

# CD54/74AC283, CD54/74ACT283

August 1998 - Revised May 2000

## 4-Bit Binary Fill Adder With Fast Carry

### Features

- Buffered Inputs
- Exceeds 2kV ESD Protection MIL-STD-883, Method 3015
- SCR-Latchup-Resistant CMOS Process and Circuit Design
- Speed of Bipolar FAST™/AS/S with Significantly Reduced Power Consumption
- Balanced Propagation Delays
- AC Types Feature 1.5V to 5.5V Operation and Balanced Noise Immunity at 30% of the Supply
- ±24mA Output Drive Current
  - Fanout to 15 FAST™ ICs
  - Drives 50Ω Transmission Lines

### Description

The 'AC283 and 'ACT283 4-bit binary adders with fast carry that utilize Advanced CMOS Logic technology. These devices add two 4-bit binary numbers and generate a carry-out bit if the sum exceeds 15.

Because of the symmetry of the add function, this device can be used with either all active-HIGH operands (positive logic) or with all active-LOW operands (negative logic). When using positive logic, the carry-in input must be tied LOW if there is no carry-in.

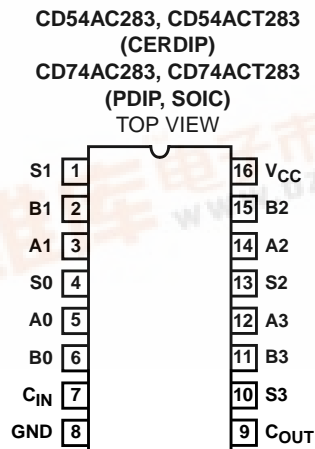
### Ordering Information

| PART NUMBER   | TEMP. RANGE (°C)                 | PACKAGE      |
|---------------|----------------------------------|--------------|
| CD54AC283F3A  | -55 to 125                       | 16 Ld CERDIP |
| CD74AC283E    | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld PDIP   |
| CD74AC283M    | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld SOIC   |
| CD54ACT283F3A | -55 to 125                       | 16 Ld CERDIP |
| CD74ACT283E   | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld PDIP   |
| CD74ACT283M   | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld SOIC   |

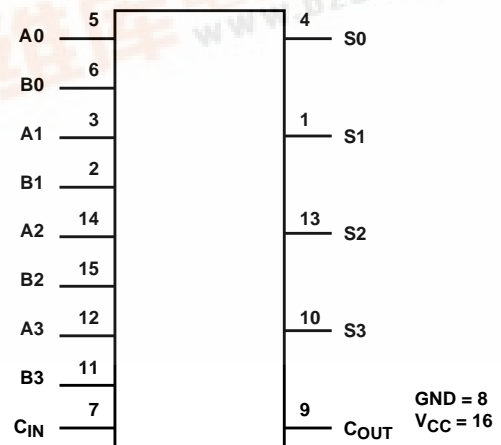
#### NOTES:

1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer and die for this part number is available which meets all electrical specifications. Please contact your local TI sales office or customer service for ordering information.

### Pinout



### Functional Diagram



## CD54/74AC283, CD54/74ACT283

### Absolute Maximum Ratings

|   |             |
|---|-------------|
| DC Supply Voltage, $V_{CC}$ .....                                   | -0.5V to 6V |
| DC Input Diode Current, $I_{IK}$                                    |             |
| For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ .....                    | $\pm 20mA$  |
| DC Output Diode Current, $I_{OK}$                                   |             |
| For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ .....                    | $\pm 50mA$  |
| DC Output Source or Sink Current per Output Pin, $I_O$              |             |
| For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ .....                    | $\pm 50mA$  |
| DC $V_{CC}$ or Ground Current, $I_{CC}$ or $I_{GND}$ (Note 3) ..... | $\pm 100mA$ |

### Thermal Information

|  |                                    |
|--|------------------------------------|
| Thermal Impedance (Typical, Note 5)                  | $\theta_{JA}$ ( $^{\circ}C/W$ )    |
| PDIP Package .....                                   | 67 $^{\circ}C/W$                   |
| SOIC Package .....                                   | 73 $^{\circ}C/W$                   |
| Maximum Junction Temperature (Plastic Package) ..... | 150 $^{\circ}C$                    |
| Maximum Storage Temperature Range .....              | -65 $^{\circ}C$ to 150 $^{\circ}C$ |
| Maximum Lead Temperature (Soldering 10s) .....       | 300 $^{\circ}C$                    |

### Operating Conditions

|   |                                    |
|---|------------------------------------|
| Temperature Range, $T_A$ .....                  | -55 $^{\circ}C$ to 125 $^{\circ}C$ |
| Supply Voltage Range, $V_{CC}$ (Note 4)         |                                    |
| AC Types .....                                  | 1.5V to 5.5V                       |
| ACT Types .....                                 | 4.5V to 5.5V                       |
| DC Input or Output Voltage, $V_I$ , $V_O$ ..... | 0V to $V_{CC}$                     |
| Input Rise and Fall Slew Rate, $dt/dv$          |                                    |
| AC Types, 1.5V to 3V .....                      | 50ns (Max)                         |
| AC Types, 3.6V to 5.5V .....                    | 20ns (Max)                         |
| ACT Types, 4.5V to 5.5V .....                   | 10ns (Max)                         |

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

#### NOTES:

3. For up to 4 outputs per device, add  $\pm 25mA$  for each additional output.
4. Unless otherwise specified, all voltages are referenced to ground.
5. The package thermal impedance is calculated in accordance with JESD 51.

### DC Electrical Specifications

| PARAMETER                 | SYMBOL   | TEST CONDITIONS      |                    | $V_{CC}$ (V)       | 25 $^{\circ}C$ |      | -40 $^{\circ}C$ TO 85 $^{\circ}C$ |      | -55 $^{\circ}C$ TO 125 $^{\circ}C$ |      | UNITS |   |
|---------------------------|----------|----------------------|--------------------|--------------------|----------------|------|-----------------------------------|------|------------------------------------|------|-------|---|
|                           |          | $V_I$ (V)            | $I_O$ (mA)         |                    | MIN            | MAX  | MIN                               | MAX  | MIN                                | MAX  |       |   |
| <b>AC TYPES</b>           |          |                      |                    |                    |                |      |                                   |      |                                    |      |       |   |
| High Level Input Voltage  | $V_{IH}$ | -                    | -                  | 1.5                | 1.2            | -    | 1.2                               | -    | 1.2                                | -    | V     |   |
|                           |          |                      |                    | 3                  | 2.1            | -    | 2.1                               | -    | 2.1                                | -    | V     |   |
|                           |          |                      |                    | 5.5                | 3.85           | -    | 3.85                              | -    | 3.85                               | -    | V     |   |
| Low Level Input Voltage   | $V_{IL}$ | -                    | -                  | 1.5                | -              | 0.3  | -                                 | 0.3  | -                                  | 0.3  | V     |   |
|                           |          |                      |                    | 3                  | -              | 0.9  | -                                 | 0.9  | -                                  | 0.9  | V     |   |
|                           |          |                      |                    | 5.5                | -              | 1.65 | -                                 | 1.65 | -                                  | 1.65 | V     |   |
| High Level Output Voltage | $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -0.05              | -0.05              | 1.5            | 1.4  | -                                 | 1.4  | -                                  | 1.4  | -     | V |
|                           |          |                      | -0.05              | -0.05              | 3              | 2.9  | -                                 | 2.9  | -                                  | 2.9  | -     | V |
|                           |          |                      | -0.05              | -0.05              | 4.5            | 4.4  | -                                 | 4.4  | -                                  | 4.4  | -     | V |
|                           |          |                      | -4                 | -4                 | 3              | 2.58 | -                                 | 2.48 | -                                  | 2.4  | -     | V |
|                           |          |                      | -24                | -24                | 4.5            | 3.94 | -                                 | 3.8  | -                                  | 3.7  | -     | V |
|                           |          |                      | -75<br>(Note 6, 7) | -75<br>(Note 6, 7) | 5.5            | -    | -                                 | 3.85 | -                                  | -    | -     | V |
|                           |          |                      | -50<br>(Note 6, 7) | -50<br>(Note 6, 7) | 5.5            | -    | -                                 | -    | -                                  | 3.85 | -     | V |

## CD54/74AC283, CD54/74ACT283

### DC Electrical Specifications (Continued)

| PARAMETER   | SYMBOL           | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C |      | -40°C TO 85°C |      | -55°C TO 125°C |      | UNITS |
|---|------------------|------------------------------------|---------------------|---------------------|------|------|---------------|------|----------------|------|-------|
|   |                  | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN  | MAX  | MIN           | MAX  | MIN            | MAX  |       |
| Low Level Output Voltage  | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | 0.05                | 1.5                 | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|   |                  |                                    | 0.05                | 3                   | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|   |                  |                                    | 0.05                | 4.5                 | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|   |                  |                                    | 12                  | 3                   | -    | 0.36 | -             | 0.44 | -              | 0.5  | V     |
|   |                  |                                    | 24                  | 4.5                 | -    | 0.36 | -             | 0.44 | -              | 0.5  | V     |
|   |                  |                                    | 75<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | 1.65 | -              | -    | V     |
|   |                  |                                    | 50<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | -    | -              | 1.65 | V     |
| Input Leakage Current   | I <sub>I</sub>   | V <sub>CC</sub> or GND             | -                   | 5.5                 | -    | ±0.1 | -             | ±1   | -              | ±1   | μA    |
| Quiescent Supply Current MSI  | I <sub>CC</sub>  | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -    | 8    | -             | 80   | -              | 160  | μA    |
| <b>ACT TYPES</b>  |                  |                                    |                     |                     |      |      |               |      |                |      |       |
| High Level Input Voltage  | V <sub>IH</sub>  | -                                  | -                   | 4.5 to 5.5          | 2    | -    | 2             | -    | 2              | -    | V     |
| Low Level Input Voltage   | V <sub>IL</sub>  | -                                  | -                   | 4.5 to 5.5          | -    | 0.8  | -             | 0.8  | -              | 0.8  | V     |
| High Level Output Voltage   | V <sub>OH</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | -0.05               | 4.5                 | 4.4  | -    | 4.4           | -    | 4.4            | -    | V     |
|   |                  |                                    | -24                 | 4.5                 | 3.94 | -    | 3.8           | -    | 3.7            | -    | V     |
|   |                  |                                    | -75<br>(Note 6, 7)  | 5.5                 | -    | -    | 3.85          | -    | -              | -    | V     |
|   |                  |                                    | -50<br>(Note 6, 7)  | 5.5                 | -    | -    | -             | -    | 3.85           | -    | V     |
| Low Level Output Voltage  | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | 0.05                | 4.5                 | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|   |                  |                                    | 24                  | 4.5                 | -    | 0.36 | -             | 0.44 | -              | 0.5  | V     |
|   |                  |                                    | 75<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | 1.65 | -              | -    | V     |
|   |                  |                                    | 50<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | -    | -              | 1.65 | V     |
| Input Leakage Current   | I <sub>I</sub>   | V <sub>CC</sub> or GND             | -                   | 5.5                 | -    | ±0.1 | -             | ±1   | -              | ±1   | μA    |
| Quiescent Supply Current MSI  | I <sub>CC</sub>  | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -    | 8    | -             | 80   | -              | 160  | μA    |
| Additional Supply Current per Input Pin TTL Inputs High 1 Unit Load | ΔI <sub>CC</sub> | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -    | 2.4  | -             | 2.8  | -              | 3    | mA    |

**NOTES:**

- Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.
- Test verifies a minimum 50Ω transmission-line-drive capability at 85°C, 75Ω at 125°C.

### ACT Input Load Table

| INPUT           | UNIT LOAD |
|-----------------|-----------|
| A0, B0, A2, B2  | 1.66      |
| A1, B1          | 1.9       |
| A3, B3          | 1.4       |
| C <sub>IN</sub> | 1.1       |

NOTE: Unit load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25°C.

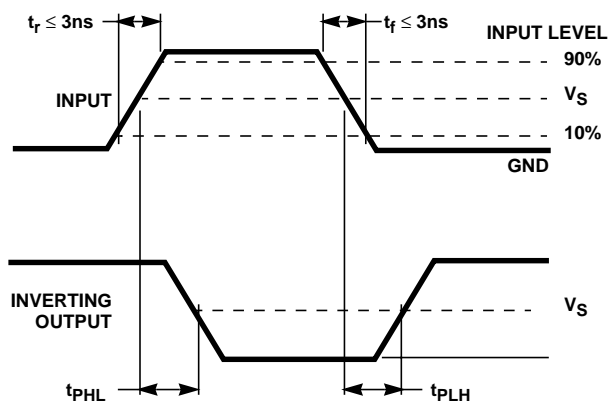
## CD54/74AC283, CD54/74ACT283

**Switching Specifications** Input  $t_r, t_f = 3\text{ns}$ ,  $C_L = 50\text{pF}$  (Worst Case)

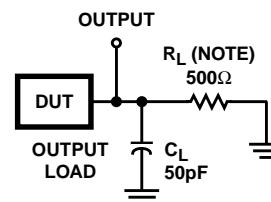
| PARAMETER  | SYMBOL                | $V_{CC}$ (V)    | -40°C TO 85°C |     |      | -55°C TO 125°C |     |      | UNITS |
|--|-----------------------|-----------------|---------------|-----|------|----------------|-----|------|-------|
|  |                       |                 | MIN           | TYP | MAX  | MIN            | TYP | MAX  |       |
| <b>AC TYPES</b>  |                       |                 |               |     |      |                |     |      |       |
| Propagation Delay,<br>An or Bn to C <sub>OUT</sub><br>C <sub>IN</sub> to Sn<br>C <sub>IN</sub> to C <sub>OUT</sub> | $t_{PLH}, t_{PHL}$    | 1.5             | -             | -   | 199  | -              | -   | 219  | ns    |
|  |                       | 3.3<br>(Note 9) | 6.3           | -   | 22.4 | 6.2            | -   | 24.6 | ns    |
|  |                       | 5<br>(Note 10)  | 4.5           | -   | 16   | 4.4            | -   | 17.6 | ns    |
| Propagation Delay,<br>An or Bn to Sn   | $t_{PLH}, t_{PHL}$    | 1.5             | -             | -   | 207  | -              | -   | 228  | ns    |
|  |                       | 3.3             | 6.6           | -   | 23.2 | 6.4            | -   | 25.5 | ns    |
|  |                       | 5               | 4.7           | -   | 16.5 | 4.6            | -   | 18.2 | ns    |
| Input Capacitance  | $C_I$                 | -               | -             | -   | 10   | -              | -   | 10   | pF    |
| Power Dissipation Capacitance  | $C_{PD}$<br>(Note 11) | -               | -             | 120 | -    | -              | 120 | -    | pF    |
| <b>ACT TYPES</b>   |                       |                 |               |     |      |                |     |      |       |
| Propagation Delay,<br>An or Bn to C <sub>OUT</sub><br>C <sub>IN</sub> to Sn<br>C <sub>IN</sub> to C <sub>OUT</sub> | $t_{PLH}, t_{PHL}$    | 5<br>(Note 10)  | 4.5           | -   | 16   | 2.7            | -   | 17.6 | ns    |
| Propagation Delay,<br>An or Bn to Sn   | $t_{PLH}, t_{PHL}$    | 5               | 4.7           | -   | 16.5 | 3.3            | -   | 18.2 | ns    |
| Input Capacitance  | $C_I$                 | -               | -             | -   | 10   | -              | -   | 10   | pF    |
| Power Dissipation Capacitance  | $C_{PD}$<br>(Note 11) | -               | -             | 120 | -    | -              | 120 | -    | pF    |

**NOTES:**

8. Limits tested 100%.
9. 3.3V Min is at 3.6V, Max is at 3V.
10. 5V Min is at 5.5V, Max is at 4.5V.
11.  $C_{PD}$  is used to determine the dynamic power consumption per function.  
 AC:  $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$   
 ACT:  $P_D = V_{CC}^2 f_i (C_{PD} + C_L) + V_{CC} \Delta I_{CC}$  where  $f_i$  = input frequency,  $C_L$  = output load capacitance,  $V_{CC}$  = supply voltage.



**FIGURE 1. PROPAGATION DELAY TIMES**



NOTE: For AC Series Only: When  $V_{CC} = 1.5\text{V}$ ,  $R_L = 1\text{k}\Omega$ .

|                                 | AC           | ACT          |
|---------------------------------|--------------|--------------|
| Input Level                     | $V_{CC}$     | 3V           |
| Input Switching Voltage, $V_S$  | $0.5 V_{CC}$ | 1.5V         |
| Output Switching Voltage, $V_S$ | $0.5 V_{CC}$ | $0.5 V_{CC}$ |

**FIGURE 2. PROPAGATION DELAY TIMES**

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