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

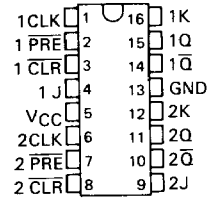
description

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	$\overline{Q}_0$
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	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	$\overline{Q}_0$
H	H	↓	H	L	H	L
H	H	↓	L	H	L	H
H	H	↓	H	H	TOGGLE	
H	H	H	X	X	Q_0	$\overline{Q}_0$

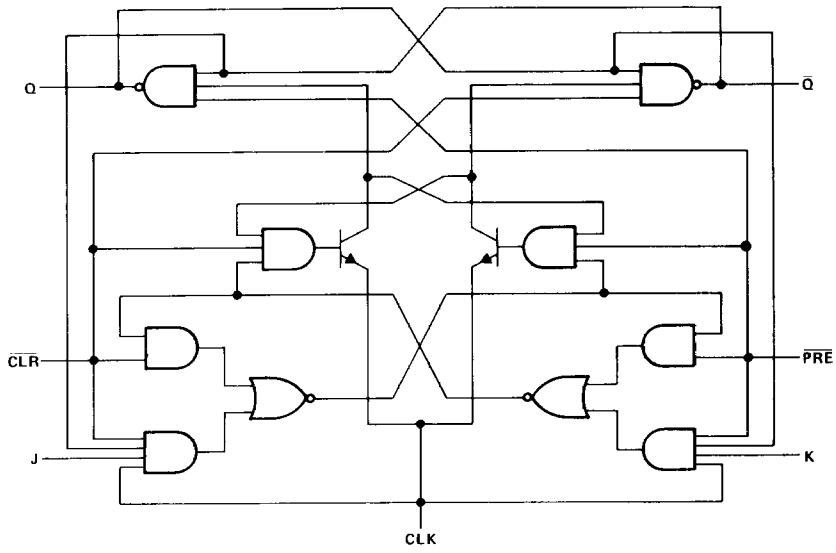
† This configuration is nonstable; that is, it will not persist when either preset or clear returns to its inactive (high) level.

FOR CHIP CARRIER INFORMATION, CONTACT THE FACTORY

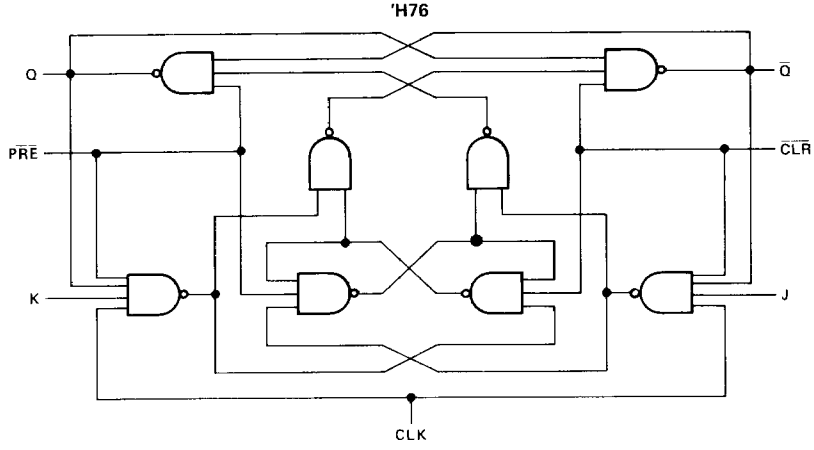
3 TTL DEVICES

logic diagrams

'76



'H76



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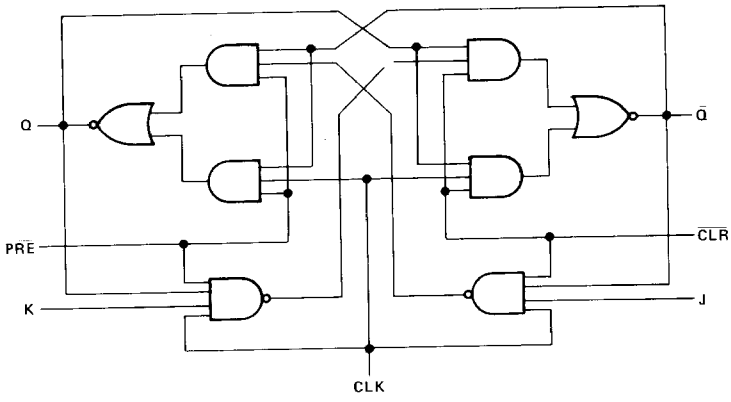
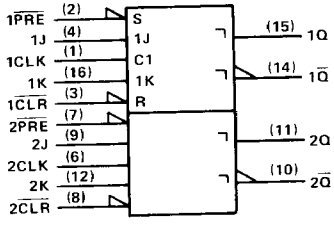
logic diagrams (continued)

'LS76A

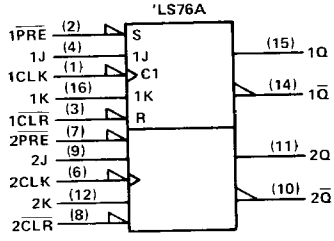


logic symbols

'76, 'H76



'LS76A

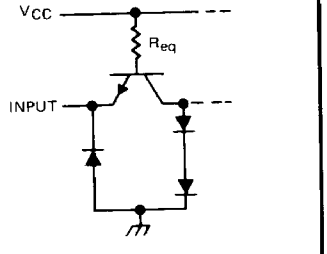


Pin numbers shown on logic notation are for D, J or N packages.

schematics of inputs and outputs

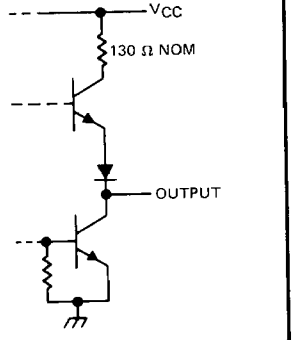
'76

EQUIVALENT OF EACH INPUT



I_{IL} MAX	R_{eq} NOM
−1.6 mA	4 kΩ
−3.2 mA	2 kΩ

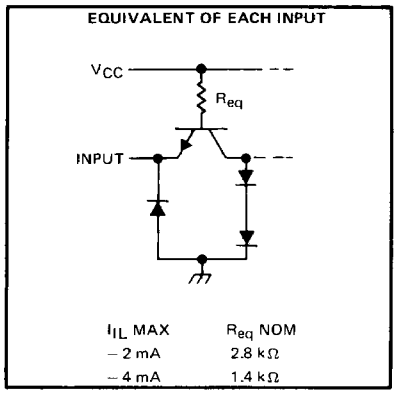
TYPICAL OF ALL OUTPUTS

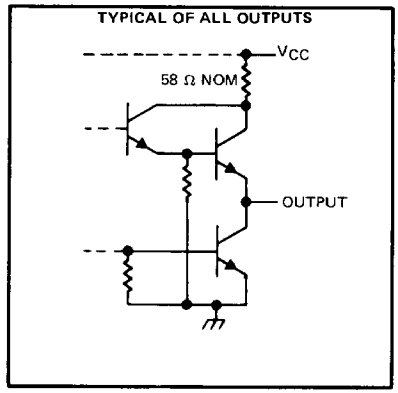


3 TTL DEVICES

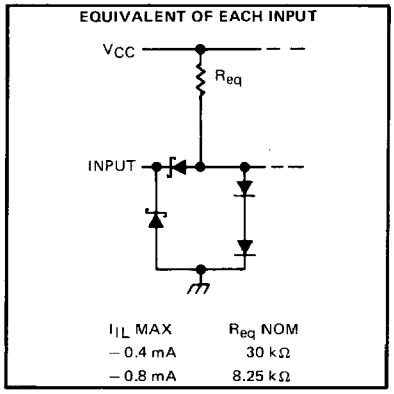
schematics of inputs and outputs (continued)

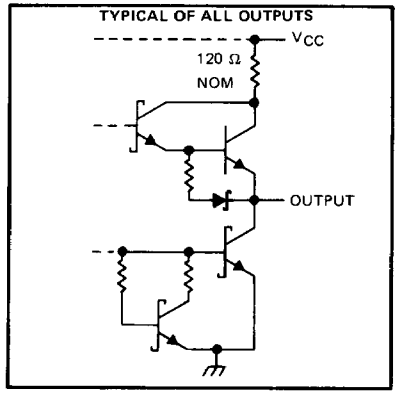
'H76





'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, '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.

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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			
		$\overline{PRE}$ or $\overline{CLR}$ 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	0		70	°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, I_{OH} = −0.4 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} = 16 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 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.
NOTE 2: With all outputs open, I_{CC} is measured with the Q and $\overline{Q}$ 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 Ω, 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: See General Information Section for load circuits and voltage waveforms.

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			
		$\overline{CLR}$ or $\overline{PRE}$ 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	TYP‡	MAX	
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
	$\overline{CLR}$ or $\overline{PRE}$						100			100	
I_{IL}	J, K, or CLK	V_{CC} = MAX,	V_I = 0.4 V				−2			−2	mA
	$\overline{CLR}$ or $\overline{PRE}$★						−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 $\overline{Q}$ 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}	$\overline{PRE}$ or $\overline{CLR}$	Q or $\overline{Q}$			6	13	ns
t_{PHL}					12	24	ns
t_{PLH}	CLK	Q or $\overline{Q}$			14	21	ns
t_{PHL}					22	27	ns

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

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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
		$\overline{PRE}$ or $\overline{CLR}$ low	25			25			
t_{su}	Setup time before CLK↓	data high or low	20			20			ns
		$\overline{CLR}$ inactive	20			20			
		$\overline{PRE}$ inactive	25			25			
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†			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
	$\overline{CLR}$ or $\overline{PRE}$						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
	$\overline{CLR}$ or $\overline{PRE}$						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}		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 $\overline{Q}$ 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}	$\overline{PRE}$, $\overline{CLR}$ or CLK	Q or $\overline{Q}$				15	20	ns
t_{PHL}						15	20	ns

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