

# HD74AC107/HD74ACT107

## Dual JK Flip-Flop (with Separate Clear and Clock)

REJ03D0243-0200Z  
 (Previous ADE-205-363 (Z))  
 Rev.2.00  
 Jul.16.2004

### Description

The HD74AC107/HD74ACT107 dual JK master/slave flip-flops have a separate clock for each flip-flop. Inputs to the master section are controlled by the clock pulse. The clock pulse also regulates the state of the coupling transistors which connect the master and slave sections. The sequence of operation is as follows: 1) isolate slave from master; 2) enter information from J and K inputs to master; 3) disable J and K inputs; 4) transfer information from master to slave.

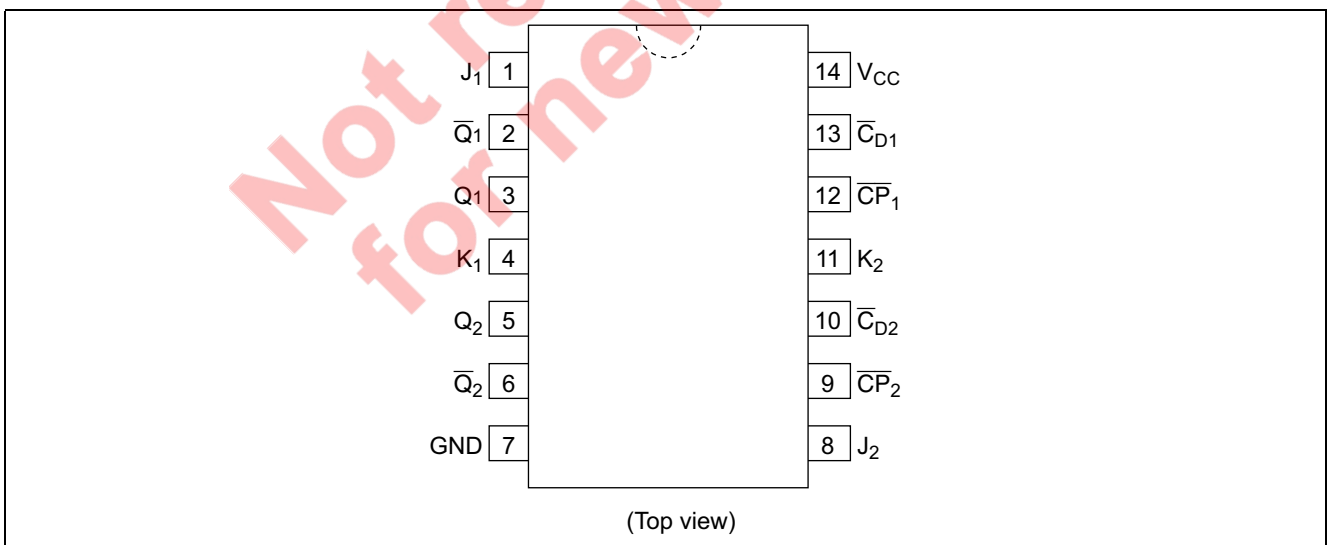
### Features

- Outputs Source/Sink 24 mA
- HD74ACT107 has TTL-Compatible Inputs
- Ordering Information: Ex. HD74AC107

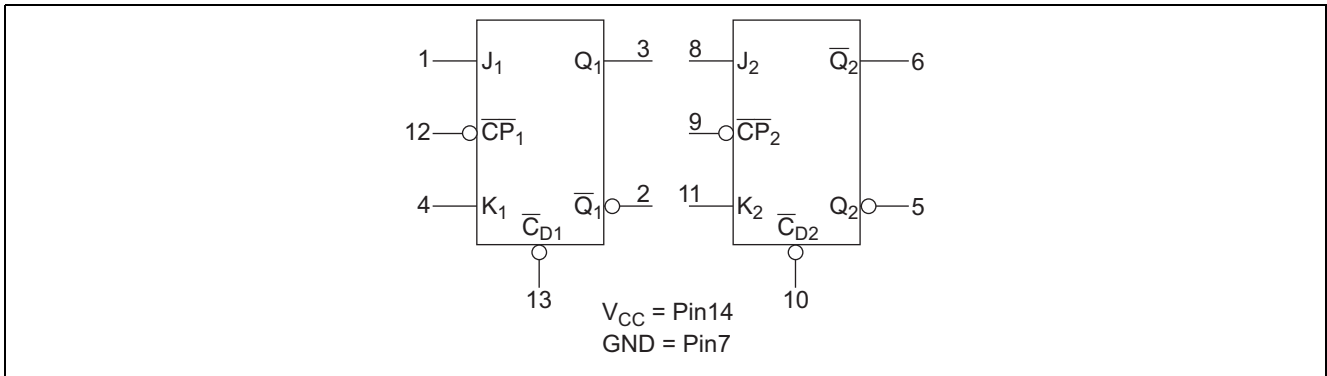
Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC107FPEL	SOP-14 pin (JEITA)	FP-14DAV	FP	EL (2,000 pcs/reel)
HD74AC107RPEL	SOP-14 pin (JEDEC)	FP-14DNV	RP	EL (2,500 pcs/reel)

- 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**

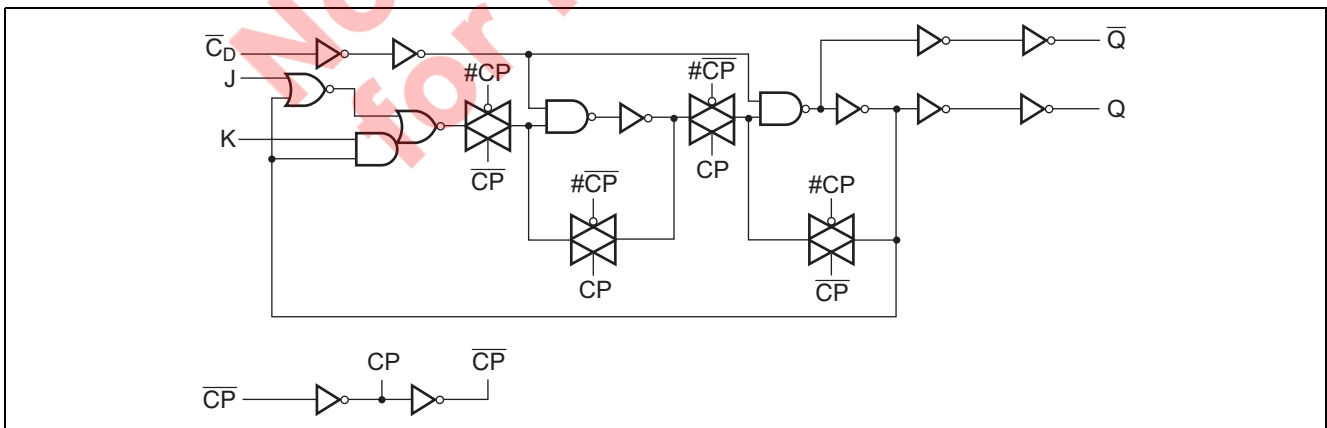
- $J_1, J_2, K_1, K_2$  Data Inputs
- $\overline{CP}_1, \overline{CP}_2$  Clock Pulse Inputs (Active Falling Edge)
- $\overline{C}_{D1}, \overline{C}_{D2}$  Direct Clear Inputs (Active Low)
- $Q_1, Q_2, \overline{Q}_1, \overline{Q}_2$  Outputs

**Truth Table**

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

- H : High Voltage Level
- L : Low Voltage Level
- $t_n$  : Bit time before clock pulse.
- $t_{n+1}$  : Bit time after clock pulse.

**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	$I_O$	$\pm 50$	mA	
DC $V_{CC}$ or ground current per output pin	$I_{CC}, I_{GND}$	$\pm 50$	mA	
Storage temperature	$T_{stg}$	-65 to +150	°C	

**Recommended Operating Conditions: HD74AC107**

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	$T_a$	-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: HD74AC107**

Item	Sym- bol	Vcc (V)	$T_a = 25^\circ C$			$T_a = -40 \text{ to } +85^\circ C$		Unit	Condition			
			min.	typ.	max.	min.	max.					
Input Voltage	$V_{IH}$	3.0	2.1	1.5	—	2.1	—	V	$V_{OUT} = 0.1 V \text{ or } V_{CC} - 0.1 V$			
		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	$V_{OUT} = 0.1 V \text{ or } V_{CC} - 0.1 V$	
		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	$V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OUT} = -50 \mu A$			
		4.5	4.4	4.49	—	4.4	—					
		5.5	5.4	5.49	—	5.4	—					
		3.0	2.58	—	—	2.48	—			$V_{IN} = V_{IL} \text{ or } V_{IH}$	$I_{OH} = -12 \text{ mA}$	
		4.5	3.94	—	—	3.80	—				$I_{OH} = -24 \text{ mA}$	
		5.5	4.94	—	—	4.80	—				$I_{OH} = -24 \text{ mA}$	
	$V_{OL}$	3.0	—	0.002	0.1	—	0.1		V	$V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OUT} = 50 \mu A$		
		4.5	—	0.001	0.1	—	0.1					
		5.5	—	0.001	0.1	—	0.1					
		3.0	—	—	0.32	—	0.37				$V_{IN} = V_{IL} \text{ or } V_{IH}$	$I_{OL} = 12 \text{ mA}$
		4.5	—	—	0.32	—	0.37					$I_{OL} = 24 \text{ mA}$
		5.5	—	—	0.32	—	0.37					$I_{OL} = 24 \text{ mA}$
Input leakage current	$I_{IN}$	5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu A$	$V_{IN} = V_{CC} \text{ or } GND$			
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	$\mu A$	$V_{IN} = V_{CC} \text{ or } \text{ground}$			

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

**Recommended Operating Conditions: HD74ACT107**

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	$T_a$	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) $V_{IN}$ 0.8 to 2.0 V	$t_r, t_f$	8	ns/V	$V_{CC} = 4.5V$ $V_{CC} = 5.5V$

**DC Characteristics: HD74ACT107**

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ C$			$T_a = -40$ to $+85^\circ C$		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	$V_{OUT} = 0.1 V$ 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 $V_{IH}$ $I_{OUT} = -50 \mu A$				
		5.5	5.4	5.49	—	5.4	—						
		4.5	3.94	—	—	3.80	—			$I_{OH} = -24 mA$			
		5.5	4.94	—	—	4.80	—						
	$V_{OL}$	4.5	—	0.001	0.1	—	0.1	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OUT} = 50 \mu A$				
		5.5	—	0.001	0.1	—	0.1						
		4.5	—	—	0.32	—	0.37			$I_{OL} = 24 mA$			
		5.5	—	—	0.32	—	0.37						
		Input current	$I_{IN}$	5.5	—	—	$\pm 0.1$			—	$\pm 1.0$	$\mu A$	$V_{IN} = V_{CC}$ 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	$\mu A$	$V_{IN} = V_{CC}$ or ground				

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

**AC Characteristics: HD74AC107**

Item	Symbol	$V_{CC}$ (V)* <sup>1</sup>	$T_a = +25^\circ C$ $C_L = 50 pF$			$T_a = -40^\circ C$ to $+85^\circ C$ $C_L = 50 pF$		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	$f_{max}$	3.3	125	—	—	100	—	MHz
		5.0	150	—	—	125	—	
Propagation delay $\bar{C}_P$ to Q or $\bar{Q}$	$t_{PLH}$	3.3	1.0	9.5	13.0	1.0	14.0	ns
		5.0	1.0	7.5	10.0	1.0	11.0	
Propagation delay $\bar{C}_P$ to Q or $\bar{Q}$	$t_{PHL}$	3.3	1.0	10.0	13.5	1.0	14.5	ns
		5.0	1.0	8.0	10.5	1.0	11.5	
Propagation delay $\bar{C}_D$ to $\bar{Q}$	$t_{PLH}$	3.3	1.0	9.5	13.0	1.0	14.0	ns
		5.0	1.0	7.5	10.0	1.0	11.0	
Propagation delay $\bar{C}_D$ to $\bar{Q}$	$t_{PHL}$	3.3	1.0	9.5	13.0	1.0	14.0	ns
		5.0	1.0	7.5	10.0	1.0	11.0	

Note: 1. Voltage Range 3.3 is 3.3 V  $\pm$  0.3 V

Voltage Range 5.0 is 5.0 V  $\pm$  0.5 V

**Operating Requirements: HD74AC107**

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF		Ta = -40°C to +85°C C <sub>L</sub> = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time J or k to $\overline{C}_P$	t <sub>su</sub>	3.3	3.0	5.5	6.0	ns
		5.0	2.0	4.0	4.5	
Hold time $\overline{C}_P$ to J or k	t <sub>h</sub>	3.3	-1.5	0.0	0.0	
		5.0	-0.5	0.0	0.0	
Pulse width $\overline{C}_P$ or $\overline{C}_D$	t <sub>w</sub>	3.3	2.0	5.5	7.0	
		5.0	2.0	4.5	5.0	
Recovery time $\overline{C}_D$ to $\overline{C}_P$	t <sub>rec</sub>	3.3	1.5	3.0	3.0	
		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: HD74ACT107**

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF			Ta = -40°C to +85°C C <sub>L</sub> = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f <sub>max</sub>	5.0	100	—	—	80	—	MHz
Propagation delay $\overline{C}_P$ to Q or $\overline{Q}$	t <sub>PLH</sub>	5.0	1.0	9.5	12.5	1.0	13.5	ns
Propagation delay $\overline{C}_P$ to Q or $\overline{Q}$	t <sub>PHL</sub>	5.0	1.0	10.5	13.0	1.0	14.0	
Propagation delay $\overline{C}_D$ to Q	t <sub>PLH</sub>	5.0	1.0	8.5	11.0	1.0	12.0	
Propagation delay $\overline{C}_D$ to Q	t <sub>PHL</sub>	5.0	1.0	8.5	11.0	1.0	12.0	

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

**Operating Requirements: HD74ACT107**

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF		Ta = -40°C to +85°C C <sub>L</sub> = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time J or k to $\overline{C}_P$	t <sub>su</sub>	5.0	2.5	7.0	8.0	ns
Hold time $\overline{C}_P$ to J or k	t <sub>h</sub>	5.0	0.0	1.5	1.5	
Pulse width $\overline{C}_P$ or $\overline{C}_D$	t <sub>w</sub>	5.0	4.5	7.0	8.0	
Recovery time $\overline{C}_D$ to $\overline{C}_P$	t <sub>rec</sub>	5.0	—	3.0	3.0	

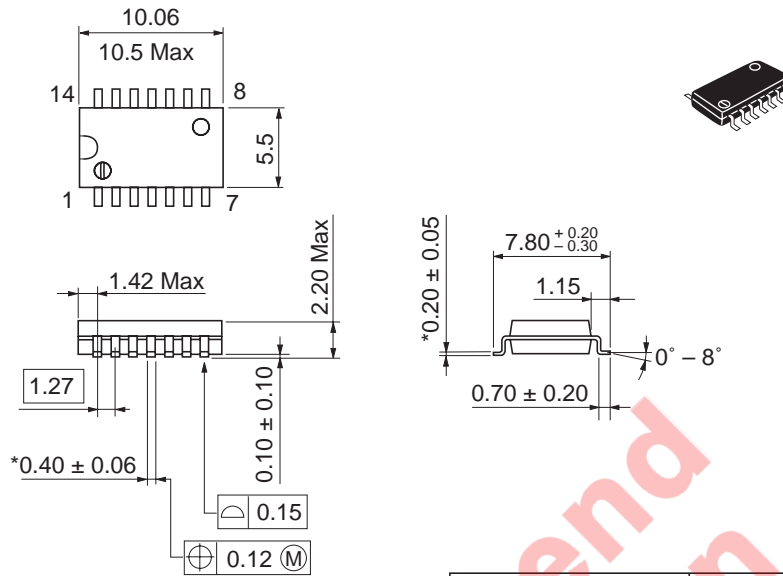
Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

**Capacitance**

Item	Symbol	Typ	Unit	Condition
Input capacitance	C <sub>IN</sub>	4.5	pF	V <sub>CC</sub> = 5.5 V
Power dissipation capacitance	C <sub>PD</sub>	35.0	pF	V <sub>CC</sub> = 5.0 V

Package Dimensions

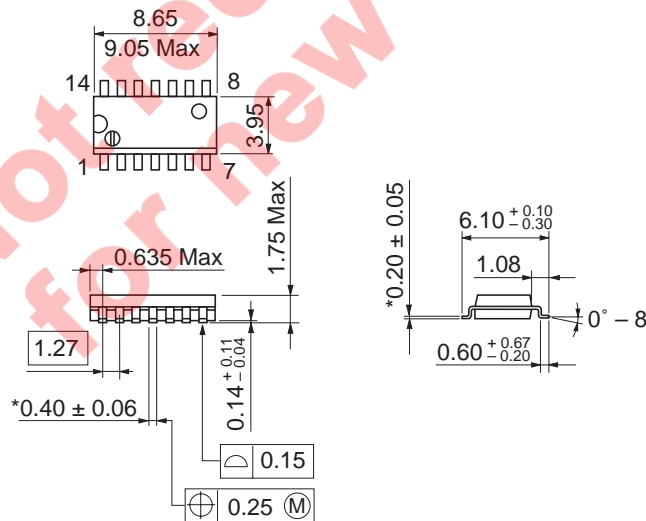
As of January, 2003  
Unit: mm



\*Ni/Pd/Au plating

Package Code	FP-14DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.23 g

As of January, 2003  
Unit: mm



\*Ni/Pd/Au plating

Package Code	FP-14DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.13 g

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