

# SN54F283, SN74F283 4-BIT BINARY FULL ADDERS WITH FAST CARRY

SDFS069A – D2932, MARCH 1987 – REVISED OCTOBER 1993

- Full-Carry Look-Ahead Across the Four Bits
- Systems Achieve Partial Look-Ahead Performance With the Economy of Ripple Carry
- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

## description

The 'F283 is a full adder that performs the addition of two 4-bit binary words. The sum ( $\Sigma$ ) outputs are provided for each bit and the resultant carry ( $C_4$ ) output is obtained from the fourth bit.

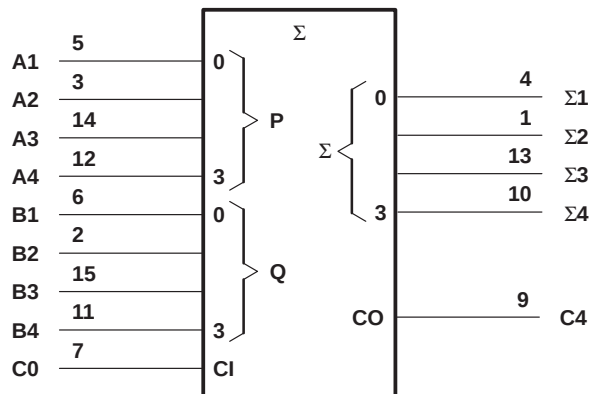
The device features full internal look-ahead across all four bits generating the carry term  $C_4$  in typically 5.7 ns. This capability provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

The adder logic, including the carry, is implemented in its true form. End-around carry can be accomplished without the need for logic or level inversion.

The 'F283 can be used with either all-active-high (positive logic) or all-active-low (negative logic) operands.

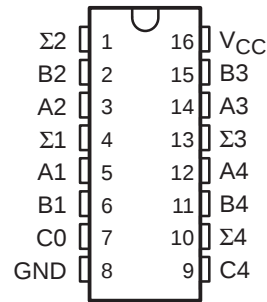
The SN54F283 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74F283 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## logic symbol†

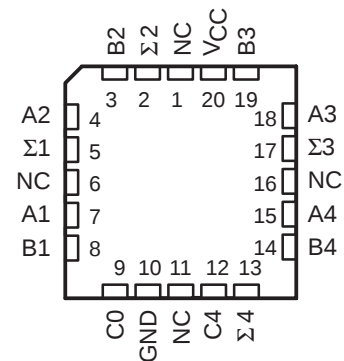


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, and N packages.

SN54F283 . . . J PACKAGE  
SN74F283 . . . D OR N PACKAGE  
(TOP VIEW)



SN54F283 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

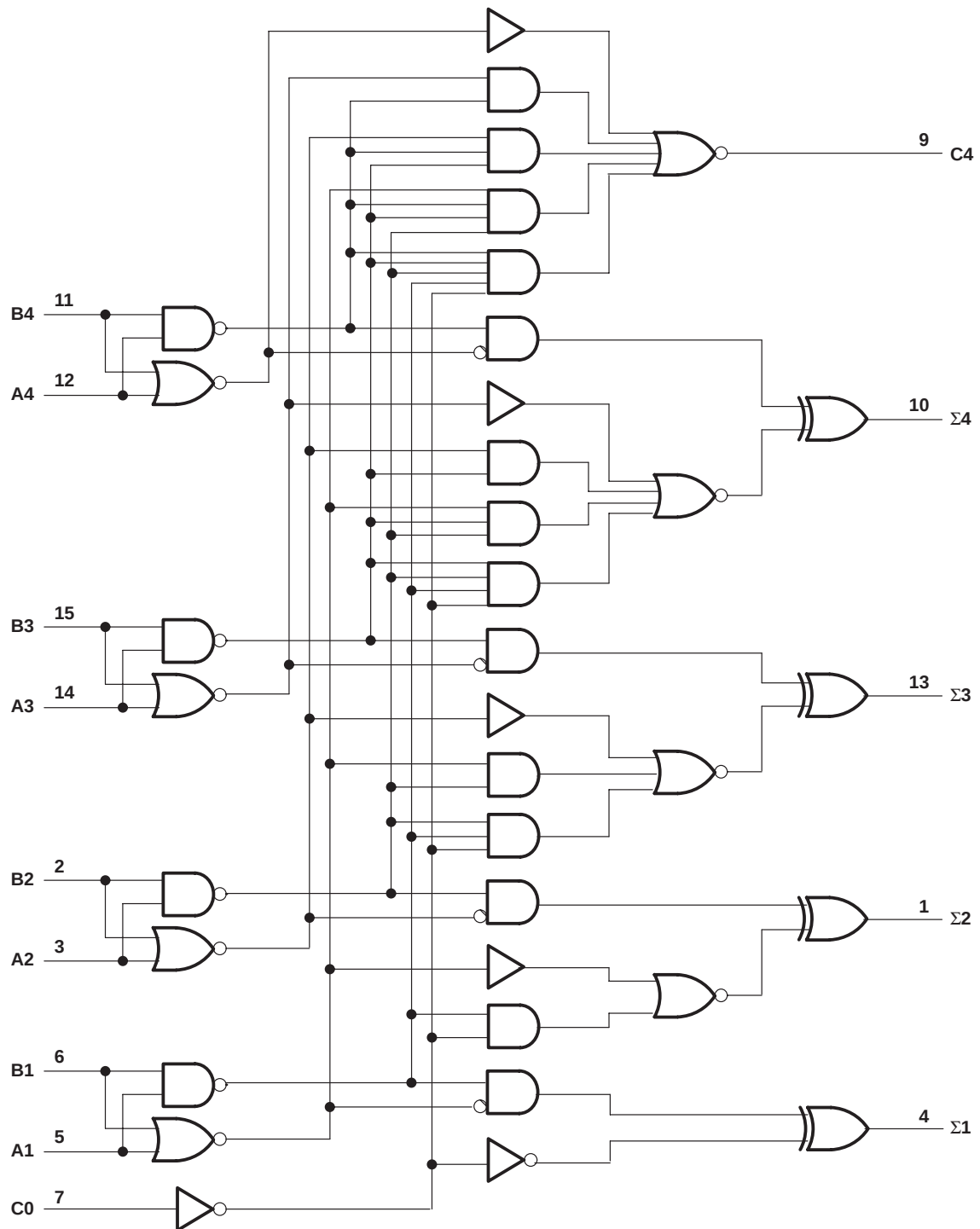
# SN54F283, SN74F283

## 4-BIT BINARY FULL ADDERS

### WITH FAST CARRY

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logic diagram (positive logic)



Pin numbers shown are for the D, J, and N packages.

**SN54F283, SN74F283**  
**4-BIT BINARY FULL ADDERS**  
**WITH FAST CARRY**

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**FUNCTION TABLE**

| INPUTS |    |    |    | OUTPUTS     |            |    |             |            |    |
|--------|----|----|----|-------------|------------|----|-------------|------------|----|
|        |    |    |    | WHEN C0 = L |            |    | WHEN C0 = H |            |    |
|        |    |    |    | WHEN C2 = L |            |    | WHEN C2 = H |            |    |
| A1     | B1 | A2 | B2 | $\Sigma 1$  | $\Sigma 2$ | C2 | $\Sigma 1$  | $\Sigma 2$ | C2 |
| A3     | B3 | A4 | B4 | $\Sigma 3$  | $\Sigma 4$ | C4 | $\Sigma 3$  | $\Sigma 4$ | C4 |
| 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  |

NOTE: Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs  $\Sigma 1$  and  $\Sigma 2$  and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs  $\Sigma 3$ ,  $\Sigma 4$ , and C4.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>**

|                                                       |                    |
|-------------------------------------------------------|--------------------|
| Supply voltage range, $V_{CC}$                        | –0.5 V to 7 V      |
| Input voltage range (see Note 1)                      | –1.2 V to 7 V      |
| Input current range                                   | –30 mA to 5 mA     |
| Voltage range applied to any output in the high state | –0.5 V to $V_{CC}$ |
| Current into any output in the low state              | 40 mA              |
| Operating free-air temperature range: SN54F283        | –55°C to 125°C     |
| SN74F283                                              | 0°C to 70°C        |
| Storage temperature range                             | –65°C to 150°C     |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

# SN54F283, SN74F283

## 4-BIT BINARY FULL ADDERS

### WITH FAST CARRY

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#### recommended operating conditions

|          |                                | SN54F283 |     |     | SN74F283 |     |     | UNIT |
|----------|--------------------------------|----------|-----|-----|----------|-----|-----|------|
|          |                                | MIN      | NOM | MAX | MIN      | NOM | MAX |      |
| $V_{CC}$ | Supply voltage                 | 4.5      | 5   | 5.5 | 4.5      | 5   | 5.5 | V    |
| $V_{IH}$ | High-level input voltage       | 2        |     |     | 2        |     |     | V    |
| $V_{IL}$ | Low-level input voltage        |          |     | 0.8 |          |     | 0.8 | V    |
| $I_{IK}$ | Input clamp current            |          |     | –18 |          |     | –18 | mA   |
| $I_{OH}$ | High-level output current      |          |     | –1  |          |     | –1  | mA   |
| $I_{OL}$ | Low-level output current       |          |     | 20  |          |     | 20  | mA   |
| $T_A$    | Operating free-air temperature | –55      |     | 125 | 0        |     | 70  | °C   |

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER         |            | TEST CONDITIONS                                       |  | SN54F283 |      |      | SN74F283 |      |      | UNIT |
|-------------------|------------|-------------------------------------------------------|--|----------|------|------|----------|------|------|------|
|                   |            |                                                       |  | MIN      | TYP† | MAX  | MIN      | TYP† | MAX  |      |
| $V_{IK}$          |            | $V_{CC} = 4.5\text{ V}$ ,<br>$I_I = -18\text{ mA}$    |  |          |      | –1.2 |          |      | –1.2 | V    |
| $V_{OH}$          |            | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OH} = -1\text{ mA}$  |  | 2.5      | 3.4  |      | 2.5      | 3.4  |      | V    |
|                   |            | $V_{CC} = 4.75\text{ V}$ ,<br>$I_{OH} = -1\text{ mA}$ |  |          |      |      | 2.7      |      |      |      |
| $V_{OL}$          |            | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OL} = 20\text{ mA}$  |  |          | 0.3  | 0.5  |          | 0.3  | 0.5  | V    |
| $I_I$             |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 7\text{ V}$       |  |          |      | 0.1  |          |      | 0.1  | mA   |
| $I_{IH}$          |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 2.7\text{ V}$     |  |          |      | 20   |          |      | 20   | μA   |
| $I_{IL}$          | Any A or B | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 0.5\text{ V}$     |  |          |      | –1.2 |          |      | –1.2 | mA   |
|                   | C0         |                                                       |  |          |      | –0.6 |          |      | –0.6 |      |
| $I_{OS}^\ddagger$ |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 0$                |  | –60      |      | –150 | –60      |      | –150 | mA   |
| $I_{CC}$          |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 4.5\text{ V}$     |  |          | 36   | 55   |          | 36   | 55   | mA   |

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

#### switching characteristics (see Note 2)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> = 5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω,<br>T <sub>A</sub> = 25°C |     |     | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω,<br>T <sub>A</sub> = MIN to MAX§ |      |          |      | UNIT |
|------------------|-----------------|----------------|-------------------------------------------------------------------------------------------------------|-----|-----|-------------------------------------------------------------------------------------------------------------------------|------|----------|------|------|
|                  |                 |                | ‘F283                                                                                                 |     |     | SN54F283                                                                                                                |      | SN74F283 |      |      |
|                  |                 |                | MIN                                                                                                   | TYP | MAX | MIN                                                                                                                     | MAX  | MIN      | MAX  |      |
| t <sub>PLH</sub> | C0              | Σ              | 2.7                                                                                                   | 6.6 | 9.5 | 2.7                                                                                                                     | 14   | 2.7      | 10.5 | ns   |
| t <sub>PHL</sub> |                 |                | 3.2                                                                                                   | 6.6 | 9.5 | 3.2                                                                                                                     | 14   | 3.2      | 10.5 |      |
| t <sub>PLH</sub> | A or B          | Σ              | 3.2                                                                                                   | 6.6 | 9.5 | 3.2                                                                                                                     | 14   | 3.2      | 10.5 | ns   |
| t <sub>PHL</sub> |                 |                | 2.7                                                                                                   | 6.6 | 9.5 | 2.7                                                                                                                     | 14   | 2.7      | 10.5 |      |
| t <sub>PLH</sub> | C0              | C4             | 2.7                                                                                                   | 5.3 | 7.5 | 2.7                                                                                                                     | 10.5 | 2.7      | 8.5  | ns   |
| t <sub>PHL</sub> |                 |                | 2.2                                                                                                   | 5   | 7   | 2.2                                                                                                                     | 10   | 2.2      | 8    |      |
| t <sub>PLH</sub> | A or B          | C4             | 2.7                                                                                                   | 5.3 | 7.5 | 2.7                                                                                                                     | 10.5 | 2.7      | 8.5  | ns   |
| t <sub>PHL</sub> |                 |                | 2.2                                                                                                   | 4.9 | 7   | 2.2                                                                                                                     | 10   | 2.2      | 8    |      |

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

NOTE 2: Load circuits and waveforms are shown in Section 1.



**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9758701Q2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 5962-9758701QEA  | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| 5962-9758701QEA  | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| 5962-9758701QFA  | OBSOLETE              | CFP          | W               | 16   |             | TBD                     | Call TI          | Call TI                      |
| 5962-9758701QFA  | OBSOLETE              | CFP          | W               | 16   |             | TBD                     | Call TI          | Call TI                      |
| JM38510/34201B2A | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| JM38510/34201B2A | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| JM38510/34201BEA | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| JM38510/34201BEA | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| JM38510/34201BFA | ACTIVE                | CFP          | W               | 16   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| JM38510/34201BFA | ACTIVE                | CFP          | W               | 16   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SN54F283J        | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SN54F283J        | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SN74F283D        | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283D        | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283DE4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283DE4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283DR       | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283DR       | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283DRE4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283DRE4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283N        | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74F283N        | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74F283N3       | OBSOLETE              | PDIP         | N               | 16   |             | TBD                     | Call TI          | Call TI                      |
| SN74F283N3       | OBSOLETE              | PDIP         | N               | 16   |             | TBD                     | Call TI          | Call TI                      |
| SN74F283NE4      | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74F283NE4      | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74F283NSR      | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283NSR      | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283NSRE4    | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74F283NSRE4    | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SNJ54F283FK      | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54F283FK      | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54F283J       | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SNJ54F283J       | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SNJ54F283W       | OBSOLETE              | CFP          | W               | 16   |             | TBD                     | Call TI          | Call TI                      |
| SNJ54F283W       | OBSOLETE              | CFP          | W               | 16   |             | TBD                     | Call TI          | Call TI                      |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |

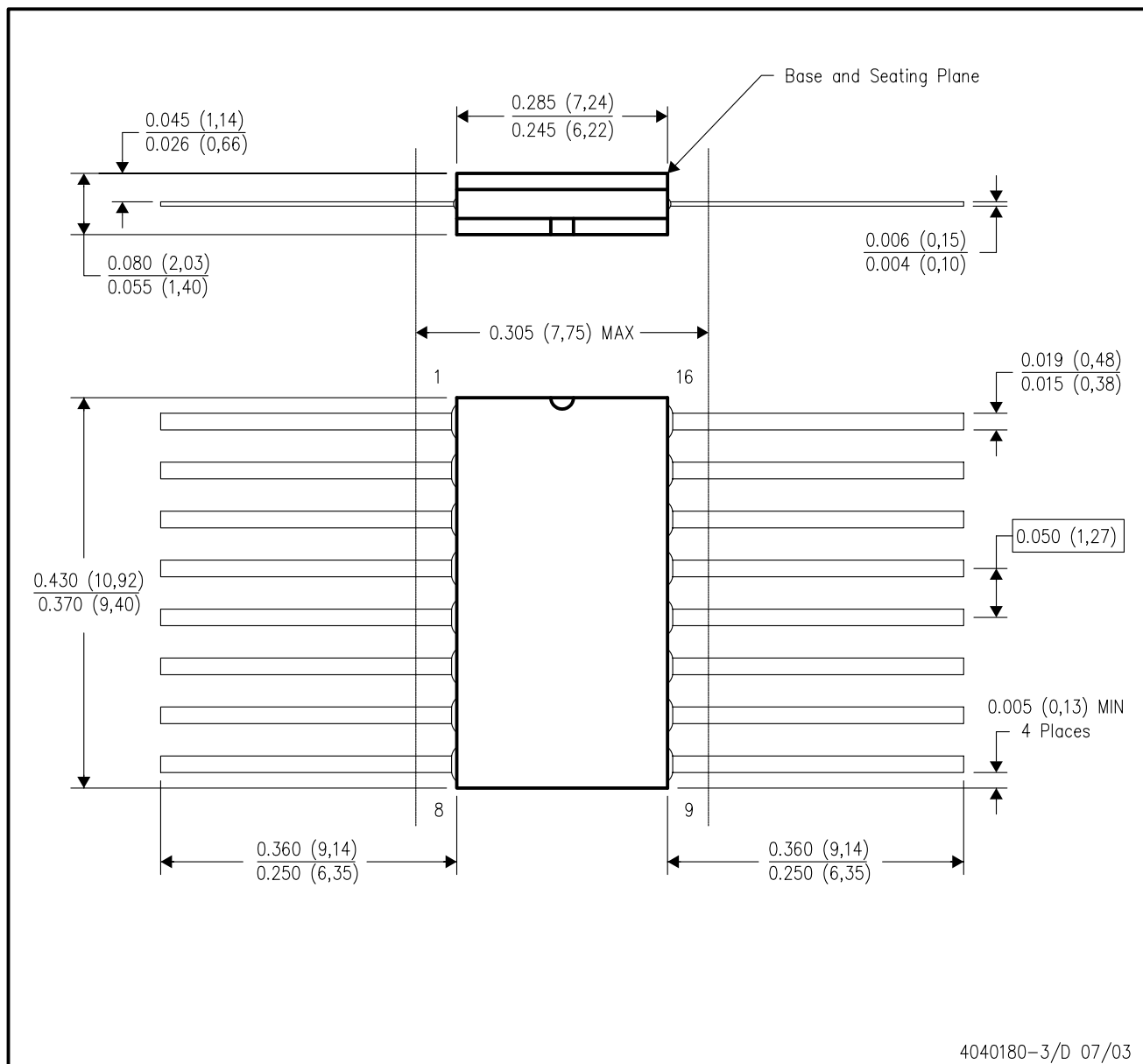


4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



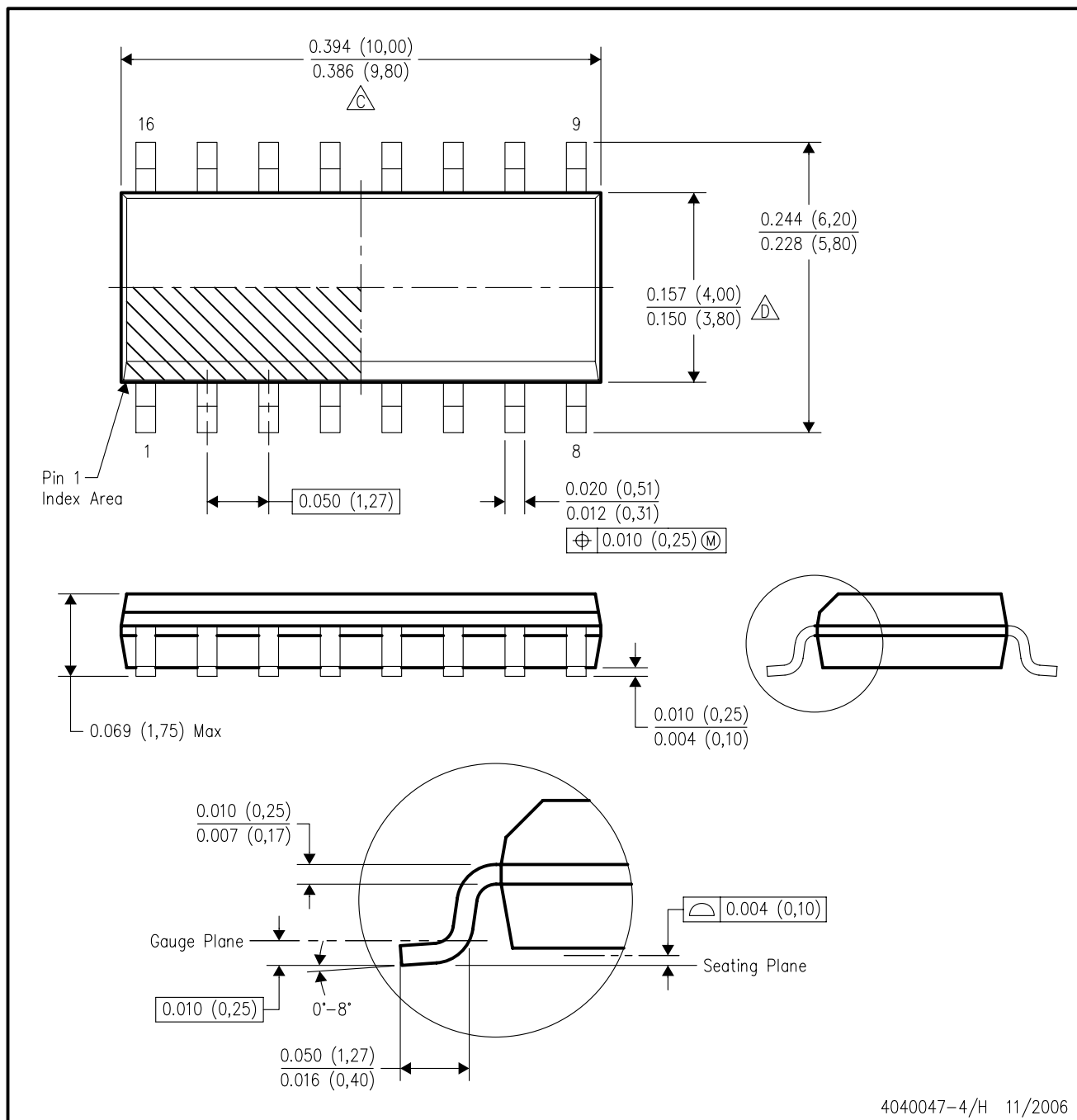
4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

## D (R-PDSO-G16)

## PLASTIC SMALL-OUTLINE PACKAGE



4040047-4/H 11/2006

## NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265