

SN54ABT16260, SN74ABTH16260 12-BIT TO 24-BIT MULTIPLEXED D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS204C – JUNE 1992 – REVISED MAY 1997

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

description

The SN54ABT16260 and SN74ABTH16260 are 12-bit to 24-bit multiplexed D-type latches used in applications in which two separate data paths must be multiplexed onto, or demultiplexed from, a single data path. Typical applications include multiplexing and/or demultiplexing of address and data information in microprocessor or bus-interface applications. This device is also useful in memory-interleaving applications.

Three 12-bit I/O ports (A_1 – A_{12} , $1B_1$ – $1B_{12}$, and $2B_1$ – $2B_{12}$) are available for address and/or data transfer. The output-enable ($\overline{OE1B}$, $\overline{OE2B}$, and $\overline{OEA}$) inputs control the bus-transceiver functions. The $\overline{OE1B}$ and $\overline{OE2B}$ control signals also allow bank control in the A-to-B direction.

Address and/or data information can be stored using the internal storage latches. The latch-enable ($LE1B$, $LE2B$, $LEA1B$, and $LEA2B$) inputs are used to control data storage. When the latch-enable input is high, the latch is transparent. When the latch-enable input goes low, the data present at the inputs is latched and remains latched until the latch-enable input is returned high.

SN54ABT16260 . . . WD PACKAGE
SN74ABTH16260 . . . DL PACKAGE
(TOP VIEW)

$\overline{OEA}$	1	56	$\overline{OE2B}$
$LE1B$	2	55	$LEA2B$
$2B_3$	3	54	$2B_4$
GND	4	53	GND
$2B_2$	5	52	$2B_5$
$2B_1$	6	51	$2B_6$
V_{CC}	7	50	V_{CC}
A_1	8	49	$2B_7$
A_2	9	48	$2B_8$
A_3	10	47	$2B_9$
GND	11	46	GND
A_4	12	45	$2B_{10}$
A_5	13	44	$2B_{11}$
A_6	14	43	$2B_{12}$
A_7	15	42	$1B_{12}$
A_8	16	41	$1B_{11}$
A_9	17	40	$1B_{10}$
GND	18	39	GND
A_{10}	19	38	$1B_9$
A_{11}	20	37	$1B_8$
A_{12}	21	36	$1B_7$
V_{CC}	22	35	V_{CC}
$1B_1$	23	34	$1B_6$
$1B_2$	24	33	$1B_5$
GND	25	32	GND
$1B_3$	26	31	$1B_4$
$LE2B$	27	30	$LEA1B$
SEL	28	29	$\overline{OE1B}$



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SN54ABT16260, SN74ABTH16260

12-BIT TO 24-BIT MULTIPLEXED D-TYPE LATCHES

WITH 3-STATE OUTPUTS

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description (continued)

When V_{CC} is between 0 and 2.1 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 2.1 V, $\overline{OE}$ 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.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN54ABT16260 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABTH16260 is characterized for operation from -40°C to 85°C .

Function Tables

B TO A ($\overline{OEB} = \text{H}$)

INPUTS						OUTPUT A
1B	2B	SEL	LE1B	LE2B	$\overline{OEA}$	
H	X	H	H	X	L	H
L	X	H	H	X	L	L
X	X	H	L	X	L	A_0
X	H	L	X	H	L	H
X	L	L	X	H	L	L
X	X	L	X	L	L	A_0
X	X	X	X	X	H	Z

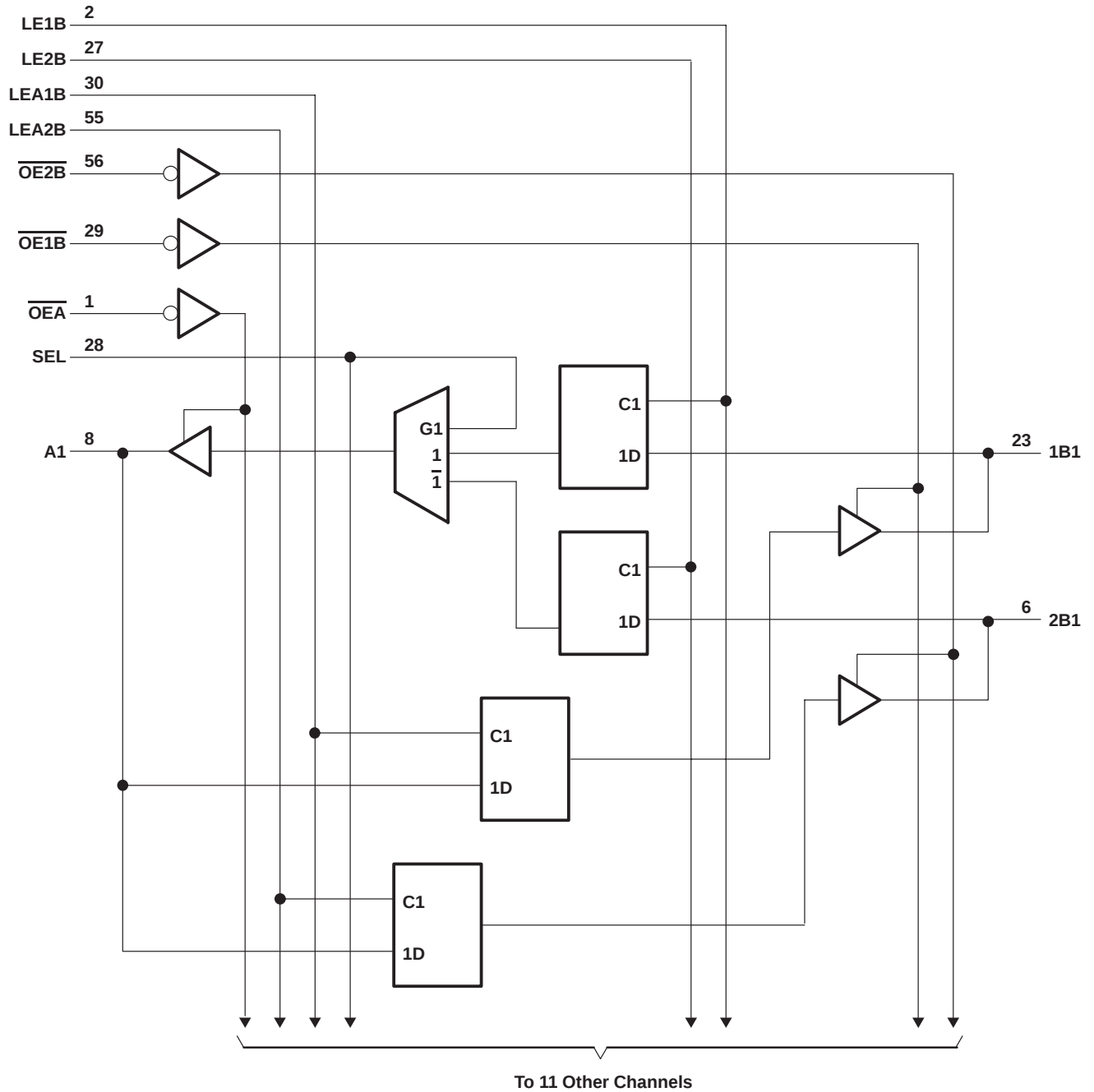
A TO B ($\overline{OEA} = \text{H}$)

INPUTS					OUTPUTS	
A	LEA1B	LEA2B	$\overline{OE1B}$	$\overline{OE2B}$	1B	2B
H	H	H	L	L	H	H
L	H	H	L	L	L	L
H	H	L	L	L	H	$2B_0$
L	H	L	L	L	L	$2B_0$
H	L	H	L	L	$1B_0$	H
L	L	H	L	L	$1B_0$	L
X	L	L	L	L	$1B_0$	$2B_0$
X	X	X	H	H	Z	Z
X	X	X	L	H	Active	Z
X	X	X	H	L	Z	Active
X	X	X	L	L	Active	Active

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logic diagram (positive logic)



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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 : SN54ABT16260	96 mA
SN74ABTH16260	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): DL package	74°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 EIA/JEDEC Std JESD51.

recommended operating conditions (see Note 3)

		SN54ABT16260		SN74ABTH16260		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	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate	200		200		μs/V
T_A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: Unused control inputs must be held high or low to prevent them from floating.



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

PARAMETER		TEST CONDITIONS	T _A = 25°C			SN54ABT16260		SN74ABTH16260		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	2			2				
			2*					2		
V _{OL}		V _{CC} = 4.5 V			0.36		0.5			V
					0.55*				0.55	
V _{hys}			100							mV
I _I	Control inputs	V _{CC} = 0 to 5.5 V, V _I = V _{CC} or GND			±1		±1		±1	µA
	A or B ports	V _{CC} = 2.1 V to 5.5 V, V _I = V _{CC} or GND			±20		±100		±20	
I _I (hold)	A or B ports	V _{CC} = 4.5 V			V _I = 0.8 V	100		100		µA
					V _I = 2 V	–100		–100		
I _{OZPU} ‡		V _{CC} = 0 to 2.1 V, V _O = 0.5 V to 2.7 V, $\overline{OE} = X$			±50		±50		±50	µA
I _{OZPD} ‡		V _{CC} = 2.1 V to 0, V _O = 0.5 V to 2.7 V, $\overline{OE} = X$			±50		±50		±50	µA
I _{OZH} §		V _{CC} = 2.1 V to 5.5 V, V _O = 2.7 V, $\overline{OE} \geq 2$ V			10		10		10	µA
I _{OZL} §		V _{CC} = 2.1 V to 5.5 V, V _O = 0.5 V, $\overline{OE} \geq 2$ 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	–225	–50	–225	–50	–225	mA
I _{CC}		V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND			Outputs high	1.5	1.5	1.5		mA
					Outputs low	63	63	63		
					Outputs disabled	1	1	1		
ΔI _{CC} #		V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND			1.5		1.5		1.5	mA
C _i		V _I = 2.5 V or 0.5 V			3					pF
C _{io}		V _O = 2.5 V or 0.5 V			11.5					pF

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

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

‡ This parameter is characterized, but not production tested.

§ The parameters I_{OZH} and I_{OZL} include the input leakage current.

¶ 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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timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

		$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}^\dagger$		SN54ABT16260		SN74ABTH16260		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, LE1B, LE2B, LEA1B, or LEA2B high	3.3		3.3		3.3		ns
t_{su}	Setup time, data before LE1B, LE2B, LEA1B, or LEA2B↓	1.5		2		1.5		ns
t_h	Hold time, data after LE1B, LE2B, LEA1B, or LEA2B↓	1		1.5		1		ns

[†] These values apply only to the SN74ABTH16260.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT16260					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A or B	B or A	1	3.1	5.3	1	5.9	ns
t _{PHL}			1	3.4	5.4	1	6.3	
t _{PLH}	LE	A or B	1.1	3.2	5.4	1.1	6.6	ns
t _{PHL}			1.1	3.3	5.3	1.1	5.9	
t _{PLH}	SEL (B1)	A	1.3	3.2	5.1	1.3	5.4	ns
	SEL (B2)		1.1	3.4	5.4	1.1	6.3	
t _{PHL}	SEL (B1)		1.5	3.1	4.6	1.5	5	
	SEL (B2)		1.6	3.6	5.3	1.6	6.2	
t _{PZH}	$\overline{\text{OE}}$	A or B	1	3.3	5.6	1	6.4	ns
t _{PZL}			1.6	3.8	5.9	1.6	6.5	
t _{PHZ}	$\overline{\text{OE}}$	A or B	2.2	4.1	5.9	2.2	7.5	ns
t _{PLZ}			1.3	3.2	5	1.3	5.4	

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABTH16260					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A or B	B or A	1	3.1	4.8	1	5.6	ns
t _{PHL}			1	3.4	5	1	5.9	
t _{PLH}	LE	A or B	1.1	3.2	4.9	1.1	5.8	ns
t _{PHL}			1.1	3.3	4.9	1.1	5.3	
t _{PLH}	SEL (B1)	A	1.3	3.2	4.6	1.3	5.3	ns
	SEL (B2)		1.1	3.4	4.9	1.1	6	
t _{PHL}	SEL (B1)		1.5	3.1	4.4	1.5	4.4	
	SEL (B2)		1.6	3.6	5.1	1.6	5.9	
t _{PZH}	$\overline{\text{OE}}$	A or B	1	3.3	4.7	1	5.7	ns
t _{PZL}			1.6	3.8	5.1	1.6	5.8	
t _{PHZ}	$\overline{\text{OE}}$	A or B	2.2	4.1	5.4	2.2	6.4	ns
t _{PLZ}			1.3	3.2	4.4	1.3	4.8	



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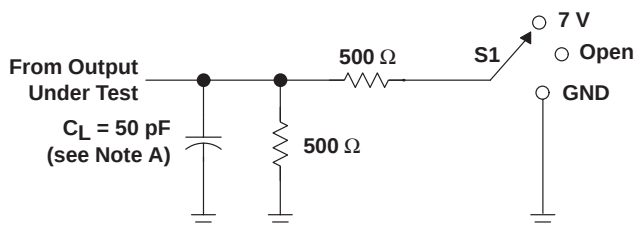
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WITH 3-STATE OUTPUTS

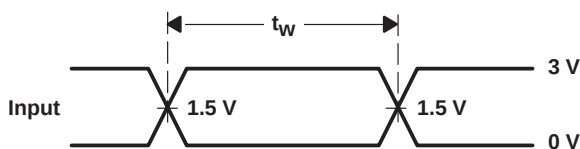
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PARAMETER MEASUREMENT INFORMATION

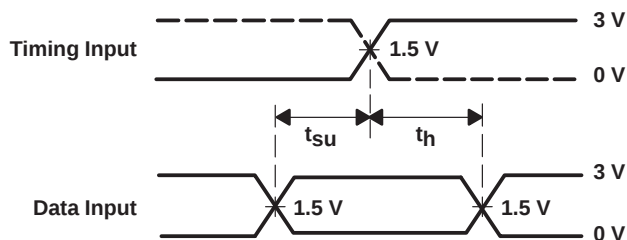


LOAD CIRCUIT

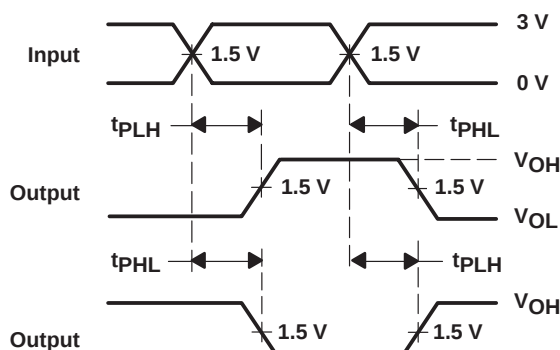
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



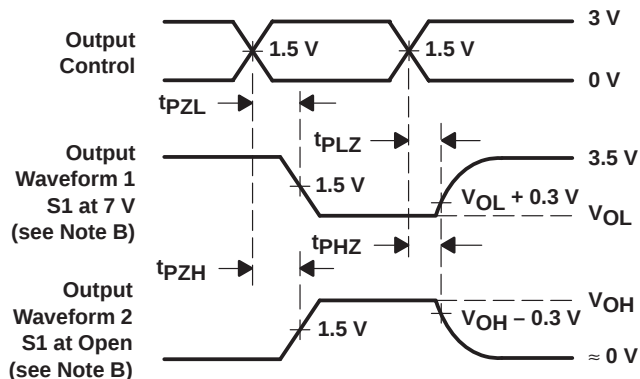
VOLTAGE WAVEFORMS
PULSE DURATION



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

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
74ABTH16260DLRG4	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABTH16260DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABTH16260DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABTH16260DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54ABT16260WD	OBSOLETE	CFP	WD	56		TBD	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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OTHER QUALIFIED VERSIONS OF SN74ABTH16260 :

- Military: [SN54ABTH16260](#)

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ABTH16260DLR	SSOP	DL	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ABTH16260DLR	SSOP	DL	56	1000	346.0	346.0	49.0

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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