

74ABT574 Octal D-Type Flip-Flop with 3-STATE Outputs

General Description

The ABT574 is an octal flip-flop with a buffered common Clock (CP) and a buffered common Output Enable (\overline{OE}). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH Clock (CP) transition.

The device is functionally identical to the ABT374 but has broadside pinouts.

Features

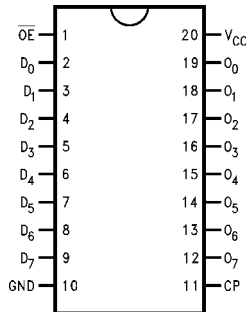
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors
- Functionally identical to ABT374
- 3-STATE outputs for bus-oriented applications
- Output sink capability of 64 mA, source capability of 32 mA
- Guaranteed output skew
- Guaranteed multiple output switching specifications
- Output switching specified for both 50 pF and 250 pF loads
- Guaranteed simultaneous switching, noise level and dynamic threshold performance
- Guaranteed latchup protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Non-destructive hot insertion capability

Ordering Code:

| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| 74ABT574CSC | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| 74ABT574CSJ | M20D | Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74ABT574CMSA | MSA20 | 20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide |
| 74ABT574CMTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.
Pb-Free package per JEDEC J-STD-020B.

Connection Diagram



Pin Descriptions

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

Functional Description

The ABT574 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 times requirements on the LOW-to-HIGH Clock (CP) transition.

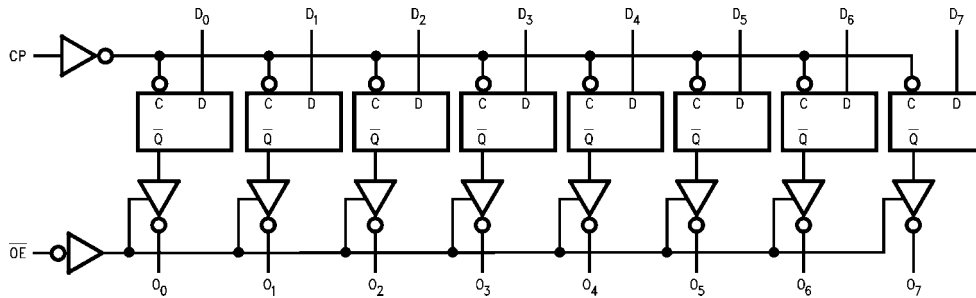
With the Output Enable (\overline{OE}) LOW, the contents of the eight flip-flops are available at the outputs. When \overline{OE} is HIGH, the outputs are in a high impedance state. Operation of the \overline{OE} input does not affect the state of the flip-flops.

Function Table

| Inputs | | | Internal | Outputs | Function |
|-----------------|--------|---|----------|---------|-------------------|
| \overline{OE} | CP | D | Q | O | |
| H | H or L | L | NC | Z | Hold |
| H | H or L | H | NC | Z | Hold |
| H | ↗ | L | L | Z | Load |
| H | ↗ | H | H | Z | Load |
| L | ↗ | L | L | L | Data Available |
| L | ↗ | H | H | H | Data Available |
| L | H or L | L | NC | NC | No Change in Data |
| L | H or L | H | NC | NC | No Change in Data |

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 Z = High Impedance
 ↗ = LOW-to-HIGH Transition
 NC = No Change

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)

| | |
|--|--------------------------------------|
| Storage Temperature | -65°C to +150°C |
| Ambient Temperature under Bias | -55°C to +125°C |
| Junction Temperature under Bias | -55°C to +150°C |
| V _{CC} Pin Potential to Ground Pin | -0.5V to +7.0V |
| Input Voltage (Note 2) | -0.5V to +7.0V |
| Input Current (Note 2) | -30 mA to +5.0 mA |
| Voltage Applied to Any Output in the Disabled or Power-Off State | -0.5V to 5.5V |
| in the HIGH State | -0.5V to V _{CC} |
| Current Applied to Output in LOW State (Max) | twice the rated I _{OL} (mA) |
| DC Latchup Source Current | -500 mA |
| Over Voltage Latchup (I/O) | 10V |

Recommended Operating Conditions

| | |
|---|----------------|
| Free Air Ambient Temperature | -40°C to +85°C |
| Supply Voltage | +4.5V to +5.5V |
| Minimum Input Edge Rate ($\Delta V/\Delta t$) | |
| Data Input | 50 mV/ns |
| Enable Input | 20 mV/ns |
| Clock Input | 100 mV/ns |

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

DC Electrical Characteristics

| Symbol | Parameter | Min | Typ | Max | Units | V _{CC} | Conditions |
|------------------|-------------------------------------|-----------------|-----|------|------------|-----------------|---|
| V _{IH} | Input HIGH Voltage | 2.0 | | | V | | Recognized HIGH Signal |
| V _{IL} | Input LOW Voltage | | | 0.8 | V | | Recognized LOW Signal |
| V _{CD} | Input Clamp Diode Voltage | | | -1.2 | V | Min | I _{IN} = -18 mA |
| V _{OH} | Output HIGH Voltage | 2.5 | | | V | Min | I _{OH} = -3 mA |
| | | 2.0 | | | V | Min | I _{OH} = -32 mA |
| V _{OL} | Output LOW Voltage | | | 0.55 | | | I _{OL} = 64 mA |
| I _{IH} | Input HIGH Current | | | 1 | μA | Max | V _{IN} = 2.7V (Note 3) |
| | | | | 1 | μA | Max | V _{IN} = V _{CC} |
| I _{BVI} | Input HIGH Current Breakdown Test | | | 7 | μA | Max | V _{IN} = 7.0V |
| I _{IL} | Input LOW Current | | | -1 | μA | Max | V _{IN} = 0.5V (Note 3) |
| | | | | -1 | μA | Max | V _{IN} = 0.0V |
| V _{ID} | Input Leakage Test | 4.75 | | | V | 0.0 | I _{ID} = 1.9 μA All Other Pins Grounded |
| I _{OZH} | Output Leakage Current | | | 10 | μA | 0 - 5.5V | V _{OUT} = 2.7V; \overline{OE} = 2.0V |
| I _{OZL} | Output Leakage Current | | | -10 | μA | 0 - 5.5V | V _{OUT} = 0.5V; \overline{OE} = 2.0V |
| I _{OS} | Output Short-Circuit Current | -100 | | -275 | mA | Max | V _{OUT} = 0.0V |
| I _{CEX} | Output High Leakage Current | | | 50 | μA | Max | V _{OUT} = V _{CC} |
| I _{ZZ} | Bus Drainage Test | | | 100 | μA | 0.0 | V _{OUT} = 5.5V; All Other GND |
| I _{CCH} | Power Supply Current | | | 50 | μA | Max | All Outputs HIGH |
| I _{CCL} | Power Supply Current | | | 30 | mA | Max | All Outputs LOW |
| I _{CCZ} | Power Supply Current | | | 50 | μA | Max | \overline{OE} = V _{CC} All Others at V _{CC} or GND |
| I _{CCT} | Additional I _{CC} /Input | Outputs Enabled | | 2.5 | mA | Max | V _I = V _{CC} - 2.1V Enable Input V _I = V _{CC} - 2.1V Data Input V _I = V _{CC} - 2.1V All Others at V _{CC} or GND |
| | | Outputs 3-STATE | | 2.5 | mA | | |
| | | Outputs 3-STATE | | 2.5 | mA | | |
| I _{CCD} | Dynamic I _{CC} (Note 3) | No Load | | 0.30 | mA/ MHz | Max | Outputs Open, \overline{OE} = GND, One Bit Toggling (Note 4), 50% Duty Cycle |

Note 3: Guaranteed, but not tested.

Note 4: For 8-bit toggling, I_{CCD} < 0.8 mA/MHz.

DC Electrical Characteristics

(SOIC Package)

| Symbol | Parameter | Min | Typ | Max | Units | V _{CC} | Conditions |
|------------------|--|------|------|-----|-------|-----------------|---|
| | | | | | | | C _L = 50 pF, R _L = 500Ω |
| V _{OLP} | Quiet Output Maximum Dynamic V _{OL} | | 0.7 | 1.0 | V | 5.0 | T _A = 25°C (Note 5) |
| V _{OLV} | Quiet Output Minimum Dynamic V _{OL} | -1.5 | -1.1 | | V | 5.0 | T _A = 25°C (Note 5) |
| V _{OHV} | Minimum HIGH Level Dynamic Output Voltage | 2.5 | 3.0 | | V | 5.0 | T _A = 25°C (Note 6) |
| V _{IHD} | Minimum HIGH Level Dynamic Input Voltage | 2.0 | 1.6 | | V | 5.0 | T _A = 25°C (Note 7) |
| V _{ILD} | Maximum LOW Level Dynamic Input Voltage | | 1.2 | 0.8 | V | 5.0 | T _A = 25°C (Note 7) |

Note 5: Max number of outputs defined as (n). n - 1 data inputs are driven 0V to 3V. One output at LOW. Guaranteed, but not tested.

Note 6: Max number of outputs defined as (n). n - 1 data inputs are driven 0V to 3V. One output HIGH. Guaranteed, but not tested.

Note 7: Max number of data inputs (n) switching. n - 1 inputs switching 0V to 3V. Input-under-test switching: 3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}). Guaranteed, but not tested.

AC Electrical Characteristics

(SOIC and SSOP Package)

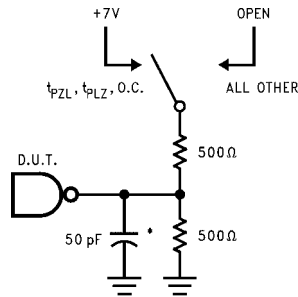
| Symbol | Parameter | T _A = +25°C V _{CC} = +5.0V C _L = 50 pF | | | T _A = -55°C to +125°C V _{CC} = 4.5V to 5.5V C _L = 50 pF | | T _A = -40°C to +85°C V _{CC} = 4.5V to 5.5V C _L = 50 pF | | Units |
|------------------|---|---|-----|-----|--|-----|---|-----|-------|
| | | Min | Typ | Max | Min | Max | Min | Max | |
| f _{MAX} | Maximum Clock Frequency | 150 | 200 | | 150 | | 150 | | MHz |
| t _{PLH} | Propagation Delay CP to O _n | 2.0 | 3.2 | 5.0 | 1.5 | 7.0 | 2.0 | 5.0 | ns |
| t _{PHL} | | 2.0 | 3.3 | 5.0 | 1.5 | 7.4 | 2.0 | 5.0 | ns |
| t _{PZH} | Output Enable Time | 1.5 | 3.1 | 5.3 | 1.0 | 6.5 | 1.5 | 5.3 | ns |
| t _{PZL} | | 1.5 | 3.1 | 5.3 | 1.0 | 7.2 | 1.5 | 5.3 | ns |
| t _{PHZ} | Output Disable Time | 1.5 | 3.6 | 5.4 | 1.0 | 7.2 | 1.5 | 5.4 | ns |
| t _{PLZ} | | 1.5 | 3.4 | 5.4 | 1.0 | 6.7 | 1.5 | 5.4 | ns |

AC Operating Requirements

| Symbol | Parameter | T _A = +25°C V _{CC} = +5.0V C _L = 50 pF | | T _A = -55°C to +125°C V _{CC} = 4.5V to 5.5V C _L = 50 pF | | T _A = -40°C to +85°C V _{CC} = 4.5V to 5.5V C _L = 50 pF | | Units |
|--------------------|-----------------------------|---|-----|--|-----|---|-----|-------|
| | | Min | Max | Min | Max | Min | Max | |
| t _S (H) | Setup Time, HIGH | 1.0 | | 1.5 | | 1.0 | | ns |
| t _S (L) | or LOW D _n to CP | 1.5 | | 2.0 | | 1.5 | | |
| t _H (H) | Hold Time, HIGH | 1.0 | | 2.0 | | 1.0 | | ns |
| t _H (L) | or LOW D _n to CP | 1.0 | | 2.0 | | 1.0 | | |
| t _W (H) | Pulse Width, CP, | 3.0 | | 3.3 | | 3.0 | | ns |
| t _W (L) | HIGH or LOW | 3.0 | | 3.3 | | 3.0 | | |

| Extended AC Electrical Characteristics | | | | | | | | |
|--|--|--|-------|--|-----|--|------|-------|
| (SOIC Package) | | | | | | | | |
| Symbol | Parameter | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 4.5\text{V to } 5.5\text{V}$ $C_L = 50\text{ pF}$ 8 Outputs Switching (Note 8) | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 4.5\text{V to } 5.5\text{V}$ $C_L = 250\text{ pF}$ (Note 9) | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 4.5\text{V to } 5.5\text{V}$ $C_L = 250\text{ pF}$ 8 Outputs Switching (Note 10) | | Units |
| | | Min | Max | Min | Max | Min | Max | |
| t_{PLH} | Propagation Delay | 1.5 | 5.7 | 2.0 | 7.8 | 2.0 | 10.0 | ns |
| t_{PHL} | CP to O_n | 1.5 | 5.7 | 2.0 | 7.8 | 2.0 | 10.0 | |
| t_{PZH} | Output Enable Time | 1.5 | 6.2 | 2.0 | 8.0 | 2.0 | 10.5 | ns |
| t_{PZL} | | 1.5 | 6.2 | 2.0 | 8.0 | 2.0 | 10.5 | |
| t_{PHZ} | Output Disable Time | 1.0 | 5.5 | (Note 11) | | (Note 11) | | ns |
| t_{PLZ} | | 1.0 | 5.5 | | | | | |
| <p>Note 8: This specification is guaranteed but not tested. The limits apply to propagation delays for all paths described switching in phase (i.e., all LOW-to-HIGH, HIGH-to-LOW, etc.).</p> <p>Note 9: This specification is guaranteed but not tested. The limits represent propagation delay with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load. This specification pertains to single output switching only.</p> <p>Note 10: This specification is guaranteed but not tested. The limits represent propagation delays for all paths described switching in phase (i.e., all LOW-to-HIGH, HIGH-to-LOW, etc.) with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load.</p> <p>Note 11: The 3-STATE Delay Times are dominated by the RC network (500Ω, 250 pF) on the output and has been excluded from the datasheet.</p> | | | | | | | | |
| Skew (Note 12) | | | | | | | | |
| (SOIC package) | | | | | | | | |
| Symbol | Parameter | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 4.5\text{V} - 5.5\text{V}$ $C_L = 50\text{ pF}$ 8 Outputs Switching (Note 12) | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 4.5\text{V} - 5.5\text{V}$ $C_L = 250\text{ pF}$ 8 Outputs Switching (Note 13) | | Units | | |
| | | Max | | Max | | | | |
| t_{OSHL} (Note 14) | Pin to Pin Skew HL Transitions | 1.0 | | 1.8 | | ns | | |
| t_{OSLH} (Note 14) | Pin to Pin Skew LH Transitions | 1.0 | | 1.8 | | ns | | |
| t_{PS} (Note 15) | Duty Cycle LH-HL Skew | 1.8 | | 4.3 | | ns | | |
| t_{OST} (Note 14) | Pin to Pin Skew LH/HL Transitions | 2.0 | | 4.3 | | ns | | |
| t_{PV} (Note 16) | Device to Device Skew LH/HL Transitions | 2.5 | | 4.6 | | ns | | |
| <p>Note 12: This specification is guaranteed but not tested. The limits apply to propagation delays for all paths described switching in phase (i.e., all LOW-to-HIGH, HIGH-to-LOW, etc.).</p> <p>Note 13: This specification is guaranteed but not tested. The limits represent propagation delays with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load.</p> <p>Note 14: Skew is defined as the absolute value of the difference between the actual propagation delays for any two separate outputs of the same device. The specification applies to any outputs switching HIGH-to-LOW (t_{OSHL}), LOW-to-HIGH (t_{OSLH}), or any combination switching LOW-to-HIGH and/or HIGH-to-LOW (t_{OST}). This specification is guaranteed but not tested.</p> <p>Note 15: This describes the difference between the delay of the LOW-to-HIGH and the HIGH-to-LOW transition on the same pin. It is measured across all the outputs (drivers) on the same chip, the worst (largest delta) number is the guaranteed specification. This specification is guaranteed but not tested.</p> <p>Note 16: Propagation delay variation for a given set of conditions (i.e., temperature and V_{CC}) from device to device. This specification is guaranteed but not tested.</p> | | | | | | | | |
| Capacitance | | | | | | | | |
| Symbol | Parameter | Typ | Units | Conditions $T_A = 25^\circ\text{C}$ | | | | |
| C_{IN} | Input Capacitance | 5.0 | pF | $V_{CC} = 0\text{V}$ | | | | |
| C_{OUT} (Note 17) | Output Capacitance | 9.0 | pF | $V_{CC} = 5.0\text{V}$ | | | | |
| <p>Note 17: C_{OUT} is measured at frequency $f = 1\text{ MHz}$, per MIL-STD-883, Method 3012.</p> | | | | | | | | |

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

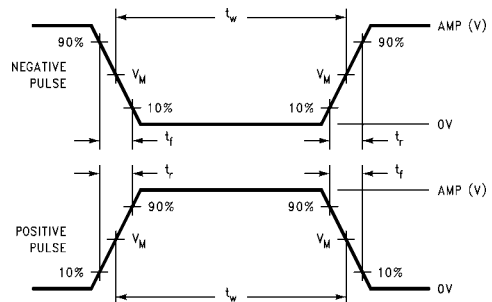


FIGURE 2. $V_M = 1.5V$

Input Pulse Requirements

| Amplitude | Rep. Rate | t_w | t_r | t_f |
|-----------|-----------|--------|--------|--------|
| 3.0V | 1 MHz | 500 ns | 2.5 ns | 2.5 ns |

FIGURE 3. Test Input Signal Requirements

AC Waveforms

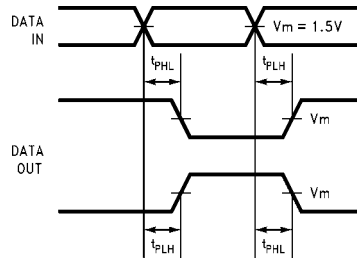


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

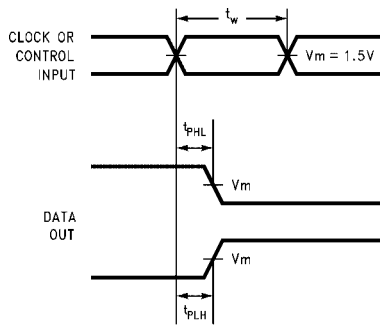


FIGURE 5. Propagation Delay, Pulse Width Waveforms

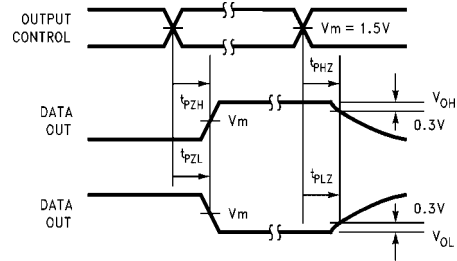


FIGURE 6. 3-STATE Output HIGH and LOW Enable and Disable Times

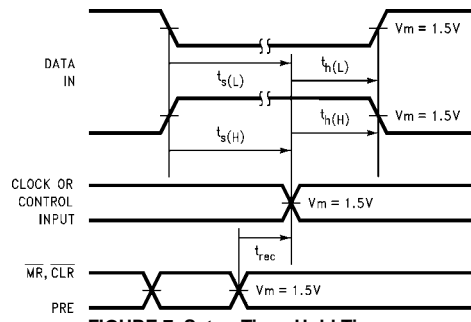
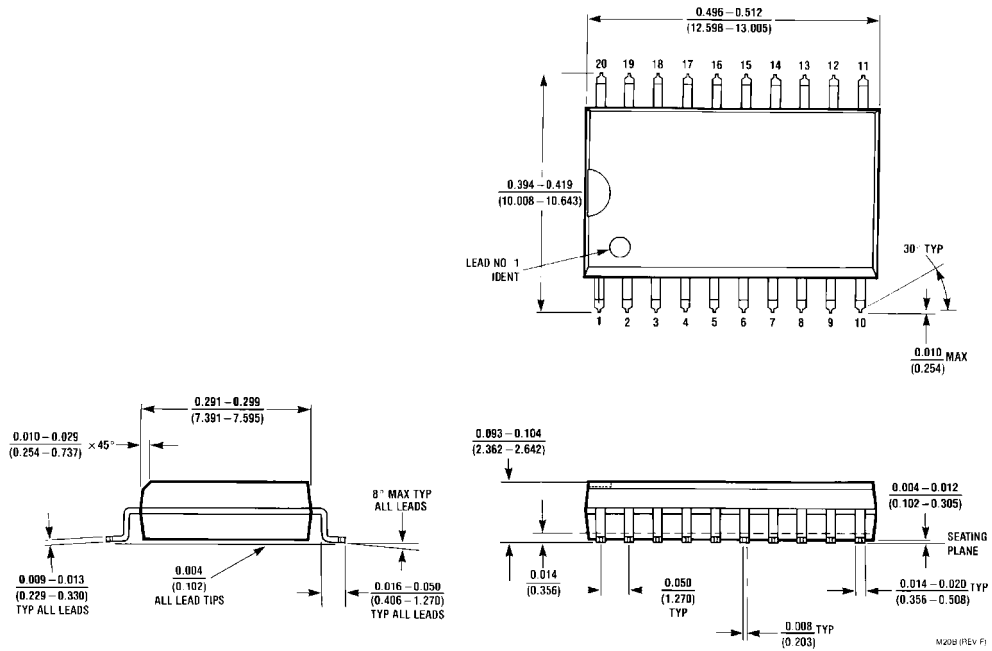


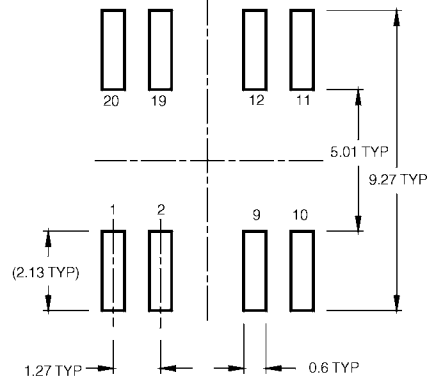
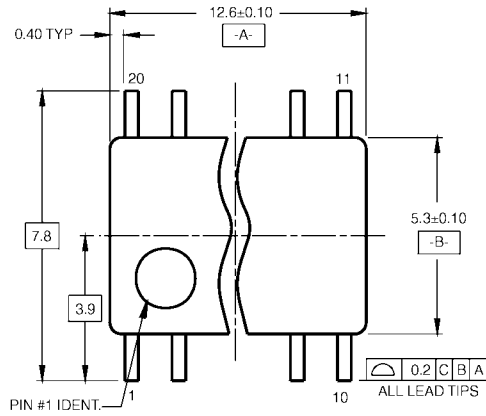
FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms

Physical Dimensions inches (millimeters) unless otherwise noted

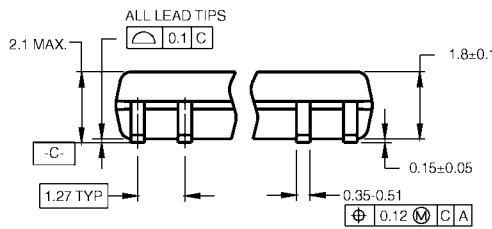


**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B**

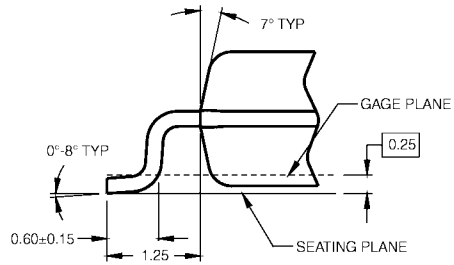
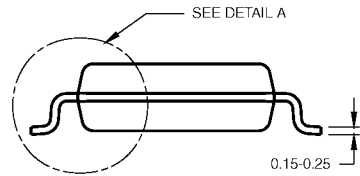
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



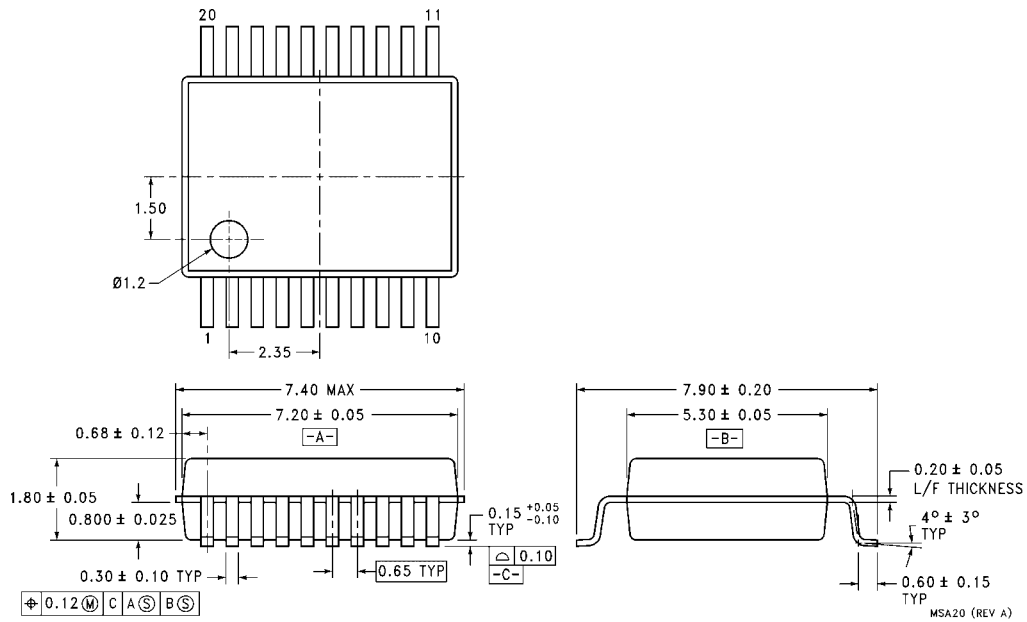
DETAIL A

- 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

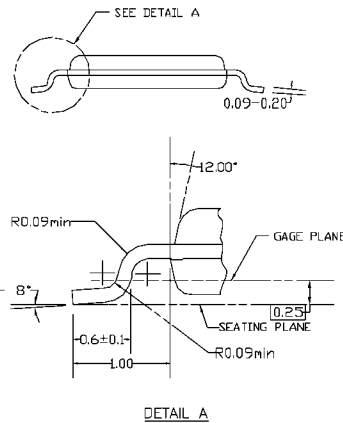
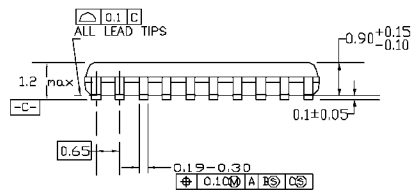
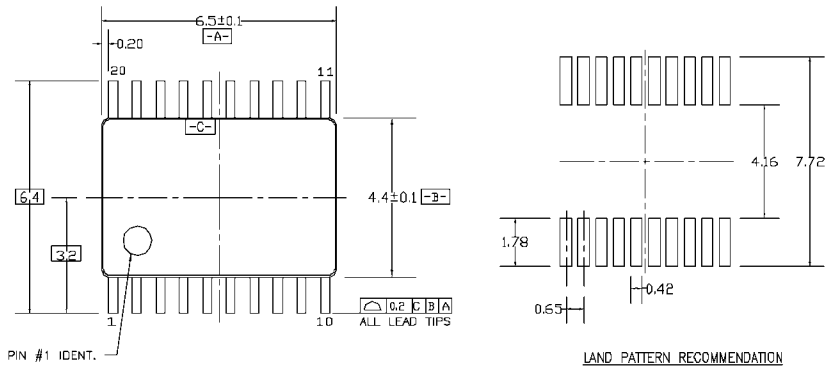
Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M20D

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



**20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide
 Package Number MSA20**

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



DIMENSIONS ARE IN MILLIMETERS

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, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20REV D1

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

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