

# 74LCX244

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

### General Description

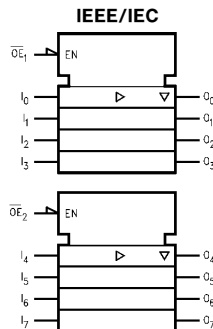
The LCX244 contains eight non-inverting buffers with TRI-STATE® outputs. The device may be employed as a memory address driver, clock driver and bus-oriented transmitter/receiver. The LCX244 is designed for low voltage (3.3V)  $V_{CC}$  applications with capability of interfacing to a 5V signal environment.

The LCX244 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

### Features

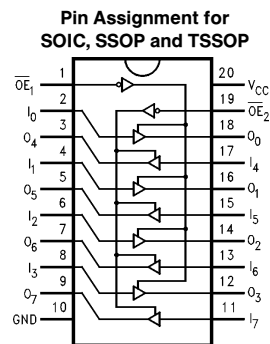
- 5V tolerant inputs and outputs
- 6.5 ns  $t_{PD}$  max, 10  $\mu A$   $I_{CCQ}$  max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal
- 2.0V–3.6V  $V_{CC}$  supply operation
- $\pm 24$  mA output drive
- Implements patented Quiet Series™ noise/EMI reduction circuitry
- Functionally compatible with the 74 series 244
- Latch-up performance exceeds 500 mA
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

### Logic Symbol



TL/F/11994-1

### Connection Diagram



TL/F/11994-2

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

### Truth Tables

Inputs		Outputs (Pins 12, 14, 16, 18)	Inputs		Outputs (Pins 3, 5, 7, 9)
$\overline{OE}_1$	$I_n$		$\overline{OE}_2$	$I_n$	
L	L	L	L	L	
L	H	H	L	H	
H	X	Z	H	X	

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

	SOIC JEDEC	SOIC EIAJ	SSOP Type II	TSSOP JEDEC
Order Number	74LCX244WM 74LCX244WMX	74LCX244SJ 74LCX244SJX	74LCX244MSA 74LCX244MSAX	74LCX244MTC 74LCX244MTCX
See NS Package Number	M20B	M20D	MSA20	MTC20

TRI-STATE® is a registered trademark of National Semiconductor Corporation.  
Quiet Series™ is a trademark of National Semiconductor Corporation.

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Symbol	Parameter	Value	Conditions	Units
$V_{CC}$	Supply Voltage	-0.5 to +7.0		V
$V_I$	DC Input Voltage	-0.5 to +7.0		V
$V_O$	DC Output Voltage	-0.5 to +7.0	Output in TRI-STATE	V
		-0.5 to $V_{CC} + 0.5$	Output in High or Low State (Note 2)	V
$I_{IK}$	DC Input Diode Current	-50	$V_I < \text{GND}$	mA
$I_{OK}$	DC Output Diode Current	-50	$V_O < \text{GND}$	mA
		+50	$V_O > V_{CC}$	
$I_O$	DC Output Source/Sink Current	$\pm 50$		mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$		mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA
$T_{STG}$	Storage Temperature	-65 to +150		$^{\circ}\text{C}$

**Note 1:** 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" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

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

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units	
$V_{CC}$	Supply Voltage	Operating	2.0	3.6	V
		Data Retention	1.5	3.6	
$V_I$	Input Voltage	0	5.5	V	
$V_O$	Output Voltage	HIGH or LOW State	0	$V_{CC}$	V
		TRI-STATE	0	5.5	
$I_{OH}/I_{OL}$	Output Current	$V_{CC} = 3.0\text{V} - 3.6\text{V}$ $V_{CC} = 2.7\text{V}$		$\pm 24$ $\pm 12$	mA
$T_A$	Free-Air Operating Temperature	-40	85	$^{\circ}\text{C}$	
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8\text{V} - 2.0\text{V}$ , $V_{CC} = 3.0\text{V}$	0	10	ns/V	

## DC Electrical Characteristics

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$		Units
				Min	Max	
$V_{IH}$	HIGH Level Input Voltage		2.7-3.6	2.0		V
$V_{IL}$	LOW Level Input Voltage		2.7-3.6		0.8	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu\text{A}$	2.7-3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -12 \text{ mA}$	2.7	2.2		V
		$I_{OH} = -18 \text{ mA}$	3.0	2.4		V
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		V
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu\text{A}$	2.7-3.6		0.2	V
		$I_{OL} = 12 \text{ mA}$	2.7		0.4	V
		$I_{OL} = 16 \text{ mA}$	3.0		0.4	V
		$I_{OL} = 24 \text{ mA}$	3.0		0.55	V
$I_I$	Input Leakage Current	$0 \leq V_I \leq 5.5\text{V}$	2.7-3.6		$\pm 5.0$	$\mu\text{A}$
$I_{OZ}$	TRI-STATE Output Leakage	$0 \leq V_O \leq 5.5\text{V}$ $V_I = V_{IH}$ or $V_{IL}$	2.7-3.6		$\pm 5.0$	$\mu\text{A}$
$I_{OFF}$	Power-Off Leakage Current	$V_I$ or $V_O = 5.5\text{V}$	0		10	$\mu\text{A}$
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or $\text{GND}$	2.7-3.6		10	$\mu\text{A}$
		$3.6\text{V} \leq V_I, V_O \leq 5.5\text{V}$	2.7-3.6		$\pm 10$	$\mu\text{A}$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6\text{V}$	2.7-3.6		500	$\mu\text{A}$

## AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
$t_{PHL}$ $t_{PLH}$	Propagation Delay Data to Output	1.5	6.5	1.5	7.5	ns
		1.5	6.5	1.5	7.5	
$t_{PZL}$ $t_{PZH}$	Output Enable Time	1.5	8.0	1.5	9.0	ns
		1.5	8.0	1.5	9.0	
$t_{PLZ}$ $t_{PHZ}$	Output Disable Time	1.5	7.0	1.5	8.0	ns
		1.5	7.0	1.5	8.0	
$t_{OSHL}$ $t_{OSLH}$	Output to Output Skew (Note 1)		1.0			ns
			1.0			

**Note 1:** 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 ( $t_{OSLH}$ ).

## Dynamic Switching Characteristics

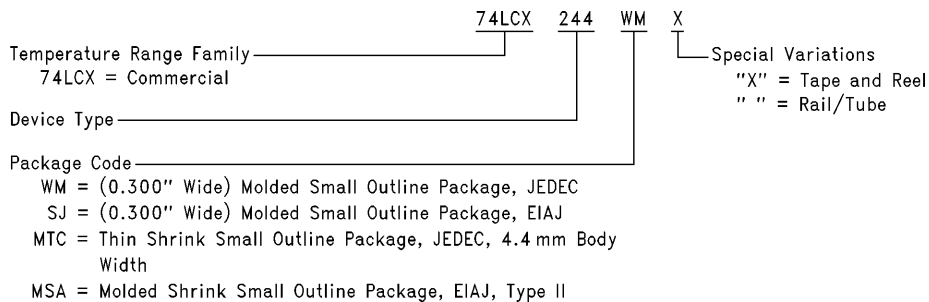
Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$	Units
				Typical	
$V_{OLP}$	Quiet Output Dynamic Peak $V_{OL}$	$C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V
$V_{OLV}$	Quiet Output Dynamic Valley $V_{OL}$	$C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	-0.8	V

## Capacitance

Symbol	Parameter	Conditions	Typical	Units
$C_{IN}$	Input Capacitance	$V_{CC} = \text{Open}, V_I = 0V \text{ or } V_{CC}$	7	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}$	8	pF
$C_{PD}$	Power Dissipation Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}, F = 10 \text{ MHz}$	25	pF

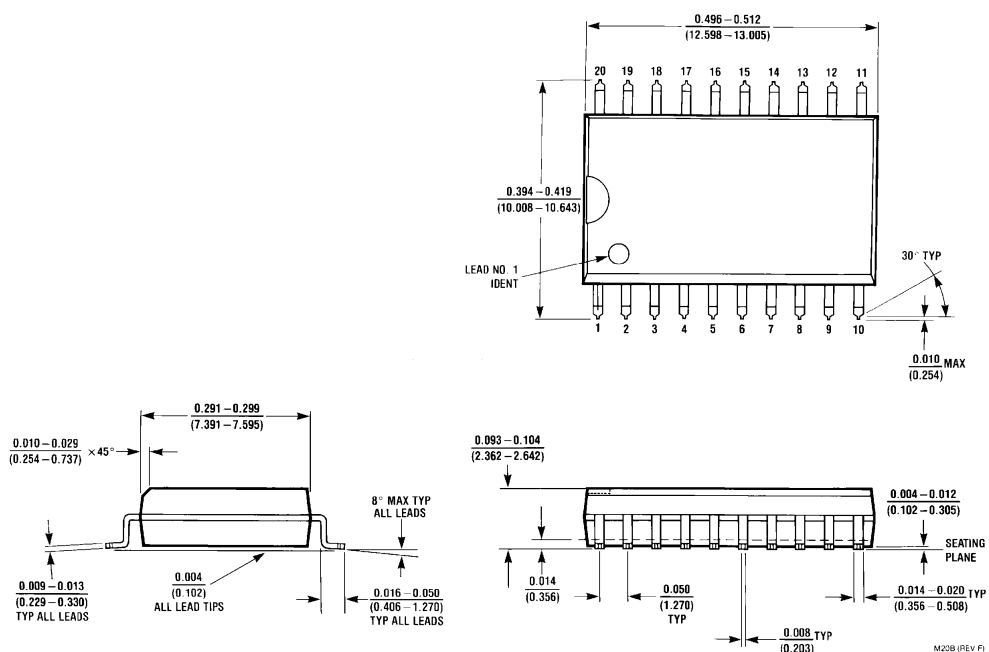
## 74LCX244 Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



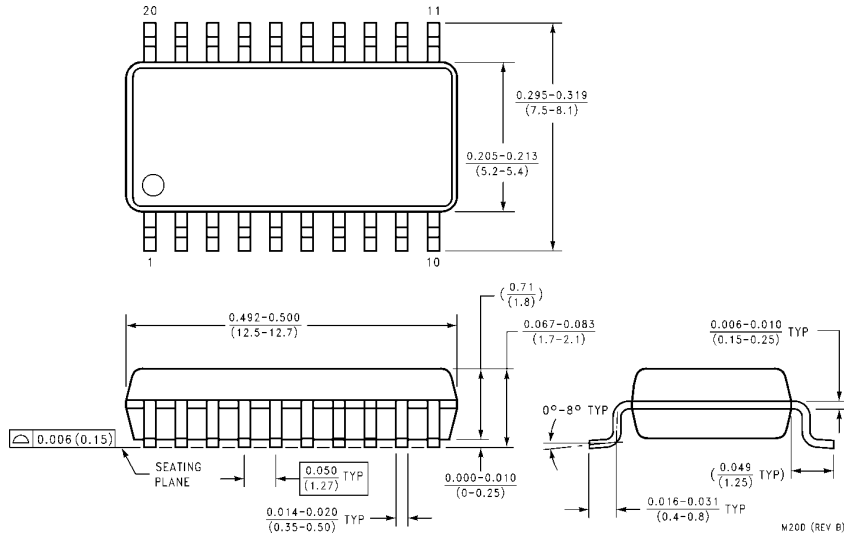
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## Physical Dimensions inches (millimeters) unless otherwise noted

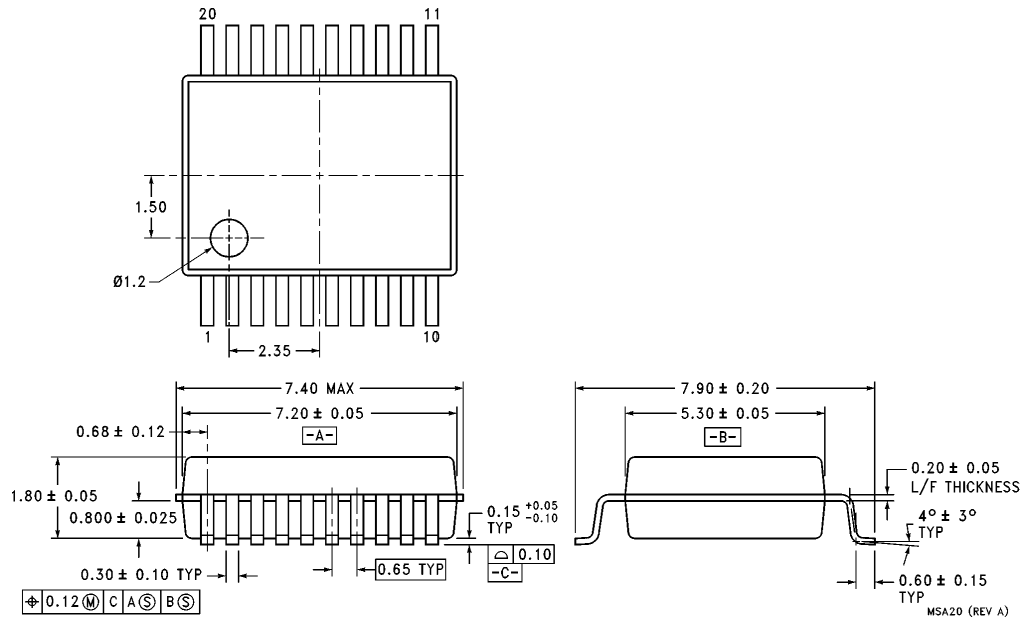


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC**  
**Order Number 74LCX244WM or 74LCX244WMX**  
**NS Package Number M20B**

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



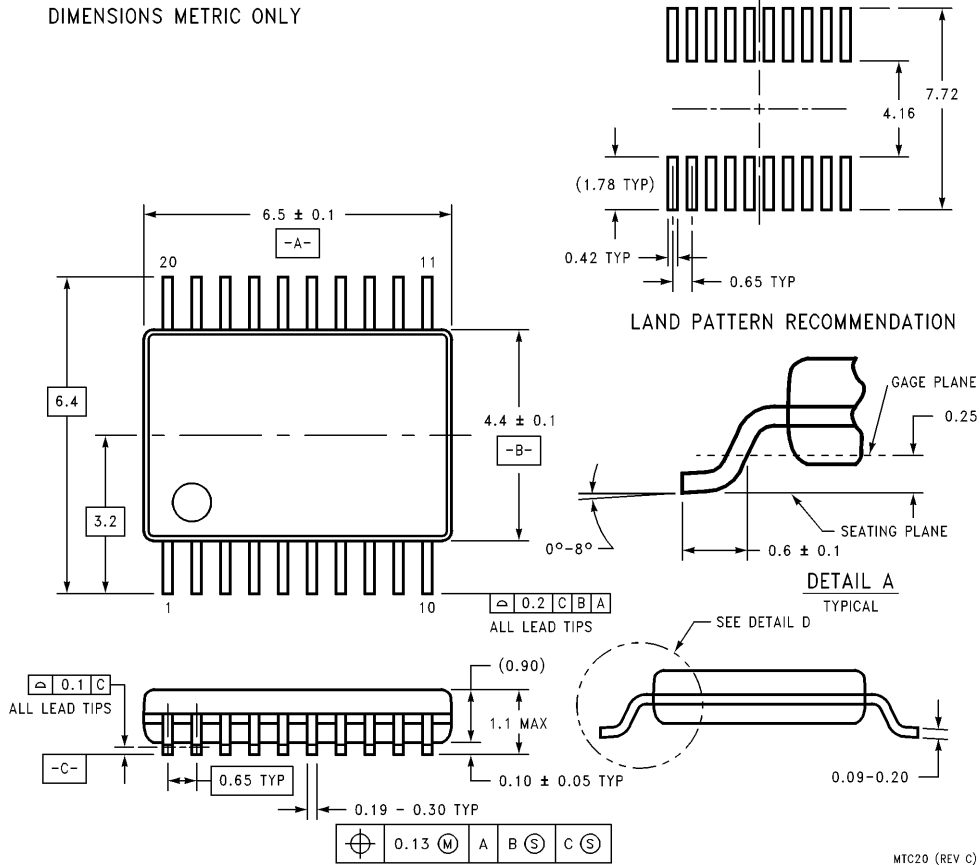
**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ**  
**Order Number 74LCX244SJ or 74LCX244SJX**  
**NS Package Number M20D**



All dimensions are in millimeters.

**20-Lead Molded Shrink Small Outline Package, EIAJ, Type II**  
**Order Number 74LCX244MSA or 74LCX244MSAX**  
**NS Package Number MSA20**

**Physical Dimensions** All dimensions are in millimeters (Continued)



**20-Lead Thin Shrink Small Outline Package, JEDEC**  
**Order Number 74LCX244MTC or 74LCX244MTCX**  
**NS Package Number MTC20**

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