

**CD54HC243, CD74HC243,  
CD54HCT243, CD74HCT243**  
**High-Speed CMOS Logic**  
**Quad-Bus Transceiver with Three-State Outputs**

**Features**

- Typical Propagation Delay (A to B, B to A) of 7ns at  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^\circ C$
- Three-State Outputs
- Buffered Inputs
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . .  $-55^\circ C$  to  $125^\circ C$
- 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 'HC243 and 'HCT243 silicon-gate CMOS three-state bidirectional noninverting buffers are intended for two-way asynchronous communication between data buses. They have high-drive-current outputs that enable high-speed operation when driving large bus capacitances. These circuits possess the low power dissipation of CMOS circuits and have speeds comparable to low-power Schottky TTL circuits. They can drive 15 LSTTL loads.

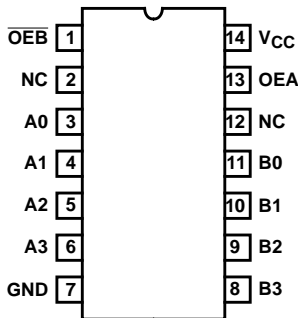
The states of the output-enable ( $\overline{OEB}$ , OEA) inputs determine both the direction of flow (A to B, B to A), and the three-state mode.

**Ordering Information**

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC243F3A	-55 to 125	14 Ld CERDIP
CD54HCT243F3A	-55 to 125	14 Ld CERDIP
CD74HC243E	-55 to 125	14 Ld PDIP
CD74HC243M	-55 to 125	14 Ld SOIC
CD74HC243MT	-55 to 125	14 Ld SOIC
CD74HC243M96	-55 to 125	14 Ld SOIC
CD74HCT243E	-55 to 125	14 Ld PDIP
CD74HCT243M	-55 to 125	14 Ld SOIC

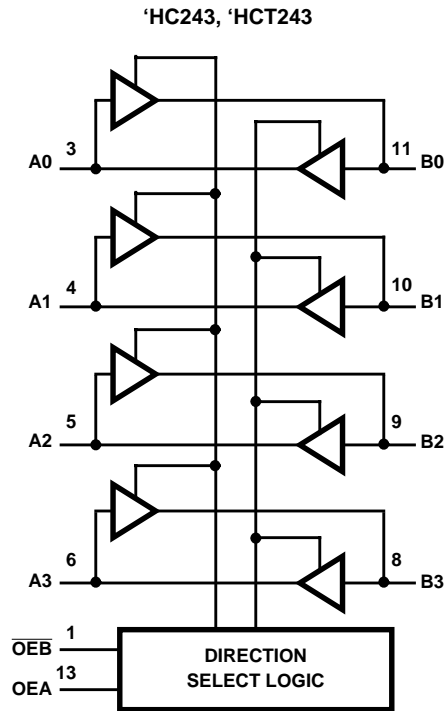
**Pinout**

CD54HC243, CD54HCT243 (CERDIP)  
CD74HC243, CD74HCT243 (PDIP, SOIC)  
TOP VIEW



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.

**Functional Diagram**



TRUTH TABLE

CONTROL INPUTS		HC, HCT243 SERIES	
		DATA PORT STATUS	
$\overline{\text{OEB}}$	OEA	An	Bn
H	H	O	I
L	H	Z	Z
H	L	Z	Z
L	L	I	O

H= High Voltage Level

L= Low Voltage Level

I= Input

O= Output (Same Level as Input)

Z= High Impedance

To prevent excess currents in the High Z modes all I/O terminals should be terminated with 10kΩ to 1MΩ resistors.

# CD54HC243, CD74HC243, CD54HCT243, CD74HCT243

## 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)	$\theta_{JA}$ (°C/W)
E (PDIP) Package .....	80
M (SOIC) Package .....	86
Maximum Junction Temperature .....	150°C
Maximum Storage Temperature Range .....	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s) .....	300°C (SOIC - Lead Tips Only)

## Operating Conditions

Temperature Range ( $T_A$ ) .....	-55°C to 125°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°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		
<b>HC TYPES</b>													
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	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	-0.02	6	5.9	-	-	5.9	-	5.9	-	V
			-6	-6	4.5	3.98	-	-	3.84	-	3.7	-	V
			-7.8	-7.8	6	5.48	-	-	5.34	-	5.2	-	V
High Level Output Voltage TTL Loads	$V_{OH}$	$V_{IH}$ or $V_{IL}$	-6	-6	4.5	3.98	-	-	3.84	-	3.7	-	V
			-7.8	-7.8	6	5.48	-	-	5.34	-	5.2	-	V
			0.02	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage CMOS Loads	$V_{OL}$	$V_{IH}$ or $V_{IL}$	0.02	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	6	-	-	0.1	-	0.1	-	0.1	V
			6	6	4.5	-	-	0.26	-	0.33	-	0.4	V
			7.8	7.8	6	-	-	0.26	-	0.33	-	0.4	V
Low Level Output Voltage TTL Loads	$V_{OL}$	$V_{IH}$ or $V_{IL}$	6	6	4.5	-	-	0.26	-	0.33	-	0.4	V
			7.8	7.8	6	-	-	0.26	-	0.33	-	0.4	V

**CD54HC243, CD74HC243, CD54HCT243, CD74HCT243**

**DC Electrical Specifications (Continued)**

PARAMETER	SYMBOL	TEST CONDITIONS		V <sub>CC</sub> (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V <sub>I</sub> (V)	I <sub>O</sub> (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Input Leakage Current	I <sub>I</sub>	V <sub>CC</sub> or GND	-	6	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I <sub>CC</sub>	V <sub>CC</sub> or GND	0	6	-	-	8	-	80	-	160	μA
Three-State Leakage Current	I <sub>OZ</sub>	V <sub>IL</sub> or V <sub>IH</sub>	-	6	-	-	±0.5	-	±0.5	-	±10	μA
<b>HCT TYPES</b>												
High Level Input Voltage	V <sub>IH</sub>	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	V <sub>IL</sub>	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V <sub>OH</sub>	V <sub>IH</sub> or V <sub>IL</sub>	-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 <sub>OL</sub>	V <sub>IH</sub> or V <sub>IL</sub>	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 <sub>I</sub>	V <sub>CC</sub> to GND	-	5.5	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I <sub>CC</sub>	V <sub>CC</sub> or GND	0	5.5	-	-	8	-	80	-	160	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	ΔI <sub>CC</sub> (Note 2)	V <sub>CC</sub> -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	μA
Three-State Leakage Current	I <sub>OZ</sub>	V <sub>IL</sub> or V <sub>IH</sub>	-	5.5	-	-	±0.5	-	±5.0	-	±10	μA

NOTE:

- For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4V, V<sub>CC</sub> = 5.5V) specification is 1.8mA.

**HCT Input Loading Table**

INPUT	UNIT LOADS
An, Bn	1.1
OEA, $\overline{OEB}$	0.6

NOTE: Unit Load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications table, e.g., 360μA max at 25°C.

**CD54HC243, CD74HC243, CD54HCT243, CD74HCT243**

**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	
<b>HC TYPES</b>								
Propagation Delay Data to Outputs	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	2	-	90	115	135	ns
			4.5	-	18	23	27	ns
		$C_L = 15\text{pF}$	5	7	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	15	20	23	ns
Output High-Z, to High Level to Low Level	$t_{PZH}, t_{PZL}$	$C_L = 50\text{pF}$	2	-	150	190	225	ns
		$C_L = 50\text{pF}$	4.5	-	30	38	45	ns
		$C_L = 15\text{pF}$	5	12	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	26	33	38	ns
Output High Level, Output Low Level to High-Z	$t_{PHZ}, t_{PLZ}$	$C_L = 50\text{pF}$	2	-	150	190	225	ns
		$C_L = 50\text{pF}$	4.5	-	30	38	45	ns
		$C_L = 15\text{pF}$	5	12	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	26	33	38	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	80	-	-	-	pF
<b>HCT TYPES</b>								
Propagation Delay Data to Outputs	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	22	28	33	ns
		$C_L = 15\text{pF}$	5	9	-	-	-	ns
Output High-Z to High Level to Low Level	$t_{PZH}, t_{PZL}$	$C_L = 50\text{pF}$	4.5	-	34	43	51	ns
		$C_L = 15\text{pF}$	5	14	-	-	-	ns
Output High Level, Output Low Level to High-Z	$t_{PHZ}, t_{PLZ}$	$C_L = 50\text{pF}$	4.5	-	35	44	53	ns
		$C_L = 15\text{pF}$	5	14	-	-	-	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	91	-	-	-	pF

**NOTES:**

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

Test Circuits and Waveforms

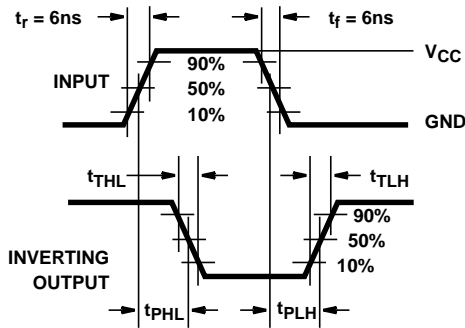


FIGURE 1. HC AND HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

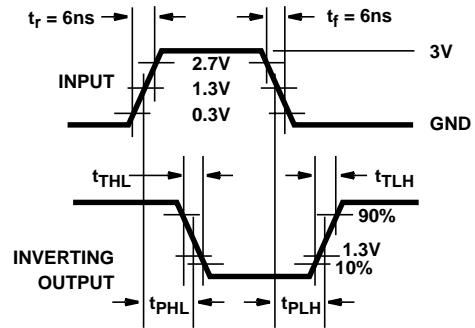


FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

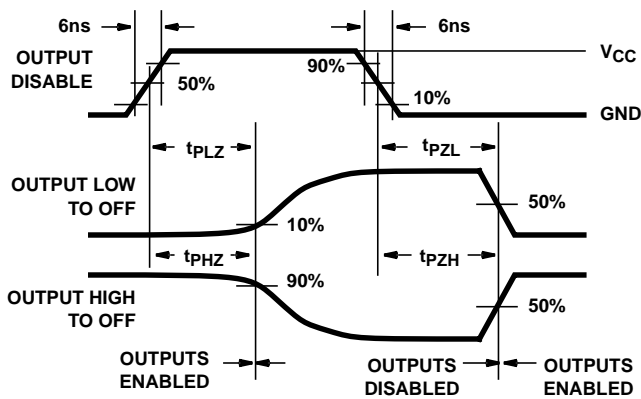


FIGURE 3. HC THREE-STATE PROPAGATION DELAY WAVEFORM

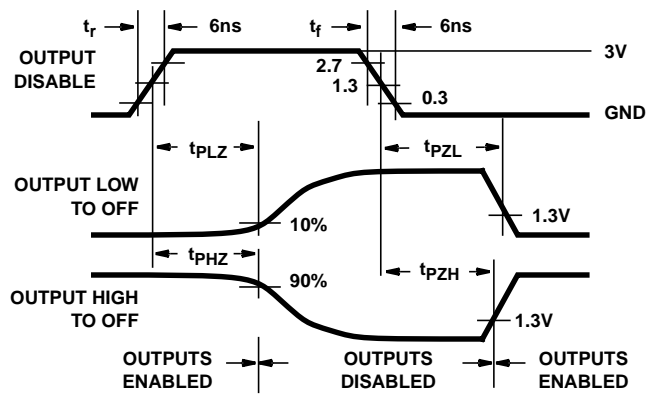
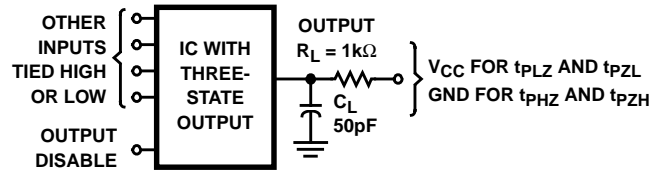


FIGURE 4. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



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  $R_L = 1k\Omega$   $V_{CC}$ ,  $C_L = 50pF$ .

FIGURE 5. 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)



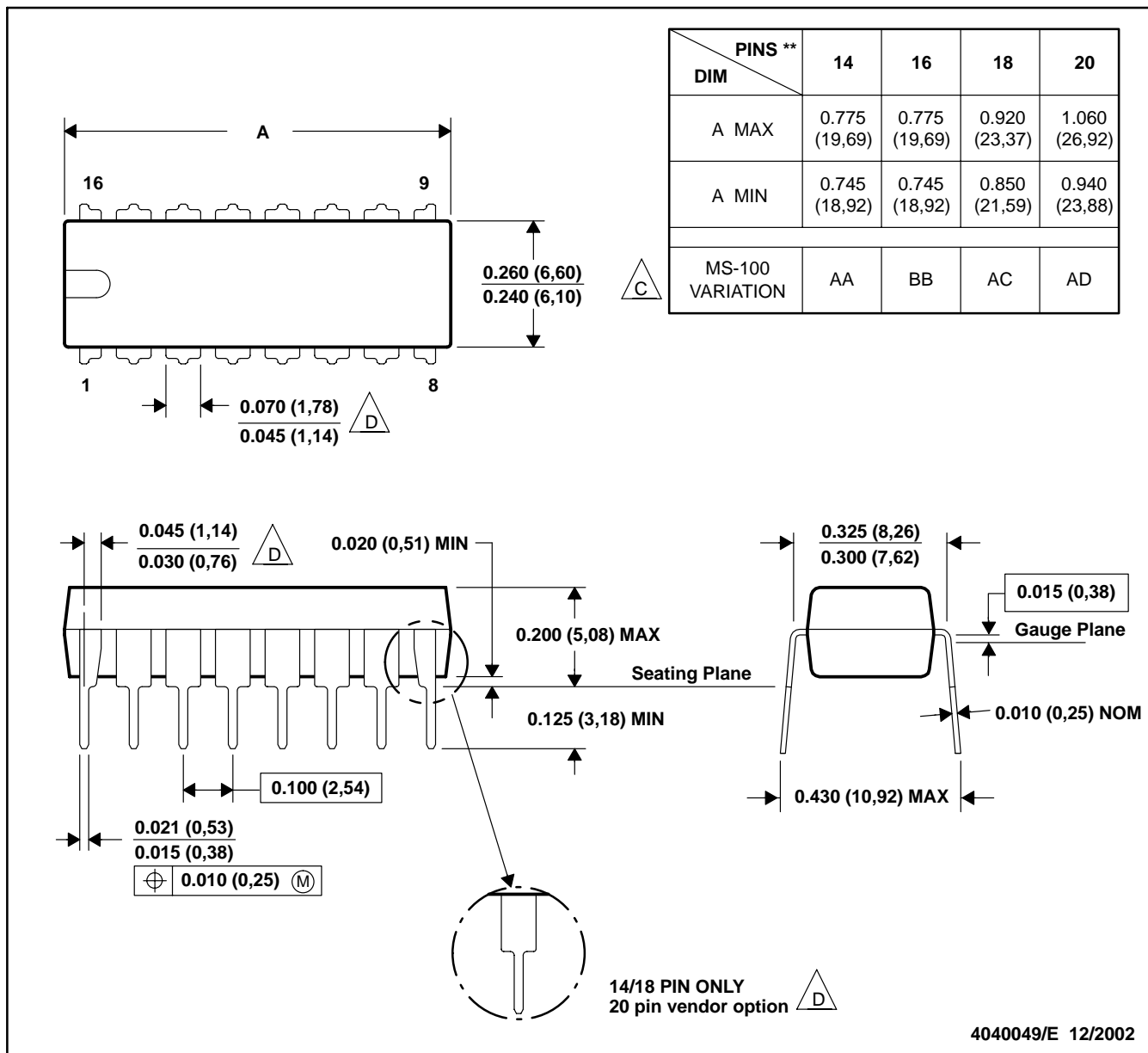
4040083/F 03/03

- 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

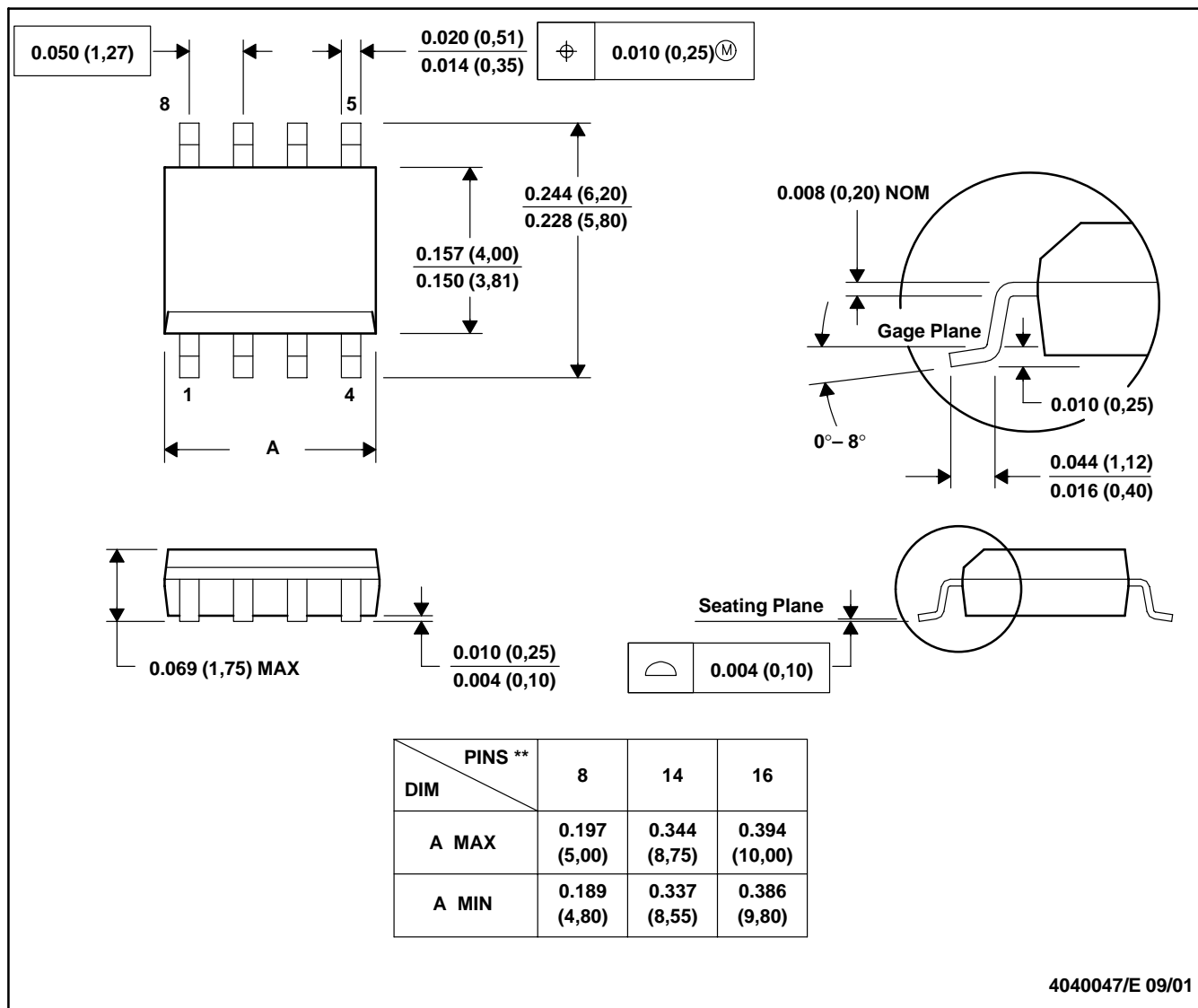


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 D The 20 pin end lead shoulder width is a vendor option, either half or full width.

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

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN



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

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Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265

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