FAIRCHILD SEMICONDUCTOR™

July 1999
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# 74LVT244 •74LVTH244
# Low Voltage Octal Buffer/Line Driver with 3-STATE Outputs

## General Description

The LVT244 and LVTH244 are octal buffers and line drivers designed to be employed as memory address drivers, clock drivers and bus oriented transmitters or receivers which provide improved PC board density.

The LVTH244 data inputs include bushold, eliminating the need for external pull-up resistors to hold unused inputs.

These octal buffers and line drivers are designed for low-voltage (3.3V) $V_{CC}$ applications, but with the capability to provide a TTL interface to a 5V environment. The LVT244 and LVTH244 are fabricated with an advanced BiCMOS technology to achieve high speed operation similar to 5V ABT while maintaining low power dissipation.

## Features

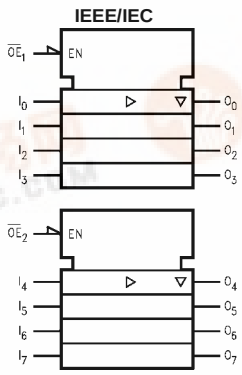
- Input and output interface capability to systems at 5V $V_{CC}$
- Bushold data inputs eliminate the need for external pull-up resistors to hold unused inputs (74LVTH244), also available without bushold feature (74LVT244)
- Live insertion/extraction permitted
- Power Up/Down high impedance provides glitch-free bus loading
- Outputs source/sink –32 mA/+64 mA
- Functionally compatible with the 74 series 244
- Latch-up performance exceeds 500 mA

## Ordering Code:

| Order Number | Package Number | Package Description |
|---|---|---|
| 74LVT244WM | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide |
| 74LVT244SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74LVT244MSA | MSA20 | 20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide |
| 74LVT244MTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74LVTH244WM | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide |
| 74LVTH244SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74LVTH244MSA | MSA20 | 20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide |
| 74LVTH244MTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

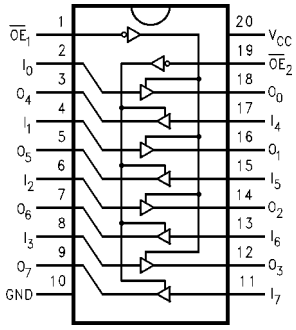
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

## Logic Symbol



## Connection Diagram




## Pin Descriptions

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

## 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(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 |
| $V_O$ | DC 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 | ±64 | | mA |
| $I_{GND}$ | DC Ground Current per Ground Pin | ±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 | |
| $T_A$ | 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 | | $V_{CC}$ (V) | $T_A = -40°C$ to $+85°C$ | | | Units | Conditions |
|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ (Note 3) | Max | | |
| $V_{IK}$ | Input Clamp Diode Voltage | | 2.7 | | | –1.2 | V | $I_I = -18$ mA |
| $V_{IH}$ | Input HIGH Voltage | | 2.7–3.6 | 2.0 | | | V | $V_O \le 0.1V$ or |
| $V_{IL}$ | Input LOW Voltage | | 2.7–3.6 | | | 0.8 | | $V_O \ge V_{CC} - 0.1V$ |
| $V_{OH}$ | Output HIGH Voltage | | 2.7–3.6 | $V_{CC}$–0.2 | | | V | $I_{OH} = -100$ µA |
| | | | 2.7 | 2.4 | | | V | $I_{OH} = -8$ mA |
| | | | 3.0 | 2.0 | | | V | $I_{OH} = -32$ mA |
| $V_{OL}$ | Output LOW Voltage | | 2.7 | | | 0.2 | V | $I_{OL} = 100$ µA |
| | | | 2.7 | | | 0.5 | V | $I_{OL} = 24$ mA |
| | | | 3.0 | | | 0.4 | V | $I_{OL} = 16$ mA |
| | | | 3.0 | | | 0.5 | V | $I_{OL} = 32$ mA |
| | | | 3.0 | | | 0.55 | V | $I_{OL} = 64$ mA |
| $I_{I(HOLD)}$ (Note 4) | Bushold Input Minimum Drive | | 3.0 | 75 | | | µA | $V_I = 0.8V$ |
| | | | | –75 | | | µA | $V_I = 2.0V$ |
| $I_{I(OD)}$ (Note 4) | Bushold Input Over-Drive Current to Change State | | 3.0 | 500 | | | µA | (Note 5) |
| | | | | –500 | | | µA | (Note 6) |
| $I_I$ | Input Current | | 3.6 | | | 10 | µA | $V_I = 5.5V$ |
| | | Control Pins | 3.6 | | | ±1 | µA | $V_I = 0V$ or $V_{CC}$ |
| | | Data Pins | 3.6 | | | –5 | µA | $V_I = 0V$ |
| | | | | | | 1 | µA | $V_I = V_{CC}$ |
| $I_{OFF}$ | Power Off Leakage Current | | 0 | | | ±100 | µA | $0V \le V_I$ or $V_O \le 5.5V$ |
| $I_{PU/PD}$ | Power up/down 3-STATE Output Current | | 0–1.5V | | | ±100 | µA | $V_O = 0.5V$ to $3.0V$<br>$V_I$ = GND or $V_{CC}$ |
| $I_{OZL}$ | 3-STATE Output Leakage Current | | 3.6 | | | –5 | µA | $V_O = 0.5V$ |
| $I_{OZH}$ | 3-STATE Output Leakage Current | | 3.6 | | | 5 | µA | $V_O = 3.0V$ |
| $I_{OZH}+$ | 3-STATE Output Leakage Current | | 3.6 | | | 10 | µA | $V_{CC} < V_O \le 5.5V$ |
| $I_{CCH}$ | Power Supply Current | | 3.6 | | | 0.19 | mA | Outputs HIGH |
| $I_{CCL}$ | Power Supply Current | | 3.6 | | | 5 | mA | Outputs LOW |
| $I_{CCZ}$ | Power Supply Current | | 3.6 | | | 0.19 | mA | Outputs Disabled |
| $I_{CCZ}+$ | Power Supply Current | | 3.6 | | | 0.19 | mA | $V_{CC} \le V_O \le 5.5V$,<br>Outputs Disabled |
| $\Delta I_{CC}$ | Increase in Power Supply Current (Note 7) | | 3.6 | | | 0.2 | mA | One Input at $V_{CC} - 0.6V$<br>Other Inputs at $V_{CC}$ or GND |

**Note 3:** All typical values are at $V_{CC} = 3.3V$, $T_A = 25°C$.

**Note 4:** Applies to bushold versions only (74LVTH244).

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

**Note 6:** An external driver must sink at least the specified current to switch from HIGH-to-LOW.

**Note 7:** This is the increase in supply current for each input that is at the specified voltage level rather than $V_{CC}$ or GND.

## Dynamic Switching Characteristics (Note 8)

| Symbol | Parameter | $V_{CC}$ (V) | $T_A = 25°C$ | | | Units | Conditions $C_L = 50$ pF, $R_L = 500\Omega$ |
|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | | |
| $V_{OLP}$ | Quiet Output Maximum Dynamic $V_{OL}$ | 3.3 | | 0.8 | | V | (Note 9) |
| $V_{OLV}$ | Quiet Output Minimum Dynamic $V_{OL}$ | 3.3 | | –0.8 | | V | (Note 9) |

**Note 8:** Characterized in SOIC package. Guaranteed parameter, but not tested.

**Note 9:** 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 | $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF, $R_L = 500\Omega$ | | | | | Units |
|---|---|---|---|---|---|---|---|
| | | $V_{CC} = 3.3V \pm 0.3V$ | | | $V_{CC} = 2.7V$ | | |
| | | Min | Typ (Note 10) | Max | Min | Max | |
| $t_{PLH}$ | Propagation Delay Data to Output | 1.1 | | 3.8 | 1.1 | 4.0 | ns |
| $t_{PHL}$ | | 1.3 | | 3.9 | 1.3 | 4.2 | |
| $t_{PZH}$ | Output Enable Time | 1.1 | | 4.5 | 1.1 | 5.3 | ns |
| $t_{PZL}$ | | 1.4 | | 4.4 | 1.4 | 5.0 | |
| $t_{PHZ}$ | Output Disable Time | 1.9 | | 4.9 | 1.9 | 5.1 | ns |
| $t_{PLZ}$ | | 1.8 | | 4.4 | 1.8 | 4.4 | |
| $t_{OSHL}$ | Output to Output Skew | | | 1.0 | | 1.0 | ns |
| $t_{OSLH}$ | (Note 11) | | | | | | |

**Note 10:** All typical values are at $V_{CC} = 3.3V$, $T_A = 25°C$.

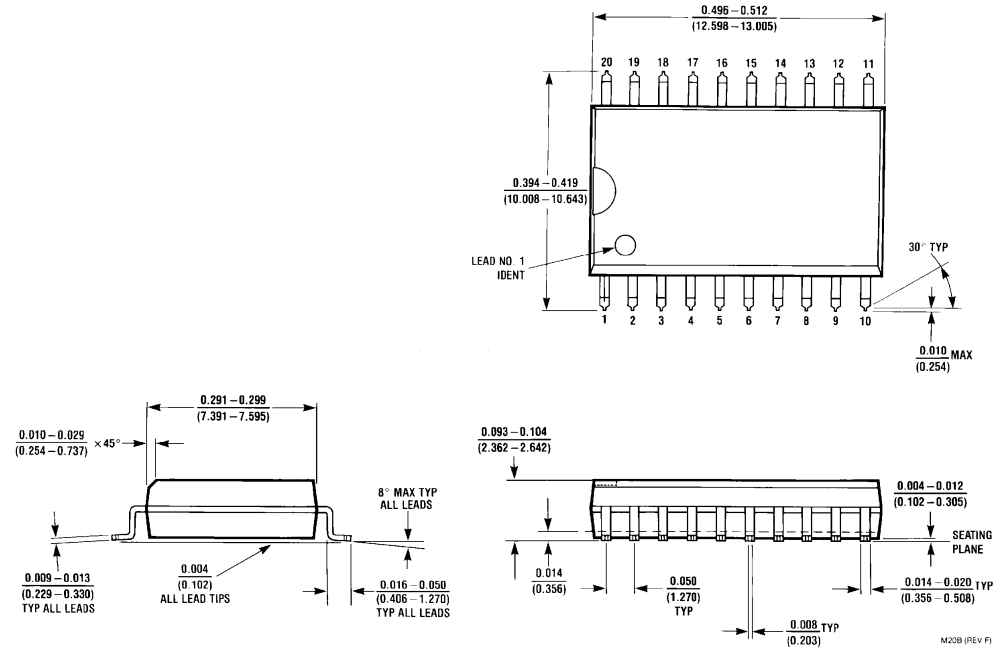
**Note 11:** Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ($t_{OSHL}$) or LOW-to-HIGH ($t_{OSLH}$). Parameter guaranteed by design.

## Capacitance (Note 12)

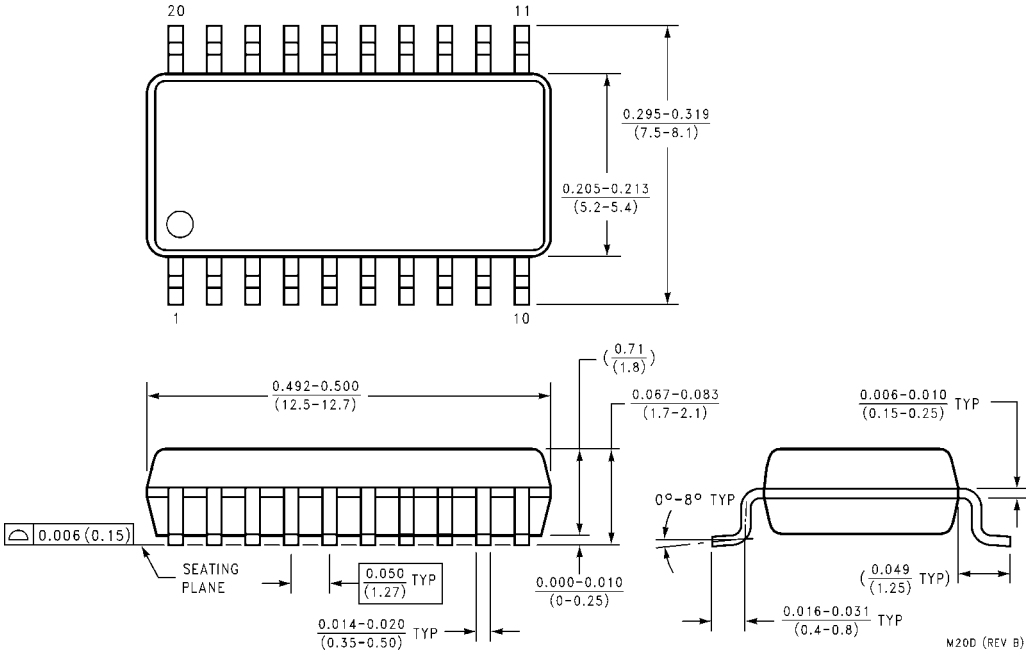
| Symbol | Parameter | Conditions | Typical | Units |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{CC} = 0V$, $V_I = 0V$ or $V_{CC}$ | 3 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{CC} = 3.0V$, $V_O = 0V$ or $V_{CC}$ | 6 | pF |

**Note 12:** Capacitance is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.

## Physical Dimensions inches (millimeters) unless otherwise noted

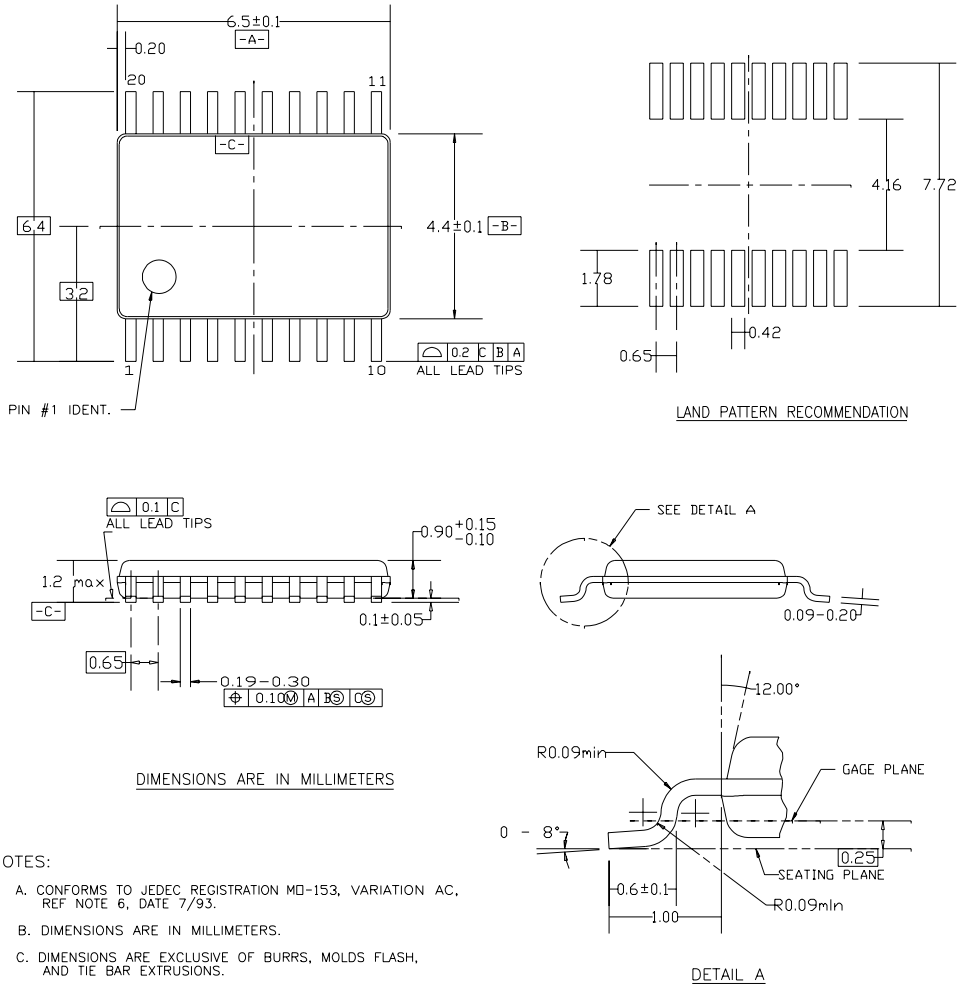



**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide**
**Package Number M20B**




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

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




NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.

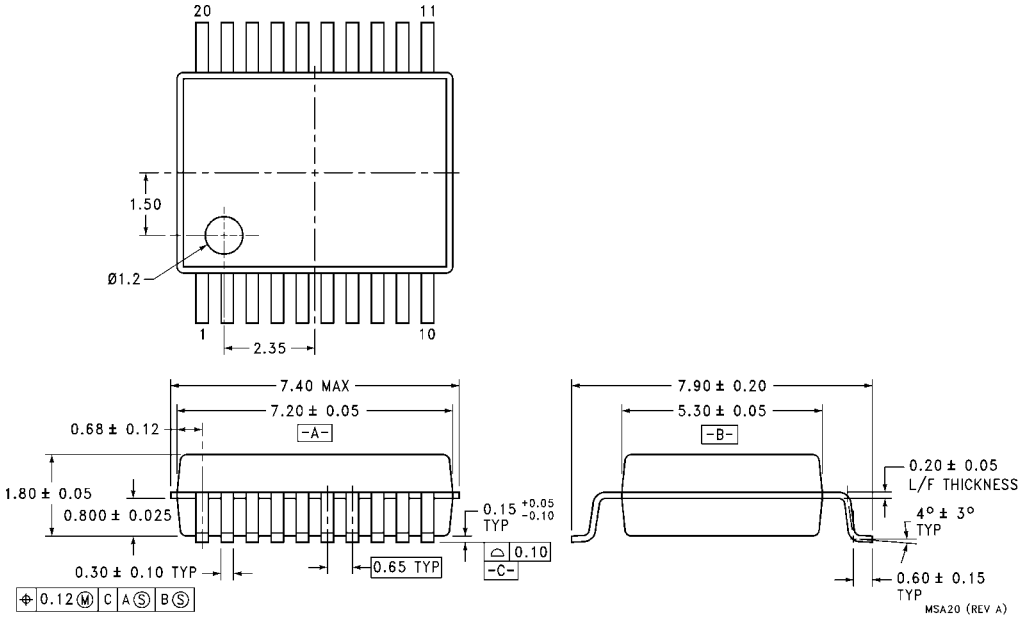
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.

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

**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)




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



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