

HD74LS83A 4-Bit Binary Full Adders (with Fast Carry)

This improved full adder performs the addition of two 4-bit binary numbers. The sum (Σ) outputs are provided for each bit and the resultant carry (C_4) is obtained from the fourth bit. This adder features full internal look ahead across all four bit generating the carry term in ten nanoseconds typically. This provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

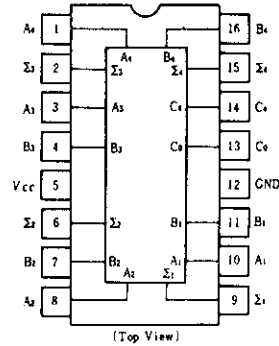
FUNCTION TABLE

Inputs				Outputs							
				When $C_0 = L$		When $C_2 = L$		When $C_0 = H$		When $C_2 = H$	
A_1 A_3	B_1 B_3	A_2 A_4	B_2 B_4	Σ_1 Σ_3	Σ_2 Σ_4	C_2 C_4	Σ_1 Σ_3	Σ_2 Σ_4	C_2 C_4	Σ_1 Σ_3	Σ_2 Σ_4
L	L	L	L	L	L	L	H	L	L	L	L
H	L	L	L	H	L	L	L	H	L	L	L
L	H	L	L	H	L	L	L	H	L	L	L
H	H	L	L	L	H	L	H	H	L	L	L
L	L	H	L	L	H	L	H	H	L	L	L
H	L	H	L	H	H	L	L	L	L	H	H
L	H	H	L	H	H	L	L	L	L	H	H
H	H	H	L	L	L	H	H	L	L	H	H
L	L	L	H	L	H	L	H	H	L	L	L
H	L	L	H	H	H	L	L	L	L	L	H
L	H	L	H	H	H	L	L	L	L	L	H
H	H	L	H	L	L	H	H	L	L	H	H
L	L	H	H	L	L	H	H	L	L	H	H
H	L	H	H	H	L	H	L	H	H	H	H
L	H	H	H	H	L	H	L	H	H	H	H
H	H	H	H	L	L	H	H	H	H	H	H

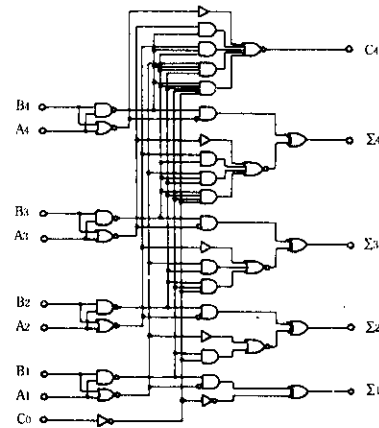
H; high level, L; low level, X; irrelevant

Note) Input conditions at A_1 , B_1 , A_2 , B_2 , and C_0 are used to determine outputs Σ_1 and Σ_2 and the value of the internal carry C_2 . The value at C_2 , A_3 , B_3 , A_4 , and B_4 are then used to determine outputs Σ_3 , Σ_4 and C_4 .

PIN ARRANGEMENT



BLOCK DIAGRAM



■ ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +75^\circ\text{C}$)

Item		Symbol	Test Conditions	min	typ*	max	Unit
Input voltage		V_{IH}		2.0		—	V
		V_{IL}		—		0.8	V
Output voltage		V_{OH}	$V_{CC} = 4.75\text{V}$, $V_{IH} = 2\text{V}$, $V_{IL} = 0.8\text{V}$, $I_{OH} = -400\mu\text{A}$	2.7		—	V
		V_{OL}	$V_{CC} = 4.75\text{V}$, $V_{IH} = 2\text{V}$	—		0.4	V
			$V_{IL} = 0.8\text{V}$			0.5	
Input current	except C0	I_{IH}	$V_{CC} = 5.25\text{V}$, $V_i = 2.7\text{V}$	—		40	μA
	C0			—		20	
	except C0	I_{IL}	$V_{CC} = 5.25\text{V}$, $V_i = 0.4\text{V}$	—		-0.8	mA
	C0			—		0.4	
	except C0	I_i	$V_{CC} = 5.25\text{V}$, $V_i = 7\text{V}$	—		0.2	mA
	C0			—		0.1	
Short circuit output current		I_{OS}	$V_{CC} = 5.25\text{V}$	-20		-100	mA
Supply current		I_{CC}	$V_{CC} = 5.25\text{V}$	All inputs = 0V		22	39
				B input 0.8V, Other inputs 4.5V		19	34
				All inputs 4.5V		19	34
Input clamp voltage		V_{IK}	$V_{CC} = 4.75\text{V}$, $I_{IS} = -18\text{mA}$	—		-1.5	V

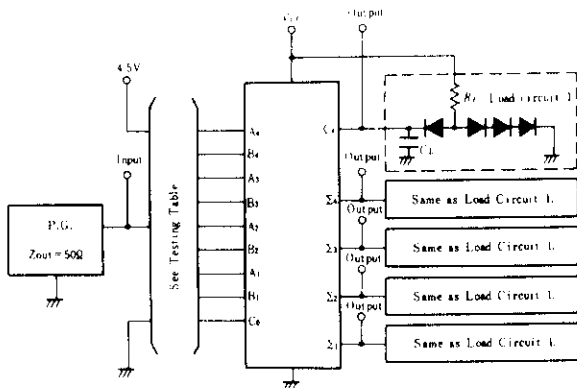
* $V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$

■ SWITCHING CHARACTERISTICS ($V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$)

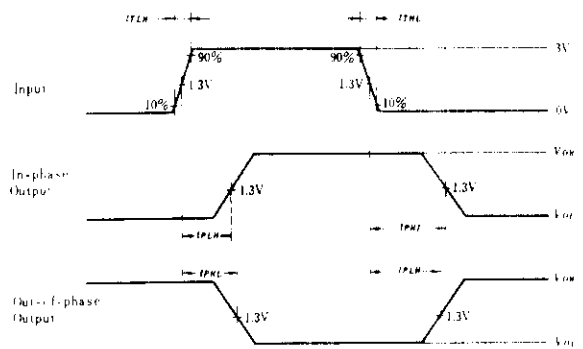
Item	Symbol	Inputs	Outputs	Test Conditions	min	typ	max	Unit
Propagation delay time	t_{PLH}	C_0	Σ	$C_L = 15\text{pF}, R_L = 2\text{k}\Omega$		16	24	ns
	t_{PHL}					15	24	ns
	t_{PLH}	A_1, B_1	Σ			15	24	ns
	t_{PHL}					15	24	ns
	t_{PLH}	C_0	C_1			11	17	ns
	t_{PHL}					15	22	ns
	t_{PLH}	A_1, B_1	C_1			11	17	ns
	t_{PHL}					12	17	ns

■ TESTING METHOD

1) Test Circuit



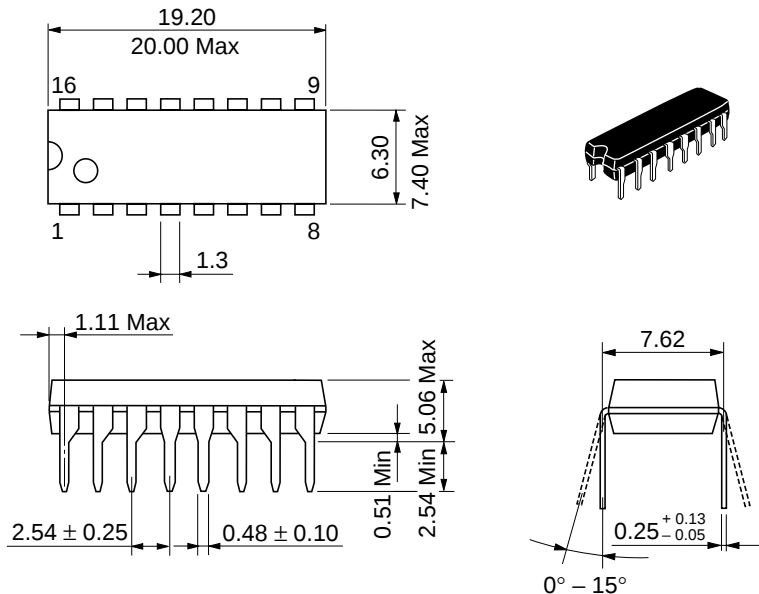
Waveform



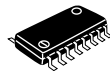
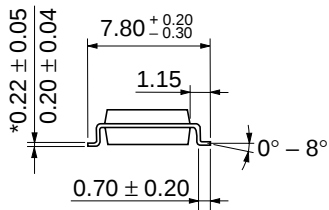
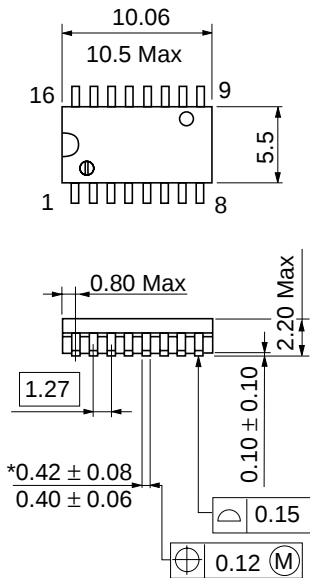
- Notes) 1. Input pulse; $t_{PLH} \leq 15\text{ns}$, $t_{PHL} \leq 6\text{ns}$,
 $PRR = 1\text{MHz}$, duty cycle = 50%
 2. C_L includes probe and jig capacitance.
 3. All diodes are 1S2074 Ⓢ .

2) Testing Table

Item	From input to output	Inputs									Outputs				
		B ₄	A ₄	B ₃	A ₃	B ₂	A ₂	B ₁	A ₁	C ₀	C ₄	Σ ₄	Σ ₃	Σ ₂	Σ ₁
<i>t_{PLH}</i> <i>t_{PHL}</i>	<i>C₀</i>	GND	GND	GND	GND	GND	GND	GND	GND	IN	---	---	---	---	OUT
	→Σ ₄ or C ₄	GND	4.5V	GND	4.5V	GND	4.5V	GND	4.5V	IN	OUT	OUT	OUT	OUT	OUT
	<i>A_i</i> or <i>B_i</i> →Σ ₄ or C ₄	GND	GND	GND	GND	GND	GND	GND	IN	GND	---	---	---	---	OUT
								IN	GND						
		GND	GND	GND	GND	GND	IN	GND	GND	GND	---	---	---	OUT	---
						IN									
		GND	GND	GND	IN	GND	GND	GND	GND	GND	---	---	OUT	---	---
				IN											
		GND	IN	GND	GND	GND	GND	GND	GND	GND	---	OUT	---	---	---
		IN	GND												
		GND	GND	GND	GND	GND	GND	4.5V	IN	GND	---	---	---	OUT	OUT
								IN	4.5V						
		GND	GND	GND	GND	4.5V	IN	GND	GND	GND	---	---	OUT	OUT	---
						IN	4.5V								
		GND	GND	4.5V	IN	GND	GND	GND	GND	GND	---	OUT	OUT	---	---
				IN	4.5V										
		4.5V	IN	GND	GND	GND	GND	GND	GND	GND	OUT	OUT	---	---	---
		IN	4.5V												

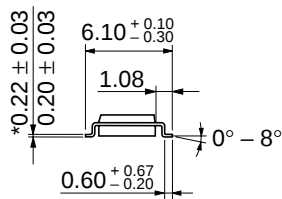
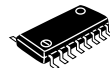


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g

*Dimension including the plating thickness
Base material dimension



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

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