

DATA SHEET

~~74F157*~~, **74F157A**, ~~74F158*~~, **74F158A** Data selectors/multiplexers

** Discontinued part. Please see the Discontinued Product List in Section 1, page 21.*

Product specification

1996 Mar 12

IC15 Data Handbook

Data selectors/multiplexers

74F157A, 74F158A

74F157A: Quad 2-input data selector/multiplexer, non-inverting
 74F158A: Quad 2-input data selector/multiplexer, inverting

DESCRIPTION

The 74F157A is a high speed Quad 2-Input Multiplexer which selects 4 bits of data from one of two sources under the control of a common Select input (S). The Enable input (\bar{E}) is active when Low. When \bar{E} is High, all of the outputs (Y_n) are forced Low regardless of all other input conditions.

Moving data from two registers to a common output bus is a common use of the 74F157A. The state of the Select input determines the particular register from which the data comes.

The device is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input.

The 74F158A is similar, but has inverting outputs (\bar{Y}_n).

- Industrial temperature range (-10°C to $+85^{\circ}\text{C}$) available for 74F157A

| TYPE | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|---------|---------------------------|--------------------------------|
| 74F157 | 4.6ns | 15mA |
| 74F157A | 4.6ns | 15mA |
| 74F158 | 3.7ns | 10mA |
| 74F158A | 3.7ns | 10mA |

ORDERING INFORMATION

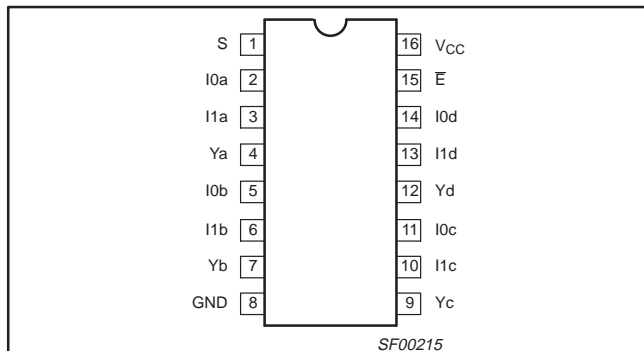
| DESCRIPTION | ORDER CODE | | PKG. DWG. # |
|--------------------|---|---|-------------|
| | COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ | INDUSTRIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ | |
| 16-pin plastic DIP | N74F157AN, N174F158AN | I74F157AN | SOT38-4 |
| 16-pin plastic SO | N74F157AD, N74F158AD | I74F157AD | SOT109-1 |

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

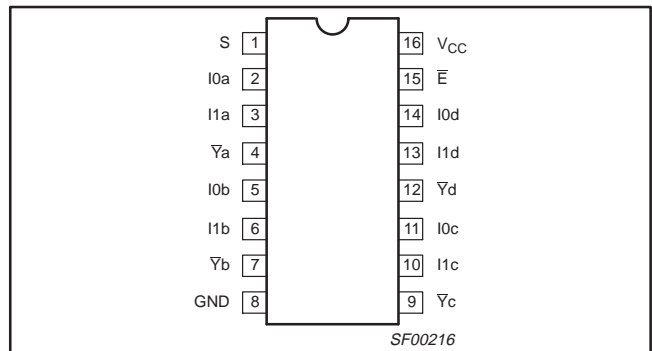
| PINS | DESCRIPTION | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|---|-------------------------------|---------------------|---------------------|
| I _{1a} , I _{1b} , I _{1c} , I _{1d} | Data inputs | 1.0/1.0 | 20 μ A/0.6mA |
| S | Select input | 1.0/1.0 | 20 μ A/0.6mA |
| \bar{E} | Enable input | 1.0/1.0 | 20 μ A/0.6mA |
| Y _a –Y _d | Data outputs (74F157/74F157A) | 50/33 | 1.0mA/20mA |
| \bar{Y}_a – \bar{Y}_d | Data outputs (74F158/74F158A) | 50/33 | 1.0mA/20mA |

NOTE: One (1.0) FAST unit load is defined as: 20 μ A in the High state and 0.6mA in the Low state.

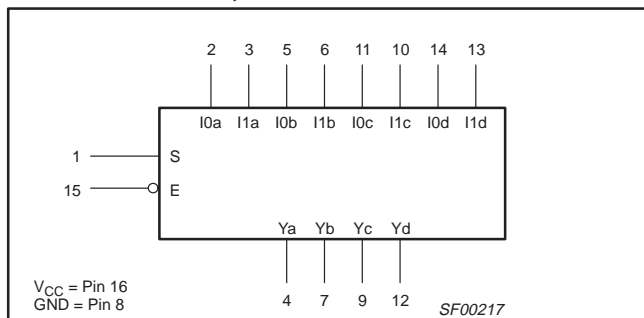
PIN CONFIGURATIONS, 74F157A



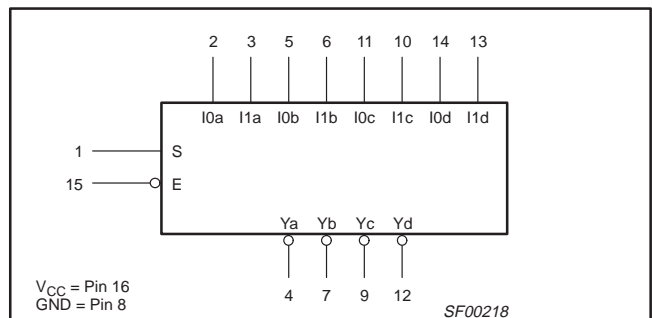
74F158A



LOGIC SYMBOLS, 74F157A



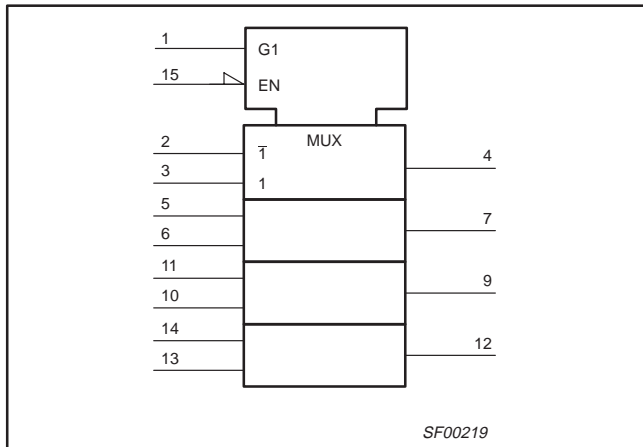
74F158A



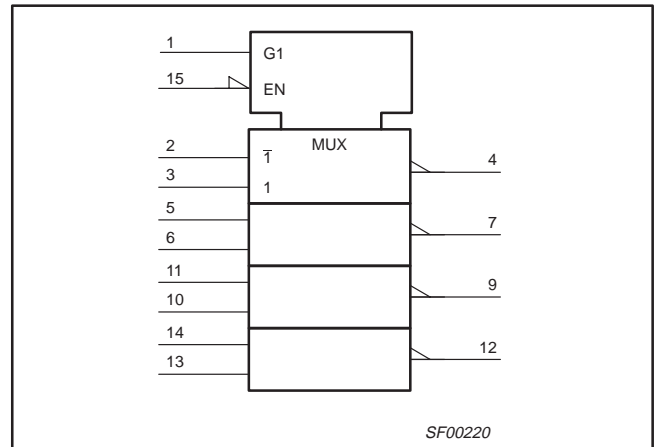
Data selectors/multiplexers

74F157A, 74F158A

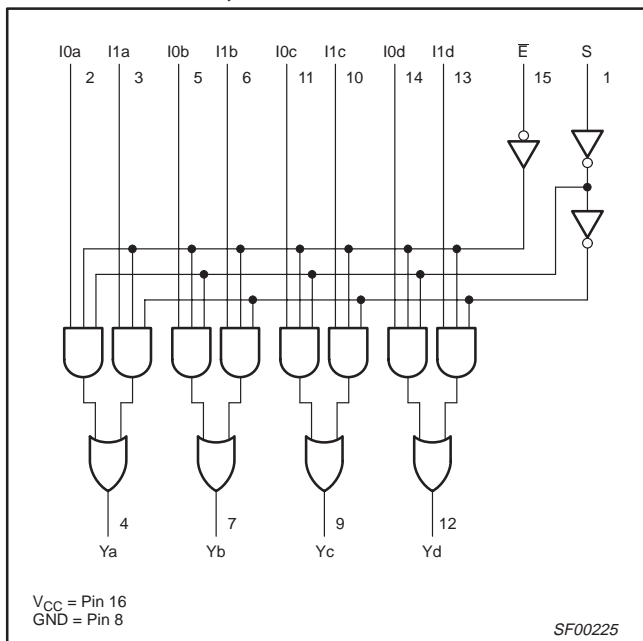
IEEE/IEC SYMBOLS, 74F157A



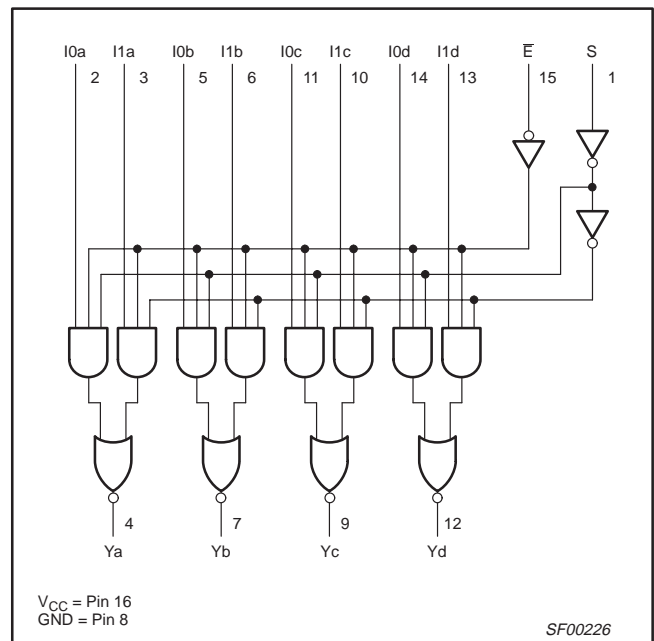
74F158A



LOGIC DIAGRAM, 74F157A



74F158A



FUNCTION TABLE, 74F157A

| INPUTS | | | | OUTPUT |
|--------|---|-----|-----|--------|
| E | S | I0n | I1n | Yn |
| H | X | X | X | L |
| L | H | X | L | L |
| L | H | X | H | H |
| L | L | L | X | L |
| L | L | H | X | H |

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

74F158A

| INPUTS | | | | OUTPUT |
|--------|---|-----|-----|--------|
| E | S | I0n | I1n | Yn |
| H | X | X | X | H |
| L | L | L | X | H |
| L | L | H | X | L |
| L | H | X | L | H |
| L | H | X | H | L |

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

Data selectors/multiplexers

74F157A, 74F158A

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 | 40 | mA |
| T _{amb} | Operating free-air temperature range | Commercial Range | 0 to +70 |
| | | Industrial Range 74F157A only | -40 to +85 |
| 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 | | | -1 | mA |
| I _{OL} | Low-level output current | | | 20 | mA |
| T _{amb} | Operating free air temperature range | Commercial Range | 0 | 70 | |
| | | Industrial Range 74F157A only | -40 | 85 | °C |

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} = MIN, V _{IL} = MAX | ±10%V _{CC} | 2.5 | | V | |
| | | V _{IH} = MIN, I _{OH} = MAX | ±5%V _{CC} | 2.7 | 3.4 | | |
| V _{OL} | Low-level output voltage | V _{CC} = MIN, V _{IL} = MAX | ±10%V _{CC} | | 0.30 | V | |
| | | V _{IH} = MIN, I _{OL} = MAX | ±5%V _{CC} | | 0.30 | | |
| V _{IK} | Input clamp voltage | V _{CC} = MIN, I _I = I _{IK} | | -0.73 | -1.2 | V | |
| I _I | Input current at maximum input voltage | V _{CC} = MAX, V _I = 7.0V | | | 100 | μA | |
| 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 | | | -0.6 | mA | |
| I _{OS} | Short-circuit output current ³ | V _{CC} = MAX | | -60 | -150 | mA | |
| I _{CC} | Supply current (total) ⁴ | 74F157A | V _{CC} = MAX | | 15.0 | 23.0 | mA |
| | | 74F158A | | | 14.0 | 19.0 | 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.
- Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
- I_{CC} is measured with 4.5V applied to all inputs and all outputs open.

Data selectors/multiplexers

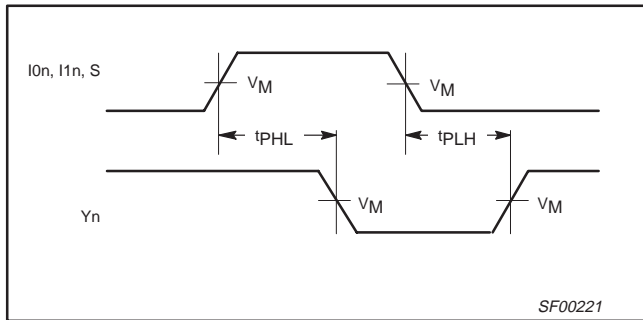
74F157A, 74F158A

AC ELECTRICAL CHARACTERISTICS FOR 74F157A AND 74F158A

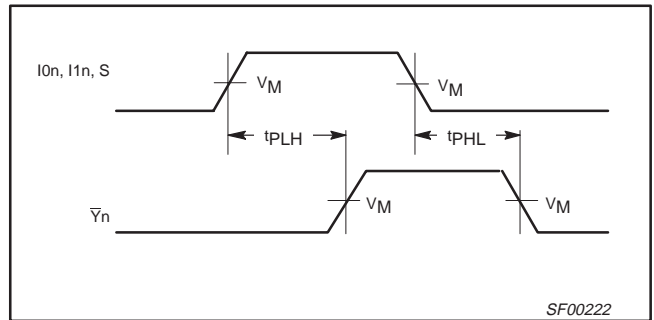
| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | | | | | | | UNIT |
|------------------------|--|----------------|---|------------|------------|---|------------|---|------------|-------------|------|
| | | | $V_{CC} = +5.0V$ $T_{amb} = +25^{\circ}C$ $C_L = 50pF$ $R_L = 500\Omega$ | | | $V_{CC} = +5.0V \pm 10\%$ $T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$ $C_L = 50pF$ $R_L = 500\Omega$ | | $V_{CC} = +5.0V \pm 10\%$ $T_{amb} = -40^{\circ}C \text{ to } +85^{\circ}C$ $C_L = 50pF$ $R_L = 500\Omega$ | | | |
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | | |
| t_{PLH} t_{PHL} | Propagation delay I_{0n}, I_{1n} to Y_n | 74F157A | Waveform 1 | 3.5 2.5 | 4.5 3.5 | 6.5 5.0 | 3.0 1.5 | 7.0 6.0 | 3.0 1.5 | 7.5 6.5 | ns |
| t_{PLH} t_{PHL} | Propagation delay \bar{E} to Y_n | | Waveform 3 | 6.0 4.0 | 7.5 5.0 | 9.0 6.5 | 5.5 4.0 | 10.5 7.0 | 5.5 4.0 | 11.0 7.5 | ns |
| t_{PLH} t_{PHL} | Propagation delay S to Y_n | | Waveform 1 | 5.5 4.5 | 7.5 6.0 | 10.0 7.5 | 5.0 4.0 | 11.0 8.5 | 5.0 4.0 | 11.5 9.0 | ns |
| t_{PLH} t_{PHL} | Propagation delay I_{0n}, I_{1n} to \bar{Y}_n | 74F158A | Waveform 2 | 3.0 1.5 | 4.0 2.5 | 6.0 4.0 | 2.5 1.0 | 7.0 4.5 | — | — | ns |
| t_{PLH} t_{PHL} | Propagation delay \bar{E} to \bar{Y}_n | | Waveform 4 | 4.5 5.0 | 5.5 6.0 | 7.0 7.5 | 4.0 5.0 | 7.5 8.0 | — | — | ns |
| t_{PLH} t_{PHL} | Propagation delay S to \bar{Y}_n | | Waveform 2 | 4.5 4.0 | 6.5 5.5 | 8.5 7.5 | 4.0 3.5 | 9.5 8.0 | — | — | ns |

AC WAVEFORMS

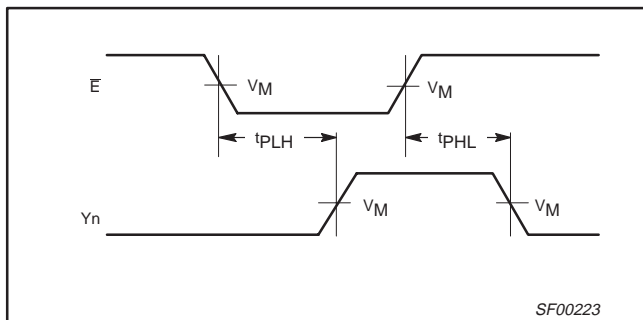
For all waveforms, $V_M = 1.5V$



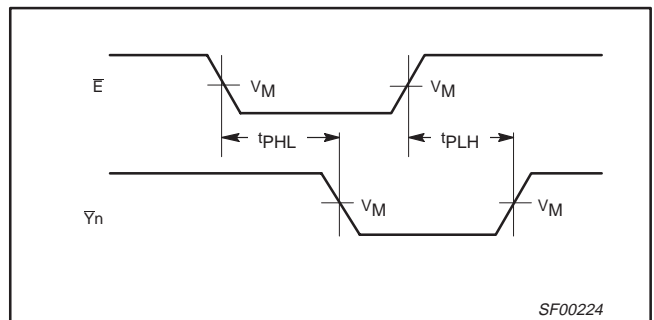
Waveform 1. Propagation Delay for Data and Select to Output



Waveform 2. Propagation Delay for Data and Select to Output



Waveform 3. Propagation Delay for Enable to Output

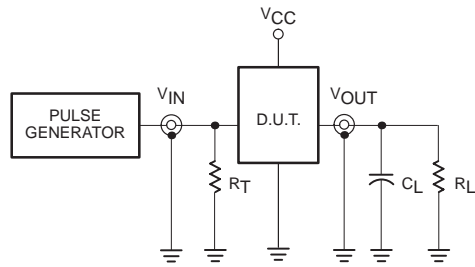


Waveform 4. Propagation Delay for Enable to Output

Data selectors/multiplexers

74F157A, 74F158A

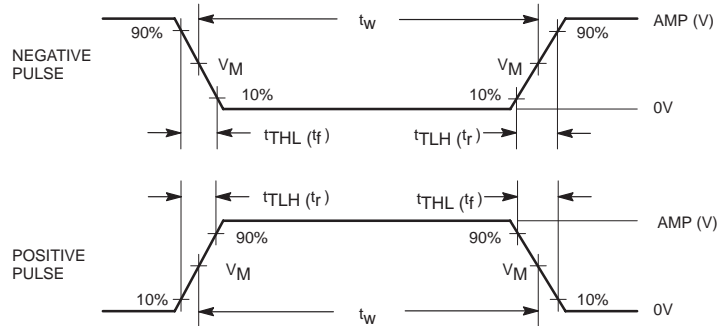
TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-Pole Outputs

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} |
| 74F | 3.0V | 1.5V | 1MHz | 500ns | 2.5ns | 2.5ns |

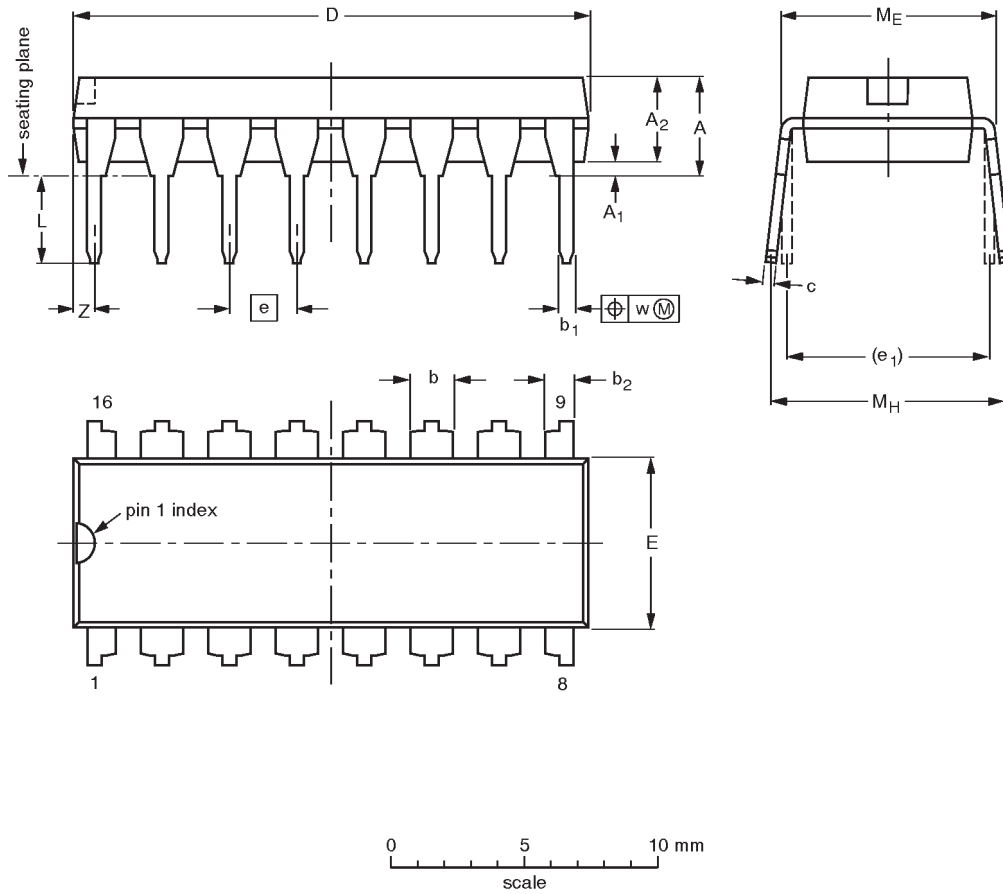
SF00006

Data selectors/multiplexers

74F157*, 74F157A
74F158*, 74F158A

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 |

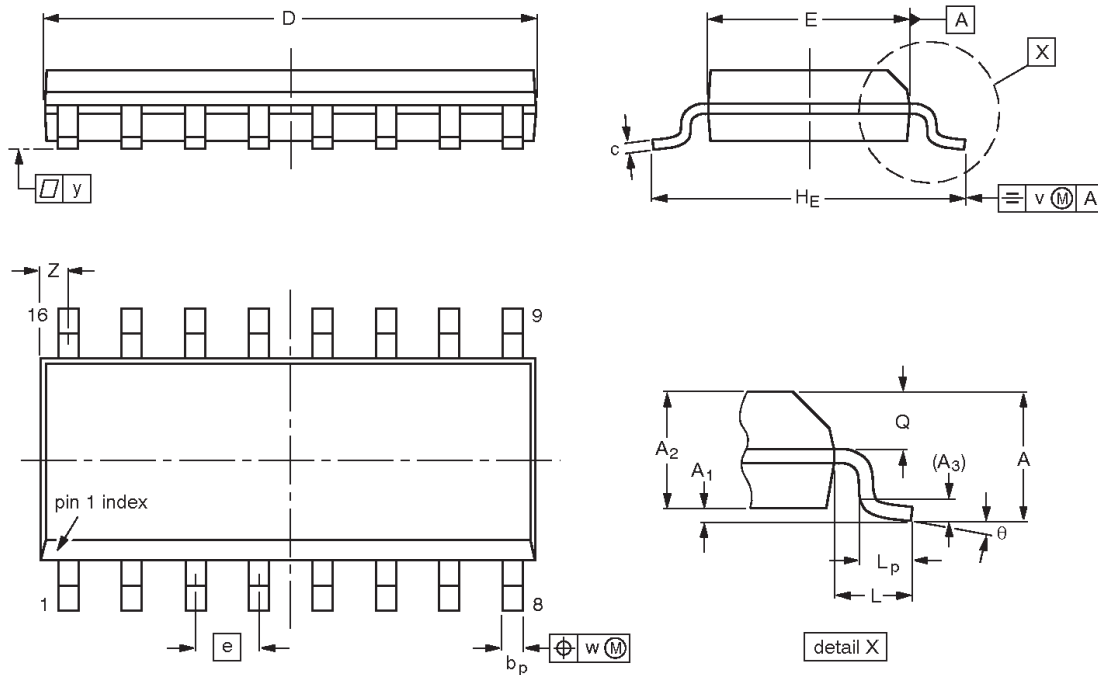
* Discontinued part. Please see the Discontinued Product List in Section 1, page 21.

Data selectors/multiplexers

74F157*, 74F157A
74F158*, 74F158A

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 | 0.010 0.004 | 0.057 0.049 | 0.01 | 0.019 0.014 | 0.0100 0.0075 | 0.39 0.38 | 0.16 0.15 | 0.050 | 0.244 0.228 | 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 | | | | 95-01-23 97-05-22 |

* Discontinued part. Please see the Discontinued Product List in Section 1, page 21.

Data selectors/multiplexers

~~74F157*~~, 74F157A
~~74F158*~~, 74F158A

NOTES

* *Discontinued part. Please see the Discontinued Product List in Section 1, page 21.*

Data selectors/multiplexers

74F157*, 74F157A,
74F158*, 74F158A

Data sheet status

| Data sheet status | Product status | Definition [1] |
|---------------------------|----------------|--|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
| Preliminary specification | Qualification | 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. |
| Product specification | Production | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |

[1] Please consult the most recently issued datasheet before initiating or completing a design.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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