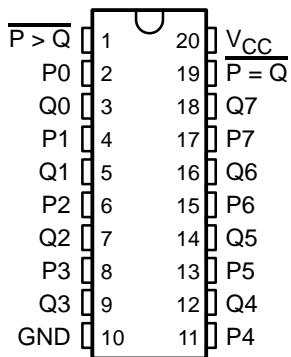
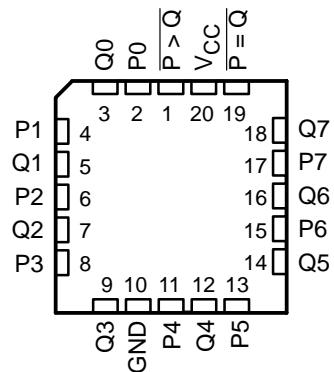


- Wide Operating Voltage Range of 2 V to 6 V
- High-Current Outputs Drive Up To 10 LSTTL Loads
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 22$ ns
- ± 4 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max
- Compare Two 8-Bit Words

SN54HC684 . . . J OR W PACKAGE
SN74HC684 . . . DW OR N PACKAGE
(TOP VIEW)



SN54HC684 . . . FK PACKAGE
(TOP VIEW)



description/ordering information

These magnitude comparators perform comparisons of two 8-bit binary or BCD words. These devices provide $\overline{P} = \overline{Q}$ and $\overline{P} > \overline{Q}$ outputs.

ORDERING INFORMATION

| TA | PACKAGE [†] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------|---------------|-----------------------|------------------|
| -40°C to 85°C | PDIP – N | Tube | SN74HC684N | SN74HC684N |
| | SOIC – DW | Tube | SN74HC684DW | HC684 |
| | | Tape and reel | SN74HC684DWR | |
| -55°C to 125°C | CDIP – J | Tube | SNJ54HC684J | SNJ54HC684J |
| | CFP – W | Tube | SNJ54HC684W | SNJ54HC684W |
| | LCCC – FK | Tube | SNJ54HC684FK | SNJ54HC684FK |

[†] Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE

| DATA INPUTS P, Q | OUTPUTS | |
|-------------------------------|-------------------------------|-------------------------------|
| | $\overline{P} = \overline{Q}$ | $\overline{P} > \overline{Q}$ |
| $\overline{P} = \overline{Q}$ | L | H |
| $\overline{P} > \overline{Q}$ | H | L |
| $\overline{P} < \overline{Q}$ | H | H |

The $\overline{P} < \overline{Q}$ function can be generated by applying $\overline{P} = \overline{Q}$ and $\overline{P} > \overline{Q}$ to a 2-input NAND gate.

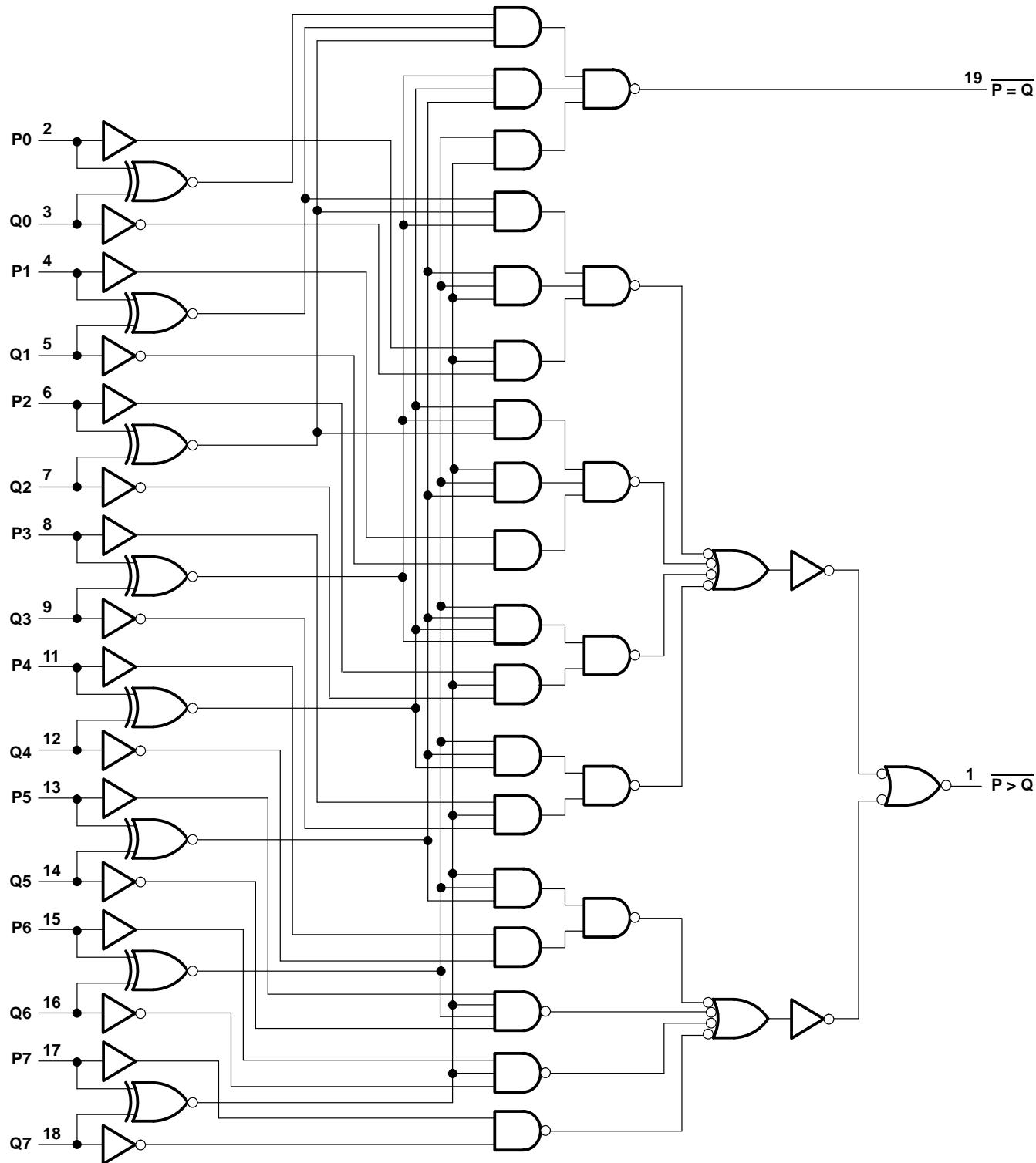


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

SN54HC684, SN74HC684 8-BIT MAGNITUDE COMPARATORS

SCLS340B – MARCH 1996 – REVISED MARCH 2003

logic diagram (positive logic)



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

| | | | |
|---|----------------------------|--|--|
| Supply voltage range, V_{CC} | –0.5 V to 7 V | | |
| Input voltage range, V_I (see Note 1) | –0.5 V to 7 V | | |
| Output voltage range, V_O (see Note 1) | –0.5 V to V_{CC} + 0.5 V | | |
| Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) | ±20 mA | | |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | ±20 mA | | |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ±25 mA | | |
| Continuous current through V_{CC} or GND | ±50 mA | | |
| Package thermal impedance, θ_{JA} (see Note 2): DW package | 58°C/W | | |
| N package | 69°C/W | | |
| Storage temperature range, T_{STG} | –65°C to 150°C | | |

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

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

| | | SN54HC684 | | | SN74HC684 | | | UNIT |
|----------|--|------------------|----------|------|-----------|------|----------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V_{CC} | Supply voltage | 2 | 5 | 6 | 2 | 5 | 6 | V |
| V_{IH} | High-level input voltage | $V_{CC} = 2$ V | 1.5 | | 1.5 | | | V |
| | | $V_{CC} = 4.5$ V | 3.15 | | 3.15 | | | |
| | | $V_{CC} = 6$ V | 4.2 | | 4.2 | | | |
| V_{IL} | Low-level input voltage | $V_{CC} = 2$ V | | 0.5 | | 0.5 | | V |
| | | $V_{CC} = 4.5$ V | | 1.35 | | 1.35 | | |
| | | $V_{CC} = 6$ V | | 1.8 | | 1.8 | | |
| V_I | Input voltage | 0 | V_{CC} | 0 | V_{CC} | 0 | V_{CC} | V |
| V_O | Output voltage | 0 | V_{CC} | 0 | V_{CC} | 0 | V_{CC} | V |
| t_t | Input transition (rise and fall) times | $V_{CC} = 2$ V | | 1000 | | 1000 | | ns |
| | | $V_{CC} = 4.5$ V | | 500 | | 500 | | |
| | | $V_{CC} = 6$ V | | 400 | | 400 | | |
| T_A | Operating free-air temperature | –55 | 125 | –40 | 85 | | °C | |

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

SN54HC684, SN74HC684 8-BIT MAGNITUDE COMPARATORS

SCLS340B – MARCH 1996 – REVISED MARCH 2003

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | SN54HC684 | | SN74HC684 | | UNIT | |
|-----------------|---|--------------------------|-----------------------|-------|-------|-----------|-----|-----------|-----|------|--|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | | |
| V _{OH} | V _I = V _{IH} or V _{IL} | I _{OH} = -20 µA | 2 V | 1.9 | 1.998 | 1.9 | | 1.9 | | V | |
| | | | 4.5 V | 4.4 | 4.499 | 4.4 | | 4.4 | | | |
| | | | 6 V | 5.9 | 5.999 | 5.9 | | 5.9 | | | |
| | | I _{OH} = -4 mA | 4.5 V | 3.98 | 4.30 | 3.7 | | 3.84 | | | |
| | | | 6 V | 5.48 | 5.80 | 5.2 | | 5.34 | | | |
| | | I _{OL} = 20 µA | 2 V | 0.002 | 0.1 | 0.1 | | 0.1 | | | |
| V _{OL} | V _I = V _{IH} or V _{IL} | | 4.5 V | 0.001 | 0.1 | 0.1 | | 0.1 | | | |
| | | | 6 V | 0.001 | 0.1 | 0.1 | | 0.1 | | | |
| | | | 4.5 V | 0.17 | 0.26 | 0.4 | | 0.33 | | | |
| | | | 6 V | 0.15 | 0.26 | 0.4 | | 0.33 | | | |
| I _{IH} | V _I = V _{CC} | 6 V | 0.1 | 100 | | 1000 | | 1000 | nA | | |
| I _{IL} | V _I = 0 | 6 V | -0.1 | -100 | | -1000 | | -1000 | nA | | |
| I _{CC} | V _I = V _{CC} or 0, I _O = 0 | 6 V | | | 8 | 160 | | 80 | µA | | |
| C _i | | 2 V to 6 V | 3 | 10 | | 10 | | 10 | pF | | |

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | T _A = 25°C | | | SN54HC684 | | SN74HC684 | | UNIT |
|-----------------|--------------|-------------|-----------------|-----------------------|-----|-----|-----------|-----|-----------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t _{pd} | P or Q | Any | 2 V | 130 | 275 | | 413 | | 344 | | ns |
| | | | 4.5 V | 26 | 55 | | 88 | | 69 | | |
| | | | 6 V | 22 | 47 | | 70 | | 58 | | |
| t _t | | Any | 2 V | 38 | 75 | | 110 | | 95 | | ns |
| | | | 4.5 V | 8 | 15 | | 22 | | 19 | | |
| | | | 6 V | 6 | 13 | | 19 | | 16 | | |

operating characteristics, T_A = 25°C

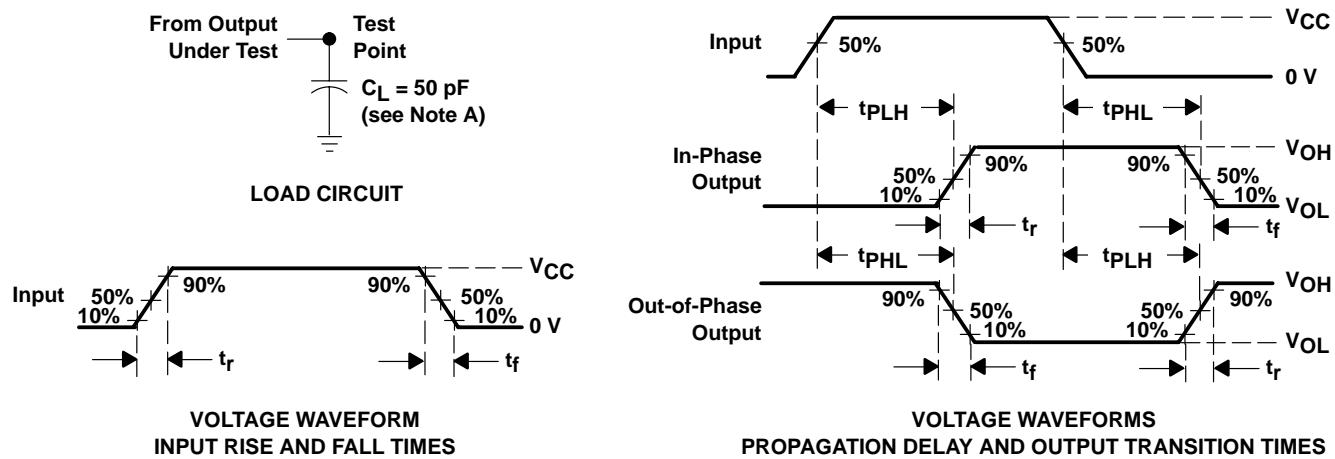
| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|-----------------|-----|------|
| C _{pd} Power dissipation capacitance | No load | 40 | pF |

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PARAMETER MEASUREMENT INFORMATION



NOTES:

- C_L includes probe and test-fixture capacitance.
- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR $\leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 6 \text{ ns}$, $t_f = 6 \text{ ns}$.
- The outputs are measured one at a time with one input transition per measurement.
- t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74HC684DW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC684DWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC684DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC684DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC684DWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC684N | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74HC684NE4 | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |

⁽¹⁾ 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.

⁽²⁾ 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)

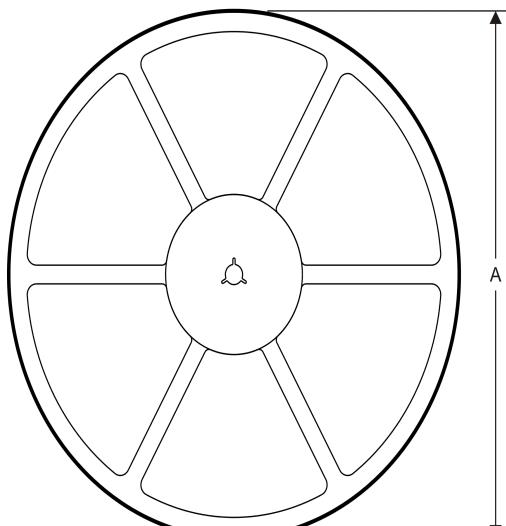
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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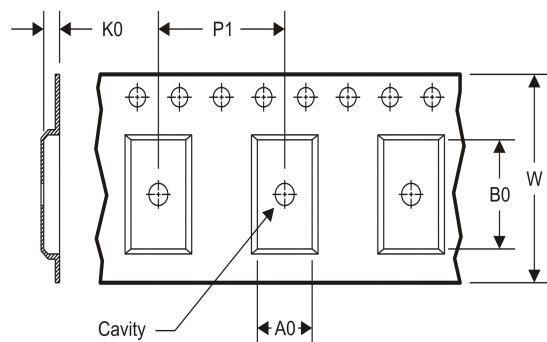
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TAPE AND REEL INFORMATION

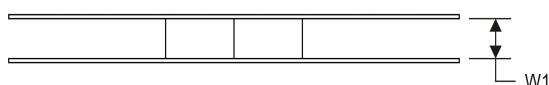
REEL DIMENSIONS



TAPE DIMENSIONS



| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |



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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HC684DWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.0 | 2.7 | 12.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS

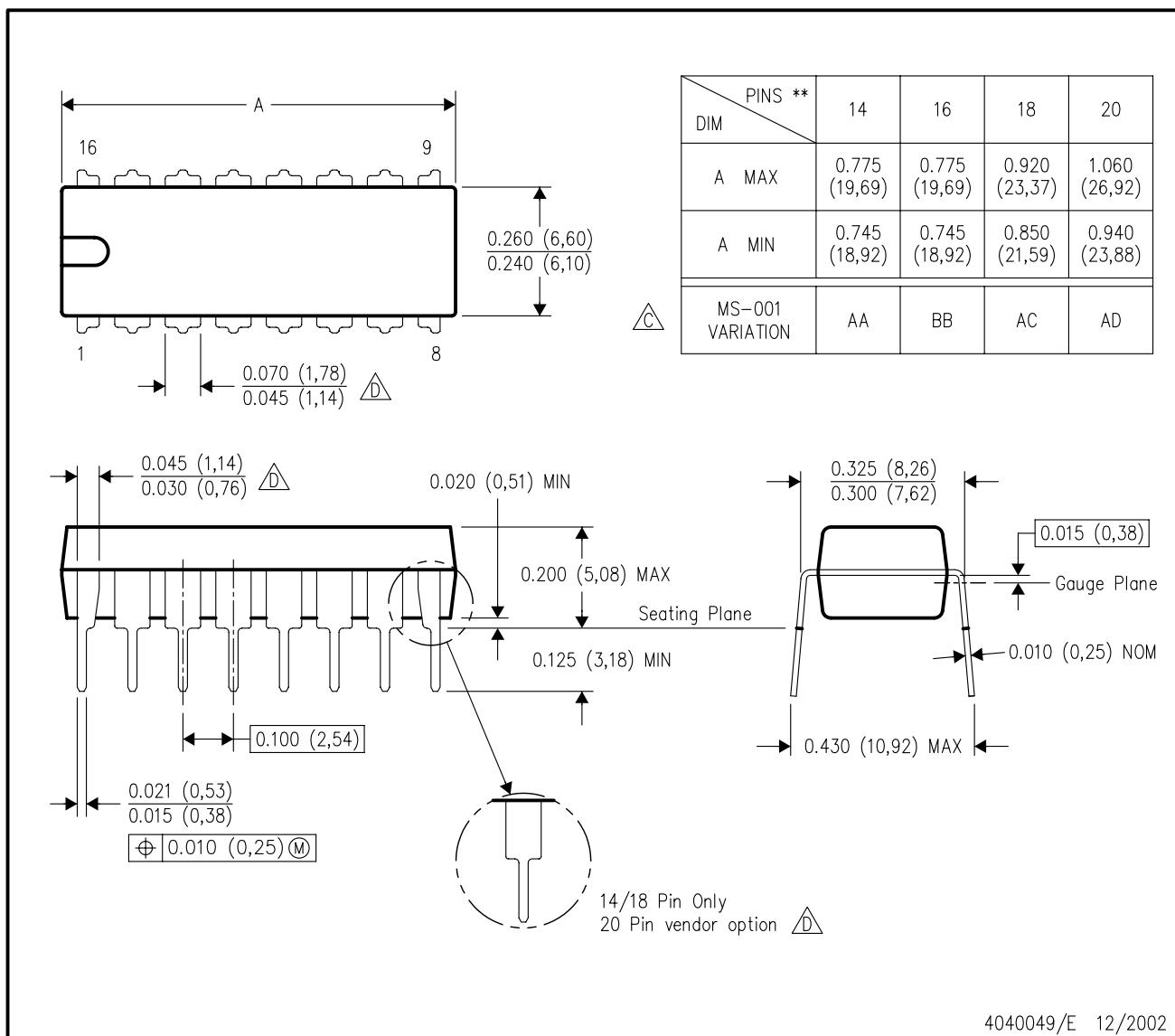
*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HC684DWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |

N (R-PDIP-T**)

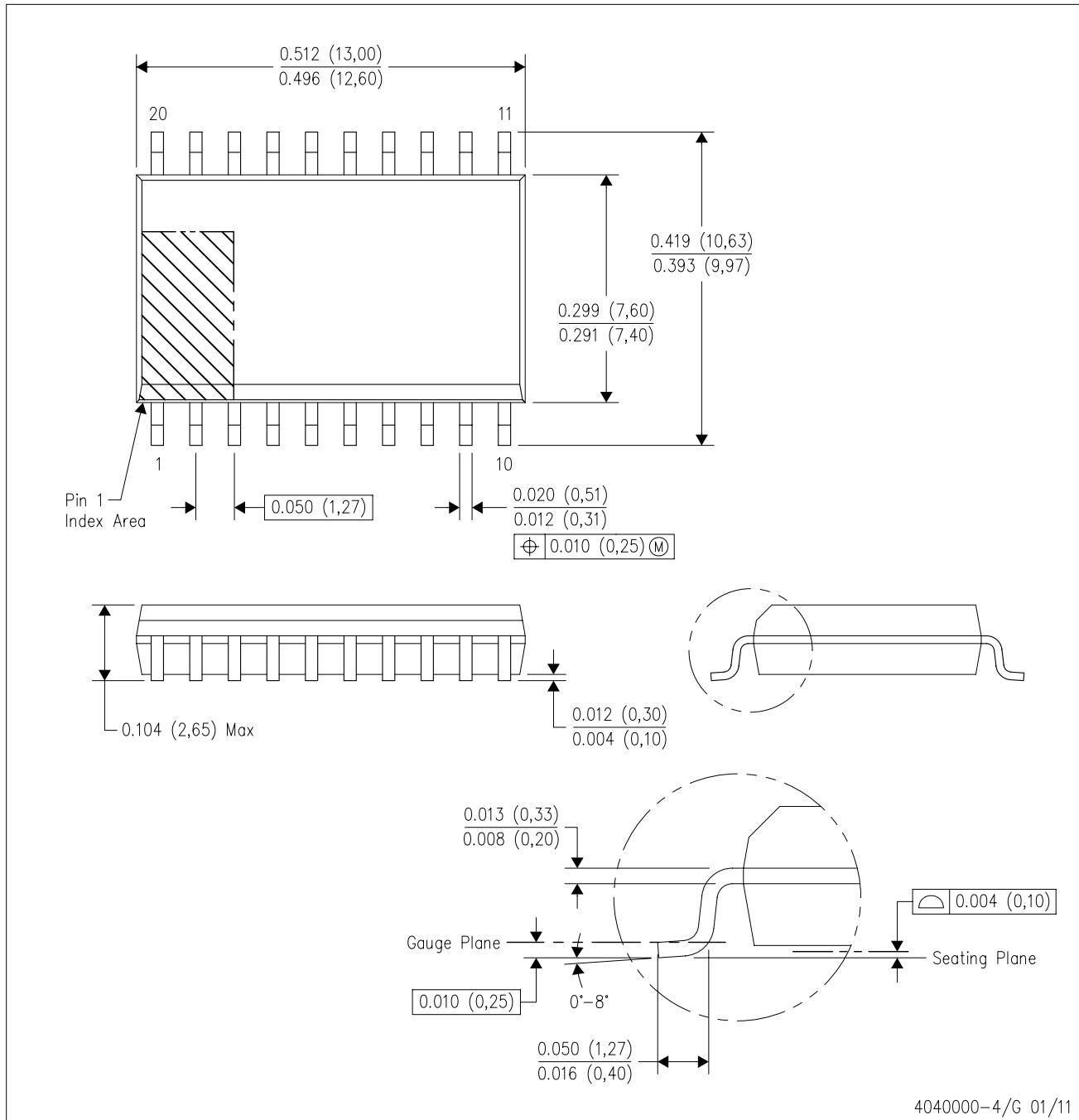
16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

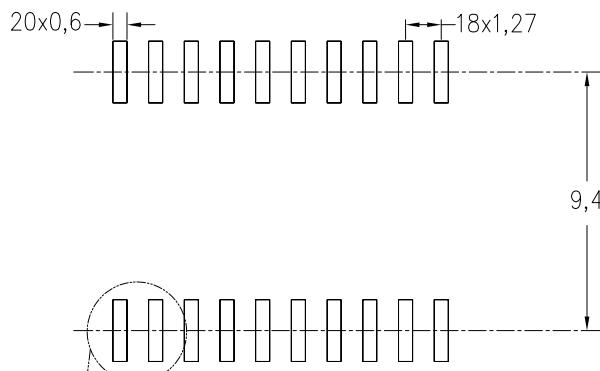
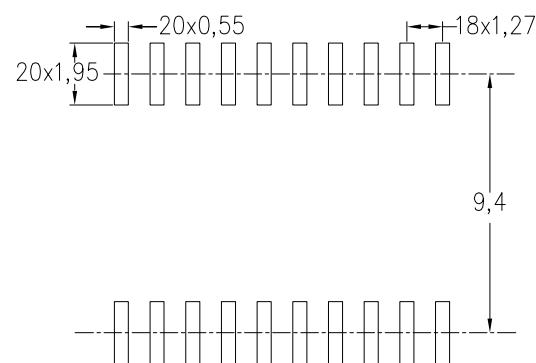


NOTES:

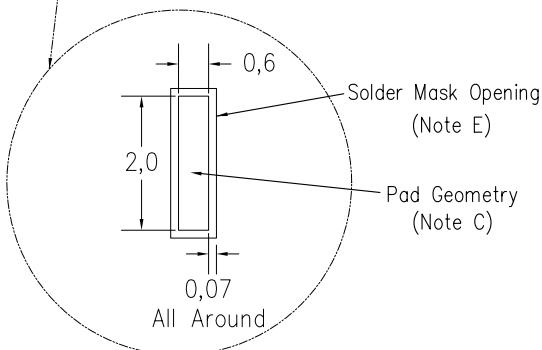
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0.15).
- Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)Stencil Openings
(Note D)

Non Solder Mask Define Pad



4209202-4/E 07/11

NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Refer to IPC7351 for alternate board design.
- Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
- Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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