

54AC74/54ACT74 Dual D-Type Positive Edge-Triggered Flip-Flop

Check for Samples: [54AC74](#), [54ACT74](#)

FEATURES

- I_{CC} Reduced by 50%
- Output Source/Sink 24 mA
- 'ACT74 has TTL-Compatible Inputs
- Standard Microcircuit Drawing (SMD)
 - 'AC74: 5962-88520
 - 'ACT74: 5962-87525
- 54AC74 Now Qualified to 300Krad RHA Designation, Refer to the SMD for More Information

DESCRIPTION

The 'AC/'ACT74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q , $\bar{Q}$) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

- Asynchronous Inputs:
 - LOW Input to $\bar{S}_D$ (Set) Sets Q to HIGH Level
 - LOW Input to $\bar{C}_D$ (Clear) Sets Q to LOW Level
 - Clear and Set are Independent of Clock
 - Simultaneous LOW on $\bar{C}_D$ and $\bar{S}_D$ Makes Both Q and $\bar{Q}$ HIGH

LOGIC SYMBOLS

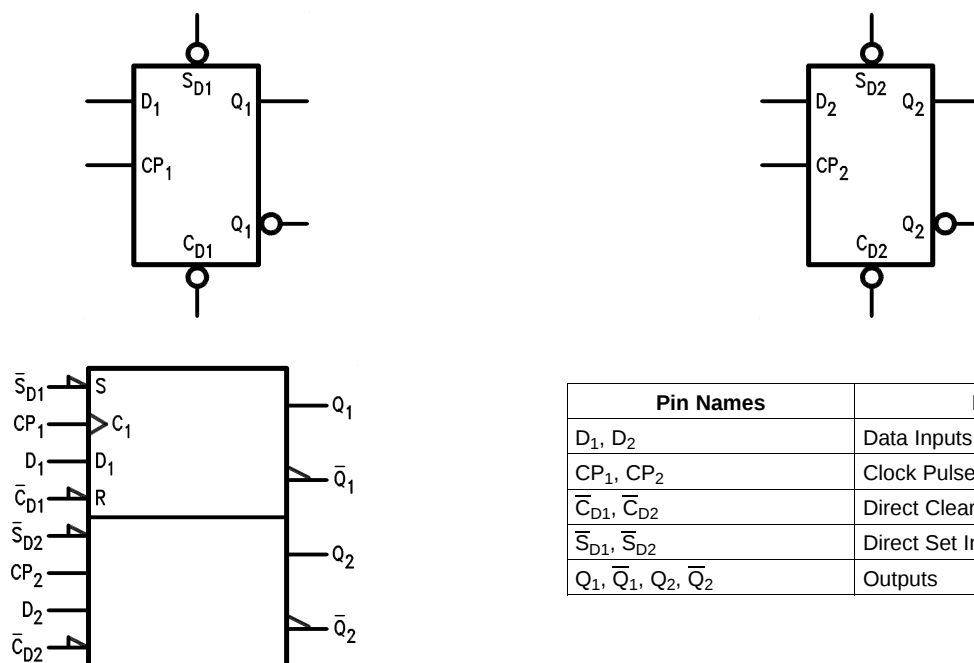


Figure 1. IEEE/IEC

Pin Names	Description
D_1, D_2	Data Inputs
CP_1, CP_2	Clock Pulse Inputs
$\bar{C}_{D1}, \bar{C}_{D2}$	Direct Clear Inputs
$\bar{S}_{D1}, \bar{S}_{D2}$	Direct Set Inputs
$Q_1, \bar{Q}_1, Q_2, \bar{Q}_2$	Outputs



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CONNECTION DIAGRAM

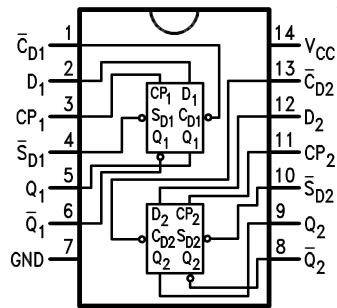


Figure 2. Pin Assignment for CDIP and CLGA

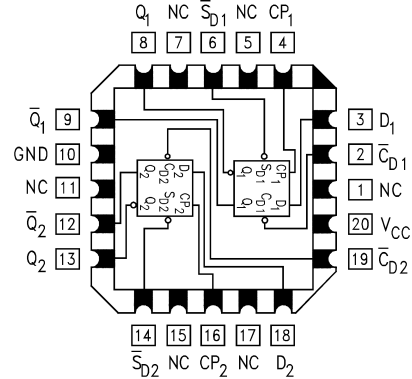


Figure 3. Pin Assignment for LCCC

TRUTH TABLE ⁽¹⁾

(Each Half)

Inputs				Outputs	
$\bar{S}_D$	$\bar{C}_D$	CP	D	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\bar{Q}_0$

(1) H = HIGH Voltage Level

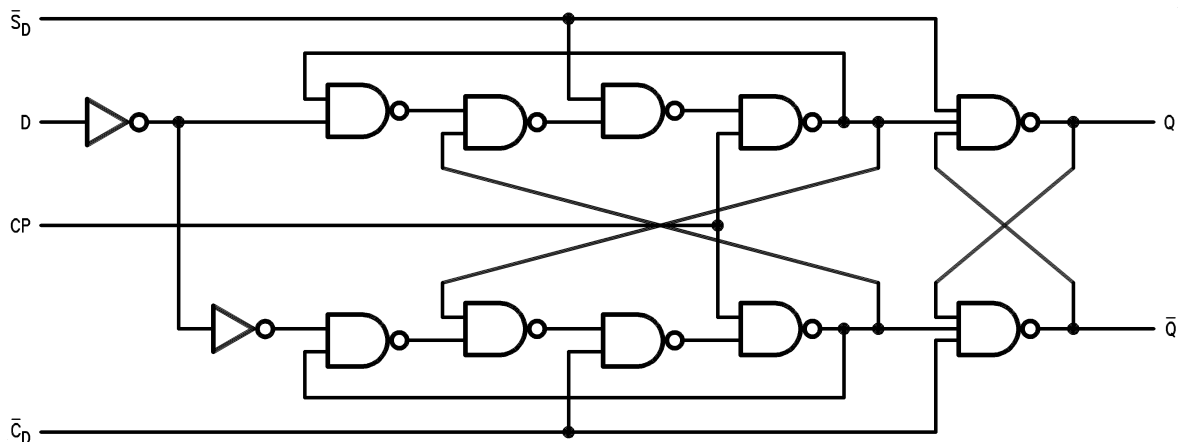
L = LOW Voltage Level

X = Immaterial

↑ = LOW-to-HIGH Clock Transition

 $Q_0(\bar{Q}_0)$ = Previous $Q(\bar{Q})$ before LOW-to-HIGH Transition of Clock

LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ABSOLUTE MAXIMUM RATINGS ⁽¹⁾⁽²⁾

Supply Voltage (V_{CC})	–0.5V to +7.0V
DC Input Diode Current (I_{IK})	
$V_I = -0.5V$	–20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage (V_I)	–0.5V to $V_{CC} + 0.5V$
DC Output Diode Current (I_{OK})	
$V_O = -0.5V$	–20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage (V_O)	–0.5V to $V_{CC} + 0.5V$
DC Output Source	
or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current	
per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	–65°C to +150°C
Junction Temperature (T_J)	
CDIP	175°C

- (1) Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. TI does not recommend operation of FACT[®] circuits outside databook specifications.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

RECOMMENDED OPERATING CONDITIONS ⁽¹⁾

Supply Voltage (V_{CC})	
'AC	2.0V to 6.0V
'ACT	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
54AC/ACT	–55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'AC Devices	
V_{IN} from 30% to 70% of V_{CC}	
V_{CC} @ 3.3V, 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'ACT Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

- (1) Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. TI does not recommend operation of FACT[®] circuits outside databook specifications.

DC CHARACTERISTICS FOR 'AC FAMILY DEVICES

Symbol	Parameter	V _{CC} (V)	54AC	Units	Conditions
			T _A = –55°C to +125°C		
			Ensured Limits		
V _{IH}	Minimum High Level Input Voltage	3.0	2.1	V	V _{OUT} = 0.1V or V _{CC} – 0.1V
		4.5	3.15		
		5.5	3.85		
V _{IL}	Maximum Low Level Input Voltage	3.0	0.9	V	V _{OUT} = 0.1V or V _{CC} – 0.1V
		4.5	1.35		
		5.5	1.65		
V _{OH}	Minimum High Level Output Voltage	3.0	2.9	V	I _{OUT} = –50 µA (1) V _{IN} = V _{IL} or V _{IH}
		4.5	4.4		
		5.5	5.4		
	Maximum Low Level Output Voltage	3.0	2.4	V	I _{OH} –12 mA –24 mA –24 mA
		4.5	3.7		
		5.5	4.7		
		5.5	4.7		
V _{OL}	Maximum Low Level Output Voltage	3.0	0.1	V	I _{OUT} = 50 µA (1) V _{IN} = V _{IL} or V _{IH}
		4.5	0.1		
		5.5	0.1		
	Maximum Low Level Output Voltage	3.0	0.5	V	I _{OL} 12 mA 24 mA 24 mA
		4.5	0.5		
		5.5	0.5		
		5.5	0.5		
I _{IN}	Maximum Input Leakage Current	5.5	±1.0	µA	V _I = V _{CC} , GND
I _{OLD}	(2) Minimum Dynamic Output Current	5.5	50	mA	V _{OLD} = 1.65V Max
I _{OHD}	Dynamic Output Current	5.5	–50	mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5	40.0	µA	V _{IN} = V _{CC} or GND

(1) All outputs loaded; thresholds on input associated with output under test.

(2) Maximum test duration 2.0 ms, one output loaded at a time.

DC CHARACTERISTICS FOR 'ACT FAMILY DEVICES

Symbol	Parameter	V _{CC} (V)	54ACT	Units	Conditions
			T _A = –55°C to +125°C		
			Ensured Limits		
V _{IH}	Minimum High Level Input Voltage	4.5	2.0	V	V _{OUT} = 0.1V or V _{CC} – 0.1V
		5.5	2.0		
V _{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	V _{OUT} = 0.1V or V _{CC} – 0.1V
		5.5	0.8		
V _{OH}	Minimum High Level Output Voltage	4.5	4.4	V	I _{OUT} = –50 µA (1) V _{IN} = V _{IL} or V _{IH}
		5.5	5.4		
	Maximum Low Level Output Voltage	4.5	3.70	V	I _{OH} –24 mA –24 mA
		5.5	4.70		
		5.5	4.70		

(1) All outputs loaded; thresholds on input associated with output under test.

DC CHARACTERISTICS FOR 'ACT FAMILY DEVICES (continued)

Symbol	Parameter	V _{CC} (V)	54ACT	Units	Conditions
			T _A = –55°C to +125°C		
			Ensured Limits		
V _{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	I _{OUT} = 50 µA
		5.5	0.1		(1)
		4.5	0.50	V	V _{IN} = V _{IL} or V _{IH}
		5.5	0.50		I _{OL} 24 mA
I _{IN}	Maximum Input Leakage Current	5.5	±1.0	µA	V _I = V _{CC} , GND
I _{CCT}	Maximum I _{CC} /Input	5.5	1.6	mA	V _I = V _{CC} – 2.1V
I _{OLD}	(2)Minimum Dynamic Output Current	5.5	50	mA	V _{OLD} = 1.65V Max
I _{OHD}		5.5	–50	mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5	40.0	µA	V _{IN} = V _{CC} or GND

(2) Maximum test duration 2.0 ms, one output loaded at a time.

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CC} (V) (1)	54AC		Units	Fig. No.
			T _A = –55°C to +125°C C _L = 50 pF			
			Min	Max		
f _{max}	Maximum Clock Frequency	3.3	70		MHz	
		5.0	95			
t _{PLH}	Propagation Delay C _{Dn} or S _{Dn} to Q _n or Q _n	3.3	1.0	13.0	ns	
		5.0	1.0	9.5		
t _{PHL}	Propagation Delay C _{Dn} or S _{Dn} to Q _n or Q _n	3.3	1.0	14.0	ns	
		5.0	1.0	10.5		
t _{PLH}	Propagation Delay CP _n to Q _n or Q _n	3.3	1.0	17.5	ns	
		5.0	1.0	12.0		
t _{PHL}	Propagation Delay CP _n to Q _n or Q _n	3.3	1.0	13.5	ns	
		5.0	1.0	10.0		

(1) Voltage Range 3.3 is 3.3V ± 0.3V Voltage Range 5.0 is 5.0V ± 0.5V

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} (V) (1)	54AC	Units	Fig. No.
			T _A = –55°C to +125°C C _L = 50 pF		
			Ensured Limits		
t _s	Set-up Time, HIGH or LOW D _n to CP _n	3.3	5.0	ns	
		5.0	4.0		
t _h	Hold Time, HIGH or LOW D _n to CP _n	3.3	0.5	ns	
		5.0	0.5		
t _w	CP _n or C _{Dn} or S _{Dn} Pulse Width	3.3	8.0	ns	
		5.0	5.5		

(1) Voltage Range 3.3 is 3.3V ± 0.3V Voltage Range 5.0 is 5.0V ± 0.5V

AC OPERATING REQUIREMENTS (continued)

Symbol	Parameter	V _{CC} (V) (1)	54AC	Units	Fig. No.
			T _A = –55°C to +125°C C _L = 50 pF		
			Ensured Limits		
t _{rec}	Recovery Time C _{Dn} or S _{Dn} to CP	3.3	0.5	ns	
		5.0	0.5		

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CC} (V) (1)	54ACT		Units	Fig. No.
			T _A = -55°C to +125°C C _L = 50 pF			
			Min	Max		
f _{max}	Maximum Clock Frequency	5.0	85		MHz	
t _{PLH}	Propagation Delay C _{Dn} or S _{Dn} to Q _n or Q _n	5.0	1.0	11.5	ns	
t _{PHL}	Propagation Delay C _{Dn} or S _{Dn} to Q _n or Q _n	5.0	1.0	12.5	ns	
t _{PLH}	Propagation Delay CP _n to Q _n or Q _n	5.0	1.0	14.0	ns	
t _{PHL}	Propagation Delay CP _n to Q _n or Q _n	5.0	1.0	12.0	ns	

(1) Voltage Range 5.0 is 5.0V ±0.5V

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} (V) (1)	54ACT	Units	Fig. No.
			T _A = –55°C C _L = 50 pF		
			Ensured Limits		
t _s	Set-up Time, HIGH or LOW D _n to CP _n	5.0	4.0	ns	
t _h	Hold Time, HIGH or LOW D _n to CP _n	5.0	1.0	ns	
t _w	CP _n or C _{Dn} or S _{Dn} Pulse Width	5.0	7.0	ns	
t _{rec}	Recovery Time C _{Dn} or S _{Dn} to CP	5.0	0.5	ns	

(1) Voltage Range 5.0 is 5.0V ±0.5V

CAPACITANCE

Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = OPEN
C _{PD}	Power Dissipation Capacitance	35.0	pF	V _{CC} = 5.0V

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