

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 (C4) 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.

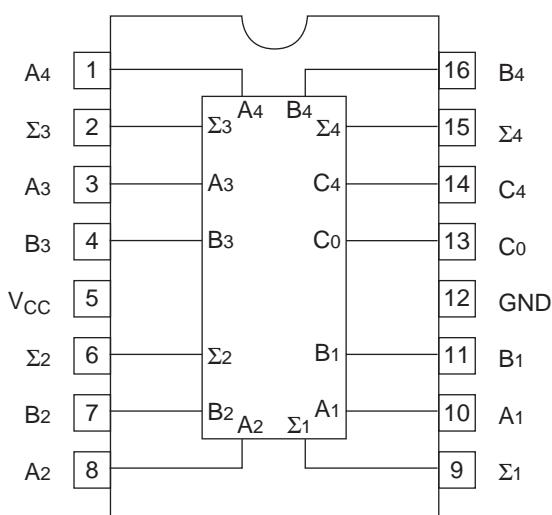
Features

- 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



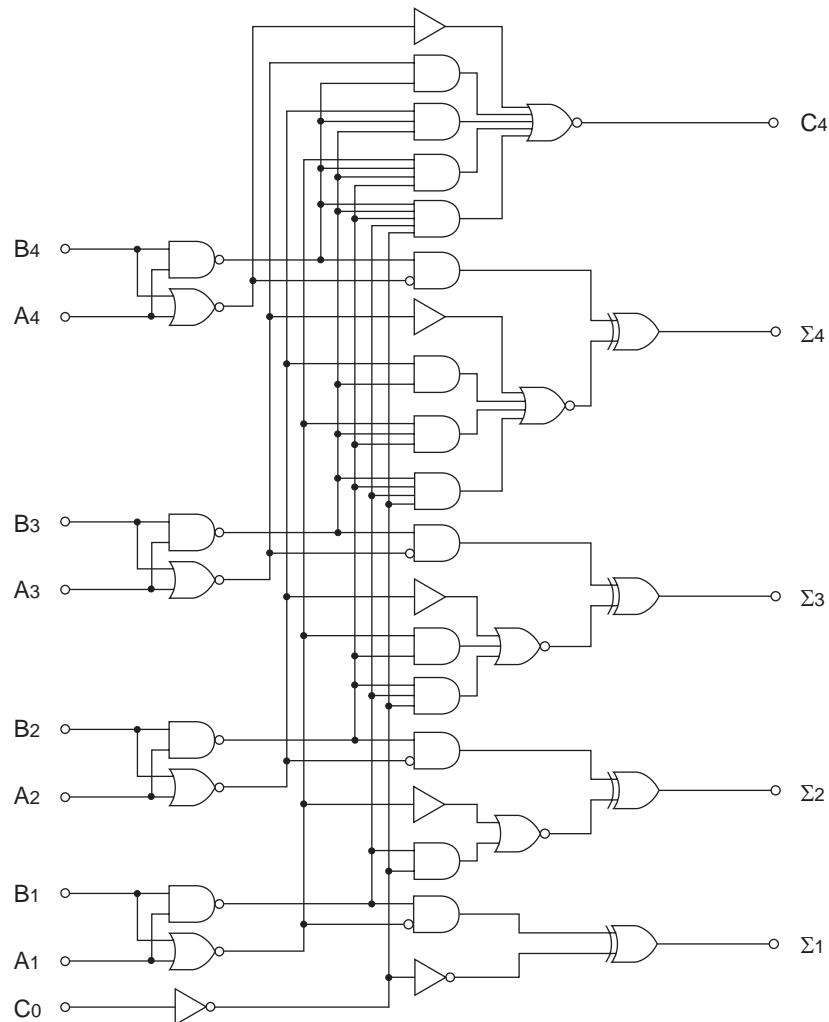
(Top view)

Function Table

Input				Output							
				When $C_0 = L$				When $C_0 = H$			
A_1	B_1	A_2	B_2	Σ_1	Σ_2	C_2	Σ_3	Σ_4	C_2	Σ_3	Σ_4
A_3	B_3	A_4	B_4	Σ_3	Σ_4	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	H		
H	H	L	L	L	H	L	H	H	H		
L	L	H	L	L	H	L	H	H	H		
H	L	H	L	H	H	L	L	L	L		
L	H	H	L	H	H	L	L	L	L		
H	H	H	L	L	L	H	H	L	L		
L	L	L	H	L	H	L	H	H	H		
H	L	L	H	H	H	L	L	L	L		
L	H	L	H	H	H	L	L	L	L		
H	H	L	H	L	L	H	H	L	L		
L	L	H	H	L	L	H	H	H	L		
H	L	H	H	H	L	H	L	L	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 than 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	Tstg	-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	μ A
	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 _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -400 μA			
	V _{IL}	—	—	0.8	V				
Output voltage	V _{OH}	2.7	—	—	V	I _{OL} = 4 mA V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V I _{OL} = 8 mA V _{CC} = 5.25 V, V _I = 2.7 V			
	V _{OL}	—	—	0.4	V				
		—	—	0.5					
Input current	I _{IH}	—	—	40	μA	V _{CC} = 5.25 V, V _I = 2.7 V			
		—	—	20					
	I _{IL}	—	—	-0.8	mA	V _{CC} = 5.25 V, V _I = 0.4 V			
		—	—	-0.4					
	I _I	—	—	0.2	mA	V _{CC} = 5.25 V, V _I = 7 V			
		—	—	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

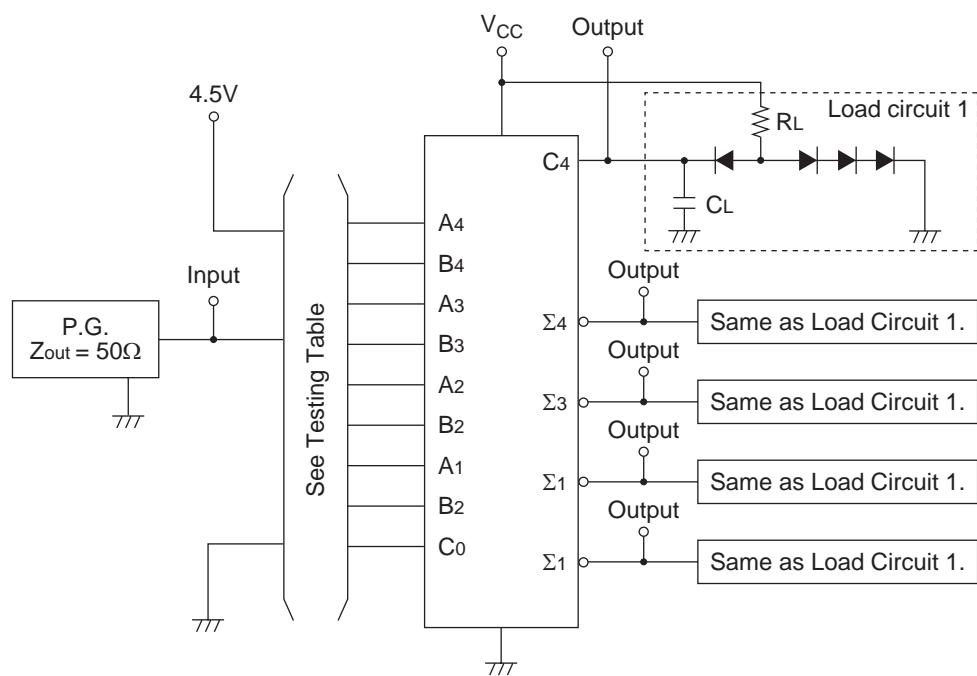
Switching Characteristics

(V_{CC} = 5 V, Ta = 25°C)

Item	Symbol	Inputs	Outputs	min.	typ.	max.	Unit	Condition
Propagation delay time	t _{PLH}	C _O	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 _O	C ₄	—	11	17		
	t _{PHL}			—	15	22		
	t _{PLH}	A _i , B _i	C ₄	—	11	17		
	t _{PHL}			—	12	17		

Testing Method

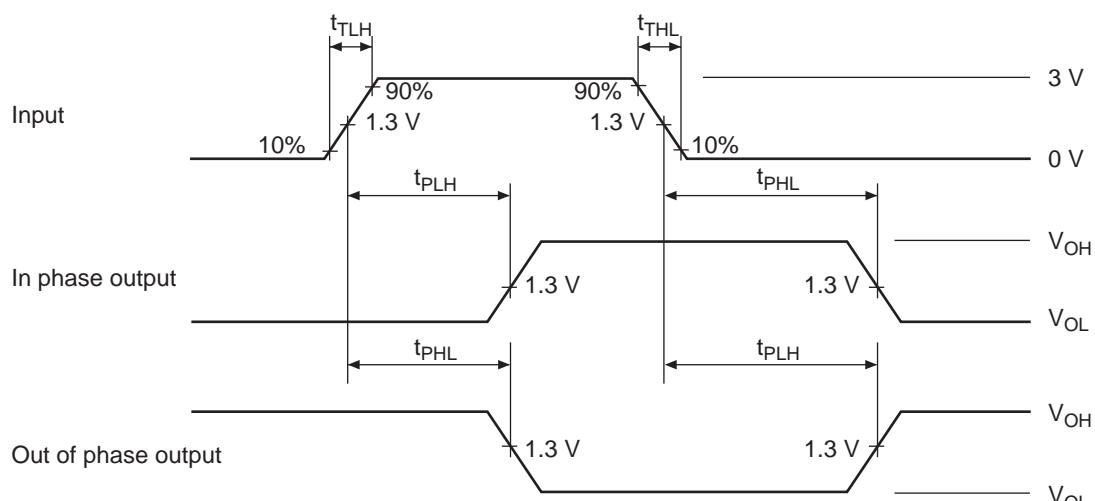
Test Circuit



Notes:

1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074(H).

Waveform

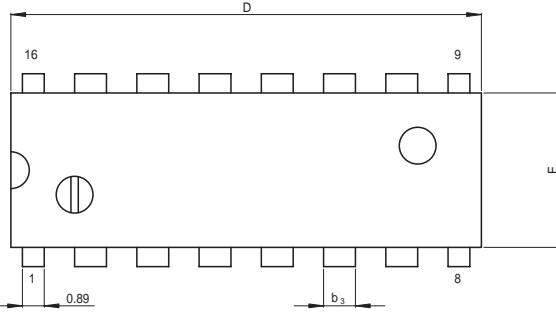
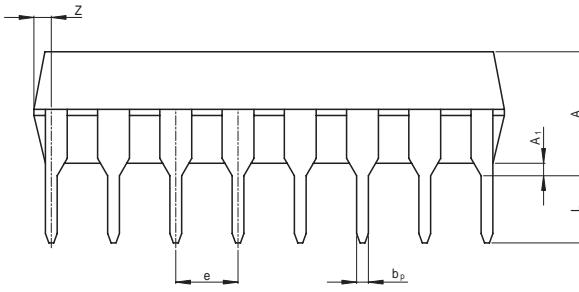
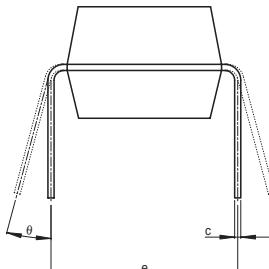


Note: Input pulse; $t_{TLH} \leq 15$ ns, $t_{THL} \leq 6$ ns, PRR = 1 MHz, duty cycle = 50%

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 A _i or B _i → Σ _i or C ₄	GND	IN	—	—	—	—	OUT							
		GND	GND	GND	4.5 v	GND	4.5 v	GND	4.5 v	IN	OUT	OUT	OUT	OUT	OUT
		GND	IN	GND	—	—	—	—	OUT						
		GND	GND	GND	GND	GND	IN	GND	IN		—	—	—	—	OUT
		GND	GND	GND	IN	GND	GND	GND	GND	GND	—	—	—	OUT	—
		IN	GND	GND	GND		GND	GND	GND	GND	—	—	OUT	—	—
		GND	—	OUT	—	—	—								
		IN	GND	—	—	—	—	—							
		GND	GND	GND	GND	GND	GND	4.5 v	IN	GND	—	—	—	OUT	OUT
		IN	GND	GND	GND	GND	GND	IN	4.5 v		—	—	—	OUT	OUT
		GND	GND	4.5 v	IN	GND	GND	GND	GND	GND	—	OUT	OUT	—	—
		IN	4.5 v	IN	4.5 v		GND	GND	GND	GND	—	OUT	OUT	—	—
		4.5 v	IN	GND	OUT	OUT	—	—	—						
		IN	4.5 v	IN	4.5 v	GND	GND	GND	GND	OUT	OUT	—	—	—	

Package Dimensions

JEITA Package Code P-DIP16-6.3x19.2-2.54	RENESAS Code PRDP0016AE-B	Previous Code DP-16FV	MASS[Typ.] 1.05g																																																							
<hr/>																																																										
16	D	9	E																																																							
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		<table border="1" data-bbox="1198 707 1436 1066"> <thead> <tr> <th rowspan="2">Reference Symbol</th><th colspan="3">Dimension in Millimeters</th></tr> <tr> <th>Min</th><th>Nom</th><th>Max</th></tr> </thead> <tbody> <tr> <td>e₁</td><td>—</td><td>7.62</td><td>—</td></tr> <tr> <td>D</td><td>—</td><td>19.2</td><td>20.32</td></tr> <tr> <td>E</td><td>—</td><td>6.3</td><td>7.4</td></tr> <tr> <td>A</td><td>—</td><td>—</td><td>5.06</td></tr> <tr> <td>A₁</td><td>0.51</td><td>—</td><td>—</td></tr> <tr> <td>b_p</td><td>0.40</td><td>0.48</td><td>0.56</td></tr> <tr> <td>b₃</td><td>—</td><td>1.30</td><td>—</td></tr> <tr> <td>c</td><td>0.19</td><td>0.25</td><td>0.31</td></tr> <tr> <td>θ</td><td>0°</td><td>—</td><td>15°</td></tr> <tr> <td>e</td><td>2.29</td><td>2.54</td><td>2.79</td></tr> <tr> <td>Z</td><td>—</td><td>—</td><td>1.12</td></tr> <tr> <td>L</td><td>2.54</td><td>—</td><td>—</td></tr> </tbody> </table>	Reference Symbol	Dimension in Millimeters			Min	Nom	Max	e ₁	—	7.62	—	D	—	19.2	20.32	E	—	6.3	7.4	A	—	—	5.06	A ₁	0.51	—	—	b _p	0.40	0.48	0.56	b ₃	—	1.30	—	c	0.19	0.25	0.31	θ	0°	—	15°	e	2.29	2.54	2.79	Z	—	—	1.12	L	2.54	—	—	(Ni/Pd/Au plating)
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