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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
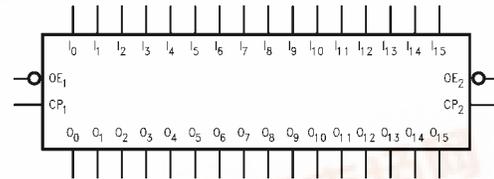
Connection Diagram
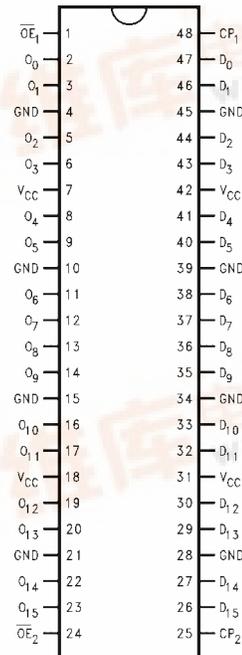
Pin Descriptions

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 OE_n input does not affect the state of the flip-flops.
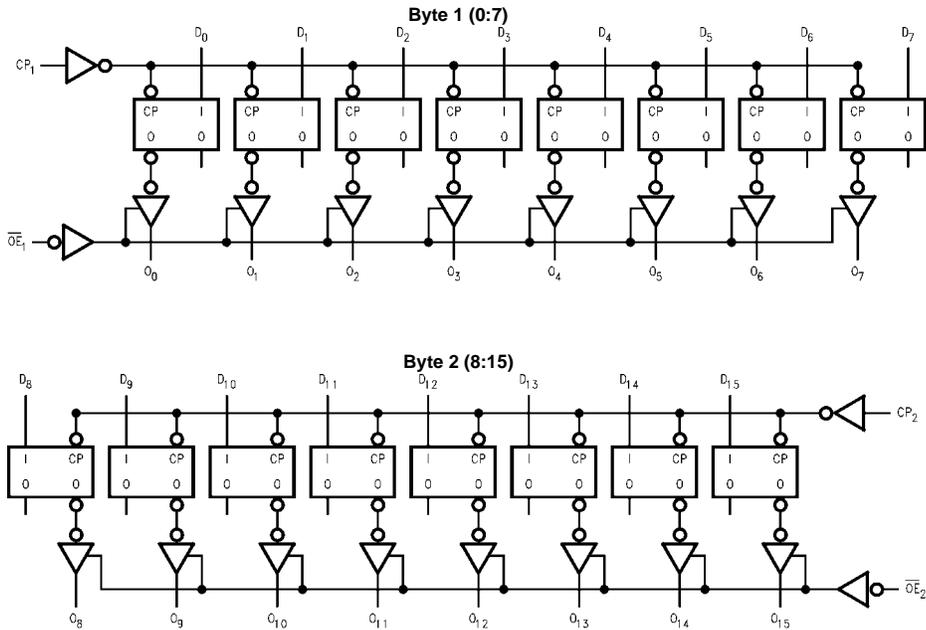
Truth Tables

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

Byte 1 (0:7)

Byte 2 (8:15)

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:	
$\overline{OE}$ Pin	−350 mA
(Across Comm Operating Range)	
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_{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	V	Min	$I_{OL} = 64$ mA
I_{IH}	Input HIGH Current				1	μA	Max	$V_{IN} = 2.7$V (Note 3)
					1			$V_{IN} = V_{CC}$
I_{BVI}	Input HIGH Current Breakdown Test				7	μA	Max	$V_{IN} = 7.0$V
I_{IL}	Input LOW Current				−1	μA	Max	$V_{IN} = 0.5$V (Note 3)
					−1			$V_{IN} = 0.0$V
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	$V_{OUT} = 2.7$V; $\overline{OE} = 2.0$V
I_{OZL}	Output Leakage Current				−10	μA	0–5.5V	$V_{OUT} = 0.5$V; $\overline{OE} = 2.0$V
I_{OS}	Output Short-Circuit Current		−100		−275	mA	Max	$V_{OUT} = 0.0$V
I_{CEX}	Output HIGH Leakage Current				50	μA	Max	$V_{OUT} = V_{CC}$
I_{ZZ}	Bus Drainage Test				100	μA	0.0	$V_{OUT} = 5.5$V; All Others V_{CC} or GND
I_{CCH}	Power Supply Current				2.0	mA	Max	All Outputs HIGH
I_{CCL}	Power Supply Current				62	mA	Max	All Outputs LOW
I_{CCZ}	Power Supply Current				2.0	mA	Max	$\overline{OE} = V_{CC}$; All Others at V_{CC} or GND
I_{CCT}	Additional I_{CC}/Input	Outputs Enabled			2.5	mA	Max	$V_I = V_{CC} − 2.1$V
		Outputs 3-STATE			2.5	mA		Enable Input $V_I = V_{CC} − 2.1$V
		Outputs 3-STATE			2.5	mA		Data Input $V_I = V_{CC} − 2.1$V All Others at V_{CC} or GND
I_{CCD}	Dynamic I_{CC} (Note 3)	No Load			0.30	mA/ MHz	Max	Outputs Open $\overline{OE} = $ GND, (Note 4) One Bit Toggling, 50% Duty Cycle

Note 3: Guaranteed, but not tested.
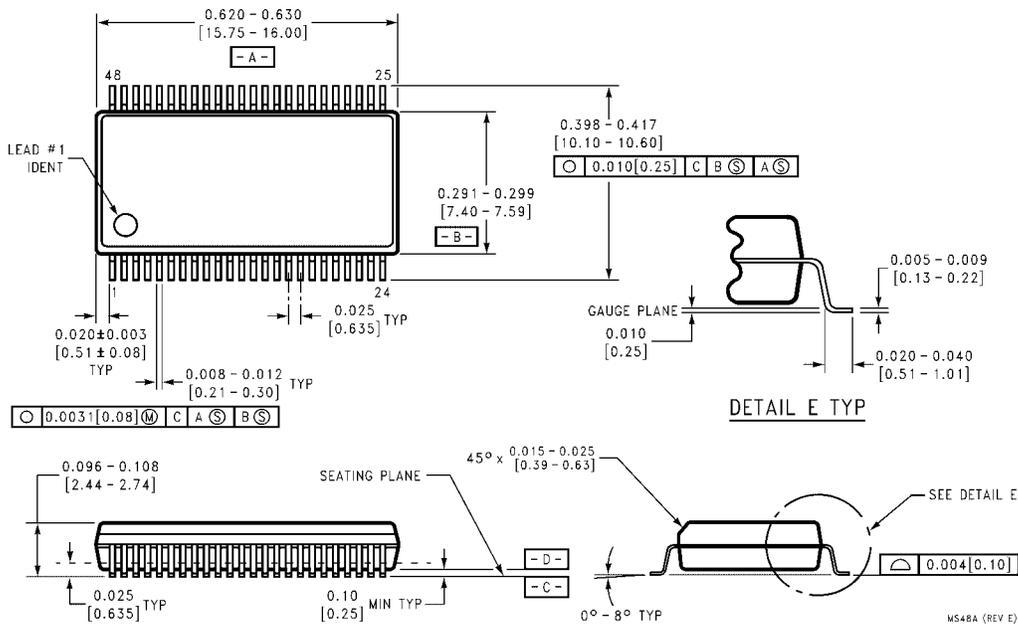
Note 4: For 8-bit toggling, $I_{CCD} < 0.8$ mA/MHz.

74ABT16374

AC Electrical Characteristics

(SSOP Package)

Symbol	Parameter	$T_A = +25°C$ $V_{CC} = +5.0V$ $C_L = 50\ pF$			$T_A = -40°C\ to\ +85°C$ $V_{CC} = 4.5V\ to\ 5.5V$ $C_L = 50\ pF$		Units
		Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	150			150		MHz
t_{PLH}	Propagation Delay	1.8		6.2	1.8	6.2	ns
t_{PHL}	CP to O_n	1.8		5.9	1.8	5.9	
t_{PZH}	Output Enable Time	1.2		5.6	1.2	5.6	ns
t_{PZL}		1.6		5.3	1.6	5.3	
t_{PHZ}	Output Disable Time	2.2		7.1	2.2	7.1	ns
t_{PLZ}		2.2		6.6	2.2	6.6	

AC Operating Requirements

Symbol	Parameter	$T_A = +25°C$ $V_{CC} = +5.0V$ $C_L = 50\ pF$		$T_A = -40°C\ to\ +85°C$ $V_{CC} = 4.5V\ to\ 5.5V$ $C_L = 50\ pF$		Units
		Min	Max	Min	Max	
$t_S(H)$	Setup Time, HIGH	1.1		1.1		ns
$t_S(L)$	or LOW D_n to CP	1.1		1.1		
$t_H(H)$	Hold Time, HIGH	1.3		1.3		ns
$t_H(L)$	or LOW D_n to CP	1.3		1.3		
$t_W(H)$	Pulse Width, CP	3.0		3.0		ns
$t_W(L)$	HIGH or LOW	3.0		3.0		

Capacitance

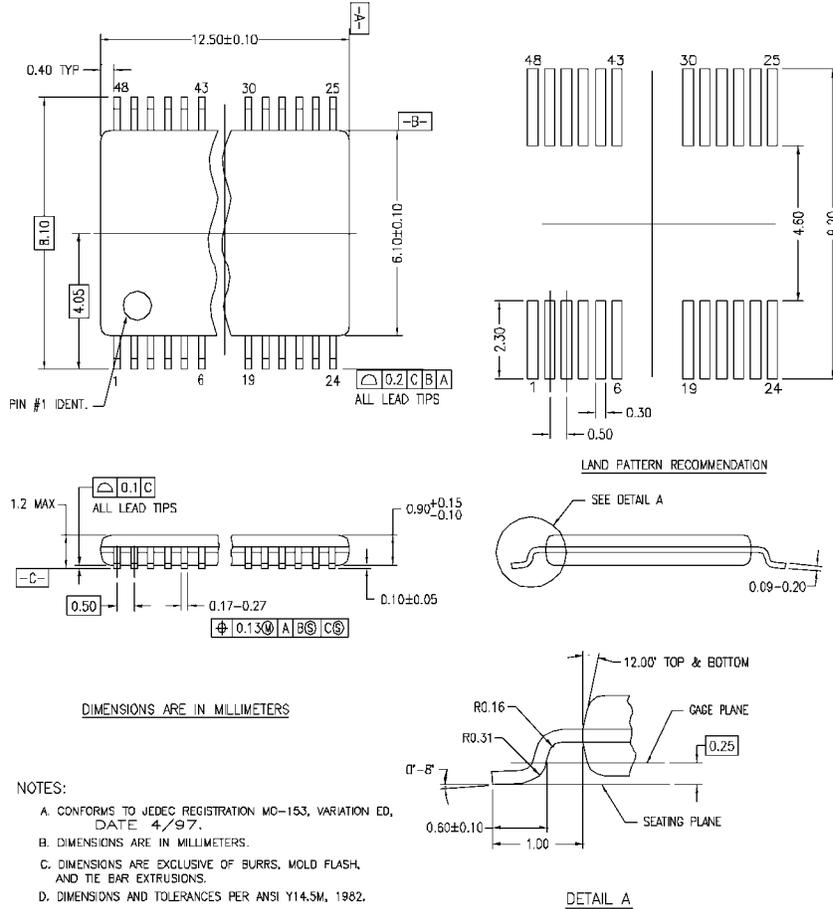| Symbol	Parameter	Typ	Units	Conditions ($T_A = 25°C$)
C_{IN}	Input Capacitance	5.0	pF	$V_{CC} = 0V$
C_{OUT} (Note 5)	Output Capacitance	11.0	pF	$V_{CC} = 5.0V$

Note 5: C_{OUT} is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.

Physical Dimensions inches (millimeters) unless otherwise noted

0.620 − 0.630
[15.75 − 16.00]
− A −

48   25

LEAD #1
IDENT

0.398 − 0.417
[10.10 − 10.60]

⌀ 0.010[0.25] C B Ⓢ A Ⓢ

0.291 − 0.299
[7.40 − 7.59]
− B −

1   24

0.025
[0.635] TYP

0.020±0.003
[0.51 ± 0.08]
TYP

0.008 − 0.012
[0.21 − 0.30] TYP

⌀ 0.0031[0.08]Ⓜ C A Ⓢ B Ⓢ

GAUGE PLANE

0.010
[0.25]

0.005 − 0.009
[0.13 − 0.22]

0.020 − 0.040
[0.51 − 1.01]

DETAIL E TYP

0.096 − 0.108
[2.44 − 2.74]

SEATING PLANE

45° x 0.015 − 0.025
[0.39 − 0.63]

SEE DETAIL E

− D −
− C −

0.025
[0.635] TYP

0.10
[0.25] MIN TYP

0° − 8° TYP

△ 0.004[0.10]

MS48A (REV E)

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

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

DIMENSIONS ARE IN MILLIMETERS

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.

MTD48REVC

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

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