

DATA SHEET

74ALVC162836A

20-bit registered driver with inverted register enable and 30Ω termination resistors (3-State)

Product specification
Supersedes data of 2000 Mar 14
IC24 Data Handbook

2000 Jun 20

20-bit registered driver with inverted register enable and 30Ω termination resistors (3-State)

74ALVC162836A

FEATURES

- Wide supply voltage range of 1.2 V to 3.6 V
- Complies with JEDEC standard no. 8-1A.
- CMOS low power consumption
- Direct interface with TTL levels
- Current drive ± 12 mA at 3.0 V
- MULTIBYTE™ flow-through standard pin-out architecture
- Low inductance multiple V_{CC} and GND pins for minimum noise and ground bounce
- Output drive capability 50 Ω transmission lines @ 85°C
- Integrated 30 Ω termination resistors
- Diode clamps to V_{CC} and GND on all inputs
- Input diodes to accommodate strong drivers

DESCRIPTION

The 74ALVC162836A is an 20-bit universal bus driver. Data flow is controlled by output enable (OE), latch enable (LE) and clock inputs (CP).

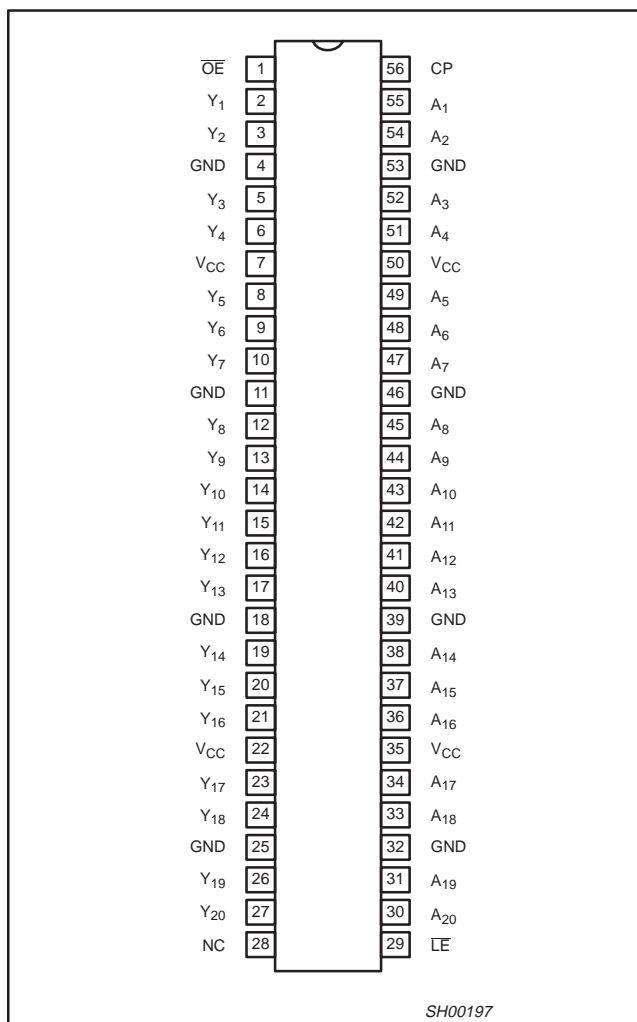
When \overline{LE} is HIGH, the A to Y data flow is transparent. When \overline{LE} is HIGH and CP is held at LOW or HIGH, the data is latched; on the LOW to HIGH transient of CP the A-data is stored in the latch/flip-flop.

The 74ALVC162836A is designed with 30 Ω_{series} resistors in both HIGH or LOW output stages.

When \overline{OE} is LOW the outputs are active. When \overline{OE} is HIGH, the outputs go to the high impedance OFF-state. Operation of the \overline{OE} input does not affect the state of the latch/flip-flop.

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.

PIN CONFIGURATION



QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25°C; t_r = t_f ≤ 2.5ns

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | UNIT | |
|------------------------------------|---|--|---|----------|----|
| t _{PHL} /t _{PLH} | Propagation delay An to Yn; LE to Yn; CP to Yn | V _{CC} = 3.3 V, C _L = 50 pF | 2.9 3.5 3.3 | ns | |
| f _{max} | Maximum clock frequency | V _{CC} = 3.3 V, C _L = 50 pF | 240 | MHz | |
| C _I | Input capacitance | | 4.0 | pF | |
| C _{I/O} | Input/Output capacitance | | 8.0 | pF | |
| C _{PD} | Power dissipation capacitance per buffer | V _I = GND to V _{CC} ¹ | transparent mode Output enabled Output disabled | 10 3 | pF |
| | | | Clocked mode Output enabled Output disabled | 21 15 | |

NOTES:

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.

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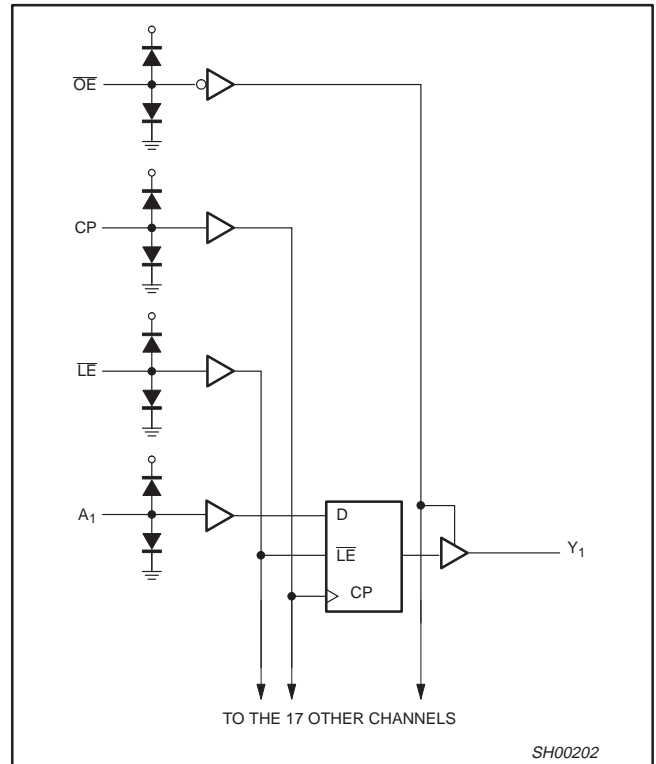
ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | ORDER CODE | DRAWING NUMBER |
|--|-------------------|-------------------|----------------|
| 56-Pin Plastic Thin Shrink Small Outline (TSSOP) Type II | -40°C to +85°C | 74ALVC162836A DGG | SOT364-1 |

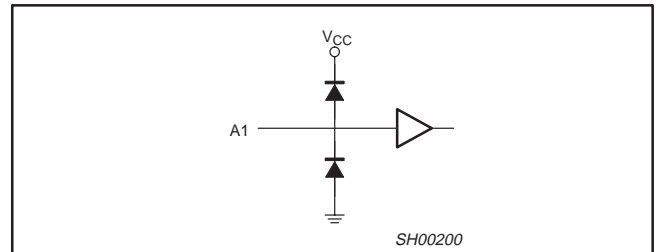
PIN DESCRIPTION

| 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 ₁ to Y ₁₈ | Data outputs |
| 4, 11, 18, 25, 32, 39, 46, 53, 56 | GND | Ground (0V) |
| 7, 22, 35, 50 | V _{CC} | Positive supply voltage |
| 1 | OE | Output enable input (active LOW) |
| 29 | 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 ₁ to A ₁₈ | Data inputs |

LOGIC SYMBOL



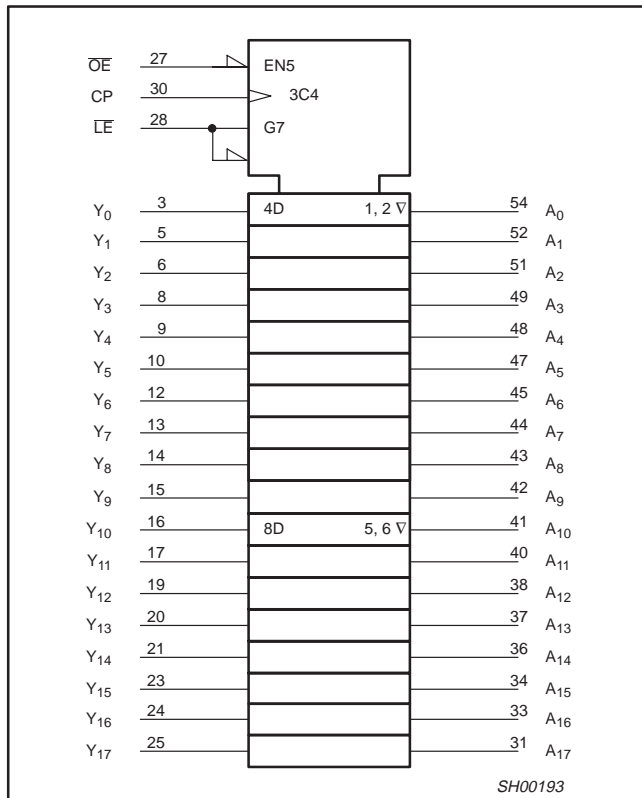
TYPICAL INPUT (DATA OR CONTROL)



20-bit registered driver with inverted register enable and 30Ω termination resistors (3-State)

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LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE

| INPUTS | | | | OUTPUTS Y |
|--------|----|----|---|-----------------------------|
| OE | 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 LE goes low.
2. Output level before the indicated steady-state input conditions were established.

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RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | MIN | MAX | UNIT |
|------------|--|--|--------|----------|------|
| V_{CC} | DC supply voltage 2.5 V range (for max. speed performance @ 30 pF output load) | | 2.3 | 2.7 | V |
| | DC supply voltage 3.3 V range (for max. speed performance @ 50 pF output load) | | 3.0 | 3.6 | |
| | DC supply voltage (for low-voltage applications) | | 1.2 | 3.6 | |
| V_I | DC Input voltage range | | 0 | V_{CC} | V |
| V_O | DC output voltage range | | 0 | V_{CC} | V |
| T_{amb} | Operating free-air temperature range | | -40 | +85 | °C |
| t_r, t_f | Input rise and fall times | $V_{CC} = 2.3$ to 3.0 V $V_{CC} = 3.0$ to 3.6 V | 0 0 | 20 10 | ns/V |

ABSOLUTE MAXIMUM RATINGS

In accordance with the Absolute Maximum Rating System (IEC 134)

Voltages are referenced to GND (ground = 0V)

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|-------------------|---|--|------------------------|------|
| V_{CC} | DC supply voltage | | -0.5 to +4.6 | V |
| I_{IK} | DC input diode current | $V_I \pm 0$ | -50 | mA |
| V_I | DC input voltage | Note 1 | -0.5 to +4.6 | V |
| I_{OK} | DC output diode current | $V_O > V_{CC}$ or $V_O \pm 0$ | ± 50 | mA |
| V_O | DC output voltage | 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 medium-shrink (SSOP) -plastic thin-medium-shrink (TSSOP) | For temperature range: -40 to +125 °C above +55°C derate linearly with 11.3 mW/K above +55°C derate linearly with 8 mW/K | 850 600 | 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} = 2.3 to 2.7 V | 1.7 | 1.2 | | V |
| | | V _{CC} = 2.7 to 3.6 V | 2.0 | 1.5 | | |
| V _{IL} | LOW level Input voltage | V _{CC} = 2.3 to 2.7 V | | 1.2 | 0.7 | V |
| | | V _{CC} = 2.7 to 3.6 V | | 1.5 | 0.8 | |
| V _{OH} | HIGH level output voltage | V _{CC} = 2.3 to 3.6 V; V _I = V _{IH} or V _{IL} ; I _O = -100 μA | V _{CC} - 0.2 | V _{CC} | | V |
| | | V _{CC} = 2.3 V; V _I = V _{IH} or V _{IL} ; I _O = -4 mA | V _{CC} - 0.4 | V _{CC} - 0.11 | | |
| | | V _{CC} = 2.3 V; V _I = V _{IH} or V _{IL} ; I _O = -6 mA | V _{CC} - 0.6 | V _{CC} - 0.17 | | |
| | | V _{CC} = 2.7 V; V _I = V _{IH} or V _{IL} ; I _O = -4 mA | V _{CC} - 0.5 | V _{CC} - 0.09 | | |
| | | V _{CC} = 2.7 V; V _I = V _{IH} or V _{IL} ; I _O = -8 mA | V _{CC} - 0.7 | V _{CC} - 0.19 | | |
| | | V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = -6 mA | V _{CC} - 0.6 | V _{CC} - 0.13 | | |
| | | V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = -12 mA | V _{CC} - 1.0 | V _{CC} - 0.27 | | |
| V _{OL} | LOW level output voltage | V _{CC} = 2.3 to 3.6 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA | | GND | 0.20 | V |
| | | V _{CC} = 2.3 V; V _I = V _{IH} or V _{IL} ; I _O = 4 mA | | 0.07 | 0.40 | |
| | | V _{CC} = 2.3 V; V _I = V _{IH} or V _{IL} ; I _O = 6 mA | | 0.11 | 0.55 | |
| | | V _{CC} = 2.7 V; V _I = V _{IH} or V _{IL} ; I _O = 4 mA | | 0.06 | 0.40 | |
| | | V _{CC} = 2.7 V; V _I = V _{IH} or V _{IL} ; I _O = 8 mA | | 0.13 | 0.60 | |
| | | V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = 6 mA | | 0.09 | 0.55 | |
| | | V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = 12 mA | | 0.19 | 0.80 | |
| I _I | Input leakage current | V _{CC} = 2.3 to 3.6 V; V _I = V _{CC} or GND | | 0.1 | 5 | μA |
| I _{OZ} | 3-State output OFF-state current | V _{CC} = 2.3 to 3.6 V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND | | 0.1 | 10 | μA |
| I _{CC} | Quiescent supply current | V _{CC} = 2.3 to 3.6 V; V _I = V _{CC} or GND; I _O = 0 | | 0.2 | 40 | μA |
| ΔI _{CC} | Additional quiescent supply current | V _{CC} = 2.3 V to 3.6 V; V _I = V _{CC} - 0.6 V; I _O = 0 | | 150 | 750 | μA |

NOTE:

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

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AC CHARACTERISTICS FOR $V_{CC} = 2.3 \text{ V TO } 2.7 \text{ V RANGE}$

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

| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | UNIT |
|-------------------|--|----------|--|------------------|-----|------|
| | | | $V_{CC} = 2.3 \text{ to } 2.7 \text{ V}$ | | | |
| | | | MIN | TYP ¹ | MAX | |
| t_{PHL}/t_{PLH} | Propagation delay An to Yn | 1, 7 | 1.0 | 3.5 | 4.4 | ns |
| | Propagation delay \overline{LE} to Yn | 2, 7 | 1.1 | 3.5 | 5.0 | |
| | Propagation delay CP to Yn | 4, 7 | 1.0 | 3.7 | 5.4 | |
| t_{PZH}/t_{PZL} | 3-State output enable time \overline{OE} to Yn | 6, 7 | 1.1 | 3.5 | 5.0 | ns |
| t_{PHZ}/t_{PLZ} | 3-State output disable time \overline{OE} to Yn | 6, 7 | 1.0 | 2.8 | 4.5 | ns |
| t_w | CP pulse width HIGH or LOW | 4, 7 | 3.3 | 1.0 | – | ns |
| | \overline{LE} pulse width HIGH | 2, 7 | 3.3 | 0.7 | – | |
| t_{SU} | Set-up time An to CP | 5, 7 | 1.0 | – | – | ns |
| | Set-up time An to \overline{LE} | 3, 7 | 1.5 | – | – | |
| t_h | Hold time An to CP | 3, 7 | 1.0 | 0.4 | – | ns |
| | Hold time An to \overline{LE} | 3, 7 | 0.5 | 0.1 | – | |
| f_{max} | Maximum clock pulse frequency | 4, 7 | 150 | 190 | – | MHz |

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

AC CHARACTERISTICS FOR $V_{CC} = 3.0 \text{ V TO } 3.6 \text{ V RANGE AND } V_{CC} = 2.7 \text{ V}$

GND = 0 V; $t_r = t_f \leq 2.5 \text{ ns}$; $C_L = 50 \text{ pF}$

| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | LIMITS | | | UNIT |
|-------------------|--|----------|----------------------------------|---------------------|-----|--------------------------|------------------|-----|------|
| | | | $V_{CC} = 3.3 \pm 0.3 \text{ V}$ | | | $V_{CC} = 2.7 \text{ V}$ | | | |
| | | | MIN | TYP ^{1, 2} | MAX | MIN | TYP ¹ | MAX | |
| t_{PHL}/t_{PLH} | Propagation delay An to Yn | 1, 7 | 1.2 | 2.8 | 4.3 | – | 3.3 | 4.6 | ns |
| | Propagation delay \overline{LE} to Yn | 2, 7 | 1.4 | 2.8 | 4.4 | – | 3.4 | 4.8 | |
| | Propagation delay CP to Yn | 4, 7 | 1.1 | 3.2 | 4.9 | – | 3.8 | 5.2 | |
| t_{PZH}/t_{PZL} | 3-State output enable time \overline{OE} to Yn | 6, 7 | 1.2 | 2.7 | 4.5 | – | 3.7 | 5.0 | ns |
| t_{PHZ}/t_{PLZ} | 3-State output disable time \overline{OE} to Yn | 6, 7 | 1.7 | 3.4 | 4.8 | – | 3.5 | 4.9 | ns |
| t_w | CP pulse width HIGH or LOW | 4, 7 | 3.3 | 0.7 | – | 3.3 | 1.2 | – | ns |
| | \overline{LE} pulse width HIGH | 2, 7 | 3.3 | 0.6 | – | 3.3 | 0.6 | – | |
| t_{SU} | Set-up time An to CP | 5, 7 | 1.0 | – | – | 1.0 | – | – | ns |
| | Set-up time An to \overline{LE} | 3, 7 | 1.5 | – | – | 1.5 | – | – | |
| t_h | Hold time An to CP | 3, 7 | 1.2 | 1.2 | – | 1.2 | 0.4 | – | ns |
| | Hold time An to \overline{LE} | 3, 7 | 1.0 | 0.4 | – | 1.0 | 0.1 | – | |
| f_{max} | Maximum clock pulse frequency | 4, 7 | 150 | 240 | – | 150 | 190 | – | MHz |

NOTES:1. All typical values are measured $T_{amb} = 25^\circ\text{C}$.2. Typical value is measured at $V_{CC} = 3.3 \text{ V}$.

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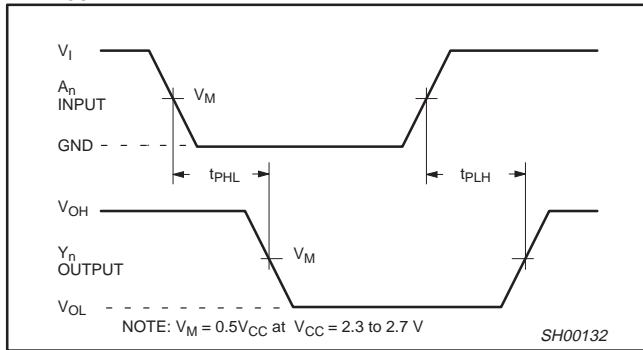
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AC WAVEFORMS FOR $V_{CC} = 3.0\text{ V TO } 3.6\text{ V AND } V_{CC} = 2.7\text{ V RANGE}$

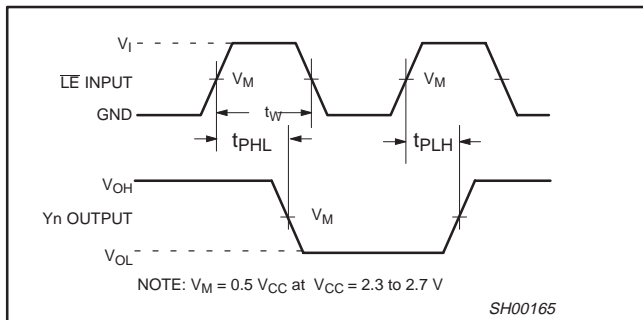
$V_M = 1.5\text{ V}$
 $V_X = V_{OL} + 0.3\text{ V}$
 $V_Y = V_{OH} - 0.3\text{ V}$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_I = 2.7\text{ V}$

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

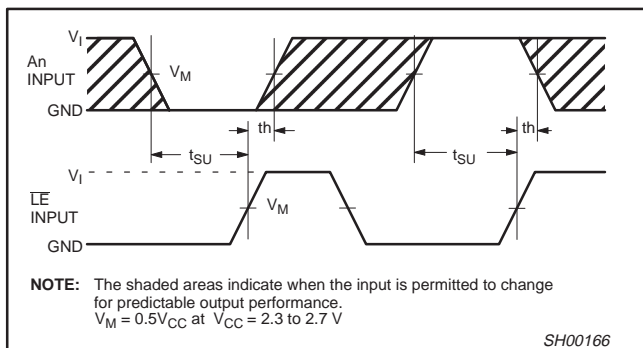
$V_M = 0.5 V_{CC}$
 $V_X = V_{OL} + 0.15\text{ V}$
 $V_Y = V_{OH} - 0.15\text{ V}$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_I = V_{CC}$



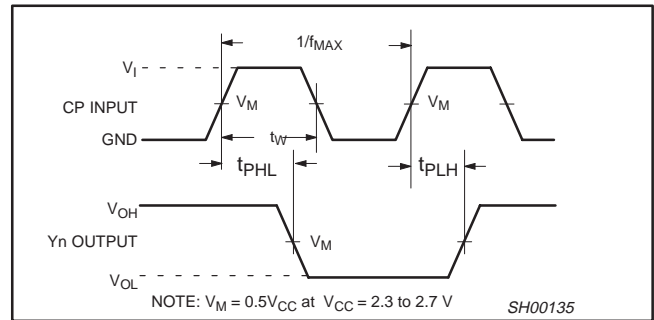
Waveform 1. Input (Dn) to output (Yn) propagation delay



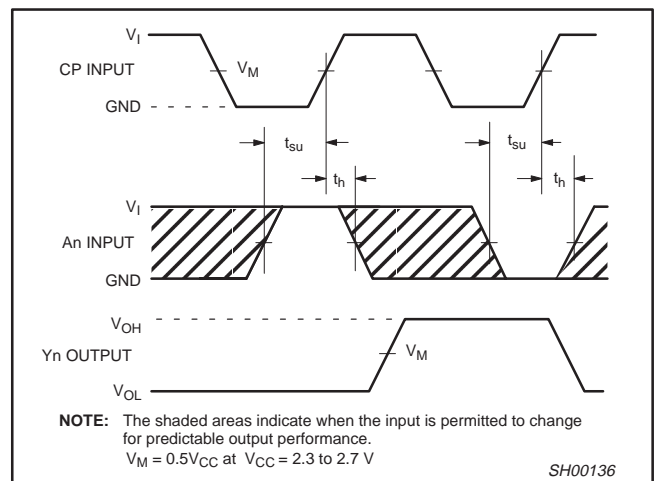
Waveform 2. Latch enable input (LE) pulse width, the latch enable input to output (Yn) propagation delays.



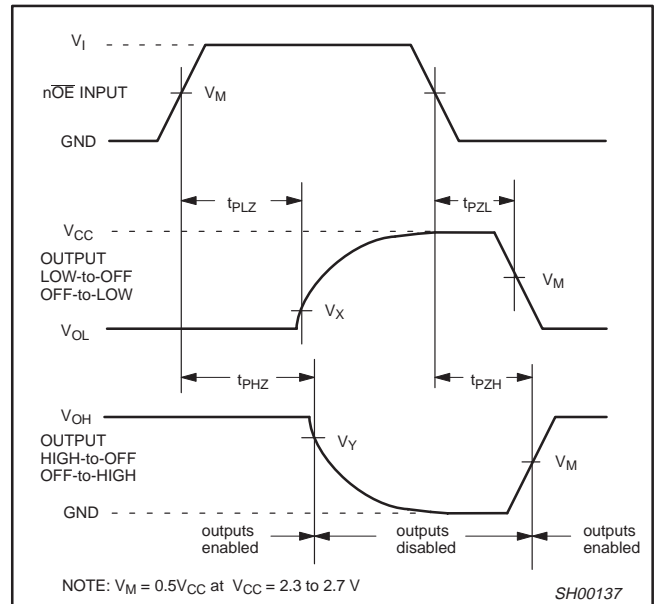
Waveform 3. Data set-up and hold times for the An input to the LE input



Waveform 4. The clock (CP) to Yn propagation delays, the clock pulse width and the maximum clock frequency.



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

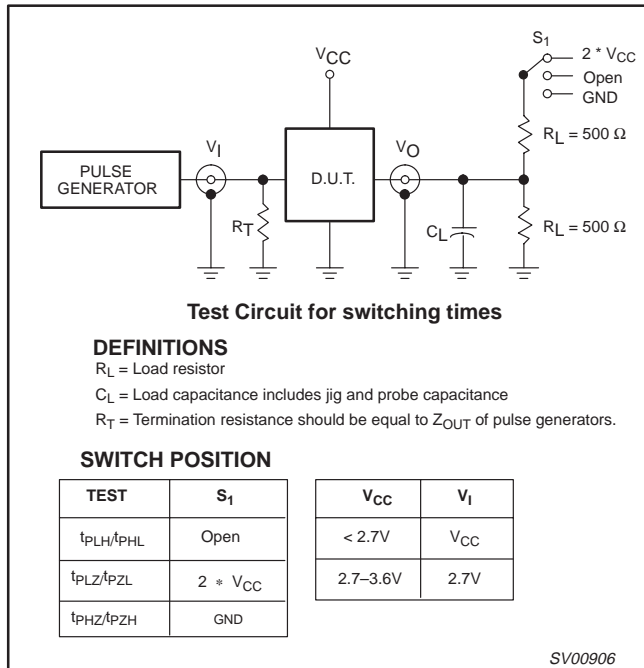


Waveform 6. 3-State enable and disable times

20-bit registered driver with inverted register enable and 30Ω termination resistors (3-State)

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TEST CIRCUIT



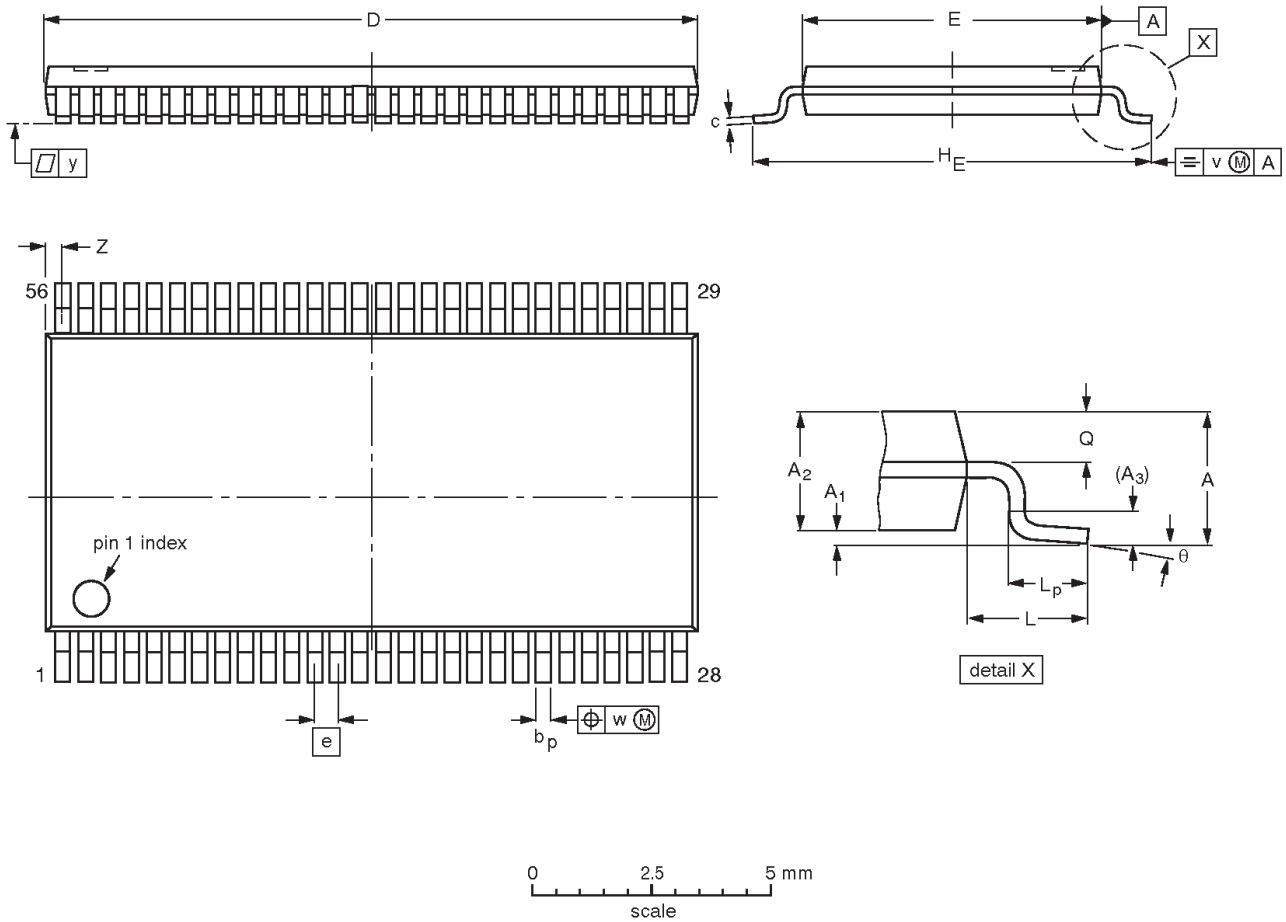
Waveform 7. Load circuitry for switching times

20-bit registered driver with inverted register enable
and 30Ω termination resistors (3-State)

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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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and 30Ω termination resistors (3-State)

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NOTES

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Data sheet status

| Data sheet status | Product status | Definition [1] |
|---------------------------|----------------|--|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
| Preliminary specification | Qualification | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| Product specification | Production | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |

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

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 134). 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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