

## 74AC374 • 74ACT374

### Octal D-Type Flip-Flop with 3-STATE Outputs

#### General Description

The AC/ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ( $\overline{OE}$ ) are common to all flip-flops.

#### Features

- $I_{CC}$  and  $I_{OZ}$  reduced by 50%
- Buffered positive edge-triggered clock
- 3-STATE outputs for bus-oriented applications
- Outputs source/sink 24 mA
- See 273 for reset version
- See 377 for clock enable version
- See 373 for transparent latch version
- See 574 for broadside pinout version
- See 564 for broadside pinout version with inverted outputs
- ACT374 has TTL-compatible inputs

#### Ordering Code:

Order Number	Package Number	Package Description
74AC374SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74AC374SCX_NL (Note 1)	M20B	Pb-Free 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74AC374SJ	M20D	Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC374MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC374PC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT374SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74ACT374SJ	M20D	Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT374MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide
74ACT374MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT374MTCX_NL (Note 1)	MTC20	Pb-Free 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT374PC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

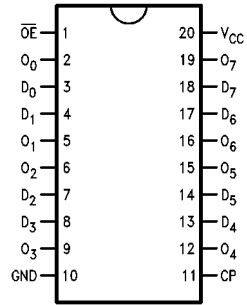
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.  
Pb-Free package per JEDEC J-STD-020B.

**Note 1:** "\_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

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### Connection Diagram



### Pin Descriptions

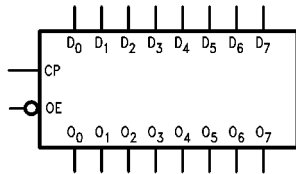
Pin Names	Description
D <sub>0</sub> -D <sub>7</sub>	Data Inputs
CP	Clock Pulse Input
$\overline{OE}$	3-STATE Output Enable Input
O <sub>0</sub> -O <sub>7</sub>	3-STATE Outputs

### Truth Table

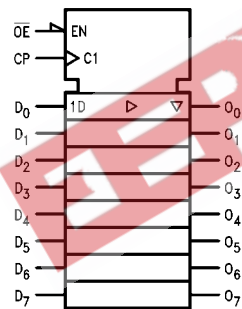
Inputs			Outputs
D <sub>n</sub>	CP	$\overline{OE}$	O <sub>n</sub>
H	↗	L	H
L	↗	L	L
X	X	H	Z

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

### Logic Symbols



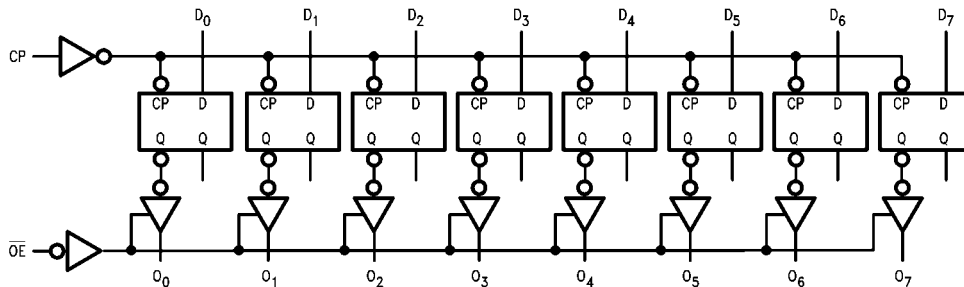
IEEE/IEC



### Functional Description

The AC/ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and 3-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable ( $\overline{OE}$ ) LOW, the contents of the eight flip-flops are available at the outputs. When the  $\overline{OE}$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

### 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 2)

Supply Voltage ( $V_{CC}$ )	- 0.5V to + 7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	- 20 mA
$V_I = V_{CC} + 0.5V$	+ 20 mA
DC Input Voltage ( $V_I$ )	- 0.5V to $V_{CC} + 0.5V$
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	- 20 mA
$V_O = V_{CC} + 0.5V$	+ 20 mA
DC Output Voltage ( $V_O$ )	- 0.5V to $V_{CC} + 0.5V$
DC Output Source	
or Sink Current ( $I_O$ )	$\pm 50$ mA
DC $V_{CC}$ or Ground Current	
per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA
Storage Temperature ( $T_{STG}$ )	- 65°C to + 150°C
Junction Temperature ( $T_J$ )	
(PDIP)	140°C

**Recommended Operating Conditions**

Supply Voltage ( $V_{CC}$ )	
AC	2.0V to 6.0V
ACT	4.5V to 5.5V
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	-40°C to +85°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
AC Devices	
$V_{IN}$ from 30% to 70% of $V_{CC}$	
$V_{CC}$ @ 3.3V, 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
ACT Devices	
$V_{IN}$ from 0.8V to 2.0V	
$V_{CC}$ @ 4.5V, 5.5V	125 mV/ns

**Note 2:** Absolute maximum ratings are those values beyond which damage to the device may occur. The datobook 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 datobook specifications.

**DC Electrical Characteristics for AC**

Symbol	Parameter	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions
			Typ	Guaranteed Limits	Guaranteed Limits	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	$I_{OUT} = -50 \mu\text{A}$	
		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 $V_{IH}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ (Note 3)	
		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	$I_{OUT} = 50 \mu\text{A}$	
		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 $V_{IH}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ (Note 3)	
		4.5		0.36	0.44			
		5.5		0.36	0.44			
$I_{IN}$ (Note 5)	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\mu\text{A}$	$V_I = V_{CC}$ , GND	
$I_{OZ}$	Maximum 3-STATE Current	5.5		$\pm 0.25$	$\pm 2.5$	$\mu\text{A}$	$V_I$ (OE) = $V_{IL}$ , $V_{IH}$ $V_I = V_{CC}$ , GND $V_O = V_{CC}$ , GND	
$I_{OLD}$	Minimum Dynamic	5.5			75	mA	$V_{OLD} = 1.65V$ Max	
$I_{OHD}$	Output Current (Note 4)	5.5			-75	mA	$V_{OHD} = 3.85V$ Min	
$I_{CC}$ (Note 5)	Maximum Quiescent Supply Current	5.5		4.0	40.0	$\mu\text{A}$	$V_{IN} = V_{CC}$ or GND	

**Note 3:** All outputs loaded; thresholds on input associated with output under test.

**Note 4:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 5:**  $I_{IN}$  and  $I_{CC}$  @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V  $V_{CC}$ .

## 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		Units	Conditions
			Typ	Guaranteed Limits				
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	4.5	1.5	2.0	2.0	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	
		5.5	1.5	2.0	2.0			
V <sub>IL</sub>	Maximum LOW Level Input Voltage	4.5	1.5	0.8	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	
		5.5	1.5	0.8	0.8			
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	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		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 6)	
		5.5		4.86	4.76			
V <sub>OL</sub>	Maximum LOW Level Output Voltage	4.5	0.001	0.1	0.1	V	I <sub>OUT</sub> = 50 μA	
		5.5	0.001	0.1	0.1			
		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 6)	
		5.5		0.36	0.44			
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>OZ</sub>	Maximum 3-STATE Current	5.5		±0.25	±2.5	μA	V <sub>I</sub> = V <sub>IL</sub> , V <sub>IH</sub> V <sub>O</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 7)	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	

Note 6: All outputs loaded; thresholds on input associated with output under test.

Note 7: Maximum test duration 2.0 ms, one output loaded at a time.

## AC Electrical Characteristics

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
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency	3.3 5.0	60 100	110 155		60 100		MHz
t <sub>PLH</sub>	Propagation Delay CP to O <sub>n</sub>	3.3	3.0	11.0	13.5	1.5	15.5	ns
		5.0	2.5	8.0	9.5	1.5	10.5	
t <sub>PHL</sub>	Propagation Delay CP to O <sub>n</sub>	3.3	2.5	10.0	12.5	2.0	14.0	ns
		5.0	2.0	7.0	9.0	1.5	10.0	
t <sub>PZH</sub>	Output Enable Time	3.3	3.0	9.5	11.5	1.5	13.0	ns
		5.0	2.0	7.0	8.5	1.0	9.5	
t <sub>PZL</sub>	Output Enable Time	3.3	2.5	9.0	11.5	1.5	13.0	ns
		5.0	2.0	6.5	8.5	1.0	9.5	
t <sub>PHZ</sub>	Output Disable Time	3.3	3.0	10.5	12.5	2.0	14.5	ns
		5.0	2.0	8.0	11.0	2.0	12.5	
t <sub>PLZ</sub>	Output Disable Time	3.3	2.0	8.0	11.5	1.0	12.5	ns
		5.0	1.5	6.5	8.5	1.0	10.0	

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

AC Operating Requirements							
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
			Typ	Guaranteed Minimum			
t <sub>S</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to CP	3.3	2.0	5.5	6.0		ns
		5.0	1.0	4.0	4.5		
t <sub>H</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	3.3	-1.0	1.0	1.0		ns
		5.0	0	1.5	1.5		
t <sub>W</sub>	CP Pulse Width, HIGH or LOW	3.3	4.0	5.5	6.0		ns
		5.0	2.5	4.0	4.5		

Note 9: Voltage Range 3.3 is 3.3V ± 0.3V  
Voltage Range 5.0 is 5.0V ± 0.5V

### AC Electrical Characteristics

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
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency	5.0	100	160		90		MHz
t <sub>PLH</sub>	Propagation Delay CP to O <sub>n</sub>	5.0	2.0	8.5	10.0	2.0	11.5	ns
t <sub>PHL</sub>	Propagation Delay CP to O <sub>n</sub>	5.0	2.0	8.0	9.5	1.5	11.0	ns
t <sub>PZH</sub>	Output Enable Time	5.0	2.0	8.0	9.5	1.5	10.5	ns
t <sub>PZL</sub>	Output Enable Time	5.0	1.5	8.0	9.0	1.5	10.5	ns
t <sub>PHZ</sub>	Output Disable Time	5.0	1.5	8.5	11.5	1.0	12.5	ns
t <sub>PLZ</sub>	Output Disable Time	5.0	1.5	7.0	8.5	1.0	10.0	ns

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

### AC Operating Requirements

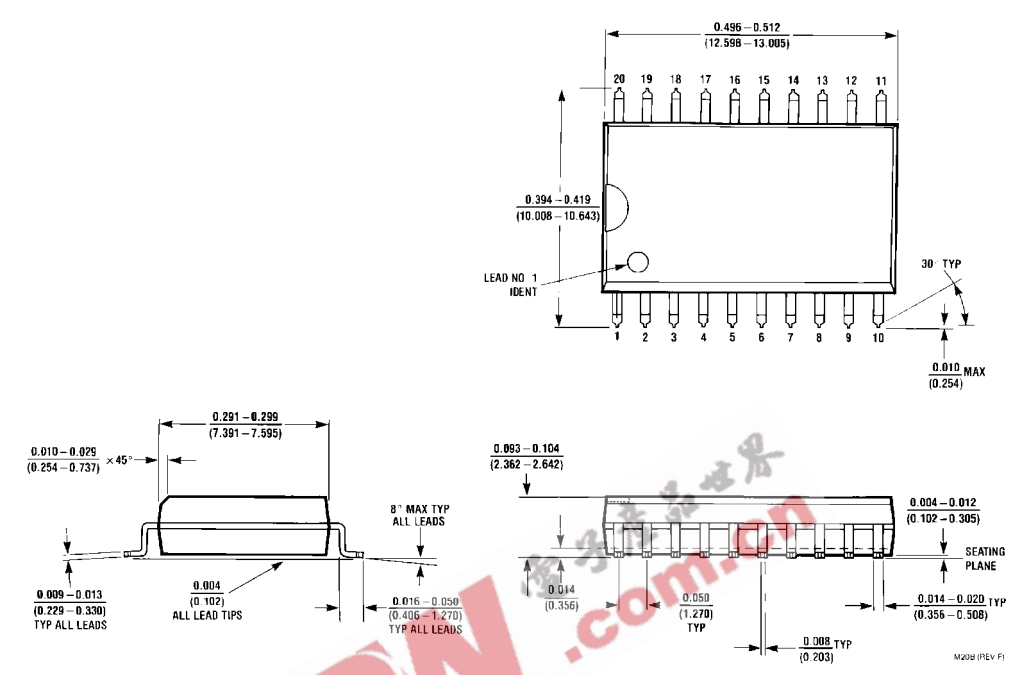
Symbol	Parameter	V <sub>CC</sub> (V) (Note 11)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Typ	Guaranteed Minimum			
t <sub>S</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to CP	5.0	1.0	5.5	5.5		ns
t <sub>H</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	5.0	0	1.5	1.5		ns
t <sub>W</sub>	CP Pulse Width, HIGH or LOW	5.0	2.5	5.0	5.0		ns

Note 11: 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> = OPEN

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



**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M20B**

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



LAND PATTERN RECOMMENDATION

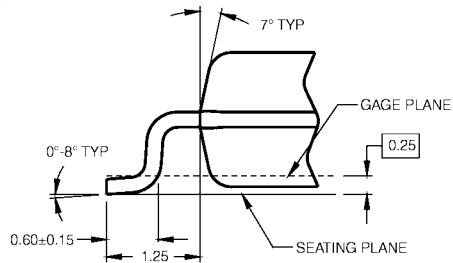


DIMENSIONS ARE IN MILLIMETERS

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 TIE BAR EXTRUSIONS.

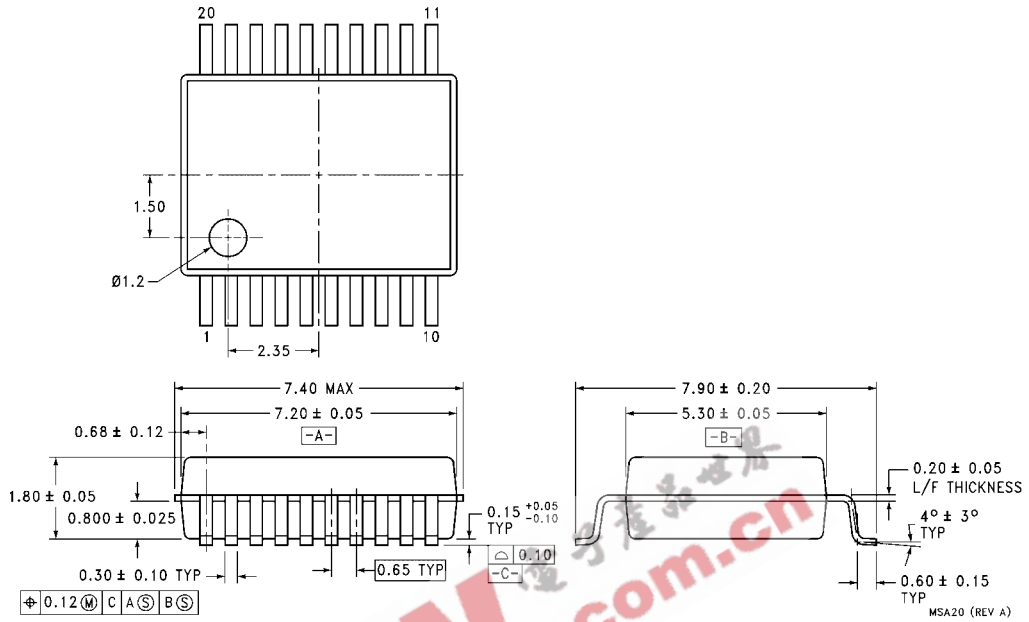
M20DRevB1



DETAIL A

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

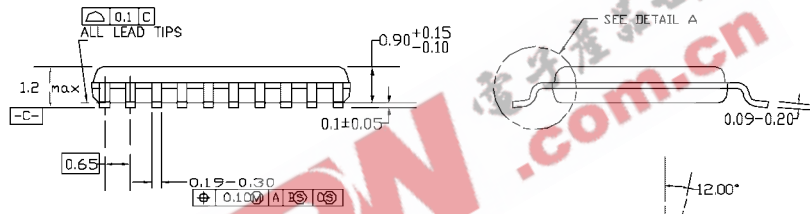
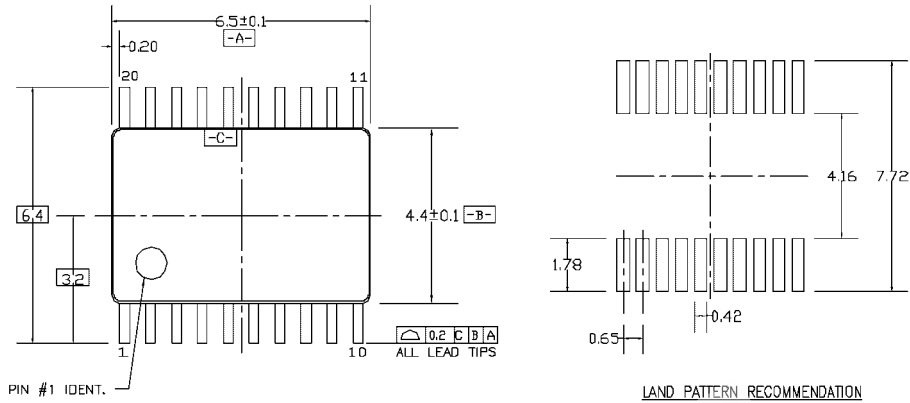
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide  
Package Number MSA20**



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



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, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20REVD1

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

