SN54ALS870, SN54AS870, SN54ALS871, SN54AS871 SN74ALS870, SN74AS870, SN74ALS871, SN74AS871 DUAL 16-BY-4 REGISTER FILES

D2661, DECEMBER 1982 - REVISED MAY 1986

- 'ALS870 and 'AS870 in 24-Pin Small Outline, 300-mil DIP and Both Plastic and Ceramic 28-Pin Chip Carriers
- 'ALS871 and 'AS871 in 28-Pin 600-mil DIP and Both Plastic and Ceramic Chip Carriers
- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Typical Access Time:
 - 'ALS is 16 ns
 - 'AS is 11 ns
- Each Register File Has Individual Write Enable Controls and Address Lines
- Designed Specifically for Multibus Architecture and Overlapping File Operations
- Prioritized B Input Port Prevents Write Conflicts During Dual Input Mode
- Dependable Texas Instruments Quality and Reliability

description

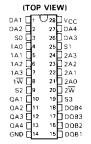
These devices feature two 16-word by 4-bit register files. Each register file has individual write-enable controls and address lines. The 'AS870 has two 4-bit data I/O ports (DQA1-DQA4 and DQB1-DQB4). The 'AS871 has one 4-bit data I/O port (DQB1-DQB4) with the other data port having individual data inputs (DA1-DA4) and data outputs (QA1-QA4). The data I/O ports can output to Bus A and Bus B, receive input from Bus A and Bus B, receive input from Bus A and output to Bus B, or output to Bus A and receive input from Bus B. To prevent writing conflicts in the dual-input mode, the B input port takes priority. Two select lines, SO and S1, control which port has access to which register. S2 determines whether the A ports are in the input or the output modes and S3 does likewise for the B ports. The address lines (1AO-1A3 or 2AO-2A3) are decoded by an internal 1-of-16 decoder to select which register word is to be accessed. All outputs are 3-state buffer-type outputs designed specifically to drive bus lines directly.

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

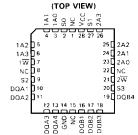
SN54ALS870, SN54AS870 . . . JT PACKAGE SN74ALS870, SN74AS870 . . . DW OR NT PACKAGE



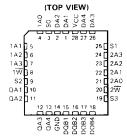
SN54ALS871, SN54AS871 . . . JD PACKAGE SN74ALS871, SN74AS871 . . . N PACKAGE



SN54ALS870, SN54AS870 . . . FK PACKAGE SN74ALS870, SN74AS870 . . . FN PACKAGE



SN54ALS871, SN54AS871 . . . FK PACKAGE SN74ALS871, SN74AS871 . . . FN PACKAGE



NC No internal connection



logic symbols†

DQA4 (11)

'ALS870, 'AS870 'ALS871, 'AS871 (REG FILE 16 X 4) [REG FILE 16 X 4] 1A0_(2) 1A0<u>(4)</u> 1A1<u>(5)</u> 1A1 (3) 1A2 (4) 1A2 (6) 1A3 (5) 1A3 (7) 2A0 (19) 2A0 (21) 2A1 (22) 2A1 (20) 2A2 (21) 2A2 (23) 2A3 (24) 2A3 (22) so_(3) SD___(1) C0/G10 C0/G10 S1 (23) S1_(25) C1/G11 C1/G11 s2_(9) S2 (7) C2 [Ain] C2 [Ain] EN12 [Aout] EN12 [Aout] sa_(19) S3⁽¹⁷⁾ C3 [Bin] C3 [Bin] EN13 [Bout] EN13 (Bout) 1W_(8) C4 C4 2W (18) 2W (20) C5 C5 DQA1 (8) (13) (1) **Z6** RAM 16 X 1 [REG 1] DQB1 **Z**7 26 RAM 16 X 1 [REG1] Z7 MUX MUX QA1_(10) √**⊘**12 -1A,0,2(1/3)4D 13 ⊳ ∇**⊘**12 1A,0,2(1/3)4D 13 ⊳ 1A,T,3,4D 1A,T,3,4D 1A 8,10 8,10 RAM 16 X 1 [REG 2] **RAM 16 X 1** [REG 2] 9,10 9,10 2A,0,2(1/3)5D 2A,0,2(1/3)5D 2A,1,3,5D 2A,1,3,5D DOA2 (9) (14) DQB2 DA2 (2) (16) DQB2 DQA3 (10) (15) DQB3 QA2_(11)

(16) DQB4

DA3 (26) QA3 (12)

DA4_(27)

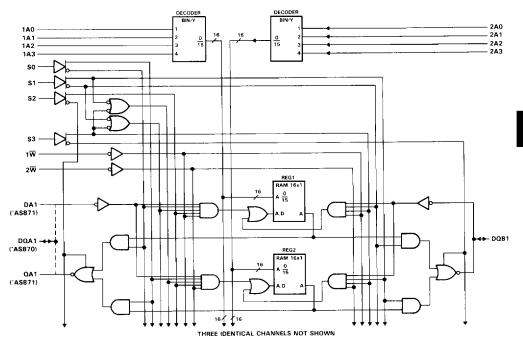
QA4 (13)

(17) DOB3

(18) DQB4

[†]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.

logic diagram (positive logic)



FUNCTION TABLE

				INDUT/OUT	DUT
	FILE SI	LECT		INPUT/OUT	
S0	S1	FILE SEL	S2		I/O SEL
L	L	1R TO A, 1R TO B			
н	L	2R TO A, 1R TO B		1	A OUT, B OUT
L	н	1R TO A, 2R TO B	_	-	1 7. 00., 5 50.
н	н	2R TO A, 2R TO B		··	
L	L	A TO 1R, 1R TO B			
н	L	A TO 2R, 1R TO B	н	1	A IN, B OUT
L	н	A TO 1R, 2R TO B	"	_	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Н	н	A TO 2R, 2R TO B			
L	L	1R TO A, B TO 1R			
н	L	2R TO A, B TO 1R	l. ,	н	A OUT, B IN
L	Н	1R TO A, B TO 2R		٠.	1
н	н	2R TO A, B TO 2R			
L	L	B TO 1R			
н	L	A TO 2R, B TO 1R	. н	н	A IN, B IN
L	н	A TO 1R, B TO 2R	''		,
H	н	B TO 2R	1		

absolute maximum ratings over operating free-air temperature range (unless otherwise noted) Operating free-air temperature range: SN54ALS870, SN54ALS871........... - 55°C to 125°C SN74ALS870, SN74ALS871...........0°C to 70°C

recommended operating conditions

			SN54ALS870 SN54ALS871			SN74ALS870 SN74ALS871			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
Vcc	Supply voltage		4.5	5	5.5	4.5	5	5.5	V
VIH	High-level input voltage		2			2			V
VIL	Low-level input voltage				0.7			0.8	V
он	High-level output current				– 1			-2.6	mA
lOL	Low-level output current				12			24	mA
t _W	Duration of write pulse			10			10		ns
		Address before write!		2			2		
t_{SU}	Setup times	Data before write1		4			4		ns
		Select before write		3.5			3.5		1
_		Address after write!		0			0		
th	Hold times	Data after write!		0			0		ns
		Select after write1		0			0		1
TA	Operating free-air temperature	•	- 55		125	0		70	°C

'ALS870 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	PARAMETER	TEST CON	DITIONS	SN	54ALS8	370	SN	74ALS8	70	UNIT
	PANAMETER	1E31 CON	DITIONS	MIN	TYP [↑]	MAX	MIN	TYP [†]	MAX	UNIT
VIK		V _{CC} = 4.5 V,	I _I = -18 mA			- 1.2		_	-1.2	V
		$V_{CC} = 4.5 \text{ V to 5.5}$	$5 \text{ V, 1}_{OH} = -0.4 \text{ mA}$	V _{CC} - 2			V _{CC} - 2			
VOH		V _{CC} = 4.5 V,	I _{OH} = -1 mA	2.4	3.2					V
		$V_{CC} = 4.5 V$,	$I_{OH} = -2.6 \text{ mA}$				2.4	3.2		
۷٥٢		$V_{CC} = 4.5 \text{ V},$	I _{OL} = 12 mA		0.25	0.5				V
VOL		$V_{CC} = 4.5 \text{ V},$	I _{OL} = 24 mA					0.35	0.5	V
l)	Control inputs	$V_{CC} = 5.5 V$,	V _I = 7 V			0.1			0.1	mA
''	DQA and DQB ports	$V_{CC} = 5.5 \text{ V},$	V _I = 5.5 V			0.2			0.2	IIIA
	1₩ and 2₩					20			20	
IIH	Other control inputs	$V_{CC} = 5.5 V$	$V_1 = 2.7 V$			40			40	μΑ
	DQA and DQB ports [‡]					50			50	
lo.	Control inputs	V _{CC} = 5.5 V,	V4 = 0.4 V			-0.2			- 0.2	mA
ΙΙL	DQA and DQB ports [‡]	VCC = 5.5 V,	VI = 0.4 V			-0.2			-0.2	mA
10§		V _{CC} = 5.5 V,	V _O = 2.25 V	30		- 112	- 30		-112	mA
¹cc	· - ·	V _{CC} = 5.5 V			70.5			70.5		mA

'ALS871 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	DADAMETER	TECT CONDIT	IONO	SN	54ALS	371	SN	74ALSE	371	
	PARAMETER	TEST CONDIT	IONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
VIK		$V_{CC} = 4.5 \text{ V},$	I _I = -18 mA			- 1.2		_	- 1.2	V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	$I_{OH} = -0.4 \text{ mA}$	V _{CC} - 2			V _{CC} ~ 2			
V_{OH}		$V_{CC} = 4.5 \text{ V},$	IOH = -1 mA	2.4	3.2					V
		$V_{CC} = 4.5 \text{ V},$	$I_{OH} = -2.6 \text{ mA}$				2.4	3.2		
VOL	-	$V_{CC} = 4.5 \text{ V},$	I _{OL} = 12 mA		0.25	0.5	1			V
VOL		$V_{CC} = 4.5 \text{ V},$	I _{OL} = 24 mA					0.35	0.5	V
lozh	QA outputs	$V_{CC} = 5.5 V,$	$V_0 = 2.7 \text{ V}$			20			20	μА
OZL	QA outputs	V _{CC} = 5.5 V,	$V_0 = 0.4 \text{ V}$			- 20			- 20	μΑ
=	Control and DA inputs	$V_{CC} = 5.5 \text{ V},$	V _I = 7 V			0.1			0.1	mA
'1	DQB ports	$V_{CC} = 5.5 V$,	$V_I = 5.5 V$			0.2			0.2	IIIA
	$1\overline{W}$, $2\overline{W}$, and DA inputs					20			20	
۱н	Other control inputs	$V_{CC} = 5.5 V$,	$V_1 = 2.7 V$			40			40	μΑ
	DQB ports‡					50			50	
1	Control and DA inputs	VCC = 5.5 V,	V: 0.4.V			-0.2			-0.2	
I ₁ L	DQB ports [‡]	νCC = 3.3 V,	v ₁ = 0.4 v			-0.2			-0.2	mA
IO§		.V _{CC} = 5.5 V,	V _O = 2.25 V	- 30		- 112	- 30		- 112	mA
1CC		V _{CC} = 5.5 V			70.5			70.5		mA

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

[‡]For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

[§]The output conditions have been chosen to produce a current that closely approximates one-half of the true short-circuit current, IOS.

'ALS870 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 C _L = 500 g R ₁ = 500 g R ₂ = 500 g T _A = MIN	oF, 1, 1,	UNIT
			SN54ALS870	SN74ALS870	1
			MIN TYPT MAX	MIN TYPT MAX	1
t _{a(A)}	Any A	Any DQ	11.5	11.5	ns
t _{a(S)}	S0	Any DQA	16	16	
(a(S)	S1	Any DQB	16	16	ns
t _{dis}	S2	Any DQA	9.5	9.5	
dis	S3	Any DQB	9.5	9.5	ns
t	S2	Any DQA	7.5	7.5	
t _{en}	S3	Any DQB	7.5	7.5	ns
	w	Any DQ	12.5	12.5	
t _{pd}	DQA	DQB	16.5	16.5	ns
	DQB	DQA	16.5	16.5	

'ALS871 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$ $C_L = 500 \text{ pF},$ $R_1 = 500 \Omega,$ $R_2 = 500 \Omega,$ $T_A = \text{MIN to MAX}$						UNIT
			SI	154ALS	871	SN	174ALS	371	1
			MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
t _{a(A)}	Any A	Any QA or DQB	1	11.5	_		11.5		ns
t (0)	S0	Any QA		16		16			
t _a (S)	S1	Any DQB	1	16			16		ns
t.e.	S2	Any QA		9.5			9.5		
^t dis —	S3	Any DQB		9.5			9.5		ns
	S2	Any QA	1	7.5			7.5		
t _{en}	S3	Any DQB	1	7.5			7.5		ns
	W	Any QA or DQB	1	12.5			12.5		
t _{pd}	DA	DQB	T	16.5			16.5		ns
	DQB	QA		16.5			16.5		

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

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

SN54AS870, SN74AS870, SN54AS871, SN74AS871 **DUAL 16-BY-4 REGISTER FILES**

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)
Supply voltage, VCC
Input voltage: All inputs
I/O ports
Voltage applied to a disabled 3-state output
Operating free-air temperature range: SN54AS870, SN54AS871
SN74AS870, SN74AS871 0 °C to 70 °C
Storage temperature range – 65 °C to 150 °C

recommended operating conditions

				SN54AS		l	N74AS		١.
				SN54AS	871	S	N74AS	371	UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V _C C	Supply voltage	<u> </u>	4.5	5	5.5	4.5	5	5.5	V
VIH	High-level input voltag	ge	2			2			V
VIL	Low-level input voltag	e			0.8			0.8	V
¹ ОН	High-level output curr	ent			- 12			- 15	mA
lOL	Low-level output curre	ent			32			48	mA
t _w	Duration of write puls	e	12			12			ns
		Address before write	5			5			
t_{SU}	Setup times	Data before write1	15			15			ns
		Select before write:	12			12			1
		Address after write1	. 0			0			
th	Hold times	Data after write1	0			0			ns
		Select after write1	12			12			1
TA	Operating free-air tem	perature	- 55		125	0		70	°C

SN54AS870, SN74AS870, SN54AS871, SN74AS871 DUAL 16-BY-4 REGISTER FILES

'AS870 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	PARAMETER	TEST CONG	NITIONE	S	N54AS	370	SI	N74AS8	70	
	FANAINCIEN	TEST CONL	DITIONS	MIN	TYP [†]	MAX	MIN	TYP	MAX	UNIT
VIK		V _{CC} = 4.5 V.	lj = - 18 mA			- 1.2			- 1.2	V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	V, I _{OH} = 2 mA	Vcc	2		Vcс	2		
Vон		V _{CC} = 4.5 V.	I _{OH} = -12 mA	2.4	3.2					V
		V _{CC} = 4.5 V,	I _{OH} = -15 mA				2.4	3.2		1
VOL		V _{CC} = 4.5 V,	I _{OL} = 32 mA		0.25	0.5				v
VOL		V _{CC} = 4.5 V,	I _{OL} - 48 mA					0.35	0.5	1 °
lq	Control inputs	$V_{CC} = 5.5 \text{ V},$	V _I = 7 V			0.1			0.1	0
'1	DQA and DQB ports	V _{CC} = 5.5 V,	V ₁ = 5.5 V			0.2			0.2	mA
	1W and 2W			1		20			20	
Ιн	Other control inputs	V _{CC} = 5.5 V,	$V_1 = 2.7 V$			40			40	μΑ
	DQA and DQB ports‡					50			50	1
f.,	Control inputs	V _{CC} = 5.5 V,				- 2			2	
اړز	DQA and DQB ports‡	ΛCC = 9:9 Λ'	V _I - 0.4 V			2			- 2	mA
IO§		V _{CC} = 5.5 V,	V _O = 2.25 V	- 30		112	- 30		- 112	mA
Icc		V _{CC} = 5.5 V			120	190		120	190	mA

'AS871 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

	ADAMETED	TEGT COND	CTIONIC	T	SN54AS	871	s	N74AS	871	
,	PARAMETER	TEST COND	THUNS	MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	UNIT
٧ _{IK}		V _{CC} = 4.5 V,	I _I = -18 mA			- 1.2			- 1.2	٧
		V _{CC} = 4.5 V to 5.5	5 V, I _{OH} = -2 mA	Vcc	2		v _{cc}	2		
νон		V _{CC} = 4.5 V,	I _{OH} =12 mA	2.4	3.2			_		V
		V _{CC} = 4.5 V,	I _{OH} = -15 mA	T			2.4	3.2		
Vai		V _{CC} = 4.5 V,	I _{OL} = 32 mA	T	0.25	0.5				V
VOL		V _{CC} = 4.5 V,	I _{OL} - 48 mA	T				0.35	0.5	V
OZH	QA outputs	V _{CC} = 5.5 V,	V _O = 2.7 V		•	50			50	μΑ
IOZL	QA outputs	V _{CC} = 5.5 V,	V _O = 0.4 V			- 50			- 50	μΑ
Ts.	Control and DA inputs	V _{CC} - 5.5 V,	V _I = 7 V			0.1			0.1	mA
h	DQB ports	V _{CC} = 5.5 V,	V ₁ = 5.5 V			0.2			0.2	mA
	1W, 2W, and DA inputs					20			20	
ΉΗ	Other control inputs	V _{CC} - 5.5 V,	$V_1 = 2.7 V$			40			40	μΑ
	DQB ports [‡]					50			50	
1	Control and DA inputs	V _{CC} = 5.5 V,	V _I = 0.4 V			2			- 2	mA
ΙL	DQB ports [‡]	VCC - 5.5 V,	V - 0.4 V			- 2			·· 2	niA.
IO§		V _{CC} = 5.5 V,	V _O = 2.25 V	- 30		- 112	30		112	mΑ
¹ CC		V _{CC} - 5.5 V			120	190		120	190	mA

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



 $^{^{\}ddagger}$ For I/O ports, the parameters IIH and IIL include the off-state output current.

The output conditions have been chosen to produce a current that closely approximates one-half of the true short-circuit current, IOS.

SN54ALS870, SN74ALS870, SN54ALS871, SN74ALS871 **DUAL 16-BY-4 REGISTER FILES**

'AS870 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)		C _L = 50 R ₁ = 500 R ₂ = 500	Ω,	V,	UNIT
			SN54	AS870	SN74A	S870	
			MIN	MAX	MIN	MAX	
t _{a(A)}	Any A	Any DQ	5	20	5	15	ns
t 101	SO	Any DQA	3	15	3	13	
t _{a(S)}	\$1	Any DQB	3	15	3	13	ns .
	S2	Any DQA	3	12	3	11	
t _{dis}	S3	Any DQB	3	12	3	11	ns
,	S2	Any DQA	3	15	3	12	
t _{en}	S3	Any DQB	3	15	3	12	ns
	W	Any DQ	5	23	5	19	
^t pd	DQA	DQB	5	25	5	22	ns
	DQB	DQA	5	25	5	22	

'AS871 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	то (ОИТРИТ)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX		$C_L = 50 \text{ pF},$ $R_1 = 500 \Omega,$ $R_2 = 500 \Omega,$				
				AS871	SN74A				
	<u> </u>		MIN	MAX	MIN	MAX			
t _{a(A)}	Any A	Any QA or DQB	5	20	5	16	ns		
t _{a(S)}	SO	Any QA	3	15	3	13			
(8(5)	S1	Any DQB	3	15	3	13	ns		
•	S2	Any QA	3	12	3	11			
^t dis	S3	Any DQB	3	. 12	3	11	ns		
	S2	Any QA	3	15	3	12			
t _{en}	S3	Any DQB	3	15	3	12	กร		
	w	Any QA or DQB	5	23	5	19			
tpd	DA	DQB	5	26	5	23	ns		
	DQB	QA	5	26	5	23			

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