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## 74LCX760

### Low Voltage Buffer/Line Driver with 5V Tolerant Inputs and Open Drain Outputs

#### General Description

The LCX760 is the Open Drain version of the LCX244. The LCX760 contains eight non-inverting buffers with 3-STATE outputs. The device may be employed as a memory address driver, clock driver and bus-oriented transmitter/receiver. The LCX760 is designed for low voltage (2.5V or 3.3V)  $V_{CC}$  applications with capability of interfacing to a 5V signal environment.

The LCX760 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

#### Features

- Open drain version of the LCX244
- 5V tolerant inputs and outputs
- 2.3V–3.6V  $V_{CC}$  specifications provided
- 8.0 ns  $t_{PD}$  max ( $V_{CC} = 3.3V$ ), 10  $\mu A$   $I_{CC}$  max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal (Note 1)
- 24 mA output drive ( $V_{CC} = 3.0V$ )
- Implements proprietary noise/EMI reduction circuitry
- Latch-up conforms to JEDEC JED78
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

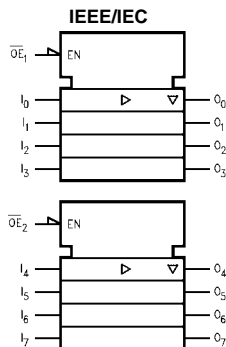
**Note 1:** To ensure the high-impedance state during power up or down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pull-up resistor; the minimum value or the resistor is determined by the current-sourcing capability of the driver.

#### Ordering Code:

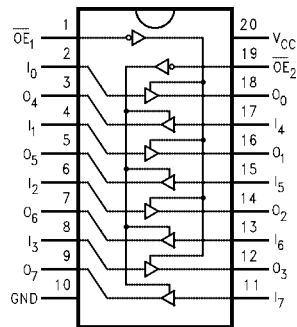
| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| 74LCX760WWM  | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| 74LCX760SJ   | M20D           | Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide       |
| 74LCX760MSA  | MSA20          | 20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide       |
| 74LCX760MTC  | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

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

#### Logic Symbol



#### Connection Diagram



## Pin Descriptions

| Pin Names                          | Description                  |
|------------------------------------|------------------------------|
| $\overline{OE}_1, \overline{OE}_2$ | 3-STATE Output Enable Inputs |
| $I_0-I_7$                          | Inputs                       |
| $O_0-O_7$                          | Outputs                      |

## Truth Tables

| Inputs            |       | Outputs               |
|-------------------|-------|-----------------------|
| $\overline{OE}_1$ | $I_n$ | (Pins 12, 14, 16, 18) |
| L                 | L     | L                     |
| L                 | H     | H                     |
| H                 | X     | Z                     |

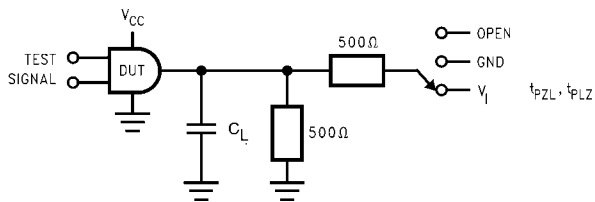
| Inputs            |       | Outputs           |
|-------------------|-------|-------------------|
| $\overline{OE}_2$ | $I_n$ | (Pins 3, 5, 7, 9) |
| L                 | L     | L                 |
| L                 | H     | H                 |
| H                 | X     | Z                 |

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

| Absolute Maximum Ratings <sup>(Note 2)</sup>   |  |  |                                      |                                 |      |       |
|--|--|--|--------------------------------------|---------------------------------|------|-------|
| Symbol   | Parameter  | Value  | Conditions                           | Units                           |      |       |
| V <sub>CC</sub>  | Supply Voltage   | -0.5 to +7.0   |                                      | V                               |      |       |
| V <sub>I</sub>   | DC Input Voltage   | -0.5 to +7.0   |                                      | V                               |      |       |
| V <sub>O</sub>   | DC Output Voltage  | -0.5 to +7.0   | Output in HIGH or LOW State (Note 3) | V                               |      |       |
| I <sub>IK</sub>  | DC Input Diode Current   | -50  | V <sub>I</sub> < GND                 | mA                              |      |       |
| I <sub>OK</sub>  | DC Output Diode Current  | -50  | V <sub>O</sub> < GND                 | mA                              |      |       |
|  |  | +50  | V <sub>O</sub> > V <sub>CC</sub>     |                                 |      |       |
| I <sub>O</sub>   | DC Output Sink Current   | 50   |                                      | mA                              |      |       |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin                                     | ±100   |                                      | mA                              |      |       |
| I <sub>GND</sub>   | DC Ground Current per Ground Pin                                     | ±100   |                                      | mA                              |      |       |
| T <sub>STG</sub>   | Storage Temperature  | -65 to +150  |                                      | °C                              |      |       |
| Recommended Operating Conditions <sup>(Note 4)</sup>   |  |  |                                      |                                 |      |       |
| Symbol   | Parameter  | Min  | Max                                  | Units                           |      |       |
| V <sub>CC</sub>  | Supply Voltage   | Operating  | 2.0                                  | 3.6                             | V    |       |
|  |  | Data Retention   | 1.5                                  | 3.6                             |      |       |
| V <sub>I</sub>   | Input Voltage  | 0  | 5.5                                  | V                               |      |       |
| V <sub>O</sub>   | Output Voltage   | 0  | 5.5                                  | V                               |      |       |
| I <sub>OL</sub>  | Output Current   | V <sub>CC</sub> = 3.0V – 3.6V  |                                      | 24                              | mA   |       |
|  |  | V <sub>CC</sub> = 2.7V – 3.0V  |                                      | 12                              |      |       |
|  |  | V <sub>CC</sub> = 2.3V – 2.7V  |                                      | 8                               |      |       |
| T <sub>A</sub>   | Free-Air Operating Temperature                                       | -40  | 85                                   | °C                              |      |       |
| Δt/ΔV  | Input Edge Rate, V <sub>IN</sub> = 0.8V–2.0V, V <sub>CC</sub> = 3.0V | 0  | 10                                   | ns/V                            |      |       |
| <p><b>Note 2:</b> The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.</p> <p><b>Note 3:</b> I<sub>O</sub> Absolute Maximum Rating must be observed.</p> <p><b>Note 4:</b> Unused inputs or I/Os must be held HIGH or LOW. They may not float.</p> |  |  |                                      |                                 |      |       |
| DC Electrical Characteristics  |  |  |                                      |                                 |      |       |
| Symbol   | Parameter  | Conditions   | V <sub>CC</sub>                      | T <sub>A</sub> = -40°C to +85°C |      | Units |
|  |  |  | (V)                                  | Min                             | Max  |       |
| V <sub>IH</sub>  | HIGH Level Input Voltage   |  | 2.3 – 2.7                            | 1.7                             |      | V     |
|  |  |  | 2.7 – 3.6                            | 2.0                             |      |       |
| V <sub>IL</sub>  | LOW Level Input Voltage  |  | 2.3 – 2.7                            |                                 | 0.7  | V     |
|  |  |  | 2.7 – 3.6                            |                                 | 0.8  |       |
| V <sub>OL</sub>  | LOW Level Output Voltage   | I <sub>OL</sub> = 100 μA   | 2.3 – 3.6                            |                                 | 0.2  | V     |
|  |  | I <sub>OL</sub> = 8 mA   | 2.3                                  |                                 | 0.6  |       |
|  |  | I <sub>OL</sub> = 12 mA  | 2.7                                  |                                 | 0.4  |       |
|  |  | I <sub>OL</sub> = 16 mA  | 3.0                                  |                                 | 0.4  |       |
|  |  | I <sub>OL</sub> = 24 mA  | 3.0                                  |                                 | 0.55 |       |
| I <sub>I</sub>   | Input Leakage Current  | 0 ≤ V <sub>I</sub> ≤ 5.5V  | 2.3 – 3.6                            |                                 | ±5.0 | μA    |
| I <sub>OZ</sub>  | 3-STATE Output Leakage   | 0 ≤ V <sub>O</sub> ≤ 5.5V<br>V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 2.3 – 3.6                            |                                 | ±5.0 | μA    |
| I <sub>OFF</sub>   | Power-Off Leakage Current  | V <sub>I</sub> or V <sub>O</sub> = 5.5V  | 0                                    |                                 | 10   | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current   | V <sub>I</sub> = V <sub>CC</sub> or GND  | 2.3 – 3.6                            |                                 | 10   | μA    |
|  |  | 3.6V ≤ V <sub>I</sub> , V <sub>O</sub> ≤ 5.5V (Note 5)                           | 2.3 – 3.6                            |                                 | ±10  |       |
| ΔI <sub>CC</sub>   | Increase in I <sub>CC</sub> per Input                                | V <sub>IH</sub> = V <sub>CC</sub> – 0.6V   | 2.3 – 3.6                            |                                 | 500  | μA    |
| I <sub>OHZ</sub>   | Off State Current  | V <sub>O</sub> = 5.5   | 2 – 3.6                              |                                 | 10   | μA    |
| <p><b>Note 5:</b> Outputs disabled or 3-STATE only.</p>  |  |  |                                      |                                 |      |       |

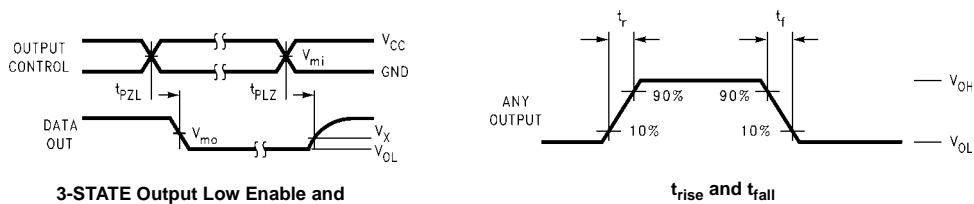
| AC Electrical Characteristics   |   |  |                        |                        |       |                              |      |       |
|---|---|--|------------------------|------------------------|-------|------------------------------|------|-------|
| Symbol  | Parameter                                     | T <sub>A</sub> = -40°C to +85°C, R <sub>L</sub> = 500Ω   |                        |                        |       |                              |      | Units |
|   |   | V <sub>CC</sub> = 3.3V ± 0.3V  |                        | V <sub>CC</sub> = 2.7V |       | V <sub>CC</sub> = 2.5V ± 0.2 |      |       |
|   |   | C <sub>L</sub> = 50 pF   |                        | C <sub>L</sub> = 50 pF |       | C <sub>L</sub> = 30 pF       |      |       |
|   |   | Min  | Max                    | Min                    | Max   | Min                          | Max  |       |
| t <sub>PZL</sub>  | Propagation Delay                             | 0.5  | 8.0                    | 0.5                    | 9.0   | 0.5                          | 10.0 | ns    |
| t <sub>PLZ</sub>  | Data to Output                                | 0.5  | 7.0                    | 0.5                    | 8.0   | 0.5                          | 8.4  |       |
| t <sub>PZL</sub>  | Output Enable Time<br>OE <sub>n</sub> to Out  | 0.5  | 8.0                    | 0.5                    | 9.0   | 0.5                          | 10.0 | ns    |
| t <sub>PLZ</sub>  | Output Disable Time<br>OE <sub>n</sub> to Out | 0.5  | 7.0                    | 0.5                    | 8.0   | 0.5                          | 8.4  | ns    |
| t <sub>OSSL</sub>   | Output to Output Skew<br>(Note 6)             |  | 1.0                    |                        |       |                              |      | ns    |
| t <sub>OSLH</sub>   |   |  | 1.0                    |                        |       |                              |      |       |
| <b>Note 6:</b> 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>OSLH</sub> ). |   |  |                        |                        |       |                              |      |       |
| Dynamic Switching Characteristics   |   |  |                        |                        |       |                              |      |       |
| Symbol  | Parameter                                     | Conditions   | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C  | Units |                              |      |       |
|   |   |  |                        | Typical                |       |                              |      |       |
| V <sub>OLP</sub>  | Quiet Output Dynamic Peak V <sub>OL</sub>     | C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V<br>C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V | 3.3                    | 0.8                    | V     |                              |      |       |
|   |   |  | 2.5                    | 0.6                    |       |                              |      |       |
| V <sub>OLV</sub>  | Quiet Output Dynamic Valley V <sub>OL</sub>   | C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V<br>C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V | 3.3                    | -0.8                   | V     |                              |      |       |
|   |   |  | 2.5                    | -0.6                   |       |                              |      |       |
| Capacitance   |   |  |                        |                        |       |                              |      |       |
| Symbol  | Parameter                                     | Conditions   | Typical                | Units                  |       |                              |      |       |
| C <sub>IN</sub>   | Input Capacitance                             | V <sub>CC</sub> = Open, V <sub>I</sub> = 0V or V <sub>CC</sub>   | 7                      | pF                     |       |                              |      |       |
| C <sub>OUT</sub>  | Output Capacitance                            | V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>   | 8                      | pF                     |       |                              |      |       |
| C <sub>PD</sub>   | Power Dissipation Capacitance                 | V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10 MHz  | 10                     | pF                     |       |                              |      |       |

**AC LOADING and WAVEFORMS**



**FIGURE 1. AC Test Circuit ( $C_L$  includes probe and jig capacitance)**

| Test               | Switch  |
|--------------------|---|
| $t_{pZL}, t_{pLZ}$ | 6V at $V_{CC} = 3.3 \pm 0.3V$<br>$V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2V$ |



**3-STATE Output Low Enable and Disable Times for Logic**

**FIGURE 2. Waveforms**  
(Input Characteristics;  $f = 1MHz, t_r = t_f = 3ns$ )

| Symbol   | $V_{CC}$        |                 |                  |
|----------|-----------------|-----------------|------------------|
|          | $3.3V \pm 0.3V$ | 2.7V            | $2.5V \pm 0.2V$  |
| $V_{mi}$ | 1.5V            | 1.5V            | $V_{CC}/2$       |
| $V_{mo}$ | 1.5V            | 1.5V            | $V_{CC}/2$       |
| $V_x$    | $V_{OL} + 0.3V$ | $V_{OL} + 0.3V$ | $V_{OL} + 0.15V$ |
| $V_y$    | $V_{OH} - 0.3V$ | $V_{OH} - 0.3V$ | $V_{OH} - 0.15V$ |

**Schematic Diagram** Generic for LCX Family (output pull-up circuitry is not applicable to open drain versions)

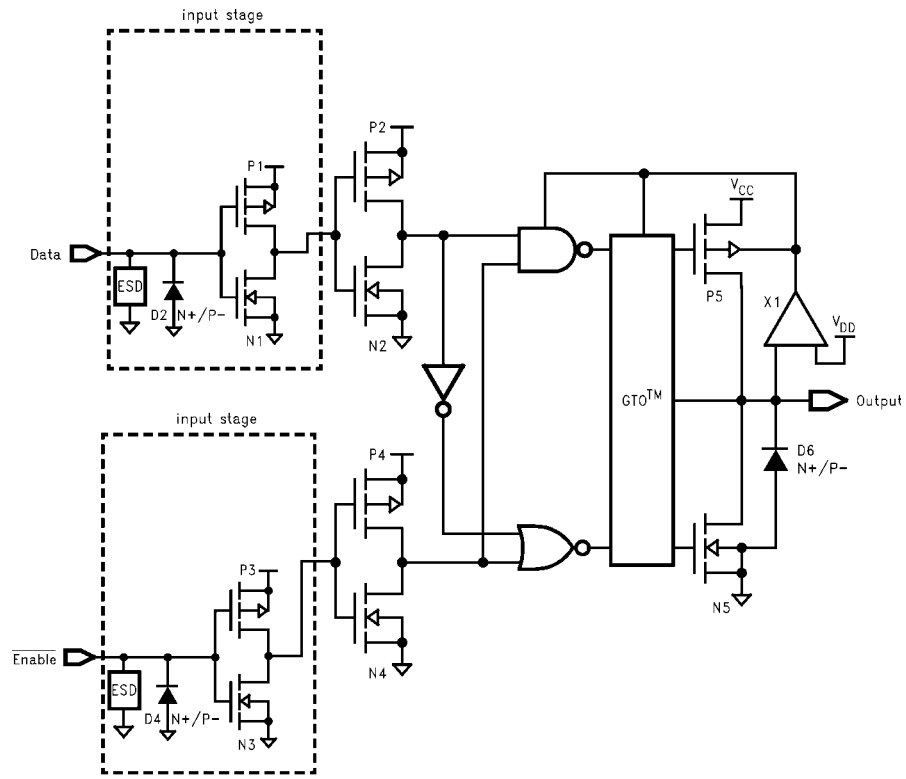
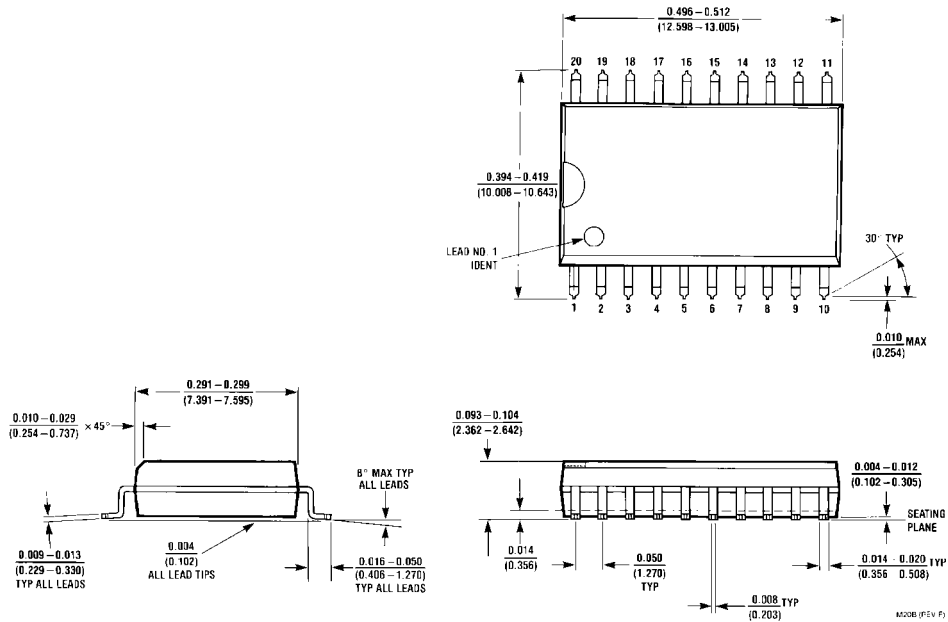


FIGURE 3.

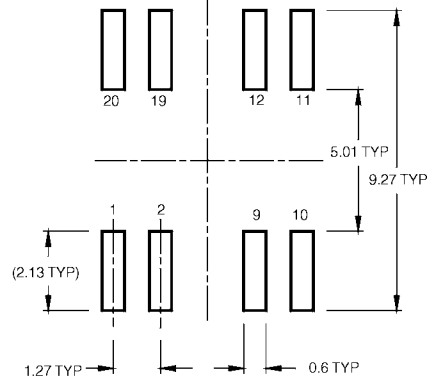
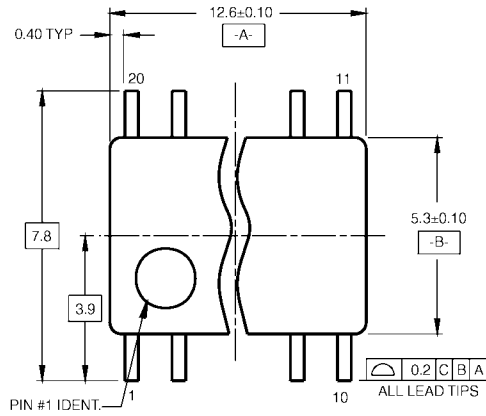
**Physical Dimensions** inches (millimeters) unless otherwise noted



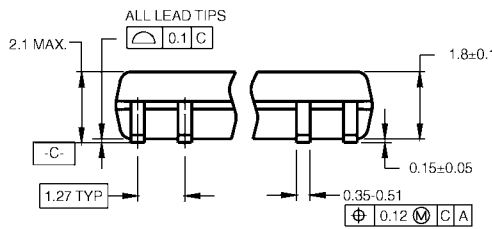
20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M20B



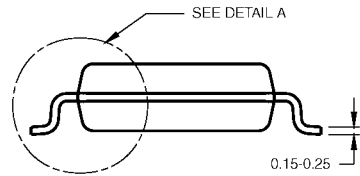
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION

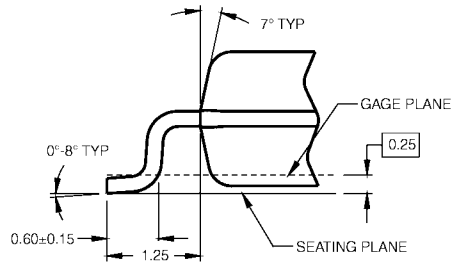


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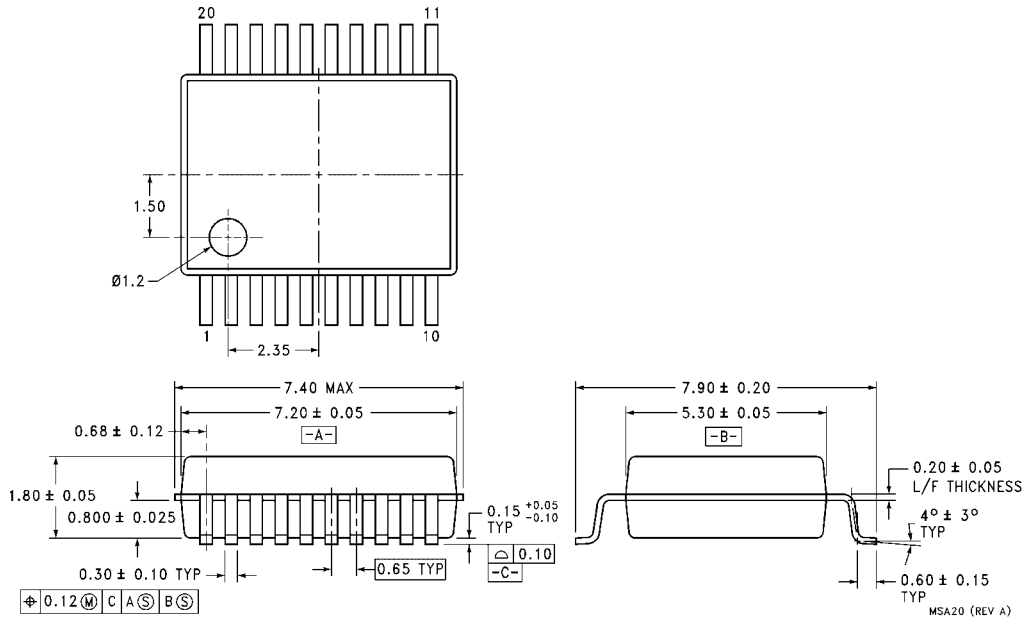
M20DRevB1



DETAIL A

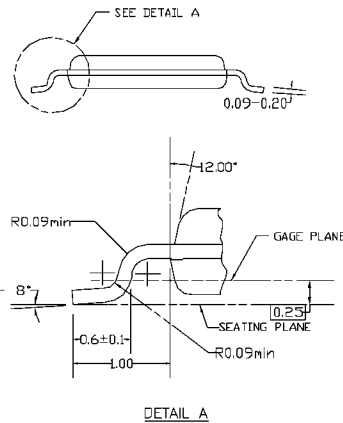
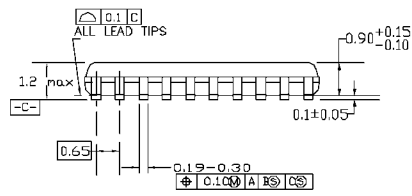
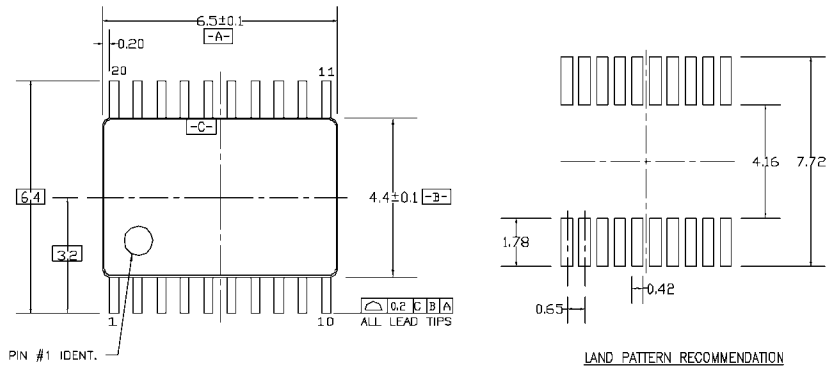
**Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M20D**

**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)



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NOTES:

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

MTC20REV D1

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

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