

SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

- D-Type Flip-Flops in a Single Package With 3-State Bus Driving True Outputs
- Full Parallel Access for Loading
- Buffered Control Inputs
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

description

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

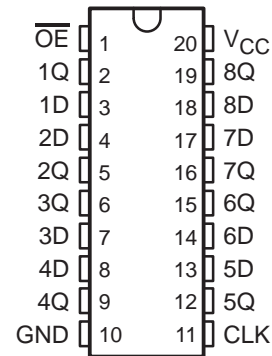
On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs.

A buffered output-enable (\overline{OE}) input places the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without interface or pullup components.

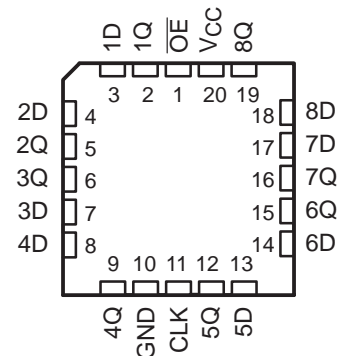
\overline{OE} does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54ALS374A and SN54AS374 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS374A and SN74AS374 are characterized for operation from 0°C to 70°C .

SN54ALS374A, SN54AS374 . . . J PACKAGE
SN74ALS374A, SN74AS374 . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS374A, SN54AS374 . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
\overline{OE}	CLK	D	Q
L	\uparrow	H	H
L	\uparrow	L	L
L	H or L	X	Q_0
H	X	X	Z



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1999, Texas Instruments Incorporated
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374

OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

logic symbol†



logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

Supply voltage range, V_{CC}	-0.5 V to 7 V
Input voltage range, V_I	-0.5 V to 7 V
Voltage applied to a disabled 3-state output	-0.5 V to 5.5 V
Package thermal impedance, θ_{JA} (see Note 1): DW package	58°C/W
N package	69°C/W
Storage temperature range, T_{stg}	-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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

	SN54ALS374A			SN74ALS374A			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
T_A Operating free-air temperature	-55	125		0	70		°C



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

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

PARAMETER	TEST CONDITIONS		SN54ALS374A			SN74ALS374A			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	$V_{CC} = 4.5\text{ V}$, $I_I = -18\text{ mA}$		-1.5			-1.5			V
V_{OH}	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $I_{OH} = -0.4\text{ mA}$		$V_{CC}-2$			$V_{CC}-2$			V
	$V_{CC} = 4.5\text{ V}$	$I_{OH} = -1\text{ mA}$	2.4	3.3					
		$I_{OH} = -2.6\text{ mA}$				2.4	3.2		
V_{OL}	$V_{CC} = 4.5\text{ V}$	$I_{OL} = 12\text{ mA}$	0.25 0.4		0.25 0.4				V
		$I_{OL} = 24\text{ mA}$				0.35	0.5		
I_{OZH}	$V_{CC} = 5.5\text{ V}$,	$V_O = 2.7\text{ V}$	20			20			μA
I_{OZL}	$V_{CC} = 5.5\text{ V}$,	$V_O = 0.4\text{ V}$	-20			-20			μA
I_I	$V_{CC} = 5.5\text{ V}$,	$V_I = 7\text{ V}$	0.1			0.1			mA
I_{IH}	$V_{CC} = 5.5\text{ V}$,	$V_I = 2.7\text{ V}$	20			20			μA
I_{IL}	$V_{CC} = 5.5\text{ V}$,	$V_I = 0.4\text{ V}$	-0.2			-0.2			mA
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$,	$V_O = 2.25\text{ V}$	-20	-112		-30	-112		mA
I_{CC}	$V_{CC} = 5.5\text{ V}$	Outputs high	11	20	11	19			mA
		Outputs low	19	28	19	28			
		Outputs disabled	20	31	20	31			

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

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

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

			SN54ALS374A		SN74ALS374A		UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		30		35		MHz
t_w	Pulse duration	CLK high or low	16.5		14		ns
t_{su}	Setup time	Data before CLK↑	10		10		ns
t_h	Hold time	Data after CLK↑	4		0		ns

switching characteristics over recommended operating conditions (unless otherwise noted (see Figure 3))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ALS374A		SN74ALS374A		UNIT
			MIN	MAX	MIN	MAX	
f_{max}			30		35		MHz
t_{PLH}	CLK	Q	3	14	3	12	ns
t_{PHL}			5	17	5	16	
t_{PZH}	\overline{OE}	Q	3	18	3	17	ns
t_{PZL}			5	21	5	18	
t_{PHZ}	\overline{OE}	Q	1	11	1	10	ns
t_{PLZ}			2	19	2	18	



SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374

OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS

WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

recommended operating conditions

		SN54AS374			SN74AS374			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	-12			-15			mA
I _{OL}	Low-level output current	32			48			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	SN54AS374			SN74AS374			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} = -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					
		I _{OL} = 48 mA				0.34	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}	OE, CLK	V _{CC} = 5.5 V, V _I = 0.4 V	-0.5			-0.5			mA
	Data		-3			-2			
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	120	77	120		mA	
		Outputs low	84	128	84	128			
		Outputs disabled	84	128	84	128			

† 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}.

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

		SN54AS374		SN74AS374		UNIT
		MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	100*		125		MHz
t _w	Pulse duration	CLK high	5.5*	4		ns
		CLK low	3*	3		
t _{su}	Setup time	Data before CLK↑	3*	2		ns
t _h	Hold time	Data after CLK↑	3*	2		ns

* On products compliant to MIL-PRF-38535, this parameter is not production tested.



SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374
OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS
WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

switching characteristics over recommended operating conditions (unless otherwise noted)
(see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54AS374		SN74AS374		UNIT
			MIN	MAX	MIN	MAX	
f_{max}			100*		125		MHz
t_{PLH}	CLK	Q	3	11	3	8	ns
t_{PHL}			4	11.5	4	9	
t_{PZH}	\overline{OE}	Q	2	7	2	6	ns
t_{PZL}			3	11	3	10	
t_{PHZ}	\overline{OE}	Q	2	10	2	6	ns
t_{PLZ}			2	7	2	6	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374
OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS
WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

APPLICATION INFORMATION

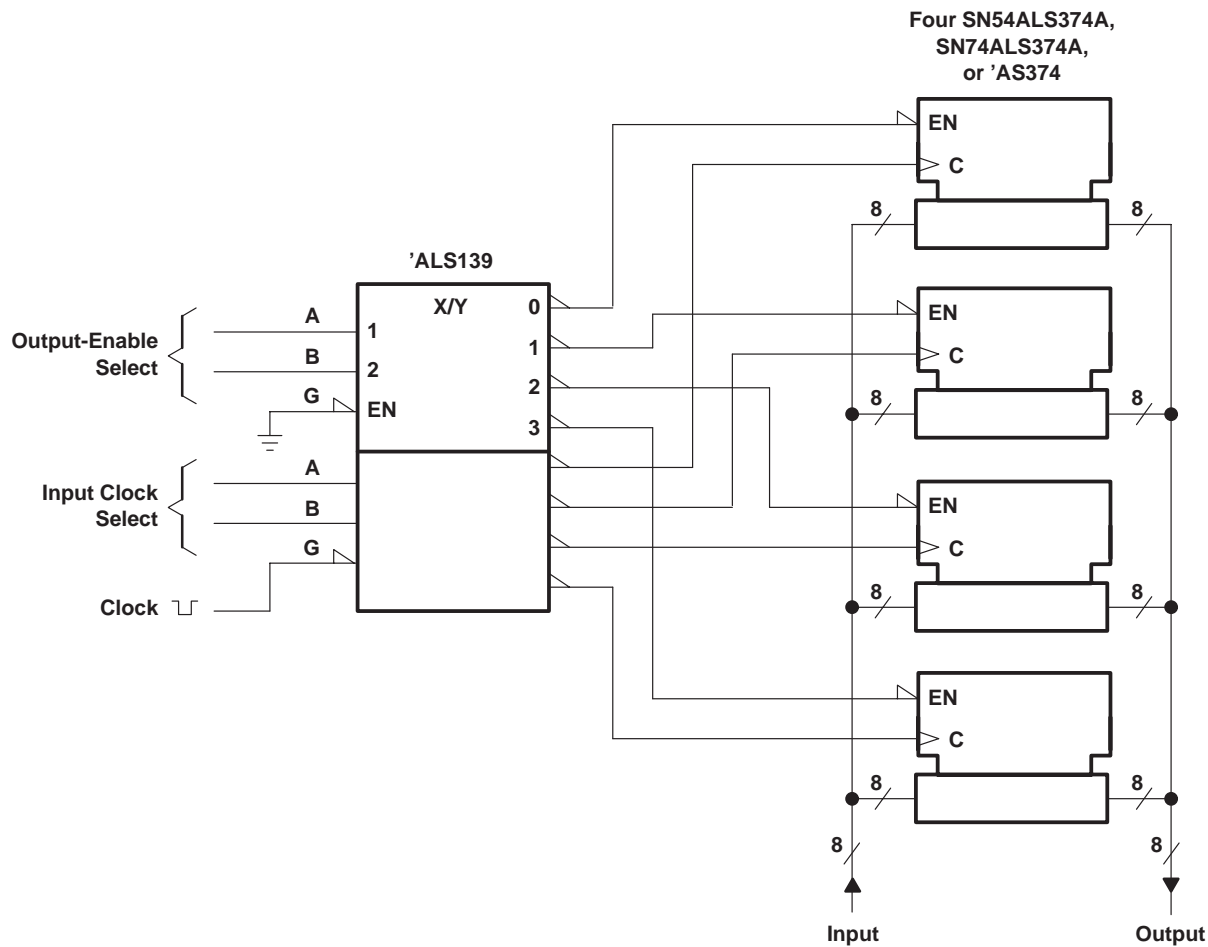


Figure 1. Expandable 4-Word by 8-Bit General File Register

SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374
 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS
 WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

APPLICATION INFORMATION

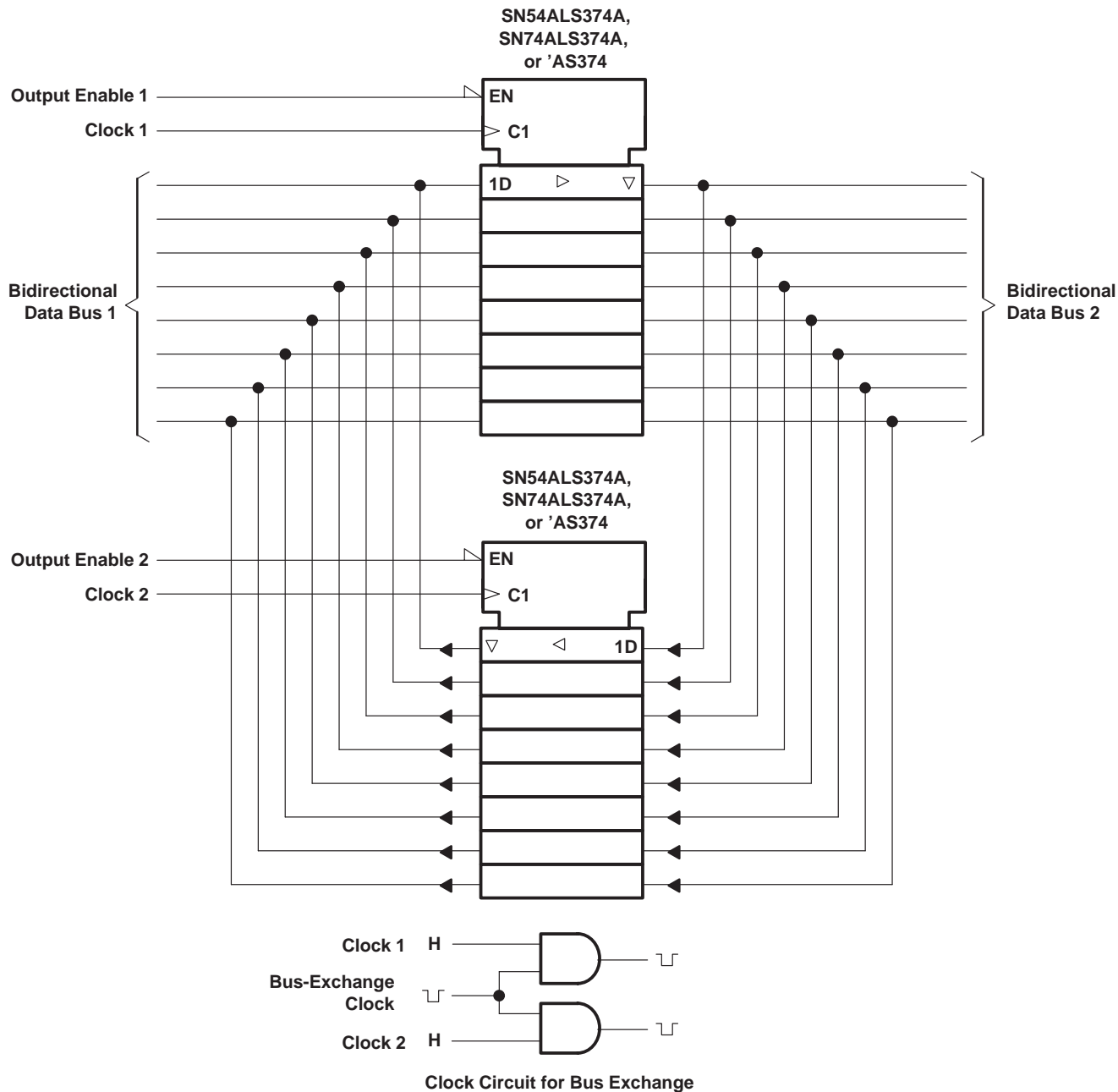
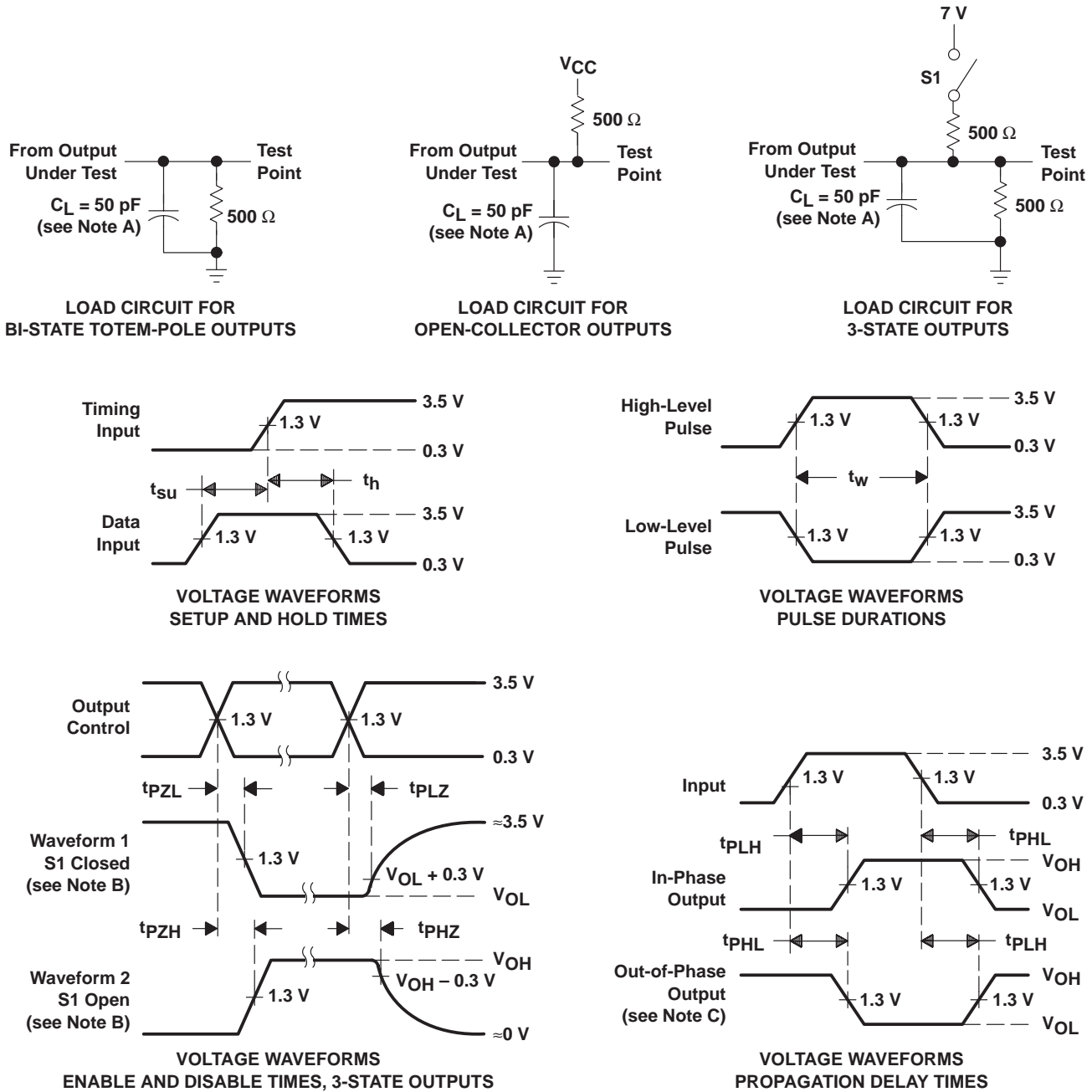


Figure 2. Bidirectional Bus Driver

SN54ALS374A, SN54AS374, SN74ALS374A, SN74AS374 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS167C – APRIL 1982 – REVISED NOVEMBER 1999

PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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: $PRR \leq 1$ 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 3. Load Circuits and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9756201Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9756201QRA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9756201QSA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
83020022A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
8302002RA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
8302002SA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
JM38510/37204B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/37204BRA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN54ALS374AJ	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN54AS374J	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN74ALS374ADBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
SN74ALS374ADBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS374AN3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74ALS374ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS374ANSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ANSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS374ANSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
						no Sb/Br)		
SN74AS374DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS374N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74AS374NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS374NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374NSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS374NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54ALS374AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS374AJ	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54ALS374AW	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54AS374FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54AS374J	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54AS374W	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS374ADBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74ALS374ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74ALS374ANSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1
SN74AS374DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74AS374NSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS374ADBR	SSOP	DB	20	2000	346.0	346.0	33.0
SN74ALS374ADWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74ALS374ANSR	SO	NS	20	2000	346.0	346.0	41.0
SN74AS374DWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74AS374NSR	SO	NS	20	2000	346.0	346.0	41.0

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within Mil-Std 1835 GDFP2-F20

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated