

### Features

- Unlimited Input Rise and Fall Times
- Exceptionally High Noise Immunity
- 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,  $I_I \leq 1\mu A$  at  $V_{OL}$ ,  $V_{OH}$

### Description

The 'HC14 and 'HCT14 each contain six inverting Schmitt triggers in one package.

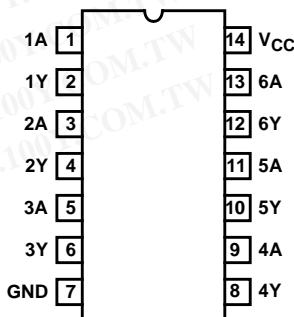
### Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC14F3A	-55 to 125	14 Ld CERDIP
CD54HCT14F3A	-55 to 125	14 Ld CERDIP
CD74HC14E	-55 to 125	14 Ld PDIP
CD74HC14M	-55 to 125	14 Ld SOIC
CD74HC14MT	-55 to 125	14 Ld SOIC
CD74HC14M96	-55 to 125	14 Ld SOIC
CD74HC14PW	-55 to 125	14 Ld TSSOP
CD74HC14PWR	-55 to 125	14 Ld TSSOP
CD74HCT14E	-55 to 125	14 Ld PDIP
CD74HCT14M	-55 to 125	14 Ld SOIC
CD74HCT14MT	-55 to 125	14 Ld SOIC
CD74HCT14M96	-55 to 125	14 Ld SOIC
CD74HCT14PW	-55 to 125	14 Ld TSSOP
CD74HCT14PWR	-55 to 125	14 Ld TSSOP

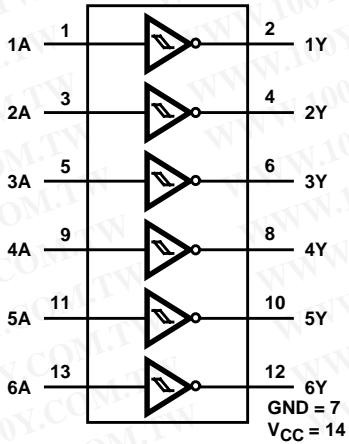
NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel. The suffix T denotes a small-quantity reel of 250.

### Pinout

CD54HC14, CD54HCT14  
 (CERDIP)  
 CD74HC14, CD74HCT14  
 (PDIP, SOIC, TSSOP)  
 TOP VIEW



**Functional Diagram**



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TRUTH TABLE

INPUT (A)	OUTPUT (Y)
L	H
H	L

H= High Level  
 L= Low Level

**Logic Diagram**

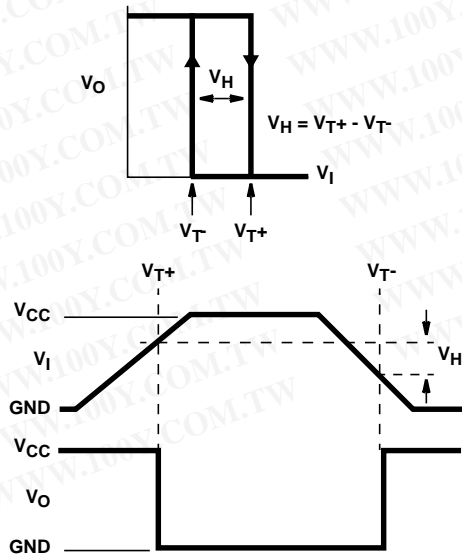


FIGURE 3. HYSTERESIS DEFINITION, CHARACTERISTIC, AND TEST SETUP

# CD54HC14, CD74HC14, CD54HCT, CD74HCT14

## 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 $-0.5V < V_O < V_{CC} + 0.5V$ .....	$\pm 25mA$
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, $I_{CC}$ .....	$\pm 50mA$

## Thermal Information

Thermal Resistance (Typical, Note 1)	$\theta_{JA}$ ( $^{\circ}C/W$ )
E (PDIP) Package .....	80
M (SOIC) Package .....	86
PW (TSSOP) Package .....	113
Maximum Junction Temperature (Hermetic Package or Die) ..	175 $^{\circ}C$
Maximum Junction Temperature (Plastic Package) .....	150 $^{\circ}C$
Maximum Storage Temperature Range .....	-65 $^{\circ}C$ to 150 $^{\circ}C$
Maximum Lead Temperature (Soldering 10s) .....	300 $^{\circ}C$
(SOIC - Lead Tips Only)	

## Operating Conditions

Temperature Range, $T_A$ .....	-55 $^{\circ}C$ to 125 $^{\circ}C$
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 $V_{CC}$

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*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 $^{\circ}C$		-40 $^{\circ}C$ TO 85 $^{\circ}C$		-55 $^{\circ}C$ TO 125 $^{\circ}C$		UNITS	
		$V_I$ (V)	$I_O$ (mA)		MIN	MAX	MIN	MAX	MIN	MAX		
<b>HC TYPES</b>												
Input Switch Points	$V_{T+}$	-	-	2	0.7	1.5	0.7	1.5	0.7	1.5	V	
				4.5	1.7	3.15	1.7	3.15	1.7	3.15	V	
				6	2.1	4.2	2.1	4.2	2.1	4.2	V	
	$V_{T-}$	-	-	2	0.3	1.0	0.3	1.0	0.3	1.0	V	
				4.5	0.9	2.2	0.9	2.2	0.9	2.2	V	
				6	1.2	3.0	1.2	3.0	1.2	3.0	V	
	$V_H$	-	-	2	0.2	1.0	0.2	1.0	0.2	1.0	V	
				4.5	0.4	1.4	0.4	1.4	0.4	1.4	V	
				6	0.6	1.6	0.6	1.6	0.6	1.6	V	
High Level Output Voltage CMOS Loads	$V_{OH}$	$V_{T-}$ or $V_{T+}$	-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
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V
High Level Output Voltage TTL Loads	$V_{OH}$	$V_{T-}$ or $V_{T+}$	-4	-4	4.5	3.98	-	3.84	-	3.7	-	V
			-5.2	-5.2	6	5.48	-	5.34	-	5.2	-	V
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	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
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V
Low Level Output Voltage TTL Loads	$V_{OL}$	$V_{IH}$ or $V_{IL}$	4	4	4.5	-	0.26	-	0.33	-	0.4	V
			5.2	5.2	6	-	0.26	-	0.33	-	0.4	V
			-	-	-	-	-	-	-	-	-	V
			-	-	-	-	-	-	-	-	-	V

**CD54HC14, CD74HC14, CD54HCT14, CD74HCT14**

**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	
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	-	2	-	20	-	40	μA
<b>HCT TYPES</b>											
Input Switch Points	$V_{T+}$	-	-	4.5	1.2	1.9	1.2	1.9	1.2	1.9	V
				5.5	1.4	2.1	1.4	2.1	1.4	2.1	V
	$V_T$			4.5	0.5	1.2	0.5	1.2	0.5	1.2	V
				5.5	0.6	1.4	0.6	1.4	0.6	1.4	V
	$V_H$			4.5	0.4	1.4	0.4	1.4	0.4	1.4	V
				5.5	0.4	1.5	0.4	1.5	0.4	1.5	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	-	5.5	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	$I_{CC}$	$V_{CC}$ or GND	0	5.5	-	2	-	20	-	40	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	$\Delta I_{CC}$ (Note 2)	$V_{CC}$ - 2.1	-	4.5 to 5.5	-	360	-	450	-	490	μA

NOTE:

2. 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
nA	0.6

NOTE: Unit Load is  $\Delta I_{CC}$  limit specified in DC Electrical Specifications table, e.g., 360μA max at 25°C.

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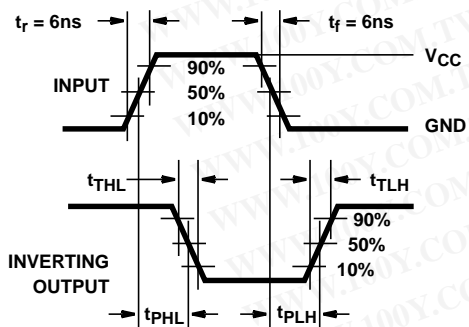
**Switching Specifications** Input  $t_r$ ,  $t_f = 6\text{ns}$

PARAMETER	SYMBOL	TEST CONDITIONS	$V_{CC}$ (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
<b>HC TYPES</b>											
Propagation Delay, A to Y	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	2	-	-	135	-	170	-	205	ns
		$C_L = 50\text{pF}$	4.5	-	-	27	-	34	-	41	ns
		$C_L = 15\text{pF}$	5	-	11	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	23	-	29	-	35	ns
Output Transition Times	$t_{TLH}, t_{THL}$	$C_L = 50\text{pF}$	2	-	-	75	-	95	18	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	$C_I$	-	-	-	10	-	10	-	10	pF	
Power Dissipation Capacitance (Notes 3, 4)	$C_{PD}$	-	5	-	20	-	-	-	-	pF	
<b>HCT TYPES</b>											
Propagation Delay, A to Y	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	-	38	-	48	-	57	ns
		$C_L = 15\text{pF}$	5	-	16	-	-	-	-	-	ns
Output Transition Times	$t_{TLH}, t_{THL}$	$C_L = 50\text{pF}$	4.5	-	-	15	-	19	-	22	ns
Input Capacitance	$C_I$	-	-	-	10	-	10	-	10	pF	
Power Dissipation Capacitance (Notes 3, 4)	$C_{PD}$	-	5	-	20	-	-	-	-	pF	

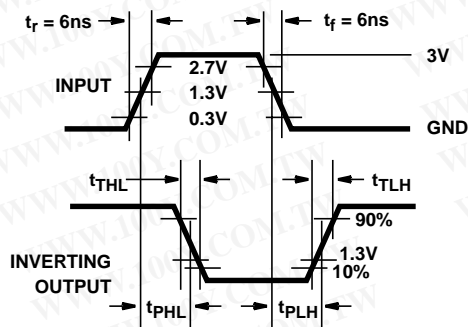
**NOTES:**

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

**Test Circuits and Waveforms**



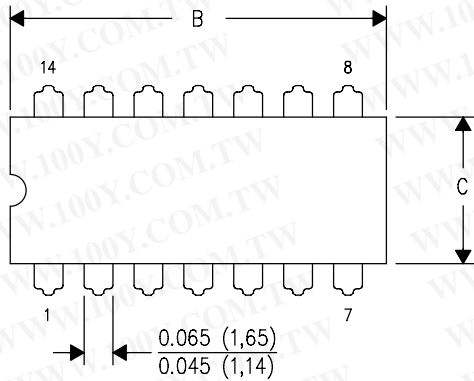
**FIGURE 4. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC**



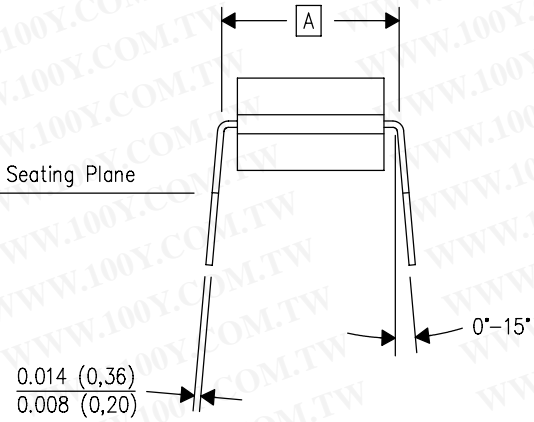
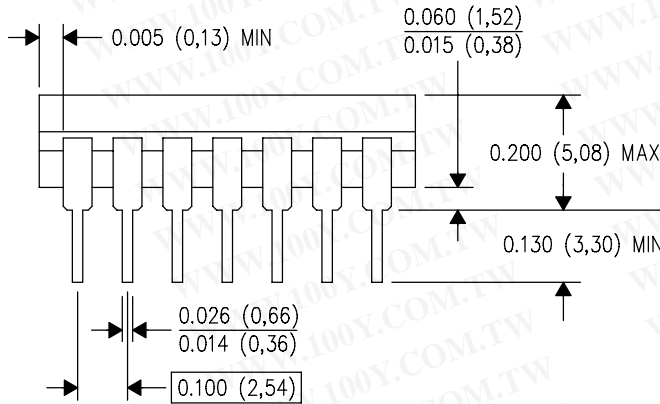
**FIGURE 5. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC**

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
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)



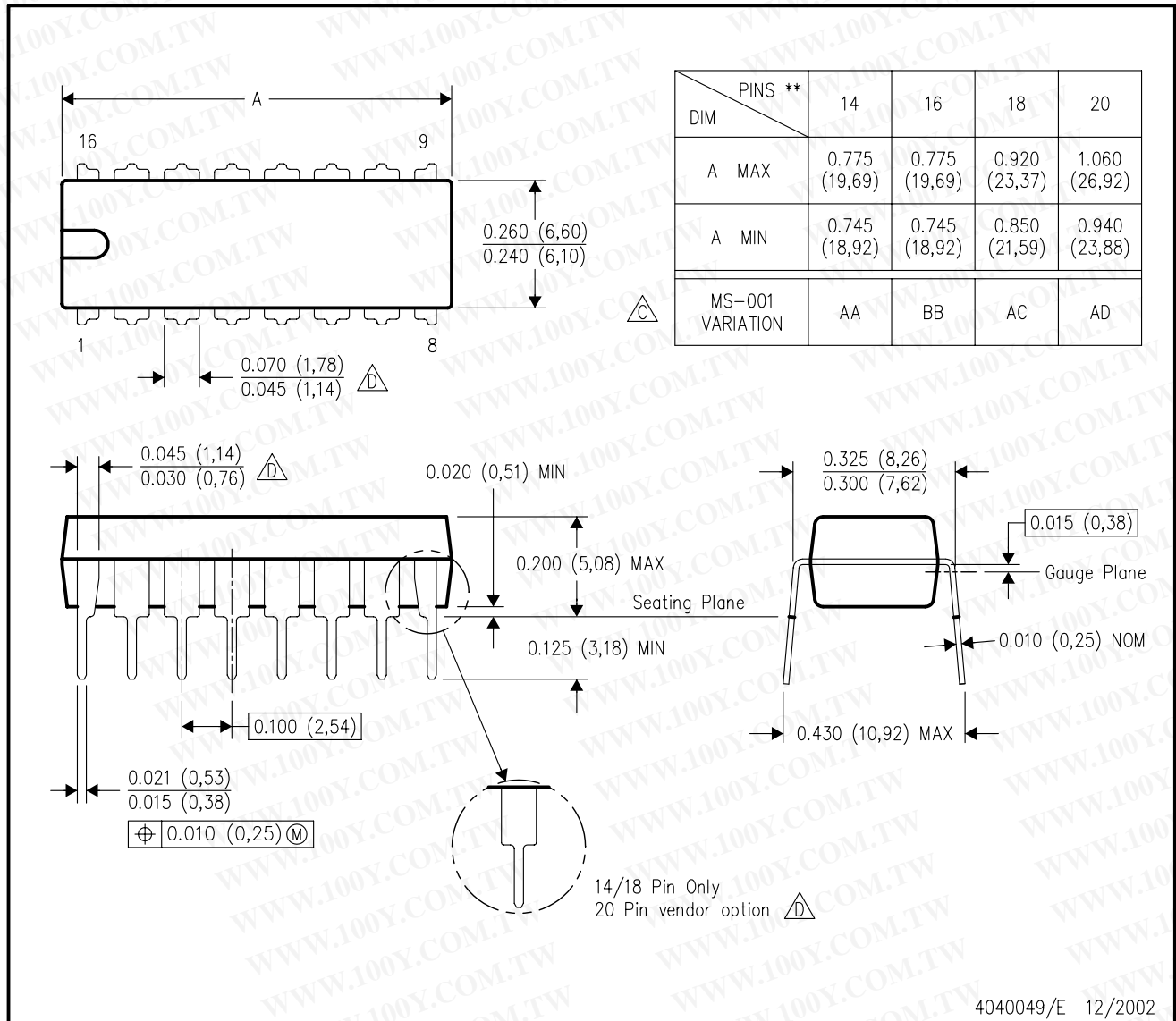
4040083/F 03/03

- 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.
  - 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.

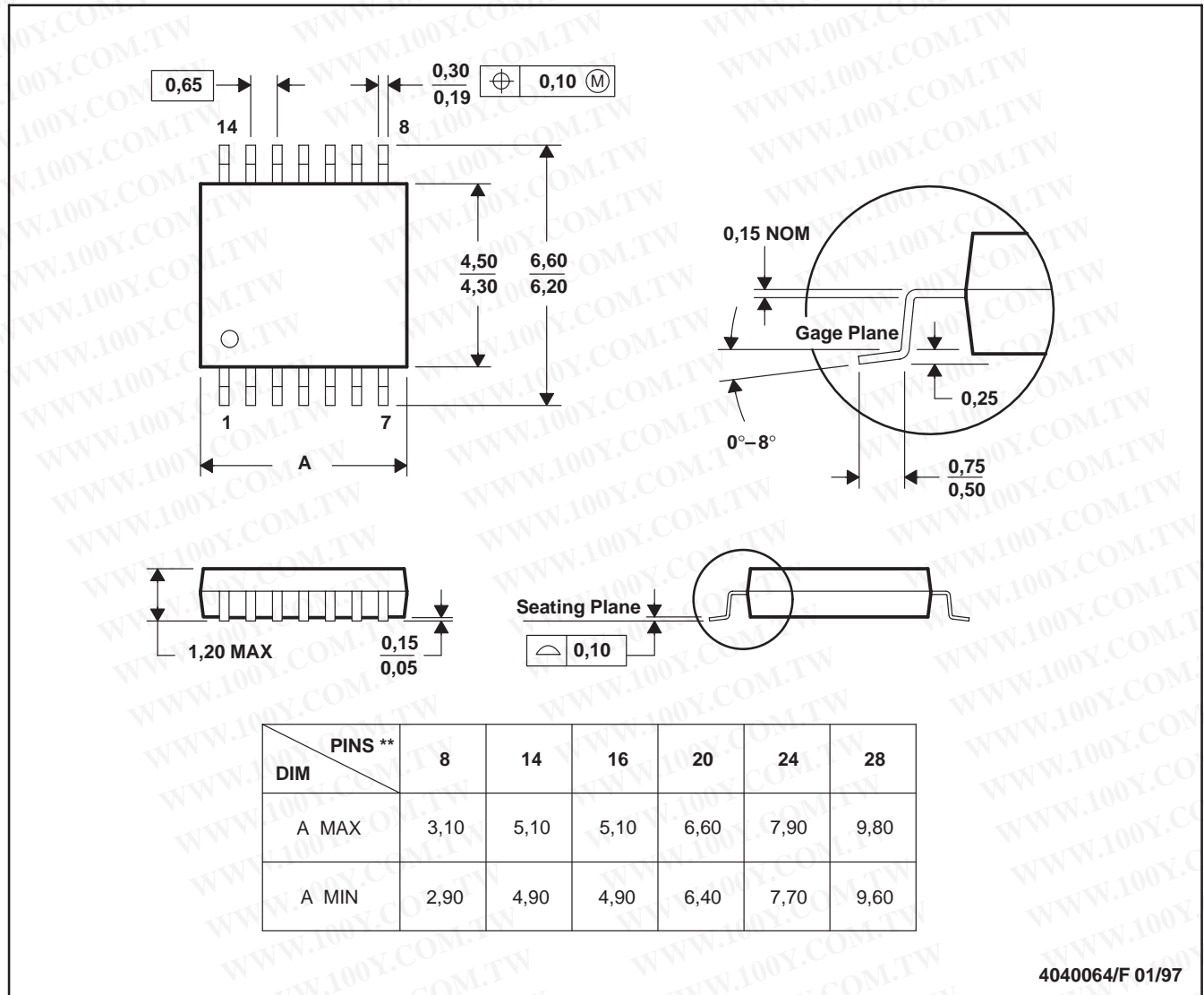




PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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-153

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