

74HC4052-Q100; 74HCT4052-Q100

Dual 4-channel analog multiplexer/demultiplexer

Rev. 4 — 21 March 2024

Product data sheet

1. General description

The 74HC4052-Q100; 74HCT4052-Q100 is a dual single-pole quad-throw analog switch ($2 \times \text{SP4T}$) 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 (\bar{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

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40°C to $+85^\circ\text{C}$ and from -40°C to $+125^\circ\text{C}$
- Wide analog input voltage range from -5 V to $+5\text{ V}$
- Low ON resistance:
 - $80\ \Omega$ (typical) at $V_{CC} - V_{EE} = 4.5\text{ V}$
 - $70\ \Omega$ (typical) at $V_{CC} - V_{EE} = 6.0\text{ V}$
 - $60\ \Omega$ (typical) at $V_{CC} - V_{EE} = 9.0\text{ V}$
- Logic level translation: to enable 5 V logic to communicate with $\pm 5\text{ V}$ analog signals
- Typical 'break before make' built-in
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Applications

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

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4. Ordering information

Table 1. Ordering information

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

5. Functional diagram

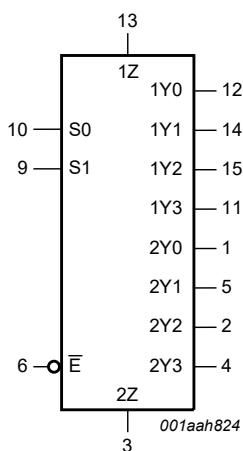


Fig. 1. Logic symbol

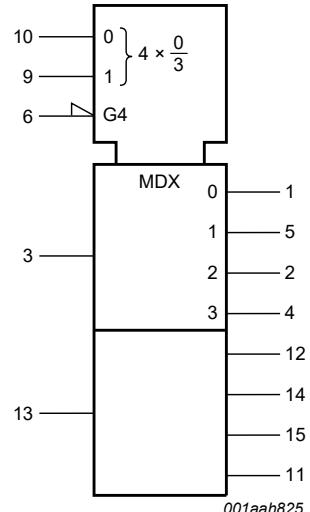


Fig. 2. IEC logic symbol

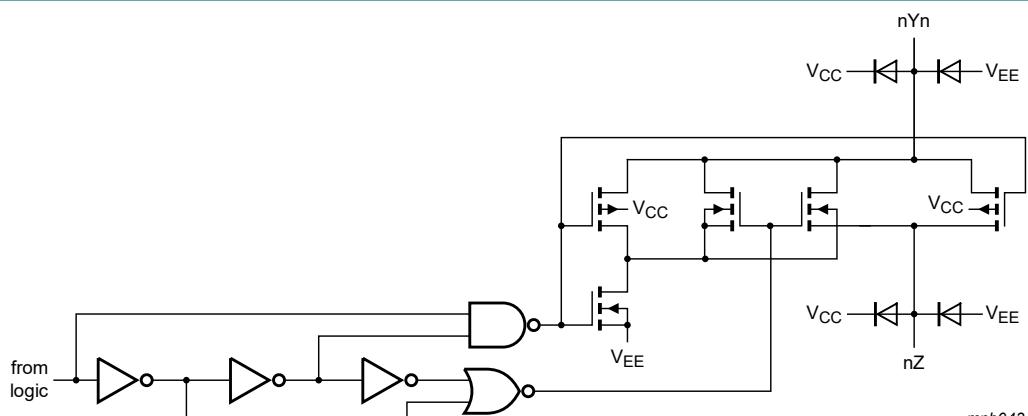


Fig. 3. Schematic diagram (one switch)

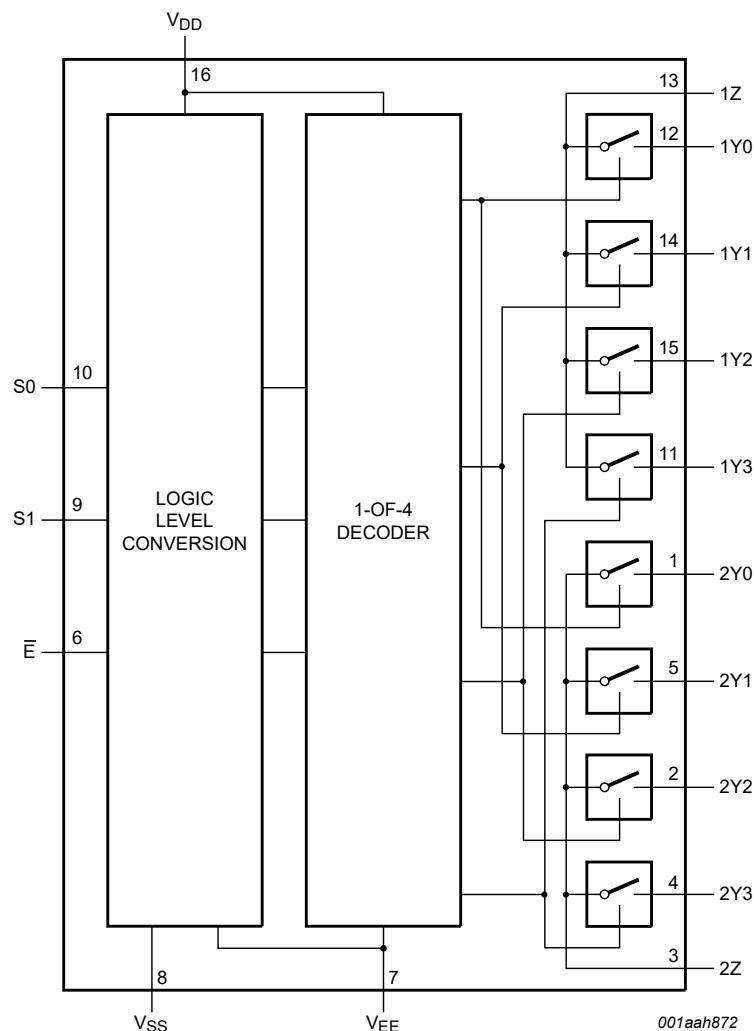
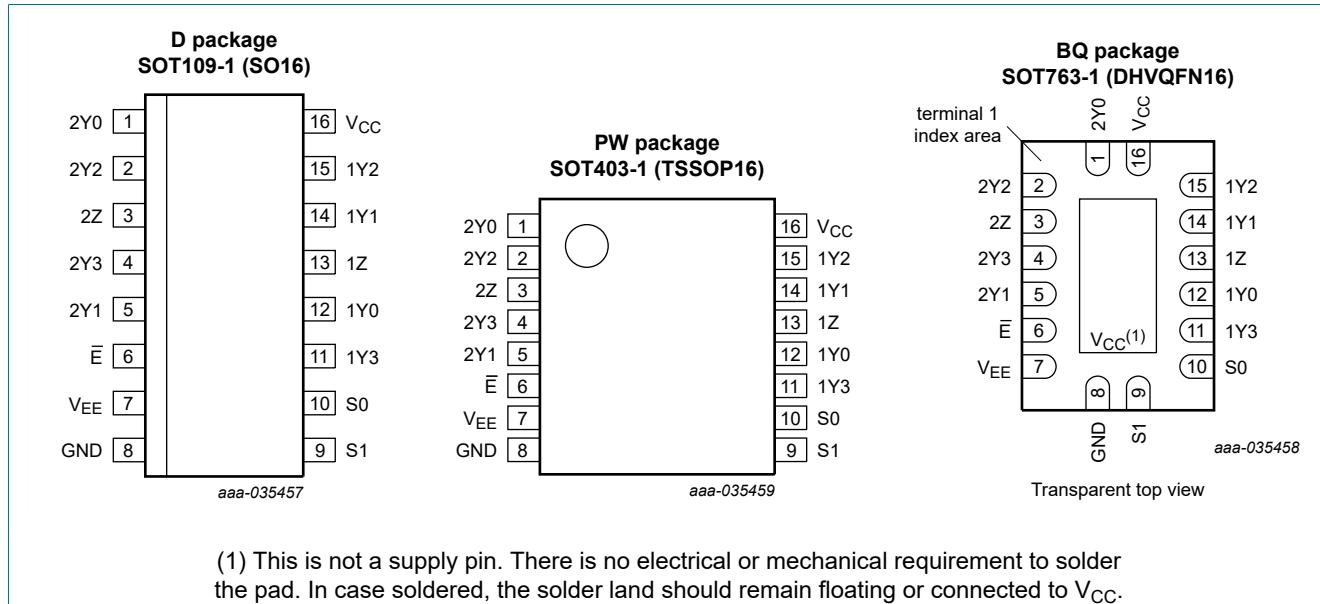


Fig. 4. Functional diagram

6. Pinning information

6.1. Pinning



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
Ē	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

Table 3. Function table

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

Input	Channel on		
Ē	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	
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	$-0.5 \text{ V} < V_{SW} < V_{CC} + 0.5 \text{ V}$	-	± 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	power dissipation	per switch	-	100	mW	
P_{tot}	total power dissipation	SOT109-1; SOT403-1; SOT763-1	[2]	-	500	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_{CC}	supply voltage	see Fig. 5 and Fig. 6							
		$V_{CC} - GND$	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	$V_{CC} = 2.0 \text{ V}$	-	-	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
		$V_{CC} = 10.0 \text{ V}$	-	-	31	-	-	-	ns/V

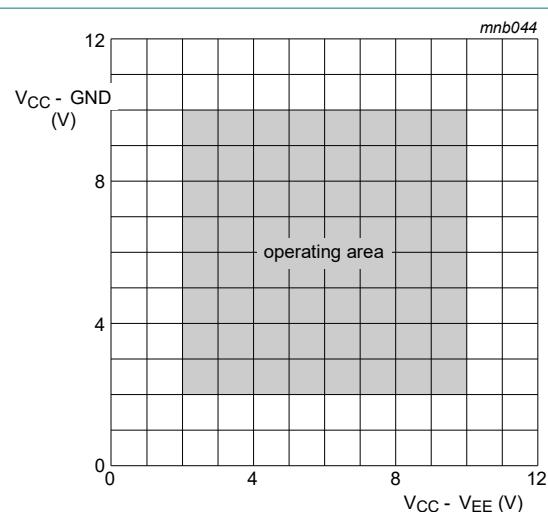


Fig. 5. Guaranteed operating area as a function of the supply voltages for 74HC4052-Q100

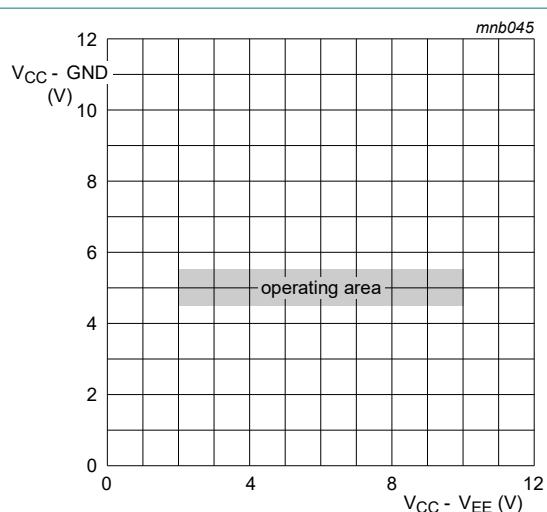


Fig. 6. Guaranteed operating area as a function of the supply voltages for 74HCT4052-Q100

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. 7.

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.

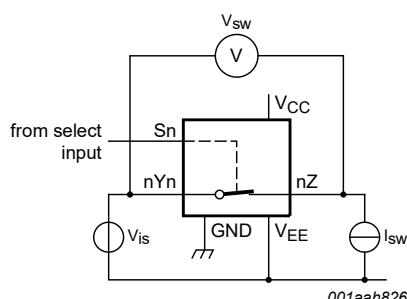
For 74HCT4052-Q100: $V_{CC} - GND = 4.5$ V and 5.5 V, $V_{CC} - V_{EE} = 2.0$ V, 4.5 V, 6.0 V and 9.0 V.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$T_{amb} = -40$ °C to +85 °C						
$R_{ON(peak)}$	ON resistance (peak)	$V_{IS} = V_{CC}$ to V_{EE}				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V; $I_{SW} = 100$ μ A	[2]	-	-	Ω
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V; $I_{SW} = 1000$ μ A		-	100	225
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V; $I_{SW} = 1000$ μ A		-	90	200
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V; $I_{SW} = 1000$ μ A		-	70	165
$R_{ON(rail)}$	ON resistance (rail)	$V_{IS} = V_{EE}$				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V; $I_{SW} = 100$ μ A	[2]	-	150	Ω
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V; $I_{SW} = 1000$ μ A		-	80	175
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V; $I_{SW} = 1000$ μ A		-	70	150
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V; $I_{SW} = 1000$ μ A		-	60	130
		$V_{IS} = V_{CC}$				
		$V_{CC} = 2.0$ V; $V_{EE} = 0$ V; $I_{SW} = 100$ μ A	[2]	-	150	Ω
		$V_{CC} = 4.5$ V; $V_{EE} = 0$ V; $I_{SW} = 1000$ μ A		-	90	200
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V; $I_{SW} = 1000$ μ A		-	80	175
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V; $I_{SW} = 1000$ μ A		-	65	150
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	-
		$V_{CC} = 6.0$ V; $V_{EE} = 0$ V		-	8	-
		$V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V		-	6	-

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
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
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.

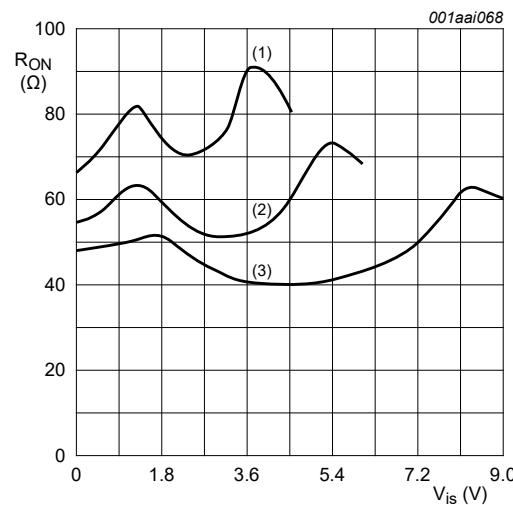
[2] When supply voltages (V_{CC} - V_{EE}) near 2.0 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 2 V, it is recommended to use these devices only for transmitting digital signals.



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

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

Fig. 7. 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. 8. 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[1]	Max	Unit
$T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	4.7	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	4.3	2.7	V
I_I	input leakage current	$V_{EE} = 0\text{ V}$; $V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}$	-	-	± 1.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	± 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 Fig. 9				
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 2.0	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 Fig. 10	-	-	± 2.0	μA
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}				
		$V_{CC} = 6.0\text{ V}$	-	-	80.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	160.0	μA
C_I	input capacitance		-	3.5	-	pF
C_{sw}	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	12	-	pF
$T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	-	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	-	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	-	-	V
		$V_{CC} = 9.0\text{ V}$	6.3	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	-	1.8	V
		$V_{CC} = 9.0\text{ V}$	-	-	2.7	V
I_I	input leakage current	$V_{EE} = 0\text{ V}$; $V_I = V_{CC}$ or GND				
		$V_{CC} = 6.0\text{ V}$	-	-	± 1.0	μA
		$V_{CC} = 10.0\text{ V}$	-	-	± 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 Fig. 9				
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 2.0	μA

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$I_{S(ON)}$	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. 10	-	-	± 2.0	μA
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	μA
		$V_{CC} = 10.0 \text{ V}$	-	-	320.0	μA

[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).

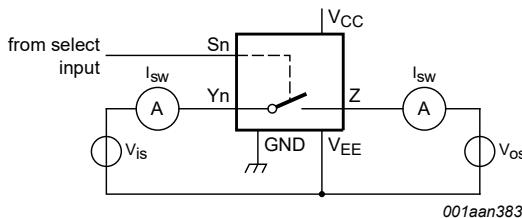
V_{is} is the input voltage at pins nYn or nZ , whichever is assigned as an input.

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
$T_{amb} = -40 \text{ }^{\circ}\text{C to } +85 \text{ }^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	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; $V_{CC} = 5.5 \text{ V}$; $V_{EE} = 0 \text{ V}$	-	-	± 1.0	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 Fig. 9				
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 2.0	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 Fig. 10	-	-	± 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}				
		$V_{CC} = 5.5 \text{ V}$; $V_{EE} = 0 \text{ V}$	-	-	80.0	μA
		$V_{CC} = 5.0 \text{ V}$; $V_{EE} = -5.0 \text{ V}$	-	-	160.0	μA
ΔI_{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	μA
C_I	input capacitance		-	3.5	-	pF
C_{sw}	switch capacitance	independent pins nYn	-	5	-	pF
		common pins nZ	-	12	-	pF
$T_{amb} = -40 \text{ }^{\circ}\text{C to } +125 \text{ }^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	V
I_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	$V_{CC} = 10.0 \text{ V}$; $V_{EE} = 0 \text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{sw} = V_{CC} - V_{EE}$; see Fig. 9				
		per channel	-	-	± 1.0	μA
		all channels	-	-	± 2.0	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 Fig. 10	-	-	± 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}				
		$V_{CC} = 5.5 \text{ V}$; $V_{EE} = 0 \text{ V}$	-	-	160.0	μA
		$V_{CC} = 5.0 \text{ V}$; $V_{EE} = -5.0 \text{ V}$	-	-	320.0	μA

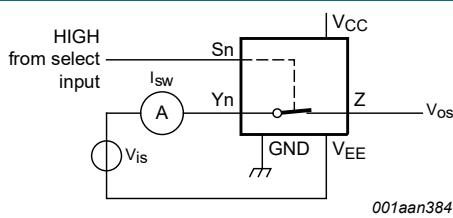
Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
ΔI_{CC}	additional supply current	per input; $V_I = V_{CC} - 2.1 \text{ V}$; other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V}$ to 5.5 V ; $V_{EE} = 0 \text{ V}$	-	-	220.5	μA

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



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

Fig. 9. 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. 10. Test circuit for measuring ON-state current

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. 13.

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
$T_{amb} = -40^\circ\text{C}$ to $+85^\circ\text{C}$						
t_{pd}	propagation delay	V_{is} to V_{os} ; $R_L = \infty \Omega$; see Fig. 11 [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	E , Sn to V_{os} ; $R_L = \infty \Omega$; see Fig. 12 [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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
t_{off}	turn-off time	\bar{E} , S_n to V_{os} ; $R_L = 1 \text{ k}\Omega$; see Fig. 12 [4]				
		$V_{\text{CC}} = 2.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	74	315	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	27	63	ns
		$V_{\text{CC}} = 5.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$; $C_L = 15 \text{ pF}$	-	21	-	ns
		$V_{\text{CC}} = 6.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	22	54	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = -4.5 \text{ V}$	-	22	48	ns
C_{PD}	power dissipation capacitance	per switch; $V_I = \text{GND}$ to V_{CC} [5]	-	57	-	pF
$T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$ to $+125 \text{ }^{\circ}\text{C}$						
t_{pd}	propagation delay	V_{IS} to V_{os} ; $R_L = \infty \Omega$; see Fig. 11 [2]				
		$V_{\text{CC}} = 2.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	90	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	18	ns
		$V_{\text{CC}} = 6.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	15	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = -4.5 \text{ V}$	-	-	12	ns
t_{on}	turn-on time	\bar{E} , S_n to V_{os} ; $R_L = \infty \Omega$; see Fig. 12 [3]				
		$V_{\text{CC}} = 2.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	490	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	98	ns
		$V_{\text{CC}} = 6.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	83	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = -4.5 \text{ V}$	-	-	69	ns
t_{off}	turn-off time	\bar{E} , S_n to V_{os} ; $R_L = 1 \text{ k}\Omega$; see Fig. 12 [4]				
		$V_{\text{CC}} = 2.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	375	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	75	ns
		$V_{\text{CC}} = 6.0 \text{ V}$; $V_{\text{EE}} = 0 \text{ V}$	-	-	64	ns
		$V_{\text{CC}} = 4.5 \text{ V}$; $V_{\text{EE}} = -4.5 \text{ V}$	-	-	57	ns

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

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

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

[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).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

N = number of inputs switching;

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

$GND = 0 V$; $t_r = t_f = 6 \text{ ns}$; $C_L = 50 \text{ pF}$; for test circuit see [Fig. 13](#).

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	
$T_{amb} = -40 \text{ }^{\circ}\text{C to } +85 \text{ }^{\circ}\text{C}$							
t_{pd}	propagation delay	V_{IS} to V_{OS} ; $R_L = \infty \Omega$; see Fig. 11	[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} , S_n to V_{OS} ; $R_L = 1 \text{ k}\Omega$; see Fig. 12	[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} , S_n to V_{OS} ; $R_L = 1 \text{ k}\Omega$; see Fig. 12	[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
$T_{amb} = -40 \text{ }^{\circ}\text{C to } +125 \text{ }^{\circ}\text{C}$							
t_{pd}	propagation delay	V_{IS} to V_{OS} ; $R_L = \infty \Omega$; see Fig. 11	[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} , S_n to V_{OS} ; $R_L = 1 \text{ k}\Omega$; see Fig. 12	[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} , S_n to V_{OS} ; $R_L = 1 \text{ k}\Omega$; see Fig. 12	[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 $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

[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 μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

N = number of inputs switching;

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

C_L = output load capacitance in pF;

C_{sw} = switch capacitance in pF;

V_{CC} = supply voltage in V.

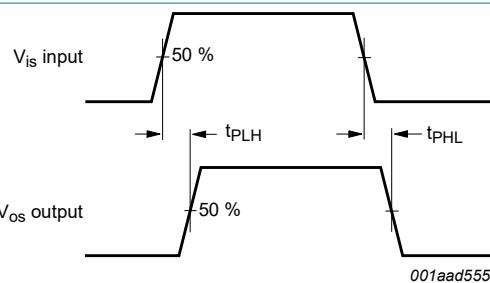
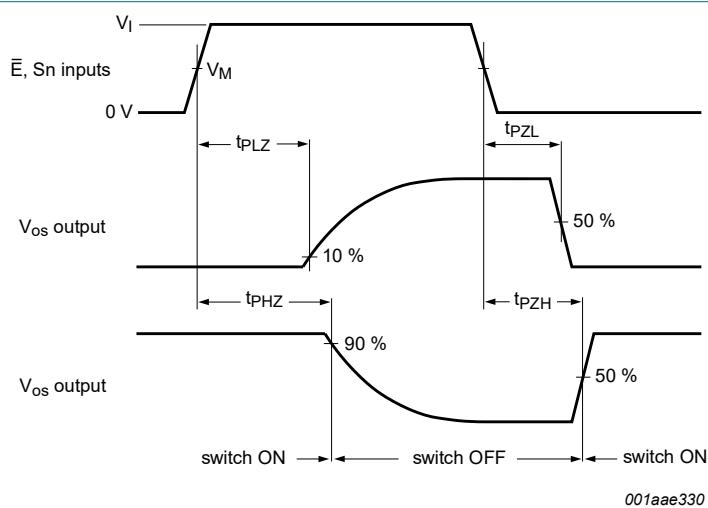
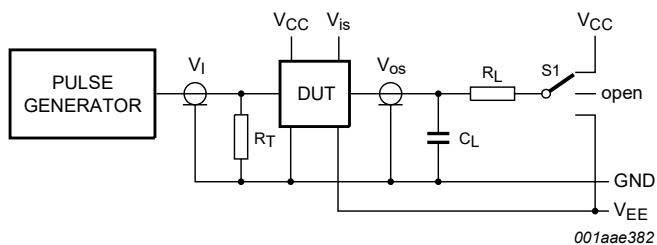
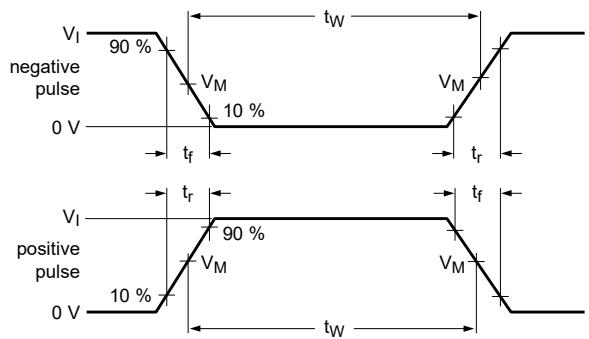
Fig. 11. Input (V_{is}) to output (V_{os}) propagation delaysFor 74HC4052-Q100: $V_M = 0.5 \times V_{CC}$.For 74HCT4052-Q100: $V_M = 1.3$ V.

Fig. 12. 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. 13. Test circuit for measuring switching 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 Ω	open	
t_{PZH}, t_{PHZ}	V_{CC}	V_{CC}	< 2 ns	6 ns	50 pF	1 k Ω	V_{EE}	
t_{PZL}, t_{PLZ}	V_{CC}	V_{EE}	< 2 ns	6 ns	50 pF	1 k Ω	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 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 Fig. 14					
		$V_{is} = 4.0$ 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 Fig. 14					
		$V_{is} = 4.0$ 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 Fig. 15					
		$V_{CC} = 2.25$ 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 Fig. 16					
		$V_{CC} = 2.25$ 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; E or Sn square wave between V_{CC} and GND; $t_r = t_f = 6$ ns; see Fig. 17					
		$V_{CC} = 4.5$ 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 Fig. 18					
		$V_{CC} = 2.25$ 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).

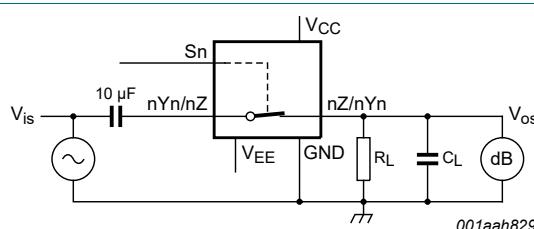
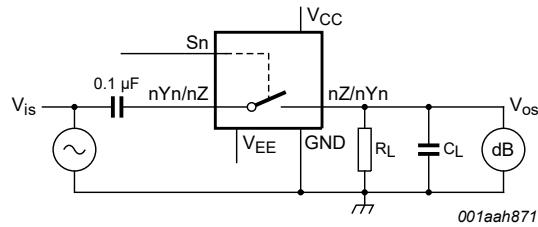
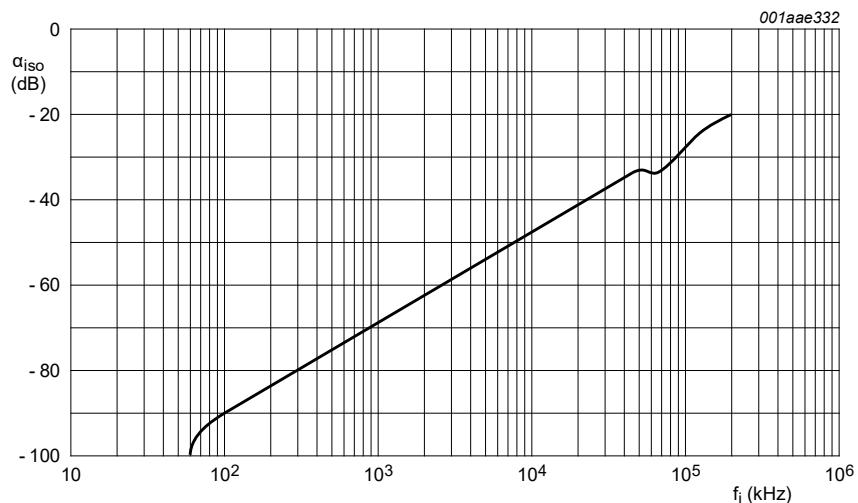


Fig. 14. Test circuit for measuring sine-wave distortion



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

a. Test circuit



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

Fig. 15. Test circuit for measuring isolation (OFF-state)

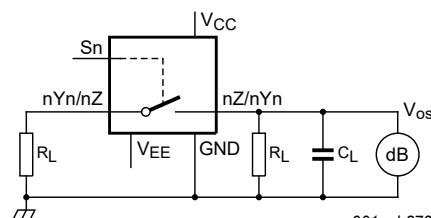
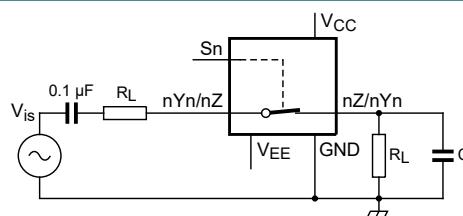


Fig. 16. Test circuits for measuring crosstalk between any two switches/multiplexers

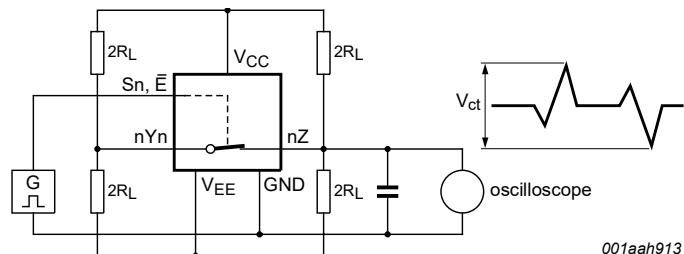
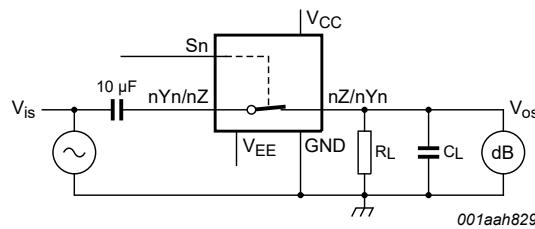
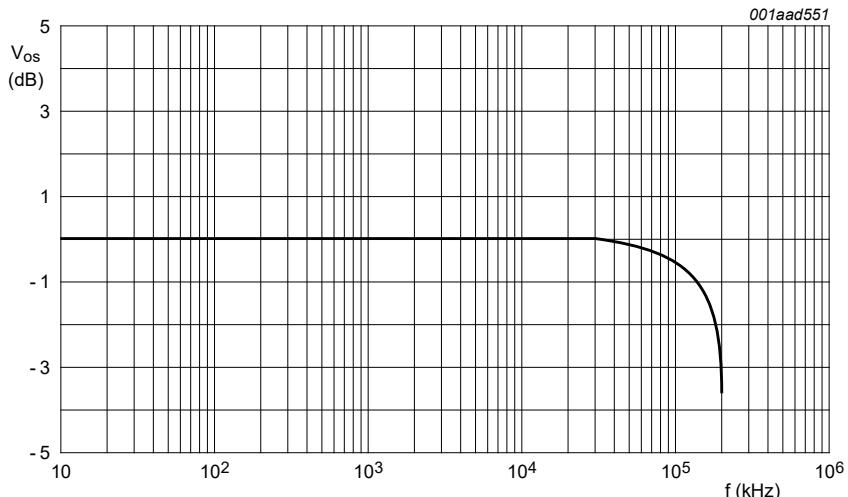


Fig. 17. Test circuit for measuring crosstalk between control input and any switch



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

a. Test circuit



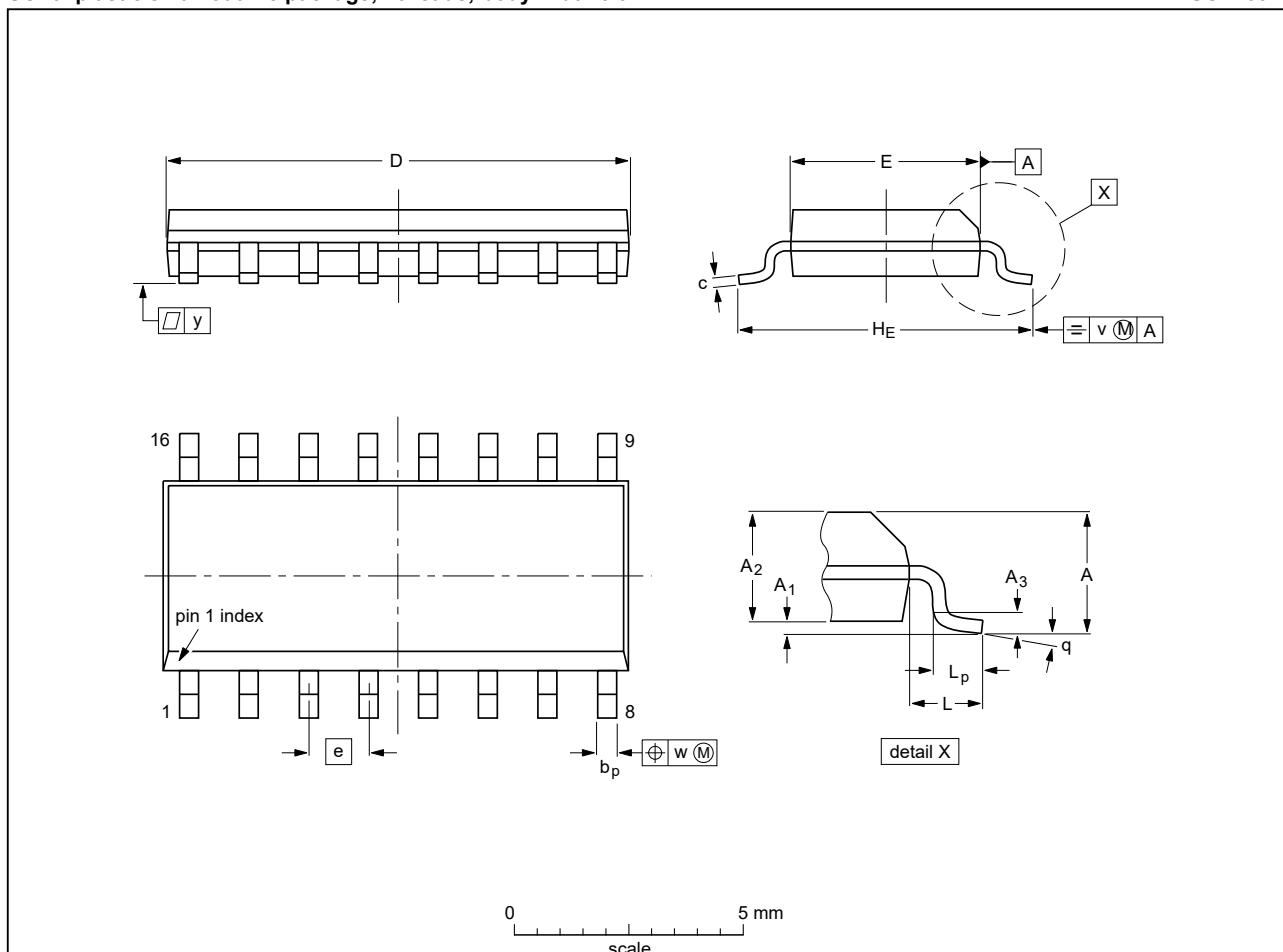
b. Typical frequency response

Fig. 18. Test circuit for frequency response

12. 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	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	v	w	y	θ
mm	max 1.75	0.25			0.51	0.25	10.0	4.0		6.2		1.27	0.2	0.25	0.1	8°
mm	nom			0.25					1.27		1.05					0°
mm	min 0.10	1.25		0.31	0.10	9.8	3.8		5.8		0.4					
inches	max 0.069	0.010		0.020	0.010	0.394	0.16		0.244		0.05					8°
inches	nom			0.01					0.05		0.041		0.008	0.01	0.004	0°
inches	min 0.004	0.049		0.012	0.004	0.386	0.15		0.228		0.016					

Note

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

sot109-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT109-1		MS-012				03-02-19 23-10-27

Fig. 19. Package outline SOT109-1 (SO16)

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

SOT403-1

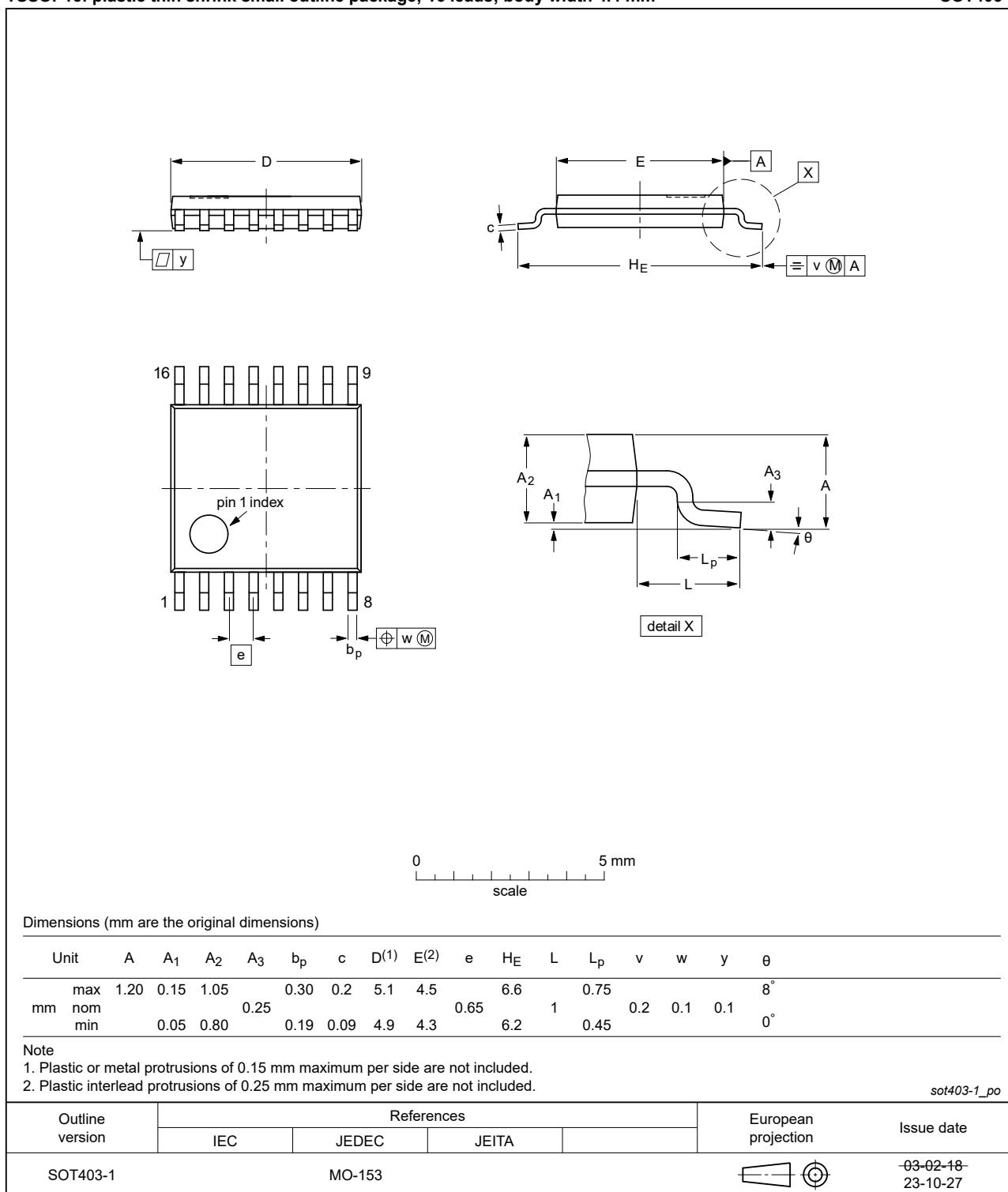


Fig. 20. Package outline SOT403-1 (TSSOP16)

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

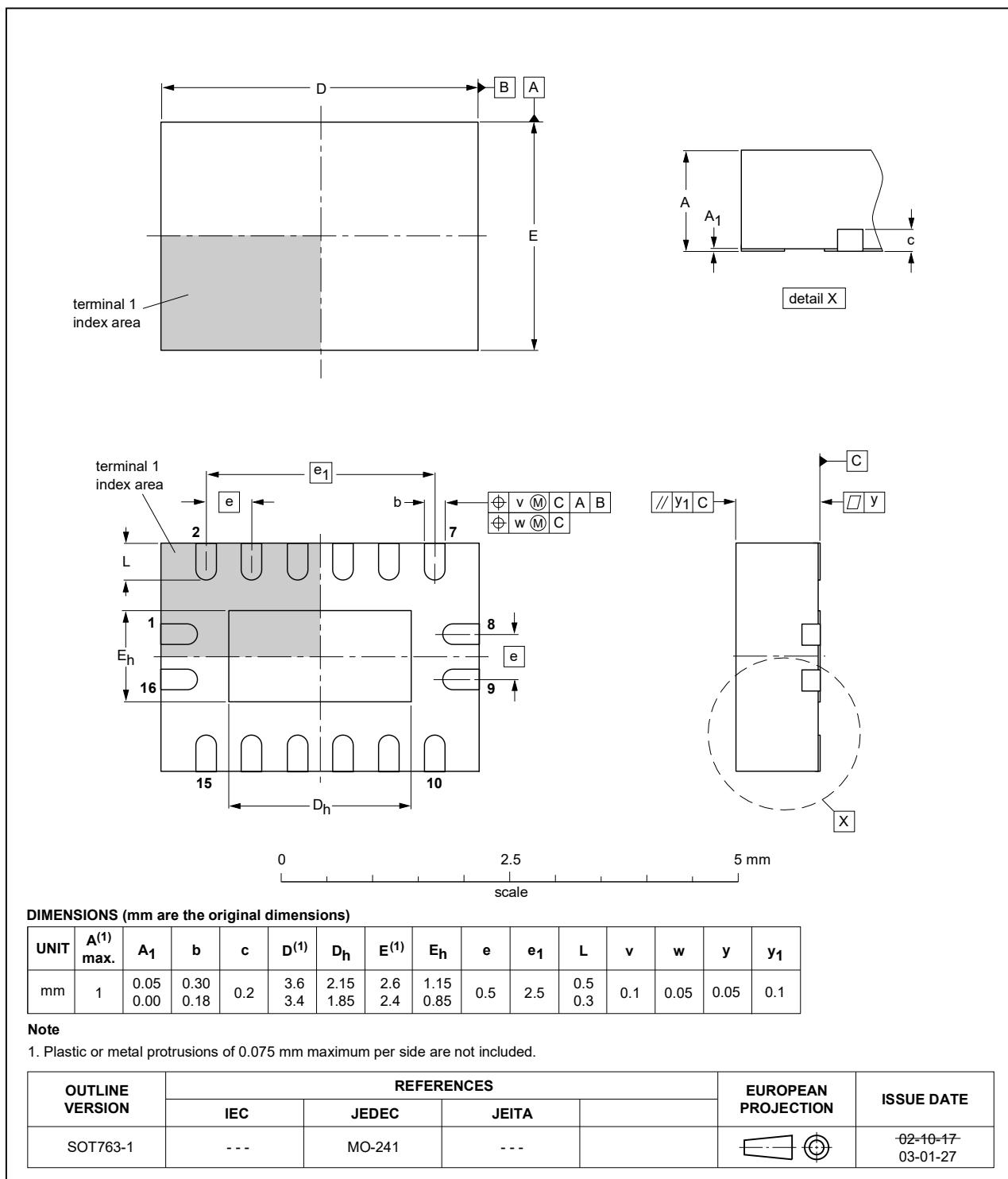


Fig. 21. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 13. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model

14. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4052_Q100 v.4	20240321	Product data sheet	-	74HC_HCT4052_Q100 v.3
Modifications:	<ul style="list-style-type: none">Fig. 19, Fig. 20: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.Section 2: ESD specification updated according to the latest JEDEC standard.			
74HC_HCT4052_Q100 v.3	20200227	Product data sheet	-	74HC_HCT4052_Q100 v.2
Modifications:	<ul style="list-style-type: none">The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.Legal texts have been adapted to the new company name where appropriate.Table 4: Derating values for P_{tot} total power dissipation updated.Section 2 updated.			
74HC_HCT4052_Q100 v.2	20121122	Product data sheet	-	74HC_HCT4052_Q100 v.1
Modifications:	<ul style="list-style-type: none">CDM added to features.			
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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For sales office addresses, please send an email to: salesaddresses@nexperia.com

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