

## 74ABT16374

### 16-Bit D-Type Flip-Flop with 3-STATE Outputs

#### General Description

The ABT16374 contains sixteen non-inverting D-type flip-flops with 3-STATE outputs and is intended for bus oriented applications. The device is byte controlled. A buffered clock (CP) and Output Enable ( $\overline{OE}$ ) are common to each byte and can be shorted together for full 16-bit operation.

#### Features

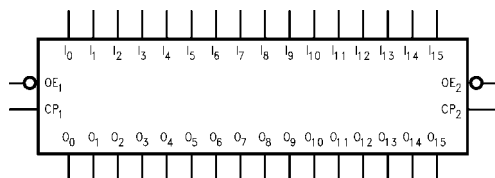
- Separate control logic for each byte
- 16-bit version of the ABT374
- Edge-triggered D-type inputs
- Buffered Positive edge-triggered clock
- High impedance glitch free bus loading during entire power up and power down cycle
- Non-destructive hot insertion capability
- Guaranteed latch-up protection

#### Ordering Code:

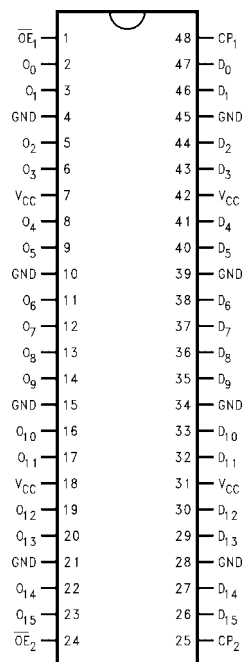
| Order Number   | Package Number | Package Description                                                         |
|----------------|----------------|-----------------------------------------------------------------------------|
| 74ABT16374CSSC | MS48A          | 48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide      |
| 74ABT16374CMTD | MTD48          | 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide |

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

#### Logic Symbol



#### Connection Diagram



#### Pin Descriptions

| Pin Name          | Description                              |
|-------------------|------------------------------------------|
| $\overline{OE}_n$ | 3-STATE Output Enable Input (Active LOW) |
| $CP_n$            | Clock Pulse Input (Active Rising Edge)   |
| $D_0-D_{15}$      | Data Inputs                              |
| $O_0-O_{15}$      | 3-STATE Outputs                          |

74ABT16374 16-Bit D-Type Flip-Flop with 3-STATE Outputs

### Functional Description

The ABT16374 consists of sixteen edge-triggered flip-flops with individual D-type inputs and 3-STATE true outputs. The device is byte controlled with each byte functioning identically, but independent of the other. The control pins can be shorted together to obtain full 16-bit operation. Each byte has a buffered clock and buffered Output Enable common to all flip-flops within that byte. The description which follows applies to each byte. Each flip-flop will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock ( $CP_n$ ) transition. With the Output Enable ( $\overline{OE}_n$ ) LOW, the contents of the flip-flops are available at the outputs. When  $\overline{OE}_n$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}_n$  input does not affect the state of the flip-flops.

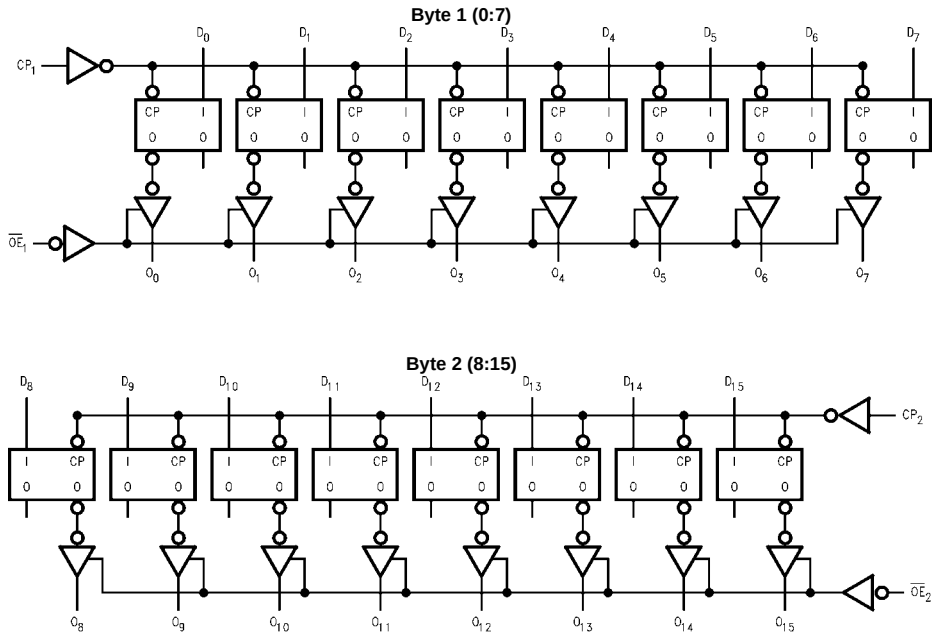
### Truth Tables

| Inputs |                   |           | Outputs    |
|--------|-------------------|-----------|------------|
| $CP_1$ | $\overline{OE}_1$ | $D_0-D_7$ | $O_0-O_7$  |
|        | L                 | H         | H          |
|        | L                 | L         | L          |
| L      | L                 | X         | (Previous) |
| X      | H                 | X         | Z          |

| Inputs |                   |              | Outputs      |
|--------|-------------------|--------------|--------------|
| $CP_2$ | $\overline{OE}_2$ | $D_8-D_{15}$ | $O_8-O_{15}$ |
|        | L                 | H            | H            |
|        | L                 | L            | L            |
| L      | L                 | X            | (Previous)   |
| X      | H                 | X            | Z            |

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 Z = High Impedance

### Logic Diagrams



**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 <sub>CC</sub> 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<br>in the Disabled or<br>Power-Off State | –0.5V to 5.5V                        |
| in the HIGH State                                                      | –0.5V to V <sub>CC</sub>             |
| Current Applied to Output<br>in LOW State (Max)                        | twice the rated I <sub>OL</sub> (mA) |
| DC Latchup Source Current:<br>OE Pin                                   | –350 mA                              |
| (Across Comm Operating Range)<br>Other Pins                            | –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                                     | 100mV/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 <sub>CC</sub> | Conditions                                                                                 |
|------------------|-------------------------------------|-----------------|-----|------|------------|-----------------|--------------------------------------------------------------------------------------------|
| V <sub>IH</sub>  | Input HIGH Voltage                  | 2.0             |     |      | V          |                 | Recognized HIGH Signal                                                                     |
| V <sub>IL</sub>  | Input LOW Voltage                   |                 |     | 0.8  | V          |                 | Recognized LOW Signal                                                                      |
| V <sub>CD</sub>  | Input Clamp Diode Voltage           |                 |     | –1.2 | V          | Min             | I <sub>IN</sub> = –18 mA                                                                   |
| V <sub>OH</sub>  | Output HIGH Voltage                 | 2.5             |     |      | V          | Min             | I <sub>OH</sub> = –3 mA                                                                    |
|                  |                                     | 2.0             |     |      | V          | Min             | I <sub>OH</sub> = –32 mA                                                                   |
| V <sub>OL</sub>  | Output LOW Voltage                  |                 |     | 0.55 | V          | Min             | I <sub>OL</sub> = 64 mA                                                                    |
| I <sub>IH</sub>  | Input HIGH Current                  |                 |     | 1    | μA         | Max             | V <sub>IN</sub> = 2.7V (Note 3)                                                            |
|                  |                                     |                 |     | 1    | μA         | Max             | V <sub>IN</sub> = V <sub>CC</sub>                                                          |
| I <sub>BVI</sub> | Input HIGH Current Breakdown Test   |                 |     | 7    | μA         | Max             | V <sub>IN</sub> = 7.0V                                                                     |
| I <sub>IL</sub>  | Input LOW Current                   |                 |     | –1   | μA         | Max             | V <sub>IN</sub> = 0.5V (Note 3)                                                            |
|                  |                                     |                 |     | –1   | μA         | Max             | V <sub>IN</sub> = 0.0V                                                                     |
| V <sub>ID</sub>  | Input Leakage Test                  | 4.75            |     |      | V          | 0.0             | I <sub>ID</sub> = 1.9 μA<br>All Other Pins Grounded                                        |
| I <sub>OZH</sub> | Output Leakage Current              |                 |     | 10   | μA         | 0–5.5V          | V <sub>OUT</sub> = 2.7V; OE = 2.0V                                                         |
| I <sub>OZL</sub> | Output Leakage Current              |                 |     | –10  | μA         | 0–5.5V          | V <sub>OUT</sub> = 0.5V; OE = 2.0V                                                         |
| I <sub>OS</sub>  | Output Short-Circuit Current        | –100            |     | –275 | mA         | Max             | V <sub>OUT</sub> = 0.0V                                                                    |
| I <sub>CEX</sub> | Output HIGH Leakage Current         |                 |     | 50   | μA         | Max             | V <sub>OUT</sub> = V <sub>CC</sub>                                                         |
| I <sub>ZZ</sub>  | Bus Drainage Test                   |                 |     | 100  | μA         | 0.0             | V <sub>OUT</sub> = 5.5V; All Others V <sub>CC</sub> or GND                                 |
| I <sub>CCH</sub> | Power Supply Current                |                 |     | 2.0  | mA         | Max             | All Outputs HIGH                                                                           |
| I <sub>CCL</sub> | Power Supply Current                |                 |     | 62   | mA         | Max             | All Outputs LOW                                                                            |
| I <sub>CCZ</sub> | Power Supply Current                |                 |     | 2.0  | mA         | Max             | OE = V <sub>CC</sub> ; All Others at V <sub>CC</sub> or GND                                |
| I <sub>CCT</sub> | Additional I <sub>CC</sub> /Input   | Outputs Enabled |     | 2.5  | mA         |                 | V <sub>I</sub> = V <sub>CC</sub> – 2.1V                                                    |
|                  |                                     | Outputs 3-STATE |     | 2.5  | mA         | Max             | Enable Input V <sub>I</sub> = V <sub>CC</sub> – 2.1V                                       |
|                  |                                     | Outputs 3-STATE |     | 2.5  | mA         | Max             | Data Input V <sub>I</sub> = V <sub>CC</sub> – 2.1V<br>All Others at V <sub>CC</sub> or GND |
| I <sub>CCD</sub> | Dynamic I <sub>CC</sub><br>(Note 3) | No Load         |     | 0.30 | mA/<br>MHz | Max             | Outputs Open<br>OE = GND, (Note 4)<br>One Bit Toggling, 50% Duty Cycle                     |

**Note 3:** Guaranteed, but not tested.

**Note 4:** For 8-bit toggling, I<sub>CCD</sub> < 0.8 mA/MHz.

## AC Electrical Characteristics

(SSOP Package)

| Symbol           | Parameter               | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     |     | T <sub>A</sub> = -40°C to +85°C<br>V <sub>CC</sub> = 4.5V to 5.5V<br>C <sub>L</sub> = 50 pF |     | Units |
|------------------|-------------------------|-----------------------------------------------------------------------------|-----|-----|---------------------------------------------------------------------------------------------|-----|-------|
|                  |                         | Min                                                                         | Typ | Max | Min                                                                                         | Max |       |
| f <sub>MAX</sub> | Maximum Clock Frequency | 150                                                                         |     |     | 150                                                                                         |     | MHz   |
| t <sub>PLH</sub> | Propagation Delay       | 1.8                                                                         |     | 6.2 | 1.8                                                                                         | 6.2 | ns    |
| t <sub>PHL</sub> | CP to O <sub>n</sub>    | 1.8                                                                         |     | 5.9 | 1.8                                                                                         | 5.9 | ns    |
| t <sub>PZH</sub> | Output Enable Time      | 1.2                                                                         |     | 5.6 | 1.2                                                                                         | 5.6 | ns    |
| t <sub>PZL</sub> |                         | 1.6                                                                         |     | 5.3 | 1.6                                                                                         | 5.3 | ns    |
| t <sub>PHZ</sub> | Output Disable Time     | 2.2                                                                         |     | 7.1 | 2.2                                                                                         | 7.1 | ns    |
| t <sub>PLZ</sub> |                         | 2.2                                                                         |     | 6.6 | 2.2                                                                                         | 6.6 | ns    |

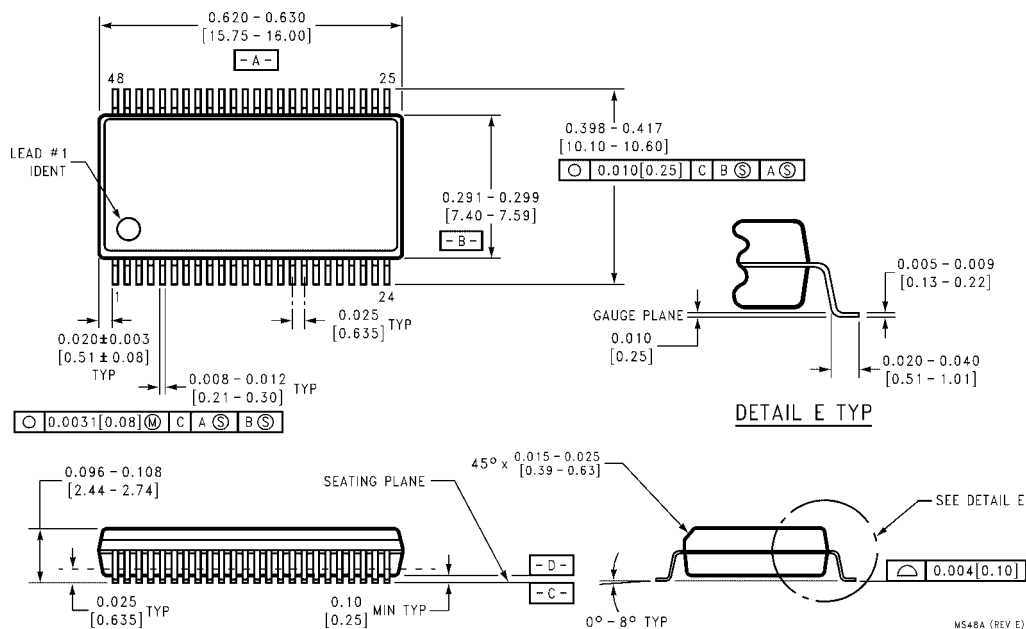
## AC Operating Requirements

| Symbol             | Parameter                   | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     | T <sub>A</sub> = -40°C to +85°C<br>V <sub>CC</sub> = 4.5V to 5.5V<br>C <sub>L</sub> = 50 pF |     | Units |
|--------------------|-----------------------------|-----------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------|-----|-------|
|                    |                             | Min                                                                         | Max | Min                                                                                         | Max |       |
| t <sub>S</sub> (H) | Setup Time, HIGH            | 1.1                                                                         |     | 1.1                                                                                         |     | ns    |
| t <sub>S</sub> (L) | or LOW D <sub>n</sub> to CP | 1.1                                                                         |     | 1.1                                                                                         |     | ns    |
| t <sub>H</sub> (H) | Hold Time, HIGH             | 1.3                                                                         |     | 1.3                                                                                         |     | ns    |
| t <sub>H</sub> (L) | or LOW D <sub>n</sub> to CP | 1.3                                                                         |     | 1.3                                                                                         |     | ns    |
| t <sub>W</sub> (H) | Pulse Width, CP             | 3.0                                                                         |     | 3.0                                                                                         |     | ns    |
| t <sub>W</sub> (L) | HIGH or LOW                 | 3.0                                                                         |     | 3.0                                                                                         |     | ns    |

## Capacitance

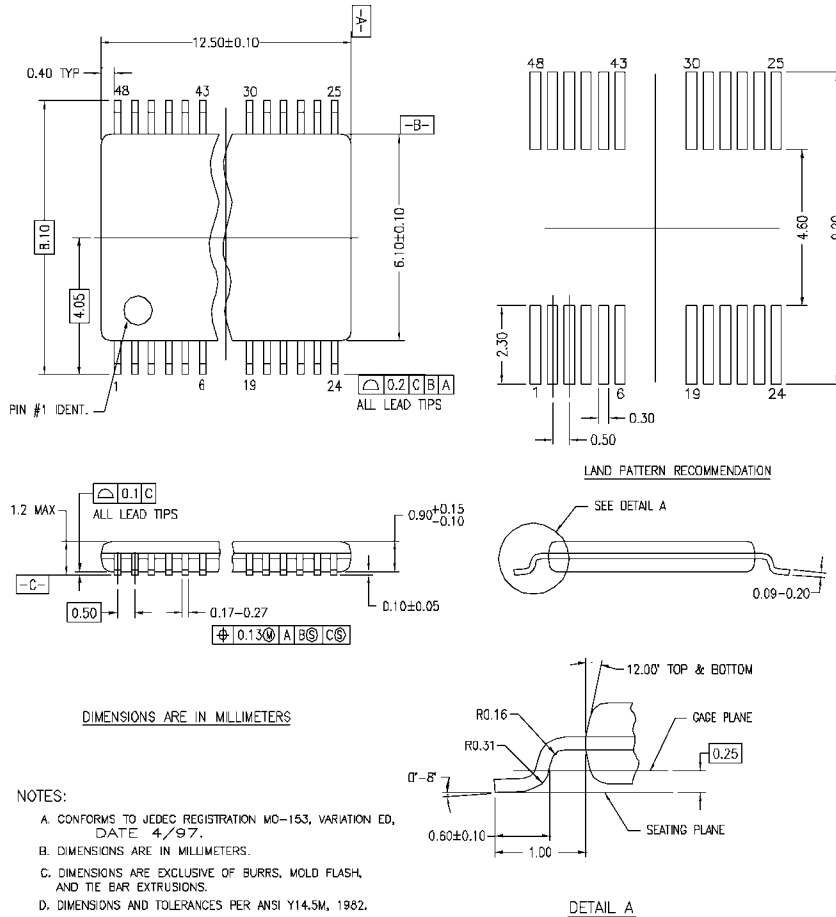
| Symbol                    | Parameter          | Typ  | Units | Conditions<br>(T <sub>A</sub> = 25°C) |
|---------------------------|--------------------|------|-------|---------------------------------------|
| C <sub>IN</sub>           | Input Capacitance  | 5.0  | pF    | V <sub>CC</sub> = 0V                  |
| C <sub>OUT</sub> (Note 5) | Output Capacitance | 11.0 | pF    | V <sub>CC</sub> = 5.0V                |

**Note 5:** C<sub>OUT</sub> is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.

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


**48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide  
Package Number MS48A**

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



## NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION ED, DATE 4/97.
- 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.

MTD48REV C

## 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide Package Number MTD48

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