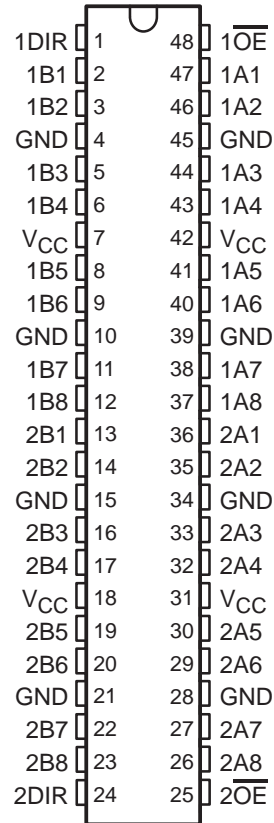


# SN54ABTH162245, SN74ABTH162245 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS712A – FEBRUARY 1998 – REVISED APRIL 1999

- **Members of the Texas Instruments Widebus™ Family**
- **A-Port Outputs Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required**
- **State-of-the-Art EPIC-IIB™ BiCMOS Design Significantly Reduces Power Dissipation**
- **Typical  $V_{OLP}$  (Output Ground Bounce) < 1 V at  $V_{CC} = 5 V$ ,  $T_A = 25^\circ C$**
- **Distributed  $V_{CC}$  and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors**
- **Latch-Up Performance Exceeds 500 mA Per JESD 17**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Package Options Include Plastic Thin Shrink Small-Outline (DGG), Thin Very Small-Outline (DGV), and Shrink Small-Outline (DL) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings**

SN54ABTH162245 . . . WD PACKAGE  
SN74ABTH162245 . . . DGG, DGV, OR DL PACKAGE  
(TOP VIEW)



## description

The 'ABTH162245 devices are 16-bit noninverting 3-state transceivers designed for synchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

These devices can be used as two 8-bit transceivers or one 16-bit transceiver. They allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

The A-port outputs, which are designed to source or sink up to 12 mA, include equivalent 25-Ω series resistors to reduce overshoot and undershoot.

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

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.

The SN54ABTH162245 is characterized for operation over the full military temperature range of  $-55^\circ C$  to  $125^\circ C$ . The SN74ABTH162245 is characterized for operation from  $-40^\circ C$  to  $85^\circ C$ .



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 **TEXAS  
INSTRUMENTS**

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# SN54ABTH162245, SN74ABTH162245

## 16-BIT BUS TRANSCEIVERS

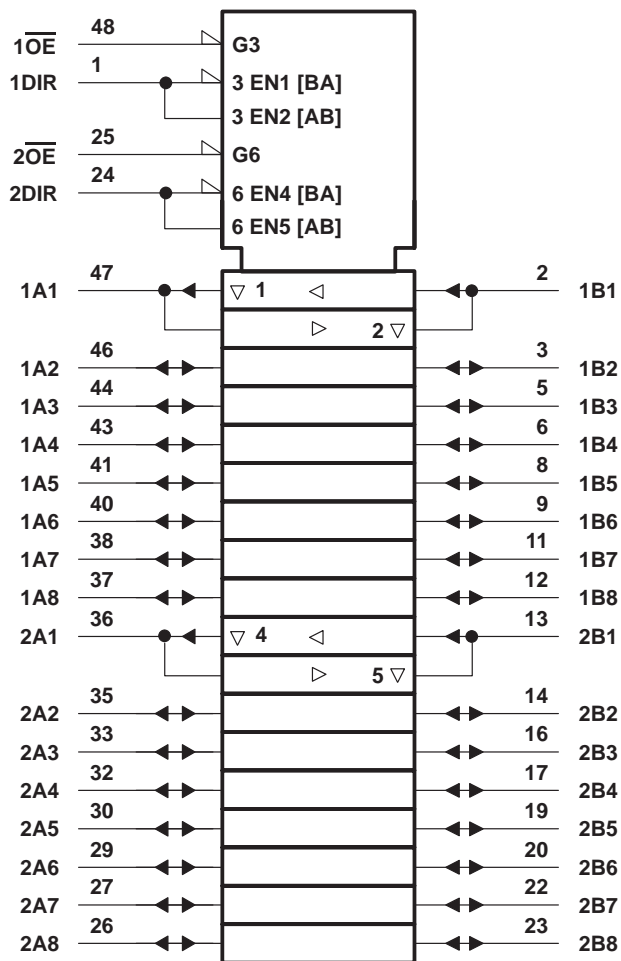
### WITH 3-STATE OUTPUTS

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**FUNCTION TABLE**  
(each 8-bit section)

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

logic symbol†

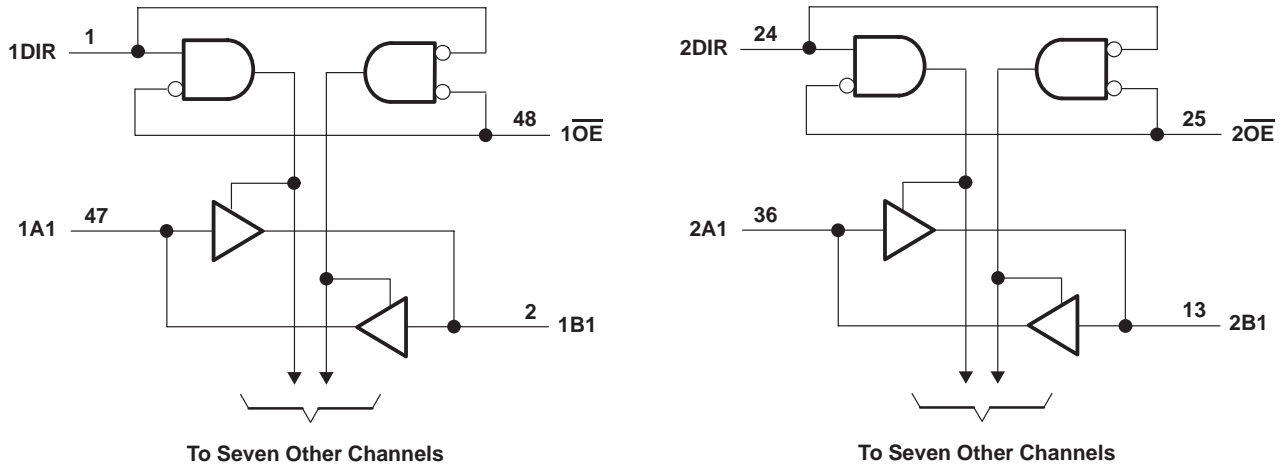


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

SN54ABTH162245, SN74ABTH162245  
16-BIT BUS TRANSCEIVERS  
WITH 3-STATE OUTPUTS

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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, $V_I$ (except I/O ports) (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, $I_O$ : SN54ABTH162245 (B port) .....	96 mA
SN74ABTH162245 (B port) .....	128 mA
SN54/74ABTH162245 (A port) .....	30 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....	-18 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ ) .....	-50 mA
Package thermal impedance, $\theta_{JA}$ (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.

**SN54ABTH162245, SN74ABTH162245**  
**16-BIT BUS TRANSCEIVERS**  
**WITH 3-STATE OUTPUTS**

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**recommended operating conditions (see Note 3)**

		SN54ABTH162245		SN74ABTH162245		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	B port	-24		-32	mA
		A port	-12		-12	
$I_{OL}$	Low-level output current	B port	48		64	mA
		A port	12		12	
$\Delta t/\Delta v$	Input transition rise or fall rate		10		10	ns/V
$T_A$	Operating free-air temperature	-55	125	-40	85	°C

NOTE 3: All unused control 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.

SN54ABTH162245, SN74ABTH162245  
16-BIT BUS TRANSCEIVERS  
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54ABTH162245		SN74ABTH162245		UNIT		
				MIN	TYP†	MAX	MIN		TYP†	MAX
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA		-1.2		-1.2		V		
V <sub>OH</sub>	A port	V <sub>CC</sub> = 5 V, I <sub>OH</sub> = -1 mA		2.5		2.5		V		
		V <sub>CC</sub> = 4.5 V		I <sub>OH</sub> = -1 mA		3				
				I <sub>OH</sub> = -3 mA		3				
	B port		V <sub>CC</sub> = 5 V, I <sub>OH</sub> = -3 mA		3		3			
			V <sub>CC</sub> = 4.5 V		I <sub>OH</sub> = -3 mA		2.5			
					I <sub>OH</sub> = -24 mA		2			
V <sub>OL</sub>		V <sub>CC</sub> = 4.5 V		I <sub>OL</sub> = 12 mA		0.8		V		
				I <sub>OL</sub> = 48 mA		0.45				
				I <sub>OL</sub> = 64 mA		0.55				
V <sub>hys</sub>				100		100		mV		
I <sub>I</sub>	Control inputs	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = V <sub>CC</sub> or GND		±1		±1		μA		
	A or B ports			±20		±20				
I <sub>I</sub> (hold)	V <sub>CC</sub> = 4.5 V		V <sub>I</sub> = 0.8 V		100		100		μA	
			V <sub>I</sub> = 2 V		-100		-100			
I <sub>off</sub>	V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> = 0 to 4.5 V						±100		μA	
I <sub>O</sub> ‡	A port	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.5 V		-25		-90		-25		mA
	B port			-50		-180		-50		
I <sub>CEX</sub>	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V		Outputs high		50		50		μA	
I <sub>CC</sub>	V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND		Outputs high		2		2		mA	
			Outputs low		32		32			
			Outputs disabled		2		2			
ΔI <sub>CC</sub> §	Data inputs	V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND		2		2		mA		
	Control inputs	V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND		1.5		1.5				
C <sub>i</sub>	V <sub>I</sub> = 2.5 V or 0.5 V		3		3		pF			
C <sub>io</sub>	V <sub>O</sub> = 2.5 V or 0.5 V		6		6		pF			

† All typical values are at V<sub>CC</sub> = 5 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<sub>CC</sub> or GND.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



**SN54ABTH162245, SN74ABTH162245**  
**16-BIT BUS TRANSCEIVERS**  
**WITH 3-STATE OUTPUTS**

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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)

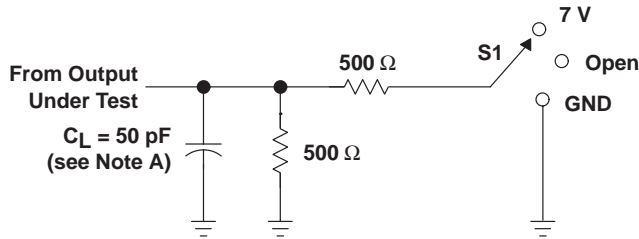
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5$ V, $T_A = 25^\circ$ C			SN54ABTH162245		SN74ABTH162245		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	A	B	1	2.2	3.4	1	4.1	1	3.9	ns
$t_{PHL}$			1	2.3	3.7	1	4.4	1	4.2	
$t_{PLH}$	B	A	1	2.7	4.1	1	4.9	1	4.6	ns
$t_{PHL}$			1.5	3.1	4.6	1.5	5.2	1.5	5.1	
$t_{PZH}$	$\overline{OE}$	B	1	3.6	5.2	1	6.4	1	6.3	ns
$t_{PZL}$			1	3.7	5.4	1	6.5	1	6.4	
$t_{PHZ}$	$\overline{OE}$	B	2	4.4	5.8	2	6.4	2	6.3	ns
$t_{PLZ}$			1.5	3.3	4.7	1.5	5.6	1.5	5.2	
$t_{PZH}$	$\overline{OE}$	A	1.5	4.1	6	1.5	7.2	1.5	7.1	ns
$t_{PZL}$			1.5	4.3	6.1	1.5	7.3	1.5	7	
$t_{PHZ}$	$\overline{OE}$	A	2	4.5	6.1	2	6.8	2	6.6	ns
$t_{PLZ}$			1.5	3.7	5.1	1.5	6.1	1.5	5.7	

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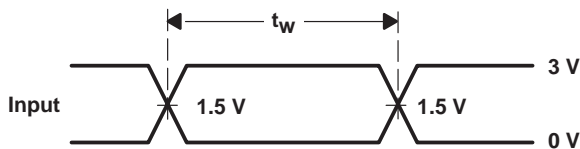
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PARAMETER MEASUREMENT INFORMATION

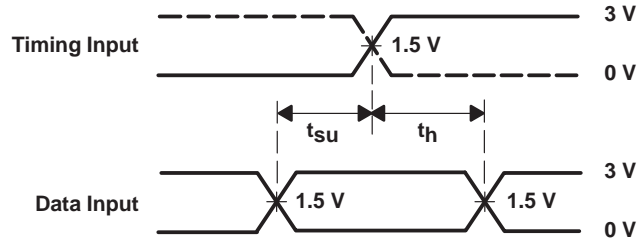


LOAD CIRCUIT

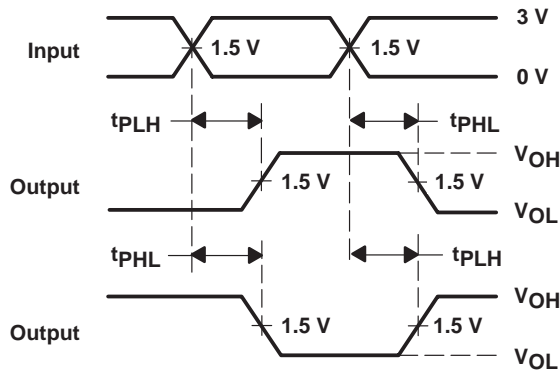
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	7 V
$t_{PHZ}/t_{PZH}$	Open



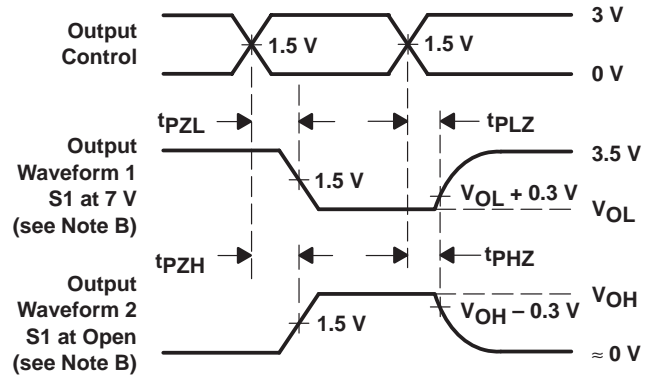
VOLTAGE WAVEFORMS  
 PULSE DURATION



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

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
74ABTH162245DGGRG4	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245
74ABTH162245DGGRG4.B	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245
<a href="#">SN74ABTH162245DGGR</a>	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245
SN74ABTH162245DGGR.B	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245
<a href="#">SN74ABTH162245DL</a>	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245
SN74ABTH162245DL.B	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
74ABTH162245DGGRG4	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74ABTH162245DGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74ABTH162245DGGRG4	TSSOP	DGG	48	2000	356.0	356.0	45.0
SN74ABTH162245DGGR	TSSOP	DGG	48	2000	356.0	356.0	45.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ABTH162245DL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74ABTH162245DL.B	DL	SSOP	48	25	473.7	14.24	5110	7.87

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