

# DATA SHEET

## **74ALVCH16825** 18-bit buffer/driver (3-State)

Product specification

1998 Jul 27

IC24 Data Handbook

## 18-bit buffer/driver (3-State)

## 74ALVCH16825

## FEATURES

- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A.
- CMOS low power consumption
- Direct interface with TTL levels
- Current drive  $\pm 24$  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
- All data inputs have bus hold
- Output drive capability 50 $\Omega$  transmission lines @ 85°C

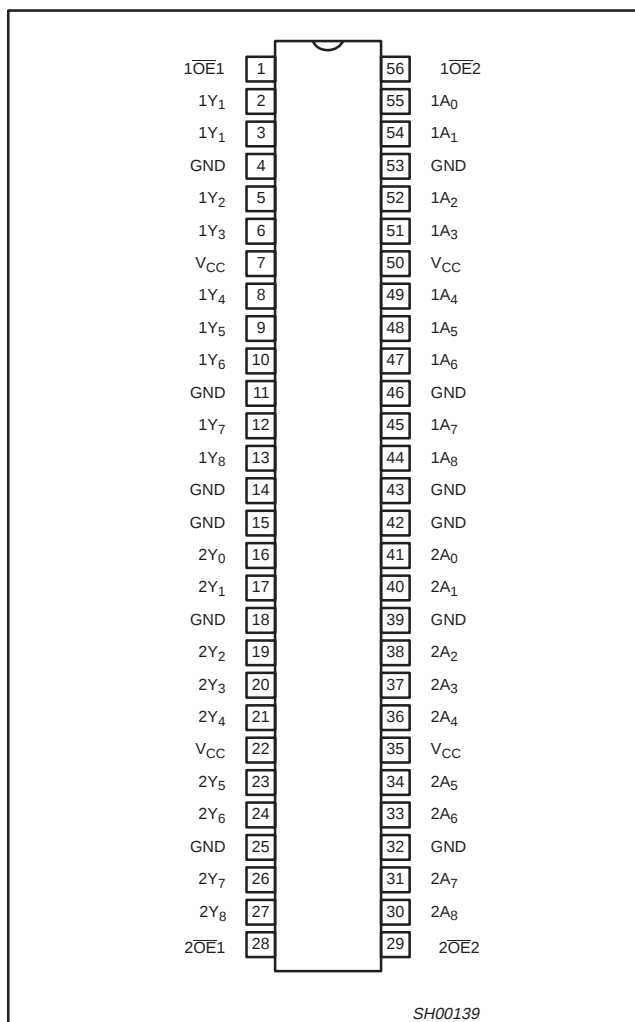
## DESCRIPTION

The 74ALVCH16825 is an 18-bit non-inverting buffer/driver with 3-State outputs for bus-oriented applications.

The 74ALVCH16825 consists of two 9-bit sections with separate output enable signals. For either 9-bit buffer section, the two output enable ( $1\overline{OE}1$  and  $1\overline{OE}2$  or  $2\overline{OE}1$  and  $2\overline{OE}2$ ) inputs must both be LOW for corresponding D outputs to be active. If either output enable input is HIGH, the outputs of that 9-buffer section are in the high impedance state.

The 74ALVCH16825 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

## PIN CONFIGURATION



## QUICK REFERENCE DATA

GND = 0V;  $T_{amb} = 25^{\circ}\text{C}$ ;  $t_r = t_f \leq 2.5\text{ns}$

| SYMBOL            | PARAMETER                               | CONDITIONS                                                                                   | TYPICAL                           | UNIT    |
|-------------------|-----------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------|---------|
| $t_{PHL}/t_{PLH}$ | Propagation delay<br>CP to Qn           | $V_{CC} = 2.5\text{V}$ , $C_L = 30\text{pF}$<br>$V_{CC} = 3.3\text{V}$ , $C_L = 50\text{pF}$ | 2.0<br>2.0                        | ns      |
| $C_i$             | Input capacitance                       |                                                                                              | 4.0                               | pF      |
| $C_{PD}$          | Power dissipation capacitance per latch | $V_i = \text{GND to } V_{CC}^1$                                                              | Output enabled<br>Output disabled | 19<br>3 |
|                   |                                         |                                                                                              |                                   | pF      |

## NOTES:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  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                              | OUTSIDE NORTH AMERICA | NORTH AMERICA | DRAWING NUMBER |
|----------------------------------------------------------|------------------------------------------------|-----------------------|---------------|----------------|
| 56-Pin Plastic Thin Shrink Small Outline (TSSOP) Type II | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ | 74ALVCH16825 DGG      | ACH16825 DGG  | SOT364-1       |

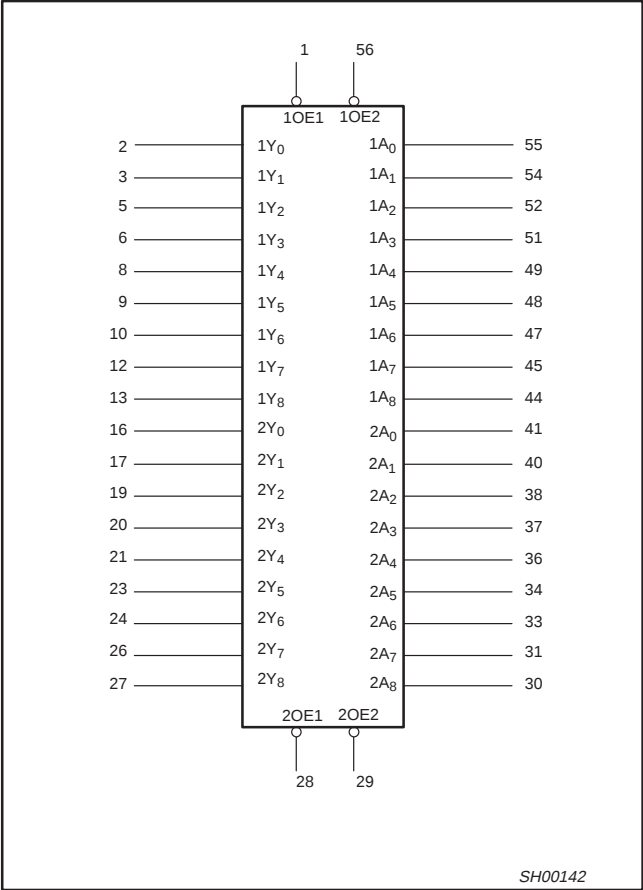
18-bit buffer/driver (3-State)

74ALVCH16825

PIN DESCRIPTION

| PIN NUMBER                                       | SYMBOL          | NAME AND FUNCTION                   |
|--------------------------------------------------|-----------------|-------------------------------------|
| 1                                                | 1OE1            | Output enable input<br>(active LOW) |
| 56                                               | 1OE2            |                                     |
| 55, 54, 52, 51, 49,<br>48, 47, 45, 44            | 1A0 to 1A8      | Data inputs                         |
| 2, 3, 5, 6, 8,<br>9, 10, 12, 13                  | 1Y0 to 1Y8      | Data outputs                        |
| 4, 11, 14, 15, 18, 25,<br>32, 39, 42, 43, 46, 53 | GND             | Ground (0V)                         |
| 7, 22, 35, 50                                    | V <sub>CC</sub> | Positive supply voltage             |
| 28                                               | 2OE1            | Output enable input<br>(active LOW) |
| 29                                               | 2OE2            |                                     |
| 43, 42, 41, 40, 38,<br>37, 36, 34, 33, 31        | 2A0 to 2A8      | Data inputs                         |
| 16, 17, 19, 20, 21,<br>23, 24, 26, 27            | 2Y0 to 2Y8      | Data outputs                        |

LOGIC SYMBOL

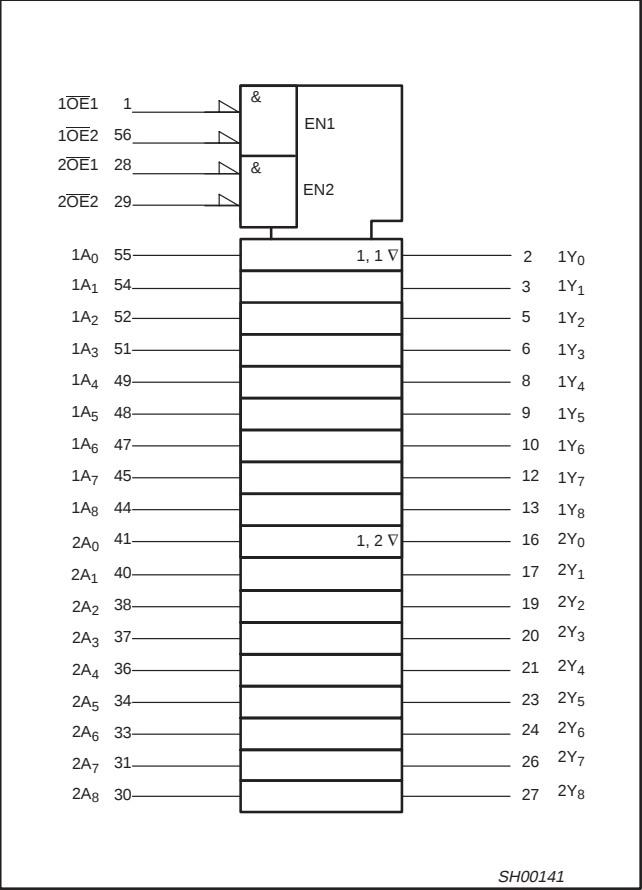


FUNCTION TABLE

| INPUTS |      |   | OUTPUT<br>Y |
|--------|------|---|-------------|
| nOE1   | nOE2 | A |             |
| L      | L    | L | L           |
| L      | L    | H | H           |
| H      | X    | X | Z           |
| X      | H    | X | Z           |

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

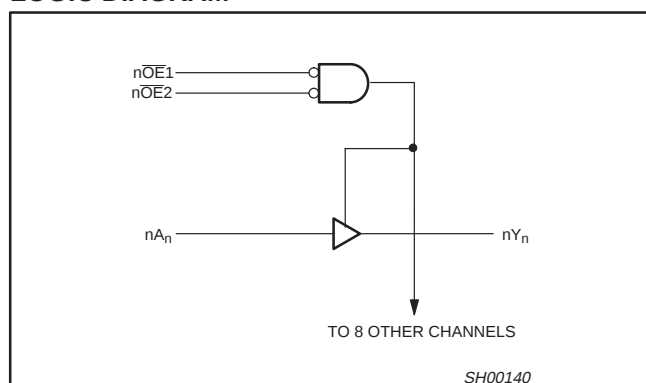
LOGIC SYMBOL (IEEE/IEC)



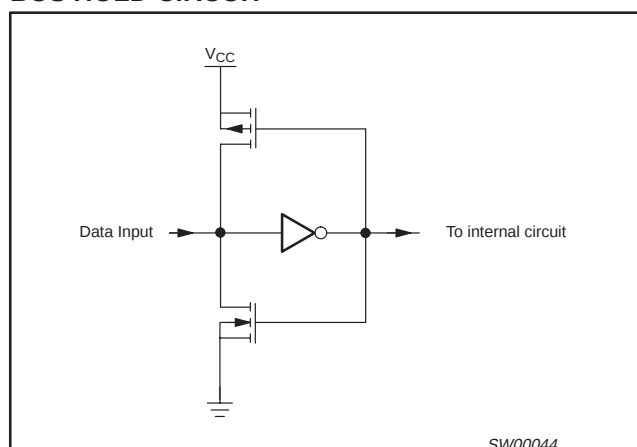
## 18-bit buffer/driver (3-State)

74ALVCH16825

## LOGIC DIAGRAM



## BUS HOLD CIRCUIT



## RECOMMENDED OPERATING CONDITIONS

| SYMBOL     | PARAMETER                                                                     | CONDITIONS                             | MIN | MAX      | UNIT |
|------------|-------------------------------------------------------------------------------|----------------------------------------|-----|----------|------|
| $V_{CC}$   | DC supply voltage 2.5V range (for max. speed performance @ 30 pF output load) |                                        | 2.3 | 2.7      | V    |
|            | DC supply voltage 3.3V range (for max. speed performance @ 50 pF output load) |                                        | 3.0 | 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                                                     | $V_{CC} = 2.3 \text{ to } 3.0\text{V}$ | 0   | 20       | ns/V |
|            |                                                                               | $V_{CC} = 3.0 \text{ to } 3.6\text{V}$ | 0   | 10       |      |

## 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                                               | $V_I < 0$                                                                                                                      | -50                    | mA   |
| $V_I$             | DC input voltage                                                     | For control pins <sup>2</sup>                                                                                                  | -0.5 to +4.6           | V    |
|                   |                                                                      | For data inputs <sup>2</sup>                                                                                                   | -0.5 to $V_{CC} + 0.5$ |      |
| $I_{OK}$          | DC output diode current                                              | $V_O > V_{CC}$ or $V_O < 0$                                                                                                    | ± 50                   | mA   |
| $V_O$             | DC output voltage                                                    | Note 2                                                                                                                         | -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                                        | For temperature range: -40 to +125 °C<br>above +55°C derate linearly with 11.3 mW/K<br>above +55°C derate linearly with 8 mW/K | 850                    | mW   |
|                   | —plastic medium-shrink (SSOP)<br>—plastic thin-medium-shrink (TSSOP) |                                                                                                                                | 600                    |      |

## NOTE:

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

## 18-bit buffer/driver (3-State)

## 74ALVCH16825

## 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 <sup>1</sup>       | MAX  |      |
| V <sub>IH</sub>                | HIGH level Input voltage            | V <sub>CC</sub> = 2.3 to 2.7V                                                                                                   | 1.7                   | 1.2                    |      | V    |
|                                |                                     | V <sub>CC</sub> = 2.7 to 3.6V                                                                                                   | 2.0                   | 1.5                    |      |      |
| V <sub>IL</sub>                | LOW level Input voltage             | V <sub>CC</sub> = 2.3 to 2.7V                                                                                                   |                       | 1.2                    | 0.7  | V    |
|                                |                                     | V <sub>CC</sub> = 2.7 to 3.6V                                                                                                   |                       | 1.5                    | 0.8  |      |
| V <sub>OH</sub>                | HIGH level output voltage           | V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100μA                    | V <sub>CC</sub> - 0.2 | V <sub>CC</sub>        |      | V    |
|                                |                                     | V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -6mA                             | V <sub>CC</sub> - 0.3 | V <sub>CC</sub> - 0.08 |      |      |
|                                |                                     | V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA                            | V <sub>CC</sub> - 0.6 | V <sub>CC</sub> - 0.26 |      |      |
|                                |                                     | V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA                            | V <sub>CC</sub> - 0.5 | V <sub>CC</sub> - 0.14 |      |      |
|                                |                                     | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA                            | V <sub>CC</sub> - 0.6 | V <sub>CC</sub> - 0.09 |      |      |
|                                |                                     | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA                            | V <sub>CC</sub> - 1.0 | V <sub>CC</sub> - 0.28 |      |      |
| V <sub>OL</sub>                | LOW level output voltage            | V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100μA                     |                       | GND                    | 0.20 | V    |
|                                |                                     | V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 6mA                              |                       | 0.07                   | 0.40 | V    |
|                                |                                     | V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA                             |                       | 0.15                   | 0.70 | V    |
|                                |                                     | V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA                             |                       | 0.14                   | 0.40 |      |
|                                |                                     | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA                             |                       | 0.27                   | 0.55 |      |
| I <sub>I</sub>                 | Input leakage current               | V <sub>CC</sub> = 2.3 to 3.6V;<br>V <sub>I</sub> = V <sub>CC</sub> or GND                                                       |                       | 0.1                    | 5    | μA   |
| I <sub>OZ</sub>                | 3-State output OFF-state current    | V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND |                       | 0.1                    | 10   | μA   |
| I <sub>CC</sub>                | Quiescent supply current            | V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0                                      |                       | 0.2                    | 40   | μA   |
| ΔI <sub>CC</sub>               | Additional quiescent supply current | V <sub>CC</sub> = 2.3V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0                                     |                       | 150                    | 750  | μA   |
| I <sub>BHL</sub> <sup>2</sup>  | Bus hold LOW sustaining current     | V <sub>CC</sub> = 2.3V; V <sub>I</sub> = 0.7V                                                                                   | 45                    | —                      |      | μA   |
|                                |                                     | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = 0.8V                                                                                   | 75                    | 150                    |      |      |
| I <sub>BHH</sub> <sup>2</sup>  | Bus hold HIGH sustaining current    | V <sub>CC</sub> = 2.3V; V <sub>I</sub> = 1.7V                                                                                   | -45                   |                        |      | μA   |
|                                |                                     | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = 2.0V                                                                                   | -75                   | -175                   |      |      |
| I <sub>BHLO</sub> <sup>2</sup> | Bus hold LOW overdrive current      | V <sub>CC</sub> = 3.6V                                                                                                          | 500                   |                        |      | μA   |
| I <sub>BHHO</sub> <sup>2</sup> | Bus hold HIGH overdrive current     | V <sub>CC</sub> = 3.6V                                                                                                          | -500                  |                        |      | μA   |

## NOTES:

1. All typical values are at T<sub>amb</sub> = 25°C.
2. Valid for data inputs of bus hold parts.

## 18-bit buffer/driver (3-State)

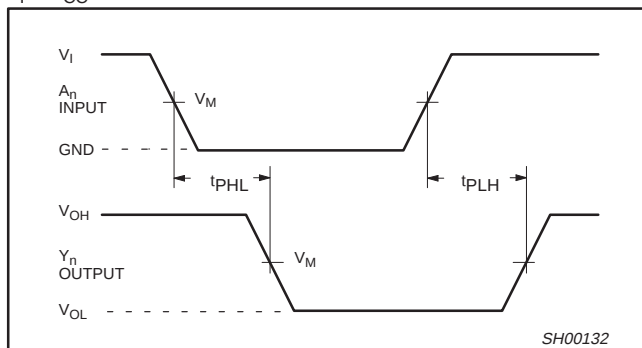
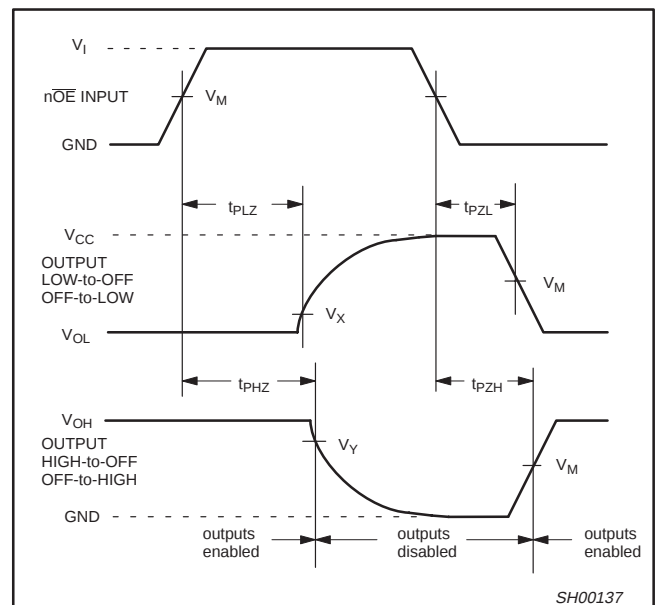
74ALVCH16825

**AC CHARACTERISTICS FOR  $V_{CC} = 2.3V$  TO  $2.7V$  RANGE**GND = 0V;  $t_r = t_f \leq 2.0ns$ ;  $C_L = 30pF$ 

| SYMBOL                             | PARAMETER                                                 | WAVEFORM | LIMITS                        |                  |     | UNIT |
|------------------------------------|-----------------------------------------------------------|----------|-------------------------------|------------------|-----|------|
|                                    |                                                           |          | V <sub>CC</sub> = 2.3 to 2.7V |                  |     |      |
|                                    |                                                           |          | MIN                           | TYP <sup>1</sup> | MAX |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | Propagation delay<br>nAn to nYn                           | 1, 3     | 1.0                           | 2.0              | 4.1 | ns   |
| t <sub>PZH</sub> /t <sub>PZL</sub> | 3-State output enable time<br>n $\overline{OE}$ n to nYn  | 2, 3     | 1.0                           | 2.9              | 6.0 | ns   |
| t <sub>PHZ</sub> /t <sub>PLZ</sub> | 3-State output disable time<br>n $\overline{OE}$ n to nYn | 2,3      | 1.2                           | 2.2              | 5.6 | ns   |

**NOTE:**1. All typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ C$ .**AC CHARACTERISTICS FOR  $V_{CC} = 3.0V$  TO  $3.6V$  RANGE AND  $V_{CC} = 2.7V$** GND = 0V;  $t_r = t_f \leq 2.5ns$ ;  $C_L = 50pF$ 

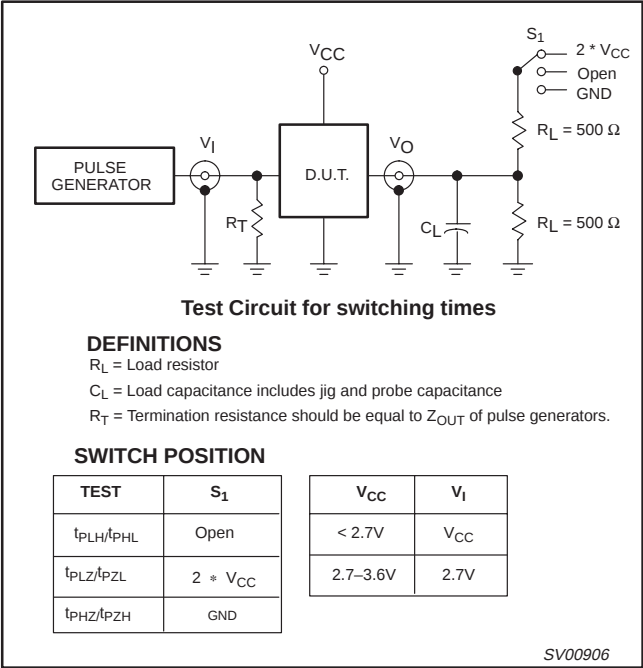
| SYMBOL                             | PARAMETER                                                 | WAVEFORM | LIMITS                       |                     |     | LIMITS                 |                  |     | UNIT |
|------------------------------------|-----------------------------------------------------------|----------|------------------------------|---------------------|-----|------------------------|------------------|-----|------|
|                                    |                                                           |          | V <sub>CC</sub> = 3.3 ± 0.3V |                     |     | V <sub>CC</sub> = 2.7V |                  |     |      |
|                                    |                                                           |          | MIN                          | TYP <sup>1, 2</sup> | MAX | MIN                    | TYP <sup>1</sup> | MAX |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | Propagation delay<br>nAn to nYn                           | 1, 3     | 1.0                          | 2.0                 | 3.4 | 1.0                    | 2.1              | 3.9 | ns   |
| t <sub>PZH</sub> /t <sub>PZL</sub> | 3-State output enable time<br>n $\overline{OE}$ n to nYn  | 2, 3     | 1.0                          | 2.8                 | 4.7 | 1.0                    | 2.9              | 5.7 | ns   |
| t <sub>PHZ</sub> /t <sub>PLZ</sub> | 3-State output disable time<br>n $\overline{OE}$ n to nYn | 2, 3     | 1.3                          | 2.9                 | 4.5 | 1.3                    | 3.0              | 4.9 | ns   |

**NOTES:**1. All typical values are measured  $T_{amb} = 25^\circ C$ .2. Typical value is measured at  $V_{CC} = 3.3V$ **AC WAVEFORMS FOR  $V_{CC} = 2.3V$  TO  $2.7V$  AND  $V_{CC} < 2.3V$  RANGE** $V_M = 0.5 V_{CC}$  $V_X = V_{OL} + 0.15V$  $V_Y = V_{OH} - 0.15V$  $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.**AC WAVEFORMS FOR  $V_{CC} = 3.0V$  TO  $3.6V$  AND  $V_{CC} = 2.7V$  RANGE** $V_M = 1.5 V$  $V_X = V_{OL} + 0.3V$  $V_Y = V_{OH} - 0.3V$  $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load. $V_I = 2.7V$  $V_I = V_{CC}$ **Waveform 1. Input (Dn) to output (Yn) propagation delay****Waveform 2. 3-State enable and disable times**

18-bit buffer/driver (3-State)

74ALVCH16825

TEST CIRCUIT



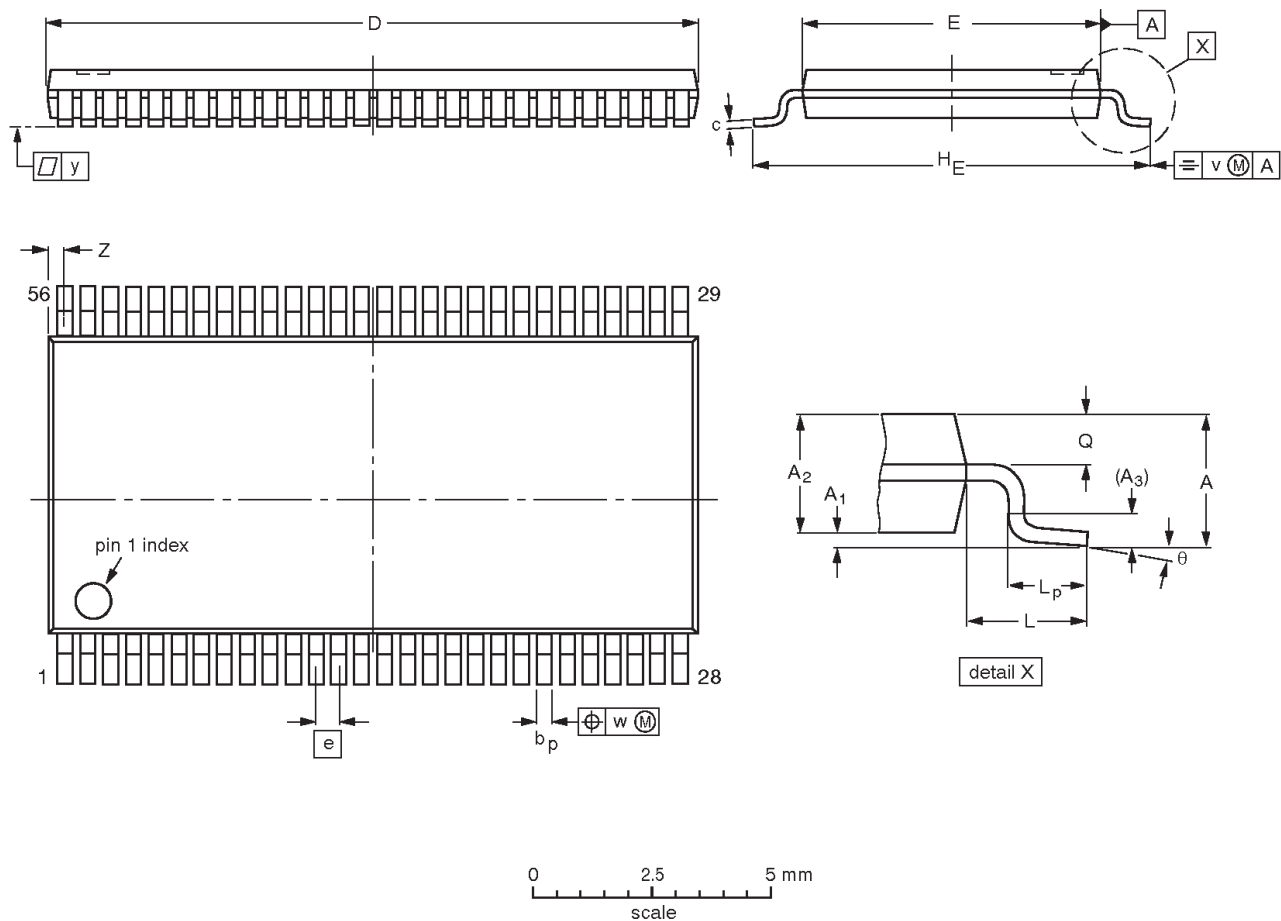
Waveform 3. Load circuitry for switching times

18-bit buffer/driver (3-State)

74ALVCH16825

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

SOT364-1



DIMENSIONS (mm are the original dimensions).

| UNIT | A<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c          | D <sup>(1)</sup> | E <sup>(2)</sup> | e   | H <sub>E</sub> | L   | L <sub>p</sub> | Q            | v    | w    | y   | Z          | θ        |
|------|-----------|----------------|----------------|----------------|----------------|------------|------------------|------------------|-----|----------------|-----|----------------|--------------|------|------|-----|------------|----------|
| mm   | 1.2       | 0.15<br>0.05   | 1.05<br>0.85   | 0.25           | 0.28<br>0.17   | 0.2<br>0.1 | 14.1<br>13.9     | 6.2<br>6.0       | 0.5 | 8.3<br>7.9     | 1.0 | 0.8<br>0.4     | 0.50<br>0.35 | 0.25 | 0.08 | 0.1 | 0.5<br>0.1 | 8°<br>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<br>VERSION | REFERENCES |          |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE                      |
|--------------------|------------|----------|------|--|------------------------|---------------------------------|
|                    | IEC        | JEDEC    | EIAJ |  |                        |                                 |
| SOT364-1           |            | MO-153EE |      |  |                        | <del>93-02-03</del><br>95-02-10 |

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**18-bit buffer/driver (3-State)****74ALVCH16825**

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**NOTES**

## 18-bit buffer/driver (3-State)

74ALVCH16825

## 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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