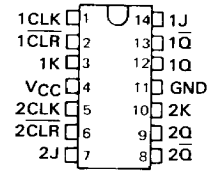
- **Package Options Include Plastic and Ceramic DIPs**
- **Dependable Texas Instruments Quality and Reliability**

SN5473, SN54H73, SN54LS73A . . . J OR W PACKAGE
SN54L73 . . . J PACKAGE
SN7473, SN74H73 . . . J OR N PACKAGE
SN74LS73A . . . D, J OR N PACKAGE
(TOP VIEW)



description

The '73, 'H73, and 'L73 contain two independent J-K flip-flops with individual J-K, clock, and direct clear inputs. The '73, 'H73, and 'L73 are positive pulse-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 'LS73A 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. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the $\overline{Q}$ output high.

The SN5473, SN54H73, SN54L73, and the SN54LS73A are characterized for operation over the full military temperature range of −55°C to 125°C. The SN7473, SN74H73, and the SN74LS73A are characterized for operation from 0°C to 70°C.

'73, 'H73, 'L73
FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{CLR}$	CLK	J	K	Q	$\overline{Q}$
L	X	X	X	L	H
H	⎍	L	L	Q_0	$\overline{Q}_0$
H	⎍	H	L	H	L
H	⎍	L	H	L	H
H	⎍	H	H	TOGGLE	

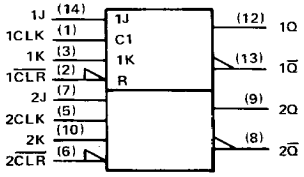
'LS73A
FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{CLR}$	CLK	J	K	Q	$\overline{Q}$
L	X	X	X	L	H
H	↓	L	L	Q_0	$\overline{Q}_0$
H	↓	H	L	H	L
H	↓	L	H	L	H
H	↓	H	H	TOGGLE	
H	H	X	X	Q_0	Q_0

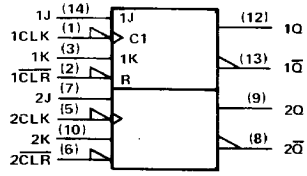
FOR CHIP CARRIER INFORMATION,
CONTACT THE FACTORY

logic symbols

'73, 'H73, 'L73



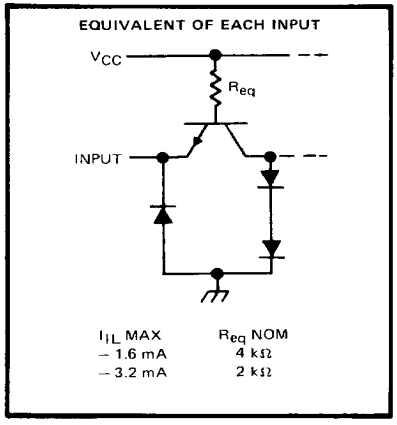
'LS73A

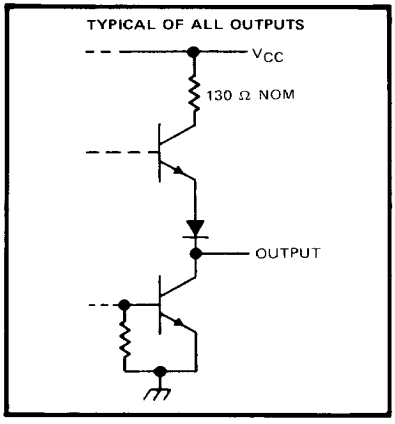


Pin numbers shown on logic notation are for D, J or N packages.

schematics of inputs and outputs

'73





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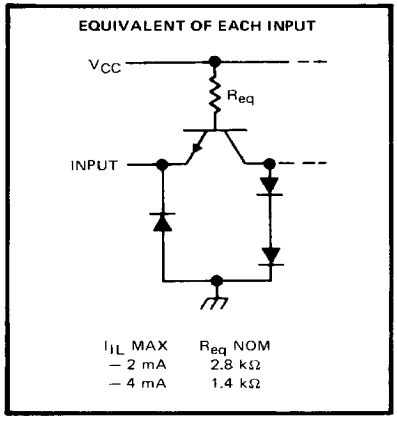

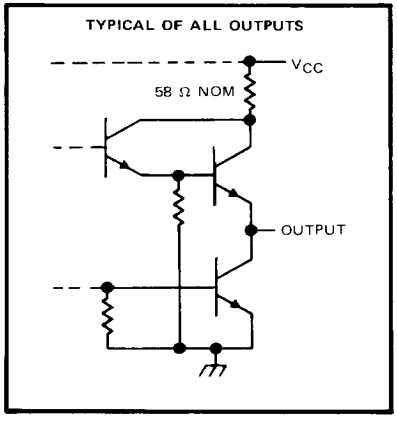

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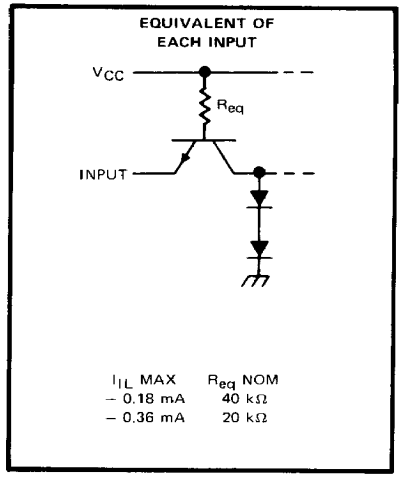
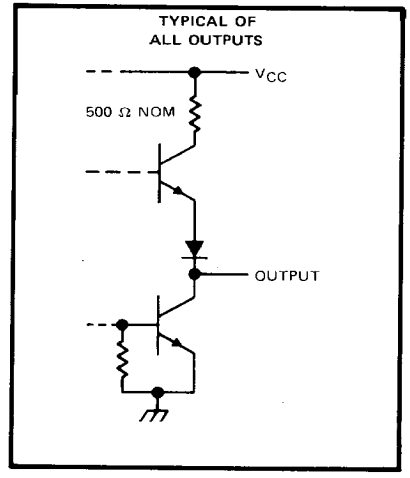
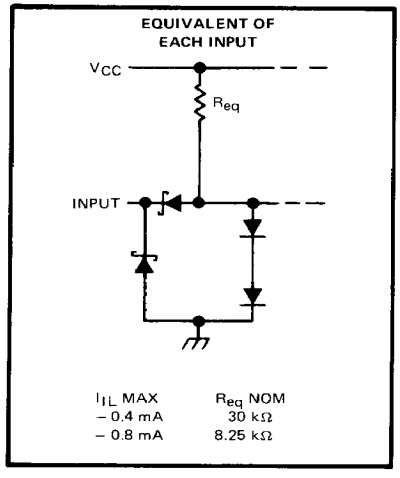
schematics of inputs and outputs (continued)

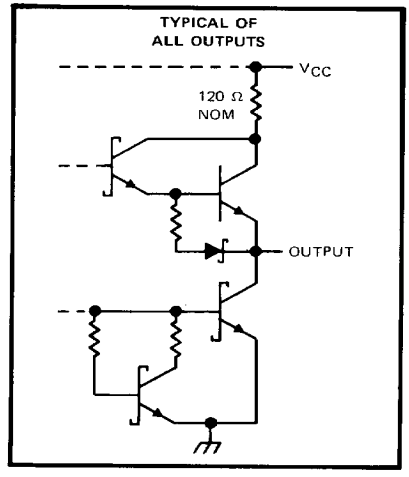
'L73





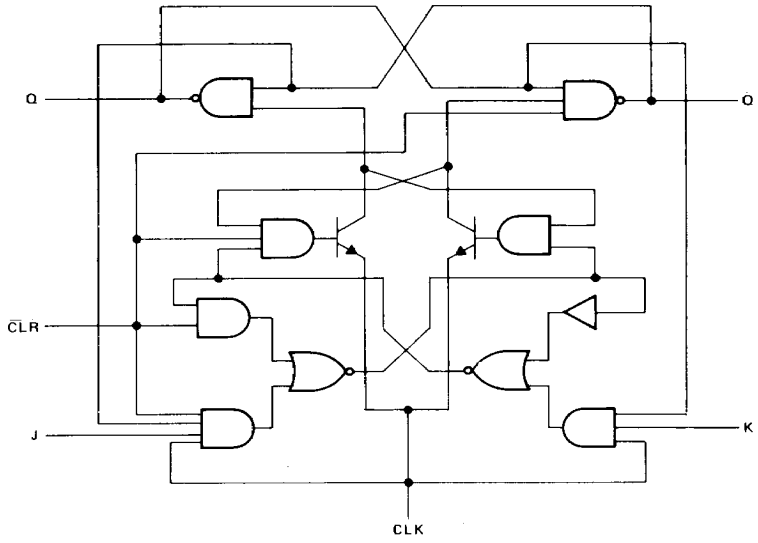
'LS73A



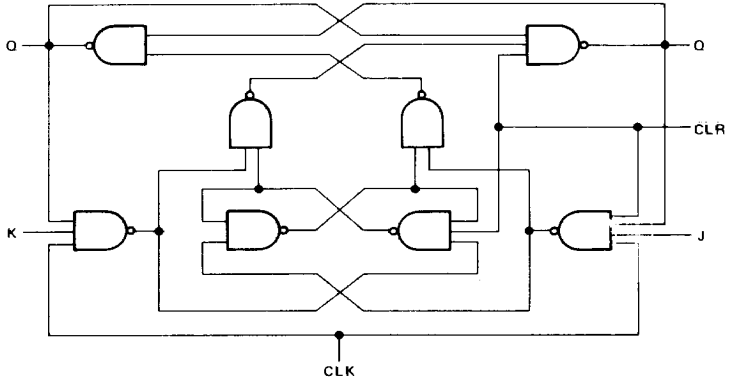


logic diagrams

'73



'H73



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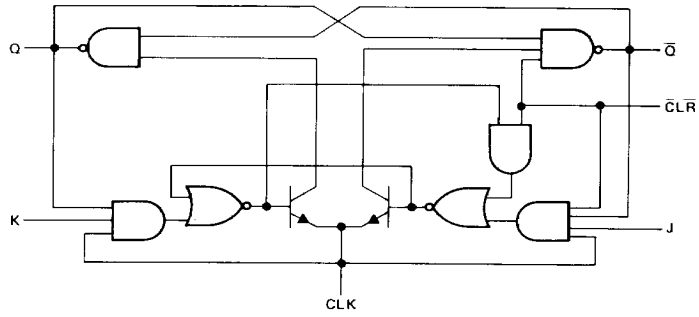
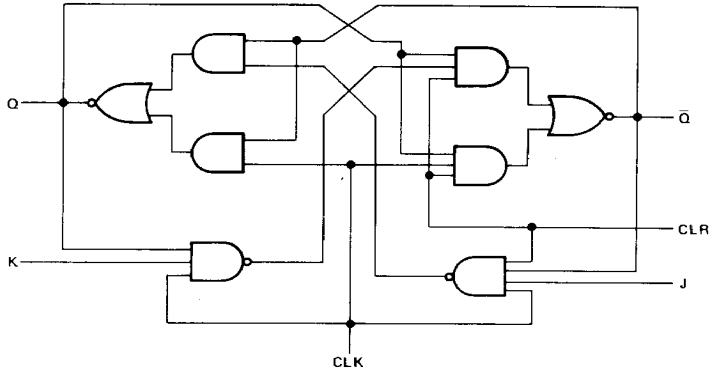
logic diagrams (continued)

'L73



'LS73A



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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage: '73, 'H73, 'L73 . . . . . 5.5 V
'LS73A . . . . . 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.

recommended operating conditions

			SN5473			SN7473			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			
		$\overline{CLR}$ 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†			SN5473			SN7473			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
	$\overline{CLR}$ or CLK						80			80	
I_{IL}	J or K	V_{CC} = MAX,	V_I = 0.4 V				−1.6			−1.6	mA
	$\overline{CLR}$						−3.2			−3.2	
	CLK						−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.
NOTE 2: With all outputs open, I_{CC} is measured with the Q and 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}	$\overline{CLR}$	$\overline{Q}$			16	25	ns
t_{PHL}		Q			25	40	ns
t_{PLH}	CLK	Q or $\overline{Q}$			16	25	ns
t_{PHL}					25	40	ns

¶ f_{max} = maximum clock frequency; t_{PLH} = propagation delay time, low-to-high-level output; t_{PHL} = propagation delay time, high-to-low-level output.
NOTE 3: See General Information Section for load circuits and voltage waveforms.

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recommended operating conditions

			SN54H73			SN74H73			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			
		$\overline{CLR}$ low	16			16			
t_{su}	Input setup time before CLK↑	High-level data	0			0			ns
		Low-level data	0			0			
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†			SN54H73			SN74H73			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
	$\overline{CLR}$						100			100	
I_{IL}	J, K, or CLK	V_{CC} = MAX,	V_I = 0.4 V				−2			−2	mA
	$\overline{CLR}$						−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.
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}	$\overline{CLR}$	$\overline{Q}$			6	13	ns
t_{PHL}		Q			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.

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		4.5	5	5.5	V
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage	Clock input			0.6	V
		All other inputs			0.7	
I_{OH}	High-level output current				−0.1	mA
I_{OL}	Low-level output current				2	mA
t_w	Pulse duration	CLK high or low	200			ns
		$\overline{CLR}$ low	100			
t_{su}	Setup time before CLK↑		0			ns
t_h	Hold time-data after CLK↓		0			ns
T_A	Operating free-air temperature		−55		125	°C

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

PARAMETER		TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
V_{OH}		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX, I_{OH} = −0.1 mA	2.4	3.3		V
V_{OL}		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX, I_{OL} = 2 mA		0.15	0.3	V
I_I	J or K	V_{CC} = MAX, V_I = 5.5 V			0.1	mA
	$\overline{CLR}$ or CLK				0.2	
I_{IH}	J or K	V_{CC} = MAX, V_I = 2.4 V			10	μA
	$\overline{CLR}$				20	
	CLK				−200	
I_{IL}	J or K	V_{CC} = MAX, V_I = 0.3 V			−0.18	mA
	$\overline{CLR}$ or CLK				−0.36	
I_{OS}		V_{CC} = MAX	−3		−15	mA
I_{CC}		V_{CC} = 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_{CC} = 5 V, T_A = 25°C.
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 = 4 kΩ, C_L = 50 pF	2.5	3		MHz
t_{PLH}	$\overline{CLR}$	Q or $\overline{Q}$			35	75	ns
t_{PHL}	$\overline{CLR}$ (CLK high)	$\overline{Q}$ or Q			60	150	ns
	$\overline{CLR}$ (CLK low)					200	
t_{PLH}	CLK	Q or $\overline{Q}$		10	35	75	ns
t_{PHL}				10	60	150	ns

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

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recommended operating conditions

			SN54LS73A			SN74LS73A			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				0.7			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
		$\overline{CLR}$ low	25			20			
t_{su}	Set up time-before CLK↓	data high or low	20			20			ns
		$\overline{CLR}$ 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†			SN54LS73A			SN74LS73A			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
	$\overline{CLR}$						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
	$\overline{CLR}$						60			60	
	CLK						80			80	
I_{IL}	J or K	V_{CC} = MAX,	V_I = 0.4 V				−0.4			−0.4	mA
	$\overline{CLR}$ or CLK						−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}	$\overline{CLR}$ 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.