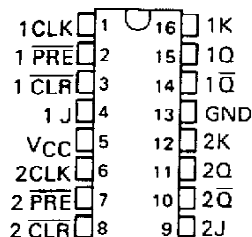


SN5476, SN54LS76A, SN7476, SN74LS76A **DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR**

DECEMBER 1983—REVISED MARCH 1988

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

SN5476, SN54LS76A . . . J PACKAGE
 SN7476 . . . N PACKAGE
 SN74LS76A . . . D OR N PACKAGE
 (TOP VIEW)



description

The '76 contains two independent J-K flip-flops with individual J-K, clock, preset, and clear inputs. The '76 is a positive-edge-triggered flip-flop. J-K input is loaded into the master while the clock is high and transferred to the slave on the high-to-low transition. For these devices the J and K inputs must be stable while the clock is high.

The 'LS76A contain two independent negative-edge-triggered flip-flops. The J and K inputs must be stable one setup time prior to the high-to-low clock transition for predictable operation. The preset and clear are asynchronous active low inputs. When low they override the clock and data inputs forcing the outputs to the steady state levels as shown in the function table.

The SN5476 and the SN54LS76A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7476 and the SN74LS76A are characterized for operation from 0°C to 70°C .

'76
FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	$\bar{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H [†]	H [†]
H	H		L	L	Q ₀	$\bar{Q}_0$
H	H		H	L	H	L
H	H		L	H	L	H
H	H		H	H	TOGGLE	

'LS76A
FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	$\bar{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H [†]	H [†]
H	H		L	L	Q ₀	$\bar{Q}_0$
H	H		H	L	H	L
H	H		L	H	L	H
H	H		H	H	TOGGLE	
H	H	H	X	X	Q ₀	$\bar{Q}_0$

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

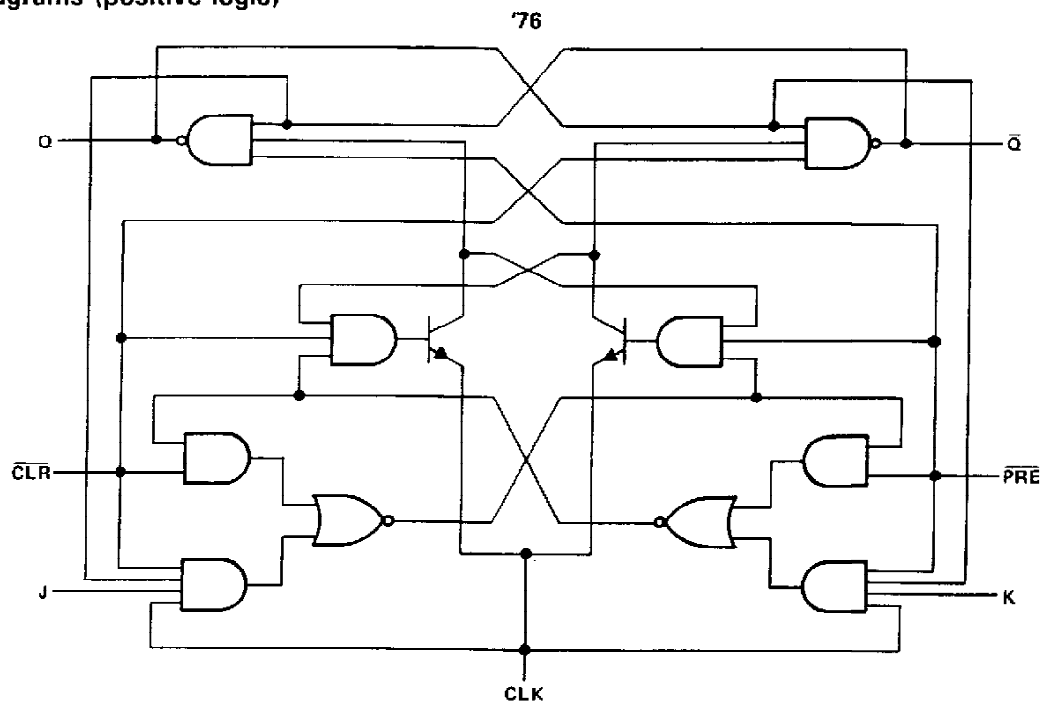
PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
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SN5476, SN7476
DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

logic diagrams (positive logic)

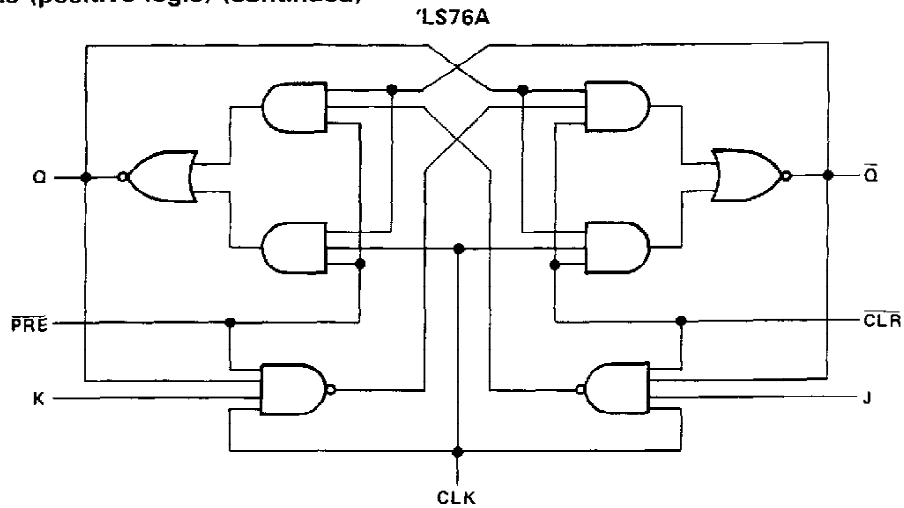


TEXAS
INSTRUMENTS

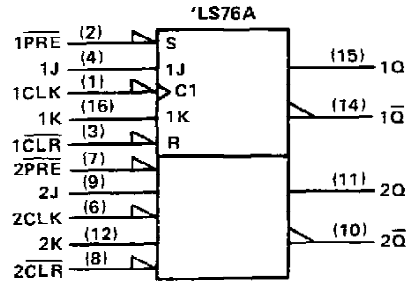
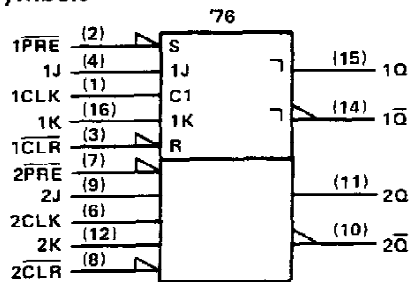
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**SN5476, SN54LS76A,
SN7476, SN74LS76A**
DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

logic diagrams (positive logic) (continued)

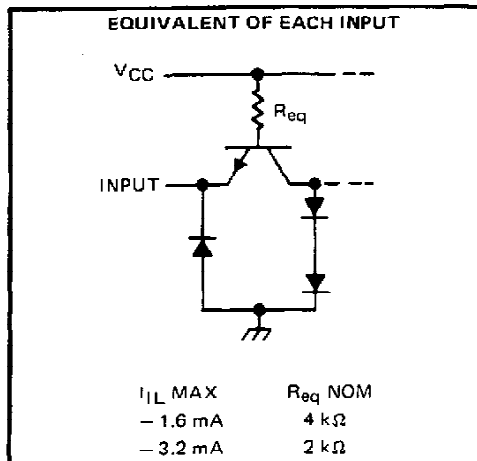


logic symbols†

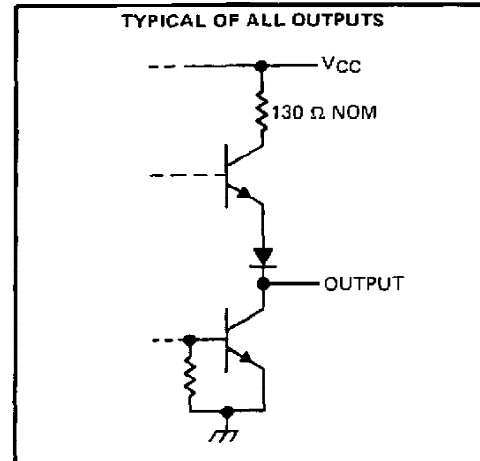


†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

schematics of inputs and outputs



76



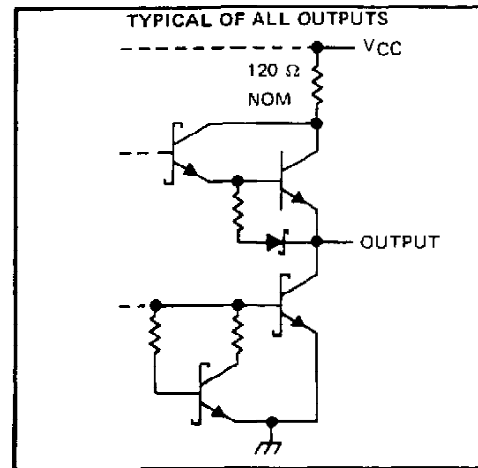
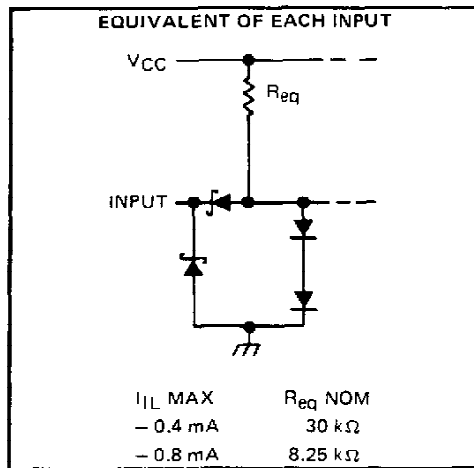
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**SN5476, SN54LS76A,
SN7476, SN74LS76A
DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR**

schematics of inputs and outputs (continued)

'LS76A



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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: '76	5.5 V
'LS76A	7 V
Operating free-air temperature range: 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.

**TEXAS
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SN5476, SN7476 DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

recommended operating conditions

			SN5476			SN7476			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			0.8			V
I _{OH}	High-level output current		− 0.4			− 0.4			mA
I _{OL}	Low-level output current		16			16			mA
t _w	Pulse duration	CLK high	20			20			ns
		CLK low	47			47			
		PRE or CLR low	25			25			
t _{su}	Input setup time before CLK ↑		0			0			ns
t _h	Input hold time-data after CLK ↓		0			0			ns
T _A	Operating free-air temperature		− 55			125			°C

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

PARAMETER		TEST CONDITIONS†		SN5476			SN7476			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}		V _{CC} = MIN, I _I = -12 mA				-1.5			-1.5	V
V _{OH}		V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -0.4 mA		2.4	3.4		2.4	3.4		V
V _{OL}		V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OL} = 16 mA			0.2	0.4		0.2	0.4	V
I _I		V _{CC} = MAX, V _I = 5.5 V				1			1	mA
I _{IH}	J or K	V _{CC} = MAX, V _I = 2.4 V				40			40	μA
	All other					80			80	
I _{IL}	J or K	V _{CC} = MAX, V _I = 0.4 V				-1.6			-1.6	mA
	All other†					-3.2			-3.2	
I _{OS} §		V _{CC} = MAX		-20		-57	-18		-57	mA
I _{CC} #		V _{CC} = MAX, See Note 2			10	20		10	20	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 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

† Clear is tested with preset high and preset is tested with clear high.

Average per flip-flop.

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 V, T_A = 25°C (see note 3)

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

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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SN54LS76A, SN74LS76A

DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

recommended operating conditions

---			SN54LS76A			SN74LS76A			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage		4.5	5	5.5	4.75	5	5.75	V
V _{IH}	High-level input voltage		2			2			V
V _{IL}	Low-level input voltage				0.7			0.8	V
I _{OH}	High-level output current				− 0.4			− 0.4	mA
I _{OL}	Low-level output current				4			8	mA
f _{clock}	Clock frequency		0		30	0		30	MHz
t _w	Pulse duration	CLK high	20			20			ns
		PRE or CLR low	25			25			
t _{su}	Setup time before CLK ↓	data high or low	20			20			ns
		CLR inactive	20			20			
		PRE inactive	25			25			
t _h	Hold time-data after CLK↓		0			0			ns
T _A	Operating free-air temperature		− 55			125			°C

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

PARAMETER		TEST CONDITIONS†		SN54LS76A		SN74LS76A		UNIT
				MIN	TYP‡	MAX	MIN	
V _{IK}		V _{CC} = MIN,	I _I = - 18 mA	- 1.5		- 1.5		V
V _{OH}		V _{CC} = MIN,	V _{IH} = 2 V, V _{IL} = MAX, I _{OH} = - 0.4 mA	2.5	3.4	2.7	3.4	V
V _{OL}		V _{CC} = MIN,	V _{IL} = MAX, V _{IH} = 2 V, I _{OL} = 4 mA	0.25 0.4		0.25 0.4		V
		V _{CC} = MIN,	V _{IL} = MAX, V _{IH} = 2 V, I _{OL} = 8 mA			0.35 0.5		
I _I	J or K	V _{CC} = MAX, V _I = 7 V		0.1		0.1		mA
	CLR or PRE			0.3		0.3		
	CLK			0.4		0.4		
I _{IH}	J or K	V _{CC} = MAX, V _I = 2.7 V		20		20		μA
	CLR or PRE			60		60		
	CLK			80		80		
I _{IL}	J or K	V _{CC} = MAX, V _I = 0.4 V		- 0.4		- 0.4		mA
	All other			- 0.8		- 0.8		
I _{OS} §		V _{CC} = MAX,	See Note 4	- 20	- 100	- 20	- 100	mA
I _{CC} (Total)		V _{CC} = MAX,	See Note 2	4	6	4	6	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 V, T_A = 25°C.

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

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.

NOTE 4: For certain devices where state commutation can be caused by shorting an output to ground, an equivalent test may be performed with V_O = 2.25 V and 2.125 V for the 54 family and the 74 family, respectively, with the minimum and maximum limits reduced to one half of their stated values.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f _{max}			R _L = 2 kΩ, C _L = 15 pF	30	45		MHz
t _{PLH}	PRE, CLR or CLK	Q or $\bar{Q}$			15	20	ns
t _{PHL}					15	20	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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