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# DATA SHEET

**74F399**

Quad 2-port register

Product specification  
Supersedes data of 1999 Jan 08  
IC15 Data Handbook

2000 Jun 30

# Quad 2-port register

74F399

## FEATURES

- Select inputs from two data sources
- Fully positive edge-triggered

## DESCRIPTION

The 74F399 is the logical equivalent of a quad 2-input multiplexer feeding into four edge-triggered flip-flops. A common Select input determines which of two 4-bit words is accepted. The selected data enters the flip-flops on the rising edge of the clock.

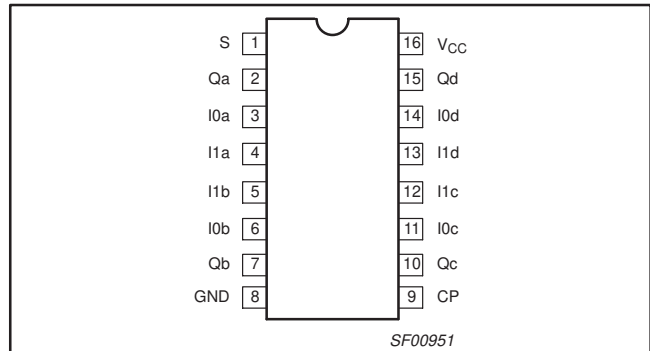
The 74F399 is a high speed quad 2-port register. They select 4 bits of data from either of two sources (Ports) under control of a common select input (S). The selected data is transferred to a 4-bit output register synchronous with the Low-to-High transition of the Clock input (CP). The 4-bit D-type output register is fully edge-triggered. The Data inputs (I0n, I1n) and Select input (S) must be stable only a setup time prior to and hold time after the Low-to-High transition of the Clock input for predictable operation.

| TYPE   | TYPICAL $f_{MAX}$ | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|-------------------|--------------------------------|
| 74F399 | 120MHz            | 22mA                           |

## ORDERING INFORMATION

| DESCRIPTION        | COMMERCIAL RANGE<br>$V_{CC} = 5V \pm 10\%$ ,<br>$T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$ | PKG DWG # |
|--------------------|--|-----------|
| 16-pin plastic DIP | N74F399N   | SOT38-4   |
| 16-pin plastic SO  | N74F399D   | SOT109-1  |

## PIN CONFIGURATION



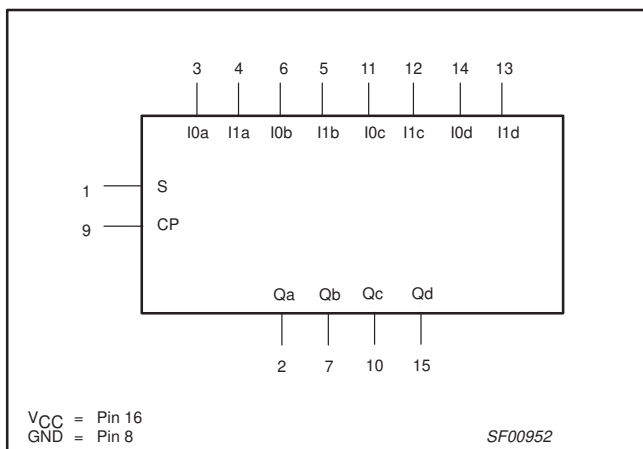
## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS               | DESCRIPTION                      | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|--------------------|----------------------------------|---------------------|---------------------|
| I0a, I0b, I0c, I0d | Data inputs from source 0        | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| I1a, I1b, I1c, I1d | Data inputs from source 1        | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| S                  | Common Select input              | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| CP                 | Clock input (active rising edge) | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| Qa, Qb, Qc, Qd     | Register true outputs            | 50/33               | 1.0mA/20mA          |

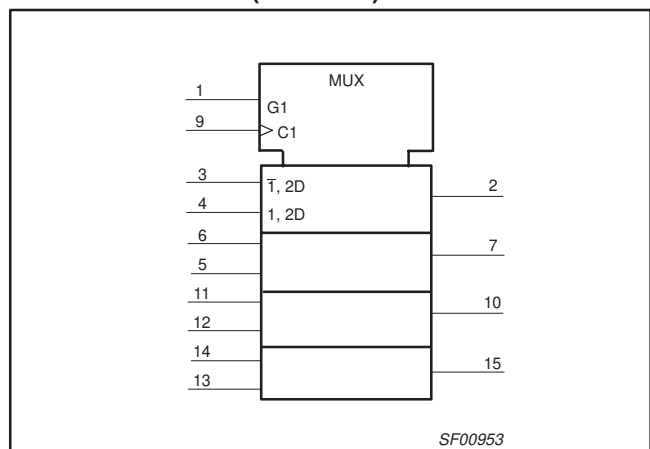
### NOTE:

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



## IEC/IEEE SYMBOL (IEEE/IEC)



# Quad 2-port register

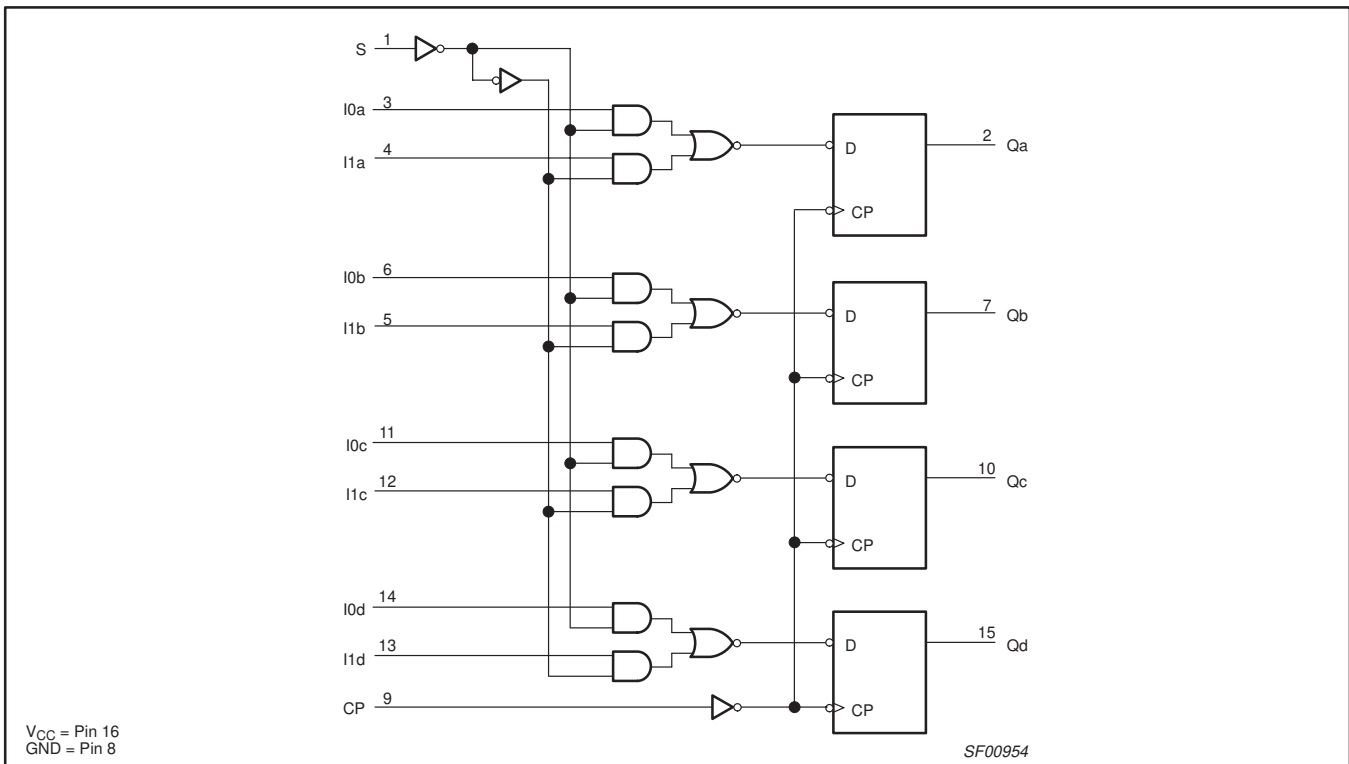
74F399

## FUNCTION TABLE

| INPUTS |   |     |     | OUTPUTS |
|--------|---|-----|-----|---------|
| CP     | S | I0n | I1n | Qn      |
| ↑      | l | l   | X   | L       |
| ↑      | l | h   | X   | H       |
| ↑      | h | X   | l   | L       |
| ↑      | 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
- ↑ = Low-to-High clock transition

## LOGIC DIAGRAM



## Quad 2-port register

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**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   |

**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            |        |     | -1  | mA   |
| I <sub>OL</sub>  | Low-level output current             |        |     | 20  | mA   |
| T <sub>amb</sub> | 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>1</sup>  | LIMITS              |                  |      | UNIT |   |
|-----------------|---|---|---------------------|------------------|------|------|---|
|                 |   |   | MIN                 | TYP <sup>2</sup> | 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>3</sup> | V <sub>CC</sub> = MAX   | -60                 |                  | -150 | mA   |   |
| I <sub>CC</sub> | Supply current (total)                    | V <sub>CC</sub> = MAX   |                     | 22               | 34   | 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.
- Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, 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<sub>OS</sub> tests should be performed last.

# Quad 2-port register

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## AC ELECTRICAL CHARACTERISTICS

| SYMBOL                 | PARAMETER                                   | TEST CONDITION | LIMITS  |            |            |   |            | UNIT |
|------------------------|---|----------------|---|------------|------------|---|------------|------|
|                        |   |                | $V_{CC} = +5V$<br>$T_{amb} = +25^{\circ}C$<br>$C_L = 50pF, R_L = 500\Omega$ |            |            | $V_{CC} = +5V \pm 10\%$<br>$T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$<br>$C_L = 50pF, R_L = 500\Omega$ |            |      |
|                        |   |                | MIN   | TYP        | MAX        | MIN   | MAX        |      |
| $f_{MAX}$              | Maximum clock frequency                     | Waveform 1     | 100   | 120        |            | 90  |            | MHz  |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>CP to Qn or $\bar{Q}n$ | Waveform 1     | 3.0<br>3.0  | 5.7<br>6.5 | 7.5<br>8.5 | 3.0<br>3.0  | 8.5<br>9.0 | ns   |

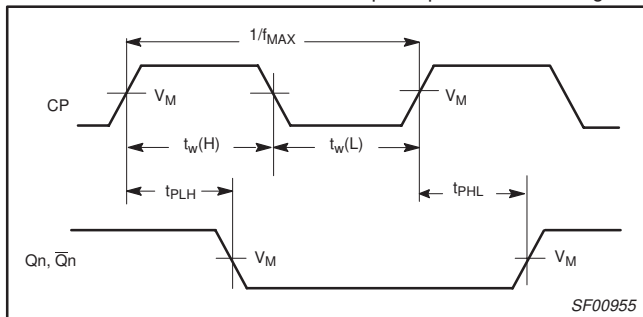
## AC SETUP REQUIREMENTS

| SYMBOL               | PARAMETER                                 | TEST CONDITION | LIMITS  |     |     |   |     | UNIT |
|----------------------|---|----------------|---|-----|-----|---|-----|------|
|                      |   |                | $V_{CC} = +5V$<br>$T_{amb} = +25^{\circ}C$<br>$C_L = 50pF, R_L = 500\Omega$ |     |     | $V_{CC} = +5V \pm 10\%$<br>$T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$<br>$C_L = 50pF, R_L = 500\Omega$ |     |      |
|                      |   |                | MIN   | TYP | MAX | MIN   | MAX |      |
| $t_s(H)$<br>$t_s(L)$ | Setup time, High or Low<br>I0n, I1n to CP | Waveform 2     | 3.0<br>3.0  |     |     | 3.0<br>3.0  |     | ns   |
| $t_h(H)$<br>$t_h(L)$ | Hold time, High or Low<br>I0n, I1n to CP  | Waveform 2     | 1.0<br>1.0  |     |     | 1.0<br>1.0  |     | ns   |
| $t_s(H)$<br>$t_s(L)$ | Setup time, High or Low<br>S to CP        | Waveform 2     | 7.5<br>7.5  |     |     | 8.5<br>8.5  |     | ns   |
| $t_h(H)$<br>$t_h(L)$ | Hold time, High or Low<br>S to CP         | Waveform 2     | 0<br>0  |     |     | 0<br>0  |     | ns   |
| $t_W(H)$<br>$t_W(L)$ | CP Pulse width<br>High or Low             | Waveform 1     | 4.0<br>6.0  |     |     | 4.0<br>6.0  |     | ns   |

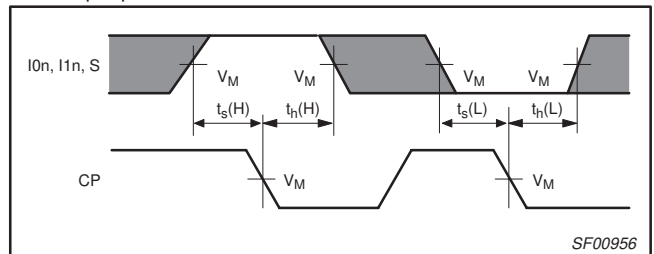
## AC WAVEFORMS

For all waveforms,  $V_M = 1.5V$ .

The shaded areas indicate when the input is permitted to change for predictable output performance.



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

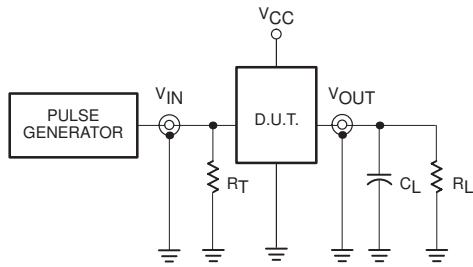


**Waveform 2. Data and Select Setup and Hold Times**

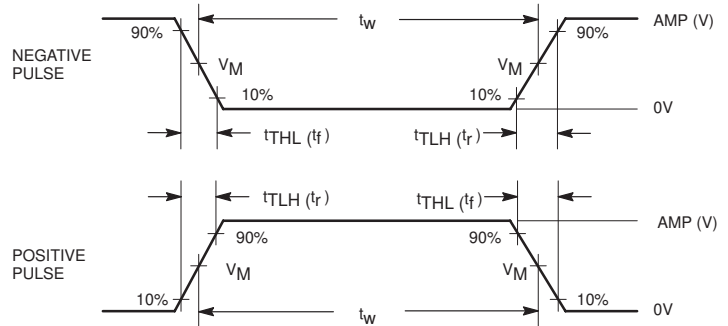
# Quad 2-port register

# 74F399

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

SF00006

# Quad 2-port register

74F399

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

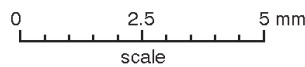
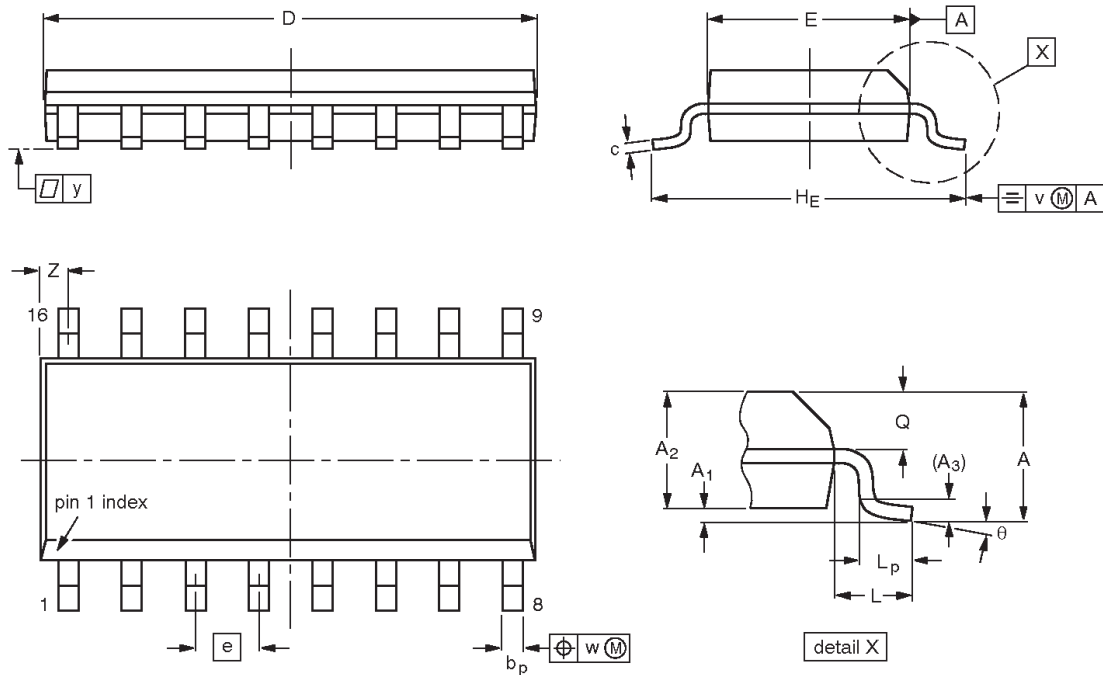


# Quad 2-port register

# 74F399

**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 <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e     | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | Z <sup>(1)</sup> | θ        |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75   | 0.25<br>0.10   | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 10.0<br>9.8      | 4.0<br>3.8       | 1.27  | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069  | 0.010<br>0.004 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.39<br>0.38     | 0.16<br>0.15     | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>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<br>97-05-22 |

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Quad 2-port register

74F399

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**NOTES**

## Quad 2-port register

74F399

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

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**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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