

DATA SHEET

74F299

8-bit universal shift/storage register
(3-State)

Product data
Supersedes data of 1990 Mar 01

2003 Feb 05

8-bit universal shift/storage register (3-State)

74F299

FEATURES

- Common parallel I/O for reduced pin count
- Additional serial inputs and outputs for expansion
- Four operating modes: Shift left, shift right, load and store
- 3-State outputs for bus-oriented applications

DESCRIPTION

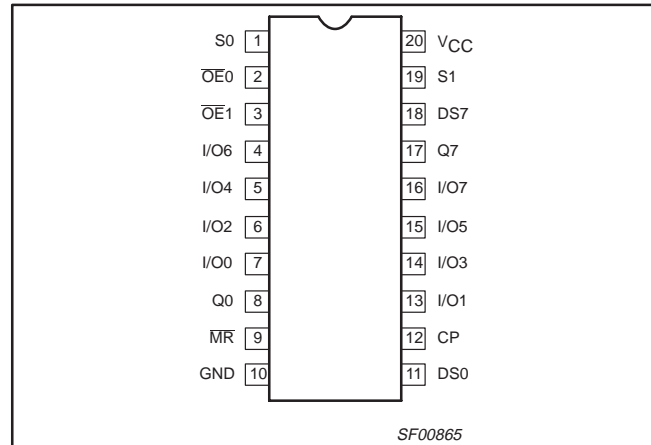
The 74F299 is an 8-bit universal shift/storage register with 3-State outputs. Four modes of operation are possible: Hold (store), shift left, shift right and parallel load. The parallel load inputs and flip-flop outputs are multiplexed to reduce the total number of package pins. Additional outputs are provided for flip-flops Q0 and Q7 to allow easy serial cascading. A separate active-LOW Master Reset is used to reset the register.

The 74F299 contains eight edge-triggered D-type flip-flops and the interstage logic necessary to perform synchronous shift left, shift right, parallel load and hold operations. The type of operation is determined by S0 and S1, as shown in the Function Table. All flip-flop outputs are brought out through 3-State buffers to separate I/O pins that also serve as data inputs in the parallel load mode. Q0 and Q7 are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on \overline{MR} overrides the Select and CP inputs and resets the flip-flops. All other state changes are initiated by the rising edge of the clock. Inputs can change when the clock is in either state provided only that the recommended set-up and hold times, relative to the rising edge of clock are observed.

A HIGH signal on either $\overline{OE}0$ or $\overline{OE}1$ disables the 3-State buffers and puts the I/O pins in the high impedance state. In this condition the shift, hold, load and reset operations can still occur. The 3-State buffers are also disabled by High signals on both S0 and S1 in preparation for a parallel load operation.

PIN CONFIGURATION



| TYPE | TYPICAL f_{MAX} | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|-------------------|--------------------------------|
| 74F299 | 115 MHz | 58 mA |

ORDERING INFORMATION

| DESCRIPTION | ORDER CODE | PKG DWG # |
|--------------------|--|-----------|
| | COMMERCIAL RANGE $V_{CC} = 5 V \pm 10\%$, $T_{amb} = 0^\circ C \text{ to } +70^\circ C$ | |
| 20-pin plastic DIP | N74F299N | SOT146-1 |
| 20-pin plastic SOL | N74F299D | SOT163-1 |

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

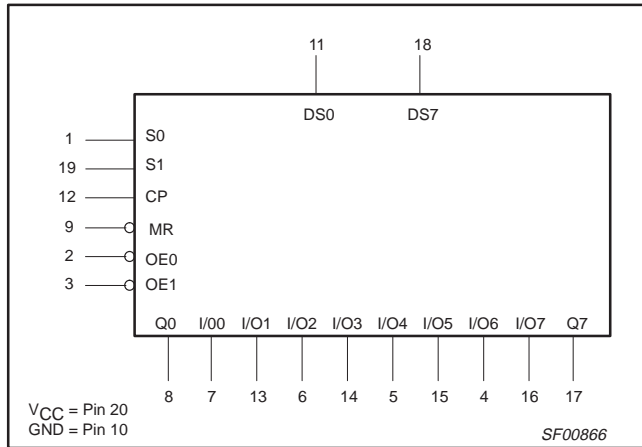
| PINS | DESCRIPTION | 74F(U.L.) HIGH / LOW | LOAD VALUE HIGH / LOW |
|----------------------------------|--|----------------------|-----------------------|
| DS0 | Serial data input for right shift | 1.0 / 1.0 | 20 μA / 0.6 mA |
| DS7 | Serial data input for left shift | 1.0 / 1.0 | 20 μA / 0.6 mA |
| S0, S1 | Mode select inputs | 1.0 / 2.0 | 20 μA / 1.2 mA |
| CP | Clock pulse input (Active rising edge) | 1.0 / 1.0 | 20 μA / 0.6 mA |
| \overline{MR} | Asynchronous Master Reset input (Active LOW) | 1.0 / 1.0 | 20 μA / 0.6 mA |
| $\overline{OE}0, \overline{OE}1$ | Output Enable input (Active LOW) | 1.0 / 1.0 | 20 μA / 0.6 mA |
| Q0, Q7 | Serial outputs | 50 / 33 | 1.0 mA / 20 mA |
| I/On | Multiplexed parallel data inputs | 3.5 / 1.0 | 70 μA / 0.6 mA |
| | 3-State parallel outputs | 150 / 40 | 3.0 mA / 24 mA |

NOTE: One (1.0) FAST Unit Load (U.L.) is defined as: 20 μA in the HIGH State and 0.6 mA in the LOW state.

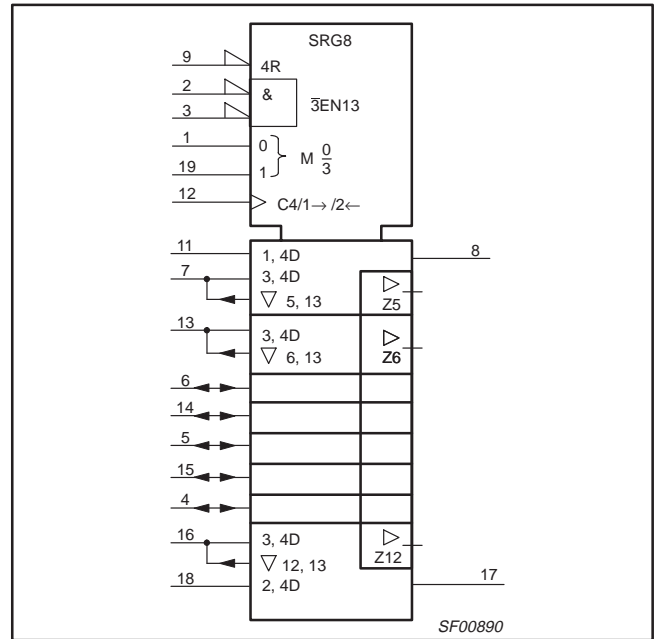
8-bit universal shift/storage register (3-State)

74F299

LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE

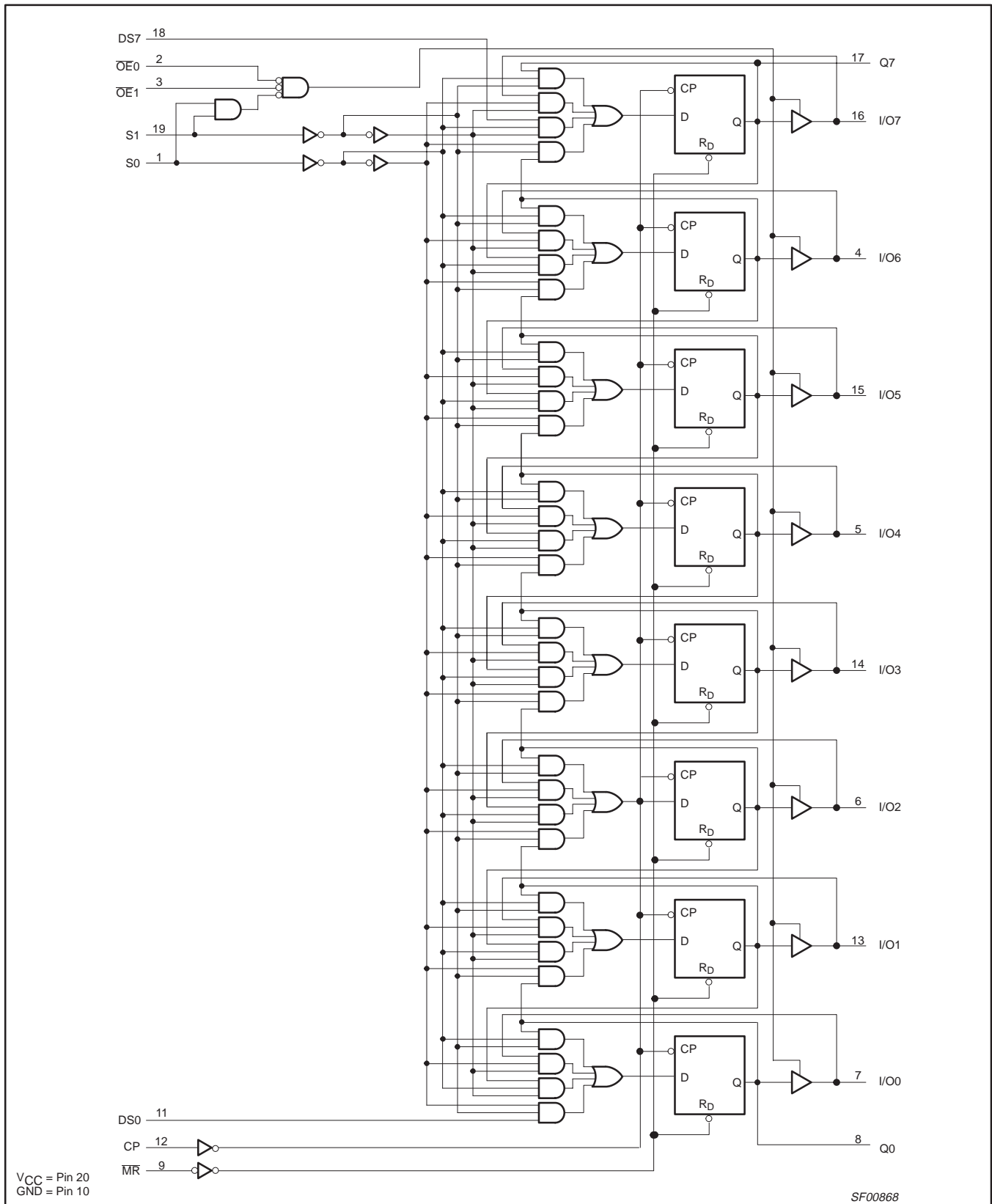
| INPUTS | | INPUTS | | | OPERATING MODE |
|-----------------|----|--------|----|----|--|
| OE _n | MR | S1 | S0 | CP | |
| L | L | X | X | X | Asynchronous Reset; Q0 – Q7 = LOW |
| L | H | H | H | ↑ | Parallel load; I/On → Qn (I/On outputs disabled) |
| L | H | L | H | ↑ | Shift right; DS0 → Q0, Q0 → Q1, etc. |
| L | H | H | L | ↑ | Shift left; DS7 → Q7, Q7 → Q6, etc. |
| L | H | L | L | X | Hold |
| H | X | X | X | X | Outputs in High-Z |

H = HIGH voltage level
 L = LOW voltage level
 X = Don't care
 ↑ = LOW-to-HIGH clock transition

8-bit universal shift/storage register (3-State)

74F299

LOGIC DIAGRAM



8-bit universal shift/storage register (3-State)

74F299

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_{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 | Q0, Q7 | 40 | mA |
| | | I/On | 48 | mA |
| T_{amb} | Operating free-air temperature range | 0 to +70 | °C | |
| T_{stg} | Storage temperature | -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 | Q0, Q7 | | -1 | mA |
| | | I/On | | -3 | mA |
| I_{OL} | LOW-level output current | Q0, Q7 | | 20 | mA |
| | | I/On | | 24 | mA |
| T_{amb} | Operating free-air temperature range | 0 | | 70 | °C |

8-bit universal shift/storage register (3-State)

74F299

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 | Q0, Q7 | V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN | I _{OH} = -1 mA | ±10%V _{CC} | 2.5 | | | V |
| | | | | | ±5%V _{CC} | 2.7 | 3.4 | | V |
| | | I/On | | I _{OH} = -3 mA | ±10%V _{CC} | 2.4 | | | V |
| | | | | | ±5%V _{CC} | 2.7 | 3.3 | | V |
| V _{OL} | LOW-level output voltage | | V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN | I _{OL} = MAX | ±10%V _{CC} | | 0.35 | 0.50 | V |
| | | | | | ±5%V _{CC} | | 0.35 | 0.50 | V |
| 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 | others | V _{CC} = MAX, V _I = 7.0 V | | | | | 100 | μA |
| | | I/On | V _{CC} = 5.5V, V _I = 5.5 V | | | | | 1 | mA |
| I _{IH} | HIGH-level input current | except I/On | V _{CC} = MAX, V _I = 2.7 V | | | | | 20 | μA |
| I _{IL} | LOW-level input current | S0, S1 | V _{CC} = MAX, V _I = 0.5 V | | | | | -1.2 | mA |
| | | others | | | | | | -0.6 | mA |
| I _{IH} + I _{OZH} | Off-state output current, HIGH-level voltage applied | I/On only | V _{CC} = MAX, V _O = 2.7 V | | | | | 70 | μA |
| I _{IL} + I _{OZL} | Off-state output current LOW-level voltage applied | | V _{CC} = MAX, V _O = 0.5 V | | | | | -0.6 | mA |
| I _{OS} | Short-circuit output current ³ | | V _{CC} = MAX | | | -60 | | -150 | mA |
| I _{CC} | Supply current (total) | I _{CCH} | V _{CC} = MAX | | | | 55 | 60 | mA |
| | | I _{CCL} | | | | | 70 | 90 | mA |
| | | I _{CCZ} | | | | | 65 | 95 | 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 V, 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.

8-bit universal shift/storage register (3-State)

74F299

AC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | | TEST CONDITIONS | LIMITS | | | | | UNIT |
|--------------------------------------|---------------------------------------|-----|--------------------------|---|------------|-------------|---|--------------|----------|
| | | | | T _{amb} = +25 °C V _{CC} = +5.0 V C _L = 50 pF, R _L = 500 Ω | | | T _{amb} = 0 °C to +70 °C V _{CC} = +5.0 V ± 10% C _L = 50 pF, R _L = 500 Ω | | |
| | | | | MIN | TYP | MAX | MIN | MAX | |
| f _{MAX} | Maximum clock frequency | I/O | Waveform 1 | 70 | 100 | | 70 | | MHz |
| | | Qn | | 85 | 115 | | 85 | | MHz |
| t _{PLH} t _{PHL} | Propagation delay CP to Q0 or Q7 | | Waveform 1 | 4.0 4.5 | 5.0 6.0 | 7.5 8.0 | 3.5 4.5 | 8.5 8.5 | ns ns |
| t _{PLH} t _{PHL} | Propagation delay CP to I/On | | Waveform 1 | 4.0 4.0 | 6.0 6.5 | 9.0 9.0 | 4.0 4.0 | 10.0 10.0 | ns ns |
| t _{PHL} | Propagation delay MR to Q0 or Q7 | | Waveform 2 | 5.5 | 7.5 | 9.5 | 5.5 | 10.5 | ns |
| t _{PHL} | Propagation delay MR to I/On | | Waveform 2 | 5.5 | 7.5 | 10.0 | 5.5 | 10.5 | ns |
| t _{PZH} t _{PZL} | Output Enable time Sn, OE to I/On | | Waveform 4 Waveform 5 | 3.5 4.0 | 6.0 7.5 | 8.0 10.0 | 3.5 4.0 | 9.0 11.0 | ns ns |
| t _{PHZ} t _{PLZ} | Output Disable time Sn, OE to I/On | | Waveform 4 Waveform 5 | 2.5 1.5 | 4.5 2.5 | 7.0 5.5 | 2.5 1.5 | 8.0 6.5 | ns ns |

AC SET-UP REQUIREMENTS

| SYMBOL | PARAMETER | | TEST CONDITIONS | LIMITS | | | | | UNIT |
|--|--|--|-----------------|---|-----|-----|---|-----|----------|
| | | | | T _{amb} = +25 °C V _{CC} = +5.0 V C _L = 50 pF, R _L = 500 Ω | | | T _{amb} = 0 °C to +70 °C V _{CC} = +5.0 V ± 10% C _L = 50 pF, R _L = 500 Ω | | |
| | | | | MIN | TYP | MAX | MIN | MAX | |
| t _s (H) t _s (L) | Set-up time, HIGH or LOW S0 or S1 to CP | | Waveform 3 | 6.5 6.5 | | | 7.5 7.5 | | ns ns |
| t _h (H) t _h (L) | Hold time, HIGH or LOW S0 or S1 to CP | | Waveform 3 | 0 0 | | | 0 0 | | ns ns |
| t _s (H) t _s (L) | Set-up time, HIGH or LOW I/On, DS _L or DS _R to CP | | Waveform 3 | 3.5 3.5 | | | 4.0 4.0 | | ns ns |
| t _h (H) t _h (L) | Hold time, HIGH or LOW I/On, DS _L or DS _R to CP | | Waveform 3 | 0 0 | | | 0 0 | | ns ns |
| t _w (H) t _w (L) | CP Pulse width, HIGH or LOW | | Waveform 1 | 5.0 4.5 | | | 5.0 4.5 | | ns |
| t _w (L) | MR Pulse width, LOW | | Waveform 2 | 4.5 | | | 4.5 | | ns |
| t _{rec} | Recovery time, MR to CP | | Waveform 2 | 4.0 | | | 4.0 | | ns |

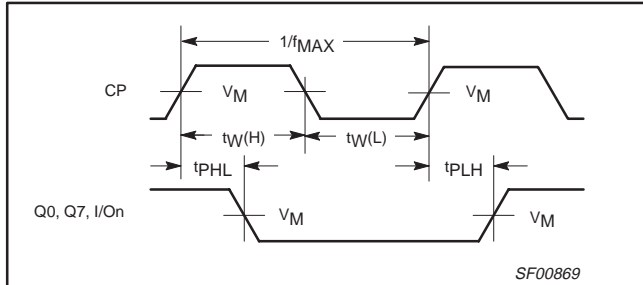
8-bit universal shift/storage register (3-State)

74F299

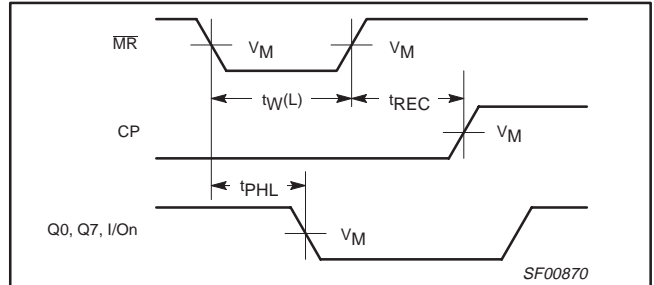
AC WAVEFORMS

For all waveforms, $V_M = 1.5\text{ V}$

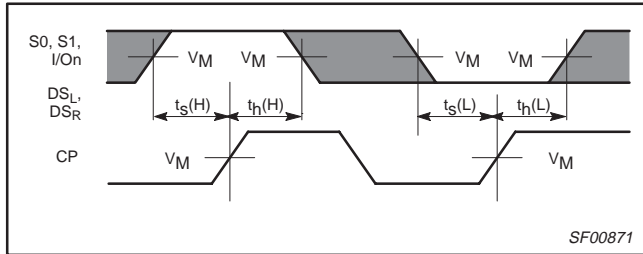
The shaded areas indicate when the input is permitted to change for predictable output performance.



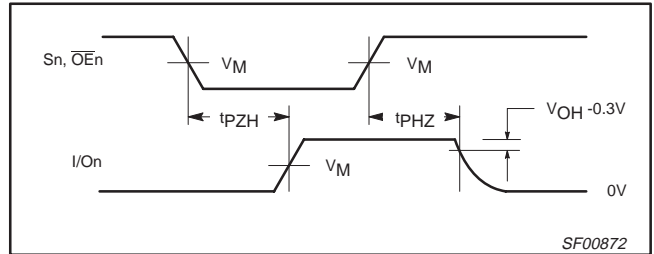
Waveform 1. Propagation delay, clock input to output, clock width, and maximum clock frequency



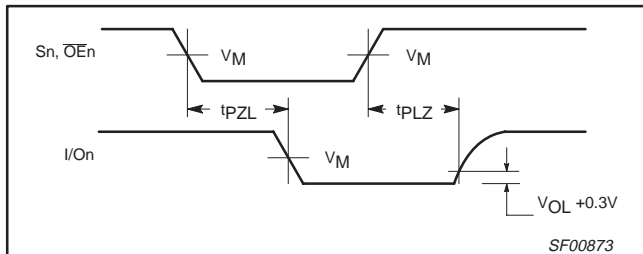
Waveform 2. Master Reset pulse width, Master Reset to output delay, and Master Reset to clock recovery time



Waveform 3. Set-up and hold times



Waveform 4. 3-State Output Enable time to HIGH level and Output Disable time from HIGH level

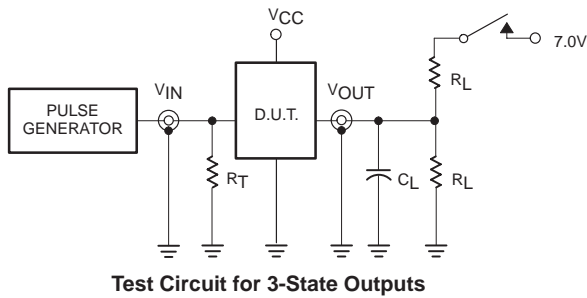


Waveform 5. 3-State Output Enable time to LOW level and Output Disable time from LOW level

8-bit universal shift/storage register (3-State)

74F299

TEST CIRCUIT AND WAVEFORM



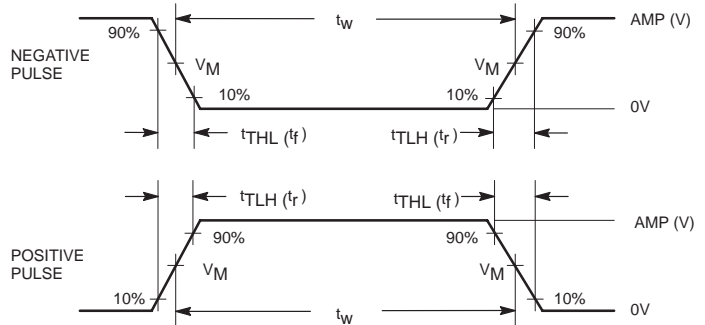
Test Circuit for 3-State Outputs

SWITCH POSITION

| TEST | SWITCH |
|-----------|--------|
| t_{PLZ} | closed |
| 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} |
| 74F | 3.0V | 1.5V | 1MHz | 500ns | 2.5ns | 2.5ns |

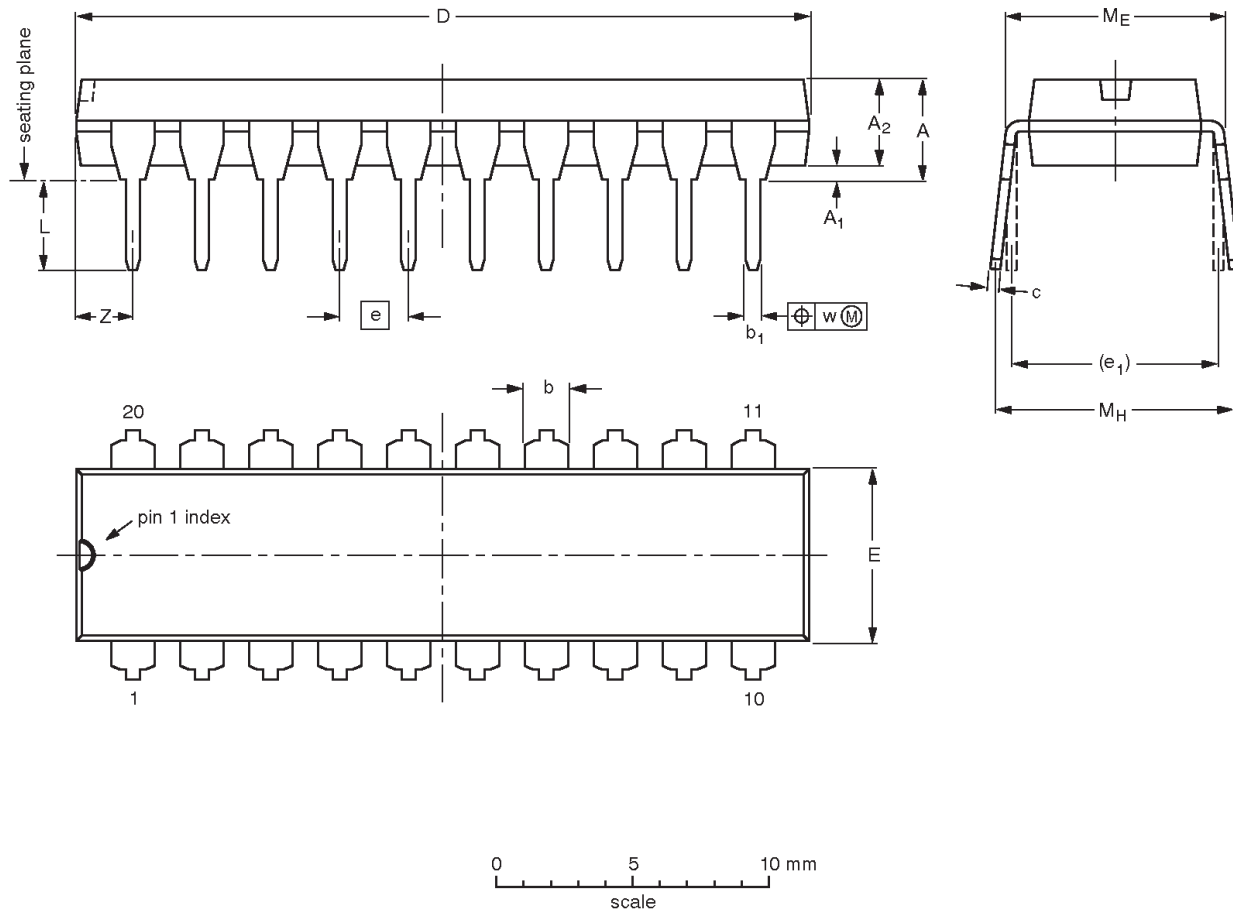
SF00777

8-bit universal shift/storage register (3-State)

74F299

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1



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

| UNIT | A max. | A ₁ min. | A ₂ max. | b | b ₁ | 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 | 0.36 0.23 | 26.92 26.54 | 6.40 6.22 | 2.54 | 7.62 | 3.60 3.05 | 8.25 7.80 | 10.0 8.3 | 0.254 | 2.0 |
| inches | 0.17 | 0.020 | 0.13 | 0.068 0.051 | 0.021 0.015 | 0.014 0.009 | 1.060 1.045 | 0.25 0.24 | 0.10 | 0.30 | 0.14 0.12 | 0.32 0.31 | 0.39 0.33 | 0.01 | 0.078 |

Note

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

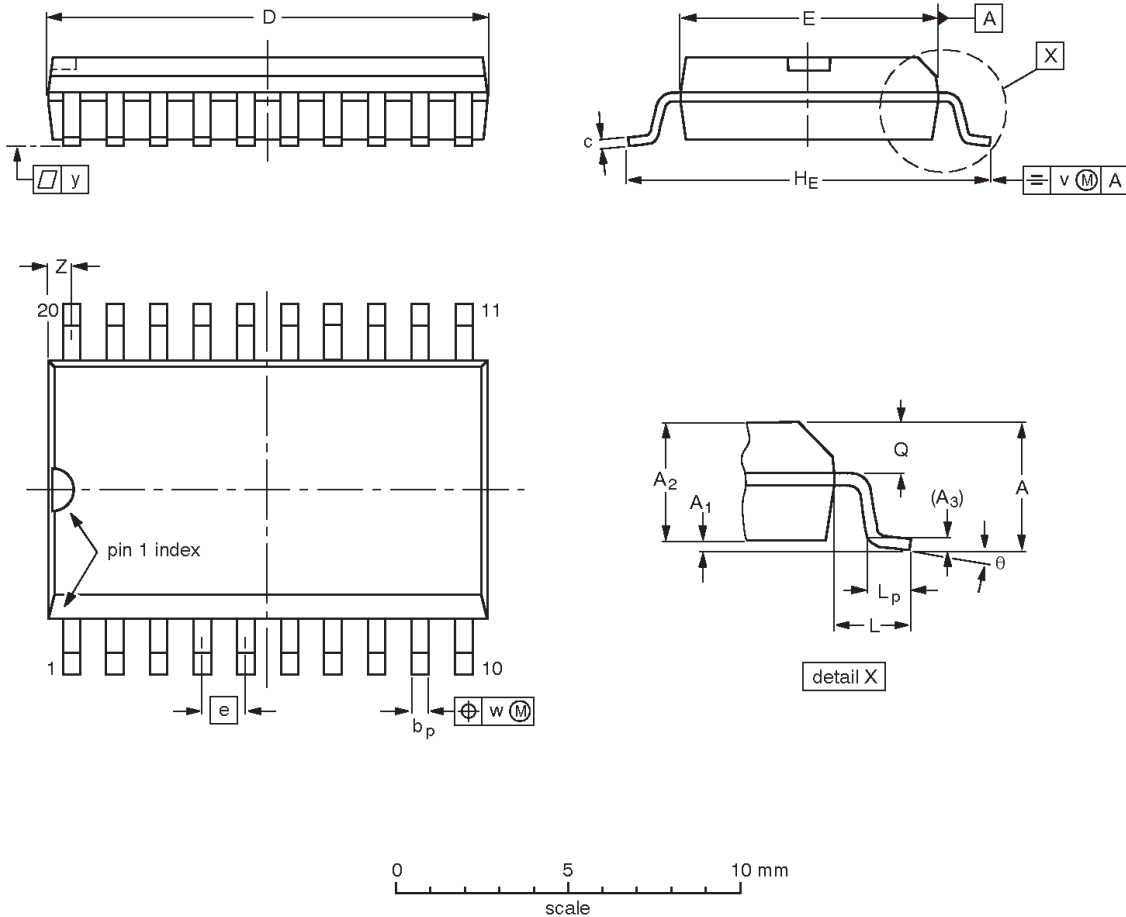
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|--------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT146-1 | | MS-001 | SC-603 | | | 95-05-24 99-12-27 |

8-bit universal shift/storage register (3-State)

74F299

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



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 | 2.65 | 0.30 0.10 | 2.45 2.25 | 0.25 | 0.49 0.36 | 0.32 0.23 | 13.0 12.6 | 7.6 7.4 | 1.27 | 10.65 10.00 | 1.4 | 1.1 0.4 | 1.1 1.0 | 0.25 | 0.25 | 0.1 | 0.9 0.4 | 8° 0° |
| inches | 0.10 | 0.012 0.004 | 0.096 0.089 | 0.01 | 0.019 0.014 | 0.013 0.009 | 0.51 0.49 | 0.30 0.29 | 0.050 | 0.419 0.394 | 0.055 | 0.043 0.016 | 0.043 0.039 | 0.01 | 0.01 | 0.004 | 0.035 0.016 | |

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 | | | |
| SOT163-1 | 075E04 | MS-013 | | | | 97-05-22 99-12-27 |

8-bit universal shift/storage register (3-State)

74F299

REVISION HISTORY

| Rev | Date | Description |
|-----|----------|--|
| _3 | 20030205 | Product data (9397 750 11037); ECN 853-0365 29307 of 17 December 2002. Supersedes Product specification (9397 750 05117) of 01 March 1990. Modifications: <ul style="list-style-type: none"> • Delete all references to DB package. Package option was discontinued. |
| _2 | 19900301 | Product specification (9397 750 05117); ECN 853-0365 29307 of 01 March 1990. |

Data sheet status

| Level | Data sheet status ^[1] | Product status ^[2] ^[3] | Definitions |
|-------|----------------------------------|--|--|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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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Document order number: 9397 750 11037

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