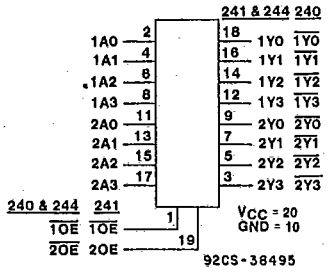
T-52-09-00

CD54/74HC240/241/244
CD54/74HCT240/241/244

File Number **1656**

High-Speed CMOS Logic



FUNCTIONAL DIAGRAM AND TERMINAL ASSIGNMENT

Octal Buffer/Line Drivers, 3-State

CD54/74HC/HCT240 Inverting
CD54/74HC/HCT241 Non-Inverting
CD54/74HC/HCT244 Non-Inverting

Type Features:

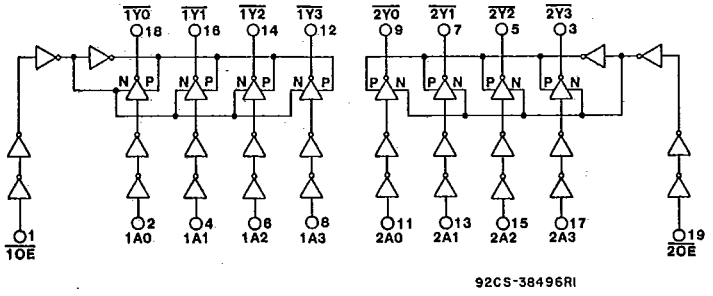
- *Typical propagation delay = 8 ns @ V_{CC}=5 V, C_L=15 pF, T_A=25° C for HC240*
- *3-State outputs*
- *Buffered inputs*
- *High-current bus driver outputs*

The RCA-CD54/74HC240 and CD54/74HCT240 are inverting 3-state buffers having two active-low output enables. The RCA CD54/74HC/HCT241 and CD54/74HC/HCT244 are non-inverting 3-state buffers that differ only in that the 241 has one active-high and one active-low output enable, and the 244 has two active-low output enables. All three types have identical pinouts.

The CD54HC240/241/244 and CD54HCT240/241/244 are supplied in 20-lead ceramic dual-in-line packages (F suffix). The CD74HC240/241/244 and CD74HCT240/241/244 are supplied in 20-lead dual-in-line plastic packages (E suffix) and in 20-lead dual-in-line surface mount plastic packages (M suffix). The CD54/74HC/HCT240/241/244 are also supplied.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
- *CD 54HCT/CD74HCT Types:*
  4.5 to 5.5 V Operation
  Direct LSTTL Input Logic Compatibility
  V_{IL}=0.8 V Mas., V_{IH}=2 V Min.
  CMOS Input Compatibility
  $I_I \leq 1\ \mu A$ @ V_{OL}, V_{OH}



TRUTH TABLE

INPUTS		OUTPUT
$\overline{1OE}$,$\overline{2OE}$	A	$\overline{Y}$
L	L	H
L	H	L
H	X	Z

(HC/HCT240)

Fig. 1 - CD54/74HC/HCT240 logic diagram.

CD54/74HC240/241/244
CD54/74HCT240/241/244

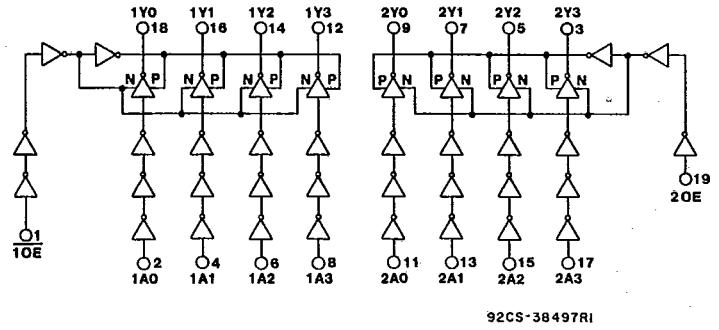


Fig. 2 - CD54/74HC/HCT241 logic diagram.

TRUTH TABLE

INPUTS		OUTPUT	INPUTS		OUTPUT
$\overline{1OE}$	1A	1Y	2OE	2A	2Y
L	L	L	L	X	Z
L	H	H	H	L	L
H	X	Z	H	H	H

H=HIGH Voltage Level
L=LOW Voltage Level
X=Immaterial
Z=HIGH Impedance

(HCT/HCT241)

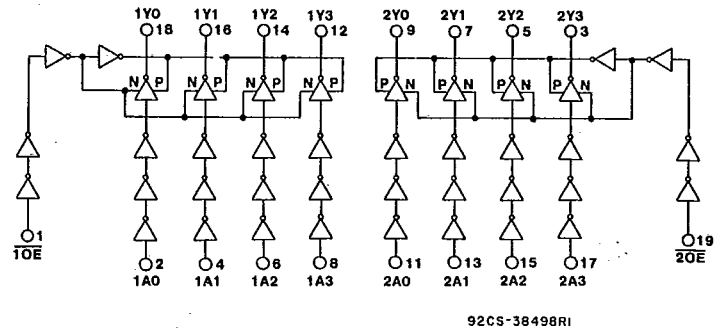


Fig. 3 - CD54/74HC/HCT244 logic diagram.

TRUTH TABLE

INPUTS		OUTPUT
$\overline{1OE}$, $\overline{2OE}$	A	Y
L	L	L
L	H	H
H	X	Z

(HC/HCT244)

CD54/74HC240/241/244
CD54/74HCT240/241/244

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) ..... ±35 mA
DC V_{CC} OR GROUND CURRENT, (I_{CC}) ..... ±70 mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -40 to +60°C (PACKAGE TYPE E) ..... 500 mW
For T_A = +60 to +85°C (PACKAGE TYPE E) ..... Derate Linearly at 8 mW/°C to 300 mW
For T_A = -55 to +100°C (PACKAGE TYPE F, H) ..... 500 mW
For T_A = +100 to +125°C (PACKAGE TYPE F, H) ..... Derate Linearly at 8 mW/°C to 300 mW
For T_A = -40 to +70°C (PACKAGE TYPE M) ..... 400 mW
For T_A = +70 to +125°C (PACKAGE TYPE M) ..... Derate Linearly at 6 mW/°C to 70 mW
OPERATING-TEMPERATURE RANGE (T_A):
PACKAGE TYPE F, H ..... -55 to +125°C
PACKAGE TYPE E, M ..... -40 to +85°C
STORAGE TEMPERATURE (T_{stg}) ..... -65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s max. ..... +265°C
Unit inserted into a PC Board (min. thickness 1/16 in., 1.59 mm)
with solder contacting lead tips only ..... +300°C

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.

CD54/74HC240/241/244
CD54/74HCT240/241/244

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CD74HC240/241/244, CD54HC240/241/244										CD74HCT240/241/244, CD54HCT240/241/244									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	Typ	Max	Min	Max	Min	Max	
High-Level Input Voltage V_{IH}			2	1.5	—	—	1.5	—	1.5	—	—	4.5 to 5.5	2	—	—	2	—	2	—	V
			4.5	3.15	—	—	3.15	—	3.15	—										
			6	4.2	—	—	4.2	—	4.2	—										
Low-Level Input Voltage V_{IL}			2	—	—	0.5	—	0.5	—	0.5	—	4.5 to 5.5	—	—	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_{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	—	V
			4.5	4.4	—	—	4.4	—	4.4	—										
			6	5.9	—	—	5.9	—	5.9	—										
TTL Loads (Bus Driver)	V_{IL} or V_{IH}	-6	4.5	3.98	—	—	3.84	—	3.7	—	V_{IL} or V_{IH}	4.5	3.98	—	—	3.84	—	3.7	—	V
		-7.8	6	5.48	—	—	5.34	—	5.2	—										
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	V
			4.5	—	—	0.1	—	0.1	—	0.1										
			6	—	—	0.1	—	0.1	—	0.1										
TTL Loads (Bus Driver)	V_{IL} or V_{IH}	6	4.5	—	—	0.26	—	0.33	—	0.4	V_{IL} or V_{IH}	4.5	—	—	0.26	—	0.33	—	0.4	V
		7.8	6	—	—	0.26	—	0.33	—	0.4										
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	μA
Quiescent Device Current I_{CC}	V_{CC} or Gnd	0	6	—	—	8	—	80	—	160	V_{CC} or Gnd	5.5	—	—	8	—	80	—	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	μA
3-state leakage current I_{OZ}	V_{IL} or V_{IH}	V_O=V_{CC} or Gnd	6	—	—	±0.5	—	±5	—	±10	V_{IL} or V_{IH}	5.5	—	—	±0.5	—	±5	—	±10	μA

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

CD54/74HC240/241/244
CD54/74HCT240/241/244

HCT Input Loading Tables

CD54/74HCT240	
Input	Unit Loads*
nA0-A3	1.5
$\overline{1OE}$	0.7
$\overline{2OE}$	0.7

CD54/74HCT241	
Input	Unit Loads*
nA0-A3	0.7
$\overline{1OE}$	0.7
2OE	1.5

CD54/74HCT244	
Input	Unit Loads*
nA0-A3	0.7
$\overline{1OE}$	0.7
$\overline{2OE}$	0.7

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

SWITCHING CHARACTERISTICS (V_{CC}=5 V, T_A=25° C, Input t_r, t_f=6 ns)

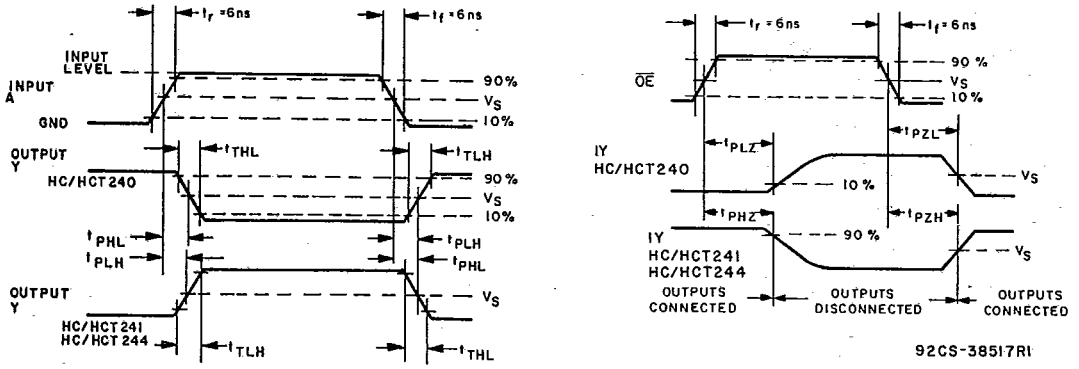
CHARACTERISTIC	SYMBOL	C_L	Typical Values						UNITS
			240		241		244		
		pF	HC	HCT	HC	HCT	HC	HCT	
Propagation Delay Data to Output	t_{PHL} t_{PLH}	15	8	9	9	10	9	10	ns
Output Disable/Enable to Outputs	t_{PZH}, t_{PZL}, t_{PHZ}, t_{PLZ}	15	12	12	12	12	12	12	ns
Power Dissipation Capacitance	C_{PD}*	—	38	40	34	38	46	40	pF

C_{PD} is used to determine the dynamic power consumption per channel.
$P_D=V_{CC}^2 f_i (C_{PD} + C_L)$
f_i=input frequency.
C_L = output load capacitance.
V_{CC} = supply voltage.

SWITCHING CHARACTERISTICS (C_L=50 pF, Input t_r, t_f=6 ns)

CHARACTERISTIC	SYMBOL	V_{CC}	25°C				-40°C to +85°C				-55°C to +125°C				UNITS
			HC		HCT		74HC		74HCT		54HC		54HCT		
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Propagation Delay, Data to Outputs HC/HCT 240	t_{PLH}	2	—	100	—	—	—	125	—	—	—	150	—	—	ns
	t_{PHL}	4.5	—	20	—	22	—	25	—	28	—	30	—	33	
		6	—	17	—	—	—	21	—	—	—	26	—	—	
Data to Outputs HC/HCT241	t_{PLH}	2	—	110	—	—	—	140	—	—	—	165	—	—	ns
	t_{PHL}	4.5	—	22	—	25	—	28	—	31	—	33	—	38	
		6	—	19	—	—	—	24	—	—	—	28	—	—	
Data to Outputs HC/HCT 244	t_{PLH}	2	—	110	—	—	—	140	—	—	—	165	—	—	ns
	t_{PHL}	4.5	—	22	—	25	—	28	—	31	—	33	—	38	
		6	—	19	—	—	—	24	—	—	—	28	—	—	
Output Enable and Disable Times	t_{PZH}	2	—	150	—	—	—	190	—	—	—	225	—	—	ns
	t_{PZL}	4.5	—	30	—	30	—	38	—	38	—	45	—	45	
	t_{PHZ}	6	—	26	—	—	—	33	—	—	—	38	—	—	
	t_{PLZ}														
Output Transition Time		2	—	60	—	—	—	75	—	—	—	90	—	—	ns
	t_{TLH}	4.5	—	12	—	12	—	15	—	15	—	18	—	18	
	t_{THL}	6	—	10	—	—	—	13	—	—	—	15	—	—	
Input Capacitance	C_I		—	10	—	10	—	10	—	10	—	10	—	10	pF
3-State Output Capacitance	C_O		—	20	—	20	—	20	—	20	—	20	—	20	pF

CD54/74HC240/241/244
CD54/74HCT240/241/244



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

Fig. 2 - Transition times and propagation delay times.

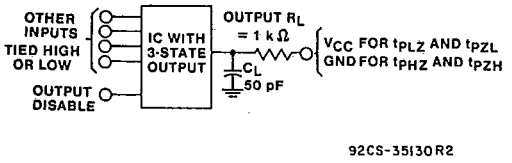


Fig. 4 - Three-state propagation delay test circuit.