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Team Nexperia

74HC4316; 74HCT4316

Quad single-pole single-throw analog switch

Rev. 3 — 2 January 2017

Product data sheet

1. General description

The 74HC4316; 74HCT4316 is a quad single pole, single throw analog switch (SPST). Each switch features two input/output terminals (nY and nZ) and an active HIGH enable input (nS). When nS is LOW, the analog switch is turned off. When \bar{E} is HIGH all four analog 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

- Input levels \bar{E} and nS inputs:
 - ◆ For 74HC4316: CMOS level
 - ◆ For 74HCT4316: TTL level
- Low ON resistance:
 - ◆ 160 Ω (typical) at $V_{CC} - V_{EE} = 4.5$ V
 - ◆ 120 Ω (typical) at $V_{CC} - V_{EE} = 6.0$ V
 - ◆ 80 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
- Specified in compliance with JEDEC standard no. 7A
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C

3. Applications

- Signal gating
- Modulation
- Demodulation
- Chopper



4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC4316D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4316D				
74HC4316DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT4316DB				
74HC4316PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4316PW				

5. Functional diagram

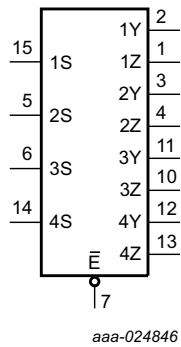


Fig 1. Logic symbol

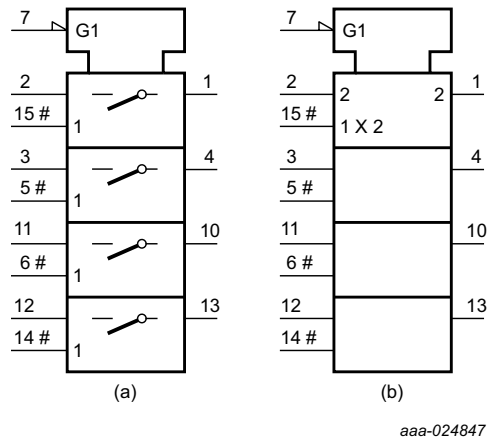


Fig 2. IEC logic symbol

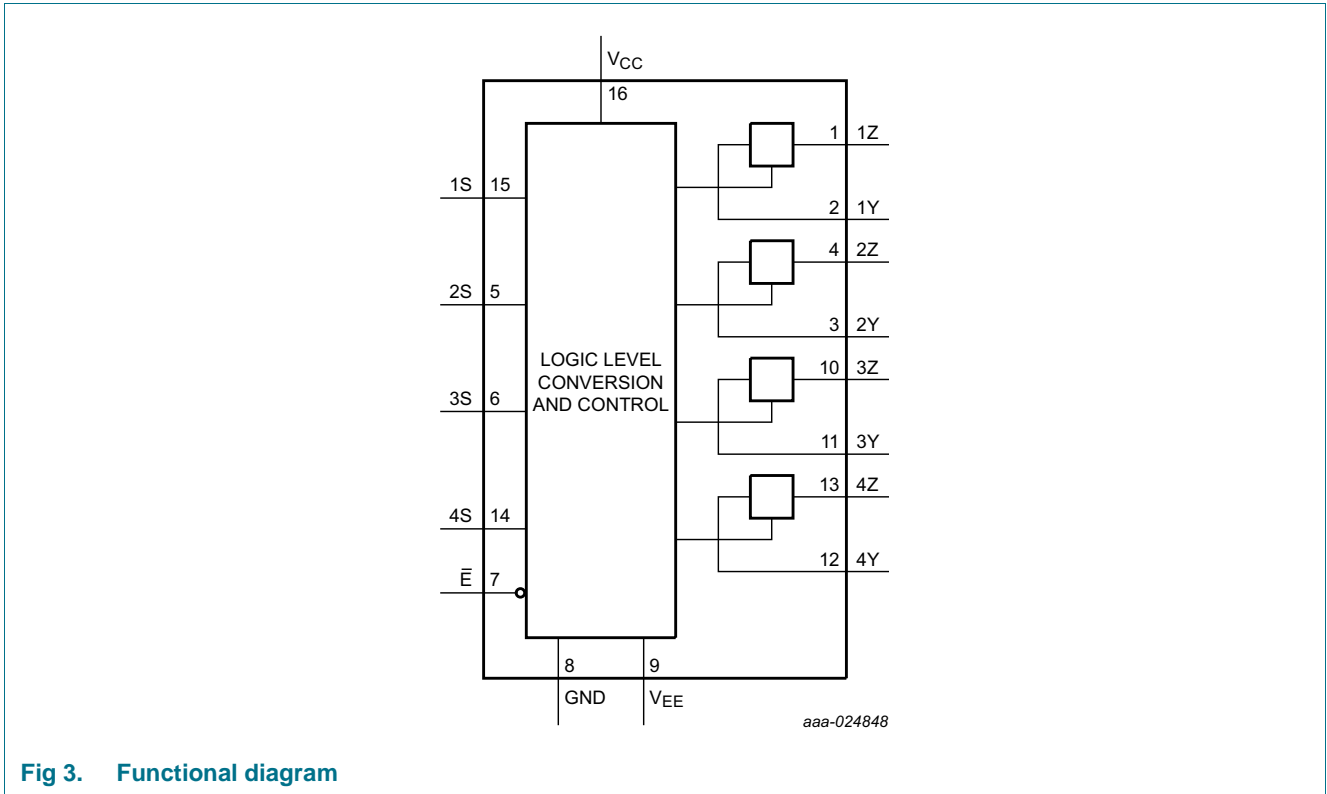


Fig 3. Functional diagram

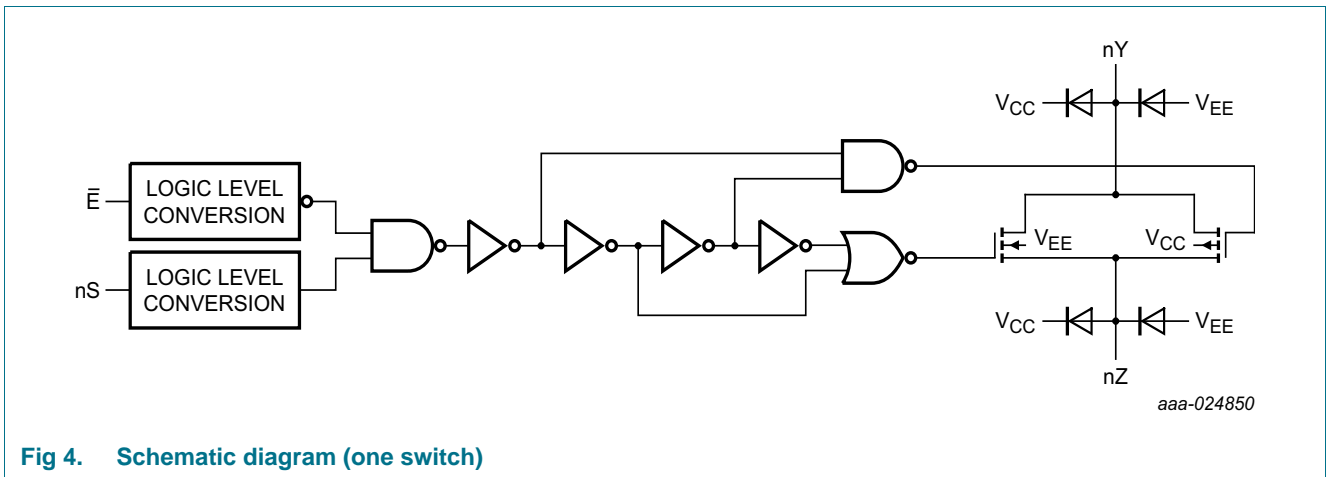


Fig 4. Schematic diagram (one switch)

6. Pinning information

6.1 Pinning

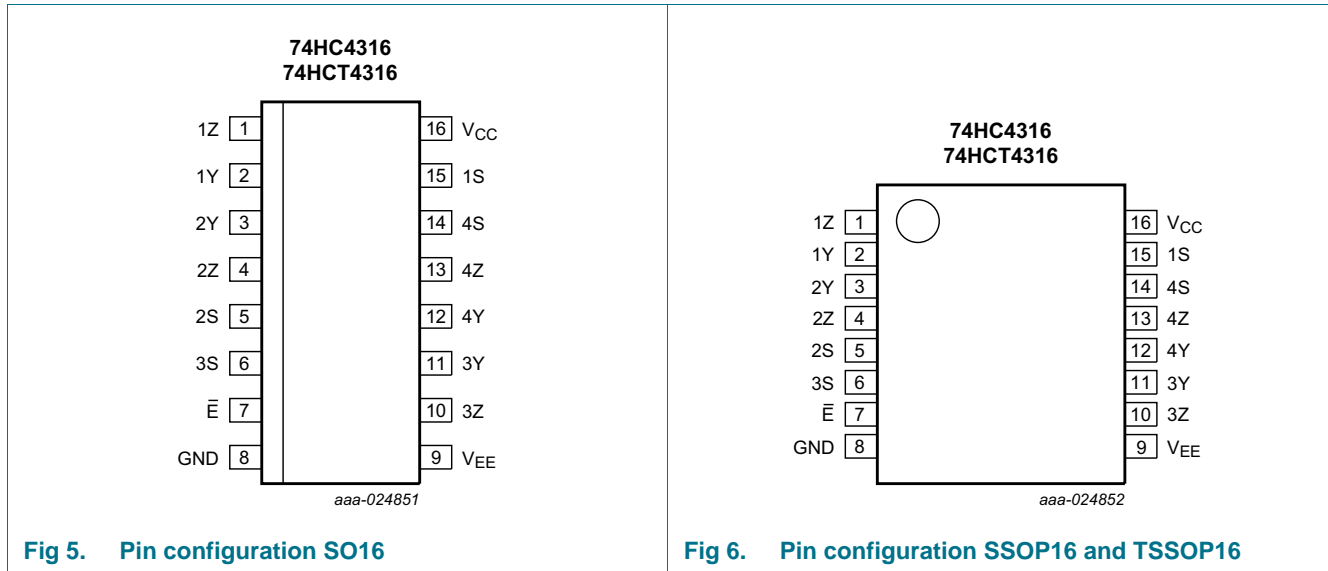


Fig 5. Pin configuration SO16

Fig 6. Pin configuration SSOP16 and TSSOP16

6.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1Z, 2Z, 3Z, 4Z	1, 4, 10, 13	independent input or output
1Y, 2Y, 3Y, 4Y	2, 3, 11, 12	independent input or output
\bar{E}	7	enable input (active LOW)
GND	8	ground (0 V)
V_{EE}	9	negative supply voltage
1S, 2S, 3S, 4S	15, 5, 6, 14	select input (active HIGH)
V_{CC}	14	positive supply voltage

7. Functional description

Table 3. Function table^[1]

Input		Switch
\bar{E}	nS	
L	L	OFF
L	H	ON
H	X	OFF

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

8. Limiting values

Table 4. Limiting values

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

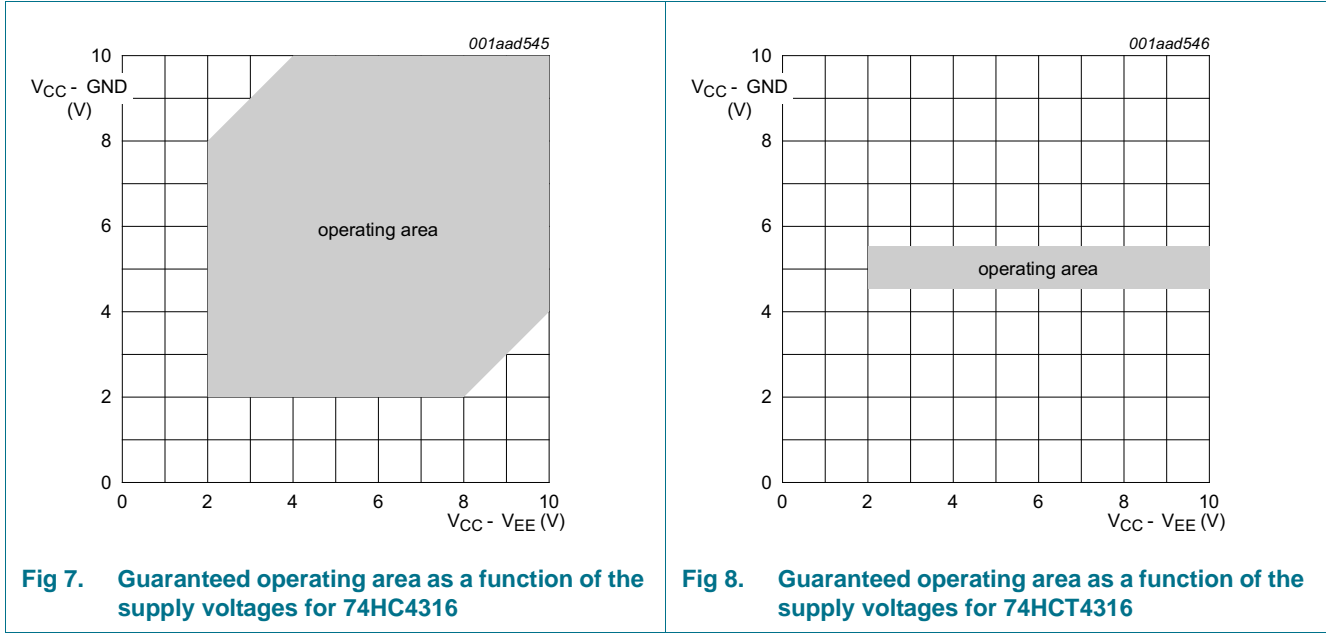
Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+11.0	V
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	± 20	mA
I_{SK}	switch clamping current	$V_{SW} < -0.5\text{ V}$ or $V_{SW} > V_{CC} + 0.5\text{ V}$	-	± 20	mA
I_{SW}	switch current	$V_{SW} = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$ [1]	-	± 25	mA
I_{EE}	supply current		-	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	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$			
		SO16 and (T)SSOP16 packages [2]	-	500	mW
P	power dissipation	per switch	-	100	mW

- [1] To avoid drawing V_{CC} current out of terminal nZ, when switch current flows in terminals nY, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal nZ, no V_{CC} current will flow out of terminals nY. In this case there is no limit for the voltage drop across the switch, but the voltages at nY and nZ may not exceed V_{CC} or V_{EE} .
- [2] For SO16 package: P_{tot} derates linearly with 8 mW/K above 70 °C.
For (T)SSOP16 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	74HC4316			74HCT4316			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage	see Figure 7 and Figure 8							
		$V_{CC} - GND$	2.0	5.0	10.0	4.5	5.0	5.5	V
		$V_{EE} - GND$	2.0	5.0	10.0	2.0	5.0	10.0	V
V_I	input voltage		GND	-	V_{CC}	GND	-	V_{CC}	V
V_{SW}	switch voltage		V_{EE}	-	V_{CC}	V_{EE}	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	-	-	-	ns/V
		$V_{CC} = 10.0\text{ V}$	-	-	35	-	-	-	ns/V



10. Static characteristics

Table 6. RON resistance per switch for types 74HC4316 and 74HCT4316

VI = VIH or VIL; for test circuit see Figure 9.

Vis is the input voltage at a nY or nZ terminal, whichever is assigned as an input.

Vos is the output voltage at a nY or nZ terminal, whichever is assigned as an output.

For 74HC4316: VCC - GND or VCC - VEE = 2.0 V, 4.5 V, 6.0 V and 9.0 V.

For 74HCT4316: VCC - GND = 4.5 V and 5.5 V; VCC - VEE = 2.0 V, 4.5 V, 6.0 V and 9.0 V.

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Typ ^[1]	Max	Min	Max	Min	Max	
RON(peak)	ON resistance (peak)	V _{is} = V _{CC} to V _{EE} ^[2]							
		V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA	-	-	-	-	-	-	Ω
		V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA	160	320	-	400	-	480	Ω
		V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA	120	240	-	300	-	360	Ω
		V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA	85	170	-	215	-	255	Ω

Table 6. R_{ON} resistance per switch for types 74HC4316 and 74HCT4316 ...continued

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

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

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

For 74HC4316: $V_{CC} - GND$ or $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$ and 9.0 V .

For 74HCT4316: $V_{CC} - GND = 4.5\text{ V}$ 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	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Typ ^[1]	Max	Min	Max	Min	Max	
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}$ ^[2]							
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	160	-	-	-	-	-	Ω
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	80	160	-	200	-	240	Ω
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	70	140	-	175	-	210	Ω
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	60	120	-	150	-	180	Ω
		$V_{is} = V_{CC}$ ^[2]							
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\ \mu\text{A}$	170	-	-	-	-	-	Ω
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	90	180	-	225	-	270	Ω
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\ \mu\text{A}$	80	160	-	200	-	240	Ω
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\ \mu\text{A}$	65	135	-	170	-	205	Ω
ΔR_{ON}	ON resistance mismatch between channels	$V_{is} = V_{CC}$ to V_{EE} ^[2]							
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	-	-	-	-	Ω
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	16	-	-	-	-	-	Ω
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	9	-	-	-	-	-	Ω
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	6	-	-	-	-	-	Ω

[1] Typical values are measured at $T_{amb} = 25\text{ °C}$.

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

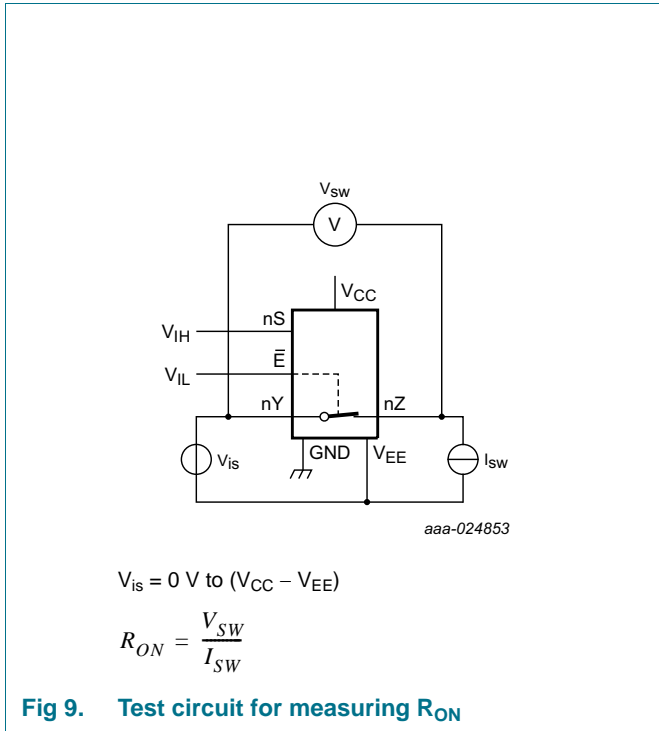


Fig 9. Test circuit for measuring R_{ON}

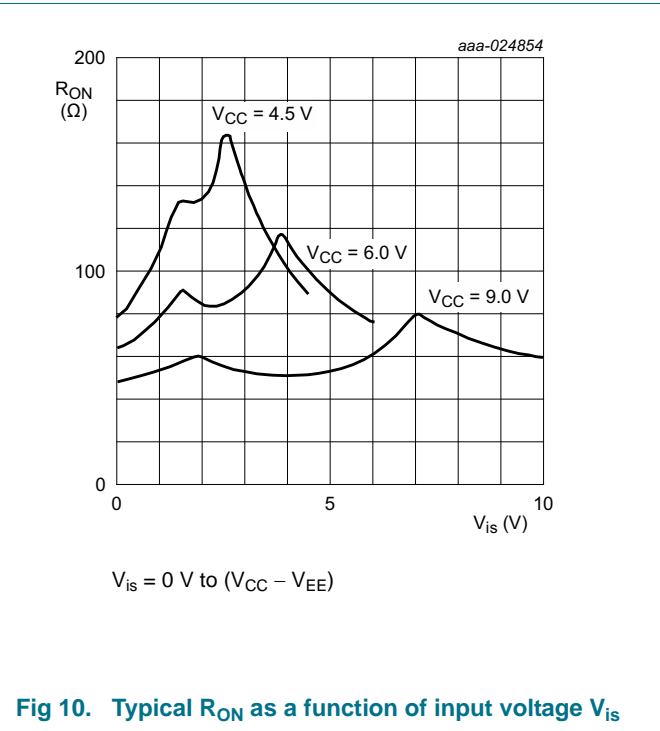


Fig 10. Typical R_{ON} as a function of input voltage V_{is}

Table 7. Static characteristics 74HC4316

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	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	4.3	-	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	$V_I = V_{CC} \text{ or GND}$				
		$V_{CC} = 6.0 \text{ V}; V_{EE} = 0 \text{ V}$	-	-	± 0.1	μA
		$V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V}$	-	-	± 0.2	μA
$I_{S(OFF)}$	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 Figure 11	-	-	± 0.1	μA
$I_{S(ON)}$	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 Figure 12	-	-	± 0.1	μA
I_{CC}	supply current	$V_I = V_{CC} \text{ or GND}; V_{is} = V_{EE} \text{ or } V_{CC}; V_{os} = V_{CC} \text{ or } V_{EE}$				
		$V_{CC} = 6.0 \text{ V}; V_{EE} = 0 \text{ V}$	-	-	8.0	μA
		$V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V}$	-	-	16.0	μA

Table 7. Static characteristics 74HC4316 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
C_i	input capacitance		-	3.5	-	pF
C_{sw}	switch capacitance		-	5	-	pF
$T_{amb} = -40\text{ °C to }+85\text{ °C}$						
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_I	input leakage current	$V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	± 1.0	μA
		$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	± 2.0	μA
$I_{S(OFF)}$	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 Figure 11	-	-	± 1.0	μA
$I_{S(ON)}$	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 Figure 12	-	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE}				
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	80.0	μA
		$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	160.0	μA
$T_{amb} = -40\text{ °C to }+125\text{ °C}$						
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_I	input leakage current	$V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	± 1.0	μA
		$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}$	-	-	± 2.0	μA
$I_{S(OFF)}$	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 Figure 11	-	-	± 1.0	μA
$I_{S(ON)}$	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 Figure 12	-	-	± 1.0	μA

Table 7. Static characteristics 74HC4316 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE}				
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V	-	-	160	μ A
		$V_{CC} = 10.0$ V; $V_{EE} = 0$ V	-	-	320	μ A

[1] Typical values are measured at $T_{amb} = 25$ °C.

Table 8. Static characteristics 74HCT4316

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
$T_{amb} = 25$ °C						
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	1.6	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	1.2	0.8	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V; $V_{EE} = 0$ V	-	-	± 0.1	μ A
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10$ V; $V_{EE} = 0$ V; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11	-	-	± 0.1	μ A
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10$ V; $V_{EE} = 0$ V; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 12	-	-	± 0.1	μ 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}				
		$V_{CC} = 5.5$ V; $V_{EE} = 0$ V	-	-	8.0	μ A
		$V_{CC} = 5.0$ V; $V_{EE} = -5.0$ V	-	-	16.0	μ A
ΔI_{CC}	additional supply current	nS and \bar{E} ; per input pin; $V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V; $V_{EE} = 0$ V	-	50	180	μ A
C_I	input capacitance		-	3.5	-	pF
C_{SW}	switch capacitance		-	5	-	pF

Table 8. Static characteristics 74HCT4316 ...continued

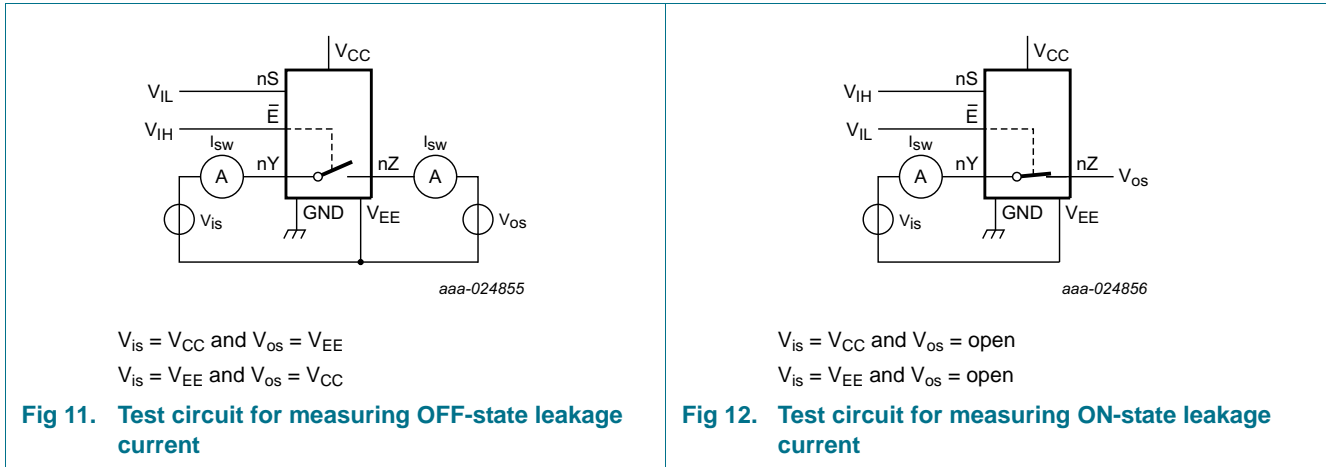
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

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

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
$T_{amb} = -40\text{ °C to }+85\text{ °C}$						
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_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	± 1.0	μA
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11	-	-	± 1.0	μA
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 12	-	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE}	-	-	-	-
		$V_{CC} = 5.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	80	μA
		$V_{CC} = 5.0\text{ V}$; $V_{EE} = -5.0\text{ V}$	-	-	160	μA
ΔI_{CC}	additional supply current	nS and \bar{E} ; per input pin; $V_I = V_{CC} - 2.1\text{ V}$; other inputs at V_{CC} or GND; $V_{CC} = 4.5\text{ V to }5.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	225	μA
$T_{amb} = -40\text{ °C to }+125\text{ °C}$						
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_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	± 1.0	μA
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11	-	-	± 1.0	μA
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 12	-	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE}	-	-	-	-
		$V_{CC} = 5.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	160	μA
		$V_{CC} = 5.0\text{ V}$; $V_{EE} = -5.0\text{ V}$	-	-	320	μA
ΔI_{CC}	additional supply current	nS and \bar{E} ; per input pin; $V_I = V_{CC} - 2.1\text{ V}$; other inputs at V_{CC} or GND; $V_{CC} = 4.5\text{ V to }5.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	-	245	μA

[1] Typical values are measured at $T_{amb} = 25\text{ °C}$.



11. Dynamic characteristics

Table 9. Dynamic characteristics 74HC4316

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

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

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

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Typ ^[1]	Max	Min	Max	Min	Max	
t_{pd}	propagation delay	nY to nZ or nZ to nY; $R_L = \infty\ \Omega$; see Figure 13 ^[2]							
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	17	60	-	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	6	12	-	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	5	10	-	13	-	15	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	4	8	-	10	-	12	ns
t_{off}	turn-off time	\bar{E} to nY or nZ; see Figure 14 ^[4]							
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	63	220	-	275	-	330	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	23	44	-	55	-	66	ns
		$V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$	20	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	18	37	-	47	-	56	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	21	39	-	49	-	59	ns
		nS to nY or nZ; see Figure 14 ^[4]							
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	55	175	-	220	-	265	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	20	35	-	44	-	53	ns
		$V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$	16	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	16	30	-	37	-	45	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	18	36	-	45	-	54	ns

Table 9. Dynamic characteristics 74HC4316 ...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 15](#).

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

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

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Typ ^[1]	Max	Min	Max	Min	Max	
t_{on}	turn-on time	\bar{E} to nY or nZ; see Figure 14 ^[3]							
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	61	205	-	255	-	310	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	22	41	-	51	-	62	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	35	-	43	-	53	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	19	37	-	47	-	56	ns
		nS to nY or nZ; see Figure 14 ^[3]							
		$V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$	52	175	-	220	-	265	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	19	35	-	44	-	53	ns
		$V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$	16	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$	15	30	-	37	-	45	ns
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	17	34	-	43	-	51	ns
C_{PD}	power dissipation capacitance	per switch; $V_I = GND$ to V_{CC} ^[5]	13	-	-	-	-	-	pF

[1] Typical values are measured at $T_{amb} = 25\text{ °C}$.

[2] t_{pd} is the same as t_{PHL} and t_{PLH} .

[3] t_{on} is the same as t_{PHZ} and t_{PLZ} .

[4] t_{off} is the same as t_{PZH} and t_{PZL} .

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

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

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

C_L = output load capacitance in pF;

C_{sw} = switch capacitance in pF;

V_{CC} = supply voltage in V.

Table 10. Dynamic characteristics 74HCT4316

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

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

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

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Typ ^[1]	Max	Min	Max	Min	Max	
t _{pd}	propagation delay	nY to nZ or nZ to nY; R _L = ∞ Ω; ^[2] see Figure 13							
		V _{CC} = 4.5 V; V _{EE} = 0 V	6	12	-	15	-	18	ns
		V _{CC} = 4.5 V; V _{EE} = -4.5 V	4	8	-	10	-	12	ns
t _{PZH}	OFF-state to HIGH propagation delay	\bar{E} to nY or nZ; see Figure 14							
		V _{CC} = 4.5 V; V _{EE} = 0 V	22	44	-	55	-	66	ns
		V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	19	-	-	-	-	-	ns
		V _{CC} = 4.5 V; V _{EE} = -4.5 V	21	42	-	53	-	63	ns
		nS to nY or nZ; see Figure 14							
		V _{CC} = 4.5 V; V _{EE} = 0 V	20	40	-	53	-	60	ns
		V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	17	-	-	-	-	-	ns
t _{PZL}	OFF-state to LOW propagation delay	\bar{E} to nY or nZ; see Figure 14							
		V _{CC} = 4.5 V; V _{EE} = 0 V	28	56	-	70	-	84	ns
		V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	24	-	-	-	-	-	ns
		V _{CC} = 4.5 V; V _{EE} = -4.5 V	21	42	-	53	-	63	ns
		nS to nY or nZ; see Figure 14							
		V _{CC} = 4.5 V; V _{EE} = 0 V	25	50	-	63	-	75	ns
		V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	21	-	-	-	-	-	ns
t _{off}	turn-off time	\bar{E} to nY or nZ; see Figure 14 ^[3]							
		V _{CC} = 4.5 V; V _{EE} = 0 V	25	50	-	63	-	75	ns
		V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	21	-	-	-	-	-	ns
		V _{CC} = 4.5 V; V _{EE} = -4.5 V	23	46	-	58	-	69	ns
		nS to nY or nZ; see Figure 14							
		V _{CC} = 4.5 V; V _{EE} = 0 V	22	44	-	55	-	66	ns
		V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF	19	-	-	-	-	-	ns
	V _{CC} = 4.5 V; V _{EE} = -4.5 V	20	40	-	50	-	60	ns	

Table 10. Dynamic characteristics 74HCT4316 ...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 15](#).

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

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

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Typ ^[1]	Max	Min	Max	Min	Max	
C_{PD}	power dissipation capacitance	per switch; $V_I = GND$ to $(V_{CC} - 1.5\text{ V})$	14	-	-	-	-	-	pF

- [1] Typical values are measured at $T_{amb} = 25\text{ °C}$.
- [2] t_{pd} is the same as t_{pHL} and t_{pLH} .
- [3] t_{off} is the same as t_{pZH} and t_{pZL} .
- [4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ where:
 f_i = input frequency in MHz;
 f_o = output frequency in MHz;
 $\sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ = sum of outputs;
 C_L = output load capacitance in pF;
 C_{sw} = switch capacitance in pF;
 V_{CC} = supply voltage in V.

12. Waveforms

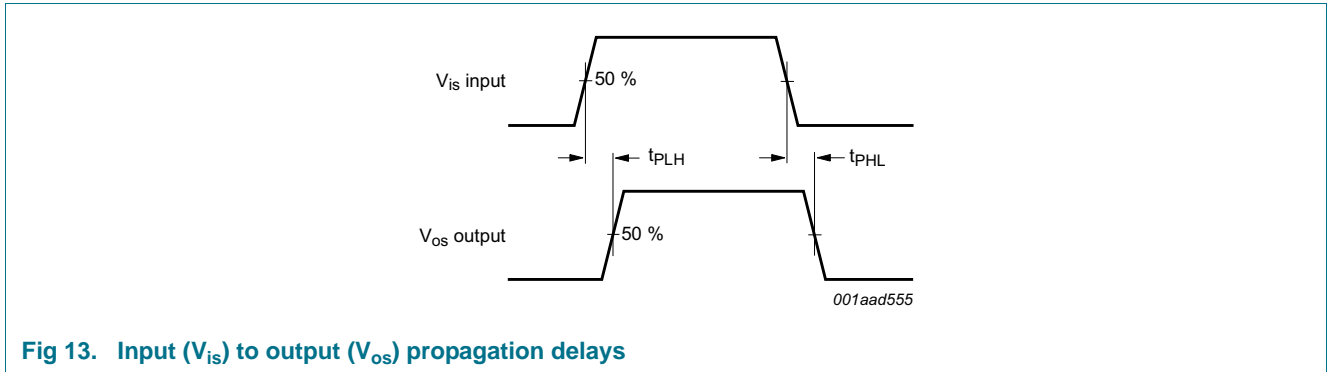
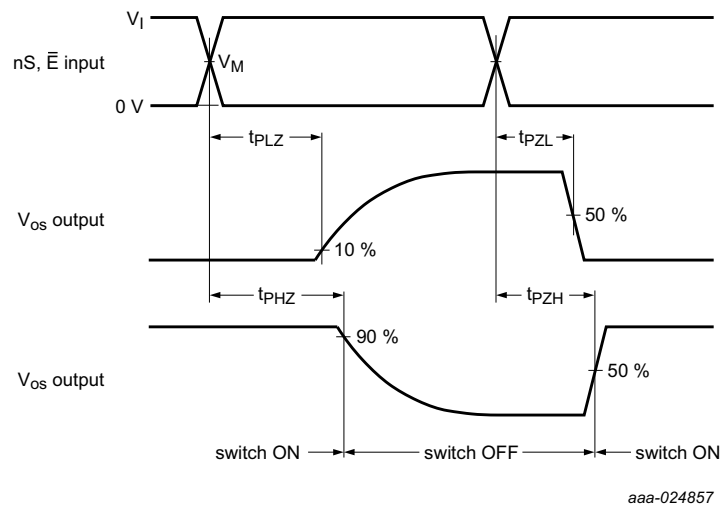


Fig 13. Input (V_{is}) to output (V_{os}) propagation delays



Measurement points are shown in [Table 11](#).

Fig 14. Turn-on and turn-off times

Table 11. Measurement points

Type	V_I	V_M
74HC4316	V_{CC}	$0.5V_{CC}$
74HCT4316	3.0 V	1.3 V

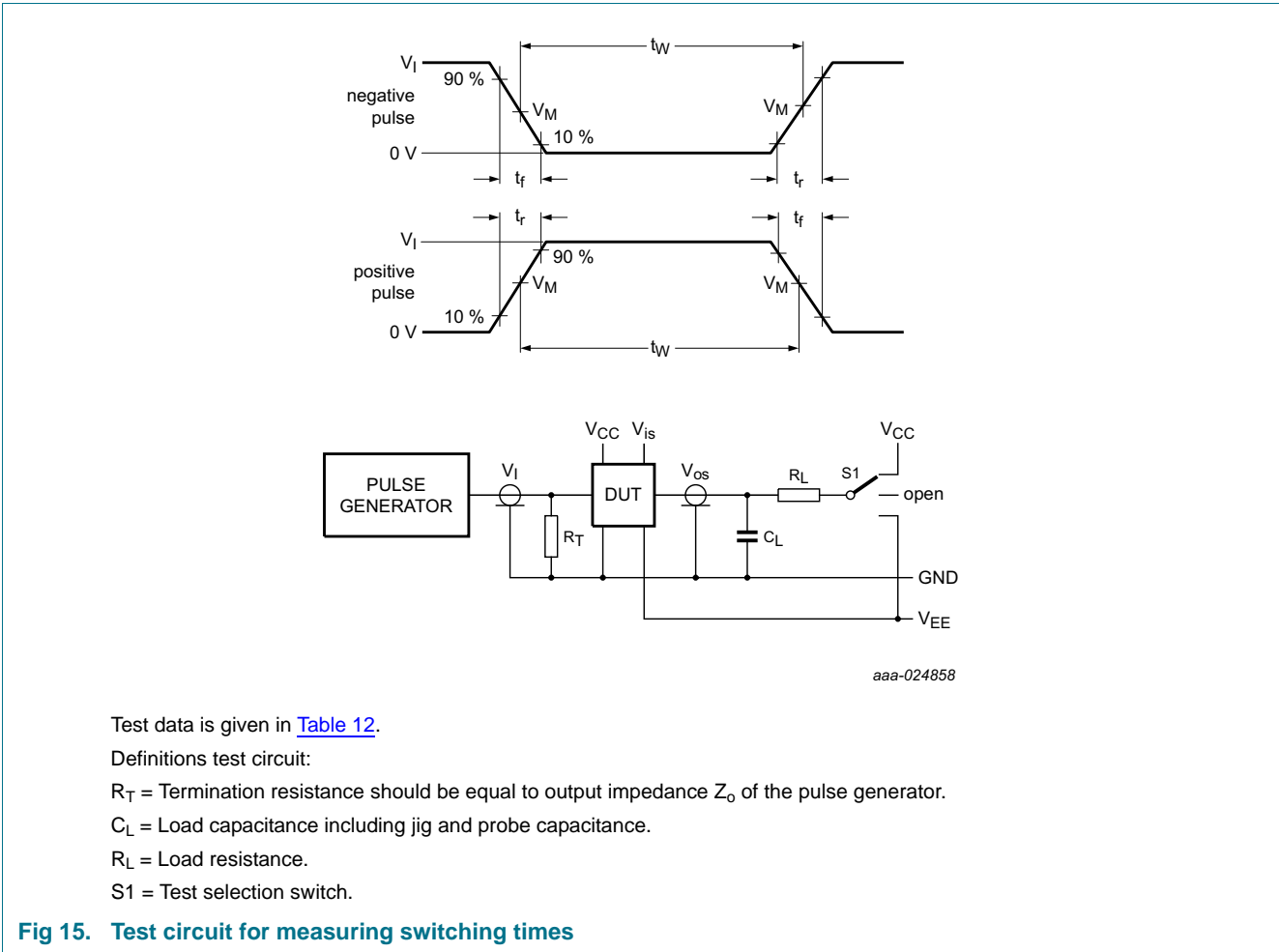


Fig 15. Test circuit for measuring switching times

Table 12. Test data

Test	Input				Output		S1 position	
	\bar{E}	nS	Switch nY (nZ)	t_r, t_f		Switch nZ (nY)		
	V_I		V_{is}	at f_{max}	other ^[1]	C_L		R_L
t_{PHL}, t_{PLH}	[2]		GND to V_{CC}	< 2 ns	6 ns	50 pF	-	open
t_{PHZ}, t_{PZH}	[2]		V_{CC}	< 2 ns	6 ns	50 pF, 15 pF	1 k Ω	V_{EE}
t_{PLZ}, t_{PZL}	[2]		V_{EE}	< 2 ns	6 ns	50 pF, 15 pF	1 k Ω	V_{CC}

[1] $t_r = t_f = 6$ ns; when measuring f_{max} , there is no constraint to t_r and t_f with 50 % duty factor.

[2] V_I values:

- a) For 74HC4316: $V_I = V_{CC}$
- b) For 74HCT4316: $V_I = 3$ V

13. Additional dynamic characteristics

Table 13. Additional dynamic characteristics

Recommended conditions and typical values; $GND = 0\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; $C_L = 50\text{ pF}$.

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
THD	total harmonic distortion	$f_i = 1\text{ kHz}$; $R_L = 10\text{ k}\Omega$; see Figure 16				
		$V_{is} = 4.0\text{ V (p-p)}$; $V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	0.80	-	%
		$V_{is} = 8.0\text{ V (p-p)}$; $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	0.40	-	%
		$f_i = 10\text{ kHz}$; $R_L = 10\text{ k}\Omega$; see Figure 16				
		$V_{is} = 4.0\text{ V (p-p)}$; $V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	2.40	-	%
		$V_{is} = 8.0\text{ V (p-p)}$; $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	1.20	-	%
$f_{(-3dB)}$	-3 dB frequency response	$R_L = 50\text{ }\Omega$; $C_L = 10\text{ pF}$; see Figure 17 [1]				
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	150	-	MHz
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	160	-	MHz
α_{iso}	isolation (OFF-state)	$R_L = 600\text{ }\Omega$; $f_i = 1\text{ MHz}$; see Figure 18 [2]				
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	-50	-	dB
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-50	-	dB
V_{ct}	crosstalk voltage	peak-to-peak value; between control and any switch; $R_L = 600\text{ }\Omega$; $f_i = 1\text{ MHz}$; \bar{E} or nS square wave between V_{CC} and GND; $t_r = t_f = 6\text{ ns}$; see Figure 19				
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$	-	110	-	mV
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	220	-	mV
Xtalk	crosstalk	between switches; $R_L = 600\text{ }\Omega$; $f_i = 1\text{ MHz}$; see Figure 20 [2]				
		$V_{CC} = 2.25\text{ V}$; $V_{EE} = -2.25\text{ V}$	-	-60	-	dB
		$V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$	-	-60	-	dB

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

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

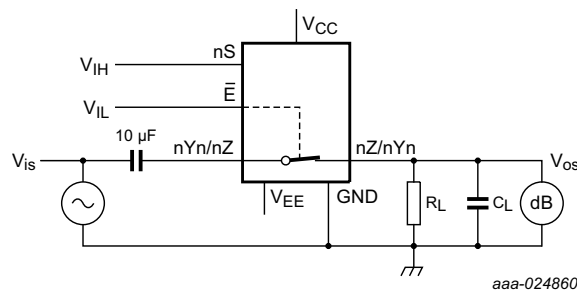
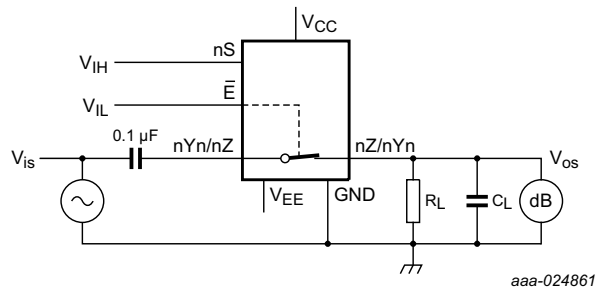
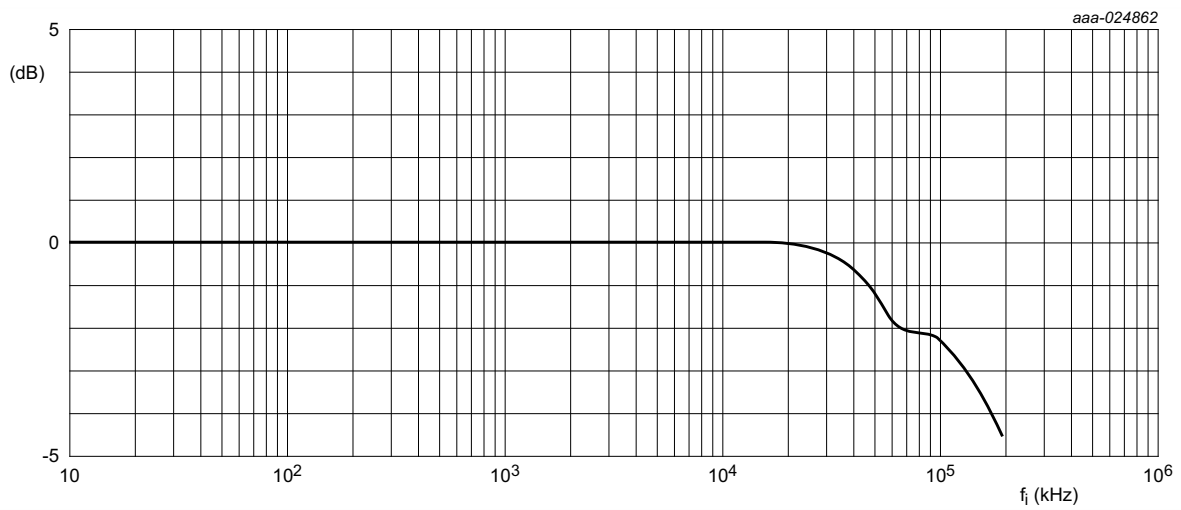


Fig 16. Test circuit for measuring total harmonic distortion



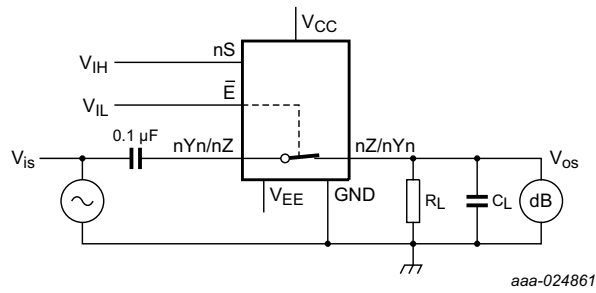
$V_{CC} = 4.5\text{ V}$; $GND = 0\text{ V}$; $V_{EE} = -4.5\text{ V}$; $R_L = 50\ \Omega$; $R_S = 1\text{ k}\Omega$.

a. Test circuit



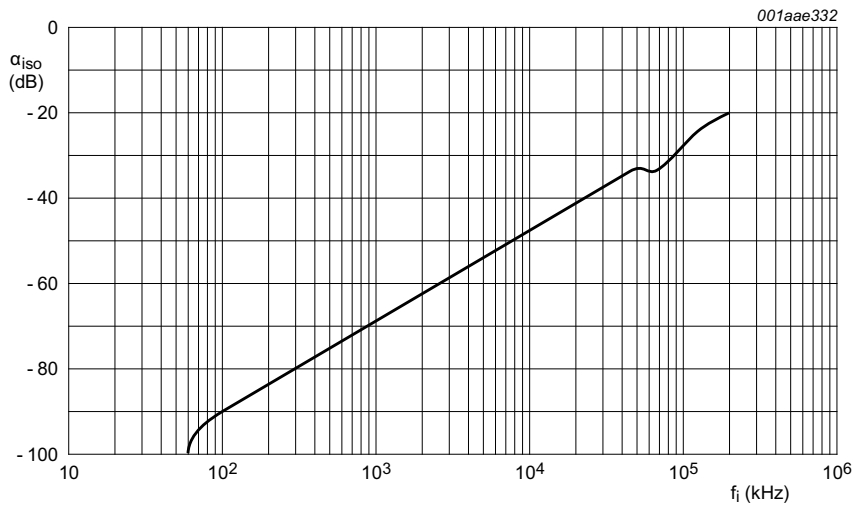
b. Typical -3 dB frequency response

Fig 17. -3 dB frequency response



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

a. Test circuit



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

Fig 18. Isolation (OFF-state) as a function of frequency

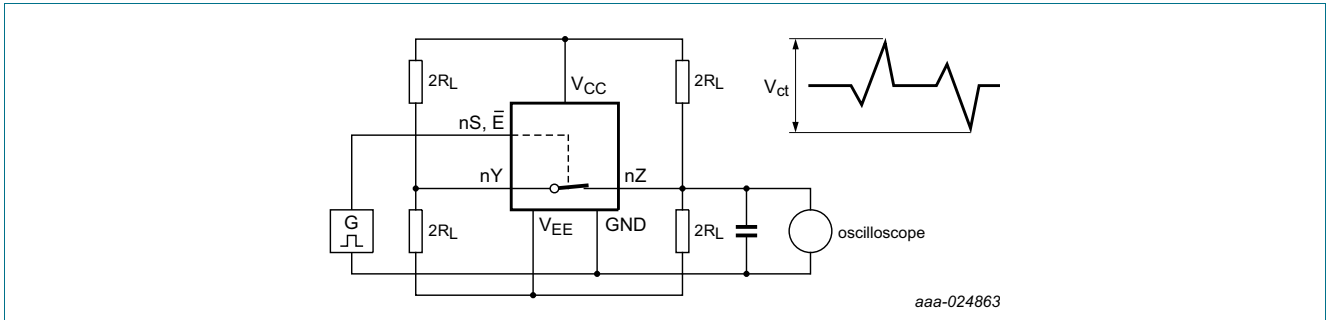


Fig 19. Test circuit for measuring crosstalk voltage (between the digital input and the switch)

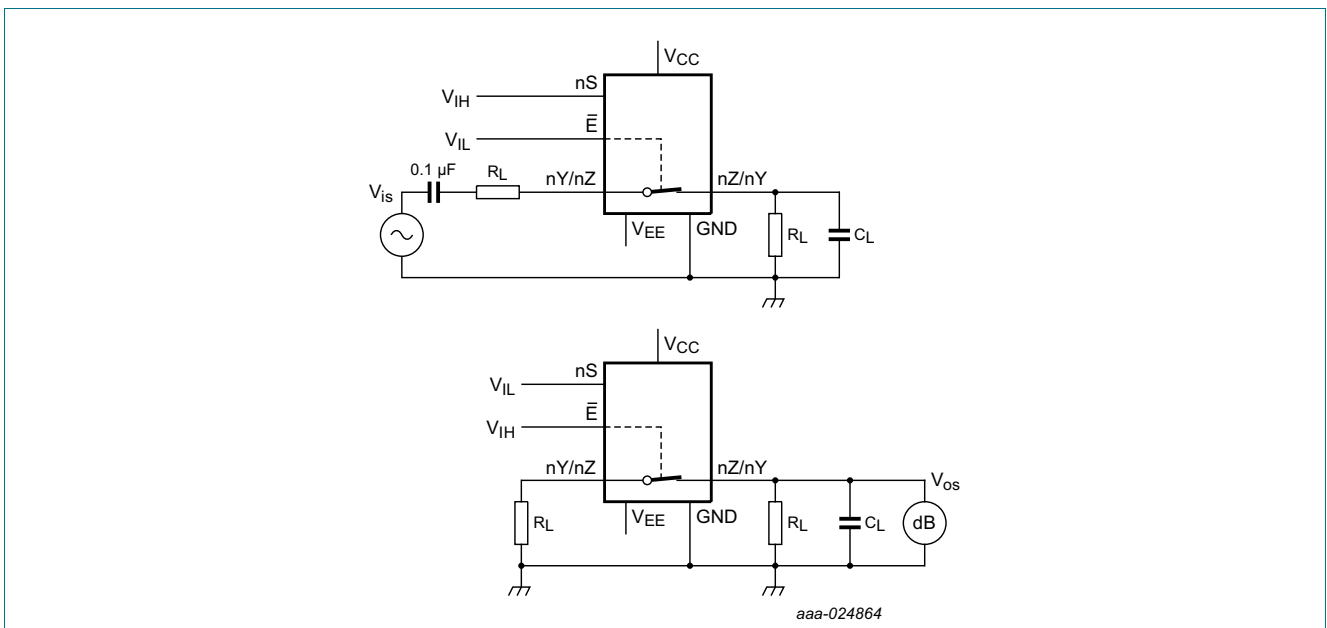


Fig 20. Test circuit for measuring crosstalk (between the switches)

14. Package outline

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

SOT109-1

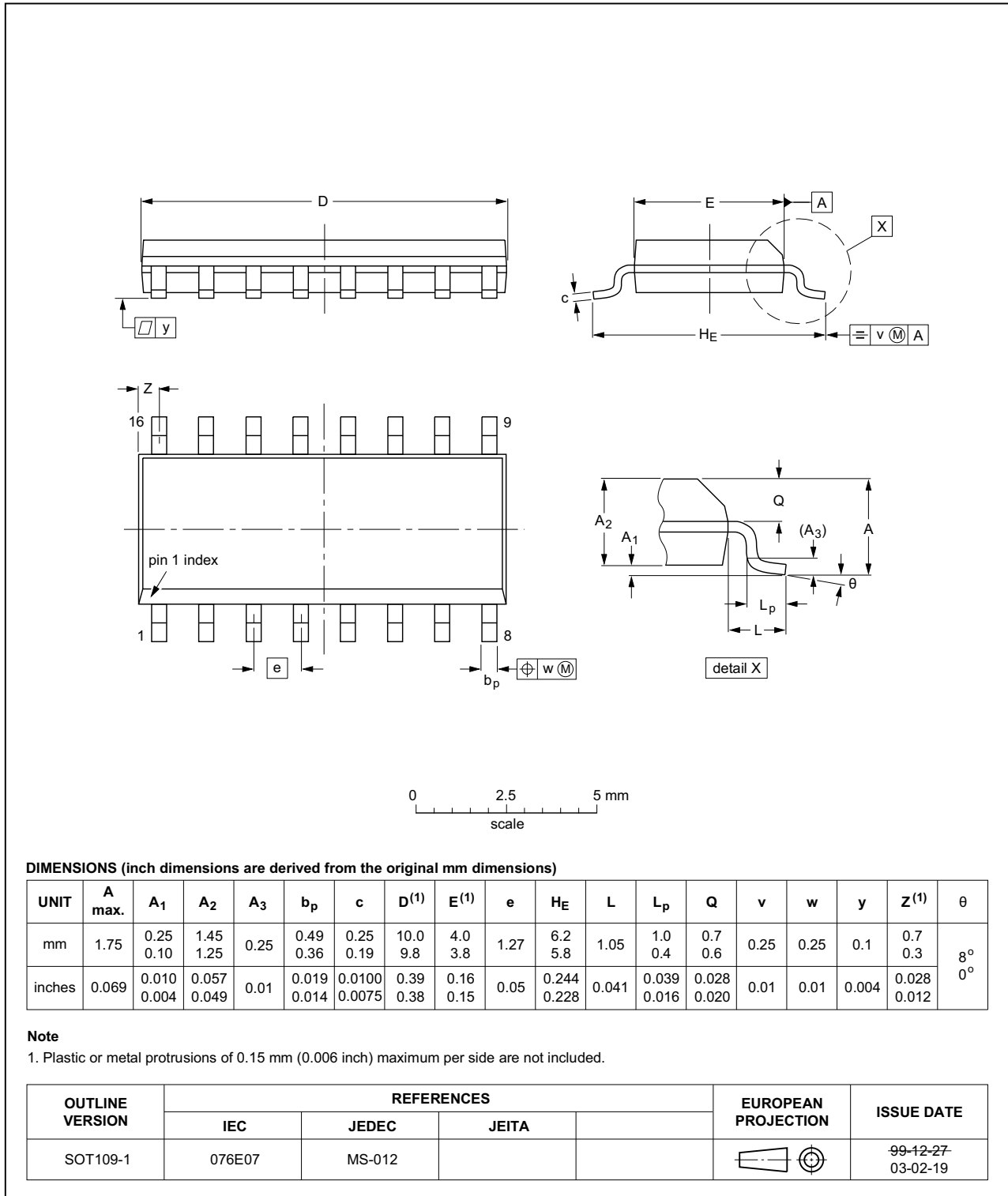


Fig 21. Package outline SOT109-1 (SO16)

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

SOT338-1

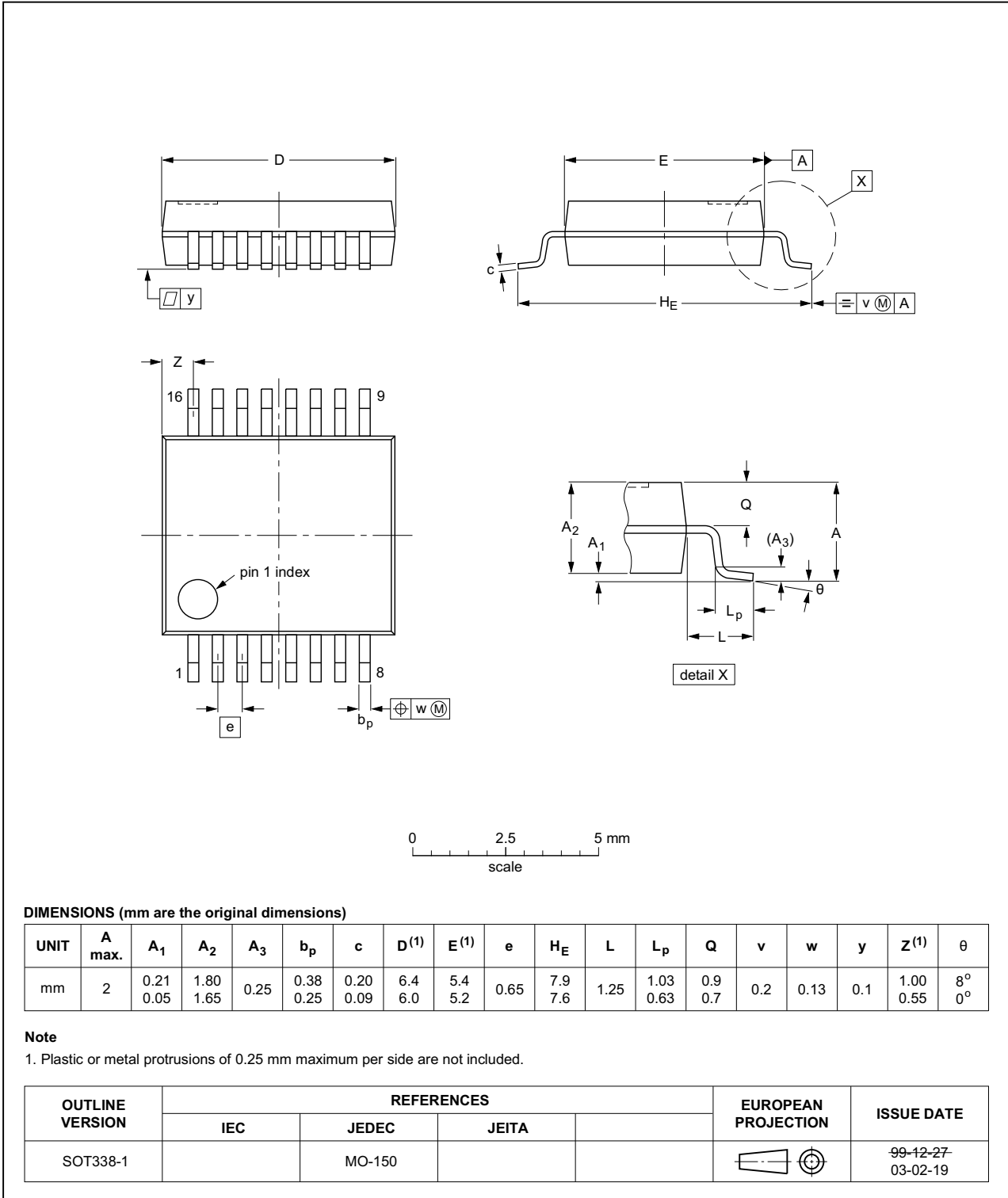


Fig 22. Package outline SOT338-1 (SSOP16)

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

SOT403-1

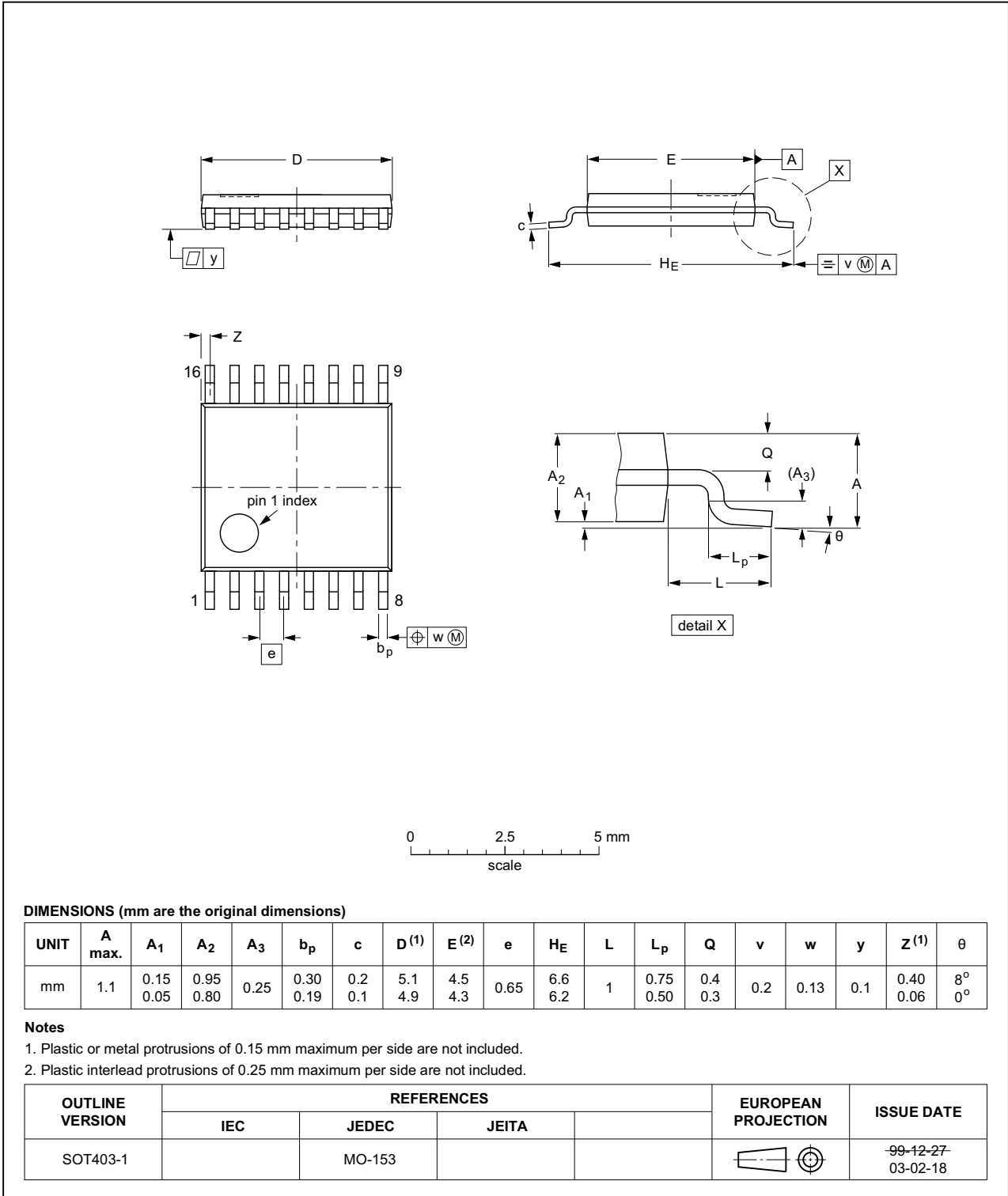


Fig 23. Package outline SOT403-1 (TSSOP16)

15. Abbreviations

Table 14. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

16. Revision history

Table 15. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4316 v.3	20170102	Product data sheet	-	74HC_HCT4316_CNV v.2
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Type numbers 74HC4316N and 74HCT4316N removed. 			
74HC_HCT4316_CNV v.2	19930901	Product specification	-	-

17. Legal information

17.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

17.2 Definitions

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