Dual 4-channel analog multiplexer/demultiplexer with injection-current effect control Rev. 4 — 28 April 2020 Product d

Product data sheet

1. General description

The 74HC4852; 74HCT4852 are dual single-pole quad-throw analog switches (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 & S1) are common to both switches. When E is HIGH, the switches are turned off. The device features injection-current effect control. This allows signals at disabled analog input channels to exceed the supply voltage without affecting the signal of the enabled analog channel, eliminating the need for external diode/resistor networks typically used to keep the analog channel signals within the supply-voltage range. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of $V_{\rm CC}$.

2. Features

- Injection-current cross coupling < 1 mV/mA
- Wide supply voltage range from 2.0 V to 6.0 V for 74HC4852
- ESD protection:
 - HBM JESD22-A114E exceeds 2000 V
 - CDM JESD22-C101C exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II level A
- Low ON-state resistance:
 - 400 Ω (typical) at V_{CC} = 2.0 V
 - 215 Ω (typical) at V_{CC} = 3.0 V
 - 120 Ω (typical) at V_{CC} = 3.3 V
 - 76 Ω (typical) at V_{CC} = 4.5 V
 - 59 Ω (typical) at V_{CC} = 6.0 V

3. Applications

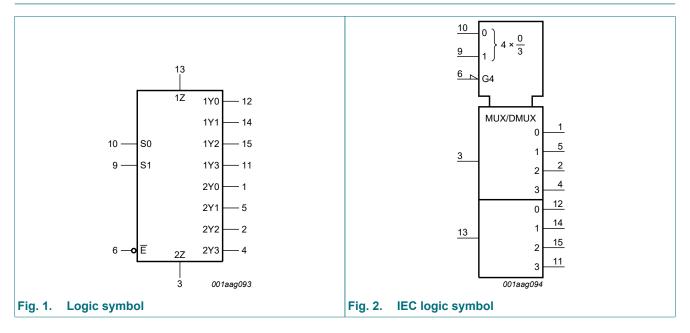
- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating

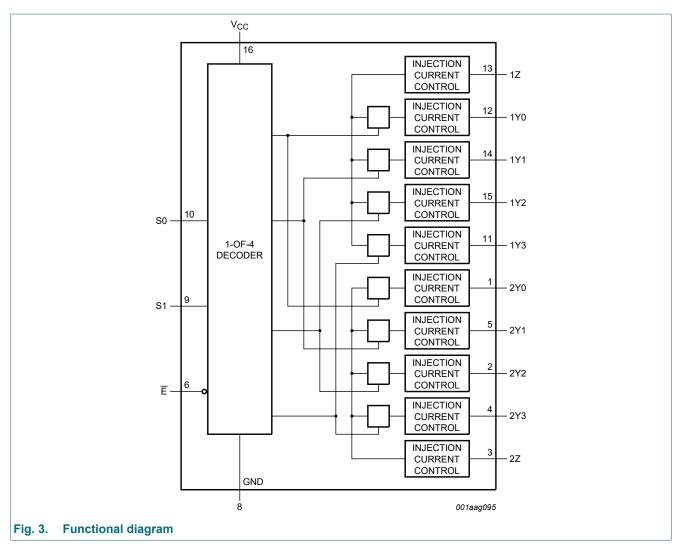


4. Ordering information

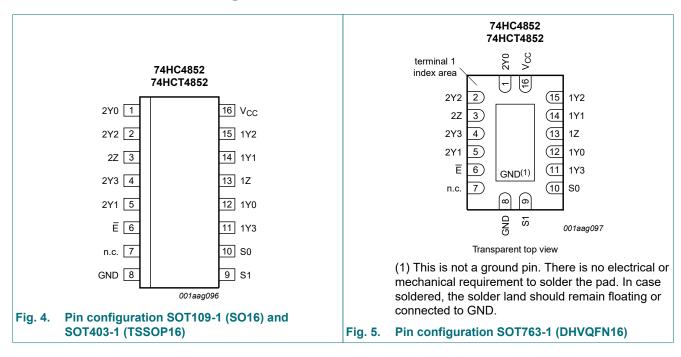
Type number	Package											
	Temperature range	Name	Description	Version								
74HC4852D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads;	SOT109-1								
74HCT4852D			body width 3.9 mm									
74HC4852PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads;	SOT403-1								
74HCT4852PW			body width 4.4 mm									
74HC4852BQ	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal	SOT763-1								
74HCT4852BQ			enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm									

5. Functional diagram





6. Pinning information



6.1. Pinning

6.2. Pin description

Table 2. Pin description		
Symbol	Pin	Description
2Y0	1	independent input/output
2Y2	2	independent input/output
2Z	3	common input/output
2Y3	4	independent input/output
2Y1	5	independent input/output
Ē	6	enable input (active LOW)
n.c.	7	not connected
GND	8	ground (0 V)
S1	9	select input
S0	10	select input
1Y3	11	independent input/output
1Y0	12	independent input/output
1Z	13	common input/output
1Y1	14	independent input/output
1Y2	15	independent input/output
V _{CC}	16	supply voltage

Table 2. Pin description

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 to nZ
L	L	Н	nY1 to nZ
L	Н	L	nY2 to nZ
L	Н	Н	nY3 to nZ
Н	Х	Х	-

8. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Мах	Unit
V _{CC}	supply voltage		-0.5	+7.0	V
VI	input voltage	[1]	-0.5	V _{CC} + 0.5	V
V _{SW}	switch voltage	[2]	-0.5	V _{CC} + 0.5	V
Ι _{ΙΚ}	input clamping current	$V_{I} < -0.5 V \text{ or } V_{I} > V_{CC} + 0.5 V$	-	±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	V_{SW} > -0.5 V or V_{SW} < V_{CC} + 0.5 V	-	±25	mA
I _{CC}	supply current		-	50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 \ ^{\circ}C \ to +125 \ ^{\circ}C$ [3]	-	500	mW

[1] The minimum and maximum input voltage rating may be exceeded if the input clamping current rating is observed.

[2] The minimum and maximum switch voltage rating may be exceeded if the switch clamping current rating is observed.

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

Symbol	Parameter	Conditions		74HC4852	2	7	Unit		
			Min	Тур	Мах	Min	Тур	Max	
V _{CC}	supply voltage		2.0	-	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
V _{SW}	switch voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	-	+125	-40	-	+125	°C
Δt/ΔV	input transition rise and	V _{CC} = 2.0 V	-	6.0	1 000	-	-	-	ns/V
	fall rate	V _{CC} = 3.0 V	-	6.0	800	-	-	-	ns/V
		V _{CC} = 3.3 V	-	6.0	800	-	-	-	ns/V
		V _{CC} = 4.5 V	-	6.0	500	-	6.0	500	ns/V
		V _{CC} = 6.0 V	-	6.0	400	-	-	-	ns/V

Table 5. Recommended operating conditions

10. Static characteristics

Table 6. R_{ON resistance}

At recommended operating conditions; voltages are referenced to GND (ground 0 V); For test circuit see Fig. 8.

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Мах	Min	Max	
74HC485	2									
R _{ON(peak)}	ON resistance	$V_I = V_{CC}$ to GND; $\overline{E} = V_{IL}$								
(p	(peak)	V _{CC} = 2.0 V; I _{SW} = 2 mA	-	400	650	-	670	-	700	Ω
		V _{CC} = 3.0 V; I _{SW} ≤ 2 mA	-	215	330	-	360	-	380	Ω
		V _{CC} = 3.3 V; I _{SW} ≤ 2 mA	-	120	270	-	305	-	345	Ω
		V _{CC} = 4.5 V; I _{SW} ≤ 2 mA	-	76	210	-	240	-	270	Ω
		V _{CC} = 6.0 V; I _{SW} ≤ 2 mA	-	59	195	-	220	-	250	Ω
ΔR _{ON}	ON resistance	V _I = 0.5 x V _{CC} ; Ē = V _{IL}								
	mismatch between channels	V _{CC} = 2.0 V; I _{SW} = 2 mA	-	4	10	-	15	-	20	Ω
		V _{CC} = 3.0 V; I _{SW} ≤ 2 mA	-	2	8	-	12	-	16	Ω
		V _{CC} = 3.3 V; I _{SW} ≤ 2 mA	-	2	8	-	12	-	16	Ω
		V _{CC} = 4.5 V; I _{SW} ≤ 2 mA	-	2	8	-	12	-	16	Ω
		V _{CC} = 6.0 V; I _{SW} ≤ 2 mA	-	3	9	-	13	-	18	Ω
74HCT48	52									
R _{ON(peak)}	ON resistance	$V_I = V_{CC}$ to GND; $\overline{E} = V_{IL}$								
	(peak)	V _{CC} = 4.5 V; I _{SW} ≤ 2 mA	-	76	210	-	240	-	270	Ω
ΔR _{ON}	ON resistance	V _I = 0.5 x V _{CC} ;								
	mismatch between channels	V_{CC} = 4.5 V; $I_{SW} \le 2 \text{ mA}$	-	2	8	-	12	-	16	Ω

Table 7. Injection current coupling

At recommended operating conditions; voltages are referenced to GND (ground 0 V); For test circuit see Fig. 9.

Symbol	Parameter	Conditions		74HC485	2	7	4HCT485	52	Unit
			Min	Typ[1]	Мах	Min	Typ[1]	Мах	
T _{amb} = -40) °C to +125 °C								
ΔV _O	output voltage	$ I_{SW} \le 1 \text{ mA}; R_S \le 3.9 \text{ k}\Omega$ [2][3]							
	variation	V _{CC} = 3.3 V	-	0.05	1	-	-	-	mV
		V _{CC} = 5.0 V	-	0.03	1	-	0.03	1	mV
		$ I_{SW} \le 10 \text{ mA}; \text{ R}_{S} \le 3.9 \text{ k}\Omega$							
		V _{CC} = 3.3 V	-	0.55	5	-	-	-	mV
		V _{CC} = 5.0 V	-	0.27	5	-	0.27	5	mV
		$ I_{SW} \le 1 \text{ mA}; R_S \le 20 \text{ k}\Omega$							
		V _{CC} = 3.3 V	-	0.04	2	-	-	-	mV
		V _{CC} = 5.0 V	-	0.03	2	-	0.03	2	mV
		$ I_{SW} \le 10 \text{ mA}; \text{ R}_{S} \le 20 \text{ k}\Omega$							
		V _{CC} = 3.3 V	-	0.56	20	-	-	-	mV
		V _{CC} = 5.0 V	-	0.48	20	-	0.48	20	mV

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

 ΔV_O here is the maximum variation of output voltage of an enabled analog channel when current is injected into any disabled channel. I_{SW} = total current injected into all disabled channels. [2]

[3]

Table 8. Static characteristics

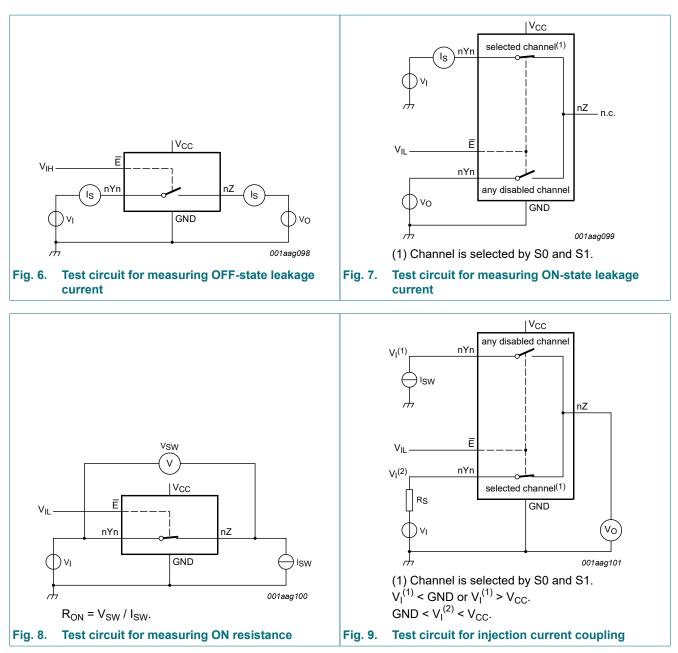
At recommended operating conditions; voltages are referenced to GND (ground 0 V).

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	
			Min	Тур	Max	Min	Max	Min	Max	Unit
74HC48	52	1						1	-	
V _{IH}	HIGH-level	control inputs								
	input voltage	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 3.3 V	2.3	-	-	2.3	-	2.3	-	V
		V _{CC} = 4.5 V	3.15	-	-	3.15	-	3.15	-	V
	V _{CC} = 6.0 V	4.2	-	-	4.2	-	4.2	-	V	
V _{IL} LOW-level		control inputs								
	input voltage	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 3.3 V	-	-	1.0	-	1.0	-	1.0	V
		V _{CC} = 4.5 V	-	-	1.35	-	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	-	1.8	-	1.8	V
l _l	input leakage	control inputs; $V_I = GND$ or V_{CC}								
	current	V _{CC} = 6.0 V	-	-	±0.1	-	±0.1	-	±1.0	μA
I _{S(OFF)}	OFF-state leakage current	$E = V_{IH}; V_I = GND \text{ or } V_{CC};$ $V_O = V_{CC} \text{ or } GND; V_{CC} = 6.0 \text{ V};$ see Fig. 6								
		nYn; per channel	-	-	±0.1	-	±0.5	-	±1.0	μA
		nZ; all channels	-	-	±0.2	-	±2.0	-	±4.0	μA

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	
			Min	Тур	Max	Min	Max	Min	Max	Unit
I _{S(ON)}	ON-state leakage current	$\overline{E} = V_{IL}; V_I = GND \text{ or } V_{CC};$ $V_O = V_{CC} \text{ or } GND; V_{CC} = 6.0 \text{ V};$ see <u>Fig. 7</u>	-	-	±0.1	-	±0.5	-	±1.0	μA
I _{CC}	supply	V _I = GND or V _{CC}								
	current	$V_{CC} = 6.0 V$		-	2.0	-	5.0	-	20.0	μA
CI	input capacitance	S0, S1, S2 and E	-	2	10	-	10	-	10	pF
C _{sw}	switch	nZ; OFF-state	-	15	40	-	40	-	40	pF
	capacitance	nYn; OFF-state	-	3	15	-	15	-	15	pF
74HCT4	852	-	_						•	
V _{IH}	HIGH-level	control inputs								
	input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V _{IL}	LOW-level	control inputs								
	input voltage	V _{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
l _l	input leakage	control inputs; $V_I = GND$ or V_{CC}								
	current	V _{CC} = 5.5 V	-	-	±0.1	-	±0.1	-	±1.0	μA
I _{S(OFF)}	OFF-state leakage current	$ \overline{E} = V_{IH}; V_I = GND \text{ or } V_{CC}; V_O = V_{CC} \text{ or GND}; V_{CC} = 5.5 \text{ V}; see Fig. 6 $								
		per channel	-	-	±0.1	-	±0.5	-	±1.0	μA
		all channels	-	-	±0.2	-	±2.0	-	±4.0	μA
I _{S(ON)}	ON-state leakage current	$\overline{E} = V_{IL}; V_I = GND \text{ or } V_{CC};$ $V_O = V_{CC} \text{ or } GND; V_{CC} = 5.5 \text{ V};$ see Fig. 7	-	-	±0.1	-	±0.5	-	±1.0	μA
I _{CC}	supply	V _I = GND or V _{CC}								
	current	V _{CC} = 5.5 V	-	-	2.0	-	5.0	-	20.0	μA
ΔI _{CC}	additional supply current	control inputs; $V_I = V_{CC} - 2.1 V$; other inputs at V_{CC} or GND; $V_{CC} = 4.5 V$ to 5.5 V; $I_0 = 0 A$	-	-	300	-	370	-	370	μA
CI	input capacitance	S0, S1, S2 and E	-	2	10	-	10	-	10	pF
C _{sw}	switch	nZ; OFF-state	-	9	40	-	40	-	40	pF
	capacitance	nYn; OFF-state	-	3	15	-	15	-	15	pF

Dual 4-channel analog multiplexer/demultiplexer with injection-current effect control

Dual 4-channel analog multiplexer/demultiplexer with injection-current effect control



Product data sheet

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11. Dynamic characteristics

Table 9. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground 0 V); for test circuit see Fig. 14.

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Мах	Min	Max	1
74HC48	52							1		
t _{pd}	propagation delay	nZ, nYn to nYn, nZ; [1] see <u>Fig. 10</u>								
		V _{CC} = 2.0 V	2.2	9.3	33	2.2	34	2.2	35	ns
		V _{CC} = 3.0 V	2.2	4.9	16.5	1.9	18	1.9	19.5	ns
		V _{CC} = 3.3 V	2.0	4.4	15.0	1.6	16.5	1.6	18.5	ns
		V _{CC} = 4.5 V	1.6	3.2	11.6	1.1	12.5	1.1	13.5	ns
		V _{CC} = 6.0 V	1.5	2.5	10.2	0.9	11	0.9	12	ns
		Sn to nZ, nYn; see Fig. 11 [1]								
		V _{CC} = 2.0 V	7.7	16.8	38	6.3	40	6.3	42	ns
		V _{CC} = 3.0 V	4.9	8.8	20	3.9	21.5	3.9	23	ns
		V _{CC} = 3.3 V	4.4	7.9	17.5	3.4	19	3.4	22	ns
		V _{CC} = 4.5 V	3.2	5.8	14	2.3	15	2.3	17	ns
		V _{CC} = 6.0 V	2.4	4.8	12.6	1.6	14.5	1.6	16.5	ns
t _{en}	enable time	E to nZ, nYn; see Fig. 12 [2]								
		V _{CC} = 2.0 V	10.5	20.5	47.5	8.5	52.5	8.5	57.5	ns
		V _{CC} = 3.0 V	6.2	10.6	45	5.2	50	5.2	55	ns
		V _{CC} = 3.3 V	5.6	9.4	42.5	4.6	47.5	4.6	52.5	ns
		V _{CC} = 4.5 V	4.2	6.9	40	3	45	3	50	ns
		V _{CC} = 6.0 V	3.2	5.6	39	2.2	40	2.2	40	ns
t _{dis}	disable time	E to nZ, nYn; see Fig. 12 [3]								
		V _{CC} = 2.0 V	39.5	75.4	100	39.3	105	39	115	ns
		V _{CC} = 3.0 V	35.2	69.5	90	35.5	100	35	110	ns
		V _{CC} = 3.3 V	34.6	68.1	85	34.6	95	34.5	105	ns
		V _{CC} = 4.5 V	28.5	63	80	28.2	90	28	100	ns
		V _{CC} = 6.0 V	14.4	57.9	78	13.5	80	13.0	80	ns
C _{PD}	power	per channel; see Fig. 13 [4]								
	dissipation capacitance	V _{CC} = 3.3 V	-	42	-	-	-	-	-	pF
	capacitarice	V _{CC} = 5.0 V	-	47	-	-	-	-	-	pF

Dual 4-channel analog multiplexer/demultiplexer with injection-current effect control

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HCT4	852									
t _{pd}	propagation delay	nZ, nYn to nYn, nZ; [1] see <u>Fig. 10</u>								
		V _{CC} = 4.5 V	1.6	3.5	11.5	1.1	12.5	1.1	13.5	ns
		Sn to nZ, nYn; see Fig. 11 [1]								
		V _{CC} = 4.5 V	3.2	7.6	13	2.3	15	1.6	17	ns
t _{en}	enable time	E to nZ, nYn; see Fig. 12 [2]								
		V _{CC} = 4.5 V	4.2	8.3	25	3.0	30	3.0	35	ns
t _{dis}	disable time	E to nZ, nYn; see Fig. 12 [3]								
		V _{CC} = 4.5 V	28.5	61.8	80	28.2	90	28.0	100	ns
C _{PD}	power	per channel; see Fig. 13 [4]								
	dissipation capacitance	V _{CC} = 5.0 V	-	47	-	-	-	-	-	pF

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

 $\label{eq:eq:product} [2] \quad t_{en} \text{ is the same as } t_{PZH} \text{ and } t_{PZL}.$

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

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W):

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

f_i = input frequency in MHz;

fo = output frequency in MHz;

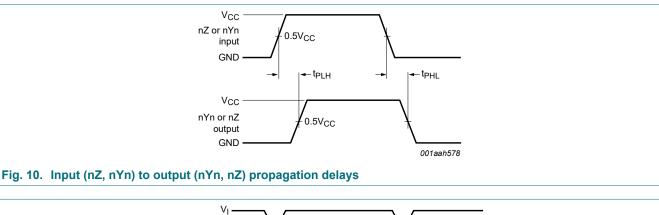
 $\sum \{ (C_{L} + C_{sw}) \times V_{CC}^{2} \times f_{o} \} = sum of outputs;$

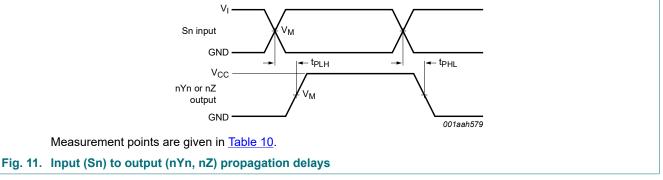
 C_L = output load capacitance in pF;

 C_{sw} = switch capacitance in pF;

 V_{CC} = supply voltage in V.

11.1. Waveforms

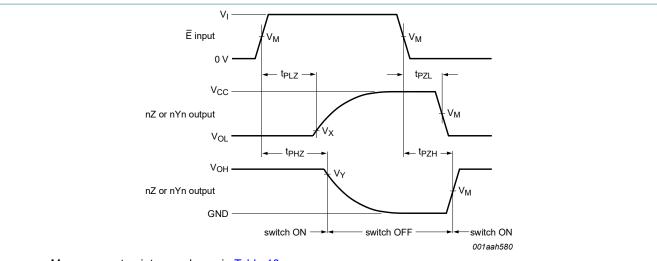




Nexperia

74HC4852; 74HCT4852

Dual 4-channel analog multiplexer/demultiplexer with injection-current effect control



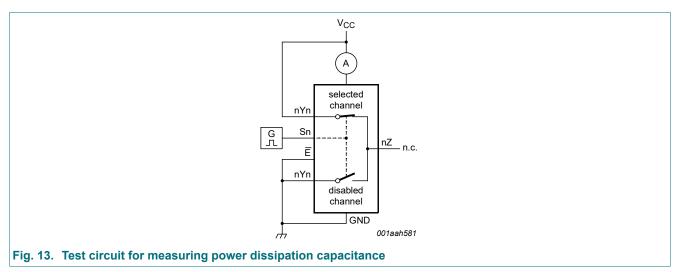
Measurement points are shown in <u>Table 10</u>.

Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

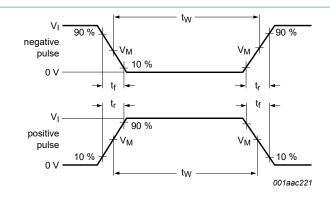
Fig. 12. Enable and disable times

Table 10. Measurement points

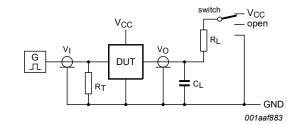
Туре	Input		Output					
	V _M	VI	V _M	V _X	V _Y			
74HC4852	0.5V _{CC}	V _{CC}	0.5V _{CC}	V _{OL} + 0.1(V _{CC} - V _{OL})	0.9V _{OH}			
74HCT4852	1.3 V	3.0 V	0.5V _{CC}	V _{OL} + 0.1(V _{CC} - V _{OL})	0.9V _{OH}			



Dual 4-channel analog multiplexer/demultiplexer with injection-current effect control



a. Input pulse definition



Definitions for test circuit:

R_L = load resistance.

 C_L = load capacitance including jig and probe capacitance.

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

b. Test circuit

Test data is given in Table 11.

Fig. 14. Input pulse definition and test circuit

Table 11. Test data

Test	Input			Output	Output	
	Control E, Sn	Switch nYn (nZ)	t _r , t _f	Switch nZ (nYn)		
	V _I [1]	VI		CL	RL	
t _{PHL,} t _{PLH}	V _{CC}	V _{CC}	6 ns	50 pF	-	open
t _{PHZ} , t _{PZH}	V _{CC}	V _{CC}	6 ns	50 pF	10 kΩ	GND
t _{PLZ} , t _{PZL}	V _{CC}	V _{CC}	6 ns	50 pF	10 kΩ	V _{CC}
C _{PD}	V _{CC}	V _{CC}	6 ns	0 pF	-	open

[1] For 74HCT4852: input voltage V_I = 3.0 V.

12. Package outline

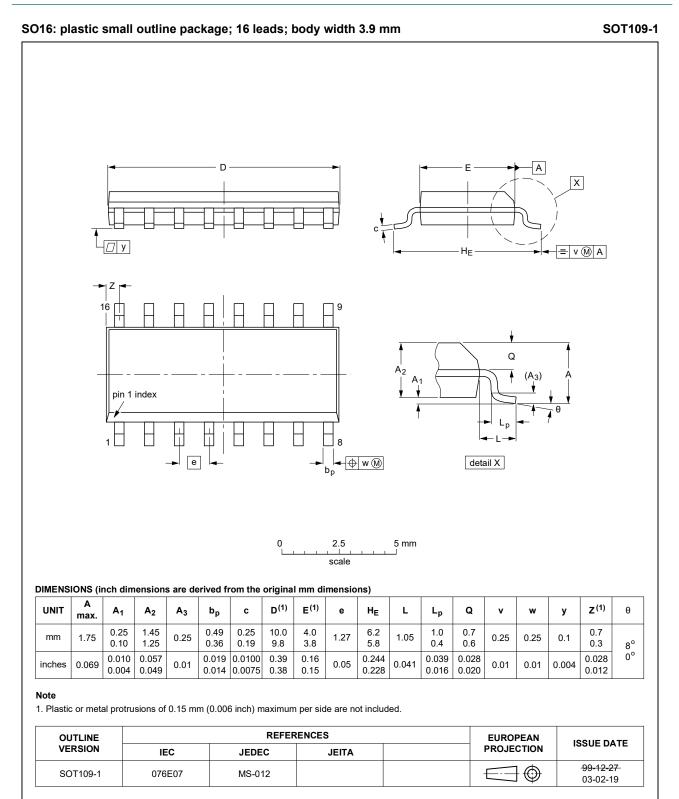


Fig. 15. Package outline SOT109-1 (SO16)

74HC_HCT4852

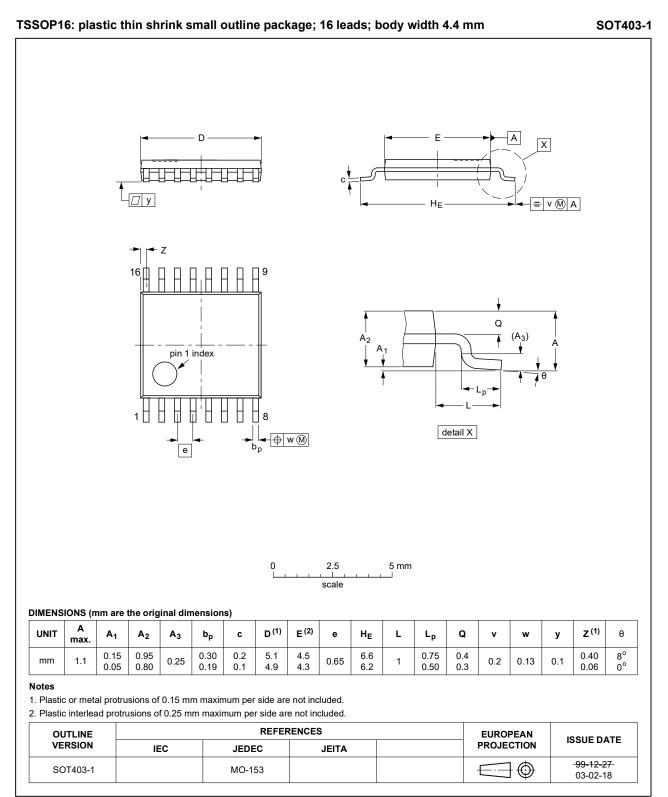


Fig. 16. Package outline SOT403-1 (TSSOP16)

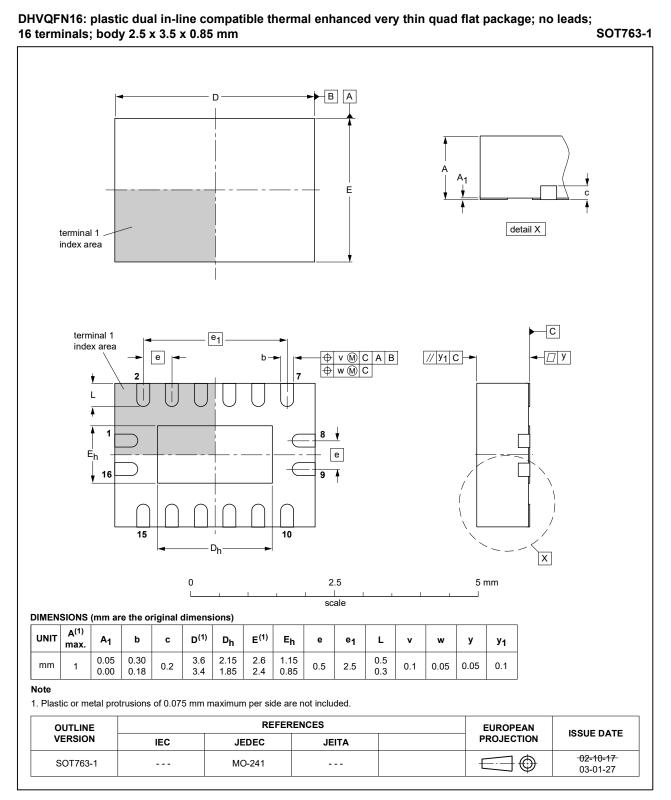


Fig. 17. Package outline SOT763-1 (DHVQFN16)

⁷⁴HC_HCT4852

13. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model

14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4852 v.4	20200428	Product data sheet	-	74HC4852 v.3
Modifications:	 <u>Section 1</u>: update <u>Table 4</u>: Deration 	ated. ng values for P _{tot} total pov	ver dissipation have b	een updated.
74HC_HCT4852 v.3	20080902	Product data sheet	-	74HC4852 v.2
Modifications:	• 74HCT4852 de	evice added.		1
74HC4852 v.2	20070530	Product data sheet	-	74HC4852 v.1
74HC4852 v.1	20070323	Product data sheet	_	_

74HC_HCT4852

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.

 Please consult the most recently issued document before initiating or completing a design.

- [2] The term 'short data sheet' is explained in section "Definitions".
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