

MC74AC299, MC74ACT299



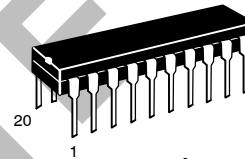
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<http://onsemi.com>

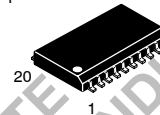
8-Input Universal Shift/Storage Register with Common Parallel I/O Pins

The MC74AC299/74ACT299 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 load data. 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, Q₇ to allow easy serial cascading. A separate active LOW Master Reset is used to reset the register.

- 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
- Outputs Source/Sink 24 mA
- 'ACT299 Has TTL Compatible Inputs
- **These devices are available in Pb-free package(s). Specifications herein apply to both standard and Pb-free devices. Please see our website at www.onsemi.com for specific Pb-free orderable part numbers, or contact your local ON Semiconductor sales office or representative.**



PDIP-20
N SUFFIX
CASE 738



SO-20
DW SUFFIX
CASE 751

ORDERING INFORMATION

| Device | Package | Shipping |
|----------------|---------|------------------|
| MC74AC299N | PDIP-20 | 18 Units/Rail |
| MC74ACT299N | PDIP-20 | 18 Units/Rail |
| MC74AC299DW | SOIC-20 | 38 Units/Rail |
| MC74AC299DWR2 | SOIC-20 | 1000 Tape & Reel |
| MC74ACT299DW | SOIC-20 | 38 Units/Rail |
| MC74ACT299DWR2 | SOIC-20 | 1000 Tape & Reel |

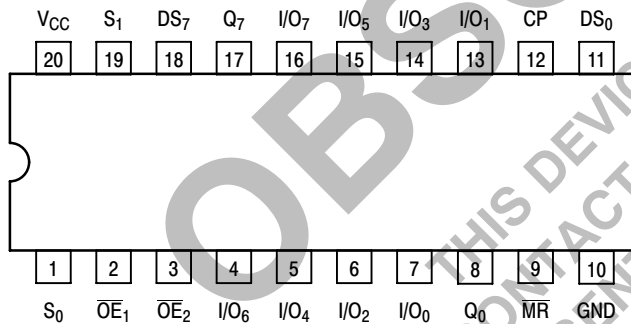


Figure 1. Pinout: 20-Lead Packages Conductors (Top View)

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 9 of this data sheet.

PIN ASSIGNMENT

| PIN | FUNCTION |
|------------------------------------|--|
| CP | Clock Pulse Input |
| DS ₀ | Serial Data Input for Right Shift |
| DS ₇ | Serial Data Input for Left Shift |
| S ₀ , S ₁ | Mode Select Inputs |
| MR | Asynchronous Master Reset |
| OE ₁ , OE ₂ | 3-State Output Enable Inputs |
| I/O ₀ -I/O ₇ | Parallel Data Inputs or 3-State Parallel Outputs |
| Q ₀ , Q ₇ | Serial Outputs |

MC74AC299, MC74ACT299

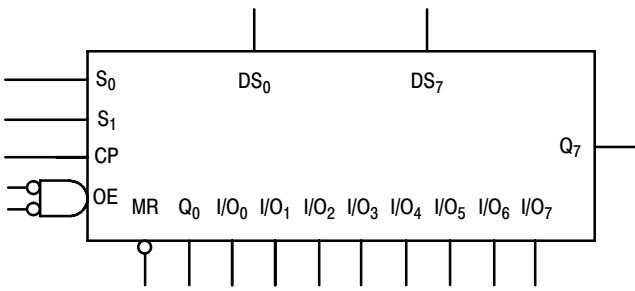
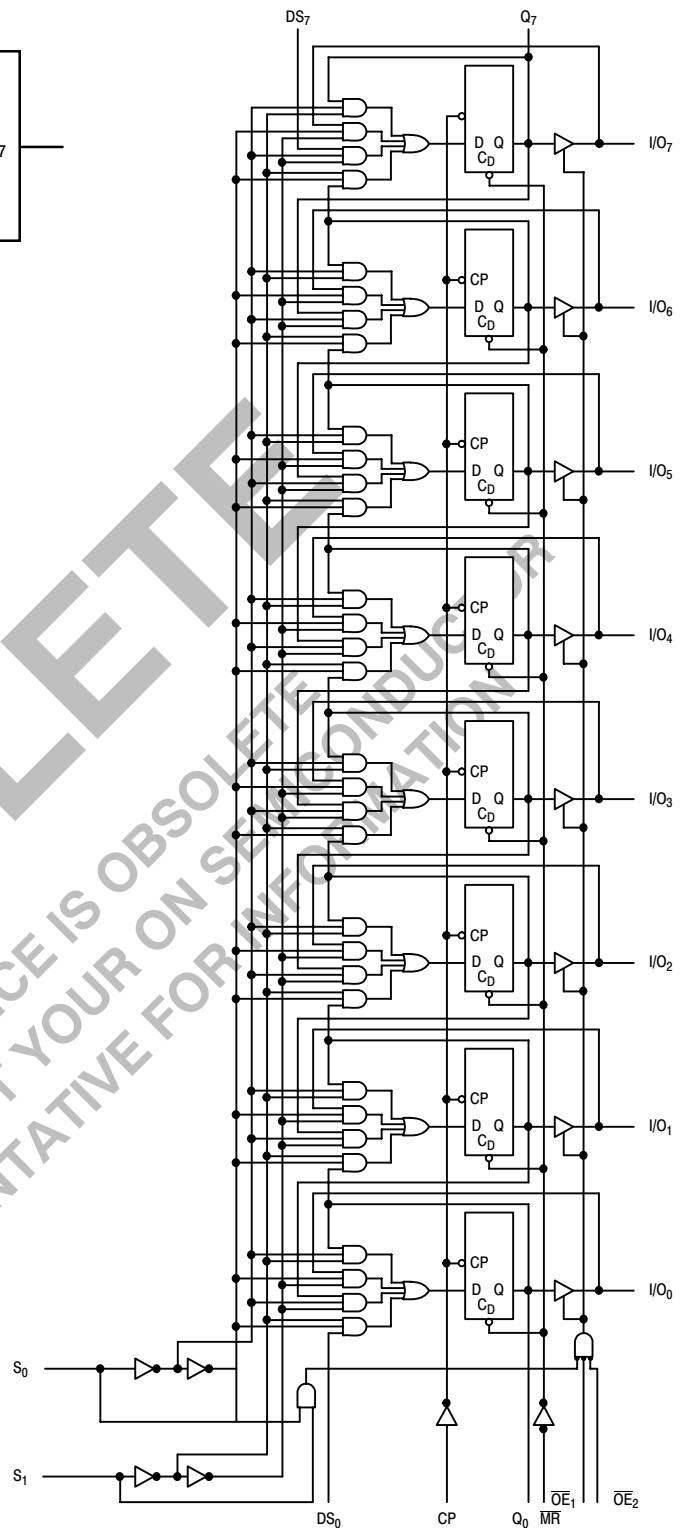


Figure 2. Logic Symbol



NOTE: That this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 3. Logic Diagram

MC74AC299, MC74ACT299

FUNCTIONAL DESCRIPTION

The MC74AC299/74ACT299 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 S_0 and S_1 , as shown in the Truth 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. Q_0 and Q_7 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 setup and hold times, relative to the rising edge of CP, are observed.

A HIGH signal on either \overline{OE}_1 or \overline{OE}_2 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 S_0 and S_1 in preparation for a parallel load operation.

TRUTH TABLE

| Inputs | | | | Response |
|--------|-------|-------|-------------|--|
| MR | S_1 | S_0 | CP | |
| L | X | X | X | Asynchronous Reset; $Q_0-Q_7 = \text{LOW}$ |
| H | H | H | \lrcorner | Parallel Load; $I/O_n \rightarrow Q_n$ |
| H | L | H | \lrcorner | Shift Rights; $DS_0 \rightarrow Q_0, Q_0 \rightarrow Q_1, \text{etc.}$ |
| H | H | L | \lrcorner | Shift Left; $DS_7 \rightarrow Q_7, Q_7 \rightarrow Q_6, \text{etc.}$ |
| H | L | L | X | Hold |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

\lrcorner = LOW-to-HIGH Transition

MAXIMUM RATINGS*

| Symbol | Parameter | Value | Unit |
|-----------|---|------------------------|--------------------|
| V_{CC} | DC Supply Voltage (Referenced to GND) | -0.5 to +7.0 | V |
| V_{IN} | DC Input Voltage (Referenced to GND) | -0.5 to $V_{CC} + 0.5$ | V |
| V_{OUT} | DC Output Voltage (Referenced to GND) | -0.5 to $V_{CC} + 0.5$ | V |
| I_{IN} | DC Input Current, per Pin | ± 20 | mA |
| I_{OUT} | DC Output Sink/Source Current, per Pin | ± 50 | mA |
| I_{CC} | DC V_{CC} or GND Current per Output Pin | ± 50 | mA |
| T_{stg} | Storage Temperature | -65 to +150 | $^{\circ}\text{C}$ |

*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Unit | |
|-------------------|---|--------------------------|-----|----------|--------------------|------|
| V_{CC} | Supply Voltage | 'AC | 2.0 | 5.0 | 6.0 | V |
| | | 'ACT | 4.5 | 5.0 | 5.5 | |
| V_{IN}, V_{OUT} | DC Input Voltage, Output Voltage (Ref. to GND) | 0 | - | V_{CC} | V | |
| t_r, t_f | Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs | $V_{CC} @ 3.0 \text{ V}$ | - | 150 | - | ns/V |
| | | $V_{CC} @ 4.5 \text{ V}$ | - | 40 | - | |
| | | $V_{CC} @ 5.5 \text{ V}$ | - | 25 | - | |
| t_r, t_f | Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs | $V_{CC} @ 4.5 \text{ V}$ | - | 10 | - | ns/V |
| | | $V_{CC} @ 5.5 \text{ V}$ | - | 8.0 | - | |
| T_J | Junction Temperature (PDIP) | - | - | 140 | $^{\circ}\text{C}$ | |
| T_A | Operating Ambient Temperature Range | -40 | 25 | 85 | $^{\circ}\text{C}$ | |
| I_{OH} | Output Current - High | - | - | -24 | mA | |
| I_{OL} | Output Current - Low | - | - | 24 | mA | |

1. V_{IN} from 30% to 70% V_{CC} ; see individual Data Sheets for devices that differ from the typical input rise and fall times.

2. V_{IN} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

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DC CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | 74AC | | 74AC | | Unit | Conditions |
|------------------|-----------------------------------|---------------------|------------------------|-------------------|---------------------------------|------|---|---|
| | | | T _A = +25°C | | T _A = -40°C to +85°C | | | |
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum High Level Input Voltage | 3.0 | 1.5 | 2.1 | 2.1 | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V | |
| | | 4.5 | 2.25 | 3.15 | 3.15 | | | |
| | | 5.5 | 2.75 | 3.85 | 3.85 | | | |
| V _{IL} | Maximum Low Level Input Voltage | 3.0 | 1.5 | 0.9 | 0.9 | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V | |
| | | 4.5 | 2.25 | 1.35 | 1.35 | | | |
| | | 5.5 | 2.75 | 1.65 | 1.65 | | | |
| V _{OH} | Minimum High Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | V | I _{OUT} = -50 μA | |
| | | 4.5 | 4.49 | 4.4 | 4.4 | | | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | 3.0 | - | 4.5 | - | 2.56 | 2.46 | V | *V _{IN} = V _{IL} or V _{IH} |
| | | | | | 3.86 | 3.76 | | -12 mA |
| | | | | | 4.86 | 4.76 | | I _{OH} -24 mA |
| V _{OL} | Maximum Low Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | V | I _{OUT} = 50 μA | |
| | | 4.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | 3.0 | - | 4.5 | - | 0.36 | 0.44 | V | *V _{IN} = V _{IL} or V _{IH} |
| | | | | | 0.36 | 0.44 | | 12 mA |
| | | | | | 0.36 | 0.44 | | I _{OL} 24 mA |
| I _{IN} | Maximum Input Leakage Current | 5.5 | - | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND | |
| I _{OZT} | Maximum 3-State Current | 5.5 | - | ±0.6 | ±6.0 | μA | V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = V _{CC} , GND | |
| I _{OLD} | †Minimum Dynamic Output Current | 5.5 | - | - | 75 | mA | V _{OLD} = 1.65 V Max | |
| I _{OHD} | | 5.5 | - | - | -75 | mA | V _{OHD} = 3.85 V Min | |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | - | 8.0 | 80 | μA | V _{IN} = V _{CC} or GND | |

*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

NOTE: I_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC}.

AC CHARACTERISTICS (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol | Parameter | V _{CC} * (V) | 74AC | | | 74AC | | Unit | Fig. No. |
|------------------|---|-----------------------|--|-----|------|---|-----|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Input Frequency | 3.3 | 90 | - | - | 80 | - | MHz | 3-3 |
| | | 5.0 | 130 | - | - | 105 | - | | |
| t _{PLH} | Propagation Delay CP to Q ₀ or Q ₇ | 3.3 | 8.5 | - | 20.5 | 7.0 | 22 | ns | 3-6 |
| | | 5.0 | 5.5 | - | 14 | 4.5 | 15 | | |
| t _{PHL} | Propagation Delay CP to Q ₀ or Q ₇ | 3.3 | 8.5 | - | 21.5 | 7.0 | 23 | ns | 3-6 |
| | | 5.0 | 5.5 | - | 14.5 | 5.0 | 16 | | |

*Voltage Range 3.3 V is 3.3 V ±0.3 V.

Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC299, MC74ACT299

AC CHARACTERISTICS (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol | Parameter | V _{CC} * (V) | 74AC | | | 74AC | | Unit | Fig. No. |
|------------------|---|-----------------------|--|--------|--------------|--|--------------|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| t _{PLH} | Propagation Delay CP to I/O _n | 3.3 5.0 | 9.0 6.0 | – – | 20.5 14.5 | 7.5 5.0 | 22.5 16 | ns | 3–6 |
| t _{PHL} | Propagation Delay CP to I/O _n | 3.3 5.0 | 10 6.5 | – – | 23 16 | 8.5 6.0 | 24.5 17.5 | ns | 3–6 |
| t _{PHL} | Propagation Delay MR to Q ₀ or Q ₇ | 3.3 5.0 | 9.0 5.5 | – – | 22.5 15.5 | 7.5 5.0 | 25.0 17.0 | ns | 3–6 |
| t _{PHL} | Propagation Delay MR to I/O _n | 3.3 5.0 | 9.0 5.5 | – – | 21.5 15.0 | 7.5 5.0 | 24.0 16.5 | ns | 3–6 |
| t _{PZH} | Output Enable Time OE to I/O _n | 3.3 5.0 | 7.0 4.5 | – – | 18 12.5 | 6.0 4.0 | 19.5 13.5 | ns | 3–7 |
| t _{PZL} | Output Enable Time OE to I/O _n | 3.3 5.0 | 7.0 5.0 | – – | 18 12.5 | 6.0 4.0 | 20.5 14 | ns | 3–8 |
| t _{PHZ} | Output Disable Time OE to I/O _n | 3.3 5.0 | 6.5 3.5 | – – | 18.5 14 | 5.5 3.0 | 19.5 15 | ns | 3–7 |
| t _{PLZ} | Output Disable Time OE to I/O _n | 3.3 5.0 | 5.5 3.5 | – – | 17 12.5 | 4.5 2.0 | 19 13.5 | ns | 3–8 |

*Voltage Range 3.3 V is 3.3 V ±0.3 V.
Voltage Range 5.0 V is 5.0 V ±0.5 V.

AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74AC | | 74AC | | Unit | Fig. No. |
|------------------|---|-----------------------|--|--------------------|--|----|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Typ | Guaranteed Minimum | | | | |
| t _s | Setup Time, HIGH or LOW S ₀ or S ₁ to CP | 3.3 5.0 | – – | 8.0 5.0 | 8.5 5.5 | ns | 3–9 | |
| t _h | Hold Time, HIGH or LOW S ₀ or S ₁ to CP | 3.3 5.0 | – – | 0.5 1.0 | 0.5 1.0 | ns | 3–9 | |
| t _s | Setup Time, HIGH or LOW I/O _n to CP | 3.3 5.0 | – – | 5.5 3.5 | 6.0 4.0 | ns | 3–9 | |
| t _h | Hold Time, HIGH or LOW I/O _n to CP | 3.3 5.0 | – – | 0 1.0 | 0 1.0 | ns | 3–9 | |
| t _s | Setup Time, HIGH or LOW DS ₀ or DS ₇ to CP | 3.3 5.0 | – – | 6.5 4.0 | 7.0 4.5 | ns | 3–6 | |
| t _h | Hold Time, HIGH or LOW DS ₀ or DS ₇ to CP | 3.3 5.0 | – – | 0 1.0 | 0.5 1.0 | ns | 3–6 | |
| t _w | CP Pulse Width, LOW | 3.3 5.0 | – – | 4.5 3.5 | 5.0 3.5 | ns | 3–6 | |
| t _w | MR Pulse Width, LOW | 3.3 5.0 | – – | 4.5 3.5 | 5.0 3.5 | ns | 3–9 | |
| t _{rec} | Recovery Time MR to CP | 3.3 5.0 | – – | 1.5 1.5 | 1.5 1.5 | ns | 3–9 | |

*Voltage Range 3.3 V is 3.3 V ±0.3 V.
Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC299, MC74ACT299

DC CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | 74ACT | | 74ACT | | Unit | Conditions |
|-------------------|--|------------------------|------------------------|-------------------|---------------------------------------|----|---|------------|
| | | | T _A = +25°C | | T _A = -40°C to +85°C | | | |
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum High Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V | |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | | |
| V _{IL} | Maximum Low Level Input Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V | |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | | |
| V _{OH} | Minimum High Level Output Voltage | 4.5 | 4.49 | 4.4 | 4.4 | V | I _{OUT} = -50 μA | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 4.5 | - | 3.86 | 3.76 | V | *V _{IN} = V _{IL} or V _{IH} I _{OH} = -24 mA | |
| | | 5.5 | - | 4.86 | 4.76 | | | |
| V _{OL} | Maximum Low Level Output Voltage | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 4.5 | - | 0.36 | 0.44 | V | *V _{IN} = V _{IL} or V _{IH} I _{OL} = 24 mA | |
| | | 5.5 | - | 0.36 | 0.44 | | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | - | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND | |
| I _{OZT} | Maximum 3-State Current | 5.5 | - | ±0.6 | ±6.0 | μA | V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = V _{CC} , GND | |
| ΔI _{CCT} | Additional Max. I _{CC} /Input | 5.5 | 0.6 | - | 1.5 | mA | V _I = V _{CC} - 2.1 V | |
| I _{OLD} | †Minimum Dynamic Output Current | 5.5 | - | - | 75 | mA | V _{OLD} = 1.65 V Max | |
| I _{OHD} | | 5.5 | - | - | -75 | mA | V _{OHD} = 3.85 V Min | |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | - | 8.0 | 80 | μA | V _{IN} = V _{CC} or GND | |

*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

MC74AC299, MC74ACT299

AC CHARACTERISTICS (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol | Parameter | V _{CC} * (V) | 74ACT | | | 74ACT | | Unit | Fig. No. |
|------------------|---|--------------------------|--|-----|------|--|------|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Input Frequency | 5.0 | 120 | – | – | 110 | – | MHz | 3–3 |
| t _{PLH} | Propagation Delay CP to Q ₀ or Q ₇ | 5.0 | 4.0 | – | 12.5 | 3.0 | 14 | ns | 3–6 |
| t _{PHL} | Propagation Delay CP to Q ₀ or Q ₇ | 5.0 | 4.0 | – | 13.5 | 3.5 | 15 | ns | 3–6 |
| t _{PLH} | Propagation Delay CP to I/O _n | 5.0 | 4.5 | – | 12.5 | 4.5 | 13.5 | ns | 3–6 |
| t _{PHL} | Propagation Delay CP to I/O _n | 5.0 | 5.0 | – | 15 | 4.5 | 16.5 | ns | 3–6 |
| t _{PHL} | Propagation Delay M _R to Q ₀ or Q ₇ | 5.0 | 4.0 | – | 15 | 4.0 | 18 | ns | 3–6 |
| t _{PHL} | Propagation Delay M _R to I/O _n | 5.0 | 4.0 | – | 14.5 | 3.5 | 17.5 | ns | 3–6 |
| t _{PZH} | Output Enable Time O _E to I/O _n | 5.0 | 2.5 | – | 12 | 1.5 | 13 | ns | 3–7 |
| t _{PZL} | Output Enable Time O _E to I/O _n | 5.0 | 2.0 | – | 12 | 1.5 | 13.5 | ns | 3–8 |
| t _{PHZ} | Output Disable Time O _E to I/O _n | 5.0 | 2.0 | – | 12.5 | 2.0 | 13.5 | ns | 3–7 |
| t _{PLZ} | Output Disable Time O _E to I/O _n | 5.0 | 2.5 | – | 11.5 | 2.0 | 12.5 | ns | 3–8 |

*Voltage Range 5.0 V is 5.0 V ±0.5 V.

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AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74ACT | | 74ACT | | Unit | Fig. No. |
|------------------|---|--------------------------|--|--------------------|--|----|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Typ | Guaranteed Minimum | | | | |
| t _s | Setup Time, HIGH or LOW S ₀ or S ₁ to CP | 5.0 | - | 5.0 | 5.5 | ns | 3-9 | |
| t _h | Hold Time, HIGH or LOW S ₀ or S ₁ to CP | 5.0 | - | 1.0 | 1.0 | ns | 3-9 | |
| t _s | Setup Time, HIGH or LOW I/O _n to CP | 5.0 | - | 4.0 | 4.5 | ns | 3-9 | |
| t _h | Hold Time, HIGH or LOW I/O _n to CP | 5.0 | - | 1.0 | 1.0 | ns | 3-9 | |
| t _s | Setup Time, HIGH or LOW DS ₀ or DS ₇ to CP | 5.0 | - | 4.5 | 5.0 | ns | 3-6 | |
| t _h | Hold Time, HIGH or LOW DS ₀ or DS ₇ to CP | 5.0 | - | 1.0 | 1.0 | ns | 3-6 | |
| t _w | CP Pulse Width HIGH or LOW | 5.0 | - | 4.0 | 4.5 | ns | 3-9 | |
| t _w | MR Pulse Width, LOW | 5.0 | - | 3.5 | 3.5 | ns | 3-9 | |
| t _{rec} | Recovery Time MR to CP | 5.0 | - | 1.5 | 1.5 | ns | 3-9 | |

*Voltage Range 5.0 V is 5.0 V ±0.5 V.

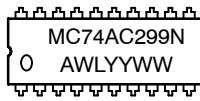
CAPACITANCE

| Symbol | Parameter | Value Typ | Unit | Test Conditions |
|-----------------|-------------------------------|--------------|------|-------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = 5.0 V |
| C _{PD} | Power Dissipation Capacitance | 170 | pF | V _{CC} = 5.0 V |

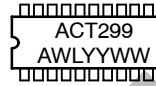
MC74AC299, MC74ACT299

MARKING DIAGRAMS

PDIP-20



SO-20



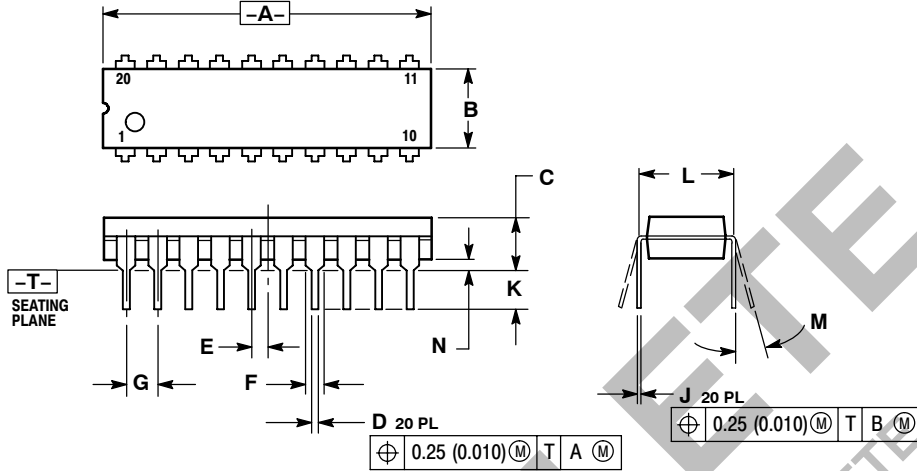
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

OBSOLETE
THIS DEVICE IS OBSOLETE
PLEASE CONTACT YOUR ON SEMICONDUCTOR
REPRESENTATIVE FOR INFORMATION

MC74AC299, MC74ACT299

PACKAGE DIMENSIONS

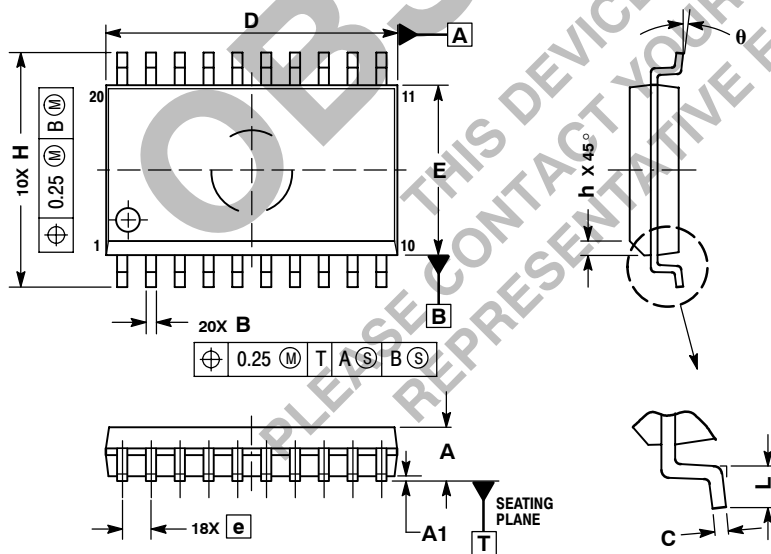
PDIP-20
N SUFFIX
 20 PIN PLASTIC DIP PACKAGE
 CASE 738-03
 ISSUE E



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
 4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.010 | 1.070 | 25.66 | 27.17 |
| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.150 | 0.180 | 3.81 | 4.57 |
| D | 0.015 | 0.022 | 0.39 | 0.55 |
| E | 0.050 BSC | | 1.27 BSC | |
| F | 0.050 | 0.070 | 1.27 | 1.77 |
| G | 0.100 BSC | | 2.54 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.110 | 0.140 | 2.80 | 3.55 |
| L | 0.300 BSC | | 7.62 BSC | |
| M | 0° | 15° | 0° | 15° |
| N | 0.020 | 0.040 | 0.51 | 1.01 |

SO-20
DW SUFFIX
 20 PIN PLASTIC SOIC PACKAGE
 CASE 751D-05
 ISSUE F



- NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
 3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
 5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | |
|----------|-------------|-------|
| | MIN | MAX |
| A | 2.35 | 2.65 |
| A1 | 0.10 | 0.25 |
| B | 0.35 | 0.49 |
| C | 0.23 | 0.32 |
| D | 12.65 | 12.95 |
| E | 7.40 | 7.60 |
| e | 1.27 BSC | |
| H | 10.05 | 10.55 |
| h | 0.25 | 0.75 |
| L | 0.50 | 0.90 |
| θ | 0° | 7° |

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