

## 74LVT245 • 74LVTH245

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

#### 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/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.

#### Features

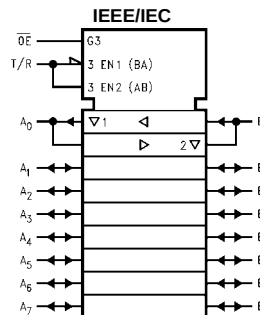
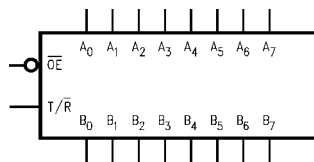
- Input and output interface capability to systems at 5V  $V_{CC}$
- Bushold data inputs eliminate the need for external pull-up resistors to hold unused inputs (74LVTH245), also available without bushold feature (74LVT245).
- Live insertion/extraction permitted
- Power Up/Down high impedance provides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

#### Ordering Code:

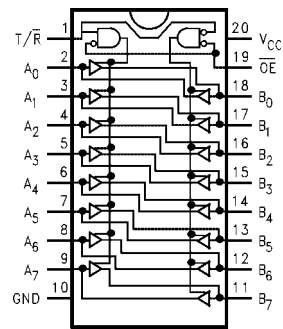
| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| 74LVT245WM   | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), 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), EIAJ TYPE II, 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), EIAJ TYPE II, 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 code.

#### Logic Symbols



Connection Diagram



Pin Descriptions

| 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**(Note 1)

| Symbol    | Parameter                        | Value        | Conditions                           | Units |
|-----------|----------------------------------|--------------|--------------------------------------|-------|
| $V_{CC}$  | Supply Voltage                   | -0.5 to +4.6 |                                      | V     |
| $V_I$     | DC Input Voltage                 | -0.5 to +7.0 |                                      | V     |
| $V_O$     | Output Voltage                   | -0.5 to +7.0 | Output in 3-STATE                    | V     |
|           |                                  | -0.5 to +7.0 | Output in HIGH or LOW State (Note 2) | V     |
| $I_{IK}$  | DC Input Diode Current           | -50          | $V_I < GND$                          | mA    |
| $I_{OK}$  | DC Output Diode Current          | -50          | $V_O < GND$                          | mA    |
| $I_O$     | DC Output Current                | 64           | $V_O > V_{CC}$ Output at HIGH State  | mA    |
|           |                                  | 128          | $V_O > V_{CC}$ Output at LOW State   |       |
| $I_{CC}$  | DC Supply Current per Supply Pin | $\pm 64$     |                                      | mA    |
| $I_{GND}$ | DC Ground Current per Ground Pin | $\pm 128$    |                                      | mA    |
| $T_{STG}$ | Storage Temperature              | -65 to +150  |                                      | °C    |

**Recommended Operating Conditions**

| 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  |

**Note 1:** Absolute Maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum rated conditions is not implied.

**Note 2:**  $I_O$  Absolute Maximum Rating must be observed.

**DC Electrical Characteristics**

| Symbol                    | Parameter                                           | $V_{CC}$<br>(V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |           | Units         | Conditions                                          |
|---------------------------|-----------------------------------------------------|-----------------|-------------------------------------------------|-----------|---------------|-----------------------------------------------------|
|                           |                                                     |                 | Min                                             | Max       |               |                                                     |
| $V_{IK}$                  | Input Clamp Diode Voltage                           | 2.7             |                                                 | -1.2      | V             | $I_I = -18\text{ mA}$                               |
| $V_{IH}$                  | Input HIGH Voltage                                  | 2.7-3.6         | 2.0                                             |           | V             | $V_O \leq 0.1V$ or<br>$V_O \geq V_{CC} - 0.1V$      |
| $V_{IL}$                  | Input LOW Voltage                                   | 2.7-3.6         |                                                 | 0.8       | V             |                                                     |
| $V_{OH}$                  | Output HIGH Voltage                                 | 2.7-3.6         | $V_{CC} - 0.2$                                  |           | V             | $I_{OH} = -100\text{ }\mu\text{A}$                  |
|                           |                                                     | 2.7             | 2.4                                             |           | V             | $I_{OH} = -8\text{ mA}$                             |
|                           |                                                     | 3.0             | 2.0                                             |           | V             | $I_{OH} = -32\text{ mA}$                            |
| $V_{OL}$                  | Output LOW Voltage                                  | 2.7             |                                                 | 0.2       | V             | $I_{OL} = 100\text{ }\mu\text{A}$                   |
|                           |                                                     | 2.7             |                                                 | 0.5       | V             | $I_{OL} = 24\text{ mA}$                             |
|                           |                                                     | 3.0             |                                                 | 0.4       | V             | $I_{OL} = 16\text{ mA}$                             |
|                           |                                                     | 3.0             |                                                 | 0.5       | V             | $I_{OL} = 32\text{ mA}$                             |
| $I_{I(HOLD)}$<br>(Note 3) | Bushold Input Minimum Drive                         | 3.0             | 75                                              |           | $\mu\text{A}$ | $V_I = 0.8V$                                        |
|                           |                                                     |                 | -75                                             |           | $\mu\text{A}$ | $V_I = 2.0V$                                        |
| $I_{I(OD)}$<br>(Note 3)   | Bushold Input Over-Drive<br>Current to Change State | 3.0             | 500                                             |           | $\mu\text{A}$ | (Note 4)                                            |
|                           |                                                     |                 | -500                                            |           | $\mu\text{A}$ | (Note 5)                                            |
| $I_I$                     | Input Current                                       | 3.6             |                                                 | 10        | $\mu\text{A}$ | $V_I = 5.5V$                                        |
|                           |                                                     | Control Pins    | 3.6                                             | $\pm 1$   | $\mu\text{A}$ | $V_I = 0V$ or $V_{CC}$                              |
|                           |                                                     | Data Pins       | 3.6                                             | -5        | $\mu\text{A}$ | $V_I = 0V$                                          |
|                           |                                                     |                 |                                                 | 1         | $\mu\text{A}$ | $V_I = V_{CC}$                                      |
| $I_{OFF}$                 | Power Off Leakage Current                           | 0               |                                                 | $\pm 100$ | $\mu\text{A}$ | $0V \leq V_I$ or $V_O \leq 5.5V$                    |
| $I_{PU/PD}$               | Power Up/Down<br>3-STATE Current                    | 0-1.5V          |                                                 | $\pm 100$ | $\mu\text{A}$ | $V_O = 0.5V$ to $V_{CC}$<br>$V_I = GND$ to $V_{CC}$ |
| $I_{OZL}$                 | 3-STATE Output Leakage Current                      | 3.6             |                                                 | -5        | $\mu\text{A}$ | $V_O = 0.5V$                                        |
| $I_{OZL}$ (Note 3)        | 3-STATE Output Leakage Current                      | 3.6             |                                                 | -5        | $\mu\text{A}$ | $V_O = 0.0V$                                        |
| $I_{OZH}$                 | 3-STATE Output Leakage Current                      | 3.6             |                                                 | 5         | $\mu\text{A}$ | $V_O = 3.0V$                                        |

## DC Electrical Characteristics (Continued)

| Symbol                    | Parameter                                    | V <sub>CC</sub><br>(V) | T <sub>A</sub> = -40°C to +85°C |      | Units | Conditions                                                                    |
|---------------------------|----------------------------------------------|------------------------|---------------------------------|------|-------|-------------------------------------------------------------------------------|
|                           |                                              |                        | Min                             | Max  |       |                                                                               |
| I <sub>OZH</sub> (Note 3) | 3-STATE Output Leakage Current               | 3.6                    |                                 | 5    | μA    | V <sub>O</sub> = 3.6V                                                         |
| I <sub>OZH+</sub>         | 3-STATE Output Leakage Current               | 3.6                    |                                 | 10   | μA    | V <sub>CC</sub> < V <sub>O</sub> ≤ 5.5V                                       |
| I <sub>CCH</sub>          | Power Supply Current                         | 3.6                    |                                 | 0.19 | mA    | Outputs HIGH                                                                  |
| I <sub>CCL</sub>          | Power Supply Current                         | 3.6                    |                                 | 5    | mA    | Outputs LOW                                                                   |
| I <sub>CCZ</sub>          | Power Supply Current                         | 3.6                    |                                 | 0.19 | mA    | Outputs Disabled                                                              |
| I <sub>CCZ+</sub>         | Power Supply Current                         | 3.6                    |                                 | 0.19 | mA    | V <sub>CC</sub> ≤ V <sub>O</sub> ≤ 5.5V,<br>Outputs Disabled                  |
| ΔI <sub>CC</sub>          | Increase in Power Supply Current<br>(Note 6) | 3.6                    |                                 | 0.2  | mA    | One Input at V <sub>CC</sub> - 0.6V<br>Other Inputs at V <sub>CC</sub> or GND |

**Note 3:** Applies to Bushold versions only (LVTH245).

**Note 4:** An external driver must source at least the specified current to switch from LOW-to-HIGH.

**Note 5:** An external driver must sink at least the specified current to switch from HIGH-to-LOW.

**Note 6:** 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 (Note 7)

| Symbol           | Parameter                                    | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |      |     | Units | Conditions<br>C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω |
|------------------|----------------------------------------------|------------------------|-----------------------|------|-----|-------|-------------------------------------------------------------|
|                  |                                              |                        | Min                   | Typ  | Max |       |                                                             |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 3.3                    |                       | 0.8  |     | V     | (Note 8)                                                    |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 3.3                    |                       | -0.8 |     | V     | (Note 8)                                                    |

**Note 7:** Characterized in SOIC package. Guaranteed parameter, but not tested.

**Note 8:** 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<br>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>OSHL</sub> | Output to Output Skew |                                                                                  | 1.0 |                        | 1.0 | ns    |
| t <sub>OSLH</sub> | (Note 9)              |                                                                                  |     |                        |     |       |

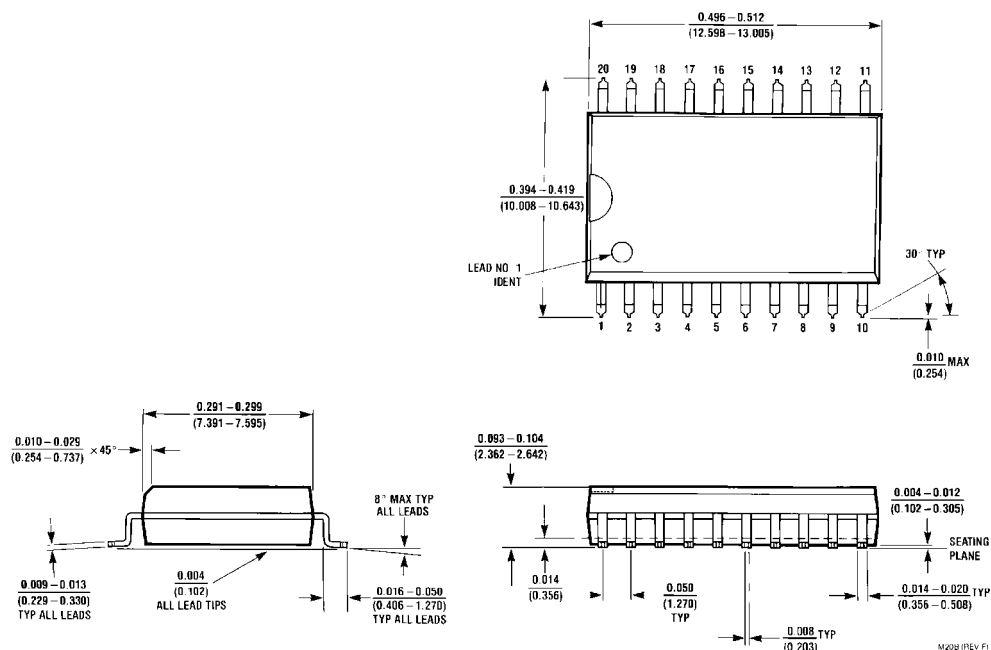
**Note 9:** Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

## Capacitance (Note 10)

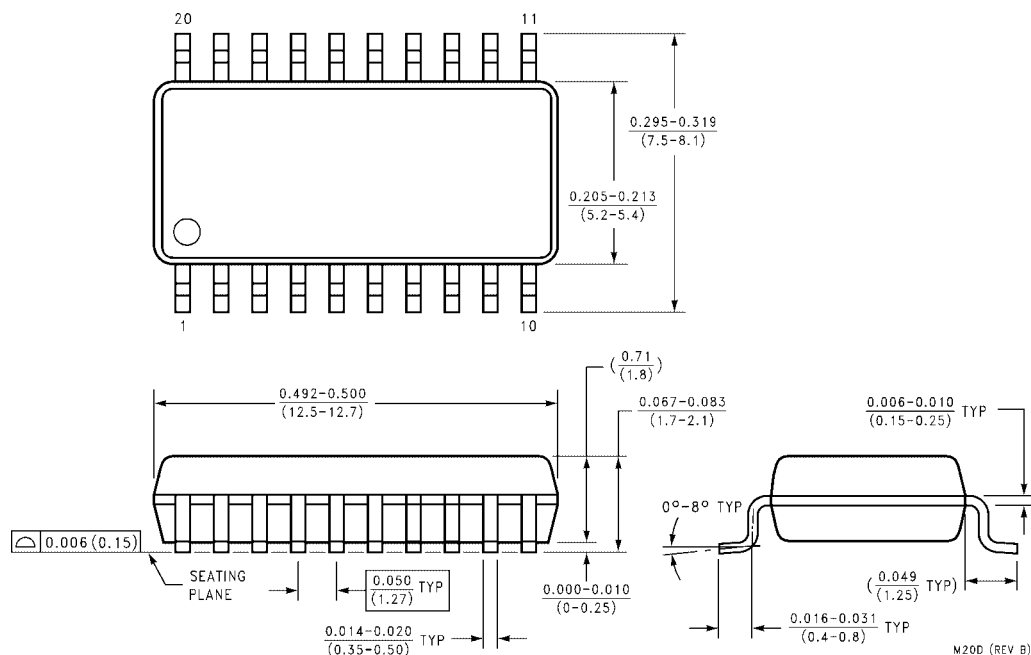
| Symbol           | Parameter                | Conditions                                                     | Typical | Units |
|------------------|--------------------------|----------------------------------------------------------------|---------|-------|
| C <sub>IN</sub>  | Input Capacitance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

**Note 10:** Capacitance is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.

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

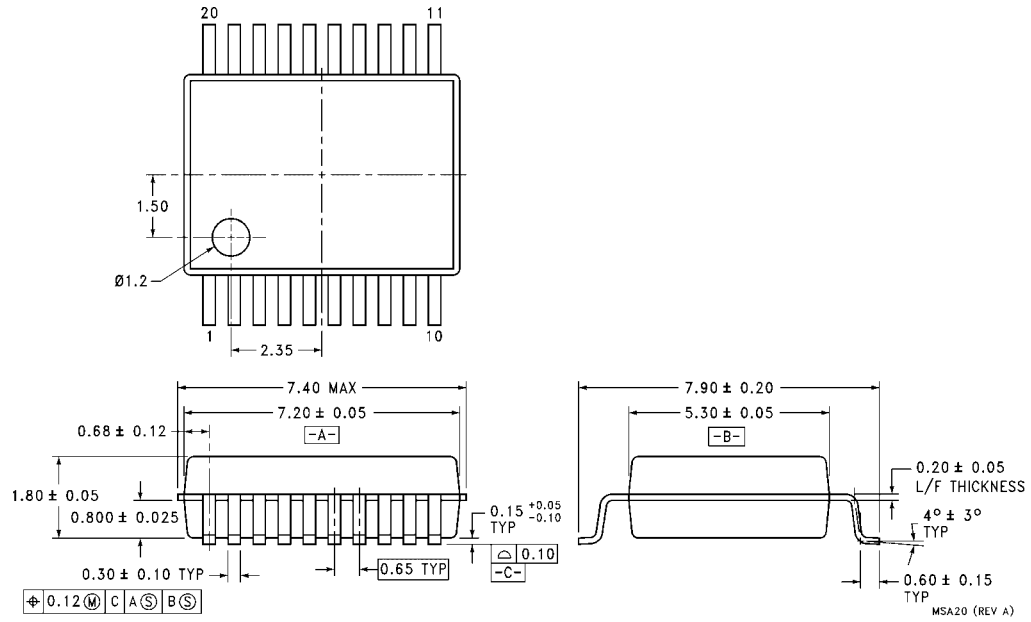


**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M20B**



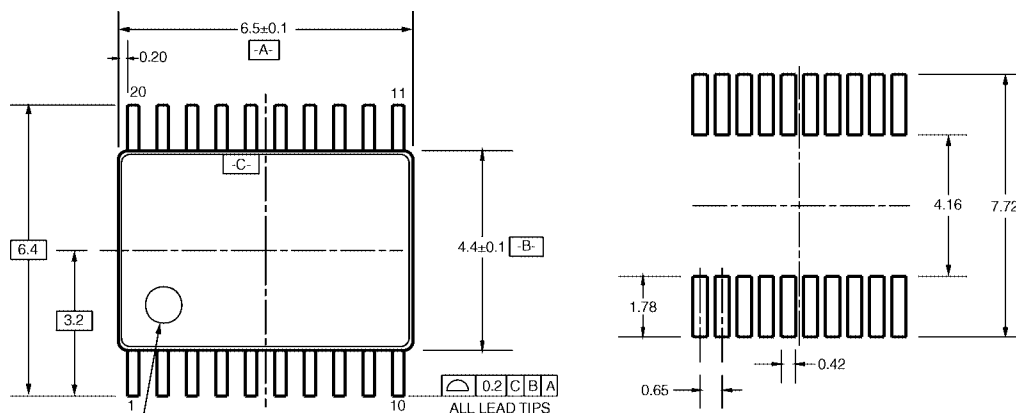
**20-Lead Small Outline Package (SOP), EIAJ TYPE II 5.3mm Wide  
Package Number M20D**

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

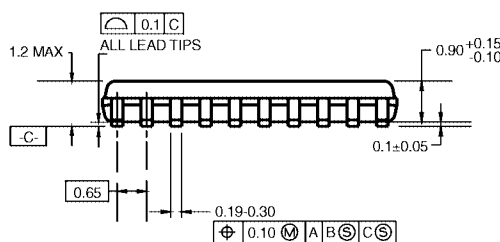


**20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide  
Package Number MSA20**

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



LAND PATTERN RECOMMENDATION

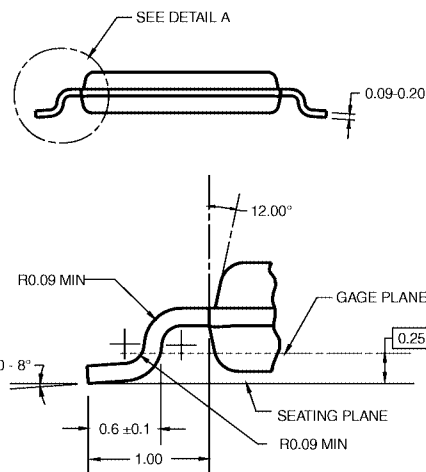


DIMENSIONS ARE IN MILLIMETERS

## 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

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