

# DATA SHEET

**74ALS251**

8-input multiplexer (3-State)

Product specification  
IC05 Data Handbook

1991 Feb 08

8-input multiplexer (3-State)

74ALS251

FEATURES

- 8-to-1 multiplexing
- On chip decoding
- Multifunction capability
- Inverting and non-inverting outputs
- Both outputs are 3-State for further multiplexer expansion

DESCRIPTION

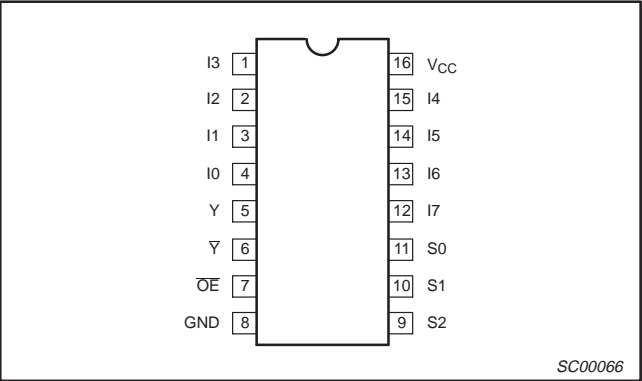
The 74ALS251 is a logic implementation of a single 8-position switch with the switch position controlled by the state of three select (S0, S1, S2) inputs. True (Y) and complementary ( $\bar{Y}$ ) outputs are both provided.

The output enable ( $\overline{OE}$ ) is active Low. When  $\overline{OE}$  is High, both outputs are in High impedance state, allowing multiple connections to a common bus without driving nor loading the bus significantly.

When the outputs of more than one device are tied together, the user must ensure that there is no overlap in the active-Low portion of the output enable voltages in order to avoid high currents that could exceed the maximum current rating.

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74ALS251	7.0ns	7.5mA

PIN CONFIGURATION



ORDERING INFORMATION

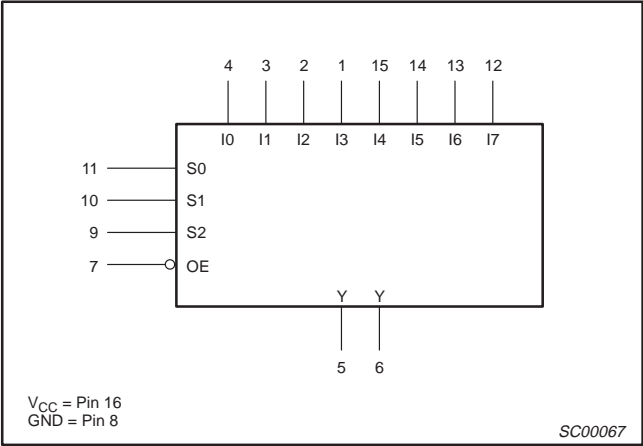
DESCRIPTION	ORDER CODE	DRAWING NUMBER
	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$ , $T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$	
16-pin plastic DIP	74ALS251N	SOT38-4
16-pin plastic SO	74ALS251D	SOT109-1

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

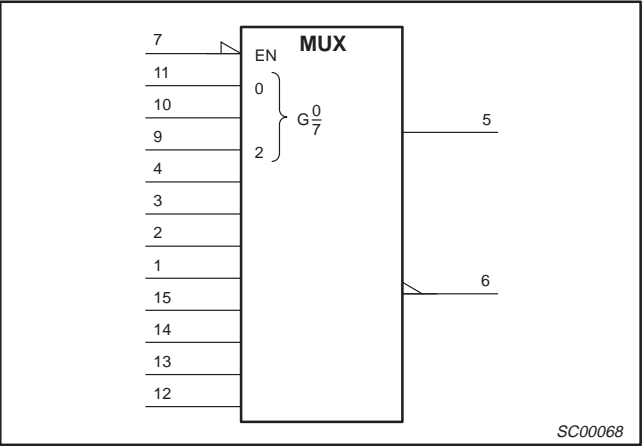
PINS	DESCRIPTION	74ALS (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
I0 – I7	Data inputs	1.0/1.0	20 $\mu$ A/0.1mA
S0 – S2	Select inputs	1.0/1.0	20 $\mu$ A/0.1mA
$\overline{OE}$	Output Enable input (active-Low)	1.0/1.0	20 $\mu$ A/0.1mA
Y, $\bar{Y}$	Data outputs	130/240	2.5mA/24mA

NOTE: One (1.0) ALS unit load is defined as: 20 $\mu$ A in the High state and 0.1mA in the Low state.

LOGIC SYMBOL



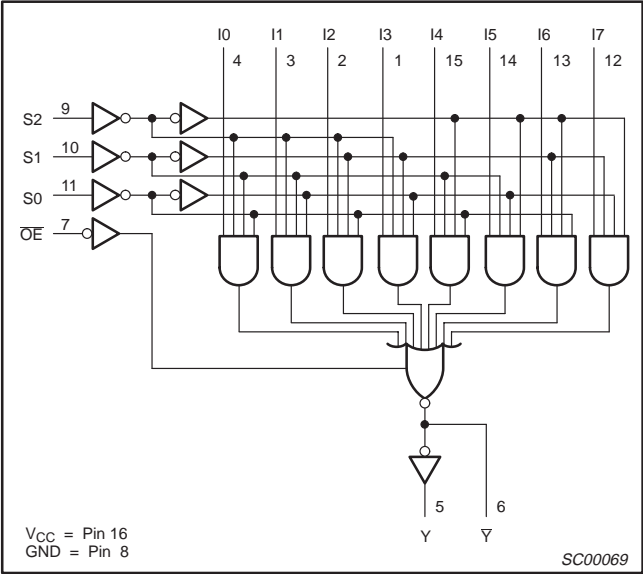
IEC/IEEE SYMBOL



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LOGIC DIAGRAM



FUNCTION TABLE

INPUTS				OUTPUTS	
S2	S1	S0	OE	Y	Y̅
X	X	X	H	Z	Z
L	L	L	L	I0	I̅0
L	L	H	L	I1	I̅1
L	H	L	L	I2	I̅2
L	H	H	L	I3	I̅3
H	L	L	L	I4	I̅4
H	L	H	L	I5	I̅5
H	H	L	L	I6	I̅6
H	H	H	L	I7	I̅7

H = High voltage level  
L = Low voltage level  
X = Don't care  
Z = High impedance "off" state

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device.  
Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V <sub>CC</sub>	Supply voltage	−0.5 to +7.0	V
V <sub>IN</sub>	Input voltage	−0.5 to +7.0	V
I <sub>IN</sub>	Input current	−30 to +5	mA
V <sub>OUT</sub>	Voltage applied to output in High output state	−0.5 to V <sub>CC</sub>	V
I <sub>OUT</sub>	Current applied to output in Low output state	48	mA
T <sub>amb</sub>	Operating free-air temperature range	0 to +70	°C
T <sub>stg</sub>	Storage temperature range	−65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	High-level input voltage	2.0			V
V <sub>IL</sub>	Low-level input voltage			0.8	V
I <sub>IK</sub>	Input clamp current			−18	mA
I <sub>OH</sub>	High-level output current			−2.6	mA
I <sub>OL</sub>	Low-level output current			24	mA
T <sub>amb</sub>	Operating free-air temperature range	0		+70	°C

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## DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>	LIMITS			UNIT
			MIN	TYP <sup>2</sup>	MAX	
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> ± 10%, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OH</sub> = -0.4mA	V <sub>CC</sub> - 2		V
			I <sub>OH</sub> = -2.6mA	2.4	3.2	V
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OL</sub> = 12mA		0.25	V
			I <sub>OL</sub> = 24mA		0.35	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>		-0.73	-1.5	V
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V			0.1	mA
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	μA
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4V			-0.1	mA
I <sub>OZH</sub>	Off-state output current, High-level voltage applied	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	μA
I <sub>OZL</sub>	Off-state output current, Low-level voltage applied	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4V			-20	μA
I <sub>O</sub>	Output current <sup>3</sup>	V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.25V	-30		-112	mA
I <sub>CC</sub>	Supply current (total)	I <sub>CC</sub> I <sub>CCZ</sub>	V <sub>CC</sub> = MAX	7.0	10	mA
				9.0	14	mA

## NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

## AC ELECTRICAL CHARACTERISTICS

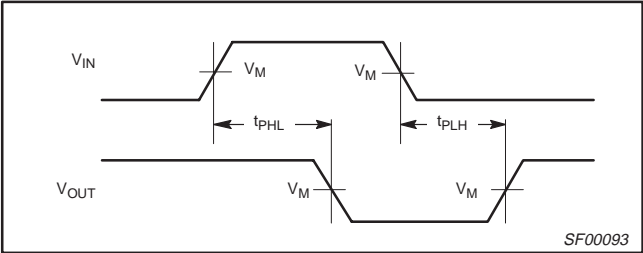
SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	MAX	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay In to Y	Waveform 2	4.0 4.0	12.0 12.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay In to $\bar{Y}$	Waveform 1	3.0 6.0	10.0 15.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay Sn to Y	Waveform 1, 2	5.0 7.0	15.0 16.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay Sn to $\bar{Y}$	Waveform 1, 2	8.0 5.0	17.0 15.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Propagation delay $\overline{OE}$ to Y	Waveform 3 Waveform 4	2.0 3.0	8.0 9.0	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Propagation delay $\overline{OE}$ to Y	Waveform 3 Waveform 4	2.0 1.0	8.0 7.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Propagation delay $\overline{OE}$ to $\bar{Y}$	Waveform 3 Waveform 4	2.0 3.0	8.0 9.0	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Propagation delay $\overline{OE}$ to $\bar{Y}$	Waveform 3 Waveform 4	2.0 1.0	8.0 7.0	ns

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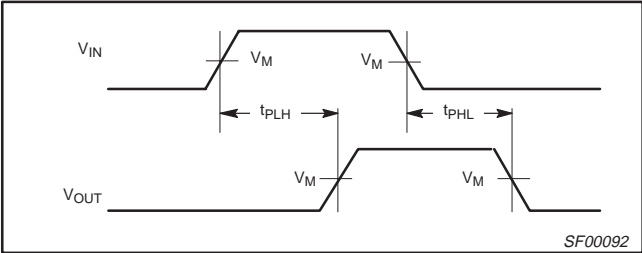
74ALS251

AC WAVEFORMS

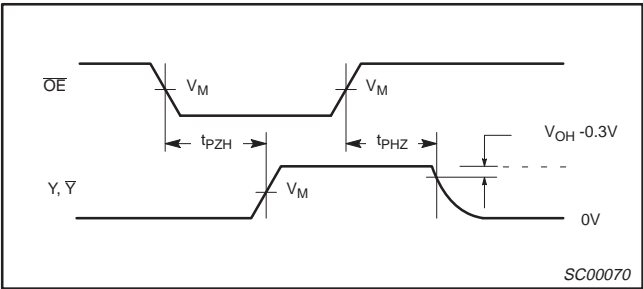
For all waveforms,  $V_M = 1.3V$ .



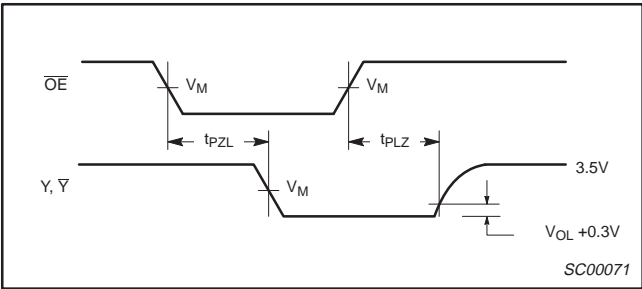
Waveform 1. Propagation Delay for Inverting Output



Waveform 2. Propagation Delay for Non-inverting Output



Waveform 3. 3-State Output Enable Time to High Level and Output Disable Time from High Level



Waveform 4. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

TEST CIRCUIT AND WAVEFORMS

**Test Circuit for 3-State Outputs**

SWITCH POSITION	
TEST	SWITCH
$t_{PLZ}, t_{PZL}$	closed
All other	open

**DEFINITIONS:**  
 $R_L$  = Load resistor; see AC electrical characteristics for value.  
 $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.  
 $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

**Input Pulse Definition**

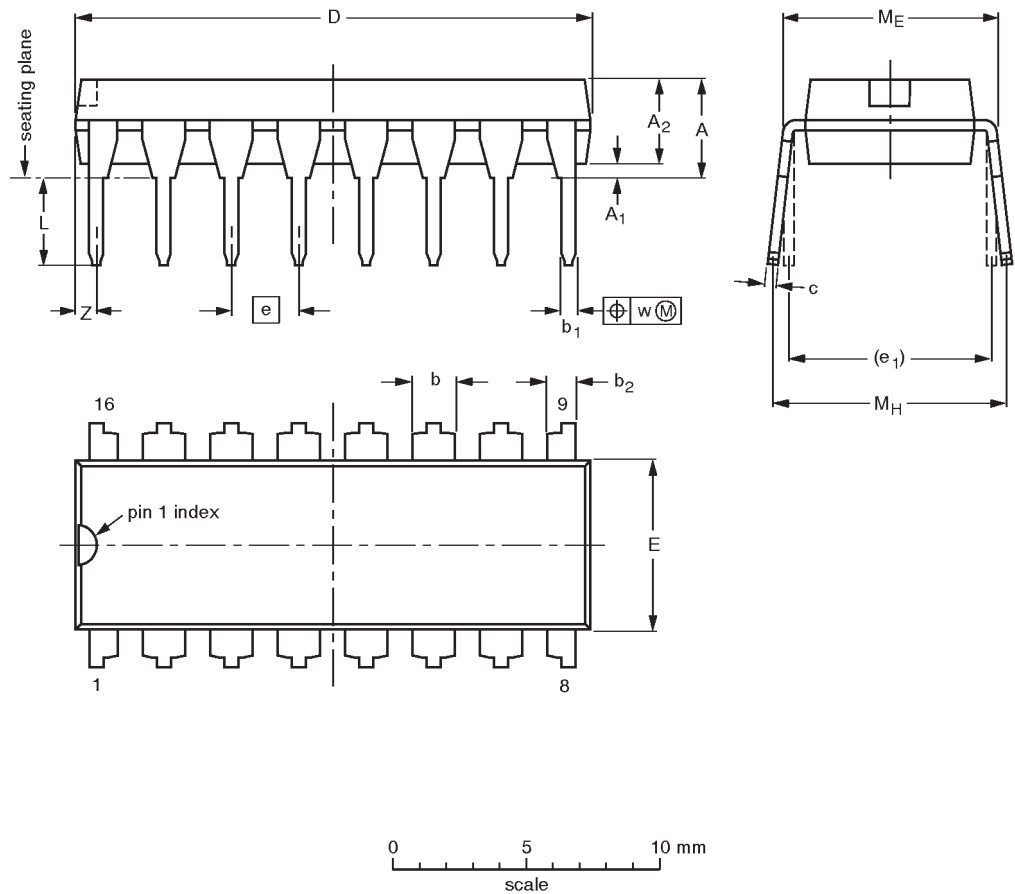
Family	INPUT PULSE REQUIREMENTS					
	Amplitude	$V_M$	Rep.Rate	$t_w$	$t_{TLH}$	$t_{THL}$
74ALS	3.5V	1.3V	1MHz	500ns	2.0ns	2.0ns

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DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4




DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

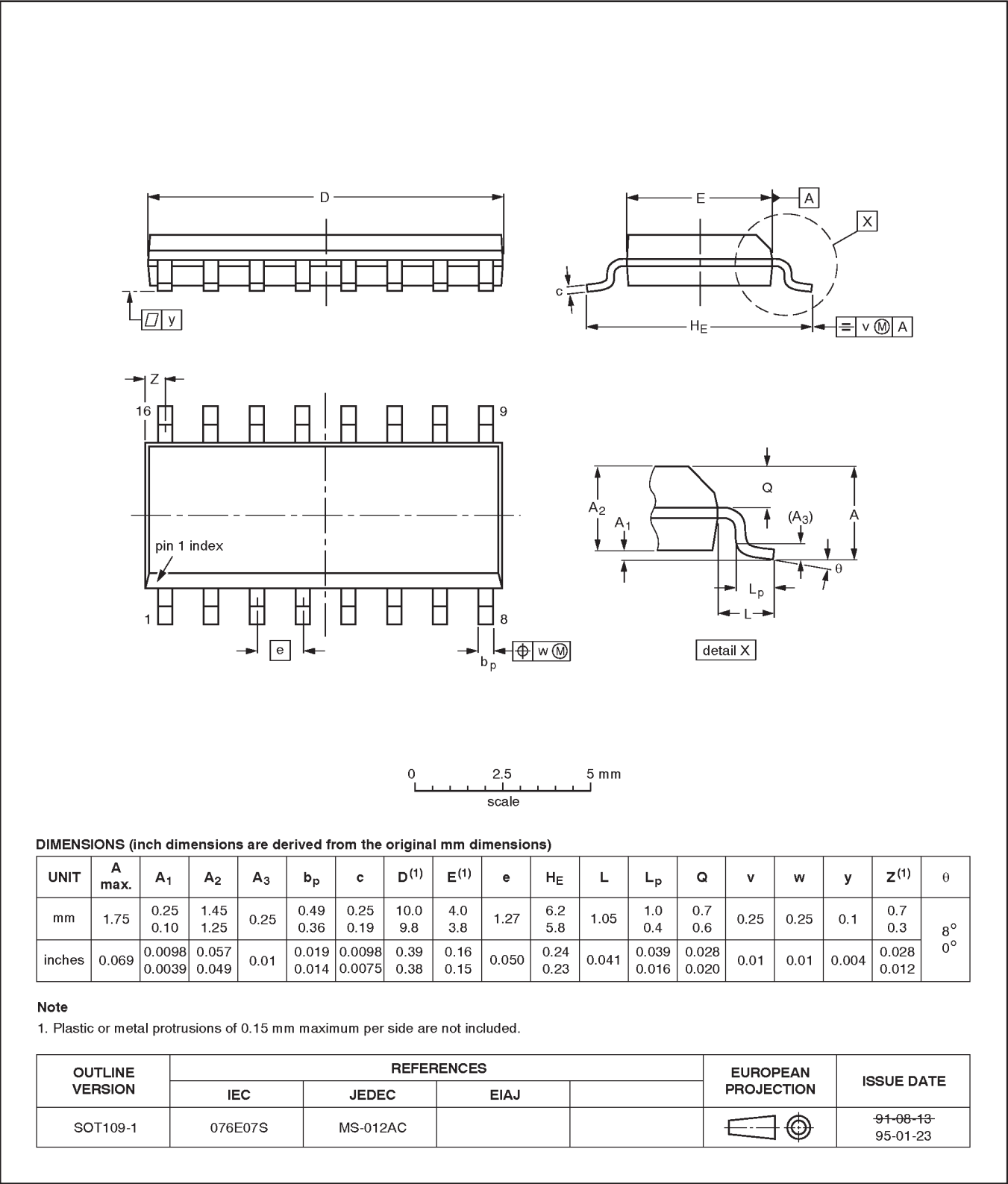
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						92-11-17 95-01-14

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

SOT109-1



8–input multiplexer (3–State)

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DEFINITIONS

Data Sheet Identification	Product Status	Definition
Objective Specification	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
Preliminary Specification	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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