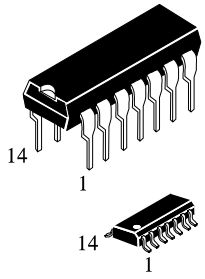
IN74HCU04A

Hex Unbuffered Inverters
High-Performance Silicon-Gate CMOS



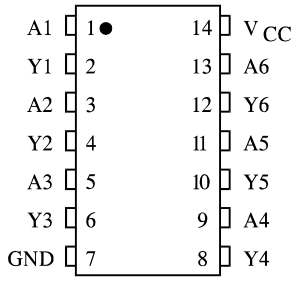
ORDERING INFORMATION
IN74HCU04AN Plastic
IN74HCU04AD SOIC
T_A = -55° to 125° C for all packages

The IN74HCU04A is identical in pinout to the 74LS04. This contain six independent unbuffered inverters. These inverters are well suited for use as oscillators, pulse shapers and in many other applications requiring a high-input impedance amplifier.

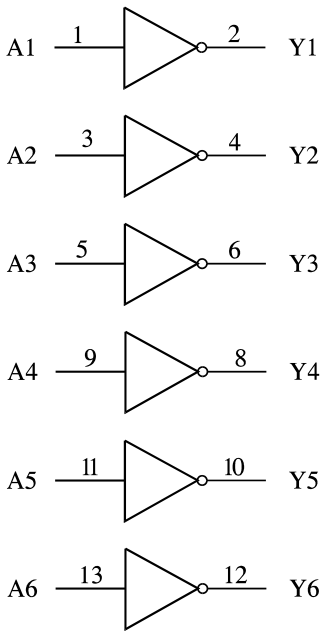
This device is characterized for over wide temperature ranges to meet industry and ation over military specifications.

- Low Power consumption characteristic of CMOS devices
- Output drive capability: 10 LS TTL Loads Min.
- Operating speed superior to LS TTL
- Wide operating voltage range: 2.0 to 6.0 V
- Low input current: 1.0 μA Max.
- Low quiescent current: 20μA Max.
- High noise immunity characteristic of CMOS
- Diode protection on all inputs

PIN ASSIGNMENT



LOGIC DIAGRAM



PIN 14 =V_{CC}
PIN 7 = GND

FUNCTION TABLE

Inputs	Output
A	Y
L	H
H	L

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V_{IN}	DC Input Voltage (Referenced to GND)	-1.5 to V_{CC} +1.5	V
V_{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to V_{CC} +0.5	V
I_{IN}	DC Input Current, per Pin	±20	mA
I_{OUT}	DC Output Current, per Pin	±25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	±50	mA
P_D	Power Dissipation in Still Air, Plastic DIP+ SOIC Package+	750 500	mW
Tstg	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)	260	°C

*Maximum Ratings are those values beyond which damage to the device may occur.
Functional operation should be restricted to the Recommended Operating Conditions.
+Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C
SOIC Package: : - 7 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V_{IN}, V_{OUT}	DC Input Voltage, Output Voltage (Referenced to GND)		0	V_{CC}	V
T_A	Operating Temperature, All Package Types		-55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	V_{CC} =2.0 V V_{CC} =4.5 V V_{CC} =6.0 V	0 0 0	1000 500 400	ns

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND≤(V_{IN} or V_{OUT})≤V_{CC}.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				25 °C to -55°C	≤85 °C	≤125 °C	
V_{IH}	Minimum High-Level Input Voltage		2.0 4.5 6.0	1.7 3.6 4.8	1.7 3.6 4.8	1.7 3.6 4.8	V
V_{IL}	Maximum Low - Level Input Voltage		2.0 4.5 6.0	0.3 0.8 1.1	0.3 0.8 1.1	0.3 0.8 1.1	V
V_{OH}	Minimum High-Level Output Voltage	$V_{IN}=V_{IH}$ or V_{IL} I_{OH} = -20 μA	2.0 4.5 6.0	1.8 4.0 5.5	1.8 4.0 5.5	1.8 4.0 5.5	V
		$V_{IN}=V_{IH}$ or V_{IL} I_{OH} = -4 mA I_{OH} = -5.2 mA	 4.5 6.0	 3.86 5.36	 3.76 5.26	 3.7 5.2	
V_{OL}	Maximum Low-Level Output Voltage	$V_{IN}=V_{IH}$ or V_{IL} I_{OL} = 20 μA	2.0 4.5 6.0	0.2 0.5 0.5	0.2 0.5 0.5	0.2 0.5 0.5	V
		$V_{IN}=V_{IH}$ or V_{IL} I_{OL} = 4 mA I_{OL} = 5.2 mA	 4.5 6.0	 0.32 0.32	 0.37 0.37	 0.4 0.4	
I_{IN}	Maximum Input Leakage Current	$V_{IN}=V_{CC}$ or GND	6.0	±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	$V_{IN}=V_{CC}$ or GND I_{OUT}=0 μA	6.0	2.0	20	40	μA

AC ELECTRICAL CHARACTERISTICS (C_L=50pF,Input t_r=t_f=6.0 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			25 °C to -55°C	≤85°C	≤125°C	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Input A to Output Y (Figures 1 and 2)	2.0 4.5 6.0	80 16 14	100 20 17	120 24 20	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 2)	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C_{IN}	Maximum Input Capacitance	-	10	10	10	pF

C_{PD}	Power Dissipation Capacitance (Per Inverter) Used to determine the no-load dynamic power consumption: $P_D=C_{PD}V_{CC}^2f+I_{CC}V_{CC}$	Typical @25°C,V_{CC}=5.0 V 15	pF

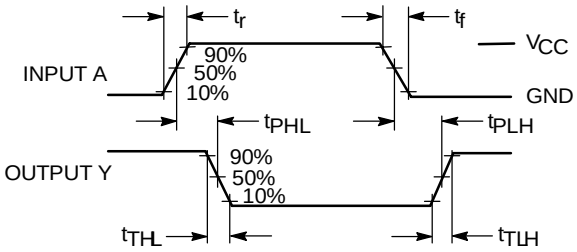


Figure 1. Switching Waveforms.

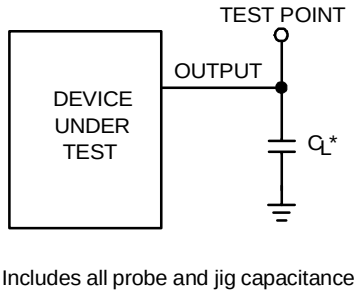
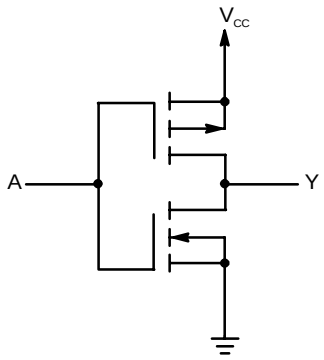


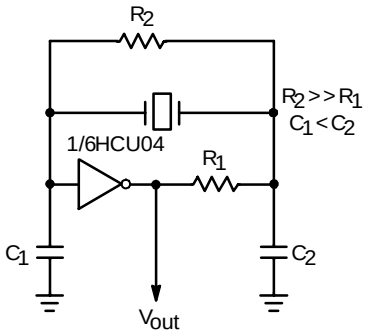
Figure 2. Test Circuit

LOGIC DETAIL
(1/6 of Device Show)

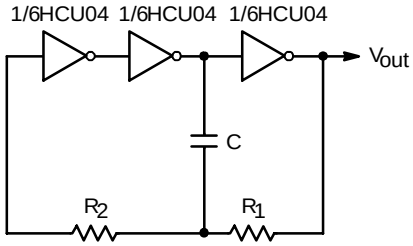


TYPICAL APPLICATIONS

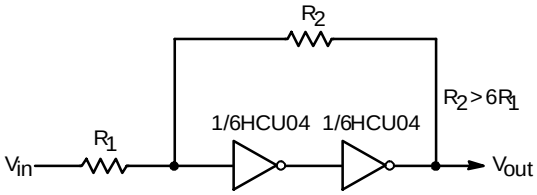
Crystal Oscillator



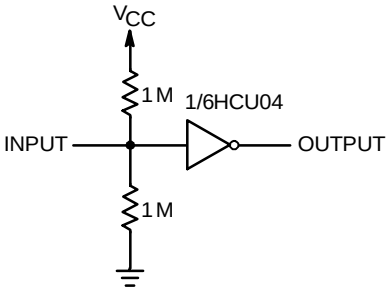
Stable RC Oscillator



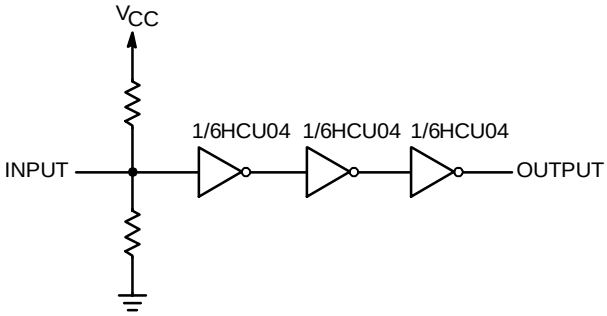
Schmitt Trigger



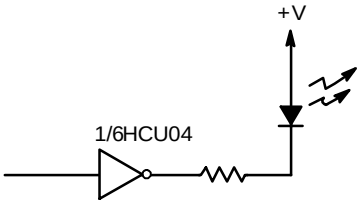
High Input Single-Stage Amplifier with a 2 to 6 V Supply Range



Multi-Stage Amplifier

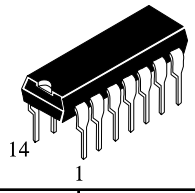


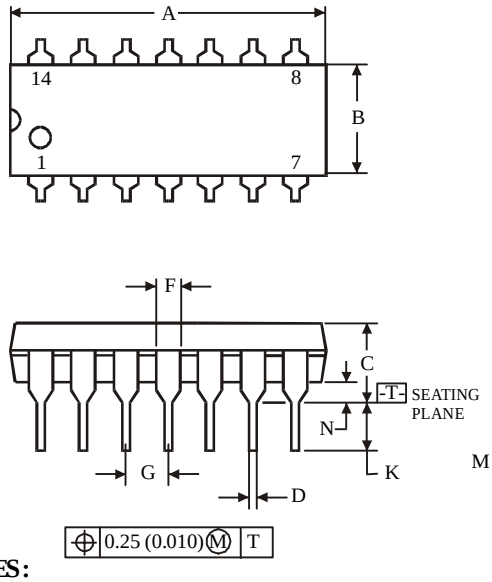
LED Driver



For reduced power suplly current, use high-efficiency LEDs such as the Hewlett-Packard HLMP series or equivalent

N SUFFIX PLASTIC DIP
(MS - 001AA)



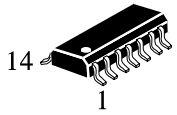


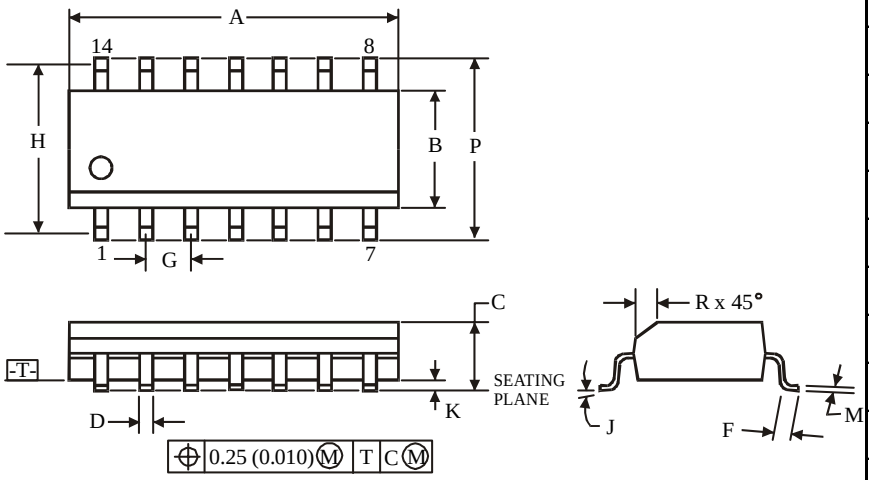
	Dimension, mm	
Symbol	**MIN**	**MAX**
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

NOTES:

1. Dimensions “A”, “B” do not include mold flash or protrusions.
   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 012AB)





	Dimension, mm	
Symbol	**MIN**	**MAX**
A	8.55	8.75
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.27	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B – 0.25 mm (0.010) per side.