

# SN5474, SN54LS74A, SN54S74 SN7474, SN74LS74A, SN74S74

## DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

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- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

### description

These devices contain two independent D-type positive-edge-triggered flip-flops. A low level at the preset or clear inputs sets or resets the outputs regardless of the levels of the other inputs. When preset and clear are inactive (high), data at the D input meeting the setup time requirements are transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold time interval, data at the D input may be changed without affecting the levels at the outputs.

The SN54' family is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74' family is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE

| INPUTS |     |     |   | OUTPUTS        |                |
|--------|-----|-----|---|----------------|----------------|
| PRE    | CLR | CLK | D | Q              | $\bar{Q}$      |
| L      | H   | X   | X | H              | L              |
| H      | L   | X   | X | L              | H              |
| L      | L   | X   | X | H <sup>†</sup> | H <sup>†</sup> |
| H      | H   | ↑   | H | H              | L              |
| H      | H   | ↑   | L | L              | H              |
| H      | H   | L   | X | $Q_0$          | $\bar{Q}_0$    |

† The output levels in this configuration are not guaranteed to meet the minimum levels in  $V_{OH}$  if the lows at preset and clear are near  $V_{IL}$  maximum. Furthermore, this configuration is nonstable; that is, it will not persist when either preset or clear returns to its inactive (high) level.

### logic symbol<sup>‡</sup>

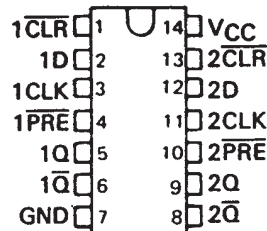


<sup>‡</sup>This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

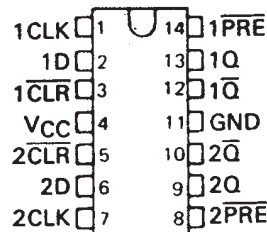
Pin numbers shown are for D, J, N, and W packages.

SN5474 . . . J PACKAGE  
SN54LS74A, SN54S74 . . . J OR W PACKAGE  
SN7474 . . . N PACKAGE  
SN74LS74A, SN74S74 . . . D OR N PACKAGE

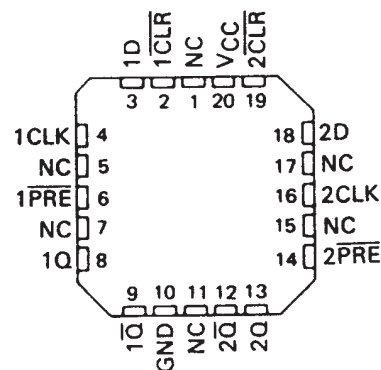
(TOP VIEW)



SN5474 . . . W PACKAGE  
(TOP VIEW)

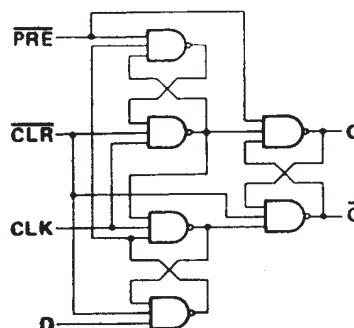


SN54LS74A, SN54S74 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

### logic diagram (positive logic)



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

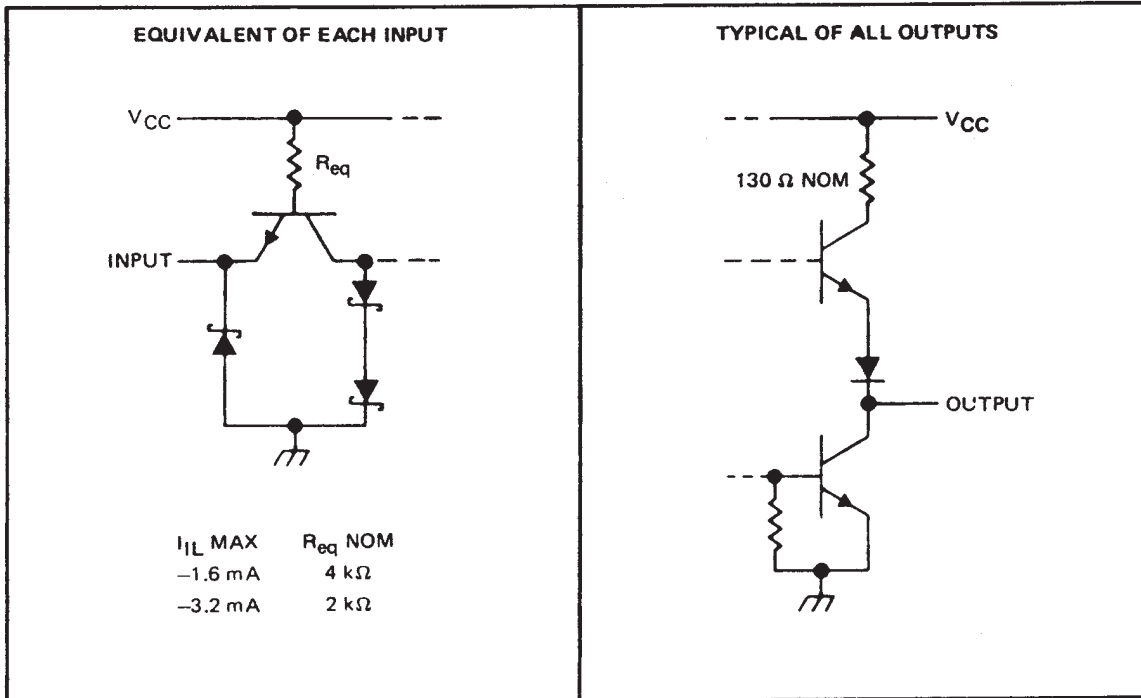


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schematics of inputs and outputs

74



'S74



DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

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schematic



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

|   |                |
|---|----------------|
| Supply voltage, $V_{CC}$ (see Note 1) .....       | 7 V            |
| Input voltage: '74, 'S74 .....                    | 5.5 V          |
| 'LS74A .....                                      | 7 V            |
| Operating free-air temperature range: SN54' ..... | -55°C to 125°C |
| SN74' .....                                       | 0°C to 70°C    |
| Storage temperature range .....                   | -65°C to 150°C |

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

**SN5474, SN54LS74A, SN54S74**

**SN7474, SN74LS74A, SN74S74**

**DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR**

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**recommended operating conditions**

|                 |                                  | SN5474         |     |      | SN7474 |     |      | UNIT |
|-----------------|----------------------------------|----------------|-----|------|--------|-----|------|------|
|                 |                                  | MIN            | NOM | MAX  | MIN    | NOM | MAX  |      |
| V <sub>CC</sub> | Supply voltage                   | 4.5            | 5   | 5.5  | 4.75   | 5   | 5.25 | V    |
| V <sub>IH</sub> | High-level input voltage         | 2              |     |      | 2      |     |      | V    |
| V <sub>IL</sub> | Low-level input voltage          |                |     | 0.8  |        |     | 0.8  | 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   |
| t <sub>w</sub>  | Pulse duration                   | CLK high       |     | 30   | 30     |     | ns   |      |
|                 |                                  | CLK low        |     | 37   | 37     |     |      |      |
|                 |                                  | PRE or CLR low |     | 30   | 30     |     |      |      |
| t <sub>SU</sub> | Input setup time before CLK ↑    | 20             |     |      | 20     |     |      | ns   |
| t <sub>H</sub>  | Input hold time-data after CLK ↑ | 5              |     |      | 5      |     |      | ns   |
| 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†       |  | SN5474 |      | SN7474 |     | UNIT |
|-------------------|-----------|------------------------|--|--------|------|--------|-----|------|
|                   |           |                        |  | MIN    | TYP‡ | MAX    | MIN |      |
| V <sub>IK</sub>   |           | V <sub>CC</sub> = MIN, | I <sub>I</sub> = -12 mA  | -1.5   |      | -1.5   |     | V    |
| V <sub>OH</sub>   |           | V <sub>CC</sub> = MIN, | V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V,<br>I <sub>OH</sub> = -0.4 mA | 2.4    | 3.4  | 2.4    | 3.4 | V    |
| V <sub>OL</sub>   |           | V <sub>CC</sub> = MIN, | V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V,<br>I <sub>OL</sub> = 16 mA   | 0.2    | 0.4  | 0.2    | 0.4 | V    |
| I <sub>I</sub>    |           | V <sub>CC</sub> = MAX, | V <sub>I</sub> = 5.5 V   | 1      |      | 1      |     | mA   |
| I <sub>IH</sub>   | D         | V <sub>CC</sub> = MAX, | V <sub>I</sub> = 2.4 V   | 40     |      | 40     |     | μA   |
|                   | CLR       |                        |  | 120    |      | 120    |     |      |
|                   | All Other |                        |  | 80     |      | 80     |     |      |
| I <sub>IL</sub>   | D         | V <sub>CC</sub> = MAX, | V <sub>I</sub> = 0.4 V   | -1.6   |      | -1.6   |     | mA   |
|                   | PRE‡      |                        |  | -1.6   |      | -1.6   |     |      |
|                   | CLR‡      |                        |  | -3.2   |      | -3.2   |     |      |
|                   | CLK       |                        |  | -3.2   |      | -3.2   |     |      |
| I <sub>OS</sub> † |           | V <sub>CC</sub> = MAX  |  | -20    | -57  | -18    | -57 | mA   |
| I <sub>CC</sub> # |           | V <sub>CC</sub> = MAX, | See Note 2   | 8.5    | 15   | 8.5    | 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.

§Clear is tested with preset high and preset is tested with clear high.

†Not more than one output should be shown at a time.

#Average per flip-flop.

NOTE 2: With all outputs open, I<sub>CC</sub> is measured with the Q and Q̄ outputs high in turn. At the time of measurement, the clock input is grounded.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)**

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                                |  | MIN | TYP | MAX | UNIT |    |
|------------------|--------------|-------------|--|--|-----|-----|-----|------|----|
| f <sub>max</sub> |              |             |  |  | 15  | 25  |     | MHz  |    |
| t <sub>PLH</sub> | PRE or CLR   | Q or Q̄     | R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 15 pF |  |     |     | 25  | ns   |    |
| t <sub>PHL</sub> |              |             |  |  |     |     | 40  | ns   |    |
| t <sub>PLH</sub> | CLK          | Q or Q̄     |  |  |     |     | 14  | 25   | ns |
| t <sub>PHL</sub> |              |             |  |  |     |     | 20  | 40   | ns |

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



DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

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recommended operating conditions

|                    |                                | SN54LS74A       |     |      | SN74LS74A |     |      | UNIT |
|--------------------|--------------------------------|-----------------|-----|------|-----------|-----|------|------|
|                    |                                | MIN             | NOM | MAX  | MIN       | NOM | MAX  |      |
| V <sub>CC</sub>    | Supply voltage                 | 4.5             | 5   | 5.5  | 4.75      | 5   | 5.25 | V    |
| V <sub>IH</sub>    | High-level input voltage       | 2               |     |      | 2         |     |      | V    |
| V <sub>IL</sub>    | Low-level input voltage        |                 |     | 0.7  |           |     | 0.8  | V    |
| I <sub>OH</sub>    | High-level output current      |                 |     | -0.4 |           |     | -0.4 | mA   |
| I <sub>OL</sub>    | Low-level output current       |                 |     | 4    |           |     | 8    | mA   |
| f <sub>clock</sub> | Clock frequency                | 0               |     | 25   | 0         |     | 25   | MHz  |
| t <sub>w</sub>     | Pulse duration                 | CLK high        |     | 25   | 25        |     | ns   |      |
|                    |                                | PRE or CLR low  |     | 25   | 25        |     |      |      |
| t <sub>su</sub>    | Setup time-before CLK ↑        | High-level data |     | 20   | 20        |     | ns   |      |
|                    |                                | Low-level data  |     | 20   | 20        |     |      |      |
| t <sub>h</sub>     | Hold time-data after CLK ↑     | 5               |     | 5    |           | ns  |      |      |
| 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†   | SN54LS74A                                     |      |      | SN74LS74A |      |      | UNIT |
|-------------------------|--|---|------|------|-----------|------|------|------|
|                         |  | MIN   | TYP‡ | MAX  | MIN       | TYP‡ | MAX  |      |
| V <sub>IK</sub>         | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA   |   |      | -1.5 |           |      | -1.5 | V    |
| V <sub>OH</sub>         | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -0.4 mA | 2.5   | 3.4  |      | 2.7       | 3.4  |      | V    |
| V <sub>OL</sub>         | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA    |   | 0.25 | 0.4  |           | 0.25 | 0.4  | V    |
|                         | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA    |   |      |      |           | 0.35 | 0.5  |      |
| I <sub>I</sub>          | D or CLK   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V   |      | 0.1  | 0.1       |      | mA   |      |
|                         | CLR or PRE   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V   |      | 0.2  | 0.2       |      |      |      |
| I <sub>IH</sub>         | D or CLK   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V |      | 20   | 20        |      | μA   |      |
|                         | CLR or PRE   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V |      | 40   | 40        |      |      |      |
| I <sub>IL</sub>         | D or CLK   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V |      | -0.4 | -0.4      |      | mA   |      |
|                         | CLR or PRE   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V |      | -0.8 | -0.8      |      |      |      |
| I <sub>OS</sub> §       | V <sub>CC</sub> = MAX, See Note 4  | -20   |      | -100 | -20       |      | -100 | mA   |
| I <sub>CC</sub> (Total) | V <sub>CC</sub> = MAX, See Note 2  |   | 4    | 8    |           | 4    | 8    | 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 the duration of the short circuit should not exceed one second.

NOTE 2: With all outputs open, I<sub>CC</sub> is measured with the Q and Q̄ outputs high in turn. At the time of measurement, the clock input is grounded.

NOTE 4: For certain devices where state commutation can be caused by shorting an output to ground, an equivalent test may be performed with V<sub>O</sub> = 2.25 V and 2.125 V for the 54 family and the 74 family, respectively, with the minimum and maximum limits reduced to one half of their stated values.

switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)

| PARAMETER        | FROM (INPUT)    | TO (OUTPUT) | TEST CONDITIONS                               | MIN | TYP | MAX | UNIT |
|------------------|-----------------|-------------|---|-----|-----|-----|------|
| f <sub>max</sub> |                 |             |   | 25  | 33  |     | MHz  |
| t <sub>PLH</sub> | CLR, PRE or CLK | Q or Q̄     | R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF |     | 13  | 25  | ns   |
| t <sub>PHL</sub> |                 |             |   |     | 25  | 40  | ns   |

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

**SN5474, SN54LS74A, SN54S74**

**SN7474, SN74LS74A, SN74S74**

**DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR**

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**recommended operating conditions**

|                 |                                    | SN54S74         |     |     | SN74S74 |     |      | UNIT |
|-----------------|------------------------------------|-----------------|-----|-----|---------|-----|------|------|
|                 |                                    | MIN             | NOM | MAX | MIN     | NOM | MAX  |      |
| V <sub>CC</sub> | Supply voltage                     | 4.5             | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| V <sub>IH</sub> | High-level input voltage           | 2               |     |     | 2       |     |      | V    |
| V <sub>IL</sub> | Low-level input voltage            | 0.8             |     |     | 0.8     |     |      | V    |
| I <sub>OH</sub> | High-level output current          | -1              |     |     | -1      |     |      | mA   |
| I <sub>OL</sub> | Low-level output current           | 20              |     |     | 20      |     |      | mA   |
| t <sub>w</sub>  | Pulse duration                     | CLK high        |     | 6   | 6       |     | ns   |      |
|                 |                                    | CLK low         |     | 7.3 | 7.3     |     |      |      |
|                 |                                    | CLR or PRE low  |     | 7   | 7       |     |      |      |
| t <sub>su</sub> | Setup time, before CLK ↑           | High-level data |     | 3   | 3       |     | ns   |      |
|                 |                                    | Low-level data  |     | 3   | 3       |     |      |      |
| t <sub>h</sub>  | Input hold time - data after CLK ↑ | 2               |     |     | 2       |     |      | ns   |
| 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†   | SN54S74 |      |     | SN74S74 |      |     | UNIT |
|-------------------|------------|--|---------|------|-----|---------|------|-----|------|
|                   |            |  | MIN     | TYP‡ | MAX | MIN     | TYP‡ | MAX |      |
| V <sub>IK</sub>   |            | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA,  | -1.2    |      |     | -1.2    |      |     | V    |
| V <sub>OH</sub>   |            | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -1 mA | 2.5     | 3.4  |     | 2.7     | 3.4  |     | V    |
| V <sub>OL</sub>   |            | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 20 mA | 0.5     |      |     | 0.5     |      |     | V    |
| I <sub>I</sub>    |            | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V  | 1       |      |     | 1       |      |     | mA   |
| I <sub>IH</sub>   | D          | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V  | 50      |      |     | 50      |      |     | μA   |
|                   | CLR        |  | 150     |      |     | 150     |      |     |      |
|                   | PRE or CLK |  | 100     |      |     | 100     |      |     |      |
| I <sub>IL</sub>   | D          | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V  | -2      |      |     | -2      |      |     | mA   |
|                   | CLR†       |  | -6      |      |     | -6      |      |     |      |
|                   | PRE†       |  | -4      |      |     | -4      |      |     |      |
|                   | CLK        |  | -4      |      |     | -4      |      |     |      |
| I <sub>OS</sub> ‡ |            | V <sub>CC</sub> = MAX  | -40     | -100 |     | -40     | -100 | mA  |      |
| I <sub>CC</sub> # |            | V <sub>CC</sub> = MAX, See Note 2  | 15      | 25   |     | 15      | 25   | 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 the duration of the short circuit should not exceed one second.

†Clear is tested with preset high and preset is tested with clear high.

#Average per flip-flop.

NOTE 2: With all outputs open, I<sub>CC</sub> is measured with the Q and Q̄ outputs high in turn. At the time of measurement, the clock input is grounded.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)**

| PARAMETER        | FROM (INPUT)          | TO (OUTPUT) | TEST CONDITIONS                                | MIN | TYP  | MAX | UNIT |
|------------------|-----------------------|-------------|--|-----|------|-----|------|
| f <sub>max</sub> |                       |             | R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 15 pF | 75  | 110  |     | MHz  |
| t <sub>PLH</sub> | PRE or CLR            | Q or Q̄     |  | 4   | 6    |     | ns   |
| t <sub>PHL</sub> | PRE or CLR (CLK high) | Q̄ or Q     |  | 9   | 13.5 |     | ns   |
|                  | PRE or CLR (CLK low)  |             |  | 5   | 8    |     | ns   |
| t <sub>PLH</sub> | CLK                   | Q or Q̄     |  | 6   | 9    |     | ns   |
| t <sub>PHL</sub> |                       |             |  | 6   | 9    |     | ns   |

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



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)  | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| JM38510/07101BCA | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BCA        | <a href="#">Samples</a> |
| JM38510/07101BDA | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BDA        | <a href="#">Samples</a> |
| JM38510/07101BDA | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BDA        | <a href="#">Samples</a> |
| JM38510/30102B2A | ACTIVE        | LCCC         | FK              | 20   | 55          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102B2A        | <a href="#">Samples</a> |
| JM38510/30102B2A | ACTIVE        | LCCC         | FK              | 20   | 55          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102B2A        | <a href="#">Samples</a> |
| JM38510/30102BCA | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BCA        | <a href="#">Samples</a> |
| JM38510/30102BCA | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BCA        | <a href="#">Samples</a> |
| JM38510/30102BDA | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BDA        | <a href="#">Samples</a> |
| JM38510/30102BDA | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BDA        | <a href="#">Samples</a> |
| JM38510/30102SCA | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SCA        | <a href="#">Samples</a> |
| JM38510/30102SCA | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SCA        | <a href="#">Samples</a> |
| JM38510/30102SDA | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SDA        | <a href="#">Samples</a> |
| JM38510/30102SDA | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SDA        | <a href="#">Samples</a> |
| M38510/07101BCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BCA        | <a href="#">Samples</a> |
| M38510/07101BCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BCA        | <a href="#">Samples</a> |
| M38510/07101BDA  | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BDA        | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)      | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|----------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| M38510/07101BDA  | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/07101BDA        | <a href="#">Samples</a> |
| M38510/30102B2A  | ACTIVE        | LCCC         | FK              | 20   | 55          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102B2A        | <a href="#">Samples</a> |
| M38510/30102B2A  | ACTIVE        | LCCC         | FK              | 20   | 55          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102B2A        | <a href="#">Samples</a> |
| M38510/30102BCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Non-Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BCA        | <a href="#">Samples</a> |
| M38510/30102BCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Non-Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BCA        | <a href="#">Samples</a> |
| M38510/30102BDA  | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BDA        | <a href="#">Samples</a> |
| M38510/30102BDA  | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102BDA        | <a href="#">Samples</a> |
| M38510/30102SCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SCA        | <a href="#">Samples</a> |
| M38510/30102SCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SCA        | <a href="#">Samples</a> |
| M38510/30102SDA  | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SDA        | <a href="#">Samples</a> |
| M38510/30102SDA  | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/30102SDA        | <a href="#">Samples</a> |
| SN54LS74AJ       | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54LS74AJ              | <a href="#">Samples</a> |
| SN54LS74AJ       | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54LS74AJ              | <a href="#">Samples</a> |
| SN54S74J         | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54S74J                | <a href="#">Samples</a> |
| SN54S74J         | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green     | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54S74J                | <a href="#">Samples</a> |
| SN74LS74AD       | OBSOLETE      | SOIC         | D               | 14   |             | TBD                  | Call TI                              | Call TI              | 0 to 70      | LS74A                   |                         |
| SN74LS74AD       | OBSOLETE      | SOIC         | D               | 14   |             | TBD                  | Call TI                              | Call TI              | 0 to 70      | LS74A                   |                         |
| SN74LS74ADBR     | ACTIVE        | SSOP         | DB              | 14   | 2000        | RoHS & Green         | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS74A                   | <a href="#">Samples</a> |
| SN74LS74ADBR     | ACTIVE        | SSOP         | DB              | 14   | 2000        | RoHS & Green         | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS74A                   | <a href="#">Samples</a> |



| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LS74ADR      | ACTIVE        | SOIC         | D               | 14   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS74A                   | <a href="#">Samples</a> |
| SN74LS74ADR      | ACTIVE        | SOIC         | D               | 14   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS74A                   | <a href="#">Samples</a> |
| SN74LS74ADRG4    | ACTIVE        | SOIC         | D               | 14   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS74A                   | <a href="#">Samples</a> |
| SN74LS74ADRG4    | ACTIVE        | SOIC         | D               | 14   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS74A                   | <a href="#">Samples</a> |
| SN74LS74AN       | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS74AN              | <a href="#">Samples</a> |
| SN74LS74AN       | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS74AN              | <a href="#">Samples</a> |
| SN74LS74ANE4     | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS74AN              | <a href="#">Samples</a> |
| SN74LS74ANE4     | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS74AN              | <a href="#">Samples</a> |
| SN74LS74ANSR     | ACTIVE        | SOP          | NS              | 14   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS74A                 | <a href="#">Samples</a> |
| SN74LS74ANSR     | ACTIVE        | SOP          | NS              | 14   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS74A                 | <a href="#">Samples</a> |
| SN74LS74ANSRG4   | ACTIVE        | SOP          | NS              | 14   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS74A                 | <a href="#">Samples</a> |
| SN74LS74ANSRG4   | ACTIVE        | SOP          | NS              | 14   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS74A                 | <a href="#">Samples</a> |
| SN74S74D         | ACTIVE        | SOIC         | D               | 14   | 50          | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | S74                     | <a href="#">Samples</a> |
| SN74S74D         | ACTIVE        | SOIC         | D               | 14   | 50          | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | S74                     | <a href="#">Samples</a> |
| SN74S74N         | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74S74N                | <a href="#">Samples</a> |
| SN74S74N         | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74S74N                | <a href="#">Samples</a> |
| SNJ54LS74AFK     | ACTIVE        | LCCC         | FK              | 20   | 55          | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS<br>74AFK        | <a href="#">Samples</a> |
| SNJ54LS74AFK     | ACTIVE        | LCCC         | FK              | 20   | 55          | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS<br>74AFK        | <a href="#">Samples</a> |
| SNJ54LS74AJ      | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS74AJ             | <a href="#">Samples</a> |
| SNJ54LS74AJ      | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS74AJ             | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)  | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SNJ54LS74AW      | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS74AW             | <a href="#">Samples</a> |
| SNJ54LS74AW      | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS74AW             | <a href="#">Samples</a> |
| SNJ54S74J        | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54S74J               | <a href="#">Samples</a> |
| SNJ54S74J        | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54S74J               | <a href="#">Samples</a> |
| SNJ54S74W        | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54S74W               | <a href="#">Samples</a> |
| SNJ54S74W        | ACTIVE        | CFP          | W               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54S74W               | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

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

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

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

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

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

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

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

(6) Lead finish/Ball material - Orderable Devices 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.

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**OTHER QUALIFIED VERSIONS OF SN54LS74A, SN54LS74A-SP, SN54S74, SN74LS74A, SN74S74 :**

- Catalog : [SN74LS74A](#), [SN54LS74A](#), [SN74S74](#)
  
- Military : [SN54LS74A](#), [SN54S74](#)
  
- Space : [SN54LS74A-SP](#)

NOTE: Qualified Version Definitions:

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

**TAPE AND REEL INFORMATION**

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


\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS74ADBR | SSOP         | DB              | 14   | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| SN74LS74ADR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS74ANSR | SOP          | 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) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS74ADBR | SSOP         | DB              | 14   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LS74ADR  | SOIC         | D               | 14   | 2500 | 356.0       | 356.0      | 35.0        |
| SN74LS74ANSR | SOP          | NS              | 14   | 2000 | 367.0       | 367.0      | 38.0        |

**TUBE**


\*All dimensions are nominal

| Device           | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| JM38510/07101BDA | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| JM38510/30102B2A | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| JM38510/30102BDA | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| JM38510/30102SDA | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| M38510/07101BDA  | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| M38510/30102B2A  | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| M38510/30102BDA  | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| M38510/30102SDA  | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| SN74LS74AN       | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS74AN       | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS74ANE4     | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS74ANE4     | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74S74D         | D            | SOIC         | 14   | 50  | 506.6  | 8      | 3940   | 4.32   |
| SN74S74N         | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74S74N         | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SNJ54LS74AFK     | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| SNJ54LS74AW      | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |
| SNJ54S74W        | W            | CFP          | 14   | 25  | 506.98 | 26.16  | 6220   | NA     |

D0014A



# PACKAGE OUTLINE

## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

NOTES:

- All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
- This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
- Reference JEDEC registration MS-012, variation AB.

# EXAMPLE BOARD LAYOUT

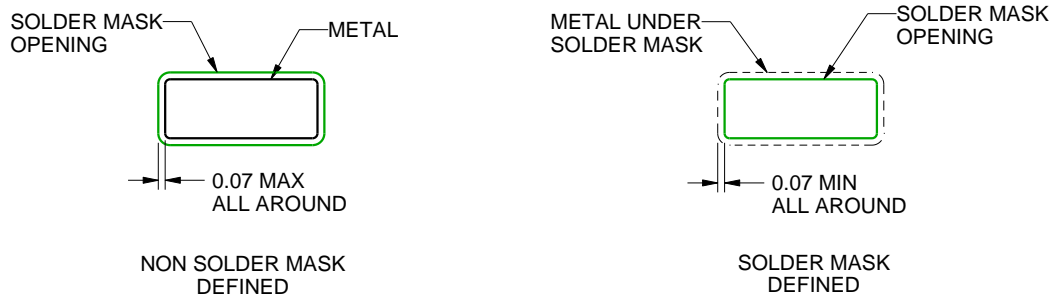
D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

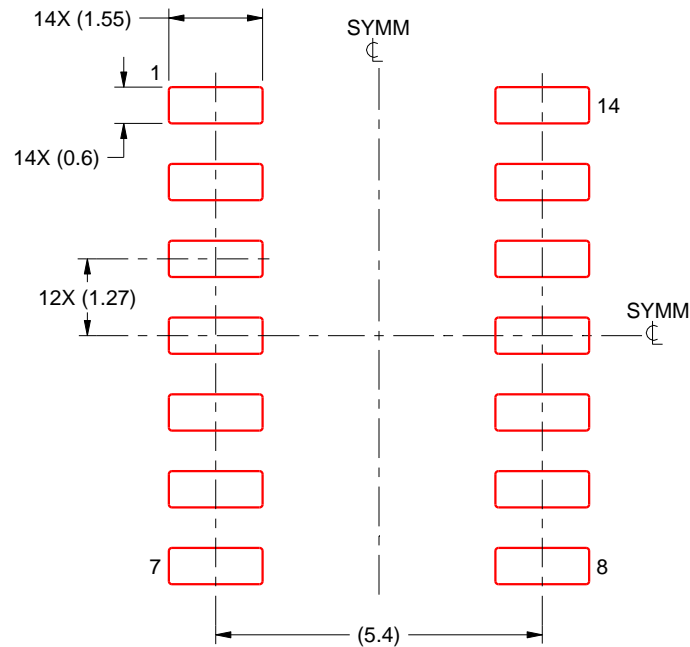


# EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

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

## 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.

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

# DB0014A



# PACKAGE OUTLINE

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4220762/A 05/2024

### NOTES:

- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
- Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220762/A 05/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220762/A 05/2024

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.

## 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 14

**GENERIC PACKAGE VIEW**  
**CDIP - 5.08 mm max height**  
CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4040083-5/G



J0014A



# PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

# EXAMPLE BOARD LAYOUT

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE  
NON-SOLDER MASK DEFINED  
SCALE: 5X



4214771/A 05/2017

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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

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