

AC Electrical Characteristics $V_{CC}=5V$, $T_A=25^\circ C$, $C_L=15\text{ pF}$, $t_r=t_f=6\text{ ns}$

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency		50	30	MHz
t_{PHL} , t_{PLH}	Maximum Propagation Delay Clock to Q or \bar{Q}		16	21	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay Clear to Q or \bar{Q}		21	26	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay Preset to Q or \bar{Q}		23	28	ns
t_{REM}	Minimum Removal Time		10	20	ns
t_s	Minimum Setup Time J or K to Clock		14	20	ns
t_H	Minimum Hold Time J or K to Clock		-3	0	ns
t_W	Minimum Pulse Width Preset, Clear or Clock		10	16	ns

AC Electrical Characteristics $C_L=50\text{ pF}$, $t_r=t_f=6\text{ ns}$ (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A=25^\circ C$		74HC	54HC	Units
						$T_A=-40\text{ to }85^\circ C$	$T_A=-55\text{ to }125^\circ C$	
				Typ	Guaranteed Limits			
f_{MAX}	Maximum Operating Frequency		2.0V	9	5	4	3	MHz
			4.5V	45	27	21	18	MHz
			6.0V	53	31	24	20	MHz
t_{PHL} , t_{PLH}	Maximum Propagation Delay Clock to Q or \bar{Q}		2.0V	100	126	160	183	ns
			4.5V	20	25	31	37	ns
			6.0V	17	21	27	32	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay Clear to Q or \bar{Q}		2.0V	126	155	191	250	ns
			4.5V	25	31	39	47	ns
			6.0V	21	26	33	40	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Preset to Q or \bar{Q}		2.0V	137	165	210	240	ns
			4.5V	27	33	41	50	ns
			6.0V	23	28	35	40	ns
t_{REM}	Minimum Removal Time Preset or Clear to Clock		2.0V	55	100	125	150	ns
			4.5V	11	20	25	30	ns
			6.0V	9	17	21	25	ns
t_s	Minimum Setup Time J or K to Clock		2.0V	77	100	125	150	ns
			4.5V	15	20	25	30	ns
			6.0V	13	17	21	25	ns
t_H	Minimum Hold Time J or K from Clock		2.0V	-3	0	0	0	ns
			4.5V	-3	0	0	0	ns
			6.0V	-3	0	0	0	ns
t_W	Minimum, Pulse Width, Preset, Clear or Clock		2.0V	55	80	100	120	ns
			4.5V	11	16	20	24	ns
			6.0V	9	14	18	21	ns
t_{TLH} , t_{THL}	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns
			4.5V	8	15	19	22	ns
			6.0V	7	13	16	19	ns
t_r , t_f	Maximum Input Rise and Fall Time		2.0V		1000	1000	1000	ns
			4.5V		500	500	500	ns
			6.0V		400	400	400	ns
C_{PD}	Power Dissipation Capacitance (Note 5)	(per flip-flop)		80				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	-0.5 to +7.0V
DC Input Voltage (V_{IN})	-1.5 to $V_{CC} + 1.5V$
DC Output Voltage (V_{OUT})	-0.5 to $V_{CC} + 0.5V$
Clamp Diode Current (I_{IK}, I_{OK})	± 20 mA
DC Output Current, per pin (I_{OUT})	± 25 mA
DC V_{CC} or GND Current, per pin (I_{CC})	± 50 mA
Storage Temperature Range (T_{STG})	-65°C to +150°C
Power Dissipation (P_D)	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temp. (T_L) (Soldering 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temp. Range (T_A)			
MM74HC	-40	+85	°C
MM54HC	-55	+125	°C
Input Rise or Fall Times (t_r, t_f)			
$V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ C$		74HC $T_A = -40$ to $85^\circ C$		54HC $T_A = -55$ to $125^\circ C$		Units
				Typ	Guaranteed Limits					
V_{IH}	Minimum High Level Input Voltage		2.0V		1.5	1.5	1.5		V	
			4.5V		3.15	3.15	3.15	V		
			6.0V		4.2	4.2	4.2	V		
V_{IL}	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	V		
			4.5V		1.35	1.35	1.35	V		
			6.0V		1.8	1.8	1.8	V		
V_{OH}	Minimum High Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu A$	2.0V	2.0	1.9	1.9	1.9	V		
			4.5V	4.5	4.4	4.4	4.4	V		
			6.0V	6.0	5.9	5.9	5.9	V		
		$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ mA	4.5V	4.2	3.98	3.84	3.7	V		
			6.0V	5.7	5.48	5.34	5.2	V		
V_{OL}	Maximum Low Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu A$	2.0V	0	0.1	0.1	0.1	V		
			4.5V	0	0.1	0.1	0.1	V		
			6.0V	0	0.1	0.1	0.1	V		
		$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ mA	4.5V	0.2	0.26	0.33	0.4	V		
			6.0V	0.2	0.26	0.33	0.4	V		
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		± 0.1	± 1.0	± 1.0	μA		
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	6.0V		4.0	40	80	μA		

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C; ceramic "J" package: -12 mW/°C from 100°C to 125°C.

Note 4: For a power supply of $5V \pm 10\%$ the worst case output voltages (V_{OH} and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

** V_{IL} limits are currently tested at 20% of V_{CC} . The above V_{IL} specification (30% of V_{CC}) will be implemented no later than Q1, CY'89.

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AC Electrical Characteristics $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15 pF$, $t_r = t_f = 6 ns$

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency		50	30	MHz
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Clock to Q or \bar{Q}		16	21	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Preset to Q or \bar{Q}		23	28	ns
t_{REM}	Minimum Removal Time, Preset to Clock		10	20	ns
t_s	Minimum Setup Time, J or K to Clock		14	20	ns
t_H	Minimum Hold Time, J or K from Clock		-3	0	ns
t_W	Minimum Pulse Width, Preset, Clear or Clock		10	16	ns

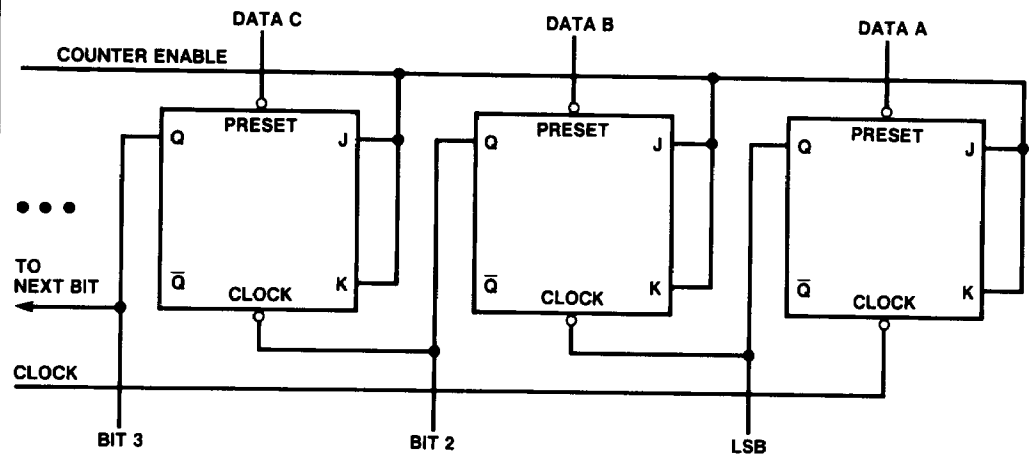
AC Electrical Characteristics $C_L = 50 pF$, $t_r = t_f = 6 ns$ (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ C$		$74HC$	$54HC$	Units
						$T_A = -40 to 85^\circ C$	$T_A = -55 to 125^\circ C$	
				Typ	Guaranteed Limits			
f_{MAX}	Maximum Operating Frequency		2.0V	9	5	4	3	MHz MHz MHz
			4.5V	45	27	21	18	
			6.0V	53	31	24	20	
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Clock to Q or \bar{Q}		2.0V	100	125	160	183	ns ns ns
			4.5V	20	25	32	37	
			6.0V	17	33	27	32	
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Preset to Q or \bar{Q}		2.0V	137	165	206	239	ns ns ns
			4.5V	27	33	41	47	
			6.0V	23	28	35	40	
t_{REM}	Minimum Removal Time Preset to Clock		2.0V	55	100	125	150	ns ns ns
			4.5V	11	20	25	30	
			6.0V	9	17	21	25	
t_s	Minimum Setup Time J or K to Clock		2.0V	77	100	125	150	ns ns ns
			4.5V	15	20	25	30	
			6.0V	13	17	21	25	
t_H	Minimum Hold Time J or K from Clock		2.0V	-3	0	0	0	ns ns ns
			4.5V	-3	0	0	0	
			6.0V	-3	0	0	0	
t_W	Minimum Pulse Width, Preset, Clear or Clock		2.0V	55	80	100	120	ns ns ns
			4.5V	11	16	20	24	
			6.0V	9	14	18	20	
t_{TLH} , t_{THL}	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns ns ns
			4.5V	8	15	19	22	
			6.0V	7	13	16	19	
t_r , t_f	Maximum Input Rise and Fall Time		2.0V		1000	1000	1000	ns ns ns
			4.5V		500	500	500	
			6.0V		400	400	400	
C_{PD}	Power Dissipation Capacitance (Note 5)	(per flip-flop)		80				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

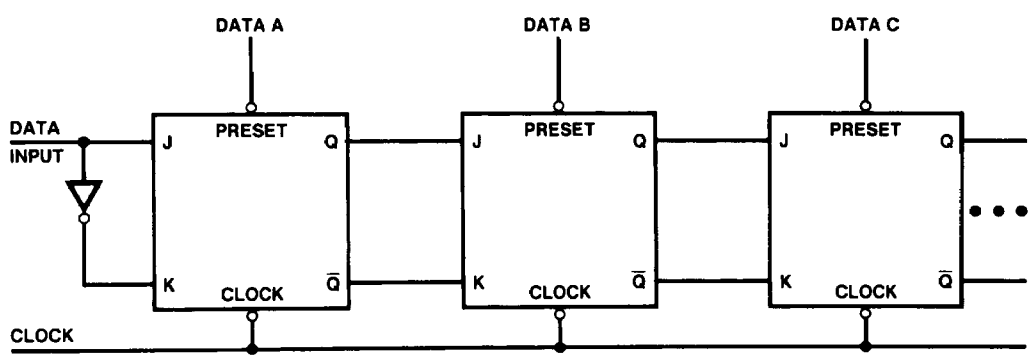
Typical Applications

N Bit Presettable Binary Ripple Counter with Enable



TL/F/5073-3

N Bit Parallel Load/Serial Load Shift Register



TL/F/5073-4