

# SN5485, SN54LS85, SN54S85 SN7485, SN74LS85, SN74S85 4-BIT MAGNITUDE COMPARATORS

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| TYPE  | TYPICAL<br>POWER<br>DISSIPATION | TYPICAL<br>DELAY<br>(4-BIT WORDS) |
|-------|---------------------------------|-----------------------------------|
| '85   | 275 mW                          | 23 ns                             |
| 'LS85 | 52 mW                           | 24 ns                             |
| 'S85  | 365 mW                          | 11 ns                             |

SN5485, SN54LS85, SN54S85 . . . J OR W PACKAGE  
SN7485 . . . N PACKAGE  
SN74LS85, SN74S85 . . . D OR N PACKAGE  
(TOP VIEW)



## description

These four-bit magnitude comparators perform comparison of straight binary and straight BCD (8-4-2-1) codes. Three fully decoded decisions about two 4-bit words (A, B) are made and are externally available at three outputs. These devices are fully expandable to any number of bits without external gates. Words of greater length may be compared by connecting comparators in cascade. The  $A > B$ ,  $A < B$ , and  $A = B$  outputs of a stage handling less-significant bits are connected to the corresponding  $A > B$ ,  $A < B$ , and  $A = B$  inputs of the next stage handling more-significant bits. The stage handling the least-significant bits must have a high-level voltage applied to the  $A = B$  input. The cascading paths of the '85, 'LS85, and 'S85 are implemented with only a two-gate-level delay to reduce overall comparison times for long words. An alternate method of cascading which further reduces the comparison time is shown in the typical application data.

SN54LS85, SN54S85 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

FUNCTION TABLE

| COMPARING INPUTS |         |         |         | CASCADING INPUTS |       |       | OUTPUTS |       |       |
|------------------|---------|---------|---------|------------------|-------|-------|---------|-------|-------|
| A3, B3           | A2, B2  | A1, B1  | A0, B0  | A > B            | A < B | A = B | A > B   | A < B | A = B |
| A3 > B3          | X       | X       | X       | X                | X     | X     | H       | L     | L     |
| A3 < B3          | X       | X       | X       | X                | X     | X     | L       | H     | L     |
| A3 = B3          | A2 > B2 | X       | X       | X                | X     | X     | H       | L     | L     |
| A3 = B3          | A2 < B2 | X       | X       | X                | X     | X     | L       | H     | L     |
| A3 = B2          | A2 = B2 | A1 > B1 | X       | X                | X     | X     | H       | L     | L     |
| A3 = B3          | A2 = B2 | A1 < B1 | X       | X                | X     | X     | L       | H     | L     |
| A2 = B3          | A2 = B2 | A1 = B1 | A0 > B0 | X                | X     | X     | H       | L     | L     |
| A3 = B3          | A2 = B2 | A1 = B1 | A0 < B0 | X                | X     | X     | L       | H     | L     |
| A3 = B3          | A2 = B2 | A1 = B1 | A0 = B0 | H                | L     | L     | H       | L     | L     |
| A3 = B3          | A2 = B2 | A1 = B1 | A0 = B0 | L                | H     | L     | L       | H     | L     |
| A3 = B3          | A2 = B2 | A1 = B1 | A0 = B0 | X                | X     | H     | L       | L     | H     |
| A3 = B3          | A2 = B2 | A1 = B1 | A0 = B0 | H                | H     | L     | L       | L     | L     |
| A3 = B3          | A2 = B2 | A1 = B1 | A0 = B0 | L                | L     | L     | H       | H     | L     |

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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logic diagrams (positive logic)



logic symbol †



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



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schematics of inputs and outputs



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                       | SN54'<br>SN54S' | SN54LS' | SN74'<br>SN74S' | SN74LS' | UNIT               |
|---------------------------------------|-----------------|---------|-----------------|---------|--------------------|
| Supply voltage, $V_{CC}$ (see Note 1) | 7               | 7       | 7               | 7       | V                  |
| Input voltage                         | 5.5             | 7       | 5.5             | 7       | V                  |
| Interemitter voltage (see Note 2)     | 5.5             |         | 5.5             |         | V                  |
| Operating free-air temperature range  | -55 to 125      |         | -0 to 70        |         | $^{\circ}\text{C}$ |
| Storage temperature range             | -65 to 150      |         | -65 to 150      |         | $^{\circ}\text{C}$ |

- NOTES: 1. Voltage values, except interemitter voltage, are with respect to network ground terminal.  
 2. This is the voltage between two emitters of a multiple-emitter input transistor. This rating applies to each A input in conjunction with its respective B input of the '85 and 'S85.

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**recommended operating conditions**

|                                       | SN5485 |     |     | SN7485 |     |      | UNIT        |
|---------------------------------------|--------|-----|-----|--------|-----|------|-------------|
|                                       | MIN    | NOM | MAX | MIN    | NOM | MAX  |             |
| Supply voltage, $V_{CC}$              | 4.5    | 5   | 5.5 | 4.75   | 5   | 5.25 | V           |
| High-level output current, $I_{OH}$   | -400   |     |     | -400   |     |      | $\mu A$     |
| Low-level output current, $I_{OL}$    | 16     |     |     | 16     |     |      | mA          |
| Operating free-air temperature, $T_A$ | -55    |     |     | 0      |     |      | $^{\circ}C$ |

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

| PARAMETER |  | TEST CONDITIONS†  | MIN    | TYP‡ | MAX  | UNIT    |
|-----------|--|---|--------|------|------|---------|
| $V_{IH}$  | High-level input voltage               |   | 2      |      |      | V       |
| $V_{IL}$  | Low-level input voltage                |   |        |      | 0.8  | V       |
| $V_{IK}$  | Input clamp voltage                    | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$                         |        |      | -1.5 | V       |
| $V_{OH}$  | High-level output voltage              | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -400 \mu A$  | 2.4    | 3.4  |      | V       |
| $V_{OL}$  | Low-level output voltage               | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 16 \text{ mA}$ | 0.2    | 0.4  |      | V       |
| $I_I$     | Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                          |        |      | 1    | mA      |
| $I_{IH}$  | High-level input current               | A < B, A > B inputs   |        |      | 40   | $\mu A$ |
|           |  | all other inputs  |        |      | 120  |         |
| $I_{IL}$  | Low-level input current                | A < B, A > B inputs   |        |      | -1.6 | mA      |
|           |  | all other inputs  |        |      | -4.8 |         |
| $I_{OS}$  | Short-circuit output current§          | $V_{CC} = \text{MAX}, V_O = 0$                                      | SN5485 | -20  | -55  | mA      |
|           |  |   | SN7485 | -18  | -55  |         |
| $I_{CC}$  | Supply current                         | $V_{CC} = \text{MAX},$ See Note 4                                   |        | 55   | 88   | mA      |

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

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

§ Not more than one output should be shorted at a time.

NOTE 4:  $I_{CC}$  is measured with outputs open, A = B grounded, and all other inputs at 4.5 V.

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

| PARAMETER¶ | FROM INPUT            | TO OUTPUT    | NUMBER OF GATE LEVELS | TEST CONDITIONS  | MIN | TYP | MAX | UNIT |
|------------|-----------------------|--------------|-----------------------|--|-----|-----|-----|------|
| $t_{PLH}$  | Any A or B data input | A < B, A > B | 1                     | $C_L = 15 \text{ pF}, R_L = 400 \Omega,$<br>See Note 5 |     | 7   |     | ns   |
|            |                       |              | 2                     |  |     | 12  |     |      |
|            |                       | 3            |                       |  | 17  | 26  |     |      |
|            |                       | 4            |                       |  | 23  | 35  |     |      |
| $t_{PHL}$  | Any A or B data input | A < B, A > B | 1                     |  |     | 11  |     | ns   |
|            |                       |              | 2                     |  |     | 15  |     |      |
|            |                       | 3            |                       |  | 20  | 30  |     |      |
|            |                       | 4            |                       |  | 20  | 30  |     |      |
| $t_{PLH}$  | A < B or A = B        | A > B        | 1                     |  |     | 7   | 11  | ns   |
| $t_{PHL}$  | A < B or A = B        | A > B        | 1                     |  |     | 11  | 17  | ns   |
| $t_{PLH}$  | A = B                 | A = B        | 2                     |  | 13  | 20  | ns  |      |
| $t_{PHL}$  | A = B                 | A = B        | 2                     |  | 11  | 17  | ns  |      |
| $t_{PLH}$  | A > B or A = B        | A < B        | 1                     |  | 7   | 11  | ns  |      |
| $t_{PHL}$  | A > B or A = B        | A < B        | 1                     |  | 11  | 17  | ns  |      |

¶  $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

NOTE 5: Load circuits and voltage waveforms are shown in Section 1.



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**recommended operating conditions**

|                                       | SN54LS85 |     |      | SN74LS85 |     |      | UNIT         |
|---------------------------------------|----------|-----|------|----------|-----|------|--------------|
|                                       | MIN      | NOM | MAX  | MIN      | NOM | MAX  |              |
| Supply voltage, $V_{CC}$              | 4.5      | 5   | 5.5  | 4.75     | 5   | 5.25 | V            |
| High-level output current, $I_{OH}$   |          |     | -400 |          |     | -400 | $\mu$ A      |
| Low-level output current, $I_{OL}$    |          |     | 4    |          |     | 8    | mA           |
| Operating free-air temperature, $T_A$ | -55      |     | 125  | 0        |     | 70   | $^{\circ}$ C |

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

| PARAMETER |   | TEST CONDITIONS <sup>†</sup>  | SN54LS85 |                  | SN74LS85 |      | UNIT    |
|-----------|---|---|----------|------------------|----------|------|---------|
|           |   |   | MIN      | TYP <sup>‡</sup> | MAX      | MIN  |         |
| $V_{IH}$  | High-level input voltage                  |   | 2        |                  | 2        |      | V       |
| $V_{IL}$  | Low-level input voltage                   |   |          | 0.7              |          | 0.7  | V       |
| $V_{IK}$  | Input clamp voltage                       | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$   |          | -1.5             |          | -1.5 | V       |
| $V_{OH}$  | High-level output voltage                 | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$ | 2.5      | 3.4              | 2.7      | 3.4  | V       |
| $V_{OL}$  | Low-level output voltage                  | $V_{CC} = \text{MIN}, I_{OL} = 4 \text{ mA}$  | 0.25     | 0.4              | 0.25     | 0.4  | V       |
|           |   | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 8 \text{ mA}$     |          |                  | 0.35     | 0.5  |         |
| $I_I$     | Input current at maximum input voltage    | A < B, A > B inputs   | 0.1      |                  | 0.1      |      | mA      |
|           |   | all other inputs  | 0.3      |                  | 0.3      |      |         |
| $I_{IH}$  | High-level input current                  | A < B, A > B inputs   | 20       |                  | 20       |      | $\mu$ A |
|           |   | all other inputs  | 60       |                  | 60       |      |         |
| $I_{IL}$  | Low-level input current                   | A < B, A > B inputs   | -0.4     |                  | -0.4     |      | mA      |
|           |   | all other inputs  | -1.2     |                  | -1.2     |      |         |
| $I_{OS}$  | Short-circuit output current <sup>§</sup> | $V_{CC} = \text{MAX}$   | -20      | -100             | -20      | -100 | mA      |
| $I_{CC}$  | Supply current                            | $V_{CC} = \text{MAX},$ See Note 4   | 10.4     | 20               | 10.4     | 20   | mA      |

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$ .

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

NOTE 4:  $I_{CC}$  is measured with outputs open, A = B grounded, and all other inputs at 4.5 V.

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

| PARAMETER <sup>†</sup> | FROM INPUT            | TO OUTPUT    | NUMBER OF GATE LEVELS | TEST CONDITIONS   | MIN | TYP | MAX | UNIT |    |
|------------------------|-----------------------|--------------|-----------------------|---|-----|-----|-----|------|----|
| $t_{PLH}$              | Any A or B data input | A < B, A > B | 1                     | $C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega,$<br>See Note 5 |     | 14  |     | ns   |    |
|                        |                       |              | 2                     |   |     | 19  |     |      |    |
|                        |                       |              | 3                     |   |     | 24  | 36  |      |    |
|                        |                       |              | 4                     |   |     | 27  | 45  |      |    |
| $t_{PHL}$              | Any A or B data input | A < B, A > B | 1                     |   |     | 11  |     |      | ns |
|                        |                       |              | 2                     |   |     | 15  |     |      |    |
|                        |                       |              | 3                     |   |     | 20  | 30  |      |    |
|                        |                       |              | 4                     |   |     | 23  | 45  |      |    |
| $t_{PLH}$              | A < B or A = B        | A > B        | 1                     |   |     | 14  | 22  | ns   |    |
| $t_{PHL}$              | A < B or A = B        | A > B        | 1                     |   |     | 11  | 17  | ns   |    |
| $t_{PLH}$              | A = B                 | A = B        | 2                     |   |     | 13  | 20  | ns   |    |
| $t_{PHL}$              | A = B                 | A = B        | 2                     |   |     | 13  | 26  | ns   |    |
| $t_{PLH}$              | A > B or A = B        | A < B        | 1                     |   | 14  | 22  | ns  |      |    |
| $t_{PHL}$              | A > B or A = B        | A < B        | 1                     |   | 11  | 17  | ns  |      |    |

<sup>†</sup> $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

NOTE 5: Load circuits and voltage waveforms are shown in Section 1.

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**recommended operating conditions**

|                                       | SN54S85 |     |     | SN74S85 |     |      | UNIT |
|---------------------------------------|---------|-----|-----|---------|-----|------|------|
|                                       | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| Supply voltage, $V_{CC}$              | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| High-level output current, $I_{OH}$   |         |     | -1  |         |     | -1   | mA   |
| Low-level output current, $I_{OL}$    |         |     | 20  |         |     | 20   | mA   |
| Operating free-air temperature, $T_A$ | -55     |     | 125 | 0       |     | 70   | °C   |

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

| PARAMETER |  | TEST CONDITIONS†  | MIN  | TYP‡ | MAX  | UNIT          |
|-----------|--|---|--|------|------|---------------|
| $V_{IH}$  | High-level input voltage               |   | 2  |      |      | V             |
| $V_{IL}$  | Low-level input voltage                |   |  |      | 0.8  | V             |
| $V_{IK}$  | Input clamp voltage                    | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$   |  |      | -1.2 | V             |
| $V_{OH}$  | High-level output voltage              | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1 \text{ mA}$ | SN54S85<br>2.5                             | 3.4  |      | V             |
| $V_{OL}$  | Low-level output voltage               | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 20 \text{ mA}$ |  |      | 0.5  | V             |
| $I_I$     | Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$  |  |      | 1    | mA            |
| $I_{IH}$  | High-level input current               | A < B, A > B inputs   | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$ |      | 50   | $\mu\text{A}$ |
|           |  | all other inputs  |  |      | 150  |               |
| $I_{IL}$  | Low-level input current                | A < B, A > B inputs   | $V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$ |      | -2   | mA            |
|           |  | all other inputs  |  |      | -6   |               |
| $I_{OS}$  | Short-circuit output current§          | $V_{CC} = \text{MAX}$   | -40  |      | -100 | mA            |
| $I_{CC}$  | Supply current                         | $V_{CC} = \text{MAX}$ , See Note 4  |  | 73   | 115  | mA            |
|           |  | $V_{CC} = \text{MAX}, T_A = 125^\circ\text{C}$ , See Note 4                                 | SN54S85W                                   |      |      |               |

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

‡ 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 duration of the short-circuit should not exceed one second.

NOTE 4:  $I_{CC}$  is measured with outputs open, A = B grounded, and all other inputs at 4.5 V.

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

| PARAMETER¶ | FROM INPUT            | TO OUTPUT    | NUMBER OF GATE LEVELS | TEST CONDITIONS  | MIN  | TYP  | MAX | UNIT |
|------------|-----------------------|--------------|-----------------------|--|------|------|-----|------|
| $t_{PLH}$  | Any A or B data input | A < B, A > B | 1                     | $C_L = 15 \text{ pF}, R_L = 280 \Omega,$<br>See Note 5 |      | 5    |     | ns   |
|            |                       |              | 2                     |  | 7.5  |      |     |      |
|            |                       | 3            | 10.5                  |  | 16   |      |     |      |
|            |                       | 4            | 12                    |  | 18   |      |     |      |
| $t_{PHL}$  | Any A or B data input | A < B, A > B | 1                     |  | 5.5  |      | ns  |      |
|            |                       |              | 2                     |  | 7    |      |     |      |
|            |                       | 3            | 11                    |  | 16.5 |      |     |      |
|            |                       | 4            | 11                    |  | 16.5 |      |     |      |
| $t_{PLH}$  | A < B or A = B        | A > B        | 1                     |  |      | 5    | 7.5 | ns   |
| $t_{PHL}$  | A < B or A = B        | A > B        | 1                     |  |      | 5.5  | 8.5 | ns   |
| $t_{PLH}$  | A = B                 | A = B        | 2                     |  | 7    | 10.5 | ns  |      |
| $t_{PHL}$  | A = B                 | A = B        | 2                     |  | 5    | 7.5  | ns  |      |
| $t_{PLH}$  | A > B or A = B        | A < B        | 1                     |  | 5    | 7.5  | ns  |      |
| $t_{PHL}$  | A > B or A = B        | A < B        | 1                     |  | 5.5  | 8.5  | ns  |      |

¶  $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

NOTE 5: Load circuits and voltage waveforms are shown in Section 1.





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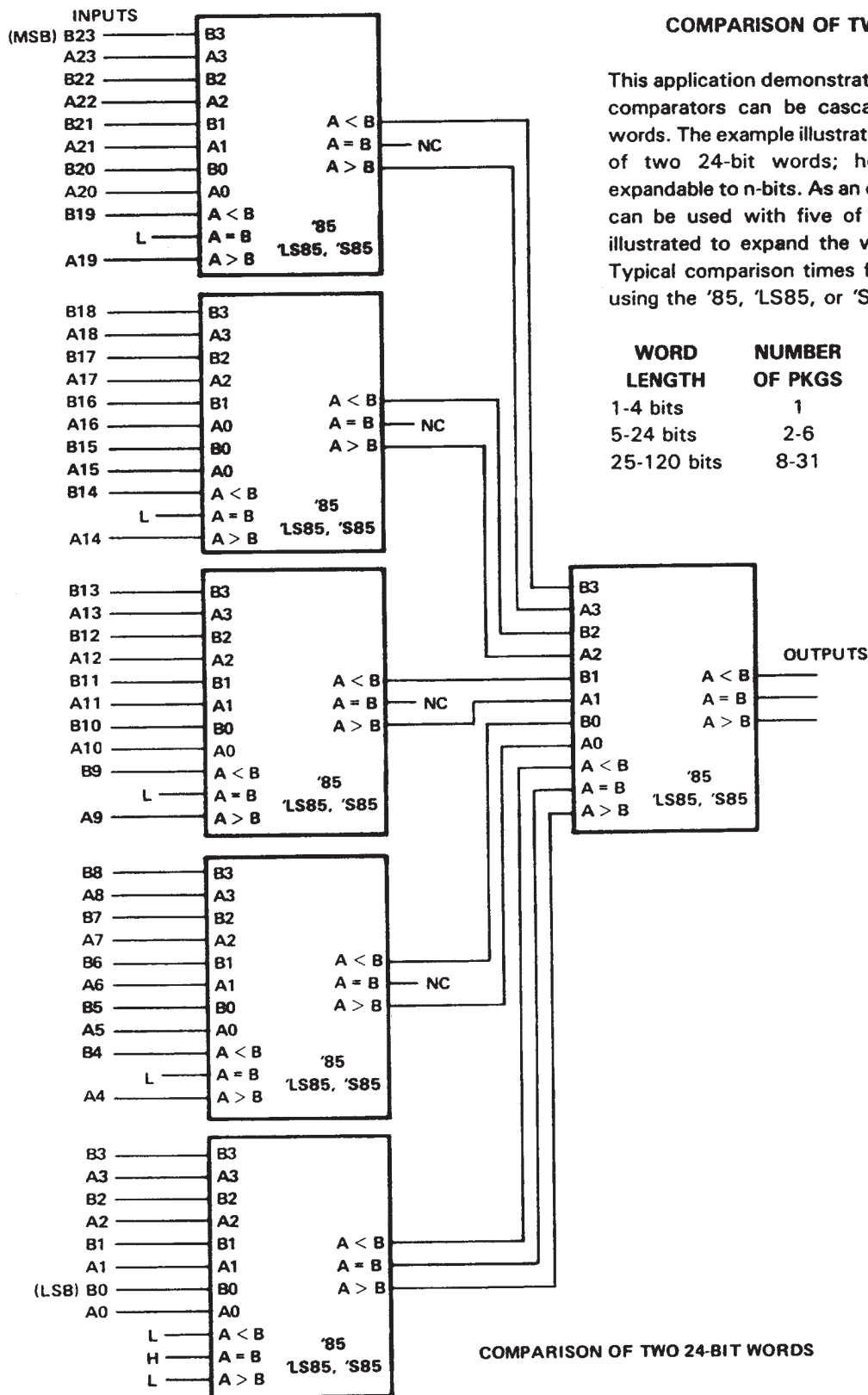
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**TYPICAL APPLICATION DATA**

**COMPARISON OF TWO N-BIT WORDS**

This application demonstrates how these magnitude comparators can be cascaded to compare longer words. The example illustrated shows the comparison of two 24-bit words; however, the design is expandable to n-bits. As an example, one comparator can be used with five of the 24-bit comparators illustrated to expand the word length to 120-bits. Typical comparison times for various word lengths using the '85, 'LS85, or 'S85 are:

| WORD LENGTH | NUMBER OF PKGS | '85   | 'LS85 | 'S85  |
|-------------|----------------|-------|-------|-------|
| 1-4 bits    | 1              | 23 ns | 24 ns | 11 ns |
| 5-24 bits   | 2-6            | 46 ns | 48 ns | 22 ns |
| 25-120 bits | 8-31           | 69 ns | 72 ns | 33 ns |



**PACKAGING INFORMATION**

| Orderable part number            | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)                    |
|----------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|--|
| <a href="#">5962-9754701Q2A</a>  | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9754701Q2A<br>SNJ54LS<br>85FK |
| <a href="#">5962-9754701QEA</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701QE<br>A<br>SNJ54LS85J      |
| <a href="#">5962-9754701QFA</a>  | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701QF<br>A<br>SNJ54LS85W      |
| <a href="#">JM38510/08201BEA</a> | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>08201BEA                   |
| JM38510/08201BEA.A               | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>08201BEA                   |
| <a href="#">JM38510/31101B2A</a> | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101B2A                   |
| JM38510/31101B2A.A               | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101B2A                   |
| <a href="#">JM38510/31101BEA</a> | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101BEA                   |
| JM38510/31101BEA.A               | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101BEA                   |
| <a href="#">JM38510/31101BFA</a> | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101BFA                   |
| JM38510/31101BFA.A               | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101BFA                   |
| <a href="#">M38510/08201BEA</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>08201BEA                   |
| <a href="#">M38510/31101B2A</a>  | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101B2A                   |
| <a href="#">M38510/31101BEA</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101BEA                   |
| <a href="#">M38510/31101BFA</a>  | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31101BFA                   |



| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)               |
|-----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|-----------------------------------|
| <a href="#">SN54LS85J</a>   | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SN54LS85J                         |
| SN54LS85J.A                 | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SN54LS85J                         |
| <a href="#">SN54S85J</a>    | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SN54S85J                          |
| SN54S85J.A                  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SN54S85J                          |
| <a href="#">SN74LS85D</a>   | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | LS85                              |
| <a href="#">SN74LS85DR</a>  | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | LS85                              |
| SN74LS85DR.A                | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | LS85                              |
| <a href="#">SN74LS85N</a>   | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74LS85N                         |
| SN74LS85N.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74LS85N                         |
| <a href="#">SN74LS85NSR</a> | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 74LS85                            |
| SN74LS85NSR.A               | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 74LS85                            |
| <a href="#">SN74S85D</a>    | Active        | Production           | SOIC (D)   16  | 40   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | S85                               |
| SN74S85D.A                  | Active        | Production           | SOIC (D)   16  | 40   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | S85                               |
| <a href="#">SN74S85N</a>    | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74S85N                          |
| SN74S85N.A                  | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74S85N                          |
| <a href="#">SNJ54LS85FK</a> | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701Q2A<br>SNJ54LS85FK    |
| SNJ54LS85FK.A               | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701Q2A<br>SNJ54LS85FK    |
| <a href="#">SNJ54LS85J</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701QE<br>A<br>SNJ54LS85J |
| SNJ54LS85J.A                | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701QE<br>A<br>SNJ54LS85J |
| <a href="#">SNJ54LS85W</a>  | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701QF<br>A<br>SNJ54LS85W |

| Orderable part number      | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)               |
|----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|-----------------------------------|
| SNJ54LS85W.A               | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9754701QF<br>A<br>SNJ54LS85W |
| <a href="#">SNJ54S85FK</a> | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SNJ54S<br>85FK                    |
| SNJ54S85FK.A               | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SNJ54S<br>85FK                    |
| <a href="#">SNJ54S85J</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SNJ54S85J                         |
| SNJ54S85J.A                | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SNJ54S85J                         |

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**OTHER QUALIFIED VERSIONS OF SN54LS85, SN54S85, SN74LS85, SN74S85 :**

- Catalog : [SN74LS85](#), [SN74S85](#)
- Military : [SN54LS85](#), [SN54S85](#)

## NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS85DR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS85NSR | SOP          | NS              | 16   | 2000 | 330.0              | 16.4               | 8.1     | 10.4    | 2.5     | 12.0    | 16.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS85DR  | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| SN74LS85NSR | SOP          | NS              | 16   | 2000 | 353.0       | 353.0      | 32.0        |

**TUBE**


\*All dimensions are nominal

| Device             | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|--------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-9754701Q2A    | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| 5962-9754701QFA    | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| JM38510/31101B2A   | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| JM38510/31101B2A.A | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| JM38510/31101BFA   | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| JM38510/31101BFA.A | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| M38510/31101B2A    | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| M38510/31101BFA    | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| SN74LS85N          | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS85N          | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS85N.A        | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS85N.A        | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74S85D           | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74S85D.A         | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74S85N           | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74S85N           | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74S85N.A         | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74S85N.A         | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SNJ54LS85FK        | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| SNJ54LS85FK.A      | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| SNJ54LS85W         | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| SNJ54LS85W.A       | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| SNJ54S85FK         | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| SNJ54S85FK.A       | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |





# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



#### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



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NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- 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 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP2-F16

## GENERIC PACKAGE VIEW

**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4229370VA\



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

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

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