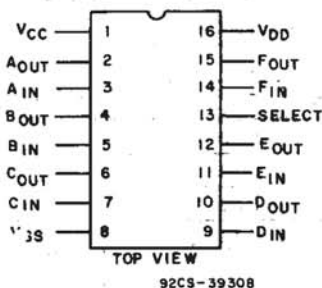


CD4504B Types



TERMINAL ASSIGNMENT

CMOS Hex Voltage-Level Shifter for TTL-to-CMOS or CMOS-to-CMOS Operation

High-Voltage Types (20-Volt Rating)

Features:

- Independence of power-supply sequence considerations— V_{CC} can exceed V_{DD} ; input signals can exceed both V_{CC} and V_{DD}
- Up and down level-shifting capability
- Shiftable input threshold for either CMOS or TTL compatibility
- Standardized symmetrical output characteristics
- 100% tested for quiescent current @ 20 V
- Maximum input current of 1 μ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- 5 V, 10 V, and 15 V parametric ratings
- Meets all requirements of JEDEC Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

■ CD4504B hex voltage level-shifter consists of six circuits which shift input signals from the V_{CC} logic level to the V_{DD} logic level. To shift TTL signals to CMOS logic levels, the SELECT input is at the V_{CC} HIGH logic state. When the SELECT input is at a LOW logic state, each circuit translates signals from one CMOS level to another.

The CD4504B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, and MT suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

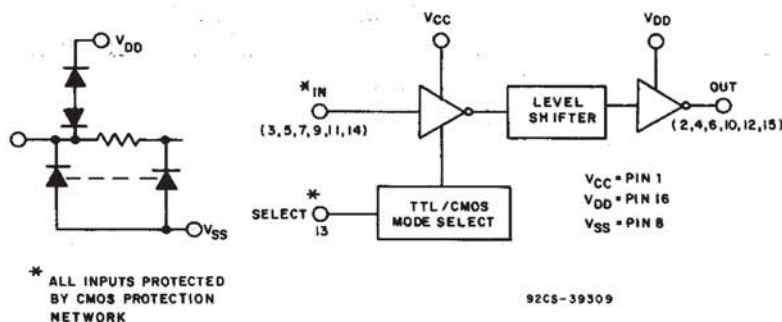


Fig. 1 - Functional diagram for CD4504B.

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_{CC} +0.5V

DC INPUT CURRENT, ANY ONE INPUT $\pm$ 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 Linearly 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 $\pm$ 1/32 inch (1.59 $\pm$ 0.79mm) from case for 10s max +265°C

CD4504B Types

V_{GEN}

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC		CONDITIONS				LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
		V _O (V)	V _{IN} (V)	V _{CC} (V)	V _{DD} (V)	-55	-40	+85	+125	+25			
										MIN	TYP	MAX	
Quiescent Device Current, I _{DD} Max and I _{CC} in CMOS-CMOS Mode		—	0, 5	5	5	1.5	1.5	1.5	1.5	—	0.02	1.5	mA
		—	0, 10	5	10	2	2	2	2	—	0.02	2	
		—	0, 15	5	15	4	4	120	120	—	0.02	4	μA
		—	0, 20	5	20	20	20	600	600	—	0.04	20	
Quiescent Device Current, I _{CC} Max TTL-CMOS Mode		—	0, 5	5	5	5	5	6	6	—	2.5	5	mA
		—	0, 10	5	10	5	5	6	6	—	2.5	5	
		—	0, 15	5	15	5	5	6	6	—	2.5	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		4.8	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		—	0, 5	—	5	0.05				—	0	0.05	V
		—	0, 10	—	10	0.05				—	0	0.05	
		—	0, 15	—	15	0.05				—	0	0.05	
Output Voltage: High-Level, V _{OH} Min		—	0, 5	—	5	4.95				4.95	5	—	
		—	0, 10	—	10	9.95				9.95	10	—	
		—	0, 15	—	15	14.95				14.95	15	—	
Input Low Voltage, V _{IL} Max Note 1	TTL-CMOS	1	—	5	10	0.8				—	—	0.8	V
	TTL-CMOS	1	—	5	15	0.8				—	—	0.8	
	CMOS-CMOS	1	—	5	10	1.5				—	—	1.5	
	CMOS-CMOS	1.5	—	5	15	1.5				—	—	1.5	
	CMOS-CMOS	1.5	—	10	15	3				—	—	3	
Input High Voltage, V _{IH} Min Note 1	TTL-CMOS	9	—	5	10	2				2	—	—	
	TTL-CMOS	13.5	—	5	15	2				2	—	—	
	CMOS-CMOS	9	—	5	10	3.5				3.5	—	—	
	CMOS-CMOS	13.5	—	5	15	3.5				3.5	—	—	
	CMOS-CMOS	13.5	—	10	15	7				7	—	—	
Input Current, I _{IN} Max		—	0, 18	—	18	±0.1	±0.1	±1	±1	—	±10 ⁻⁵	±0.1	μA

Note 1: Applies to the 6 input signals. For mode control (P13), only the CMOS-CMOS ratings apply.

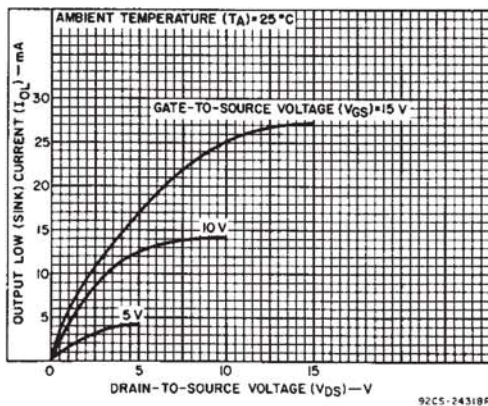


Fig. 2 - Typical output low (sink) current characteristics.

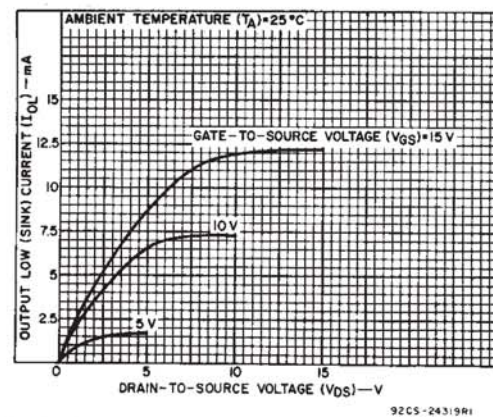


Fig. 3 - Minimum output low (sink) current characteristics.

CD4504B Types

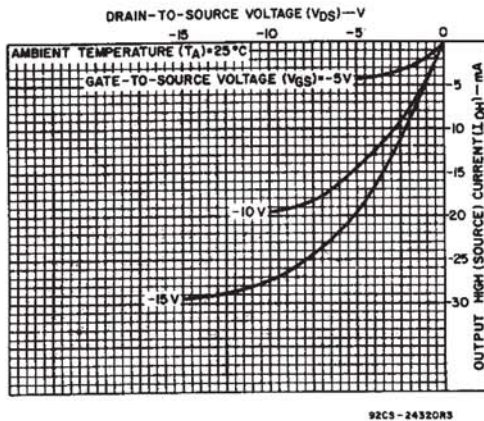


Fig. 4 - Typical output high (source) current characteristics.

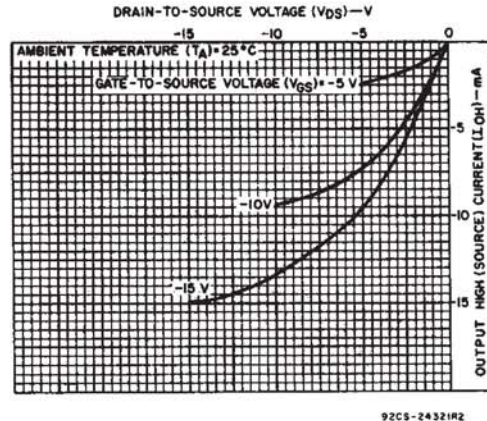


Fig. 5 - Minimum output high (source) current characteristics.

RECOMMENDED OPERATING CONDITIONS

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

CHARACTERISTIC	V _{DD} (V)	LIMITS		UNITS
		Min.	Max.	
Supply-Voltage Range (For T _A = Full Package-Temperature Range)	—	5	18	V

DYNAMIC ELECTRICAL CHARACTERISTICS, At T_A = 25°C; Input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 Ω

CHARACTERISTIC	SHIFTING MODE	V _{CC} (V)	V _{DD} (V)	LIMITS		UNITS
				TYP.	MAX.	
Propagation Delay: High-to-Low, t _{PHL}	TTL to CMOS V _{DD} > V _{CC}	5	10	140	280	ns
	CMOS to CMOS V _{DD} > V _{CC}	5	10	120	240	
		5	15	120	240	
		10	15	70	140	
	CMOS to CMOS V _{CC} > V _{DD}	10	5	275	550	
		15	5	275	550	
		15	10	70	140	
Low-to-High, t _{PLH}	TTL to CMOS V _{DD} > V _{CC}	5	10	140	280	ns
	CMOS to CMOS V _{DD} > V _{CC}	5	10	120	240	
		5	15	120	240	
		10	15	70	140	
	CMOS to CMOS V _{CC} > V _{DD}	10	5	200	400	
		15	5	200	400	
		15	10	60	120	
Transition Time, t _{THL} , t _{TLH}	All Modes		5	100	200	pF
			10	50	100	
			15	40	80	
Input Capacitance, C _{IN}	Any Input			5	7.5	pF

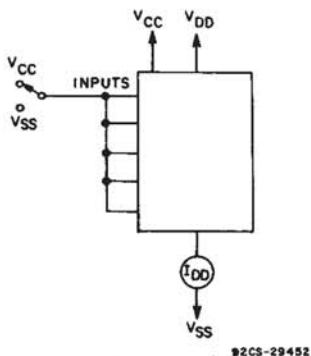


Fig. 6 - Quiescent device current.

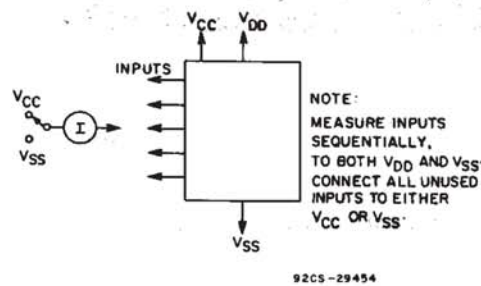


Fig. 7 - Input current.

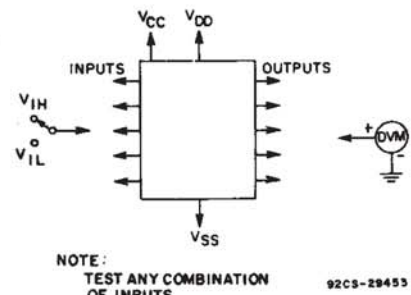


Fig. 8 - Input voltage.

CD4504B Types

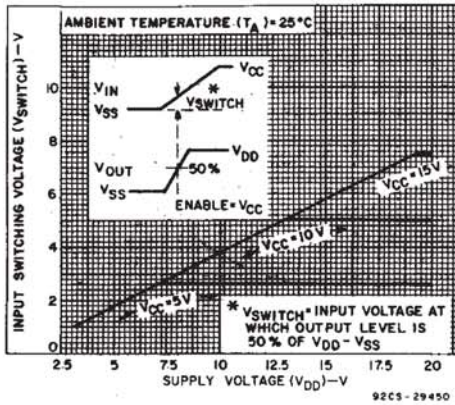


Fig. 9 - Typical input switching as a function of high-level supply voltage. (SELECT at V_{CC} -CMOS mode).

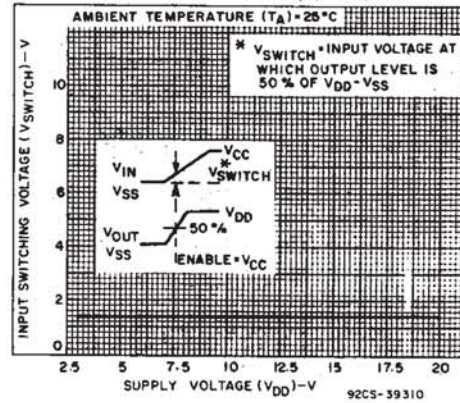


Fig. 10 - Typical input switching as a function of high-level supply voltage (SELECT at V_{SS} -TTL mode).

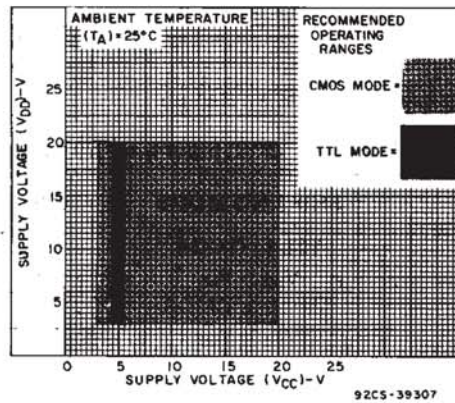
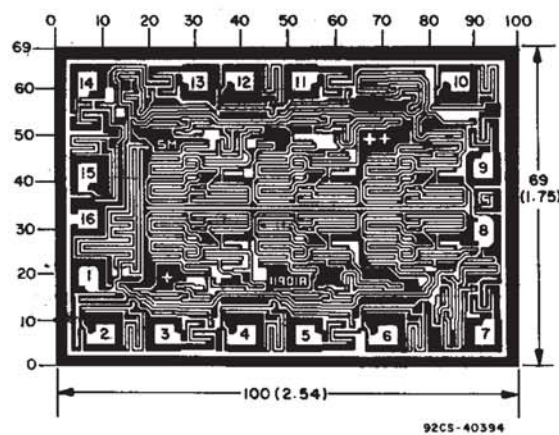


Fig. 11 - High-level supply voltage vs. low-level supply voltage.



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 CD4504BH.

PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CD4504BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD4504BE	Samples
CD4504BEE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD4504BE	Samples
CD4504BF3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	CD4504BF3A	Samples
CD4504BM	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BM96	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BM96E4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BM96G4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BMG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BMT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4504BM	Samples
CD4504BPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM504B	Samples
CD4504BPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM504B	Samples
CD4504BPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM504B	Samples
CD4504BPWRG4	ACTIVE	TSSOP	PW	16		TBD	Call TI	Call TI	-55 to 125		Samples

(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.

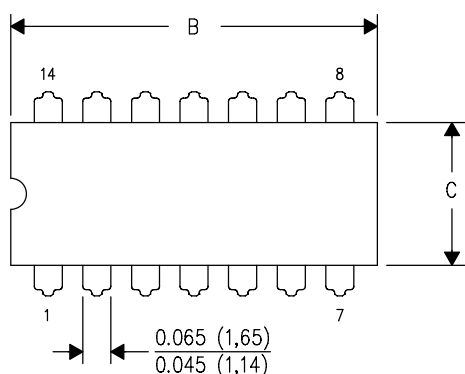
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

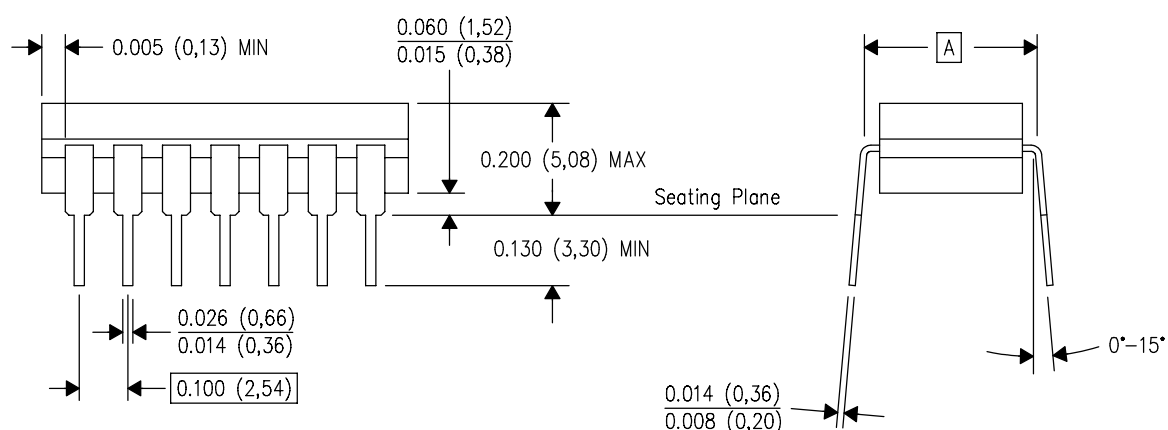
OBSELETE: TI has discontinued the production of the device.

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)



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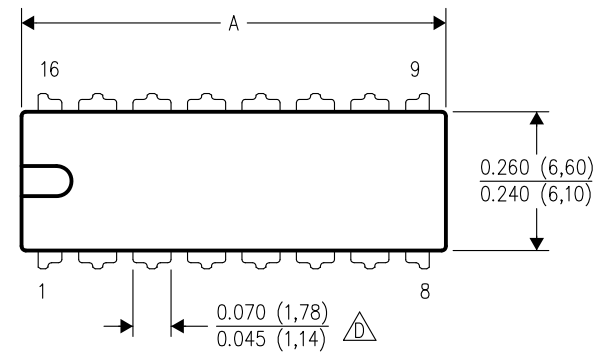
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

MECHANICAL DATA

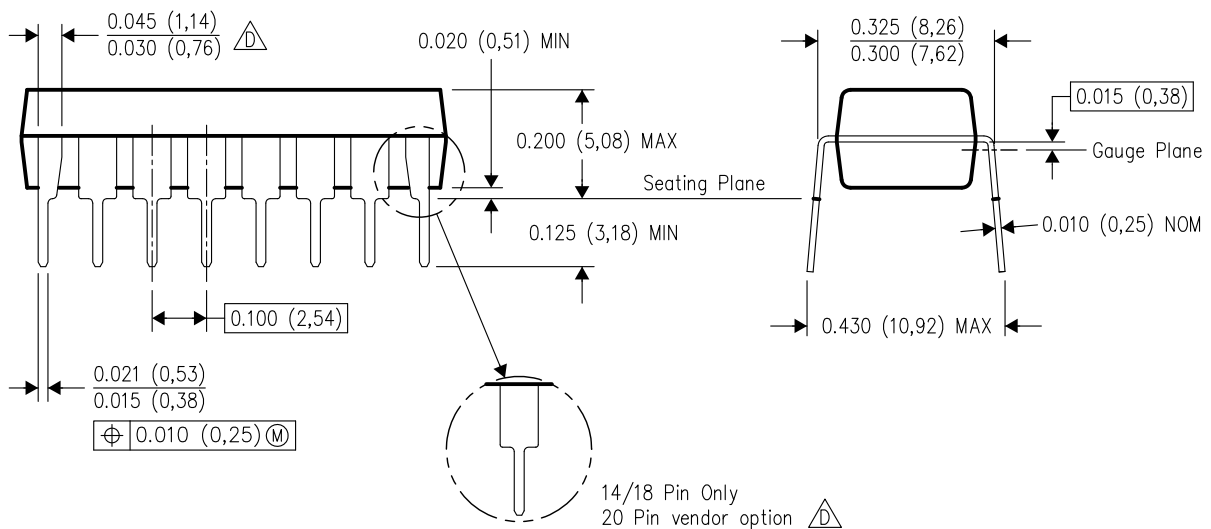
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



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	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.
-  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.