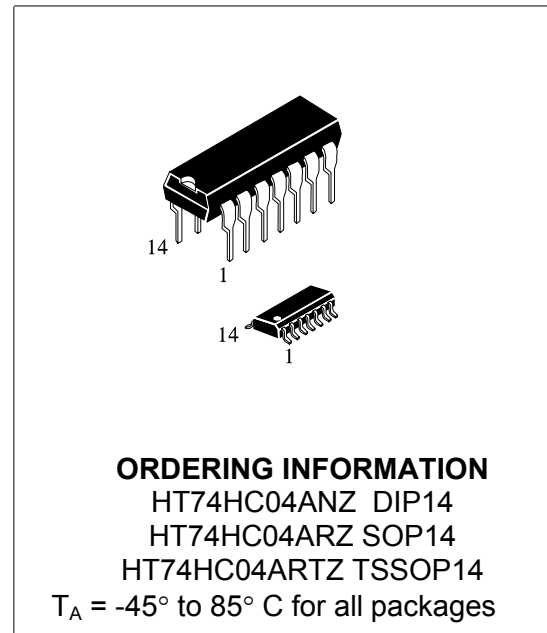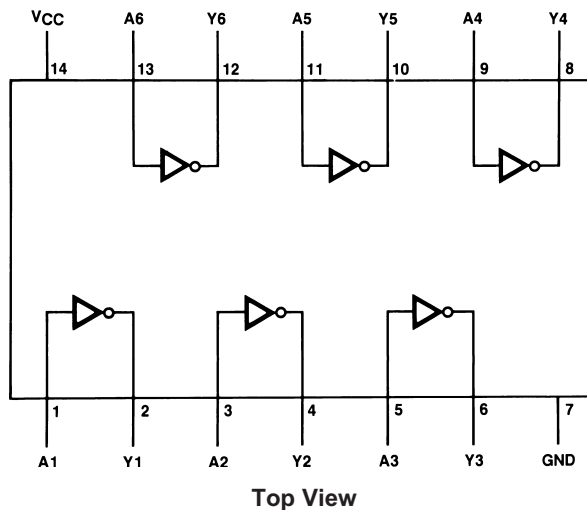# HT74HC04 Hex Inverter

General Description

The HT74HC04 inverters utilize advanced silicon-gate CMOS technology to achieve operating speeds similar to LS-TTL gates with the low power consumption of stan-dard CMOS integrated circuits.The HT74HC04 is a triple buffered inverter. It has high noise immunity and the ability to drive 10 LS-TTL loads. The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

- Typical propagation delay: 8ns
- Fan out of 10 LS-TTL loads
- Quiescent power consumption: 10µW maximum at room temperature
- Low input current: 1µA maximum

Connection Diagram

Pin Assignments for DIP, SOIC, SOP and TSSOP

Top View

ORDERING INFORMATION
HT74HC04ANZ DIP14
HT74HC04ARZ SOP14
HT74HC04ARTZ TSSOP14
T_A = -45° to 85° C for all packages

Absolute Maximum Ratings[1]

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	–0.5 to +7.0V
V_{IN}	DC Input Voltage	–1.5 to V_{CC}+1.5V
V_{OUT}	DC Output Voltage	–0.5 to V_{CC}+0.5V
I_{IK}, I_{OK}	Clamp Diode Current	±20mA
I_{OUT}	DC Output Current, per pin	±25mA
I_{CC}	DC V_{CC} or GND Current, per pin	±50mA
T_{STG}	Storage Temperature Range	–65°C to +150°C
P_D	Power Dissipation Note 2	600mW
	S.O. Package only	500mW
T_L	Lead Temperature (Soldering 10 seconds)	260°C

Notes:

1. Unless otherwise specified all voltages are referenced to ground.

2. Power Dissipation temperature derating — plastic "N" package: –12mW/°C from 65°C to 85°C.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the data sheet specifications. ON Semiconductor does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Units
V_{CC}	Supply Voltage	2	6	V
V_{IN}, V_{OUT}	DC Input or Output Voltage	0	V_{CC}	V
T_A	Operating Temperature Range	–40	+85	°C
t_r, t_f	Input Rise or Fall Times $V_{CC} = 2.0V$		1000	ns
	$V_{CC} = 4.5V$		500	ns
	$V_{CC} = 6.0V$		400	ns

DC Electrical Characteristics[(3)]

Symbol	Parameter	V_{CC} (V)	Conditions	$T_A = 25°C$ Typ.	$T_A = -40°C$ to 85°C	$T_A = -55°C$ to 125°C	Units
					Guaranteed Limits		
V_{IH}	Minimum HIGH Level Input Voltage	2.0			1.5	1.5	1.5	V
		4.5			3.15	3.15	3.15	
		6.0			4.2	4.2	4.2	
V_{IL}	Maximum LOW Level Input Voltage	2.0			0.5	0.5	0.5	V
		4.5			1.35	1.35	1.35	
		6.0			1.8	1.8	1.8	
V_{OH}	Minimum HIGH Level Output Voltage	2.0	$V_{IN} = V_{IL}$, $|I_{OUT}| \leq 20\mu A$	2.0	1.9	1.9	1.9	V
		4.5		4.5	4.4	4.4	4.4	
		6.0		6.0	5.9	5.9	5.9	
		4.5	$V_{IN} = V_{IL}$, $|I_{OUT}| \leq 4.0mA$	4.2	3.98	3.84	3.7	
		6.0	$V_{IN} = V_{IL}$, $|I_{OUT}| \leq 5.2mA$	5.7	5.48	5.34	5.2	
V_{OL}	Maximum LOW Level Output Voltage	2.0	$V_{IN} = V_{IH}$, $|I_{OUT}| \leq 20\mu A$	0	0.1	0.1	0.1	V
		4.5		0	0.1	0.1	0.1	
		6.0		0	0.1	0.1	0.1	
		4.5	$V_{IN} = V_{IH}$, $|I_{OUT}| \leq 4.0mA$	0.2	0.26	0.33	0.4	
		6.0	$V_{IN} = V_{IH}$, $|I_{OUT}| \leq 5.2mA$	0.2	0.26	0.33	0.4	
I_{IN}	Maximum Input Current	6.0	$V_{IN} = V_{CC}$ or GND		±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	6.0	$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0\mu A$		2.0	20	40	μA

Note:

3. For a power supply of 5V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5V and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics

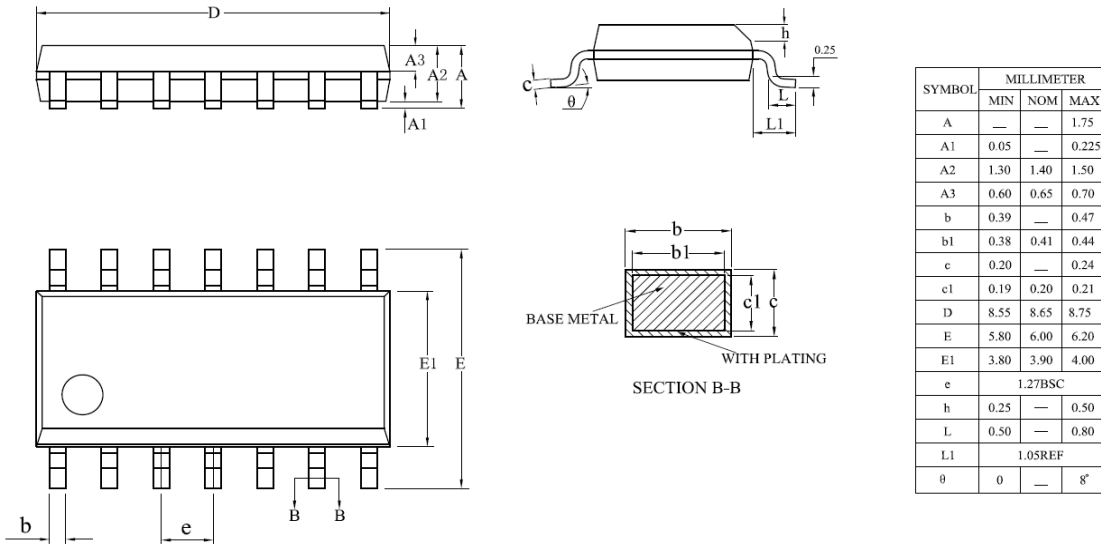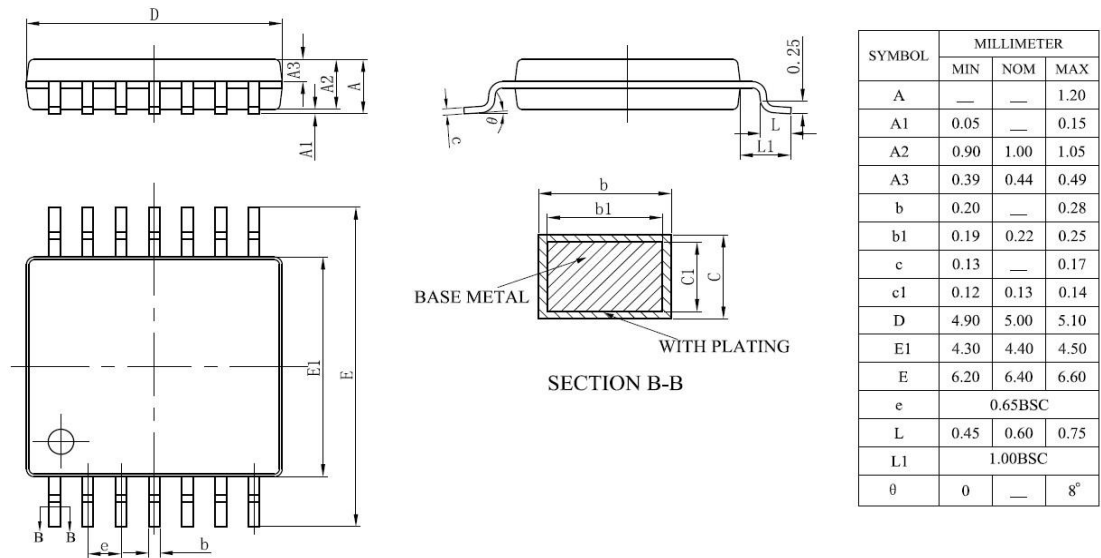$V_{CC} = 5V$, $T_A = 25°C$, $C_L = 15pF$, $t_r = t_f = 6ns$

Symbol	Parameter	Conditions	Typ.	Guaranteed Limit	Units
t_{PHL}, t_{PLH}	Maximum Propagation Delay		8	15	ns

AC Electrical Characteristics

$V_{CC} = 2.0V$ to $6.0V$, $C_L = 50pF$, $t_r = t_f = 6ns$ (unless otherwise specified)
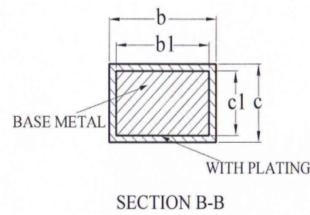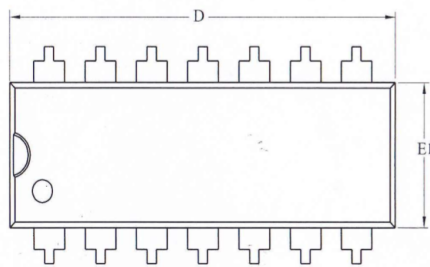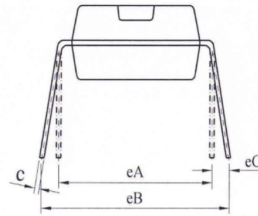
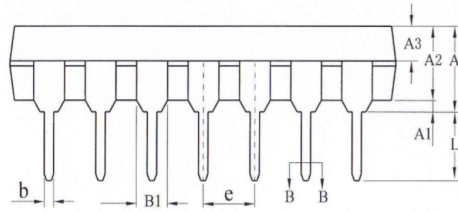| Symbol	Parameter	V_{CC} (V)	Conditions	$T_A = 25°C$ Typ.	$T_A = -40°C$ to $85°C$ Guaranteed Limits		$T_A = -55°C$ to $125°C$	Units
t_{PHL}, t_{PLH}	Maximum Propagation Delay	2.0		55	95	120	145	ns
		4.5		11	19	24	29	
		6.0		9	16	20	24	
t_{TLH}, t_{THL}	Maximum Output Rise and Fall Time	2.0		30	75	95	110	ns
		4.5		8	15	19	22	
		6.0		7	13	16	19	
C_{PD}	Power Dissipation Capacitance[4]		(per gate)	20				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note:

4. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

SOP14

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.05	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	8.55	8.65	8.75
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

BASE METAL

WITH PLATING

SECTION B-B

TSSOP-14

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.39	0.44	0.49
b	0.20	—	0.28
b1	0.19	0.22	0.25
c	0.13	—	0.17
c1	0.12	0.13	0.14
D	4.90	5.00	5.10
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00BSC		
θ	0	—	8°

BASE METAL

WITH PLATING

SECTION B-B

DIP14

SECTION B-B

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.60	3.80	4.00
A1	0.51	—	—
A2	3.20	3.30	3.40
A3	1.47	1.52	1.57
b	0.44	—	0.52
b1	0.43	0.46	0.49
B1	1.52REF		
c	0.25	—	0.29
c1	0.24	0.25	0.26
D	19.00	19.10	19.20
E1	6.25	6.35	6.45
e	2.54BSC		
eA	7.62REF		
eB	7.62	—	9.30
eC	0	—	0.84
L	3.00	—	—

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