

June 1988 Revised October 1998

74ACT323

8-Bit Universal Shift/Storage Register with Synchronous Reset and Common I/O Pins

General Description

The ACT323 is an 8-bit universal shift/storage register with 3-STATE outputs. Parallel load inputs and flip-flop outputs are multiplexed to minimize pin count. Separate serial inputs and outputs are provided for Q_0 and Q_7 to allow easy cascading. Four operation modes are possible: hold (store), shift left, shift right and parallel load.

Features

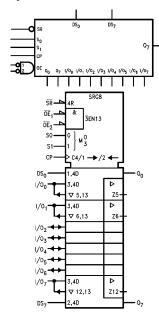
- I_{CC} and I_{OZ} reduced by 50%
- Common parallel I/O for reduced pin count
- Additional serial inputs and outputs for expansion
- Four operating modes: shift left, shift right, load and
- 3-STATE outputs for bus-oriented applications
- Outputs source/sink 24 mA
- TTL-compatible inputs

Ordering Code:

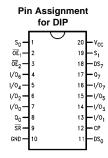
| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| 74ACT323PC | N20A | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Logic Symbols



Connection Diagram



Pin Descriptions

| Pin Name | Description |
|---|-------------------------------------|
| СР | 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 |
| SR | Synchronous Reset Input |
| \overline{OE}_1 , \overline{OE}_2 I/O ₀ -I/O ₇ | 3-STATE Output Enable Inputs |
| I/O ₀ -I/O ₇ | Multiplexed Parallel Data Inputs or |
| | 3-STATE Parallel Data Outputs |
| Q ₀ , Q ₇ | Serial Outputs |

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Functional Description

The ACT323 contains eight edge-triggered D-type flip-flops and the interstage logic necessary to perform synchronous reset, 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 Mode Select 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. $\rm Q_0$ and $\rm Q_7$ are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on $\overline{\rm SR}$ overrides the Select inputs and allows the flip-flops to be reset by the next rising edge of CP. All other state changes are also initiated by the LOW-to-HIGH CP transition. 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 $\overline{\rm OE}_1$ or $\overline{\rm OE}_2$ disables the 3-STATE buffers and puts the I/O pins in the high impedance state. In this condition the shift, load, hold 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.

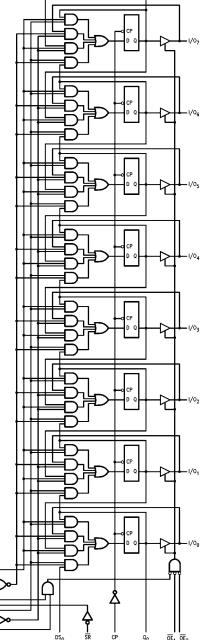
Mode Select Table

| | Inp | uts | | Response | | | |
|----|----------------|----------------|----|---|--|--|--|
| SR | S ₁ | S ₀ | СР | | | | |
| L | Х | Х | ~ | Synchronous Reset; Q ₀ –Q ₇ = LOW | | | |
| Н | Н | Н | ~ | ✓ Parallel Load; I/O _n →Q _n | | | |
| Н | L | Н | ~ | $ ightharpoonup$ Shift Right; DS ₀ \rightarrow Q ₀ , Q ₀ \rightarrow Q ₁ , etc. | | | |
| Н | Н | L | ~ | Shift Left; $DS_7 \rightarrow Q_7$, $Q_7 \rightarrow Q_6$, etc. | | | |
| Н | L | L | Х | Hold | | | |

H = HIGH Voltage Level L = LOW Voltage Level

^{∠ =} LOW-to-HIGH Clock Transition

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

Supply Voltage (V_{CC}) -0.5V to +7.0V

DC Input Diode Current (I_{IK})

 $\begin{aligned} &V_{I} = -0.5V & -20 \text{ mA} \\ &V_{I} = V_{CC} + 0.5V & +20 \text{ mA} \end{aligned}$

DC Input Voltage (V_I) -0.5V to $V_{CC} + 0.5V$

DC Output Diode Current (I_{OK})

 $\begin{aligned} \text{V}_{\text{O}} &= -0.5 \text{V} & -20 \text{ mA} \\ \text{V}_{\text{O}} &= \text{V}_{\text{CC}} + 0.5 \text{V} & +20 \text{ mA} \end{aligned}$

DC Output Voltage (V_O) -0.5 V to V $_{\text{CC}} + 0.5 \text{V}$

DC Output Source or

Sink Current (I_O) $\pm 50 \text{ mA}$

 ${\rm DC}\ {\rm V}_{\rm CC}\ {\rm or}\ {\rm Ground}\ {\rm Current}$

Per Output Pin (I_{CC} or I_{GND}) ± 50 mA Storage Temperature (T_{STG}) -65° C to +150 $^{\circ}$ C

Junction Temperature (T_J)

Recommended Operating Conditions

Supply Voltage (V_{CC}) 4.5V to 5.5V Input Voltage (V_{I}) 0V to V_{CC}

140°C

Output Voltage (V_O)

Operating Temperature (T_A)

Over to +85°C

Minimum Input Edge Rate ($\Delta V/\Delta t$)

V_{IN} from 0.8V to 2.0V

 $V_{CC} @ 4.5V, 5.5V$ 125 mV/ns

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.

DC Electrical Characteristics

| Symbol | Parameter | V _{CC} | T _A = +25°C | | T _A = -40°C to +85°C | Units | Conditions |
|------------------|-------------------------------------|-----------------|------------------------|------|---------------------------------|-------|------------------------------------|
| - | | (V) | Typ Gua | | aranteed Limits | | |
| V _{IH} | Minimum High Level | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1V |
| | Input Voltage | 5.5 | 1.5 | 2.0 | 2.0 | | or V _{CC} - 0.1V |
| V _{IL} | Maximum Low Level | 4.5 | 1.5 | 0.8 | 0.8 | V | $V_{OUT} = 0.1V$ |
| | Input Voltage | 5.5 | 1.5 | 0.8 | 0.8 | | or V _{CC} - 0.1V |
| V _{OH} | Minimum High Level | 4.5 | 4.49 | 4.4 | 4.4 | V | $I_{OUT} = -50 \mu A$ |
| | Output Voltage | 5.5 | 5.49 | 5.4 | 5.4 | | |
| | | | | | | | $V_{IN} = V_{IL}$ or V_{IH} |
| | | 4.5 | | 3.86 | 3.76 | V | $I_{OH} = -24 \text{ mA}$ |
| | | 5.5 | | 4.86 | 4.76 | | $I_{OH} = -24 \text{ mA (Note 2)}$ |
| V _{OL} | Maximum Low Level | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA |
| | Output Voltage | 5.5 | 0.001 | 0.1 | 0.1 | | |
| | | | | | | | $V_{IN} = V_{IL}$ or V_{IH} |
| | | 4.5 | | 0.36 | 0.44 | V | $I_{OL} = -24 \text{ mA}$ |
| | | 5.5 | | 0.36 | 0.44 | | $I_{OL} = -24 \text{ mA (Note 2)}$ |
| I _{IN} | Maximum Input | 5.5 | | ±0.1 | ±1.0 | μΑ | $V_I = V_{CC}$, GND |
| | Leakage Current | | | | | | |
| I _{OZT} | Maximum I/O | 5.5 | | ±0.3 | ±3.0 | μΑ | $V_{I/O} = V_{CC}$ or GND |
| | Leakage Current | | | | | | $V_{IN} = V_{IH}, \ V_{IL}$ |
| I _{CCT} | Maximum I _{CC} /Input | 5.5 | 0.6 | | 1.5 | mA | $V_{I} = V_{CC} - 2.1V$ |
| I _{OLD} | Minimum Dynamic | 5.5 | | | 75 | mA | V _{OLD} = 1.65V Max |
| I _{OHD} | Output Current (Note 3) | 5.5 | | | -75 | mA | V _{OHD} = 3.85V Min |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40.0 | μΑ | $V_{IN} = V_{CC}$ or GND |

Note 2: All outputs loaded; thresholds on input associated with output under test.

Note 3: Maximum test duration 2.0 ms, one output loaded at a time.

AC Electrical Characteristics

| | Parameter | V _{CC} | | T _A = 25°C | | T _A = -40° | C to +85°C | |
|------------------|--|-----------------|-----|--|------|-----------------------|------------|-------|
| Symbol | | (V) | | $\textbf{C}_{\boldsymbol{L}} = \textbf{50 pF}$ | | $C_L = 50 \text{ pF}$ | | Units |
| | | (Note 4) | Min | Тур | Max | Min | Max | |
| f _{max} | Maximum Input Frequency | 5.0 | 120 | 125 | | 110 | | MHz |
| t _{PLH} | Propagation Delay | 5.0 | 5.0 | 9.0 | 12.5 | 4.0 | 14.0 | ns |
| | CP to Q ₀ or Q ₇ | | | | | | | |
| t _{PHL} | Propagation Delay | 5.0 | 5.0 | 9.0 | 13.5 | 4.5 | 15.0 | ns |
| | CP to Q ₀ or Q ₇ | | | | | | | |
| t _{PLH} | Propagation Delay | 5.0 | 5.0 | 8.5 | 12.5 | 4.5 | 14.5 | ns |
| | CP to I/O _n | | | | | | | |
| t _{PHL} | Propagation Delay | 5.0 | 6.0 | 10.0 | 14.5 | 5.0 | 16.0 | ns |
| | CP to I/O _n | | | | | | | |
| t _{PZH} | Output Enable Time | 5.0 | 3.5 | 7.5 | 11.0 | 3.0 | 12.5 | ns |
| t _{PZL} | Output Enable Time | 5.0 | 3.5 | 7.5 | 11.5 | 3.0 | 13.0 | ns |
| t _{PHZ} | Output Disable Time | 5.0 | 4.0 | 8.5 | 12.5 | 3.0 | 13.5 | ns |
| t _{PLZ} | Output Disable Time | 5.0 | 3.0 | 8.0 | 11.5 | 2.5 | 12.5 | ns |

Note 4: Voltage Range 5.0 is 5.0V ±0.5V

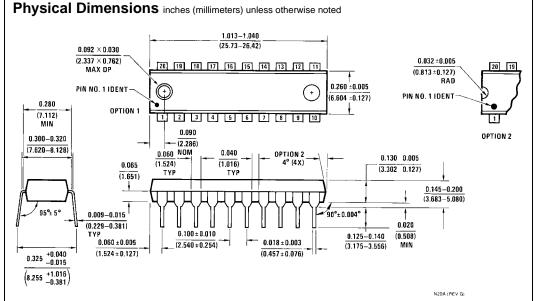
AC Operating Requirements

| Symbol Parameter | | | $T_A = 25^{\circ}C$ $C_L = 50 \text{ pF}$ | | $T_A = -40^{\circ}C$ to $+85^{\circ}C$ | | |
|------------------|--|-----------------|---|-----|--|-------|--|
| | | V _{CC} | | | C _L = 50 pF | Units | |
| | | (V) | $V_{CC} = +5.0V$ | | $V_{CC} = +5.0V$ | | |
| | | (Note 5) | Typ Guara | | ranteed Minimum | | |
| t _S | Setup Time, HIGH or LOW | 5.0 | 2.0 | 5.0 | 5.0 | ns | |
| | S ₀ or S ₁ to CP | | | | | | |
| t _H | Hold Time, HIGH or LOW | 5.0 | 0 | 1.5 | 1.5 | ns | |
| | S ₀ or S ₁ to CP | | | | | | |
| t _S | Setup Time, HIGH or LOW | 5.0 | 1.0 | 4.0 | 4.5 | ns | |
| | I/O _n , DS ₀ , DS ₇ to CP | | | | | | |
| t _H | Hold Time, HIGH or LOW | 5.0 | 0 | 1.0 | 1.0 | ns | |
| | I/O _n , DS ₀ , DS ₇ to CP | | | | | | |
| t _S | Setup Time, HIGH or LOW | 5.0 | 1.0 | 2.5 | 2.5 | ns | |
| | SR to CP | | | | | | |
| t _H | Hold Time, HIGH or LOW | 5.0 | 0 | 1.0 | 1.0 | ns | |
| | SR to CP | | | | | | |
| t _W | CP Pulse Width | 5.0 | 2.0 | 4.0 | 4.5 | ns | |
| | HIGH or LOW | | | | | | |

Note 5: Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

| Symbol | Parameter | Тур | Units | Conditions |
|-----------------|-------------------------------|-----|-------|------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = OPEN |
| C _{PD} | Power Dissipation Capacitance | 170 | pF | V _{CC} = 5.0V |



20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N20A

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