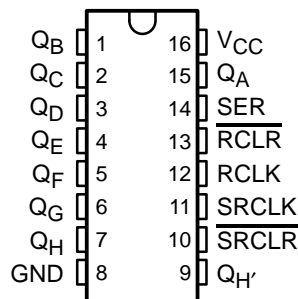- **Inputs Are TTL-Voltage Compatible**
- **8-Bit Serial-In, Parallel-Out Shift Registers With Storage**
- **Independent Direct Overriding Clears on Shift and Storage Registers**
- **Independent Clocks for Both Shift and Storage Registers**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**

SN54AHCT594 . . . J OR W PACKAGE
SN74AHCT594 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)

Q_B	1	16	V_{CC}
Q_C	2	15	Q_A
Q_D	3	14	$\overline{SER}$
Q_E	4	13	$\overline{RCLR}$
Q_F	5	12	RCLK
Q_G	6	11	SRCLK
Q_H	7	10	$\overline{SRCLR}$
GND	8	9	$Q_{H'}$

SN54AHCT594 . . . FK PACKAGE
(TOP VIEW)

Pins (top, left to right): Q_C (3), Q_B (2), NC (1), V_{CC} (20), Q_A (19)
Left side: Q_D (4), Q_E (5), NC (6), Q_F (7), Q_G (8)
Right side: SER (18), $\overline{RCLR}$ (17), NC (16), RCLK (15), SRCLK (14)
Bottom (left to right): Q_H (9), GND (10), NC (11), $Q_{H'}$ (12), $\overline{SRCLR}$ (13)

NC – No internal connection
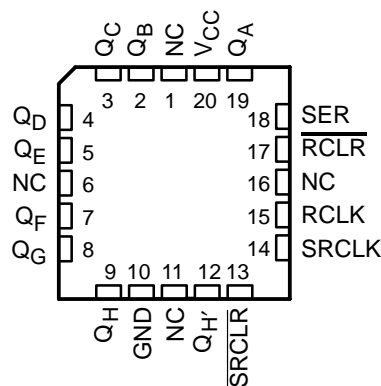
description/ordering information

The 'AHCT594 devices contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Separate clocks and direct overriding clear ($\overline{SRCLR}$, $\overline{RCLR}$) inputs are provided on both the shift and storage registers. A serial ($Q_{H'}$) output is provided for cascading purposes.

Both the shift register (SRCLK) and storage register (RCLK) clocks are positive edge triggered. If both clocks are connected together, the shift register always is one count pulse ahead of the storage register.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	PDIP – N	Tube	SN74AHCT594N	SN74AHCT594N
	SOIC – D	Tube	SN74AHCT594D	AHCT594
		Tape and reel	SN74AHCT594DR	
	SOP – NS	Tape and reel	SN74AHCT594NSR	AHCT594
	SSOP – DB	Tape and reel	SN74AHCT594DBR	HB594
	TSSOP – PW	Tape and reel	SN74AHCT594PWR	HB594
−55°C to 125°C	CDIP – J	Tube	SNJ54AHCT594J	SNJ54AHCT594J
	CFP – W	Tube	SNJ54AHCT594W	SNJ54AHCT594W
	LCCC – FK	Tube	SNJ54AHCT594FK	SNJ54AHCT594FK

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

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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FUNCTION TABLE

INPUTS					FUNCTION
SER	SRCLK	$\overline{\text{SRCLR}}$	RCLK	$\overline{\text{RCLR}}$	
X	X	L	X	X	Shift register is cleared.
L	↑	H	X	X	First stage of shift register goes low. Other stages store the data of previous stage, respectively.
H	↑	H	X	X	First stage of shift register goes high. Other stages store the data of previous stage, respectively.
L	↓	H	X	X	Shift-register state is not changed.
X	X	X	X	L	Storage register is cleared.
X	X	X	↑	H	Shift-register data is stored in the storage register.
X	X	X	↓	H	Storage-register state is not changed.

TEXAS
INSTRUMENTS

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logic diagram (positive logic)
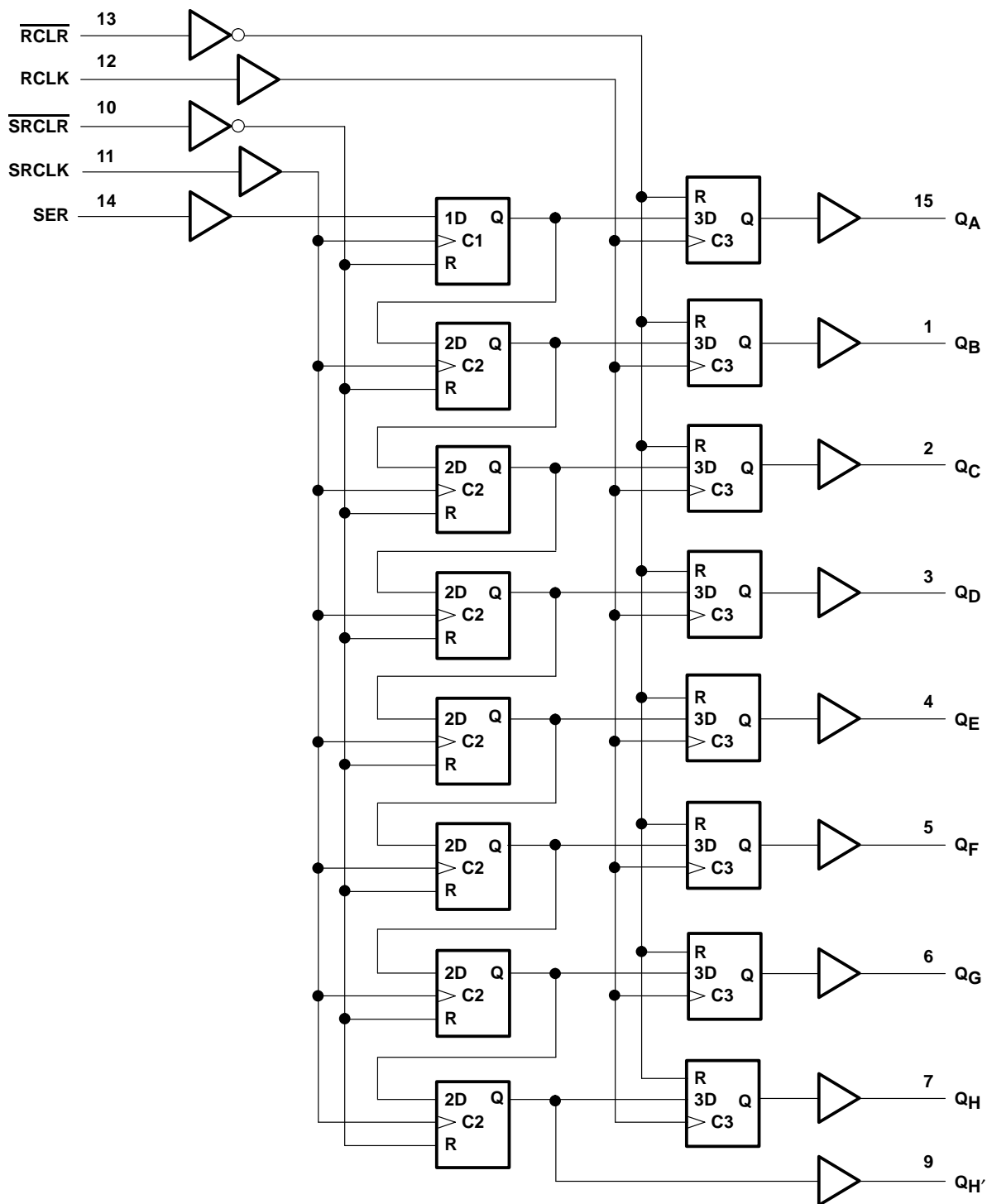
Pin numbers shown are for the D, DB, J, N, NS, PW, and W packages.
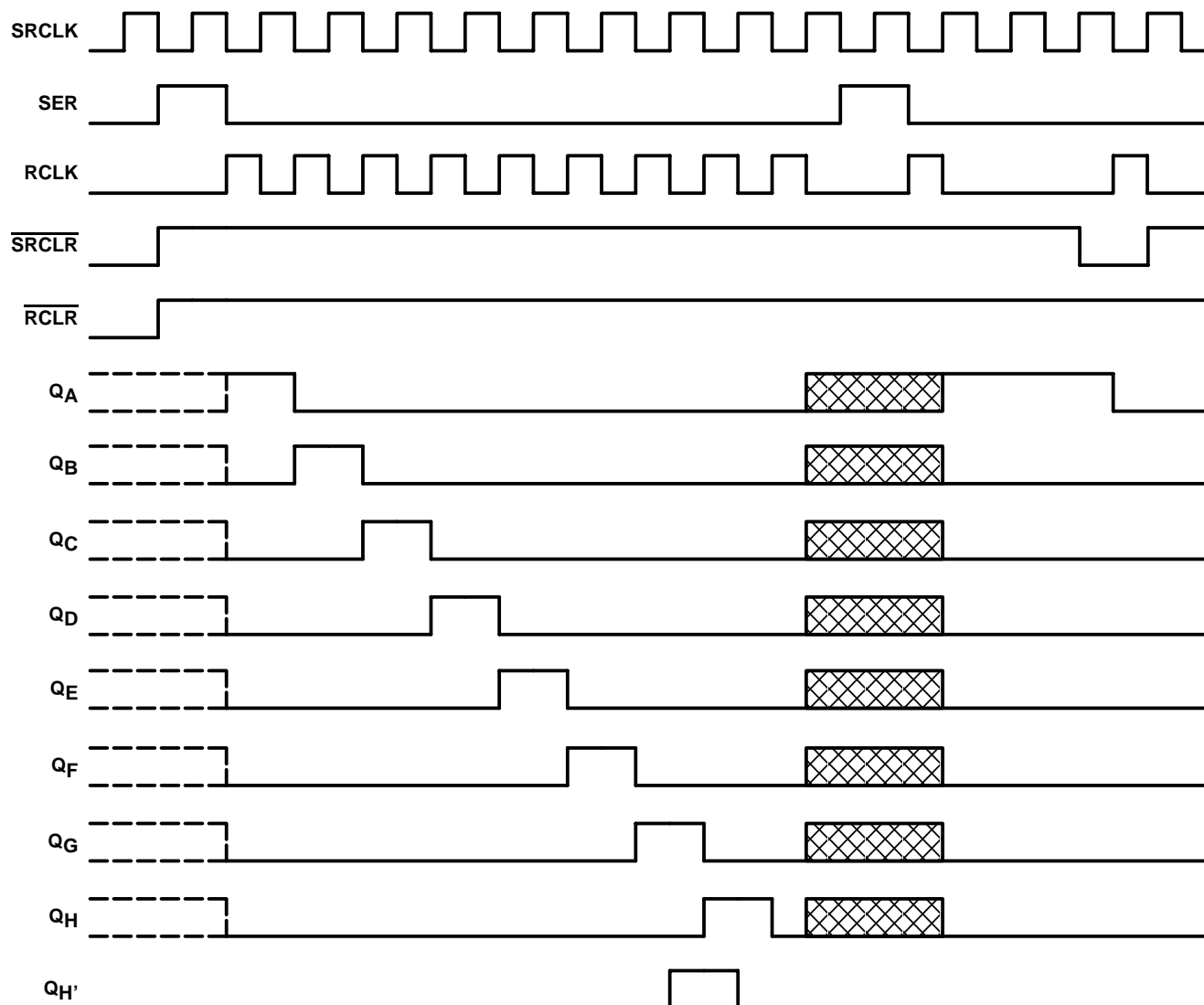
SN54AHCT594, SN74AHCT594
8-BIT SHIFT REGISTERS
WITH OUTPUT REGISTERS

timing diagram

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

Supply voltage range, V_{CC} .... −0.5 V to 7 V
Input voltage range, V_I (see Note 1) .... −0.5 V to 7 V
Output voltage range, V_O (see Note 1) .... −0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$) .... −20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) .... ±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC}) .... ±25 mA
Continuous current through V_{CC} or GND .... ±75 mA
Package thermal impedance, θ_{JA} (see Note 2): D package .... 73°C/W
　　　　　　　　　　　　　　　　　　DB package .... 82°C/W
　　　　　　　　　　　　　　　　　　N package .... 67°C/W
　　　　　　　　　　　　　　　　　　NS package .... 64°C/W
　　　　　　　　　　　　　　　　　　PW package .... 108°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.

recommended operating conditions (see Note 3)

		SN54AHCT594		SN74AHCT594		UNIT
		MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage	4.5	5.5	4.5	5.5	V
V_{IH}	High-level input voltage	2		2		V
V_{IL}	Low-level input voltage		0.8		0.8	V
V_I	Input voltage	0	5.5	0	5.5	V
V_O	Output voltage	0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current		−8		−8	mA
I_{OL}	Low-level output current		8		8	mA
$\Delta t/\Delta v$	Input transition rise or fall rate		20		20	ns/V
T_A	Operating free-air temperature	−55	125	−40	85	°C

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.

TEXAS INSTRUMENTS

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

PARAMETER		TEST CONDITIONS	V_{CC}	$T_A = 25°C$			SN54AHCT594		SN74AHCT594		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}		$I_{OH} = -50$ μA	4.5 V	4.4	4.5		4.4		4.4		V
		$I_{OH} = -8$ mA		3.94			3.8		3.8		
V_{OL}		$I_{OL} = 50$ μA	4.5 V			0.1		0.1		0.1	V
		$I_{OL} = 8$ mA				0.36		0.44		0.44	
I_I		$V_I = 5.5$ V or GND	0 V to 5.5 V			±0.1		±1*		±1	μA
I_{CC}		$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			2		20		20	μA
ΔI_{CC}†		One input at 3.4 V, Other inputs at V_{CC} or GND	5.5 V			2		2.2		2.2	mA
C_i		$V_I = V_{CC}$ or GND	5 V		2	10				10	pF

* On products compliant to MIL-PRF-38535, this parameter is not production tested at $V_{CC} = 0$ V.
† This is the increase in supply current for each input at one of the specified TTL voltage levels rather than 0 V or V_{CC}.

timing requirements over recommended operating free-air temperature range,
$V_{CC} = 5$ V $\pm$ 0.5 V (unless otherwise noted) (see Figure 1)

			$T_A = 25°C$		SN54AHCT594		SN74AHCT594		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	RCLK or SRCLK high or low	5		5.5		5.5		ns
		$\overline{RCLR}$ or $\overline{SRCLR}$ low	5.2		5.5		5.5		
t_{su}	Setup time	SER before SRCLK↑	3		3		3		ns
		SRCLK↑ before RCLK↑‡	5		5		5		
		$\overline{SRCLR}$ low before RCLK↑	5		5		5		
		$\overline{SRCLR}$ high (inactive) before SRCLK↑	2.9		3.3		3.3		
		$\overline{RCLR}$ high (inactive) before RCLK↑	3.4		3.8		3.8		
t_h	Hold time	SER after SRCLK↑	2		2		2		ns

‡ This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

![Texas Instruments logo]

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switching characteristics over recommended operating free-air temperature range,
V_{CC} = 5 V $\pm$ 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54AHCT594		SN74AHCT594		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	135*	170*		115*		115		MHz
			C_L = 50 pF	120	140		95		95		
t_{PLH}	RCLK	Q_A–Q_H	C_L = 15 pF		3.3*	6.2*	1*	6.5*	1	6.5	ns
t_{PHL}					3.7*	6.5*	1*	6.9*	1	6.9	
t_{PLH}	SRCLK	$Q_{H'}$	C_L = 15 pF		3.7*	6.8*	1*	7.2*	1	7.2	ns
t_{PHL}					4.1*	7.2*	1*	7.6*	1	7.6	
t_{PHL}	$\overline{RCLR}$	Q_A–Q_H	C_L = 15 pF		4.5*	7.6*	1*	8.2*	1	8.2	ns
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 15 pF		4.1*	7.1*	1*	7.6*	1	7.6	ns
t_{PLH}	RCLK	Q_A–Q_H	C_L = 50 pF		4.9	7.8	1	8.3	1	8.3	ns
t_{PHL}					5.8	8.9	1	9.7	1	9.7	
t_{PLH}	SRCLK	$Q_{H'}$	C_L = 50 pF		5.5	8.6	1	9.1	1	9.1	ns
t_{PHL}					6	9.2	1	10.1	1	10.1	
t_{PHL}	$\overline{RCLR}$	Q_A–Q_H	C_L = 50 pF		6.6	10	1	10.7	1	10.7	ns
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 50 pF		6	9.2	1	10.1	1	10.1	ns

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics, V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C (see Note 4)

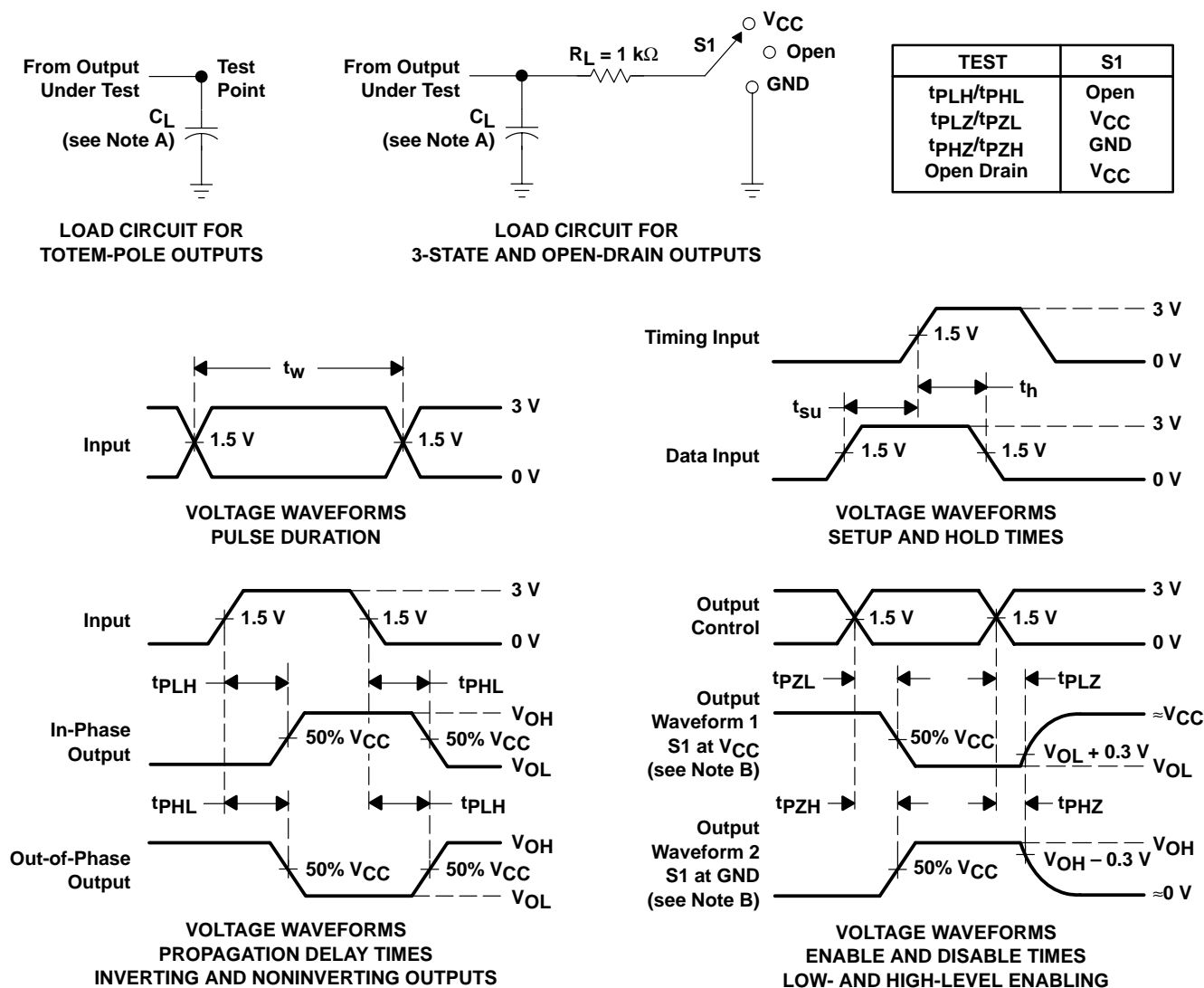| PARAMETER		SN74AHCT594			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		1		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		−0.6		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		3.8		V
$V_{IH(D)}$	High-level dynamic input voltage	2			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.8	V

NOTE 4: Characteristics are for surface-mount packages only.

operating characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	112	pF

TEXAS INSTRUMENTS

PARAMETER MEASUREMENT INFORMATION

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}

**LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS**

**LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS**

**VOLTAGE WAVEFORMS
PULSE DURATION**

**VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES**

**VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS**

**VOLTAGE WAVEFORMS
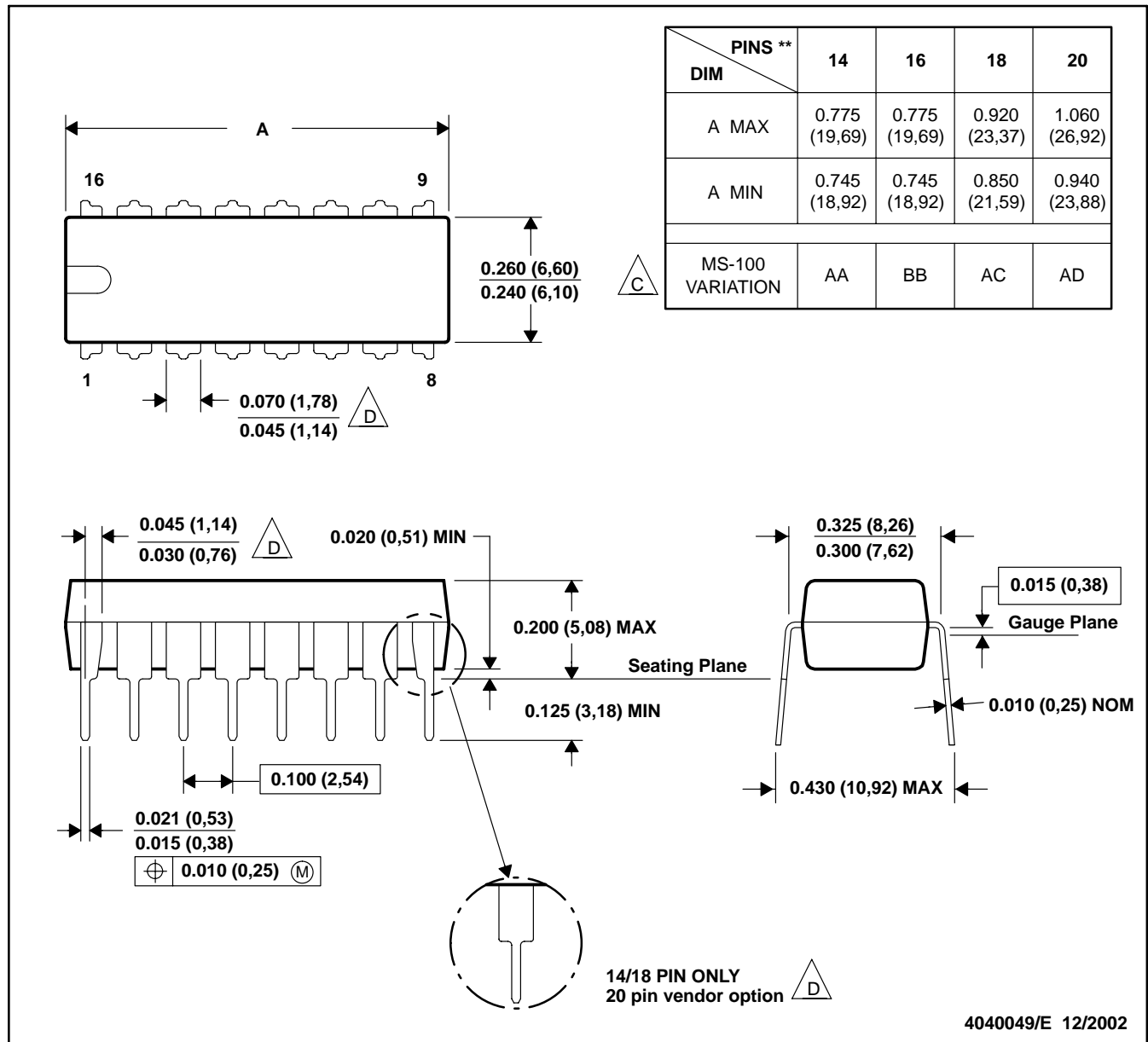ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING**

NOTES: A. C_L includes probe and jig capacitance.
B. 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.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.
D. The outputs are measured one at a time with one input transition per measurement.
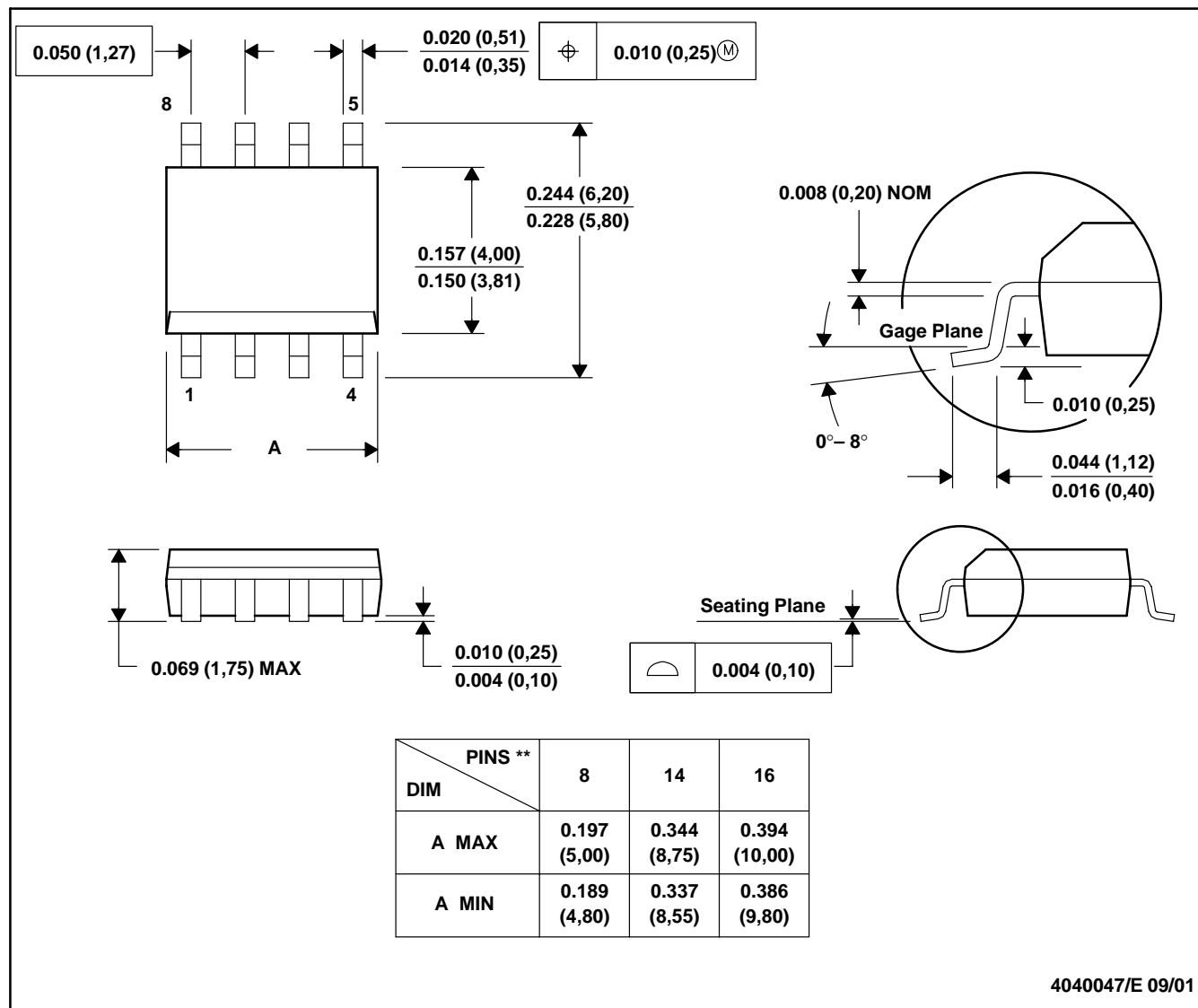
Figure 1. Load Circuit and Voltage Waveforms

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MECHANICAL

N (R-PDIP-T**)   **PLASTIC DUAL-IN-LINE PACKAGE**

16 PINS SHOWN

PINS ** DIM	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-100 VARIATION	AA	BB	AC	AD

A

16   9

0.260 (6,60)
0.240 (6,10)

1   8

0.070 (1,78)
0.045 (1,14) D

0.045 (1,14)
0.030 (0,76) D

0.020 (0,51) MIN

0.325 (8,26)
0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.010 (0,25) NOM

0.100 (2,54)

0.021 (0,53)
0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

0.430 (10,92) MAX

14/18 PIN ONLY
20 pin vendor option D

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 lrngth (Dim A).

  D. The 20 pin end lead shoulder width is a vendor option, either half or full width.
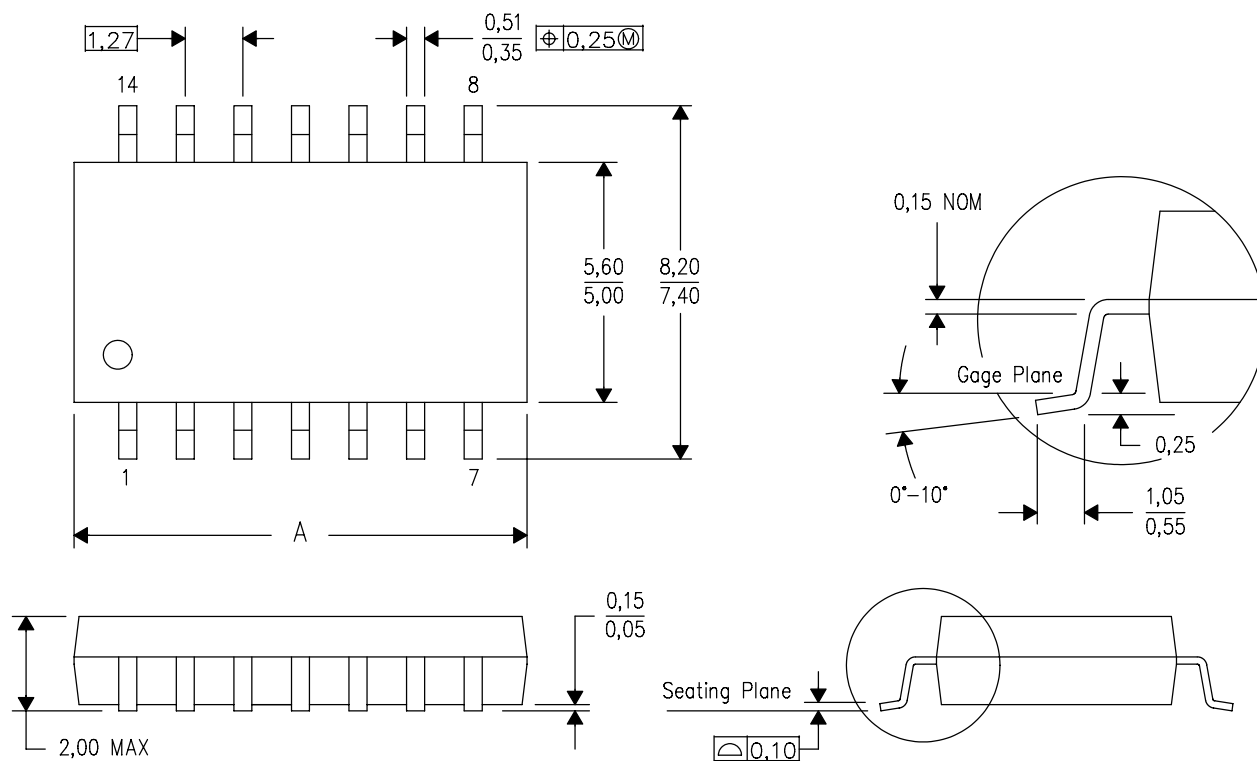
1

D (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

8 PINS SHOWN

0.050 (1,27)

0.020 (0,51)
0.014 (0,35)

⊕ 0.010 (0,25) Ⓜ

8

5

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,81)

0.008 (0,20) NOM

Gage Plane

0.010 (0,25)

1

4

0°– 8°

0.044 (1,12)
0.016 (0,40)

A

0.069 (1,75) MAX

0.010 (0,25)
0.004 (0,10)

Seating Plane

⌒ 0.004 (0,10)

DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

4040047/E 09/01

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-012

1,27

0,51
0,35

⌖ 0,25 Ⓜ

14

8

5,60
5,00

8,20
7,40

1

7

A

0,15 NOM

Gage Plane

0°–10°

0,25

1,05
0,55

0,15
0,05

2,00 MAX

Seating Plane

⌒ 0,10

DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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.

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

28 PINS SHOWN

PINS ** DIM	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

PW (R-PDSO-G****)**   **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN

0,65

0,30
0,19

⊕ 0,10 Ⓜ

14   8

4,50
4,30

6,60
6,20

1   7

A

0,15 NOM

Gage Plane

0°−8°

0,25

0,75
0,50

1,20 MAX

0,15
0,05

Seating Plane

◯ 0,10

DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

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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