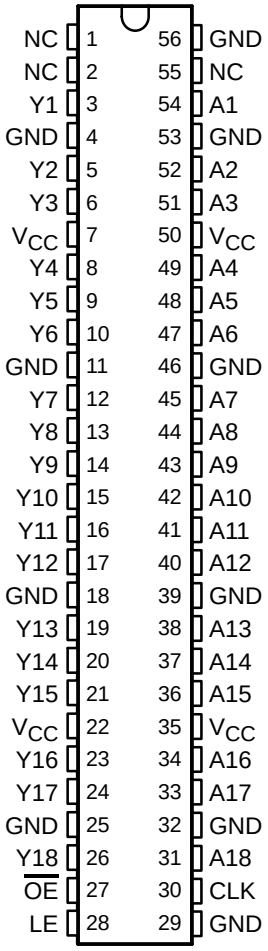
- **Member of the Texas Instruments Widebus™ Family**
- **Ideal for Use in PC133 Register DIMM**
- **Typical Output Skew . . . <250 ps**
- **V_{CC} = 3.3 V ± 0.3 V . . . Normal Range**
- **V_{CC} = 2.7 V to 3.6 V . . . Extended Range**
- **V_{CC} = 2.5 V ± 0.2 V**
- **Rail-to-Rail Output Swing for Increased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

DGG, DGV, OR DL PACKAGE
(TOP VIEW)



NC – No internal connection

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 (LE) input is high. When LE is low, 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 CLK. When $\overline{OE}$ is high, the outputs are in the high-impedance state.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SSOP – DL	Tube	SN74ALVCF162835DL	ALVCF162835
		Tape and reel	SN74ALVCF162835DLR	
	TSSOP – DGG	Tape and reel	SN74ALVCF162835GR	ALVCF162835
	TVSOP – DGV	Tape and reel	SN74ALVCF162835VR	VF2835

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

description/ordering information (continued)

The ALVCF162835 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 ±18 mA, this device is a midway drive between the ALVC162835 (±12 mA) and ALVC16835 (±24 mA).

The SN74ALVCF162835 is a faster version of the SN74ALVC162835. It is suitable for PC133 applications and, particularly, SDRAM modules clocked at 133 MHz.

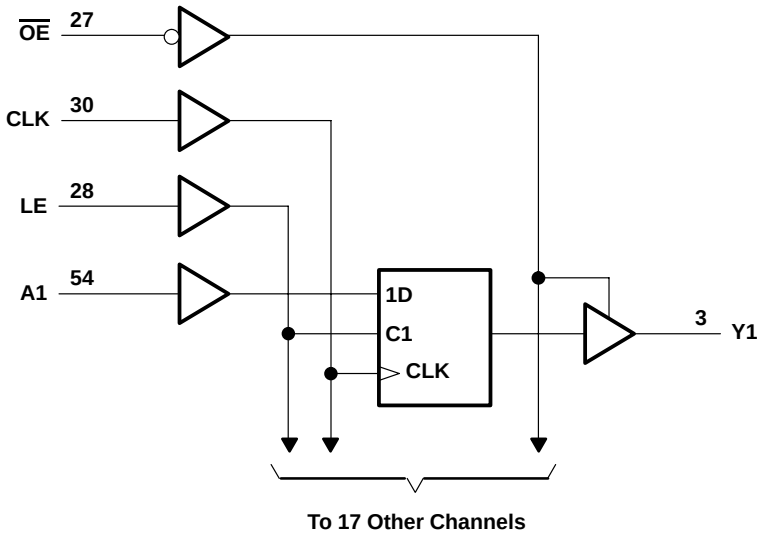
To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

FUNCTION TABLE

INPUTS				OUTPUT
$\overline{OE}$	LE	CLK	A	Y
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	↑	L	L
L	L	↑	H	H
L	L	L or H	X	Y_0†

† Output level before the indicated steady-state input conditions were established

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 4.6 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 4.6 V
Output voltage range, V_O (see Notes 1 and 2) . . . . . –0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I < V_{CC}$) . . . . . –50 mA
Output clamp current, I_{OK} ($V_O < 0$) . . . . . –50 mA
Continuous output current, I_O . . . . . ±50 mA
Continuous current through each V_{CC} or GND . . . . . ±100 mA
Package thermal impedance, θ_{JA} (see Note 3): DGG package . . . . . 64°C/W
DGV package . . . . . 48°C/W
DL package . . . . . 56°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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. This value is limited to 4.6 V maximum.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

			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

NOTE 4: 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.

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

PARAMETER		TEST CONDITIONS		V_{CC}	MIN	TYP†	MAX	UNIT
V_{OH}		I_{OH} = –0.1 mA		2.3 V to 3.6 V	V_{CC}–0.2			V
		I_{OH} = –6 mA		2.3 V	1.9			
		I_{OH} = –8 mA			1.7			
		I_{OH} = –6 mA		2.7 V	2.2			
		I_{OH} = –12 mA			2			
		I_{OH} = –8 mA		3 V	2.4			
		I_{OH} = –18 mA			2			
V_{OL}		I_{OL} = 0.1 mA		2.3 V to 3.6 V			0.2	V
		I_{OL} = 6 mA		2.3 V			0.4	
		I_{OL} = 8 mA					0.55	
		I_{OL} = 6 mA		2.7 V			0.4	
		I_{OL} =12 mA					0.6	
		I_{OL} = 8 mA		3 V			0.55	
		I_{OL} = 18 mA					0.8	
V_{IK}		V_{CC} = 2.3 V,	I_I = –18 mA	3.6 V			–1.2	V
V_{hys}		V_{CC} = 3.6 V		3.6 V		100		mV
I_I		V_I = V_{CC} or GND		3.6 V			±5	µA
I_{OZ}		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		0.1	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	Inputs	V_I = 0 V		3.3 V		3.5		pF
C_o	Outputs	V_O = 0 V		3.3 V		4.5		pF

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

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

				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				150		150		150	MHz
t_w	Pulse duration	LE high		3.3		3.3		3.3		ns
		CLK high or low		3.3		3.3		3.3		
t_{su}	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_h	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 Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	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_{max}			150		150		150		MHz
t_{pd}	A	Y	1	4		4.6	1	3.5	ns
	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

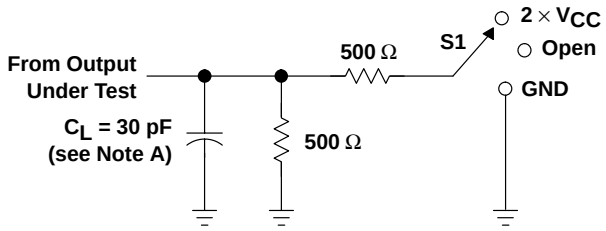
switching characteristics from 0°C to 65°C, C_L = 50 pF

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

operating characteristics, T_A = 25°C

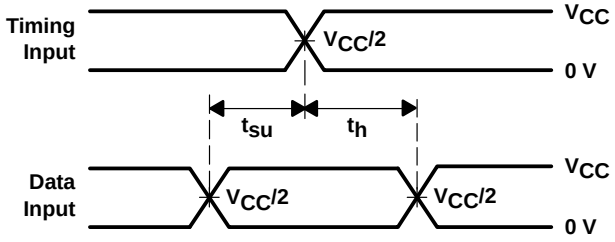
PARAMETER			TEST CONDITIONS	V_{CC} = 2.5 V	V_{CC} = 3.3 V	UNIT
				TYP	TYP	
C_{pd}	Power dissipation capacitance	Outputs enabled	C_L = 0, f = 10 MHz	27	33	pF
		Outputs disabled		16	21	

PARAMETER MEASUREMENT INFORMATION
V_{CC} = 2.5 V ± 0.2 V

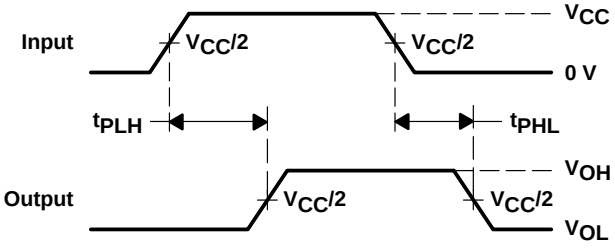


TEST	S1
t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open 2 × V_{CC} GND

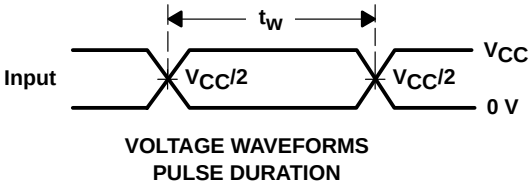
LOAD CIRCUIT



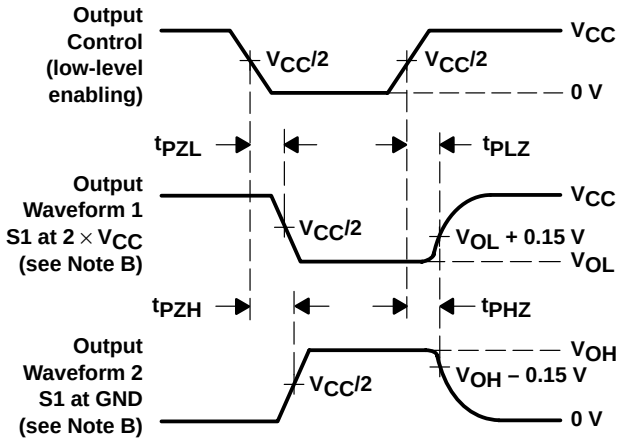
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION

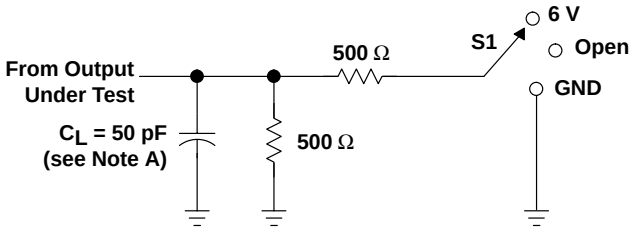


VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

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, t_r ≤ 2 ns, t_f ≤ 2 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}.

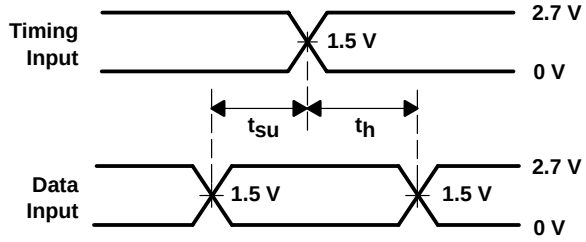
Figure 1. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION
V_{CC} = 2.7 V AND 3.3 V ± 0.3 V

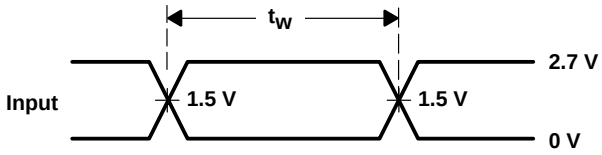


TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

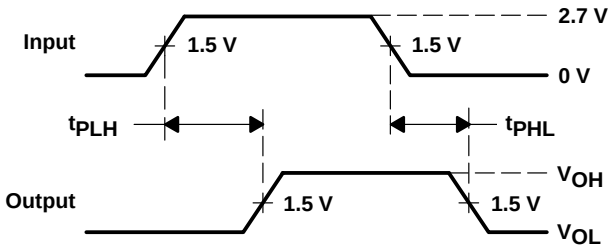
LOAD CIRCUIT



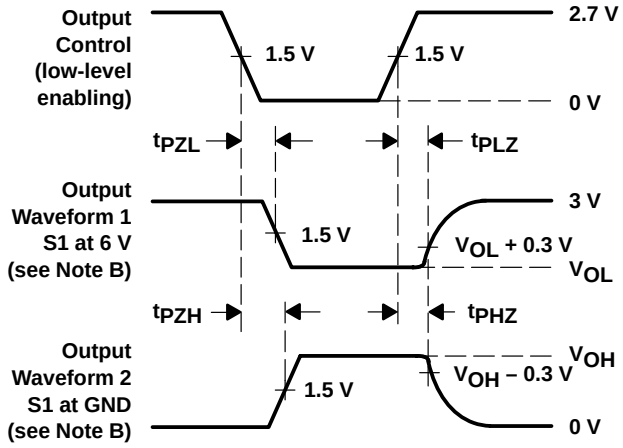
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

NOTES: A. C_L includes probe and jig capacitance.
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C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 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

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