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# HD74HC83

## 4-Bit Binary Full Adder (with Fast Carry)

# HITACHI

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### 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  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )

Function Table

| Inputs                         |                                |                                |                                | Outputs                                         |                                |                                |                                                 |                                |                                |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------------------------|--------------------------------|--------------------------------|-------------------------------------------------|--------------------------------|--------------------------------|
|                                |                                |                                |                                | When C <sub>0</sub> = L/When C <sub>2</sub> = L |                                |                                | When C <sub>0</sub> = H/When C <sub>2</sub> = H |                                |                                |
| A <sub>1</sub> /A <sub>3</sub> | B <sub>1</sub> /B <sub>3</sub> | A <sub>2</sub> /A <sub>4</sub> | B <sub>2</sub> /B <sub>4</sub> | Σ <sub>1</sub> /Σ <sub>3</sub>                  | Σ <sub>2</sub> /Σ <sub>4</sub> | C <sub>2</sub> /C <sub>4</sub> | Σ <sub>1</sub> /Σ <sub>3</sub>                  | Σ <sub>2</sub> /Σ <sub>4</sub> | C <sub>2</sub> /C <sub>4</sub> |
| 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

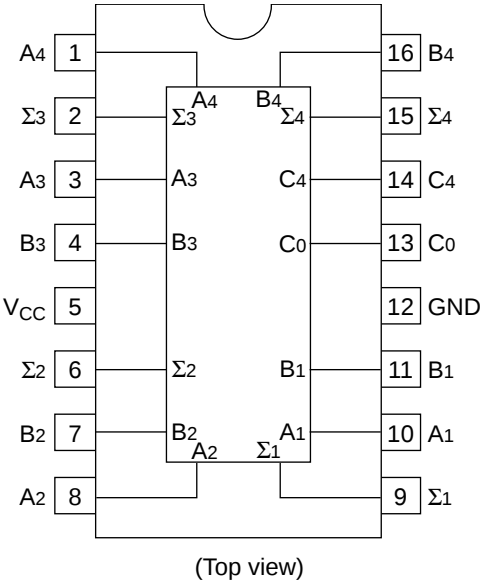
L : Low level

X : Irrelevant

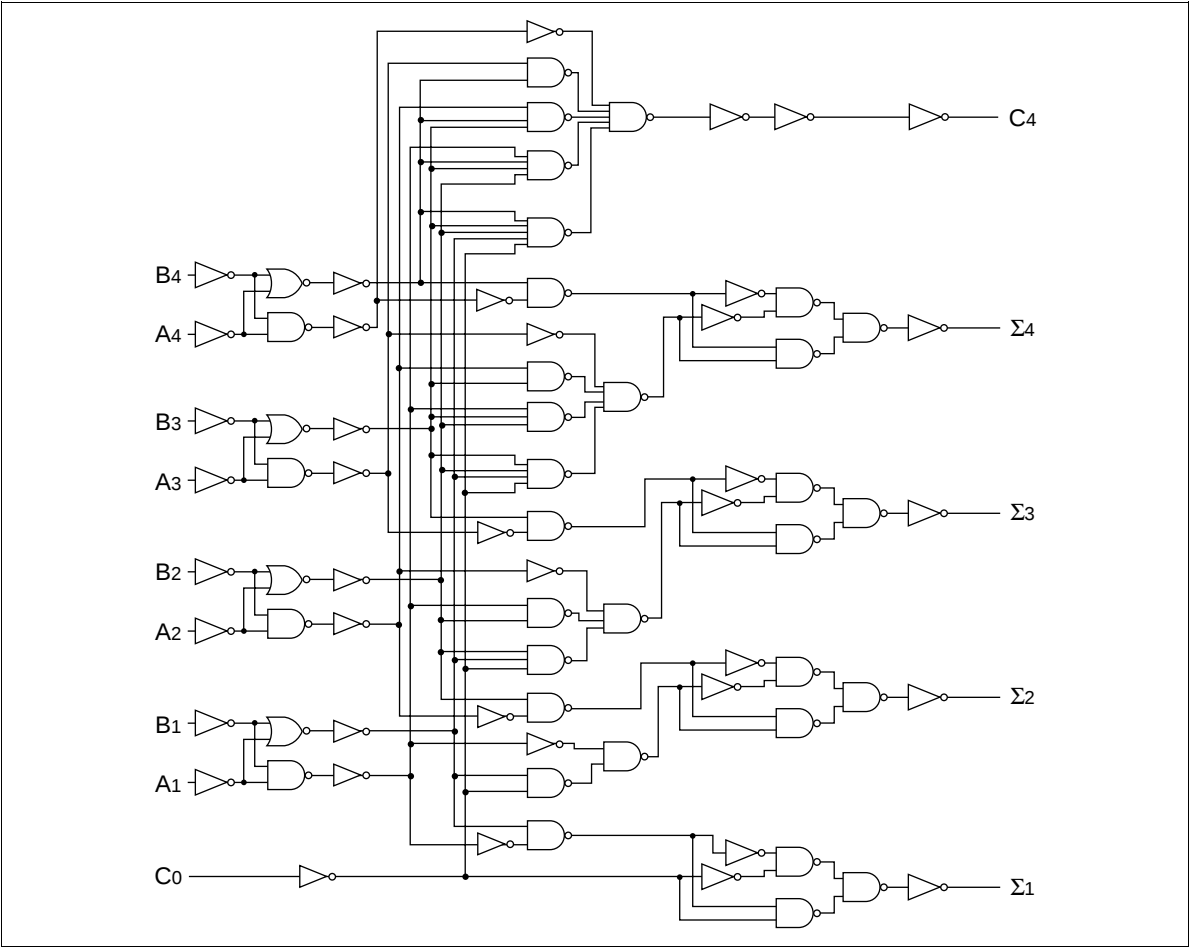
Note: Input conditions at A<sub>1</sub>, B<sub>1</sub>, A<sub>2</sub>, B<sub>2</sub> and C<sub>0</sub> are used to determine outputs Σ<sub>1</sub> and Σ<sub>2</sub> and the value of the internal carry C<sub>2</sub>.

The value at C<sub>2</sub>, A<sub>3</sub>, B<sub>3</sub>, A<sub>4</sub> and B<sub>4</sub> are than used to determine outputs Σ<sub>3</sub>, Σ<sub>4</sub> and C<sub>4</sub>

Pin Arrangement



Block Diagram (1//2)



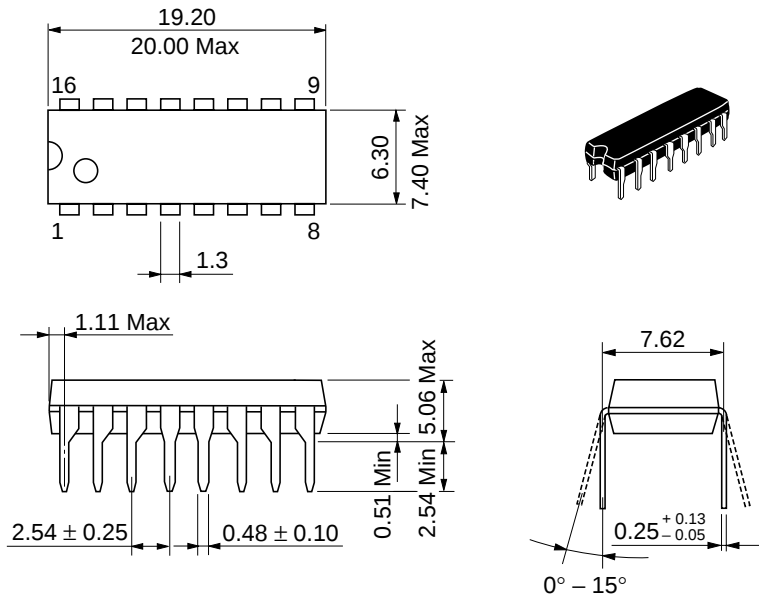
## DC Characteristics

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

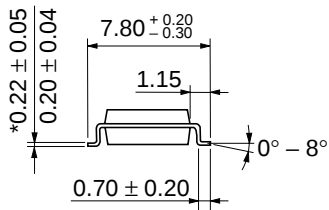
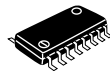
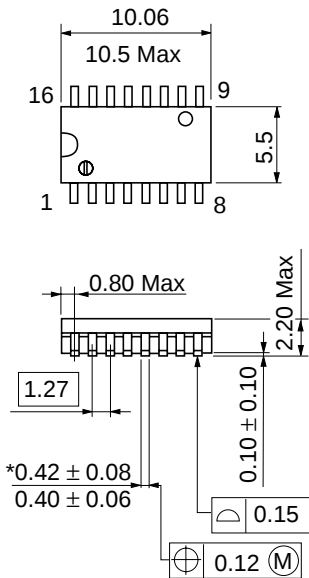
HD74HC83

AC Characteristics (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

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

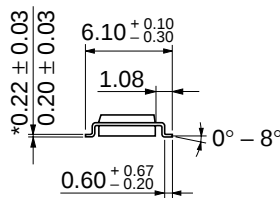
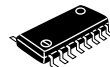
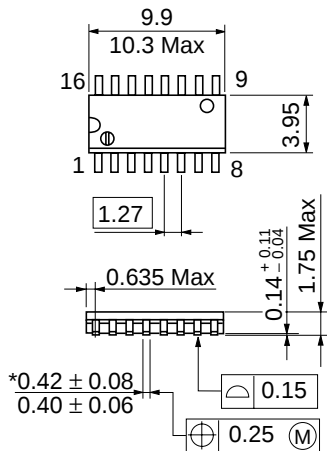


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|--------------------------|----------|
| Hitachi Code             | DP-16    |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 1.07 g   |



\*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   |