

74AC374 • 74ACT374

Octal D-Type Flip-Flop with 3-STATE Outputs

General Description

The AC/ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable (\overline{OE}) are common to all flip-flops.

Features

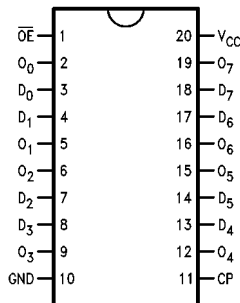
- I_{CC} and I_{OZ} reduced by 50%
- Buffered positive edge-triggered clock
- 3-STATE outputs for bus-oriented applications
- Outputs source/sink 24 mA
- See 273 for reset version
- See 377 for clock enable version
- See 373 for transparent latch version
- See 574 for broadside pinout version
- See 564 for broadside pinout version with inverted outputs
- ACT374 has TTL-compatible inputs

Ordering Code:

| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| 74AC374SC | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| 74AC374SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74AC374MTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74AC374PC | N20A | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |
| 74ACT374SC | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| 74ACT374SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74ACT374MSA | MSA20 | 20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide |
| 74ACT374MTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74ACT374PC | N20A | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Connection Diagram

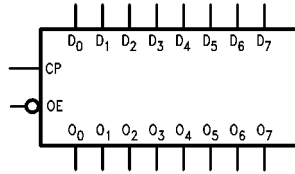


Pin Descriptions

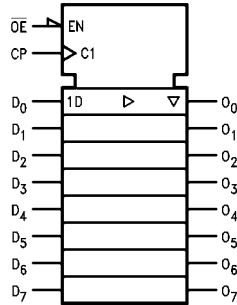
| Pin Names | Description |
|-----------------|-----------------------------|
| D_0 - D_7 | Data Inputs |
| CP | Clock Pulse Input |
| \overline{OE} | 3-STATE Output Enable Input |
| O_0 - O_7 | 3-STATE Outputs |

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Logic Symbols



IEEE/IEC



Functional Description

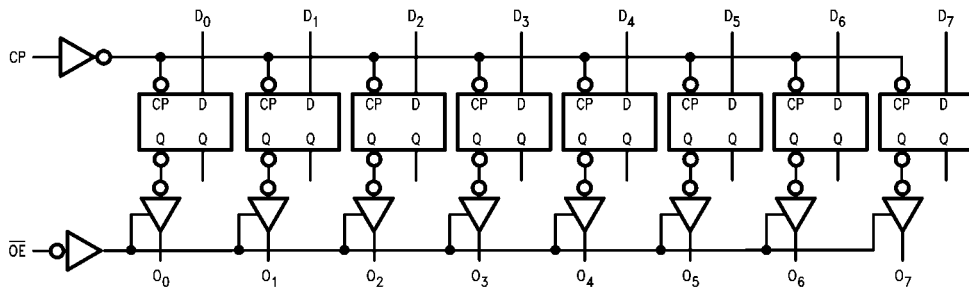
The AC/ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and 3-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable (\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. Operation of the \overline{OE} input does not affect the state of the flip-flops.

Truth Table

| Inputs | | | Outputs |
|--------|----|-----------------|---------|
| D_n | CP | \overline{OE} | O_n |
| H | ↗ | L | H |
| L | ↗ | L | L |
| X | X | H | Z |

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 Z = High Impedance
 ↗ = LOW-to-HIGH Transition

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

| | |
|--|---------------------------|
| Supply Voltage (V_{CC}) | - 0.5V to + 7.0V |
| DC Input Diode Current (I_{IK}) | |
| $V_I = -0.5V$ | - 20 mA |
| $V_I = V_{CC} + 0.5V$ | + 20 mA |
| DC Input Voltage (V_I) | - 0.5V to $V_{CC} + 0.5V$ |
| DC Output Diode Current (I_{OK}) | |
| $V_O = -0.5V$ | - 20 mA |
| $V_O = V_{CC} + 0.5V$ | + 20 mA |
| DC Output Voltage (V_O) | - 0.5V to $V_{CC} + 0.5V$ |
| DC Output Source or Sink Current (I_O) | ± 50 mA |
| DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND}) | ± 50 mA |
| Storage Temperature (T_{STG}) | - 65°C to + 150°C |
| Junction Temperature (T_J) (PDIP) | 140°C |

Recommended Operating Conditions

| | |
|---|----------------|
| Supply Voltage (V_{CC}) | |
| AC | 2.0V to 6.0V |
| ACT | 4.5V to 5.5V |
| Input Voltage (V_I) | 0V to V_{CC} |
| Output Voltage (V_O) | 0V to V_{CC} |
| Operating Temperature (T_A) | -40°C to +85°C |
| Minimum Input Edge Rate ($\Delta V/\Delta t$) | |
| AC Devices | |
| V_{IN} from 30% to 70% of V_{CC} | |
| V_{CC} @ 3.3V, 4.5V, 5.5V | 125 mV/ns |
| Minimum Input Edge Rate ($\Delta V/\Delta t$) | |
| ACT Devices | |
| V_{IN} from 0.8V to 2.0V | |
| V_{CC} @ 4.5V, 5.5V | 125 mV/ns |

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.

DC Electrical Characteristics for AC

| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ\text{C}$ | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | Units | Conditions |
|-------------------|-----------------------------------|-----------------|---------------------------|-------------------|---|--|---------------|---|
| | | | Typ | Guaranteed Limits | | | | |
| V_{IH} | Minimum HIGH Level Input Voltage | 3.0 | 1.5 | 2.1 | 2.1 | | V | $V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$ |
| | | 4.5 | 2.25 | 3.15 | 3.15 | | | |
| | | 5.5 | 2.75 | 3.85 | 3.85 | | | |
| V_{IL} | Maximum LOW Level Input Voltage | 3.0 | 1.5 | 0.9 | 0.9 | | V | $V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$ |
| | | 4.5 | 2.25 | 1.35 | 1.35 | | | |
| | | 5.5 | 2.75 | 1.65 | 1.65 | | | |
| V_{OH} | Minimum HIGH Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | | V | $I_{OUT} = -50 \mu\text{A}$ |
| | | 4.5 | 4.49 | 4.4 | 4.4 | | | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 3.0 | | 2.56 | 2.46 | | V | $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA (Note 2)}$ |
| | | 4.5 | | 3.86 | 3.76 | | | |
| | | 5.5 | | 4.86 | 4.76 | | | |
| V_{OL} | Maximum LOW Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | | V | $I_{OUT} = 50 \mu\text{A}$ |
| | | 4.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 3.0 | | 0.36 | 0.44 | | V | $V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA (Note 2)}$ |
| | | 4.5 | | 0.36 | 0.44 | | | |
| | | 5.5 | | 0.36 | 0.44 | | | |
| I_{IN} (Note 4) | Maximum Input Leakage Current | 5.5 | | ± 0.1 | ± 1.0 | | μA | $V_I = V_{CC}, \text{ GND}$ |
| I_{OZ} | Maximum 3-STATE Current | 5.5 | | ± 0.25 | ± 2.5 | | μA | $V_I (\text{OE}) = V_{IL}, V_{IH}$ $V_I = V_{CC}, \text{ GND}$ $V_O = V_{CC}, \text{ GND}$ |
| I_{OLD} | Minimum Dynamic | 5.5 | | | 75 | | mA | $V_{OLD} = 1.65V \text{ Max}$ |
| I_{OHD} | Output Current (Note 3) | 5.5 | | | -75 | | mA | $V_{OHD} = 3.85V \text{ Min}$ |
| I_{CC} (Note 4) | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40.0 | | μA | $V_{IN} = V_{CC}$ or GND |

Note 2: All outputs loaded; thresholds on input associated with output under test.

Note 3: Maximum test duration 2.0 ms, one output loaded at a time.

Note 4: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC} .

DC Electrical Characteristics for ACT

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | T _A = -40°C to +85°C | | Units | Conditions |
|------------------|--------------------------------------|------------------------|------------------------|-------------------|---------------------------------|----|--|------------|
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum HIGH Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1V or V _{CC} - 0.1V | |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | | |
| V _{IL} | Maximum LOW Level Input Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | V _{OUT} = 0.1V or V _{CC} - 0.1V | |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | | |
| V _{OH} | Minimum HIGH Level Output Voltage | 4.5 | 4.49 | 4.4 | 4.4 | V | I _{OUT} = -50 μA | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 4.5 | | 3.86 | 3.76 | V | V _{IN} = V _{IL} or V _{IH} I _{OH} = -24 mA I _{OH} - 24 mA (Note 5) | |
| | | 5.5 | | 4.86 | 4.76 | | | |
| V _{OL} | Maximum LOW Level Output Voltage | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 4.5 | | 0.36 | 0.44 | V | V _{IN} = V _{IL} or V _{IH} I _{OL} = 24 mA I _{OL} = 24 mA (Note 5) | |
| | | 5.5 | | 0.36 | 0.44 | | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND | |
| I _{OZ} | Maximum 3-STATE Current | 5.5 | | ±0.25 | ±2.5 | μA | V _I = V _{IL} , V _{IH} V _O = V _{CC} , GND | |
| I _{CC} | Maximum I _{CC} /Input | 5.5 | 0.6 | | 1.5 | mA | V _I = V _{CC} - 2.1V | |
| I _{OLD} | Minimum Dynamic | 5.5 | | | 75 | mA | V _{OLD} = 1.65V Max | |
| I _{OHD} | Output Current (Note 6) | 5.5 | | | -75 | mA | V _{OHD} = 3.85V Min | |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40.0 | μA | V _{IN} = V _{CC} or GND | |

Note 5: All outputs loaded; thresholds on input associated with output under test.

Note 6: Maximum test duration 2.0 ms, one output loaded at a time.

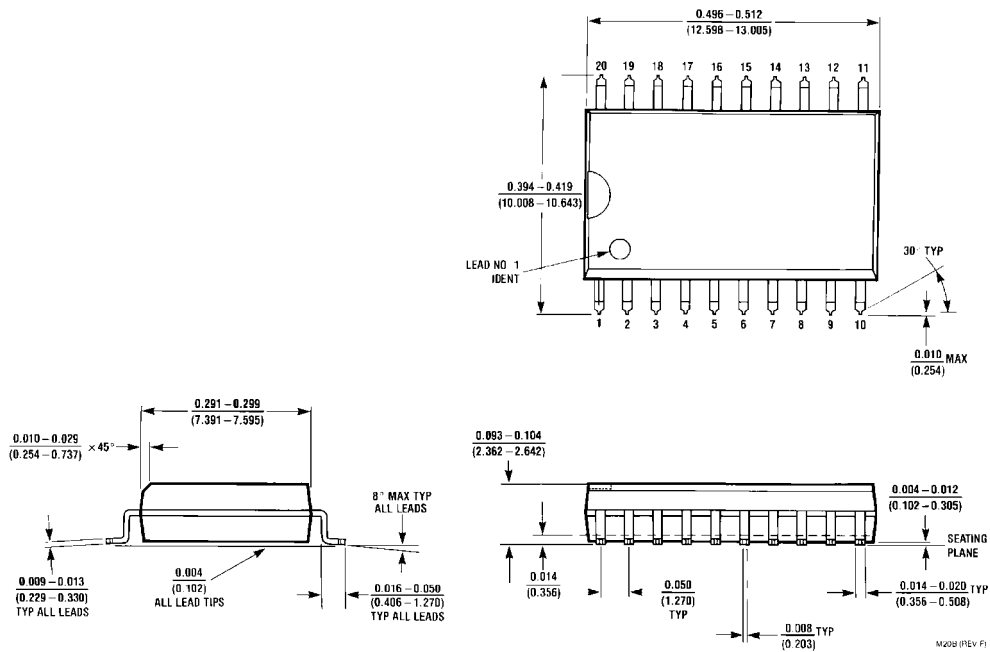
AC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) (Note 7) | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
|------------------|---|------------------------------------|--|------|------|---|------|-------|
| | | | Min | Typ | Max | Min | Max | |
| f _{MAX} | Maximum Clock Frequency | 3.3 | 60 | 110 | | 60 | MHz | |
| | | 5.0 | 100 | 155 | | 100 | | |
| t _{PLH} | Propagation Delay CP to O _n | 3.3 | 3.0 | 11.0 | 13.5 | 1.5 | 15.5 | ns |
| | | 5.0 | 2.5 | 8.0 | 9.5 | 1.5 | 10.5 | |
| t _{PHL} | Propagation Delay CP to O _n | 3.3 | 2.5 | 10.0 | 12.5 | 2.0 | 14.0 | ns |
| | | 5.0 | 2.0 | 7.0 | 9.0 | 1.5 | 10.0 | |
| t _{PZH} | Output Enable Time | 3.3 | 3.0 | 9.5 | 11.5 | 1.5 | 13.0 | ns |
| | | 5.0 | 2.0 | 7.0 | 8.5 | 1.0 | 9.5 | |
| t _{PZL} | Output Enable Time | 3.3 | 2.5 | 9.0 | 11.5 | 1.5 | 13.0 | ns |
| | | 5.0 | 2.0 | 6.5 | 8.5 | 1.0 | 9.5 | |
| t _{PHZ} | Output Disable Time | 3.3 | 3.0 | 10.5 | 12.5 | 2.0 | 14.5 | ns |
| | | 5.0 | 2.0 | 8.0 | 11.0 | 2.0 | 12.5 | |
| t _{PLZ} | Output Disable Time | 3.3 | 2.0 | 8.0 | 11.5 | 1.0 | 12.5 | ns |
| | | 5.0 | 1.5 | 6.5 | 8.5 | 1.0 | 10.0 | |

Note 7: Voltage Range 3.3 is 3.3V ± 0.3V
Voltage Range 5.0 is 5.0V ± 0.5V

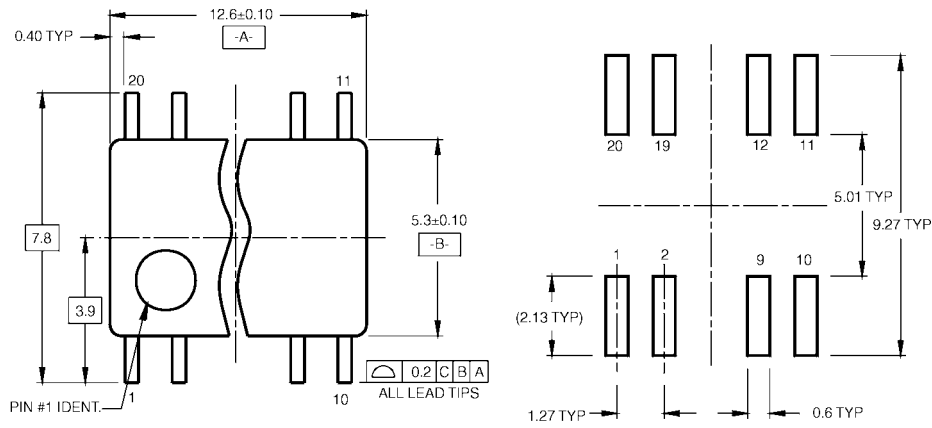
| AC Operating Requirements | | | | | | | | |
|---|---|-------------------------------------|--|------------------------|---|---|------|-------|
| Symbol | Parameter | V _{CC} (V) (Note 8) | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | Units | | |
| | | | Typ | Guaranteed Minimum | | | | |
| t _S | Setup Time, HIGH or LOW D _n to CP | 3.3 | 2.0 | 5.5 | 6.0 | ns | | |
| | | | 5.0 | 1.0 | 4.0 | | 4.5 | |
| t _H | Hold Time, HIGH or LOW D _n to CP | 3.3 | -1.0 | 1.0 | 1.0 | ns | | |
| | | | 5.0 | 0 | 1.5 | | 1.5 | |
| t _W | CP Pulse Width, HIGH or LOW | 3.3 | 4.0 | 5.5 | 6.0 | ns | | |
| | | | 5.0 | 2.5 | 4.0 | | 4.5 | |
| Note 8: Voltage Range 3.3 is 3.3V ± 0.3V Voltage Range 5.0 is 5.0V ± 0.5V | | | | | | | | |
| AC Electrical Characteristics | | | | | | | | |
| Symbol | Parameter | V _{CC} (V) (Note 9) | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
| | | | Min | Typ | Max | Min | Max | |
| f _{MAX} | Maximum Clock Frequency | 5.0 | 100 | 160 | | 90 | MHz | |
| t _{PLH} | Propagation Delay CP to O _n | 5.0 | 2.0 | 8.5 | 10.0 | 2.0 | 11.5 | ns |
| t _{PHL} | Propagation Delay CP to O _n | 5.0 | 2.0 | 8.0 | 9.5 | 1.5 | 11.0 | ns |
| t _{PZH} | Output Enable Time | 5.0 | 2.0 | 8.0 | 9.5 | 1.5 | 10.5 | ns |
| t _{PZL} | Output Enable Time | 5.0 | 1.5 | 8.0 | 9.0 | 1.5 | 10.5 | ns |
| t _{PHZ} | Output Disable Time | 5.0 | 1.5 | 8.5 | 11.5 | 1.0 | 12.5 | ns |
| t _{PLZ} | Output Disable Time | 5.0 | 1.5 | 7.0 | 8.5 | 1.0 | 10.0 | ns |
| Note 9: Voltage Range 5.0 is 5.0V ± 0.5V | | | | | | | | |
| AC Operating Requirements | | | | | | | | |
| Symbol | Parameter | V _{CC} (V) (Note 10) | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | Units | | |
| | | | Typ | Guaranteed Minimum | | | | |
| t _S | Setup Time, HIGH or LOW D _n to CP | 5.0 | 1.0 | 5.5 | 5.5 | ns | | |
| | | | | | | | | |
| t _H | Hold Time, HIGH or LOW D _n to CP | 5.0 | 0 | 1.5 | 1.5 | ns | | |
| | | | | | | | | |
| t _W | CP Pulse Width, HIGH or LOW | 5.0 | 2.5 | 5.0 | 5.0 | ns | | |
| | | | | | | | | |
| Note 10: Voltage Range 5.0 is 5.0V ± 0.5V | | | | | | | | |
| Capacitance | | | | | | | | |
| Symbol | Parameter | Typ | Units | Conditions | | | | |
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = OPEN | | | | |

Physical Dimensions inches (millimeters) unless otherwise noted

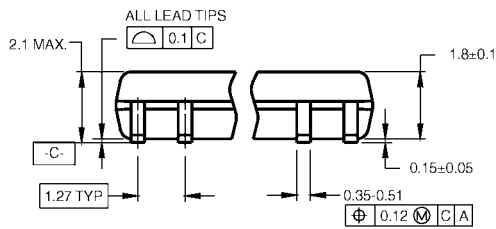


20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body Package Number M20B

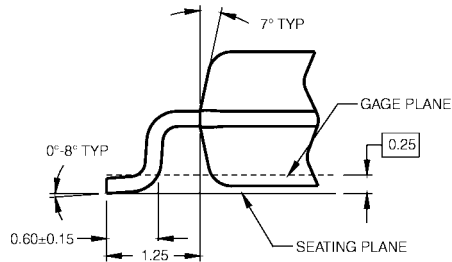
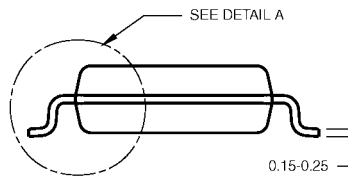
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



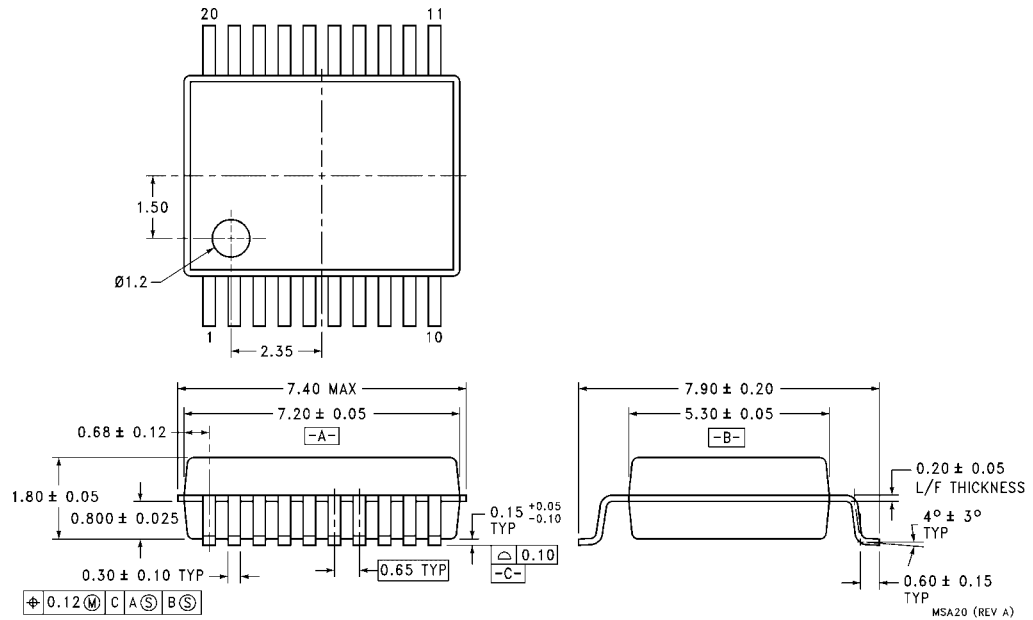
DETAIL A

- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M20DRevB1

**20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D**

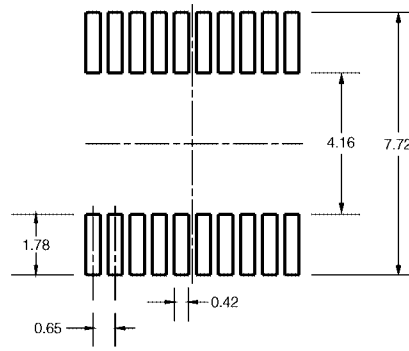
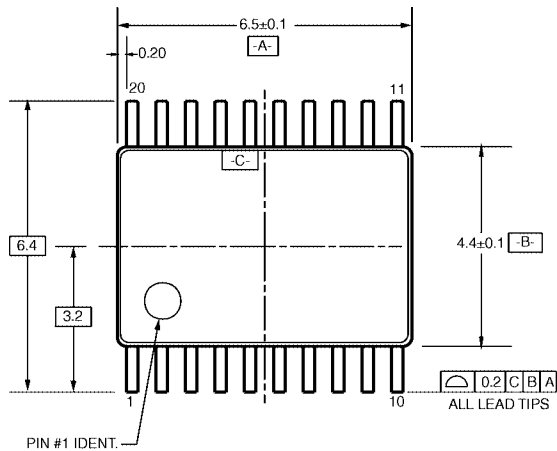
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



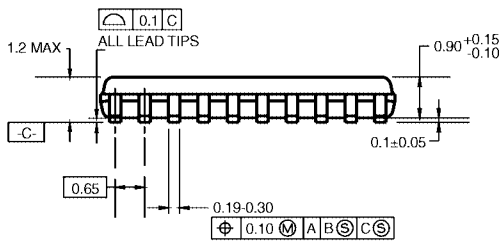
**20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
Package Number MSA20**

MSA20 (REV A)

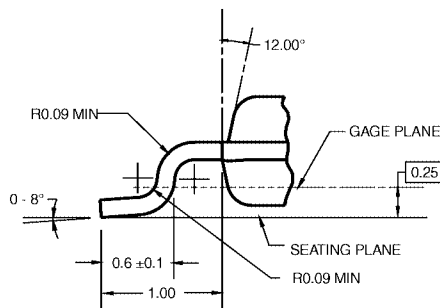
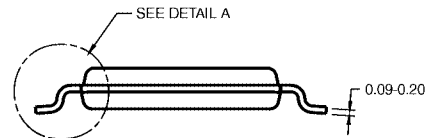
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



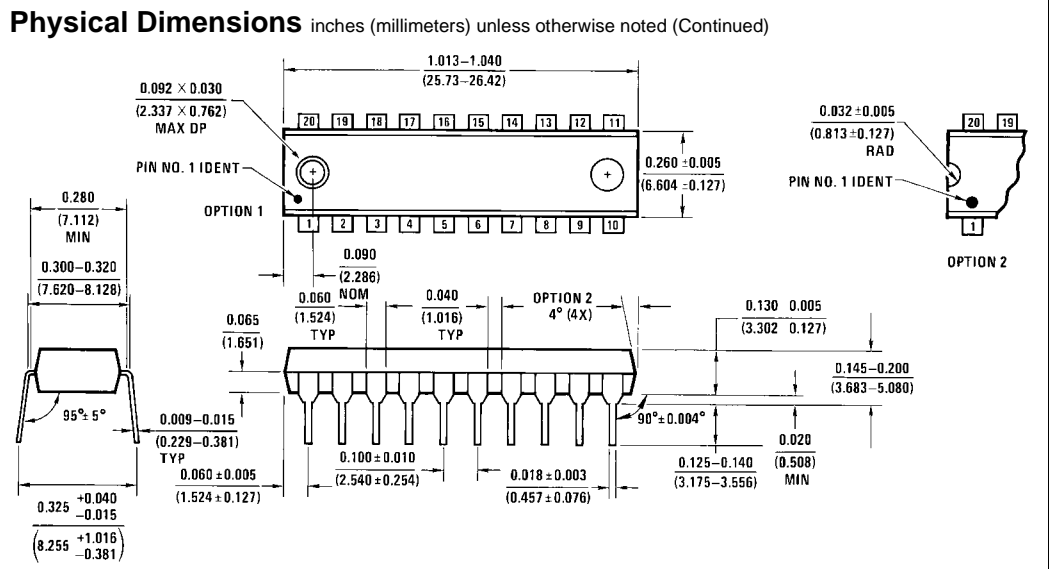
DETAIL A

NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20RevD1

**20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC20**



20-Lead Plastic Dual-in-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N20A

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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