

# SN54LS595, SN54LS596, SN74LS595, SN74LS596 8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

SDLS006

D2634, JANUARY 1981 (REVISED MARCH 1988)

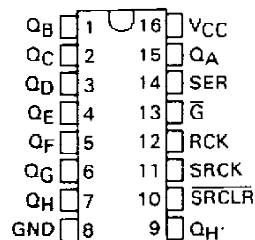
- 8-Bit Serial-In, Parallel-Out Shift Registers with Storage
- Choice of 3-State ('LS595) or Open-Collector ('LS596) Parallel Outputs
- Shift Register Has Direct Clear
- Accurate Shift Frequency: DC to 20 MHz

## description

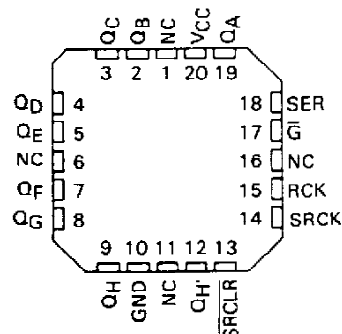
These devices each contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state ('LS595) or open-collector ('LS596) outputs. Separate clocks are provided for both the shift register and the storage register. The shift register has a direct-overriding clear, serial input, and serial output pins for cascading.

Both the shift register and storage register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the shift register state will always be one clock pulse ahead of the storage register.

SN54LS595, SN54LS596 . . . J OR W PACKAGE  
SN74LS595, SN74LS596 . . . N PACKAGE  
(TOP VIEW)

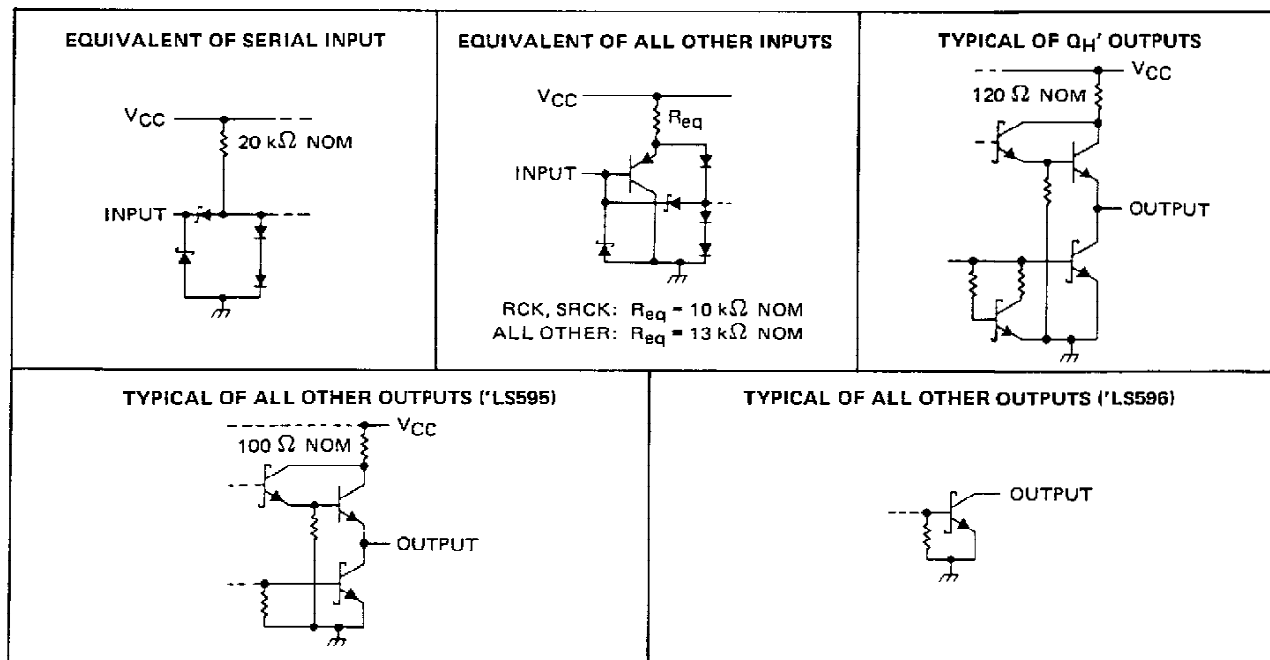


SN54LS595, SN54LS596 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

## schematics of inputs and outputs



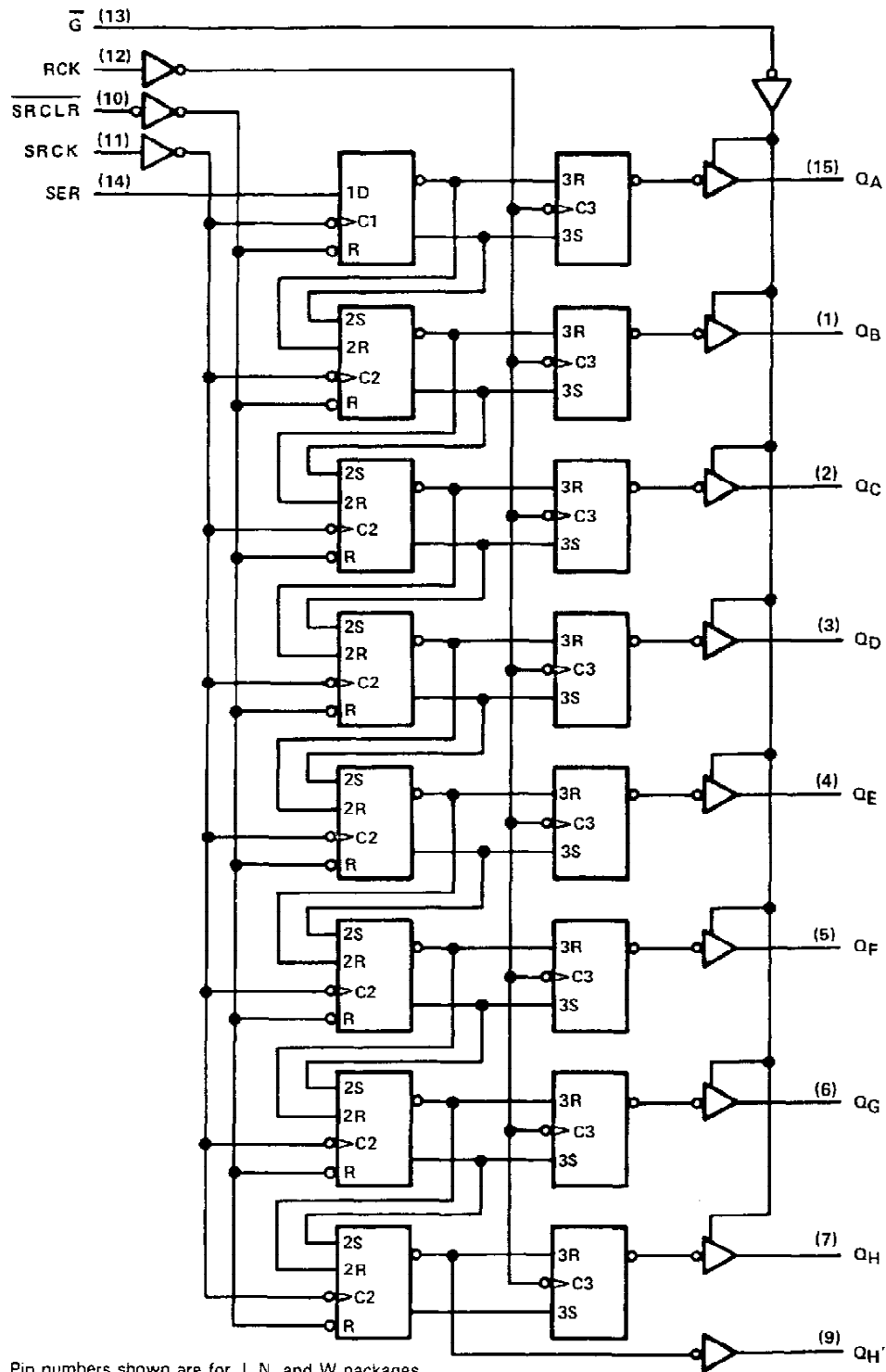
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# **SN54LS595, SN54LS596, SN74LS595, SN74LS596** **8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES**

logic diagram (positive logic)



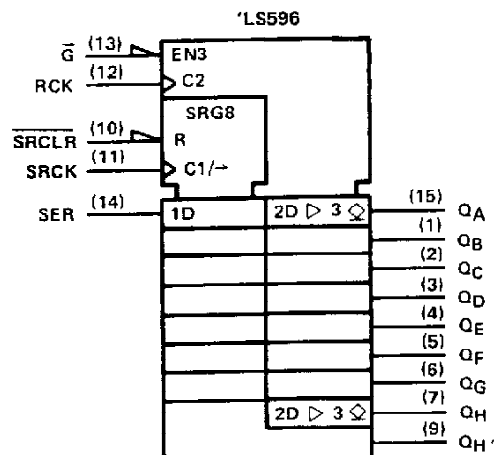
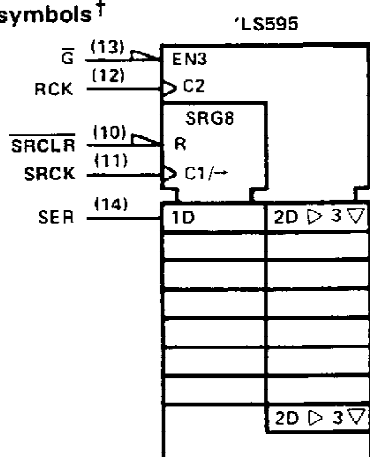
Pin numbers shown are for J, N, and W packages.

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# SN54LS595, SN54LS596, SN74LS595, SN74LS596 8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for J, N, and W packages.

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	7 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54LS595, SN54LS596	–55°C to 125°C
SN74LS595, SN74LS596	0°C to 70°C
Storage temperature range	–65°C to 150°C

NOTE 1: Voltage values are with respect to the network ground terminal.

## recommended operating conditions

		SN54LS'			SN74LS'			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.7			0.8	V
$V_{OH}$	High-level output voltage			5.5			5.5	V
$I_{OH}$	High-level output current			–1			–1	mA
				–1			–2.6	
$I_{OL}$	Low-level output current			8			16	mA
				12			24	
$f_{SRCK}$	Shift clock frequency	0		20	0		20	MHz
$t_w(SRCK)$	Duration of shift clock pulse	25			25			ns
$t_w(RCK)$	Duration of register clock pulse	20			20			ns
$t_w(SRCLR)$	Duration of shift clear pulse, low level	20			20			ns
$t_{su}$	Setup time	SRCLR inactive before SRCK ↑	20		20			ns
		SER before SRCK ↑	20		20			
		SRCK ↑ before RCK ↑ (see Note 2)	40		40			
		SRCLR low before RCK ↑	40		40			
$t_h$	Hold time		0			0		ns
$T_A$	Operating free-air temperature	–55		125	0		70	°C

NOTE 2: This setup time ensures the register will see stable data from the shift-register outputs. The clocks may be connected together, in which case the storage register state will be one clock pulse behind the shift register.

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**SN54LS595, SN54LS596, SN74LS595, SN74LS596**  
**8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES**

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

PARAMETER		TEST CONDITIONS †	SN54LS*		SN74LS*		UNIT		
			MIN	TYP‡	MAX	MIN		TYP‡	MAX
V <sub>IK</sub>		V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5		-1.5	V	
V <sub>OH</sub>	'LS595 Q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX	I <sub>OH</sub> = -1 mA		2.4	3.2		V	
	I <sub>OH</sub> = -2.6 mA			2.4	3.1				
	Q <sub>H</sub> '		I <sub>OH</sub> = -1 mA		2.4	3.2	2.4		3.2
I <sub>OH</sub>	'LS596 Q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V			0.1		0.1	mA	
V <sub>OL</sub>	Q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX	I <sub>OL</sub> = 12 mA		0.25	0.4	0.25	0.4	V
	I <sub>OL</sub> = 24 mA				0.35	0.5			
	I <sub>OL</sub> = 8 mA		0.25	0.4	0.25	0.4			
	Q <sub>H</sub> '		I <sub>OL</sub> = 16 mA				0.35	0.5	
I <sub>OZH</sub>	'LS595 Q	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 2.7 V			20		20	μA	
I <sub>OZL</sub>	'LS595 Q	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 0.4 V			-20		-20	μA	
I <sub>I</sub>		V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1		0.1	mA	
I <sub>IH</sub>		V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			20		20	μA	
I <sub>IL</sub>	SER	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-0.4		-0.4	mA	
	All others				-0.2		-0.2		
I <sub>OS</sub> §	'LS595 Q	V <sub>CC</sub> = MAX, V <sub>O</sub> = 0 V			-30	-130	-30	-130	mA
	Q <sub>H</sub> '				-20	-100	-20	-100	
I <sub>CCH</sub>	'LS595	V <sub>CC</sub> = MAX, All possible inputs grounded, All outputs open			33	50	33	50	mA
	'LS596				30	45	30	45	
I <sub>CCL</sub>	'LS595				42	65	42	65	mA
	'LS596				36	55	36	55	
I <sub>CCZ</sub>	'LS595				44	65	44	65	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

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**SN54LS595, SN54LS596, SN74LS595, SN74LS596**  
**8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES**

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS595			'LS596			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$t_{PLH}$	SRCK $\uparrow$	$Q_H'$	$R_L = 1\text{ k}\Omega$ , $C_L = 30\text{ pF}$		12	18		14	21	ns
$t_{PHL}$					17	25		20	30	ns
$t_{PLH}$	RCK $\uparrow$	$Q_A$ thru $Q_H$	$R_L = 667\ \Omega$ , $C_L = 45\text{ pF}$		12	18		28	42	ns
$t_{PHL}$					24	35		24	35	ns
$t_{PZH}$	$\overline{G} \downarrow$	$Q_A$ thru $Q_H$			20	30				ns
$t_{PZL}$					25	38				ns
$t_{PHZ}$	$\overline{G} \uparrow$	$Q_A$ thru $Q_H$	$R_L = 667\ \Omega$ , $C_L = 5\text{ pF}$		20	30				ns
$t_{PLZ}$					25	38				ns
$t_{PLH}$	$\overline{G} \uparrow$	$Q_A$ thru $Q_H$	$R_L = 667\ \Omega$ , $C_L = 45\text{ pF}$					40	60	ns
$t_{PHL}$	$\overline{G} \downarrow$	$Q_A$ thru $Q_H$						25	38	ns
$t_{PHL}$	SRCLR $\downarrow$	$Q_H'$	$R_L = 1\text{ k}\Omega$ , $C_L = 30\text{ pF}$		24	35		24	35	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-86717012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 86717012A SNJ54LS 595FK	<a href="#">Samples</a>
5962-8671701EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	<a href="#">Samples</a>
5962-8671701EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	<a href="#">Samples</a>
5962-8671701FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	<a href="#">Samples</a>
5962-8671701FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	<a href="#">Samples</a>
SN54LS595J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54LS595J	<a href="#">Samples</a>
SN54LS595J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54LS595J	<a href="#">Samples</a>
SN74LS595D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LS595DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	<a href="#">Samples</a>
SN74LS595N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS595N	<a href="#">Samples</a>
SN74LS595N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS595N	<a href="#">Samples</a>
SN74LS595N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	0 to 70		
SN74LS595N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	0 to 70		
SN74LS595NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS595N	<a href="#">Samples</a>
SN74LS595NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS595N	<a href="#">Samples</a>
SN74LS596D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	0 to 70		
SN74LS596D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	0 to 70		
SN74LS596N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS596N	<a href="#">Samples</a>
SN74LS596N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS596N	<a href="#">Samples</a>
SN74LS596NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS596N	<a href="#">Samples</a>
SN74LS596NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS596N	<a href="#">Samples</a>
SNJ54LS595FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 86717012A SNJ54LS 595FK	<a href="#">Samples</a>
SNJ54LS595FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 86717012A SNJ54LS 595FK	<a href="#">Samples</a>
SNJ54LS595J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SNJ54LS595J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	<a href="#">Samples</a>
SNJ54LS595W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	<a href="#">Samples</a>
SNJ54LS595W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	<a href="#">Samples</a>

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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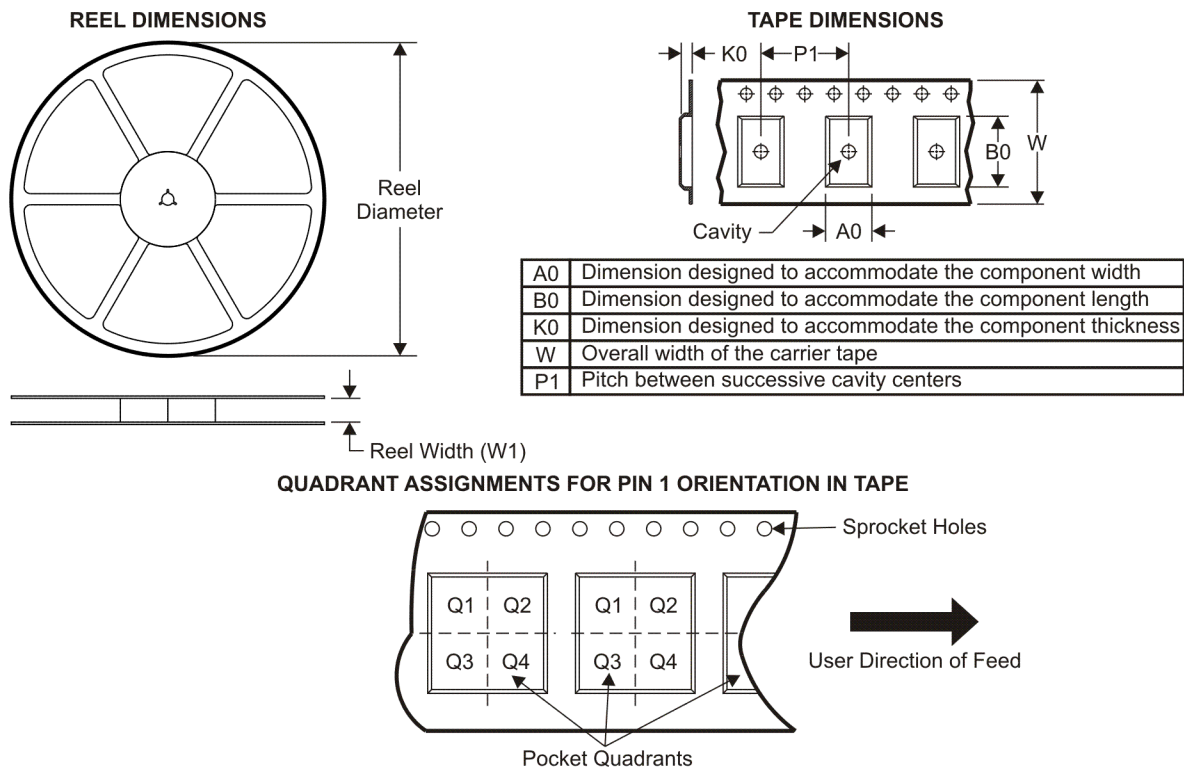


**OTHER QUALIFIED VERSIONS OF SN54LS595, SN74LS595 :**

- Catalog: [SN74LS595](#)
- Military: [SN54LS595](#)

**NOTE: Qualified Version Definitions:**

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

**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS595DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS595DR	SOIC	D	16	2500	333.2	345.9	28.6

J (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)

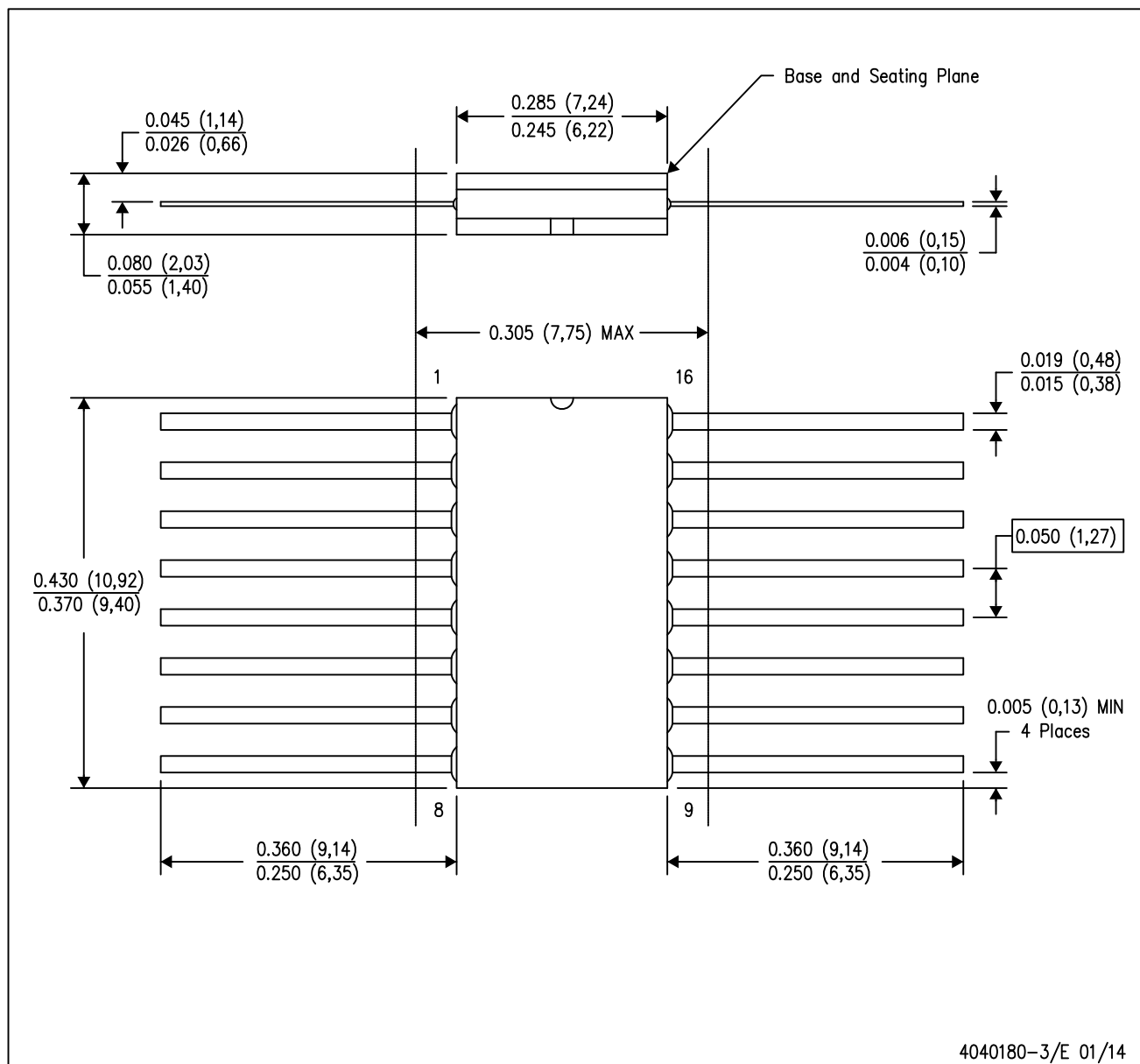


4040083/F 03/03

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

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP2-F16 and JEDEC MO-092AC

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

## 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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



## NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AC.



D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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