

74HC4851-Q100; 74HCT4851-Q100

8-channel analog multiplexer/demultiplexer with
injection-current effect control

Rev. 3 — 18 February 2020

Product

1. General description

The 74HC4851-Q100; 74HCT4851-Q100 are high-speed Si-gate CMOS devices and are specified in compliance with JEDEC standard no. 7A.

The 74HC4851-Q100; 74HCT4851-Q100 are 8-channel analog multiplexers/demultiplexers with three digital select inputs (S0 to S2), an active-LOW enable input ($\overline{E}$), eight independent inputs/outputs (Y0 to Y7) and a common input/output (Z). The devices feature injection-current effect control, which has excellent value in automotive applications where voltages in excess of the supply voltage are common.

With $\overline{E}$ LOW, one of the eight switches is selected (low impedance ON-state) by S0 to S2. With $\overline{E}$ HIGH, all switches are in the high-impedance OFF-state, independent of S0 to S2.

The injection-current effect control allows signals at disabled analog input channels to exceed the supply voltage without affecting the signal of the enabled analog channel. This eliminates the need for external diode/resistor networks typically used to keep the analog channel signals within the supply-voltage range.

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
- Injection-current cross coupling < 1 mV/mA
- Wide supply voltage range from 2.0 V to 6.0 V for 74HC4851-Q100
- 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)
- 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
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Applications

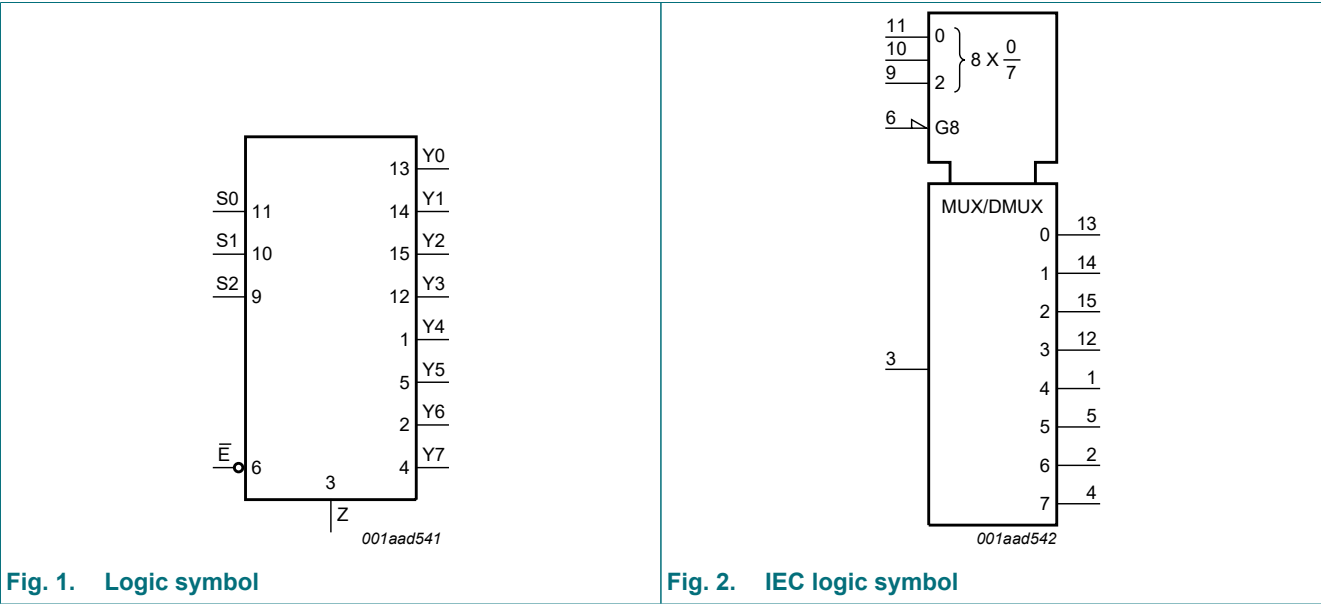
- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating
- Automotive application

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC4851D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4851D-Q100				
74HC4851PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4851PW-Q100				
74HC4851BQ-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 x 3.5 x 0.85 mm	SOT763-1
74HCT4851BQ-Q100				

5. Functional diagram



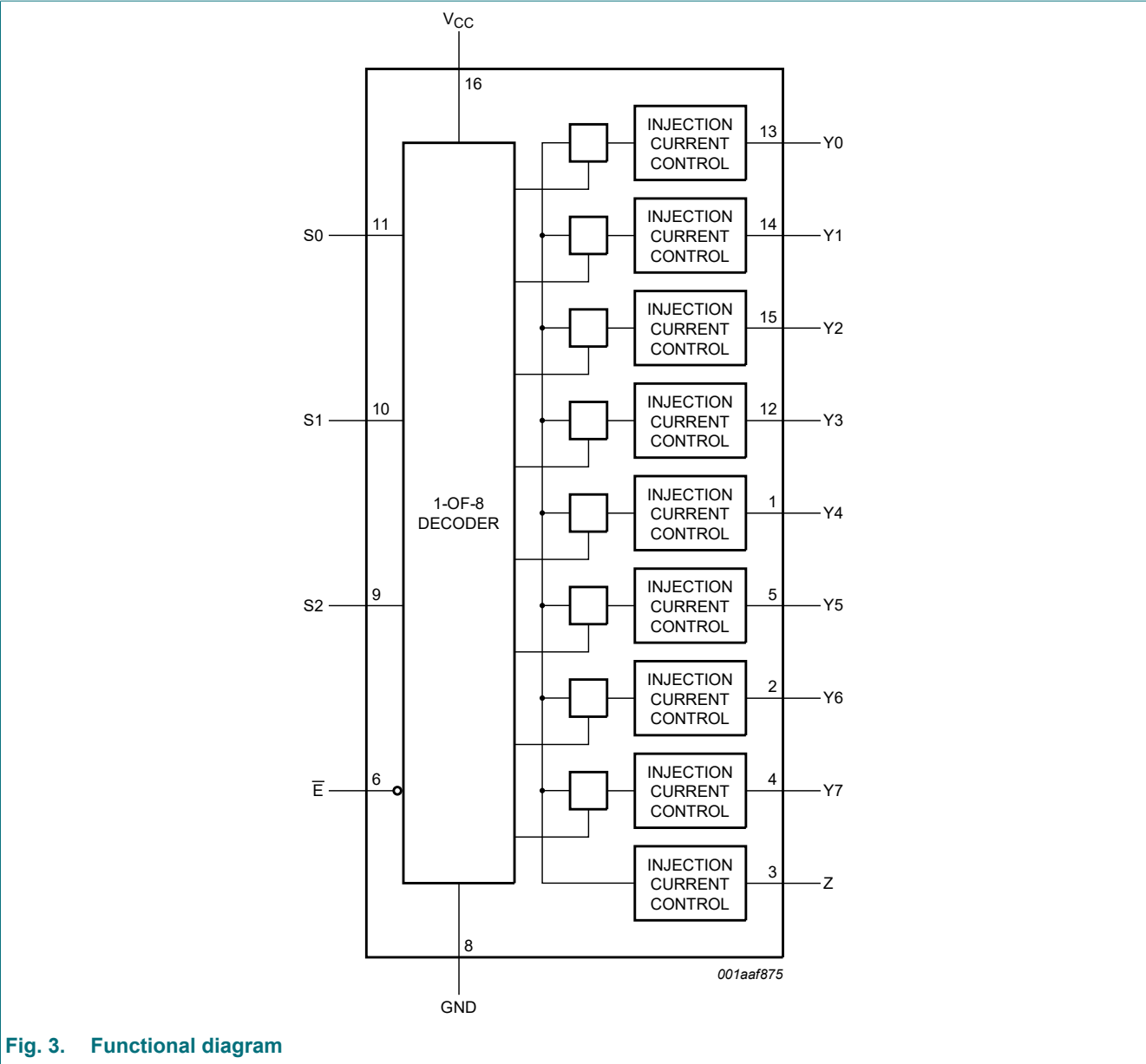
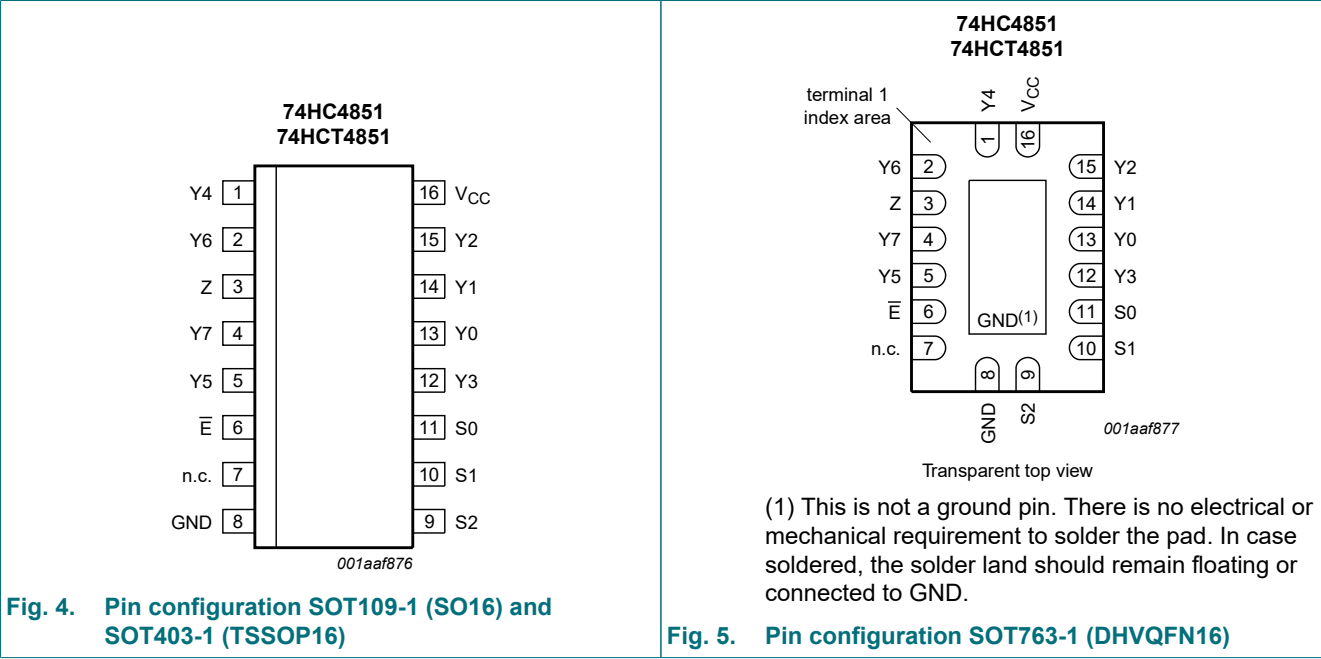


Fig. 3. Functional diagram

6. Pinning information

6.1. Pinning



6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
Y4	1	independent input/output
Y6	2	independent input/output
Z	3	common input/output
Y7	4	independent input/output
Y5	5	independent input/output
E	6	enable input (active LOW)
n.c.	7	not connected
GND	8	ground (0 V)
S2	9	select input
S1	10	select input
S0	11	select input
Y3	12	independent input/output
Y0	13	independent input/output
Y1	14	independent input/output
Y2	15	independent input/output
V _{CC}	16	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	S2	S1	S0	
L	L	L	L	Y0 to Z
L	L	L	H	Y1 to Z
L	L	H	L	Y2 to Z
L	L	H	H	Y3 to Z
L	H	L	L	Y4 to Z
L	H	L	H	Y5 to Z
L	H	H	L	Y6 to Z
L	H	H	H	Y7 to Z
H	X	X	X	-

8. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+7.0	V
V_I	input voltage	[1]	-0.5	$V_{CC} + 0.5$	V
V_{SW}	switch voltage	[2]	-0.5	$V_{CC} + 0.5$	V
I_{IK}	input clamping current	$V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$	-	± 20	mA
I_{SK}	switch clamping current	$V_{SW} < -0.5 \text{ V}$ or $V_{SW} > V_{CC} + 0.5 \text{ V}$	-	± 20	mA
I_{SW}	switch current	$V_{SW} > -0.5 \text{ V}$ or $V_{SW} < V_{CC} + 0.5 \text{ V}$	-	± 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	$T_{amb} = -40 \text{ °C}$ to $+125 \text{ °C}$ [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.

[3] 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	74HC4851-Q100			74HCT4851-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	-	6.0	4.5	5.0	5.5	V
V_I	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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	6.0	1000	-	-	-	ns/V
		$V_{CC} = 3.0\text{ V}$	-	6.0	800	-	-	-	ns/V
		$V_{CC} = 3.3\text{ V}$	-	6.0	800	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	-	6.0	500	ns/V
		$V_{CC} = 6.0\text{ V}$	-	6.0	400	-	-	-	ns/V

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 to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC4851-Q100										
R _{ON(peak)}	ON resistance (peak)	V _I = V _{CC} to GND; $\bar{E}$ = V _{IL}								
		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 mismatch between channels	V _I = 0.5 × V _{CC} ; $\bar{E}$ = V _{IL}								
		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
74HCT4851-Q100										
R _{ON(peak)}	ON resistance (peak)	V _I = V _{CC} to GND; $\bar{E}$ = V _{IL}								
		V _{CC} = 4.5 V; I _{SW} ≤ 2 mA	-	76	210	-	240	-	270	Ω
ΔR _{ON}	ON resistance mismatch between channels	V _I = 0.5 × V _{CC} ; $\bar{E}$ = V _{IL}								
		V _{CC} = 4.5 V; I _{SW} ≤ 2 mA	-	2	8	-	12	-	16	Ω

8-channel analog multiplexer/demultiplexer with injection-current effect control

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	74HC4851-Q100			74HCT4851-Q100			Unit
			Min	Typ [1]	Max	Min	Typ [1]	Max	
T _{amb} = -40 °C to +125 °C									
ΔV _O	output voltage variation	I _{SW} ≤ 1 mA; R _S ≤ 3.9 kΩ [2][3]							
		V _{CC} = 3.3 V	-	0.05	1	-	-	-	mV
		V _{CC} = 5.0 V	-	0.03	1	-	0.03	1	mV
		I _{SW} ≤ 10 mA; R _S ≤ 3.9 kΩ							
		V _{CC} = 3.3 V	-	0.55	5	-	-	-	mV
		V _{CC} = 5.0 V	-	0.27	5	-	0.27	5	mV
		I _{SW} ≤ 1 mA; R _S ≤ 20 kΩ							
		V _{CC} = 3.3 V	-	0.04	2	-	-	-	mV
		V _{CC} = 5.0 V	-	0.03	2	-	0.03	2	mV
		I _{SW} ≤ 10 mA; R _S ≤ 20 kΩ							
		V _{CC} = 3.3 V	-	0.56	20	-	-	-	mV
		V _{CC} = 5.0 V	-	0.48	20	-	0.48	20	mV

[1] Typical values are measured at T_{amb} = 25 °C.[2] ΔV_O here is the maximum variation of output voltage of an enabled analog channel when current is injected into any disabled channel.[3] I_{SW} = total current injected into all disabled channels.

Table 8. Static characteristics

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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC4851-Q100										
V _{IH}	HIGH-level input voltage	control inputs								
		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 input voltage	control inputs								
		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

8-channel analog multiplexer/demultiplexer with injection-current effect control

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
I _I	input leakage current	control inputs; V _I = GND or V _{CC} ; V _{CC} = 6.0 V	-	-	±0.1	-	±0.1	-	±1.0	µA
I _{S(OFF)}	OFF-state leakage current	$\bar{E}$ = V _{IH} ; V _I = GND or V _{CC} ; V _O = V _{CC} or GND; V _{CC} = 6.0 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	$\bar{E}$ = V _{IL} ; V _I = GND or V _{CC} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V; see Fig. 7	-	-	±0.1	-	±0.5	-	±1.0	µA
I _{CC}	supply current	V _I = GND or V _{CC} ; V _{CC} = 6.0 V	-	-	2.0	-	5.0	-	20.0	µA
C _I	input capacitance	S0, S1, S2 and $\bar{E}$	-	2	10	-	10	-	10	pF
C _{SW}	switch capacitance	Z; OFF-state	-	15	40	-	40	-	40	pF
		Y _n ; OFF-state	-	3	15	-	15	-	15	pF
74HCT4851-Q100										
V _{IH}	HIGH-level input voltage	control inputs; V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	control inputs; V _{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
I _I	input leakage current	control inputs; V _I = GND or V _{CC} ; V _{CC} = 5.5 V	-	-	±0.1	-	±0.1	-	±1.0	µA
I _{S(OFF)}	OFF-state leakage current	$\bar{E}$ = V _{IH} ; V _I = GND or V _{CC} ; V _O = V _{CC} or GND; V _{CC} = 5.5 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	$\bar{E}$ = V _{IL} ; V _I = GND or V _{CC} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V; see Fig. 7	-	-	±0.1	-	±0.5	-	±1.0	µA
I _{CC}	supply current	V _I = GND or V _{CC} ; 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 _O = 0 A	-	-	300	-	370	-	370	µA
C _I	input capacitance	S0, S1, S2 and $\bar{E}$	-	2	10	-	10	-	10	pF
C _{SW}	switch capacitance	Z; OFF-state	-	15	40	-	40	-	40	pF
		Y _n ; OFF-state	-	3	15	-	15	-	15	pF

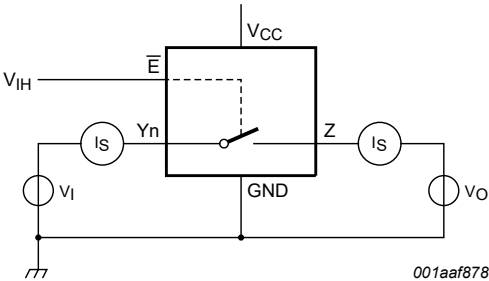


Fig. 6. Test circuit for measuring OFF-state leakage current

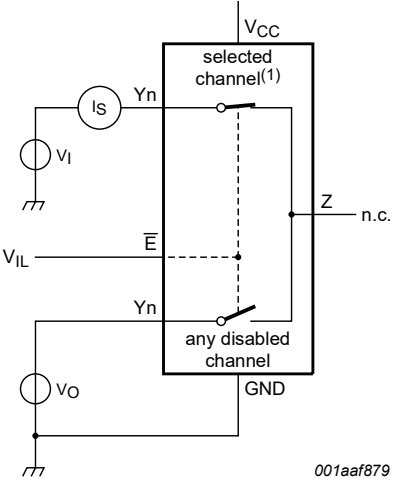
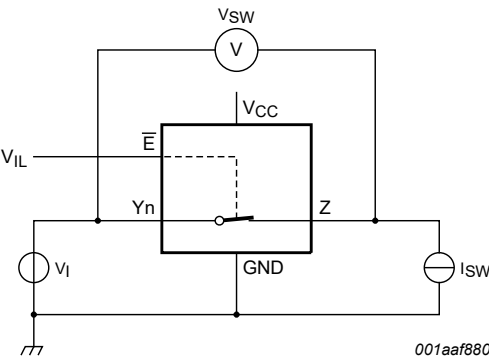


Fig. 7. Test circuit for measuring ON-state leakage current



$R_{ON} = V_{SW} / I_{SW}$.

Fig. 8. Test circuit for measuring ON resistance

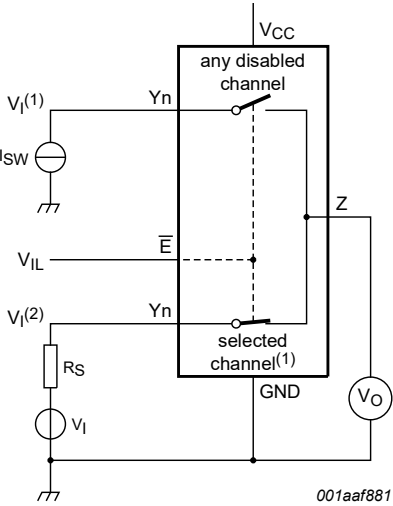


Fig. 9. Test circuit for injection current coupling

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 to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC4851-Q100										
t _{pd}	propagation delay	Z to Y _n , Y _n to Z; see Fig. 10 [1]								
		V _{CC} = 2.0 V	-	10.0	25	-	29	-	32	ns
		V _{CC} = 3.0 V	-	6.0	15.5	-	17.5	-	19.5	ns
		V _{CC} = 3.3 V	-	5.0	14.5	-	16.5	-	18.5	ns
		V _{CC} = 4.5 V	-	4.0	11.5	-	12.5	-	13.5	ns
		V _{CC} = 6.0 V	-	3.0	10	-	11	-	12	ns
		Sn to Z, Sn to Y _n ; see Fig. 11 [1]								
		V _{CC} = 2.0 V	-	18.0	32	-	35	-	40	ns
		V _{CC} = 3.0 V	-	9.5	17.5	-	20	-	23	ns
		V _{CC} = 3.3 V	-	8.5	16.5	-	19	-	22	ns
		V _{CC} = 4.5 V	-	6.5	13	-	15	-	17	ns
		V _{CC} = 6.0 V	-	5.0	12.5	-	14.5	-	16.5	ns
t _{en}	enable time	$\bar{E}$ to Z, $\bar{E}$ to Y _n ; see Fig. 12 [2]								
		V _{CC} = 2.0 V	-	-	95	-	105	-	115	ns
		V _{CC} = 3.0 V	-	-	90	-	100	-	110	ns
		V _{CC} = 3.3 V	-	-	85	-	95	-	105	ns
		V _{CC} = 4.5 V	-	-	80	-	90	-	100	ns
		V _{CC} = 6.0 V	-	-	78	-	80	-	80	ns
t _{dis}	disable time	$\bar{E}$ to Z, $\bar{E}$ to Y _n ; see Fig. 12 [3]								
		V _{CC} = 2.0 V	-	-	99	-	105	-	115	ns
		V _{CC} = 3.0 V	-	-	90	-	100	-	110	ns
		V _{CC} = 3.3 V	-	-	85	-	95	-	105	ns
		V _{CC} = 4.5 V	-	-	80	-	90	-	100	ns
		V _{CC} = 6.0 V	-	-	78	-	80	-	80	ns
C _{PD}	power dissipation capacitance	per channel; see Fig. 13 [4]								
		V _{CC} = 3.3 V	-	28	-	-	-	-	-	pF
		V _{CC} = 5.0 V	-	33	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT4851-Q100										
t _{pd}	propagation delay	Z to Yn, Yn to Z; see Fig. 10 [1]								
		V _{CC} = 4.5 V	1.6	3.7	11.5	1.1	12.5	1.1	13.5	ns
		Sn to Z, Sn to Yn; see Fig. 11 [1]								
		V _{CC} = 4.5 V	3.2	8.0	13	2.3	15	2.3	17	ns
t _{en}	enable time	E to Z, E to Yn; see Fig. 12 [2]								
		V _{CC} = 4.5 V	4.2	8.6	25	3.0	30	3.0	35	ns
t _{dis}	disable time	E to Z, E to Yn; see Fig. 12 [3]								
		V _{CC} = 4.5 V	28.5	64.7	80	28.2	90	28	100	ns
C _{PD}	power dissipation capacitance	per channel; see Fig. 13 [4]								
		V _{CC} = 5.0 V	-	30	-	-	-	-	-	pF

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

[2] t_{en} is the same as t_{PZH} 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 μW):

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

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

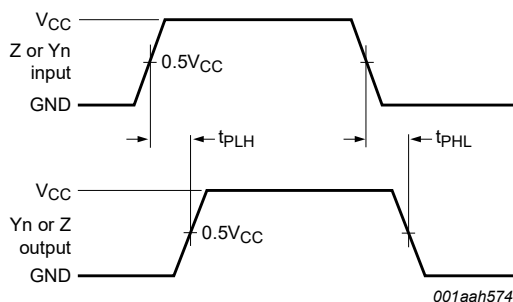
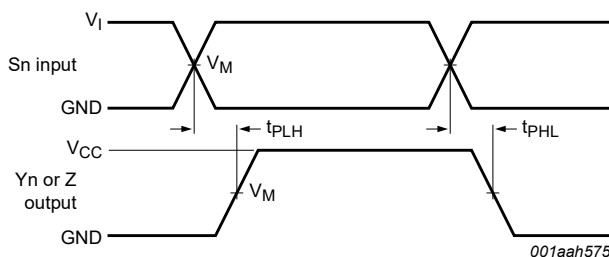


Fig. 10. Input (Z, Yn) to output (Yn, Z) propagation delays



Measurement points are given in Table 10.

Fig. 11. Input (Sn) to output (Yn, Z) propagation delays

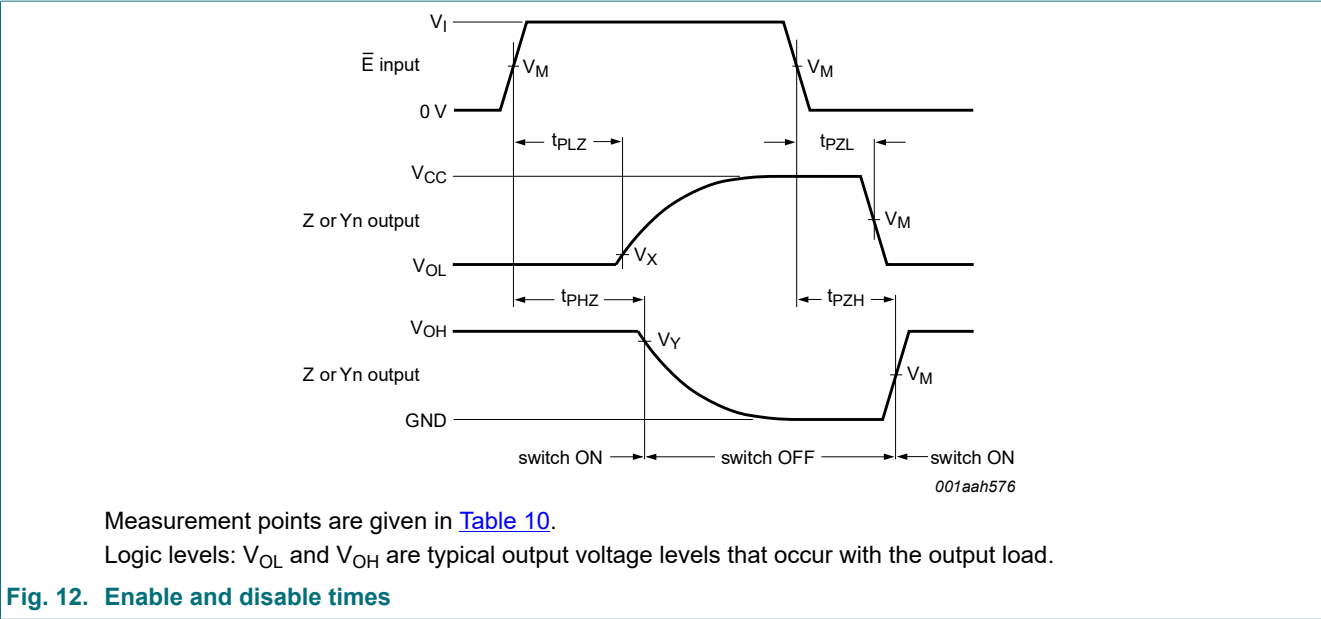
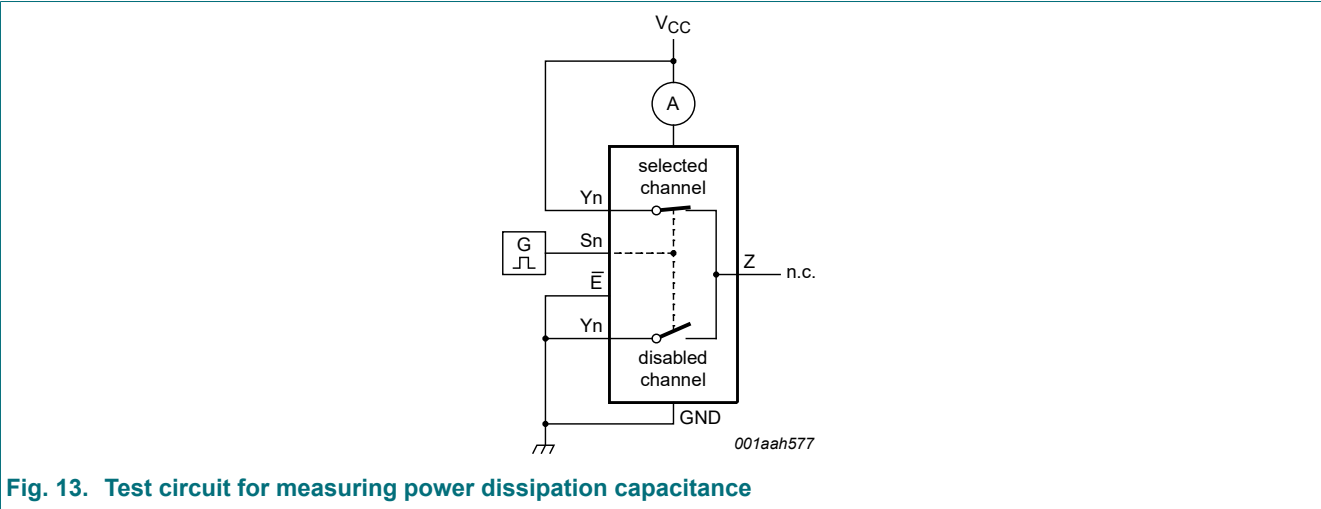


Table 10. Measurement points

Type	Input		Output		
	V_M	V_I	V_M	V_X	V_Y
74HC4851-Q100	$0.5V_{CC}$	V_{CC}	$0.5V_{CC}$	$V_{OL} + 0.1(V_{CC} - V_{OL})$	$0.9V_{OH}$
74HCT4851-Q100	1.3 V	3.0 V	$0.5V_{CC}$	$V_{OL} + 0.1(V_{CC} - V_{OL})$	$0.9V_{OH}$



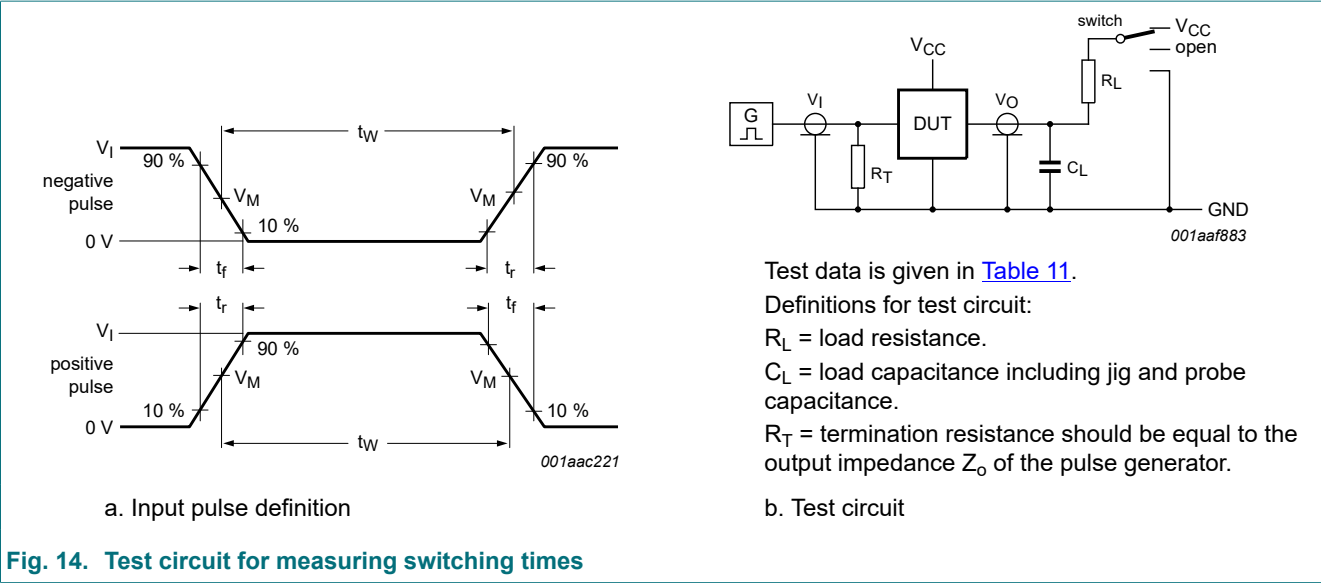


Fig. 14. Test circuit for measuring switching times

Table 11. Test data

Test	Input			Output		S1 position
	Control E, Sn	Switch Yn (Z)	t _r , t _f	Switch Z (Yn)		
	V _I [1]	V _I		C _L	R _L	
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 74HCT4851-Q100: input voltage $V_I = 3.0$ V.

12. Package outline

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

SOT109-1

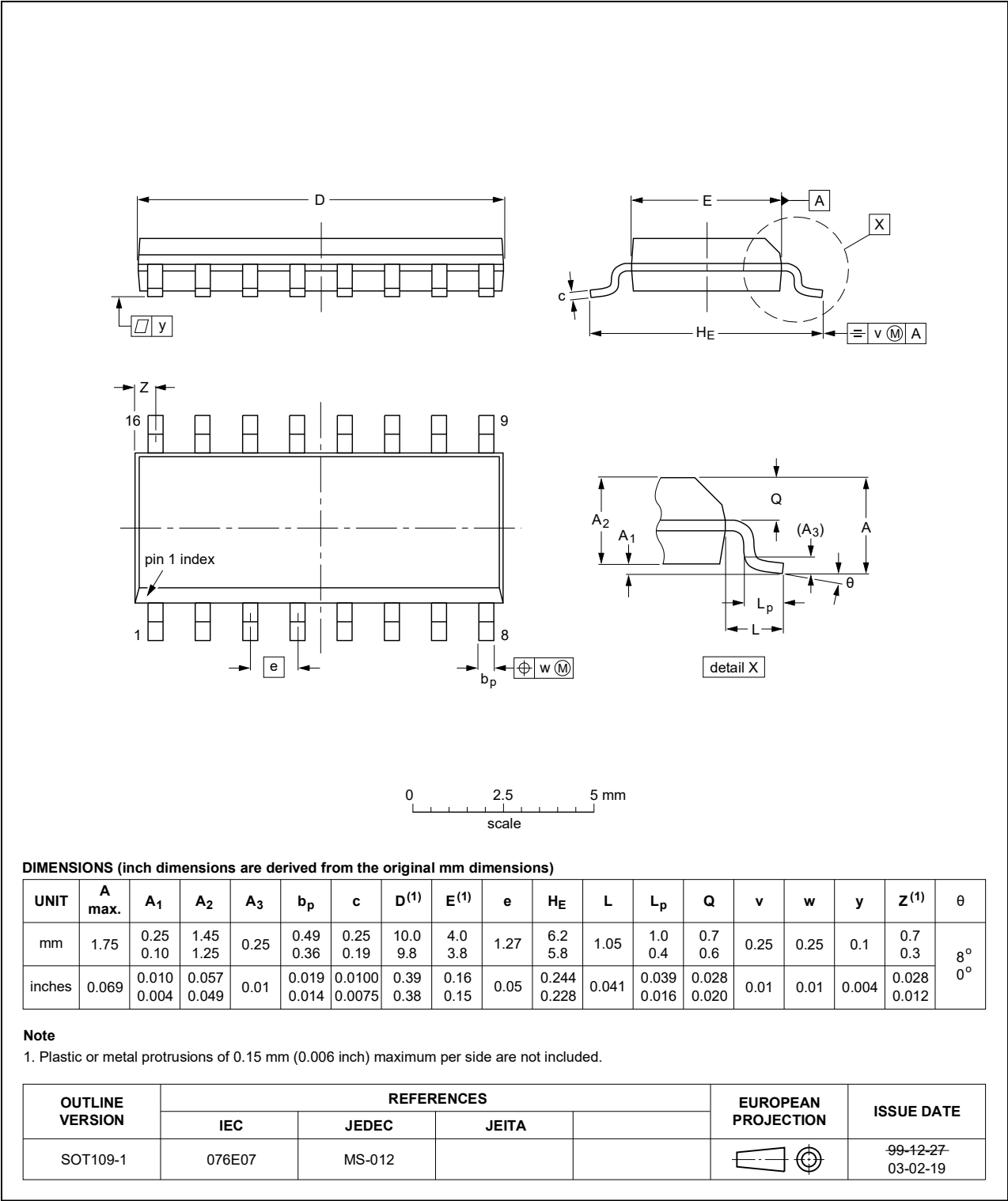


Fig. 15. Package outline SOT109-1 (SO16)

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

SOT403-1

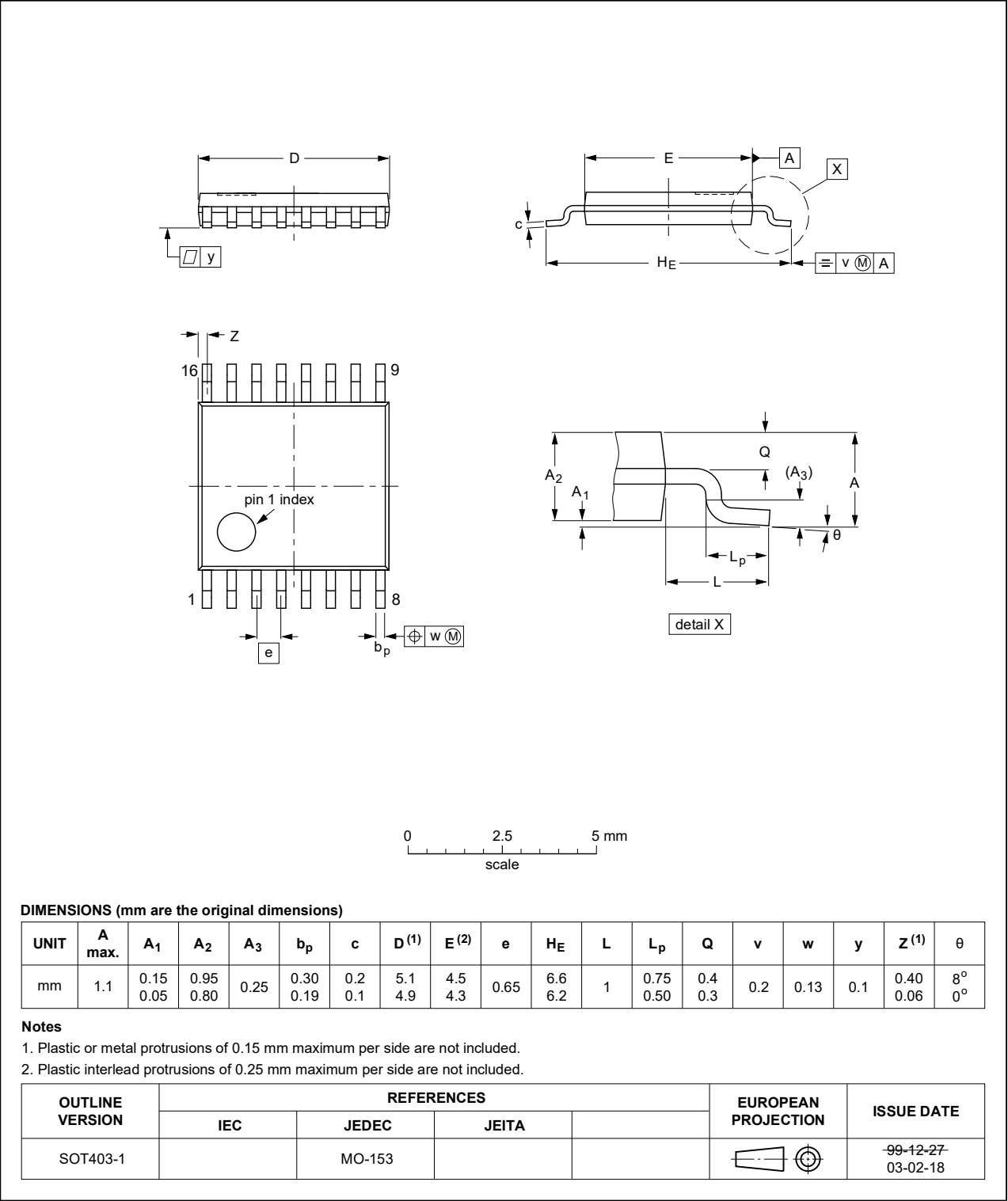


Fig. 16. Package outline SOT403-1 (TSSOP16)

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

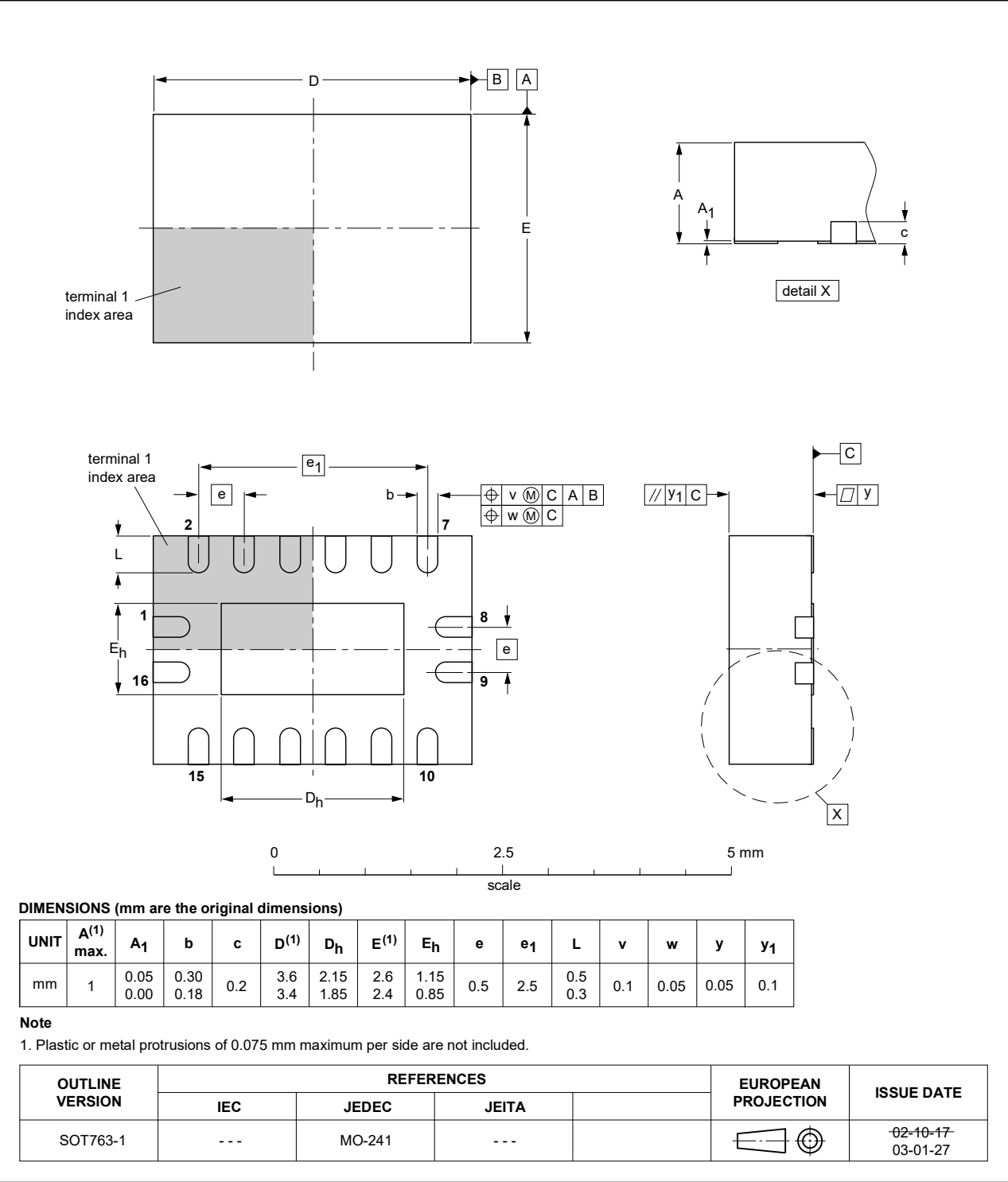


Fig. 17. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 12. Abbreviations

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

14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4851_Q100 v.3	20200218	Product data sheet	-	74HC_HCT4851_Q100 v.2
Modifications:	Section 2 updated.			
74HC_HCT4851_Q100 v.2	20180824	Product data sheet	-	74HC_HCT4851_Q100 v.1
Modifications:	- 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.			
74HC_HCT4851_Q100 v.1	20120802	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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