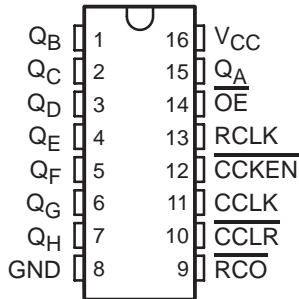


# SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

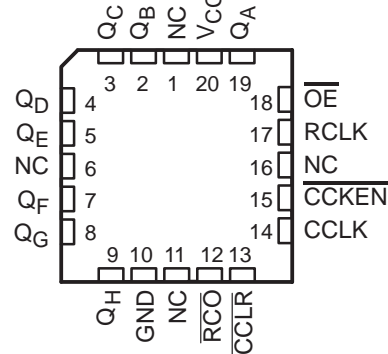
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- 2-V to 6-V  $V_{CC}$  Operation
- High-Current 3-State Parallel Register Outputs Can Drive Up To 15 LSTTL Loads
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 14$  ns
- $\pm 6$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max
- 8-Bit Counter With Register
- Counter Has Direct Clear

SN54HC590A . . . J OR W PACKAGE  
SN74HC590A . . . D, DW, OR N PACKAGE  
(TOP VIEW)



SN54HC590A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

The 'HC590A devices contain an 8-bit binary counter that feeds an 8-bit storage register. The storage register has parallel outputs. Separate clocks are provided for both the binary counter and storage register. The binary counter features direct clear ( $\overline{CCLR}$ ) and count-enable ( $\overline{CCKEN}$ ) inputs. A ripple-carry output ( $\overline{RCO}$ ) is provided for cascading. Expansion is accomplished easily for two stages by connecting  $\overline{RCO}$  of the first stage to  $\overline{CCKEN}$  of the second stage. Cascading for larger count chains can be accomplished by connecting  $\overline{RCO}$  of each stage to the counter clock (CCLK) input of the following stage.

CCLK and the register clock (RCLK) inputs are positive-edge triggered. If both clocks are connected together, the counter state always is one count ahead of the register. Internal circuitry prevents clocking from the clock enable.

## ORDERING INFORMATION

| TA             | PACKAGE†  |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-----------|---------------|-----------------------|------------------|
| -40°C to 85°C  | PDIP – N  | Tube of 25    | SN74HC590AN           | SN74HC590AN      |
|                | SOIC – D  | Tube of 40    | SN74HC590AD           | HC590A           |
|                |           | Reel of 2500  | SN74HC590ADR          |                  |
|                |           | Reel of 250   | SN74HC590ADT          |                  |
|                | SOIC – DW | Tube of 40    | SN74HC590ADW          | HC590A           |
| Reel of 2000   |           | SN74HC590ADWR |                       |                  |
| -55°C to 125°C | CDIP – J  | Tube of 25    | SNJ54HC590AJ          | SNJ54HC590AJ     |
|                | CFP – W   | Tube of 150   | SNJ54HC590AW          | SNJ54HC590AW     |
|                | LCCC - FK | Tube of 55    | SNJ54HC590AFK         | SNJ54HC590AFK    |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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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.

 **TEXAS  
INSTRUMENTS**

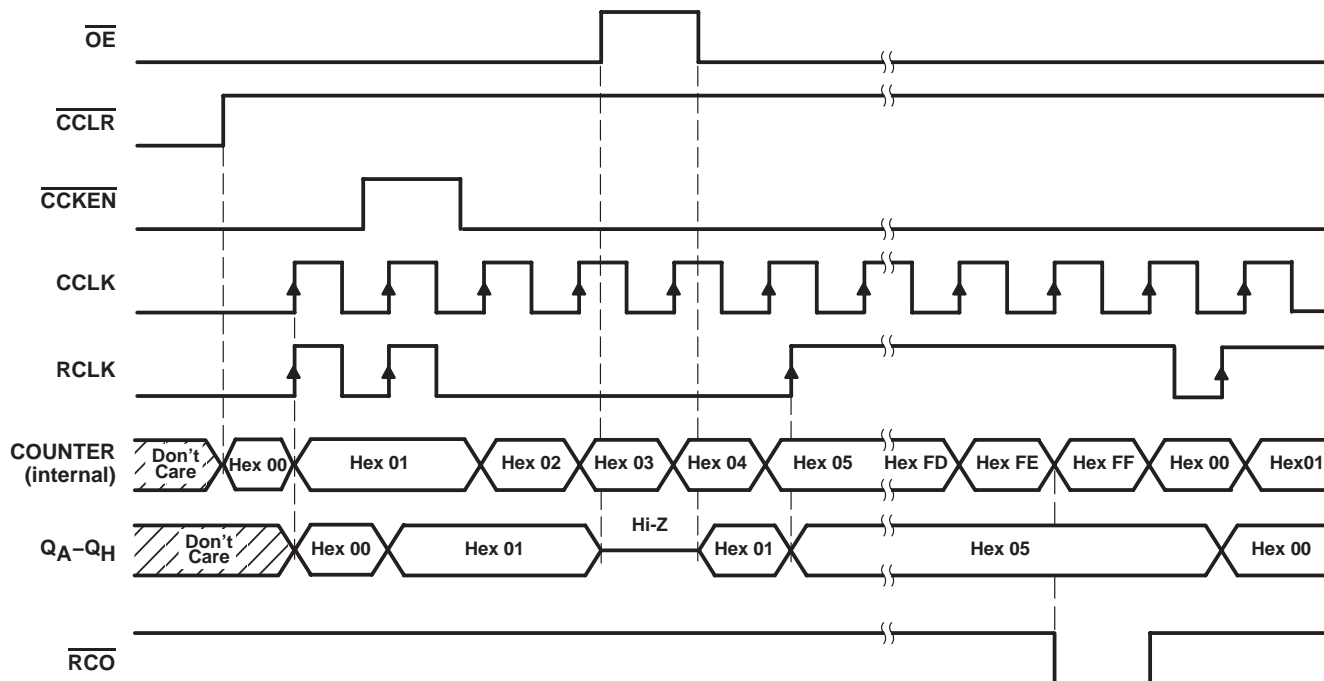
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# SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

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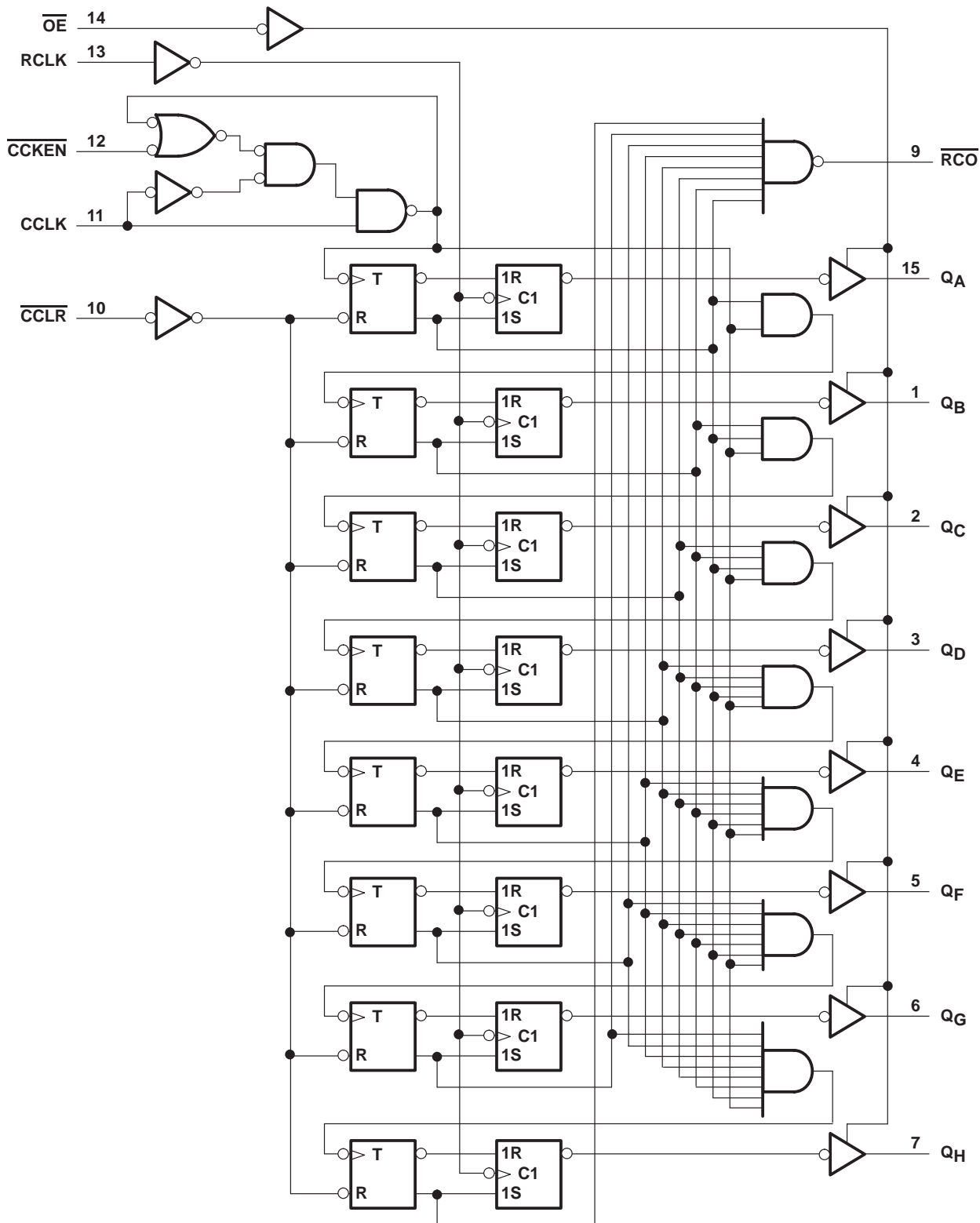
## timing diagram



### TIMING SEQUENCE

1. Clear Counter (asynchronous).
2. Count up: 0x01. Store 0x00 in register.
3. Inhibit counter clock (CCKEN = HIGH). Store 0x01 in register.
4. Count 0x02, 0x03.
5. 3-state the outputs
6. Count up: 0x04
7. Enable outputs.
8. Continue up: 0x05
9. Store 0x05 in register.
10. Continue counting: 0x06...0xFD, 0xFE, 0xFF, 0x00, etc.
11. Store 0x00 in register.

logic diagram (positive logic)



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

# SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                             |                |
|-----------------------------------------------------------------------------|----------------|
| Supply voltage range, $V_{CC}$                                              | -0.5 V to 7 V  |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)  | $\pm 20$ mA    |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1) | $\pm 20$ mA    |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )                  | $\pm 35$ mA    |
| Continuous current through $V_{CC}$ or GND                                  | $\pm 70$ mA    |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): D package            | 73°C/W         |
| DW package                                                                  | 57°C/W         |
| N package                                                                   | 67°C/W         |
| Storage temperature range, $T_{stg}$                                        | -65°C to 150°C |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 3)

|                  |                                       | SN54HC590A       |          |      | SN74HC590A |          |     | UNIT |
|------------------|---------------------------------------|------------------|----------|------|------------|----------|-----|------|
|                  |                                       | MIN              | NOM      | MAX  | MIN        | NOM      | MAX |      |
| $V_{CC}$         | Supply voltage                        | 2                | 5        | 6    | 2          | 5        | 6   | V    |
| $V_{IH}$         | High-level input voltage              | $V_{CC} = 2$ V   |          | 1.5  | 1.5        |          | V   |      |
|                  |                                       | $V_{CC} = 4.5$ V |          | 3.15 | 3.15       |          |     |      |
|                  |                                       | $V_{CC} = 6$ V   |          | 4.2  | 4.2        |          |     |      |
| $V_{IL}$         | Low-level input voltage               | $V_{CC} = 2$ V   |          | 0.5  | 0.5        |          | V   |      |
|                  |                                       | $V_{CC} = 4.5$ V |          | 1.35 | 1.35       |          |     |      |
|                  |                                       | $V_{CC} = 6$ V   |          | 1.8  | 1.8        |          |     |      |
| $V_I$            | Input voltage                         | 0                | $V_{CC}$ |      | 0          | $V_{CC}$ |     | V    |
| $V_O$            | Output voltage                        | 0                | $V_{CC}$ |      | 0          | $V_{CC}$ |     | V    |
| $t_t^{\ddagger}$ | Input transition (rise and fall) time | $V_{CC} = 2$ V   |          | 1000 | 1000       |          | ns  |      |
|                  |                                       | $V_{CC} = 4.5$ V |          | 500  | 500        |          |     |      |
|                  |                                       | $V_{CC} = 6$ V   |          | 400  | 400        |          |     |      |
| $T_A$            | Operating free-air temperature        | -55              | 125      |      | -40        | 85       |     | °C   |

<sup>‡</sup> If this device is used in the threshold region (from  $V_{ILmax} = 0.5$  V to  $V_{IHmin} = 1.5$  V), there is a potential to go into the wrong state from induced grounding, causing double clocking. Operating with the inputs at  $t_t = 1000$  ns and  $V_{CC} = 2$  V does not damage the device; however, functionally, the CCLK and RCLK inputs are not ensured while in the shift, count, or toggle operating modes.

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

**SN54HC590A, SN74HC590A**  
**8-BIT BINARY COUNTERS**  
**WITH 3-STATE OUTPUT REGISTERS**  
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER       | TEST CONDITIONS                                            | V <sub>CC</sub>          | T <sub>A</sub> = 25°C                                    |       |       | SN54HC590A |       | SN74HC590A |       | UNIT |      |
|-----------------|------------------------------------------------------------|--------------------------|----------------------------------------------------------|-------|-------|------------|-------|------------|-------|------|------|
|                 |                                                            |                          | MIN                                                      | TYP   | MAX   | MIN        | MAX   | MIN        | MAX   |      |      |
| V <sub>OH</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>        | I <sub>OH</sub> = -20 μA | 2 V                                                      | 1.9   | 1.998 |            | 1.9   |            | 1.9   | V    |      |
|                 |                                                            |                          | 4.5 V                                                    | 4.4   | 4.499 |            | 4.4   |            | 4.4   |      |      |
|                 |                                                            |                          | 6 V                                                      | 5.9   | 5.999 |            | 5.9   |            | 5.9   |      |      |
|                 |                                                            | 4.5 V                    | $\overline{RCO}$ , I <sub>OH</sub> = -4 mA               | 3.98  | 4.3   |            | 3.7   |            | 3.84  |      |      |
|                 |                                                            |                          | Q <sub>A</sub> -Q <sub>H</sub> , I <sub>OH</sub> = -6 mA | 3.98  | 4.3   |            | 3.7   |            | 3.84  |      |      |
|                 |                                                            |                          | $\overline{RCO}$ , I <sub>OH</sub> = -5.2 mA             | 5.48  | 5.8   |            | 5.2   |            | 5.34  |      |      |
| 6 V             | Q <sub>A</sub> -Q <sub>H</sub> , I <sub>OH</sub> = -7.8 mA | 5.48                     | 5.8                                                      |       | 5.2   |            | 5.34  |            |       |      |      |
| V <sub>OL</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>        | I <sub>OL</sub> = 20 μA  | 2 V                                                      |       | 0.002 | 0.1        |       | 0.1        |       | V    |      |
|                 |                                                            |                          | 4.5 V                                                    |       | 0.001 | 0.1        |       | 0.1        |       |      | 0.1  |
|                 |                                                            |                          | 6 V                                                      |       | 0.001 | 0.1        |       | 0.1        |       |      | 0.1  |
|                 |                                                            | 4.5 V                    | $\overline{RCO}$ , I <sub>OL</sub> = 4 mA                |       | 0.17  | 0.26       |       | 0.4        |       |      | 0.33 |
|                 |                                                            |                          | Q <sub>A</sub> -Q <sub>H</sub> , I <sub>OL</sub> = 6 mA  |       | 0.17  | 0.26       |       | 0.4        |       |      | 0.33 |
|                 |                                                            |                          | $\overline{RCO}$ , I <sub>OL</sub> = 5.2 mA              |       | 0.15  | 0.26       |       | 0.4        |       |      | 0.33 |
| 6 V             | Q <sub>A</sub> -Q <sub>H</sub> , I <sub>OL</sub> = 7.8 mA  |                          | 0.15                                                     | 0.26  |       | 0.4        |       | 0.33       |       |      |      |
| I <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or 0                      | 6 V                      |                                                          | ±0.1  | ±100  |            | ±1000 |            | ±1000 | nA   |      |
| I <sub>OZ</sub> | V <sub>O</sub> = V <sub>CC</sub> or 0                      | 6 V                      |                                                          | ±0.01 | ±0.5  |            | ±10   |            | ±5    | μA   |      |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0  | 6 V                      |                                                          |       | 8     |            | 160   |            | 80    | μA   |      |
| C <sub>i</sub>  |                                                            | 2 V<br>to 6 V            |                                                          | 3     | 10    |            | 10    |            | 10    | pF   |      |

**SN54HC590A, SN74HC590A**  
**8-BIT BINARY COUNTERS**  
**WITH 3-STATE OUTPUT REGISTERS**

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timing requirements over recommended operating free-air temperature range (unless otherwise noted)

|                    |                                   | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     | SN54HC590A |     | SN74HC590A |     | UNIT |
|--------------------|-----------------------------------|-----------------|-----------------------|-----|------------|-----|------------|-----|------|
|                    |                                   |                 | MIN                   | MAX | MIN        | MAX | MIN        | MAX |      |
| f <sub>clock</sub> | Clock frequency                   | 2 V             | 4                     |     | 2.5        |     | 3.2        |     | MHz  |
|                    |                                   | 4.5 V           | 20                    |     | 13         |     | 16         |     |      |
|                    |                                   | 6 V             | 24                    |     | 16         |     | 19         |     |      |
| t <sub>w</sub>     | CCLK or RCLK high or low          | 2 V             | 125                   |     | 200        |     | 155        |     | ns   |
|                    |                                   | 4.5 V           | 25                    |     | 38         |     | 31         |     |      |
|                    |                                   | 6 V             | 21                    |     | 32         |     | 26         |     |      |
|                    | CCLR low                          | 2 V             | 100                   |     | 150        |     | 125        |     |      |
|                    |                                   | 4.5 V           | 20                    |     | 30         |     | 25         |     |      |
|                    |                                   | 6 V             | 17                    |     | 26         |     | 21         |     |      |
| t <sub>su</sub>    | CCKEN low before CCLK↑            | 2 V             | 100                   |     | 150        |     | 125        |     | ns   |
|                    |                                   | 4.5 V           | 20                    |     | 30         |     | 25         |     |      |
|                    |                                   | 6 V             | 17                    |     | 26         |     | 21         |     |      |
|                    | CCLR high (inactive) before CCLK↑ | 2 V             | 100                   |     | 150        |     | 125        |     |      |
|                    |                                   | 4.5 V           | 20                    |     | 30         |     | 25         |     |      |
|                    |                                   | 6 V             | 17                    |     | 26         |     | 21         |     |      |
|                    | CCLK↑ before RCLK↑†               | 2 V             | 100                   |     | 150        |     | 125        |     |      |
|                    |                                   | 4.5 V           | 20                    |     | 30         |     | 25         |     |      |
|                    |                                   | 6 V             | 17                    |     | 26         |     | 21         |     |      |
| t <sub>h</sub>     | CCKEN low after CCLK↑             | 2 V             | 50                    |     | 75         |     | 60         |     | ns   |
|                    |                                   | 4.5 V           | 10                    |     | 15         |     | 12         |     |      |
|                    |                                   | 6 V             | 9                     |     | 13         |     | 11         |     |      |

† This setup time ensures that the register gets stable data from the counter outputs. The clocks may be tied together, in which case the register is one clock pulse behind the counter.



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**8-BIT BINARY COUNTERS**  
**WITH 3-STATE OUTPUT REGISTERS**  
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switching characteristics over recommended operating free-air temperature range,  $C_L = 50 \text{ pF}$  (unless otherwise noted) (see Figure 1)

| PARAMETER  | FROM (INPUT)                | TO (OUTPUT)      | $V_{CC}$ | SN54HC590A               |     |     |     | UNIT |     |
|------------|-----------------------------|------------------|----------|--------------------------|-----|-----|-----|------|-----|
|            |                             |                  |          | $T_A = 25^\circ\text{C}$ |     |     | MIN |      | MAX |
|            |                             |                  |          | MIN                      | TYP | MAX |     |      |     |
| $f_{\max}$ |                             |                  | 2 V      | 4                        | 8   | 2.5 | MHz |      |     |
|            |                             |                  | 4.5 V    | 20                       | 35  | 13  |     |      |     |
|            |                             |                  | 6 V      | 24                       | 40  | 16  |     |      |     |
| $t_{pd}$   | CCLK $\uparrow$             | $\overline{RCO}$ | 2 V      | 80                       | 150 | 225 | ns  |      |     |
|            |                             |                  | 4.5 V    | 20                       | 31  | 45  |     |      |     |
|            |                             |                  | 6 V      | 15                       | 26  | 38  |     |      |     |
| $t_{PLH}$  | $\overline{CCLR}\downarrow$ | $\overline{RCO}$ | 2 V      | 70                       | 130 | 195 | ns  |      |     |
|            |                             |                  | 4.5 V    | 18                       | 28  | 39  |     |      |     |
|            |                             |                  | 6 V      | 14                       | 23  | 33  |     |      |     |
| $t_{pd}$   | RCLK $\uparrow$             | Q                | 2 V      | 70                       | 140 | 210 | ns  |      |     |
|            |                             |                  | 4.5 V    | 18                       | 31  | 42  |     |      |     |
|            |                             |                  | 6 V      | 14                       | 25  | 36  |     |      |     |
| $t_{en}$   | $\overline{OE}\downarrow$   | Q                | 2 V      | 80                       | 125 | 185 | ns  |      |     |
|            |                             |                  | 4.5 V    | 20                       | 30  | 37  |     |      |     |
|            |                             |                  | 6 V      | 15                       | 28  | 31  |     |      |     |
| $t_{dis}$  | $\overline{OE}\uparrow$     | Q                | 2 V      | 80                       | 125 | 185 | ns  |      |     |
|            |                             |                  | 4.5 V    | 20                       | 30  | 37  |     |      |     |
|            |                             |                  | 6 V      | 15                       | 28  | 31  |     |      |     |
| $t_t^*$    |                             | $\overline{RCO}$ | 2 V      | 38                       | 75  | 110 | ns  |      |     |
|            |                             |                  | 4.5 V    | 8                        | 15  | 22  |     |      |     |
|            |                             |                  | 6 V      | 6                        | 13  | 19  |     |      |     |
|            |                             | Q                | 2 V      | 38                       | 60  | 90  |     |      |     |
|            |                             |                  | 4.5 V    | 8                        | 12  | 18  |     |      |     |
|            |                             |                  | 6 V      | 6                        | 10  | 15  |     |      |     |

\* This parameter is not production tested for the SN54HC590A.

**SN54HC590A, SN74HC590A**  
**8-BIT BINARY COUNTERS**  
**WITH 3-STATE OUTPUT REGISTERS**

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switching characteristics over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT)        | TO (OUTPUT)      | V <sub>CC</sub> | SN74HC590A            |     |     |     | UNIT |     |
|------------------|---------------------|------------------|-----------------|-----------------------|-----|-----|-----|------|-----|
|                  |                     |                  |                 | T <sub>A</sub> = 25°C |     |     | MIN |      | MAX |
|                  |                     |                  |                 | MIN                   | TYP | MAX |     |      |     |
| f <sub>max</sub> |                     |                  | 2 V             | 4                     | 8   | 3.2 | MHz |      |     |
|                  |                     |                  | 4.5 V           | 20                    | 35  | 16  |     |      |     |
|                  |                     |                  | 6 V             | 24                    | 40  | 19  |     |      |     |
| t <sub>pd</sub>  | CCLK↑               | $\overline{RCO}$ | 2 V             |                       | 80  | 150 | 190 | ns   |     |
|                  |                     |                  | 4.5 V           |                       | 20  | 30  | 38  |      |     |
|                  |                     |                  | 6 V             |                       | 15  | 26  | 33  |      |     |
| t <sub>PLH</sub> | $\overline{CCLR}$ ↓ | $\overline{RCO}$ | 2 V             |                       | 70  | 130 | 165 | ns   |     |
|                  |                     |                  | 4.5 V           |                       | 18  | 26  | 33  |      |     |
|                  |                     |                  | 6 V             |                       | 14  | 22  | 28  |      |     |
| t <sub>pd</sub>  | RCLK↑               | Q                | 2 V             |                       | 70  | 140 | 175 | ns   |     |
|                  |                     |                  | 4.5 V           |                       | 18  | 28  | 35  |      |     |
|                  |                     |                  | 6 V             |                       | 14  | 24  | 30  |      |     |
| t <sub>en</sub>  | $\overline{OE}$ ↓   | Q                | 2 V             |                       | 80  | 125 | 155 | ns   |     |
|                  |                     |                  | 4.5 V           |                       | 20  | 25  | 31  |      |     |
|                  |                     |                  | 6 V             |                       | 15  | 21  | 26  |      |     |
| t <sub>dis</sub> | $\overline{OE}$ ↑   | Q                | 2 V             |                       | 80  | 125 | 155 | ns   |     |
|                  |                     |                  | 4.5 V           |                       | 20  | 25  | 31  |      |     |
|                  |                     |                  | 6 V             |                       | 15  | 21  | 26  |      |     |
| t <sub>t</sub>   |                     | $\overline{RCO}$ | 2 V             |                       | 38  | 75  | 95  | ns   |     |
|                  |                     |                  | 4.5 V           |                       | 8   | 15  | 19  |      |     |
|                  |                     |                  | 6 V             |                       | 6   | 13  | 16  |      |     |
|                  |                     | Q                | 2 V             |                       | 38  | 60  | 75  |      |     |
|                  |                     |                  | 4.5 V           |                       | 8   | 12  | 15  |      |     |
|                  |                     |                  | 6 V             |                       | 6   | 10  | 13  |      |     |



**SN54HC590A, SN74HC590A**  
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switching characteristics over recommended operating free-air temperature range,  $C_L = 150 \text{ pF}$  (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CC}$ | SN54HC590A               |     |     |     | UNIT |     |
|-----------|-----------------|-------------|----------|--------------------------|-----|-----|-----|------|-----|
|           |                 |             |          | $T_A = 25^\circ\text{C}$ |     |     | MIN |      | MAX |
|           |                 |             |          | MIN                      | TYP | MAX |     |      |     |
| $t_{pd}$  | RCLK $\uparrow$ | Q           | 2 V      | 100                      | 300 | 447 | ns  |      |     |
|           |                 |             | 4.5 V    | 24                       | 60  | 90  |     |      |     |
|           |                 |             | 6 V      | 20                       | 51  | 77  |     |      |     |
| $t_{en}$  | $\overline{OE}$ | Q           | 2 V      | 90                       | 200 | 300 | ns  |      |     |
|           |                 |             | 4.5 V    | 23                       | 40  | 60  |     |      |     |
|           |                 |             | 6 V      | 19                       | 34  | 51  |     |      |     |
| $t_t^*$   |                 | Q           | 2 V      | 45                       | 210 | 315 | ns  |      |     |
|           |                 |             | 4.5 V    | 17                       | 42  | 63  |     |      |     |
|           |                 |             | 6 V      | 13                       | 36  | 53  |     |      |     |

\* This parameter is not production tested for the SN54HC590A.

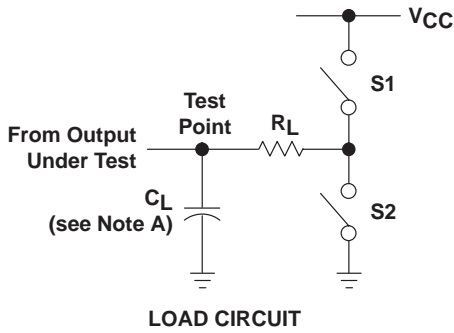
switching characteristics over recommended operating free-air temperature range,  $C_L = 150 \text{ pF}$  (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CC}$ | SN74HC590A               |     |     |     | UNIT |     |
|-----------|-----------------|-------------|----------|--------------------------|-----|-----|-----|------|-----|
|           |                 |             |          | $T_A = 25^\circ\text{C}$ |     |     | MIN |      | MAX |
|           |                 |             |          | MIN                      | TYP | MAX |     |      |     |
| $t_{pd}$  | RCLK $\uparrow$ | Q           | 2 V      | 100                      | 300 | 380 | ns  |      |     |
|           |                 |             | 4.5 V    | 24                       | 60  | 76  |     |      |     |
|           |                 |             | 6 V      | 20                       | 51  | 65  |     |      |     |
| $t_{en}$  | $\overline{OE}$ | Q           | 2 V      | 90                       | 200 | 250 | ns  |      |     |
|           |                 |             | 4.5 V    | 23                       | 40  | 50  |     |      |     |
|           |                 |             | 6 V      | 19                       | 34  | 43  |     |      |     |
| $t_t$     |                 | Q           | 2 V      | 45                       | 210 | 265 | ns  |      |     |
|           |                 |             | 4.5 V    | 17                       | 42  | 53  |     |      |     |
|           |                 |             | 6 V      | 13                       | 36  | 45  |     |      |     |

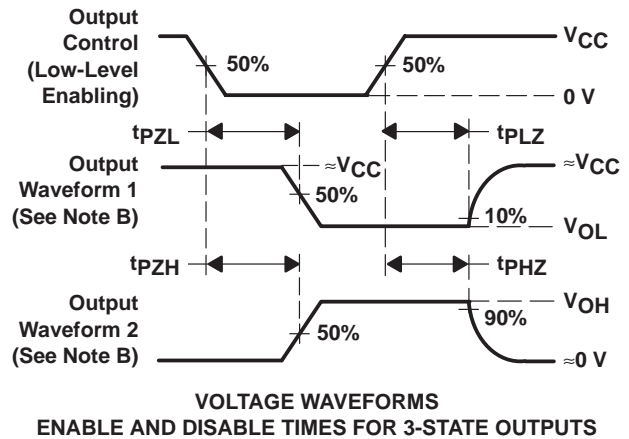
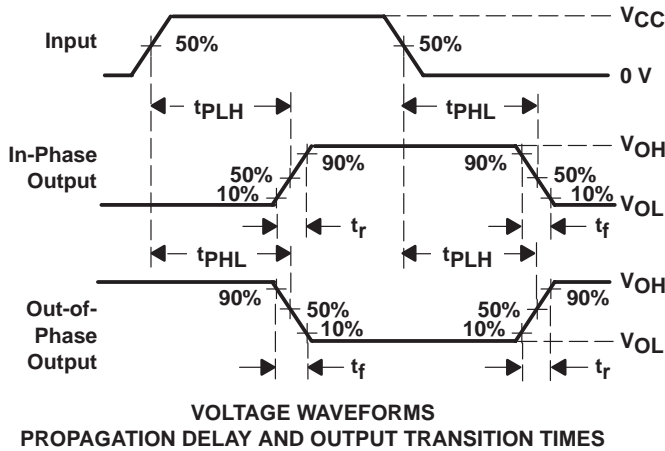
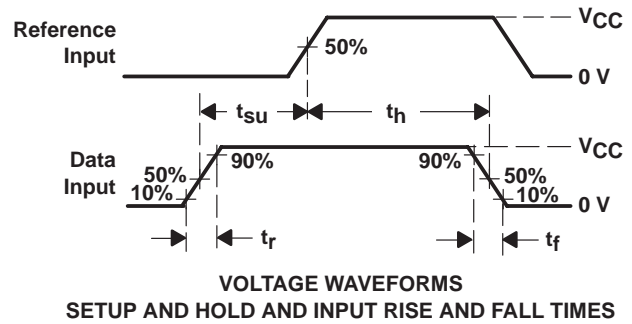
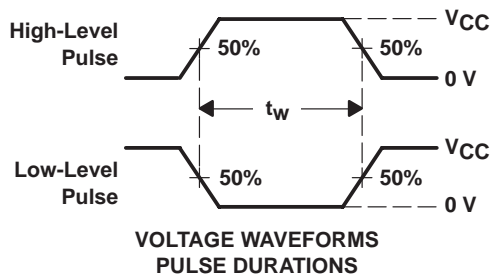
operating characteristics,  $T_A = 25^\circ\text{C}$

| PARAMETER                              | TEST CONDITIONS | TYP | UNIT |
|----------------------------------------|-----------------|-----|------|
| $C_{pd}$ Power dissipation capacitance | No load         | 250 | pF   |

**PARAMETER MEASUREMENT INFORMATION**



| PARAMETER         | $R_L$        | $C_L$                 | $S_1$  | $S_2$  |
|-------------------|--------------|-----------------------|--------|--------|
| $t_{en}$          | 1 k $\Omega$ | 50 pF<br>or<br>150 pF | Open   | Closed |
|                   |              |                       | Closed | Open   |
| $t_{dis}$         | 1 k $\Omega$ | 50 pF                 | Open   | Closed |
|                   |              |                       | Closed | Open   |
| $t_{pd}$ or $t_t$ | --           | 50 pF<br>or<br>150 pF | Open   | Open   |



- NOTES: A.  $C_L$  includes probe and test-fixture capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r = 6$  ns,  $t_f = 6$  ns.  
 D. The outputs are measured one at a time with one input transition per measurement.  
 E.  $t_{pZL}$  and  $t_{pZH}$  are the same as  $t_{dis}$ .  
 F.  $t_{pZL}$  and  $t_{pZH}$  are the same as  $t_{en}$ .  
 G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

**Figure 1. Load Circuit and Voltage Waveforms**

**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                 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------------------|-------------------------|
| 5962-89603012A   | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-89603012A<br>SNJ54HC<br>590AFK | <a href="#">Samples</a> |
| 5962-8960301EA   | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8960301EA<br>SNJ54HC590AJ      | <a href="#">Samples</a> |
| 5962-8960301FA   | ACTIVE        | CFP          | W               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8960301FA<br>SNJ54HC590AW      | <a href="#">Samples</a> |
| SN54HC590AJ      | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54HC590AJ                         | <a href="#">Samples</a> |
| SN74HC590AD      | ACTIVE        | SOIC         | D               | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590ADE4    | ACTIVE        | SOIC         | D               | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590ADG4    | ACTIVE        | SOIC         | D               | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590ADR     | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590ADT     | ACTIVE        | SOIC         | D               | 16   | 250         | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590ADW     | ACTIVE        | SOIC         | DW              | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590ADWR    | ACTIVE        | SOIC         | DW              | 16   | 2000        | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HC590A                              | <a href="#">Samples</a> |
| SN74HC590AN      | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | -40 to 85    | SN74HC590AN                         | <a href="#">Samples</a> |
| SN74HC590ANE4    | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | -40 to 85    | SN74HC590AN                         | <a href="#">Samples</a> |
| SNJ54HC590AFK    | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-89603012A<br>SNJ54HC<br>590AFK | <a href="#">Samples</a> |
| SNJ54HC590AJ     | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8960301EA<br>SNJ54HC590AJ      | <a href="#">Samples</a> |
| SNJ54HC590AW     | ACTIVE        | CFP          | W               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8960301FA<br>SNJ54HC590AW      | <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  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm 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 SN54HC590A, SN74HC590A :**

● Catalog : [SN74HC590A](#)

● Military : [SN54HC590A](#)

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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HC590ADR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN74HC590ADWR | SOIC         | DW              | 16   | 2000 | 330.0              | 16.4               | 10.75   | 10.7    | 2.7     | 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) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HC590ADR  | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| SN74HC590ADWR | SOIC         | DW              | 16   | 2000 | 350.0       | 350.0      | 43.0        |

**TUBE**


\*All dimensions are nominal

| Device         | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-89603012A | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| 5962-8960301FA | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |
| SN74HC590AN    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74HC590AN    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74HC590ANE4  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74HC590ANE4  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SNJ54HC590AFK  | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| SNJ54HC590AW   | W            | CFP          | 16   | 25  | 506.98 | 26.16  | 6220   | NA     |



D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

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

## GENERIC PACKAGE VIEW

**DW 16**

**SOIC - 2.65 mm max height**

7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

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



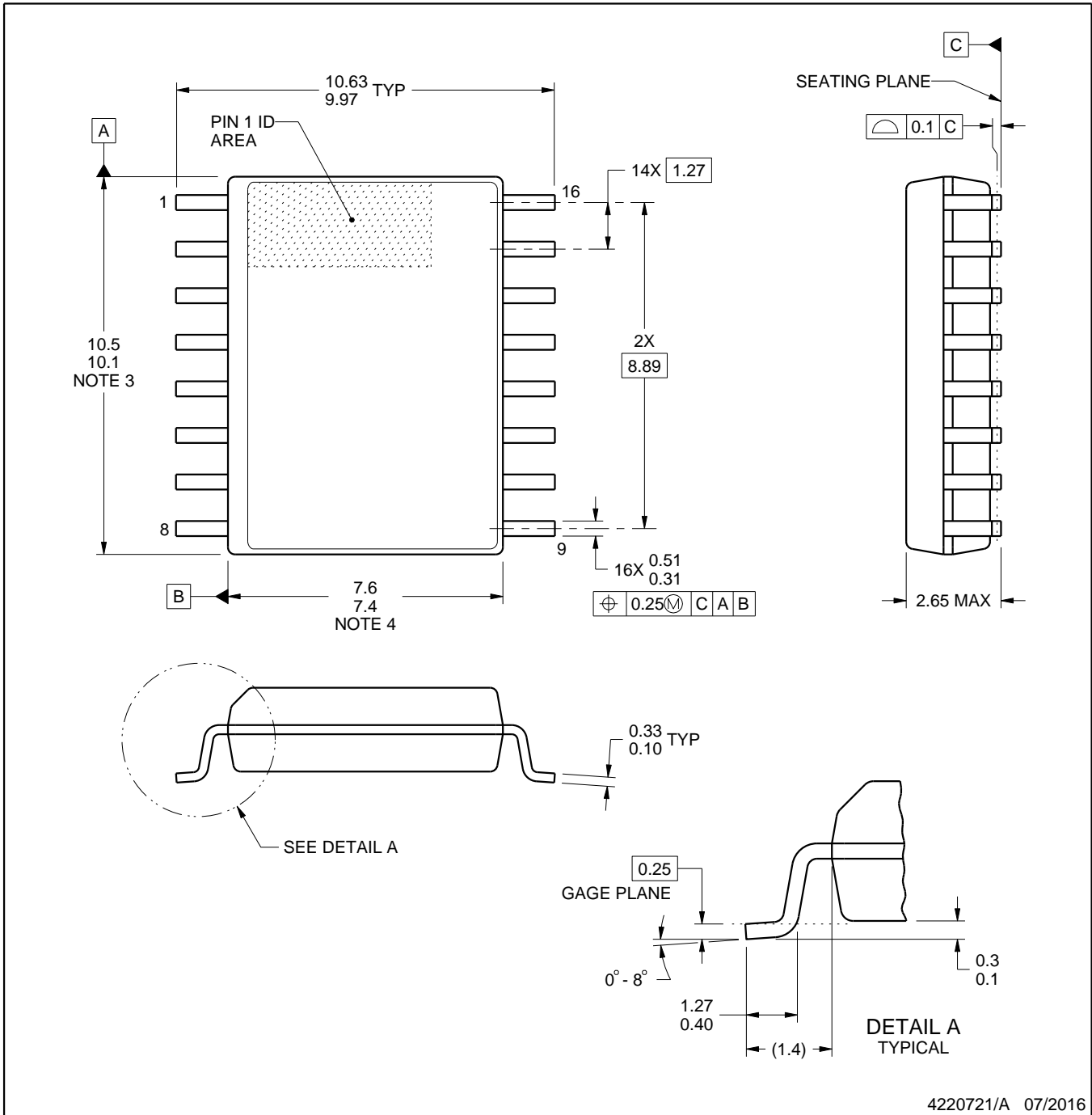
4224780/A



# DW0016A

# PACKAGE OUTLINE SOIC - 2.65 mm max height

SOIC



4220721/A 07/2016

### NOTES:

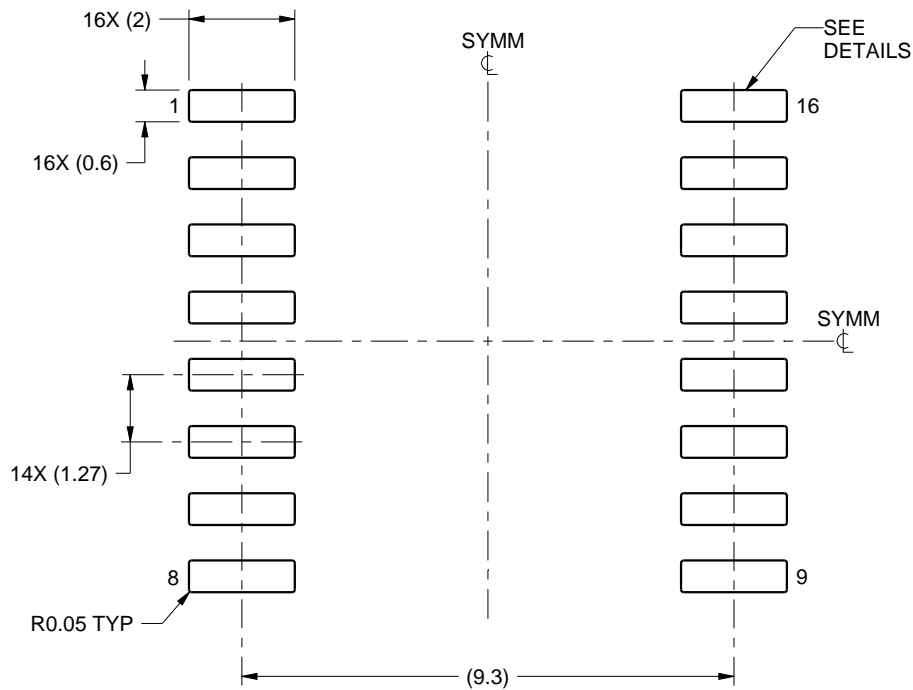
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0016A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:7X



SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

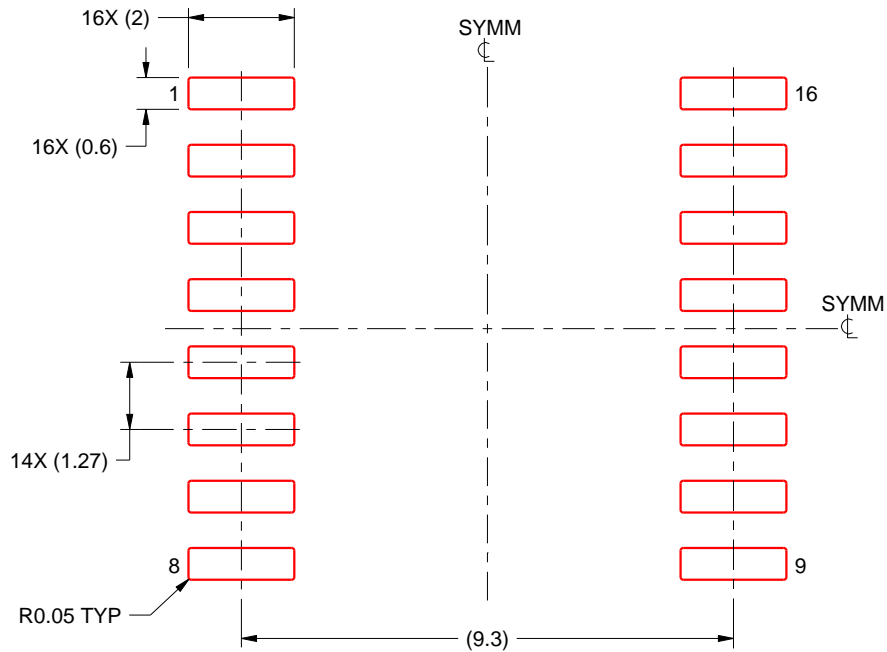
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0016A

SOIC - 2.65 mm max height

SOIC



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

4220721/A 07/2016

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.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



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

## GENERIC PACKAGE VIEW

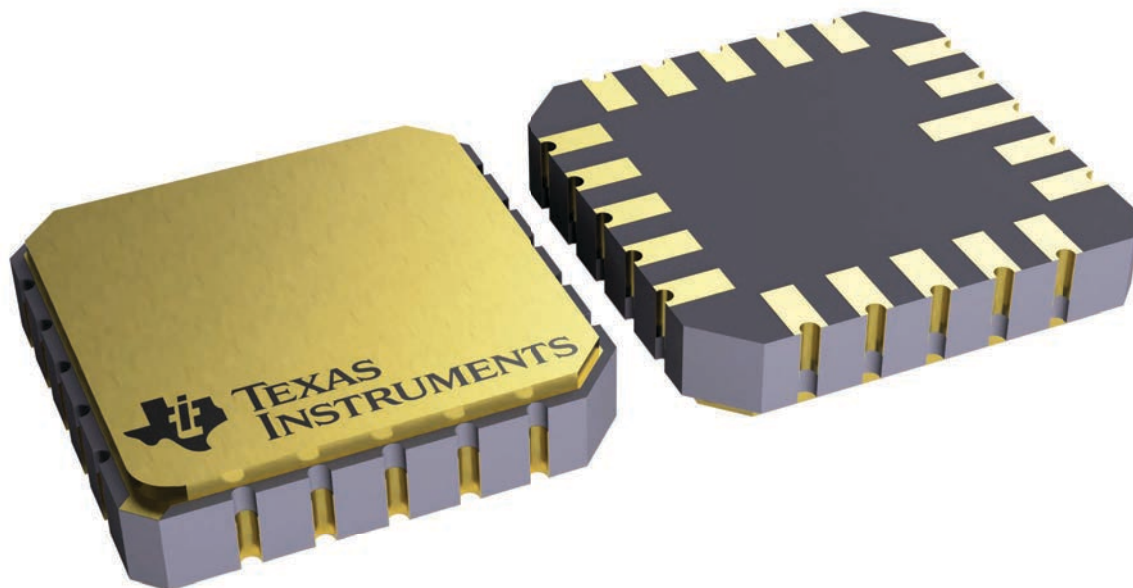
**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

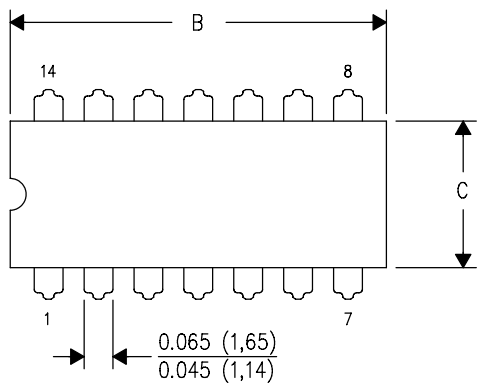
This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



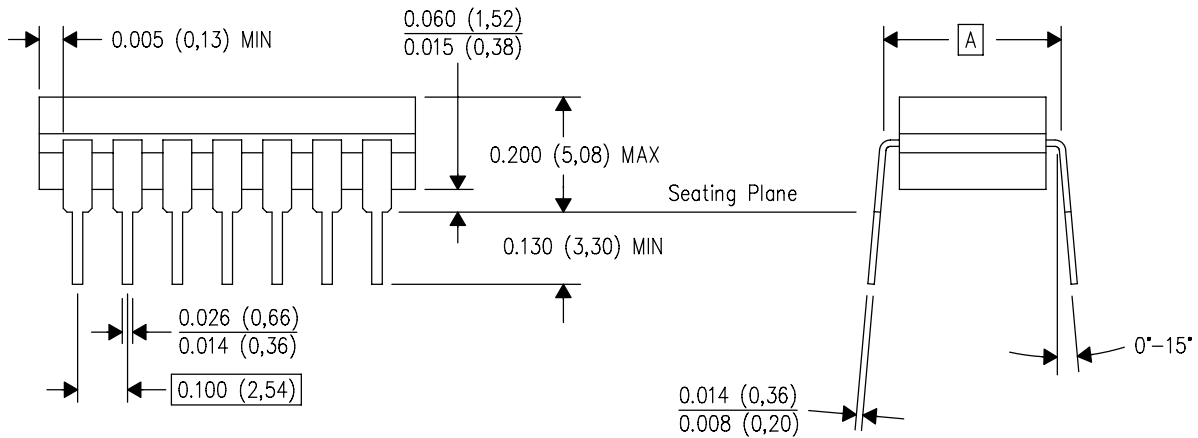
4229370VA\

J (R-GDIP-T\*\*)  
14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14                     | 16                     | 18                     | 20                     |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A             | 0.300<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.



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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

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

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