

**TYPES SN54ALS638A, SN54ALS639A, SN54AS638, SN54AS639
SN74ALS638A, SN74ALS639A, SN74AS638, SN74AS639
OCTAL BUS TRANSCEIVERS**

D2261, DECEMBER 1983

- Bidirectional Bus Transceivers in High-Density 20-Pin Packages
- Choice of True or Inverting Logic
- A Bus Outputs are Open-Collector; B Bus Outputs are 3-State
- Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

These octal bus transceivers are designed for asynchronous two-way communication between open-collector and 3-state buses. The devices transmit data from the A bus (open-collector) to the B bus (3-state) or from the B bus to the A bus depending upon the level at the direction control (DIR) input. The enable input (\bar{G}) can be used to disable the device so the buses are isolated.

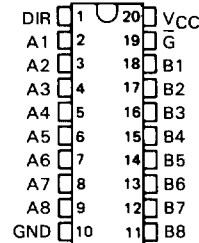
DEVICE	A OUTPUT	B OUTPUT	LOGIC
'ALS638A, 'AS638	Open-Collector	3-State	Inverting
'ALS639A, 'AS639	Open-Collector	3-State	True

The -1 versions of the SN74ALS' parts are identical to the standard versions except that recommended maximum of I_{OL} is increased to 48 milliamperes. There are no -1 versions of the SN54ALS' parts.

The SN54' family is characterized for operation over the full military temperature range of -55°C to 125°C. The SN74' family is characterized for operation from 0°C to 70°C.

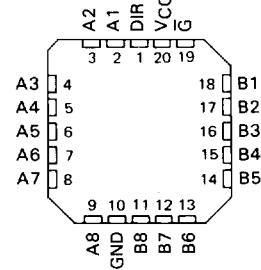
SN54ALS', SN54AS' . . . J PACKAGE
SN74ALS', SN74AS' . . . N PACKAGE

(TOP VIEW)



SN54ALS', SN54AS' . . . FH PACKAGE
SN74ALS', SN74AS' . . . FN PACKAGE

(TOP VIEW)



FUNCTION TABLE

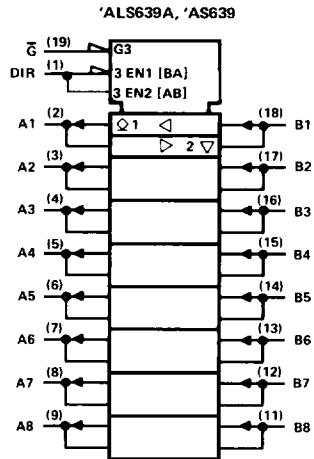
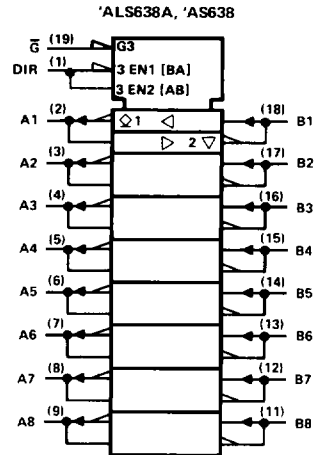
CONTROL INPUTS		OPERATION	
		'ALS638A 'AS638	'ALS639A 'AS639
G	DIR	\bar{B} data to A bus	B data to A bus
L	L	\bar{A} data to B bus	A data to B bus
L	H	Isolation	Isolation
H	X	Isolation	Isolation

2

ALS AND AS CIRCUITS

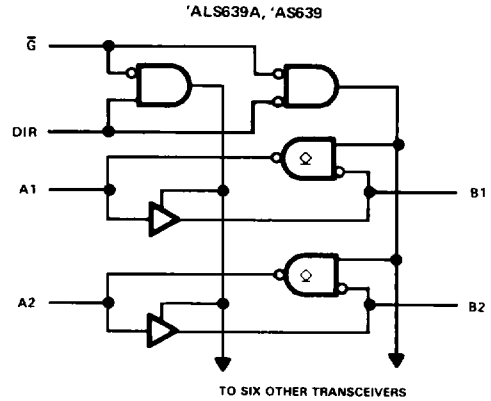
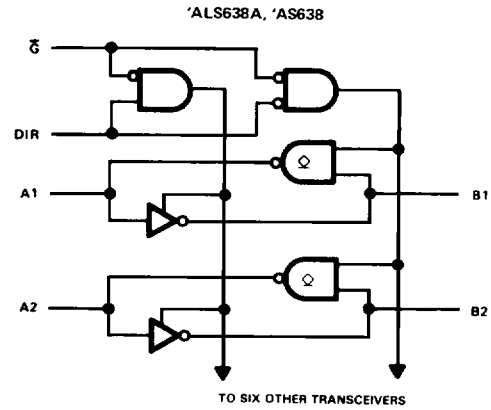
**TYPES SN54ALS638A, SN54ALS639A, SN54AS638, SN54AS639
SN74ALS638A, SN74ALS639A, SN74AS638, SN74AS639
OCTAL BUS TRANSCEIVERS**

logic symbols



Pin numbers shown are for J and N packages.

functional block diagrams (positive logic)



2
ALS AND AS CIRCUITS

TYPES SN54ALS638A, SN54ALS639A, SN74ALS638A, SN74ALS639A OCTAL BUS TRANSCEIVERS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC}	7 V
Input voltage: All inputs	7 V
A bus I/O ports	7 V
B bus I/O ports	5.5 V
Operating free-air temperature range: SN54ALS638A, SN54ALS639A	-55°C to 125°C
SN74ALS638A, SN74ALS639A	0°C to 70°C
Storage temperature range	-65°C to 150°C

recommended operating conditions

		SN54ALS638A SN54ALS639A			SN74ALS638A SN74ALS639A			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
V_{OH}	High-level output voltage			5.5			5.5	V
I_{OH}	High-level output current						-12	mA
I_{OL}	Low-level output current			12			24	mA
							48†	
T_A	Operating free-air temperature	-55		125	0		70	°C

†The extended limits apply only if V_{CC} is maintained between 4.75 V and 5.25 V.
The 48-mA limit applies for the SN74ALS638A-1 and SN74ALS639A-1 only.

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

PARAMETER	TEST CONDITIONS	SN54ALS638A SN54ALS639A		SN74ALS638A SN74ALS639A		UNIT	
		MIN	TYP‡	MAX	MIN		TYP‡
V_{IK}	$V_{CC} = 4.5$ V, $I_I = -18$ mA			-1.5		-1.5	V
I_{OH}	A ports $V_{CC} = 4.5$ V, $V_{OH} = 5.5$ V					0.1	mA
V_{OH}	B ports $V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -0.4$ mA	$V_{CC} - 2$		$V_{CC} - 2$			
		$V_{CC} = 4.5$ V, $I_{OH} = -3$ mA	2.4	3.2	2.4	3.2	V
		$V_{CC} = 4.5$ V, $I_{OH} = -12$ mA	2				
		$V_{CC} = 4.5$ V, $I_{OH} = -15$ mA			2		
V_{OL}	A or B ports $V_{CC} = 4.5$ V, $I_{OL} = 12$ mA $V_{CC} = 4.5$ V, $I_{OL} = 24$ mA ($I_{OL} = 48$ mA for -1 versions)	0.25	0.4	0.25	0.4	V	
				0.35	0.5		
I_I	Control inputs $V_{CC} = 5.5$ V, $V_I = 7$ V			0.1		0.1	mA
	A or B ports $V_{CC} = 5.5$ V, $V_I = 5.5$ V			0.1		0.1	
I_{IH}	Control inputs $V_{CC} = 5.5$ V, $V_I = 2.7$ V			20		20	µA
	A or B ports‡ $V_{CC} = 5.5$ V, $V_I = 2.7$ V			20		20	
I_{IL}	Control inputs $V_{CC} = 5.5$ V, $V_I = 0.4$ V			-0.1		-0.1	mA
	A or B ports‡ $V_{CC} = 5.5$ V, $V_I = 0.4$ V			-0.1		-0.1	
I_{OI}	B ports $V_{CC} = 5.5$ V, $V_O = 2.25$ V	-30		-112	-30	-112	mA
I_{CC}	ALS638A ALS639A $V_{CC} = 5.5$ V	Outputs high	18	36	18	30	mA
		Outputs low	25	48	26	41	
		Outputs disabled	16	35	16	30	
		Outputs high	25	45	25	40	
		Outputs low	30	55	30	50	
		Outputs disabled	33	60	33	54	

‡All typical values are at $V_{CC} = 5$ V, $T_A = 25$ °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 output current, I_{OS} .

2

ALS AND AS CIRCUITS

**TYPES SN54ALS638A, SN54ALS639A, SN74ALS638A, SN74ALS639A
OCTAL BUS TRANSCEIVERS**

***ALS638A switching characteristics (see Note 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V,}$ $C_L = 50 \text{ pF,}$ $R_L = 680 \Omega \text{ (A outputs),}$ $R_1 = R_2 = 500 \Omega \text{ (B outputs),}$ $T_A = \text{MIN to MAX}$				UNIT
			SN54ALS638A		SN74ALS638A		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2	15	2	12	ns
t_{PHL}			2	15	2	12	
t_{PLH}	B	A	8	30	8	25	ns
t_{PHL}			8	35	8	30	
t_{PLH}	\bar{G}	A	5	30	5	25	ns
t_{PHL}			10	50	10	45	
t_{PZH}	\bar{G}	B	5	25	5	20	ns
t_{PZL}			5	28	5	22	
t_{PHZ}	\bar{G}	B	2	12	2	10	ns
t_{PLZ}			3	18	3	15	

***ALS639A switching characteristics (see Note 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V,}$ $C_L = 50 \text{ pF,}$ $R_L = 680 \Omega \text{ (A outputs),}$ $R_1 = R_2 = 500 \Omega \text{ (B outputs),}$ $T_A = \text{MIN to MAX}$				UNIT
			SN54ALS639A		SN74ALS639A		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2	15	2	12	ns
t_{PHL}			2	15	2	12	
t_{PLH}	B	A	10	35	10	30	ns
t_{PHL}			5	28	5	22	
t_{PLH}	\bar{G}	A	10	35	10	30	ns
t_{PHL}			10	40	10	35	
t_{PZH}	\bar{G}	B	6	28	6	21	ns
t_{PZL}			8	30	8	25	
t_{PHZ}	\bar{G}	B	2	12	2	10	ns
t_{PLZ}			3	19	3	16	

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

TYPES SN54AS638, SN54AS639, SN74AS638, SN74AS639 OCTAL BUS TRANSCEIVERS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC}	7 V
Input voltage: All inputs	7 V
A bus I/O ports	7 V
B bus I/O ports	5.5 V
Operating free-air temperature range: SN54AS638, SN54AS639	-55 °C to 125 °C
SN74AS638, SN74AS639	0 °C to 70 °C
Storage temperature range	-65 °C to 150 °C

recommended operating conditions

		SN54AS638 SN54AS639			SN74AS638 SN74AS639			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
		V_{CC}	Supply voltage	4.5	5	5.5	4.5	
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage				0.8			V
V_{OH}	High-level output voltage	A ports			5.5			V
I_{OH}	High-level output current	B ports			-12			mA
I_{OL}	Low-level output current	A or B ports			64			mA
T_A	Operating free-air temperature	-55			125			°C

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

PARAMETER		TEST CONDITIONS	SN54AS638 SN54AS639			SN74AS638 SN74AS639			UNIT
			MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
			V_{IK}		$V_{CC} = 4.5 \text{ V}, I_I = -18 \text{ mA}$	-1.2			
I_{OH}	A ports	$V_{CC} = 4.5 \text{ V}, V_{OH} = 5.5 \text{ V}$	0.1			0.1			mA
V_{OH}	B ports	$V_{CC} = 4.5 \text{ V}, \text{ to } 5.5 \text{ V}, I_{OH} = -2 \text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
		$V_{CC} = 4.5 \text{ V}, I_{OH} = -3 \text{ mA}$	2.4	3.2		2.4	3.2		
		$V_{CC} = 4.5 \text{ V}, I_{OH} = -12 \text{ mA}$	2.4						
		$V_{CC} = 4.5 \text{ V}, I_{OH} = -15 \text{ mA}$				2.4			
V_{OL}	A or B ports	$V_{CC} = 4.5 \text{ V}, I_{OL} = 48 \text{ mA}$	0.3	0.55				V	
		$V_{CC} = 4.5 \text{ V}, I_{OL} = 64 \text{ mA}$				0.35	0.55		
I_I	Control inputs	$V_{CC} = 5.5 \text{ V}, V_I = 7 \text{ V}$	0.1			0.1			mA
	A or B ports	$V_{CC} = 5.5 \text{ V}, V_I = 5.5 \text{ V}$	0.1			0.1			
I_{IH}	Control inputs	$V_{CC} = 5.5 \text{ V}, V_I = 2.7 \text{ V}$	20			20			μA
	A or B ports [‡]		50			50			
I_{IL}	Control inputs	$V_{CC} = 5.5 \text{ V}, V_I = 0.4 \text{ V}$	-0.5			-0.5			mA
	A or B ports [‡]		-0.75			-0.75			
I_O^{\S}		$V_{CC} = 5.5 \text{ V}, V_O = 2.25 \text{ V}$	-30	-112	-30	-112	-112	mA	
I_{CC}	'AS638	$V_{CC} = 5.5 \text{ V}$	Outputs high	24	40	24	40	mA	
			Outputs low	75	122	75	122		
			Outputs disabled	37	61	37	61		
	'AS639		Outputs high	56	92	56	92		
			Outputs low	95	154	95	154		
			Outputs disabled	62	100	62	100		

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

[‡]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 output current, I_{OS} .

2

ALS AND AS CIRCUITS

TYPES SN54AS638, SN54AS639, SN74AS638, SN74AS639
OCTAL BUS TRANSCEIVERS

'AS638 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V,}$ $C_L = 50 \text{ pF,}$ $R_L = 680 \Omega \text{ (A outputs),}$ $R_1 = R_2 = 500 \Omega \text{ (B outputs),}$ $T_A = \text{MIN to MAX}$				UNIT
			SN54AS638		SN74AS638		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2	8	2	7	ns
t_{PHL}			2	7.5	2	6.5	
t_{PLH}	B	A	5	23	5	20	ns
t_{PHL}			2	8	2	7	
t_{PLH}	\bar{C}	A	5	20	5	19	ns
t_{PHL}			2	10	2	9	
t_{PZH}	\bar{C}	B	2	10	2	8	ns
t_{PZL}			2	12	2	10	
t_{PHZ}	\bar{C}	B	2	8	2	7	ns
t_{PLZ}			2	12	2	10	

'AS639 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V,}$ $C_L = 50 \text{ pF,}$ $R_L = 680 \Omega \text{ (A outputs),}$ $R_1 = R_2 = 500 \Omega \text{ (B outputs),}$ $T_A = \text{MIN to MAX}$				UNIT
			SN54AS639		SN74AS639		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2	11	2	9.5	ns
t_{PHL}			2	10.5	2	9	
t_{PLH}	B	A	5	25	5	22	ns
t_{PHL}			2	10	2	9	
t_{PLH}	\bar{C}	A	5	23	5	21.5	ns
t_{PHL}			2	12.5	2	11.5	
t_{PZH}	\bar{C}	B	2	12	2	10.5	ns
t_{PZL}			2	12	2	10.5	
t_{PHZ}	\bar{C}	B	2	7.5	2	7	ns
t_{PLZ}			2	12	2	10.5	

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

2

ALS AND AS CIRCUITS