

# 74HC4053; 74HCT4053

Triple 2-channel analog multiplexer/demultiplexer

Rev. 04 — 9 May 2006

Product data sheet

## 1. General description

The 74HC4053; 74HCT4053 is a high-speed Si-gate CMOS device and is pin compatible with the HEF4053B. It is specified in compliance with JEDEC standard no. 7A.

The 74HC4053; 74HCT4053 is triple 2-channel analog multiplexer/demultiplexer with a common enable input ( $\bar{E}$ ). Each multiplexer/demultiplexer has two independent inputs/outputs ( $nY0$  and  $nY1$ ), a common input/output ( $nZ$ ) and three digital select inputs ( $S_n$ ).

With  $\bar{E}$  LOW, one of the two switches is selected (low-impedance ON-state) by  $S1$  to  $S3$ . With  $\bar{E}$  HIGH, all switches are in the high-impedance OFF-state, independent of  $S1$  to  $S3$ .

$V_{CC}$  and GND are the supply voltage pins for the digital control inputs ( $S1$  to  $S3$  and  $\bar{E}$ ). The  $V_{CC}$  to GND ranges are 2.0 V to 10.0 V for 74HC4053 and 4.5 V to 5.5 V for 74HCT4053. The analog inputs/outputs ( $nY0$  and  $nY1$ , 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).

## 2. Features

- Low ON resistance:
  - ◆ 80  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 4.5$  V
  - ◆ 70  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 6.0$  V
  - ◆ 60  $\Omega$  (typical) 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
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-C exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and from  $-40$  °C to  $+125$  °C

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### 3. Applications

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

### 4. Quick reference data

**Table 1: Quick reference data**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>74HC4053</b>						
$t_{PZH}$ , $t_{PZL}$	turn-ON time	$C_L = 15\text{ pF}$ ; $R_L = 1\text{ k}\Omega$ ; $V_{CC} = 5\text{ V}$				
	$\bar{E}$ to $V_{OS}$		-	17	-	ns
	Sn to $V_{OS}$		-	21	-	ns
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time	$C_L = 15\text{ pF}$ ; $R_L = 1\text{ k}\Omega$ ; $V_{CC} = 5\text{ V}$				
	$\bar{E}$ to $V_{OS}$		-	18	-	ns
	Sn to $V_{OS}$		-	17	-	ns
$C_i$	input capacitance		-	3.5	-	pF
$C_S$	switch capacitance					
	independent I/O (nYn)		-	5	-	pF
	common I/O (nZ)		-	8	-	pF
$C_{PD}$	power dissipation capacitance	per switch; $V_I = GND$ to $V_{CC}$	[1]	-	36	pF
<b>74HCT4053</b>						
$t_{PZH}$ , $t_{PZL}$	turn-ON time	$C_L = 15\text{ pF}$ ; $R_L = 1\text{ k}\Omega$ ; $V_{CC} = 5\text{ V}$				
	$\bar{E}$ to $V_{OS}$		-	23	-	ns
	Sn to $V_{OS}$		-	21	-	ns
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time	$C_L = 15\text{ pF}$ ; $R_L = 1\text{ k}\Omega$ ; $V_{CC} = 5\text{ V}$				
	$\bar{E}$ to $V_{OS}$		-	20	-	ns
	Sn to $V_{OS}$		-	19	-	ns
$C_i$	input capacitance		-	3.5	-	pF
$C_S$	switch capacitance					
	independent I/O (nYn)		-	5	-	pF
	common I/O(nZ)		-	8	-	pF
$C_{PD}$	power dissipation capacitance	per switch; $V_I = GND$ to $(V_{CC} - 1.5\text{ V})$	[1]	-	36	pF

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum\{(C_L + C_S) \times V_{CC}^2 \times f_o\}$  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;  
 $C_S$  = maximum switch capacitance in pF;  
 $V_{CC}$  = supply voltage in V.

## 5. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<b>74HC4053</b>				
74HC4053N	-40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-4
74HC4053D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC4053DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HC4053PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HC4053BQ	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1
<b>74HCT4053</b>				
74HCT4053N	-40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-4
74HCT4053D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4053DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT4053PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4053BQ	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1

6. Functional diagram

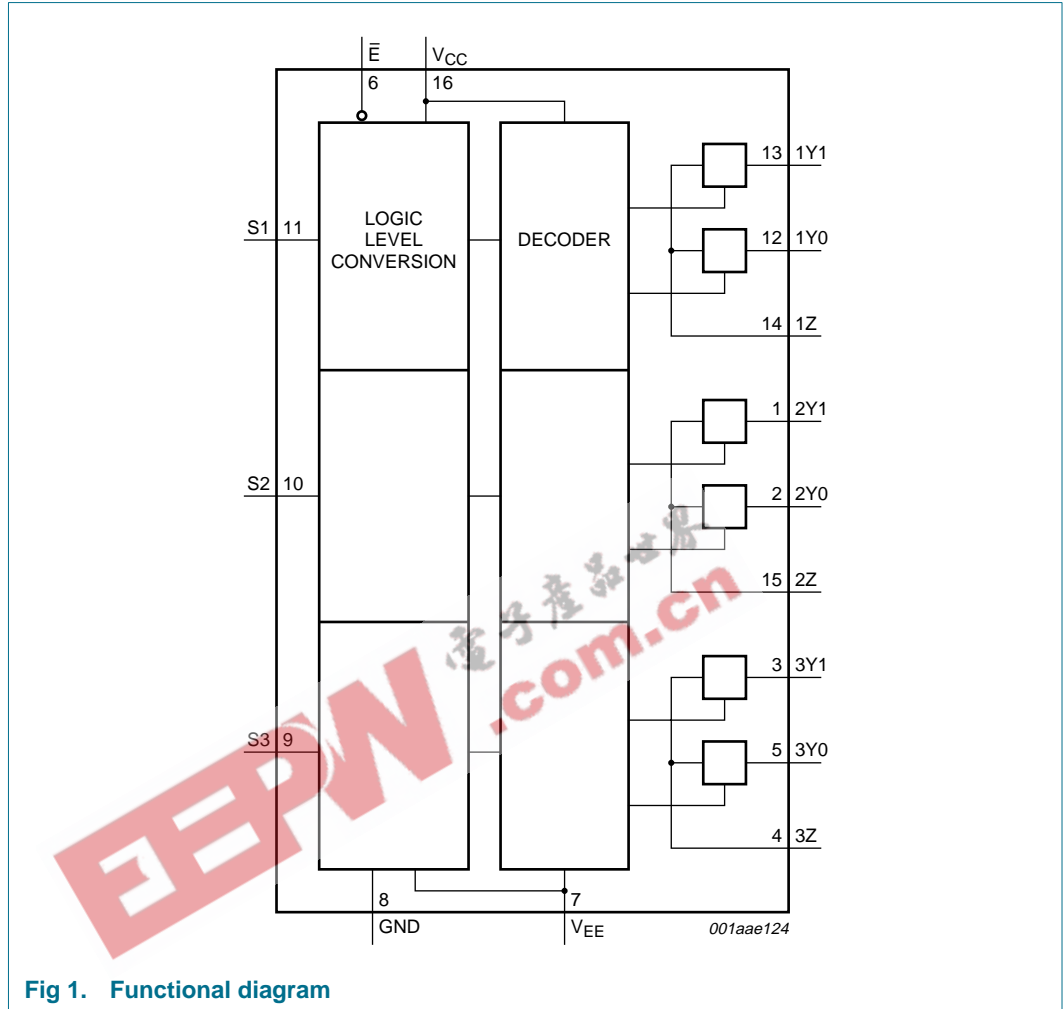


Fig 1. Functional diagram

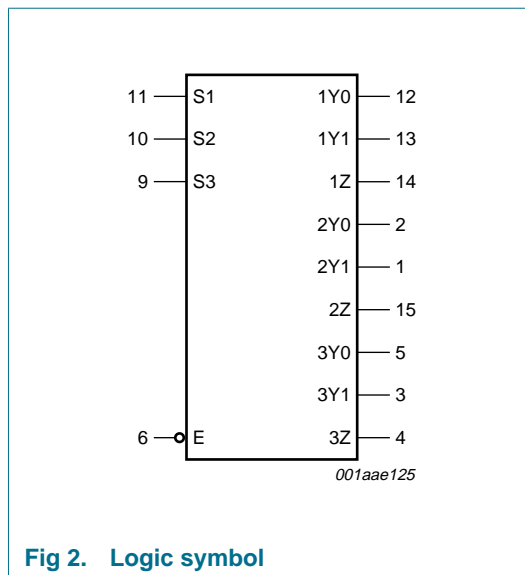


Fig 2. Logic symbol

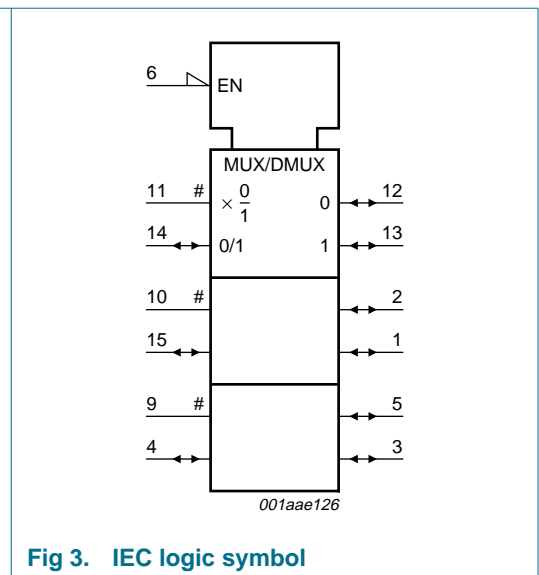


Fig 3. IEC logic symbol

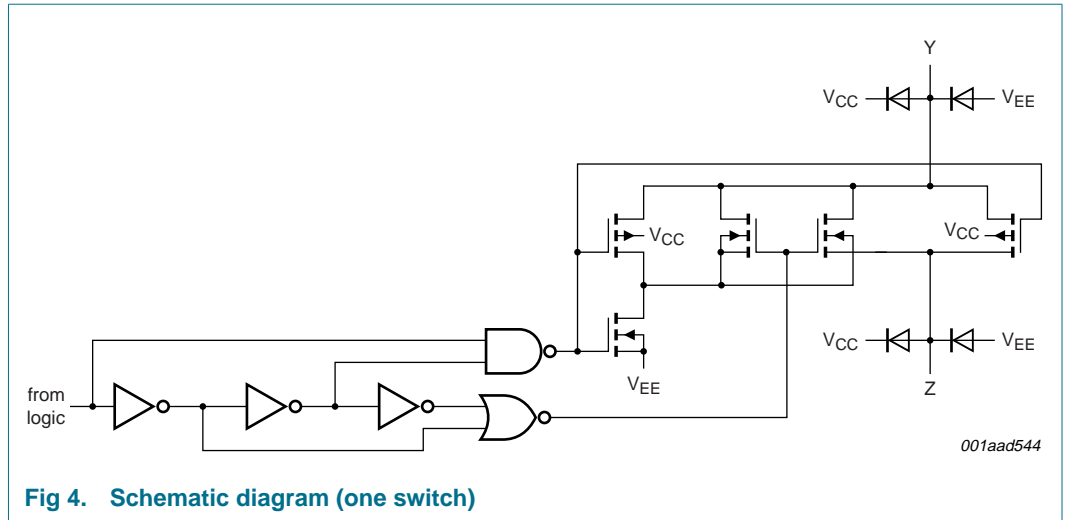


Fig 4. Schematic diagram (one switch)

## 7. Pinning information

### 7.1 Pinning

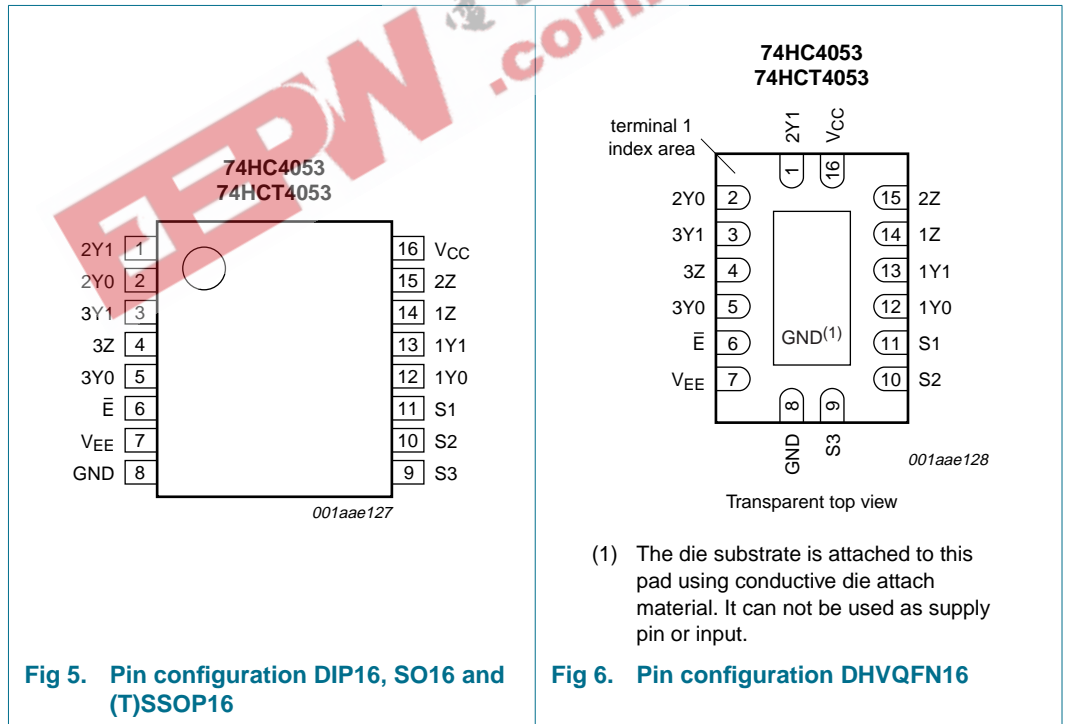


Fig 5. Pin configuration DIP16, SO16 and (T)SSOP16

Fig 6. Pin configuration DHVQFN16

## 7.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
2Y1	1	2 independent input/output 1
2Y0	2	2 independent input/output 0
3Y1	3	3 independent input/output 1
3Z	4	3 common input/output
3Y0	5	3 independent input/output 0
$\bar{E}$	6	enable input (active LOW)
$V_{EE}$	7	negative supply voltage
GND	8	ground (0 V)
S3	9	select input 3
S2	10	select input 2
S1	11	select input 1
1Y0	12	1 independent input/output 0
1Y1	13	1 independent input/output 1
1Z	14	1 common input/output
2Z	15	2 common input/output
$V_{CC}$	16	supply voltage

## 8. Functional description

### 8.1 Function table

Table 4: Function table<sup>[1]</sup>

Control		Channel on
$\bar{E}$	$S_n$	
L	L	nY0 to nZ
	H	nY1 to nZ
H	X	none

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

## 9. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to  $V_{EE} = GND$  (ground = 0 V).<sup>[1]</sup>

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+11.0	V
$I_{IK}$	input clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	±20	mA
$I_{SK}$	switch clamping current	$V_S < -0.5$ V or $V_S > V_{CC} + 0.5$ V	-	±20	mA

**Table 5: Limiting values ...continued**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to  $V_{EE} = GND$  (ground = 0 V). [1]

Symbol	Parameter	Conditions	Min	Max	Unit	
$I_S$	switch current	$-0.5\text{ V} < V_S < V_{CC} + 0.5\text{ V}$	-	$\pm 25$	mA	
$I_{EE}$	negative supply current		-	-20	mA	
$I_{CC}$	quiescent supply current		-	50	mA	
$I_{GND}$	ground current		-	-50	mA	
$T_{stg}$	storage temperature		-65	+150	°C	
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C to } +125\text{ °C}$				
	DIP16 package		[2]	-	750	mW
	SO16 package		[3]	-	500	mW
	SSOP16 package		[4]	-	500	mW
	TSSOP16 package		[4]	-	500	mW
	DHVQFN16 package		[5]	-	500	mW
$P_S$	power dissipation per switch		-	100	mW	

[1] To avoid drawing  $V_{CC}$  current out of terminals nZ, when switch current flows in terminals nYn, 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 nYn. 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  $V_{EE}$ .

[2] For DIP16 package:  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.

[3] For SO16 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

[4] For SSOP16 and TSSOP16 packages:  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C.

[5] For DHVQFN16 packages:  $P_{tot}$  derates linearly with 4.5 mW/K above 60 °C.

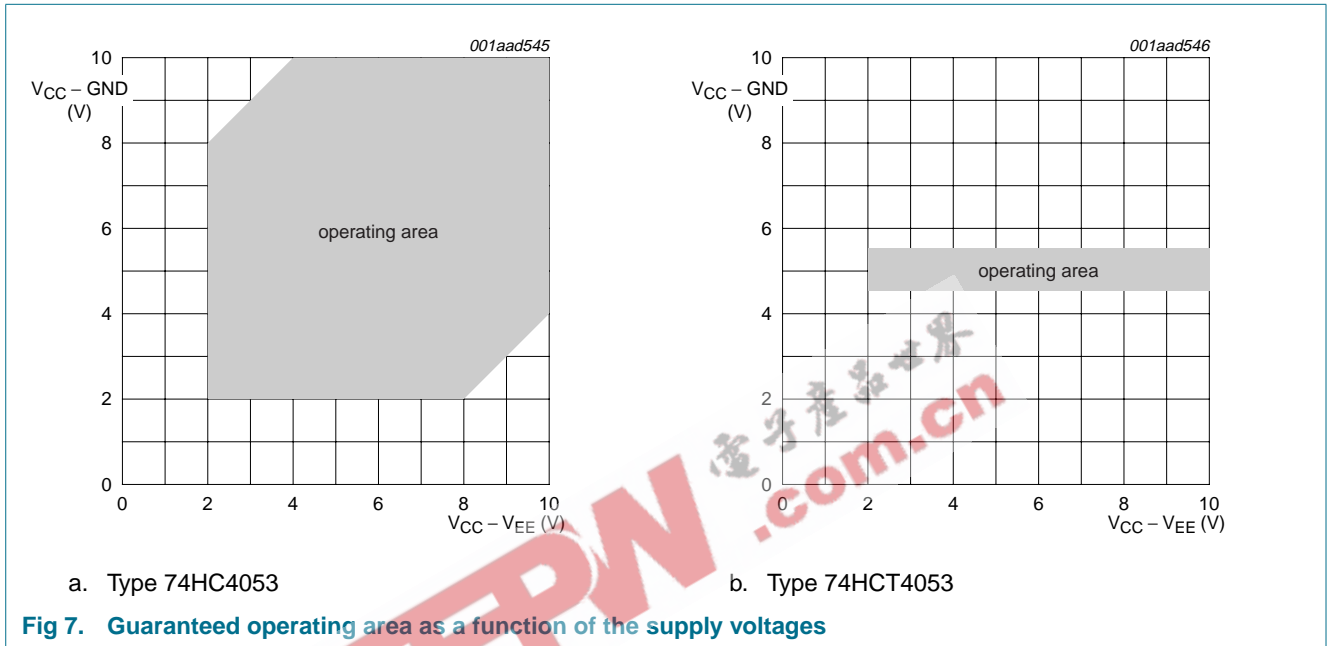
## 10. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>74HC4053</b>						
$\Delta V_{CC}$	supply voltage difference	see <a href="#">Figure 7</a>				
	$V_{CC} - GND$		2.0	5.0	10.0	V
	$V_{CC} - V_{EE}$		2.0	5.0	10.0	V
$V_I$	input voltage		GND	-	$V_{CC}$	V
$V_S$	switch voltage		$V_{EE}$	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$t_r, t_f$	input rise and fall times	$V_{CC} = 2.0\text{ V}$	-	6.0	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	6.0	400	ns
		$V_{CC} = 10.0\text{ V}$	-	6.0	250	ns
<b>74HCT4053</b>						
$\Delta V_{CC}$	supply voltage difference	see <a href="#">Figure 7</a>				
	$V_{CC} - GND$		4.5	5.0	5.5	V
	$V_{CC} - V_{EE}$		2.0	5.0	10.0	V

Table 6: Recommended operating conditions ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_I$	input voltage		GND	-	$V_{CC}$	V
$V_S$	switch voltage		$V_{EE}$	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$t_r, t_f$	input rise and fall times	$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns



## 11. Static characteristics

Table 7:  $R_{ON}$  resistance per switch 74HC4053 and 74HCT4053

For test circuit see Figure 8.

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

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

74HC4053 supply voltages:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

74HCT4053 supply voltages:  $V_{CC} - GND = 4.5\text{ V}$  or  $5.5\text{ V}$ ;  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = 25\text{ °C}$						
$R_{ON(peak)}$	ON resistance (peak)	$V_{is} = V_{CC}$ to $V_{EE}$ ; $V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	100	180	$\Omega$
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	90	160	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	70	130	$\Omega$



**Table 7: R<sub>ON</sub> resistance per switch 74HC4053 and 74HCT4053 ...continued**

For test circuit see [Figure 8](#).

V<sub>is</sub> is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V<sub>os</sub> is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

74HC4053 supply voltages: V<sub>CC</sub> – GND or V<sub>CC</sub> – V<sub>EE</sub> = 2.0 V, 4.5 V, 6.0 V and 9.0 V.

74HCT4053 supply voltages: V<sub>CC</sub> – GND = 4.5 V or 5.5 V; V<sub>CC</sub> – V<sub>EE</sub> = 2.0 V, 4.5 V, 6.0 V and 9.0 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>is</sub> = V <sub>EE</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 100 μA	[1]	-	150	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	80	140	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	70	120	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>S</sub> = 1000 μA	-	-	60	105	Ω
		V <sub>is</sub> = V <sub>CC</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 100 μA	[1]	-	150	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	90	160	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	80	140	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>S</sub> = 1000 μA	-	-	65	120	Ω
ΔR <sub>ON</sub>	ON resistance mismatch between channels	V <sub>is</sub> = V <sub>CC</sub> to V <sub>EE</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	[1]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	9	-	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	8	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	6	-	Ω
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>							
R <sub>ON(peak)</sub>	ON resistance (peak)	V <sub>is</sub> = V <sub>CC</sub> to V <sub>EE</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 100 μA	[1]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	225	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	200	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>S</sub> = 1000 μA	-	-	-	165	Ω
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>is</sub> = V <sub>EE</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 100 μA	[1]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	175	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	150	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>S</sub> = 1000 μA	-	-	-	130	Ω
		V <sub>is</sub> = V <sub>CC</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 100 μA	[1]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	200	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	175	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>S</sub> = 1000 μA	-	-	-	150	Ω
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>							
R <sub>ON(peak)</sub>	ON resistance (peak)	V <sub>is</sub> = V <sub>CC</sub> to V <sub>EE</sub> ; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 100 μA	[1]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	270	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>S</sub> = 1000 μA	-	-	-	240	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>S</sub> = 1000 μA	-	-	-	195	Ω

**Table 7:**  $R_{ON}$  resistance per switch 74HC4053 and 74HCT4053 ...continued

For test circuit see Figure 8.

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

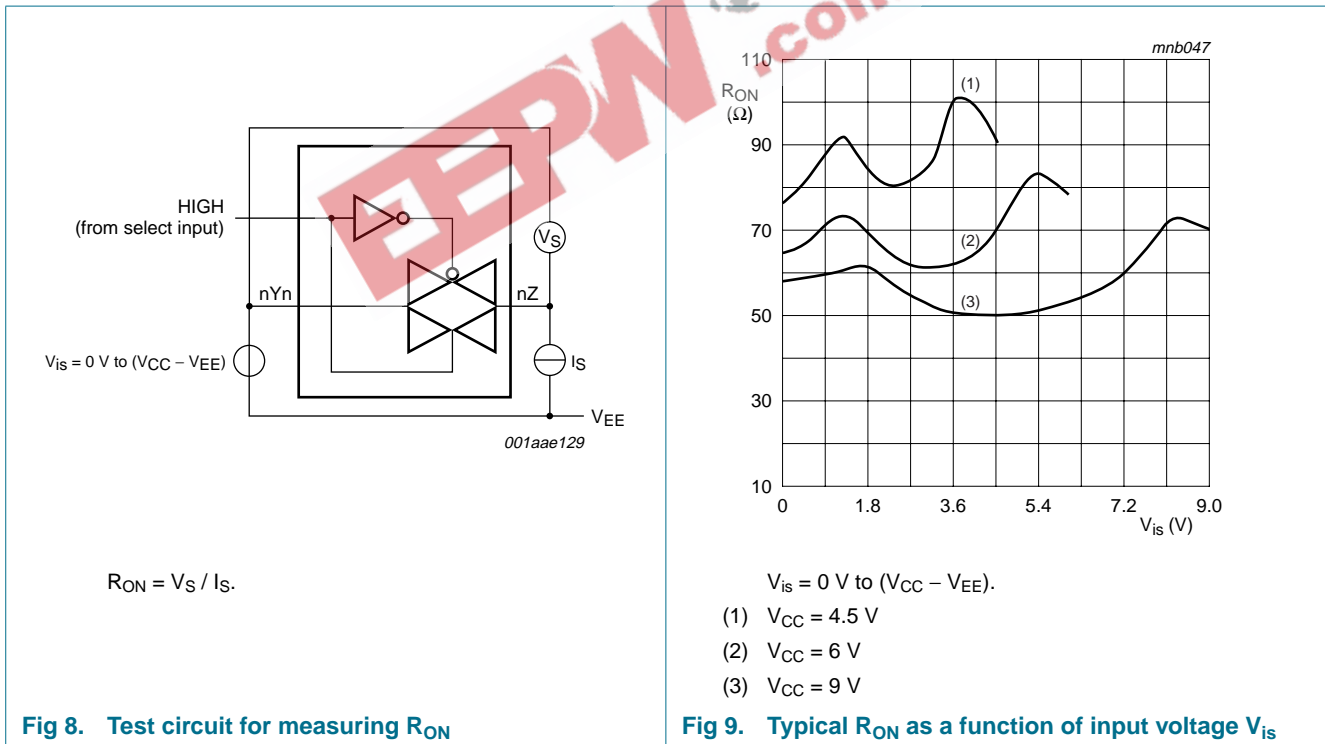
$V_{os}$  is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

74HC4053 supply voltages:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

74HCT4053 supply voltages:  $V_{CC} - GND = 4.5\text{ V}$  or  $5.5\text{ V}$ ;  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}; V_I = V_{IH}$ or $V_{IL}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\ \mu\text{A}$	-	-	210	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\ \mu\text{A}$	-	-	180	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\ \mu\text{A}$	-	-	160	$\Omega$	
		$V_{is} = V_{CC}; V_I = V_{IH}$ or $V_{IL}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\ \mu\text{A}$	-	-	240	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\ \mu\text{A}$	-	-	210	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\ \mu\text{A}$	-	-	180	$\Omega$	

[1] 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.



**Table 8: Static characteristics 74HC4053**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ }^{\circ}\text{C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	4.7	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	4.3	2.7	V
$I_{LI}$	input leakage current	$V_I = V_{CC}$ or GND; $V_{EE} = 0\text{ V}$				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 0.1$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 0.2$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 10</a>				
		per channel	-	-	$\pm 0.1$	$\mu\text{A}$
		all channels	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{CC}$	quiescent supply current	$V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$ ; $V_I = V_{CC}$ or GND; $V_{EE} = 0\text{ V}$				
		$V_{CC} = 6.0\text{ V}$	-	-	8.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	16.0	$\mu\text{A}$
$C_i$	input capacitance		-	3.5	-	pF
$C_S$	switch capacitance	independent I/O (nYn)	-	5	-	pF
		common I/O (nZ)	-	8	-	pF
<b><math>T_{amb} = -40\text{ }^{\circ}\text{C}</math> to <math>+85\text{ }^{\circ}\text{C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 2.0\text{ V}$	1.5	-	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	-	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	-	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	-	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 2.0\text{ V}$	-	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	-	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	-	2.7	V
$I_{LI}$	input leakage current	$V_I = V_{CC}$ or GND; $V_{EE} = 0\text{ V}$				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 2.0$	$\mu\text{A}$

**Table 8: Static characteristics 74HC4053 ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 10</a>				
		per channel	-	-	±1.0	µA
		all channels	-	-	±1.0	µA
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>	-	-	±1.0	µA
$I_{CC}$	quiescent supply current	$V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$ ; $V_I = V_{CC}$ or GND; $V_{EE} = 0\text{ V}$				
		$V_{CC} = 6.0\text{ V}$	-	-	80.0	µA
		$V_{CC} = 10.0\text{ V}$	-	-	160.0	µA
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 2.0\text{ V}$	1.5	-	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	-	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	-	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	-	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 2.0\text{ V}$	-	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	-	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	-	2.7	V
$I_{LI}$	input leakage current	$V_I = V_{CC}$ or GND; $V_{EE} = 0\text{ V}$				
		$V_{CC} = 6.0\text{ V}$	-	-	±1.0	µA
		$V_{CC} = 10.0\text{ V}$	-	-	±2.0	µA
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 10</a>				
		per channel	-	-	±1.0	µA
		all channels	-	-	±1.0	µA
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>	-	-	±1.0	µA
$I_{CC}$	quiescent supply current	$V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$ ; $V_I = V_{CC}$ or GND; $V_{EE} = 0\text{ V}$				
		$V_{CC} = 6.0\text{ V}$	-	-	160.0	µA
		$V_{CC} = 10.0\text{ V}$	-	-	320.0	µA

**Table 9: Static characteristics 74HCT4053**

Voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ °C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	2.0	1.6	-	µA
$V_{IL}$	LOW-state input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	1.2	0.8	µA

**Table 9: Static characteristics 74HCT4053 ...continued**

Voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{LI}$	input leakage current	$V_{CC} = 5.5 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{CC} \text{ or GND}$	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL}; V_{EE} = 0 \text{ V};  V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 10</a>	-	-	$\pm 0.1$	$\mu\text{A}$
		per channel	-	-	$\pm 0.1$	$\mu\text{A}$
		all channels	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL}; V_{EE} = 0 \text{ V};  V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{CC}$	quiescent 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	$\mu\text{A}$
		$V_{CC} = 5.0 \text{ V}; V_{EE} = -5.0 \text{ V}$	-	-	16.0	$\mu\text{A}$
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{CC} - 2.1 \text{ V}$ ; other inputs at $V_{CC}$ or GND	-	50	180	$\mu\text{A}$
$C_i$	input capacitance		-	3.5	-	pF
$C_S$	switch capacitance	independent I/O (nYn)	-	5	-	pF
		common I/O (nZ)	-	8	-	pF
<b><math>T_{amb} = -40 \text{ }^\circ\text{C to } +85 \text{ }^\circ\text{C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	$\mu\text{A}$
$V_{IL}$	LOW-state input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	$\mu\text{A}$
$I_{LI}$	input leakage current	$V_{CC} = 5.5 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{CC} \text{ or GND}$	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL}; V_{EE} = 0 \text{ V};  V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 10</a>	-	-	$\pm 1.0$	$\mu\text{A}$
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL}; V_{EE} = 0 \text{ V};  V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	quiescent 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	$\mu\text{A}$
		$V_{CC} = 5.0 \text{ V}; V_{EE} = -5.0 \text{ V}$	-	-	160.0	$\mu\text{A}$
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{CC} - 2.1 \text{ V}$ ; other inputs at $V_{CC}$ or GND	-	-	225	$\mu\text{A}$
<b><math>T_{amb} = -40 \text{ }^\circ\text{C to } +125 \text{ }^\circ\text{C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	$\mu\text{A}$
$V_{IL}$	LOW-state input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	$\mu\text{A}$
$I_{LI}$	input leakage current	$V_{CC} = 5.5 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{CC} \text{ or GND}$	-	-	$\pm 1.0$	$\mu\text{A}$

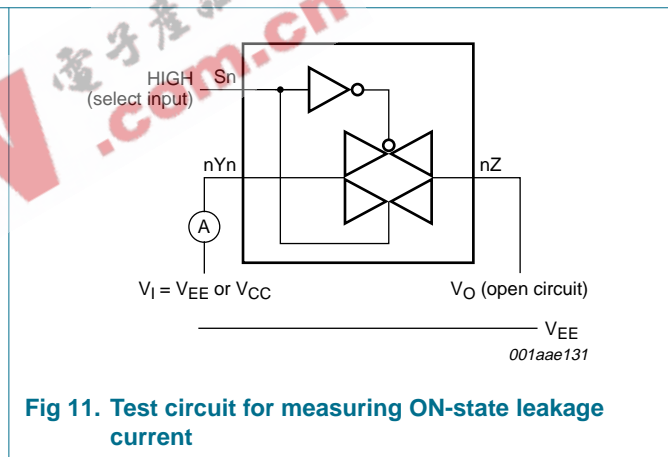
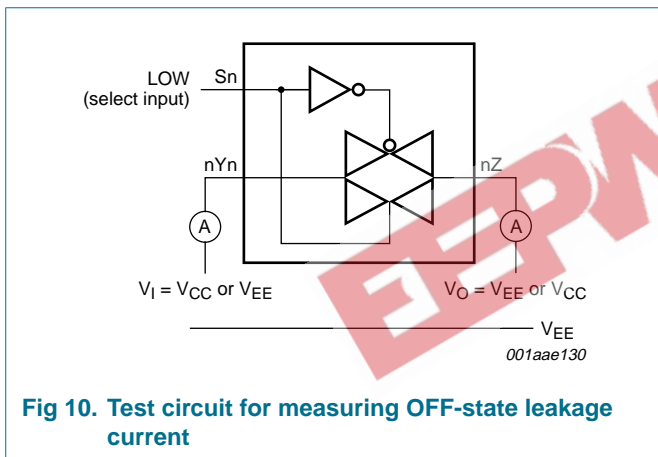
**Table 9: Static characteristics 74HCT4053 ...continued**

Voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 10</a>	-	-	$\pm 1.0$	$\mu\text{A}$
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_{EE} = 0\text{ V}$ ; $ V_S  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$	-	-	-	-
		$V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	160.0	$\mu\text{A}$
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$	-	-	320.0	$\mu\text{A}$
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{CC} - 2.1\text{ V}$ ; other inputs at $V_{CC}$ or GND	-	-	245	$\mu\text{A}$



## 12. Dynamic characteristics

**Table 10: Dynamic characteristics type 74HC4053**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$  unless otherwise specified; for test circuit see [Figure 14](#).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ }^\circ\text{C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$	$R_L = \infty\ \Omega$ ; see <a href="#">Figure 12</a>	-	-	-	-
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	15	60	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	5	12	ns
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	4	10	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	4	8	ns

**Table 10: Dynamic characteristics type 74HC4053 ...continued**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see Figure 14.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PZH}$ , $t_{PZL}$	turn-ON time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	60	220	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	20	44	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
		$V_{CC} = 5$ V; $V_{EE} = 0$ V; $C_L = 15$ pF	-	17	-	ns
	Sn to $V_{os}$	$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	75	220	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	25	44	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
		$V_{CC} = 5$ V; $V_{EE} = 0$ V; $C_L = 15$ pF	-	21	-	ns
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	63	210	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	21	42	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
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	18	-	ns
	Sn to $V_{os}$	$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	60	210	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	20	42	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
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	17	-	ns
$C_{PD}$	power dissipation capacitance	per switch; $V_I =$ GND to $V_{CC}$	[1] -	36	-	pF

 **$T_{amb} = -40$  °C to  $+85$  °C**

$t_{PHL}$ , $t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$	$R_L = \infty$ $\Omega$ ; see Figure 12				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	75	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	-	15	ns
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V	-	-	13	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	-	10	ns

**Table 10: Dynamic characteristics type 74HC4053 ...continued**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see Figure 14.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PZH}$ , $t_{PZL}$	turn-ON time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	275	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	-	55	ns
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V	-	-	47	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	-	39	ns
	Sn to $V_{os}$	$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	275	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	-	55	ns
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V	-	-	47	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	-	39	ns
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	265	ns
		$V_{CC} = 4.5$ 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 $V_{os}$	$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	265	ns
		$V_{CC} = 4.5$ 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
<b><math>T_{amb} = -40</math> °C to <math>+125</math> °C</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$	$R_L = \infty$ $\Omega$ ; see Figure 12				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	90	ns
		$V_{CC} = 4.5$ 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
$t_{PZH}$ , $t_{PZL}$	turn-ON time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	330	ns
		$V_{CC} = 4.5$ 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 $V_{os}$	$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	330	ns
		$V_{CC} = 4.5$ 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



**Table 10: Dynamic characteristics type 74HC4053 ...continued**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see Figure 14.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	315	ns
		$V_{CC} = 4.5$ 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 $V_{os}$	$V_{CC} = 2.0$ V; $V_{EE} = 0$ V	-	-	315	ns
		$V_{CC} = 4.5$ 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

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W):

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

$C_S$  = maximum switch capacitance in pF;

$V_{CC}$  = supply voltage in V.

**Table 11: Dynamic characteristics type 74HCT4053**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see Figure 14.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25</math> °C</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$	$V_{CC} = 4.5$ V; $R_L = \infty$ $\Omega$ ; see Figure 12				
		$V_{EE} = 0$ V	-	5	12	ns
		$V_{EE} = -4.5$ V	-	4	8	ns
$t_{PZH}$ , $t_{PZL}$	turn-ON time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	27	48	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	16	34	ns
		$V_{CC} = 5$ V; $V_{EE} = 0$ V; $C_L = 15$ pF	-	23	-	ns
	Sn to $V_{os}$	$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	25	48	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	16	34	ns
		$V_{CC} = 5$ V; $V_{EE} = 0$ V; $C_L = 15$ pF	-	21	-	ns

**Table 11: Dynamic characteristics type 74HCT4053 ...continued**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see Figure 14.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time $\bar{E}$ to $V_{os}$	$R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	24	44	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	15	31	ns
		$V_{CC} = 5$ V; $V_{EE} = 0$ V; $C_L = 15$ pF	-	20	-	ns
	Sn to $V_{os}$	$V_{CC} = 4.5$ V; $V_{EE} = 0$ V	-	22	44	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	-	15	31	ns
		$V_{CC} = 5$ V; $V_{EE} = 0$ V; $C_L = 15$ pF	-	19	-	ns
$C_{PD}$	power dissipation capacitance	per switch; $V_I =$ GND to $(V_{CC} - 1.5$ V)	[1]	36	-	pF
<b><math>T_{amb} = -40</math> °C to <math>+85</math> °C</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$	$V_{CC} = 4.5$ V; $R_L = \infty$ $\Omega$ ; see Figure 12				
		$V_{EE} = 0$ V	-	-	15	ns
		$V_{EE} = -4.5$ V	-	-	10	ns
$t_{PZH}$ , $t_{PZL}$	turn-ON time $\bar{E}$ to $V_{os}$	$V_{CC} = 4.5$ V; $R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{EE} = 0$ V	-	-	60	ns
		$V_{EE} = -4.5$ V	-	-	43	ns
	Sn to $V_{os}$	$V_{EE} = 0$ V	-	-	60	ns
		$V_{EE} = -4.5$ V	-	-	43	ns
$t_{PHZ}$ , $t_{PLZ}$	turn-OFF time $\bar{E}$ to $V_{os}$	$V_{CC} = 4.5$ V; $R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{EE} = 0$ V	-	-	55	ns
		$V_{EE} = -4.5$ V	-	-	39	ns
	Sn to $V_{os}$	$V_{EE} = 0$ V	-	-	55	ns
		$V_{EE} = -4.5$ V	-	-	39	ns
<b><math>T_{amb} = -40</math> °C to <math>+125</math> °C</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay $V_{is}$ to $V_{os}$	$V_{CC} = 4.5$ V; $R_L = \infty$ $\Omega$ ; see Figure 12				
		$V_{EE} = 0$ V	-	-	18	ns
		$V_{EE} = -4.5$ V	-	-	12	ns
$t_{PZH}$ , $t_{PZL}$	turn-ON time $\bar{E}$ to $V_{os}$	$V_{CC} = 4.5$ V; $R_L = 1$ k $\Omega$ ; see Figure 13				
		$V_{EE} = 0$ V	-	-	72	ns
		$V_{EE} = -4.5$ V	-	-	51	ns
	Sn to $V_{os}$	$V_{EE} = 0$ V	-	-	72	ns
		$V_{EE} = -4.5$ V	-	-	51	ns

**Table 11: Dynamic characteristics type 74HCT4053 ...continued**

Voltages are referenced to GND (ground = 0 V);  $t_r = t_f = 6 \text{ ns}$ ;  $C_L = 50 \text{ pF}$  unless otherwise specified; for test circuit see Figure 14.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHZ}$	turn-OFF time	$V_{CC} = 4.5 \text{ V}$ ; $R_L = 1 \text{ k}\Omega$ ; see Figure 13				
$t_{PLZ}$	$\bar{E}$ to $V_{os}$	$V_{EE} = 0 \text{ V}$	-	-	66	ns
		$V_{EE} = -4.5 \text{ V}$	-	-	47	ns
	Sn to $V_{os}$	$V_{EE} = 0 \text{ V}$	-	-	66	ns
		$V_{EE} = -4.5 \text{ V}$	-	-	47	ns

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

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

where:

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

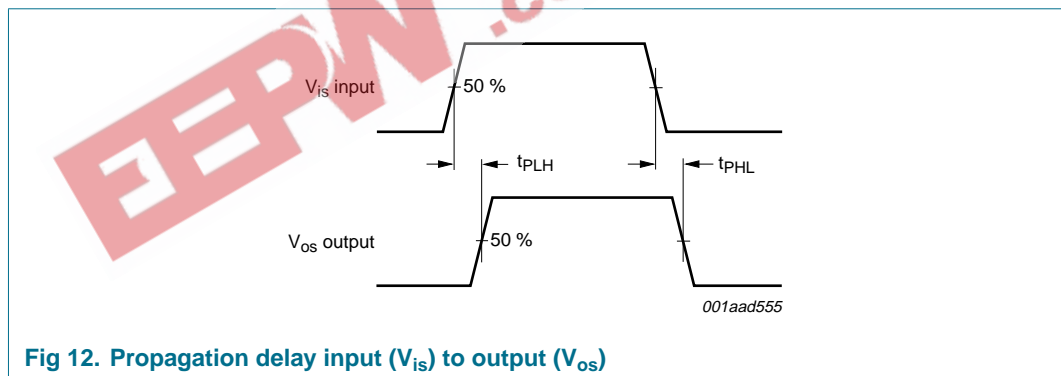
$\sum\{(C_L + C_S) \times V_{CC}^2 \times f_o\}$  = sum of outputs;

$C_L$  = output load capacitance in pF;

$C_S$  = maximum switch capacitance in pF;

$V_{CC}$  = supply voltage in V.

### 13. Waveforms



**Fig 12. Propagation delay input ( $V_{is}$ ) to output ( $V_{os}$ )**

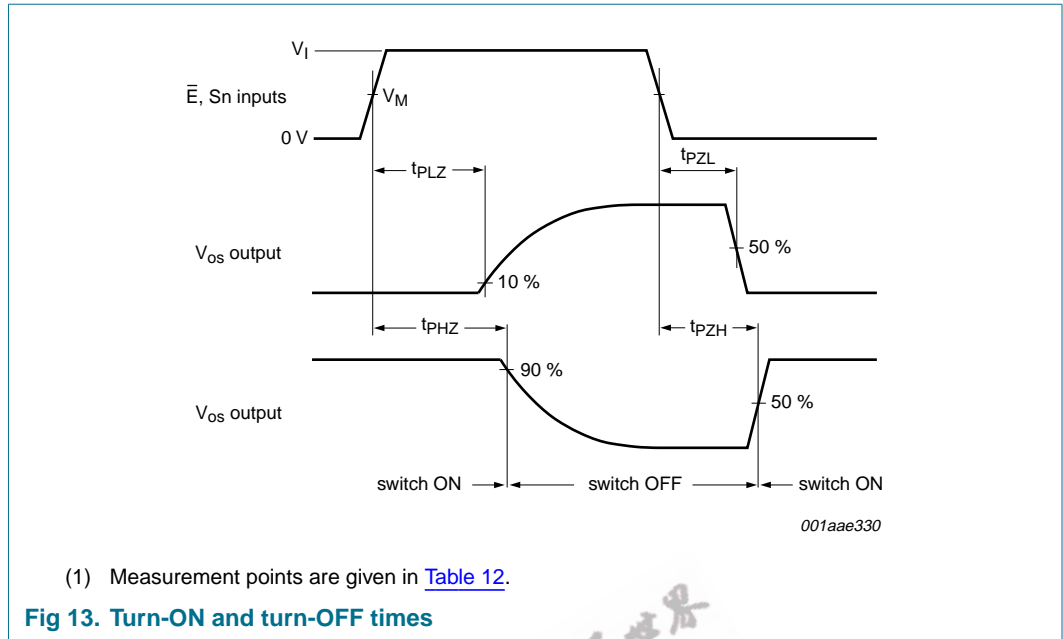
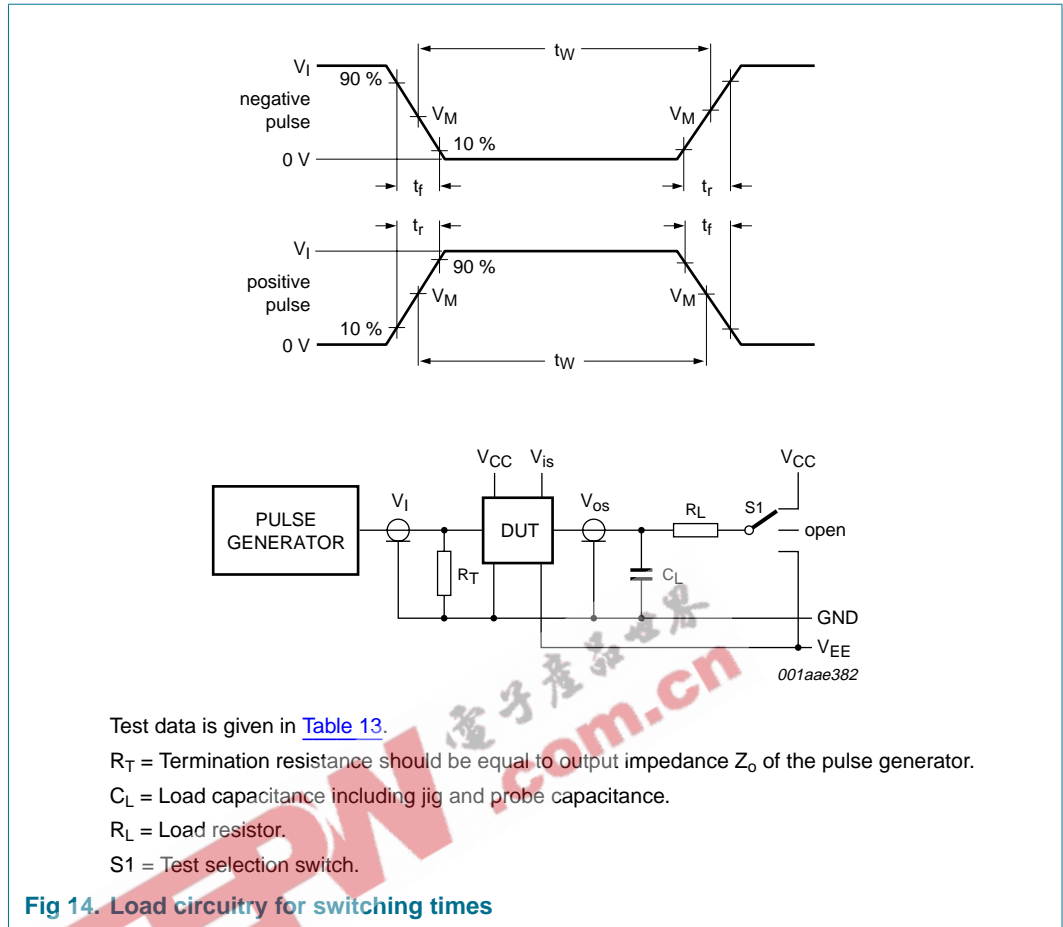


Table 12: Measurement points

Type	Input
	$V_M$
74HC4053	$0.5V_{CC}$
74HCT4053	1.3 V



**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			
$t_{PHL}, t_{PLH}$	[1]	pulse	< 2 ns	6 ns	15 pF, 50 pF	1 k $\Omega$	open
$t_{PZH}, t_{PHZ}$	[1]	$V_{CC}$	< 2 ns	6 ns	15 pF, 50 pF	1 k $\Omega$	$V_{EE}$
$t_{PZL}, t_{PLZ}$	[1]	$V_{EE}$	< 2 ns	6 ns	15 pF, 50 pF	1 k $\Omega$	$V_{CC}$

- [1]  $V_I$  values:
- For 74HC4053:  $V_I = V_{CC}$ .
  - For 74HCT4053:  $V_I = 3$  V.

## 14. Additional dynamic characteristics

**Table 14: Additional dynamic characteristics 74HC4053 and 74HCT4053**

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

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

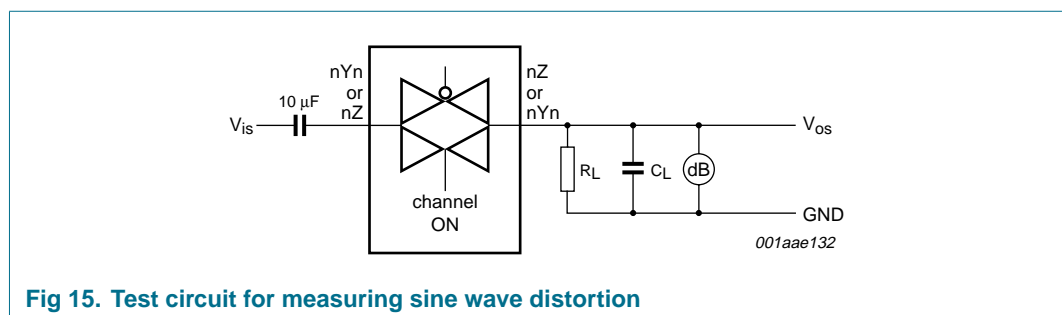
$V_{os}$  is the output voltage at an nYn or nZ terminal, whichever is assigned as an output.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$d_{sin}$	sine wave distortion	$R_L = 10\text{ k}\Omega$ ; $C_L = 50\text{ pF}$ ; see <a href="#">Figure 15</a>				
		$f_i = 1\text{ kHz}$				
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$ ; $V_{is} = 4.0\text{ V (p-p)}$	-	0.04	-	%
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$ ; $V_{is} = 8.0\text{ V (p-p)}$	-	0.02	-	%
		$f_i = 10\text{ kHz}$				
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$ ; $V_{is} = 4.0\text{ V (p-p)}$	-	0.12	-	%
$\alpha_{(OFF)(ft)}$	OFF-state feed-through attenuation	$R_L = 600\text{ }\Omega$ ; $C_L = 50\text{ pF}$ ; $f_i = 1\text{ MHz}$ ; see <a href="#">Figure 16</a>	[1]			
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$		-50	-	dB
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$		-50	-	dB
$V_{ct(sw-sw)}$	crosstalk between switches	$R_L = 600\text{ }\Omega$ ; $C_L = 50\text{ pF}$ ; $f_i = 1\text{ MHz}$ ; see <a href="#">Figure 17</a>	[1]			
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$		-60	-	dB
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$		-60	-	dB
$V_{ct(d-sw)}$	crosstalk between digital inputs and switch	$V_{CC} = 4.5\text{ V}$ ; $R_L = 600\text{ k}\Omega$ ; $C_L = 50\text{ pF}$ ; $f_i = 1\text{ MHz}$ ; see <a href="#">Figure 18</a>	[2]			
		$V_{EE} = 0\text{ V}$		110	-	mV
		$V_{EE} = -4.5\text{ V}$		220	-	mV
$f_{(-3dB)}$	-3 dB frequency response	$R_L = 50\text{ }\Omega$ ; $C_L = 10\text{ pF}$ ; see <a href="#">Figure 19</a>	[3]			
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$		160	-	MHz
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$		170	-	MHz

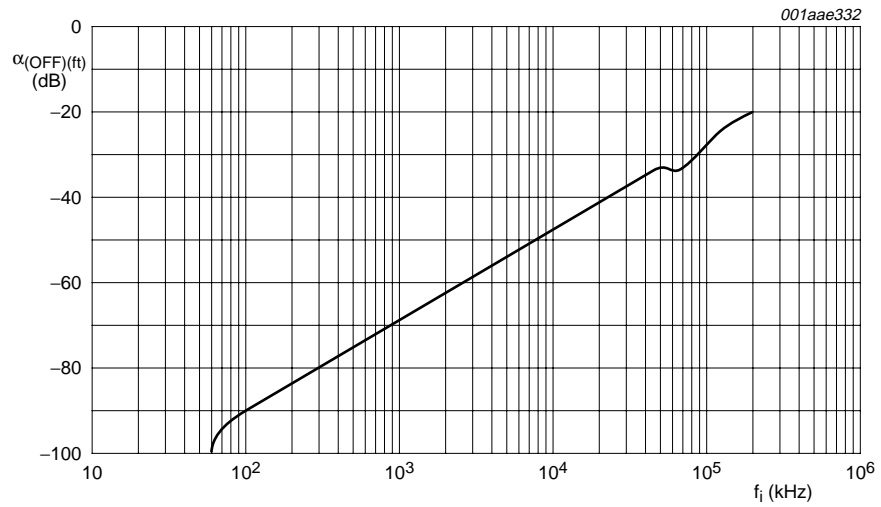
[1] Adjust input voltage  $V_{is}$  to 0 dBm level (0 dBm = 1 mW into 600  $\Omega$ ).

[2] Control input  $\bar{E}$  or Sn, with square-wave between  $V_{CC}$  and GND.

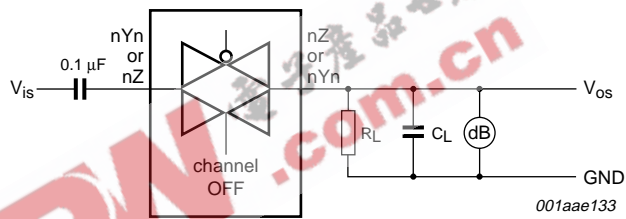
[3] Adjust input voltage  $V_{is}$  to 0 dBm level at  $V_{os}$  for 1 MHz (0 dBm = 1 mW into 50  $\Omega$ ).



**Fig 15. Test circuit for measuring sine wave distortion**

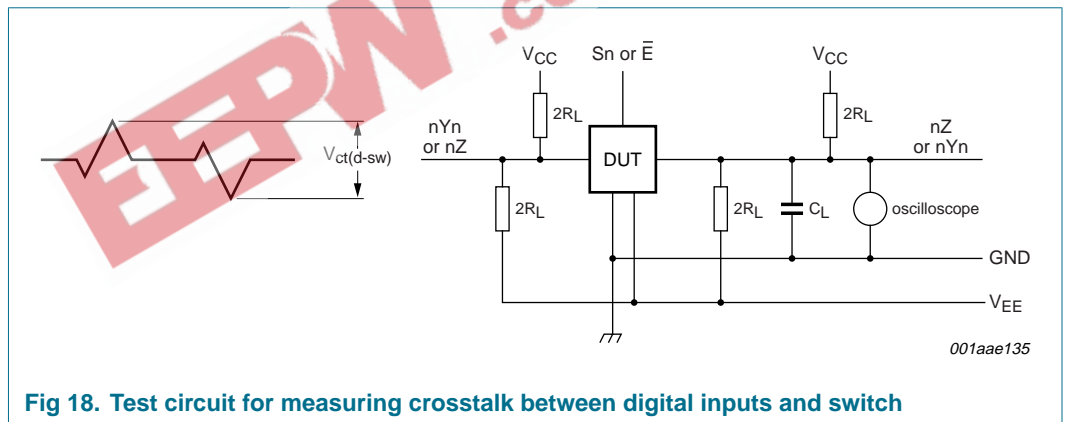
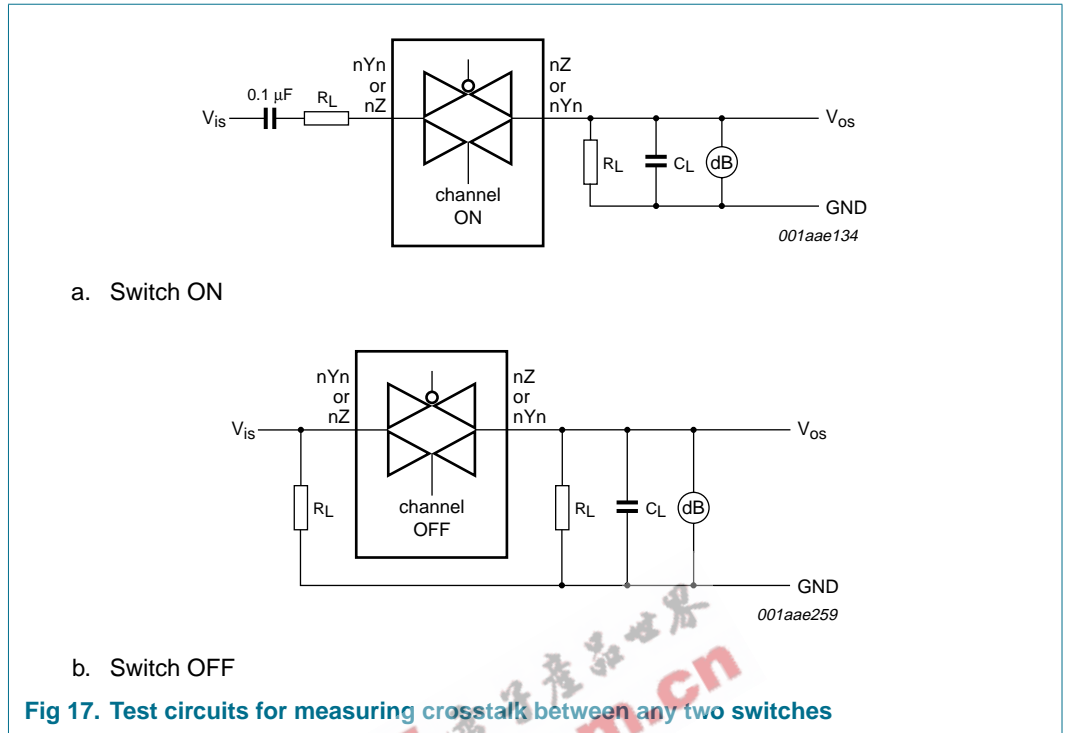


a. Feed-through as function of the frequency

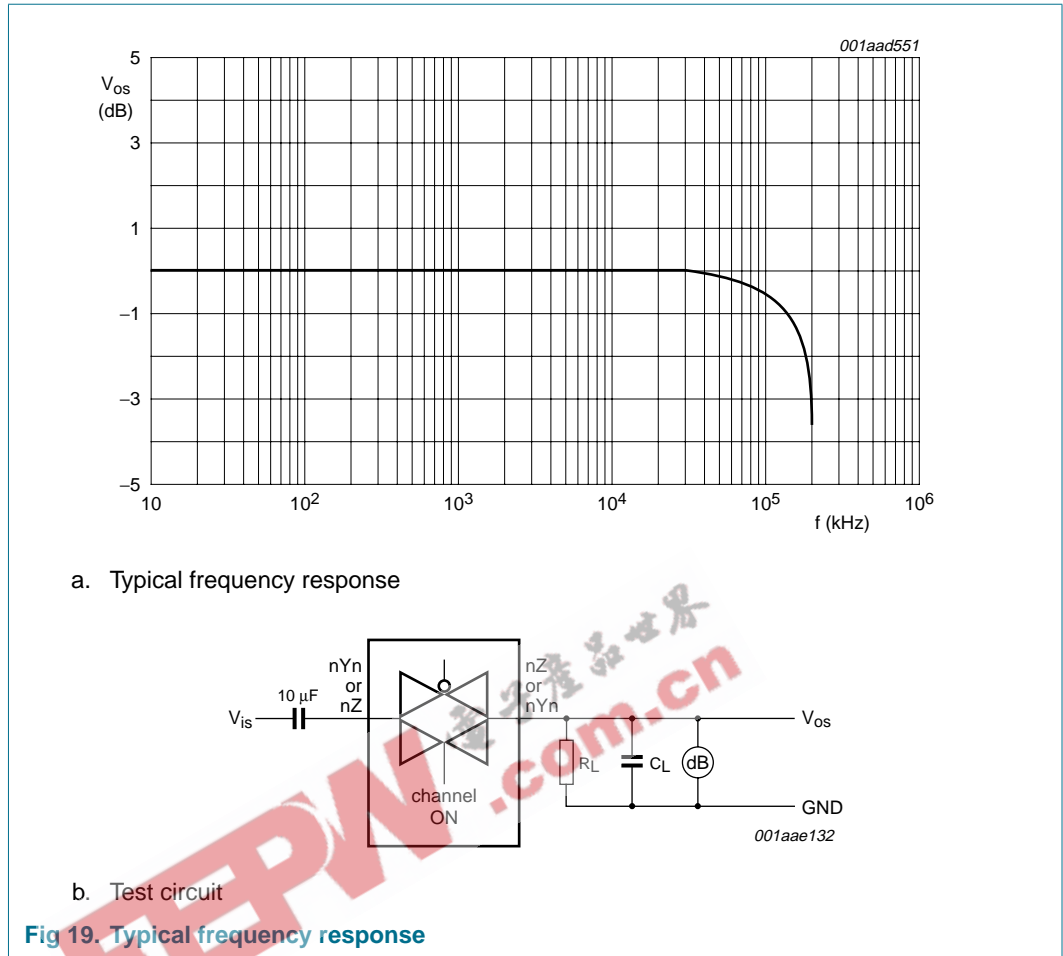


b. Test circuit

Fig 16. Typical switch OFF signal feed-through as a function of frequency







15. Package outline

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4

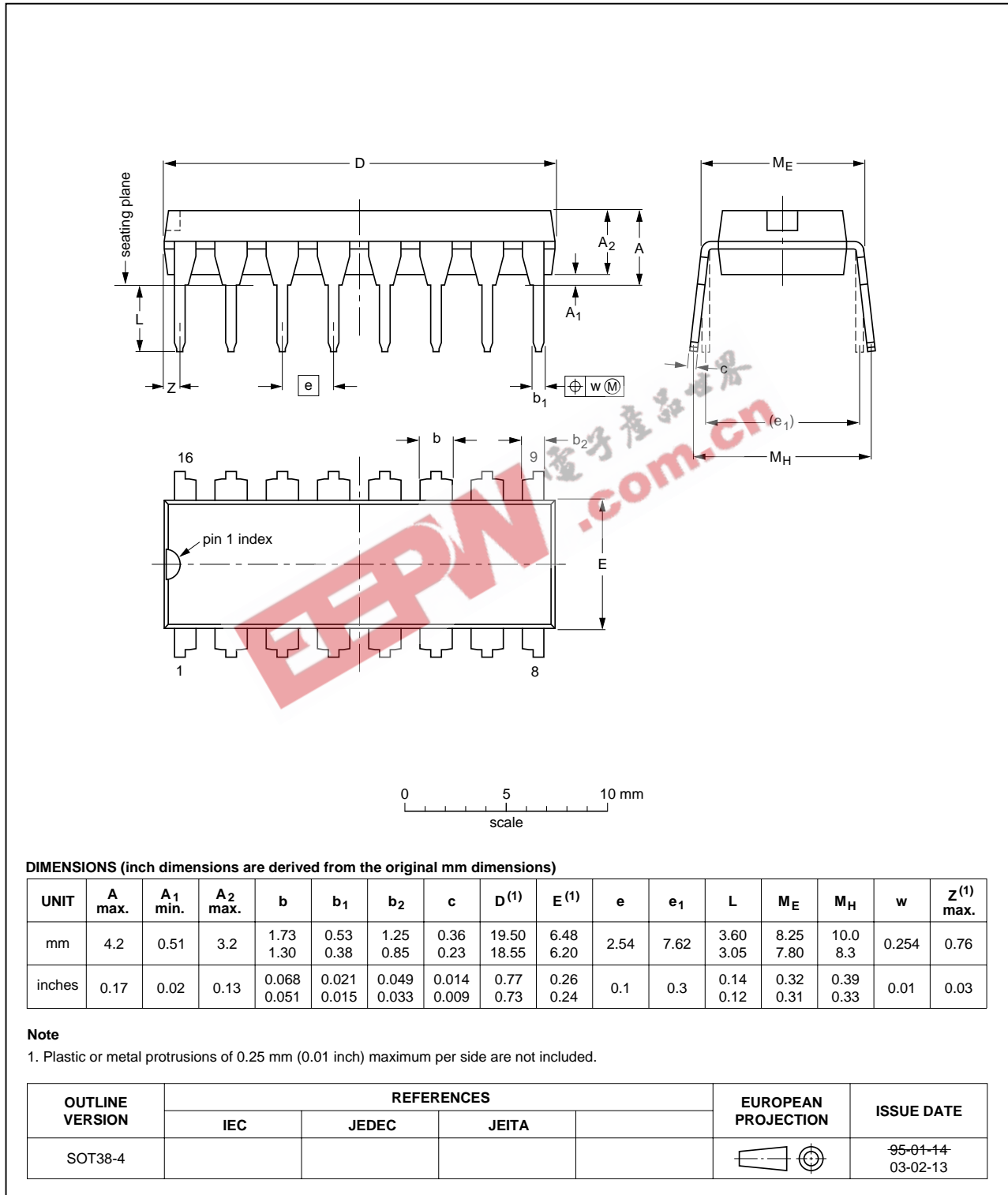


Fig 20. Package outline SOT38-4 (DIP16)

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

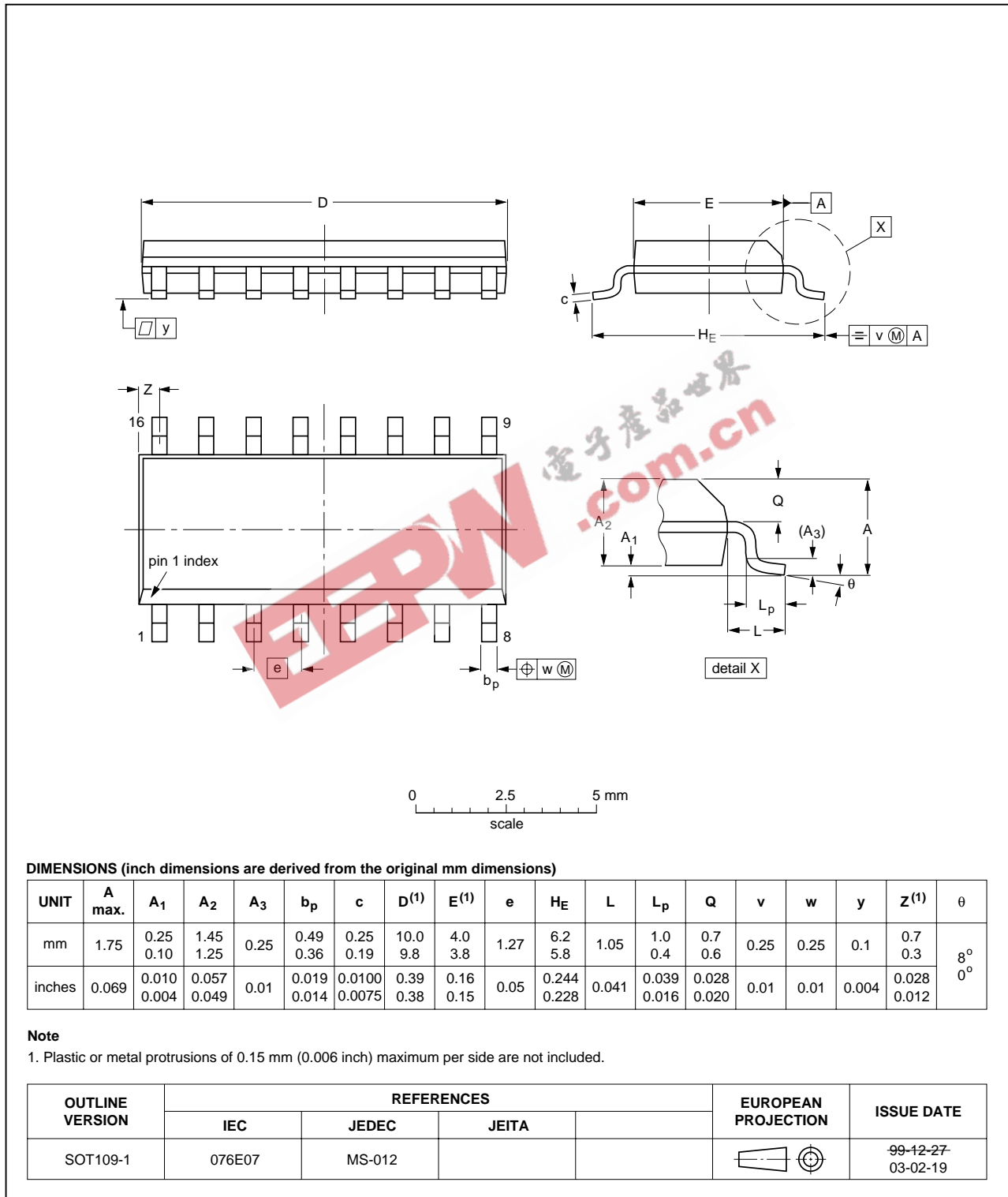


Fig 21. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

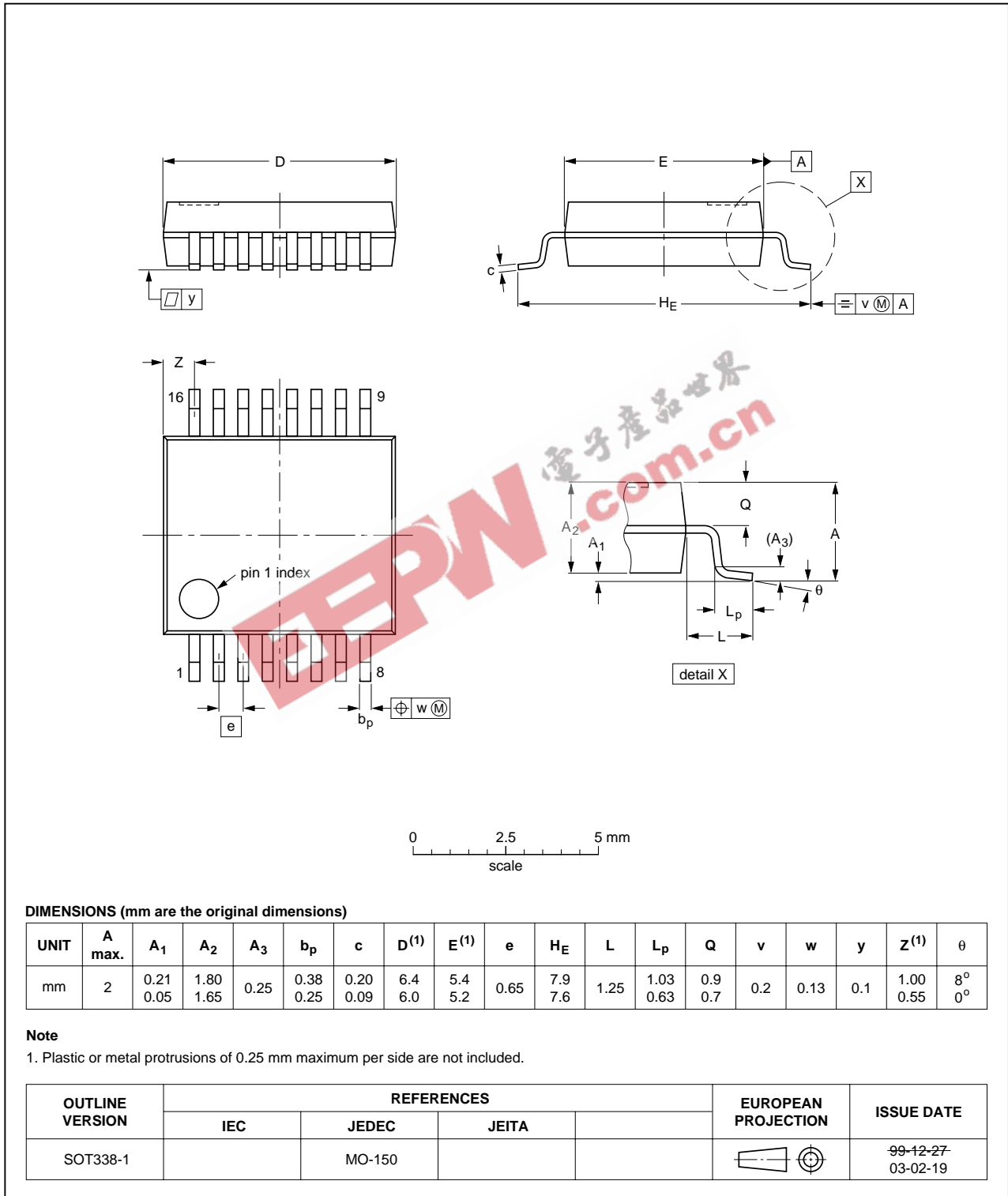


Fig 22. Package outline SOT338-1 (SSOP16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

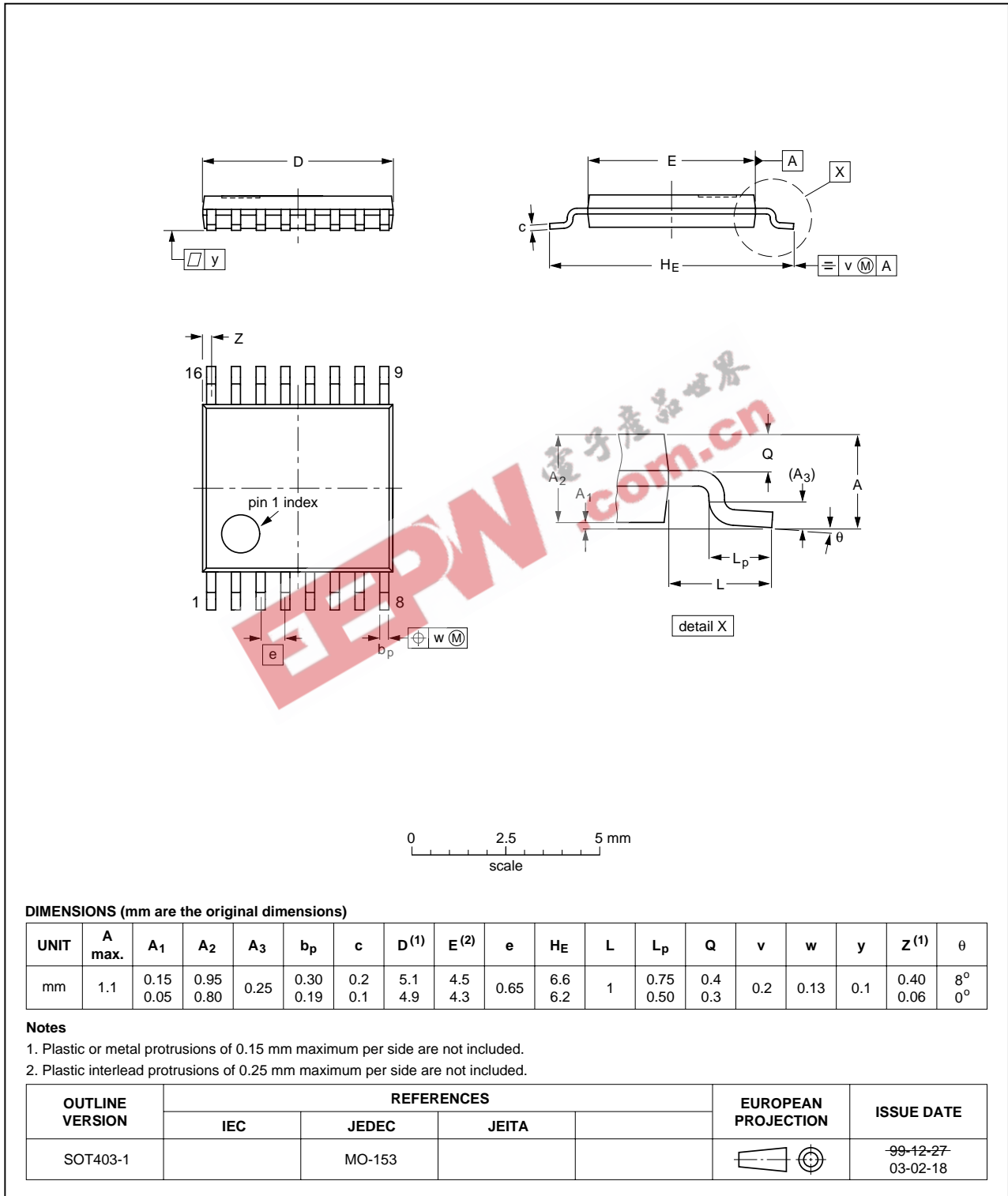


Fig 23. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

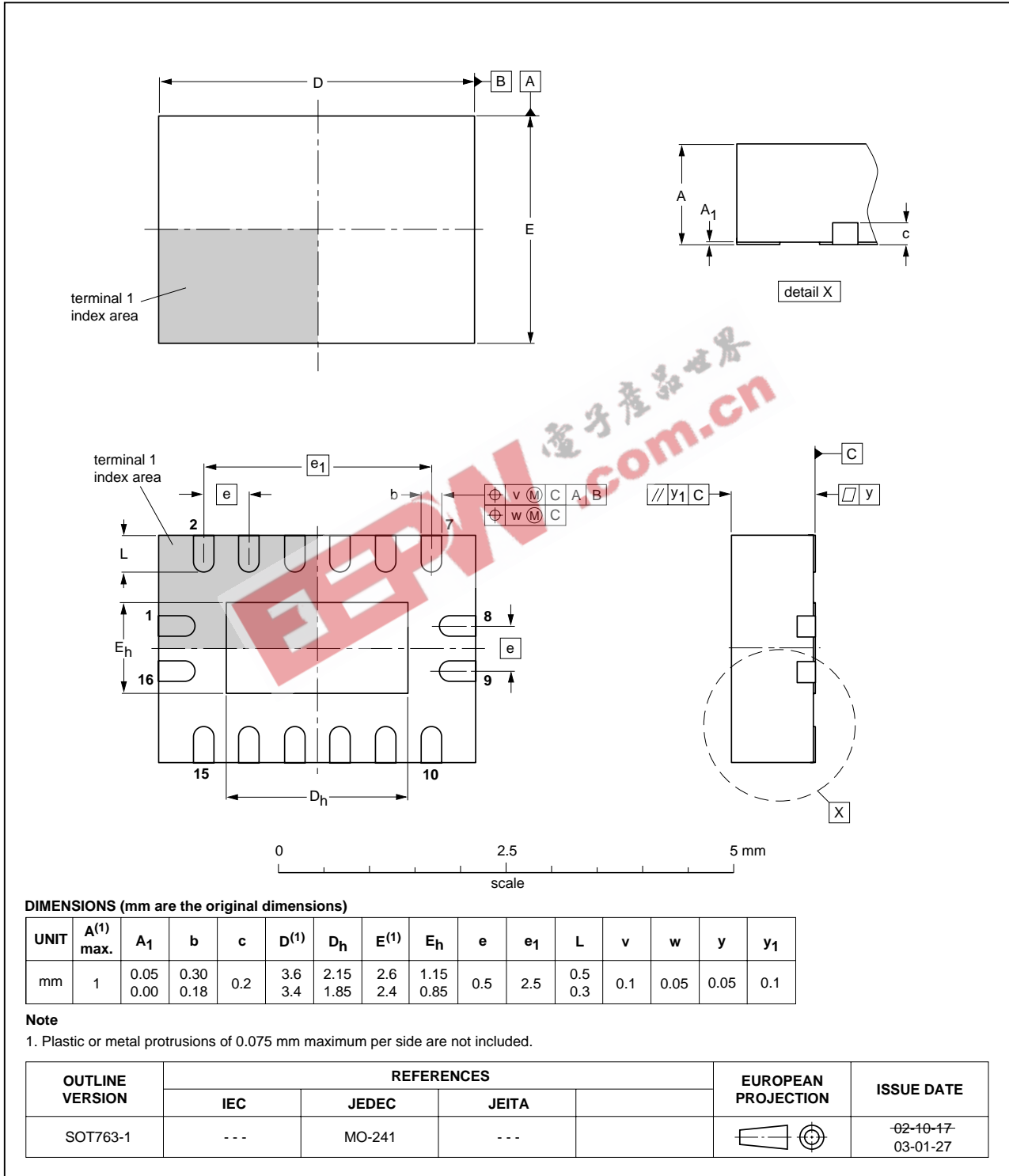


Fig 24. Package outline SOT763-1 (DHVQFN16)

## 16. Abbreviations

Table 15: Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
HBM	Human Body Model
ESD	ElectroStatic Discharge
MM	Machine Model
DUT	Device Under Test

## 17. Revision history

Table 16: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74HC_HCT4053_4	20060509	Product data sheet	-	-	74HC_HCT4053_3
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Section 5 "Ordering information"</a>: errors corrected, type numbers in wrong order and SOT38-4 is the package for types 74HC4053N and 74HCT4053N</li> </ul>				
74HC_HCT4053_3	20060315	Product data sheet	-	-	74HC_HCT4053_CNV_2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li>Added type numbers 74HC4053BQ and 74HCT4053BQ (DHVQFN16) package to <a href="#">Section 5 "Ordering information"</a>, <a href="#">Section 7 "Pinning information"</a> and <a href="#">Section 15 "Package outline"</a></li> </ul>				
74HC_HCT4053_CNV_2	19901201	Product specification	-	-	-

## 18. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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