

54AC11112, 74AC11112 DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET

SCAS073A – JUNE 1989 – REVISED APRIL 1993

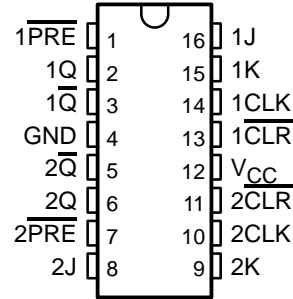
- Flow-Through Architecture Optimizes PCB Layout
- Center-Pin V_{CC} and GND Configuration Minimizes High-Speed Switching Noise
- **EPIC™** (Enhanced-Performance Implanted CMOS) 1- μ m Process
- 500-mA Typical Latch-Up Immunity at 125°C
- ESD Protection Exceeds 2000 V, MIL STD-883C Method 3015
- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

description

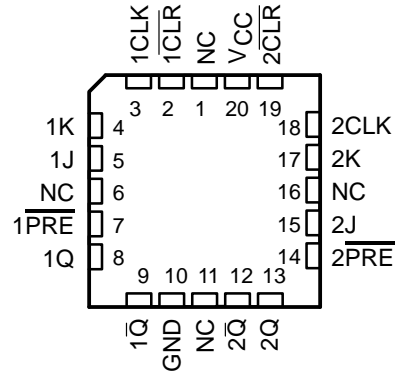
These devices contain two independent J-K negative-edge-triggered flip-flops. A low level at the preset (\overline{PRE}) or clear (\overline{CLR}) inputs sets or resets the outputs regardless of the levels of the other inputs. When preset and clear are inactive (high), data at the J and K inputs meeting the setup time requirements are transferred to the outputs on the negative-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the fall time of the clock pulse. Following the hold time interval, data at the J and K inputs may be changed without affecting the levels at the outputs. These versatile flip-flops can perform as toggle flip-flops by tying J and K high.

The 54AC11112 is characterized for operation over the full military temperature range of -55°C to 125°C . The 74AC11112 is characterized for operation from -40°C to 85°C .

54AC11112 . . . J PACKAGE
74AC11112 . . . D OR N PACKAGE
(TOP VIEW)



54AC11112 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE
(each gate)

INPUTS					OUTPUTS	
\overline{PRE}	\overline{CLR}	CLK	J	K	Q	\overline{Q}
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H^{\dagger}	H^{\dagger}
H	H	\downarrow	L	L	Q_O	$\overline{Q_O}$
H	H	\downarrow	H	L	H	L
H	H	\downarrow	L	H	L	H
H	H	\downarrow	H	H	Toggle	
H	H	H	X	X	Q_O	$\overline{Q_O}$

† This configuration is nonstable; that is, it will not persist when either \overline{PRE} or \overline{CLR} returns to its inactive (high) level.

EPIC is a trademark of Texas Instruments Incorporated.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

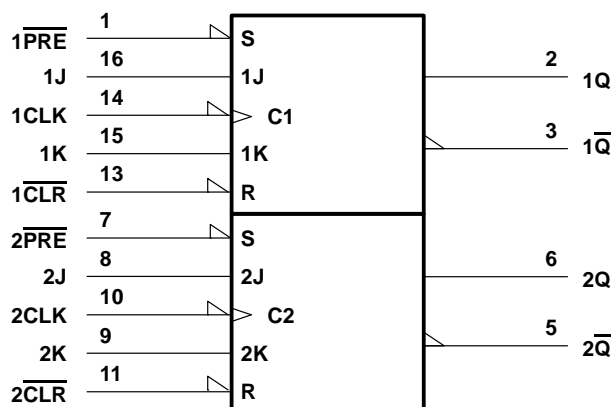
Copyright © 1993, Texas Instruments Incorporated

54AC11112, 74AC11112

DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET

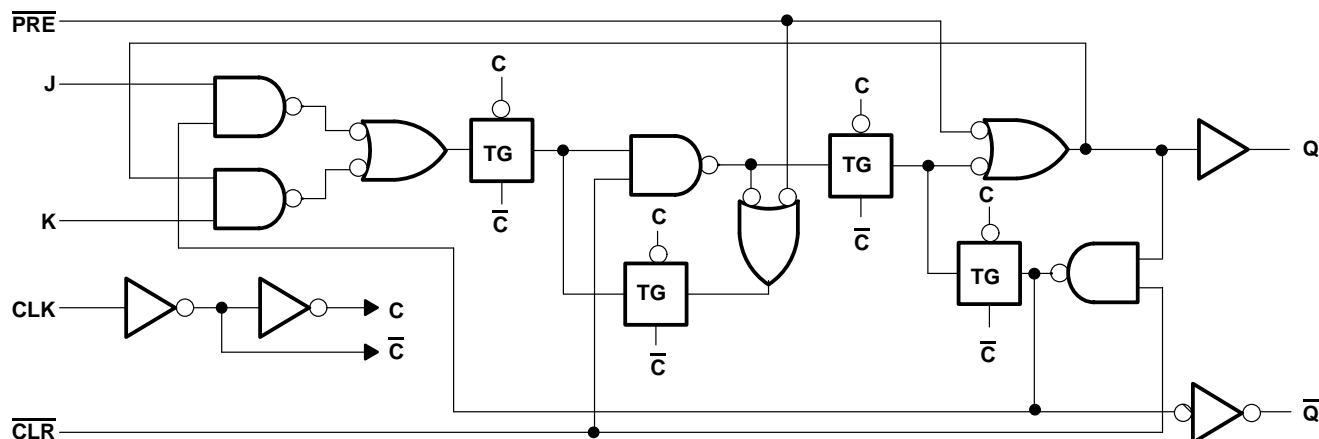
SCAS073A – JUNE 1989 – REVISED APRIL 1993

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, J, and N packages.

logic diagram, each flip-flop (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Output voltage range, V_O (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$)	±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±50 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Storage temperature range	–65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

54AC11112, 74AC11112
DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS
WITH CLEAR AND PRESET
SCAS073A – JUNE 1989 – REVISED APRIL 1993

recommended operating conditions

			54AC11112			74AC11112			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage		3	5	5.5	3	5	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 3 V	2.1			2.1			V
		V _{CC} = 4.5 V	3.15			3.15			
		V _{CC} = 5.5 V	3.85			3.85			
V _{IL}	Low-level input voltage	V _{CC} = 3 V	0.9			0.9			V
		V _{CC} = 4.5 V	1.35			1.35			
		V _{CC} = 5.5 V	1.65			1.65			
V _I	Input voltage		0	V _{CC}		0	V _{CC}		V
V _O	Output voltage		0	V _{CC}		0	V _{CC}		V
I _{OH}	High-level output current	V _{CC} = 3 V	−4			−4			mA
		V _{CC} = 4.5 V	−24			−24			
		V _{CC} = 5.5 V	−24			−24			
I _{OL}	Low-level output current	V _{CC} = 3 V	12			12			mA
		V _{CC} = 4.5 V	24			24			
		V _{CC} = 5.5 V	24			24			
Δt/Δv	Input transition rise or fall rate		0	10		0	10		ns/V
T _A	Operating free-air temperature		−55	125		−40	85		°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}	$T_A = 25^\circ\text{C}$			54AC11112		74AC11112		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	$I_{OH} = -50\text{ }\mu\text{A}$	3 V	2.9			2.9		2.9		V
		4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
	$I_{OH} = -4\text{ mA}$	3 V	2.58			2.4		2.48		
		4.5 V	3.94			3.7		3.8		
		5.5 V	4.94			4.7		4.8		
	$I_{OH} = -50\text{ mA}^\dagger$	5.5 V				3.85				
	$I_{OH} = -75\text{ mA}^\dagger$	5.5 V						3.85		
V_{OL}	$I_{OL} = 50\text{ }\mu\text{A}$	3 V			0.1		0.1		0.1	V
		4.5 V			0.1		0.1		0.1	
		5.5 V			0.1		0.1		0.1	
	$I_{OL} = 12\text{ mA}$	3 V			0.36		0.5		0.44	
		4.5 V			0.36		0.5		0.44	
		5.5 V			0.36		0.5		0.44	
	$I_{OL} = 50\text{ mA}^\dagger$	5.5 V					1.65			
	$I_{OL} = 75\text{ mA}^\dagger$	5.5 V							1.65	
I_I	$V_I = V_{CC}$ or GND	5.5 V			± 0.1		± 1		± 1	μA
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			4		80		40	μA
C_i	$V_I = V_{CC}$ or GND	5 V			3.5					pF

[†] Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

54AC11112, 74AC11112

DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS

WITH CLEAR AND PRESET

SCAS073A – JUNE 1989 – REVISED APRIL 1993

timing requirements, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (see Figure 1)

			$T_A = 25^\circ\text{C}$		54AC11112		74AC11112		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	100	0	70	0	70	MHz
t_w	Pulse duration	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low	5		5		5		ns
		CLK low or CLK high	5		5		5		
t_{su}	Setup time before CLK↓	Data high or low	5		5		5		ns
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ inactive	2.5		2.5		2.5		
t_h	Hold time after CLK↓		0.5		0.5		0.5		ns

timing requirements, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (see Figure 1)

			$T_A = 25^\circ\text{C}$		54AC11112		74AC11112		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	125	0	125	0	125	MHz
t_w	Pulse duration	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low	4		4		4		ns
		CLK low or CLK high	4		4		4		
t_{su}	Setup time before CLK↓	Data high or low	3.5		3.5		3.5		ns
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ inactive	2		2		2		
t_h	Hold time after CLK↓		1		1		1		ns

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54AC11112		74AC11112		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			100	150		100		100		MHz
t_{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \overline{Q}	1.5	4.9	6.7	1.5	7.6	1.5	7.3	ns
t_{PHL}			1.5	7	9.2	1.5	10.3	1.5	9.9	
t_{PLH}	CLK	Q or \overline{Q}	1.5	5.4	7.1	1.5	7.9	1.5	7.6	ns
t_{PHL}			1.5	6	7.9	1.5	9	1.5	8.5	

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

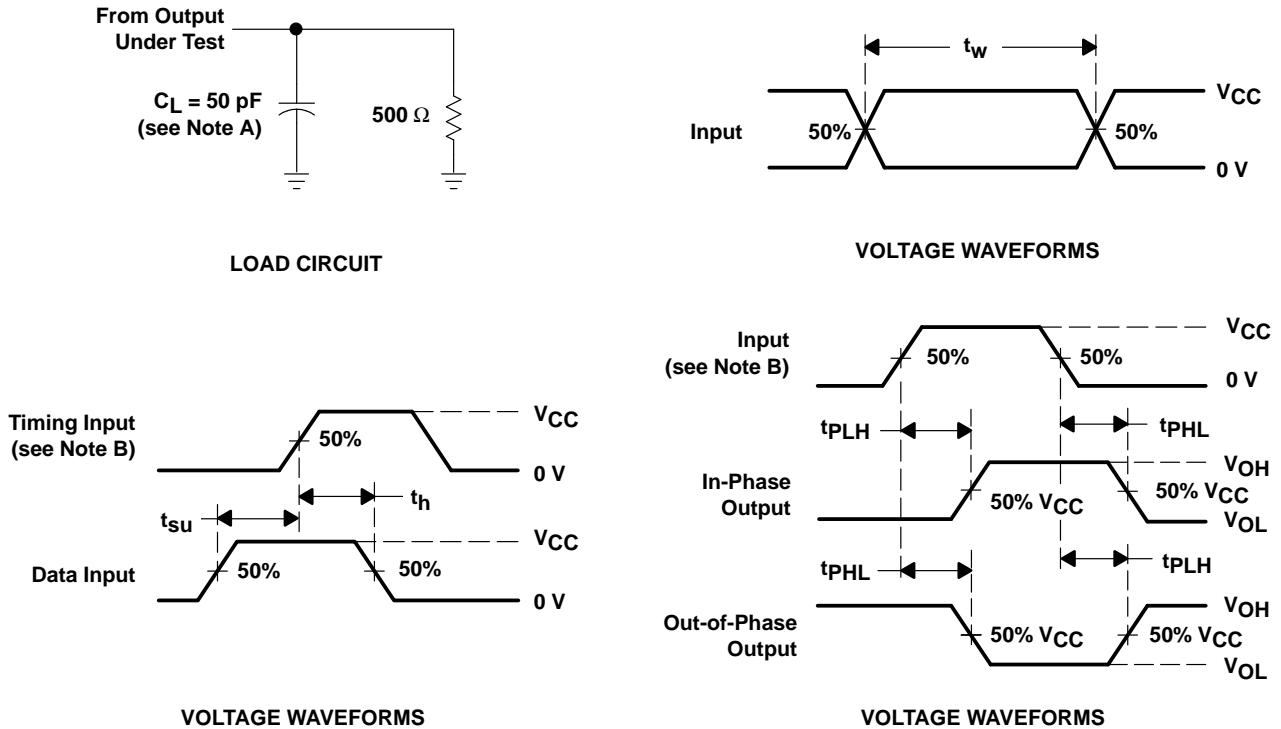
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54AC11112		74AC11112		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			125	175		125		125		MHz
t_{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \overline{Q}	1.5	3.3	5.1	1.5	5.6	1.5	5.4	ns
t_{PHL}			1.5	4.6	6.7	1.5	7.7	1.5	7.3	
t_{PLH}	CLK	Q or \overline{Q}	1.5	3.4	5.1	1.5	5.8	1.5	5.6	ns
t_{PHL}			1.5	4.2	6.3	1.5	7.4	1.5	7	

operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance per gate	$C_L = 50\text{ pF}$, $f = 1\text{ MHz}$		37	pF



PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.