

SN54ALS534A, SN74ALS534A, SN74AS534 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS168B – APRIL 1982 – REVISED JULY 1996

- 3-State Bus Driving Inverting Outputs
- Buffered Control Inputs
- Package Options Include Plastic Small-Outline (DW), Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

description

These octal D-type edge-triggered flip-flops 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.

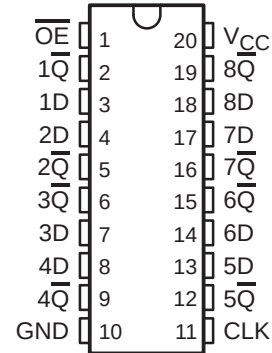
On the positive transition of the clock (CLK) input, the $\bar{Q}$ outputs are set to the complement of the logic states set up at the data (D) inputs. The 'ALS534A and SN74AS534 have inverted outputs, but otherwise are functionally equivalent to the 'ALS374A and SN74AS374.

A buffered output-enable ($\overline{OE}$) 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.

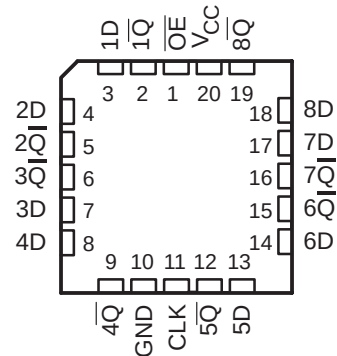
$\overline{OE}$ does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are off.

The SN54ALS534A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS534A and SN74AS534 are characterized for operation from 0°C to 70°C .

SN54ALS534A . . . J PACKAGE
SN74ALS534A, SN74AS534 . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS534A . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	$\bar{Q}$
L	$\uparrow$	H	L
L	$\uparrow$	L	H
L	H or L	X	$\bar{Q}_0$
H	X	X	Z



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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**

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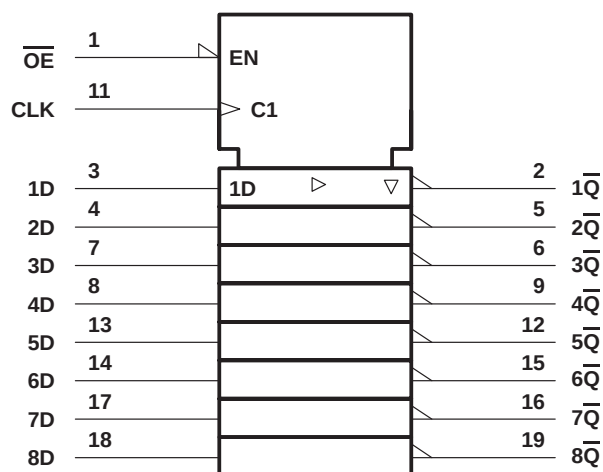
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OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS

WITH 3-STATE OUTPUTS

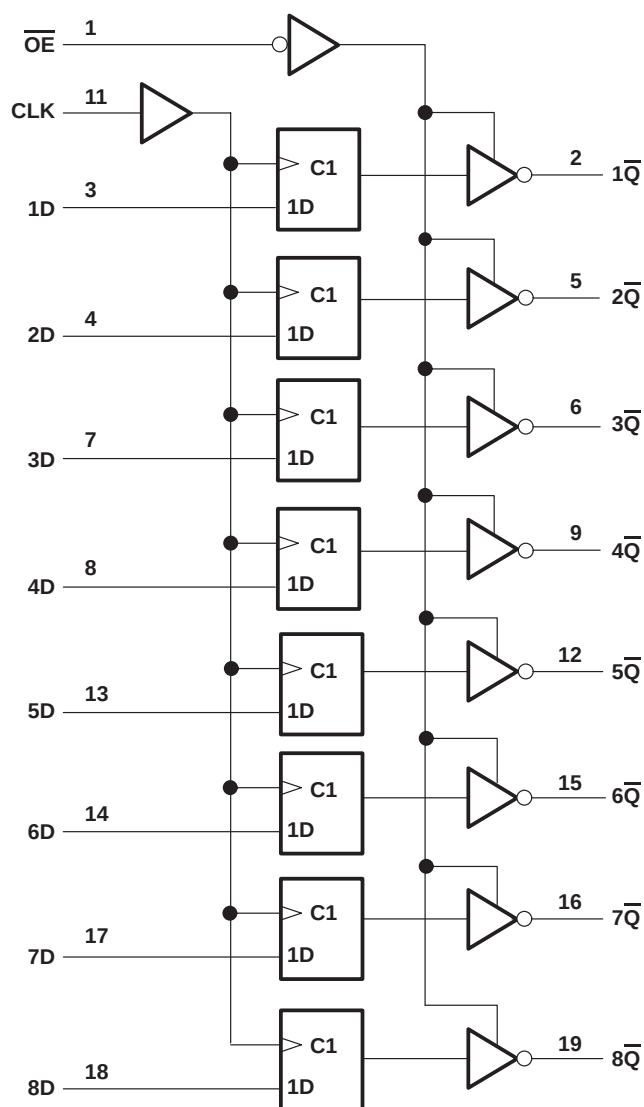
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logic symbol†



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

logic diagram (positive logic)



SN54ALS534A, SN74ALS534A, SN74AS534 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V_{CC}	7 V
Input voltage, V_I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T_A : SN54ALS534A	–55°C to 125°C
SN74ALS534A	0°C to 70°C
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.

recommended operating conditions

		SN54ALS534A			SN74ALS534A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.7			0.8	V
I_{OH}	High-level output current			–1			–2.6	mA
I_{OL}	Low-level output current			12			24	mA
f_{clock}	Clock frequency	0		30	0		35	MHz
t_w	Pulse duration, CLK high or low	16.5			14			ns
t_{su}	Setup time, data before CLK $\uparrow$	10			10			ns
t_h	Hold time, data after CLK $\uparrow$	0			0			ns
T_A	Operating free-air temperature	–55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS	SN54ALS534A			SN74ALS534A			UNIT
			MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX	
V_{IK}		$V_{CC} = 4.5\text{ V}$, $I_I = -18\text{ mA}$			–1.5			–1.5	V
V_{OH}		$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$, $I_{OH} = -0.4\text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
		$V_{CC} = 4.5\text{ V}$, $I_{OH} = -1\text{ mA}$	2.4	3.3					
		$V_{CC} = 4.5\text{ V}$, $I_{OH} = -2.6\text{ mA}$				2.4	3.2		
V_{OL}		$V_{CC} = 4.5\text{ V}$, $I_{OL} = 12\text{ mA}$		0.25	0.4		0.25	0.4	V
		$V_{CC} = 4.5\text{ V}$, $I_{OL} = 24\text{ mA}$					0.35	0.5	
I_{OZH}		$V_{CC} = 5.5\text{ V}$, $V_O = 2.7\text{ V}$			20			20	μA
I_{OZL}		$V_{CC} = 5.5\text{ V}$, $V_O = 0.4\text{ V}$			–20			–20	μA
I_I		$V_{CC} = 5.5\text{ V}$, $V_I = 7\text{ V}$			0.1			0.1	mA
I_{IH}		$V_{CC} = 5.5\text{ V}$, $V_I = 2.7\text{ V}$			20			20	μA
I_{IL}	CLK, $\overline{OE}$	$V_{CC} = 5.5\text{ V}$, $V_I = 0.4\text{ V}$			–0.1			–0.1	mA
	D				–0.2			–0.2	
$I_{OS}^{\S}$		$V_{CC} = 5.5\text{ V}$, $V_O = 2.25\text{ V}$	–20		–112	–30		–112	mA
I_{CC}		$V_{CC} = 5.5\text{ V}$, Outputs high		11	19		11	19	mA
		$V_{CC} = 5.5\text{ V}$, Outputs low		19	28		19	28	
		$V_{CC} = 5.5\text{ V}$, Outputs disabled		10	31		20	31	

[‡] All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

^{\S} The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .



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WITH 3-STATE OUTPUTS

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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†				UNIT
			SN54ALS534A		SN74ALS534A		
			MIN	MAX	MIN	MAX	
f _{max}			30		35		MHz
t _{PLH}	CLK	Any $\overline{Q}$	3	17	3	12	ns
t _{PHL}			4	18	4	16	
t _{PZH}	$\overline{OE}$	Any $\overline{Q}$	3	19	3	17	ns
t _{PZL}			4	20	4	18	
t _{PHZ}	$\overline{OE}$	Any $\overline{Q}$	1	12	1	10	ns
t _{PLZ}			1	25	2	14	

[†] 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 _{CC}	7 V
Input voltage, V _I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T _A : SN74AS534	0°C to 70°C
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.

recommended operating conditions

		SN74AS534			UNIT
		MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			V
V _{IL}	Low-level input voltage			0.8	V
I _{OH}	High-level output current			–15	mA
I _{OL}	Low-level output current			48	mA
f _{clock}	Clock frequency	0		125	MHz
t _w	Pulse duration	CLK high		4	ns
		CLK low		3	
t _{su}	Setup time, data before CLK [↑]	2			ns
t _h	Hold time, data after CLK [↑]	2			ns
T _A	Operating free-air temperature	0		70	°C



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

PARAMETER		TEST CONDITIONS	SN74AS534			UNIT
			MIN	TYP [†]	MAX	
V_{IK}		$V_{CC} = 4.5\text{ V}$, $I_I = -18\text{ mA}$			-1.2	V
V_{OH}		$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$, $I_{OH} = -2\text{ mA}$	$V_{CC} - 2$			V
		$V_{CC} = 4.5\text{ V}$, $I_{OH} = -15\text{ mA}$	2.4	3.3		
V_{OL}		$V_{CC} = 4.5\text{ V}$, $I_{OL} = 48\text{ mA}$	0.34	0.5		V
I_{OZH}		$V_{CC} = 5.5\text{ V}$, $V_O = 2.7\text{ V}$		50		μA
I_{OZL}		$V_{CC} = 5.5\text{ V}$, $V_I = 0.4\text{ V}$		-50		μA
I_I		$V_{CC} = 5.5\text{ V}$, $V_I = 7\text{ V}$		0.1		mA
I_{IH}		$V_{CC} = 5.5\text{ V}$, $V_I = 2.7\text{ V}$		20		μA
I_{IL}	$\overline{OE}$, CLK	$V_{CC} = 5.5\text{ V}$, $V_I = 0.4\text{ V}$		-0.5		mA
	D			-2		
$I_{O\ddagger}$		$V_{CC} = 5.5\text{ V}$, $V_O = 2.25\text{ V}$	-30		-112	mA
I_{CC}		$V_{CC} = 5.5\text{ V}$	Outputs high		77 120	mA
			Outputs low		84 128	
			Outputs disabled		84 128	

[†] All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

[‡] The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

switching characteristics (see Figure 1)

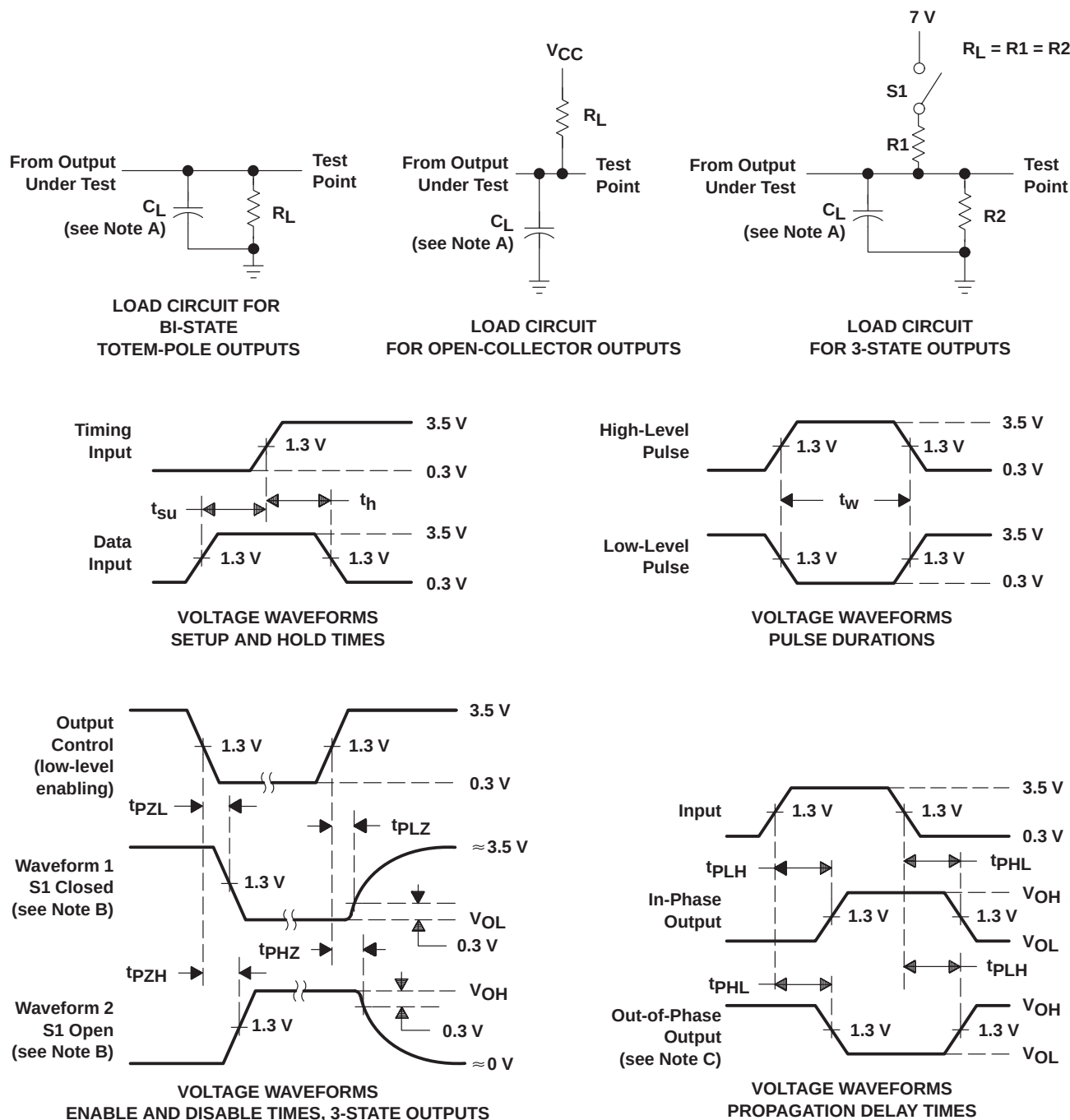
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX [§]		UNIT
			SN74AS534		
			MIN	MAX	
f _{max}			125		MHz
t _{PLH}	CLK	Any $\overline{Q}$	3	8	ns
t _{PHL}			4	9	
t _{PZH}	$\overline{OE}$	Any $\overline{Q}$	2	6	ns
t _{PZL}			3	10	
t _{PHZ}	$\overline{OE}$	Any $\overline{Q}$	2	6	ns
t _{PLZ}			2	6	

[§] For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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



- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - When measuring propagation delay items of 3-state outputs, switch S1 is open.
 - All input pulses have the following characteristics: $PRR \leq 1$ MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
 - The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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