

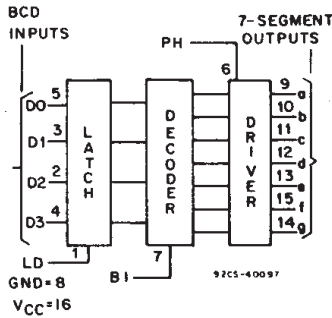
CD54/74HC4543 CD54/74HCT4543



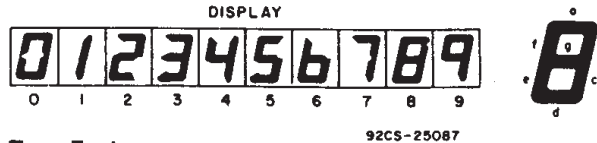
Data sheet acquired from Harris Semiconductor
SCHS281

High-Speed CMOS Logic

BCD-to-7 Segment Latch/ Decoder/Driver for LCDs



FUNCTIONAL DIAGRAM



Type Features:

- Input latches for BCD code storage
- Blanking capability
- Phase input for complementing outputs

The RCA CD54/74HC4543 and CD54/74HCT4543 high-speed silicon-gate devices are BCD-to-7 segment latch/decoder/drivers designed primarily for directly driving liquid-crystal displays. They have an active-high disable input (LD), an active high blanking input (BI) and a phase input (PH) to which a square wave is applied for liquid-crystal applications. This square wave is also applied to the backplane of the liquid-crystal display.

These devices can also be used, in conjunction with current amplifying devices, for driving LEDs, incandescent, fluorescent, and gas-discharge displays. For these applications the phase input provides a means for obtaining active-high or active-low segment outputs. (See Function Table.)

The CD54HC/HCT4543 are supplied in 16-lead ceramic dual-in-line frit-seal packages (F suffix). The CD74HC/HCT-4543 are supplied in 16-lead dual-in-line plastic packages (E suffix) and in 16-lead dual-in-line surface-mount plastic packages (M suffix). Both types are also available in chip form (H suffix).

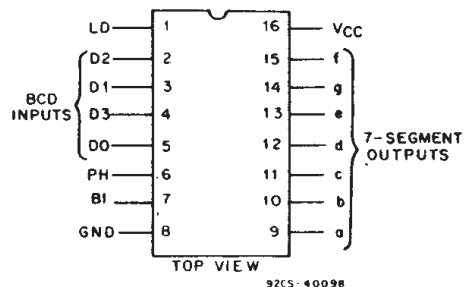
Family Features:

- Fanout (over temperature range):
Standard outputs - 10 LSTTL loads
Bus driver outputs - 15 LSTTL loads
- Wide operating temperature range:
CD74HC/HCT: -40 to +85°C
- Balanced propagation delay and transition times
- Significant power reduction compared to LSTTL logic ICs
- Alternate source is Philips/Signetics
- CD54HC/CD74HC types:
2 to 6 V operation
High noise immunity:
 $N_{IL}=30\%$, $N_{IH}=30\%$ of V_{CC} ; @ $V_{CC}=5 V$
- CD54HCT/CD74HCT types:
4.5 to 5.5 V operation
Direct LSTTL input logic compatibility
 $V_{IL}=0.8 V$ max., $V_{IH}=2 V$ min.
CMOS input compatibility
 $I_i \leq 1 \mu A$ @ V_{OL} , V_{OH}

FUNCTION TABLE

INPUTS								OUTPUTS							DISPLAY
LD	BI	PH	D3	D2	D1	D0		a	b	c	d	e	f	g	
X	H	L	X	X	X	X	L	L	L	L	L	L	L	L	Blank
H	L	L	L	L	L	L	H	H	H	H	H	H	H	H	0
H	L	L	L	L	L	H	L	H	H	L	L	L	L	L	1
H	L	L	L	L	H	L	H	H	L	H	H	L	L	L	2
H	L	L	L	L	H	H	H	H	H	H	L	L	L	H	3
H	L	L	L	H	L	L	L	H	H	L	L	L	H	H	4
H	L	L	L	H	L	H	H	L	H	H	L	L	H	H	5
H	L	L	L	H	H	L	H	L	H	H	H	H	H	H	6
H	L	L	L	H	H	H	H	H	H	L	L	L	L	L	7
H	L	L	H	L	L	L	H	H	H	H	H	H	H	H	8
H	L	L	H	L	L	H	H	H	H	L	L	L	L	L	9
H	L	L	H	L	H	L	L	L	L	L	L	L	L	L	Blank
H	L	L	H	L	H	H	L	L	L	L	L	L	L	L	Blank
H	L	L	H	L	L	L	L	L	L	L	L	L	L	L	Blank
H	L	L	H	L	L	L	L	L	L	L	L	L	L	L	Blank
H	L	L	H	L	L	L	L	L	L	L	L	L	L	L	Blank
H	L	L	H	L	L	L	L	L	L	L	L	L	L	L	Blank
H	L	L	H	L	L	L	L	L	L	L	L	L	L	L	Blank
L	L	L	X	X	X	X									...
as above	H		as above												as above

**Depends upon the BCD code previously applied when LD = High



TERMINAL ASSIGNMENT

This data sheet is applicable to the CD74HCT4543. The CD54HC4543 and CD54HCT4543 were not acquired from Harris Semiconductor. See SCHS217 for information on the CD74HCT4543.

CD54/74HC4543 CD54/74HCT4543

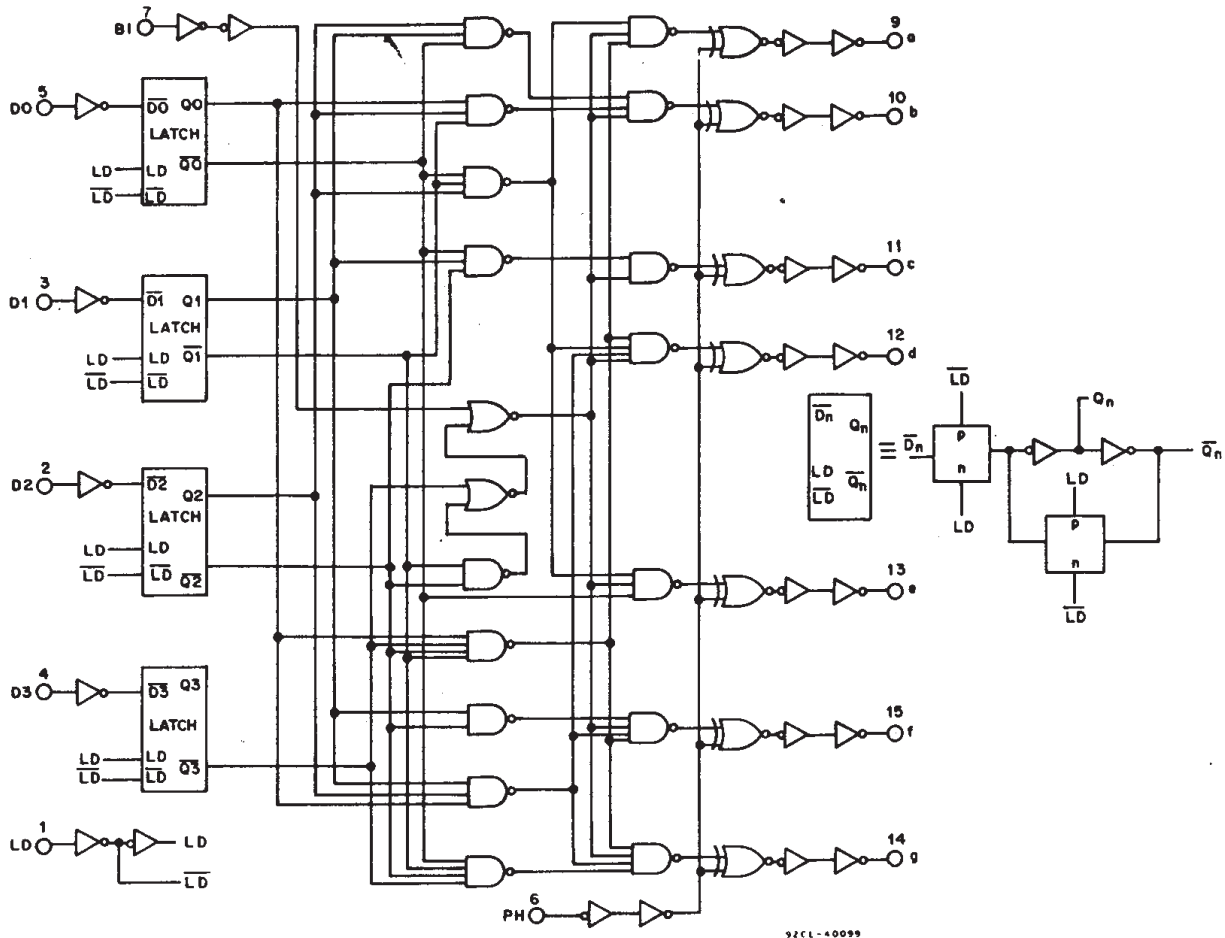


Fig. 1 - Logic diagram.

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) ± 20 mA
DC OUTPUT DIODE CURRENT, I_{OK} (FOR $V_o < -0.5$ V OR $V_o > V_{CC} + 0.5$ V) ± 20 mA
DC DRAIN CURRENT, PER OUTPUT (I_o) (FOR -0.5 V $< V_o < V_{CC} + 0.5$ V) ± 25 mA
DC V_{CC} OR GROUND CURRENT (I_{CC}) ± 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 ± 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

CD54/74HC4543

CD54/74HCT4543

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	15	28	33		
LD to Output	15	31	32		
BI to Output	15	22	27		
PH to Output	15	17	27		
Power Dissipation Capacitance*	—	52	54		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.	Min.	Max.	
Setup Time, D_n to LD	2	60	—	—	—	75	—	—	—	90	—	—	—	ns
	4.5	12	—	12	—	15	—	15	—	18	—	18	—	
	6	10	—	—	—	13	—	—	—	15	—	—	—	
Hold Time, D_n to LD	2	30	—	—	—	40	—	—	—	45	—	—	—	
	4.5	6	—	8	—	8	—	10	—	9	—	12	—	
	6	5	—	—	—	7	—	—	—	8	—	—	—	
Latch Disable Pulse Width,	2	50	—	—	—	65	—	—	—	75	—	—	—	
	4.5	10	—	10	—	13	—	13	—	15	—	15	—	
	6	9	—	—	—	11	—	—	—	13	—	—	—	

CD54/74HC4543 CD54/74HCT4543

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CD74HC4543/CD54HC4543										CD74HCT4543/CD54HCT4543										UNITS				
	TEST CONDITIONS			74HC/54HC TYPES			74HC TYPES			54HC TYPES			TEST CONDITIONS			74HCT/54HCT TYPES			74HCT TYPES			54HCT TYPES			
	V _I V	I _O mA	V _{CC} V	+25°C			-40/ +85°C			-55/ +125°C			V _I V	V _{CC} V	+25°C			-40/ +85°C				-55/ +125°C			
				Min	Typ	Max	Min	Max	Min	Max	Min	Max			Min	Max	Min	Max	Min	Max		Min	Max		
High-Level Input Voltage V _{IH}			2	1.5	—	—	1.5	—	1.5	—	—	—	4.5	to	2	—	—	2	—	2	—	—	V		
			4.5	3.15	—	—	3.15	—	3.15	—	—	—	5.5												
			6	4.2	—	—	4.2	—	4.2	—	—	—													
Low-Level Input Voltage V _{IL}			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	—	—	5.5												
			6	—	—	1.8	—	1.8	—	1.8	—	—													
High-Level Output Voltage V _{OH} CMOS Loads	V _{IL} or V _{IH}	-0.02	2	1.9	—	—	1.9	—	1.9	—	—	V _{IL} or V _{IH}	4.5	4.4	—	—	4.4	—	4.4	—	4.4	—	V		
			4.5	4.4	—	—	4.4	—	4.4	—	—														
			6	5.9	—	—	5.9	—	5.9	—	—														
TTL Loads Non-Standard Output	V _{IL} or V _{IH}	-1 -1.3	4.5	3.98	—	—	3.84	—	3.7	—	—	V _{IL} or V _{IH}	4.5	3.98	—	—	3.84	—	3.7	—	—	—	V		
Low-Level Output Voltage V _{OL} CMOS Loads	V _{IL} or V _{IH}	0.02	2	—	—	0.1	—	0.1	—	0.1	—	V _{IL} or V _{IH}	4.5	—	—	0.1	—	0.1	—	0.1	—	0.1	V		
			4.5	—	—	0.1	—	0.1	—	0.1	—														
			6	—	—	0.1	—	0.1	—	0.1	—														
TTL Loads Non-Standard Output	V _{IL} or V _{IH}	1 1.3	4.5	—	—	0.26	—	0.33	—	0.4	—	V _{IL} or V _{IH}	4.5	—	—	0.26	—	0.33	—	0.4	—	0.4	V		
Input Leakage Current I _I	V _{CC} or Gnd		6	—	—	±0.1	—	±1	—	±1	—	Any Voltage Between V _{CC} & Gnd	5.5	—	—	±0.1	—	±1	—	±1	—	±1	μA		
Quiescent Device Current I _{CC}	V _{CC} or Gnd	0	6	—	—	8	—	80	—	160	—	V _{CC} or Gnd	5.5	—	—	8	—	80	—	160	—	160	μA		
Additional Quiescent Device Current per input pin: 1 unit load ΔI _{CC} *												V _{CC} -2.1	4.5 to 5.5	—	100	360	—	450	—	490	—	490	μA		

*For dual-supply systems theoretical worst case (V_I = 2.4 V, V_{CC} = 5.5 V) specification is 1.8 mA.

HCT Input Loading Table

Input	Unit Loads*
D0, D1, D2	1
D3, BI	0.5
PH	1.25
LD	1.5

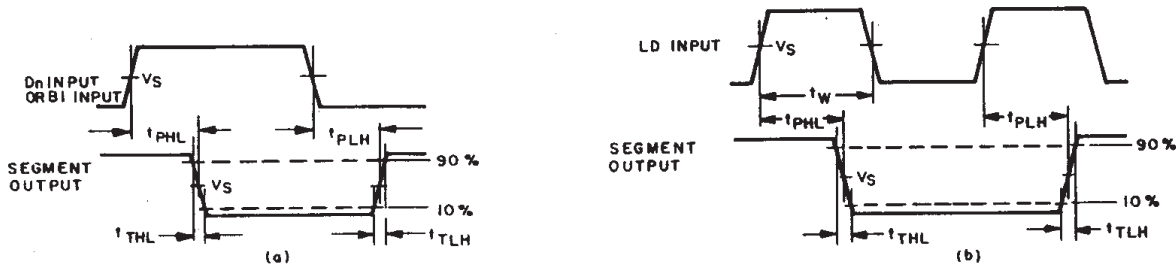
*Unit Load is ΔI_{CC} limit specified in Static Characteristics Chart, e.g., 360 μA max. @ 25°C.

CD54/74HC4543

CD54/74HCT4543

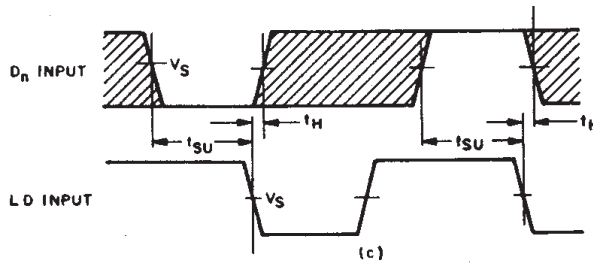
SWITCHING CHARACTERISTICS ($C_L=50$ pF, Input $t_r, t_f=8$ ns)

CHARACTERISTIC		V_{CC}	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_n to Output	t_{PLH}	2	—	340	—	—	—	425	—	—	—	510	—	—	ns
	t_{PHL}	4.5	—	68	—	80	—	85	—	100	—	102	—	120	
		6	—	58	—	—	—	72	—	—	—	87	—	—	
LD to Output	t_{PLH}	2	—	370	—	—	—	465	—	—	—	555	—	—	ns
	t_{PHL}	4.5	—	74	—	77	—	93	—	96	—	111	—	116	
		6	—	63	—	—	—	79	—	—	—	94	—	—	
BI to Output	t_{PLH}	2	—	265	—	—	—	330	—	—	—	400	—	—	ns
	t_{PHL}	4.5	—	53	—	66	—	66	—	83	—	80	—	99	
		6	—	45	—	—	—	56	—	—	—	68	—	—	
PH to Output	t_{PLH}	2	—	200	—	—	—	250	—	—	—	300	—	—	ns
	t_{PHL}	4.5	—	40	—	66	—	50	—	83	—	60	—	99	
		6	—	34	—	—	—	43	—	—	—	51	—	—	
Transition Time	t_{TLH}	2	—	250	—	—	—	315	—	—	—	375	—	—	ns
	t_{THL}	4.5	—	50	—	50	—	63	—	63	—	75	—	75	
		6	—	43	—	—	—	54	—	—	—	64	—	—	
Input Capacitance	C_i		—	10	—	10	—	10	—	10	—	10	—	10	pF



(a) WAVEFORMS SHOWING THE ADDRESS AND BLANKING (D_n , BI) TO OUTPUT PROPAGATION DELAYS AND THE OUTPUT TRANSITION TIMES.

(b) WAVEFORMS SHOWING THE LATCH DISABLE INPUT (LD) TO OUTPUT PROPAGATION DELAYS AND THE OUTPUT TRANSITION TIMES.



NOTE:
THE SHADED AREAS INDICATE WHEN THE INPUT IS PERMITTED TO CHANGE FOR PREDICTABLE OUTPUT PERFORMANCE.

(c) WAVEFORMS SHOWING THE ADDRESS (D_n) TO LATCH DISABLE (LD) INPUT SET-UP AND HOLD TIMES.

92CM-40103

	54/74HC	54/74HCT
Input Level	V_{CC}	3 V
Switching Voltage, V_S	50% V_{CC}	1.3 V

Fig. 2 - AC waveforms.

CD54/74HC4543 CD54/74HCT4543

APPLICATION CIRCUITS

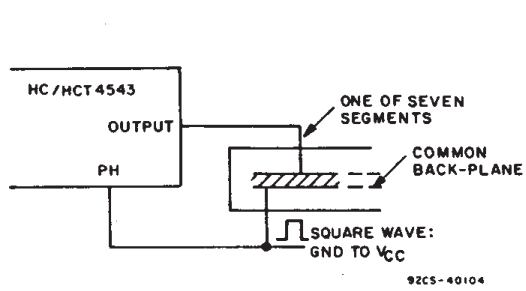


Fig. 3 - Connection to liquid-crystal (LCD) display readout.

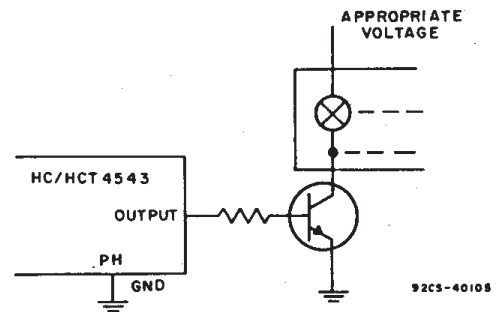


Fig. 4 - Connection to incandescent display readout.

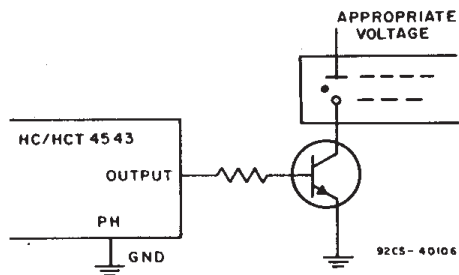


Fig. 5 - Connection to gas-discharge display readout.

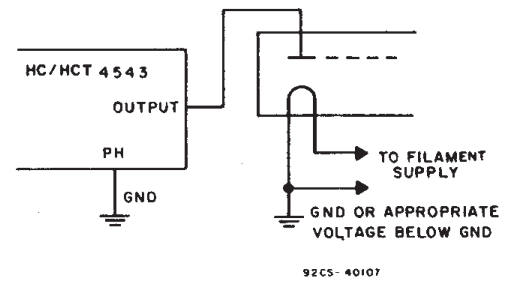


Fig. 6 - Connection to fluorescent display readout.

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