

# 74ABT541

## Octal Buffer/Line Driver with 3-STATE Outputs

### General Description

The ABT541 is an octal buffer and line driver with 3-STATE outputs designed to be employed as a memory and address driver, clock driver, or bus-oriented transmitter/receiver. The ABT541 is similar to the ABT244 with broad-side pinout.

### Features

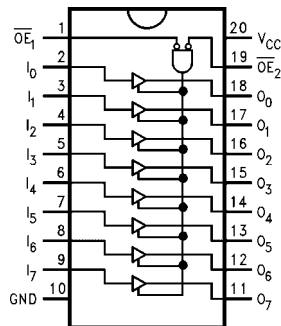
- Non-inverting buffers
- Output sink capability of 64 mA, source capability of 32 mA
- Guaranteed output skew
- Guaranteed multiple output switching specifications
- Output switching specified for both 50 pF and 250 pF loads
- Guaranteed simultaneous switching, noise level and dynamic threshold performance
- Guaranteed latchup protection
- High impedance, glitch free bus loading during entire power up and power down cycle
- Nondestructive hot insertion capability
- Flow-through pinout for ease of PC board layout
- Disable time less than enable time to avoid bus contention

### Ordering Code:

Order Number	Package Number	Package Description
74ABT541CSC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body
74ABT541CSJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ABT541CMSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
74ABT541CMTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ABT541CPC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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

### Connection Diagram



### Pin Descriptions

Pin Names	Description
$\overline{OE}_1, \overline{OE}_2$	Output Enable Input (Active LOW)
$I_0-I_7$	Inputs
$O_0-O_7$	Outputs

### Truth Table

Inputs			Outputs
$\overline{OE}_1$	$\overline{OE}_2$	I	
L	L	H	H
H	X	X	Z
X	H	X	Z
L	L	L	L

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = High Impedance

**Absolute Maximum Ratings**(Note 1)

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +150°C
V <sub>CC</sub> Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Any Output in the Disabled or Power-Off State	−0.5V to 5.5V
in the HIGH State	−0.5V to V <sub>CC</sub>
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (mA)
DC Latchup Source Current	−500 mA
Over Voltage Latchup (I/O)	10V

**Recommended Operating Conditions**

Free Air Ambient Temperature	−40°C to +85°C
Supply Voltage	+4.5V to +5.5V
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
Data Input	50 mV/ns
Enable Input	20 mV/ns

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**DC Electrical Characteristics**

Symbol	Parameter	Min	Typ	Max	Units	V <sub>CC</sub>	Conditions
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			−1.2	V	Min	I <sub>IN</sub> = −18 mA
V <sub>OH</sub>	Output HIGH Voltage	2.5			V	Min	I <sub>OH</sub> = −3 mA
		2.0			V	Min	I <sub>OH</sub> = −32 mA
V <sub>OL</sub>	Output LOW Voltage			0.55	V	Min	I <sub>OL</sub> = 64 mA
I <sub>IH</sub>	Input HIGH Current			1	μA	Max	V <sub>IN</sub> = 2.7V (Note 4)
				1	μA		V <sub>IN</sub> = V <sub>CC</sub>
I <sub>BVI</sub>	Input HIGH Current Breakdown Test			7	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>IL</sub>	Input LOW Current			−1	μA	Max	V <sub>IN</sub> = 0.5V (Note 4)
				−1	μA		V <sub>IN</sub> = 0.0V
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OZH</sub>	Output Leakage Current			10	μA	0 – 5.5V	V <sub>OUT</sub> = 2.7V; $\overline{OE}_n$ = 2.0V
I <sub>OZL</sub>	Output Leakage Current			−10	μA	0 – 5.5V	V <sub>OUT</sub> = 0.5V; $\overline{OE}_n$ = 2.0V
I <sub>OS</sub>	Output Short-Circuit Current	−100		−275	mA	Max	V <sub>OUT</sub> = 0.0V
I <sub>CEX</sub>	Output HIGH Leakage Current			50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
I <sub>ZZ</sub>	Bus Drainage Test			100	μA	0.0	V <sub>OUT</sub> = 5.5V; All Others GND
I <sub>CCH</sub>	Power Supply Current			50	μA	Max	All Outputs HIGH
I <sub>CCL</sub>	Power Supply Current			30	mA	Max	All Outputs LOW
I <sub>CCZ</sub>	Power Supply Current			50	μA	Max	$\overline{OE}_n$ = V <sub>CC</sub> ; All Others at V <sub>CC</sub> or Ground
I <sub>CCT</sub>	Additional I <sub>CC</sub> /Input			2.5	mA		V <sub>I</sub> = V <sub>CC</sub> − 2.1V
	Outputs Enabled			2.5	mA	Max	Enable Input V <sub>I</sub> = V <sub>CC</sub> − 2.1V
	Outputs 3-STATE			50	μA		Data Input V <sub>I</sub> = V <sub>CC</sub> − 2.1V;
	Outputs 3-STATE						All Others at V <sub>CC</sub> or Ground
I <sub>CCD</sub>	Dynamic I <sub>CC</sub>				mA/ MHz	Max	Outputs Open, $\overline{OE}_n$ = GND, One Bit Toggling (Note 3), 50% Duty Cycle
	(Note 4)			0.1			

**Note 3:** For 8 bits toggling, I<sub>CCD</sub> < 0.8 mA/MHz.

**Note 4:** Guaranteed, but not tested.

## DC Electrical Characteristics

(SOIC Package)

Symbol	Parameter	Min	Typ	Max	Units	V <sub>CC</sub>	Conditions C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω
V <sub>OLP</sub>	Quiet Output Maximum Dynamic V <sub>OL</sub>		0.7	1.0	V	5.0	T <sub>A</sub> = 25°C (Note 5)
V <sub>OLV</sub>	Quiet Output Minimum Dynamic V <sub>OL</sub>	-1.3	-0.8		V	5.0	T <sub>A</sub> = 25°C (Note 5)
V <sub>OHV</sub>	Minimum HIGH Level Dynamic Output Voltage	2.7	3.1		V	5.0	T <sub>A</sub> = 25°C (Note 6)
V <sub>IHD</sub>	Minimum HIGH Level Dynamic Input Voltage	2.0	1.4		V	5.0	T <sub>A</sub> = 25°C (Note 7)
V <sub>ILD</sub>	Maximum LOW Level Dynamic Input Voltage		1.1	0.6	V	5.0	T <sub>A</sub> = 25°C (Note 7)

**Note 5:** Max number of outputs defined as (n). n – 1 data inputs are driven 0V to 3V. One output at LOW. Guaranteed, but not tested.

**Note 6:** Max number of outputs defined as (n). n – 1 data inputs are driven 0V to 3V. One output HIGH. Guaranteed, but not tested.

**Note 7:** Max number of data inputs (n) switching. n – 1 inputs switching 0V to 3V. Input-under-test switching: 3V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>). Guaranteed, but not tested.

## AC Electrical Characteristics

(SOIC and SSOP Package)

Symbol	Parameter	T <sub>A</sub> = +25°C V <sub>CC</sub> = +5V C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C V <sub>CC</sub> = 4.5V–5.5V C <sub>L</sub> = 50 pF		Units
		Min	Typ	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay	1.0	2.0	3.6	1.0	3.6	ns
t <sub>PHL</sub>	Data to Outputs	1.0	2.4	3.6	1.0	3.6	
t <sub>PZH</sub>	Output Enable Time	1.5	3.1	6.0	1.5	6.0	ns
t <sub>PZL</sub>		1.5	3.7	6.0	1.5	6.0	
t <sub>PHZ</sub>	Output Disable Time	1.7	3.5	6.1	1.7	6.1	ns
t <sub>PLZ</sub>		1.7	3.1	5.6	1.7	5.6	

## Extended AC Electrical Characteristics

(SOIC Package)

Symbol	Parameter	-40°C to +85°C V <sub>CC</sub> = 4.5V–5.5V C <sub>L</sub> = 50 pF 8 Outputs Switching (Note 8)			T <sub>A</sub> = -40°C to +85°C V <sub>CC</sub> = 4.5V–5.5V C <sub>L</sub> = 250 pF 1 Output Switching (Note 9)		T <sub>A</sub> = -40°C to +85°C V <sub>CC</sub> = 4.5V–5.5V C <sub>L</sub> = 250 pF 8 Outputs Switching (Note 10)		Units
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>TOGGLE</sub>	Max Toggle Frequency		100						MHz
t <sub>PLH</sub>	Propagation Delay	1.5		5.0	1.5	6.0	2.5	8.5	ns
t <sub>PHL</sub>	Data to Outputs	1.5		5.0	1.5	6.0	2.5	8.5	
t <sub>PZH</sub>	Output Enable Time	1.5		6.5	2.5	7.5	2.5	9.5	ns
t <sub>PZL</sub>		1.5		6.5	2.5	7.5	2.5	10.5	
t <sub>PHZ</sub>	Output Disable Time	1.0		6.1	(Note 11)				ns
t <sub>PLZ</sub>		1.0		5.6					

**Note 8:** This specification is guaranteed but not tested. The limits apply to propagation delays for all paths described switching in phase (i.e., all LOW-to-HIGH, HIGH-to-LOW, etc.).

**Note 9:** This specification is guaranteed but not tested. The limits represent propagation delay with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load. This specification pertains to single output switching only.

**Note 10:** This specification is guaranteed but not tested. The limits represent propagation delays for all paths described switching in phase (i.e., all LOW-to-HIGH, HIGH-to-LOW, etc.) with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load.

**Note 11:** The 3-STATE delays are dominated by the RC network (500Ω, 250 pF) on the output and have been excluded from the datasheet.

**Skew**

(SOIC Package)

Symbol	Parameter	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ $V_{CC} = 4.5\text{V} - 5.5\text{V}$ $C_L = 50\text{ pF}$ 8 Outputs Switching (Note 12)	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ $V_{CC} = 4.5\text{V} - 5.5\text{V}$ $C_L = 250\text{ pF}$ 8 Outputs Switching (Note 13)	Units
		Max	Max	
$t_{OSHL}$ (Note 14)	Pin to Pin Skew, HL Transitions	1.3	2.3	ns
$t_{OSLH}$ (Note 14)	Pin to Pin Skew, LH Transitions	1.0	1.8	ns
$t_{PS}$ (Note 15)	Duty Cycle, LH/HL Skew	2.0	3.5	ns
$t_{OST}$ (Note 14)	Pin to Pin Skew, LH/HL Transitions	2.0	3.5	ns
$t_{PV}$ (Note 16)	Device to Device Skew, LH/HL Transitions	2.0	3.5	ns

**Note 12:** This specification is guaranteed but not tested. The limits apply to propagation delays for all paths described switching in phase (i.e., all LOW-to-HIGH, HIGH-to-LOW, etc.)

**Note 13:** These specifications guaranteed but not tested. The limits represent propagation delays with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load.

**Note 14:** Skew is defined as the absolute value of the difference between the actual propagation delays for any two separate outputs of the same device. The specification applies to any outputs switching HIGH-to-LOW ( $t_{OSHL}$ ), LOW-to-HIGH ( $t_{OSLH}$ ), or any combination switching LOW-to-HIGH and/or HIGH-to-LOW ( $t_{OST}$ ). The specification is guaranteed but not tested.

**Note 15:** This describes the difference between the delay of the LOW-to-HIGH and the HIGH-to-LOW transition on the same pin. It is measured across all the outputs (drivers) on the same chip, the worst (largest delta) number is the guaranteed specification. This specification is guaranteed but not tested.

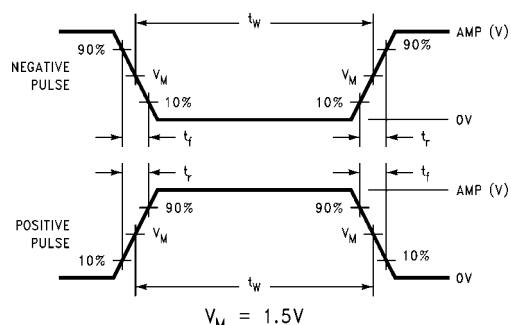
**Note 16:** Propagation delay variation for a given set of conditions (i.e., temperature and  $V_{CC}$ ) from device to device. This specification is guaranteed but not tested.

**Capacitance**

Symbol	Parameter	Typ	Units	Conditions
				$T_A = 25^{\circ}\text{C}$
$C_{IN}$	Input Capacitance	5.0	pF	$V_{CC} = 0.0\text{V}$
$C_{OUT}$ (Note 17)	Output Capacitance	9.0	pF	$V_{CC} = 5.0\text{V}$

**Note 17:**  $C_{OUT}$  is measured at frequency of  $f = 1\text{ MHz}$ , per MIL-STD-883, Method 3012.

**FIGURE 1. Standard AC Test Load**

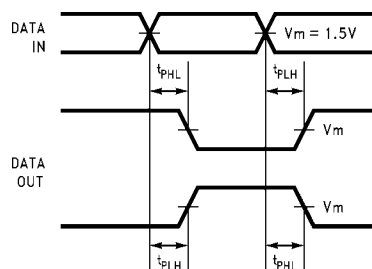


**FIGURE 2. Test Input Signal Levels**

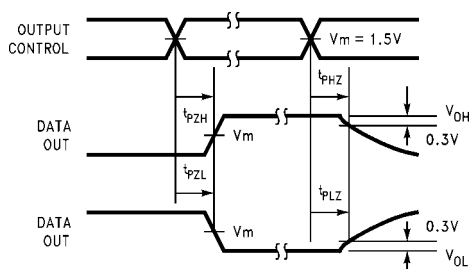
Amplitude	Rep. Rate	$t_W$	$t_r$	$t_f$
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

**FIGURE 3. Test Input Signal Requirements**

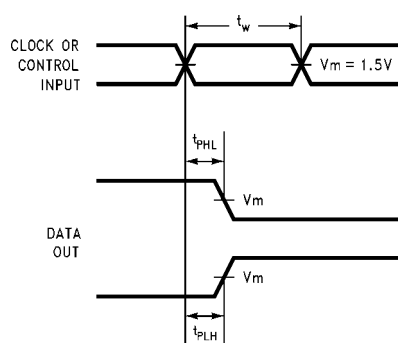
## AC Waveforms



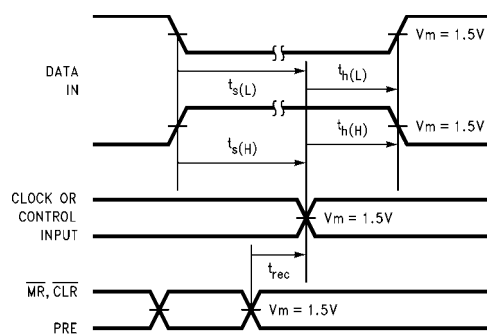
**FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions**



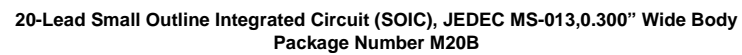
**FIGURE 6. 3-STATE Output HIGH and LOW Enable and Disable Time**

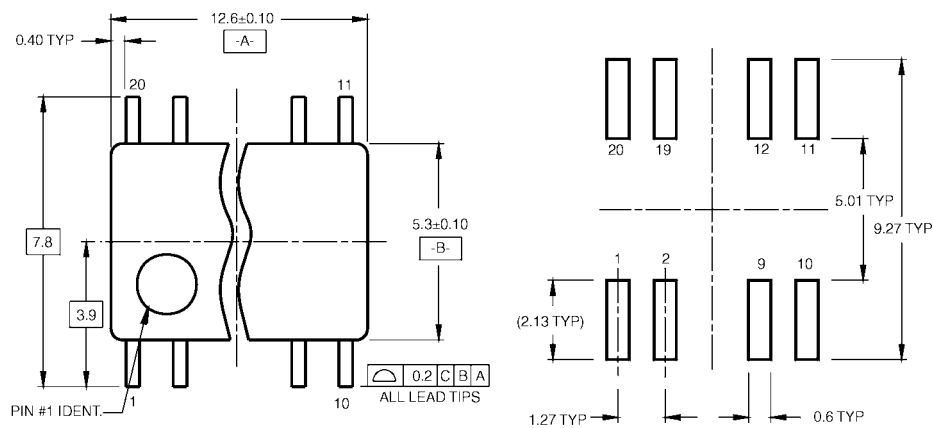
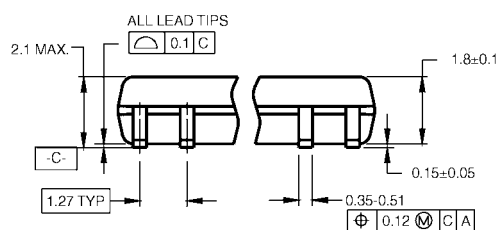


**FIGURE 5. Propagation Delay, Pulse Width Waveforms**

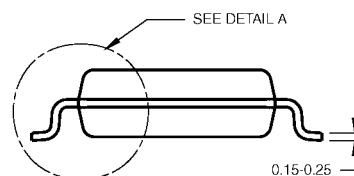


**FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms**



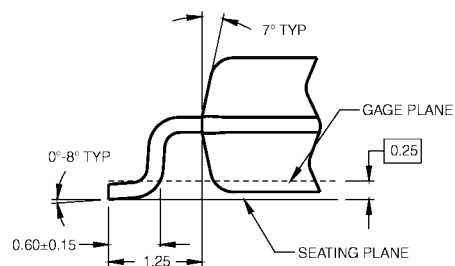
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

**LAND PATTERN RECOMMENDATION**


DIMENSIONS ARE IN MILLIMETERS


**NOTES:**

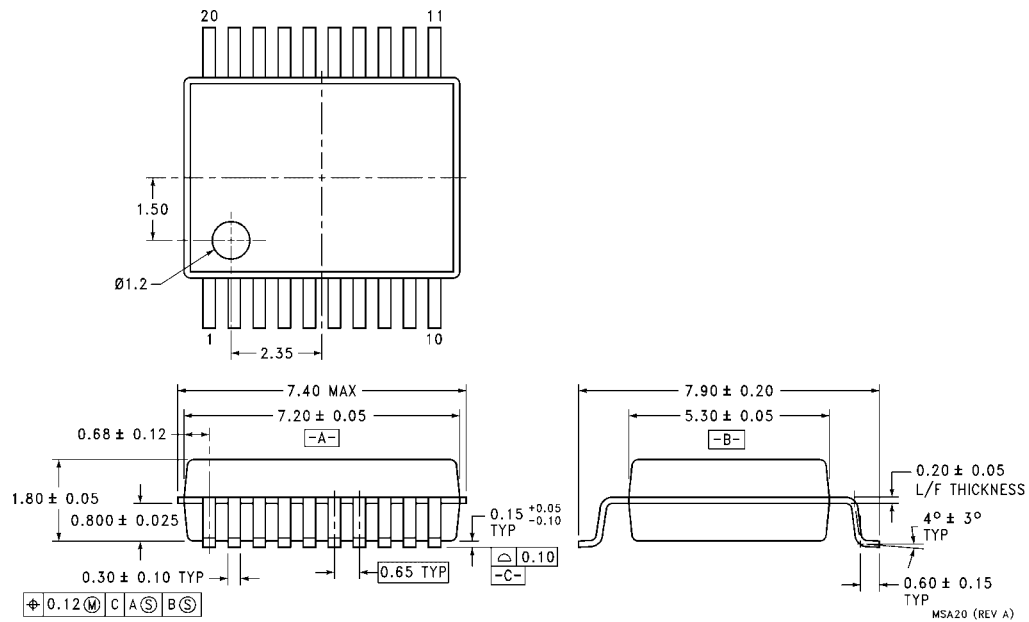
- CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M20DRevB1


**DETAIL A**

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

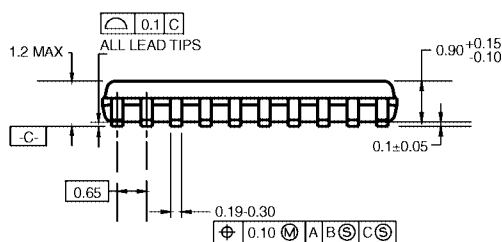
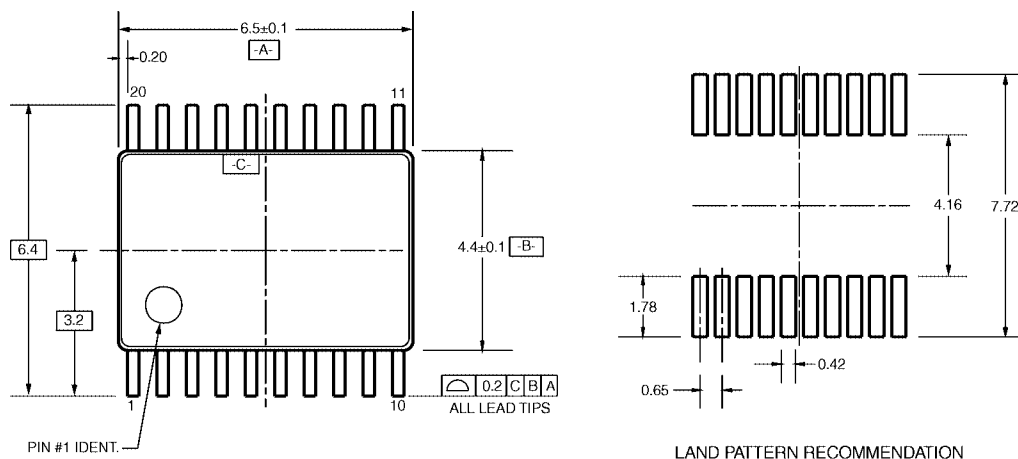
# Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



**20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide  
Package Number MSA20**



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

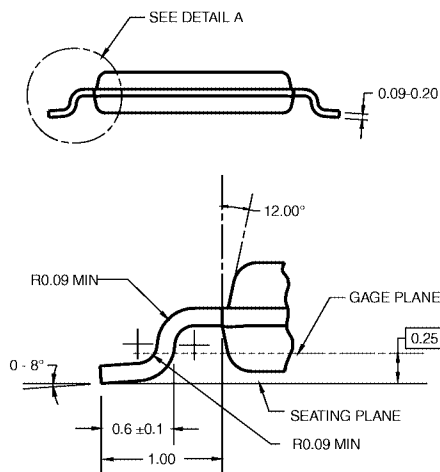


DIMENSIONS ARE IN MILLIMETERS

## NOTES:

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

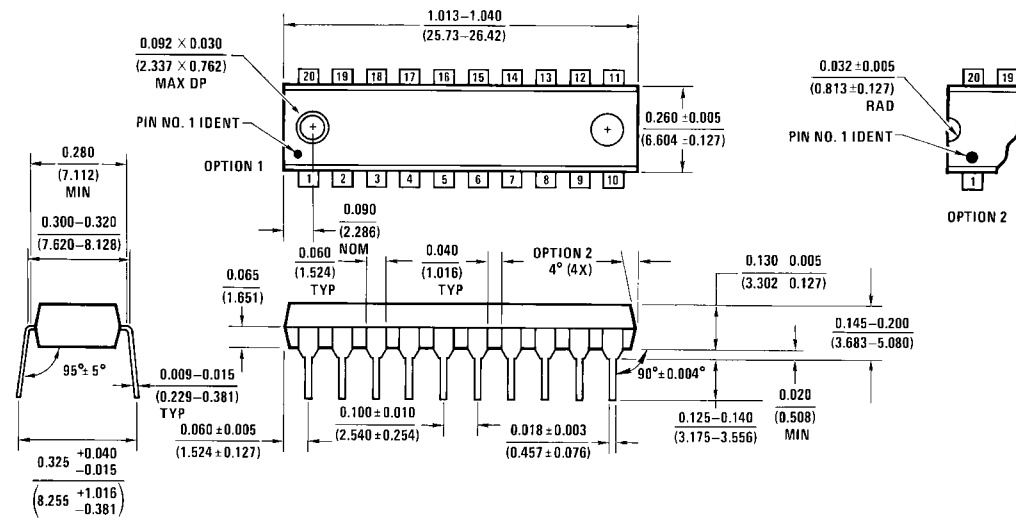
MTC20RevD1



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)



N20A (REV G)

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

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