

# MC74LCX244

## Low-Voltage CMOS Octal Buffer

### With 5 V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX244 is a high performance, non-inverting octal buffer operating from a 2.3 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A  $V_I$  specification of 5.5 V allows MC74LCX244 inputs to be safely driven from 5 V devices. The MC74LCX244 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

Current drive capability is 24 mA at the outputs. The Output Enable ( $\overline{OE}$ ) input, when HIGH, disables the output by placing them in a HIGH Z condition.

#### Features

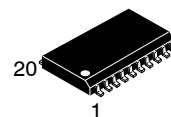
- Designed for 2.3 to 3.6 V  $V_{CC}$  Operation
- 5 V Tolerant – Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- $I_{OFF}$  Specification Guarantees High Impedance When  $V_{CC} = 0$  V
- LVTTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10  $\mu$ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance:
  - ◆ Human Body Model >2000 V
  - ◆ Machine Model >200 V
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



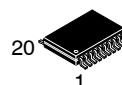
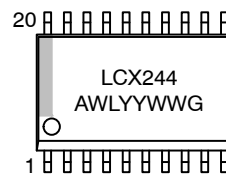
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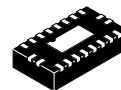
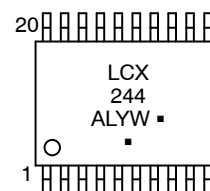
#### MARKING DIAGRAMS



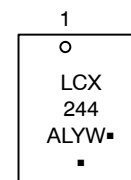
SOIC-20 WB  
DW SUFFIX  
CASE 751D



TSSOP-20  
DT SUFFIX  
CASE 948E



QFN20  
MN SUFFIX  
CASE 485AA



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

# MC74LCX244

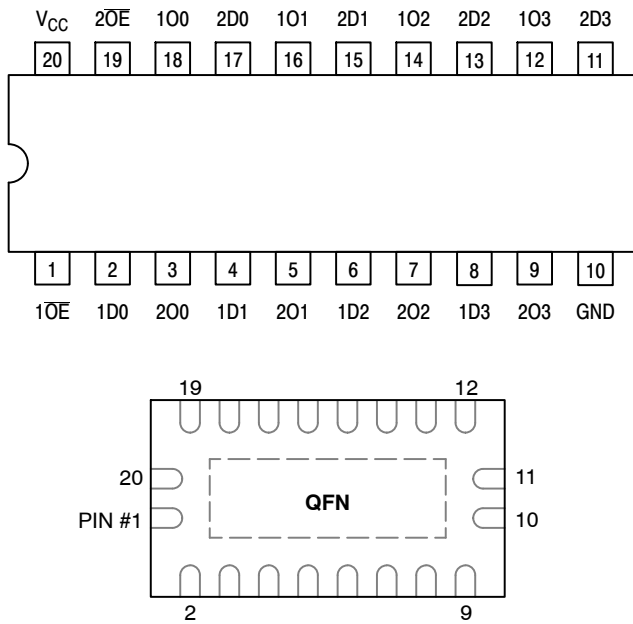


Figure 1. Pinouts: 20-Lead (Top View)

## PIN NAMES

PINS	FUNCTION
$\overline{nOE}$	Output Enable Inputs
1Dn, 2Dn	Data Inputs
1On, 2On	3-State Outputs

## TRUTH TABLE

INPUTS		OUTPUTS
$\overline{1OE}$ $\overline{2OE}$	1Dn 2Dn	1On, 2On
L	L	L
L	H	H
H	X	Z

H = High Voltage Level  
 L = Low Voltage Level  
 Z = High Impedance State  
 X = High or Low Voltage Level and Transitions are Acceptable  
 For  $I_{CC}$  reasons, DO NOT FLOAT Inputs

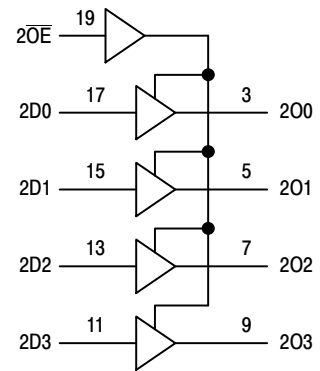
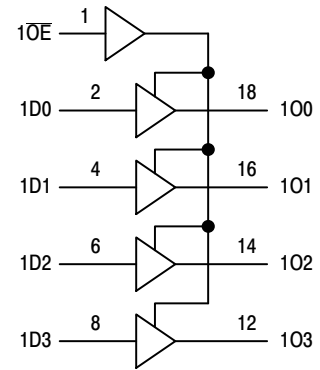


Figure 2. Logic Diagram

# MC74LCX244

## MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Units
$V_{CC}$	DC Supply Voltage	-0.5 to +7.0		V
$V_I$	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$		V
$V_O$	DC Output Voltage	$-0.5 \leq V_O \leq +7.0$	Output in 3-State	V
		$-0.5 \leq V_O \leq V_{CC} + 0.5$	Output in HIGH or LOW State (Note 1)	V
$I_{IK}$	DC Input Diode Current	-50	$V_I < GND$	mA
$I_{OK}$	DC Output Diode Current	-50	$V_O < GND$	mA
		+50	$V_O > V_{CC}$	mA
$I_O$	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 Range	-65 to +150		$^{\circ}C$
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	$T_L = 260$		$^{\circ}C$
$T_J$	Junction Temperature Under Bias	$T_J = 150$		$^{\circ}C$
$\theta_{JA}$	Thermal Resistance (Note 2)	$\theta_{JA} = 140$		$^{\circ}C/W$
MSL	Moisture Sensitivity		Level 1	

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

- $I_O$  absolute maximum rating must be observed.
- Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Units
$V_{CC}$	Supply Voltage Operating Data Retention Only	2.0	2.5, 3.3	3.6	V
		1.5	2.5, 3.3	3.6	
$V_I$	Input Voltage	0		5.5	V
$V_O$	Output Voltage HIGH or LOW State 3-State	0		$V_{CC}$	V
		0		5.5	
$I_{OH}$	HIGH Level Output Current $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$			-24	mA
				-12	
$I_{OL}$	LOW Level Output Current $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$			24	mA
				12	
$T_A$	Operating Free-Air Temperature	-55		+125	$^{\circ}C$
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, $V_{IN}$ from 0.8 V to 2.0 V, $V_{CC} = 3.0\text{ V}$	0		10	ns/V

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T <sub>A</sub> = -55°C to +125°C		Units
			Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage (Note 3)	2.3 V ≤ V <sub>CC</sub> ≤ 2.7 V	1.7		V
		2.7 V ≤ V <sub>CC</sub> ≤ 3.6 V	2.0		
V <sub>IL</sub>	LOW Level Input Voltage (Note 3)	2.3 V ≤ V <sub>CC</sub> ≤ 2.7 V		0.7	V
		2.7 V ≤ V <sub>CC</sub> ≤ 3.6 V		0.8	
V <sub>OH</sub>	HIGH Level Output Voltage	2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; I <sub>OL</sub> = 100 μA	V <sub>CC</sub> - 0.2		V
		V <sub>CC</sub> = 2.3 V; I <sub>OH</sub> = -8 mA	1.8		
		V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -12 mA	2.2		
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -18 mA	2.4		
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -24 mA	2.2		
V <sub>OL</sub>	LOW Level Output Voltage	2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; I <sub>OL</sub> = 100 μA		0.2	V
		V <sub>CC</sub> = 2.3 V; I <sub>OL</sub> = 8 mA		0.6	
		V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 12 mA		0.4	
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 16 mA		0.4	
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 24 mA		0.55	
I <sub>OZ</sub>	3-State Output Current	V <sub>CC</sub> = 3.6 V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 0 to 5.5 V		±5	μA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>CC</sub> = 0, V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V		10	μA
I <sub>IN</sub>	Input Leakage Current	V <sub>CC</sub> = 3.6 V, V <sub>IN</sub> = 5.5 V or GND		±5	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>CC</sub> = 3.6 V, V <sub>IN</sub> = 5.5 V or GND		10	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	2.3 ≤ V <sub>CC</sub> ≤ 3.6 V; V <sub>IH</sub> = V <sub>CC</sub> - 0.6 V		500	μA

3. These values of V<sub>I</sub> are used to test DC electrical characteristics only.

## AC CHARACTERISTICS (t<sub>R</sub> = t<sub>F</sub> = 2.5 ns; R<sub>L</sub> = 500 Ω)

Symbol	Parameter	Waveform	Limits						Units
			T <sub>A</sub> = -55°C to +125°C						
			V <sub>CC</sub> = 3.0 V to 3.6 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 2.5 V ± 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>PLH</sub> t <sub>PHL</sub>	Propagation Delay Input to Output	1	1.5 1.5	6.5 6.5	1.5 1.5	7.5 7.5	1.5 1.5	7.8 7.8	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time to High and Low Level	2	1.5 1.5	8.0 8.0	1.5 1.5	9.0 9.0	1.5 1.5	10 10	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time From High and Low Level	2	1.5 1.5	7.0 7.0	1.5 1.5	8.0 8.0	1.5 1.5	8.4 8.4	ns
t <sub>OSSL</sub> t <sub>OSLH</sub>	Output-to-Output Skew (Note 4)			1.0 1.0					ns

4. 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>); parameter guaranteed by design.

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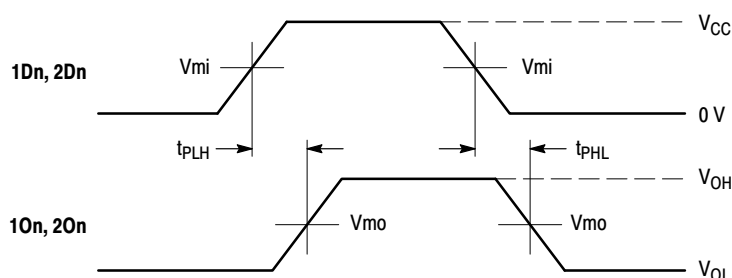
## DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	$T_A = +25^\circ\text{C}$			Units
			Min	Typ	Max	
$V_{OLP}$	Dynamic LOW Peak Voltage (Note 5)	$V_{CC} = 3.3\text{ V}, C_L = 50\text{ pF}, V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ $V_{CC} = 2.5\text{ V}, C_L = 30\text{ pF}, V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$		0.8 0.6		V
$V_{OLV}$	Dynamic LOW Valley Voltage (Note 5)	$V_{CC} = 3.3\text{ V}, C_L = 50\text{ pF}, V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ $V_{CC} = 2.5\text{ V}, C_L = 30\text{ pF}, V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$		-0.8 -0.6		V

5. Number of outputs defined as “n”. Measured with “n-1” outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

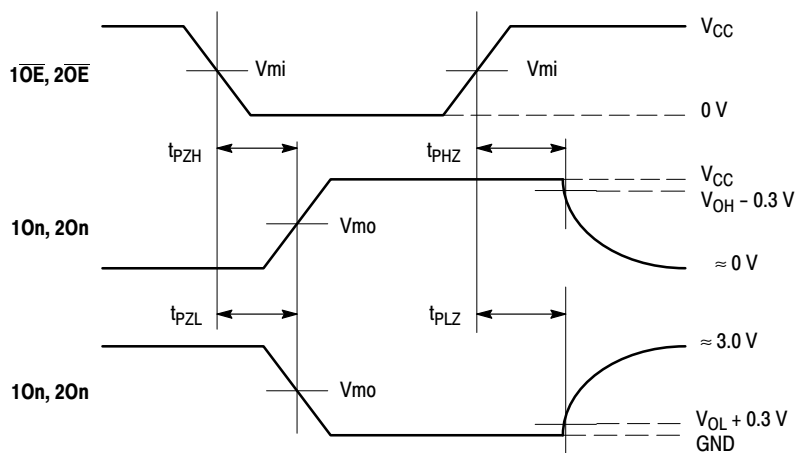
## CAPACITIVE CHARACTERISTICS

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



**WAVEFORM 1 - PROPAGATION DELAYS**

$t_R = t_F = 2.5\text{ ns}$ , 10% to 90%;  $f = 1\text{ MHz}$ ;  $t_W = 500\text{ ns}$



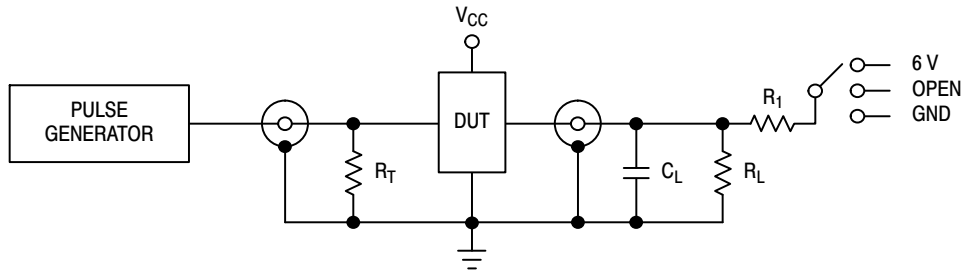
**WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES**

$t_R = t_F = 2.5\text{ ns}$ , 10% to 90%;  $f = 1\text{ MHz}$ ;  $t_W = 500\text{ ns}$

**Figure 3. AC Waveforms**

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

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TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	6 V at $V_{CC} = 3.3 \pm 0.3$ V 6 V at $V_{CC} = 2.5 \pm 0.2$ V
Open Collector/Drain $t_{PLH}$ and $t_{PHL}$	6 V
$t_{PZH}$ , $t_{PHZ}$	GND

$C_L = 50$  pF at  $V_{CC} = 3.3 \pm 0.3$  V or equivalent (includes jig and probe capacitance)

$C_L = 30$  pF at  $V_{CC} = 2.5 \pm 0.2$  V or equivalent (includes jig and probe capacitance)

$R_L = R_1 = 500 \Omega$  or equivalent

$R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ )

Figure 4. Test Circuit

## ORDERING INFORMATION

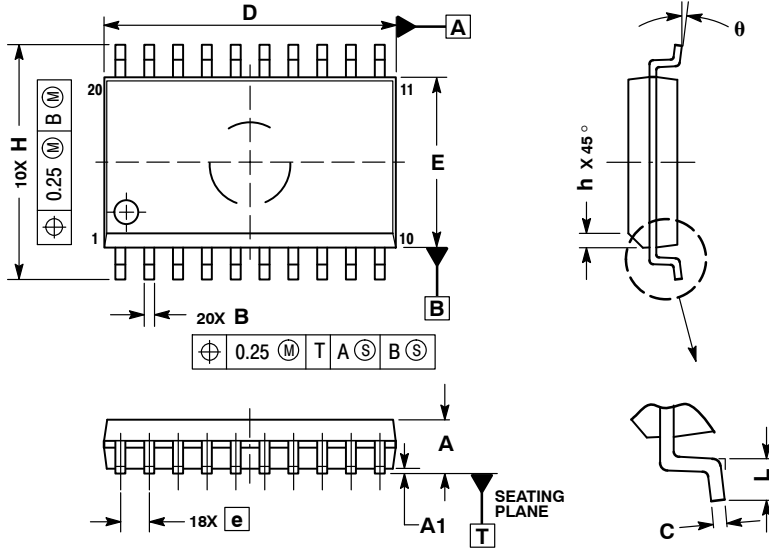
Device	Package	Shipping <sup>†</sup>
MC74LCX244DWG	SOIC-20 WB (Pb-Free)	38 Units / Rail
MC74LCX244DWR2G	SOIC-20 WB (Pb-Free)	1000 / Tape & Reel
MC74LCX244DTG	TSSOP-20 (Pb-Free)	75 Units / Rail
MC74LCX244DTR2G	TSSOP-20 (Pb-Free)	2500 / Tape & Reel
MC74LCX244MNTWG	QFN20 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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## PACKAGE DIMENSIONS

SOIC-20 WB  
CASE 751D-05  
ISSUE G



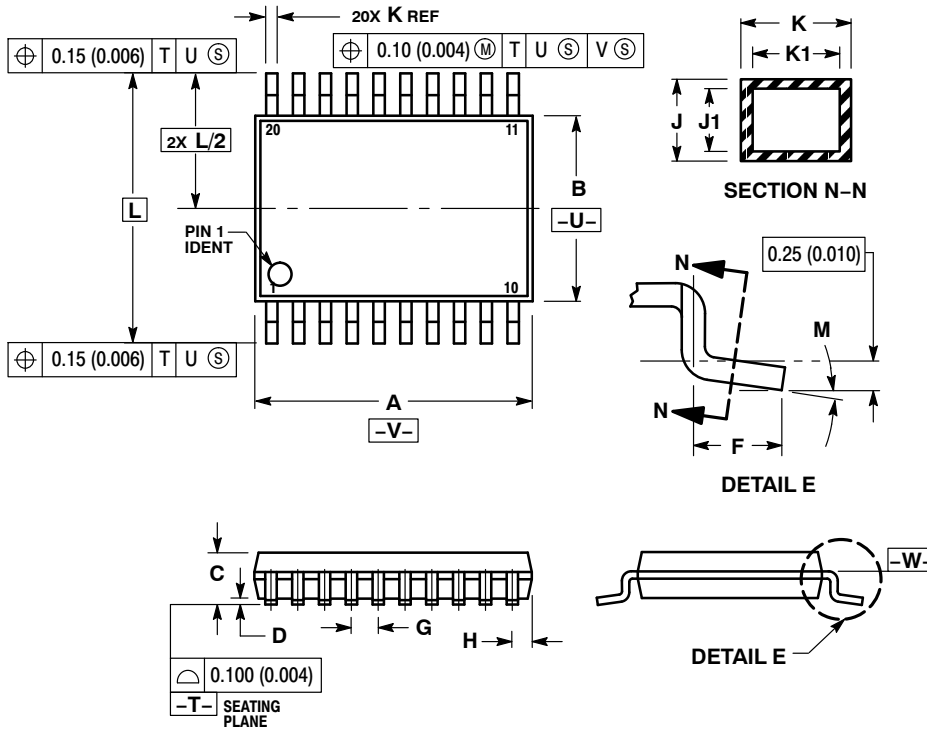
- NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
  2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
  3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
  5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
$\theta$	0°	7°

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## PACKAGE DIMENSIONS

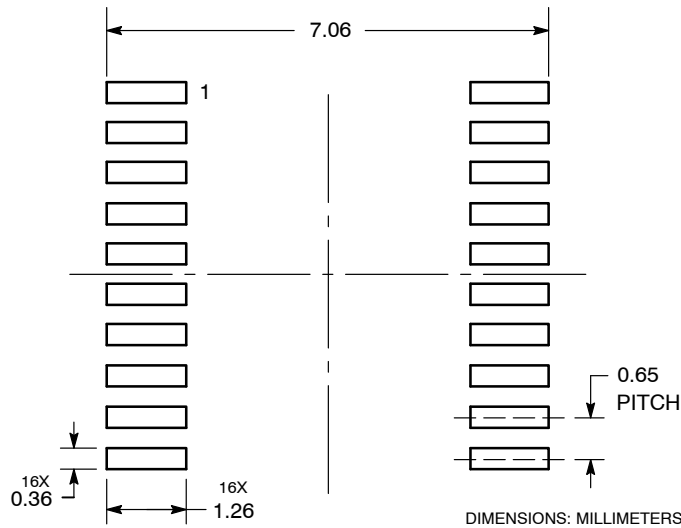
TSSOP-20  
CASE 948E-02  
ISSUE C



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

### SOLDERING FOOTPRINT

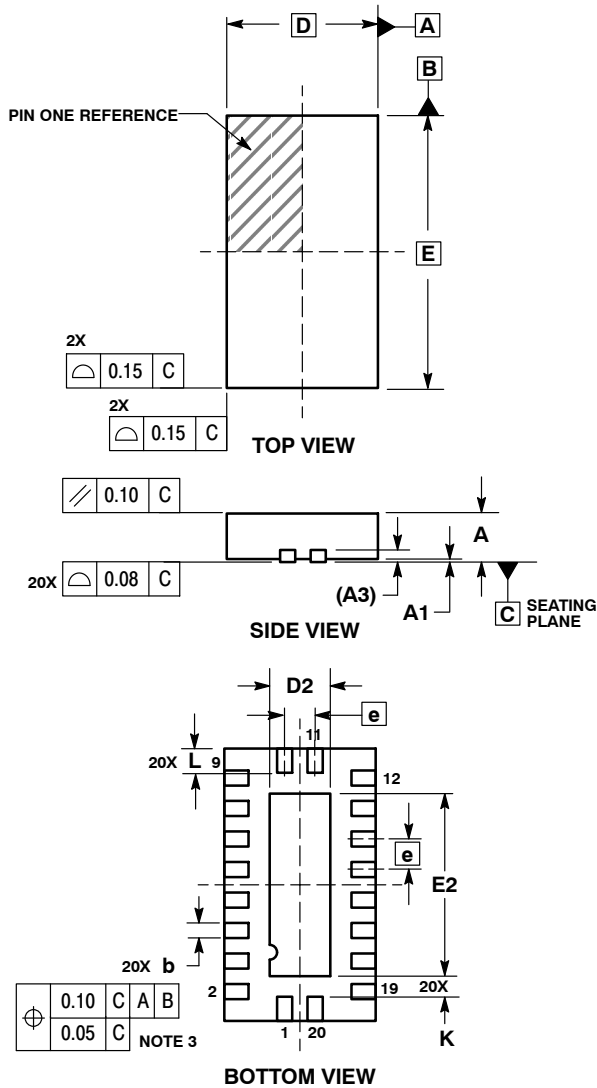




# MC74LCX244

## PACKAGE DIMENSIONS

QFN20, 2.5x4.5 MM  
CASE 485AA  
ISSUE B



### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: MILLIMETERS.
- DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
- COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.20	0.30
D	2.50 BSC	
D2	0.85	1.15
E	4.50 BSC	
E2	2.85	3.15
e	0.50 BSC	
K	0.20	---
L	0.35	0.45

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