

TYPES SN5476, SN54H76, SN54LS76A, SN7476, SN74H76, SN74LS76A DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

REVISED DECEMBER 1983

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

description

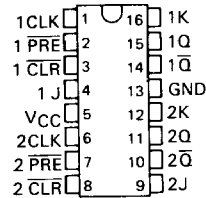
The '76 and 'H76 contain two independent J-K flip-flops with individual J-K, clock, preset, and clear inputs. The '76 and 'H76 are positive-edge-triggered flip-flops. J-K input is loaded into the master while the clock is high and transferred to the slave on the high-to-low transition. For these devices 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, SN54H76, and the SN54LS76A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7476, SN74H76, and the SN74LS76A are characterized for operation from 0°C to 70°C .

SN5476, SN54H76, SN54LS76A ... J OR W PACKAGE
SN7476, SN74H76 ... J OR N PACKAGE
SN74LS76A ... D, J OR N PACKAGE

(TOP VIEW)



'76, 'H76
FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	Q̄
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	Q̄ ₀
H	H	↓	H	L	H	L
H	H	↓	L	H	L	H
H	H	↓	H	H	TOGGLE	TOGGLE

'LS76A
FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	Q̄
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	Q̄ ₀
H	H	↓	H	L	H	L
H	H	↓	L	H	L	H
H	H	↓	H	H	TOGGLE	TOGGLE
H	H	H	X	X	Q ₀	Q̄ ₀

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

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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

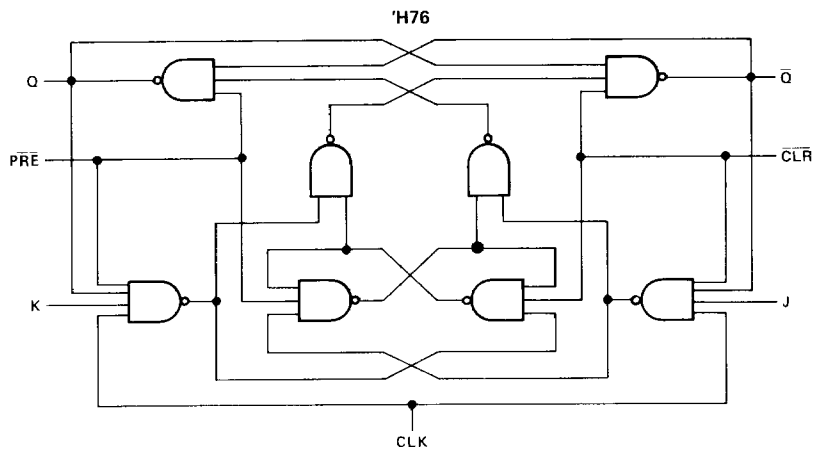
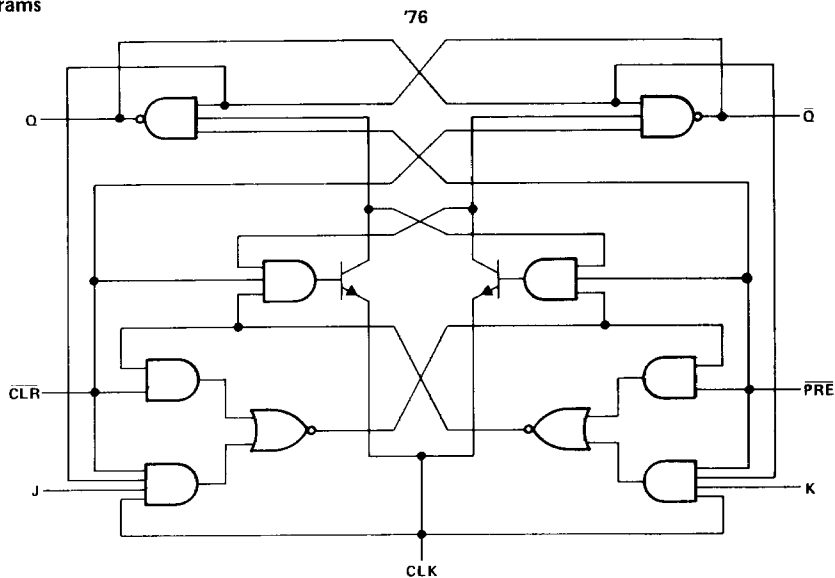
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**TYPES SN5476, SN54H76,
SN7476, SN74H76
DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR**

logic diagrams

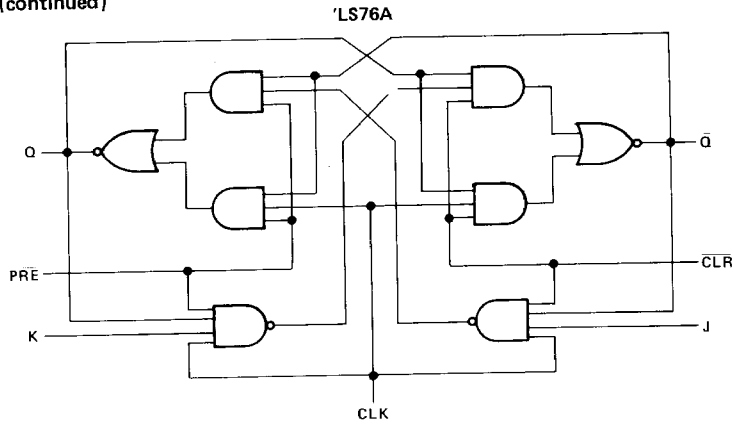


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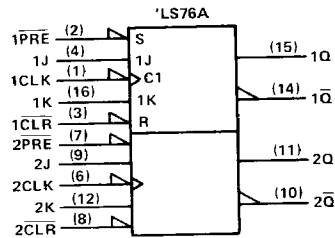
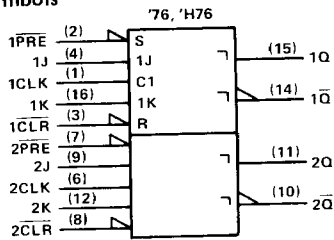
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TYPES SN5476, SN54H76, SN54LS76A,
SN7476, SN74H76, SN74LS76A
DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

logic diagrams (continued)

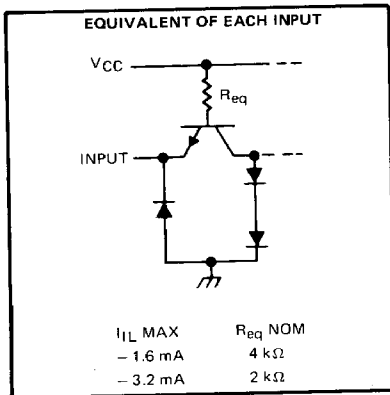


logic symbols

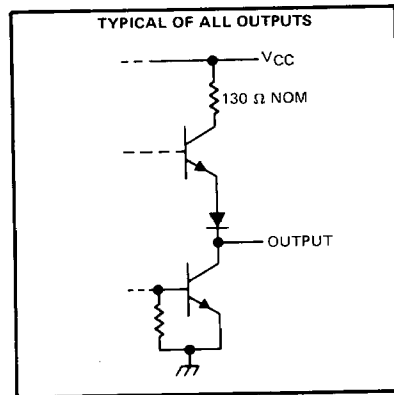


Pin numbers shown on logic notation are for D, J or N packages.

schematics of inputs and outputs



'76

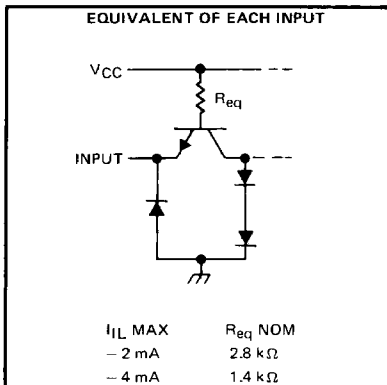


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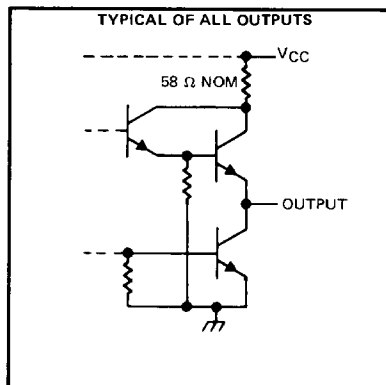
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**TYPES SN5476, SN54H76, SN54LS76A,
SN7476, SN74H76, SN74LS76A
DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR**

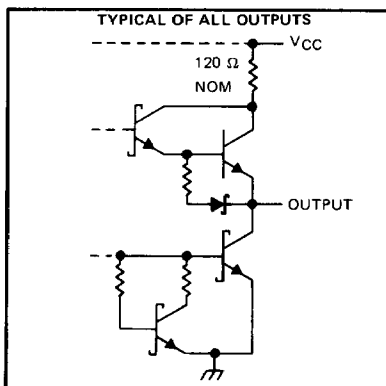
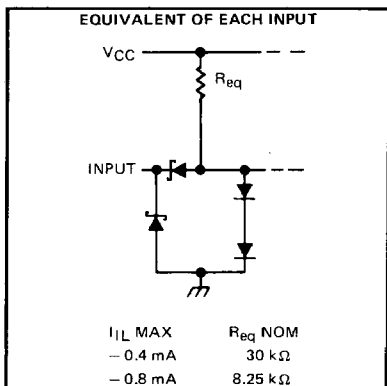
schematics of inputs and outputs (continued)



'H76



'LS76A



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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: '76, 'H76	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.

TYPES 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 $\uparrow$	0			0			ns
t_h	Input hold time-data after CLK $\downarrow$	0			0			ns
T_A	Operating free-air temperature	-55		125	0		70	$^{\circ}$ 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}		$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$					-1.5			-1.5	V
V_{OH}		$V_{CC} = \text{MIN}$, $I_{OH} = -0.4 \text{ mA}$	$V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$		2.4	3.4		2.4	3.4		V
V_{OL}		$V_{CC} = \text{MIN}$, $I_{OL} = 16 \text{ mA}$	$V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$			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 or K	$V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$					40			40	μ A
	All other						80			80	μ A
I_{IL}	J or K	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$					-1.6			-1.6	mA
	All other★						-3.2			-3.2	mA
$I_{OS}^{\S}$		$V_{CC} = \text{MAX}$			-20		-57	-18		-57	mA
I_{CC}		$V_{CC} = \text{MAX}$, See Note 2				10	20		10	20	mA

[†] 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.

★ 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}			$R_L = 400 \Omega, \quad C_L = 15 \text{ pF}$	15	20		MHz
t_{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$			16	25	ns
t_{PHL}				25	40	ns	
t_{PLH}	CLK	Q or $\overline{\text{Q}}$			16	25	ns
t_{PHL}				25	40	ns	

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

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TTL DEVICES

TYPES SN54H76, SN74H76 DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

recommended operating conditions

			SN54H76			SN74H76			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				− 0.5			− 0.5	mA		
I _{OL}	Low-level output current				20			20	mA		
t _w	Pulse duration	CLK high	12			12			ns		
		CLK low	28			28					
		CLR or PRE low	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		SN54H76		SN74H76		UNIT
				MIN	TYP ‡	MAX	MIN	
V _{IK}		V _{CC} = MIN, I _I = - 8 mA		- 1.5		- 1.5		V
V _{OH}		V _{CC} = MIN, I _{OH} = - 0.5 mA	V _{IH} = 2 V, V _{IL} = 0.8 V,	2.4	3.4	2.4	3.4	V
V _{OL}		V _{CC} = MIN, I _{OL} = 20 mA	V _{IH} = 2 V, V _{IL} = 0.8 V,	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, K, or CLK	V _{CC} = MAX, V _I = 2.4 V		50		50		μA
	CLR or PRE		100		100			
I _{IL}	J, K, or CLK	V _{CC} = MAX, V _I = 0.4 V		- 2		- 2		mA
	CLR or PRE★		- 4		- 4			
I _{OS} §		V _{CC} = MAX		- 40	- 100	- 40	- 100	mA
I _{CC}		V _{CC} = 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 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.

* 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 V, T_A = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f _{max}			R _L = 280 Ω, C _L = 25 pF	25	30		MHz
t _{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\bar{Q}$		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.

TYPES 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		TYP‡	MAX
V _{IK}		V _{CC} = MIN, I _I = - 18 mA			- 1.5		- 1.5	V		
V _{OH}		V _{CC} = MIN, I _{OH} = - 0.4 mA	V _{IH} = 2 V, V _{IL} = MAX,		2.5	3.4	2.7	3.4	V	
V _{OL}		V _{CC} = MIN, I _{OL} = 4 mA	V _{IL} = MAX, V _{IH} = 2 V,		0.25	0.4	0.25	0.4	V	
		V _{CC} = MIN, I _{OL} = 8 mA	V _{IL} = MAX, V _{IH} = 2 V,				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		- 20		- 100	mA
I _{CC}		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: See General Information Section for load circuits and voltage waveforms.

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