- Eight Latches in a Single Package
- 3-State Bus-Driving Inverting Outputs
- Full Parallel Access for Loading
- Buffered Control Inputs
- pnp Inputs Reduce dc Loading on Data Lines
- Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic (N) 300-mil DIPs

#### OE V<sub>C</sub>C 1Q **∏** 2 19 8Q 1D **∏** 3 18 N 8D 2D ∏ 17**∏** 7D 2<mark>0</mark> 5 16 7 7Q 3Q [ 15 6Q 3D [ 14**∏** 6D 4D Π 13**∏** 5D 4Q [ 12 | 5Q GND [] 11 🛮 LE

DW OR N PACKAGE

(TOP VIEW)

#### description

These 8-bit D-type transparent latches 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.

While latch-enable (LE) input is high, the  $\overline{\mathbb{Q}}$  outputs follow the complements of the data (D) inputs. When LE is taken low, the  $\overline{\mathbb{Q}}$  outputs are latched at the inverses of the levels set up at the D inputs. The SN74ALS533A and SN74AS533A are functionally equivalent to the SN74ALS373A and SN74AS373, except for having inverted outputs.

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

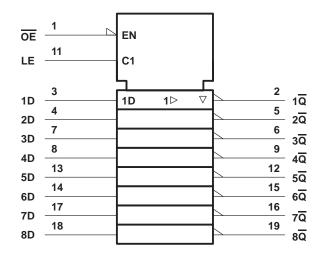
OE does not affect the internal operations of the latches. Old data can be retained or new data can be entered while the outputs are off.

The SN74ALS533A and SN74AS533A are characterized for operation from 0°C to 70°C.

# FUNCTION TABLE (each latch)

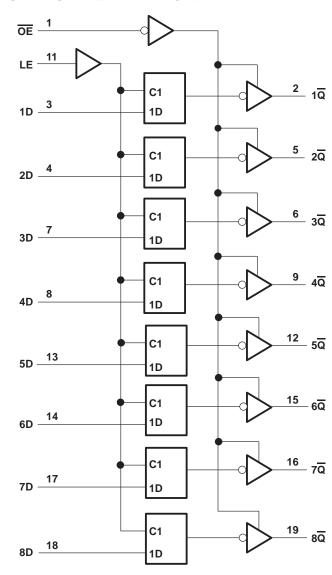
	INPUTS	OU <u>T</u> PUT			
OE	LE	D	Q		
L	Н	Н	L		
L	Н	L	Н		
L	L	Χ	$\overline{Q}_0$		
Н	Χ	Χ	Z		

#### logic symbol†



<sup>&</sup>lt;sup>†</sup>This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

### logic diagram (positive logic)



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

Supply voltage, V <sub>CC</sub>	7 V
Input voltage, V <sub>I</sub>	7 V
Voltage applied to a disabled 3-state output	
Operating free-air temperature range, T <sub>A</sub> : SN74ALS533A	0°C to 70°C
Storage temperature range	-65°C to 150°C

<sup>‡</sup> 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

		SN74ALS533A			UNIT
		MIN	NOM	MAX	UNII
VCC	Supply voltage	4.5	5	5.5	V
VIH	High-level input voltage	2			V
VIL	Low-level input voltage			0.8	V
IOH	High-level output current			-2.6	mA
loL	Low-level output current			24	mA
t <sub>W</sub>	Pulse duration, LE high	15			ns
t <sub>su</sub>	Setup time, data before LE↓	15			ns
t <sub>h</sub>	Hold time, data after LE↓	7			ns
TA	Operating free-air temperature	0		70	°C

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

PARAMETER	AMETER TEST CONDITIONS				3A	UNIT
PARAMETER			MIN	TYP†	MAX	UNII
VIK	$V_{CC} = 4.5 V$ ,	$I_{I} = -18 \text{ mA}$			-1.5	V
Voн	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$	$I_{OH} = -0.4 \text{ mA}$	V <sub>CC</sub> -2			V
VОН	$V_{CC} = 4.5 V$ ,	$I_{OH} = -2.6 \text{ mA}$	2.4	3.2		
Ver	V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 12 mA		0.25	0.4	V
VoL	∨CC = 4.5 V	I <sub>OL</sub> = 24 mA		0.35	0.5	V
lozн	$V_{CC} = 5.5 V,$	V <sub>O</sub> = 2.7 V			20	μΑ
lozL	$V_{CC} = 5.5 V,$	V <sub>O</sub> = 0.4 V			-20	μΑ
lj	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 7 V			0.1	mA
liн	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 2.7 V			20	μΑ
I <sub>IL</sub>	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 0.4 V			-0.1	mA
IO <sup>‡</sup>	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 2.25 V	-30		-112	mA
		Outputs high		10	17	
ICC	$V_{CC} = 5.5 V$	Outputs low		17	26	mA
		Outputs disabled		18.5	28	

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



<sup>&</sup>lt;sup>‡</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, los.

## SN74ALS533A, SN74AS533A OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

SDAS270 - DECEMBER 1994

#### switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5$ $C_{L} = 50 \text{ pF}$ $R1 = 500 \Omega$ $R2 = 500 \Omega$ $T_{A} = \text{MIN to}$ $SN74AL$	, , , , , , , , , , , , , , , , , , ,	UNIT
			MIN	MAX	
<sup>t</sup> PLH	D	Q	4	19	ns
<sup>t</sup> PHL	נ	g	4	13	110
<sup>t</sup> PLH	LE	A G	5	23	ns
<sup>t</sup> PHL	LL	Any Q	4	18	115
<sup>t</sup> PZH		A <del>G</del>	1	17	
tPZL	ŌĒ	Any Q	4	18	ns
t <sub>PHZ</sub>	ŌĒ	Any Q	2	10	
<sup>t</sup> PLZ	)E	Ally Q	2	16	ns

<sup>†</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

Supply voltage, V <sub>CC</sub>	7 V
Input voltage, V <sub>I</sub>	$\dots \dots \dots \ 7 \ V$
Voltage applied to a disabled 3-state output	
Operating free-air temperature range, T <sub>A</sub> : SN74AS533A	$\dots$ 0°C to 70°C
Storage temperature range	-65°C to 150°C

<sup>‡</sup> 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

		SN74AS533A			UNIT
		MIN	NOM	MAX	UNII
Vcc	Supply voltage	4.5	5	5.5	V
VIH	High-level input voltage	2			V
V <sub>IL</sub>	Low-level input voltage			0.8	V
ІОН	High-level output current			-15	mA
loL	Low-level output current			48	mA
t <sub>W</sub>	Pulse duration, LE high	2			ns
t <sub>su</sub>	Setup time, data before LE↓	2			ns
th	Hold time, data after LE↓	3			ns
TA	Operating free-air temperature	0		70	°C

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

PARAMETER	TEST COND	SN	74AS533	3A	UNIT	
PARAMETER	TEST CONL	THONS	MIN	TYP†	MAX	UNIT
VIK	$V_{CC} = 4.5 V,$	$I_{I} = -18 \text{ mA}$			-1.5	V
Van	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$	$I_{OH} = -2 \text{ mA}$	V <sub>CC</sub> -2			V
Voн	$V_{CC} = 4.5 V,$	$I_{OH} = -15 \text{ mA}$	2.4	3.3		V
V <sub>OL</sub>	$V_{CC} = 4.5 V,$	$I_{OL} = 48 \text{ mA}$		0.34	0.5	V
IOZH	$V_{CC} = 5.5 V,$	V <sub>O</sub> = 2.7 V			50	μΑ
lozL	$V_{CC} = 5.5 V,$	V <sub>O</sub> = 0.4 V			-50	μΑ
II	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 7 V			0.1	mA
lін	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 2.7 V			20	μΑ
I <sub>IL</sub>	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 0.4 V		-0.02	-0.5	mA
1 <sub>O</sub> ‡	$V_{CC} = 5.5 V,$	V <sub>O</sub> = 2.25 V	-30		-112	mA
		Outputs high		62	100	
Icc	$V_{CC} = 5.5 V$	Outputs low		64	100	mA
		Outputs disabled		71	110	

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

### switching characteristics (see Figure 1)

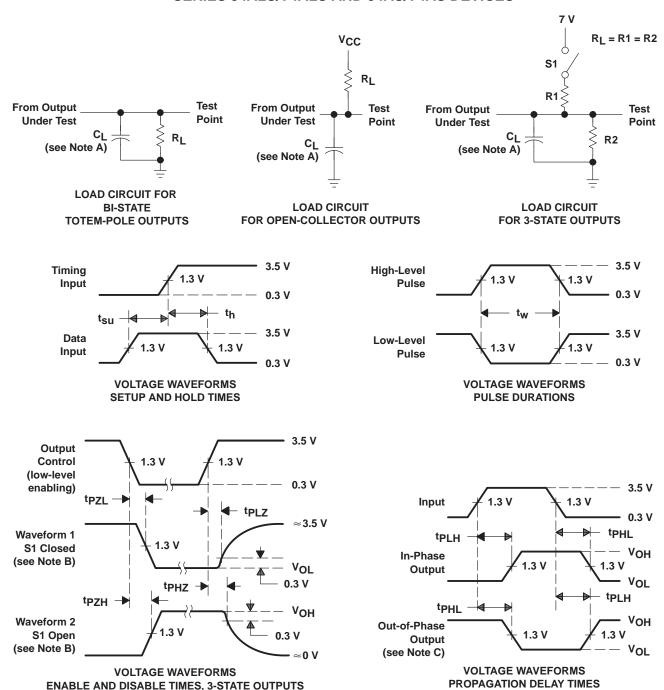
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$ = 4.5 $^{\circ}$ $C_L$ = 50 pF R1 = 500 $\Omega$ R2 = 500 $\Omega$ $T_A$ = MIN to SN74A	; e, o MAX§	UNIT
			MIN	MAX	1
<sup>t</sup> PLH	D	Q	4	7.5	ns
<sup>t</sup> PHL	ט	α	4	7	115
<sup>t</sup> PLH	LE	A <del>-</del>	5	9	
<sup>t</sup> PHL	LE	Any Q	4	8	ns
<sup>t</sup> PZH	ŌĒ	A <del>-</del>	2	6.5	ne ne
tPZL	OE	Any Q	4	9.5	ns
<sup>t</sup> PHZ	ŌĒ	Any 0	2	6.5	
tPLZ	)E	Any $\overline{Q}$	3	7	ns

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



<sup>‡</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, IOS.

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



NOTES: A. C<sub>L</sub> 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,  $t_f = t_f = 2$  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



#### PACKAGE OPTION ADDENDUM

www.ti.com 29-Apr-2010

#### PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Packag Qty	e Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74ALS533ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS533ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS533ANSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ANSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS533ANSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS533ADW	NRND	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS533ADWE4	NRND	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS533ADWG4	NRND	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS533AN	NRND	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS533ANE4	NRND	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

<sup>&</sup>lt;sup>(1)</sup> 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.

**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)

<sup>(2)</sup> 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.



#### PACKAGE OPTION ADDENDUM

www.ti.com 29-Apr-2010

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

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PACKAGE MATERIALS INFORMATION

www.ti.com 29-Jul-2009

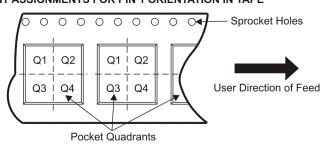
### TAPE AND REEL INFORMATION





		Dimension designed to accommodate the component width
I	B0	Dimension designed to accommodate the component length
	K0	Dimension designed to accommodate the component thickness
	W	Overall width of the carrier tape
-	P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS533ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74ALS533ANSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1

**PACKAGE MATERIALS INFORMATION** 

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#### \*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS533ADWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74ALS533ANSR	SO	NS	20	2000	346.0	346.0	41.0

## 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.



DW (R-PDSO-G20)

### PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.

- 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.



DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Refer to IPC7351 for alternate board design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC—7525
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



### **MECHANICAL DATA**

## NS (R-PDSO-G\*\*)

# 14-PINS SHOWN

#### PLASTIC SMALL-OUTLINE PACKAGE



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.



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