

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

The MC74AC323/74ACT323 is an 8-bit universal shift/storage register with 3-state outputs. Its function is similar to the MC74AC299/74ACT299 with the exception of Synchronous Reset. 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.

- 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
- 'ACT323 Has TTL Compatible Inputs

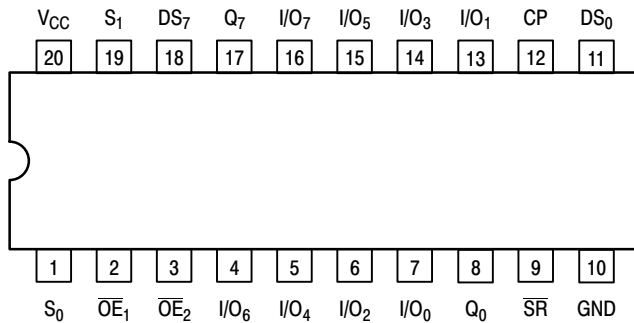


Figure 1. Pinout: 20-Lead Packages Conductors (Top View)

PIN NAMES

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
SR	Synchronous Master Reset
$\overline{OE}_1, \overline{OE}_2$	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

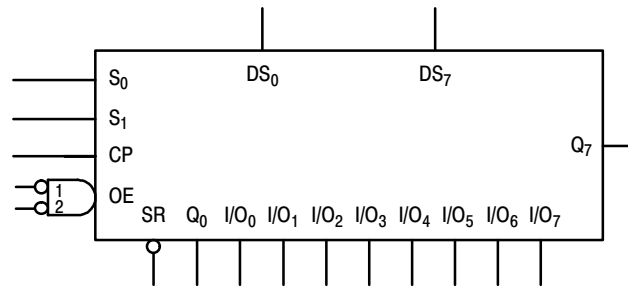
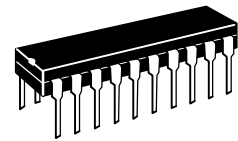


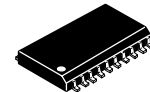
Figure 2. LOGIC SYMBOL

MC74AC323
MC74ACT323

**8-INPUT UNIVERSAL SHIFT/
STORAGE REGISTER WITH
SYNCHRONOUS RESET
AND COMMON I/O PINS**

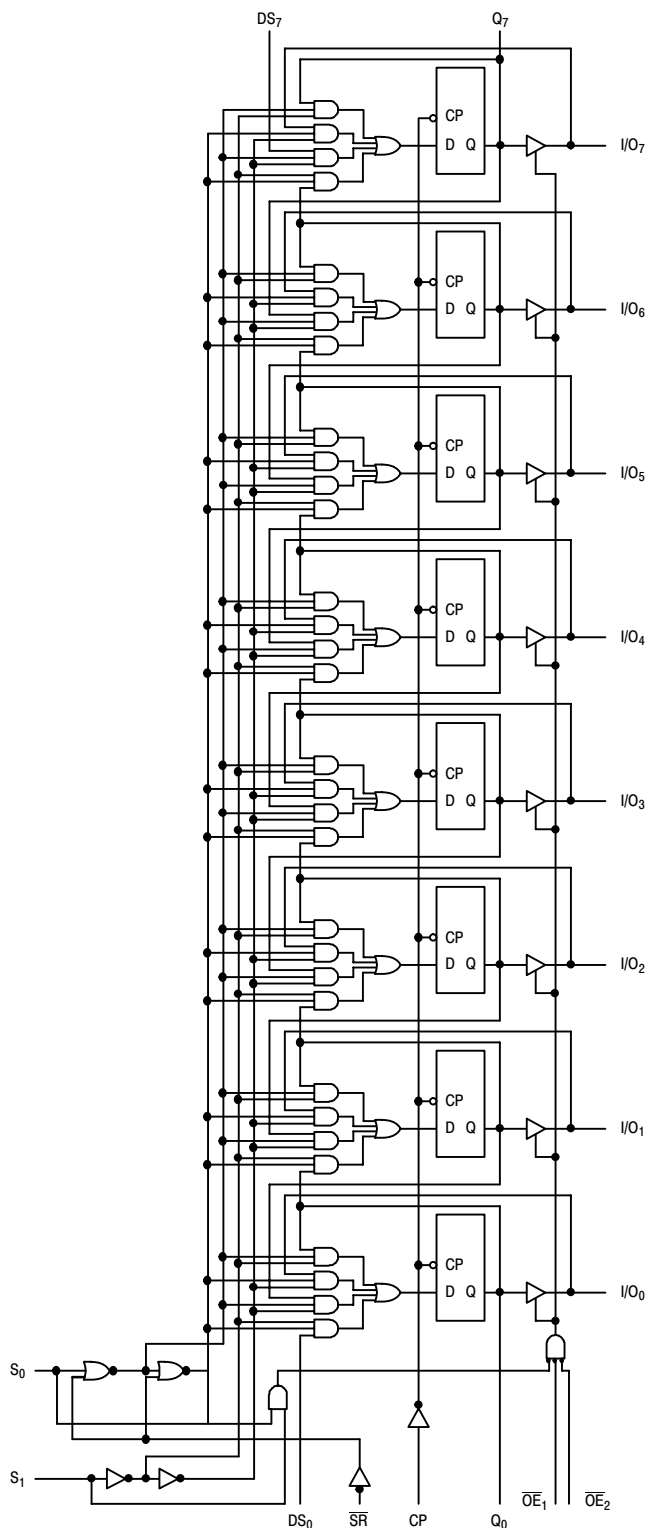


**N SUFFIX
CASE 738-03
PLASTIC**



**DW SUFFIX
CASE 751D-04
PLASTIC**

MC74AC323 MC74ACT323



Please 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

FUNCTIONAL DESCRIPTION

The MC74AC323/74ACT323 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 S₀ and S₁ 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. Q₀ and Q₇ are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on \overline{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{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 S₀ and S₁ in preparation for a parallel load operation.

TRUTH TABLE

Inputs				Response
\overline{SR}	S ₁	S ₀	CP	
L	X	X	\downarrow	Synchronous Reset; Q ₀ – Q ₇ = LOW
H	H	H	\downarrow	Parallel Load; I/O _n → Q _n
H	L	H	\downarrow	Shift Right; DS ₀ → Q ₀ , Q ₀ → Q ₁ , etc.
H	H	L	\downarrow	Shift Left; DS ₇ → Q ₇ , Q ₇ → Q ₆ , etc.
H	L	L	X	Hold

H = HIGH Voltage Level X = Immaterial
L = LOW Voltage Level \downarrow = LOW-to-HIGH Clock 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	°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 V		150	ns/V	
		V _{CC} @ 4.5 V		40		
		V _{CC} @ 5.5 V		25		
t _r , t _f	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	V _{CC} @ 4.5 V		10	ns/V	
		V _{CC} @ 5.5 V		8.0		
T _J	Junction Temperature (PDIP)			140	°C	
T _A	Operating Ambient Temperature Range	–40	25	85	°C	
I _{OH}	Output Current — High			–24	mA	
I _{OL}	Output Current — Low			24	mA	

- V_{in} from 30% to 70% V_{CC}; see individual Data Sheets for devices that differ from the typical input rise and fall times.
- 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		2.56	2.46	V	*V _{IN} = V _{IL} or V _{IH} -12 mA I _{OH} -24 mA -24 mA	
		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 μA	
		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} 12 mA I _{OL} 24 mA 24 mA	
		4.5		0.36	0.44			
		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	
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}.

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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	Max	Min	Max		
f _{max}	Maximum Input Frequency	3.3 5.0					MHz	3-3
t _{PLH}	Propagation Delay CP to Q ₀ or Q ₇	3.3 5.0					ns	3-6
t _{PHL}	Propagation Delay CP to Q ₀ or Q ₇	3.3 5.0					ns	3-6
t _{PLH}	Propagation Delay CP to I/O _n	3.3 5.0					ns	3-6
t _{PHL}	Propagation Delay CP to I/O _n	3.3 5.0					ns	3-6
t _{PZH}	Output Enable Time	3.3 5.0					ns	3-7
t _{PZL}	Output Enable Time	3.3 5.0					ns	3-8
t _{PHZ}	Output Disable Time	3.3 5.0					ns	3-7
t _{PLZ}	Output Disable Time	3.3 5.0					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					ns	3-9
t _h	Hold Time, HIGH or LOW S ₀ or S ₁ to CP	3.3 5.0					ns	3-9
t _s	Setup Time, HIGH or LOW I/O _n , DS ₀ , DS ₇ to CP	3.3 5.0					ns	3-9
t _h	Hold Time, HIGH or LOW I/O _n , DS ₀ , DS ₇ to CP	3.3 5.0					ns	3-9
t _s	Setup Time, HIGH or LOW SR to CP	3.3 5.0					ns	3-9
t _h	Hold Time, HIGH or LOW SR to CP	3.3 5.0					ns	3-9
t _w	CP Pulse Width HIGH or LOW	3.3 5.0					ns	3-6

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

MC74AC323 MC74ACT323

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} -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} 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.

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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	125		110		MHz	3-3
t _{PLH}	Propagation Delay CP to Q ₀ or Q ₇	5.0	5.0	9.0	12.5	4.0	14	ns	3-6
t _{PHL}	Propagation Delay CP to Q ₀ or Q ₇	5.0	5.0	9.0	13.5	4.5	15	ns	3-6
t _{PLH}	Propagation Delay CP to I/O _n	5.0	5.0	8.5	12.5	4.5	14.5	ns	3-6
t _{PHL}	Propagation Delay CP to I/O _n	5.0	6.0	10	14.5	5.0	16	ns	3-6
t _{PZH}	Output Enable Time	5.0	3.5	7.5	11	3.0	12.5	ns	3-7
t _{PZL}	Output Enable Time	5.0	3.5	7.5	11.5	3.0	13	ns	3-8
t _{PHZ}	Output Disable Time	5.0	4.0	8.5	12.5	3.0	13.5	ns	3-7
t _{PLZ}	Output Disable Time	5.0	3.0	8.0	11.5	2.5	12.5	ns	3-8

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

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	2.0	5.0	5.0	ns	3-9	
t _h	Hold Time, HIGH or LOW S ₀ or S ₁ to CP	5.0	0	1.5	1.5	ns	3-9	
t _s	Setup Time, HIGH or LOW I/O _n , DS ₀ , DS ₇ to CP	5.0	1.0	4.0	4.5	ns	3-9	
t _h	Hold Time, HIGH or LOW I/O _n , DS ₀ , DS ₇ to CP	5.0	0	1.0	1.0	ns	3-9	
t _s	Setup Time, HIGH or LOW SR to CP	5.0	1.0	2.5	2.5	ns	3-9	
t _h	Setup Time, HIGH or LOW SR to CP	5.0	0	1.0	1.0	ns	3-9	
t _w	CP Pulse Width HIGH or LOW	5.0	2.0	4.0	4.5	ns	3-6	

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

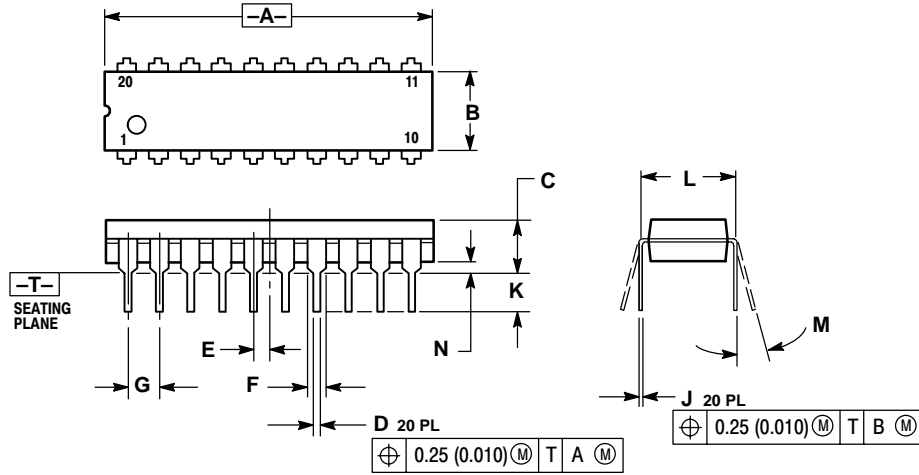
CAPACITANCE

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

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OUTLINE DIMENSIONS

N SUFFIX
 PLASTIC DIP PACKAGE
 CASE 738-03
 ISSUE E



NOTES:

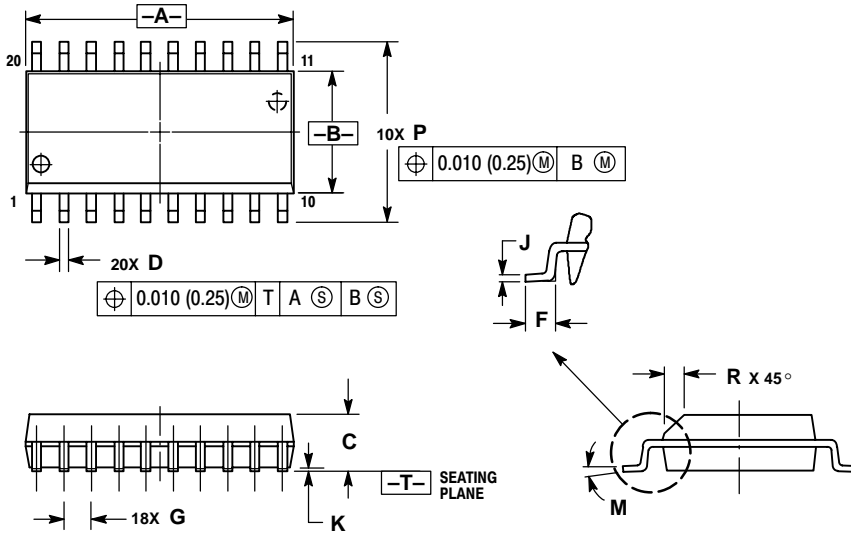
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

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

MC74AC323 MC74ACT323

OUTLINE DIMENSIONS

DW SUFFIX
 PLASTIC SOIC PACKAGE
 CASE 751D-04
 ISSUE E




NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.65	12.95	0.499	0.510
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

Notes

Notes

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