

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.

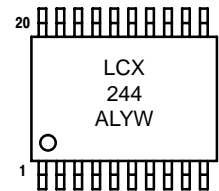
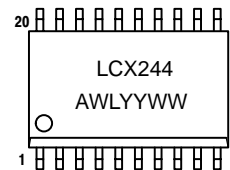
- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant – Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0$ V
- LVTTL Compatible
- LVC MOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V; Machine Model >200 V



ON Semiconductor™

<http://onsemi.com>

MARKING DIAGRAMS



A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
W, WW = Work Week

ORDERING INFORMATION

| Device | Package | Shipping |
|----------------|---------------|-----------------|
| MC74LCX244DW | SO-20 | 38 Units/Rail |
| MC74LCX244DWR2 | SO-20 | 1000 Units/Reel |
| MC74LCX244DT | TSSOP-20 | 75 Units/Rail |
| MC74LCX244DTEL | TSSOP-20 | 2000 Units/Reel |
| MC74LCX244DTR2 | TSSOP-20 | 2500 Units/Reel |
| MC74LCX244M | SO EIAJ-20 | 40 Units/Rail |
| MC74LCX244MEL | SO EIAJ-20 | 2000 Units/Reel |

MC74LCX244

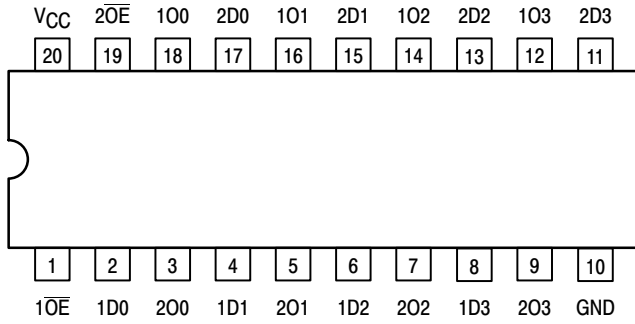


Figure 1. Pinout: 20-Lead (Top View)

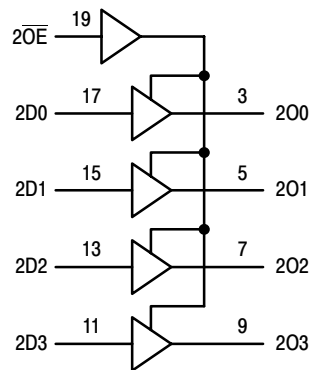
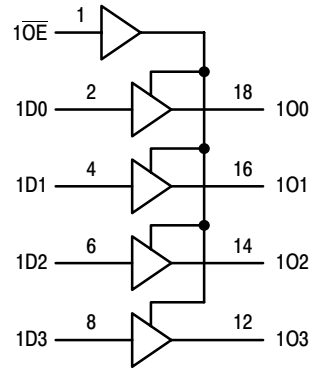


Figure 2. Logic Diagram

PIN NAMES

| PINS | FUNCTION |
|----------|----------------------|
| nOE | Output Enable Inputs |
| 1Dn, 2Dn | Data Inputs |
| 1On, 2On | 3-State Outputs |

TRUTH TABLE

| INPUTS | | OUTPUTS |
|------------|------------|----------|
| 1OE 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

MC74LCX244

MAXIMUM RATINGS

| Symbol | Parameter | Value | Condition | Unit |
|------------------|----------------------------------|---|---------------------------------------|------|
| V _{CC} | DC Supply Voltage | -0.5 to +7.0 | | V |
| V _I | DC Input Voltage | -0.5 ≤ V _I ≤ +7.0 | | V |
| V _O | DC Output Voltage | -0.5 ≤ V _O ≤ +7.0 | Output in 3-State | V |
| | | -0.5 ≤ V _O ≤ 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 | ±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 Range | -65 to +150 | | °C |

Maximum 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. Functional operation should be restricted to the Recommended Operating Conditions.

1. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Unit | |
|-----------------|---|---------------------|-----|-----------------|------|---|
| V _{CC} | Supply Voltage | Operating | 2.0 | 2.5, 3.3 | 3.6 | V |
| | | Data Retention Only | 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 V – 3.6 V V _{CC} = 2.7 V – 3.0 V | | | -24 -12 | mA | |
| I _{OL} | LOW Level Output Current V _{CC} = 3.0 V – 3.6 V V _{CC} = 2.7 V – 3.0 V | | | 24 12 | mA | |
| T _A | Operating Free-Air Temperature | -40 | | +85 | °C | |
| Δt/ΔV | Input Transition Rise or Fall Rate, V _{IN} from 0.8 V to 2.0 V, V _{CC} = 3.0 V | 0 | | 10 | ns/V | |

MC74LCX244

DC ELECTRICAL CHARACTERISTICS

| Symbol | Characteristic | Condition | $T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ | | Unit |
|------------------|---------------------------------------|---|---|------|------|
| | | | Min | Max | |
| V _{IH} | HIGH Level Input Voltage (Note 2.) | $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$ | 1.7 | | V |
| | | $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$ | 2.0 | | |
| V _{IL} | LOW Level Input Voltage (Note 2.) | $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$ | | 0.7 | V |
| | | $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$ | | 0.8 | |
| V _{OH} | HIGH Level Output Voltage | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\ \mu\text{A}$ | $V_{CC} - 0.2$ | | V |
| | | $V_{CC} = 2.3\text{ V}; I_{OH} = -8\text{ mA}$ | 1.8 | | |
| | | $V_{CC} = 2.7\text{ V}; I_{OH} = -12\text{ mA}$ | 2.2 | | |
| | | $V_{CC} = 3.0\text{ V}; I_{OH} = -18\text{ mA}$ | 2.4 | | |
| | | $V_{CC} = 3.0\text{ V}; I_{OH} = -24\text{ mA}$ | 2.2 | | |
| V _{OL} | LOW Level Output Voltage | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\ \mu\text{A}$ | | 0.2 | V |
| | | $V_{CC} = 2.3\text{ V}; I_{OL} = 8\text{ mA}$ | | 0.6 | |
| | | $V_{CC} = 2.7\text{ V}; I_{OL} = 12\text{ mA}$ | | 0.4 | |
| | | $V_{CC} = 3.0\text{ V}; I_{OL} = 16\text{ mA}$ | | 0.4 | |
| | | $V_{CC} = 3.0\text{ V}; I_{OL} = 24\text{ mA}$ | | 0.55 | |
| I _I | Input Leakage Current | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; 0\text{ V} \leq V_I \leq 5.5\text{ V}$ | | ±5 | μA |
| I _{OZ} | 3-State Output Current | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; 0\text{ V} \leq V_O \leq 5.5\text{ V}; V_I = V_{IH}\text{ or } V_{IL}$ | | ±5 | μA |
| I _{OFF} | Power-Off Leakage Current | $V_{CC} = 0\text{ V}; V_I\text{ or } V_O = 5.5\text{ V}$ | | 10 | μA |
| I _{CC} | Quiescent Supply Current | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; V_I = \text{GND or } V_{CC}$ | | 10 | μA |
| | | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; 3.6\text{ V} \leq V_I\text{ or } V_O \leq 5.5\text{ V}$ | | ±10 | |
| ΔI _{CC} | Increase in I _{CC} per Input | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; V_{IH} = V_{CC} - 0.6\text{ V}$ | | 500 | μA |

2. These values of V_I are used to test DC electrical characteristics only.

MC74LCX244

AC CHARACTERISTICS ($t_R = t_F = 2.5 \text{ ns}$; $R_L = 500 \Omega$)

| Symbol | Parameter | Waveform | Limits | | | | | | Unit |
|--------------------------|--|----------|---|------------|--------------------------|------------|-----------------------------------|------------|------|
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | | | | |
| | | | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ | | $V_{CC} = 2.7 \text{ V}$ | | $V_{CC} = 2.5 \text{ V } \pm 0.2$ | | |
| | | | $C_L = 50 \text{ pF}$ | | $C_L = 50 \text{ pF}$ | | $C_L = 30 \text{ pF}$ | | |
| | | | Min | Max | Min | Max | Min | Max | |
| t_{PLH} t_{PHL} | 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_{PZH} t_{PZL} | 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_{PHZ} t_{PLZ} | 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_{OSHL} t_{OSLH} | Output-to-Output Skew (Note 3.) | | | 1.0 1.0 | | | | | ns |

3. 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.

DYNAMIC SWITCHING CHARACTERISTICS

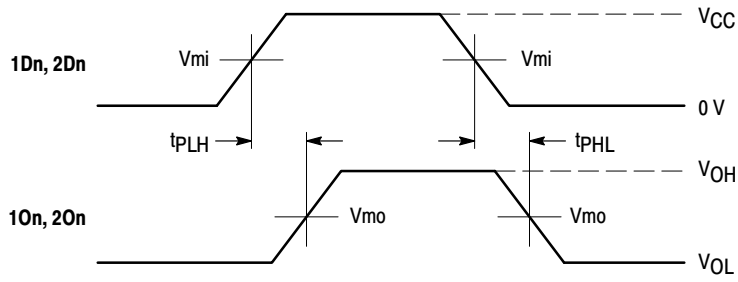
| Symbol | Characteristic | Condition | $T_A = +25^\circ\text{C}$ | | | Unit |
|-----------|--------------------------------------|--|---------------------------|--------------|-----|------|
| | | | Min | Typ | Max | |
| V_{OLP} | Dynamic LOW Peak Voltage (Note 4.) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ | | 0.8 0.6 | | V |
| V_{OLV} | Dynamic LOW Valley Voltage (Note 4.) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ | | -0.8 -0.6 | | V |

4. 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

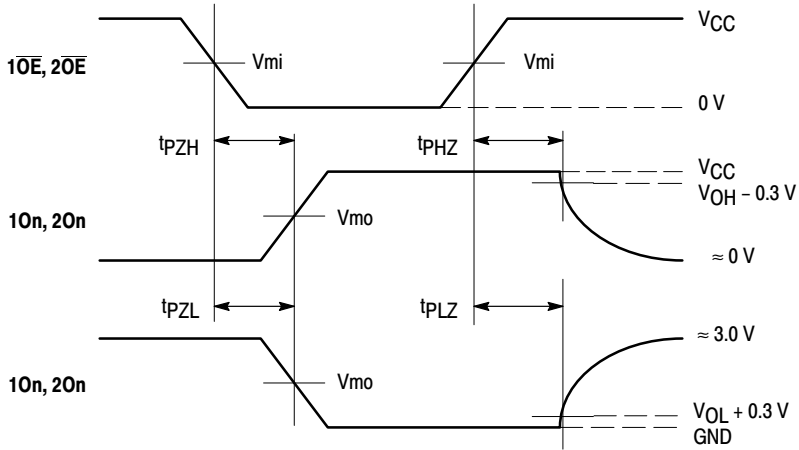
| Symbol | Parameter | Condition | Typical | Unit |
|-----------|-------------------------------|--|---------|------|
| C_{IN} | Input Capacitance | $V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$ | 7 | pF |
| C_{OUT} | Output Capacitance | $V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$ | 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 |

MC74LCX244



WAVEFORM 1 – PROPAGATION DELAYS

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



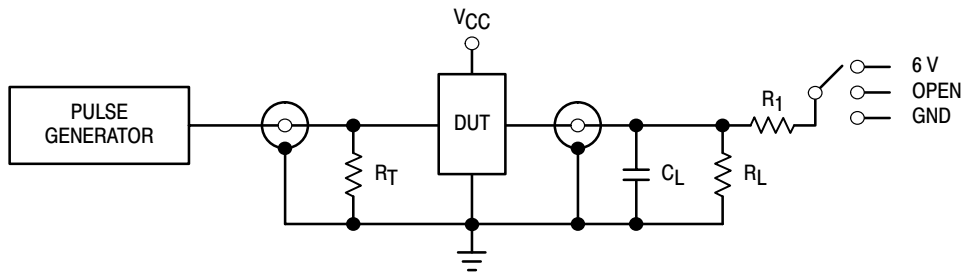
WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES

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

Figure 3. AC Waveforms

| Symbol | V _{CC} | | |
|-----------------|-------------------------|-------------------------|--------------------------|
| | 3.3 V ± 0.3 V | 2.7 V | 2.5 V ± 0.2 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 V | V _{OL} + 0.3 V | V _{OL} + 0.15 V |
| V _{LZ} | V _{OH} - 0.3 V | V _{OH} - 0.3 V | V _{OH} - 0.15 V |

MC74LCX244



| 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 50Ω)

Figure 4. Test Circuit