

8-BIT SHIFT REGISTERS WITH 3-STATE OUTPUT REGISTERS

Check for Samples: [SN74HC595-EP](#)

FEATURES

- 8-Bit Serial-In, Parallel-Out Shift
- Wide Operating Voltage Range of 2 V to 6 V
- High-Current 3-State Outputs Can Drive Up To 15 LSTTL Loads
- Low Power Consumption: 80- μ A (Max) I_{CC}
- $t_{pd} = 13$ ns (Typ)
- ± 6 -mA Output Drive at 5 V
- Low Input Current: 1 μ A (Max)
- Shift Register Has Direct Clear

SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

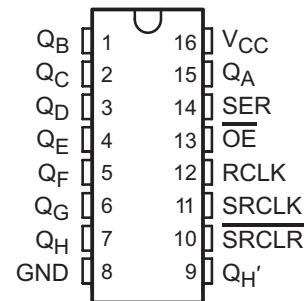
- Controlled Baseline
- One Assembly/Test Site
- One Fabrication Site
- Available in Military ($-55^{\circ}\text{C}/125^{\circ}\text{C}$) Temperature Range⁽¹⁾
- Extended Product Life Cycle
- Extended Product-Change Notification
- Product Traceability

(1) Additional temperature ranges available - contact factory

DESCRIPTION

The SN74HC595 contains 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 both the shift and storage register. The shift register has a direct overriding clear ($\overline{\text{SRCLR}}$) input, serial ($\overline{\text{SER}}$) 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 ($\overline{\text{SRCLK}}$) and storage register clock ($\overline{\text{RCLK}}$) are positive-edge triggered. If both clocks are connected together, the shift register always is one clock pulse ahead of the storage register.

PW PACKAGE
(TOP VIEW)


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.

ORDERING INFORMATION⁽¹⁾

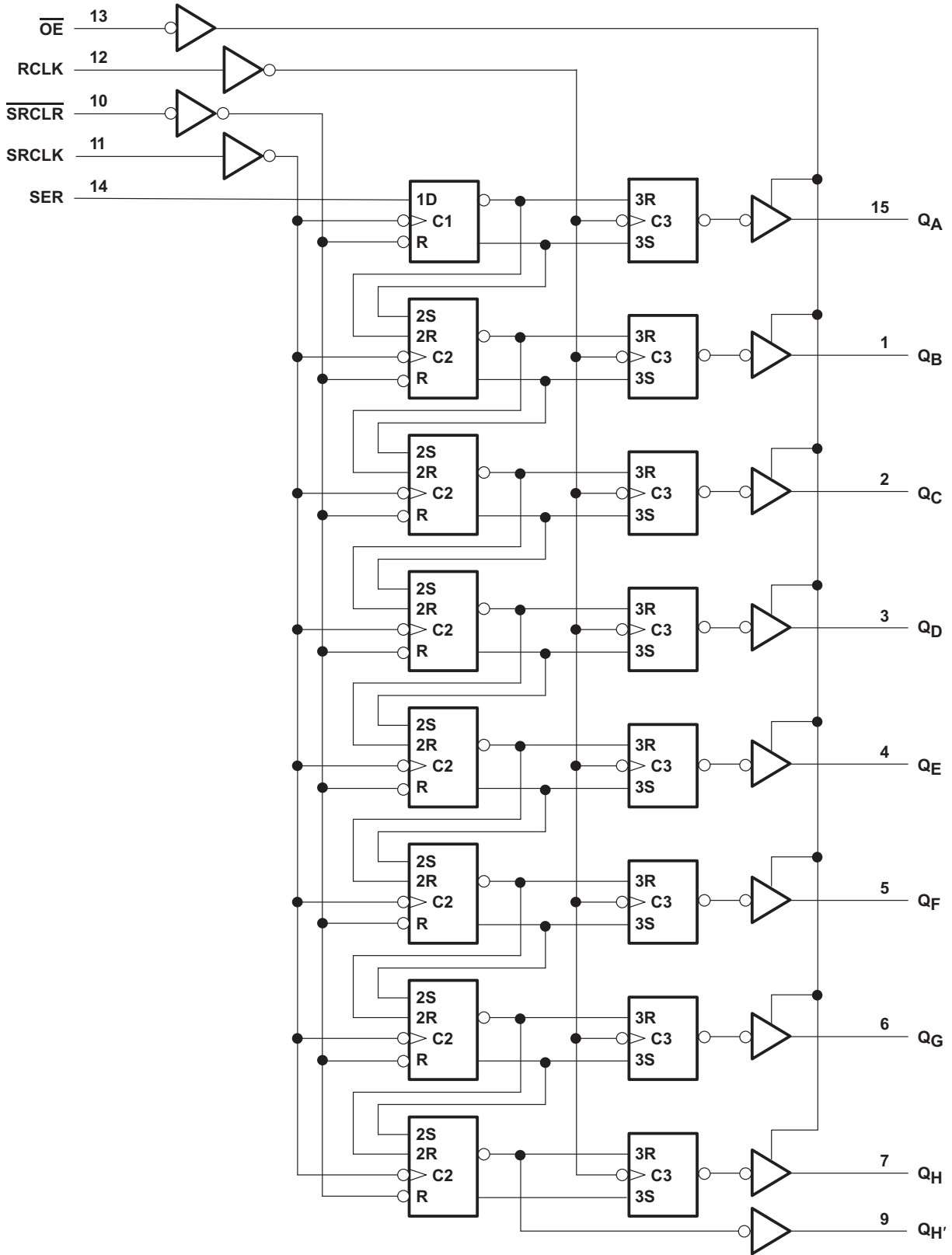
T_A	PACKAGE⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-55°C to 125°C	TSSOP – PW	Reel of 2000	SN74HC595MPWREP	HC595EP

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

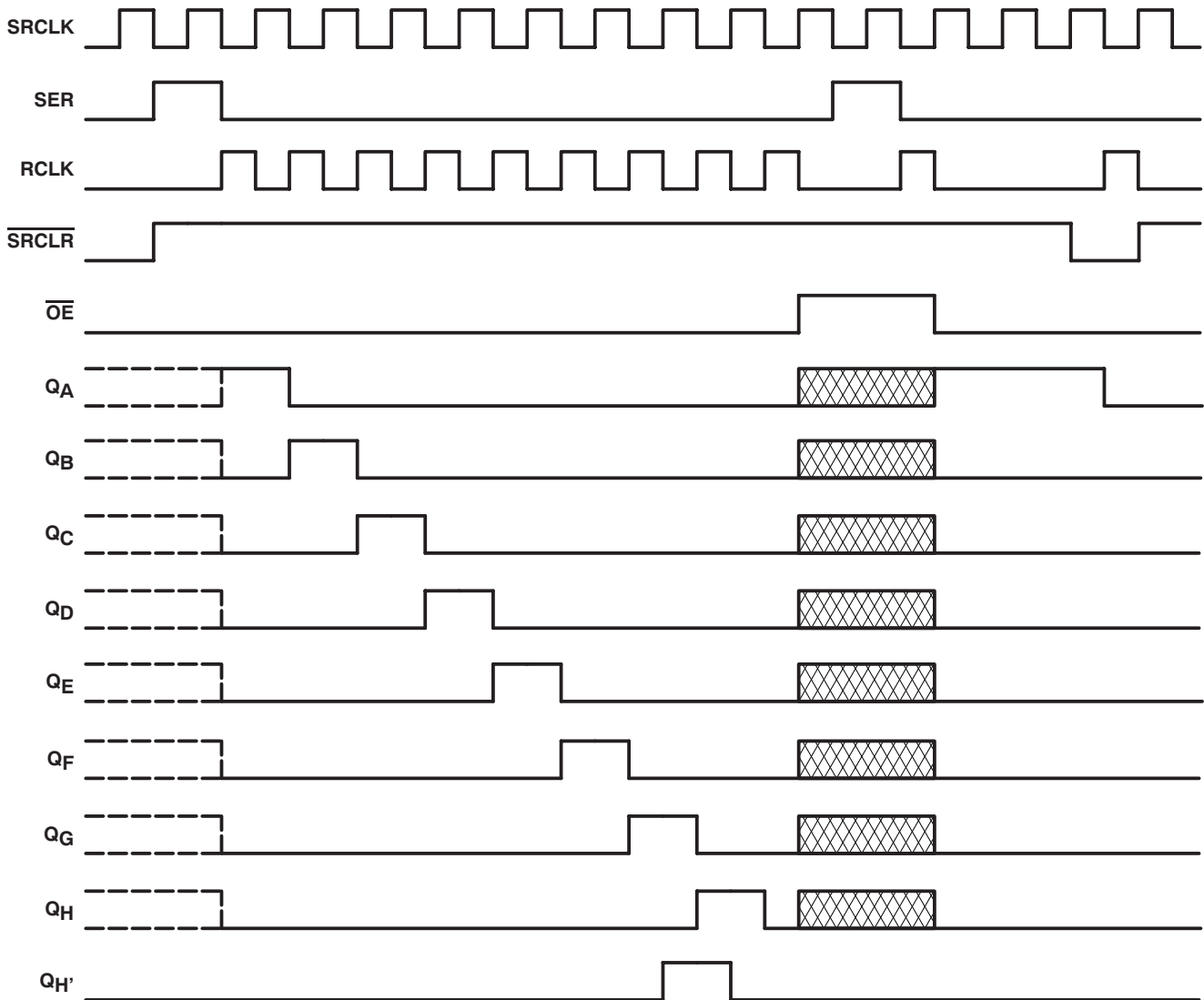
Table 1. FUNCTION TABLE


INPUTS					FUNCTION
SER	SRCLK	SRCLR	RCLK	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	X	X	↑	X	Shift-register data is stored in the storage register.

LOGIC DIAGRAM (POSITIVE LOGIC)



TIMING DIAGRAM



NOTE:  implies that the output is in 3-State mode.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

V_{CC}	Supply voltage range		-0.5 V to 7 V
I_{IK}	Input clamp current ⁽²⁾	$V_I < 0$ or $V_I > V_{CC}$	± 20 mA
I_{OK}	Output clamp current ⁽²⁾	$V_O < 0$ or $V_O > V_{CC}$	± 20 mA
I_O	Continuous output current	$V_O = 0$ to V_{CC}	± 35 mA
	Continuous current through VCC or GND		± 70 mA
θ_{JA}	Package thermal impedance ⁽³⁾		108°C/W
T_{stg}	Storage temperature range		-65°C to 150°C

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

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

		MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	2	5	6	V
V _{IH}	High-level input voltage	V _{CC} = 2 V	1.5		V
		V _{CC} = 4.5 V	3.15		
		V _{CC} = 6 V	4.2		
V _{IL}	Low-level input voltage	V _{CC} = 2 V		0.5	V
		V _{CC} = 4.5 V		1.35	
		V _{CC} = 6 V		1.8	
V _I	Input voltage	0		V _{CC}	V
V _O	Output voltage	0		V _{CC}	V
Δt/Δv	Input transition rise/fall time ⁽²⁾	V _{CC} = 2 V		1000	ns
		V _{CC} = 4.5 V		500	
		V _{CC} = 6 V		400	
T _A	Operating free-air temperature	-55		125	°C

- (1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).
- (2) If this device is used in the threshold region (from V_{ILmax} = 0.5 V to V_{IHmin} = 1.5 V), there is a potential to go into the wrong state from induced grounding, causing double clocking. Operating with the inputs at t_i = 1000 ns and V_{CC} = 2 V does not damage the device; however, functionally, the CLK inputs are not ensured while in the shift, count, or toggle operating modes.

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		UNIT
				MIN	TYP	MAX	MIN	MAX	
V _{OH}	V _I = V _{IH} or V _{IL}	I _{OH} = -20 μA	2 V	1.9	1.998		1.9	V	
			4.5 V	4.4	4.499		4.4		
			6 V	5.9	5.999		5.9		
		4.5 V	Q _H , I _{OH} = -4 mA	3.98	4.3		3.7		
			Q _A -Q _H , I _{OH} = -6 mA	3.98	4.3		3.7		
			6 V	Q _H , I _{OH} = -5.2 mA	5.48	5.8			5.2
Q _A -Q _H , I _{OH} = -7.8 mA	5.48	5.8		5.2					
V _{OL}	V _I = V _{IH} or V _{IL}	I _{OL} = 20 μA	2 V		0.002	0.1		0.1	
			4.5 V		0.001	0.1		0.1	
			6 V		0.001	0.1		0.1	
		4.5 V	Q _H , I _{OL} = 4 mA		0.17	0.26		0.4	
			Q _A -Q _H , I _{OL} = 6 mA		0.17	0.26		0.4	
			6 V	Q _H , I _{OL} = 5.2 mA		0.15	0.26		0.4
Q _A -Q _H , I _{OL} = 7.8 mA		0.15	0.26		0.4				
I _I	V _I = V _{CC} or 0	6 V		±0.1	±100		±1000	nA	
I _{OZ}	V _O = V _{CC} or 0, Q _A -Q _H	6 V		±0.01	±0.5		±10	μA	
I _{CC}	V _I = V _{CC} or 0, I _O = 0	6 V			8		160	μA	
C _i		2 V to 6 V		3	10		10	pF	

TIMING REQUIREMENTS

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

		V _{CC}	T _A = 25°C		T _A = –55°C to 125°C		UNIT
			MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	2 V		6		4.2	MHz
		4.5 V		31		21	
		6 V		36		25	
t _w	SRCLK or RCLK high or low	2 V	80		120		ns
		4.5 V	16		24		
		6 V	14		20		
	$\overline{\text{SRCLR}}$ low	2 V	80		120		
		4.5 V	16		24		
		6 V	14		20		
t _{su}	SER before SRCLK↑	2 V	100		150		ns
		4.5 V	20		30		
		6 V	17		25		
	SRCLK↑ before RCLK↑ ⁽¹⁾	2 V	75		113		
		4.5 V	15		23		
		6 V	13		19		
	$\overline{\text{SRCLR}}$ low before RCLK↑	2 V	50		75		
		4.5 V	10		15		
		6 V	9		13		
	$\overline{\text{SRCLR}}$ high (inactive) before SRCLK↑	2 V	50		75		
		4.5 V	10		15		
		6 V	9		13		
t _h	Hold time, SER after SRCLK↑	2 V	0		0		ns
		4.5 V	0		0		
		6 V	0		0		

(1) 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, $C_L = 50$ pF (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
f_{max}			2 V	6	26		4.2	MHz	
			4.5 V	31	38		21		
			6 V	36	42		25		
t_{pd}	SRCLK	$Q_{H'}$	2 V		50	160		240	ns
			4.5 V		17	32		48	
			6 V		14	27		41	
	RCLK	Q_A-Q_H	2 V		50	150		225	
			4.5 V		17	30		45	
			6 V		14	26		38	
t_{PHL}	$\overline{\text{SRCLR}}$	$Q_{H'}$	2 V		51	175		261	ns
			4.5 V		18	35		52	
			6 V		15	30		44	
t_{en}	$\overline{\text{OE}}$	Q_A-Q_H	2 V		40	150		255	ns
			4.5 V		15	30		45	
			6 V		13	26		38	
t_{dis}	$\overline{\text{OE}}$	Q_A-Q_H	2 V		42	200		300	ns
			4.5 V		23	40		60	
			6 V		20	34		51	
t_t		Q_A-Q_H	2 V		28	60		90	ns
			4.5 V		8	12		18	
			6 V		6	10		15	
		$Q_{H'}$	2 V		28	75		110	
			4.5 V		8	15		22	
			6 V		6	13		19	

SWITCHING CHARACTERISTICS

 over recommended operating free-air temperature range, $C_L = 150$ pF (unless otherwise noted)

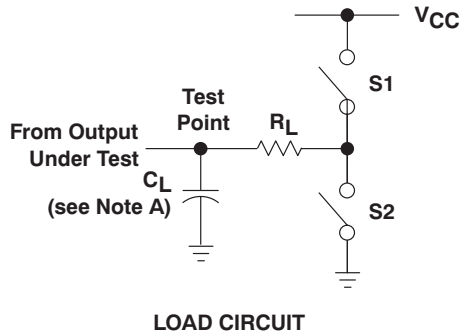
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	RCLK	Q_A-Q_H	2 V		60	200		300	ns
			4.5 V		22	40		60	
			6 V		19	34		51	
t_{en}	$\overline{\text{OE}}$	Q_A-Q_H	2 V		70	200		298	ns
			4.5 V		23	40		60	
			6 V		19	34		51	
t_t		Q_A-Q_H	2 V		45	210		315	ns
			4.5 V		17	42		63	
			6 V		13	36		53	

OPERATING CHARACTERISTICS

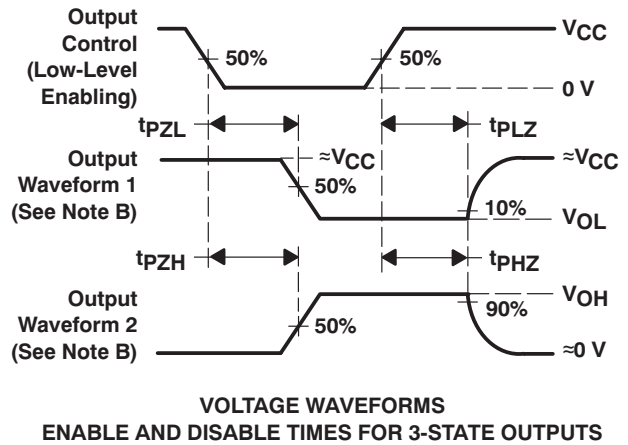
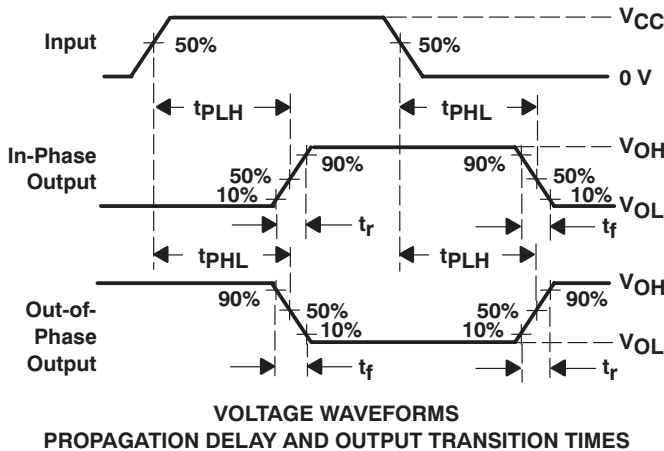
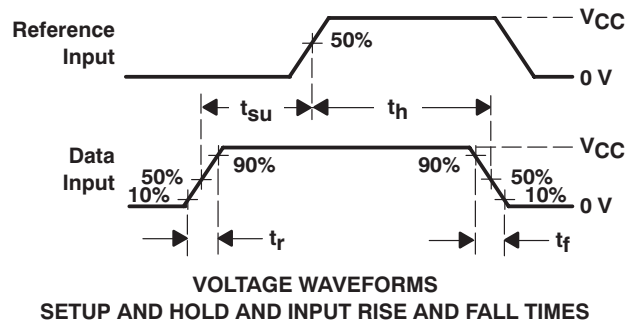
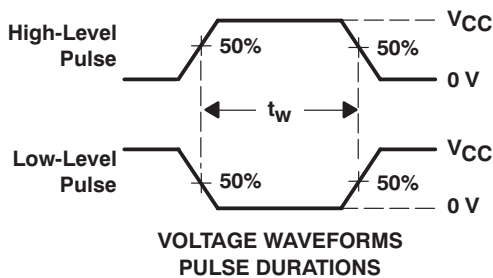
 $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load	400	pF

PARAMETER MEASUREMENT INFORMATION



PARAMETER	R_L	C_L	S1	S2
t_{en}	1 k Ω	50 pF or 150 pF	Open	Closed
			Closed	Open
t_{dis}	1 k Ω	50 pF	Open	Closed
			Closed	Open
t_{pd} or t_t		50 pF or 150 pF	Open	Open



- NOTES:
- A. C_L includes probe and test-fixture 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. 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.
 - D. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
 - E. The outputs are measured one at a time, with one input transition per measurement.
 - F. t_{pLZ} and t_{pHZ} are the same as t_{dis} .
 - G. t_{pZL} and t_{pZH} are the same as t_{en} .
 - H. 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⁾
SN74HC595MPWREP	PREVIEW	TSSOP	PW	16	2000	TBD	Call TI	Call TI

⁽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), Pb-Free (RoHS Exempt), 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.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74HC595-EP :

- Catalog: [SN74HC595](#)
- Military: [SN54HC595](#)

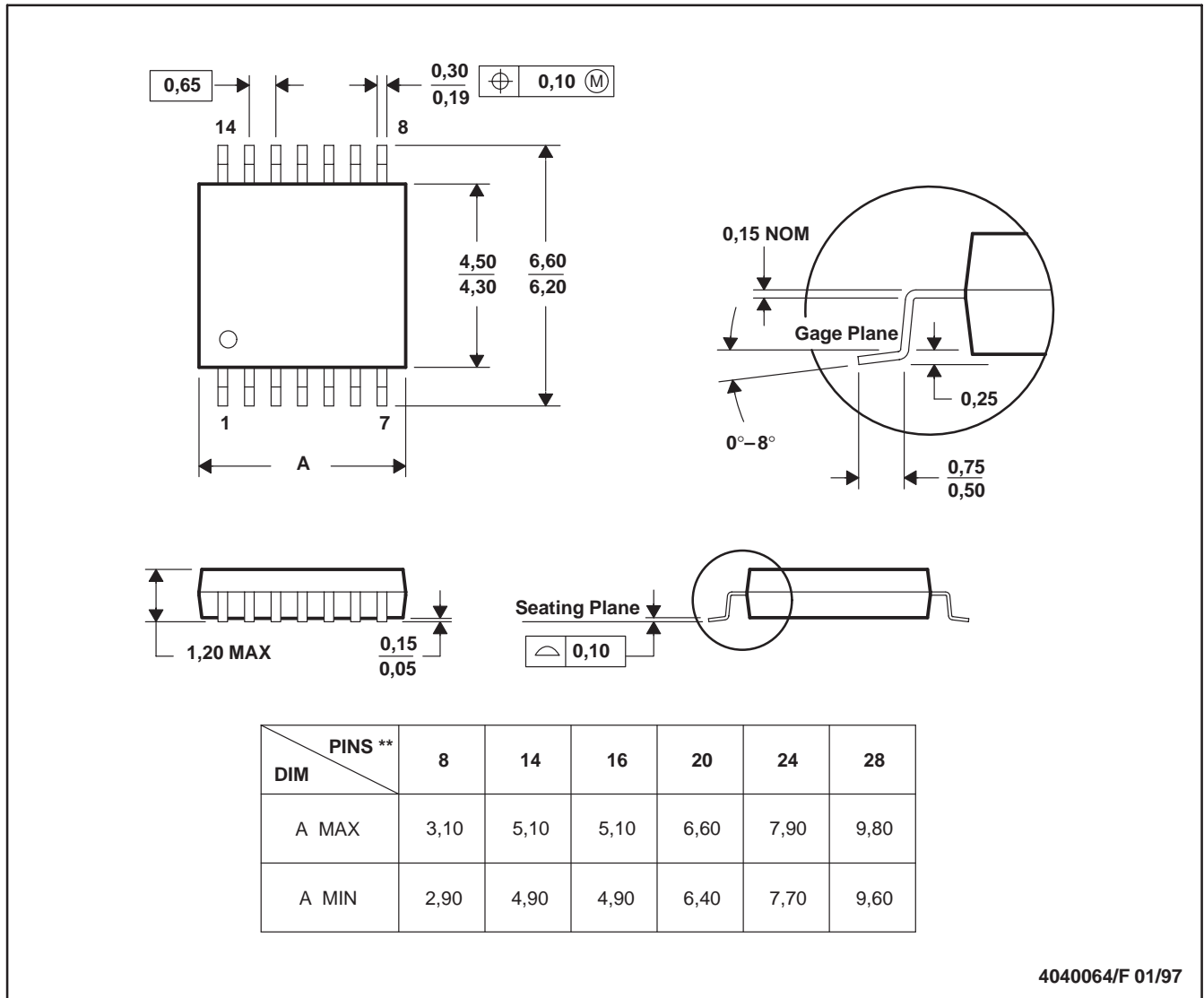
NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated