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SN74ALVCH162268
12-BIT TO 24-BIT REGISTERED BUS EXCHANGER
WITH 3-STATE OUTPUTS

SCES018L−AUGUST 1995−REVISED SEPTEMBER 2004

FEATURES

- **Member of the Texas Instruments Widebus™ Family**

- **Operates From 1.65 V to 3.6 V**

- **Max t_{pd} of 4.8 ns at 3.3 V**

- **±24-mA Output Drive at 3.3 V**

- **B-Port Outputs Have Equivalent 26-Ω Series Resistors, So No External Resistors Are Required**

- **Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors**

- **Latch-Up Performance Exceeds 250 mA Per JESD 17**

- **ESD Protection Exceeds JESD 22**
    - **– 2000-V Human-Body Model (A114-A)**
    - **– 200-V Machine Model (A115-A)**
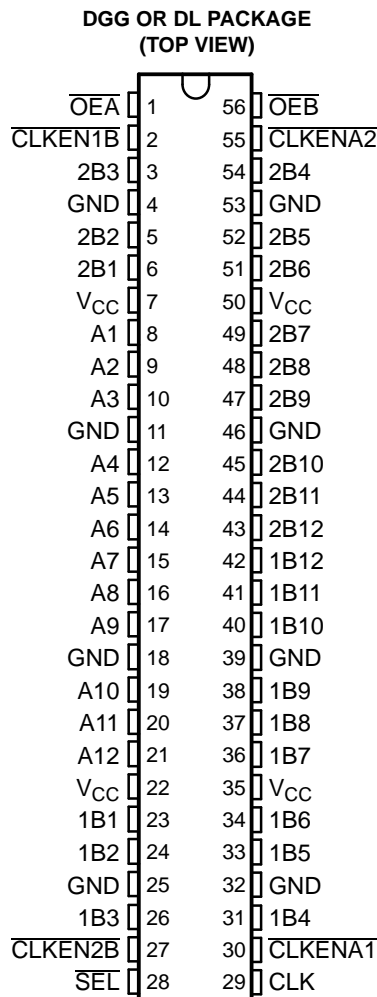
DESCRIPTION/ORDERING INFORMATION

This 12-bit to 24-bit registered bus exchanger is designed for 1.65-V to 3.6-V V_{CC} operation.

The SN74ALVCH162268 is used for applications in which data must be transferred from a narrow high-speed bus to a wide, lower-frequency bus.

The device provides synchronous data exchange between the two ports. Data is stored in the internal registers on the low-to-high transition of the clock (CLK) input when the appropriate clock-enable (CLKEN) inputs are low. The select (SEL) line is synchronous with CLK and selects 1B or 2B input data for the A outputs.

DGG OR DL PACKAGE
(TOP VIEW)

OEA	1	56	OEB
CLKEN1B	2	55	CLKENA2
2B3	3	54	2B4
GND	4	53	GND
2B2	5	52	2B5
2B1	6	51	2B6
V_{CC}	7	50	V_{CC}
A1	8	49	2B7
A2	9	48	2B8
A3	10	47	2B9
GND	11	46	GND
A4	12	45	2B10
A5	13	44	2B11
A6	14	43	2B12
A7	15	42	1B12
A8	16	41	1B11
A9	17	40	1B10
GND	18	39	GND
A10	19	38	1B9
A11	20	37	1B8
A12	21	36	1B7
V_{CC}	22	35	V_{CC}
1B1	23	34	1B6
1B2	24	33	1B5
GND	25	32	GND
1B3	26	31	1B4
CLKEN2B	27	30	CLKENA1
SEL	28	29	CLK

For data transfer in the A-to-B direction, a two-stage pipeline is provided in the A-to-1B path, with a single storage register in the A-to-2B path. Proper control of these inputs allows two sequential 12-bit words to be presented synchronously as a 24-bit word on the B port. Data flow is controlled by the active-low output enables (OEA, OEB). These control terminals are registered, so bus direction changes are synchronous with CLK.

The B outputs, which are designed to sink up to 12 mA, include equivalent 26-Ω resistors to reduce overshoot and undershoot.

ORDERING INFORMATION

T_A	PACKAGE[1]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SSOP - DL	Tube	SN74ALVCH162268DL	ALVCH162268
		Tape and reel	SN74ALVCH162268DLR	
	TSSOP - DGG	Tape and reel	SN74ALVCH162268GR	ALVCH162268
	VFBGA - GQL	Tape and reel	SN74ALVCH162268KR	VH2268
	VFBGA - ZQL (Pb-free)		74ALVCH162268ZQLR	

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

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Widebus is a trademark of Texas Instruments.

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

To ensure the high-impedance state during power up or power down, a clock pulse should be applied as soon as possible, and $\overline{\text{OE}}$ 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. Due to $\overline{\text{OE}}$ being routed through a register, the active state of the outputs cannot be determined prior to the arrival of the first clock pulse.

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

GQL OR ZQL PACKAGE
(TOP VIEW)
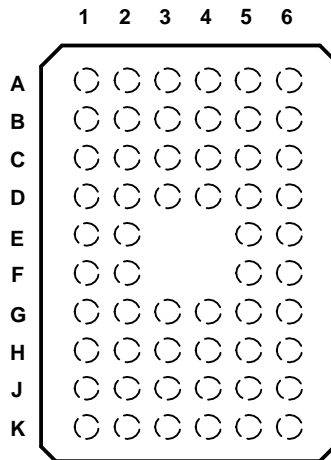
TERMINAL ASSIGNMENTS

	1	2	3	4	5	6
A	2B3	$\overline{\text{CLKEN1B}}$	$\overline{\text{OEA}}$	$\overline{\text{OEB}}$	$\overline{\text{CLKENA2}}$	2B4
B	2B1	2B2	GND	GND	2B5	2B6
C	A2	A1	V_{CC}	V_{CC}	2B7	2B8
D	A4	A3	GND	GND	2B9	2B10
E	A6	A5			2B11	2B12
F	A7	A8			1B11	1B12
G	A9	A10	GND	GND	1B9	1B10
H	A11	A12	V_{CC}	V_{CC}	1B7	1B8
J	1B1	1B2	GND	GND	1B5	1B6
K	1B3	$\overline{\text{CLKEN2B}}$	$\overline{\text{SEL}}$	CLK	$\overline{\text{CLKENA1}}$	1B4

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FUNCTION TABLES

OUTPUT ENABLE

INPUTS			OUTPUTS	
CLK	$\overline{OEA}$	$\overline{OEB}$	A	1B, 2B
↑	H	H	Z	Z
↑	H	L	Z	Active
↑	L	H	Active	Z
↑	L	L	Active	Active

A-TO-B STORAGE ($\overline{OEB}$ = L)

INPUTS				OUTPUTS	
$\overline{CLKENA1}$	$\overline{CLKENA2}$	CLK	A	1B	2B
H	H	X	X	$1B_0$[1]	$2B_0$[1]
L	L	↑	L	L[2]	X
L	L	↑	H	H[2]	X
X	L	↑	L	X	L
X	L	↑	H	X	H

(1) Output level before the indicated steady-state input conditions were established
(2) Two CLK edges are needed to propagate data.

B-TO-A STORAGE ($\overline{OEA}$ = L)

INPUTS						OUTPUT
$\overline{CLKEN1B}$	$\overline{CLKEN2B}$	CLK	$\overline{SEL}$	1B	2B	A
H	X	X	H	X	X	A_0[1]
X	H	X	L	X	X	A_0[1]
L	L	↑	H	L	X	L
L	L	↑	H	H	X	H
X	L	↑	L	X	L	L
X	L	↑	L	X	H	H

(1) Output level before the indicated steady-state input conditions were established

LOGIC DIAGRAM (POSITIVE LOGIC)
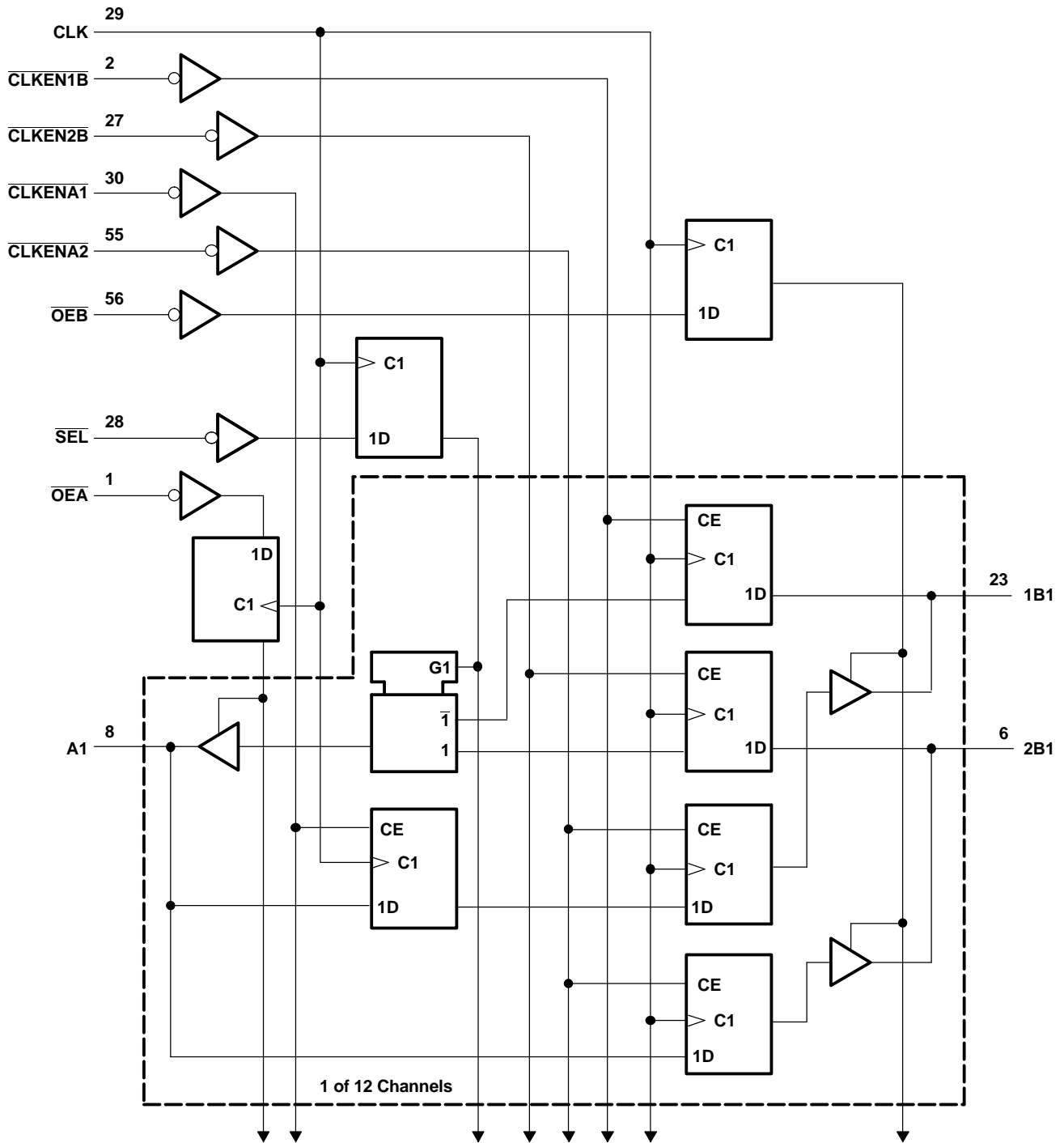
Pin numbers shown are for the DGG and DL packages.

ABSOLUTE MAXIMUM RATINGS[1]

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		-0.5	4.6	V
V_I	Input voltage range	Except I/O ports[2]	-0.5	4.6	V
		I/O ports[2][3]	-0.5	V_{CC} + 0.5	
V_O	Output voltage range[2][3]		-0.5	V_{CC} + 0.5	V
I_{IK}	Input clamp current	V_I < 0		-50	mA
I_{OK}	Output clamp current	V_O < 0		-50	mA
I_O	Continuous output current			±50	mA
	Continuous current through each V_{CC} or GND			±100	mA
θ_{JA}	Package thermal impedance[4]	DGG package		64	°C/W
		DL package		56	
		GQL/ZQL package		42	
T_{stg}	Storage temperature range		-65	150	°C

(1) 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.
(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
(3) This value is limited to 4.6 V, maximum.
(4) The package thermal impedance is calculated in accordance with JESD 51-7.

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RECOMMENDED OPERATING CONDITIONS[1]

			MIN	MAX	UNIT
V_{CC}	Supply voltage		1.65	3.6	V
V_{IH}	High-level input voltage	V_{CC} = 1.65 V to 1.95 V	$0.65 \times V_{CC}$		V
		V_{CC} = 2.3 V to 2.7 V	1.7		
		V_{CC} = 2.7 V to 3.6 V	2		
V_{IL}	Low-level input voltage	V_{CC} = 1.65 V to 1.95 V		$0.35 \times V_{CC}$	V
		V_{CC} = 2.3 V to 2.7 V		0.7	
		V_{CC} = 2.7 V to 3.6 V		0.8	
V_I	Input voltage		0	V_{CC}	V
V_O	Output voltage		0	V_{CC}	V
I_{OH}	High-level output current (A port)	V_{CC} = 1.65 V		-4	mA
		V_{CC} = 2.3 V		-12	
		V_{CC} = 2.7 V		-12	
		V_{CC} = 3 V		-24	
	High-level output current (B port)	V_{CC} = 1.65 V		-2	
		V_{CC} = 2.3 V		-6	
		V_{CC} = 2.7 V		-8	
		V_{CC} = 3 V		-12	
I_{OL}	Low-level output current (A port)	V_{CC} = 1.65 V		4	mA
		V_{CC} = 2.3 V		12	
		V_{CC} = 2.7 V		12	
		V_{CC} = 3 V		24	
	Low-level output current (B port)	V_{CC} = 1.65 V		2	
		V_{CC} = 2.3 V		6	
		V_{CC} = 2.7 V		8	
		V_{CC} = 3 V		12	
$\Delta t/\Delta v$	Input transition rise or fall rate			10	ns/V
T_A	Operating free-air temperature		-40	85	°C

(1) 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.

ELECTRICAL CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS	V_{CC}	MIN	TYP[1]	MAX	UNIT
V_{OH}	A port	I_{OH} = -100 µA	1.65 V to 3.6 V	V_{CC} - 0.2			V
		I_{OH} = -4 mA	1.65 V	1.2			
		I_{OH} = -6 mA	2.3 V	2			
		I_{OH} = -12 mA	2.3 V	1.7			
			2.7 V	2.2			
			3 V	2.4			
		I_{OH} = -24 mA	3 V	2			
	B port	I_{OH} = -100 µA	1.65 V to 3.6 V	V_{CC} - 0.2			
		I_{OH} = -2 mA	1.65 V	1.2			
		I_{OH} = -4 mA	2.3 V	1.9			
		I_{OH} = -6 mA	2.3 V	1.7			
			3 V	2.4			
		I_{OH} = -8 mA	2.7 V	2			
		I_{OH} = -12 mA	3 V	2			
V_{OL}	A port	I_{OL} = 100 µA	1.65 V to 3.6 V			0.2	V
		I_{OL} = 4 mA	1.65 V			0.45	
		I_{OL} = 6 mA	2.3 V			0.4	
		I_{OL} = 12 mA	2.3 V			0.7	
			2.7 V			0.4	
		I_{OL} = 24 mA	3 V			0.55	
	B port	I_{OL} = 100 µA	1.65 V to 3.6 V			0.2	
		I_{OL} = 2 mA	1.65 V			0.45	
		I_{OL} = 4 mA	2.3 V			0.4	
		I_{OL} = 6 mA	2.3 V			0.55	
			3 V			0.55	
		I_{OL} = 8 mA	2.7 V			0.6	
		I_{OL} = 12 mA	3 V			0.8	
I_I		V_I = V_{CC} or GND	3.6 V			±5	µA
$I_{I(hold)}$		V_I = 0.58 V	1.65 V		25		µA
		V_I = 1.07 V			-25		
		V_I = 0.7 V	2.3 V		45		
		V_I = 1.7 V			-45		
		V_I = 0.8 V	3 V		75		
		V_I = 2 V			-75		
		V_I = 0 to 3.6 V[2]	3.6 V			±500	
I_{OZ}[3]		V_O = V_{CC} or GND	3.6 V			±10	µA
I_{CC}		V_I = V_{CC} or GND, I_O = 0	3.6 V			40	µA
ΔI_{CC}		One input at V_{CC} - 0.6 V, Other inputs at V_{CC} or GND	3 V to 3.6 V			750	µA
C_i	Control inputs	V_I = V_{CC} or GND	3.3 V		3.5		pF
C_{io}	A or B ports	V_O = V_{CC} or GND	3.3 V		9		pF

(1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
(2) This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.
(3) For I/O ports, the parameter I_{OZ} includes the input leakage current.

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TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

		V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V ± 0.3 V		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		120		125		150	MHz
t_w	Pulse duration, CLK high or low	3.3		3.3		3.3		ns
t_{su}	Setup time							ns
	A data before CLK↑	4.5		4		3.4		
	B data before CLK↑	0.8		1.2		1		
	$\overline{SEL}$ before CLK↑	1.4		1.6		1.3		
	$\overline{CLKENA1}$ or $\overline{CLKENA2}$ before CLK↑	3.6		3.4		2.8		
	$\overline{CLKEN1B}$ or $\overline{CLKEN2B}$ before CLK↑	3.2		3		2.5		
	$\overline{OE}$ before CLK↑	4.2		3.9		3.2		
t_h	Hold time							ns
	A data after CLK↑	0		0		0.2		
	B data after CLK↑	1.3		1.2		1.3		
	$\overline{SEL}$ after CLK↑	1		1		1		
	$\overline{CLKENA1}$ or $\overline{CLKENA2}$ after CLK↑	0.1		0.1		0.4		
	$\overline{CLKEN1B}$ or $\overline{CLKEN2B}$ after CLK↑	0.1		0		0.5		
	$\overline{OE}$ after CLK↑	0		0		0.2		

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 1.8 V	V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V ± 0.3 V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	
f_{max}				120		125		150		MHz
t_{pd}	CLK	B	8	1.6	6.1		5.9	1.8	5.4	ns
		A (1B)	8	1.6	5.8		5.4	1.7	4.8	
		A (2B)	8	1.6	5.8		5.3	1.8	4.8	
		A ($\overline{SEL}$)	11	2.5	7.3		6.5	2.4	5.8	
t_{en}	CLK	B	12	2.7	7.2		6.8	2.6	6.1	ns
		A	9	2	6.2		5.6	1.8	5.1	
t_{dis}	CLK	B	10	2.8	7.2		6.1	2.5	5.9	ns
		A	9	2	6.5		5.4	2.1	5	

OPERATING CHARACTERISTICS

T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CC} = 2.5 V TYP	V_{CC} = 3.3 V TYP	UNIT
C_{pd} Power dissipation capacitance	Outputs enabled	C_L = 50 pF, f = 10 MHz	87	120	pF
	Outputs disabled		80.5	118	

PARAMETER MEASUREMENT INFORMATION
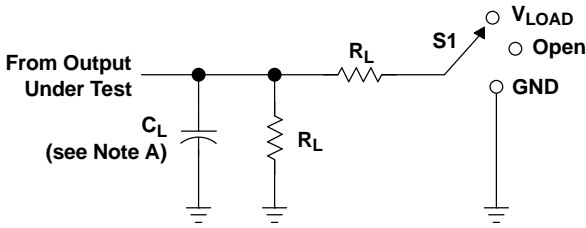
LOAD CIRCUIT

TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

V_{CC}	INPUT		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
1.8 V ± 0.15 V	V_{CC}	≤2 ns	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 kΩ	0.15 V
2.5 V ± 0.2 V	V_{CC}	≤2 ns	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 Ω	0.15 V
2.7 V	2.7 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
3.3 V ± 0.3 V	2.7 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
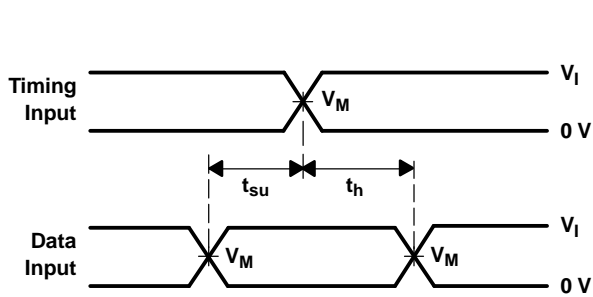
**VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES**

**VOLTAGE WAVEFORMS
PULSE DURATION**
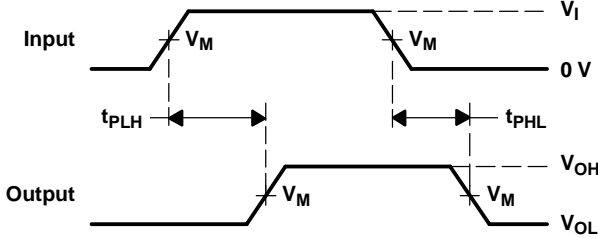
**VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES**
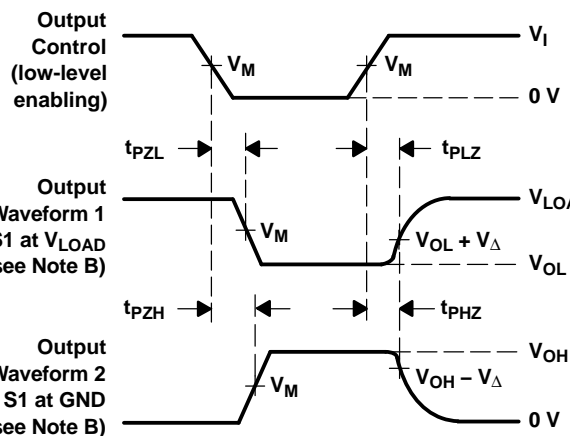
**VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES**

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 ≤ 10 MHz, Z_O = 50 Ω.
  D. The outputs are measured one at a time, with one transition per measurement.
  E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
  F. t_{PZL} and t_{PZH} are the same as t_{en}.
  G. t_{PLH} and t_{PHL} are the same as t_{pd}.
  H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
74ALVCH162268DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
74ALVCH162268GRE4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
74ALVCH162268GRG4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
74ALVCH162268ZQLR	ACTIVE	BGA MICROSTAR JUNIOR	ZQL	56		TBD	Call TI	Call TI	Purchase Samples
SN74ALVCH162268DGGR	OBSOLETE	TSSOP	DGG	56		TBD	Call TI	Call TI	Replaced by SN74ALVCH162268GR
SN74ALVCH162268DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
SN74ALVCH162268GR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
SN74ALVCH162268KR	NRND	BGA MICROSTAR JUNIOR	GQL	56	1000	TBD	SNPB	Level-1-240C-UNLIM	Samples Not Available

[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.

PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
SN74ALVCH162268GR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1
SN74ALVCH162268KR	BGA MICROSTAR JUNIOR	GQL	56	1000	330.0	16.4	4.8	7.3	1.45	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALVCH162268GR	TSSOP	DGG	56	2000	346.0	346.0	41.0
SN74ALVCH162268KR	BGA MICROSTAR JUNIOR	GQL	56	1000	346.0	346.0	33.0

ZQL (R−PBGA−N56) PLASTIC BALL GRID ARRAY

3,25

0,65

0,325

4,60 / 4,40 [B]

[A]

7,10 / 6,90

3X Via Hole Without Ball

0,65

5,85

0,325

Missing Via Hole Indicates Pin A1 Quadrant

A1 Corner

K J H G F E D C B A

1 2 3 4 5 6

Bottom View

56X Ø 0,45 / 0,35

⊕ | Ø 0,15 Ⓜ | C A B
Ø 0,08 Ⓜ | C

1,00 Max

⌒ 0,10 C

Seating Plane

0,35 / 0,15

C

4204437−3/G 06/2007

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
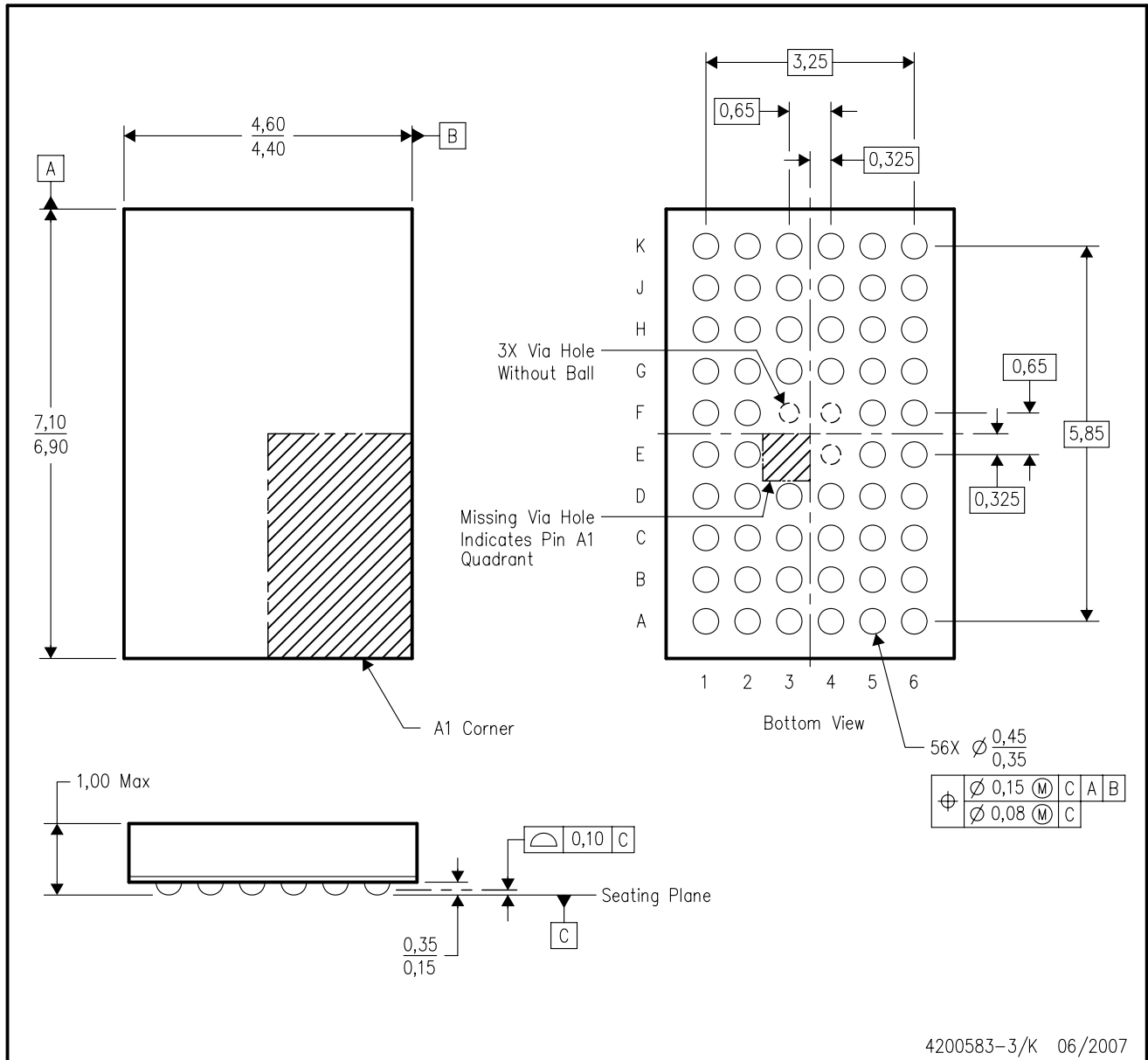
4,60 / 4,40 | B

A

7,10 / 6,90

A1 Corner

1,00 Max

0,35 / 0,15

0,10 | C

Seating Plane

C

3,25

0,65

0,325

K J H G F E D C B A

3X Via Hole Without Ball

Missing Via Hole Indicates Pin A1 Quadrant

1 2 3 4 5 6

Bottom View

0,65

5,85

0,325

56X Ø 0,45 / 0,35

⊕ | Ø 0,15 Ⓜ | C | A | B
Ø 0,08 Ⓜ | C

4200583−3/K 06/2007

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.

MECHANICAL DATA

MSSO001C – JANUARY 1995 – REVISED DECEMBER 2001

DL (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN

PINS ** DIM	28	48	56
A MAX	0.380 (9,65)	0.630 (16,00)	0.730 (18,54)
A MIN	0.370 (9,40)	0.620 (15,75)	0.720 (18,29)

4040048 / E 12/01

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

TEXAS INSTRUMENTS

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

DGG (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN

DIM \ PINS **	48	56	64
A MAX	12,60	14,10	17,10
A MIN	12,40	13,90	16,90

4040078 / F 12/97

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

TEXAS
INSTRUMENTS
POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

IMPORTANT NOTICE