

DATA SHEET

74AVC16836A

20-bit registered driver with inverted
register enable and
Dynamic Controlled Outputs™ (3-State)

Product data
Supersedes data of 2000 Aug 03

2002 Aug 02

20-bit registered driver with inverted register enable and Dynamic Controlled Outputs™ (3-State)

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FEATURES

- Wide supply voltage range of 1.2 V to 3.6 V
- Complies with JEDEC standard no. 8-1A/5/7.
- CMOS low power consumption
- Input/output tolerant up to 3.6 V
- DCO (Dynamic Controlled Output) circuit dynamically changes output impedance, resulting in noise reduction without speed degradation
- Low inductance multiple V_{CC} and GND pins for minimum noise and ground bounce
- Power off disables 74AVC16836A outputs, permitting Live Insertion
- Integrated input diodes to minimize input overshoot and undershoot
- Full PC133 solution provided when used with PCK2509S or PCK2510S and CBT16292

DESCRIPTION

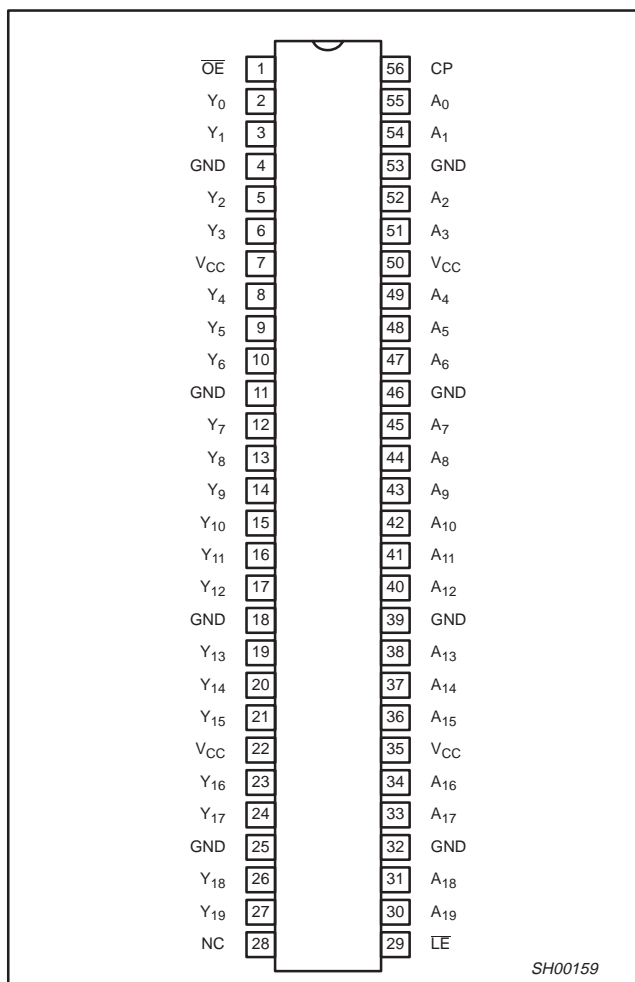
The 74AVC16836A is a 20-bit universal bus driver. Data flow is controlled by output enable (\overline{OE}), latch enable (\overline{LE}) and clock inputs (CP).

This product is designed to have an extremely fast propagation delay and a minimum amount of power consumption.

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor (Live Insertion).

A Dynamic Controlled Output (DCO) circuitry is implemented to support termination line drive during transient. See the graphs on page 8 for typical curves.

PIN CONFIGURATION



SH00159

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_r = t_f \leq 2.0\text{ ns}$; $C_L = 30\text{ pF}$.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT	
t_{PHL}/t_{PLH}	Propagation delay An to Yn	$V_{CC} = 1.8\text{ V}$ $V_{CC} = 2.5\text{ V}$ $V_{CC} = 3.3\text{ V}$	2.4 1.7 1.5	ns	
t_{PHL}/t_{PLH}	Propagation delay LE to Yn; CP to Yn	$V_{CC} = 1.8\text{ V}$ $V_{CC} = 2.5\text{ V}$ $V_{CC} = 3.3\text{ V}$	2.7 2.1 1.7	ns	
C_I	Input capacitance		3.8	pF	
C_{PD}	Power dissipation capacitance per buffer	$V_I = \text{GND to } V_{CC}^1$	Outputs enabled Output disabled	25 6	pF

NOTE:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$$

where: f_i = input frequency in MHz; C_L = output load capacitance in pF;
 f_o = output frequency in MHz; V_{CC} = supply voltage in V; $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DRAWING NUMBER
56-Pin Plastic 0.5 mm pitch TSSOP	-40 to +85 $^{\circ}\text{C}$	74AVC16836ADGG	SOT364-1
56-Pin Plastic 0.4 mm pitch TVSOP	-40 to +85 $^{\circ}\text{C}$	74AVC16836ADGV	SOT481-2

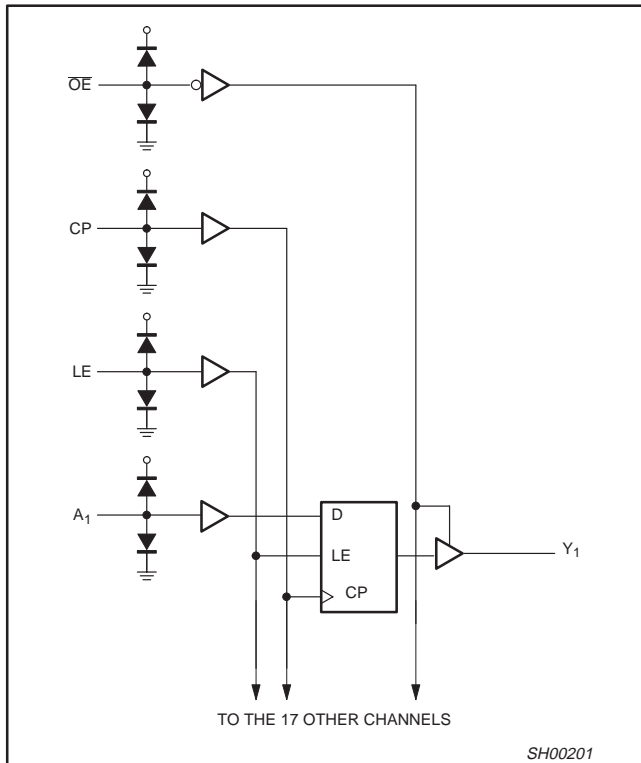
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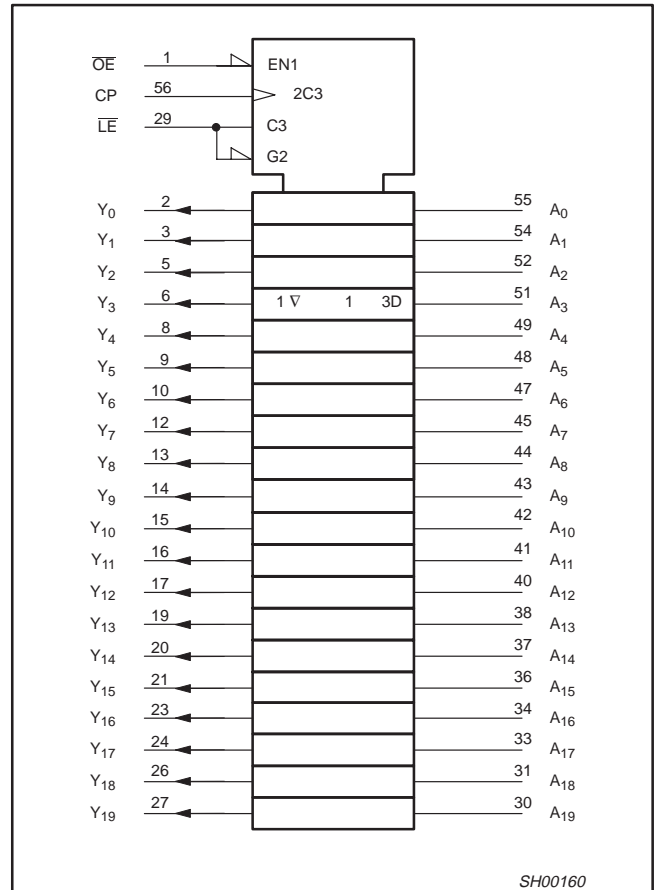
PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
28	NC	No connection
2, 3, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 26, 27	Y ₀ to Y ₁₉	Data outputs
4, 11, 18, 25, 32, 35, 39, 46, 53	GND	Ground (0V)
7, 22, 35, 50	V _{CC}	Positive supply voltage
1	\overline{OE}	Output enable input (active LOW)
29	\overline{LE}	Latch enable input (active LOW)
56	CP	Clock input
55, 54, 52, 51, 49, 48, 47, 45, 44, 43, 42, 41, 40, 38, 37, 36, 34, 33, 31, 30	A ₀ to A ₁₉	Data inputs

LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE

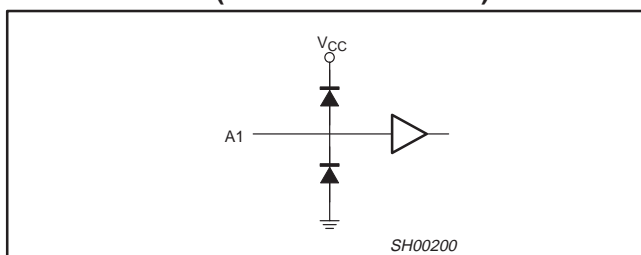
INPUTS				OUTPUTS
\overline{OE}	\overline{LE}	CP	A	
H	X	X	X	Z
L	L	X	L	L
L	L	X	H	H
L	H	↑	L	L
L	H	↑	H	H
L	H	H	X	Y ₀ ¹
L	H	L	X	Y ₀ ²

- H = HIGH voltage level
- L = LOW voltage level
- X = Don't care
- Z = High impedance "off" state
- ↑ = LOW-to-HIGH level transition

NOTES:

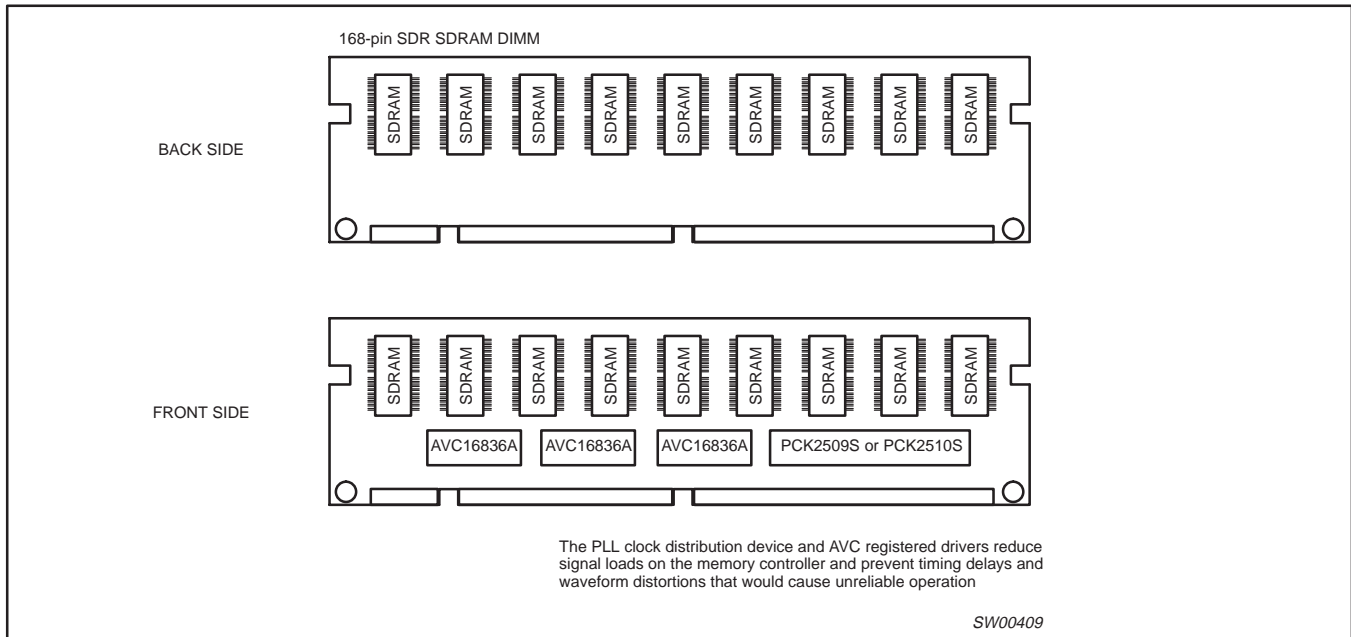
1. Output level before the indicated steady-state input conditions were established, provided that CP is high before \overline{LE} goes low.
2. Output level before the indicated steady-state input conditions were established.

TYPICAL INPUT (DATA OR CONTROL)



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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{CC}	DC supply voltage (according to JEDEC Low Voltage Standards)		1.65 2.3 3.0	1.95 2.7 3.6	V
	DC supply voltage (for low voltage applications)		1.2	3.6	V
V_I	DC Input voltage range		0	3.6	V
V_O	DC output voltage range; output 3-State		0	3.6	V
	DC output voltage range; output HIGH or LOW state		0	V_{CC}	
T_{amb}	Operating free-air temperature range		-40	+85	°C
t_r, t_f	Input rise and fall times	$V_{CC} = 1.65$ to 2.3 V	0	30	ns/V
		$V_{CC} = 2.3$ to 3.0 V	0	20	
		$V_{CC} = 3.0$ to 3.6 V	0	10	

ABSOLUTE MAXIMUM RATINGS

In accordance with the Absolute Maximum Rating System (IEC 134). Voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +4.6	V
I_{IK}	DC input diode current	$V_I < 0$	-50	mA
V_I	DC input voltage	For all inputs ¹	-0.5 to 4.6	V
I_{OK}	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	±50	mA
V_O	DC output voltage; output 3-State	Note 1	-0.5 to 4.6	V
V_O	DC output voltage; output HIGH or LOW state	Note 1	-0.5 to $V_{CC} + 0.5$	V
I_O	DC output source or sink current	$V_O = 0$ to V_{CC}	±50	mA
I_{GND}, I_{CC}	DC V_{CC} or GND current		±100	mA
T_{stg}	Storage temperature range		-65 to +150	°C
P_{TOT}	Power dissipation per package -plastic thin-medium-shrink (TSSOP)	For temperature range: -40 to +125 °C above +55°C derate linearly with 8 mW/K	600	mW

NOTE:

- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltage are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP ¹	MAX	
V _{IH}	HIGH level Input voltage	V _{CC} = 1.2 V	V _{CC}	–	–	V
		V _{CC} = 1.65 to 1.95 V	0.65V _{CC}	0.9	–	
		V _{CC} = 2.3 to 2.7 V	1.7	1.2	–	
		V _{CC} = 3.0 to 3.6 V	2.0	1.5	–	
V _{IL}	LOW level Input voltage	V _{CC} = 1.2 V	–	–	GND	V
		V _{CC} = 1.65 to 1.95 V	–	0.9	0.35V _{CC}	
		V _{CC} = 2.3 to 2.7 V	–	1.2	0.7	
		V _{CC} = 3.0 to 3.6 V	–	1.5	0.8	
V _{OH}	HIGH level output voltage	V _{CC} = 1.65 to 3.6 V; V _I = V _{IH} or V _{IL} ; I _O = -100 μA	V _{CC} - 0.20	V _{CC}	–	V
		V _{CC} = 1.65 V; V _I = V _{IH} or V _{IL} ; I _O = -4 mA	V _{CC} - 0.45	V _{CC} - 0.10	–	
		V _{CC} = 2.3 V; V _I = V _{IH} or V _{IL} ; I _O = -8 mA	V _{CC} - 0.55	V _{CC} - 0.28	–	
		V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = -12 mA	V _{CC} - 0.70	V _{CC} - 0.32	–	
V _{OL}	LOW level output voltage	V _{CC} = 1.65 to 3.6 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA	–	GND	0.20	V
		V _{CC} = 1.65 V; V _I = V _{IH} or V _{IL} ; I _O = 4 mA	–	0.10	0.45	
		V _{CC} = 2.3 V; V _I = V _{IH} or V _{IL} ; I _O = 8 mA	–	0.26	0.55	
		V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = 12 mA	–	0.36	0.70	
I _I	Input leakage current	V _{CC} = 3.6 V; V _I = V _{CC} or GND	–	0.1	2.5	μA
I _{OFF}	3-State output OFF-state current	V _{CC} = 0 V; V _I or V _O = 3.6 V	–	0.1	± 10	μA
I _{OZ}	3-State output OFF-state current	V _{CC} = 1.65 to 2.7 V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND	–	0.1	5	μA
		V _{CC} = 3.0 to 3.6 V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND	–	0.1	10	
I _{CC}	Quiescent supply current	V _{CC} = 1.65 to 2.7 V; V _I = V _{CC} or GND; I _O = 0	–	0.1	20	μA
		V _{CC} = 3.0 to 3.6 V; V _I = V _{CC} or GND; I _O = 0	–	0.2	40	

NOTE:

1. All typical values are at T_{amb} = 25 °C.

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AC CHARACTERISTICS

GND = 0 V; $t_r = t_f \leq 2.0$ ns; $C_L = 30$ pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS												UNIT
			$V_{CC} = 3.3 \pm 0.3$ V			$V_{CC} = 2.5 \pm 0.2$ V			$V_{CC} = 1.8 \pm 0.15$ V			$V_{CC} = 1.5 \pm 0.1$ V		$V_{CC} = 1.2$ V	
			MIN	TYP ¹	MAX	MIN	TYP ¹	MAX	MIN	TYP ¹	MAX	MIN	MAX	TYP	
t_{PHL}/t_{PLH}	Propagation delay An to Yn	1, 7	0.7	1.5	2.7	0.8	1.7	3.2	1.0	2.4	4.4	2.0	5.3	4.7	ns
	Propagation delay \overline{LE} to Yn	2, 7	0.7	1.7	3.4	1.0	2.1	3.5	1.5	2.7	5.0	2.0	5.6	5.0	ns
	Propagation delay CP to Yn	3, 7	0.7	1.6	3.0	0.8	1.7	3.2	1.2	2.3	4.1	2.0	4.7	5.7	ns
t_{PZH}/t_{PZL}	3-State output enable time OE to Yn	6, 7	1.0	1.9	3.6	1.0	2.4	4.0	1.5	3.0	5.4	2.5	6.8	6.0	ns
t_{PHZ}/t_{PLZ}	3-State output disable time OE to Yn	6, 7	1.0	2.5	4.8	1.0	2.1	4.7	1.5	3.7	7.5	2.5	7.6	6.6	ns
t_w	CP pulse width HIGH or LOW	3, 7	1.0	–	–	1.2	–	–	2.0	–	–	–	–	–	ns
	LE pulse width HIGH	2, 7	1.0	–	–	1.2	–	–	2.0	–	–	–	–	–	ns
t_{SU}	Set-up time An to CP	5, 7	0.2	0	–	0.3	0	–	0.2	0	–	0.3	–	0	ns
	Set-up time An to \overline{LE}	4, 7	0.3	0	–	0.6	0.2	–	0.9	0.4	–	1.3	–	1.2	ns
t_h	Hold time An to CP	5, 7	1.2	0.5	–	0.6	0.2	–	0.6	0.2	–	0.6	–	0.1	ns
	Hold time An to \overline{LE}	4, 7	1.0	0.5	–	0.5	0.1	–	0.4	0	–	0.2	–	–0.7	ns
f_{max}	Maximum clock pulse frequency	3, 7	500	–	–	400	–	–	250	–	–	–	–	–	MHz

NOTE:

1. All typical values are measured at $T_{amb} = 25^\circ\text{C}$ and at $V_{CC} = 1.8$ V, 2.5 V, 3.3 V.

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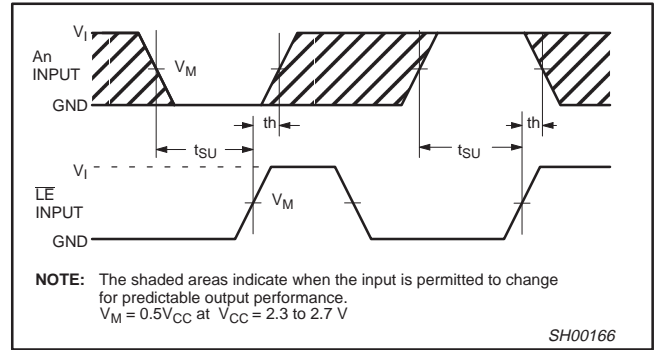
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AC WAVEFORMS FOR $V_{CC} = 3.0\text{ V TO } 3.6\text{ V RANGE}$

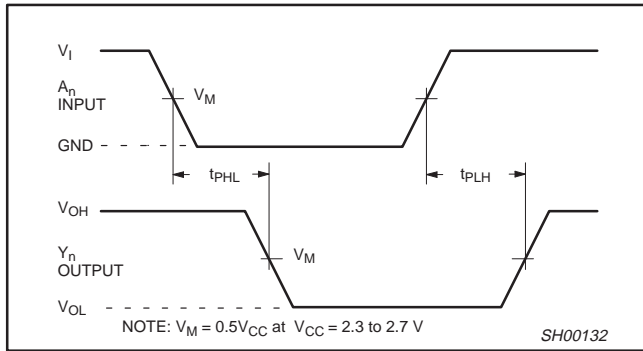
$V_M = 0.5 V_{CC}$
 $V_X = V_{OL} + 0.300\text{ V}$
 $V_Y = V_{OH} - 0.300\text{ V}$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_I = V_{CC}$

AC WAVEFORMS FOR $V_{CC} = 2.3\text{ V TO } 2.7\text{ V AND } V_{CC} < 2.3\text{ V RANGE}$

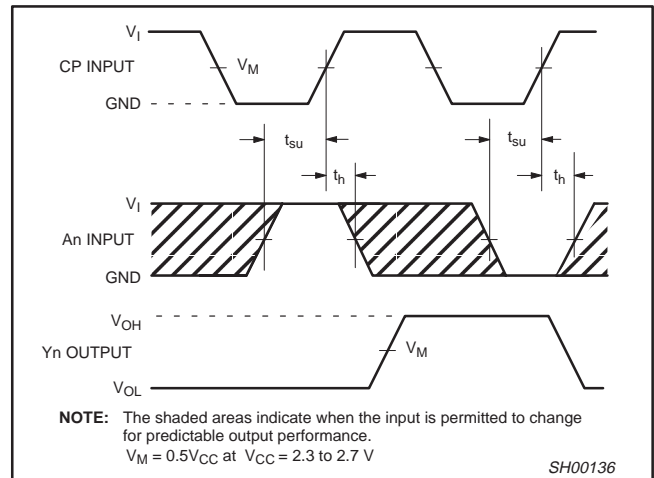
$V_M = 0.5 V_{CC}$
 $V_X = V_{OL} + 0.15\text{ V}$
 $V_Y = V_{OH} - 0.15\text{ V}$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_I = V_{CC}$



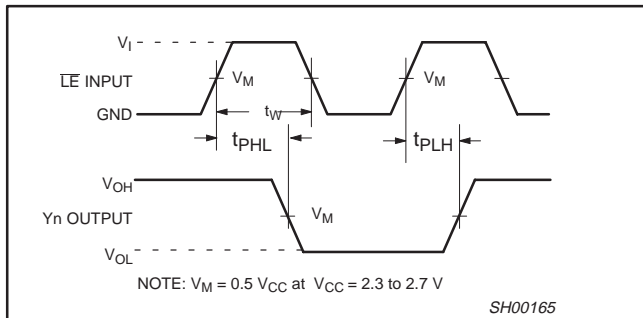
Waveform 4. Data set-up and hold times for the An input to the LE input



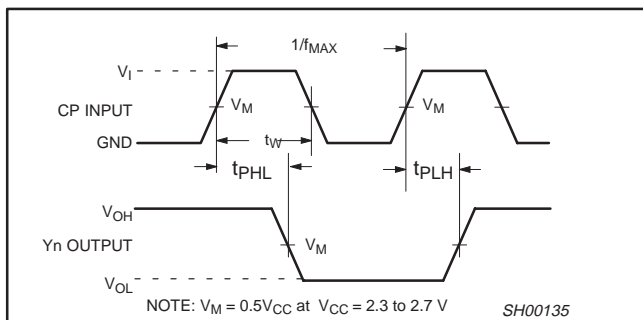
Waveform 1. Input (An) to output (Yn) propagation delay



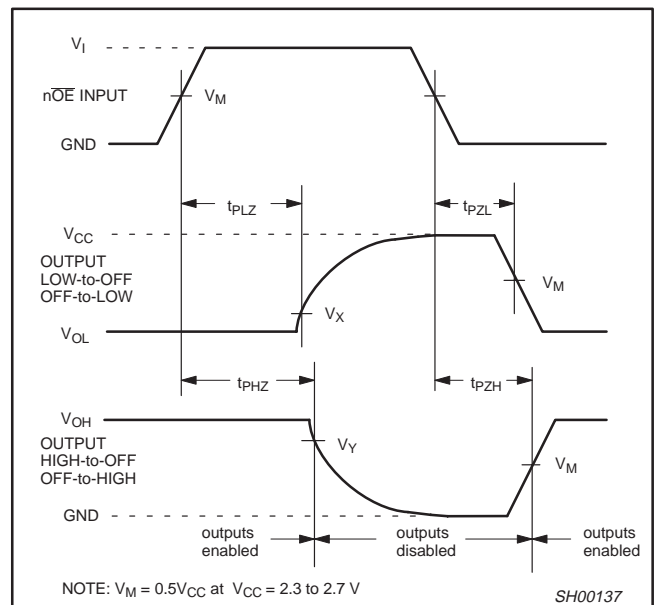
Waveform 5. Data set-up and hold times for the An input to the clock CP input



Waveform 2. Latch enable input (LE) pulse width, the latch enable input to output (Yn) propagation delays.



Waveform 3. The clock (CP) to Yn propagation delays, the clock pulse width and the maximum clock frequency.

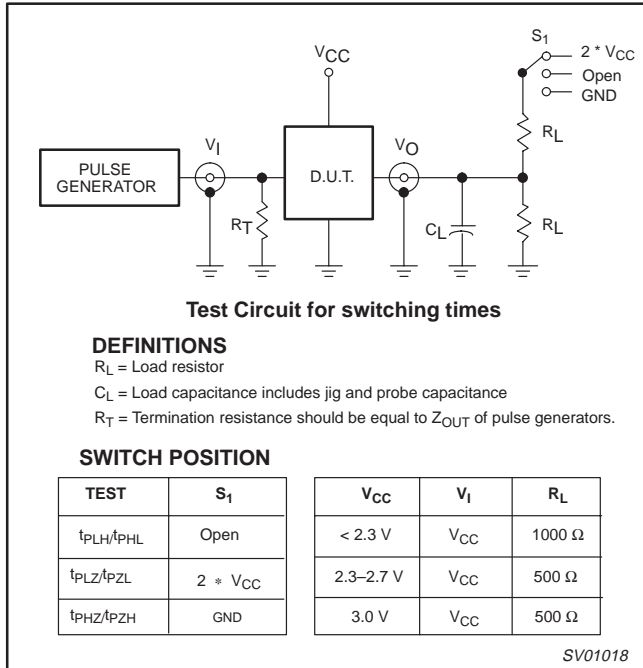


Waveform 6. 3-State enable and disable times

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TEST CIRCUIT



Waveform 7. Load circuitry for switching times

GRAPHS

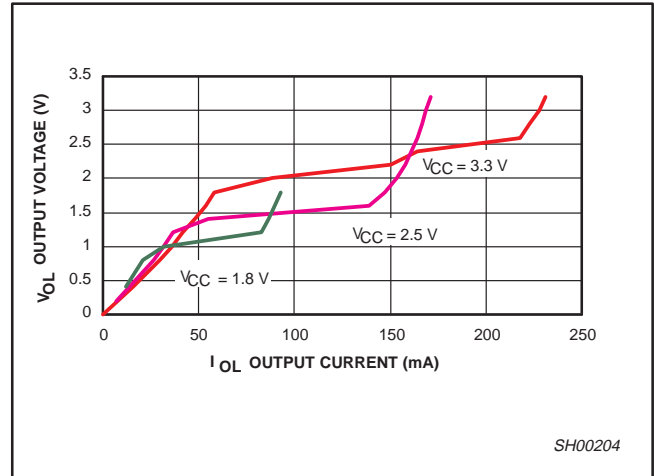


Figure 1. Output voltage (V_{OL}) vs. output current (I_{OL})

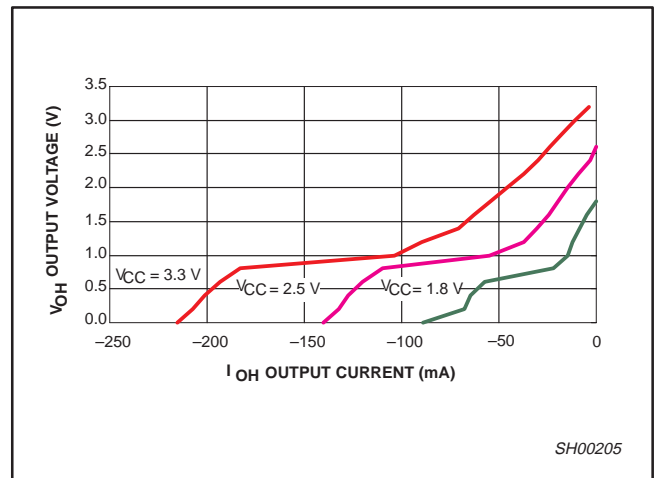


Figure 2. Output voltage (V_{OH}) vs. output current (I_{OH})

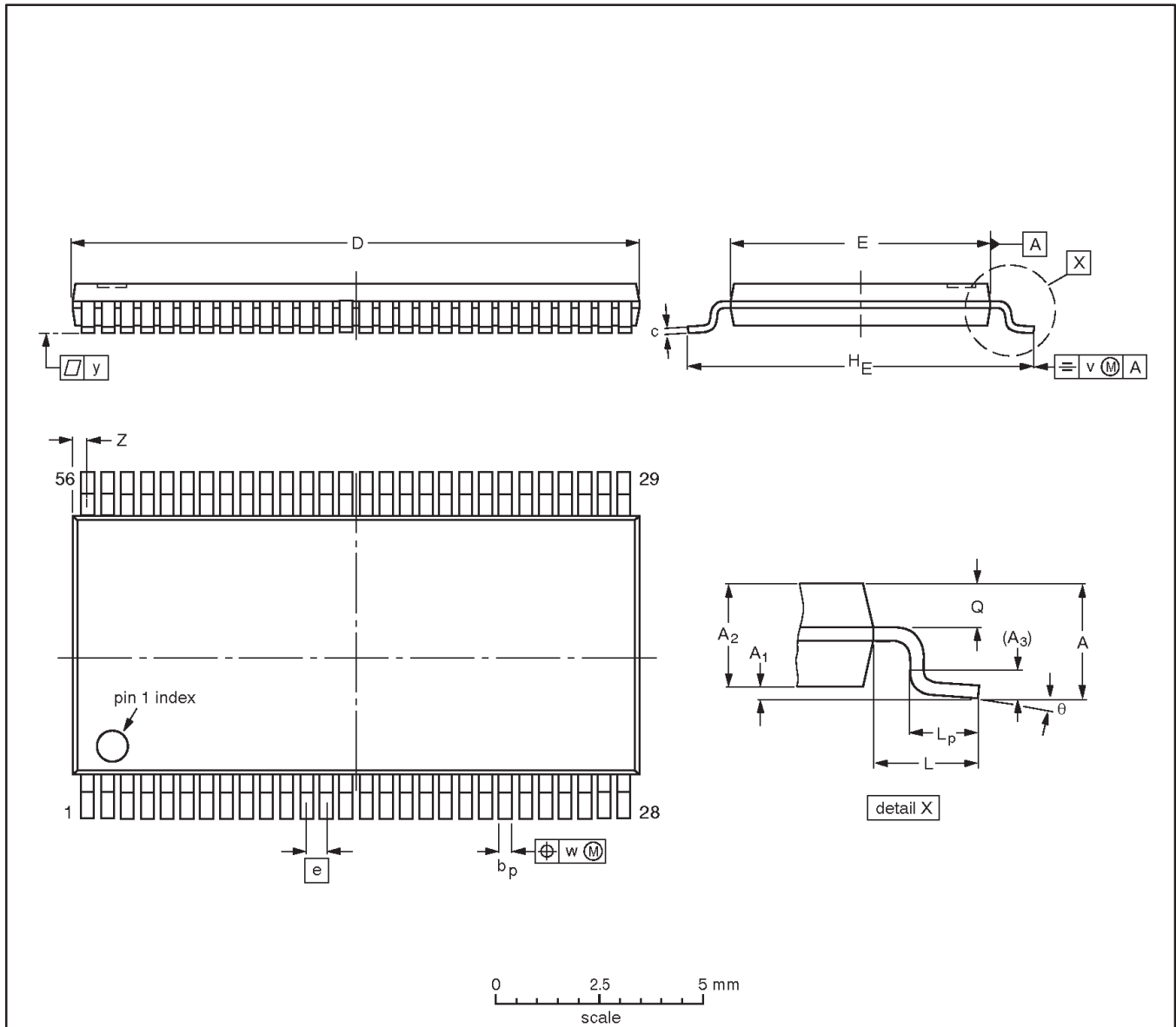
A Dynamic Controlled Output (DCO) circuit is designed in. During the transition, it initially lowers the output impedance to effectively drive the load and, subsequently, raises the impedance to reduce noise. Figures 1 and 2 show V_{OL} vs. I_{OL} and V_{OH} vs. I_{OH} curves to illustrate the output impedance and drive capability of the circuit. At the beginning of the signal transition, the DCO circuit provides a maximum dynamic drive that is equivalent to a high drive standard output device.

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TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm

SOT364-1



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	Z	θ
mm	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	14.1 13.9	6.2 6.0	0.5	8.3 7.9	1.0	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.5 0.1	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

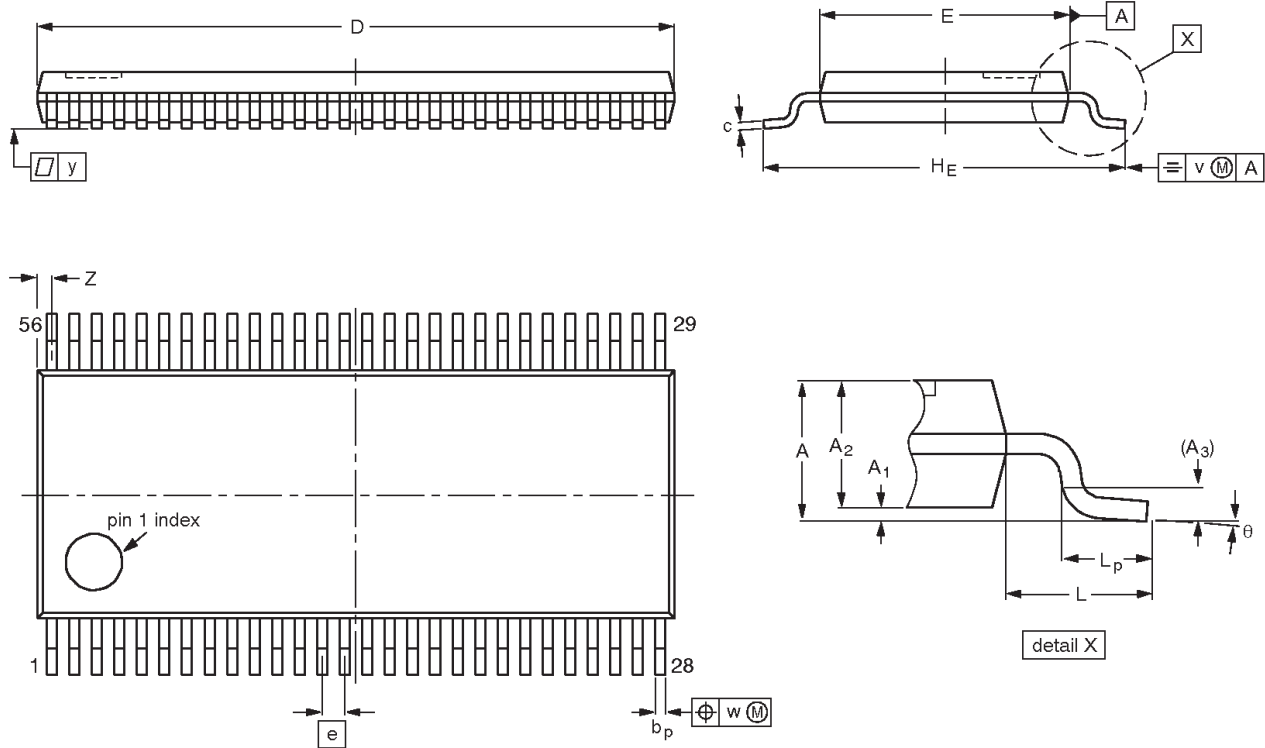
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT364-1		MO-153				95-02-10 99-12-27

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TSSOP56: plastic thin shrink small outline package; 56 leads; body width 4.4 mm

SOT481-2



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D (1)	E (2)	e	H _E	L	L _p	v	w	y	Z (1)	θ
mm	1.2	0.15 0.05	1.05 0.80	0.25	0.23 0.13	0.20 0.09	11.4 11.2	4.5 4.3	0.4	6.6 6.2	1	0.75 0.45	0.2	0.07	0.08	0.4 0.1	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT481-2	---	MO-194	---			01-11-24

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Data sheet status

Data sheet status [1]	Product status [2]	Definitions
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Document order number:

Date of release: 08-02

9397 750 10178

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