

DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

74HCU04 Hex inverter

Product specification
File under Integrated Circuits, IC06

September 1993

Hex inverter

74HCU04

FEATURES

- Output capability: standard
- I_{CC} category: SSI

GENERAL DESCRIPTION

The 74HCU04 is a high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard no. 7A.

The 74HCU04 is a general purpose hex inverter. Each of the six inverters is a single stage

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C; t_r = t_f = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
t _{PHL} / t _{PLH}	propagation delay nA to nY	C _L = 15 pF; V _{CC} = 5 V	5	ns
C _I	input capacitance		3.5	pF
C _{PD}	power dissipation capacitance per inverter	note 1	10	pF

Note

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f_i = input frequency in MHz

f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = supply voltage in V

∑ (C_L × V_{CC}² × f_o) = sum of outputs

ORDERING INFORMATION

See "74HC/HCT/HCU/HCMOS Logic Package Information".

FUNCTION TABLE

INPUT	OUTPUT
nA	nY
L	H
H	L

Note

1. H = HIGH voltage level
L = LOW voltage level

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PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 3, 5, 9, 11, 13	1A to 6A	data inputs
2, 4, 6, 8, 10, 12	1Y to 6Y	data outputs
7	GND	ground (0 V)
14	V _{CC}	positive supply voltage

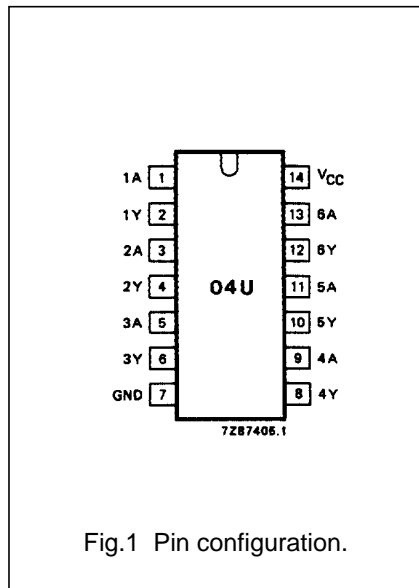


Fig.1 Pin configuration.

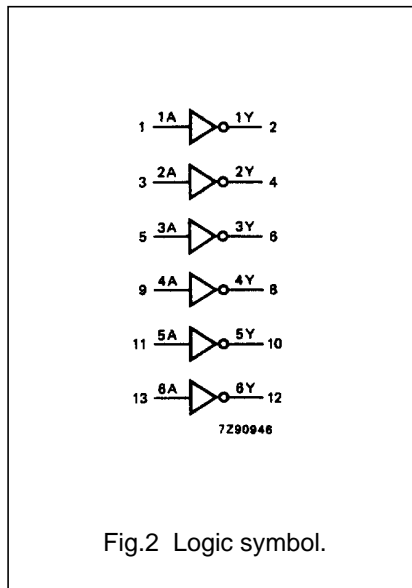


Fig.2 Logic symbol.

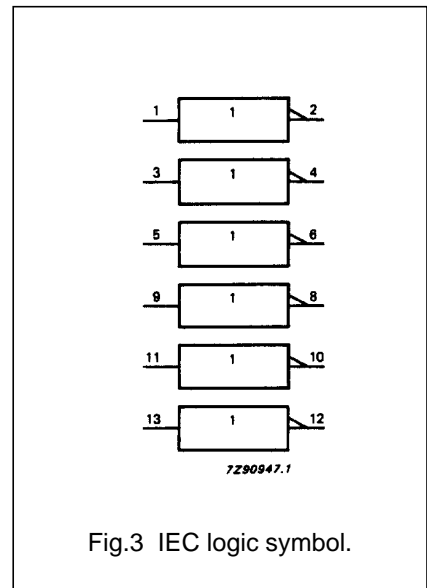


Fig.3 IEC logic symbol.

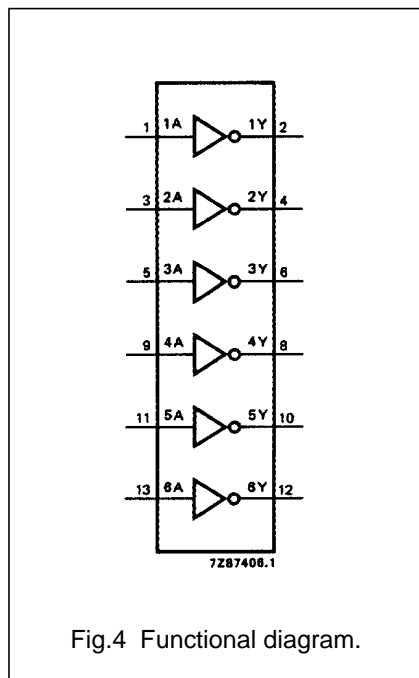


Fig.4 Functional diagram.

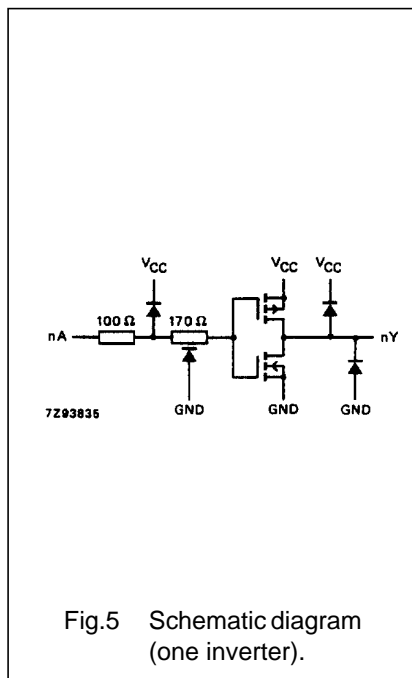


Fig.5 Schematic diagram (one inverter).

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DC CHARACTERISTICS FOR 74HCU

Voltages are referenced to GND (ground = 0 V)

SYMBOL	PARAMETER	$T_{amb}(^{\circ}C)$							UNIT	TEST CONDITIONS		
		74HCU								V_{CC} (V)	V_I	OTHER
		+25			-40 to +85		-40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
V_{IH}	HIGH level input voltage	1.7 3.6 4.8	1.4 2.6 3.4		1.7 3.6 4.8		1.7 3.6 4.8		V	2.0 4.5 6.0		
V_{IL}	LOW level input voltage		0.6 1.9 2.6	0.3 0.9 1.2		0.3 0.9 1.2		0.3 0.9 1.2	V	2.0 4.5 6.0		
V_{OH}	HIGH level output voltage	1.8 4.0 5.5	2.0 4.5 6.0		1.8 4.0 5.5		1.8 4.0 5.5		V	2.0 4.5 6.0	V_{IH} or V_{IL}	$-I_O = 20 \mu A$ $-I_O = 20 \mu A$ $-I_O = 20 \mu A$
V_{OH}	HIGH level output voltage	3.98 5.48	4.32 5.81		3.84 5.34		3.7 5.2		V	4.5 6.0	V_{CC} or GND	$-I_O = 4.0 mA$ $-I_O = 5.2 mA$
V_{OL}	LOW level output voltage		0 0 0	0.2 0.5 0.5		0.2 0.5 0.5		0.2 0.5 0.5	V	2.0 4.5 6.0	V_{IH} or V_{IL}	$I_O = 20 \mu A$ $I_O = 20 \mu A$ $I_O = 20 \mu A$
V_{OL}	LOW level output voltage		0.15 0.16	0.26 0.26		0.33 0.33		0.4 0.4	V	4.5 6.0	V_{CC} or GND	$I_O = 4.0 mA$ $I_O = 5.2 mA$
$\pm I_I$	input leakage current			0.1		1.0		1.0	μA	6.0	V_{CC} or GND	
I_{CC}	quiescent supply current			2.0		20.0		40.0	μA	6.0	V_{CC} or GND	$I_O = 0$

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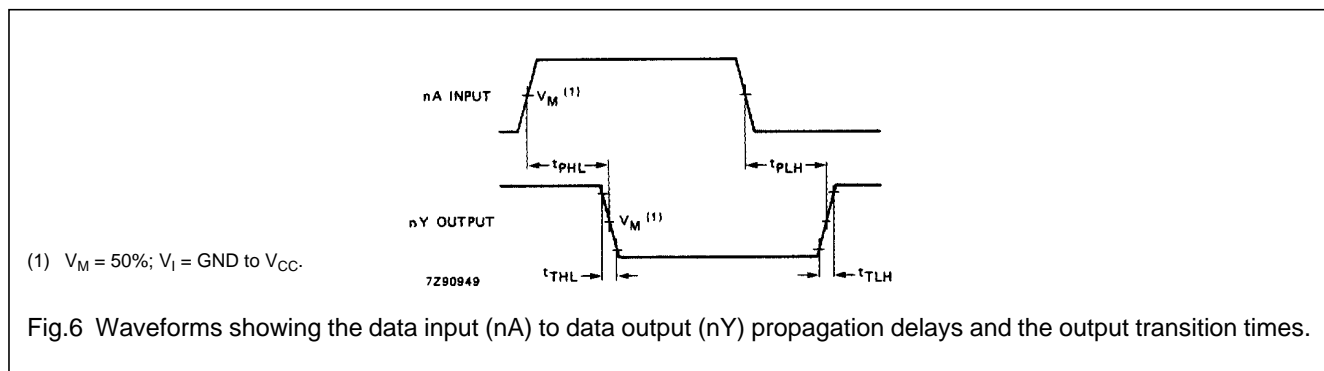
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AC CHARACTERISTICS FOR 74HCU

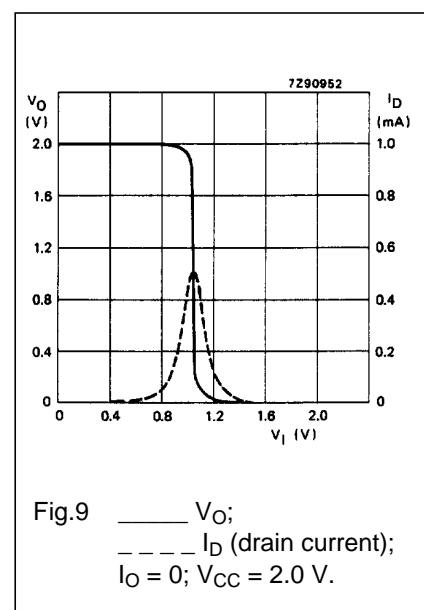
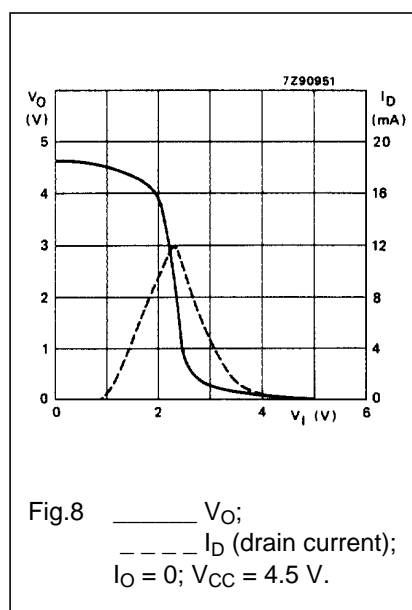
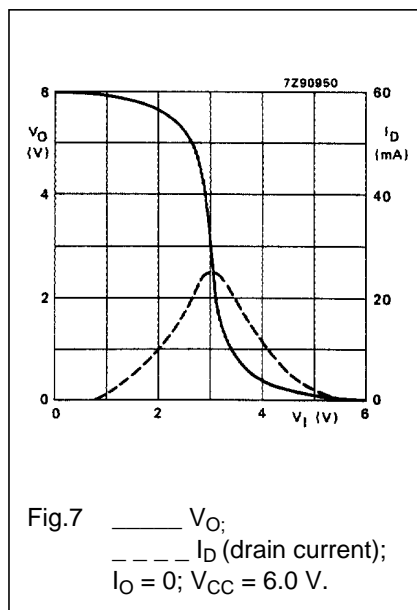
GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF

SYMBOL	PARAMETER	T_{amb} (°C)						UNIT	TEST CONDITIONS		
		74HCU							V_{CC} (V)	WAVEFORMS	
		+25			-40 to +85		-40 to +125				
		min.	typ.	max.	min.	max.	min.				max.
t_{PHL} / t_{PLH}	propagation delay nA to nY		19 7 6	70 14 12		90 18 15		105 21 18	ns	2.0 4.5 6.0	Fig.6
t_{THL} / t_{TLH}	output transition time		19 7 6	75 15 13		95 19 16		110 22 19	ns	2.0 4.5 6.0	Fig.6

AC WAVEFORMS

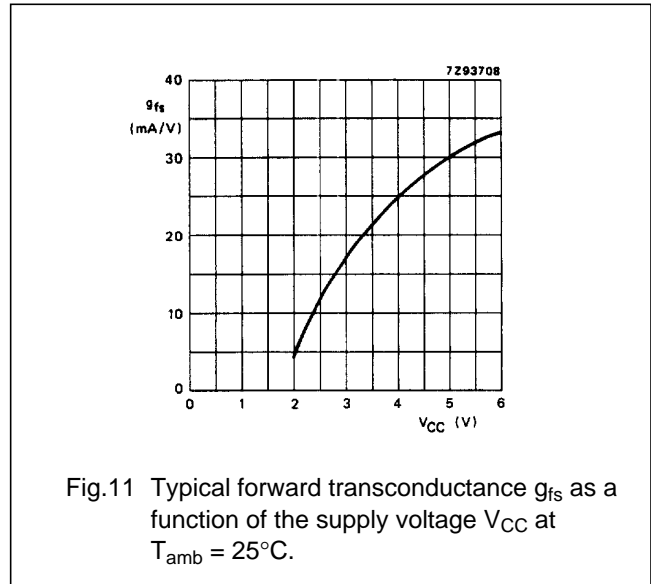
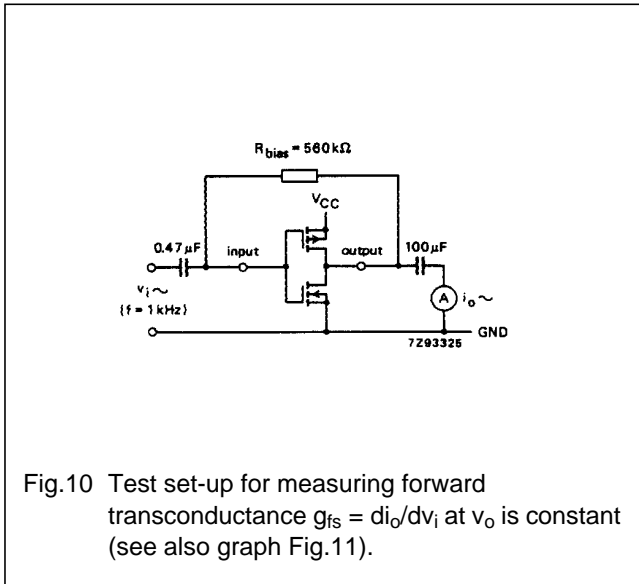


TYPICAL TRANSFER CHARACTERISTICS



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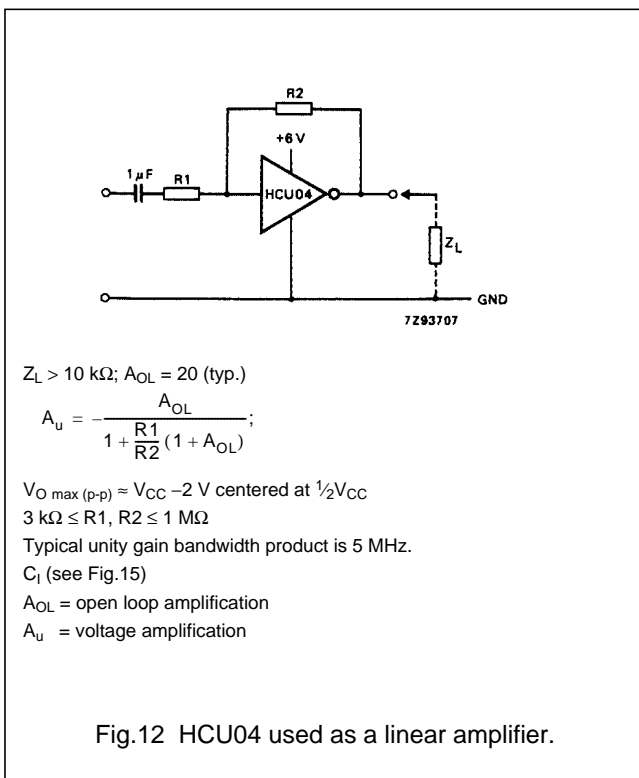
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APPLICATION INFORMATION

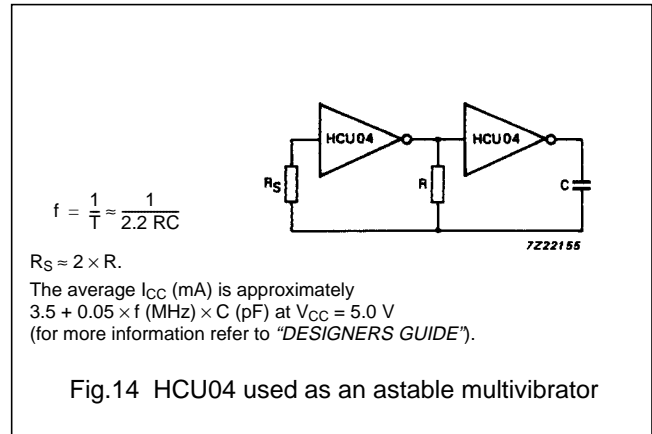
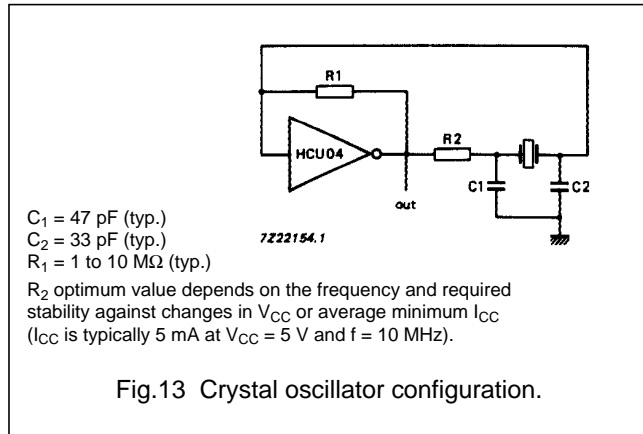
Some applications for the “HCU04” are:

- Linear amplifier (see Fig.12)
- In crystal oscillator designs (see Fig.13)
- Astable multivibrator (see Fig.14)



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OPTIMUM VALUE FOR R_2

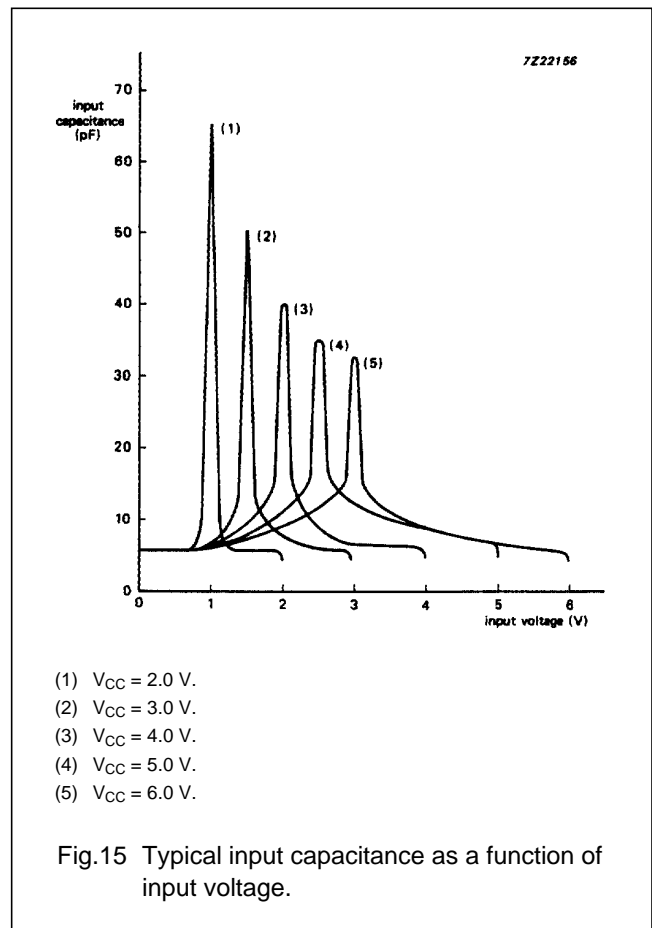
FREQUENCY (MHz)	R_2 (k Ω)	OPTIMUM FOR
3	2 8	minimum required I_{CC} minimum influence due to change in V_{CC}
6	1 4.7	minimum I_{CC} minimum influence by V_{CC}
10	0.5 2	minimum I_{CC} minimum influence by V_{CC}
14	0.5 1	minimum I_{CC} minimum influence by V_{CC}
> 14	replace R_2 by C_3 with a typical value of 35 pF	

EXTERNAL COMPONENTS FOR RESONATOR ($f < 1 \text{ MHz}$)

FREQUENCY (kHz)	R_1 (M Ω)	R_2 (k Ω)	C_1 (pF)	C_2 (pF)
10 to 15.9	22	220	56	20
16 to 24.9	22	220	56	10
25 to 54.9	22	100	56	10
55 to 129.9	22	100	47	5
130 to 199.9	22	47	47	5
200 to 349.9	10	47	47	5
350 to 600	10	47	47	5

Note

- All values given are typical and must be used as an initial set-up.



Note to Application information

All values given are typical unless otherwise specified.

PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".