TC74HC4543AP/AF

BCD-to-7 Segment Latch/Decoder/LCD Driver

The TC74HC4543A is a high speed CMOS BCD-TO-7 SEGMENT DECODER fabricated with silicon gate C^2MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

This device consists of BCD-To-7 segment decoder with the BCD input latch and a 7-segment driver for the liquid crystal display (LCD).

When an error code (over 10) is applied to BCD inputs or, when blanking input (BI) is held high, all segment outputs will go low (turn off).

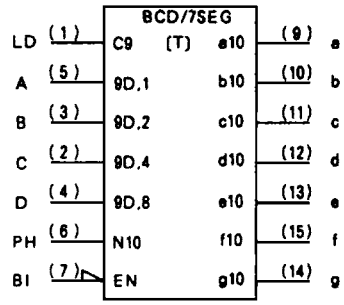
When driving LCD, a common square wave signal should be applied not only to the PH input of this device but also to the electrically common backplane of the display.

For other types of readouts, such as light emitting diodes (LED), some additional driver, such as a transistor array, is required.

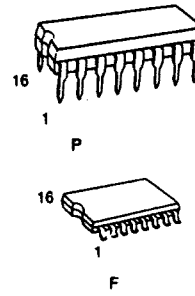
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

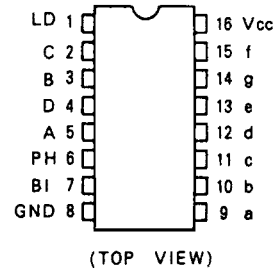
Features

- High Speed: t_w = 6ns(Typ.) at V_{CC} = 5V
- Low Power Dissipation: I_{CC} = 4μA(Max.) at Ta = 25°C
- High Noise Immunity: $V_{NIH} = V_{NIL}$ = 28%V_{CC}(Min.)
- Output Drive Capability: 10 LSTTL Loads
- Symmetrical Output Impedance: $|I_{OH}| = I_{OL}$ = 4mA(Min.)
- Balanced Propagation Delays: $t_{pLH} = t_{pHL}$
- Wide Operating Voltage Range: V_{CC}(opr) = 2V~6V
- Pin and Function Compatible with 4543B



IEC Logic Symbol





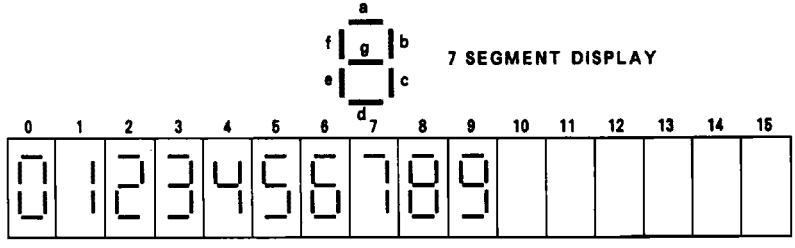
(TOP VIEW)

Pin Assignment

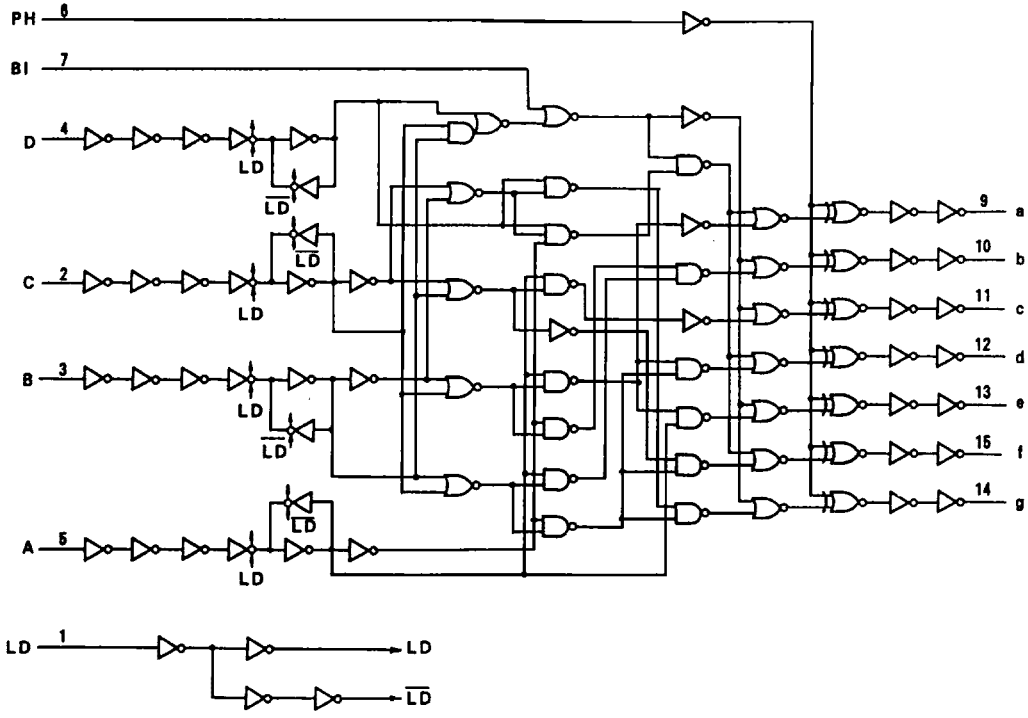
Truth Table

Inputs				Outputs	
LD	BI	PH	D C B A	a b c d e f g	
X	H	L	X X X X	L L L L L L L	Blank
H	L	L	L L L L	H H H H H H H	0
H	L	L	L L L H	L H H L L L L	1
H	L	L	L L H L	H H L H H L H	2
H	L	L	L L H H	H H H H L L H	3
H	L	L	L H L L	L H H L L H H	4
H	L	L	L H L H	H L H H L H H	5
H	L	L	L H H L	H L H H H H H	6
H	L	L	L H H H	H H H L L L L	7
H	L	L	H L L L	H H H H H H H	8
H	L	L	H L L H	H H H H L H H	9
H	L	L	H X H X	L L L L L L L	Blank
H	L	L	H H X X	L L L L L L L	Blank
L	L	L	X X X X	###	###
↑	↑	H	↑	Inverse of above output level	Display as above

X: Don't care
↑: Same as above combinations
###: Depends upon the BCD code previously applied when LD = H"



Display Mode



Logic Diagram

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage Range	V_{CC}	-0.5 ~ 7	V
DC Input Voltage	V_{IN}	-0.5 ~ V_{CC} + 0.5	V
DC Output Voltage	V_{OUT}	-0.5 ~ V_{CC} + 0.5	V
Input Diode Current	I_{IK}	±20	mA
Output Diode Current	I_{OK}	±20	mA
DC Output Current	I_{OUT}	±25	mA
DC V_{CC}/Ground Current	I_{CC}	±50	mA
Power Dissipation	P_D	500(DIP)*/180(MFP)	mW
Storage Temperature	T_{stg}	-65 ~ 150	°C
Lead Temperature 10sec	T_L	300	°C

*500mW in the range of Ta = -40°C ~ 65°C. From Ta = 65°C to 85°C a derating factor of -10mW/°C shall be applied until 300mW.

Recommended Operating Conditions

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	2 ~ 6	V
Input Voltage	V_{IN}	0 ~ V_{CC}	V
Output Voltage	V_{OUT}	0 ~ V_{CC}	V
Operating Temperature	T_{opr}	-40 ~ 85	°C
Input Rise and Fall Time	t_r, t_f	0 ~ 1000(V_{CC} = 2.0V) 0 ~ 500(V_{CC} = 4.5V) 0 ~ 400(V_{CC} = 6.0V)	ns

DC Electrical Characteristics

Parameter	Symbol	Test Condition		V_{CC}	Ta = 25°C Min.	Ta = 25°C Typ.	Ta = 25°C Max.	Ta = -40 ~ 85°C Min.	Ta = -40 ~ 85°C Max.	Unit
High-Level Input Voltage	V_{IH}	–		2.0 4.5 6.0	1.5 3.15 4.2	– – –	– – –	1.5 3.15 4.2	– – –	V
Low-Level Input Voltage	V_{IL}	–		2.0 4.5 6.0	– – –	– – –	0.5 1.35 1.8	– – –	0.5 1.35 1.8	V
High-Level Output Voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -20μA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	– – –	1.9 4.4 5.9	– – –	V
			I_{OH} = -4 mA I_{OH} = -5.2mA	4.5 6.0	4.18 5.68	4.31 5.80	– –	4.13 5.63	– –	
Low-Level Output Voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20μA	2.0 4.5 6.0	– – –	0.0 0.0 0.0	0.1 0.1 0.1	– – –	0.1 0.1 0.1	V
			I_{OL} = 4 mA I_{OL} = 5.2mA	4.5 6.0	– –	0.17 0.18	0.26 0.26	– –	0.33 0.33	
Input Leakage Current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	–	–	±0.1	–	±1.0	μA
Quiescent Supply Current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	–	–	4.0	–	40.0	

Timing Requirements (Input $t_r = t_f = 6ns$)

Parameter	Symbol	Test Condition		Ta = 25°C		Ta = -40 ~ 85°C	Unit
			V_{CC}	Typ.	Limit	Limit	
Minimum Pulse Width (CLOCK)	$t_{W(L)}$ $t_{W(H)}$	–	2.0	–	75	95	ns
			4.5	–	15	19	
			6.0	–	13	16	
Minimum Set-up Time	t_s	–	2.0	–	75	95	
			4.5	–	15	19	
			6.0	–	13	16	
Minimum Hold Time	t_h	–	2.0	–	0	0	
			4.5	–	0	0	
			6.0	–	0	0	

AC Electrical Characteristics ($C_L = 15pF$, $V_{CC} = 5V$, Ta = 25°C)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Output Transition Time	t_{TLH} t_{THL}	–	–	4	8	ns
Propagation Delay Time (BCD-OUT)	t_{pLH} t_{pHL}	–	–	32	53	
Propagation Delay Time (BI-OUT)	t_{pLH} t_{pHL}	–	–	18	30	
Propagation Delay Time (PH-OUT)	t_{pLH} t_{pHL}	–	–	13	22	
Propagation Delay Time (LD-OUT)	t_{pLH} t_{pHL}	–	–	28	46	

AC Electrical Characteristics ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

Parameter	Symbol	Test Condition		Ta = 25°C			Ta = -40 ~ 85°C		Unit
			V_{CC}	Min	Typ.	Max.	Min.	Max.	
Output Transition Time	t_{TLH} t_{THL}	–	2.0	–	30	75	–	95	ns
			4.5	–	8	15	–	19	
			6.0	–	7	13	–	16	
Propagation Delay Time (BCD-OUT)	t_{pLH} t_{pHL}	–	2.0	–	160	300	–	375	
			4.5	–	40	60	–	75	
			6.0	–	30	51	–	64	
Propagation Delay Time (BI-OUT)	t_{pLH} t_{pHL}	–	2.0	–	80	175	–	220	
			4.5	–	23	35	–	44	
			6.0	–	17	30	–	37	
Propagation Delay Time (PH-OUT)	t_{pLH} t_{pHL}	–	2.0	–	58	130	–	165	
			4.5	–	17	26	–	33	
			6.0	–	14	22	–	28	
Propagation Delay Time (LD-OUT)	t_{pLH} t_{pHL}	–	2.0	–	130	265	–	335	
			4.5	–	35	53	–	66	
			6.0	–	16	45	–	56	
Input Capacitance	C_{IN}	–		–	5	10	–	10	pF
Power Dissipation Capacitance	C_{PD}(1)	–		–	115	–	–	–	

Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:

$I_{CC(opr)} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$

Notes