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

D2825, JANUARY 1986

- **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

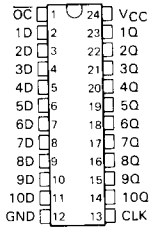
These 10-bit flip-flops feature three-state outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

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.

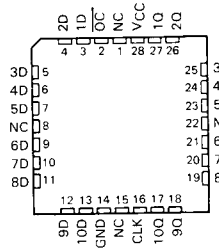
A buffered output-control ($\overline{OC}$)input can be used to place the ten outputs in either a normal logic state (high or low levels) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive 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°C to 125°C. The SN74' family is characterized for operation from 0°C to 70°C.

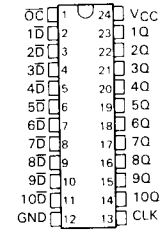
SN54ALS29821 . . . JT PACKAGE
SN74ALS29821 . . . DW OR NT PACKAGE
(TOP VIEW)



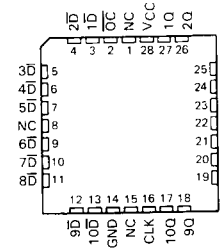
SN54ALS29821 . . . FK PACKAGE
SN74ALS29821 . . . FN PACKAGE
(TOP VIEW)



SN54ALS29822 . . . JT PACKAGE
SN74ALS29822 . . . DW OR NT PACKAGE
(TOP VIEW)



SN54ALS29822 . . . FK PACKAGE
SN74ALS29822 . . . FN PACKAGE
(TOP VIEW)



NC—No internal connection

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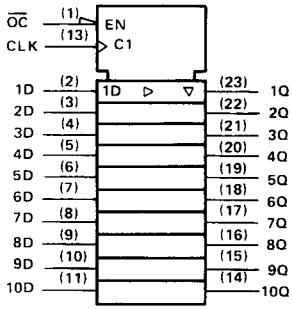
'ALS29821 FUNCTION TABLE (EACH FLIP-FLOP)

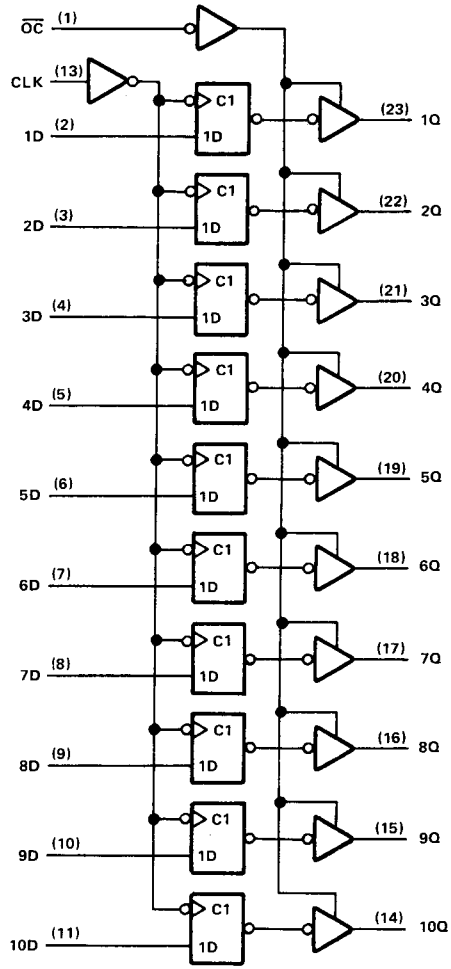
INPUTS			OUTPUT
$\overline{OC}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

'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.

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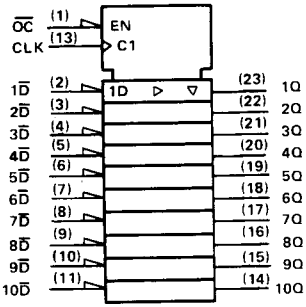
'ALS29822 FUNCTION TABLE (EACH FLIP-FLOP)

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†



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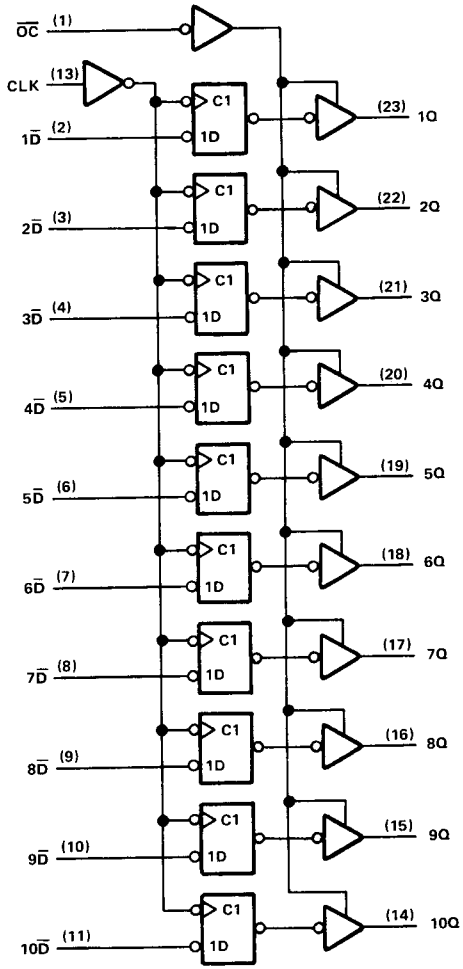
Pin numbers shown are for DW, JT, and NT packages.

'ALS29822 logic diagram (positive logic)



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

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

recommended operating conditions

		SN54ALS29821 SN54ALS29822			SN74ALS29821 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 currrent			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 SN54ALS29822			SN74ALS29821 SN74ALS29822			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = MIN,	I_I = −18 mA			−1.2			−1.2	V
V_{OH}		V_{CC} = MIN to MAX,	I_{OH} = −0.4 mA	V_{CC}−2			V_{CC}−2			V
		V_{CC} = MIN,	I_{OH} = −15 mA	2.4	3.3					
		V_{CC} = MIN,	I_{OH} = −24 mA				2.4	3.2		
V_{OL}		V_{CC} = MIN,	I_{OL} = 32 mA		0.25	0.4		0.25	0.4	V
		V_{CC} = MIN,	I_{OL} = 48 mA					0.35	0.5	
I_{OZH}		V_{CC} = MAX,	V_O = 2.4 V			20			20	μA
I_{OZL}		V_{CC} = MAX,	V_O = 0.4 V			−20			−20	μA
I_I		V_{CC} = MAX,	V_I = 5.5 V			0.1			0.1	mA
I_{IH}		V_{CC} = MAX,	V_I = 2.7 V			20			20	μA
I_{IL}		V_{CC} = MAX,	V_I = 0.4 V			−0.1			−0.1	mA
I_{OS}§		V_{CC} = MAX,	V_O = 0 V	−75		−250	−75		−250	mA
I_{CC}	'ALS29821	V_{CC} = 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 V, T_A = 25°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.

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switching characteristics

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS See Figure 1	V_{CC} = 5 V, T_A = 25°C			V_{CC} = MIN TO MAX,† T_A = MIN TO MAX†				UNIT
				'ALS29821 'ALS29822			SN54ALS29821 SN54ALS29822		SN74ALS29821 SN74ALS29822		
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	CLK	Any Q	C_L = 300 pF								ns
t_{PHL}											
t_{PLH}			C_L = 50 pF		6						
t_{PHL}					7						
t_{PZH}	$\overline{OC}$	Any Q	C_L = 300 pF								ns
t_{PZL}											
t_{PZH}			C_L = 50 pF		12						
t_{PZL}					11						
t_{PHZ}	$\overline{OC}$	Any Q	C_L = 50 pF								ns
t_{PLZ}											
t_{PHZ}			C_L = 5 pF		5						
t_{PLZ}					6						

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

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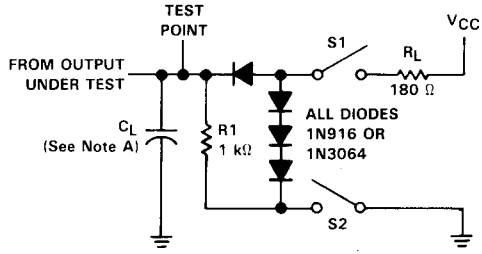
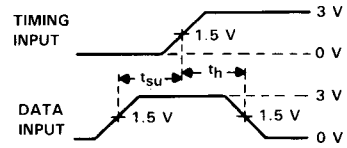
PARAMETER MEASUREMENT INFORMATION



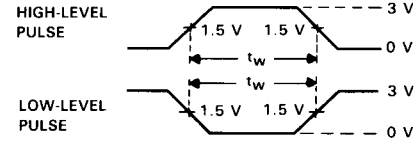
LOAD CIRCUIT

SWITCH POSITION TABLE

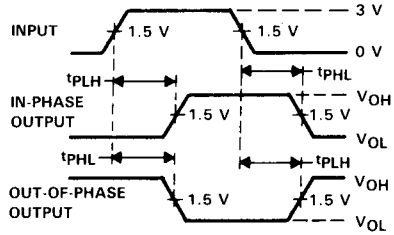
TEST	S1	S2
t_{PLH}	Closed	Closed
t_{PHL}	Closed	Closed
t_{PZH}	Open	Closed
t_{PZL}	Closed	Open
t_{PHZ}	Closed	Closed
t_{PLZ}	Closed	Closed



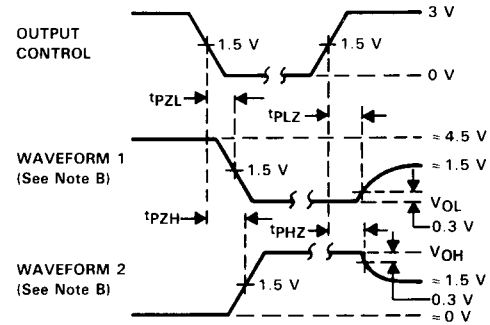
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



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 ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.

FIGURE 1