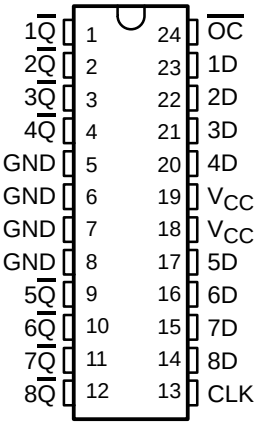
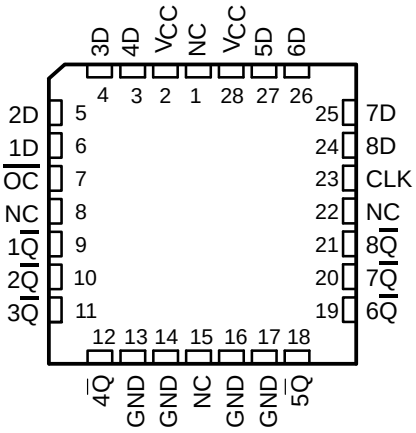
- **Eight D-Type Flip-Flops in a Single Package**
- **3-State Bus Driving Inverting Outputs**
- **Full Parallel Access for Loading**
- **Inputs Are TTL-Voltage Compatible**
- **Flow-Through Architecture to Optimize PCB Layout**
- **Center-Pin V_{CC} and GND Configurations to Minimize High-Speed Switching Noise**
- ***EPIC***™ **(Enhanced-Performance Implanted CMOS) 1-μm Process**
- **500-mA Typical Latch-Up Immunity at 125°C**
- **Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs**

54AC11534 . . . JT PACKAGE
74AC11534 . . . DW OR NT PACKAGE
(TOP VIEW)



54AC11534 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

These eight flip-flops feature 3-state outputs designed for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight flip-flops of the ′AC11534 are edge-triggered, D-type flip-flops. On the positive transition of the clock, the $\overline{Q}$ outputs are set to the complement of the logic levels at the D inputs. The ′AC11534 is functionally equivalent to the ′AC11374 except for having inverted outputs.

An output-control input ($\overline{OC}$) is 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 ($\overline{OC}$) 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 in the high-impedance state.

The 54AC11534 is characterized for operation over the full military temperature range of –55°C to 125°C. The 74AC11534 is characterized for operation from – 40°C to 85°C.

FUNCTION TABLE
(each filp-flop)

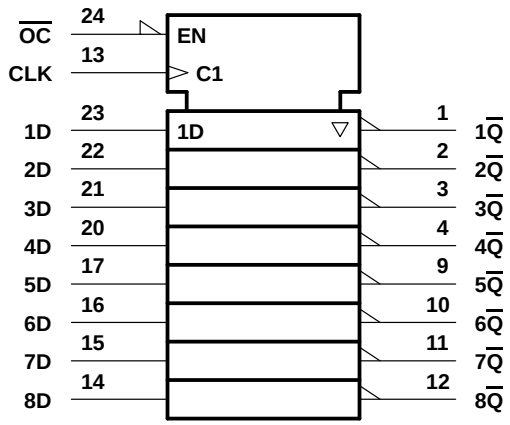
INPUTS			OUTPUT
$\overline{OC}$	CLK	D	$\overline{Q}$
L	↑	H	L
L	↑	L	H
L	L	X	$\overline{Q}_0$
H	X	X	Z

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.

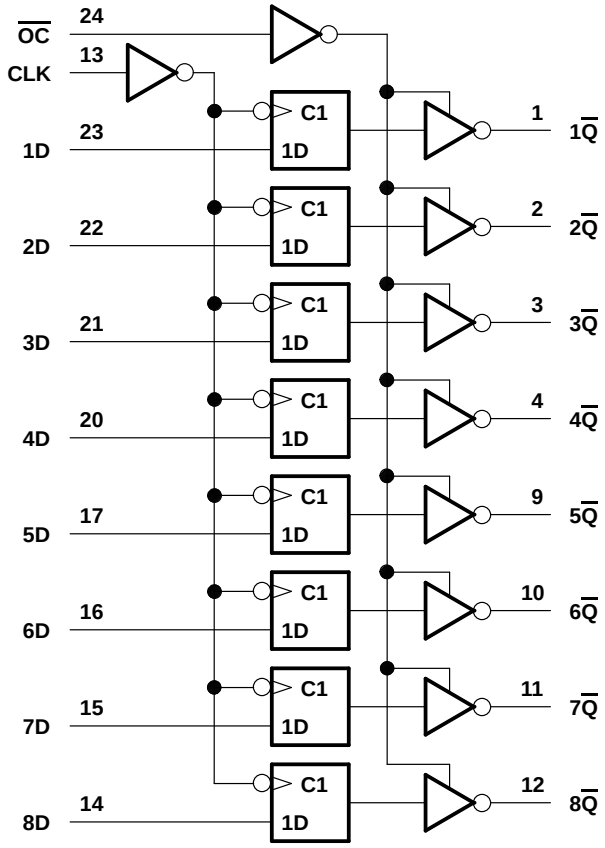
Copyright © 1993, Texas Instruments Incorporated

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 the DW, JT, and NT packages.

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}) . . . . . ± 20 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{CC}) . . . . . ± 50 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . . ± 50 mA
Continuous current through V_{CC} or GND . . . . . ± 200 mA
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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

recommended operating conditions

			54AC11534			74AC11534			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		3	5	5.5	3	5	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 3 V	2.1			2.1			V
		V_{CC} = 4.5 V	3.15			3.15			
		V_{CC} = 5.5 V	3.85			3.85			
V_{IL}	Low-level input voltage	V_{CC} = 3 V			0.9			0.9	V
		V_{CC} = 4.5 V			1.35			1.35	
		V_{CC} = 5.5 V			1.65			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 V			– 4			– 4	mA
		V_{CC} = 4.5 V			– 24			– 24	
		V_{CC} = 5.5 V			–24			–24	
I_{OL}	Low-level output current	V_{CC} = 3 V			12			12	mA
		V_{CC} = 4.5 V			24			24	
		V_{CC} = 5.5 V			24			24	
$\Delta t/\Delta v$	Input transition rise or fall rate	OC	0		5	0		5	ns/V
		D	0		10	0		10	
T_A	Operating free-air temperature		–55		125	– 40		85	°C

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

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			54AC11534		74AC11534		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	I_{OH} = – 50 μA	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} = – 4 mA	3 V	2.58			2.4		2.48		
	I_{OH} = – 24 mA	4.5 V	3.94			3.7		3.8		
		5.5 V	4.94			4.7		4.8		
	I_{OH} = – 50 mA†	5.5 V				3.85				
	I_{OH} = – 75 mA†	5.5 V						3.85		
V_{OL}	I_{OL} = 50 μA	3 V			0.1		0.1		0.1	V
		4.5 V			0.1		0.1		0.1	
		5.5 V			0.1		0.1		0.1	
	I_{OL} = 12 mA	3 V			0.36		0.5		0.44	
	I_{OL} = 24 mA	4.5 V			0.36		0.5		0.44	
		5.5 V			0.36		0.5		0.44	
	I_{OL} = 50 mA†	5.5 V					1.65			
	I_{OL} = 75 mA†	5.5 V							1.65	
I_{OZ}	$V_O = V_{CC}$ or GND	5.5 V			± 0.5		± 10		± 5	μA
I_I	$V_I = V_{CC}$ or GND	5.5 V			± 0.1		± 1		± 1	μA
I_{CC}	$V_I = V_{CC}$ or GND, I_O = 0	5.5 V			8		160		80	μA
C_i	$V_I = V_{CC}$ or GND	5 V		4						pF
C_o	$V_O = V_{CC}$ or GND	5 V		10						pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

timing requirements, V_{CC} = 3.3 V ± 0.3 V (see Figure 1)

		T_A = 25°C		54AC11534		74AC11534		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency	0	50	0	50	0	50	MHz
t_w	Pulse duration, CLK low or CLK high	10		10		10		ns
t_{su}	Setup time, data before CLK ↑	3.5		3.5		3.5		ns
t_h	Hold time, data after CLK ↑	5.5		5.5		5.5		ns

timing requirements, V_{CC} = 5 V ± 0.5 V (see Figure 1)

		T_A = 25°C		54AC11534		74AC11534		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency	0	75	0	75	0	75	MHz
t_w	Pulse duration, CLK low or CLK high	6.5		6.5		6.5		ns
t_{su}	Setup time, data before CLK ↑	3.5		3.5		3.5		ns
t_h	Hold time, data after CLK ↑	4.5		4.5		4.5		ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC11534		74AC11534		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			50	75		50		50		MHz
t_{PLH}	CLK	$\overline{Q}$	1.5	11	15.3	1.5	19.1	1.5	17.6	ns
t_{PHL}			1.5	11	15.7	1.5	19	1.5	17.7	
t_{PZH}	$\overline{OC}$	$\overline{Q}$	1.5	9	12.8	1.5	15.8	1.5	14.6	ns
t_{PZL}			1.5	9	12.6	1.5	15.6	1.5	14.3	
t_{PHZ}	$\overline{OC}$	$\overline{Q}$	1.5	10	12.6	1.5	13.8	1.5	13.3	ns
t_{PLZ}			1.5	8	13	1.5	14.2	1.5	13.8	

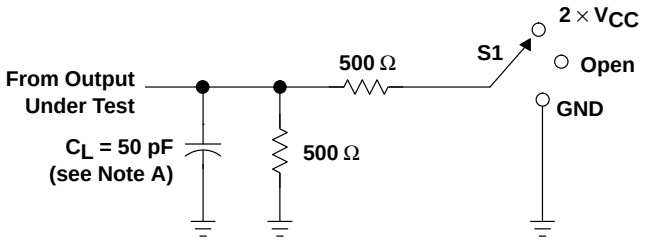
switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC11534		74AC11534		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			75	100		75		75		MHz
t_{PLH}	CLK	$\overline{Q}$	1.5	7	10.3	1.5	12.7	1.5	11.7	ns
t_{PHL}			1.5	7	10.7	1.5	13.2	1.5	12.1	
t_{PZH}	$\overline{OC}$	$\overline{Q}$	1.5	6	9.2	1.5	11.2	1.5	10.4	ns
t_{PZL}			1.5	6	9.2	1.5	11.3	1.5	10.4	
t_{PHZ}	$\overline{OC}$	$\overline{Q}$	1.5	9	11.1	1.5	11.9	1.5	11.6	ns
t_{PLZ}			1.5	6	8.8	1.5	9.6	1.5	9.2	

operating characteristics, V_{CC} = 5 V, T_A = 25°C

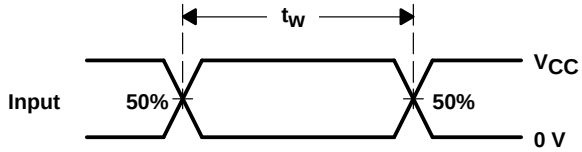
PARAMETER			TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per flip-flop	Outputs enabled	C_L = 50 pF, f = 1 MHz	75	pF
		Outputs disabled		65	

PARAMETER MEASUREMENT INFORMATION

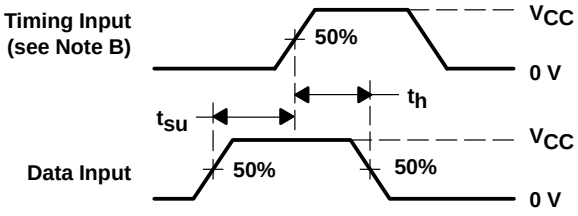


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	2 × V_{CC}
t_{PHZ}/t_{PZH}	GND

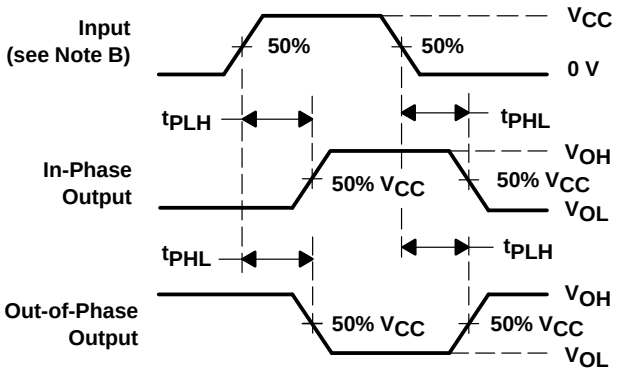
LOAD CIRCUIT



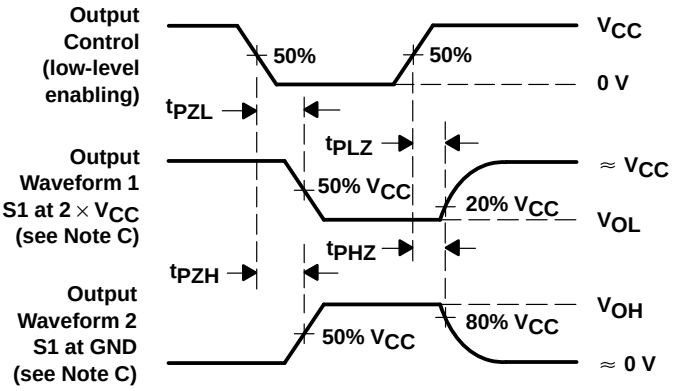
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 ns.
C. 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.
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.

Copyright © 1996, Texas Instruments Incorporated