



MC74AC113 MC74ACT113

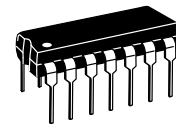
Dual JK Negative Edge-Triggered Flip-Flop

The MC74AC113/74ACT113 consists of two high-speed completely independent transition clocked JK flip-flops. The clocking operation is independent of rise and fall times of the clock waveform. The JK design allows operation as a D flip-flop (refer to MC74AC74/74ACT74 data sheet) by connecting the J and K inputs together.

Asynchronous Inputs:

- LOW input to $\overline{S_D}$ (Set) sets Q to HIGH level
Set is independent of clock
- Outputs Source/Sink 24 mA
- 'ACT113 Has TTL Compatible Inputs

DUAL JK NEGATIVE
EDGE-TRIGGERED
FLIP-FLOP

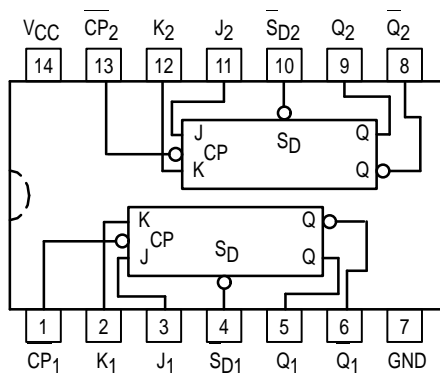


N SUFFIX
CASE 646-06
PLASTIC

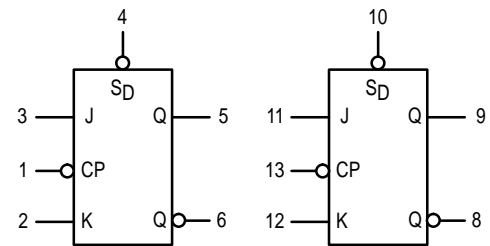


D SUFFIX
CASE 751A-03
PLASTIC

CONNECTION DIAGRAM



LOGIC SYMBOL



V_{CC} = PIN 14
GND = PIN 7

MODE SELECT — TRUTH TABLE

Operating Mode	Inputs			Outputs	
	$\overline{S_D}$	J	K	Q	\overline{Q}
Set	L	X	X	H	L
Toggle	H	h	h	q	q
Load "0" (Reset)	H	l	h	L	H
Load "1" (Set)	H	h	l	H	L
Hold	H	l	l	q	q

H, h = HIGH Voltage Level

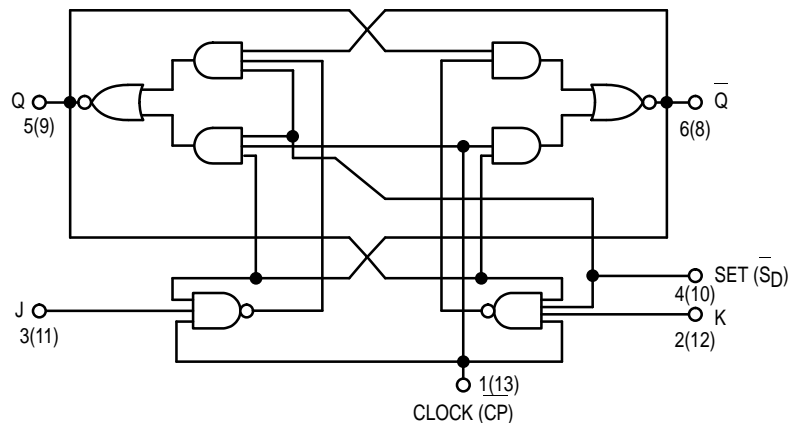
L, l = LOW Voltage Level

X = Don't Care

l, h (q) = Lower case letters indicate the state of the referenced input (or output) one set-up time prior to the HIGH to LOW clock transition.

MC74AC113 MC74ACT113

LOGIC DIAGRAM (Each Flip-Flop)



MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V_{in}	DC Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
V_{out}	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
I_{in}	DC Input Current, per Pin	± 20	mA
I_{out}	DC Output Sink/Source Current, per Pin	± 50	mA
I_{CC}	DC V_{CC} or GND Current per Output Pin	± 50	mA
T_{stg}	Storage Temperature	-65 to +150	$^{\circ}\text{C}$

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
V_{CC}	Supply Voltage	'AC	2.0	5.0	6.0	V
		'ACT	4.5	5.0	5.5	
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Ref. to GND)	0		V_{CC}	V	
t_r, t_f	Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs	$V_{CC} @ 3.0\text{ V}$		150		ns/V
		$V_{CC} @ 4.5\text{ V}$		40		
		$V_{CC} @ 5.5\text{ V}$		25		
t_r, t_f	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	$V_{CC} @ 4.5\text{ V}$		10		ns/V
		$V_{CC} @ 5.5\text{ V}$		8.0		
T_J	Junction Temperature (PDIP)			140	$^{\circ}\text{C}$	
T_A	Operating Ambient Temperature Range	-40	25	85	$^{\circ}\text{C}$	
I_{OH}	Output Current — High			-24	mA	
I_{OL}	Output Current — Low			24	mA	

- V_{in} from 30% to 70% V_{CC} ; see individual Data Sheets for devices that differ from the typical input rise and fall times.
- V_{in} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

MC74AC113 MC74ACT113

DC CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	74AC		74AC		Unit	Conditions
			T _A = +25°C		T _A = -40°C to +85°C			
			Typ	Guaranteed Limits				
V _{IH}	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1		V	V _{OUT} = 0.1 V or V _{CC} - 0.1 V
		4.5	2.25	3.15	3.15			
		5.5	2.75	3.85	3.85			
V _{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9		V	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			
V _{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9		V	I _{OUT} = -50 μA
		4.5	4.49	4.4	4.4			
		5.5	5.49	5.4	5.4			
		3.0		2.56	2.46		V	*V _{IN} = V _{IL} or V _{IH} -12 mA I _{OH} -24 mA -24 mA
		4.5		3.86	3.76			
		5.5		4.86	4.76			
V _{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1		V	I _{OUT} = 50 μA
		4.5	0.001	0.1	0.1			
		5.5	0.001	0.1	0.1			
		3.0		0.36	0.44		V	*V _{IN} = V _{IL} or V _{IH} 12 mA I _{OL} 24 mA 24 mA
		4.5		0.36	0.44			
		5.5		0.36	0.44			
I _{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0		μA	V _I = V _{CC} , GND
I _{OLD}	†Minimum Dynamic Output Current	5.5			75		mA	V _{OLD} = 1.65 V Max
I _{OHD}		5.5			-75		mA	V _{OHD} = 3.85 V Min
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0	40		μA	V _{IN} = V _{CC} or GND

* All outputs loaded; thresholds on input associated with output under test.

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

Note: I_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC}.

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V _{CC} * (V)	74AC			74AC		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF			T _A = -40°C to +85°C C _L = 50 pF			
			Min	Typ	Max	Min	Max		
f _{max}	Maximum Clock Frequency	3.3 5.0	145 145			125 125		MHz	3-3
t _{PLH}	Propagation Delay C _{Pn} to Q _n or Q _n	3.3 5.0	1.0 1.0		14.5 12.0	1.0 1.0	16.0 13.0	ns	3-6
t _{PHL}	Propagation Delay C _{Pn} to Q _n or Q _n	3.3 5.0	1.0 1.0		14.5 12.5	1.0 1.0	15.5 13.0	ns	3-6
t _{PLH}	Propagation Delay S _{Dn} to Q _n	3.3 5.0	1.0 1.0		10.0 9.0	1.0 1.0	11.0 9.5	ns	3-6
t _{PHL}	Propagation Delay S _{Dn} to Q _n	3.3 5.0	1.0 1.0		13.0 11.0	1.0 1.0	14.0 11.5	ns	3-6

* Voltage Range 3.3 V is 3.3 V ±0.3 V.

Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC113 MC74ACT113

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} * (V)	74AC		Unit	Fig. No.	
			T _A = +25°C C _L = 50 pF				T _A = -40°C to +85°C C _L = 50 pF
			Typ	Guaranteed Minimum			
t _s	Set-up Time, HIGH or LOW J _N or K _N to CP _N	3.3	6.5	7.5	ns	3-9	
		5.0	4.5	5.0			
t _h	Hold Time, HIGH or LOW J _N or K _N to CP _N	3.3	0	0	ns	3-9	
		5.0	0	0			
t _w	Pulse Width Clock	3.3	5.0	5.5	ns	3-6	
		5.0	4.0	4.5			
t _w	Pulse Width S _{Dn}	3.3	5.5	6.0	ns	3-6	
		5.0	5.0	5.5			
t _{rec}	Recovery Time S _{Dn} to CP	3.3	0	0	ns	3-9	
		5.0	0	0			

* Voltage Range 3.3 V is 3.3 V ± 0.3 V.
Voltage Range 5.0 V is 5.0 V ± 0.5 V.

DC CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	74ACT		74ACT		Unit	Conditions
			T _A = +25°C		T _A = -40°C to +85°C			
			Typ	Guaranteed Limits				
V _{IH}	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	V	V _{OUT} = 0.1 V or V _{CC} - 0.1 V	
		5.5	1.5	2.0	2.0			
V _{IL}	Maximum Low Level Input Voltage	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			
V _{OH}	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	V	I _{OUT} = -50 μA	
		5.5	5.49	5.4	5.4			
		4.5		3.86	3.76	V	*V _{IN} = V _{IL} or V _{IH} -24 mA	
5.5		4.86	4.76					
V _{OL}	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	V	I _{OUT} = 50 μA	
		5.5	0.001	0.1	0.1			
		4.5		0.36	0.44	V	*V _{IN} = V _{IL} or V _{IH} 24 mA	
5.5		0.36	0.44					
I _{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V _I = V _{CC} , GND	
ΔI _{CCT}	Additional Max. I _{CC} /Input	5.5	0.6		1.5	mA	V _I = V _{CC} - 2.1 V	
I _{OLD}	†Minimum Dynamic Output Current	5.5			75	mA	V _{OLD} = 1.65 V Max	
I _{OHD}		5.5			-75	mA	V _{OHD} = 3.85 V Min	
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0	40	μA	V _{IN} = V _{CC} or GND	

* All outputs loaded; thresholds on input associated with output under test.

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

MC74AC113 MC74ACT113

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V _{CC} * (V)	74ACT			74ACT		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF			T _A = -40°C to +85°C C _L = 50 pF			
			Min	Typ	Max	Min	Max		
f _{max}	Maximum Clock Frequency	5.0	145			125		MHz	3-3
t _{PLH}	Propagation Delay CP _N to Q _N or Q _N	5.0	1.0		14.0	1.0	15.5	ns	3-6
t _{PHL}	Propagation Delay CP _N to Q _N or Q _N	5.0	1.0		13.5	1.0	15.0	ns	3-6
t _{PLH}	Propagation Delay S _{DN} to Q _N	5.0	1.0		11.5	1.0	12.5	ns	3-6
t _{PHL}	Propagation Delay S _{DN} to Q _N	5.0	1.0		13.0	1.0	14.0	ns	3-6

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} * (V)	74ACT		74ACT		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF			
			Typ	Guaranteed Minimum				
t _s	Set-up Time, HIGH or LOW J _N or K _N to CP _N	5.0		2.0	2.5		ns	3-9
t _h	Hold Time, HIGH or LOW J _N or K _N to CP _N	5.0		2.0	2.0		ns	3-9
t _w	Pulse Width Clock	5.0		5.0	6.0		ns	3-6
t _w	Pulse Width S _{DN}	5.0		5.5	6.0		ns	3-6
t _{rec}	Recovery Time S _{DN} to CP	5.0		0	0		ns	3-9

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

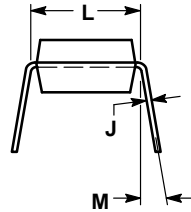
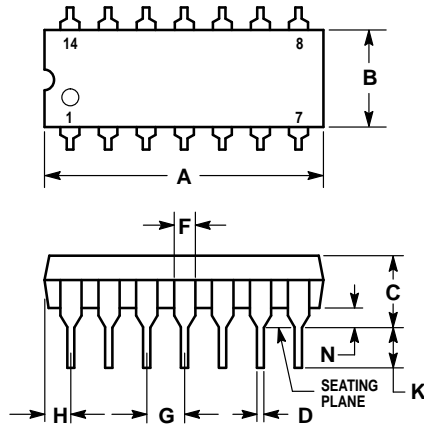
CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = 5.0 V
CPD	Power Dissipation Capacitance	35	pF	V _{CC} = 5.0 V

MC74AC113 MC74ACT113

OUTLINE DIMENSIONS

N SUFFIX PLASTIC DIP PACKAGE CASE 646-06 ISSUE L

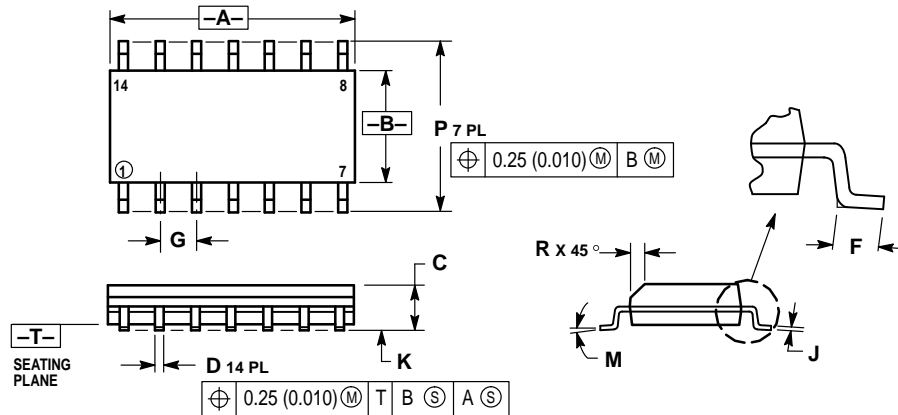


NOTES:

- LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
- ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC		7.62 BSC	
M	0°	10°	0°	10°
N	0.015	0.039	0.39	1.01


D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE F



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:

USA/EUROPE: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

MFAX: RMFAX0@email.sps.mot.com -TOUCHTONE (602) 244-6609
INTERNET: http://Design-NET.com

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



MC74AC113/D

