

# MC74LCX158

## Low-Voltage CMOS Quad 2-Input Multiplexer

### With 5 V-Tolerant Inputs (Inverting)

The MC74LCX158 is a high performance, quad 2-input inverting multiplexer 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 MC74LCX158 inputs to be safely driven from 5 V devices.

Four bits of data from two sources can be selected using the Select and Enable inputs. The four outputs present the selected data in the inverted form. The MC74LCX158 can also be used as a function generator. Current drive capability is 24 mA at the outputs.

#### Features

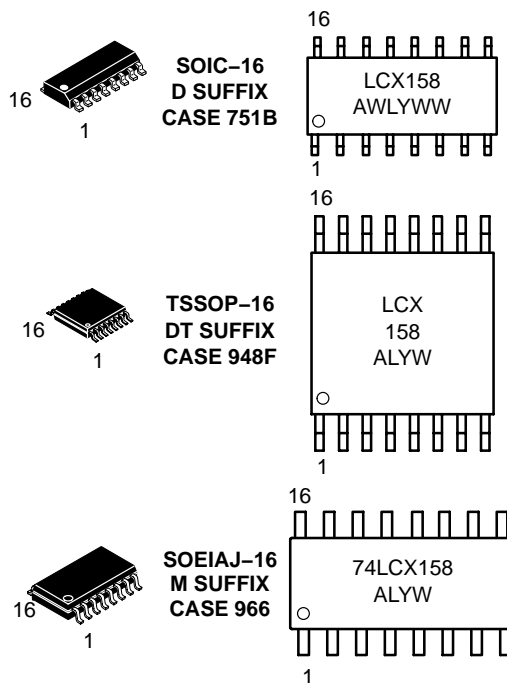
- Designed for 2.3 to 3.6 V  $V_{CC}$  Operation
- 5 V Tolerant Inputs – Interface Capability With 5 V TTL Logic
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10  $\mu$ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V  
Machine Model >200 V
- Pb-Free Packages are Available\*



ON Semiconductor®

<http://onsemi.com>

#### MARKING DIAGRAMS



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

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74LCX158

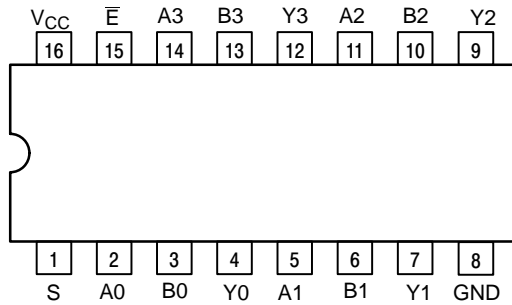


Figure 1. Pinout: 16-Lead Plastic Package (Top View)

## PIN NAMES

| Pins      | Function             |
|-----------|----------------------|
| An        | Source 0 Data Inputs |
| Bn        | Source 1 Data Inputs |
| $\bar{E}$ | Enable Input         |
| S         | Select Input         |
| Yn        | Outputs              |

## TRUTH TABLE

| Inputs        |        | Outputs |
|---------------|--------|---------|
| Output Enable | Select | Y0–Y3   |
| H             | X      | H       |
| L             | L      | A0–A3   |
| L             | H      | B0–B3   |

X = Don't Care  
A0–A3, B0–B3 = The levels of the respective Data-Word Inputs

## PIN DESCRIPTIONS

### INPUTS

#### A0–A3 (Pins 2, 5, 11, 14)

Nibble A inputs. The data present on these pins is transferred to the outputs when the Select input is at a low level and the Output Enable input is at a low level. The data is presented to the outputs in inverted form for the LCX158.

#### B0–B3 (Pins 3, 6, 10, 13)

Nibble B inputs. The data present on these pins is transferred to the outputs when the Select input is at a high level and the Output Enable input is at a low level. The data is presented to the outputs in inverted form for the LCX158.

### OUTPUTS

#### Y0–Y3 (Pins 4, 7, 9, 12)

Data outputs. The selected input nibble is presented at these outputs when the Output Enable input is at a low level. The data present on these pins is in its inverted form for the LCX158. For the Output Enable input at a high level, the outputs are at a high level for the LCX158.

#### Select (Pin 1)

Nibble select. This input determines the data word to be transferred to the outputs. A low level on this input selects the A inputs and a high level selects the B inputs.

### CONTROL INPUTS

#### Enable (Pin 15)

Output Enable input. A low level on this input allows the selected data to be presented at the outputs. A high level on this input sets all of the outputs to a high level for the LCX158.

# MC74LCX158

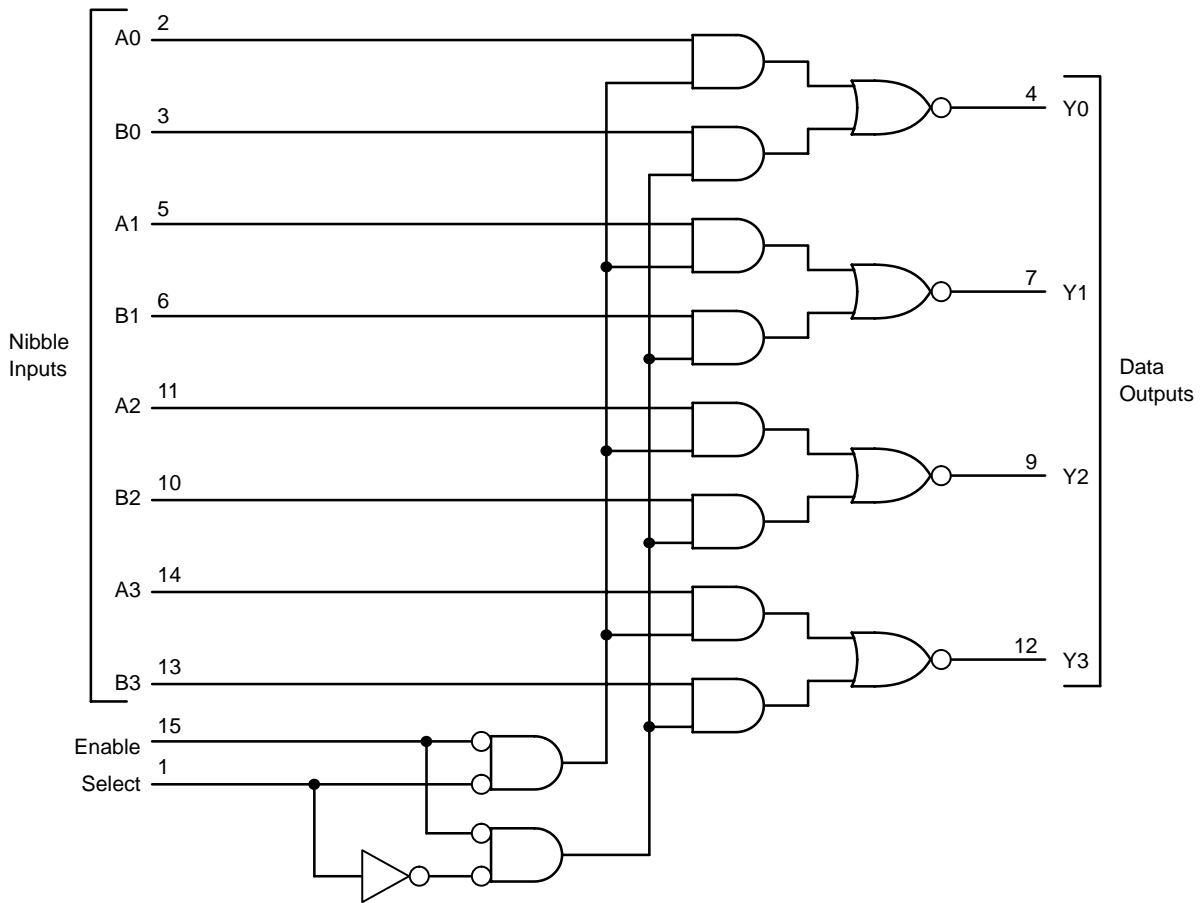


Figure 2. Expanded Logic Diagram

## ORDERING INFORMATION

| Device         | Package              | Shipping†        |
|----------------|----------------------|------------------|
| MC74LCX158D    | SOIC-16              | 48 Units / Rail  |
| MC74LCX158DG   | SOIC-16<br>(Pb-Free) | 48 Units / Rail  |
| MC74LCX158DR2  | SOIC-16              | 2500 Tape & Reel |
| MC74LCX158DR2G | SOIC-16<br>(Pb-Free) | 2500 Tape & Reel |
| MC74LCX158DT   | TSSOP-16*            | 96 Units / Rail  |
| MC74LCX158DTR2 | TSSOP-16*            | 2500 Tape & Reel |
| MC74LCX158M    | SOEIAJ-16            | 48 Units / Rail  |
| MC74LCX158MEL  | SOEIAJ-16            | 2000 Tape & Reel |

†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.

\*This package is inherently Pb-Free.

# MC74LCX158

## MAXIMUM RATINGS

| Symbol    | Parameter                        | Value                             | Condition                            | Unit |
|-----------|----------------------------------|-----------------------------------|--------------------------------------|------|
| $V_{CC}$  | DC Supply Voltage                | -0.5 to +7.0                      |                                      | V    |
| $V_I$     | DC Input Voltage                 | $-0.5 \leq V_I \leq +7.0$         |                                      | V    |
| $V_O$     | DC Output Voltage                | $-0.5 \leq V_O \leq V_{CC} + 0.5$ | 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                       |                                      | °C   |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1.  $I_O$  absolute maximum rating must be observed.

## RECOMMENDED OPERATING CONDITIONS

| Symbol              | Parameter                                                                                    | Min                 | Typ        | Max                                    | Unit |     |
|---------------------|----------------------------------------------------------------------------------------------|---------------------|------------|----------------------------------------|------|-----|
| $V_{CC}$            | Supply Voltage                                                                               | Operating           | 2.3 to 3.3 | 3.6                                    | V    |     |
|                     |                                                                                              | Data Retention Only |            | 1.5                                    |      | 3.6 |
| $V_I$               | Input Voltage                                                                                | 0                   |            | 5.5                                    | V    |     |
| $V_O$               | Output Voltage (HIGH or LOW State)<br>(3-State)                                              | 0                   |            | $V_{CC}$                               | V    |     |
| $I_{OH}$            | HIGH Level Output Current                                                                    |                     |            | $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ | mA   |     |
|                     |                                                                                              |                     |            | $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$ |      | -12 |
|                     |                                                                                              |                     |            | $V_{CC} = 2.3\text{ V} - 2.7\text{ V}$ |      | -8  |
| $I_{OL}$            | LOW Level Output Voltage                                                                     |                     |            | $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ | mA   |     |
|                     |                                                                                              |                     |            | $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$ |      | +12 |
|                     |                                                                                              |                     |            | $V_{CC} = 2.3\text{ V} - 2.7\text{ V}$ |      | +8  |
| $T_A$               | Operating Free-Air Temperature                                                               | -40                 |            | +85                                    | °C   |     |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate, $V_{IN}$ from 0.8 V to 2.0 V,<br>$V_{CC} = 3.0\text{ V}$ | 0                   |            | 10                                     | ns/V |     |

# MC74LCX158

## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Characteristic                            | Condition                                                                                                                                                                                                                                                                     | T <sub>A</sub> = -40°C to +85°C                   |                                  | Unit |
|------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|------|
|                  |                                           |                                                                                                                                                                                                                                                                               | Min                                               | Max                              |      |
| V <sub>IH</sub>  | Minimum HIGH Level Input Voltage (Note 2) | 2.3 V ≤ V <sub>CC</sub> ≤ 2.7 V<br>2.7 V ≤ V <sub>CC</sub> ≤ 3.0 V<br>3.0 V ≤ V <sub>CC</sub> ≤ 3.6 V                                                                                                                                                                         | 1.7<br>2.0<br>2.0                                 |                                  | V    |
| V <sub>IL</sub>  | Maximum LOW Level Input Voltage (Note 2)  | 2.3 V ≤ V <sub>CC</sub> ≤ 2.7 V<br>2.7 V ≤ V <sub>CC</sub> ≤ 3.0 V<br>3.0 V ≤ V <sub>CC</sub> ≤ 3.6 V                                                                                                                                                                         |                                                   | 0.7<br>0.8<br>0.8                | V    |
| V <sub>OH</sub>  | Minimum HIGH Level Output Voltage         | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; I <sub>OH</sub> = -100 μA<br>V <sub>CC</sub> = 2.3 V; I <sub>OH</sub> = -8 mA<br>V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -12 mA<br>V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -18 mA<br>V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -24 mA | V <sub>CC</sub> - 0.2<br>1.7<br>2.2<br>2.4<br>2.2 |                                  | V    |
| V <sub>OL</sub>  | Maximum LOW Level Output Voltage          | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; I <sub>OH</sub> = 100 μA<br>V <sub>CC</sub> = 2.3 V; I <sub>OH</sub> = 8 mA<br>V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = 12 mA<br>V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = 16 mA<br>V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = 24 mA      |                                                   | 0.2<br>0.7<br>0.4<br>0.4<br>0.55 | V    |
| I <sub>I</sub>   | Input Leakage Current                     | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; 0 V ≤ V <sub>I</sub> ≤ 5.5 V                                                                                                                                                                                                                 |                                                   | ±5.0                             | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current                  | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND<br>2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; 3.6 V ≤ V <sub>I</sub> ≤ 5.5 V                                                                                                                                   |                                                   | 10<br>±10                        | μA   |
| ΔI <sub>CC</sub> | Increase in I <sub>CC</sub> per Input     | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; V <sub>IH</sub> = V <sub>CC</sub> - 0.6 V                                                                                                                                                                                                    |                                                   | 500                              | μA   |

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

## AC CHARACTERISTICS

| Symbol            | Parameter             | Limits                          |     |                         |     |                                  |     | Unit |
|-------------------|-----------------------|---------------------------------|-----|-------------------------|-----|----------------------------------|-----|------|
|                   |                       | T <sub>A</sub> = -40°C to +85°C |     |                         |     |                                  |     |      |
|                   |                       | V <sub>CC</sub> = 3.0 V ± 3.6 V |     | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 2.3 V to 2.7 V |     |      |
|                   |                       | 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>  | Propagation Delay     | 1.0                             | 6.5 | 1.0                     | 7.5 | 1.0                              | 8.5 | ns   |
| t <sub>PHL</sub>  | A or B to Y           | 1.0                             | 6.5 | 1.0                     | 7.5 | 1.0                              | 8.5 |      |
| t <sub>PLH</sub>  | Propagation Delay     | 1.0                             | 7.0 | 1.0                     | 8.0 | 1.0                              | 9.0 | ns   |
| t <sub>PHL</sub>  | S to Y                | 1.0                             | 7.0 | 1.0                     | 8.0 | 1.0                              | 9.0 |      |
| t <sub>PLH</sub>  | Propagation Delay     | 1.0                             | 7.0 | 1.0                     | 8.0 | 1.0                              | 9.0 | ns   |
| t <sub>PHL</sub>  | Output Enable to Y    | 1.0                             | 7.0 | 1.0                     | 8.0 | 1.0                              | 9.0 |      |
| t <sub>OSSL</sub> | Output-to-Output Skew |                                 | 1.0 |                         |     |                                  |     | ns   |
| t <sub>OSLH</sub> |                       |                                 | 1.0 |                         |     |                                  |     |      |

## DYNAMIC SWITCHING CHARACTERISTICS

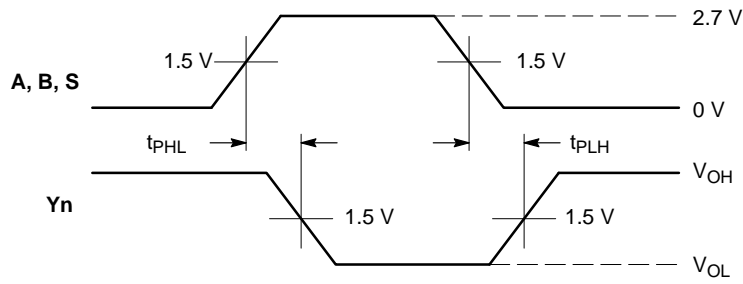
| Symbol           | Characteristic                      | Condition                                                                                       | T <sub>A</sub> = +25°C |     |     | Unit |
|------------------|-------------------------------------|-------------------------------------------------------------------------------------------------|------------------------|-----|-----|------|
|                  |                                     |                                                                                                 | Min                    | Typ | Max |      |
| V <sub>OLP</sub> | Dynamic LOW Peak Voltage (Note 3)   | V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V |                        | 0.8 |     | V    |
| V <sub>OLV</sub> | Dynamic LOW Valley Voltage (Note 3) | V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V |                        | 0.8 |     | V    |

3. 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

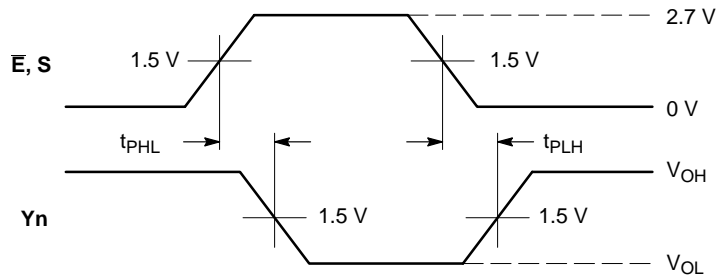
| Symbol           | Parameter                     | Condition                                                                | Typical | Unit |
|------------------|-------------------------------|--------------------------------------------------------------------------|---------|------|
| C <sub>IN</sub>  | Input Capacitance             | V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>         | 7       | pF   |
| C <sub>OUT</sub> | Output Capacitance            | V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>         | 8       | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance | 10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> | 25      | pF   |

# MC74LCX158



**WAVEFORM 1 – INVERTING PROPAGATION DELAYS**

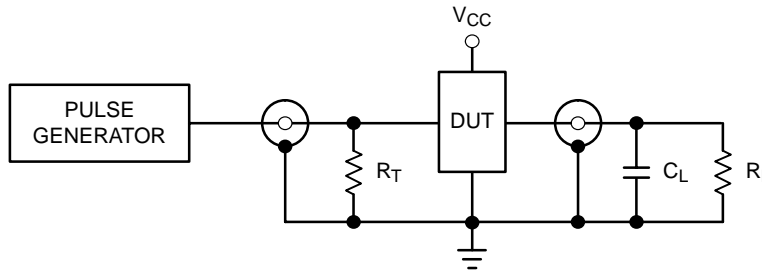
$t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$



**WAVEFORM 2 – INVERTING PROPAGATION DELAYS**

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

**Figure 3. AC Waveforms**



$C_L = 50 \text{ pF}$  or equivalent (Includes jig and probe capacitance)

$R_L = R_1 = 500 \text{ } \Omega$  or equivalent

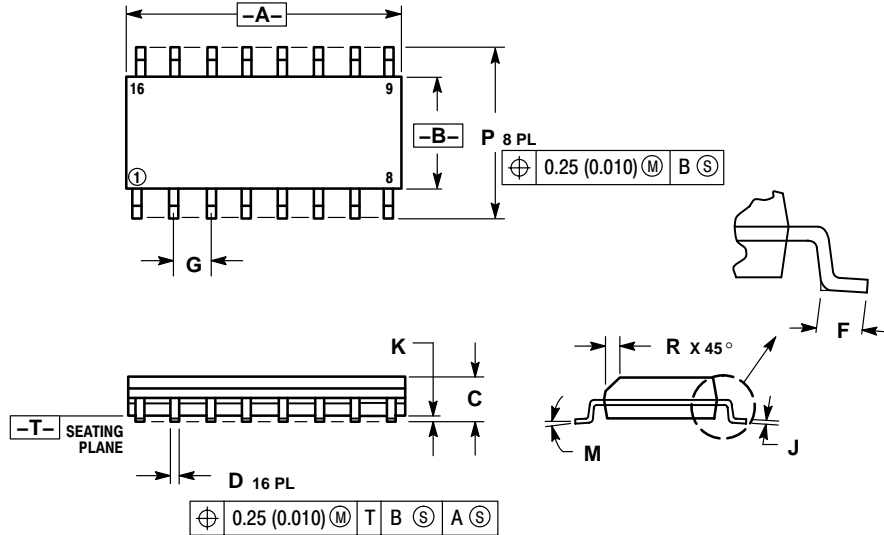
$R_T = Z_{OUT}$  of pulse generator (typically  $50 \text{ } \Omega$ )

**Figure 4. Test Circuit**

# MC74LCX158

## PACKAGE DIMENSIONS

SOIC-16  
D SUFFIX  
CASE 751B-05  
ISSUE J

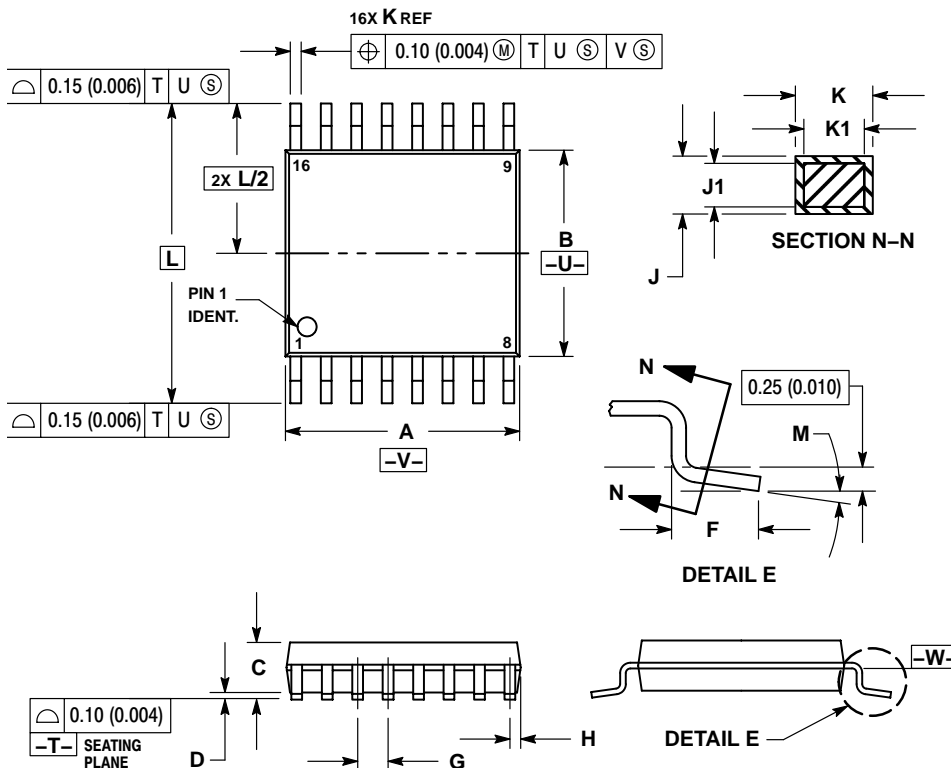


NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

TSSOP-16  
DT SUFFIX  
CASE 948F-01  
ISSUE O



NOTES:

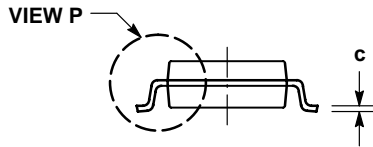
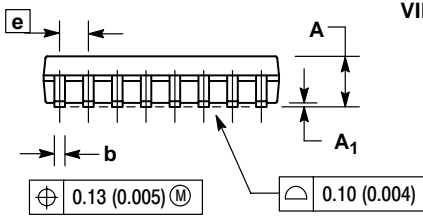
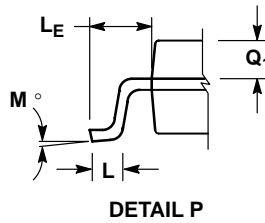
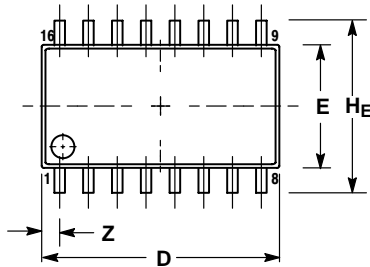
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- 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.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.18        | 0.28 | 0.007     | 0.011 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

# MC74LCX158

## PACKAGE DIMENSIONS


SOEIAJ-16  
M SUFFIX  
CASE 966-01  
ISSUE O



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.18        | 0.27  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.78  | ---       | 0.031 |

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