SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576
OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS065B – DECEMBER 1982 – REVISED JANUARY 1995

- **3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly**
- **Bus-Structured Pinout**
- **Buffered Control Inputs**
- **SN74ALS577A Has Synchronous Clear**
- **Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), Standard Plastic (N, NT) and Ceramic (J) 300-mil DIPs, and Ceramic Flat (W) Packages**

SN54ALS576B, SN54AS576 . . . J OR W PACKAGE
SN74ALS576B, SN74AS576 . . . DW OR N PACKAGE
(TOP VIEW)

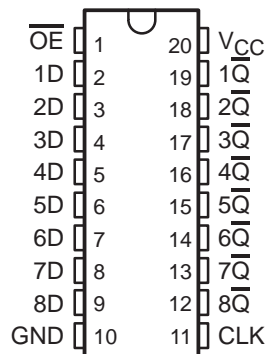| Pin			Pin
$\overline{OE}$	1	20	V_{CC}
1D	2	19	$1\overline{Q}$
2D	3	18	$2\overline{Q}$
3D	4	17	$3\overline{Q}$
4D	5	16	$4\overline{Q}$
5D	6	15	$5\overline{Q}$
6D	7	14	$6\overline{Q}$
7D	8	13	$7\overline{Q}$
8D	9	12	$8\overline{Q}$
GND	10	11	CLK

description

These octal D-type edge-triggered flip-flops feature 3-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

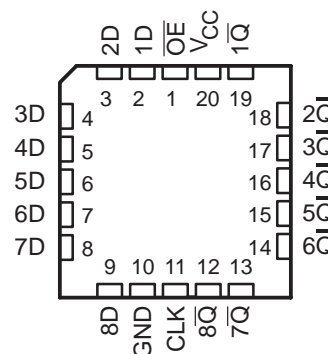These flip-flops enter data on the low-to-high transition of the clock (CLK) input.

The output-enable ($\overline{OE}$) input does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are disabled.

The SN54ALS576B and SN54AS576 are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74ALS576B, SN74ALS577A, and SN74AS576 are characterized for operation from 0°C to 70°C.

SN54ALS576B, SN54AS576 . . . FK PACKAGE
(TOP VIEW)

Top pins (left to right): 2D (3), 1D (2), $\overline{OE}$ (1), V_{CC} (20), $1\overline{Q}$ (19)

Left	Pin		Pin	Right
3D	4		18	$2\overline{Q}$
4D	5		17	$3\overline{Q}$
5D	6		16	$4\overline{Q}$
6D	7		15	$5\overline{Q}$
7D	8		14	$6\overline{Q}$

Bottom pins (left to right): 8D (9), GND (10), CLK (11), $8\overline{Q}$ (12), $7\overline{Q}$ (13)

SN74ALS577A . . . DW OR NT PACKAGE
(TOP VIEW)

Pin			Pin
CLR	1	24	V_{CC}
OE	2	23	NC
1D	3	22	$1\overline{Q}$
2D	4	21	$2\overline{Q}$
3D	5	20	$3\overline{Q}$
4D	6	19	$4\overline{Q}$
5D	7	18	$5\overline{Q}$
6D	8	17	$6\overline{Q}$
7D	9	16	$7\overline{Q}$
8D	10	15	$8\overline{Q}$
NC	11	14	CLK
GND	12	13	NC

NC – No internal connection

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1

Function Tables

′ALS576B, ′AS576
(each flip-flop)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	$\overline{Q}$
L	↑	H	L
L	↑	L	H
L	L	X	$\overline{Q}_0$
H	X	X	Z

SN74ALS577A
(each flip-flop)

INPUTS				OUTPUT
$\overline{OE}$	$\overline{CLR}$	CLK	D	$\overline{Q}$
L	L	↑	X	H
L	H	↑	H	L
L	H	↑	L	H
L	H	L	X	$\overline{Q}_0$
H	X	X	X	Z

logic symbols†

′ALS576B, ′AS576
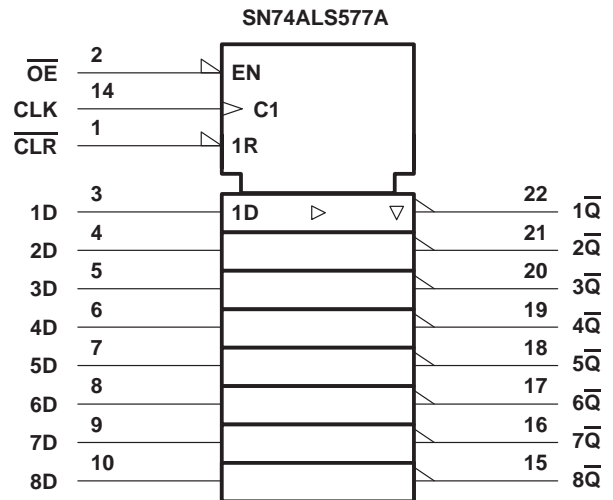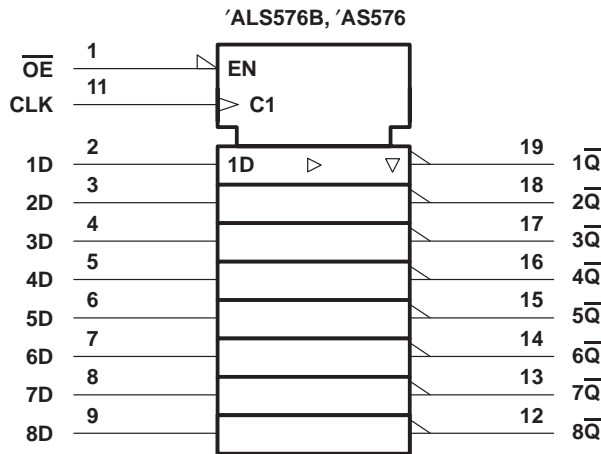
SN74ALS577A

† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown for the ′ALS576B and ′AS576 are for the DW, J, N, and W packages.
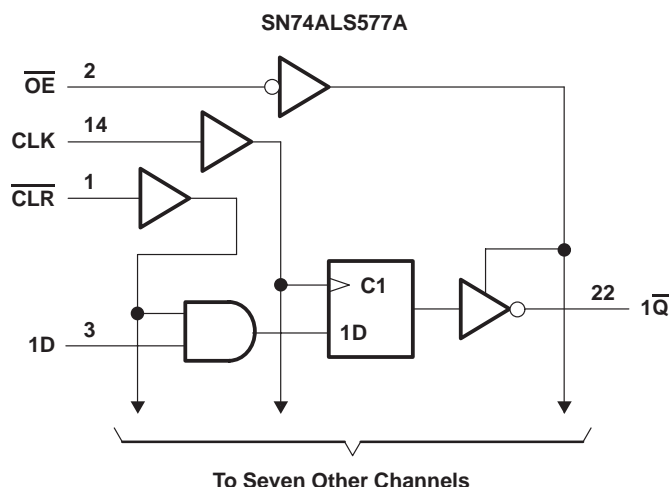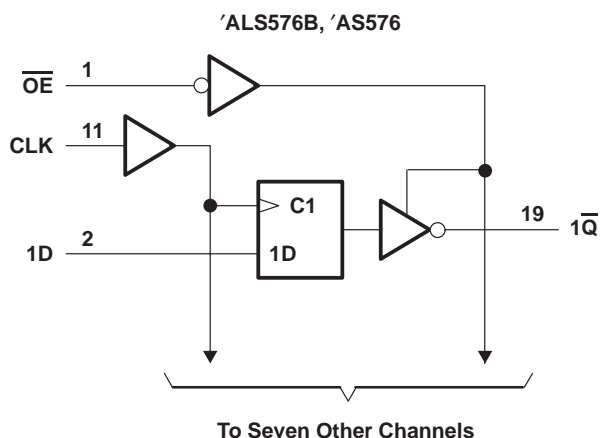
Pin numbers shown for the SN74ALS577A are for the DW and NT packages.

logic diagrams (positive logic)

'ALS576B, 'AS576

SN74ALS577A

To Seven Other Channels

Pin numbers shown are for the DW, J, N, and W packages.

Pin numbers shown are for the DW and NT packages.

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

Supply voltage, V_{CC} . . . . 7 V
Input voltage, V_I . . . . 7 V
Voltage applied to a disabled 3-state output . . . . 5.5 V
Operating free-air temperature range, T_A: SN54ALS576B . . . . −55°C to 125°C
SN74ALS576B, SN74ALS577A . . . . 0°C to 70°C
Storage temperature range . . . . −65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and
functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not
implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

			SN54ALS576B			SN74ALS576B SN74ALS577A			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				0.7			0.8	V
I_{OH}	High-level output current				−1			−2.6	mA
I_{OL}	Low-level output current				12			24	mA
f_{clock}	Clock frequency	'ALS576B	0		22	0		30	MHz
		SN74ALS577A				0		30	
t_w	Pulse duration	'ALS576B, CLK high or low	25			16.5			ns
		SN74ALS577A, CLK high or low				16.5			
t_{su}	Setup time before CLK↑	Data	15			15			ns
		SN74ALS577A $\overline{CLR}$				15			
t_h	Hold time after CLK↑	Data	4			0			ns
		SN74ALS577A $\overline{CLR}$				0			
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		SN54ALS576B			SN74ALS576B SN74ALS577A			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} = −0.4 mA	V_{CC} −2			V_{CC} −2			V
	V_{CC} = 4.5 V	I_{OH} = −1 mA	2.4	3.3					
		I_{OH} = −2.6 mA				2.4	3.2		
V_{OL}	V_{CC} = 4.5 V	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
		I_{OL} = 24 mA					0.35	0.5	
I_{OZH}	V_{CC} = 5.5 V,	V_O = 2.7 V			20			20	µA
I_{OZL}	V_{CC} = 5.5 V,	V_O = 0.4 V			−20			−20	µA
I_I	V_{CC} = 5.5 V,	V_I = 7 V			0.1			0.1	mA
I_{IH}	V_{CC} = 5.5 V,	V_I = 2.7 V			20			20	µA
I_{IL}	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.2			−0.2	mA
I_O‡	V_{CC} = 5.5 V,	V_O = 2.25 V	−20		−112	−30		−112	mA
I_{CC}	V_{CC} = 5.5 V	Outputs high		10	18		10	18	mA
		Outputs low		15	24		15	24	
		Outputs disabled		16	30		16	30	

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

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

switching characteristics (see Figure 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
			SN54ALS576B		SN74ALS576B		SN74ALS577A		
			MIN	MAX	MIN	MAX	MIN	MAX	
f_{max}			22		30		30		MHz
t_{PLH}	CLK	Any $\overline{Q}$	4	24	3	14	4	14	ns
t_{PHL}			4	20	4	14	4	14	
t_{PZH}	$\overline{OE}$	Any $\overline{Q}$	4	24	3	18	4	18	ns
t_{PZL}			3	23	4	18	4	18	
t_{PHZ}	$\overline{OE}$	Any $\overline{Q}$	2	14	1	10	2	10	ns
t_{PLZ}			3	29	2	15	3	15	

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

Supply voltage, V_{CC} . . . . 7 V
Input voltage, V_I . . . . 7 V
Voltage applied to a disabled 3-state output . . . . 5.5 V
Operating free-air temperature range, T_A: SN54AS576 . . . . −55°C to 125°C
SN74AS576 . . . . 0°C to 70°C
Storage temperature range . . . . −65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

			SN54AS576			SN74AS576			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		100	0		125	MHz
t_w*	Pulse duration	CLK high	5			4			ns
		CLK low	4			2			
t_{su}*	Setup time, data before CLK↑		3			2			ns
t_h*	Hold time, data after CLK↑		3			2			ns
T_A	Operating free-air temperature		−55		125	0		70	°C

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

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

PARAMETER		TEST CONDITIONS		SN54AS576 MIN	TYP†	MAX	SN74AS576 MIN	TYP†	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} = −2 mA	V_{CC} −2			V_{CC} −2			V
		V_{CC} = 4.5 V	I_{OH} = −12 mA	2.4	3.2					
			I_{OH} = −15 mA				2.4	3.3		
V_{OL}		V_{CC} = 4.5 V	I_{OL} = 32 mA		0.29	0.5				V
			I_{OL} = 48 mA					0.33	0.5	
I_{OZH}		V_{CC} = 5.5 V,	V_O = 2.7 V			50			50	μA
I_{OZL}		V_{CC} = 5.5 V,	V_O = 0.4 V			−50			−50	μA
I_I		V_{CC} = 5.5 V,	V_I = 7 V			0.1			0.1	mA
I_{IH}		V_{CC} = 5.5 V,	V_I = 2.7 V			20			20	μA
I_{IL}	D	V_{CC} = 5.5 V,	V_I = 0.4 V			−3			−2	mA
	All others					−0.5			−0.5	
I_O‡		V_{CC} = 5.5 V,	V_O = 2.25 V	−30		−112	−30		−112	mA
I_{CC}		V_{CC} = 5.5 V	Outputs high		77	125		77	125	
			Outputs low		84	135		84	135	mA
			Outputs disabled		84	135		84	135	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

switching characteristics (see Figure 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§ SN54AS576 MIN	MAX	SN74AS576 MIN	MAX	UNIT
f_{max}*			100		125		MHz
t_{PLH}	CLK	Any $\overline{Q}$	3	11	3	8	ns
t_{PHL}			4	11	4	9	
t_{PZH}	$\overline{OE}$	Any $\overline{Q}$	2	7	2	6	ns
t_{PZL}			3	11	3	10	
t_{PHZ}	$\overline{OE}$	Any $\overline{Q}$	2	7	2	6	ns
t_{PLZ}			2	7	2	6	

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.
§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
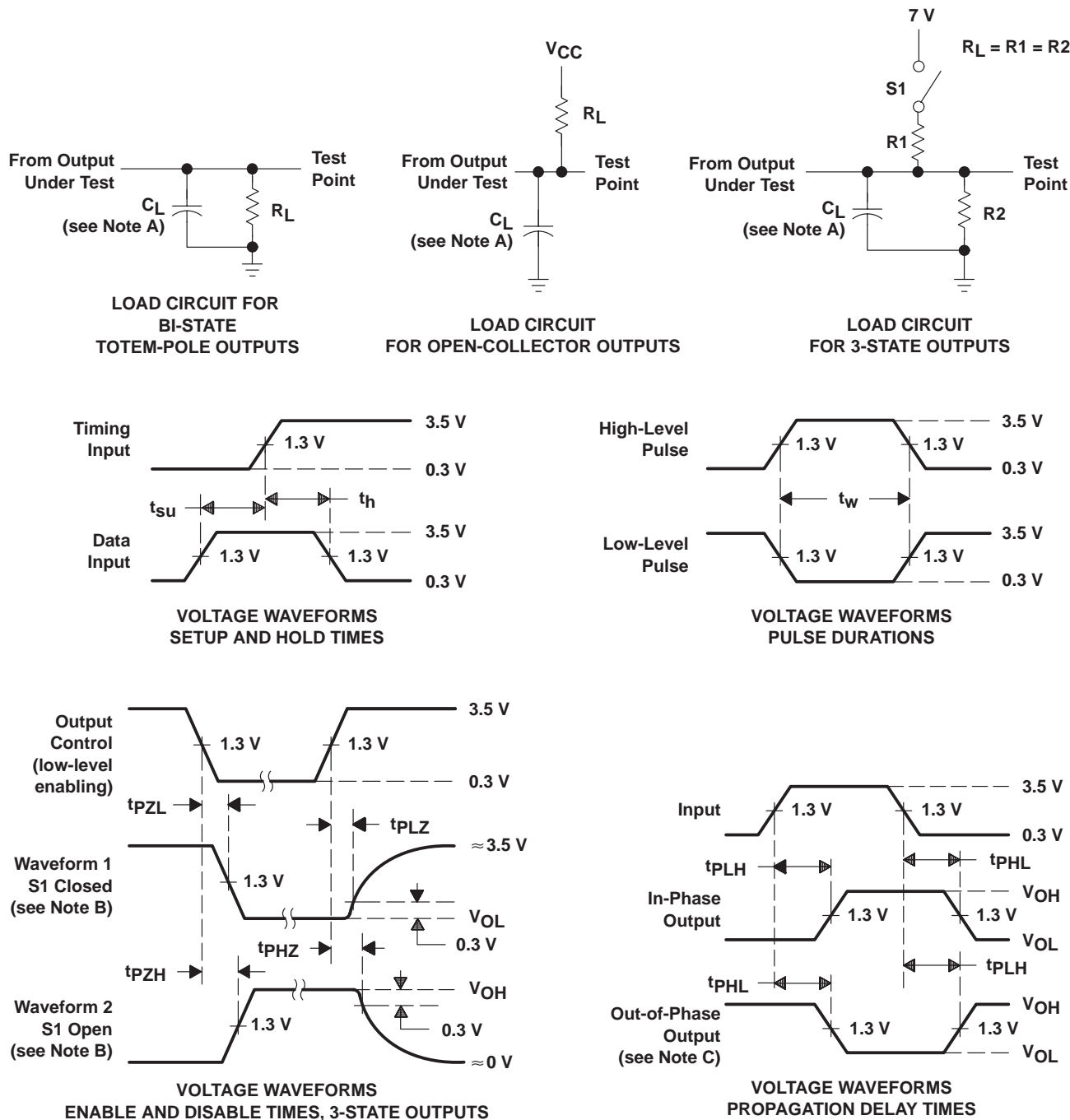
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PARAMETER MEASUREMENT INFORMATION
SERIES 54ALS/74ALS AND 54AS/74AS DEVICES

LOAD CIRCUIT FOR BI-STATE TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR OPEN-COLLECTOR OUTPUTS

LOAD CIRCUIT FOR 3-STATE OUTPUTS

$R_L = R1 = R2$

VOLTAGE WAVEFORMS SETUP AND HOLD TIMES

VOLTAGE WAVEFORMS PULSE DURATIONS

VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES

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. When measuring propagation delay items of 3-state outputs, switch S1 is open.
      D. All input pulses have the following characteristics: PRR ≤ 1 MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
      E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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Products ◢   Applications ◢   Support ◢

PRODUCT FOLDER | PRODUCT INFO: <u>FEATURES</u> | <u>DESCRIPTION</u> | <u>DATASHEETS</u> | <u>PRICING/AVAILABILITY/PKG</u> |
<u>APPLICATION NOTES</u> | <u>USER GUIDES</u> | <u>MORE LITERATURE</u>

PRODUCT SUPPORT: <u>TRAINING</u>

SN54ALS576B, Octal D-type Edge-Triggered Flip-Flops With 3-State Outputs
DEVICE STATUS: **ACTIVE**

PARAMETER NAME	SN54ALS576B	SN74ALS576B
Voltage Nodes (V)	5	5
Vcc range (V)	4.5 to 5.5	4.5 to 5.5
Input Level	TTL	TTL
Output Level	TTL	TTL
Output Drive (mA)		-2.6/24
No. of Outputs	8	8
Static Current		21
th (ns)		0
tpd max (ns)		14
tsu (ns)		15
Logic	Inv	Inv

FEATURES
▲Back to Top

- 3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Buffered Control Inputs
- SN74ALS577A Has Synchronous Clear
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), Standard Plastic (N, NT) and Ceramic (J) 300-mil DIPs, and Ceramic Flat (W) Packages

DESCRIPTION
▲Back to Top

These octal D-type edge-triggered flip-flops feature 3-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

These flip-flops enter data on the low-to-high transition of the clock (CLK) input.

The output-enable ($\overline{OE}$) input does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are disabled.

The SN54ALS576B and SN54AS576 are characterized for operation over the full military temperature range of -55°C to 125°C. The SN74ALS576B, SN74ALS577A, and SN74AS576 are characterized for operation from 0°C to 70°C.

TECHNICAL DOCUMENTS
▲Back to Top

To view the following documents, <u>Acrobat Reader 4.0</u> is required.
To download a document to your hard drive, right-click on the link and choose 'Save'.

Product Folder: SN54ALS576B, Octal D-type Edge-Triggered Flip-Flops With 3-State Outputs

Full datasheet in Acrobat PDF: sn54als576b.pdf (127 KB,Rev.B) (Updated: 01/01/1995)

View Application Notes for Digital Logic

- Advanced Schottky (ALS and AS) Logic Families (SDAA010 - Updated: 08/01/1995)
- Bus-Interface Devices With Output-Damping Resistors Or Reduced-Drive Outputs (Rev. A) (SCBA012A - Updated: 08/01/1997)
- Designing With Logic (Rev. C) (SDYA009C - Updated: 06/01/1997)
- Evaluation of Nickel/Palladium/Gold-Finished Surface-Mount Integrated Circuits (SZZA026 - Updated: 06/20/2001)
- Input and Output Characteristics of Digital Integrated Circuits (SDYA010 - Updated: 10/01/1996)
- Live Insertion (SDYA012 - Updated: 10/01/1996)
- TI IBIS File Creation, Validation, and Distribution Processes (SZZA034 - Updated: 08/29/2002)
- Understanding and Interpreting Texas Instruments Standard-Logic Products Data Sh (Rev. A) (SZZA036A - Updated: 02/27/2003)

- Enhanced Plastic Portfolio Brochure (SGZB004, 387 KB - Updated: 08/19/2002)
- Logic Reference Guide (SCYB004, 1032 KB - Updated: 10/23/2001)
- MicroStar Junior BGA Design Summary (SCET004, 167 KB - Updated: 07/28/2000)
- Military Brief (SGYN138, 803 KB - Updated: 10/10/2000)
- Overview of IEEE Std 91-1984, Explanation of Logic Symbols Training Booklet (Rev. A) (SDYZ001A, 138 KB - Updated: 07/01/1996)
- Palladium Lead Finish User's Manual (SDYV001, 2041 KB - Updated: 11/01/1996)
- QML Class V Space Products Military Brief (Rev. A) (SGZN001A, 257 KB - Updated: 10/07/2002)

- LOGIC Pocket Data Book (SCYD013, 4837 KB - Updated: 12/05/2002)

DEVICE INFORMATION Updated Daily								TI INVENTORY STATUS As Of 09:00 AM GMT, 17 Apr 2003			REPORTED DISTRIBUTOR INVENTORY As Of 09:00 AM GMT, 17 Apr 2003		
ORDERABLE DEVICE	STATUS	PACKAGE TYPE | PINS	TEMP (ºC)	DSCC NUMBER	PRODUCT CONTENT	BUDGETARY PRICING QTY | $US	STD PACK QTY	IN STOCK	IN PROGRESS QTY | DATE	LEAD TIME	DISTRIBUTOR COMPANY | REGION	IN STOCK	PURCHASE
84001022A	ACTIVE	LCCC (FK) | 20	-55 TO 125		View Contents	1KU | 10.65	1	58*	3856 | 20 May	8 WKS	None Reported View Distributors		
									>10k | 27 May				
8400102RA	ACTIVE	CDIP (J) | 20	-55 TO 125		View Contents	1KU | 5.72	1	235*	>10k | 20 May	8 WKS	Avnet | Americas	43	BUY NOW
SN54ALS576BJ	ACTIVE	CDIP (J) | 20	-55 TO 125		View Contents	1KU | 4.86	1	45*	>10k | 20 May	8 WKS	Avnet | Americas	456	BUY NOW
SNJ54ALS576BFK	ACTIVE	LCCC (FK) | 20	-55 TO 125	84001022A	View Contents	1KU | 10.65	1	44*	3757 | 20 May	8 WKS	None Reported View Distributors		
									>10k | 27 May				
SNJ54ALS576BJ	ACTIVE	CDIP (J) | 20	-55 TO 125	8400102RA	View Contents	1KU | 5.72	1	163*	>10k | 20 May	8 WKS	None Reported View Distributors		
SNJ54ALS576BW	ACTIVE	CFP (W) | 20	-55 TO 125		View Contents	1KU | 10.01	1	0*	>10k | 20 May	8 WKS	None Reported View Distributors		

Table Data Updated on: 4/17/2003