74HC4052-Q100; 74HCT4052-Q100

Dual 4-channel analog multiplexer/demultiplexer

Rev. 2 — 22 November 2012 Product data sheet

1. General description

The 74HC4052-Q100; 74HCT4052-Q100 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 74HC4052-Q100; 74HCT4052-Q100 is a dual 4-channel analog multiplexer/demultiplexer with common select logic. Each multiplexer has four independent inputs/outputs (pins nY0 to nY3) and a common input/output (pin nZ). The common channel select logics include two digital select inputs (pins S0 and S1) and an active LOW enable input (pin $\overline{E}$). When pin $\overline{E}$ = LOW, one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin $\overline{E}$ = HIGH, all switches are in the high-impedance OFF-state, independent of pins S0 and S1.

V_{CC} and GND are the supply voltage pins for the digital control inputs (pins S0, S1 and $\overline{E}$). The V_{CC} to GND ranges are 2.0 V to 10.0 V for the 74HC4052-Q100, and 4.5 V to 5.5 V for the 74HCT4052-Q100. The analog inputs/outputs (pins nY0 to nY3 and nZ) 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).

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

- 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 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
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
  - CDM AEC-Q100-011 revision B exceeds 1000 V
- Multiple package options

3. Applications

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

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
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

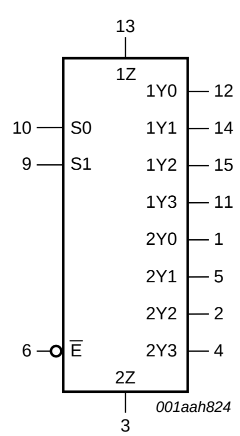


Fig 1. Logic symbol

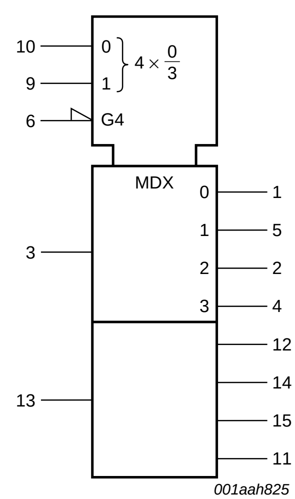


Fig 2. IEC logic symbol

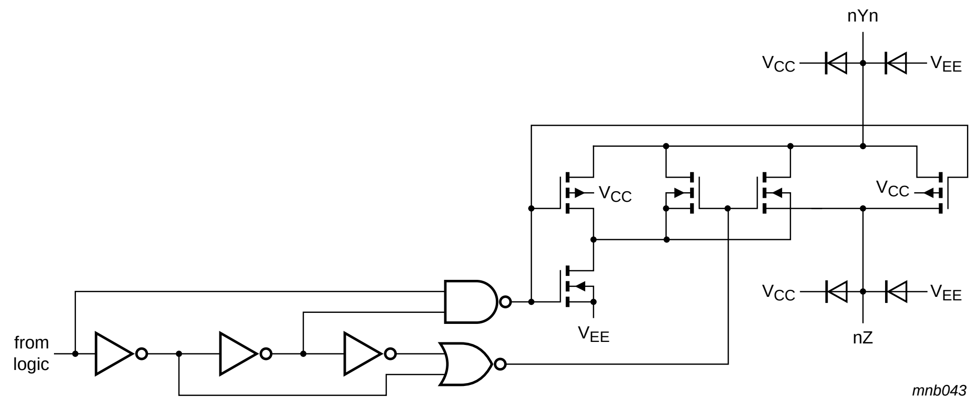


Fig 3. Schematic diagram (one switch)

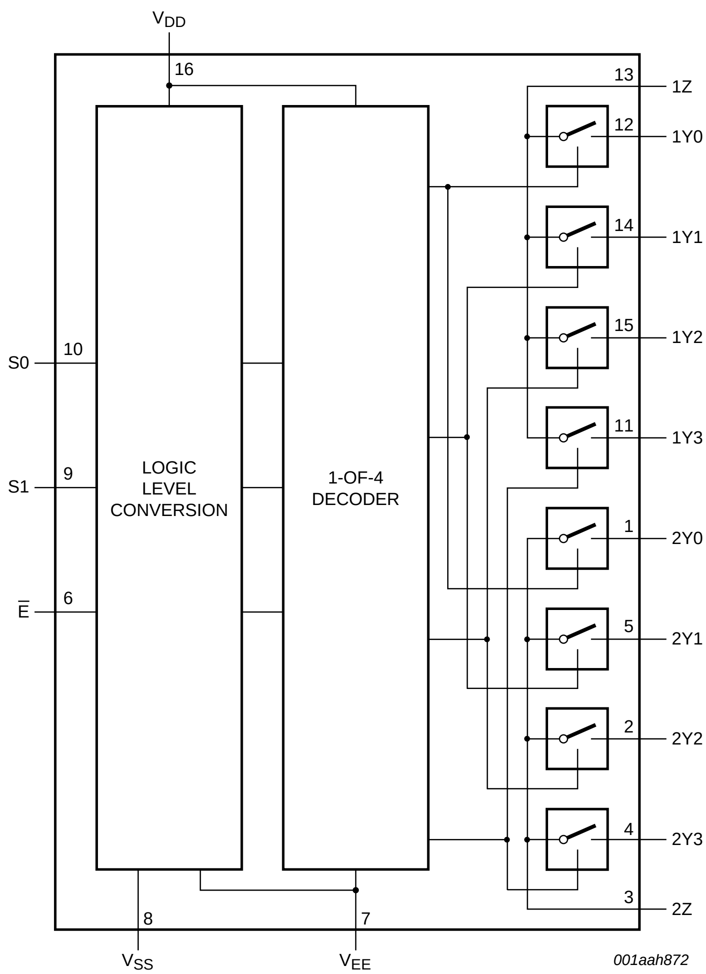


Fig 4. Functional diagram

6. Pinning information

6.1 Pinning

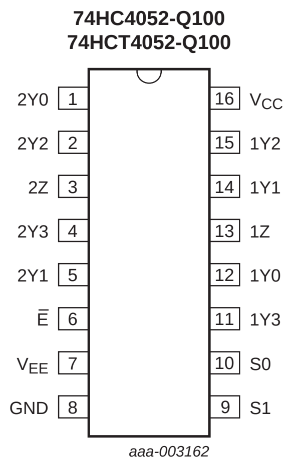
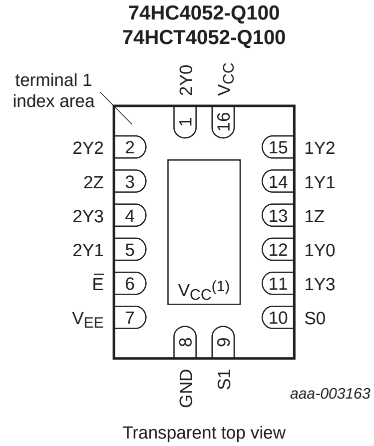


Fig 5. Pin configuration for SO16 and TSSOP16



(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to V_{CC}.

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
$\overline{E}$	6	enable input (active LOW)
V_{EE}	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_{CC}	16	positive supply voltage

7. Functional description

7.1 Function table

Table 3. Function table[1]

Input			Channel on
$\overline{E}$	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

[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 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	$V_{SW} < -0.5$ V or $V_{SW} > V_{CC} + 0.5$ V		-	±20	mA
I_{SW}	switch current	-0.5 V $< V_{SW} < V_{CC} + 0.5$ V		-	±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		[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 flows 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 SO16 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
For TSSOP16 package: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
For DHVQFN16 package: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	74HC4052-Q100			74HCT4052-Q100			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_{CC} − V_{EE}	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 V	-	-	625	-	-	-	ns/V
		V_{CC} = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V_{CC} = 6.0 V	-	-	83	-	-	-	ns/V
		V_{CC} = 10.0 V	-	-	31	-	-	-	ns/V

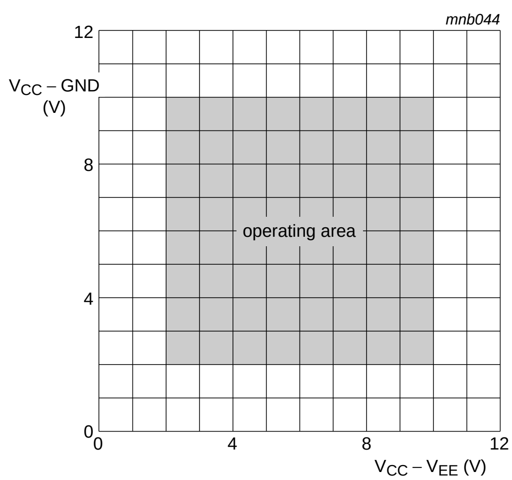


Fig 7. Guaranteed operating area as a function of the supply voltages for 74HC4052-Q100

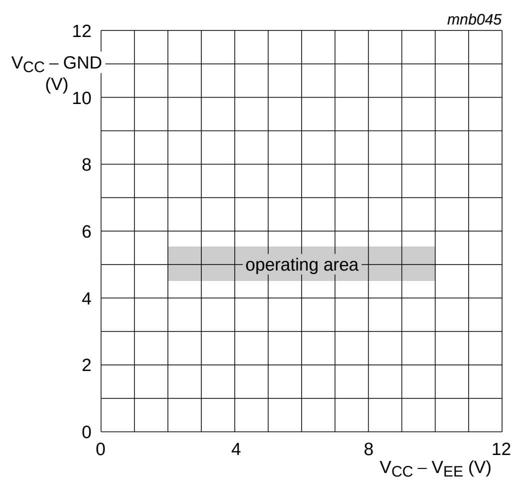


Fig 8. Guaranteed operating area as a function of the supply voltages for 74HCT4052-Q100

10. Static characteristics

Table 6. R_{ON} resistance per switch for 74HC405-Q100 and 74HCT4052-Q100

$V_I = V_{IH}$ or V_{IL}; for test circuit see Figure 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 V, 4.5 V, 6.0 V and 9.0 V.
For 74HCT4052-Q100: $V_{CC} - GND$ = 4.5 V and 5.5 V, $V_{CC} - V_{EE}$ = 2.0 V, 4.5 V, 6.0 V and 9.0 V.

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

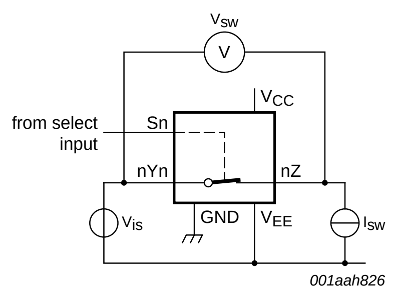
Table 6. R_{ON} resistance per switch for 74HC405-Q100 and 74HCT4052-Q100 *…continued*

$V_I = V_{IH}$ or V_{IL}; for test circuit see Figure 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 V, 4.5 V, 6.0 V and 9.0 V.
For 74HCT4052-Q100: V_{CC} − GND = 4.5 V and 5.5 V, V_{CC} − V_{EE} = 2.0 V, 4.5 V, 6.0 V and 9.0 V.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{ON(rail)}$	ON resistance (rail)	$V_{is} = V_{EE}$					
		V_{CC} = 2.0 V; V_{EE} = 0 V; I_{SW} = 100 μA	[2]	-	-	-	Ω
		V_{CC} = 4.5 V; V_{EE} = 0 V; I_{SW} = 1000 μA		-	-	210	Ω
		V_{CC} = 6.0 V; V_{EE} = 0 V; I_{SW} = 1000 μA		-	-	180	Ω
		V_{CC} = 4.5 V; V_{EE} = −4.5 V; I_{SW} = 1000 μA		-	-	160	Ω
		$V_{is} = V_{CC}$					
		V_{CC} = 2.0 V; V_{EE} = 0 V; I_{SW} = 100 μA	[2]	-	-	-	Ω
		V_{CC} = 4.5 V; V_{EE} = 0 V; I_{SW} = 1000 μA		-	-	240	Ω
		V_{CC} = 6.0 V; V_{EE} = 0 V; I_{SW} = 1000 μA		-	-	210	Ω
		V_{CC} = 4.5 V; V_{EE} = −4.5 V; I_{SW} = 1000 μA		-	-	180	Ω

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

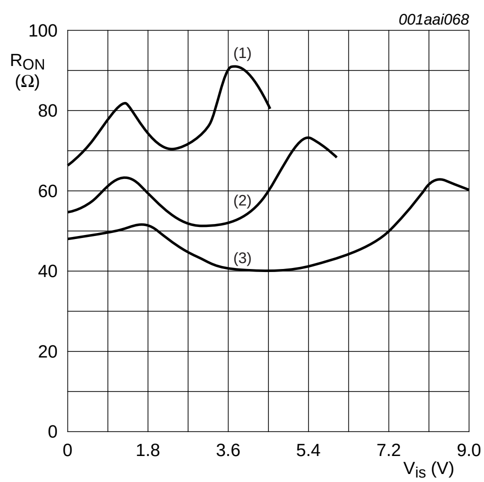
[2] When supply voltages ($V_{CC} - V_{EE}$) near 2.0 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 2 V, only use these devices for transmitting digital signals.



V_{is} = 0 V to ($V_{CC} - V_{EE}$).

$$R_{ON} = \frac{V_{sw}}{I_{sw}}$$

Fig 9. Test circuit for measuring R_{ON}



V_{is} = 0 V to ($V_{CC} - V_{EE}$).

(1) V_{CC} = 4.5 V

(2) V_{CC} = 6 V

(3) V_{CC} = 9 V

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

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

Table 7. Static characteristics for 74HC4052-Q100 *...continued*

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	Max	Unit
$I_{S(OFF)}$	OFF-state leakage current	V_{CC} = 10.0 V; V_{EE} = 0 V; V_I = V_{IH} or V_{IL}; $\lvert V_{SW}\rvert$ = V_{CC} − V_{EE}; see Figure 11				
		per channel	-	-	±1.0	μA
		all channels	-	-	±2.0	μA
$I_{S(ON)}$	ON-state leakage current	V_I = V_{IH} or V_{IL}; $\lvert V_{SW}\rvert$ = V_{CC} − V_{EE}; V_{CC} = 10.0 V; V_{EE} = 0 V; see Figure 12	-	-	±2.0	μA
I_{CC}	supply current	V_{EE} = 0 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 V	-	-	160.0	μA
		V_{CC} = 10.0 V	-	-	320.0	μA

[1] All typical values are measured at T_{amb} = 25 °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.

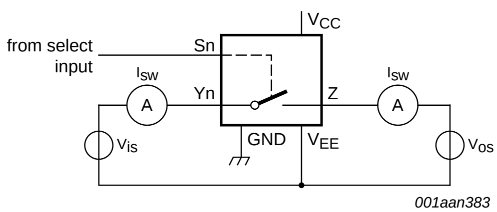
V_{os} is the output voltage at pins nZ or nYn, whichever is assigned as an output.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C[1]						
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	-	-	±1.0	μA
$I_{S(OFF)}$	OFF-state leakage current	V_{CC} = 10.0 V; V_{EE} = 0 V; V_I = V_{IH} or V_{IL}; $\lvert V_{SW}\rvert$ = V_{CC} − V_{EE}; see Figure 11				
		per channel	-	-	±1.0	μA
		all channels	-	-	±2.0	μA
$I_{S(ON)}$	ON-state leakage current	V_{CC} = 10.0 V; V_{EE} = 0 V; V_I = V_{IH} or V_{IL}; $\lvert V_{SW}\rvert$ = V_{CC} − V_{EE}; see Figure 12	-	-	±2.0	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 V; V_{EE} = 0 V	-	-	80.0	μA
		V_{CC} = 5.0 V; V_{EE} = −5.0 V	-	-	160.0	μA
ΔI_{CC}	additional supply current	per input; 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	-	45	202.5	μA
C_I	input capacitance		-	3.5	-	pF
C_{sw}	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	12	-	pF
T_{amb} = −40 °C to +125 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V

Table 8. Static characteristics for 74HCT4052-Q100 *...continued*
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	Max	Unit
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V; V_{EE} = 0 V	-	-	±1.0	μA
$I_{S(OFF)}$	OFF-state leakage current	V_{CC} = 10.0 V; V_{EE} = 0 V; $V_I = V_{IH}$ or V_{IL}; $\|V_{SW}\| = V_{CC} - V_{EE}$; see Figure 11				
		per channel	-	-	±1.0	μA
		all channels	-	-	±2.0	μA
$I_{S(ON)}$	ON-state leakage current	V_{CC} = 10.0 V; V_{EE} = 0 V; $V_I = V_{IH}$ or V_{IL}; $\|V_{SW}\| = V_{CC} - V_{EE}$; see Figure 12	-	-	±2.0	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 V; V_{EE} = 0 V	-	-	160.0	μA
		V_{CC} = 5.0 V; V_{EE} = –5.0 V	-	-	320.0	μA
ΔI_{CC}	additional supply current	per input; $V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND; V_{CC} = 4.5 V to 5.5 V; V_{EE} = 0 V	-	-	220.5	μA

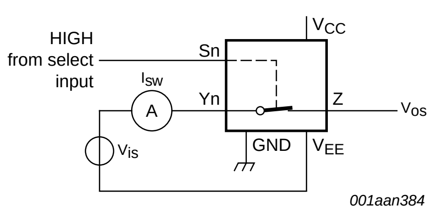
[1] All typical values are measured at T_{amb} = 25 °C.



$V_{is} = V_{CC}$ and $V_{os} = V_{EE}$.

$V_{is} = V_{EE}$ and $V_{os} = V_{CC}$.

Fig 11. Test circuit for measuring OFF-state current



$V_{is} = V_{CC}$ and V_{os} = open-circuit.

$V_{is} = V_{EE}$ and V_{os} = open-circuit.

Fig 12. Test circuit for measuring ON-state current

11. Dynamic characteristics

Table 9. Dynamic characteristics for 74HC4052-Q100
GND = 0 V; t_r = t_f = 6 ns; C_L = 50 pF; for test circuit see Figure 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	Max	Unit
T_{amb} = –40 °C to +85 °C[1]							
t_{pd}	propagation delay	V_{is} to V_{os}; R_L = ∞ Ω; see Figure 13	[2]				
		V_{CC} = 2.0 V; V_{EE} = 0 V		-	14	75	ns
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	5	15	ns
		V_{CC} = 6.0 V; V_{EE} = 0 V		-	4	13	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	4	10	ns
t_{on}	turn-on time	$\overline{E}$, Sn to V_{os}; R_L = ∞ Ω; see Figure 14	[3]				
		V_{CC} = 2.0 V; V_{EE} = 0 V		-	105	405	ns
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	38	81	ns
		V_{CC} = 5.0 V; V_{EE} = 0 V; C_L = 15 pF		-	28	-	ns
		V_{CC} = 6.0 V; V_{EE} = 0 V		-	30	69	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	26	58	ns
t_{off}	turn-off time	$\overline{E}$, Sn to V_{os}; R_L = 1 kΩ; see Figure 14	[4]				
		V_{CC} = 2.0 V; V_{EE} = 0 V		-	74	315	ns
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	27	63	ns
		V_{CC} = 5.0 V; V_{EE} = 0 V; C_L = 15 pF		-	21	-	ns
		V_{CC} = 6.0 V; V_{EE} = 0 V		-	22	54	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	22	48	ns
C_{PD}	power dissipation capacitance	per switch; V_I = GND to V_{CC}	[5]	-	57	-	pF
T_{amb} = –40 °C to +125 °C							
t_{pd}	propagation delay	V_{is} to V_{os}; R_L = ∞ Ω; see Figure 13	[2]				
		V_{CC} = 2.0 V; V_{EE} = 0 V		-	-	90	ns
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	-	18	ns
		V_{CC} = 6.0 V; V_{EE} = 0 V		-	-	15	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	-	12	ns
t_{on}	turn-on time	$\overline{E}$, Sn to V_{os}; R_L = ∞ Ω; see Figure 14	[3]				
		V_{CC} = 2.0 V; V_{EE} = 0 V		-	-	490	ns
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	-	98	ns
		V_{CC} = 6.0 V; V_{EE} = 0 V		-	-	83	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	-	69	ns

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

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; for test circuit see Figure 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	Max	Unit
t_{off}	turn-off time	$\overline{E}$, Sn to V_{os}; $R_L = 1$ kΩ; see Figure 14	[4]				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V		-	-	375	ns
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V		-	-	75	ns
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V		-	-	64	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	-	57	ns

[1] All typical values are measured at $T_{amb} = 25$ °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 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_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.

Table 10. Dynamic characteristics for 74HCT4052-Q100

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; for test circuit see Figure 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	Max	Unit
T_{amb} = –40 °C to +85 °C[1]							
t_{pd}	propagation delay	V_{is} to V_{os}; $R_L = \infty$ Ω; see Figure 13	[2]				
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V		-	5	15	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	4	10	ns
t_{on}	turn-on time	$\overline{E}$, Sn to V_{os}; $R_L = 1$ kΩ; see Figure 14	[3]				
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V		-	41	88	ns
		$V_{CC} = 5.0$ V; $V_{EE} = 0$ V; $C_L = 15$ pF		-	18	-	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	28	60	ns
t_{off}	turn-off time	$\overline{E}$, Sn to V_{os}; $R_L = 1$ kΩ; see Figure 14	[4]				
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V		-	26	63	ns
		$V_{CC} = 5.0$ V; $V_{EE} = 0$ V; $C_L = 15$ pF		-	13	-	ns
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	21	48	ns
C_{PD}	power dissipation capacitance	per switch; V_I = GND to $V_{CC} - 1.5$ V	[5]	-	57	-	pF

Table 10. Dynamic characteristics for 74HCT4052-Q100 *...continued*
GND = 0 V; t_r = t_f = 6 ns; C_L = 50 pF; for test circuit see Figure 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	Max	Unit
T_{amb} = –40 °C to +125 °C							
t_{pd}	propagation delay	V_{is} to V_{os}; R_L = ∞ Ω; see Figure 13	[2]				
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	-	18	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	-	12	ns
t_{on}	turn-on time	$\overline{E}$, Sn to V_{os}; R_L = 1 kΩ; see Figure 14	[3]				
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	-	105	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	-	72	ns
t_{off}	turn-off time	$\overline{E}$, Sn to V_{os}; R_L = 1 kΩ; see Figure 14	[4]				
		V_{CC} = 4.5 V; V_{EE} = 0 V		-	-	75	ns
		V_{CC} = 4.5 V; V_{EE} = –4.5 V		-	-	57	ns

[1] All typical values are measured at T_{amb} = 25 °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 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_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.

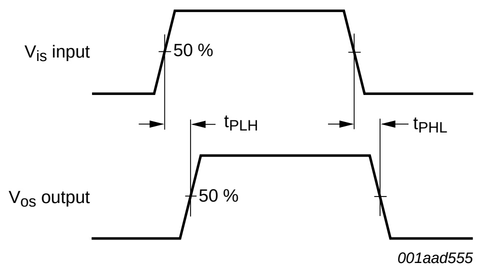
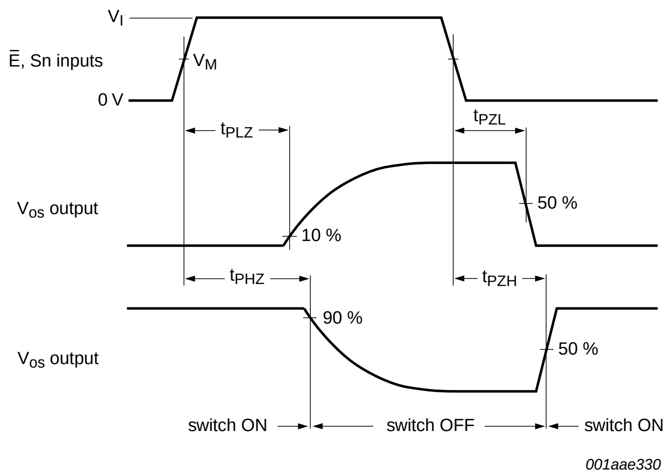


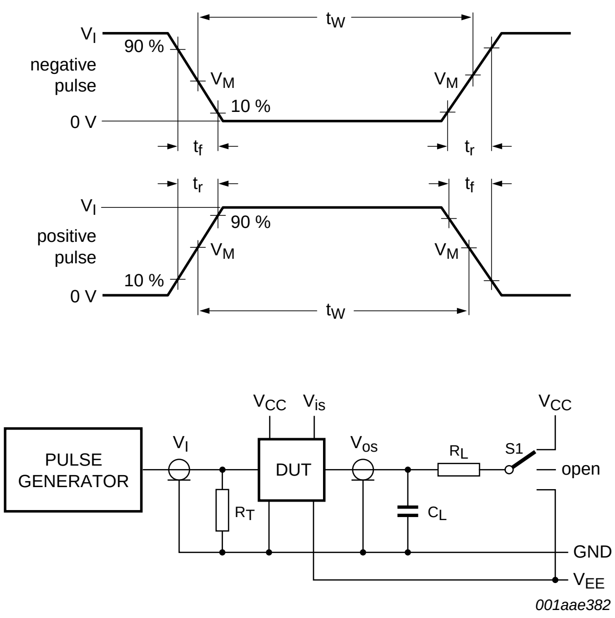
Fig 13. Input (V_{is}) to output (V_{os}) propagation delays



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

For 74HCT4052-Q100: $V_M = 1.3$ V.

Fig 14. Turn-on and turn-off times



Definitions for test circuit; see Table 11:

R_T = termination resistance should be equal to the output impedance Z_o of the pulse generator.

C_L = load capacitance including jig and probe capacitance.

R_L = load resistance.

S1 = Test selection switch.

Fig 15. Test circuit for measuring AC performance

Table 11. Test data

Test	Input				Load		S1 position
	V_I	V_{is}	t_r, t_f		C_L	R_L	
			at f_{max}	other[1]			
t_{PHL}, t_{PLH}	[2]	pulse	< 2 ns	6 ns	50 pF	1 kΩ	open
t_{PZH}, t_{PHZ}	[2]	V_{CC}	< 2 ns	6 ns	50 pF	1 kΩ	V_{EE}
t_{PZL}, t_{PLZ}	[2]	V_{EE}	< 2 ns	6 ns	50 pF	1 kΩ	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 74HC4052-Q100: $V_I = V_{CC}$

b) For 74HCT4052-Q100: $V_I = 3$ V

12. Additional dynamic characteristics

Table 12. Additional dynamic characteristics

Recommended conditions and typical values; GND = 0 V; $T_{amb} = 25$ °C; $C_L = 50$ 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	$f_i = 1$ kHz; $R_L = 10$ kΩ; see Figure 16					
		$V_{is} = 4.0$ V (p-p); $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V		-	0.04	-	%
		$V_{is} = 8.0$ V (p-p); $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	0.02	-	%
		$f_i = 10$ kHz; $R_L = 10$ kΩ; see Figure 16					
		$V_{is} = 4.0$ V (p-p); $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V		-	0.12	-	%
		$V_{is} = 8.0$ V (p-p); $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	0.06	-	%
α_{iso}	isolation (OFF-state)	$R_L = 600$ Ω; $f_i = 1$ MHz; see Figure 17					
		$V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V	[1]	-	–50	-	dB
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	[1]	-	–50	-	dB
Xtalk	crosstalk	between two switches/multiplexers; $R_L = 600$ Ω; $f_i = 1$ MHz; see Figure 18					
		$V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V	[1]	-	–60	-	dB
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	[1]	-	–60	-	dB
V_{ct}	crosstalk voltage	peak-to-peak value between control and any switch. $R_L = 600$ Ω; $f_i = 1$ MHz; $\overline{E}$ or Sn square wave between V_{CC} and GND; $t_r = t_f = 6$ ns; see Figure 19					
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V		-	110	-	mV
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	220	-	mV
$f_{(-3dB)}$	–3 dB frequency response	$R_L = 50$ Ω; see Figure 20					
		$V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V	[2]	-	170	-	MHz
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V	[2]	-	180	-	MHz

[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).

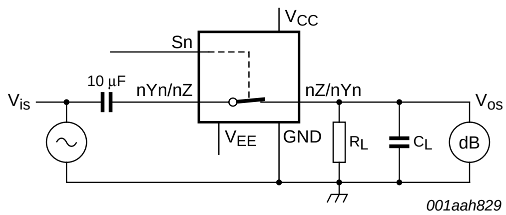
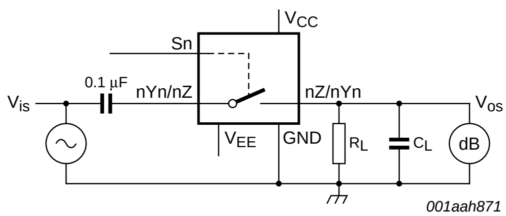
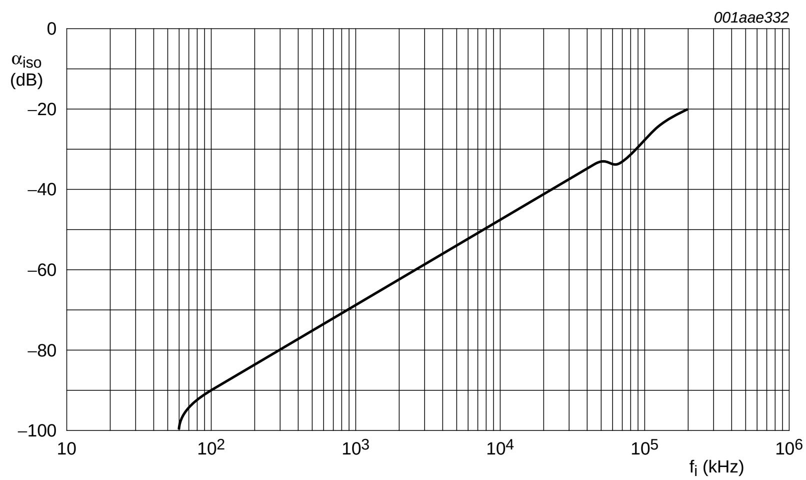


Fig 16. Test circuit for measuring sine-wave distortion



V_{CC} = 4.5 V; GND = 0 V; V_{EE} = –4.5 V; R_L = 600 Ω; R_S = 1 kΩ.

a. Test circuit



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

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

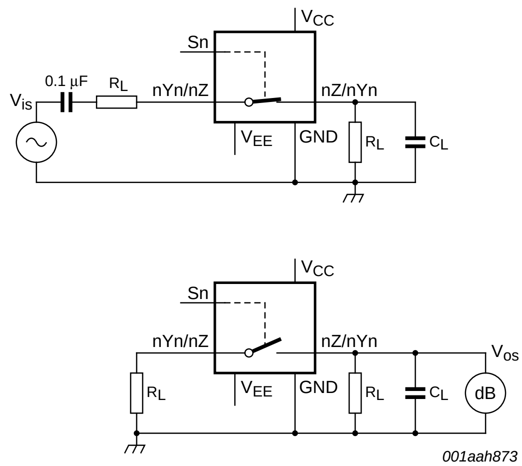


Fig 18. Test circuits for measuring crosstalk between any two switches/multiplexers

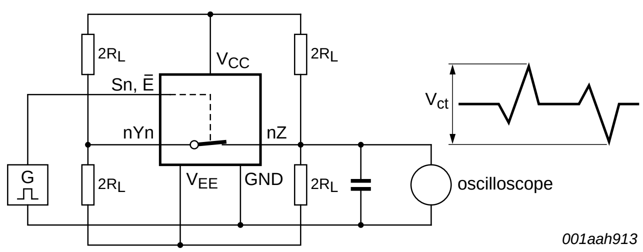
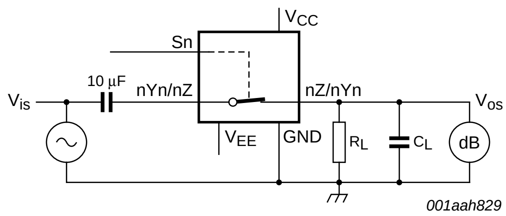
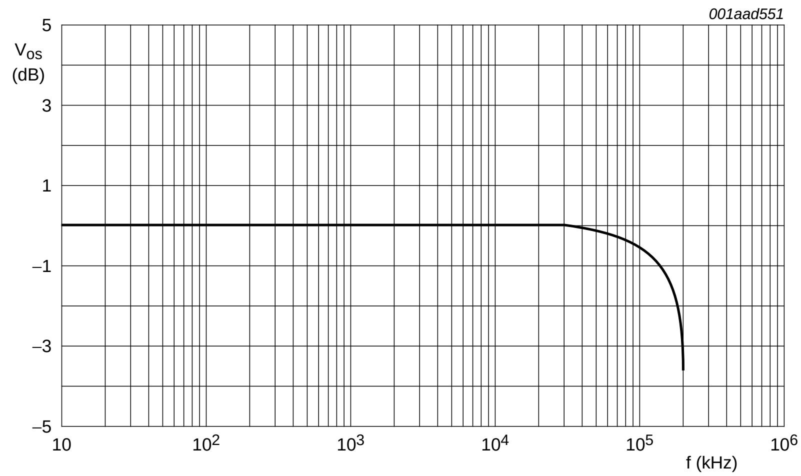


Fig 19. Test circuit for measuring crosstalk between control input and any switch



V_{CC} = 4.5 V; GND = 0 V; V_{EE} = –4.5 V; R_L = 50 Ω; R_S = 1 kΩ.

a. Test circuit

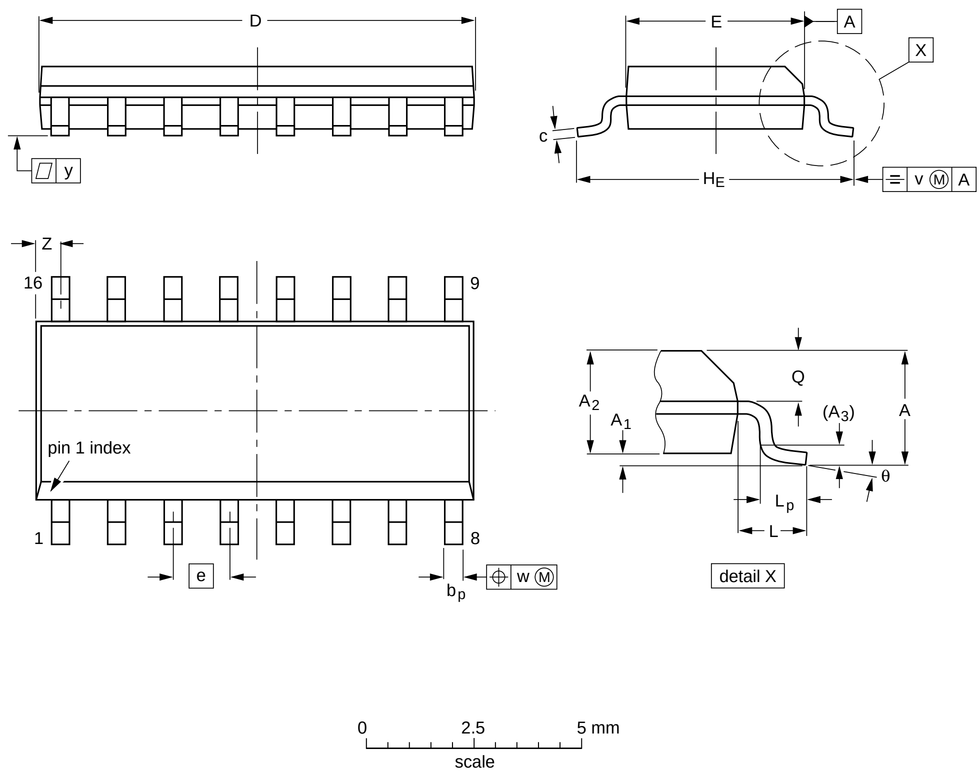


b. Typical frequency response

Fig 20. Test circuit for frequency response

13. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

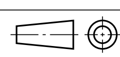
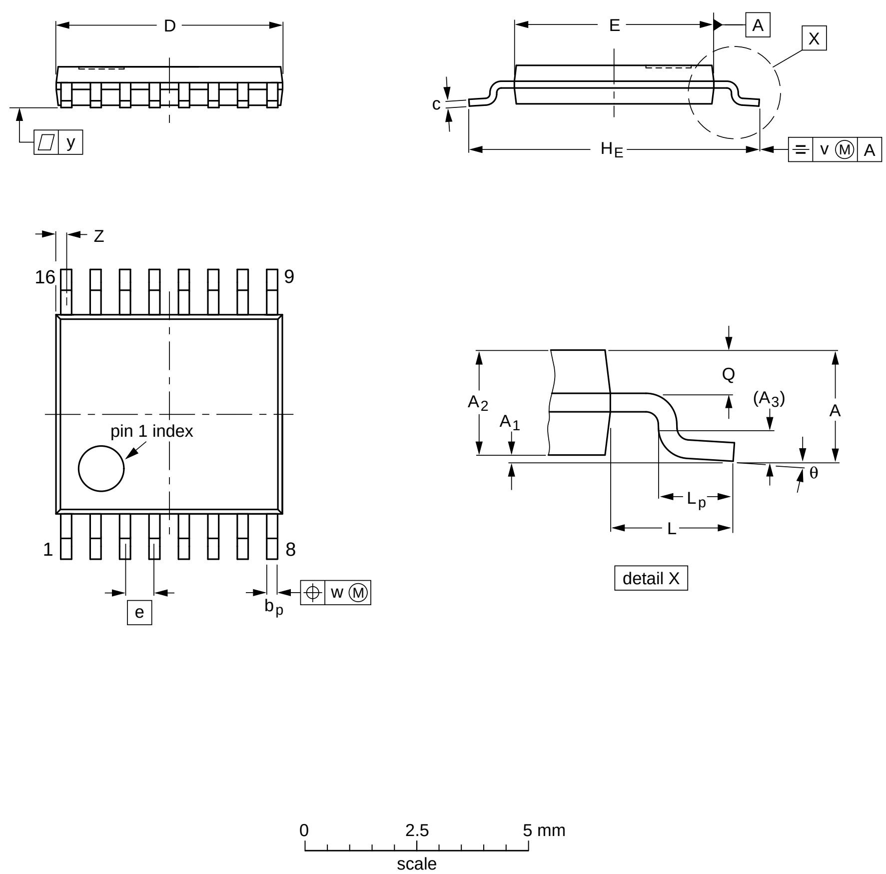
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT109-1	076E07	MS-012				~~99-12-27~~ 03-02-19

Fig 21. Package outline SOT109-1 (SO16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm **SOT403-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°

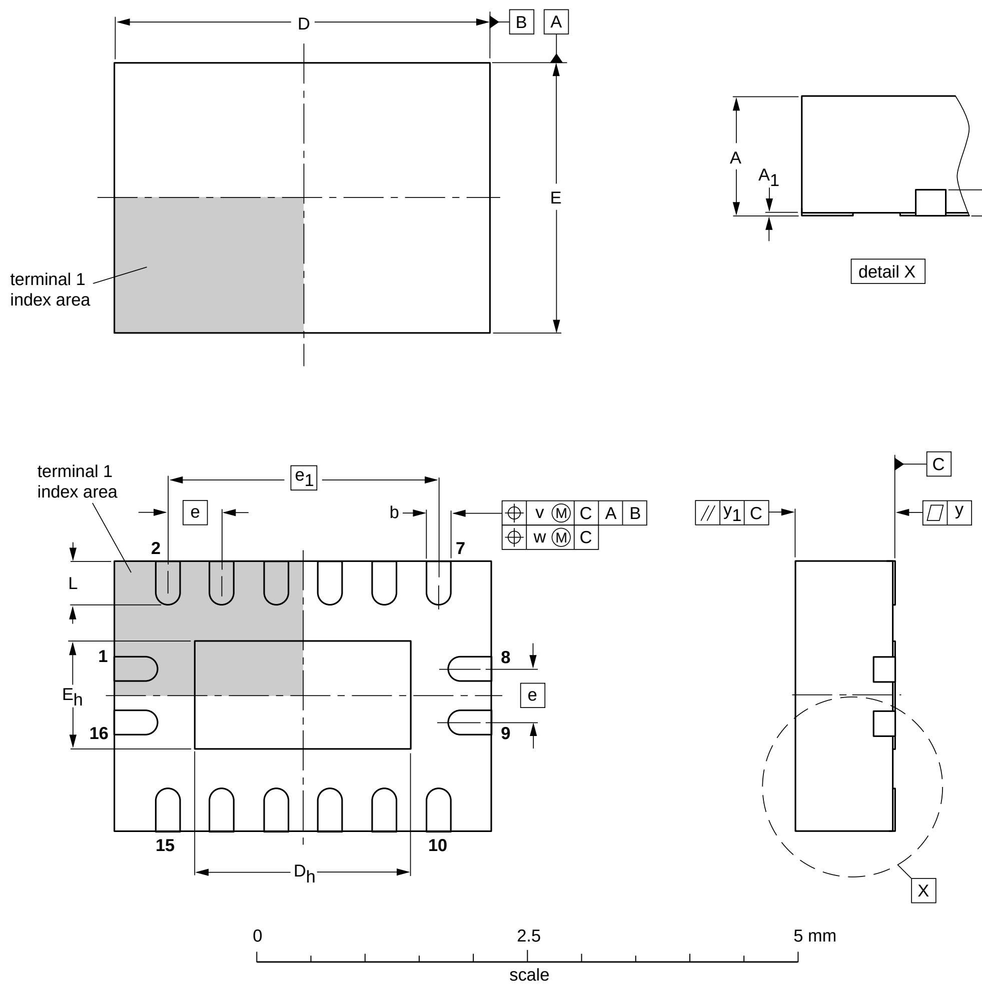
Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT403-1		MO-153				~~99-12-27~~ 03-02-18

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max.	A_1	b	c	D(1)	D_h	E(1)	E_h	e	e_1	L	v	w	y	y_1
mm	1	0.05 0.00	0.30 0.18	0.2	3.6 3.4	2.15 1.85	2.6 2.4	1.15 0.85	0.5	2.5	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

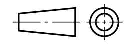
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT763-1	- - -	MO-241	- - -			~~02-10-17~~ 03-01-27

Fig 23. Package outline SOT763-1 (DHVQFN16)

14. Abbreviations

Table 13. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
MIL	Military

15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4052_Q100 v.2	20121122	Product data sheet	-	74HC_HCT4052_Q100 v.1
Modifications:	• CDM added to features.			
74HC_HCT4052_Q100 v.1	20120720	Product data sheet	-	-

16. Legal information

16.1 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.

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17. Contact information

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For sales office addresses, please send an email to: **salesaddresses@nxp.com**

18. Contents

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