

Product Features

- Very high-speed, low-noise universal bus driver with embedded resistor outputs
- Meets PC133 SDRAM Registered DIMM specification
- Implements output impedance control for low-noise and heavy-load applications
- Fast Propagation Delay:
2.5ns max. for 50pF test load
- V_{CC} = 3.3V or 2.5V or 1.8V
- Packaging (Pb-free and Green available):
–56-pin, 240 mil wide plastic TSSOP (A)

Product Description

Data flow from A to Y is controlled by Output Enable ($\overline{OE}$). The device operates in the transparent mode when LE is HIGH. The A data is latched if CLK is held at a high or low logic level. If LE is LOW, the A-bus 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.

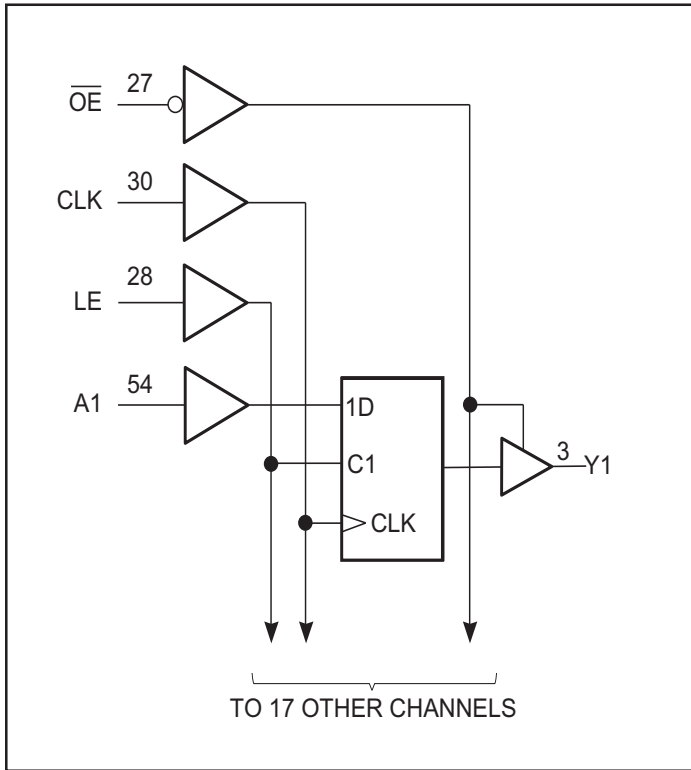
The PI74AVC16835 bus driver is designed to drive an array of 133 MHz synchronous memory chips, with minimal undershoot/overshoot noise, and to meet the input signal rise/fall time requirement of memory chips.

The output drivers of this part have an embedded series-resistor. For DIMM module design, no external series termination resistors near the buffer drivers or any other termination resistors are required. This feature simplifies DIMM module layout design, and results in cost savings.

Product Pin Configuration

NC	1	56	GND
NC	2	55	NC
Y1	3	54	A1
GND	4	53	GND
Y2	5	52	A2
Y3	6	51	A3
VDD	7	50	VDD
Y4	8	49	A4
Y5	9	48	A5
Y6	10	47	A6
GND	11	46	GND
Y7	12	45	A7
Y8	13	44	A8
Y9	14	43	A9
Y10	15	42	A10
Y11	16	41	A11
Y12	17	40	A12
GND	18	39	GND
Y13	19	38	A13
Y14	20	37	A14
Y15	21	36	A15
VDD	22	35	VDD
Y16	23	34	A16
Y17	24	33	A17
GND	25	32	GND
Y18	26	31	A18
OE	27	30	CLK
LE	28	29	LE

Logic Block Diagram



Truth Table⁽¹⁾

Inputs				Outputs Y
OE	LE	CLK	A	
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	H	X	Yo ⁽²⁾
L	L	L	X	Yo ⁽³⁾

Notes:

- 1 H = High Signal Level
L = Low Signal Level
Z = High Impedance
↑ = Transition LOW-to-HIGH
X = Irrelevant
2. Output level before the indicated steady-state input conditions were established, provided that CLK is HIGH before LE goes LOW.
3. Output level before the indicated steady-state input conditions were established.

Product Pin Description

Pin Name	Description
OE	Output Enable Input (Active LOW)
LE	Latch Enable
CLK	Clock Input
A	Data Input
Y	Data Output
GND	Ground
VCC	Power

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature	–65°C to +150°C
Ambient Temperature with Power Applied	–40°C to +85°C
Supply Voltage Range, V_{CC}	–0.5V to +4.6V
Input Voltage Range, $V_I^{(1)}$	–0.5V to +4.6V
Voltage range applied to any output in the high-impedance or power-off state, $V_O^{(1)}$	–0.5V to +4.6V
Voltage range applied to any output in the high or low state, $V_O^{(1,2)}$	–0.5V to $V_{CC} + 0.5V$
Input clamp current, I_{IK} ($V_I < 0$)	–50mA
Output clamp current, I_{OK} ($V_O < 0$)	–50mA
Continuous output current, I_O	±50mA
Continuous current through each V_{CC} or GND	±100mA
Package thermal impedance, $\theta_{JA}^{(3)}$: A (TSSOP) package	81°C/W

Notes:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

1. Input and output negative voltage ratings may be exceeded if the input and output current ratings are observed.
2. Output positive voltage rating may be exceeded up to 4.6V maximum if the output current rating is observed.
3. Package thermal impedance is calculated in accordance with JESD 51.

Recommended Operating Conditions⁽¹⁾

Parameters	Description	Test Conditions	Min.	Max.	Units
V_{CC}	Supply Voltage	Operating	1.65	3.6	V
		Data Retention Only	1.2		
V_{IH}	High-level Input Voltage	$V_{CC} = 1.2V$	V_{CC}		
		$V_{CC} = 1.65V$ to $1.95V$	$0.65 \times V_{CC}$		
		$V_{CC} = 2.3V$ to $2.7V$	1.7		
		$V_{CC} = 3V$ to $3.6V$	2		
V_{IL}	Low-level Input Voltage	$V_{CC} = 1.2V$		GND	
		$V_{CC} = 1.65V$ to $1.95V$		$0.35 \times V_{CC}$	
		$V_{CC} = 2.3V$ to $2.7V$		0.7	
		$V_{CC} = 3V$ to $3.6V$		0.8	
V_{IN}	Input Voltage		0	3.6	
V_{OUT}	Output Voltage	Active State	0	V_{CC}	
		3-State	0	3.6	
I_{OHS}	High-level Output Current ⁽²⁾	$V_{CC} = 1.65V$ to $1.95V$		-4	mA
		$V_{CC} = 2.3V$ to $2.7V$		-8	
		$V_{CC} = 3V$ to $3.6V$		-12	
I_{OLS}	Low-level Output Current ⁽²⁾	$V_{CC} = 1.65V$ to $1.95V$		4	
		$V_{CC} = 2.3V$ to $2.7V$		8	
		$V_{CC} = 3V$ to $3.6V$		12	
$\Delta t/\Delta v$	Input transition rise or fall rate			5	ns/V
T_A	Operating Free-Air Temperature		-40	85	°C

Notes:

- Unused control inputs must be held HIGH or LOW to prevent them from floating.
- Dynamic drive is greater than standard output drive of $I_{OH} = -24mA$ and $I_{OL} = 24mA$

DC Electrical Characteristics (Over the Operating Range, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 3.3\text{V} \pm 10\%$)

Parameters		Test Conditions		V _{CC} ⁽¹⁾	Min.	Typ. ⁽²⁾	Max.	Units
V _{OH}		I _{OHS} = −100μA	V _{IH} or V _{IL}	1.65 to 3.6	V _{CC} -0.2			V
		I _{OHS} = −4mA	V _{IH} = 1.07V	1.65	1.2			
		I _{OHS} = −8mA	V _{IH} = 1.7V	2.3	1.75			
		I _{OHS} = −12mA	V _{IH} = 2V	3.0	2.3			
V _{OL}		I _{OLS} = 100μA	V _{IH} or V _{IL}	1.65 to 3.6			0.2	
		I _{OLS} = 4mA	V _{IL} = 0.57V	1.65			0.45	
		I _{OLS} = 8mA	V _{IL} = 0.7V	2.3			0.55	
		I _{OLS} = 12mA	V _{IL} = 0.8V	3.0			0.7	
I _I	Control Inputs	V _I = V _{CC} or GND		3.6			2.5	μA
I _{OFF}		V _I = 0 or 3.6V		0			±10	
I _{OZ} ⁽³⁾		V _O = V _{CC} or GND	$\overline{\text{OE}}$ = V _{CC}	3.6			±10	
I _{CC}		V _I = V _{CC} or GND	I _O = 0	3.6			40	
C _I	Control Inputs	V _I = V _{CC} or GND		2.5		4.5		pF
				3.3		4.5		
	Data Input			2.5		4.0		
				3.3		4.0		
C _O	Outputs	V _O = V _{CC} or GND		2.5		6.5		
				3.3		6.5		

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are measured at $+25^{\circ}\text{C}$.
3. For I/O ports, the I_{OZ} includes the input leakage current.

Timing Requirements over Operating Range

Parameters	Description	$V_{CC} = 1.8\text{V} \pm 0.15\text{V}$		$V_{CC} = 2.5\text{V} \pm 0.2\text{V}$		$V_{CC} = 3.3\text{V} \pm 0.3\text{V}$		Units
		Min.	Max.	Min.	Max.	Min.	Max.	
f_{CLOCK}	Clock Frequency		150		150		150	MHz
t_W Pulse Duration	LE High	2.0		1.2		1.0		ns
	CLK High or Low	2.0		1.2		1.0		
t_{SU} Setup time	Data before $\text{CLK}\uparrow$	1.4		1.2		1.0		
	Data before $\text{LE}\downarrow$, CLK High or Low	1.4		1.2		1.0		
t_H Hold time	Data after $\text{CLK}\uparrow$	1.0		0.8		0.6		
	Data after $\text{LE}\downarrow$, CLK High or Low	1.0		0.8		0.6		

Switching Characteristics Over Recommended Operating Free-Air Temperature Range

Unless otherwise noted, see Figures 3 through 5.

Parameter	From (Input)	To (Output)	$V_{CC} = 1.8V$ $\pm 0.15V$		$V_{CC} = 2.5V$ $\pm 0.2V$		$V_{CC} = 3.3V^{(1)}$ $\pm 0.3V$		Units
			Min.	Max.	Min.	Max.	Min.	Max.	
f_{max}			150		150		150		MHz
t_{pd}	A	Y	1.0	4.5	0.8	3.0	0.7	2.4	ns
	LE		1.0	5.0	0.8	3.3	0.7	2.5	
	CLK		1.0	4.5	0.8	3.0	0.7	2.5	
t_{en}	$\overline{OE}$		1.5	5.5	1.0	4.5	1.0	4.0	
t_{DIS}	$\overline{OE}$		1.5	5.0	1.0	4.5	1.0	4.0	

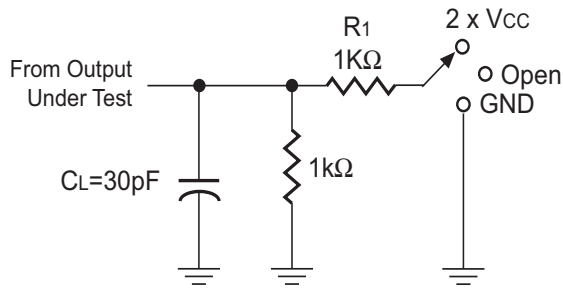
Notes:

1. Load at 50pF and 500Ω.

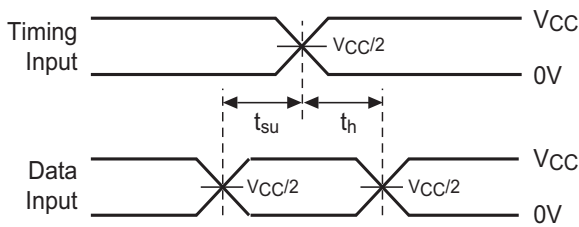
Operating Characteristics, $T_A = 25^\circ C$

Parameters		Test Conditions	$V_{CC} = 1.8V$	$V_{CC} = 2.5V$	$V_{CC} = 3.3V$	Units
			Typ.	Typ.	Typ.	
C_{pd} Power dissipation capacitance	Outputs Enabled	$C_L = 0$, $f = 10\text{ MHz}$	45	48	52	pF
	Outputs Disabled		23	25	28	

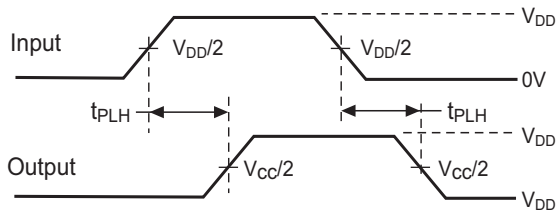
Parameter Measurement Information ($V_{CC} = 1.8V \pm 0.15V$)



Load Circuit

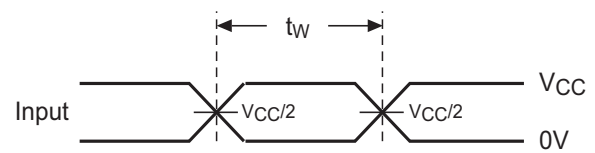


Voltage Waveforms
Setup and Hold Times

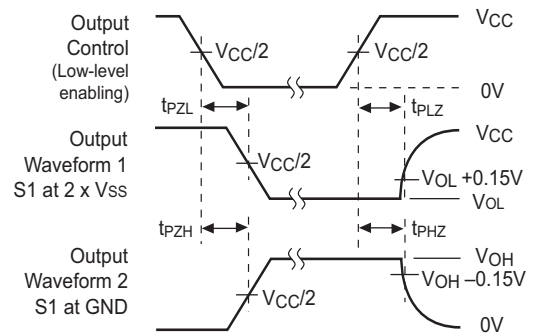


Voltage Waveforms
Propagation Delay Times

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



Voltage Waveforms
Pulse Duration



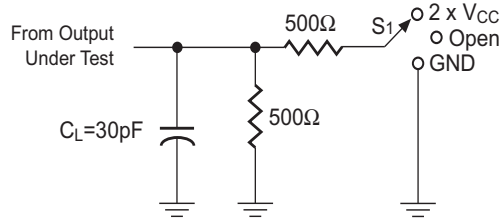
Voltage Waveforms
Enable and Disable Times

Notes:

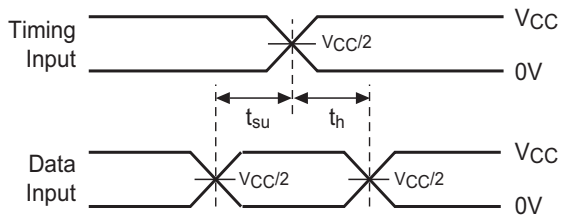
- C_L includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is LOW except when disabled by the output control.
- Waveform 2 is for an output with internal conditions such that the output is HIGH except when disabled by the output control.
- All 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_{dis} .
- t_{PZL} and t_{PZH} are the same as t_{en} .
- t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 3. Load Circuit and Voltage Waveforms

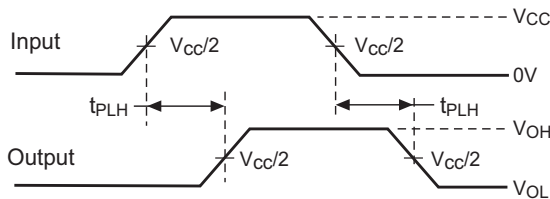
Parameter Measurement Information ($V_{CC} = 2.5V \pm 0.2V$)



Load Circuit

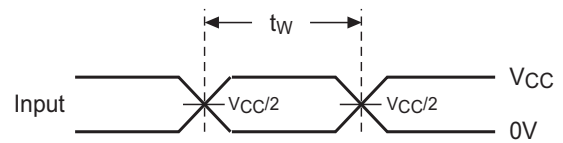


Voltage Waveforms
Setup and Hold Times

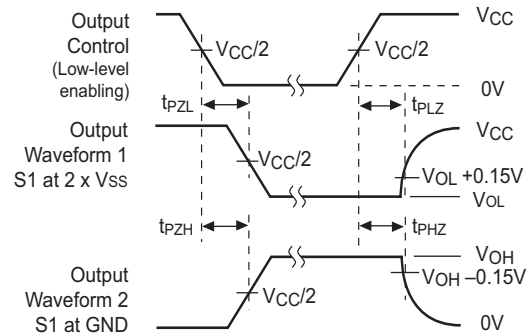


Voltage Waveforms
Propagation Delay Times

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



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Enable and Disable Times

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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50\Omega$, $t_r \leq 2ns$, $t_f \leq 2ns$.
- The outputs are measured one at a time with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- t_{PZL} and t_{PZH} are the same as t_{en} .
- t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 4. Load Circuit and Voltage Waveforms

From Output Under Test

$C_L = 50\text{pF}$

500Ω

500Ω

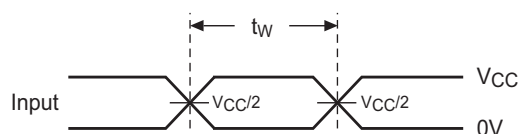
$S1$

$2 \times V_{CC}$

Open

GND

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



Output Control (Low-level enabling)

Output Waveform 1 S1 at 2 x Vss

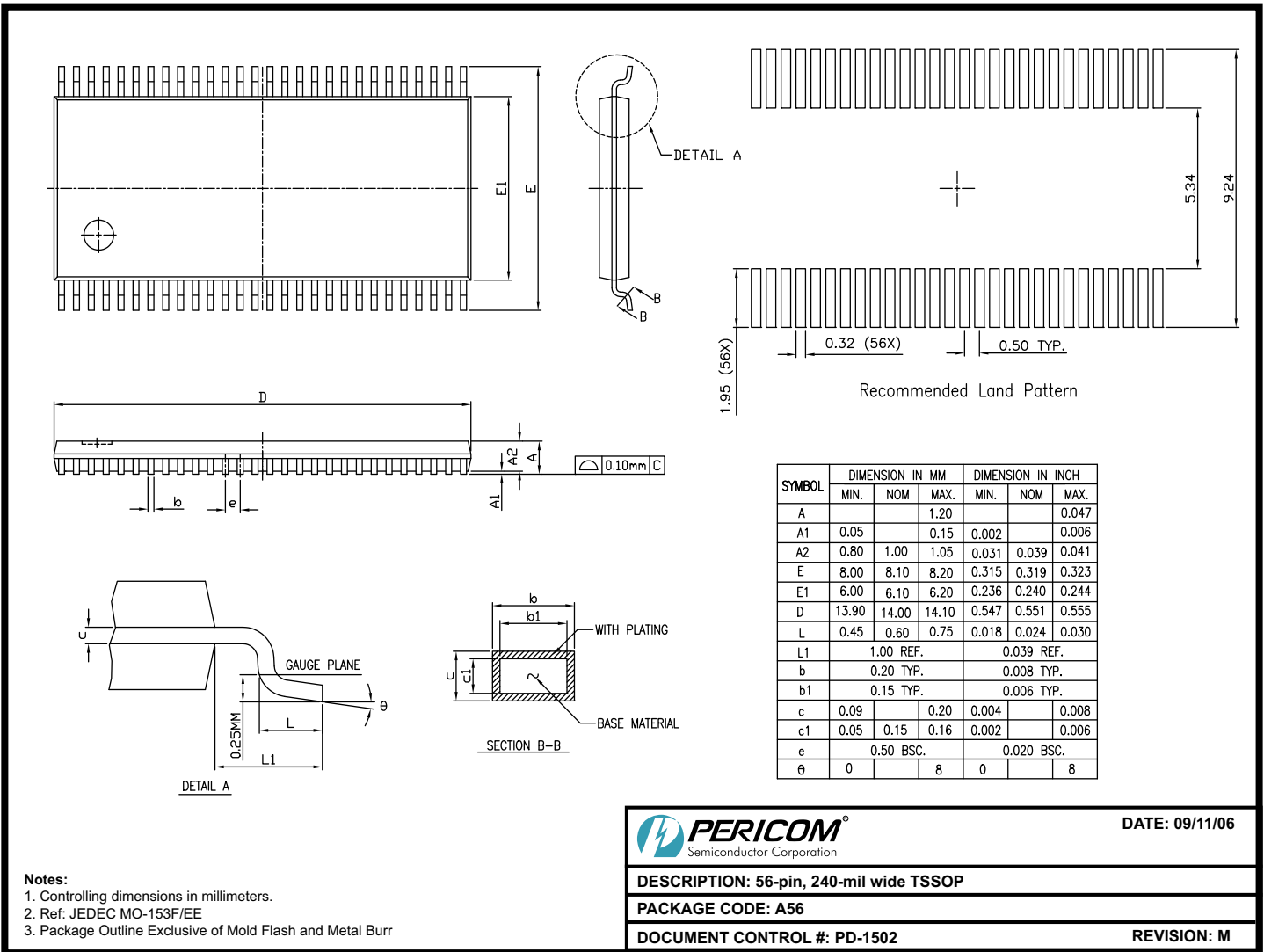
Output Waveform 2 S1 at GND

Timing parameters: t_{PZL} , t_{PLZ} , t_{PZH} , t_{PHZ}

Voltage levels: V_{CC} , $V_{CC}/2$, $0V$, $V_{OL} + 0.3V$, V_{OL} , $V_{OH} - 0.3V$, V_{OH} , $0V$

- 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_{dis} .
- t_{PZL} and t_{PZH} are the same as t_{en} .
- t_{PLH} and t_{PHL} are the same as t_{pd} .

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Notes:

- For latest package info, please check: <http://www.pericom.com/products/packaging/mechanicals.php>

Ordering Information

Ordering Code	Package Code	Package Type
PI74AVC16835AE	A	Pb-free & Green, 56-pin TSSOP

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free & Green
- Adding an X suffix = Tape/Reel