

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

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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

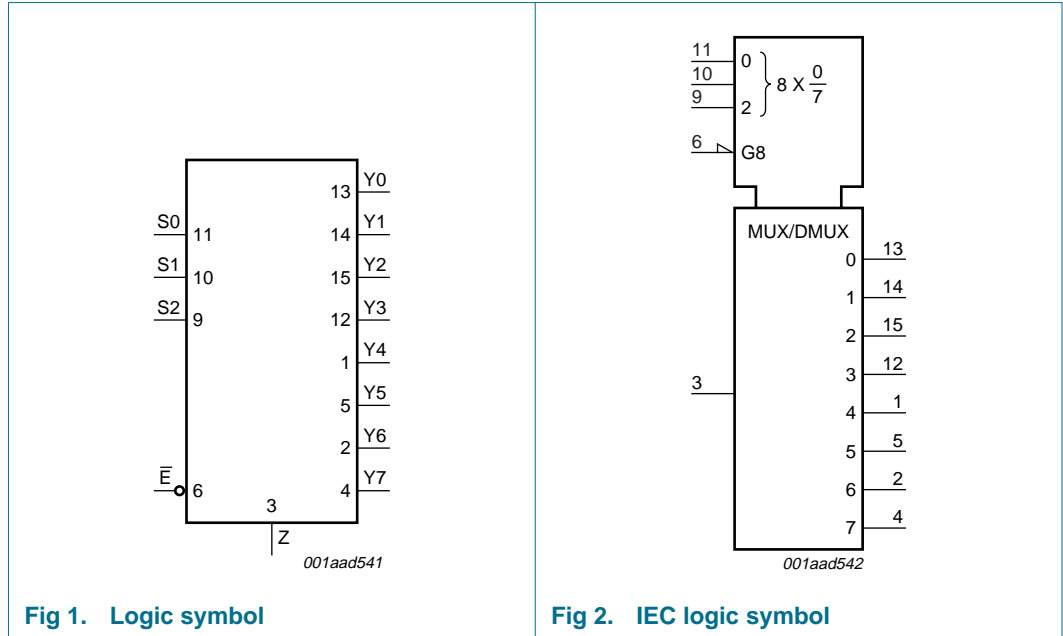


Fig 1. Logic symbol

Fig 2. IEC logic symbol

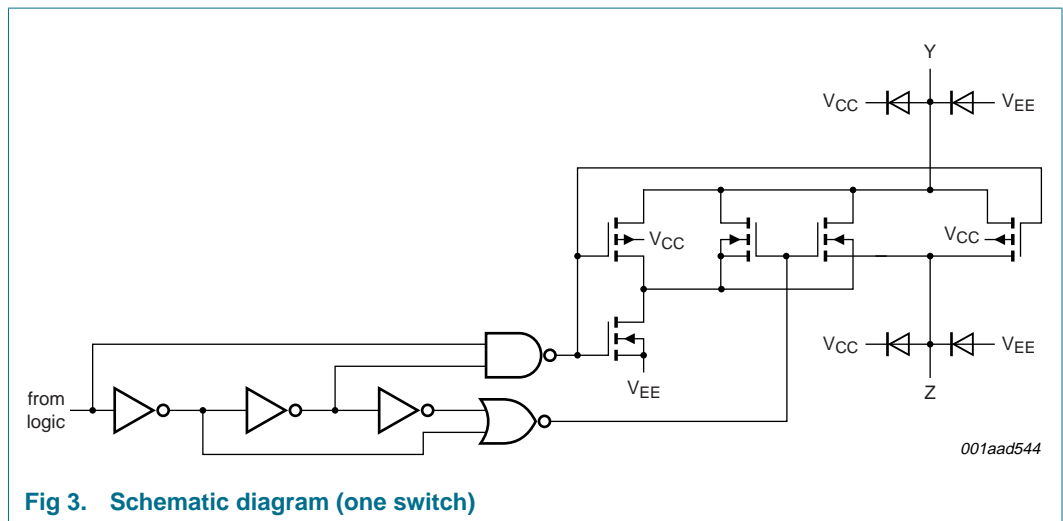
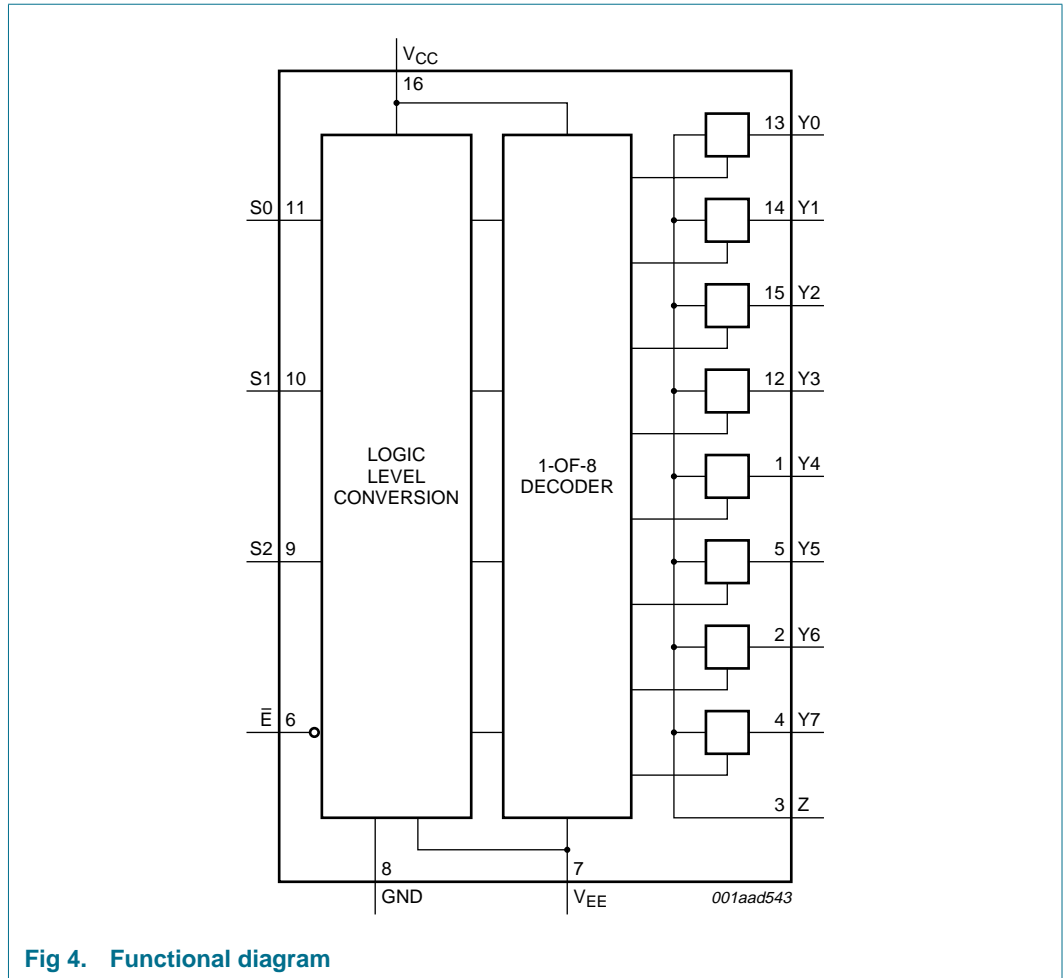
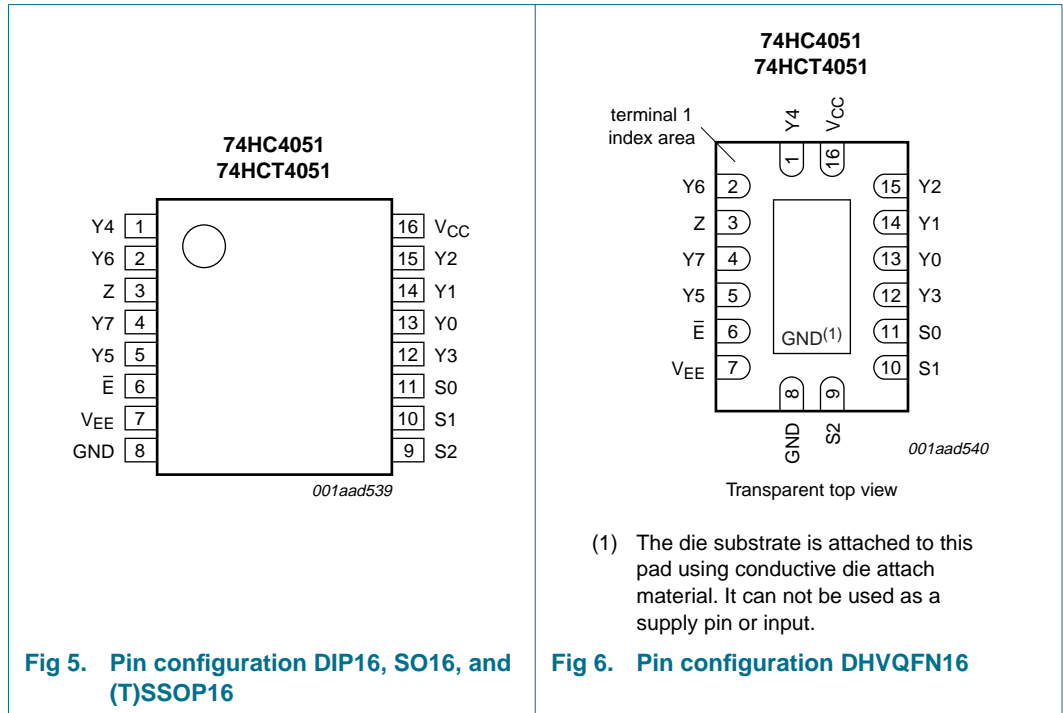


Fig 3. Schematic diagram (one switch)



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} .

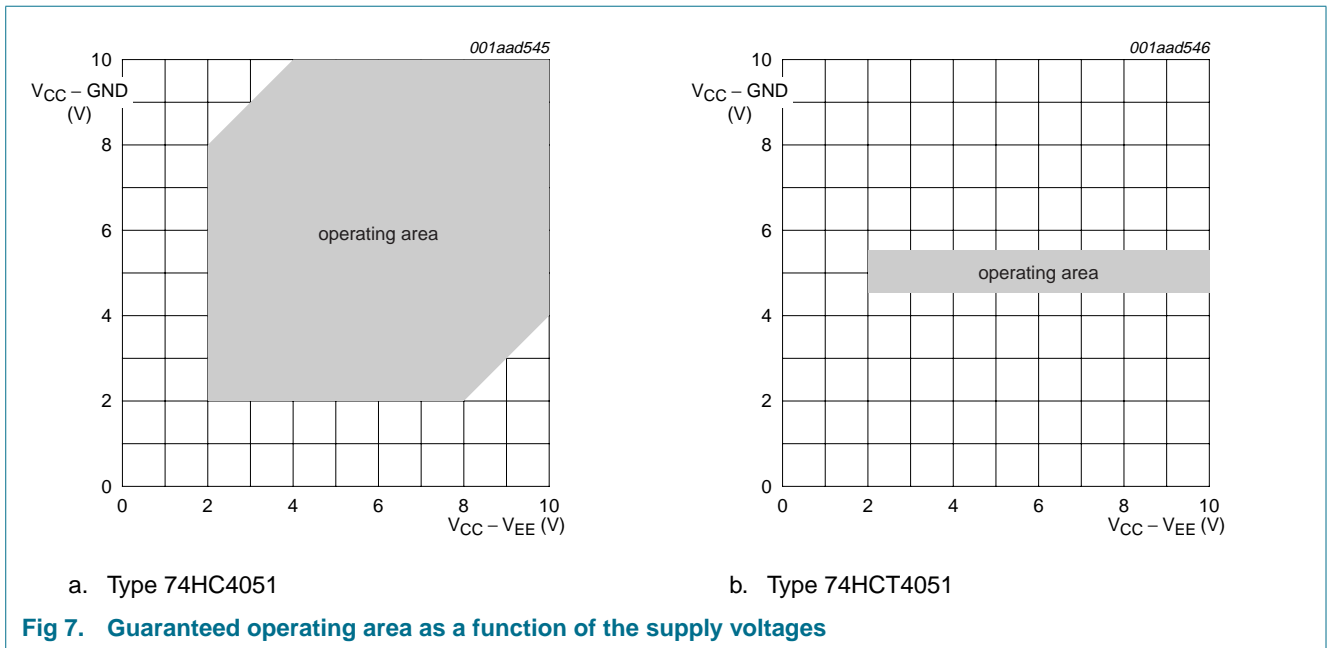
- [2] For DIP16 packages, above 70 °C, P_{tot} derates linearly with 12 mW/K.

[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 $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$ 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	
$T_{amb} = 25\text{ }^\circ\text{C}$							
$R_{ON(peak)}$	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	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	100	180	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	90	160	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	70	130	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]	-	150	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	80	140	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	70	120	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	60	105	Ω	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 100\text{ }\mu\text{A}$	[1]	-	150	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	90	160	Ω	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	80	140	Ω	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_S = 1000\text{ }\mu\text{A}$	-	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.

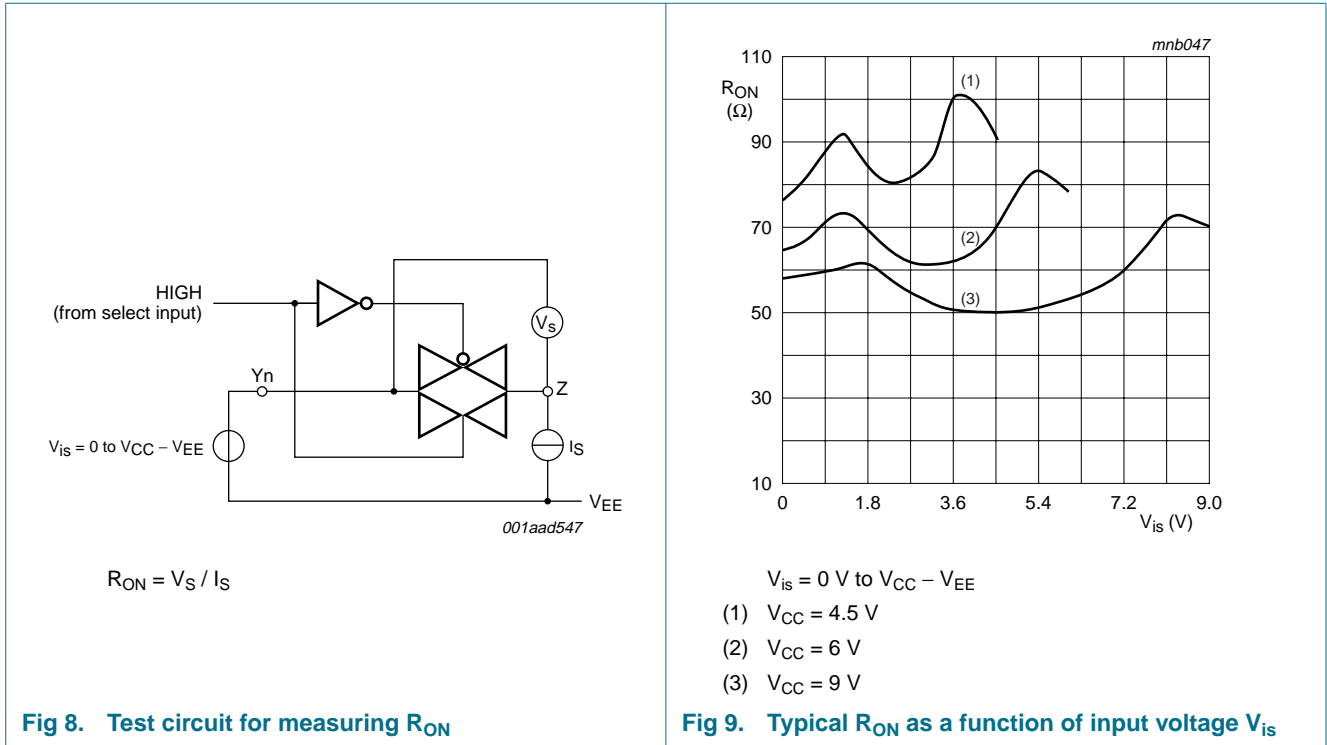


Table 8: Static characteristics type 74HC4051

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

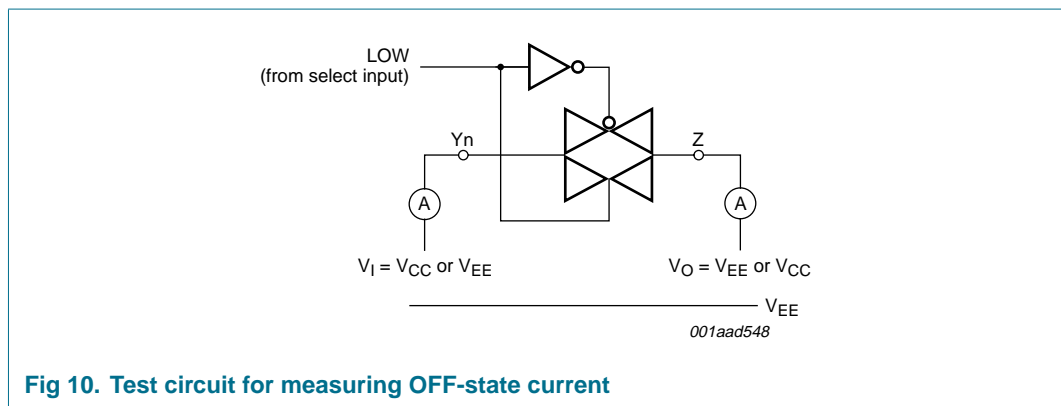


Fig 10. Test circuit for measuring OFF-state current

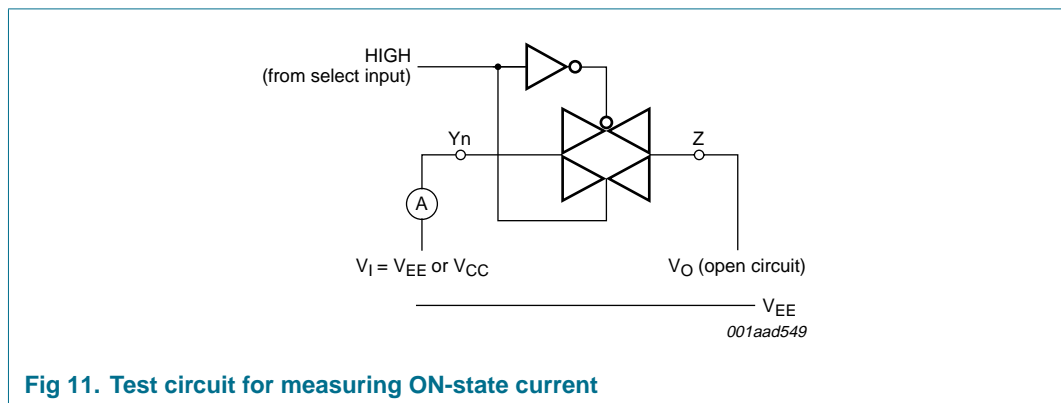


Fig 11. Test circuit for measuring ON-state current

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	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	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	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	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	$R_L = 1\text{ k}\Omega$; see Figure 13				
	\bar{E} to V_{os}	$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	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):

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

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} .

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

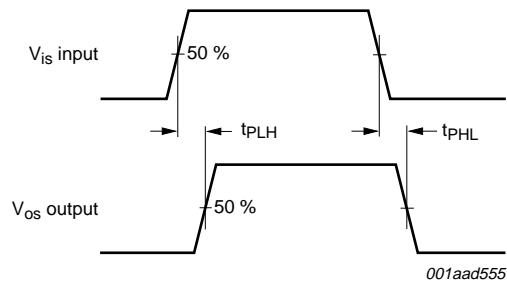


Fig 12. Input (V_{is}) to output (V_{os}) propagation delays

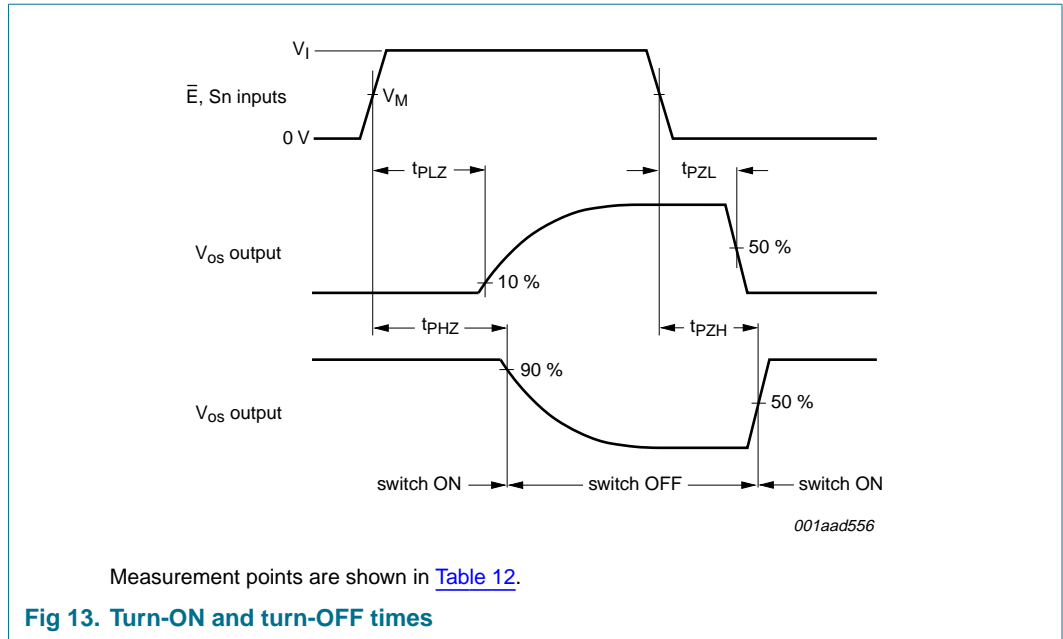


Table 12: Measuring points

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

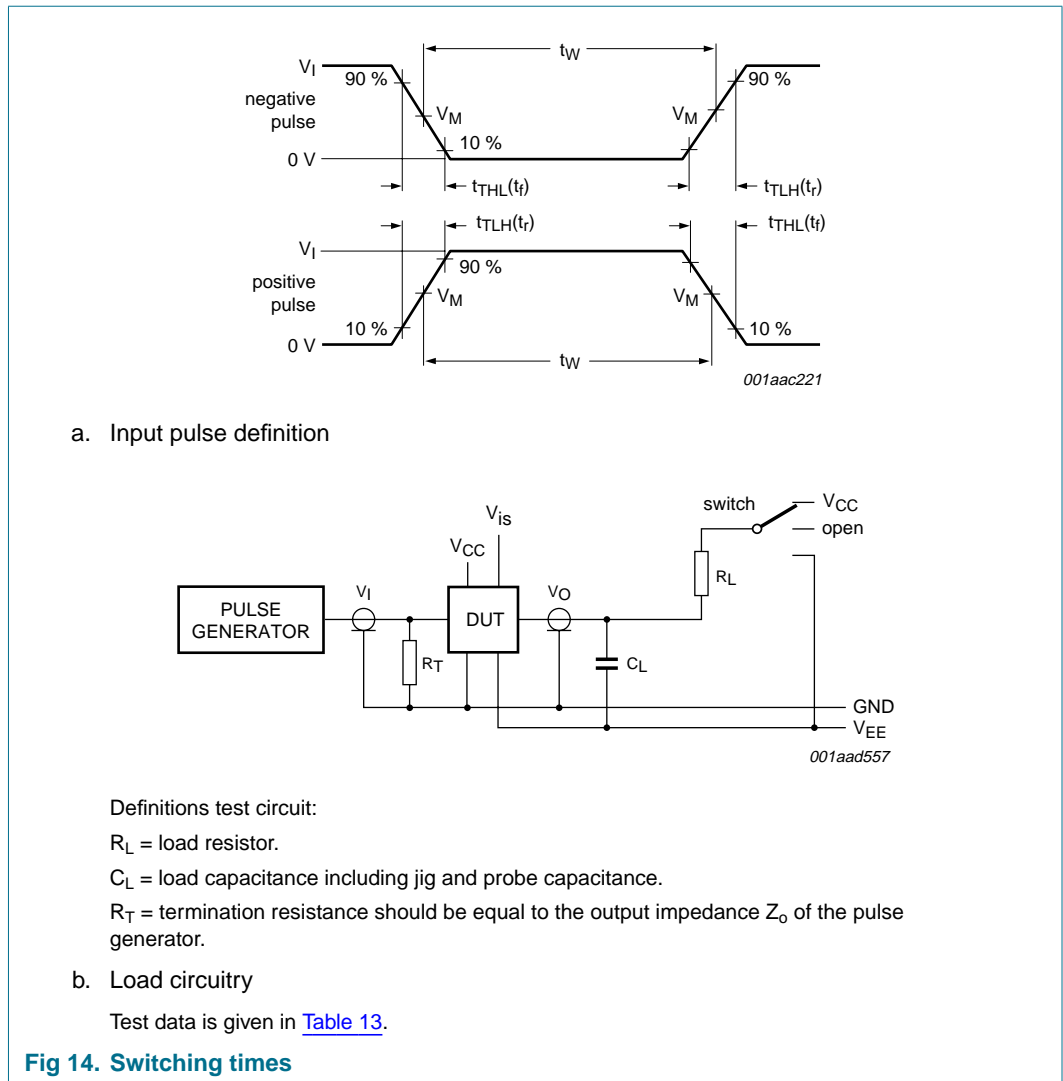


Table 13: Test data

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 V; T_{amb} = 25 °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 kΩ; C _L = 50 pF; see Figure 15				
		f _i = 1 kHz				
		V _{CC} = 2.25 V; V _{EE} = -2.25 V; V _{is(p-p)} = 4.0 V	-	0.04	-	%
		V _{CC} = 4.5 V; V _{EE} = -4.5 V; V _{is(p-p)} = 8.0 V	-	0.02	-	%
		f _i = 10 kHz				
α _{(ft)OFF}	switch OFF-state signal feed-through suppression	R _L = 600 Ω; C _L = 50 pF; see Figure 16	[1]			
		V _{CC} = 2.25 V; V _{EE} = -2.25 V	-	-50	-	dB
		V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	-50	-	dB
V _{ct(p-p)}	crosstalk voltage (peak-to-peak value)	R _L = 600 Ω; C _L = 50 pF; f _i = 1 MHz; \bar{E} or S _n square-wave between V _{CC} and GND; t _r = t _f = 6 ns; see Figure 17				
		between \bar{E} or S _n and Y _n or Z				
		V _{CC} = 4.5 V; V _{EE} = 0 V	-	110	-	mV
f _{h(-3dB)}	-3 dB high frequency	V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	220	-	mV
		R _L = 50 Ω; C _L = 10 pF; see Figure 18	[2]			
		V _{CC} = 2.25 V; V _{EE} = -2.25 V	-	170	-	MHz
C _S	switch capacitance	V _{CC} = 4.5 V; V _{EE} = -4.5 V	-	180	-	MHz
		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).

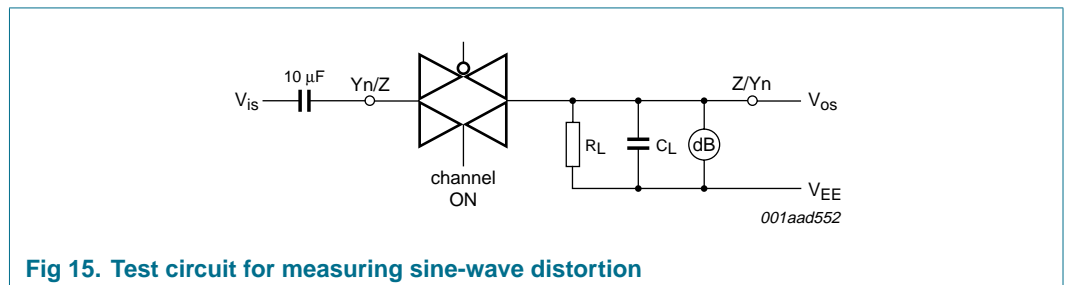
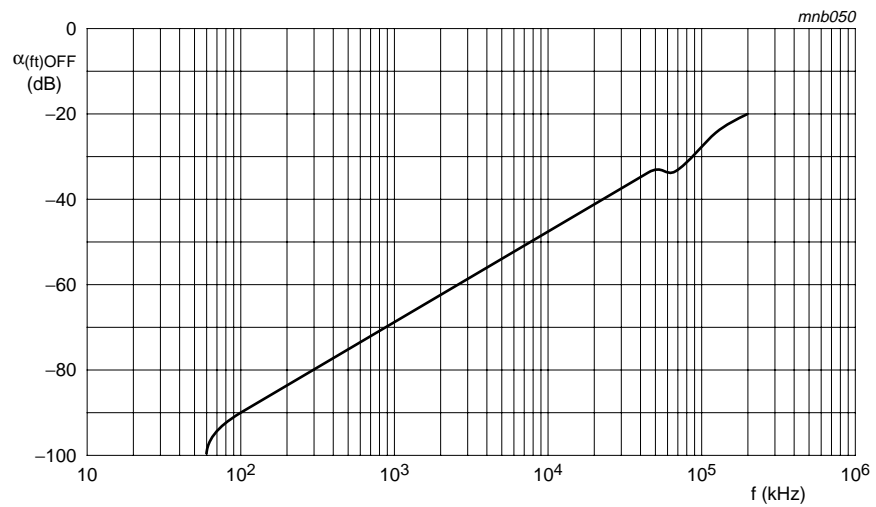
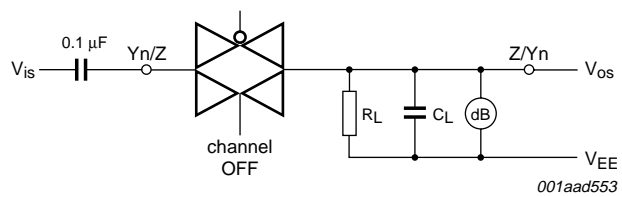


Fig 15. Test circuit for measuring sine-wave distortion



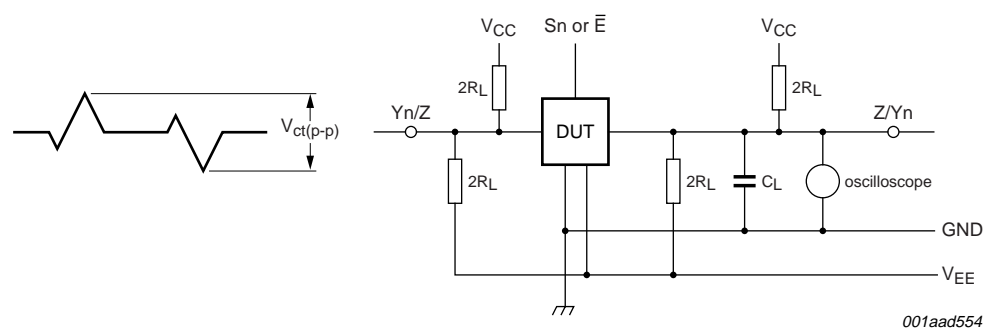
a. Feed-through as a function of frequency



b. Test circuit

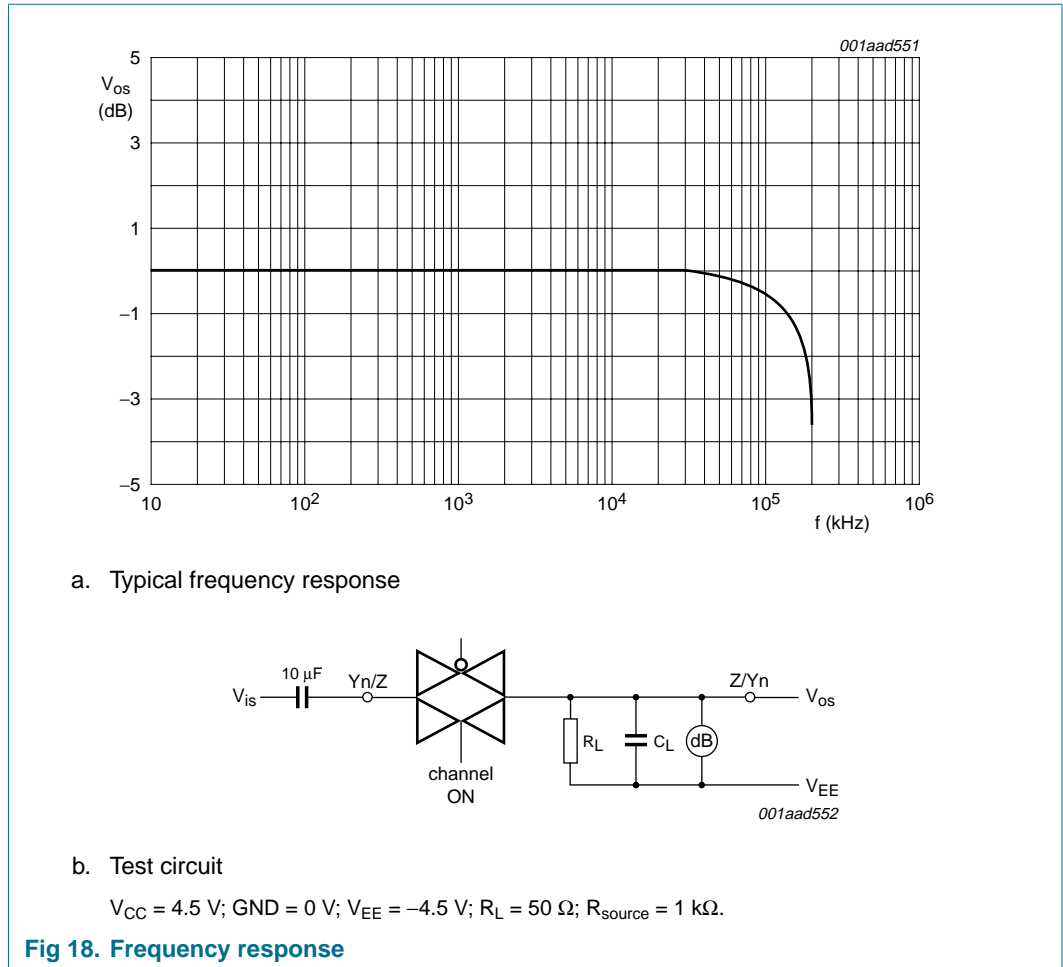
$V_{CC} = 4.5 \text{ V}$; $GND = 0 \text{ V}$; $V_{EE} = -4.5 \text{ V}$; $R_L = 600 \ \Omega$; $R_{source} = 1 \text{ k}\Omega$.

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

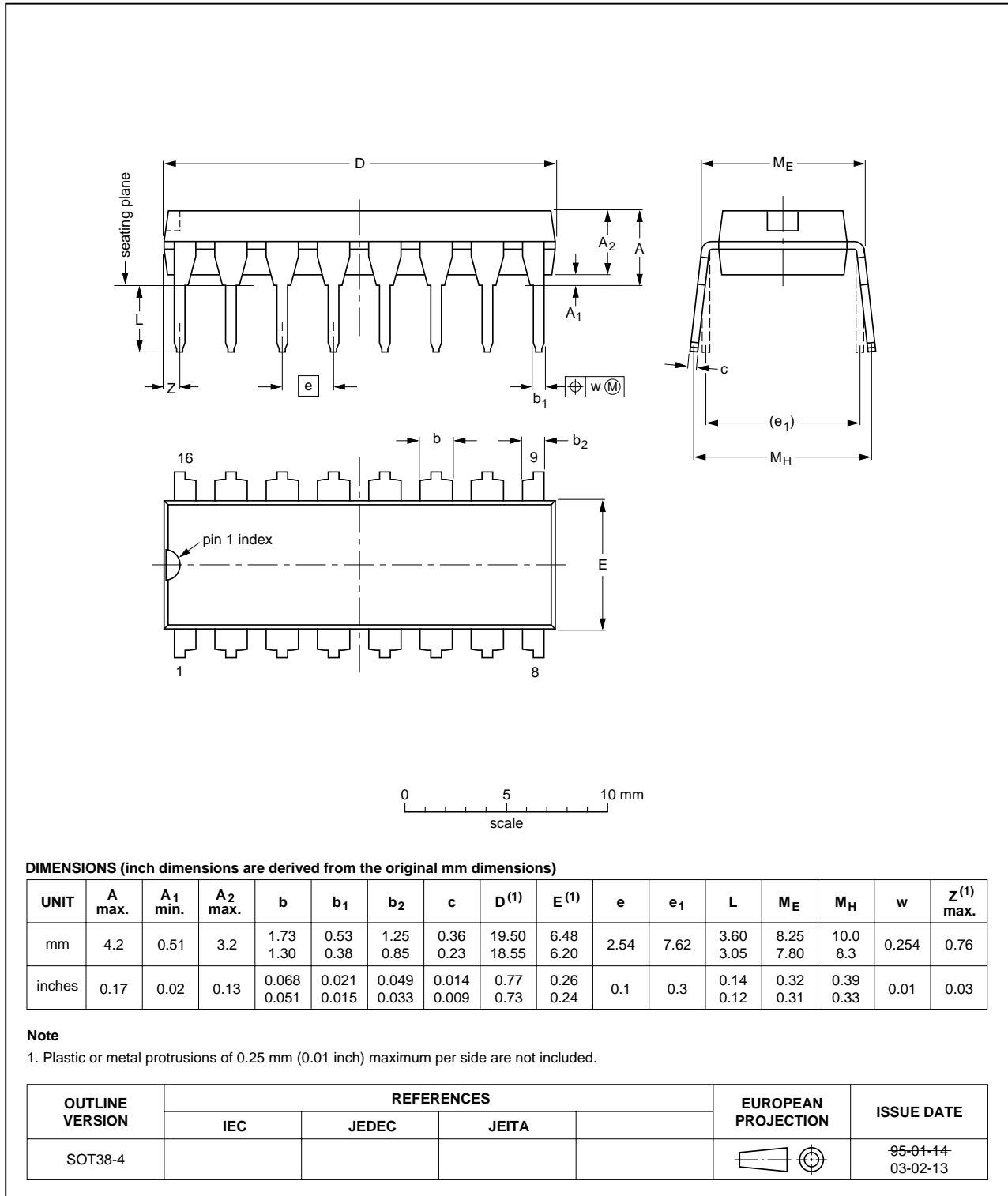


Fig 19. Package outline SOT38-4 (DIP16)

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

SOT109-1

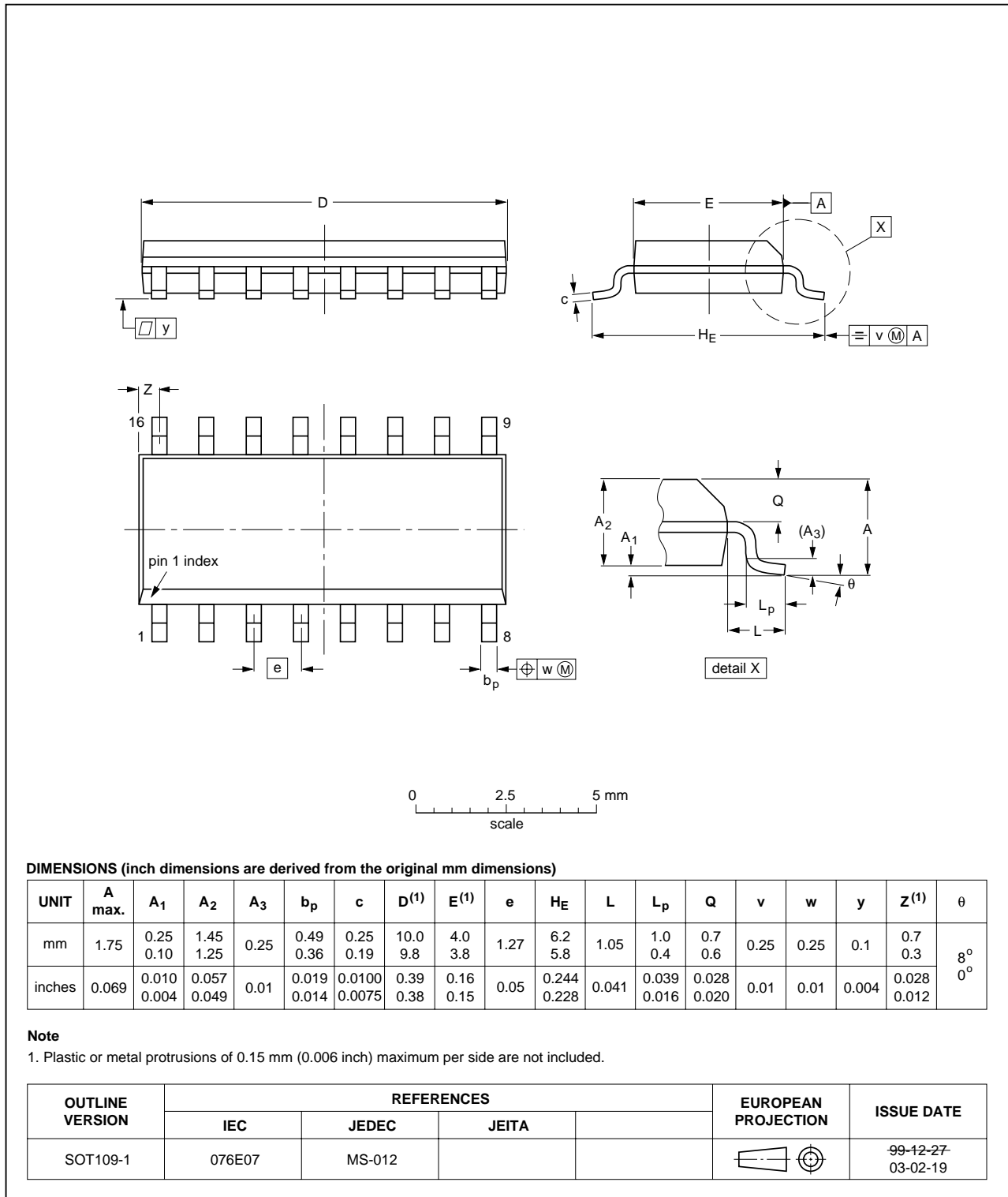


Fig 20. Package outline SOT109-1 (SO16)

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

SOT338-1

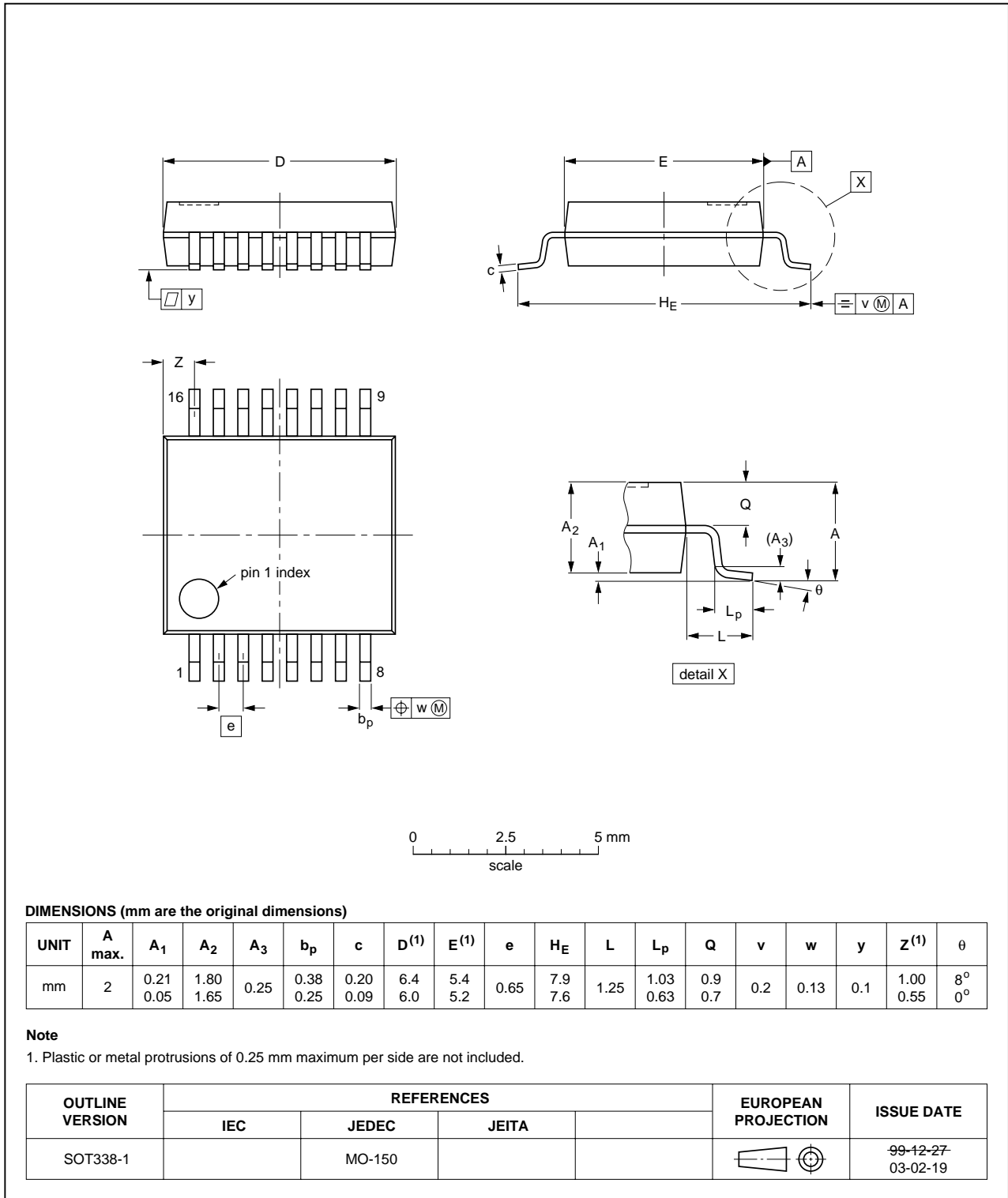


Fig 21. Package outline SOT338-1 (SSOP16)

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

SOT403-1

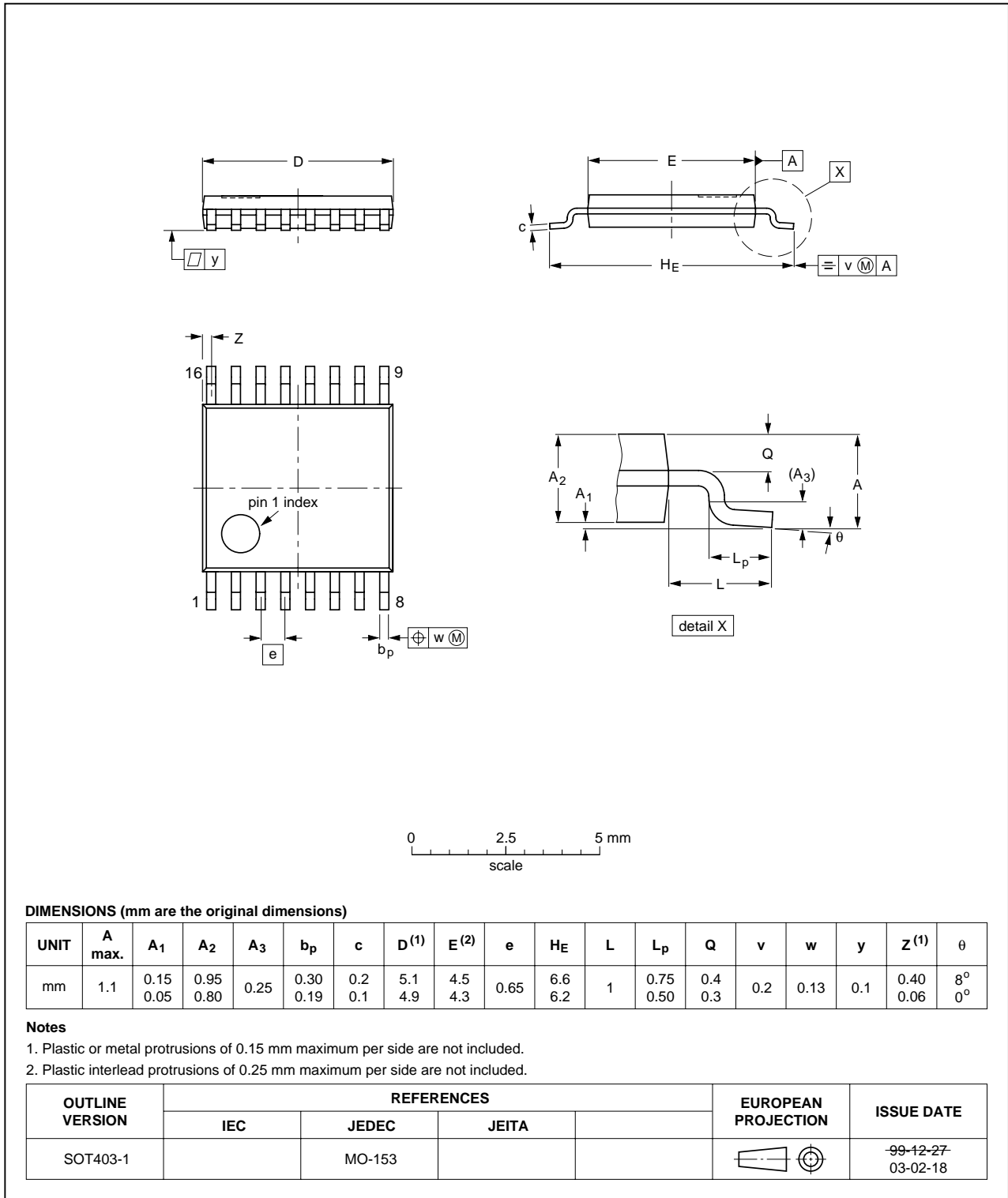


Fig 22. Package outline SOT403-1 (TSSOP16)

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

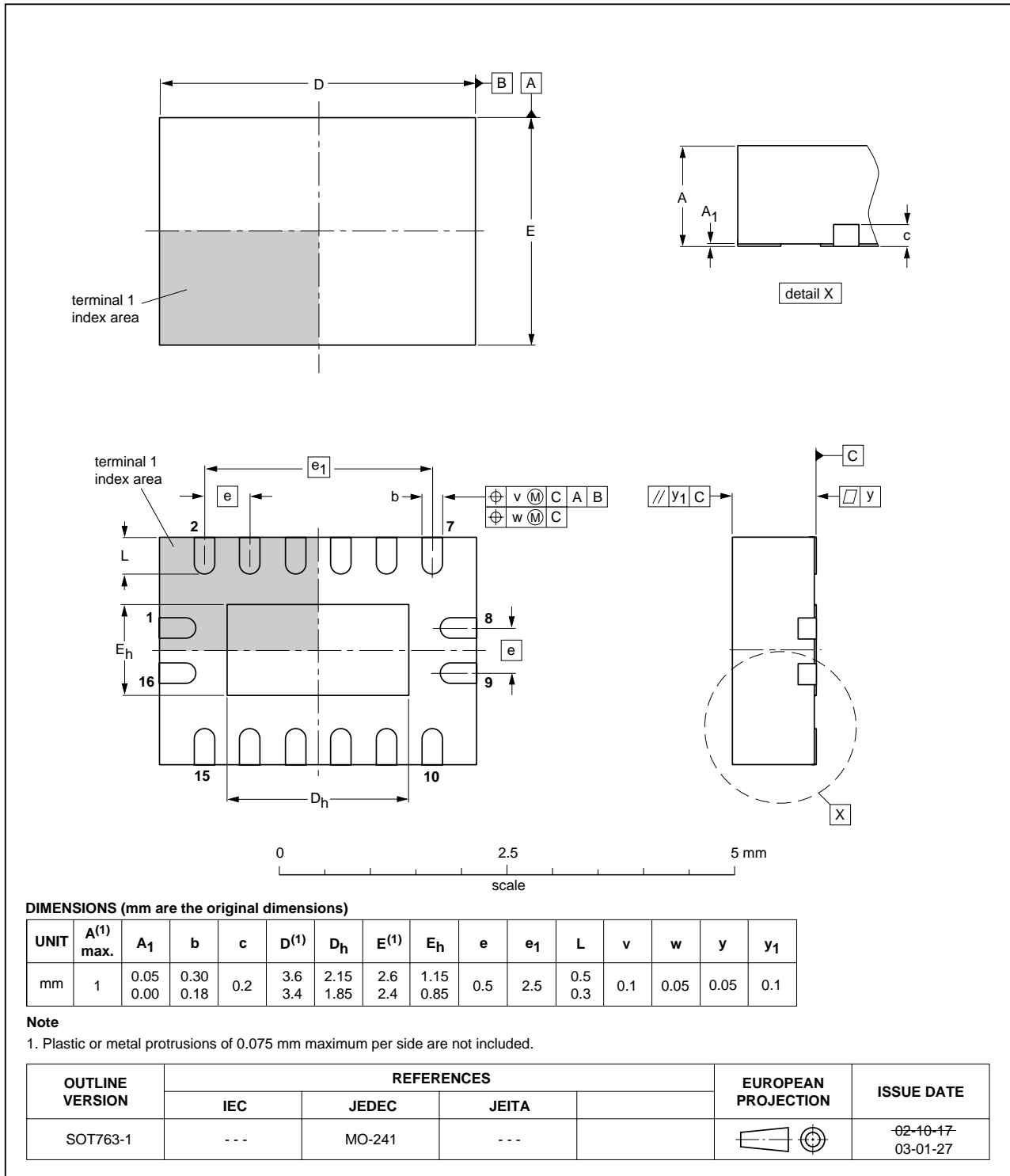


Fig 23. Package outline SOT763-1 (DHVQFN16)

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.
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[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.

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