

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

D2661, DECEMBER 1982—REVISED DECEMBER 1983

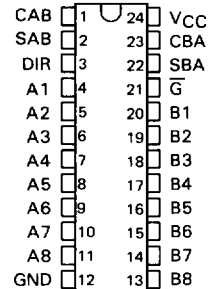
- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- Choice of True or Inverting Data Paths
- Choice of 3-State or Open-Collector Outputs
- Included Among the Package Options Are Compact 24-pin 300-mil Wide DIPs and Both 28-pin Plastic and Ceramic Chip Carriers
- Dependable 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

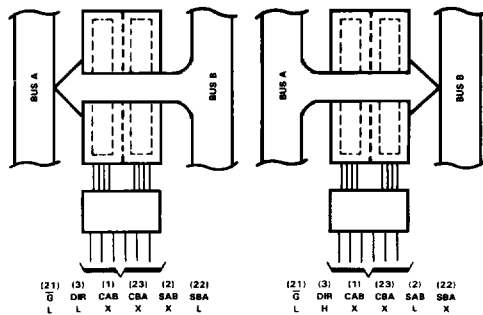
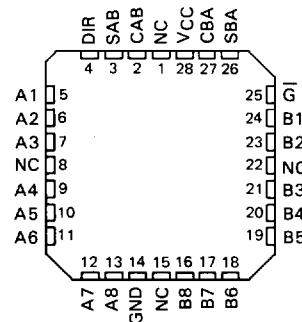
description

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 input bus or from the internal 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.

SN54ALS', SN54AS' . . . JT PACKAGE
SN74ALS', SN74AS' . . . NT PACKAGE
(TOP VIEW)

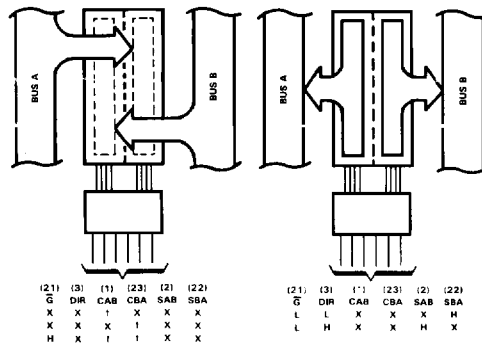


SN54ALS', SN54AS' . . . FH PACKAGE
SN74ALS', SN74AS' . . . FN PACKAGE
(TOP VIEW)



REAL-TIME TRANSFER
BUS B TO BUS A

REAL-TIME TRANSFER
BUS A TO BUS B



STORAGE FROM
A, B, OR A AND B

TRANSFER
STORED DATA
TO A OR B

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ALS AND AS CIRCUITS

TYPES SN54ALS646 THRU SN54ALS649, SN54AS646, SN54AS648 SN74ALS646 THRU SN74ALS649, SN74AS646, SN74AS649 OCTAL BUS TRANSCEIVERS AND REGISTERS

Enable (\bar{G}) and direction (DIR) pins are provided to control the transceiver functions. In the 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 direction control determines which bus will receive data when enable \bar{G} is active (low). In the isolation mode (control \bar{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.

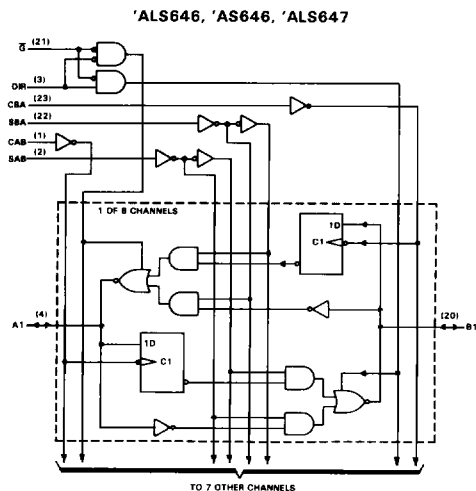
The SN54' family is characterized for operation over the full military temperature range of -55°C to 125°C. The SN74' family is characterized for operation from 0° to 70°C.

FUNCTION TABLE

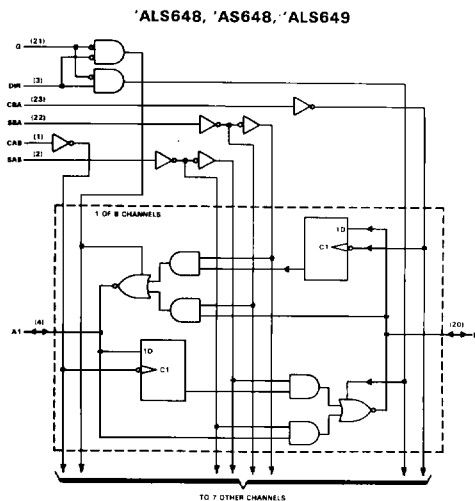
INPUTS						DATA I/O*		OPERATION OR FUNCTION	
\bar{G}	DIR	CAB	CBA	SAB	SBA	A1 THRU A8	B1 THRU B8	'ALS646, 'ALS647 'AS646	'ALS648, 'ALS649 'AS648
X	X	-	X	X	X	Input	Not specified	Store A, B unspecified	Store A, B unspecified
X	X	X	↑	X	X	Not specified	Input	Store B, A unspecified	Store B, A unspecified
H	X	-	↑	X	X	Input	Input	Store A and B Data	Store A and B Data
H	X	H or L	H or L	X	X	Input	Input	Isolation, hold storage	Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real-Time B Data to A Bus	Real-Time \bar{B} Data to A Bus
L	L	X	X	X	H	Output	Input	Stored B Data to A Bus	Stored \bar{B} Data to A Bus
L	H	X	X	L	X	Input	Output	Real-Time A Data to B Bus	Real-Time \bar{A} Data to B Bus
L	H	X	X	H	X	Input	Output	Stored A Data to B Bus	Stored \bar{A} Data to B Bus

* The data output functions may be enabled or disabled by various signals at the \bar{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)

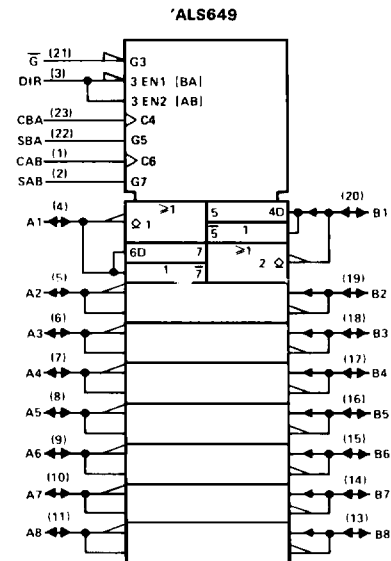
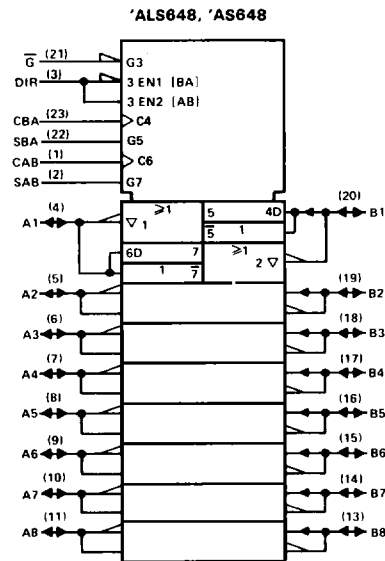
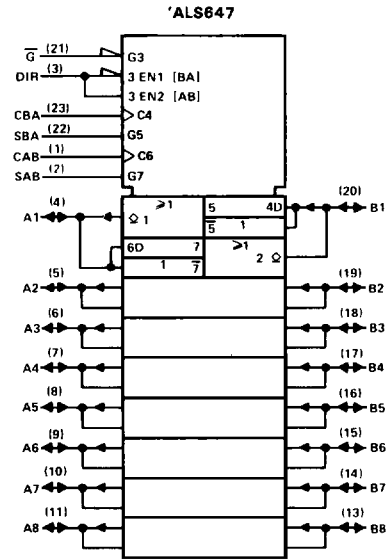
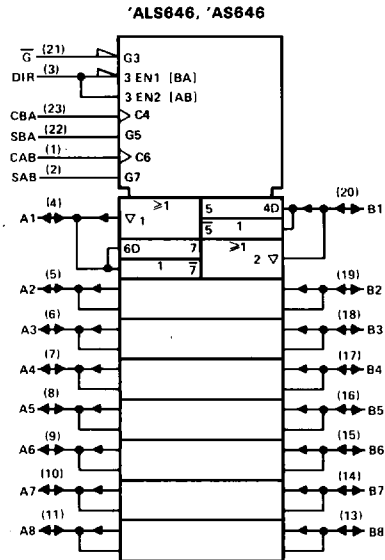


Pin numbers shown are for JT and NT packages.



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

logic symbols



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ALS AND AS CIRCUITS

TYPES SN54ALS646, SN54ALS648, SN74ALS646, SN74ALS648

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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

Supply voltage, V_{CC}	7 V
Input voltage: Control inputs	7 V
I/O ports	5.5 V
Operating free-air temperature range: SN54ALS646, SN54ALS648	-55 °C to 125 °C
SN74ALS646, SN74ALS648	0 °C to 70 °C
Storage temperature range	-65 °C to 150 °C

recommended operating conditions

		SN54ALS646 SN54ALS648			SN74ALS646 SN74ALS648			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			12			24	mA
							48†	
f_{clock}	Clock frequency							MHz
t_w	Pulse duration, clocks high or low							ns
t_{su}	Setup time, A before CAB* or B before CBA†							ns
t_h	Hold time, A after CAB* or B after CBA†							ns
T_A	Operating free-air temperature	-55		125	0		70	°C

†The extended condition applies if V_{CC} is maintained between 4.75 V and 5.25 V.
The 48-mA limit applies for the SN74ALS646-1 and SN74ALS648-1 only.

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

ALS AND AS CIRCUITS

PARAMETER	TEST CONDITIONS	SN54ALS646 SN54ALS648		SN74ALS646 SN74ALS648		UNIT	
		MIN	TYP‡	MAX	MIN		TYP‡
V_{IK}	$V_{CC} = 4.5$ V, $I_I = -18$ mA			-1.5		-1.5	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, $I_{OH} = -3$ mA	2.4	3.2		2.4	3.2	
	$V_{CC} = 4.5$ V, $I_{OH} = -12$ mA	2					
	$V_{CC} = 4.5$ V, $I_{OH} = -15$ mA				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 ($I_{OL} = 48$ mA for -1 versions)					0.35 0.5	
I_I	Control inputs	$V_{CC} = 5.5$ V,	$V_I = 7$ V			0.1	mA
	A or B ports	$V_{CC} = 5.5$ V,	$V_I = 5.5$ V			0.1	
I_{IH}	Control inputs	$V_{CC} = 5.5$ V,	$V_I = 2.7$ V			20	μ A
	A or B ports§	$V_{CC} = 5.5$ V,	$V_I = 2.7$ V			20	
I_{IL}	Control inputs	$V_{CC} = 5.5$ V,	$V_I = 0.4$ V			-0.1	mA
	A or B ports§	$V_{CC} = 5.5$ V,	$V_I = 0.4$ V			-0.2	
I_{O1}	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	-30		-112	-30		mA
I_{CC}	'ALS646	$V_{CC} = 5.5$ V	Outputs high	60		60	mA
			Outputs low	68		68	
			Outputs disabled	68		68	
			Outputs high	52		52	
			Outputs low	57		57	
			Outputs disabled	58		58	
'ALS648	$V_{CC} = 5.5$ V	Outputs high	60		60	mA	
		Outputs low	68		68		
		Outputs disabled	68		68		
		Outputs high	52		52		
		Outputs low	57		57		
		Outputs disabled	58		58		

‡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} .

Additional information on these products can be obtained from the factory as it becomes available.

PRODUCT PREVIEW

2-458 This page contains information on a product under development. Texas Instruments reserves the right to change or discontinue this product without notice.

TEXAS
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TYPES SN54ALS646, SN54ALS648, SN74ALS646, SN74ALS648 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

ALS646 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	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						UNIT
			SN54ALS646			SN74ALS646			
			MIN	TYP†	MAX	MIN	TYP†	MAX	
f _{max}									MHz
t _{PLH}	CBA or CAB	A or B	11			11			ns
t _{PHL}			13			13			
t _{PLH}	A or B	B or A	8			8			ns
t _{PHL}			8			8			
t _{PLH}	SBA or SAB‡ (with A or B high)	A or B	16			16			ns
t _{PHL}			16			16			
t _{PLH}	SBA or SAB‡ (with A or B low)	A or B	15			15			ns
t _{PHL}			12			12			
t _{PZH}	\bar{G}	A or B	17			17			ns
t _{PZL}			20			20			
t _{PHZ}	\bar{G}	A or B	10			10			ns
t _{PLZ}			12			12			
t _{PZH}	DIR	A or B	17			17			ns
t _{PZL}			20			20			
t _{PHZ}	DIR	A or B	10			10			ns
t _{PLZ}			12			12			

ALS648 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	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						UNIT
			SN54ALS648			SN74ALS648			
			MIN	TYP†	MAX	MIN	TYP†	MAX	
f _{max}									MHz
t _{PLH}	CBA or CAB	A or B	11			11			ns
t _{PHL}			13			13			
t _{PLI'}	A or B	B or A	10			10			ns
t _{PHL}			12			12			
t _{PLH}	SBA or SAB‡ (with A or B high)	A or B	16			16			ns
t _{PHL}			16			16			
t _{PLH}	SBA or SAB‡ (with A or B low)	A or B	15			15			ns
t _{PHL}			15			15			
t _{PZH}	\bar{G}	A or B	17			17			ns
t _{PZL}			20			20			
t _{PHZ}	\bar{G}	A or B	10			10			ns
t _{PLZ}			12			12			
t _{PZH}	DIR	A or B	17			17			ns
t _{PZL}			20			20			
t _{PHZ}	DIR	A or B	10			10			ns
t _{PLZ}			12			12			

†All typical values are at V_{CC} = 5 V, T_A = 25°C.

‡These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

Additional information on these products can be obtained from the factory as it becomes available.

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ALS AND AS CIRCUITS

TYPES SN54ALS647, SN54ALS649, SN74ALS647, SN74ALS649

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

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

Supply voltage, V_{CC}	7 V
Input voltage	7 V
Operating free-air temperature range: SN54ALS647, SN54ALS649	-55 °C to 125 °C
SN74ALS647, SN74ALS649	0 °C to 70 °C
Storage temperature range	-65 °C to 150 °C

recommended operating conditions

		SN54ALS647 SN54ALS649			SN74ALS647 SN74ALS649			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_{OL}	Low-level output current			12			24	mA
							48†	
f_{clock}	Clock frequency							MHz
t_w	Pulse duration, clocks high or low							ns
t_{su}	Setup time, A before CAB† or B before CBA†							ns
t_h	Hold time, A after CAB† or B after CBA†							ns
T_A	Operating free-air temperature	-55		125	0		70	°C

† The extended condition applies if V_{CC} is maintained between 4.75 and 5.25 V.
 † The 48-mA limit applies for the SN74ALS647-1 and SN74ALS649-1 only.

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ALS AND AS CIRCUITS

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

PARAMETER	TEST CONDITIONS	SN54ALS647 SN54ALS649			SN74ALS647 SN74ALS649			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	$V_{CC} = 4.5$ V, $I_I = -18$ mA			-1.5			-1.5	V
I_{OH}	$V_{CC} = 4.5$ V, $V_{OH} = 5.5$ V			0.1			0.1	mA
V_{OL}	$V_{CC} = 4.5$ V, $I_{OL} = 12$ mA			0.25			0.4	
	$V_{CC} = 4.5$ V, $I_{OL} = 24$ mA ($I_{OL} = 48$ mA for -1 versions)						0.35	0.5
I_I	A or B ports			0.1			0.1	mA
	Control inputs			0.1			0.1	
I_{IH}	A or B ports§			20			20	µA
	Control inputs			20			20	
I_{IL}	Control inputs			-0.1			-0.1	mA
	A or B ports§			-0.2			-0.2	
I_{CC}	ALS647	$V_{CC} = 5.5$ V	Outputs high	52		52	mA	
			Outputs low	62		62		
	ALS649		Outputs high	50		50		
			Outputs low	60		60		

‡ 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.

Additional information on these products can be obtained from the factory as it becomes available.

PRODUCT PREVIEW

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TEXAS
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TYPES SN54ALS647, SN54ALS649, SN74ALS647, SN74ALS649 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

'ALS647 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R _L = 680 Ω, T _A = MIN to MAX						UNIT
			SN54ALS647			SN74ALS647			
			MIN	TYP†	MAX	MIN	TYP†	MAX	
f _{max}								MHz	
t _{PLH}	CBA or CAB	A or B	24			24			ns
t _{PHL}			15			15			
t _{PLH}	A or B	B or A	24			24			ns
t _{PHL}			12			12			
t _{PLH}	SBA or SAB‡ (with A or B high)	A or B	26			26			ns
t _{PHL}			15			15			
t _{PLH}	SBA or SAB‡ (with A or B low)	A or B	26			26			ns
t _{PHL}			15			15			
t _{PLH}	G̅	A or B	24			24			ns
t _{PHL}			17			17			
t _{PLH}	DIR	A or B	24			24			ns
t _{PHL}			17			17			

'ALS649 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R _L = 680 Ω, T _A = MIN to MAX						UNIT
			SN54ALS649			SN74ALS649			
			MIN	TYP†	MAX	MIN	TYP†	MAX	
f _{max}								MHz	
t _{PLH}	CBA or CAB	A or B	24			24			ns
t _{PHL}			15			15			
t _{PLH}	A or B	B or A	24			24			ns
t _{PHL}			10			10			
t _{PLH}	SBA or SAB‡ (with A or B high)	A or B	26			26			ns
t _{PHL}			15			15			
t _{PLH}	SBA or SAB‡ (with A or B low)	A or B	26			26			ns
t _{PHL}			15			15			
t _{PLH}	G̅	A or B	24			24			ns
t _{PHL}			17			17			
t _{PLH}	DIR	A or B	24			24			ns
t _{PHL}			17			17			

† All typical values are at V_{CC} = 5 V, T_A = 25°C.

‡ These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

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

Additional information on these products can be obtained from the factory as it becomes available.

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ALS AND AS CIRCUITS

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

AS646 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	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				UNIT
			SN54AS646		SN74AS646		
			MIN	MAX	MIN	MAX	
f _{max}			75		90		MHz
t _{PLH}	CBA or CAB	A or B	2	9.5	2	8.5	ns
t _{PHL}			2	10	2	9	
t _{PLH}	A or B	B or A	2	11	2	9	ns
t _{PHL}			1	8	1	7	
t _{PLH}	SBA or SAB† (with A or B high)	A or B	2	12	2	11	ns
t _{PHL}			2	10	2	9	
t _{PZH}	\bar{G}	A or B	2	10	2	9	ns
t _{PZL}			3	15	3	14	
t _{PHZ}	\bar{G}	A or B	2	11	2	9	ns
t _{PLZ}			2	11	2	9	
t _{PZH}	DIR	A or B	3	19	3	16	ns
t _{PZL}			3	21	3	18	
t _{PHZ}	DIR	A or B	2	12	2	10	ns
t _{PLZ}			2	12	2	10	

AS648 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	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				UNIT
			SN54AS648		SN74AS648		
			MIN	MAX	MIN	MAX	
f _{max}			75		90		MHz
t _{PLH}	CBA or CAB	A or B	2	9.5	2	8.5	ns
t _{PHL}			2	10	2	9	
t _{PLH}	A or B	B or A	2	9	2	8	ns
t _{PHL}			1	8	1	7	
t _{PLH}	SBA or SAB† (with A or B high)	A or B	2	12	2	11	ns
t _{PHL}			2	10	2	9	
t _{PZH}	\bar{G}	A or B	2	10	2	9	ns
t _{PZL}			3	18	3	15	
t _{PHZ}	\bar{G}	A or B	2	11	2	9	ns
t _{PLZ}			2	11	2	9	
t _{PZH}	DIR	A or B	3	19	3	16	ns
t _{PZL}			3	21	3	18	
t _{PHZ}	DIR	A or B	2	12	2	10	ns
t _{PLZ}			2	12	2	10	

† These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

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ALS AND AS CIRCUITS