

# SN54LS682, SN54LS684, SN54LS685, SN54LS687, SN54LS688, SN74LS682, SN74LS684 THRU SN74LS688 8-BIT MAGNITUDE/IDENTITY COMPARATORS

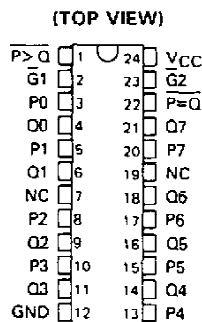
D2617, JANUARY 1981—REVISED MARCH 1988

SDLS008

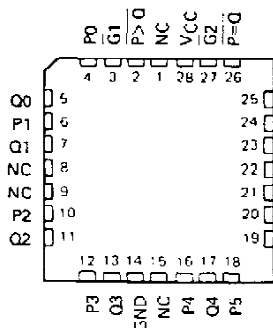
- Compares Two-8-Bit Words
- Choice of Totem-Pole or Open-Collector Outputs
- Hysteresis at P and Q Inputs
- 'LS682 has 20-k $\Omega$  Pullup Resistors on the Q Inputs
- SN74LS686 and 'LS687 . . . JT and NT 24-Pin, 300-Mil Packages

| TYPE      | P = Q | P > Q | OUTPUT<br>ENABLE | OUTPUT<br>CONFIGURATION | 20-k $\Omega$<br>PULLUP |
|-----------|-------|-------|------------------|-------------------------|-------------------------|
| 'LS682    | yes   | yes   | no               | totem-pole              | yes                     |
| 'LS684    | yes   | yes   | no               | totem-pole              | no                      |
| 'LS685    | yes   | yes   | no               | open-collector          | no                      |
| SN74LS686 | yes   | yes   | yes              | totem-pole              | no                      |
| 'LS687    | yes   | yes   | yes              | open-collector          | no                      |
| 'LS688    | yes   | no    | yes              | totem-pole              | no                      |

SN54LS687 . . . JT PACKAGE  
SN74LS686, SN74LS687 . . . DW OR NT PACKAGE

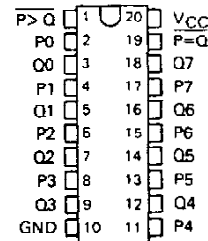


SN54LS687 . . . FK PACKAGE  
(TOP VIEW)

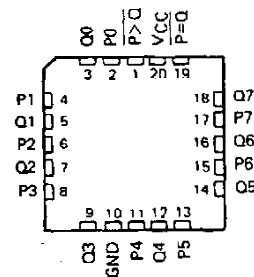


NC—No internal connection

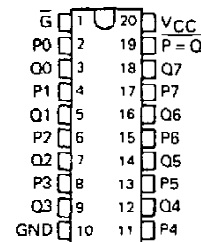
SN54LS682, SN54LS684, SN54LS685 . . . J PACKAGE  
SN74LS682, SN74LS684, SN74LS685 . . . DW OR N PACKAGE  
(TOP VIEW)



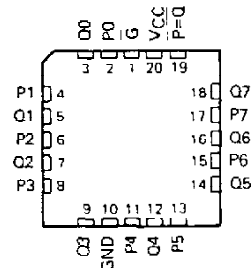
SN54LS682, SN54LS684, SN54LS685 . . . FK PACKAGE  
(TOP VIEW)



SN54LS688 . . . J PACKAGE  
SN74LS688 . . . DW OR N PACKAGE  
(TOP VIEW)



SN54LS688 . . . FK PACKAGE  
(TOP VIEW)



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**SN54LS682, SN54LS684, SN54LS685, SN54LS687, SN54LS688**  
**SN74LS682, SN74LS684 THRU SN74LS688**  
**8-BIT MAGNITUDE/IDENTITY COMPARATORS**

**description**

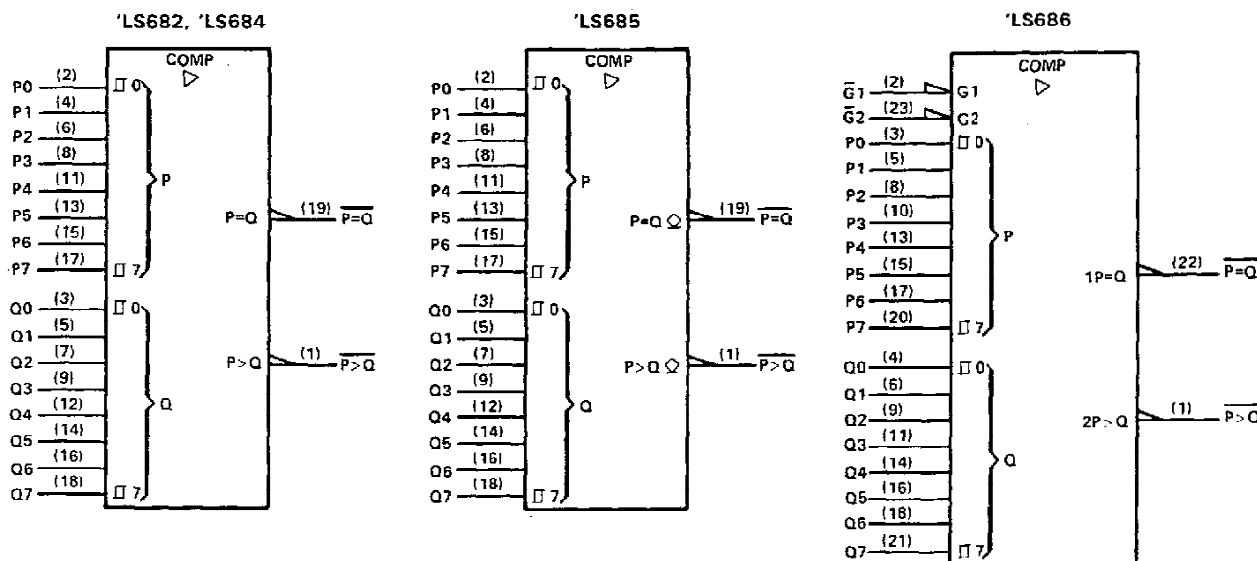
These magnitude comparators perform comparisons of two eight-bit binary or BCD words. All types provide  $\overline{P=Q}$  outputs and all except 'LS688 provide  $\overline{P>Q}$  outputs as well. The 'LS682, 'LS684, 'LS686, and 'LS688 have totem-pole outputs, while the 'LS685 and 'LS687 have open-collector outputs. The 'LS682 features 20-k $\Omega$  pullup termination resistors on the Q inputs for analog or switch data.

**FUNCTION TABLE**

| INPUTS |                               |                 | OUTPUTS          |                  |
|--------|-------------------------------|-----------------|------------------|------------------|
| DATA   | ENABLES                       |                 | $\overline{P=Q}$ | $\overline{P>Q}$ |
| P, Q   | $\overline{G}, \overline{G1}$ | $\overline{G2}$ |                  |                  |
| $P=Q$  | L                             | X               | L                | H                |
| $P>Q$  | X                             | L               | H                | L                |
| $P<Q$  | X                             | X               | H                | H                |
| $P=Q$  | H                             | X               | H                | H                |
| $P>Q$  | X                             | H               | H                | H                |
| X      | H                             | H               | H                | H                |

- NOTES: 1. The last three lines of the function table applies only to the devices having enable inputs, i.e., 'LS686 thru 'LS688.
2. The  $\overline{P<Q}$  function can be generated by applying the  $\overline{P=Q}$  and  $\overline{P>Q}$  outputs to a 2-input NAND gate.
3. For 'LS686 and 'LS687,  $\overline{G1}$  enables  $\overline{P=Q}$  and  $\overline{G2}$  enables  $\overline{P>Q}$ .

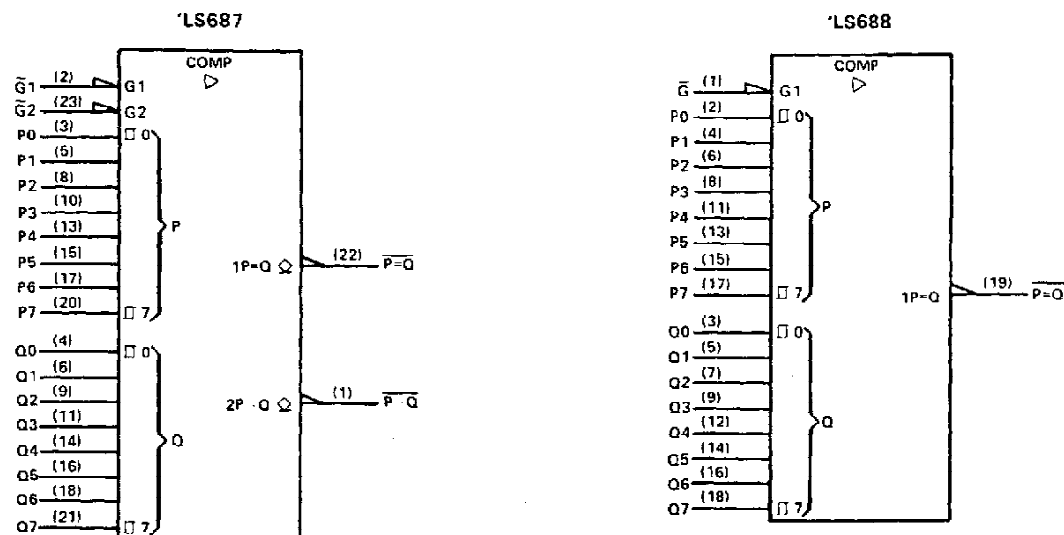
**logic symbols†**



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for DW, J, JT, N, and NT packages.

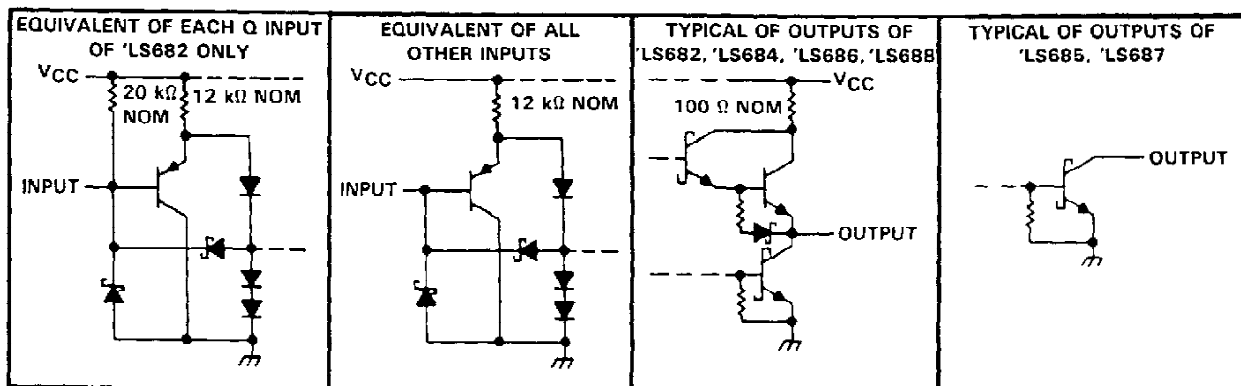
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SN74LS682, SN74LS684 THRU SN74LS688  
8-BIT MAGNITUDE/IDENTITY COMPARATORS**

logic symbols† (continued)



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for DW, J, JT, N, and NT packages.

**schematics of inputs and outputs**

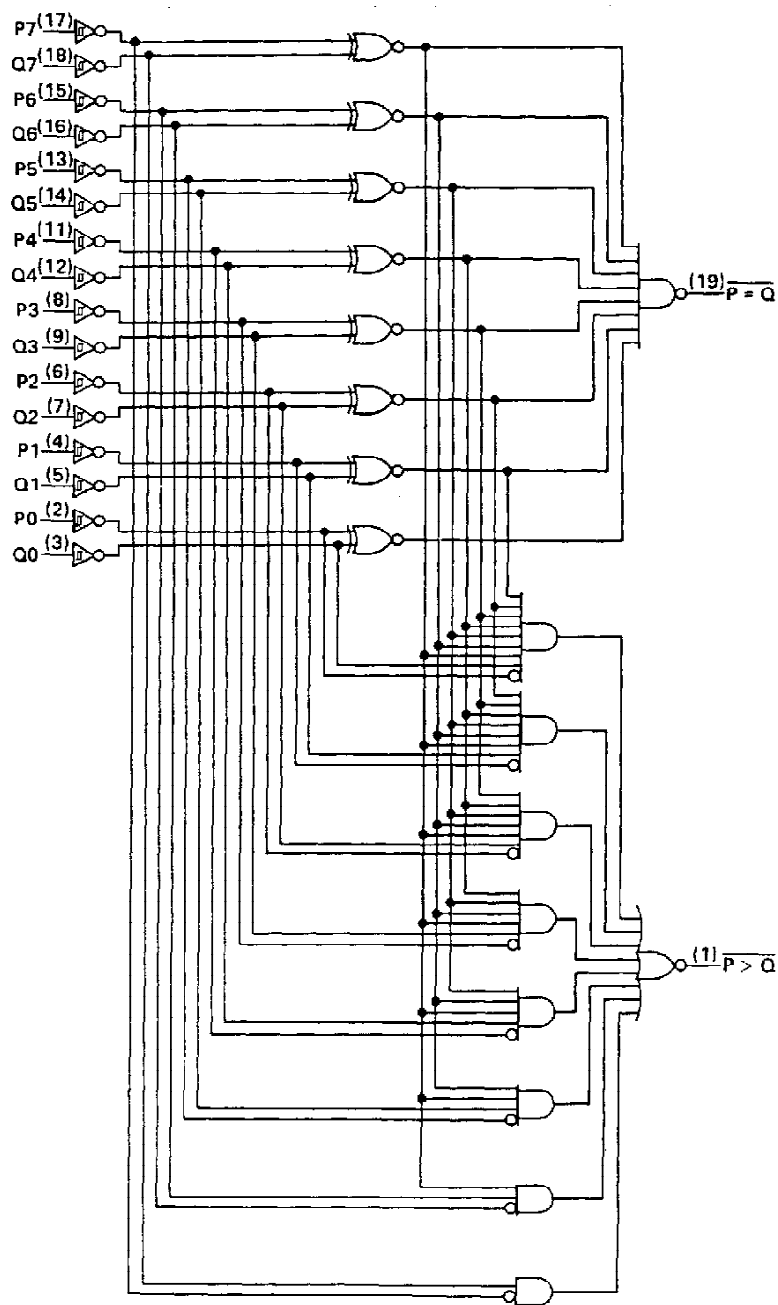


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**SN54LS682, SN54LS684, SN54LS685  
SN74LS682, SN74LS684, SN74LS685  
8-BIT MAGNITUDE/IDENTITY COMPARATORS**

'LS682, 'LS684, 'LS685 logic diagram (positive logic)



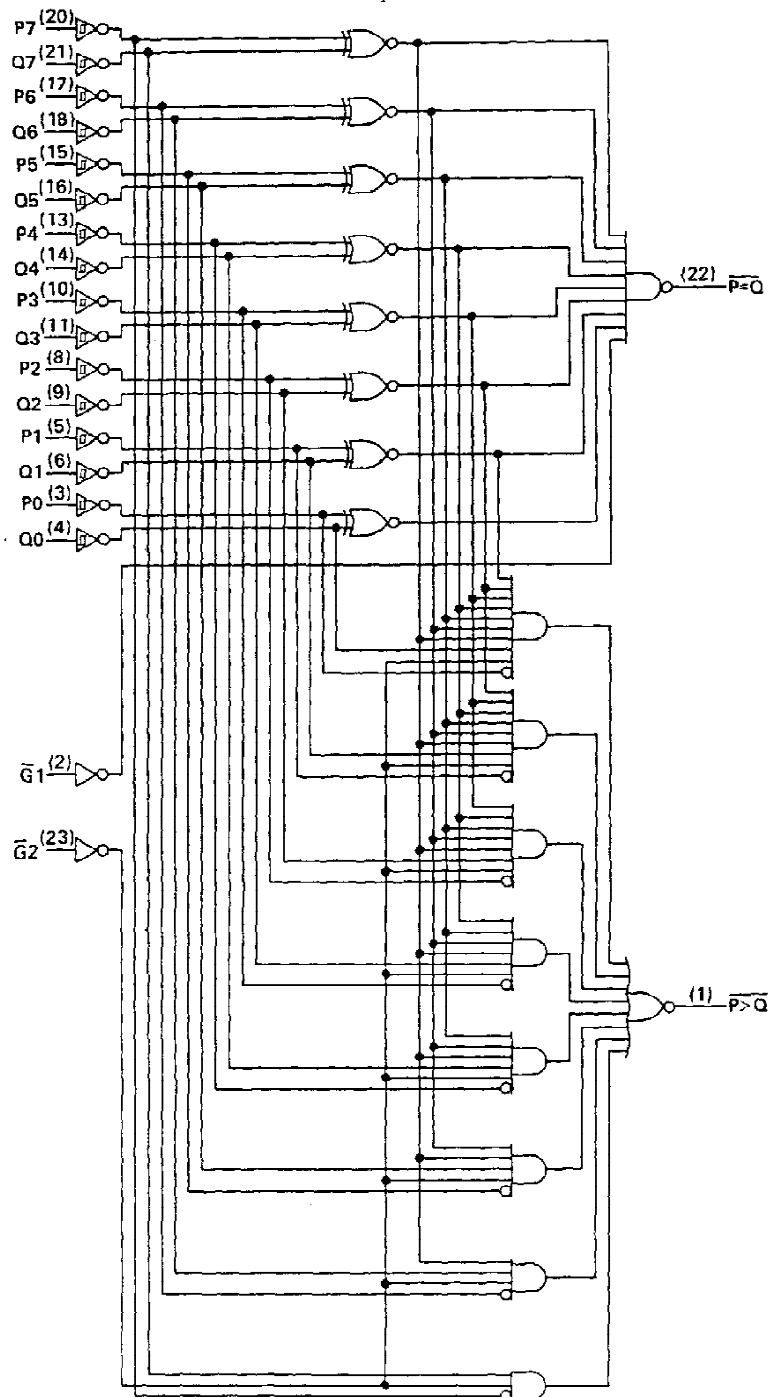
Pin numbers shown are for DW, J, and N packages.

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SN54LS687  
SN74LS686, SN74LS687  
8-BIT MAGNITUDE/IDENTITY COMPARATORS

'LS686, 'LS687 logic diagram (positive logic)



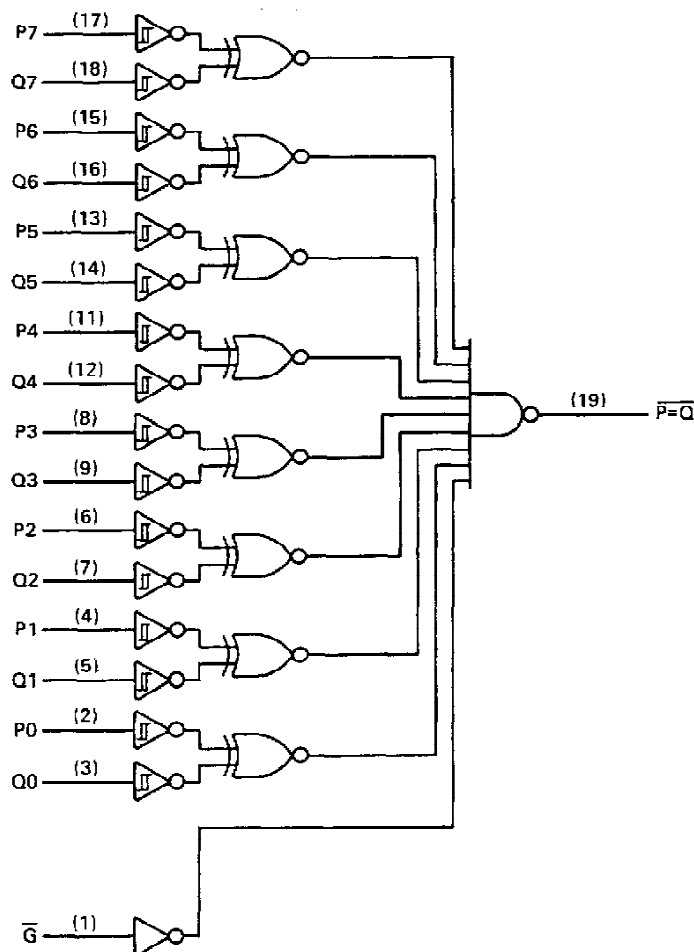
Pin numbers shown are for DW, JT, and NT packages.

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**SN54LS682, SN54LS684, SN54LS685, SN54LS687, SN54LS688  
SN74LS682, SN74LS684 THRU SN74LS688  
8-BIT IDENTITY COMPARATORS**

'LS688 logic diagram (positive logic)



Pin numbers shown are for DW, J, and N packages.

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

|                                                       |                |
|-------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                 | 7 V            |
| Input voltage: Q inputs of 'LS682                     | 5.5 V          |
| All other inputs                                      | 7 V            |
| Off-state output voltage: 'LS685, 'LS687              | 7 V            |
| Operating free-air temperature range:                 |                |
| SN54LS682, SN54LS684, SN54LS685, SN54LS687, SN54LS688 | -55°C to 125°C |
| SN74LS682, SN74LS684 thru SN74LS688                   | 0°C to 70°C    |
| Storage temperature range                             | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

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**SN54LS682, SN54LS684, SN54LS688**  
**SN74LS682, SN74LS684, SN74LS686, SN74LS688**  
**8-BIT MAGNITUDE/IDENTITY COMPARATORS WITH TOTEM-POLE OUTPUTS**

**recommended operating conditions**

|                                       | SN54LS <sup>†</sup> |     |      | SN74LS <sup>†</sup> |     |      | UNIT         |
|---------------------------------------|---------------------|-----|------|---------------------|-----|------|--------------|
|                                       | MIN                 | NOM | MAX  | MIN                 | NOM | MAX  |              |
| Supply voltage, $V_{CC}$              | 4.5                 | 5   | 5.5  | 4.85                | 5   | 5.25 | V            |
| High-level output current, $I_{OH}$   |                     |     | -400 |                     |     | -400 | $\mu$ A      |
| Low-level output current, $I_{OL}$    |                     |     | 12   |                     |     | 24   | 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†                                                                                               | SN54LS' |      | SN74LS' |      | UNIT |
|-----------------------------------|----------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------|------|---------|------|------|
|                                   |                                        |                                                                                    |                                                                                                                | MIN     | TYP‡ | MAX     | MIN  |      |
| V <sub>IH</sub>                   | High-level input voltage               |                                                                                    |                                                                                                                | 2       |      | 2       |      | V    |
| V <sub>IL</sub>                   | Low-level input voltage                |                                                                                    |                                                                                                                |         | 0.7  |         | 0.8  | V    |
| V <sub>T+</sub> - V <sub>T-</sub> | Hysteresis                             | P or Q inputs                                                                      | V <sub>CC</sub> = MIN                                                                                          | 0.4     |      | 0.4     |      | V    |
| V <sub>IK</sub>                   | Input clamp voltage                    |                                                                                    | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                                                                 |         | -1.5 |         | -1.5 | V    |
| V <sub>OH</sub>                   | High-level output voltage              |                                                                                    | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>ILmax</sub> , I <sub>OH</sub> = -400 μA | 2.5     |      | 2.7     |      | V    |
| V <sub>OL</sub>                   | Low-level output voltage               | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>ILmax</sub> | I <sub>OL</sub> = 12 mA                                                                                        | 0.25    | 0.4  | 0.25    | 0.4  | V    |
|                                   |                                        |                                                                                    | I <sub>OL</sub> = 24 mA                                                                                        |         |      | 0.35    | 0.5  |      |
| I <sub>I</sub>                    | Input current at maximum input voltage | Q inputs, 'LS682                                                                   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V                                                                  |         | 0.1  | 0.1     | mA   |      |
|                                   | All other inputs                       | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V                                        |                                                                                                                |         |      |         |      |      |
| I <sub>IH</sub>                   | High-level input current               |                                                                                    | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                                                                  | 20      |      | 20      | μA   |      |
| I <sub>IL</sub>                   | Low-level input current                | Q inputs, 'LS682                                                                   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                                  |         | -0.4 | -0.4    | mA   |      |
|                                   |                                        | All other inputs                                                                   |                                                                                                                | -0.2    | -0.2 |         |      |      |
| I <sub>OS</sub> ‡                 | Short-circuit output current           |                                                                                    | V <sub>CC</sub> = MAX, V <sub>O</sub> = 0                                                                      | -20     | -100 | -20     | -100 | mA   |
| I <sub>CC</sub>                   | Supply current                         | 'LS682                                                                             | V <sub>CC</sub> = MAX, See Note 1                                                                              | 42      | 70   | 42      | 70   | mA   |
|                                   |                                        | 'LS684                                                                             |                                                                                                                | 40      | 65   | 40      | 65   |      |
|                                   |                                        | 'LS686                                                                             |                                                                                                                | 44      | 75   | 44      | 75   |      |
|                                   |                                        | 'LS688                                                                             |                                                                                                                | 40      | 65   | 40      | 65   |      |

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

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

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

NOTE 1:  $I_{CC}$  is measured with any  $\bar{Q}$  inputs grounded, all other inputs at 4.5 V, and all outputs open.

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**SN54LS682, SN54LS684, SN54LS688**  
**SN74LS682, SN74LS684, SN74LS686, SN74LS688**  
**8-BIT MAGNITUDE/IDENTITY COMPARATORS WITH TOTEM-POLE OUTPUTS**

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

| PARAMETER† | FROM<br>(INPUTS)              | TO<br>(OUTPUT)                | TEST<br>CONDITIONS                                                   | 'LS682 |         | 'LS684 |         | 'LS686 |         | 'LS688 |         | UNIT |
|------------|-------------------------------|-------------------------------|----------------------------------------------------------------------|--------|---------|--------|---------|--------|---------|--------|---------|------|
|            |                               |                               |                                                                      | MIN    | TYP MAX | MIN    | TYP MAX | MIN    | TYP MAX | MIN    | TYP MAX |      |
| tPLH       | P                             | $\overline{P} = \overline{Q}$ | RL = 667 Ω,<br>CL = 45 pF,<br>All other<br>inputs low,<br>See Note 2 | 13     | 25      | 15     | 25      | 13     | 25      | 12     | 18      | ns   |
| tPHL       |                               |                               |                                                                      | 15     | 25      | 17     | 25      | 20     | 30      | 17     | 23      |      |
| tPLH       | Q                             | $\overline{P} = \overline{Q}$ |                                                                      | 14     | 25      | 16     | 25      | 13     | 25      | 12     | 18      | ns   |
| tPHL       |                               |                               |                                                                      | 15     | 25      | 15     | 25      | 21     | 30      | 17     | 23      |      |
| tPLH       | $\overline{Q}, \overline{Q}1$ | $\overline{P} = \overline{Q}$ |                                                                      |        |         |        |         | 11     | 20      | 12     | 18      | ns   |
| tPHL       |                               |                               |                                                                      |        |         |        |         | 19     | 30      | 13     | 20      |      |
| tPLH       | P                             | $\overline{P} > \overline{Q}$ |                                                                      | 20     | 30      | 22     | 30      | 19     | 30      |        |         | ns   |
| tPHL       |                               |                               |                                                                      | 15     | 30      | 17     | 30      | 15     | 30      |        |         |      |
| tPLH       | Q                             | $\overline{P} > \overline{Q}$ |                                                                      | 21     | 30      | 24     | 30      | 18     | 30      |        |         | ns   |
| tPHL       |                               |                               |                                                                      | 19     | 30      | 20     | 30      | 19     | 30      |        |         |      |
| tPLH       | $\overline{Q}2$               | $\overline{P} > \overline{Q}$ |                                                                      |        |         |        |         | 21     | 30      |        |         | ns   |
| tPHL       |                               |                               |                                                                      |        |         |        |         | 16     | 25      |        |         |      |

† $t_{PLH}$  = propagation delay time, low-to-high-level outputs;  $t_{PHL}$  = propagation delay time, high-to-low-level output.

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

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**SN54LS685, SN54LS687**  
**SN74LS685, SN74LS687, SN74LS688**

**8-BIT MAGNITUDE/IDENTITY COMPARATORS WITH TOTEM-POLE OUTPUTS**

**recommended operating conditions**

|                                       | SN54LS <sup>*</sup> |     |     | SN74LS <sup>*</sup> |     |      | UNIT |
|---------------------------------------|---------------------|-----|-----|---------------------|-----|------|------|
|                                       | MIN                 | NOM | MAX | MIN                 | NOM | MAX  |      |
| Supply voltage, $V_{CC}$              | 4.5                 | 5   | 5.5 | 4.85                | 5   | 5.25 | V    |
| High-level output current, $V_{OH}$   |                     |     | 5.5 |                     |     | 5.5  | V    |
| Low-level output current, $I_{OL}$    |                     |     | 12  |                     |     | 24   | 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 <sup>†</sup>                                                            | SN54LS <sup>*</sup> |      |      | SN74LS <sup>*</sup> |      |      | UNIT          |
|-------------------|---------------------------|-----------------------------------------------------------------------------------------|---------------------|------|------|---------------------|------|------|---------------|
|                   |                           |                                                                                         | MIN                 | TYP  | MAX  | MIN                 | TYP  | MAX  |               |
| $V_{IH}$          | High-level input voltage  |                                                                                         | 2                   |      |      | 2                   |      |      | V             |
| $V_{IL}$          | Low-level input voltage   |                                                                                         |                     |      | 0.7  |                     |      | 0.8  | V             |
| $V_{T+} - V_{T-}$ | Hysteresis                | P or Q inputs                                                                           |                     | 0.4  |      |                     | 0.4  |      | V             |
| $V_{IK}$          | Input clamp voltage       | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$                                             |                     |      | -1.5 |                     |      | -1.5 | V             |
| $I_{OH}$          | High-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{ILmax}, V_{OH} = 5.5 \text{ V}$ |                     |      | 250  |                     |      | 100  | $\mu\text{A}$ |
| $V_{OL}$          | Low-level output voltage  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{ILmax}, I_{OL} = 12 \text{ mA}$ | 0.25                | 0.4  |      | 0.25                | 0.4  |      | V             |
|                   |                           | $I_{OL} = 24 \text{ mA}$                                                                |                     |      |      | 0.35                | 0.5  |      |               |
| $I_I$             |                           | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$                                                |                     | 0.1  |      |                     | 0.1  |      | mA            |
| $I_{IH}$          | High-level input current  | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$                                              |                     | 20   |      |                     | 20   |      | $\mu\text{A}$ |
| $I_{IL}$          | Low-level input current   | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                                              |                     | -0.2 |      |                     | -0.2 |      | mA            |
| $I_{CC}$          | Supply current            | 'LS685                                                                                  | 40                  | 65   |      | 40                  | 65   |      | mA            |
|                   |                           | 'LS687                                                                                  | 44                  | 75   |      | 44                  | 75   |      |               |

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

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

NOTE 1:  $I_{CC}$  is measure with any  $\bar{Q}$  inputs grounded, all other inputs at 4.5 V, and all outputs open.

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SN54LS685, SN54LS687

SN74LS685, SN74LS687

8-BIT MAGNITUDE/IDENTITY COMPARATORS WITH OPEN-COLLECTOR OUTPUTS

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

| PARAMETER        | FROM<br>(INPUT)               | TO<br>(OUTPUT)   | TEST CONDITIONS                                                                              | 'LS685 |     |     | 'LS687 |     |     | UNIT |
|------------------|-------------------------------|------------------|----------------------------------------------------------------------------------------------|--------|-----|-----|--------|-----|-----|------|
|                  |                               |                  |                                                                                              | MIN    | TYP | MAX | MIN    | TYP | MAX |      |
| t <sub>PLH</sub> | P                             | $\overline{P=Q}$ | R <sub>L</sub> = 667 Ω,<br>C <sub>L</sub> = 45 pF,<br>All other<br>inputs low,<br>See Note 2 |        | 30  | 45  |        | 24  | 35  | ns   |
| t <sub>PHL</sub> |                               |                  |                                                                                              |        | 19  | 35  |        | 20  | 30  |      |
| t <sub>PLH</sub> | Q                             | $\overline{P=Q}$ |                                                                                              |        | 24  | 45  |        | 24  | 35  | ns   |
| t <sub>PHL</sub> |                               |                  |                                                                                              |        | 23  | 35  |        | 20  | 30  |      |
| t <sub>PLH</sub> | $\overline{Q}, \overline{Q1}$ | $\overline{P=Q}$ |                                                                                              |        |     |     |        | 21  | 35  | ns   |
| t <sub>PHL</sub> |                               |                  |                                                                                              |        |     |     |        | 18  | 30  |      |
| t <sub>PLH</sub> | P                             | $\overline{P>Q}$ |                                                                                              |        | 32  | 45  |        | 24  | 35  | ns   |
| t <sub>PHL</sub> |                               |                  |                                                                                              |        | 16  | 35  |        | 16  | 30  |      |
| t <sub>PLH</sub> | Q                             | $\overline{P>Q}$ |                                                                                              |        | 30  | 45  |        | 24  | 35  | ns   |
| t <sub>PHL</sub> |                               |                  |                                                                                              |        | 20  | 35  |        | 16  | 30  |      |
| t <sub>PLH</sub> | $\overline{Q2}$               | $\overline{P>Q}$ |                                                                                              |        |     |     |        | 24  | 35  | ns   |
| t <sub>PHL</sub> |                               |                  |                                                                                              |        |     |     |        | 15  | 30  |      |

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

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

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**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 84151012A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 8415101RA        | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| 8415101RA        | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| 8415101SA        | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| 8415101SA        | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| 84152012A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 8415201RA        | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| 8415201SA        | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| 84153012A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 8415301RA        | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| 8415301SA        | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SN54LS682J       | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SN54LS682J       | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SN54LS684J       | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SN54LS688J       | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SN74LS682DW      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DW      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWE4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWE4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWG4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWG4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWR     | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWR     | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWRE4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWRE4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWRG4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682DWRG4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682N       | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LS682N       | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LS682NE4     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LS682NE4     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |

| 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74LS682NSR     | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682NSR     | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682NSRE4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682NSRE4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682NSRG4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS682NSRG4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684DW      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684DWE4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684DWG4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684DWR     | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684DWRE4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684DWRG4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684N       | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LS684NE4     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LS684NSR     | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684NSRE4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS684NSRG4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS686DW      | OBSOLETE              | SOIC         | DW              | 24   |             | TBD                     | Call TI          | Call TI                      |
| SN74LS686NT      | OBSOLETE              | PDIP         | NT              | 24   |             | TBD                     | Call TI          | Call TI                      |
| SN74LS687NT      | OBSOLETE              | PDIP         | NT              | 24   |             | TBD                     | Call TI          | Call TI                      |
| SN74LS687NT      | OBSOLETE              | PDIP         | NT              | 24   |             | TBD                     | Call TI          | Call TI                      |
| SN74LS688DW      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688DWE4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688DWG4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688DWR     | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688DWRE4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688DWRG4   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688N       | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free                 | CU NIPDAU        | N / A for Pkg Type           |

| 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| (RoHS)           |                       |              |                 |      |             |                         |                  |                              |
| SN74LS688N3      | OBSOLETE              | PDIP         | N               | 20   |             | TBD                     | Call TI          | Call TI                      |
| SN74LS688NE4     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LS688NSR     | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688NSRE4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LS688NSRG4   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SNJ54LS682FK     | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54LS682FK     | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54LS682J      | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SNJ54LS682J      | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SNJ54LS682W      | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SNJ54LS682W      | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SNJ54LS684FK     | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54LS684J      | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SNJ54LS684W      | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SNJ54LS688FK     | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54LS688J      | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SNJ54LS688W      | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |

<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)

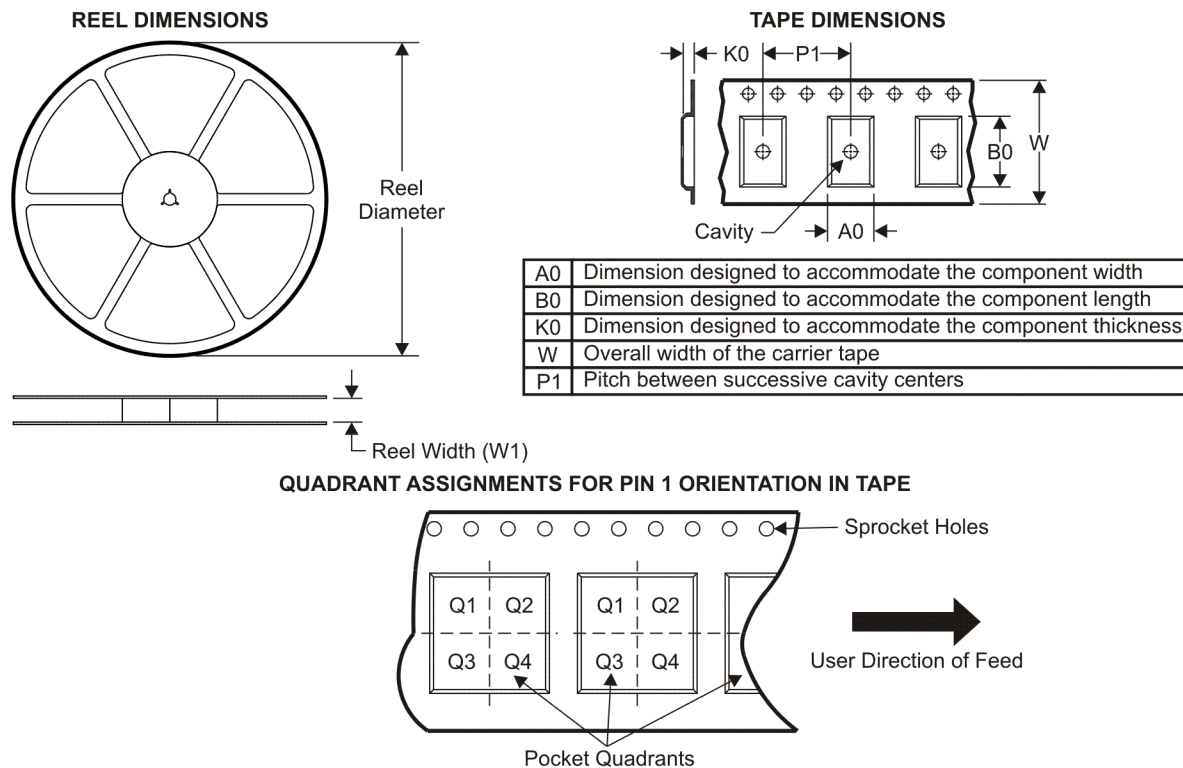
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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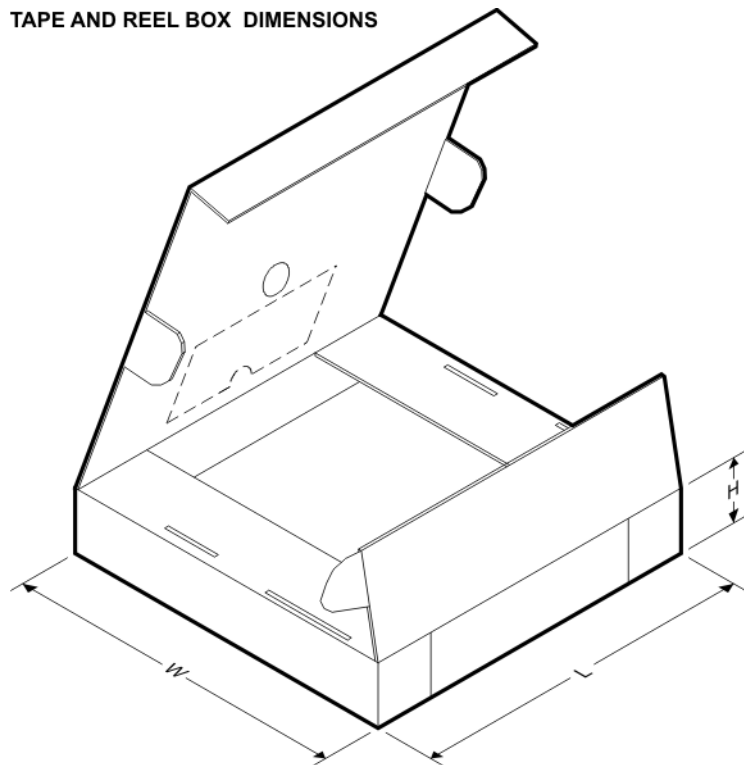
**TAPE AND REEL INFORMATION**



\*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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS682DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LS682NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |
| SN74LS684DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LS684NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |
| SN74LS688DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LS688NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



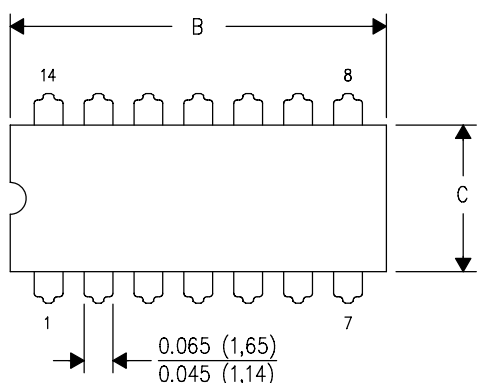
\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS682DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74LS682NSR | SO           | NS              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74LS684DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74LS684NSR | SO           | NS              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74LS688DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74LS688NSR | SO           | NS              | 20   | 2000 | 346.0       | 346.0      | 41.0        |

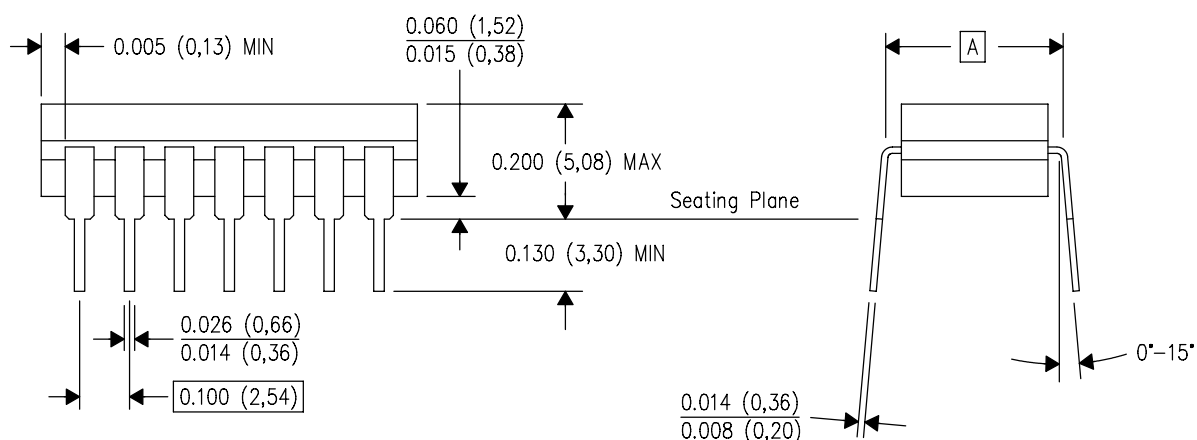
J (R-GDIP-T\*\*)

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)        |

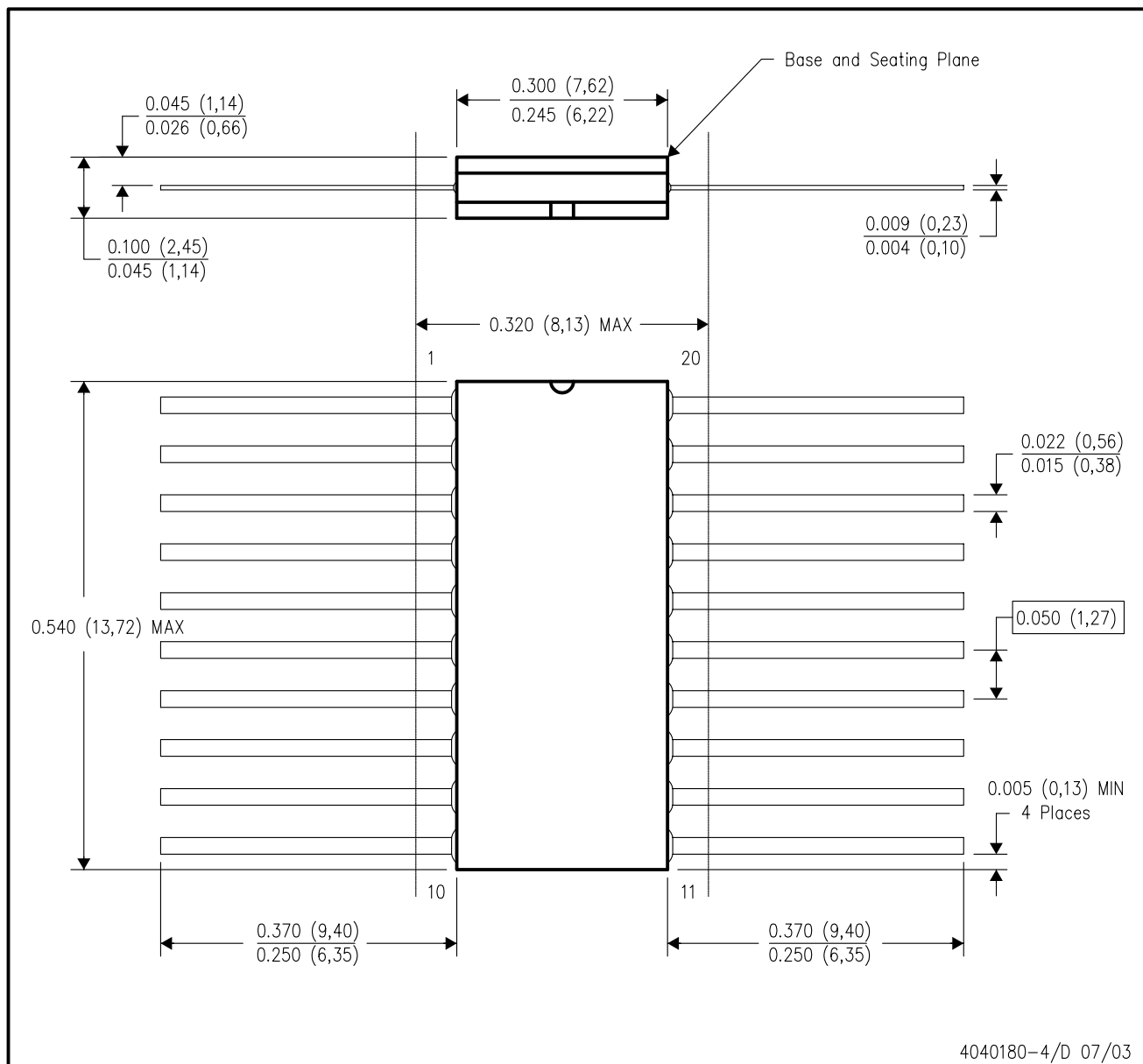


4040083/F 03/03

- 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-F20)

CERAMIC DUAL FLATPACK

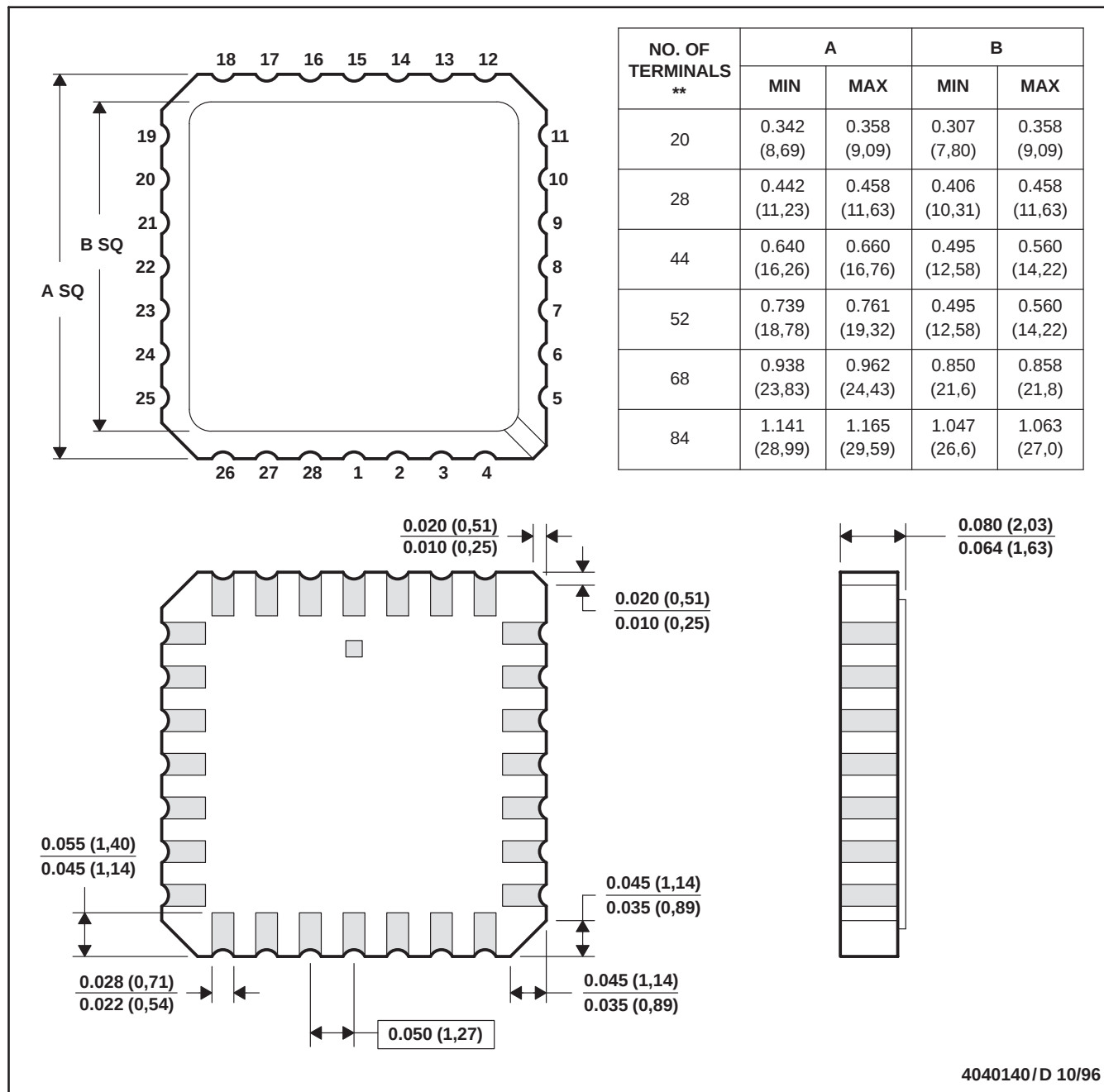


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

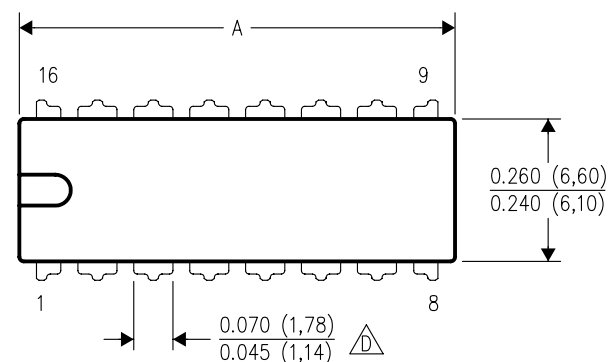


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

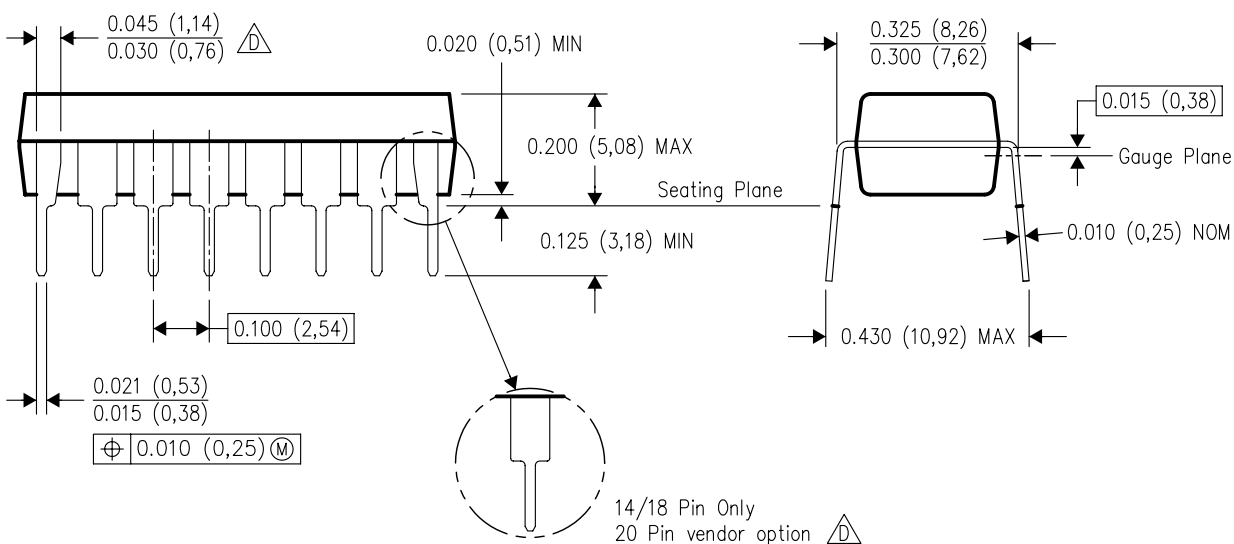
N (R-PDIP-T\*\*)

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:

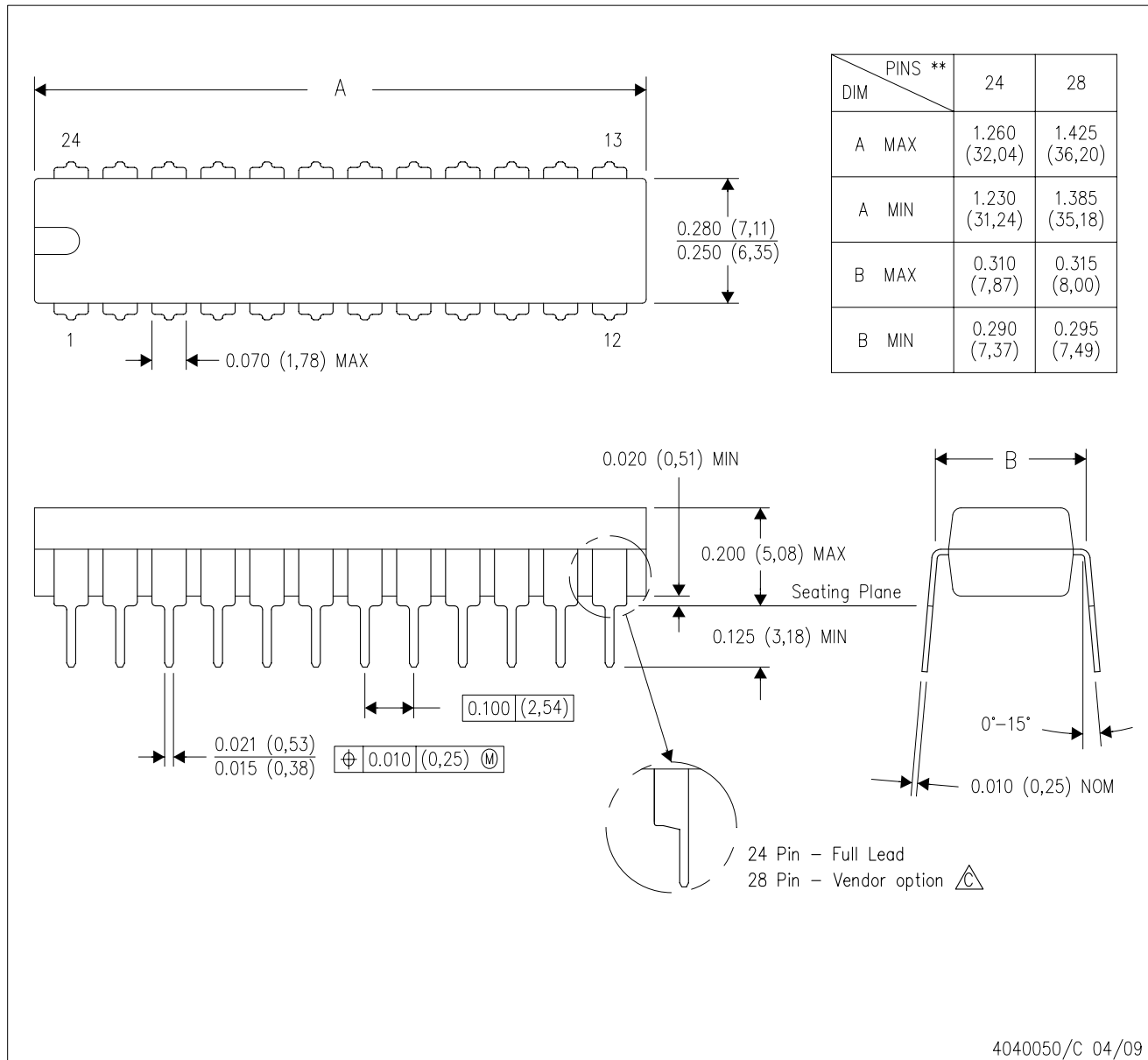
- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

# MECHANICAL DATA

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

24 PINS SHOWN

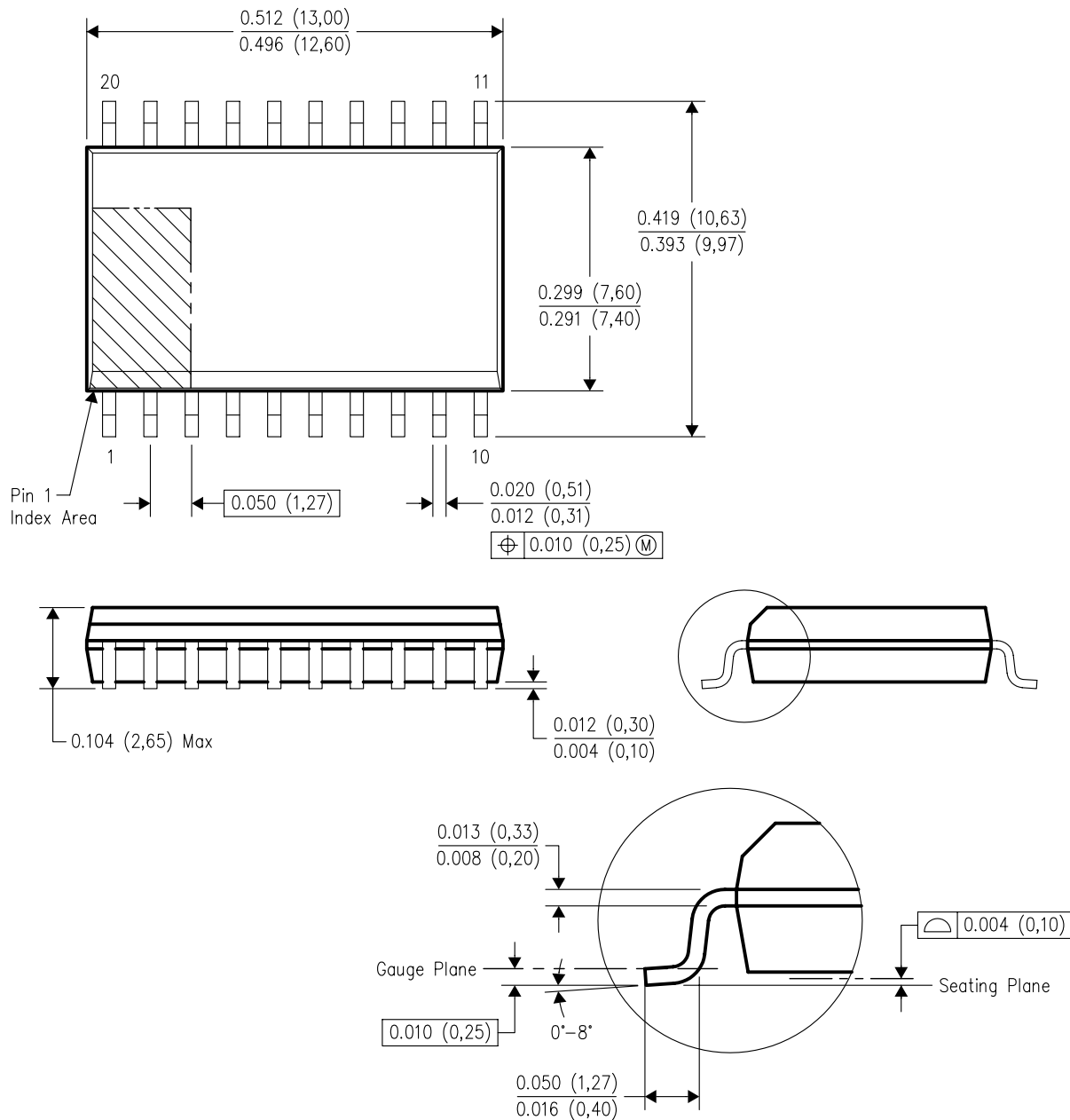
PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - The 28 pin end lead shoulder width is a vendor option, either half or full width.

## DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE

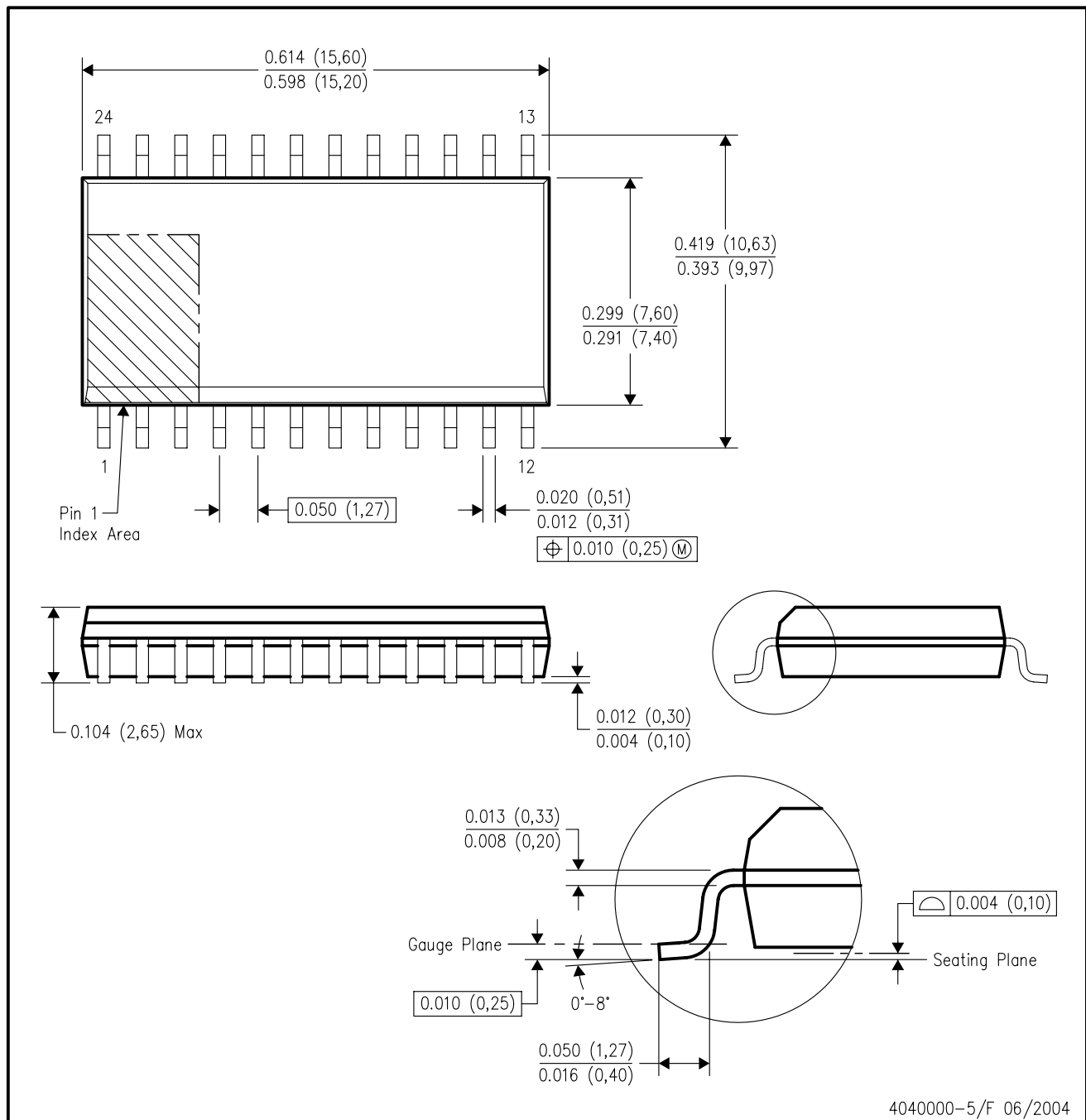


4040000-4/F 06/2004

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AC.

## DW (R-PDSO-G24)

## PLASTIC SMALL-OUTLINE PACKAGE

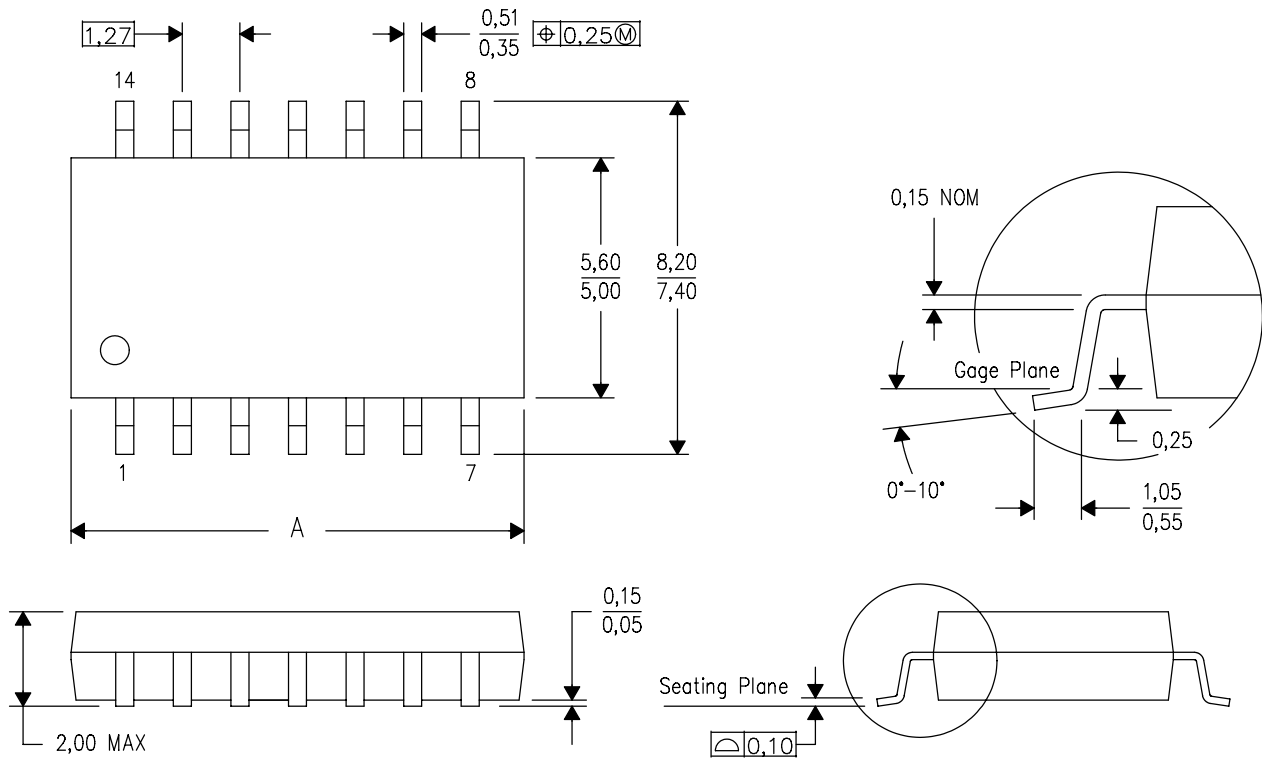


# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

4040062/C 03/03

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