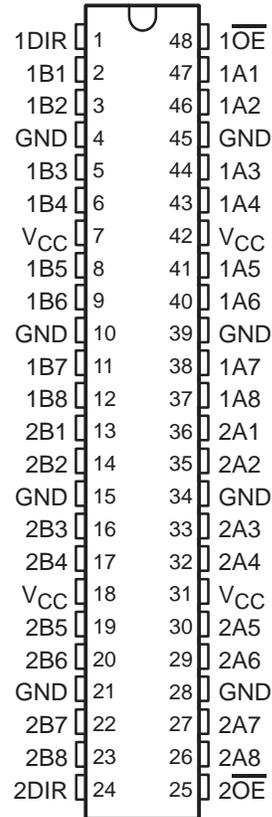


# SN54ABTH162245, SN74ABTH162245 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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- **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,  $T_A = 25^\circ\text{C}$**
- **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  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABTH162245 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .



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 **TEXAS  
INSTRUMENTS**

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# SN54ABTH162245, SN74ABTH162245

## 16-BIT BUS TRANSCEIVERS

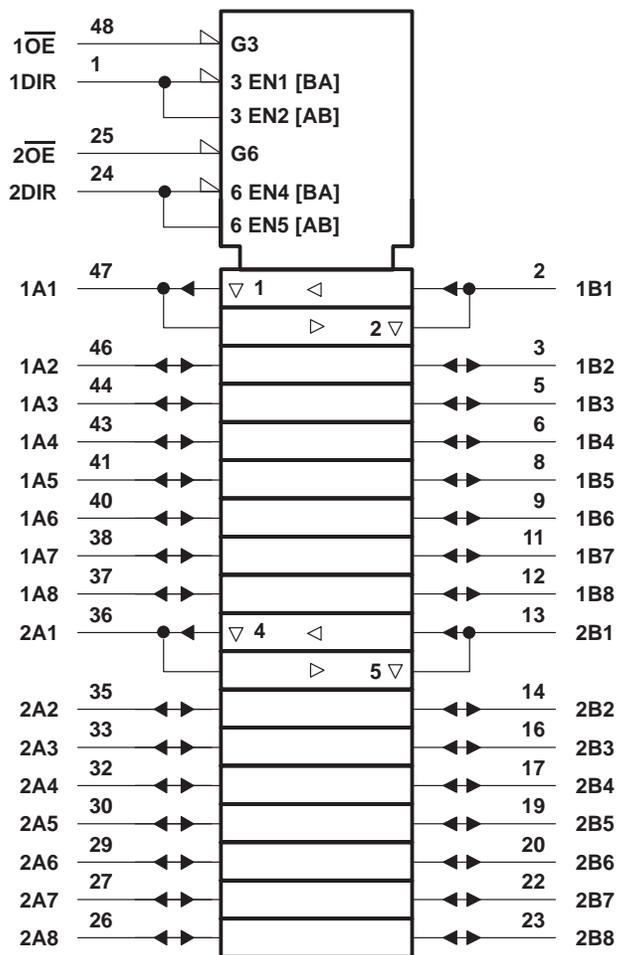
### WITH 3-STATE OUTPUTS

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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†

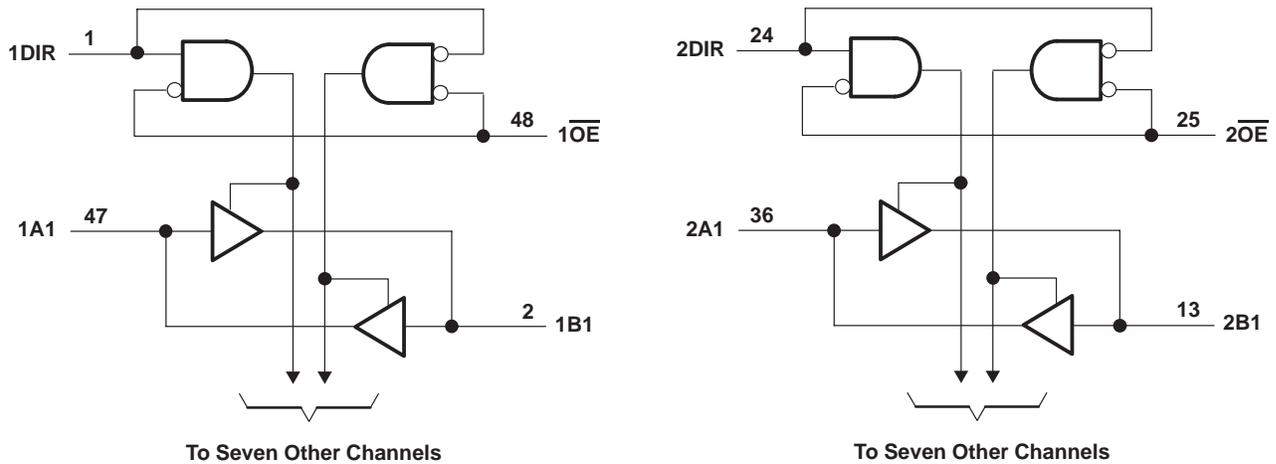


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

SCBS712A – FEBRUARY 1998 – REVISED APRIL 1999

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

SCBS712A – FEBRUARY 1998 – REVISED APRIL 1999

#### 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	Outputs enabled		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  
WITH 3-STATE OUTPUTS

SCBS712A – FEBRUARY 1998 – REVISED APRIL 1999

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		3		pF	
C <sub>io</sub>	V <sub>O</sub> = 2.5 V or 0.5 V		6		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.

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

SCBS712A – FEBRUARY 1998 – REVISED APRIL 1999

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

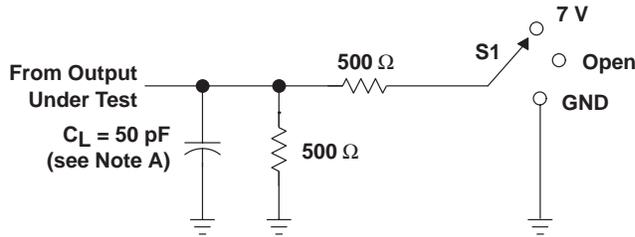
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5$ V, $T_A = 25^\circ$ C			SN54ABTH162245		SN74ABTH162245		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	A	B	1	2.2	3.4	1	4.1	1	3.9	ns
$t_{PHL}$			1	2.3	3.7	1	4.4	1	4.2	
$t_{PLH}$	B	A	1	2.7	4.1	1	4.9	1	4.6	ns
$t_{PHL}$			1.5	3.1	4.6	1.5	5.2	1.5	5.1	
$t_{PZH}$	$\overline{OE}$	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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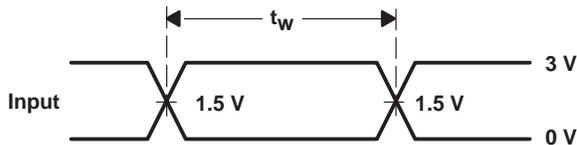
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PARAMETER MEASUREMENT INFORMATION

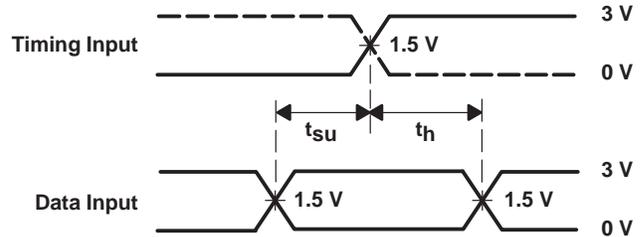


LOAD CIRCUIT

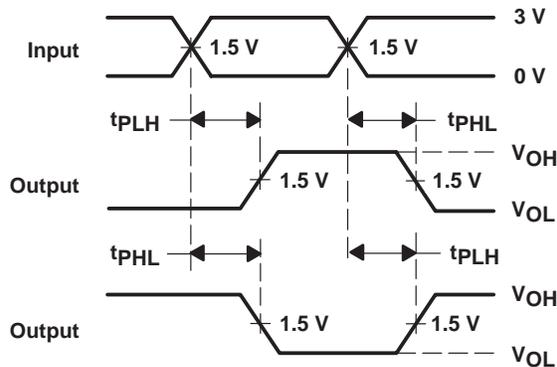
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	7 V
$t_{PHZ}/t_{PZH}$	Open



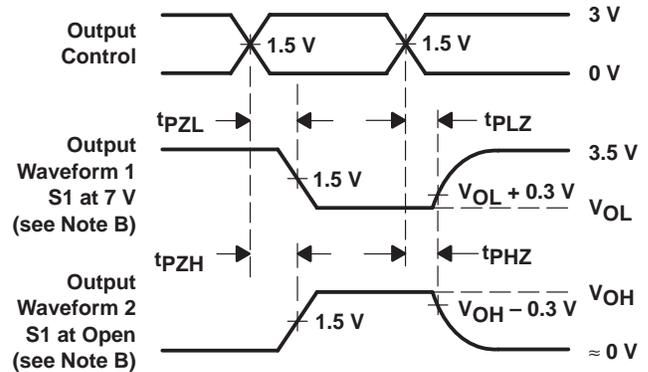
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74ABTH162245DGGR	ACTIVE	TSSOP	DGG	48	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245	<b>Samples</b>
SN74ABTH162245DL	ACTIVE	SSOP	DL	48	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABTH162245	<b>Samples</b>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

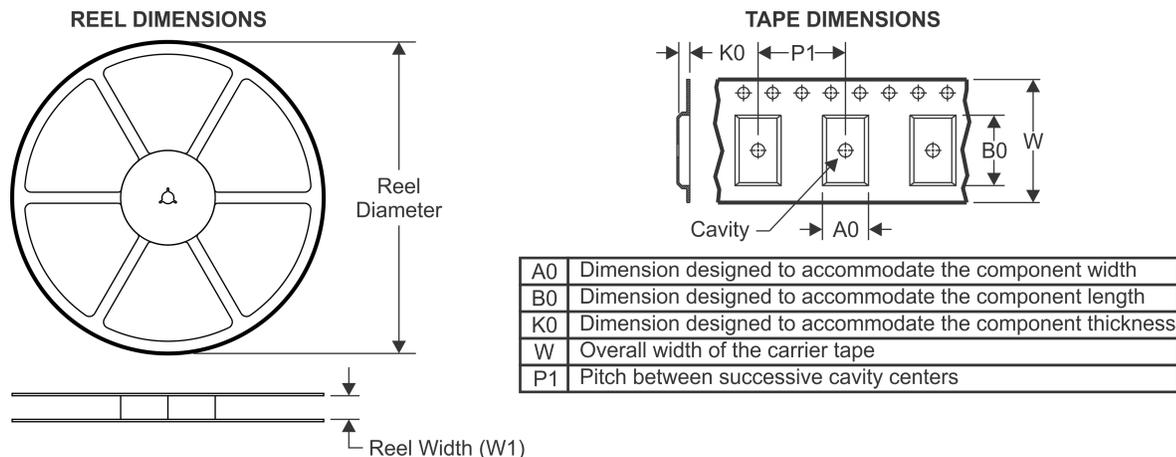
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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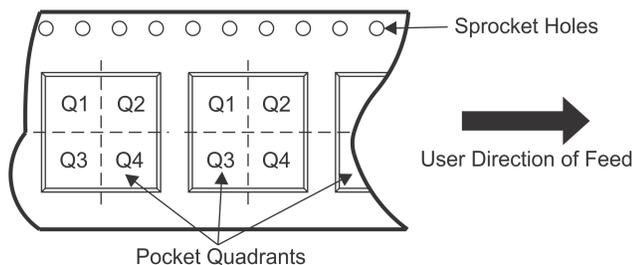
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## TAPE AND REEL INFORMATION

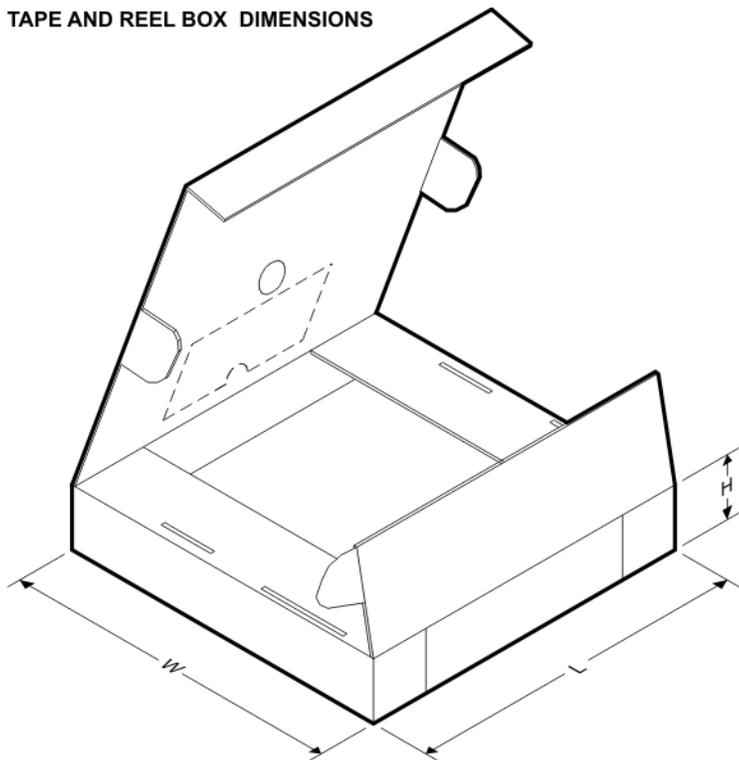


### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



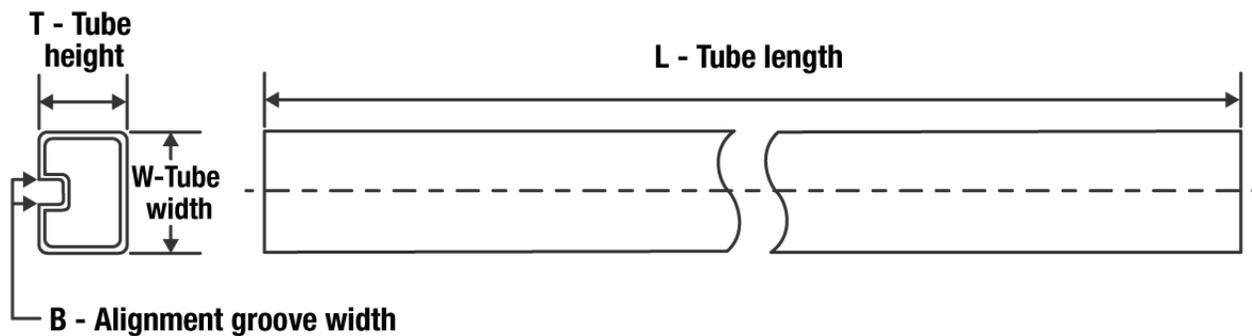
\*All dimensions are nominal

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
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)
SN74ABTH162245DGGR	TSSOP	DGG	48	2000	367.0	367.0	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

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