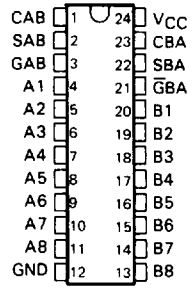
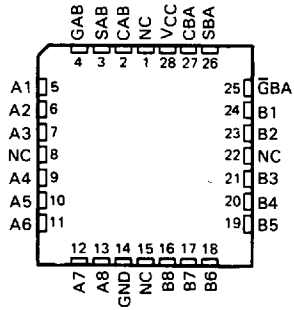
- **Bus Transceivers/Registers**
- **Independent Registers and Enables for A and B Buses**
- **Multiplexed Real-Time and Stored Data**
- **Choice of True and Inverting Data Paths**
- **Choice of 3-State or Open-Collector Outputs to A Bus**
- **Package Options Include Plastic "Small Outline" Packages, Plastic and Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs**

DEVICE	A OUTPUT	B OUTPUT	LOGIC
'ALS651, 'AS651	3-State	3-State	Inverting
'ALS652, 'AS652	3-State	3-State	True
'ALS653	Open-Collector	3-State	Inverting
'ALS654	Open-Collector	3-State	True

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



SN54ALS', SN54AS' . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

These devices consist of bus transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers. Enable GAB and $\overline{\text{GBA}}$ are provided to control the transceiver functions. SAB and SBA control pins are provided to select whether real-time or stored data is transferred. The circuitry used for select control will eliminate the typical decoding glitch that occurs in a multiplexer during the transition between stored and real-time data. A low input level selects real-time data, and a high selects stored data. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the octal bus transceivers and registers.

Data on the A or B data bus, or both, can be stored in the internal D flip-flops by low-to-high transitions at the appropriate clock pins (CAB or CBA) regardless of the select or enable control pins. When SAB and SBA are in the real-time transfer mode, it is also possible to store data without using the internal D-type flip-flops by simultaneously enabling GAB and $\overline{\text{GBA}}$. In this configuration, each output reinforces its input. Thus, when all other data sources to the two sets of bus lines are at high impedance, each set of bus lines will remain at its last state.

The -1 versions of the SN74ALS651 through SN74ALS653 are identical to the standard versions except that the recommended maximum I_{OL} is increased to 48 milliamperes. There are no -1 versions of the SN54' series.

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.

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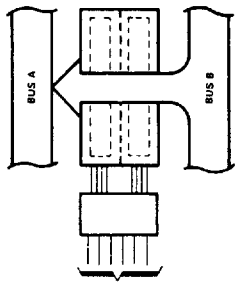
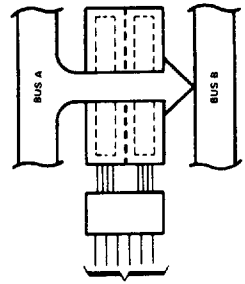


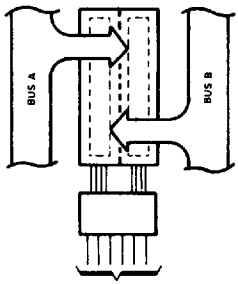
GAB	$\overline{G}$BA	CAB	CBA	SAB	SBA
L	L	X	X	X	L

REAL-TIME TRANSFER
BUS B TO BUS A



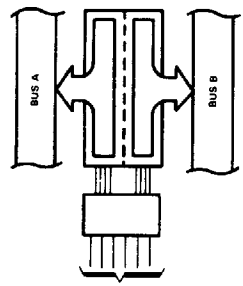
GAB	$\overline{G}$BA	CAB	CBA	SAB	SBA
H	H	X	X	L	X

REAL-TIME TRANSFER
BUS A TO BUS B



GAB	$\overline{G}$BA	CAB	CBA	SAB	SBA
X	H	↑	X	X	X
L	X	X	↑	X	X
L	H	↑	↑	X	X

STORAGE FROM
A AND/OR B



GAB	$\overline{G}$BA	CAB	CBA	SAB	SBA
H	L	H or L	H or L	H	H

TRANSFER
STORED DATA
TO A AND/OR B

Figure 1. Bus Transfer Diagram

TEXAS INSTRUMENTS

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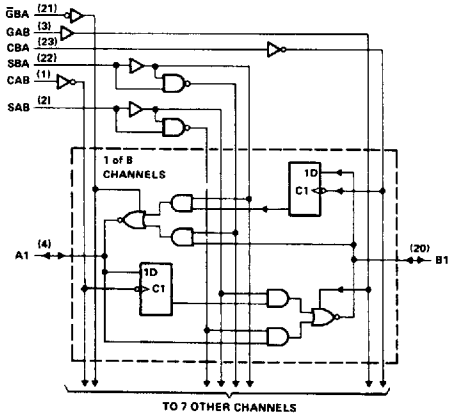
FUNCTION TABLE

INPUTS						DATA I/O		OPERATION OR FUNCTION	
GAB	$\overline{GBA}$	CAB	CBA	SAB	SBA	A1 THRU A8	B1 THRU B8	'ALS651, 'ALS653 'AS651	'ALS652, 'ALS654 'AS652
L	H	H or L	H or L	X	X	Input	Input	Isolation	Isolation
L	H	↑	↑	X	X			Store A and B Data	Store A and B Data
X	H	↑	H or L	X	X	Input	Unspecified†	Store A, Hold B	Store A, Hold B
H	H	↑	↑	X‡	X	Input	Output	Store A in both registers	Store A in both registers
L	X	H or L	↑	X	X	Unspecified†	Input	Hold A, Store B	Hold A, Store B
L	L	↑	↑	X	X‡	Output	Input	Store B in both registers	Store B in both registers
L	L	X	X	X	L	Output	Input	Real-Time $\overline{B}$ Data to A Bus	Real-Time B Data to A Bus
L	L	X	H or L	X	H			Stored $\overline{B}$ Data to A Bus	Stored B Data to A Bus
H	H	X	X	L	X	Input	Output	Real-Time $\overline{A}$ Data to B Bus	Real-Time A Data to B Bus
H	H	H or L	X	H	X			Stored $\overline{A}$ Data to B Bus	Stored A Data to B Bus
H	L	H or L	H or L	H	H	Output	Output	Stored $\overline{A}$ Data to B Bus and Stored $\overline{B}$ Data to A Bus	Stored A Data to B Bus and Stored B Data to A Bus

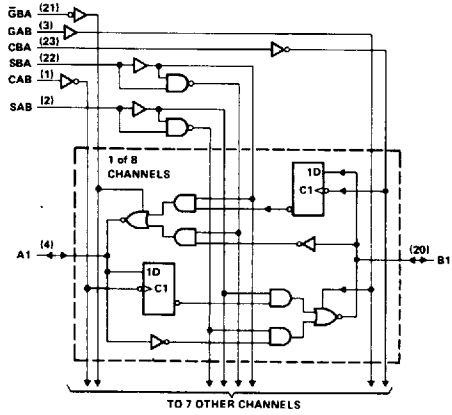
†The data output functions may be enabled or disabled by various signals at the GAB or $\overline{GBA}$ inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every low-to-high transition on the clock inputs.
‡Select control = L: clocks can occur simultaneously.
Select control = H: clocks must be staggered in order to load both registers.

logic diagram (positive logic)

'ALS651, 'AS651, 'ALS653



'ALS652, 'AS652, 'ALS654



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

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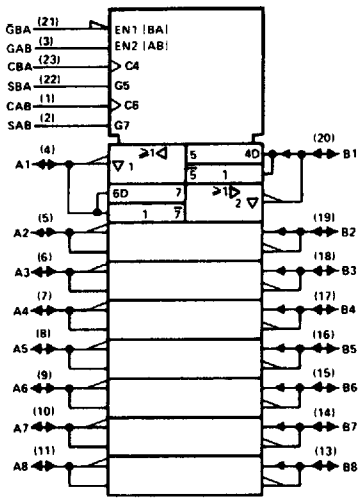
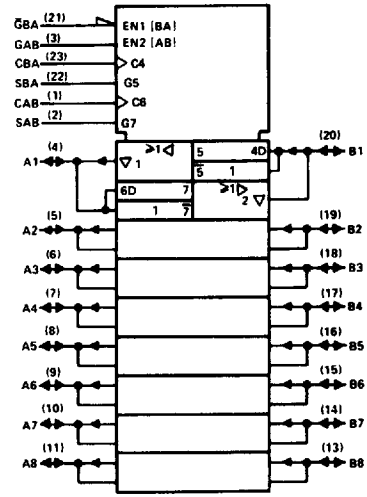
logic symbols†

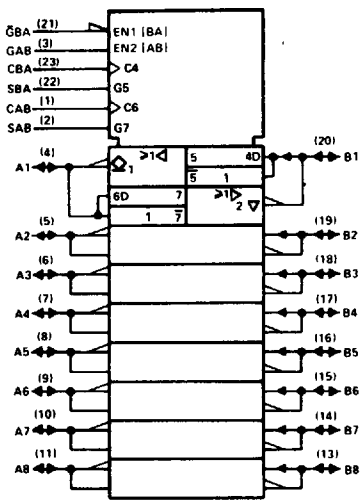
'ALS651, 'AS651



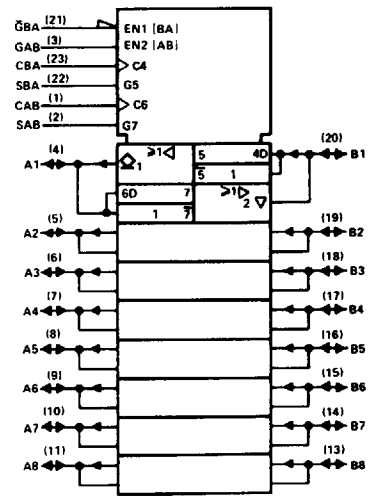
'ALS652, 'AS652



'ALS653



'ALS654



†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

TEXAS INSTRUMENTS

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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: SN54ALS652 . . . . . −55°C to 125°C
SN74ALS651, SN74ALS652 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

'ALS651 recommended operating conditions

			SN74ALS651			UNIT
			MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	V
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage				0.8	V
I_{OH}	High-level output current				−15	mA
I_{OL}	Low-level output current				24	mA
					48†	
f_{clock}	Clock frequency		0		40	MHz
t_w	Pulse duration	CBA or CAB high	12.5			ns
		CBA or CAB low	12.5			
t_{su}	Setup time before CABꜛ or CBAꜛ	A or B	10			ns
t_h	Hold time after CABꜛ or CBAꜛ	A or B	0			ns
T_A	Operating free-air temperature		0		70	°C

'ALS652 recommended operating conditions

			SN54ALS652			SN74ALS652			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		0		35	0		40	MHz
t_w	Pulse duration	CBA or CAB high	14.5			12.5			ns
		CBA or CAB low	14.5			12.5			
t_{su}	Setup time before CABꜛ or CBAꜛ	A or B	15			10			ns
t_h	Hold time after CABꜛ or CBAꜛ	A or B	5			0			ns
T_A	Operating free-air temperature		−55		125	0		70	°C

†The 48-mA limit applies for the SN74ALS651-1 and SN74ALS652-1 and if V_{CC} is maintained between 4.75 V and 5.25 V

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'ALS651 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN74ALS651 MIN	SN74ALS651 TYP†	SN74ALS651 MAX	UNIT
V_{IK}		V_{CC} = 4.5 V,	I_I = −18 mA			−1.2	V
V_{OH}		V_{CC} = 4.5 V to 5.5 V,	I_{OH} = −0.4 mA	V_{CC}−2			V
		V_{CC} = 4.5 V,	I_{OH} = −3 mA	2.4	3.2		
		V_{CC} = 4.5 V,	I_{OH} = −12 mA				
		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	V
		V_{CC} = 4.5 V,	I_{OL} = 24 mA		0.35	0.5	
		V_{CC} = 4.75 V, I_{OL} = 48 mA (−1 versions)					
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	µA
	A or B ports ‡					20	
I_{IL}	Control inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.2	mA
	A or B ports ‡					−0.2	
I_O§	B ports	V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	mA
I_{CC}	'ALS651	V_{CC} = 5.5 V	Outputs high		42	68	mA
			Outputs low		52	82	
			Outputs disabled		52	82	

'ALS652 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54ALS652 MIN	SN54ALS652 TYP†	SN54ALS652 MAX	SN74ALS652 MIN	SN74ALS652 TYP†	SN74ALS652 MAX	UNIT
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} = −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					0.35	0.5	
		V_{CC} = 4.75 V, I_{OL} = 48 mA (−1 versions)								
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‡					20			20	
I_{IL}	Control inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.2			−0.2	mA
	A or B ports‡					−0.2			−0.2	
I_O§		V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	−30		−112	mA
I_{CC}	'ALS652	V_{CC} = 5.5 V	Outputs high		47	76		47	76	mA
			Outputs low		55	88		55	88	
			Outputs disabled		55	88		55	88	

†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}

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TEXAS INSTRUMENTS

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'ALS651 switching characteristics (see Figure 2)

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
			SN74ALS651		
			MIN	MAX	
f_{max}			40		MHz
t_{PLH}	CBA or CAB	A or B	10	32	ns
t_{PHL}			5	17	
t_{PLH}	A or B	B or A	4	18	ns
t_{PHL}			2	10	
t_{PLH}	SBA or SAB† (with A or B high)	A or B	13	38	ns
t_{PHL}			7	21	
t_{PLH}	SBA or SAB† (with A or B low)	A or B	8	25	ns
t_{PHL}			7	21	
t_{PZH}	$\overline{G}$BA	A	5	20	ns
t_{PZL}			5	18	
t_{PHZ}	$\overline{B}$BA	A	2	9	ns
t_{PLZ}			3	12	
t_{PZH}	GAB	B	7	22	ns
t_{PZL}			7	21	
t_{PHZ}	GAB	B	2	12	ns
t_{PLZ}			2	14	

'ALS652 switching characteristics (see Figure 2)

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
			SN54ALS652		SN74ALS652		
			MIN	MAX	MIN	MAX	
f_{max}			35		40		MHz
t_{PLH}	CBA or CAB	A or B	10	35	10	30	ns
t_{PHL}			5	20	5	17	
t_{PLH}	A or B	B or A	5	20	5	18	ns
t_{PHL}			3	15	3	12	
t_{PLH}	SBA or SAB† (with A or B high)	A or B	15	40	15	35	ns
t_{PHL}			6	23	6	20	
t_{PLH}	SBA or SAB† (with A or B low)	A or B	8	30	8	25	ns
t_{PHL}			5	24	5	20	
t_{PZH}	$\overline{G}$BA	A	3	20	3	17	ns
t_{PZL}			5	22	5	18	
t_{PHZ}	$\overline{G}$BA	A	1	12	1	10	ns
t_{PLZ}			2	20	2	16	
t_{PZH}	GAB	B	8	25	8	22	ns
t_{PZL}			6	21	6	18	
t_{PHZ}	GAB	B	1	12	1	10	ns
t_{PLZ}			2	21	2	16	

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

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

Supply voltage, V_{CC} . . . . . 7 V
Input voltage: All inputs and A I/O ports . . . . . 7 V
B I/O ports . . . . . 5.5 V
Operating free-air temperature range: SN54ALS653 . . . . . −55°C to 125°C
SN74ALS653, SN74ALS654 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

'ALS653 recommended operating conditions

			SN54ALS653			SN74ALS653			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	A ports			5.5			5.5	V
I_{OH}	High-level output current	B ports			−12			−15	mA
I_{OL}	Low-level output current				12			24	mA
f_{clock}	Clock frequency	A ports	0		12.5	0		35	MHz
		B ports	0		25				
t_w	Pulse duration	CBA or CAB high	25			14.5			ns
		CBA or CAB low	25			14.5			
t_{su}	Setup time before CAB↑ or CBA↑	A or B	15			10			ns
t_h	Hold time after CAB↑ or CBA↑	A or B	5			0			ns
T_A	Operating free-air temperature		−55		125	0		70	°C

'ALS654 recommended operating conditions

			SN74ALS654			UNIT
			MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	V
V_{IH}	High-level input voltage		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			−15	mA
I_{OL}	Low-level output current				24	mA
					48†	
f_{clock}	Clock frequency	A ports	0		35	MHz
		B ports				
t_w	Pulse duration	CBA or CAB high	14.5			ns
		CBA or CAB low	14.5			
t_{su}	Setup time before CAB↑ or CBA↑	A or B	10			ns
t_h	Hold time after CAB↑ or CBA↑	A or B	0			ns
T_A	Operating free-air temperature		0		70	°C

† The 48-mA limit applies for the SN74ALS653-1, only, if V_{CC} is maintained between 4.75 V and 5.25 V.

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TEXAS INSTRUMENTS

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'ALS653 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54ALS653			SN74ALS653			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}	B ports	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			
I_{OH}	A ports	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		0.25	0.4	V
		V_{CC} = 4.75 V,	I_{OL} = 24 mA					0.35	0.5	
		V_{CC} = 4.75 V, I_{OL} = 48 mA (-1 versions)								
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‡					20			20	
I_{IL}	Control inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.2			−0.2	mA
	A or B ports‡					−0.2			−0.2	
I_O§	B ports	V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	−30		−112	mA
I_{CC}	'ALS653	V_{CC} = 5.5 V	Outputs high		47	76		47	76	mA
			Outputs low		55	88		55	88	
			Outputs disabled		55	88		55	88	

'ALS654 electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN74ALS654			UNIT
				MIN	TYP†	MAX	
V_{IK}		V_{CC} = 4.5 V,	I_I = −18 mA			−1.2	V
V_{OH}	B ports	V_{CC} = 4.5 V to 5.5 V,	I_{OH} = −0.4 mA	V_{CC}−2			V
		V_{CC} = 4.5 V,	I_{OH} = −3 mA	2.4	3.2		
		V_{CC} = 4.5 V,	I_{OH} = −12 mA				
		V_{CC} = 4.5 V,	I_{OH} = −15 mA	2			
I_{OH}	A ports	V_{CC} = 4.5 V,	V_{OH} = 5.5 V			0.1	mA
V_{OL}		V_{CC} = 4.5 V,	I_{OL} = 12 mA		0.25	0.4	V
		V_{CC} = 4.75 V,	I_{OL} = 24 mA		0.35	0.5	
		V_{CC} = 4.75 V, I_{OL} = 48 mA (−1 versions)					
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	µA
	A or B ports ‡					20	
I_{IL}	Control inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.2	mA
	A or B ports ‡					−0.2	
I_O§	B ports	V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	mA
I_{CC}	'ALS654	V_{CC} = 5.5 V	Outputs high		47	76	mA
			Outputs low		55	88	
			Outputs disabled		55	88	

† 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}

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switching characteristics (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 to 5.5 V, C_L = 50 pF, R_L = 680 Ω (A outputs), R1 = R2 = 500 Ω (B outputs), T_A = MIN to MAX				UNIT
			SN54ALS653		SN74ALS653		
			MIN	MAX	MIN	MAX	
f_{max}		A	12.5				MHz
		B	25				
t_{PLH}	CBA	A	16	71	16	64	ns
t_{PHL}			6	24	6	22	
t_{PLH}	CAB	B	10	35	10	30	ns
t_{PHL}			5	20	5	17	
t_{PLH}	A	B	5	20	5	18	ns
t_{PHL}			15	18	2	15	
t_{PLH}	B	A	8	63	12	56	ns
t_{PHL}			2	18	2	15	
t_{PLH}	SBA† (with B high)	A	19	68	19	62	ns
t_{PHL}			5	27	5	25	
t_{PLH}	SBA† (with B low)	A	19	68	19	62	ns
t_{PHL}			5	27	5	25	
t_{PLH}	SAB† (with A high)	B	8	30	15	35	ns
t_{PHL}			6	25	6	22	
t_{PLH}	SAB† (with A low)	B	12	40	8	25	ns
t_{PHL}			6	25	6	22	
t_{PLH}	$\overline{G}$BA	A	6	35	6	30	ns
t_{PHL}			6	27	6	24	
t_{PZH}	GAB	B	7	25	8	22	ns
t_{PZL}			6	25	6	22	
t_{PHZ}	GAB	B	1	16	1	14	ns
t_{PLZ}			2	21	2	16	

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

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switching characteristics (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R_L = 680 Ω (A outputs), R1 = R2 = 500 Ω (B outputs), T_A = MIN to MAX		UNIT
			SN74ALS654		
			MIN	MAX	
f_{max}		A	35		MHz
		B			
t_{PLH}	CBA	A	16	64	ns
t_{PHL}			6	22	
t_{PLH}	CAB	B	10	30	ns
t_{PHL}			5	17	
t_{PLH}	A	B	5	18	ns
t_{PHL}			2	15	
t_{PLH}	B	A	12	56	ns
t_{PHL}			2	15	
t_{PLH}	SBA† (with B high)	A	19	62	ns
t_{PHL}			5	25	
t_{PLH}	SBA† (with B low)	A	19	62	ns
t_{PHL}			5	25	
t_{PLH}	SAB† (with A high)	B	15	35	ns
t_{PHL}			6	22	
t_{PLH}	SAB† (with A low)	B	8	25	ns
t_{PHL}			6	22	
t_{PLH}	$\overline{G}$BA	A	6	30	ns
t_{PHL}			6	24	
t_{PZH}	GAB	B	8	22	ns
t_{PZL}			6	22	
t_{PHZ}	GAB	B	1	14	ns
t_{PLZ}			2	16	

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

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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: SN54ALS651, SN54ALS652 . . . . . −55°C to 125°C
SN74ALS651, SN74ALS652 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

recommended operating conditions

			SN54AS651 SN54AS652			SN74AS651 SN74AS652			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		75	0		90	MHz
t_w	Pulse duration	CBA or CAB high	6			5			ns
		CBA or CAB low	7			6			
t_{su}	Setup time before CAB↑ or CBA↑	A or B	7			6			ns
t_h	Hold time after CAB↑ or CBA↑	A or B	0			0			ns
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		SN54AS651 SN54AS652			SN74AS651 SN74AS652			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} = −2 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} = 32 mA		0.25	0.50				V
		V_{CC} = 4.5 V,	I_{OL} = 48 mA					0.35	0.50	
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‡					70			70	
I_{IL}	Control inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.5			−0.5	mA
	A or B ports‡					−0.75			−0.75	
I_O§		V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	−30		−112	mA
I_{CC}	'AS651	V_{CC} = 5.5 V	Outputs high		110	185		110	185	mA
			Outputs low		120	195		120	195	
			Outputs disabled		130	195		130	195	
	'AS652		Outputs high		120	195		120	195	
			Outputs low		130	211		130	211	
			Outputs disabled		130	211		130	211	

† 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}.

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'AS651 switching characteristics (see Figure 2)

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
			SN54AS651		SN74AS651		
			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†	A or B	2	12	2	11	ns
t_{PHL}			2	10	2	9	
t_{PZH}	$\overline{G}$BA	A	2	11	2	10	ns
t_{PZL}			3	18	3	16	
t_{PHZ}	$\overline{G}$BA	A	2	10	2	9	ns
t_{PLZ}			2	10	2	9	
t_{PZH}	GAB	B	3	12	3	11	ns
t_{PZL}			3	20	3	16	
t_{PHZ}	GAB	B	2	11	2	10	ns
t_{PLZ}			2	12	2	11	

'AS652 switching characteristics (see Figure 2)

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
			SN54AS652		SN74AS652		
			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†	A or B	2	12	2	11	ns
t_{PHL}			2	10	2	9	
t_{PZH}	$\overline{G}$BA	A	2	11	2	10	ns
t_{PZL}			3	18	3	16	
t_{PHZ}	$\overline{G}$BA	A	2	10	2	9	ns
t_{PLZ}			2	10	2	9	
t_{PZH}	GAB	B	3	12	3	11	ns
t_{PZL}			3	20	3	16	
t_{PHZ}	GAB	B	2	11	2	10	ns
t_{PLZ}			2	12	2	11	

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

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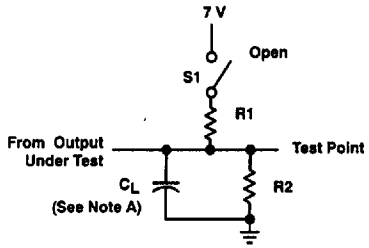
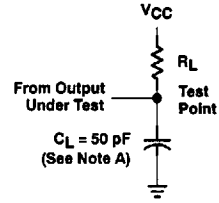
PARAMETER MEASUREMENT INFORMATION



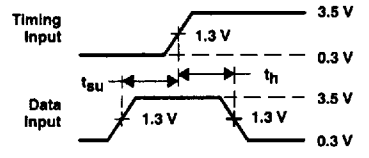
LOAD CIRCUIT FOR
3-STATE OUTPUTS

SWITCH POSITION TABLE

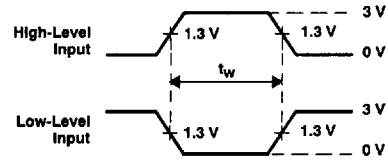
TEST	S1
t_{PLH}	Open
t_{PHL}	Open
t_{PZH}	Open
t_{PZL}	Closed
t_{PHZ}	Open
t_{PLZ}	Closed



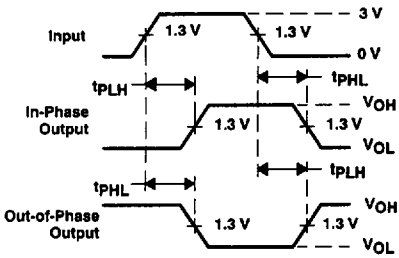
LOAD CIRCUIT FOR
OPEN-COLLECTOR OUTPUTS



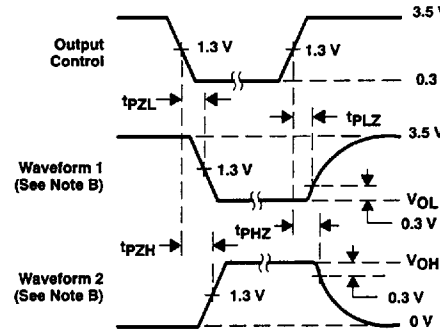
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLED TIMES, 3-STATE OUTPUTS

NOTES. A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. Input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $t_r = t_f = 2$ ns, duty cycle = 50%
D. The outputs are measured one at a time with one transition per measurement.

Figure 2. Load Circuits and Voltage Waveforms

TEXAS INSTRUMENTS

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