

# SN54ALS576A, SN54ALS577A, SN54AS576, SN54AS577 SN74ALS576A, SN74ALS577A, SN74AS576, SN74AS577 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

D2661, DECEMBER 1982 — REVISED MAY 1986

- 3-State Buffer-Type Inverting Outputs Drive Bus-Lines Directly
- Bus-Structured Pinout
- Buffered Control Inputs
- 'ALS577A and 'AS577 Have Synchronous Clear
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

## description

These 8-bit registers feature three-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

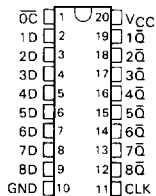
The eight-bit edge-triggered D-type flip-flops enter data on the low-to-high transition of the clock.

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 off.

The SN54ALS' and SN54AS' devices are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS' and SN74AS' devices are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

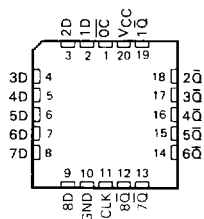
SN54ALS576A, SN54AS576 ... J PACKAGE  
SN74ALS576A, SN74AS576 ... DW OR N PACKAGE

(TOP VIEW)



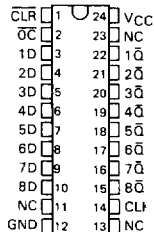
SN54ALS576A, SN54AS576 ... FK PACKAGE

(TOP VIEW)



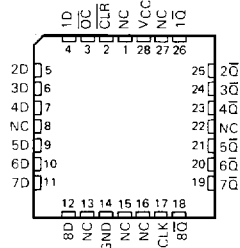
SN54ALS577A, SN54AS577 ... JT PACKAGE  
SN74ALS577A, SN74AS577 ... DW OR NT PACKAGE

(TOP VIEW)



SN54ALS577A, SN54AS577 ... FK PACKAGE  
SN74ALS577A, SN74AS577 ... FN PACKAGE

(TOP VIEW)



NC - No internal connection

# SN54ALS576A, SN54ALS577A, SN54AS576, SN54AS577 SN74ALS576A, SN74ALS577A, SN74AS576, SN74AS577 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

## FUNCTION TABLES

ALS576A, AS576  
(Each Flip-Flop)

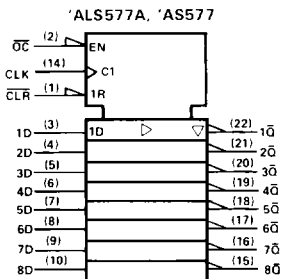
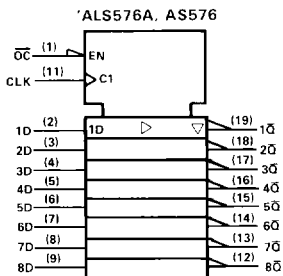
INPUTS			OUTPUT
$\overline{OC}$	CLK	D	$\overline{Q}$
L	↑	H	L
L	↑	L	H
L	L	X	$\overline{Q}_0$
H	X	X	Z

ALS577A, AS577  
(Each Flip-Flop)

INPUTS				OUTPUT
$\overline{OC}$	CLR	CLK	D	$\overline{Q}$
L	L	↑	X	H
L	H	↑	H	L
L	H	↑	L	H
L	H	L	X	$\overline{Q}_0$
H	X	X	X	Z

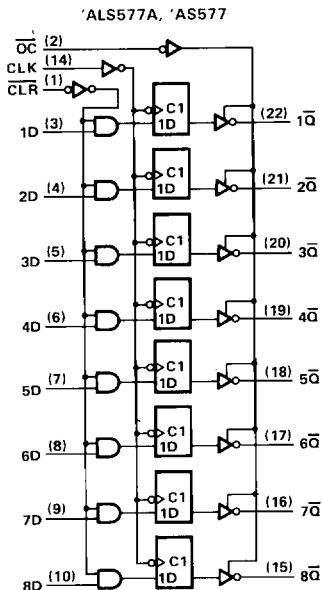
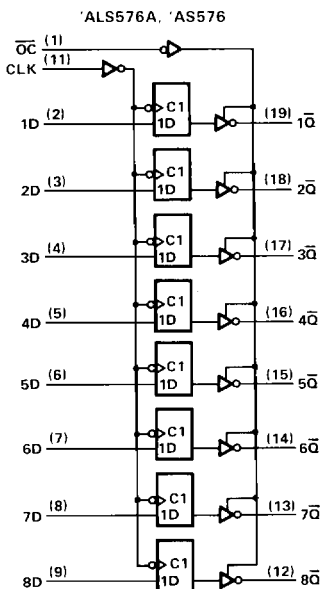
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logic symbols†



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagrams (positive logic)



Pin numbers shown are for DW, J, and N packages.

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

# SN54ALS576A, SN54ALS577A, SN74ALS576A, SN74ALS577A

## OCTAL D-TYPE EDGE-TRIGGERED 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 .....	7 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range: SN54ALS', SN54AS' .....	-55 °C to 125 °C
SN74ALS', SN74AS' .....	0 °C to 70 °C
Storage temperature range .....	-65 °C to 150 °C

### recommended operating conditions

		SN54ALS576A SN54ALS577A			SN74ALS576A SN74ALS577A			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			V
$I_{OH}$	High-level output current				2.6			mA
$I_{OL}$	Low-level output current				24			mA
$f_{clock}$	Clock frequency	'ALS576A		25	30		MHz	
		'ALS577A		25	30			
$t_w$	Pulse duration	CLK high or low 'ALS576A		20	16.5		ns	
		CLK high or low 'ALS577A		20	16.5			
$t_{su}$	Setup time before CLK1	Data		15		ns		
		CLR ('ALS577A)		15				
$t_h$	Hold time after CLK1	Data		0		ns		
		CLR ('ALS577A)		4				
$T_A$	Operating free-air temperature	55	125		0	70	°C	

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

PARAMETER	TEST CONDITIONS	SN54ALS576A SN54ALS577A			SN74ALS576A SN74ALS577A			UNIT
		MIN	TYP <sup>†</sup>	MAX	MIN	TYP <sup>†</sup>	MAX	
$V_{IK}$	$V_{CC} = 4.5 V, I_I = 18 mA$	-1.2			-1.2			V
$V_{OH}$	$V_{CC} = 4.5 V \text{ to } 5.5 V, I_{OH} = 0.4 mA$	$V_{CC} \cdot 2$			$V_{CC} \cdot 2$			V
	$V_{CC} = 4.5 V, I_{OH} = 1 mA$	2.4	3.3		2.4			
	$V_{CC} = 4.5 V, I_{OH} = 2.6 mA$				2.4			
$V_{OL}$	$V_{CC} = 4.5 V, I_{OL} = 12 mA$	0.25			0.4	0.25	0.4	V
	$V_{CC} = 4.5 V, I_{OL} = 24 mA$				0.35			
$I_{OZH}$	$V_{CC} = 5.5 V, V_O = 2.7 V$				20			$\mu A$
$I_{OZL}$	$V_{CC} = 5.5 V, V_O = 0.4 V$				20			$\mu A$
$I_I$	$V_{CC} = 5.5 V, V_I = 7 V$				0.1			mA
$I_{IH}$	$V_{CC} = 5.5 V, V_I = 2.7 V$				20			$\mu A$
$I_{IL}$	$V_{CC} = 5.5 V, V_I = 0.4 V$				0.2			mA
$I_O^2$	$V_{CC} = 5.5 V, V_O = 2.25 V$	30	112		30	112		mA
$I_{CC}$	$V_{CC} = 5.5 V$	Outputs high		10	18	10	18	mA
		Outputs low		15	24	15	24	
		Outputs disabled		16	30	16	30	

<sup>†</sup>All typical values are at  $V_{CC} = 5 V, T_A = 25^\circ C$ .

<sup>‡</sup>The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

# SN54ALS576A, SN54ALS577A, SN74ALS576A, SN74ALS577A

## OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

### 'ALS576A switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$ , $T_A = 25^\circ\text{C}$			$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$ , $T_A = \text{MIN to MAX}$			UNIT	
			'ALS576A			SN54ALS576A		SN74ALS576A		
			TYP	MIN	MAX	MIN	MAX			
$f_{\text{max}}$			50	25		30		MHz		
$t_{\text{PLH}}$	CLK	Any $\bar{Q}$	9	4	15	4	14	ns		
$t_{\text{PHL}}$			9	4	15	4	14			
$t_{\text{PZH}}$	$\bar{OC}$	Any $\bar{Q}$	11	4	21	4	18	ns		
$t_{\text{PZL}}$			11	4	21	4	18			
$t_{\text{PHZ}}$	$\bar{OC}$	Any $\bar{Q}$ 'ALS576	6	2	12	2	10	ns		
$t_{\text{PLZ}}$		Any $\bar{Q}$	8	3	17	3	15			

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

### 'ALS577A switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$ , $T_A = 25^\circ\text{C}$			$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$ , $T_A = \text{MIN to MAX}$			UNIT	
			'ALS577A			SN54ALS577A		SN74ALS577A		
			MIN	TYP	MAX	MIN	MAX	MIN		MAX
$f_{\text{max}}$			40	50		25		30	MHz	
$t_{\text{PLH}}$	CLK	Any $\bar{Q}$	9	11	4	15	4	14	ns	
$t_{\text{PHL}}$			9	11.5	4	15	4	14		
$t_{\text{PZH}}$	$\bar{OC}$	Any $\bar{Q}$	11	15	4	21	4	18	ns	
$t_{\text{PZL}}$			11	15	4	21	4	18		
$t_{\text{PHZ}}$	$\bar{OC}$	Any $\bar{Q}$ 'ALS577	6	8	2	12	2	10	ns	
$t_{\text{PLZ}}$		Any $\bar{Q}$	8	12	3	17	3	15		

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

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ALS and AS Circuits

# SN54AS576, SN54AS577, SN74AS576, SN74AS577

## OCTAL D-TYPE EDGE-TRIGGERED FLOP-FLOPS WITH 3-STATE OUTPUTS

### recommended operating conditions

			SN54AS576			SN74AS576			UNIT
			SN54AS577			SN74AS577			
			MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage		4.5	5	5.5	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage		2			2			V
V <sub>IL</sub>	Low-level input voltage		0.8			0.8			V
I <sub>OH</sub>	High-level output current		-12			15			mA
I <sub>OL</sub>	Low-level output current		32			48			mA
f <sub>clock</sub>	Clock frequency		0			125			MHz
t <sub>w</sub>	Pulse duration	CLK high	5			4			ns
		CLK low	4			2			
t <sub>su</sub>	Setup time before CLK <sup>1</sup>	Data	3			2			ns
		CLR ('AS577)	6.5			5.5			
t <sub>h</sub>	Hold time after CLK <sup>1</sup>	Data	3			2			ns
		CLR ('AS577)	0			0			
T <sub>A</sub>	Operating free-air temperature		55			125			°C

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

PARAMETER		TEST CONDITIONS		SN54AS576		SN74AS576		UNIT	
				MIN	TYP <sup>†</sup> MAX	MIN	TYP <sup>†</sup> MAX		
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA			-1.2		-1.2		V
V <sub>OH</sub>		V <sub>CC</sub> = 4.5 V to 5.5 V, I <sub>OH</sub> = -2 mA	V <sub>CC</sub> <sup>2</sup>		V <sub>CC</sub> <sup>2</sup>				V
		V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = -12 mA	2.4		3.2				
		V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = -15 mA			2.4		3.3		
V <sub>OL</sub>		V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 32 mA	0.29		0.5				V
		V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 48 mA					0.33		
I <sub>OZH</sub>		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V			50				μA
I <sub>OZL</sub>		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.4 V			-50				μA
I <sub>I</sub>		V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V			0.1		0.1		mA
I <sub>IH</sub>		V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V			20		20		μA
I <sub>IL</sub>	D	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V			-3		-2		mA
	All other				-0.5		0.5		
I <sub>O<sup>†</sup></sub>		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V	30		-112		-30		mA
I <sub>CC</sub>	'AS576	V <sub>CC</sub> = 5.5 V	Outputs high	77	125	77	125	mA	
			Outputs low	84	135	84	135		
			Outputs disabled	84	135	84	135		
	'AS577		Outputs high	78	126	78	126		
			Outputs low	76	123	76	123		
			Outputs disabled	88	142	88	142		

<sup>†</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C.

<sup>2</sup>The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>O<sup>S</sup></sub>.

**SN54AS576, SN54AS577, SN74AS576, SN74AS577**  
**OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V,}$ $C_L = 50 \text{ pF,}$ $R_1 = 500 \Omega,$ $R_2 = 500 \Omega,$ $T_A = \text{MIN to MAX}$				UNIT
			SN54AS576		SN74AS576		
			MIN	MAX	MIN	MAX	
$f_{max}$			100		125		MHz
$t_{PLH}$	CLK,	Any $\bar{Q}$	3	11	3	8	ns
$t_{PHL}$			4	11	4	9	
$t_{PZH}$	$\bar{OC}$	Any $\bar{Q}$	2	7	2	6	ns
$t_{PZL}$			3	11	3	10	
$t_{PHZ}$	$\bar{OC}$	Any $\bar{Q}$	2	7	2	6	ns
$t_{PLZ}$			2	7	2	6	

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

**2 ALS and AS Circuits**