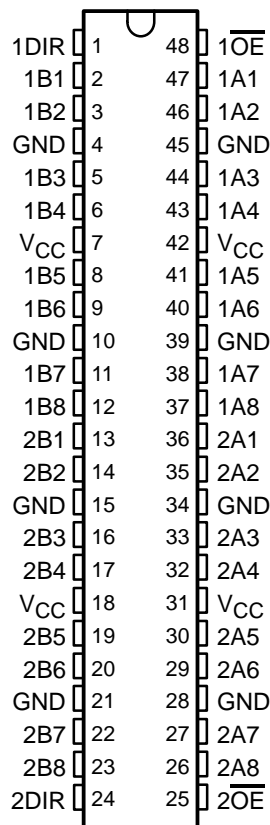


# SN54ALVTHR16245, SN74ALVTHR16245 2.5-V/3.3-V 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCES075D – JUNE 1996 – REVISED DECEMBER 2002

- State-of-the-Art Advanced BiCMOS Technology (ABT) Widebus™ Design for 2.5-V and 3.3-V Operation and Low Static-Power Dissipation
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 2.3-V to 3.6-V  $V_{CC}$ )
- Typical  $V_{OLP}$  (Output Ground Bounce)  $<0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- High Drive ( $-12/12$  mA at 3.3-V  $V_{CC}$ )
- $I_{off}$  and Power-Up 3-State Support Hot Insertion
- Use Bus Hold on Data Inputs in Place of External Pullup/Pulldown Resistors to Prevent the Bus From Floating
- Output Ports Have Equivalent 30- $\Omega$  Series Resistors, So No External Resistors Are Required
- Flow-Through Architecture Facilitates Printed Circuit Board Layout
- Distributed  $V_{CC}$  and GND Pins Minimize High-Speed Switching Noise
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

SN54ALVTHR16245 . . . WD PACKAGE  
SN74ALVTHR16245 . . . DGG, DGV, OR DL PACKAGE  
(TOP VIEW)



## description/ordering information

The ALVTHR16245 devices are 16-bit (dual-octal) noninverting 3-state transceivers designed for 2.5-V or 3.3-V  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment.

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SSOP – DL	Tape and reel	SN74ALVTHR16245LR	ALVTHR16245
	TSSOP – DGG	Tape and reel	SN74ALVTHR16245GR	ALVTHR16245
	TVSOP – DGV	Tape and reel	SN74ALVTHR16245VR	TR245
	VFBGA – GQL	Tape and reel	SN74ALVTHR16245KR	TR245
–55°C to 125°C	CFP – WD	Tube	SNJ54ALVTHR16245W	SNJ54ALVTHR16245W

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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 **TEXAS  
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# SN54ALVTHR16245, SN74ALVTHR16245 2.5-V/3.3-V 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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## description/ordering information (continued)

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.

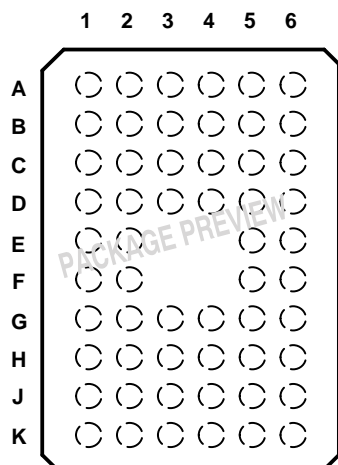
All outputs are designed to sink up to 12 mA, and include equivalent 30- $\Omega$  resistors to reduce overshoot and undershoot.

These devices are fully specified for hot-insertion applications using  $I_{off}$  and power-up 3-state. The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

When  $V_{CC}$  is between 0 and 1.2 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.2 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.

### SN74ALVTHR16245 . . . GQL PACKAGE (TOP VIEW)



### terminal assignments

	1	2	3	4	5	6
A	1DIR	NC	NC	NC	NC	$\overline{1OE}$
B	1B2	1B1	GND	GND	1A1	1A2
C	1B4	1B3	$V_{CC}$	$V_{CC}$	1A3	1A4
D	1B6	1B5	GND	GND	1A5	1A6
E	1B8	1B7			1A7	1A8
F	2B1	2B2			2A2	2A1
G	2B3	2B4	GND	GND	2A4	2A3
H	2B5	2B6	$V_{CC}$	$V_{CC}$	2A6	2A5
J	2B7	2B8	GND	GND	2A8	2A7
K	2DIR	NC	NC	NC	NC	$\overline{2OE}$

NC – No internal connection

### 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



# SN54ALVTHR16245, SN74ALVTHR16245

## 2.5-V/3.3-V 16-BIT BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

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#### recommended operating conditions, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ (see Note 3)

		SN54ALVTHR16245			SN74ALVTHR16245			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{CC}$	Supply voltage	2.3		2.7	2.3		2.7	V
$V_{IH}$	High-level input voltage	1.7			1.7			V
$V_{IL}$	Low-level input voltage			0.7			0.7	V
$V_I$	Input voltage	0	$V_{CC}$	5.5	0	$V_{CC}$	5.5	V
$I_{OH}$	High-level output current			-6			-8	mA
$I_{OL}$	Low-level output current			6			12	mA
$\Delta t/\Delta v$	Input transition rise or fall rate			10			10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate	200			200			$\mu\text{s/V}$
$T_A$	Operating free-air temperature	-55		125	-40		85	$^{\circ}\text{C}$

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.

#### recommended operating conditions, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (see Note 3)

		SN54ALVTHR16245			SN74ALVTHR16245			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{CC}$	Supply voltage	3		3.6	3		3.6	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	$V_{CC}$	5.5	0	$V_{CC}$	5.5	V
$I_{OH}$	High-level output current			-8			-12	mA
$I_{OL}$	Low-level output current			8			12	mA
$\Delta t/\Delta v$	Input transition rise or fall rate			10			10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate	200			200			$\mu\text{s/V}$
$T_A$	Operating free-air temperature	-55		125	-40		85	$^{\circ}\text{C}$

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.

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# SN54ALVTHR16245, SN74ALVTHR16245 2.5-V/3.3-V 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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electrical characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SN54ALVTHR16245		SN74ALVTHR16245		UNIT
			MIN	TYP†	MAX	MIN	
$V_{IK}$	$V_{CC} = 2.3 \text{ V}$ , $I_I = -18 \text{ mA}$		-1.2		-1.2		V
$V_{OH}$	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ , $I_{OH} = -100 \mu\text{A}$		$V_{CC}-0.2$		$V_{CC}-0.2$		V
	$V_{CC} = 2.3 \text{ V}$	$I_{OH} = -6 \text{ mA}$	1.7				
$V_{OL}$	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ , $I_{OL} = 100 \mu\text{A}$		0.2		0.2		V
	$V_{CC} = 2.3 \text{ V}$	$I_{OL} = 6 \text{ mA}$	0.7				
		$I_{OL} = 12 \text{ mA}$			0.7		
$I_I$	Control inputs	$V_{CC} = 2.7 \text{ V}$ , $V_I = V_{CC}$ or GND	$\pm 1$		$\pm 1$		$\mu\text{A}$
		$V_{CC} = 0$ or $2.7 \text{ V}$ , $V_I = 5.5 \text{ V}$	10		10		
	A or B ports	$V_{CC} = 2.7 \text{ V}$ , $V_I = 5.5 \text{ V}$	20		20		
		$V_{CC} = 2.7 \text{ V}$ , $V_I = V_{CC}$	1		1		
	$V_{CC} = 2.7 \text{ V}$ , $V_I = 0$	-5		-5			
$I_{off}$	$V_{CC} = 0$ , $V_I$ or $V_O = 0$ to $4.5 \text{ V}$			$\pm 100$		$\mu\text{A}$	
$I_{BHL}^\ddagger$	$V_{CC} = 2.3 \text{ V}$ , $V_I = 0.7 \text{ V}$	115		115		$\mu\text{A}$	
$I_{BHH}^\S$	$V_{CC} = 2.3 \text{ V}$ , $V_I = 1.7 \text{ V}$	-10		-10		$\mu\text{A}$	
$I_{BHLO}^\P$	$V_{CC} = 2.7 \text{ V}$ , $V_I = 0$ to $V_{CC}$	300		300		$\mu\text{A}$	
$I_{BHHO}^\#$	$V_{CC} = 2.7 \text{ V}$ , $V_I = 0$ to $V_{CC}$	-300		-300		$\mu\text{A}$	
$I_{EX}^\parallel$	$V_{CC} = 2.3 \text{ V}$ , $V_O = 5.5 \text{ V}$	125		125		$\mu\text{A}$	
$I_{OZ}(\text{PU/PD})^*$	$V_{CC} \leq 1.2 \text{ V}$ , $V_O = 0.5 \text{ V to } V_{CC}$ , $V_I = \text{GND or } V_{CC}$ , $\overline{OE} = \text{don't care}$	$\pm 100$		$\pm 100$		$\mu\text{A}$	
$I_{CC}$	$V_{CC} = 2.7 \text{ V}$ , $I_O = 0$ , $V_I = V_{CC}$ or GND	Outputs high	0.04	0.1	0.04	0.1	mA
		Outputs low	2.5	4.5	2.5	4.5	
		Outputs disabled	0.04	0.1	0.04	0.1	
$C_i$	$V_{CC} = 2.5 \text{ V}$ , $V_I = 2.5 \text{ V or } 0$	3.5		3.5		pF	
$C_{io}$	$V_{CC} = 2.5 \text{ V}$ , $V_O = 2.5 \text{ V or } 0$	8		8		pF	

† All typical values are at  $V_{CC} = 2.5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ The bus-hold circuit can sink at least the minimum low sustaining current at  $V_{IL}$  max.  $I_{BHL}$  should be measured after lowering  $V_{IN}$  to GND and then raising it to  $V_{IL}$  max.

§ The bus-hold circuit can source at least the minimum high sustaining current at  $V_{IH}$  min.  $I_{BHH}$  should be measured after raising  $V_{IN}$  to  $V_{CC}$  and then lowering it to  $V_{IH}$  min.

¶ An external driver must source at least  $I_{BHLO}$  to switch this node from low to high.

# An external driver must sink at least  $I_{BHHO}$  to switch this node from high to low.

|| Current into an output in the high state when  $V_O > V_{CC}$

\* High-impedance state during power up or power down

# SN54ALVTHR16245, SN74ALVTHR16245

## 2.5-V/3.3-V 16-BIT BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

SCES075D – JUNE 1996 – REVISED DECEMBER 2002

electrical characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SN54ALVTHR16245			SN74ALVTHR16245			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$	$V_{CC} = 3\text{ V}$ , $I_I = -18\text{ mA}$		-1.2			-1.2			V
$V_{OH}$	$V_{CC} = 3\text{ V to } 3.6\text{ V}$ , $I_{OH} = -100\text{ }\mu\text{A}$		$V_{CC}-0.2$			$V_{CC}-0.2$			V
	$V_{CC} = 3\text{ V}$	$I_{OH} = -8\text{ mA}$	2			2			
$V_{OL}$	$V_{CC} = 3\text{ V to } 3.6\text{ V}$ , $I_{OL} = 100\text{ }\mu\text{A}$		0.2			0.2			V
	$V_{CC} = 3\text{ V}$	$I_{OL} = 8\text{ mA}$	0.8						
		$I_{OL} = 12\text{ mA}$				0.8			
$I_I$	Control inputs	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}$ or GND	$\pm 1$			$\pm 1$			$\mu\text{A}$
		$V_{CC} = 0$ or $3.6\text{ V}$ , $V_I = 5.5\text{ V}$	10			10			
	A or B ports	$V_{CC} = 3.6\text{ V}$ , $V_I = 5.5\text{ V}$	20			20			
		$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}$	1			1			
	$V_{CC} = 3.6\text{ V}$ , $V_I = 0$	-5			-5				
$I_{off}$	$V_{CC} = 0$ , $V_I$ or $V_O = 0$ to $4.5\text{ V}$				$\pm 100$			$\mu\text{A}$	
$I_{BHL}^\ddagger$	$V_{CC} = 3\text{ V}$ , $V_I = 0.8\text{ V}$	75			75			$\mu\text{A}$	
$I_{BHH}^\S$	$V_{CC} = 3\text{ V}$ , $V_I = 2\text{ V}$	-75			-75			$\mu\text{A}$	
$I_{BHLO}^\P$	$V_{CC} = 3.6\text{ V}$ , $V_I = 0$ to $V_{CC}$	500			500			$\mu\text{A}$	
$I_{BHHO}^\#$	$V_{CC} = 3.6\text{ V}$ , $V_I = 0$ to $V_{CC}$	-500			-500			$\mu\text{A}$	
$I_{EX}^\parallel$	$V_{CC} = 3\text{ V}$ , $V_O = 5.5\text{ V}$	125			125			$\mu\text{A}$	
$I_{OZ(PU/PD)}^*$	$V_{CC} \leq 1.2\text{ V}$ , $V_O = 0.5\text{ V to } V_{CC}$ , $V_I = \text{GND or } V_{CC}$ , $\overline{OE} = \text{don't care}$	$\pm 100$			$\pm 100$			$\mu\text{A}$	
$I_{CC}$	$V_{CC} = 3.6\text{ V}$ , $I_O = 0$ , $V_I = V_{CC}$ or GND	Outputs high	0.07	0.1	0.07	0.1	mA		
		Outputs low	3.5	5	3.5	5			
		Outputs disabled	0.07	0.1	0.07	0.1			
$\Delta I_{CC}^\square$	$V_{CC} = 3\text{ V to } 3.6\text{ V}$ , One input at $V_{CC} - 0.6\text{ V}$ , Other inputs at $V_{CC}$ or GND		0.4			0.4			mA
$C_i$	$V_{CC} = 3.3\text{ V}$ , $V_I = 3.3\text{ V or } 0$	3.5			3.5			pF	
$C_{io}$	$V_{CC} = 3.3\text{ V}$ , $V_O = 3.3\text{ V or } 0$	8			8			pF	

† All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ The bus-hold circuit can sink at least the minimum low sustaining current at  $V_{IL}$  max.  $I_{BHL}$  should be measured after lowering  $V_{IN}$  to GND and then raising it to  $V_{IL}$  max.

§ The bus-hold circuit can source at least the minimum high sustaining current at  $V_{IH}$  min.  $I_{BHH}$  should be measured after raising  $V_{IN}$  to  $V_{CC}$  and then lowering it to  $V_{IH}$  min.

¶ An external driver must source at least  $I_{BHLO}$  to switch this node from low to high.

# An external driver must sink at least  $I_{BHHO}$  to switch this node from high to low.

|| Current into an output in the high state when  $V_O > V_{CC}$

\* High-impedance state during power up or power down

□ 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 operating free-air temperature range,  $C_L = 30$  pF,  $V_{CC} = 2.5$  V  $\pm$  0.2 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ALVTHR16245		SN74ALVTHR16245		UNIT
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	B or A	0.5	4.3	0.5	4.3	ns
t <sub>PHL</sub>			0.5	3.7	0.5	3.7	
t <sub>PZH</sub>	$\overline{OE}$	A or B	1.8	5.6	1.8	5.6	ns
t <sub>PZL</sub>			1.6	4.7	1.6	4.7	
t <sub>PHZ</sub>	$\overline{OE}$	A or B	1.7	5	1.7	5	ns
t <sub>PLZ</sub>			1.4	4.4	1.4	4.4	

switching characteristics over recommended operating free-air temperature range,  $C_L = 50$  pF,  $V_{CC} = 3.3$  V  $\pm$  0.3 V (unless otherwise noted) (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ALVTHR16245		SN74ALVTHR16245		UNIT
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	B or A	0.5	3.7	0.5	3.7	ns
t <sub>PHL</sub>			0.5	3.9	0.5	3.9	
t <sub>PZH</sub>	$\overline{OE}$	A or B	1.3	5.2	1.3	5.2	ns
t <sub>PZL</sub>			1.3	4	1.3	4	
t <sub>PHZ</sub>	$\overline{OE}$	A or B	2	5.1	2	5.1	ns
t <sub>PLZ</sub>			1.5	4.8	1.5	4.8	

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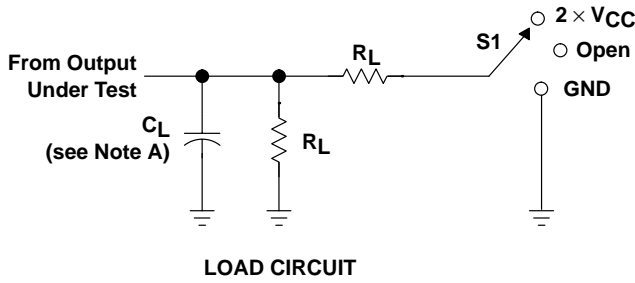


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**SN54ALVTHR16245, SN74ALVTHR16245**  
**2.5-V/3.3-V 16-BIT BUS TRANSCEIVERS**  
**WITH 3-STATE OUTPUTS**

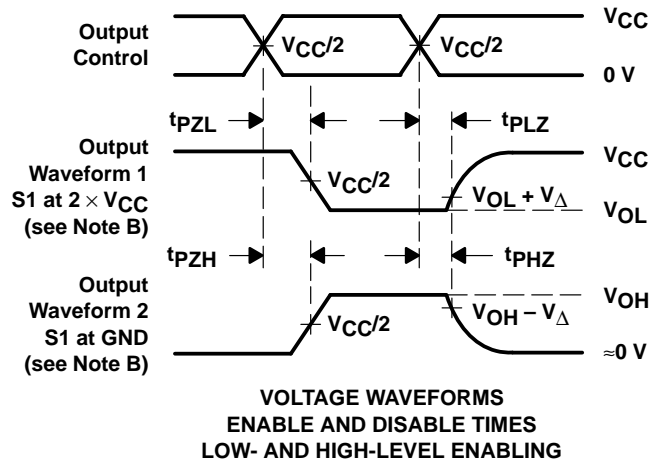
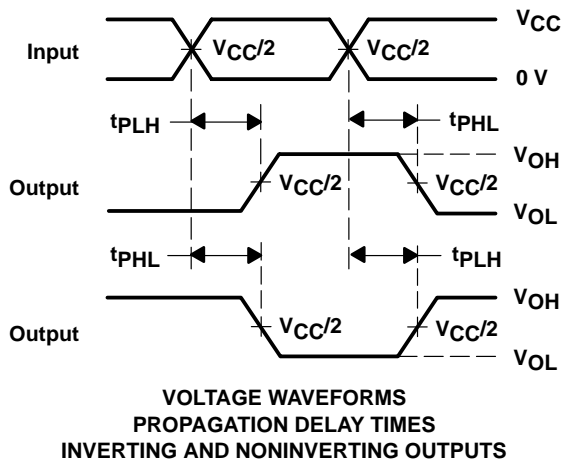
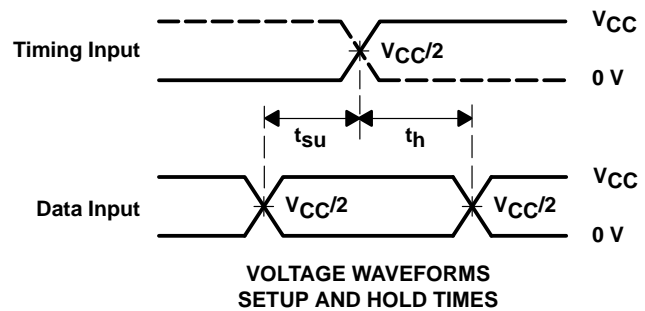
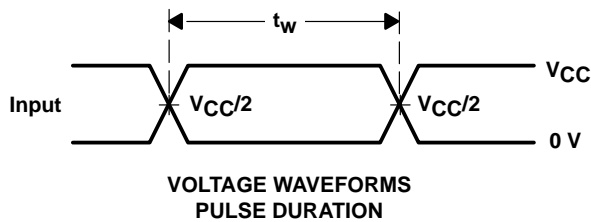
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**PARAMETER MEASUREMENT INFORMATION**



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$C_L$	$R_L$	$V_{\Delta}$
$2.5\text{ V} \pm 0.2\text{ V}$	30 pF	500 $\Omega$	0.15 V
$3.3\text{ V} \pm 0.3\text{ V}$	50 pF	500 $\Omega$	0.3 V



- 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:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 2\text{ ns}$ ,  $t_f \leq 2\text{ ns}$ .  
 D. The outputs are measured one at a time with one transition per measurement.  
 E. All parameters and waveforms are not applicable to all devices.

**Figure 1. Load Circuit and Voltage Waveforms**



**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
74ALVTHR16245DLG4	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTHR16245GRE4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTHR16245GRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTHR16245LRG4	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTHR16245VRE4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTHR16245VRG4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTHR16245ZQLR	ACTIVE	BGA MICROSTAR JUNIOR	ZQL	56	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM
SN74ALVTHR16245DL	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTHR16245GR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTHR16245KR	NRND	BGA MICROSTAR JUNIOR	GQL	56	1000	TBD	SNPB	Level-1-240C-UNLIM
SN74ALVTHR16245LR	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTHR16245VR	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> 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)

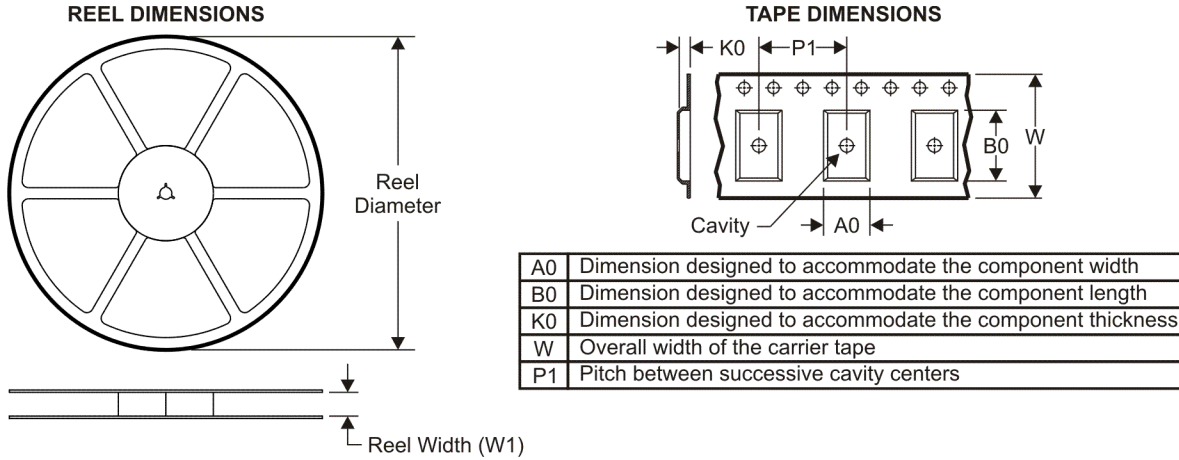
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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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
74ALVTHR16245ZQLR	BGA MICROSTAR JUNIOR	ZQL	56	1000	330.0	16.4	4.8	7.3	1.45	8.0	16.0	Q1
SN74ALVTHR16245GR	TSSOP	DGG	48	2000	330.0	24.4	8.6	15.8	1.8	12.0	24.0	Q1
SN74ALVTHR16245KR	BGA MICROSTAR JUNIOR	GQL	56	1000	330.0	16.4	4.8	7.3	1.45	8.0	16.0	Q1
SN74ALVTHR16245LR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1
SN74ALVTHR16245VR	TVSOP	DGV	48	2000	330.0	24.4	6.8	10.1	1.6	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)
74ALVTHR16245ZQLR	BGA MICROSTAR JUNIOR	ZQL	56	1000	346.0	346.0	33.0
SN74ALVTHR16245GR	TSSOP	DGG	48	2000	346.0	346.0	41.0
SN74ALVTHR16245KR	BGA MICROSTAR JUNIOR	GQL	56	1000	346.0	346.0	33.0
SN74ALVTHR16245LR	SSOP	DL	48	1000	346.0	346.0	49.0
SN74ALVTHR16245VR	TVSOP	DGV	48	2000	346.0	346.0	41.0

ZQL (R-PBGA-N56)

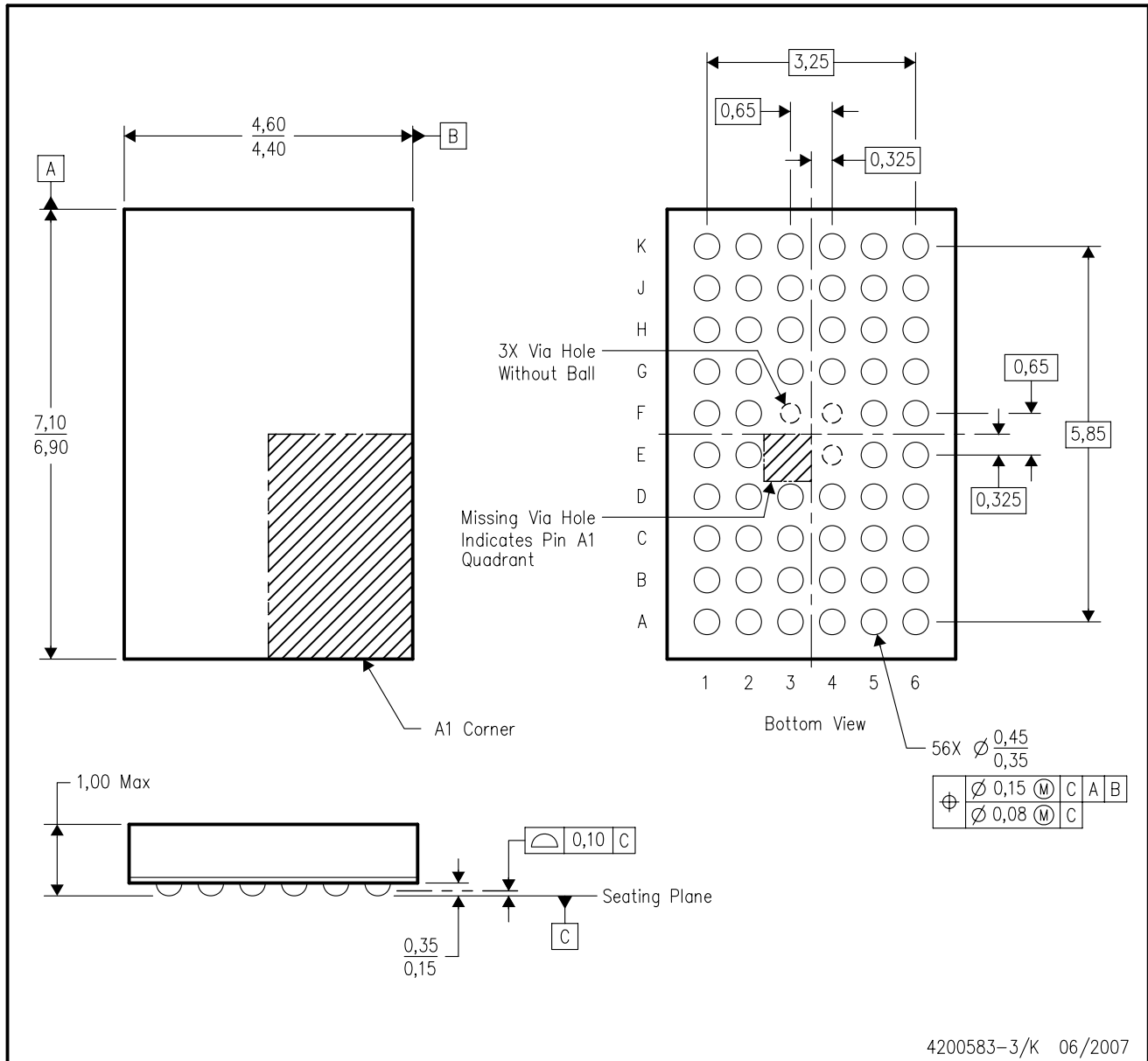
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-285 variation BA-2.
  - D. This package is lead-free. Refer to the 56 GQL package (drawing 4200583) for tin-lead (SnPb).

GQL (R-PBGA-N56)

PLASTIC BALL GRID ARRAY

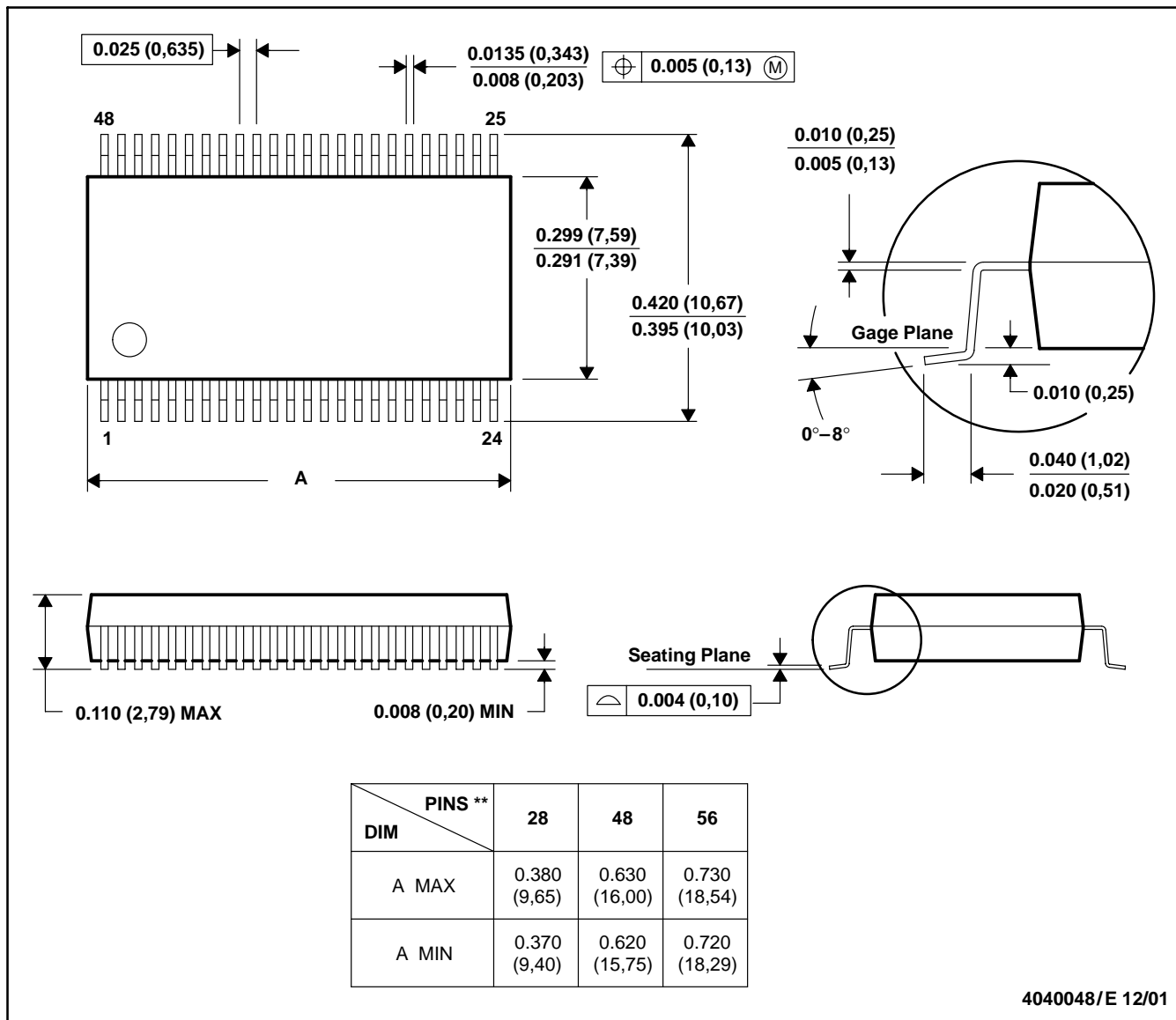


- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-285 variation BA-2.
  - D. This package is tin-lead (SnPb). Refer to the 56 ZQL package (drawing 4204437) for lead-free.

DL (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MO-118

DGG (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153



DGV (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

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