

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

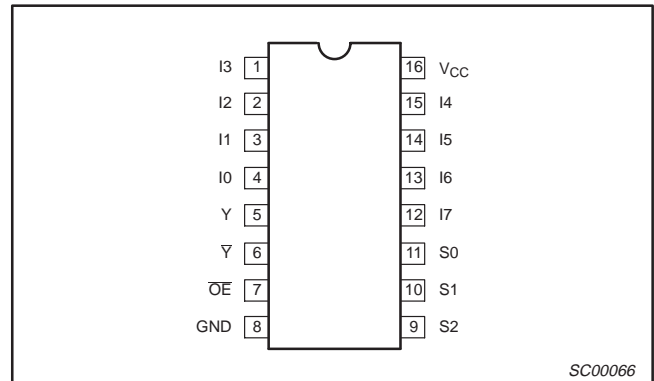
The 74ALS251 is a logic implementation of a single 8-position switch with the switch position controlled by the state of three select (S0, S1, S2) inputs. True (Y) and complementary (Ȳ) outputs are both provided.

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

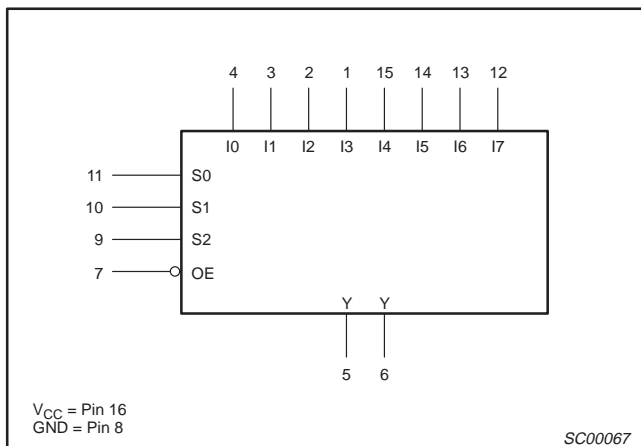
| DESCRIPTION | ORDER CODE | DRAWING NUMBER |
|--------------------|--|----------------|
| | COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$ | |
| 16-pin plastic DIP | 74ALS251N | SOT38-4 |
| 16-pin plastic SO | 74ALS251D | SOT109-1 |

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

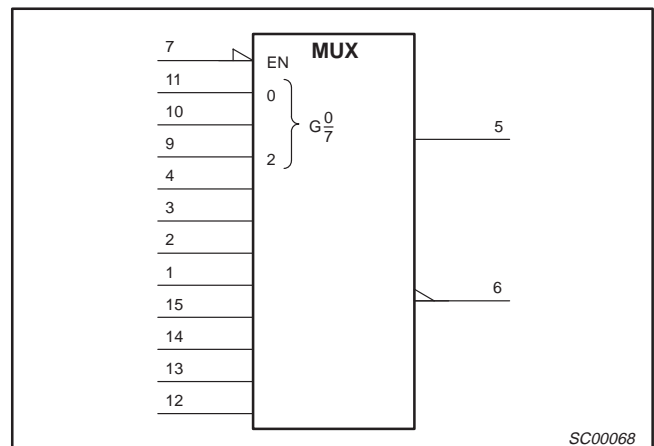
| PINS | DESCRIPTION | 74ALS (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|-----------------|----------------------------------|-----------------------|---------------------|
| I0 – I7 | Data inputs | 1.0/1.0 | 20 μ A/0.1mA |
| S0 – S2 | Select inputs | 1.0/1.0 | 20 μ A/0.1mA |
| \overline{OE} | Output Enable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

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

LOGIC SYMBOL



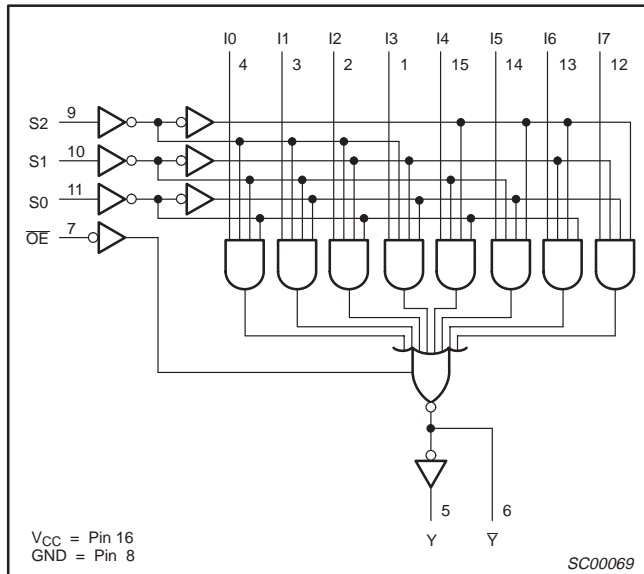
IEC/IEEE SYMBOL



8-input multiplexer (3-State)

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LOGIC DIAGRAM



FUNCTION TABLE

| INPUTS | | | | OUTPUTS | |
|--------|----|----|----|---------|-----|
| S2 | S1 | S0 | OE | Y | Ȳ |
| X | X | X | H | Z | Z |
| L | L | L | L | I0 | Ī0 |
| L | L | H | L | I1 | Ī1 |
| L | H | L | L | I2 | Ī2 |
| L | H | H | L | I3 | Ī3 |
| H | L | L | L | I4 | Ī4 |
| H | L | H | L | I5 | Ī5 |
| H | H | L | L | I6 | Ī6 |
| H | H | H | L | I7 | Ī7 |

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 _{CC} | Supply voltage | -0.5 to +7.0 | V |
| V _{IN} | Input voltage | -0.5 to +7.0 | V |
| I _{IN} | Input current | -30 to +5 | mA |
| V _{OUT} | Voltage applied to output in High output state | -0.5 to V _{CC} | V |
| I _{OUT} | Current applied to output in Low output state | 48 | mA |
| T _{amb} | Operating free-air temperature range | 0 to +70 | °C |
| T _{stg} | Storage temperature range | -65 to +150 | °C |

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | | UNIT |
|------------------|--------------------------------------|--------|-----|------|------|
| | | MIN | NOM | MAX | |
| V _{CC} | Supply voltage | 4.5 | 5.0 | 5.5 | V |
| V _{IH} | High-level input voltage | 2.0 | | | V |
| V _{IL} | Low-level input voltage | | | 0.8 | V |
| I _{IK} | Input clamp current | | | -18 | mA |
| I _{OH} | High-level output current | | | -2.6 | mA |
| I _{OL} | Low-level output current | | | 24 | mA |
| T _{amb} | 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 ¹ | LIMITS | | | UNIT | |
|------------------|---|--|--------------------------|---------------------|------|------|----|
| | | | MIN | TYP ² | MAX | | |
| V _{OH} | High-level output voltage | V _{CC} ±10%, V _{IL} = MAX, V _{IH} = MIN | I _{OH} = -0.4mA | V _{CC} - 2 | | V | |
| | | | I _{OH} = -2.6mA | 2.4 | 3.2 | V | |
| V _{OL} | Low-level output voltage | V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN | I _{OL} = 12mA | | 0.25 | 0.40 | V |
| | | | I _{OL} = 24mA | | 0.35 | 0.50 | V |
| V _{IK} | Input clamp voltage | V _{CC} = MIN, I _I = I _{IK} | | -0.73 | -1.5 | V | |
| I _I | Input current at maximum input voltage | V _{CC} = MAX, V _I = 7.0V | | | 0.1 | mA | |
| I _{IH} | High-level input current | V _{CC} = MAX, V _I = 2.7V | | | 20 | μA | |
| I _{IL} | Low-level input current | V _{CC} = MAX, V _I = 0.4V | | | -0.1 | mA | |
| I _{OZH} | Off-state output current, High-level voltage applied | V _{CC} = MAX, V _I = 2.7V | | | 20 | μA | |
| I _{OZL} | Off-state output current, Low-level voltage applied | V _{CC} = MAX, V _I = 0.4V | | | -20 | μA | |
| I _O | Output current ³ | V _{CC} = MAX, V _O = 2.25V | -30 | | -112 | mA | |
| I _{CC} | Supply current (total) | I _{CC} I _{CCZ} | V _{CC} = 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_{CC} = 5V, T_{amb} = 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_{OS}.

AC ELECTRICAL CHARACTERISTICS

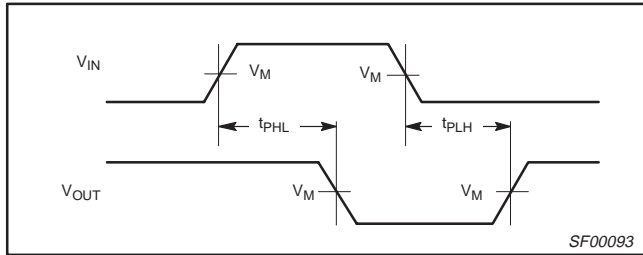
| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | UNIT |
|--------------------------------------|--------------------------------------|--------------------------|--|--------------|------|
| | | | T _{amb} = 0°C to +70°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω | | |
| | | | MIN | MAX | |
| t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

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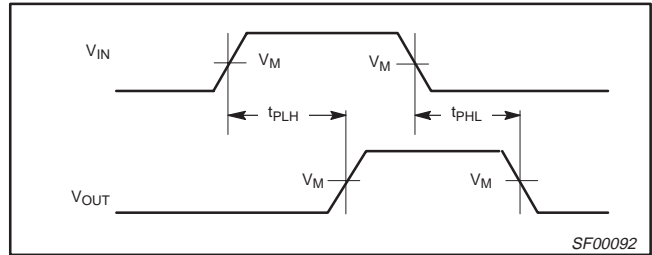
74ALS251

AC WAVEFORMS

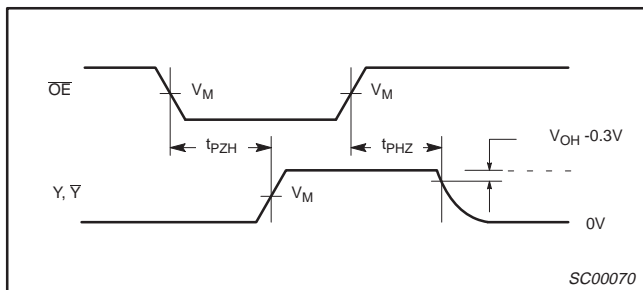
For all waveforms, $V_M = 1.3V$.



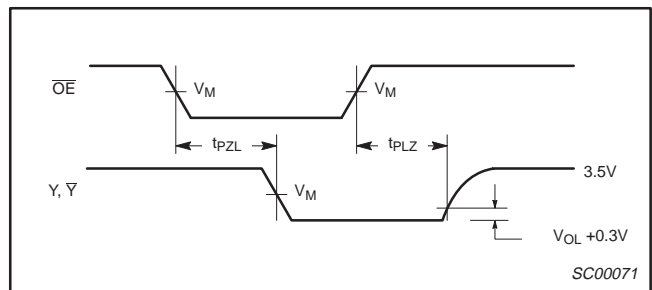
Waveform 1. Propagation Delay for Inverting Output



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 |

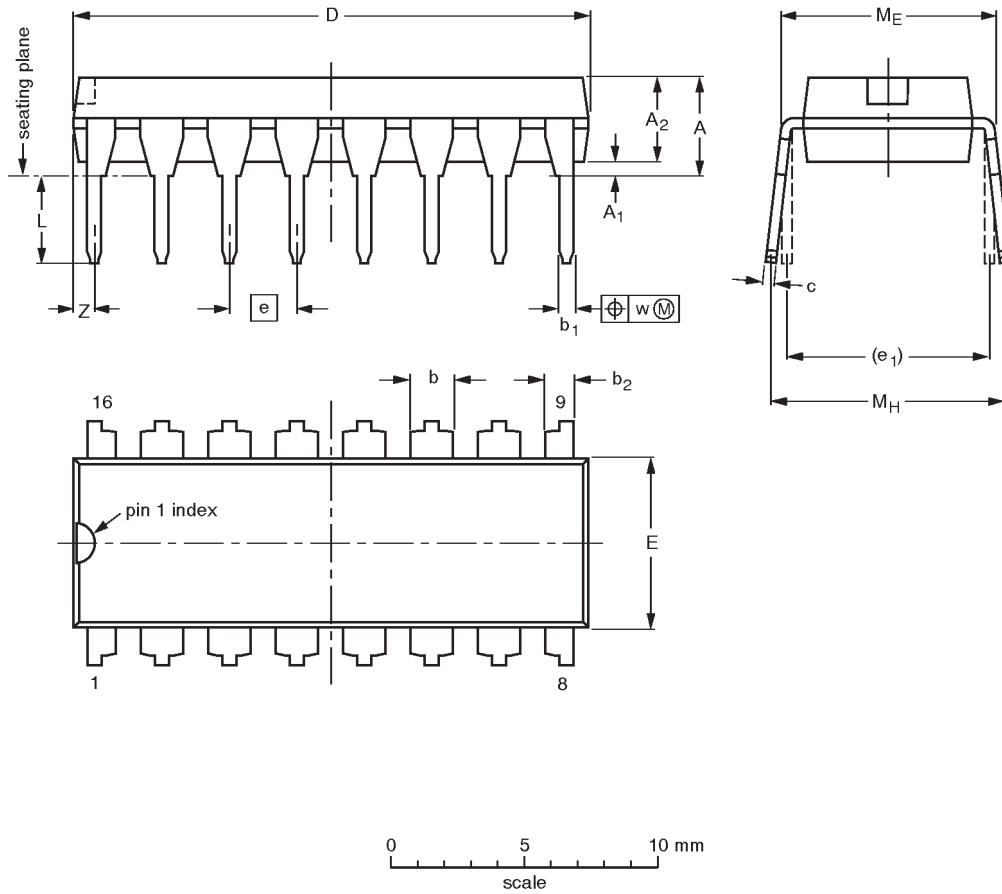
SC00072

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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 ₁ min. | A ₂ max. | b | b ₁ | b ₂ | c | D ⁽¹⁾ | E ⁽¹⁾ | e | e ₁ | L | M _E | M _H | w | Z ⁽¹⁾ 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.

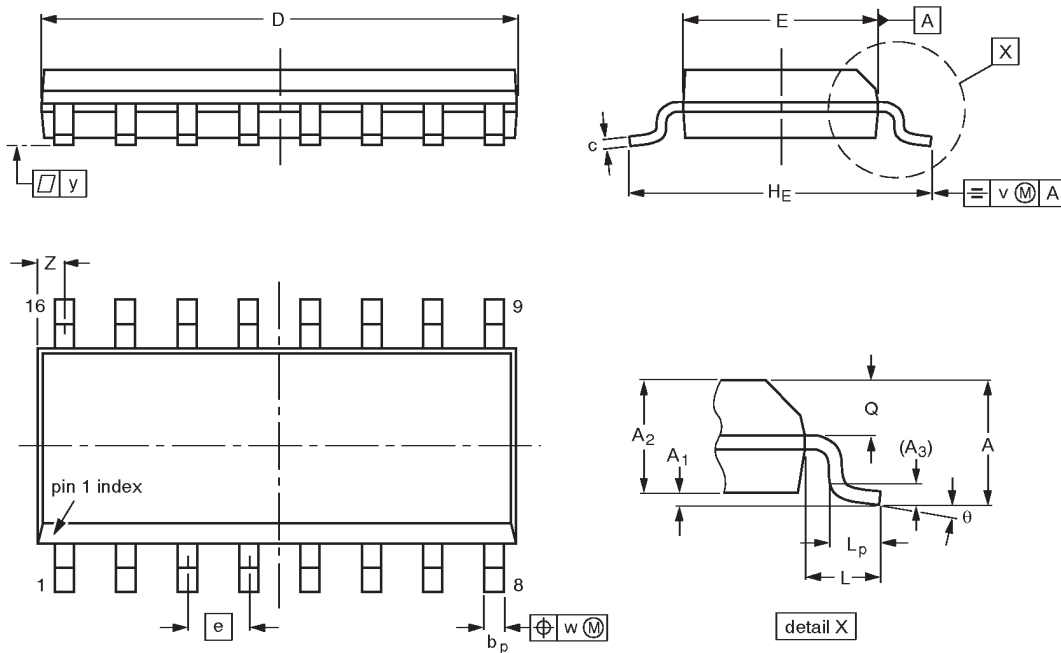
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|--|---------------------|-----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT38-4 | | | | | | -92-11-17 95-01-14 |

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

SOT109-1



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

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | z ⁽¹⁾ | θ |
|--------|--------|------------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 1.75 | 0.25 0.10 | 1.45 1.25 | 0.25 | 0.49 0.36 | 0.25 0.19 | 10.0 9.8 | 4.0 3.8 | 1.27 | 6.2 5.8 | 1.05 | 1.0 0.4 | 0.7 0.6 | 0.25 | 0.25 | 0.1 | 0.7 0.3 | 8° 0° |
| inches | 0.069 | 0.0098 0.0039 | 0.057 0.049 | 0.01 | 0.019 0.014 | 0.0098 0.0075 | 0.39 0.38 | 0.16 0.15 | 0.050 | 0.24 0.23 | 0.041 | 0.039 0.016 | 0.028 0.020 | 0.01 | 0.01 | 0.004 | 0.028 0.012 | |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT109-1 | 076E07S | MS-012AC | | | | 91-08-13 95-01-23 |

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DEFINITIONS

| Data Sheet Identification | Product Status | Definition |
|----------------------------------|-------------------------------|--|
| <i>Objective Specification</i> | 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. |
| <i>Preliminary Specification</i> | 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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