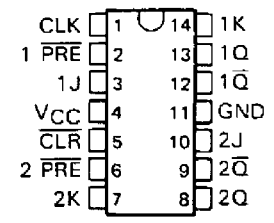
SN54LS78A, SN74LS78A
DUAL J-K FLIP-FLOPS WITH PRESET, COMMON CLOCK, AND COMMON CLEAR

SDLS200

DECEMBER 1983–REVISED MARCH 1988

- **Package Options Include Plastic "Small Outline" Packages, Flat Packages, and Plastic and Ceramic DIPs**
- **Dependable Texas Instrument Quality and Reliability**

SN54LS78A . . . J OR W PACKAGE
SN74LS78A . . . D OR N PACKAGE
(TOP VIEW)

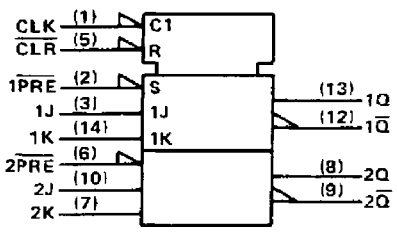


description

The 'LS78A contains two negative-edge-triggered flip-flops with individual J-K, preset inputs, and common clock and common clear inputs. The logic levels at the J and k inputs may be allowed to change while the clock pulse is high and the flip-flop will perform according to the function talbe as long as minimum setup and hold times are observed. 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 SN54LS78A is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74LS78A is characterized for operation from 0°C to 70°C.

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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	$\bar{Q}_0$
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 preset and clear inputs return to their inactive (high) level.

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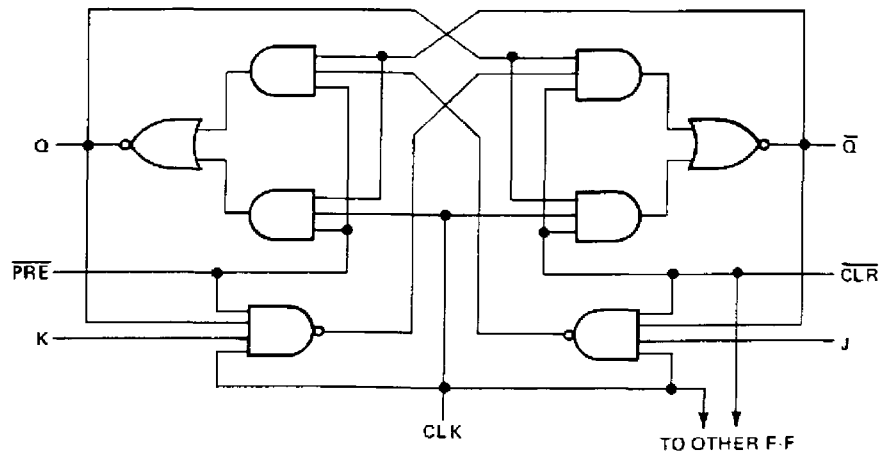
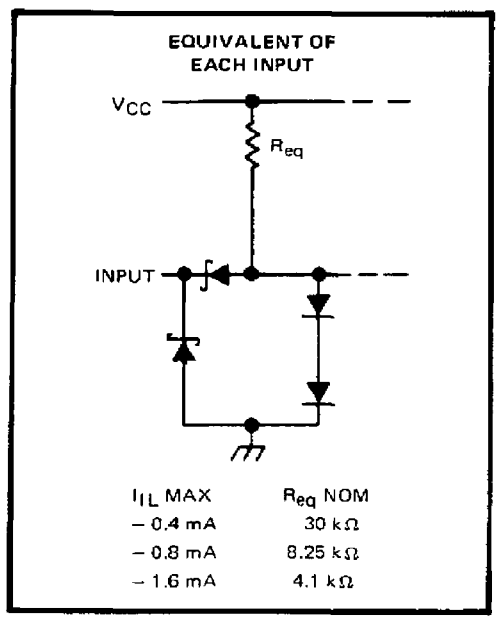
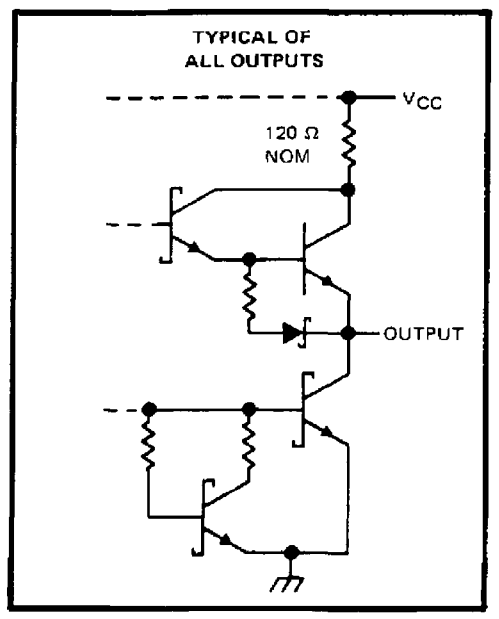
logic diagram (positive logic)



schematics of inputs and outputs (continued)





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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage . . . . . 7 V
Operating free-air temperature range: SN54LS78A . . . . . –55°C to 125°C
SN74LS78A . . . . . 0°C to 70°C
Storage temperature range . . . . . –65°C to 150°C

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

recommended operating conditions

			SN54LS78A			SN74LS78A			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
		$\overline{PRE}$ or $\overline{CLR}$ inactive	20			20			
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†			SN54LS78A			SN74LS78A			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} = 0.7 V,	2.5	3.4					V
		V_{CC} = MIN, I_{OH} = −0.4 mA	V_{IH} = 2 V,	V_{IL} = 0.8 V,				2.7	3.4		
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
	$\overline{CLR}$						0.6			0.6	
	$\overline{PRE}$						0.3			0.3	
	CLK						0.8			0.8	
I_{IH}	J or K	V_{CC} = MAX,	V_I = 2.7 V				20			20	μA
	$\overline{CLR}$						120			120	
	$\overline{PRE}$						60			60	
	CLK						160			160	
I_{IL}	J or K	V_{CC} = MAX,	V_I = 0.4 V				−0.4			−0.4	mA
	$\overline{CLR}$						−1.6			−1.6	
	$\overline{PRE}$						−0.8			−0.8	
	CLK						−1.6			−1.6	
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 $\overline{Q}$ 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: Load circuits and voltage waveforms are shown in Section 1.

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