

# 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

| TYPES          | TYPICAL MAXIMUM<br>COUNT FREQUENCY | TYPICAL<br>POWER DISSIPATION |
|----------------|------------------------------------|------------------------------|
| '192, '193     | 32 MHz                             | 325 mW                       |
| 'LS192, 'LS193 | 32 MHz                             | 95 mW                        |

## 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.

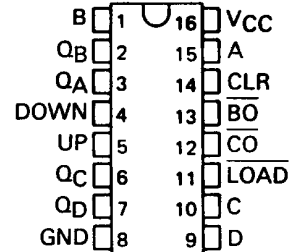
## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                       | 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.

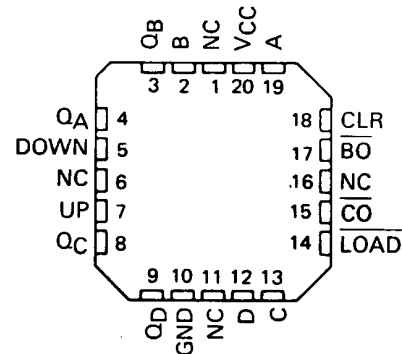
SN54192, SN54193, SN54LS192,  
SN54LS193 . . . J OR W PACKAGE  
SN74192, SN74193 . . . N PACKAGE  
SN74LS192, SN74LS193 . . . D OR N PACKAGE

(TOP VIEW)



SN54LS192, SN54LS193 . . . FK PACKAGE

(TOP VIEW)



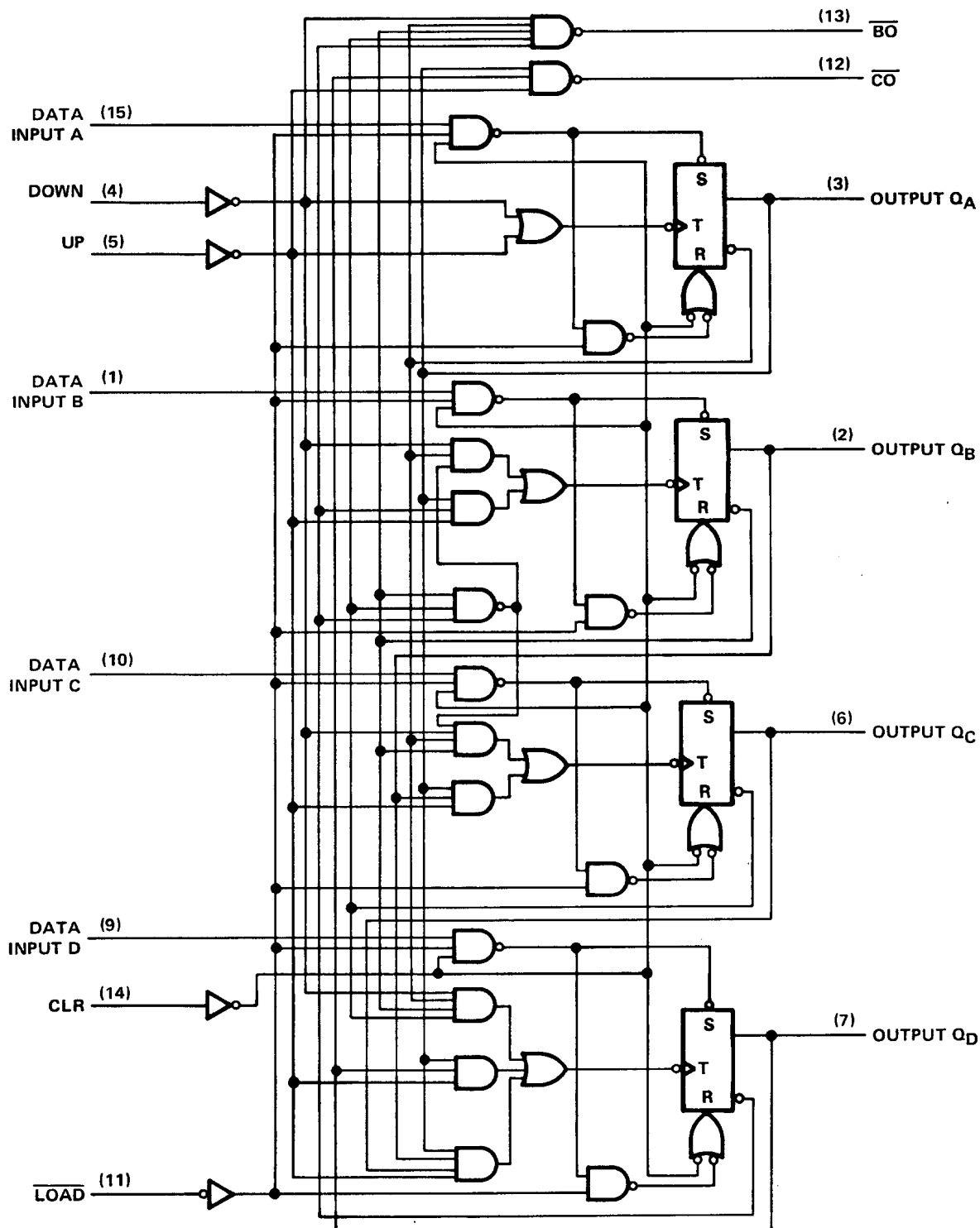
NC - No internal connection

# SN54192, SN54LS192, SN74192, SN74LS192

## SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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logic diagram (positive logic)

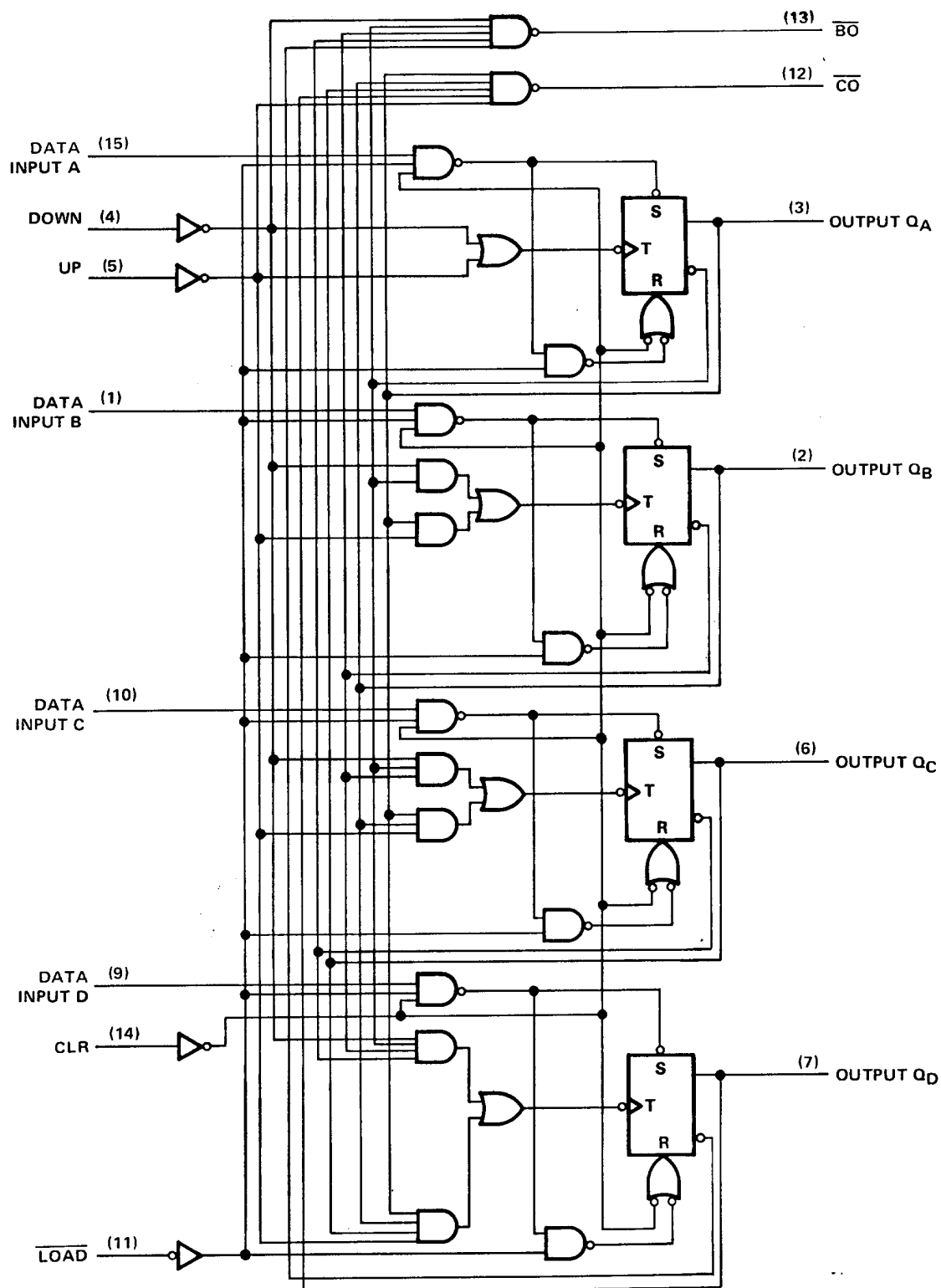


Pin numbers shown are for D, J, N, and W packages.

# 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.

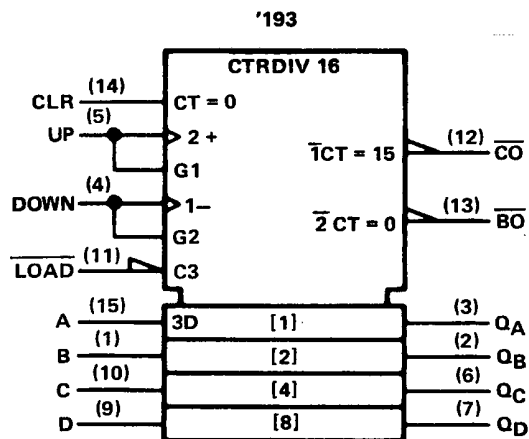
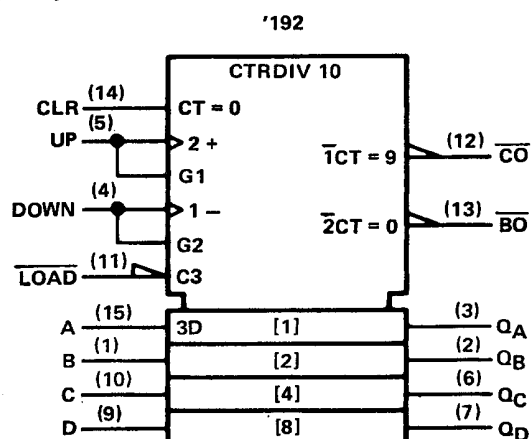


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**SN54192, SN54193, SN54LS192, SN54LS193,  
SN74192, SN74193, SN74LS192, SN74LS193  
SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)**

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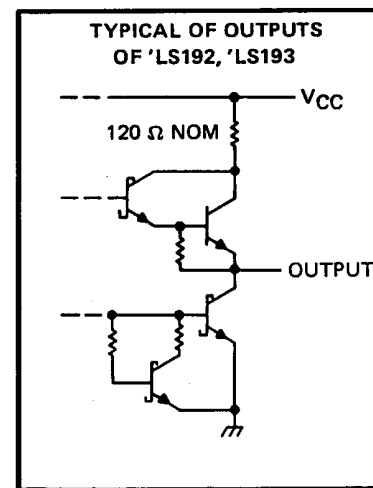
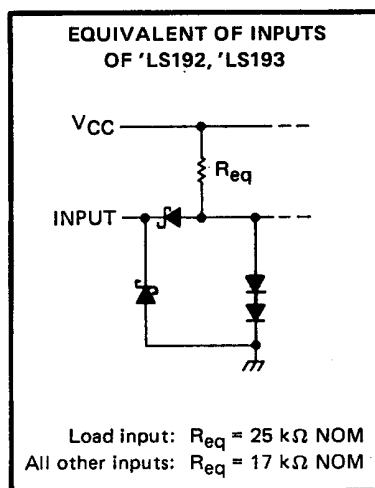
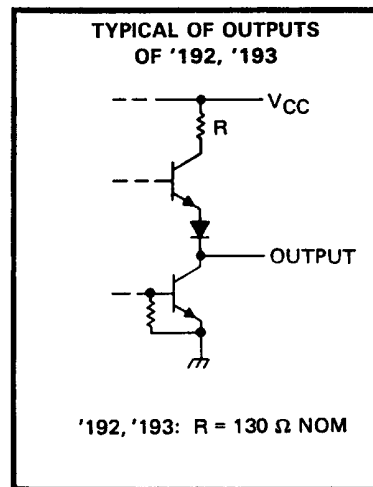
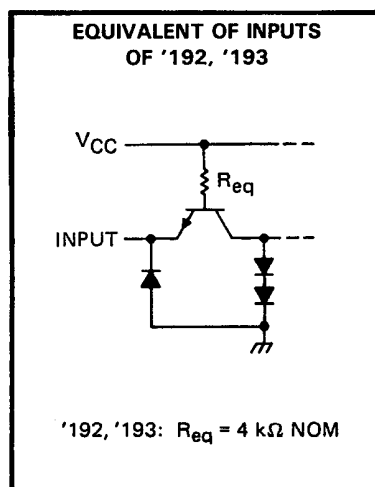
logic symbols†



†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)

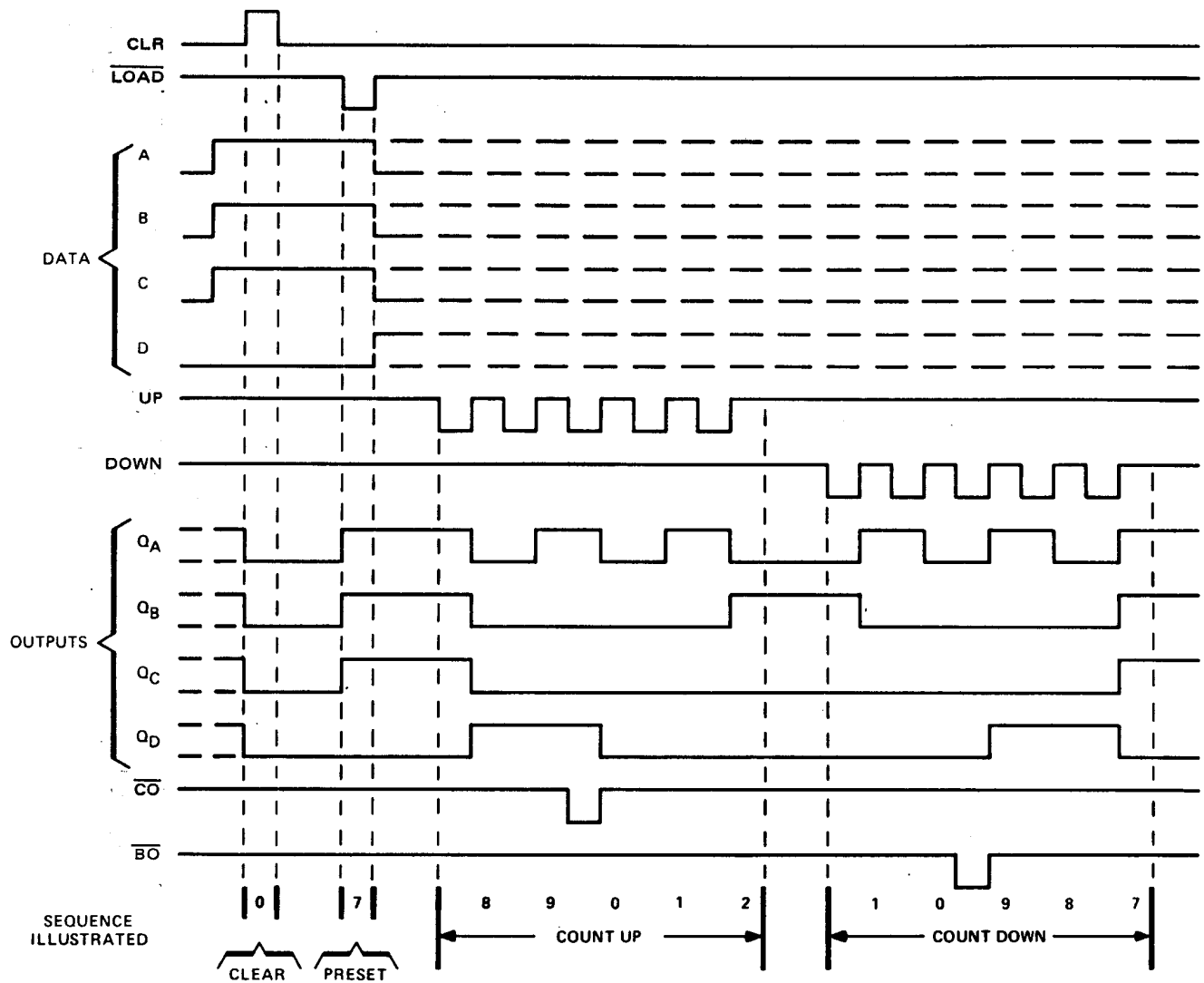
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## '192, 'LS192 DECADE COUNTERS

### 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.



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

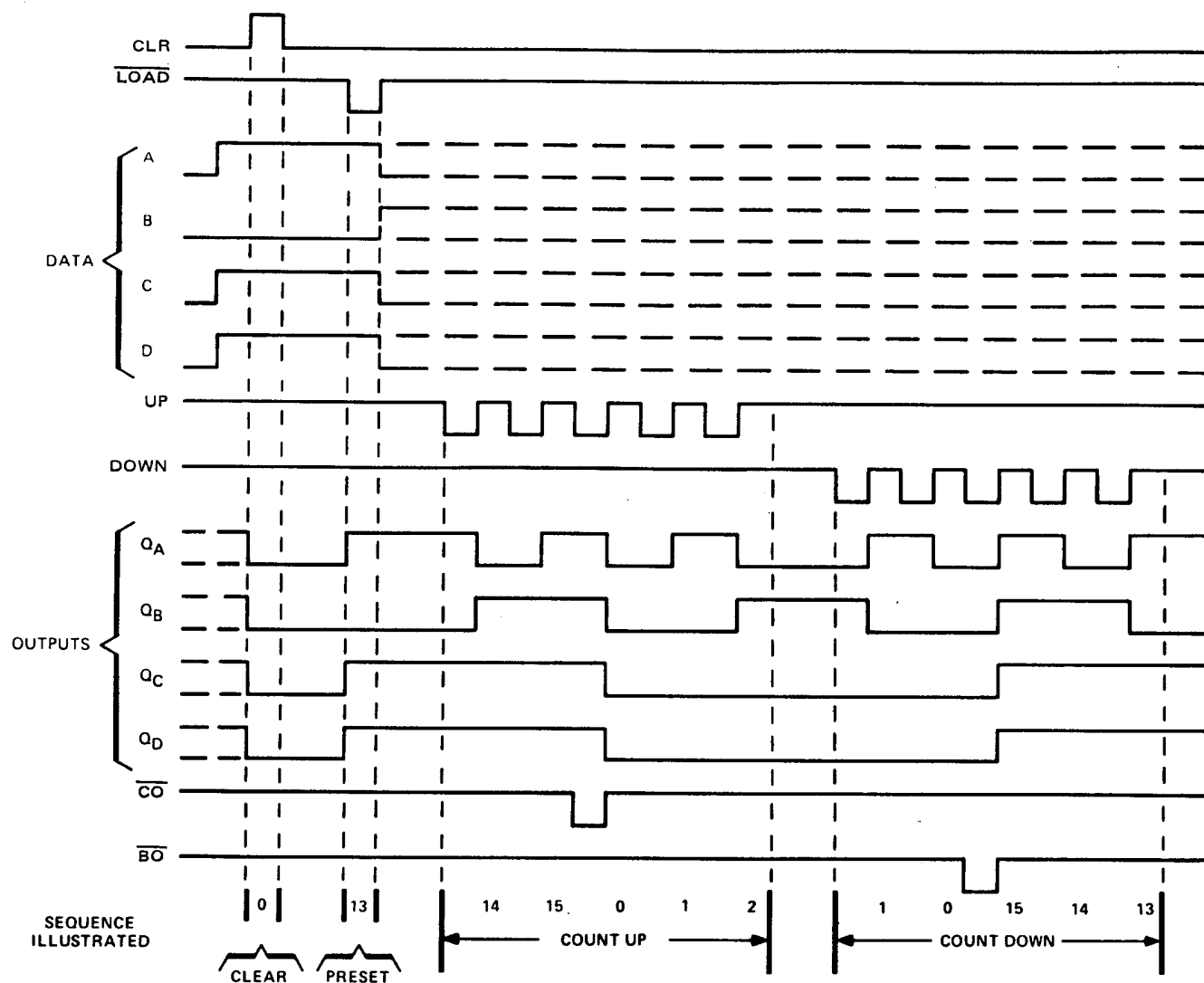
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## '193, 'LS193 BINARY COUNTERS

### 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<br>SN54193           |     |     | SN74192<br>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                            |     |     | 0                         |     |      | ns   |
|                    |                                 | LOAD              | 3                            |     |     | 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<br>SN54193                                                                                  |      |     | SN74192<br>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,<br>V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = −0.4 mA |      |     | 2.4                | 3.4  |      | V    |
| V <sub>OL</sub> | Low-level output voltage               | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,<br>V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 16 mA   |      |     |                    | 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    | mA   |
| I <sub>IH</sub> | High-level input current               | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V                                                       |      |     |                    |      | 40   | μA   |
| I <sub>IL</sub> | Low-level input current                | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                       |      |     |                    |      | −1.6 | mA   |
| I <sub>OS</sub> | Short-circuit output current§          | V <sub>CC</sub> = MAX                                                                               |      |     | −20                |      | −65  | mA   |
| I <sub>CC</sub> | Supply current                         | V <sub>CC</sub> = MAX, See Note 2                                                                   |      |     |                    | 65   | 89   | 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<br>INPUT     | TO<br>OUTPUT    | TEST CONDITIONS                                                           | MIN | TYP | MAX | UNIT |
|------------------|-------------------|-----------------|---------------------------------------------------------------------------|-----|-----|-----|------|
| f <sub>max</sub> |                   |                 | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 400 Ω,<br>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



**TEXAS  
INSTRUMENTS**

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# SN54LS192, SN54LS193, SN74LS192, SN74LS193

## SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

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### recommended operating conditions

|             |                                      | SN54LS192<br>SN54LS193 |     |      | SN74LS192<br>SN74LS193 |     |      | UNIT         |
|-------------|--------------------------------------|------------------------|-----|------|------------------------|-----|------|--------------|
|             |                                      | MIN                    | NOM | MAX  | MIN                    | NOM | MAX  |              |
| $V_{CC}$    | Supply voltage                       | 4.5                    | 5   | 5.5  | 4.75                   | 5   | 5.25 | V            |
| $I_{OH}$    | High-level output current            |                        |     | -400 |                        |     | -400 | $\mu$ A      |
| $I_{OL}$    | Low-level output current             |                        |     | 4    |                        |     | 8    | mA           |
| $f_{clock}$ | Clock frequency                      | 0                      |     | 25   | 0                      |     | 25   | MHz          |
| $t_w$       | Width of any input pulse             | 20                     |     |      | 20                     |     |      | ns           |
| $t_{su}$    | 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           |
| $t_h$       | Data hold time                       | 5                      |     |      | 5                      |     |      | ns           |
| $T_A$       | Operating free-air temperature range | -55                    |     | 125  | 0                      |     | 70   | $^{\circ}$ C |

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

| PARAMETER                                             | TEST CONDITIONS†                                                                                                  | SN54LS192<br>SN54LS193 |      |      | SN74LS192<br>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,<br>V <sub>IL</sub> = V <sub>IL</sub> max, 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,<br>V <sub>IL</sub> = V <sub>IL</sub> max                            | 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  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$ .

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

NOTE 2:  $I_{CC}$  is measured with all outputs open, clear and load inputs grounded, and all other inputs at 4.5 V.

### switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$

| PARAMETER        | FROM INPUT        | TO OUTPUT       | TEST CONDITIONS                                                          | MIN | TYP | MAX | UNIT |
|------------------|-------------------|-----------------|--------------------------------------------------------------------------|-----|-----|-----|------|
| f <sub>max</sub> |                   |                 | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 2 kΩ,<br>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>PHI</sub> | CLR               | Q               |                                                                          |     | 23  | 35  | ns   |



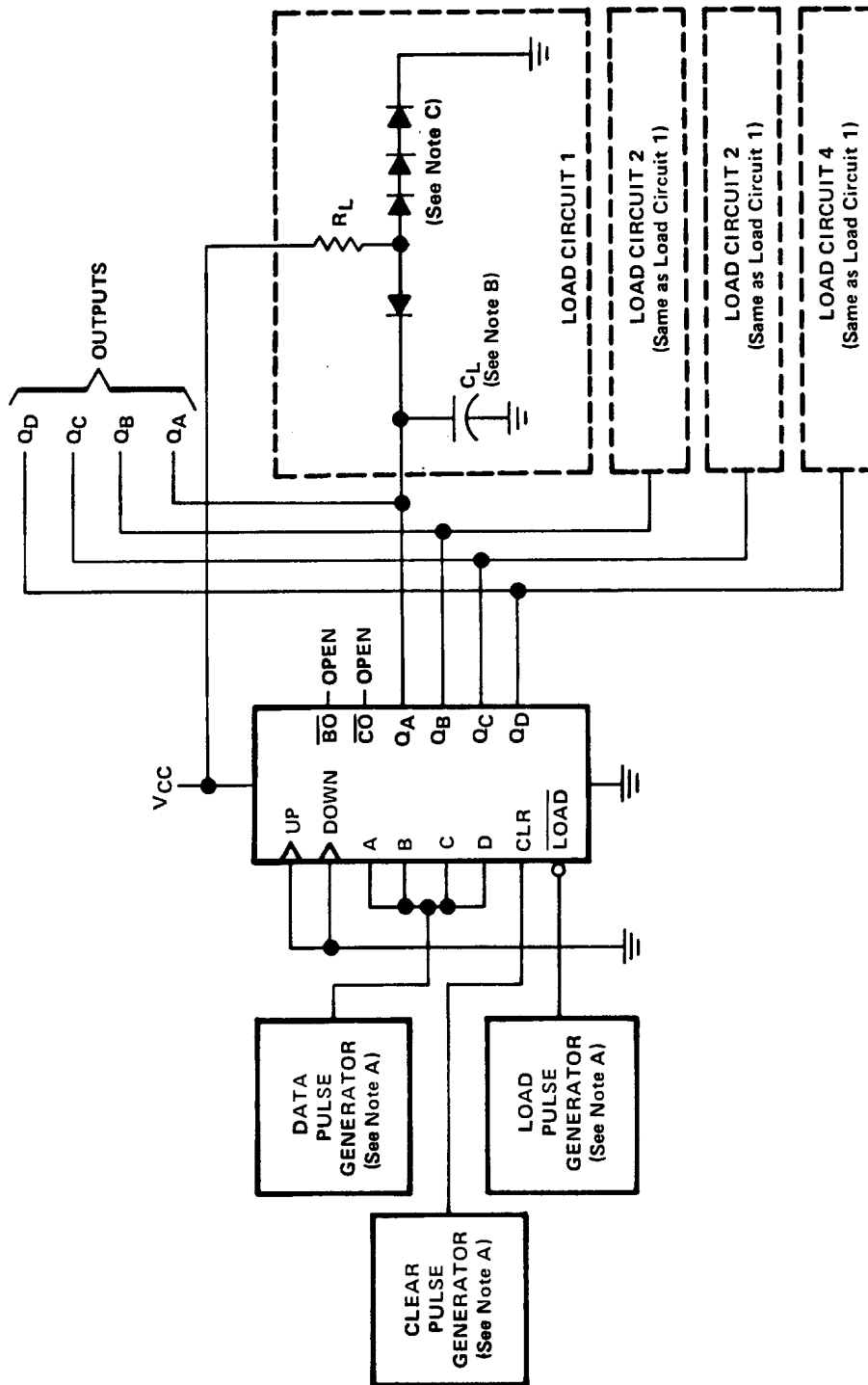
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SN74192, SN74193, SN74LS192, SN74LS193  
**SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)**

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**PARAMETER MEASUREMENT INFORMATION**



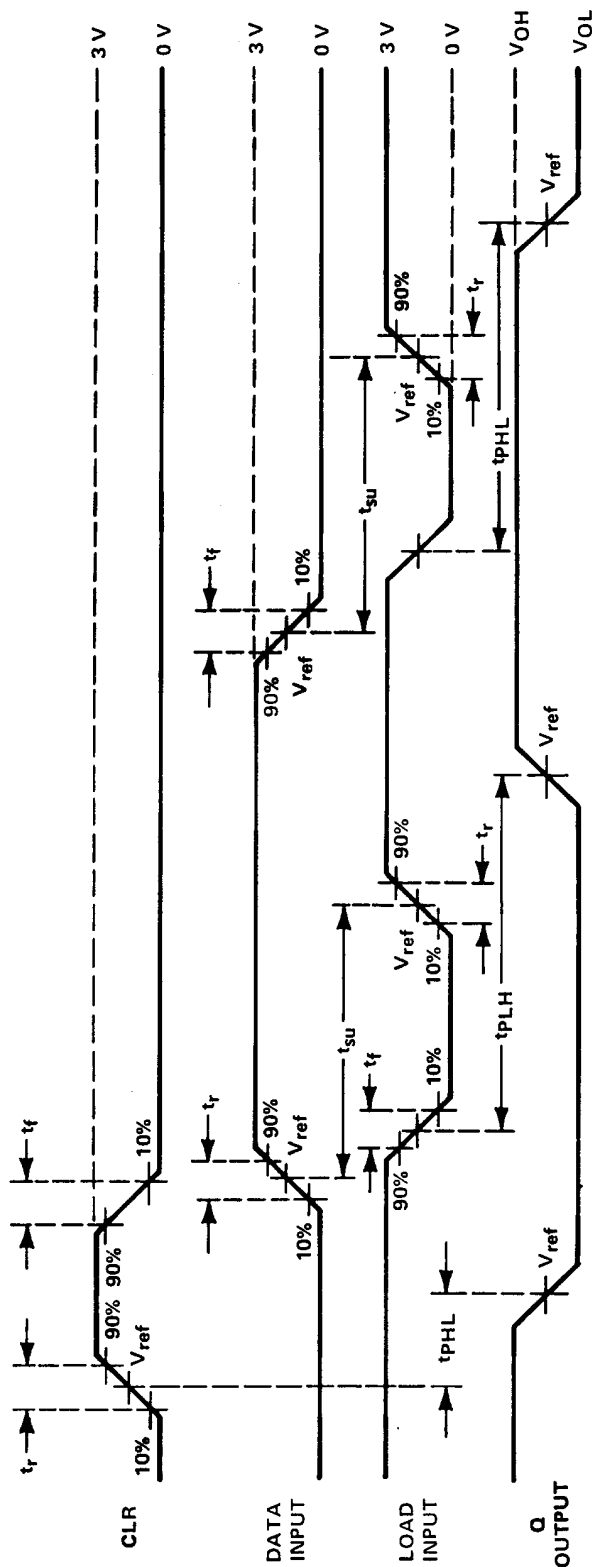
**TEST CIRCUIT**

- 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.

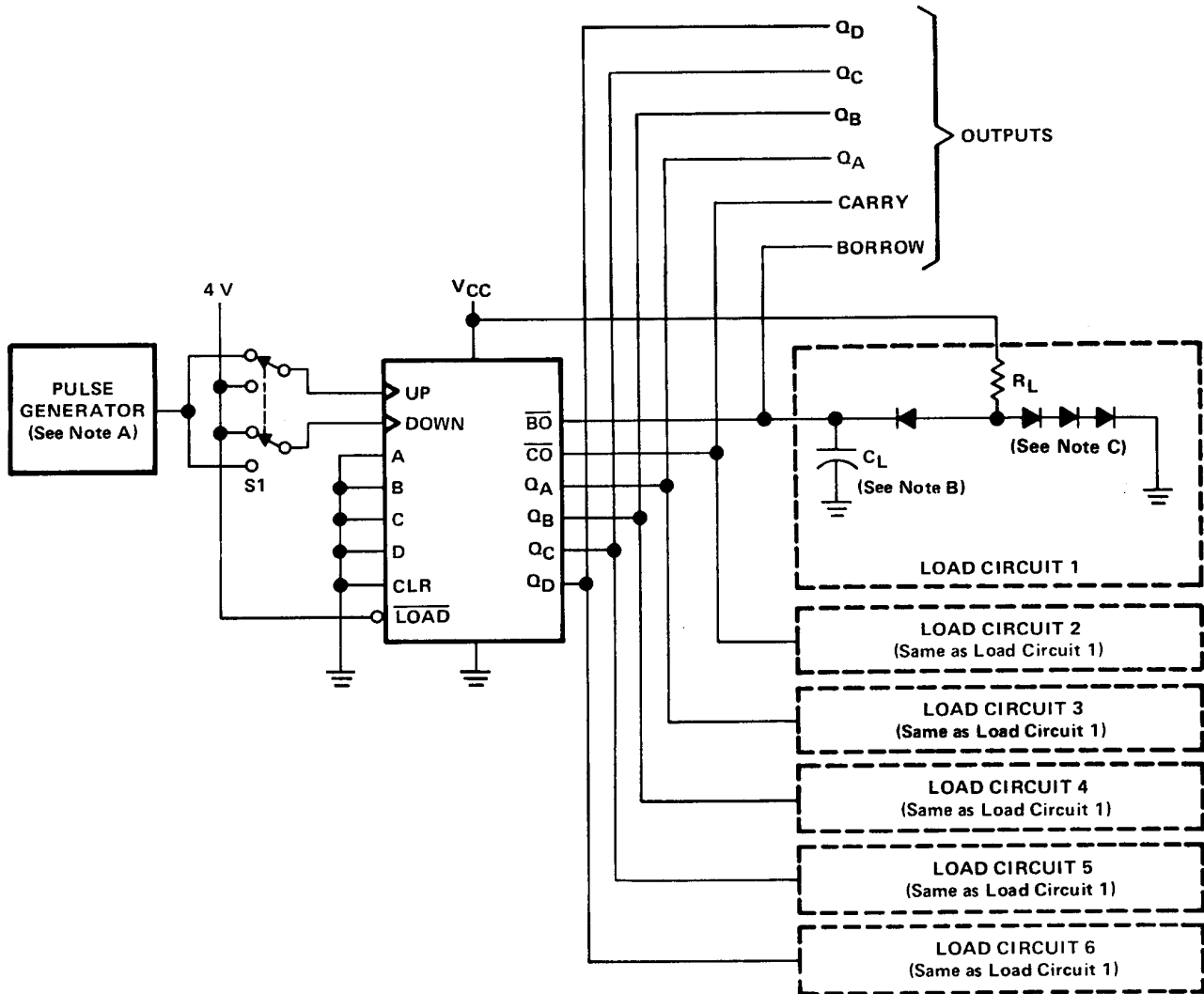
FIGURE 1B – CLEAR, SETUP, AND LOAD TIMES

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

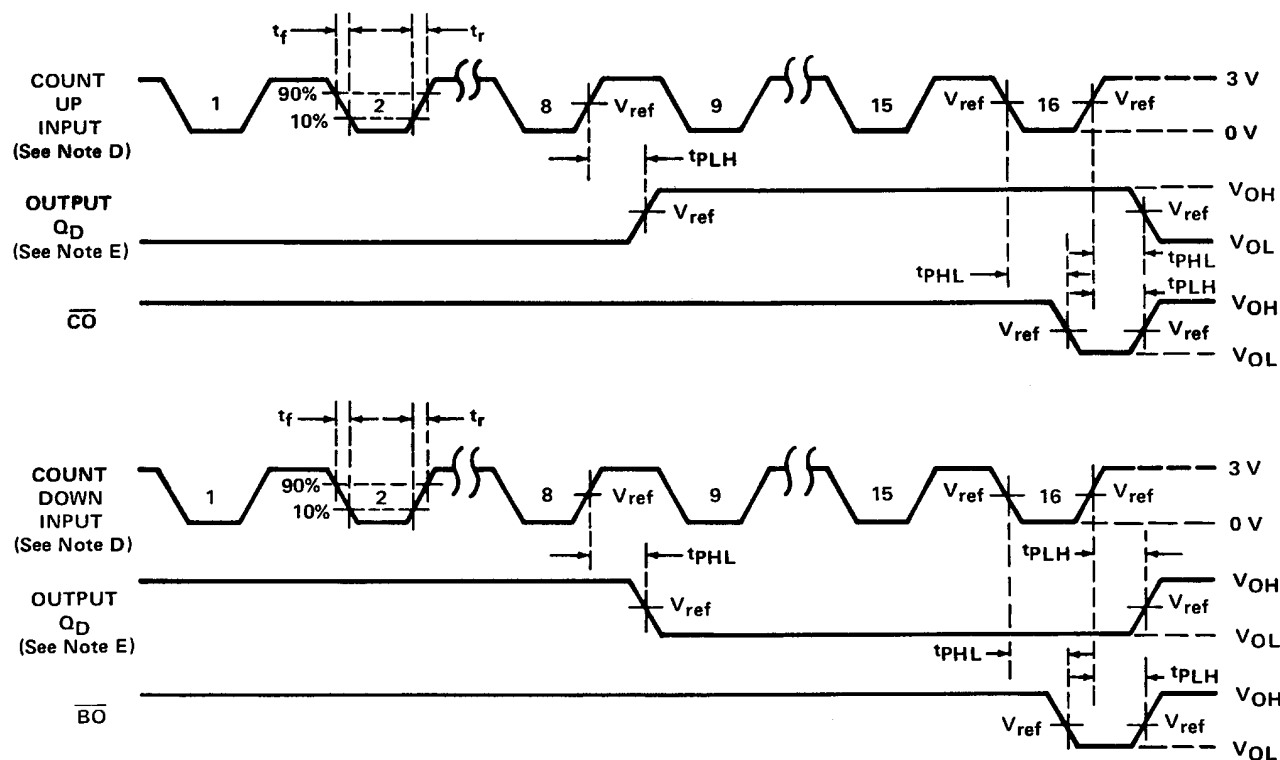
- NOTES: A. The pulse generators have the following characteristics: PRR  $\approx$  1 MHz,  $Z_{out} \approx 50 \Omega$ , duty cycle = 50%.
- B.  $C_L$  includes probe and jig capacitance.
- C. Diodes are 1N3064 or equivalent.
- D. Count-up and count-down pulse shown are for the '193 and 'LS193 binary 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 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<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)              |
|----------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|----------------------------------|
| <a href="#">5962-9558401QE</a>   | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9558401QE<br>A<br>SNJ54192J |
| <a href="#">5962-9558401QFA</a>  | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9558401QF<br>A<br>SNJ54192W |
| <a href="#">5962-9558401QFA</a>  | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9558401QF<br>A<br>SNJ54192W |
| <a href="#">76006012A</a>        | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 76006012A<br>SNJ54LS<br>193FK    |
| <a href="#">76006012A</a>        | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 76006012A<br>SNJ54LS<br>193FK    |
| <a href="#">7600601EA</a>        | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 7600601EA<br>SNJ54LS193J         |
| <a href="#">7600601EA</a>        | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 7600601EA<br>SNJ54LS193J         |
| <a href="#">7600601FA</a>        | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 7600601FA<br>SNJ54LS193W         |
| <a href="#">7600601FA</a>        | Active        | Production           | CFP (W)   16   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 7600601FA<br>SNJ54LS193W         |
| <a href="#">JM38510/31508B2A</a> | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31508B2A             |
| <a href="#">JM38510/31508B2A</a> | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31508B2A             |
| JM38510/31508B2A.A               | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31508B2A             |
| JM38510/31508B2A.A               | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31508B2A             |
| <a href="#">JM38510/31508BEA</a> | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>31508BEA             |

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

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

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



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

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

<sup>(2)</sup> **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.

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

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

**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.

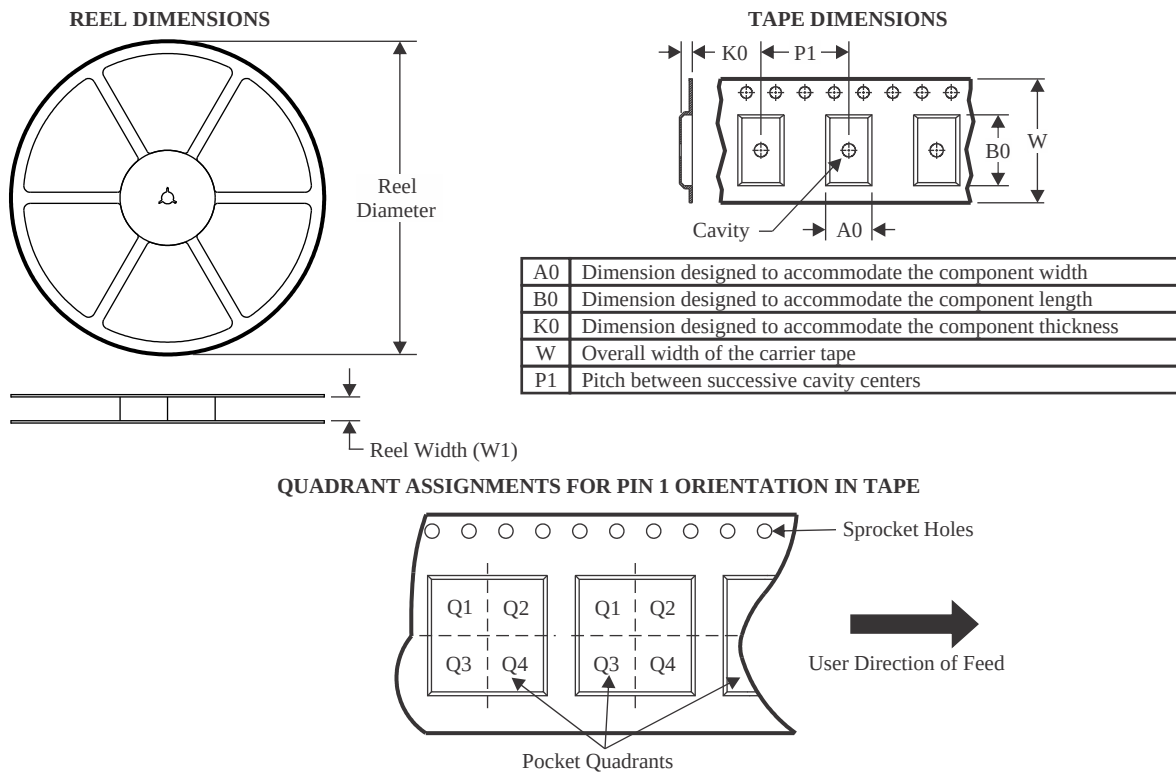
**OTHER QUALIFIED VERSIONS OF SN54LS193, SN54LS193-SP, SN74LS193 :**

- 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

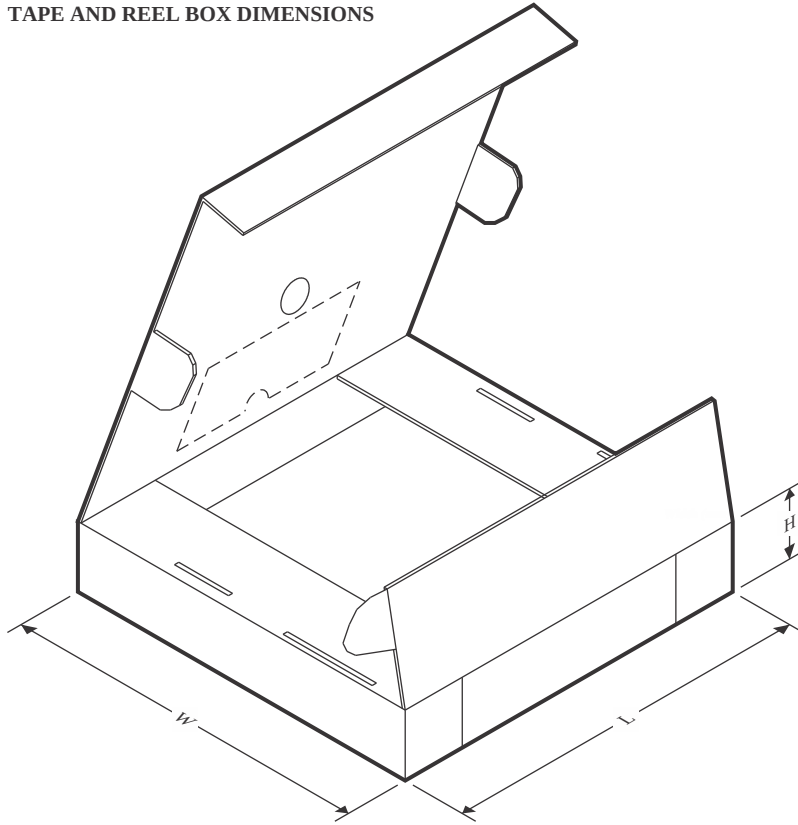
## TAPE AND REEL INFORMATION



\*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            |

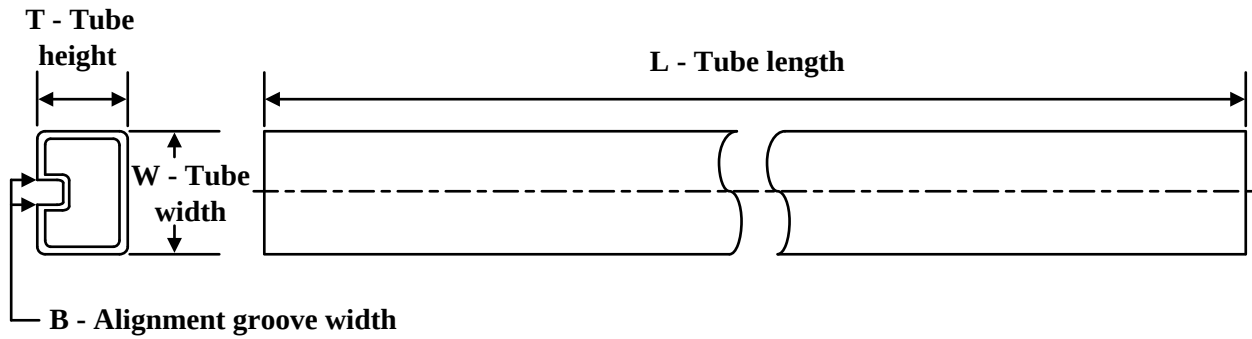
## TAPE AND REEL BOX DIMENSIONS



\*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

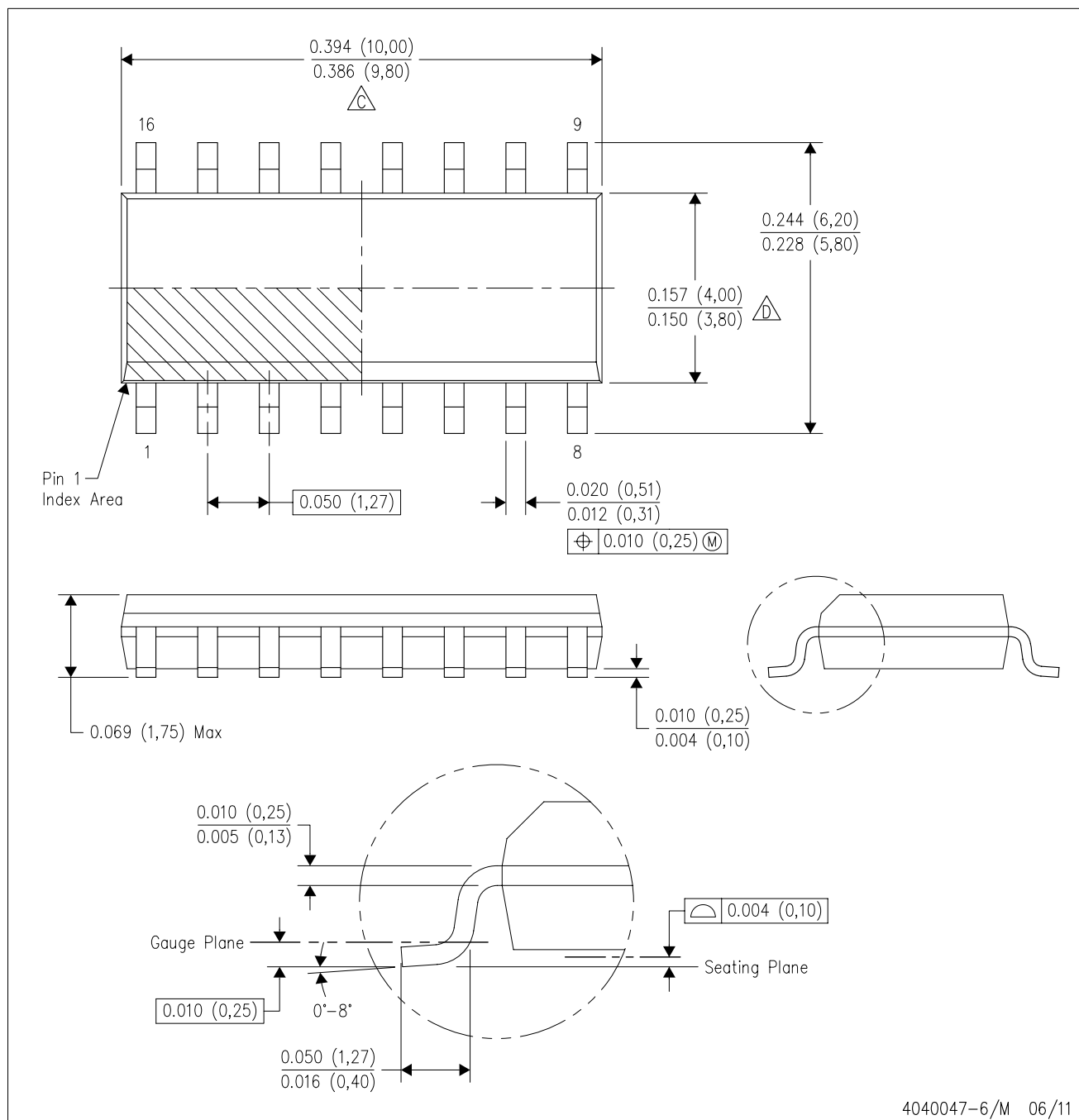


\*All dimensions are nominal

| 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     |

D (R-PDSO-G16)

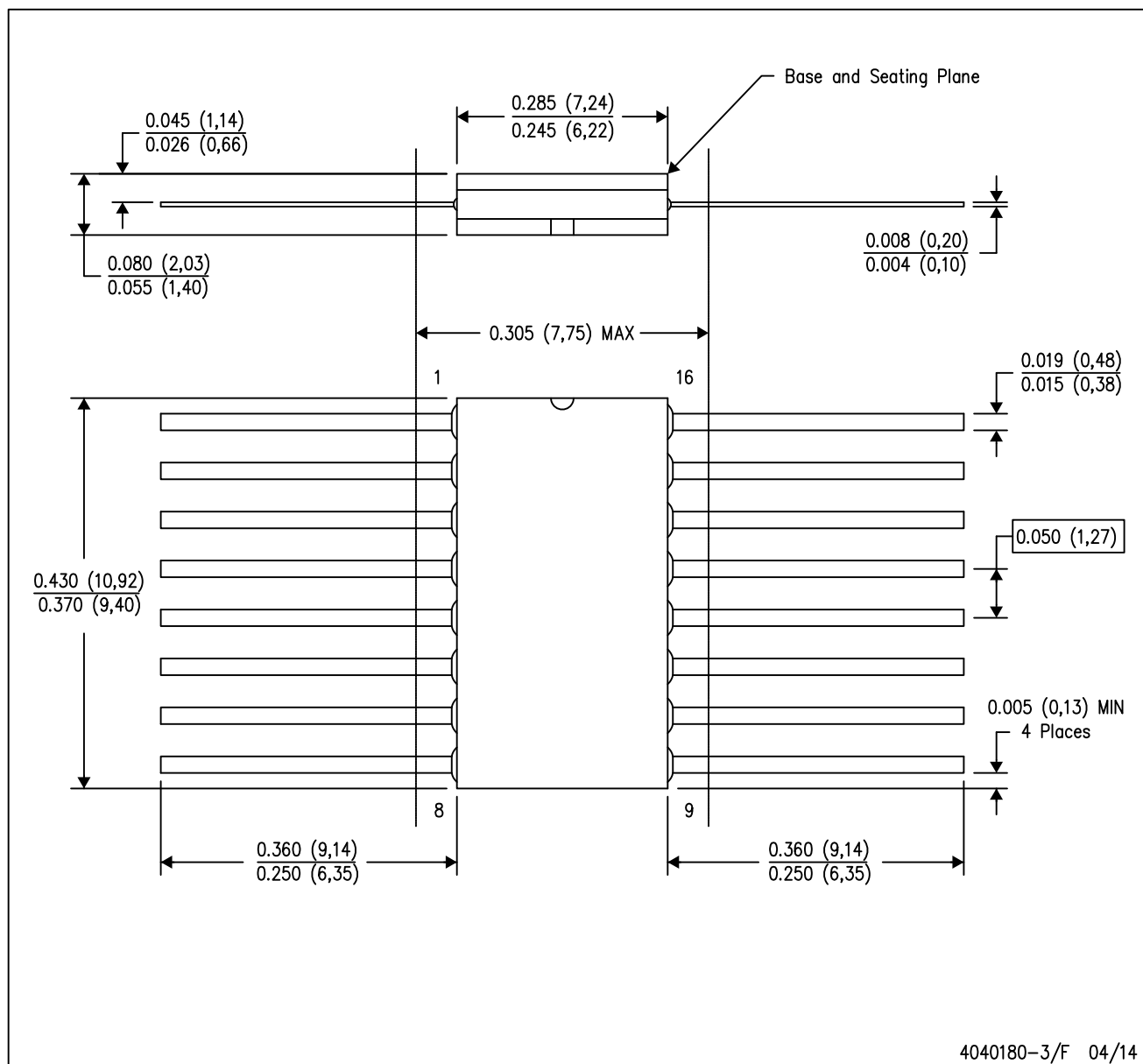
PLASTIC SMALL OUTLINE



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

## GENERIC PACKAGE VIEW

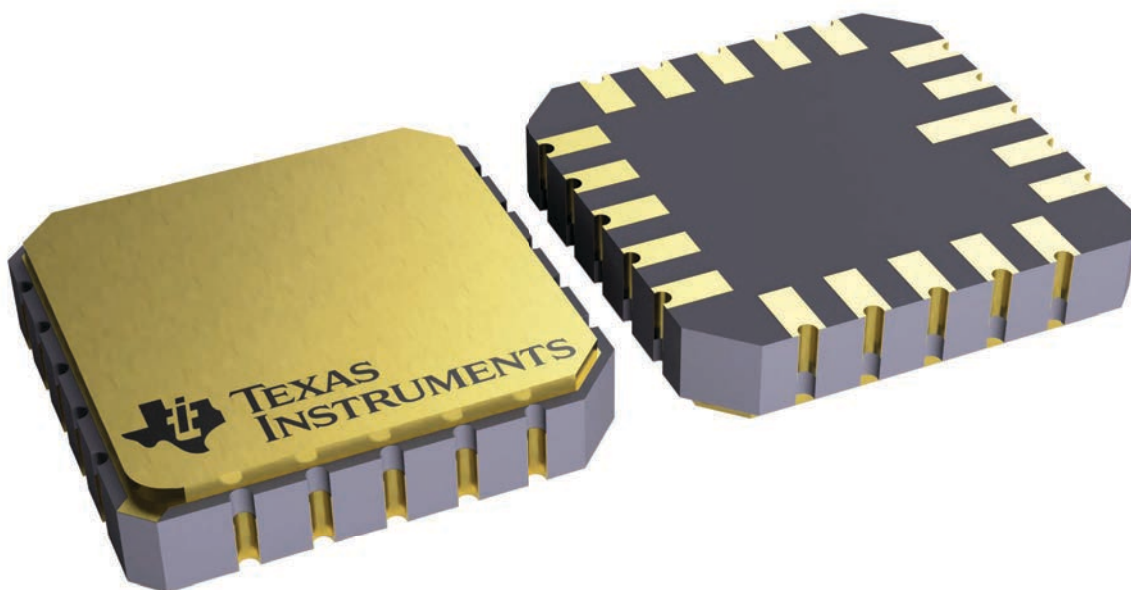
**FK 20**

**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.



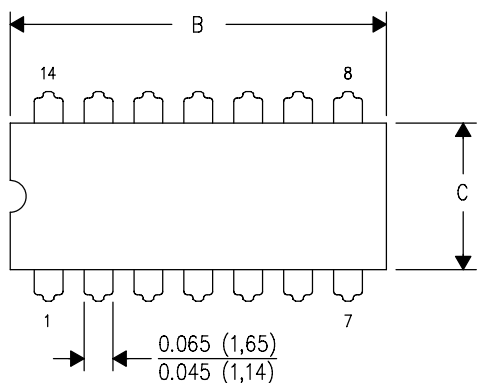
4229370VA\



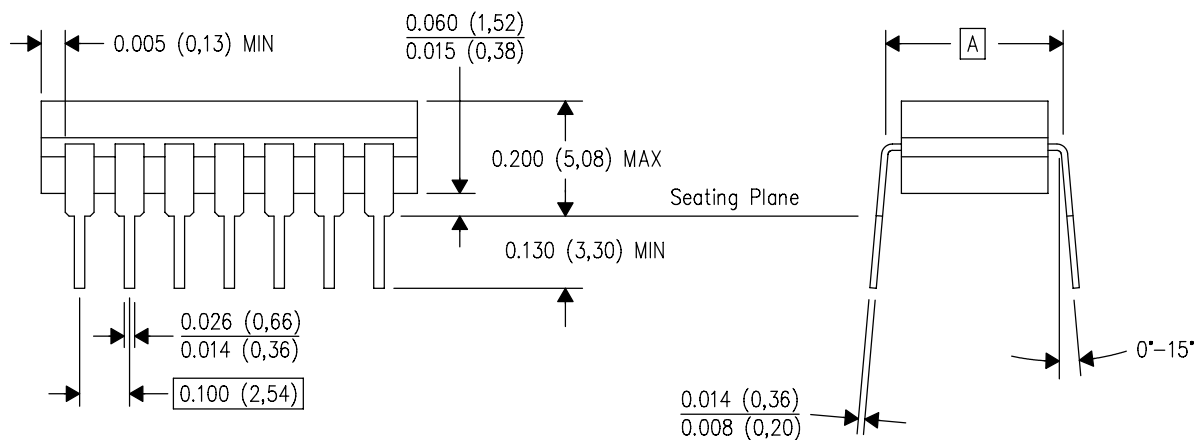
J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14                     | 16                     | 18                     | 20                     |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A             | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX         | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN         | —                      | —                      | —                      | —                      |
| C MAX         | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN         | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



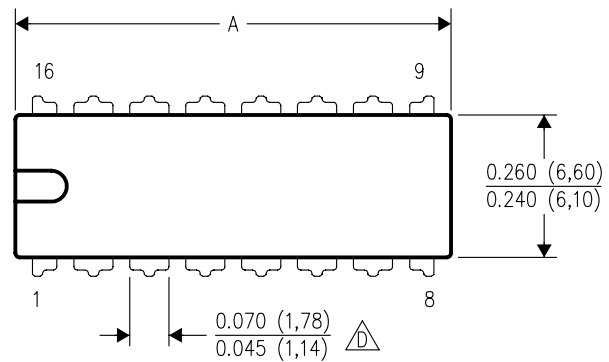
4040083/F 03/03

- 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.

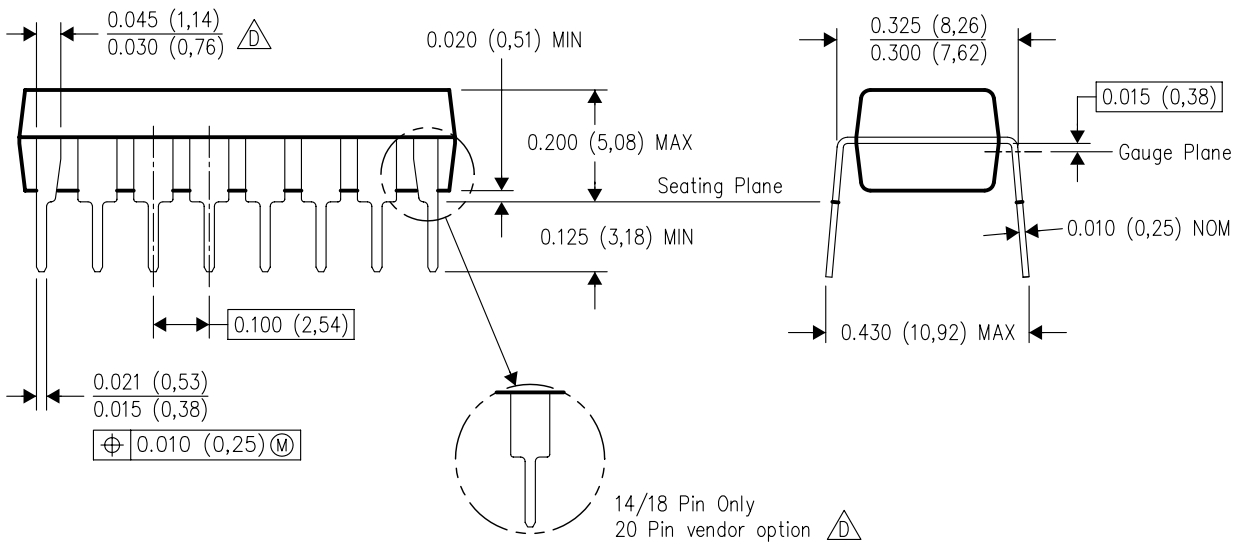
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



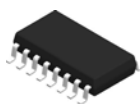
| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

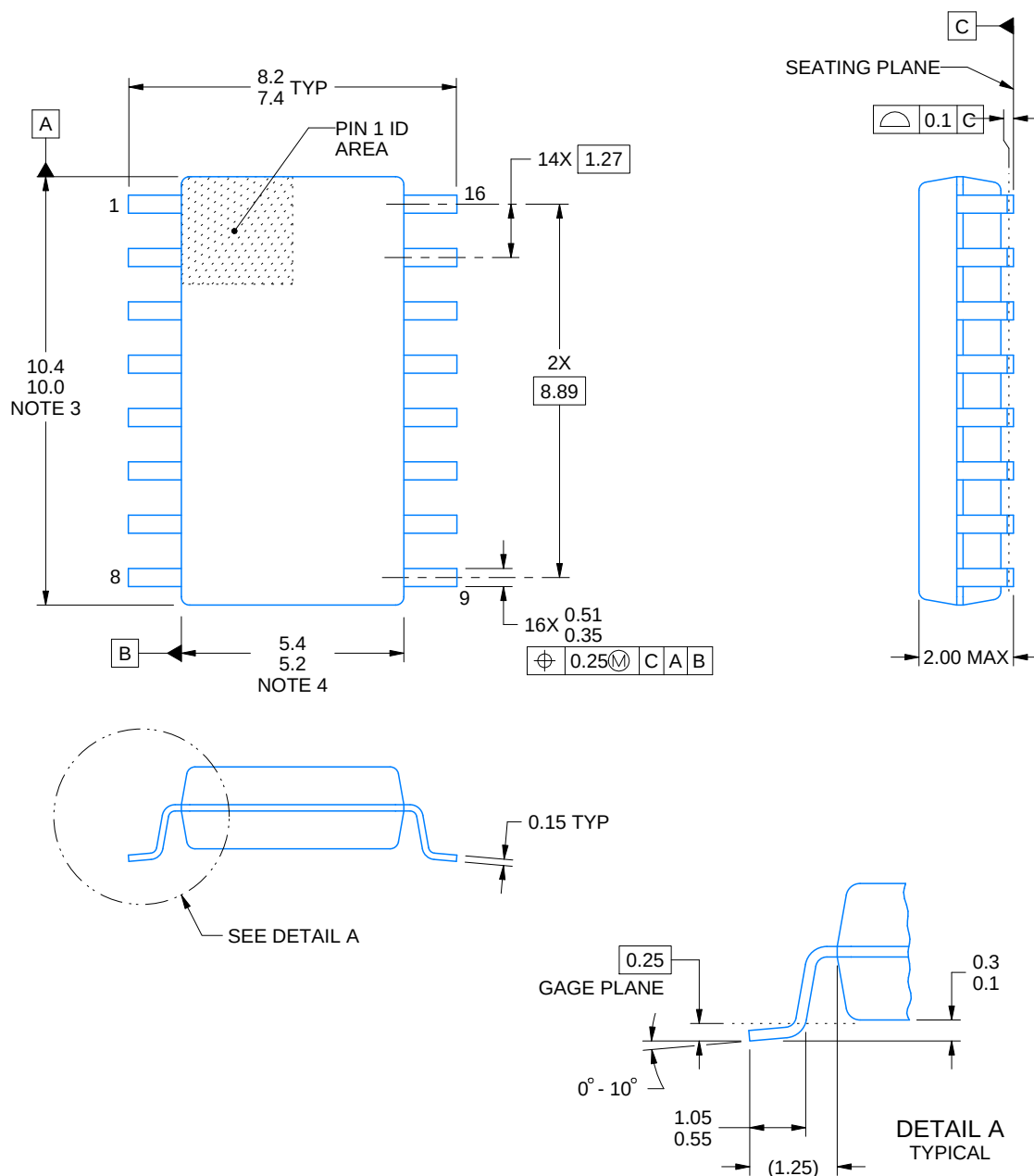


# PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

## NOTES:

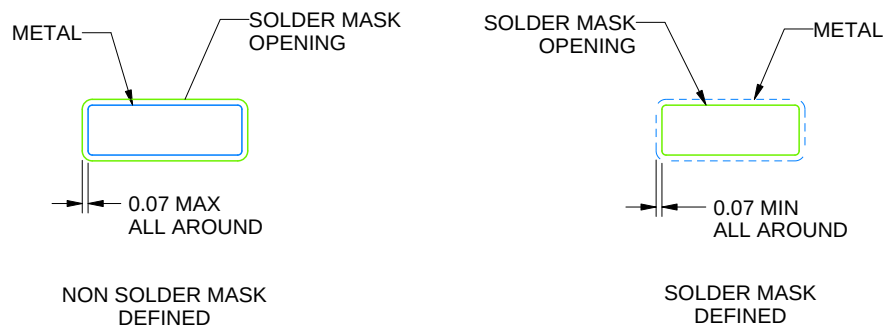
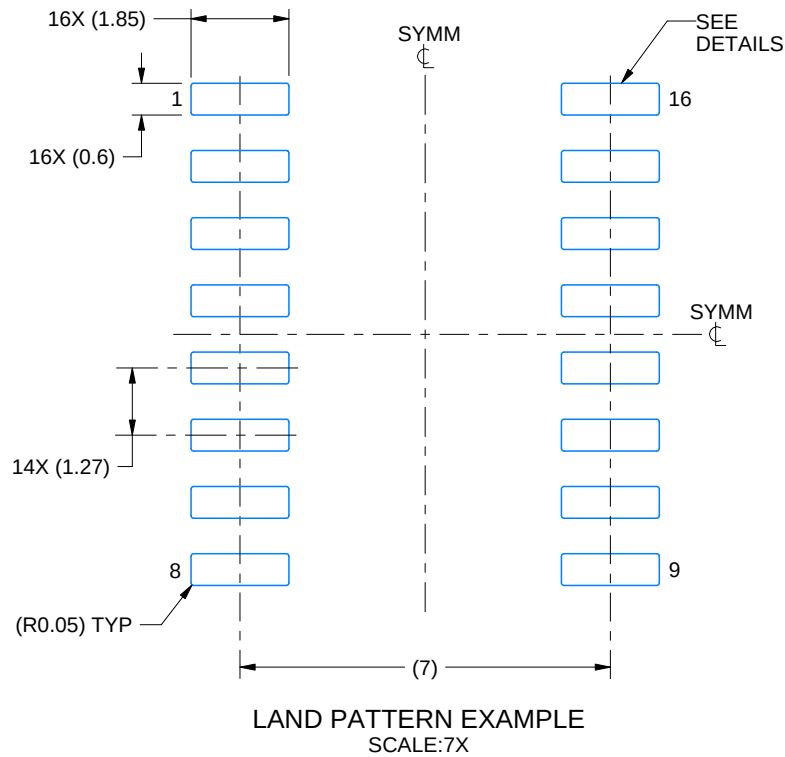
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. 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

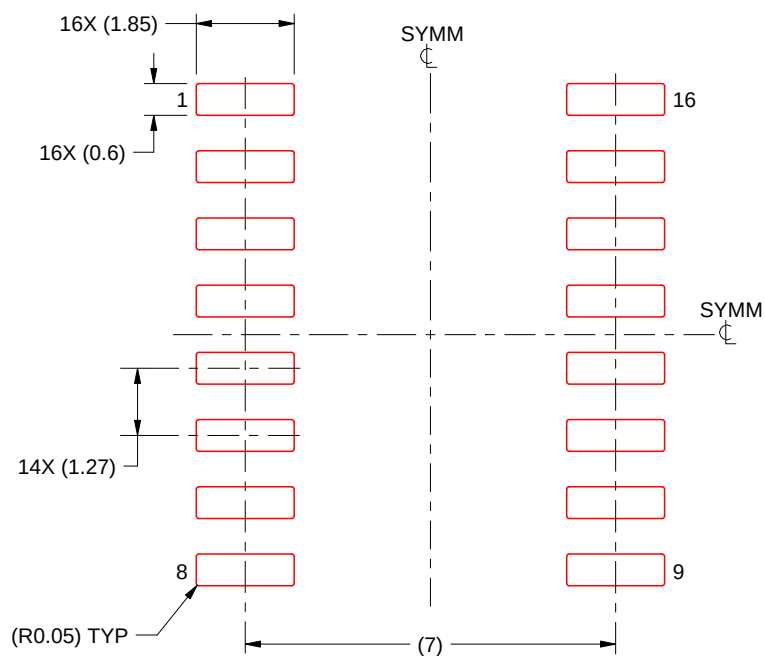


4220735/A 12/2021

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.



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.

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