

# 74HC4052-Q100; 74HCT4052-Q100

Dual 4-channel analog multiplexer/demultiplexer

Rev. 3 — 27 February 2020

Product data sheet

## 1. General description

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The 74HC4052-Q100; 74HCT4052-Q100 is a dual single-pole quad-throw analog switch (2x SP4T) suitable for use in analog or digital 4:1 multiplexer/demultiplexer applications. Each switch features four independent inputs/outputs (nY0, nY1, nY2 and nY3) and a common input/output (nZ).

A digital enable input (E) and two digital select inputs (S0 and S1) are common to both switches. When  $\bar{E}$  is HIGH, the switches are turned off. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide analog input voltage range from -5 V to +5 V
- Low ON resistance:
  - 80  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 4.5$  V
  - 70  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 6.0$  V
  - 60  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 9.0$  V
- Logic level translation: to enable 5 V logic to communicate with  $\pm 5$  V analog signals
- Typical 'break before make' built-in
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2 000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )
  - CDM AEC-Q100-011 revision B exceeds 1000 V
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

## 3. Applications

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

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC4052D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4052D-Q100				
74HC4052PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4052PW-Q100				
74HC4052BQ-Q100	-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
74HCT4052BQ-Q100				

### 5. Functional diagram

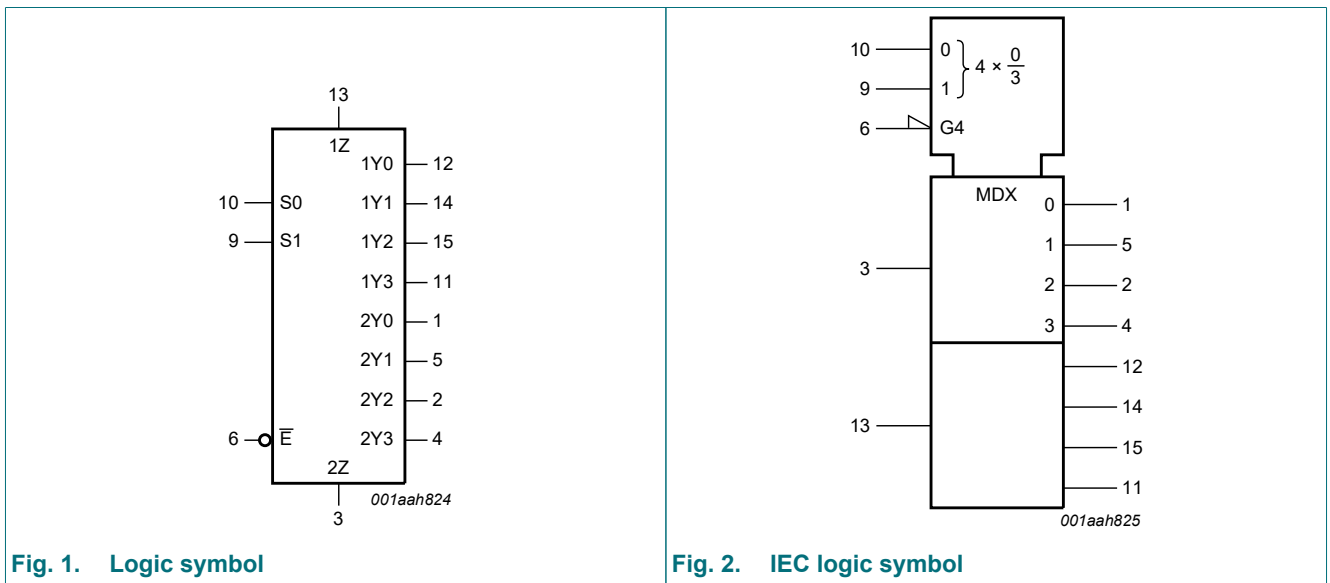


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

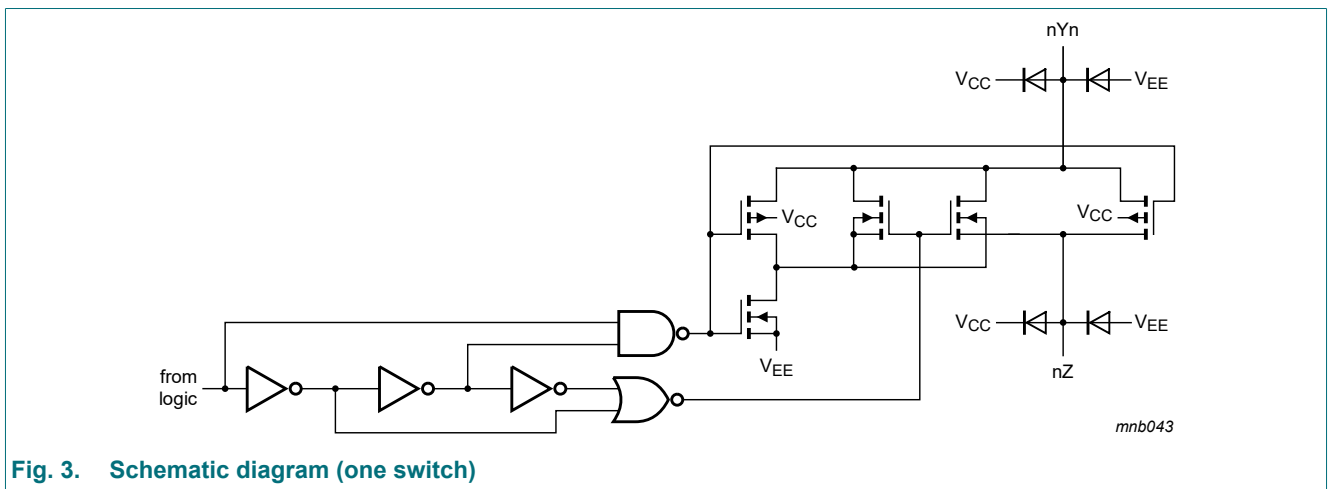


Fig. 3. Schematic diagram (one switch)

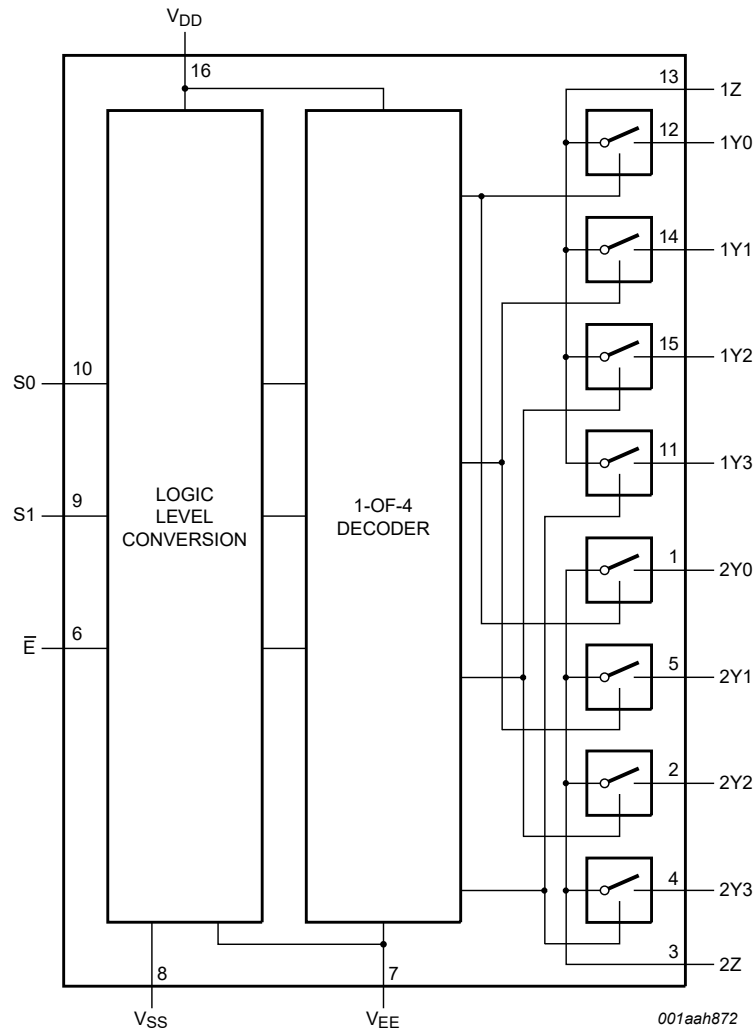


Fig. 4. Functional diagram

## 6. Pinning information

### 6.1. Pinning

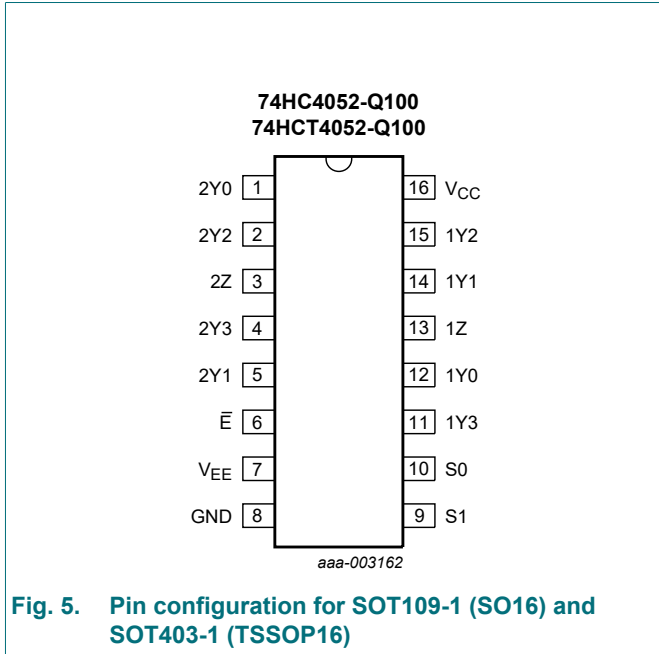


Fig. 5. Pin configuration for SOT109-1 (SO16) and SOT403-1 (TSSOP16)

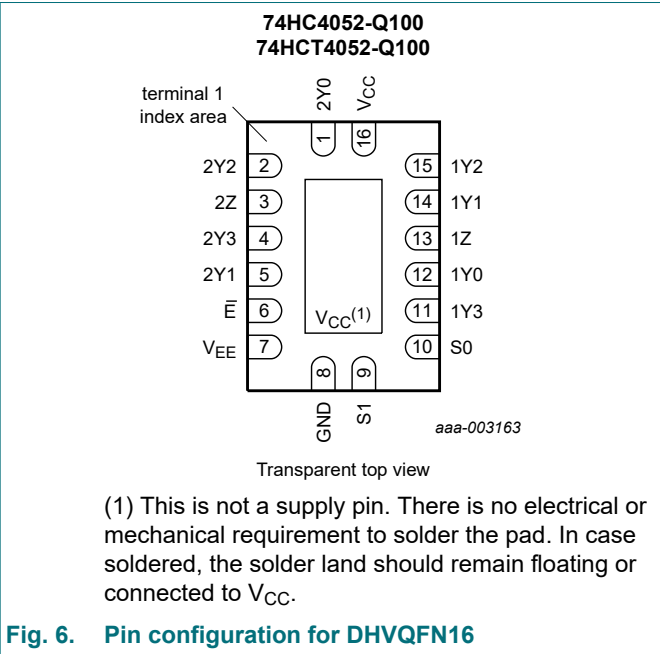


Fig. 6. Pin configuration for DHVQFN16

### 6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
2Y0, 2Y1, 2Y2, 2Y3	1, 5, 2, 4	independent input or output
1Z, 2Z	13, 3	common input or output
E̅	6	enable input (active LOW)
V <sub>EE</sub>	7	negative supply voltage
GND	8	ground (0 V)
S0, S1	10, 9	select logic input
1Y0, 1Y1, 1Y2, 1Y3	12, 14, 15, 11	independent input or output
V <sub>CC</sub>	16	positive supply voltage

## 7. Functional description

**Table 3. Function table**

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

Input			Channel on
E	S1	S0	
L	L	L	nY0 and nZ
L	L	H	nY1 and nZ
L	H	L	nY2 and nZ
L	H	H	nY3 and nZ
H	X	X	none

## 8. Limiting values

**Table 4. 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	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_{SK}$	switch clamping current	$V_{SW} < -0.5\text{ V}$ or $V_{SW} > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_{SW}$	switch current	$-0.5\text{ V} < V_{SW} < V_{CC} + 0.5\text{ V}$	-	$\pm 25$	mA
$I_{EE}$	supply current		-	$\pm 20$	mA
$I_{CC}$	supply current		-	50	mA
$I_{GND}$	ground current		-	-50	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	[2]	-	500	mW
P	power dissipation	per switch	-	100	mW

[1] To avoid drawing  $V_{CC}$  current out of pins nZ, when switch current flows in pins nYn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into pins nZ, no  $V_{CC}$  current will flow out of pins nYn. In this case there is no limit for the voltage drop across the switch, but the voltages at pins nYn and nZ may not exceed  $V_{CC}$  or  $V_{EE}$ .

[2] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.  
 For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.  
 For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

## 9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	74HC4052-Q100			74HCT4052-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage	see Fig. 7 and Fig. 8							
		V <sub>CC</sub> - GND	2.0	5.0	10.0	4.5	5.0	5.5	V
		V <sub>CC</sub> - V <sub>EE</sub>	2.0	5.0	10.0	2.0	5.0	10.0	V
V <sub>I</sub>	input voltage		GND	-	V <sub>CC</sub>	GND	-	V <sub>CC</sub>	V
V <sub>SW</sub>	switch voltage		V <sub>EE</sub>	-	V <sub>CC</sub>	V <sub>EE</sub>	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V
		V <sub>CC</sub> = 10.0 V	-	-	31	-	-	-	ns/V

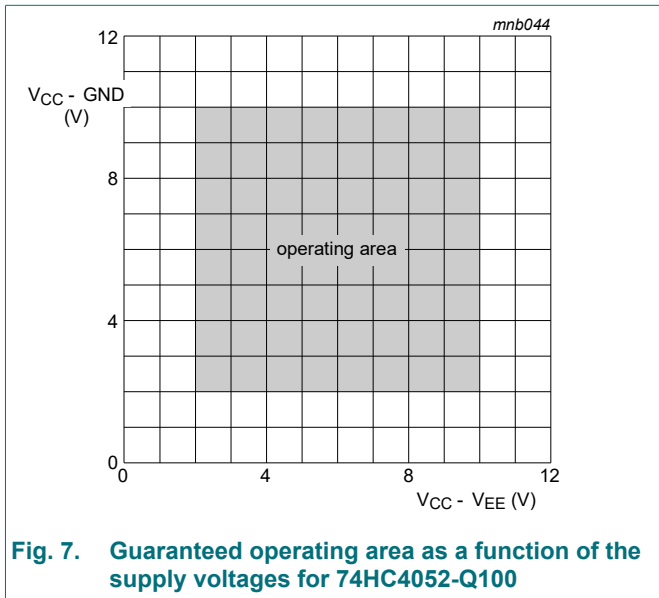


Fig. 7. Guaranteed operating area as a function of the supply voltages for 74HC4052-Q100

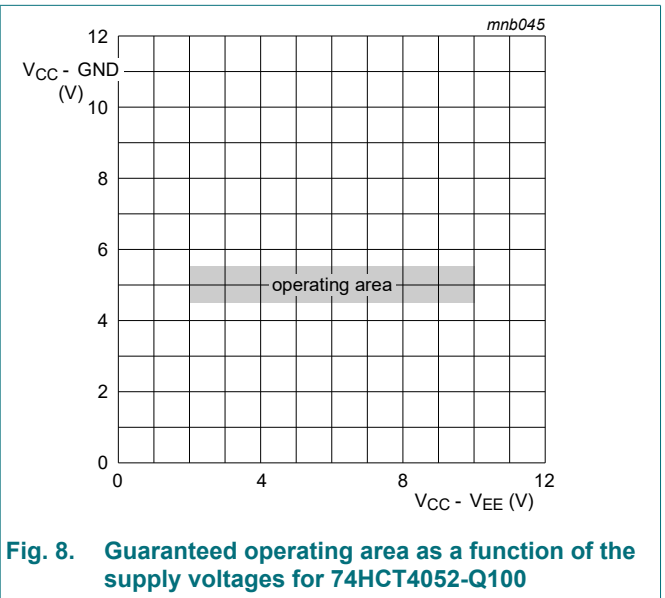


Fig. 8. Guaranteed operating area as a function of the supply voltages for 74HCT4052-Q100

## 10. Static characteristics

**Table 6.  $R_{ON}$  resistance per switch for 74HC4052-Q100 and 74HCT4052-Q100**

$V_I = V_{IH}$  or  $V_{IL}$ ; for test circuit see Fig. 9.

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

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

For 74HC4052-Q100:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

For 74HCT4052-Q100:  $V_{CC} - GND = 4.5\text{ V}$  and  $5.5\text{ V}$ ,  $V_{CC} - V_{EE} = 2.0\text{ V}, 4.5\text{ V}, 6.0\text{ V}$  and  $9.0\text{ V}$ .

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit	
<b><math>T_{amb} = -40\text{ °C}</math> to <math>+85\text{ °C}</math></b>							
$R_{ON(peak)}$	ON resistance (peak)	$V_{is} = V_{CC}$ to $V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$ [2]	-	-	-	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	100	225	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	90	200	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	70	165	$\Omega$	
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$ [2]	-	150	-	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	80	175	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	70	150	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	60	130	$\Omega$	
		$V_{is} = V_{CC}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$ [2]	-	150	-	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	90	200	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	80	175	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	65	150	$\Omega$	
$\Delta R_{ON}$	ON resistance mismatch between channels	$V_{is} = V_{CC}$ to $V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}$ [2]	-	-	-	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}$	-	9	-	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}$	-	8	-	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}$	-	6	-	$\Omega$	
<b><math>T_{amb} = -40\text{ °C}</math> to <math>+125\text{ °C}</math></b>							
$R_{ON(peak)}$	ON resistance (peak)	$V_{is} = V_{CC}$ to $V_{EE}$					
		$V_{CC} = 2.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 100\text{ }\mu\text{A}$ [2]	-	-	-	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	-	270	$\Omega$	
		$V_{CC} = 6.0\text{ V}; V_{EE} = 0\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	-	240	$\Omega$	
		$V_{CC} = 4.5\text{ V}; V_{EE} = -4.5\text{ V}; I_{SW} = 1000\text{ }\mu\text{A}$	-	-	195	$\Omega$	

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit	
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>is</sub> = V <sub>EE</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA	[2]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA		-	-	210	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA		-	-	180	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA		-	-	160	Ω
		V <sub>is</sub> = V <sub>CC</sub>					
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 100 μA	[2]	-	-	-	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA		-	-	240	Ω
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V; I <sub>SW</sub> = 1000 μA		-	-	210	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V; I <sub>SW</sub> = 1000 μA		-	-	180	Ω

- [1] All typical values are measured at T<sub>amb</sub> = 25 °C.
- [2] When supply voltages (V<sub>CC</sub> - V<sub>EE</sub>) near 2.0 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 2 V, it is recommended to use these devices only for transmitting digital signals.

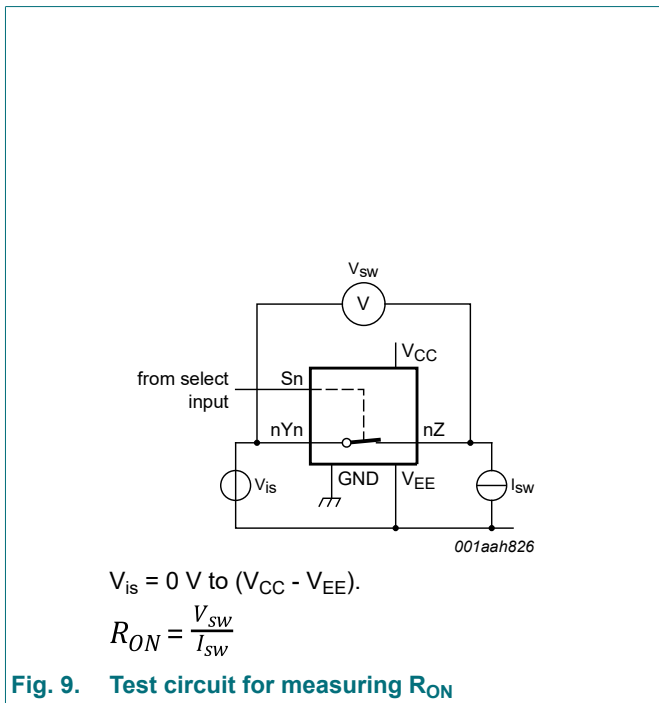


Fig. 9. Test circuit for measuring R<sub>ON</sub>

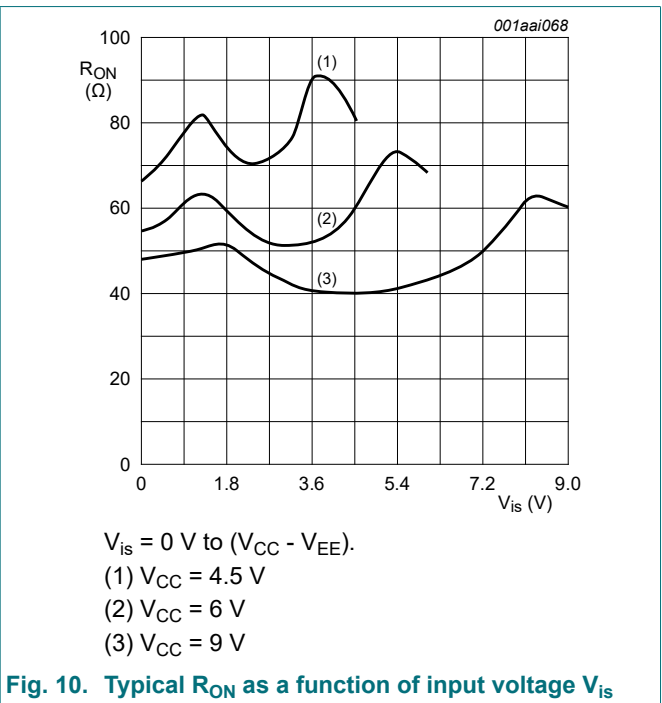


Fig. 10. Typical R<sub>ON</sub> as a function of input voltage V<sub>is</sub>



Table 7. Static characteristics for 74HC4052-Q100

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

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

$V_{os}$  is the output voltage at pins nZ or nYn, whichever is assigned as an output.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	4.7	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	4.3	2.7	V
$I_I$	input leakage current	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{IH}\text{ or }V_{IL};  V_{SW}  = V_{CC} - V_{EE};$ see Fig. 11				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V}; V_I = V_{IH}\text{ or }V_{IL};  V_{SW}  = V_{CC} - V_{EE};$ see Fig. 12	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}; V_{is} = V_{EE}\text{ or }V_{CC}; V_{os} = V_{CC}\text{ or }V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	80.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	160.0	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	pF
$C_{sw}$	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	12	-	pF
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	-	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	-	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	-	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	-	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	-	2.7	V

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$I_I$	input leakage current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see Fig. 11				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see Fig. 12	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{EE} = 0\text{ V}$ ; $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$				
		$V_{CC} = 6.0\text{ V}$	-	-	160.0	$\mu\text{A}$
		$V_{CC} = 10.0\text{ V}$	-	-	320.0	$\mu\text{A}$

[1] All typical values are measured at  $T_{amb} = 25\text{ }^\circ\text{C}$ .

**Table 8. Static characteristics for 74HCT4052-Q100**

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

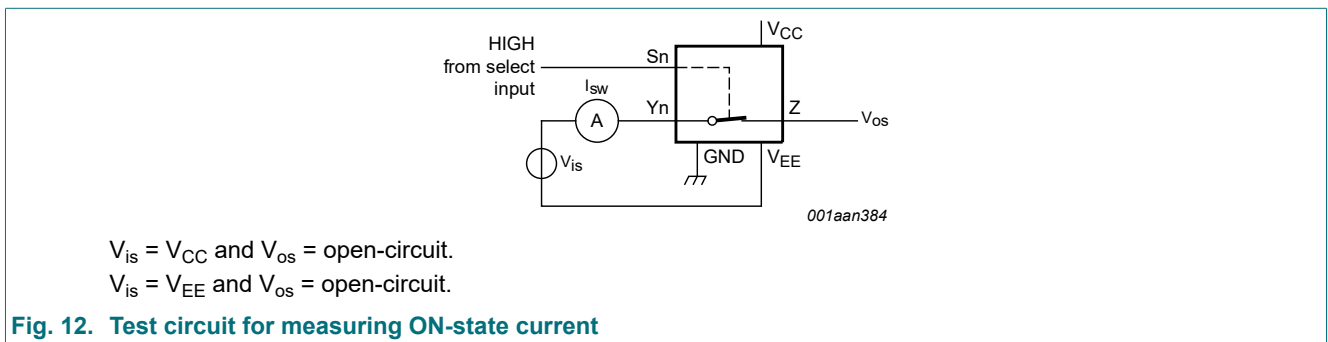
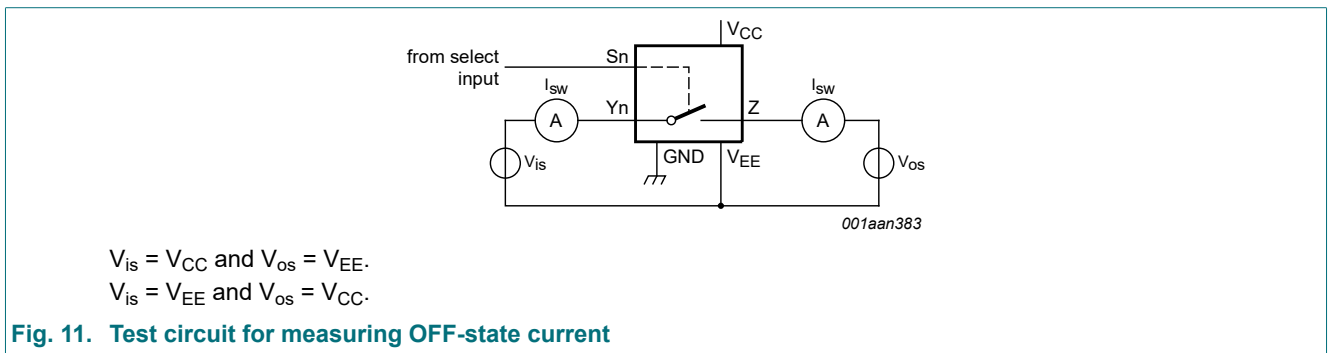
$V_{is}$  is the input voltage at pins nYn or nZ, whichever is assigned as an input.

$V_{os}$  is the output voltage at pins nZ or nYn, whichever is assigned as an output.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
<b><math>T_{amb} = -40\text{ }^\circ\text{C}</math> to <math>+85\text{ }^\circ\text{C}</math></b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$	2.0	1.6	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$	-	1.2	0.8	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	$\pm 1.0$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see Fig. 11				
		per channel	-	-	$\pm 1.0$	$\mu\text{A}$
		all channels	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 10.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $ V_{SW}  = V_{CC} - V_{EE}$ ; see Fig. 12	-	-	$\pm 2.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or $V_{EE}$				
		$V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	80.0	$\mu\text{A}$
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$	-	-	160.0	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input; $V_I = V_{CC} - 2.1\text{ V}$ ; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	45	202.5	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	pF
$C_{sw}$	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	12	-	pF

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V; V <sub>EE</sub> = 0 V	-	-	±1.0	µA
I <sub>S(OFF)</sub>	OFF-state leakage current	V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> - V <sub>EE</sub> ; see Fig. 11				
		per channel	-	-	±1.0	µA
		all channels	-	-	±2.0	µA
I <sub>S(ON)</sub>	ON-state leakage current	V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> - V <sub>EE</sub> ; see Fig. 12	-	-	±2.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>is</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>os</sub> = V <sub>CC</sub> or V <sub>EE</sub>				
		V <sub>CC</sub> = 5.5 V; V <sub>EE</sub> = 0 V	-	-	160.0	µA
		V <sub>CC</sub> = 5.0 V; V <sub>EE</sub> = -5.0 V	-	-	320.0	µA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>EE</sub> = 0 V	-	-	220.5	µA

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.



## 11. Dynamic characteristics

**Table 9. Dynamic characteristics for 74HC4052-Q100**

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

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

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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>						
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Fig. 13</a> [2]				
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	14	75	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	5	15	ns
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	4	13	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	4	10	ns
$t_{on}$	turn-on time	$\bar{E}$ , Sn to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Fig. 14</a> [3]				
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	105	405	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	38	81	ns
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	28	-	ns
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	30	69	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	26	58	ns
$t_{off}$	turn-off time	$\bar{E}$ , Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Fig. 14</a> [4]				
		$V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	74	315	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	27	63	ns
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	21	-	ns
		$V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	22	54	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	22	48	ns
$C_{PD}$	power dissipation capacitance	per switch; $V_I = GND$ to $V_{CC}$ [5]	-	57	-	pF

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>pd</sub>	propagation delay	V <sub>is</sub> to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 13 [2]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	90	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	18	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	15	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	12	ns
t <sub>on</sub>	turn-on time	$\bar{E}$ , Sn to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see Fig. 14 [3]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	490	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	98	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	83	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	69	ns
t <sub>off</sub>	turn-off time	$\bar{E}$ , Sn to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see Fig. 14 [4]				
		V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V	-	-	375	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V	-	-	75	ns
		V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V	-	-	64	ns
		V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V	-	-	57	ns

- [1] All typical values are measured at T<sub>amb</sub> = 25 °C.
- [2] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [3] t<sub>on</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [4] t<sub>off</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.
- [5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 N = number of inputs switching;  
 Σ{(C<sub>L</sub> + C<sub>sw</sub>) × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>} = sum of outputs;  
 C<sub>L</sub> = output load capacitance in pF;  
 C<sub>sw</sub> = switch capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V.

Table 10. Dynamic characteristics for 74HCT4052-Q100

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see Fig. 15.

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

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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>						
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see Fig. 13 [2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	5	15	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	4	10	ns
$t_{on}$	turn-on time	$\bar{E}$ , Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 14 [3]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	41	88	ns
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	18	-	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	28	60	ns
$t_{off}$	turn-off time	$\bar{E}$ , Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 14 [4]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	26	63	ns
		$V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$	-	13	-	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	21	48	ns
$C_{PD}$	power dissipation capacitance	per switch; $V_I = GND$ to $V_{CC} - 1.5\text{ V}$ [5]	-	57	-	pF
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$t_{pd}$	propagation delay	$V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see Fig. 13 [2]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	18	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	12	ns
$t_{on}$	turn-on time	$\bar{E}$ , Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 14 [3]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	105	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	72	ns
$t_{off}$	turn-off time	$\bar{E}$ , Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see Fig. 14 [4]				
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$	-	-	75	ns
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	-	57	ns

[1] All 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  $t_{PZH}$  and  $t_{PZL}$ .

[4]  $t_{off}$  is the same as  $t_{PHZ}$  and  $t_{PLZ}$ .

[5]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$N$  = number of inputs switching;

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

$C_L$  = output load capacitance in pF;

$C_{sw}$  = switch capacitance in pF;

$V_{CC}$  = supply voltage in V.

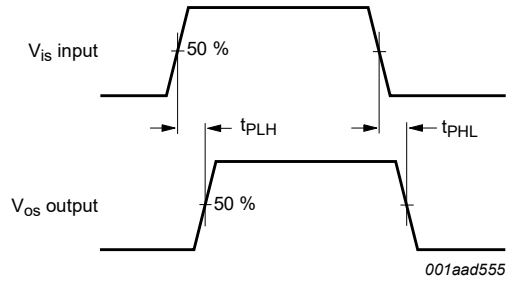
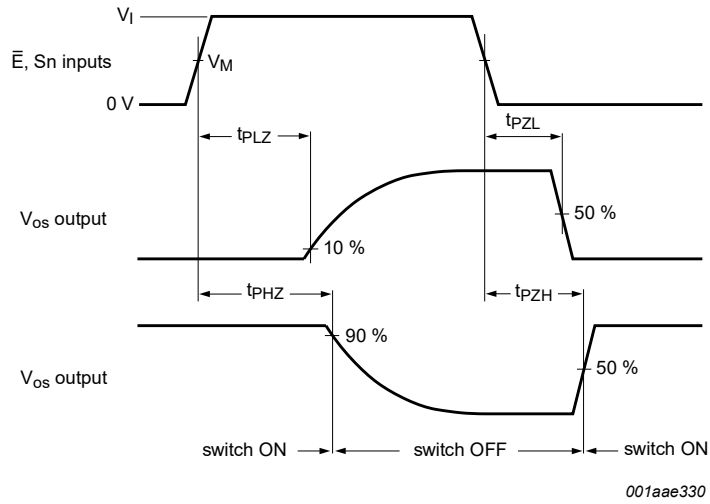


Fig. 13. Input ( $V_{is}$ ) to output ( $V_{os}$ ) propagation delays



For 74HC4052-Q100:  $V_M = 0.5 \times V_{CC}$ .  
 For 74HCT4052-Q100:  $V_M = 1.3 \text{ V}$ .

Fig. 14. Turn-on and turn-off times

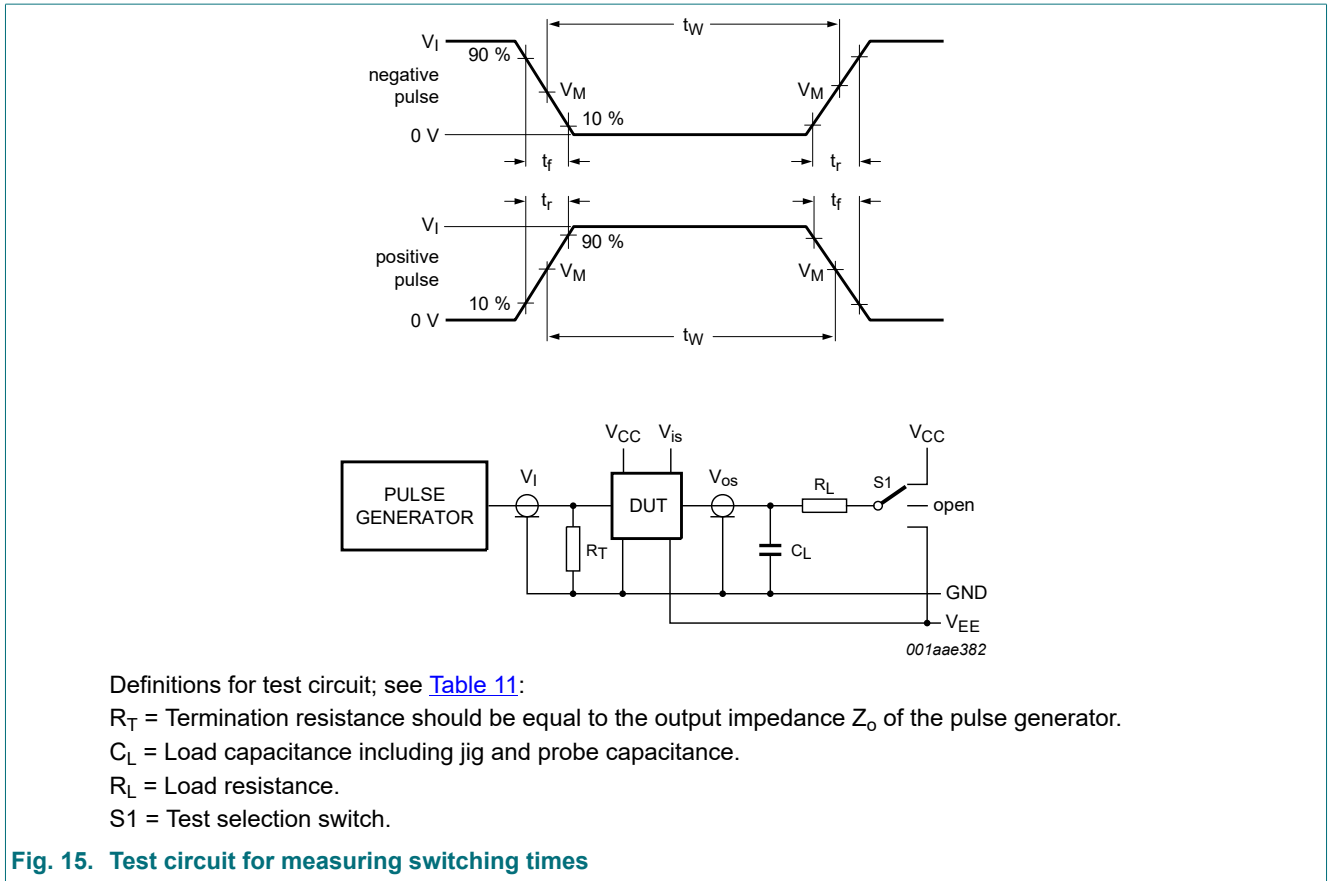


Table 11. Test data

Test	Input				Load		S1 position
	$V_I$ [1]	$V_{is}$	$t_r, t_f$		$C_L$	$R_L$	
			at $f_{max}$	other [2]			
$t_{PHL}, t_{PLH}$	$V_{CC}$	pulse	< 2 ns	6 ns	50 pF	1 k $\Omega$	open
$t_{PZH}, t_{PHZ}$	$V_{CC}$	$V_{CC}$	< 2 ns	6 ns	50 pF	1 k $\Omega$	$V_{EE}$
$t_{PZL}, t_{PLZ}$	$V_{CC}$	$V_{EE}$	< 2 ns	6 ns	50 pF	1 k $\Omega$	$V_{CC}$

[1] For 74HCT4052-Q100:  $V_I = 3$  V

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



### 11.1. Additional dynamic characteristics

**Table 12. Additional dynamic characteristics**

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

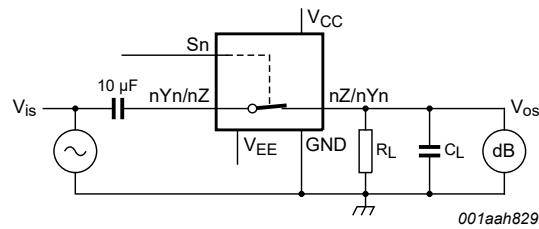
$V_{is}$  is the input voltage at pins  $nYn$  or  $nZ$ , whichever is assigned as an input.

$V_{os}$  is the output voltage at pins  $nYn$  or  $nZ$ , whichever is assigned as an output.

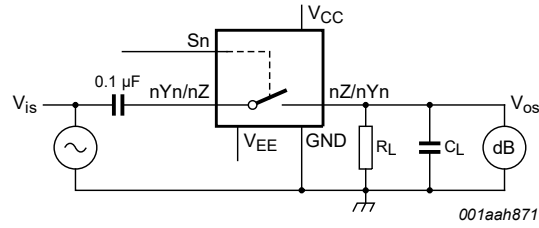
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$d_{sin}$	sine-wave distortion	$f_i = 1\text{ kHz}$ ; $R_L = 10\text{ k}\Omega$ ; see Fig. 16					
		$V_{is} = 4.0\text{ V (p-p)}$ ; $V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$	-	0.04	-	%	
		$V_{is} = 8.0\text{ V (p-p)}$ ; $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	0.02	-	%	
		$f_i = 10\text{ kHz}$ ; $R_L = 10\text{ k}\Omega$ ; see Fig. 16					
		$V_{is} = 4.0\text{ V (p-p)}$ ; $V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$	-	0.12	-	%	
		$V_{is} = 8.0\text{ V (p-p)}$ ; $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	-	0.06	-	%	
$\alpha_{iso}$	isolation (OFF-state)	$R_L = 600\text{ }\Omega$ ; $f_i = 1\text{ MHz}$ ; see Fig. 17					
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$	[1]	-	-50	-	dB
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	[1]	-	-50	-	dB
Xtalk	crosstalk	between two switches/multiplexers; $R_L = 600\text{ }\Omega$ ; $f_i = 1\text{ MHz}$ ; see Fig. 18					
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$	[1]	-	-60	-	dB
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	[1]	-	-60	-	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 $S_n$ square wave between $V_{CC}$ and $GND$ ; $t_r = t_f = 6\text{ ns}$ ; see Fig. 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	
$f_{(-3dB)}$	-3 dB frequency response	$R_L = 50\text{ }\Omega$ ; see Fig. 20					
		$V_{CC} = 2.25\text{ V}$ ; $V_{EE} = -2.25\text{ V}$	[2]	-	170	-	MHz
		$V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$	[2]	-	180	-	MHz

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

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

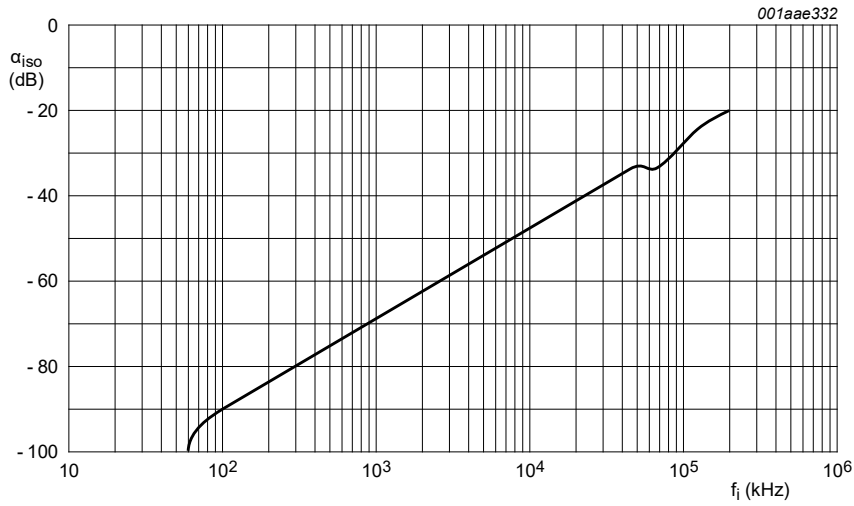


**Fig. 16. Test circuit for measuring sine-wave distortion**



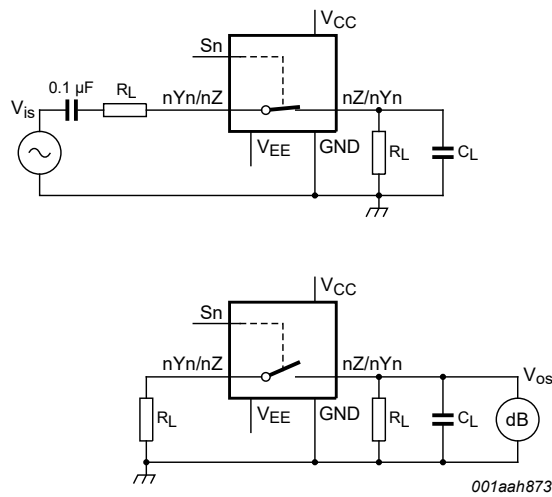
$V_{CC} = 4.5\text{ V}$ ;  $GND = 0\text{ V}$ ;  $V_{EE} = -4.5\text{ V}$ ;  $R_L = 600\ \Omega$ ;  $R_S = 1\text{ k}\Omega$ .

a. Test circuit



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

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



**Fig. 18. Test circuits for measuring crosstalk between any two switches/multiplexers**

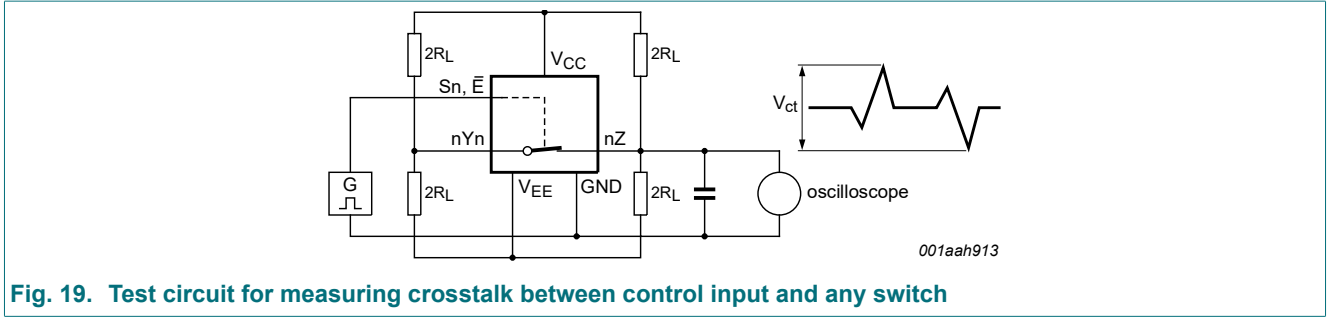


Fig. 19. Test circuit for measuring crosstalk between control input and any switch

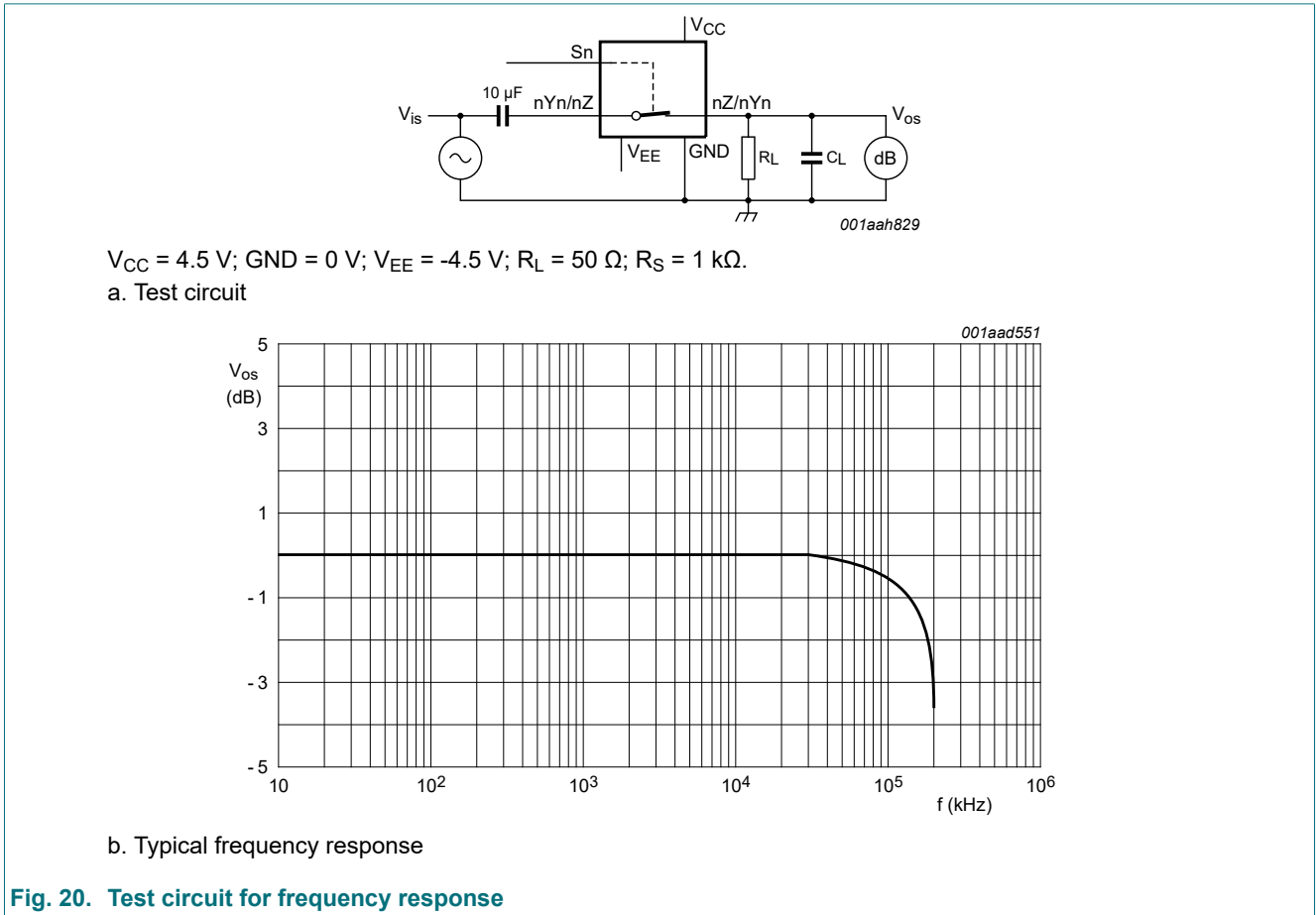


Fig. 20. Test circuit for frequency response

## 12. Package outline

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

SOT109-1

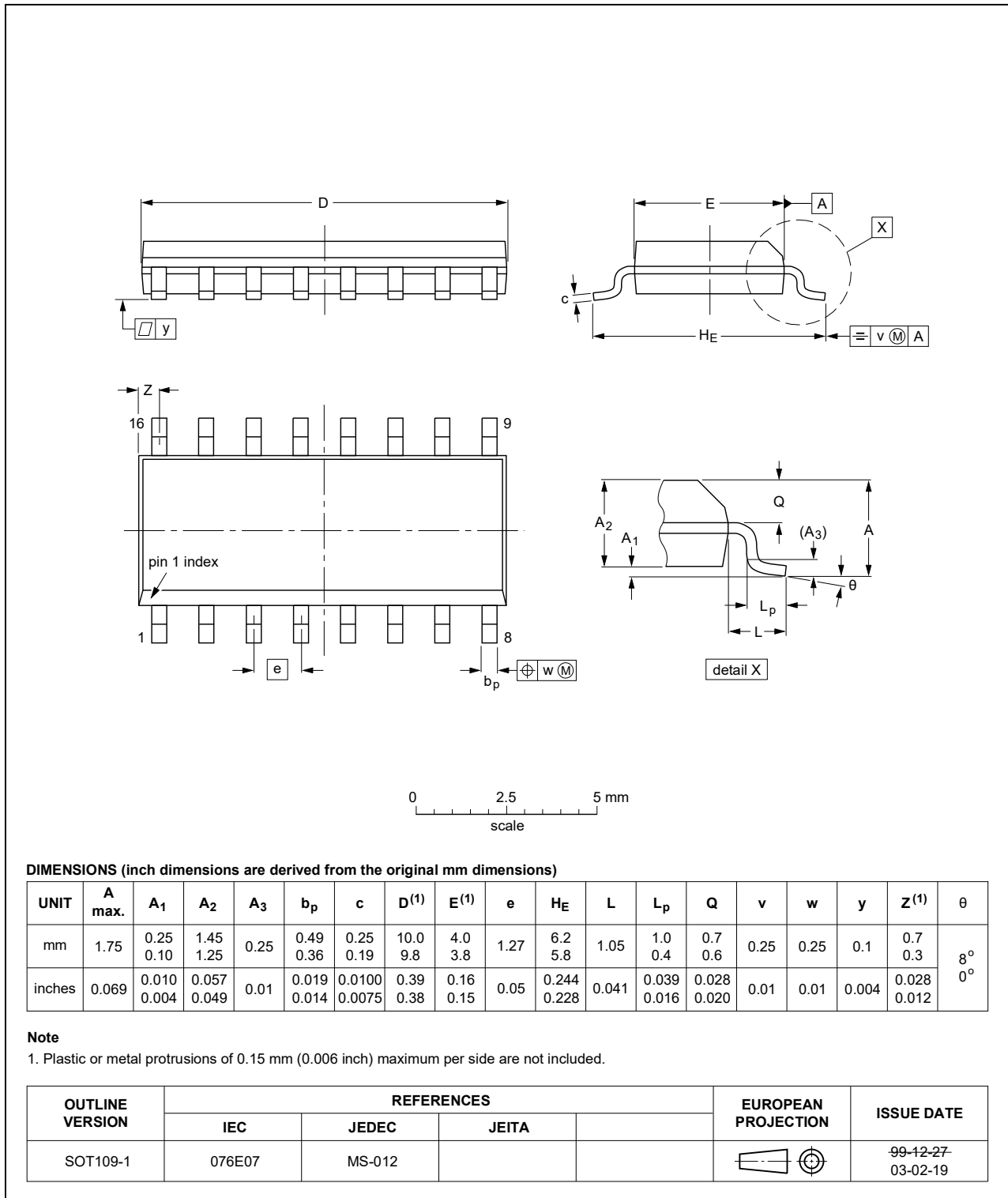


Fig. 21. Package outline SOT109-1 (SO16)

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)

## 13. Abbreviations

Table 13. Abbreviations

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

## 14. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4052_Q100 v.3	20200227	Product data sheet	-	74HC_HCT4052_Q100 v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li><a href="#">Section 2</a> updated.</li> </ul>			
74HC_HCT4052_Q100 v.2	20121122	Product data sheet	-	74HC_HCT4052_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>CDM added to features.</li> </ul>			
74HC_HCT4052_Q100 v.1	20120720	Product data sheet	-	-

## 15. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [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 <https://www.nexperia.com>.

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