

# SN54AC533, SN74AC533 OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCAS555C – NOVEMBER 1995 – REVISED OCTOBER 2003

- 2-V to 6-V  $V_{CC}$  Operation
- Inputs Accept Voltages to 6 V
- Max  $t_{pd}$  of 10.5 ns at 5 V
- 3-State Inverting Outputs Drive Bus Lines Directly
- Full Parallel Access for Loading

## description/ordering information

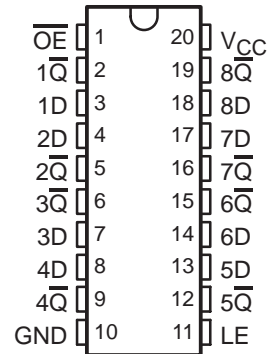
The 'AC533 devices are octal transparent D-type latches with 3-state outputs. When the latch-enable (LE) input is high, the  $\bar{Q}$  outputs follow the complements of the data (D) inputs. When LE is taken low, the  $\bar{Q}$  outputs are latched at the inverse logic levels set up at the D inputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place 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 increased drive provide the capability to drive bus lines without need for interface or pullup components.

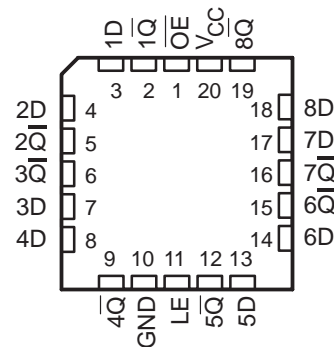
$\overline{OE}$  does not affect the internal operations of the latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

SN54AC533 . . . J OR W PACKAGE  
SN74AC533 . . . DB, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54AC533 . . . FK PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube	SN74AC533N	SN74AC533N
		Tube	SN74AC533DW	AC533
	SOIC – DW	Tape and reel	SN74AC533DWR	
	SOP – NS	Tape and reel	SN74AC533NSR	AC533
	SSOP – DB	Tape and reel	SN74AC533DBR	AC533
-55°C to 125°C	TSSOP – PW	Tube	SN74AC533PW	AC533
		Tape and reel	SN74AC533PWR	
	CDIP – J	Tube	SNJ54AC533J	SNJ54AC533J
	CFP – W	Tube	SNJ54AC533W	SNJ54AC533W
	LCCC – FK	Tube	SNJ54AC533FK	SNJ54AC533FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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 **TEXAS  
INSTRUMENTS**

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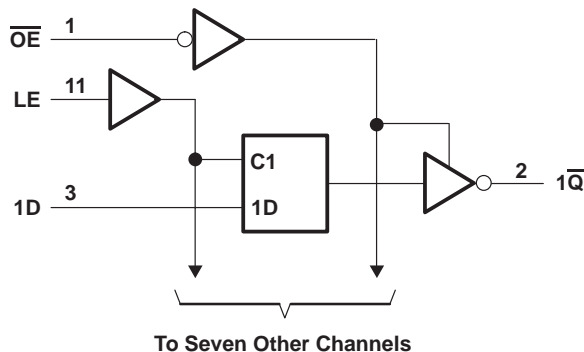
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FUNCTION TABLE  
(each latch)

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

## logic diagram (positive logic)



## 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, $V_I$ (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND	$\pm 200$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DB package	70°C/W
DW package	58°C/W
N package	69°C/W
NS package	60°C/W
PW package	83°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.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

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## recommended operating conditions (see Note 3)

		SN54AC533		SN74AC533		UNIT
		MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	2	6	2	6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 3\text{ V}$		2.1		V
		$V_{CC} = 4.5\text{ V}$		3.15		
		$V_{CC} = 5.5\text{ V}$		3.85		
$V_{IL}$	Low-level input voltage	$V_{CC} = 3\text{ V}$		0.9		V
		$V_{CC} = 4.5\text{ V}$		1.35		
		$V_{CC} = 5.5\text{ V}$		1.65		
$V_I$	Input voltage	0	$V_{CC}$	0	$V_{CC}$	V
$V_O$	Output voltage	0	$V_{CC}$	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 3\text{ V}$		-12		mA
		$V_{CC} = 4.5\text{ V}$		-24		
		$V_{CC} = 5.5\text{ V}$		-24		
$I_{OL}$	Low-level output current	$V_{CC} = 3\text{ V}$		12		mA
		$V_{CC} = 4.5\text{ V}$		24		
		$V_{CC} = 5.5\text{ V}$		24		
$\Delta t/\Delta v$	Input transition rise or fall rate			8		ns/V
$T_A$	Operating free-air temperature	-55	125	-40	85	°C

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER	TEST CONDITIONS	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54AC533		SN74AC533		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$V_{OH}$	$I_{OH} = -50\ \mu\text{A}$	3 V	2.9			2.9		2.9		V
		4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
	$I_{OH} = -12\ \text{mA}$	3 V	2.56			2.4		2.46		
		4.5 V	3.86			3.7		3.76		
		5.5 V	4.86			4.7		4.76		
$V_{OL}$	$I_{OL} = 50\ \mu\text{A}$	3 V				0.1		0.1		V
		4.5 V				0.1		0.1		
		5.5 V				0.1		0.1		
	$I_{OL} = 12\ \text{mA}$	3 V				0.36		0.44		
		4.5 V				0.36		0.44		
		5.5 V				0.36		0.44		
$I_{OZ}$	$V_O = V_{CC}$ or GND	5.5 V				$\pm 0.25$		$\pm 5$		$\mu\text{A}$
$I_I$	$V_I = V_{CC}$ or GND	5.5 V				$\pm 0.1$		$\pm 1$		$\mu\text{A}$
$I_{CC}$	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V				4		80		$\mu\text{A}$
$C_i$	$V_I = V_{CC}$ or GND	5 V	4.5							pF

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timing requirements over recommended operating free-air temperature range,  $V_{CC} = 3.3 V \pm 0.3 V$  (unless otherwise noted) (see Figure 1)

		$T_A = 25^\circ C$		SN54AC533		SN74AC533		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse duration, LE high	6		8		6.5		ns
$t_{su}$	Setup time, data before LE $\downarrow$	5.5		7.5		6		ns
$t_h$	Hold time, data after LE $\downarrow$	1.5		2.5		1		ns

timing requirements over recommended operating free-air temperature range,  $V_{CC} = 5 V \pm 0.5 V$  (unless otherwise noted) (see Figure 1)

		$T_A = 25^\circ C$		SN54AC533		SN74AC533		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse duration, LE high	4.5		6.5		5		ns
$t_{su}$	Setup time, data before LE $\downarrow$	4		6		4.5		ns
$t_h$	Hold time, data after LE $\downarrow$	1.5		2.5		1		ns

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 3.3 V \pm 0.3 V$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ C$		SN54AC533		SN74AC533		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	D	$\bar{Q}$	2	14	1	17.5	1.5	16	ns
$t_{PHL}$			2	13	1	16	1.5	14.5	
$t_{PLH}$	LE	$\bar{Q}$	2	14.5	1	18	1.5	16.5	ns
$t_{PHL}$			2	13	1	16	1.5	14.5	
$t_{PZH}$	$\overline{OE}$	$\bar{Q}$	2	12.5	1	15.5	1.5	14	ns
$t_{PZL}$			2	12.5	1	15.5	1.5	14	
$t_{PHZ}$	$\overline{OE}$	$\bar{Q}$	2	13	1	16	1.5	14.5	ns
$t_{PLZ}$			2	13	1	16	1.5	14.5	

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 5 V \pm 0.5 V$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ C$		SN54AC533		SN74AC533		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	D	$\bar{Q}$	2	10	1	12.5	1.5	11	ns
$t_{PHL}$			2	9.5	1	12	1.5	10.5	
$t_{PLH}$	LE	$\bar{Q}$	2	10.5	1	13	1.5	11.5	ns
$t_{PHL}$			2	10	1	13	1.5	11	
$t_{PZH}$	$\overline{OE}$	$\bar{Q}$	2	9.5	1	12	1.5	10.5	ns
$t_{PZL}$			2	9.5	1	12	1.5	10.5	
$t_{PHZ}$	$\overline{OE}$	$\bar{Q}$	2	10	1	12.5	1.5	11	ns
$t_{PLZ}$			2	10	1	12.5	1.5	11	

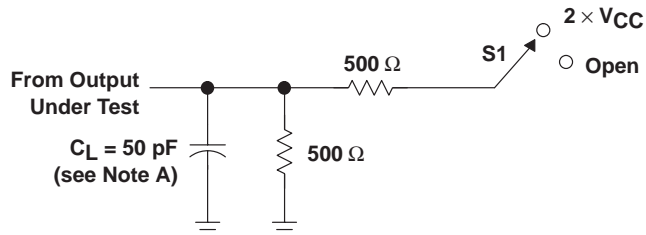
operating characteristics,  $V_{CC} = 5 V, T_A = 25^\circ C$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance	$C_L = 50 pF, f = 1 MHz$	40	pF

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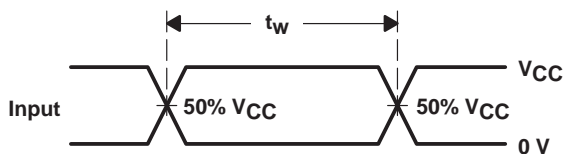


PARAMETER MEASUREMENT INFORMATION

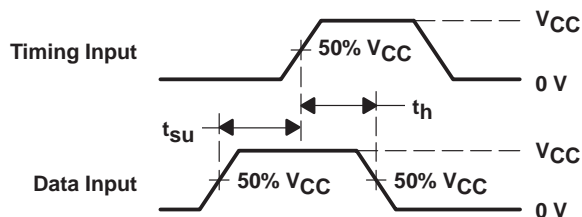


LOAD CIRCUIT

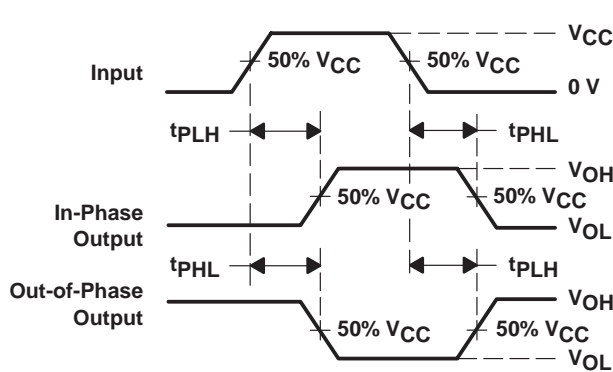
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	Open



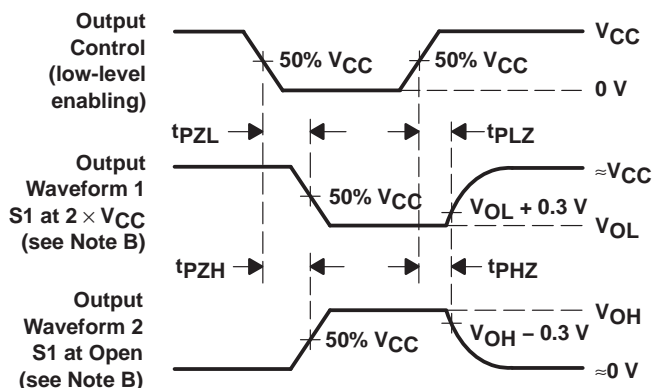
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

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. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .

D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AC533DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC533	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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