# MC74LCX257

# Low-Voltage CMOS Quad 2-Input Multiplexer

## With 5.0 V–Tolerant Inputs and Outputs (3–State, Non–Inverting)

The MC74LCX257 is a high performance, quad 2–input multiplexer with 3–state outputs 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 MC74LCX257 inputs to be safely driven from 5.0 V devices.

Four bits of data from two sources can be selected using the Select input. The four outputs present the selected data in the true (non–inverted) form. The outputs may be switched to a high impedance state by placing a logic HIGH on the Output Enable ($\overline{OE}$) input. Current drive capability is 24 mA at the outputs.

- Designed for 2.3 to 3.6 V $V_{CC}$ Operation
- 5.0 V Tolerant – Interface Capability with 5.0 V TTL Logic
- Supports Live Insertion and Withdrawal
- $I_{OFF}$ Specification Guarantees High Impedance When $V_{CC}$ = 0 V
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V; Machine Model >200 V

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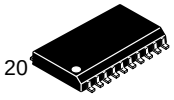
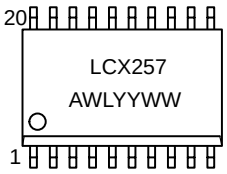
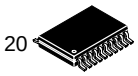
**MARKING DIAGRAMS**

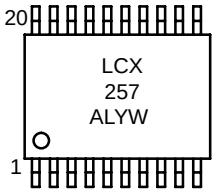


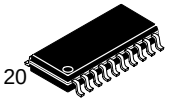

**SO–20**
**DW SUFFIX**
**CASE 751D**




**TSSOP–20**
**DT SUFFIX**
**CASE 948E**




**SO EIAJ–20**
**M SUFFIX**
**CASE 967**


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

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MC74LCX257DW | SO–20 | 38 Units/Rail |
| MC74LCX257DWR2 | SO–20 | 1000 Units/Reel |
| MC74LCX257DT | TSSOP–20 | 75 Units/Rail |
| MC74LCX257DTEL | TSSOP–20 | 2000 Units/Reel |
| MC74LCX257DTR2 | TSSOP–20 | 2500 Units/Reel |
| MC74LCX257M | SO EIAJ–20 | 40 Units/Rail |
| MC74LCX257MEL | SO EIAJ–20 | 2000 Units/Reel |

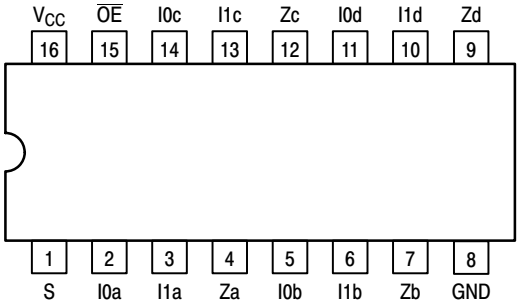



**Figure 1. Pinout: 16–Lead Plastic Package**
(Top View)

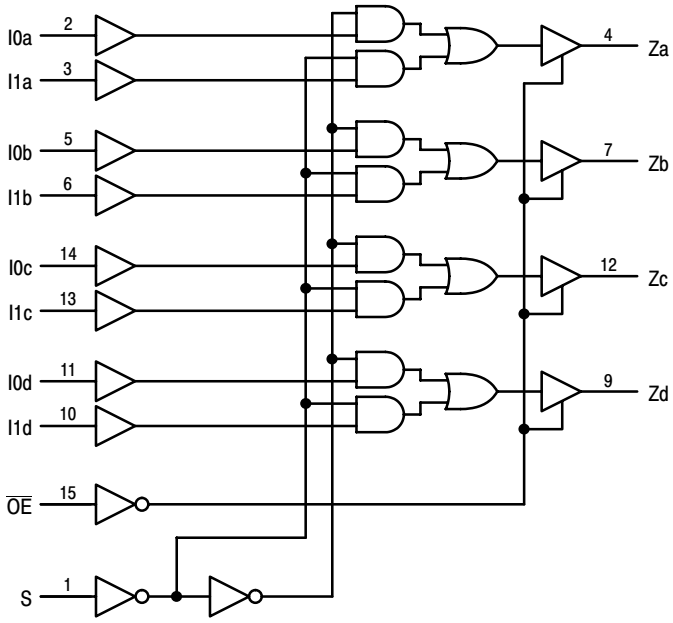



**Figure 2. Logic Diagram**

**PIN NAMES**

| Pins | Function |
|---|---|
| I0n | Source 0 Data Inputs |
| I1n | Source 1 Data Inputs |
| $\overline{OE}$ | Output Enable Input |
| S | Select Input |
| Zn | Outputs |

**TRUTH TABLE**

| Inputs | | | | Outputs |
|---|---|---|---|---|
| $\overline{OE}$ | S | I0n | I1n | Zn |
| H | X | X | X | Z |
| L | H | X | L | L |
| L | H | X | H | H |
| L | L | L | X | L |
| L | L | H | X | H |

H = High Voltage Level
L = Low Voltage Level
X = High or Low Voltage Level
Z = High Impedance State
For $I_{CC}$ Reasons, DO NOT FLOAT Inputs

**ABSOLUTE MAXIMUM RATINGS***

| Symbol | Parameter | Value | Condition | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | –0.5 to +7.0 | | V |
| $V_I$ | DC Input Voltage | $–0.5 \le V_I \le +7.0$ | | V |
| $V_O$ | DC Output Voltage | $–0.5 \le V_O \le +7.0$ | Output in 3–State | V |
| | | $–0.5 \le V_O \le V_{CC} + 0.5$ | 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 |

* Absolute maximum continuous 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.

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

**RECOMMENDED OPERATING CONDITIONS**

| Symbol | Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | Operating<br>Data Retention Only | 2.0<br>1.5 | 3.3<br>3.3 | 3.6<br>3.6 | V |
| $V_I$ | Input Voltage | | 0 | | 5.5 | V |
| $V_O$ | Output Voltage | (HIGH or LOW State)<br>(3–State) | 0<br>0 | | $V_{CC}$<br>5.5 | V |
| $I_{OH}$ | HIGH Level Output Current | $V_{CC}$ = 3.0 V – 3.6 V<br>$V_{CC}$ = 2.7 V – 3.0 V<br>$V_{CC}$ = 2.3 V – 2.7 V | | | – 24<br>– 12<br>– 8.0 | mA |
| $I_{OL}$ | LOW Level Output Current | $V_{CC}$ = 3.0 V – 3.6 V<br>$V_{CC}$ = 2.7 V – 3.0 V<br>$V_{CC}$ = 2.3 V – 2.7 V | | | + 24<br>+ 12<br>+ 8.0 | mA |
| $T_A$ | 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, $V_{CC}$ = 3.0V | | 0 | | 10 | ns/V |

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Characteristic | Condition | $T_A$ = –40°C to +85°C | | Unit |
|---|---|---|---|---|---|
| | | | Min | Max | |
| $V_{IH}$ | HIGH Level Input Voltage (Note 2.) | 2.3 V ≤ $V_{CC}$ ≤ 2.7 V | 1.7 | | V |
| | | 2.7 V ≤ $V_{CC}$ ≤ 3.6 V | 2.0 | | |
| $V_{IL}$ | LOW Level Input Voltage (Note 2.) | 2.3 V ≤ $V_{CC}$ ≤ 2.7 V | | 0.7 | V |
| | | 2.7 V ≤ $V_{CC}$ ≤ 3.6 V | | 0.8 | |
| $V_{OH}$ | HIGH Level Output Voltage | 2.3 V ≤ $V_{CC}$ ≤ 3.6 V; $I_{OL}$ = 100 μA | $V_{CC}$ – 0.2 | | V |
| | | $V_{CC}$ = 2.3 V; $I_{OH}$ = –8.0 mA | 1.8 | | |
| | | $V_{CC}$ = 2.7 V; $I_{OH}$ = –12 mA | 2.2 | | |
| | | $V_{CC}$ = 3.0 V; $I_{OH}$ = –18 mA | 2.4 | | |
| | | $V_{CC}$ = 3.0 V; $I_{OH}$ = –24 mA | 2.2 | | |
| $V_{OL}$ | LOW Level Output Voltage | 2.3 V ≤ $V_{CC}$ ≤ 3.6 V; $I_{OL}$ = 100 μA | | 0.2 | V |
| | | $V_{CC}$ = 2.3 V; $I_{OL}$= 8.0 mA | | 0.6 | |
| | | $V_{CC}$ = 2.7 V; $I_{OL}$= 12 mA | | 0.4 | |
| | | $V_{CC}$ = 3.0 V; $I_{OL}$ = 16 mA | | 0.4 | |
| | | $V_{CC}$ = 3.0 V; $I_{OL}$ = 24 mA | | 0.55 | |
| $I_I$ | Input Leakage Current | 2.3 V ≤ $V_{CC}$ ≤ 3.6 V; 0 V ≤ $V_I$ ≤ 5.5 V | | ±5.0 | μA |
| $I_{OZ}$ | 3–State Output Current | 2.3 ≤ $V_{CC}$ ≤ 3.6 V; 0V ≤ $V_O$ ≤ 5.5 V; $V_I$ = $V_{IH}$ or $V_{IL}$ | | ±5.0 | μA |
| $I_{OFF}$ | Power–Off Leakage Current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 5.5 V | | 10 | μA |
| $I_{CC}$ | Quiescent Supply Current | 2.3 ≤ $V_{CC}$ ≤ 3.6 V; $V_I$ = GND or $V_{CC}$ | | 10 | μA |
| | | 2.3 ≤ $V_{CC}$ ≤ 3.6 V; 3.6 ≤ $V_I$ or $V_O$ ≤ 5.5 V | | ±10 | |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input | 2.3 ≤ $V_{CC}$ ≤ 3.6 V; $V_{IH}$ = $V_{CC}$ – 0.6 V | | 500 | μA |

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

## AC CHARACTERISTICS ($t_R$ = $t_F$ = 2.5 ns; $R_L$ = 500 Ω)

| Symbol | Parameter | Waveform | Limits | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | $T_A$ = –40°C to +85°C | | | | | | |
| | | | $V_{CC}$ = 3.3 V ± 0.3 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | |
| | | | $C_L$ = 50 pF | | $C_L$ = 50 pF | | $C_L$ = 30 pF | | |
| | | | Min | Max | Min | Max | Min | Max | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>In to Zn | 1 | 1.5<br>1.5 | 6.0<br>6.0 | 1.5<br>1.5 | 6.5<br>6.5 | 1.5<br>1.5 | 7.2<br>7.2 | ns |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>S to Zn | 1,2 | 1.5<br>1.5 | 7.0<br>7.0 | 1.5<br>1.5 | 8.5<br>8.5 | 1.5<br>1.5 | 9.1<br>9.1 | ns |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time to<br>High and Low Level | 3 | 1.5<br>1.5 | 7.0<br>7.0 | 1.5<br>1.5 | 8.5<br>8.5 | 1.5<br>1.5 | 9.1<br>9.1 | ns |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time From<br>High and Low Level | 3 | 1.5<br>1.5 | 5.5<br>5.5 | 1.5<br>1.5 | 6.0<br>6.0 | 1.5<br>1.5 | 6.6<br>6.6 | ns |
| $t_{OSHL}$<br>$t_{OSLH}$ | Output–to–Output Skew<br>(Note 3.) | | | 1.0<br>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.

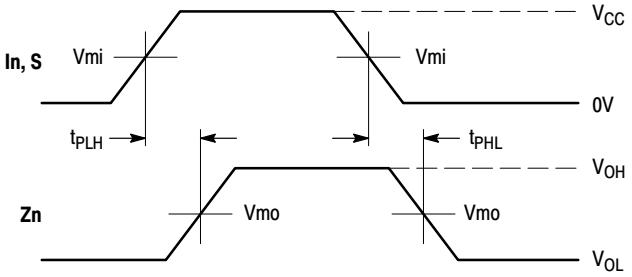
## DYNAMIC SWITCHING CHARACTERISTICS

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

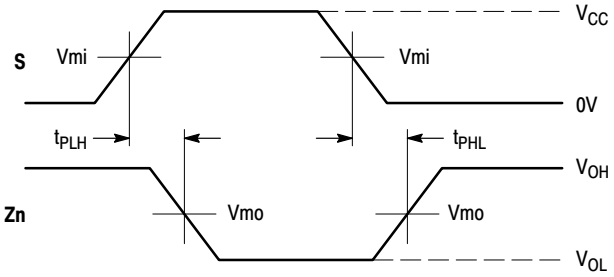
4. Number of outputs defined as “n”. Measured with “n–1” outputs switching from HIGH–to–LOW or LOW–to–HIGH. The remaining output is measured in the LOW state.

## CAPACITIVE CHARACTERISTICS

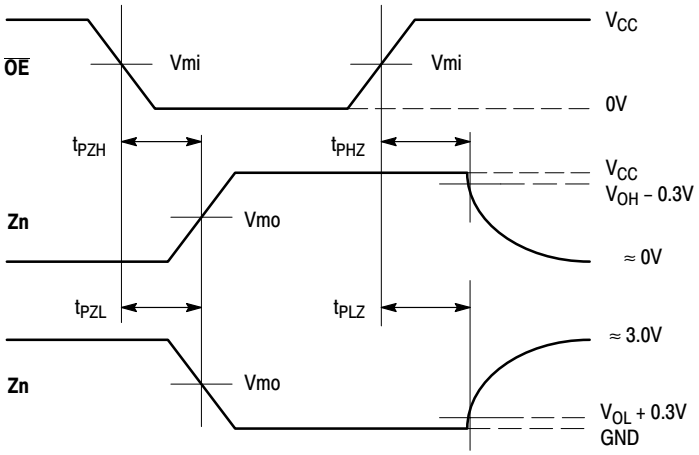
| Symbol | Parameter | Condition | Typical | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$ | 7.0 | pF |
| $C_{I/O}$ | Input/Output Capacitance | $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$ | 8.0 | pF |
| $C_{PD}$ | Power Dissipation Capacitance | 10 MHz, $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$ | 25 | pF |




**WAVEFORM 1 – NON–INVERTING PROPAGATION DELAYS**
$t_R = t_F$ = 2.5 ns, 10% to 90%; f = 1.0 MHz; $t_W$ = 500 ns




**WAVEFORM 2 – INVERTING PROPAGATION DELAYS**
$t_R = t_F$ = 2.5 ns, 10% to 90%; f = 1.0 MHz; $t_W$ = 500 ns



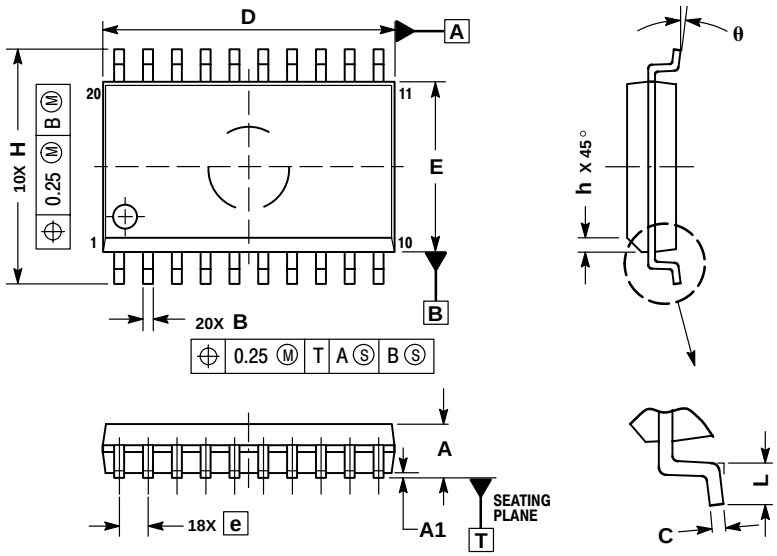

**WAVEFORM 3 – OUTPUT ENABLE AND DISABLE TIMES**
$t_R = t_F$ = 2.5 ns, 10% to 90%; f = 1.0 MHz; $t_W$ = 500 ns

| | $V_{CC}$ | | |
|---|---|---|---|
| **Symbol** | **3.3 V ± 0.3 V** | **2.7 V** | **2.5 V ± 0.2 V** |
| Vmi | 1.5 V | 1.5 V | $V_{CC}/2$ |
| Vmo | 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 | $V_{OH}$ – 015 V |

**Figure 3. AC Waveforms**

## PACKAGE DIMENSIONS

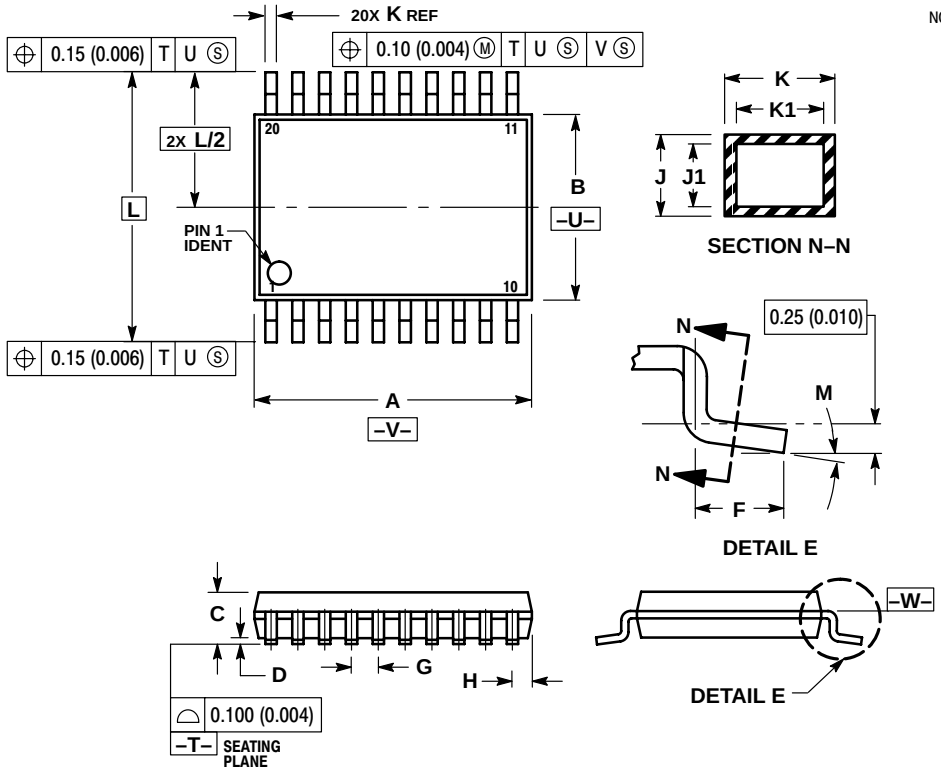
**SO–20**
**DW SUFFIX**
CASE 751D–05
ISSUE F




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.

| | MILLIMETERS | |
|---|---|---|
| DIM | 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 |
| θ | 0° | 7° |

**TSSOP–20**
**DT SUFFIX**
CASE 948E–02
ISSUE A

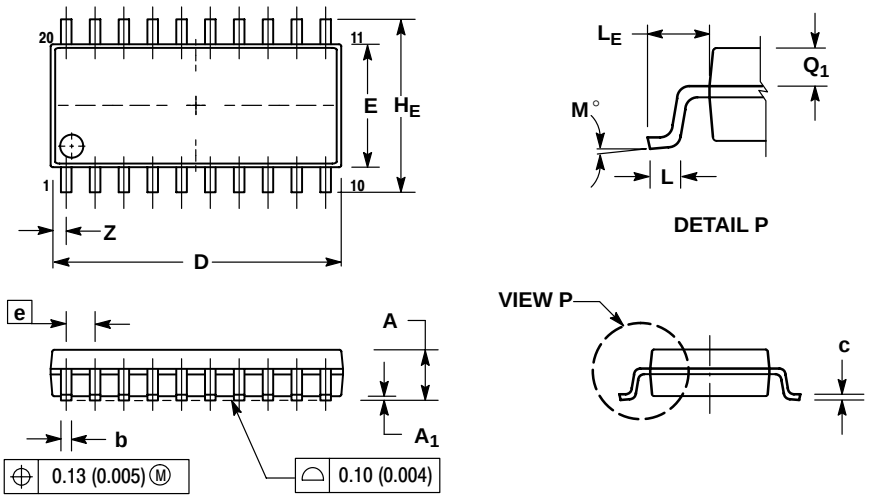



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD 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–.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 6.40 | 6.60 | 0.252 | 0.260 |
| 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 | 0.27 | 0.37 | 0.011 | 0.015 |
| 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° |

## PACKAGE DIMENSIONS

**SO EIAJ–20**
**M SUFFIX**
CASE 967–01
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).

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | ––– | 2.05 | ––– | 0.081 |
| $A_1$ | 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 | 12.35 | 12.80 | 0.486 | 0.504 |
| E | 5.10 | 5.45 | 0.201 | 0.215 |
| e | 1.27 BSC | | 0.050 BSC | |
| $H_E$ | 7.40 | 8.20 | 0.291 | 0.323 |
| L | 0.50 | 0.85 | 0.020 | 0.033 |
| $L_E$ | 1.10 | 1.50 | 0.043 | 0.059 |
| M | 0 ° | 10 ° | 0 ° | 10 ° |
| $Q_1$ | 0.70 | 0.90 | 0.028 | 0.035 |
| Z | ––– | 0.81 | ––– | 0.032 |



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