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# DATA SHEET

Jameco Part Number 310113

## **74ALS74A**

Dual D-type flip-flop with set and reset

Product specification

1996 Jul 01

IC05 Data Handbook

# Dual D-type flip-flop with set and reset

# 74ALS74A

## DESCRIPTION

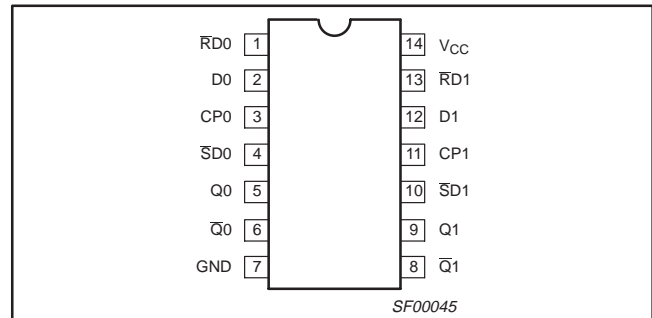
The 74ALS74 is a dual positive edge-triggered D-type flip-flop featuring individual data, clock, set, and reset inputs; also true and complementary outputs. Set ( $\overline{SD}$ ) and reset ( $\overline{RD}$ ) are asynchronous active-Low inputs and operate independently of the clock input. When set and reset are inactive (High), data at the D input is transferred to the Q and  $\overline{Q}$  outputs on the Low-to-High transition of the clock. Data must be stable just one setup time prior to the Low-to-High transition of the clock for predictable operation. Clock triggering occurs at a voltage level and is not directly related to the transition time of the positive-going pulse. Following the hold time interval, data at the D input may be changed without affecting the levels of the output.

TYPE	TYPICAL $f_{MAX}$	TYPICAL SUPPLY CURRENT (TOTAL)
74ALS74A	150MHz	3.0mA

## ORDERING INFORMATION

DESCRIPTION	ORDER CODE	DRAWING NUMBER
	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$ , $T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$	
14-pin plastic DIP	74ALS74AN	SOT27-1
14-pin plastic SO	74ALS74AD	SOT108-1
14-pin plastic SSOP Type II	74ALS74ADB	SOT337-1

## PIN CONFIGURATION

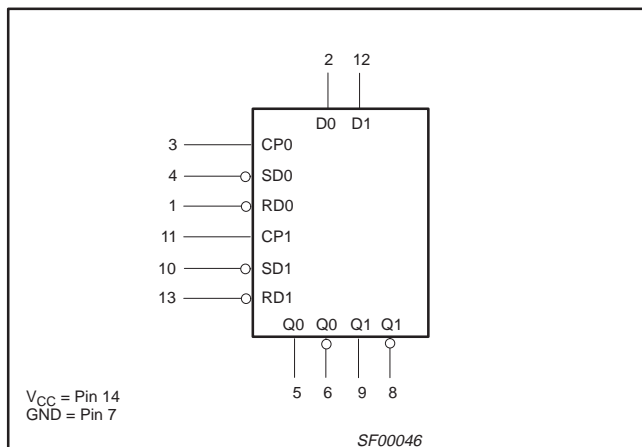


## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

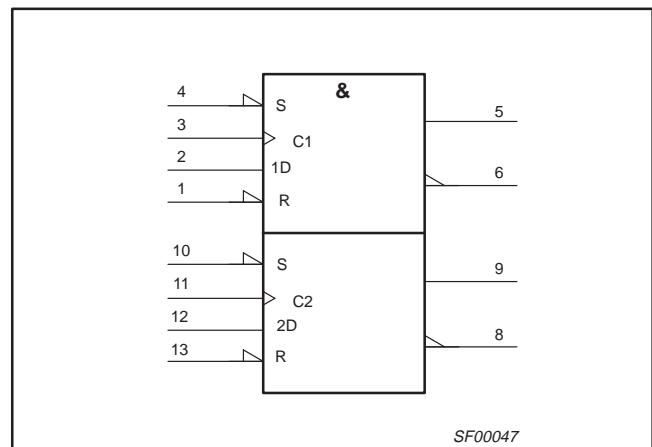
PINS	DESCRIPTION	74ALS (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0, D1	Data inputs	1.0/2.0	20 $\mu$ A/0.2mA
CP0, CP1	Clock inputs (active rising edge)	1.0/2.0	20 $\mu$ A/0.2mA
$\overline{SD}$ 0, $\overline{SD}$ 1	Set inputs (active-Low)	2.0/4.0	40 $\mu$ A/0.4mA
$\overline{RD}$ 0, $\overline{RD}$ 1	Reset inputs (active-Low)	2.0/4.0	40 $\mu$ A/0.4mA
Q0, Q1, $\overline{Q}$ 0, $\overline{Q}$ 1	Data outputs	20/80	0.4mA/8mA

**NOTE:** One (1.0) ALS unit load is defined as: 20 $\mu$ A in the High state and 0.1mA in the Low state.

## LOGIC SYMBOL



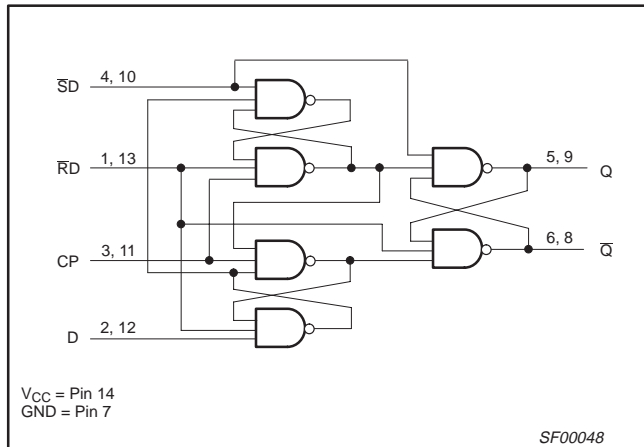
## IEC/IEEE SYMBOL



# Dual D-type flip-flop with set and reset

# 74ALS74A

## LOGIC DIAGRAM



## FUNCTION TABLE

INPUTS				OUTPUTS		OPERATING MODE
$\overline{SD}$	$\overline{RD}$	CP	D	Q	$\overline{Q}$	
L	H	X	X	H	L	Asynchronous set
H	L	X	X	L	H	Asynchronous reset
L	L	X	X	H	H	Undetermined*
H	H	$\uparrow$	h	H	L	Load "1"
H	H	$\uparrow$	l	L	H	Load "0"
H	H	$\uparrow$	X	NC	NC	Hold

H = High voltage level  
 h = High state must be present one setup time prior to Low-to-High clock transition  
 L = Low voltage level  
 l = Low state must be present one setup time prior to Low-to-High clock transition  
 NC = No change from the previous setup  
 X = Don't care  
 $\uparrow$  = Low-to-High clock transition  
 $\uparrow$  = Not Low-to-High clock transition  
 \* = Both outputs will be High while both  $\overline{SD}$  and  $\overline{RD}$  are Low, but the output states are unpredictable if  $\overline{SD}$  and  $\overline{RD}$  go High simultaneously

## ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
$V_{CC}$	Supply voltage	-0.5 to +7.0	V
$V_{IN}$	Input voltage	-0.5 to +7.0	V
$I_{IN}$	Input current	-30 to +5	mA
$V_{OUT}$	Voltage applied to output in High output state	-0.5 to $V_{CC}$	V
$I_{OUT}$	Current applied to output in Low output state	16	mA
$T_{amb}$	Operating free-air temperature range	0 to +70	°C
$T_{stg}$	Storage temperature range	-65 to +150	°C

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5.0	5.5	V
$V_{IH}$	High-level input voltage	2.0			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{ik}$	Input clamp current			-18	mA
$I_{OH}$	High-level output current			-0.4	mA
$I_{OL}$	Low-level output current			8	mA
$T_{amb}$	Operating free-air temperature range	0		+70	°C

## Dual D-type flip-flop with set and reset

74ALS74A

## DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>		LIMITS			UNIT
				MIN	TYP <sup>2</sup>	MAX	
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = ±10%, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OH</sub> = MAX	V <sub>CC</sub> - 2			V
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OL</sub> = 4mA		0.25	0.40	V
			I <sub>OL</sub> = 8mA		0.35	0.50	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			-0.73	-1.5	V
I <sub>I</sub>	Input current at maximum input voltage	Dn, CPn SDn, RDn	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V			0.1	mA
						0.2	mA
I <sub>IH</sub>	High-level input current	Dn, CPn SDn, RDn	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	μA
						40	μA
I <sub>IL</sub>	Low-level input current	Dn, CPn SDn, RDn	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4V			-0.2	mA
						-0.4	mA
I <sub>O</sub>	Output current <sup>3</sup>	V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.25V		-30		-112	mA
I <sub>CC</sub>	Supply current (total) <sup>4</sup>	V <sub>CC</sub> = MAX			3.0	4.0	mA

## NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.
- Measure I<sub>CC</sub> with the Dn, CPn, and SDn grounded, then with Dn, CPn, and RDn grounded.

## AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	MAX	
f <sub>max</sub>	Maximum clock frequency	Waveform 1	80		MHz
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CPn to Qn or Q̄n	Waveform 1	3.0	14.0	ns
			3.0	14.0	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay SDn or RDn to Qn or Q̄n	Waveform 2, 3	1.0	8.0	ns
			3.0	10.0	

## AC SETUP REQUIREMENTS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	MAX	
t <sub>su</sub> (H) t <sub>su</sub> (L)	Setup time, High or Low Dn to CPn	Waveform 1	6.0 6.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low Dn to CPn	Waveform 1	0.0 0.0		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	CPn Pulse width High or Low	Waveform 1	6.0 6.0		ns
t <sub>w</sub> (L)	SDn or RDn Pulse width, Low	Waveform 2, 3	6.0		ns
t <sub>rec</sub>	Recovery time, SDn or RDn to CPn	Waveform 2, 3	6.0		ns

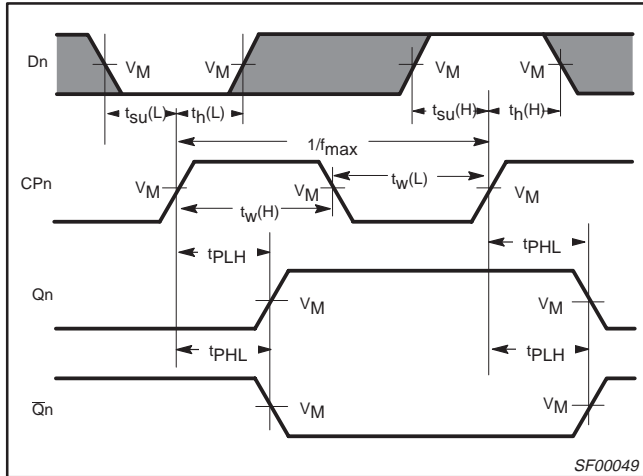
# Dual D-type flip-flop with set and reset

# 74ALS74A

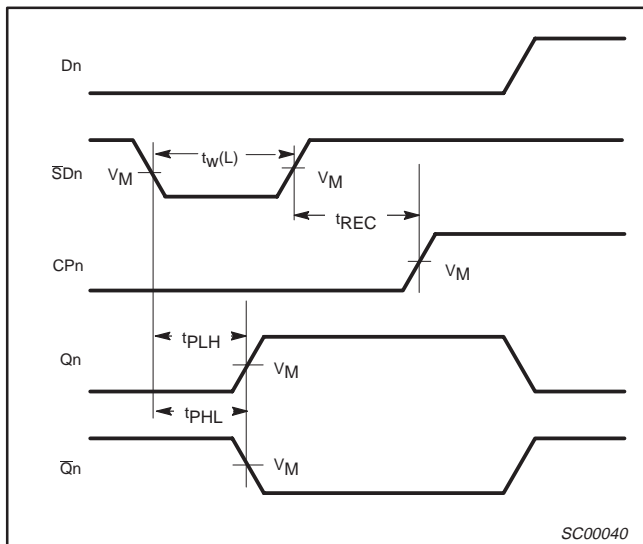
## AC WAVEFORMS

For all waveforms,  $V_M = 1.3V$ .

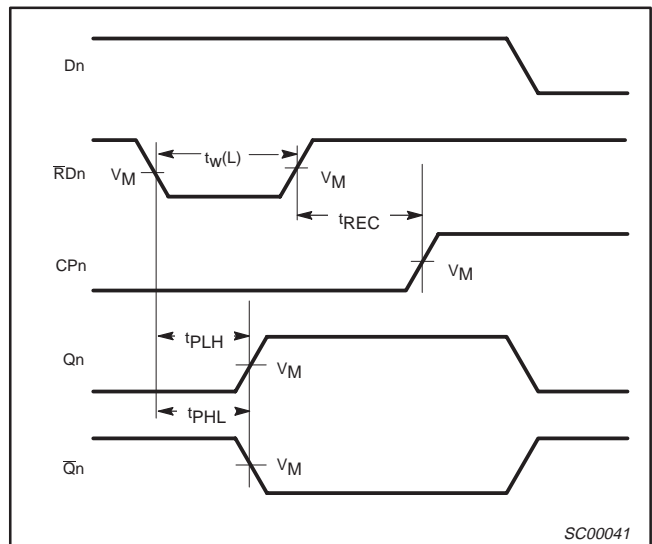
The shaded areas indicate when the input is permitted to change for predictable output performance.



**Waveform 1. Propagation Delay for Data to Output, Data Setup and Hold Times, Clock Width, and Maximum Clock Frequency**



**Waveform 2. Propagation Delay for Set to Output, Set Pulse Width and Recovery Time for Set to Clock**

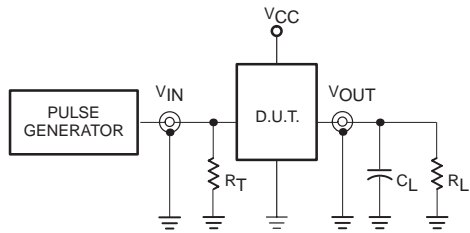


**Waveform 3. Propagation Delay for Reset to Output, Reset Pulse Width and Recovery Time for Reset to Clock**

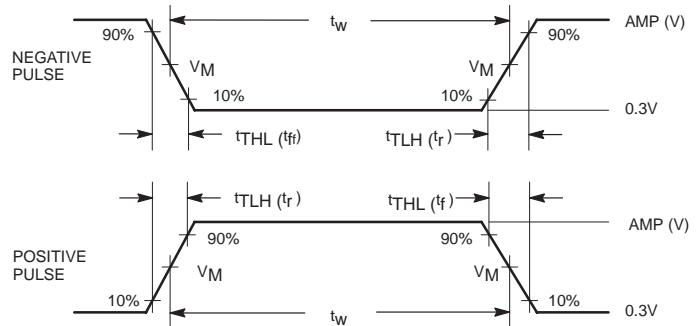
# Dual D-type flip-flop with set and reset

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## TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-pole Outputs



Input Pulse Definition

**DEFINITIONS:**

- $R_L$  = Load resistor; see AC electrical characteristics for value.
- $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

Family	INPUT PULSE REQUIREMENTS					
	Amplitude	$V_M$	Rep.Rate	$t_w$	$t_{TLH}$	$t_{THL}$
74ALS	3.5V	1.3V	1MHz	500ns	2.0ns	2.0ns

SC00005

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## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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**DIP14:** plastic dual in-line package; 14 leads (300 mil)

**SOT27-1**

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Dual D-type flip-flop with set and reset

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**SO14:** plastic small outline package; 14 leads; body width 3.9 mm

**SOT108-1**

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**NOTES**