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July 1988  
 Revised November 1999

## 74AC299 • 74ACT299 8-Input Universal Shift/Storage Register with Common Parallel I/O Pins

### General Description

The AC/ACT299 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 Q<sub>0</sub>, Q<sub>7</sub> to allow easy serial cascading. A separate active LOW Master Reset is used to reset the register.

### Features

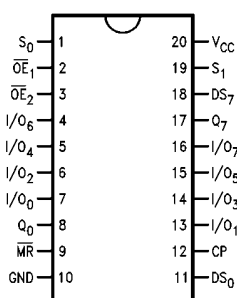
- I<sub>CC</sub> and I<sub>OZ</sub> reduced by 50%
- Common parallel I/O for reduced pin count
- Additional serial inputs and outputs for expansion
- Four operating modes: shift left, shift right, load and store
- 3-STATE outputs for bus-oriented applications
- Outputs source/sink 24 mA
- ACT299 has TTL-compatible inputs

### Ordering Code:

Order Number	Package Number	Package Description
74AC299SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body
74AC299SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC299MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC299PC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT299SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body
74ACT299MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT299PC	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.

### Connection Diagram



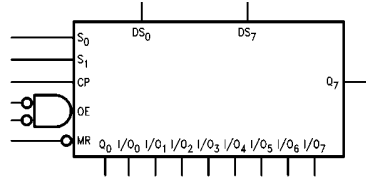
### Pin Descriptions

Pin Names	Description
CP	Clock Pulse Input
DS <sub>0</sub>	Serial Data Input for Right Shift
DS <sub>7</sub>	Serial Data Input for Left Shift
S <sub>0</sub> , S <sub>1</sub>	Mode Select Inputs
MR	Asynchronous Master Reset
OE <sub>1</sub> , OE <sub>2</sub>	3-STATE Output Enable Inputs
I/O <sub>0</sub> -I/O <sub>7</sub>	Parallel Data Inputs or 3-STATE Parallel Outputs
Q <sub>0</sub> , Q <sub>7</sub>	Serial Outputs

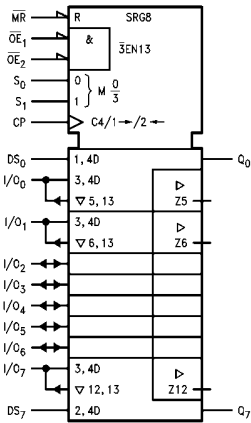
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**Logic Symbols**



**IEEE/IEC**



**Truth Table**

Inputs				Response
MR	S <sub>1</sub>	S <sub>0</sub>	CP	
L	X	X	X	Asynchronous Reset; Q <sub>0</sub> -Q <sub>7</sub> = LOW
H	H	H	↗	Parallel Load; I/O <sub>n</sub> → Q <sub>n</sub>
H	L	H	↗	Shift Right; DS <sub>0</sub> → Q <sub>0</sub> , Q <sub>0</sub> → Q <sub>1</sub> , etc.
H	H	L	↗	Shift Left; DS <sub>7</sub> → Q <sub>7</sub> , Q <sub>7</sub> → Q <sub>6</sub> , etc.
H	L	L	X	Hold

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
↗ = LOW-to-HIGH Transition

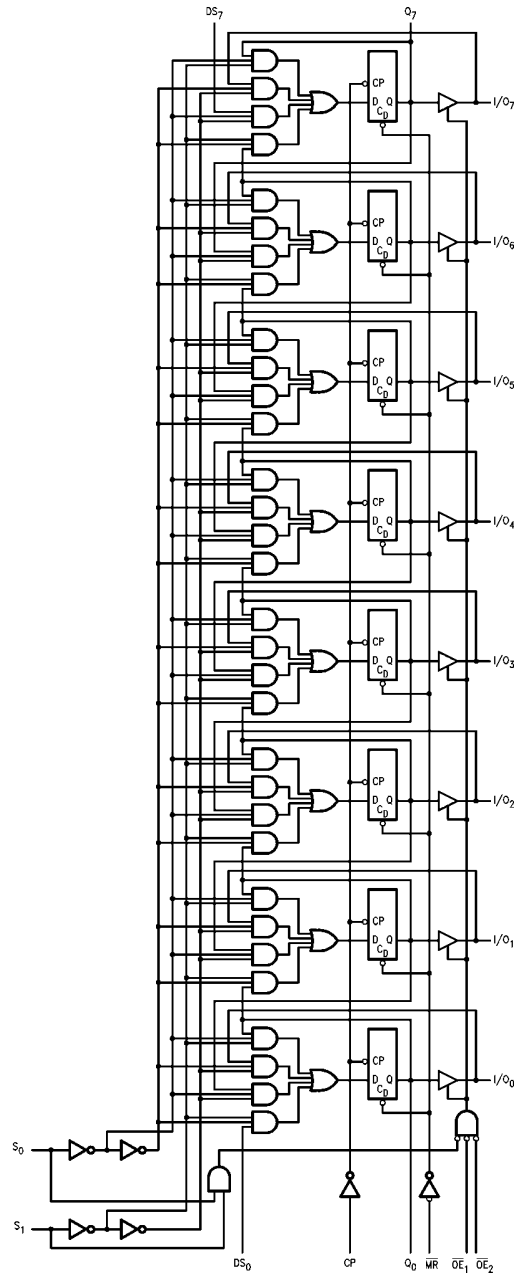
**Functional Description**

The AC/ACT299 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<sub>0</sub> and S<sub>1</sub>, 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<sub>0</sub> and Q<sub>7</sub> are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on 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 OE<sub>1</sub> or OE<sub>2</sub> 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<sub>0</sub> and S<sub>1</sub> in preparation for a parallel load operation.

**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.

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Absolute Maximum Ratings (Note 1)		Recommended Operating Conditions	
Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V	Supply Voltage ( $V_{CC}$ )	(Unless Otherwise Specified)
DC Input Diode Current ( $I_{IK}$ )		AC	2.0V to 6.0V
$V_I = -0.5V$	-20 mA	ACT	4.5V to 5.0V
$V_I = V_{CC} + 0.5V$	+20 mA	Input Voltage ( $V_I$ )	0V to $V_{CC}$
DC Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$	Output Voltage ( $V_O$ )	0V to $V_{CC}$
DC Output Diode Current ( $I_{OK}$ )		Operating Temperature ( $T_A$ )	-40°C to +85°C
$V_O = -0.5V$	-20 mA	Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
$V_O = V_{CC} + 0.5V$	+20 mA	AC Devices	
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$	$V_{IN}$ from 30% to 70% of $V_{CC}$	
DC Output Source or Sink Current ( $I_O$ )	$\pm 50$ mA	$V_{CC}$ @ 3.3V, 4.5V, 5.5V	125 mV/ns
DC $V_{CC}$ or Ground Current		Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
Per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA	ACT Devices	
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C	$V_{IN}$ from 0.8V to 2.0V	
Junction Temperature ( $T_J$ )		$V_{CC}$ @ 4.5V, 5.5V	125 mV/ns
(PDIP)	140°C		

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. Obviously 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 for AC

Symbol	Parameter	$V_{CC}$ (V)	$T_A = 25^\circ C$		$T_A = -40^\circ C$ to $+85^\circ C$		Units	Conditions
			Typ	Guaranteed Limits				
$V_{IH}$	Minimum HIGH Level Input Voltage	3.0	1.5	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		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	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		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	$I_{OUT} = -50 \mu A$	
		4.5	4.49	4.4	4.4			
		5.5	5.49	5.4	5.4			
		3.0		2.56	2.46	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -12$ mA $I_{OH} = -24$ mA $I_{OH} = -24$ mA (Note 2)	
		4.5		3.86	3.76			
		5.5		4.86	4.76			
$V_{OL}$	Maximum LOW Level Output Voltage	3.0	0.002	0.1	0.1	V	$I_{OUT} = 50 \mu A$	
		4.5	0.001	0.1	0.1			
		5.5	0.001	0.1	0.1			
		3.0		0.36	0.44	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = 12$ mA $I_{OH} = 24$ mA $I_{OH} = 24$ mA (Note 2)	
		4.5		0.36	0.44			
		5.5		0.36	0.44			
$I_{IN}$ (Note 4)	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\mu A$	$V_I = V_{CC}, GND$	
$I_{OLD}$	Minimum Dynamic	5.5			86	mA	$V_{OLD} = 1.65V$ Max	
$I_{OHD}$	Output Current (Note 3)				-75	mA	$V_{OHD} = 3.85V$ Min	
$I_{CC}$ (Note 4)	Maximum Quiescent Supply Current	5.5		4.0	40.0	$\mu A$	$V_{IN} = V_{CC}$ or GND	

DC Electrical Characteristics for AC (Continued)							
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C to +85°C		
			Typ	Guaranteed Limits		Units	Conditions
I <sub>OZT</sub>	Maximum I/O Leakage Current	5.5		± 0.3	± 3.0		
<p><b>Note 2:</b> All outputs loaded; threshold on input associated with output under test.  <b>Note 3:</b> Maximum test duration 20 ms, one output loaded at a time.  <b>Note 4:</b> I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.</p>							
DC Electrical Characteristics for ACT							
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C to +85°C		
			Typ	Guaranteed Limits		Units	Conditions
V <sub>IH</sub>	Minimum HIGH Level	4.5	1.5	2.0	2.0		
	Input Voltage	5.5	1.5	2.0	2.0		
V <sub>IL</sub>	Maximum LOW Level	3.0	1.5	0.8	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
	Input Voltage	4.5	1.5	0.8	0.8		
V <sub>OH</sub>	Minimum HIGH Level	4.5	4.49	4.4	4.4	V	I <sub>OUT</sub> = -50 μA
		5.5	5.49	5.4	5.4		
		4.5	0.0001	3.86	3.76	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -24 mA (Note 5)
V <sub>OL</sub>	Maximum LOW Level	4.5	0.001	0.1	0.1	V	I <sub>OUT</sub> = 50 μA
		5.5	0.001	0.1	0.1		
	Output Voltage	4.5		0.36	0.44	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 24 mA (Note 5)
I <sub>IN</sub>	Maximum Input Leakage Current	5.5		± 0.1	± 1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	0.6		1.5	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V
I <sub>OLD</sub>	Minimum Dynamic	5.5			75	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>	Output Current (Note 6)	5.5			-75	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		4.0	40.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
I <sub>OZT</sub>	Maximum I/O Leakage Current	5.5		±0.3	±3.0	μA	V <sub>I</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>I</sub> = V <sub>CC</sub> , GND V <sub>O</sub> = V <sub>CC</sub> , GND
<p><b>Note 5:</b> All outputs loaded; thresholds on input associated with output under test.  <b>Note 6:</b> Maximum test duration 2.0 ms, one output loaded at a time.</p>							

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AC Electrical Characteristics for AC								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 7)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Input Frequency	3.3 5.0	90 130	124 173		80 105		MHz
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>0</sub> or Q <sub>7</sub> (Shift Left or Right)	3.3 5.0	8.5 5.5	14.0 9.5	20.5 14.0	7.0 4.5	22.0 15.0	ns
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>0</sub> or Q <sub>7</sub> (Shift Left or Right)	3.3 5.0	8.5 5.5	14.5 10.0	21.5 14.5	7.0 5.0	23.0 16.0	ns
t <sub>PLH</sub>	Propagation Delay $\overline{CP}$ to I/O <sub>n</sub>	3.3 5.0	9.0 6.0	14.5 10.0	20.5 14.5	7.5 5.0	22.5 16.0	ns
t <sub>PHL</sub>	Propagation Delay $\overline{CP}$ to I/O <sub>n</sub>	3.3 5.0	10.0 6.5	16.0 11.0	23.0 16.0	8.5 6.0	24.5 17.5	ns
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>0</sub> or Q <sub>7</sub>	3.3 5.0	9.0 5.5	15.5 10.5	22.5 15.5	7.5 5.0	25.0 17.0	ns
t <sub>PHL</sub>	Propagation Delay MR to I/O <sub>n</sub>	3.3 5.0	9.0 5.5	15.0 10.0	21.5 15.0	7.5 5.0	24.0 16.5	ns
t <sub>PZH</sub>	Output Enable Time $\overline{OE}$ to I/O <sub>n</sub>	3.3 5.0	7.0 4.5	12.0 8.5	18.0 12.5	6.0 4.0	19.5 13.5	ns
t <sub>PZL</sub>	Output Enable Time $\overline{OE}$ to I/O <sub>n</sub>	3.3 5.0	7.0 5.0	12.5 8.0	18.0 12.5	6.0 4.0	20.5 14.0	ns
t <sub>PHZ</sub>	Output Disable Time $\overline{OE}$ to I/O <sub>n</sub>	3.3 5.0	6.5 3.5	13.0 9.5	18.5 14.0	5.5 3.0	19.5 15.0	ns
t <sub>PLZ</sub>	Output Disable Time $\overline{OE}$ to I/O <sub>n</sub>	3.3 5.0	5.5 3.5	11.5 8.0	17.0 12.5	4.5 2.0	19.0 13.5	ns

**Note 7:** Voltage Range 3.3 is 3.3V ± 0.3V.  
Voltage Range 5.0 is 5.0V ± 0.5V.

AC Operating Requirements for AC							
Symbol	Parameter	V <sub>CC</sub> (V) (Note 8)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Typ	Guaranteed Minimum			
t <sub>S</sub>	Setup Time, HIGH or LOW S <sub>0</sub> or S <sub>1</sub> to CP	3.3 5.0	3.0 2.0	8.0 5.0	8.5 5.5		ns
t <sub>H</sub>	Hold Time, HIGH or LOW S <sub>0</sub> or S <sub>1</sub> to CP	3.3 5.0	-3.0 -1.5	0.5 1.0	0.5 1.0		ns
t <sub>S</sub>	Setup Time, HIGH or LOW I/O <sub>n</sub> to CP	3.3 5.0	2.0 1.0	5.5 3.5	6.0 4.0		ns
t <sub>H</sub>	Hold Time, HIGH or LOW I/O <sub>n</sub> to CP	3.3 5.0	-2.0 -1.0	0 1.0	0 1.0		ns
t <sub>S</sub>	Setup Time, HIGH or LOW DS <sub>0</sub> or DS <sub>7</sub> to CP	3.3 5.0	2.5 1.5	6.5 4.0	7.0 4.5		ns
t <sub>H</sub>	Hold Time, HIGH or LOW DS <sub>0</sub> or DS <sub>7</sub> to CP	3.3 5.0	-2.0 -1.0	0 1.0	0.5 1.0		ns
t <sub>W</sub>	CP Pulse Width, LOW	3.3 5.0	3.5 2.0	4.5 3.5	5.0 3.5		ns
t <sub>W</sub>	$\overline{MR}$ Pulse Width, LOW	3.3 5.0	4.0 2.0	4.5 3.5	5.0 3.5		ns
t <sub>REC</sub>	Recovery Time MR to CP	3.3 5.0	0 0.5	1.5 1.5	1.5 1.5		ns

**Note 8:** Voltage Range 3.3 is 3.3V ± 0.3V  
Voltage Range 5.0 is 5.0V ± 0.5V

AC Electrical Characteristics for ACT								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 9)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Input Frequency	5.0	120	170		110		MHz
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>0</sub> or Q <sub>7</sub> (Shift Left or Right)	5.0	4.0	8.5	12.5	3.0	14.0	ns
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>0</sub> or Q <sub>7</sub> (Shift Left or Right)	5.0	4.0	9.0	13.5	3.5	15.0	ns
t <sub>PLH</sub>	Propagation Delay CP to I/O <sub>n</sub>	5.0	4.5	8.5	12.5	4.5	13.5	ns
t <sub>PHL</sub>	Propagation Delay CP to I/O <sub>n</sub>	5.0	5.0	9.5	15.0	4.5	16.5	ns
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>0</sub> or Q <sub>7</sub>	5.0	4.0	14.0	15.0	4.0	18.0	ns
t <sub>PHL</sub>	Propagation Delay MR to I/O <sub>n</sub>	5.0	4.0	13.0	14.5	3.5	17.5	ns
t <sub>PZH</sub>	Output Enable Time OE to I/O <sub>n</sub>	5.0	2.5	8.0	12.0	1.5	13.0	ns
t <sub>PZL</sub>	Output Enable Time OE to I/O <sub>n</sub>	5.0	2.0	8.0	12.0	1.5	13.5	ns
t <sub>PHZ</sub>	Output Disable Time OE to I/O <sub>n</sub>	5.0	2.0	8.5	12.5	2.0	13.5	ns
t <sub>PLZ</sub>	Output Disable Time OE to I/O <sub>n</sub>	5.0	2.5	8.0	11.5	2.0	12.5	ns

**Note 9:** Voltage Range 5.0 is 5.0V ± 0.5V.

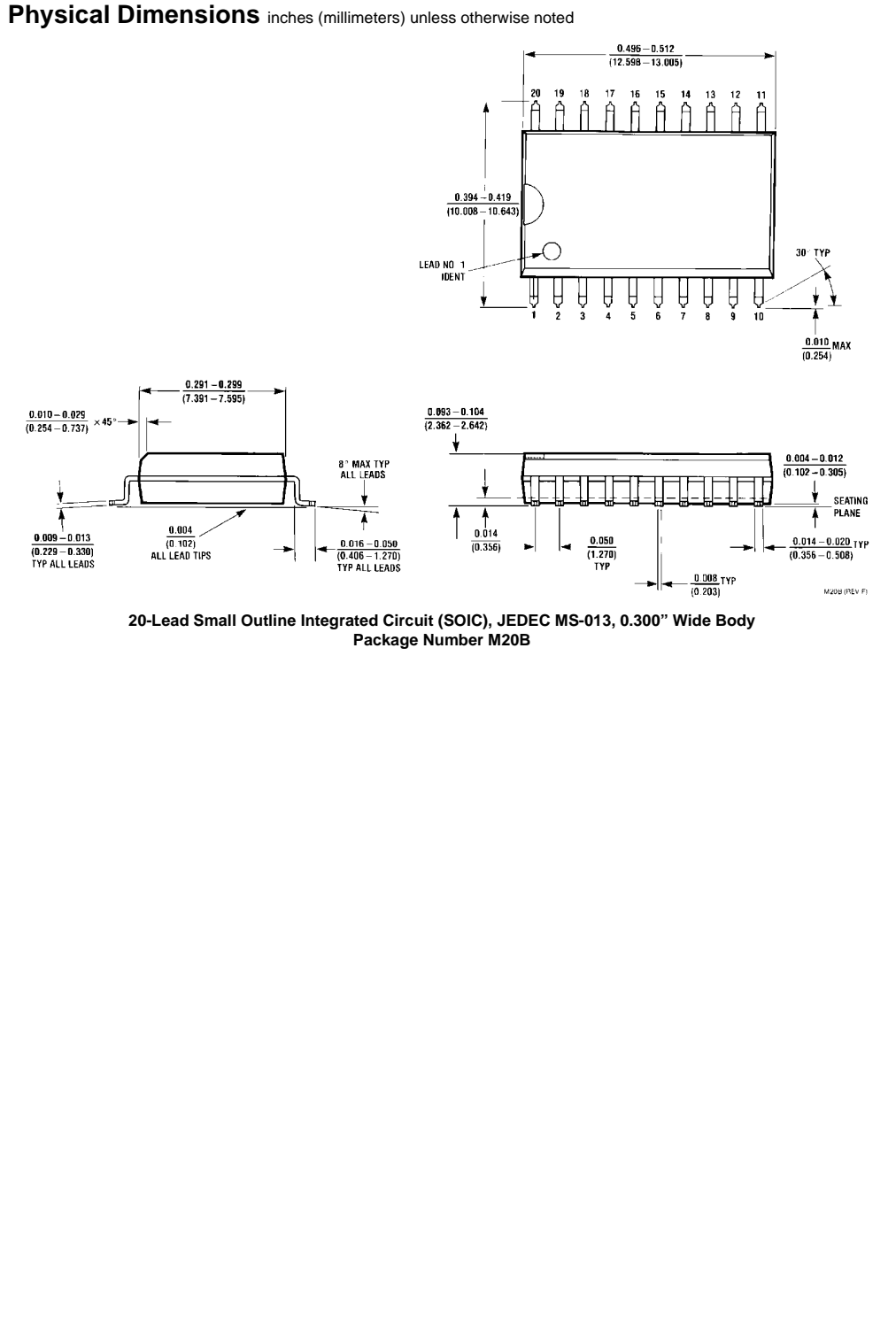
AC Operating Requirements for ACT						
Symbol	Parameter	V <sub>CC</sub> (V) (Note 10)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF	Units
			Typ	Guaranteed Minimum		
t <sub>S</sub>	Setup Time, HIGH or LOW S <sub>0</sub> or S <sub>1</sub> to CP	5.0	2.0	5.0	5.5	ns
t <sub>H</sub>	Hold Time, HIGH or LOW S <sub>0</sub> or S <sub>1</sub> to CP	5.0	-2.0	1.0	1.0	ns
t <sub>S</sub>	Setup Time, HIGH or LOW I/O <sub>n</sub> to CP	5.0	1.5	4.0	4.5	ns
t <sub>H</sub>	Hold Time, HIGH or LOW I/O <sub>n</sub> to CP	5.0	-1.0	1.0	1.0	ns
t <sub>S</sub>	Setup Time, HIGH or LOW DS <sub>0</sub> or DS <sub>7</sub> to CP	5.0	1.5	4.5	5.0	ns
t <sub>H</sub>	Hold Time, HIGH or LOW DS <sub>0</sub> or DS <sub>7</sub> to CP	5.0	-1.0	1.0	1.0	ns
t <sub>W</sub>	CP Pulse Width HIGH or LOW	5.0	2.0	4.0	4.5	ns
t <sub>W</sub>	MR Pulse Width, LOW	5.0	2.0	3.5	3.5	ns
t <sub>REC</sub>	Recovery Time, MR to CP	5.0	0	1.5	1.5	ns

**Note 10:** Voltage Range 5.0 is 5.0V ± 0.5V.

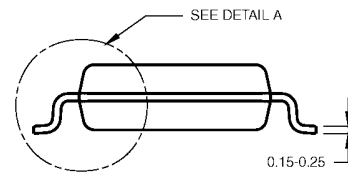
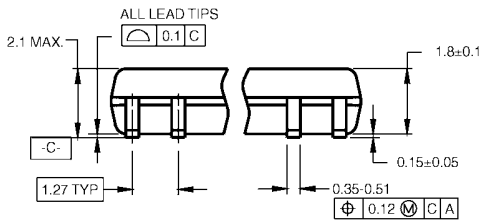
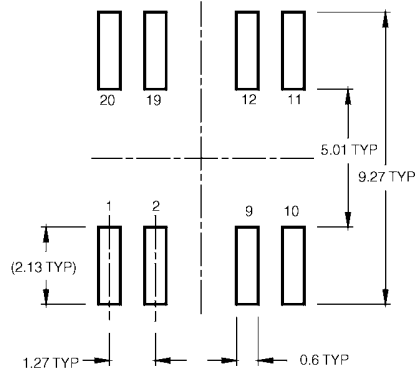
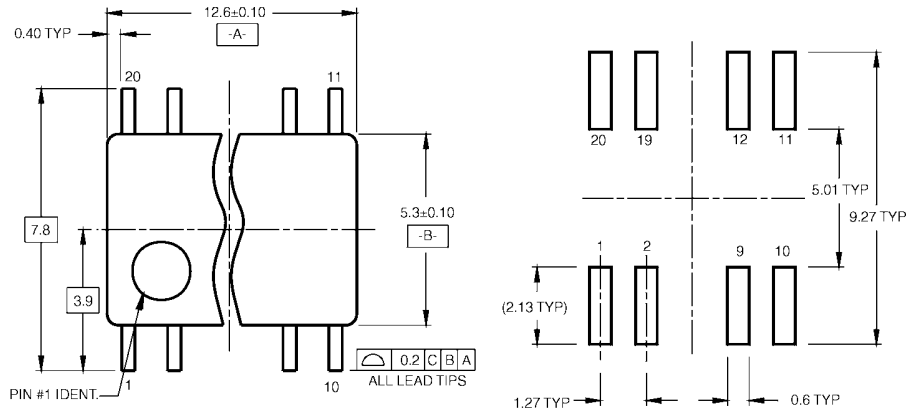
Capacitance				
Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = 5.0V
C <sub>PD</sub>	Power Dissipation Capacitance	170	pF	V <sub>CC</sub> = 5.5V



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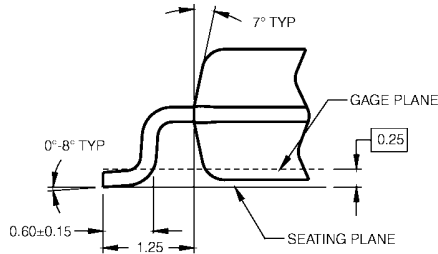
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

- NOTES:  
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.  
 B. DIMENSIONS ARE IN MILLIMETERS.  
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND THE BAR EXTRUSIONS.

M20DRRevB1

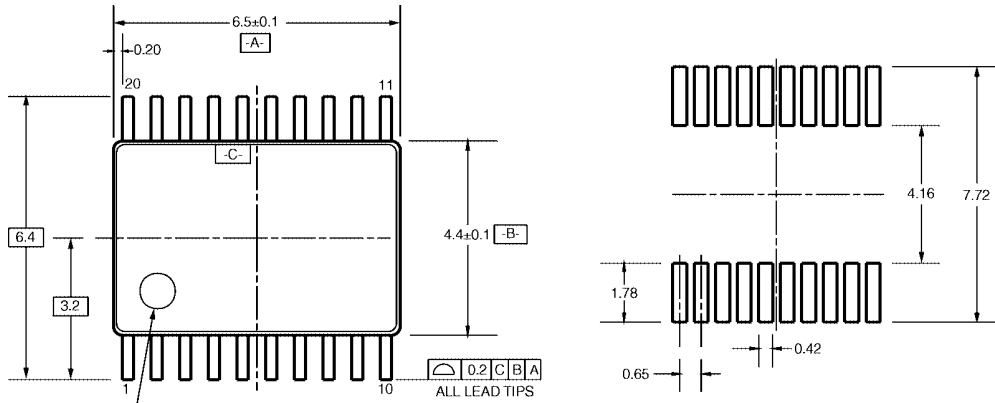


DETAIL A

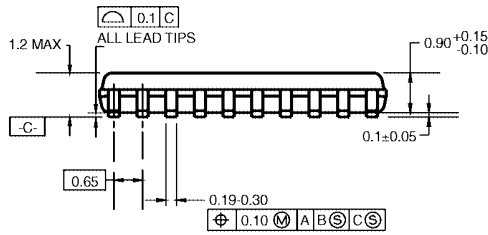
**20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**  
**Package Number M20D**

74AC299 • 74ACT299

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION

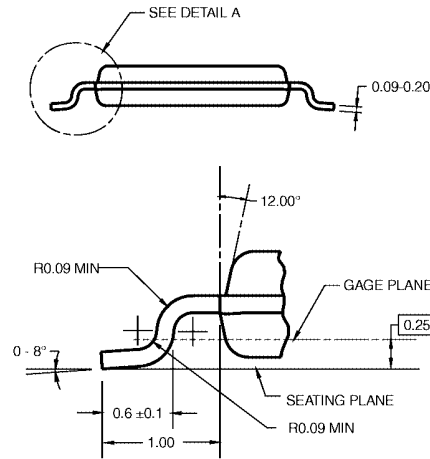


DIMENSIONS ARE IN MILLIMETERS

NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20RevD1



DETAIL A

**20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC20**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

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

N20A (REV G)

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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74ACT299 • 74ACT299 8-Input Universal Shift/Storage Register