

# SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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'90A, 'LS90 . . . Decade Counters

'92A, 'LS92 . . . Divide By-Twelve Counters

'93A, 'LS93 . . . 4-Bit Binary Counters

| TYPES               | TYPICAL<br>POWER DISSIPATION |
|---------------------|------------------------------|
| '90A                | 145 mW                       |
| '92A, '93A          | 130 mW                       |
| 'LS90, 'LS92, 'LS93 | 45 mW                        |

## description

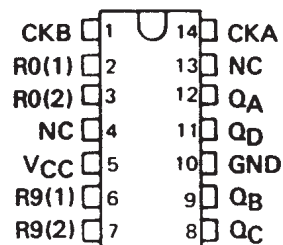
Each of these monolithic counters contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and a three-stage binary counter for which the count cycle length is divide-by-five for the '90A and 'LS90, divide-by-six for the '92A and 'LS92, and the divide-by-eight for the '93A and 'LS93.

All of these counters have a gated zero reset and the '90A and 'LS90 also have gated set-to-nine inputs for use in BCD nine's complement applications.

To use their maximum count length (decade, divide-by-twelve, or four-bit binary) of these counters, the CKB input is connected to the  $Q_A$  output. The input count pulses are applied to CKA input and the outputs are as described in the appropriate function table. A symmetrical divide-by-ten count can be obtained from the '90A or 'LS90 counters by connecting the  $Q_D$  output to the CKA input and applying the input count to the CKB input which gives a divide-by-ten square wave at output  $Q_A$ .

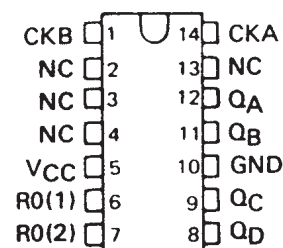
SN5490A, SN54LS90 . . . J OR W PACKAGE  
SN7490A . . . N PACKAGE  
SN74LS90 . . . D OR N PACKAGE

(TOP VIEW)



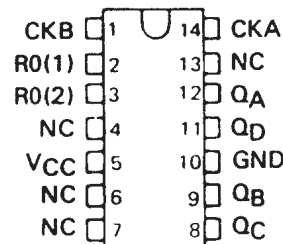
SN5492A, SN54LS92 . . . J OR W PACKAGE  
SN7492A . . . N PACKAGE  
SN74LS92 . . . D OR N PACKAGE

(TOP VIEW)



SN5493A, SN54LS93 . . . J OR W PACKAGE  
SN7493 . . . N PACKAGE  
SN74LS93 . . . D OR N PACKAGE

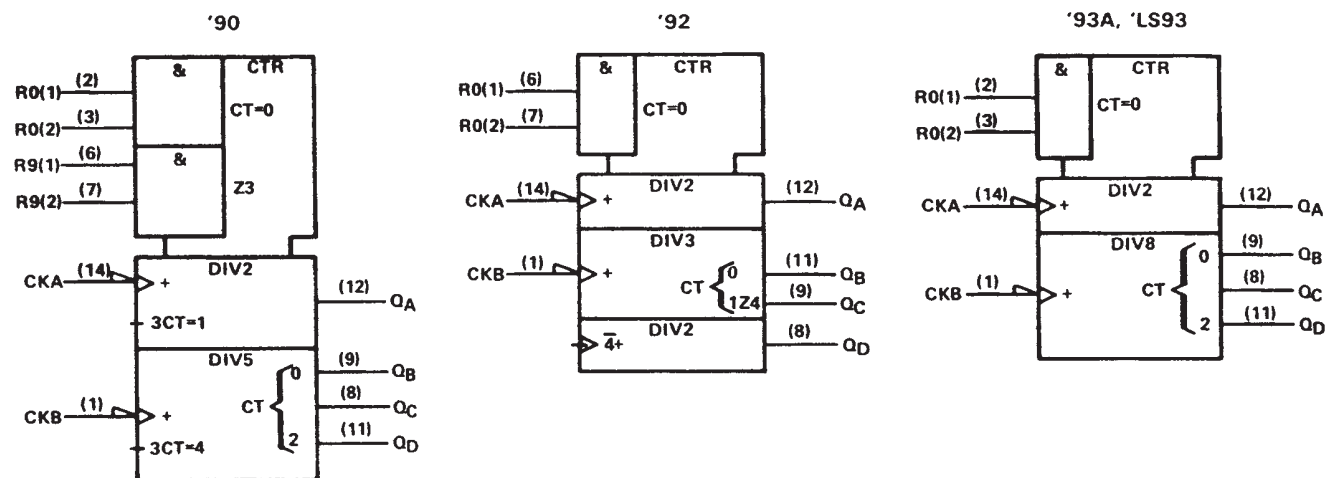
(TOP VIEW)



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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logic symbols†



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

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 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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'90A, 'LS90  
 BCD COUNT SEQUENCE  
 (See Note A)

| COUNT | OUTPUT         |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | L              | H              | H              | L              |
| 7     | L              | H              | H              | H              |
| 8     | H              | L              | L              | L              |
| 9     | H              | L              | L              | H              |

'90A, 'LS90  
 BI-QUINARY (5-2)  
 (See Note B)

| COUNT | OUTPUT         |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>A</sub> | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | H              | L              | L              | L              |
| 6     | H              | L              | L              | H              |
| 7     | H              | L              | H              | L              |
| 8     | H              | L              | H              | H              |
| 9     | H              | H              | L              | L              |

'92A, 'LS92  
 COUNT SEQUENCE  
 (See Note C)

| COUNT | OUTPUT         |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | H              | L              | L              | L              |
| 7     | H              | L              | L              | H              |
| 8     | H              | L              | H              | L              |
| 9     | H              | L              | H              | H              |
| 10    | H              | H              | L              | L              |
| 11    | H              | H              | L              | H              |

'90A, 'LS90  
 RESET/COUNT FUNCTION TABLE

| RESET INPUTS       |                    |                    |                    | OUTPUT         |                |                |                |
|--------------------|--------------------|--------------------|--------------------|----------------|----------------|----------------|----------------|
| R <sub>0</sub> (1) | R <sub>0</sub> (2) | R <sub>9</sub> (1) | R <sub>9</sub> (2) | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| H                  | H                  | L                  | X                  | L              | L              | L              | L              |
| H                  | H                  | X                  | L                  | L              | L              | L              | L              |
| X                  | X                  | H                  | H                  | H              | L              | L              | H              |
| X                  | L                  | X                  | L                  | COUNT          |                |                |                |
| L                  | X                  | L                  | X                  | COUNT          |                |                |                |
| L                  | X                  | X                  | L                  | COUNT          |                |                |                |
| X                  | L                  | L                  | X                  | COUNT          |                |                |                |

'93A, 'LS93  
 COUNT SEQUENCE  
 (See Note C)

| COUNT | OUTPUT         |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | L              | H              | H              | L              |
| 7     | L              | H              | H              | H              |
| 8     | H              | L              | L              | L              |
| 9     | H              | L              | L              | H              |
| 10    | H              | L              | H              | L              |
| 11    | H              | L              | H              | H              |
| 12    | H              | H              | L              | L              |
| 13    | H              | H              | L              | H              |
| 14    | H              | H              | H              | L              |
| 15    | H              | H              | H              | H              |

'92A, 'LS92, '93A, 'LS93  
 RESET/COUNT FUNCTION TABLE

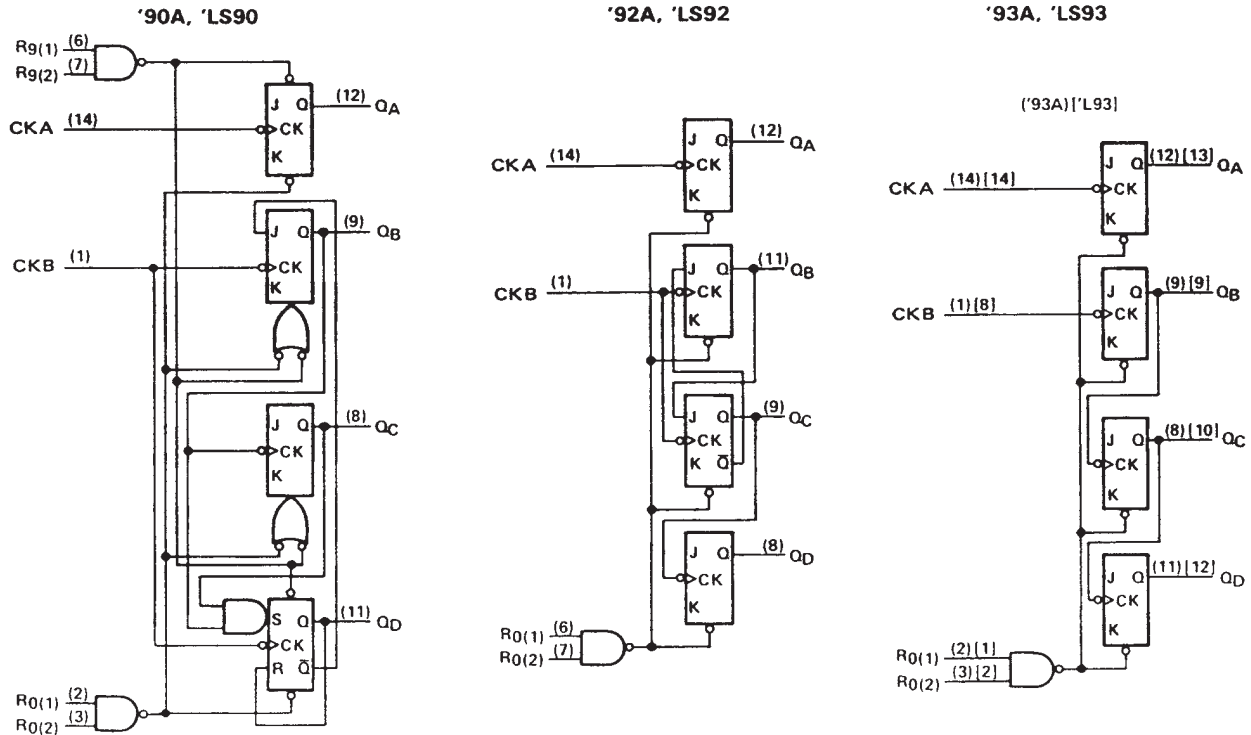
| RESET INPUTS       |                    | OUTPUT         |                |                |                |
|--------------------|--------------------|----------------|----------------|----------------|----------------|
| R <sub>0</sub> (1) | R <sub>0</sub> (2) | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| H                  | H                  | L              | L              | L              | L              |
| L                  | X                  | COUNT          |                |                |                |
| X                  | L                  | COUNT          |                |                |                |

- NOTES: A. Output Q<sub>A</sub> is connected to input CKB for BCD count.  
 B. Output Q<sub>D</sub> is connected to input CKA for bi-quinary count.  
 C. Output Q<sub>A</sub> is connected to input CKB.  
 D. H = high level, L = low level, X = irrelevant

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## logic diagrams (positive logic)



The J and K inputs shown without connection are for reference only and are functionally at a high level. Pin numbers shown in ( ) are for the 'LS93 and '93A and pin numbers shown in [ ] are for the 54L93.

## schematics of inputs and outputs

'90A, '92A, '93A

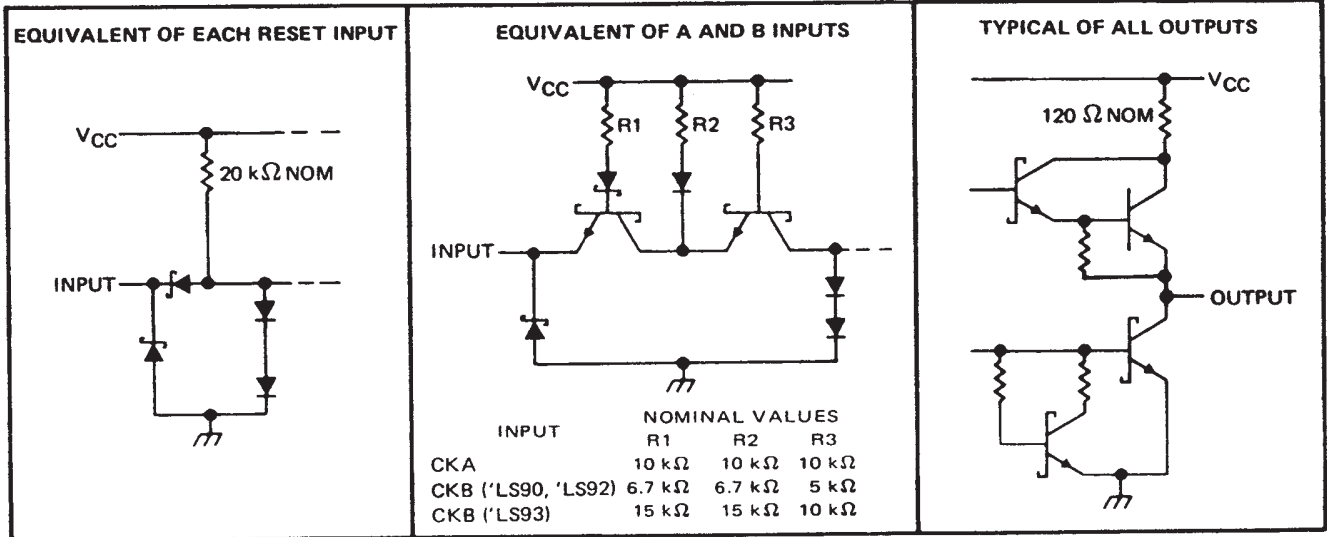


SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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schematics of inputs and outputs (continued)

'LS90, 'LS92, 'LS93



# SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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

|   |                |
|---|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                           | 7 V            |
| Input voltage   | 5.5 V          |
| Interemitter voltage (see Note 2)                               | 5.5 V          |
| Operating free-air temperature range: SN5490A, SN5492A, SN5493A | -55°C to 125°C |
| SN7490A, SN7492A, SN7493A                                       | 0°C to 70°C    |
| Storage temperature range                                       | -65°C to 150°C |

NOTES: 1. Voltage values, except interemitter voltage, are with respect to network ground terminal.  
2. This is the voltage between two emitters of a multiple-emitter transistor. For these circuits, this rating applies between the two  $R_0$  inputs, and for the '90A circuit, it also applies between the two  $R_0$  inputs.

## recommended operating conditions

|   | SN5490A, SN5492A<br>SN5493A |     |      | SN7490A, SN7492A<br>SN7493A |     |      | UNIT    |
|---|-----------------------------|-----|------|-----------------------------|-----|------|---------|
|   | MIN                         | NOM | MAX  | MIN                         | NOM | MAX  |         |
| Supply voltage, $V_{CC}$                    | 4.5                         | 5   | 5.5  | 4.75                        | 5   | 5.25 | V       |
| High-level output current, $I_{OH}$         |                             |     | -800 |                             |     | -800 | $\mu$ A |
| Low-level output current, $I_{OL}$          |                             |     | 16   |                             |     | 16   | mA      |
| Count frequency, $f_{count}$ (see Figure 1) | A input                     | 0   | 32   | 0                           | 32  |      | MHz     |
|   | B input                     | 0   | 16   | 0                           | 16  |      |         |
| Pulse width, $t_w$                          | A input                     | 15  |      | 15                          |     |      | ns      |
|   | B input                     | 30  |      | 30                          |     |      |         |
|   | Reset inputs                | 15  |      | 15                          |     |      |         |
| Reset inactive-state setup time, $t_{su}$   |                             | 25  |      |                             | 25  |      | ns      |
| Operating free-air temperature, $T_A$       |                             | -55 | 125  |                             | 0   | 70   | °C      |

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

| PARAMETER <sup>¶</sup>                             | TEST CONDITIONS <sup>†</sup>  | '90A                                       |                  |      | '92A                                       |                  |      | '93A                                       |                  |      | UNIT    |
|--|---|--|------------------|------|--|------------------|------|--|------------------|------|---------|
|  |   | MIN  | TYP <sup>‡</sup> | MAX  | MIN  | TYP <sup>‡</sup> | MAX  | MIN  | TYP <sup>‡</sup> | MAX  |         |
| $V_{IH}$ High-level input voltage                  |   | 2  |                  |      | 2  |                  |      | 2  |                  |      | V       |
| $V_{IL}$ Low-level input voltage                   |   |  |                  | 0.8  |  |                  | 0.8  |  |                  | 0.8  | V       |
| $V_{IK}$ Input clamp voltage                       | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$   |  |                  | -1.5 |  |                  | -1.5 |  |                  | -1.5 | V       |
| $V_{OH}$ High-level output voltage                 | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -800 \mu\text{A}$          | 2.4  | 3.4              |      | 2.4  | 3.4              |      | 2.4  | 3.4              |      | V       |
| $V_{OL}$ Low-level output voltage                  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}^{\parallel}$ |  | 0.2              | 0.4  |  | 0.2              | 0.4  |  | 0.2              | 0.4  | V       |
| $I_I$ Input current at maximum input voltage       | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$  |  |                  | 1    |  |                  | 1    |  |                  | 1    | mA      |
| $I_{IH}$ High-level input current                  | Any reset   |  |                  | 40   |  |                  | 40   |  |                  | 40   | $\mu$ A |
|  | CKA   | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ |                  | 80   | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ |                  | 80   | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ |                  | 80   |         |
|  | CKB   | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ |                  | 120  | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ |                  | 120  | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ |                  | 80   |         |
| $I_{IL}$ Low-level input current                   | Any reset   |  |                  | -1.6 |  |                  | -1.6 |  |                  | -1.6 | mA      |
|  | CKA   | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ |                  | -3.2 | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ |                  | -3.2 | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ |                  | -3.2 |         |
|  | CKB   | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ |                  | -4.8 | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ |                  | -4.8 | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ |                  | -3.2 |         |
| $I_{OS}$ Short-circuit output current <sup>§</sup> | $V_{CC} = \text{MAX}$   | SN54'                                      | -20              | -57  | -20  | -57              | -20  | -57  |                  |      | mA      |
|  |   | SN74'                                      | -18              | -57  | -18  | -57              | -18  | -57  |                  |      |         |
| $I_{CC}$ Supply current                            | $V_{CC} = \text{MAX}, \text{ See Note 3}$   |  | 29               | 42   |  | 26               | 39   |  | 26               | 39   | mA      |

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

<sup>‡</sup> All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

<sup>§</sup> Not more than one output should be shorted at a time.

<sup>¶</sup> '90A outputs are tested at  $I_{OL} = 16 \text{ mA}$  plus the limit value for  $I_{IL}$  for the CKB input. This permits driving the CKB input while maintaining full fan-out capability.

NOTE 3:  $I_{CC}$  is measured with all outputs open, both  $R_0$  inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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

| PARAMETER† | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS   | '90A |     |     | '92A |     |     | '93A |     |     | UNIT |
|------------|-----------------|----------------|---|------|-----|-----|------|-----|-----|------|-----|-----|------|
|            |                 |                |   | MIN  | TYP | MAX | MIN  | TYP | MAX | MIN  | TYP | MAX |      |
| $f_{\max}$ | CKA             | $Q_A$          | $C_L = 15\text{ pF}$ ,<br>$R_L = 400\ \Omega$ ,<br>See Figure 1 | 32   | 42  |     | 32   | 42  |     | 32   | 42  |     | MHz  |
|            | CKB             | $Q_B$          |   | 16   |     |     | 16   |     |     | 16   |     |     |      |
| $t_{PLH}$  | CKA             | $Q_A$          |   | 10   | 16  |     | 10   | 16  |     | 10   | 16  |     | ns   |
| $t_{PHL}$  |                 |                |   | 12   | 18  |     | 12   | 18  |     | 12   | 18  |     |      |
| $t_{PLH}$  | CKA             | $Q_D$          |   | 32   | 48  |     | 32   | 48  |     | 46   | 70  |     | ns   |
| $t_{PHL}$  |                 |                |   | 34   | 50  |     | 34   | 50  |     | 46   | 70  |     |      |
| $t_{PLH}$  | CKB             | $Q_B$          |   | 10   | 16  |     | 10   | 16  |     | 10   | 16  |     | ns   |
| $t_{PHL}$  |                 |                |   | 14   | 21  |     | 14   | 21  |     | 14   | 21  |     |      |
| $t_{PLH}$  | CKB             | $Q_C$          |   | 21   | 32  |     | 10   | 16  |     | 21   | 32  |     | ns   |
| $t_{PHL}$  |                 |                |   | 23   | 35  |     | 14   | 21  |     | 23   | 35  |     |      |
| $t_{PLH}$  | CKB             | $Q_D$          |   | 21   | 32  |     | 21   | 32  |     | 34   | 51  |     | ns   |
| $t_{PHL}$  |                 |                |   | 23   | 35  |     | 23   | 35  |     | 34   | 51  |     |      |
| $t_{PHL}$  | Set-to-0        | Any            |   | 26   | 40  |     | 26   | 40  |     | 26   | 40  |     | ns   |
| $t_{PLH}$  | Set-to-9        | $Q_A, Q_D$     |   | 20   | 30  |     |      |     |     |      |     |     | ns   |
| $t_{PHL}$  |                 | $Q_B, Q_C$     |   | 26   | 40  |     |      |     |     |      |     |     |      |

†  $f_{\max}$  = maximum count frequency  
 $t_{PLH}$  = propagation delay time, low-to-high-level output  
 $t_{PHL}$  = propagation delay time, high-to-low-level output



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

|  |                |
|--|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                  | 7 V            |
| Input voltage: R inputs                                | 7 V            |
| A and B inputs   | 5.5 V          |
| Operating free-air temperature range: SN54LS' Circuits | -55°C to 125°C |
| SN74LS' Circuits                                       | 0°C to 70°C    |
| Storage temperature range                              | -65°C to 150°C |

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

## recommended operating conditions

|   |              | SN54LS90<br>SN54LS92<br>SN54LS93 |     |      | SN74LS90<br>SN74LS92<br>SN74LS93 |     |      | UNIT    |
|---|--------------|----------------------------------|-----|------|----------------------------------|-----|------|---------|
|   |              | MIN                              | NOM | MAX  | MIN                              | NOM | MAX  |         |
| Supply voltage, $V_{CC}$                    |              | 4.5                              | 5   | 5.5  | 4.75                             | 5   | 5.25 | V       |
| High-level output current, $I_{OH}$         |              |                                  |     | -400 |                                  |     | -400 | $\mu$ A |
| Low-level output current, $I_{OL}$          |              |                                  |     | 4    |                                  |     | 8    | mA      |
| Count frequency, $f_{count}$ (see Figure 1) | A input      | 0                                |     | 32   | 0                                |     | 32   | MHz     |
|   | B input      | 0                                |     | 16   | 0                                |     | 16   |         |
| Pulse width, $t_w$                          | A input      | 15                               |     |      | 15                               |     |      | ns      |
|   | B input      | 30                               |     |      | 30                               |     |      |         |
|   | Reset inputs | 30                               |     |      | 30                               |     |      |         |
| Reset inactive-state setup time, $t_{su}$   |              | 25                               |     |      | 25                               |     |      | ns      |
| Operating free-air temperature, $T_A$       |              | -55                              |     | 125  | 0                                |     | 70   | °C      |

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

| PARAMETER                                    | TEST CONDITIONS†  | SN54LS90<br>SN54LS92                          |      |      | SN74LS90<br>SN74LS92 |      |      | UNIT    |
|--|---|---|------|------|----------------------|------|------|---------|
|  |   | MIN   | TYP‡ | MAX  | MIN                  | TYP‡ | MAX  |         |
| $V_{IH}$ High-level input voltage            |   | 2   |      |      | 2                    |      |      | V       |
| $V_{IL}$ Low-level input voltage             |   |   |      | 0.7  |                      |      | 0.8  | V       |
| $V_{IK}$ Input clamp voltage                 | $V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$  |   |      | -1.5 |                      |      | -1.5 | V       |
| $V_{OH}$ High-level output voltage           | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = V_{IL \text{ max}}$ , $I_{OH} = -400 \mu\text{A}$ | 2.5   | 3.4  |      | 2.7                  | 3.4  |      | V       |
| $V_{OL}$ Low-level output voltage            | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = V_{IL \text{ max}}$                               | $I_{OL} = 4 \text{ mA} \parallel$             | 0.25 | 0.4  | 0.25                 | 0.4  |      | V       |
|  |   | $I_{OL} = 8 \text{ mA} \parallel$             |      |      | 0.35                 | 0.5  |      |         |
| $I_I$ Input current at maximum input voltage | Any reset   | $V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$   |      |      | 0.1                  |      |      | mA      |
|  | CKA   | $V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$ |      |      | 0.2                  |      |      |         |
|  | CKB   |   |      |      | 0.4                  |      |      |         |
| $I_{IH}$ High-level input current            | Any reset   | $V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$ |      |      | 20                   |      |      | $\mu$ A |
|  | CKA   |   |      |      | 40                   |      |      |         |
|  | CKB   |   |      |      | 80                   |      |      |         |
| $I_{IL}$ Low-level input current             | Any reset   | $V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$ |      |      | -0.4                 |      |      | mA      |
|  | CKA   |   |      |      | -2.4                 |      |      |         |
|  | CKB   |   |      |      | -3.2                 |      |      |         |
| $I_{OS}$ Short-circuit output current§       | $V_{CC} = \text{MAX}$   | -20   |      | -100 | -20                  |      | -100 | mA      |
| $I_{CC}$ Supply current                      | $V_{CC} = \text{MAX}$ , See Note 3  | 'LS90   | 9    | 15   | 9                    | 15   |      | mA      |
|  |   | 'LS92   | 9    | 15   | 9                    | 15   |      |         |

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

‡ 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.

¶  $I_{QA}$  outputs are tested at specified  $I_{OL}$  plus the limit value of  $I_{IL}$  for the CKB input. This permits driving the CKB input while maintaining full fan-out capability.

NOTE 3:  $I_{CC}$  is measured with all outputs open, both  $R_0$  inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.





SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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

| PARAMETER       |  | TEST CONDITIONS†   | SN54LS93                                      |      |      | SN74LS93 |          |      | 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</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, V <sub>IL</sub> = V <sub>IL</sub> max                            | I <sub>OL</sub> = 4 mA¶                       |      | 0.25 | 0.4      | 0.25 0.4 |      | V    |
|                 |  |  | I <sub>OL</sub> = 8 mA¶                       |      |      |          | 0.35 0.5 |      |      |
| I <sub>I</sub>  | Input current at maximum input voltage | Any reset  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V   |      | 0.1  |          | 0.1      |      | mA   |
|                 |  | CKA or CKB   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V |      | 0.2  |          | 0.2      |      |      |
| I <sub>IH</sub> | High-level input current               | Any reset  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V |      | 20   |          | 20       |      | μA   |
|                 |  | CKA or CKB   |   |      | 40   |          | 80       |      |      |
| I <sub>IL</sub> | Low-level input current                | Any reset  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V |      | -0.4 |          | -0.4     |      | mA   |
|                 |  | CKA  |   |      | -2.4 |          | -2.4     |      |      |
|                 |  | CKB  |   |      | -1.6 |          | -1.6     |      |      |
| 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 3  | 9   | 15   | 9    | 15       |          |      | mA   |

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

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

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

¶ Q<sub>A</sub> outputs are tested at specified I<sub>OL</sub> plus the limit value for I<sub>IL</sub> for the CKB input. This permits driving the CKB input while maintaining full fan-out capability.

NOTE 3: I<sub>CC</sub> is measured with all outputs open, both R<sub>Q</sub> inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

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

| PARAMETER#       | FROM (INPUT) | TO (OUTPUT)                     | TEST CONDITIONS  | 'LS90 |     |     | 'LS92 |     |     | 'LS93 |     |     | UNIT |
|------------------|--------------|---------------------------------|--|-------|-----|-----|-------|-----|-----|-------|-----|-----|------|
|                  |              |                                 |  | MIN   | TYP | MAX | MIN   | TYP | MAX | MIN   | TYP | MAX |      |
| f <sub>max</sub> | CKA          | Q <sub>A</sub>                  | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 2 kΩ<br>See Figure 1 | 32    | 42  |     | 32    | 42  |     | 32    | 42  |     | MHz  |
|                  | CKB          | Q <sub>B</sub>                  |  | 16    |     |     | 16    |     |     | 16    |     |     |      |
| t <sub>PLH</sub> | CKA          | Q <sub>A</sub>                  |  | 10    | 16  |     | 10    | 16  |     | 10    | 16  |     | ns   |
|                  |              |                                 |  | 12    | 18  |     | 12    | 18  |     | 12    | 18  |     |      |
| t <sub>PLH</sub> | CKA          | Q <sub>D</sub>                  |  | 32    | 48  |     | 32    | 48  |     | 46    | 70  |     | ns   |
|                  |              |                                 |  | 34    | 50  |     | 34    | 50  |     | 46    | 70  |     |      |
| t <sub>PLH</sub> | CKB          | Q <sub>B</sub>                  |  | 10    | 16  |     | 10    | 16  |     | 10    | 16  |     | ns   |
|                  |              |                                 |  | 14    | 21  |     | 14    | 21  |     | 14    | 21  |     |      |
| t <sub>PLH</sub> | CKB          | Q <sub>C</sub>                  |  | 21    | 32  |     | 10    | 16  |     | 21    | 32  |     | ns   |
|                  |              |                                 |  | 23    | 35  |     | 14    | 21  |     | 23    | 35  |     |      |
| t <sub>PLH</sub> | CKB          | Q <sub>D</sub>                  |  | 21    | 32  |     | 21    | 32  |     | 34    | 51  |     | ns   |
|                  |              |                                 |  | 23    | 35  |     | 23    | 35  |     | 34    | 51  |     |      |
| t <sub>PHL</sub> | Set-to-0     | Any                             |  | 26    | 40  |     | 26    | 40  |     | 26    | 40  |     | ns   |
| t <sub>PLH</sub> | Set-to-9     | Q <sub>A</sub> , Q <sub>D</sub> |  | 20    | 30  |     |       |     |     |       |     |     | ns   |
|                  |              | Q <sub>B</sub> , Q <sub>C</sub> |  | 26    | 40  |     |       |     |     |       |     |     |      |

#f<sub>max</sub> = maximum count frequency

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

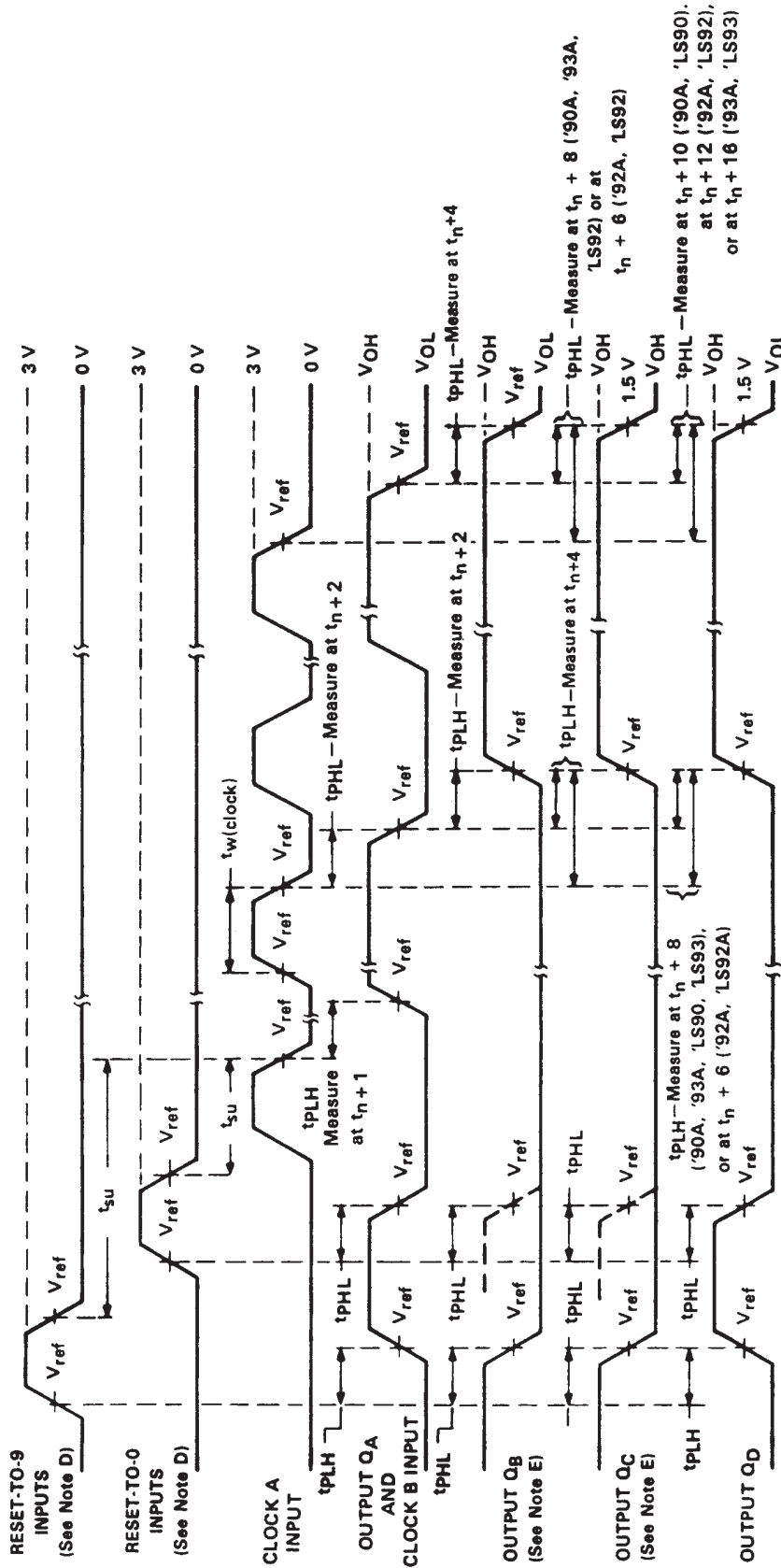
t<sub>PHL</sub> = propagation delay time, high-to-low-level output



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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PARAMETER MEASUREMENT INFORMATION

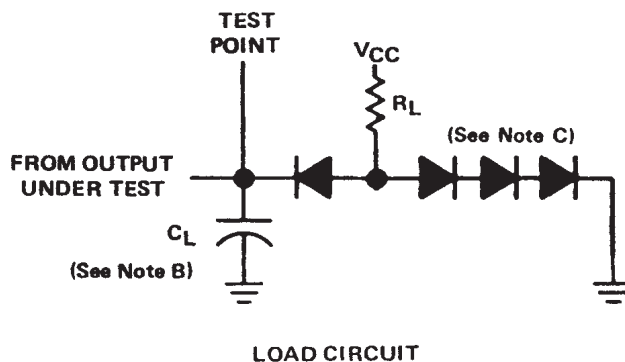


NOTES: A. Input pulses are supplied by a generator having the following characteristics:

- for '90A, '92A, '93A,  $t_r \leq 5$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms;
- for 'LS90, 'LS92, 'LS93,  $t_r \leq 15$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms.
- B.  $C_L$  includes probe and jig capacitance.
- C. All diodes are 1N3064 or equivalent.
- D. Each reset input is tested separately with the other reset at 4.5 V.
- E. Reference waveforms are shown with dashed lines.
- F. For '90A, '92A, and '93A;  $V_{ref} = 1.5$  V. For 'LS90, 'LS92, and 'LS93;  $V_{ref} = 1.3$  V.

FIGURE 1A

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Input pulses are supplied by a generator having the following characteristics:  
for '90A, '92A, '93A,  $t_r \leq 5$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms;  
for 'LS90, 'LS92, 'LS93,  $t_r \leq 15$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms.
- B.  $C_L$  includes probe and jig capacitance.
- C. All diodes are 1N3064 or equivalent.
- D. Each reset input is tested separately with the other reset at 4.5 V.
- E. Reference waveforms are shown with dashed lines.
- F. For '90A, '92A, and '93A;  $V_{ref} = 1.5$  V. For 'LS90, 'LS92, and 'LS93;  $V_{ref} = 1.3$  V.

FIGURE 1B

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| 7603201CA        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | Call TI              | Call TI                      |                             |
| 7603201DA        | ACTIVE                | CFP          | W               | 14   | 1           | TBD                        | Call TI              | Call TI                      |                             |
| 7700101CA        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | Call TI              | Call TI                      |                             |
| 7700101DA        | ACTIVE                | CFP          | W               | 14   | 1           | TBD                        | Call TI              | Call TI                      |                             |
| JM38510/31501BCA | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| JM38510/31501BDA | ACTIVE                | CFP          | W               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| JM38510/31502BCA | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| JM38510/31502BDA | ACTIVE                | CFP          | W               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| M38510/31501BCA  | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| M38510/31501BDA  | ACTIVE                | CFP          | W               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| M38510/31502BCA  | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| M38510/31502BDA  | ACTIVE                | CFP          | W               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| SN5490AJ         | OBSOLETE              | CDIP         | J               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN5492AJ         | OBSOLETE              | CDIP         | J               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN54LS90J        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| SN54LS93J        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| SN7490AN         | OBSOLETE              | PDIP         | N               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN7492AN         | OBSOLETE              | PDIP         | N               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN7493AN         | OBSOLETE              | PDIP         | N               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN74LS90D        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS90DE4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS90DG4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS90DR       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS90DRE4     | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS90DRG4     | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| SN74LS90N        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)             | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74LS90NE4      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)             | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74LS92D        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS92DE4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS92DG4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS92N        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)             | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74LS92N3       | OBSOLETE              | PDIP         | N               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN74LS92NE4      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)             | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74LS92NSR      | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS92NSRE4    | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS92NSRG4    | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS93D        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS93DE4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS93DG4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS93N        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)             | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74LS93N3       | OBSOLETE              | PDIP         | N               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SN74LS93NE4      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)             | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74LS93NSR      | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS93NSRE4    | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74LS93NSRG4    | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SNJ5490AJ        | OBSOLETE              | CDIP         | J               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |
| SNJ5490AW        | OBSOLETE              | CFP          | W               | 14   |             | TBD                        | Call TI              | Call TI                      |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|-----------------------------|
| SNJ5492AJ        | OBSOLETE              | CDIP         | J               | 14   |             | TBD                     | Call TI              | Call TI                      |                             |
| SNJ5492AW        | OBSOLETE              | CFP          | W               | 14   |             | TBD                     | Call TI              | Call TI                      |                             |
| SNJ54LS90J       | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42                  | N / A for Pkg Type           |                             |
| SNJ54LS90W       | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | A42                  | N / A for Pkg Type           |                             |
| SNJ54LS93J       | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42                  | N / A for Pkg Type           |                             |
| SNJ54LS93W       | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | A42                  | N / A for Pkg Type           |                             |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**OTHER QUALIFIED VERSIONS OF SN5490A, SN5492A, SN54LS90, SN54LS93, SN7490A, SN7492A, SN74LS90, SN74LS93 :**

● Catalog: [SN7490A](#), [SN7492A](#), [SN74LS90](#), [SN74LS93](#)

- Military: [SN5490A](#), [SN5492A](#), [SN54LS90](#), [SN54LS93](#)

NOTE: Qualified Version Definitions:

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

## 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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS90DR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS92NSR | SO           | NS              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LS93NSR | SO           | NS              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS90DR  | SOIC         | D               | 14   | 2500 | 346.0       | 346.0      | 33.0        |
| SN74LS92NSR | SO           | NS              | 14   | 2000 | 346.0       | 346.0      | 33.0        |
| SN74LS93NSR | SO           | NS              | 14   | 2000 | 346.0       | 346.0      | 33.0        |

# 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)        |

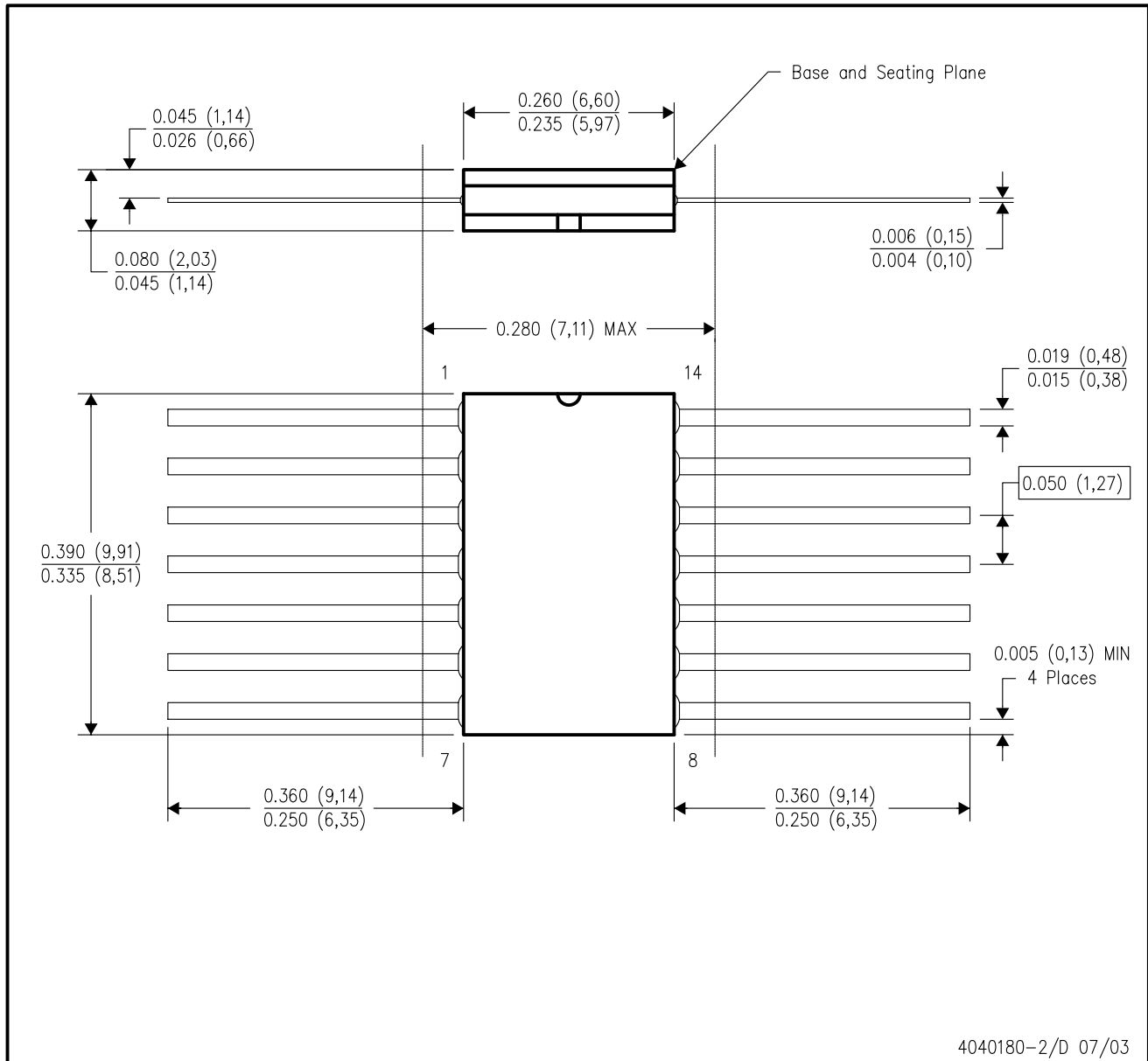


4040083/F 03/03

- NOTES:
- 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.

W (R-GDFP-F14)

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 GDFP1-F14 and JEDEC MO-092AB

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

PLASTIC DUAL-IN-LINE PACKAGE

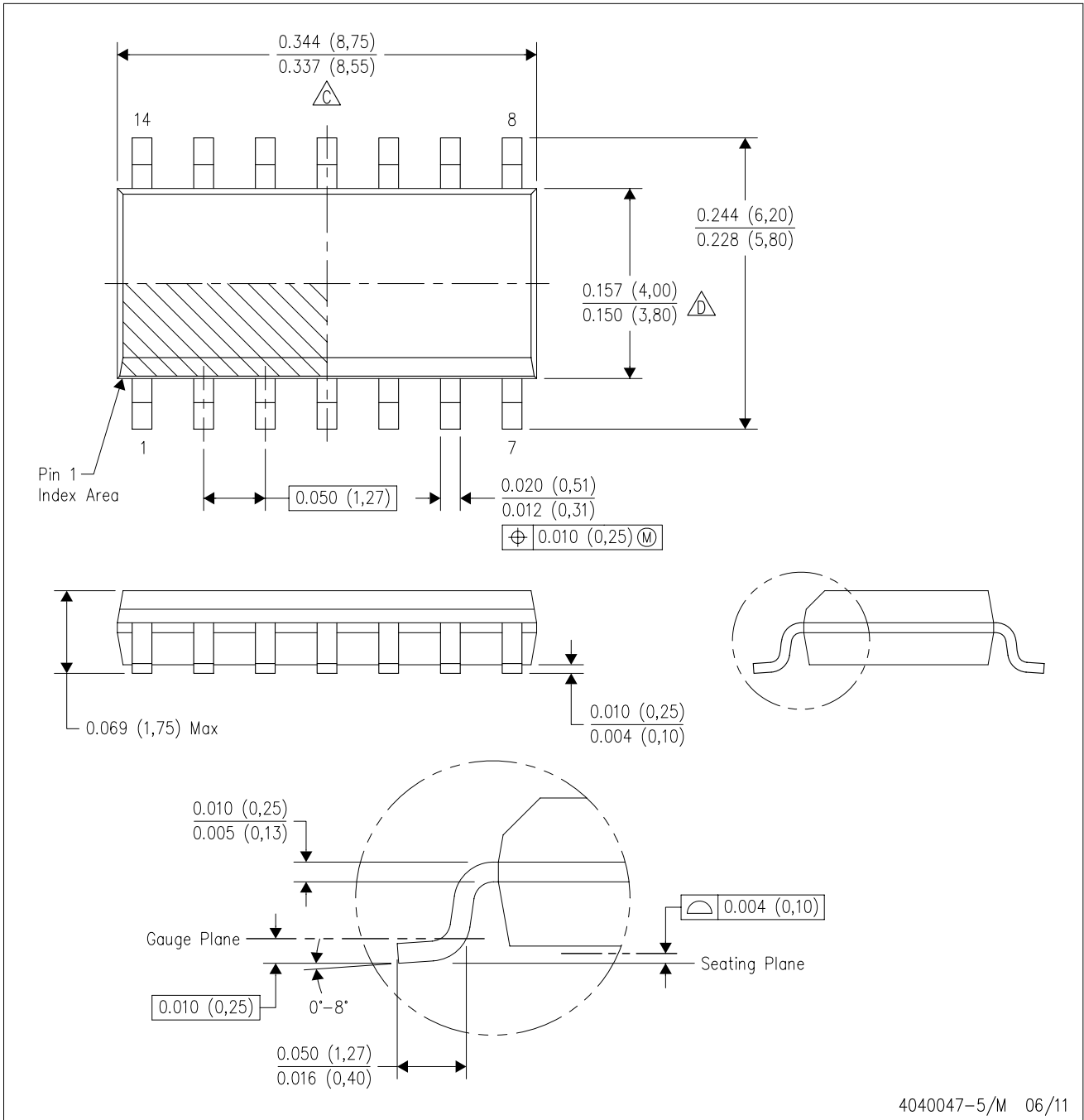
16 PINS SHOWN



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

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE

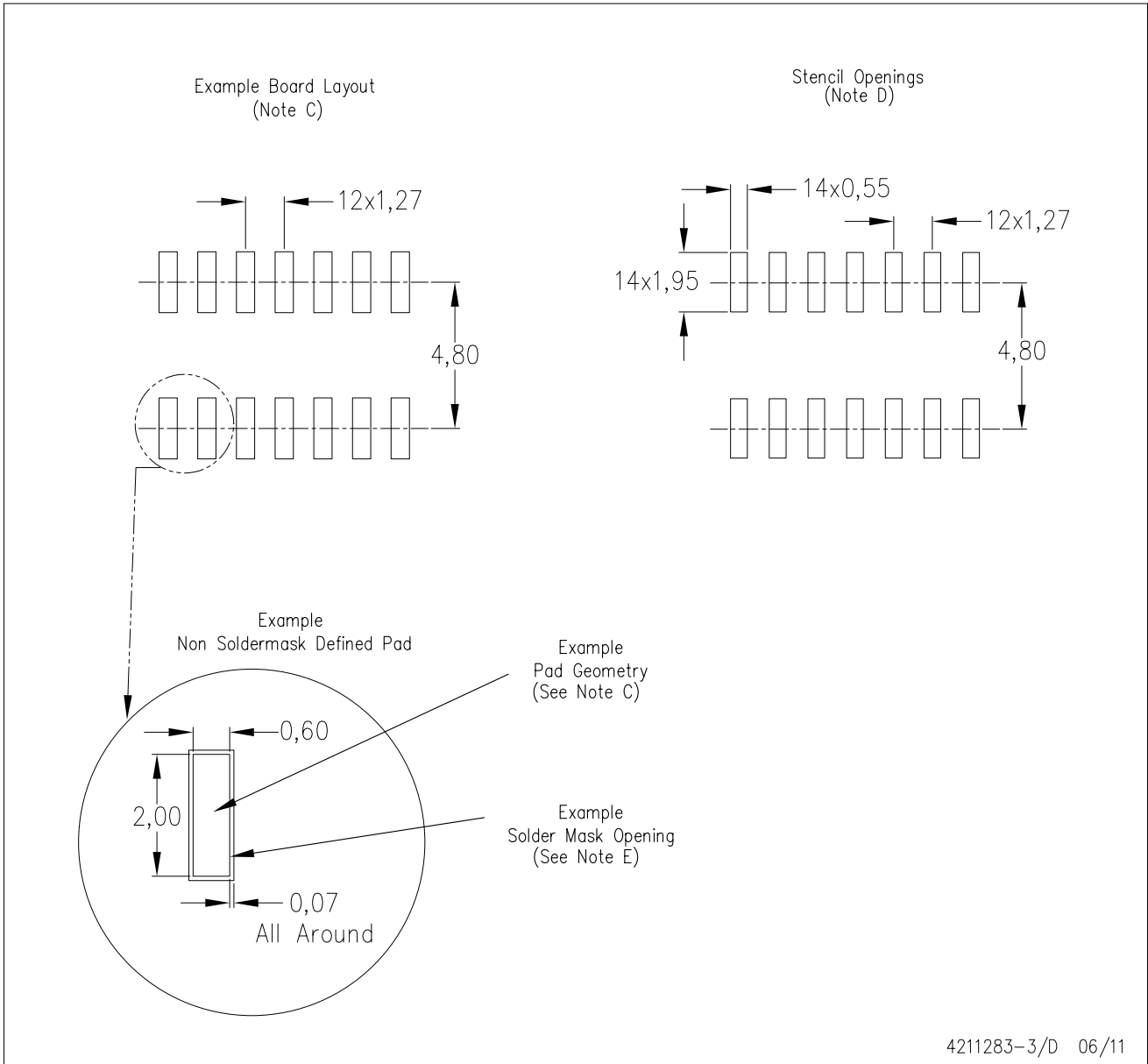


4040047-5/M 06/11

- 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 AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



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

## MECHANICAL DATA

**NS (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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