

CD54HCT373, CD74HCT373 OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCLS453B – FEBRUARY 2001 – REVISED MAY 2003

- 4.5-V to 5.5-V V_{CC} Operation
- Wide Operating Temperature Range of -55°C to 125°C
- Balanced Propagation Delays and Transition Times
- Standard Outputs Drive Up To 10 LS-TTL Loads
- Significant Power Reduction Compared to LS-TTL Logic ICs
- Inputs Are TTL-Voltage Compatible

description/ordering information

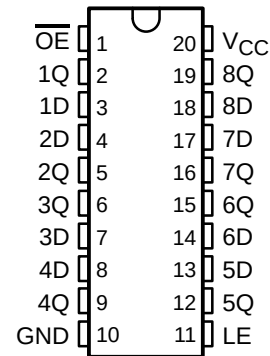
The 'HCT373 devices are octal transparent D-type latches. When the latch-enable (LE) input is high, the Q outputs follow the data (D) inputs. When LE is low, the Q outputs are latched at the logic levels of the D inputs.

A buffered output-enable ($\overline{\text{OE}}$) input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

$\overline{\text{OE}}$ does not affect the internal operations of the latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, $\overline{\text{OE}}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

CD54HCT373 . . . F PACKAGE
CD74HCT373 . . . E OR M PACKAGE
(TOP VIEW)



ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-55°C to 125°C	PDIP – E	Tube	CD74HCT373E	CD74HCT373E
	SOIC – M	Tube	CD74HCT373M	HCT373M
		Tape and reel	CD74HCT373M96	
	CDIP – F	Tube	CD54HCT373F3A	CD54HCT373F3A

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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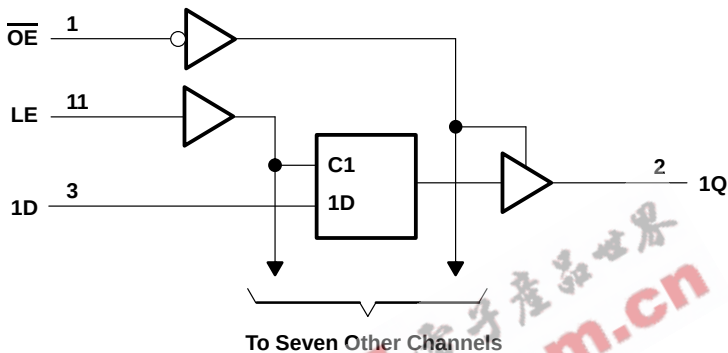
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SCLS453B – FEBRUARY 2001 – REVISED MAY 2003

FUNCTION TABLE
(each latch)

INPUTS			OUTPUT
$\overline{OE}$	LE	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q ₀
H	X	X	Z

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1)	±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1)	±20 mA
Continuous output drain current per output, I_O ($V_O = 0$ to V_{CC})	±35 mA
Continuous output source or sink current per output, I_O ($V_O = 0$ to V_{CC})	±25 mA
Continuous current through V_{CC} or GND	±50 mA
Package thermal impedance, θ_{JA} (see Note 2): E package	69°C/W
M package	58°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

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SCLS453B – FEBRUARY 2001 – REVISED MAY 2003

recommended operating conditions (see Note 3)

	T _A = 25°C		T _A = -55°C TO 125°C		T _A = -40°C TO 85°C		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
V _{CC} Supply voltage	4.5	5.5	4.5	5.5	4.5	5.5	V
V _{IH} High-level input voltage	2		2		2		V
V _{IL} Low-level input voltage		0.8		0.8		0.8	V
V _I Input voltage		V _{CC}		V _{CC}		V _{CC}	V
V _O Output voltage		V _{CC}		V _{CC}		V _{CC}	V
Δt/Δv Input transition rise or fall rate		500		500		500	ns

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		V _{CC}	T _A = 25°C		T _A = -55°C TO 125°C		T _A = -40°C TO 85°C		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
V _{OH}	V _I = V _{IH} or V _{IL}	I _{OH} = -20 μA	4.5 V	4.4		4.4		4.4		V
		I _{OH} = -6 mA		3.98		3.7		3.84		
V _{OL}	V _I = V _{IH} or V _{IL}	I _{OL} = 20 μA	4.5 V		0.1		0.1		0.1	V
		I _{OL} = 6 mA			0.26		0.4		0.33	
I _I	V _I = V _{CC} or 0		5.5 V		±0.1		±1		±1	μA
I _{OZ}	V _O = V _{CC} or 0		5.5 V		±0.5		±10		±5	μA
I _{CC}	V _I = V _{CC} or 0, I _O = 0		5.5 V		8		160		80	μA
ΔI _{CC} [‡]	One input at V _{CC} - 2.1 V, Other inputs at 0 or V _{CC}		4.5 V to 5.5 V		360		490		450	μA
C _i					10		10		10	pF
C _O					10		10		10	pF

[‡] Additional quiescent supply current per input pin, TTL inputs high, 1 unit load. For dual-supply systems, theoretical worst-case (V_I = 2.4 V, V_{CC} = 5.5 V) specification is 1.8 mA.

HCT INPUT LOADING TABLE

INPUT	UNIT LOAD
$\overline{\text{OE}}$	1.5
Any D	0.4
LE	1

Unit load is ΔI_{CC} limit specified in electrical characteristics table (e.g., 360 μA max at 25°C).



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WITH 3-STATE OUTPUTS

SCLS453B – FEBRUARY 2001 – REVISED MAY 2003

timing requirements over recommended operating free-air temperature range, $V_{CC} = 4.5\text{ V}$ (unless otherwise noted) (see Figure 1)

		$T_A = 25^\circ\text{C}$		$T_A = -55^\circ\text{C}$ TO 125°C		$T_A = -40^\circ\text{C}$ TO 85°C		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration, LE high	16		24		20		ns
t_{SU}	Setup time, data before LE↓	13		20		16		ns
t_H	Hold time, data after LE↓	10		15		13		ns

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 4.5\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$		$T_A = -55^\circ\text{C}$ TO 125°C		$T_A = -40^\circ\text{C}$ TO 85°C		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	D	Q	$C_L = 50\text{ pF}$	32		48		40		ns
	LE			35		53		44		
t_{en}	$\overline{OE}$	Q	$C_L = 50\text{ pF}$	35		53		44		ns
t_{dis}	$\overline{OE}$	Q	$C_L = 50\text{ pF}$	35		53		44		ns
t_t		Q	$C_L = 50\text{ pF}$	12		18		15		ns

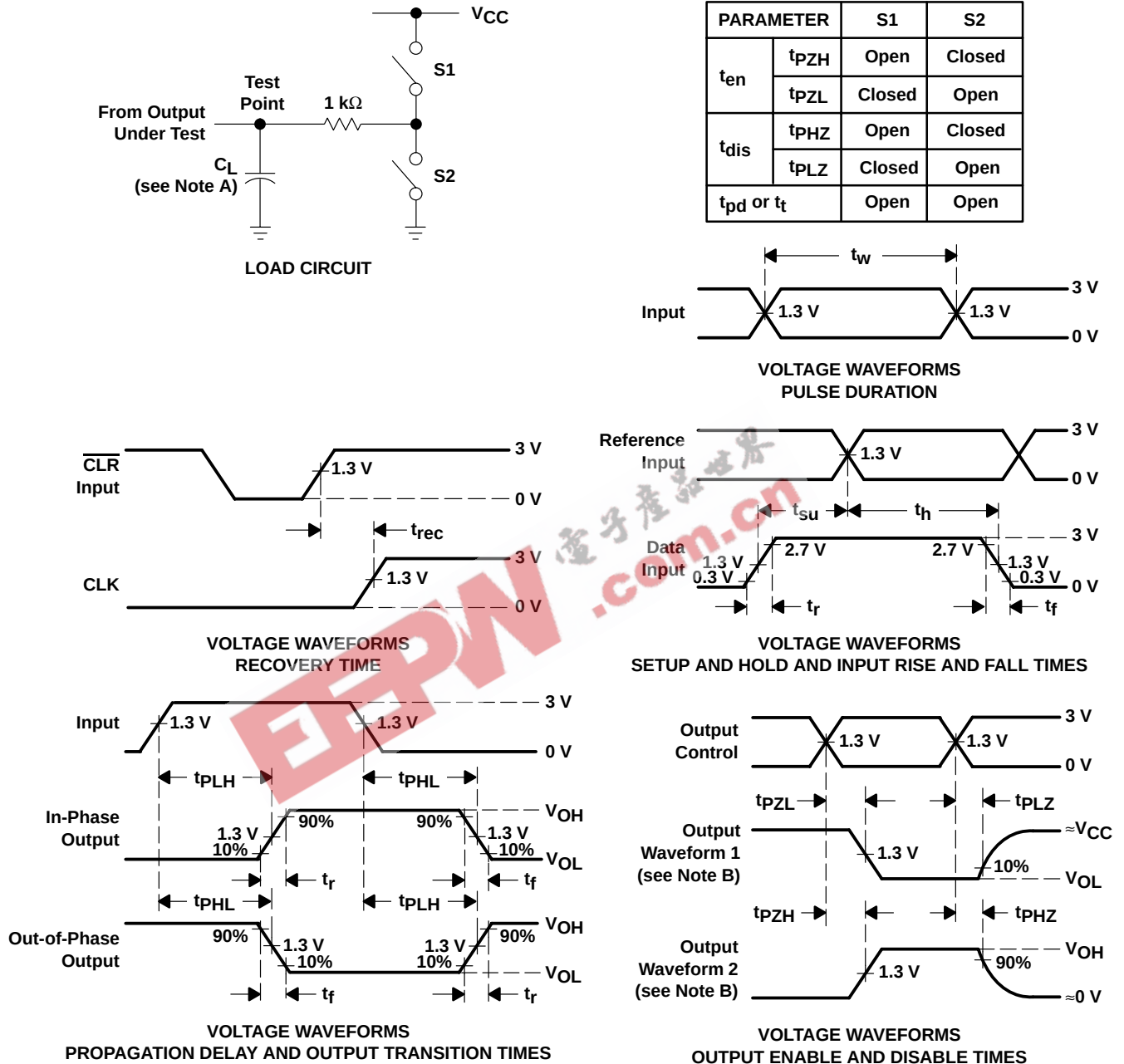
operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TYP	UNIT
C_{pd} Power dissipation capacitance	53	pF

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SCLS453B – FEBRUARY 2001 – REVISED MAY 2003

PARAMETER MEASUREMENT INFORMATION



- NOTES:
- C_L includes probe and test-fixture capacitance.
 - Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 - Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r = 6$ ns, $t_f = 6$ ns.
 - For clock inputs, f_{max} is measured with the input duty cycle at 50%.
 - The outputs are measured one at a time with one input transition per measurement.
 - t_{pLZ} and t_{pHZ} are the same as t_{dis} .
 - t_{pZL} and t_{pZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CD54HCT373F	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
CD54HCT373F3A	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
CD74HCT373E	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD74HCT373M	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CD74HCT373M96	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-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.

OBSELETE: 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.

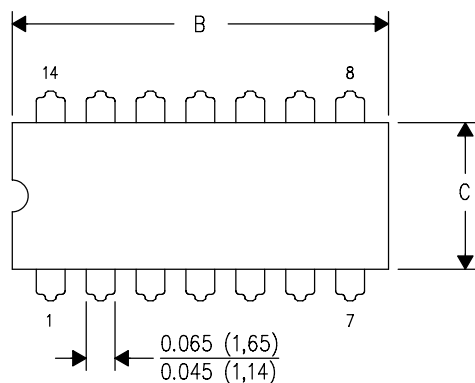
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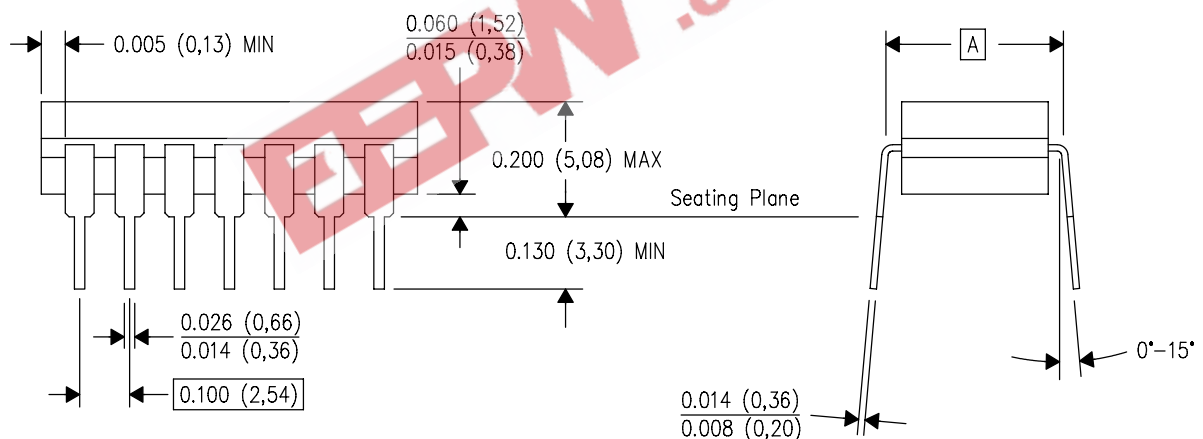
J (R—GDIP—T**) (R—GDIP—T**)

14 LEADS SHOWN

CERAMIC DUAL IN—LINE PACKAGE



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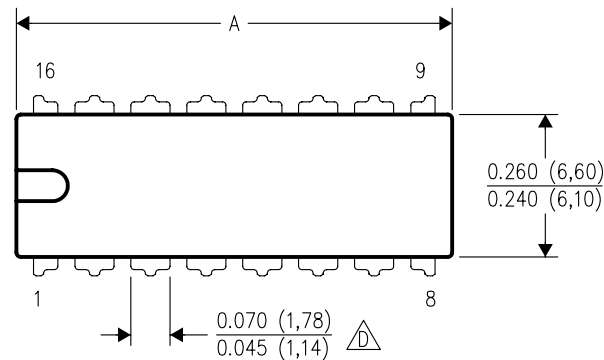
- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls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

MECHANICAL DATA

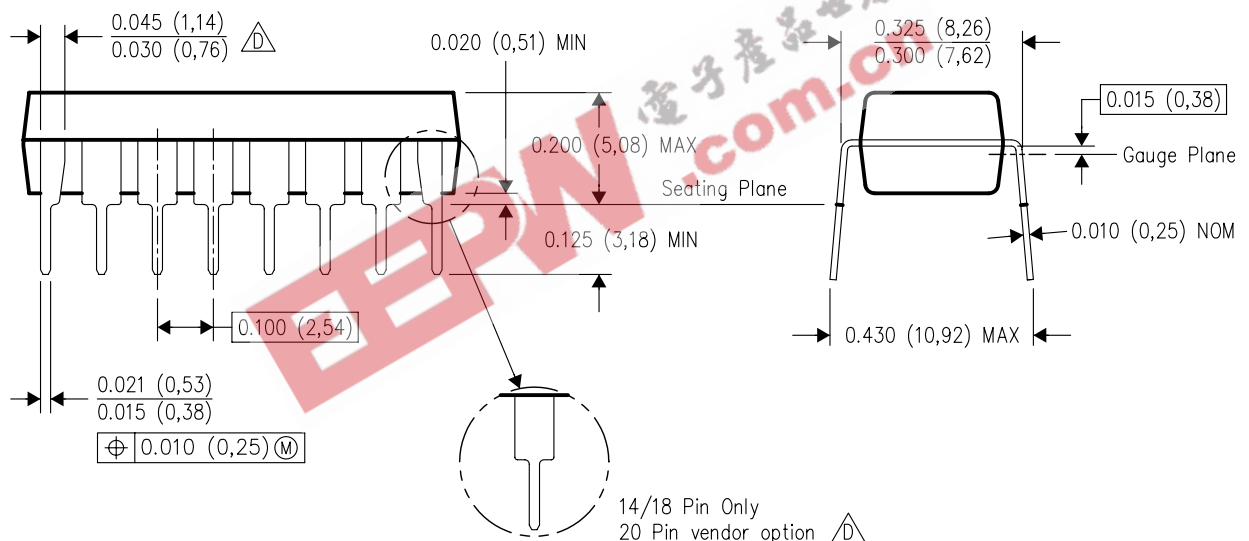
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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



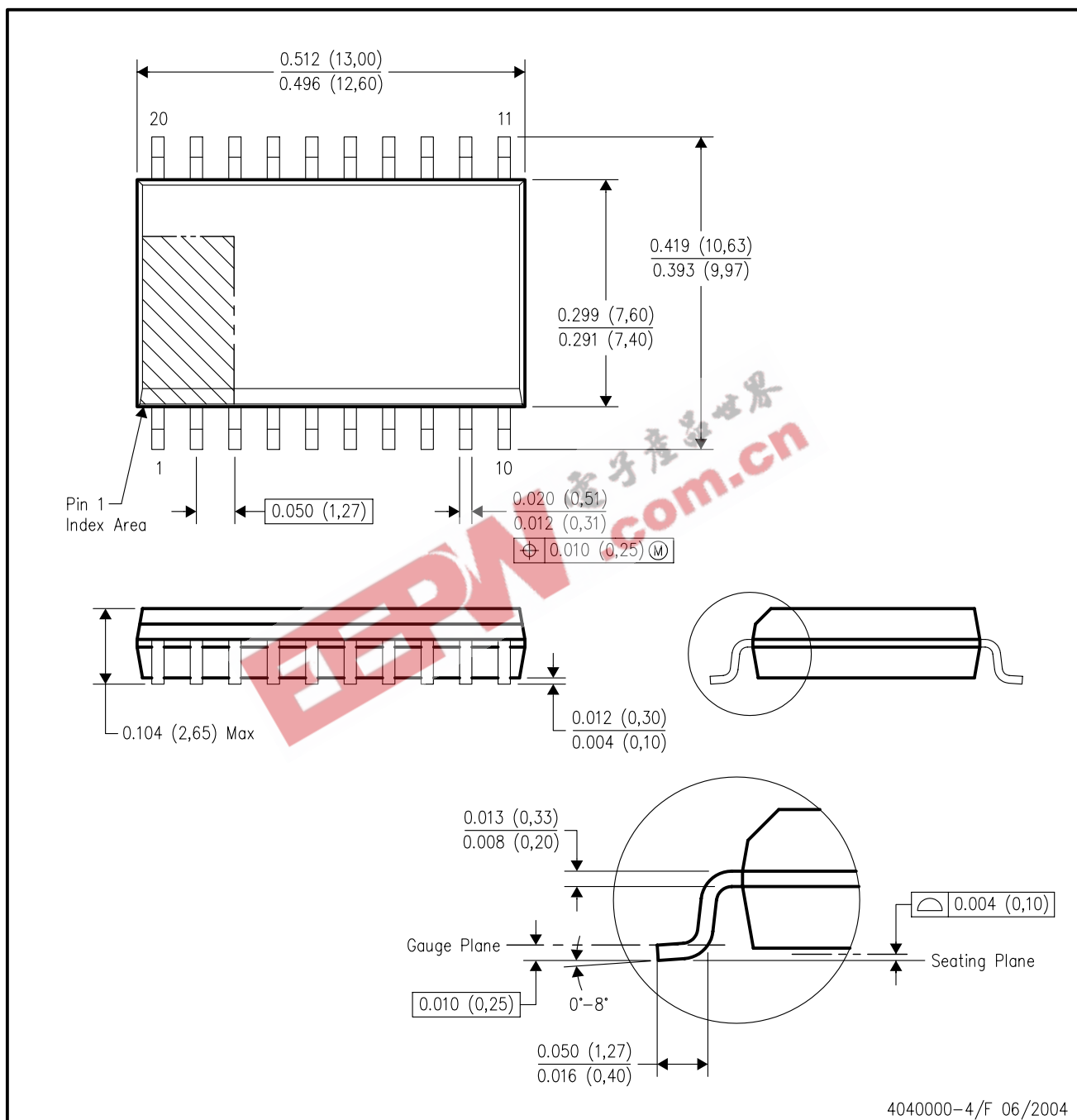
4040049/E 12/2002

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

MECHANICAL DATA

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

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

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