

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.

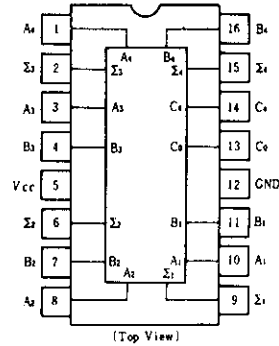
FUNCTION TABLE

| Inputs | | | | Outputs | | | | | |
|--------|-------|-------|-------|----------------|------------|----------------|----------------|------------|----------------|
| | | | | When $C_0 = L$ | | When $C_2 = L$ | When $C_0 = H$ | | When $C_2 = H$ |
| A_1 | B_1 | A_2 | B_2 | Σ_1 | Σ_2 | C_2 | 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 | L |
| H | H | L | L | L | L | 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 | L | H | H | H | H |

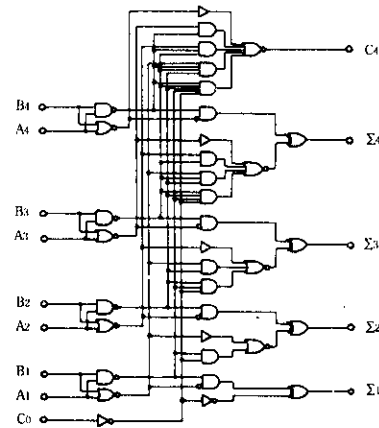
H; high level, L; low level, X; irrelevant

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



HD74LS83A

■ 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} | $V_{CC} = 4.75\text{V}, V_{IH} = 2\text{V}, V_{IL} = 0.8\text{V}$ | $I_{OL} = 4\text{mA}$ | — | 0.4 | V | |
| | | | | $I_{OL} = 8\text{mA}$ | — | 0.5 | V | |
| Input current | except C0 | I_{IH} | $V_{CC} = 5.25\text{V}, V_i = 2.7\text{V}$ | — | | 40 | μA | |
| | C0 | | | — | | 20 | μA | |
| | except C0 | I_{IL} | $V_{CC} = 5.25\text{V}, V_i = 0.4\text{V}$ | — | | -0.8 | mA | |
| | C0 | | | — | | 0.4 | mA | |
| Input current | except C0 | I_i | $V_{CC} = 5.25\text{V}, V_i = 7\text{V}$ | — | | 0.2 | mA | |
| | C0 | | | — | | 0.1 | mA | |
| 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 | mA |
| | | | | 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 | |

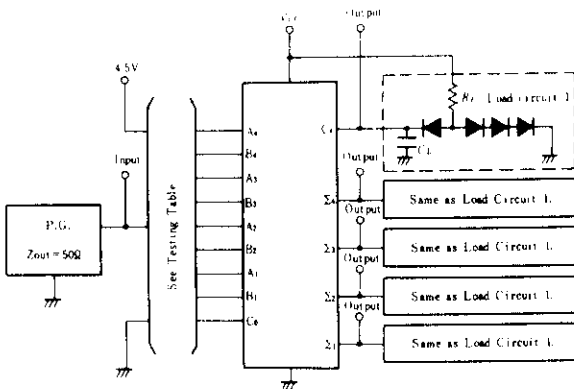
* $V_{CC} = 5\text{V}, T_a = 25^\circ\text{C}$

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

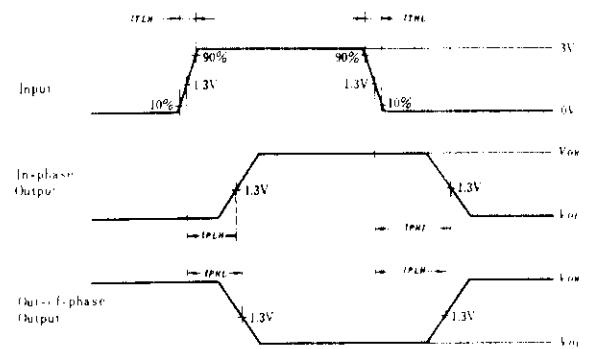
| Item | Symbol | Inputs | Outputs | Test Conditions | min | typ | max | Unit |
|------------------------|-----------|---------------------------------|----------------|--|-----|-----|-----|------|
| Propagation delay time | t_{PLH} | C _i | Σ | $C_L = 15\text{pF}, R_t = 2\text{k}\Omega$ | — | 16 | 24 | ns |
| | t_{PHL} | | | | — | 15 | 24 | ns |
| | t_{PLH} | A _i , B _i | Σ | | — | 15 | 24 | ns |
| | t_{PHL} | | | | — | 15 | 24 | ns |
| | t_{PLH} | C _i | C _o | | — | 11 | 17 | ns |
| | t_{PHL} | | | | — | 15 | 22 | ns |
| | t_{PLH} | A _i , B _i | C _o | | — | 11 | 17 | ns |
| | t_{PHL} | | | | — | 12 | 17 | ns |

■ TESTING METHOD

1) Test Circuit



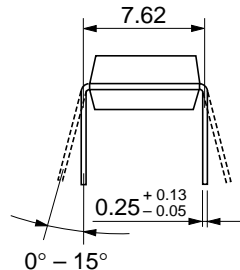
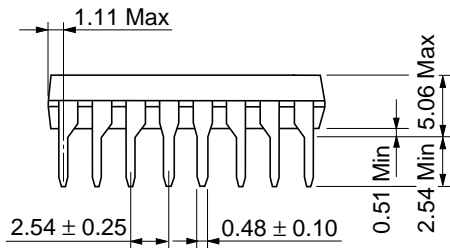
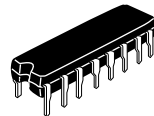
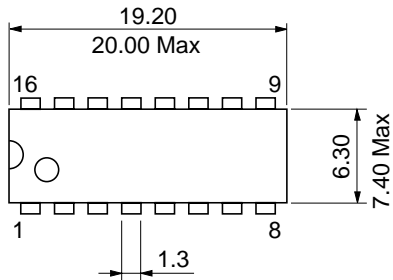
Waveform



- 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> →Σ ₄ or C ₄ | GND | GND | GND | GND | GND | GND | GND | GND | GND | IN | --- | --- | --- | --- | OUT | | |
| | | GND | 4.5V | 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 | GND | IN | IN | GND | --- | --- | --- | --- | OUT | |
| | | GND | GND | GND | GND | GND | GND | GND | IN | IN | GND | GND | --- | --- | --- | --- | OUT | |
| | | GND | GND | GND | IN | IN | GND | GND | GND | GND | GND | GND | --- | --- | OUT | --- | --- | |
| | | GND | IN | IN | GND | GND | GND | GND | GND | GND | GND | GND | --- | OUT | --- | --- | --- | |
| | | IN | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | --- | OUT | --- | --- | --- | |
| | | GND | GND | GND | GND | GND | GND | GND | GND | 4.5V | IN | IN | GND | --- | --- | --- | OUT | OUT |
| | | GND | GND | GND | GND | GND | GND | GND | GND | IN | 4.5V | GND | GND | --- | --- | OUT | OUT | --- |
| | | GND | GND | GND | 4.5V | IN | IN | GND | GND | GND | GND | GND | GND | --- | OUT | OUT | --- | --- |
| | | GND | GND | IN | 4.5V | IN | 4.5V | GND | GND | GND | GND | GND | GND | --- | OUT | OUT | --- | --- |
| | | 4.5V | IN | IN | GND | GND | GND | GND | GND | GND | GND | GND | OUT | OUT | --- | --- | --- | |
| | | IN | 4.5V | 4.5V | GND | GND | GND | GND | GND | GND | GND | GND | OUT | OUT | --- | --- | --- | |



| | |
|--------------------------|----------|
| 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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