

November 1997 - Revised September 2003

High-Speed CMOS Logic Quad Buffer, Three-State

Features

- Three-State Outputs
- Separate Output Enable Inputs
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5V$
- HCT Types
 - 4.5V to 5.5V Operation
 - Direct LSTTL Input Logic Compatibility, $V_{IL} = 0.8V$ (Max), $V_{IH} = 2V$ (Min)
 - CMOS Input Compatibility, $I_I \leq 1\mu A$ at V_{OL} , V_{OH}

Description

The 'HC126 and 'HCT126 contain four independent three-state buffers, each having its own output enable input, which when "low" puts the output in the high-impedance state.

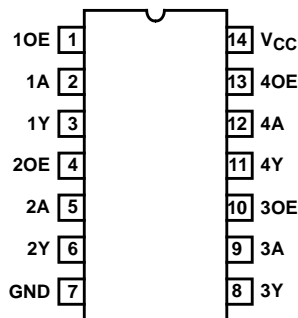
Ordering Information

| PART NUMBER | TEMP. RANGE (°C) | PACKAGE |
|---------------|------------------|--------------|
| CD54HC126F3A | -55 to 125 | 14 Ld CERDIP |
| CD54HCT126F3A | -55 to 125 | 14 Ld CERDIP |
| CD74HC126E | -55 to 125 | 14 Ld PDIP |
| CD74HC126M | -55 to 125 | 14 Ld SOIC |
| CD74HC126MT | -55 to 125 | 14 Ld SOIC |
| CD74HC126M96 | -55 to 125 | 14 Ld SOIC |
| CD74HCT126E | -55 to 125 | 14 Ld PDIP |
| CD74HCT126M | -55 to 125 | 14 Ld SOIC |
| CD74HCT126MT | -55 to 125 | 14 Ld SOIC |
| CD74HCT126M96 | -55 to 125 | 14 Ld SOIC |

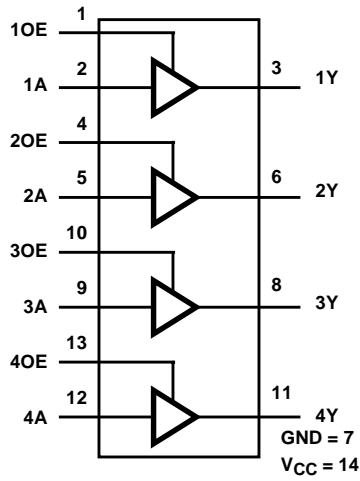
NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel. The suffix T denotes a small-quantity reel of 250.

Pinout

CD54HC126, CD54HCT126
(CERDIP)
CD74HC126, CD74HCT126
(PDIP, SOIC)
TOP VIEW



Functional Diagram

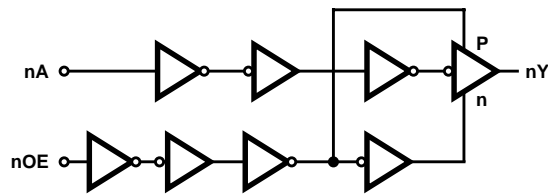


TRUTH TABLE

| INPUTS | | OUTPUTS |
|--------|-----|---------|
| nA | nOE | nY |
| H | H | H |
| L | H | L |
| X | L | Z |

H= High Voltage Level
 L= Low Voltage Level
 X= Don't Care
 Z= High Impedance, OFF State

Logic Diagram



CD54HC126, CD74HC126, CD54HCT126, CD74HCT126

Absolute Maximum Ratings

| | |
|--|-------------|
| DC Supply Voltage, V_{CC} | -0.5V to 7V |
| DC Input Diode Current, I_{IK} | |
| For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ | $\pm 20mA$ |
| DC Output Diode Current, I_{OK} | |
| For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ | $\pm 20mA$ |
| DC Drain Current, per Output, I_O | |
| For $-0.5V < V_O < V_{CC} + 0.5V$ | $\pm 35mA$ |
| DC Output Source or Sink Current per Output Pin, I_O | |
| For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ | $\pm 25mA$ |
| DC V_{CC} or Ground Current, I_{CC} | $\pm 70mA$ |

Thermal Information

| | |
|--|---|
| Thermal Resistance (Typical, Note 1) | θ_{JA} ($^{\circ}C/W$) |
| E (PDIP) Package | 80 |
| M (SOIC) Package | 86 |
| Maximum Junction Temperature | $150^{\circ}C$ |
| Maximum Storage Temperature Range | $-65^{\circ}C$ to $150^{\circ}C$ |
| Maximum Lead Temperature (Soldering 10s) | $300^{\circ}C$ (SOIC - Lead Tips Only) |

Operating Conditions

| | |
|--|----------------------------------|
| Temperature Range (T_A) | $-55^{\circ}C$ to $125^{\circ}C$ |
| Supply Voltage Range, V_{CC} | |
| HC Types | .2V to 6V |
| HCT Types | 4.5V to 5.5V |
| DC Input or Output Voltage, V_I, V_O | 0V to V_{CC} |
| Input Rise and Fall Time | |
| 2V | 1000ns (Max) |
| 4.5V | 500ns (Max) |
| 6V | 400ns (Max) |

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

NOTE:

- The package thermal impedance is calculated in accordance with JESD 51-7.

DC Electrical Specifications

| PARAMETER | SYMBOL | TEST CONDITIONS | | V_{CC} (V) | 25 $^{\circ}C$ | | | -40 $^{\circ}C$ TO 85 $^{\circ}C$ | | -55 $^{\circ}C$ TO 125 $^{\circ}C$ | | UNITS |
|---|----------|-------------------------|------------|--------------|----------------|-----|-----------|-----------------------------------|---------|------------------------------------|---------|---------|
| | | V_I (V) | I_O (mA) | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| HC TYPES | | | | | | | | | | | | |
| High Level Input Voltage | V_{IH} | - | - | 2 | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | | | 4.5 | 3.15 | - | - | 3.15 | - | 3.15 | - | V |
| | | | | 6 | 4.2 | - | - | 4.2 | - | 4.2 | - | V |
| Low Level Input Voltage | V_{IL} | - | - | 2 | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | | | 4.5 | - | - | 1.35 | - | 1.35 | - | 1.35 | V |
| | | | | 6 | - | - | 1.8 | - | 1.8 | - | 1.8 | V |
| High Level Output Voltage CMOS Loads | V_{OH} | V_{IH} or V_{IL} | -0.02 | 2 | 1.9 | - | - | 1.9 | - | 1.9 | - | V |
| | | | -0.02 | 4.5 | 4.4 | - | - | 4.4 | - | 4.4 | - | V |
| | | | -0.02 | 6 | 5.9 | - | - | 5.9 | - | 5.9 | - | V |
| High Level Output Voltage TTL Loads | V_{OH} | V_{IH} or V_{IL} | -6 | 4.5 | 3.98 | - | - | 3.84 | - | 3.7 | - | V |
| | | | -7.8 | 6 | 5.48 | - | - | 5.34 | - | 5.2 | - | V |
| Low Level Output Voltage CMOS Loads | V_{OL} | V_{IH} or V_{IL} | 0.02 | 2 | - | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 0.02 | 4.5 | - | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 0.02 | 6 | - | - | 0.1 | - | 0.1 | - | 0.1 | V |
| Low Level Output Voltage TTL Loads | V_{OL} | V_{IH} or V_{IL} | 6 | 4.5 | - | - | 0.26 | - | 0.33 | - | 0.4 | V |
| | | | 7.8 | 6 | - | - | 0.26 | - | 0.33 | - | 0.4 | V |
| Input Leakage Current | I_I | V_{CC} or GND | - | 6 | - | - | ± 0.1 | - | ± 1 | - | ± 1 | μA |

CD54HC126, CD74HC126, CD54HCT126, CD74HCT126

DC Electrical Specifications (Continued)

| PARAMETER | SYMBOL | TEST CONDITIONS | | V _{CC} (V) | 25°C | | | -40°C TO 85°C | | -55°C TO 125°C | | UNITS |
|--|---------------------------|------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|-----|-------|
| | | V _I (V) | I _O (mA) | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| Quiescent Device Current | I _{CC} | V _{CC} or GND | 0 | 6 | - | - | 8 | - | 80 | - | 160 | μA |
| Three-State Leakage Current | I _{OZ} | V _{IL} or V _{IH} | - | 6 | - | - | ±0.5 | - | ±5 | - | ±10 | μA |
| HCT TYPES | | | | | | | | | | | | |
| High Level Input Voltage | V _{IH} | - | - | 4.5 to 5.5 | 2 | - | - | 2 | - | 2 | - | V |
| Low Level Input Voltage | V _{IL} | - | - | 4.5 to 5.5 | - | - | 0.8 | - | 0.8 | - | 0.8 | V |
| High Level Output Voltage CMOS Loads | V _{OH} | V _{IH} or V _{IL} | -0.02 | 4.5 | 4.4 | - | - | 4.4 | - | 4.4 | - | V |
| High Level Output Voltage TTL Loads | | | -6 | 4.5 | 3.98 | - | - | 3.84 | - | 3.7 | - | V |
| Low Level Output Voltage CMOS Loads | V _{OL} | V _{IH} or V _{IL} | 0.02 | 4.5 | - | - | 0.1 | - | 0.1 | - | 0.1 | V |
| Low Level Output Voltage TTL Loads | | | 6 | 4.5 | - | - | 0.26 | - | 0.33 | - | 0.4 | V |
| Input Leakage Current | I _I | V _{CC} to GND | 0 | 5.5 | - | - | ±0.1 | - | ±1 | - | ±1 | μA |
| Quiescent Device Current | I _{CC} | V _{CC} or GND | 0 | 5.5 | - | - | 8 | - | 80 | - | 160 | μA |
| Additional Quiescent Device Current Per Input Pin: 1 Unit Load | ΔI _{CC} (Note 2) | V _{CC} -2.1 | - | 4.5 to 5.5 | - | 100 | 360 | - | 450 | - | 490 | μA |
| Three-State Leakage Current | I _{OZ} | V _{IL} or V _{IH} | - | 5.5 | - | - | ±0.5 | - | ±5 | - | ±10 | μA |

NOTE:

- For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

HCT Input Loading Table

| INPUT | UNIT LOADS |
|---------|------------|
| nA, nOE | 1 |

NOTE: Unit Load is ΔI_{CC} limit specified in DC Electrical Specifications table, e.g., 360μA max at 25°C.

CD54HC126, CD74HC126, CD54HCT126, CD74HCT126

Switching Specifications Input $t_r, t_f = 6\text{ns}$

| PARAMETER | SYMBOL | TEST CONDITIONS | V_{CC} (V) | 25°C | | -40°C TO 85°C | -55°C TO 125°C | UNITS |
|--|--------------------|---------------------|--------------|------|-----|---------------|----------------|-------|
| | | | | TYP | MAX | MAX | MAX | |
| HC TYPES | | | | | | | | |
| Propagation Delay Data to Outputs | t_{PLH}, t_{PHL} | $C_L = 50\text{pF}$ | 2 | - | 100 | 125 | 150 | ns |
| | | | 4.5 | - | 20 | 25 | 30 | ns |
| | | $C_L = 15\text{pF}$ | 5 | 8 | - | - | - | ns |
| | | $C_L = 50\text{pF}$ | 6 | - | 17 | 21 | 36 | ns |
| Enable Delay Time | t_{PZL}, t_{PZH} | $C_L = 50\text{pF}$ | 2 | - | 125 | 155 | 190 | ns |
| | | | 4.5 | - | 25 | 31 | 38 | ns |
| | | $C_L = 15\text{pF}$ | 5 | 10 | - | - | - | ns |
| | | $C_L = 50\text{pF}$ | 6 | - | 21 | 26 | 32 | ns |
| Disabling Delay Time | t_{PLZ}, t_{PHZ} | $C_L = 50\text{pF}$ | 2 | - | 125 | 155 | 190 | ns |
| | | $C_L = 50\text{pF}$ | 4.5 | - | 25 | 31 | 38 | ns |
| | | $C_L = 15\text{pF}$ | 5 | 10 | - | - | - | ns |
| | | $C_L = 50\text{pF}$ | 6 | - | 21 | 26 | 32 | ns |
| Output Transition Times | t_{TLH}, t_{THL} | $C_L = 50\text{pF}$ | 2 | - | 60 | 75 | 90 | ns |
| | | | 4.5 | - | 12 | 15 | 18 | ns |
| | | | 6 | - | 10 | 13 | 15 | ns |
| Input Capacitance | C_I | - | - | - | 10 | 10 | 10 | pF |
| Three-State Output Capacitance | C_O | - | - | - | 20 | 20 | 20 | pF |
| Power Dissipation Capacitance (Notes 3, 4) | C_{PD} | - | 5 | 30 | - | - | - | pF |
| HCT TYPES | | | | | | | | |
| Propagation Delay Time to Outputs | t_{PLH}, t_{PHL} | $C_L = 50\text{pF}$ | 4.5 | - | 24 | 30 | 36 | ns |
| | | $C_L = 15\text{pF}$ | 5 | 9 | - | - | - | ns |
| Output Enable Time | t_{PZL}, t_{PZH} | $C_L = 50\text{pF}$ | 4.5 | - | 25 | 31 | 38 | ns |
| | | $C_L = 15\text{pF}$ | 5 | 10 | - | - | - | ns |
| Output Disabling Time | t_{PLZ}, t_{PHZ} | $C_L = 50\text{pF}$ | 4.5 | - | 28 | 35 | 42 | ns |
| | | $C_L = 15\text{pF}$ | 5 | 11 | - | - | - | ns |
| Output Transition Times | t_{TLH}, t_{THL} | $C_L = 50\text{pF}$ | 4.5 | - | 12 | 15 | 18 | ns |
| Input Capacitance | C_I | - | - | - | 10 | 10 | 10 | pF |
| Three-State Output Capacitance | C_O | - | - | - | 20 | 20 | 20 | pF |
| Power Dissipation Capacitance (Notes 3, 4) | C_{PD} | - | 5 | 36 | - | - | - | pF |

NOTES:

- C_{PD} is used to determine the dynamic power consumption, per multiplexer.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where f_i = Input Frequency, C_L = Output Load Capacitance, V_{CC} = Supply Voltage.

Test Circuits and Waveforms

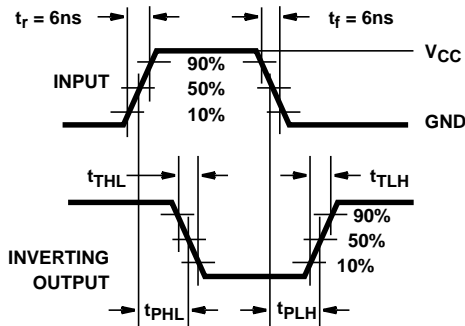


FIGURE 6. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

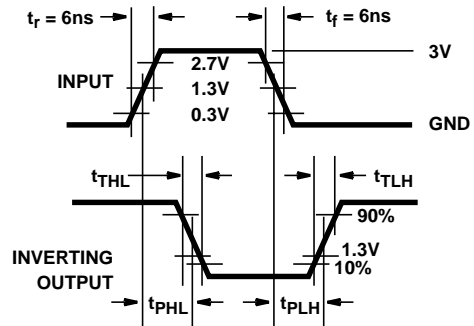


FIGURE 7. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

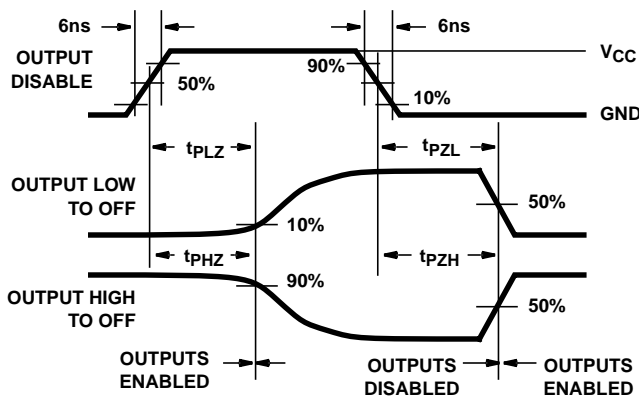


FIGURE 8. HC THREE-STATE PROPAGATION DELAY WAVEFORM

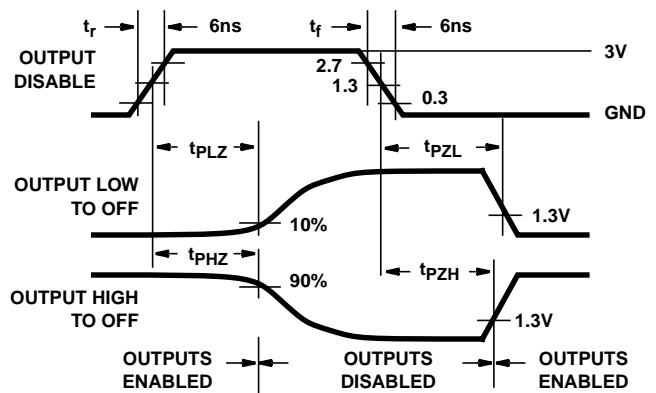
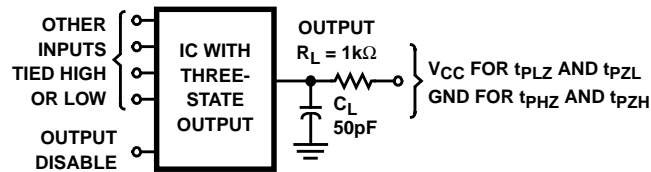


FIGURE 9. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



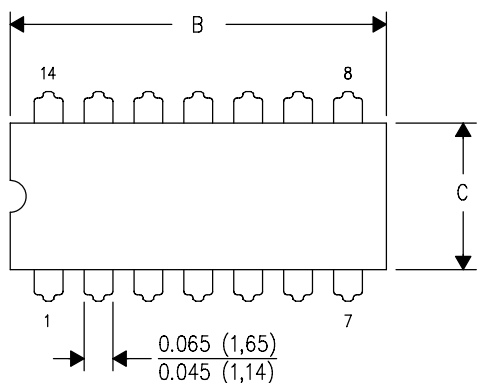
NOTE: Open drain waveforms t_{PLZ} and t_{PZL} are the same as those for three-state shown on the left. The test circuit is Output $R_L = 1k\Omega$ to V_{CC} , $C_L = 50pF$.

FIGURE 10. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT

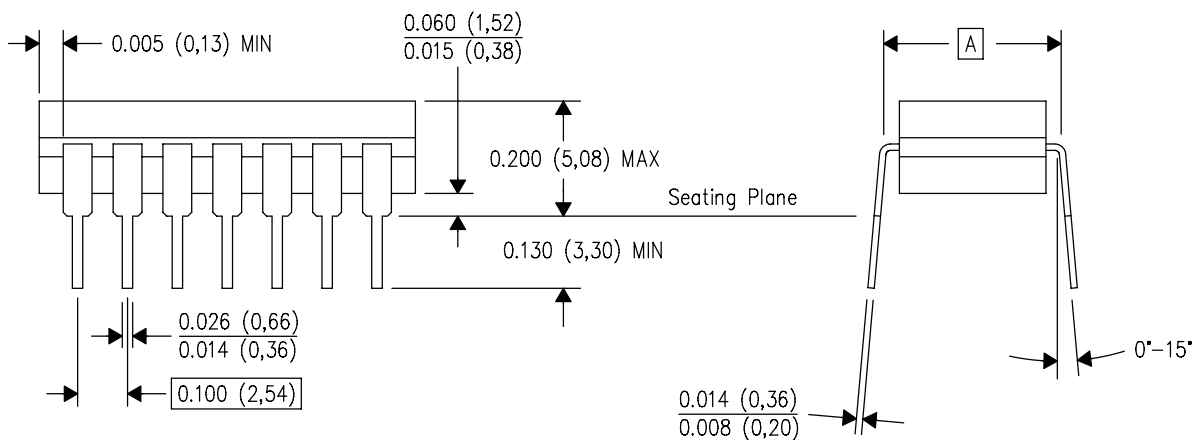
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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



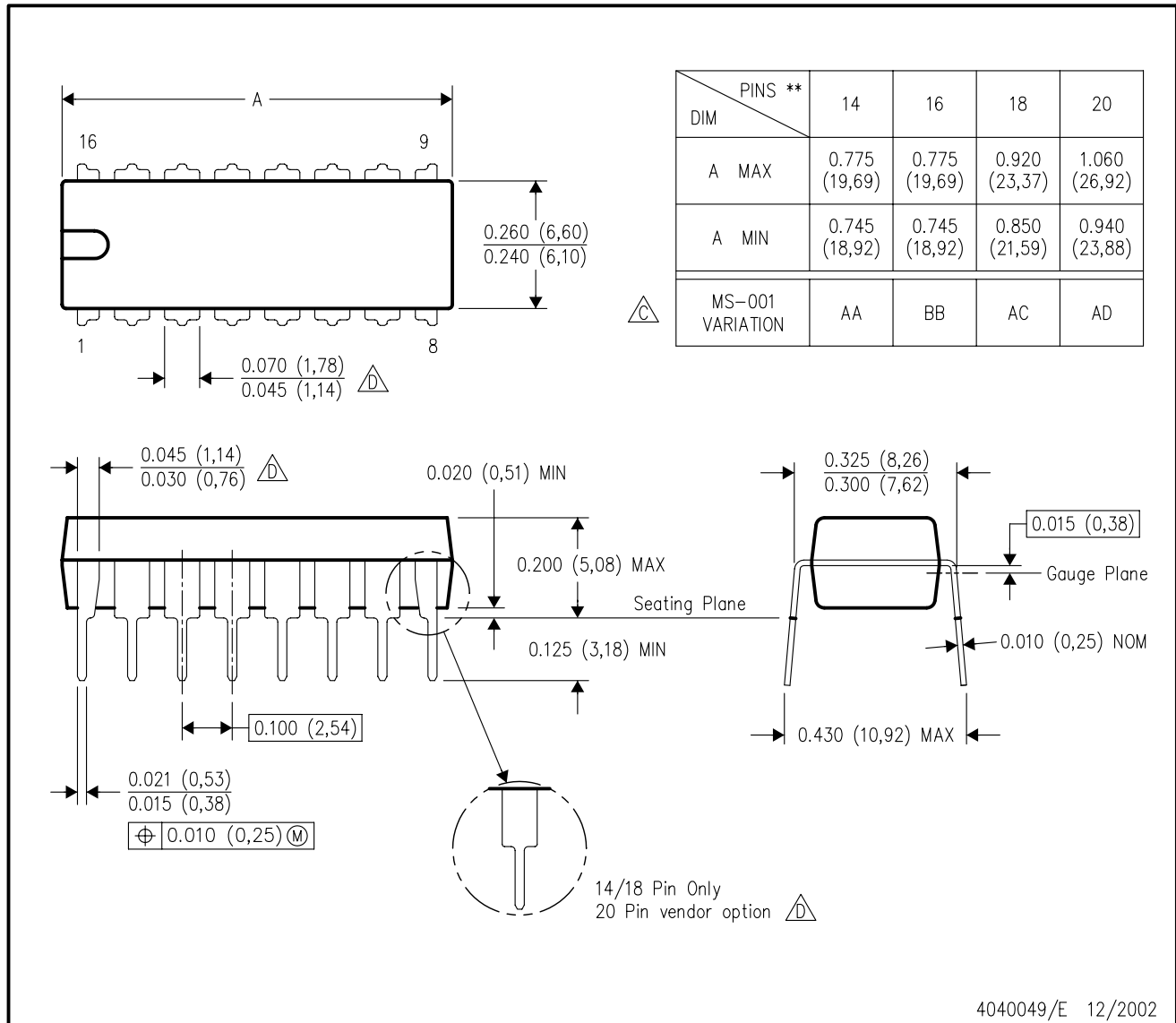
4040083/F 03/03

- 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

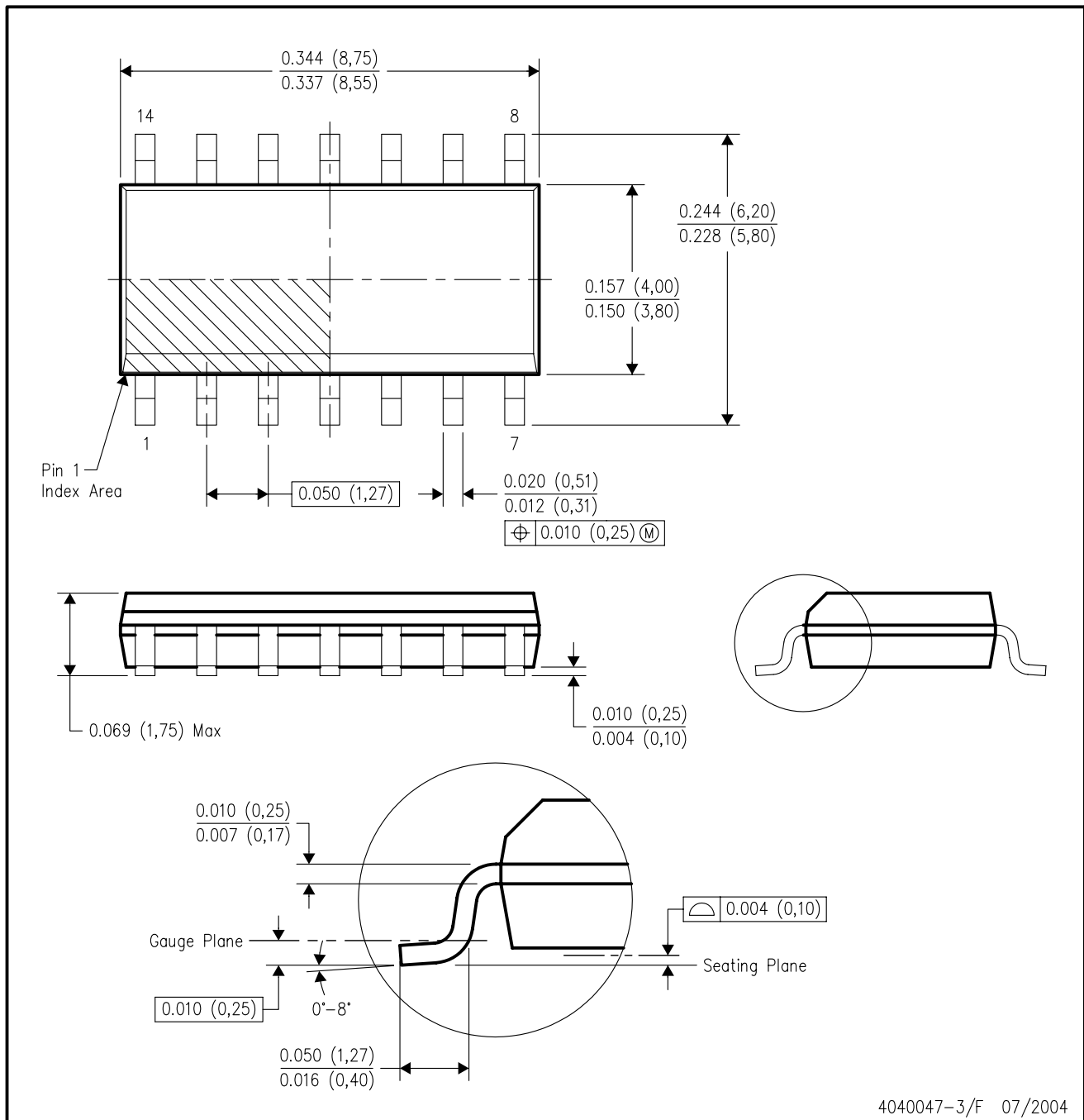
16 PINS SHOWN



- 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.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-012 variation AB.

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