

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.

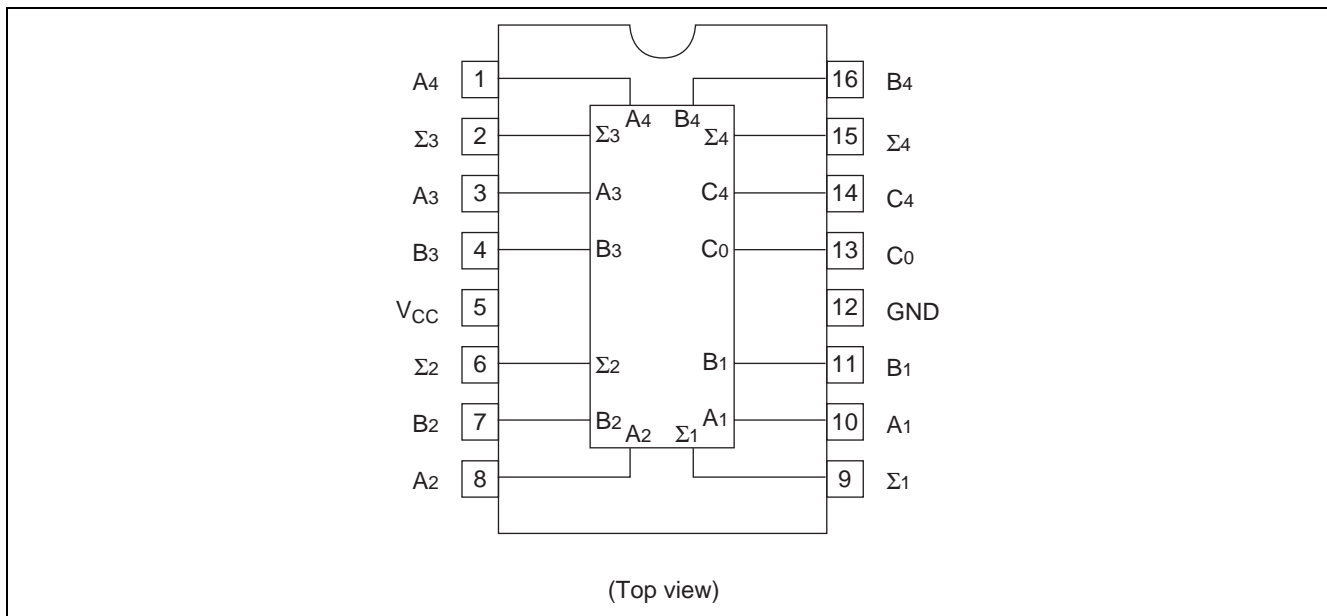
Features

- 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



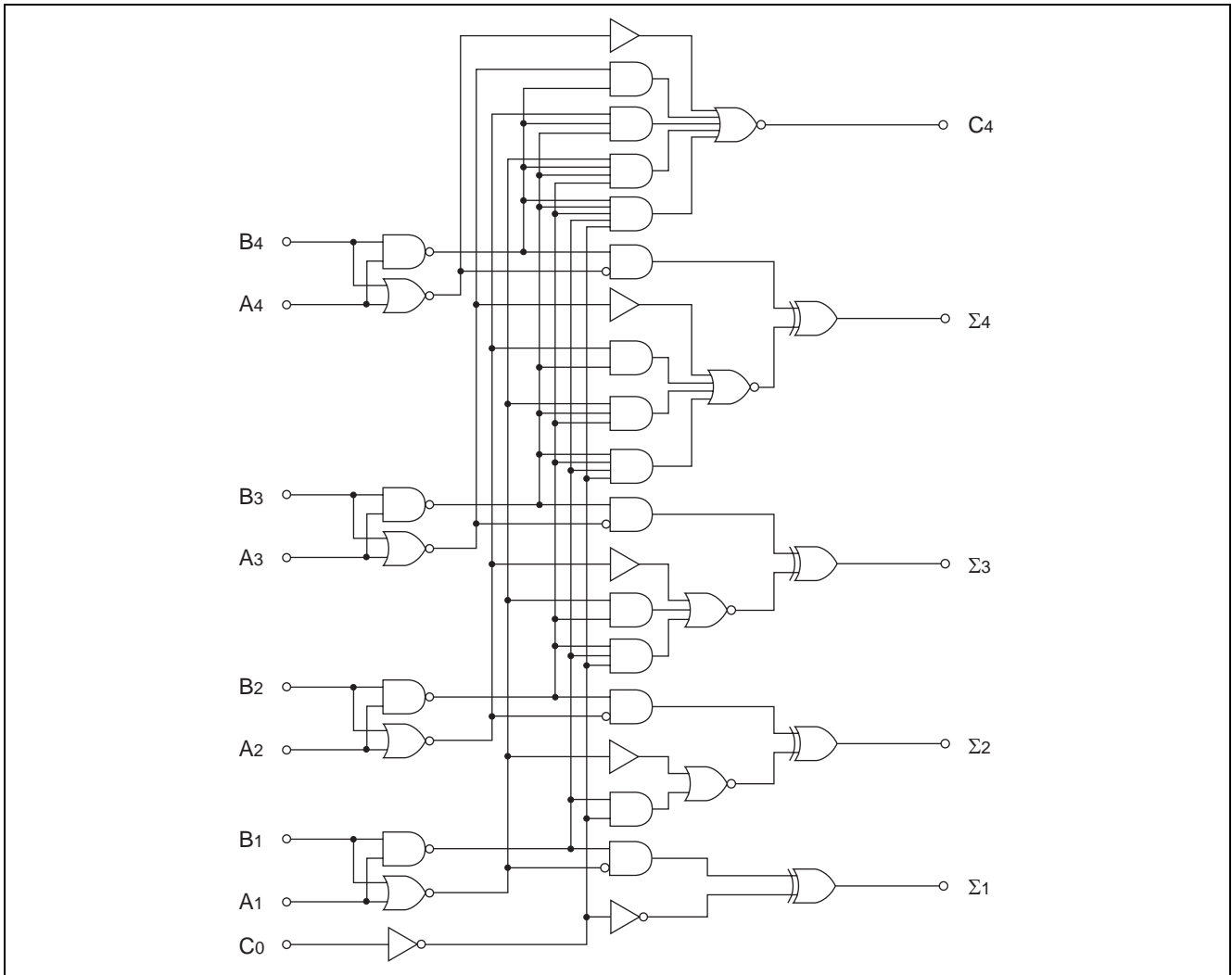
Function Table

| 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 ₁ | Σ ₂ | C ₂ |
| A ₃ | B ₃ | A ₄ | B ₄ | Σ ₃ | Σ ₄ | C 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 | 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 then used to determine outputs Σ₃, Σ₄ and C₄.

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 | V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V |
| — | | — | 0.5 | | | |
| Input current | except C ₀ | — | — | 40 | μA | V _{CC} = 5.25 V, V _I = 2.7 V |
| | C ₀ | | | 20 | | |
| | except C ₀ | — | — | -0.8 | mA | |
| | C ₀ | | | -0.4 | | |
| | except C ₀ | — | — | 0.2 | mA | |
| 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 |
| | | — | 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

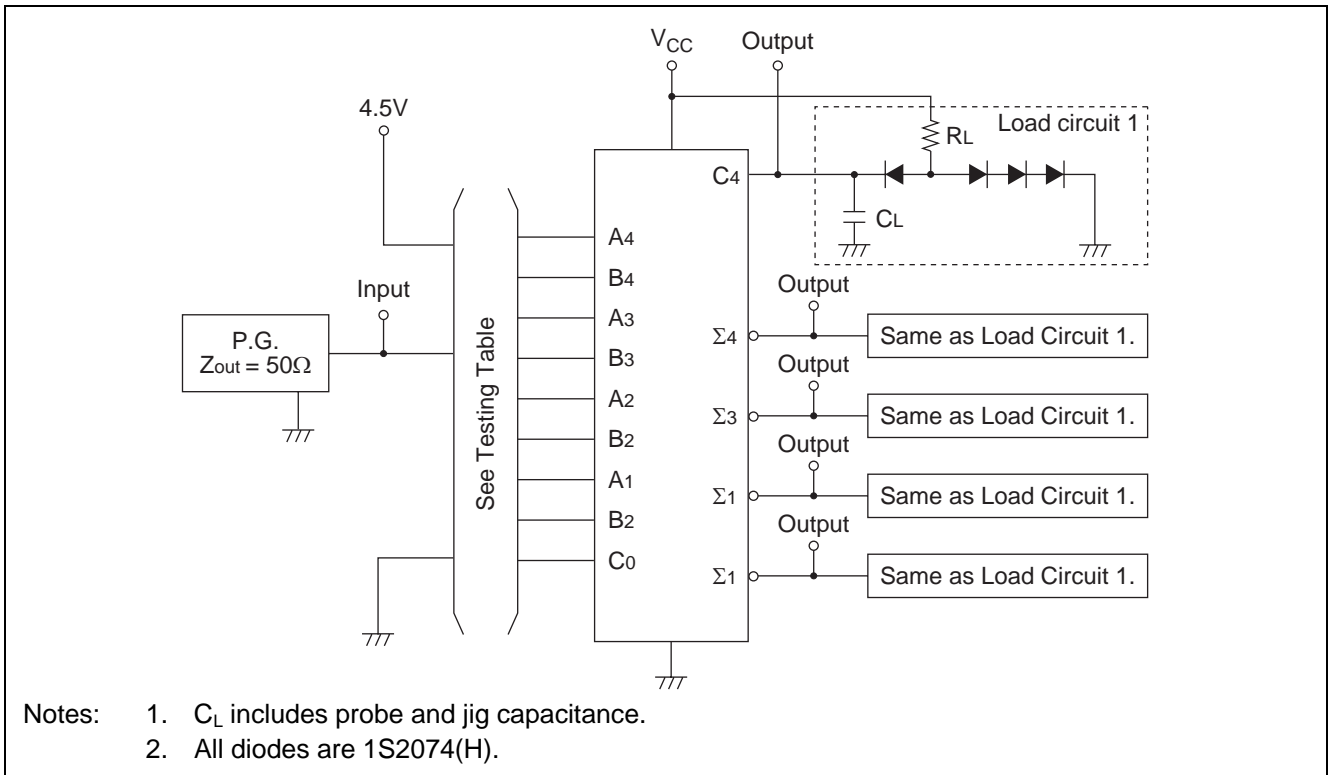
Switching Characteristics

(V_{CC} = 5 V, Ta = 25°C)

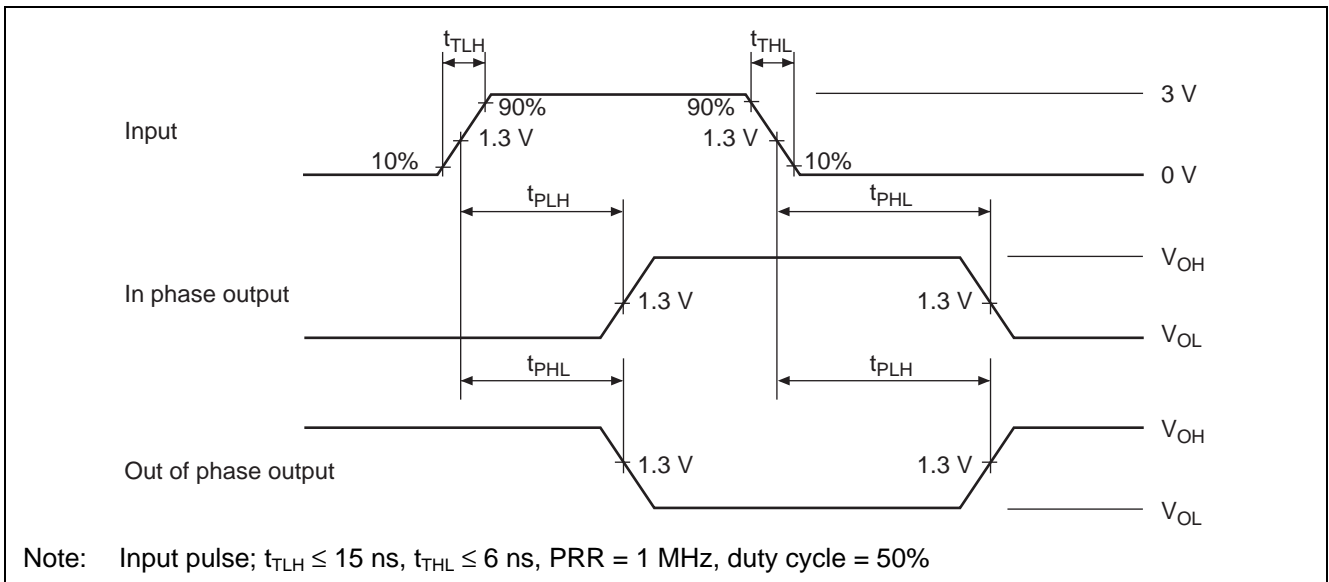
| Item | Symbol | Inputs | Outputs | min. | typ. | max. | Unit | Condition |
|------------------------|------------------|---------------------------------|----------------|------|------|------|------|---|
| Propagation delay time | t _{PLH} | C ₀ | Σ ₁ | — | 16 | 24 | ns | C _L = 15 pF, R _L = 2 kΩ |
| | 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



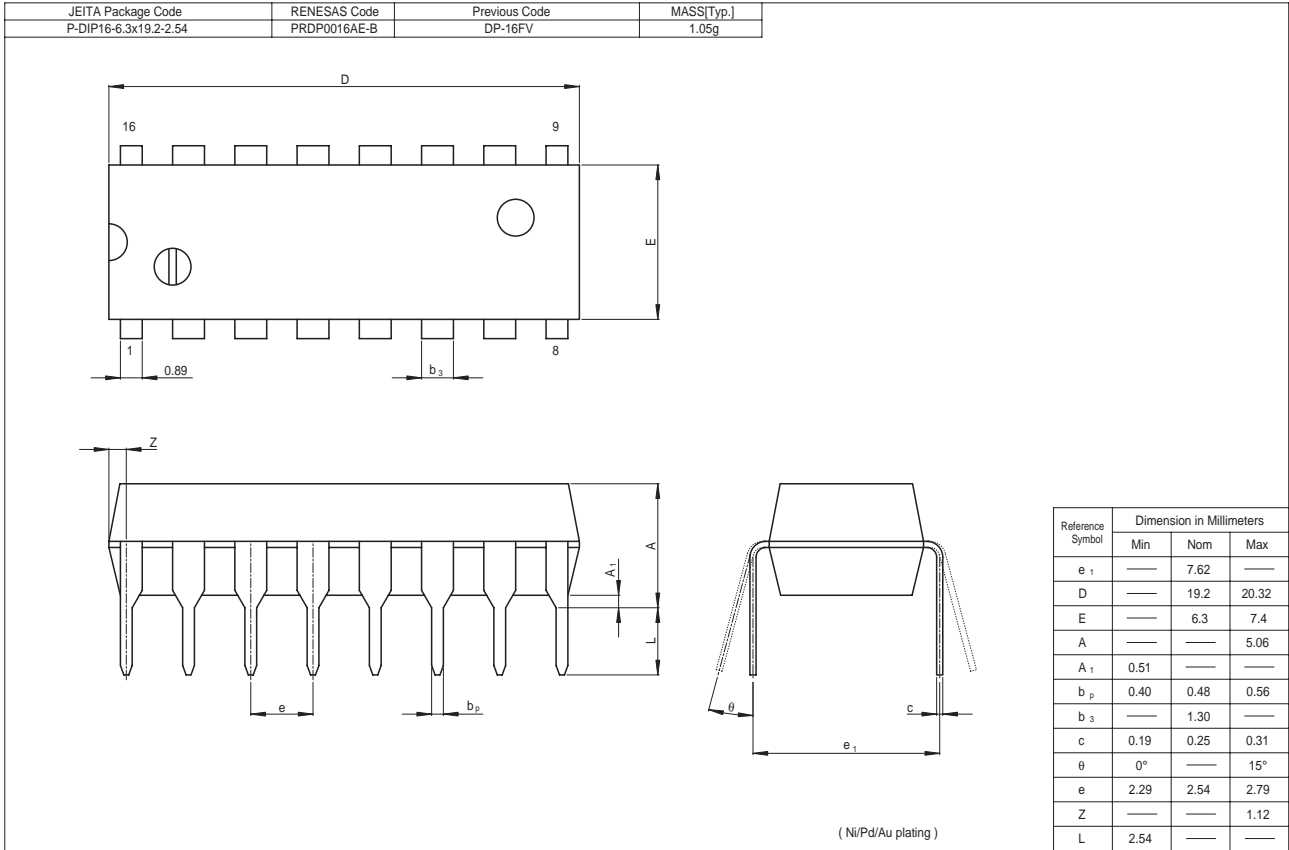
Waveform



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

Package Dimensions



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