

# SN54HC541, SN74HC541 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SCLS305 – JANUARY 1996

- High-Current 3-State Outputs Drive Bus Lines Directly or up to 15 LSTTL Loads
- Data Flow-Through Pinout (All Inputs on Opposite Side From Outputs)
- Package Options Include Plastic Small-Outline (DW), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

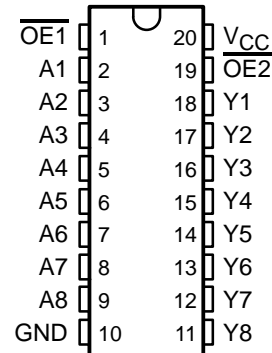
## description

These octal buffers and line drivers feature the performance of the popular 'HC240 series and offer a pinout with inputs and outputs on opposite sides of the package. This arrangement greatly enhances printed-circuit-board layout.

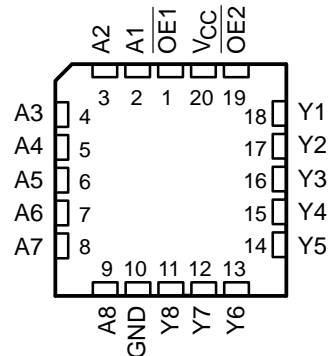
The 3-state control gate is a 2-input NOR. If either output-enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all eight outputs are in the high-impedance state. The 'HC541 provide true data at the outputs.

The SN54HC541 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74HC541 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

SN54HC541 . . . J OR W PACKAGE  
SN74HC541 . . . DW, N, OR PW PACKAGE  
(TOP VIEW)



SN54HC541 . . . 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



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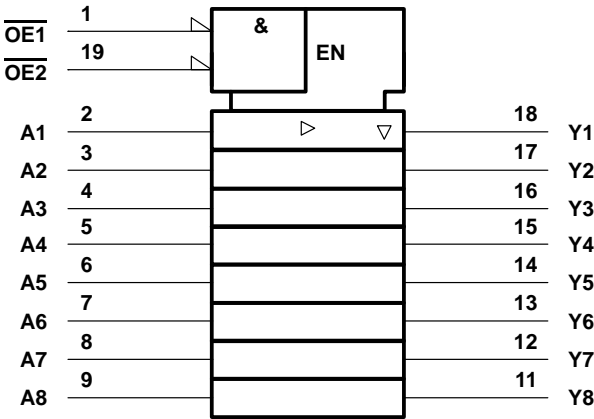
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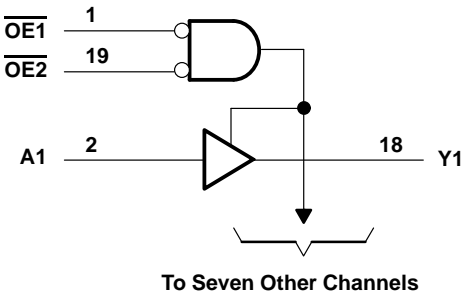
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**logic symbol†**



† 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‡**

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1)	±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±35 mA
Continuous current through $V_{CC}$ or GND	±70 mA
Maximum power dissipation at $T_A = 55^{\circ}\text{C}$ (in still air) (see Note 2):	
DW package	1.6 W
N package	1.3 W
PW package	0.7 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 maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the N package, which has a trace length of zero.

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**recommended operating conditions**

			SN54HC541			SN74HC541			UNIT	
			MIN	NOM	MAX	MIN	NOM	MAX		
V <sub>CC</sub>	Supply voltage		2	5	6	2	5	6	V	
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5			1.5			V	
		V <sub>CC</sub> = 4.5 V	3.15			3.15				
		V <sub>CC</sub> = 6 V	4.2			4.2				
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V	0			0	0.5			V
		V <sub>CC</sub> = 4.5 V	0			0	1.35			
		V <sub>CC</sub> = 6 V	0			0	1.8			
V <sub>I</sub>	Input voltage		0			V <sub>CC</sub>			V	
V <sub>O</sub>	Output voltage		0			V <sub>CC</sub>			V	
t <sub>t</sub>	Input transition (rise and fall) time	V <sub>CC</sub> = 2 V	0			0	1000			ns
		V <sub>CC</sub> = 4.5 V	0			0	500			
		V <sub>CC</sub> = 6 V	0			0	400			
T <sub>A</sub>	Operating free-air temperature		−55			125			°C	

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

PARAMETER	TEST CONDITIONS		V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC541		SN74HC541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = –20 µA	2 V	1.9	1.998		1.9		1.9		V
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		I <sub>OH</sub> = –6 mA	4.5 V	3.98	4.3		3.7		3.84		
		I <sub>OH</sub> = –7.8 mA	6 V	5.48	5.8		5.2		5.34		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 µA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		I <sub>OL</sub> = 6 mA	4.5 V		0.17	0.26		0.4		0.33	
		I <sub>OL</sub> = 7.8 mA	6 V		0.15	0.26		0.4		0.33	
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0		6 V		±0.1	±100		±1000		±1000	nA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or 0		6 V		±0.01	±0.5		±10		±5	µA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0		6 V			8		160		80	µA
C <sub>i</sub>			2 V to 6 V		3	10		10		10	pF

# SN54HC541, SN74HC541

## OCTAL BUFFERS AND LINE DRIVERS

### WITH 3-STATE OUTPUTS

SCLS305 – JANUARY 1996

switching characteristics over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC541		SN74HC541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	2 V		40	115		171		144	ns
			4.5 V		12	23		34		29	
			6 V		10	20		29		25	
$t_{en}$	$\overline{OE}$	Y	2 V		80	150		224		188	ns
			4.5 V		17	30		45		38	
			6 V		15	26		38		32	
$t_{dis}$	$\overline{OE}$	Y	2 V		40	150		224		188	ns
			4.5 V		18	30		45		38	
			6 V		17	26		38		32	
$t_t$		Y	2 V		28	60		90		75	ns
			4.5 V		8	12		18		15	
			6 V		6	10		15		13	

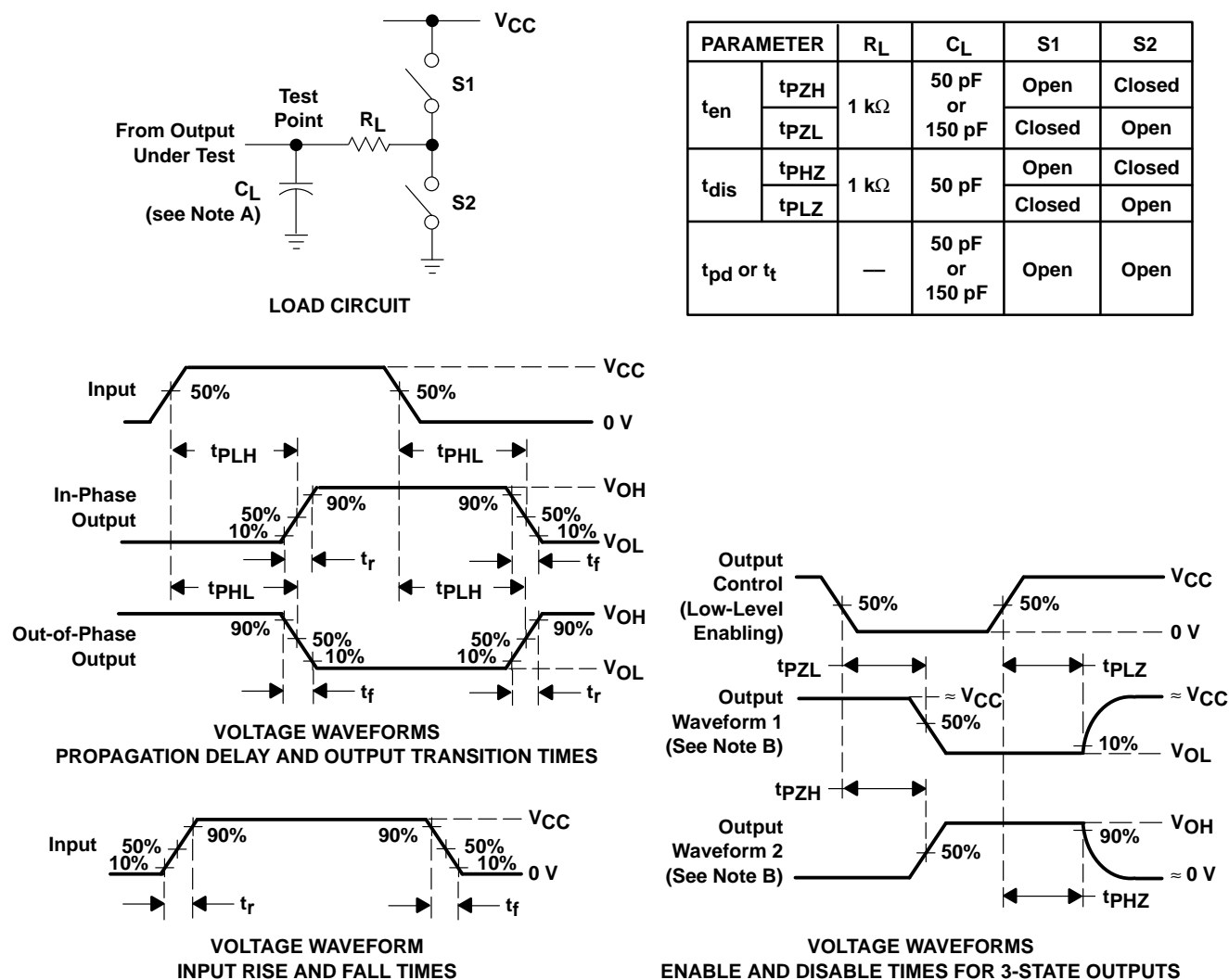
switching characteristics over recommended operating free-air temperature range,  $C_L = 150$  pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC541		SN74HC541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	2 V		65	165		246		206	ns
			4.5 V		16	33		49		41	
			6 V		14	28		42		35	
$t_{en}$	$\overline{OE}$	Y	2 V		100	200		298		250	ns
			4.5 V		20	40		60		50	
			6 V		17	34		51		43	
$t_t$		Y	2 V		45	210		315		265	ns
			4.5 V		17	42		63		53	
			6 V		13	36		53		45	

operating characteristics,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
$C_{pd}$	Power dissipation capacitance per buffer/driver	No load	35	pF

## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A.  $C_L$  includes probe and test-fixture 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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r = 6\text{ ns}$ ,  $t_f = 6\text{ ns}$ .
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E.  $tpLZ$  and  $tpHZ$  are the same as  $t_{dis}$ .
  - F.  $tpZL$  and  $tpZH$  are the same as  $t_{en}$ .
  - G.  $tpLH$  and  $tpHL$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

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