

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

SDAS062A - 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

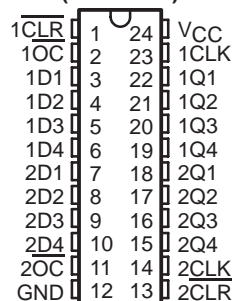
## description

These dual 4-bit registers feature 3-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.

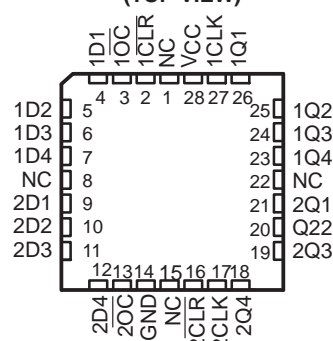
The dual 4-bit edge-triggered flip-flops enter data on the low-to-high transition of the clock (1CLK and 2CLK). All types have individual synchronous clear inputs and output control pins for each group of 4-bit registers.

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.

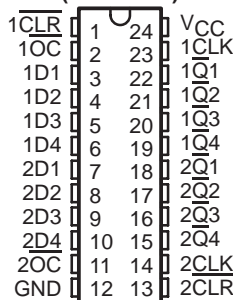
SN54ALS878A, SN54AS878 . . . JT PACKAGE  
SN74ALS878A, SN74AS878 . . . DW OR NT PACKAGE  
(TOP VIEW)



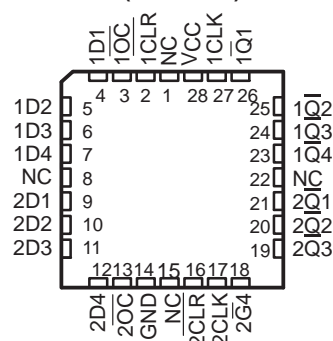
SN54ALS878A, SN54AS878 . . . FK PACKAGE  
SN74ALS878A, SN74AS878 . . . FN PACKAGE  
(TOP VIEW)



SN54ALS879A, SN54AS879 . . . JT PACKAGE  
SN74ALS879A, SN74AS879 . . . DW OR NT PACKAGE  
(TOP VIEW)



SN54ALS879A, SN54AS879 . . . FK PACKAGE  
SN74ALS879A, SN74AS879 . . . FN PACKAGE  
(TOP VIEW)



NC - No internal connection

PRODUCTION DATA information is 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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## FUNCTION TABLES

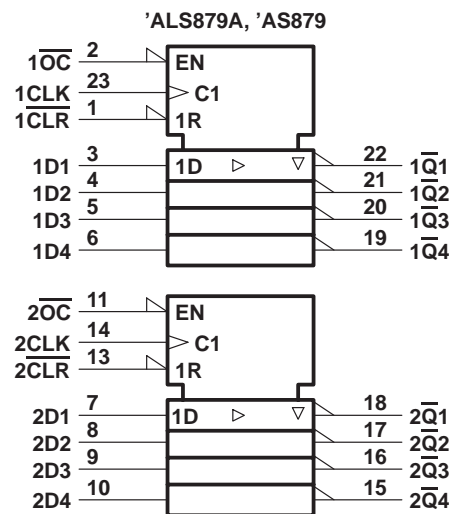
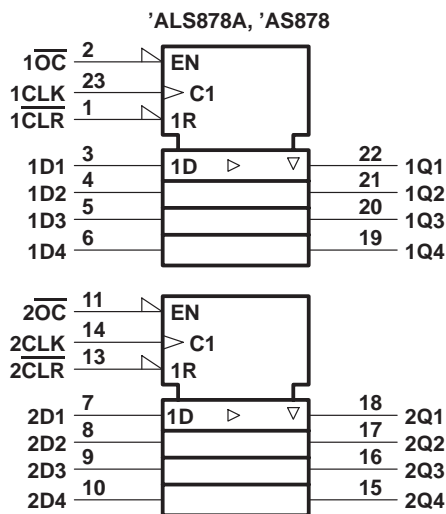
'ALS878A, 'AS878  
(each flip-flop)

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

'ALS879A, 'AS879  
(each flip-flop)

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

## logic symbols †

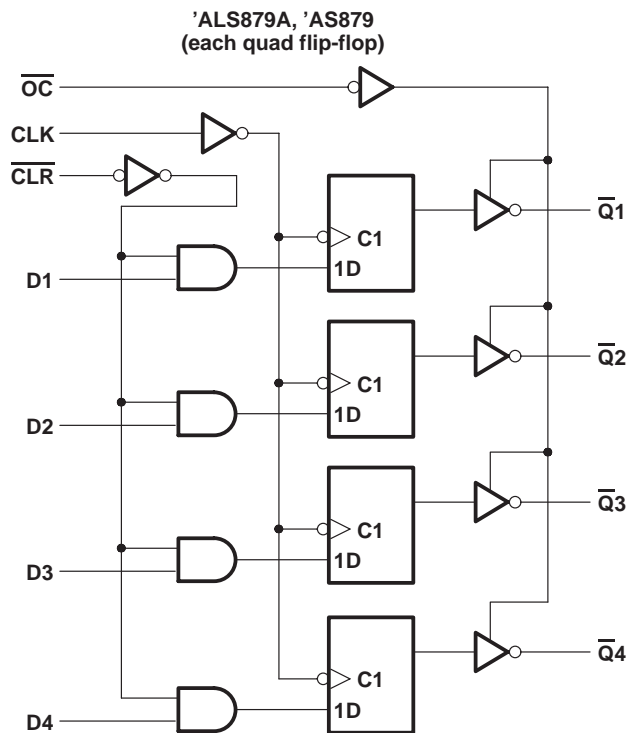
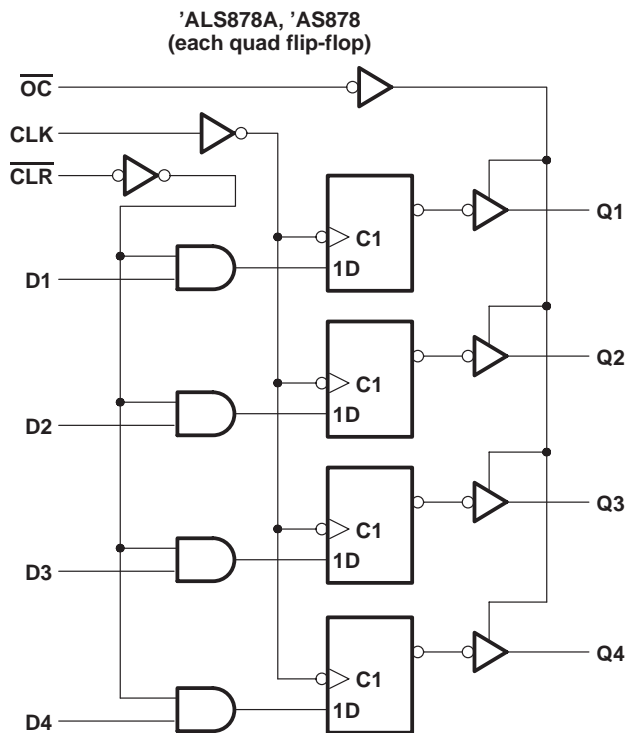


† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for DW, JT, and NT packages.

**SN54ALS878A, SN54ALS879A**  
**SN74ALS878A, SN74ALS879A**

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**logic diagrams (positive logic)**



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

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### 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↑	Data	15		15			ns
		CLR	20		20			
$t_h$	Hold time after CLK↑	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†	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 $5.5 V$ , $I_{OH} = -0.4 mA$	$V_{CC} - 2$			$V_{CC} - 2$			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
$I_{IH}$	$V_{CC} = 5.5 V$ , $V_O = 2.7 V$			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	

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

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



**SN54ALS878A, SN54ALS879A**  
**SN74ALS878A, SN74ALS879A**

**DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

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**switching characteristics (see Note 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, R1 = 500 Ω, R2 = 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, R1 = 500 Ω, R2 = 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>	$\bar{OC}$	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>	$\bar{OC}$	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.



**SN54AS878, SN54AS879**

**SN74AS878, SN74AS879**

**DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

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**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 SN54AS879			SN74AS878 SN74AS879			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 low	4		2		ns	
		CLK high	5		4			
$t_{su}$	Setup time before CLK↑	Data	3		2		ns	
		CLR	6.5		5.5			
$t_h$	Hold time after CLK↑	Data	3		2		ns	
		CLR	0		0			
$T_A$	Operating free-air temperature	-55		125	0		70°	°C



DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS		SN54AS878			SN74AS878			UNIT		
			SN54AS879			SN74AS879					
			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> -2			V <sub>CC</sub> -2			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 0.5					
I <sub>OZH</sub>	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 2.7 V	50			50			μA		
I <sub>OZL</sub>	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 0.4 V	-50			-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		-112		mA
I <sub>CC</sub>	'AS878	V <sub>CC</sub> = 5.5 V, See Note 2	Outputs high		82 132		82 132		mA		
			Outputs low		96 155		96 155				
			Outputs disabled		100 160		100 160				
			Outputs high		88 142		88 142				
			Outputs low		94 150		94 150				
			Outputs disabled		100 160		100 160				
I <sub>CC</sub>	'AS879	V <sub>CC</sub> = 5.5 V, See Note 2	Outputs high		82 132		82 132		mA		
			Outputs low		96 155		96 155				
			Outputs disabled		100 160		100 160				
			Outputs high		88 142		88 142				
			Outputs low		94 150		94 150				
			Outputs disabled		100 160		100 160				

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

NOTE 2: I<sub>CC</sub> 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 <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
			SN54AS878		SN74AS878		
			SN54AS879	MIN	MAX	SN74AS879	
t <sub>max</sub>			100		125		MHz
t <sub>PLH</sub>	CLK	Q or $\bar{Q}$	3	11.5	3	8.5	ns
t <sub>PHL</sub>			4	12.5	4	10.5	
t <sub>PZH</sub>	$\overline{OC}$	Q or $\bar{Q}$	2	8	2	7	ns
t <sub>PZL</sub>			3	11.5	3	10.5	
t <sub>PHZ</sub>	$\overline{OC}$	Q or $\bar{Q}$	2	7	2	6	ns
t <sub>PLZ</sub>			2	7	2	6	

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

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