

CD54HC154, CD74HC154, CD54HCT154, CD74HCT154

High-Speed CMOS Logic 4- to 16-Line Decoder/Demultiplexer

Features

- Two Enable Inputs to Facilitate Demultiplexing and Cascading Functions
- 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, $I_l \leq 1\mu A$ at V_{OL} , V_{OH}

Description

The 'HC154 and 'HCT154 are 4- to 16-line decoders/demultiplexers with two enable inputs, E1 and E2.

A High on either enable input forces the output into the High state. The demultiplexing function is performed by using the four input lines, A0 to A3, to select the output lines \bar{Y}_0 to \bar{Y}_{15} , and using one enable as the data input while holding the other enable low.

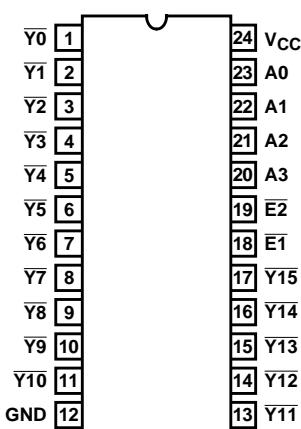
Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC154F3A	-55 to 125	24 Ld CERDIP
CD54HCT154F3A	-55 to 125	24 Ld CERDIP
CD74HC154E	-55 to 125	24 Ld PDIP
CD74HC154EN	-55 to 125	24 Ld PDIP
CD74HC154M	-55 to 125	24 Ld SOIC
CD74HC154M96	-55 to 125	24 Ld SOIC
CD74HCT154E	-55 to 125	24 Ld PDIP
CD74HCT154EN	-55 to 125	24 Ld PDIP
CD74HCT154M	-55 to 125	24 Ld SOIC
CD74HCT154M96	-55 to 125	24 Ld SOIC

NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel.

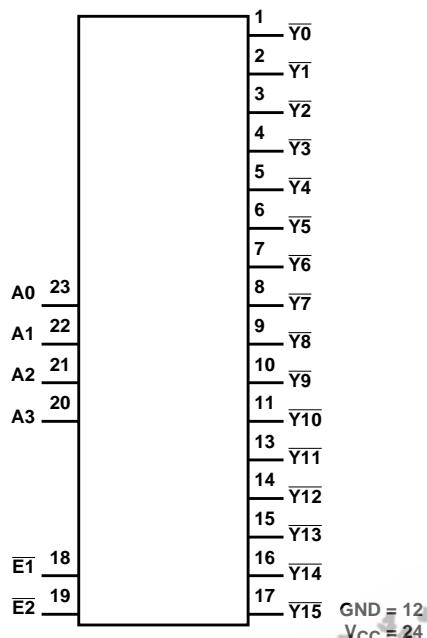
Pinout

**CD54HC154, CD54HCT154
(CERDIP)
CD74HC154, CD74HCT154
(PDIP, SOIC)**
TOP VIEW



CD54HC154, CD74HC154, CD54HCT154, CD74HCT154

Functional Diagram



TRUTH TABLE

INPUTS						OUTPUTS															
E1	E2	A3	A2	A1	A0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	
L	L	L	H	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	
L	L	L	H	H	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	
L	L	L	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	
L	L	H	L	L	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	
L	L	H	L	H	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	
L	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	
L	L	H	H	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	

H = High Voltage Level, L = Low Voltage Level, X = Don't Care

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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	.....	±20mA
DC Output Diode Current, I _{OK}		
For V _O < -0.5V or V _O > V _{CC} + 0.5V	.....	±20mA
DC Output Source or Sink Current per Output Pin, I _O		
For V _O > -0.5V or V _O < V _{CC} + 0.5V	.....	±25mA
DC V _{CC} or Ground Current, I _{CC} or I _{GND}	.....	±50mA

Thermal Information

Thermal Resistance (Typical)	θ _{JA} (°C/W)
E (PDIP) Package (.600) (Note 1)	67
EN (PDIP) Package (.300) (Note 1)	67
M (SOIC) Package (Note 2)	46
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.

NOTES:

1. The package thermal impedance is calculated in accordance with JESD 51-3.
2. 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	
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
			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	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
			4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	µA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	6	-	-	8	-	80	-	160	µA

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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	
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			-4	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			4	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} and 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 3)	V _{CC} -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	µA

NOTE:

3. 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
A0 - A3	1.4
Ē1, Ē2	1.3

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

Switching Specifications Input t_r, t_f = 6ns

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES											
Propagation Delay (Figure 1) Address to Output	t _{PLH} , t _{PHL}	C _L = 50pF C _L = 15pF C _L = 50pF	2 4.5 5 6	-	-	175 35 14 30	-	220 44 - 37	-	265 53 - 45	ns ns ns ns

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

PARAMETER	SYMBOL	TEST CONDITIONS	$V_{CC}(\text{V})$	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
E1 to Output	t _{PLH} , t _{PHL}	$C_L = 50\text{pF}$	2	-	-	175	-	220	-	265	ns
			4.5	-	-	35	-	44	-	53	ns
		$C_L = 15\text{pF}$	5	-	14	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	30	-	37	-	45	ns
E2 to Output	t _{PLH} , t _{PHL}	$C_L = 50\text{pF}$	2	-	-	175	-	220	-	265	ns
			4.5	-	-	35	-	44	-	53	ns
		$C_L = 15\text{pF}$	5	-	14	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	30	-	37	-	45	ns
Output Transition Time (Figure 1)	t _{TLH} , t _{THL}	$C_L = 50\text{pF}$	2	-	-	75	-	95	-	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	C_{IN}	-	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 4, 5)	C_{PD}	-	5	-	88	-	-	-	-	-	pF
HCT TYPES											
Propagation Delay (Figure 2) Address to Output	t _{PLH} , t _{PHL}	$C_L = 50\text{pF}$	4.5	-	-	35	-	44	-	53	ns
			$C_L = 15\text{pF}$	5	-	14	-	-	-	-	ns
E1 to Output	t _{PLH} , t _{PHL}	$C_L = 50\text{pF}$	4.5	-	-	34	-	43	-	51	ns
			$C_L = 15\text{pF}$	5	-	14	-	-	-	-	ns
E2 to Output	t _{PLH} , t _{PHL}	$C_L = 50\text{pF}$	4.5	-	-	34	-	43	-	51	ns
			$C_L = 15\text{pF}$	5	-	14	-	-	-	-	ns
Output Transition Time	t _{TLH} , t _{THL}	$C_L = 50\text{pF}$	4.5	-	-	15	-	19	-	22	ns
Input Capacitance	C_{IN}	-	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 4, 5)	C_{PD}	-	5	-	84	-	-	-	-	-	pF

NOTES:

4. C_{PD} is used to determine the dynamic power consumption, per gate.
5. $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where f_i = input frequency, C_L = output load capacitance, V_{CC} = supply voltage.

Test Circuits and Waveforms

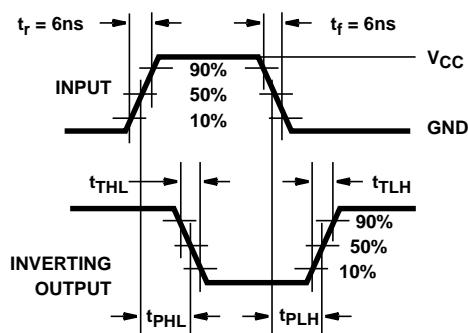


FIGURE 1. HC AND HCU TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

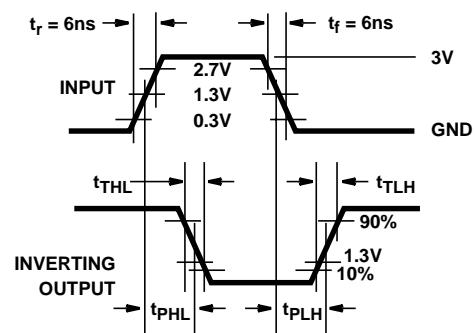


FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-8670101JA	ACTIVE	CDIP	J	24	1	TBD	Call TI	Level-NC-NC-NC
5962-8682201JA	ACTIVE	CDIP	J	24	1	TBD	Call TI	Level-NC-NC-NC
CD54HC154F3A	ACTIVE	CDIP	J	24	1	TBD	Call TI	Level-NC-NC-NC
CD54HCT154F3A	ACTIVE	CDIP	J	24	1	TBD	Call TI	Level-NC-NC-NC
CD74HC154E	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HC154EE4	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HC154EN	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HC154ENE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HC154M	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC154M96	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC154M96E4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC154ME4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT154E	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HCT154EE4	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HCT154EN	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HCT154ENE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HCT154M	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT154M96	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT154M96E4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT154ME4	ACTIVE	SOIC	DW	24	25	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) 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.

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.

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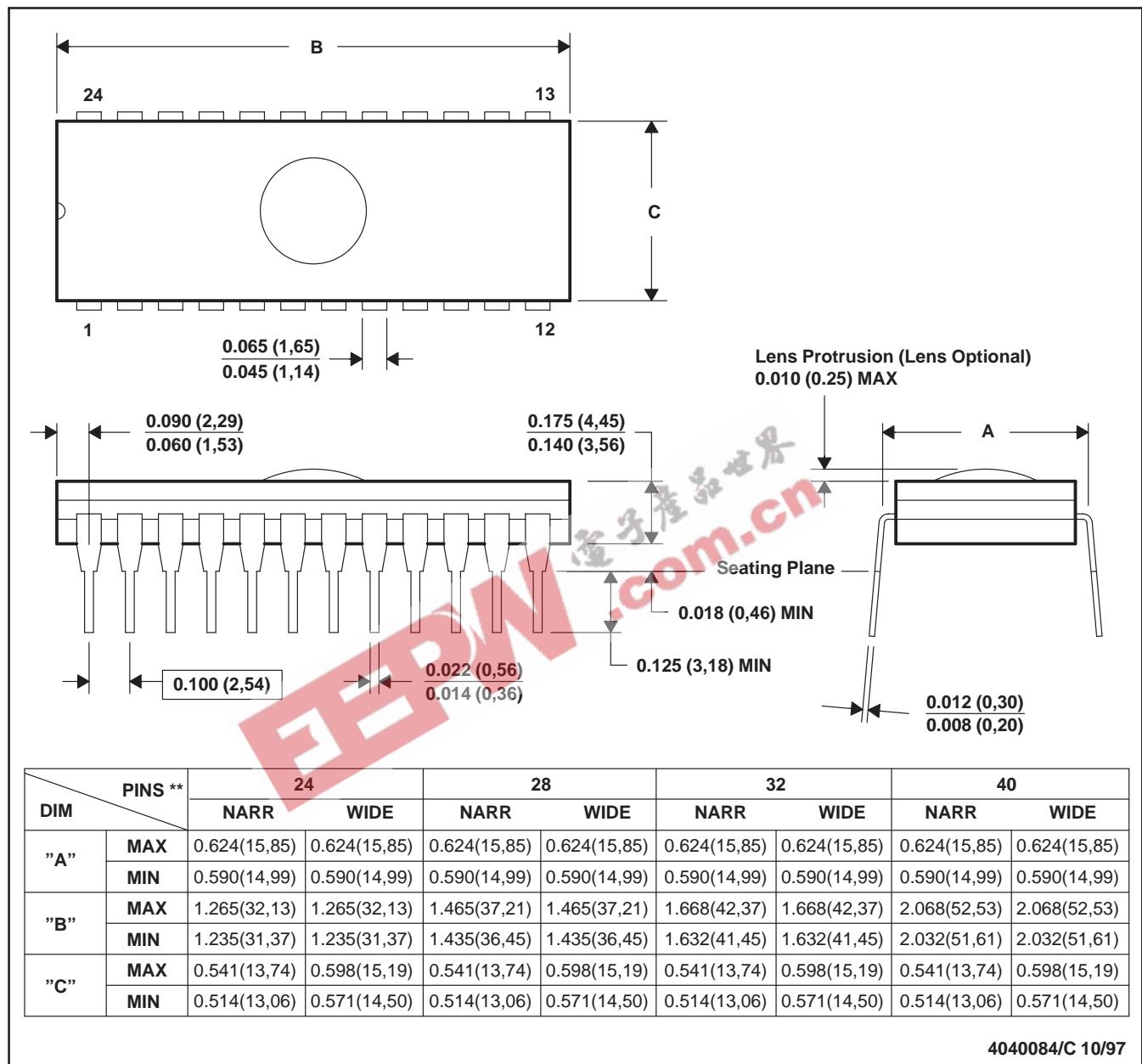
MECHANICAL DATA

MCDI004A – JANUARY 1995 – REVISED NOVEMBER 1997

J (R-GDIP-T**)

24 PINS SHOWN

CERAMIC DUAL-IN-LINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Window (lens) added to this group of packages (24-, 28-, 32-, 40-pin).
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification.

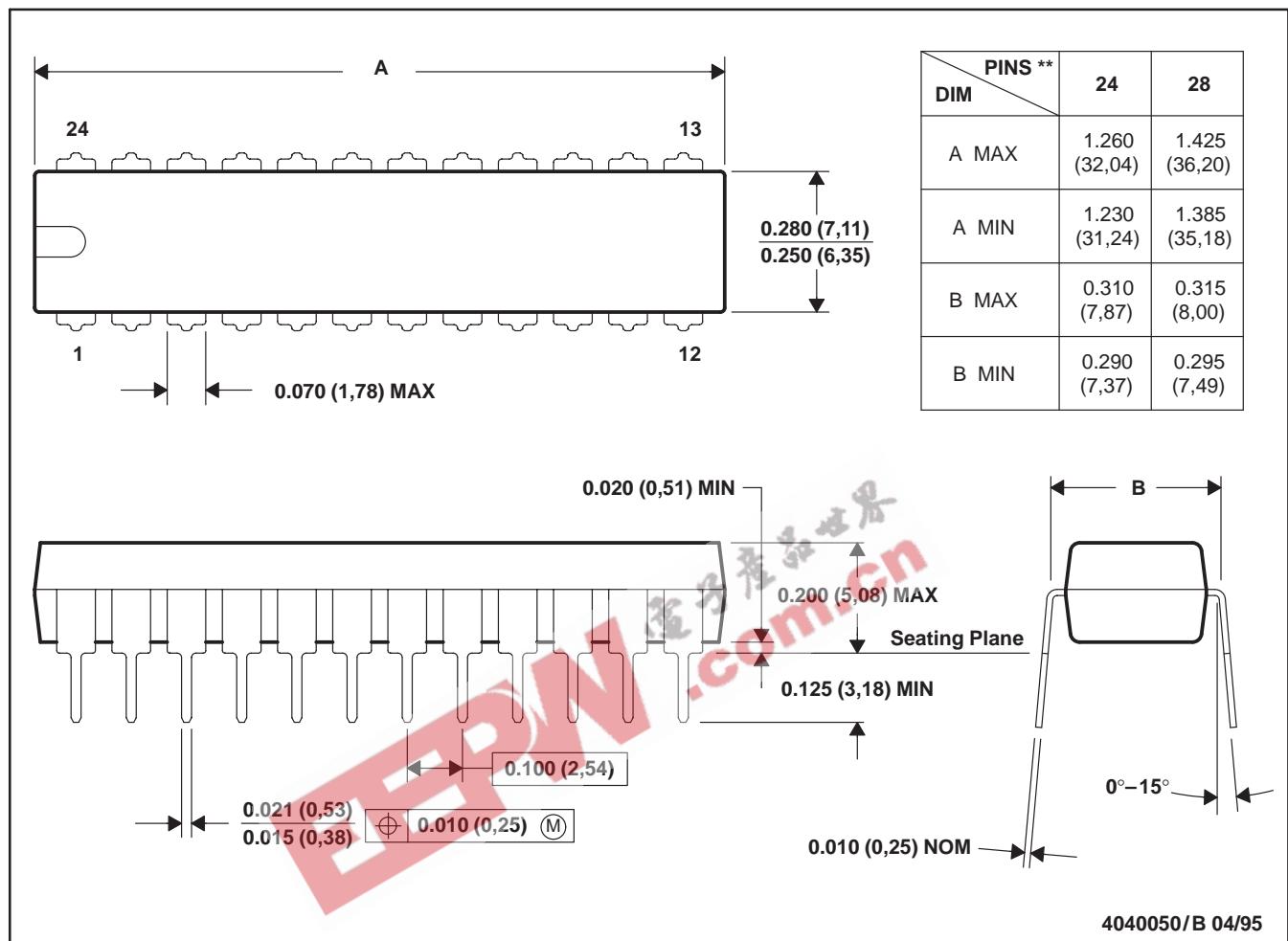
MECHANICAL DATA

MPDI004 – OCTOBER 1994

NT (R-PDIP-T**)

24 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



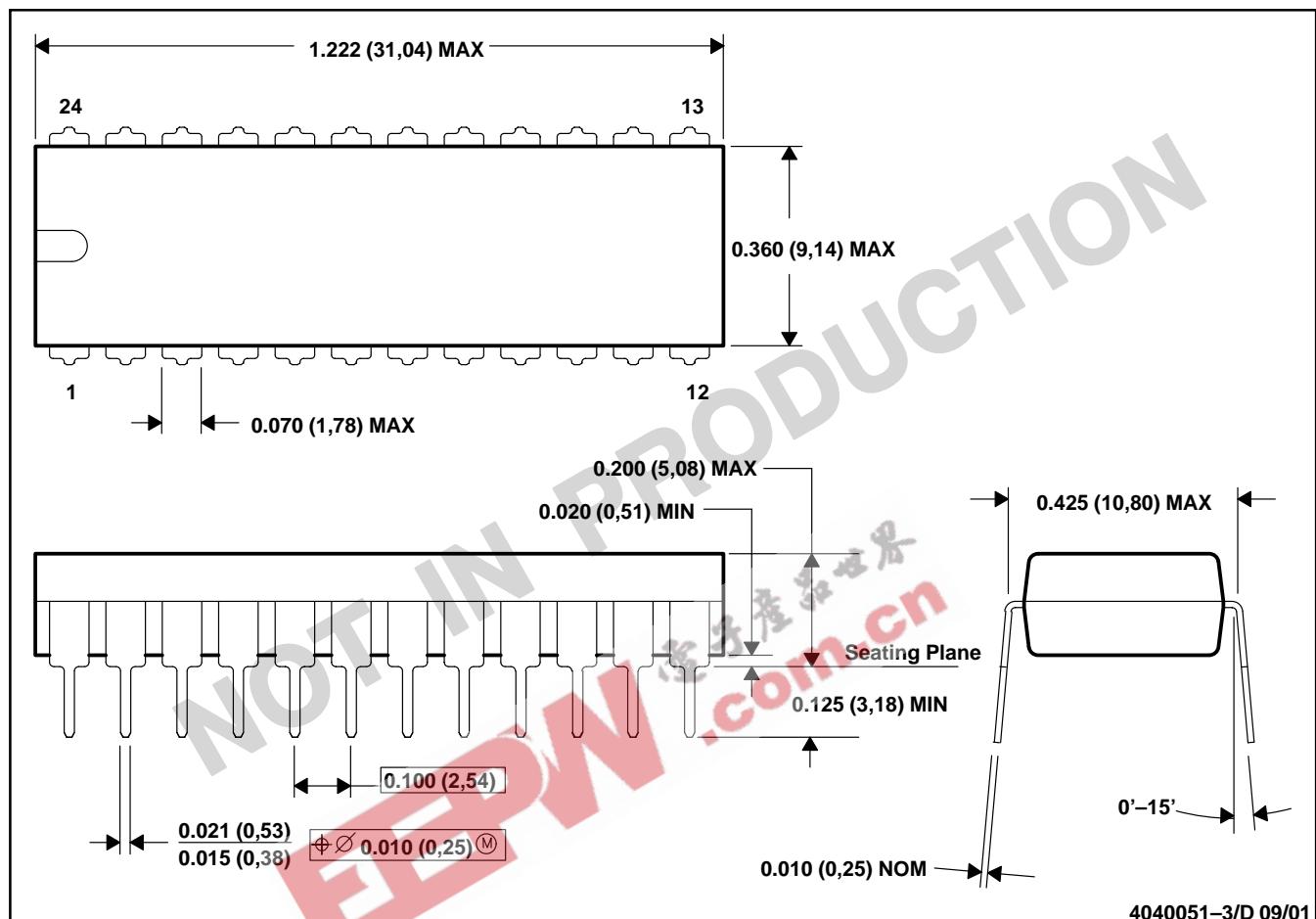
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

MECHANICAL DATA

MPDI006B – SEPTEMBER 2001 – REVISED APRIL 2002

N (R-PDIP-T24)

PLASTIC DUAL-IN-LINE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-010

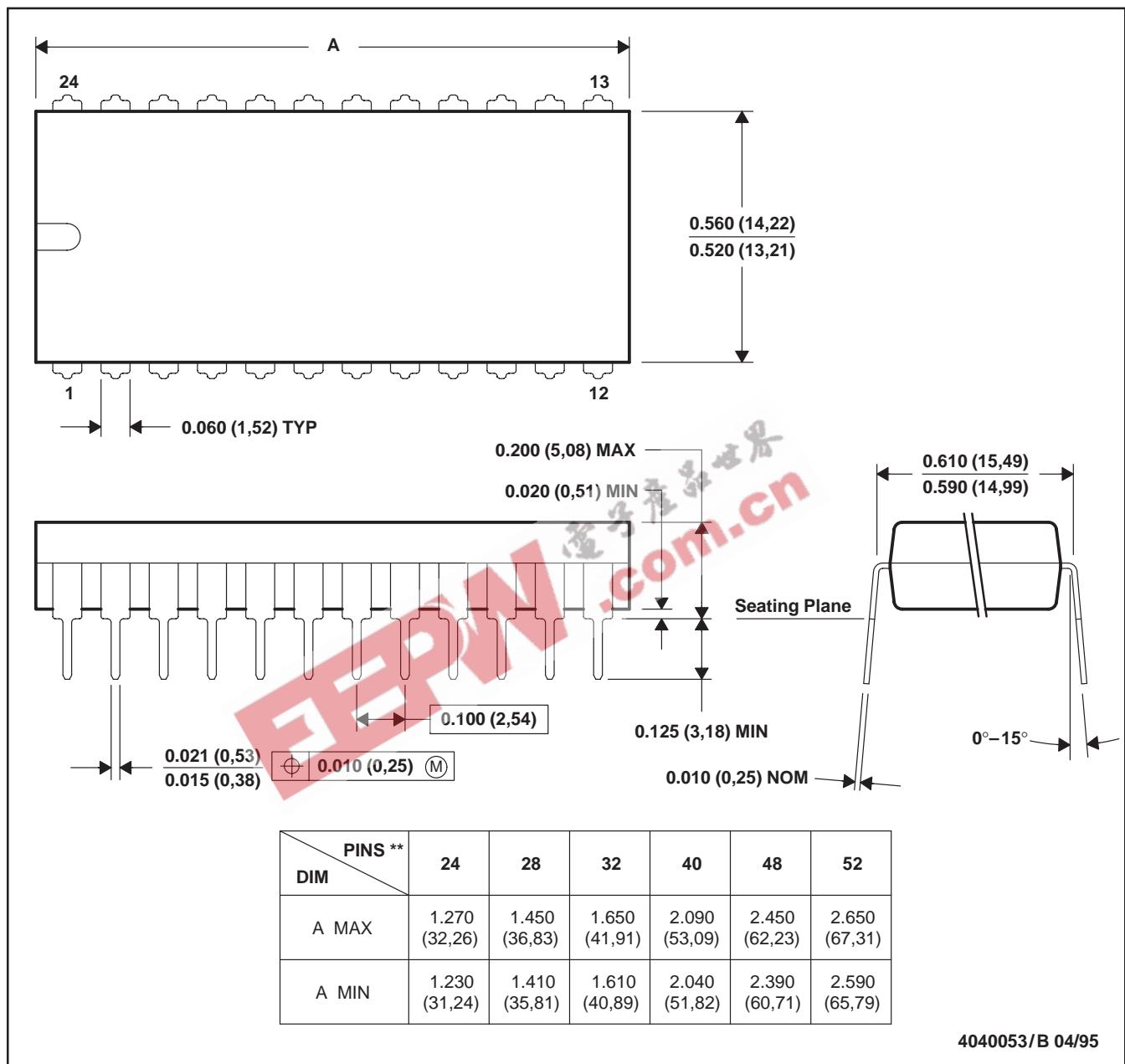
MECHANICAL DATA

MPDI008 – OCTOBER 1994

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

24 PIN SHOWN

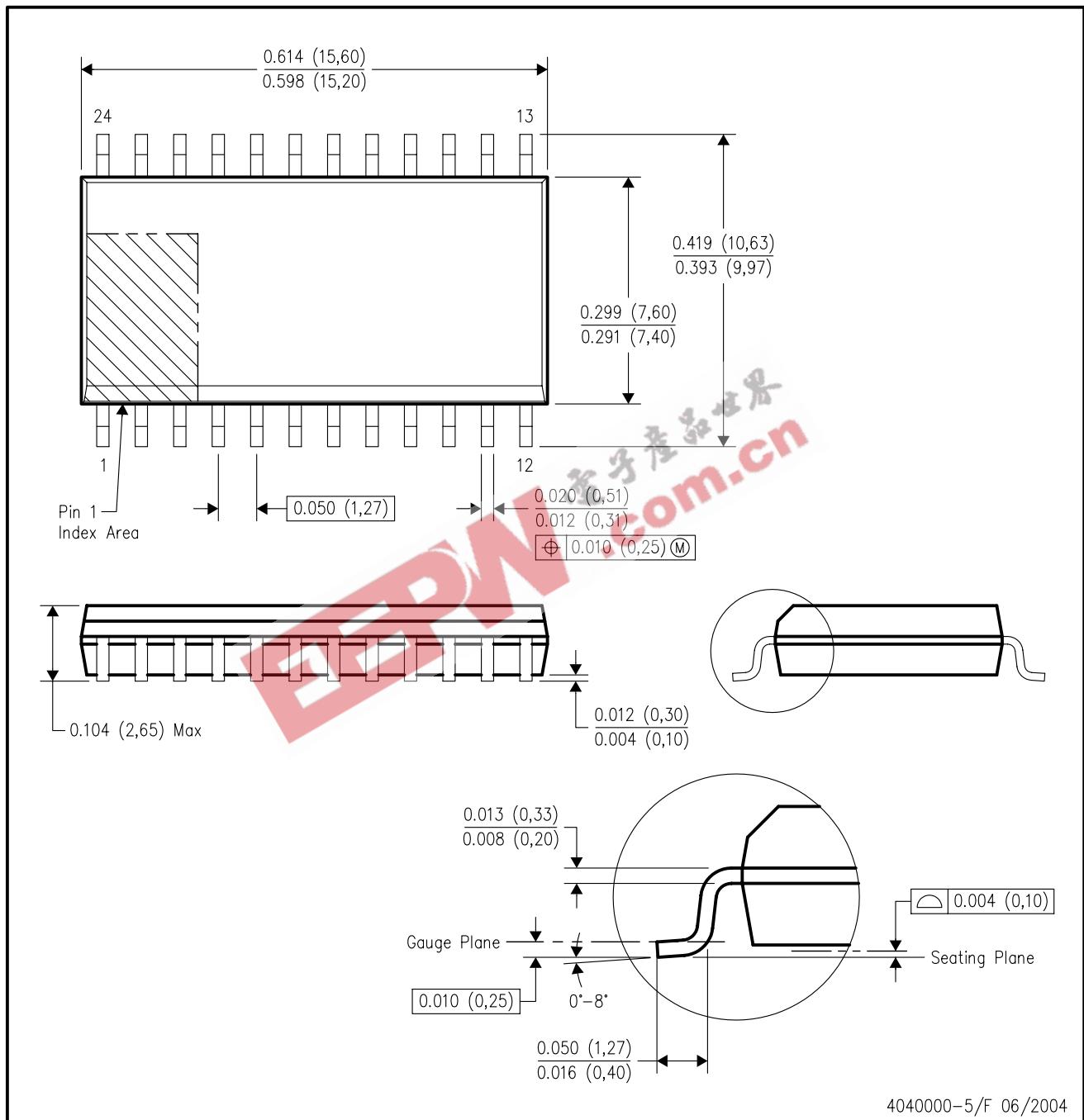


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-011
 - D. Falls within JEDEC MS-015 (32 pin only)

MECHANICAL DATA

DW (R-PDSO-G24)

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 AD.

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