

**KK4017B**

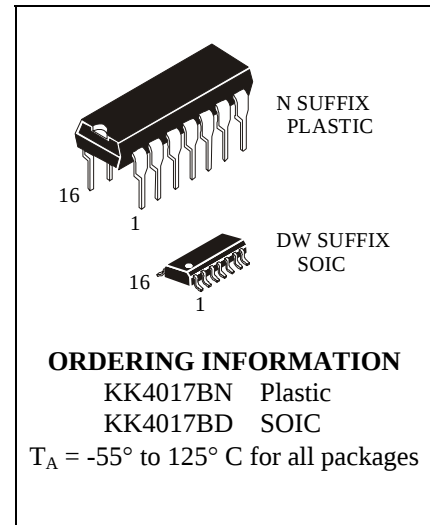
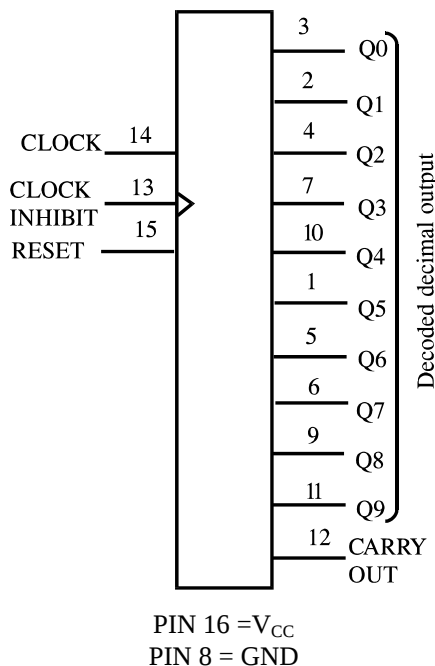
## Counter/Divider

The KK4017B is 5-stage Johnson counter having 10 decoded outputs. Inputs include a CLOCK, a RESET, and a CLOCK INHIBIT signal. Schmitt trigger action in the CLOCK input circuit provides pulse shaping that allows unlimited clock input pulse rise and fall times.

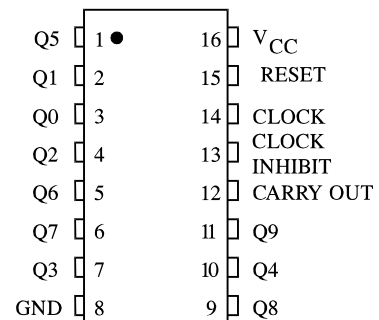
The counter is advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. Counter advancement via the clock line is inhibited when the CLOCK INHIBIT signal is high. A high RESET signal clears the counter to its zero count. Use of the Johnson counter configuration permits high-speed operation, 2-input decode-gating and spike-free decoded outputs. Anti-lock gating is provided, thus assuring proper counting sequence. The decoded outputs are normally low and go high only at their respective decoded time slot. Each decoded output remains high for one full clock cycle. A CARRY-OUT signal completes one cycle every 10 clock input cycles.

- Operating Voltage Range: 3.0 to 18 V
- Maximum input current of 1  $\mu$ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package temperature range):  
1.0 V min @ 5.0 V supply  
2.0 V min @ 10.0 V supply  
2.5 V min @ 15.0 V supply

### LOGIC DIAGRAM



### PIN ASSIGNMENT



### FUNCTION TABLE

| Clock | Clock Enable | Reset | Output State                            |
|-------|--------------|-------|-----------------------------------------|
| L     | X            | L     | no change                               |
| X     | H            | L     | no change                               |
| X     | X            | H     | reset counter<br>Q0=H, Q1-Q9=L,<br>C0=H |
|       | L            | L     | Advance to next state                   |
|       | X            | L     | no change                               |
| X     |              | L     | no change                               |
| H     |              | L     | Advance to next state                   |

Carry Out=H for Q0,Q1,Q2,Q3 or Q4=H  
 Carry Out = L otherwise, X=don't care

**MAXIMUM RATINGS\***

| Symbol    | Parameter                                                                        | Value                | Unit |
|-----------|----------------------------------------------------------------------------------|----------------------|------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)                                            | -0.5 to 20           | V    |
| $V_{IN}$  | DC Input Voltage (Referenced to GND)                                             | -0.5 to $V_{CC}$ 0.5 | V    |
| $V_{OUT}$ | DC Output Voltage (Referenced to GND)                                            | -0.5 to $V_{CC}$ 0.5 | V    |
| $I_{IN}$  | DC Input Current, per Pin                                                        | $\pm 10$             | mA   |
| $P_D$     | Power Dissipation in Still Air, Plastic DIP**<br>SOIC Package**                  | 750<br>500           | mW   |
| $P_D$     | Power Dissipation per Output Transistor                                          | 100                  | mW   |
| Tstg      | Storage Temperature                                                              | -65 to 150           | °C   |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds<br>(Plastic DIP or SOIC Package) | 260                  | °C   |

\*Maximum Ratings are those values beyond which damage to the device may occur.  
Functional operation should be restricted to the Recommended Operating Conditions.

\*\*Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C  
SOIC Package: : - 7 mW/°C from 65° to 125°C

**RECOMMENDED OPERATING CONDITIONS**

| Symbol            | Parameter                                            | Min | Max      | Unit |
|-------------------|------------------------------------------------------|-----|----------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                | 3.0 | 18       | V    |
| $V_{IN}, V_{OUT}$ | DC Input Voltage, Output Voltage (Referenced to GND) | 0   | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature, All Package Types             | -55 | 125      | °C   |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{IN}$  and  $V_{OUT}$  should be constrained to the range  $GND \leq (V_{IN} \text{ or } V_{OUT}) \leq V_{CC}$ .

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

**DC ELECTRICAL CHARACTERISTICS** (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Test Conditions                                                    | V <sub>CC</sub><br>V | Guaranteed Limit |       |        | Unit |
|-----------------|------------------------------------------------|--------------------------------------------------------------------|----------------------|------------------|-------|--------|------|
|                 |                                                |                                                                    |                      | ≥-55°C           | 25°C  | ≤125°C |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>OUT</sub> =0.5 V or V <sub>CC</sub> - 0.5 V                 | 5.0                  | 3.5              | 3.5   | 3.5    | V    |
|                 |                                                | V <sub>OUT</sub> =1.0 V or V <sub>CC</sub> - 1.0 V                 | 10                   | 7                | 7     | 7      |      |
|                 |                                                | V <sub>OUT</sub> =1.5 V or V <sub>CC</sub> - 1.5 V                 | 15                   | 11               | 11    | 11     |      |
| V <sub>IL</sub> | Maximum Low - Level Input Voltage              | V <sub>OUT</sub> =0.5 V or V <sub>CC</sub> - 0.5 V                 | 5.0                  | 1.5              | 1.5   | 1.5    | V    |
|                 |                                                | V <sub>OUT</sub> =1.0 V or V <sub>CC</sub> - 1.0 V                 | 10                   | 3                | 3     | 3      |      |
|                 |                                                | V <sub>OUT</sub> =1.5 V or V <sub>CC</sub> - 1.5 V                 | 15                   | 4                | 4     | 4      |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>IN</sub> =GND or V <sub>CC</sub>                            | 5.0                  | 4.95             | 4.95  | 4.95   | V    |
|                 |                                                |                                                                    | 10                   | 9.95             | 9.95  | 9.95   |      |
|                 |                                                |                                                                    | 15                   | 14.95            | 14.95 | 14.95  |      |
|                 |                                                | V <sub>IL</sub> =1.5V, V <sub>IH</sub> =3.5V, I <sub>O</sub> =-1μA | 5.0                  | 4.5              | 4.5   | 4.5    |      |
|                 |                                                | V <sub>IL</sub> =3.0V, V <sub>IH</sub> =7.0V, I <sub>O</sub> =-1μA | 10                   | 9.0              | 9.0   | 9.0    |      |
|                 |                                                | V <sub>IL</sub> =4.0V, V <sub>IH</sub> =11V, I <sub>O</sub> =-1μA  | 15                   | 13.5             | 13.5  | 13.5   |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>IN</sub> =GND or V <sub>CC</sub>                            | 5.0                  | 0.05             | 0.05  | 0.05   | V    |
|                 |                                                |                                                                    | 10                   | 0.05             | 0.05  | 0.05   |      |
|                 |                                                |                                                                    | 15                   | 0.05             | 0.05  | 0.05   |      |
|                 |                                                | V <sub>IL</sub> =1.5V, V <sub>IH</sub> =3.5V, I <sub>O</sub> =1μA  | 5.0                  | 0.5              | 0.5   | 0.5    |      |
|                 |                                                | V <sub>IL</sub> =3.0V, V <sub>IH</sub> =7.0V, I <sub>O</sub> =1μA  | 10                   | 1.0              | 1.0   | 1.0    |      |
|                 |                                                | V <sub>IL</sub> =4.0V, V <sub>IH</sub> =11V, I <sub>O</sub> =1μA   | 15                   | 1.5              | 1.5   | 1.5    |      |
| I <sub>IN</sub> | Maximum Input Leakage Current                  | V <sub>IN</sub> = GND or V <sub>CC</sub>                           | 18                   | ±0.1             | ±0.1  | ±1.0   | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package) | V <sub>IN</sub> = GND or V <sub>CC</sub>                           | 5.0                  | 1.0              | 1.0   | 30     | μA   |
|                 |                                                |                                                                    | 10                   | 2.0              | 2.0   | 60     |      |
|                 |                                                |                                                                    | 15                   | 4.0              | 4.0   | 120    |      |
|                 |                                                |                                                                    | 20                   | 20               | 20    | 600    |      |
| I <sub>OL</sub> | Minimum Output Low (Sink) Current              | V <sub>IN</sub> = GND or V <sub>CC</sub>                           |                      |                  |       |        | mA   |
|                 |                                                | V <sub>OL</sub> =0.4 V                                             | 5.0                  | 0.64             | 0.51  | 0.36   |      |
|                 |                                                | V <sub>OL</sub> =0.5 V                                             | 10                   | 1.6              | 1.3   | 0.9    |      |
| I <sub>OH</sub> | Minimum Output High (Source) Current           | V <sub>OL</sub> =1.5 V                                             | 15                   | 4.2              | 3.4   | 2.4    | mA   |
|                 |                                                | V <sub>IN</sub> = GND or V <sub>CC</sub>                           |                      |                  |       |        |      |
|                 |                                                | V <sub>OH</sub> =4.6 V                                             | 5.0                  | -0.64            | -0.51 | -0.36  |      |
|                 |                                                | V <sub>OH</sub> =2.5 V                                             | 5.0                  | -2.0             | -1.6  | -1.15  |      |
|                 |                                                | V <sub>OH</sub> =9.5 V                                             | 10                   | -1.8             | -1.3  | -0.9   |      |
|                 |                                                | V <sub>OH</sub> =13.5 V                                            | 15                   | -4.2             | -3.4  | -2.4   |      |

**AC ELECTRICAL CHARACTERISTICS** ( $C_L=50\text{pF}$ ,  $R_L=200\text{k}\Omega$ , Input  $t_r=t_f=20\text{ ns}$ )

| Symbol                           | Parameter                                                                    | V <sub>CC</sub><br>V | Guaranteed Limit         |                    |                          | Unit |
|----------------------------------|------------------------------------------------------------------------------|----------------------|--------------------------|--------------------|--------------------------|------|
|                                  |                                                                              |                      | $\geq -55^\circ\text{C}$ | $25^\circ\text{C}$ | $\leq 125^\circ\text{C}$ |      |
| $f_{\text{max}}$                 | Maximum Clock Frequency                                                      | 5.0                  | 2.5                      | 2.5                | 2.0                      | MHz  |
|                                  |                                                                              | 10                   | 5                        | 5                  | 4.0                      |      |
|                                  |                                                                              | 15                   | 5.5                      | 5.5                | 5.0                      |      |
| $t_{\text{PLH}}, t_{\text{PHL}}$ | Maximum Propagation Delay, Clock to Decode Output (Figure 1)                 | 5.0                  | 650                      | 650                | 800                      | ns   |
|                                  |                                                                              | 10                   | 270                      | 270                | 350                      |      |
|                                  |                                                                              | 15                   | 170                      | 170                | 250                      |      |
| $t_{\text{PLH}}, t_{\text{PHL}}$ | Maximum Propagation Delay, Clock to Carry Output (Figure 1)                  | 5.0                  | 600                      | 600                | 750                      | ns   |
|                                  |                                                                              | 10                   | 250                      | 250                | 300                      |      |
|                                  |                                                                              | 15                   | 160                      | 160                | 200                      |      |
| $t_{\text{TLH}}, t_{\text{THL}}$ | Maximum Output Transition Time, Carry Output or Decode Output (Figure 1)     | 5.0                  | 200                      | 200                | 300                      | ns   |
|                                  |                                                                              | 10                   | 100                      | 100                | 150                      |      |
|                                  |                                                                              | 15                   | 80                       | 80                 | 120                      |      |
| $t_{\text{PLH}}, t_{\text{PHL}}$ | Maximum Propagation Delay, Reset to Carry Output or Decode Output (Figure 1) | 5.0                  | 530                      | 530                | 700                      | ns   |
|                                  |                                                                              | 10                   | 230                      | 230                | 300                      |      |
|                                  |                                                                              | 15                   | 170                      | 170                | 250                      |      |
| $C_{\text{IN}}$                  | Maximum Input Capacitance                                                    | -                    |                          | 5                  |                          | pF   |

**TIMING REQUIREMENTS** ( $V_{\text{CC}}=5.0\text{V}\pm 10\%$ ,  $C_L=50\text{pF}$ , Input  $t_r=t_f=20\text{ ns}$ ,  $R_L=200\text{k}\Omega$ )

| Symbol           | Parameter                                             | V <sub>CC</sub><br>V | Guaranteed Limit         |                    |                          | Unit          |
|------------------|-------------------------------------------------------|----------------------|--------------------------|--------------------|--------------------------|---------------|
|                  |                                                       |                      | $\geq -55^\circ\text{C}$ | $25^\circ\text{C}$ | $\leq 125^\circ\text{C}$ |               |
| $t_w$            | Minimum Pulse Width, Clock (Figure 1)                 | 5.0                  | 200                      | 200                | 300                      | ns            |
|                  |                                                       | 10                   | 90                       | 90                 | 150                      |               |
|                  |                                                       | 15                   | 60                       | 60                 | 100                      |               |
| $t_r, t_f$       | Maximum Input Rise and Fall Times, Clock (Figure 1)   | 5.0<br>10<br>15      | UNLIMITED                |                    |                          | $\mu\text{s}$ |
| $t_w$            | Minimum Pulse Width, Reset (Figure 1)                 | 5.0                  | 260                      | 260                | 400                      | ns            |
|                  |                                                       | 10                   | 110                      | 110                | 180                      |               |
|                  |                                                       | 15                   | 60                       | 60                 | 100                      |               |
| $t_{\text{rem}}$ | Minimum Removal Time, Reset (Figure 1)                | 5.0                  | 400                      | 400                | 550                      | ns            |
|                  |                                                       | 10                   | 280                      | 280                | 400                      |               |
|                  |                                                       | 15                   | 150                      | 150                | 200                      |               |
| $t_{\text{SU}}$  | Minimum Setup Time, Clock Inhibit to Clock (Figure 1) | 5.0                  | 230                      | 230                | 300                      | ns            |
|                  |                                                       | 10                   | 100                      | 100                | 150                      |               |
|                  |                                                       | 15                   | 70                       | 70                 | 100                      |               |

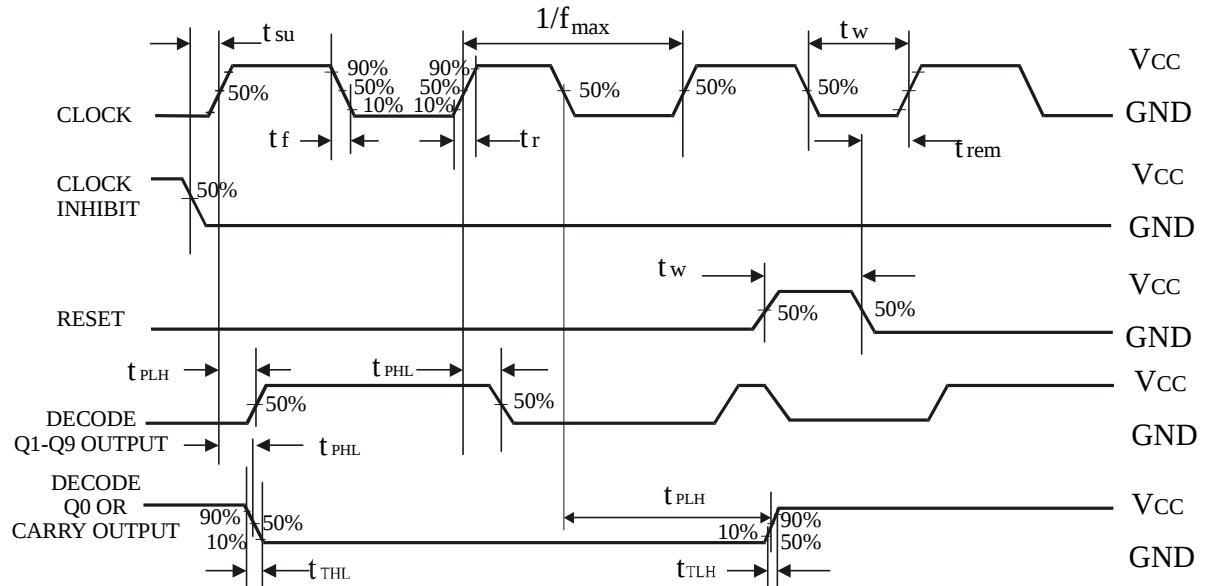
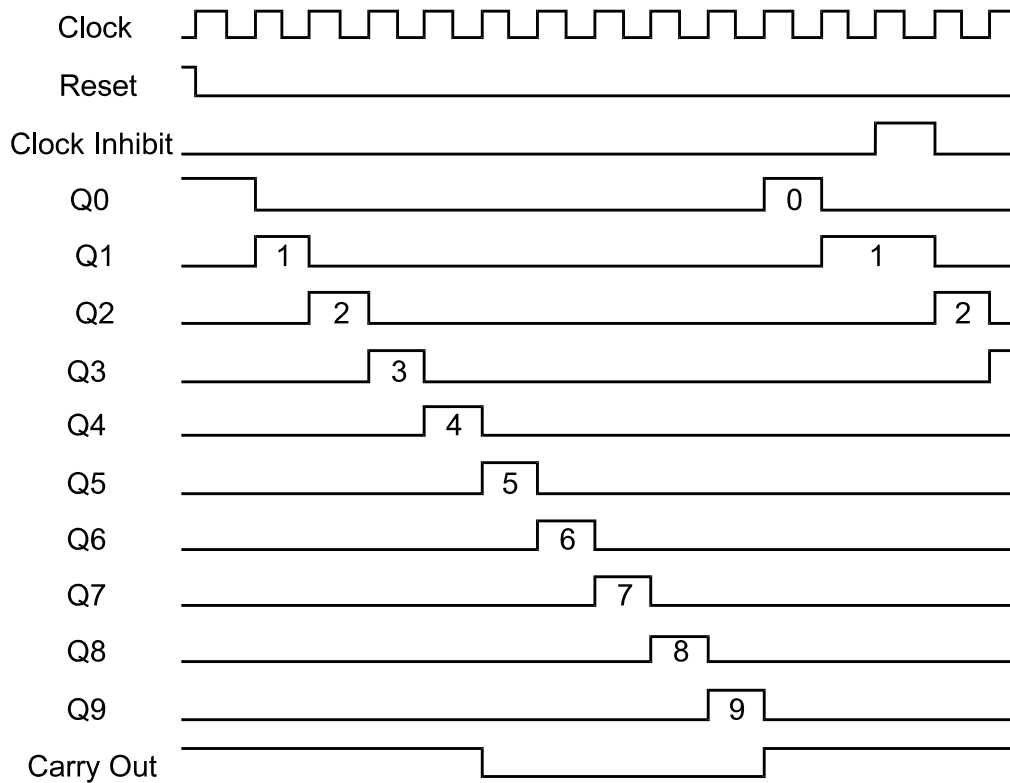
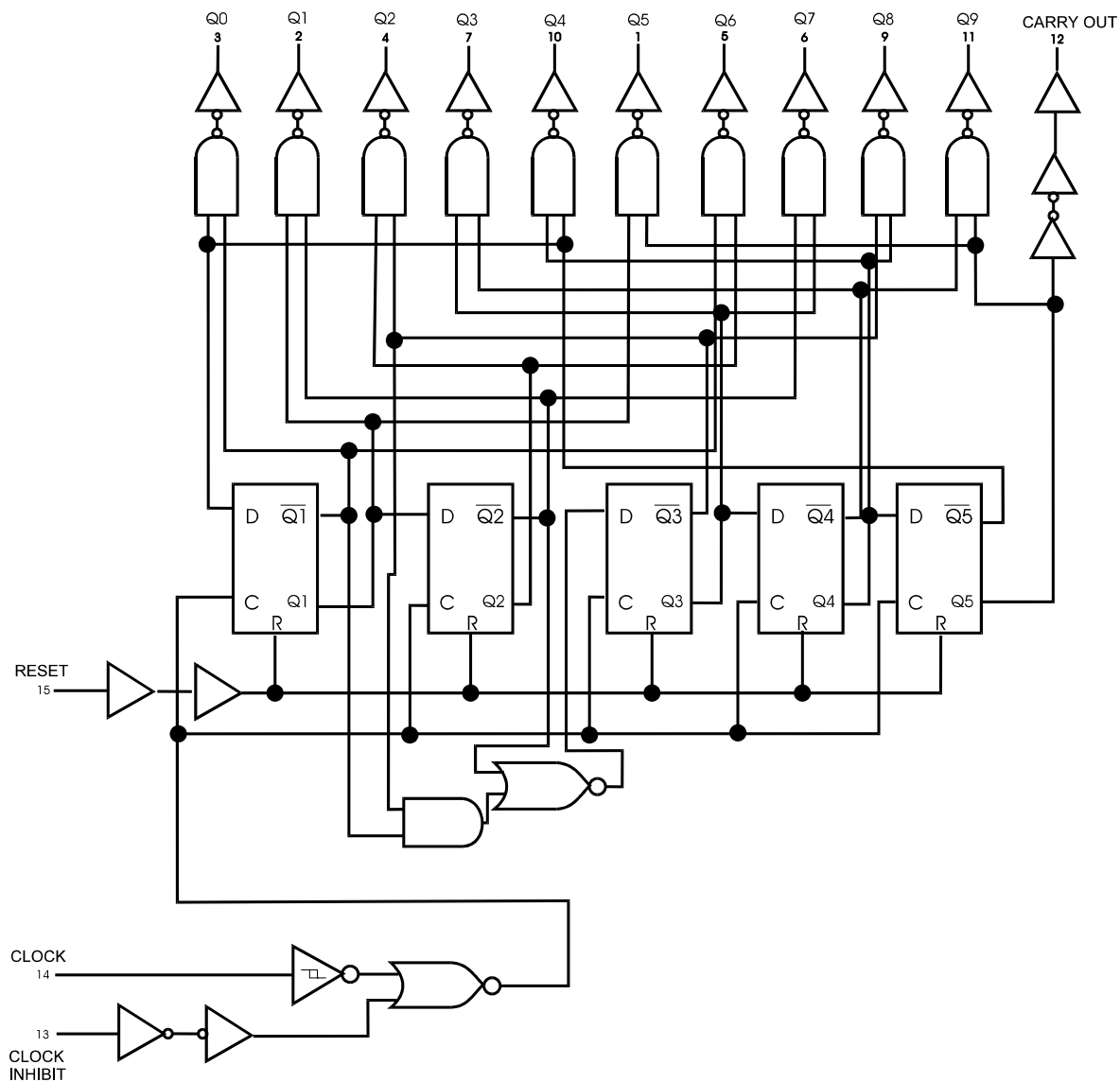


Figure 1. Switching Waveforms

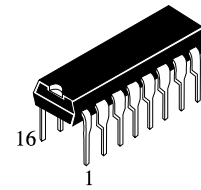
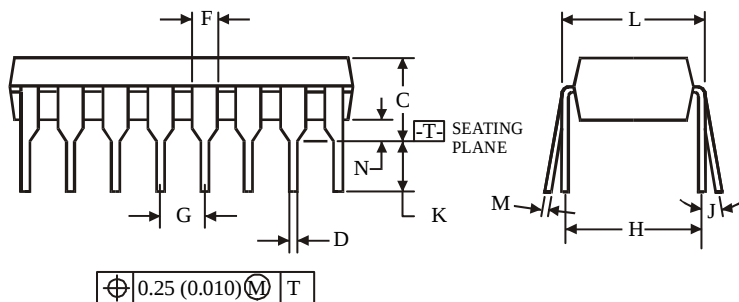
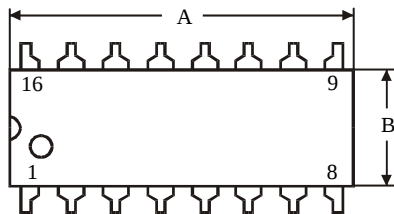
### Timing diagram



## EXPANDED LOGIC DIAGRAM



## N SUFFIX PLASTIC (MS - 001BB)

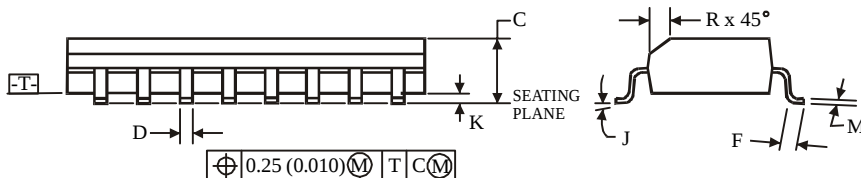
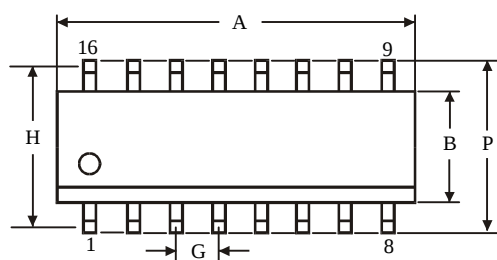
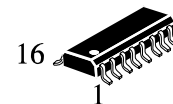


| Symbol | Dimensions, mm |       |
|--------|----------------|-------|
|        | MIN            | MAX   |
| A      | 18.67          | 19.69 |
| B      | 6.10           | 7.11  |
| C      |                | 5.33  |
| D      | 0.36           | 0.56  |
| F      | 1.14           | 1.78  |
| G      | 2.54           |       |
| H      | 7.62           |       |
| J      | 0°             | 10°   |
| K      | 2.92           | 3.81  |
| L      | 7.62           | 8.26  |
| M      | 0.20           | 0.36  |
| N      | 0.38           |       |

### NOTES:

- Dimensions "A", "B" do not include mold flash or protrusions.  
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

## D SUFFIX SOIC (MS - 012AC)



| Symbol. | Dimensions, mm |      |
|---------|----------------|------|
|         | MIN            | MAX  |
| A       | 9.80           | 10.0 |
| B       | 3.80           | 4.00 |
| C       | 1.35           | 1.75 |
| D       | 0.33           | 0.51 |
| F       | 0.40           | 1.27 |
| G       | 1.27           |      |
| H       | 5.72           |      |
| J       | 0°             | 8°   |
| K       | 0.10           | 0.25 |
| M       | 0.19           | 0.25 |
| P       | 5.80           | 6.20 |
| R       | 0.25           | 0.50 |

### NOTES:

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A, for B - 0.25 mm (0.010) per side.