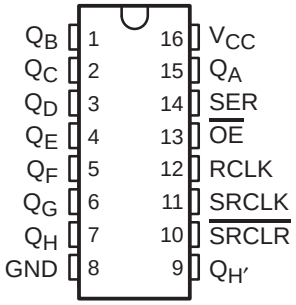
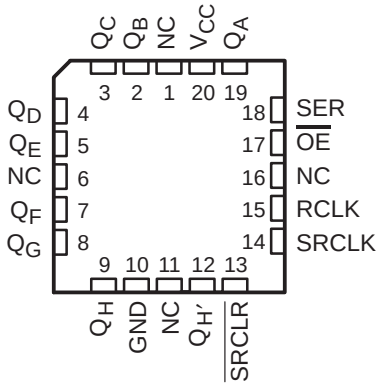
- ***EPIC***™ **(Enhanced-Performance Implanted CMOS) Process**
- **Inputs Are TTL-Voltage Compatible**
- **8-Bit Serial-In, Parallel-Out Shift**
- **Shift Register Has Direct Clear**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs**

SN54AHCT595 . . . J OR W PACKAGE
SN74AHCT595 . . . D, DB, N, OR PW PACKAGE
(TOP VIEW)



SN54AHCT595 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

The ’AHCT595 devices contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state outputs. Separate clocks are provided for the shift and storage registers. The shift register has a direct overriding clear ($\overline{\text{SRCLR}}$) input, serial (SER) input, and serial outputs for cascading. When the output-enable ($\overline{\text{OE}}$) input is high, the outputs are in the high-impedance state.

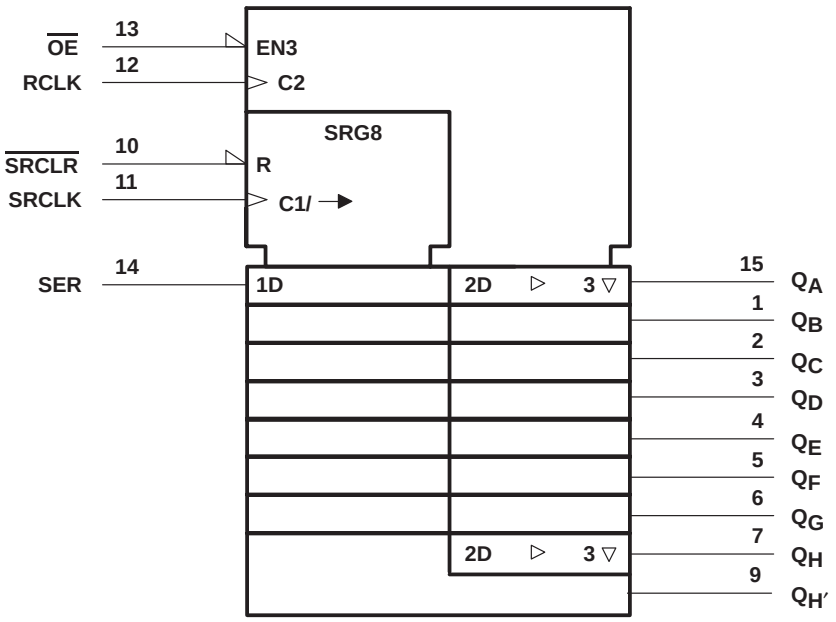
Both the shift register clock (RCLK) and storage register clock (SRCLK) are positive-edge triggered. If both clocks are connected together, the shift register always is one clock pulse ahead of the storage register.

The SN54AHCT595 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74AHCT595 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE

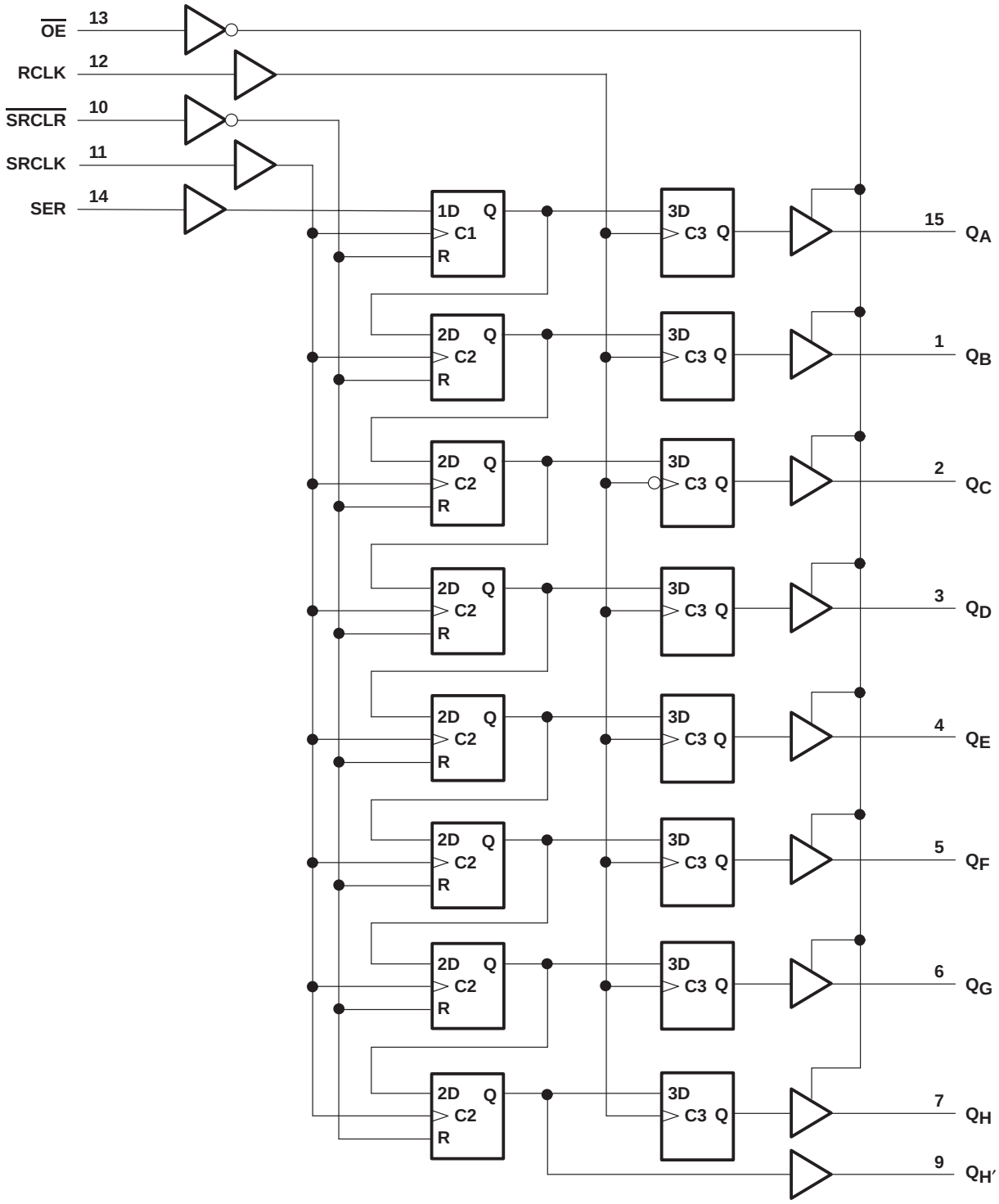
INPUTS					FUNCTION
SER	SRCLK	$\overline{\text{SRCLR}}$	RCLK	$\overline{\text{OE}}$	
X	X	X	X	H	Outputs Q_A–Q_H are disabled.
X	X	X	X	L	Outputs Q_A–Q_H are enabled.
X	X	L	X	X	Shift register is cleared.
L	↑	H	X	X	First stage of the shift register goes low. Other stages store the data of previous stage,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

logic symbol†



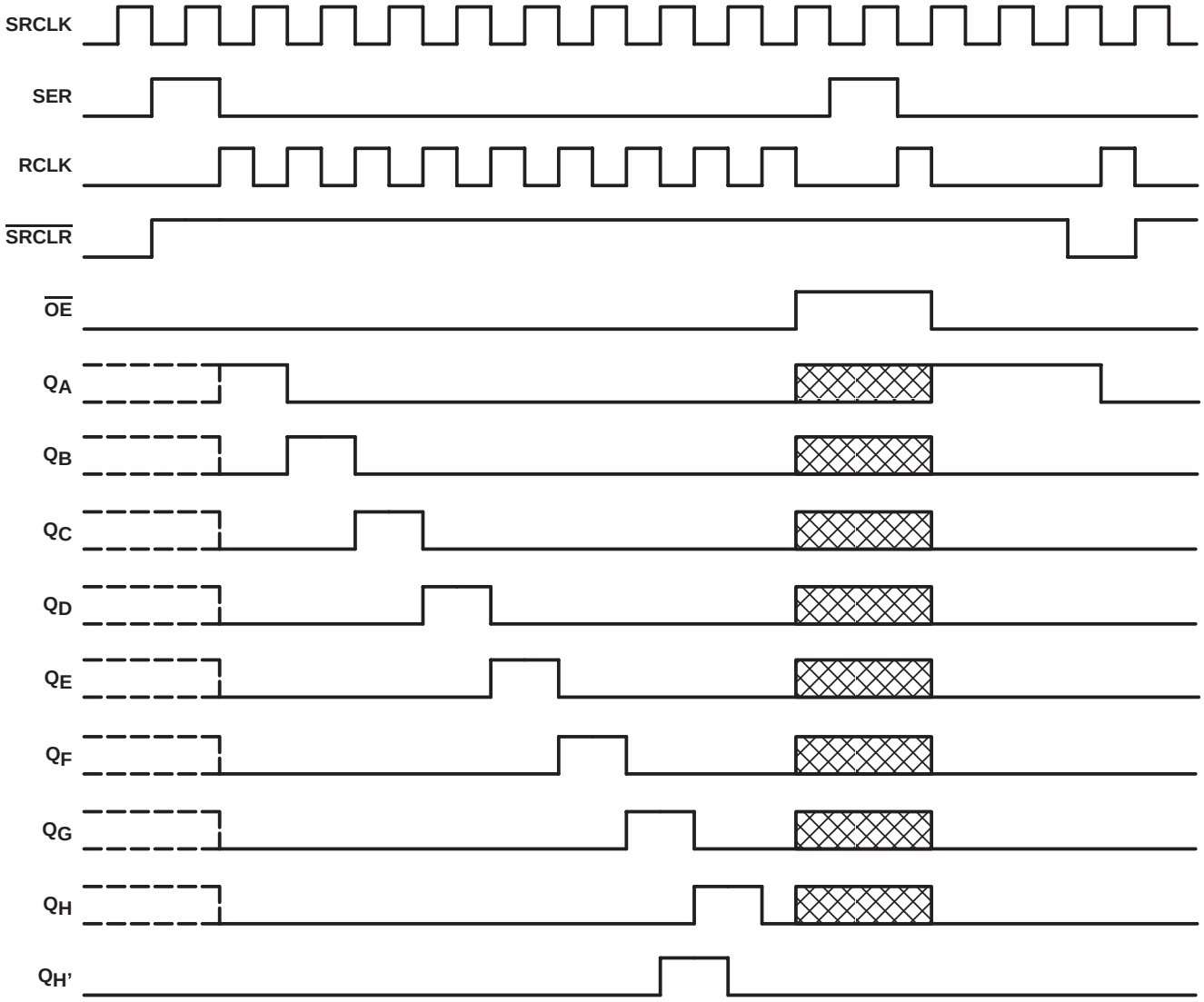
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, DB, J, N, PW, and W packages.

logic diagram (positive logic)



Pin numbers shown are for the D, DB, J, N, PW, and W packages.

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 . . . . . ±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package . . . . . 73°C/W
DB package . . . . . 82°C/W
N package . . . . . 67°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.

recommended operating conditions (see Note 3)

		SN54AHCT595		SN74AHCT595		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.

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

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			SN54AHCT595		SN74AHCT595		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	$V_I = V_{CC}$ or GND	0 V to 5.5 V			±0.1		±1*		±1	μA
I_{OZ}	$V_O = V_{CC}$ or GND	5.5 V			±0.25		±2.5		±2.5	μA
I_{CC}	$V_I = V_{CC}$ or GND, I_O = 0	5.5 V			4		40		40	μA
ΔI_{CC}†	One input at 3.4 V, Other inputs at V_{CC} or GND	5.5 V			1.35		1.5		1.5	mA
C_i	$V_I = V_{CC}$ or GND	5 V		3	10				10	pF
C_o	$V_O = V_{CC}$ or GND	5 V		5.5						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 ± 0.5 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C		SN54AHCT595		SN74AHCT595		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	SRCLK high or low	5		5.5		5.5		ns
		RCLK high or low	5		5.5		5.5		
		$\overline{\text{SRCLR}}$ low	5		5		5		
t_{su}	Setup time	SER before SRCLK↑	3		3		3		ns
		SRCLK↑ before RCLK↑‡	5		5		5		
		$\overline{\text{SRCLR}}$ low before RCLK↑	5		5		5		
		$\overline{\text{SRCLR}}$ high (inactive) before SRCLK↑	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.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54AHCT595		SN74AHCT595		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	135*	170*		115*		115		MHz
			C_L = 50 pF	95	140		85		85		
t_{PLH}	RCLK	Q_A–Q_H	C_L = 15 pF		4.3*	7.4*	1*	8.5*	1	8.5	ns
t_{PHL}					4.3*	7.4*	1*	8.5*	1	8.5	
t_{PLH}	SRCLK	$Q_{H'}$	C_L = 15 pF		4.5*	8.2*	1*	9.4*	1	9.4	ns
t_{PHL}					4.5*	8.2*	1*	9.4*	1	9.4	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 15 pF		4.5*	8*	1*	9.1*	1	9.1	ns
t_{PZH}	$\overline{OE}$	Q_A–Q_H	C_L = 15 pF		4.3*	8.6*	1*	10*	1	10	ns
t_{PZL}					5.4*	8.6*	1*	10*	1	10	
t_{PLH}	RCLK	Q_A–Q_H	C_L = 50 pF		5.6	9.4	1	10.5	1	10.5	ns
t_{PHL}					5.6	9.4	1	10.5	1	10.5	
t_{PLH}	SRCLK	$Q_{H'}$	C_L = 50 pF		6.4	10.2	1	11.4	1	11.4	ns
t_{PHL}					6.4	10.2	1	11.4	1	11.4	
t_{PHL}	$\overline{SRCLR}$	$Q_{H'}$	C_L = 50 pF		6.4	10	1	11.1	1	11.1	ns
t_{PZH}	$\overline{OE}$	Q_A–Q_H	C_L = 50 pF		5.7	10.6	1	12	1	12	ns
t_{PZL}					6.8	10.6	1	12	1	12	
t_{PHZ}	$\overline{OE}$	Q_A–Q_H	C_L = 50 pF		3.5	10.3	1	11	1	11	ns
t_{PLZ}					3.4	10.3	1	11	1	11	

* 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)

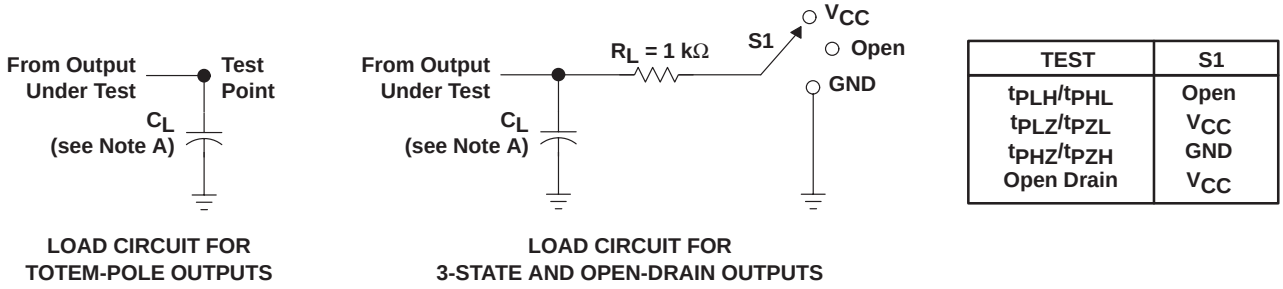
PARAMETER		SN74AHCT595			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		1		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.6		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		3.8		V
$V_{IH(D)}$	High-level dynamic input voltage	2			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.8	V

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

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

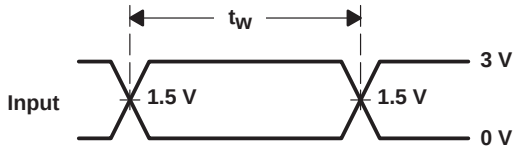
PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	112	pF

PARAMETER MEASUREMENT INFORMATION

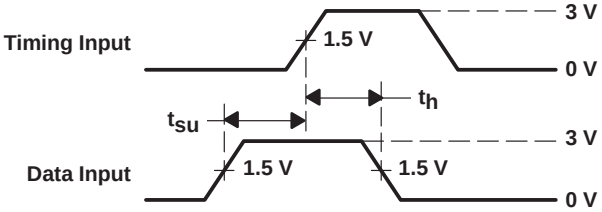


LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

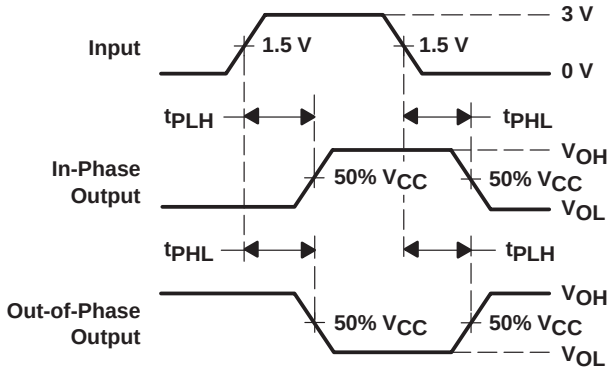
LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS



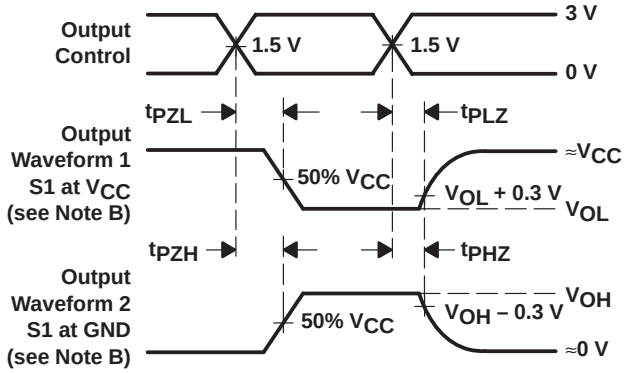
VOLTAGE WAVEFORMS
PULSE DURATION



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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