National Semiconductor

December 1996

74LCX240
Low-Voltage Octal Buffer/Line Driver with 5V Tolerant Inputs and Outputs

General Description

The LCX240 is an inverting octal buffer and line driver designed to be employed as a memory address driver, clock driver and bus oriented transmitter or receiver. The device is designed for low voltage (3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment.

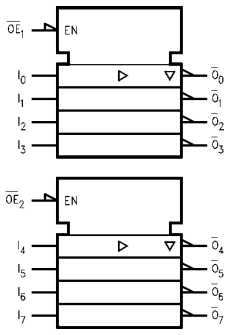
The LCX240 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

Features

- 5V tolerant inputs and outputs
- 6.5 ns t_{PD} max, 10 μA 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 240
- Latch-up performance exceeds 500 mA
- ESD performance:
  Human Body Model > 2000V
  Machine Model > 200V

Logic Symbol

IEEE/IEC



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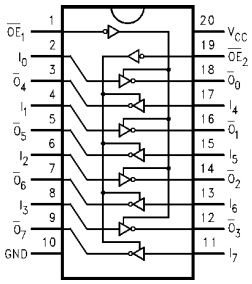
Connection Diagram

Pin Assignment for SOIC, SSOP and TSSOP



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Pin Names	Description
$\overline{OE}_1$, $\overline{OE}_2$	TRI-STATE® Output Enable Inputs
I_0–I_7	Inputs
$\overline{O}_0$–$\overline{O}_7$	Outputs

Truth Tables

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

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

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

	SOIC JEDEC	SOIC EIAJ	SSOP Type II	TSSOP
Order Number	74LCX240WM 74LCX240WMX	74LCX240SJ 74LCX240SJX	74LCX240MSA 74LCX240MSAX	74LCX240MTC 74LCX240MTCX
See NS Package Number	M20B	M20D	MSA20	MTC20

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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 < GND	mA
I_{OK}	DC Output Diode Current	−50 +50	V_O < GND V_O > V_{CC}	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current per Supply Pin	±100		mA
I_{GND}	DC Ground Current per Ground Pin	±100		mA
T_{STG}	Storage Temperature	−65 to +150		°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 Data Retention	2.0 1.5	3.6 3.6	V
V_I	Input Voltage		0	5.5	V
V_O	Output Voltage	HIGH or LOW State TRI-STATE	0 0	V_{CC} 5.5	V
I_{OH}/I_{OL}	Output Current	V_{CC} = 3.0V–3.6V V_{CC} = 2.7V		±24 ±12	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	Conditions	V_{CC} (V)	T_A = −40°C to +85°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 μA	2.7–3.6	V_{CC} − 0.2		V
		I_{OH} = −12 mA	2.7	2.2		V
		I_{OH} = −18 mA	3.0	2.4		V
		I_{OH} = −24 mA	3.0	2.2		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 μA	2.7–3.6		0.2	V
		I_{OL} = 12 mA	2.7		0.4	V
		I_{OL} = 16 mA	3.0		0.4	V
		I_{OL} = 24 mA	3.0		0.55	V
I_I	Input Leakage Current	0 ≤ V_I ≤ 5.5V	2.7–3.6		±5.0	μA
I_{OZ}	TRI-STATE Output Leakage	0 ≤ V_O ≤ 5.5V V_I = V_{IH} or V_{IL}	2.7–3.6		±5.0	μA
I_{OFF}	Power-Off Leakage Current	V_I or V_O = 5.5V	0		10	μA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	2.7–3.6		10	μA
		3.6V ≤ V_I, V_O ≤ 5.5V	2.7–3.6		±10	μA
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} − 0.6V	2.7–3.6		500	μA

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$				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 1.5	6.5 6.5	1.5 1.5	7.5 7.5	ns
t_{PZL} t_{PZH}	Output Enable Time	1.5 1.5	8.0 8.0	1.5 1.5	9.0 9.0	ns
t_{PLZ} t_{PHZ}	Output Disable Time	1.5 1.5	7.0 7.0	1.5 1.5	8.0 8.0	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 1)		1.0 1.0			ns

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

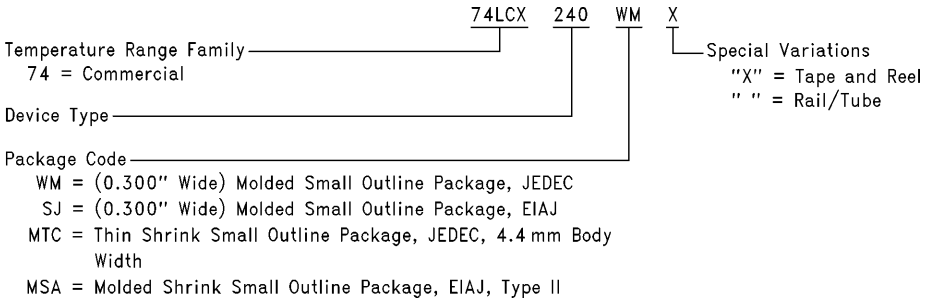
Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25°C$	Units
				Typical	
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 50$ pF, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.8	V
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 50$ pF, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	−0.8	V

Capacitance

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

74LCX240 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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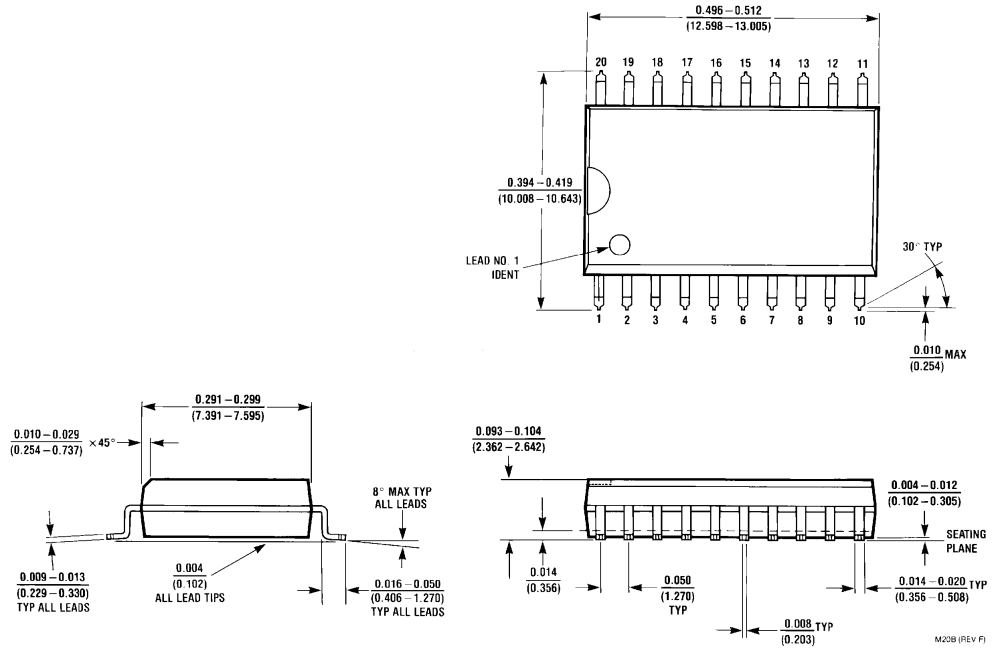
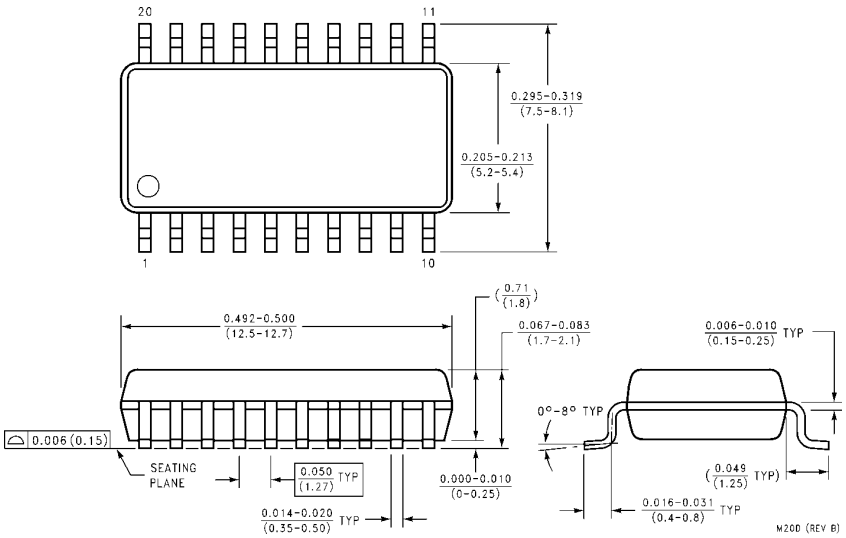
Physical Dimensions inches (millimeters) unless otherwise noted

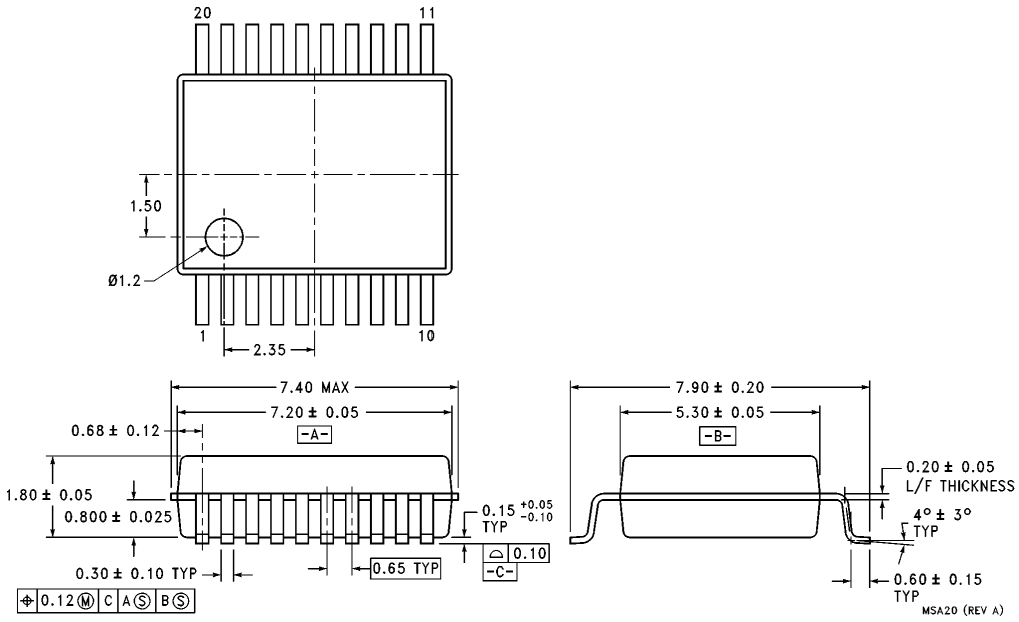


20-Lead Small Outline Integrated Circuit
Order Number 74LCX240WM or 74LCX240WMX
NS Package Number M20B

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



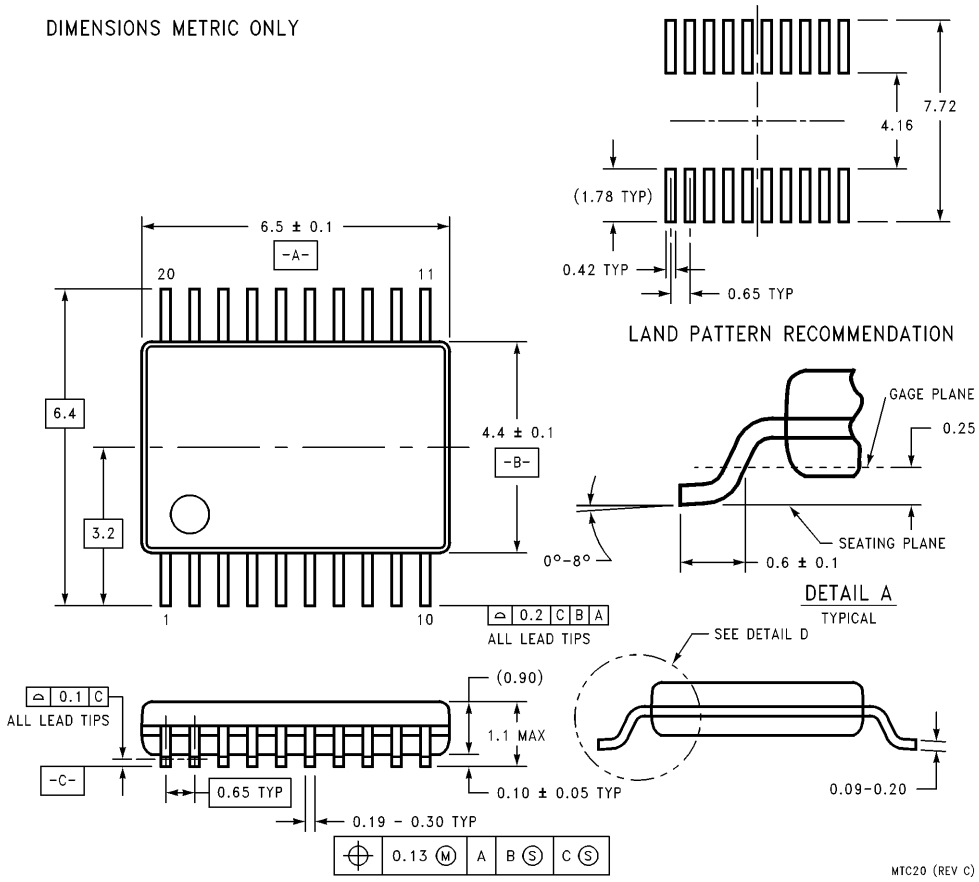
20-Lead Small Outline Package, EIAJ (SJ)
Order Number 74LCX240SJ or 74LCX240SJX
NS Package Number M20D



All dimensions are in millimeters.

20-Lead Molded Shrink Small Outline Package, EIAJ, Type II
Order Number 74LCX240MSA or 74LCX240MSAX
NS Package Number MSA20

Physical Dimensions All dimensions are in millimeters (Continued)



20-Lead Thin Shrink Small Outline Package, JEDEC
Order Number 74LCX240MTC or 74LCX240MTCX
NS Package Number MTC20

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