

DATA SHEET

74ALS139

Dual 1-of-4 decoder/demultiplexer

Product specification

1991 Feb 08

IC05 Data Handbook

Dual 1-of-4 decoder/demultiplexer

74ALS139

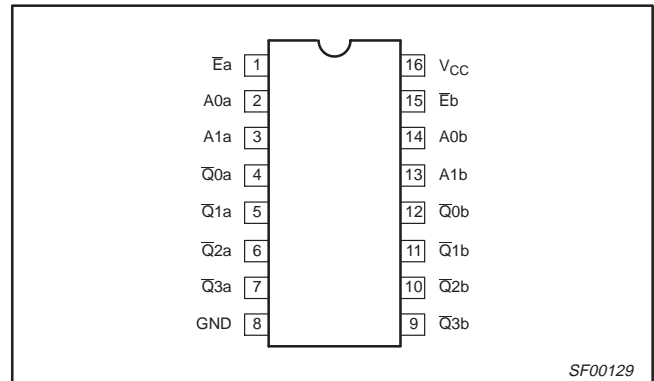
FEATURES

- Demultiplexing capability
- Two independent 1-of-4 decoders
- Multi-function capability

DESCRIPTION

The 74ALS139 is a dual 1-of-4 decoder/demultiplexer. This device has two independent decoders, each accepting two binary weighted inputs (A_{0n} , A_{1n}) and providing four mutually exclusive active-Low outputs (\bar{Q}_{0n} – \bar{Q}_{3n}). Each decoder has an active-Low enable (\bar{E}). When \bar{E} is High, every output is forced High. The enable can be used as the data input for a 1-of-4 demultiplexer application.

PIN CONFIGURATION



SF00129

| TYPE | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|----------|---------------------------|--------------------------------|
| 74ALS139 | 6.0ns | 4mA |

ORDERING INFORMATION

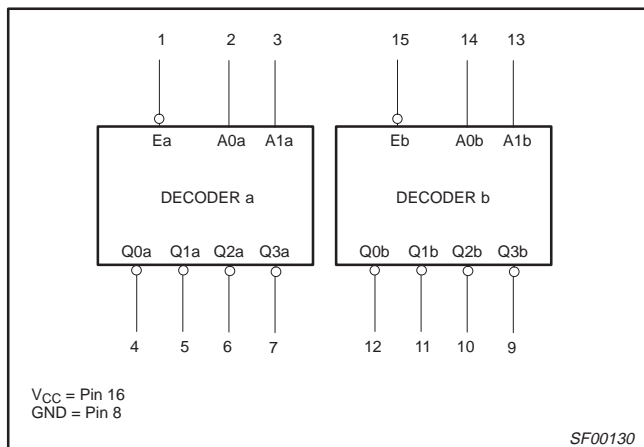
| DESCRIPTION | ORDER CODE | DRAWING NUMBER |
|--------------------|--|----------------|
| | COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$ | |
| 16-pin plastic DIP | 74ALS139N | SOT38-4 |
| 16-pin plastic SO | 74ALS139D | SOT109-1 |

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS | DESCRIPTION | 74ALS (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|---------------------------------|----------------------------|-----------------------|---------------------|
| A_{0n} , A_{1n} | Address inputs | 1.0/1.0 | 20 μ A/0.1mA |
| \bar{E}_a , \bar{E}_b | Enable inputs (active-Low) | 1.0/1.0 | 20 μ A/0.1mA |
| \bar{Q}_{0n} , \bar{Q}_{1n} | Data outputs | 20/80 | 0.4mA/8mA |

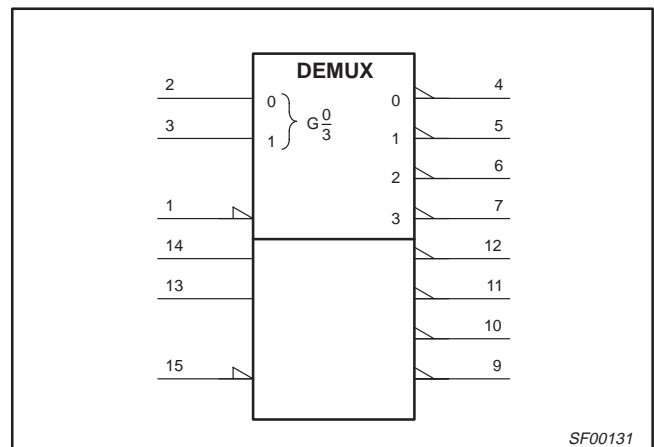
NOTE: One (1.0) ALS unit load is defined as: 20 μ A in the High state and 0.1mA in the Low state.

LOGIC SYMBOL



SF00130

IEC/IEEE SYMBOL

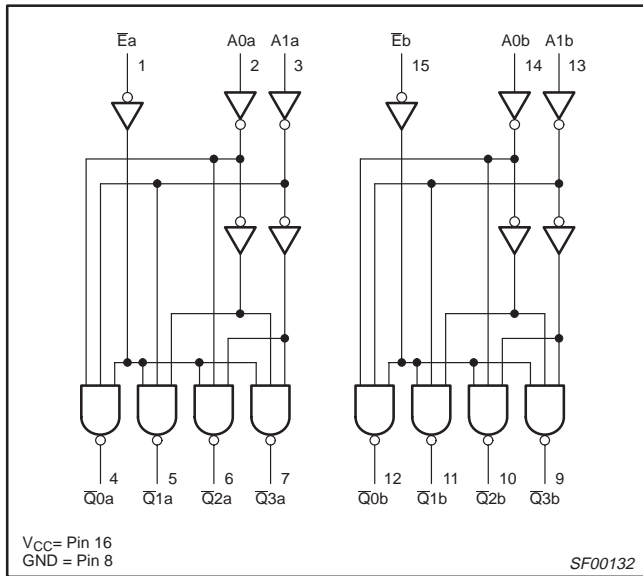


SF00131

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LOGIC DIAGRAM



FUNCTION TABLE

| INPUTS | | | OUTPUTS | | | |
|-----------|----|----|------------|------------|------------|------------|
| \bar{E} | A0 | A1 | $\bar{Q}0$ | $\bar{Q}1$ | $\bar{Q}2$ | $\bar{Q}3$ |
| H | X | X | H | H | H | H |
| L | L | L | L | H | H | H |
| L | H | L | H | L | H | H |
| L | L | H | H | H | L | H |
| L | H | H | H | H | H | L |

H = High voltage level
 L = Low voltage level
 X = Don't care

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 | 16 | 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 | | | -0.4 | mA |
| I_{OL} | Low-level output current | | | 8 | 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 |
| V _{OL} | Low-level output voltage | V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN | I _{OL} = 4mA | 0.25 | 0.40 | V |
| | | | I _{OL} = 8mA | 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 = 0.5V | | | -0.1 | mA |
| I _O | Output current ³ | V _{CC} = MAX, V _O = 2.25V | -30 | | -112 | mA |
| I _{CC} | Supply current (total) | V _{CC} = MAX | | 4.0 | 7.0 | mA |

NOTES:

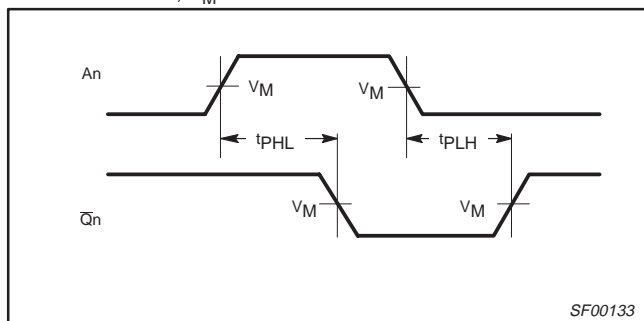
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
3. The output conditions have been chosen to produce a current that closely approximate one half of the true short-circuit output current, I_{OS}.

AC ELECTRICAL CHARACTERISTICS

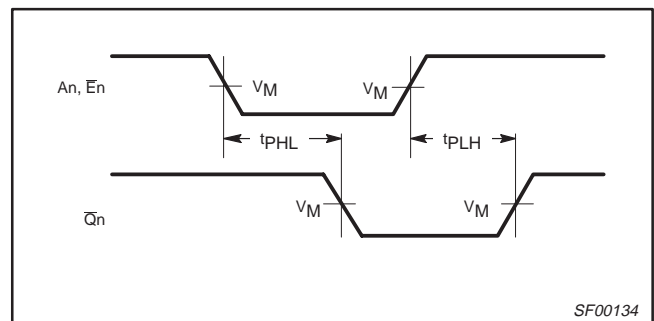
| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | UNIT |
|--------------------------------------|---|----------------|--|--------------|------|
| | | | T _{amb} = 0°C to +70°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω | | |
| | | | MIN | MAX | |
| t _{PLH} t _{PHL} | Propagation delay An to Q _n | Waveform 1, 2 | 3.0 3.0 | 10.0 12.0 | ns |
| t _{PLH} t _{PHL} | Propagation delay Ēn to Q _n | Waveform 2 | 3.0 3.0 | 8.0 8.0 | ns |

AC WAVEFORMS

For all waveforms, V_M = 1.3V.



Waveform 1. Propagation Delay for Inverting Outputs

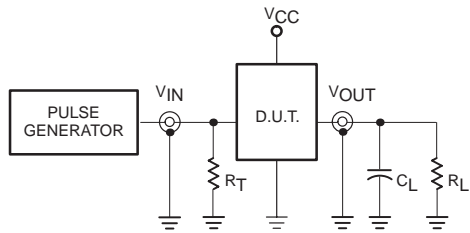


Waveform 2. Propagation Delay for Non-inverting Outputs

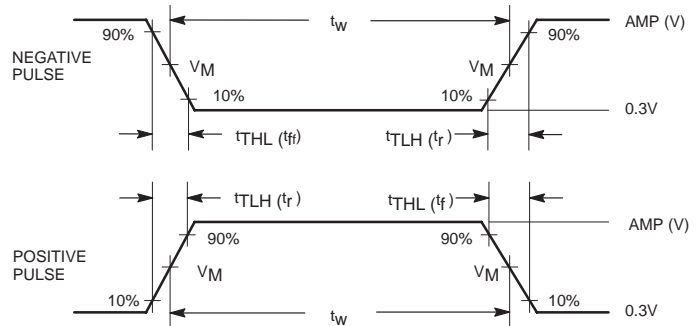
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TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-pole Outputs



Input Pulse Definition

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.

| 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 |

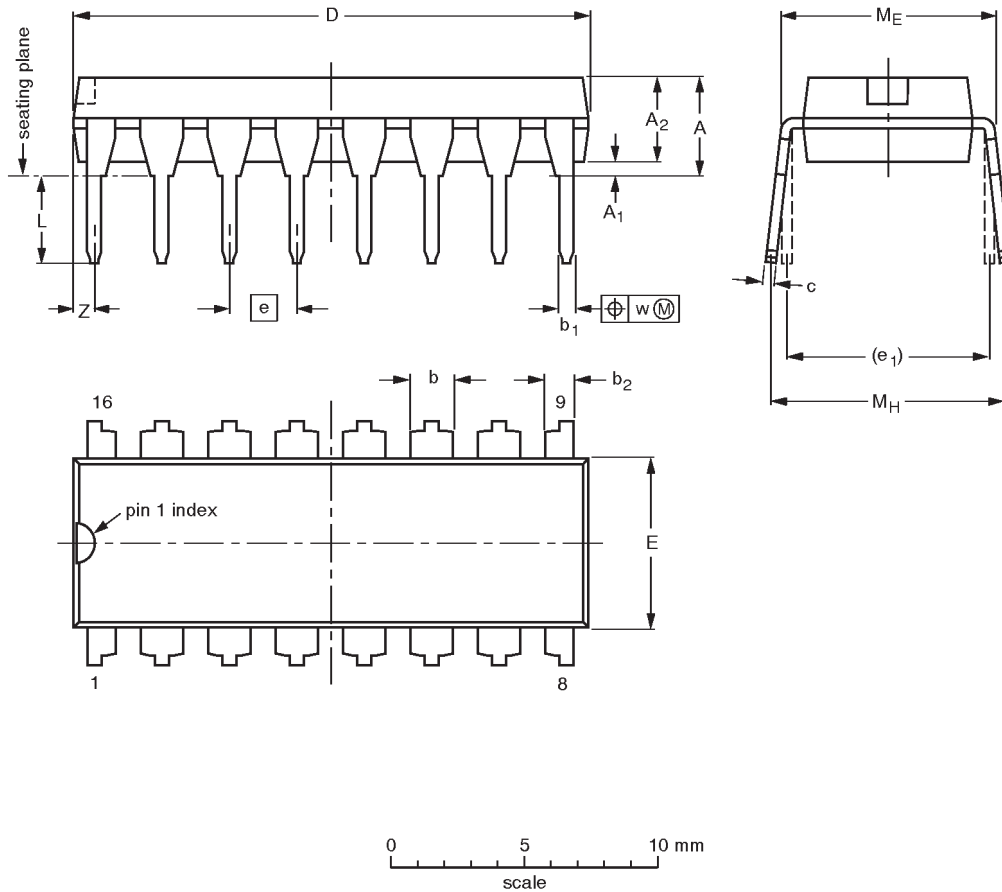
SC00005

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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.

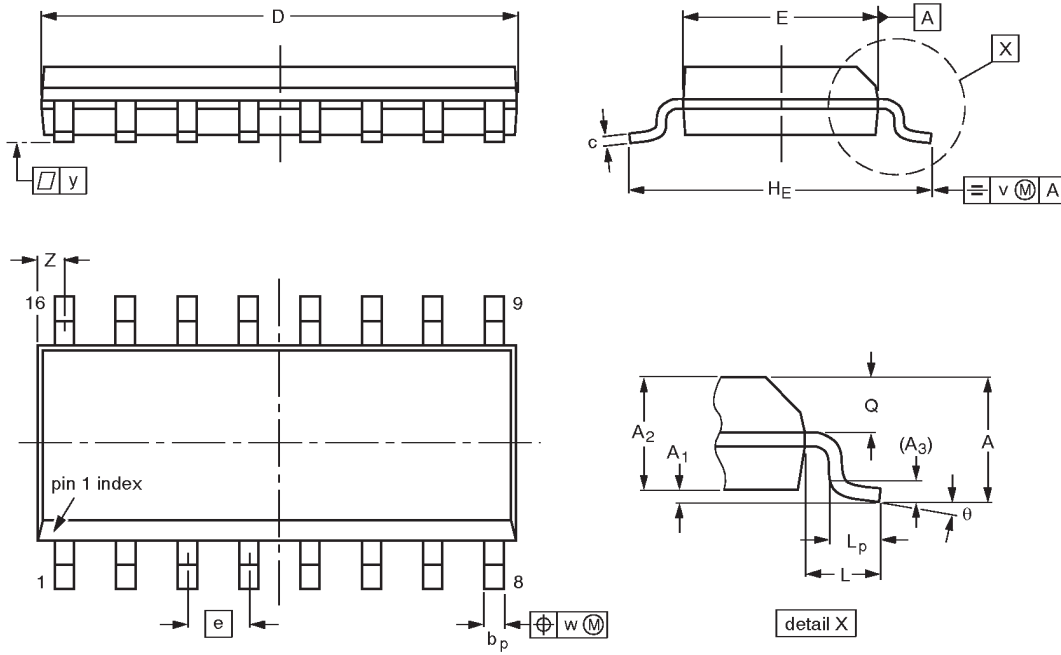
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|--|---------------------|-----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT38-4 | | | | | | -92-11-17 95-01-14 |

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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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