

HD74LS83A

4-bit Binary Full Adder (with Fast Carry)

REJ03D0420-0200

Rev.2.00

Feb.18.2005

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.

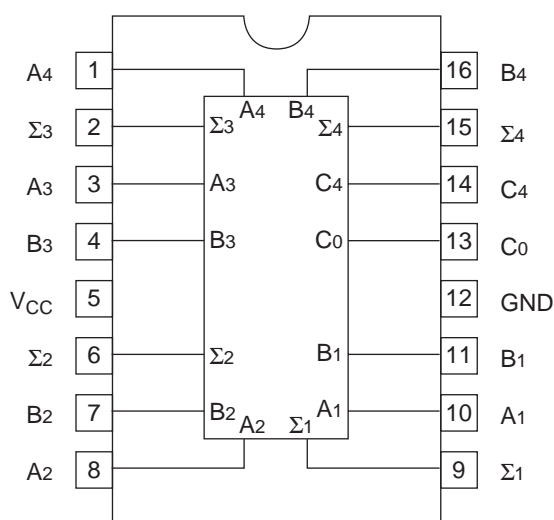
Features

- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LS83AP	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—

Note: Please consult the sales office for the above package availability.

Pin Arrangement



(Top view)

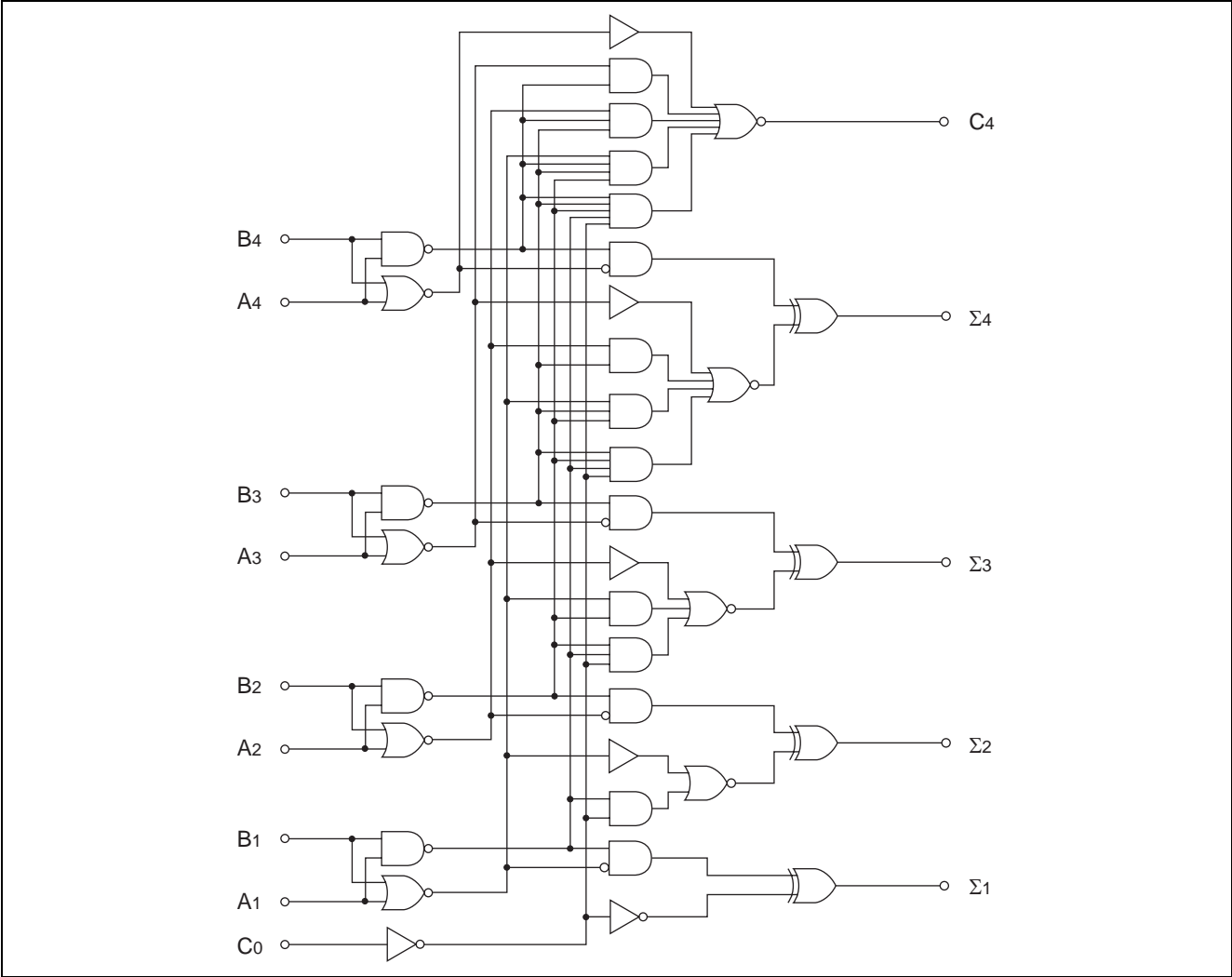
Function Table

Input				Output					
				When $C_0 = L$			When $C_0 = H$		
				When $C_2 = L$			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 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 .

Block Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}	7	V
Input voltage	V_{IN}	7	V
Power dissipation	P_T	400	mW
Storage temperature	T_{stg}	-65 to +150	°C

Note: Voltage value, unless otherwise noted, are with respect to network ground terminal.

Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{CC}	4.75	5.00	5.25	V
Output current	I_{OH}	—	—	-400	μA
	I_{OL}	—	—	8	mA
Operating temperature	T_{opr}	-20	25	75	°C

Electrical Characteristics

(Ta = -20 to +75 °C)

Item		Symbol	min.	typ.*	max.	Unit	Condition	
Input voltage		V _{IH}	2.0	—	—	V		
		V _{IL}	—	—	0.8	V		
Output voltage		V _{OH}	2.7	—	—	V	V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = −400 μA	
		V _{OL}	—	—	0.4	V	I _{OL} = 4 mA	V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V
			—	—	0.5		I _{OL} = 8 mA	
Input current	except C ₀	I _{IH}	—	—	40	μA	V _{CC} = 5.25 V, V _I = 2.7 V	
	C ₀		—	—	20			
	except C ₀	I _{IL}	—	—	−0.8	mA	V _{CC} = 5.25 V, V _I = 0.4 V	
	C ₀		—	—	−0.4			
	except C ₀	I _I	—	—	0.2	mA	V _{CC} = 5.25 V, V _I = 7 V	
	C ₀		—	—	0.1			
Short-circuit output current		I _{OS}	−20	—	−100	mA	V _{CC} = 5.25 V	
Supply current		I _{CC}	—	22	39	mA	All inputs = 0 V	V _{CC} = 5.25 V
			—	19	34		B input = 0.8 V, Other inputs 4.5 V	
			—	19	34		All inputs = 4.5 V	
Input clamp voltage		V _{IR}	—	—	−1.5	V	V _{CC} = 4.75 V, I _{IN} = −18 mA	

Note: * V_{CC} = 5 V, Ta = 25°C

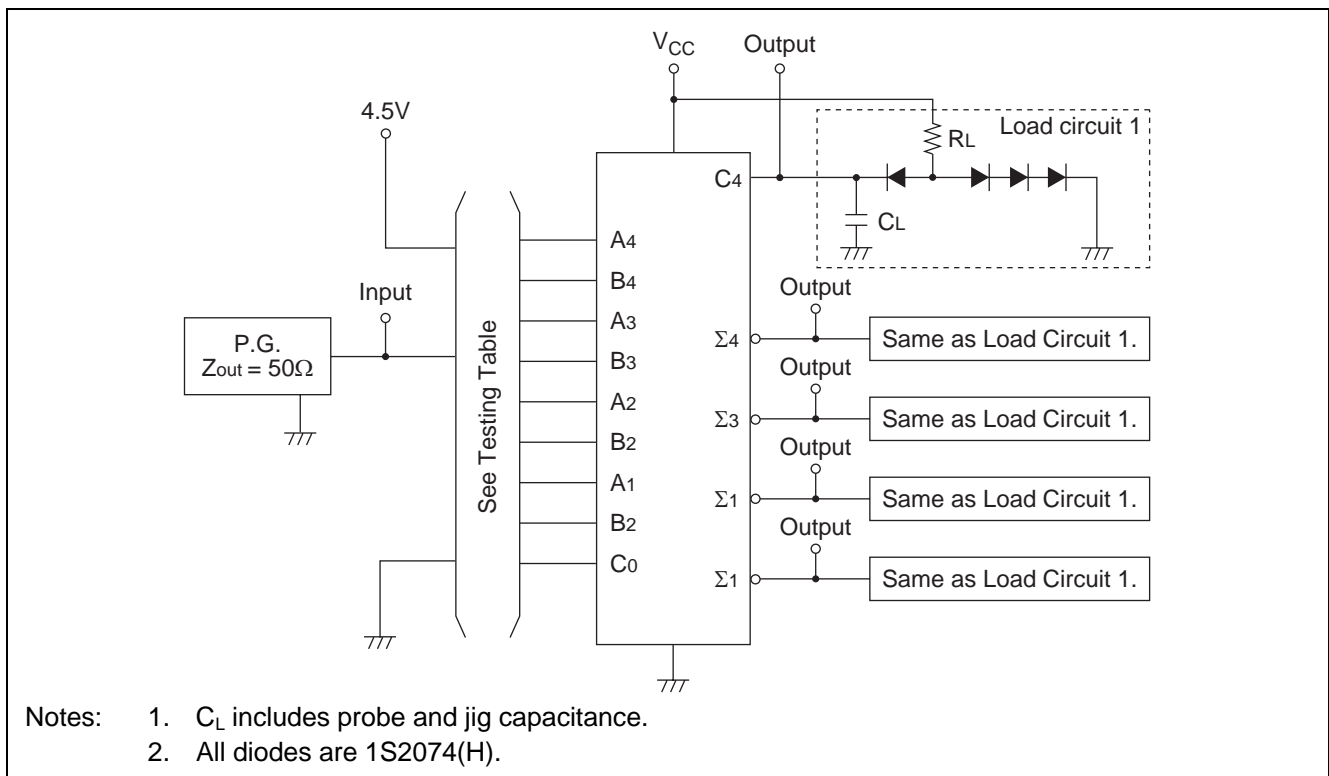
Switching Characteristics

(V_{CC} = 5 V, Ta = 25°C)

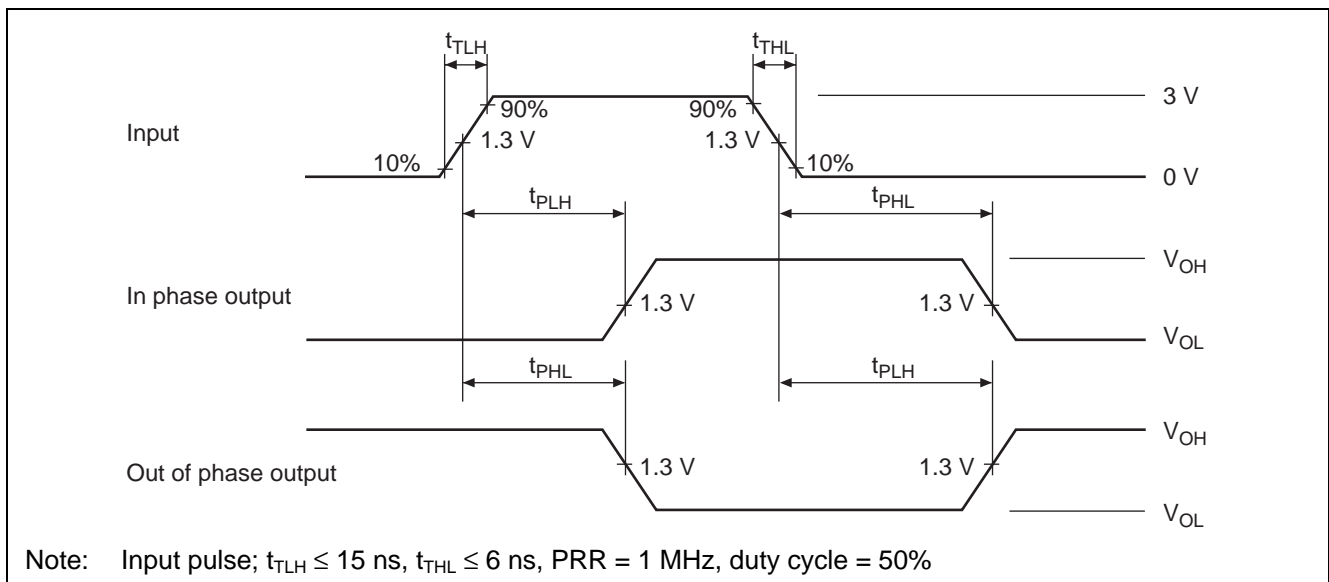
Item	Symbol	Inputs	Outputs	min.	typ.	max.	Unit	Condition
Propagation delay time	t _{PLH}	C ₀	Σ ₁	—	16	24	ns	C _L = 15 pF, R _L = 2 kΩ
	t _{PHL}			—	15	24		
	t _{PLH}	A _i , B _i	Σ ₁	—	15	24		
	t _{PHL}			—	15	24		
	t _{PLH}	C ₀	C ₄	—	11	17		
	t _{PHL}			—	15	22		
	t _{PLH}	A _i , B _i	C ₄	—	11	17		
	t _{PHL}			—	12	17		

Testing Method

Test Circuit



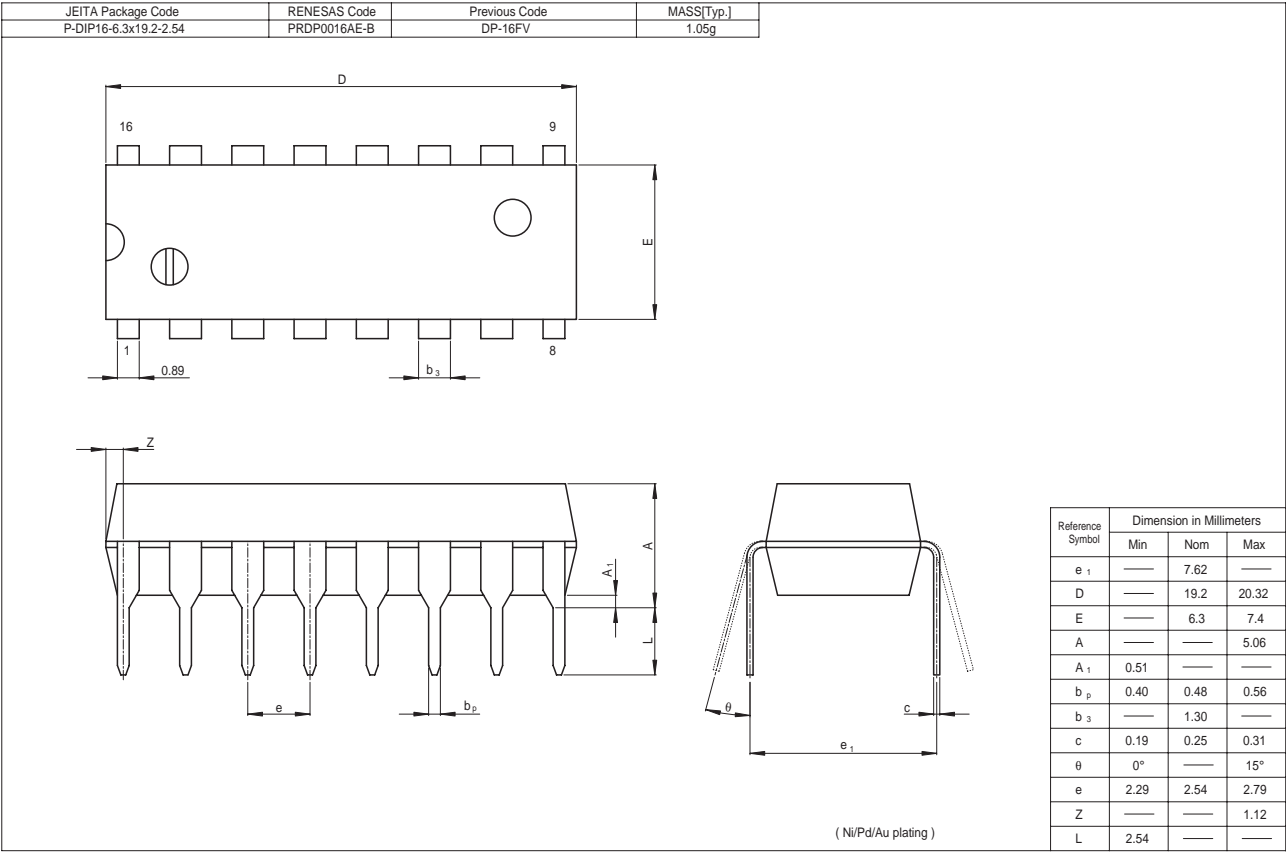
Waveform



Testing Table

Item	From input to output	Input									Output				
		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
t _{PLH} t _{PHL}	C ₀ → Σ _i or C ₄	GND	GND	GND	GND	GND	GND	GND	GND	IN	—	—	—	—	OUT
		GND	GND	GND	4.5 v	GND	4.5 v	GND	4.5 v	IN	OUT	OUT	OUT	OUT	OUT
	A _i or B _i → Σ _i or C ₄	GND	GND	GND	GND	GND	GND	GND	IN	IN	GND	—	—	—	OUT
		GND	GND	GND	GND	GND	IN	IN	GND	GND	GND	—	—	—	OUT
		GND	GND	GND	IN	IN	GND	GND	GND	GND	GND	—	—	OUT	—
		GND	GND	GND	IN	GND	GND	GND	GND	GND	GND	—	—	OUT	—
		GND	IN	GND	GND	GND	GND	GND	GND	GND	—	OUT	—	—	—
		GND	GND	GND	GND	GND	GND	4.5 v	IN	IN	GND	—	—	—	OUT
		GND	GND	GND	GND	GND	GND	IN	4.5 v	4.5 v	GND	—	—	OUT	OUT
		GND	GND	GND	IN	IN	GND	GND	GND	GND	GND	—	OUT	OUT	—
		GND	GND	GND	IN	GND	GND	GND	GND	GND	GND	—	OUT	OUT	—
		4.5 v	IN	GND	GND	GND	GND	GND	GND	GND	OUT	OUT	—	—	—
		IN	4.5 v	GND	GND	GND	GND	GND	GND	GND	OUT	OUT	—	—	—

Package Dimensions



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