

- **Functionally Equivalent to AMD's AM29821 and AM29822**
- **Provides Extra Data Width Necessary for Wider Address/Data Paths or Buses with Parity**
- **Outputs Have Undershoot Protection Circuitry**
- **Power-Up High-Impedance State**
- **Package Options Include Both Plastic and Ceramic Carriers in Addition to Plastic and Ceramic DIPs**
- **Buffered Control Inputs to Reduce DC Loading Effects**
- **Dependable Texas Instruments Quality and Reliability**

**description**

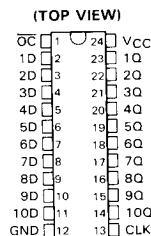
These 10-bit flip-flops feature three-state outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

The ten flip-flops are edge-triggered D-type flip-flops. On the positive transition of the clock the Q outputs on the 'ALS29821 will be true, and on the 'ALS29822 will be complementary to the data input.

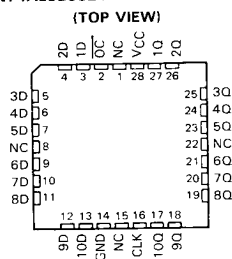
A buffered output-control ( $\overline{OC}$ ) input can be used to place the ten outputs in either a normal logic state (high or low levels) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive the bus lines in a bus-organized system without need for interface or pull-up components. The output control does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54' family is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74' family is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

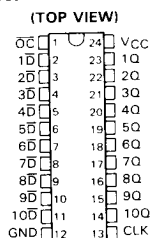
SN54ALS29821 . . . JT PACKAGE  
SN74ALS29821 . . . DW OR NT PACKAGE



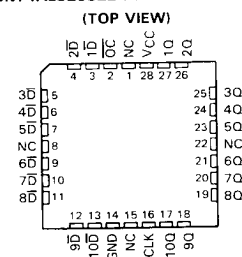
SN54ALS29821 . . . FK PACKAGE  
SN74ALS29821 . . . FN PACKAGE



SN54ALS29822 . . . JT PACKAGE  
SN74ALS29822 . . . DW OR NT PACKAGE



SN54ALS29822 . . . FK PACKAGE  
SN74ALS29822 . . . FN PACKAGE



NC—No internal connection

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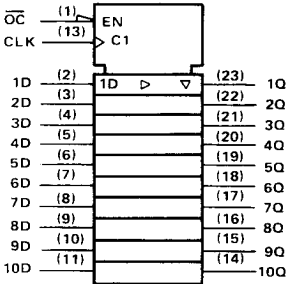
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SN54ALS29821, SN74ALS29821  
10-BIT BUS INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

'ALS29821 FUNCTION TABLE (EACH FLIP-FLOP)

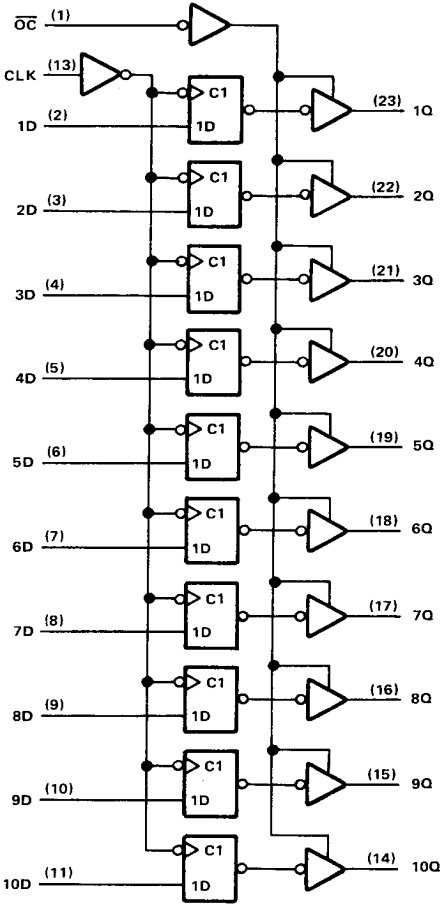
| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| OC     | CLK | D | Q              |
| L      | 1   | H | H              |
| L      | 1   | L | L              |
| L      | L   | X | Q <sub>O</sub> |
| H      | X   | X | Z              |

'ALS29821 logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for DW, JT, and NT packages.

'ALS29821 logic diagram (positive logic)



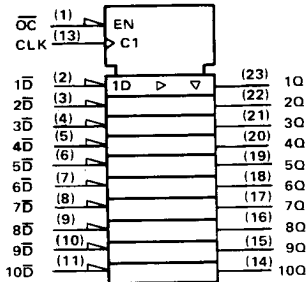
Pin numbers shown are for DW, JT, and NT packages.

# SN54ALS29822, SN74ALS29822 10-BIT BUS INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

'ALS29822 FUNCTION TABLE (EACH FLIP-FLOP)

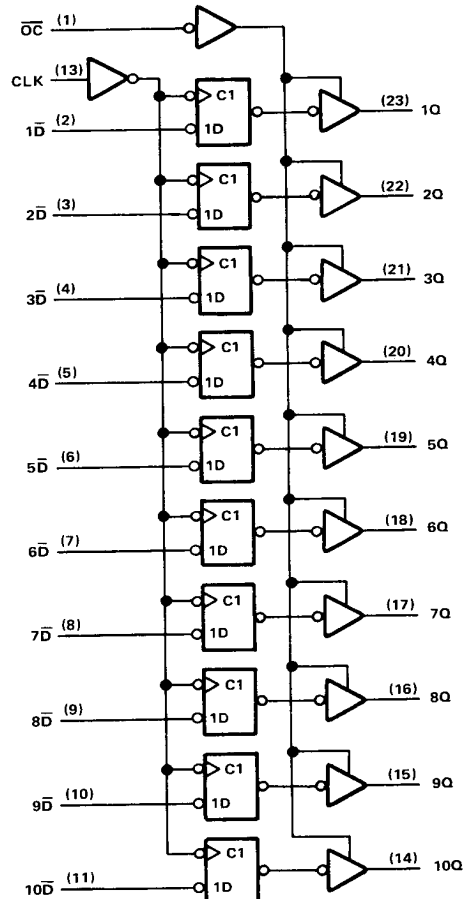
| INPUTS          |     |                | OUTPUT |
|-----------------|-----|----------------|--------|
| $\overline{OC}$ | CLK | $\overline{D}$ | Q      |
| L               | ↑   | H              | L      |
| L               | ↑   | L              | H      |
| L               | L   | X              | $Q_0$  |
| H               | X   | X              | Z      |

'ALS29822 logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for DW, JT, and NT packages.

'ALS29822 logic diagram (positive logic)



Pin numbers shown are for DW, JT, and NT packages.

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ALS and AS Circuits

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2-941

# SN54ALS29821, SN54ALS29822, SN74ALS29821, SN74ALS29822

## 10-BIT BUS INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                                                  |                |
|------------------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$                                         | 7 V            |
| Input voltage                                                    | 5.5 V          |
| Voltage applied to a disabled 3-state output                     | 5.5 V          |
| Input current                                                    | 100 mA         |
| Output current                                                   | –30 mA to 5 mA |
| Operating free-air temperature range: SN54ALS29821, SN54ALS29822 | –55°C to 125°C |
| SN74ALS29821, SN74ALS29822                                       | 0°C to 70°C    |
| Storage temperature range                                        | –65°C to 150°C |

2

recommended operating conditions

|          |                                 | SN54ALS29821<br>SN54ALS29822 |     |     | SN74ALS29821<br>SN74ALS29822 |     |      | UNIT |
|----------|---------------------------------|------------------------------|-----|-----|------------------------------|-----|------|------|
|          |                                 | MIN                          | NOM | MAX | MIN                          | NOM | MAX  |      |
| $V_{CC}$ | Supply voltage                  | 4.5                          | 5   | 5.5 | 4.75                         | 5   | 5.25 | V    |
| $V_{IH}$ | High-level input voltage        | 2                            |     |     | 2                            |     |      | V    |
| $V_{IL}$ | Low-level input voltage         |                              |     | 0.7 |                              |     | 0.8  | V    |
| $I_{OH}$ | High-level output current       |                              |     | –15 |                              |     | –24  | mA   |
| $I_{OL}$ | Low-level output current        |                              |     | 32  |                              |     | 48   | mA   |
| $t_w$    | Pulse duration, CLK high or low |                              |     |     |                              |     |      | ns   |
| $t_{su}$ | Setup time, data before CLK↑    |                              |     |     |                              |     |      | ns   |
| $t_h$    | Hold time, data after CLK↑      |                              |     |     |                              |     |      | ns   |
| $T_A$    | Operating free-air temperature  | –55                          |     | 125 | 0                            |     | 70   | °C   |

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

| PARAMETER |           | TEST CONDITIONS†  |                  | SN54ALS29821<br>SN54ALS29822 |      | SN74ALS29821<br>SN74ALS29822 |      | UNIT |
|-----------|-----------|-------------------|------------------|------------------------------|------|------------------------------|------|------|
|           |           |                   |                  | MIN                          | TYP‡ | MAX                          | MIN  |      |
| VIK       |           | VCC = MIN,        | II = -18 mA      | -1.2                         |      | -1.2                         |      | V    |
| VOH       |           | VCC = MIN to MAX, | IOH = -0.4 mA    | VCC - 2                      |      | VCC - 2                      |      | V    |
|           |           | VCC = MIN,        | IOH = -15 mA     | 2.4                          | 3.3  |                              |      |      |
|           |           | VCC = MIN,        | IOH = -24 mA     |                              |      | 2.4                          | 3.2  |      |
| VOL       |           | VCC = MIN,        | IOL = 32 mA      | 0.25                         | 0.4  | 0.25                         | 0.4  | V    |
|           |           | VCC = MIN,        | IOL = 48 mA      |                              |      | 0.35                         | 0.5  |      |
| IOZH      |           | VCC = MAX,        | VO = 2.4 V       | 20                           |      | 20                           |      | µA   |
| IOZL      |           | VCC = MAX,        | VO = 0.4 V       | -20                          |      | -20                          |      | µA   |
| II        |           | VCC = MAX,        | VI = 5.5 V       | 0.1                          |      | 0.1                          |      | mA   |
| IIH       |           | VCC = MAX,        | VI = 2.7 V       | 20                           |      | 20                           |      | µA   |
| IIL       |           | VCC = MAX,        | VI = 0.4 V       | -0.1                         |      | -0.1                         |      | mA   |
| IOS §     |           | VCC = MAX,        | VO = 0 V         | -75                          | -250 | -75                          | -250 | mA   |
| ICC       | 'ALS29821 | VCC = MAX         | Outputs high     |                              |      |                              |      | mA   |
|           |           |                   | Outputs low      |                              |      |                              |      |      |
|           |           |                   | Outputs disabled | 48                           | 48   |                              |      |      |
|           | 'ALS29822 |                   | Outputs high     |                              |      |                              |      |      |
|           |           |                   | Outputs low      |                              |      |                              |      |      |
|           |           |                   | Outputs disabled | 48                           | 48   |                              |      |      |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Additional information on these products can be obtained from the factory as it becomes available.

**SN54ALS29821, SN54ALS29822, SN74ALS29821, SN74ALS29822**  
**10-BIT BUS INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS**

**switching characteristics**

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST<br>CONDITIONS<br>See Figure 1 | V <sub>CC</sub> = 5 V,<br>T <sub>A</sub> = 25°C |     |     | V <sub>CC</sub> = MIN TO MAX, <sup>†</sup><br>T <sub>A</sub> = MIN TO MAX <sup>†</sup> |     |                              | UNIT |
|------------------|-----------------|----------------|------------------------------------|-------------------------------------------------|-----|-----|----------------------------------------------------------------------------------------|-----|------------------------------|------|
|                  |                 |                |                                    | ALS29821<br>ALS29822                            |     |     | SN54ALS29821<br>SN54ALS29822                                                           |     | SN74ALS29821<br>SN74ALS29822 |      |
|                  |                 |                |                                    | MIN                                             | TYP | MAX | MIN                                                                                    | MAX | MIN                          | MAX  |
| t <sub>PLH</sub> | CLK             | Any Q          | C <sub>L</sub> = 300 pF            |                                                 |     |     |                                                                                        |     |                              | ns   |
| t <sub>PHL</sub> |                 |                |                                    |                                                 |     |     |                                                                                        |     |                              |      |
| t <sub>PLH</sub> |                 |                | C <sub>L</sub> = 50 pF             |                                                 | 6   |     |                                                                                        |     |                              |      |
| t <sub>PHL</sub> |                 |                |                                    |                                                 | 7   |     |                                                                                        |     |                              |      |
| t <sub>PZH</sub> | $\overline{OC}$ | Any Q          | C <sub>L</sub> = 300 pF            |                                                 |     |     |                                                                                        |     |                              | ns   |
| t <sub>PZL</sub> |                 |                |                                    |                                                 |     |     |                                                                                        |     |                              |      |
| t <sub>PZH</sub> |                 |                | C <sub>L</sub> = 50 pF             |                                                 | 12  |     |                                                                                        |     |                              |      |
| t <sub>PZL</sub> |                 |                |                                    |                                                 | 11  |     |                                                                                        |     |                              |      |
| t <sub>PHZ</sub> | $\overline{OC}$ | Any Q          | C <sub>L</sub> = 50 pF             |                                                 |     |     |                                                                                        |     |                              | ns   |
| t <sub>PLZ</sub> |                 |                |                                    |                                                 |     |     |                                                                                        |     |                              |      |
| t <sub>PHZ</sub> |                 |                | C <sub>L</sub> = 5 pF              |                                                 | 5   |     |                                                                                        |     |                              |      |
| t <sub>PLZ</sub> |                 |                |                                    |                                                 | 6   |     |                                                                                        |     |                              |      |

<sup>†</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

Additional information on these products can be obtained from the factory as it becomes available.

**2**

**ALS and AS Circuits**

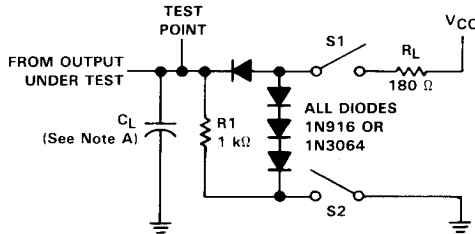
  
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2-943

# SN54ALS29821, SN54ALS29822, SN74ALS29821, SN74ALS29822 10-BIT BUS INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

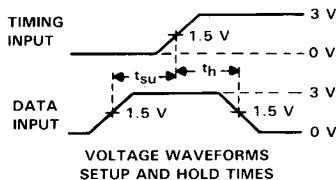
## PARAMETER MEASUREMENT INFORMATION



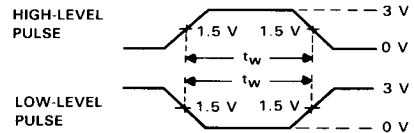
SWITCH POSITION TABLE

| TEST             | S1     | S2     |
|------------------|--------|--------|
| t <sub>PLH</sub> | Closed | Closed |
| t <sub>PHL</sub> | Closed | Closed |
| t <sub>PZH</sub> | Open   | Closed |
| t <sub>PZL</sub> | Closed | Open   |
| t <sub>PHZ</sub> | Closed | Closed |
| t <sub>PLZ</sub> | Closed | Closed |

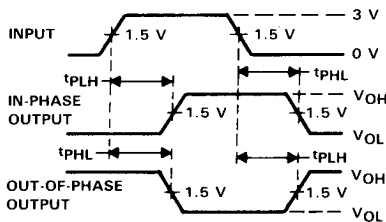
LOAD CIRCUIT



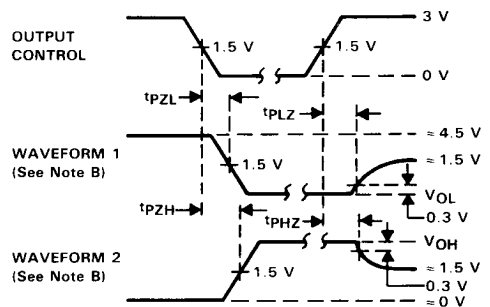
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PULSE DURATIONS



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, THREE-STATE OUTPUTS

- 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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .

FIGURE 1