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# 74LVT245, 74LVTH245

## Low Voltage Octal Bidirectional Transceiver with 3-STATE Inputs/Outputs

### Features

- Input and output interface capability to systems at 5V  $V_{CC}$
- Bushold data inputs eliminate the need for external pull-up resistors to hold unused inputs (74LVTH245), also available without bushold feature (74LVT245)
- Live insertion/extraction permitted
- Power Up/Down high impedance provides glitch-free bus loading
- Outputs source/sink,  $-32\text{mA}/+64\text{mA}$
- Latch-up performance exceeds 500mA
- ESD performance:
  - Human-body model > 2000V
  - Machine model > 200V
  - Charged-device model > 1000V

### General Description

The LVT245 and LVTH245 contain eight non-inverting bidirectional buffers with 3-STATE outputs and are intended for bus-oriented applications. The Transmit/Receive (T/ $\bar{R}$ ) input determines the direction of data flow through the bidirectional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; Receive (active-LOW) enables data from B ports to A ports. The Output Enable input, when HIGH, disables both A and B ports by placing them in a HIGH Z condition.

The LVTH245 data inputs include bushold, eliminating the need for external pull-up resistors to hold unused inputs.

These transceivers are designed for low-voltage (3.3V)  $V_{CC}$  applications, but with the capability to provide a TTL interface to a 5V environment. The LVT245 and LVTH245 are fabricated with an advanced BiCMOS technology to achieve high speed operation similar to 5V ABT while maintaining a low power dissipation.

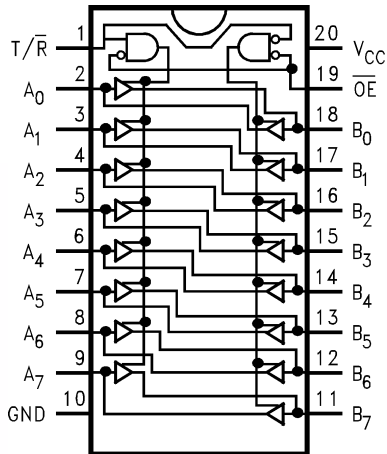
### Ordering Information

Order Number	Package Number	Package Description
74LVT245WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74LVT245SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LVT245MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide
74LVT245MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74LVTH245WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74LVTH245SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LVTH245MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide
74LVTH245MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

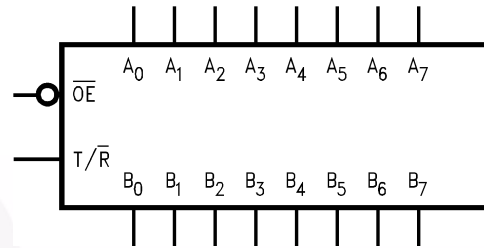
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

 All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagram

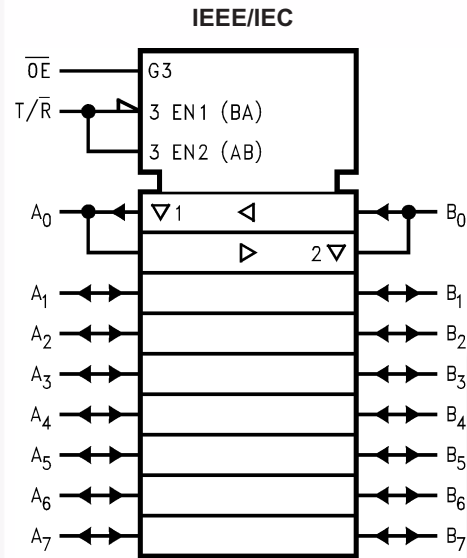


### Logic Symbols



### Pin Description

Pin Names	Description
$\overline{OE}$	Output Enable Input
$T/\overline{R}$	Transmit/Receive Input
$A_0-A_7$	Side A Inputs or 3-STATE Outputs
$B_0-B_7$	Side B Inputs or 3-STATE Outputs



### Truth Table

Inputs		Outputs
$\overline{OE}$	$T/\overline{R}$	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	HIGH-Z State

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	-0.5V to +4.6V
$V_I$	DC Input Voltage	-0.5V to +7.0V
$V_O$	DC Output Voltage Output in 3-STATE	-0.5V to +7.0V
	Output in HIGH or LOW State <sup>(1)</sup>	-0.5V to +7.0V
$I_{IK}$	DC Input Diode Current, $V_I < GND$	-50mA
$I_{OK}$	DC Output Diode Current, $V_O < GND$	-50mA
$I_O$	DC Output Current, $V_O > V_{CC}$ Output at HIGH State	64mA
	Output at LOW State	128mA
$I_{CC}$	DC Supply Current per Supply Pin	±64mA
$I_{GND}$	DC Ground Current per Ground Pin	±128mA
$T_{STG}$	Storage Temperature	-65°C to +150°C

### Note:

- $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min	Max	Units
$V_{CC}$	Supply Voltage	2.7	3.6	V
$V_I$	Input Voltage	0	5.5	V
$I_{OH}$	HIGH-Level Output Current		-32	mA
$I_{OL}$	LOW-Level Output Current		64	mA
$T_A$	Free-Air Operating Temperature	-40	85	°C
$\Delta t / \Delta V$	Input Edge Rate, $V_{IN} = 0.8V-2.0V$ , $V_{CC} = 3.0V$	0	10	ns/V

## DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = -40°C to +85°C		Units	
				Min.	Max.		
V <sub>IK</sub>	Input Clamp Diode Voltage	2.7	I <sub>I</sub> = -18mA		-1.2	V	
V <sub>IH</sub>	Input HIGH Voltage	2.7-3.6	V <sub>O</sub> ≤ 0.1V or	2.0		V	
V <sub>IL</sub>	Input LOW Voltage	2.7-3.6	V <sub>O</sub> ≥ V <sub>CC</sub> - 0.1V		0.8		
V <sub>OH</sub>	Output HIGH Voltage	2.7-3.6	I <sub>OH</sub> = -100μA	V <sub>CC</sub> - 0.2		V	
		2.7	I <sub>OH</sub> = -8mA	2.4			
		3.0	I <sub>OH</sub> = -32mA	2.0			
V <sub>OL</sub>	Output LOW Voltage	2.7	I <sub>OL</sub> = 100μA		0.2	V	
			I <sub>OL</sub> = 24mA		0.5		
		3.0	I <sub>OL</sub> = 16mA		0.4		
			I <sub>OL</sub> = 32mA		0.5		
			I <sub>OL</sub> = 64mA		0.55		
I <sub>I(HOLD)</sub> <sup>(2)</sup>	Bushold Input Minimum Drive	3.0	V <sub>I</sub> = 0.8V	75		μA	
			V <sub>I</sub> = 2.0V	-75			
I <sub>I(OD)</sub> <sup>(2)</sup>	Bushold Input Over-Drive, Current to Change State	3.0	<sup>(3)</sup>	500		μA	
			<sup>(4)</sup>	-500			
I <sub>I</sub>	Input Current	3.6	V <sub>I</sub> = 5.5V		10	μA	
		Control Pins	3.6	V <sub>I</sub> = 0V or V <sub>CC</sub>			±1
			Data Pins	3.6	V <sub>I</sub> = 0V		
							V <sub>I</sub> = V <sub>CC</sub>
I <sub>OFF</sub>	Power Off Leakage Current	0	0V ≤ V <sub>I</sub> or V <sub>O</sub> ≤ 5.5V		±100	μA	
I <sub>PU/PD</sub>	Power Up/Down, 3-STATE Current	0-1.5V	V <sub>O</sub> = 0.5V to V <sub>CC</sub> , V <sub>I</sub> = GND to V <sub>CC</sub>		±100	μA	
I <sub>OZL</sub>	3-STATE Output Leakage Current	3.6	V <sub>O</sub> = 0.5V		-5	μA	
I <sub>OZL</sub> <sup>(2)</sup>	3-STATE Output Leakage Current	3.6	V <sub>O</sub> = 0.0V		-5	μA	
I <sub>OZH</sub>	3-STATE Output Leakage Current	3.6	V <sub>O</sub> = 3.0V		5	μA	
I <sub>OZH</sub> <sup>(2)</sup>	3-STATE Output Leakage Current	3.6	V <sub>O</sub> = 3.6V		5	μA	
I <sub>OZH</sub> <sup>+</sup>	3-STATE Output Leakage Current	3.6	V <sub>CC</sub> < V <sub>O</sub> ≤ 5.5V		10	μA	
I <sub>CCH</sub>	Power Supply Current	3.6	Outputs HIGH		0.19	mA	
I <sub>CCL</sub>	Power Supply Current	3.6	Outputs LOW		5	mA	
I <sub>CCZ</sub>	Power Supply Current	3.6	Outputs Disabled		0.19	mA	
I <sub>CCZ</sub> <sup>+</sup>	Power Supply Current	3.6	V <sub>CC</sub> ≤ V <sub>O</sub> ≤ 5.5V, Outputs Disabled		0.19	mA	
ΔI <sub>CC</sub>	Increase in Power Supply Current <sup>(5)</sup>	3.6	One Input at V <sub>CC</sub> - 0.6V, Other Inputs at V <sub>CC</sub> or GND		0.2	mA	

**Notes:**

- Applies to Bushold versions only (LVTH245).
- An external driver must source at least the specified current to switch from LOW-to-HIGH.
- An external driver must sink at least the specified current to switch from HIGH-to-LOW.
- This is the increase in supply current for each input that is at the specified voltage level rather than V<sub>CC</sub> or GND.

**Dynamic Switching Characteristics<sup>(6)</sup>**

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω	T <sub>A</sub> = 25°C			Units
				Min.	Typ.	Max.	
V <sub>OLP</sub>	Quiet Output Maximum Dynamic V <sub>OL</sub>	3.3	(7)		0.8		V
V <sub>OLV</sub>	Quiet Output Minimum Dynamic V <sub>OL</sub>	3.3	(7)		-0.8		V

**Notes:**

6. Characterized in SOIC package. Guaranteed parameter, but not tested.  
7. Max number of outputs defined as (n). n-1 data inputs are driven 0V to 3V. Output under test held LOW.

**AC Electrical Characteristics**

Symbol	Parameter	T <sub>A</sub> = -40°C to +85°C, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω				Units
		V <sub>CC</sub> = 3.3V ± 0.3V		V <sub>CC</sub> = 2.7V		
		Min.	Max.	Min.	Max.	
t <sub>PLH</sub>	Propagation Delay	1.2	3.6	1.2	4.0	ns
t <sub>PHL</sub>		1.2	3.5	1.2	4.0	
t <sub>PZH</sub>	Output Enable Time	1.3	5.5	1.3	7.1	ns
t <sub>PZL</sub>		1.7	5.7	1.7	6.7	
t <sub>PHZ</sub>	Output Disable	2.0	5.9	2.0	6.5	ns
t <sub>PLZ</sub>		2.0	5.0	2.0	5.1	
t <sub>OSSL</sub> , t <sub>OSHL</sub>	Output to Output Skew <sup>(8)</sup>		1.0		1.0	ns

**Note:**

8. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t<sub>OSSL</sub>) or LOW-to-HIGH (t<sub>OSHL</sub>).

**Capacitance<sup>(9)</sup>**

Symbol	Parameter	Conditions	Typical	Units
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = 0V, V <sub>I</sub> = 0V or V <sub>CC</sub>	4	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 3.0V, V <sub>O</sub> = 0V or V <sub>CC</sub>	8	pF

**Note:**

9. Capacitance is measured at frequency f = 1MHz, per MIL-STD-883, Method 3012.

## Physical Dimensions



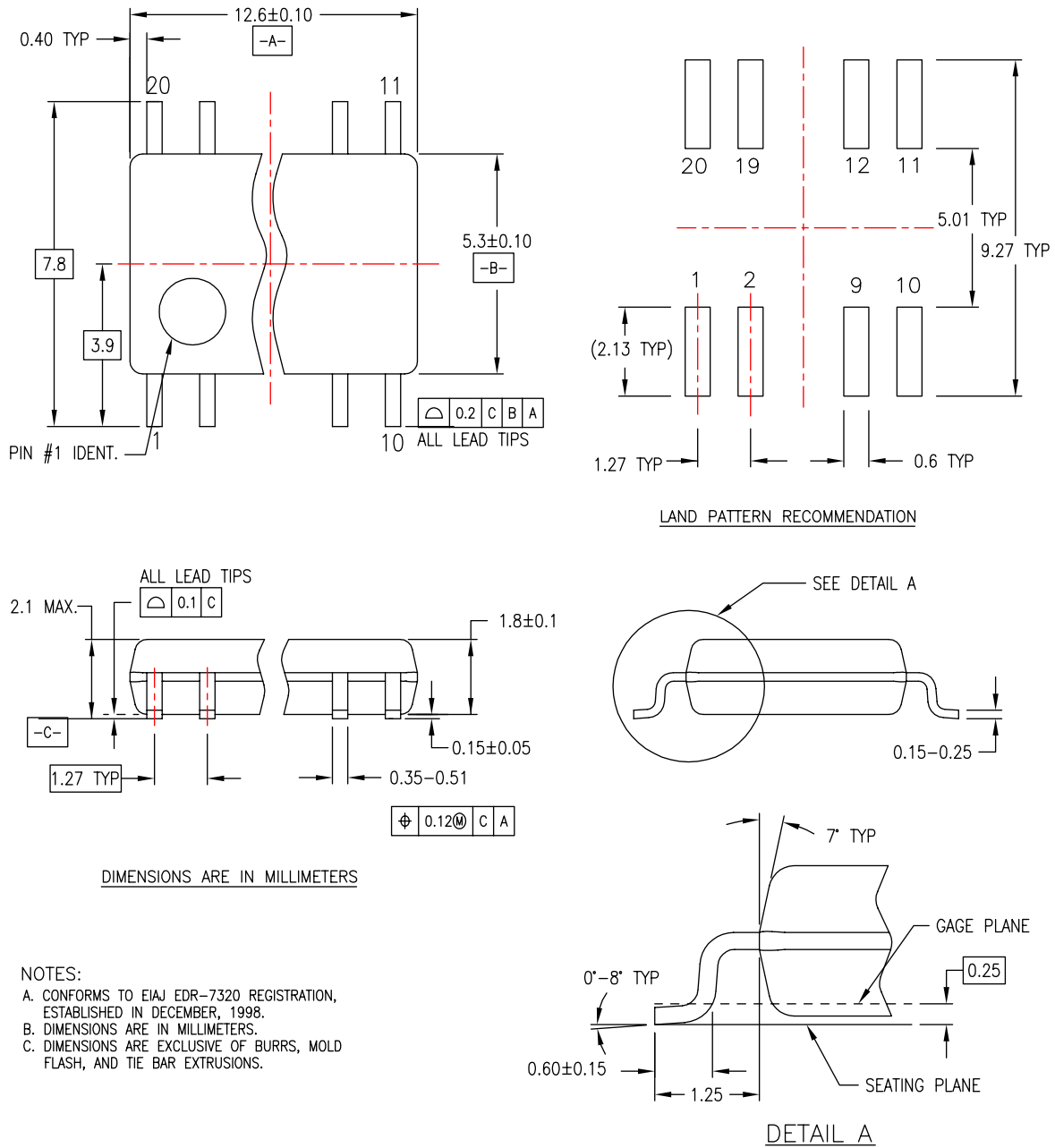
**Figure 1. 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide**

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**Physical Dimensions (Continued)**



- NOTES:
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  - B. DIMENSIONS ARE IN MILLIMETERS.
  - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M20DREVC

**Figure 2. 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

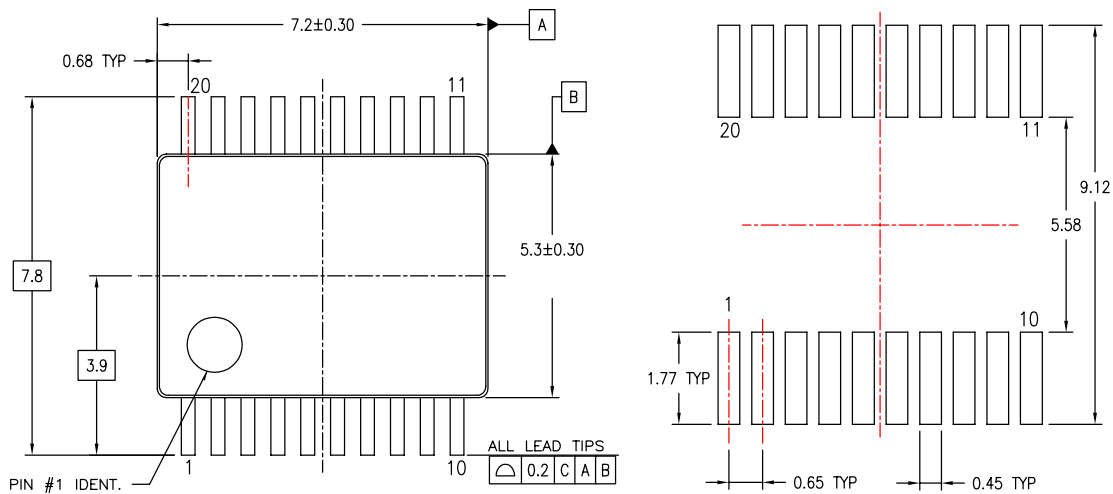
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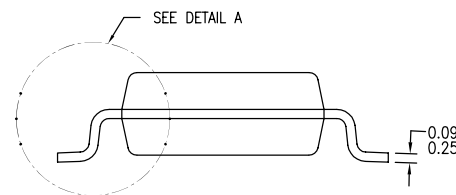
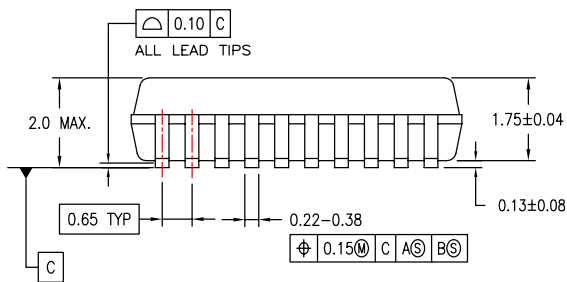
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Physical Dimensions (Continued)



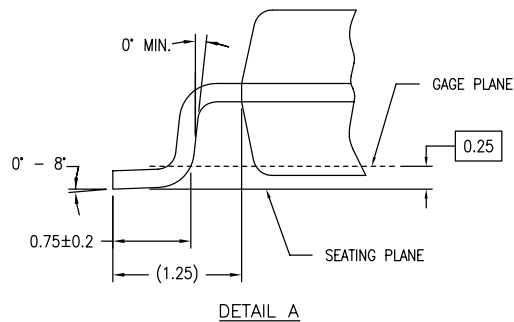
LAND PATTERN RECOMMENDATIONS



DIMENSIONS ARE IN MILLIMETERS

NOTES:

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- B. DIMENSIONS ARE IN MILLIMETERS.
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- D. DIMENSIONS AND TOLERANCES PER ASME Y14.5M - 1994.



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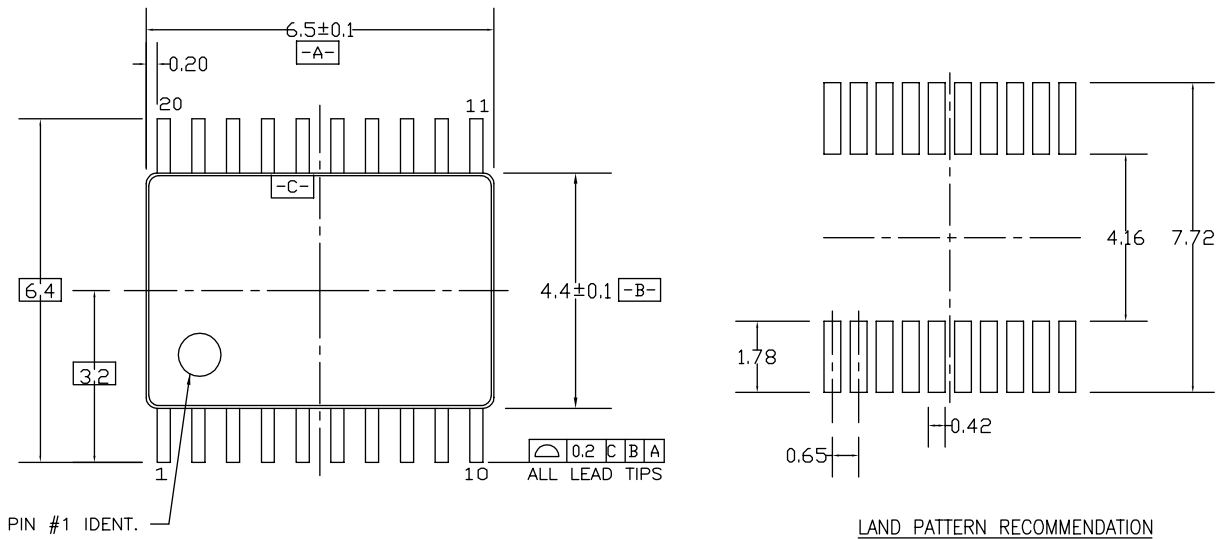
Figure 3. 20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide

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Physical Dimensions (Continued)



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- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

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Figure 4. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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