

# SN54ALS646 thru SN54ALS649, SN54AS646, SN54AS648 SN74ALS646 thru SN74ALS649, SN74AS646, SN74AS648

# Octal Bus Transceivers and Registers

These devices consist of bus transceivers circuits, with 3-state or open-collector outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers. Data on the A or B bus will be clocked into the registers on the low-to-high transition of the appropriate clock pin (CAB or CBA). The following examples demonstrate the four fundamental bus-management functions that can be performed with the octal bus transceivers and registers.

# Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

## **Quality Overview**

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
  - · Class Q Military
  - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
  - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

### SN54ALS646 THRU SN54ALS649, SN54AS646, SN54AS648 SN74ALS646 THRU SN74ALS649, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS

D2661, DECEMBER 1983-MAY 1986

- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- Choice of True or Inverting Data Paths
- Choice of 3-State or Open-Collector Outputs
- 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

DEVICE	OUTPUT	LOGIC
'ALS646, 'AS646	3-State	True
'ALS647	Open-Collector	True
'ALS648, 'AS648	3-State	Inverting
'ALS649	Open-Collector	Inverting

#### description

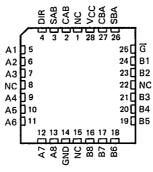
These devices consist of bus transceiver circuits, with 3-state or open-collector outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers. Data on the A or B bus will be clocked into the registers on the low-to-high transition of the appropriate clock pin (CAB or CBA). The following examples demonstrate the four fundamental bus-management functions that can be performed with the octal bus transceivers and registers.

Enable (G) and direction (DIR) pins are provided to control the transcelver functions. In the

SN54ALS', SN54AS' . . . JT PACKAGE SN74ALS', SN74AS' . . . DW OR NT PACKAGE

(TOP VIEW) T-52~31 CAB 1 U24 VCC SAB 2 23 CBA 22 SBA DIR 🗆 3 21 G A1 🛮 4 A2 5 20 B1 А3 Г 19 B2 A4 □ 18 B3 A5 **∐8** 17 B4 16 B5 15 B6 A6 [ A7 **□**10 A8 ∐11 14 B7 GND 112 13 B8

SN54ALS', SN54AS' . . . FK PACKAGE SN74ALS', SN74AS' . . . FN PACKAGE (TOP VIEW)



NC-No internal connection

transceiver mode, data present at the high-impedance port may be stored in either register or in both. The select controls (SAB and SBA) can multiplex stored and real-time (transparent mode) data. The circuitry used for select control will eliminate the typical decoding glitch which occurs in a multiplexer during the transition between stored and real-time data. The direction control determines which bus will receive data when enable  $\overline{G}$  is active (low). In the isolation mode (control  $\overline{G}$  high), A data may be stored in one register and/or B data may be stored in the other register.

When an output function is disabled, the input function is still enabled and may be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time.

The -1 versions of the SN74ALS' parts are identical to the standard versions except that the recommended maximum IOL 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.

NOTICE

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SEE ORDER OF DATA FOR ERRATA INFORMATION

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



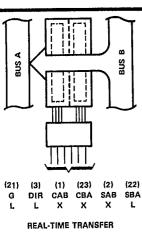
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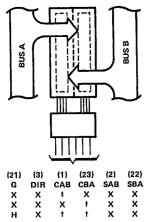
**ALS and AS Circuits** 

SN54ALS646 THRU SN54ALS649, SN54AS646, SN54AS648 SN74ALS646 THRU SN74ALS649, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS

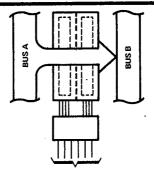
T-52-31





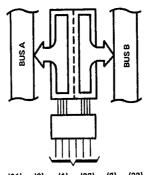


STORAGE FROM A, B, OR A AND B



(21) (3) (1) (23) (2) (22) G DIR CAB CBA SAB SBA L H X X L X

REAL-TIME TRANSFER BUS A TO BUS B



(21) (3) (23) (2) (22)DIR CAB CBA SAB \$BA H X X HorL н HorL X TRANSFER STORED DATA TO A OR B

# 8961723 0083353 7

# SN54ALS646 THRU SN54ALS649, SN54AS646, SN54AS648 SN74ALS646 THRU SN74ALS649, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS

**FUNCTION TABLE** 

T-52-31

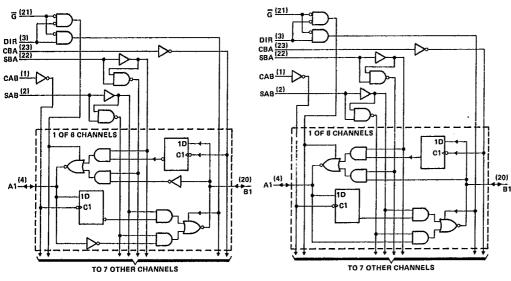
		INF	UTS			DATA	A 1/O	OPERATION OR FUNCTION						
G	DIR	САВ	СВА	SAB	SBA	A1 THRU A8	B1 THRU B8	'ALS646, 'ALS647 'AS646	'ALS648, 'ALS649 'AS648					
X	х	;	Х	X	X	Input	Unspecified †	Store A, B unspecified †	Store A, B unspecified t					
х	х	х	ż	Х	х	Unspecified <sup>†</sup>	Input	Store B, A unspecified t	Store B, A unspecified t					
Н	Х	1	t	Х	×	4	1	Store A and B Data	Store A and B Data					
Н	Х	H or L	H or L	Х	х	Input	Input	Isolation, hold storage	Isolation, hold storage					
L	L	Х	X	Х	L.	0	1	Real-Time B Data to A Bus	Real-Time B Data to A Bu					
L	L.	х	H or L	Х	Н	Output	Input	Stored B Data to A Bus	Stored B Data to A Bus					
Ļ	H	X	X	L	×		0	Real-Time A Data to B Bus	Real-Time A Data to B Bu					
L	н	H or L	х	н	×	Input	Output	Stored A Data to B Bus	Store A Data to B Bus					

<sup>†</sup>The data output functions may be enabled or disabled by various signals at the G and DIR inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every low-to-high transition on the clock inputs.

#### functional block diagrams (positive logic)

'ALS646, 'AS646, 'ALS647

'ALS648, 'AS648, 'ALS649



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

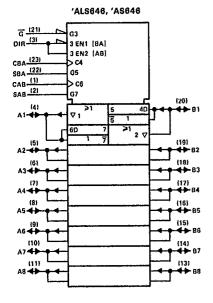
**ALS and AS Circuits** 

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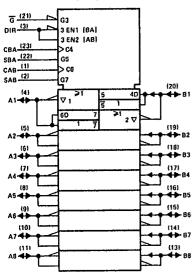
SN54ALS646 THRU SN54ALS649, SN54AS646, SN54AS648 SN74ALS646 THRU SN74ALS649, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS

T-52-31

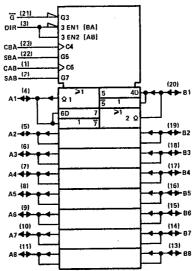




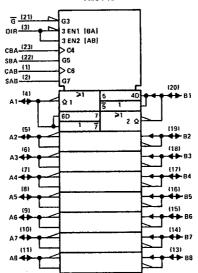




'AL\$647



#### 'AL\$649



†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.

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# OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

## T-52-31

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

Supply voltage, VCC									 	 	. ,												7	٧	
Input voltage: Control inputs									 	 													7	٧	
I/O ports										 												5	.5	V	
Operating free-air temperature range:	: 5	SΝ	154	ŀΑ	LS	6	46	 							 		- 5	55	٥٥	: 1	to	12	:5	°С	
																							0		
Ctorono tomonorotura ranco																							'n		

#### recommended operating conditions

		SN	SN54ALS646			SN74ALS646				
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT		
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		
ЮН	High-level output current			-12			15	mA		
r.	Law law law and a second			12			24	mA		
lor	Low-level output current						48 <sup>†</sup>	IIIA		
fclock	Clock frequency	0		35	0		40	MHz		
tw	Pulse duration, clocks high or low	14.5			12.5			ns		
t <sub>su</sub>	Setup time, A before CAB1 or B before CBA1	15			10			ns		
th	Hold time, A after CAB1 or B after CBA1	0			0			ns		
TA	Operating free-air temperature	-55		125	0		70	°C		

 $<sup>^\</sup>dagger$  The extended condition applies if VCC is maintained between 4.75 V and 5.25 V. The 48-mA limit applies for the SN74ALS646-1 only.

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

PARAMETER			SN	54ALS	646	SN	174ALS	646	UNIT	
PA	HAMETER	(ES) C	ONDITIONS	MIN	TYP‡	MAX	MIN	TYP‡	MAX	UNIT
VIK		V <sub>CC</sub> = 4.5 V,	l <sub>1</sub> = −18 mA			-1.2	1		- 1.2	٧
		V <sub>CC</sub> = 4.5 V to 5.	5 V, I <sub>OH</sub> = -0.4 mA	Vcc-	?		Vcc-	2		
V		V <sub>CC</sub> = 4.5 V,	I <sub>OH</sub> = -3 mA	2.4	3.2		2.4	3.2		] _
∨он		$V_{CC} = 4.5 V$ ,	I <sub>OH</sub> = -12 mA	2						] '
i		V <sub>CC</sub> = 4.5 V,	IOH = -15 mA				2			
		$V_{CC} = 4.5 \text{ V}$	IOL = 12 mA		0.25	0.4		0.25	0.4	
VOL		V <sub>CC</sub> = 4.5 V <sub>4</sub>	IOL = 24 mA				l			V
		(IOL = 48 mA for	-1 version)	Į				0.35	0.5	
1.	Control inputs	VCC = 5.5 V,	V <sub>I</sub> = 7 V			0.1			0.1	mA
l li	A or B ports	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 6.5 V			0.1			0.1	] ""
	Control inputs		V <sub>I</sub> = 2.7 V			20			20	μА
<sup>រុ</sup> អ	A or B ports§	$V_{CC} = 5.5 V$ ,	V  = 2.7 V			20	Ī		20	μA
1	Control inputs	V E E V	V <sub>I</sub> = 0.4 V			-0.2			-0.2	mA
կե	A or B ports§	V <sub>CC</sub> = 5.5 V,	V  = 0.4 V			-0.2			-0.2	
10 9		V <sub>CC</sub> = 5.5 V,	VO = 2.25 V	-30		-112	-30		-112	mA
			Outputs high		47	76		47	76	
lcc .		V <sub>CC</sub> = 5.5 V	Outputs low		55	88		55	88	mA
			Outputs disabled		55	88		55	88	

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

\$For I/O ports, the parameters I<sub>IH</sub> and I<sub>IL</sub> 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<sub>OS</sub>.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C <sub>L</sub> R1 R2 T <sub>A</sub>	C = 5 = 50 = 500 = 500 = 25	pF, ) Ω, ) Ω, •°C		V <sub>CC</sub> = 4.5 V C <sub>L</sub> = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T <sub>A</sub> = MIN to	MAX		UNIT
				ALS64	MAX	MIN	4ALS846 MAX	MIN	MAX	
	<del></del>		MIN	50	MAA	35	MAA	40		MHz
f <sub>max</sub>	_			20	25	10	35	10	30	-
tPLH	CBA or CAB	A or B	-	11	15	5	20	5	17	ns
tpht.		<del> </del>	_	11	17	5	22	5	20	<del> </del>
tPLH	A or B	B or A			10	3	15	3	12	ns
tPHL				7.5			40	15	35	ļ <u>-</u>
tPLH .	SBA or SAB†	A or B		24	32	15	23	5	20	ns
tPHL	(with A or B low)			13	17	5				
tPLH	SBA or SAB†	A or B	ļ	17	22	8	30	8	25	n\$
tPHL	(with A or B high)	7010		13	17	5	24	5	20	<del> </del>
tpzH	- G	A or B		10	15	3	20	3	17	ns
tezL	7 9 1	AUD		10	15	5	22	5	20	<u> </u>
<sup>l</sup> PHZ	G	A D		6	8	1	12	1	10	ns
tPLZ	7 <sup>6</sup>	A or B		10	13	2	20	2	16	
tPZH	· <del> </del>			22	28	10	38	10	30	ns
tPZL	DIR	A or B		14.5	20	5	30	5	25	
tPHZ	<del> </del>			6	8	1	12	1	10	ns
tPLZ	DIR	A or B		10	13	2	21	2	16	

† These parameters are measured with the internal output state of the storage register opposite to that of the bus input. NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

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#### SN54ALS647, SN74ALS647 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

T-52-31

absolute maximum ratings over operating free-air temperature range (unless oth	erwise noted)
Supply voltage, VCC	
Operating free-air temperature range: SN54ALS647	-55°C to 125°C

Storage temperature range ..... -65 °C to 150 °C

#### recommended operating conditions

		SN	SN54ALS647			SN74ALS647			
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
Vcc	Supply voltage	4.5	· 5	5.5	4.5	. 5	წ.5	V	
VIH	High-level input voltage	2			2			V	
VIL	Low-level input voltage			0.7	Π.		8.0	V	
VOH	High-level output voltage			5.5			5.5	V	
				12	l		24	mΑ	
IOL	Low-level output current						481	IIIA	
fclock	Clock frequency	0		25	0		30	MHz	
tw	Pulse duration, clocks high or low	20			16,5			រាទ	
tsu	Setup time, A before CAB1 or B before CBA1	15			10			nş	
th	Hold time, A after CAB1 or B after CBA1	0			0			ns	
TA	Operating free-air temperature	- 55		125	0		70	°C	

 $<sup>^{\</sup>rm t}$  The extended condition applies if VCC is maintained between 4.75 V and 5.25 V. The 48-mA limit applies for the SN74ALS647-1 only.

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

				SN54ALS	647	SN7	347		
PA	RAMETER	TEST CONDIT	IONS	MIN TYP\$	MAX	MIN	TYP	MAX	UNIT
VIK		V <sub>CC</sub> = 4.5 V,	I <sub>I</sub> = -18 mA		-1.2			-1.2	V
ТОН		VCC = 4.5 V,	V <sub>OH</sub> = 5.5 V		0.1			0.1	mA
		V <sub>CC</sub> = 4.5 V,	IOL ≈ 12 mA	0.25	0.4				Ī
VOL		V <sub>CC</sub> = 4.5 V,	IOL = 24 mA				0.35	0.5	l v
		$(I_{OL} = 48 \text{ mA for})$	-1 versions)				0.35	0.5	
1.	A or B ports	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 7 V		0.1			0.1	mA
lį .	Control inputs	VCC = 5.5 V.	V <sub>I</sub> = 7 V		0.1			0.1	
1	A or ports§	Vcc = 5.5 V,	VI = 2.7 V		20			20	μΑ
IН	Control inputs	AGC = 0.0 A'	V  = 2.7 V		20			20	μ
<del> </del>	Control inputs	V 551	VI = 0.4 V		-0.2			-0.2	mA
ſĮĻ	A or B ports§	V <sub>CC</sub> = 5.5 V,	VI = 0.4 V		-0.2			-0.2	
		V F E V	Outputs high	35	60		35	60	mA
ICC		V <sub>CC</sub> = 5.5 V	Outputs low	40	65		40	65	

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 $<sup>^{\</sup>ddagger}All$  typical values are at VCC = 5 V, TA = 25 °C  $^{\$}For$  I/O ports, the parameters  $l_{IH}$  and  $l_{IL}$  include the off-state output current.

### SN54ALS647, SN74ALS647 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

'ALS647 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CL RL TA	C = 5 = 50 = 680 = 25 ALS64	pF, Ω, °C 7	C <sub>L</sub> R <sub>L</sub> T <sub>A</sub> SN54	CC = 4.5 V = 50 pF, = 680 Ω, = MIN to ALS647	MAX SN74	ALS647	UNIT		
<del></del>	<del></del>	<del></del>	MIN	TYP 40	MAX	MIN 25	MAX	MIN 30	MAX	MHz		
fmax	<u> </u>	····	┿	38	50	19	72	19	58	191112		
tPLH	CBA or CAB	A or B		12	20	6	24	6	22	ns		
tPHL .			<del> </del>							<u> </u>		
tplH	AorB	B or A	B or A		35	39	17	70	17	54	ns	
t <sub>PHL</sub>	7	00174		10	13	4	19	4	16			
tPLH	SBA or SAB†	A or B		40	51	20	72	20	60	ns		
tpHL.	(with A or B low)	AUID		12	17	6	26	6	22	] ""		
tPLH	SBA or SAB†	A or B		40	51	20	72	20	60	ns		
tPHL.	(with A or B high)	AUID		12	17	6	26	6	22	1 ""		
tPLH	G	A or B	<del>                                     </del>	20	27	10	37	10	31	ns		
<sup>t</sup> PHL	1 "	A or B		10	15	2	20	2	17	] '''		
tPLH .	DIR	A 24 B	A >= 0	010		20	25	9	34	9	29	ns
tphl.	]	A OF B	A or B	13	17	2	22	2	19	115		

<sup>†</sup>These parameters are measured with the internal output state of the storage register opposite to that of the bus input, NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

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**ALS and AS Circuits** 

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		SN54ALS				
OCTAL	BUS	TRANSCEIVER	IS A	ND A	EGIST	ER:
		WITH	3-ST	ATE	OUTP	UTS
TON		7	F 0	0.1		

	NOTICE			3-STATE	
SEE	ORDER OF DATA FOR ERRATA	INFORMATION	<b>–</b> T	~52~31	
abs	olute maximum ratings over operati	ng free-air temperature range (u	ınless o	therwise	noted)
	Supply voltage, VCC				7 V
	Input voltage: Control inputs				
	I/O ports				5.5 V
	Operating free-air temperature range:	SN54ALS648		55°C	to 125°C
		SN74ALS648			
	Storage temperature range			65°C	; to 150°C

#### recommended operating conditions

		. SI	154ALS	SN54ALS648			SN74ALS648			
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT		
Vcc	Supply voltage	4.5	5	5.5	4.5	6	5.5	V		
ViH	High-level input voltage	2			2			V		
VIL	Low-level input voltage			0.7			8.0	V		
ЮН	High-level output current		•	-12			-15	mA		
				12			24	mA		
IOL	Low-level output current						481	IIIA		
fclock	Clock frequency	0		35	0		40	MHz		
tw	Pulse duration, clocks high or low	14.5			12.5			ns		
t <sub>su</sub>	Setup time, A before CAB† or B before CBA†	15			10			ns		
th	Hold time, A after CAB† or B after CBA†	0			0			ns		
TA	Operating free-air temperature	~ 55		125	0		70	°C		

 $<sup>^{\</sup>dagger}$  The extended conditon applies if VCC is maintained between 4.75 V and 5.25 V. The 48-mA limit applies for the SN74ALS648-1 only.

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

				SN	54ALS	648	SN	74ALS	648	UNIT
	PARAMETER	TEST COND	ITIONS	MIN	TYP‡	MAX	MIN	TYP‡	MAX	UNIT
VIK		V <sub>CC</sub> = 4.5 V,	lj = -18 mA			-1.2			-1.2	٧
		V <sub>CC</sub> = 4.5 V to 5.	5 V, I <sub>OH</sub> = -0.4 mA	Vcc-	2		V <sub>CC</sub> -	- 2		
	-	V <sub>CC</sub> = 4.5 V,	IOH = ~3 mA	2.4	3.2		2.4	3.2		l v
νон		V <sub>CC</sub> = 4.5 V,	IOH = -12 mA	2						l *
		V <sub>CC</sub> = 4.5 V,	I <sub>OH</sub> = -15 mA				2			
		V <sub>CC</sub> = 4.5 V,	I <sub>OL</sub> = 12 mA		0.25	0.4		0.25	0.4	
VOL		V <sub>CC</sub> = 4.5 V,	IOL = 24 mA					0.05	ο	l v
\"		(IOL = 48 mA for -	-1 version)					.0.35	0.5	
1.	Control inputs	V <sub>CC</sub> = 5.5 V,	V <sub>1</sub> = 7 V			0.1			0.1	mA
Ιſ	A or B ports	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> ≃ 5.5 V			0.1			0.1	
J	Control inputs	Vcc = 5.5 V,	Vi = 2.7 V			20			20	μΑ
lΉ	A or B ports	vCC = 5.5 v,	V  - 2.7 V			20			20	μп
l	Control inputs	Vcc = 5.5 V,	V <sub>1</sub> = 0.4 V			-0.2			-0.2	mA
IL	A or B ports	ACC = 2.2 A'	V  = 0.4 V			-0.2			-0.2	1117
101		V <sub>CC</sub> = 5.5 V,	$V_0 = 2.25 V$	- 30		- 112	-30		<b>112</b>	mA
		·	Outputs high		47	76		47	76	
ICC	cc	$V_{CC} = 5.5 V$	Outputs low		57	88		57	88	mΑ
			Outputs disabled		57	88		57	88	

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<sup>‡</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25 °C For I/O ports, the parameters I<sub>IH</sub> and I<sub>IL</sub> 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<sub>OS</sub>.

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PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 \text{ V},$ $C_L = 50 \text{ pF},$ $R1 = 500 \Omega,$ $R2 = 500 \Omega,$ $T_A = 25 ^{\circ}C$		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	
			MIN T		MAX	MIN	MAX	MIN	4ALS648 MAX	1
fmax			!	50		35		40		MHz
<sup>†</sup> PLH	CBA or CAB	A or B		21	29	8	39	8	33	ns
†PHL	CBA OF CAB	AOIB		13	18	5	23	5	20	113
tPLH	A or B	B or A		10	15	3	20	3	17	ns
<sup>t</sup> PHL	7			6	8	2	12	2	10	
tPLH	SBA or SAB†	A or B		24	32	5	44	5	39	ns
tPHL	(with A or B low)	A Or B		15	21	4	26	4	22	
tPLH	SBA or SAB†	A D		16	22	6	30	6	25	ns
t <sub>PHL</sub>	(with A or B high)	A or B		14	19	6	25	6	21	113
<sup>t</sup> PZH		A or B		12	18	4	25	4	22	ns
tpzL	7 '	AUID		12	18	4	25	4	22	110
tPHZ	- G	A or B	L	5	8	1	12	1	10	ns
tPLZ		A 01 B		7	12	2	21	2	15	
<sup>t</sup> PZH	DIR	A or B		14	22	4	35	4	27	ns
tPZL	DIII.	700		10	17	3	25	3	19	ļ <u>.</u>
tPHZ	DIR	A or B		7	12	1	17	1	14	ns
tPLZ	] ""		1	7	13	2	22	2	15	

<sup>†</sup> These parameters are measured with the internal output state of the storage register opposite to that of the bus input. NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

#### SN54ALS649, SN74ALS649 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

T-52-31

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

Supply voltage, VCC		7 V
Input voltage		7 V
Operating free-air temperature range:	SN54ALS649	55°C to 125°C
	SN74ALS649	0°C to 70°C
Storage temperature range		65°C to 150°C

#### recommended operating conditions

	SN54ALS649			SN	UNIT		
	MIN	NOM	MAX	MIN	NOM	MAX	UNII
Supply voltage	4.5	5	5.5	4.5	5	5.5	٧
High-level input voltage	2			2			V
Low-level input voltage			0.7			0.8	V
High-level output voltage			5.5			5.5	V
Law level autrus august			12			24	mA
Low-level output current						48↑	1117
Clock frequency	0		25	0		30	MHz
Pulse duration, clocks high or low	20			16.5			ns
Setup time, A before CABf or B before CBAf	15			10			ns
Hold time, A after CAB! or B after CBA!	0			0			ns
Operating free-air temperature	-55		125	0		70	°C
	High-level input voltage Low-level input voltage High-level output voltage Low-level output current Clock frequency Pulse duration, clocks high or low Setup time, A before CAB1 or B before CBA1 Hold time, A after CAB1 or B after CBA1	MIN   Supply voltage   4.5	MIN NOM   Supply voltage   4.5   5   5	MIN NOM MAX	MIN NOM MAX MIN   Supply voltage   4.5   5   5.5   4.5	Milk   NOM   MAX   MIK   NOM	Milk   NOM   MAX   MIK   NOM   MAX

 $<sup>^{\</sup>dagger}$  The extended condition applies if VCC is maintained between 4.75 V and 5.25 V. The 48-mA limit applies for the SN74ALS649-1 only.

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

24	n 4 44 F T C D	TEAT AANDS	riano.	SN54ALS	649	SN74AL	S649	
PA	RAMETER	TEST CONDI	TEST CONDITIONS			MIN TYP	* MAX	UNIT
VIK		V <sub>CC</sub> = 4.5 V,	I <sub>I</sub> = -18 mA		-1.2		-1.2	V
ЮН		V <sub>CC</sub> = 4.5 V,	V <sub>OH</sub> = 5.5 V		0.1	i	0.1	mA
		$V_{CC} = 4.5 \text{ V},$	IOL = 12 mA	0.25	0.4			
VOL		V <sub>CC</sub> = 4.5 V,	I <sub>OL</sub> = 24 mA			0,3	5 0.5	] v
		(IOL = 48 mA for -1 versions)				0.35		ł
 Ц	A or B ports	$V_{CC} = 5.5 V$	V <sub>I</sub> = 7 V		0.1		0.1	mΑ
4	Control inputs	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 7 V		0.1		0.1	] ""A
1	A or ports§	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 2.7 V		20		20	
ŀН	Control inputs	νCC = 9.9 Δ'	V  = 2.7 V		20		20	μΑ
le:	Control inputs	Vcc = 5.5 V,	V <sub>I</sub> = 0.4 V		-0.2		-0.2	
IL	A or B ports§	ACC = 9.9 A'	VI = 0.4 V		-0.2		-0.2	mA
laa		Vcc = 5.5 V	Outputs high	40	60	40	60	mA
ICC		ACC = 2.2 A	Outputs low	45	70	4:	70	1 mA

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 $<sup>^{\</sup>ddagger}AII$  typical values are at VCC = 5 V, TA = 25 °C  $^{\$}For$  I/O ports, the parameters I $_{IH}$  and I $_{IL}$  include the off-state output current.

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# SN54ALS649, SN74ALS649 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

'ALS649 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 \text{ V},$ $C_L = 50 \text{ pF},$ $R_L = 680 \Omega,$ $T_A = 25^{\circ}\text{C}$ 'ALS649		V C R T SN54	/, 1ALS649	UNIT			
			MIN		MAX	MIN	MAX	MIN	MAX	<u> </u>
fmax	<u> </u>			40		25		30		MHz
tPLH	004010	A 0		40	52	19	77	19	62	ns
tPHL	CBA or CAB	A or B		12	18	6	22	6	20	
tPLH		B or A		30	41	13	65	13	50	лѕ
tPHL	A or B	BOTA		6	9	2	11	2	10	
tPLH	SBA or SAB†			35	46	20	72	20	55	ns
tPHL	(with A or B low)	A or B		15	21	6	26	6	22	""
tPLH	SBA or SAB†	· · ·	1	35	46	20	72	20	55	ns
tPHL	(with A or B high)	A or B	<b> </b>	15	21	6	26	6	22	1115
tPLH			1	16	22	8	28	8	25	ns
tPHL	– ব	A or B		13	18	2	23	2	20	] ""
tPLH		4	$\top$	16	22	8	28	8	25	ns
tPHL	DIR	A or B		13	17	2	23	2	20	1 ''*

† These parameters are measured with the internal output state of the storage register opposite to that of the bus input. NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

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# SN54AS646, SN54AS648, SN74AS646, SN74AS648

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

T-52-31

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

Supply voltage, VCC	7 V
Input voltage: Control inputs	7 V
I/O ports	
Operating free-air temperature range: SN54AS646, SN54AS648	to 125°C
SN74AS646, SN74AS648 0°C	to 70°C
Storage temperature range65 °C	to 150°C

#### recommended operating conditions

			ľ	N54AS N54AS		SN74AS646 SN74AS648			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	UNII
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				0.8			0.8	V
<sup>1</sup> ОН	High-level output curren	nt		,	-12			15	mA
loL	Low-level output curren	t			32			48	mA
fclock	Clock frequency		0	-	75	0		90	MHz
	Pulse duration	Clock high	6			5			
tw	Pulse duration	Clock high	7			6			ns
t <sub>su</sub>	Setup time, A before Ca	ABt or B before CBA1	7			6			ns
th	Hold time, A after CAB	f or B after CBAf	0			0			ns
TA	Operating free-air temper	eratura	-55		125	0		70	°C

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

ı	PARAMETER	TEST COND	DITIONS		4AS646, 4AS648		174AS6		UNIT
				MIN T	YPT MAX	MIN	TYP <sup>†</sup>	MAX	
ViK		Vcc = 4.5 V,	I <sub>I</sub> = -18 mA		-1.2			-1.2	٧
		V <sub>CC</sub> = 4.5 V to 5.	5 V, I <sub>OH</sub> = -2 mA	V <sub>CC</sub> -2		Vcc-	2		
V		V <sub>CC</sub> = 4.5 V,	IOH = -3 mA	2.4	3.2	2.4	3.2		] <sub>v</sub>
νон		V <sub>CC</sub> = 4.5 V.	IOH = -12 mA	2					1
		$V_{CC} = 4.5 \text{ V},$	IOH = -15 mA			2			1
		V <sub>CC</sub> = 4.5 V.	IOL = 32 mA		0.25 0.50				v
VOL		$V_{CC} = 4.5 \text{ V},$	IOL = 48 mA				0.35	0.50	1 ° 1
li.	Control inputs	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 7 V		0.1			0.1	mΑ
4	A or B ports	V <sub>CC</sub> = 6.5 V,	V <sub>I</sub> = 5.5 V		0.1			0.1	IIIA
les e	Control inputs	V <sub>CC</sub> = 5.5 V,	V1 = 2.7 V		20			20	
lН	A or B ports ‡	ACC = 0.0 A'	V; = 2.7 V		70			70	μА
l	Control inputs	V 56V	V <sub>I</sub> = 0.4 V		-0.5			-0.5	mA
ll.	A or B ports§	$V_{CC} = 5.5 V$	V <sub>1</sub> = 0.4 V		-0.75	Г.,		-0.75	I MA
los		V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 2.25 V	-30	-112	-30		-112	mA
			Outputs high		120 195		120	195	
	'A\$646		Outputs low		130 211		130	211	]
100		Van - EEV	Outputs disabled		130 211		130	211	ا 👡 ا
ICC	· · · · · · · · · · · · · · · · · · ·	VCC = 5.5 V	Outputs high		110 185		110	185	mA
	'AS648		Outputs low		120 195	<u> </u>	120	195	1
	1		Outputs disabled		120 195		120	195	1

†All typical values are at VCC = 5 V, TA = 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, IQS.

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### SN54AS646, SN54AS648, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

'AS646 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	; ;	/CC = 4.5 CL = 50 pF R1 = 500 { R2 = 500 { TA = MIN 1	;, 1, 1,		UNIT
			MIN	MAX	MIN	MAX	1
f <sub>max</sub>			75		90		MHz
tpLH	004 048	A or B	2	9.5	2	8.5	ns
tPHL	CBA or CAB	A or b	2	10	2	9	
<sup>†</sup> PLH	A or B	B or A	2	11	2	9	ns
tPHL .	AUB	D 01 A	1	8	1	7	
tрцн	SBA or SAB†	A or B	2	12	2	11	ns
tehr.	JDA OF JAD		2	10	2	9	
tpzH	<u>5</u>	A or B	2	10	2	9	ns
tPZL			. 3	15	3	14	ļ <u>.</u>
tPHZ	<u></u>	A or B	2	11	2	9	ns
<sup>†</sup> PLZ			2	11	2	9	ļ
tpzH	DIR	A or B	3	19	3	16	ns
tPZL	JIII		3	21	3	18	<b> </b>
lpHZ	DIR	A or B	2	12	2	10	nş
tpLZ		0.7 0	2	12	2	10	<u> </u>

'AS648 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, R1 = 500 Ω, R2 = 500 Ω, $T_A$ = MIN to MAX				UNIT
			SN54AS648		SN74AS648		
			MIN	MAX	MIN	MAX	<del> </del>
f <sub>max</sub>			75		90		MHz
tPLH	CBA or CAB	A or B	2	9.5	2	8.5	ns
t <sub>PHL</sub>			2	. 10	2	9	
tPLH .	A or B	B or A	2	9	2	8	ns
tPHL			1	8	1	7	
IPLH	SBA or SAB†	A or B	2	12	2	11	ns
<sup>†</sup> PHL			2	10	2	9	
tPZH	<u> </u>	A or B	2	10	2	9	an L
tpZL			3	18	3	15	
tPHZ	G	A or B	2	. 11	2	. 9	L ns
tPLZ			2	11	2	9	
tPZH	DIR	A or B	3	19	3	16	ns
<sup>†</sup> PZL			3	21	3	18	5
tPHZ	DIR	A or B	2	12	2	10	ns
tPLZ			2	12	2	10	] ""

<sup>†</sup> These parameters are measured with the internal output state of the storage register opposite to that of the bus input. NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

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