

MC74LCX574

Low-Voltage CMOS Octal D-Type Flip-Flop Flow Through Pinout

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

The MC74LCX574 is a high performance, non-inverting octal D-type flip-flop 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 MC74LCX574 inputs to be safely driven from 5.0 V devices.

The MC74LCX574 consists of 8 edge-triggered flip-flops with individual D-type inputs and 3-state true outputs. The buffered clock and buffered Output Enable (\overline{OE}) are common to all flip-flops. The eight flip-flops will store the state of individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the \overline{OE} LOW, the contents of the eight flip-flops are available at the outputs. When the \overline{OE} is HIGH, the outputs go to the high impedance state. The \overline{OE} input level does not affect the operation of the flip-flops. The LCX574 flow through design facilitates easy PC board layout.

Features

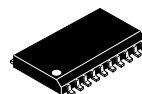
- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant – Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0$ V
- LVTTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- 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
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



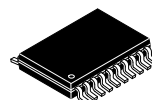
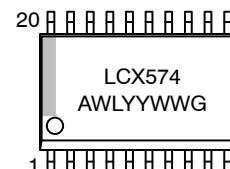
ON Semiconductor®

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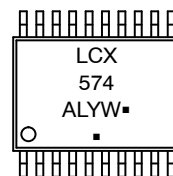
MARKING DIAGRAMS



SOIC-20 WB
DW SUFFIX
CASE 751D



TSSOP-20
DT SUFFIX
CASE 948E



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 3 of this data sheet.

MC74LCX574

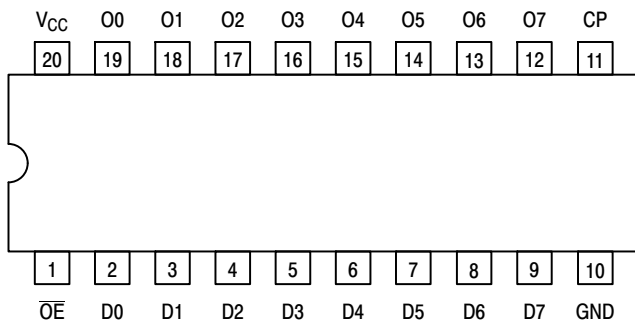


Figure 1. Pinout: 20-Lead (Top View)

PIN NAMES

| Pins | Function |
|-----------------|---------------------|
| \overline{OE} | Output Enable Input |
| CP | Clock Pulse Input |
| D0–D7 | Data Inputs |
| O0–O7 | 3–State Outputs |

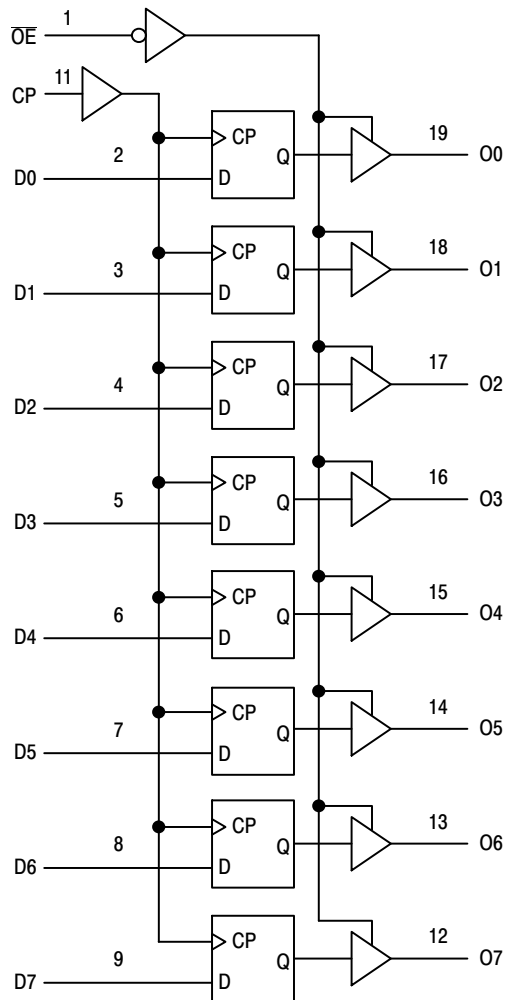


Figure 2. Logic Diagram

TRUTH TABLE

| INPUTS | | | INTERNAL LATCHES | OUTPUTS | OPERATING MODE |
|-----------------|------------|----|------------------|---------|--|
| \overline{OE} | CP | Dn | Q | On | |
| L | \uparrow | l | L | L | Load and Read Register |
| L | \uparrow | h | H | H | |
| L | \uparrow | X | NC | NC | Hold and Read Register |
| H | \uparrow | X | NC | Z | Hold and Disable Outputs |
| H | \uparrow | l | L | Z | Load Internal Register and Disable Outputs |
| H | \uparrow | h | H | Z | |

H = High Voltage Level

h = High Voltage Level One Setup Time Prior to the Low-to-High Clock Transition

L = Low Voltage Level

l = Low Voltage Level One Setup Time Prior to the Low-to-High Clock Transition

NC = No Change

X = High or Low Voltage Level and Transitions are Acceptable

Z = High Impedance State

\uparrow = Low-to-High Transition

\uparrow = Not a Low-to-High Transition; For I_{CC} Reasons, DO NOT FLOAT Inputs

MC74LCX574

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 |
| | | $-0.5 \leq V_O \leq V_{CC} + 0.5$ | (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 |
| MSL | Moisture Sensitivity | | Level 1 | |

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. Output in HIGH or LOW State. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Units |
|---------------------|---|-----|-----|-----------------|-------|
| V_{CC} | Supply Voltage Operating Data Retention Only | 2.0 | 3.3 | 3.6 | V |
| | | 1.5 | 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} 5.5 | V |
| | | 0 | | | |
| I_{OH} | HIGH Level Output Current, $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ | | | -24 | mA |
| I_{OL} | LOW Level Output Current, $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ | | | 24 | mA |
| I_{OH} | HIGH Level Output Current, $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$ | | | -12 | mA |
| I_{OL} | LOW Level Output Current, $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$ | | | 12 | 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, $V_{CC} = 3.0\text{ V}$ | 0 | | 10 | ns/V |

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|-----------------|------------------------|-----------------------|
| MC74LCX574DWR2G | SOIC-20 (Pb-Free) | 1000 Tape & Reel |
| MC74LCX574DWR2G | SOIC-20 (Pb-Free) | 1000 Tape & Reel |
| MC74LCX574DTR2G | SOEIAJ-20 (Pb-Free) | 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.

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DC ELECTRICAL CHARACTERISTICS

| Symbol | Characteristic | Condition | T _A = -40°C to +85°C | | Units |
|------------------|---------------------------------------|--|---------------------------------|------|-------|
| | | | Min | Max | |
| V _{IH} | HIGH Level Input Voltage (Note 2) | 2.7 V ≤ V _{CC} ≤ 3.6 V | 2.0 | | V |
| V _{IL} | LOW Level Input Voltage (Note 2) | 2.7 V ≤ V _{CC} ≤ 3.6 V | | 0.8 | V |
| V _{OH} | HIGH Level Output Voltage | 2.7 V ≤ V _{CC} ≤ 3.6 V; I _{OH} = -100 μA | V _{CC} - 0.2 | | V |
| | | 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 | 2.7 V ≤ V _{CC} ≤ 3.6 V; I _{OL} = 100 μA | | 0.2 | V |
| | | 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 _{OZ} | 3-State Output Current | V _{CC} = 3.6 V, V _{IN} = V _{IH} or V _{IL} , V _{OUT} = 0 to 5.5 V | | ±5 | μA |
| I _{OFF} | Power Off Leakage Current | V _{CC} = 0, V _{IN} = 5.5 V or V _{OUT} = 5.5 V | | 10 | μA |
| I _{IN} | Input Leakage Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | ±5 | μA |
| I _{CC} | Quiescent Supply Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | ±10 | μA |
| ΔI _{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; C_L = 50 pF; R_L = 500 Ω)

| Symbol | Parameter | Waveform | Limits | | | | Units |
|--|--|----------|----------------------------------|-----|-------------------------|-----|-------|
| | | | T _A = -40°C to +85°C | | | | |
| | | | V _{CC} = 3.0 V to 3.6 V | | V _{CC} = 2.7 V | | |
| | | | Min | Max | Min | Max | |
| f _{max} | Clock Pulse Frequency | 1 | 150 | | | | MHz |
| t _{PLH} t _{PHL} | Propagation Delay CP to On | 1 | 1.5 | 8.5 | 1.5 | 9.5 | ns |
| | | | 1.5 | 8.5 | 1.5 | 9.5 | |
| t _{PZH} t _{PZL} | Output Enable Time to HIGH and LOW Levels | 2 | 1.5 | 8.5 | 1.5 | 9.5 | ns |
| | | | 1.5 | 8.5 | 1.5 | 9.5 | |
| t _{PHZ} t _{PLZ} | Output Disable Time from HIGH and LOW Levels | 2 | 1.5 | 6.5 | 1.5 | 7.0 | ns |
| | | | 1.5 | 6.5 | 1.5 | 7.0 | |
| t _s | Setup Time, HIGH or LOW Dn to CP | 1 | 2.5 | | 2.5 | | ns |
| t _h | Hold Time, HIGH or LOW Dn to CP | 1 | 1.5 | | 1.5 | | ns |
| t _w | CP Pulse Width, HIGH or LOW | 3 | 3.3 | | 3.3 | | ns |
| t _{OSHL} t _{OSLH} | Output-to-Output Skew (Note 3) | | | 1.0 | | | ns |
| | | | | 1.0 | | | |

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.

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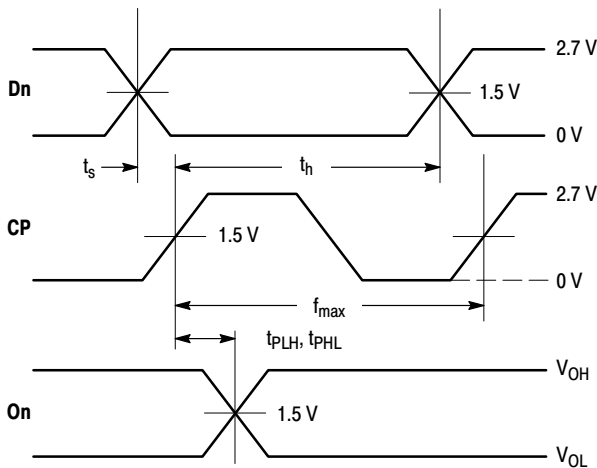
DYNAMIC SWITCHING CHARACTERISTICS

| Symbol | Characteristic | Condition | T _A = +25°C | | | Units |
|------------------|-------------------------------------|---|------------------------|-----|-----|-------|
| | | | 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 | | 0.8 | | 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 | | 0.8 | | 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.

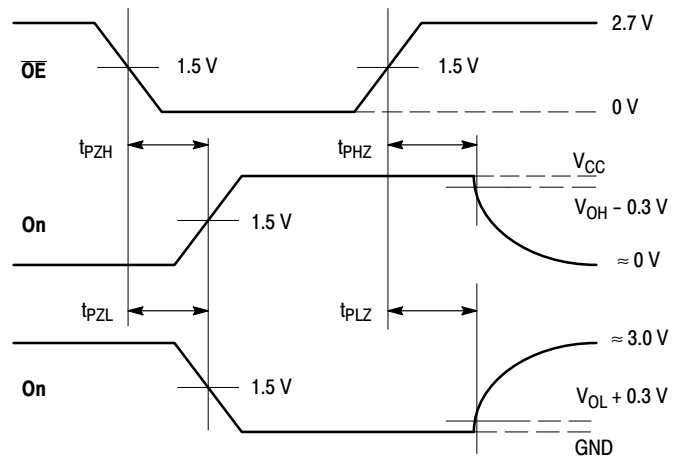
CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Units |
|------------------|-------------------------------|--|---------|-------|
| C _{IN} | Input Capacitance | V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 7 | pF |
| C _{OUT} | Output Capacitance | V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 8 | pF |
| C _{PD} | Power Dissipation Capacitance | 10 MHz, V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 25 | pF |



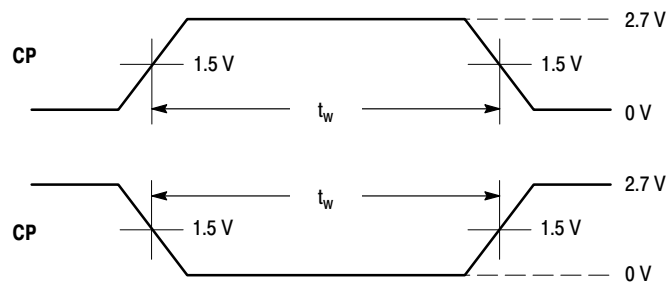
WAVEFORM 1 - PROPAGATION DELAYS, SETUP AND HOLD TIMES

t_R = t_F = 2.5 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns



WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES

t_R = t_F = 2.5 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns

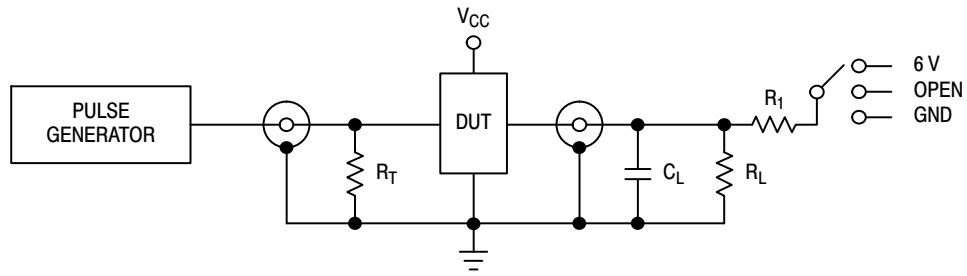


WAVEFORM 3 - PULSE WIDTH

t_R = t_F = 2.5 ns (or fast as required) from 10% to 90%;
Output requirements: V_{OL} ≤ 0.8 V, V_{OH} ≥ 2.0 V

Figure 3. AC Waveforms

MC74LCX574



| Test | Switch |
|--|--------|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | 6 V |
| Open Collector/Drain t_{PLH} and t_{PHL} | 6 V |
| t_{PZH} , t_{PHZ} | GND |

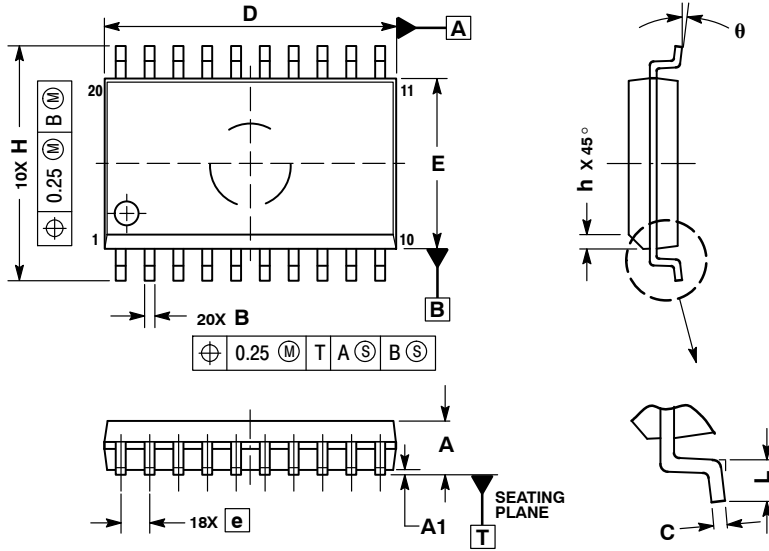
$C_L = 50$ pF or equivalent (Includes jig and probe capacitance)
 $R_L = R_1 = 500$ Ω or equivalent
 $R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

Figure 4. Test Circuit

MC74LCX574

PACKAGE DIMENSIONS

SOIC-20 WB
CASE 751D-05
ISSUE G



NOTES:

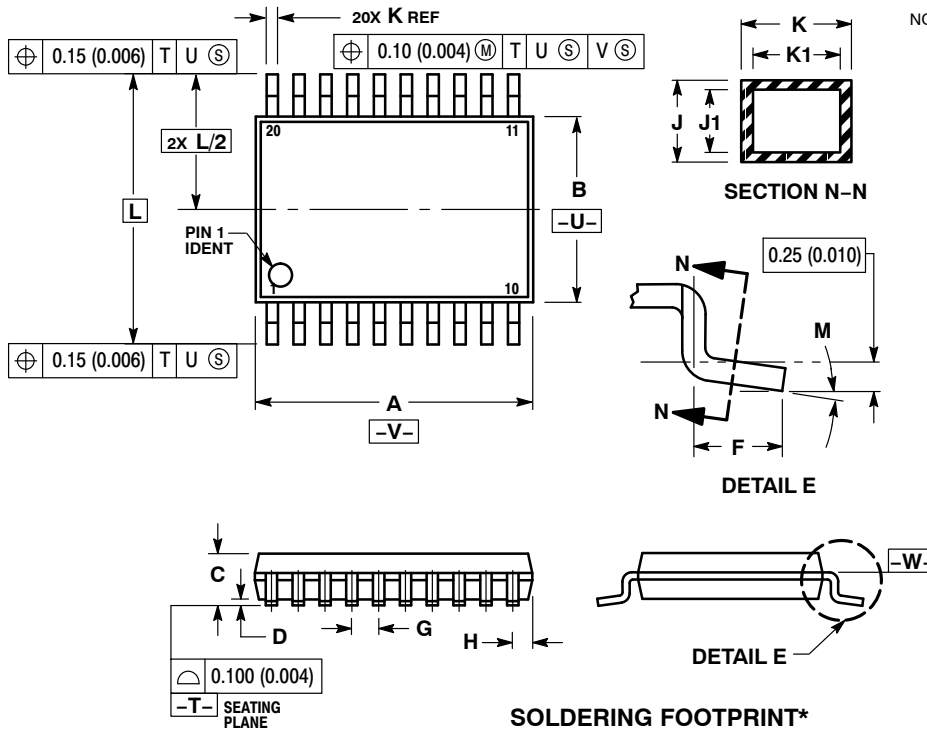
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION 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 |
| θ | 0° | 7° |

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PACKAGE DIMENSIONS

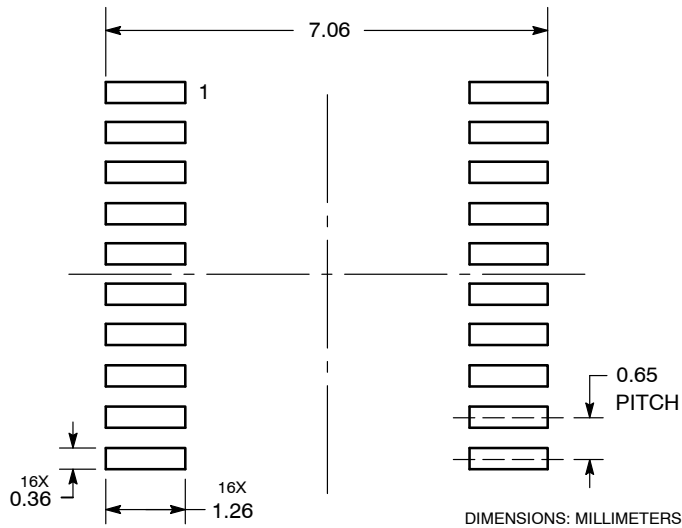
TSSOP-20
CASE 948E-02
ISSUE C




- 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-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | 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° |

SOLDERING FOOTPRINT*



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

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