D2825, DECEMBER 1983—REVISED 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

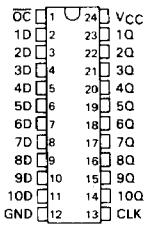
These 10-bit flip-flops feature three-state outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

The ten flip-flops are edge-triggered D-type flip-flops. On the positive transition of the clock the Q outputs on the 'AS821 will be true, and on the 'AS822 will be complementary to the data input.

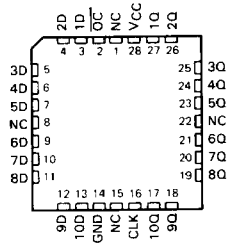
A buffered output-control input can be used to place the ten outputs in either a normal logic state (high or low levels) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive the bus lines in a bus-organized system without need for interface or pull-up components. The output control ($\overline{OC}$) 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 SN54AS' family is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74AS' family is characterized for operation from 0°C to 70°C.

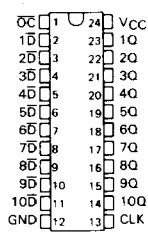
SN54AS821 . . . JT PACKAGE
SN74AS821 . . . DW OR NT PACKAGE
(TOP VIEW)



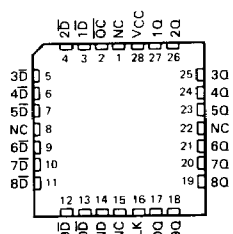
SN54AS821 . . . FK PACKAGE
SN74AS821 . . . FN PACKAGE
(TOP VIEW)



SN54AS822 . . . JT PACKAGE
SN74AS822 . . . DW OR NT PACKAGE
(TOP VIEW)



SN54AS822 . . . FK PACKAGE
SN74AS822 . . . FN PACKAGE
(TOP VIEW)

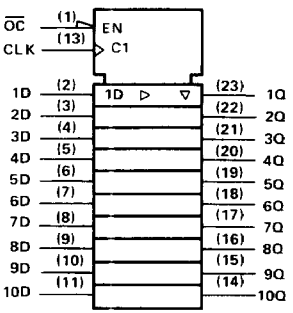


NC—No internal connection

'AS821 FUNCTION TABLE (EACH FLIP-FLOP)

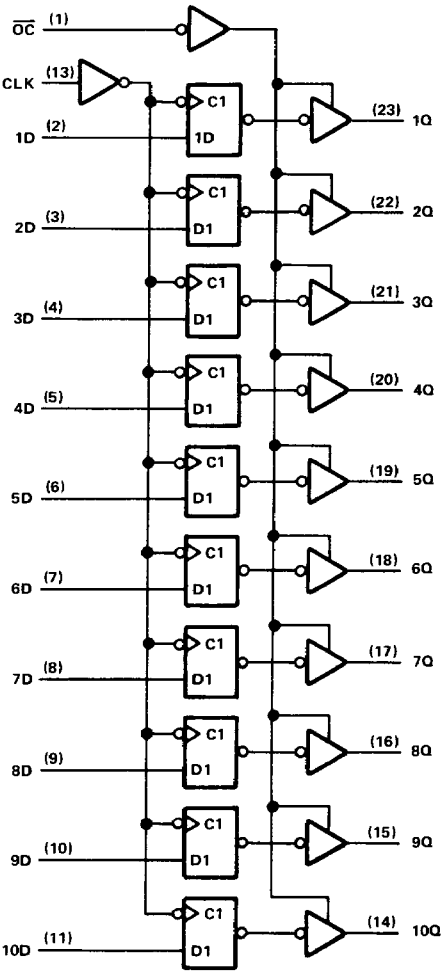
INPUTS			OUTPUT
$\overline{OC}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

'AS821 logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

'AS821 logic diagram (positive logic)



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

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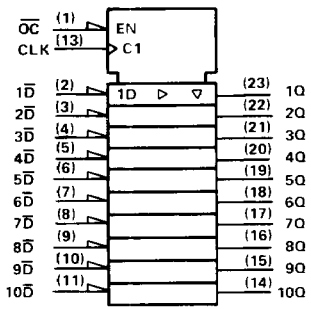
'AS822 FUNCTION TABLE (EACH FLIP-FLOP)

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

'AS822 logic symbol†



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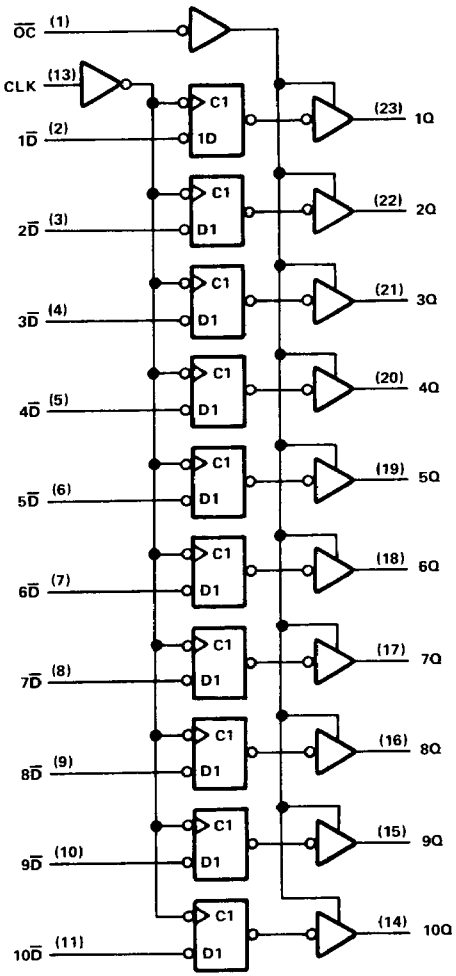
'AS822 logic diagram (positive logic)



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 . . . . . 7 V
Voltage applied to a disabled 3-state output . . . . . 5.5 V
Operating free-air temperature range: SN54AS821, SN54AS822 . . . . . −55°C to 125°C
SN74AS821, SN74AS822 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

recommended operating conditions

		SN54AS821 SN54AS822			SN74AS821 SN74AS822			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			−24			−24	mA
I_{OL}	Low-level output currrent			32			48	mA
t_w	Pulse duration, CLK high or low	9			8			ns
t_{su}	Setup time, data before CLK↑	7			6			ns
t_h	Hold time, data after CLK↑	0			0			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		SN54AS821 SN54AS822			SN74AS821 SN74AS822			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 4.5 V, I_I = −18 mA				−1.2			−1.2	V
V_{OH}		V_{CC} = 4.5 V to 5.5 V, I_{OH} = −2 mA		V_{CC} − 2			V_{CC} − 2			V
		V_{CC} = 4.5 V, I_{OH} = −15 mA		2.4	3.2		2.4	3.2		
		V_{CC} = 4.5 V, I_{OH} = −24 mA		2			2			
V_{OL}		V_{CC} = 4.5 V, I_{OL} = 32 mA			0.25	0.5				V
		V_{CC} = 4.5 V, I_{OL} = 48 mA						0.35	0.5	
I_{OZH}		V_{CC} = 5.5 V, V_O = 2.7 V				50			50	μA
I_{OZL}		V_{CC} = 5.5 V, V_O = 0.4 V				−50			−50	μA
I_I		V_{CC} = 5.5 V, V_I = 7 V				0.1			0.1	mA
I_{IH}		V_{CC} = 5.5 V, V_I = 2.7 V				20			20	μA
I_{IL}		V_{CC} = 5.5 V, V_I = 0.4 V				−0.5			−0.5	mA
I_O‡		V_{CC} = 5.5 V, V_O = 2.25 V		−30		−112	−30		−112	mA
I_{CC}	'AS821	V_{CC} = 5.5 V	Outputs high		55	88		55	88	mA
			Outputs low		68	109		68	109	
			Outputs disabled		70	113		70	113	
	'AS822		Outputs high		55	88		55	88	
			Outputs low		68	109		68	109	
			Outputs disabled		70	113		70	113	

†All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

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switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = MIN to MAX				UNIT
			SN54AS821 SN54AS822		SN74AS821 SN74AS822		
			MIN	MAX	MIN	MAX	
t_{PLH}	CLK	Any Q	3.5	9	3.5	7.5	ns
t_{PHL}			3.5	11.5	3.5	10.5	
t_{PZH}	$\overline{OC}$	Any Q	4	12	4	11	ns
t_{PZL}			4	13	4	12	
t_{PHZ}	$\overline{OC}$	Any Q	2	10	2	8	ns
t_{PZL}			2	10	2	8	

NOTE 1: Load circuit and vo tage waveforms are shown in Section 1.