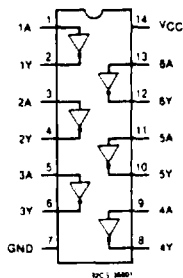


High-Speed CMOS Logic



FUNCTIONAL DIAGRAM AND TERMINAL ASSIGNMENT

Hex Inverter

Type Features:

- Typical propagation delay=6 ns @ $V_{CC}=5\text{ V}$
 $C_L=15\text{ pF}$, $T_A=25^\circ\text{ C}$, fastest part in QMOS line
- Wide operating temperature range:
CD74HCU04: -40° C to $+85^\circ\text{ C}$
- Balanced Propagation Delay and Transition Times
- Significant power reduction compared to LSTTL logic ICs
- Alternate source is Philips/Signetics

The RCA-CD54/74HCU04 unbuffered hex inverter utilizes silicon-gate CMOS technology to achieve operating speeds similar to LSTTL gates with the low power consumption of standard CMOS integrated circuits. These devices are especially useful in crystal oscillator and analog applications. Figs. 4 and 5 are supplied as design information for the above applications.

The CD54HCU04 is supplied in 14-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HCU04 is supplied in 14-lead dual-in-line plastic packages (E suffix). The CD74HCU04 is supplied in 14-lead dual-in-line surface mount plastic packages (M suffix). These types are also available in chip form (H suffix).

- CD54HCU04/CD74HCU04 types:
2 to 6 V operation
High noise immunity: $N_{IL}=20\%$,
 $N_{IH}=30\%$ of V_{CC} ; @ $V_{CC}=5\text{ V}$
- CMOS input compatibility
 $I_i \leq 1\text{ }\mu\text{A}$ @ V_{OL} , V_{OH}

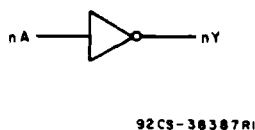


Fig. 1 - Logic diagram.

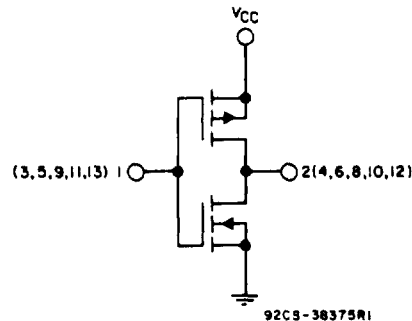


Fig. 2 - Inverter schematic.

CHRIS 142x

CD54/74HCU04

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

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} *	2	6	V
DC Input or Output Voltage, V_i, V_o	0	V_{CC}	V
Operating Temperature, T_A :			
CD74 Types	-40	+85	$^\circ$ 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.

CD54/74HCU04

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS			CD54HCU04 CD74HCU04		CD74HCU04		CD54HCU04		UNITS
	V _I V	I _O mA	V _{CC} V	+25°C		-40°C to +85°C		-55°C to +125°C		
				Min.	Max.	Min.	Max.	Min.	Max.	
High-Level Input Voltage V _{IH}	—	—	2	1.7	—	1.7	—	1.7	—	V
	—	—	4.5	3.6	—	3.6	—	3.6	—	
	—	—	6	4.8	—	4.8	—	4.8	—	
Low-Level Input Voltage V _{IL}	—	—	2	—	0.3	—	0.3	—	0.3	
	—	—	4.5	—	0.8	—	0.8	—	0.8	
	—	—	6	—	1.1	—	1.1	—	1.1	
High-Level Output Voltage V _{OH}	V _{IL} or V _{IH}	-0.02	2	1.8	—	1.8	—	1.8	—	
			4.5	4	—	4	—	4	—	
			6	5.5	—	5.5	—	5.5	—	
	V _{CC} or Gnd	-4	4.5	3.98	—	3.84	—	3.7	—	
Low-Level Output Voltage V _{OL}	V _{IL} or V _{IH}	0.02	2	—	0.2	—	0.2	—	0.2	
			4.5	—	0.5	—	0.5	—	0.5	
			6	—	0.5	—	0.5	—	0.5	
	V _{CC} or Gnd	4	4.5	—	0.26	—	0.33	—	0.4	
Input Leakage Current I _I	V _{CC} or Gnd	—	6	—	±0.1	—	±1	—	±1	μA
			—	—	—	—	—	—	—	
Quiescent Device Current I _{CC}	V _{CC} or Gnd	0	6	—	2	—	20	—	40	

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

CHARACTERISTIC	SYMBOL	TYPICAL VALUES	UNITS
		CD54/74U04	
Propagation Delay, Data Input to Output Y (Fig. 3) (C _L =15 pF)	t _{PLH} t _{PHL}	5	ns
Power Dissipation Capacitance*	C _{PD}	14	pF

*C_{PD} is used to determine the dynamic power consumption, per inverter when:

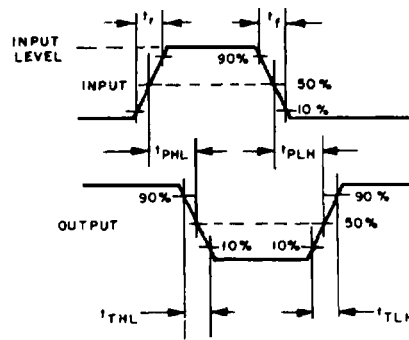
$$P_D = V_{CC}^2 f_i (C_{PD} + C_L)$$

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
			CD54/74HCU04		CD74HCU04		CD54HCU04		
			Min.	Max.	Min.	Max.	Min.	Max.	
Propagation Delay Input to Output (See Fig. 3)	t _{PLH}	2	—	70	—	90	—	105	ns
	t _{PHL}	4.5	—	14	—	18	—	21	
		6	—	12	—	15	—	18	
Transition Times (Fig. 3)	t _{TLH}	2	—	75	—	95	—	110	
	t _{THL}	4.5	—	15	—	19	—	22	
		6	—	13	—	16	—	19	
Input Capacitance	C _I	—	See Fig. 5						



92CS-38377

Fig. 3 - Propagation delay and transition times.

**DESIGN INFORMATION FOR CRYSTAL OSCILLATOR
 AND ANALOG APPLICATIONS**

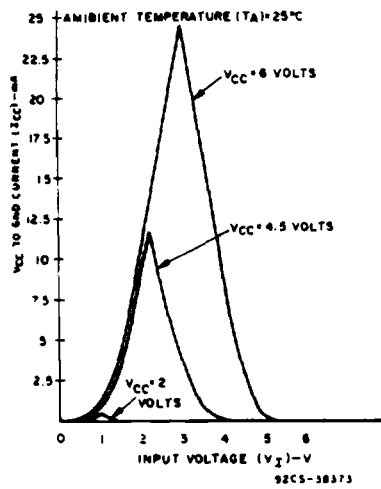


Fig. 4 - Typical inverter supply current as a function of input voltage.

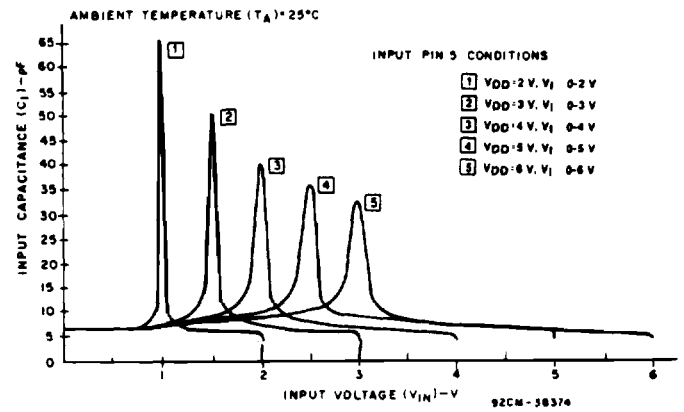


Fig. 5 - Input capacitance as a function of input voltage.