

## FEATURES

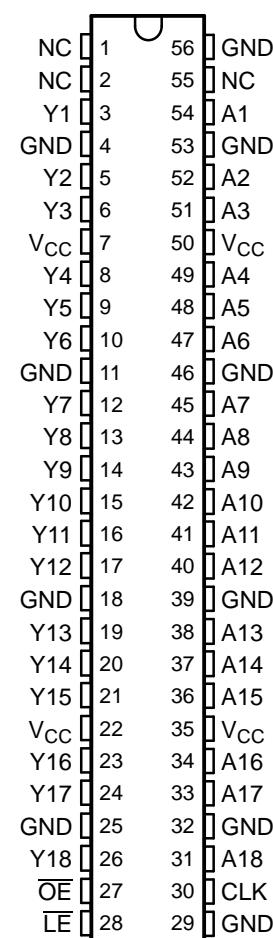
- Member of the Texas Instruments Widebus™ Family
- Ideal for Use in PC133 Register DIMM
- Typical Output Skew . . . <250 ps
- $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  . . . Normal Range
- $V_{CC} = 2.7\text{ V}$  to  $3.6\text{ V}$  . . . Extended Range
- $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$
- Rail-to-Rail Output Swing for Increased Noise Margin
- Balanced Output Drivers . . .  $\pm 18\text{ mA}$
- Low 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)

## DESCRIPTION/ORDERING INFORMATION

This 18-bit universal bus driver is designed for 2.3-V to 3.6-V  $V_{CC}$  operation.

Data flow from A to Y is controlled by the output-enable ( $\overline{OE}$ ) input. The device operates in the transparent mode when the latch-enable ( $\overline{LE}$ ) input is low. When  $\overline{LE}$  is high, the A data is latched if the clock (CLK) input is held at a high or low logic level. If  $\overline{LE}$  is high, the A data is stored in the latch/flip-flop on the low-to-high transition of CLK. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

**DGG, DGV, OR DL PACKAGE  
(TOP VIEW)**



NC – No internal connection

The ALVCF162834 has series damping resistors in the device output structure that reduce switching noise in 128-MB and 256-MB SDRAM modules. Designed with a drive capability of  $\pm 18\text{ mA}$ , this device is a midway drive between the ALVC162834 ( $\pm 12\text{ mA}$ ) and ALVC16834 ( $\pm 24\text{ mA}$ ).

The SN74ALVCF162834 is a faster version of the SN74ALVC162834. It is suitable for PC133 applications, particularly for SDRAM modules clocked at 133 MHz.

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.

## ORDERING INFORMATION

$T_A$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SSOP - DL	Tube	SN74ALVCF162834DL	ALVCF162834
		Tape and reel	SN74ALVCF162834DLR	
	TSSOP - DGG	Tape and reel	SN74ALVCF162834GR	ALVCF162834
	TVSOP - DGV	Tape and reel	SN74ALVCF162834VR	VF162834

(1) 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).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

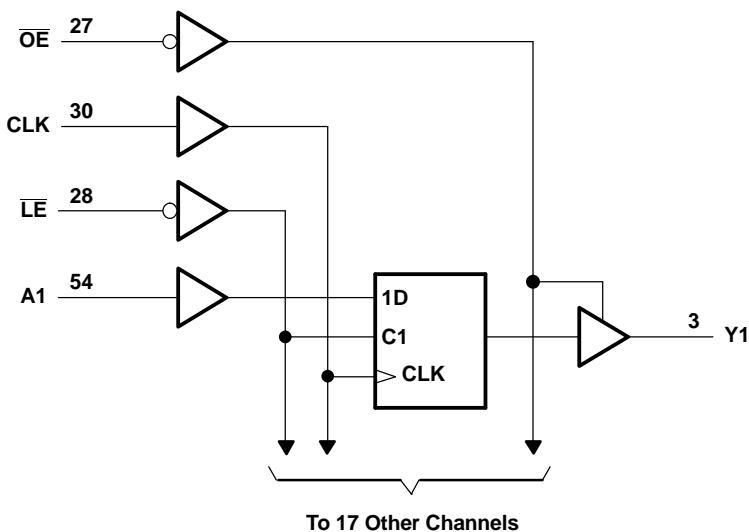
Widebus is a trademark of Texas Instruments.

## FUNCTION TABLE

INPUTS				OUTPUT Y
$\overline{OE}$	$\overline{LE}$	CLK	A	
H	X	X	X	Z
L	L	X	L	L
L	L	X	H	H
L	H	↑	L	L
L	H	↑	H	H
L	H	L or H	X	$Y_0^{(1)}$

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

## LOGIC DIAGRAM (POSITIVE LOGIC)



**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

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 <sup>(2)</sup>	-0.5	4.6	V
$V_O$	Output voltage range <sup>(2)(3)</sup>	-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		$\pm 50$	mA
	Continuous current through each $V_{CC}$ or GND		$\pm 100$	mA
$\theta_{JA}$	Package thermal impedance <sup>(4)</sup>	DGG package	64	°C/W
		DGV package	48	
		DL package	56	
$T_{stg}$	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.

**RECOMMENDED OPERATING CONDITIONS<sup>(1)</sup>**

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	2.3	3.6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2.3$ V to 2.7 V	1.7	V
		$V_{CC} = 2.7$ V to 3.6 V	2	
$V_{IL}$	Low-level input voltage	$V_{CC} = 2.3$ V to 2.7 V	0.7	V
		$V_{CC} = 2.7$ 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	$V_{CC} = 2.3$ V	-6	mA
			-8	
		$V_{CC} = 2.7$ V	-6	
			-12	
		$V_{CC} = 3$ V	-8	
			-18	
$I_{OL}$	Low-level output current	$V_{CC} = 2.3$ V	6	mA
			8	
		$V_{CC} = 2.7$ V	6	
			12	
		$V_{CC} = 3$ V	8	
			18	
$\Delta t/\Delta v$	Input transition rise or fall rate		10	ns/V
$T_A$	Operating free-air temperature	-40	85	°C

- (1) All unused 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.

SN74ALVCF162834

3.3-V CMOS 18-BIT UNIVERSAL BUS DRIVER  
WITH 3-STATE OUTPUTS

SCES409B—AUGUST 2002—REVISED OCTOBER 2004

## ELECTRICAL CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>OH</sub>	I <sub>OH</sub> = -0.1 mA	2.3 V to 3.6 V	V <sub>CC</sub>	- 0.2		V
	I <sub>OH</sub> = -6 mA	2.3 V		1.9		
	I <sub>OH</sub> = -8 mA			1.7		
	I <sub>OH</sub> = -6 mA	2.7 V		2.2		
	I <sub>OH</sub> = -12 mA			2		
	I <sub>OH</sub> = -8 mA	3 V		2.4		
	I <sub>OH</sub> = -18 mA			2		
V <sub>OL</sub>	I <sub>OL</sub> = 0.1 mA	2.3 V to 3.6 V			0.2	V
	I <sub>OL</sub> = 6 mA	2.3 V			0.4	
	I <sub>OL</sub> = 8 mA				0.55	
	I <sub>OL</sub> = 6 mA	2.7 V			0.4	
	I <sub>OL</sub> = 12 mA				0.6	
	I <sub>OL</sub> = 8 mA	3 V			0.55	
	I <sub>OL</sub> = 18 mA				0.8	
V <sub>IK</sub>	V <sub>CC</sub> = 2.3 V, I <sub>I</sub> = -18 mA	3.6 V			-1.2	V
V <sub>hys</sub>	V <sub>CC</sub> = 3.6 V	3.6 V		100		mV
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.6 V			±5	µA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	3.6 V			±10	µA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6 V		0.1	40	µA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND	3 V to 3.6 V			750	µA
C <sub>i</sub>	Inputs	V <sub>I</sub> = 0 V	3.3 V		3	pF
C <sub>o</sub>	Outputs	V <sub>O</sub> = 0 V	3.3 V		4	pF

(1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

## TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1 and Figure 2)

			V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency			150	150	150	150	150	MHz
t <sub>w</sub>	Pulse duration	LE low	3.3		3.3		3.3		ns
		CLK high or low	3.3		3.3		3.3		
t <sub>su</sub>	Setup time	Data before CLK↑		1.8	1.5	1			ns
		Data before LE↑	CLK high	1.9	1.6	1.5			
			CLK low	1.3	1.1	1			
t <sub>h</sub>	Hold time	Data after CLK↑			0.6	0.6	0.6		ns
		Data after LE↑	CLK high or low	1.4	1.7	1.4			

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1 and Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		
			MIN	MAX	MIN	MAX	MIN	MAX	
$f_{max}$			150		150		150		MHz
$t_{pd}$	A	Y	1	4		4.6	1	3.5	ns
	$\overline{LE}$		1.3	5.5		5.4	1.3	4.6	
	CLK		1.4	5.9		5.6	1.4	3.5	
$t_{en}$	$\overline{OE}$	Y	1.4	5.9		6	1.1	5	ns
$t_{dis}$	$\overline{OE}$	Y	1	4.7		4.6	1.3	4.2	ns
$t_{sk(o)}$							500	ps	

## SWITCHING CHARACTERISTICS

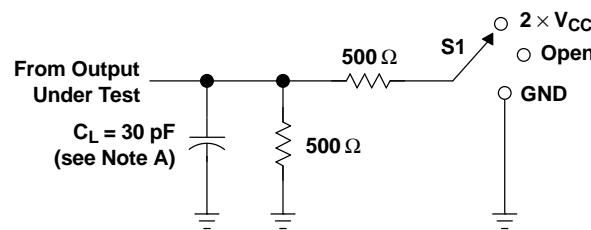
from 0°C to 65°C,  $C_L = 50\text{ pF}$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 3.3\text{ V}$ $\pm 0.15\text{ V}$		UNIT
			MIN	MAX	
$t_{pd}$	CLK	Y	1.8	3.5	ns

## OPERATING CHARACTERISTICS

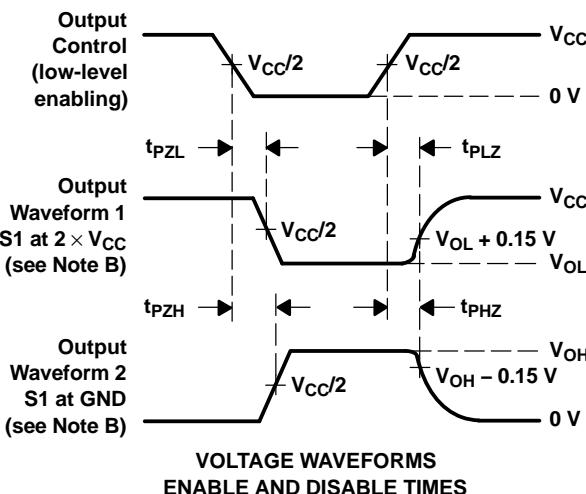
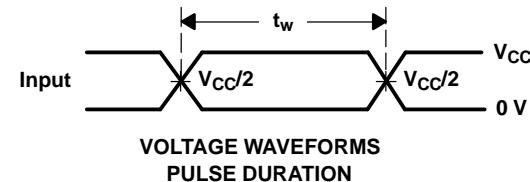
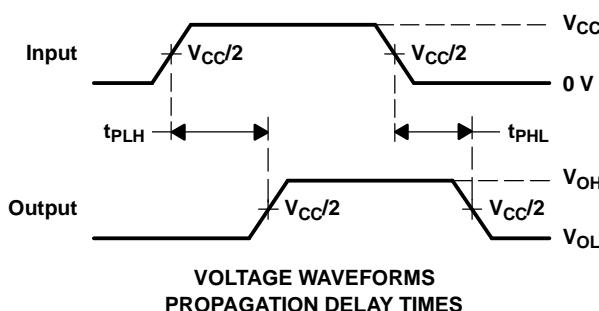
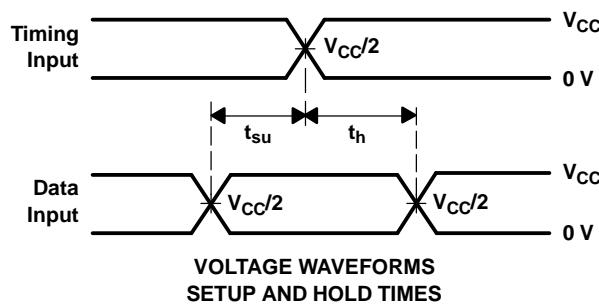
$T_A = 25^\circ\text{C}$

C <sub>pd</sub>	Power dissipation capacitance	Outputs enabled Outputs disabled	$C_L = 0, f = 10\text{ MHz}$	TEST CONDITIONS		UNIT	
				$V_{CC} = 2.5\text{ V}$			
				TYP	TYP		
28	33	pF					
16	21						

**PARAMETER MEASUREMENT INFORMATION**  
 $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ 


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

LOAD CIRCUIT



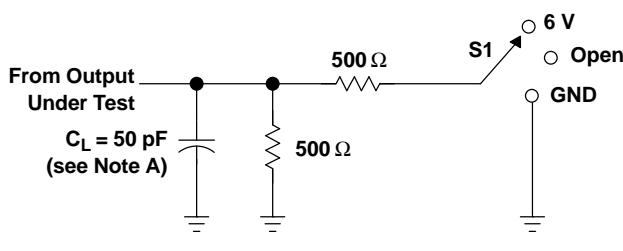
NOTES:

- $C_L$  includes probe and jig capacitance.
- 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.
- All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2 \text{ ns}$ ,  $t_f \leq 2 \text{ ns}$ .
- The outputs are measured one at a time, with one transition per measurement.
- $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{pd}$ .
- $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

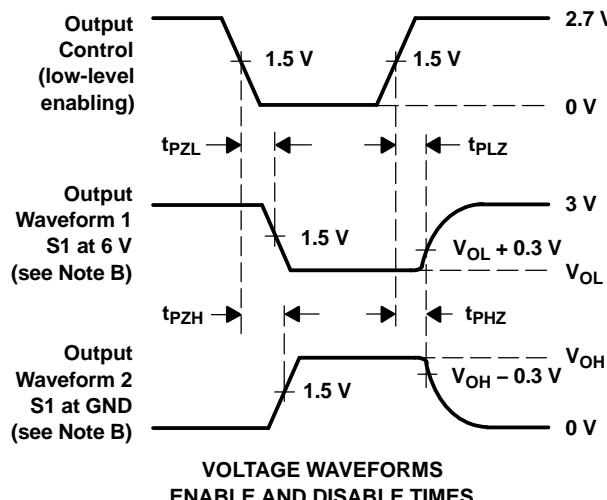
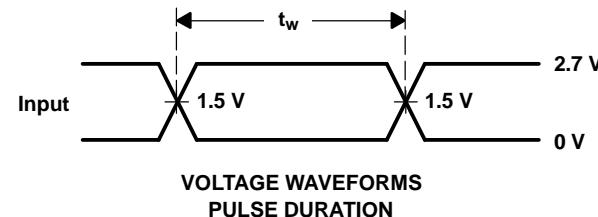
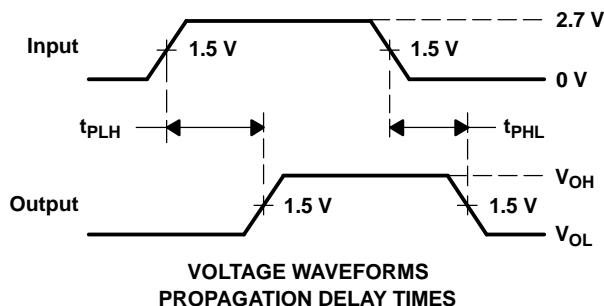
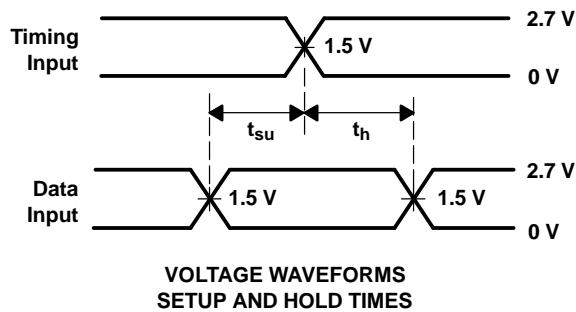
Figure 1. Load Circuit and Voltage Waveforms

**PARAMETER MEASUREMENT INFORMATION**

$V_{CC} = 2.7\text{ V AND }3.3\text{ V} \pm 0.3\text{ V}$



TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



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  $\leq 10\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ .
- D. The outputs are measured one at a time, with one transition per measurement.
- 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  $t_{pd}$ .

**Figure 2. Load Circuit and Voltage Waveforms**

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74ALVCF162834DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	ALVCF162834	<b>Samples</b>
SN74ALVCF162834GR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	ALVCF162834	<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) 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.

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

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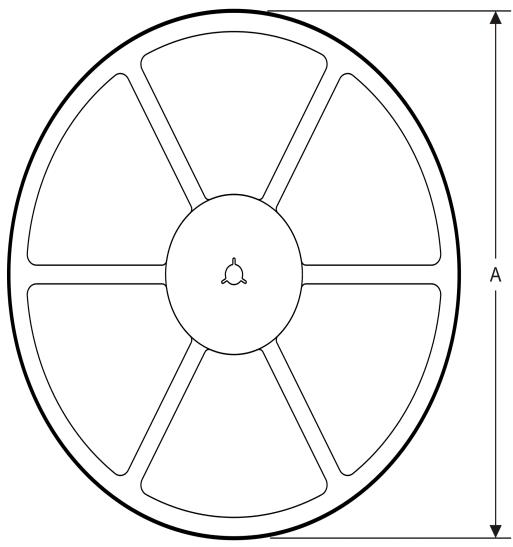
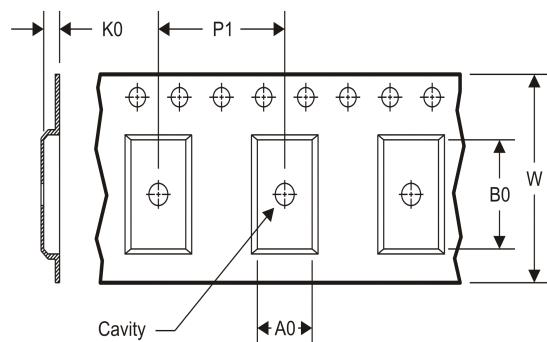
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## PACKAGE OPTION ADDENDUM

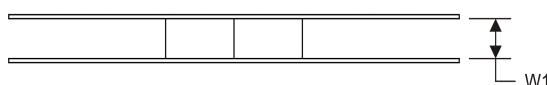
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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**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


**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
SN74ALVCF162834GR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1

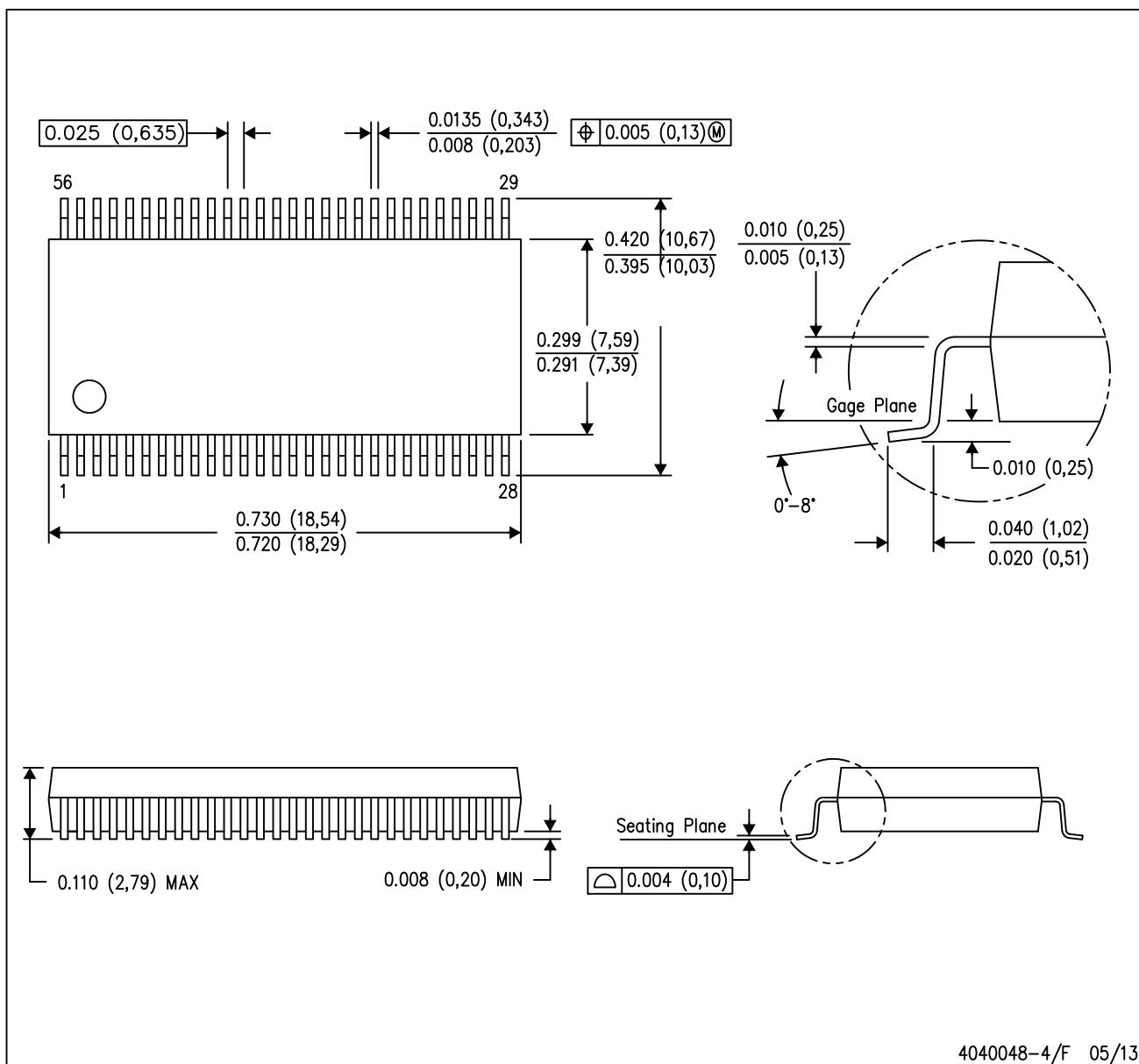
**TAPE AND REEL BOX DIMENSIONS**

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALVCF162834GR	TSSOP	DGG	56	2000	367.0	367.0	45.0

DL (R-PDSO-G56)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES:

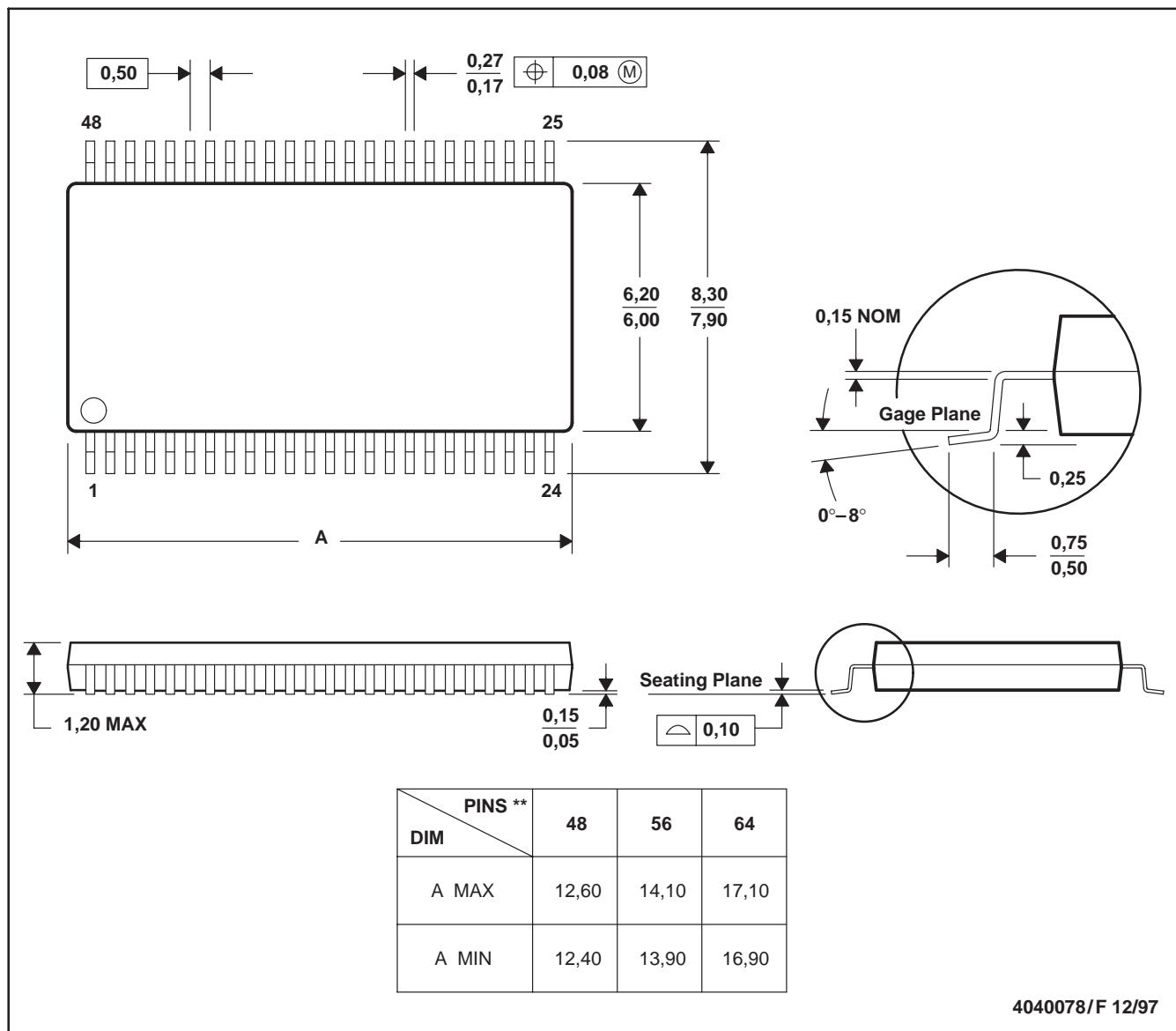
- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0.15).
- Falls within JEDEC MO-118

PowerPAD is a trademark of Texas Instruments.

## 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

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No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products	Applications
Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>
	<b>TI E2E Community</b>
	<a href="http://e2e.ti.com">e2e.ti.com</a>