Dual 4-input multiplexer Rev. 6 — 11 May 2016

Product data sheet

1. **General description**

The 74HC153; 74HCT153 is a dual 4-input multiplexer. The device features independent enable inputs (nE) and common data select inputs (S0 and S1). For each multiplexer, the select inputs select one of the four binary inputs and routes it to the multiplexer output (nY). A HIGH on \overline{E} forces the corresponding multiplexer outputs LOW. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

2. **Features and benefits**

- Input levels:
 - For 74HC153: CMOS level
 - For 74HCT153: TTL level
- Non-inverting outputs
- Separate enable input for each output
- Common select inputs
- Complies with JEDEC standard no. 7A
- Permits multiplexing from n lines to 1 line
- Enable line provided for cascading (n lines to 1 line)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.

Ordering information 3.

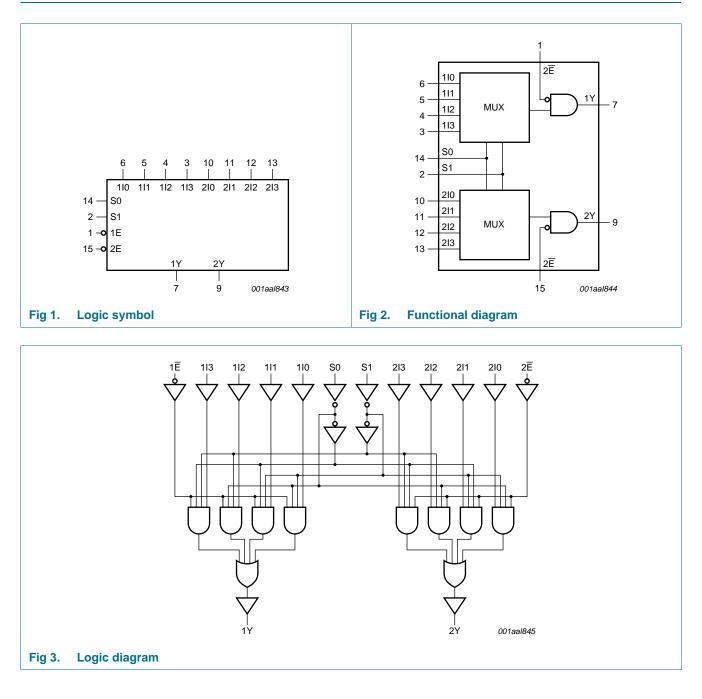
Table 1. **Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74HC153D	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width	SOT109-1
74HCT153D			3.9 mm	
74HC153DB	–40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body	SOT338-1
74HCT153DB			width 5.3 mm	
74HC153PW	–40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads;	SOT403-1
74HCT153PW			body width 4.4 mm	



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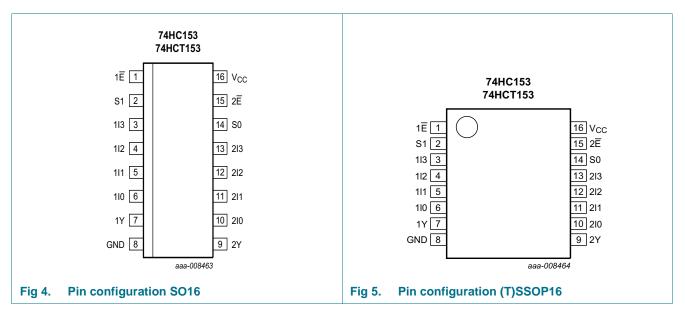
4. Functional diagram



Dual 4-input multiplexer

5. Pinning information

5.1 Pinning



5.2 Pin description

Symbol	Pin	Description
1Ē, 2Ē	1, 15	output enable inputs (active LOW)
S0, S1	14, 2	data select inputs
110, 111, 112, 113	6, 5, 4, 3	data inputs source 1
1Y	7	multiplexer output source 1
GND	8	ground (0 V)
2Y	9	multiplexer output source 2
210, 211, 212, 213	data inputs source 2	
V _{CC}	16	supply voltage

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6. Functional description

Table 3. Function table

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

select Inputs		data inputs				output enable	output
S0	S1	nl0	nl1	nl2	nl3	nE	nY
Х	Х	Х	Х	Х	Х	Н	L
L	L	L	Х	Х	Х	L	L
L	L	Н	Х	Х	Х	L	Н
Н	L	Х	L	Х	Х	L	L
Н	L	Х	Н	Х	Х	L	Н
L	Н	Х	Х	L	Х	L	L
L	Н	Х	Х	Н	Х	L	Н
Н	Н	Х	Х	Х	L	L	L
Н	Н	Х	Х	Х	Н	L	Н

7. 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	V
I _{IK}	input clamping current	V_{I} < -0.5 V or V_{I} > V_{CC} + 0.5 V	<u>[1]</u>	-	±20	mA
Ι _{ΟΚ}	output clamping current	V_{O} < -0.5 V or V_{O} > V_{CC} + 0.5 V	<u>[1]</u>	-	±20	mA
I _O	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$		-	±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	SO16 and (T)SSOP16 packages	[2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SO16 package: Ptot derates linearly with 8 mW/K above 70 °C.

For (T)SSOP16 packages: P_{tot} derates linearly with 5.5 mW/K above 60 $^\circ$ C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions		74HC153			4HCT15	3	Unit
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
Vo	output voltage		0	-	V _{CC}	0	-	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

9. Static characteristics

Table 6. 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	Unit
			Min	Тур	Max	Min	Max	Min	Max	-
74HC15	3		1				1	1	1	-
V _{IH}	HIGH-level	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V _{IL}	LOW-level	V _{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V _{OH}	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_{O} = -20 \ \mu A; \ V_{CC} = 2.0 \ V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_{O} = -20 \ \mu A; \ V_{CC} = 4.5 \ V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -20 \ \mu A; \ V_{CC} = 6.0 \ V$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V
V _{OL}	LOW-level	$V_I = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_{O} = 20 \ \mu A; \ V_{CC} = 2.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 20 \ \mu A; \ V_{CC} = 6.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		I_{O} = 4.0 mA; V_{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
I	input leakage current	$V_{I} = V_{CC} \text{ or } GND;$ $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1	-	±1	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0$ V	-	-	8.0	-	80	-	160	μA

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Table 6. Static characteristics ...continued

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	Unit
			Min	Тур	Max	Min	Max	Min	Мах	
CI	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT1	53									
V _{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V _{OH} HI	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V _{OL}	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
	output voltage	$I_{O} = 20 \ \mu A; V_{CC} = 4.5 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
I _I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 V$	-	-	±0.1	-	±1	-	±1	μA
I _{CC}	supply current		-	-	8	-	80	-	160	μΑ
ΔI _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}; I_O = 0 \text{ A};$ other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V}$ to 5.5 V								
		1ln, 2ln	-	45	162	-	203	-	221	μA
		nĒ	-	60	216	-	270	-	294	μA
		Sn	-	135	486	-	608	-	662	μA
CI	input capacitance		-	3.5	-	-	-	-	-	pF

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10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; for test circuit, see <u>Figure 8</u>; unless otherwise specified

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	
74HC153	3			1	1		-			-1
t _{pd} propagation delay		1In to nY, 2In to nY;1see Figure 6	1							
		V _{CC} = 2.0 V	-	47	145	-	180	-	220	ns
		V _{CC} = 4.5 V	-	17	29	-	36	-	44	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$	-	14	-	-	-	-	-	ns
		$V_{CC} = 6.0 V$	-	14	25	-	31	-	38	ns
		Sn to nY; see Figure 7								
		V _{CC} = 2.0 V	-	50	150	-	190	-	225	ns
		V _{CC} = 4.5 V	-	18	30	-	38	-	45	ns
	V _{CC} = 5.0 V; C _L = 15 pF	-	15	-	-	-	-	-	ns	
		V _{CC} = 6.0 V	-	14	26	-	33	-	38	ns
	nE to nY; see Figure 7									
		V _{CC} = 2.0 V	-	33	100	-	125	-	150	ns
		V _{CC} = 4.5 V	-	12	20	-	25	-	30	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	10	-	-	-	-	-	ns
		$V_{CC} = 6.0 V$	-	10	17	-	21	-	26	ns
t _t	transition time	see Figure 6	1							
		V _{CC} = 2.0 V	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5 V$	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0 V$	-	6	13	-	16	-	19	ns
C _{PD}	power dissipation capacitance	per package; [3 $V_I = GND$ to V_{CC}	1 -	30	-	-	-	-	-	pF
74HCT1	53									
t _{PHL}	HIGH to LOW propagation	1In to nY, 2In to nY;1see Figure 6	1							
	delay	V _{CC} = 4.5 V	-	19	34	-	43	-	51	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	16	-	-	-	-	-	ns
t _{PLH}	LOW to HIGH propagation	1In to nY, 2In to nY;[1]see Figure 6	1							
	delay	V _{CC} = 4.5 V	-	13	24	-	30	-	36	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$	-	16	-	-	-	-	-	ns

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Symbol	Parameter	Conditions			25 °C		–40 °C t	o +85 °C	–40 °C to +125 °C		Unit
				Min	Тур	Max	Min	Max	Min	Max	
t _{pd} propag	propagation	Sn to nY; see Figure 7	<u>[1]</u>								
	delay	V _{CC} = 4.5 V		-	20	34	-	43	-	51	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$		-	17	-	-	-	-	-	ns
		nE to nY; see Figure 7	<u>[1]</u>								
		V _{CC} = 4.5 V		-	14	27	-	34	-	41	ns
		V _{CC} = 5.0 V; C _L = 15 pF		-	11	-	-	-	-	-	ns
t _t	transition time	see Figure 6	[2]								
		V _{CC} = 4.5 V		-	7	15	-	19	-	22	ns
C _{PD}	power dissipation capacitance	per package; V _I = GND to V _{CC} – 1.5 V	<u>[3]</u>	-	30	-	-	-	-	-	pF

Table 7. Dynamic characteristics ...continued

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; for test circuit, see Figure 8; unless otherwise specified

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

[2] t_t is the same as t_{THL} and t_{TLH} .

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

- $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
- f_i = input frequency in MHz;
- f_o = output frequency in MHz;
- C_L = output load capacitance in pF;
- V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma~(C_L \times V_{CC}{}^2 \times f_o)$ = sum of outputs.

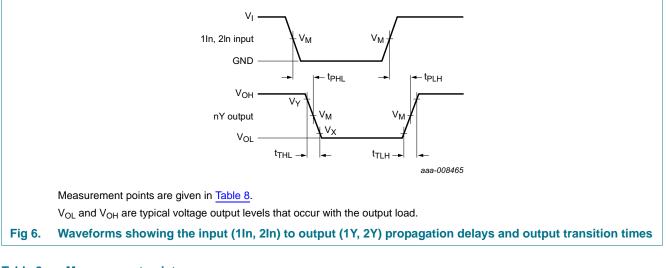


Table 8.Measurement points

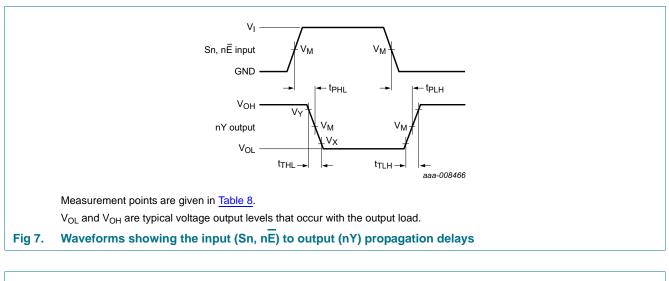
Туре	Input	Output					
	V _M	V _M	V _X	V _Y			
74HC153	0.5V _{CC}	0.5V _{CC}	0.1V _{CC}	0.9V _{CC}			
74HCT153	1.3 V	1.3 V	0.1V _{CC}	0.9V _{CC}			

74HC_HCT153 Product data sheet

NXP Semiconductors

74HC153; 74HCT153

Dual 4-input multiplexer



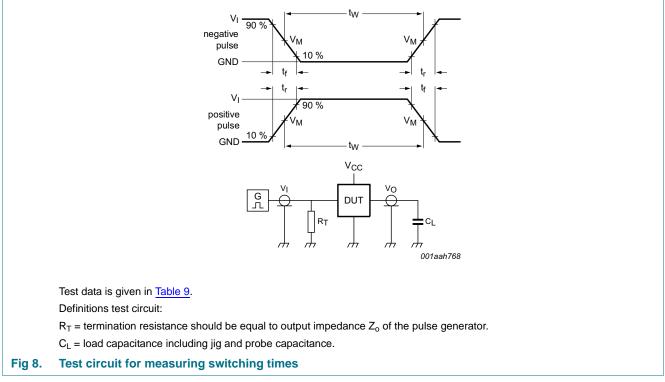


Table 9.	Test data
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Туре	Input		Load	Test
	VI	t _r , t _f	CL	
74HC153	V _{CC}	6.0 ns	15 pF, 50 pF	t _{PLH} , t _{PHL}
74HCT153	3.0 V	6.0 ns	15 pF, 50 pF	t _{PLH} , t _{PHL}

74HC_HCT153
Product data sheet

11. Package outline

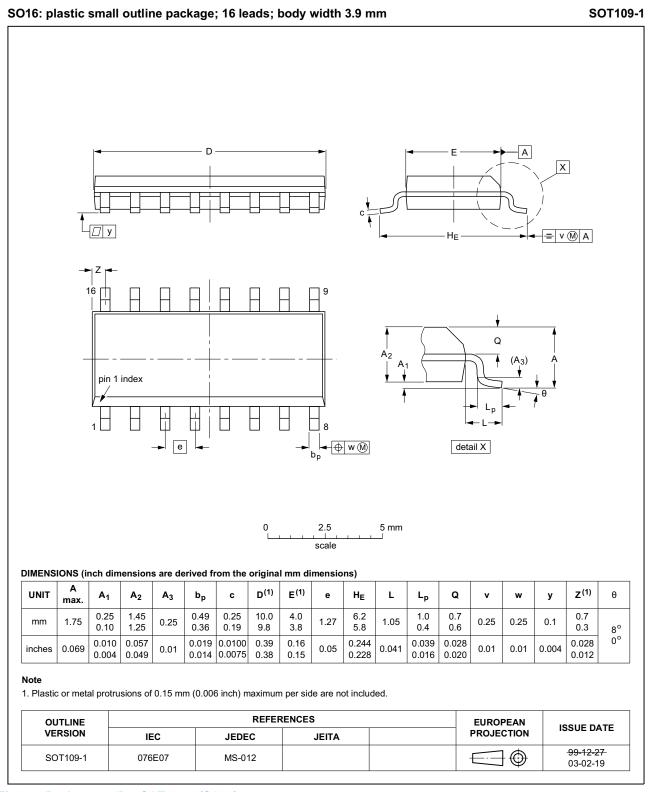


Fig 9. Package outline SOT109-1 (SO16)

Dual 4-input multiplexer

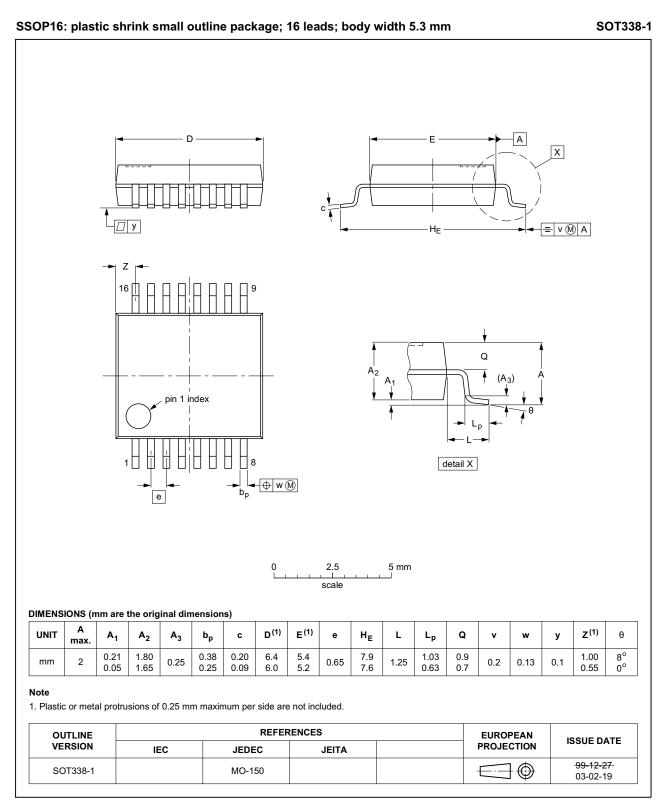


Fig 10. Package outline SOT338-1 (SSOP16)

74HC_HCT153

Dual 4-input multiplexer

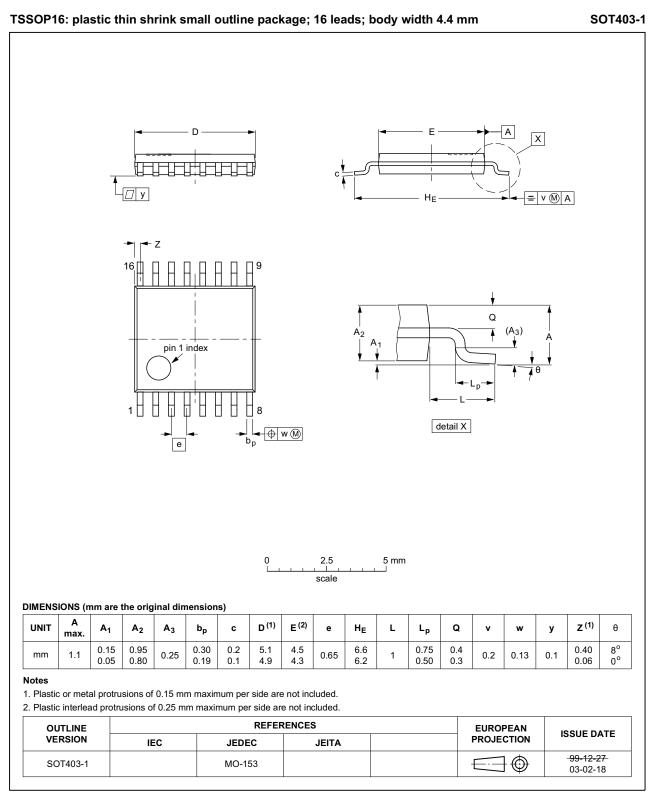


Fig 11. Package outline SOT403-1 (TSSOP16)

74HC_HCT153 Product data sheet

12. Abbreviations

Table 10. Abbreviations		
Acronym	Description	
CMOS	Complementary Metal-Oxide Semiconductor	
DUT	Device Under Test	
ESD	ElectroStatic Discharge	
НВМ	Human Body Model	
LSTTL	Low-power Schottky Transistor-Transistor Logic	
MM	Machine Model	
TTL	Transistor-Transistor Logic	

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT153 v.6	20160511	Product data sheet	-	74HC_HCT153 v.5
Modifications:	 Type numbers 	74HC153N and 74HCT15	3N (SOT38-4) remo	oved.
74HC_HCT153 v.5	20140123	Product data sheet	-	74HC_HCT153 v.4
Modifications:	• <u>Table 1</u> and <u>Section 11</u> : all references to 14 pin packages removed.			
74HC_HCT153 v.4	20131128	Product data sheet	-	74HC_HCT153 v.3
74HC_HCT153 v.3	20130722	Product data sheet	-	74HC_HCT153_CNV v.2
74HC_HCT153_CNV v.2	19970827	Product specification	-	-

14. Legal information

14.1 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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74HC HCT153

Dual 4-input multiplexer

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Dual 4-input multiplexer

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