

SN54AHC541, SN74AHC541 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCLS261H – DECEMBER 1995 – REVISED JUNE 1997

- Operating Range 2-V to 5.5-V V_{CC}
- **EPIC™** (Enhanced-Performance Implanted CMOS) Process
- High Latch-Up Immunity Exceeds 250 mA Per JESD 17
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

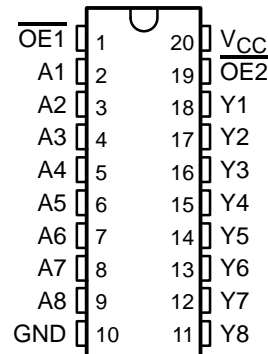
description

The 'AHC541 octal buffers/drivers are ideal for driving bus lines or buffer memory address registers. These devices feature inputs and outputs on opposite sides of the package to facilitate printed circuit board layout.

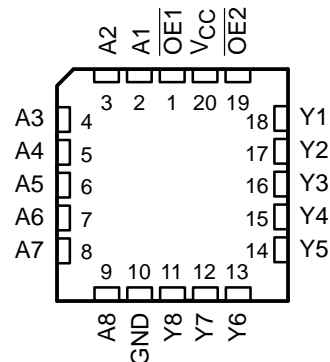
The 3-state control gate is a two-input AND gate with active-low inputs so that if either output-enable ($\overline{OE1}$ or $\overline{OE2}$) input is high, all corresponding outputs are in the high-impedance state. The outputs provide noninverted data when they are not in the high-impedance state.

The SN54AHC541 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74AHC541 is characterized for operation from -40°C to 85°C .

SN54AHC541 ... J OR W PACKAGE
SN74AHC541 ... DB, DW, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC541 ... FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each buffer/driver)

INPUTS			OUTPUT Y
$\overline{OE1}$	$\overline{OE2}$	A	
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	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.

EPIC is a trademark of Texas Instruments Incorporated.

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**

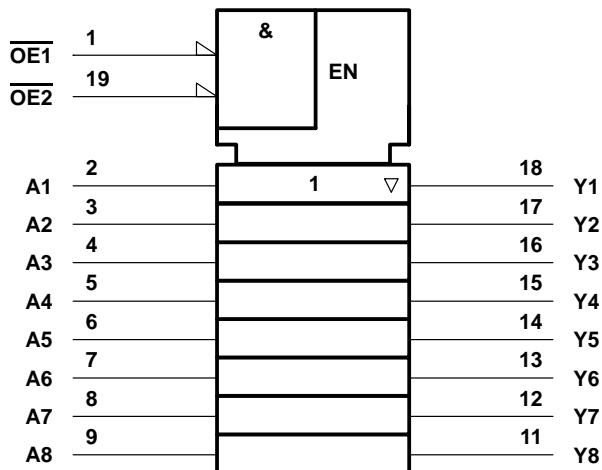
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1997, Texas Instruments Incorporated

SN54AHC541, SN74AHC541 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

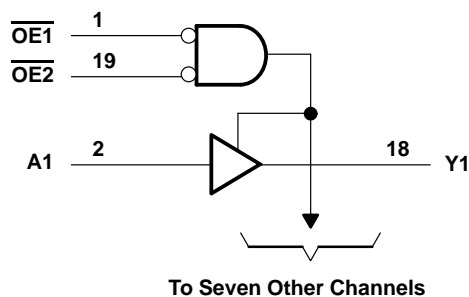
SCLS261H – DECEMBER 1995 – REVISED JUNE 1997

logic symbol†



[†] 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 range, V_{CC}	.....	-0.5 V to 7 V
Input voltage range, V_I (see Note 1)	.....	-0.5 V to 7 V
Output voltage range, V_O (see Note 1)	.....	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	.....	-20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	± 20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	± 25 mA
Continuous current through V_{CC} or GND	± 75 mA
Package thermal impedance, θ_{JA} (see Note 2): DB package	.....	115°C/W
	DW package	97°C/W
	N package	67°C/W
	PW package	128°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, except for through-hole packages, which use a trace length of zero.

SN54AHC541, SN74AHC541 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCLS261H – DECEMBER 1995 – REVISED JUNE 1997

recommended operating conditions (see Note 3)

			SN54AHC541		SN74AHC541		UNIT
			MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage		2	5.5	2	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 2 V	1.5		1.5		V
		V _{CC} = 3 V	2.1		2.1		
		V _{CC} = 5.5 V	3.85		3.85		
V _{IL}	Low-level input voltage	V _{CC} = 2 V		0.5		0.5	V
		V _{CC} = 3 V		0.9		0.9	
		V _{CC} = 5.5 V		1.65		1.65	
V _I	Input voltage		0	5.5	0	5.5	V
V _O	Output voltage		0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2 V		–50		–50	μA
		V _{CC} = 3.3 V ± 0.3 V		–4		–4	mA
		V _{CC} = 5 V ± 0.5 V		–8		–8	
I _{OL}	Low-level output current	V _{CC} = 2 V		50		50	μA
		V _{CC} = 3.3 V ± 0.3 V		4		4	mA
		V _{CC} = 5 V ± 0.5 V		8		8	
Δt/Δv	Input transition rise or fall rate	V _{CC} = 3.3 V ± 0.3 V		100		100	ns/V
		V _{CC} = 5 V ± 0.5 V		20		20	
T _A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

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

PARAMETER		TEST CONDITIONS	V _{CC}	T _A = 25°C			SN54AHC541		SN74AHC541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}		I _{OH} = –50 μA	2 V	1.9	2		1.9		1.9		V
			3 V	2.9	3		2.9		2.9		
			4.5 V	4.4	4.5		4.4		4.4		
		I _{OH} = –4 mA	3 V	2.58			2.48		2.48		
			4.5 V	3.94			3.8		3.8		
V _{OL}		I _{OL} = 50 μA	2 V			0.1		0.1		0.1	V
			3 V			0.1		0.1		0.1	
			4.5 V			0.1		0.1		0.1	
		I _{OL} = 4 mA	3 V			0.36		0.5		0.44	
			4.5 V			0.36		0.5		0.44	
I _I	Data inputs	V _I = V _{CC} or GND	5.5 V			±0.1		±1		±1	μA
	Control inputs					±0.1		±1		±1	
I _{OZ} [†]		V _O = V _{CC} or GND, V _I (OE) = V _{IL} or V _{IH}	5.5 V			±0.25		±2.5		±2.5	μA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	5.5 V			4		40		40	μA
C _i		V _I = V _{CC} or GND	5 V			2				10	pF
C _o		V _O = V _{CC} or GND	5 V			4					pF

† For input and output, I_{OZ} includes the input leakage current.



SN54AHC541, SN74AHC541

OCTAL BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

SCLS261H – DECEMBER 1995 – REVISED JUNE 1997

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHC541				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH} [*]	A	Y	C _L = 15 pF	5	7	1	8.5	ns	
t _{PHL} [*]				5	7	1	8.5		
t _{PZH} [*]	\overline{OE}	Y	C _L = 15 pF	6	10.5	1	11	ns	
t _{PZL} [*]				6	10.5	1	11		
t _{PHZ} [*]	\overline{OE}	Y	C _L = 15 pF	7	11	1	12	ns	
t _{PLZ} [*]				7	11	1	12		
t _{PLH}	A	Y	C _L = 50 pF	7.5	10.5	1	12	ns	
t _{PHL}				7.5	10.5	1	12		
t _{PZH}	\overline{OE}	Y	C _L = 50 pF	8	14	1	16	ns	
t _{PZL}				8	14	1	16		
t _{PHZ}	\overline{OE}	Y	C _L = 50 pF	9	15.4	1	17.5	ns	
t _{PLZ}				9	15.4	1	17.5		

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHC541				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH}	A	Y	C _L = 15 pF	5	7	1	8.5	ns	
t _{PHL}				5	7	1	8.5		
t _{PZH}	$\overline{\text{OE}}$	Y	C _L = 15 pF	6	10.5	1	11	ns	
t _{PZL}				6	10.5	1	11		
t _{PHZ}	$\overline{\text{OE}}$	Y	C _L = 15 pF	7	11	1	12	ns	
t _{PLZ}				7	11	1	12		
t _{PLH}	A	Y	C _L = 50 pF	7.5	10.5	1	12	ns	
t _{PHL}				7.5	10.5	1	12		
t _{PZH}	$\overline{\text{OE}}$	Y	C _L = 50 pF	8	14	1	16	ns	
t _{PZL}				8	14	1	16		
t _{PHZ}	$\overline{\text{OE}}$	Y	C _L = 50 pF	9	15.4	1	17.5	ns	
t _{PLZ}				9	15.4	1	17.5		

SN54AHC541, SN74AHC541 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCLS261H – DECEMBER 1995 – REVISED JUNE 1997

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHC541				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH} [*]	A	Y	C _L = 15 pF	3.5	5	1	6	ns	
t _{PHL} [*]				3.5	5	1	6		
t _{PZH} [*]	\overline{OE}	Y	C _L = 15 pF	4.7	7.2	1	8.5	ns	
t _{PZL} [*]				4.7	7.2	1	8.5		
t _{PHZ} [*]	\overline{OE}	Y	C _L = 15 pF	5	7.5	1	8	ns	
t _{PLZ} [*]				5	7.5	1	8		
t _{PLH}	A	Y	C _L = 50 pF	5	7	1	8	ns	
t _{PHL}				5	7	1	8		
t _{PZH}	\overline{OE}	Y	C _L = 50 pF	6.2	9.2	1	10.5	ns	
t _{PZL}				6.2	9.2	1	10.5		
t _{PHZ}	\overline{OE}	Y	C _L = 50 pF	6	8.8	1	10	ns	
t _{PLZ}				6	8.8	1	10		

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHC541				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH}	A	Y	C _L = 15 pF	3.5	5	1	6	ns	
t _{PHL}				3.5	5	1	6		
t _{PZH}	\overline{OE}	Y	C _L = 15 pF	4.7	7.2	1	8.5	ns	
t _{PZL}				4.7	7.2	1	8.5		
t _{PHZ}	\overline{OE}	Y	C _L = 15 pF	5	7.5	1	8	ns	
t _{PLZ}				5	7.5	1	8		
t _{PLH}	A	Y	C _L = 50 pF	5	7	1	8	ns	
t _{PHL}				5	7	1	8		
t _{PZH}	\overline{OE}	Y	C _L = 50 pF	6.2	9.2	1	10.5	ns	
t _{PZL}				6.2	9.2	1	10.5		
t _{PHZ}	\overline{OE}	Y	C _L = 50 pF	6	8.8	1	10	ns	
t _{PLZ}				6	8.8	1	10		

output-skew characteristics, $C_L = 50\text{ pF}$ (see Note 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	SN74AHC541				UNIT
				T _A = 25°C		MIN	MAX	
				MIN	MAX			
t _{sk(o)}	A	Y	3.3 V ± 0.3 V	1.5		1.5		ns
			5 V ± 0.5 V	1		1		

NOTE 4: Characteristics are determined during product characterization and ensured by design.

SN54AHC541, SN74AHC541 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCLS261H – DECEMBER 1995 – REVISED JUNE 1997

noise characteristics, $V_{CC} = 5\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ (see Note 5)

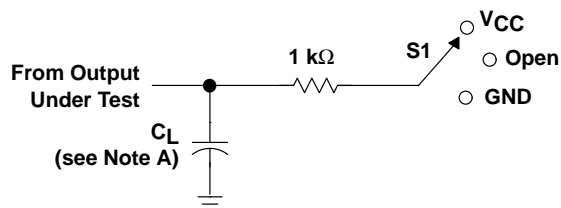
PARAMETER	SN74AHC541		UNIT
	MIN	MAX	
$V_{OL(P)}$ Quiet output, maximum dynamic V_{OL}		0.8	V
$V_{OL(V)}$ Quiet output, minimum dynamic V_{OL}		-0.8	V
$V_{OH(V)}$ Quiet output, minimum dynamic V_{OH}	4.7		V
$V_{IH(D)}$ High-level dynamic input voltage	3.5		V
$V_{IL(D)}$ Low-level dynamic input voltage		1.5	V

NOTE 5: Characteristics are determined during product characterization and ensured by design for surface-mount packages only.

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

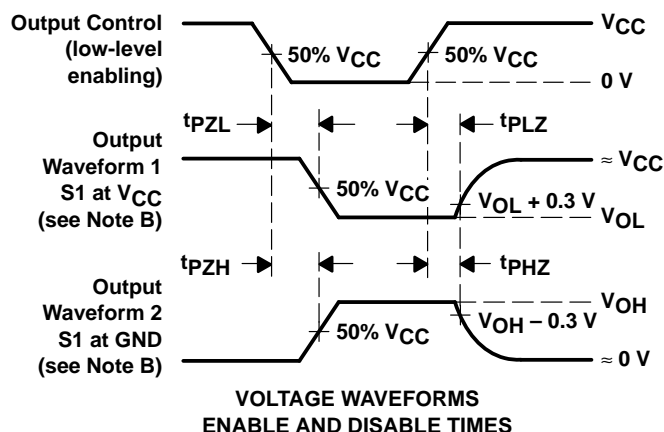
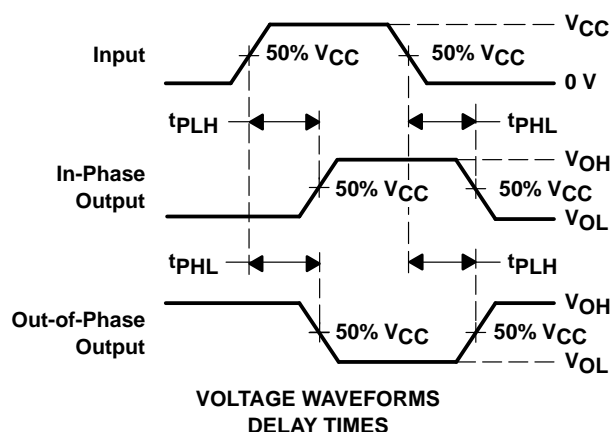
PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1\text{ MHz}$	12	pF

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND



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: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r = 3\text{ ns}$, $t_f = 3\text{ ns}$.

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

Figure 1. Load Circuit and Voltage Waveforms

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.