

# SN54HC534, SN74HC534 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

D2684, DECEMBER 1982 - REVISED SEPTEMBER 1987

- High-Current 3-State Inverting Outputs Can Drive Up to 15 LSTTL Loads
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-Mil DIPs
- Dependable Texas Instruments Quality and Reliability

## description

These 8-bit flip-flops feature three-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly attractive for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

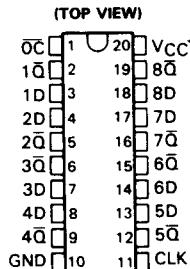
The eight flip-flops of the 'HC534 are edge-triggered D-type flip-flops. On the positive transition of the clock, the Q outputs will be set to the complement of the logic states that were set up at the D inputs. The 'HC534 is functionally equivalent to the 'HC374 except for having inverted outputs.

An output-control ( $\overline{OC}$ ) input can be used to place 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 third state and increased drive provide the capability to drive the bus lines in a bus-organized system without need for interface or pull-up components.

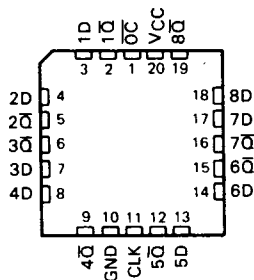
The output control does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are off.

The SN54HC534 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74HC534 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

SN54HC534 . . . J PACKAGE  
SN74HC534 . . . DW OR N PACKAGE



SN54HC534 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE (EACH FLIP-FLOP)

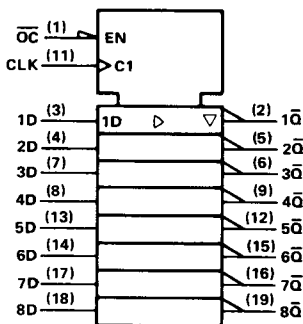
INPUTS			OUTPUT
$\overline{OC}$	CLK	D	$\overline{Q}$
L	↑	H	L
L	↑	L	H
L	L	X	$Q_0$
H	X	X	Z

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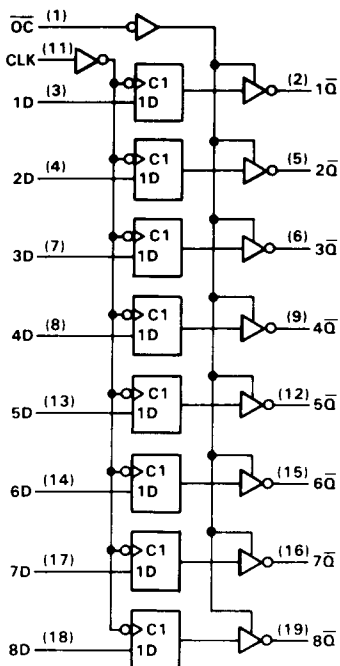
**SN54HC534, SN74HC534**  
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**WITH 3-STATE OUTPUTS**

logic symbol†



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

logic diagram (positive logic)



Pin numbers shown are for DW, J, and N packages.

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# SN54HC534, SN74HC534 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

## absolute maximum ratings over operating free-air temperature range†

Supply voltage, $V_{CC}$ .....	-0.5 V to 7 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 $V_{CC}$ ) .....	$\pm 35$ mA
Continuous current through $V_{CC}$ or GND pins .....	$\pm 70$ mA
Lead temperature 1,6 mm (1/16 in) from case for 60 s: FK or J package .....	300 °C
Lead temperature 1,6 mm (1/16 in) from case for 10 s: DW or N package .....	260 °C
Storage temperature range .....	-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.

## recommended operating conditions

		SN54HC534			SN74HC534			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	2	5	6	2	5	6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V	1.5		1.5			V
		$V_{CC} = 4.5$ V	3.15		3.15			
		$V_{CC} = 6$ V	4.2		4.2			
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V	0	0.3	0	0.3	V	
		$V_{CC} = 4.5$ V	0	0.9	0	0.9		
		$V_{CC} = 6$ V	0	1.2	0	1.2		
$V_I$	Input voltage	0		$V_{CC}$	0		$V_{CC}$	V
$V_O$	Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$t_t$	Input transition (rise and fall) times	$V_{CC} = 2$ V	0	1000	0	1000	ns	
		$V_{CC} = 4.5$ V	0	500	0	500		
		$V_{CC} = 6$ V	0	400	0	400		
$T_A$	Operating free-air temperature	-55		125	-40		85	°C

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**WITH 3-STATE OUTPUTS**

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			SN54HC534		SN74HC534		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		
	4.5 V	3.98	4.30		3.7		3.84			
	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -7.8 mA	6 V	5.48	5.80		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	
	4.5 V		0.17	0.26		0.4		0.33		
	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , 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, V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	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 to 6 V		3	10		10		10	pF

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

			V <sub>CC</sub>	T <sub>A</sub> = 25 °C		SN54HC534		SN74HC534		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency		2 V	0	6	0	4.2	0	5	MHz
			4.5 V	0	31	0	21	0	25	
			6 V	0	36	0	25	0	29	
t <sub>w</sub>	Pulse duration	CLK high or low	2 V	80		120		100		ns
			4.5 V	16		24		20		
			6 V	14		20		17		
t <sub>su</sub>	Setup time, data before CLK†		2 V	100		150		125		ns
			4.5 V	20		30		25		
			6 V	17		26		21		
t <sub>h</sub>	Hold time, data after CLK†		2 V	5		5		5		ns
			4.5 V	5		5		5		
			6 V	5		5		5		

**SN54HC534, SN74HC534**  
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switching characteristics over recommended operating free-air temperature range (unless otherwise noted),  $C_L = 50$  pF (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25 °C			SN54HC534		SN74HC534		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			2 V	6	11		4.2		5	MHz	
			4.5 V	31	36		21		25		
			6 V	36	40		25		29		
t <sub>pd</sub>	CLK	Any $\bar{Q}$	2 V		88	180		270		225	ns
			4.5 V		28	36		54		45	
			6 V		24	31		46		38	
t <sub>en</sub>	$\bar{OC}$	Any $\bar{Q}$	2 V		77	150		225		190	ns
			4.5 V		26	30		45		38	
			6 V		23	26		38		32	
t <sub>dis</sub>	$\bar{OC}$	Any $\bar{Q}$	2 V		51	150		225		190	ns
			4.5 V		25	30		45		38	
			6 V		23	26		38		32	
t <sub>t</sub>		Any $\bar{Q}$	2 V		28	60		90		75	ns
			4.5 V		8	12		18		15	
			6 V		6	10		15		13	

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C <sub>pd</sub>	Power dissipation per flip-flop	No load, T <sub>A</sub> = 25 °C	100 pF typ
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NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25 °C			SN54HC534		SN74HC534		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	CLK	Any $\bar{Q}$	2 V		105	230		345		290	ns
			4.5 V		35	46		69		58	
			6 V		31	39		58		49	
t <sub>en</sub>	$\bar{OC}$	Any $\bar{Q}$	2 V		95	200		300		250	ns
			4.5 V		32	40		60		50	
			6 V		29	34		51		43	
t <sub>t</sub>		Any Q	2 V		60	210		315		265	ns
			4.5 V		17	42		63		53	
			6 V		14	36		53		45	

NOTE 1: Load circuit and voltage waveforms are shown in Section 1.