

# SN54ALS878A, SN54ALS879A, SN54AS878, SN54AS879 SN74ALS878A, SN74ALS879A, SN74AS878, SN74AS879 DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

D2661, APRIL 1982 REVISED MAY 1986

- 3-State Bus Driving Outputs
- Full Parallel-Access for Loading
- Buffered Control Inputs
- Choice of True or Inverting Logic  
'ALS878A, 'AS878 True Outputs  
'ALS879A, 'AS879 Inverting Outputs
- Synchronous Clear
- Package Options Include Plastic "Small Outline" Packages, Both Plastic and Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

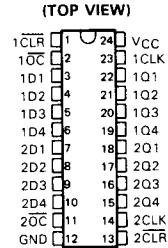
## description

These dual 4-bit registers feature three-state outputs designed specifically for bus driving. This makes these devices particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

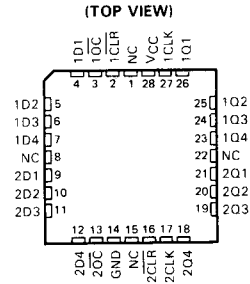
The dual 4-bit edge-triggered flip-flops enter data on the low-to-high transition of the clock (1CLK and 2CLK). All types have individual synchronous clear inputs and output control pins for each group of 4-bit registers.

The SN54ALS' and SN54AS' devices are characterized for operation over the full military temperature range of -55°C to 125°C. The SN74ALS' and SN74AS' devices are characterized for operation from 0°C to 70°C.

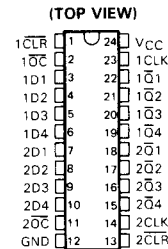
SN54ALS878A, SN54AS878 . . . JT PACKAGE  
SN74ALS878A, SN74AS878 . . . DW OR NT PACKAGE



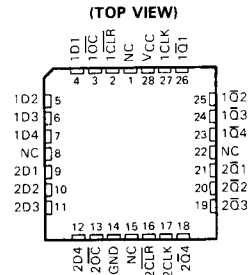
SN54ALS878A, SN54AS878 . . . FK PACKAGE  
SN74ALS878A, SN74AS878 . . . FN PACKAGE



SN54ALS879A, SN54AS879 . . . JT PACKAGE  
SN74ALS879A, SN74AS879 . . . DW OR NT PACKAGE



SN54ALS879A, SN54AS879 . . . FK PACKAGE  
SN74ALS879A, SN74AS879 . . . FN PACKAGE



NC - No internal connection

PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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**SN54ALS878A, SN54ALS879A, SN54AS878, SN54AS879**  
**SN74ALS878A, SN74ALS879A, SN74AS878, SN74AS879**  
**DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

FUNCTION TABLES

'ALS878A, 'AS878  
(EACH FLIP-FLOP)

INPUTS				OUTPUT
OC	CLR	CLK	D	Q
L	L	↑	X	L
L	H	↑	H	H
L	H	↑	L	L
L	H	L	X	Q <sub>0</sub>
H	X	X	X	Z

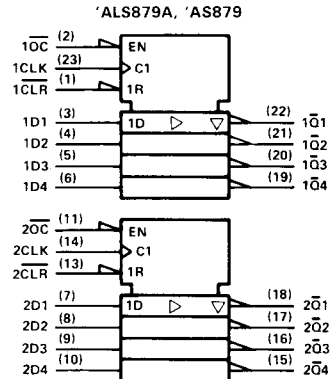
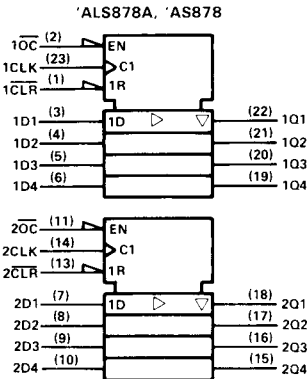
'ALS879A, 'AS879  
(EACH FLIP-FLOP)

INPUTS				OUTPUT
OC	CLR	CLK	D	Q
L	L	↑	X	H
L	H	↑	H	L
L	H	↑	L	H
L	H	L	X	Q <sub>0</sub>
H	X	X	X	Z

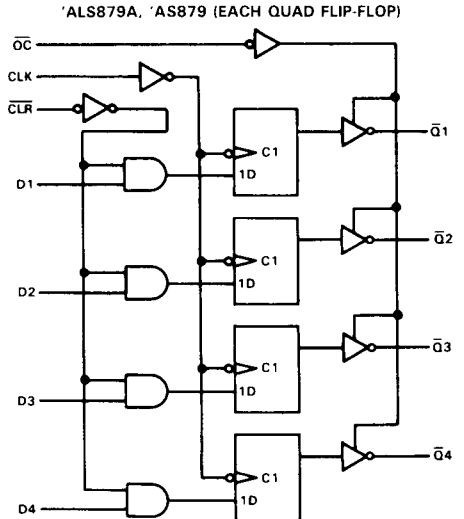
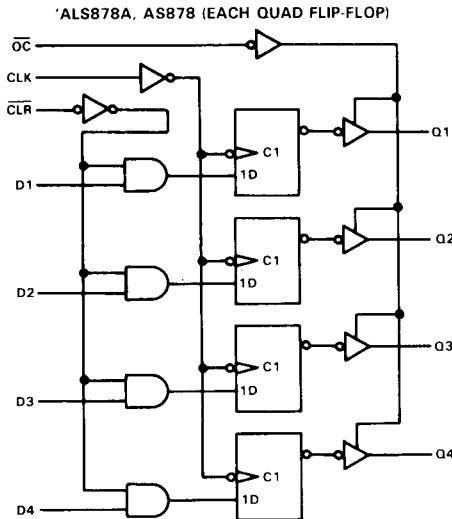
2

ALS and AS Circuits

logic symbols†



logic diagrams (positive logic)



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

# SN54ALS878A, SN54ALS879A, SN74ALS878A, SN74ALS879A DUAL 4-BIT 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: SN54ALS878A, SN54ALS879A .....	-55 °C to 125 °C
SN74ALS878A, SN74ALS879A .....	0 °C to 70 °C
Storage temperature range .....	-65 °C to 150 °C

## recommended operating conditions

		SN54ALS878A SN54ALS879A			SN74ALS878A SN74ALS879A			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			0.7			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	'ALS878A		0	25	0	30	MHz
		'ALS879A		0	20	0	25	
$t_w$	Pulse duration	'ALS878A CLK high or low			20		16.5	ns
		'ALS879A CLK high or low			25		20	
$t_{su}$	Setup time before CLK <sup>†</sup>	Data			15		15	ns
		CLR			20		20	
$t_h$	Hold time after CLK <sup>†</sup>	Data			4		4	ns
		CLR			0		0	
$T_A$	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS	SN54ALS878A SN54ALS879A			SN74ALS878A SN74ALS879A			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
$V_{OH}$	$V_{CC} = 4.5 V \text{ to } 5.5 V, I_{OH} = -0.4 mA$	$V_{CC} - 2$			$V_{CC} - 2$			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
$I_{OZL}$	$V_{CC} = 5.5 V, V_O = 0.4 V$			-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
$I_O^{\ddagger}$	$V_{CC} = 5.5 V, V_O = 2.25 V$	-30		-112	-30		-112	mA
$I_{CC}$	$V_{CC} = 5.5 V$	Outputs high		14	23	14	23	mA
		Outputs low		18	31	18	31	
		Outputs disabled		20	33	20	33	

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

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

**SN54ALS878A, SN54ALS879A, SN74ALS878A, SN74ALS879A**  
**DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

switching characteristics (see Note 1)

PARAMETER	FROM	TO (OUTPUT)	V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = 25°C			V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX				UNIT
			'ALS878A 'ALS879A			SN54ALS878A SN54ALS879A		SN74ALS878A SN74ALS879A		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>	'ALS878A		40	50	25		30		MHz	
	'ALS879A		40	50	20		25			
t <sub>PLH</sub>	CLK	Q or $\bar{Q}$	8 10		4	15	4	14	ns	
t <sub>PHL</sub>			9 13		4	17	4	16		
t <sub>PZH</sub>	$\overline{OC}$	Q or $\bar{Q}$	9 13		4	22	4	20	ns	
t <sub>PZL</sub>			11 15		4	22	4	20		
t <sub>PHZ</sub>	$\overline{OC}$	Q or $\bar{Q}$	6 8		2	12	2	10	ns	
t <sub>PLZ</sub>			7 10		3	18	3	15		

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

**2** ALS and AS Circuits

# SN54AS878, SN54AS879, SN74AS878, SN74AS879

## DUAL 4-BIT 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 SN54AS878, SN54AS879 .....	-55°C to 125°C
SN74AS878, SN74AS879 .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

**recommended operating conditions**

		SN54AS878			SN74AS878			UNIT
		SN54AS879			SN74AS879			
		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 low		2				ns
		CLK high		4				
$t_{su}$	Setup time before CLK↑	Data		2				ns
		CLR		5.5				
$t_h$	Hold time after CLK↓	Data		2				ns
		CLR		0				
$T_A$	Operating free-air temperature	-55		125	0		70	°C

**SN54AS878, SN54AS879, SN74AS878, SN74AS879**  
**DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

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

**2 ALS and AS Circuits**

PARAMETER	TEST CONDITIONS	SN54AS878 SN54AS879		SN74AS878 SN74AS879		UNIT	
		MIN	TYP†	MAX	MIN		TYP†
$V_{IK}$	$V_{CC} = 4.5 \text{ V}$ , $I_I = -18 \text{ mA}$			-1.2		-1.2	V
$V_{OH}$	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ , $I_{OH} = -2 \text{ mA}$	$V_{CC} - 2$		$V_{CC} - 2$			
	$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -12 \text{ mA}$	2.4	3.2				
	$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -15 \text{ mA}$			2.4	3.3		
$V_{OL}$	$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 32 \text{ mA}$		0.29	0.5			
	$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 48 \text{ mA}$				0.33	0.5	
$I_{OZH}$	$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.7 \text{ V}$			50		50	
$I_{OZL}$	$V_{CC} = 5.5 \text{ V}$ , $V_O = 0.4 \text{ V}$			-50		-50	
$I_I$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 7 \text{ V}$			0.1		0.1	
$I_{IH}$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 2.7 \text{ V}$			20		20	
$I_{IL}$	D All other	$V_{CC} = 5.5 \text{ V}$ , $V_I = 0.4 \text{ V}$		-3		-2	
				-0.5		-0.5	
$I_O^\ddagger$	$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.25 \text{ V}$	-30	-112	-30	-112	mA	
$I_{CC}$	'AS878 'AS879	$V_{CC} = 5.5 \text{ V}$ , See Note 1	Outputs high	82	132	82	132
			Outputs low	96	155	96	155
			Outputs disabled	100	160	100	160
			Outputs high	88	142	88	142
			Outputs low	94	150	94	150
			100	160	100	160	

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

‡The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .  
 NOTE 1:  $I_{CC}$  is measured with CLR and all D inputs grounded, and CLK and OC at 4.5 V.

**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
			SN54AS878 SN54AS879		SN74AS878 SN74AS879		
			MIN	MAX	MIN	MAX	
$f_{max}$			100		125	MHz	
$t_{PLH}$	CLK	Q or $\bar{Q}$	3	11.5	3	8.5	
$t_{PHL}$			4	12.5	4	10.5	
$t_{PZH}$	$\overline{OC}$	Q or $\bar{Q}$	2	8	2	7	
$t_{PZL}$			3	11.5	3	10.5	
$t_{PHZ}$	$\overline{OC}$	Q or $\bar{Q}$	2	7	2	6	
$t_{PLZ}$			2	7	2	6	

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