TEXAS INSTRUMENTS

Data sheet acquired from Harris Semiconductor
SCHS097D – Revised September 2003

# CD40106B Types

## CMOS Hex Schmitt Triggers

High-Voltage Types (20-Volt Rating)

■ CD40106B consists of six Schmitt-trigger circuits. Each circuit functions as an inverter with Schmitt-trigger action on the input. The trigger switches at different points for positive- and negative-going signals. The difference between the positive-going voltage ($V_P$) and the negative-going voltage ($V_N$) is defined as hysteresis voltage ($V_H$) (see Fig.6).

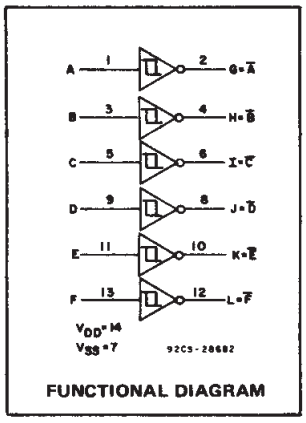
The CD40106B types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PW and PWR suffixes).

*Features:*

- **Schmitt-trigger action with no external components**
- **Hysteresis voltage (typ.) 0.9 V at $V_{DD}$ = 5 V, 2.3 V at $V_{DD}$ = 10 V, and 3.5 V at $V_{DD}$ = 15 V**
- **Noise immunity greater than 50%**
- **No limit on input rise and fall times**
- **Standardized, symmetrical output characteristics**
- **100% tested for quiescent current at 20 V**
- **Maximum input current of 1 μA at 18 V over full package-temperature range; 100 nA at 18 V and 25°C**
- **Low $V_{DD}$ to $V_{SS}$ current during slow input ramp**
- **5-V, 10-V, and 15-V parametric ratings**
- **Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"**

*Applications:*

- **Wave and pulse shapers**
- **High-noise-environment systems**
- **Monostable multivibrators**
- **Astable multivibrators**



FUNCTIONAL DIAGRAM

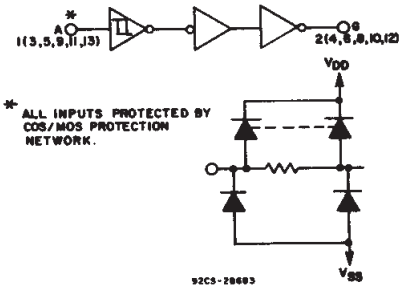


*Fig.1 – Logic diagram (1 of 6 Schmitt triggers).*

**MAXIMUM RATINGS,** *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE RANGE, ($V_{DD}$)
(Voltages referenced to $V_{SS}$ Terminal) ..... -0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to $V_{DD}$ +0.5V
DC INPUT CURRENT, ANY ONE INPUT ..... ±10mA
POWER DISSIPATION PER PACKAGE ($P_D$):
For $T_A$ = -55°C to +100°C ..... 500mW
For $T_A$ = +100°C to +125°C ..... Derate Linearity at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR
FOR $T_A$ = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)..... 100mW
OPERATING-TEMPERATURE RANGE ($T_A$) .....-55°C to +125°C
STORAGE TEMPERATURE RANGE ($T_{stg}$) .....-65°C to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max ..... +265°C

**RECOMMENDED OPERATING CONDITIONS**

*For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:*

| CHARACTERISTIC | LIMITS | | UNITS |
|---|---|---|---|
| | MIN. | MAX. | |
| Supply-Voltage Range (For $T_A$ Full Package-Temperature Range) | 3 | 18 | V |

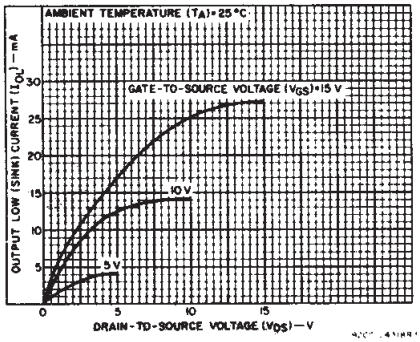


*Fig.2 – Typical output low (sink) current characteristics.*

**DYNAMIC ELECTRICAL CHARACTERISTICS**

*At $T_A$ = 25°C, Input $t_r$, $t_f$ = 20 ns, $C_L$ = 50 pF, $R_L$ = 200 kΩ*

| CHARACTERISTIC | TEST CONDITIONS | | LIMITS | | UNITS |
|---|---|---|---|---|---|
| | | $V_{DD}$ (V) | TYP. | MAX. | |
| Propagation Delay Time: $t_{PHL}$, $t_{PLH}$ | | 5 | 140 | 280 | ns |
| | | 10 | 70 | 140 | |
| | | 15 | 60 | 120 | |
| Transition Time: $t_{THL}$, $t_{TLH}$ | | 5 | 100 | 200 | ns |
| | | 10 | 50 | 100 | |
| | | 15 | 40 | 80 | |
| Input Capacitance, $C_{IN}$ | Any Input | | 5 | 7.5 | pF |

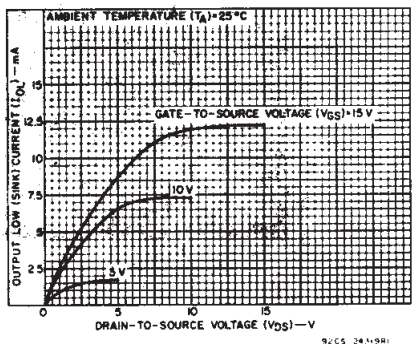


*Fig.3 – Minimum output low (sink) current characteristics.*

## STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | CONDITIONS | | | LIMITS AT INDICATED TEMPERATURES (°C) | | | | | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_O$ (V) | $V_{IN}$ (V) | $V_{DD}$ (V) | −55 | −40 | +85 | +125 | +25 Min. | +25 Typ. | +25 Max. | |
| Quiescent Device Current, $I_{DD}$ Max. | – | 0,5 | 5 | 1 | 1 | 30 | 30 | – | 0.02 | 1 | μA |
| | – | 0,10 | 10 | 2 | 2 | 60 | 60 | – | 0.02 | 2 | |
| | – | 0,15 | 15 | 4 | 4 | 120 | 120 | – | 0.02 | 4 | |
| | – | 0,20 | 20 | 20 | 20 | 600 | 600 | – | 0.04 | 20 | |
| Positive Trigger Threshold Voltage $V_P$ Min. | – | – | 5 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.9 | – | V |
| | – | – | 10 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 5.9 | – | |
| | – | – | 15 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 8.8 | | |
| $V_P$ Max. | – | – | 5 | 3.6 | 3.6 | 3.6 | 3.6 | – | 2.9 | 3.6 | |
| | – | – | 10 | 7.1 | 7.1 | 7.1 | 7.1 | – | 5.9 | 7.1 | |
| | – | – | 15 | 10.8 | 10.8 | 10.8 | 10.8 | – | 8.8 | 10.8 | |
| Negative Trigger Threshold Voltage $V_N$ Min. | – | – | 5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 1.9 | – | V |
| | – | – | 10 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.9 | – | |
| | – | – | 15 | 4 | 4 | 4 | 4 | 4 | 5.8 | – | |
| $V_N$ Max. | – | – | 5 | 2.8 | 2.8 | 2.8 | 2.8 | – | 1.9 | 2.8 | |
| | – | – | 10 | 5.2 | 5.2 | 5.2 | 5.2 | – | 3.9 | 5.2 | |
| | – | – | 15 | 7.4 | 7.4 | 7.4 | 7.4 | – | 5.8 | 7.4 | |
| Hysteresis Voltage $V_H$ Min. | – | – | 5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.9 | – | V |
| | – | – | 10 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 2.3 | – | |
| | – | – | 15 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 3.5 | – | |
| $V_H$ Max. | – | – | 5 | 1.6 | 1.6 | 1.6 | 1.6 | – | 0.9 | 1.6 | |
| | – | – | 10 | 3.4 | 3.4 | 3.4 | 3.4 | – | 2.3 | 3.4 | |
| | – | – | 15 | 5 | 5 | 5 | 5 | – | 3.5 | 5 | |
| Output Low (Sink) Current, $I_{OL}$ Min. | 0.4 | 0,5 | 5 | 0.64 | 0.61 | 0.42 | 0.36 | 0.51 | 1 | – | mA |
| | 0.5 | 0,10 | 10 | 1.6 | 1.5 | 1.1 | 0.9 | 1.3 | 2.6 | – | |
| | 1.5 | 0,15 | 15 | 4.2 | 4 | 2.8 | 2.4 | 3.4 | 6.8 | – | |
| Output High (Source) Current, $I_{OH}$ Min. | 4.6 | 0,5 | 5 | −0.64 | −0.61 | −0.42 | −0.36 | −0.51 | −1 | – | |
| | 2.5 | 0.5 | 5 | −2 | −1.8 | −1.3 | −1.15 | −1.6 | −3.2 | – | |
| | 9.5 | 0,10 | 10 | −1.6 | −1.5 | −1.1 | −0.9 | −1.3 | −2.6 | – | |
| | 13.5 | 0,15 | 15 | −4.2 | −4 | −2.8 | −2.4 | −3.4 | −6.8 | – | |
| Output Voltage Low-Level, $V_{OL}$ Max. | – | 5 | 5 | 0.05 | | | | – | 0 | 0.05 | V |
| | – | 10 | 10 | 0.05 | | | | – | 0 | 0.05 | |
| | – | 15 | 15 | 0.05 | | | | – | 0 | 0.05 | |
| Output Voltage High Level, $V_{OH}$ Min. | – | 0 | 5 | 4.95 | | | | 4.95 | 5 | – | |
| | – | 0 | 10 | 9.95 | | | | 9.95 | 10 | – | |
| | – | 0 | 15 | 14.95 | | | | 14.95 | 15 | – | |
| Input Current, $I_{IN}$ Max. | – | 0,18 | 18 | ±0.1 | ±0.1 | ±1 | ±1 | – | $\pm 10^{-5}$ | ±0.1 | μA |

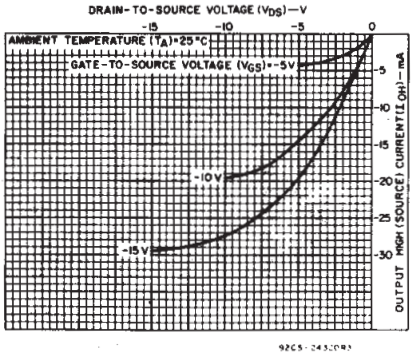



*Fig.4 – Typical output high (source) current characteristics.*

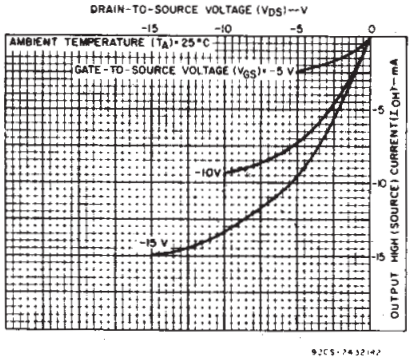



*Fig.5 – Minimum output high (source) current characteristics.*

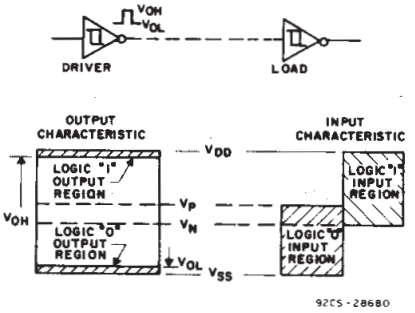
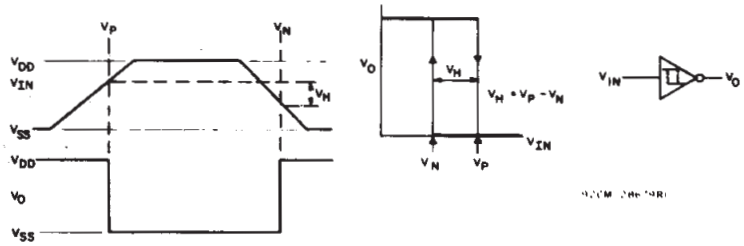



*Fig.7 – Input and output characteristics.*




*a) Definition of $V_P$, $V_N$, $V_H$* *b) Transfer characteristics of 1 of 6 gates*

*Fig.6 – Hysteresis definition, characteristics, and test set-up.*

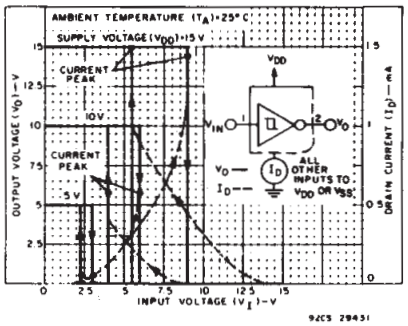



*Fig.8 – Typical current and voltage transfer characteristics.*

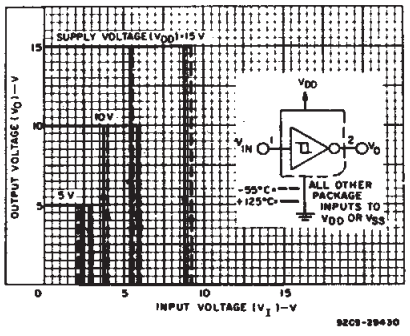



*Fig.9 – Typical voltage transfer characteristics as a function of temperature.*

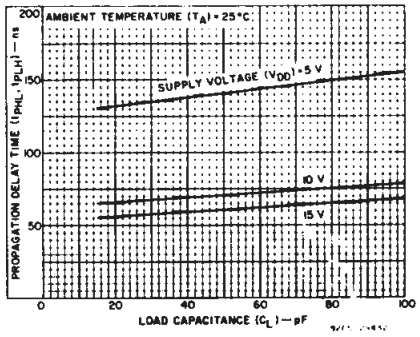



*Fig.10 – Typical propagation delay time as a function of load capacitance.*

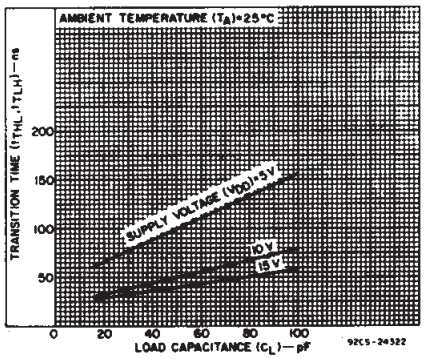



*Fig.11 – Typical transition time as a function of load capacitance.*

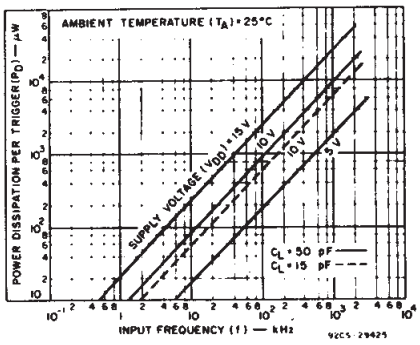



*Fig.12 – Typical power dissipation per trigger as a function of input frequency.*

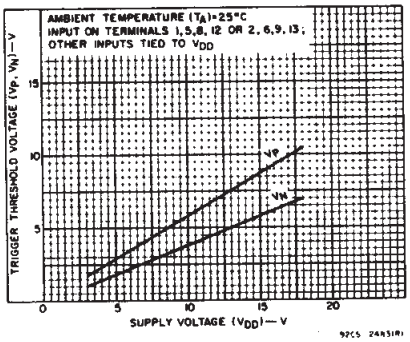



*Fig.13 – Typical trigger threshold voltage as a function of supply voltage.*

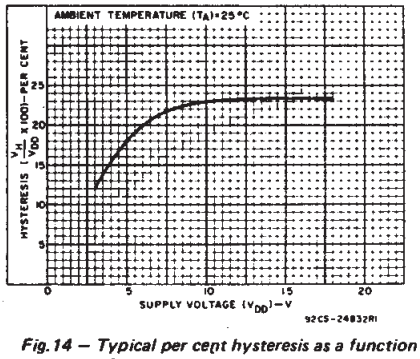



*Fig.14 – Typical per cent hysteresis as a function of supply voltage.*

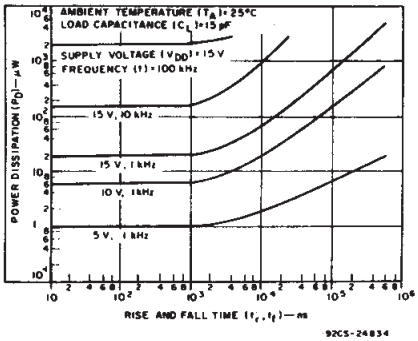



*Fig.15 – Typical power dissipation as a function of rise and fall times.*

## APPLICATIONS

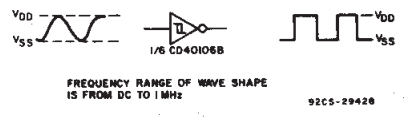



*Fig.16 – Wave shaper.*

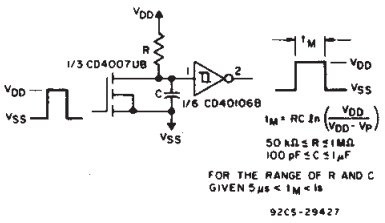



*Fig.17 – Monostable multivibrator.*

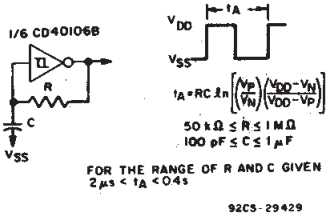



*Fig.18 – Astable multivibrator.*

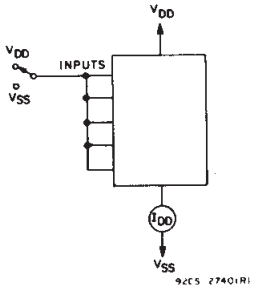



*Fig.19 – Quiescent device current test circuit.*

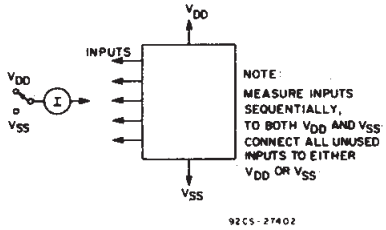



*Fig.20 – Input current test circuit.*

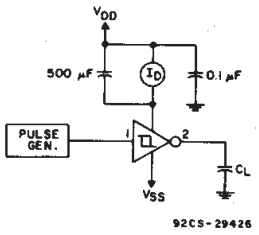
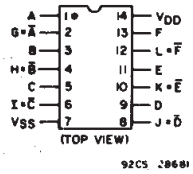
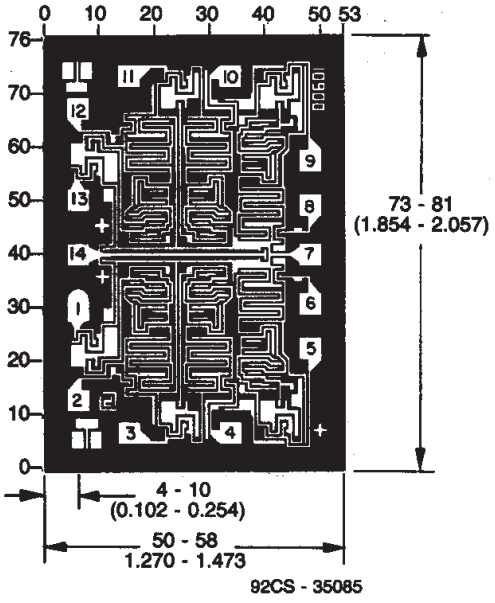



Fig.21 – Dynamic power dissipation test circuit.




**TERMINAL ASSIGNMENT**



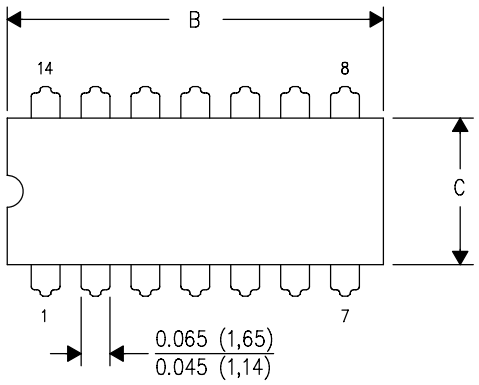

*Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils ($10^{-3}$ inch).*

*Dimensions and Pad Layout for CD40106BH*

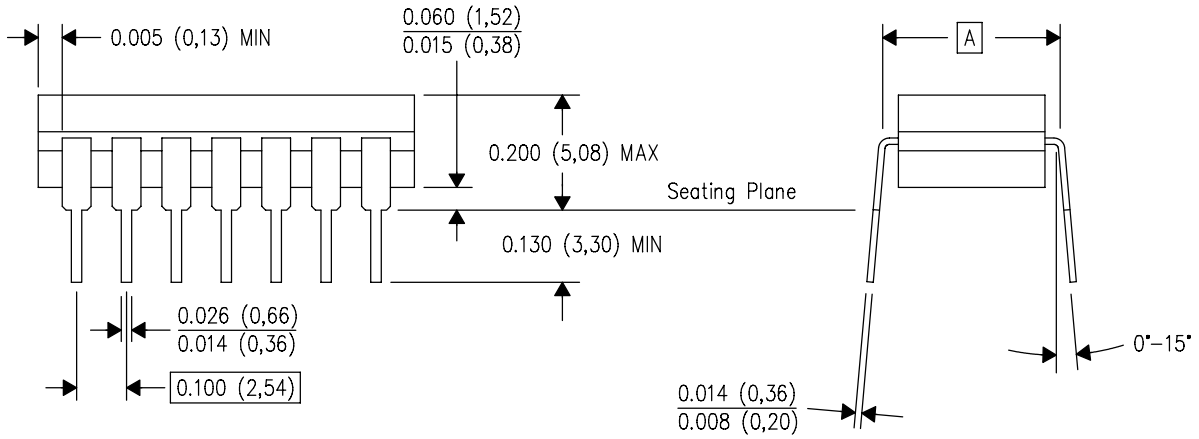
J (R–GDIP–T**)

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) |



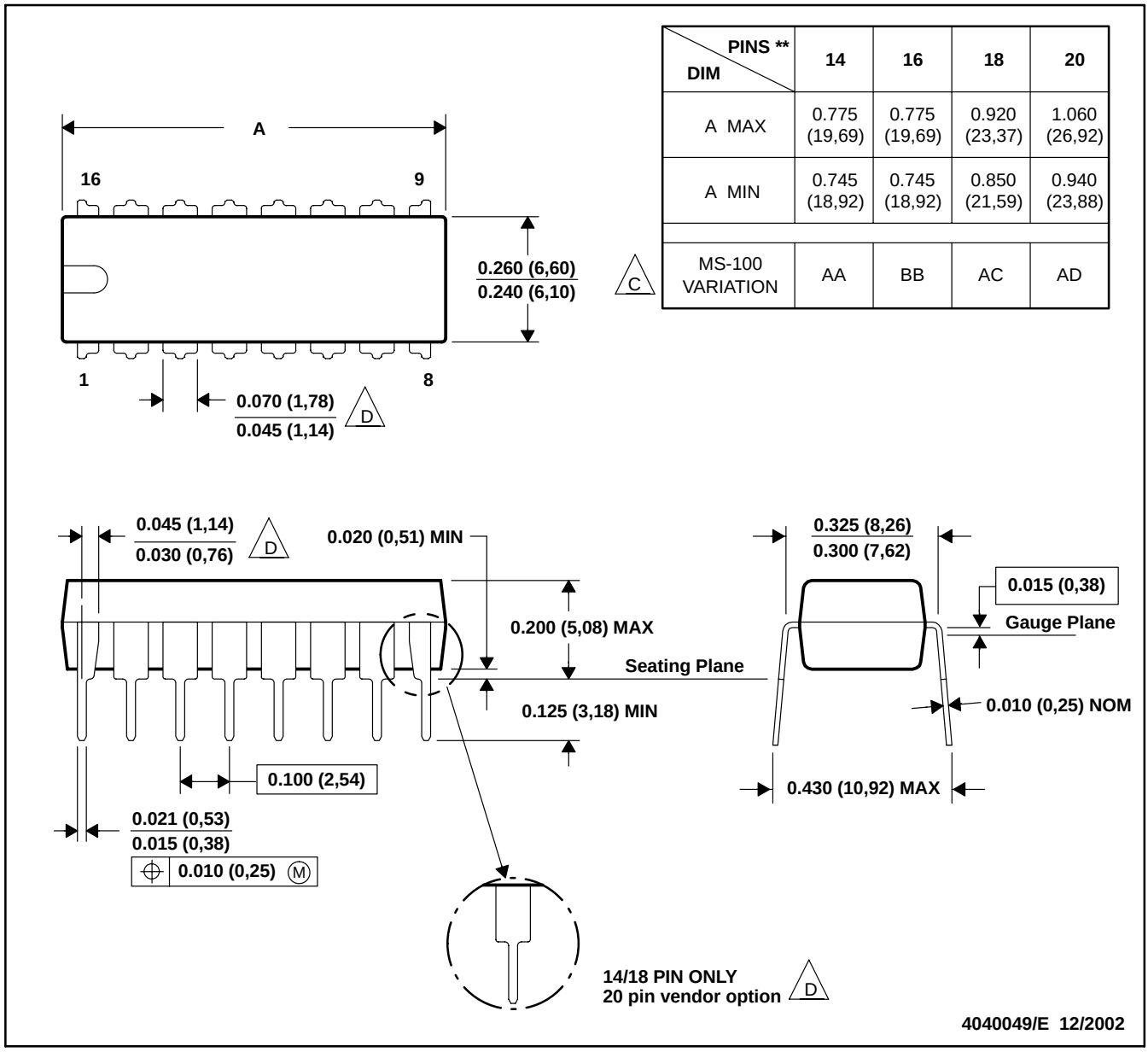

4040083/F 03/03

NOTES:
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.

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

## PLASTIC DUAL-IN-LINE PACKAGE

**16 PINS SHOWN**




| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS-100 VARIATION | AA | BB | AC | AD |

NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body lrngth (Dim A).

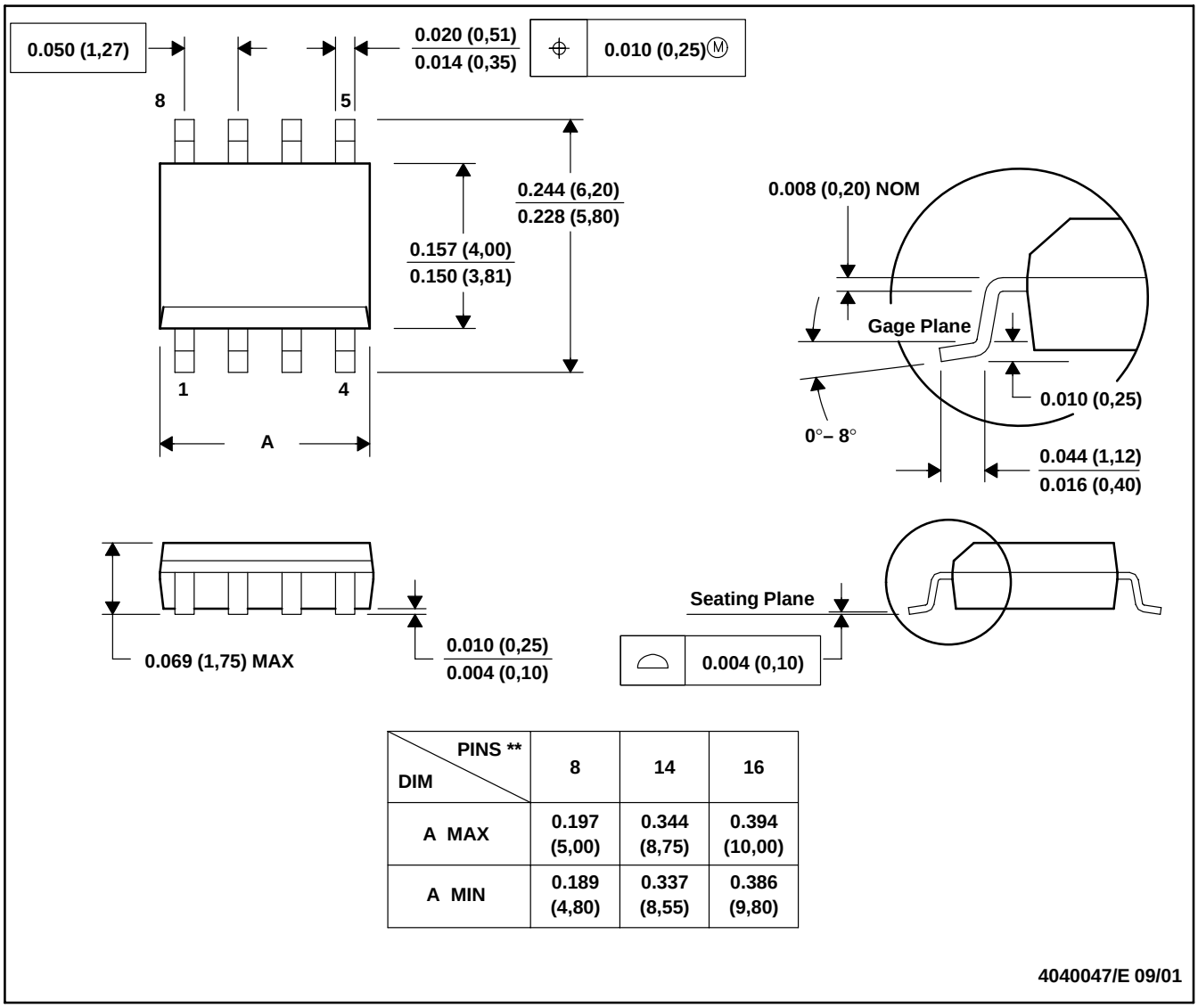
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

MSOI002B – JANUARY 1995 – REVISED SEPTEMBER 2001

## D (R-PDSO-G**)

## PLASTIC SMALL-OUTLINE PACKAGE

**8 PINS SHOWN**




| DIM \ PINS ** | 8 | 14 | 16 |
|---|---|---|---|
| A MAX | 0.197 (5,00) | 0.344 (8,75) | 0.394 (10,00) |
| A MIN | 0.189 (4,80) | 0.337 (8,55) | 0.386 (9,80) |

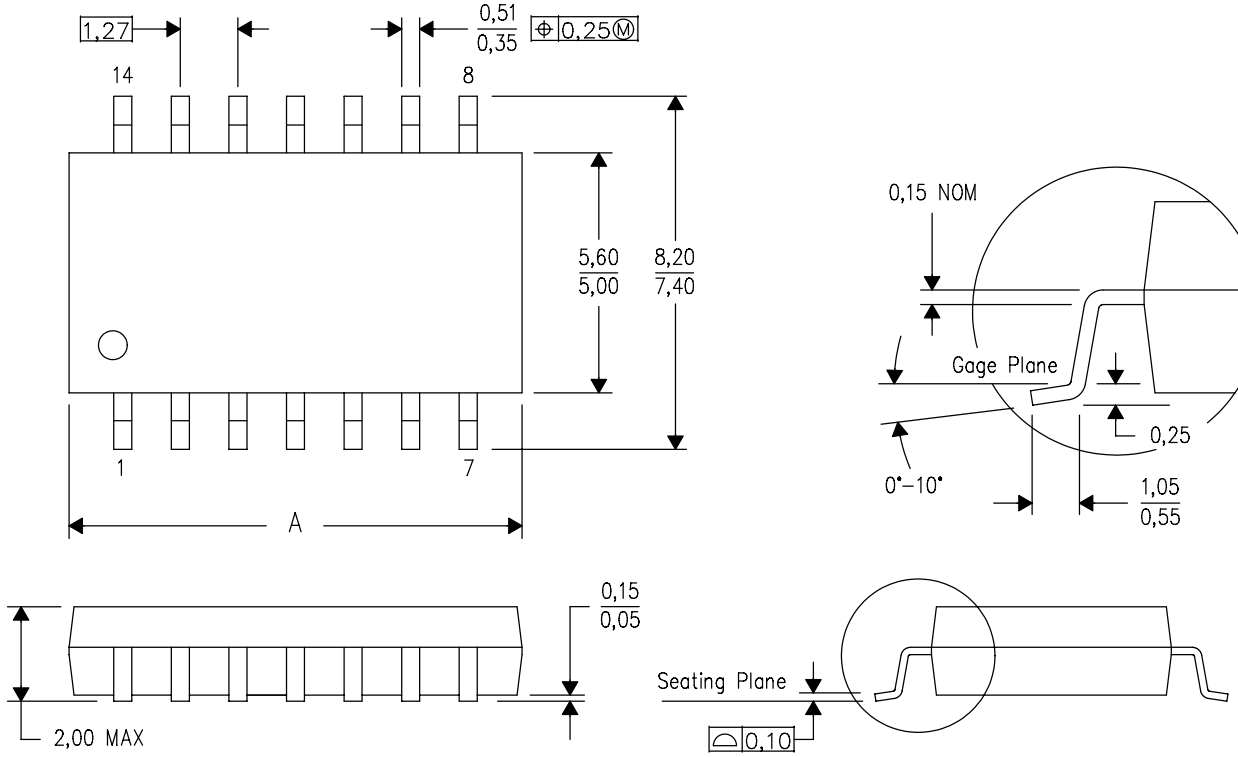
4040047/E 09/01

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

## MECHANICAL DATA

**NS (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



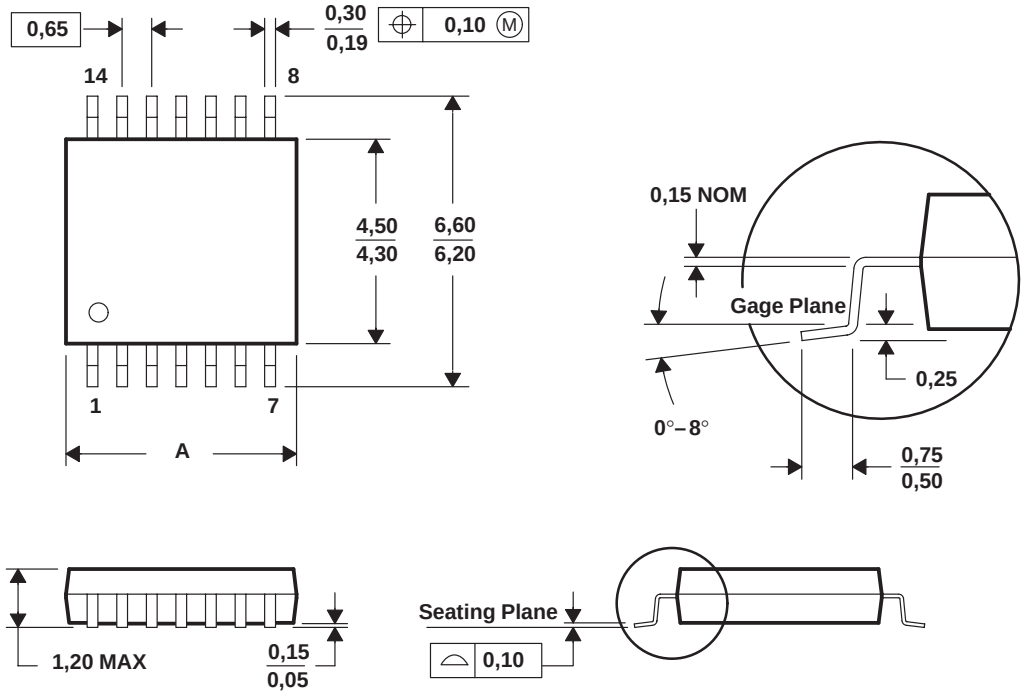

| DIM \ PINS ** | 14 | 16 | 20 | 24 |
|---|---|---|---|---|
| A MAX | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN | 9,90 | 9,90 | 12,30 | 14,70 |

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.

**PW (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE PACKAGE**

**14 PINS SHOWN**




| DIM \ PINS ** | 8 | 14 | 16 | 20 | 24 | 28 |
|---|---|---|---|---|---|---|
| A MAX | 3,10 | 5,10 | 5,10 | 6,60 | 7,90 | 9,80 |
| A MIN | 2,90 | 4,90 | 4,90 | 6,40 | 7,70 | 9,60 |

**4040064/F 01/97**

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.
D. Falls within JEDEC MO-153

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