

# 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/HCT73**

**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/HCT73

## FEATURES

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

## GENERAL DESCRIPTION

The 74HC/HCT73 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/HCT73 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	C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V			
	$\overline{nCP}$ to nQ		16	15	ns
	$\overline{nCP}$ to $\overline{nQ}$		16	18	ns
	$\overline{nR}$ to nQ, $\overline{nQ}$		15	15	ns
f <sub>max</sub>	maximum clock frequency		77	79	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 μW):

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

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

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

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = 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

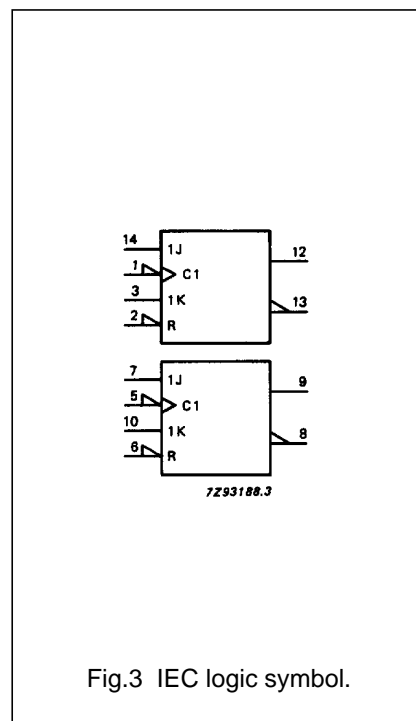
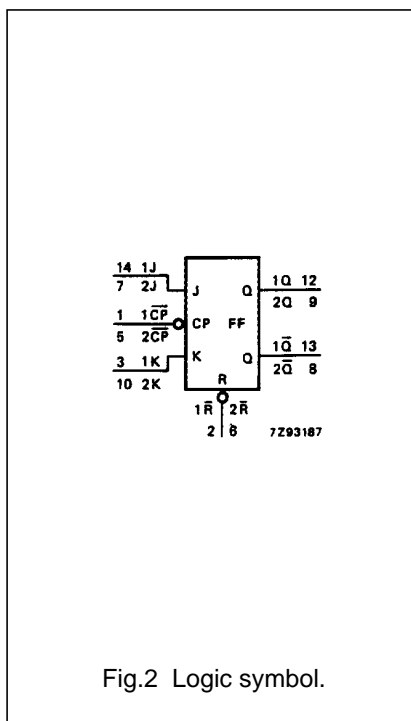
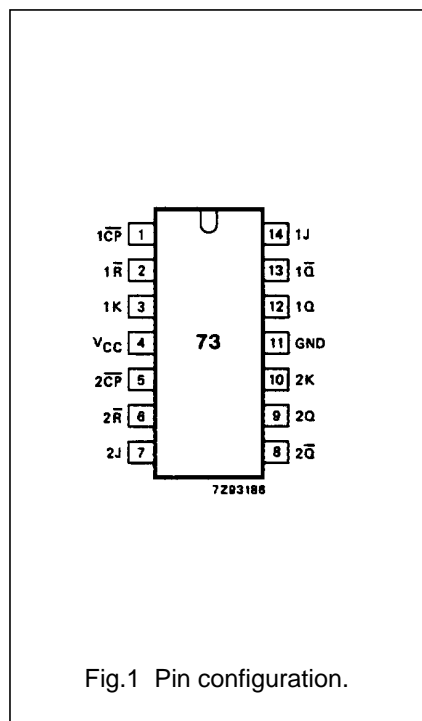
See "74HC/HCT/HCU/HCMOS Logic Package Information".

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PIN DESCRIPTION

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



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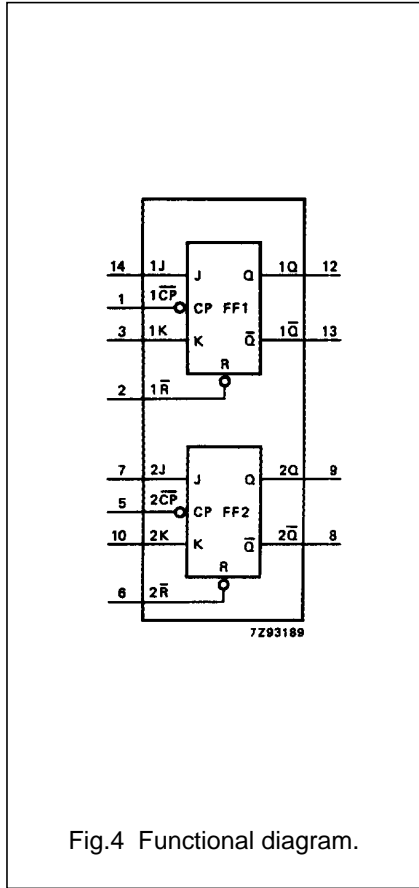


Fig.4 Functional diagram.

FUNCTION TABLE

OPERATING MODE	INPUTS				OUTPUTS	
	nR	nCP	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

Notes

- 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

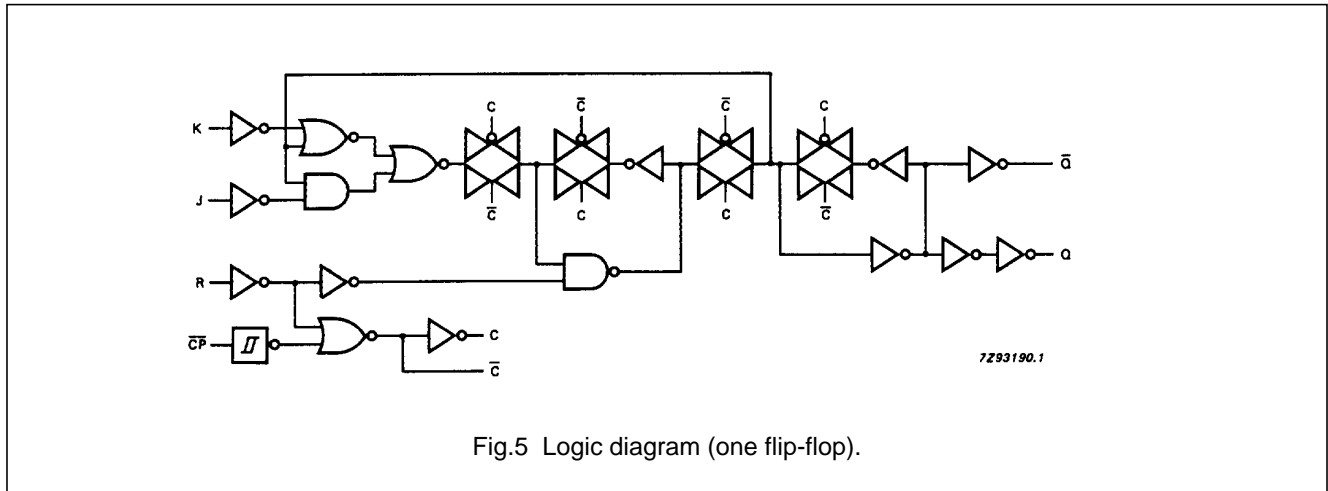


Fig.5 Logic diagram (one flip-flop).

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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		50 18 14	145 29 25		180 36 31		220 44 38	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 HIGH or 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 nR to nCP	80 16 14	22 8 6		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig.7
t <sub>su</sub>	set-up time nJ, nK to nCP̄	80 16 14	22 8 6		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig.6
t <sub>h</sub>	hold time nJ, nK to nCP̄	3 3 3	-8 -3 -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 83		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

$I_{CC}$  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
n $\bar{R}$	0.65
n $\overline{CP}$ , nJ	1.00

**AC CHARACTERISTICS FOR 74HCT**

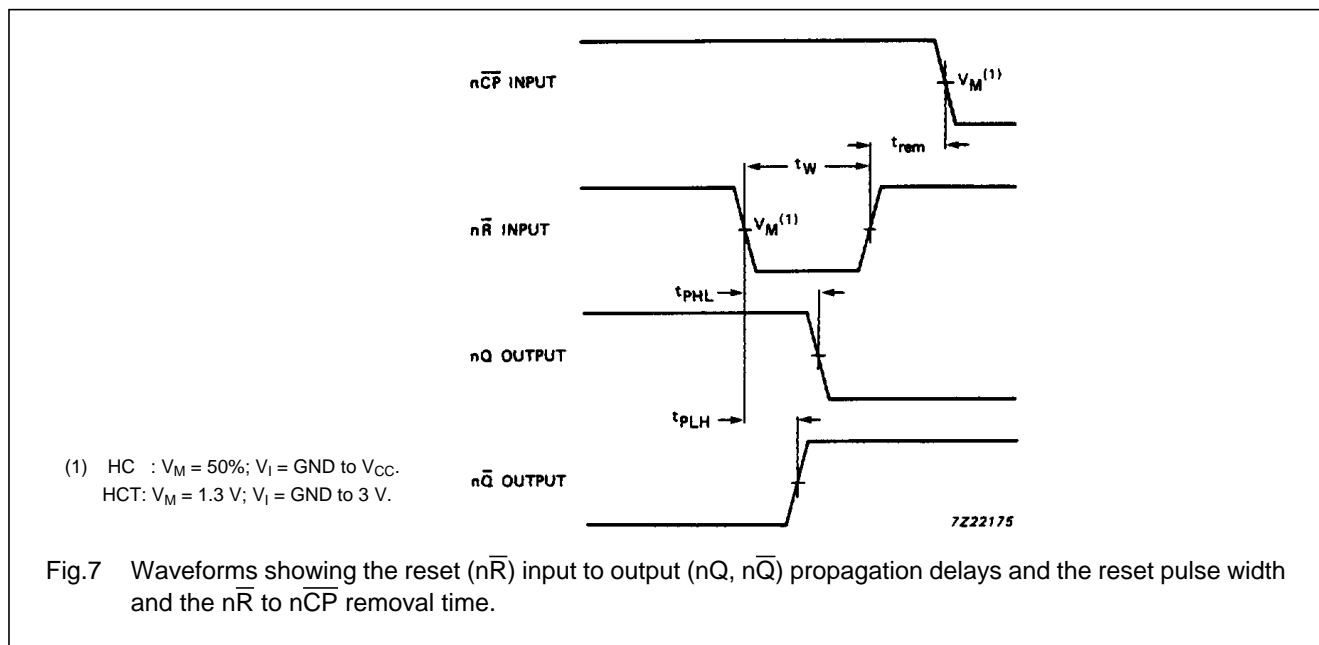
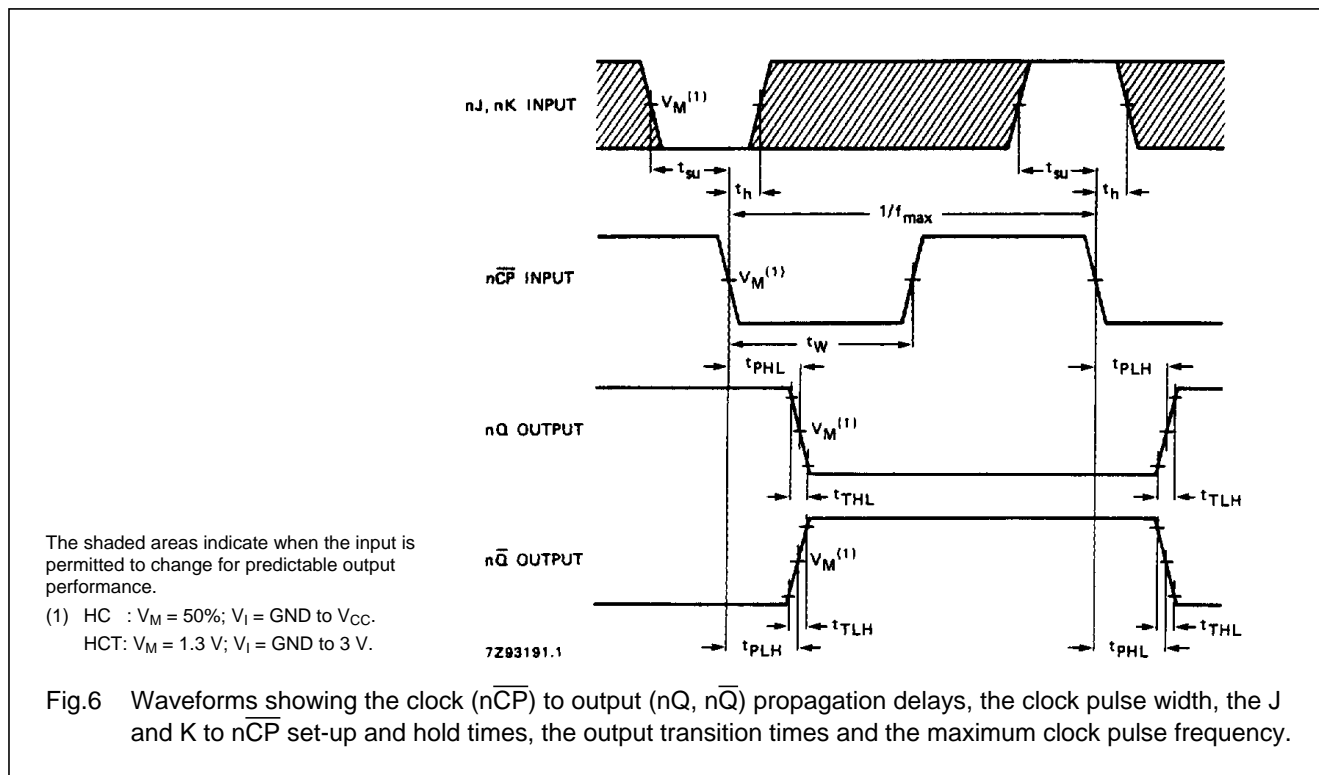
GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

SYMBOL	PARAMETER	$T_{amb}$ (°C)							UNIT	TEST CONDITIONS	
		74 HCT								$V_{CC}$ (V)	WAVEFORMS
		+25			-40 to +85		-40 to +125				
		min.	typ.	max.	min.	max.	min.	max.			
$t_{PHL} / t_{PLH}$	propagation delay n $\overline{CP}$ to nQ		18	38		48		57	ns	4.5	Fig.6
$t_{PHL} / t_{PLH}$	propagation delay n $\overline{CP}$ to n $\overline{Q}$		21	36		45		54	ns	4.5	Fig.6
$t_{PHL} / t_{PLH}$	propagation delay n $\bar{R}$ to nQ, n $\overline{Q}$		20	34		43		51	ns	4.5	Fig.7
$t_{THL} / t_{TLH}$	output transition time		7	15		19		22	ns	4.5	Fig.6
$t_W$	clock pulse width HIGH or LOW	16	8		20		24		ns	4.5	Fig.6
$t_W$	reset pulse width HIGH or LOW	18	9		23		27		ns	4.5	Fig.7
$t_{rem}$	removal time n $\bar{R}$ to n $\overline{CP}$	14	8		18		21		ns	4.5	Fig.7
$t_{su}$	set-up time nJ, nK to n $\overline{CP}$	12	6		15		18		ns	4.5	Fig.6
$t_h$	hold time nJ, nK to n $\overline{CP}$	3	-2		3		3		ns	4.5	Fig.6
$f_{max}$	maximum clock pulse frequency	30	72		24		20		MHz	4.5	Fig.6

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AC WAVEFORMS



PACKAGE OUTLINES

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