

SN54ABT16241A, SN74ABT16241A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS096G – FEBRUARY 1991 – REVISED OCTOBER 1998

- Members of the Texas Instruments *Widebus™* Family
- State-of-the-Art *EPIC-II B™* BiCMOS Design Significantly Reduces Power Dissipation
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- High-Drive Outputs ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), and Thin Very Small-Outline (DGV) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings

description

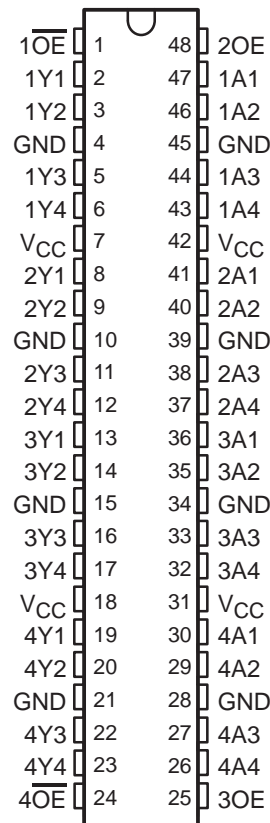
The 'ABT16241A devices are 16-bit buffers and line drivers designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

These devices can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. These devices provide true outputs and complementary output-enable (OE and \overline{OE}) inputs.

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver. OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

The SN54ABT16241A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT16241A is characterized for operation from -40°C to 85°C .

SN54ABT16241A . . . WD PACKAGE
SN74ABT16241A . . . DGG, DGV, OR DL PACKAGE
(TOP VIEW)



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

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16-BIT BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

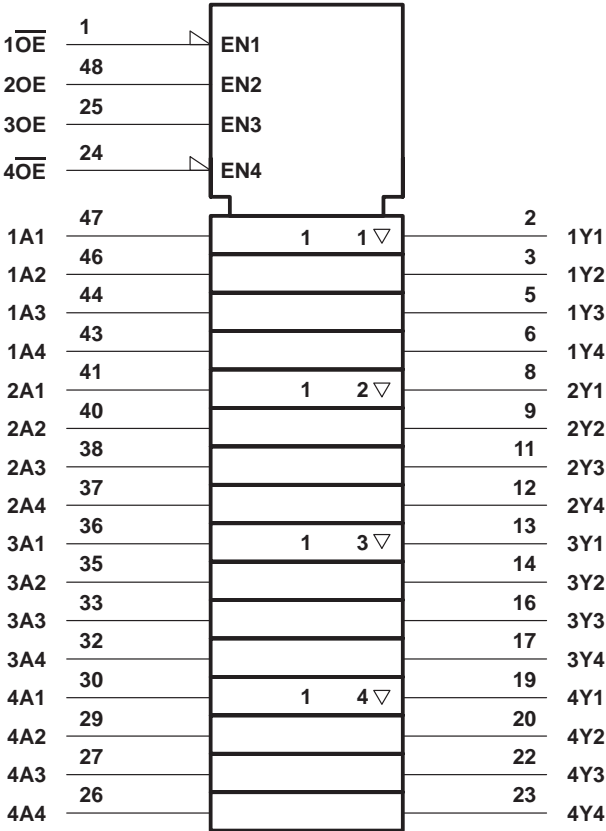
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FUNCTION TABLES

INPUTS		OUTPUTS
1OE, 4OE	1A, 4A	1Y, 4Y
L	H	H
L	L	L
H	X	Z

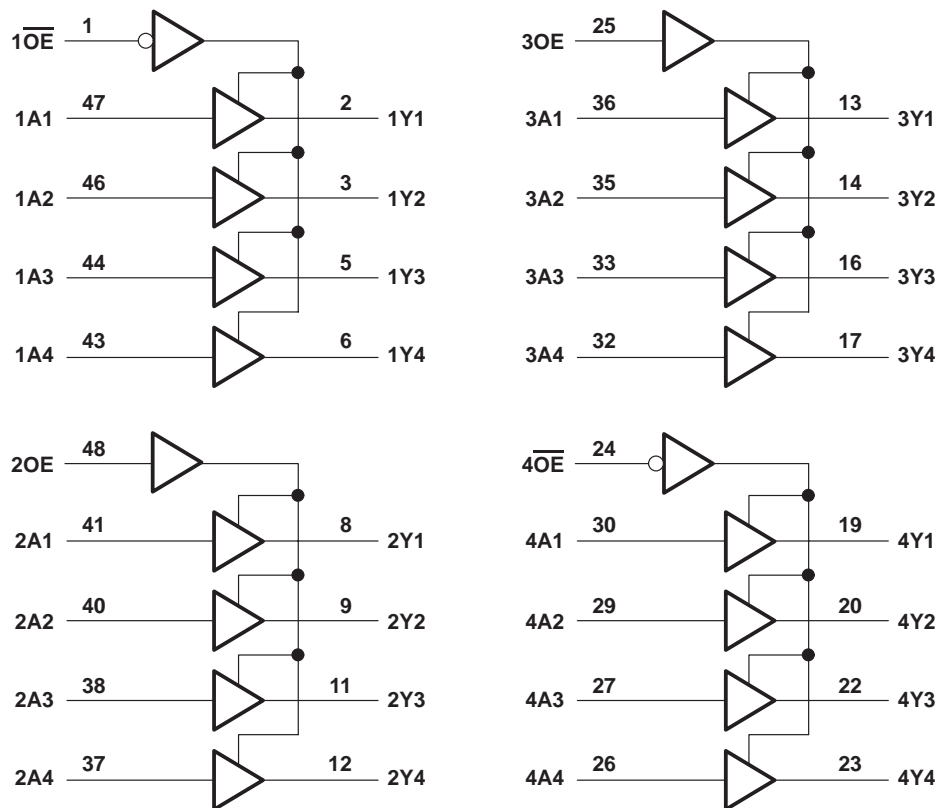
INPUTS		OUTPUTS
2OE, 3OE	2A, 3A	2Y, 3Y
H	H	H
H	L	L
L	X	Z

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high or power-off state, V_O	–0.5 V to 5.5 V
Current into any output in the low state, I_O : SN54ABT16241A	96 mA
SN74ABT16241A	128 mA
Input clamp current, I_{IK} ($V_I < 0$)	–18 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package	89°C/W
DGV package	93°C/W
DL package	94°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51.

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recommended operating conditions (see Note 3)

			SN54ABT16241A		SN74ABT16241A		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		4.5	5.5	4.5	5.5	V
V_{IH}	High-level input voltage		2		2		V
V_{IL}	Low-level input voltage			0.8		0.8	V
V_I	Input voltage		0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current			–24		–32	mA
I_{OL}	Low-level output current			48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T _A = 25°C			SN54ABT16241A		SN74ABT16241A		UNIT	
			MIN	TYP†	MAX	MIN	MAX	MIN	MAX		
V _{IK}		V _{CC} = 4.5 V, I _I = –18 mA	–1.2			–1.2		–1.2		V	
V _{OH}		V _{CC} = 4.5 V, I _{OH} = –3 mA	2.5			2.5		2.5		V	
		V _{CC} = 5 V, I _{OH} = –3 mA	3			3		3			
		V _{CC} = 4.5 V	I _{OH} = –24 mA	2			2				
			I _{OH} = –32 mA	2*					2		
V _{OL}		V _{CC} = 4.5 V	I _{OL} = 48 mA	0.55			0.55		V		
			I _{OL} = 64 mA	0.55*			0.55				
V _{hys}			100							mV	
I _I		V _{CC} = 5.5 V, V _I = V _{CC} or GND	±1			±1		±1		μA	
I _{OZH}		V _{CC} = 5.5 V, V _O = 2.7 V	10			10		10		μA	
I _{OZL}		V _{CC} = 5.5 V, V _O = 0.5 V	–10			–10		–10		μA	
I _{off}		V _{CC} = 0, V _I or V _O ≤ 4.5 V	±100					±100		μA	
I _{CEX}		V _{CC} = 5.5 V, V _O = 5.5 V	50			50		50		μA	
I _O ‡		V _{CC} = 5.5 V, V _O = 2.5 V	–50	–100	–180	–50	–180	–50	–180	mA	
I _{CC}		V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND	Outputs high			3		3		mA	
			Outputs low			34		34			
			Outputs disabled			3		3			
ΔI _{CC} §	Data inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND	Outputs enabled			1		1.5		mA	
			Outputs disabled			0.05		1			
	Control inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND		1.5			1.5		1.5		
C _i		V _I = 2.5 V or 0.5 V	3.5							pF	
C _O		V _O = 2.5 V or 0.5 V	7.5							pF	

* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at $V_{CC} = 5\text{ V}$.

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.



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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT16241A					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	0.9	2.7	3.4	0.9	3.8	ns
t _{PHL}			0.9	2.7	3.9	0.9	4.6	
t _{PZH}	OE or \overline{OE}	Y	1.2	3.3	4.2	1.2	5.1	ns
t _{PZL}			1.3	3.4	5.9	1.3	7	
t _{PHZ}	OE or \overline{OE}	Y	1.5	4.1	5.5	1.5	7	ns
t _{PLZ}			1.7	3.6	5.1	1.7	5.7	

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABT16241A					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	1	2.7	3.4	1	3.7	ns
t _{PHL}			1	2.7	3.9	1	4.5	
t _{PZH}	OE or \overline{OE}	Y	1.2	3.3	4.2	1.2	5	ns
t _{PZL}			1.3	3.4	5.9	1.3	6.9	
t _{PHZ}	OE or \overline{OE}	Y	1.5	4.1	5.2	1.5	6.2	ns
t _{PLZ}			1.7	3.6	5.1	1.7	5.6	

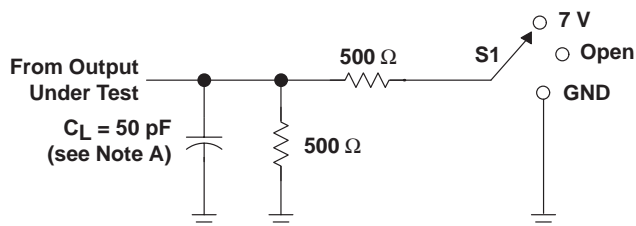
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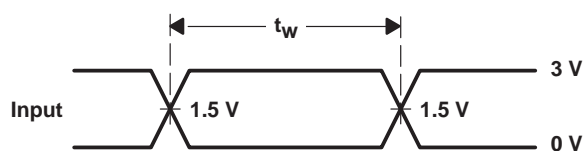
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PARAMETER MEASUREMENT INFORMATION

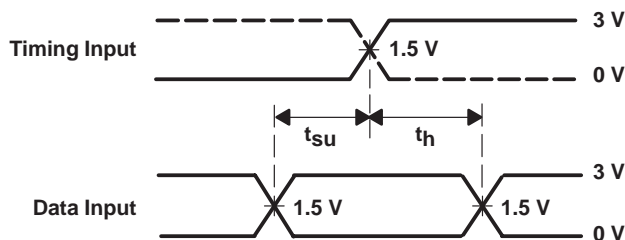


LOAD CIRCUIT

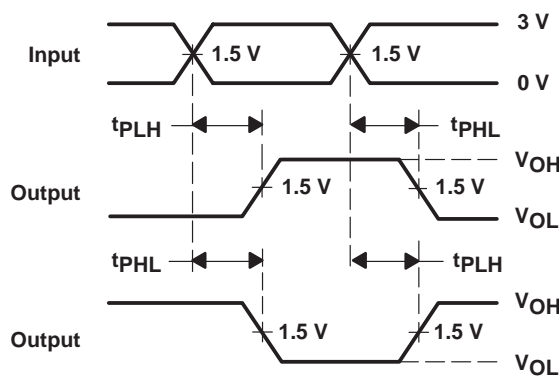
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



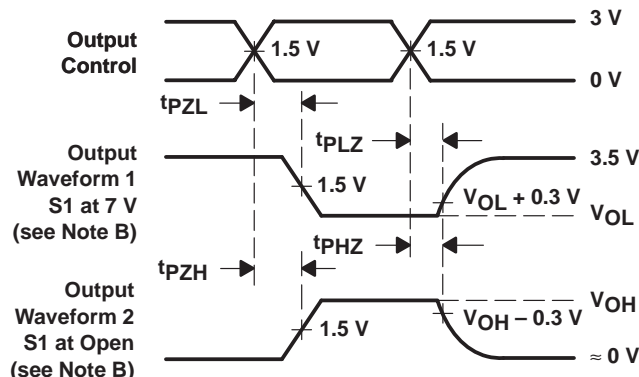
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
- D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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