

# SN54192, SN54193, SN54LS192, SN54LS193, SN74192, SN74193, SN74LS192, SN74LS193 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

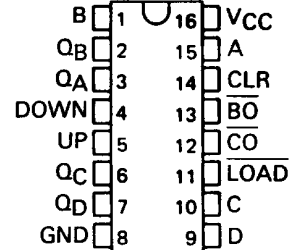
SDLS074 - DECEMBER 1972 - REVISED MARCH 1988

- Cascading Circuitry Provided Internally
- Synchronous Operation
- Individual Preset to Each Flip-Flop
- Fully Independent Clear Input

SN54192, SN54193, SN54LS192,  
SN54LS193 . . . J OR W PACKAGE  
SN74192, SN74193 . . . N PACKAGE  
SN74LS192, SN74LS193 . . . D OR N PACKAGE

TYPES	TYPICAL MAXIMUM COUNT FREQUENCY	TYPICAL POWER DISSIPATION
'192, '193	32 MHz	325 mW
'LS192, 'LS193	32 MHz	95 mW

(TOP VIEW)



## description

These monolithic circuits are synchronous reversible (up/down) counters having a complexity of 55 equivalent gates. The '192 and 'LS192 circuits are BCD counters and the '193 and 'LS193 are 4-bit binary counters. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincidentally with each other when so instructed by the steering logic. This mode of operation eliminates the output counting spikes which are normally associated with asynchronous (ripple-clock) counters.

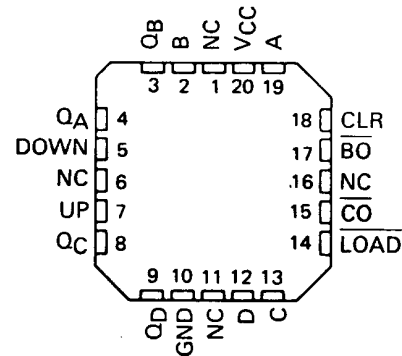
The outputs of the four master-slave flip-flops are triggered by a low-to-high-level transition of either count (clock) input. The direction of counting is determined by which count input is pulsed while the other count input is high.

All four counters are fully programmable; that is, each output may be preset to either level by entering the desired data at the data inputs while the load input is low. The output will change to agree with the data inputs independently of the count pulses. This feature allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

A clear input has been provided which forces all outputs to the low level when a high level is applied. The clear function is independent of the count and load inputs. The clear, count, and load inputs are buffered to lower the drive requirements. This reduces the number of clock drivers, etc., required for long words.

These counters were designed to be cascaded without the need for external circuitry. Both borrow and carry outputs are available to cascade both the up- and down-counting functions. The borrow output produces a pulse equal in width to the count-down input when the counter underflows. Similarly, the carry output produces a pulse equal in width to the count-up input when an overflow condition exists. The counters can then be easily cascaded by feeding the borrow and carry outputs to the count-down and count-up inputs respectively of the succeeding counter.

SN54LS192, SN54LS193 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

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

	SN54'	SN54LS'	SN74'	SN74LS'	UNIT
Supply voltage, $V_{CC}$ (see Note 1)	7	7	7	7	V
Input voltage	5.5	7	5.5	7	V
Operating free-air temperature range	-55 to 125		0 to 70		°C
Storage temperature range	-65 to 150		-65 to 150		°C

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

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



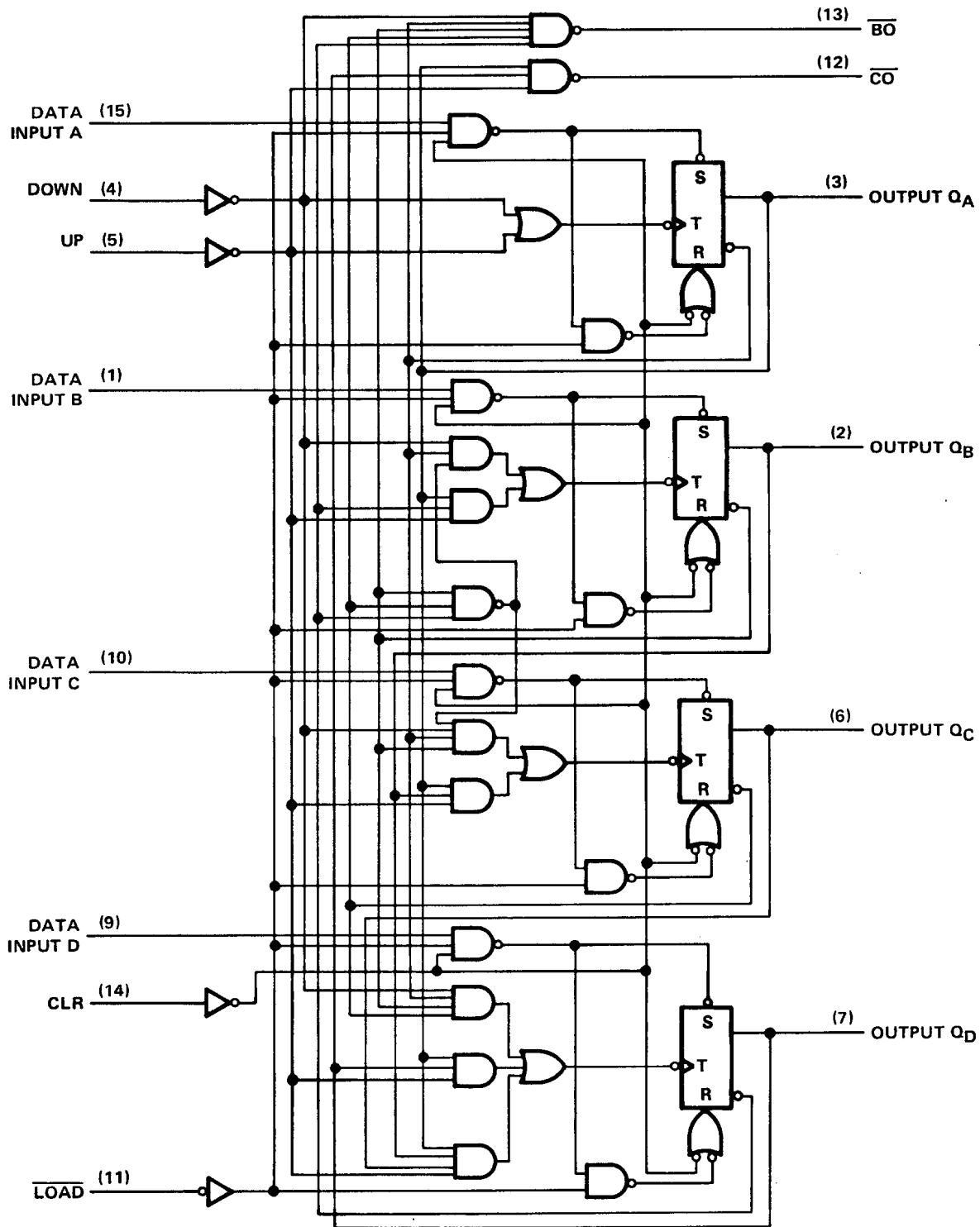
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# SN54192, SN54LS192, SN74192, SN74LS192 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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logic diagram (positive logic)



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

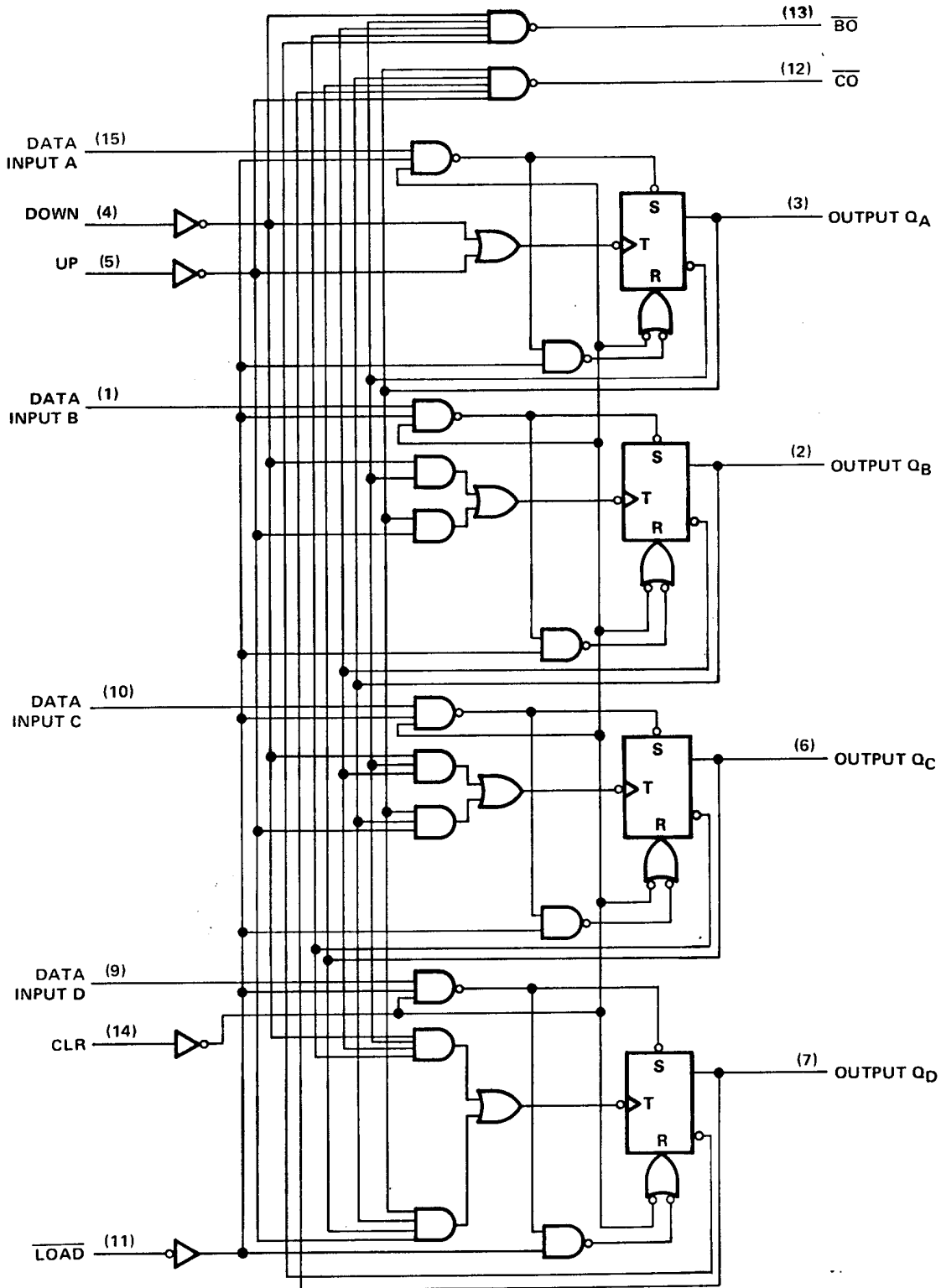


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# SN54193, SN54LS193, SN74193, SN74LS193 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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logic diagram (positive logic)



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

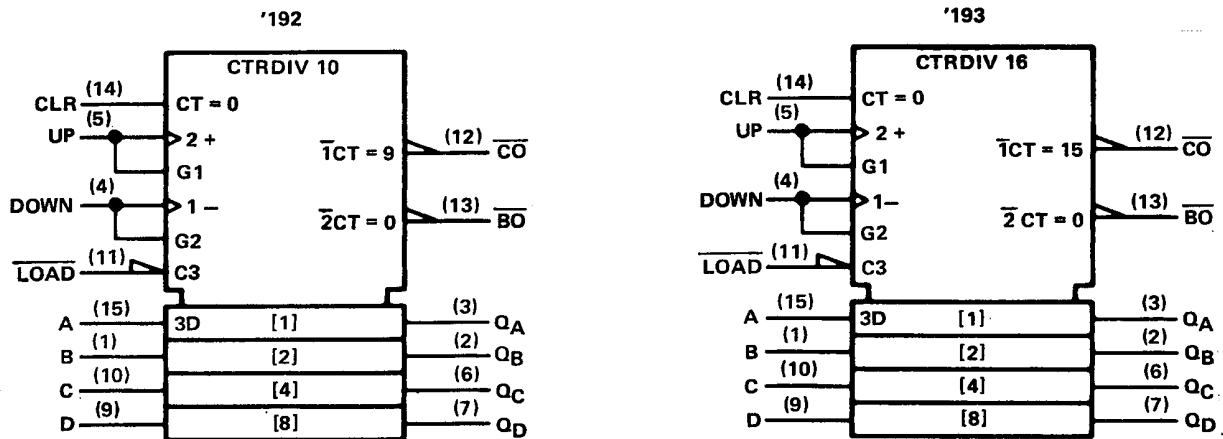


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**SN54192, SN54193, SN54LS192, SN54LS193,  
SN74192, SN74193, SN74LS192, SN74LS193  
SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)**

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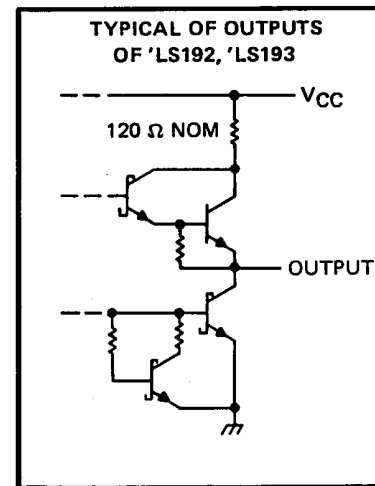
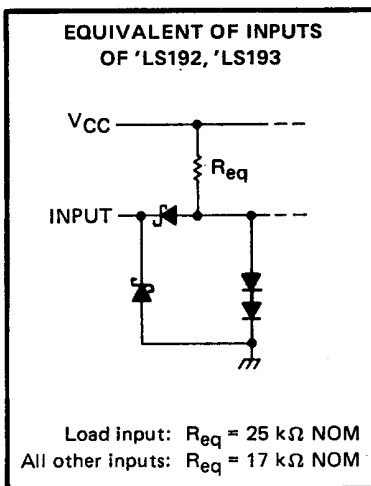
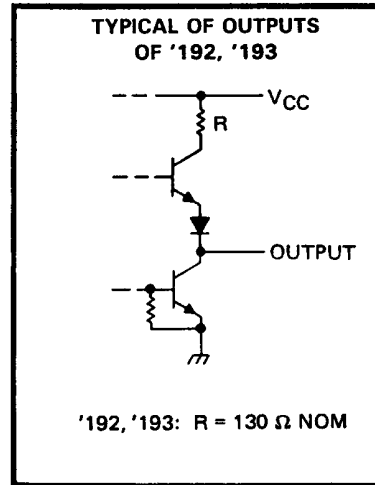
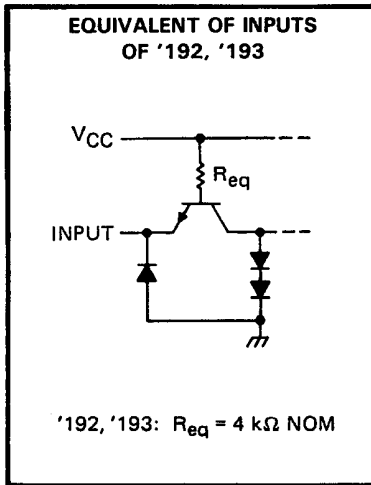
logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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

schematics of inputs and outputs



# SN54192, SN54LS192, SN74192, SN74LS192 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

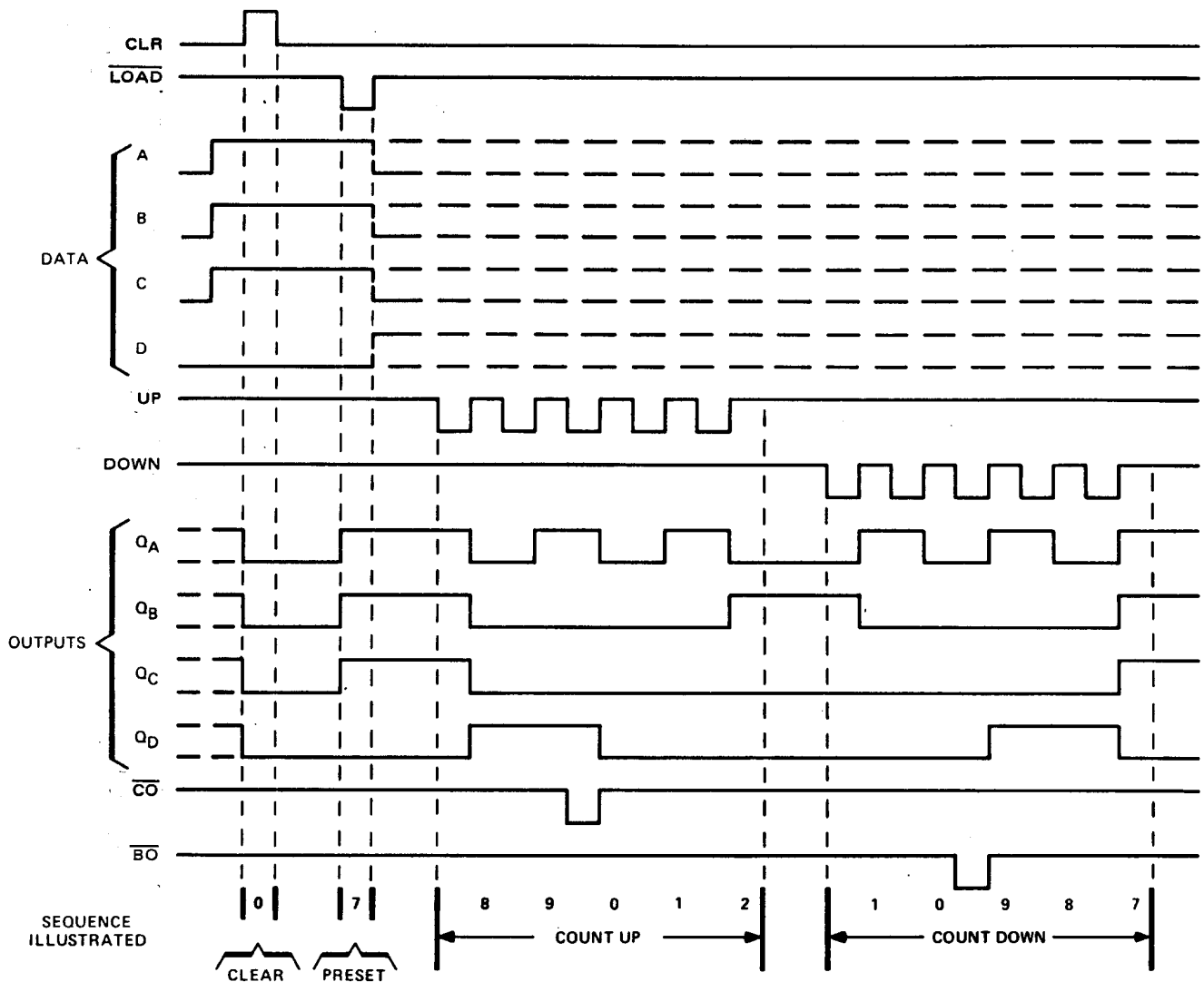
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## '192, 'LS192 DECADE COUNTERS

### typical clear, load, and count sequences

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to BCD seven.
3. Count up to eight, nine, carry, zero, one, and two.
4. Count down to one, zero, borrow, nine, eight, and seven.



NOTES: A. Clear overrides load, data, and count inputs.

B. When counting up, count-down input must be high; when counting down, count-up input must be high.



# SN54193, SN54LS193, SN74193, SN74LS193 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

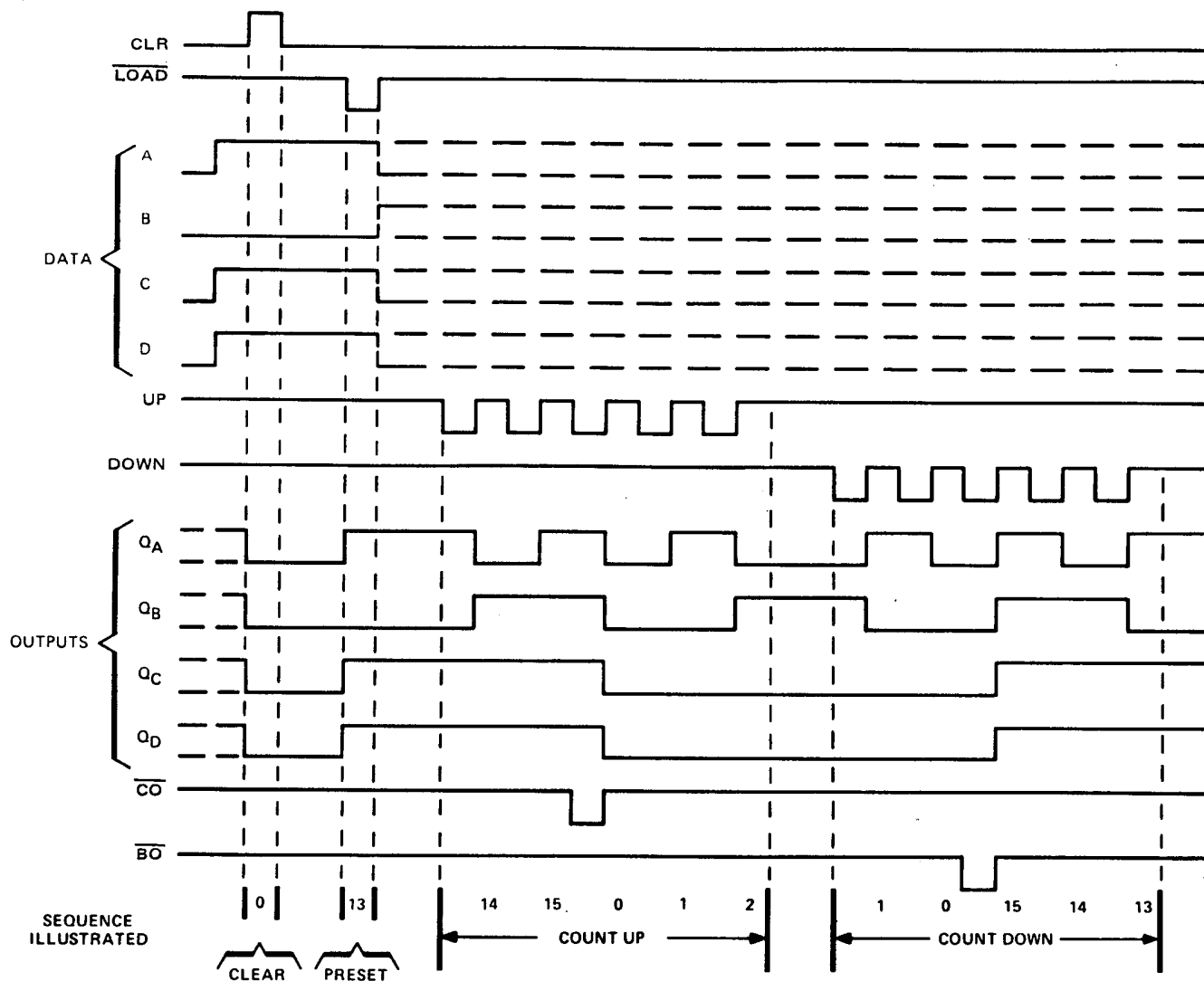
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## '193, 'LS193 BINARY COUNTERS

### typical clear, load, and count sequences

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to binary thirteen.
3. Count up to fourteen, fifteen, carry, zero, one, and two.
4. Count down to one, zero, borrow, fifteen, fourteen, and thirteen.



NOTES: A. Clear overrides load, data, and count inputs.  
B. When counting up, count-down input must be high; when counting down, count-up input must be high.



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# SN54192, SN54193, SN74192, SN74193 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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## recommended operating conditions

		SN54192 SN54193			SN74192 SN74193			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I <sub>OH</sub>	High-level output current			-0.4			-0.4	mA
I <sub>OL</sub>	Low-level output current			16			16	mA
f <sub>clock</sub>	Clock frequency	0		25	0		25	MHz
t <sub>w</sub>	Width of any input pulse	20			20			ns
t <sub>su</sub>	Data setup time, (see Figure 1)	20			20			ns
t <sub>h</sub>	Hold time	Data, high or low			0			ns
		LOAD			3			
T <sub>A</sub>	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54192 SN54193			SN74192 SN74193			UNIT	
		MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V <sub>IH</sub>	High-level input voltage		2			2		V	
V <sub>IL</sub>	Low-level input voltage			0.8			0.8	V	
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA					-1.5	V	
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -0.4 mA			2.4	3.4		2.4 3.4	V
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 16 mA				0.2 0.4		0.2 0.4	V
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V					1	1	mA
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V					40	40	μA
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V					-1.6	-1.6	mA
I <sub>OS</sub>	Short-circuit output current§	V <sub>CC</sub> = MAX			-20		-65	-18 -65	mA
I <sub>CC</sub>	Supply current	V <sub>CC</sub> = MAX, See Note 2				65 89		65 102	mA

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

‡ 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.

NOTE 2: I<sub>CC</sub> is measured with all outputs open, clear and load inputs grounded, and all other inputs at 4.5 V.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

PARAMETER¶	FROM INPUT	TO OUTPUT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f <sub>max</sub>			C <sub>L</sub> = 15 pF, R <sub>L</sub> = 400 Ω, See Figures 1 and 2	25	32		MHz
t <sub>PLH</sub>	UP	$\overline{CO}$			17	26	ns
t <sub>PHL</sub>					16	24	
t <sub>PLH</sub>	DOWN	$\overline{BO}$			16	24	ns
t <sub>PHL</sub>					16	24	
t <sub>PLH</sub>	UP OR DOWN	Q			25	38	ns
t <sub>PHL</sub>					31	47	
t <sub>PLH</sub>	$\overline{LOAD}$	Q			27	40	ns
t <sub>PHL</sub>					29	40	
t <sub>PHL</sub>	CLR	Q			22	35	ns

¶ f<sub>max</sub> ≡ maximum clock frequency

t<sub>PLH</sub> ≡ propagation delay time, low-to-high-level output

t<sub>PHL</sub> ≡ propagation delay time, high-to-low-level output



# SN54LS192, SN54LS193, SN74LS192, SN74LS193 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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## recommended operating conditions

		SN54LS192 SN54LS193			SN74LS192 SN74LS193			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I <sub>OH</sub>	High-level output current			-400			-400	μA
I <sub>OL</sub>	Low-level output current			4			8	mA
f <sub>clock</sub>	Clock frequency	0		25	0		25	MHz
t <sub>w</sub>	Width of any input pulse	20			20			ns
t <sub>su</sub>	Clear inactive-state setup time	15			15			ns
	Load inactive-state setup time	15			15			ns
	Data setup time (see Figure 1)	20			20			ns
t <sub>h</sub>	Data hold time	5			5			ns
T <sub>A</sub>	Operating free-air temperature range	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS192 SN54LS193			SN74LS192 SN74LS193			UNIT	
		MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V <sub>IH</sub>	High-level input voltage	2			2			V	
V <sub>IL</sub>	Low-level input voltage			0.7			0.8	V	
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA		-1.5	-1.5		V		
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL max</sub> , I <sub>OH</sub> = -400 μA		2.5	3.4		2.7	3.4	V
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL max</sub>		I <sub>OL</sub> = 4 mA	0.25	0.4	0.15	0.4	V
		I <sub>OL</sub> = 8 mA			0.35	0.5			
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V		0.1		0.1		mA	
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V		20		20		μA	
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V		-0.4		-0.4		mA	
I <sub>OS</sub>	Short-circuit output current§	V <sub>CC</sub> = MAX		-20	-100	-20	-100	mA	
I <sub>CC</sub>	Supply current	V <sub>CC</sub> = MAX, See Note 2		19	34	19	34	mA	

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

‡ 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.

NOTE 2: I<sub>CC</sub> is measured with all outputs open, clear and load inputs grounded, and all other inputs at 4.5 V.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

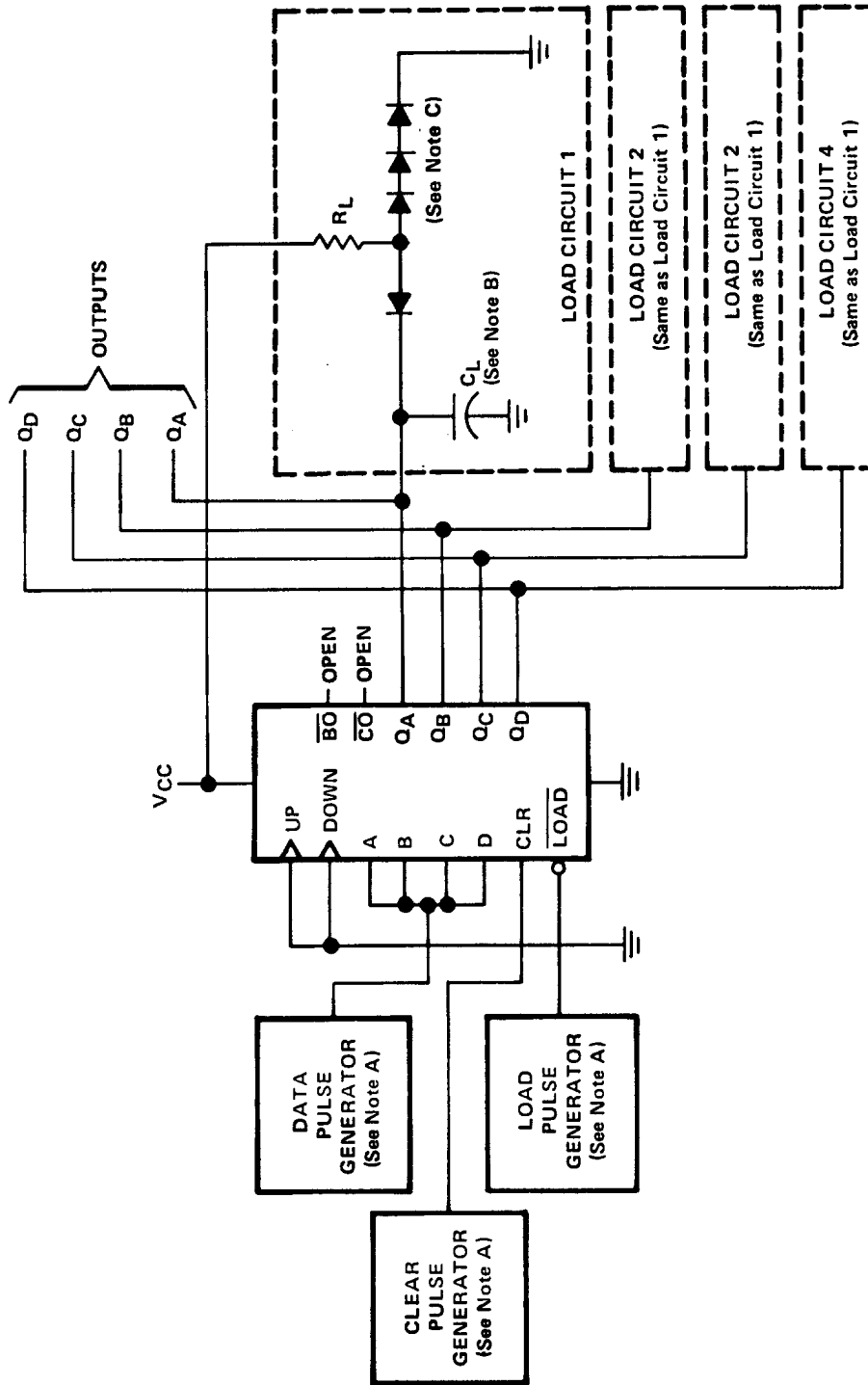
PARAMETER	FROM INPUT	TO OUTPUT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f <sub>max</sub>			C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2 kΩ, See Figures 1 and 2	25	32		MHz
t <sub>PLH</sub>	UP	$\overline{CO}$			17	26	ns
t <sub>PHL</sub>					18	24	
t <sub>PLH</sub>	DOWN	$\overline{BO}$			16	24	ns
t <sub>PHL</sub>					15	24	
t <sub>PLH</sub>	UP OR DOWN	Q			27	38	ns
t <sub>PHL</sub>					30	47	
t <sub>PLH</sub>	$\overline{LOAD}$	Q			24	40	ns
t <sub>PHL</sub>					25	40	
t <sub>PHL</sub>	CLR	Q			23	35	ns



SN54192, SN54193, SN54LS192, SN54LS193,  
 SN74192, SN74193, SN74LS192, SN74LS193  
 SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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PARAMETER MEASUREMENT INFORMATION



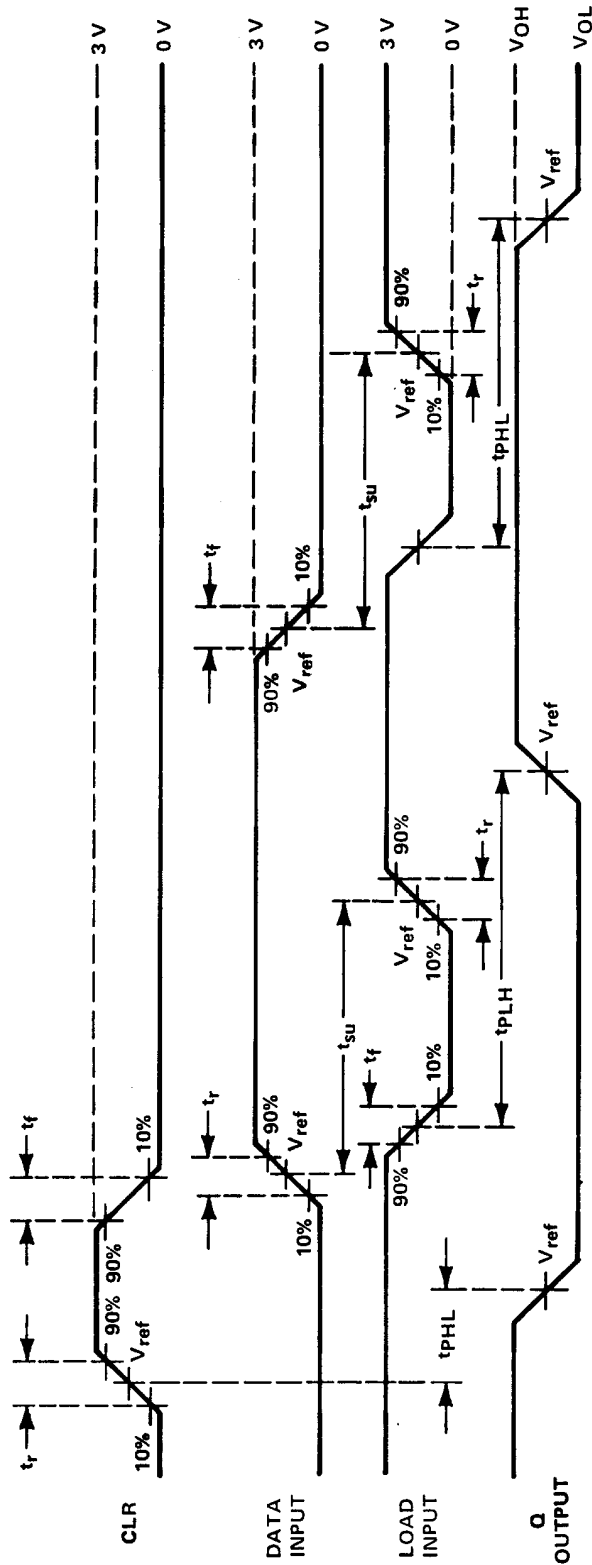
TEST CIRCUIT

- NOTES: A. The pulse generators have the following characteristics:  $Z_{out} \approx 50 \Omega$  and for the data pulse generator  $PRR \leq 500 \text{ kHz}$ , duty cycle = 50%; for the load pulse generator  $PRR$  is two times data  $PRR$ , duty cycle = 50%.
- B.  $C_L$  includes probe and jig capacitance.
- C. Diodes are 1N3064 or equivalent.
- D.  $t_r$  and  $t_f \leq 7 \text{ ns}$ .
- E.  $V_{ref}$  is 1.5 V for '192 and '193, 1.3 V for 'LS192 and 'LS193.

FIGURE 1A - CLEAR, SETUP AND LOAD TIMES

SN54192, SN54193, SN54LS192, SN54LS193,  
 SN74192, SN74193, SN74LS192, SN74LS193  
**SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)**  
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PARAMETER MEASUREMENT INFORMATION



VOLTAGE WAVEFORMS

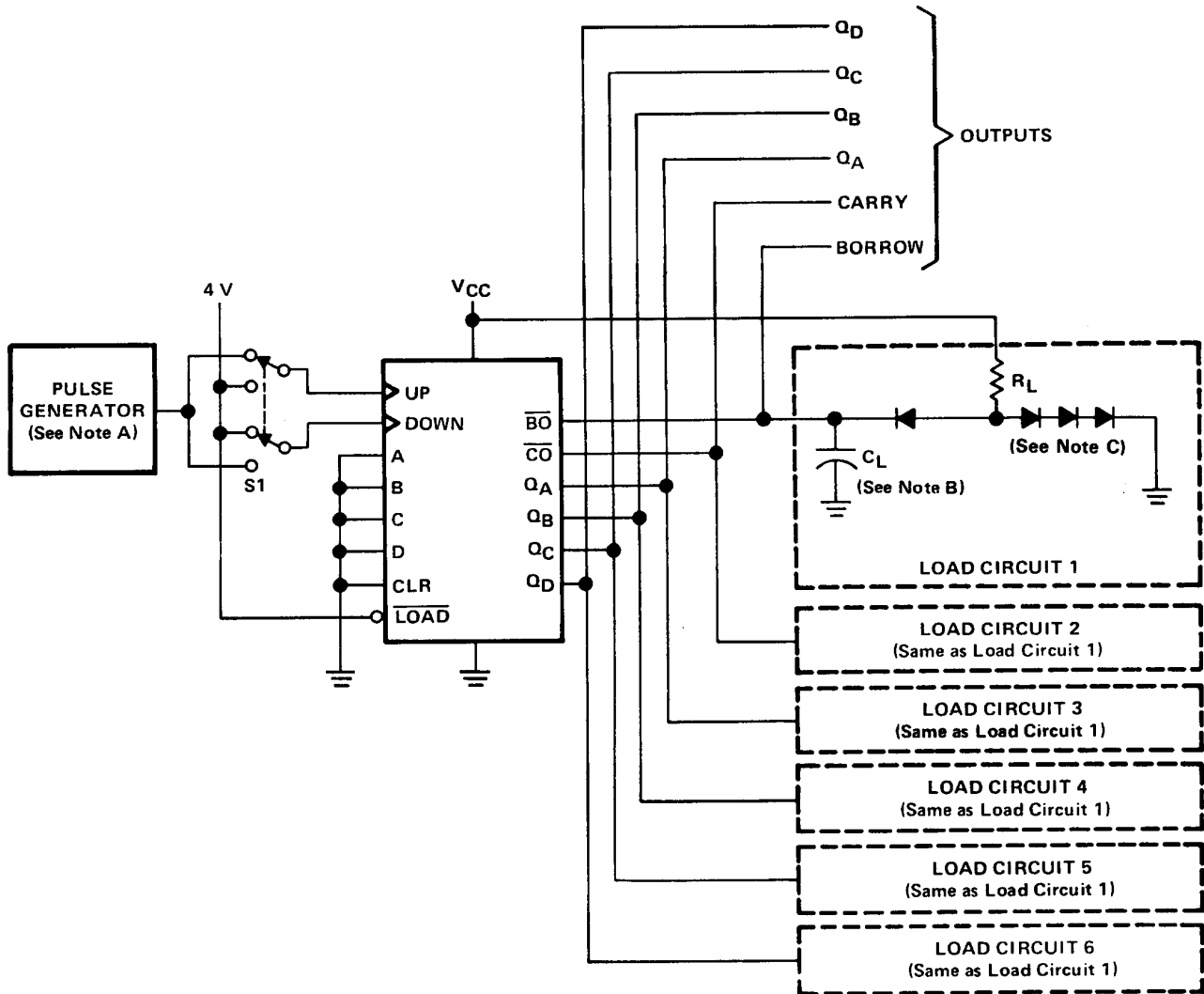
- NOTES: A. The pulse generators have the following characteristics:  $Z_{out} \approx 50 \Omega$  and for the data pulse generator PRR  $\leq 500$  kHz, duty cycle = 50%; for the load pulse generator PRR is two times data PRR, duty cycle = 50%  
 B.  $C_L$  includes probe and jig capacitance.  
 C. Diodes are 1N3064 or equivalent.  
 D.  $t_r$  and  $t_f \leq 7$  ns.  
 E.  $V_{ref}$  is 1.5 V for '192 and '193, 1.3 V for 'LS192 and 'LS193.

FIGURE 1B - CLEAR, SETUP, AND LOAD TIMES

**SN54192, SN54193, SN54LS192, SN54LS193,  
SN74192, SN74193, SN74LS192, SN74LS193**  
**SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)**

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**PARAMETER MEASUREMENT INFORMATION**



**TEST CIRCUIT**

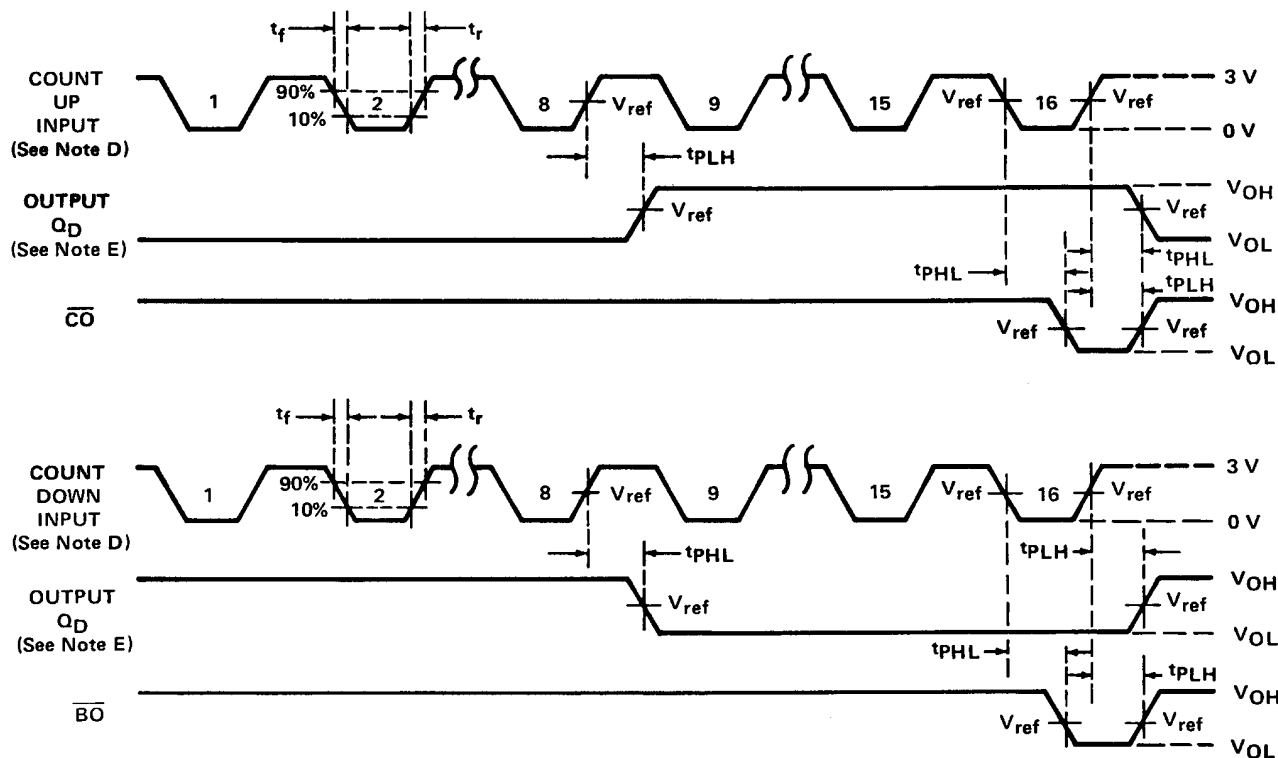
- NOTES:**
- A. The pulse generators have the following characteristics:  $PRR \approx 1 \text{ MHz}$ ,  $Z_{out} \approx 50 \Omega$ , duty cycle = 50%.
  - B.  $C_L$  includes probe and jig capacitance.
  - C. Diodes are 1N3064 or equivalent.
  - D. Count-up and count-down pulse shown are for the '193 and 'LS193 binary counters. Count cycle for '192 and 'LS192 decade counters is 1 through 10.
  - E. Waveforms for outputs  $Q_A$ ,  $Q_B$ , and  $Q_C$  are omitted to simplify the drawing.
  - F.  $t_r$  and  $t_f \leq 7 \text{ ns}$ .
  - G.  $V_{ref}$  is 1.5 V for '192 and '193, 1.3 V for 'LS192 and 'LS193.

**FIGURE 2A - PROPAGATION DELAY TIMES**

**SN54192, SN54193, SN54LS192, SN54LS193,  
SN74192, SN74193, SN74LS192, SN74LS193  
SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)**

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**PARAMETER MEASUREMENT INFORMATION**



**VOLTAGE WAVEFORMS**

- NOTES: A. The pulse generators have the following characteristics: PRR  $\approx$  1 MHz,  $Z_{out} \approx 50 \Omega$ , duty cycle = 50%.  
 B.  $C_L$  includes probe and jig capacitance.  
 C. Diodes are 1N3064 or equivalent.  
 D. Count-up and count-down pulse shown are for the '193 and 'LS193 binary counters. Count cycle for '192 and 'LS192 decade counters is 1 through 10.  
 E. Waveforms for outputs  $Q_A$ ,  $Q_B$ , and  $Q_C$  are omitted to simplify the drawing.  
 F.  $t_r$  and  $t_f \leq 7$  ns.  
 G.  $V_{ref}$  is 1.5 V for '192 and '193, 1.3 V for 'LS192 and 'LS193.

**FIGURE 2B - PROPAGATION DELAY TIMES**



**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
5962-9558401QEA	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QE A SNJ54192J
5962-9558401QFA	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QF A SNJ54192W
5962-9558401QFA	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QF A SNJ54192W
76006012A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76006012A SNJ54LS 193FK
76006012A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76006012A SNJ54LS 193FK
7600601EA	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601EA SNJ54LS193J
7600601EA	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601EA SNJ54LS193J
7600601FA	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601FA SNJ54LS193W
7600601FA	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601FA SNJ54LS193W
<a href="#">JM38510/31508B2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508B2A
<a href="#">JM38510/31508B2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508B2A
JM38510/31508B2A.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508B2A
JM38510/31508B2A.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508B2A
<a href="#">JM38510/31508BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BEA

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">JM38510/31508BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BEA
JM38510/31508BEA.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BEA
JM38510/31508BEA.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BEA
<a href="#">JM38510/31508BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BFA
<a href="#">JM38510/31508BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BFA
JM38510/31508BFA.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BFA
JM38510/31508BFA.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BFA
<a href="#">JM38510/31508SFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508SFA
<a href="#">JM38510/31508SFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508SFA
JM38510/31508SFA.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508SFA
JM38510/31508SFA.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508SFA
<a href="#">M38510/31508B2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508B2A
<a href="#">M38510/31508B2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508B2A
<a href="#">M38510/31508BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BEA
<a href="#">M38510/31508BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BEA
<a href="#">M38510/31508BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BFA
<a href="#">M38510/31508BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508BFA

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
M38510/31508SFA	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508SFA
M38510/31508SFA	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31508SFA
SN54192J	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54192J
SN54192J	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54192J
SN54192J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54192J
SN54192J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54192J
SN54LS193J	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS193J
SN54LS193J	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS193J
SN54LS193J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS193J
SN54LS193J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS193J
SN74LS193D	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	0 to 70	LS193
SN74LS193D	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	0 to 70	LS193
SN74LS193DR	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS193
SN74LS193DR	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS193
SN74LS193DR.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS193
SN74LS193DR.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS193
SN74LS193N	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS193N
SN74LS193N	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS193N
SN74LS193N.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS193N
SN74LS193N.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS193N
SN74LS193NE4	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS193N
SN74LS193NE4	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS193N
SN74LS193NSR	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS193
SN74LS193NSR	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS193
SN74LS193NSR.A	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS193
SN74LS193NSR.A	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS193
SNJ54192J	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QE A SNJ54192J

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SNJ54192J</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QE A SNJ54192J
SNJ54192J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QE A SNJ54192J
SNJ54192J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QE A SNJ54192J
<a href="#">SNJ54192W</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QF A SNJ54192W
<a href="#">SNJ54192W</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QF A SNJ54192W
SNJ54192W.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QF A SNJ54192W
SNJ54192W.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9558401QF A SNJ54192W
<a href="#">SNJ54LS193FK</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76006012A SNJ54LS 193FK
<a href="#">SNJ54LS193FK</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76006012A SNJ54LS 193FK
SNJ54LS193FK.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76006012A SNJ54LS 193FK
SNJ54LS193FK.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76006012A SNJ54LS 193FK
<a href="#">SNJ54LS193J</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601EA SNJ54LS193J
<a href="#">SNJ54LS193J</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601EA SNJ54LS193J

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SNJ54LS193J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601EA SNJ54LS193J
SNJ54LS193J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601EA SNJ54LS193J
<a href="#">SNJ54LS193W</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601FA SNJ54LS193W
<a href="#">SNJ54LS193W</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601FA SNJ54LS193W
SNJ54LS193W.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601FA SNJ54LS193W
SNJ54LS193W.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600601FA SNJ54LS193W

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**OTHER QUALIFIED VERSIONS OF SN54LS193, SN54LS193-SP, SN74LS193 :**

- Catalog : [SN74LS193](#), [SN54LS193](#)
- Military : [SN54LS193](#)
- Space : [SN54LS193-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

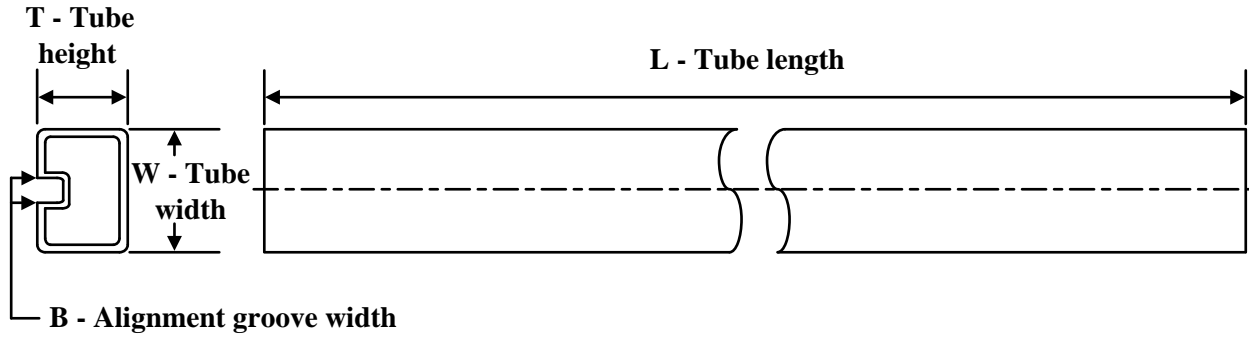
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS193DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS193DR	SOIC	D	16	2500	340.5	336.1	32.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9558401QFA	W	CFP	16	25	506.98	26.16	6220	NA

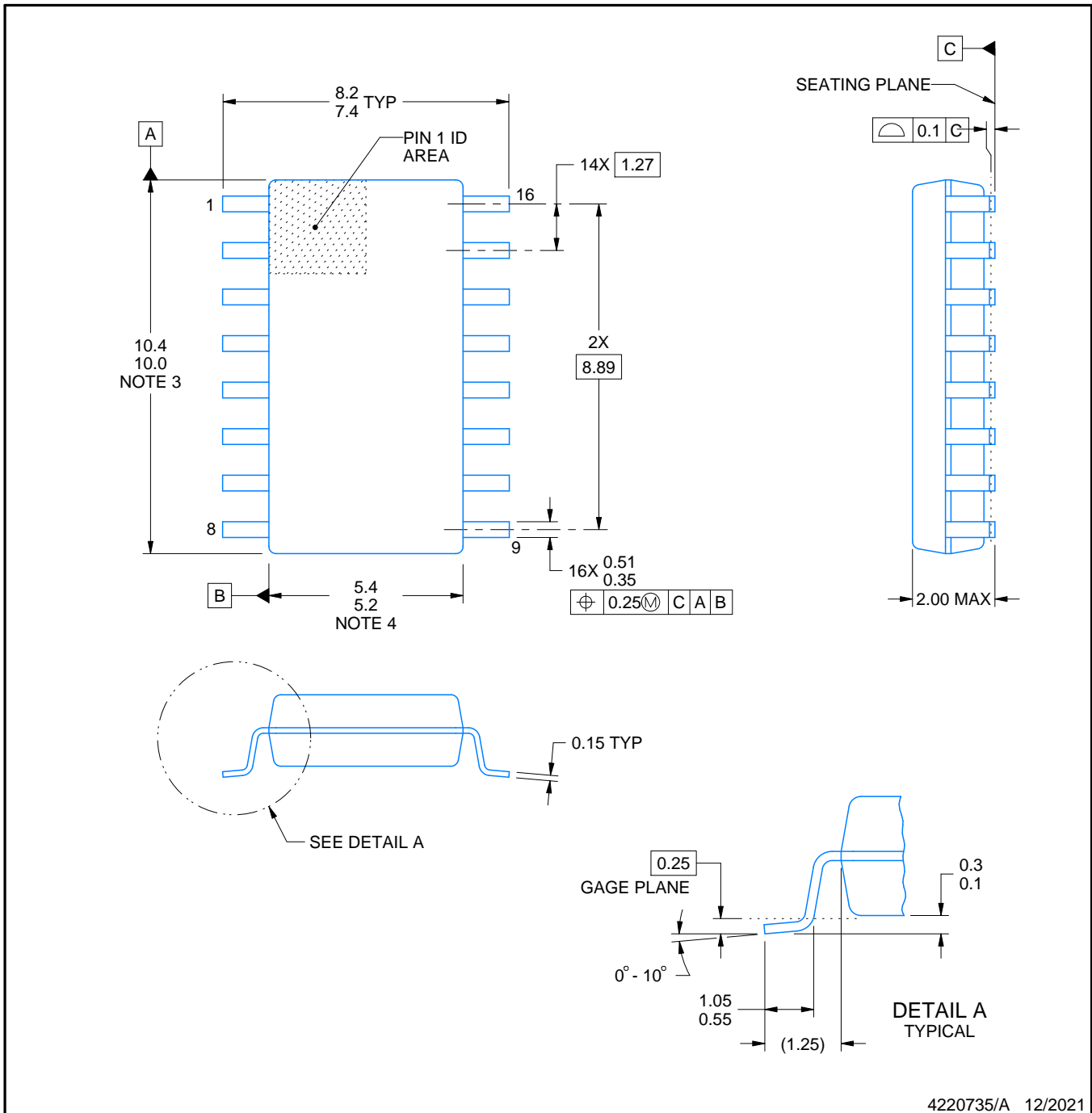


# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



4220735/A 12/2021

#### NOTES:

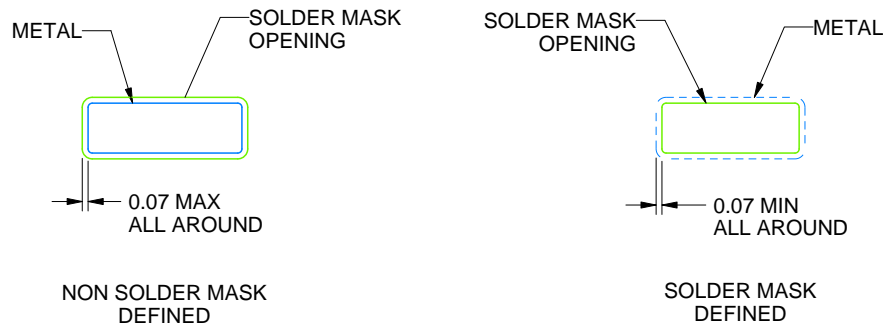
- All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
- This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

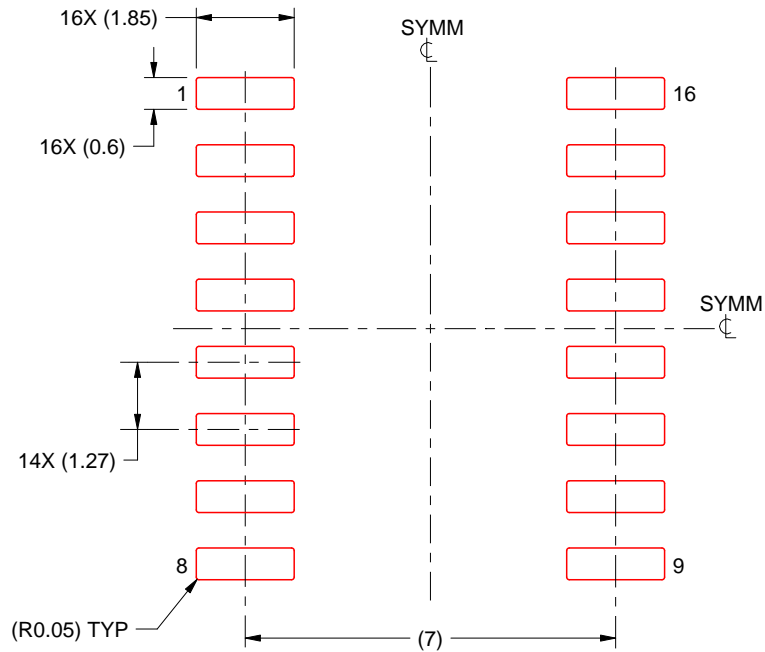
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220735/A 12/2021

NOTES: (continued)



7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE

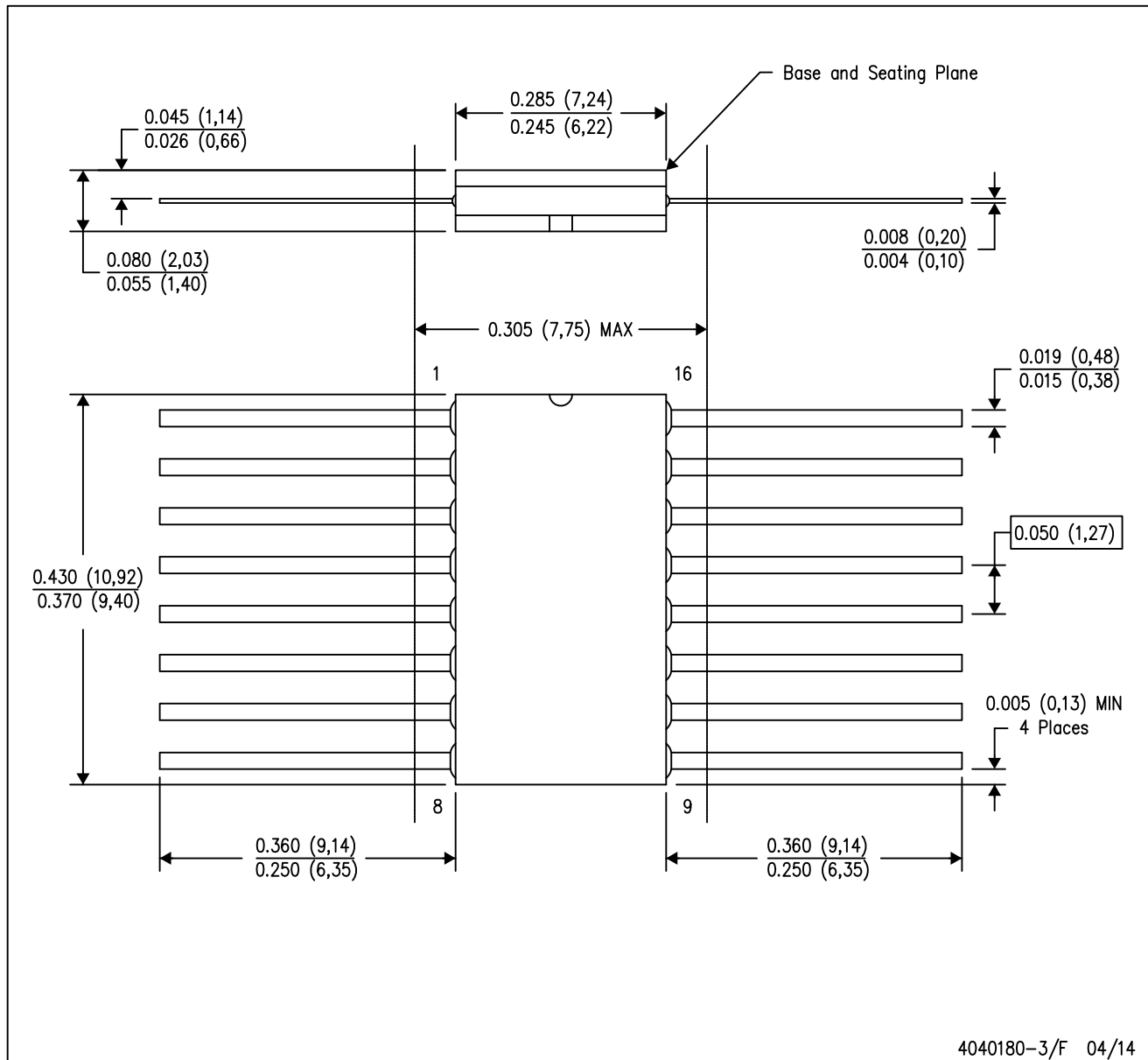


4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  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.
  -  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.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



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

## GENERIC PACKAGE VIEW

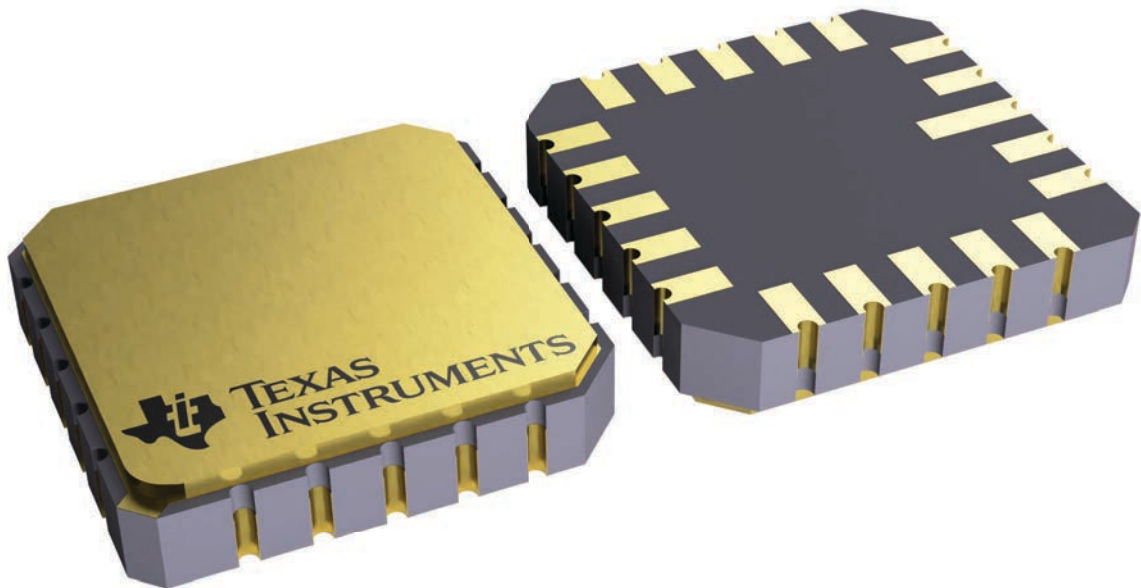
**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4229370VA\

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	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.
  - 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.

4040049/E 12/2002

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