

# TYPES SN5472, SN54H72, SN54L72, SN7472, SN74H72

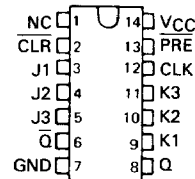
## AND-GATED J-K MASTER-SLAVE FLIP-FLOPS WITH PRESET AND CLEAR

REVISED DECEMBER 1983

- Package Options Include Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

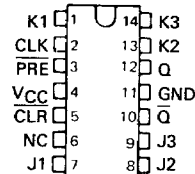
SN5472, SN54H72, SN54L72 ... J PACKAGE  
SN7472, SN74H72 ... J OR N PACKAGE

(TOP VIEW)



SN5472, SN54H72 ... W PACKAGE

(TOP VIEW)



NC - No internal connection

### description

These J-K flip-flops are based on the master-slave principle and each has AND gate inputs for entry into the master section which 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 AND gate inputs to master
3. Disable AND gate inputs
4. Transfer information from master to slave

Logical state of J and K inputs must not be allowed to change when the clock pulse is in a high state.

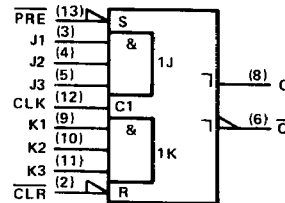
The SN5472, SN54H72, and the SN54L72 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7472 and the SN74H72 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE

INPUTS		OUTPUTS	
PRE	CLR	Q	$\bar{Q}$
L	H	X	X
H	L	X	X
L	L	X	X
H	H	$\downarrow$	$\downarrow$
H	H	$\downarrow$	$\downarrow$
H	H	$\downarrow$	$\downarrow$
H	H	$\downarrow$	$\downarrow$
H	H	$\downarrow$	$\downarrow$

† This configuration is nonstable; that is, it will not persist when either preset or clear returns to its inactive (high) level.

### logic symbol



Pin numbers shown are for J and N packages.

### positive logic

$$J = J1 \cdot J2 \cdot J3$$

$$K = K1 \cdot K2 \cdot K3$$

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### PRODUCTION DATA

This document contains information 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.

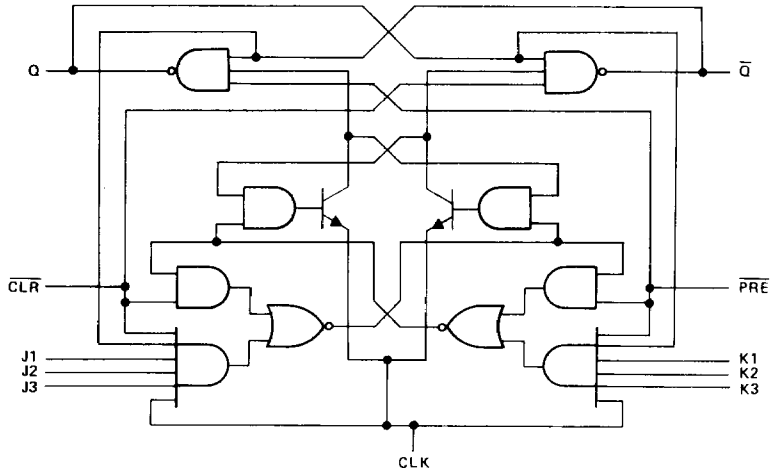
TEXAS  
INSTRUMENTS

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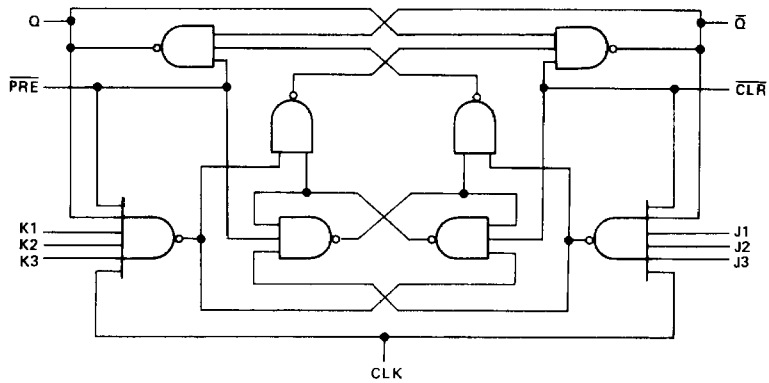
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 SN7472, SN74H72  
 AND-GATED J-K MASTER-SLAVE FLIP-FLOPS WITH PRESET AND CLEAR

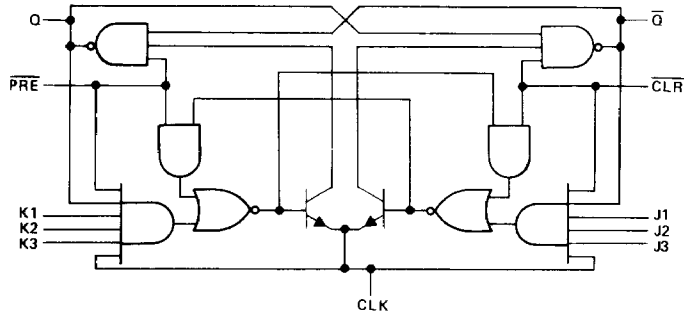
logic diagrams  
 '72



'H72



'L72

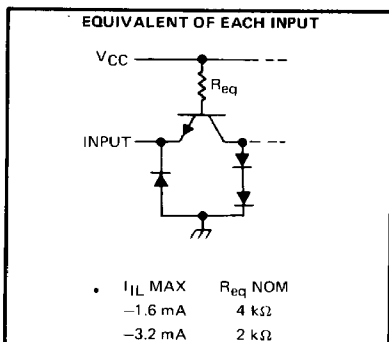


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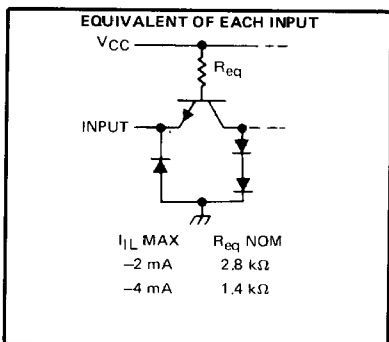
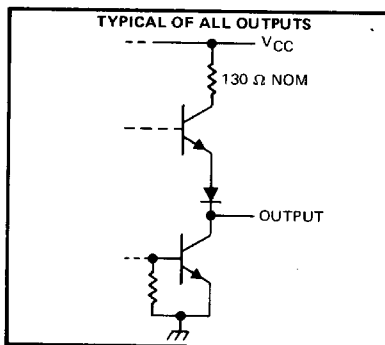
TYPES SN5472, SN54H72, SN54L72,  
SN7472, SN74H72

**AND-GATED J-K MASTER-SLAVE FLIP-FLOPS WITH PRESET AND CLEAR**

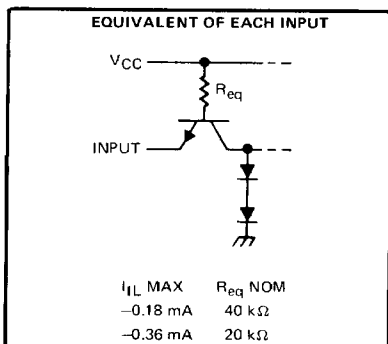
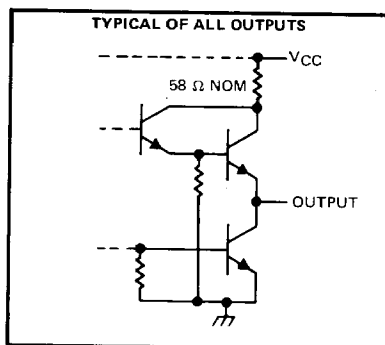
schematics of inputs and outputs



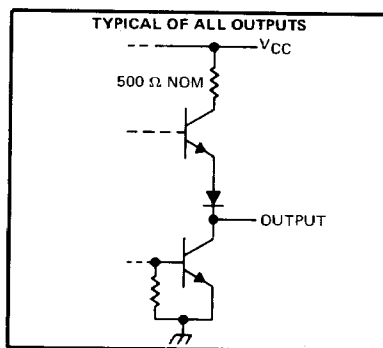
'72



'H72



'L72



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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature: SN54'	-55°C to 125°C
SN74'	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

# TYPES SN5472, SN7472 AND-GATED J-K MASTER-SLAVE FLIP-FLOPS WITH PRESET AND CLEAR

## recommended operating conditions

		SN5472			SN7472			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage				0.8			V
$I_{OH}$	High-level output current				-0.4			mA
$I_{OL}$	Low-level output current				16			mA
$t_w$	Pulse duration	CLK high		20	20		ns	
		CLK low		47	47			
		PRE or CLR		25	25			
$t_{su}$	Input setup time before CLK $\dagger$	0			0			ns
$t_h$	Input hold time-data after CLK $\dagger$	0			0			ns
$T_A$	Operating free-air temperature	-55			125			$^{\circ}$ C

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

PARAMETER	TEST CONDITIONS $\dagger$	SN5472			SN7472			UNIT
		MIN	TYP $\ddagger$	MAX	MIN	TYP $\ddagger$	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	-1.5			-1.5			V
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OH} = -0.4 \text{ mA}$	2.4	3.4		2.4	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 16 \text{ mA}$		0.2	0.4		0.2	0.4	V
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$	1			1			mA
$I_{IH}$	J or K	40			40			$\mu$ A
	All other	80			80			
$I_{IL}$	J or K	-1.6			-1.6			mA
	All other	-3.2			-3.2			
$I_{OS} \S$	$V_{CC} = \text{MAX}$	-20	-57		-18	-57	mA	
$I_{CC}$	$V_{CC} = \text{MAX}$ , See Note 2	10	20		10	20	mA	

$\dagger$  For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

$\ddagger$  All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ .

$\S$  Not more than one output should be shorted at a time.

NOTE 2: With all outputs open,  $I_{CC}$  is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

## switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$ (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{max}$				15	20		MHz
$t_{PLH}$	PRE or CLR	Q or $\bar{Q}$	$R_L = 400 \Omega$ , $C_L = 15 \text{ pF}$	16	25		ns
$t_{PHL}$				25	40		ns
$t_{PLH}$	CLK	Q or $\bar{Q}$		16	25		ns
$t_{PHL}$				25	40		ns

NOTE 3: See General Information Section for load circuits and voltage waveforms.

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# TYPES SN54H72, SN74H72 AND-GATED J-K MASTER-SLAVE FLIP-FLOPS WITH PRESET AND CLEAR

## recommended operating conditions

		SN54H72			SN74H72			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage				0.8			V
$I_{OH}$	High-level output current				-0.5			mA
$I_{OL}$	Low-level output current				20			mA
$t_w$	Pulse duration	CLK high		12		12		ns
		CLK low		28		28		
		CLR or PRE		16		16		
$t_{su}$	Setup time, before CLK †	data high or low		0		0		ns
$t_h$	Hold time-data after CLK †			0		0		ns
$T_A$	Operating free-air temperature	-55		125		0		70 °C

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

PARAMETER	TEST CONDITIONS †	SN54H72		SN74H72		UNIT
		MIN	TYP ‡	MAX	MIN	
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -8 \text{ mA}$	-1.5		-1.5		V
$V_{OH}$	$V_{CC} = \text{MIN}, I_{OH} = -0.5 \text{ mA}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}$	2.4	3.4	2.4	3.4	V
$V_{OL}$	$V_{CC} = \text{MIN}, I_{OL} = 20 \text{ mA}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}$	0.2	0.4	0.2	0.4	V
$I_I$	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$	1		1		mA
$I_{IH}$	J, K or CLK	50		50		$\mu\text{A}$
	PRE or CLR*	100		100		
$I_{IL}$	J, K or CLR	-2		-2		mA
	PRE or CLR*	-4		-4		
$I_{OS} \S$	$V_{CC} = \text{MAX}$	-40	-100	-40	-100	mA
$I_{CC}$	$V_{CC} = \text{MAX},$ See Note 2	16	25	16	25	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$ .

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

\* Clear is tested with preset high and preset is tested with clear high.

NOTE 2: With all outputs open,  $I_{CC}$  is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

## switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$ (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{max}$				25	30		MHz
$t_{PLH}$	PRE or CLR	Q or $\bar{Q}$	$R_L = 280 \Omega, C_L = 25 \text{ pF}$	6	13		ns
$t_{PHL}$				12	24		ns
$t_{PLH}$	CLK	Q or $\bar{Q}$		14	21		ns
$t_{PHL}$				22	27		ns

NOTE 3: See General Information Section for load circuits and voltage waveforms.

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# TYPE SN54L72 AND-GATED J-K MASTER-SLAVE FLIP-FLOPS WITH PRESET AND CLEAR

## recommended operating conditions

		MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage	2			V
V <sub>IL</sub>	Low-level input voltage	Clock input		0.6	V
		All other inputs		0.7	
I <sub>OH</sub>	High-level output current	-0.1			mA
I <sub>OL</sub>	Low-level output current	2			mA
t <sub>w</sub>	Pulse duration	CLK high or low		200	ns
		PRE or CLR low		100	
t <sub>su</sub>	Setup time before CLK ↑	0			ns
t <sub>h</sub>	Hold time, data after CLK ↓	0			ns
T <sub>A</sub>	Operating free-air temperature	-55		125	°C

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

PARAMETER	TEST CONDITIONS †	MIN	TYP ‡	MAX	UNIT
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -0.1 mA	2.4	3.3		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OL</sub> = 2 mA		0.15	0.3	V
I <sub>I</sub>	J or K	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			0.1
	All other				
I <sub>IH</sub>	J or K	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			10
	PRE or CLR				20
	CLK				-200
I <sub>IL</sub>	J or K	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.3 V			-0.18
	All other				-0.36
I <sub>OS</sub>	V <sub>CC</sub> = MAX	-3		-15	mA
I <sub>CC</sub>	V <sub>CC</sub> = MAX, See Note 2		0.76	1.44	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

NOTE 2: With all outputs open, I<sub>CC</sub> is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>max</sub>				2.5	3		MHz
t <sub>PLH</sub>	PRE or CLR	Q or $\bar{Q}$	R <sub>L</sub> = 4 kΩ, C <sub>L</sub> = 50 pF		35	75	ns
t <sub>PHL</sub>	PRE or CLR (CLK high)	$\bar{Q}$ or Q		60	150	ns	
	PRE or CLR (CLK low)				200		
t <sub>PLH</sub>	CLK	Q or $\bar{Q}$		10	35	75	ns
t <sub>PHL</sub>	CLK	Q or $\bar{Q}$		10	60	150	ns

NOTE 3: See General Information Section for load circuits and voltage waveforms.

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