CD54/74AC245, CD54/74ACT245

Data sheet acquired from Harris Semiconductor
SCHS245B

September 1998 - Revised October 2000

Octal-Bus Transceiver, Three-State, Non-Inverting

Features

- **Buffered Inputs**
- **Typical Propagation Delay**
  - **4ns at V_{CC} = 5V, T_A = 25^{o}C, C_L = 50pF**
- **Exceeds 2kV ESD Protection per MIL-STD-883, Method 3015**
- **SCR-Latchup-Resistant CMOS Process and Circuit Design**
- **Speed of Bipolar FAST™/AS/S with Significantly Reduced Power Consumption**
- **Balanced Propagation Delays**
- **AC Types Feature 1.5V to 5.5V Operation and Balanced Noise Immunity at 30% of the Supply**
- **±24mA Output Drive Current**
  - **Fanout to 15 FAST™ ICs**
  - **Drives 50Ω Transmission Lines**

Description

The ’AC245 and ’ACT245 are octal-bus transceivers that utilize Advanced CMOS Logic technology. They are non-inverting three-state bidirectional transceiver-buffers intended for two-way transmission from “A” bus to “B” bus or “B” bus to “A”. The logic level present on the direction input (DIR) determines the data direction. When the output enable input ($\overline{OE}$) is HIGH, the outputs are in the high-impedance state.

Ordering Information

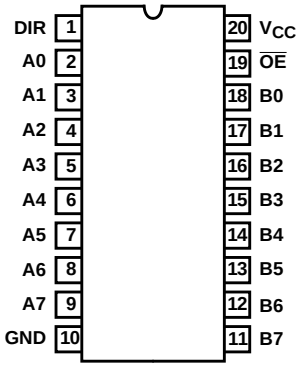
PART NUMBER	TEMP. RANGE (^{o}C)	PACKAGE
CD54AC245F3A	-55 to 125	20 Ld CERDIP
CD74AC245E	-55 to 125	20 Ld PDIP
CD74AC245M	-55 to 125	20 Ld SOIC
CD74AC245SM	-55 to 125	20 Ld SSOP
CD54ACT245F3A	-55 to 125	20 Ld CERDIP
CD74ACT245E	-55 to 125	20 Ld PDIP
CD74ACT245M	-55 to 125	20 Ld SOIC
CD74ACT245SM	-55 to 125	20 Ld SSOP

NOTES:

1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer and die for this part number is available which meets all electrical specifications. Please contact your local TI sales office or customer service for ordering information.

Pinout

CD54AC245, CD54ACT245
(CERDIP)
CD74AC245, CD74ACT245
(PDIP, SOIC, SSOP)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

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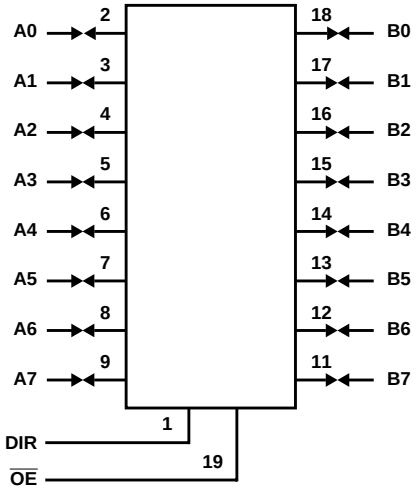
Functional Diagram



TRUTH TABLE

CONTROL INPUTS		
$\overline{OE}$	DIR	OPERATION
L	L	B Data to A Bus
L	H	A Data to B Bus
H	X	Isolation

H = High Level, L = Low Level, X = Irrelevant
To prevent excess currents in the High-Z (isolation) modes, all I/O terminals should be terminated with 10kΩ to 1MΩ resistors.

Absolute Maximum Ratings

DC Supply Voltage, V_{CC} . . . . . -0.5V to 6V
DC Input Diode Current, I_{IK}
For V_I < -0.5V or V_I > V_{CC} + 0.5V . . . . . ±20mA
DC Output Diode Current, I_{OK}
For V_O < -0.5V or V_O > V_{CC} + 0.5V . . . . . ±50mA
DC Output Source or Sink Current per Output Pin, I_O
For V_O > -0.5V or V_O < V_{CC} + 0.5V . . . . . ±50mA
DC V_{CC} or Ground Current, I_{CC} or I_{GND} (Note 3) . . . . . ±100mA

Operating Conditions

Temperature Range, T_A . . . . . -55°C to 125°C
Supply Voltage Range, V_{CC} (Note 4)
AC Types. . . . . 1.5V to 5.5V
ACT Types . . . . . 4.5V to 5.5V
DC Input or Output Voltage, V_I, V_O . . . . . 0V to V_{CC}
Input Rise and Fall Slew Rate, dt/dv
AC Types, 1.5V to 3V . . . . . 50ns (Max)
AC Types, 3.6V to 5.5V. . . . . 20ns (Max)
ACT Types, 4.5V to 5.5V. . . . . 10ns (Max)

Thermal Information

Thermal Resistance (Typical, Note 5)	θ_{JA} (°C/W)
E Package	69
M Package	58
SM Package	70

Maximum Junction Temperature (Plastic Package) . . . . . 150°C
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . . 300°C

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.

NOTES:

3. For up to 4 outputs per device, add ±25mA for each additional output.
4. Unless otherwise specified, all voltages are referenced to ground.
5. 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	MAX	MIN	MAX	MIN	MAX	
AC TYPES											
High Level Input Voltage	V_{IH}	-	-	1.5	1.2	-	1.2	-	1.2	-	V
				3	2.1	-	2.1	-	2.1	-	V
				5.5	3.85	-	3.85	-	3.85	-	V
Low Level Input Voltage	V_{IL}	-	-	1.5	-	0.3	-	0.3	-	0.3	V
				3	-	0.9	-	0.9	-	0.9	V
				5.5	-	1.65	-	1.65	-	1.65	V
High Level Output Voltage	V_{OH}	V_{IH} or V_{IL}	-0.05	1.5	1.4	-	1.4	-	1.4	-	V
			-0.05	3	2.9	-	2.9	-	2.9	-	V
			-0.05	4.5	4.4	-	4.4	-	4.4	-	V
			-4	3	2.58	-	2.48	-	2.4	-	V
			-24	4.5	3.94	-	3.8	-	3.7	-	V
			-75 (Note 6, 7)	5.5	-	-	3.85	-	-	-	V
			-50 (Note 6, 7)	5.5	-	-	-	-	3.85	-	V

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	MAX	MIN	MAX	MIN	MAX	
Low Level Output Voltage	V_{OL}	V_{IH} or V_{IL}	0.05	1.5	-	0.1	-	0.1	-	0.1	V
			0.05	3	-	0.1	-	0.1	-	0.1	V
			0.05	4.5	-	0.1	-	0.1	-	0.1	V
			12	3	-	0.36	-	0.44	-	0.5	V
			24	4.5	-	0.36	-	0.44	-	0.5	V
			75 (Note 6, 7)	5.5	-	-	-	1.65	-	-	V
			50 (Note 6, 7)	5.5	-	-	-	-	-	1.65	V
Input Leakage Current	I_I	V_{CC} or GND	-	5.5	-	±0.1	-	±1	-	±1	µA
Three-State Leakage Current	I_{OZ}	V_{IH} or V_{IL} $V_O = V_{CC}$ or GND	-	5.5	-	±0.5	-	±5	-	±10	µA
Quiescent Supply Current MSI	I_{CC}	V_{CC} or GND	0	5.5	-	8	-	80	-	160	µA
ACT 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	V_{OH}	V_{IH} or V_{IL}	-0.05	4.5	4.4	-	4.4	-	4.4	-	V
			-24	4.5	3.94	-	3.8	-	3.7	-	V
			-75 (Note 6, 7)	5.5	-	-	3.85	-	-	-	V
			-50 (Note 6, 7)	5.5	-	-	-	-	3.85	-	V
Low Level Output Voltage	V_{OL}	V_{IH} or V_{IL}	0.05	4.5	-	0.1	-	0.1	-	0.1	V
			24	4.5	-	0.36	-	0.44	-	0.5	V
			75 (Note 6, 7)	5.5	-	-	-	1.65	-	-	V
			50 (Note 6, 7)	5.5	-	-	-	-	-	1.65	V
Input Leakage Current	I_I	V_{CC} or GND	-	5.5	-	±0.1	-	±1	-	±1	µA
Three-State or Leakage Current	I_{OZ}	V_{IH} or V_{IL} $V_O = V_{CC}$ or GND	-	5.5	-	±0.5	-	±5	-	±10	µA
Quiescent Supply Current MSI	I_{CC}	V_{CC} or GND	0	5.5	-	8	-	80	-	160	µA
Additional Supply Current per Input Pin TTL Inputs High 1 Unit Load	ΔI_{CC}	V_{CC} -2.1	-	4.5 to 5.5	-	2.4	-	2.8	-	3	mA

NOTES:

6. Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.
7. Test verifies a minimum 50Ω transmission-line-drive capability at 85°C, 75Ω at 125°C.

ACT Input Load Table

INPUT	UNIT LOAD
An, Bn	0.83
$\overline{OE}$	0.64
DIR	0.25

NOTE: Unit load is ΔI_{CC} limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25^oC.

Switching Specifications Input t_r, t_f = 3ns, C_L = 50pF (Worst Case)

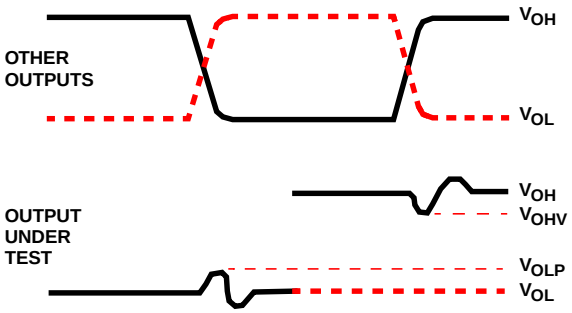
PARAMETER	SYMBOL	V_{CC} (V)	-40^oC TO 85^oC			-55^oC TO 125^oC			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
AC TYPES									
Propagation Delay, Data to Output	t_{PLH}, t_{PHL}	1.5	-	-	96	-	-	106	ns
		3.3 (Note 9)	3.2	-	10.8	3	-	11.9	ns
		5 (Note 10)	2.2	-	7.7	2.1	-	8.5	ns
Propagation Delay, Output Disable to Output	t_{PLZ}, t_{PHZ}	1.5	-	-	159	-	-	175	ns
		3.3	4.7	-	15.9	4.4	-	17.5	ns
		5	3.7	-	12.7	3.5	-	14	ns
Propagation Delay, Output Enable to Output	t_{PZL}, t_{PZH}	1.5	-	-	159	-	-	175	ns
		3.3	5.6	-	19	5.3	-	21	ns
		5	3.7	-	12.7	3.5	-	14	ns
Minimum (Valley) V_{OH} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OHV} See Figure 1	5	-	4 at 25^oC	-	-	4 at 25^oC	-	V
Maximum (Peak) V_{OL} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OLP} See Figure 1	5	-	1 at 25^oC	-	-	1 at 25^oC	-	V
Three-State Output Capacitance	C_O	-	-	15	-	-	15	-	pF
Input Capacitance	C_I	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C_{PD} (Note 11)	-	-	57	-	-	57	-	pF
ACT TYPES									
Propagation Delay, Data to Output	t_{PLH}, t_{PHL}	5 (Note 10)	2.7	-	9.1	2.5	-	10	ns
Propagation Delay, Output Disable to Output	t_{PLZ}, t_{PHZ}	5	3.7		12.7	3.5		14	ns
Propagation Delay, Output Enable to Output	t_{PZL}, t_{PZH}	5	3.8		13.1	3.6		14.4	ns
Minimum (Valley) V_{OH} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OHV} See Figure 1	5	-	4 at 25^oC	-	-	4 at 25^oC	-	V
Maximum (Peak) V_{OL} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OLP} See Figure 1	5	-	1 at 25^oC	-	-	1 at 25^oC	-	V

Switching Specifications Input t_r, t_f = 3ns, C_L = 50pF (Worst Case) **(Continued)**

PARAMETER	SYMBOL	V_{CC} (V)	-40°C TO 85°C			-55°C TO 125°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Three-State Output Capacitance	C_O	-	-	15	-	-	15	-	pF
Input Capacitance	C_I	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C_{PD} (Note 11)	-	-	57	-	-	57	-	pF

NOTES:

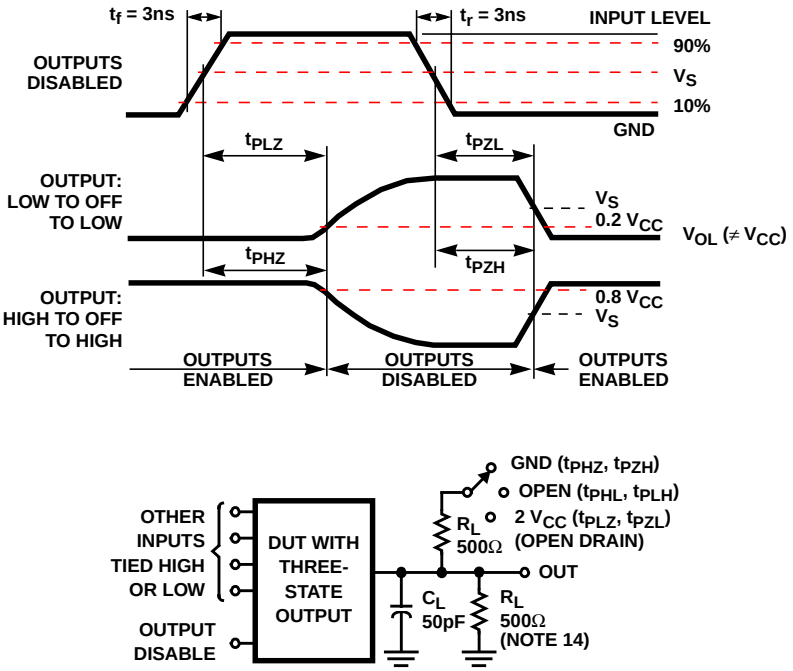
8. Limits tested 100%
9. 3.3V Min is at 3.6V, Max is at 3V.
10. 5V Min is at 5.5V, Max is at 4.5V.
11. C_{PD} is used to determine the dynamic power consumption per channel.
    AC: $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$
    ACT: $P_D = V_{CC}^2 f_i (C_{PD} + C_L) + V_{CC} \Delta I_{CC}$ where f_i = input frequency, C_L = output load capacitance, V_{CC} = supply voltage.



NOTES:

12. Input pulses have the following characteristics: PRR ≤ 1MHz, t_r = 3ns, SKEW 1ns.
13. R.F. fixture with 700MHz design rules required. IC should be soldered into test board and bypassed with 0.1µF capacitor. Scope and probes require 700MHz bandwidth.

FIGURE 1. SIMULTANEOUS SWITCHING TRANSIENT WAVEFORMS



NOTE:

14. For AC Series only: When V_{CC} = 1.5V, R_L = 1kΩ.

FIGURE 2. THREE-STATE PROPAGATION DELAY TIMES AND TEST CIRCUIT

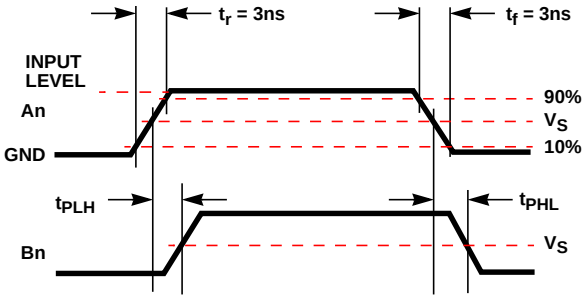
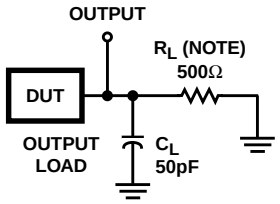


FIGURE 3. PROPAGATION DELAY TIMES



NOTE: For AC Series Only: When V_{CC} = 1.5V, R_L = 1kΩ.

	AC	ACT
Input Level	V_{CC}	3V
Input Switching Voltage, V_S	0.5 V_{CC}	1.5V
Output Switching Voltage, V_S	0.5 V_{CC}	0.5 V_{CC}

FIGURE 4. PROPAGATION DELAY TIMES

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
CD54AC245F3A	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
CD54ACT245F3A	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
CD74AC245E	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74AC245EE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74AC245M	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74AC245M96	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74AC245M96E4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74AC245ME4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74AC245SM	OBSOLETE	SSOP	DB	20		Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74AC245SM96	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74AC245SM96E4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245E	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74ACT245EE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74ACT245M	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245M96	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245M96E4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245ME4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245SM	OBSOLETE	SSOP	DB	20		Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245SM96	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74ACT245SM96E4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(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

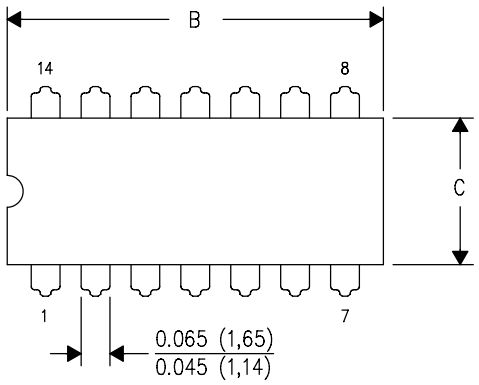
for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 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.

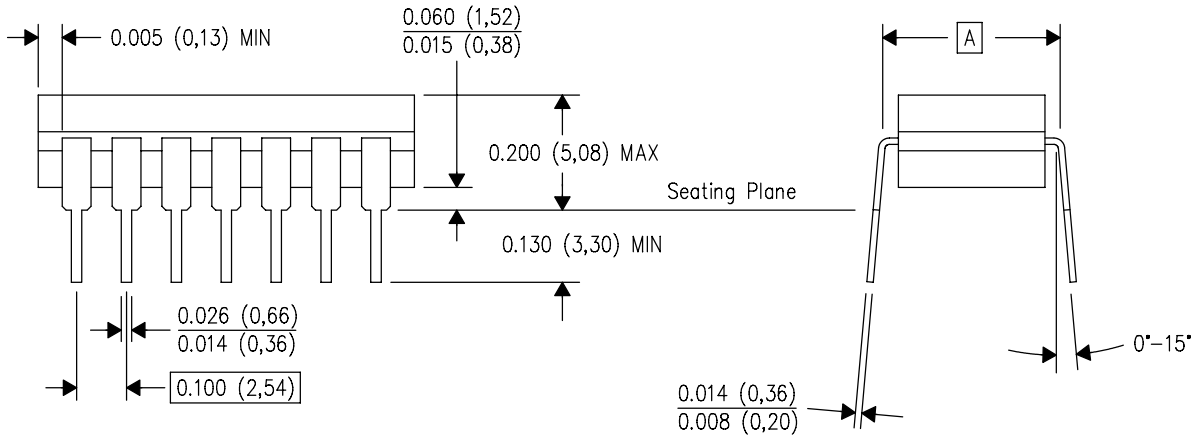
J (R–GDIP–T**)

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)



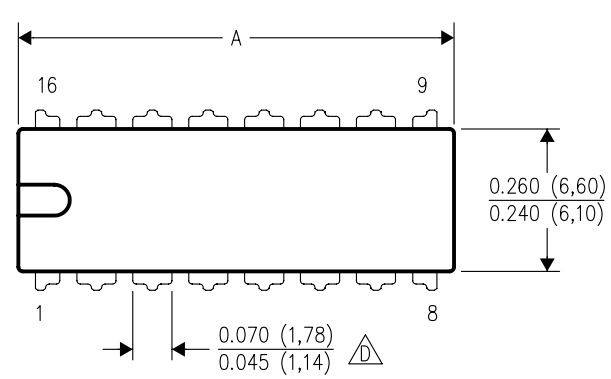
4040083/F 03/03

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.

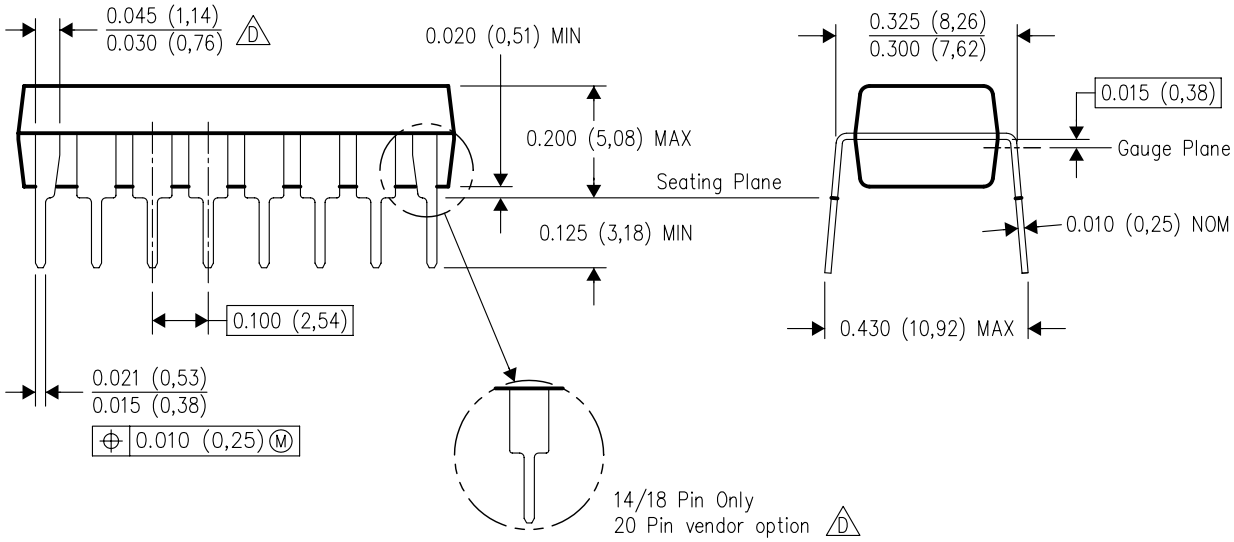
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



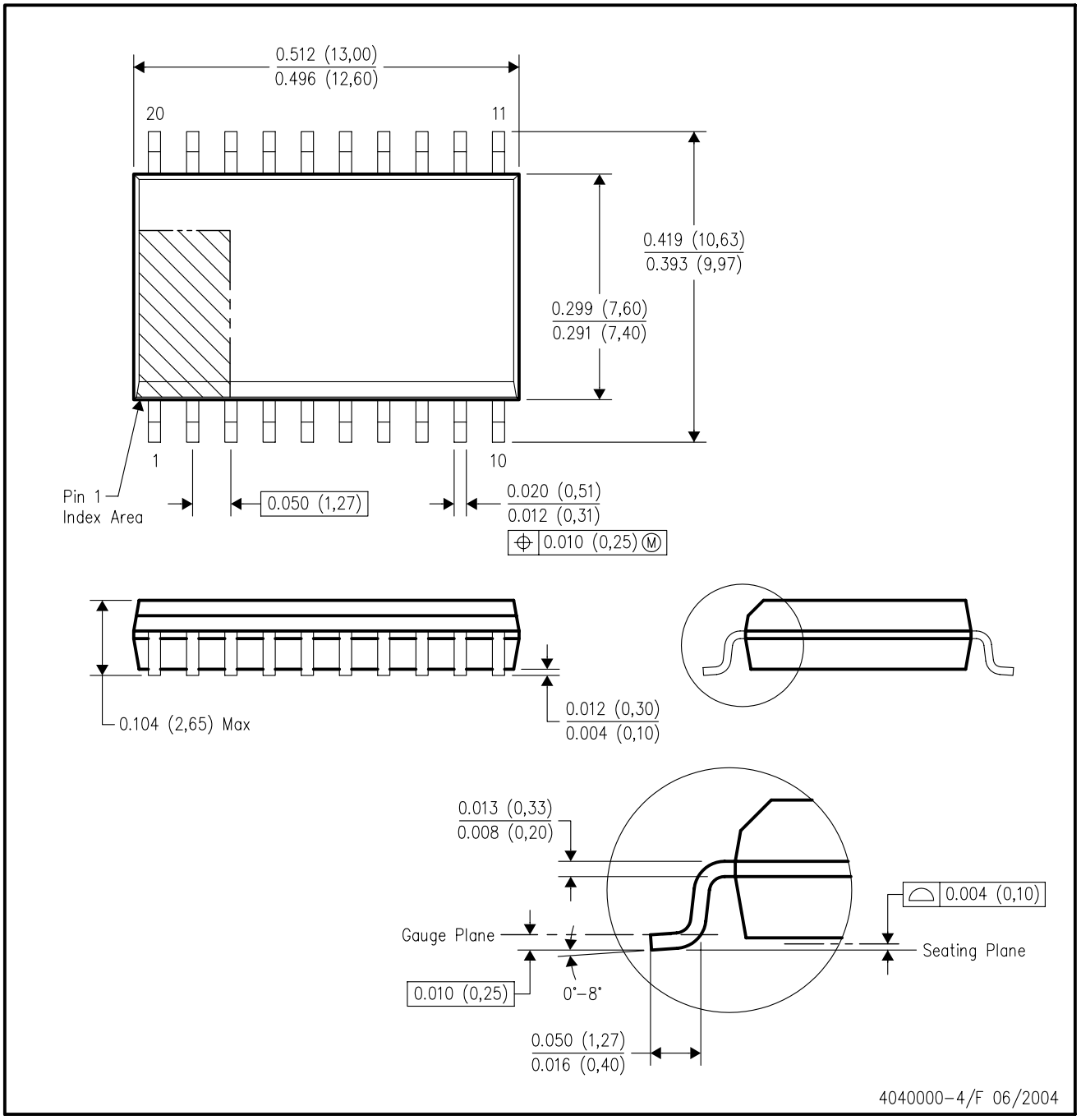
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
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.

DW (R–PDSO–G20) PLASTIC SMALL–OUTLINE PACKAGE

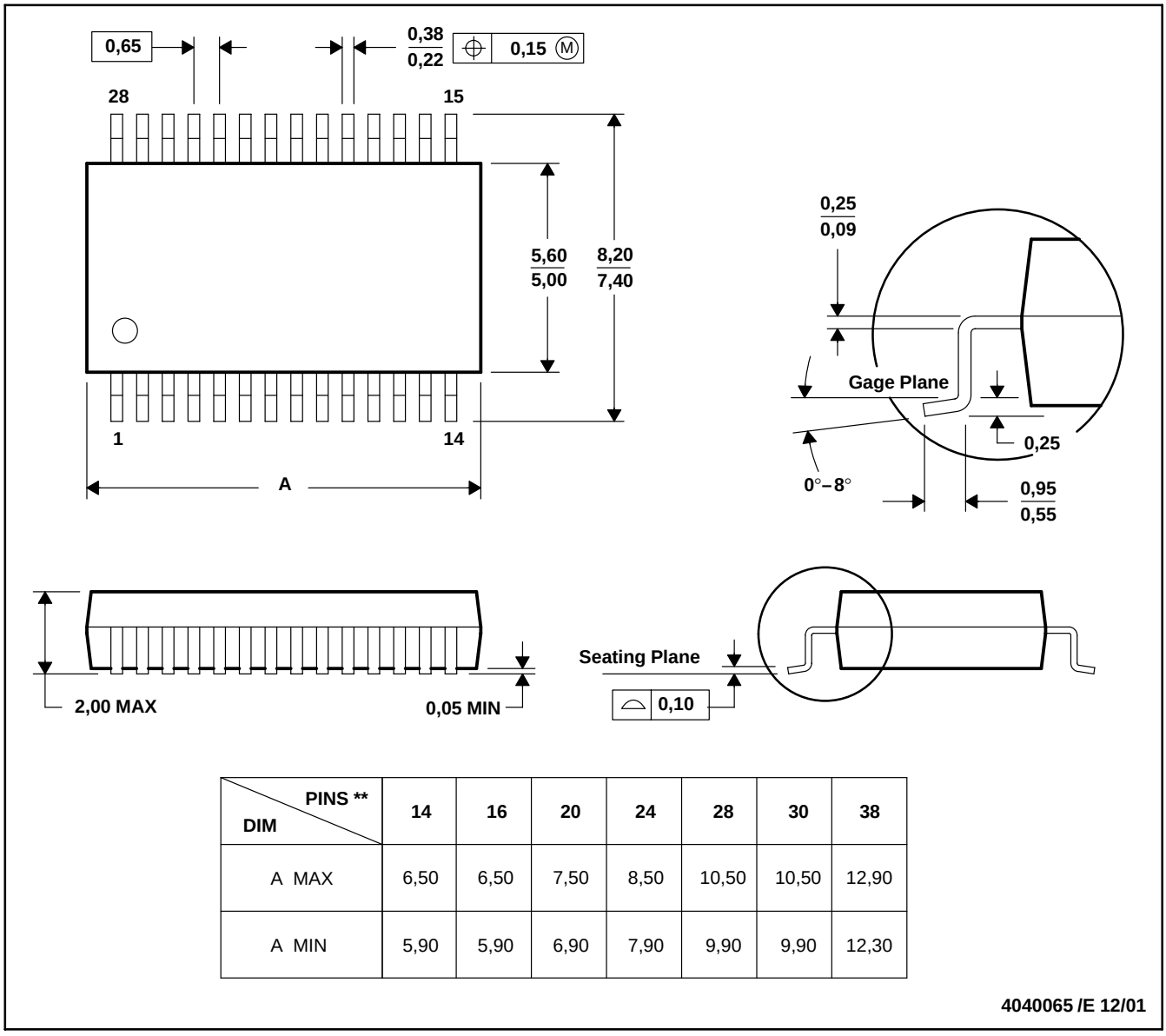


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–013 variation AC.

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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-150

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