

# 74HC4053-Q100; 74HCT4053-Q100

## Triple 2-channel analog multiplexer/demultiplexer

Rev. 2 — 22 November 2012

Product data sheet

## 1. General description

The 74HC4053-Q100; 74HCT4053-Q100 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard no. 7A.

The 74HC4053-Q100; 74HCT4053-Q100 is triple 2-channel analog multiplexer/demultiplexer with a common enable input ( $\overline{E}$ ). Each multiplexer/demultiplexer has two independent inputs/outputs ( $nY0$  and  $nY1$ ), a common input/output ( $nZ$ ) and three digital select inputs ( $S_n$ ). With  $\overline{E}$  LOW, one of the two switches is selected (low-impedance ON-state) by  $S1$  to  $S3$ . With  $\overline{E}$  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 ( $S0$  to  $S2$ , and  $\overline{E}$ ). The  $V_{CC}$  to GND ranges are 2.0 V to 10.0 V for 74HC4053-Q100, and 4.5 V to 5.5 V for 74HCT4053-Q100. The analog inputs/outputs ( $nY0$  to  $nY1$ , 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).

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Wide analog input voltage range from  $-5\text{ V}$  to  $+5\text{ V}$
- Low ON resistance:
  - ◆  $80\ \Omega$  (typical) at  $V_{CC} - V_{EE} = 4.5\text{ V}$
  - ◆  $70\ \Omega$  (typical) at  $V_{CC} - V_{EE} = 6.0\text{ V}$
  - ◆  $60\ \Omega$  (typical) at  $V_{CC} - V_{EE} = 9.0\text{ V}$
- Logic level translation: to enable 5 V logic to communicate with  $\pm 5\text{ V}$  analog signals
- Typical 'break before make' built-in
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\ \Omega$ )
  - ◆ CDM AEC-Q100-011 revision B exceeds 1000 V
- Multiple package options



### 3. Applications

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

### 4. Ordering information

**Table 1. Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74HC4053D-Q100 74HCT4053D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC4053PW-Q100 74HCT4053PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HC4053BQ-Q100 74HCT4053BQ-Q100	-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

## 5. Functional diagram

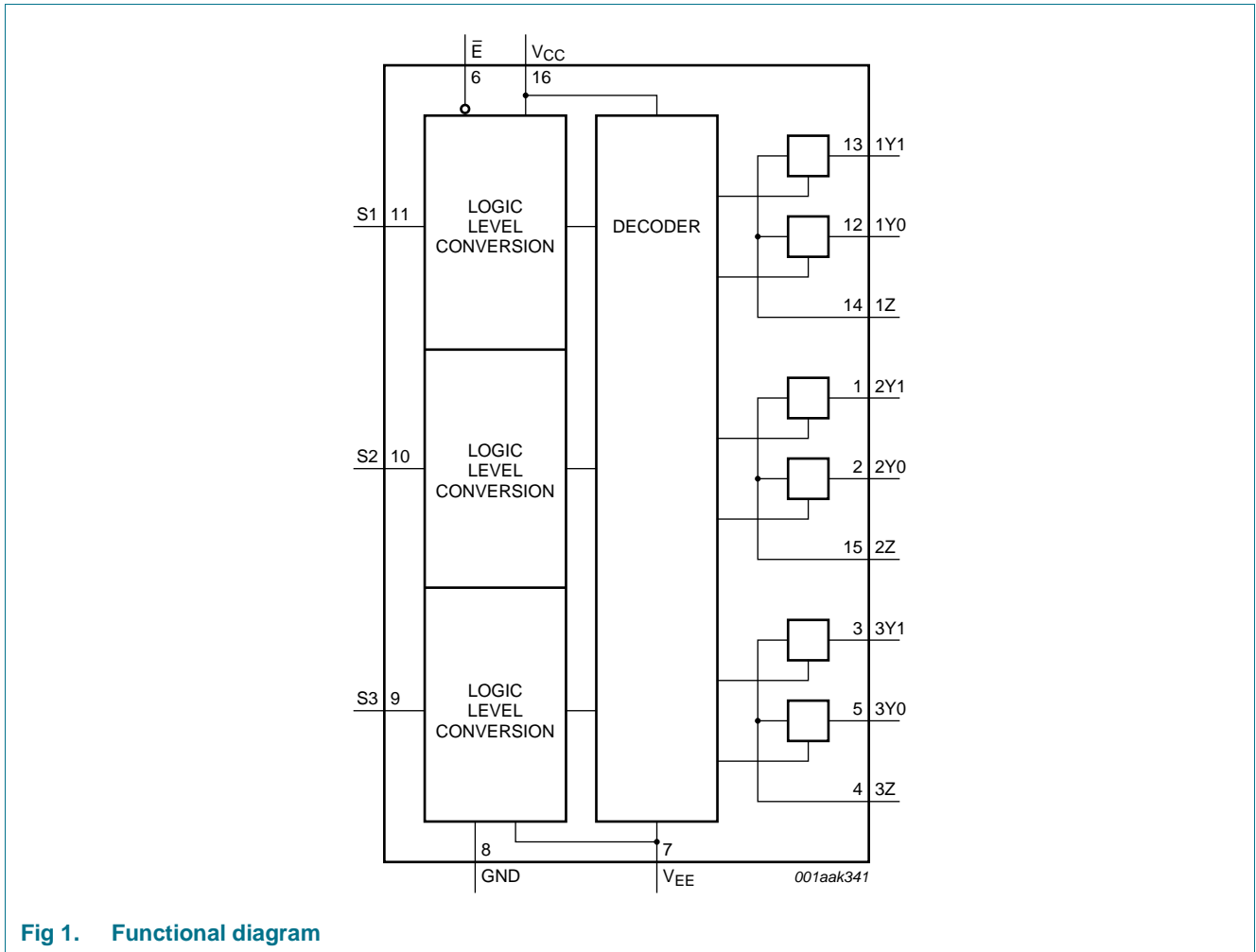


Fig 1. Functional diagram

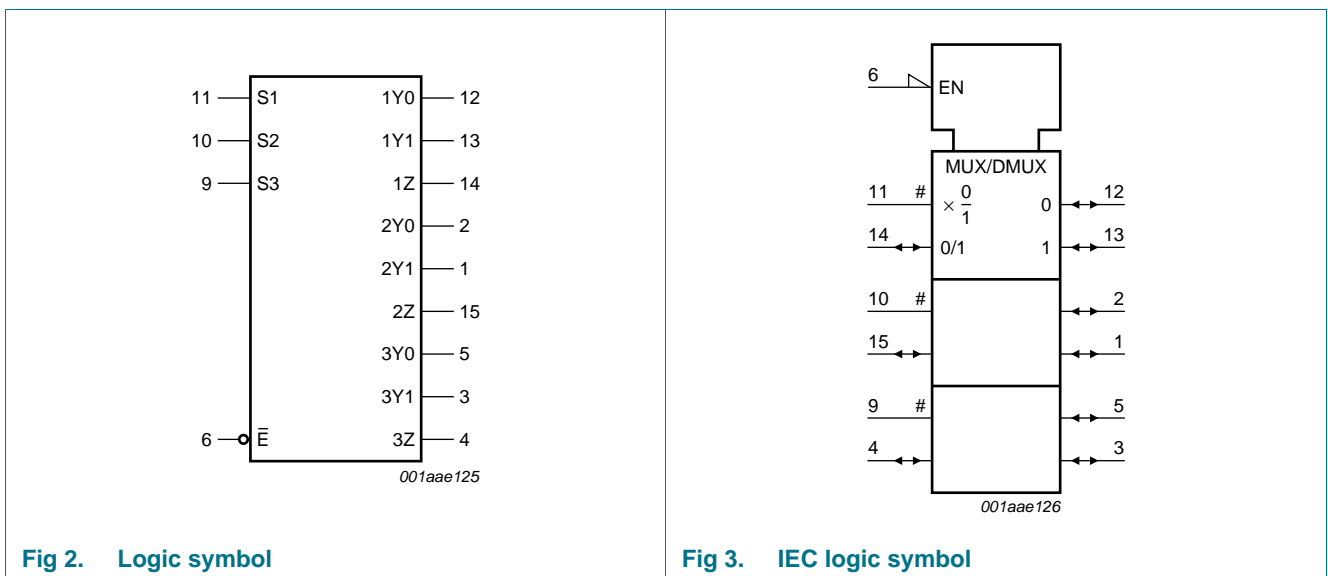


Fig 2. Logic symbol

Fig 3. IEC logic symbol

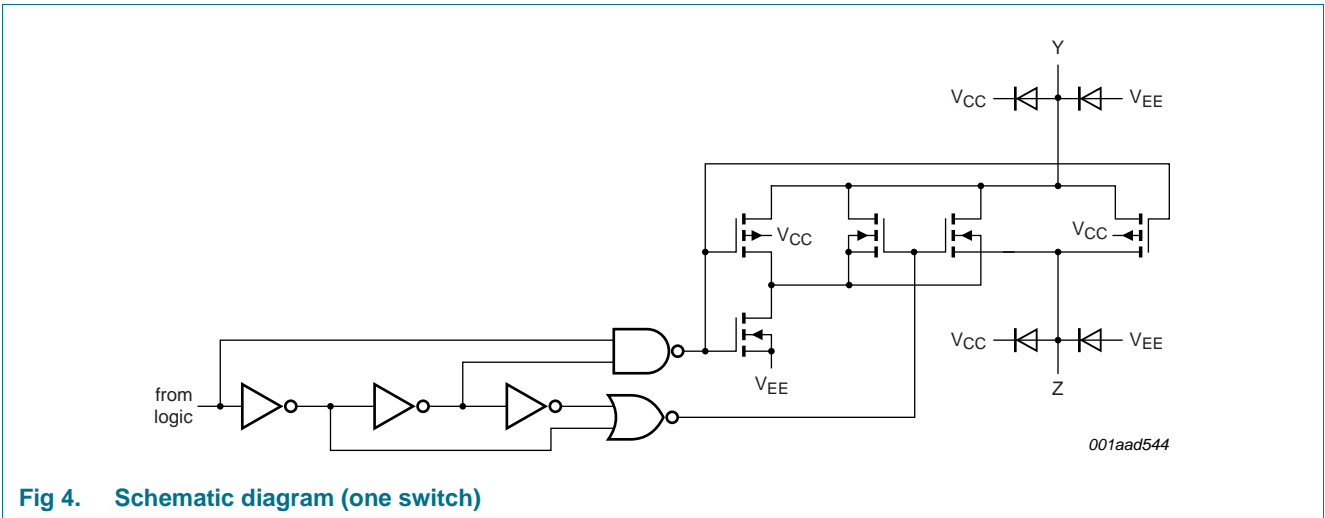


Fig 4. Schematic diagram (one switch)

## 6. Pinning information

### 6.1 Pinning

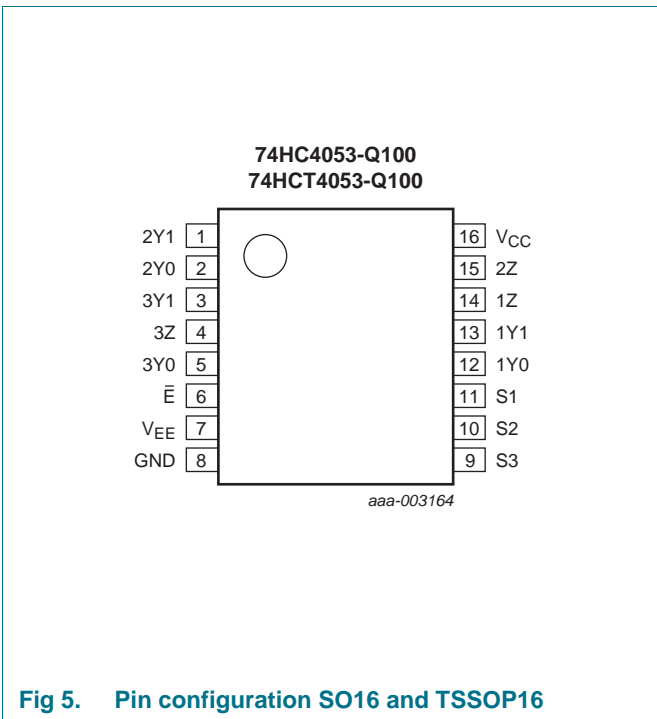


Fig 5. Pin configuration SO16 and TSSOP16

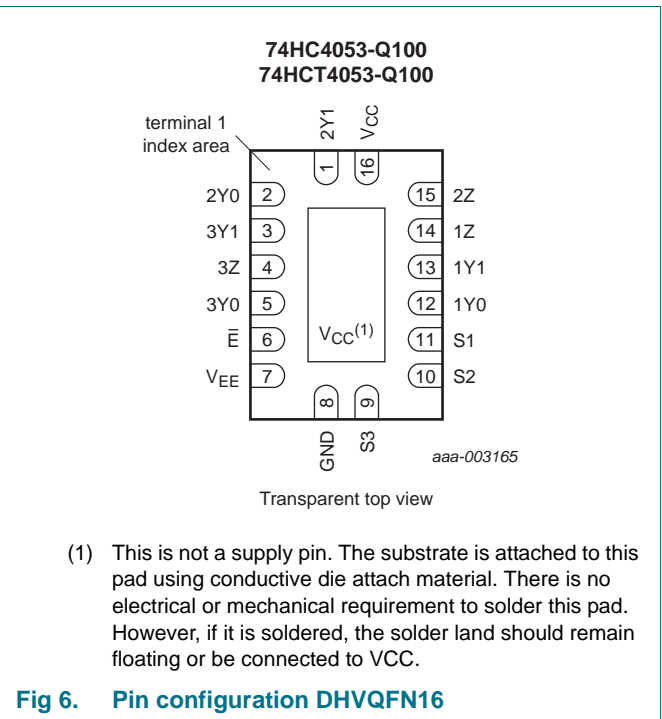


Fig 6. Pin configuration DHVQFN16

## 6.2 Pin description

Table 2. Pin description

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

## 7. Functional description

Table 3. Function table [1]

Inputs		Channel on
$\bar{E}$	$S_n$	
L	L	nY0 to nZ
L	H	nY1 to nZ
H	X	switches off

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

## 8. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		[1] -0.5	+11.0	V
$I_{IK}$	input clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	$\pm 20$	mA
$I_{SK}$	switch clamping current	$V_{SW} < -0.5$ V or $V_{SW} > V_{CC} + 0.5$ V	-	$\pm 20$	mA
$I_{SW}$	switch current	$-0.5$ V $< V_{SW} < V_{CC} + 0.5$ V	-	$\pm 25$	mA
$I_{EE}$	supply current		-	$\pm 20$	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		[2] -	500	mW
P	power dissipation	per switch	-	100	mW

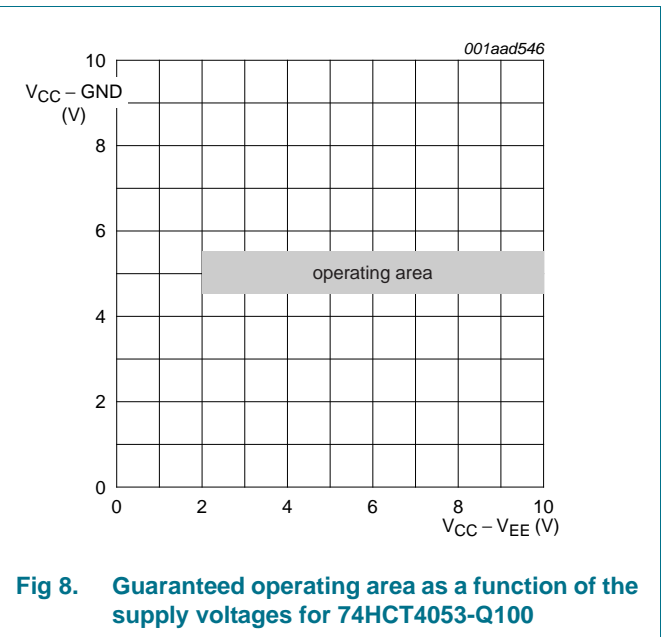
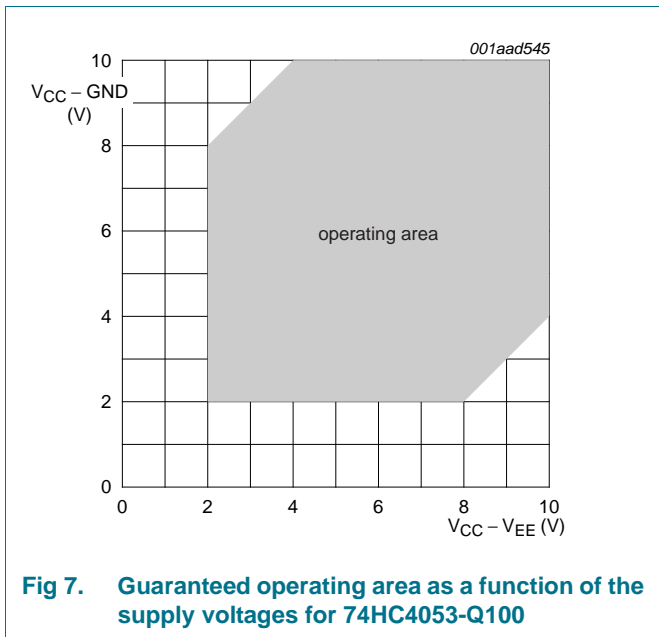
[1] To avoid drawing  $V_{CC}$  current out of terminal nZ, when switch current flows into terminals nYn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal nZ, no  $V_{CC}$  current flows out of terminals nYn. In this case, there is no limit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

[2] For SO16 package: above 70 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.  
 For TSSOP16 package: above 60 °C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.  
 For DHVQFN16 package: above 60 °C the value of  $P_{tot}$  derates linearly with 4.5 mW/K.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	74HC4053-Q100			74HCT4053-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>							
		$V_{CC} - GND$	2.0	5.0	10.0	4.5	5.0	5.5	V
		$V_{CC} - V_{EE}$	2.0	5.0	10.0	2.0	5.0	10.0	V
$V_I$	input voltage		GND	-	$V_{CC}$	GND	-	$V_{CC}$	V
$V_{SW}$	switch voltage		$V_{EE}$	-	$V_{CC}$	$V_{EE}$	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	-	-	-	ns/V
		$V_{CC} = 10.0\text{ V}$	-	-	31	-	-	-	ns/V



## 10. Static characteristics

**Table 6.**  $R_{ON}$  resistance per switch for 74HC4053-Q100 and 74HCT4053-Q100

$V_I = V_{IH}$  or  $V_{IL}$ ; for test circuit see [Figure 9](#).

$V_{is}$  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.

For 74HC4053-Q100:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

For 74HCT4053-Q100:  $V_{CC} - GND = 4.5\text{ V}$  and  $5.5\text{ V}$ ,  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ }^\circ\text{C}</math></b>						
$R_{ON(peak)}$	ON resistance (peak)	$V_{is} = V_{CC}$ to $V_{EE}$				
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$	[1] -	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	100	180	$\Omega$
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	90	160	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	70	130	$\Omega$
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}$				
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$	[1] -	150	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	80	140	$\Omega$
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	70	120	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	60	105	$\Omega$
		$V_{is} = V_{CC}$				
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$	[1] -	150	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	90	160	$\Omega$
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	80	140	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	65	120	$\Omega$
$\Delta R_{ON}$	ON resistance mismatch between channels	$V_{is} = V_{CC}$ to $V_{EE}$				
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}$	[1] -	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	9	-	$\Omega$
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	8	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	6	-	$\Omega$
<b><math>T_{amb} = -40\text{ }^\circ\text{C}</math> to <math>+85\text{ }^\circ\text{C}</math></b>						
$R_{ON(peak)}$	ON resistance (peak)	$V_{is} = V_{CC}$ to $V_{EE}$				
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$	[1] -	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	-	225	$\Omega$
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	-	200	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	-	165	$\Omega$

**Table 6.**  $R_{ON}$  resistance per switch for 74HC4053-Q100 and 74HCT4053-Q100 ...continued

$V_I = V_{IH}$  or  $V_{IL}$ ; for test circuit see [Figure 9](#).

$V_{is}$  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.

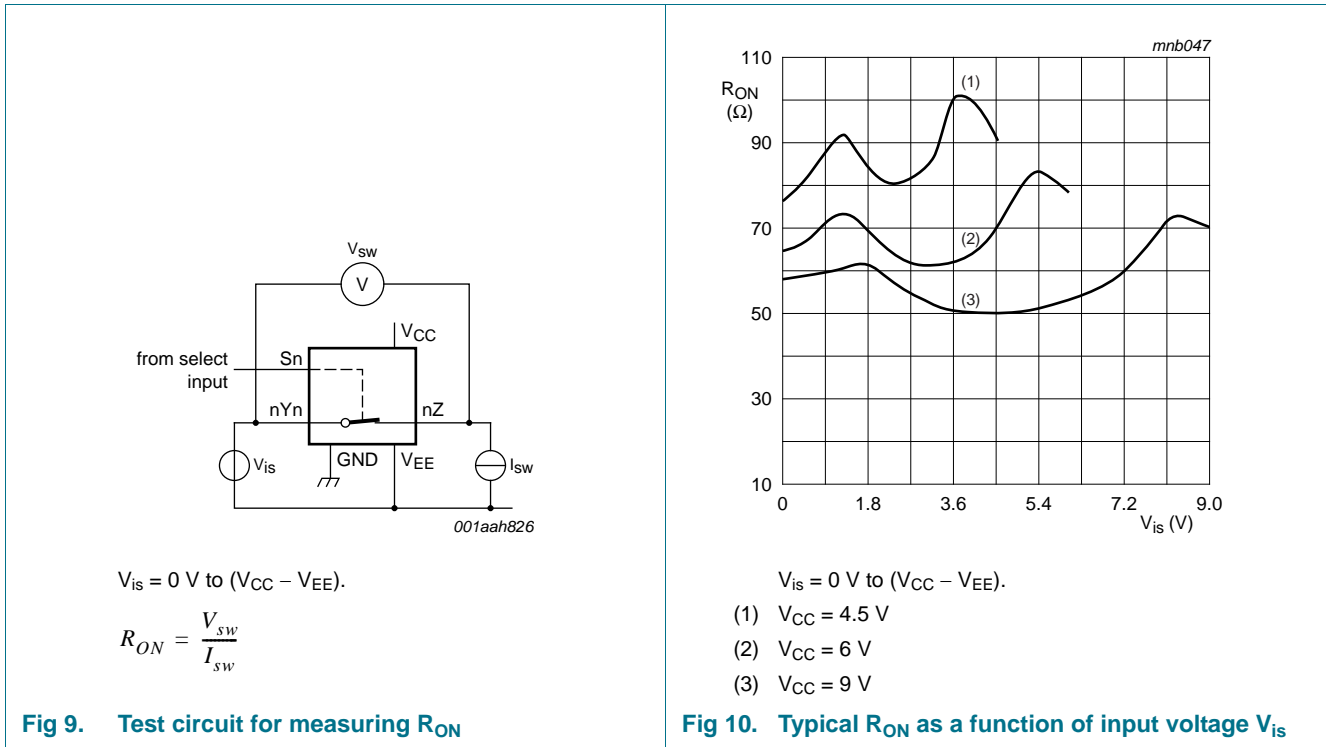
For 74HC4053-Q100:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

For 74HCT4053-Q100:  $V_{CC} - GND = 4.5\text{ V}$  and  $5.5\text{ V}$ ,  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	175	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	150	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	130	$\Omega$	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	200	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	175	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	150	$\Omega$	
<b><math>T_{amb} = -40\text{ }^\circ\text{C}</math> to <math>+125\text{ }^\circ\text{C}</math></b>							
$R_{ON(peak)}$	ON resistance (peak)	$V_{is} = V_{CC}$ to $V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	270	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	240	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	195	$\Omega$	
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	210	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	180	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	160	$\Omega$	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	[1]	-	-	-	$\Omega$
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	240	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	210	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	-	-	180	$\Omega$	

[1] When supply voltages ( $V_{CC} - V_{EE}$ ) near 2.0 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 2 V, only use these devices for transmitting digital signals.





**Table 7. Static characteristics for 74HC4053-Q100**

Voltages are referenced to GND (ground = 0 V).  
 $V_{is}$  is the input voltage at pins nYn or nZ, whichever is assigned as an input.  
 $V_{os}$  is the output voltage at pins nZ or nYn, 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-level 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-level 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
$I_I$	input leakage current	$V_{EE} = 0 \text{ V}; V_I = V_{CC} \text{ or GND}$				
		$V_{CC} = 6.0 \text{ V}$	-	-	$\pm 0.1$	$\mu\text{A}$
		$V_{CC} = 10.0 \text{ V}$	-	-	$\pm 0.2$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL};  V_{SW}  = V_{CC} - V_{EE};$ see <a href="#">Figure 11</a>				
		per channel	-	-	$\pm 0.1$	$\mu\text{A}$
		all channels	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_I = V_{IH} \text{ or } V_{IL};  V_{SW}  = V_{CC} - V_{EE}; V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V};$ see <a href="#">Figure 12</a>	-	-	$\pm 0.1$	$\mu\text{A}$

**Table 7. Static characteristics for 74HC4053-Q100 ...continued**

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

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC}$	supply current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	8.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	16.0	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	pF
$C_{SW}$	switch capacitance	independent pins nYn	-	5	-	pF
		common pins 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-level 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-level 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
$I_I$	input leakage current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; $V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; see <a href="#">Figure 12</a>	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	80.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	160.0	$\mu\text{A}$
<b><math>T_{amb} = -40\text{ }^\circ\text{C}</math> to <math>+125\text{ }^\circ\text{C}</math></b>						
$V_{IH}$	HIGH-level 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-level 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

**Table 7. Static characteristics for 74HC4053-Q100 ...continued**

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

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_I$	input leakage current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; $V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; see <a href="#">Figure 12</a>	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	160.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	320.0	$\mu\text{A}$

**Table 8. Static characteristics for 74HCT4053-Q100**

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

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

$V_{os}$  is the output voltage at pins nZ or nYn, 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-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	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</a>				
		per channel	-	-	$\pm 0.1$	$\mu\text{A}$
		all channels	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 12</a>	-	-	$\pm 0.1$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$				
		$V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	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 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 $5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	50	180	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	pF
$C_{sw}$	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	8	-	pF

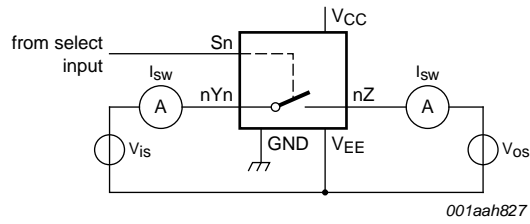
**Table 8. Static characteristics for 74HCT4053-Q100 ...continued**

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

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

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

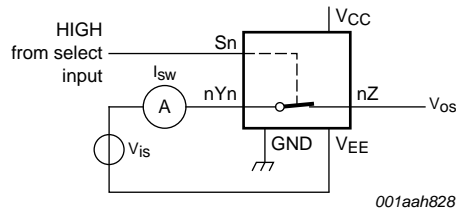
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}</math></b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	2.0	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	0.8	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</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	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 12</a>	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$	-	-	80.0	$\mu\text{A}$
		$V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	160.0	$\mu\text{A}$
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$	-	-	160.0	$\mu\text{A}$
$\Delta I_{CC}$	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	$\mu\text{A}$
<b><math>T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}</math></b>						
$V_{IH}$	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	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 11</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	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see <a href="#">Figure 12</a>	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$	-	-	160.0	$\mu\text{A}$
		$V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	320.0	$\mu\text{A}$
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$	-	-	320.0	$\mu\text{A}$
$\Delta I_{CC}$	additional 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	$\mu\text{A}$



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

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

**Fig 11. Test circuit for measuring OFF-state current**



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

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

**Fig 12. Test circuit for measuring ON-state current**

## 11. Dynamic characteristics

**Table 9. Dynamic characteristics for 74HC4053-Q100**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 15](#).

$V_{is}$  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>									
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>	[1]						
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	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			
$t_{on}$	turn-on time	$\bar{E}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 14</a>	[2]						
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	60	220	ns			
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	20	44	ns			
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	17	-	ns			
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	16	37	ns			
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	15	31	ns			
		Sn to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 14</a>	[2]						
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	75	220	ns			
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	25	44	ns			
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	21	-	ns			
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	20	37	ns			
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	15	31	ns			
		$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]				
				$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	63	210	ns	
				$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	21	42	ns	
$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-			18	-	ns			
$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			17	36	ns			
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-			15	29	ns			
Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]								
$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			60	210	ns			
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			20	42	ns			
$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-			17	-	ns			
$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			16	36	ns			
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-			15	29	ns			
$C_{PD}$	power dissipation capacitance			per switch; $V_I = GND$ to $V_{CC}$	[4]	-	36	-	pF

**Table 9. Dynamic characteristics for 74HC4053-Q100 ...continued**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 15](#).

$V_{is}$  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} = -40\text{ °C to }+85\text{ °C}</math></b>								
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>	[1]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	75	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	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	$\bar{E}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 14</a>	[2]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	275	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	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 <a href="#">Figure 14</a>	[2]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	275	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	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		
		$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]			
				$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	265	ns
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	53	ns		
$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	45	ns		
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-			-	36	ns		
Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]							
$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	265	ns		
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	53	ns		
$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	45	ns		
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-			-	36	ns		
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>								
$t_{pd}$	propagation delay			$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>	[1]			
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	90	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	18	ns		
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	15	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	12	ns		

**Table 9. Dynamic characteristics for 74HC4053-Q100 ...continued**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 15](#).

$V_{is}$  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		
$t_{on}$	turn-on time	$\bar{E}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 14</a>	[2]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	330	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	66	ns		
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	56	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	47	ns		
		Sn to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 14</a>	[2]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	330	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	66	ns		
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	56	ns		
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	47	ns		
		$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]			
				$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	315	ns
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	63	ns		
$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	54	ns		
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-			-	44	ns		
Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]							
$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	315	ns		
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	63	ns		
$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-			-	54	ns		
$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-			-	44	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]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$N$  = number of inputs switching;

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

$C_L$  = output load capacitance in pF;

$C_{sw}$  = switch capacitance in pF;

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



**Table 10. Dynamic characteristics for 74HCT4053-Q100**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 15](#).

$V_{is}$  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>							
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>	[1]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	5	12	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	4	8	ns	
$t_{on}$	turn-on time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	27	48	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	23	-	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	34	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	25	48	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	21	-	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	34	ns	
$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[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 <a href="#">Figure 14</a>	[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; $V_I = GND$ to $V_{CC} - 1.5\text{ V}$	[4]	-	36	-	pF
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>							
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>	[1]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	15	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	10	ns	
$t_{on}$	turn-on time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	60	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	43	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	60	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	43	ns	
$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	55	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	39	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	55	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	39	ns	

**Table 10. Dynamic characteristics for 74HCT4053-Q100 ...continued**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 15](#).

$V_{is}$  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} = -40\text{ °C to }+125\text{ °C}</math></b>							
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>	[1]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	18	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	12	ns	
$t_{on}$	turn-on time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	72	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	51	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	72	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	51	ns	
$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	66	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	47	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>	[3]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	66	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	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]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

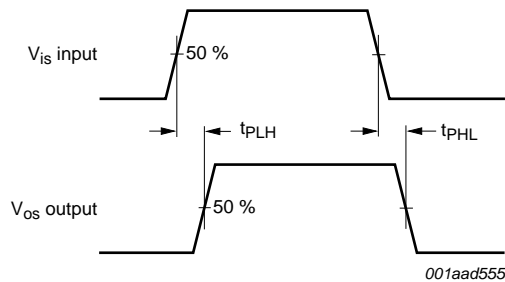
N = number of inputs switching;

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

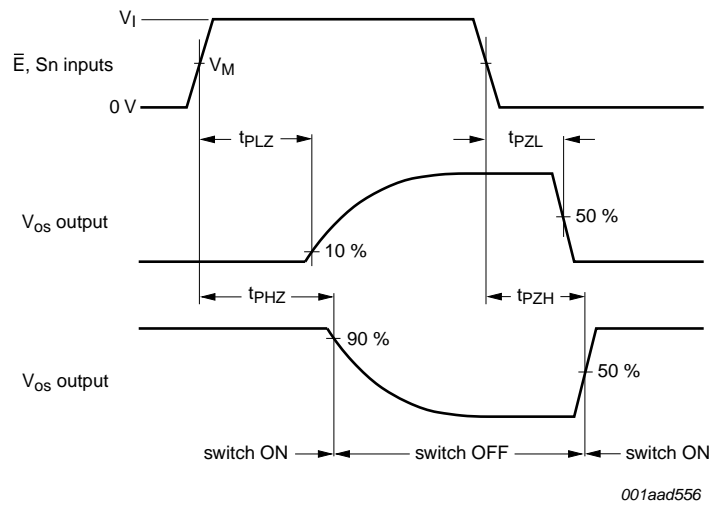
$C_L$  = output load capacitance in pF;

$C_{sw}$  = switch capacitance in pF;

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



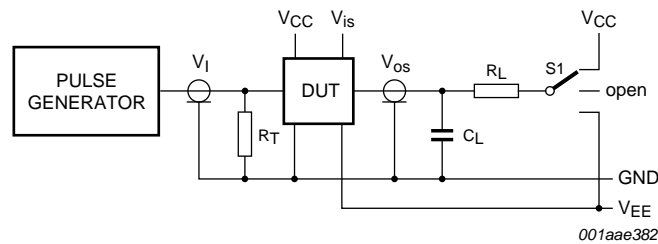
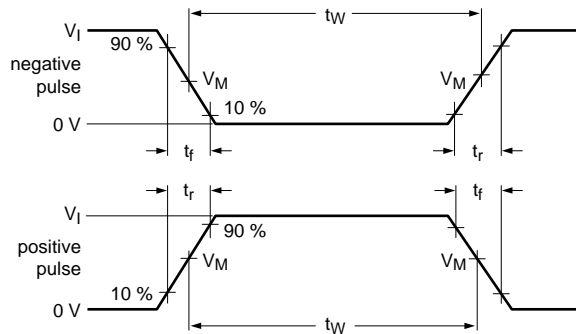
**Fig 13. Input ( $V_{is}$ ) to output ( $V_{os}$ ) propagation delays**



For 74HC4053-Q100:  $V_M = 0.5 \times V_{CC}$ .

For 74HCT4053-Q100:  $V_M = 1.3 \text{ V}$ .

**Fig 14. Turn-on and turn-off times**



Definitions for test circuit; see [Table 11](#):

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

$C_L$  = load capacitance including jig and probe capacitance.

$R_L$  = load resistance.

S1 = Test selection switch.

**Fig 15. Test circuit for measuring switching times**

**Table 11. Test data**

Test	Input				Load		S1 position
	V <sub>I</sub>	V <sub>is</sub>	t <sub>r</sub> , t <sub>f</sub>		C <sub>L</sub>	R <sub>L</sub>	
			at f <sub>max</sub>	other <sup>[1]</sup>			
t <sub>PHL</sub> , t <sub>PLH</sub>	[2]	pulse	< 2 ns	6 ns	50 pF	1 kΩ	open
t <sub>PZH</sub> , t <sub>PHZ</sub>	[2]	V <sub>CC</sub>	< 2 ns	6 ns	50 pF	1 kΩ	V <sub>EE</sub>
t <sub>PZL</sub> , t <sub>PLZ</sub>	[2]	V <sub>EE</sub>	< 2 ns	6 ns	50 pF	1 kΩ	V <sub>CC</sub>

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

[2] V<sub>I</sub> values:

- a) For 74HC4053-Q100: V<sub>I</sub> = V<sub>CC</sub>
- b) For 74HCT4053-Q100: V<sub>I</sub> = 3 V

## 11.1 Additional dynamic characteristics

**Table 12. Additional dynamic characteristics**

Recommended conditions and typical values; GND = 0 V; T<sub>amb</sub> = 25 °C; C<sub>L</sub> = 50 pF.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
d <sub>sin</sub>	sine-wave distortion	f <sub>i</sub> = 1 kHz; R <sub>L</sub> = 10 kΩ; see <a href="#">Figure 16</a>					
		V <sub>is</sub> = 4.0 V (p-p); V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V	-	0.04	-	%	
		V <sub>is</sub> = 8.0 V (p-p); V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	0.02	-	%	
		f <sub>i</sub> = 10 kHz; R <sub>L</sub> = 10 kΩ; see <a href="#">Figure 16</a>					
		V <sub>is</sub> = 4.0 V (p-p); V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V	-	0.12	-	%	
		V <sub>is</sub> = 8.0 V (p-p); V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	0.06	-	%	
α <sub>iso</sub>	isolation (OFF-state)	R <sub>L</sub> = 600 Ω; f <sub>i</sub> = 1 MHz; see <a href="#">Figure 17</a>					
		V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V	[1]	-	-50	-	dB
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	[1]	-	-50	-	dB
Xtalk	crosstalk	between two switches/multiplexers; R <sub>L</sub> = 600 Ω; f <sub>i</sub> = 1 MHz; see <a href="#">Figure 18</a>					
		V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V	[1]	-	-60	-	dB
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	[1]	-	-60	-	dB
V <sub>ct</sub>	crosstalk voltage	peak-to-peak value between control and any switch. R <sub>L</sub> = 600 Ω; f <sub>i</sub> = 1 MHz; $\bar{E}$ or Sn square wave between V <sub>CC</sub> and GND; t <sub>r</sub> = t <sub>f</sub> = 6 ns; see <a href="#">Figure 19</a>					
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	110	-	mV	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	220	-	mV	
f <sub>(-3dB)</sub>	-3 dB frequency response	R <sub>L</sub> = 50 Ω; see <a href="#">Figure 20</a>					
		V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V	[2]	-	160	-	MHz
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	[2]	-	170	-	MHz

[1] Adjust input voltage V<sub>is</sub> to 0 dBm level (0 dBm = 1 mW into 600 Ω).

[2] Adjust input voltage V<sub>is</sub> to 0 dBm level at V<sub>os</sub> for 1 MHz (0 dBm = 1 mW into 50 Ω).

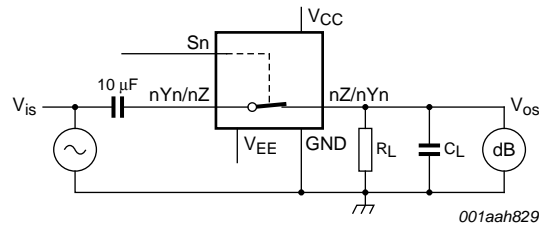
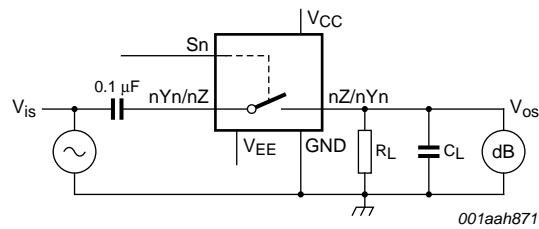
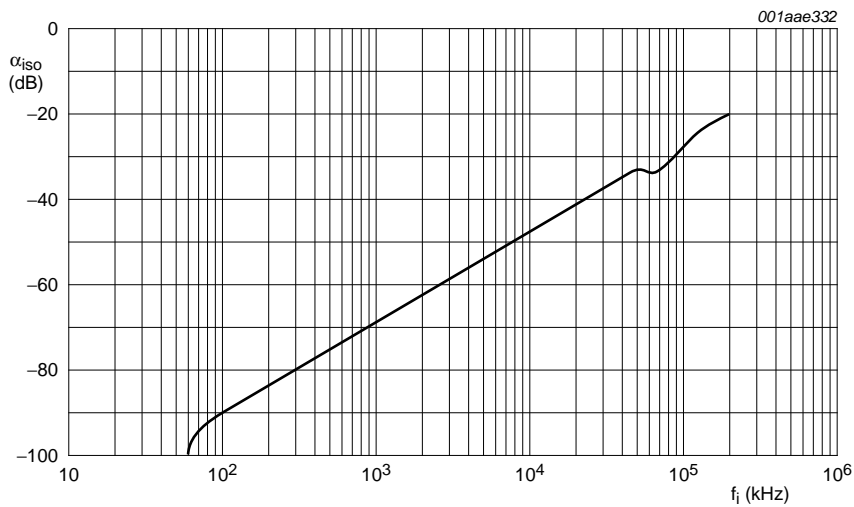


Fig 16. Test circuit for measuring sine-wave distortion



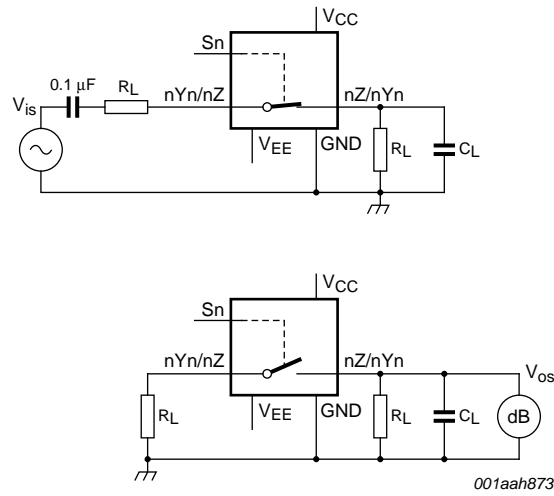
$V_{CC} = 4.5\text{ V}$ ;  $GND = 0\text{ V}$ ;  $V_{EE} = -4.5\text{ V}$ ;  $R_L = 600\ \Omega$ ;  $R_S = 1\text{ k}\Omega$ .

a. Test circuit

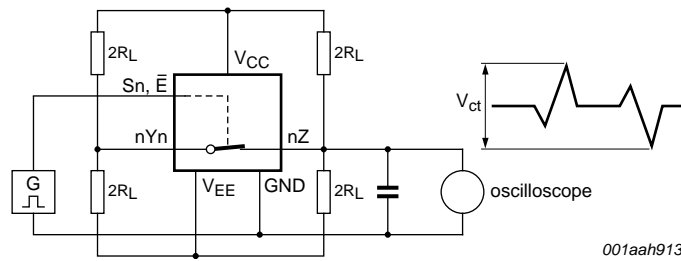


b. Isolation (OFF-state) as a function of frequency

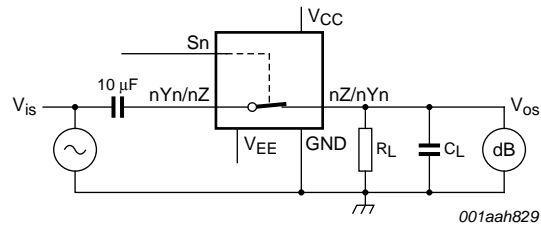
Fig 17. Test circuit for measuring isolation (OFF-state)



**Fig 18. Test circuits for measuring crosstalk between any two switches/multiplexers**

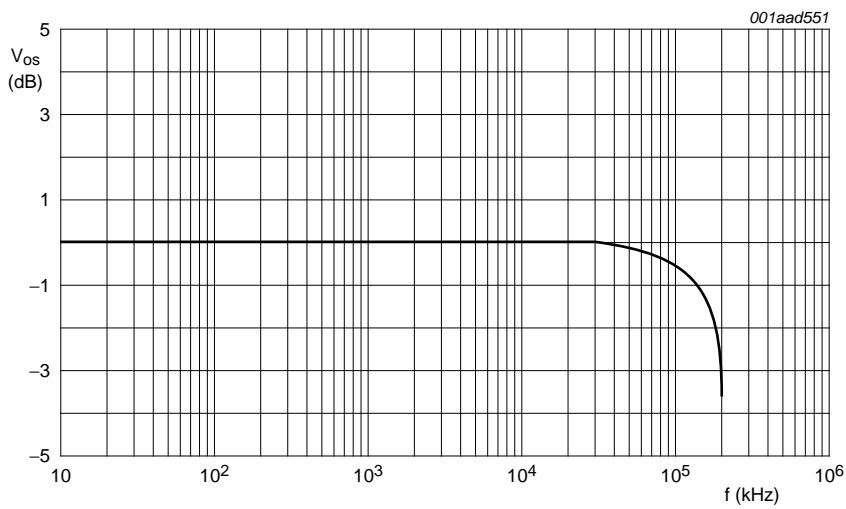


**Fig 19. Test circuit for measuring crosstalk between control input and any switch**



$V_{CC} = 4.5\text{ V}$ ;  $GND = 0\text{ V}$ ;  $V_{EE} = -4.5\text{ V}$ ;  $R_L = 50\ \Omega$ ;  $R_S = 1\text{ k}\Omega$ .

a. Test circuit



b. Typical frequency response

**Fig 20. Test circuit for frequency response**

## 12. Package outline

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

SOT109-1

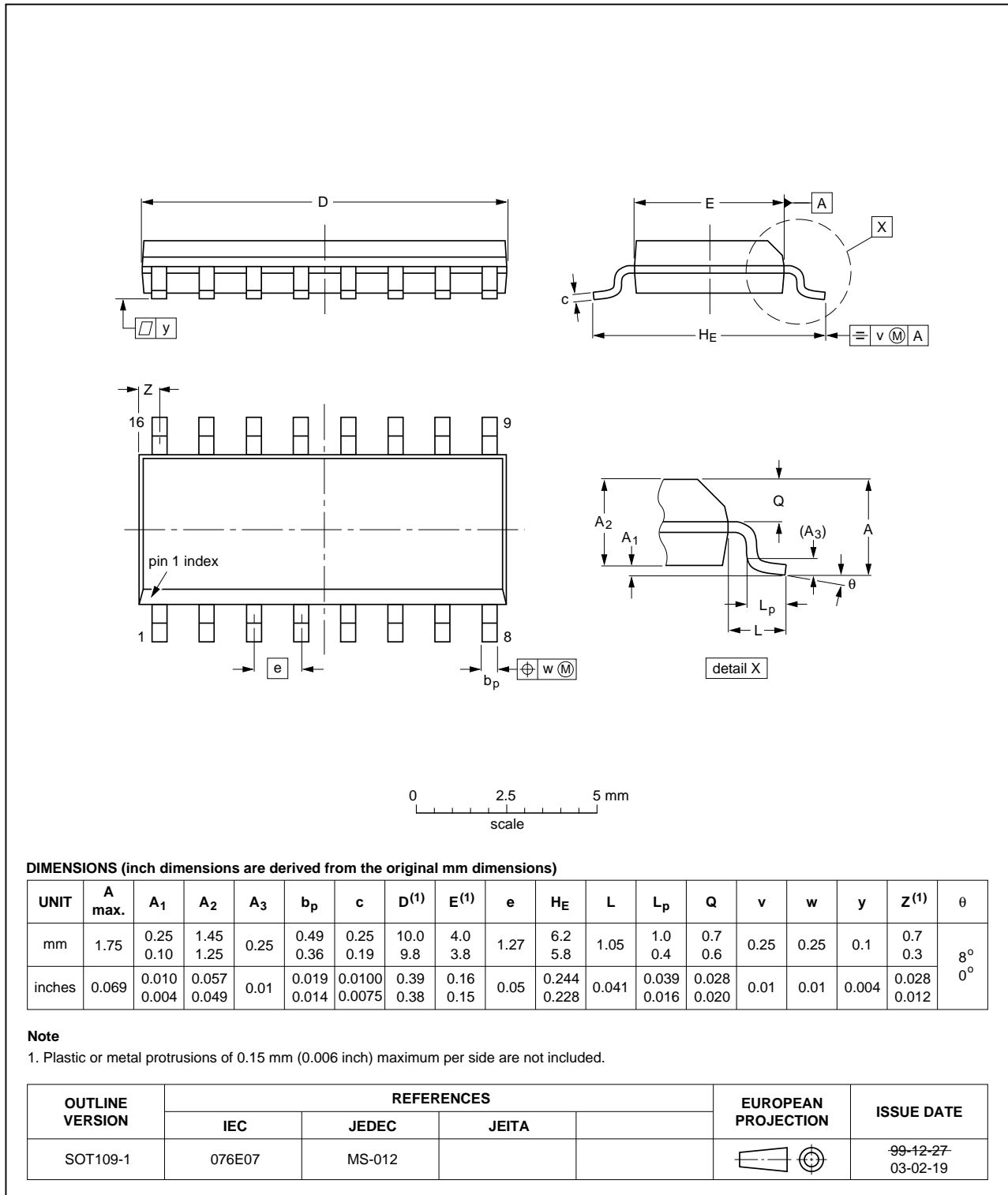


Fig 21. Package outline SOT109-1 (SO16)



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

SOT403-1

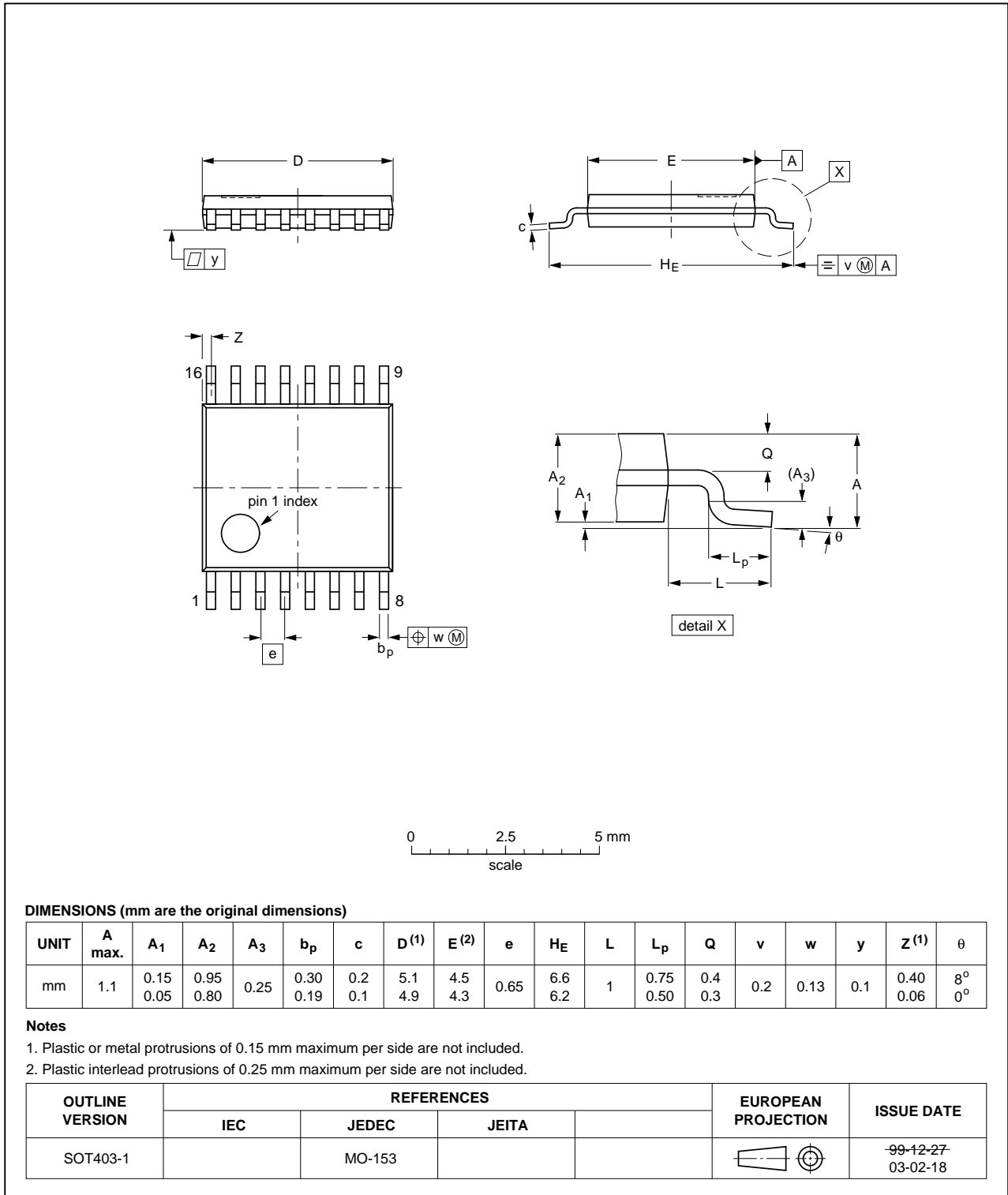


Fig 22. Package outline SOT403-1 (TSSOP16)

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

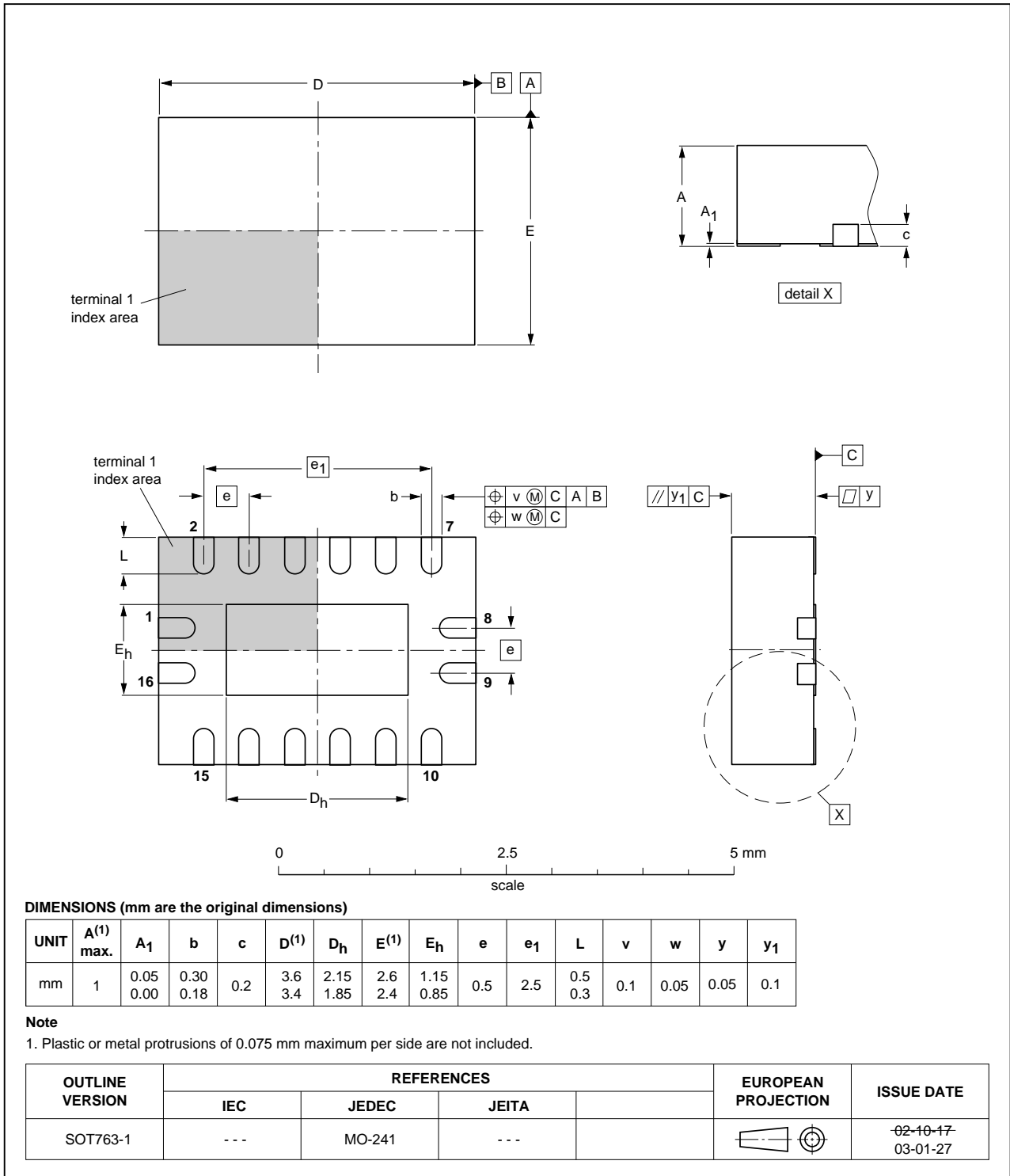


Fig 23. Package outline SOT763-1 (DHVQFN16)

## 13. Abbreviations

**Table 13. Abbreviations**

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
MIL	Military

## 14. Revision history

**Table 14. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4053_Q100 v.2	20121122	Product data sheet	-	74HC_HCT4053_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>• CDM added to features.</li> </ul>			
74HC_HCT4053_Q100 v.1	20120720	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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