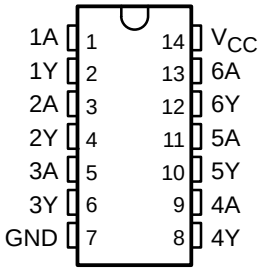
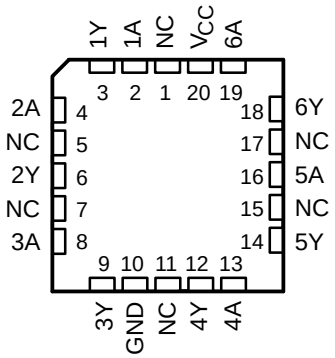
SCLS234D – OCTOBER 1995 – REVISED JUNE 1997

- **Operating Range 2-V to 5.5-V V_{CC}**
- ***EPIC***™ **(Enhanced-Performance Implanted CMOS) Process**
- **Unbuffered Outputs**
- **High Latch-Up Immunity Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Very Small-Outline (DGV), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

SN54AHCU04 . . . J OR W PACKAGE
SN74AHCU04 . . . D, DB, DGV, N, OR PW PACKAGE
(TOP VIEW)



SN54AHCU04 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

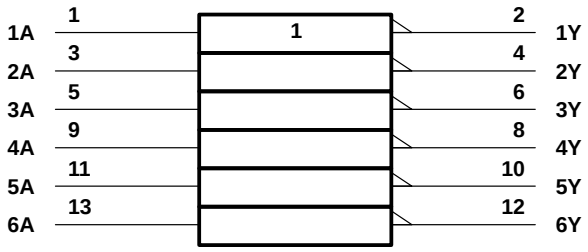
The ’AHCU04 contain six independent inverters. These devices perform the Boolean function $Y = \overline{A}$. Internal circuitry consists of single-stage inverters that can be used in analog applications such as crystal oscillators.

The SN54AHCU04 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74AHCU04 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE
(each inverter)

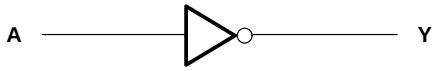
INPUT A	OUTPUT Y
H	L
L	H

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 7 V
Output voltage range, V_O (see Note 1) . . . . . –0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} (V_I < 0) . . . . . –20 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{CC}) . . . . . ±20 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . . ±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package . . . . . 127°C/W
DB package . . . . . 158°C/W
DGV package . . . . . 182°C/W
N package . . . . . 78°C/W
PW package . . . . . 170°C/W
Storage temperature range, T_{stg} . . . . . –65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions (see Note 3)

			SN54AHCU04		SN74AHCU04		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		2	5.5	2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.7		1.7		V
		V_{CC} = 3 V	2.4		2.4		
		V_{CC} = 5.5 V	4.4		4.4		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.3		0.3	V
		V_{CC} = 3 V		0.6		0.6	
		V_{CC} = 5.5 V		1.1		1.1	
V_I	Input voltage		0	5.5	0	5.5	V
V_O	Output voltage		0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 2 V		–50		–50	μA
		V_{CC} = 3.3 V ± 0.3 V		–4		–4	mA
		V_{CC} = 5 V ± 0.5 V		–8		–8	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	μA
		V_{CC} = 3.3 V ± 0.3 V		4		4	mA
		V_{CC} = 5 V ± 0.5 V		8		8	
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			SN54AHCU04		SN74AHCU04		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	I_{OH} = –50 μA	2 V	1.8	2		1.8		1.8		V
		3 V	2.7	3		2.7		2.7		
		4.5 V	4	4.5		4		4		
	I_{OH} = –4 mA	3 V	2.58			2.48		2.48		
	I_{OH} = –8 mA	4.5 V	3.94			3.8		3.8		
V_{OL}	I_{OL} = 50 μA	2 V			0.2		0.2		0.2	V
		3 V			0.3		0.3		0.3	
		4.5 V			0.5		0.5		0.5	
	I_{OL} = 4 mA	3 V			0.36		0.5		0.44	
	I_{OL} = 8 mA	4.5 V			0.36		0.5		0.44	
I_I	V_I = V_{CC} or GND	5.5 V			±0.1		±1		±1	μA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	5.5 V			2		20		20	μA
C_i	V_I = V_{CC} or GND	5 V		2	10				10	pF

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHCU04					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
t_{PLH}*	A	Y	C_L = 15 pF		5	8.9	1	10.5	ns
t_{PHL}*					5	8.9	1	10.5	
t_{PLH}	A	Y	C_L = 50 pF		7.5	11.4	1	13	ns
t_{PHL}					7.5	11.4	1	13	

* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHCU04					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
t_{PLH}	A	Y	C_L = 15 pF		5	8.9	1	10.5	ns
t_{PHL}					5	8.9	1	10.5	
t_{PLH}	A	Y	C_L = 50 pF		7.5	11.4	1	13	ns
t_{PHL}					7.5	11.4	1	13	

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHCU04					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
t_{PLH}*	A	Y	C_L = 15 pF		3.5	5.5	1	6.5	ns
t_{PHL}*					3.5	5.5	1	6.5	
t_{PLH}	A	Y	C_L = 50 pF		5	7	1	8	ns
t_{PHL}					5	7	1	8	

* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHCU04					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
t_{PLH}	A	Y	C_L = 15 pF		3.5	5.5	1	6.5	ns
t_{PHL}					3.5	5.5	1	6.5	
t_{PLH}	A	Y	C_L = 50 pF		5	7	1	8	ns
t_{PHL}					5	7	1	8	

noise characteristics, V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C (see Note 4)

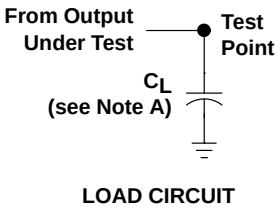
PARAMETER		SN74AHCU04			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.5		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.5		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		4.3		V
$V_{IH(D)}$	High-level dynamic input voltage	4			V
$V_{IL(D)}$	Low-level dynamic input voltage			1	V

NOTE 4: Characteristics are determined during product characterization and ensured by design for surface-mount packages only.

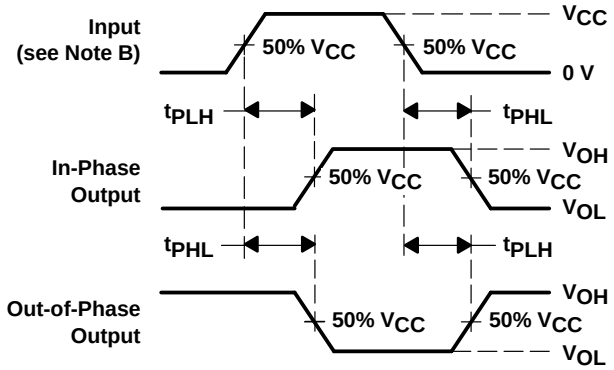
operating characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	7.3	pF

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT



VOLTAGE WAVEFORMS
DELAY TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. Input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 ns.
C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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