

HD74AC112/HD74ACT112

Dual JK Negative Edge-Triggered Flip-Flop

REJ03D0244-0200Z
 (Previous ADE-205-364 (Z))
 Rev.2.00
 Jul.16.2004

Description

The HD74AC112/HD74ACT112 features individual J, K, Clock and asynchronous Set and Clear inputs to each flip-flop. When the clock goes High, the inputs are enabled and data will be accepted. The logic level of the J and K inputs may change when the clock is High and the bistable will perform according to the Truth Table as long as minimum setup and hold times are observed. Input data is transferred to the outputs on the falling edge of the clock pulse.

Features

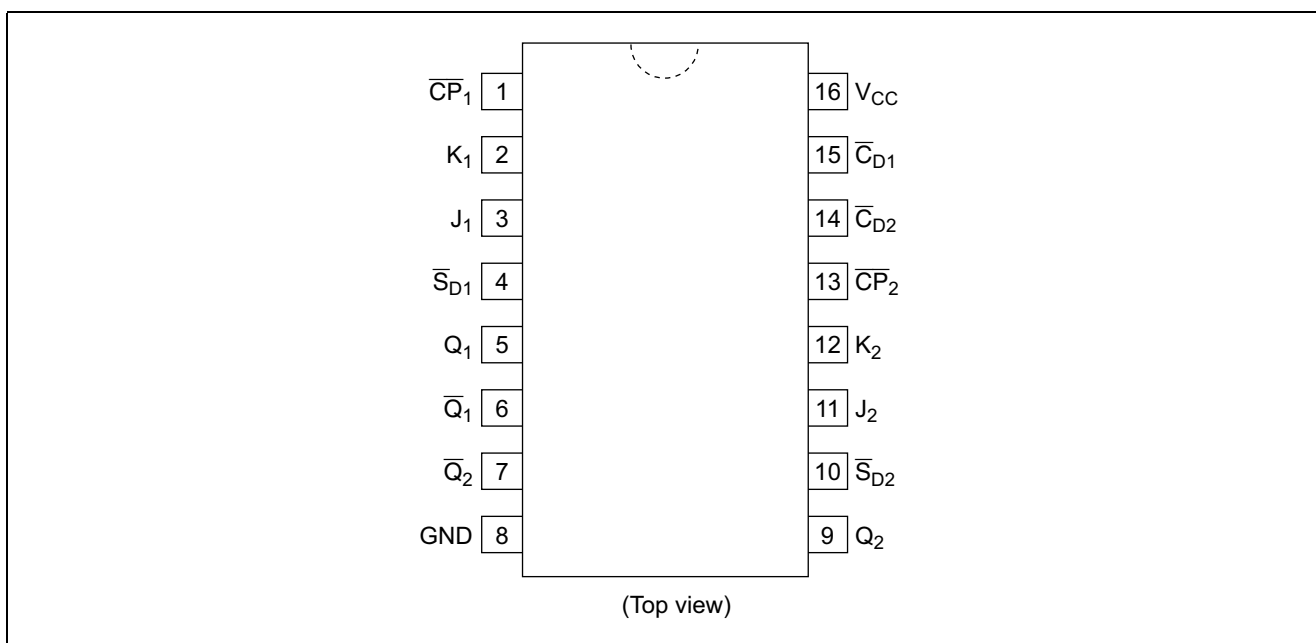
- Outputs Source/Sink 24 mA
- HD74ACT112 has TTL-Compatible Inputs
- Ordering Information: Ex. HD74AC112

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC112FPEL	SOP-16 pin (JEITA)	FP-16DAV	FP	EL (2,000 pcs/reel)
HD74AC112RPEL	SOP-16 pin (JEDEC)	FP-16DNV	RP	EL (2,500 pcs/reel)

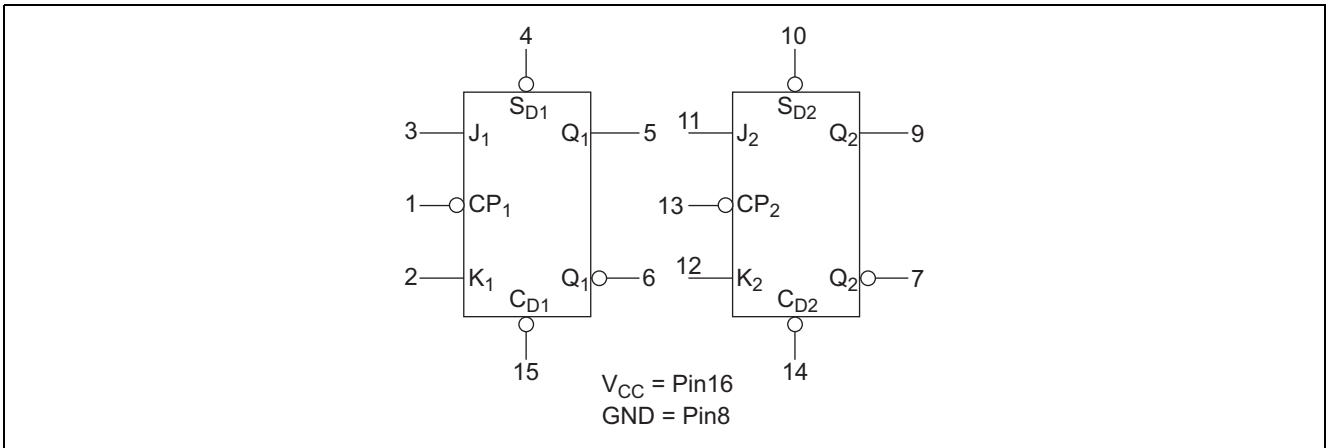
Notes: 1. Please consult the sales office for the above package availability.

2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

Pin Arrangement



Logic Symbol



Pin Names

- J_1, J_2, K_1, K_2 Data Inputs
- $\overline{CP}_1, \overline{CP}_2$ Clock Pulse Inputs (Active Falling Edge)
- $\overline{C}_{D1}, \overline{C}_{D2}$ Direct Clear Inputs (Active Low)
- $\overline{S}_{D1}, \overline{S}_{D2}$ Direct Set Inputs (Active Low)
- $Q_1, Q_2, \overline{Q}_1, \overline{Q}_2$ Outputs

Asynchronous Inputs:

- Low input to \overline{S}_D sets Q to High level
- Low input to \overline{C}_D sets Q to Low level
- Clear and Set are independent of clock
- Simultaneous Low on \overline{C}_D and \overline{S}_D makes both Q and \overline{Q} High

Truth Table

Inputs		Outputs
@ t_n		@ t_{n+1}
J	K	Q
L	L	Qn
L	H	L
H	L	H
H	H	\overline{Q}_n

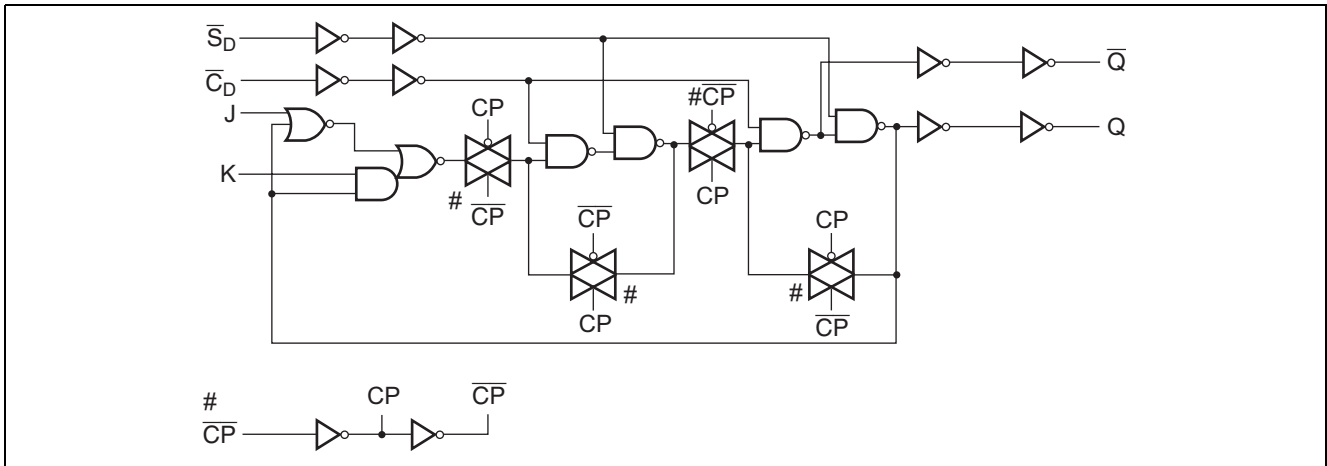
t_n : Bit time before clock pulse.

t_{n+1} : Bit time after clock pulse.

H : High Voltage Level

L : Low Voltage Level

Logic Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	-0.5 to 7	V	
DC input diode current	I_{IK}	-20	mA	$V_I = -0.5V$
		20	mA	$V_I = V_{CC}+0.5V$
DC input voltage	V_I	-0.5 to $V_{CC}+0.5$	V	
DC output diode current	I_{OK}	-50	mA	$V_O = -0.5V$
		50	mA	$V_O = V_{CC}+0.5V$
DC output voltage	V_O	-0.5 to $V_{CC}+0.5$	V	
DC output source or sink current	I_O	± 50	mA	
DC V_{CC} or ground current per output pin	I_{CC}, I_{GND}	± 50	mA	
Storage temperature	Tstg	-65 to +150	°C	

Recommended Operating Conditions: HD74AC112

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	2 to 6	V	
Input and output voltage	V_I, V_O	0 to V_{CC}	V	
Operating temperature	Ta	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V_{IN} 30% to 70% V_{CC}	tr, tf	8	ns/V	$V_{CC} = 3.0V$
				$V_{CC} = 4.5 V$
				$V_{CC} = 5.5 V$

DC Characteristics: HD74AC112

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Condition		
			min.	typ.	max.	min.	max.				
Input Voltage	V _{IH}	3.0	2.1	1.5	—	2.1	—	V	V _{OUT} = 0.1 V or V _{CC} -0.1 V		
		4.5	3.15	2.25	—	3.15	—				
		5.5	3.85	2.75	—	3.85	—				
	V _{IL}	3.0	—	1.50	0.9	—	0.9		V _{OUT} = 0.1 V or V _{CC} -0.1 V		
		4.5	—	2.25	1.35	—	1.35				
		5.5	—	2.75	1.65	—	1.65				
Output voltage	V _{OH}	3.0	2.9	2.99	—	2.9	—	V	V _{IN} = V _{IL} or V _{IH} I _{OUT} = -50 μA		
		4.5	4.4	4.49	—	4.4	—				
		5.5	5.4	5.49	—	5.4	—				
		3.0	2.58	—	—	2.48	—			V _{IN} = V _{IL} or V _{IH}	I _{OH} = -12 mA
		4.5	3.94	—	—	3.80	—				I _{OH} = -24 mA
		5.5	4.94	—	—	4.80	—				I _{OH} = -24 mA
	V _{OL}	3.0	—	0.002	0.1	—	0.1	V	V _{IN} = V _{IL} or V _{IH} I _{OUT} = 50 μA		
		4.5	—	0.001	0.1	—	0.1				
		5.5	—	0.001	0.1	—	0.1				
		3.0	—	—	0.32	—	0.37			V _{IN} = V _{IL} or V _{IH}	I _{OL} = 12 mA
		4.5	—	—	0.32	—	0.37				I _{OL} = 24 mA
		5.5	—	—	0.32	—	0.37				I _{OL} = 24 mA
	Input leakage current	I _{IN}	5.5	—	—	±0.1	—	±1.0	μA	V _{IN} = V _{CC} or GND	
	Dynamic output current*	I _{OLD}	5.5	—	—	—	86	—	mA	V _{OLD} = 1.1 V	
		I _{OHD}	5.5	—	—	—	-75	—	mA	V _{OHD} = 3.85 V	
Quiescent supply current	I _{CC}	5.5	—	—	4.0	—	40	μA	V _{IN} = V _{CC} or ground		

*Maximum test duration 2.0 ms, one output loaded at a time.

Recommended Operating Conditions: HD74ACT112

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V _{CC}	2 to 6	V	
Input and output voltage	V _I , V _O	0 to V _{CC}	V	
Operating temperature	Ta	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V _{IN} 0.8 to 2.0 V	tr, tf	8	ns/V	V _{CC} = 4.5V V _{CC} = 5.5V

DC Characteristics: HD74ACT112

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Condition				
			min.	typ.	max.	min.	max.						
Input voltage	V _{IH}	4.5	2.0	1.5	—	2.0	—	V	V _{OUT} = 0.1 V or V _{CC} -0.1 V				
		5.5	2.0	1.5	—	2.0	—						
	V _{IL}	4.5	—	1.5	0.8	—	0.8		V _{OUT} = 0.1 V or V _{CC} -0.1 V				
		5.5	—	1.5	0.8	—	0.8						
Output voltage	V _{OH}	4.5	4.4	4.49	—	4.4	—	V	V _{IN} = V _{IL} or V _{IH} I _{OUT} = -50 μA				
		5.5	5.4	5.49	—	5.4	—						
		4.5	3.94	—	—	3.80	—			V _{IN} = V _{IL}	I _{OH} = -24 mA		
		5.5	4.94	—	—	4.80	—				I _{OH} = -24 mA		
	V _{OL}	4.5	—	0.001	0.1	—	0.1		V _{IN} = V _{IL} or V _{IH} I _{OUT} = 50 μA				
		5.5	—	0.001	0.1	—	0.1						
		4.5	—	—	0.32	—	0.37			V _{IN} = V _{IL}	I _{OL} = 24 mA		
		5.5	—	—	0.32	—	0.37				I _{OL} = 24 mA		
		Input current	I _{IN}	5.5	—	—	±0.1			—	±1.0	μA	V _{IN} = V _{CC} or GND
		I _{CC} /input current	I _{CCT}	5.5	—	0.6	—			—	1.5	mA	V _{IN} = V _{CC} -2.1 V
Dynamic output current*	I _{OLD}	5.5	—	—	—	86	—	mA	V _{OLD} = 1.1 V				
	I _{OHD}	5.5	—	—	—	-75	—	mA	V _{OHD} = 3.85 V				
Quiescent supply current	I _{CC}	5.5	—	—	4.0	—	40	μA	V _{IN} = V _{CC} or ground				

*Maximum test duration 2.0 ms, one output loaded at a time.

AC Characteristics: HD74AC112

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF			Ta = -40°C to +85°C C _L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f _{max}	3.3	125	—	—	100	—	MHz
		5.0	150	—	—	125	—	
Propagation delay C _P to Q or Q̄	t _{PLH}	3.3	1.0	11.0	14.0	1.0	15.0	ns
		5.0	1.0	8.5	11.0	1.0	12.0	
Propagation delay C _P to Q or Q̄	t _{PHL}	3.3	1.0	11.0	14.0	1.0	15.0	
		5.0	1.0	8.5	11.0	1.0	12.0	
Propagation delay C _D , S _D to Q or Q̄	t _{PLH}	3.3	1.0	9.5	12.5	1.0	13.5	
		5.0	1.0	7.0	9.5	1.0	10.5	
Propagation delay C _D , S _D to Q or Q̄	t _{PHL}	3.3	1.0	11.5	14.5	1.0	15.5	
		5.0	1.0	9.0	11.0	1.0	12.5	

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

AC Operating Requirements: HD74AC112

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF		Ta = -40°C to +85°C C _L = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time J or K to \overline{C}_P	t _{su}	3.3	3.0	5.5	6.0	ns
			5.0	2.0	4.5	
Hold time \overline{C}_P to J or K	t _h	3.3	-1.5	0.0	0.0	
			5.0	-0.5	0.0	
Pulse width \overline{C}_P or \overline{C}_D or \overline{S}_D	t _w	3.3	2.0	5.5	7.0	
			5.0	2.0	4.5	
Recovery time \overline{C}_D or \overline{S}_D to \overline{C}_P	t _{rec}	3.3	1.5	3.5	3.5	
			5.0	1.0	3.0	3.0

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

AC Characteristics: HD74ACT112

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF			Ta = -40°C to +85°C C _L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f _{max}	5.0	100	—	—	80	—	MHz
Propagation delay \overline{C}_P to Q or \overline{Q}	t _{PLH}	5.0	1.0	10.5	13.0	1.0	14.0	ns
Propagation delay \overline{C}_P to Q or \overline{Q}	t _{PHL}	5.0	1.0	10.5	13.0	1.0	14.0	
Propagation delay \overline{C}_D , \overline{S}_D to Q or \overline{Q}	t _{PLH}	5.0	1.0	8.0	10.0	1.0	11.0	
Propagation delay \overline{C}_D , \overline{S}_D to Q or \overline{Q}	t _{PHL}	5.0	1.0	10.5	12.5	1.0	13.5	

Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

AC Operating Requirements: HD74ACT112

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF		Ta = -40°C to +85°C C _L = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time J or K to \overline{C}_P	t _{su}	5.0	2.5	7.0	8.0	ns
			5.0	0.0	1.5	
Hold time \overline{C}_P to J or K	t _h	5.0	0.0	1.5	1.5	
			5.0	4.5	7.0	
Recovery time \overline{C}_D , \overline{S}_D to \overline{C}_P	t _{rec}	5.0	-2.5	3.0	3.0	

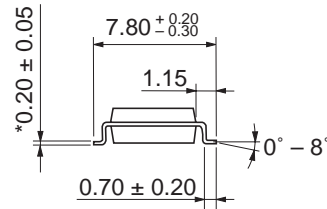
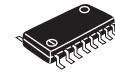
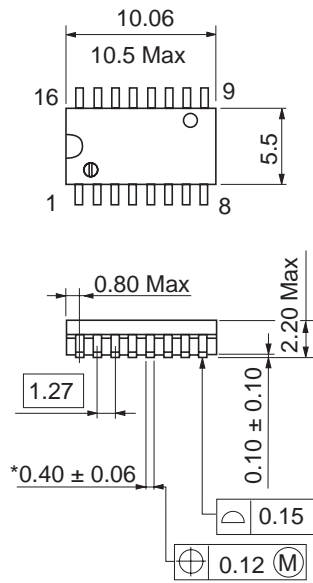
Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

Capacitance

Item	Symbol	Typ	Unit	Condition
Input capacitance	C _{IN}	4.5	pF	V _{CC} = 5.5 V
Power dissipation capacitance	C _{PD}	35.0	pF	V _{CC} = 5.0 V

Package Dimensions

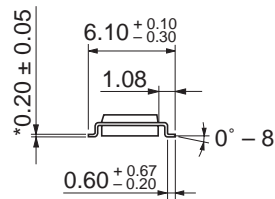
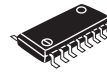
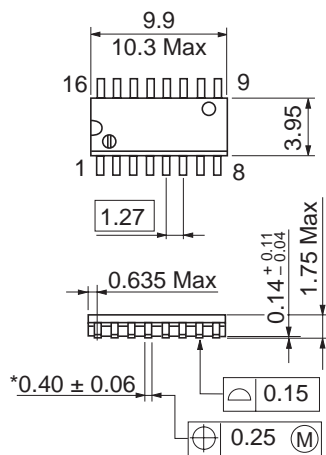
As of January, 2003
Unit: mm



*Ni/Pd/Au plating

Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

As of January, 2003
Unit: mm



*Ni/Pd/Au plating

Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

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