

74HC4051; 74HCT4051

8-channel analog multiplexer/demultiplexer

Rev. 03 — 19 December 2005

Product data sheet

1. General description

The 74HC4051; 74HCT4051 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL). The device is specified in compliance with JEDEC standard no. 7A.

The 74HC4051; 74HCT4051 is an 8-channel analog multiplexer/demultiplexer with three digital select inputs (S0 to S2), an active-LOW enable input (\bar{E}), eight independent inputs/outputs (Y0 to Y7) and a common input/output (Z).

With \bar{E} LOW, one of the eight switches is selected (low impedance ON-state) by S0 to S2. With \bar{E} HIGH, all switches are in the high-impedance OFF-state, independent of S0 to S2.

V_{CC} and GND are the supply voltage pins for the digital control inputs (S0 to S2, and \bar{E}). The V_{CC} to GND ranges are 2.0 V to 10.0 V for 74HC4051 and 4.5 V to 5.5 V for 74HCT4051. The analog inputs/outputs (Y0 to Y7, and Z) can swing between V_{CC} as a positive limit and V_{EE} as a negative limit. $V_{CC} - V_{EE}$ may not exceed 10.0 V.

For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND (typically ground).

2. Features

- Wide analog input voltage range: ± 5 V
- Low ON-state resistance:
 - ◆ 80 Ω (typical) at $V_{CC} - V_{EE} = 4.5$ V
 - ◆ 70 Ω (typical) at $V_{CC} - V_{EE} = 6.0$ V
 - ◆ 60 Ω (typical) at $V_{CC} - V_{EE} = 9.0$ V
- Logic level translation:
 - ◆ To enable 5 V logic to communicate with ± 5 V analog signals
- Typical 'break before make' built in

3. Applications

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

PHILIPS

4. Quick reference data

Table 1: Quick reference data

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Type 74HC4051						
t_{PZH}, t_{PZL}	turn-ON time	$C_L = 15 pF$; $R_L = 1 k\Omega$; $V_{CC} = 5 V$				
	\bar{E} to V_{OS}		-	22	-	ns
	Sn to V_{OS}		-	20	-	ns
t_{PHZ}, t_{PLZ}	turn-OFF time	$C_L = 15 pF$; $R_L = 1 k\Omega$; $V_{CC} = 5 V$				
	\bar{E} to V_{OS}		-	18	-	ns
	Sn to V_{OS}		-	19	-	ns
C_i	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance (per switch)		[1][2]	25	-	pF
C_S	switch capacitance					
	independent input/output Yn		-	5	-	pF
	common input/output Z		-	25	-	pF
Type 74HCT4051						
t_{PZH}, t_{PZL}	turn-ON time	$C_L = 15 pF$; $R_L = 1 k\Omega$; $V_{CC} = 5 V$				
	\bar{E} to V_{OS}		-	22	-	ns
	Sn to V_{OS}		-	24	-	ns
t_{PHZ}, t_{PLZ}	turn-OFF time	$C_L = 15 pF$; $R_L = 1 k\Omega$; $V_{CC} = 5 V$				
	\bar{E} to V_{OS}		-	16	-	ns
	Sn to V_{OS}		-	20	-	ns
C_i	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance (per switch)		[1][3]	25	-	pF
C_S	switch capacitance					
	independent input/output Yn		-	5	-	pF
	common input/output Z		-	25	-	pF

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

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

 f_i = input frequency in MHz; f_o = output frequency in MHz; $\sum \{(C_L + C_S) \times V_{CC}^2 \times f_o\}$ = sum of outputs; C_L = output load capacitance in pF; C_S = switch capacitance in pF; V_{CC} = supply voltage in V.[2] For 74HC4051 the condition is $V_I = GND$ to V_{CC} .[3] For 74HCT4051 the condition is $V_I = GND$ to $V_{CC} - 1.5 V$.

5. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
Type 74HC4051				
74HC4051N	−40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HC4051D	−40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC4051DB	−40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HC4051PW	−40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
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
Type 74HCT4051				
74HCT4051N	−40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HCT4051D	−40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4051DB	−40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT4051PW	−40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4051BQ	−40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1

6. Functional diagram

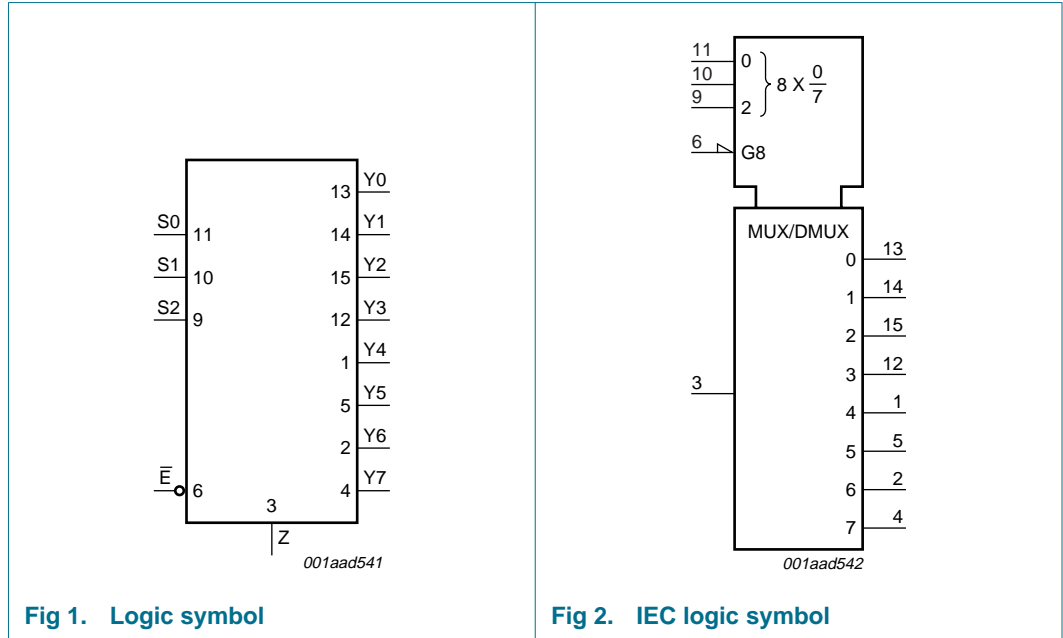


Fig 1. Logic symbol

Fig 2. IEC logic symbol

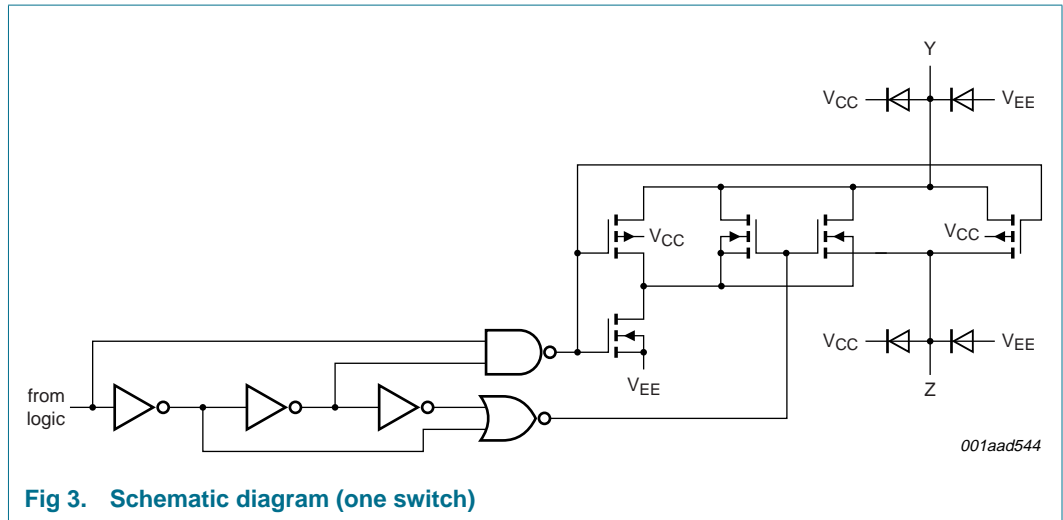
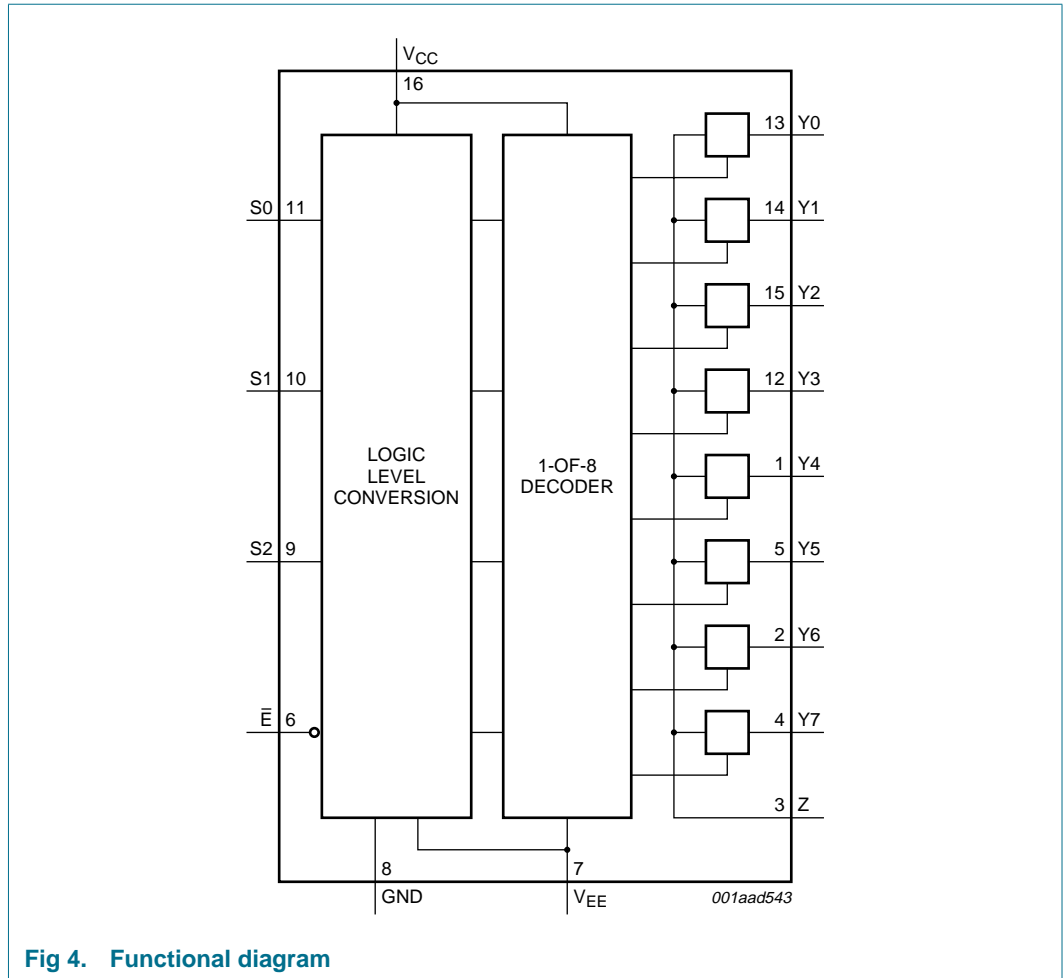
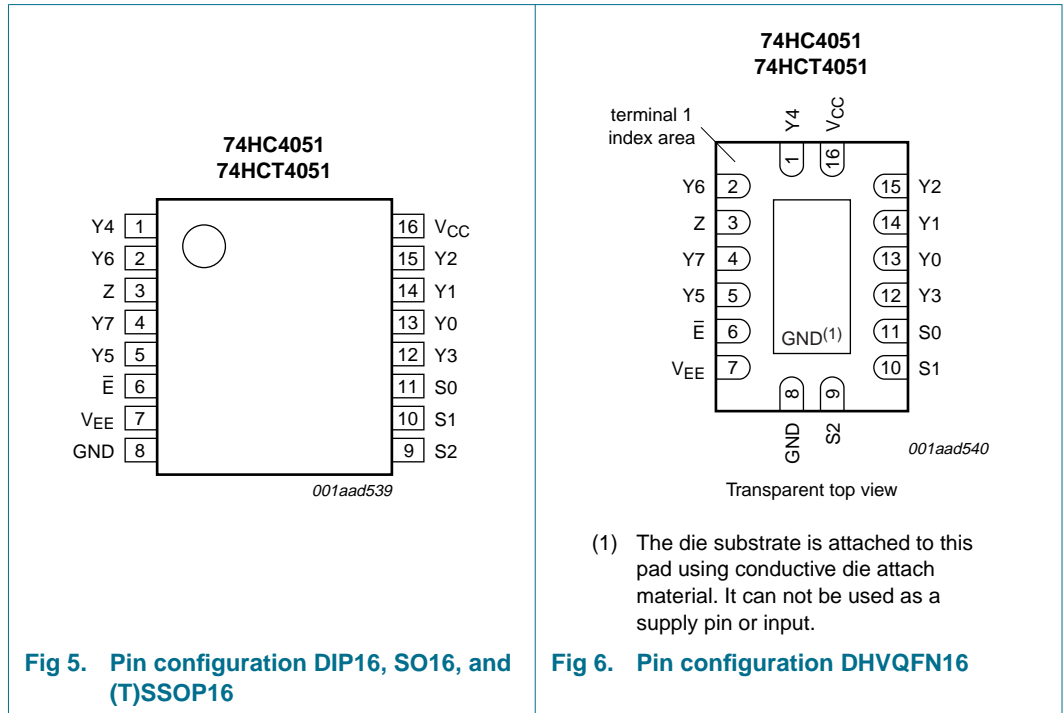


Fig 3. Schematic diagram (one switch)



7. Pinning information

7.1 Pinning



7.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
Y4	1	independent input/output 4
Y6	2	independent input/output 6
Z	3	common input/output
Y7	4	independent input/output 7
Y5	5	independent input/output 5
\bar{E}	6	enable input (active LOW)
V _{EE}	7	negative supply voltage
GND	8	ground (0 V)
S2	9	select input 2
S1	10	select input 1
S0	11	select input 0
Y3	12	independent input/output 3
Y0	13	independent input/output 0
Y1	14	independent input/output 1
Y2	15	independent input/output 2
V _{CC}	16	positive supply voltage

8. Functional description

8.1 Function table

Table 4: Function table ^[1]

Input				Channel ON
\bar{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	-

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

9. Limiting values

Table 5: Limiting values

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

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	-	±20	mA
I_{SK}	switch clamping current	$V_S < -0.5$ V or $V_S > V_{CC} + 0.5$ V	-	±20	mA
I_S	switch current	$V_S = -0.5$ V to $(V_{CC} + 0.5)$ V	-	±25	mA
I_{EE}	negative supply current		-	±20	mA
I_{CC}	quiescent supply current		-	50	mA
I_{GND}	ground supply current		-	-50	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °C			
	DIP16 package		^[2] -	750	mW
	SO16, (T)SSOP16, and DHVQFN16 package		^[3] -	500	mW
P_S	power dissipation per switch		-	100	mW

- [1] To avoid drawing V_{CC} current out of terminal Z, when switch current flows in 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 . 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} .

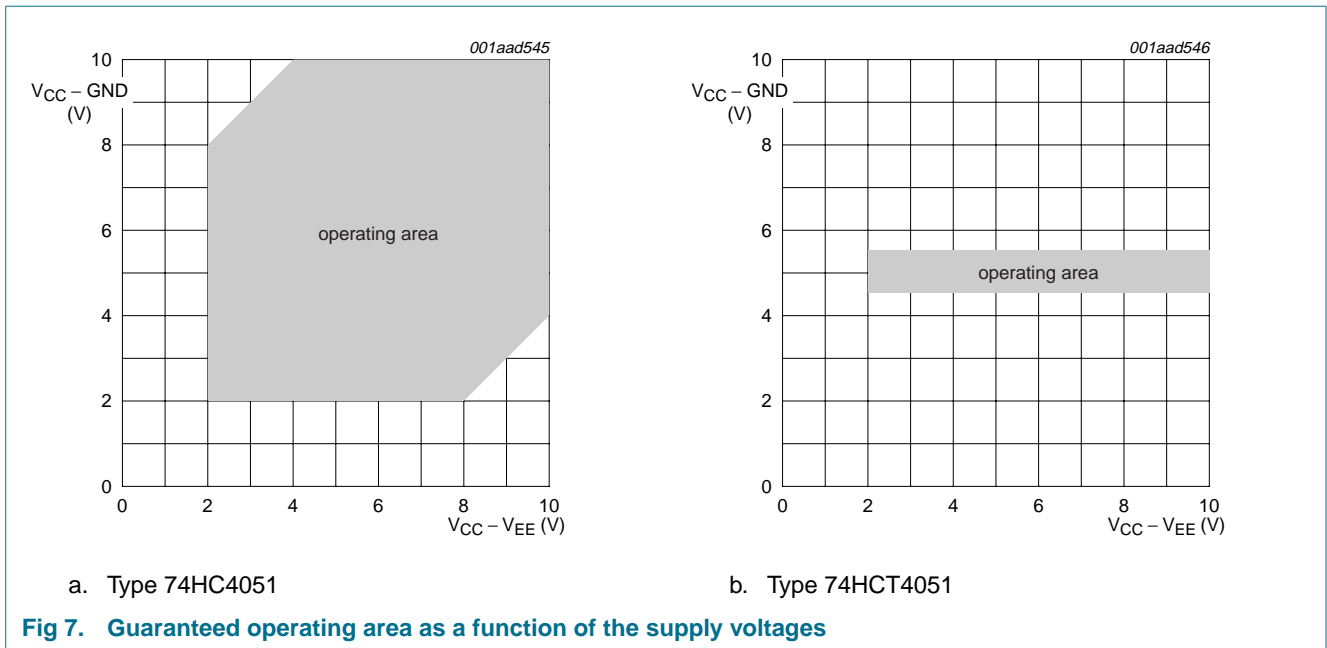
- [2] For DIP16 packages, above 70 °C, P_{tot} derates linearly with 12 mW/K.

[3] For SO16, (T)SSOP16, and DHVQFN16 packages, above 70 °C, P_{tot} derates linearly with 8 mW/K.

10. Recommended operating conditions

Table 6: Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Type 74HC4051						
ΔV_{CC}	supply voltage difference	see Figure 7				
	$V_{CC} - GND$		2.0	5.0	10.0	V
	$V_{CC} - V_{EE}$		2.0	5.0	10.0	V
V_I	input voltage		GND	-	V_{CC}	V
V_S	switch voltage		V_{EE}	-	V_{CC}	V
T_{amb}	ambient temperature		-40	-	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 2.0\text{ V}$	-	6.0	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	6.0	400	ns
		$V_{CC} = 10.0\text{ V}$	-	6.0	250	ns
Type 74HCT4051						
ΔV_{CC}	supply voltage difference	see Figure 7				
	$V_{CC} - GND$		4.5	5.0	5.5	V
	$V_{CC} - V_{EE}$		2.0	5.0	10.0	V
V_I	input voltage		GND	-	V_{CC}	V
V_S	switch voltage		V_{EE}	-	V_{CC}	V
T_{amb}	ambient temperature		-40	-	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 2.0\text{ V}$	-	6.0	500	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	6.0	500	ns
		$V_{CC} = 10.0\text{ V}$	-	6.0	500	ns



11. Static characteristics

Table 7: R_{ON} resistance per switch for types 74HC4051 and 74HCT4051

$V_I = V_{IH}$ or V_{IL} ; for test circuit see [Figure 8](#).

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

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

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

For 74HCT4051: $V_{CC} - GND = 4.5$ V and 5.5 V; $V_{CC} - V_{EE} = 2.0$ V, 4.5 V, 6.0 V and 9.0 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
T_{amb} = 25 °C							
R _{ON(peak)}	ON-state resistance (peak)	$V_{is} = V_{CC}$ to V_{EE}					
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V; $I_S = 100$ μ A	[1]	-	-	Ω	
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V; $I_S = 1000$ μ A	-	100	180	Ω	
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V; $I_S = 1000$ μ A	-	90	160	Ω	
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V; $I_S = 1000$ μ A	-	70	130	Ω	
R _{ON(rail)}	ON-state resistance (rail)	$V_{is} = V_{EE}$					
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V; $I_S = 100$ μ A	[1]	-	150	-	Ω
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V; $I_S = 1000$ μ A	-	80	140	Ω	
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V; $I_S = 1000$ μ A	-	70	120	Ω	
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V; $I_S = 1000$ μ A	-	60	105	Ω	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V; $I_S = 100$ μ A	[1]	-	150	-	Ω
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V; $I_S = 1000$ μ A	-	90	160	Ω	
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V; $I_S = 1000$ μ A	-	80	140	Ω	
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V; $I_S = 1000$ μ A	-	65	120	Ω	

Table 7: R_{ON} resistance per switch for types 74HC4051 and 74HCT4051 ...continued

$V_I = V_{IH}$ or V_{IL} ; for test circuit see Figure 8.

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 V .

For 74HCT4051: $V_{CC} - GND = 4.5\text{ V}$ and 5.5 V ; $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$ and 9.0 V .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$\Delta R_{ON(max)}$	maximum ON-state resistance variation between any two channels	$V_{is} = V_{CC}$ to V_{EE}					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	9	-	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	8	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	6	-	Ω	
$T_{amb} = -40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$							
$R_{ON(peak)}$	ON-state resistance (peak)	$V_{is} = V_{CC}$ to V_{EE}					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	225	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	200	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	165	Ω	
$R_{ON(rail)}$	ON-state resistance (rail)	$V_{is} = V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	175	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	150	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	130	Ω	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	200	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	175	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	150	Ω	
$T_{amb} = -40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$							
$R_{ON(peak)}$	ON-state resistance (peak)	$V_{is} = V_{CC}$ to V_{EE}					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	270	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	240	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	195	Ω	
$R_{ON(rail)}$	ON-state resistance (rail)	$V_{is} = V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	210	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	180	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	160	Ω	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	-	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	240	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	210	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	-	180	Ω	

- [1] At supply voltages ($V_{CC} - V_{EE}$) approaching 2.0 V the analog switch ON-state resistance becomes extremely non-linear. Therefore it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.

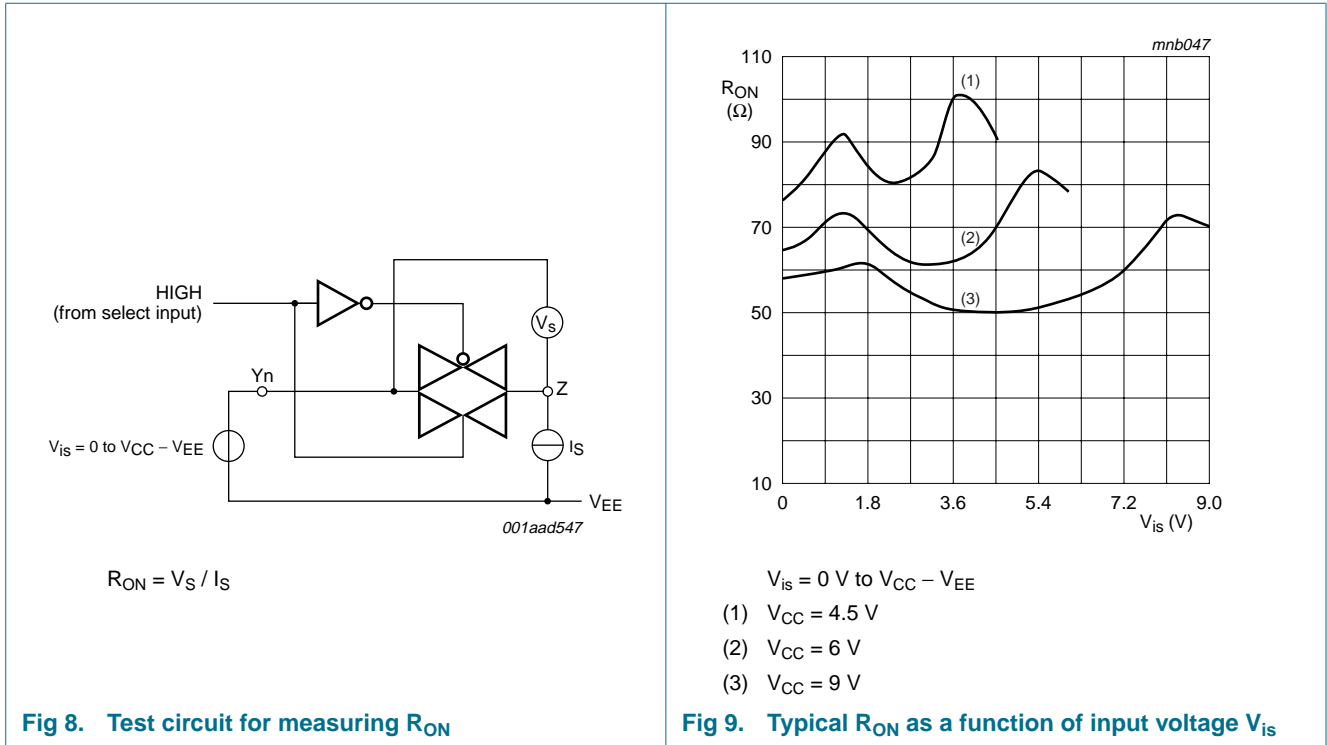


Table 8: Static characteristics type 74HC4051

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

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = 25\text{ }^\circ\text{C}$						
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_{LI}	input leakage current	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$				
		$V_{CC} = 6.0\text{ V}$	-	-	± 0.1	μA
		$V_{CC} = 10.0\text{ V}$	-	-	± 0.2	μA
$I_{S(OFF)}$	switch OFF-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE};$ see Figure 10				
		per channel	-	-	± 0.1	μA
		all channels	-	-	± 0.4	μA

Table 8: Static characteristics type 74HC4051 ...continued

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

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
$I_{S(ON)}$	switch ON-state current	$V_{CC} = 10.0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $V_{EE} = 0\text{ V}$; $ V_S = V_{CC} - V_{EE}$; see Figure 11	-	-	± 0.4	μA
I_{CC}	quiescent 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}	-	-	8.0	μA
		$V_{CC} = 6.0\text{ V}$	-	-	16.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	-	-
C_i	input capacitance		-	3.5	-	pF
$T_{amb} = -40\text{ }^\circ\text{C to } +85\text{ }^\circ\text{C}$						
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_{LI}	input leakage current	$V_{EE} = 0\text{ V}$; $V_I = V_{CC}$ or GND	-	-	± 1.0	μA
		$V_{CC} = 6.0\text{ V}$	-	-	± 2.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	-	-
$I_{S(OFF)}$	switch OFF-state current	$V_{CC} = 10.0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $V_{EE} = 0\text{ V}$; $ V_S = V_{CC} - V_{EE}$; see Figure 10	-	-	± 1.0	μA
		per channel	-	-	± 4.0	μA
		all channels	-	-	-	-
$I_{S(ON)}$	switch ON-state current	$V_{CC} = 10.0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $V_{EE} = 0\text{ V}$; $ V_S = V_{CC} - V_{EE}$; see Figure 11	-	-	± 4.0	μA
I_{CC}	quiescent 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}	-	-	80.0	μA
		$V_{CC} = 6.0\text{ V}$	-	-	160.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	-	-
$T_{amb} = -40\text{ }^\circ\text{C to } +125\text{ }^\circ\text{C}$						
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 8: Static characteristics type 74HC4051 ...continued

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

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{LI}	input leakage current	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$				
		$V_{CC} = 6.0\text{ V}$	-	-	± 1.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	± 2.0	μA
$I_{S(OFF)}$	switch OFF-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE};$ see Figure 10				
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 4.0	μA
$I_{S(ON)}$	switch ON-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE};$ see Figure 11	-	-	± 4.0	μA
I_{CC}	quiescent supply current	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}; V_{is} = V_{EE}\text{ or }V_{CC}; V_{os} = V_{CC}\text{ or }V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	160.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	320.0	μA

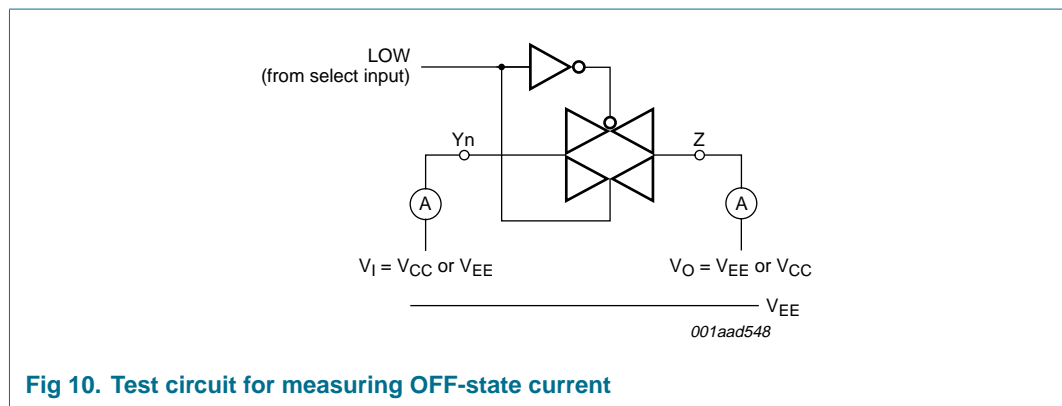


Fig 10. Test circuit for measuring OFF-state current

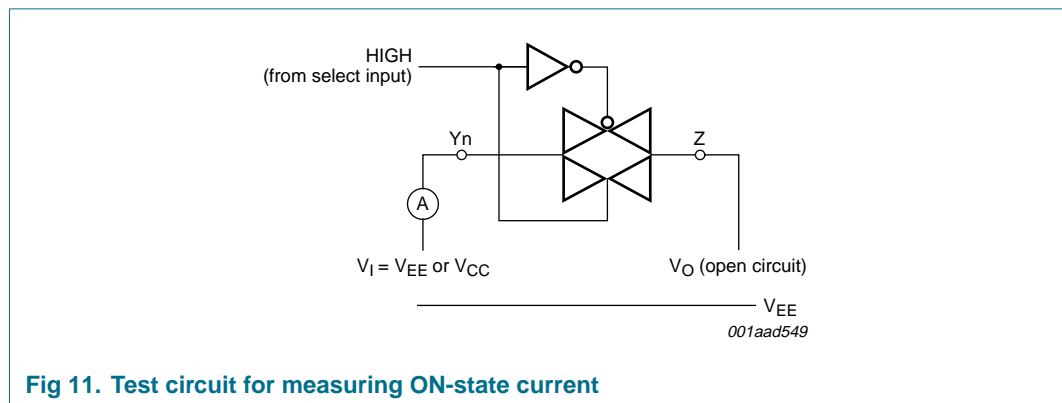


Fig 11. Test circuit for measuring ON-state current

Table 9: Static characteristics type 74HCT4051

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

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
$T_{amb} = 25\text{ }^{\circ}\text{C}$						
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_{LI}	input leakage current	$V_{CC} = 5.5\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$	-	-	0.1	μA
$I_{S(OFF)}$	switch OFF-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE}$; see Figure 10	-	-	± 0.1	μA
		per channel	-	-	± 0.1	μA
		all channels	-	-	± 0.4	μA
$I_{S(ON)}$	switch ON-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE}$; see Figure 11	-	-	± 0.4	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}\text{ or GND}; V_{is} = V_{EE}\text{ or }V_{CC}; V_{os} = V_{CC}\text{ or }V_{EE}$	-	-	-	-
		$V_{EE} = 0\text{ V}; V_{CC} = 5.5\text{ V}$	-	-	8.0	μA
		$V_{EE} = -5.0\text{ V}; V_{CC} = 5.0\text{ V}$	-	-	16.0	μA
ΔI_{CC}	additional quiescent supply current per input pin	$V_{CC} = 4.5\text{ V to }5.5\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{CC} - 2.1\text{ V};$ other inputs at V_{CC} or GND	-	-	-	-
		Sn input	-	50	180	μA
		\bar{E} input	-	50	180	μA
C_i	input capacitance		-	3.5	-	pF
$T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$						
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_{LI}	input leakage current	$V_{CC} = 5.5\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$	-	-	± 1.0	μA
$I_{S(OFF)}$	switch OFF-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE}$; see Figure 10	-	-	± 1.0	μA
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 4.0	μA
$I_{S(ON)}$	switch ON-state current	$V_{CC} = 10.0\text{ V}; V_I = V_{IH}\text{ or }V_{IL}; V_{EE} = 0\text{ V}; V_S = V_{CC} - V_{EE}$; see Figure 11	-	-	± 4.0	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}\text{ or GND}; V_{is} = V_{EE}\text{ or }V_{CC}; V_{os} = V_{CC}\text{ or }V_{EE}$	-	-	-	-
		$V_{EE} = 0\text{ V}; V_{CC} = 5.5\text{ V}$	-	-	80.0	μA
		$V_{EE} = -5.0\text{ V}; V_{CC} = 5.0\text{ V}$	-	-	160.0	μA
ΔI_{CC}	additional quiescent supply current per input pin	$V_{CC} = 4.5\text{ V to }5.5\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{CC} - 2.1\text{ V};$ other inputs at V_{CC} or GND	-	-	-	-
		Sn input	-	-	225	μA
		\bar{E} input	-	-	225	μA
$T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$						
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_{LI}	input leakage current	$V_{CC} = 5.5\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$	-	-	± 1.0	μA

Table 9: Static characteristics type 74HCT4051 ...continued

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

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
$I_{S(OFF)}$	switch OFF-state current	$V_{CC} = 10.0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $V_{EE} = 0\text{ V}$; $ V_S = V_{CC} - V_{EE}$; see Figure 10				
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 4.0	μA
$I_{S(ON)}$	switch ON-state current	$V_{CC} = 10.0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $V_{EE} = 0\text{ V}$; $ V_S = V_{CC} - V_{EE}$; see Figure 11	-	-	± 4.0	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE}				
		$V_{EE} = 0\text{ V}$; $V_{CC} = 5.5\text{ V}$	-	-	160.0	μA
		$V_{EE} = -5.0\text{ V}$; $V_{CC} = 5.0\text{ V}$	-	-	320.0	μA
ΔI_{CC}	additional quiescent supply current per input pin	$V_{CC} = 4.5\text{ V}$ to 5.5 V ; $V_{EE} = 0\text{ V}$; $V_I = V_{CC} - 2.1\text{ V}$; other inputs at V_{CC} or GND				
		Sn input	-	-	245	μA
		\bar{E} input	-	-	245	μA

12. Dynamic characteristics

Table 10: Dynamic characteristics type 74HC4051

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

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	
$T_{amb} = 25\text{ }^\circ\text{C}$							
t_{PHL} , t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty\ \Omega$; see Figure 12					
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	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_{PZH} , t_{PZL}	turn-ON time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13					
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	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}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	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		

Table 10: Dynamic characteristics type 74HC4051 ...continued

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

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
t_{PHZ} , t_{PLZ}	turn-OFF time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	58	290	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	31	58	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	49	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	18	42	ns
	Sn to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	61	290	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	25	58	ns
		$V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$	-	19	-	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	18	49	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	18	42	ns
C_{PD}	power dissipation capacitance (per switch)		[1] [2]	25	-	pF
$T_{amb} = -40\text{ }^\circ\text{C to }+85\text{ }^\circ\text{C}$						
t_{PHL} , t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty\ \Omega$; see Figure 12				
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	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_{PZH} , t_{PZL}	turn-ON time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	430	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	86	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	73	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	64	ns
	Sn to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	430	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	86	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	73	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	64	ns
t_{PHZ} , t_{PLZ}	turn-OFF time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	365	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	73	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	62	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	53	ns
	Sn to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	365	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	73	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	62	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	53	ns

Table 10: Dynamic characteristics type 74HC4051 ...continued

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

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
$T_{amb} = -40\text{ °C to }+125\text{ °C}$						
t_{PHL} , t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty\ \Omega$; see Figure 12				
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	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
t_{PZH} , t_{PZL}	turn-ON time	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	520	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	104	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	88	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	77	ns
	Sn to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	520	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	104	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	88	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	77	ns
t_{PHZ} , t_{PLZ}	turn-OFF time	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	435	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	87	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	74	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	72	ns
	Sn to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	435	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	87	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	74	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-	72	ns

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

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

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

C_L = output load capacitance in pF;

C_S = switch capacitance in pF;

V_{CC} = supply voltage in V.

[2] For 74HC4051 the condition is $V_i = GND$ to V_{CC} .

Table 11: Dynamic characteristics type 74HCT4051

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$ and $V_{CC} = 4.5\text{ V}$ unless specified otherwise; for test circuit see [Figure 14](#).

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
$T_{amb} = 25\text{ °C}$						
t_{PHL} , t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty\ \Omega$; see Figure 12				
		$V_{EE} = 0\text{ V}$	-	5	12	ns
		$V_{EE} = -4.5\text{ V}$	-	4	8	ns
t_{PZH} , t_{PZL}	turn-ON time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{EE} = 0\text{ V}$	-	26	55	ns
		$V_{EE} = 0\text{ V}$; $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	22	-	ns
		$V_{EE} = -4.5\text{ V}$	-	16	39	ns
	Sn to V_{os}	$V_{EE} = 0\text{ V}$	-	28	55	ns
		$V_{EE} = 0\text{ V}$; $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	24	-	ns
		$V_{EE} = -4.5\text{ V}$	-	16	39	ns
t_{PHZ} , t_{PLZ}	turn-OFF time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{EE} = 0\text{ V}$	-	19	45	ns
		$V_{EE} = 0\text{ V}$; $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	16	-	ns
		$V_{EE} = -4.5\text{ V}$	-	16	32	ns
	Sn to V_{os}	$V_{EE} = 0\text{ V}$	-	23	45	ns
		$V_{EE} = 0\text{ V}$; $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	20	-	ns
		$V_{EE} = -4.5\text{ V}$	-	16	32	ns
C_{PD}	power dissipation capacitance (per switch)		[1] [2]	25	-	pF
$T_{amb} = -40\text{ °C to }+85\text{ °C}$						
t_{PHL} , t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty\ \Omega$; see Figure 12				
		$V_{EE} = 0\text{ V}$	-	-	15	ns
		$V_{EE} = -4.5\text{ V}$	-	-	10	ns
t_{PZH} , t_{PZL}	turn-ON time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{EE} = 0\text{ V}$	-	-	69	ns
		$V_{EE} = -4.5\text{ V}$	-	-	49	ns
	Sn to V_{os}	$V_{EE} = 0\text{ V}$	-	-	69	ns
		$V_{EE} = -4.5\text{ V}$	-	-	49	ns
t_{PHZ} , t_{PLZ}	turn-OFF time \bar{E} to V_{os}	$R_L = 1\text{ k}\Omega$; see Figure 13				
		$V_{EE} = 0\text{ V}$	-	-	56	ns
		$V_{EE} = -4.5\text{ V}$	-	-	40	ns
	Sn to V_{os}	$V_{EE} = 0\text{ V}$	-	-	56	ns
		$V_{EE} = -4.5\text{ V}$	-	-	40	ns
$T_{amb} = -40\text{ °C to }+125\text{ °C}$						
t_{PHL} , t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty\ \Omega$; see Figure 12				
		$V_{EE} = 0\text{ V}$	-	-	18	ns
		$V_{EE} = -4.5\text{ V}$	-	-	12	ns

Table 11: Dynamic characteristics type 74HCT4051 ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$ and $V_{CC} = 4.5\text{ V}$ unless specified otherwise; for test circuit see [Figure 14](#).

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
t_{PZH} , t_{PZL}	turn-ON time	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{EE} = 0\text{ V}$	-	-	83	ns
		$V_{EE} = -4.5\text{ V}$	-	-	59	ns
	Sn to V_{os}	$V_{EE} = 0\text{ V}$	-	-	83	ns
		$V_{EE} = -4.5\text{ V}$	-	-	59	ns
t_{PHZ} , t_{PLZ}	turn-OFF time	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{EE} = 0\text{ V}$	-	-	68	ns
		$V_{EE} = -4.5\text{ V}$	-	-	48	ns
	Sn to V_{os}	$V_{EE} = 0\text{ V}$	-	-	68	ns
		$V_{EE} = -4.5\text{ V}$	-	-	48	ns

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

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

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

C_L = output load capacitance in pF;

C_S = switch capacitance in pF;

V_{CC} = supply voltage in V.

[2] For 74HCT4051 the condition is $V_I = GND$ to $V_{CC} - 1.5\text{ V}$.

13. Waveforms

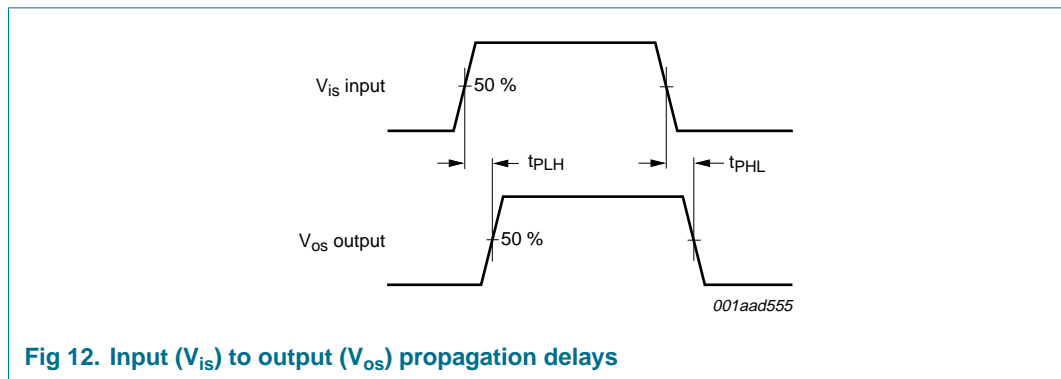


Fig 12. Input (V_{is}) to output (V_{os}) propagation delays

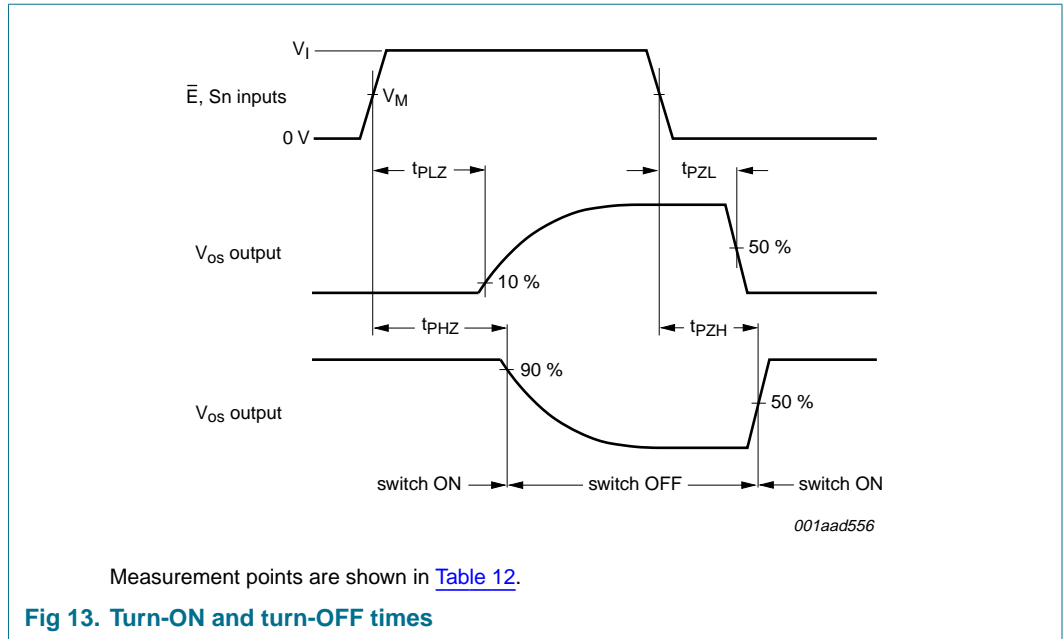


Table 12: Measuring points

Type	V_I	V_M
74HC4051	GND to V_{CC}	50 %
74HCT4051	GND to 3.0 V	1.3 V

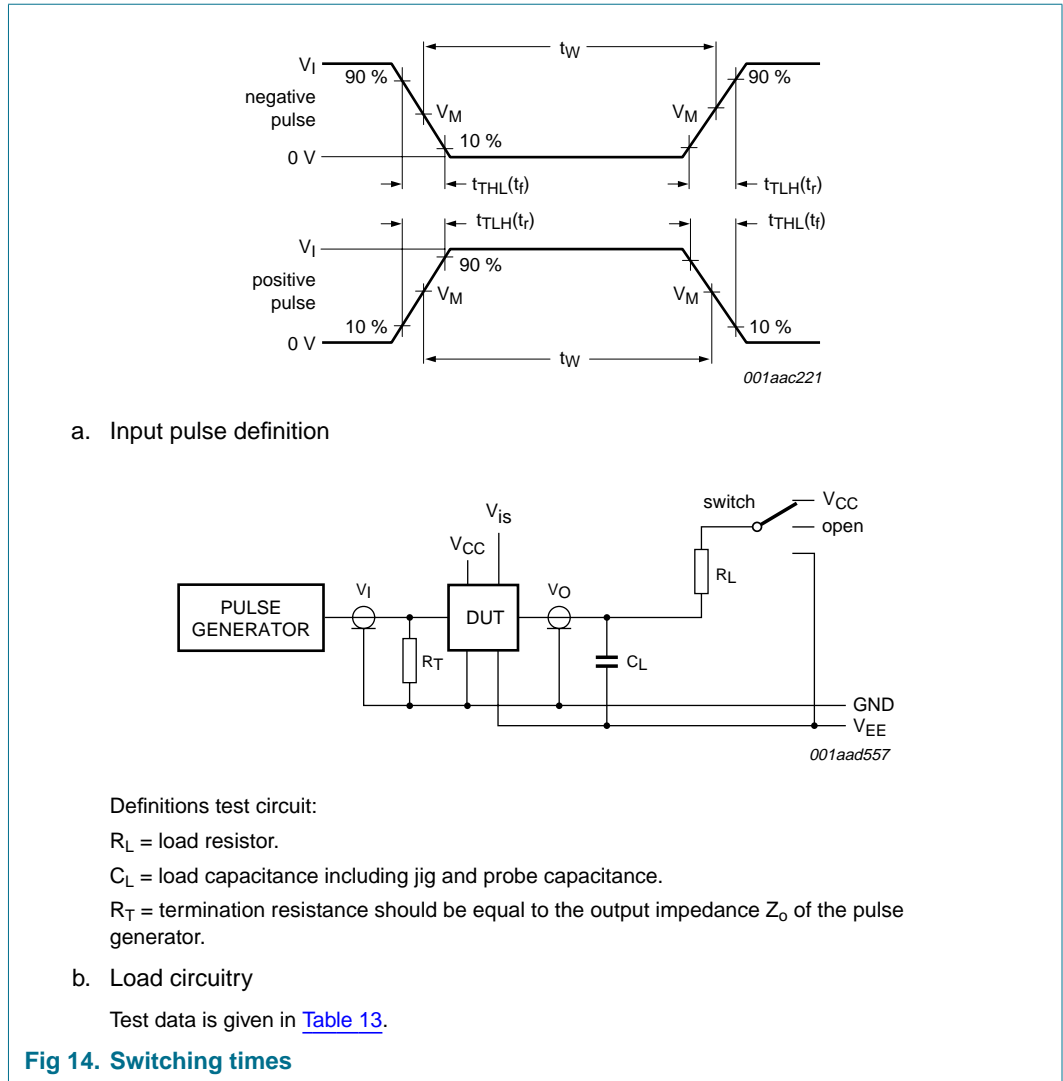


Table 13: Test data

Test	Input		Switch
	t_r, t_f [1]	V_{is}	
t_{PZH}, t_{PHZ}	6 ns	V_{CC}	V_{EE}
t_{PZL}, t_{PLZ}	6 ns	V_{EE}	V_{CC}
t_{PHL}, t_{PLH}	6 ns	pulse	open

[1] When measuring f_{max} there is no constraint to t_r and t_f with 50 % duty factor (< 2 ns).

14. Additional dynamic characteristics

Table 14: Additional dynamic characteristics

Recommended conditions and typical values; $GND = 0\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
d_{sin}	sine-wave distortion	$R_L = 10\text{ k}\Omega$; $C_L = 50\text{ pF}$; see Figure 15					
		$f_i = 1\text{ kHz}$					
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$; $V_{is(p-p)} = 4.0\text{ V}$	-	0.04	-	%	
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$; $V_{is(p-p)} = 8.0\text{ V}$	-	0.02	-	%	
		$f_i = 10\text{ kHz}$					
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$; $V_{is(p-p)} = 4.0\text{ V}$	-	0.12	-	%	
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$; $V_{is(p-p)} = 8.0\text{ V}$	-	0.06	-	%	
$\alpha_{(ft)OFF}$	switch OFF-state signal feed-through suppression	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; see Figure 16	[1]				
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	-50	-	dB	
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-50	-	dB	
$V_{ct(p-p)}$	crosstalk voltage (peak-to-peak value)	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; $f_i = 1\text{ MHz}$; \bar{E} or S_n square-wave between V_{CC} and GND ; $t_r = t_f = 6\text{ ns}$; see Figure 17					
		between \bar{E} or S_n and Y_n or Z	$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	110	-	mV
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	220	-	mV	
$f_{h(-3dB)}$	-3 dB high frequency	$R_L = 50\text{ }\Omega$; $C_L = 10\text{ pF}$; see Figure 18	[2]				
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	170	-	MHz	
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	180	-	MHz	
C_S	switch capacitance	independent input/output Y_n		5		pF	
		common input/output Z		25		pF	

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

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

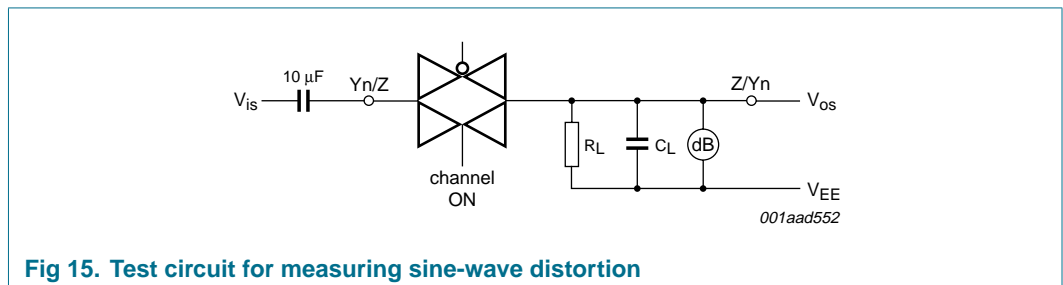
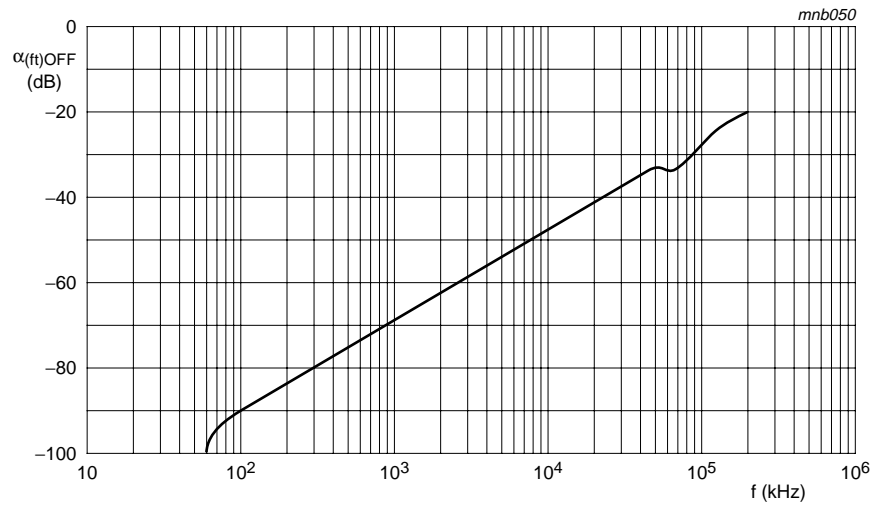
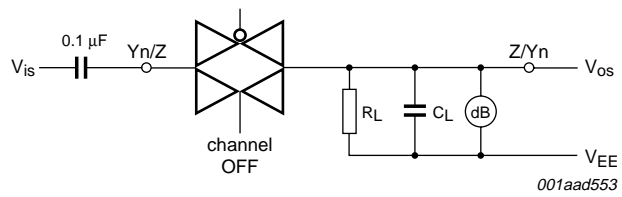


Fig 15. Test circuit for measuring sine-wave distortion



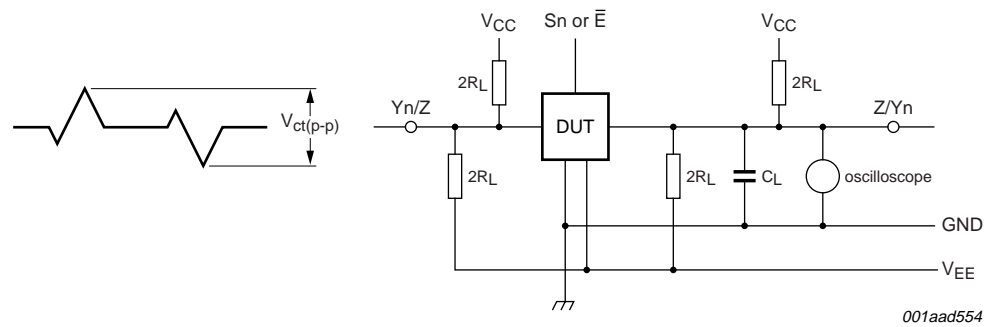
a. Feed-through as a function of frequency



b. Test circuit

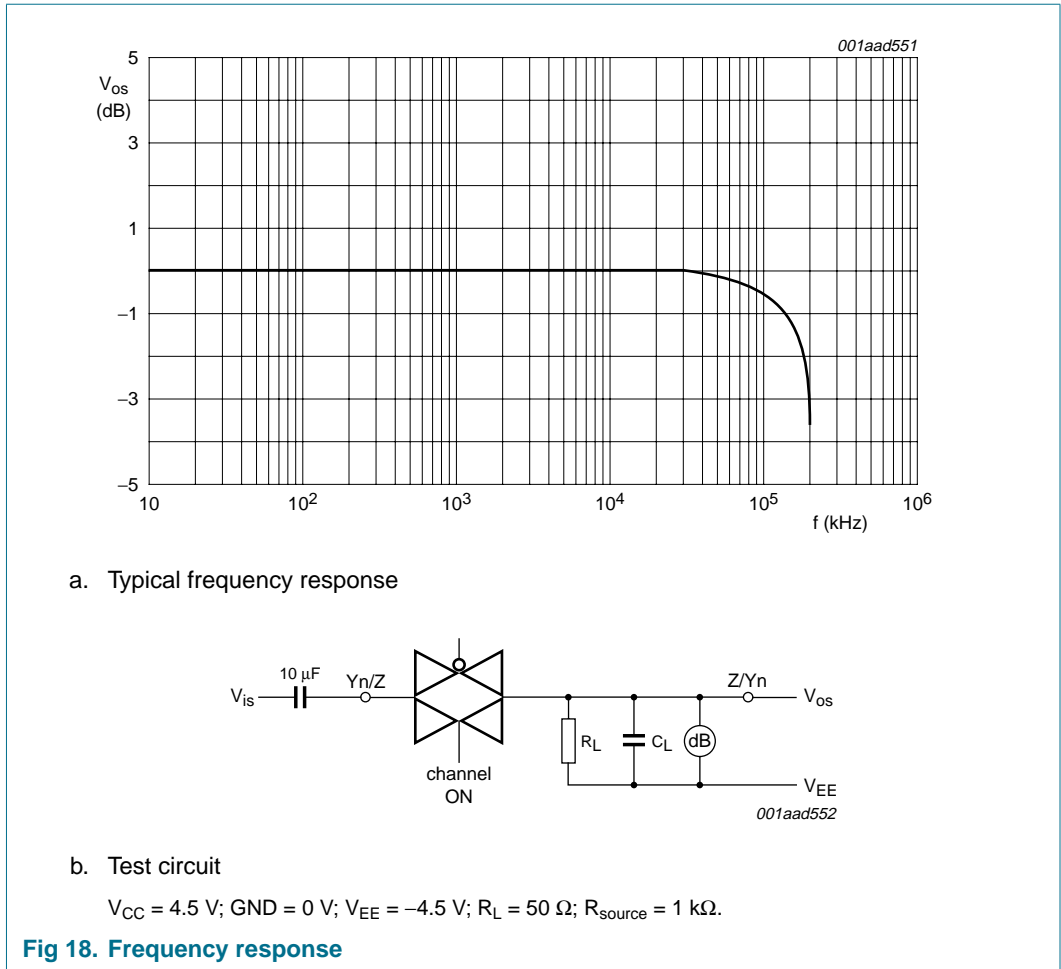
$V_{CC} = 4.5 \text{ V}$; $GND = 0 \text{ V}$; $V_{EE} = -4.5 \text{ V}$; $R_L = 600 \text{ } \Omega$; $R_{source} = 1 \text{ k}\Omega$.

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



The crosstalk resembles the oscilloscope output shown in the left-hand drawing above.

Fig 17. Crosstalk between any control input and any switch



15. Package outline

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

SOT38-4

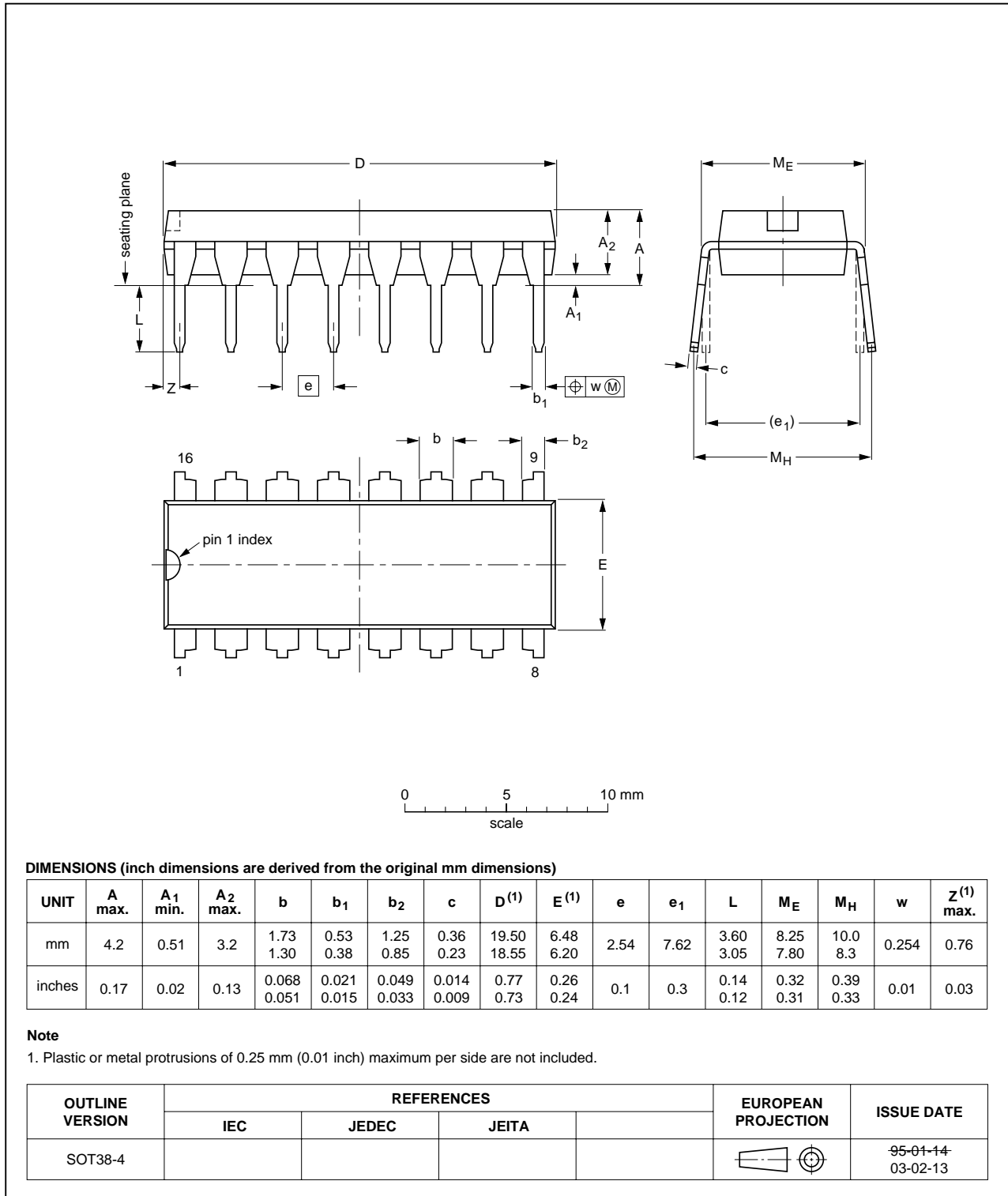


Fig 19. Package outline SOT38-4 (DIP16)

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

SOT109-1

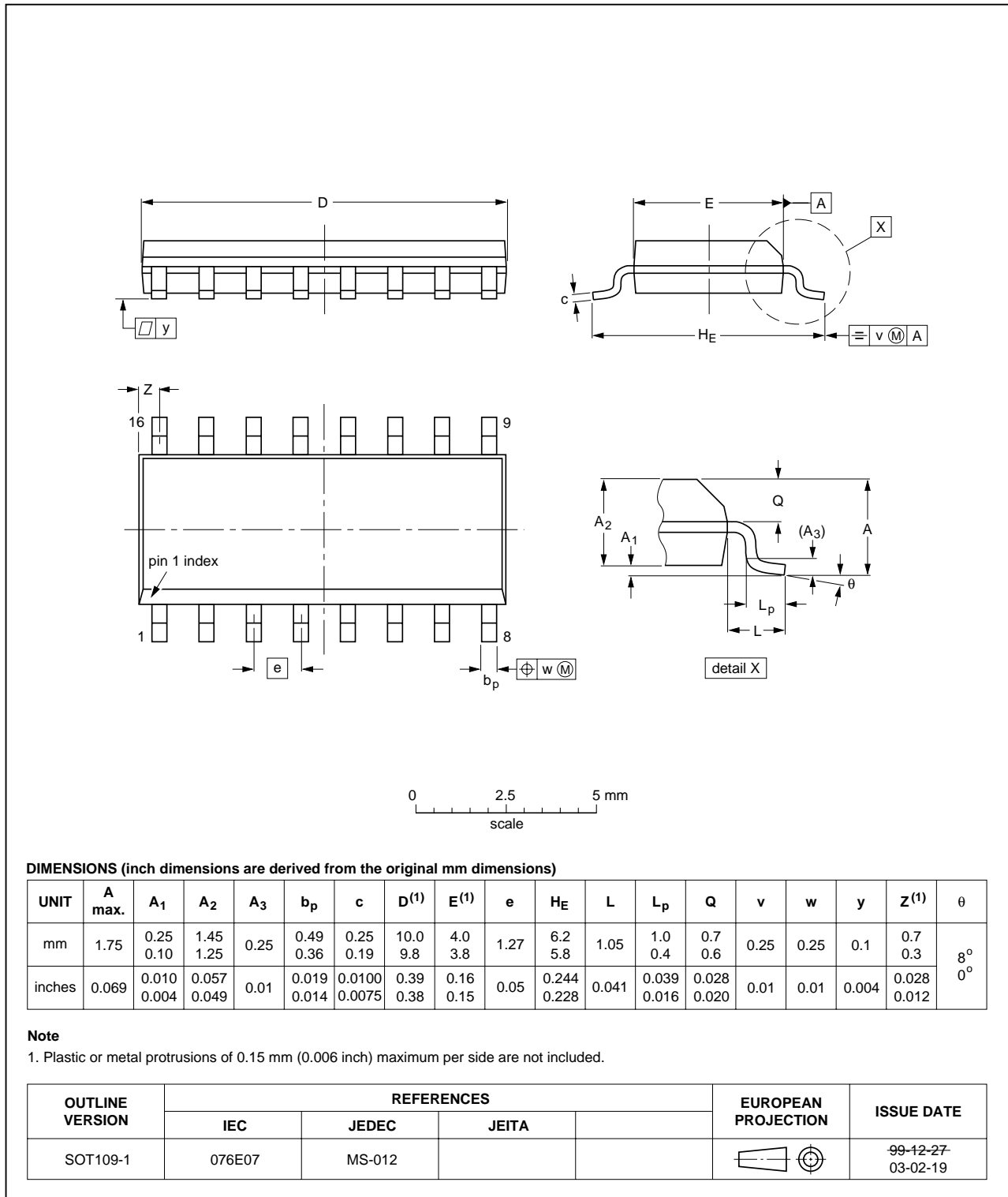


Fig 20. Package outline SOT109-1 (SO16)

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

SOT338-1

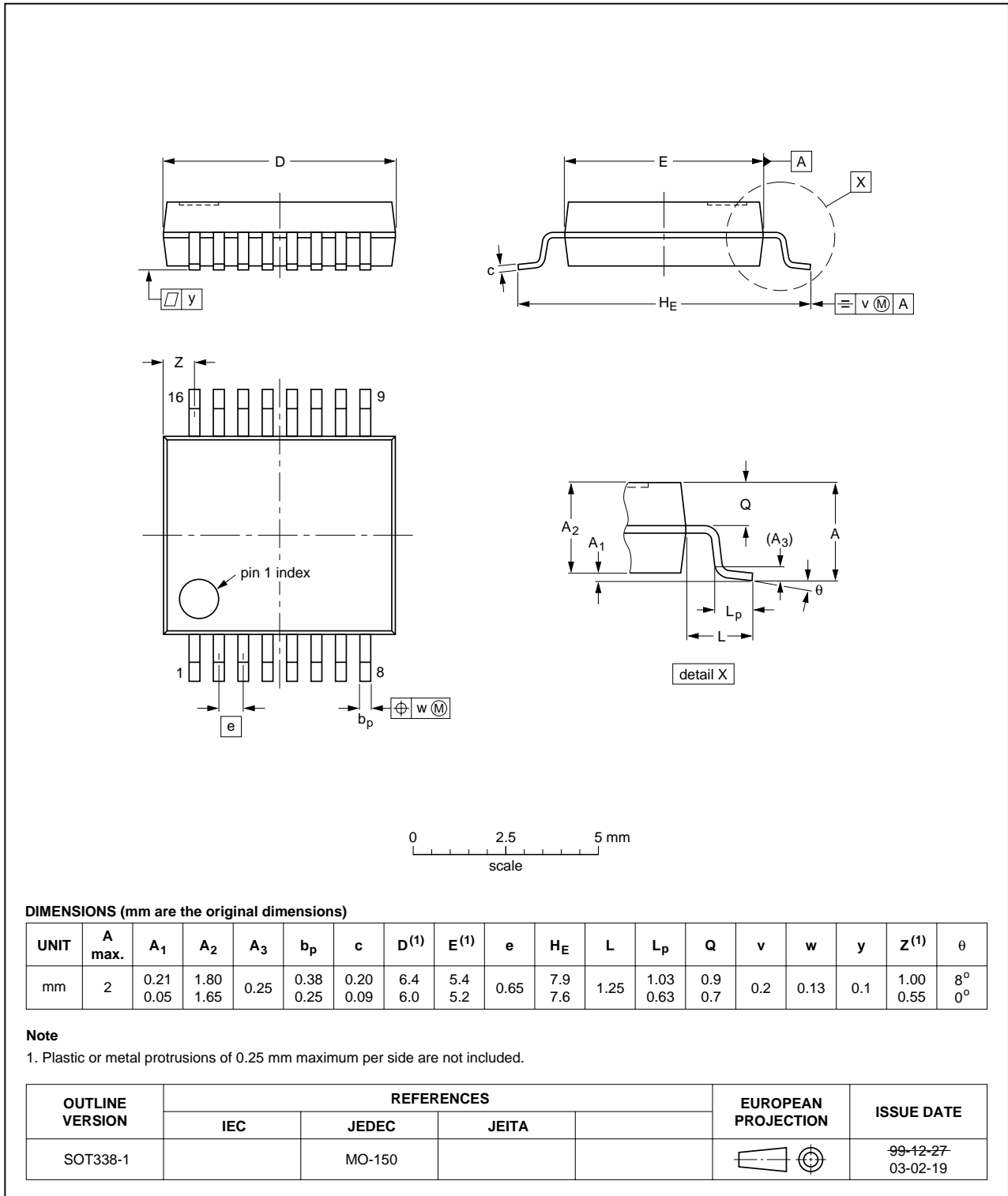


Fig 21. Package outline SOT338-1 (SSOP16)

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

SOT403-1

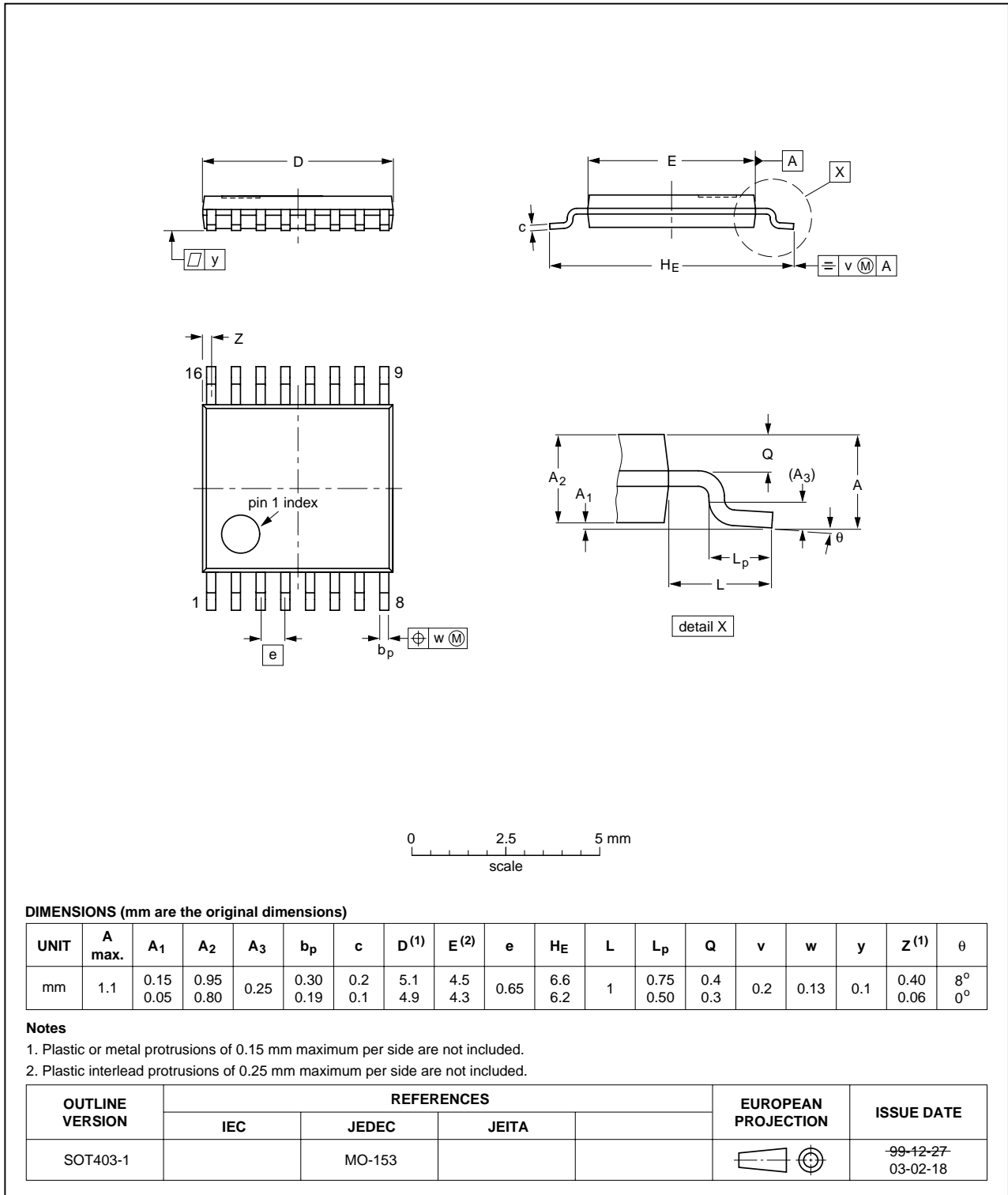


Fig 22. Package outline SOT403-1 (TSSOP16)

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

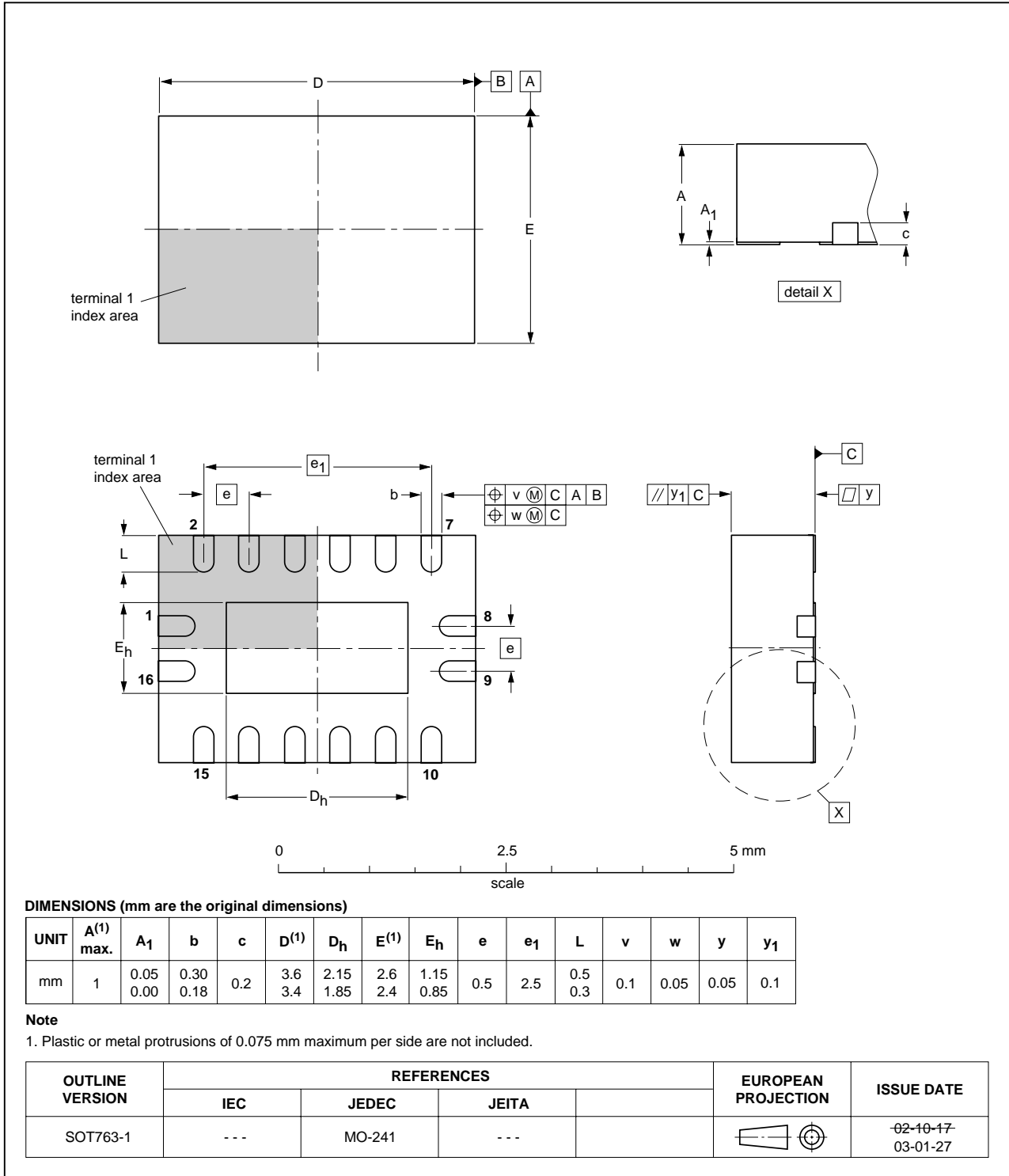


Fig 23. Package outline SOT763-1 (DHVQFN16)

16. Revision history

Table 15: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74HC_HCT4051_3	20051219	Product specification	-	-	74HC_HCT4051_CNV_2

Modifications:

- The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.
- [Section 5 “Ordering information”](#) and [Section 15 “Package outline”](#): modified to include type numbers 74HC4051BQ and 4HC4T051BQ (DHVQFN16 package).

17. Data sheet status

Level	Data sheet status ^[1]	Product status ^[2] ^[3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

18. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

19. Disclaimers

Life support — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors

21. Contact information

For additional information, please visit: <http://www.semiconductors.philips.com>

For sales office addresses, send an email to: sales.addresses@www.semiconductors.philips.com

customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

20. Trademarks

Notice — All referenced brands, product names, service names and trademarks are the property of their respective owners.

22. Contents

1	General description	1
2	Features	1
3	Applications	1
4	Quick reference data	2
5	Ordering information	3
6	Functional diagram	4
7	Pinning information	6
7.1	Pinning	6
7.2	Pin description	6
8	Functional description	7
8.1	Function table	7
9	Limiting values	7
10	Recommended operating conditions	8
11	Static characteristics	9
12	Dynamic characteristics	15
13	Waveforms	19
14	Additional dynamic characteristics	22
15	Package outline	25
16	Revision history	30
17	Data sheet status	31
18	Definitions	31
19	Disclaimers	31
20	Trademarks	31
21	Contact information	31



© Koninklijke Philips Electronics N.V. 2005

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Date of release: 19 December 2005
Document number: 74HC_HCT4051_3

Published in The Netherlands