

# 74HC4051; 74HCT4051

## 8-channel analog multiplexer/demultiplexer

Rev. 10 — 8 September 2021

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 JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101E 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	
74HC4051D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4051D				
74HC4051PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4051PW				
74HC4051BQ	-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
74HCT4051BQ				

### 5. Functional diagram

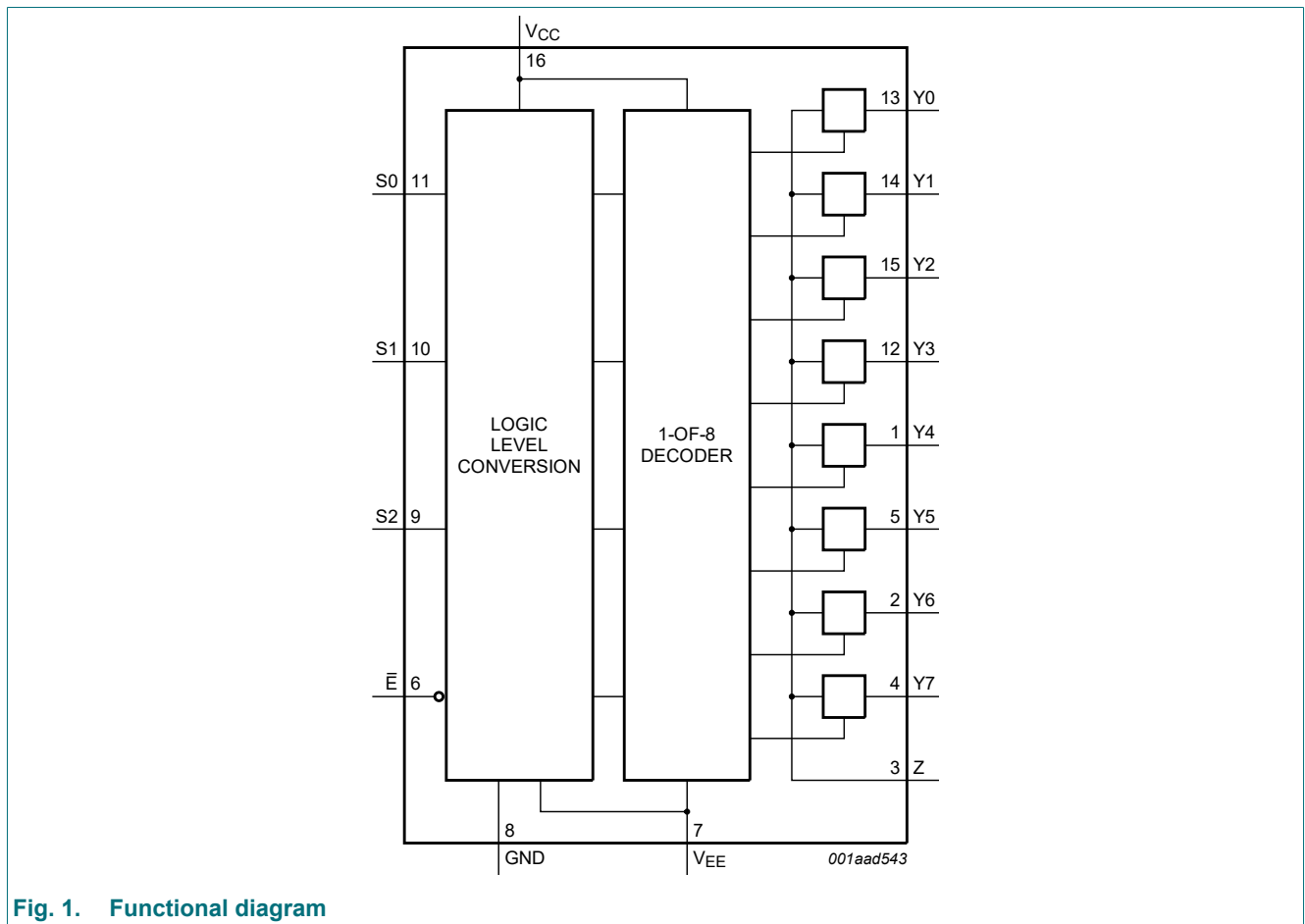


Fig. 1. Functional diagram

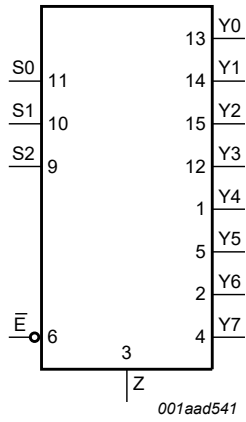


Fig. 2. Logic symbol

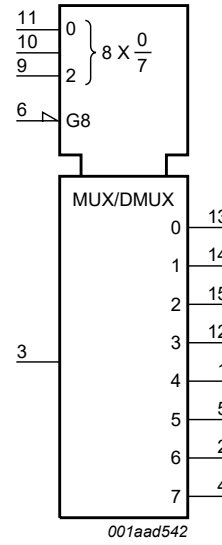


Fig. 3. IEC logic symbol

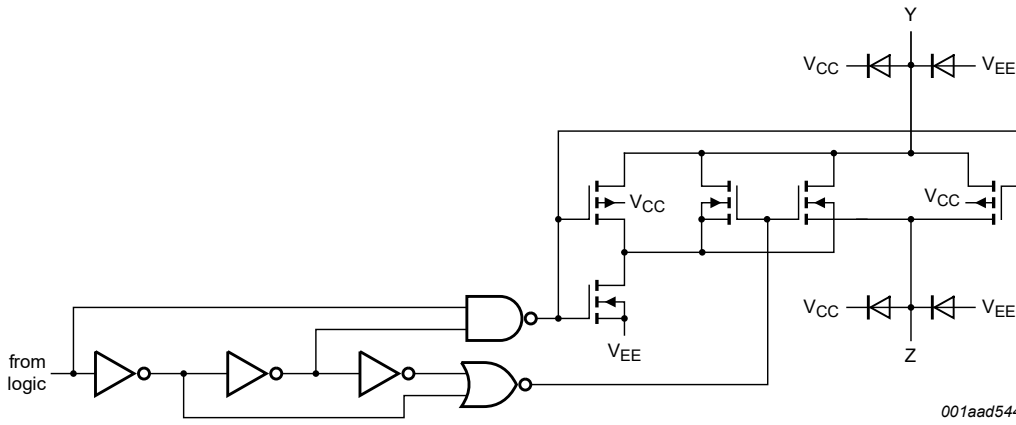
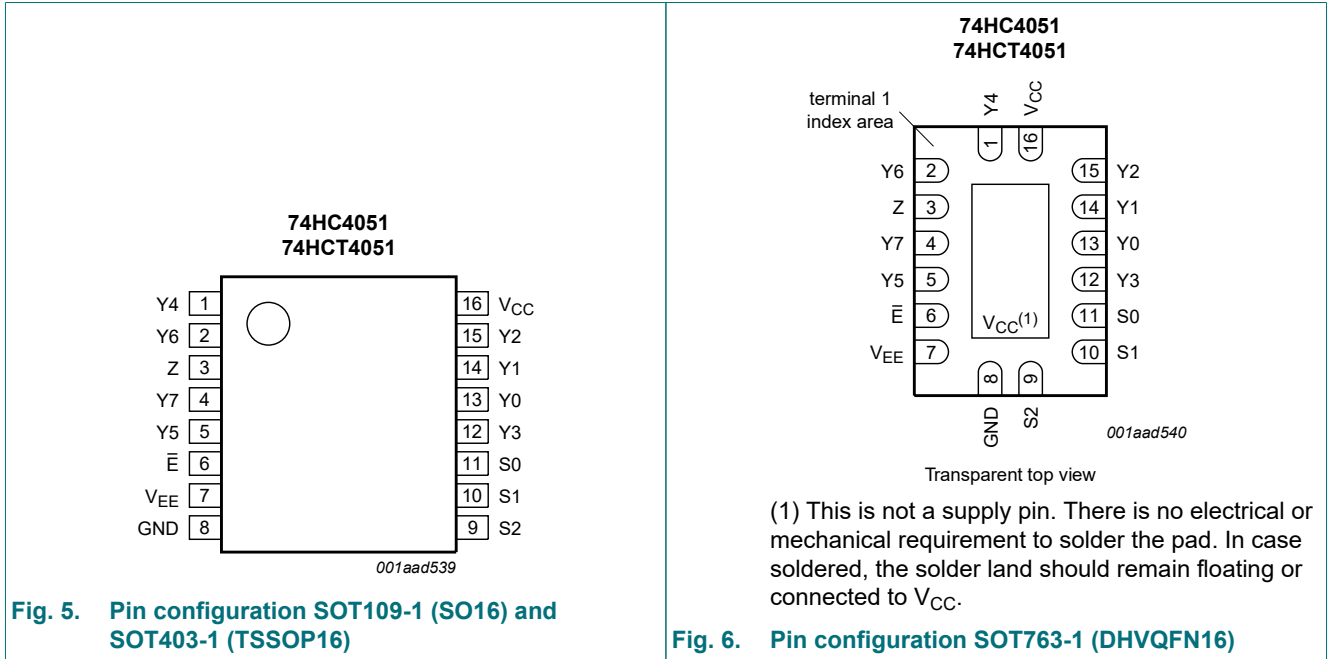


Fig. 4. Schematic diagram (one switch)

## 6. Pinning information

### 6.1. Pinning



### 6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$\bar{E}$	6	enable input (active LOW)
$V_{EE}$	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
$V_{CC}$	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
$P_{tot}$	total power dissipation	[2]	-	500	mW
P	power dissipation	per switch	-	100	mW

[1] To avoid drawing  $V_{CC}$  current out of terminal Z, when switch current flows into terminals  $Y_n$ , 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  $Y_n$ , and in this case there is no limit for the voltage drop across the switch, but the voltages at  $Y_n$  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.  
 For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.  
 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. 7 and Fig. 8							
		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

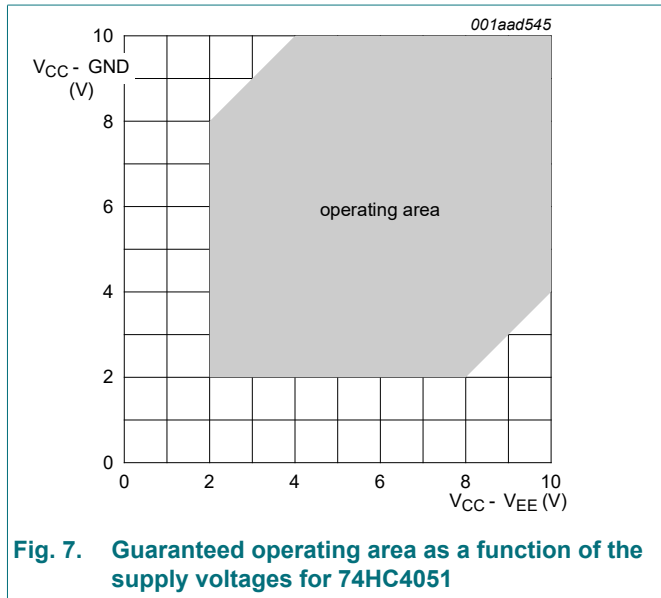


Fig. 7. Guaranteed operating area as a function of the supply voltages for 74HC4051

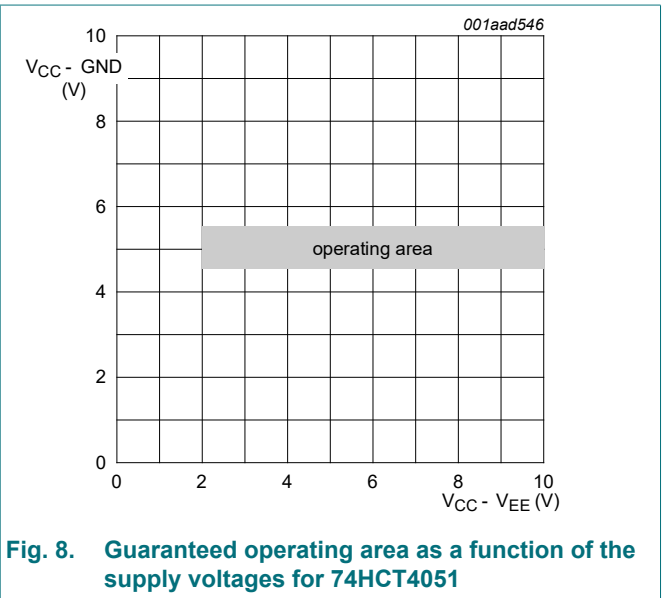


Fig. 8. Guaranteed operating area as a function of the supply voltages for 74HCT4051

## 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. 9.

$V_{is}$  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.



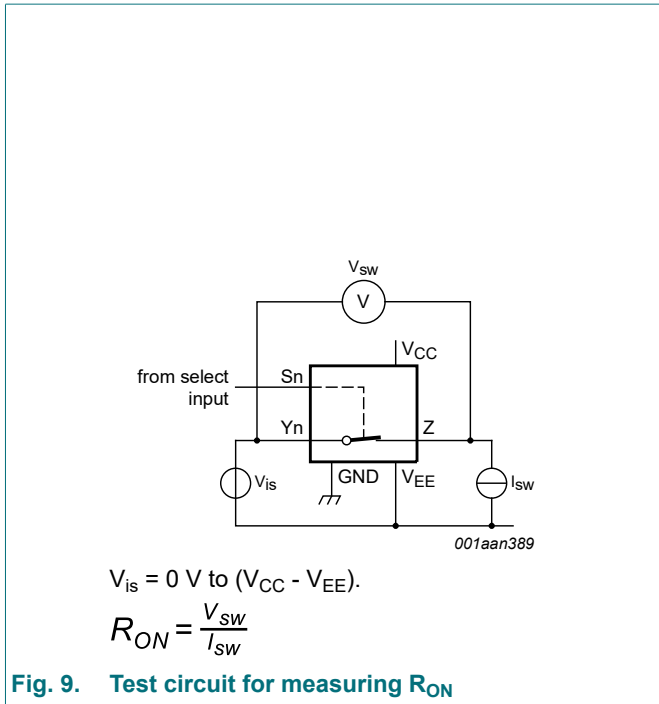


Fig. 9. Test circuit for measuring  $R_{ON}$

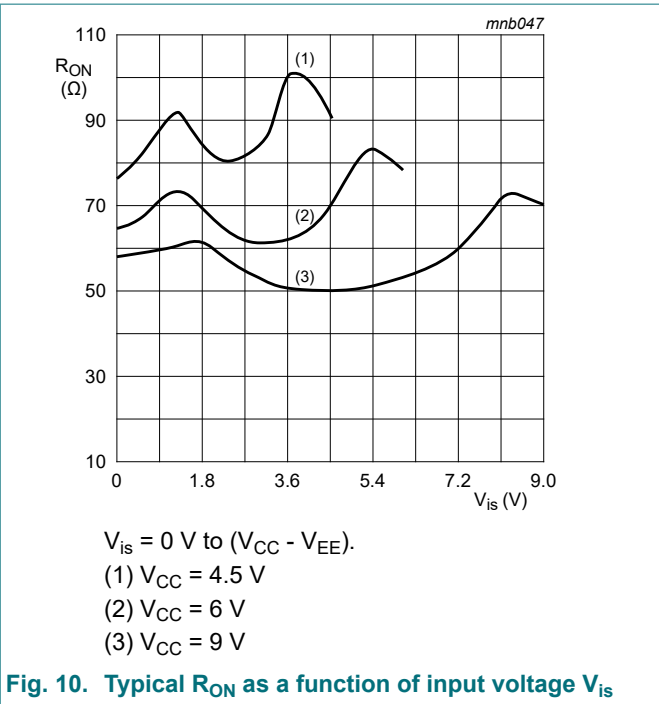


Fig. 10. Typical  $R_{ON}$  as a function of input voltage  $V_{is}$

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. 11				
		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. 12	-	-	$\pm 0.4$	$\mu\text{A}$
$I_{CC}$	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. 11				
		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. 12	-	-	$\pm 4.0$	$\mu\text{A}$
$I_{CC}$	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. 11				
		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. 12	-	-	$\pm 4.0$	$\mu\text{A}$
$I_{CC}$	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

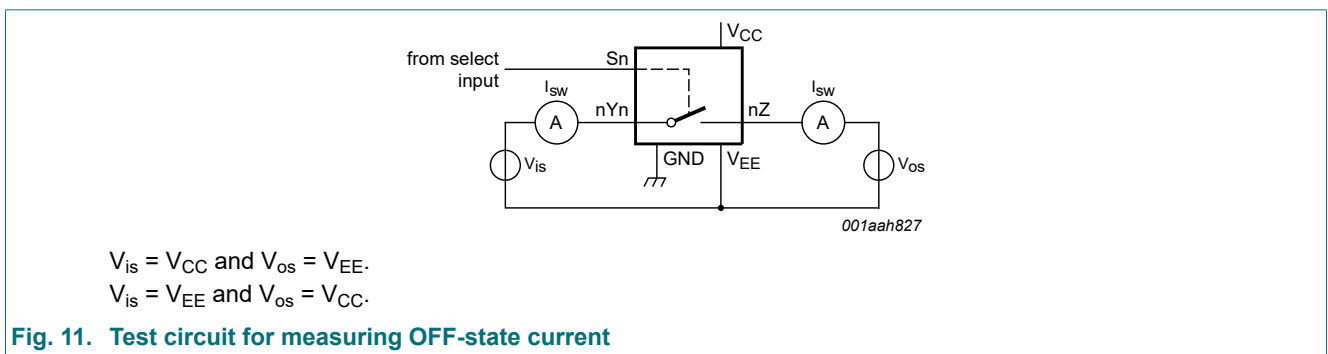
Voltages are referenced to GND (ground = 0 V).

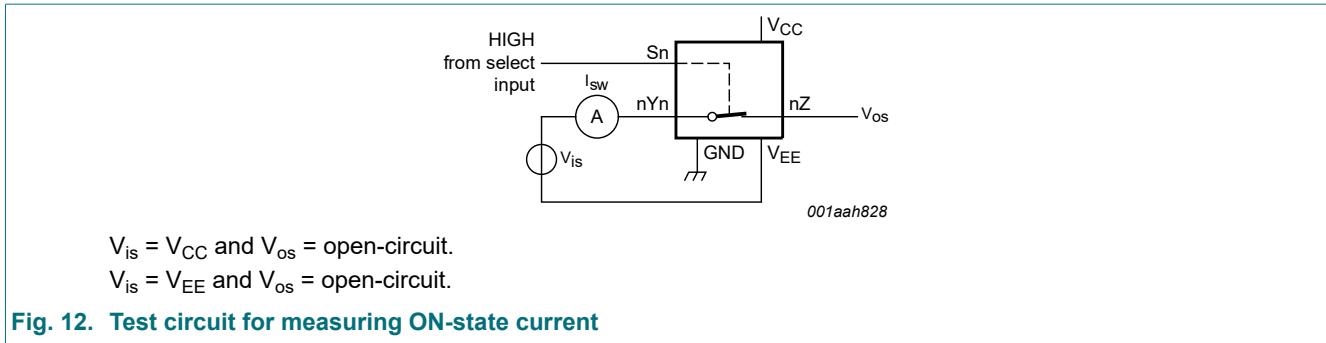
$V_{is}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.

$V_{os}$  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. 11				
		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. 12	-	-	$\pm 0.4$	$\mu\text{A}$
$I_{CC}$	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. 11				
		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. 12	-	-	±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. 11				
		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. 12	-	-	±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. 15.

$V_{is}$  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 Fig. 13 [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 Fig. 14 [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	
		$Sn$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see Fig. 14 [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. 14 [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. 14 [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. 13 [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. 14 [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. 14 [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. 14 [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. 14 [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. 13 [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. 14 [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. 14 [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. 14 [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. 14 [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. 15.

$V_{is}$  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. 13 [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. 14 [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. 14 [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. 14 [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. 14 [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. 13 [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. 14 [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. 14 [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. 14 [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. 14 [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. 13 [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. 14 [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. 14 [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. 14 [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. 14 [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).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 N = number of inputs switching;  
 $\sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$  = 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.

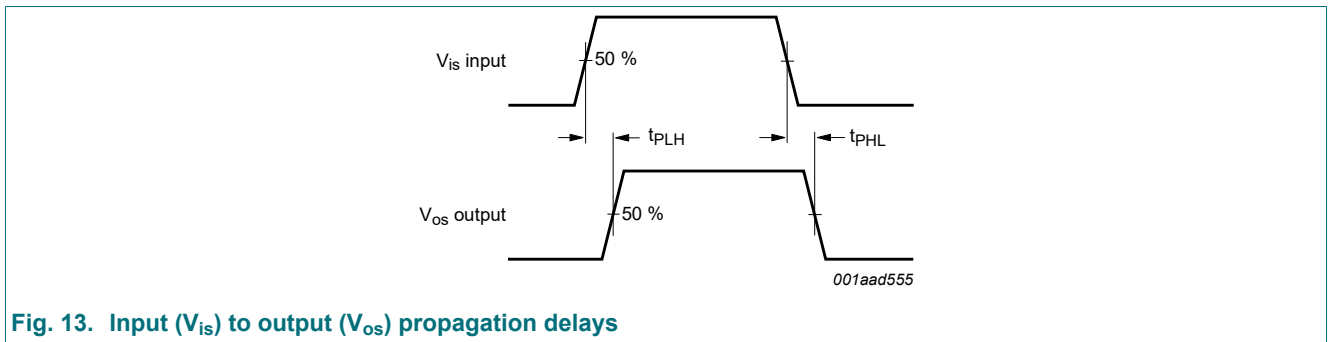
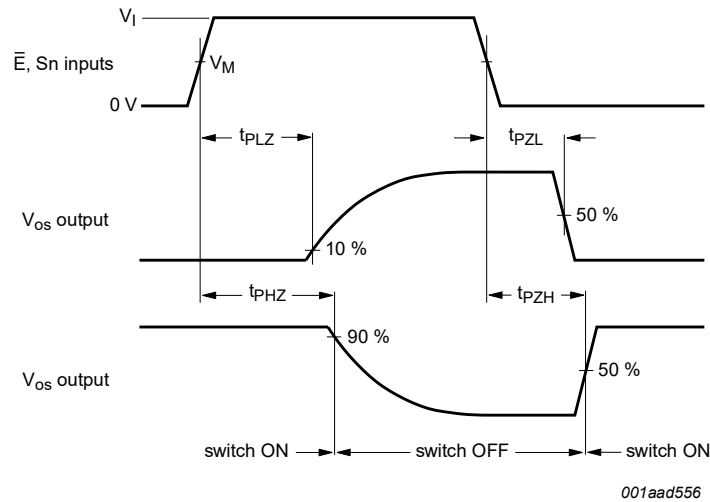
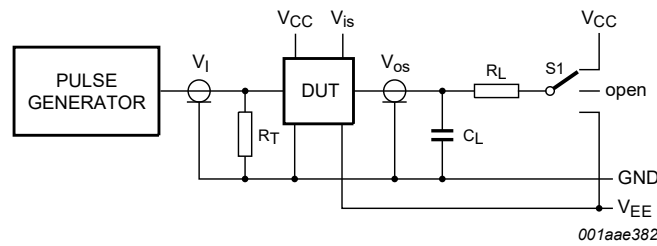
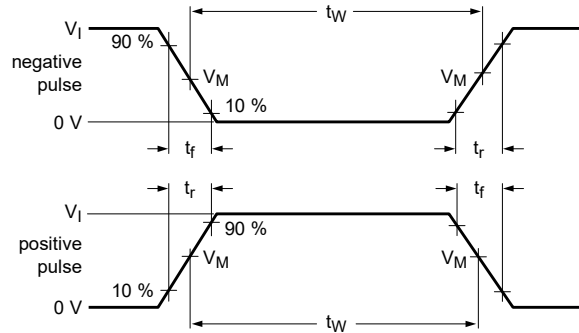


Fig. 13. Input (V<sub>is</sub>) to output (V<sub>os</sub>) propagation delays



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

Fig. 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> [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. 16				
		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. 16				
		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. 17				
		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. 18				
		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. 19				
		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).

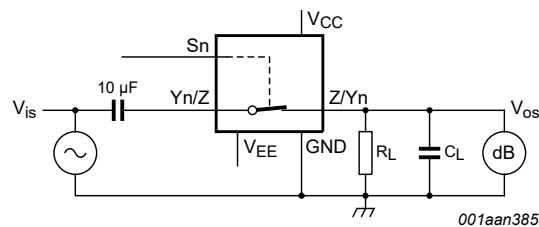
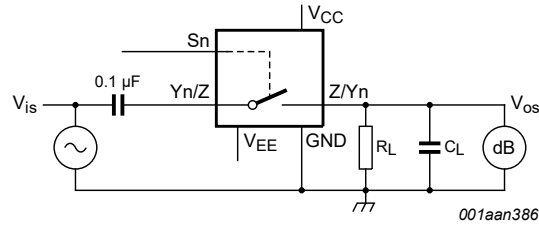
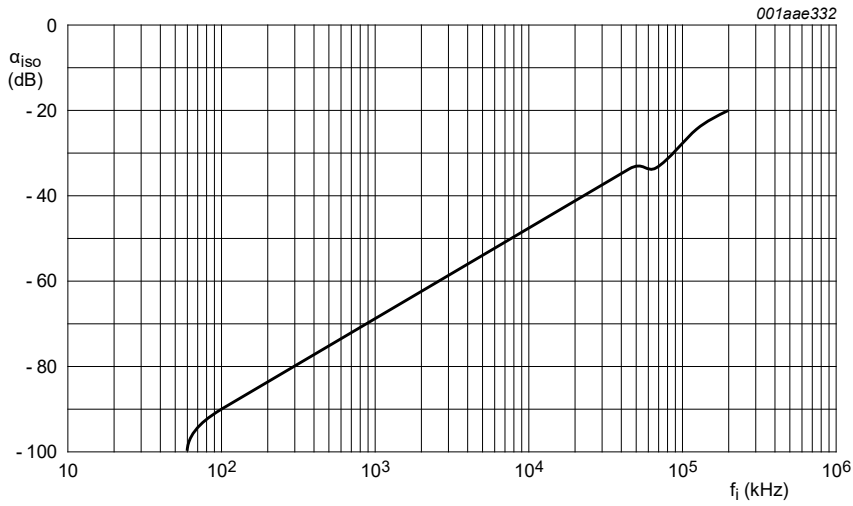


Fig. 16. Test circuit for measuring sine-wave distortion



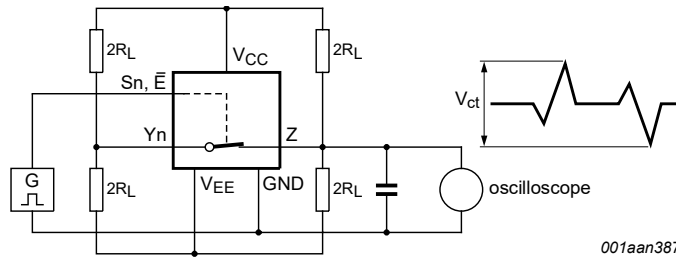
$V_{CC} = 4.5\text{ V}$ ;  $GND = 0\text{ V}$ ;  $V_{EE} = -4.5\text{ V}$ ;  $R_L = 600\ \Omega$ ;  $R_S = 1\text{ k}\Omega$ .

a. Test circuit

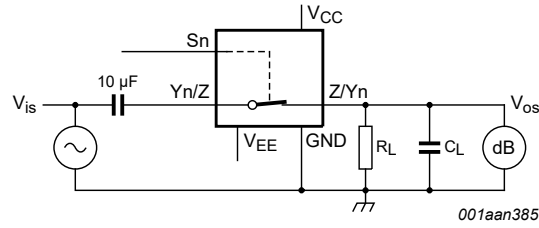


b. Isolation (OFF-state) as a function of frequency

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

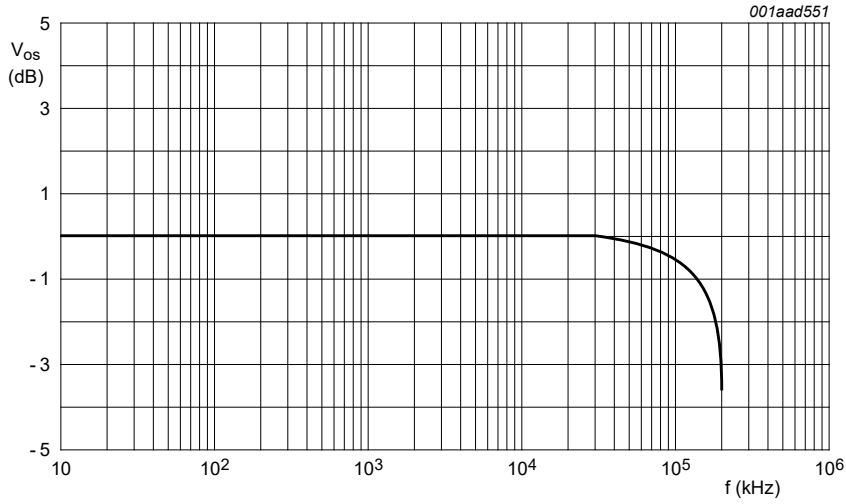


**Fig. 18. Test circuit for measuring crosstalk between control input and any switch**



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

a. Test circuit



b. Typical frequency response

**Fig. 19. Test circuit for frequency response**

12. Package outline

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

SOT109-1



Fig. 20. Package outline SOT109-1 (SO16)

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

SOT403-1



Fig. 21. 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. 22. Package outline SOT763-1 (DHVQFN16)



## 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.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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