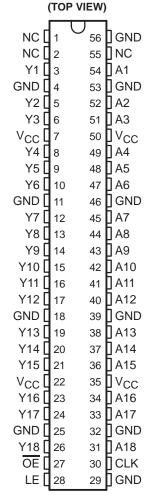
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- **Members of the Texas Instruments** Widebus™ Family
- State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low Static-Power Dissipation
- **Support Mixed-Mode Signal Operation** (5-V Input and Output Voltages With 3.3-V V_{CC})
- **Support Unregulated Battery Operation** Down to 2.7 V
- Typical V_{OLP} (Output Ground Bounce) $< 0.8 \text{ V at V}_{CC} = 3.3 \text{ V}, T_A = 25^{\circ}\text{C}$
- I_{off} and Power-Up 3-State Support Hot Insertion
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown **Resistors**
- Distributed V_{CC} and GND Pin Configuration **Minimizes High-Speed Switching Noise**
- Flow-Through Architecture Optimizes PCB
- Latch-Up Performance Exceeds 500 mA Per **JESD 17**
- **ESD Protection Exceeds 2000 V Per** MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- **Package Options Include Plastic Shrink** Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package **Using 25-mil Center-to-Center Spacings**

SN54LVTH16835 . . . WD PACKAGE SN74LVTH16835... DGG OR DL PACKAGE



NC - No internal connection

description

The 'LVTH16835 devices are 18-bit universal bus drivers designed for low-voltage (3.3-V) V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

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

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

When V_{CC} is between 0 and 1.5 V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, $\overline{\text{OE}}$ 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.



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 Incorporated



SN54LVTH16835, SN74LVTH16835 3.3-V ABT 18-BIT UNIVERSAL BUS DRIVERS WITH 3-STATE OUTPUTS

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description (continued)

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 devices when they are 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.

The SN54LVTH16835 is characterized for operation over the full military temperature range of -55° C to 125° C. The SN74LVTH16835 is characterized for operation from -40° C to 85° C.

FUNCTION TABLE

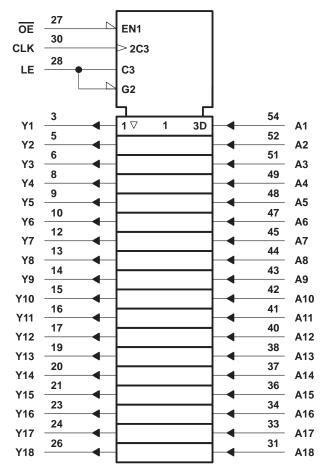
	INP	UTS		OUTPUT
OE	LE	CLK	Α	Y
Н	Х	Х	Χ	Z
L	Н	Χ	L	L
L	Н	X	Н	Н
L	L	\uparrow	L	L
L	L	\uparrow	Н	Н
L	L	Н	Χ	Y ₀ †
L	L	L	Χ	Y ₀ ‡

[†] Output level before the indicated steady-state input conditions were established, provided that CLK is high before LE goes low



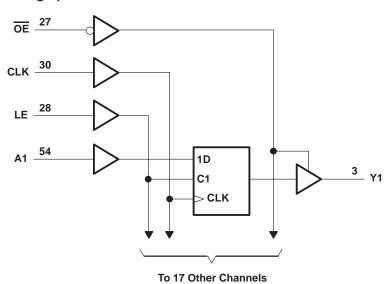
[‡] Output level before the indicated steady-state input conditions were established

logic symbol†



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

logic diagram (positive logic)





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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V _{CC}	0.5 V to 4.6 V
Input voltage range, V _I (see Note 1)	
Voltage range applied to any output in the high-impedance	
or power-off state, V _O (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state, V _O (see Note 1)	$-0.5 \text{ V to V}_{CC} + 0.5 \text{ V}$
Current into any output in the low state, I _O : SN54LVTH16835	96 mA
SN74LVTH16835	128 mA
Current into any output in the high state, I _O (see Note 2): SN54LVTH16835	48 mA
SN74LVTH16835	64 mA
Input clamp current, I _{IK} (V _I < 0)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ _{JA} (see Note 3): DGG package	81°C/W
DL package	74°C/W
Storage temperature range, T _{stq}	–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. This current flows only when the output is in the high state and $V_O > V_{CC}$.
 - 3. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions (see Note 4)

			SN54LVTI	H16835	SN74LVTI	H16835	UNIT
			MIN	MAX	MIN	MAX	UNII
Vcc	Supply voltage	2.7	3.6	2.7	3.6	V	
VIH	High-level input voltage	2	3	2		V	
V _{IL}	Low-level input voltage			0.8		0.8	V
٧ _I	Input voltage	4	5.5		5.5	V	
loh	High-level output current		1	-24		-32	mA
loL	Low-level output current		22	48		64	mA
Δt/Δν	Input transition rise or fall rate	Outputs enabled	70,	10		10	ns/V
Δt/ΔV _{CC}	Power-up ramp rate		200		200		μs/V
T _A	Operating free-air temperature		-55	125	-40	85	°C

NOTE 4: 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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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

DADA	AMETED	TEST C	ONDITIONS	SN5	4LVTH16	835	SN7	4LVTH16	835	UNIT
PARA	AMETER	lesi co	ONDITIONS	MIN	TYP†	MAX	MIN	TYP†	MAX	UNII
VIK		$V_{CC} = 2.7 \text{ V},$	I _I = -18 mA			-1.2			-1.2	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V},$	I _{OH} = -100 μA	V _{CC} -0	.2		V _{CC} -0	.2		
VOH		$V_{CC} = 2.7 \text{ V},$	I _{OH} = -8 mA	2.4			2.4			V
vОН		V _{CC} = 3 V	$I_{OH} = -24 \text{ mA}$	2						v
		VCC = 3 V	$I_{OH} = -32 \text{ mA}$					2		
		V _{CC} = 2.7 V	$I_{OL} = 100 \mu A$			0.2			0.2	
		VCC = 2.7 V	$I_{OL} = 24 \text{ mA}$			0.5			0.5	
VoL			I _{OL} = 16 mA			0.4			0.4	V
VOL		V _{CC} = 3 V	$I_{OL} = 32 \text{ mA}$			0.5			0.5	v
		VCC = 3 V	$I_{OL} = 48 \text{ mA}$			0.55				
			$I_{OL} = 64 \text{ mA}$						0.55	
	Control inputs	$V_{CC} = 0 \text{ or } 3.6 \text{ V},$	V _I = 5.5 V			10			10	
	Control inputs	$V_{CC} = 3.6 \text{ V},$	$V_I = V_{CC}$ or GND			±1		±1		
lj .		V _{CC} = 3.6 V	AI = ACC	1					1	μΑ
	A inputs		V _I = 5.5 V		10				10	
			V _I = 0		5	- 5			– 5	
l _{off}		$V_{CC} = 0$,	V_I or $V_O = 0$ to 4.5 V	4	2				±100	μΑ
		V _{CC} = 3 V	V _I = 0.8 V	75)		75			
l _{l(hold)}		VCC = 3 V	V _I = 2 V	-75		-75 ±500		μΑ		
		$V_{CC} = 3.6 V^{\ddagger}$,	$V_{ } = 0 \text{ to } 3.6 \text{ V}$					±500	1	
lozh		$V_{CC} = 3.6 \text{ V},$	V _O = 3 V			5			5	μΑ
I _{OZL}		$V_{CC} = 3.6 \text{ V},$	V _O = 0.5 V			-5			– 5	μΑ
lozpu		$\frac{V_{CC}}{OE} = 0$ to 1.5 V, $V_{O} = 0$	0.5 V to 3 V,			±100*			±100	μΑ
lozpd		$\frac{V_{CC}}{OE}$ = 1.5 V to 0, V_{O} = $\frac{V_{CC}}{OE}$ = don't care	0.5 V to 3 V,			±100*			±100	μΑ
		V _{CC} = 3.6 V,	Outputs high			0.19			0.19	
ICC		$I_{O} = 0$,	Outputs low		5		5	mA		
		$V_I = V_{CC}$ or GND	Outputs disabled	0.19			9 0.19			
Δlcc§		$V_{CC} = 3 \text{ V to } 3.6 \text{ V, One}$ Other inputs at V_{CC} or				0.2			0.2	mA
C		V _I = 3 V or 0		3.5			3.5		pF	
Ci										

^{*} On products compliant to MIL-PRF-38535, this parameter is not production tested.



[†] All typical values are at V_{CC} = 3.3 V, T_A = 25°C. ‡ This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

[§] This is the increase in supply current for each input that is at the specified TTL voltage level rather than VCC or GND.

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

						ГН16835		5	N74LV	ГН16835			
				V _{CC} =		V _{CC} =	2.7 V	V _{CC} =		V _{CC} =	2.7 V	UNIT	
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
fclock	Clock frequency				150		150		150		150	MHz	
	Pulse duration	LE high	3.3		3.3		3.3		3.3		ns		
t _W	Fuise duration	CLK high or low	3.3		3.3		3.3		3.3		115		
		Data before CLK↑	2.2		2.5		2.1		2.4				
t _{su}	Setup time	Data before LE↓	CLK high	2.5	Ć,	1.7		2.3		1.5		ns	
		Data before LEV	CLK low	1.5	200	0.5		1.5		0.5			
.	Hold time	Data after CLK↑		1	720	0		1		0		20	
th th	Hold time	Data after LE↓		0.8		0.8		0.8		0.8		ns	

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

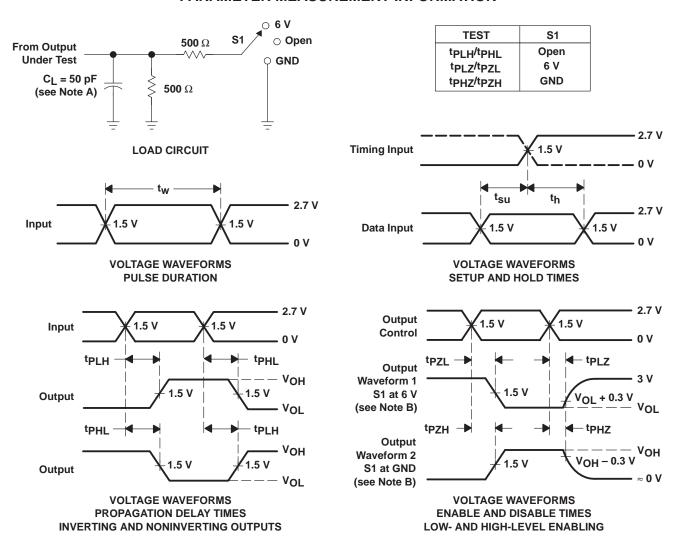
				SN54LV	ГН16835			SN74	LVTH16	6835		
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} =		V _{CC} = 2.7 V			CC = 3.3 ± 0.3 V	V	VCC =	2.7 V	UNIT
			MIN	MAX	MIN	MAX	MIN	TYP [†]	MAX	MIN	MAX	
f _{max}			150		150		150			150		MHz
t _{PLH}	А	Y	1.2	3.9		4.3	1.3	2.6	3.7		4	ns
t _{PHL}	A	'	1.2	3.9	2	4.3	1.3	2.4	3.7		4	115
t _{PLH}	LE	Y	1.4	5.3	N.	5.9	1.5	3.2	5.1		5.7	ns
^t PHL	LE	'	1.4	5.3	74	5.9	1.5	3.3	5.1		5.7	115
t _{PLH}	CLK	Y	1.4	5.3		5.9	1.5	3.5	5.1		5.7	ns
t _{PHL}	CLK	ī	1.4	5.3		5.9	1.5	3.4	5.1		5.7	115
^t PZH	<u></u>	Y	1.2	O 5		5.9	1.3	2.9	4.6		5.5	20
t _{PZL}	ŌĒ	Y	1.2	5		5.9	1.3	3	4.6		5.5	ns
t _{PHZ}	ŌE	V	1.6	6		6.5	1.7	4.2	5.8		6.3	nc
t _{PLZ}) DE	Y	1.6	6		6.5	1.7	3.7	5.8		6.3	ns

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



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PARAMETER MEASUREMENT INFORMATION



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, $Z_O = 50 \ \Omega$, $t_f \leq 2.5 \ ns$, $t_f \leq 2.5 \ ns$.
- D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms



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PACKAGING INFORMATION

Orderable Device	Status	Package Type	•	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
	(1)		Drawing			(2)		(3)		(4)	
74LVTH16835DGGRE4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH16835	Samples
SN74LVTH16835DGGR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH16835	Samples

(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) Only one of markings shown within the brackets will appear on the physical device.

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OTHER QUALIFIED VERSIONS OF SN74LVTH16835:

■ Enhanced Product: SN74LVTH16835-EP





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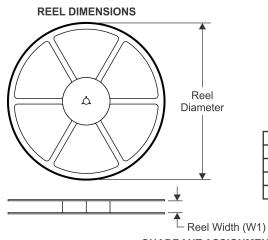
NOTE: Qualified Version Definitions:

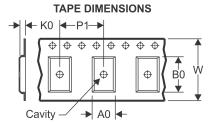
• Enhanced Product - Supports Defense, Aerospace and Medical Applications

PACKAGE MATERIALS INFORMATION

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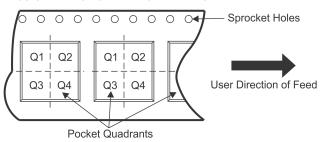
TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
	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

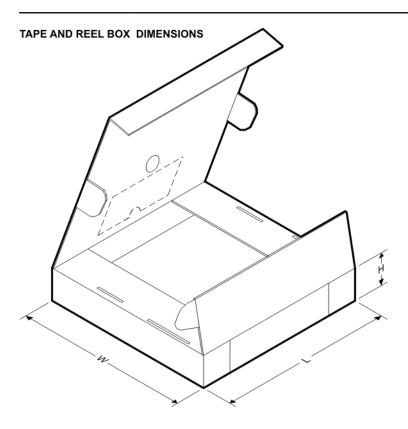
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVTH16835DGGR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1

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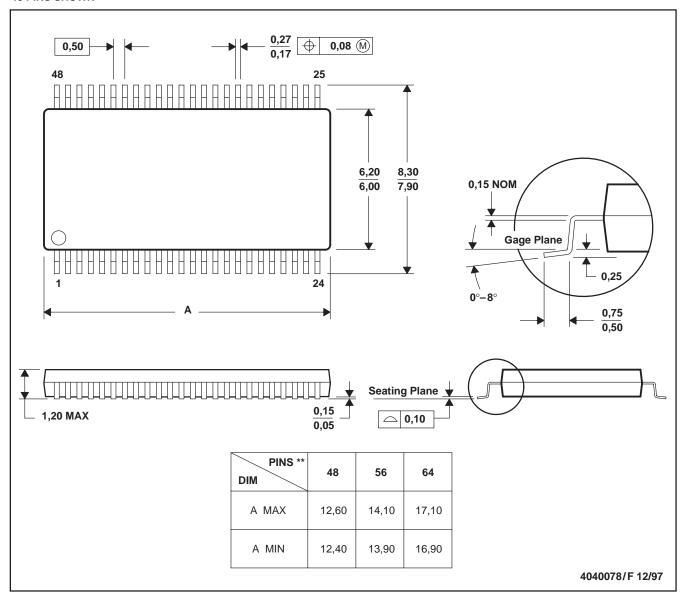
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)	
SN74LVTH16835DGGR	TSSOP	DGG	56	2000	367.0	367.0	45.0	

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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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001:
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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