74HC257; 74HCT257 Quad 2-input multiplexer; 3-state Rev. 7 – 2 February 2016

General description 1.

The 74HC257; 74HCT257 is a quad 2-input multiplexer with 3-state outputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

Features and benefits 2.

- Non-inverting data path
- 3-state outputs interface directly with system bus
- Complies with JEDEC standard no. 7A
- Input levels:
 - For 74HC257: CMOS level
 - For 74HCT257: TTL level
- 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 from –40 °C to +125 °C

3. **Ordering information**

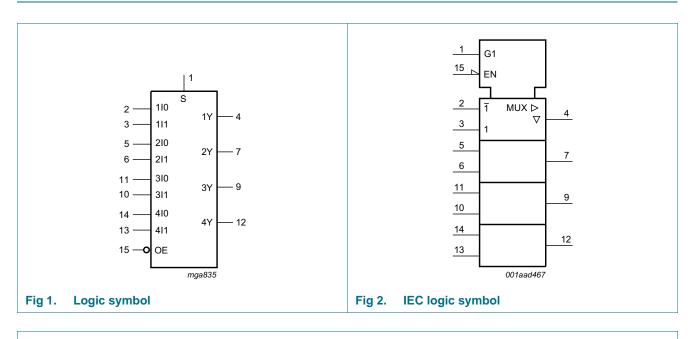
Table 1. **Ordering information**

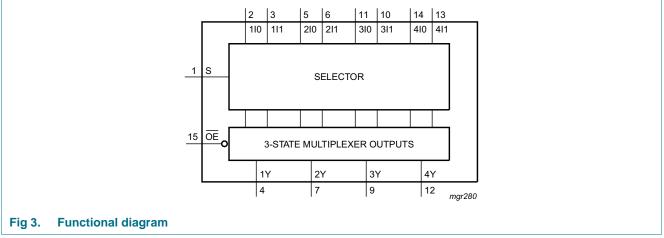
Type number	Package	kage						
	Temperature range	Name	Description	Version				
74HC257D	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1				
74HCT257D								
74HC257DB	–40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads;	SOT338-1				
74HCT257DB			body width 5.3 mm					
74HC257PW	–40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads;	SOT403-1				
74HCT257PW			body width 4.4 mm					

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Quad 2-input multiplexer; 3-state

4. Functional diagram

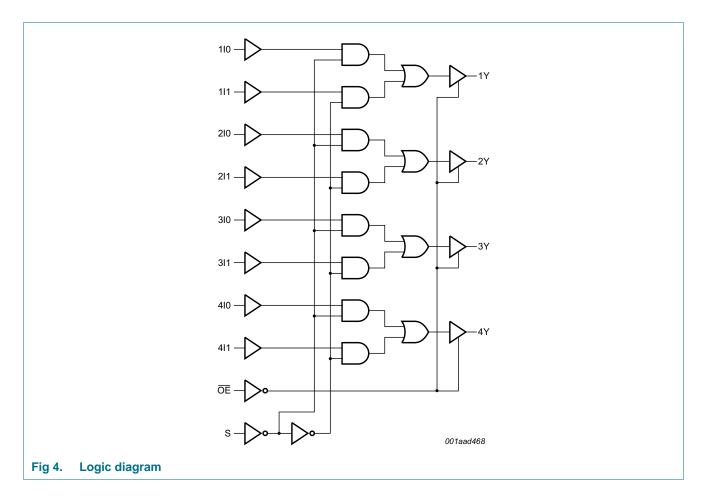




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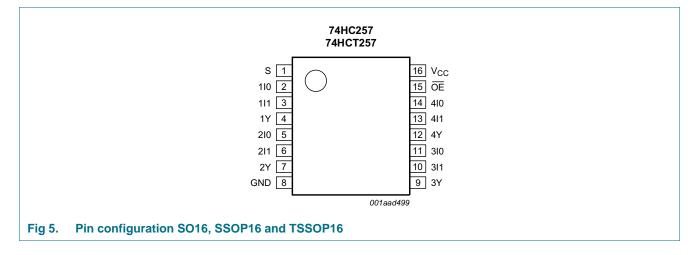
74HC257; 74HCT257

Quad 2-input multiplexer; 3-state



5. Pinning information





5.2 Pin description

Table 2.Pin description		
Symbol	Pin	Description
S	1	common data select input
110 to 410	2, 5, 11, 14	data input from source 0
1I1 to 4I1	3, 6, 10, 13	data input from source 1
1Y to 4Y	4, 7, 9, 12	3-state multiplexer output
GND	8	ground (0 V)
OE	15	3-state output enable input (active LOW)
V _{CC}	16	supply voltage

6. Functional description

6.1 Function table

Table 3. Function table ^[1]							
		Input		Output			
OE	S	nl0	nl1	nY			
Н	Х	Х	Х	Z			
L	Н	Х	L	L			
L	Н	Х	Н	Н			
L	L	L	Х	L			
L	L	Н	Х	Н			

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

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
I _{OK}	output clamping current	$V_{\rm O}$ < –0.5 V or $V_{\rm O}$ > $V_{\rm CC}$ + 0.5 V	[1]	-	±20	mA
lo	output current	V_{O} = -0.5 V to V_{CC} + 0.5 V		-	±35	mA
I _{CC}	supply current			-	+70	mA
I _{GND}	ground current			-70	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	SO16 package	[2]	-	500	mW
		SSOP16 package	<u>[3]</u>	-	500	mW
		TSSOP16 package	<u>[3]</u>	-	500	mW

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

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

[3] For SSOP16 and TSSOP16 packages: above 60 °C, Ptot derates linearly with 5.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
74HC257					1	
V _{CC}	supply voltage		2.0	5.0	6.0	V
VI	input voltage		0	-	V _{CC}	V
Vo	output voltage		0	-	V _{CC}	V
$\Delta t / \Delta V$ input transition rise and fall rates	•	V _{CC} = 2.0 V	-	-	625	ns
	V _{CC} = 4.5 V	-	1.67	139	ns	
		V _{CC} = 6.0 V	-	-	83	ns
T _{amb}	ambient temperature		-40	-	+125	°C
74HCT257				1		
V _{CC}	supply voltage		4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	V
Vo	output voltage		0	-	V _{CC}	V
$\Delta t / \Delta V$	input transition rise and fall rates	V _{CC} = 4.5 V	-	1.67	139	ns
T _{amb}	ambient temperature		-40	-	+125	°C

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions		25 °C		-	°C to i °C			Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC257	7									
V _{IH} HIGH-level input voltage		$V_{CC} = 2.0 V$	1.5	1.2	-	1.5	-	1.5	-	V
	$V_{CC} = 4.5 V$	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} LO	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
		$I_{O} = -6.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_{O} = -7.8 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V

Quad 2-input multiplexer; 3-state

Table 6. Static characteristics ...continued

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

Symbol	Parameter	Conditions		25 °C			°C to 5 °C		°C to 5 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	-
V _{OL}	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 20 \ \mu A; \ V_{CC} = 6.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 6.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
		I _O = 7.8 mA; V _{CC} = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I _I	input leakage current	$V_{I} = V_{CC}$ or GND; $V_{CC} = 6.0$ V	-	-	±0.1	-	±1.0	-	±1.0	μA
I _{OZ}	OFF-state output current	$ \begin{array}{l} V_{I} = V_{IH} \text{ or } V_{IL}; \\ V_{O} = V_{CC} \text{ or } GND; \\ V_{CC} = 6.0 \ V \end{array} $	-	-	±0.5	-	±5.0	-	±10.0	μA
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0$ V	-	-	8.0	-	80	-	160	μΑ
Ci	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT2	57	1								
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}	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
		$I_0 = -6 \text{ mA}$	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 μA	-	0	0.1	-	0.33	-	0.4	V
		I _O = 6.0 mA	-	0.15	0.26	-	0.33	-	0.4	V
l _l	input leakage current	$V_{I} = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	±0.1	-	±1.0	-	±1.0	μA
I _{OZ}	OFF-state output current		-	-	±0.5	-	±5.0	-	±10	μA
I _{CC}	supply current		-	-	8.0	-	80	-	160	μΑ
∆I _{CC}	additional supply current	$\label{eq:VI} \begin{array}{l} V_{I} = V_{CC} - 2.1 \; V;\\ \text{other inputs at } V_{CC} \; \text{or GND};\\ V_{CC} = 4.5 \; V \; \text{to } 5.5 \; V; \; I_{O} = 0 \; A \end{array}$								
		per input pin; nI0, nI1 inputs	-	40	144	-	180	-	196	μΑ
		per input pin; OE input	-	135	486	-	608	-	662	μΑ
		per input pin; S input	-	70	252	-	315	-	343	μA
CI	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); For test circuit see Figure 8.

Symbol	Parameter	Conditions		25	°C	–40 °C to +85 °C	–40 °C to +125 °C	Unit
				Тур	Max	Max	Max	
74HC257	7							
t _{pd}	propagation	nl0 to nY or nl1 to nY; see Figure 6	<u>[1]</u>					
	delay	V _{CC} = 2.0 V		36	110	140	165	ns
		V _{CC} = 4.5 V		13	22	28	33	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$		11	-	-	-	ns
		V _{CC} = 6.0 V		10	19	24	28	ns
		S to nY; see Figure 6						
		V _{CC} = 2.0 V		47	150	190	225	ns
		V _{CC} = 4.5 V		17	30	38	45	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$		14	-	-	-	ns
		V _{CC} = 6.0 V		14	26	33	38	ns
t _{en}	enable time	OE to nY; see Figure 7	[2]					
		V _{CC} = 2.0 V		33	150	190	225	ns
	V _{CC} = 4.5 V		12	30	38	45	ns	
		V _{CC} = 6.0 V		10	26	33	38	ns
t _{dis} disable time	disable time	OE to nY; see Figure 7	<u>[3]</u>					
		V _{CC} = 2.0 V		41	150	190	225	ns
		V _{CC} = 4.5 V		15	30	38	45	ns
		V _{CC} = 6.0 V		12	26	33	38	ns
t _t	transition time	see Figure 6	<u>[4]</u>					
		V _{CC} = 2.0 V		14	60	75	90	ns
		V _{CC} = 4.5 V		5	12	15	18	ns
		V _{CC} = 6.0 V		4	10	13	15	ns
C _{PD}	power dissipation capacitance	per multiplexer; $V_I = GND$ to V_{CC}	<u>[5]</u>	45	-	-	-	pF
74HCT2	57	-						
t _{pd}	propagation	nl0 to nY or nl1 to nY; see Figure 6	<u>[1]</u>					
	delay	V _{CC} = 4.5 V		16	30	38	45	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$		13	-	-	-	ns
		S to nY; see <u>Figure 6</u>						
		V _{CC} = 4.5 V		20	35	44	53	ns
		$V_{CC} = 5.0 \text{ V}; \text{ C}_{L} = 15 \text{ pF}$		17	-	-	-	ns
t _{en}	enable time	\overline{OE} to nY; V _{CC} = 4.5 V; see <u>Figure 7</u>	[2]	15	30	38	45	ns
t _{dis}	disable time	\overline{OE} to nY; V _{CC} = 4.5 V; see Figure 7	[3]	16	30	38	45	ns
t _t	transition time	V _{CC} = 4.5 V; see Figure 6	[4]	5	12	15	18	ns

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Quad 2-input multiplexer; 3-state

Table 7. Dynamic characteristics ... continued

Voltages are referenced to GND (ground = 0 V); For test circuit see Figure 8.

Symbol	Parameter	conditions		°C –40 °C to +85 °C		–40 °C to +125 °C	Unit
			Тур	Max	Max	Мах	
C _{PD}	power dissipation capacitance	per multiplexer; $V_I = GND$ to $V_{CC} - 1.5 V$ [5]	45	-	-	-	pF

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

[2] t_{en} is the same as t_{PZH} , t_{PZL} .

- $[3] \quad t_{\text{dis}} \text{ is the same as } t_{\text{PHZ}}, t_{\text{PLZ}}.$
- [4] t_t is the same as t_{THL} , t_{TLH} .

[5] 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;

 $f_o = output frequency in MHz;$

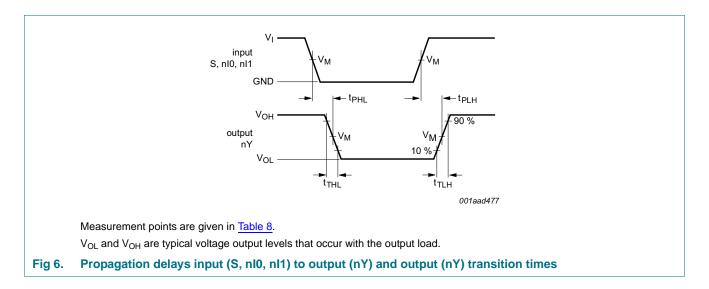
 C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11. Waveforms



Quad 2-input multiplexer; 3-state

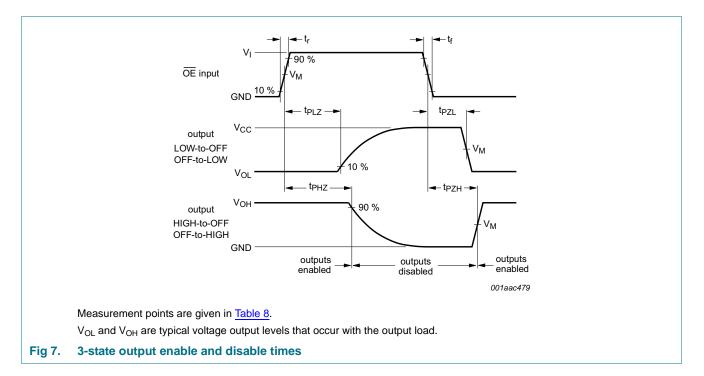


Table 8. Measurement points

Туре	Input	Output
	V _M	V _M
74HC257	0.5V _{CC}	0.5V _{CC}
74HCT257	1.3 V	1.3 V

Quad 2-input multiplexer; 3-state

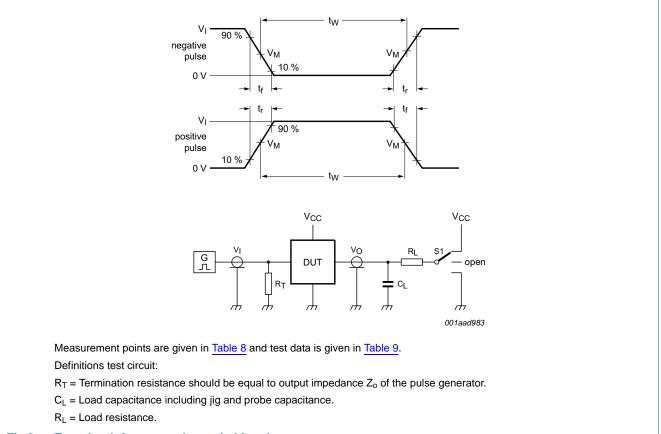


Fig 8. Test circuit for measuring switching times

Table 9. Test data

Туре	Input		Load		Switch position	on			
	VI	t _r , t _f	CL	RL	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}		
74HC257	V _{CC}	6 ns	50 pF	1 kΩ	open	GND	V _{CC}		
74HCT257	3 V	6 ns	50 pF	1 kΩ	open	GND	V _{CC}		



12. Package outline

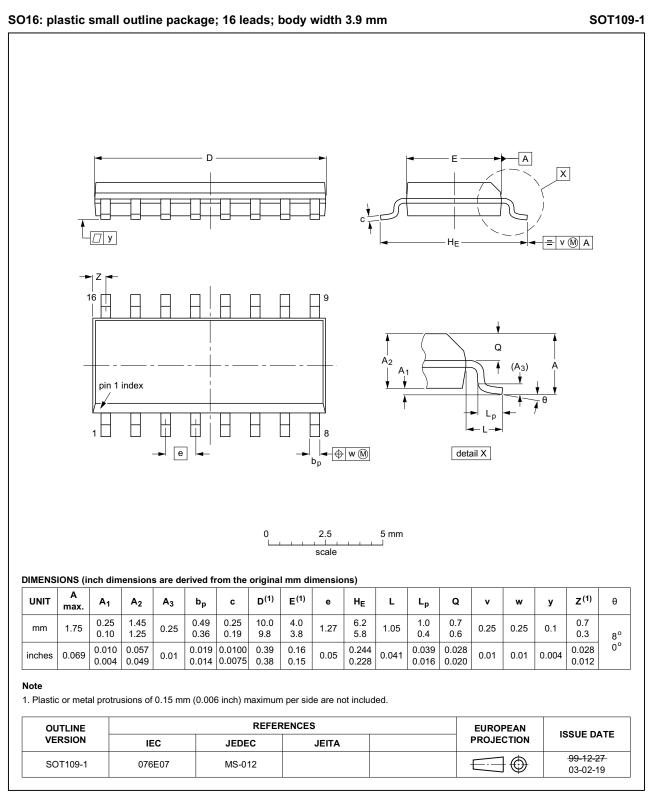


Fig 9. Package outline SOT109-1 (SO16)

Quad 2-input multiplexer; 3-state

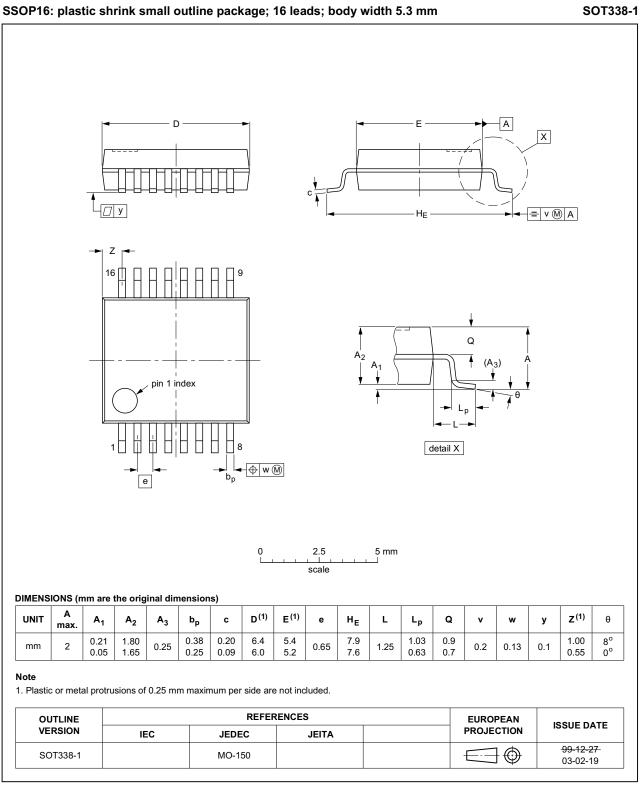


Fig 10. Package outline SOT338-1 (SSOP16)

Quad 2-input multiplexer; 3-state

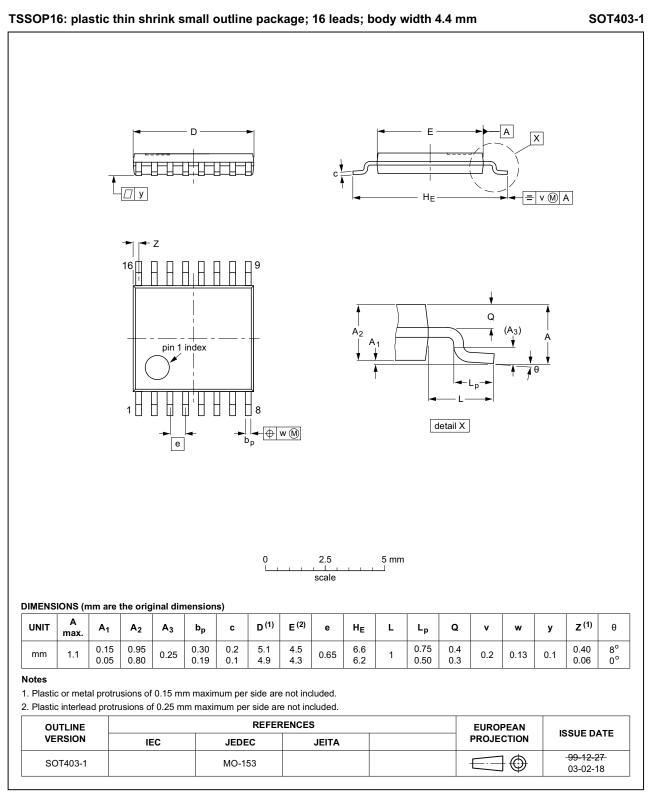


Fig 11. Package outline SOT403-1 (TSSOP16)

74HC_HCT257

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13. Abbreviations

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

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT257 v.7	20160202	Product data sheet	-	74HC_HCT257 v.6
Modifications:	 Type numbers 74HC257N and 74HCT257N (SOT38-4) removed. 			
74HC_HCT257 v.6	20150126	Product data sheet	-	74HC_HCT257 v.5
Modifications:	• <u>Table 7</u> : Power dissipation capacitance condition for 74HCT257 is corrected.			
74HC_HCT257 v.5	20100113	Product data sheet	-	74HC_HCT257 v.4
Modifications:	• <u>Table 7</u> : changed <u>3OE</u> to <u>OE</u>			
74HC_HCT257 v.4	20090608	Product data sheet	-	74HC_HCT257 v.3
74HC_HCT257 v.3	20050920	Product data sheet	-	74HC_HCT257_CNV v.2
74HC_HCT257_CNV v.2	19980930	Product specification	-	-

15. Legal information

15.1 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".

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Quad 2-input multiplexer; 3-state

17. Contents

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