

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT107**

**Dual JK flip-flop with reset;  
negative-edge trigger**

Product specification  
File under Integrated Circuits, IC06

December 1990

## Dual JK flip-flop with reset; negative-edge trigger

## 74HC/HCT107

## FEATURES

- Output capability: standard
- I<sub>CC</sub> category: flip-flops

## GENERAL DESCRIPTION

The 74HC/HCT107 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT107 are dual negative-edge triggered JK-type flip-flops featuring individual J, K, clock ( $\overline{nCP}$ ) and reset ( $\overline{nR}$ ) inputs; also complementary Q and  $\overline{Q}$  outputs.

The J and K inputs must be stable one set-up time prior to the HIGH-to-LOW clock transition for predictable operation.

The reset ( $\overline{nR}$ ) is an asynchronous active LOW input. When LOW, it overrides the clock and data inputs, forcing the Q output LOW and the  $\overline{Q}$  output HIGH.

Schmitt-trigger action in the clock input makes the circuit highly tolerant to slower clock rise and fall times.

## QUICK REFERENCE DATA

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay n $\overline{CP}$ to nQ n $\overline{CP}$ to n $\overline{Q}$ n $\overline{R}$ to nQ, n $\overline{Q}$	C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V	16	16	ns
			16	18	ns
			16	17	ns
f <sub>max</sub>	maximum clock frequency		78	73	MHz
C <sub>I</sub>	input capacitance		3.5	3.5	pF
C <sub>PD</sub>	power dissipation capacitance per flip-flop	notes 1 and 2	30	30	pF

## Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>  
For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> - 1.5 V.

## ORDERING INFORMATION

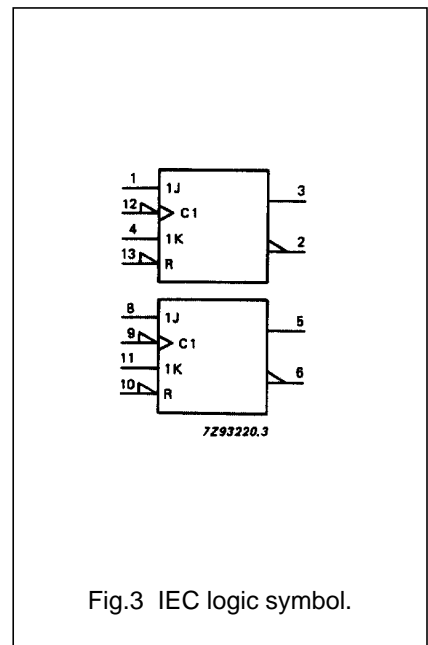
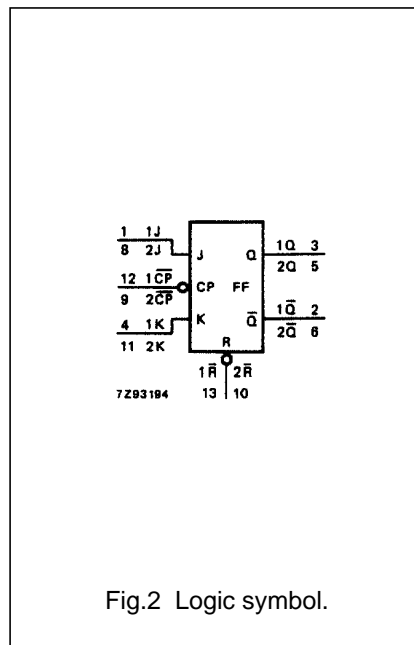
See "74HC/HCT/HCU/HCMOS Logic Package Information".

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PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 8, 4, 11	1J, 2J, 1K, 2K	synchronous inputs; flip-flops 1 and 2
2, 6	1 $\bar{Q}$ , 2 $\bar{Q}$	complement flip-flop outputs
3, 5	1Q, 2Q	true flip-flop outputs
7	GND	ground (0 V)
12, 9	1 $\bar{C}P$ , 2 $\bar{C}P$	clock input (HIGH-to-LOW, edge-triggered)
13, 10	1 $\bar{R}$ , 2 $\bar{R}$	asynchronous reset inputs (active LOW)
14	V <sub>CC</sub>	positive supply voltage



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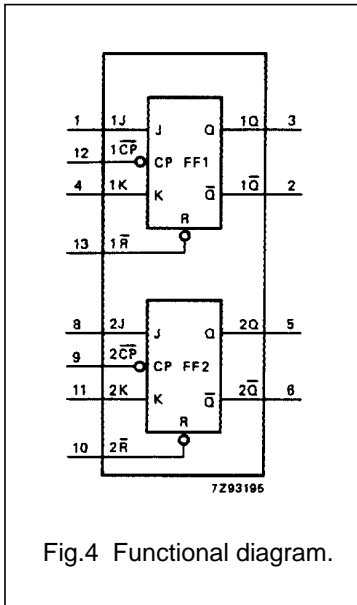


Fig.4 Functional diagram.

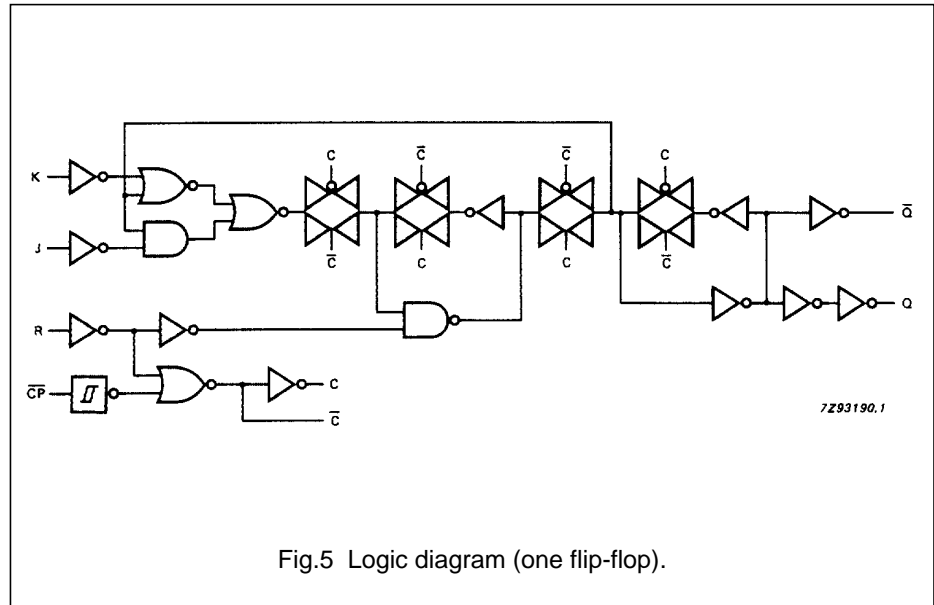


Fig.5 Logic diagram (one flip-flop).

FUNCTION TABLE

OPERATING MODE	INPUTS				OUTPUTS	
	nR-bar	nCP-bar	J	K	Q	Q-bar
asynchronous reset	L	X	X	X	L	H
toggle	H	↓	h	h	q-bar	q
load "0" (reset)	H	↓	l	h	L	H
load "1" (set)	H	↓	h	l	H	L
hold "no change"	H	↓	l	l	q	q-bar

Note

- H = HIGH voltage level  
 h = HIGH voltage level one set-up time prior to the HIGH-to-LOW CP transition  
 L = LOW voltage level  
 l = LOW voltage level one set-up time prior to the HIGH-to-LOW CP transition  
 q = lower case letters indicate the state of the referenced output one set-up time prior to the HIGH-to-LOW CP transition  
 X = don't care  
 ↓ = HIGH-to-LOW CP transition

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**DC CHARACTERISTICS FOR 74HC**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard

I<sub>CC</sub> category: flip-flops

**AC CHARACTERISTICS FOR 74HC**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)						UNIT	TEST CONDITIONS		
		74HC							V <sub>CC</sub> (V)	WAVEFORMS	
		+25			-40 to +85		-40 to +125				
		min.	typ.	max.	min.	max.	min.				max.
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP to nQ		52 19 15	160 32 27		200 40 34		240 48 41	ns	2.0 4.5 6.0	Fig.6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP to nQ̄		52 19 15	160 32 27		200 40 34		240 48 41	ns	2.0 4.5 6.0	Fig.6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nR̄ to nQ, nQ̄		52 19 15	155 31 26		195 39 33		235 47 40	ns	2.0 4.5 6.0	Fig.7
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		19 7 6	75 15 13		95 19 16		110 22 19	ns	2.0 4.5 6.0	Fig.6
t <sub>w</sub>	clock pulse width HIGH or LOW	80 16 14	22 8 6		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig.6
t <sub>w</sub>	reset pulse width LOW	80 16 14	22 8 6		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig.7
t <sub>rem</sub>	removal time nR̄ to nCP	60 12 10	19 7 6		75 15 13		90 18 15		ns	2.0 4.5 6.0	Fig.7
t <sub>su</sub>	set-up time nJ, nK to nCP	100 20 17	22 8 6		125 25 21		150 30 26		ns	2.0 4.5 6.0	Fig.6
t <sub>h</sub>	hold time nJ, nK to nCP	3 3 3	-6 -2 -2		3 3 3		3 3 3		ns	2.0 4.5 6.0	Fig.6
f <sub>max</sub>	maximum clock pulse frequency	6.0 30 35	23 70 85		4.8 24 28		4.0 20 24		MHz	2.0 4.5 6.0	Fig.6

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**DC CHARACTERISTICS FOR 74HCT**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard

I<sub>CC</sub> category: flip-flops

**Note to HCT types**

The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given in the family specifications. To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

INPUT	UNIT LOAD COEFFICIENT
nK	0.60
nR	0.65
nCP, nJ	1.00

**AC CHARACTERISTICS FOR 74HCT**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)								UNIT	TEST CONDITIONS	
		74HCT									V <sub>CC</sub> (V)	WAVEFORMS
		+25			-40 to +85		-40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP to nQ		19	36		45		54	ns	4.5	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP to nQ		21	36		45		54	ns	4.5	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nR to nQ, nQ		20	38		48		57	ns	4.5	Fig.7	
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		7	15		19		22	ns	4.5	Fig.6	
t <sub>w</sub>	clock pulse width HIGH or LOW	16	9		20		24		ns	4.5	Fig.6	
t <sub>w</sub>	reset pulse width LOW	20	11		25		30		ns	4.5	Fig.7	
t <sub>rem</sub>	removal time nR to nCP	14	8		18		21		ns	4.5	Fig.7	
t <sub>su</sub>	set-up time nJ, nK to nCP	20	7		25		30		ns	4.5	Fig.6	
t <sub>h</sub>	hold time nJ, nK to nCP	5	-2		5		5		ns	4.5	Fig.6	
f <sub>max</sub>	maximum clock pulse frequency	30	66		24		20		MHz	4.5	Fig.6	

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AC WAVEFORMS

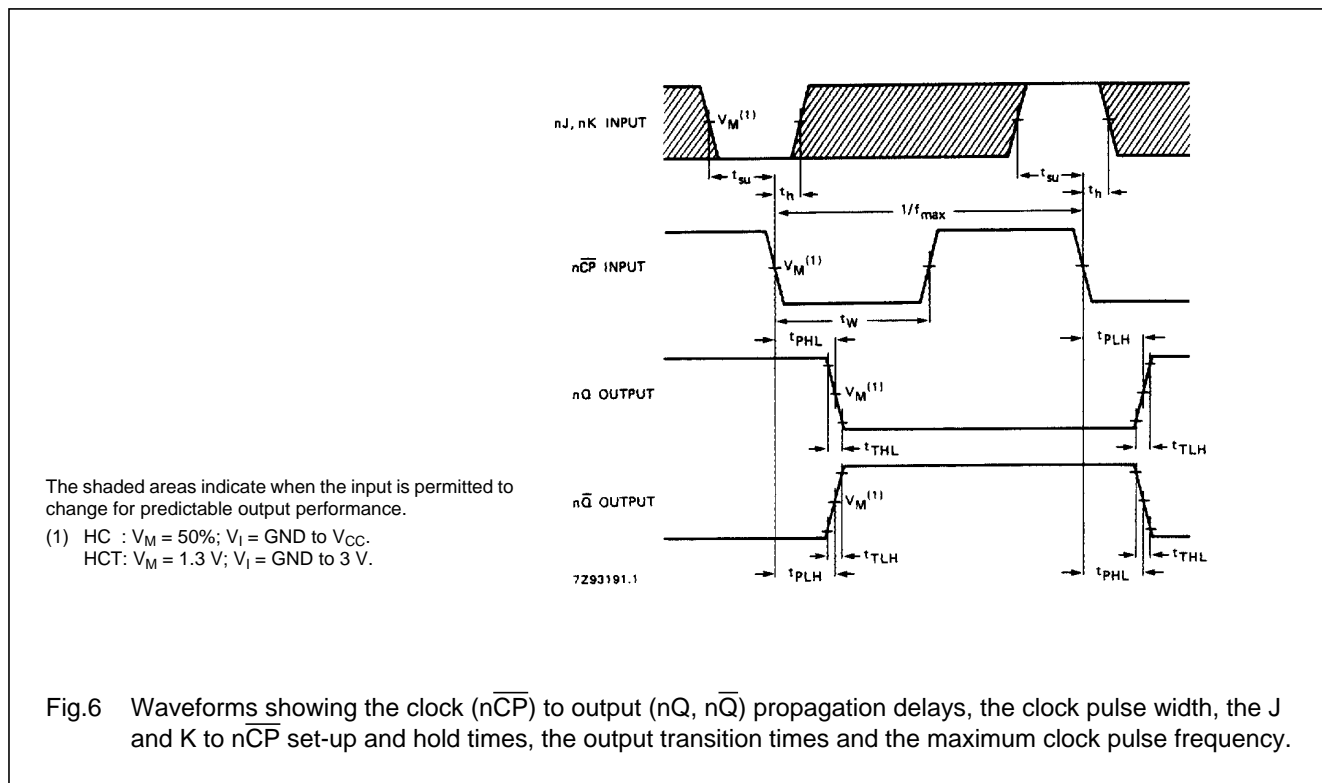


Fig.6 Waveforms showing the clock ( $\overline{nCP}$ ) to output ( $nQ$ ,  $\overline{nQ}$ ) propagation delays, the clock pulse width, the J and K to  $\overline{nCP}$  set-up and hold times, the output transition times and the maximum clock pulse frequency.

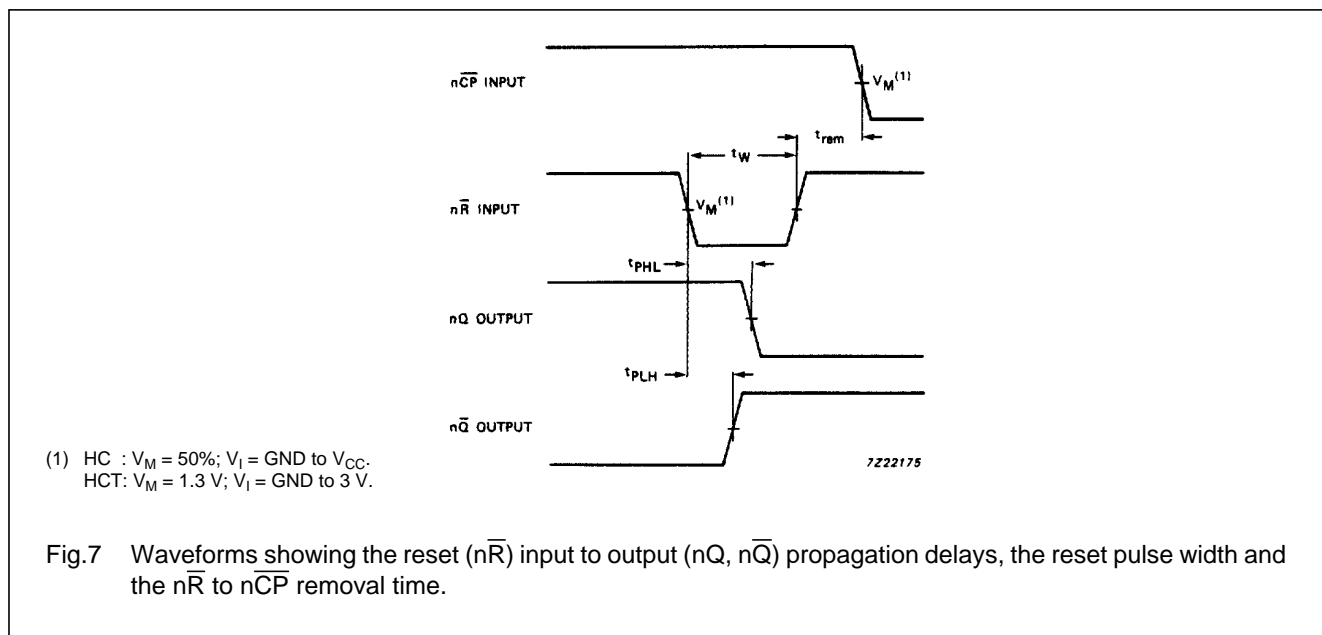


Fig.7 Waveforms showing the reset ( $\overline{nR}$ ) input to output ( $nQ$ ,  $\overline{nQ}$ ) propagation delays, the reset pulse width and the  $\overline{nR}$  to  $\overline{nCP}$  removal time.

PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".