
HD74HC83

4-Bit Binary Full Adder (with Fast Carry)

HITACHI

Description

This improved full adder performs the addition of two 4-bit binary numbers. The sum () output 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.

Features

- High Speed Operation: t_{pd} (A_i or B_i to Z_i) = 16 ns typ ($C_L = 50$ pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC} = 2$ to 6 V
- Low Input Current: 1 μ A max
- Low Quiescent Supply Current: I_{CC} (static) = 4 μ A max ($T_a = 25^\circ\text{C}$)

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
L	L	L	L	L	L	L	H	L	L
H	L	L	L	H	L	L	L	H	L
L	H	L	L	H	L	L	L	H	L
H	H	L	L	L	H	L	H	H	L
L	L	H	L	L	H	L	H	H	L
H	L	H	L	H	H	L	L	L	H
L	H	H	L	H	H	L	L	L	H
H	H	H	L	L	L	H	H	L	H
L	L	L	H	L	H	L	H	H	L
H	L	L	H	H	H	L	L	L	H
L	H	L	H	H	H	L	L	L	H
H	H	L	H	L	L	H	H	L	H
L	L	H	H	L	L	H	H	L	H
H	L	H	H	H	L	H	L	H	H
L	H	H	H	H	L	H	L	H	H
H	H	H	H	L	H	H	H	H	H

H : High level

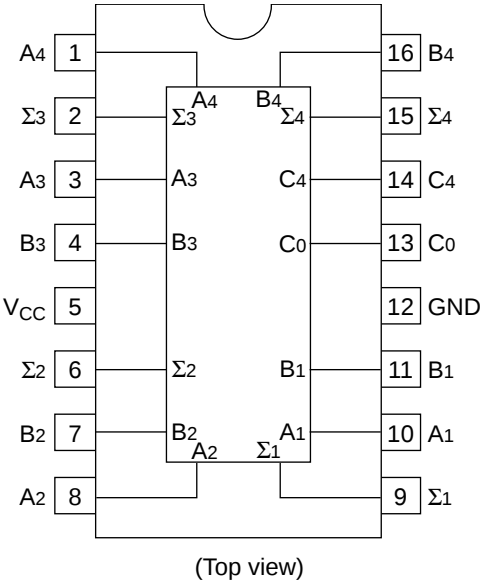
L : Low level

X : Irrelevant

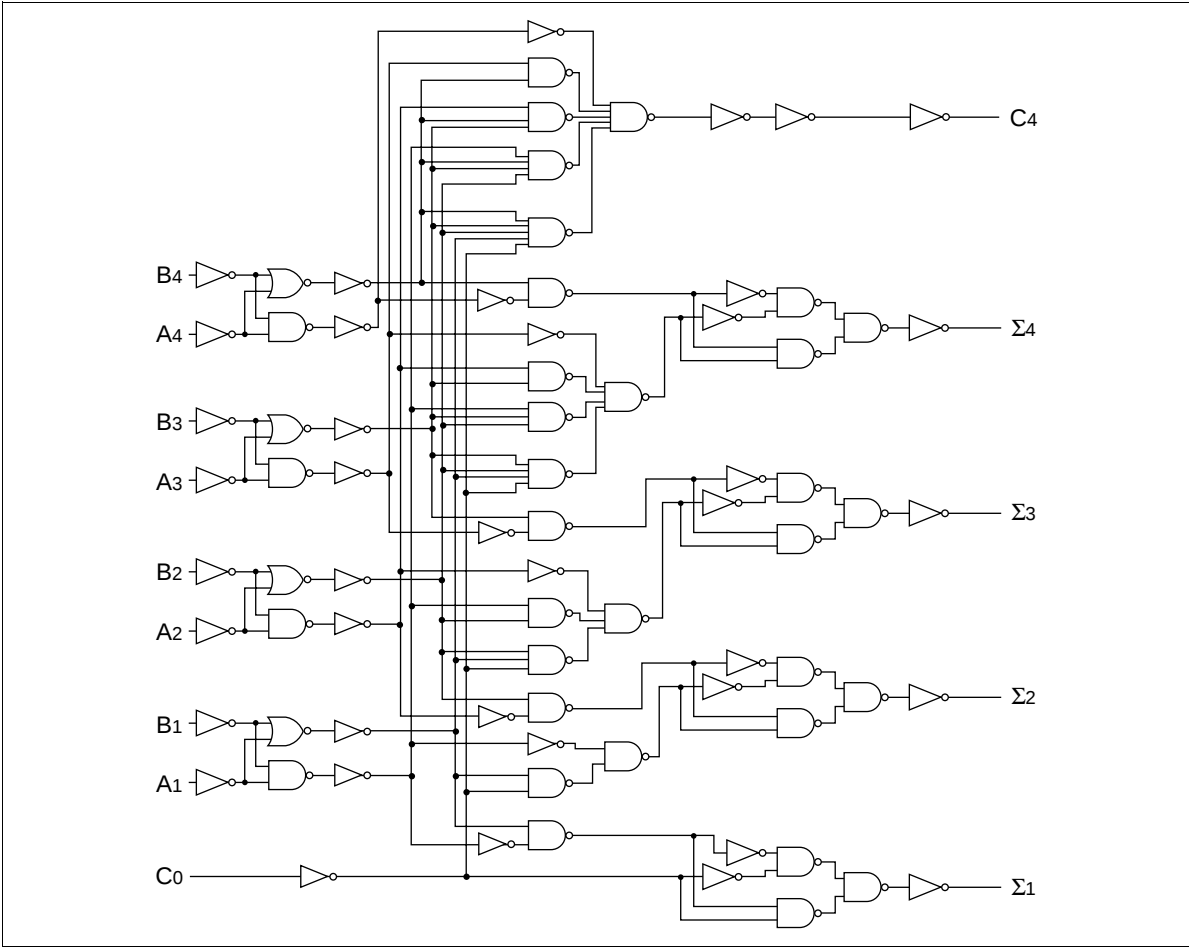
Note: Input conditions at A₁, B₁, A₂, B₂ and C₀ are used to determine outputs Σ₁ and Σ₂ and the value of the internal carry C₂.

The value at C₂, A₃, B₃, A₄ and B₄ are than used to determine outputs Σ₃, Σ₄ and C₄

Pin Arrangement



Block Diagram (1//2)



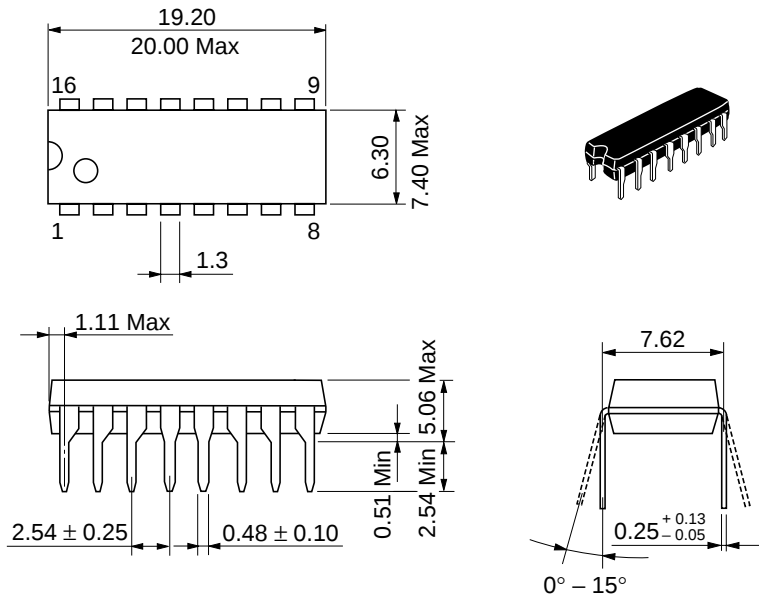
DC Characteristics

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Input voltage	V _{IH}	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	V _{IL}	2.0	—	—	0.5	—	0.5	V		
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
Output voltage	V _{OH}	2.0	1.9	2.0	—	1.9	—	V	Vin = V _{IH} or V _{IL} I _{OH} = -20 μA	
		4.5	4.4	4.5	—	4.4	—			
		6.0	5.9	6.0	—	5.9	—			
		4.5	4.18	—	—	4.13	—			I _{OH} = -4 mA
		6.0	5.68	—	—	5.63	—			I _{OH} = -5.2 mA
	V _{OL}	2.0	—	0.0	0.1	—	0.1	V	Vin = V _{IH} or V _{IL} I _{OL} = 20 μA	
		4.5	—	0.0	0.1	—	0.1			
		6.0	—	0.0	0.1	—	0.1			
		4.5	—	—	0.26	—	0.33			I _{OL} = 4 mA
		6.0	—	—	0.26	—	0.33			I _{OL} = 5.2 mA
Input current	I _{in}	6.0	—	—	±0.1	—	±1.0	μA	Vin = V _{CC} or GND	
Quiescent supply current	I _{CC}	6.0	—	—	4.0	—	40	μA	Vin = V _{CC} or GND, I _{out} = 0 μA	

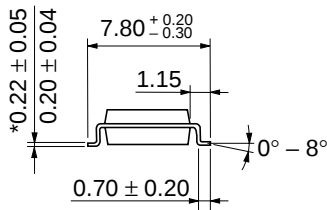
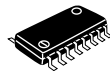
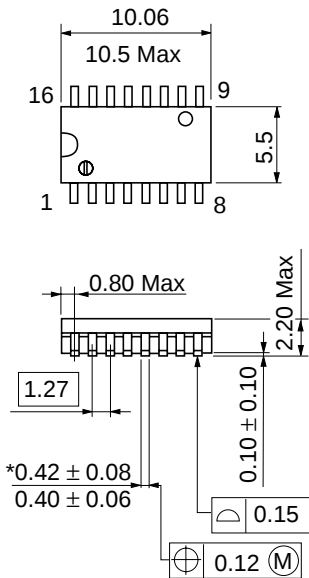
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AC Characteristics (C_L = 50 pF, Input t_r = t_f = 6 ns)

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	t _{PLH}	2.0	—	—	150	—	190	ns	C ₀ to Σ _i
		4.5	—	19	30	—	38		
		6.0	—	—	26	—	33		
	t _{PHL}	2.0	—	—	150	—	190	ns	A _i or B _i to Σ _i
		4.5	—	16	30	—	38		
		6.0	—	—	26	—	33		
	t _{PLH}	2.0	—	—	150	—	190	ns	C ₀ to C ₄
		4.5	—	17	30	—	38		
		6.0	—	—	26	—	33		
	t _{PHL}	2.0	—	—	150	—	190	ns	A _i or B _i to C ₄
		4.5	—	18	30	—	38		
		6.0	—	—	26	—	33		
Output rise/fall time	t _{TLH}	2.0	—	—	75	—	95	ns	
		4.5	—	5	15	—	19		
		6.0	—	—	13	—	16		
Input capacitance	C _{in}	—	—	5	10	—	10	pF	

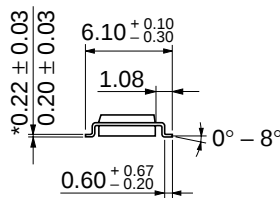
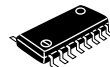
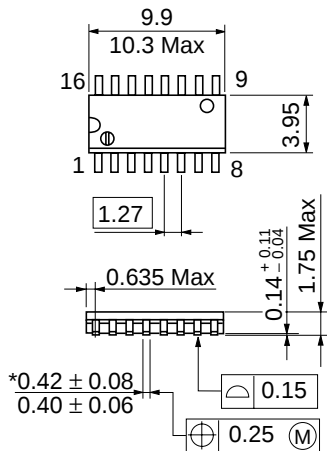


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



*Dimension including the plating thickness
Base material dimension

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



*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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