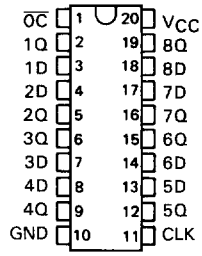
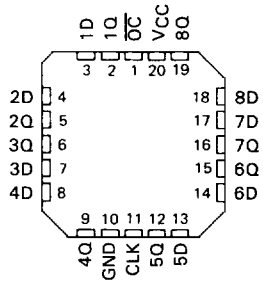
D2661, APRIL 1982—REVISED DECEMBER 1983

- D-Type Flip-Flops In a Single Package
- 3-State Bus-Driving True Outputs
- Full Parallel Access for Loading
- Buffered Control Inputs
- Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

SN54ALS374, SN54AS374 . . . J PACKAGE
SN74ALS374, SN74AS374 . . . N PACKAGE
(TOP VIEW)



SN54ALS374, SN54AS374 . . . FH PACKAGE
SN74ALS374, SN74AS374 . . . FN PACKAGE
(TOP VIEW)



description

These 8-bit flip-flops feature three-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight flip-flops of the 'ALS374 and 'AS374 are edge-triggered D-type flip-flops. On the positive transition of the clock the Q outputs will be set to the logic levels that were set up at the D inputs.

A buffered output-control input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly. The high-impedance third 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.

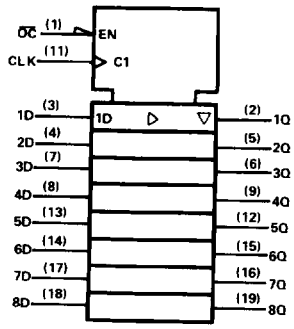
The SN54ALS374 and SN54AS374 are characterized for operation over the full military temperature range of −55 °C to 125 °C. The SN74ALS374 and SN74AS374 are characterized for operation from 0 °C to 70 °C.

FUNCTION TABLE (EACH FLIP-FLOP)

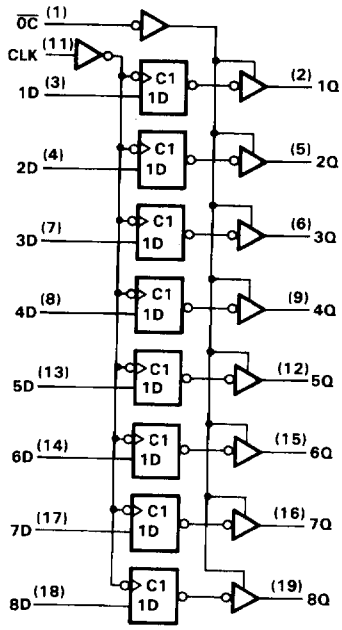
INPUTS			OUTPUT
$\overline{OC}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

2 ALS AND AS CIRCUITS

logic symbol



logic diagram (positive logic)



Pin numbers shown are for J and N 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: SN54ALS374, SN54AS374 . . . . . −55 °C to 125 °C
SN74ALS374, SN74AS374 . . . . . 0 °C to 70 °C
Storage temperature range . . . . . −65 °C to 150 °C

recommended operating conditions

			SN54ALS374			SN74ALS374			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				−1			−2.6	mA
I_{OL}	Low-level output current				12			24	mA
f_{clock}	Clock frequency		0		30	0		35	MHz
t_w	Pulse duration	CLK high	16.5			14			ns
		CLK low	16.5			14			
t_{su}	Setup time, data before CLK↑		10			10			ns
t_h	Hold time, data after CLK↑		4			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		SN54ALS374			SN74ALS374			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	V_{CC} = 4.5 V,	I_I = −18 mA			−1.5			−1.5	V
V_{OH}	V_{CC} = 4.5 V to 5.5 V,	I_{OH} = −0.4 mA	V_{CC} −2			V_{CC} −2			V
	V_{CC} = 4.5 V,	I_{OH} = −1 mA	2.4	3.3					
	V_{CC} = 4.5 V,	I_{OH} = −2.6 mA				2.4	3.2		
V_{OL}	V_{CC} = 4.5 V,	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
	V_{CC} = 4.5 V	I_{OL} = 24 mA					0.35	0.5	
I_{OZH}	V_{CC} = 5.5 V,	V_O = 2.7 V			20			20	μA
I_{OZL}	V_{CC} = 5.5 V,	V_I = 0.4 V			−20			−20	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			−0.2			−0.2	mA
I_O‡	V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	−30		−112	mA
I_{CC}	V_{CC} = 5.5 V	Outputs high		11	19		11	19	mA
		Outputs low		19	28		19	28	
		Outputs disabled		20	31		20	31	

†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}.

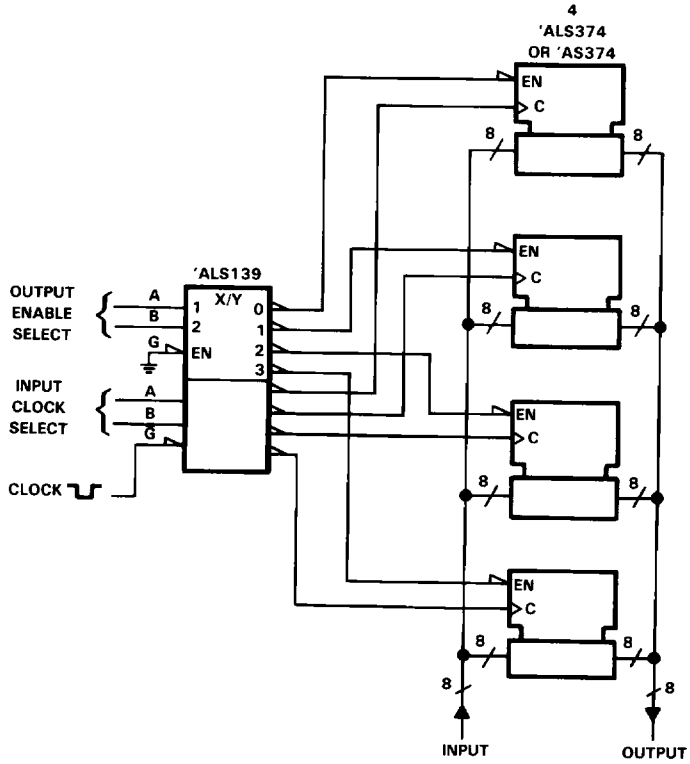
switching characteristics (see Note 1)

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
			SN54ALS374		SN74ALS374		
			MIN	MAX	MIN	MAX	
f_{max}			30		35		MHz
t_{PLH}	CLK	Q	3	15	3	12	ns
t_{PHL}			5	18	5	16	
t_{PZH}	$\overline{OC}$	Q	5	19	5	17	ns
t_{PZL}			7	20	7	18	
t_{PHZ}	$\overline{OC}$	Q	2	12	2	10	ns
t_{PLZ}			3	24	3	18	

NOTE 1: For load circuit and voltage waveforms, see page 1-12.

TYPICAL APPLICATION DATA

EXPANDABLE 4-WORD BY 8-BIT GENERAL REGISTER FILE



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recommended operating conditions

			SN54AS374			SN74AS374			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				−12			−15	mA
I_{OL}	Low-level output current				32			48	mA
f_{clock}	Clock frequency		0		100	0		125	MHz
t_w	Pulse duration	CLK high	5.5			4			ns
		CLK low	5			3			
t_{su}	Setup time data before CLK↑		3			2			ns
t_h	Hold time, data after CLK↑		3			2			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		SN54AS374			SN74AS374			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} = −12 mA	2.4	3.2					
		V_{CC} = 4.5 V,	I_{OH} = −15 mA				2.4	3.3		
V_{OL}		V_{CC} = 4.5 V,	I_{OL} = 32 mA		0.29	0.5				V
		V_{CC} = 4.5 V	I_{OL} = 48 mA					0.34	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_I = 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}	OC, CLK	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.5			−0.5	mA
	Data					−3			−2	
I_O‡		V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	−30		−112	mA
I_{CC}		V_{CC} = 5.5 V	Outputs high		77	120		77	120	mA
			Outputs low		84	128		84	128	
			Outputs disabled		84	128		84	128	

†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}.

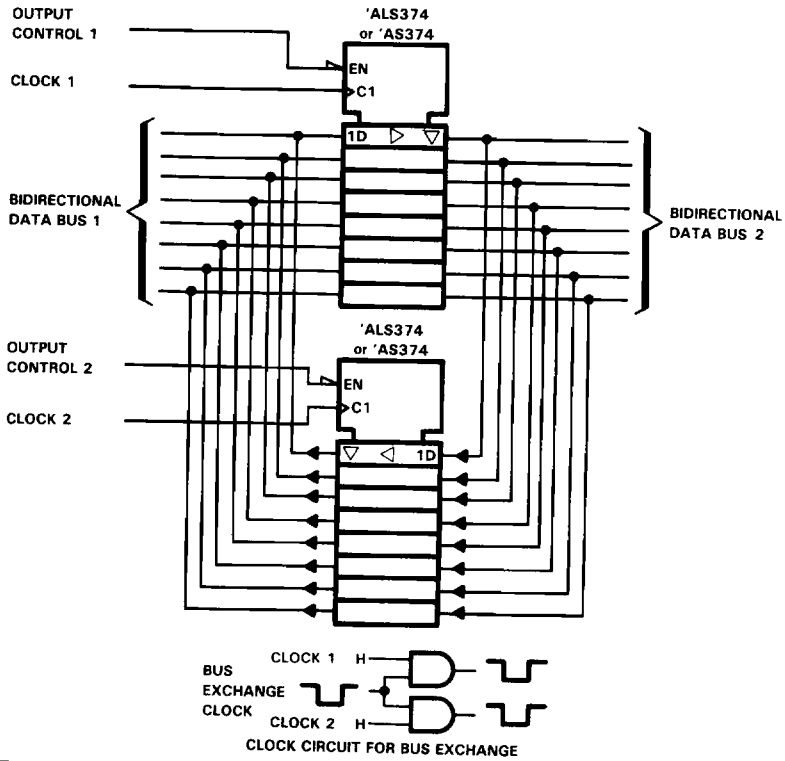
switching characteristics (see Note 1)

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
			SN54AS374		SN74AS374		
			MIN	MAX	MIN	MAX	
f_{max}			100		125		MHz
t_{PLH}	CLK	Q	3	11	3	8	ns
t_{PHL}			4	11.5	4	9	
t_{PZH}	$\overline{OC}$	Q	2	7	2	6	ns
t_{PZL}			3	11	3	10	
t_{PHZ}	$\overline{OC}$	Q	2	7	2	6	ns
t_{PLZ}			2	7	2	6	

NOTE 1: For load circuit and voltage waveforms, see page 1-12.

TYPICAL APPLICATION DATA

BIDIRECTIONAL BUS DRIVER



CLOCK CIRCUIT FOR BUS EXCHANGE

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