

# 74HC4051; 74HCT4051

## 8-channel analog multiplexer/demultiplexer

Rev. 11 — 5 December 2022

Product data sheet

### 1. General description

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The 74HC4051; 74HCT4051 is a single-pole octal-throw analog switch (SP8T) suitable for use in analog or digital 8:1 multiplexer/demultiplexer applications. The switch features three digital select inputs (S0, S1 and S2), eight independent inputs/outputs (Yn), a common input/output (Z) and a digital enable input (E). When  $\bar{E}$  is HIGH, the switches are turned off. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### 2. Features and benefits

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- Wide analog input voltage range from -5 V to +5 V
- CMOS low power dissipation
- High noise immunity
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- 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
- ESD protection:
  - HBM: ANSI/ESDA/Jedec JS-001 Class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/Jedec JS-002 Class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

### 3. Applications

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

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
<a href="#">74HC4051D</a> <a href="#">74HCT4051D</a>	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	<a href="#">SOT109-1</a>
<a href="#">74HC4051PW</a> <a href="#">74HCT4051PW</a>	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	<a href="#">SOT403-1</a>
<a href="#">74HC4051BQ</a> <a href="#">74HCT4051BQ</a>	-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	<a href="#">SOT763-1</a>
<a href="#">74HC4051BZ</a> <a href="#">74HCT4051BZ</a>	-40 °C to +125 °C	DHXQFN16	plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package; no leads; 16 terminals; 0.4 mm pitch; body 2 mm × 2.4 mm × 0.48 mm	<a href="#">SOT8016-1</a>

### 5. Functional diagram

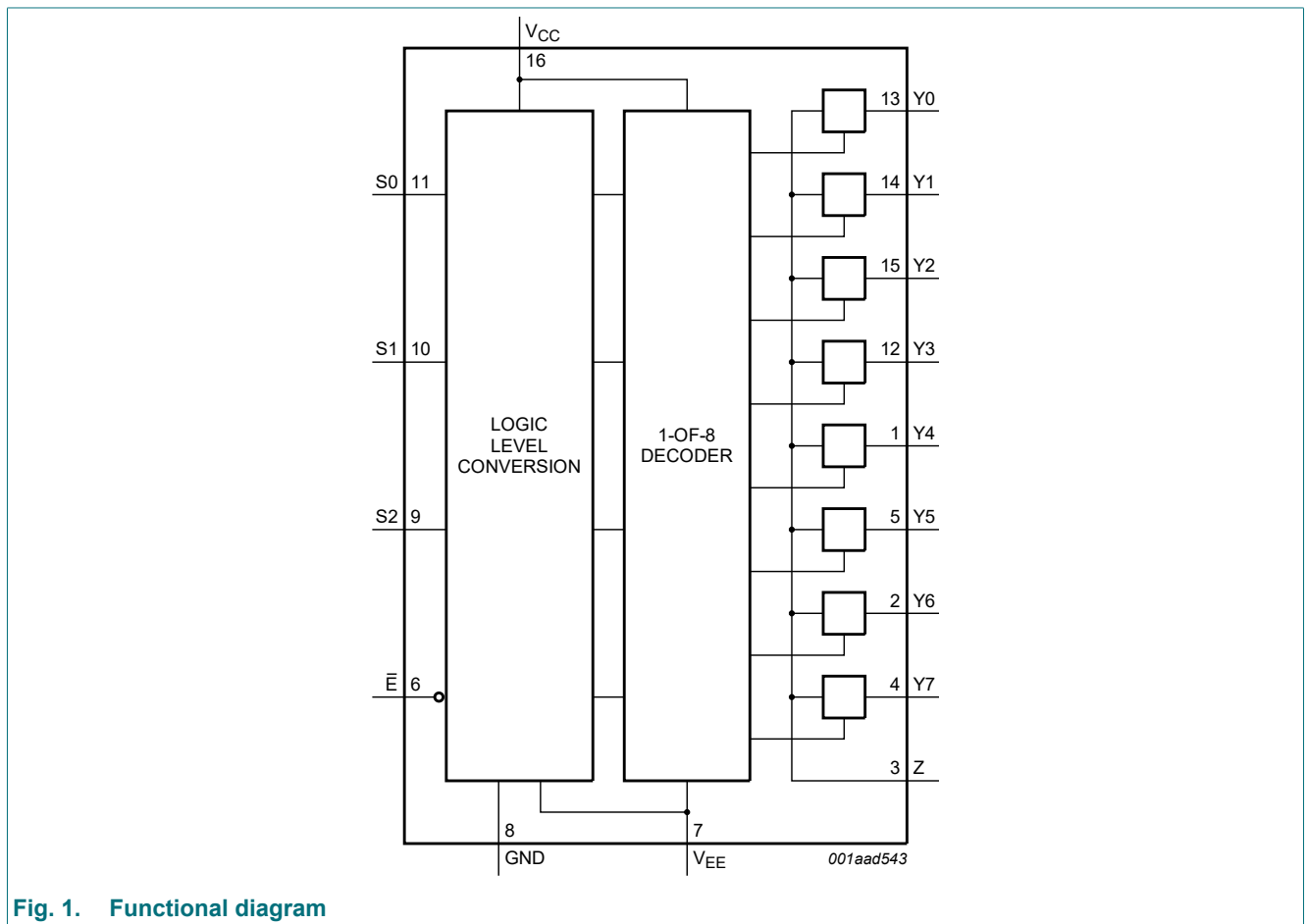


Fig. 1. Functional diagram

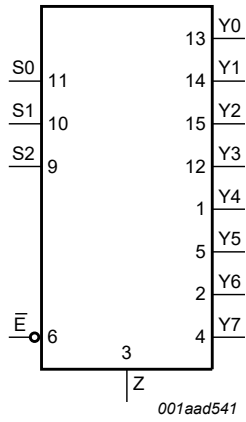


Fig. 2. Logic symbol

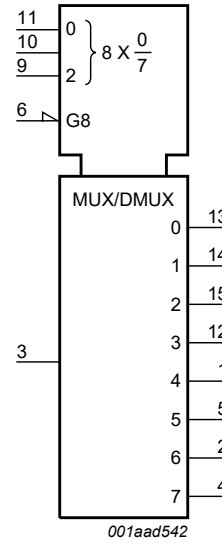


Fig. 3. IEC logic symbol

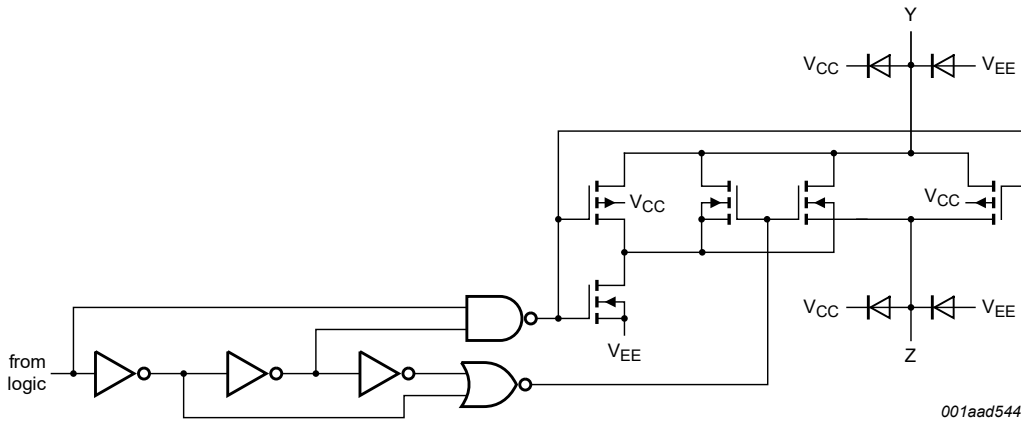
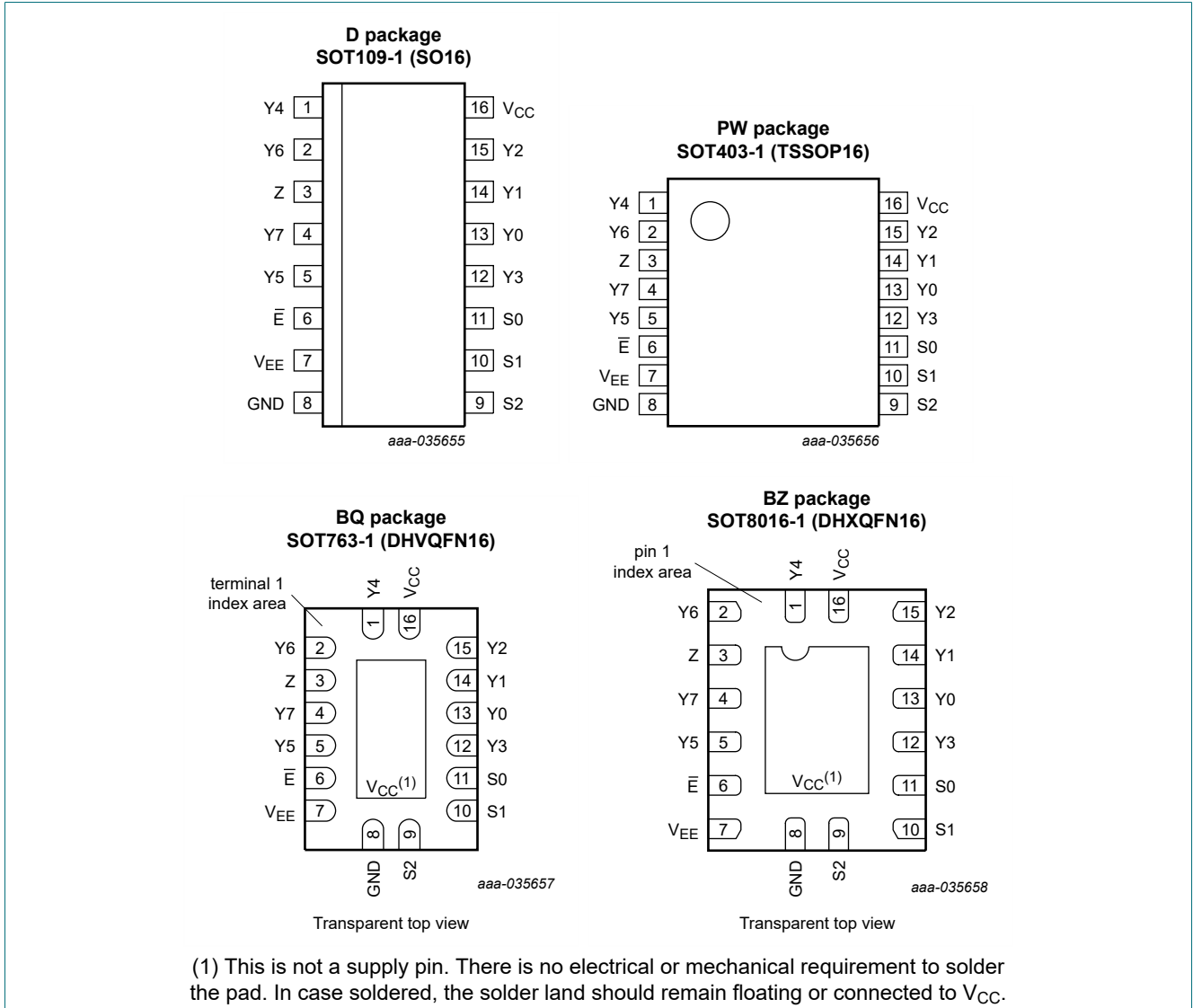


Fig. 4. Schematic diagram (one switch)

## 6. Pinning information

### 6.1. Pinning



### 6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$\bar{E}$	6	enable input (active LOW)
V <sub>EE</sub>	7	supply voltage
GND	8	ground supply voltage
S0, S1, S2	11, 10, 9	select input
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7	13, 14, 15, 12, 1, 5, 2, 4	independent input or output
Z	3	common output or input
V <sub>CC</sub>	16	supply voltage

## 7. Function description

**Table 3. Function table**

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

Input				Channel ON
E	S2	S1	S0	
L	L	L	L	Y0 to Z
L	L	L	H	Y1 to Z
L	L	H	L	Y2 to Z
L	L	H	H	Y3 to Z
L	H	L	L	Y4 to Z
L	H	L	H	Y5 to Z
L	H	H	L	Y6 to Z
L	H	H	H	Y7 to Z
H	X	X	X	switches off

## 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	power dissipation	per switch	-	100	mW
$P_{tot}$	total power dissipation	SOT109-1 (SO16) [2]	-	500	mW
		SOT403-1 (TSSOP16) [3]			
		SOT763-1 (DHVQFN16) [4]			
		SOT8016-1 (DHXQFN16)			

- [1] To avoid drawing  $V_{CC}$  current out of terminal Z, when switch current flows into terminals Yn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no  $V_{CC}$  current will flow out of terminals Yn, and in this case there is no limit for the voltage drop across the switch, but the voltages at Yn and Z may not exceed  $V_{CC}$  or  $V_{EE}$ .
- [2] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.
- [3] For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.
- [4] For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

## 9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	74HC4051			74HCT4051			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage	see Fig. 5 and Fig. 6							
		V <sub>CC</sub> - GND	2.0	5.0	10.0	4.5	5.0	5.5	V
		V <sub>CC</sub> - V <sub>EE</sub>	2.0	5.0	10.0	2.0	5.0	10.0	V
V <sub>I</sub>	input voltage		GND	-	V <sub>CC</sub>	GND	-	V <sub>CC</sub>	V
V <sub>SW</sub>	switch voltage		V <sub>EE</sub>	-	V <sub>CC</sub>	V <sub>EE</sub>	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V
		V <sub>CC</sub> = 10.0 V	-	-	31	-	-	-	ns/V

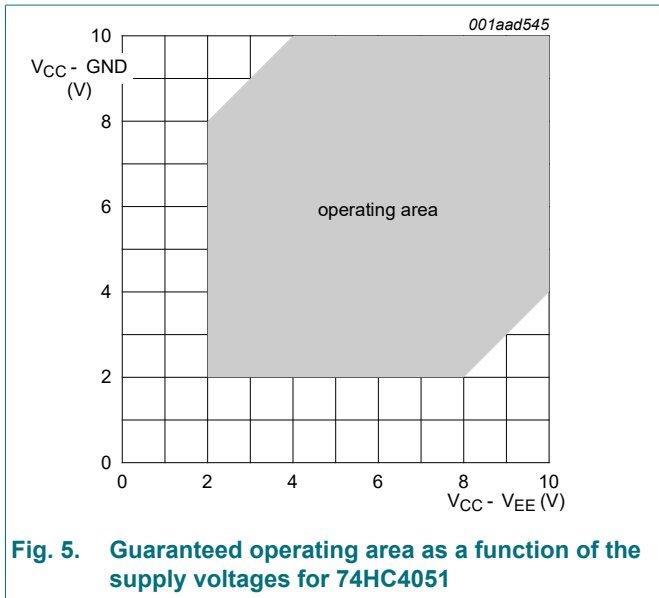


Fig. 5. Guaranteed operating area as a function of the supply voltages for 74HC4051

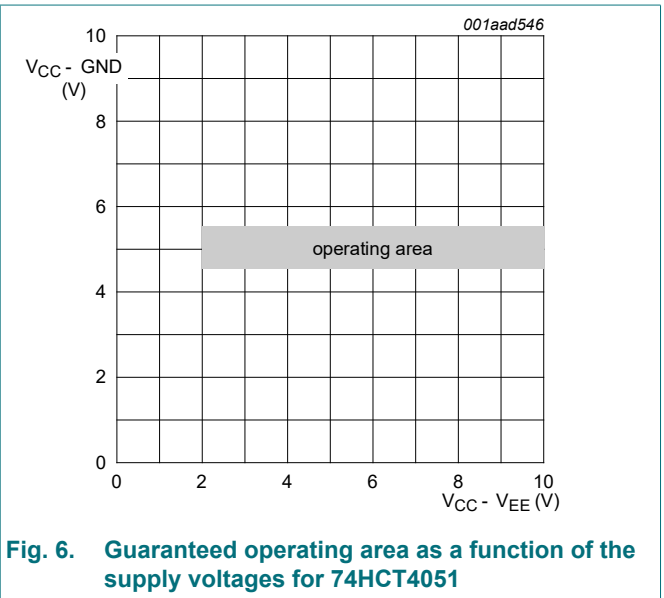


Fig. 6. Guaranteed operating area as a function of the supply voltages for 74HCT4051

## 10. Static characteristics

**Table 6.  $R_{ON}$  resistance per switch for 74HC4051 and 74HCT4051**

$V_I = V_{IH}$  or  $V_{IL}$ ; for test circuit see Fig. 7.

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

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

For 74HC4051:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

For 74HCT4051:  $V_{CC} - GND = 4.5\text{ V}$  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{ °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	-	$\Omega$	

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<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>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA [1]	-	-	-	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	225	Ω	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	200	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA	-	-	165	Ω	
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>is</sub> = V <sub>EE</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA [1]	-	-	-	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	175	Ω	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	150	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA	-	-	130	Ω	
		V <sub>is</sub> = V <sub>CC</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA [1]	-	-	-	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	200	Ω	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	175	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</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>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA [1]	-	-	-	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	270	Ω	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	240	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA	-	-	195	Ω	
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>is</sub> = V <sub>EE</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA [1]	-	-	-	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	210	Ω	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	180	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA	-	-	160	Ω	
		V <sub>is</sub> = V <sub>CC</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA [1]	-	-	-	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	240	Ω	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA	-	-	210	Ω	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA	-	-	180	Ω	

[1] When supply voltages (V<sub>CC</sub> - V<sub>EE</sub>) near 2.0 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 2 V, it is recommended to use these devices only for transmitting digital signals.



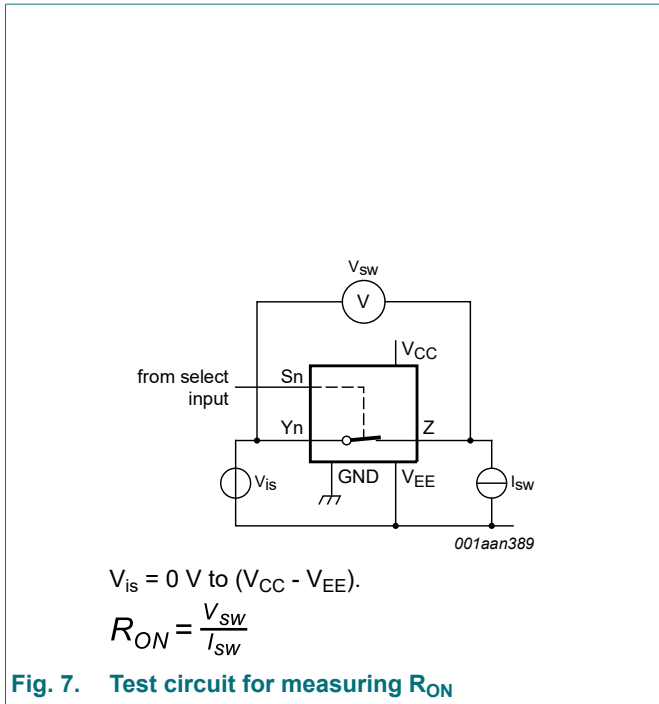


Fig. 7. Test circuit for measuring  $R_{ON}$

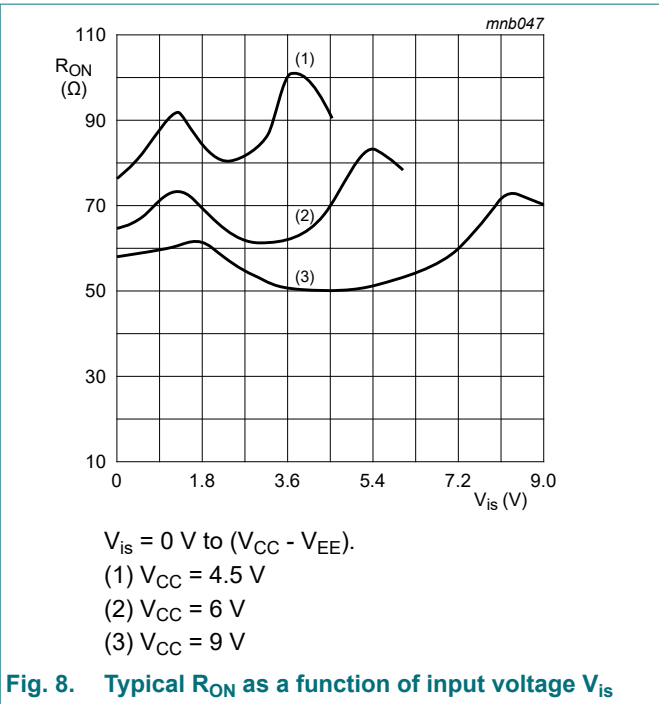


Fig. 8. Typical  $R_{ON}$  as a function of input voltage  $V_{is}$

Table 7. Static characteristics for 74HC4051

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

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

$V_{os}$  is the output voltage at pins  $Z$  or  $Y_n$ , 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 Fig. 9				
		per channel	-	-	$\pm 0.1$	$\mu\text{A}$
		all channels	-	-	$\pm 0.4$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL};  V_{SW}  = V_{CC} - V_{EE};$ see Fig. 10	-	-	$\pm 0.4$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{EE} = 0 \text{ V}; V_I = V_{CC} \text{ or GND}; V_{is} = V_{EE} \text{ or } V_{CC}; V_{os} = V_{CC} \text{ or } V_{EE}$				
		$V_{CC} = 6.0 \text{ V}$	-	-	8.0	$\mu\text{A}$
		$V_{CC} = 10.0 \text{ V}$	-	-	16.0	$\mu\text{A}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_I$	input capacitance		-	3.5	-	pF
$C_{SW}$	switch capacitance	independent pins Yn	-	5	-	pF
		common pins Z	-	25	-	pF
<b><math>T_{amb} = -40\text{ °C to }+85\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	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{IH}\text{ or }V_{IL};  V_{SW}  = V_{CC} - V_{EE};$ see Fig. 9				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 4.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{IH}\text{ or }V_{IL};  V_{SW}  = V_{CC} - V_{EE};$ see Fig. 10	-	-	$\pm 4.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}; V_{is} = V_{EE}\text{ or }V_{CC}; V_{os} = V_{CC}\text{ or }V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	80.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	160.0	$\mu\text{A}$
<b><math>T_{amb} = -40\text{ °C to }+125\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

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 Fig. 9				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 4.0$	$\mu\text{A}$
$I_{S(ON)}$	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 Fig. 10	-	-	$\pm 4.0$	$\mu\text{A}$
$I_{CC}$	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 74HCT4051

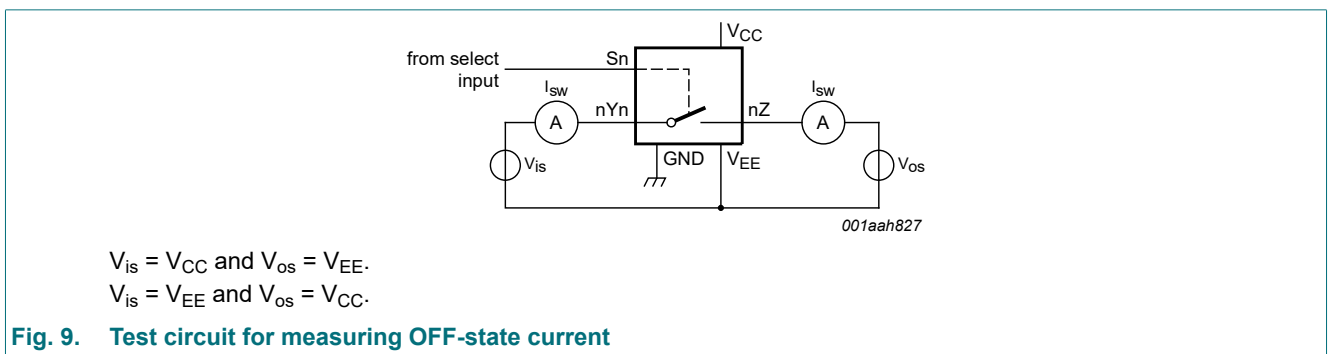
Voltages are referenced to GND (ground = 0 V).

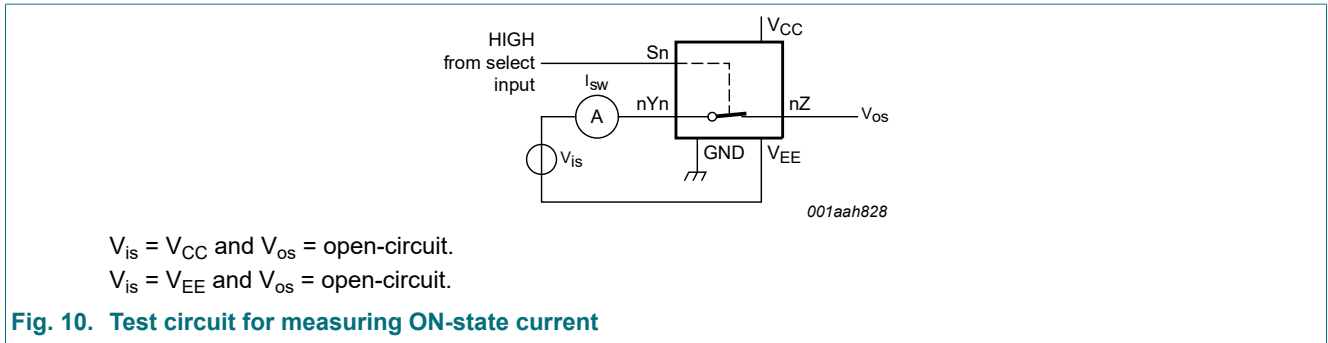
$V_{is}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.

$V_{os}$  is the output voltage at pins Z or Yn, 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 Fig. 9				
		per channel	-	-	$\pm 0.1$	$\mu\text{A}$
		all channels	-	-	$\pm 0.4$	$\mu\text{A}$
$I_{S(ON)}$	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 Fig. 10	-	-	$\pm 0.4$	$\mu\text{A}$
$I_{CC}$	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 Yn	-	5	-	pF
		common pins Z	-	25	-	pF

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V; V <sub>EE</sub> = 0 V	-	-	±1.0	µA
I <sub>S(OFF)</sub>	OFF-state leakage current	V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> - V <sub>EE</sub> ; see Fig. 9				
		per channel	-	-	±1.0	µA
		all channels	-	-	±4.0	µA
I <sub>S(ON)</sub>	ON-state leakage current	V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> - V <sub>EE</sub> ; see Fig. 10	-	-	±4.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>is</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>os</sub> = V <sub>CC</sub> or V <sub>EE</sub>				
		V <sub>CC</sub> = 5.5 V; V <sub>EE</sub> = 0 V	-	-	80.0	µA
		V <sub>CC</sub> = 5.0 V; V <sub>EE</sub> = -5.0 V	-	-	160.0	µA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>EE</sub> = 0 V	-	-	225	µA
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V; V <sub>EE</sub> = 0 V	-	-	±1.0	µA
I <sub>S(OFF)</sub>	OFF-state leakage current	V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> - V <sub>EE</sub> ; see Fig. 9				
		per channel	-	-	±1.0	µA
		all channels	-	-	±4.0	µA
I <sub>S(ON)</sub>	ON-state leakage current	V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> - V <sub>EE</sub> ; see Fig. 10	-	-	±4.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>is</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>os</sub> = V <sub>CC</sub> or V <sub>EE</sub>				
		V <sub>CC</sub> = 5.5 V; V <sub>EE</sub> = 0 V	-	-	160.0	µA
		V <sub>CC</sub> = 5.0 V; V <sub>EE</sub> = -5.0 V	-	-	320.0	µA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>EE</sub> = 0 V	-	-	245	µA





## 11. Dynamic characteristics

**Table 9. Dynamic characteristics for 74HC4051**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Fig. 13](#).

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>T<sub>amb</sub> = 25 °C</b>							
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Fig. 11</a> [1]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	14	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="#">Fig. 12</a> [2]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	72	345	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	29	69	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	22	-	ns	
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	21	59	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	18	51	ns	
		$S_n$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Fig. 12</a> [2]					
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	66	345	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	28	69	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	20	-	ns	
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	19	59	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	51	ns	

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t <sub>off</sub>	turn-off time	$\bar{E}$ to V <sub>OS</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	58	290	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	31	58	ns
		V <sub>CC</sub> = 5.0 V; V <sub>EE</sub> = 0 V; C <sub>L</sub> = 15 pF	-	18	-	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	17	49	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	18	42	ns
		Sn to V <sub>OS</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	61	290	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	25	58	ns
		V <sub>CC</sub> = 5.0 V; V <sub>EE</sub> = 0 V; C <sub>L</sub> = 15 pF	-	19	-	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	18	49	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	18	42	ns
C <sub>PD</sub>	power dissipation capacitance	per switch; V <sub>I</sub> = GND to V <sub>CC</sub> [4]	-	25	-	pF
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
t <sub>pd</sub>	propagation delay	V <sub>is</sub> to V <sub>OS</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 11 [1]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	75	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	15	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	13	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	10	ns
t <sub>on</sub>	turn-on time	$\bar{E}$ to V <sub>OS</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 12 [2]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	430	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	86	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	73	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	64	ns
		Sn to V <sub>OS</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 12 [2]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	430	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	86	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	73	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	64	ns
t <sub>off</sub>	turn-off time	$\bar{E}$ to V <sub>OS</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	365	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	73	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	62	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	53	ns
		Sn to V <sub>OS</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	365	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	73	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	62	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	53	ns

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>							
t <sub>pd</sub>	propagation delay	V <sub>is</sub> to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 11 [1]					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	90	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	18	ns	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	15	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	12	ns	
t <sub>on</sub>	turn-on time	$\bar{E}$ to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 12 [2]					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	520	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	104	ns	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	88	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	77	ns	
		Sn to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 12 [2]					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	520	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	104	ns	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	88	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	77	ns	
t <sub>off</sub>	turn-off time	$\bar{E}$ to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	435	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	87	ns	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	74	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	72	ns	
		Sn to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	435	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	87	ns	
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	74	ns	
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	72	ns	

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [2] t<sub>on</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [3] t<sub>off</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = 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<sub>L</sub> = output load capacitance in pF;  
 C<sub>sw</sub> = switch capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V.

Table 10. Dynamic characteristics for 74HCT4051

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see Fig. 13.

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

$V_{os}$  is the output voltage at a Yn or Z 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 Fig. 11 [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 Fig. 12 [2]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	26	55	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	22	-	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	39	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 12 [2]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	28	55	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	24	-	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	39	ns	
$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 12 [3]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	19	45	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	16	-	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	32	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 12 [3]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	23	45	ns	
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	20	-	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	16	32	ns	
$C_{PD}$	power dissipation capacitance	per switch; $V_I = GND$ to $V_{CC} - 1.5\text{ V}$ [4]	-	25	-	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 Fig. 11 [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 Fig. 12 [2]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	69	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	49	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 12 [2]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	69	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	49	ns	
$t_{off}$	turn-off time	$\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 12 [3]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	56	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	40	ns	
		Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 12 [3]					
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	56	ns	
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	40	ns	



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>pd</sub>	propagation delay	V <sub>is</sub> to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 11 [1]				
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	18	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	12	ns
t <sub>on</sub>	turn-on time	$\bar{E}$ to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [2]				
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	83	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	59	ns
		Sn to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [2]				
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	83	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	59	ns
t <sub>off</sub>	turn-off time	$\bar{E}$ to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]				
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	68	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	48	ns
		Sn to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 12 [3]				
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	68	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	48	ns

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [2] t<sub>on</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [3] t<sub>off</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = 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<sub>L</sub> = output load capacitance in pF;  
 C<sub>sw</sub> = switch capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V.

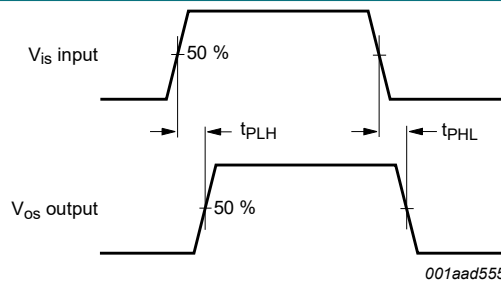
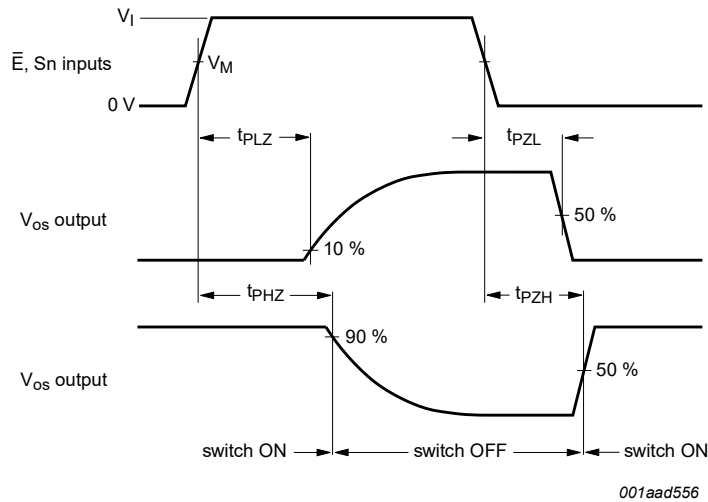
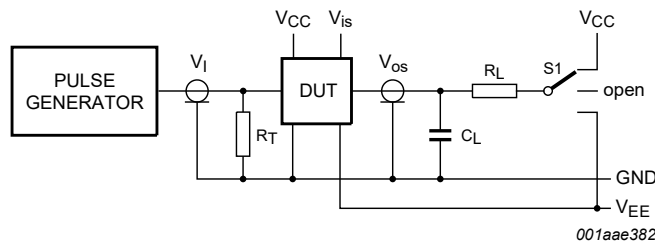
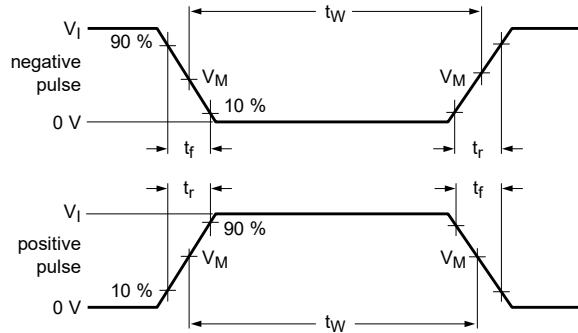


Fig. 11. Input (V<sub>is</sub>) to output (V<sub>os</sub>) propagation delays



For 74HC4051:  $V_M = 0.5 \times V_{CC}$ .  
 For 74HCT4051:  $V_M = 1.3 \text{ V}$ .

Fig. 12. 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. 13. Test circuit for measuring switching times

Table 11. Test data

Test	Input				Load		S1 position
	V <sub>I</sub> [1]	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 [2]			
t <sub>PHL</sub> , t <sub>PLH</sub>	V <sub>CC</sub>	pulse	< 2 ns	6 ns	50 pF	1 kΩ	open
t <sub>PZH</sub> , t <sub>PHZ</sub>	V <sub>CC</sub>	V <sub>CC</sub>	< 2 ns	6 ns	50 pF	1 kΩ	V <sub>EE</sub>
t <sub>PZL</sub> , t <sub>PLZ</sub>	V <sub>CC</sub>	V <sub>EE</sub>	< 2 ns	6 ns	50 pF	1 kΩ	V <sub>CC</sub>

[1] For 74HCT4051: V<sub>I</sub> = 3 V

[2] 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.

### 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 Fig. 14				
		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 Fig. 14				
		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 Fig. 15				
		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	-
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; E or Sn square wave between V <sub>CC</sub> and GND; t <sub>r</sub> = t <sub>f</sub> = 6 ns; see Fig. 16				
		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 Fig. 17				
		V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V	[2]	170	-	MHz
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	[2]	-	180	-

[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).

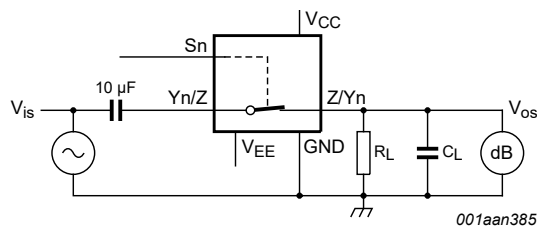
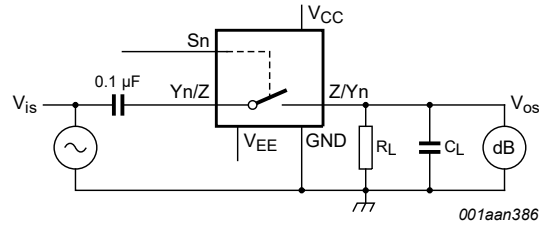
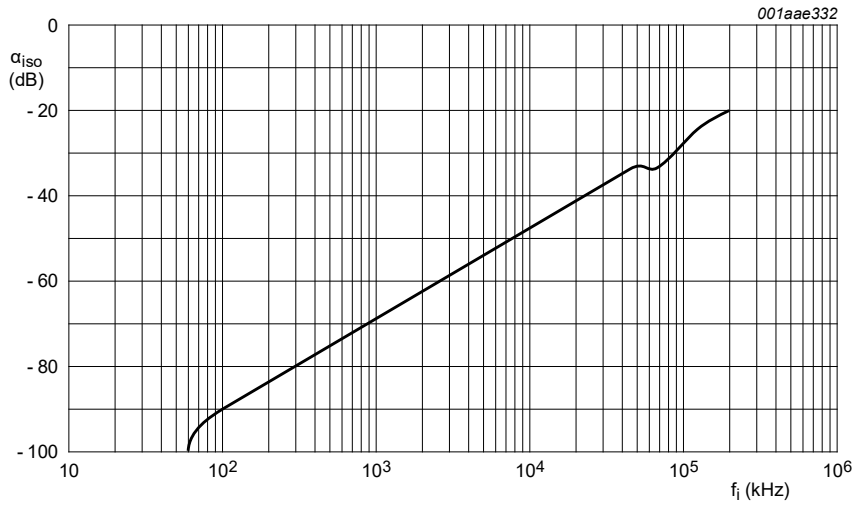


Fig. 14. Test circuit for measuring sine-wave distortion



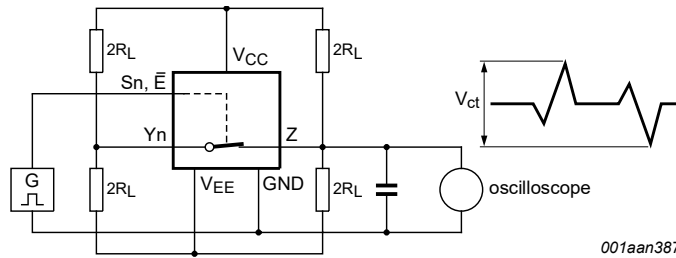
$V_{CC} = 4.5\text{ V}$ ;  $GND = 0\text{ V}$ ;  $V_{EE} = -4.5\text{ V}$ ;  $R_L = 600\ \Omega$ ;  $R_S = 1\text{ k}\Omega$ .

a. Test circuit

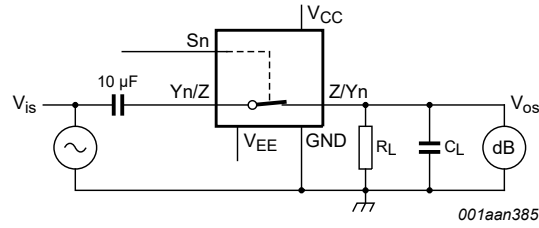


b. Isolation (OFF-state) as a function of frequency

**Fig. 15. Test circuit for measuring isolation (OFF-state)**

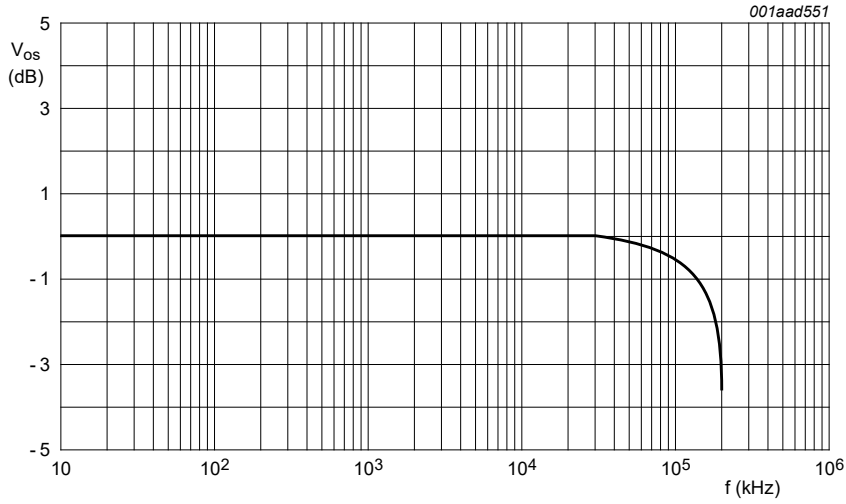


**Fig. 16. Test circuit for measuring crosstalk between control input and any switch**



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

a. Test circuit



b. Typical frequency response

**Fig. 17. Test circuit for frequency response**

12. Package outline

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

SOT109-1



Fig. 18. Package outline SOT109-1 (SO16)

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

SOT403-1

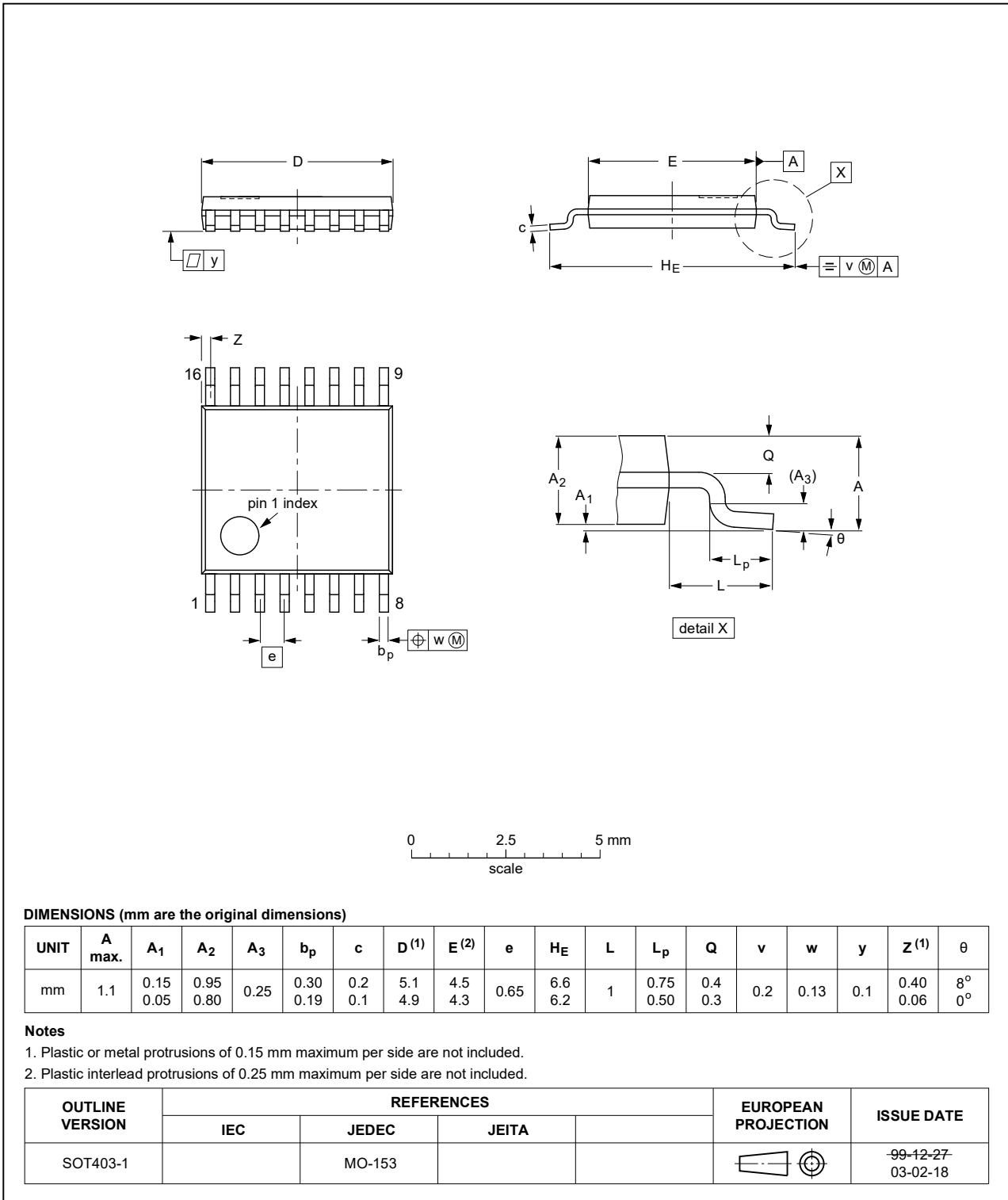


Fig. 19. Package outline SOT403-1 (TSSOP16)

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. 20. Package outline SOT763-1 (DHVQFN16)



DHXQFN16: plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package; no leads; 16 terminals; 0.4 mm pitch; body 2 mm x 2.4 mm x 0.48 mm

SOT8016-1

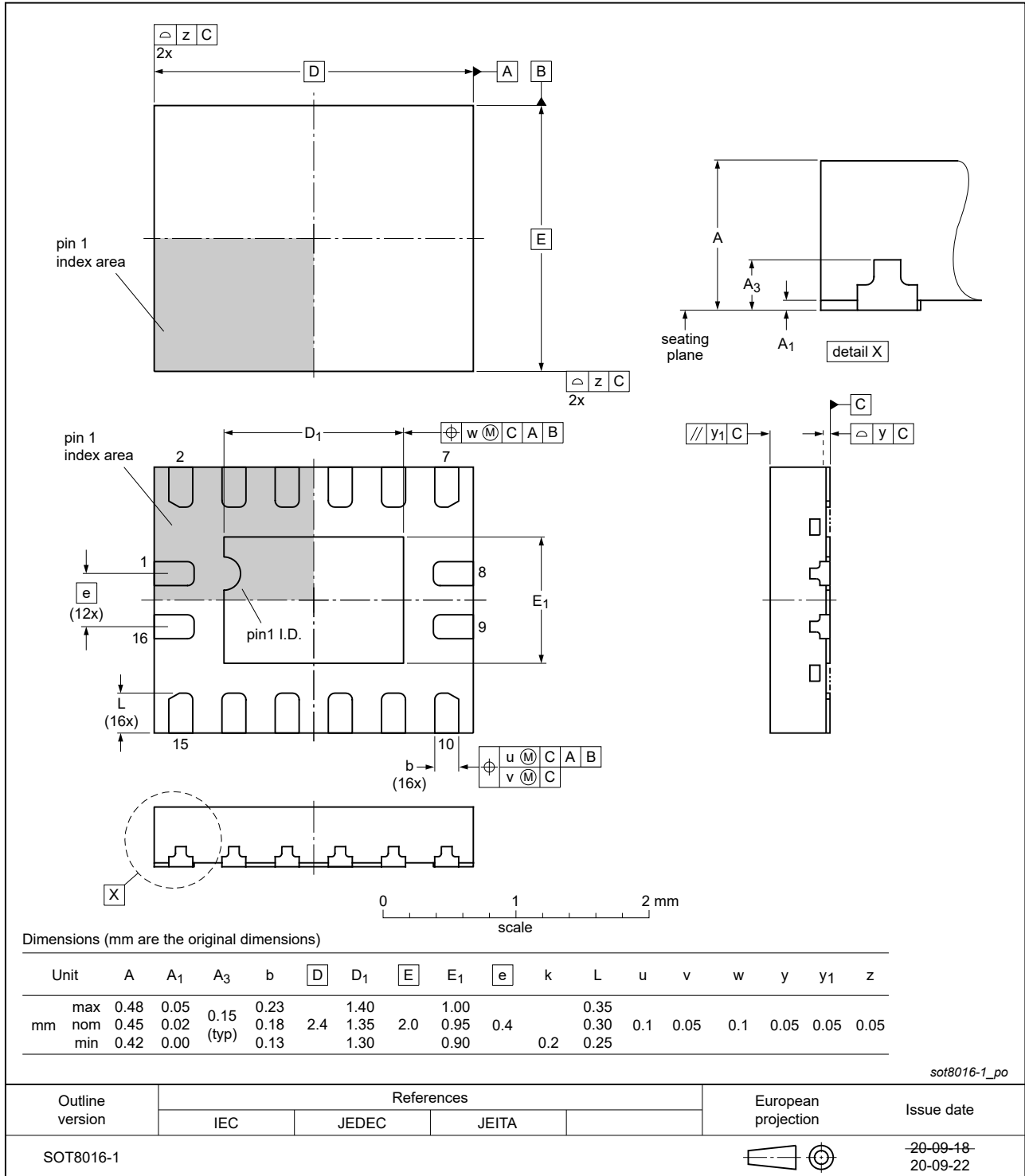


Fig. 21. Package outline SOT8016-1 (DHXQFN16)

## 13. Abbreviations

Table 13. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

## 14. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4051 v.11	20221205	Product data sheet	-	74HC_HCT4051 v.10
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74HC4051BZ and 74HCT4051BZ (SOT8016-1/DHXQFN16) added.</li> </ul>			
74HC_HCT4051 v.10	20210908	Product data sheet	-	74HC_HCT4051 v.9
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74HC4051DB and 74HCT4051DB (SOT338-1/SSOP16) removed.</li> <li><a href="#">Section 2</a> updated.</li> <li><a href="#">Section 8</a>: Derating values for <math>P_{tot}</math> total power dissipation have been updated.</li> </ul>			
74HC_HCT4051 v.9	20170926	Product data sheet	-	74HC_HCT4051 v.8
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74HC_HCT4051 v.8	20160205	Product data sheet	-	74HC_HCT4051 v.7
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74HC4051N and 74HCT4051N (SOT38-4) removed.</li> </ul>			
74HC_HCT4051 v.7	20120719	Product data sheet	-	74HC_HCT4051 v.6
Modifications:	<ul style="list-style-type: none"> <li>CDM added to features.</li> </ul>			
74HC_HCT4051 v.6	20111213	Product data sheet	-	74HC_HCT4051 v.5
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
74HC_HCT4051 v.5	20110513	Product data sheet	-	74HC_HCT4051 v.4
74HC_HCT4051 v.4	20110117	Product data sheet	-	74HC_HCT4051 v.3
74HC_HCT4051 v.3	20051219	Product specification	-	74HC_HCT4051_CNV_2

## 15. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	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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