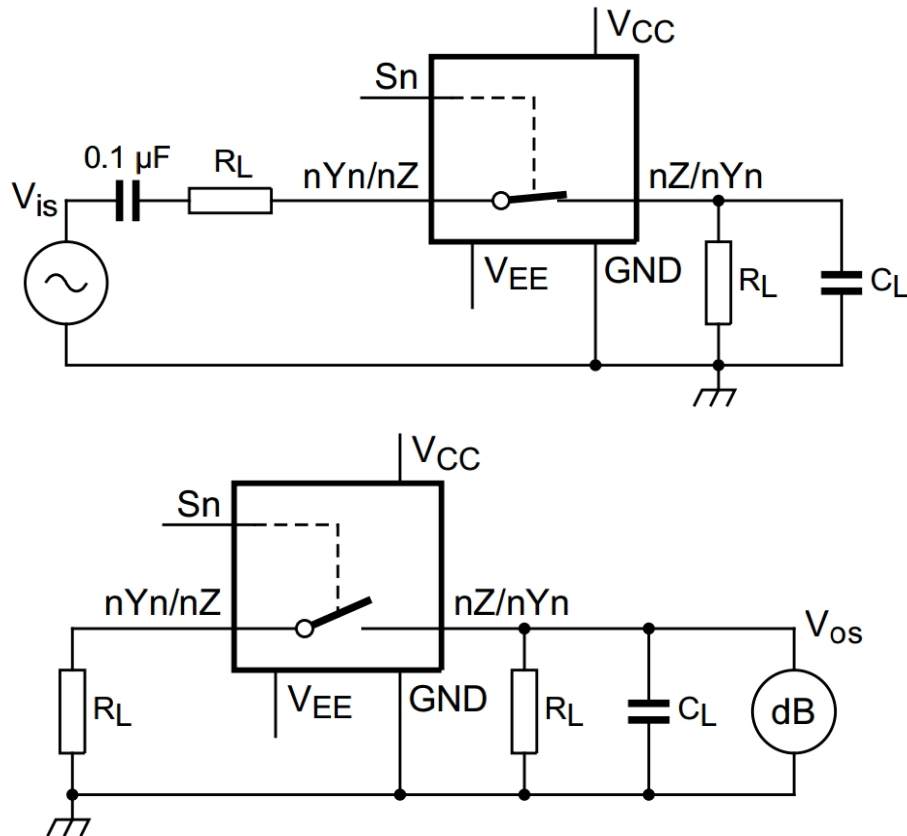


Fig. 14. Test circuit for measuring crosstalk between control input and any switch

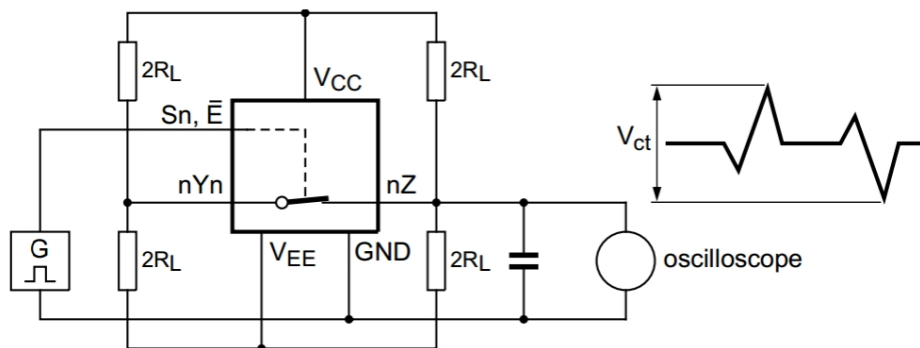
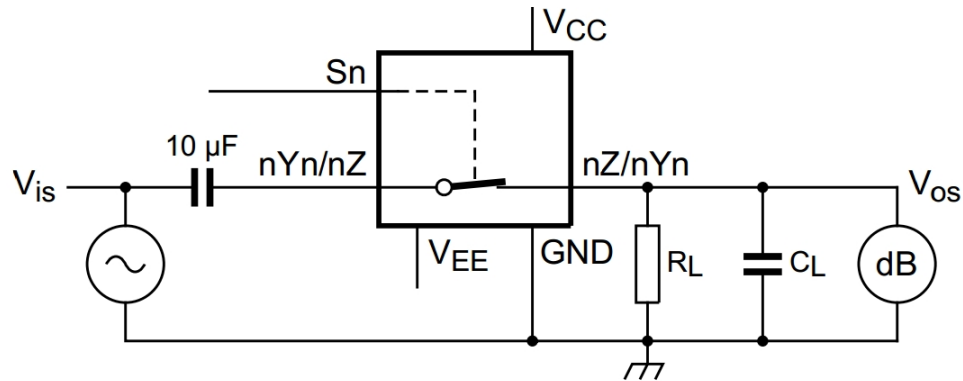
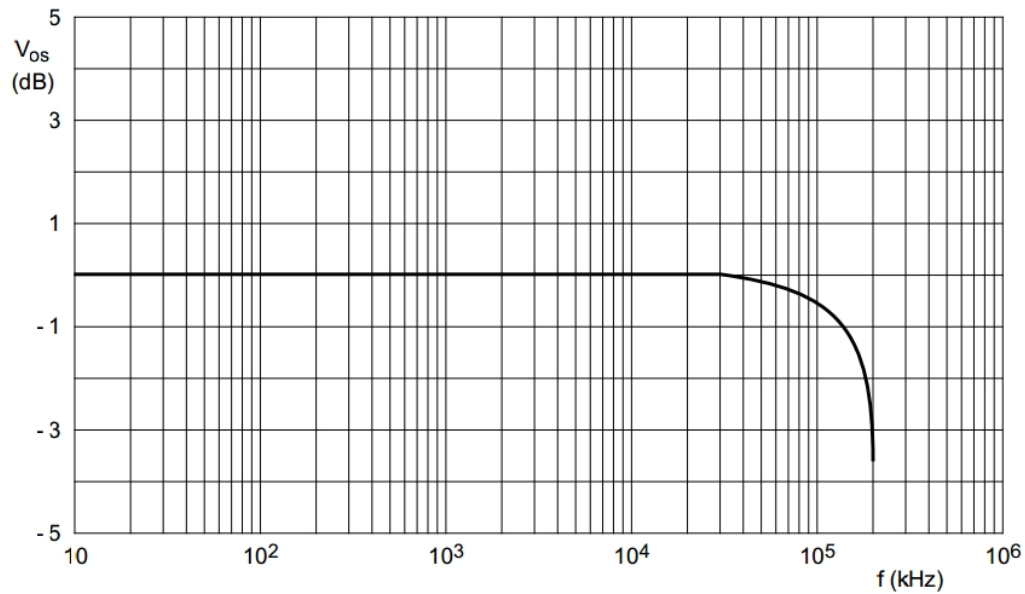


Fig. 15. Test circuit for measuring crosstalk between control input and any switch



a. Test circuit

$V_{CC} = 4.5\ \text{V}$; $GND = 0\ \text{V}$; $V_{EE} = -4.5\ \text{V}$; $R_L = 600\ \Omega$; $R_S = 1\ \text{k}\Omega$

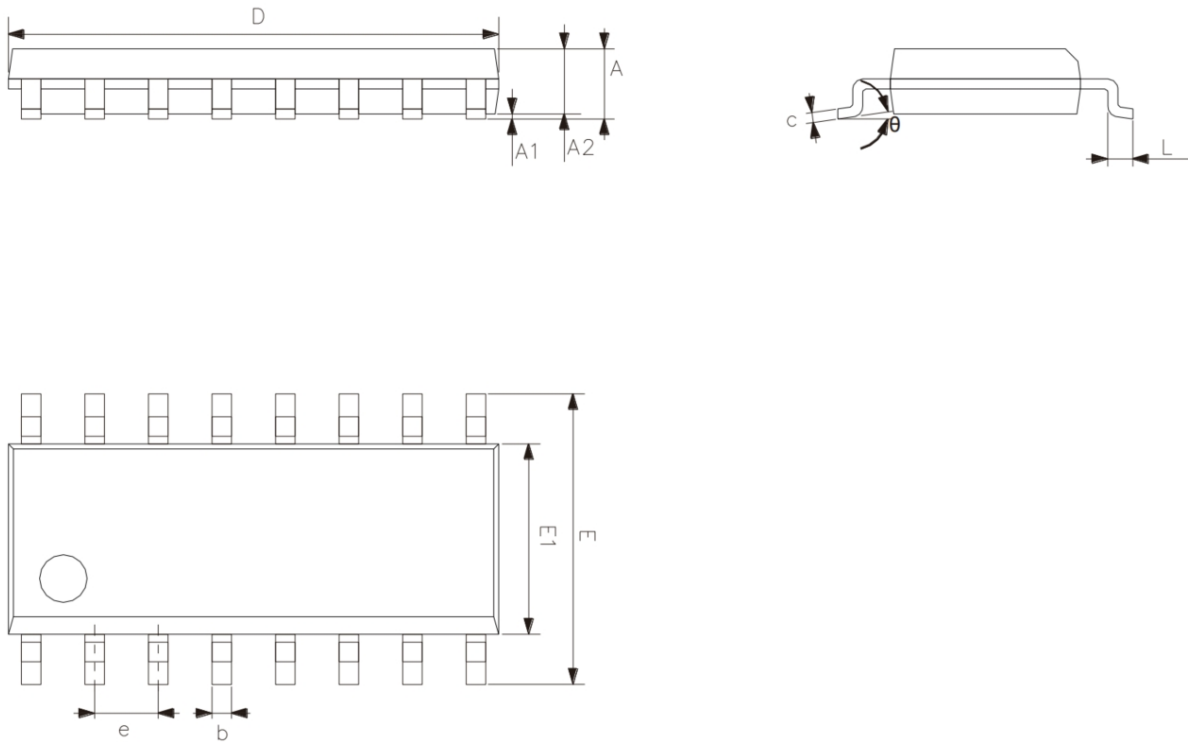


b. Typical frequency response

Fig. 16. Test circuit for frequency response

11. Package Outline

SOP-16



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
θ	0°	8°

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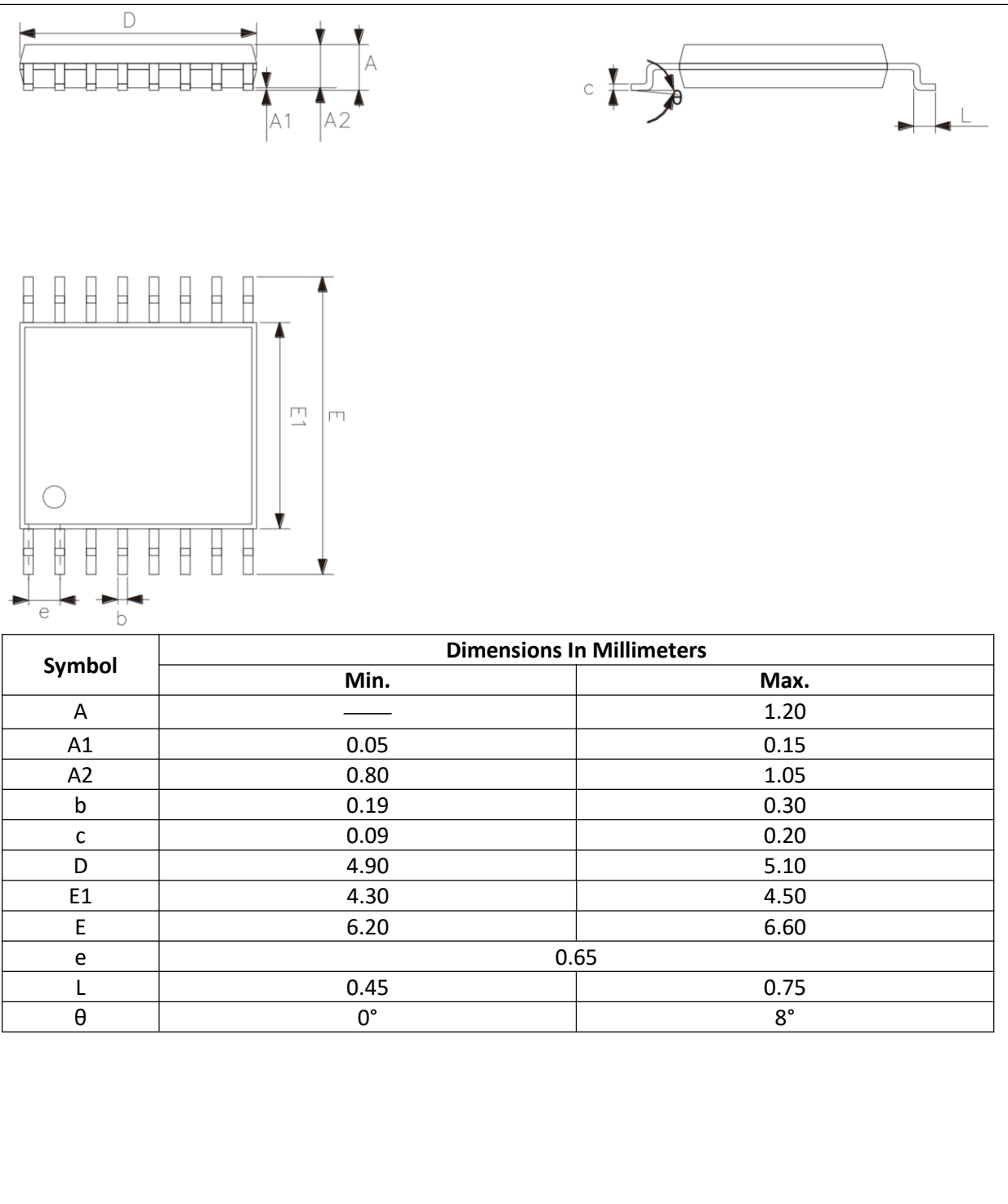


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12. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
CDM	Charged Device Model
TTL	Transistor-Transistor Logic

13. Revision History

Document ID	Release Date	Data sheet status	Change notice	Supersedes
74HC_HCT4053 Rev. 1.0	Aug 08, 2024	Product datasheet		