

# DATA SHEET

**74F298**

Quad 2-input multiplexer with storage

Product specification

1989 Aug 14

IC15 Data Handbook

Quad 2-input multiplexer with storage

74F298

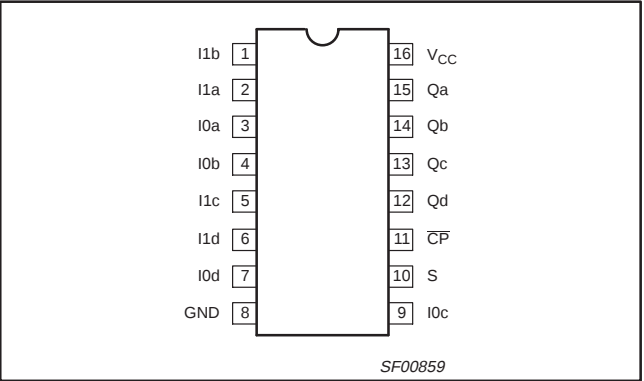
FEATURES

- Fully synchronous operation
- Select from two data sources
- Buffered, negative edge triggered clock
- Provides the equivalent of function capabilities of two separate MSI functions (74F157 and 74F175)

DESCRIPTION

The 74F298 is a high speed Quad 2-Input Multiplexer with storage. It selects 4 bits of data from two sources (ports) under the control of a common Select input (S). The selected data is transferred to the 4-bit output register synchronous with the High-to-Low transition of the clock ( $\overline{CP}$ ). The 4-bit register is fully edge triggered. The data inputs (I0 and I1) and Select input (S) must be stable only one setup time prior to the High-to-Low transition of the clock for predictable operation.

PIN CONFIGURATION



| TYPE   | TYPICAL $f_{MAX}$ | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|-------------------|--------------------------------|
| 74F298 | 115MHz            | 30mA                           |

ORDERING INFORMATION

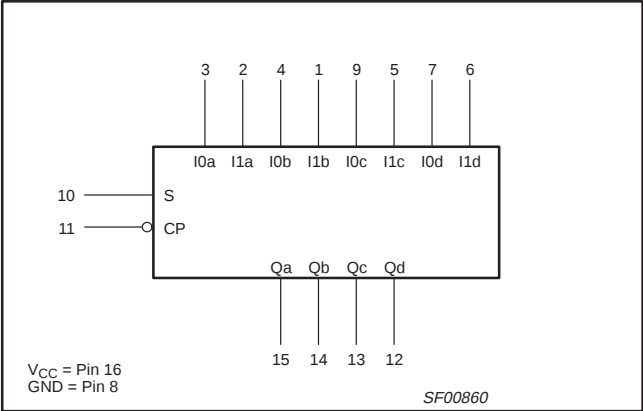
| DESCRIPTION        | ORDER CODE                                                                                      | PKG DWG # |
|--------------------|-------------------------------------------------------------------------------------------------|-----------|
|                    | COMMERCIAL RANGE<br>$V_{CC} = 5V \pm 10\%$ ,<br>$T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$ |           |
| 16-pin plastic DIP | N74F298N                                                                                        | SOT38-4   |
| 16-pin plastic SO  | N74F298D                                                                                        | SOT109-1  |

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

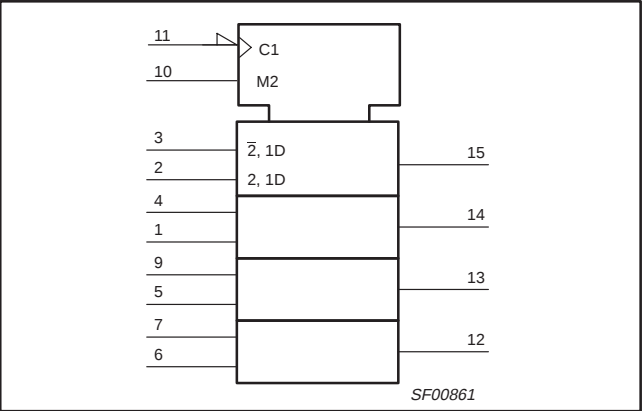
| PINS               | DESCRIPTION                       | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|--------------------|-----------------------------------|---------------------|---------------------|
| I0a, I0b, I0c, I0d | Data inputs                       | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| I1a, I1b, I1c, I1d | Data inputs                       | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| S                  | Select input                      | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| $\overline{CP}$    | Clock input (active falling edge) | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| Qa, Qb, Qc, Qd     | Data outputs                      | 50/33               | 1.0mA/20mA          |

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

LOGIC SYMBOL



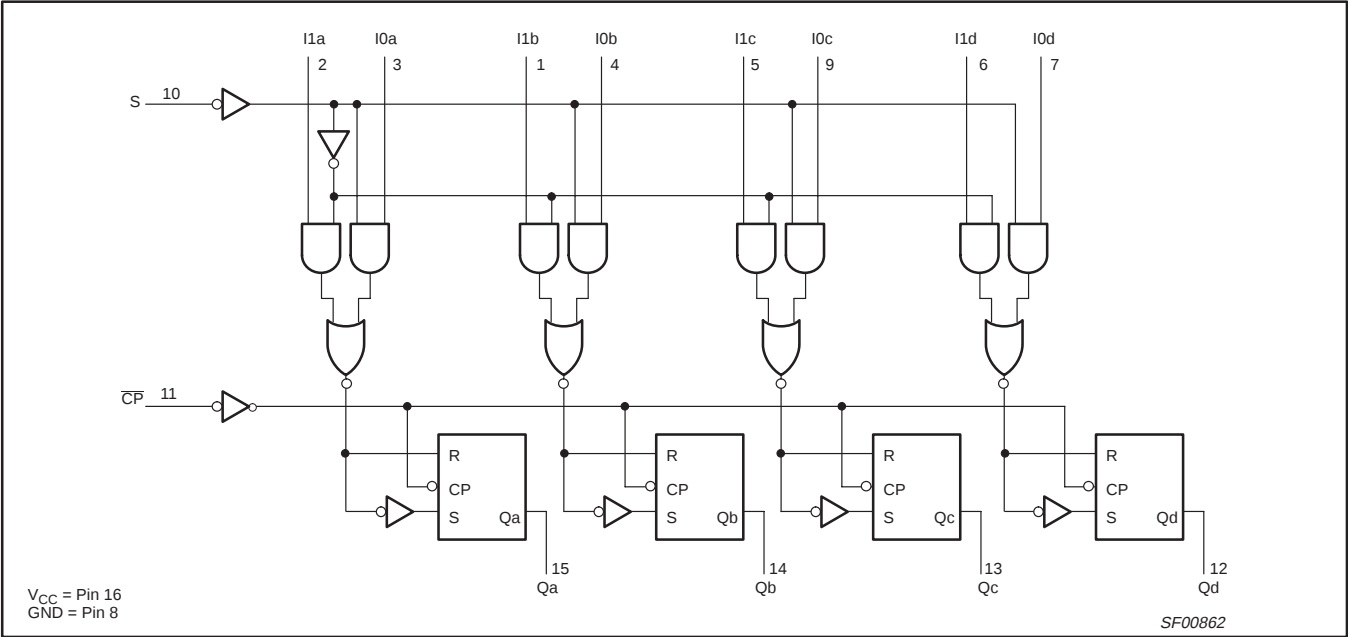
LOGIC SYMBOL (IEEE/IEC)



Quad 2-input multiplexer with storage

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LOGIC DIAGRAM



FUNCTION TABLE

| INPUTS |   |     |     | OUTPUT | OPERATING MODE  |
|--------|---|-----|-----|--------|-----------------|
| CP     | S | I0n | I1n | Qn     |                 |
| ↓      | l | l   | X   | L      | Load source "0" |
| ↓      | l | h   | X   | H      |                 |
| ↓      | h | X   | l   | L      | Load source "1" |
| ↓      | h | X   | h   | H      |                 |

- H = High voltage level
- h = High voltage level one setup time prior to the High-to-Low clock transition
- L = Low voltage level
- l = Low voltage level one setup time prior to the High-to-Low clock transition
- X = Don't care
- ↓ = High-to-Low clock transition

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits 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  | 40                      | 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   |

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## 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 | 0      |     | 70  | °C   |

## DC ELECTRICAL CHARACTERISTICS

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

| SYMBOL          | PARAMETER                                      | TEST CONDITIONS <sup>NO TAG</sup>                                                              |                       | LIMITS |               |      | UNIT |    |
|-----------------|------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------|--------|---------------|------|------|----|
|                 |                                                |                                                                                                |                       | MIN    | TYP<br>NO TAG | MAX  |      |    |
| V <sub>OH</sub> | High-level output voltage                      | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX,<br>V <sub>IH</sub> = MIN, I <sub>OH</sub> = −MAX | ±10%V <sub>CC</sub>   | 2.5    |               |      | V    |    |
|                 |                                                |                                                                                                | ±5%V <sub>CC</sub>    | 2.7    | 3.4           |      | V    |    |
| V <sub>OL</sub> | Low-level output voltage                       | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX,<br>V <sub>IH</sub> = MIN, I <sub>OL</sub> =− MAX | ±10%V <sub>CC</sub>   |        | 0.30          | 0.50 | V    |    |
|                 |                                                |                                                                                                | ±5%V <sub>CC</sub>    |        | 0.30          | 0.50 | V    |    |
| V <sub>IK</sub> | Input clamp voltage                            | V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>                                        |                       |        | −0.73         | −1.2 | V    |    |
| I <sub>I</sub>  | Input current at maximum input voltage         | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V                                                   |                       |        |               | 100  | μA   |    |
| 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> = 0.5V                                                   |                       |        |               | −0.6 | mA   |    |
| I <sub>OS</sub> | Short-circuit output current <sup>NO TAG</sup> |                                                                                                | V <sub>CC</sub> = MAX |        | −60           | −150 | mA   |    |
| I <sub>CC</sub> | Supply current (total)                         | I <sub>CCH</sub>                                                                               | V <sub>CC</sub> = MAX |        |               | 30   | 40   | mA |
|                 |                                                | I <sub>CCL</sub>                                                                               |                       |        |               | 32   | 40   | 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  $V_{CC} = 5\text{V}$ ,  $T_{amb} = 25^\circ\text{C}$ .
- 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.

## AC ELECTRICAL CHARACTERISTICS

| SYMBOL                               | PARAMETER                     | TEST<br>CONDITION  | LIMITS                                                                                                |            |            |                                                                                                                    |            | UNIT |
|--------------------------------------|-------------------------------|--------------------|-------------------------------------------------------------------------------------------------------|------------|------------|--------------------------------------------------------------------------------------------------------------------|------------|------|
|                                      |                               |                    | T <sub>amb</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50pF<br>R <sub>L</sub> = 500Ω |            |            | T <sub>amb</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V ± 10%<br>C <sub>L</sub> = 50pF<br>R <sub>L</sub> = 500Ω |            |      |
|                                      |                               |                    | MIN                                                                                                   | TYP        | MAX        | MIN                                                                                                                | MAX        |      |
| f <sub>MAX</sub>                     | Maximum clock frequency       | Waveform<br>NO TAG | 110                                                                                                   | 115        |            | 105                                                                                                                |            | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>CP to Qn | Waveform<br>NO TAG | 4.0<br>4.5                                                                                            | 5.5<br>6.5 | 7.5<br>8.5 | 4.0<br>4.5                                                                                                         | 9.0<br>9.5 | ns   |

Quad 2-input multiplexer with storage

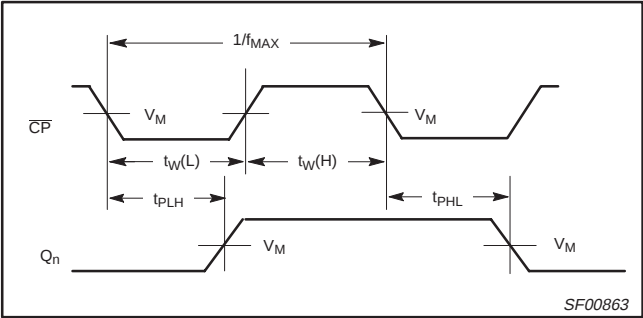
74F298

AC SETUP REQUIREMENTS

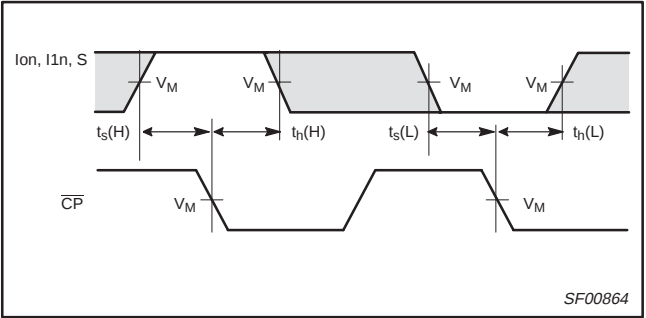
| SYMBOL                                   | PARAMETER                                                                       | TEST<br>CONDITION  | LIMITS                                                                                                |     |     |                                                                                                                    |     | UNIT |
|------------------------------------------|---------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------|-----|-----|--------------------------------------------------------------------------------------------------------------------|-----|------|
|                                          |                                                                                 |                    | T <sub>amb</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50pF<br>R <sub>L</sub> = 500Ω |     |     | T <sub>amb</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V ± 10%<br>C <sub>L</sub> = 50pF<br>R <sub>L</sub> = 500Ω |     |      |
|                                          |                                                                                 |                    | MIN                                                                                                   | TYP | MAX | MIN                                                                                                                | MAX |      |
| t <sub>s</sub> (H)<br>t <sub>s</sub> (L) | Setup time, High or Low<br>I <sub>0n</sub> , I <sub>1n</sub> to $\overline{CP}$ | Waveform<br>NO TAG | 2.0<br>2.0                                                                                            |     |     | 2.0<br>2.0                                                                                                         |     | ns   |
| t <sub>h</sub> (H)<br>t <sub>h</sub> (L) | Hold time, High or Low<br>I <sub>0n</sub> , I <sub>1n</sub> to $\overline{CP}$  | Waveform<br>NO TAG | 1.0<br>1.0                                                                                            |     |     | 1.0<br>1.0                                                                                                         |     | ns   |
| t <sub>s</sub> (H)<br>t <sub>s</sub> (L) | Setup time, High or Low<br>S to $\overline{CP}$                                 | Waveform<br>NO TAG | 6.0<br>5.0                                                                                            |     |     | 7.0<br>6.0                                                                                                         |     | ns   |
| t <sub>h</sub> (H)<br>t <sub>h</sub> (L) | Hold time, High or Low<br>S to $\overline{CP}$                                  | Waveform<br>NO TAG | 0<br>0                                                                                                |     |     | 0<br>0                                                                                                             |     | ns   |
| t <sub>w</sub> (H)<br>t <sub>w</sub> (L) | $\overline{CP}$ Pulse width,<br>High or Low                                     | Waveform<br>NO TAG | 5.0<br>5.0                                                                                            |     |     | 5.0<br>7.0                                                                                                         |     | ns   |

AC WAVEFORMS

For all waveforms,  $V_M = 1.5V$ .  
The shaded areas indicate when the input is permitted to change for predictable output performance.



Waveform 1. Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency



Waveform 2. Data Setup and Hold Times

TEST CIRCUIT AND WAVEFORMS

**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 | $t_w$ | $t_{TLH}$ | $t_{THL}$ |
| 74F    | 3.0V                     | 1.5V  | 1MHz      | 500ns | 2.5ns     | 2.5ns     |

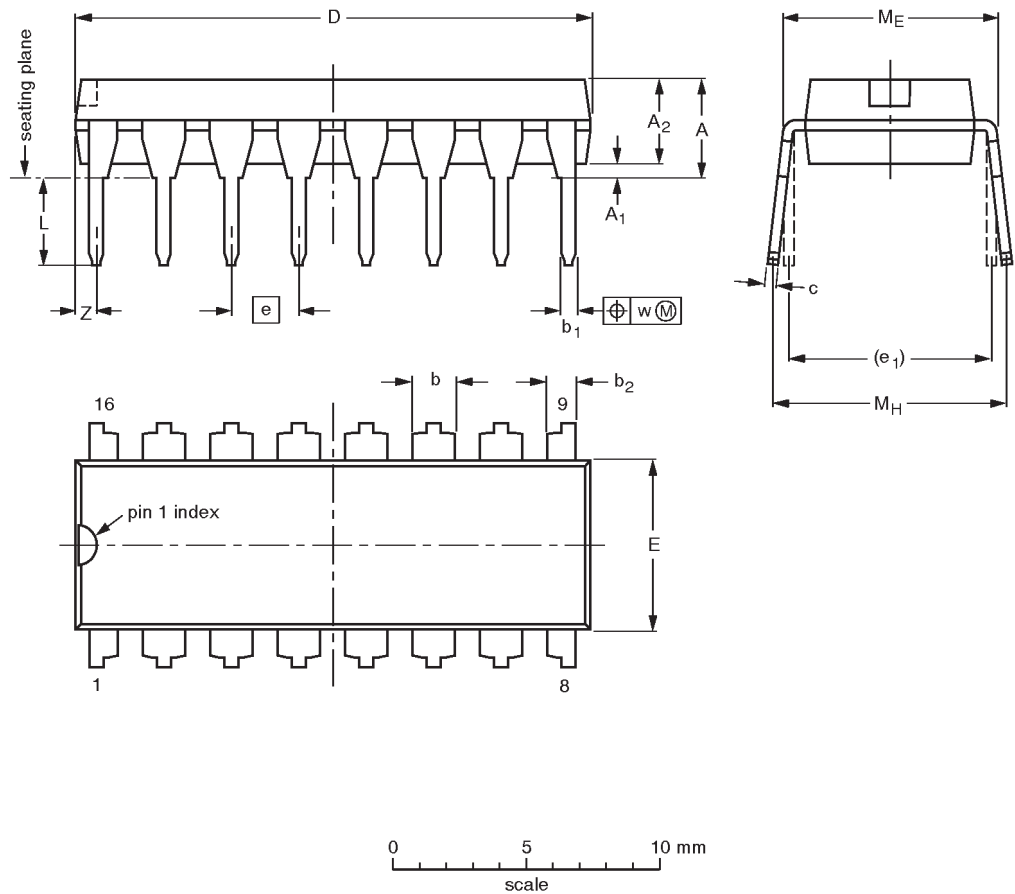
SF00006

Quad 2-input multiplexer with storage

74F298

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

SOT38-4



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

| UNIT   | A<br>max. | A <sub>1</sub><br>min. | A <sub>2</sub><br>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><br>max. |
|--------|-----------|------------------------|------------------------|----------------|----------------|----------------|----------------|------------------|------------------|------|----------------|--------------|----------------|----------------|-------|--------------------------|
| mm     | 4.2       | 0.51                   | 3.2                    | 1.73<br>1.30   | 0.53<br>0.38   | 1.25<br>0.85   | 0.36<br>0.23   | 19.50<br>18.55   | 6.48<br>6.20     | 2.54 | 7.62           | 3.60<br>3.05 | 8.25<br>7.80   | 10.0<br>8.3    | 0.254 | 0.76                     |
| inches | 0.17      | 0.020                  | 0.13                   | 0.068<br>0.051 | 0.021<br>0.015 | 0.049<br>0.033 | 0.014<br>0.009 | 0.77<br>0.73     | 0.26<br>0.24     | 0.10 | 0.30           | 0.14<br>0.12 | 0.32<br>0.31   | 0.39<br>0.33   | 0.01  | 0.030                    |

Note

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

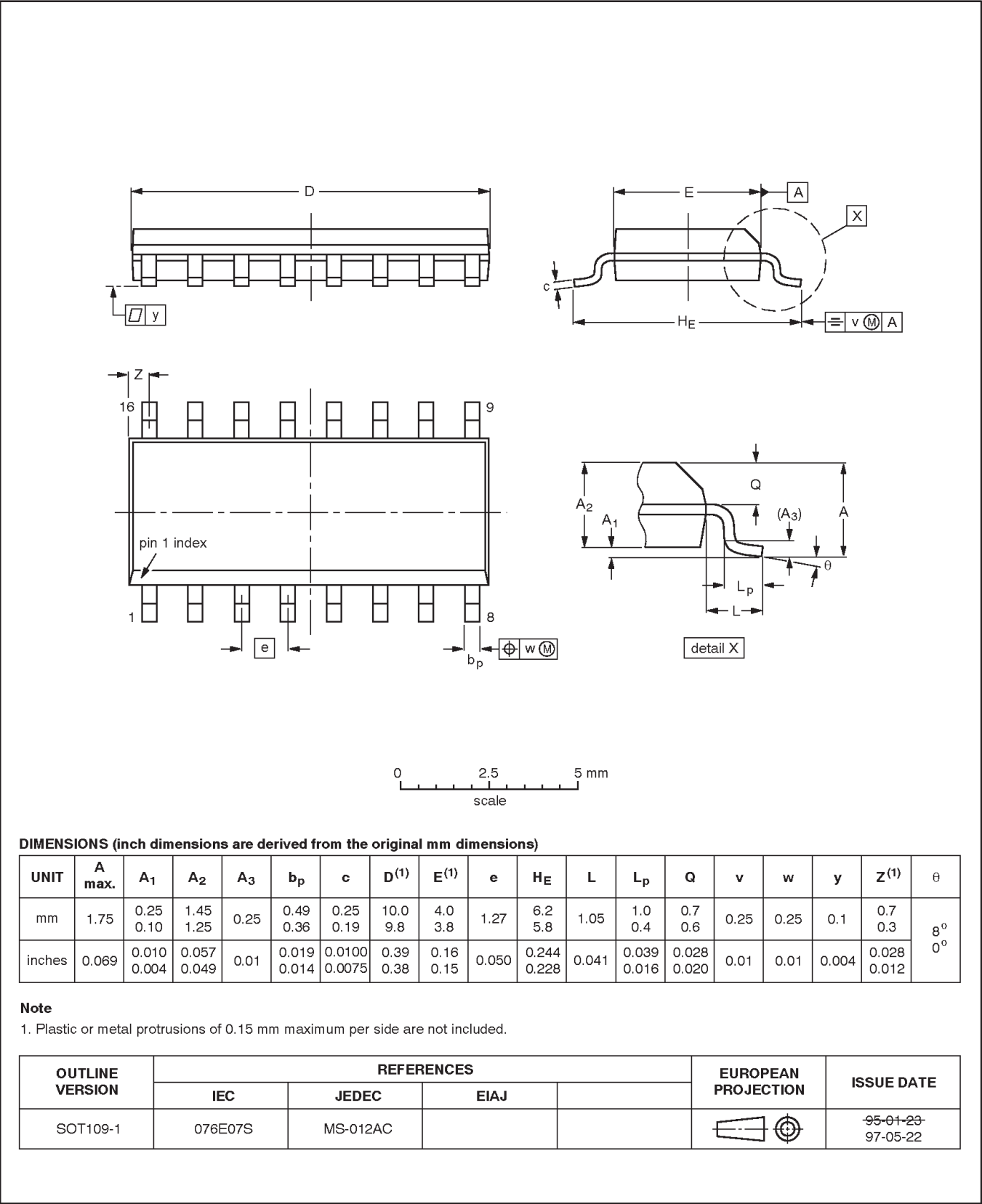
| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE           |
|--------------------|------------|-------|------|--|---------------------------------------------------------------------------------------|----------------------|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

Quad 2-input multiplexer with storage

74F298

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

SOT109-1



## Quad 2-input multiplexer with storage

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## 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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