



# CD54/74HC4511 CD54/74HCT4511

**MAXIMUM RATINGS, Absolute-Maximum Values:**

DC SUPPLY-VOLTAGE, ( $V_{CC}$ ): (Voltages referenced to ground) .....	-0.5 to +7 V
DC INPUT DIODE CURRENT, $I_{IK}$ (FOR $V_i < -0.5$ V OR $V_i > V_{CC} + 0.5$ V) .....	$\pm 20$ mA
DC OUTPUT DIODE CURRENT, $I_{OK}$ (FOR $V_o < -0.5$ V OR $V_o > V_{CC} + 0.5$ V) .....	$\pm 20$ mA
DC DRAIN CURRENT, PER OUTPUT ( $I_o$ ) (FOR $-0.5$ V $< V_o < V_{CC} + 0.5$ V) .....	$\pm 25$ mA
DC $V_{CC}$ OR GROUND CURRENT ( $I_{CC}$ ) .....	$\pm 50$ mA
POWER DISSIPATION PER PACKAGE ( $P_D$ ):	
For $T_A = -40$ to $+60^\circ$ C (PACKAGE TYPE E) .....	500 mW
For $T_A = +60$ to $+85^\circ$ C (PACKAGE TYPE E) .....	Derate Linearly at 8 mW/ $^\circ$ C to 300 mW
For $T_A = -55$ to $+100^\circ$ C (PACKAGE TYPE F,H) .....	500 mW
For $T_A = +100$ to $+125^\circ$ C (PACKAGE TYPE F,H) .....	Derate Linearly at 8 mW/ $^\circ$ C to 300 mW
For $T_A = -40$ to $+70^\circ$ C (PACKAGE TYPE M) .....	400 mW
For $T_A = +70$ to $+125^\circ$ C (PACKAGE TYPE M) .....	Derate Linearly at 6 mW/ $^\circ$ C to 70 mW
OPERATING-TEMPERATURE RANGE ( $T_A$ ):	
PACKAGE TYPE F,H .....	$-55$ to $+125^\circ$ C
PACKAGE TYPE E,M .....	$-40$ to $+85^\circ$ C
STORAGE TEMPERATURE ( $T_{STG}$ ) .....	$-65$ to $+150^\circ$ C
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ in. ( $1.59 \pm 0.79$ mm) from case for 10 s max. ....	$+265^\circ$ C
Unit inserted into a PC Board (min. thickness $1/16$ in., 1.59 mm) with solder contacting lead tips only .....	$+300^\circ$ C

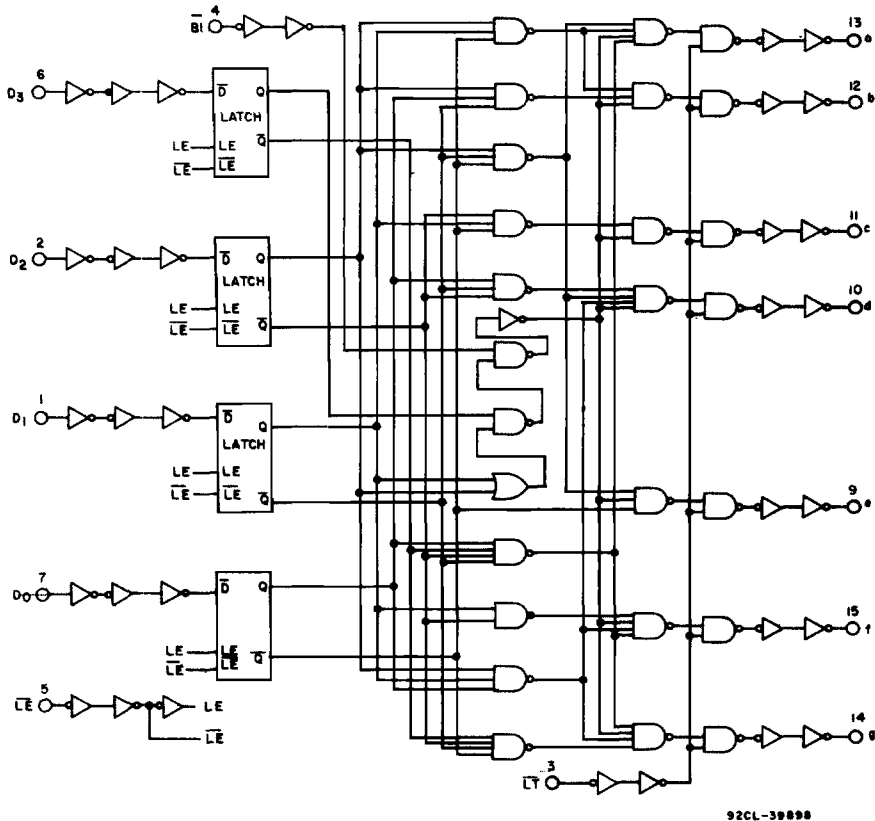


Fig. 1 - Logic diagram.

**CD54/74HC4511**  
**CD54/74HCT4511**

**STATIC ELECTRICAL CHARACTERISTICS**

CHARACTERISTIC	CD74HC4511/CD54HC4511										CD74HCT4511/CD54HCT4511								UNITS			
	TEST CONDITIONS			74HC/54HC TYPES			74HC TYPES		54HC TYPES		TEST CONDITIONS		74HCT/54HCT TYPES			74HCT TYPES		54HCT TYPES				
	V <sub>i</sub> V	I <sub>o</sub> mA	V <sub>cc</sub> V	+25° C			-40/ +85° C		-55/ +125° C		V <sub>i</sub> V	V <sub>cc</sub> V	+25° C			-40/ +85° C		-55/ +125° C				
				Min	Typ	Max	Min	Max	Min	Max			Min	Typ	Max	Min	Max	Min		Max		
High-Level Input Voltage	V <sub>IH</sub>		2	1.5	—	—	1.5	—	1.5	—	—	4.5	to	2	—	—	2	—	2	—	V	
			4.5	3.15	—	—	3.15	—	3.15	—												
			6	4.2	—	—	4.2	—	4.2	—												
Low-Level Input Voltage	V <sub>IL</sub>		2	—	—	0.5	—	0.5	—	0.5	—	4.5	to	—	—	0.8	—	0.8	—	0.8	—	V
			4.5	—	—	1.35	—	1.35	—	1.35	—											
			6	—	—	1.8	—	1.8	—	1.8	—											
High-Level Output Voltage	V <sub>OH</sub>	V <sub>IL</sub> or -0.02	2	1.9	—	—	1.9	—	1.9	—	V <sub>IL</sub> or 4.5	4.5	4.4	—	—	4.4	—	4.4	—	4.4	—	V
CMOS Loads			4.5	4.4	—	—	4.4	—	4.4	—												
TTL Loads			6	5.9	—	—	5.9	—	5.9	—	V <sub>IH</sub>											
Non-Standard Output		V <sub>IL</sub> or -7.5	4.5	3.98	—	—	3.84	—	3.7	—	V <sub>IL</sub> or 4.5	3.98	—	—	3.84	—	3.7	—	—	—	—	V
		V <sub>IH</sub> -10	6	5.48	—	—	5.34	—	5.2	—	V <sub>IH</sub>											
Low-Level Output Voltage	V <sub>OL</sub>	V <sub>IL</sub> or 0.02	2	—	—	0.1	—	0.1	—	0.1	V <sub>IL</sub> or 4.5	4.5	—	—	0.1	—	0.1	—	0.1	—	0.1	V
CMOS Loads			4.5	—	—	0.1	—	0.1	—	0.1												
			6	—	—	0.1	—	0.1	—	0.1	V <sub>IH</sub>											
TTL Loads		V <sub>IL</sub> or 4	4.5	—	—	0.26	—	0.33	—	0.4	V <sub>IL</sub> or 4.5	4.5	—	—	0.26	—	0.33	—	0.4	—	0.4	V
Standard Output		V <sub>IH</sub> 5.2	6	—	—	0.26	—	0.33	—	0.4	V <sub>IH</sub>											
Input Leakage Current	I <sub>i</sub>	V <sub>cc</sub> or Gnd	6	—	—	±0.1	—	±1	—	±1	Any Voltage Between V <sub>cc</sub> & Gnd	5.5	—	—	±0.1	—	±1	—	±1	—	±1	µA
Quiescent Device Current	I <sub>cc</sub>	V <sub>cc</sub> or Gnd	0	6	—	—	8	—	80	—	160	V <sub>cc</sub> or Gnd	5.5	—	—	8	—	80	—	160	—	µA
Additional Quiescent Device Current per input pin: 1 unit load	ΔI <sub>cc</sub> *										V <sub>cc</sub> -2.1	4.5 to 5.5	—	100	360	—	450	—	490	—	—	µA

\*For dual-supply systems theoretical worst case (V<sub>i</sub> = 2.4 V, V<sub>cc</sub> = 5.5 V) specification is 1.8 mA.

**HCT Input Loading Table**

Input	Unit Loads*
$\overline{LT}$ , $\overline{LE}$	1.5
$\overline{BI}$ , Dn	0.3

\*Unit Load is ΔI<sub>cc</sub> limit specified in Static Characteristics Chart, e.g., 360 µA max. @ 25° C.

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### RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range (For $T_A$ =Full Package Temperature Range) $V_{CC}$ .*			
CD54/74HC Types	2	6	V
CD54/74HCT Types	4.5	5.5	
DC Input or Output Voltage, $V_I$ , $V_O$	0	$V_{CC}$	V
Operating Temperature, $T_A$ :			
CD74 Types	-40	+85	°C
CD54 Types	-55	+125	
Input Rise and Fall Times, $t_r$ , $t_f$ :			
at 2 V	0	1000	ns
at 4.5 V	0	500	
at 6 V	0	400	

\*Unless otherwise specified, all voltages are referenced to Ground.

### SWITCHING CHARACTERISTICS ( $V_{CC}=5$ V, $T_A=25^\circ$ C, Input $t_r, t_f=6$ ns)

CHARACTERISTIC	$C_L$ (pF)	TYPICAL VALUES		UNITS	
		HC	HCT		
Propagation Delay:				ns	
$D_n$ to Output	$t_{PLH}$ $t_{PHL}$	15	25		
$\overline{LE}$ to Output	$t_{PLH}$ $t_{PHL}$	15	23		
$\overline{BI}$ to Output	$t_{PLH}$ $t_{PHL}$	15	18		
$\overline{LT}$ to Output	$t_{PLH}$ $t_{PHL}$	15	13		
Power Dissipation Capacitance*	$C_{PD}$	—	114	110	pF

\* $C_{PD}$  is used to determine the dynamic power consumption, per package.

$$P_D = C_{PD} V_{CC}^2 f_i + \sum C_L V_{CC}^2 f_o$$

where  $f_i$  = input frequency  
 $f_o$  = output frequency  
 $C_L$  = output load capacitance  
 $V_{CC}$  = supply voltage.

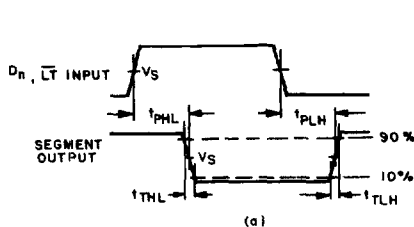
### PRE-REQUISITE FOR SWITCHING FUNCTION

CHARACTERISTIC	TEST CONDITIONS $V_{CC}$ (V)	LIMITS										UNITS		
		25°C				-40°C to +85°C				-55°C to +125°C				
		HC		HCT		74HC		74HCT		54HC			54HCT	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.			
Setup Time, $D_n$ to $\overline{LE}$	$t_{SU}$	2	—	—	—	75	—	—	—	90	—	—	ns	
		4.5	12	—	12	—	15	—	15	—	18	—		
		6	10	—	—	—	13	—	—	—	15	—		
Hold Time, $D_n$ to $\overline{LE}$	$t_{H1}$	2	3	—	—	—	3	—	—	3	—	—	ns	
		4.5	3	—	5	—	3	—	5	—	3	—		
		6	3	—	—	—	3	—	—	3	—	—		
Latch Enable Pulse Width,	$t_w$	2	80	—	—	—	100	—	—	—	120	—	MHz	
		4.5	16	—	16	—	20	—	20	—	24	—		
		6	14	—	—	—	17	—	—	—	20	—		

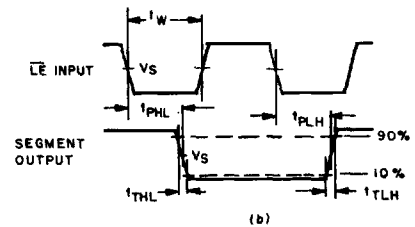
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SWITCHING CHARACTERISTICS (C<sub>L</sub>=50 pF, Input t<sub>r</sub>,t<sub>f</sub>=6 ns)

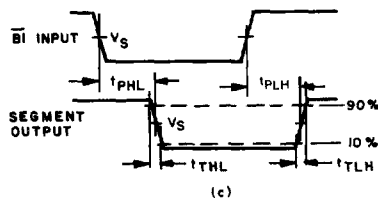
CHARACTERISTIC	V <sub>CC</sub>	LIMITS												UNITS	
		25° C				-40° C to +85° C				-55° C to +125° C					
		HC		HCT		74HC		74HCT		54HC		54HCT			
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
Propagation Delay, D <sub>n</sub> to Output	t <sub>PLH</sub>	2	—	300	—	—	—	375	—	—	—	450	—	—	ns
	t <sub>PHL</sub>	4.5	—	60	—	60	—	75	—	75	—	90	—	90	
		6	—	51	—	—	—	64	—	—	—	77	—	—	
$\overline{\text{LE}}$ to Output	t <sub>PLH</sub>	2	—	270	—	—	—	340	—	—	—	405	—	—	rs
	t <sub>PHL</sub>	4.5	—	54	—	54	—	68	—	68	—	81	—	81	
		6	—	46	—	—	—	58	—	—	—	69	—	—	
$\overline{\text{BI}}$ to Output	t <sub>PLH</sub>	2	—	220	—	—	—	275	—	—	—	330	—	—	ns
	t <sub>PHL</sub>	4.5	—	44	—	44	—	55	—	55	—	66	—	66	
		6	—	37	—	—	—	47	—	—	—	56	—	—	
$\overline{\text{LT}}$ to Output	t <sub>PLH</sub>	2	—	160	—	—	—	200	—	—	—	240	—	—	ns
	t <sub>PHL</sub>	4.5	—	32	—	33	—	40	—	41	—	48	—	50	
		6	—	27	—	—	—	34	—	—	—	41	—	—	
Transition Time	t <sub>THL</sub>	2	—	75	—	—	—	95	—	—	—	110	—	—	ns
	t <sub>TLH</sub>	4.5	—	15	—	15	—	19	—	19	—	22	—	22	
		6	—	13	—	—	—	16	—	—	—	19	—	—	
Input Capacitance	C <sub>i</sub>		—	10	—	10	—	10	—	10	—	10	—	10	pF



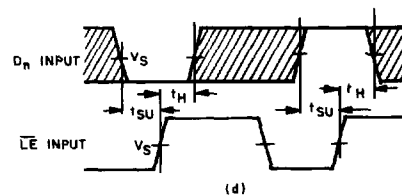
Input (D<sub>n</sub>,  $\overline{\text{LT}}$ ) to output propagation delays and output transition times



Input ( $\overline{\text{LE}}$ ) to output propagation delays and latch enable pulse width



Input ( $\overline{\text{BI}}$ ) to output propagation delays.



Note

The shaded areas indicate when the input is permitted to change for predictable output performance.

Waveforms showing the data set-up and hold times for D<sub>n</sub> input to  $\overline{\text{LE}}$  input.

	54/74HC	54/74HCT
Input Level	V <sub>CC</sub>	3 V
Switching Voltage, V <sub>s</sub>	50% V <sub>CC</sub>	1.3 V

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Fig. 2 - AC waveforms.